

## Instructions for start-up, operation and maintenance

**Klaro Easy SBR wastewater  
treatment system**

**Control unit version**

**KLbasic / KL24base**

**KLplus / KL24plus**



General building authorities' approval:

In the Carat septic tank:

No.: Z-55.31-319

(discharge class C)

No.: Z-55.31-437

(discharge class D)

In the Carat XL septic tank:

No.: Z-55.31-319

(discharge class C)

No.: Z-55.31-435

(discharge class D)

**Be sure to read before starting  
up!**

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# WARRANTY CERTIFICATE

Otto Graf GmbH  
Kunststofferzeugnisse



Dear Sir/Madam,

Congratulations on purchasing a quality product from Otto Graf GmbH. We hereby confirm that your small wastewater treatment system is covered by warranty for

**3 years**

The warranty only applies to the wastewater treatment technology. Accessories and additional options are not covered by the warranty. Within the warranty period, Otto Graf GmbH shall replace materials free of charge. No other services are covered by the warranty.

## Conditions of warranty

The warranty applies if the following requirements are met:

1. The wastewater treatment system must be installed and started up by a specialist. Companies certified by the DWA or trained by Otto Graf GmbH are considered specialists.
2. Maintenance must be undertaken by a specialist company as described in the operating manual and the approval. If claims for warranty are submitted, all maintenance logs must be provided if requested.
3. Wearing parts are not covered by the warranty, nor are defects and damage for which we are not responsible and which are the result of improper system operation, failure to undertake maintenance, faults caused by the customer and unauthorised changes to the system.
4. Follow-on costs resulting from replacing the unit, shutting down the system etc. are not covered by the warranty.

Statutory warranty claims are not affected by this warranty and remain in place in their entirety.

Teningen, April 2015

Otto Graf GmbH  
Carl-Zeiss-Str. 2-6  
DE-79331 Teningen

Dear Sir/Madam,

We are delighted that you have chosen to buy a modern **Klaro Easy** SBR system. **Klaro Easy** is a quality product that as a complete system meets the requirements of DIN EN 12566-3 and DIN 4261-1, making it a fully biological small wastewater treatment system. Below you will find some important information for safely operating your system for a long time to come.

- The SBR system is designed to receive all domestic wastewater. Other wastewater, e.g. from restaurants and / or commercial premises etc., may only be received if this was specified and taken into account in the system's design.
- Biocides, toxic substances or substances which are not biocompatible must not enter this system because they hinder bacteria important to wastewater cleaning and cause problems in the biological process (detailed information is provided on the following pages).

**To meet official cleaning requirements, it is essential that the system is operated in accordance with our operating and maintenance instructions.** You will find these instructions on the following pages.

We also ask you to read the following information carefully:

- The internal control cabinet must be installed in a dry, well ventilated room (cellar or garage).
- External control cabinets should be located as much in the shade as possible to prevent them from overheating in the summer.
- At all times ensure that the cabinet, especially its ventilation apertures, are not covered and are freely accessible for maintenance work.
  - EPP control cabinet: Ventilation apertures on the front and top
  - Internal control cabinet: Ventilation apertures on the sides
  - External control cabinet: Ventilation apertures on the rear
- The power supply must be ensured at all times. Please ensure that the fuse on the control cabinet is sufficient (16 A). Additional electrical fixtures on the same fuse may disrupt operation.

Otto Graf GmbH in Teningen



# 1. General

## 1. General

### 1.1 Details about your system

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

You will find the details on the type plate fitted to the outside of internal cabinets and the inside of external cabinets.

	<b>KLARO Easy</b>	<b>4 PE</b>
Discharge class C		Approval No. Z-55.31-319
Serial No.	<input type="text"/>	
Order No.	<input type="text"/>	15
Type of cabinet	<b>EPP-cabinet with KL24base</b>	EN 12566-3
<b>Volume</b>		
Sludge storage	<input type="text" value="1,00"/> m <sup>3</sup>	Compressor type <input type="text" value="LA 60"/>
Buffer	<input type="text" value="0,30"/> m <sup>3</sup>	Connected load <input type="text" value="64 W"/>
SBR-reactor	<input type="text" value="1,20"/> m <sup>3</sup>	Tension <input type="text" value="230V/50Hz"/>
		Protection class <input type="text" value="IP20"/>
Max. pre-treatment sludge level		<input type="text" value="0,78 m"/>
Otto Graf GmbH - Carl-Zeiss-Straße 2-6 - D-79331 Teningen - Tel.: +49(0)7641/589-0		

## 1. General

### 1.2 Original EC declaration of conformity for small wastewater system in plastic tank

Manufacturer: Otto Graf GmbH Kunststoffzeugnisse  
Carl-Zeiss-Str. 2-6  
DE-79331 Teningen  
Tel. +49 7641 589-0  
Fax +49 7641 589-50  
www.graf.info

hereby declares that the **KLARO Easy**, small wastewater system in plastic tanks for 4 to 50 inhabitants meets the requirements of the following directives:

- 2011/305/EC** "Regulation no. 305/2011 of the European Parliament and of the Council of 9 March 2011 on defining harmonised conditions for marketing construction products".
- 2006/42/EC** "Directive of the European Parliament and of the Council of 17 May 2006 on machines and changes to Directive 95/16/EC".
- 2006/95/EC** "Directive of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits".
- 2004/108/EC** "Directive of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC".

#### The following harmonised standards were applied:

- EN 12566-3:2005+A2:2013** "Small wastewater treatment systems for up to 50 PT Part 3: Packaged and/or site assembled domestic wastewater treatment plants."
- EN 60204-1/A1: 2009** "Electrical equipment of machines. Part 1: General requirements."
- EN 13849-1: 2008** "Safety of machinery – Safety-related parts of control systems. – Part 1: General principles for design."

This EC declaration of conformity ceases to apply if the product is modified without consent.

Responsible for documentation: Otto Graf GmbH

Teningen, 31.03.15



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Arne Schröder  
(Product management team leader)

## 2. Safety notices

### 2. Safety notices

This chapter contains details relating to safety measures and residual risks. Read this chapter through carefully before using the system to ensure that it is used as safely as possible.

#### 2.1 Explanation of warning notices and prohibitions



Warning of danger



Warning of dangerous voltage



Warning of tripping risk



Warning of hot surface



Warning of hand injuries



Warning of explosive atmospheres



Fire, naked flames and smoking prohibited

#### 2.2 Danger notices

1. To ensure safety, everyone who comes into direct contact with the system must note the content of this documentation.
2. The system must not be used for any purpose other than that described by the manufacturer.
3. Local operating and safety requirements and legislation must be followed at all times, even if not explicitly mentioned in these instructions. The same applies to environmental requirements.
4. If the operator becomes aware of mistakes or dangers, the manufacturer or responsible maintenance company must be informed immediately.

## 2. Safety notices

5. Safety precautions must never be removed or bypassed during normal operation of the machine. Safety precautions may only be temporarily bypassed or deactivated by the maintenance fitter during repairs and maintenance.
6. When working with chemical substances, contact with the chemicals should be avoided as far as possible. Before these substances may be used, the instructions for use on the packaging must be read and followed.
7. If the use of personal protective equipment (safety shoes, protective glasses, gloves, ear defenders, etc.) is prescribed, ensure that they are used. Defective or damaged protective equipment must be immediately replaced with fully functional equipment.
8. Work on electrical equipment may only be undertaken by specialists.
9. All safety and danger notices on the machine should always be kept fully legible.
10. Hot parts must not come into contact with explosive or highly flammable chemicals.
11. Do not put vessels containing liquids on electric switch cabinets; short circuits may occur if the liquid is spilled.
12. The system must not be operated by anyone under the influence of alcohol (remember that alcohol may still remain in the body the day after consumption!) or medication which limits cognitive ability or ability to react.
13. The system must be de-energised before any maintenance or cleaning work.
14. Other than for maintenance purposes, the system should always be left switched on, otherwise correct wastewater cleaning cannot be guaranteed.

## 2. Safety notices

### 2.3 Warning notices



Installation location

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



Mains connection

Only connect the machine cabinet to a correctly installed 230 V socket or earth cable which is fused with an upstream 16 A fuse as specified in the technical data.

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.



Explosive atmospheres

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.



Interferences

The control unit may cause medical equipment to malfunction. This device should therefore not be used in close proximity to medical equipment.



Damage

The control unit must not be operated if the housing or cable insulation is damaged or crushed.



Service work

Service work on the machine cabinet may only be undertaken by authorised specialists / electricians.



Voltage supply

The power supply must be ensured at all times. Please ensure that the fuse on the control cabinet is sufficient (16 A). Additional electrical fixtures on the same fuse may disrupt operation.



## 3. Scope of supply

### 3. Scope of supply

The wastewater treatment system basically comprises the septic tank with wastewater treatment technology setting-up kit and control cabinet. These main parts are connected to one another using air hoses laid in the ground.

The septic tank(s) is(are) split into two areas, the sludge reservoir and buffer in the inlet area and the SBR reactor in the outlet area. In a one-tank system, these two stages are housed in one tank and separated by a partition. In a multi-tank system, the sludge reservoir buffer and bio reactor each have their own tank. A feed lifter is present in the sludge reservoir in the form of a mammoth pump with its own air supply.

In the sludge reservoir / buffer you will find:

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

In the bio reactor you will find:

- stainless steel air distributor system with membrane pipes or aerator plates
- feed lifter in the form of a mammoth pump with its own air supply (marked in red)
- stainless steel air supply system with EPDM membrane, finely perforated
- outflow lifter in the form of a mammoth pump with its own air supply (marked in black)
- secondary sludge lifter in the form of a mammoth pump with its own air supply (marked in white)
- integrated sampling points (only in one- and two-tank systems!)

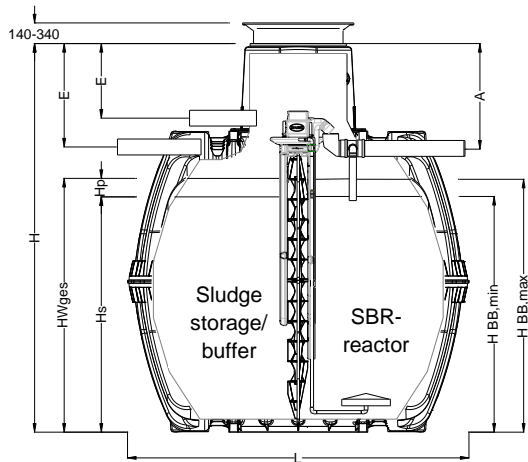
In the control cabinet for mounting on indoor walls or in the control column for outdoor installation you will find:

- a quiet, low-maintenance air compressor
- a valve unit
- a control unit which conforms to the requirements of BGV A3 and DIN EN 60204-1

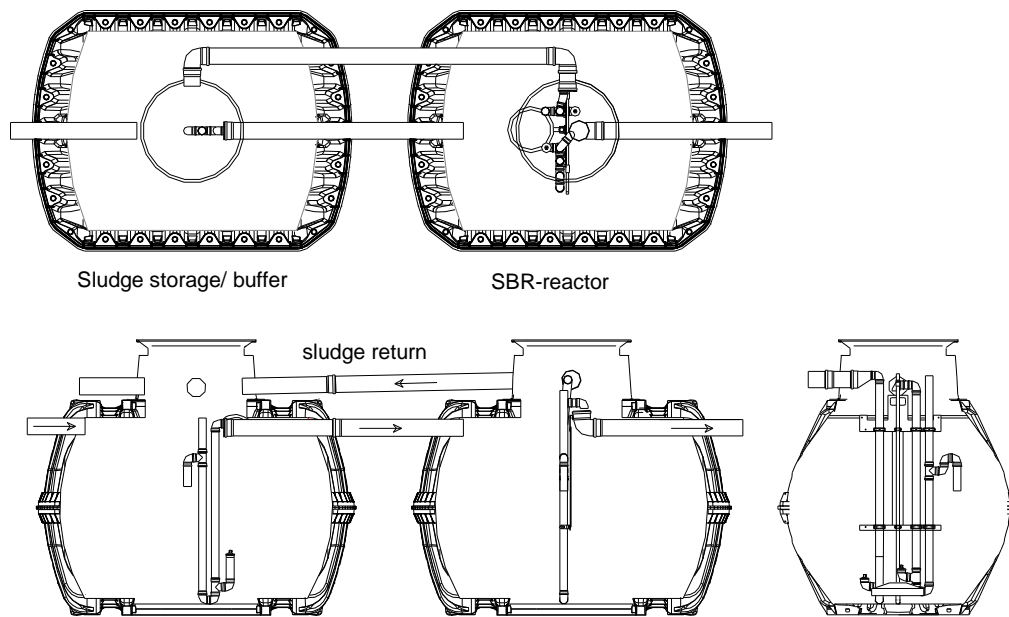
As an option, the system can be fitted with an integrated sampling facility from which a water sample can be taken.

### 3. Scope of supply

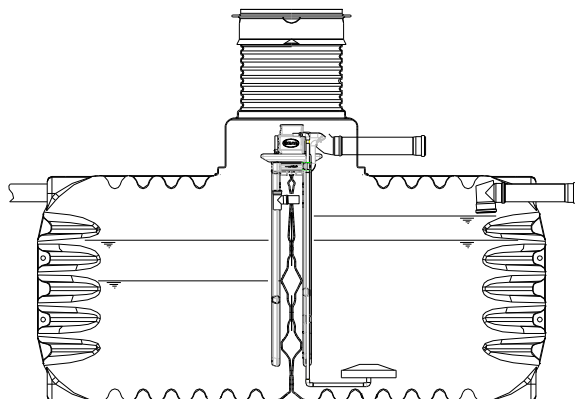
#### 3.1 One-tank system in the Carat septic tank



#### 3.2 Two-tank system in the Carat tank



#### 3.3 One-reservoir system in a TWIN underground tank



## 4. Function of the SBR system

### 4. Function of the SBR system

The **Klaro Easy** is a fully biological small wastewater treatment system, which functions on the principle of the SBR process (aeration system in retention process). The system basically comprises 2 stages: A sludge reservoir with integrated upstream buffer and activated sludge stage in closed retention mode (SBR reactor).

The upstream sludge reservoir with integrated buffer fulfils 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 wastewater treatment system is operated using a microprocessor control, which controls the air compressor and air distribution for the various lifters via solenoid valves / stepped motors.

#### 4.1 Systems for breaking down the organic matter present in the water (removal of carbon: discharge class C)

The process is a series of 5 steps undertaken in turn and repeated several times a day (usually 4 times).

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##### **Step 1: Feed**

The raw wastewater held in the sludge reservoir is fed to the SBR reactor via an air lift 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.

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##### **Step 2: Aeration**

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

The system'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.

## 4. Function of the SBR system

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### **Step 3:                      Settling 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.

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### **Step 4:                      Clear water extraction**

In this phase, the biologically cleaned waste water (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 such that any floating sludge present at the layer of clear water is not pumped out and a minimum water level is retained in the SBR stage without further components.

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### **Step 5:                      Removal of excess sludge**

In this phase, excess activated sludge is pumped by an air lift pump from the SBR reactor chamber to the sludge reservoir chamber, where it is stored. This excess sludge is pumped out of the base of the SBR chamber.

---

Once the 5th step is complete, 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.

The system can also be manually switched to holiday mode.

When in holiday mode, system operation is greatly reduced during long periods without a supply of wastewater.

## 4. Function of the SBR system

### 4.2 Systems with extra nitrogen elimination (discharge class D)

Nitrogen is also removed biologically using certain strains of microorganisms. In systems which are also designed for additional denitrification, a short burst of aeration is undertaken at the start of the aeration phase to circulate the water and stimulate denitrifying bacteria which convert nitrate into elementary nitrogen.

### 4.3 Systems with extra phosphate elimination (discharge class D+P)

Phosphate precipitation results from the addition of polyaluminium chloride in the SBR reactor. The phosphate precipitation equipment includes a removable support platform in the dome (accessory, art. no. 107362). The precipitant canister is located on this platform. Alternatively, the precipitant canister can be positioned separately near the switch cabinet. There is a metering pump in the system's switch cabinet, which pumps the precipitant out of the precipitant canister and into the SBR reactor. The precipitant is added during the reactor's feed 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.

Details of how to start up and operate the pump can be found under Item 6.

### 4.4 Systems with extra hygiene (discharge class D+H)

The extra Klaro UV module removes germs from the biologically cleaned wastewater using ultraviolet light (UV), which kills microorganisms within a matter of seconds, leaving no residue or harmful by-products.

Separate instructions are available explaining how to install and start up the UV module.

## 5. Control and machine cabinet

### 5. Control and machine cabinet

All the system's mechanical and electrical components are installed in a switch cabinet. The cabinet for internal installation is made from expanded polypropylene (EPP; used for wastewater treatment systems for 4-10 inhabitants) or is a powder-coated metal cabinet (used for wastewater treatment systems for 11 or more inhabitants).

For installation out of doors, the components are fitted in a plastic cabinet. The cabinet contains both the control unit and all machine elements needed. It is opened using the key provided.

#### 5.1 Technical setup

The main components of the machine unit are:

- quiet air compressor
- valve unit with 4 solenoid valves / stepped motors for distributing the air for aeration and lifting using air lift pumps (feed, discharge, sludge return)
- control unit for automatic mode with preset operating cycles
- cooling fan (only in systems with a rotary valve blower)
- phosphate precipitant pump (optional)
- GPRS communication module (optional)

The elements of the control unit visible from the outside are:

- keypad for operating the control unit
- two-row LCD for displaying operating statuses and fault messages
- 1 LED (operating check) for visually displaying operation (green/red)

#### 5.2 Machine cabinet

The internal switch cabinets may only be installed in dry, dust-free and well ventilated rooms (cellar, technical room or garage). There must be a 230 V socket (16A, slow blow) near the cabinet. **Additional electrical fixtures on the same fuse may disrupt operation.**

The cabinets should be freely accessible at all times; in particular the ventilation apertures should always be uncovered.

## 5. Control and machine cabinet



Fuse connections!

The electrical connection of the switch cabinet must only be carried out by a qualified electrician.

### **EPP switch cabinet for indoor installation (380 x 580 x 300 mm)**

The EPP machine cabinet is secured to a wall with the hanger bolts supplied. The hanger bolts should be secured to the wall horizontally using dowels spaced 280 mm apart. The cabinet is then affixed to them and secured with wing nuts.

When choosing where to install the cabinet, note that the hose connections are on the underside of the cabinet.



### **Metal cabinet for indoor installation (500 x 500 x 300 mm)**

The machine cabinet is prepared for mounting on the wall. The wall brackets provided must be attached to the rear of the cabinet first. There must be a 230 V socket (16A, slow blow) near the cabinet. The mains supply with a main switch and ventilation grille are located on the right-hand side. The hose connections and another ventilation grille can be found on the right.



Large systems for more than 40 inhabitants are supplied with a two-door cabinet for installing on the ground.

Systems for 75 or more inhabitants, running on a 3-phase current of 380 V, must be connected by an electrician as shown in the terminal diagram provided. Be sure that the compressor is rotating in the right direction.

## 5. Control and machine cabinet

### Plastic column for outdoor installation

The plastic column intended for installation out of doors should be sunk into the ground up to the mark on the front of the cabinet (see installation instructions). A ditch of a sufficient depth should be dug.

In order to replace the ventilation grille on the rear of the column, there must be a free space of at least 10 cm around the grille. The location should be cool and protected from direct sunlight during the summer months. If shading is provided on site, this should be designed with open sides so that the column is sufficiently ventilated and in order to avoid trapped heat.

The outdoor column should be sunk into the soil up to the mark. Finally the ditch should be filled correctly such that the column is stable, firm and stands upright in the soil.

To reduce earth moisture, we recommend filling the space inside the base with a thin layer of cement screed or base filling granulate (accessory, art. no. 107607). **If this is not done, the electric parts may be damaged by corrosion if the soil is very damp.**



Main components:

1. Maintenance switch
2. Control unit
3. Strip of valves with 4 solenoid valves / stepped motors
4. Air compressor
5. Cabinet fan on rear of cabinet
6. Socket

**Caution:** When doing anything other than operating the control unit, the maintenance switch should be turned to the "0" position!

An underground cable is laid to supply power to the cabinet. This is connected to socket (6) in the switch cabinet. **To disconnect from the mains, a mains disconnecter must be fitted on site** as close as possible to the switch cabinet between the fuse and switch cabinet. **Ensure that the mains disconnecter is always easily accessible for maintenance and repairs!**



## 5. Control and machine cabinet

A cabinet made from facing concrete is needed for a compressor size of DT 4.16 or more. This requires a concrete foundation (foundation plan available from GRAF).



Figure 1: Inside of two-door concrete cabinet

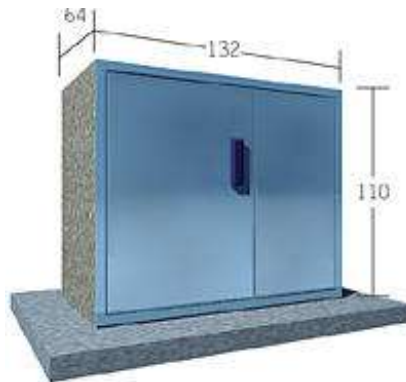


Figure 2: Two-door concrete cabinet

When starting up the system (i.e. once assembly is complete), all chambers should be filled up to the bottom edge of the discharge if this hasn't been done already.

**Caution:** Because the sludge reservoir and SBR reactor do not communicate with one another, they must be filled individually.

### 5.3 Starting up the cabinet

Once the system has been connected to the power supply, it performs a quick self-test (if the control cabinet has a main switch, it should be in position "1"). This test takes a few seconds, then the system automatically enters normal operation (automatic). During the self-test the words "SYSTEM TEST ... OK", the program version and the control unit's serial number are displayed briefly. The system's current operating mode is then displayed in the liquid crystal display. If a battery has not yet been placed in the control unit and the time and date have not yet been set, the control unit will display fault messages. These can be acknowledged using the Esc key. The time and date can then be set via the menu (see below).

The function of the control unit, three lifters, aeration and if present the cabinet fan should then be checked. This can be done via the Manual operation menu item in the control unit.

**Please note:** The lifters will only work if the tanks are filled.

If the time and date are not set correctly, operating faults are saved with the wrong times.

The system should be reset to automatic mode once the test is completed successfully.

## 5. Control and machine cabinet

### 5.4 System response to disconnection from the voltage supply

If the system is disconnected from the mains (e.g. due to a power cut), the control program and the operating hours counted are retained in the system control's memory. An intermittent warning tone sounds. This warning tone only sounds after a delay of several seconds (see Item 10.3, Power cut detector). When the power supply to the system is restored, it automatically restarts as described above, provided that there is a sufficiently charged battery in the control unit.

#### **Important information:**

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

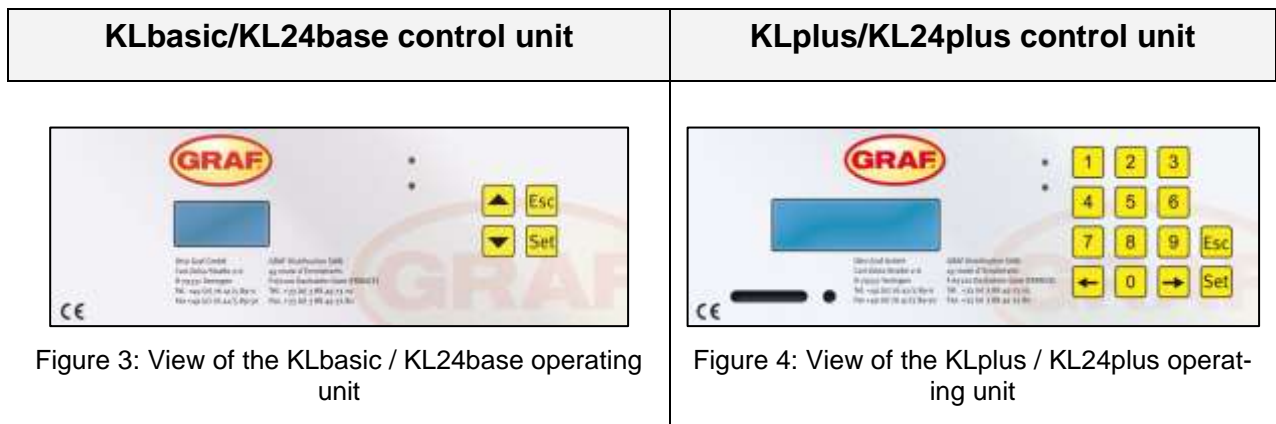
## 6. The small wastewater treatment system's control unit

### 6. The small wastewater treatment system's control unit

The system is operated using the control unit in the cabinet door (or inside the cabinet with outdoor cabinets). The control unit allows operating parameters to be set, operating statuses to be displayed, system parameters to be queried and operating times to be programmed by a specialist.

You can change the display contrast in automatic mode by pressing the ESC and arrow buttons at the same time.

The figures below show the setup of the operating units.



#### Operating status display

The system's operating status is indicated by the LED (Green = Operation / Red = Fault) and by text on the LC screen.

In normal operating mode (aeration mode), the liquid crystal display looks like this:

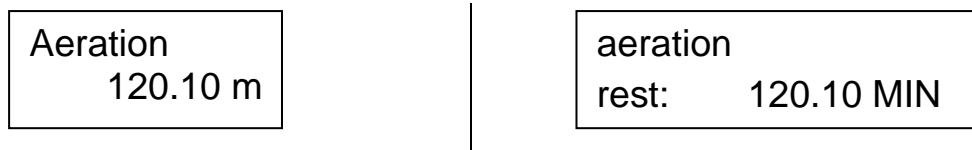


Figure 5: View of liquid crystal display during aeration phase

In automatic mode, the liquid crystal display shows the current operating phase and time remaining in this stage of operation.

Should a fault occur, a message appears in the liquid crystal display indicating which component is faulty (e.g. compressor fault).

→ **Note:** Item 9 describes in more detail how the system behaves in the event of a fault.

## 6. The small wastewater treatment system's control unit

<b>KLbasic/KL24base control unit</b>	<b>KLplus/KL24plus control unit</b>
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The following operating phases are displayed:

KLbasic / KL24base display	Process undertaken	KLplus / KL24plus display
Charchng	Valve 1 is activated, the feed lifter pumps the wastewater to be cleaned from the sludge reservoir into the bio reactor.	charging
Denitrif	Valve 2 is intermittently activated, the activated sludge is briefly mixed with the wastewater. There are long pauses in between (reaction times).	denitrification
Aeration	Valve 2 is activated, the bio reactor is aerated at intervals.	aeration
Sediment	No valves are activated, the activated sludge settles in the bio reactor.	sedimentation
Discharc	Valve 1 is activated, the wastewater is pumped into the discharge.	discharching
SludgeRe	Valve 4 is activated, the excess sludge is pumped from the reactor into the sludge reservoir.	sludge return
Pause	Valve 2 is activated, the bio reactor is aerated at intervals (considerably less than in the "aeration" phase).	cyclepause
Vacation	Valve 2 is activated, the bio reactor is aerated at intervals, no cleaning cycles are undertaken.	vacation oper.
XX.XX m	Display showing time remaining.	rest: XXX.XX min

The control unit is operated using the keypad.

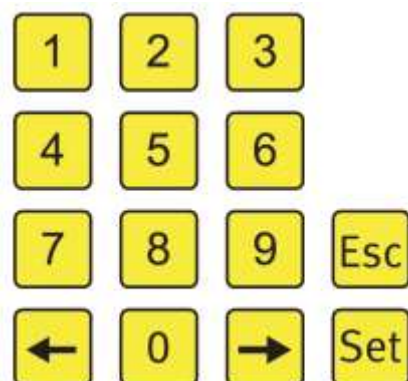












Figure 6: View of operating panel

## 6. The small wastewater treatment system's control unit

KLbasic/KL24base control unit			KLplus/KL24plus control unit	
Symbol	Key assignment	Function	Symbol	
	Enter	Select operating mode, confirm input		
 	Scroll	Display the operating modes and queries	 	
	Acknowledgement	Acknowledge input without saving Acknowledge fault messages		
-----	Numbers	Program system by entering numbers	 .. 	

### 6.1 Connections to the KL control units

On the rear of the KLbasic and KLplus control units are the connector plugs and fuses.

**Please note: Whenever working on the electrical system, move the maintenance switch into position "0" (OFF) and disconnect the mains plug!**

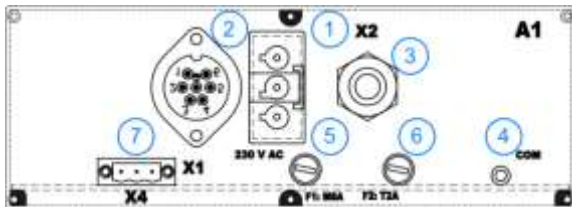


Figure 7: View of rear of KLbasic control unit

#### **Connections:**

- 1 Connection for mains cable  
230 V AC ~ 50 Hz,
- 2 X1: Bayonet connection for the solenoid valves,
- 3 X2: Schuko coupling for the air compressor connection,
- 4 COM: Connection for communication module (optional) and/or port for PC,
- 5 F1: T8A fuse, medium slow blow, for the mains connection,
- 6 F2: T2A fuse, slow blow, for the connected consumers,

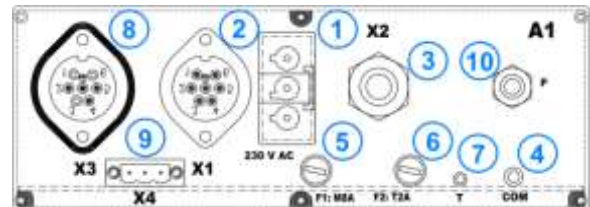


Figure 8: View of rear of KLplus control unit

#### **Connections:**

- 1 Connection for mains cable  
230 V AC ~ 50 Hz,
- 2 X1: Bayonet connection for the solenoid valves,
- 3 X2: Schuko coupling for the air compressor connection,
- 4 COM: Connection for communication module (optional) and/or port for PC,
- 5 F1: T8A fuse, medium slow blow, for the mains connection,
- 6 F2: T2A fuse, slow blow, for the connected consumers,

## 6. The small wastewater treatment system's control unit

KLbasic/KL24base control unit	KLplus/KL24plus control unit
<p>7 X4: Connection for extension cable: external indicator.</p>	<p>7 Connection for temperature sensor, "must be plugged in!",</p> <p>8 X3: Connection for extension cable: UV module and metering pump,</p> <p>9 X4: Connection for external indicator and contactor monitor,</p> <p>10 P: Connection for pressure measuring hose.</p>

### 6.2 Connections on the KL24 control units

On the rear of the KL24base and KL24plus control units are the connector plugs and fuses.

**Please note: Whenever working on the electrical system, move the maintenance switch into position "0" (OFF) and disconnect the mains plug!**

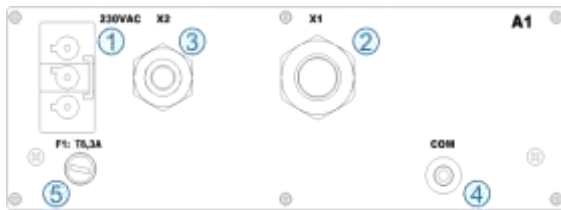


Figure 9: View of rear of KL24base control unit

#### **Connections:**

- 1 Connection for mains cable  
230 V AC ~ 50 Hz,
- 2 X1: Pre-assembled valve cable,
- 3 X2: Schuko coupling for the air compressor connection,
- 4 COM: Connection for communication module (optional) and/or port for PC,
- 5 F1: T6.3A main fuse, slow blow.

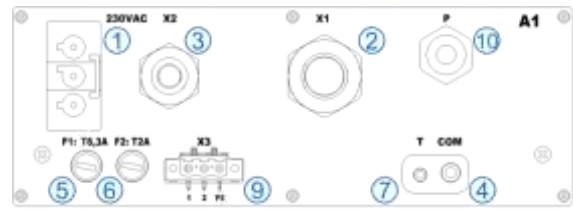


Figure 10: View of rear of KL24plus control unit

#### **Connections:**





- 1 Connection for mains cable  
230 V AC ~ 50 Hz,
- 2 X1: Pre-assembled valve cable,
- 3 X2: Schuko coupling for the air compressor connection,
- 4 COM: Connection for communication module (optional) and/or port for PC,
- 5 F1: T6.3A main fuse, slow blow,
- 6 F2: T2A fuse for UV module, slow blow,
- 7 Connection for temperature sensor, "must be plugged in!",
- 9 X3: Connection for UV module
- 10 P: Connection for pressure measuring hose.





## 6. The small wastewater treatment system's control unit


<b>KLbasic/KL24base control unit</b>	<b>KLplus/KL24plus control unit</b>
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### 6.3 Operating the control unit

You can start various queries when in automatic mode.

Pressing  takes you to the first operating level. Now you can call up the individual queries by pressing the two arrow keys   followed by .


Pressing  takes you to the first maintenance level. Now you can call up the individual queries by pressing the two arrow keys   followed by .

KLbasic / KL24base display	Meaning	KLplus / KL24plus display
Operating mode remaining time	Time remaining in current operating phase	Operating mode remaining time
Operatin hours	Operating hours display for individual valves and compressor	operating hours meter reading
Manual operatio	Manual activation of valves	manual operation
Hh:mm dd dd-mm-yy	Current time, day and date. Can be set by pressing SET	Date Time
Vacationinput	Set holiday mode (max. 90 days)	vacation date setup
Error report	Operational faults are saved here and can be read out. Press  to switch between the error message and the associated date	read out old errors
Adjust- ments:	The current settings can be viewed using the arrow keys	setup report
Operatiocode	For specialists	operation code
Service menu	For specialists	service code




## 6. The small wastewater treatment system's control unit



KLbasic/KL24base control unit	KLplus/KL24plus control unit
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### 6.3.1 Operating hours query

Press the  key. Screen shows:




Operatin hours


By again pressing , the operating hours can be called up for valves 1-4 in turn using the arrow keys  . The total compressor operating hours are then displayed.

Pressing  once takes you back to the "Show operating hours" display. Pressing  takes you to the "Manual mode" menu.

Press the  key. Screen shows:

operating hours  
meter reading



Pressing  again displays the number of operating hours for valve 1 (feed). Pressing the arrow keys   allows you to call up the operating hours of other valves, the compressor, UV module and pump for phosphate precipitation in turn. The system utilisation is also displayed.

Pressing the  key once takes you back to the maintenance level. And pressing again restores automatic mode.


→ **Note:** If no key is pressed for 10 minutes, normal mode engages automatically.

### 6.3.2 Manually controlling the valves and cabinet fan using "Manual mode"



Each valve should run for at least 5 seconds when testing because it takes some time to monitor the power consumption of valves before any faults are detected. After the valves, the cabinet fan (if fitted) can also be activated and checked.

In automatic mode, press , then press the arrow key  until the following appears on screen:




Manual opera-  
tio

Pressing the  key again displays the following:

valve1

Press , then press the arrow key  until the following appears on screen:

manual operation

Manual mode can now be set for all functions by again pressing  and using the arrow keys   to make the relevant selection.



## 6. The small wastewater treatment system's control unit

KLbasic/KL24base control unit	KLplus/KL24plus control unit
<p>You can activate and deactivate the selected valve by pressing .</p> <p>The individual valves can be selected with the arrow keys  . Pressing  once takes you back to the "Manual mode" display.</p>	<p>Taking the example of valve 1, the screen now shows:</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="margin: 0;">manual operation.</p> <p style="margin: 0;">valve1:        off</p> </div> <p>By selecting "1" for "ON" and "0" for "OFF", valve 1 can be activated and deactivated in manual mode. You can proceed in the same way with the other valves. The valves are selected with the arrow keys   as described above.</p> <p>Pressing the  key once takes you back to the maintenance level. And pressing again restores automatic mode.</p>

### 6.3.3 Setting date/time

Press , then press the arrow keys until the following appears on screen (example):

20:15 Mo

19-12-07

By pressing you can set the time and date using the arrow keys . To confirm each change, you must press .

Pressing once takes you back on to holiday mode. Pressing takes you back to manual mode.

Press , then press the arrow keys until the following appears on screen (example):

19-12-2007 Mo

20:15:56

By pressing you can set the time and date using the numerical keys. To confirm each change, you must press .

Pressing once takes you back on to holiday mode. Pressing takes you back to manual mode.




















The system's time and date MUST be set correctly to ensure accurate recording of operating hours and any malfunctions that may occur. The built-in clock has a maximum deviation of 5 minutes per year. There is no automatic switchover from summer to winter time.

→ **Note:** If no key is pressed for 10 minutes, normal mode engages automatically.

### 6.3.4 Setting holiday mode

→ **Note:** The wastewater treatment system has a reduced operation when in holiday mode. This mode should only be used if no wastewater will be fed into the wastewater treatment system during the selected period. Wastewater which does enter the system during holiday mode is not cleaned. Holiday mode is automatically activated and deactivated on the dates entered.

## 6. The small wastewater treatment system's control unit

KLbasic/KL24base control unit	KLplus/KL24plus control unit
<p>Press , then press the arrow keys   until the following appears on screen:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">Vacationinput</div> <p>The input of holiday data is released by again pressing :</p> <p><b>Start of holiday:</b></p> <p>Pressing   enters the day, month and year in the format DD-MM-YY.  should be pressed each time a day, month or year is entered.</p> <p><b>End of holiday:</b></p> <p>Pressing   enters the day, month and year in the format DD-MM-YY.  should be pressed each time a day, month or year is entered.</p> <p>Pressing  completes the input of data for holiday mode and saves it.</p> <p>Pressing  takes you back to the automatic mode display.</p>	<p>Press , then press the arrow keys   until the following appears on screen:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">vacation date setup</div> <p>The input of holiday data is released by again pressing :</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">vacation start.: <u>2</u>1-05-2007</div> <p>Press the  key again and enter the end date for holiday mode using the numerical keys:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">vacation end.: <u>2</u>1-05-2007</div> <p>Pressing the  key saves the input of data for holiday mode and exits this function.</p> <p>→ Holiday mode can be set for a maximum of 90 days.</p> <p>Pressing  once takes you back to the maintenance level. And pressing again restores automatic mode.</p>

→ **Note:** If no key is pressed for 2 minutes, normal mode engages automatically without the date just entered being saved.

### 6.3.5 Reading out errors – reading out old faults

The control unit saves fault messages and the operation of valves using "Manual mode" in what is known as a logbook. This function can be used to call up previous fault messages with time and date. The individual messages can be called up using the arrow keys. The menu item can be exited using "Esc".

→ **Note:** 128 fault messages can be saved. Once this figure is reached, each new message overwrites the oldest one. The memory can be cleared by a maintenance specialist in the Service menu using the "Clear logbook" command.

## 6. The small wastewater treatment system's control unit

### 6.3.6 Displaying settings

The current control unit settings can be viewed under this menu item. These settings cannot be changed. This menu item is used to analyse the settings without changing them.

### 6.3.7 Service menu and action code

Operating parameters can be changed in the Service menu. Access is protected by a code. The operating parameters can also be changed using a particular action code. This second maintenance level is reserved for qualified specialists only!

**→ No claims for warranty can be made if the control unit settings are accessed without authorisation!**

### 6.4 Changing fuses

**Before fuses are changed, the system should be switched off using the red maintenance switch!**

To change or check the fuses, the control and machine cabinet must be opened using the key provided.

The microfuses described above are located on the rear of the control unit.

Fuses used:

230 V / 50 Hz microfuse	KLbasic	KLplus	KL24plus	KL24base
F1 supply	8 A, medium slow blow		6.3 A, slow blow	
Consumer F2	2 A, slow blow			-

## 6. The small wastewater treatment system's control unit

Proceed as follows to change the microfuses:

- Using an SL 1.0 x 5.5 slotted screwdriver, apply a little pressure to turn the head of the fixture one quarter turn to the left (anticlockwise)
- Remove the head of the fixture with the fuse
- Change the fuse
- Place the head and fuse in the fixture's opening
- Using a screwdriver, apply a little pressure to the head of the fixture and anchor the fuse by turning the head one quarter turn to the right (clockwise).

**→Note:**

If you are not able to remedy the problem, please contact your maintenance company or GRAF as soon as possible.

### 6.5 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. It charges when the control unit is switched on. In the event of a power cut, the charge of one emergency power supply for indicating the power cut 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:** 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, program settings etc., is 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.

If the system is disconnected from the mains (e.g. due to a power cut, should the internal fuse blow or by disconnecting from the socket), the indicator issues an acoustic and optical signal in turn regardless of the cause. There is a 5-second delay before the device responds to a mains failure. This prevents brief interrupts, which often occur e.g. during a storm but do not impact on the wastewater treatment system's overall function, from being indicated unnecessarily.

## 6. The small wastewater treatment system's control unit

- After the 5-second delay, there is an intermittent beep with a red flashing signal. Five flashing signals and one beep repeat at intervals of 5 seconds for around 12 hours (if the emergency power supply is fully charged).
- The device cannot be switched off when in this state.

When the mains voltage is restored, the device is returned to the monitoring status and the control unit continues from where it left off without any keys having to be pressed. The fault message disappears automatically. If the emergency power supply is flat, the device restarts with a cycle pause.



Power cut

→ **Please note:** If the system is disconnected from the mains for more than 24 hours, the system will be unable to clean the wastewater properly if at all. **Never switch off system** (the only exceptions are if maintaining system parts and in the case of system faults restricting function)

## 7. Additional function of the KLplus/KL24plus and KLbasic/KL24base control unit

### 7. Additional function of the KLplus/KL24plus and KLbasic/KL24base control unit

#### 7.1 Underload detection (KLplus/KL24plus)



Malfunction

→ Please note: Level-dependent operation should be activated by a maintenance fitter or an expert. Incorrect calibration of the system could cause it to operate constantly in economy mode (with cycle pause). Correct cleaning is not then possible.

This function is deactivated when the system is supplied. When the system is started up, it runs in automatic mode regardless of the volume of wastewater flowing in. **We would recommend activating this function after a run-in phase of 3 months at the earliest!** The KLplus control unit is fitted with a pressure sensor as standard and this can be used to establish the level in the first chamber. This function is used to save energy when the flow of wastewater is low.

##### 7.1.1 Function

The water level is measured using the pressure in the feed lifter during the feed phase. If the water level in the sludge reservoir/buffer (chamber 1) exceeds a preset level ("Level measurement setting"), the system starts a cleaning cycle. If the level is not reached, the system goes into cycle pause for 6 hours. In this mode, the SBR reactor is only vented sporadically to keep the bacteria alive. If the preset water level is not reached in the first chamber after 4 consecutive measurements, the system pumps water from the reactor into the first chamber via the excess sludge lifter. After pumping back, the system 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.

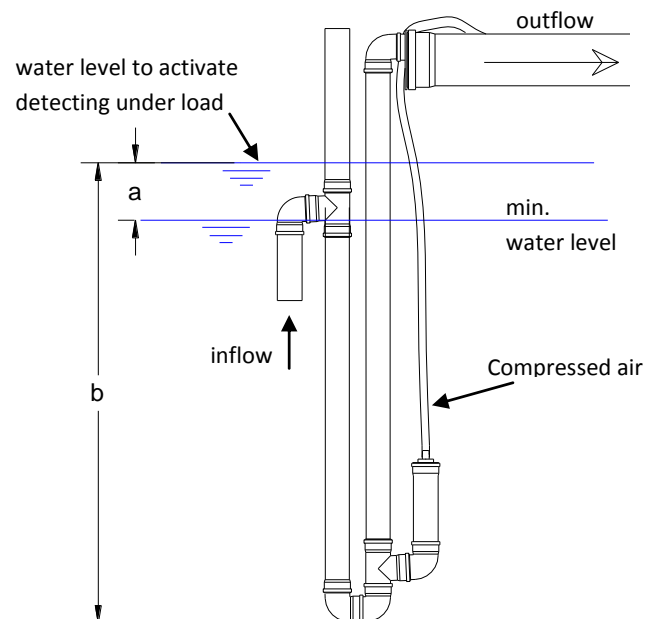


Figure 11: Feed lifter

The number of cleaning cycles undertaken can be queried using the operating hours menu item. This indicates the cleaning cycles actually undertaken with the cycles performed in automatic mode (4 a day) as a ratio and as a percentage (25% to 100% utilisation).

## 7. Additional function of the KLplus/KL24plus and KLbasic/KL24base control unit

### 7.1.2 Start-up



**When working with an open cesspit cover, there is a risk of stumbling and falling!**

Risk of falling

**Suitable measures must be taken to cordon off the open pit.**

The first chamber (sludge reservoir/buffer), where the feed lifter is located, 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. The recommended buffer heights a above the minimum water level are specified for the various configurations in the table below.

## 7. Additional function of the KLplus/KL24plus and KLbasic/KL24base control unit

### 7.2 Recommended maximum buffer heights in sludge reservoir / buffer:

SBR chamber	Concrete semi-circle Ø 200 cm			Concrete semi-circle 250 cm in diameter				
	No. of inhab.	4	6	8	4	6	8	12
b [cm]	10	15	20	6	9	12	18	24

SBR chamber	Concrete full circle Ø 200 cm				Concrete full circle Ø 250 cm			
	No. of inhab.	12	16	20	20	25	30	35
a [cm]	15	20	25	15	20	25	30	35

Type	Klaro Easy Professional Carat			Klaro Easy TWIN-TANK		
	No. of inhab.	4	6	8	4	6
Type	3750 l	4800 l	6500 l	3200 l	5200 l	5200 l
b [cm]	101	127	150	92	93	95

Type	Carat Klaro Easy, multiple tanks						Carat XL	
	No. of inhab.	8	10	12	18	25	35	25
Type	2x 2700 l	2x 3750 l	2x 4800 l	2x 6500 l	4x 4800 l	4x 6500 l	2x 8500 l	2x 10000 l
b [cm]	106	109	128	148	192	154	153	169





Type	Carat Klaro E Professional										
	No. of inhab.	5	8	10	14	10	16	22	28	32	44
Type	2700 l	3750 l	4800 l	6500 l	2 x 2700 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]	90	105	122	142	100	113	126	146	113	126	146



## 7. Additional function of the KLplus/KL24plus and KLbasic/KL24base control unit





### 1st step: Calibrating the 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:


service code	Go to "SERVICE CODE INPUT", press the  key and enter the following code when prompted to do so: 9 9 9 9
calibrate? No	Use the arrow keys (←→) to select "CALIBRATE YES", confirm with the  key and start the calibration ...
measuring...	3 measurement processes are undertaken automatically
enter current water level: xxx cm	Enter the current level $b$ of chamber 1 as measured with rule (measured from base of tank to surface of water) and confirm with  .
save? ___ cm No	The measurement now specified states the distance $c$ between the tank base and blow-in point of the lifter. Use the arrow keys (←→) to select "Save yes" and confirm with the  key. The calibration is complete and you can exit this menu with the "ESC" key.

### 2nd step: Setting the control parameters

It is absolutely essential that the control parameters for the level measurement are set for the system to function correctly. Please carefully work through the following points in order:

service code	Go to "SERVICE CODE INPUT", press the  key and enter the general service code when prompted to do so:
level measuring setup	Use the left arrow key (←) to select "Level measurement setting" and confirm with the  key.
water level start at: xxx cm	Enter the water level $b$ from which a treatment cycle is to start. Confirm with the  key.
Recirculation 2 min	Use the numerical keys to enter "2 min" and confirm with the  key. The necessary settings are complete and you can exit the menu with "ESC".
alert flooding at: xxx cm	(as of software 8.29) → <b>NOTE:</b> It is not essential for the overflow warning message to be activated for the system to function correctly. If 000 cm is saved, this warning message remains deactivated.

## 7. Additional function of the KLplus/KL24plus and KLbasic/KL24base control unit

To activate, measure the height between the base of the tank and bottom edge of the emergency overflow in the dividing wall or, in full circle systems, on the discharge. With tanks, you can enter the relevant value for your system from the table (see p.32). Please refer to the delivery slip for the name of your tank. Confirm with the  key.

→ If 000 cm is saved, the overflow warning message is deactivated.

### 3rd step: Function check

The level measurement can now also be undertaken in manual operation for checking purposes. This requires the level measurement to be activated with "1". The control unit automatically takes a measurement. Once the process is complete, the measured value appears.

#### 7.2.1 Deactivating the level measurement

To deactivate the level measurement and again run the cycles dependent on time, the 2nd step described above must be repeated. Water level b must be set to 0 cm. Recirculation can remain at 2 minutes.

#### 7.2.2 Safety and fault messages

If the sensor measures a value below 40 mbar, the following message appears in the display: "Fault: min. level". If this happens, the system reverts to the normal time-controlled mode. This is either triggered by too low a water level ( $\leq 40$  cm) in the sludge reservoir / buffer or a leak in the pressure or measurement line. We recommend contacting the manufacturer if this happens.

### 7.3 Optional additional functions with extension cable (KLplus and KLbasic)

Extra functions can be added to the control unit by connecting an extra cable to connection X3 or X4.

The following additions are available:

- connection for a phosphate metering pump (→ X3 / ST5)
- connection for an external indicator (→ X4), also for KLbasic
- monitor for contactor for 3-phase compressor (→ X4)
- connection for a UV reactor (→ X3 / ST8)

#### 7.3.1 Connecting an external fault indicator

An external warning indicator, such as a warning lamp fitted outside the cabinet, can be connected using the potential-free output X4.

### 7.3.2 Connecting a contactor to switch the compressor

If the inbuilt compressor has a power consumption in excess of 6 A, a contactor for controlling the compressor is also fitted in the cabinet. The switching status of the contactor is monitored via the contactor monitoring input X4.

### 7.3.3 Connecting a UV reactor

A downstream UV reactor can be connected to the control unit via the connection (X3 / ST8). Consult the installation instructions for the UV module for more details.

Phosphate precipitation with metering pump



Precipitant

→ **Please note:** Iron(III)chloride is harmful if swallowed and is irritating to skin. There is a risk of serious damage to eyes.

There is a danger of explosion if the product comes into contact with alkali metals, allyl chloride or ethylene oxide.

**Please read the accompanying safety data sheet before using phosphate precipitants!**

**Wear protective clothing when handling iron(III)chloride.**

Keep precipitant containers out of the reach of children and unauthorised persons.

A phosphate metering pump can be connected to the control unit via the connection (X3 / ST5).

## 7. Additional function of the KLplus/KL24plus and KLbasic/KL24base control unit

### 7.3.4 Phosphate precipitation with dosing pump



**Attention:** The precipitant (ferric chloride or polyaluminium chloride) is harmful to health when swallowed and irritates the skin. There is the danger of serious eye injuries.

There is a danger of explosion in conjunction with alkali metals, allyl chloride and ethylene oxide. **Before using phosphate precipitants, read the associated safety data sheet! Wear protective clothing when handling ferric chloride.** Store precipitant containers in a secure area so that they are inaccessible to unauthorised persons and out of the reach of children.

Systems delivered with the phosphate precipitation function come with the necessary peristaltic pump in the cabinet. One suction hose and one pressure hose are connected to the pump.

The runtime of the peristaltic pump is determined by the pump time set in the service menu. The amount of precipitant added is therefore dependent on the set time. The large Compact pump has a potentiometer for setting delivery. The table below shows the amounts that can be metered. Refer to the building authority approval for the amount required in each case.

In order to start up the precipitant device, the precipitant container must be placed in a frost-proof location (e.g. machine cabinet, on the dividing wall or in the system's dome shaft). The pressure and intake hoses should 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, ensuring that the precipitant flows directly into the wastewater to be treated and does not dampen any components (aggressive chemicals entail a risk of damage to components!). The outlet must never be submerged in the water!

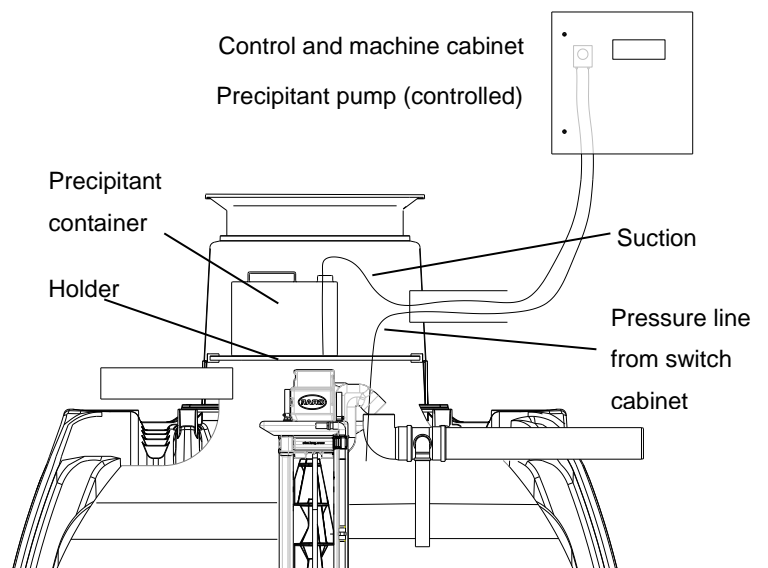


Figure 12: Sketch of precipitant equipment

## 7. Additional function of the KLplus/KL24plus and KLbasic/KL24base control unit

- Feed the suction hose into the precipitant container far enough to ensure suction from the base.
- Connect the suction and pressure hoses to the hose nozzles of the pump and fix them with the cap nuts.
- Switch the phosphate pump on via the menu item 'Manual Operation' and check that the precipitant is sucked in correctly. Swap the hose connections if necessary.
- The suction hose can optionally be equipped with a suction lance.

### 7.3.5 Overview precipitant pumps



**Compact**

Figure 13: Compact precipitant pump



**DP12**

Figure 14: DP12 and DP24 precipitant pumps

Delivery volume: 5.5 ml/min



**DP24**

#### Reference values for adjusting pump performance for precipitant pump compact

<b>P</b>	1	2	3	4	5	6	7	8	9	10
<b>[ml/min]</b>	1,5	5,5	11,0	15,0	19,0	22,5	26,0	30,5	35,0	37,5

## 8. Operation and maintenance

### 8. Operation and maintenance

The system must be kept switched on at all times. As the operator of a small wastewater treatment system, you are obliged to ensure that the system runs perfectly. Almost all operating problems will result in the system's cleaning capacity being impaired. Such problems should therefore be detected early on and immediately rectified by yourself or a qualified maintenance fitter.



When working with an open cesspit cover, there is a risk of stumbling and falling!

Suitable measures must be taken to cordon off the open pit. People could fall into the tank whether they are involved in the maintenance work or not! Children are at particular risk!

The biological decomposition processes that take place in small wastewater treatment systems result in the formation of (potentially toxic) gases. Anyone entering the system must therefore always be accompanied by a second person. Never follow anyone who has lost consciousness, instead seek help as quickly as possible.



When doing anything other than operating the control unit, the maintenance switch should be turned to the "0" position and/or the cabinet's mains connector disconnected!

Work, such as maintenance and repairs on the cabinet system, should be undertaken by a maintenance fitter or electrician!

#### 8.1 Duties of the operator

Measurements, deviations from nominal values and operating faults should be entered in an operating log. The water authorities may ask to see this log. To ensure smooth operation, the following checks must be undertaken:

##### Daily check

- Check that the system is running properly. This is the case when the operating telltale is green and there are no warning signals. A fault is indicated as described in the System control unit chapter. Should a fault occur, please consult the LCD and inform the service staff of the displayed fault or, if possible, remedy it yourself.

## 8. Operation and maintenance

**Weekly checks** (Weekly checks are not prescribed, but are recommended)

- Check water levels, sludge must not enter the SBR chamber uncontrolled.
- Check the supply and discharge routes for blockages (visual check).
- Read operating hours counter for air compressor (total operating hours), aeration (valve 2) and sludge return (valve 4) and if necessary any other units and note in operating log.
- Check function of lifters and aeration using the "Manual mode" setting.

**Monthly checks**

- Visually check for any sludge leaks, clouding or discolouration in the discharge.
- Check the supply and discharge routes for blockages (visual check).
- Read operating hours counter for air compressor (total operating hours), aeration (valve 2) and sludge return (valve 4) and if necessary any other units and note in operating log.

**Checking the air filters:**

The filter for aerating the control cabinet (ventilation grille on left and right in housing wall of internal cabinet or on rear of external cabinet) should be checked and cleaned or replaced if required. The grille on the outside of the cabinet must be removed for this purpose. Apply a little pressure with a screwdriver to release the clip fastener and remove the grille by hand. 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.

### 8.2 Emptying sludge

The level of sludge that has accumulated in the sludge reservoir is measured by a maintenance specialist using a sludge plunging siphon. Systems with DIBt approvals are designed such that the sludge reservoir compartment is generally sufficient for 12 months if run permanently at full load and if the operator and maintenance obligations are met. This period extends accordingly if used less. DIN stipulates "empty sludge as required", i.e. if a high level of sludge is measured during maintenance, it must be reduced. Floating sludge must also be taken into consideration during the measurement. The sludge should be disposed of when the sludge reservoir is 70% full or before. The operator must arrange for the sludge to be disposed of.

If maintenance and sludge removal are to be undertaken at the same time, perform maintenance first. Sludge removal should be noted in the operating log. Note the information provided by your specialist firm.

## 8. Operation and maintenance

The following should be noted when removing sludge:

- **First** remove the floating sludge from the surface, **then** place the intake pipe on the floor of the pit.
- **Around 10 cm of water should be allowed to remain in the pre-treatment section.**
- **After emptying the pre-treatment section should be refilled with fresh water.**

### 8.3 Maintenance by a maintenance specialist

The maintenance should be undertaken by a specialist company (experts)<sup>1</sup>. Depending on the discharge class selected, it should take place at least twice (three times) a year (interval of approx. 4/6 months). The intervals and work defined by the local water authority in the licence issued under water law also apply. The system owner should take out a maintenance contract with a qualified specialist for this work.

Maintenance should include the following:

- Inspection of the operating log to check 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 Annexes)**
- Function check on mechanical, electro-technical and other system parts key to operation, such as aerator, lifts, control unit, valves, alarm equipment and battery in power cut detector
- Check level of sludge in the sludge reservoir. If necessary, the operator must arrange for the sludge to be removed (see Item 8.1),
- Carry out general cleaning work, e.g. remove deposits
- Check the structural condition of the system
- Check sufficient aeration and ventilation
- Analysis of the aeration basin:

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<sup>1</sup> Specialist companies are those not affiliated to an operator, whose staff (specialists) are suitably qualified to operate and maintain small wastewater treatment systems through their professional training and from having received relevant qualification measures.



## 8. Operation and maintenance



- oxygen concentration ( $O_2/l > 2$  mg), if necessary adapt the compressor operating times
- sludge as proportion of volume ( $< 400$  ml/l)
  - ➔ if the sludge makes up more than 400 ml/l, the sludge should be removed more frequently in agreement with the manufacturer;
- Sampling from discharge and analysis of the following values:
  - temperature of wastewater
  - substances that can settle
  - pH
  - odour
  - colour
  - depth of visibility
  - BOD<sub>5</sub> (every other maintenance)
  - COD value
  - NH<sub>4</sub>-N (if required)
  - nanorg (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 system 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.

## 9. Fault messages and rectification

### 9. Fault messages and rectification

Technical system operation faults (failure of a unit) are indicated both visually and acoustically.

The control unit's acoustic fault signal can be deactivated by pressing . The optical error display is only acknowledged once  is pressed again.

If the power supply fails, an integrated non-mains-dependent power cut detector emits an alarm which alternates with a visual signal. If this happens, no acknowledgement can be performed.



Voltage!

**During all work on the machine cabinet extending beyond operating the control unit, the cabinet should be disconnected from the mains voltage.**

#### 9.1 Fault message on display

- Error message as text on the liquid crystal display
- Operating telltale lights up red

Display		Possible cause	Rectification
<b>Liquid crystal display</b>			
KLbasic / KL24base	KLplus / KL 24plus		
No display, no lamp		<ul style="list-style-type: none"> <li>• Power supply is interrupted</li> </ul>	<ul style="list-style-type: none"> <li>• Check the power supply to the system and control unit</li> <li>• Check microfuse F1 on the supply cable</li> <li>• Check the position of the maintenance switch (position 1)</li> </ul> <p>→If the buffer is flat, mains failure will not be indicated acoustically or optically.</p>
No display, lamp green			<ul style="list-style-type: none"> <li>• Switch off system and switch on again after 10 seconds.</li> </ul>
No / faint display		<ul style="list-style-type: none"> <li>• Contrast is set incorrectly</li> </ul>	<ul style="list-style-type: none"> <li>• Press and hold Esc key and use arrow keys to adjust contrast.</li> </ul>
Set clock	Set clock	<ul style="list-style-type: none"> <li>• Internal time/date not set</li> </ul>	<ul style="list-style-type: none"> <li>• Go to Time and date to set</li> </ul>
Compresofailure	**error** compressor error	<ul style="list-style-type: none"> <li>• Compressor not working / not drawing power</li> </ul>	<ul style="list-style-type: none"> <li>• Check main fuse F1</li> <li>• Check compressor in manual mode</li> </ul>
Valve 1 failure	valve 1 error	<ul style="list-style-type: none"> <li>• Valve not working</li> <li>• Fuse tripped</li> <li>• Solenoid defective</li> <li>• Valve blocked by dirt</li> </ul>	<ul style="list-style-type: none"> <li>• Check valve in manual mode</li> <li>• Check microfuse of consumers F2</li> <li>• Check valve for traces of powder</li> <li>• Unscrew valve from metal strip and check for contamination and remove any found</li> </ul>
Valve 2 failure	valve 2 error		

## 9. Fault messages and rectification

Display		Possible cause	Rectification
Liquid crystal display			
KLbasic / KL24base	KLplus / KL 24plus		
Valve 3 failure	valve 3 error		(see maintenance instructions in Annex).
Valve 4 failure	valve 4 error		
-	UV unit error	<ul style="list-style-type: none"> <li>• UV module not working</li> </ul>	<ul style="list-style-type: none"> <li>• Check UV module and remaining lamp life</li> </ul>
-	**error** min. water level	<ul style="list-style-type: none"> <li>• Compressed air line leaking between control unit and feed lifter, e.g. due to loose hose</li> </ul>	<ul style="list-style-type: none"> <li>• Check hose line for leaks</li> </ul>
-	Alert flooding	<ul style="list-style-type: none"> <li>• Water level in 1 chamber is too high</li> <li>• Compressed air line blocked, e.g. due to kink in hose</li> </ul>	<ul style="list-style-type: none"> <li>• See Item 9.2</li> <li>• Check hose line for kinks</li> </ul>
-	temperature max.	<ul style="list-style-type: none"> <li>• Temperature sensor not plugged in</li> <li>• Cabinet fan not working</li> <li>• Filters in cabinet and in compressor are dirty</li> <li>• Direct sunlight on cabinet</li> <li>• The temperatures entered in the Service menu for switching on the cooling fan and the maximum temperature are too high</li> <li>• Air compressor defective</li> <li>• Temperature sensor defective</li> </ul>	<ul style="list-style-type: none"> <li>• Plug temperature sensor onto rear of control unit</li> <li>• Check the functionality of the cabinet fan</li> <li>• Check air filter in cabinet</li> <li>• Provide site with shade</li> <li>• Ensure good aeration</li> <li>• Check air filter in air compressor</li> <li>• Check air compressor in manual mode</li> <li>• Have set temperatures checked by maintenance company</li> <li>• Replace temperature sensor</li> </ul>
-	**error** temp.-sensor	<ul style="list-style-type: none"> <li>• No temperature sensor</li> <li>• Temperature sensor not fully plugged into bush</li> <li>• Temperature sensor defective</li> </ul>	<ul style="list-style-type: none"> <li>• Replace sensor</li> <li>• Ensure a reliable connection between control unit and temperature sensor, then de-energise control unit for 10 sec. and switch on again, check whether a temp. sensor fault message is displayed.</li> </ul>
Power failure	**error** power failure	<ul style="list-style-type: none"> <li>• Power cut</li> <li>• System switched off via maintenance switch</li> <li>• Switch cabinet is not energised</li> <li>• FI fuse has blown</li> </ul>	<ul style="list-style-type: none"> <li>• Wait for power to be restored</li> <li>• Switch system back on via maintenance switch</li> <li>• Check supply line to switch cabinet</li> <li>• Establish cause for earth leakage circuit breaker blowing and remedy (possible cause: solenoid valve defective).</li> <li>•</li> </ul>

## 9. Fault messages and rectification

Display		Possible cause	Rectification
<b>Liquid crystal display</b>			
KLbasic / KL24base	KLplus / KL 24plus		
-	modem error	<ul style="list-style-type: none"> <li>• Batteries in module are not yet fully charged</li> <li>• Modem has no mains voltage</li> <li>• No SIM card inserted in modem</li> <li>• SIM card not logged into mains</li> </ul>	<ul style="list-style-type: none"> <li>• Wait 5 minutes until batteries are charged</li> <li>• Connect modem to the mains</li> <li>• Insert SIM card in modem</li> <li>• Wait until card has logged in or move antenna into position where reception is available.</li> </ul>

### 9.2 Unusual water levels - remedying a fault

Observation	Possible cause	Rectification
The water level in the pre-treatment section is unusually high, but is normal in the aeration section.	<ul style="list-style-type: none"> <li>• The lifter at valve 1 is not activated.</li> <li>• The pump time for lifter 1 has too short a setting.</li> <li>• The feed lifter is blocked.</li> <li>• The air supply to the feed lifter is leaking.</li> </ul>	<ul style="list-style-type: none"> <li>• In manual mode, activate valve 1 and check function of lifter.</li> <li>• Have time for valve 1 extended by service company</li> <li>• Allow pre-treatment section to be pumped empty and clean lifter</li> <li>• Allow pre-treatment section to be pumped empty and seal hose connections</li> </ul>
The water level in the pre-treatment section and aeration basin is unusually high.	<ul style="list-style-type: none"> <li>• System running in holiday mode.</li> <li>• System running continuously in cycle pause.</li> <li>• Control unit settings are incorrect.</li> <li>• The discharge lifter is blocked.</li> <li>• The air hose to the discharge lifter is leaking.</li> <li>• Flooding in the discharging system is not allowing water to drain from the system.</li> <li>• Control unit is defective.</li> </ul>	<ul style="list-style-type: none"> <li>• Exit holiday mode (see Item 6.3.4)</li> <li>• Have control unit settings checked by a maintenance specialist</li> <li>• Allow SBR reactor to be pumped empty and clean lifter</li> <li>• Allow SBR reactor to be pumped empty and seal hose connections</li> <li>• Wait for flooding to drain away</li> <li>• Contact maintenance company</li> </ul>
The system smells, the cleaned wastewater is cloudy and/or discoloured	<ul style="list-style-type: none"> <li>• Too little air is being drawn into the system</li> <li>• Aeration on one side only due to defective membrane unit</li> </ul>	<ul style="list-style-type: none"> <li>• Have aeration time extended by service company</li> <li>• Check aeration pattern, contact maintenance company</li> </ul>
Aeration pattern is one-sided and/or large air bubbles are forming in some areas	<ul style="list-style-type: none"> <li>• Membrane unit defective</li> <li>• Seal on aerator bar leaking</li> </ul>	<ul style="list-style-type: none"> <li>• Contact maintenance company</li> <li>• Contact maintenance company</li> </ul>
Solenoid valves switching unusually loudly	<ul style="list-style-type: none"> <li>• Valve seat of solenoid valve is dirty</li> </ul>	<ul style="list-style-type: none"> <li>• Screw open and clean solenoid valve</li> </ul>

## 9. Fault messages and rectification

### 9.3 Possible faults on solenoid valves

Observation	Possible cause
Anchor does not make contact.	<ul style="list-style-type: none"><li>• Connection voltage is interrupted or is insufficient.</li><li>• Solenoid defective.</li><li>• Anchor blocked in dirty tube space. If the anchor does not reach the stroke end position, when the AC coil is excited this will soon result in coil failure (due to thermal overload).</li><li>• Rated voltage different from coil voltage.</li></ul>
Valve does not close.	<ul style="list-style-type: none"><li>• Anchor blocked!</li><li>• Rated voltage still present</li></ul>
Valve does not open.	<ul style="list-style-type: none"><li>• Rated voltage not present.</li><li>• Solenoid defective.</li><li>• Rated voltage different from coil voltage.</li></ul>

## 10. Operating instructions

### 10. Operating instructions

Basically only substances with the characteristics of domestic wastewater may enter the system.

Biocides, toxic substances or substances which are not biocompatible or biodegradable must not enter the system because they 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 keeping animals
- 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

If discharging larger volumes of grease or plant-based oils, we would recommend pre-cleaning the wastewater containing the greases/oils in a grease separator upstream of the wastewater treatment system (caution: faeces must not be allowed to enter the grease separator!).

## 10. Operating instructions

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

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

## 10. Operating instructions

<b>Food waste</b>	Cause blockages, attract rats	Dustbin
<b>Wallpaper paste</b>	Causes blockages	Local collection point
<b>Textiles (e.g. nylon tights, cleaning cloths, handkerchiefs etc.)</b>	Block pipes, may paralyse a pump station	Used textiles collection point
<b>Thinner</b>	Contaminates the wastewater	Local collection point
<b>Bird sand, cat litter</b>	Cause deposits and pipe blockages	Dustbin
<b>Cotton buds</b>	Block the system	Dustbin
<b>Toilet blocks</b>	Contaminate the wastewater	Do not use
<b>Nappies</b>	Block the pipes	Dustbin
<b>Cement water</b>	Is deposited, results in production of concrete	Contact specialist company

Thank you for your trust.

Otto Graf GmbH, Teningen

Dated 08/2015

*Subject to technical modifications.*









## 12. Maintenance log for KLARO small wastewater treatment systems

### 12. Maintenance log for KLARO small wastewater treatment systems

Location (address): \_\_\_\_\_

Maintenance company: \_\_\_\_\_ Date of maintenance: \_\_\_\_\_

Serial number: \_\_\_\_\_ Order no.: \_\_\_\_\_

System size: \_\_\_\_\_ PE Actual connection \_\_\_\_\_ PE

Operator's name: \_\_\_\_\_ Customer no.: \_\_\_\_\_

1st line of address: \_\_\_\_\_ Tel. no.: \_\_\_\_\_

Town/city, postcode: \_\_\_\_\_ Fax no.: \_\_\_\_\_

Installed by: \_\_\_\_\_ Start-up: \_\_\_\_\_

Will the system process commercial wastewater too?  No

Restaurant without kitchen  Restaurant with kitchen  Other \_\_\_\_\_

Grease separator present, NG  Emptying needed \_\_\_\_\_

Structural condition (visual evaluation of pit body when filled):

Dividing walls are OK  Pit is sealed to the outside

Dividing wall between sludge reservoir  
+ buffer & SBR is leaking  Corrosion damage

Comments: \_\_\_\_\_

Function check of system parts important to operation:

Feed lifter / valve 1 (red)  Aeration / valve 2 (blue)

Discharge lifter / valve 3 (black)  Excess sludge lifter / valve 4 (white)

Power cut detector (optional)

Air inlet / aeration:  moderate  intensive, circulation clearly visible

Aerator pattern / aeration:  fine bubbles  even

Comments: \_\_\_\_\_

## 12. Maintenance log for KLARO small wastewater treatment systems

### Sludge accumulator + buffer:

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 400 ml/l)

Comments: \_\_\_\_\_

### Control unit:

Control unit type: \_\_\_\_\_       $\Sigma$  operating hours: \_\_\_\_\_

Feed (valve 1): \_\_\_\_\_      Aeration (valve 2): \_\_\_\_\_

Discharge (valve 3): \_\_\_\_\_      Excess sludge reservoir (valve 4): \_\_\_\_\_

Comments: \_\_\_\_\_

### Blower:

Blower type: \_\_\_\_\_       Blower OK

Change the slats (slat length: \_\_\_\_\_ mm)       Change the membranes

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

## 12. Maintenance log for KLARO small wastewater treatment systems

Dry substance

Activated sludge

kg SOL / m<sup>3</sup> P<sub>total</sub>

Substances that can settle

ml / l pH

BOD<sub>5</sub>

ml / l COD

ml / l

NH<sub>4</sub>-N

ml / l N<sub>tot</sub>

ml / l

**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 system (see operating log).

Pit is overflowing, operator must discharge content.

Empty pit (dispose of sludge reservoir).

---

Date and signature