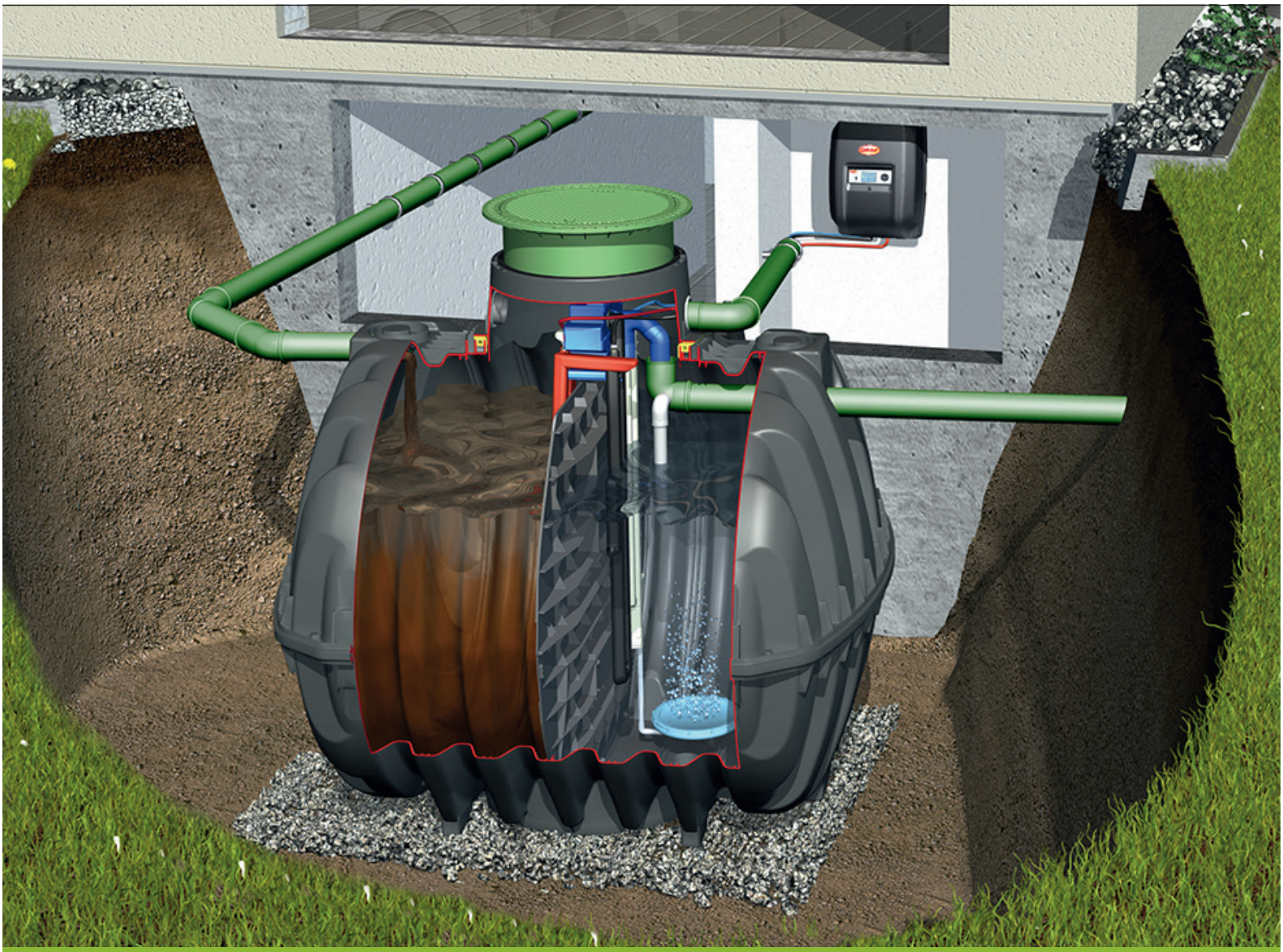
OPERATION MANUAL

Startup | Operation | Maintenance

oneAdvanced | one2cleanXtra



Intended and safe use requires you to heed the instructions and other information in this documentation.

- Read carefully these instructions before installation, assembly, and startup.
- Keep these in a safe place for future reference.

Instructions for startup, operation, and maintenance
Issued for GRAF oneAdvanced and one2cleanXtra wastewater treatment plant
Control unit KLcontrol.M

EAN no. 4023122286325
Date issued 29/11/2024
Original operating instructions
Original language: German

.

Otto Graf GmbH Kunststofferzeugnisse
Carl-Zeiss-Straße 2–6, 79331 Teningen
Germany

Tel. +49 7641 589-0
mail@graf.info www.graf.info

Contents

Contents

Contents

1 About these instructions

This Technical Documentation for the wastewater treatment system is divided into several sections. This documentation forms an integral part of the product and must be handed over to the new owner or at the new site. The full Technical Documentation consists of:

- installation instructions for the underground tank
- Assembly instructions for the installation kit
- instructions for startup, operation, and maintenance

All persons coming into direct contact with the plant must have read and understood the contents of this documentation.

This section contains the startup, operating, and maintenance instructions. These are intended for all persons handling the plant, and are prefaced with a description of the plant and its functions as well as details pertaining to its handling safety and potential residual risks. These are followed by details on the available switch and machine cabinets and their positions; a description of the controller and its functions; and instructions for its startup. Concluding these are instructions on how to operate and service the plant and a description of the fault messages, together with troubleshooting instructions. We recommend keeping this section in the vicinity of the plant.

Copyright

1 About these instructions

1.1 Typeface conventions

These instructions make use of the following typeface conventions.

Format	Meaning
Italic text	This refers the reader to other contents in this document, other sections of the instructions for use, or additional information. Digitised media (e.g. PDFs) present links to the destinations that the user can click or tap directly.
»…«	This reproduces lettering or a label on the product or component.
[…]	This represents a key or switch.

1.2 Symbols and signal words

These instructions make use of the following symbols. An overview of the safety symbols and signal words used can be found in *Subsection 2.1.1*.

Symbol	Signal word and meaning
	**IMPORTANT / TIP / INFO** This highlights important information, tips, and other particularly useful details

2 Safety

Despite all safety precautions, the plant may nevertheless pose some degree of residual risk, particularly when handled incorrectly or negligently. To protect yourself and others from all danger and to prevent damage and pollution as a result of incorrect handling, therefore, please read and follow the safety and other instructions in both this and the other sections making up the instructions for use.

WARNING

Failure to heed the safety instructions may cause accidents and damage.

- The consequences can extend to serious, and even fatal injury and harm to health.

→ Read and follow both the safety and the other instructions.

2.1 General safety instructions

2.1.1 Safety symbols and signal words

The following safety symbols and signal words are used in these instructions and on the plant's components:

DANGER

This highlights imminent danger. Failure to observe this will cause death or grievous injury.

WARNING

This highlights a potentially hazardous situation. Failure to observe this may cause death or grievous injury.

CAUTION

This highlights a potentially hazardous situation. Failure to observe this may cause slight or minor injury.

IMPORTANT

This highlights a scenario that may cause pollution to the environment or damage to the product or nearby property.

This highlights potential risks from electricity.

This highlights a potential risk of falling.

This highlights potential risks from hot surfaces.

This highlights potential risks from optical radiation.

2.1.2 Intended use

The SBR plant has been designed to channel domestic wastewater from private homes. Domestic wastewater contains faeces and other substances found in bath, washing, sink, and mop water such as soap, detergent, and food scraps.

The SBR plant can also handle other wastewater types, such as those from restaurants, dairies, winemakers, breweries, and other commercial establishments. This capability was considered during the plant's design and layout.

2.1.3 Incorrect use

The SBR plant may be used only for the purposes described in these instructions. The plant may not be used for industrial wastewater. Under no circumstances may the plant be used to channel biocides, toxic substances, or substances which are not biocompatible: these hinder bacteria important to wastewater cleaning and cause problems in the biological process.

A detailed list of substances that may not be channelled through the plant can be found in *Subsection 6*.

WARNING

- Failure to use the plant for its intended purpose may cause harm to health, pollution to the environment, and damage to property.

2.2 Safety instructions for the operator

The operator of the plant is responsible for its correct installation and operation. He is also responsible for ensuring adherence to the safety and other instructions in this section, but also to the laws, standards, rules, and regulations pertaining to the plant's site. These include in particular the health and safety, accident prevention, and environmental protection regulations as well as the inspection and maintenance specifications applying to the plant's site.

To meet official cleaning requirements, it is essential that the plant is operated in accordance with the operating and maintenance instructions.

Operator's obligations

In order to maintain the plant's operating safety, the operator must:

- (re)configure and inspect the plant at the prescribed regular intervals and maintain an operating log book (*see Subsection 7.2*)
- commission a specialist to service the plant at the prescribed regular intervals
- Immediately on signs of damage to the controller or wiring, the plant must be shut down and disconnected from the power supply.
- Malfunctions and damage must be remedied immediately or repaired by a specialist
- All safety labels on the plant must be maintained in an easily legible condition at all times.

2.2.1 Personnel qualifications

The operator must make sure that the installation, assembly, inspection, and maintenance personnel are adequately qualified or possess the adequate knowhow for their assigned tasks, and all persons handling the product have received adequate instruction. The requisite qualifications may be subject to additional regulations.

The plant must not be operated by anyone under the influence of alcohol, narcotics, or medication that limits cognitive ability or ability to react.

Installation, care, maintenance

Only specialists may perform care and maintenance work on the plant. Specialists are those persons whose professional training and qualifications render them suitable for operating and servicing wastewater treatment systems. Only specialised electricians may be assigned to work on the electrical installations and to connect the plant to its power supply.

2.3 General safety measures

- **Keep tank covers closed at all times. Never leave open tank covers unattended.**
  - Tank covers may be opened for inspection and maintenance purposes only. There is a danger of persons or animals falling into the tank. This may result in serious injury or drowning.
  - → Keep unassigned persons, in particular children, away from open tank covers.
  - → Closed tank covers must resist all attempts by a child to open them. Before closing, make sure that there are no persons or animals in the tank.

- **Keep control cabinets closed at all times. Never leave an opened control cabinet unattended.**
  - Control cabinets house components that may be hot to the touch. Touching these may cause burning injuries.
  - Unauthorised access to the controller may cause serious malfunctions.
  - → Open the control cabinet only for the purpose of operating or servicing the plant.
  - → At the end of the work, close and lock the cabinet.

- **Operate the controller only when it is in perfect working condition**
  - Any damage, however slight, to the controller’s housing or the wiring insulation poses a risk of electric shock.
  - → Immediately on signs of damage, shut down the plant, disconnect it from its power supply, and commission a specialist for its repair.

- **Do not place any receptacles containing liquids on the control cabinet.**
  - Spilled or discharging liquids may cause short circuits. Fire or electric shock may be the consequence.

- **Do not transport or deposit any substances hazardous to water near the tank cover.**

- **Wear personal protective equipment (PPE)**
  - PPE (protective gloves, goggles, safety shoes, etc.) protects the wearer against injury and harm to health.
  - → Whenever necessary, wear the prescribed protective equipment.
  - → Do not use damaged or defective protective equipment, which must be replaced immediately with fully functional equivalents.

2.4 Safety measures for inspection and maintenance

- **Do not consume any food or drink when operating or working at or on the plant.**
  - Edibles coming into contact with microbes may carry and cause infection.
- **Shutting down the plant's installations electrical components and equipment.**
  - Equipment may start to operate unexpectedly. Damaged wiring poses a risk of electric shock.
  - → Before all repair, maintenance, and cleaning work on the plant, shut it down completely, including all of its installations, and secure it against reactivation.
  - → Disconnect the electrical installations from their power supplies.
- **Only specialised electricians may be assigned to work on the electrical installations electrical components and to connect the plant to its power supply.**
  - Danger from electric shock.
- **Handle chemicals properly.**
  - Chemicals can cause poisoning, harm to health, and caustic injuries.
  - → Consult their manufacturers' safety data sheets for details.
  - → Whenever necessary, wear PPE.
  - → Keep chemicals safely away from children and unauthorised access.

2.4.1 Safety measures for work inside the tank

Harmful gases may form inside wastewater treatment systems. The wastewater may carry pathogens and substances harmful to health. The plant's tanks and shafts may be accessed bodily for repair and maintenance work only.

- **Verify that work in the tank is necessary.**
  - → Always examine first whether this work may be performed from outside (e.g. inspections with a remote controlled camera).
- **Assign a second person to supervise all work.**
  - This second person must remain at the access point. He must remain in constant contact with the person in the tank and be in a position to fetch assistance immediately.
  - → Never enter the tank without this second, supervising person.
- **Empty tank completely**
  - An accident victim can also drown in shallow depths.
  - → Never enter a tank, even when it is only partially full.
- **Provide a supply of healthy air to the tank.**
  - → Before being accessed, the tank must first be vented adequately to clear it of any gases.
  - → If adequate cross or diagonal venting (chimney effect) cannot be ensured, a supply of air must be provided with equipment.
  - → Whenever necessary, measure and monitor constantly the air quality.

- **Increase access safety and provide an escape route**
  - → Use only suitable equipment, e.g. ladder, to access the tank.
  - → Make sure that the escape route remains unobstructed.

2.4.1.1 In the event of an accident in the tank

- **If the accident victim is unconscious, do not under any circumstances attempt to climb in to his rescue.**
  - There is danger of death from asphyxiation or noxious gases.
  - → Call the emergency services and follow their instructions.
  - → While you are waiting, vent the tank from outside, using e.g. a fan or similar.

3 General

3.1 Details about your plant

In case you have any queries while operating the plant, please enter the details of your plant here as follows. Should you encounter a fault, these details will enable our staff to find a remedy faster.

Your plant's specifications can be found on the type plate. This type plate is affixed to the external housing of internal control cabinets and inside external control cabinets.

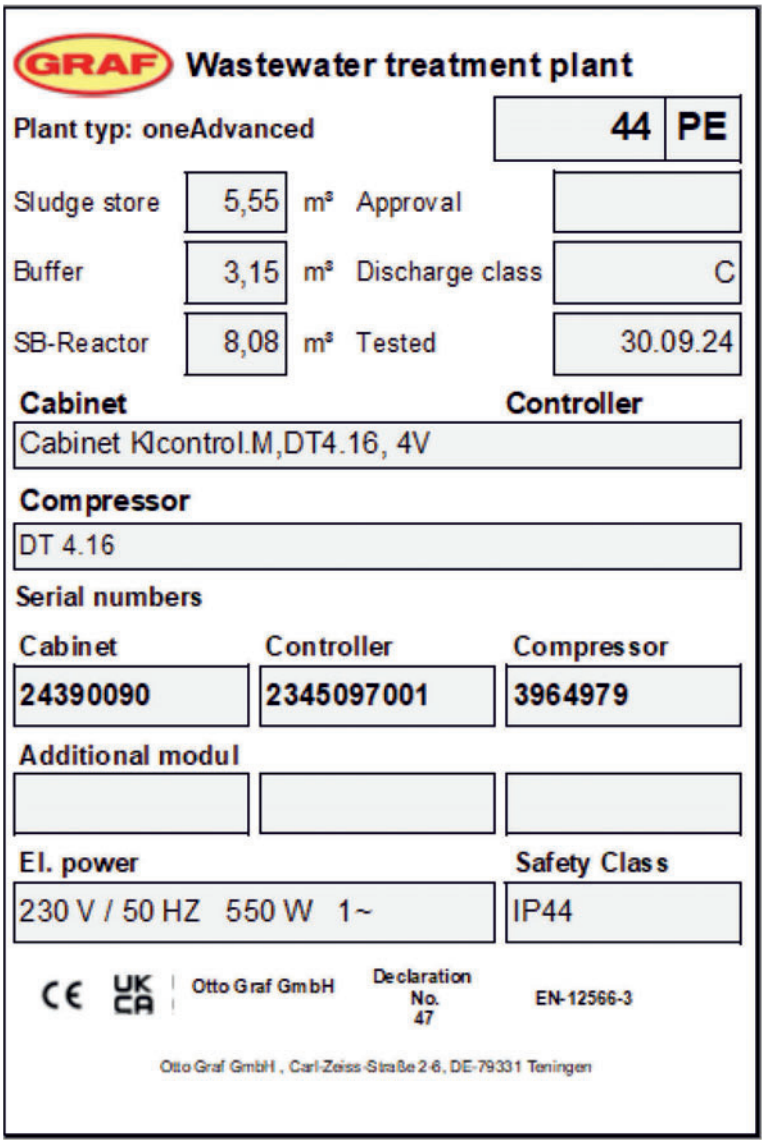


Figure 1: Example oneAdvanced type plate

3.2 Layout and functions

The basic wastewater treatment plant consists of the following components:

- one or more tanks
- wastewater treatment installation kit
- control cabinet

The internal components in the tanks are connected to the control cabinet via air hoses laid in the ground.

In the control cabinet, you will find:

- one or two quiet, low-maintenance air compressor
- a valve unit
- a control unit

3.2.1 Layout of one2cleanXtra 3-70 PE

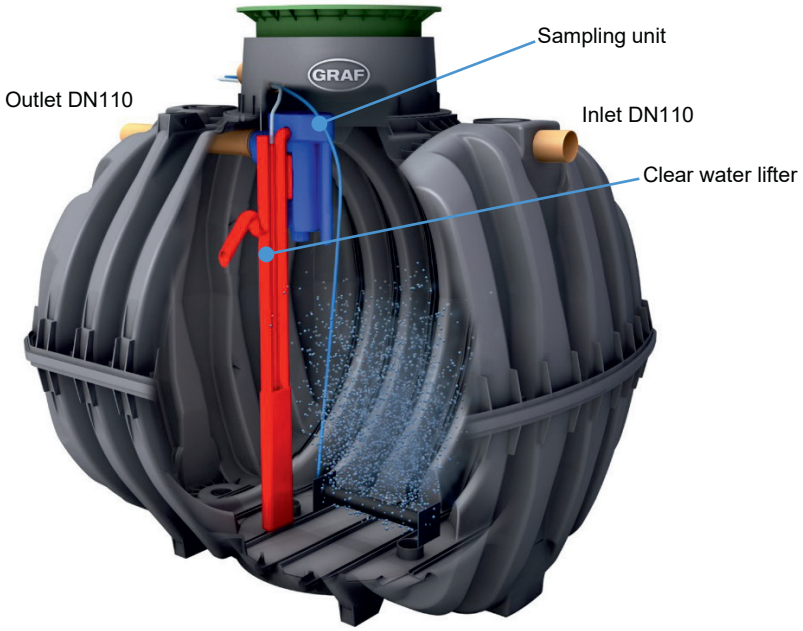


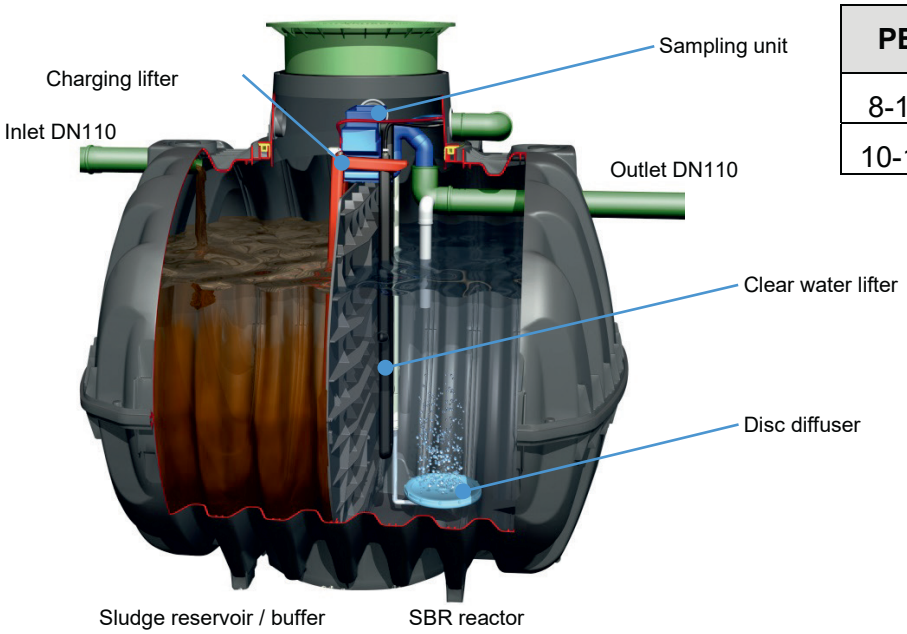
Figure 2: one2cleanXtra 3–70 PE in a Carat tank (example)

PE	tank
3	2.700 L
5	3.750 L
7	4.800 L
9	6.500 L
12	8.500 L
15	10.000 L
19	13.000 L
24	16.000 L
32	22.000 L
45	32.000 L
50	38.000 L
60	44.000 L
70	48.000 L

The tank houses:

- a baffle
- a stainless steel air distribution system with disc diffusers or membrane tubes
- clear water lifter in the form of a mammoth pump with its own air supply
- an integrated water sampling point up to 32 PE
- a sludge sampling pipe for easy sludge extraction from 12 PE

3.2.2 Layout of oneAdvanced 10–14 PE



PE	tank
8-10	4.800 L
10-14	6.500 L

Figure 3: oneAdvanced 10–14 PE in a Carat tank (example)

The tank is split into two areas by a dividing baffle: a sludge reservoir and buffer in the inlet area and an SBR reactor in the outlet area.

The wastewater treatment installation kit is fitted to the dividing baffle. This consists of:

on the sludge reservoir / buffer side:

- charging lifter in the form of a mammoth pump with its own air supply (marked in red)

on the SBR reactor side.

- a stainless steel pipe with disc diffuser
- clear water lifter in the form of a mammoth pump with its own air supply (marked in black)
- an excess sludge lifter in the form of a mammoth pump with its own air supply (marked in white)

above the dividing baffle:

- an integrated water sampling point

3.2.3 Layout of oneAdvanced 12–1000 PE

oneAdvanced domestic in Carat S	
PE	**tank**
12-16	2x 3.750 L
16-22	2x 4.800 L
20-28	2x 6.500 L
25-32	4x 3.750 L
32-44	4x 4.800 L
42-50	4x 6.500 L
51-60	4x 6.500 L
61-90	5x 6.500 L

oneAdvanced commercial in Carat XL and Carat XXL	
PE	**tank**
38	2x 8500 L
46	2x 10.000 L
60	2x 13.000 L
75	2x 16.000 L
100	2x 22.000 L

oneAdvanced commercial in Carat XXL	
PE	**tank**
125	2x 26.000 L
150	2x 32.000 L
175	2x 38.000 L
200	4x 22.000 L
220	2x 44.000 L
250	1x 32000 L 1x 16.000 L 2x 26.000 L
275	1x 52000 L 2x 32.000 L
300	1x 52.000 L 2x 32.000 L
350	3x 22.000 L 2x 38.000 L
400	2x 26.000 L 2x 44.000 L
450 / 500	3x 22.000 L 4x 26.000 L
550 / 600	3x 26.000 L 4x 32.000 L
650 / 700	1x 42000 L 2x 32000 L 4x 38.000 L
750 / 800	1x 38.000 L 3x 22.000 L 3x 54.000 L
850 / 900	4x 54000 L 3x 22.000 L
950 / 1000	1x 54.000 L 3x 22.000 L 6x 38.000 L

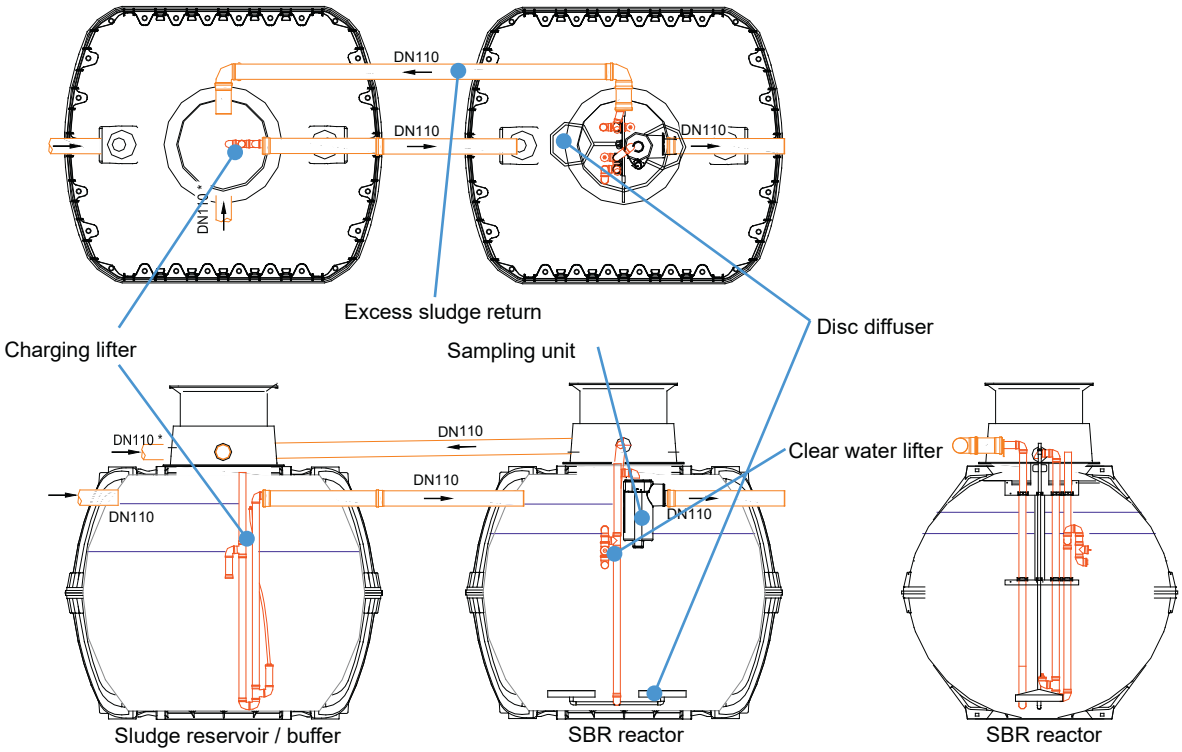


Figure 4: Example multi tank system in two Carat tanks

The wastewater treatment plant is made up of several tanks. The preliminary cleaning tank integrates the sludge reservoir, buffer, and SBR tank. Plants from 25 up to 32 PE can consist of multiple preliminary cleaning and SBR tanks.

In the sludge reservoir / buffer you will find:

- Charging lifter in the form of a mammoth pump with its own air supply (marked in red)

In the SBR reactor you will find:

- a stainless steel air distributor system with membrane tube aerators or disc diffusers
- clear water lifter in the form of a mammoth pump with its own air supply (marked in black)
- an excess sludge lifter in the form of a mammoth pump with its own air supply (marked in white)
- optionally, an integrated water sampling point

3.2.4 Function of the SBR plant

The **oneAdvanced** and the **one2cleanXtra** are fully biological wastewater treatment systems, which function on the principle of the SBR process (aeration system in retention process).

This fully biological treatment takes place with aerated sludge. Aerated sludge basically consists of microorganisms that break down the pollutants dissolved in wastewaster

The oneAdvanced-Plants feature upstream sludge reservoirs with integrated buffer that perform the following functions:

- storage of primary and secondary sludge,
- retention of deposited materials and floating solids,
- storage of supply water,
- compensation of fluctuations in the wastewater supply related to volume and concentration.

The SBR reactor provides the following functions:

- biological cleaning with aerated slurry
- nitrification and denitrification
- phosphate precipitation

The wastewater treatment plant is operated using a microprocessor control, which controls the air compressor and air distribution for the various lifters via stepped motors.

3.2.4.1 Process flow of one2cleanXtra

The SBR process follows a 3 step process, undertaken one after another and twice a day.

Step 1: Aeration

In the first phase, the wastewater is put straight through aerobic treatment for a fixed time. As a result, firstly the microorganisms (aerated sludge) are supplied with the oxygen needed for the breakdown and secondly pressure aeration causes mixing. The system's aeration equipment is supplied with ambient air by a compressor. Aeration is intermittent so that targeted wastewater cleaning is possible. Different ambient conditions can thereby be achieved.

Step 2: Sedimentation phase

There is no aeration in the second phase. The aerated sludge and the remaining settleable solids can now settle with the aid of gravity. A clear water zone forms at the top and a sludge layer at the bottom. Any floating sludge is on top of the clear water zone.

Step 3: Discharging

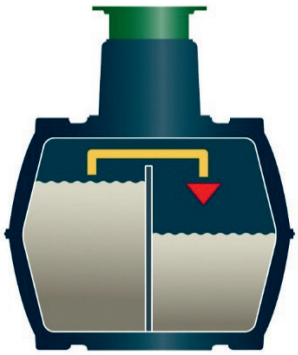
In this phase, the biologically cleaned wastewater (clear water) is drawn out of the SBR stage. It is pumped out by an airlift (or mammoth) pump, which uses compressed air. The airlift pump is designed not to pump out any floating sludge on top of the clear water layer. A minimum water level is maintained in the system without any further components.

Once step 3 is complete, the cleaning process starts again with step 1.

2 cycles are undertaken a day. The maintenance company can individually adapt the switching times.

3.2.4.2 Process flow of oneAdvanced

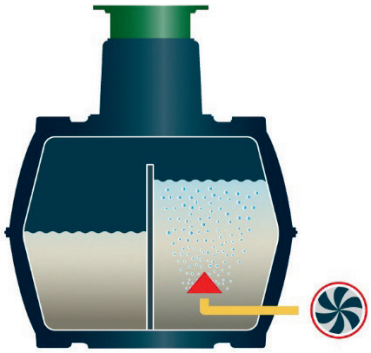
The process is a series of 5 steps undertaken in turn and repeated several times a day (usually four times).



Step 1: Charging

The raw wastewater held in the sludge reservoir is fed to the SBR reactor via an airlift pump. This is arranged such that only water free of solids is pumped. The special design of the lifter guarantees a minimum water level in the sludge reservoir.

Duration: approx 5–20 min



Step 2: Aeration

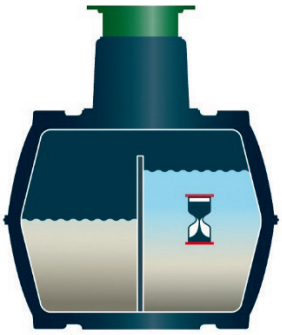
In this step, the wastewater is aerated and mixed. Membrane tube aerators or disc diffuser fitted on the base of the chamber aerate the wastewater.

The plant's aeration equipment is supplied with ambient air by a control cabinet installed separately. An air compressor produces the compressed air needed. Aeration usually takes place intermittently.

with two simultaneous outcomes:

- the microorganisms in the activated sludge are supplied with oxygen, which is needed for their metabolism and therefore for the pollutants to be broken down.
- there is intensive contact between the wastewater and bacteria.

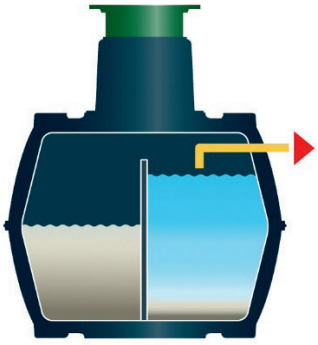
Duration: approx 240 min



Step 3: Sedimentation phase

This step is a rest phase in which no aeration takes place. The activated sludge settles with gravity (sedimentation phase). A clear water zone forms at the top and a sludge layer at the bottom. Any floating sludge is on top of the clear water zone.

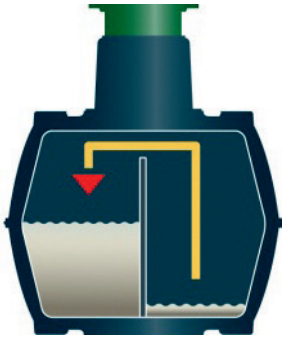
Duration: approx 90 min



Step 4: Discharging

In this phase, the biologically cleaned wastewater (clear water) is drawn out of the SBR stage. It is pumped out by an air-lift (or mammoth) pump, which uses compressed air. The air-lift pump is designed not to pump out any floating sludge on top of the clear water layer.

Duration: 5–20 min



Step 5: Excess sludge return

In this phase, the excess activated sludge at the bottom is pumped by an airlift pump from the SBR reactor chamber to the sludge reservoir chamber, where it is stored.

Duration: 1–2 min

At the end of this treatment cycle, the plant pauses for the time remaining until the next cycle start time (about 1–10 minutes). Afterwards, the cleaning process starts again with step 1.

The cycle described above is usually undertaken four times a day. The switching times and number of cycles can be adapted following discussion with the manufacturer. They may only be adapted by an authorised maintenance specialist.

3.2.4.3 Holiday mode

The operator can switch the plant to holiday mode when he is planning to be away for an extended period. In this event, water is no longer discharged from the plant. Aeration is minimal to maintain the aerated sludge. In addition, a small quantity of wastewater is recirculated (in plants larger than 10 PE) over the sludge and charging lifters inside the plant. This continues to provide nutrients to the aerated sludge („recirculation“).

3.2.4.4 Underload detection

Alternatively, the plant can be time-controlled to operate depending on its filled level. For this purpose, the controller is fitted as standard with a pressure sensor that can be activated by a specialist on request. This pressure sensor should be activated on new plants only after they have been run in reliably.

This pressure sensor tests the filling level every six hours for the oneAdvanced and every twelve hours for the one2cleanXtra - or at the nominal start of each cycle. When there is little or no inflow or the level is low, no treatment cycle is initiated. Instead, there is minimum aeration to maintain the aerated sludge. In addition, in the oneAdvanced a small quantity of wastewater is recirculated over the sludge and charging lifters inside the plant. This continues to provide nutrients to the aerated sludge. The controller then displays “Cyclepause”. Once the measured level exceeds a certain limit, a normal treatment cycle is initiated.

When fitted with underload detection, the plant can run independently of the actual hydraulic load, helping to cut operating costs. This mode proves above all practicable when the inlet fluctuates greatly over the course of the week, e.g. when the residents are not regularly at home. Underload detection must be configured by a specialist.

3.2.4.5 Plants with extra nitrogen elimination (discharge class N and D)

The wastewater treatment plant applies the biological processes of nitrification and denitrification to remove nitrogen content. Plants designed for extra nitrification generate a particularly intensive aeration that provides the optimal living conditions for nitrifying bacteria, which covert the ammonium content of wastewater into nitrate. Plants designed in addition for extra denitrification generate brief aeration pulses that recirculate the water at the suitable time. This serves to stimulate the denitrifying bacteria responsible for converting the nitrate into elementary nitrogen, which discharges as a gas out of the plant.

All GRAF treatment systems can be used for nitrification and denitrification. No additional componentry is needed. Solely the controller's cleaning program must be configured accordingly.

3.2.4.6 Plants with extra phosphate elimination (discharge class +P, P module)

Phosphates are precipitated out by means of polyaluminium chloride dosed to the SBR reactor. A removable holding platform in the tank dome (accessory, item no. 107362) can be purchased for the phosphate precipitation device.

The precipitant canister is located on this platform. Alternatively, the precipitant canister can be positioned separately near the control cabinet. There is a dosing pump in the plant's control cabinet. This dosing pump conveys the precipitant out of the precipitant canister and into the SBR reactor. The precipitant is supplied to the reactor during the aeration phase. The amount of precipitant needed can be set on the metering pump. Mixing takes place during the aeration phase. The precipitant forms an insoluble compound with the phosphate, which settles in the tank.

3.2.4.7 Plants with extra hygiene (discharge class +H)

The additional module can also be fitted to remove germs from the biologically cleaned water. This disinfection takes place with ultraviolet (UV) light or a dose of chlorine.

3.2.4.8 Plants with additional carbon dosing (C module)

Carbon can be dosed to the aeration stage to offset any nutrient deficiency. This may become necessary during extreme underload phases or when the wastewater exhibits a suboptimal quality.

In this event, a dosing pump in the control cabinet conveys automatically a specific quantity of special nutrient solution directly into the aeration basin. This dose can be adjusted at the controller. Carbon dosing serves to maintain the stability of the aerated sludge quantity in the system, even when there is only a sporadic or very low supply of wastewater.

3.3 Internal and external cabinet

All the plant's mechanical and electrical components are installed in a control cabinet. The cabinet for internal installation is made of expanded polypropylene (PP; used for wastewater treatment plants for 3–28 PE) or powder-coated metal (used for wastewater treatment plants for 28 PE or more).

The internal PP control cabinet can be fitted in a GRAF external control cabinet M, and in this manner used outdoors as well.

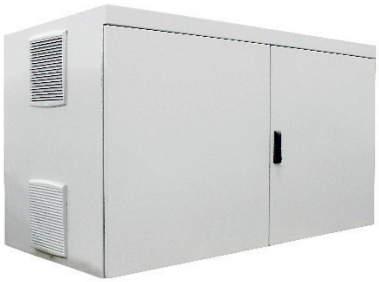
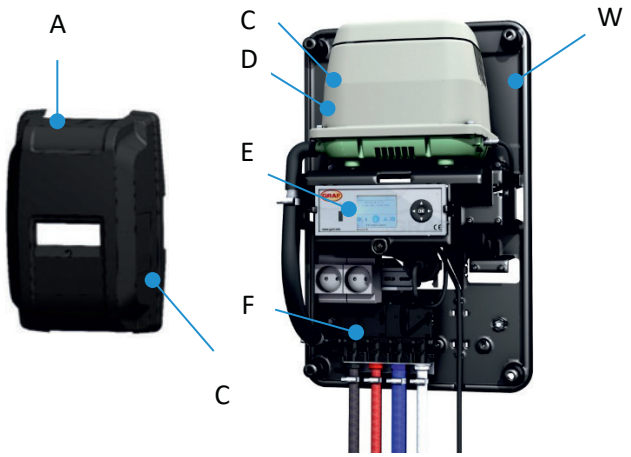
		
Internal PP control cabinet (no more than 28 PE)	Steel cabinet for indoor installation (32 - 175 PE)	External control cabinet M for internal PP control cabinet (no more than 28 PE)
		
External control cabinet L Plastic (left) (32 - 44 PE) Steel (right) (45 - 60 PE)	XL metal external cabinet (60–175 PE)	XXL metal external cabinet (from 200 PE)

Figure 5: Available control cabinets

3.3.1 Technical setup

The main components of the controller are:



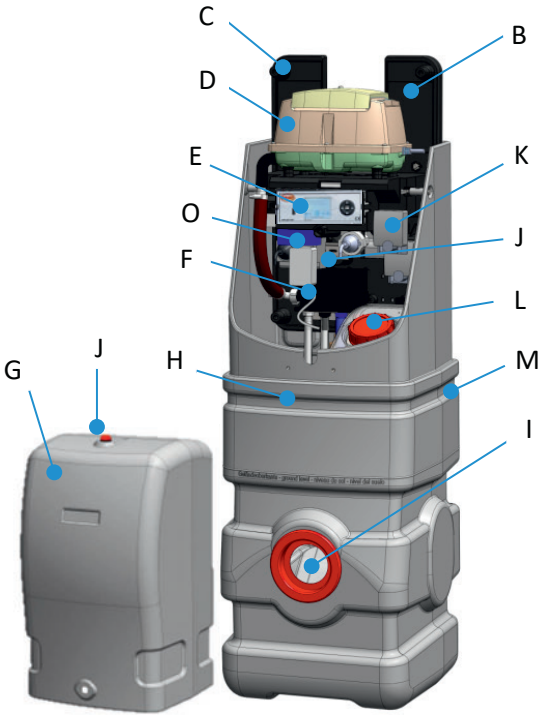


Figure 6: Example layout of an external control cabinet M

A	Internal cabinet hood
B	Bearer
C	Type plate
D	compressor
E	Control unit
F	Air distributor
G	External cabinet hood
H	External cabinet base section
I	Empty pipe aperture for external cabinet
J	Power strip 230 V
K	Dosing pump (optional)
L	Chemicals tank 37 l (optional)
M	Chemicals tank vent (optional)
N	Warning light
O	Communication module (optional)
P	Empty pipe seal (accessories)
Q	Air hoses (accessories)

Figure 7: Accessories

3.3.2 Siting

The control unit must not be fitted or activated in environments with potential explosive atmospheres or in places where there are flammable materials. Sparks in such environments may cause an explosion or fire and this may result in physical injuries or even death.

Ensure that the machine cabinet is not installed above or in the direct vicinity of water vessels. Risk of electric shock if improperly installed.

The control cabinet must be freely accessible at all times for maintenance work. The ventilation apertures in the control cabinet must remain unobstructed at all times and may not be covered.

- PP control cabinet: Ventilation apertures on the bottom and top
- Internal control cabinet: Ventilation apertures on the sides
- External control cabinet: Ventilation apertures on the rear

Control cabinets for indoor installation

Control cabinets for indoor installation must be sited in a dry, well ventilated room, e.g. basement or garage.

Control cabinets for outdoor installation

Control cabinets for outdoor installation should be sited, whenever possible, away from direct sunlight which would otherwise cause overheating in the summer.

3.3.3 Power supply

WARNING

Hazardous voltage

- Danger from electric shock. An electric shock can cause serious burns and life threatening injury.
- → Only specialised electricians may be assigned to work on the electrical installations and to connect the plant to its power supply.

The machine cabinet may be connected only to a correctly installed 230 V socket or earth cable fitted with an upstream 16 A fuse. Additional electrical fixtures on the same fuse may disrupt operation.

The power supply to the control cabinet must be ensured at all times. If the plant is disconnected from the mains for more than 24 hours, it will be unable to clean the wastewater properly, if at all.

Electrical equipment connected to the mains may be damaged during a storm. We would recommend fitting surge protection in the building to protect against this. The connection cable must be laid such that it does not represent a tripping hazard.

4 The wastewater treatment system’s control unit

The plant is controlled at the operating unit on the controller’s face side. The controller is used to configure the operating parameters, view the operating statuses, query the plant parameters, and program the operating times (this last by a specialist).

The controller presents two access levels with basic and advanced functions and parameters:

- **Operator menu** (not password protected)
- **Service menu for specialists** (password protected)

Use the small wastewater treatment plant only when it is in perfect working condition, only for its intended purpose, and only with all due diligence to safety and risks as set down in the full Technical Documentation. The housing enclosing the controller for wastewater treatment plants may not be opened. Please refer any questions to the manufacturer.

IMPORTANT

Keep the plant switched ON at all times!

- If the plant is disconnected from the mains for more than 24 hours, it will be unable to clean the wastewater properly, if at all.

→ Switch OFF the plant for maintenance and repair purposes only.
→ Immediately after this work, switch the plant back ON.

4.1 Operating unit

The operating unit consists of a USB port (A), a display (B), a cursor pad (C), and a status LED (D).

Figure 8: KLcontrol.M operating unit

USB port (A)

The USB port accepts a USB stick (*see also Subsection 4.4.7 on page 41*).

Display (B)

Menu navigation is presented on a colour display. The backlight switches OFF after 60 seconds of user inactivity and back ON when the cursor pad (C) is pressed. The display should not be exposed to prolonged direct sunlight.

Cursor pad (C)

The cursor pad is used to navigate through the menus and enter parameters. The cursor pad offers five input options:

▲ cursor up

◄ Cursor left OK key Cursor right ►

▼ cursor down

Figure 9: Cursor pad

- [◄] [►] Left/right cursor keys
  - navigate between menus
  - navigate in config parameters
- [▲] [▼] up/down cursor keys
  - navigate in menus
  - edit config parameters

- [**OK**] key
  - opens menu item
  - opens config parameters or view
  - confirms settings

Status LED (D)

This LED indicates the present status as one of the four following colours:

- green: Auto mode. Everything OK.
- blue: manual mode
- yellow: Warning. Clarification cycle continuing.
- red: Fault. Intervention necessary. Clarification cycle suspended.

4.2 Display information and menu navigation

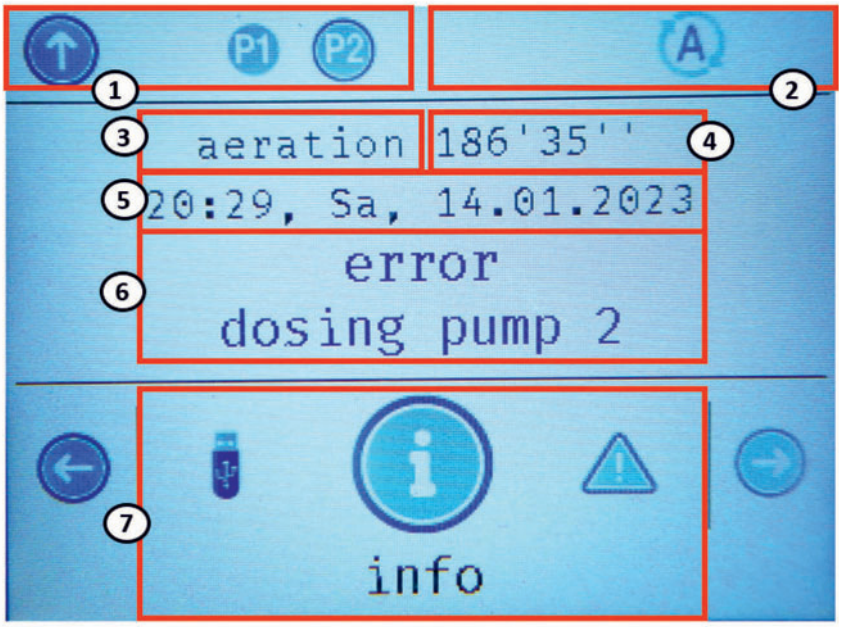


Figure 10: KLcontrol.M graphic display

1. Actions now possible (menu navigation at cursor pad)
2. Status bar (*see Subsection 4.2.1 Status bar symbols*)
3. Current step of the wastewater treatment plant
4. Remaining runtime of the current step
5. Date and time
6. Event bar (fault, malfunction, info) sorted according to relevance (*see Subsection 11.2 on page 99*).
7. Menu selection (*see Subsection 4.2.2 Menu bar symbols*)

4.2.1 Status bar symbols

The controller status appears in the status bar. The displayed symbols also serve as navigation aids through the menu structure. The following symbols are provided:

Symbol	Description
	**Auto mode:** The controller is in auto mode.
	**Manual mode:** Auto mode has been suspended.
	**Pressure sensor 1, pressure sensor 2** (icon without boundary)**:** Pressure sensor has been detected and calibrated to factory default.
	**Pressure sensor 1, pressure sensor 2** (icon with boundary)**:** Pressure sensor has been detected, calibrated on service level, and activated.
	**Service level:** The service menu has been enabled.
	**USB stick:** A USB memory has been inserted and detected.
	**Wireless module:** A wireless module has been connected to KLcontrol. There is no signal.
	**Wireless module:** A wireless module has been connected to KLcontrol. The link to the remote display is active.
	**Communication module:** The communication module's link to the WebMonitor has been detected. On detected activity, either the transmit or receive arrow flashes.

4.2.2 Menu bar symbols

Symbol	Description
	**Information:** This presents e.g. total operating hours, controller settings, and sensor measurements.
	**Events:** This presents information, malfunctions, and errors with time stamps. The max number of messages is 125.
	**Mode:** Manual mode can be activated here.
	Times/date: This is used to set dates, the clock, and holiday periods.
	Settings: Here the user can choose from 25 languages and enter or edit buzzer and display settings.

4 The wastewater treatment system’s control unit

	Service: This is the access area for specialists.
	USB: This is used to update the software, save/load configurations, and save logging data.

4.3 Operating the controller

4.3.1 Menu navigation

1. Using the cursor keys [◄] [►], select the menu you need.
2. Press [**OK**] to open the menu.
3. Using the cursor keys [▼] [▲], select the menu item you need.
4. Press [**OK**] to open the submenu.

■ Press the left cursor key [◄] to exit the menu.

4.3.2 Editing config parameters

1. Open the submenu with the parameters you want to edit.
2. Using the cursor keys [▼] [▲], edit the parameters you want to change.
3. Press [**OK**].
   → The results vary depending on the menu:
   a) the parameter is assigned the new value;
   b) the parameter adopts a green background: Use the cursor keys [▼] [▲] to select a new value, and confirm with [OK].

Date and time settings

1. Open the submenu with the parameters you want to edit.
2. If necessary, use the cursor keys [◄] [►] to navigate to the place you want to edit in the parameter.
3. Using the cursor keys [▲] [▼], edit the parameter.
4. Press [**OK**] to save your edit(s).

4.3.3 Auto return to auto

In auto mode, the control unit switches back automatically to auto mode when no keys have been pressed for longer than two minutes. In manual mode, the control unit switches back automatically to auto mode after ten minutes.

4.3.4 Control unit restart (hardware reset)

■ Press [**OK**] and keep this pressed for at least five seconds.
   → The control unit restarts.
   → All settings and stored data are preserved.

See *Subsection 4.7* for further details.

4.4 Operator menu

4.4.1 Information menu – show operating hours, settings, sensor values

Information	
Operating hours tot.	This presents the total operating hours generated by the outputs. Outputs that have not generated operating hours are hidden. The remaining runtime of the UV lamp is given in brackets.
Operating hours this week	This presents the operating hours generated during the week since midnight on Monday.
Operating hours last week	This presents the operating hours generated during the previous week from midnight on Monday to 11:59 pm on Sunday.
Workload	This presents the utilised capacity of the wastewater treatment plant in level-dependent mode (ratio of treatment cycles actually performed to standard possible treatment cycles in percent)
Show all settings	This presents all settings on the service level. These settings cannot be edited.
Version	This presents the firmware version currently in use
Show current + voltage	This presents the measurements returned by the current and voltage sensors. U_eff (~AC): V applied mains voltage I_eff (~AC): mA current drawn by the 230 V consumers U_out (24 V): mV internal voltage for 24 V consumers I_out (24 V): mA current drawn by the 24 V consumers

Show sensor values	This presents the measurements returned by the pressure and temperature sensors. Pressure sensor P1: mbar Pressure sensor P2: mbar Temperature sensor: °C
Show switches	This presents the status of switching contacts (e.g. for float switches and contactors) X12.9 ON/OFF X12.11 ON/OFF X20.1 ON/OFF

4.4.2 Events menu – show events

 **Events**	
	View of fault memory. Max 125 events are stored. The latest event is placed at the top of the list.

A new event committed to a full memory overwrites the oldest. The events shown are prefixed with <abbreviation> <date> <clock>. The abbreviations are as follows:

- "H" – information
- "S" – fault
- "F" – error

Pressing [**OK**] shows additional information on the selected event, e.g. the event type (information / fault / error), the full event name, and its date and clock time.

An overview of all events can be found in *Subsection 11.2* on *pages 99* ff.

4.4.3 Mode menu

This switches between auto and manual mode.

Operation	
Mode	Switch between auto and manual mode. All assigned outputs are listed. In manual mode, each output can be switched ON and OFF.
Comp. + valve 1–4	Switch compressor in combination with valve 1–4.
Compressor 1	Switch compressor 1 only (without valves).
Valve 1–4	Switch valves 1–4 only (without compressors).
Dosing pump 1–3	Switch dosing pumps 1–3 only.
Cooling fan 1–3	Switch cooling fans 1–3 only.
Warning lamp	Switch external warning lamp only.
Level measuring	Measure level in wastewater treatment plant. Possible only when underload detection has been activated (see *Subsection 9.1*).

4.4.3.1 Actuate consumers in manual mode

1. Using the cursor keys [◄] [►], select the menu “Mode”, and open it with [**OK**].
   → The current mode appears in the topmost line of the “Mode” view.
2. When the control unit is in auto mode, again press [**OK**] to activate manual mode.
   → When manual mode is active, the icon appears in the symbol bar
   → The status LED lights up blue.
   → The treatment cycle is suspended in the background.
3. Each of the consumers can now be selected with the cursor keys [▼] [▲].
   → Only those consumers are visible that have been activated in the controller.
4. To switch ON or OFF the selected consumer, press [**OK**].
5. Leave each consumer switched ON for at least five seconds.
   → Monitoring the valves’ current consumption may take some time. When the consumers are not left switched ON for long enough, faults may escape detection.

6. To revert to auto mode, select the Mode menu with the cursor keys [▼] [▲] and confirm “Auto” with [**OK**].
   - ➝ When auto mode is active, the icon  appears in the symbol bar.
   - ➝ The status LED lights up green.

When active, manual mode allows users to open other menus, e.g. to read the current draws measured for the operating consumers.

The control unit switches back automatically to auto mode when no keys have been pressed for longer than ten minutes. The treatment cycle is then resumed where it was suspended on the change to manual mode.

NOTE

When a consumer is switched to manual mode during the sedimentation phase, the control unit restarts the sedimentation phase from the beginning on reverting to auto mode. This ensures that the sludge deposits reliably and the cycle concludes properly with clear water discharge, etc.

NOTE

A protracted suspension of auto mode may exceed the cycle time, overshooting the start of the next. This next treatment cycle is then lost: The control unit switches to “Cyclepause” mode until the next starting time has been reached.

4.4.4 Times/date menu – set date, clock, holiday period

Times/date	
Setting date + clock	This sets the current date and clock time.
Set holiday period	Set the start and end dates of the holiday period. The holiday period then starts at midnight on the entered starting date and ends at 11:59 pm on the entered end date.
Delete holiday period	Deleting the holiday period.

4.4.4.1 Holiday mode

Holiday mode activates energy saving. Holiday mode does not execute a normal treatment cycle, but provides minimal ventilation to keep the aerated sludge viable. Also, there is no discharge of clear water.

Holiday mode may be activated only when the plant is not supplied with wastewater.

Alternatively, the wastewater treatment plant may simply continue in auto mode. Holiday mode need not be set when the plant is operating in level dependent mode with underload detection. The plant then switches automatically to an energy saving mode when wastewater is no longer being supplied.

4.4.5 Settings menu – languages, buzzer, display settings

Settings			
Language	Select your language for the menus.		
Buzzer	Settings for the acoustic alarm.		
	Buzzer test	ON/OFF	Test acoustic alarm. The buzzer emits an acoustic signal.
	Mains voltage	ON/OFF	Suppress acoustic alarm on power failure.
	Events	ON/OFF	Suppress acoustic alarms on detected events.
Display	Display settings		
	Brightness	0–100%	Backlight brightness.
	Backlight off after	0–30 min	The backlight switches OFF automatically after the set time [min].
	Backlight cursor pad.	OFF/blue/red	The cursor pad can be backlit in the colour blue or red.

4.4.6 Service menu – access for specialists

The service level can be enabled when a service code is entered.

When service mode is active, the icon appears. Service mode lets users toggle between service and operator mode without their having to reenter the code.

“Exit menu” again disables the service level. The service level is disabled automatically when no keys have been pressed for longer than three minutes.

Service (code required)	
* * * *	Service code
1 3 1 1	Reset function to restart the control unit. All settings and stored data are preserved. See *Subsection 4.7* for further details.
9 9 9 9	Service calibration for lifter

IMPORTANT

Unqualified changes to service-level settings may prove detrimental to the plant’s correct and reliable operations.

4.4.7 USB menu – software update, maintenance manual

The control unit's face side presents a USB port that can take a storage medium. This USB port lets you:

- update software
- save/load a configuration
- save logging data
- save a maintenance manual

USB	
Software update	This updates the microcontroller's firmware via USB. See *Subsection 4.4.7.3* for further details.
Cycle settings to USB	Transfer a config file with operating parameters from the control unit to USB memory. See below for further details.
Record events	All controller events are recorded and saved to USB.
Record everything	All controller events and sensor measurements are recorded and saved to USB.
Remove safely	To prevent data loss, make sure before removing the memory that data are no longer being written to or read from it.

IMPORTANT

Moisture and dirt may enter the device through an unprotected USB port. For this reason, make sure that after using the face-side USB port it is sealed properly with the rubber cover. Check this rubber cover regularly, and replace immediately when damaged.

4.4.7.1 USB stick requirements:

- FAT32 file system (NTFS not supported)
- Read only OFF
- No partitioning

4.4.7.2 Removing the USB stick safely

To prevent data loss, make sure before removing the memory that data are no longer being written to or read from it.

Execute the menu function "Remove safely" before withdrawing the USB stick.

4.4.7.3 Updating the software

The firmware may be updated only as instructed by the manufacturer (see the provided README file).

Before updating the microcontroller’s firmware, you will first need a USB memory stick containing the manufacturer’s original file.

Back up your data before updating. To do so, save the current configuration and the log book to a USB stick.

IMPORTANT

Incorrectly updated firmware can damage the controller.

- The power supply to the controller may not be disconnected during the update.
- Do not remove the USB stick during the update.

→ Consult the operating instructions provided by the manufacturer.

The update is complete when the controller reboots. During the update, the screen is OFF.

4.4.7.4 Saving/loading a configuration

A config file containing the controller’s settings can be saved to a USB stick or loaded into the controller from the same. Data saved to the stick generates the new file “config.txt”. If the receiving stick already contains a file of this name, this will be overwritten by the data from the controller.

4.4.7.5 Recording

All sensor values are saved every 5 minutes. The Operator menu provides a function to copy these logging data as a CSV file to a USB stick.

There are two logging options:

- **Record everything:** All data from sensors, including pressure and temperature sensors, and all voltages and current measurements, T-steps, remaining times, and occurred events are logged to the USB memory at five-minute intervals.
- **Record events:** Only all occurred events are written to the logging file.

The file name of this log is log.txt. If the USB stick already contains a file with this name, then the names of all successive log files are incremented accordingly as log1.txt, log2.txt, etc.

4.5 Function of the power cut detector

The control unit is equipped with a power cut detector, which is powered via an integrated emergency power supply (buffer). Upon delivery, the emergency power supply is flat, but recharges after the controller has been switched ON. In the event of a power cut, the charge of one emergency power supply for power cut signals will last around 12 hours. If the emergency power supply is not required in response to power cuts, it is prevented from discharging by a switching circuit.

IMPORTANT

If the plant is disconnected from the mains for more than 24 hours, it will be unable to clean the wastewater properly, if at all.

In the event of mains failure, the time / date setting is powered for around 10 days by an extra buffer. All saved data, such as operating hours and program settings, are retained. If the time and date are not set, weekly operating hours for the units are no longer saved. Error messages occurring in the future are saved with the wrong date

4.6 Monitoring the mains voltage

The controller detects failed and excessive mains voltage. It detects an incorrect mains voltage by measuring the input voltage and comparing this with defined limits. The limits defined for an incorrect input voltage are < 90 Veff and > 250 Veff respectively.

Brief outages (e.g. during thunderstorms) are ignored within a certain time delay. After this time, the controller disconnects from its power supply.

- **Action – immediately on incorrect mains voltage:**
  - All relevant data are saved to nonvolatile memory
  - All outputs and the backlight are switched OFF as a measure to protect these and to avoid unnecessary draws on the buffer battery.
  - The error is entered in the log book.
  - If the mains voltage returns to its defined range within 5 seconds, the controller resumes the active cycle. A message is entered in the log book.
- **Action – incorrect mains voltage after 5 seconds:**
  - An intermittent beeping is heard, and the LED flashes red in sync. This beeping can be deactivated in the menu "Settings" → "Buzzer" → "Power failure". In this event, only the LED flashes red.
  - The external warning lamp (if fitted) is not activated.

Once the mains voltage returns to its defined range, the controller is rebooted.

If power has failed for less than 90 minutes, auto mode resumes where it left off. If the power failure equals or exceeds 90 minutes, the clarified water is discharged and then the sludge returned. Afterwards, the controller switches to auto mode.

4.7 Hardware reset

If the controller no longer responds, its hardware must be reset.

■ To reset the hardware, press and keep pressed [**OK**] for 5 seconds.
  → The controller powers down and reboots.
  → When the hardware is reset in auto mode, the program resumes where it left off.

The hardware can also be reset in the menu  "Service" (code 1311).

5 Initial use

The wastewater treatment plant may be put into operation only when all of its components have been installed and connected to the full extent. Before commissioning, confirm that all electrical connections and air hoses have been fitted correctly and firmly!

5.1 Charging the tanks

- Before switching ON the plant, fill all SBR and, if applicable, primary settling chambers/tanks, to the top with fresh water.

5.2 Switching ON the control cabinet

- Control cabinets with main switch: Set the main switch to the position »1«.
- Control cabinets without main switch: Insert the mains power plug into a socket.

The treatment cycles have been preconfigured to factory defaults and can be edited only by a service specialist. During commissioning, “Cyclepause” and its remaining time appear on the display. After this remaining time, the first clarification cycle is initiated.

5.3 Commissioning wizard

The commissioning wizard appears when not all of the parameters have been set prior to delivery (e.g. current data/time).

The wizard queries the basic settings and offers a brief test run. Each query item can be called with [**OK**] or skipped with the down cursor [▼].

Query points:

- **Language**: Select your language for the menus.
- **Date and clock**: This sets the current date and clock time.
- **Cycle settings**: Check and, if necessary, adjust the settings, e.g. PE number and discharge class. The settings are configured at the factory before shipping.
- **Function test**: All valves and compressors are actuated in turn as a means to test the hydraulic function of the lifters and the aeration in the tank. The time setting can be used to define the wait times after which each of the valves are actuated.

Commissioning is concluded only when the function test has completed. If commissioning is not possible, the plant switches to auto mode after a brief time. Commissioning may be repeated at a later date, when the plant must be restarted in service mode (code 1311). Without this code, only the language, date, and time may be set. Cycle settings can be edited only by specialists after entering a service code.

The commissioning wizard can be skipped/aborted at the left cursor key [◄].

5.4 Function tests

- Activate “manual” mode.
  - → In manual mode, tests can be performed on the lifters, aeration, and other connected consumers.
  - → The ventilation bubbles must be consistent and thorough.
  - → The airlift pumps operate only when the tank is sufficiently filled with water.

For further details on these function tests, see *Subsection 4.3 on page 33*.

5.5 Startup behaviour

In general, GRAF wastewater treatment plants require only a short startup phase. The startup phase is the time needed until the biotope generated in the wastewater treatment plant has become adequate to deliver and maintain the required discharge values.

The bacteria are carried in the wastewater into the treatment plant. The plant may also be “inoculated” with aerated sludge taken from another treatment system, but normally this is unnecessary.

The startup phase depends on many factors, including e.g. the wastewater quantity and quality, the water temperature, the intended treatment, etc.

If the intended treatment is based solely on carbon removal (discharge class C), the results are obtained after only a few days. Higher requirements (discharge class N, D) can extend this period to a number of weeks until adequate aerated sludge has formed. Specifically, the bacteria responsible for nitrification grow more slowly.

Usually, the startup phase is shorter in summer than winter because the bacteria multiply more readily at higher temperatures.

The startup phase may generate foaming. This characteristic bacterial foaming has a dull, beige-brownish colour. This foam can pile up on the surface of the water, but cannot impair operations.

6 Operating instructions

The plant must remain switched ON at all times. The sole exception is during maintenance. If the plant is switched OFF for more than 24 hours, it will be unable to clean the wastewater properly, if at all.

Basically, only substances with the characteristics of domestic wastewater may enter the plant. Biocides, toxic substances or substances which are not biocompatible or biodegradable must not, under any circumstances, enter the plant: these will otherwise cause biological process problems. The following are not permitted:

- rainwater from roofs and yards
- infiltration water (e.g. drainage water)
- liquid or solid residue from animal husbandry
- commercial or agricultural wastewater, unless it is comparable to domestic wastewater
- chemicals, pharmaceuticals, mineral oils, solvents
- cooling water
- solids in the form of food waste, plastics and hygiene articles, coffee filters, bottle tops and other domestic items
- milk and milk products
- water discharged from swimming pools
- large volumes of blood
- large quantities of grease or vegetable oils

If larger volumes of grease or plant-based oils are discharged, we would recommend pre-cleaning the wastewater containing the greases/oils with a grease separator upstream of the wastewater treatment plant.
Important: Faeces must not be allowed to enter the grease separator!

The wastewater from commercial kitchens must be pretreated separately in an upstream grease separator. GRAF offers grease separators with nominal sizes up to 15.

General recommendations for cleaning agents:

- Note the recommended doses on the packaging.
- Heed all warnings on the packaging, e.g. “Harmful to aquatic life with long-lasting effects”.
- In most cases, cleaning agents in powder form are more eco friendly than liquids.
- Whenever possible, refrain from using tabs, pods, and toilet fresheners.
- The general rule – “The dose makes the poison” or “It’s the quantity that matters”!

The table below contains a list of substances which must not be disposed of in the wastewater treatment plant:

substances which should not be disposed of via the sink or toilet:	Why not:	Where then:
Ash	Does not break down	Dustbin
Chemicals	Contaminate the wastewater	Collection points
Disinfectants	Kill bacteria	Do not use
Paints	Contaminate the wastewater	Local collection point
Photochemicals	Contaminate the wastewater	Local collection point
Chip fat	Is deposited in pipes and causes blockages	Dustbin
Adhesive plaster	Blocks the pipes	Dustbin
Cat litter	Blocks the pipes	Dustbin
Cigarette butts	Are deposited in the plant	Dustbin
Condoms	Blockages	Dustbin
Corks	Are deposited in the plant	Dustbin
Varnishes	Contaminate the wastewater	Local collection point
Medicines	Contaminate the wastewater	Collection points, pharmacies
Engine oil	Contaminate the wastewater	Collection points, service stations
Waste containing oil	Contaminate the wastewater	Collection points, service stations
Plant protection agents	Contaminate the wastewater	Local collection point
Paintbrush cleaners	Contaminate the wastewater	Local collection point
Cleaning agents, except chlorine-free products (environmentally sound)	Contaminate the wastewater, corrode piping and seals	Local collection point
Razor blades	Risk of injury to staff in the sewage system and treatment plant	Dustbin
Pipe cleaners	Corrode piping and seals, contaminate the wastewater	Local collection point
Pesticides	Contaminate the wastewater	Local collection point
Panty liners	Cause blockages, non-degradable plastic films blight watercourses	Dustbin
Cooking oil	Cause deposits and pipe blockages	Local collection points
Food waste	Cause blockages, attract rats	Dustbin

substances which should not be disposed of via the sink or toilet:	Why not:	Where then:
Wallpaper paste	Causes blockages	Local collection point
Textiles (e.g. nylon tights, cleaning cloths, handkerchiefs etc.)	Block pipes, may paralyse a pump station	Used textiles collection point
Thinner	Contaminates the wastewater	Local collection point
Bird sand, cat litter	Cause deposits and pipe blockages	Dustbin
Cotton buds	Block the plant	Dustbin
Toilet blocks	Contaminate the wastewater	Do not use
Nappies	Block the pipes	Dustbin
Cement water	Is deposited, results in production of concrete	Contact specialist company

7 Operation and maintenance

Almost all operating problems will result in the plant's cleaning capacity being impaired. This must be detected in good time and remedied immediately by the operator or a maintenance specialist.

Before commencing work

- → Prior to all inspection and maintenance work, familiarise yourself with the safety instructions in *Subsection* 2.
- → Read and follow the instructions given in the following.

WARNING

Danger of tripping and falling at open tank covers

- There is a danger of persons or animals falling into the tank. This may result in harm to health, serious injury, or drowning.

→ Secure open tank covers with suitable measures, and never leave them unattended.
→ Keep unassigned persons, in particular children, away from open tank covers.

WARNING

Danger of poisoning and asphyxiation from harmful gases

- Wastewater treatment plants can pose risks to health and life in the form of poisonous, harmful, and asphyxiating gases.

→ Whenever possible, avoid working inside the tank.
→ When entering the tank, do not fail to observe *Safety measures for work inside* the tank in *Subsection 2.4.1*.
→ Never enter the tank without a second, supervising person at the entrance.

7.1 General specifications for maintenance, inspections, and operation

The plant must remain switched ON at all times. The sole exception is during maintenance. If the plant is switched OFF for more than 24 hours, it will be unable to clean the wastewater properly, if at all.

- ➙ Switch OFF the plant for maintenance and repair purposes only, and switch it back ON immediately after this work!
- ➙ Before all work on the mechanical, electrical, and pneumatic/hydraulic components, first set the main switch to the position »0« or disconnect the controller's mains plug.

7.2 Duties of the operator

The operator of a wastewater treatment system is obliged to safeguard its reliable operation and to maintain an operating log book.

This operating log book must list e.g.

- Measured values
- deviations from nominal values
- malfunctions

The water authorities may ask to see this log. Reliable operation requires the operator to conduct the regular inspections listed in the following.

7.2.1 Daily check

- ■ Check that the plant is operating properly.
  - ➙ The illuminated inspection LED is green, and there is no acoustic warning:
    The plant is operating properly.
  - ➙ The illuminated inspection LED is yellow or red:
    The plant is malfunctioning. Immediately remedy the malfunction, or notify your maintenance partner.

7.2.2 Monthly checks

These monthly inspections must be documented.

- Visually check for any sludge leaks, clouding, or discoloration in the discharge
- Visual check for clogged supply and discharge routes
- Read operating hours counter for air compressor (total operating hours), aeration (valve 2), sludge return (valve 4), and if necessary any other units (when fitted), and note in operating log.
- Check the control cabinet's air filter
  - → Check and, if necessary, clean or replace the filter for venting the control cabinet (ventilation grille on left and right in housing wall of internal cabinet or on rear of external cabinet).
  - → To clean or replace the grille, first remove it by hand from the cabinet's outside. The filter mat is not secured in the ventilation shaft and can be shaken and/or blown out. The time at which the air compressor filter is to be cleaned or replaced depends on the extent of contamination caused by the atmospheric conditions of the application. Follow the service documents provided by the compressor manufacturer to check or replace the filter on the compressor.

Figure 11: Opening the ventilation grille 15 x 15 cm

Figure 12: Opening the ventilation grille 32 x 32 cm

- Check the +H module (if existing).
  - → See the operating instructions for the UV module or the operating instructions blue.cycle for chlorination
- Check the +P module (if existing).
  - → Check that the dosing pump is operating properly.
  - → Check the level in the precipitant container.

- Check the Infiltration (if fitted).
  - → Implement preventive measures immediately you detect any signs of failure, e.g. wet surfaces or wastewater backflow in the infeed section.
  - → Remove regularly any buildup in the distributor units and open infiltration areas.

7.2.3 Yearly checks

- Determine the consumption of mains water, and enter this in the operating log book.

7.3 Care and maintenance by a maintenance specialist only.

A specialist must be commissioned to service the plant at least every six months. This is reduced to at least every four months on plants with discharge classes +P and +H. To this end, the plant owner should take out a maintenance contract with a qualified specialist. A maintenance contract may also be stipulated by law.

7.3.1 Maintenance work

- Inspect the operating log book for correct operation (nominal/actual comparison)
- Check the air filter of the air compressor and the supply/exhaust air openings on the control cabinet
- Air compressor maintenance according to details provided by manufacturer (see *Subsection 16*)
- Check that all essential, mechanical, and electrical installations are operating properly, e.g. aerator, lifts, control unit, valves, alarm equipment, and battery in power cut detector
- Only for oneAdvanced: Check level of sludge in the sludge reservoir. If necessary, the operator must arrange for the sludge to be removed (see also instructions in *Subsection 7.5*).
- Carry out general cleaning work, e.g. to remove deposits
- Check the structural condition of the plant
- Check sufficient aeration and ventilation
- Analysis of the aeration basin:
  - → Oxygen concentration (O_2/l > 2 mg); if necessary, adjust compressor operating times
  - → In the one2cleanXtra:
    Sludge volume SV_{30} (< 700 ml/l); sludge volume > 700 ml/l must be removed
  - → In the oneAdvanced:
    Sludge volume SV_{30} (< 400 ml/l); if > 400 ml/l, increase the duration of sludge removal following consultation with the manufacturer
  - → Check that there is an even aeration pattern (bubbling)

- Sampling from discharge and analysis of the following values:
  - → temperature of wastewater
  - → substances that can settle
  - → pH
  - → odour
  - → Colour
  - → depth of visibility
  - → BOD_5 (every other maintenance)
  - → COD value
  - → NH_4-N (if required)
  - → N_{anorg} (if required)
  - → P (if required)

The maintenance work undertaken, any damage found, repairs undertaken and other information should be summarised in a maintenance report by the maintenance company. A suitable template is provided in the Annex. Anything established during the analyses should also be documented in this report. The plant operator should be given the maintenance report so that it can be passed to the responsible authorities if demanded. The maintenance report should be attached to the operating manual. Please keep the operating log in a place where it can be easily accessed.

Plant failures resulting from insufficient maintenance (e.g. of the compressor) will not be covered by free replacement under warranty.

7.4 Sludge measurements

7.4.1 Sludge measurements on the one2cleanXtra

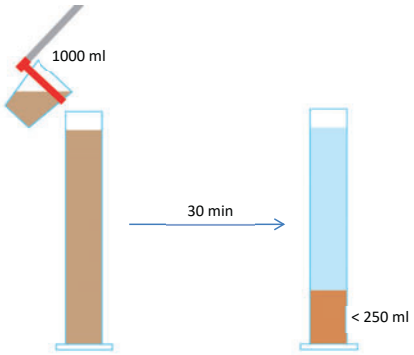
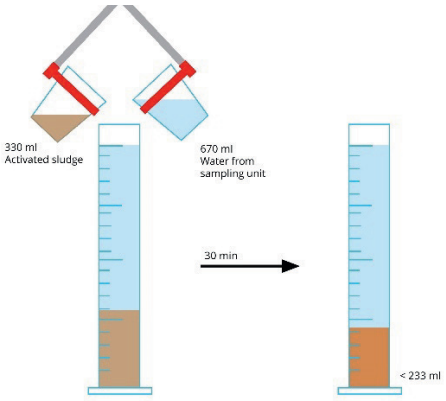
In the one2cleanXtra there is only aerated sludge. Sludge removal is recommended when sludge volume **exceeds 70%**.

A measurement cylinder is used to quantify the sludge (SV30 test). The measurements must proceed as follows:

Preparations:

The ventilation for the aeration basis must be active or switched ON in manual mode. Once the aeration basin has been adequately mixed, a scoop can be used to take a sludge sample.

The measurement cylinders should be placed in a location free of vibrations and shielded from direct sunlight. The one2cleanXtra generally operates with higher sludge contents, so there must be two sets of measurements here:

Double quantification with two measurement cylinders: 1 x undiluted, 1 x diluted	
	
Fill with sludge sample to the 1000 ml mark	Fill with sludge to the 330 ml mark only, then to the 1000 ml mark with water discharged from the sample
After 30 min, read and round off to the nearest 10 ml/l	
< 250 ml/l: Note value > 250 ml/l: Reject measurement, dilute	< 250 ml/l: Multiply value by 3, write down result > 250 ml/l: Result "> 750 ml/l" Write down
Measures: < 250 ml/l: none/OK	Measures: < 700 ml/l: none/OK > 700 ml/l: Have sludge removed, increase aeration
Example:	
Measured result, undiluted: 750 ml/l ➔ Reject 	Measured result, diluted: 190 ml/l ➔ 190 x 3 = 570 ➔ Result: 570 ml/l 

7.4.2 Sludge measurements on the oneAdvanced

With the oneAdvanced, only the sludge in the primary settlement needs to be removed. A distinction is made here between floating sludge and bottom sludge.

Some plants present a distinct layer of floating sludge, others none at all. The bottom sludge is measured with a plunging siphon or level sensor, and the thickness estimated.

Sludge must be removed when bottom and floating sludge together have verifiably filled 50% of the total capacity.

Systems in Carat tanks do not exhibit a linear relationship between fill level and capacity. The following table lists the sludge removal levels.

Carat tank	50% Total volume [cm]
3,750L	66
4,800L	80
6,500L	94

Table 1: Sludge removal levels based on 50% rule

7.5 Sludge must be removed by a specialist only

Over the course of time, sludge starts accumulating in the wastewater treatment plant. On reaching certain limits, this sludge must be removed. When sludge must be removed is decided during maintenance.

Basically:

- Sludge is removed when necessary.
- Sludge must be removed by a specialist following the pertinent, applicable regulations.
- The sludge removal must be confirmed, and this confirmation handed over to the operator.
- Failure to remove sludge promptly will pose an additional stress on the biotope. Adequate cleaning performance is then no longer ensured.
- Needs-based sludge removal is determined by the sludge levels measured during maintenance. Sludge must be removed in compliance with the local provisions.

When the sludge is being removed:

- All preliminary cleaning tanks must be emptied.
- The inlet, overflows, outlet, and vents must be kept clear of floating sludge.
- After they have been emptied and freed of sludge, the tanks must be refilled immediately with water if there is to be no adverse effects on the downstream biological cleaning stage.

Special measure for the one2cleanXtra

- 10 cm of water-sludge mixture should remain in the plant for maintaining the effectiveness of biological cleaning. Make sure there is no damage to the internal components (membrane tube aerators / disc diffusers!)

Procedure:

1. Switch ON aeration in manual mode, and leave to mix briefly
2. Extract to a remaining water level of 10 cm.

8 Service menu for authorised specialist

Configuring the parameters in the Service menu requires specific knowhow.

NOTE

The Service menu is intended for specialists only and is code protected.

- Do not attempt to edit any of the settings here. This may otherwise prove detrimental to the plant's correct and reliable operation.

8.1 Menu overview

Service	
Cycle settings	Treatment system, PE, discharge class, starting times T-settings Output assignments Valve size Restart cycle
Pressure sensor	Level measuring Pressure monitoring
Information	Reset operating hours Delete events
Temperature sensor	Define temperature thresholds
Current measurements	Define maximum/minimum currents for alarms
Maintenance	Organise maintenance
Modules	Configure dosing installations of +P, +C, +H chlorination Configure UV module
Contactor monitoring	Compressor monitoring by means of external motor circuit breakers
Exit menu	Exit and disable service level

8.2 Cycle settings

Service » Cycle settings	
Treatment process settings	Generate table based on process, PE number, and discharge class. The tables can afterwards be viewed and edited in the “T-settings” menu.
	Process There are a number of SBR processes to choose from, as well as “Continuous systems” like e.g. fixed or fluidised beds. SBR 4V: oneAdvanced 4 valves, 4 cycles/day SBR One 3V: 3 valves, 2 cycles/day SBR One 2V: one2cleanXtra, 2 valves, 2 cycles/day SBR MAX 4V KLARO MAX large-scale plants, 4 valves SBR MAX 3V KLARO MAX large-scale plants, 3 valves Flow 2V Continuous systems, 2 valves, day/night cycle Flow 1V Continuous systems, 1 valve, day/night cycle
	System Trade name of wastewater treatment system. The selection does not affect the cycle parameters.
	PE number The PE number affects above all the lifters’ runtime and allows continuous adjustment. The plant size is set prior to shipping (see type plate). The PE can be adjusted to the number of residents.
	Discharge class The selection of discharge class also configures the nitrification and denitrification processes. C Carbon removal. Target parameters: BSB5, CSB, AFS N Nitrification. Target parameters: BSB5, CSB, AFS, NH4N D Denitrification. Target parameters: BSB5, CSB, AFS, NH4N, Ntot D+ Denitrification. Target parameters: BSB_5, CSB, AFS, NH_4-N, N_{tot} (program with interim charging)

Start times	Editing the cycle start times. Each process comes with its own start time defaults. The number of cycles can be edited in the “T-settings” submenu. NOTE The edited start time is adopted only when ALL start times are confirmed with [**OK**].
Valve size	The size of the fitted step motor valves is selected to ensure that the right stroke is executed. These values are ½", 1", and 2".
Restart cycle	After editing the cycle settings, you should afterwards restart the cycle. The current treatment cycle is aborted, and the control unit switches to “Cyclepause” until the next start time is reached. Otherwise, the current cycle is ended with the old settings and then the next cycle with the new ones.
Assigning outputs	The electric components/consumers can be assigned here a control unit output. Preassigned functions and outputs appear, which can be selected and edited. Additional consumers added later must be assigned to the corresponding output if they too are to be addressed by the control unit. See *Subsection 8.2.2* for an overview of the functions and outputs.
T-settings	For viewing and editing each of the T-settings (work steps) and the number of treatment cycles. See *Subsection 8.2.1.1* for further details.

8.2.1 Overview of processes, systems, and discharge classes

There are a total of 7 cleaning processes with up to 4 discharge classes each to choose from.

	1	2	3	4	5	6	7
Process	**SBR 4V**	SBR One 3V	SBR One 2V	**SBR One 3V**	**SBR One 2V**	Flow 2V	Flow 1V
System	**KLARO**	KLARO One	KLARO One	**KLARO One**	**KLARO One**	Logo	Moving bed
	Klaro Easy	easyOne	easyOne	**KLARO One+**	**easyOne**	Fixed bed	Fixed bed
	EPro	one Advanced	one Advanced	**easyOne**	**one2clean Xtra**	Fluid-ised bed	Fluid-ised bed
	Graf prof	one2clean	one2clean	**one2clean Xtra**	**one Advanced**	-	-
	one Advanced	-	EClean	**one Advanced**	**EClean**	-	-
	Demo	Demo	Demo	**Demo**	**Demo**	Demo	Demo
Dis-charge class	**C/N/D/D+**	C/N/D	C/N/D	**C/N/D**	**C/N/D**	C/N	C/N

These instructions describe exclusively plants with two (2V, one2cleanXtra) and four valves (4V, oneAdvanced). These must therefore be selected.

8.2.1.1 Table layouts

The table is divided into work steps, e.g. charging, and runtime calculations. Also the number of cleaning cycles per day can be edited.

All work steps are made up of 3 T-steps. The first T-step of a work step is the total duration of the work step. The two following T-steps specify the activation and deactivation periods within this work step.

Example work step for aeration: T7 = 240 min is the total duration of aeration. Within these 240 minutes, aeration alternates between ON for 6 min (T8) and OFF for 4 min (T9).

Functions	Example values for 5 PE SBR 2V Flow class D	Example values for 14 PE SBR 4V Discharge class C
Charging	X31,	X31, X16.V1
T 1 Σ	0.00 min	13.11 min
T 2 ON	0.00 min	13.11 min
T 3 OFF	0.00 min	0.00 min
Denitrification	X31, X16.V1	X31, X16.V2
T 4 Σ	90.00 min	0.00 min
T 5 OFF	18.00 min	0.00 min
T 6 ON	1.00 min	0.00 min
Aeration	X31, X16.V1	X31, X16.V2
T 7 Σ	480.00 min	232.70 min
T 8 ON	15.00 min	10.00 min
T 9 OFF	5.00 min	10.00 min
Sedimentation	X31, -	X31, -
T 10 Σ	120.00 min	90.00 min
T 11 ON	0.00 min	0.00 min
T 12 OFF	120.00 min	90.00 min
Discharging	X31, X16.V2	X31, X16.V3
T 13 Σ	9.36 min	13.11 min
T 14 ON	9.36 min	13.11 min
T 15 OFF	0.00 min	0.00 min
Sludge return	X31, -	X31, X16.V4
T 16 Σ	0.00 min	1.00 min
T 17 ON	0.00 min	1.00 min
T 18 OFF	0.00 min	0.00 min
Cyclepause	X31, X16.V1	X31, X16.V2
T 19 OFF	30.00 min	15.00 min
T 20 ON	4.00 min	2.00 min
Holiday	X31, X16.V1	X31, X16.V2
T 21 ON	4.00 min	2.00 min
T 22 OFF	30.00 min	15.00 min
Total cycle time	699.36 min	349.93 min
Total Aeration time	12.13 h/d	8.00 h/d
Total runtime	12.44 h/d	9.81 h/d
Cycles per day	2 1/d	4 1/d

Table 2: Layout of cycle tables

NOTE

When settings have been edited in the “Table selection” menu and the menu exited with the left cursor key [◄], the message “Please wait …” appears briefly. The edited settings are saved, and the new table can then be viewed in the “T-settings” menu. A restart is not necessary.

NOTE

Each cycle phase and each work step also shows the outputs used. Example: “Charging: X31, X16.V1” signals that, for charging purposes, output X31 for the compressor and X16.V1 for valve 1 are being addressed. Edits are possible in the menu “Assign outputs”.

NOTE

The T-settings may be edited in steps of one minute. Steps of 0.10 min are also possible for subminute durations. The setting 0.00 min means that the T step is not activated.

8.2.2 Outputs

Prior to shipping, the output functions and assignments have been provided with the defaults listed in the following table. Additional components must be connected accordingly if the control cabinet wiring is to continue complying with the circuit diagrams (clarity).

Function	KLcontrol.M	Note
Valve 1	X16.1	Standard assignments for transport processes with pneumatic lifter via **step motor valves**. Alternatives also include solenoid valves (see *Subsection 9.7*) or submersible pumps (see *Subsection 9.5*).
Valve 2	X16.2	
Valve 3	X16.3	
Valve 4	X16.4	
Function	**KLcontrol.M**	**Note**
Compressor 1	X31	If only one compressor, always select “Compressor 1”
Compressor 2	X32	Runs in parallel to compressor 1. For monitoring, check the current threshold settings.
UV module	X33	
Cooling fan 1	X34	Cooling fan 230 V
Cooling fan 2	X35	Cooling fan 230 V
Pump	X32	For submersible pump, e.g. for secondary buffer. Operating parameters via “reserve module”
Dosing pump 1	X12.7	C module
Dosing pump 2	X12.1	P module
Dosing pump 3	X12.5	Chlorination module
Warning lamp	X12.5	External warning lamp 24 V
Cooling fan 3	X12.3	Cooling fan 24 V
Output 24 V	…	Reserve

Multiple outputs must be interpreted as “either or”. Each output can be used once only.

NOTE

A compressor is assigned as standard to the valves. After confirming your selection, you are prompted with “Deactivate compressor Yes/No”. If pneumatic lifters are to operate, press [◄] “No”. If submersible pumps are to operate, press [►] “Yes”. For the use of submersible pumps, see also *Subsection 9.5* on *page 92*.

8.2.3 Inputs

The KLcontrol.M control unit presents three inputs. These are not managed in the menu “Assign outputs”.

Function	KLcontrol.M	Note
Float switches	X12.9	For their use as “canister empty” monitors, see *Subsection 9.3*; as flooding alarms, see *Subsection 8.2.4*)…
Float switches	X12.11	
Contactor monitoring	X20	See *Subsection 8.2.10*.

8.2.4 Pressure sensor

The control units are fitted with two pressure sensors that can be used to measure the level and/or for monitoring the operating pressure. Before use, a specialist must first perform an on-site calibration (“service calibration”). The functions and their execution are described in *Subsections 9.1 and 9.2*.

Service » Pressure sensor	
Level measuring	Setting the parameters for level-dependent operations. The sensor must be service-calibrated (see *Subsection 9.1.3*).
	Cycle start from 0–999 cm Enter the level above which a cycle is to be started. A value of 0 cm deactivates level measurements, and the plant operations are time-controlled. The factory default is 0 cm.
	Overflow alarm from 0–999 cm Level above which an alarm sounds. Meaningful is e.g. the distance between the tank base and the emergency overflow, or just under. The setting “0 cm” deactivates the fault message “Max level”. It is not necessary for the overflow alarm to be activated for the plant to function correctly.
	Recirculation 0–999 s This selects the duration of the recirculation or the excess sludge lifter’s runtime. We recommend 120 s.

Operating pressure monitoring	This lets you configure the parameters for pressure monitoring (see *Subsection 9.2*).
	Activate Yes/No
	Measured values This reads out the measurements, together with their time stamps, stored for compressor 1, valve 1–4. Saved measurements can be deleted; this does not affect the values from the teach-in phase.
	Limit values This reads out the limit values for compressor 1, valve 1–4 detected during the teach-in phase. If this teach-in phase is still active, the limit values are 0.
	Reset Restart of the teach-in phase.
Lifter calibration	**one2cleanXtra** This starts the service calibration for level measurements via the membrane aerators. Same calibration process as with code 8 8 8 8 (see *Subsection 9.1.4*). **oneAdvanced** The service calibration for level measurements via the charging lifter are also started with the service code 9 9 9 9 (see *Subsection 9.1.4*).

Flooding alarm 2	Level monitoring in any tank by means of a float switch. Exceeding the threshold outputs the fault message S.32 “Flooding 2”. This alarm can be delayed and temporarily suppressed.
	Input Define the input for the sensor: X12.9 / X12.11 The float switch must be an NO switch. Max conductor cross section 1.5 mm² (see circuit diagram for connections).
	Alarm delay 0–999 min This defines a waiting time in the event of false alarms as a result of fluctuating water levels. The alarm is not sounded until the sensor continues signalling after this time has expired.
	Alarm mute 0–99 h This suppresses the flooding alarm for the set time. Before it can be suppressed, the alarm must first be acknowledged (by the operator). After expiry of the suppression time, the alarm is again sounded when the sensor continues signalling. The operator then has time to remedy the overflow and yet is still alerted when the problem persists.

8.2.5 Information

This also lets users manage the operating hours counters and event messages.

Service » Information	
Show wkl. operating hours	This presents for each output the weekly operating hours for the last 53 weeks. Outputs that have not generated operating hours are hidden.
Delete wkl. operating hours	This deletes the weekly operating hours.
Delete all operating hours	This deletes all operating hour totals.
Delete events	This deletes all events (info messages, malfunctions, errors) in the log book.

8.2.6 Temperature sensor

The control unit is fitted with a temperature sensor that measures continuously the temperature inside the control cabinet. The currently measured temperature can be viewed on the operator level in the menu “Information” » “Show sensor values”.

Service » Temperature sensor	
Temp 1: Fan ON	ON temperature of the cooling fan (when fitted). 0–100 °C We recommend 35 °C. The fan switches OFF when the temperature drops below the threshold by 5 °C.
Temp 2: Tmax	Warning of overheating. 0–100 °C We recommend 45 °C. When the set temperature is reached, the message H.7 “Temp 2 max” appears.
Temp 3: Compressor OFF	Emergency shutdown. 0–100 °C We recommend 55 °C. When the set temperature is reached, all current outputs are switched OFF, with the exception of the cooling fan, to protect components against overheating. Power is reinstated when the temperature drops below the set threshold by 5 °C.

8.2.7 Current limits

The control unit's outputs are monitored on the basis of current measurements. The control unit has been provided with minimum and maximum defaults prior to shipping. Threshold violations cause a fault message to appear. The values can be changed manually when necessary. To deactivate the current monitor for an output, set its maximum value to 0.

An output is assigned unambiguously only when this is the only one (24 V or 230 V) active during measurements. If more than one output is active, an error message assumes a general nature.

8.2.8 Maintenance

This menu can be used to organise maintenance schedules and intervals.

Service » Maintenance	
Set service date	Set any date for a maintenance job. The info message "H.1: Maintenance needed" appears on the display as a reminder to the operator.
Maintenance interval	Set regular maintenance (e.g. every six months) 0–12 months The next date is calculated automatically and appears as a service message on this day.
Maintenance interval	Setting a maintenance interval causes the next maintenance date to appear automatically after this interval, also in an optional box.
Service completed	The maintenance performed on this date must be confirmed by the service personnel. This confirmation is entered in the log book.

8.2.9 Modules

This menu can be used to steer and monitor additional modules.

Service » Modules	
C module	Additional dosing from an external carbon source. Setting the operating parameters for dosing pumps. In addition, level monitoring can be activated for the canister (see *Subsection 9.3.4* on *page 88*).
P module	Setting the simultaneous phosphate precipitation in the SBR reactor. Setting the operating parameters for the dosing pumps. In addition, level monitoring can be activated for the canister (see *Subsection 9.3.3* on *page 85*).
Chlorination module	Setting a tertiary cleaning stage for the disinfection of wastewater with a chloride solution. Setting the operating parameters for one or more dosing pumps. In addition, monitoring can be activated for the canister (see *Subsection 9.3.5* on *page 89*).
UV module	Setting a tertiary cleaning stage for the disinfection of wastewater with UVC. Setting the operating parameters for a UV emitter, either with a pump (time controlled) or with a float switch (level controlled). The emitter's maximum service life can be set. After the service life, a message appears prompting the replacement of the emitter (see *Subsection 9.4* on *page 91*).

Redundancy module	Two compressors can be operated in parallel or in turn (on a cyclic or daily basis). If a compressor fails, an event message “Compressor X fault” appears. The plant then continues running with the other compressor.
	Activate OFF/Cyclic/Daily OFF — No alternating operation. Both compressors run in parallel. Cyclic — The compressors alternate each time a new cycle starts. Daily — On a daily basis: The compressors alternate each time a new cycle starts on a new day.
	Output X31, – This shows for inspection purposes the outputs addressed for the compressors.
Reserve module	This sets the start T-step and the runtime for the “Pump” function. This function is suitable e.g. for operating a submersible pump in a secondary buffer (see *Subsection 9.5*).

8.2.10 Contactor monitoring

If higher performance consumers are required, these can also be supplied via a contactor. The increased load is then no longer borne by the controller. This contactor can be monitored via the input at the connector X20.

Activating contactor monitoring deactivates automatically the current monitor for the consumer's original output, irrespectively of the current measuring limits set in the Service menu.

The contactor is monitored with a defined debouncing time. Also contactors activated with 24 V can be used.

 **Service » Contactor monitoring**	
Output	Select the consumer you wish to monitor (e.g. "Compressor 1").
Input X20.1	This presents the input X20.1 provided for contactor monitoring

8.2.11 Exit menu

Execute this function to exit and disable the service menu. To open the service menu, you will need to reenter a service code.

If no key has been pressed for three minutes, the service menu is disabled automatically.

9 Additional controller functions

9.1 Underload detection

Underload detection is deactivated by default. When the plant is started up, it runs in automatic mode regardless of the volume of wastewater flowing in.

Note

We recommend activating this function after a run-in phase of 3 months at the earliest!

KLcontrol.S and KLcontrol.M control units are fitted with a pressure sensor as standard and this can be used to establish the filling level. This function is used to save energy when the flow of wastewater is low.

IMPORTANT

Incorrect settings will cause malfunction

- Incorrect calibration of the plant could cause it to operate constantly in economy mode (with cyclepause). Correct cleaning of wastewater is not then possible.

→ Calibration and level-dependent operation must be activated by a maintenance fitter or expert only.

9.1.1 Function

9.1.1.1 Functions of one2cleanXtra

The water level is measured at adjustable intervals at the start of a cleaning cycle by means of the pressure in the membrane aerator. If the level in the tank exceeds a previously set level ("Level measurement" in service level), the system starts a cleaning cycle. If the set level is not reached, the system automatically goes into cyclepause for the set interval. Only enough oxygen to maintain the biological components is then pumped into the system. The water level continues to be measured during the cyclepause at set intervals. Should sufficient wastewater have again flowed into the system after a certain time, the control unit switches to the normal cleaning cycle once the set level is reached.

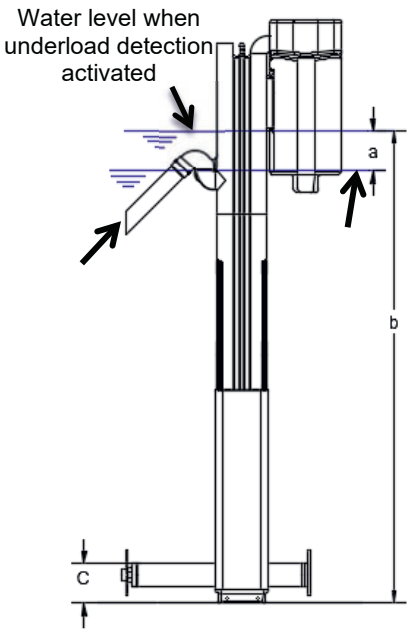


Figure 13: Clear water lifter, levels in SBR reactor

9.1.1.2 Functions of the oneAdvanced

The water level is measured using the pressure in the charging lifter during the charging phase. If the water level in the sludge reservoir/buffer (first chamber) exceeds a preset level (“Level measuring setting”), the plant starts a cleaning cycle. If the level is not reached, the plant goes into cyclepause for 6 hours. The SBR reactor is then aerated only sporadically to maintain the bacterial biotope. If the preset water level is not reached in the first chamber after 4 consecutive measurements, the plant pumps water from the reactor into the first chamber via the excess sludge lifter.

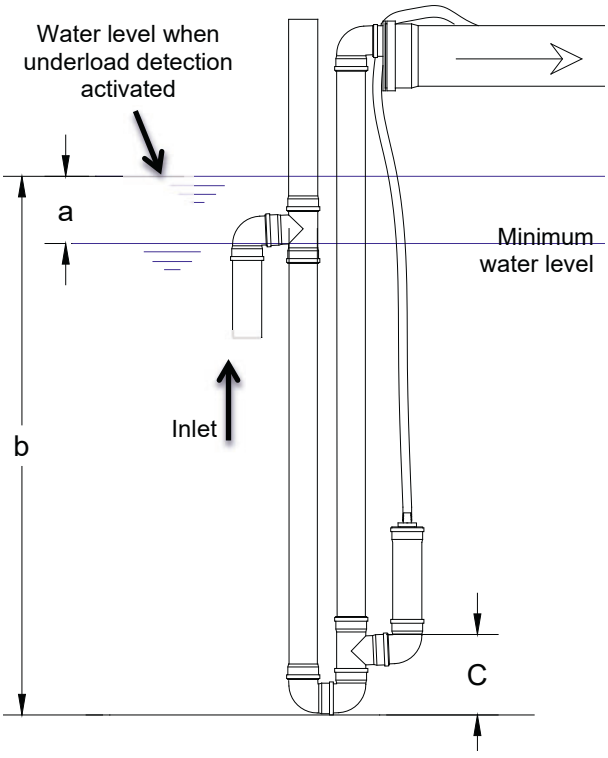


Figure 14: Charging lifter, levels in preliminary cleaning

After pumping back, the plant measures the water level again. After a certain time, new feed is therefore supplied to the reactor even with little or no wastewater supply. The normal cleaning line can therefore be kept for long periods even in the event of absence or underload.

9.1.2 Cleaning cycle queries

The number of cleaning cycles undertaken can be queried using the “Information” item under the “'Utilised capacity” menu. This indicates the cleaning cycles actually undertaken with the cycles performed in automatic mode as a ratio and as a percentage (25% to 100% utilisation).

9.1.3 Calibrating level measuring

Calibrating adjusts the offset for the level's characteristic curve. This involves adjusting the measurements to the height of the airlifter or membrane aerator. Level measuring always makes use of pressure sensor 1.

Calibration can be accessed in the Service menu under "Pressure sensor" or following the entry of the password "8888" (one2cleanXtra) or "9999" (oneAdvanced) for the Service menu.

Before and during calibration, the water level must be measured from the tank base.

Calibration functions

The controller guides the user through the calibration and displays the remaining time and the current pressure. The controller performs 3 measurements. Afterwards, the measured water level must be entered (in cm).

In the event of an implausible input, the value can be reentered or the calibration aborted. If the entry corresponds to the calculated value, the calibration can be saved. The displayed offset is the distance between the tank base and the lifter's or membrane aerator's blow-in point.

9.1.4 Starting level measuring

The one2cleanXtra plant or the first chamber in the oneAdvanced (sludge reservoir/buffer) must be filled with water up to the height at which a cleaning cycle is to be triggered. This level depends on the geometry of the tank and the number of connected inhabitants (PE). The recommended buffer heights *b* (*see Figure 14*, *page 76*) above the minimum water level are specified for the various configurations in the table below.

Recommended settings for the buffer height:

Type	**one2cleanXtra**										
PE	**3**	**5**	**7**	**9**	**12**	**15**	**19**	**24**	**32**	**45**	**50**
Type	2700 L	3750 L	4800 L	6500 L	8500 L	10000 L	13000 L	16000 L	22000 L	32000 L	38000 L
b [cm]	100	118	140	165	150	162	172	178	180	182	182

Type	**oneAdvanced**							
PE	**8-10**	**10-14**	**12-16**	**16-22**	**20-28**	**25-32**	**32-44**	**42-50**
Type	4800 L	6500 L	2 x 3750 L	2 x 4800 L	2 x 6500 L	4 x 3750 L	4 x 4800 L	4 x 6500 L
b [cm]	122	142	113	126	146	113	126	146

1. step: Calibrate pressure sensor

It is absolutely essential that the sensor is calibrated for starting up underload detection. Please carefully work through the following points in order.

Measure level	Use a dipstick to measure the level from the bottom of the tank to the water level, and note this. one2cleanXtra: Measure in the SBR reactor oneAdvanced: Measure in preliminary cleaning
Enter service code: *** * * ***	Open the menu “Service”, press [**OK**], and enter for the calibration the following code: one2cleanXtra: 8 8 8 8 oneAdvanced: 9 9 9 9
Calibrate **◄ No Yes ►**	Using the cursor keys [◄] [►], select “Calibrate Yes”, and confirm with [**OK**] to start calibration.
Measurement underway	3 measurement processes are undertaken automatically.
000 cm **Current level**	Enter the level you have measured, and confirm this with [**OK**]. Measuring the level: On oneAdvanced plants, measurements must be taken in the first chamber or tank.
Save **◄ No Yes ►** **Offset XX cm**	This offset is the distance *c* between the tank base and the lifter’s blow-in point (for lifter calibration). Using the cursor keys [◄] [►], select “Save Yes” to end calibration.

2. step: Set controller parameters

Setting the level from which a treatment cycle is started is absolutely essential for this level function. Please carefully work through the following points in order:

Service **Enter code:** *** * * ***	Open the menu  “Service”, press [**OK**], and, when prompted, enter the general service code.
Pressure sensor » Level measurement	Using the cursor key [▼], select “Pressure sensor”, and confirm with [**OK**]. In the menu “Pressure sensor” now appearing, press [**OK**] to open “Level measuring”.
Cycle start from 000 cm	Press [**OK**] to open the menu “Cycle start from”. Using the cursor keys [▲] [▼], enter the water level *b* above which a treatment cycle is to be started (*see table above*). Confirm your entry with [**OK**].
Overflow alarm from 000 cm	**NOTE** It is not essential for the overflow warning message to be activated for the plant to function correctly. If 000 cm is saved, this warning message remains deactivated. To activate, measure the height between the base of the tank and bottom edge of the emergency overflow in the discharge. Confirm your entry with [**OK**]. → Saving the value 000 cm deactivates the overflow warning message.
Recirculation 120 s (from 10 PE)	Press [**OK**] to open the menu “Recirculation”. Using the cursor keys[▲] [▼], enter the value 120 s, and confirm this with [**OK**]. The necessary settings are now complete. Press [◄] to exit the menu.

3. step: Function check

Level measuring can now be undertaken in manual mode for checking purposes. This requires level measuring to be activated with [**OK**]. The control unit automatically takes a measurement. Once the process is complete, the measured value appears.

9.1.5 Deactivating the level measurement

To deactivate the level measurement and again run the cycles dependent on time, proceed as described under *“Step 2: Set control unit parameters”* in *Subsection 9.1.4*, and set the water level b to 0 cm. The set recirculation can remain at 120 seconds.

9.1.6 Safety and fault messages

If the sensor measures a value below 40 cm, the following message appears on the display: “Fault: Min. level”. If this happens, the plant reverts to the normal time-controlled mode. This is either triggered by too low a water level (≤ 40 cm) in the measuring chamber or a leak in the pressure or measurement line. In this event, we recommend contacting your maintenance company.

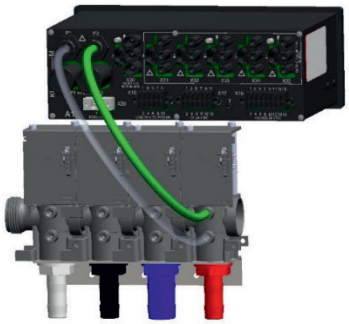
If the sensor measures a value greater than “Warning overflow”, this message appears on the display. If this happens, the plant reverts to the normal time-controlled mode. The cause is either too high a wastewater supply or a clogged clear water lifter. In this event, we recommend contacting the maintenance company.

9.2 Compressed air monitoring

This function lets you monitor the operating pressure in the air distributor for all valves. A pressure measured outside of the normal range causes a warning to appear. The causes of too low a pressure can be a leak or e.g. a pressure hose detached or detaching from the compressor. Too high a pressure may indicate crushed air hoses or problems with the membrane aerators.

9.2.1 Technical requirements

The KLcontrol.M control unit uses automatically pressure sensor 2. This necessitates an additional compressed air line between pressure sensor 2 and the top connector on valve 1.



KLcontrol.M with connection P2

9.2.2 Settings

Compressed air monitoring is decoupled from the actual cycle process. Monitored are compressor 1, valve 1, valve 2, valve 3, and valve 4. Compressed air monitoring switches to one of two states: teach-in phase and monitoring phase:

9.2.3 Teach-in phase

In the teach-in phase, each monitored output returns the pressure values based on the set parameters. At the end of the teach-in phase, these are used to derive a minimum and a maximum limit value. If the menu does not present a minimum and maximum value, the controller is still in the teach-in phase. We recommend setting the teach-in phase to thirty days.

9.2.4 Monitoring phase

The set parameters provide the basis for pressure measurements that are compared with the calculated minimum and maximum values with consideration to the set tolerance. If a measured value exceeds this tolerance, a fault is generated and entered in the log book.

9.3 Dosing installations

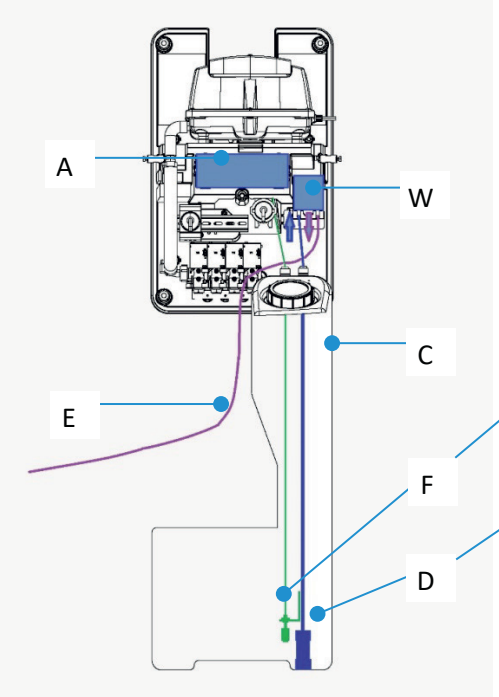
The one2cleanXtra and the oneAdvanced can be fitted with dosing moduls.

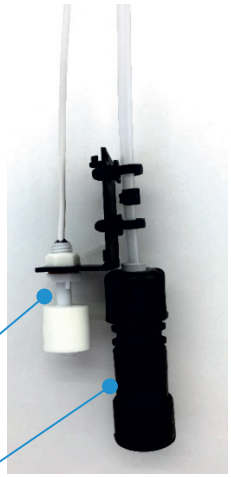
Dosing applications include:

- phosphate precipitation
- dosed carbon additions
- chlorination

The control unit provides a number of components and functions for these applications.

9.3.1 Components

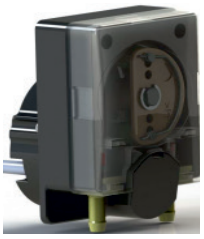




A	Control unit
W	Dosing pump
C	Canister
D	Suction line with base filter
E	Pressure line to wastewater treatment plant
F	Float switch for empty alarm (optional)

9.3.2 Dosing pumps

Two types of dosing pumps are used. These can be fitted with various suction lines for a range of delivery rates. The suction lines fitted as standard are highlighted grey.

Description		DP24	Compact			
Image						
Voltage	[V]	DC 24	DC 24			
Rpm	[rpm]	5	Variable			
Suction line	Type	PS 138-3.2x1.6 PH		PS 138-1.6x1.6 PH	PS 138-3.2x1.6 PH	PS 140-4.8x1.6 PH
I/E diameter	[mm]	3.2/6.4	P	1.6/4.8	3.2/6.4	4.8/8.0
Pump capacity	[ml/min]	4.4	1	0.3	1.1	2.0
			2	1.3	5.0	10.0
			3	3.1	10.9	20.2
			4	4.4	16.3	32.3
			5	5.7	20.6	39.8
			6	7.0	24.9	48.2
			7	8.1	29.1	57.7
			8	9.5	34.9	69.5
			9	11.5	39.9	77.6
			10	12.4	44.0	83.4

9.3.3 Phosphate precipitation with P module

The function and the principle of P precipitation with the P module are described in *Subsection 3.2.4.6* on *page 23*.

9.3.3.1 Control unit settings

Plants with P module are provided with defaults prior to shipping. The settings can be viewed and edited on the service level.

Module » P module	Select “P module” in the module’s submenu.
Output	This presents the control unit’s outputs addressed via the P module. Provided here as standard are “Dosing pump 2” and output “X12.1”.
Modules	Also more than one dosing pump can be operated in parallel via various outputs. The number of pumps is set here (1, 2, 3).
Start with T-step	T-step with which the dosing pump is to start. In principle, all steps from T1 to T22 are possible here. We recommend starting the dosing pump for P precipitation with T07 (aeration phase).
Runtime	The dosing pump’s runtime is set here. Possible are 0–99 min.
Canister monitoring (KIcontrol.M only)	When a float switch is fitted for “canister empty” monitoring, this monitoring can be activated here. This involves selecting the input used. The control unit then signals: “P canister empty”. The treatment cycle and the dosing pump are not suspended. Select “–” to deactivate monitoring.

9.3.3.2 Precipitant

The choice of precipitant depends on availability, pH value, water hardness, concentration of the active ingredient, shelf life, thermal stability, and other factors. Please bear in mind that all of these agents are declared hazardous substances!

There are a number of precipitants available for phosphorus. The most common of these are:

- polyaluminium chloride (PAC)
- iron(III) chloride ($FeCl_3$)
- sodium aluminate

WARNING

Highly corrosive and harmful substances

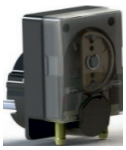
- The precipitant sodium aluminate causes serious chemical burns. This may result in serious injury and damage to eyes.
- The precipitants iron(III) chloride and polyaluminium chloride are harmful to health. There is a danger of severe irritation to skin and eyes. Ingestion can be harmful to health.

→ Wear goggles, protective gloves, and protective clothing.
→ Consult the safety data sheet provided by the manufacturer.

9.3.3.3 Set dosing

The correct dosage of precipitant depends on several factors, e.g. the quantity of dissolved phosphate, the targeted cleaning level, the precipitant used, etc.

During commissioning, the runtime per cycle can be preset according to the values in the table below. We recommend during maintenance to measure the P content in the discharge and to adjust the dosage by adjusting the runtime.

	DP24		Compact		
					
PE	ml/min	Runtime min	P	ml/min	Runtime min
4	4.4	2	1	2	5
5		3			6
6		3			7
8		4			9
10		5			11
12		5	2	10	2
15		6			3
16		7			3
20		8			4
25		10			4
30		12			5
35		15			6
40		17			7
50		21			9

9.3.3.4 Initial use

The precipitant tank must be placed in a frost-proof location (e.g. in the machine cabinet or the plant's dome shaft). The pressure and intake hoses must also be laid in frost-free areas. The pressure hose is to be routed into the SBR reactor and placed inside the reactor with the outlet located above the reactor basin. The precipitant must fall directly into the wastewater to be treated and not dampen any components. Precipitants are aggressive chemicals and may cause damage to components. The outlet must never be submerged in the water!

- Insert the suction hose into the precipitant tank until you are sure it is drawing precipitant from the base.
- Connect the suction and pressure hoses to the pump's hose connectors and lock with union nuts.

9.3.4 Pumped carbon dosing (C module)

Doses added from an external carbon source are described in *Subsection 3.2.4.8* on *page 23*.

9.3.4.1 Control unit settings

Plants with C module are provided with defaults prior to shipping. The settings can be viewed and edited on the service level.

Module » C module	Select “C module” in the module’s submenu.
Output	This presents the control unit’s outputs addressed via the C module. Provided here as standard are “Dosing pump 1” and output “X12.7”.
Modules	Also more than one dosing pump can be operated in parallel via various outputs. The number of pumps is set here (1, 2, 3).
Start with T-step	T-step with which the dosing pump is to start. In principle, all steps from T1 to T22 are possible here. We recommend the following starting procedures: • to support denitrification, to start at commencement of denitrification (T04 denitrification), or before (01 charging) • on underload T07 (aeration phase)
Runtime	The dosing pump’s runtime is set here. Possible are 0–99 min.
Holiday mode	With holiday mode (operator-)activated, added dosing always commences when the cycle start time is reached, and no longer as set in “Start with T-step”.
Canister monitoring	For KLcontrol.M only. When a float switch is fitted for “canister empty” monitoring, this monitoring can be activated here. This involves selecting the input used. The control unit then signals: “C-canister empty”. The treatment cycle and the dosing pump are not suspended. Select “–” to deactivate monitoring.

9.3.4.2 Carbon source

The usual carbon sources serving as nutrient solutions are:

- Brenntaplus VP1 (recommended, available from Otto Graf GmbH: item no. 106556)
- simple alcohols like methanol, ethanol, etc.
- sugar solutions, syrup, molasses, etc.

The choice of carbon source depends on availability, C fraction (how effective is the agent?), shelf life, thermal stability, and other factors. The nutrient solutions are generally harmless and completely biodegradable. Please bear in mind that the nutrient content and the odour may attract vermin (e.g. ants).

9.3.4.3 Dosing

The right C dose depends above all on the application. Approximate or calculated values are therefore first entered for the dose and control unit settings during commissioning. Please refer any questions to GRAF. Maintenance work may then readjust the dosage by changing the runtime.

9.3.5 Chlorine dosing with dosing pump (chlorination module)

9.3.5.1 Function

The biologically purified wastewater may afterwards be treated with a chlorine solution that destroys bacteria and other microbes.

CAUTION

Substances harmful to health

- The liquid chlorine compound (sodium hydrochloride) is harmful to health. There is a danger of severe irritation to eyes and the respiratory tract. Ingestion can be harmful to health.

→ Wear goggles, protective gloves, and protective clothing.
→ Consult the safety data sheet provided by the manufacturer.

9.3.5.2 Control unit settings:

Plants fitted as ordered with the chlorine module are provided with defaults prior to shipping. The settings can be viewed and edited on the service level.

Chlorine modules combined with sand filtration run coupled via a clear water pump. Please note the control settings for submersible pumps instead of airlift pumps (*page 93*). The control settings for these are sent separately with the module and still need to be set.

Modules **Chlorination module**	Select “Chlorine module” in the module’s submenu.
Output	This presents the control unit’s outputs addressed via the Chlorine module. The default here is “Dosing pump 3”. An unassigned output must then be selected.
Modules	Also more than one dosing pump can be operated in parallel via various outputs. The number of pumps is set here (1, 2, 3).
Start with T-step	T-step with which the dosing pump is to start. In principle, all steps from T1 to T22 are possible here. We recommend starting with discharging T13.
Runtime	The dosing pump’s runtime is set here. Possible are 0–99 min.
Input	You can select here the input for a float switch that enables the module to operate in level dependent mode.
Canister monitoring (KLcontrol.M only)	When a float switch is fitted for “canister empty” monitoring, this monitoring can be activated here. This involves selecting the input used. The control unit then signals: “Chlorine canister empty”. The treatment cycle and the dosing pump are not suspended. Select “–” to deactivate monitoring.

The installation, operation, and maintenance of the chlorine module is described in separate instructions.

9.4 UV reactor (UV module)

9.4.1 Function

The biologically purified wastewater may afterwards be treated with UV radiation that destroys bacteria and other microbes. To this end, GRAF offers separate UV modules that can be sited directly in the SBR chamber or a downstream shaft. See also *Subsection 3.2.4.7* for further details.

CAUTION

Danger to health from UV radiation

- UV radiation is harmful to skin and eyes.

→ Operate UV emitters in closed reactors only.
→ Before all repair, maintenance, and cleaning work, first disconnect the UV module from its power supply.
→ Consult the operating instructions provided for the UV module.

9.4.2 Control unit settings:

Plants fitted as ordered with a UV module are provided with defaults prior to shipping. The settings can be viewed and edited on the service level.

Module » UV module	Select “UV module” in the module’s submenu.
Output	This presents the control unit’s outputs addressed via the UV module.
Start with T-step	T-step with which the UV module is to start. In principle, all steps from T1 to T22 are possible here. We recommend starting with discharging T13.
Runtime	The runtime is set here. Possible are 0–99 min.
Input	You can select here the input for a float switch that enables the module to operate in level dependent mode.
Max operating hours	This lets you activate an operating hours countdown. UV emitters are prone to wear. The UV emitters have a service life of 1500 h, after which they must be replaced. When the entered number of operating hours has been reached, the message H.4 “UV operating hours” appears. Select “0 h” to deactivate monitoring.
Reset	After the emitter’s replacement, the counter can be reset.

The installation, operation, and maintenance of the UV module is described in separate instructions.

9.5 Submersible pumps

The control units KLcontrol.M can work together with 230 V submersible pumps. These can be used either in lieu of pneumatic lifters or for an additional transport process (e.g. from a secondary buffer tank).

NOTE

A total current of 10 A is provided for the outputs. Make sure that this total current cannot be exceeded.

9.5.1 Submersible pump in lieu of pneumatic lifters

Here the pump is actuated in lieu of the valve; the starting point and runtime depend on the valve's T-step.

Procedure:

1. Open the menu Service » Cycle settings » Assign outputs.
2. Select the valve you want to replace and the 230 V output (X …) you want to connect to the pump.
   → You are then prompted with "Deactivate compressor Yes/No".
3. Select **"Yes"**.
   → (The compressor is not needed to operate the pump and would otherwise work against the closed valve)
4. Open the menu Service » Current limits » Min current limits.
5. Select the valve you want and set its value to "0 mA".
6. The pump's current monitor is deactivated. Otherwise, deactivation would cause a fault to be signalled by dry running protection (float switch).
7. Open the menu Service » Current limits » Max current limit.
   → The value for the valve to be actuated in lieu of the pump must be set to "5000 mA".

9.5.2 Submersible pump for additional conveying process

The pump is actuated via the reserve module. Starting point and runtime can be selected.

Procedure:

1. Open the menu Service » Cycle settings » Assign outputs.
2. Select the pump and the 230 V output (X …) you want to connect to it.
3. Open the menu Service » Modules » Reserve module, and set the starting point and runtime.
4. Open the menu Service » Current limits » Min current limit.
   → Current monitoring for the "Pump" function is disabled prior to shipping. This setting should therefore be checked to dispel any doubts.
   → The "Pump" value must be "0 mA". Otherwise, deactivation would cause a fault to be signalled by dry running protection (float switch).

9.6 External warning indicator

A warning lamp can be connected to one of the 24 V outputs. The output X12.5 has been configured as the factory default for the warning lamp. The output for the warning lamp is configured in the menu “Service”, “Cycle settings”, “Assign outputs”. The warning lamp is activated at the same time as the buzzer. The warning lamp and the buzzer are switched OFF when the fault message has been acknowledged in the menu.

9.7 Actuate solenoid valves

KLcontrol.M can also be used to operate solenoid valves (230 V) in lieu of step motor valves (24 V).

Procedure:

1. Open the menu Service » Cycle settings » Assign outputs.
2. Select the valve you want and the 230 V output (X32–35) connected to the solenoid valve.
   → You are then prompted with “Deactivate compressor Yes/No”.
3. Select **<No>**.
   → The compressor is necessary and may not be deactivated.
   → The valve and compressor are always switched ON and OFF together.
   → Normally, the current monitor need not be adjusted

10 Electrical connections

WARNING

Hazardous voltage

- Danger from electric shock. An electric shock can cause serious burns and life threatening injury.

→ Only specialised electricians may be assigned to work on the electrical installations and to connect the plant to its power supply.

→ Before all work on the electrical system, disconnect the controller from its power source and secure it against reactivation.

- On removal of the power supply, there may still be voltage across charged capacitors.

→ Wait until the capacitors have discharged!

An onsite all-pole circuit breaker for the mains voltage must be used for the electrical connections. The controller for wastewater treatment plants may be operated in a control cabinet only, which must comply with IP44 or NEMA 3 or higher. All electrical connections to the rear side of this controller must lie inside the control cabinet.

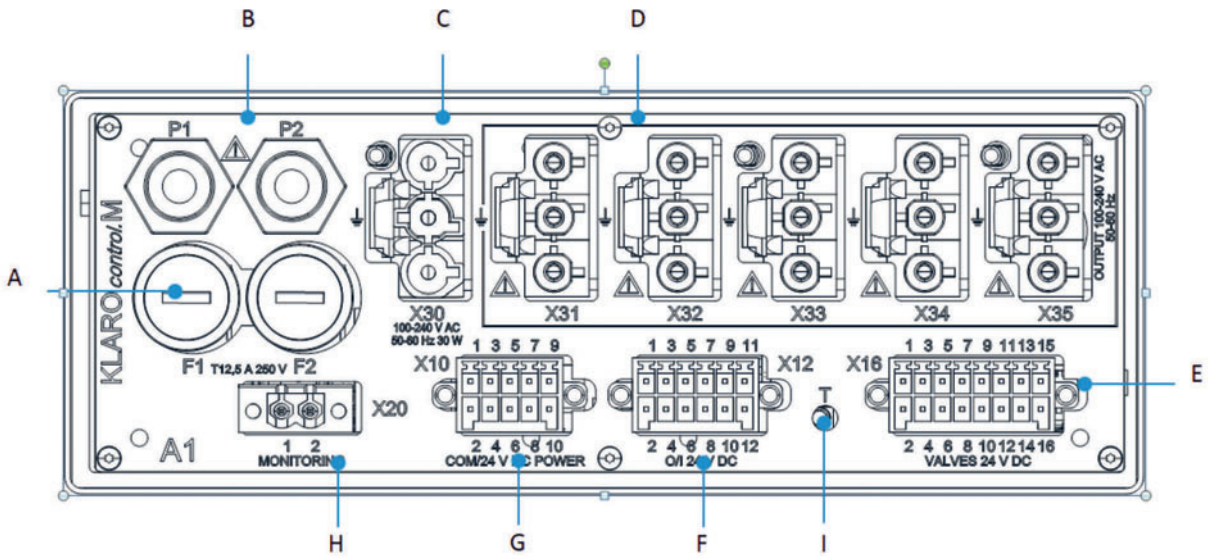


Figure 15: Electrical connections for KLcontrol.M

		KLcontrol.M
A	Microfusing	F1, F2: T12.5 A / 250 V 5x20 mm
W	Pressure sensor	P1, P2
C	Mains IN 230 V	X30
D	Outputs 230 V	X31, X32, X33, X34, X35
E	Valve outputs 24 V	X16 for 4 step motor valves
F	Inputs/outputs 24 V	X12: 4 outputs 2 inputs
G	Serial interface	X10: RS485
H	Contactor monitoring	X20
I	Temperature sensor	D

NOTE

A total current of 10 A is provided for the outputs. Make sure that this total current cannot be exceeded.

The 230 V sockets X30–X35 are fitted with an interlock preventing the plugs from detaching. The plugs must be inserted into the control unit until they click audibly. The plugs can be detached only when this interlock has first been bent open or loosened with a fully insulated screwdriver (e.g. voltage tester).

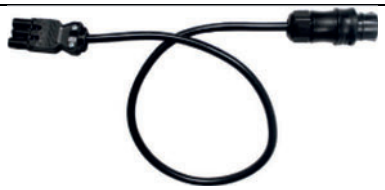
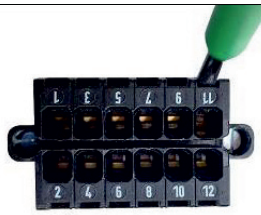
Figure 16: Loosening the claw for the 230 V plug

Figure 17: Opening the terminal

To connect the conductors to the plugs X12 and X20, use a small flat tpi screwdriver to press down the terminal springs (see Figure 17), then insert the conductors into the aperture, and withdraw the screwdriver. The conductors are now clamped tightly.

Before their use, newly connected components must first be assigned their respective function in the menu Service » Cycle settings » Assign outputs (see *Subsection 8.2*).

10 Electrical connections

Cables and connecting plugs on the control unit		
 230 V power cable	 230 V cable for output with safety (Schuko) plug	 230 V cable for output with Phoenix (terminal) plug
 230 V cable for output with plug for solenoid valve	 230 V cable for output (UV module & submersible pump)	 24 V cable for output to step motor valves
 Cable X10 for communication module	 Plug X12 for 24 V inputs and outputs	 Plug X20 for contactor monitoring

11 Fault messages and rectification

Technical plant operation faults (failure of a consumer) are indicated both visually and acoustically. Pressing [**OK**] deactivates the control unit's acoustic fault signal for 10 minutes. The displayed error can be acknowledged when the message is selected with the cursor key [▲] and [**OK**] is pressed.

If the power supply fails, an integrated non-mains-dependent power cut detector emits an alarm which alternates with a visual signal. This fault signal cannot be acknowledged. The acoustic fault signal can be deactivated in advance in the menu  "Settings" > "Buzzer" > "Mains voltage".

Please note: This setting is not reset automatically.

11.1 Power failure

The controller KLcontrol.M for wastewater treatment plants comes with a wide-range power supply delivering alternating voltages of 100–240 V at a frequency of 50–60 Hz. Voltage failure within this range can be safely offset.

In addition, all relevant data are saved to nonvolatile EEPROM in the controller. In other words, these saved data can be retrieved after a power failure or controller reset (if undamaged).

The following data are saved to EEPROM:

- general data (UI language, treatment process settings, current T-step, E number, pressure measuring method, holiday period, etc.)
- calibration data and settings for both pressure sensors
- event memory data (information, error, fault)
- current cycle settings adopted from the cycle editor
- operating hours (valves, UV lamp, phosphate pump, compressor)

11.2 Events in tabular form

events are sorted in ascending order of urgency and divided into information (**H**.xx), faults (**S**.xx), and errors (**F**.xx).

All occurred events appear on the home screen. Events can be deleted with the [**OK**] key in the operator menu. An ongoing event (fault or error only) cannot be deleted. After acknowledgement, the entry remains in the log book.

code	Event	LED	Acoustic alarm	Warning lamp	Clarification cycle
H**.xx**	note	yellow	no	no	continues running
S**.xx**	fault	yellow	yes	yes	continues running
F**.xx**	error	red	yes	yes	stops

11.2.1 Information messages

Information messages refer the operator, service personnel, etc., to mandatory actions. The program continues running normally in the background.

code	Event	Meaning	Measures, remedy
H.1	Maintenance due	Message from maintenance timer, maintenance due	Notify specialist
H.2	Maintenance message acknowledged	Read confirmation from H.1 Entered in log book only.	-
H.3	Service completed	Completed maintenance can be confirmed in the Service menu.	-
H.4	Max operating hours	The UV lamp has reached its maximum operating hours	Notify specialist to replace UV lamp
H.6	System restart	The system has been restarted (software update, power failure). Entered in log book only.	-
H.7	Temp 2: Tmax	Warning of overheating. The entered alarm temperature “Max temp 2” has been exceeded (KLcontrol.M only)	Ensure cooling, e.g. by providing shades for exterior cabinets Test cooling fan in manual mode (if fitted); if necessary, install one Check air filter fleece Notify specialist
H.8	Overflow cycle time	Cycle time too long. Entered in log book only.	-
H.9	Change to cycle settings.	The cycle settings have been edited. Entered in log book only.	-
H.10	Manual mode ON	Manual mode has been activated manually. Entered in log book only.	-
H.11	Mains voltage back	Mains voltage back after power failure.	-

11.2.2 Fault messages

Fault messages appear when the system is not operating properly and needs to be checked. This may require the expertise of a specialist. The program continues running in the background, possibly with restrictions. The status LED lights up yellow, and also a warning tone sounds. Confirmation deactivates the warning tone temporarily. Not until after the fault has been remedied can the event be acknowledged at [**OK**]. An entry is made in the log book.

Note

If you are unable to remedy the fault yourself or at short notice, you can at least disable the acoustic alarm temporarily in the menu “Settings” (see *Subsection 4.4.5* on *page 39*)

Please note: This setting is not reset automatically.

code	Event	Meaning	Measures, remedy
S.1	Max level	The maximum (set) level has been exceeded; the treatment process continues for the purpose of lowering the high water level.	• **Check in the tank for backflow or whether the water level has regulated itself independently** • **If necessary, notify specialist**
S.2	Min level	An unusually low level has been measured; for safety reasons, the treatment plant switches back to purely time-controlled operations and no longer takes any level measurements	• **Check in the tank whether the water level is unusually low** • **If necessary, notify specialist**
S.3 **S.4**	Pressure sensor P1 Pressure sensor P2	The pressure sensor has encountered a problem; the treatment plant switches back to purely time-controlled operations and no longer takes any level measurements; pressure can no longer be monitored.	• **Notify specialist**
S.6 **S.7** **S.8**	Cooling fan 1 Cooling fan 2 Cooling fan 3	Short circuit or break at the fan output	• **Notify specialist**
S.9	Temperature sensor	Temperature sensor defective or not connected	• **Plug sensor firmly in control unit** • **Notify specialist**
S.10	USB	The USB storage medium has encountered a problem. (E.g. defective file system or memory full)	• **Try another USB stick**
S.11 **S.13** **S.15** **S.17**	Min valve pressure 1–4	The compressed air monitor detects an unusually low pressure at valve 1–4. Manual examination necessary.	• **In manual mode, run the compressor with the valve and check for air leaks** • **Notify specialist**
S.12 **S.14**	Max valve pressure 1–4	The compressed air monitor detects an unusually high pressure at valve 1–4. Manual examination	• **In manual mode, run the compressor with the valve**

code	Event	Meaning	Measures, remedy
S.16 **S.18**		necessary.	**and check for any hose kinks or blocked valves** • **Notify specialist**
S.19	Min compressor pressure	Apparently the compressor can no longer build up adequate pressure.	• **In manual mode, test the compressor** • **Notify specialist**
S.20	XX d until plant stops	The control unit prompts for an activation code. Refer to your specialist or the manufacturer.	• **Notify specialist**
S.21 **S.22** **S.23**	C-canister empty P-canister empty Chlorine-canister empty	Canister monitoring of carbon dosing, P precipitation, or chlorine dosing signals an empty tank	• **Check the level in the canister** • **Refill** • **Notify specialist**
S.24 – S.26	Dosing pump 1–3	Short circuit / break at the output for dosing pump 1–3	• **Notify specialist**
S.27	**Warning lamp**	**Short circuit or break at the output for warning lamp**	• **Notify specialist**

11.2.3 Error messages

Error messages appear when the system is not operating properly and needs to be checked. This may require the expertise of a specialist. The program is stopped as a measure to prevent damage. The status LED lights up red, and also a warning tone sounds. Confirmation deactivates the warning tone temporarily. Not until after the error has been remedied can the event be acknowledged at [**OK**]. An entry is made in the log book.

Note

If you are unable to remedy the fault yourself or at short notice, you can at least disable the acoustic alarm temporarily in the menu “Settings” (see *Subsection 4.4.5* on *page 39*).

Please note: This setting is not reset automatically.

11 Fault messages and rectification

code	Event	Meaning	Measures, remedy
F.1 **F.2**	Compressor 1–2	Short circuit or break at the output for compressor 1 or 2	• Test compressor in manual mode • Test compressor at external power supply (wall socket) • Notify specialist
F.3	UV module	Short circuit or break at the output for UV lamp	• Notify specialist
F.4	Pump	Short circuit or break at the output for pump	• Notify specialist
F.9	Reserve module	Short circuit or break at the reserve output	• Notify specialist
F.11 – F.14	Valve 1–4	Short circuit or break at the output for valve 1–4	• Test valve in manual mode • Notify specialist
F.15	Mains voltage	Power failure. The treatment cycle must be stopped. A data backup is made.	• Check power supply • Notify specialist
F.16	Temp 3: Compressor OFF	Emergency shutdown for protecting components against overheating. All power outputs are switched OFF, except for cooling fans. This message is cleared automatically as soon as the temperature returns within its normal range.	• Ensure cooling, e.g. by providing shades for exterior cabinets • Test cooling fan in manual mode (if fitted); if necessary, install one • Check air filter fleece • Notify specialist
F.21	EEPROM	Control unit has encountered memory problem; proper functioning is no longer ensured.	• Notify specialist
F.22	230 V output	Fault on 230 V outputs If more than one mains output is active at the same time, the controller is unable to derive from the total current measurements the precise location of this error.	• Test all fitted 230 V consumers in succession in manual mode • Notify specialist
F.23	24 V output	Fault on 24 V outputs If more than one output is active at the same time, the controller is unable to derive from the total current measurements the precise location of this error.	• Test all fitted 24 V consumers in succession in manual mode • Notify specialist
F.24	Activation required	Control unit is disabled. Activation codes required, Not until the code provided by the manufacturer has been entered in the Service menu can the plant be put back into operation and the message acknowledged.	• Notify specialist

11.3 Unusual water levels– remedying a fault

It is normal that the water levels fluctuate in the chambers of SBR wastewater treatment plant. The water levels depend on the supplied quantity, the time of day, and/or the current step of the treatment cycle.

Observation	Possible cause	Rectification
Unusually low water level making the lifter's inlet visible	• No adequate refilling after sludge removal • Tank leaking	• Continue refilling and observe tank • If necessary, notify specialist
Only for oneAdvanced plants: The water level in the first chamber (preliminary cleaning) reaches to the emergency overflow, but is normal in the aeration section.	• Unusually large supply (e.g. after family party)	• Continue observing water level; it should normalise over the course of one day
	• The charging lifter (valve 1) not activating	• In manual mode, test valve 1 • Notify specialist
	• The runtime set for the charging lifter is too short	• Have the settings checked by a specialist
	• The charging lifter is blocked	• Try to wash the lifter back with a garden hose • Pump off chamber and clean lifter
	• The air supply to the charging lifter is leaking.	• Tighten hose clips according to feeling
The water level in all chambers reaches to the emergency overflow. The plant overflows.	• Plant running in holiday mode although house again occupied	• End holiday mode
	• Plant runs in level dependent mode and "Cyclepause" appears on display although the water levels are high	• Notify specialist to check the level measurements
	• Unusually large supply (e.g. after family party)	• Continue observing water level; it should normalise over the course of one day; otherwise notify specialist
	• Tank's outlet pipe blocked, or infiltration not working	• Test clear water lifter in manual mode and check whether water can discharge • Notify specialist
	• Flooding in the discharging system is not allowing water to drain from the system.	• Wait for flooding to drain away
	• Clear water lifter is blocked	• Try to wash the lifter back with a garden hose • Pump off chamber and clean lifter
	• Air supply to clear water lifter leaking.	• Tighten hose clips according to feeling
	• The runtime set for the clear water lifter is too short	• Have the settings checked by a specialist

11.4 Possible faults on step motor valves

Observation	Possible cause
Valve does not close.	• Rated voltage not present • Motor winding defective • Gears defective • Valve seized
Valve does not open.	• Rated voltage not present • Motor winding defective • Gears defective • Valve seized

11.5 Water quality

In most cases, also nonprofessionals can recognise bad cleaning performance: The discharge water is smelly, cloudy, and discoloured and contains a lot of suspended matter. The cause can be technical problems, overload, or incorrect introduction. Identifying the cause is the job of a specialist with the right knowhow and the right instruments. Consult the information in *Subsection 6 "*Operating instructions*" on page 48*.

11.6 Odours

Operating a wastewater treatment system can give rise to odours. This is predominantly the case in anaerobic conditions (no oxygen dissolved in the water), e.g. in the preliminary cleaning stage. This can form ammonia (NH_3), hydrogen sulfide (H_2S), organic acids, etc.

In all cases, the exhaust air should carry any odours out of the plant and through the roof ventilation. Fully operative roof ventilation is therefore important.

Observation	Possible cause	Rectification
Odours in the building	• Conduit at the cabinet's site not closed properly (when odours in this room)	• Reseal conduit
	• Siphon has run dry; frequently floor drains or other rarely "used" facilities	• Refill with water from a watering can
Odours at the tank	• Technical problem, e.g. too little aeration • Roof ventilation not working properly	• Commission a specialist
Odours only on certain days (e.g. weekends)	• Overload as a result e.g. of many visitors, laundry day, etc.	• Try to distribute the peaks better • Have a specialist identify potential optimisations for the settings
Odours only in sultry weather	• Roof ventilation not working or properly or to capacity (natural phenomenon)	-

11.7 Noise levels

The control cabinet generates noise; specifically, compressor humming (comparable with a refrigerator), cooling fan noise (if fitted), and the control unit's acoustic alarm. The other components are virtually soundless. If you can hear a loud humming or vibration, check whether the compressor has shifted its position in the cabinet and is touching the cabinet wall directly or indirectly (e.g. cables) If necessary, reposition the components or notify a specialist.

12 Disposing of the controller

Electric and electronic products may not be disposed of as domestic or bulky waste and must be collected at a separate site.

Introduce the device to a collecting point provided by your community, and contribute actively to the protection of the environment.

13 Declarations of performance

Declaration of performance one2cleanXtra

Nr. 113/Translation

1. Unique identification code of the product-type	**one2cleanXtra**
2. Type, batch or serial number or any other element allowing identification of the construction product as required pursuant to Article 11(4)	**one2cleanXtra 3 – 50 PE** **Type size and serial number on control cabinet type plate**
3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer	**EN 12566-3:2005+A2:2013: Prefabricated and/or site assembled domestic wastewater treatment plants**
4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11(5)	**Otto Graf GmbH Kunststofferzeugnisse** **Carl-Zeiss-Str. 2-6** **79331 Teningen** **Germany**
5. System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V	**System 3**
6. Name and identification number of the notified body	**PIA - Prüfinstitut für Abwassertechnik GmbH - NB 1739**

7. **Declared performance** (with regard to the harmonised standard EN 12566-3:2005+A2:2013)

	Performance	Test report No.
Cleaning capacity	Nominal organic daily dirt cargo (BOD_5) = 0.06 kg/d per PE. Nominal daily inflow (Q_N) = 150 l per PE.	
Treatment efficiency	COD: 94.8 % 41 mg/l BOD_5: 98.1 % 7 mg/l NH_4-N: 98.3 % 0.5 mg/l N_{tot}: 87.0 % 7.9 mg/ SS: 96.6 % 14 mg/l	PIA2014-216B14.03
Watertightness	Passed	PIA2016-WD-1509-1050.02 / PIA2021-WD-2101-1002.03 (Carat S) PIA2010-WD-AT1005-1027 / PIA2023-WD-2302-1011 (Carat XL) PIA2015-WD-1502-1010.01 (Carat XXL)
Stability	Passed	PIA2016-ST-PIT-1509-1050.02 (Carat S) PIA2023-ST-PIT-2302-1011 (Carat XL) PIA2013-ST-CAL-1302-1010 (Carat XXL)
Durability	Passed	PIA2016-DH-1509-1050.02 (Carat S) CAPE AT 14-218 (Carat XL / Carat XXL)
Reaction to fire	Class E	PIA2016-RF-1509-1050.02 (Carat S) PIA2018-RF-1810-1055 (Carat XL / Carat XXL)
Release of dangerous substances	NPD	

8. **The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 7. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.**

Signed for and on behalf of the manufacturer by:

Ralf Oestreicher
Head of Product Division
-DIY / garden / wastewater treatment-
Teningen, 22.10.2024

Declaration of performance oneAdvanced 10-50 PE

Nr. 47/Translation

1. Unique identification code of the product-type	oneAdvanced 8-10 PE oneAdvanced 10-14 PE oneAdvanced 12-16 PE oneAdvanced 16-22 PE	oneAdvanced 20-28 PE oneAdvanced 25-32 PE oneAdvanced 32-44 PE oneAdvanced 42-50 PE
2. Type, batch or serial number or any other element allowing identification of the construction product as required pursuant to Article 11(4)	type size and serial number on control cabinet type plate	
3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer	EN 12566-3:2005+A2:2013: Prefabricated and/ on-site installations for the treatment of domestic waste water	
4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11(5)	Otto Graf GmbH Kunststofferzeugnisse Carl-Zeiss-Str. 2-6 79331 Teningen, Germany	
5. System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V	System 3	
6. Name and identification number of the notified body	PIA Prüfinstitut für Abwassertechnik GmbH - NB 1739	

7. Declared performance (according to the harmonised standard EN 12566-3:2005+A2:2013)

	Performance	Test report No.
Treatment capacity	Nominal organic daily load (BOD_5) = 0.06 kg/d per PT Nominal hydraulic daily flow (Q_N) = 150 l per PT	
Treatment efficiency	COD: 91.9 % 51 mg/l BOD_5: 95.9 % 12 mg/l NH_4-N: 65.6 % 12.0 mg/l N_{tot}: 62.0 % 21.1 mg/l SS: 94.4 % 20 mg/l	PIA2011-141B15
Watertightness	Passed	PIA2016-WD-1509-1050.02 / PIA2021-WD-2101-1002.03 (Carat S)
Stability	Passed	PIA2016-ST-PIT-1509-1050.02 (Carat S)
Durability	Passed	PIA2016-DH-1509-1050.02 (Carat S)
Reaction to fire	Class E	PIA2016-RF-1509-1050.02 (Carat S)
Release of dangerous substances	NPD	

8. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 7. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

Ralf Oestreicher
Head of Product Division
-DIY / garden / wastewater treatment-
Teningen, 23.10.2024

Declaration of performance one2cleanXtra +P

Nr. 114/Translation

1. Unique identification code of the product-type	**one2cleanXtra +P**
2. Type, batch or serial number or any other element allowing identification of the construction product as required pursuant to Article 11(4)	**one2cleanXtra +P 3-50 PE** **Type size and serial number on control cabinet type plate**
3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer	**EN 12566-3:2005+A2:2013: Prefabricated and/or site assembled domestic wastewater treatment plants**
4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11(5)	**Otto Graf GmbH Kunststofferzeugnisse** **Carl-Zeiss-Str. 2-6** **79331 Teningen, Germany**
5. System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V	**System 3**
6. Name and identification number of the notified body	**PIA - Prüfinstitut für Abwassertechnik GmbH - NB 1739**

7. **Declared performance** (with regard to the harmonised standart EN 12566-3:2005+A2:2013)

	Performance	Test report No.
Cleaning capacity	Biochemical oxygen demand (BOD_5) = 0.06 kg/d per PE. Nominal daily inflow (Q_N) = 150 l per PE.	
Treatment efficiency	COD: 94.7 % 36 mg/l BOD_5: 98.1 % 6 mg/l NH_4-N: 88.7 % 4.6 mg/l N_{tot}: 86.8 % 9.1 mg/l SS: 95.7 % 14 mg/l P_{tot}: 95.1 % 0.4 mg/l	PIA2015-208B15
Watertightness	Passed	PIA2016-WD-1509-1050.02 / PIA2021-WD-2101-1002.03 (Carat S) PIA2010-WD-AT1005-1027 / PIA2023-WD-2302-1011 (Carat XL) PIA2015-WD-1502-1010.01 (Carat XXL)
Stability	Passed	PIA2016-ST-PIT-1509-1050.02 (Carat S) PIA2023-ST-PIT-2302-1011 (Carat XL) PIA2013-ST-CAL-1302-1010 (Carat XXL)
Durability	Passed	PIA2016-DH-1509-1050.02 (Carat S) CAPE AT 14-218 (Carat XL / Carat XXL)
Reaction to fire	Class E	PIA2016-RF-1509-1050.02 (Carat S) PIA2018-RF-1810-1055 (Carat XL / Carat XXL)
Release of dangerous substances	NPD	

8. **The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 7. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.**

Signed for and on behalf of the manufacturer by:

Ralf Oestreicher
Head of Product Division
-DIY / garden / wastewater treatment-
Teningen, 22.10.2024

Declaration of performance oneAdvanced 10-50 PE +P

Nr. 48/Translation

1. Unique identification code of the product-type	**oneAdvanced 8*-10 PE +P** **oneAdvanced 20*-28 PE +P** **oneAdvanced 10*-14 PE +P** **oneAdvanced 25*-32 PE +P** **oneAdvanced 12*-16 PE +P** **oneAdvanced 32*-44 PE +P** **oneAdvanced 16*-22 PE +P** **oneAdvanced 42*-50 PE +P** *Maximum population equivalents (PE) with phosphate removal (+P)
2. Type, batch or serial number or any other element allowing identification of the construction product as required pursuant to Article 11(4)	**Type size and serial number on control cabinet type plate**
3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer	**EN 12566-3:2005+A2:2013: Prefabricated and/ on-site installations for the treatment of domestic waste water**
4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11(5)	**Otto Graf GmbH Kunststofferzeugnisse** **Carl-Zeiss-Str. 2-6** **79331 Teningen/ Germany**
5. System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V	**System 3**
6. Name and identification number of the notified body	**PIA Prüfinstitut für Abwassertechnik GmbH - NB 1739**

7. **Declared performance** (according to the harmonised standard EN 12566-3:2005+A2:2013)

	Performance	Test report No.
Treatment capacity	Nominal organic daily load (BOD_5) = 0.06 kg/d per PE Nominal hydraulic daily flow (Q_N) = 150 l per PE	
Treatment efficiency	COD: 93.1 % 47 mg/l BOD_5: 96.9 % 10 mg/l NH_4-N: 74.7 % 11.0 mg/l N_{tot}: 69.9 % 21.2 mg/l P_{ges}: 94.5 % 0.4 mg/l SS: 96.9 % 11 mg/l	PIA2014-194B16.02
Watertightness	Passed	PIA2016-WD-1509-1050.02 / PIA2021-WD-2101-1002.03 (Carat S)
Stability	Passed	PIA2016-ST-PIT-1509-1050.02 (Carat S)
Durability	Passed	PIA2016-DH-1509-1050.02 (Carat S)
Reaction to fire	Class E	PIA2016-RF-1509-1050.02 (Carat S)
Release of dangerous substances	NPD	

8. **The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 7. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.**

Signed for and on behalf of the manufacturer by:

Ralf Oestreicher
Head of Product Division
-DIY / garden / wastewater treatment-
Teningen, 23.10.2024

14 Maintenance log for GRAF wastewater treatment systems

Location (address): _____

Maintenance company: _____ Date of maintenance: _____

Serial number: _____ Order no.: _____

Plant size: _____ PE Actual Connection _____ PE

Operator's name: _____ Customer no.: _____

Street: _____ Town/city, postcode: _____

Installed by: _____ Commissioning: _____

Will the plant process commercial wastewater too? ☐ No

☐ Restaurant without kitchen ☐ Restaurant with kitchen ☐ Other _____

☐ Grease separator present, NG _____ ☐ Emptying needed

Function check of plant parts important to operation:

☐ Charging / valve 1 (red) ☐ Aeration / valve 2 or 1 (blue)

☐ Clear water lifter / valve 3 or 2 (black) ☐ Excess sludge lifter / valve 4 (white)

☐ Power cut indicator

Air inlet / aeration: ☐ moderate ☐ intensive, circulation clearly visible

Aerator pattern / aeration: ☐ fine bubbles ☐ even

Comments:

Sludge reservoir / buffer (only oneAdvanced)

Sludge height: _____ cm Floating sludge height: _____ cm

☐ The operator should arrange for the cesspit to be emptied.

SBR reactor:

Oxygen concentration: _____ mg/l (normally approx. 4-6 mg/l, at least 2 mg/l)

Sludge as proportion of volume: _____ ml/l (maximum 700 ml/l)

Comments: _____

14 Maintenance log for GRAF wastewater treatment systems

Control unit:

Control unit type: _____ Σ operating hours: _____

Charging lifter (valve 1 oneAdvanced): _____ Aeration (valve 2 oneAdvanced or valve 1 one2cleanXtra): _____

Clear water lifter (valve 3 oneAdvanced or valve 2 one2cleanXtra): _____ Excess sludge lifter (valve 4 oneAdvanced) _____

Comments: _____

Blower:

Blower type: _____ ☐ Blower OK

☐ Change the vane (vane length: mm) ☐ Change the membranes/piston

☐ Filter change ☐ Cooling fan OK

Comments: _____

Time of sampling: Date: _____ Time: _____

Sampling site: _____ ☐ Sampling shaft ☐ SBR chamber

Sample transport: _____ ☐ cooled 4°C ☐ frozen

Air temperature: _____ °C Water temperature: _____ °C

odour	☐ none	☐ weak	☐ strong	☐ rotten	☐ earthy
Colouring	☐ none	☐ weak	☐ strong	☐ beige	☐ brown
Cloudiness	☐ none	☐ weak	☐ strong	☐ opaque	
Floating matter	☐ none	☐ a little	☐ a lot		

Activated sludge _____ kg SOL / m³ P_{total} _____ ml / l

Substances that can settle _____ ml / l pH _____

BOD_5 _____ ml / l COD _____ ml / l

NH_4-N _____ ml / l N_{tot} _____ ml / l

14 Maintenance log for GRAF wastewater treatment systems

Additional comments:

☐ Operating log available.

☐ Maintenance noted in the log.

☐ Programming modified: _____

_____

☐ Fault rectified: _____

☐ Additional comments: _____

_____

To be arranged by the operator:

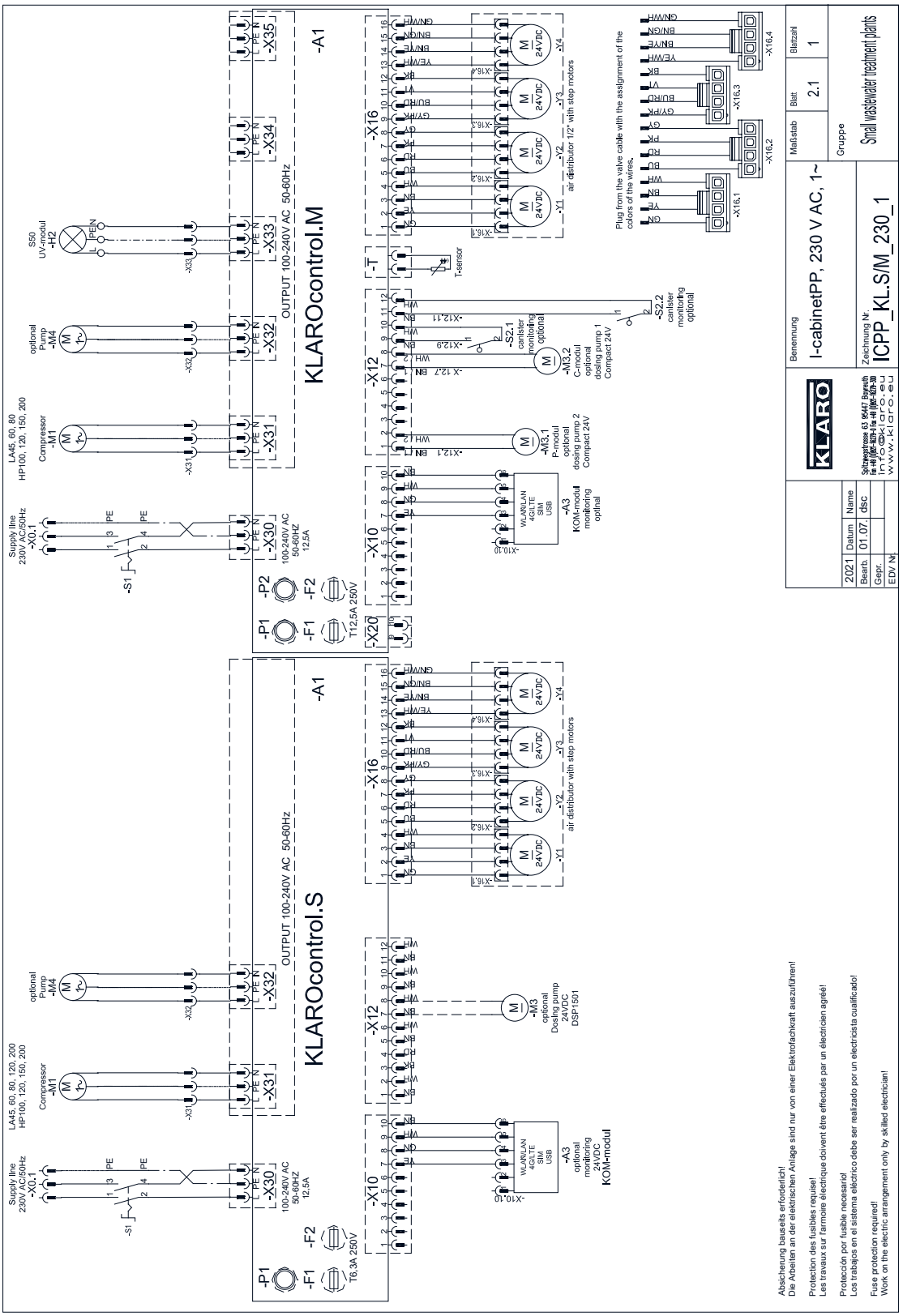
☐ The operator is asked to note the substances which must not enter the plant (see operating manual).

☐ Pit is overflowing, operator must discharge content.

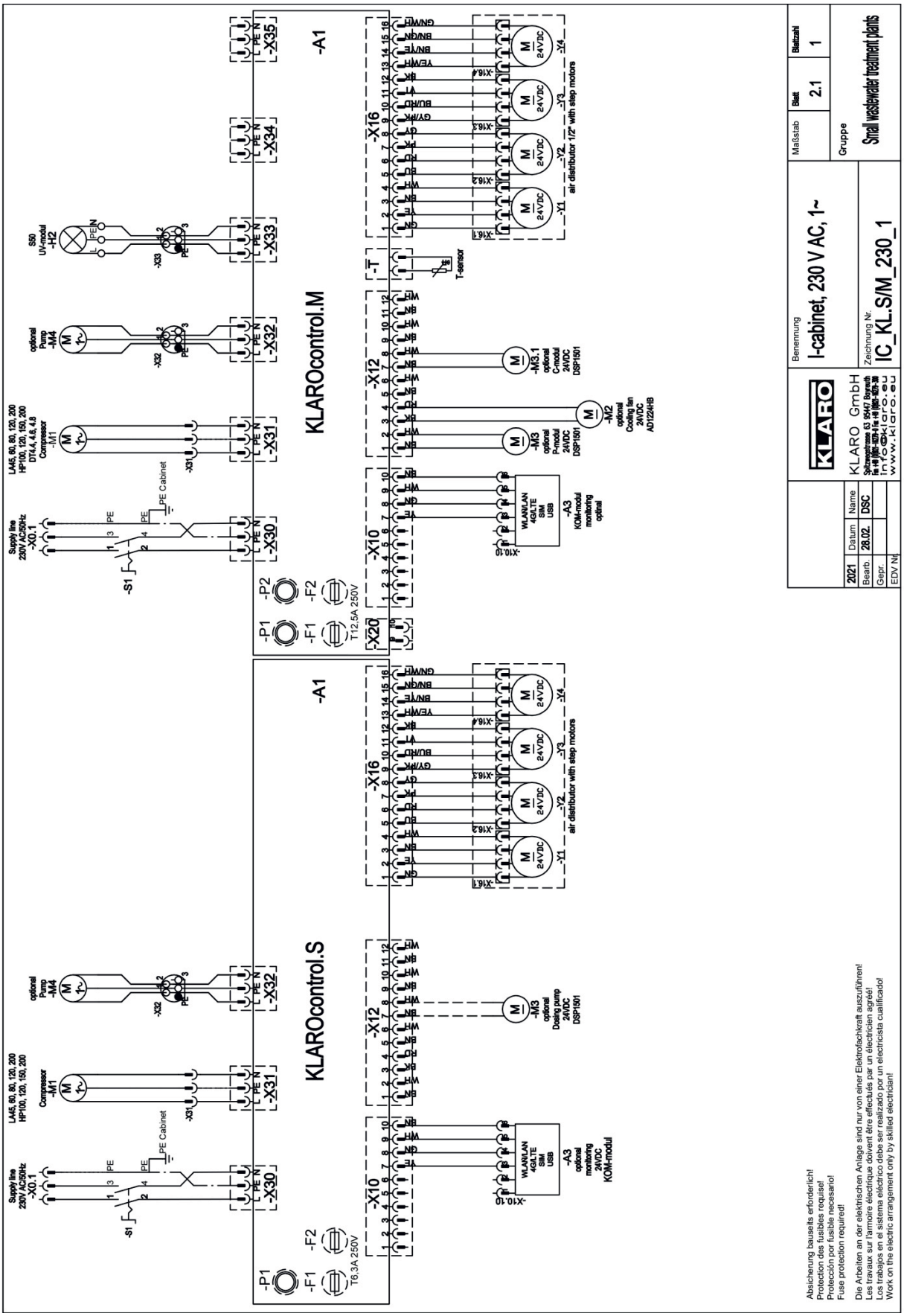
☐ Sludge removal

15 Circuit diagrams

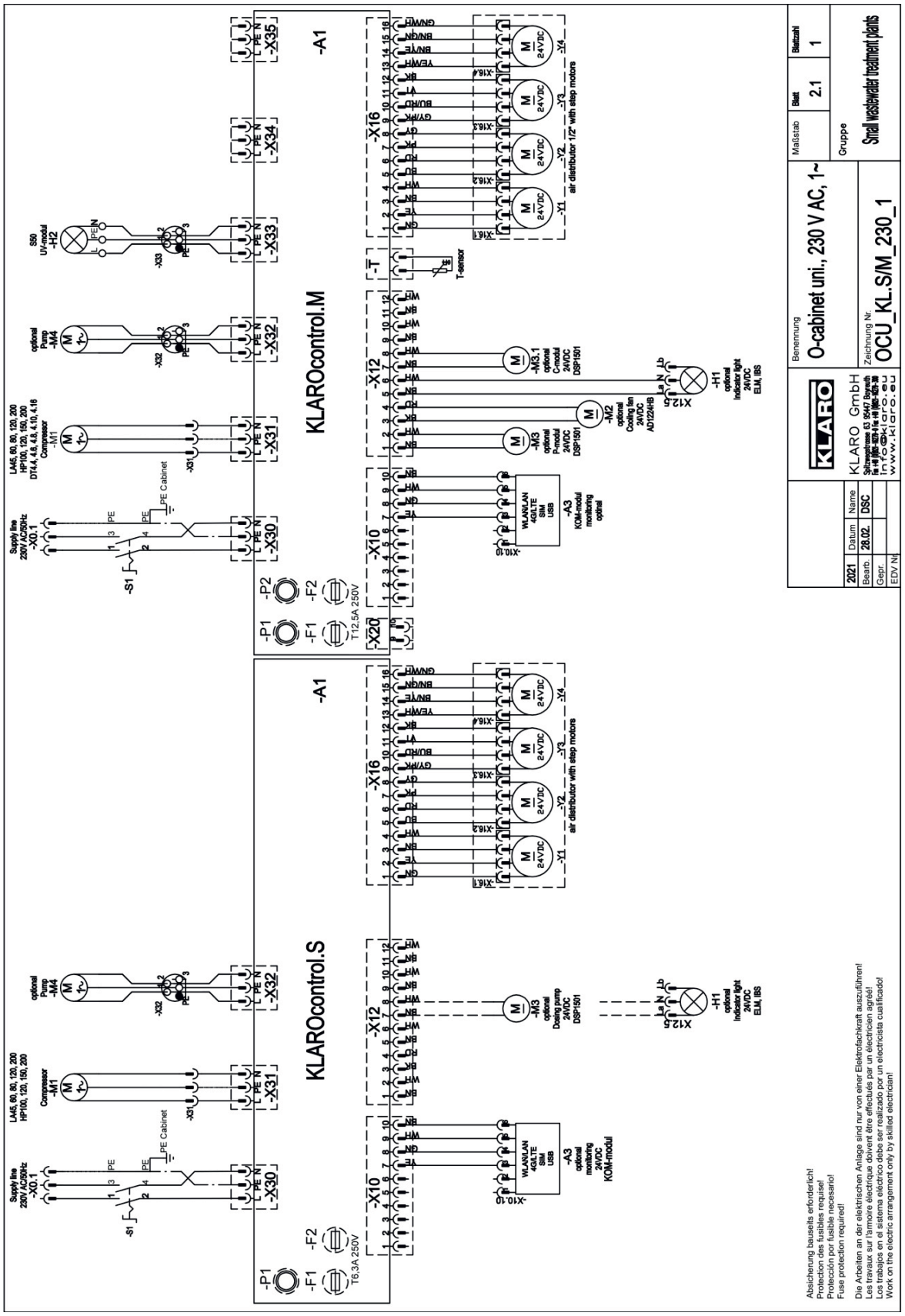
15.1 PP cabinet with KLcontrol.S and KLcontrol.M



15.2 I cabinet (steel) with KLcontrol.S and KLcontrol.M



15.3 E cabinet L (plastic) with KLcontrol.S and KLcontrol.M



16 Maintenance instructions for compressor

16.1 Nitto piston compressor

1. Model and Specifications

Model	LA-28B	LA-45B	LA-60A	LA-80A	LA-100	LA-120
Standard Voltage *	120V AC OR 230V AC					
Rated Frequency	50Hz/60Hz					
Rated Pressure	0.011MPa(0.11kgf/cm²)		0.015MPa(0.15kgf/cm²)		0.018MPa(0.18kgf/cm²)	
Operating Pressure	0.005～0.02MPa (0.05～0.2kgf/cm²)		0.005～0.02MPa (0.05～0.2kgf/cm²)		0.005～0.025MPa (0.05～0.25kgf/cm²)	
Rated Airflow	28ℓ/min.	45ℓ/min.	60ℓ/min.	80ℓ/min.	100ℓ/min.	120ℓ/min.
Power Consumption	29/26W	47/45W	64/60W	86/80W	100/95W	130/118W
Weight	2.9kg	3.0kg	5.0kg	5.3kg	9.4kg	9.4kg

* The unit must only be operated at the voltage as indicated on the outer casing of the blower.

2. Dimensions

LA-28B/LA-45B

LA-60A/LA-80A

LA-100/LA-120

2

3. Safety Instruction

Explanation of Diagrammatic Expressions

The term "Attention" used in this manual is to alert you to dangers such as the following:

Term	Degree of Danger Indicated by The Term
⚠ ATTENTION	This term indicates the possibility that continuing to work while ignoring this "Attention", or working incorrectly without full understanding, may cause personal injury or physical damage.

The Meaning of the Symbols

Symbols

⚠ This symbol advises you of an item which should **BE NOTED** (including Danger and Warning) and the general notes will be shown by a picture, word or explanatory text inside or along the symbol mark.

⊘ This symbol advises you of an action which must **NOT BE TAKEN (IS PROHIBITED)** in order to avoid danger. The general actions which must not be taken will be shown by a picture or explanatory text inside or along the symbol mark.

❗ This symbol advises you of an action which must **BE TAKEN (IS MANDATORY)** in order to avoid danger and the general emphasis of the action which must be taken will be shown by a picture or explanatory text inside or along the symbol mark.

Safety and Opeating Instructions

The following safety precautions should always be followed to reduce the risk of breakdown and/or accident.

⚠ ATTENTION ● ● ● To Prevent Electric Shock And Fire

① Don't install the blower where it will be flooded with water. ⊘
② Electrical work must be done by a qualified electrician. ❗
③ The power supply should be the rated voltage shown on the label on the blower and be fitted with an earth leakage breaker and over current breaker. ❗
④ The power outlet used should be waterproof and include an earth connected to ground. ❗
⑤ If the supply cord is damaged, it must be replaced by the manufacturer or its service agent or similarly qualified person in order to avoid a hazard. ❗
⑥ Don't place any objects on the electric cable. ⊘
⑦ Be sure to unplug the blower before starting maintenance. ⚠
⑧ Be sure to put the Upper Case back after maintenance. ❗ ⚠
⑨ Don't touch the metal part of the blower until it is cooled down as the blower runs very hot. ⊘
Ignoring any of the above may cause an electric shock, a fire or a burn.

3

4. Installation (Septic Tank Application)

1. Installation site selection

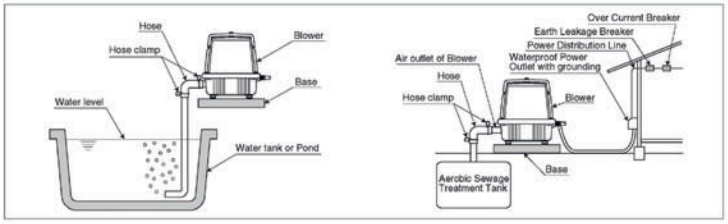
① Install near the septic tank. ⚠
If the pipeline is long, the sewage treatment may not perform well due to an insufficient airflow.
② Install in a place which is convenient for maintenance. ⚠
③ Don't install over a manhole or on soft ground. ⊘
④ Avoid areas where wind-blown leaves and dust gathers. ⚠
⑤ Install in a well ventilated place. ⚠
⑥ Install at least 30cm away from the wall of a house. ⚠
⑦ Installation in the shade is recommended to suppress heat generation of the blower. ⚠
⑧ Don't install the blower where it will be flooded with water. ⊘
⑨ Don't install where there is excess moisture or humidity. ⊘

2. Method of Installation

① The base should be made of concrete strong enough to bear the weight and block vibration from the blower. ⚠
② The base should be at least 10cm above the ground level and 5cm larger than the external dimensions of the blower. ⚠
③ Provide a separate power outlet to be only used for the blower. ❗
④ Electrical work must be done by a qualified electrician. ❗
⑤ The power supply should be the rated voltage shown on the label on the blower and be fitted with an earth leakage breaker and over-current breaker. ❗
⑥ The power outlet used should be waterproof and include an earth connected to ground. ❗
⑦ Place the blower horizontally on the base. ⚠
⑧ A soft rubber hose must be used for connection between the air outlet of the blower and the pipe. ❗
⑨ The rubber hose must be fastened with hose clamps. ❗
⑩ When making the connection, level the air outlet and the pipe to ensure the hose is not kinked or blocked. ❗
⑪ Before starting the operation of the blower, ensure that the water level in the septic tank is appropriate and the valves on the pipeline are properly opened. ⚠

3. Start operation

Insert the power plug into the power outlet with full contact so that the plug itself does not wobble. Incomplete connection may cause and electric shock or a fire.
After starting operation ensure that there is;
No air leakage from the hose and the pipe connection.
No abnormal noise from the blower.
No vibration transmitted to the ground due to strained piping.



5. Maintenance (Refer the sketches on the next page)

1. Cautions

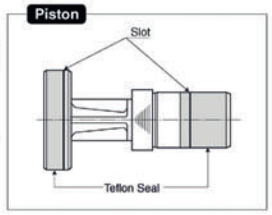
① MEDO blowers are OILLESS. Never lubricate them. ⊘
② All blowers have already been precisely adjusted. Never disassemble them. ⊘
(Do not try to loosen the Hex. Bolts on the Endcap)

2. Replacement of Filter Element

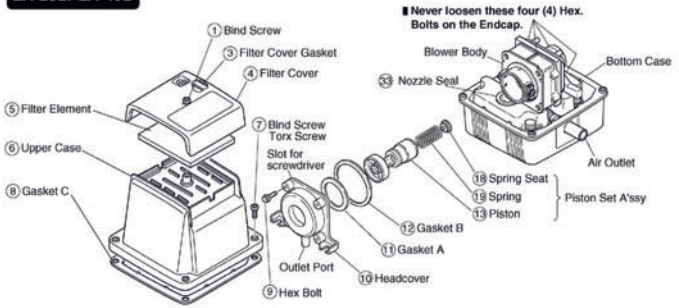
① Be sure to unplug the blower before starting the replacement work. ❗
② Loosen the Bind Screw① and remove the Filter Cover④.
③ Remove the Filter Element(s)⑤ from the Upper Case⑥ and replace with new One(s). At the same time, clean the air inlet of the Filter Cover④ and the Upper Case⑥.
④ Assemble the Filter Cover④ with the Filter Cover Gasket③ securely positioned.
⑤ Mount the Filter Cover④ to the Upper Case⑥, then tighten with the Bind Screw(s)①.
⑥ Time to replace the Filter Element
It is recommended that the Filter Element(s) is cleaned or replaced with new one(s) depending on the extent of its deterioration as determined by the atomospheric conditions around the application. The filter element(s) should be checked every three months.

3. Replacement of Piston Set Assy

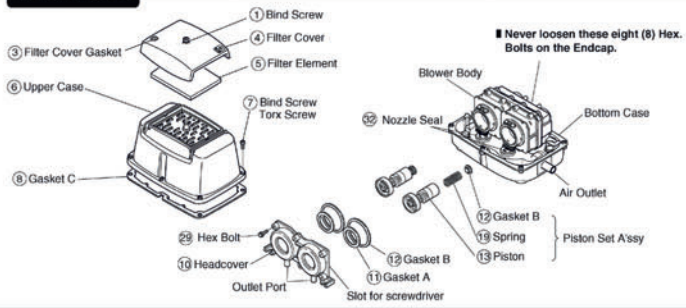
① Be sure to unplug the blower before starting the maintenance work. ❗
② Remove the Upper Case⑥, loosen all the Hex. Bolts⑨ on the Headcover ⑩ and remove it. In case it is hard to remove the Headcover ⑩ insert a flat head screwdriver to the slot(s) on the edge of the Headcover ⑩ and twist the screwdriver gently to open.
③ Take out the Piston Set Assy(s).
④ Replace all Piston Set Assys, Gasket A ⑪ and Gasket B ⑫ with new ones.
Be sure to keep the Teflon Seal of the Piston ⑬ away from any dust, swarf, water, oil or grease. Try not to touch the Teflon Seal of the Piston ⑬ with your fingers.
⑤ Insert the Piston Set Assy(s) into the Pump Body. Install Gasket A ⑪ on the Headcover ⑩ and Gasket B ⑫ on the Pump Body, then fasten the Headcover ⑩ with the Hex. Bolts⑨. Tighten the Hex. Bolts⑨ evenly and alternately then gradually fully tighten.
⑥ Before putting the Upper Case⑥ back, start the blower and check if there is any air leakage along the Headcover ⑩ or the Nozzle Seal(s) ㉝ by briefly blocking the air outlet. In case there is an air leakage along the Headcover ⑩, re-position Gasket A ⑪ and Gasket B ⑫ then re-fasten the Hex Bolts⑨. In case there is an air leakage along the Nozzle Seal(s) ㉝ check if the nozzle seal is installed on the airtank properly and press the pump body down to allow the outlet port of the Headcover to catch the Nozzle Seal(s) correctly.
⑦ Put the Upper Case⑥ back after installing GasketC⑧ on the Bottom Case properly. Fasten the Bind Screws/Torx Screws⑦ evenly and alternately.
⑧ Time to replace the Piston Set Assy
It is suggested that the Piston Set Assy is replaced every 12 to 24 months depending on the extent of pressure and airflow drop of the blower. There is a slot on each Teflon Seal of the Piston. The slot shows the degree of wear. If one or both slots have gone, the replacement of the Piston Set Assy is recommended.



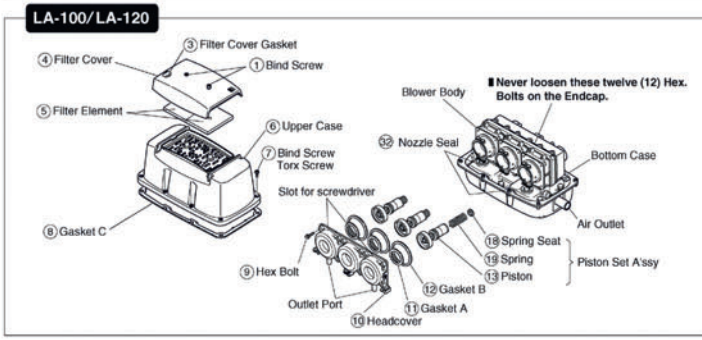
LA-28B/LA-45B



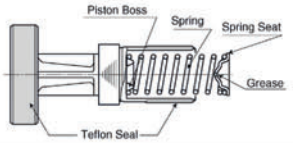
LA-60A/LA-80A



LA-100/LA-120



Piston sectional view



Cautions

- Locat the spring into the piston by rotating it clockwise.
- Check that grease is present on the convex face of the spring seat.
- (If no grease is present, please contact your supplier)
- Never use standard grease as it may cause a malfunction.
- Keep the Teflon Seal away from any dust, swarf, water, oil or grease.

4. Purchasing suggestion for the maintenance parts

① Filter Element

Model	Part No.	Quantity
LA-28B/LA-45B/LA-100/LA-120	LB02369	10pcs.set
LA-60A/LA-80A	LB03937	10pcs.set

② Repair Parts Kit

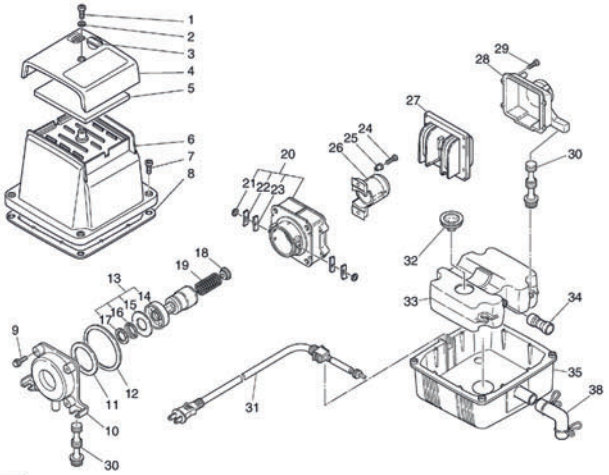
Model	Part No.	Quantity
LA-28B	LB01288	1 set
LA-45B	LB03514	1 set
LA-60A	LB03519	1 set
LA-80A	LB03517	1 set
LA-100/LA-120	LB04151	1 set

③ Contents of Repair Parts Kit

Parts Included	LA-28B/LA-45B	LA-60A/LA-80A	LA-100/LA-120
⑤ Filter Element	1	1	2
⑪ Gasket A	1	2	3
⑫ Gasket B	1	2	3
⑬ Piston	1	2	3
⑱ Spring Seat	1	2	3
⑲ Spring	1	2	3

Exploded View

LA-28B/LA-45B

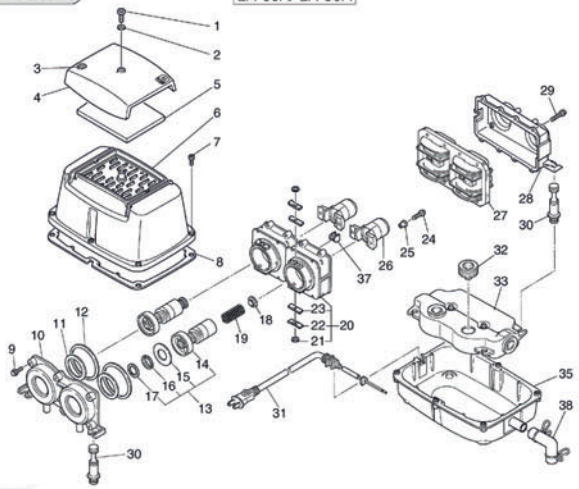


Parts List

No.	Part Name	LA28B	Q'ty	LA45B	Q'ty	No.	Part Name	LA28B	Q'ty	LA45B	Q'ty
1	Bind Screw	LP30581	1	LP30581	1	27	Field Core Assy P	LB01536	1	LB03466	1
2	Seal Washer	LP30635	2	LP30635	2		Field Core Assy Q				
3	Filter Cover Gasket	LQ02607	2	LQ02607	2		Field Core Assy E	LB04038	1	LB04028	1
4	Filter Cover	LQ02575	1	LQ02575	1	28	Endcap	LQ01052	1	LQ02892	1
5	Filter Element	LQ02605	1	LQ02605	1	29	Hex Bolt	LP31316	4	LP31316	4
6	Upper Case	LB02937	1	LB02937	1	30	Rubber Feet	LQ04256	4	LQ04256	4
7	Bind Screw UL	LP30581	4	LP30581	4	31	Cable Assy UK	LB05341	1	LB05341	1
	Torx Screw CE	LQ03082	4	LQ03082	4		Cable Assy D	LB05307	1	LB05307	1
8	Gasket C	LQ02601	1	LQ02601	1		Cable Assy A				
9	Hex Bolt	LP31316	4	LP31316	4		Cable Assy J	LQ01037	1	LQ01037	1
10	Headcover	LQ02567	1	LQ02063	1		Cable Assy UL	LB04770	1	LB04770	1
11	Gasket A	LQ01043	1	LQ01043	1	32	Nozzle Seal	LQ02598	1	LQ02598	1
12	Gasket B	LQ01042	1	LQ01042	1	33	Air Tank Assy	LB02987	1	LB02987	1
13	Piston	LA70625	1	LB03132	1	34	Joint Hose	LQ02602	1	LQ02602	1
⑭	Piston Sub Assy	LA70626	1	LB03133	1	35	Bottom Case	LB02938	1	LB02938	1
⑮	Inlet Valve	LP30916	1	LP30916	1	36	Cushion				
⑯	Valve Retainer A	LP11548	1	LP11548	1	37	Rubber Plug				
⑰	CS Ring	LP12948	1	LP12948	1	OPTION					
18	Spring Seat	LP12155	1	LP12155	1	38	Hose Assy				
19	Spring	LP30620	1	LQ02743	1		LA97475			LB03185	
20	Housing	LB03184	1	LB03184	1						
㉑	SE Ring	LP12475	2	LP12475	2						
㉒	Valve Retainer B	LP13735	2	LP13735	2						
㉓	Outlet Valve	LP10359	2	LP10359	2						
24	Screw 5 x 20	LP12599	2	LP12599	2						
25	Insulation Bush	LP10355	2	LP10355	2						
26	Rear Cylinder	LA71843	1	LA71843	1						

Exploded View

LA-60A/LA-80A



Parts List

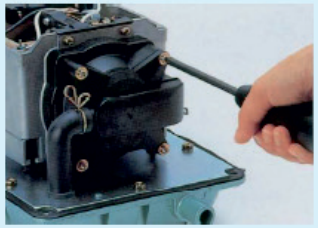
No.	Part Name	LA60A	Q'ty	LA80A	Q'ty	No.	Part Name	LA60A	Q'ty	LA80A	Q'ty
1	Bind Screw	LP30581	1	LP30581	1	27	Field Core Assy P	LB04901	1	LB04905	1
2	Seal Washer	LP30635	2	LP30635	2		Field Core Assy Q	LB05126	1	LB05134	1
3	Filter Cover Gasket	LQ02607	2	LQ02607	2		Field Core Assy E	LB05099	1	LB05048	1
4	Filter Cover	LB03213	1	LB03213	1	28	Endcap	LQ03767	1	LQ03767	1
5	Filter Element	LQ02730	1	LQ02730	1	29	Hex Bolt	LP31316	8	LP31316	8
6	Upper Case	LB04597	1	LB04597	1	30	Rubber Feet	LQ04256	4	LQ04256	4
7	Bind Screw UL	LP30581	6	LP30581	6	31	Cable Assy UK	LB05341	1	LB05341	1
	Torx Screw CE	LQ03082	6	LQ03082	6		Cable Assy D	LB05307	1	LB05307	1
8	Gasket C	LQ03768	1	LQ03768	1		Cable Assy A	LB05220	1	LB05220	1
9	Hex Bolt	LP31316	6	LP31316	6		Cable Assy J	LQ01037	1	LQ01037	1
10	Headcover	LQ03766	1	LQ03773	1		Cable Assy UL	LB04770	1	LB04770	1
11	Gasket A	LQ01043	2	LQ01043	2	32	Nozzle Seal	LQ02598	3	LQ02598	3
12	Gasket B	LQ01042	2	LQ01042	2	33	Air Tank Assy	LB04600	1	LB04600	1
13	Piston	LB03132	2	LB03132	2	34	Joint Hose				
⑭	Piston Sub Assy	LB03133	2	LB03133	2	35	Bottom Case	LB04599	1	LB04599	1
⑮	Inlet Valve	LP30916	2	LP30916	2	36	Cushion				
⑯	Valve Retainer A	LP11548	2	LP11548	2	37	Rubber Plug	LQ03775	1	LQ03775	1
⑰	CS Ring	LP12948	2	LP12948	2	OPTION					
18	Spring Seat	LP12155	2	LP12155	2	38	Hose Assy				
19	Spring	LP30620	2	LQ02743	2		LA97475			LB03185	
20	Housing	LB03184	2	LB03184	2						
㉑	SE Ring	LP12475	4	LP12475	4						
㉒	Valve Retainer B	LP13735	4	LP13735	4						
㉓	Outlet Valve	LP10359	4	LP10359	4						
24	Screw 5 x 20	LP12599	4	LP12599	4						
25	Insulation Bush	LP10355	4	LP10355	4						
26	Rear Cylinder	LB02443	2	LB02443	2						

16.2 Hiblow membrane compressor

HP-100/120 REPLACING THE CHAMBER BLOCK

STEP 4

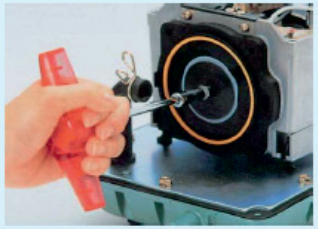
Remove the 4 screws holding the chamber block and the casing block.
(4 screws on each side)



STEP 5

Remove 1 U-lock nuts from one side holding the diaphragm mounting block to the rod.

- Use the nut driver to loosen (or tighten) the U-lock nut.



STEP 6

Remove one of the diaphragm mounting blocks from the actuating rod and pull out the other diaphragm mounting block with the rod. After that, separate the diaphragm mounting block and the rod.

- When pulling out the rod, be sure not to catch the rod projection on the lever of the SP switch.
- If the pump stops automatically, the safety pin must be broken to prevent any further damage to the pump. Be sure all broken pieces are removed from the unit.(See Step 15)

STEP 7 REPLACING THE DIAPHRAGM

In case of replacing the whole diaphragm mounting block, move straight to **STEP 12.**
Remove the diaphragm ring from the diaphragm, and then, detach the diaphragm from the diaphragm base.

HP-100/120 REPLACING THE CHAMBER BLOCK

STEP 8

Fit a new diaphragm and diaphragm ring in the diaphragm base.

- Be sure not to leave a gap between them.

STEP 9 REPLACING THE VALVE

In case of replacing the whole diaphragm casing block, move straight to **STEP 12.**
Separate casing A and casing B.
Remove the valves from the casing B.

- If it is difficult to separate them, insert the tip of a flatblade screwdriver into the clearance.
- Pull out the valves as they can be removed easily.

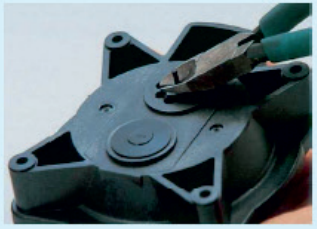
STEP 10

Insert each new valve into the center hold of valve seat, and secure them by pulling with radio pliers.

- When reinstalling the valves, make sure the exhaust and intake sides are correctly fitted.

STEP 11

Cut away end of respective valves pulling parts (just in front of thick parts) by scissors or nippers.



HP-100/120
REPLACING THE CHAMBER BLOCK
STEP 12
FITTING THE CHAMBER BLOCKS
Fit the actuating rod by aligning it with the groove and tighten U-lock nut and flat washer by the nut driver.
• Use new U-lock nut and washer, otherwise, U-lock nut may work loose and cause malfunction.
STEP 13
Insert the actuating rod into the machine body. Be sure to fit the positioning boss on the diaphragm base into the concave part of the frame stay.
Secure the diaphragm mounting block on the other side and tighten washers and U-lock nuts with the nut driver.
Make sure that gap between the actuating rod and the electromagnets is even.
STEP 14
Mount the casing block with screws (4 screws on each side).
And insert L-tube into the nozzle of casing A.
Then, fix it with hose clip.
Complete the other casing block in the same way.
STEP 15
REPLACEMENT OF SAFETY PIN
Check that the broken pin is removed from unit.
• If the broken pin is left inside the unit, it can get caught in between electromagnets and actuating rod, which can cause breakdown.

HP-100/120
REPLACING THE CHAMBER BLOCK
STEP 16
Insert a new safety pin through the hole on the terminal side.
(Please Insert safety pin through the spring electrode, L-shaped lever in such order.)
STEP 17
Install the locking collar from the other side of the terminal and insert it until it clicks.
STEP 18
This completes the replacement of the safety pin procedure.
Make sure the gap between L-shaped lever and tab of the actuating rod is even.
• Be careful not to touch the terminal when the power is on, testing the operating conditions as this will result in an electric shock.
• Unplug the pump immediately after the check.
STEP 19
Secure the frame cover with the screws.

HP-100/120 REPLACING THE ELECTROMAGNET

⚠ CAUTION

- Be sure to unplug the pump unit.
- When performing replacement work, the pump body may still be hot and you could get burned. So please wait until the pump has cooled before handling.
- Be sure to remove the chamber block and the actuating rod before replacing the electromagnet.
- It is better to let an experienced technician handle the soldering process. Take precautions against getting burned.

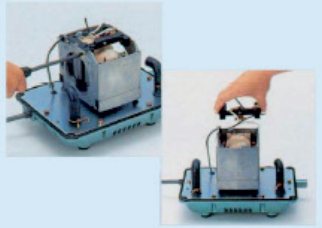
STEP 1 REMOVAL OF ELECTROMAGNET

Cut the wire from the terminals on electromagnets with nippers.

- It is recommended that you make a note of the wiring.

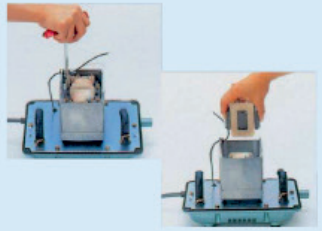
STEP 2

Loosen the screw, fixing SP switch and remove it. (There are hexagonal nuts at SP switch side. Be sure not to lose them as they fall inside the unit.)



STEP 3

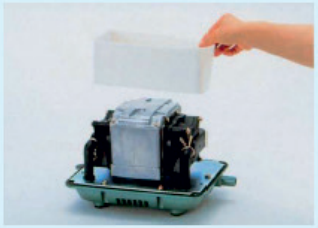
Remove the nuts by the box driver. (8mm wrench)
Pull out the electromagnet from the pump body.



HP-100/120 REPLACING THE CHAMBER BLOCK

STEP 20

Install the sound absorber.



STEP 21

Place the upper housing back on body.

- Be extremely careful not to catch the sound absorber on the upper housing.

Fasten it with the bolts.
Then, place the filter and filter cover on the upper housing. (Refer to "FILTER CLEANING AND REPLACEMENT")

HP-100/120

REPLACING THE ELECTROMAGNET

FITTING THE ELECTROMAGNET

STEP 4

Mount new the electromagnets in the unit.
Tighten up nuts with nut driver.

STEP 5

Install the SP switch to the frame with the screws.

- Be careful of the direction of switch lever. (Refer to the pictures)

STEP 6

Insert the wire into the silicon tube, and tie up in a bundle.
Strip the coating off each wire.
(5~7mm from the end)
Connect the wires to the terminals.
Solder the wires to the terminals.
The wire requires a soldered connection.

STEP 7

This completes the electromagnet replacement procedure.

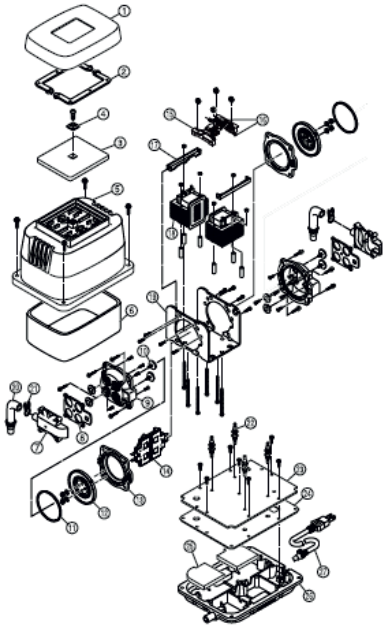
HIBLOW

HP-150/200

Air pump	Start of production	Discontinuance of production
HP-150	2001/9	—
HP-200	2001/9	—

HP Series

STRUCTURE AND PART NAMES



HP-150/200

① Filter Cover
② Semi Cover Packing
③ Filter
④ Fitting Boss
⑤ Upper Housing
⑥ Sound Absorber (Lap)
⑦ Casing A
⑧ Valve Chamber Packing
⑨ Casing B
⑩ Valve
⑪ Diaphragm Ring
⑫ Diaphragm
⑬ Diaphragm Base
⑭ Actuating Rod
⑮ SP Switch
⑯ Safety pin +Locking collar
⑰ Frame Stay
⑱ Electromagnet
⑲ Frame Cover
⑳ L-Tube
㉑ Hose Band
㉒ Vibration Control Rubber
㉓ Center Plate
㉔ Gasket
㉕ Sound Absorber (Filter)
㉖ Lower Housing
㉗ Power Cord

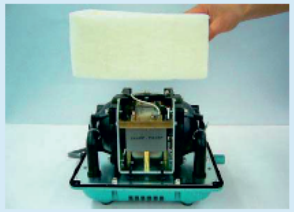
HP-150/200 REPLACING THE CHAMBER BLOCK

⚠ CAUTION

- Be sure to unplug the pump unit.
- Replace the diaphragms and the valves with new ones at least once a year to one and a half year regularly in order to maintain their initial performance.
- For chamber block replacement, be sure to change both chamber blocks at the same time.
- The rod employs powerful permanent magnets. Therefore, be sure to remove your watch and any other precision machines before operation as they may be affected by the strong magnetic force.
- Do not put the actuating rod close to a magnetic card, magnetic disk or other magnetic media as the data may be destroyed.

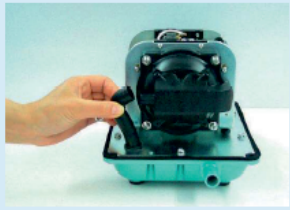
STEP 1 REMOVAL OF THE CHAMBER BLOCKS

To remove the upper housing.
(Refer to "REMOVING UPPER HOUSING")
Remove the sound absorber.



STEP 2

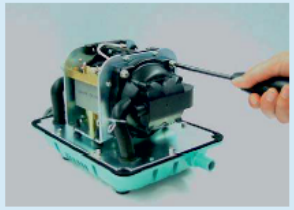
Pull out the L-tube from the casing block.



STEP 3

Remove the 4 screws holding the chamber block and the casing block.

(4 screws on each side)



HP-150/200 REPLACING THE CHAMBER BLOCK

STEP 4

Remove 2 U-lock nuts from one side holding the diaphragm mounting block to the rod.

• Use the nut driver to loosen (or tighten) the U-lock nut.

STEP 5

Remove one of the diaphragm mounting blocks from the actuating rod and pull out the other diaphragm mounting block with the rod. After that, separate the diaphragm mounting block and the rod.

• When pulling out the rod, be sure not to catch the rod projection on the lever of the SP switch.

• If the pump stops automatically, the safety pin must be broken to prevent any further damage to the pump. Be sure all broken pieces are removed from the unit. (See Step 14)

STEP 6 REPLACING THE DIAPHRAGM

In case of replacing the whole diaphragm mounting block, move straight to **STEP 11**. Remove the diaphragm ring from the diaphragm, and then, detach the diaphragm from the diaphragm base.

STEP 7

Fit a new diaphragm and diaphragm ring in the diaphragm base.

• Be sure not to leave a gap between them.

HP-150/200 REPLACING THE CHAMBER BLOCK

STEP 8 REPLACING THE VALVE

In case of replacing the whole diaphragm casing block, move straight to **STEP 11**. separate casing A and casing B, by removing 5 inner screws.
Remove the valves from casing B.

• If it is difficult to separate them, insert the tip of a flathead screwdriver into the clearance.

• Pull out the valves as they can be removed easily.

• Check if the valve chamber packing is broken.

STEP 9

Insert each new valve into the center hold of valve seat, and secure them by pulling with radio pliers.

• When reinstalling the valves, make sure the exhaust and intake sides are correctly fitted.

STEP 10

Cut away end of respective valves pulling parts (just in front of thick parts) by scissors or nippers. Hold the valve chamber packing between casing A and casing B.
Then, fix them with 5 screws.

STEP 11 FITTING CHAMBER BLOCKS

Fit the actuating rod by aligning it with the groove and tighten U-lock nut and flat washer by the nut driver.

• Use new U-lock nut and washer, otherwise, U-lock nut may work loose and cause malfunction.

HP-150/200 REPLACING THE CHAMBER BLOCK

STEP 12

Insert the actuating rod into the machine body. Be sure to fit the positioning boss on the diaphragm base into the concave part of the frame stay.
Secure the diaphragm mounting block on the other side and tighten washers and U-lock nuts with the nut driver.
Make sure that gap between the actuating rod and the electromagnets is even.

STEP 13

Mount the casing block with screws (4 screws on each side).
And insert L-tube into the nozzle of casing A.
Then, fix it with hose clip.
Complete the other casing block in the same way.

STEP 14

REPLACEMENT OF SAFETY PIN

Check that the broken pin is removed from unit.

- If the broken pin is left inside the unit, it can get caught in between electromagnets and actuating rod, which can cause breakdown.

STEP 15

Insert a new safety pin through the hole on the terminal side.
(Please Insert safety pin through the spring electrode, L-shaped lever in such order.)

HP-150/200 REPLACING THE CHAMBER BLOCK

STEP 16

Install the locking collar from the other side of the terminal and insert it until it clicks.

STEP 17

This completes the replacement of the safety pin procedure.
Make sure the gap between L-shaped lever and tab of the actuating rod is even.

- Be careful not to touch the terminal when the power is on, testing the operating conditions as this will result in an electric shock.
- Unplug the pump immediately after the check.

STEP 18

Install the sound absorber.

STEP 19

Place the upper housing back on body.

- Be extremely careful not to catch the sound absorber on the upper housing.

Fasten it with the bolts.
Then, place the filter and filter cover on the upper housing. (Refer to "**FILTER CLEANING AND REPLACEMENT**")

HP-150/200 REPLACING THE ELECTROMAGNET

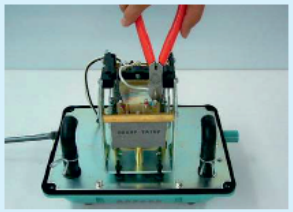
⚠ CAUTION

- Be sure to unplug the pump unit.
- When performing replacement work, the pump body may still be hot and you could get burned. So please wait until the pump has cooled before handling.
- Be sure to remove the chamber block and the actuating rod before replacing the electromagnet.
- It is better to let an experienced technician handle the soldering process. Take precautions against getting burned.

STEP 1 REMOVAL OF ELECTROMAGNET

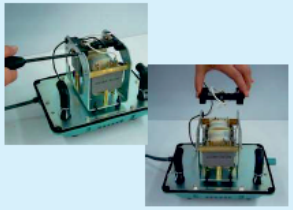
Cut the wire from the terminals on electromagnets with nippers.

- It is recommended that you make a note of the wiring.



STEP 2

Loosen the screw, fixing SP switch and remove it . (There are hexagonal nuts at SP switch side. Be sure not to lose them as they fall inside the unit.)



STEP 3

Remove the hexagonal nuts by the nut driver. (8mm wrench)
Loosen the screw holding the frame stay, and remove it.
Pull out the electromagnet from the pump body.

HP-150/200 REPLACING THE ELECTROMAGNET

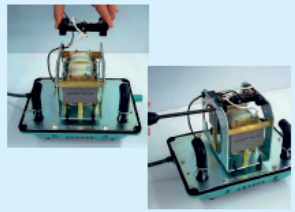
STEP 4 MOUNTING THE ELECTROMAGNET

Mount new electromagnet in the unit.
Fix frame stay temporarily.
(Do not tighten screw of frame stay and keep them rather loose.)
Tighten up hexagonal nuts with nut driver.
Fasten screws of frame stay.

STEP 5

Install the SP switch to the frame with the screws.

- Be careful of the direction of switch lever. (Refer to the pictures)

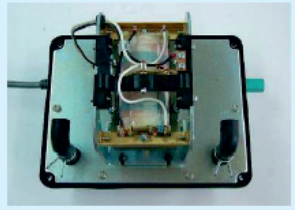


STEP 6

Insert the wire into the silicon tube, and tie up in a bundle.
Strip the coating off each wire.
(5-7mm from the end)
Connect the wires to the terminals.
Solder the wires to the terminals.
The wire requires a soldered connection.

STEP 7

This completes the electromagnet replacement procedure.



16.3 Becker rotary vane compressor

BECKER

1. Warning Notice

High Voltage Only qualified staff may work on electronic components	**High Voltage** according to **ANSI** American, National StandardsInstitute	**Qualified Staff** Marked operations may only be executed by qualified electricians
Automatic Start-Up When servicing the device must be turned off	**Hot Surface** will cause burns. Let device cool down before maintenance	**Note** Ignoring notices will cause severe damage to the pump

2. Interdiction

Pump works without oil Avoid absorption of oil fumes	Marked areas **may not be subject to weight**	**Liquids** may not be conveyed
Explosive substances may not be conveyed	**Flammable Substances** may not be conveyed	**Toxic Substances** may not be conveyed
Assembly Incorrect fitting position		

3. Rules

Wear protective goggles	**Wear protective gloves**	**Wear protective ear-muffs** Sound level information e.g. 85 dB (A)

4. Advice

Active principle Rotary vane pump Only air may be conveyed	**Active principle** side channel fan only air may be conveyed	**Maintenance** Regularly execute the marked procedures
Storing / Assembly Protect pump from humidity	**Assembly** Characteristic data is valid up to 800m above sea level	**Further Information** (optional Data) - name plate - Internet
Specification Vacuum pump	**Specification** Compressor	**Safety valve**
Factory-made Revolving field clockwise as pre-requisite for pump attachment	**Switch interval** Not more than 10x per hour	Arrange Motor-circuit switch
Blow out marked areas with air pressure	**Maintenance interval** Observe minimum gate valve measurement every 3.000 hours	**Filter Maintenance** Service according to dust accumulation exchange old cartridge dispose old

www.becker-international.com

BECKER

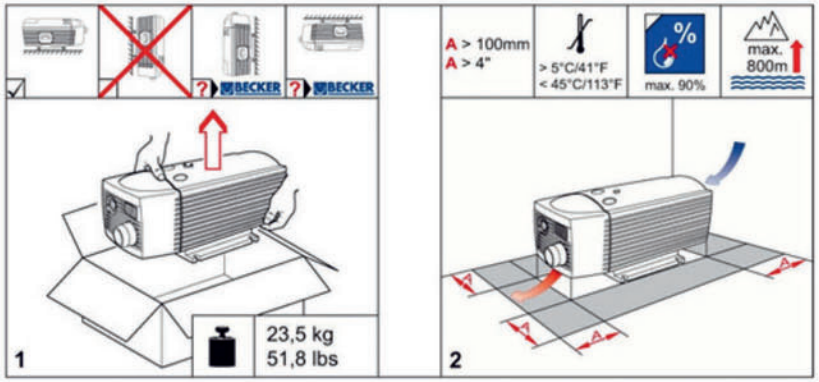
DT 4.16

Betriebsanleitung
Operating Instructions
Instructions de service
Istruzioni d'uso
Handleiding
Instrucciones para el manejo
Manual de instruções
Naudojimosi instrukcija
Kasutusjuhend
Lietošanas instrukcija
Οδηγίες χρήσης
取扱説明書
사용설명서

Driftsinstruks
Driftsinstruktioner
Käyttöohje
Driftsvejledning
Instrukcja obsługi
Kezelési útmutató
Návod k obsluze
Navodilo za uporabo
Návod na obsluhu
El Kitabi
Инструкция по эксплуатации
使用说明书

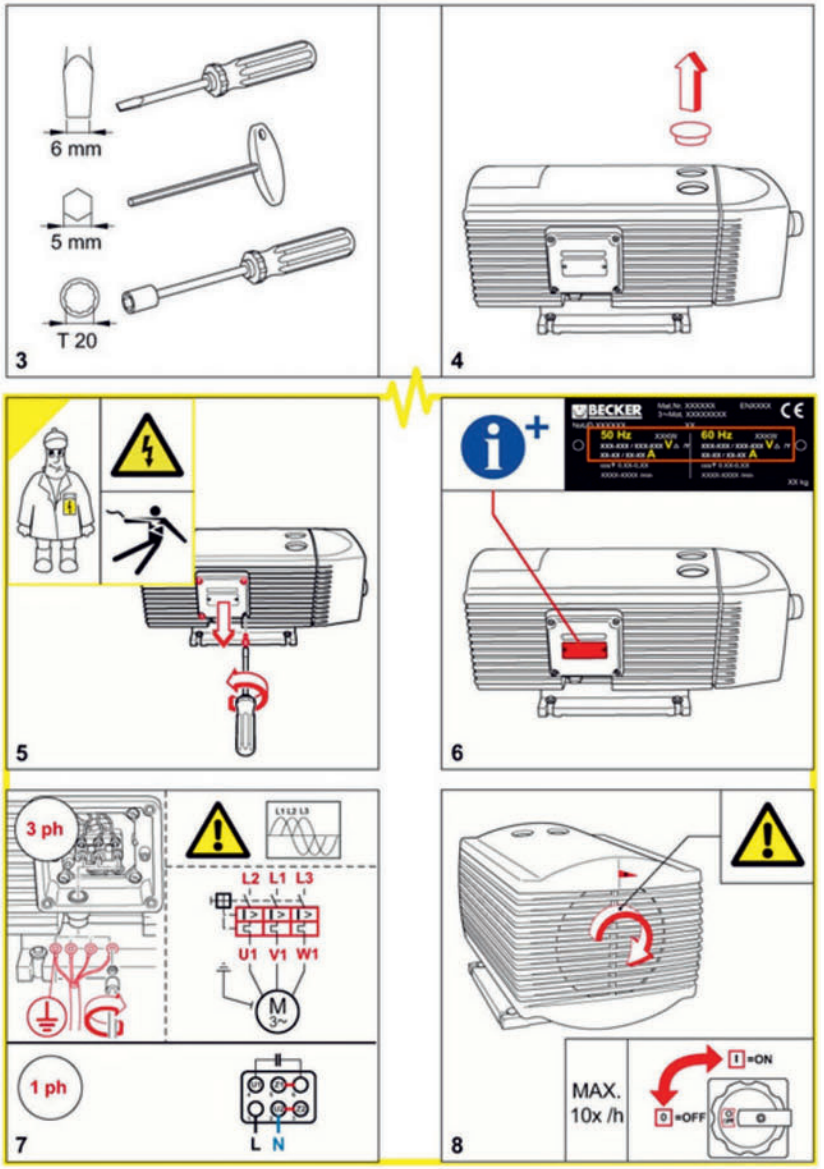
2006/42/EG

CE



28100027401 05/11

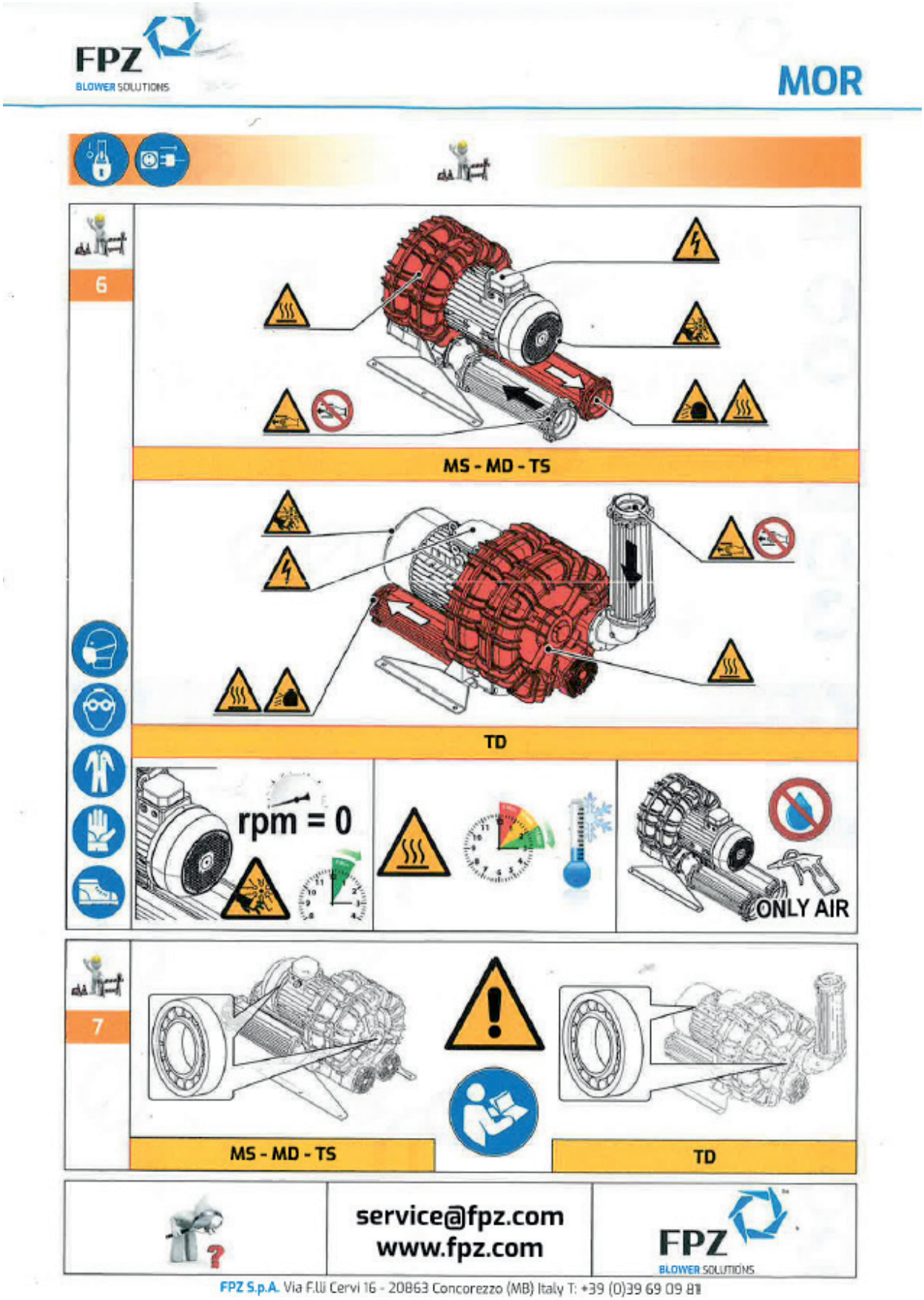
www.becker-international.com



www.becker-international.com

16 Maintenance instructions for compressor

16.4 FPZ Side Channel Blower



Notes

Otto Graf GmbH
Kunststofferzeugnisse
Carl-Zeiss-Straße 2 – 6
DE-79331 Teningen

Tel.: +49 7641 589-0
Fax: +49 7641 589-50
mail@graf.info
www.graf.info