

AQUATO® K-PILOT
2.4 + 2.4P



PLEASE NOTE THE FOLLOWING:

The installation manual and the operating diary must be kept directly at the facility, so that both operators and qualified personnel can inspect it at any time.

Manufacturer

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I	Table of Contents	
I	Table of Contents	3
II	List of Figures	7
1	Important Information	9
1.1	General Information	9
1.2	Important Notes	9
2	Safety Instructions	12
2.1	General Information on Safety Instructions	12
2.2	Definition of Terms	12
2.3	Hazard Analysis	12
2.4	Warning Symbols Used	13
2.5	Operator's Duty of Care	13
2.6	General Safety Instructions	14
2.7	Safety Instructions for Qualified Personnel	16
2.8	Rescue Measures	16
3	Application Range of the Control Unit	17
3.1	Standard Settings	18
3.1.1	Operation with Pump Instead of Airlift	18
3.1.2	Operation with Double Float Switch	18
3.1.3	Operation with Float Switch BP	18
3.2	Use in an SSB System	19
3.2.1	Function	19

3.2.2	Presettings	22
3.2.3	Switching Times- Basic Settings	22
3.3	Use for an SBR Compressor System.....	23
3.3.1	Function	23
3.3.2	Presettings	25
3.3.3	Switching Times – Basic Settings	25
3.4	Use in an SBR Submersible Motor Pump System	26
3.4.1	Function	26
3.4.2	Presettings	28
3.5	Use for Fixed-Bed System	29
3.6	Use for a Fluidized-Bed System	29
3.7	Use for a Trickling Filter System	29
3.8	Use for a Constructed Wetland System.....	29
4	Installation Instructions for the Control Unit	30
4.1	Safety Instructions	30
4.2	Installation of the K-Pilot 2.4 Control Unit	31
4.3	Solenoid Valves and Rotary Valve.....	32
5	Connections on the Control Unit.....	33
5.1	Overview	33
5.2	Air Connections.....	36
5.3	Electrical Connections.....	37
5.3.1	Mains Connection of the Control Unit.....	39
5.3.2	Compressor	40
5.3.3	Potential-Free Contact.....	41

5.3.4	Additional Connections-Operation with Motor Pumps.....	43
5.3.5	Float Switch.....	45
5.3.6	Clear Water Pump.....	51
6	Operation and Displays of the Control Unit.....	52
6.1	Direct Operation	53
6.2	Faults.....	55
	<p>Faults are indicated by the operating LED flashing red and by the buzzer sounding. On the display, errors are reported in the main menu by showing “FAULT” in the bottom line. An example of an error message is shown in the following figure:.....</p>	
	55	
6.3	Mains Failure Alarm.....	56
6.4	Operation via the Web Interface	57
7	Commissioning the System.....	58
7.1	Before Commissioning.....	58
7.2	Commissioning.....	59
7.3	Commissioning the Control Unit.....	60
8	Menus	62
8.1	Main Display	62
8.2	Menu.....	63
8.2.1	Menu Structure.....	63
8.2.2	STATUS 1 Menu.....	67
8.2.3	STATUS 2 Menu.....	68
8.2.4	OPERATING HOURS Menu	69

8.2.5	MEASURED DATA Menu	71
8.2.6	OPERATING PARAMETERS Menu.....	74
8.2.7	MONITORING PARAMETERS Menu	75
8.2.8	ALARM Menu	76
8.2.9	SETTINGS Menu	77
8.2.10	SERVICE Menu.....	78
9	Error message and troubleshooting	81
10	Technical Data	83
11	Operating Logbook.....	84
12	Decommissioning and Disposal.....	85
12.1	Temporary Decommissioning	85
12.2	Dismantling the Complete System.....	85
12.3	Disposal.....	85
13	Addresses	86

II List of Figures

Abbildung 1: K-Pilot 2.4 control unit with rotary valve and compressor	16
Abbildung 2: Connections on the K-Pilot 2.4 control unit	32
Abbildung 3: K-Pilot 2.4 control unit opened	33
Abbildung 4: K-Pilot 2.4 control unit – important components on the circuit boards	34
Abbildung 5: K-Pilot 2.4 control unit – air connections.....	35
Abbildung 6: External electrical connections on the K-Pilot 2.4 control unit	36
Abbildung 7: Electrical connections inside the K-Pilot 2.4.....	37
Abbildung 8: K-Pilot 2.4 control unit with socket for compressor	39
Abbildung 9: Potential-free contact.....	40
Abbildung 10: Potential-free contact with power supply from the control unit.....	41
Abbildung 11: Potential-free contact with fault message also in the event of a power failure....	41
Abbildung 12: K-Pilot 2.4 – additional connections in the control unit.....	42
Abbildung 13: K-Pilot 2.4 with connections for float switches.....	44
Abbildung 14: K-Pilot 2.4 – float switch connection.....	46
Abbildung 15: Connection of 2nd float switch as high-water alarm	47
Abbildung 16: Connection of double float switch on K-Pilot 2.4	49
Abbildung 17: Clear water pump with external float switch.....	50
Abbildung 18: K-Pilot 2.4 control unit – clear water pump connection	50
Abbildung 19: Operating buttons	52
Abbildung 20.: K-Pilot 2.4 menu structure	62

Manufacturer's Declaration

Declaration of Conformity

This certifies the conformity of the AQUATO® K-Pilot 2.4 control unit with the EU directives for CE marking.

Device type::	Electronic control devices for the automatic operation of a fully biological small wastewater treatment plant in accordance with DIN 4261-2 and DIN EN 12566-3	
	AQUATO® K-Pilot 2.4	
Directives / Regulations:	1. 2014 / 30 / EU	EMC Directive
	2. 2014 / 35 / EU	Low Voltage Directive
	3. 2011 / 65 / EU	RoHS Directive
	4. 2006 / 42 / EG	Machinery Directive
	5. 305 / 2011	Construction Products Regulation

Applied standards:

for 1.	EN 61000-6-3 (2006) EN 61000-6-1 (2007) EN 61000-3-2 (2014)
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for 2.	EN 60204-1 (2010)
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for 3.	- not applicable -
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Special notes	- none -
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This document certifies conformity with the listed directives, but does not constitute a guarantee of properties.

The declaration of conformity becomes invalid if the product is modified without the manufacturer's approval.

Date:	11.09.2028
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Nils Homburg, Technischer Manager

Manufacturer:	AQUATO® Umwelttechnologien GmbH Ernstmeierstraße 24 32052 Herford
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1 Important Information

1.1 General Information

This manual describes the operation of the K-Pilot 2.4 control unit.

With the AQUATO® K-Pilot 2.4 control unit, you receive a quality product designed for controlling small wastewater treatment plants. Compressors and pumps are automatically controlled for this purpose. During operation, the power consumption of the units is monitored to ensure operational reliability.

The K-Pilot 2.4 control unit can be used to operate SSB, SBR, fixed-bed and fluidized-bed systems, as well as trickling filter and constructed wetland wastewater treatment systems..

Please read this information in advance to ensure proper operation and permanent compliance with the required discharge values.



The complete operating manual must be kept directly at the system so that both operators and qualified specialist personnel, such as the maintenance company, can consult it at any time.

1.2 Important Notes

Faults are indicated by the AQUATO® K-Pilot 2.4 control unit both acoustically and visually. It has a mains-independent power failure monitoring system as well as an integrated Wi-Fi interface, allowing it to be operated via a web interface..

Some functions of the control unit are password-protected to prevent incorrect operation.

After commissioning has been completed, make sure you receive instruction in the system technology and the function of the AQUATO® K-Pilot 2.4 control unit..

Improper use will void the warranty.

For repairs, proper function and preservation of the warranty can only be guaranteed if original spare parts or spare parts approved by AQUATO® are used.

The control unit must not be switched off during operation; otherwise, the treatment performance of the system can no longer be ensured. If the control unit emits alarm signals, please inform your maintenance service immediately so that they can remedy the fault.



**The small wastewater treatment plant must be in continuous operation.
It must not be switched off.**

If you have problems with your control unit, please discuss them with your maintenance company. They will be happy to assist you in solving the problem.

If the AQUATO® control unit is used for other purposes without the express approval of AQUATO® Umwelttechnologien GmbH and/or if the safety instructions are disregarded, this may result in danger to or injury of persons, as well as malfunctions or defects in the system.

In this case, all liability is excluded.



The relevant accident prevention regulations must be observed.

Modifications to the control unit or unauthorized conversion are not permitted.

The AQUATO® K-Pilot 2.4 control unit must be properly installed before use and in accordance with the installation instructions; see Chapter 5.

The operating manual for the control unit must be read carefully before installation and commissioning, and the instructions contained therein must be strictly followed.

During assembly and installation, commissioning and operation, and, if applicable, decommissioning, the applicable standards and regulations must be observed.

All work may only be carried out by trained specialists with the corresponding proof of professional competence.

The operator of the system must be instructed in its operation by the installer.

The operation of the small wastewater treatment plant must be carried out by the owner or by a competent person appointed by the owner, referred to as the operator.

When connecting the control unit, the nationally applicable regulations as well as the information on the type plate must be observed. The device may only be operated on mains systems that include a protective earth conductor, PE. The connection to the power supply must be made by means of separate fuse protection and residual-current protection.

Installation work may only be carried out by qualified electricians.

Whenever work is carried out on the device, the mains plug must always be disconnected.

Do not operate any device that:

- ▶ shows malfunctions,
- ▶ has been dropped,
- ▶ has been damaged in any other way,
- ▶ visibly has a damaged connection cable / connecting cable, or
- ▶ visibly has a damaged plug.

During all maintenance and repair work, the system must be disconnected from the power supply.

If it is necessary to enter the system, this may only be done in the presence of a second person and with appropriate safety measures, such as a gas warning device and safety lines.

The applicable accident prevention regulations and accepted technical rules must be observed.

2 Safety Instructions

2.1 General Information on Safety Instructions

This manual contains basic instructions that must be observed during installation, commissioning and maintenance.



The complete manual must be kept directly at the system so that both the operators and qualified specialist personnel, such as the maintenance company, can consult it at any time.

The safety instructions listed in this operating manual, the existing national accident prevention regulations, and any internal work, operating and safety regulations must always be observed.

Failure to observe the safety instructions may pose a risk both to persons and to the environment, and may result in the loss of any claims for damages.

2.2 Definition of Terms

Operator

The operator of the system is the person who ensures that the system is operated in working order.

Qualified Specialist Personnel

Qualified specialist personnel are able, on the basis of their professional training and the knowledge and skills they have acquired, to assess and carry out the work assigned to them and to identify and evaluate hazards..

2.3 Hazard Analysis

The AQUATO® systems have been developed in accordance with the state of the art and subjected to a hazard analysis. To eliminate or minimize risks, please observe the following instructions.

2.4 Warning Symbols Used

Below is an overview of the symbols used in this manual and their meaning:



Warning of a hazardous area



Warning of dangerous electrical voltage

2.5 Operator's Duty of Care

Ensure that:

- the system is only used for its intended purpose; see Chapter 4,
- the system is only operated when in proper working condition,
- self-checks are carried out by the operator,
- the maintenance intervals are observed,
- maintenance and repairs are only carried out by qualified specialist personnel,
- the operating manual for the control unit, as well as the installation, operating and maintenance manual and the operating logbook, can be consulted at any time,
- only wear parts and spare parts approved by the manufacturer are used.

2.6 General Safety Instructions

The accident prevention regulations for work on wastewater systems, DGUV Regulation 21 and DGUV Regulation 22, must be observed. The respectively applicable regulations, such as EN, VDE, etc., as well as the regulations of the local energy suppliers, must be strictly complied with. The work should only be carried out by qualified personnel.

The following safety instructions must always be observed for your own safety when working on or coming into contact with the small wastewater treatment plant:

This device may be used by children aged 10 years and above, as well as by persons with reduced physical, sensory or mental abilities or a lack of experience and knowledge, provided that they are supervised or have been instructed in the safe use of the device and understand the resulting hazards.

Children must not play with the device. Cleaning and user maintenance must not be carried out by children without supervision.



1. Disconnect the small wastewater treatment plant from the power supply.

Particular care must be taken during maintenance work in the pit. In this case, the system technology must always be disconnected from the power supply and secured against unintended restoration of the power supply..



Danger of electric shock in the event of a defective compressor or defective power cables..

During fine-bubble aeration, AQUATO® aeration systems create a water-air bubble mixture that has a lower density than pure water. This reduces buoyancy in the water. If a person were to accidentally fall into the reactor, it would not be possible for them to swim. Danger of drowning.



2. Ventilate the system well; entry into the pit only with safety precautions and a supervising person.

Biological processes produce gases that are dangerous to humans. These can lead to unconsciousness and/or death by suffocation, even if they cannot be detected by smell. For this reason, entry into the small wastewater treatment plant is only permitted under the supervision of a person keeping watch outside, after thorough ventilation, and with appropriate safety measures, such as a gas warning device and safety lines.

A rescue/fall-arrest harness must be worn by every person entering the system.

Never climb in after unconscious persons; call for help immediately.



3. Electrical protection, residual-current device, RCD.

AQUATO® systems operate with 230 V / 50 Hz alternating voltage or with 400 V / 50 Hz alternating voltage. When operating the control unit, personnel must not be exposed to the risk of electric shock, even through carelessness, such as wet fingers. The socket intended for the control unit must be separately protected by a residual-current device, RCD, in accordance with DIN VDE 0100-410:2018-10, and connected to the power supply by electrically qualified personnel. Before commissioning the system, the proper functioning of the electrical protective measures must be checked by an authorized qualified electrician..



2.7 Safety Instructions for Qualified Personnel

- Installation, maintenance work and repairs may only be carried out by qualified specialist personnel. Before carrying out the work, it must be ensured that:
- the knowledge and skills of the personnel correspond to the intended task,
- the personnel have been instructed,
- the operating manual has been read and understood.



Before and during work inside the tank, ventilation must be used to ensure that no gases occur in concentrations hazardous to health, and that no explosive atmosphere or oxygen deficiency is present. Entry into the tank may only take place in the presence of a second person and with appropriate safety measures, such as a gas warning device and safety lines.



Before and during the work, it must be ensured that the system has been disconnected from the power supply and secured against being switched on again.



Work in tanks requires protective measures even at low heights. Suitable measures must therefore be taken to prevent falls. If technical measures are not possible, personal protective measures against falls should be taken.



Always wear suitable protective clothing as well as hand, foot and face protection. Avoid contact with wastewater.

We point out that, despite all safety measures taken, residual risks at the installation site cannot be ruled out:

- **risk of slipping and tripping,**
- **danger from electrical voltage,**
- **risk of infection from germs and bacteria.**

2.8 Rescue Measures

Ensure that, when work is carried out inside the tank, a second person is always present to provide safety support. Never climb in after an unconscious person; call for help.

3 Application Range of the Control Unit

The K-Pilot 2.4 control unit is used to operate small wastewater treatment plants. The control unit has an integrated mains failure warning system as well as current and pressure monitoring. A wide range of aggregate combinations is possible with this control unit. It has an integrated Wi-Fi interface, allowing it to be operated via a web interface.

This control unit can be used to operate SSB, SBR, fixed-bed and fluidized-bed systems, as well as trickling filter and constructed wetland wastewater treatment systems.



Figure 1: K-Pilot 2.4 control unit with rotary valve and compressor

The K-Pilot 2.4 control unit has four electrical outputs and two float switch inputs. This means that a wide range of aggregate combinations is possible with this control unit for operating the system.

3.1 Standard Settings

As standard, all required wastewater transport processes in SSB, SBR compressor, fixed-bed and fluidized-bed systems are carried out using airlifts. The airlifts are controlled by means of a rotary valve. If required, however, they can also be operated with solenoid valves..

In trickling filter and constructed wetland systems, submersible motor pumps are controlled by the control unit as standard. The same applies when used for AQUATO-PUMP systems.

The K-Pilot 2.4 control unit can be operated both with a rotary valve with stepper motor and with solenoid valves.

It can be operated with or without a float switch. When a float switch is used, the clear water discharge time is shortened where possible and, if necessary, a high-water alarm is triggered. In addition, economical operation with slightly reduced running times is possible in SSB and SBR systems..

A float switch used purely as a high-water alarm, without affecting the cycle, can also be used with the K-Pilot 2.4 control unit in SSB, SBR, fixed-bed and fluidized-bed systems.

3.1.1 Operation with Pump Instead of Airlift

When operating with the K-Pilot 2.4 control unit, the individual airlifts can each be replaced by a submersible motor pump..

3.1.2 Operation with Double Float Switch

With the K-Pilot 2.4 control unit, it is possible to work with a double float switch, i.e. to use one float switch for the lower switching point and another for the upper switching point, thereby increasing the buffer. In this case, however, no further float switch can be used for an additional buffer.

3.1.3 Operation with Float Switch BP

The Float Switch BP function is intended for SBR systems that have a float switch with very small hysteresis installed. With the Float Switch BP setting, the float switch intervenes in the SBR cycle by ending the feeding process when it floats up, but not ending the clear water discharge when the float switch drops. However, a high-water alarm is still triggered if the float switch has not dropped after the clear water discharge

3.2 Use in an SSB System

3.2.1 Function

The system is operated fully automatically by the K-Pilot 2.4 control unit. The individual phases of the treatment process are carried out one after the other, regulated by the control unit. The cycles are programmed, but the different phases can be specifically adjusted if required.

The STABI-KOM small wastewater treatment plant operates according to the SSB® process. The abbreviation stands for sequential sludge-stabilizing activated sludge process. This is an aerobic wastewater treatment system with integrated sludge stabilization.

The STABI-KOM is a single-stage activated sludge system. The common system stage is divided into at least two chambers. All chambers of the system are hydraulically connected, creating one common system stage. The spatial connection is achieved by connections below the minimum water level between all chambers, allowing the system to be flowed through by gravity.

Wastewater treatment is essentially carried out by the natural microorganisms that form the activated sludge. The organic compounds contained in the wastewater are broken down by these microorganisms. Optionally, the denitrification process also takes place. The oxygen supply for the organisms is ensured by intermittent aeration.

In the SSB process, all steps of wastewater treatment take place in the common system stage, including wastewater treatment by activated sludge as well as sludge separation, stabilization and storage. The differences in degradation in the individual chambers are only gradual.

The individual processes in the system are not separated spatially, but chronologically. Therefore, all chambers of the system are aerated at intervals; there is no anaerobic primary treatment.

The chronological separation of the treatment processes is handled by the K-Pilot 2.4 control unit, with which the different phases can be specifically adjusted.

Wastewater can flow in at any time. It flows freely into the first chamber. Here, initial mixing with the wastewater already present in the tank takes place, as well as the first partial biological treatment of the wastewater. In addition, the first chamber acts as a coarse solids trap. Coarse solids are retained here.

At the same time, the partially treated wastewater flows by gravity from the first chamber into the following chambers. Further partial treatment takes place in each subsequent chamber.

The final partial biological treatment of the wastewater takes place in the last chamber. This chamber also serves as an intermittently operated final clarifier.

The system operates in impounding mode; therefore, the treated wastewater is only discharged from the treatment plant during the clear water discharge phase, directly after the settling phase. Clear water is discharged from the upper area of the last chamber. Since the connections between the individual chambers / tanks are located only just below the minimum water level, it is ensured that only clarified wastewater is actually discharged from the system.

All processes in the system take place in regular cycles, which are set on the control unit during commissioning but can also be adjusted later if required. A treatment cycle consists of the following 4 phases:

1. Aeration

In this phase, the pollutant load in the wastewater is biologically broken down by microorganisms in all chambers. Air is blown into the wastewater by the aeration devices. These are membrane aerators located on the floor of each chamber, which are supplied with air via hoses by an externally installed compressor. This provides the microorganisms with the oxygen required to break down the wastewater constituents. At the same time, aeration ensures good mixing in each chamber of the system. Since the load is highest in the first chamber, a particularly large amount of air is introduced there. Aeration of all chambers is intermittent. This means that it does not run continuously, but only as much as necessary to provide the microorganisms with sufficient oxygen for their metabolic processes and thus for breaking down the pollutants. This is economical and saves energy.

2. Settling Phase

During the settling phase, aeration of the water is switched off in all chambers. As the water becomes calm, the activated sludge settles at the bottom of the tank. Since the sludge sinks completely to the bottom, the treated clear water with the required water quality remains in the upper area of the system. Because this clear water supernatant forms throughout the entire system, a separate final clarification chamber is not required.

3. Clear Water Discharge

Since the activated sludge flocs and water have separated from each other during the settling phase, the clear, treated water can then be conveyed from the upper area of the last chamber of the system into the outlet during the clear water discharge phase using the clear water airlift, or, if required, the clear water pump. Since the system forms one hydraulic unit, the treated water from the front chambers flows in after it. The arrangement of the passage openings in the upper area of the water column ensures that clear wastewater flows in.

4. Sludge Return

The breakdown of wastewater pollutants causes the microorganisms to multiply. New activated sludge is continuously formed. Therefore, in this phase, the so-called excess sludge is pumped by means of the sludge airlift from the last chamber back into the first chamber of the system, allowing a sufficient clear water phase to form in the last chamber and also providing a certain degree of recirculation.

After the clear water and excess sludge discharge, the next cycle starts again with the aeration phase. As standard, the system runs through approximately 4 cycles per day. However, the cycle duration can be adjusted individually, meaning that the number of cycles per day may also vary.

During normal operation, the water level in the system fluctuates in each cycle between HW min and HW max. During clear water discharge, the water is pumped down to HW min. The water then rises again depending on the inflow, up to a maximum of HW max.

When operating with a float switch and the FLOAT SWITCH control setting, the system automatically switches to economy mode with reduced aeration if little water flows in. Once sufficient water has flowed in so that the float switch exceeds the upper switching point, the K-Pilot 2.4 control unit automatically switches the system back to normal operation with the cycles described above.

3.2.2 Presettings

Number of inhabitants	4
Effluent clas	C
Aeration	1 und 2
Control type	Time

3.2.3 Switching Times- Basic Settings

PE number	Aeration normal operation			Aeration economy mode			Denitrification normal operation			Denitrification economy mode			Settling phase (min)	Clear water discharge (min)	Sludge discharge (min)
	Aerator ON (min)	Aerator OFF (min)	Duration (min)	Aerator ON (min)	Aerator OFF (min)	Duration (min)	Aerator ON (min)	Aerator OFF (min)	Duration (min)	Aerator ON (min)	Aerator OFF (min)	Duration (min)			
4	3,0	5,0	180	2,0	5,0	120	1,0	15,0	45	1,0	15,0	45	90	10	1,0
8	5,0	5,0	180	3,0	5,0	120	1,0	15,0	45	1,0	15,0	45	90	10	1,0
12	7,0	3,0	180	5,0	5,0	120	1,0	15,0	45	1,0	15,0	45	90	15	2,0
16	7,0	3,0	180	5,0	5,0	120	1,0	15,0	45	1,0	15,0	45	90	15	2,0
20	8,0	3,0	180	6,0	3,0	120	1,0	15,0	45	1,0	15,0	45	90	20	2,0
>20	8,0	3,0	180	6,0	3,0	120	1,0	15,0	45	1,0	15,0	45	90	20	2,0

The system only switches to economy and holiday mode if a float switch is installed and the control type is set to "FLOAT SWITCH". Economy mode is activated if the float switch has not floated up after sludge discharge. Holiday mode begins after economy mode if the float switch has not floated up within 3 days of economy mode. In holiday mode, the aeration time is reduced again by 2/3. As soon as the float switch floats up again, the system switches back to normal operation. When the control type is set to "FLOAT SWITCH", all clear water discharge times are preset to 30 minutes.

3.3 Use for an SBR Compressor System

3.3.1 Function

The system is operated fully automatically by the K-Pilot 2.4 control unit. The individual phases of the treatment process are carried out one after the other, regulated by the control unit. The cycles are programmed, but the different phases can be specifically adjusted if required.

The KOM small wastewater treatment plant operates using the SBR process. This abbreviation of the English term "Sequencing Batch Reactor" can be loosely translated as "reactor charged cyclically in batches". This describes a modern variant of wastewater treatment that is not carried out continuously, but portion by portion in individual cycles.

Wastewater treatment is essentially carried out by the natural microorganisms that form the activated sludge. The organic compounds contained in the wastewater are broken down by these microorganisms. Optionally, the denitrification process also takes place. The oxygen supply for the organisms is ensured by intermittent aeration.

The system is operated fully automatically by a control unit, PLC. The individual phases of the treatment process are carried out one after the other, regulated by the control unit. The cycles are programmed, but the different phases can be specifically adjusted.

Wastewater can flow in at any time. It flows freely into the first chamber of the primary treatment stage. Here, the first partial treatment of the wastewater takes place. In addition, the first chamber acts as a coarse solids trap. Coarse solids are retained here.

The system operates in impounding mode; therefore, the treated wastewater is only discharged from the treatment plant during the clear water discharge phase, directly after the settling phase. Clear water is discharged from the upper area of the last chamber so that only clarified wastewater is actually discharged from the system.

All processes in the system take place in regular cycles, which are set on the control unit. A treatment cycle consists of the following 5 phases:

1. Feeding

Wastewater pre-treated in the primary treatment stage is transferred into the reactor in a controlled manner. In the AQUATO® KOM system, this is carried out by an airlift. Optionally, the system automatically switches to economy mode if a minimum water level in the reactor is not reached during feeding, and repeats the feeding process at regular intervals until a corresponding quantity of wastewater has flowed into the treatment plant.

2. Aeration

In this phase, the pollutant load in the wastewater is biologically broken down by microorganisms. Air is blown into the wastewater by the aeration devices. These are membrane aerators located on the floor of the reactor, which are supplied with air via hoses by an externally installed compressor. This provides the microorganisms with the oxygen required to maintain their metabolic processes

and thus to break down the pollutants. At the same time, aeration ensures good mixing of the reactor. Aeration is intermittent. This means that it does not run continuously, but only as much as necessary to provide the microorganisms with sufficient oxygen to maintain their metabolic processes and thus to break down the pollutants. This is economical and saves energy.

3. Settling Phase

During the settling phase, aeration of the water is switched off. As the water becomes calm, the activated sludge settles at the bottom of the tank. Since the sludge sinks completely to the bottom, the treated clear water with very good water quality remains in the upper area of the reactor. Because this clear water supernatant forms, a separate final clarification chamber is not required.

4. Clear Water Discharge

Since the activated sludge flocs and water have separated from each other during the settling phase, the clear, treated water can then be conveyed from the upper area of the reactor into the outlet during the clear water discharge phase using the clear water airlift, or, if required, the clear water pump. (oder bei Bedarf mit der Klarwasserpumpe) in den Ablauf gefördert werden.

5. Sludge Return

The breakdown of wastewater pollutants causes the microorganisms to multiply. New activated sludge is continuously formed. Therefore, in this phase, the so-called excess sludge is pumped by means of the sludge airlift from the reactor back into the first chamber of the system, allowing a sufficient clear water phase to form in the reactor and also providing a certain degree of recirculation.

After the clear water and excess sludge discharge, the next cycle starts again with feeding and then the aeration phase. The system runs through approximately 4 cycles per day.

During normal operation, the water level in the reactor fluctuates in each cycle between HW min and HW max. During clear water discharge, the water is pumped down to HW min. During feeding, the water level in the reactor rises again depending on the inflow, up to a maximum of HW max.

When operating with a float switch and the control type setting FLOAT SWITCH, the system automatically switches to economy mode with reduced aeration if little water flows in. Once sufficient water has flowed in so that the float switch exceeds the upper switching point during feeding, the system automatically switches back to normal operation with the cycles described above.

3.3.2 Presettings

Number of inhabitants	4
Effluent class:	C
Aeration	1
Control type	Time

3.3.3 Switching Times – Basic Settings

PE number	Aeration normal operation			Aeration economy mode			Denitrification normal operation			Denitrification economy mode			Settling phase (min)	Clear water discharge (min)	Sludge discharge (min)	Feeding (min)
	Aerator ON (min)	Aerator OFF (min)	Duration (min)	Aerator ON (min)	Aerator OFF (min)	Duration (min)	Aerator ON (min)	Aerator OFF (min)	Duration (min)	Aerator ON (min)	Aerator OFF (min)	Duration (min)				
4	3,0	5,0	180	2,0	5,0	120	1,0	15,0	45	1,0	15,0	45	90	5	1,0	5
8	5,0	5,0	180	3,0	5,0	120	1,0	15,0	45	1,0	15,0	45	90	10	1,0	10
12	7,0	3,0	180	5,0	5,0	120	1,0	15,0	45	1,0	15,0	45	90	15	2,0	15
16	7,0	3,0	180	5,0	5,0	120	1,0	15,0	45	1,0	15,0	45	90	15	2,0	15
20	8,0	3,0	180	6,0	3,0	120	1,0	15,0	45	1,0	15,0	45	90	20	2,0	20
>20	8,0	3,0	180	6,0	3,0	120	1,0	15,0	45	1,0	15,0	45	90	20	2,0	20

The system only switches to economy and holiday mode if a float switch is installed and the control type is set to "FLOAT SWITCH". Economy mode is activated if the float switch has not floated up after sludge discharge. Holiday mode begins after economy mode if the float switch has not floated up within 3 days of economy mode. In holiday mode, the aeration time is reduced again by 2/3. As soon as the float switch floats up again, the system switches back to normal operation. When the control type is set to "FLOAT SWITCH", all clear water discharge times are preset to 30 minutes.

3.4 Use in an SBR Submersible Motor Pump System

3.4.1 Function

The system is operated fully automatically by the K-Pilot 2.4 control unit. The individual phases of the treatment process are carried out one after the other, regulated by the control unit. The cycles are programmed, but the different phases can be specifically adjusted if required. The AQUATO PUMP SBR submersible motor pump system must always be operated with an external float switch connected to the control unit in order to protect the pumps against dry running.

The AQUATO PUMP small wastewater treatment plant operates according to the principle of SBR technology. This abbreviation of the English term “Sequencing Batch Reactor” can be loosely translated as “reactor charged cyclically in batches”. This describes a modern variant of wastewater treatment that is not carried out continuously, but portion by portion in individual cycles.

Wastewater treatment is essentially carried out by the natural microorganisms that form the activated sludge. The organic compounds contained in the wastewater are broken down by these microorganisms. Optionally, the denitrification process also takes place. The oxygen supply for the organisms is ensured by intermittent aeration.

Wastewater can flow in at any time. It flows freely into the first chamber of the primary treatment stage. Here, the first partial treatment of the wastewater takes place. In addition, the first chamber acts as a coarse solids trap. Coarse solids are retained here.

The system operates in impounding mode; therefore, the treated wastewater is only discharged from the treatment plant during the clear water discharge phase, directly after the settling phase. Clear water is discharged from the upper area of the last chamber so that only clarified wastewater is actually discharged from the system.

All processes in the system take place in regular cycles, which are set on the control unit. A treatment cycle consists of the following 5 phases:

1. Feeding Phase

Wastewater pre-treated in the primary treatment stage is transferred into the reactor in a controlled manner. In the AQUATO PUMP system, this is done—after a brief pump-start impulse of the feed pump to vent the feed hose—by water level equalization due to the hydraulic siphon effect according to the principle of communicating vessels. If a minimum water level in the reactor is not reached during feeding, the system automatically switches to economy mode and repeats the feeding process at regular intervals until a corresponding quantity of wastewater has flowed into the treatment plant.

2. Sludge Return

The breakdown of wastewater pollutants causes the microorganisms to multiply. New activated sludge is continuously formed. Therefore, in this phase, the so-called excess sludge is pumped from the reactor back into the first chamber of the system, allowing a sufficient clear water phase to form in the reactor and also providing a certain degree of recirculation.

3. Aeration Phase

In this phase, the pollutant load in the wastewater is biologically broken down by microorganisms. Atmospheric oxygen is introduced into the reactor. In the AQUATO PUMP system, this is mixed into the water by means of a submersible motor aerator. This not only dissolves atmospheric oxygen in the water, but also thoroughly mixes the entire contents of the reactor. This provides the microorganisms that form the activated sludge with the oxygen required to break down the wastewater constituents. At the same time, aeration ensures good mixing of the reactor. Aeration is intermittent. This means that it does not run continuously, but only as much as necessary to provide the microorganisms with sufficient oxygen to maintain their metabolic processes and thus to break down the pollutants. This is economical and saves energy.

4. Settling Phase

During the settling phase, aeration of the water is switched off. As the water becomes calm, the activated sludge settles at the bottom of the tank. Since the sludge sinks completely to the bottom, the treated clear water with the required water quality remains in the upper area of the reactor. Because this clear water supernatant forms in the reactor, no separate final clarification chamber is required.

5. Clear Water Discharge

After the settling phase, the activated sludge flocs and water have separated from each other, thereby ensuring the discharge of treated clear water. This water is pumped out of the upper area of the reactor using the clear water pump.

After the clear water discharge, the next cycle starts again with feeding and the subsequent aeration phase. As standard, the system runs through approximately 4 cycles per day. However, the cycle duration can be adjusted individually, meaning that the number of cycles per day may also vary.

During normal operation, the water level in the reactor fluctuates in each cycle between HW min and HW max. During clear water discharge, the water is pumped down to HW min. During feeding, the water level in the reactor rises again depending on the inflow, up to a maximum of HW max.

If little water flows in, the system automatically switches to economy mode with reduced aeration. Once sufficient water has flowed in so that the float switch exceeds the upper switching point during feeding, the system automatically switches back to normal operation with the cycles described above.

3.4.2 Presettings

Number of inhabitants	4
Effluent class	C
Control type:	Float switch

4 Installation Instructions for the Control Unit

4.1 Safety Instructions



Failure to comply with the following safety instructions may result in restriction or complete loss of the manufacturer's liability..

The control unit is intended for cabinet installation.



Commissioning is carried out by connecting the control unit to the power supply.

Only plug in the mains plug after the existing units have been connected to the devices provided for this purpose in the control unit.



Have the electrical installation carried out exclusively by qualified specialist personnel. The manufacturer assumes no liability for damage caused by carrying out the installation yourself.

Interventions in the device and repairs of any kind may only be carried out by specialists.



Before and during the work, it must be ensured that the system has been disconnected from the power supply and secured against being switched on again.

Vor Inbetriebnahme und Einschalten der Netzspannung ist sicherzustellen, dass

Before commissioning and switching on the mains voltage, it must be ensured that:

- the device and the connection cables show no visible damage,
- in particular, the mains connection and the connections of the units are properly connected,
- all connections have been carried out correctly and professionally,
- the routing / execution of all cables and lines complies with the applicable regulations,
- the device is properly closed,
- the system is properly protected. Mains-side fuse protection max. 1 x 16 A G.

Observe the following important notes before working on the control unit:

- Disconnect the system from the mains before opening the control unit. Pull out the mains plug.
- Open the control unit carefully and do not simply let the cover fall, in order to avoid tearing off or damaging cables or hoses.
- Only replace individual fuses when the unit is de-energized.
- Never use fuses with higher current ratings than specified.
- Do not carry out any circuit-related manipulations on the system.

- The respectively applicable regulations, such as EN, VDE, etc., as well as the regulations of the local energy suppliers, must be strictly complied with.

- If a fuse is defective, it may only be replaced by a miniature fuse of the same type. As standard, in systems with one compressor, a fuse of the following type is installed at the factory: miniature fuse, slow-blow type 3.15 A, 5 x 20 mm in accordance with EN 60127-2/III, with a maximum power dissipation of 1.5 W. In a two-compressor system, the following type is used: miniature fuse, slow-blow type 5 A, 5 x 20 mm.



Note:

For larger systems, a stronger fuse may be installed (max. 6.3 A T). Always replace fuses with a fuse of the same current rating.



Disconnect the mains plug when working on the control unit, pumps and and/or compressors..

The cables to the device must be installed properly. In particular, care must be taken to avoid major mechanical stress on the cables, e.g. due to insufficiently fixed cables, as otherwise protection class IP 54 cannot be guaranteed.

4.2 Installation of the K-Pilot 2.4 Control Unit

the control unit, you can control different treatment processes with different equipment configurations. The valves required for this are arranged outside the housing. A rotary valve with stepper motor can be used, as can solenoid valves.

The control unit can be mounted on a wall or on a mounting plate.

When installed in a wall cabinet, the control unit is mounted on the rear wall of the wall cabinet. The compressor is installed in the wall cabinet on site.

If an outdoor wall cabinet or an outdoor column is used, place it in a shaded and wind-protected location. In climatically unfavorable locations, it may be necessary to install a heater and/or a cooling fan. If a larger diaphragm compressor, rotary vane compressor or side-channel compressor is used, a cooling fan is required.

- Before commissioning the control unit, please read this manual as well as the manual for the respective process, in particular the chapters "Safety Instructions", "Commissioning the Control Unit" and "Selecting System Types".

- When selecting the installation location, the weight of the finished unit must be taken into account, in this example approx. 20 kg.
- Building structures that transmit sound or vibrations are unsuitable for installation.
- The installation location must be dry, clean and well ventilated. High dust levels must be avoided, as otherwise the compressor air filter may become clogged.
- Mount the wall cabinet vertically and horizontally on the wall.
- Place the compressor on the floor of the wall cabinet and connect the air outlet to the valve block.
- Connect the required units to the control unit terminals.
- Insert the plug for the compressor power supply into the 230 V socket at the bottom of the control unit.

If the control unit needs to be opened, disconnect the system from the mains before opening it. Open it carefully and do not simply let the cover fall, in order to avoid tearing off or damaging cables or hoses.



Attention:

Direct sunlight must be avoided in all installation variants. Place the control unit in a shaded and wind-protected location. In climatically unfavorable locations, install a heater and/or cooling fan. For larger compressors, install a cooling fan.

4.3 Solenoid Valves and Rotary Valve

The air is routed from the compressor to the valve block with the solenoid valves or to the rotary valve. The solenoid valve block or rotary valve is generally located in the wall cabinet / outdoor column. The valves are controlled by the control unit in order to open or close the valve for the respective function, depending on the system type and configuration, e.g. clear water discharge, sludge return, aeration, feeding, so that air is available for the function required in each case.

5 Connections on the Control Unit

5.1 Overview

The display and operating buttons are located on the front of the K-Pilot 2.4 control unit.

The connection for the mains cable, the socket for the compressor and the cable glands for the units to be connected are located on the underside of the control unit.

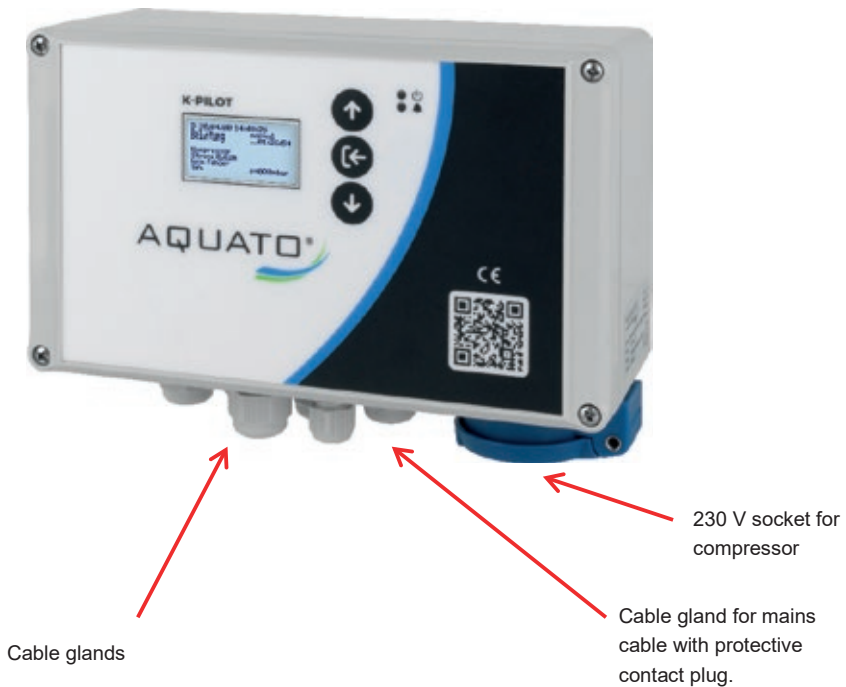


Figure 2: Connections on the K-Pilot 2.4 control unit.

Inside, the terminals for the electrical outputs and inputs are located on the circuit board on the rear wall of the control unit.

The potential-free contact is arranged on the left-hand side of the circuit board.

The miniature fuse and the rechargeable battery are also mounted on the circuit board.

Other important components are the relays and the MOD bus.



Figure 3: K-Pilot 2.4 control unit opened

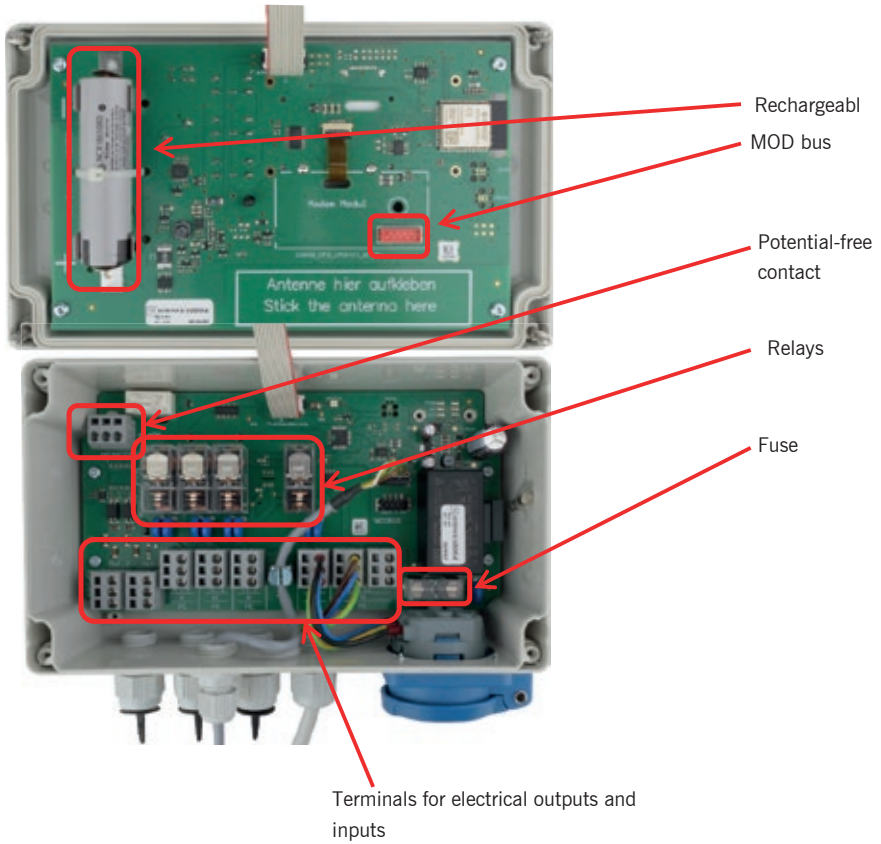


Figure 4: K-Pilot 2.4 control unit – important components on the circuit boards

5.2 Air Connections

The air from the compressor is distributed via the rotary valve or via solenoid valves in the control cabinet, which are controlled by the control unit, in such a way that the different functions are ensured.

The K-Pilot 2.4 control unit itself therefore has no air connection.



Figure 5: K-Pilot 2.4 control unit – air connections.

5.3 Electrical Connections

The first compressor is connected to the socket at the bottom of the control unit. All other units are connected directly inside the control unit; see Chapters 4 and 6.3.4.

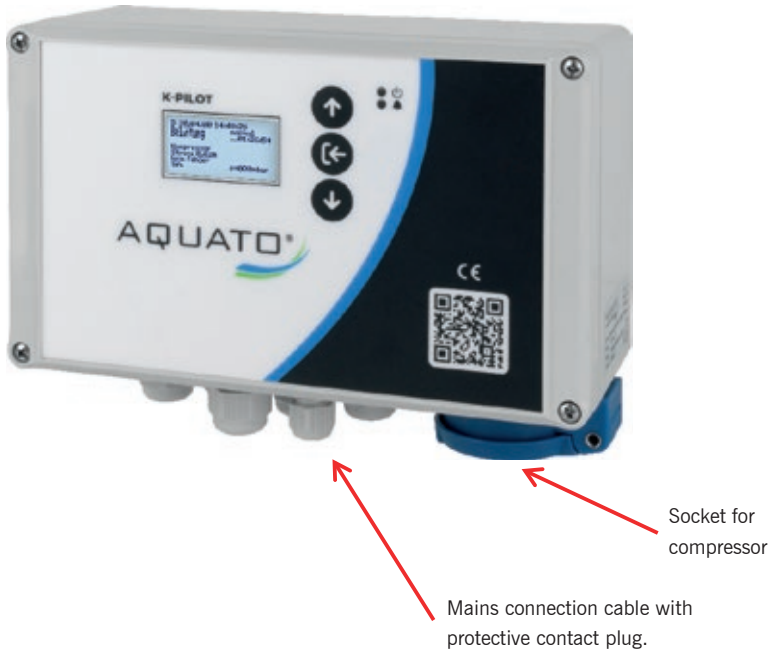


Figure 6: External electrical connections on the K-Pilot 2.4 control unit.

The electrical connections for the float switch(es), as well as the outputs for controlling the units, such as valves, pumps, etc., are located as terminals inside the housing on the circuit board on the rear wall of the control unit.

The potential-free contact is also located on the circuit board inside the housing of the control unit.

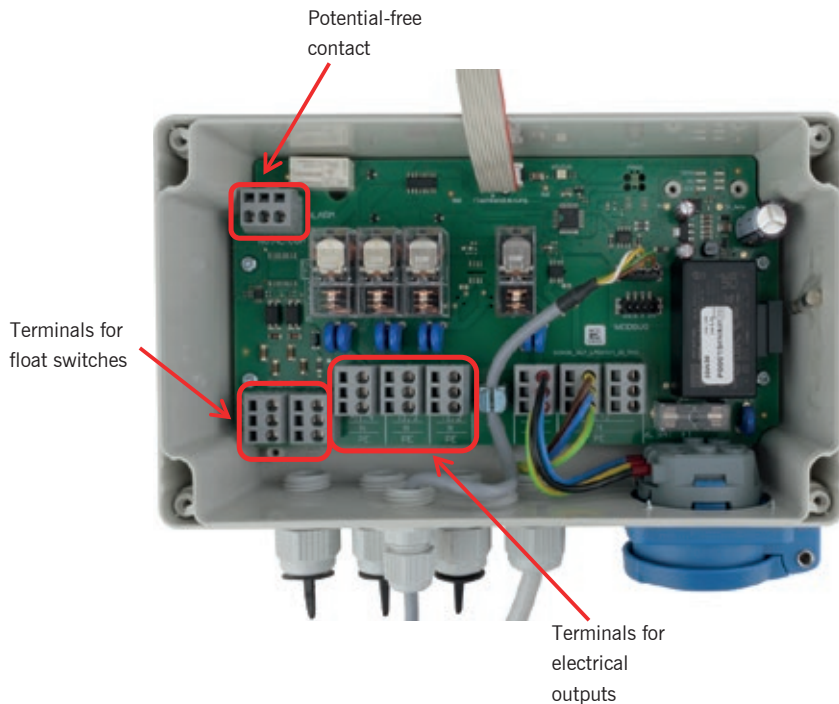


Figure 7: Electrical connections inside the K-Pilot 2.4.

5.3.1 Mains Connection of the Control Unit

A 230 V / 50 Hz power supply line must be provided on site to the location of the control unit. This must be separately protected with a slow-blow B 16 A fuse and a residual-current device, RCD, 25 A / 30 mA. A mains disconnecting device must be used for connecting the control unit.

The mains connection is made via the supplied connection cable with protective contact plug, length approx. 1.5 m. This is fixed to the control unit by an M 20 cable gland. The control unit may only be used on a 230 V / 50 Hz +/- 10 % power supply. On the mains side, the system must be protected by a residual-current device, RCD, and a fuse.

All protective devices must be checked for proper function before commissioning.

Before plugging in the mains plug, i.e. before commissioning the system, the treatment tank(s) must be filled with water up to 5 cm above $HW_{,min}$, and all required units, e.g. compressor and airlifts, must be connected; see Chapter 8.

After the plug has been inserted, the control unit starts up and, after a short time, the initialization window appears. Shortly afterwards, the standard display appears. During commissioning, several settings are still required at this point; see Chapter 8.3. The device is now ready for operation.

When the compressor, or an optional other unit, is running, the green LED lights up. In the event of a malfunction / error, the red LED flashes.



Attention: Before commissioning the system, the treatment tank(s) must be filled with water up to 5 cm above $HW_{,min}$. In addition, the compressor and airlifts as well as, if applicable, pumps and float switches must be connected.

5.3.2 Compressor

The compressor should be installed in the immediate vicinity of the control unit.

- Connect the air outlet to the air distribution system, e.g. solenoid valves or rotary valve, using the supplied 90° hose elbow and two clamp collars.
- The installation location must be dry, clean and well ventilated. High dust levels must be avoided, as otherwise the compressor air filter may become clogged.
- Insert the plug for the compressor power supply into the 230 V socket on the underside of the control unit.

The compressor is connected by inserting the plug into the socket on the underside of the control unit; see Figure 8. Its running times are controlled via the connection through this socket.



Figure 8: K-Pilot 2.4 control unit with socket for compressor

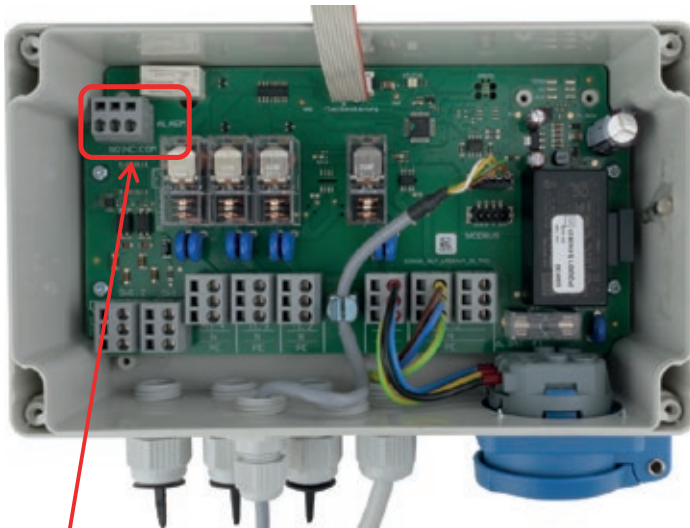


Attention: The compressor must not be connected to an external socket for power supply, as in this case the aeration cycles will not be observed.

It must be connected to the socket provided for this purpose at the bottom of the control unit.

5.3.3 Potential-Free Contact

The control unit has a potential-free contact. This serves as an on/off switch for the warning or operating indicator. It is located on the circuit board at the side next to the relays. In addition to the warning signals of the control unit, a warning lamp / flashing light can be connected via this contact. This can be supplied with power either via the control unit or via an independent external line. In the event of an alarm, the relay closes the connection between terminal NO and COM and opens the connection between NC and COM.



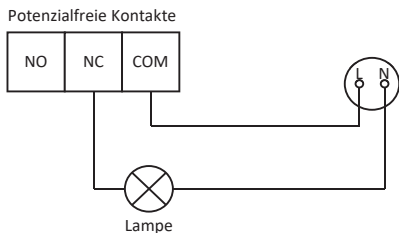
Potential-free contact
Terminals NO NC COM

Figure 9: Potential-free contact

If an additional light is to be used as an operating indicator, it is intended to be connected to contacts NC and COM.

If the warning lamp / flashing light is to light up / flash in the event of a fault to indicate an error, the connection via contacts NO and COM must be selected; see Figure 9, Figure 10 and Figure 11.

Power supply from the same circuit as the control unit
 → No signal in the event of an RCD fault!



Power supply from the same circuit as the control unit
 → No signal in the event of an RCD fault!

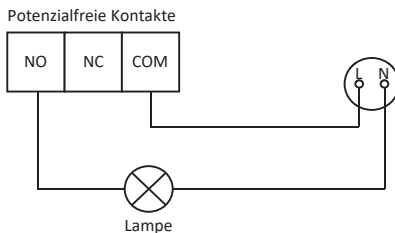
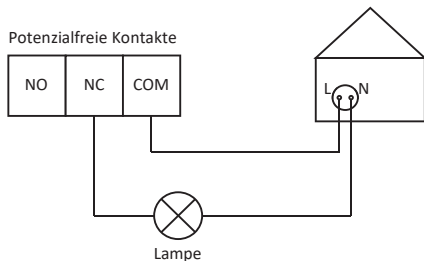


Figure 10: Potential-free contact with power supply from the control unit

Power supply from an external circuit
 → Alarm also in the event of an RCD fault!



Power supply from an external circuit
 → Alarm also in the event of an RCD fault!

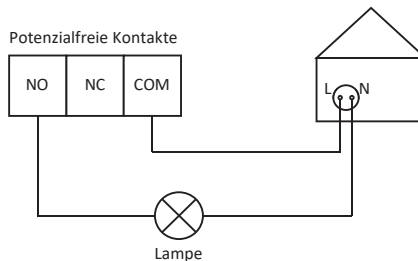


Figure 11: Potential-free contact with fault message also in the event of a power failure

To ensure that the additional warning signal is also available in the event of a power failure in the control unit, the warning lamp / flashing light must be connected to an external circuit; see Figure 11.

5.3.4 Additional Connections-Operation with Motor Pumps

With the K-Pilot 2.4 control unit, four cube connectors for connecting the solenoid valves are supplied ready for connection, so that they only need to be plugged onto the corresponding valves.

If submersible motor pumps are used, they are connected to the output whose function they take over. In trickling filter and constructed wetland systems, the pumps are connected directly inside the control unit.

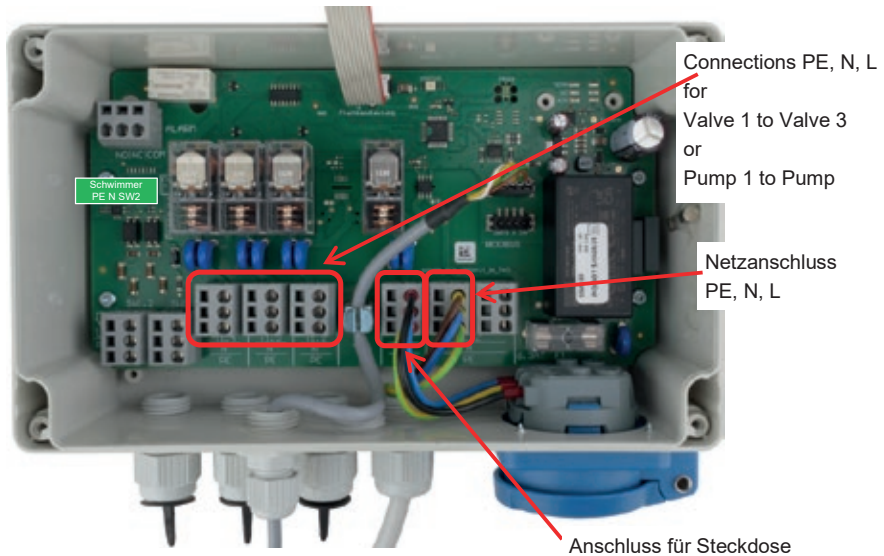


Figure 12: K-Pilot 2.4 – additional connections in the control unit.

The following Table 1 shows the assignment of the outputs on the circuit board in the control unit. The assignment of the outputs is preset, but can be adjusted

Designation Outputs	T1.2 PE N L	T1.3 PE N L	T1.4 PE N L
for	Valve 1	Valve 2	Valve 3
Connectable unit SBR	Valve ÜSS / excess sludge	Valve KW / clear water pump	Valve BES / feeding
Connectable unit FB/WSB	Valve ÜSS / sludge pump		
Connectable unit trickling filter	Pump 1 / feed pump	Pump 2 / discharge pump, equivalent to clear water pump	Pump 3 / sludge pump
Connectable unit constructed wetland	Pump 1 / feed pump	Pump 2 / discharge pump, equivalent to clear water pump	Pump 3

Table 1: Assignment of the outputs

5.3.5 Float Switch

Optionally, a float switch can be used. The float inputs are permanently assigned. The float switch for the “Float Switch” control type is connected to the K-Pilot 2.4 control unit at the terminals PE, N, SW1 provided for this purpose; for assignment, see Table 2; see Figure 13.

As standard, a normally open contact with control voltage is used: 230 V~ approx. 5 mA, switching between input L and N.

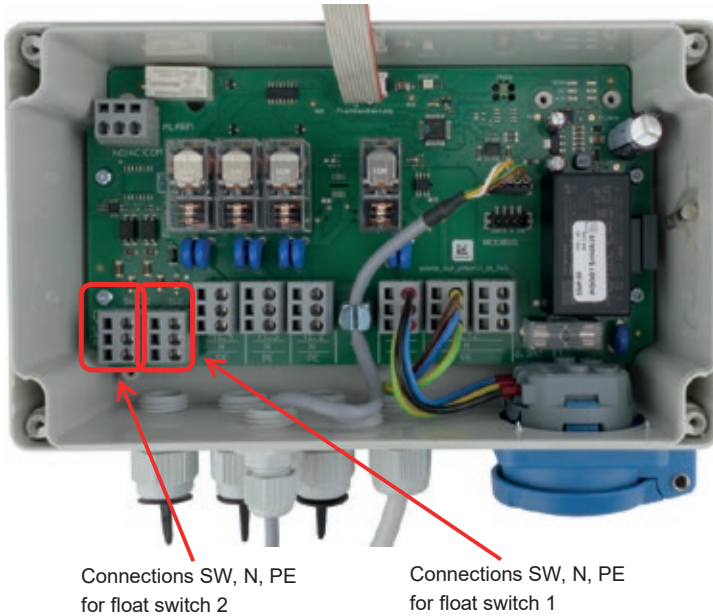


Figure 13: K-Pilot 2.4 with connections for float switches.

The preset assignments of the float inputs are listed in Table 2.

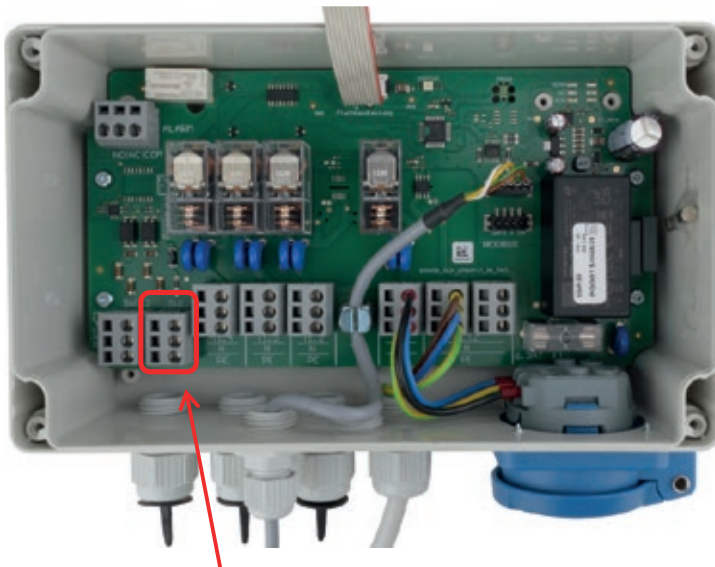
Float input 1.1, SW, N, PE:	Float input 1.2, SW, N, PE:
Float switch for economy mode with control type: Float Switch and Float Switch BP	Float switch for temporary high-water indication with control type: Float Switch
Float switch for temporary high-water indication with control type: Time	Float switch 2 with control type: Double Float Switch
Float switch 1 with control type: Double Float Switch	SW 2 for trickling filter: high water in pump chamber
SW 1 for trickling filter: dry-run protection	SW 2 for constructed wetland: high water in clear water discharge shaft
SW 1 for constructed wetland: high water in feed shaft	

Table 2: Assignment of the inputs

5.3.5.1 Float Switch with „Float Switch“ Control

If the float switch for the “Float Switch” control type is connected to the SW 1.1 terminal provided for this purpose; see Figure 14, and the “FLOAT SWITCH” control is selected during commissioning, it controls the clear water discharge and the aeration times, and triggers a high-water alarm.

When the float switch drops, it switches off the clear water discharge. If it does not drop by the end of the clear water discharge, it triggers a high-water alarm. If it remains down after the clear water discharge, or after the subsequent sludge discharge, until the end of the aeration time, the system switches to economy mode, with shorter running times for the units and no clear water discharge. When the float switch floats up again, economy mode ends and the cycle continues with the aeration phase.



Connection SW 1.1 for float switch
with Float Switch control.

Figure 14: K-Pilot 2.4 – float switch connection

5.3.5.2 Float Switch with „Time“ Control as High-Water Alarm

If the “Time” control type option is selected and the float switch is connected to the SW 1.2 terminal provided for this purpose; see Figure 14, on the longer terminal block, the float switch works only as a high-water alarm without intervening in the sequence of the cycle. The float switch indicator for this float switch is then only shown temporarily on the display in the event of high water.

5.3.5.3 Second Float Switch as High-Water Alarm

If the float switch for the “Float Switch” control type is connected to the terminals “PE”, “N”, “SW1” provided for this purpose on the longer terminal block; for assignment, see Table 2, and the “FLOAT SWITCH” control type is selected during commissioning, an additional second float switch can be connected to the terminals “PE”, “N”, “SW2” provided for this purpose on the short terminal block; see Figure 15. This second float switch works purely as a high-water alarm, without intervening in the sequence of the cycle; see chapter and **Error! Reference source not found. and Error! Reference source not found.**

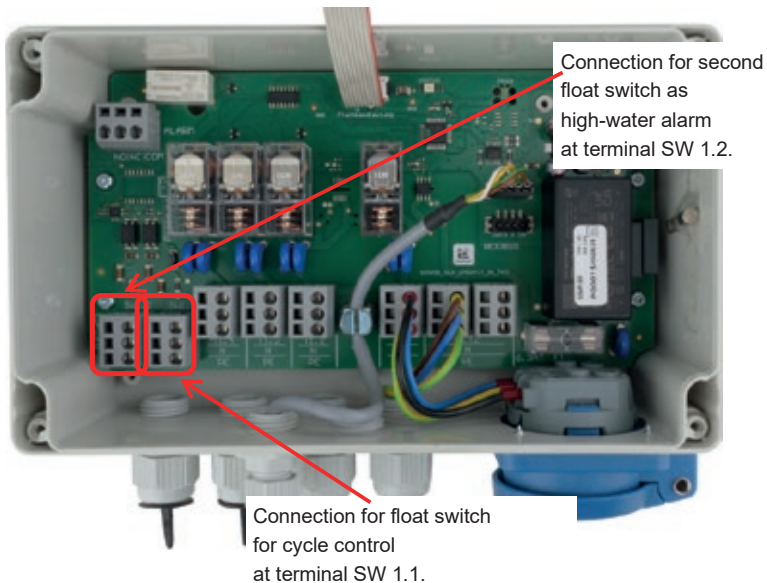
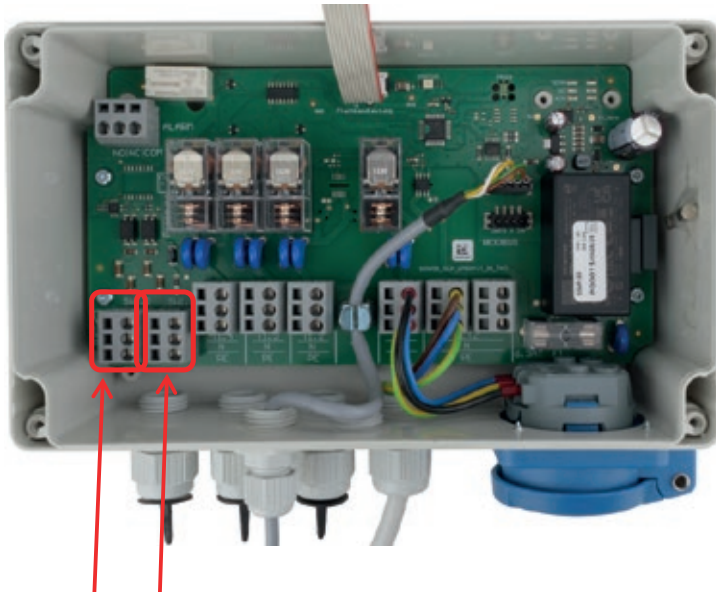


Figure 15: Connection of 2nd float switch as high-water alarm

5.3.5.4 Double Float Switch

With the K-Pilot 2.4 control unit, it is possible to work with a double float switch. The float switch (S1) for the “Double Float Switch” control type is connected to the terminals “PE”, “N”, “SW1” provided for this purpose on the longer terminal block; for assignment, see Table 2; see Figure 16. The float switch (S2) is connected to the socket “PE”, “N”, “SW2” on the short terminal block; see Figure 16.

With this control setting, the two float switches are AND-linked, i.e. the control unit only switches ON when both float switches have floated up, and it only switches OFF when both float switches have dropped.



Connection for double float switch in the K-Pilot 2.4 control unit at terminal SW 1.1 and terminal SW 1.2.

Figure 16: Connection of double float switch on K-Pilot 2.4

5.3.5.5 Float Switch BP

With the Float Switch BP setting, the float switch intervenes in the SBR cycle as follows:

When the float switch floats up, feeding is ended. The clear water discharge is not ended when the float switch drops. However, an HW fault is reported if the float switch has not dropped after the CW discharge.

For this purpose, the float switch is connected to terminal SW 1.1; see Figure 14. For assignment, see Table 2. During commissioning, the “FLOAT SWITCH BP” control type is selected.

This function is particularly useful for existing SBR systems that have a float switch with very small hysteresis installed.

5.3.6 Clear Water Pump

A clear water pump is used to overcome greater delivery heights. In this case, it replaces the clear water airlift. A pump and an external float switch are used. The float switch is attached to the pump holder of the clear water pump.



Figure 17: Clear water pump with external float switch

The clear water pump is connected to output T1.4 in the control unit as standard, but can also be controlled via the other outputs if required.

The external float switch is connected to the terminal SW 1.1 provided for this purpose inside the housing of the control unit; see Figure 14.

When operating with a clear water pump, the “Float Switch” control type must be selected. Required control unit settings: see Chapter **Error! Reference source not found.** and Chapter **Error! Reference source not found.**

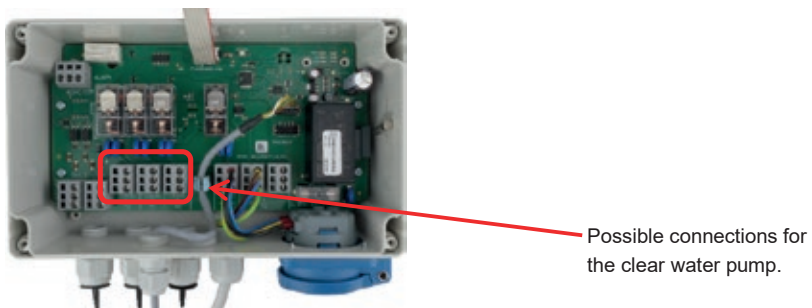


Figure 18: K-Pilot 2.4 control unit – clear water pump connection.

6 Operation and Displays of the Control Unit

The control unit must not be switched off during operation; otherwise, the treatment performance of the system can no longer be ensured. If the control unit emits alarm signals, please inform your maintenance service immediately so that they can remedy the fault.

The K-Pilot 2.4 control unit can be operated directly via the keypad and display or via a web interface.

Direct operation on the control unit is explained first; see Chapter 7.1. This is followed by a description of operation via the web interface; see Chapter 7.4.

6.1 Direct Operation

Direct operation on the control unit is explained first here.

The information is displayed in plain text on a graphical LCD display and by two LEDs, one green and one red. Operation is carried out using three buttons.

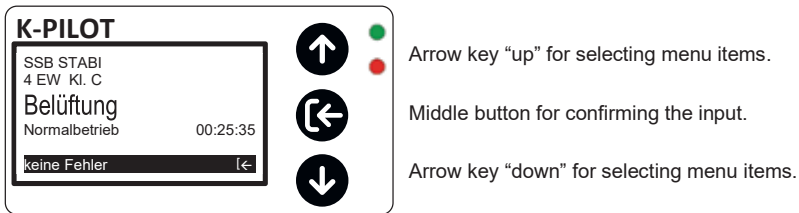


Figure 19: Operating buttons

The display remains switched on during the entire operation. When a button is pressed, the display backlight is switched on.







If a connected unit, e.g. pump or compressor, is active, this is indicated by the green LED lighting up at the top right next to the display. In addition, the active device is marked in the “STATUS” menu.

In the event of a fault, the red LED flashes and the buzzer sounds.



The standard LCD display shows the selected wastewater treatment plant type in the top line, with the selected PE number and the effluent class below it. Below this, the current cycle phase, e.g. “AERATION”, is displayed in large text. The last line either shows the message “no errors” or, in the event of an alarm, “FAULT”.

In the other menus, the name of the respective menu appears at the very top with a black background, and the individual menu items are listed below it. Switching from one menu to another is carried out using the keys . Pressing the middle button takes you into the respective menu. Switching between the menu entries is also carried out using the arrow keys or via . Here, too, pressing the middle button takes you into the respective submenu. The menu item “back” or “save” takes you from the submenu back up one level.

The selected menu item is marked by a black bar. After selecting the line of the desired menu item, pressing the middle button takes you into the input mode of the respective submenu. The input mode can be recognized by a selected line or digit shown in inverse display. The options or digits can then be selected or changed using the keys . The desired entry is confirmed by pressing the middle button.

If a multi-digit number entry is required, the highest digit is first changed using the arrow keys  . The selection is confirmed with the middle button , and you then move to the next digit, and so on. If the input requires selecting from different options, e.g. YES / NO, the desired selection is also made using the buttons  . When the desired option appears on the display, it is confirmed with the middle button .

Returning from the subitems to the main menu level is also carried out using the “back” menu item. This command is always the last menu item. It takes you back up one level from the submenu.


If the highlight bar is moved down or up with the arrow keys   until it disappears from the menu, it reappears at the top or bottom of the menu..


On the left side of the display, there is a scroll bar indicating which area of the menu you are currently in.

6.2 Faults

Faults are indicated by the operating LED flashing red and by the buzzer sounding. On the display, errors are reported in the main menu by showing "FAULT" in the bottom line. An example of an error message is shown in the following figure:



The acknowledgement of an error message is carried out by pressing the button . This switches off the buzzer.

The "AQUATO" "INFO" window opens. Selecting "Fault" displays the current errors in the "FAULT" menu. Pressing the button  opens the "Delete error?" window. If "YES" is selected, the error is deleted and the red LED is switched off.



"DELETE ALARM".

The fault message on the display only disappears once the error has been eliminated and also reset on the control unit, as described above or in the "SETTINGS" menu.

The error message remains stored in the error logbook and can therefore still be evaluated later.

The possible faults / messages and information on troubleshooting can be found in Chapter 10.

6.3 Mains Failure Alarm

The control unit has a battery-operated mains failure alarm. In the event of a power failure, an alarm tone sequence is generated approximately every 30 seconds to alert the operator to the missing treatment function. The message “No mains available.” is shown on the display, without backlighting. The warning tone can be switched off with the Enter button . If the button  is pressed and held until the acknowledgement tone sequence sounds, the alarm is permanently switched off. Once the power supply returns after the mains failure, the device switches itself back on automatically.

Note:



In a new device, the internal rechargeable batteries only reach their full capacity after a few days, in order to achieve the maximum alarm duration. If the function of the internal rechargeable batteries decreases, they must be replaced with 2 rechargeable NiMH batteries, size AA.



The rechargeable batteries may only be replaced by a qualified electrician. Disconnect the mains plug before opening the device. The rechargeable batteries must be disposed of properly.



According to the Battery Ordinance of the Federal Government (Federal Law Gazette 1998/I/20 of 2 April 1998), since 1 October 1998 all end users of batteries and rechargeable batteries have been obliged to return them to retailers or recycling disposal facilities, e.g. municipal collection points. Disposal with household waste is expressly prohibited.

6.4 Operation via the Web Interface

The K-Pilot 2.4 control unit has an integrated Wi-Fi interface, allowing it to be operated via a web interface.

7 Commissioning the System

7.1 Before Commissioning



When constructing and operating wastewater systems, the relevant accident prevention regulations, UVV, guidelines, safety rules and information sheets of the responsible employers' liability insurance association, DGUV, as well as the regulations of the Association of German Electrical Engineers, VDE, must be observed.

Before commissioning the system, the installation and assembly of the system components must be completed as described in the installation and operating manual.

The volumes and structure of the tanks must be designed in accordance with the wastewater treatment and process engineering specifications. The pipelines must be connected appropriately.

Care must be taken to ensure that the roof ventilation is functioning. If this is not sufficient, a separate ventilation pipe must be installed. Forced ventilation may also be required, for example checked by means of smoke testing.

The watertightness test must be carried out before commissioning.

The technology must be properly installed in accordance with the wastewater treatment and process engineering requirements, and all required units must be connected to the control unit.



Before commissioning, the system must be filled with water up to 5 cm above $H_{W,min.}$



The electrical installation must have been carried out and completed by qualified specialist personnel. The housing of the control unit must be closed before commissioning if it has been opened.



All required units, such as compressor, membrane aerators, airlifts, float switches, pumps, etc., must be connected to the control unit electrically and/or by hose to the respective inputs and outputs before commissioning.

7.2 Commissioning

After the required units have been connected, the system is commissioned by commissioning the control unit; see the following chapter.



Only plug in the mains plug of the control unit after the compressor and, if present, the air hose, float switch and submersible motor pump have been connected to the devices provided for this purpose on/in the control unit.



If the control unit has already been preset, the message “Initialization” appears briefly and the system then switches to automatic mode..

During initial commissioning of the control unit, several entries must first be made in order to adjust the control unit individually to the respective system; see the following Chapter 8.3. The control unit then switches to the standard display. The device is now ready for operation. The system now runs fully automatically.



The commissioning engineer must ensure that the parameter settings in the control unit have been made in such a way that they correspond to the requirements, e.g. wastewater treatment plant type, PE number and effluent class, from the approval and the water-law permit for the system on which the control unit is to be used.

The system is now in automatic mode and must no longer be switched off.


7.3 Commissioning the Control Unit



Before commissioning the system, the primary treatment stage and the biological stage must be filled with water up to 5 cm above HW,min, and the housing of the control unit must be closed if it has been opened. All required units must be connected to the control unit electrically and/or by hose.

Commissioning of the control unit begins by plugging in the mains plug of the control unit.

If the control unit has already been preset, the message “Initialization” appears briefly and the system then switches to automatic mode.

During initial commissioning of the control unit, after the plug has been inserted, it starts with the “PASSWORD” window. Here, the password is entered digit by digit and confirmed with the button .

The control unit then switches to the “LANGUAGE” menu. The language is selected and confirmed here. The current date and current time are then entered and confirmed.

In the “WASTEWATER TREATMENT PLANT TYPE” menu, the desired system type, e.g. SSB, SBR, etc., must be selected and, if necessary after scrolling further, confirmed with “save”.

Then, in the “SYSTEM SIZE” menu, the PE number is entered. In this window, the effluent class is also selected and confirmed with “save”. Hygienization or phosphate elimination can also be selected here.

In the “AERATION” menu, a second and third compressor, for example, can be selected if required and confirmed with “save”.

In the “CONTROL” menu, it is selected whether the system is operated purely time-controlled or whether a float switch is also connected; this is then confirmed with “save”.

Afterwards, when password 2 is used, the “ADDITIONAL FUNCTIONS”, e.g. denitrification, clear water pump, etc., are queried. The selection in this menu must also be confirmed with “save”.

The window then changes and a menu opens with the selected wastewater treatment plant type in the first line, e.g. “SSB-STABI”.

Depending on the selection, further settings may be required here, e.g. assigning outputs in the “RELAY OUTPUTS” menu item, such as clear water pump T1.2. Here, an output is assigned to each required function and then confirmed with “save”.

Once this information has been entered, commissioning is completed by confirming the menu item “Complete settings”..

If the outputs have not been assigned, the control unit reports “Configuration incomplete”, and pressing the Enter button takes you back to the previous menu with the wastewater treatment plant type in the first line.

If the menu item “Complete settings” has been successfully confirmed, the “SETTINGS COMPLETED” window opens, the control unit counts down for a few seconds and then, after a short time, briefly displays the “Initialization” window.

The control unit then switches to the standard display with the wastewater treatment plant type in the first line, e.g. “SSB-STABl”. The device is now ready for operation. The system is now in automatic mode.



The commissioning engineer must ensure that the parameter settings in the control unit have been made in such a way that they correspond to the requirements, e.g. basic type and effluent class, of the approval and the water-law permit for the system on which the control unit is to be used.

Commissioning is now complete. From this point onward, the control unit must no longer be switched off; otherwise, the treatment performance of the system can no longer be ensured.

The automatic cycle starts and runs through the operating phases belonging to the cycle. These may vary depending on the exact setting.

A cycle could, for example, look as follows:

- Aeration
- Settling phase
- Clear water discharge
- Sludge discharge

After these phases have been completed, the next cycle starts again from the beginning.

Sequence during commissioning of the control unit:

SSB

Language

Date

Time

Wastewater treatment plant type

System size

Aeration

Control

Additional functions

Possible further settings

8 Menus


8.1 Main Display

In the standard OPERATING DISPLAY, the control unit shows the switching status of the system and the units, e.g.:



The standard LCD display shows “OPERATING DISPLAY” in a black bar in the top line. The wastewater treatment plant type is displayed in the top line. Below this, the size of the system, i.e. the PE number, and the effluent class are shown. The next line shows the current operating phase of the system in large text. Below this, the remaining running time of the current phase is displayed. The last line indicates whether an error has occurred.

In this menu , the alarm can also be switched off with the Enter button if the buzzer is sounding warning signals. See also Chapter **Error! Reference source not found.**

If the button  is pressed in the standard display and the buzzer is not beeping, the “INFO” menu opens. The following is displayed there:



8.2 Menu

8.2.1 Menu Structure

The menu structure is shown in Figure 4.

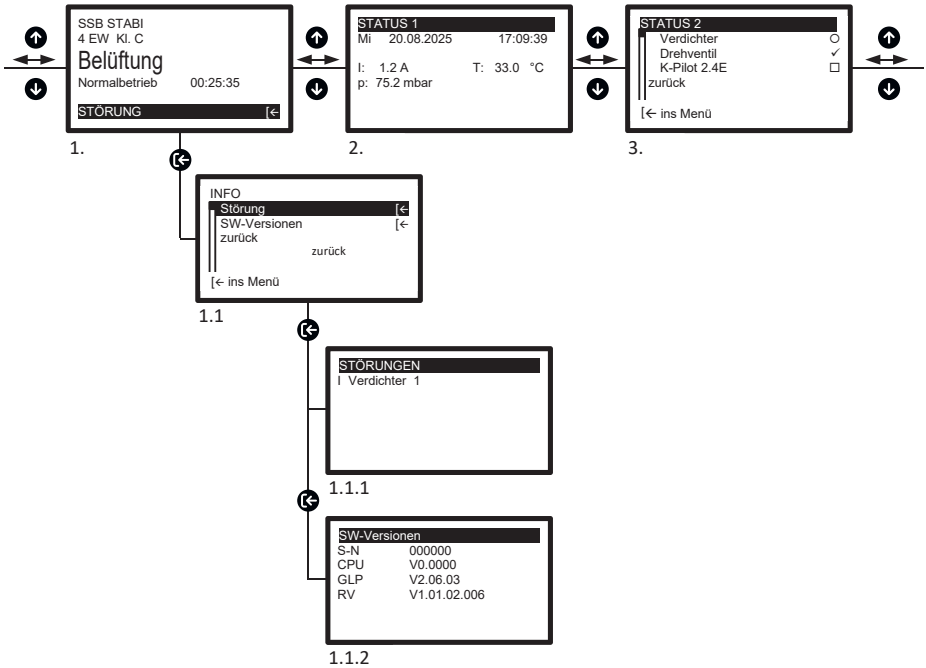
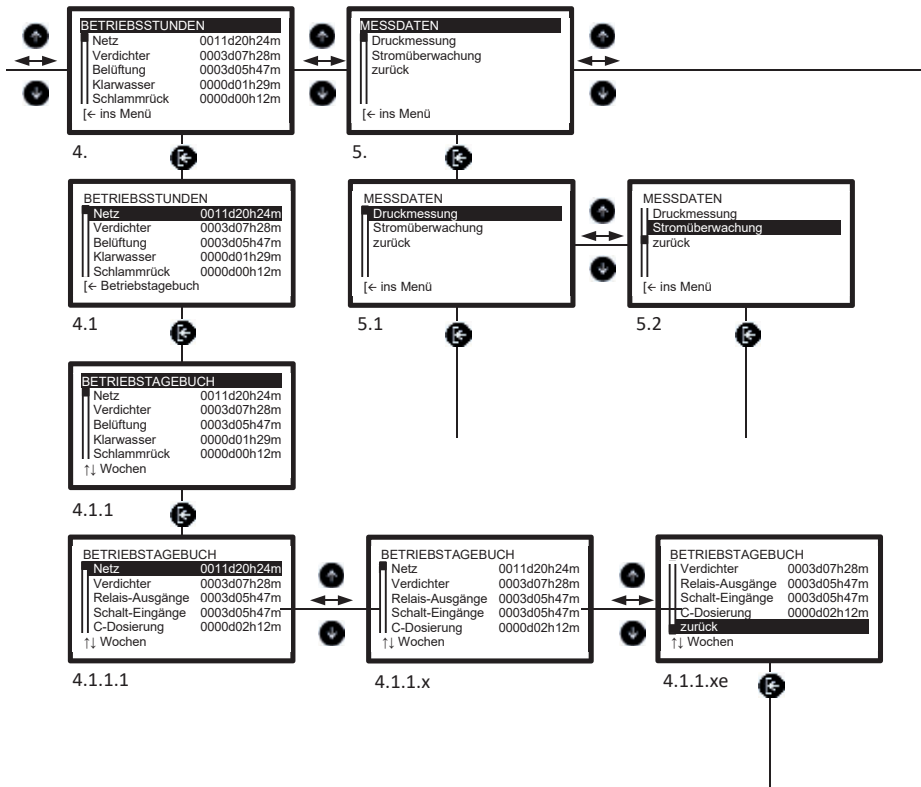
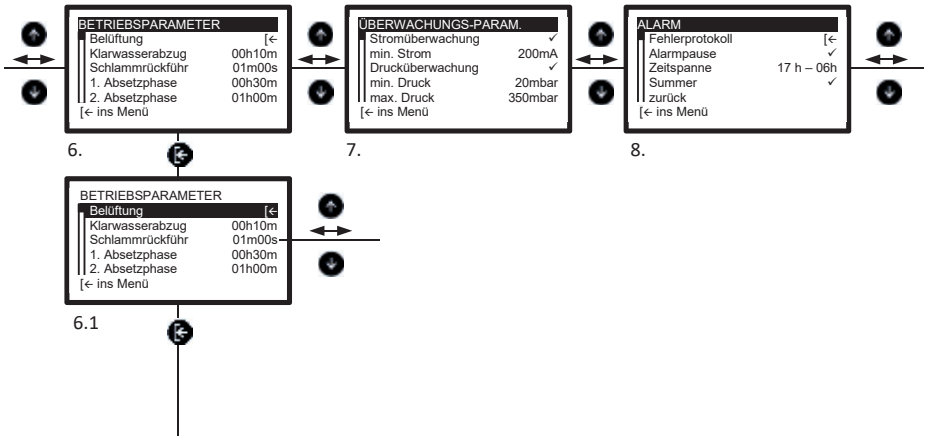
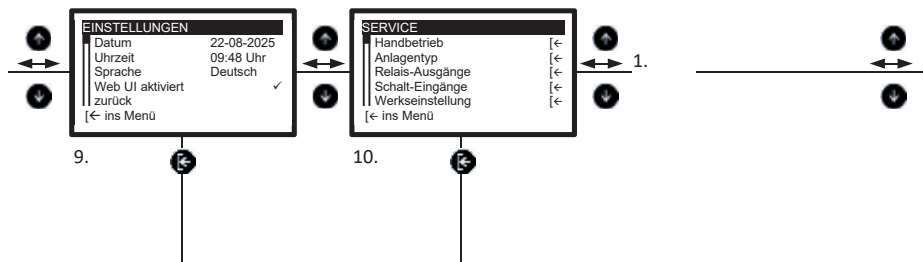


Figure 20: K-Pilot 2.4 menu structure

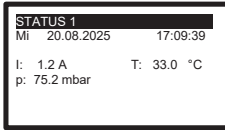
The exact display depends on the status of the system and on the parameters set. The different display variants are explained in more detail below.







8.2.2 STATUS 1 Menu

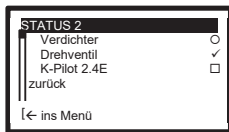


STATUS 1	
Mi	20.08.2025 17:09:39
I:	1.2 A
T:	33.0 °C
p:	75.2 mbar

Here, the current date and current time are displayed, along with the following information:

- I: current consumption
- T: current temperature
- p: current pressure

8.2.3 STATUS 2 Menu



Here, information is displayed showing which units are connected and whether they are currently active.

8.2.4 OPERATING HOURS Menu

BETRIEBSSTUNDEN	
Netz	0011d20h24m
Verdichter	0003d07h28m
Belüftung	0003d05h47m
Klarwasser	0000d01h29m
Schlammrück	0000d00h12m
[← ins Menü	

Here, the number of operating hours of the individual units is displayed.

8.2.4.1 Operating Logbook

BETRIEBSTAGEBUCH	
Netz	0011d20h24m
Verdichter	0003d07h28m
Belüftung	0003d05h47m
Klarwasser	0000d01h29m
Schlammrück	0000d00h12m
↑↓ Wochen	

Here, the weekly consumption values of the connected units are displayed.

8.2.5 MEASURED DATA Menu

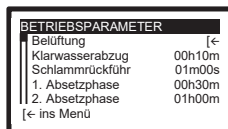


Here, the measurements from the connected sensors are displayed.

8.2.5.1 Pressure Measurement

8.2.5.2 Current Monitoring

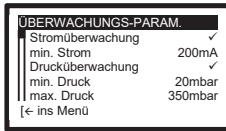
8.2.6 OPERATING PARAMETERS Menu



BETRIEBSPARAMETER	
Belüftung	[←
Klarwasserabzug	00h10m
Schlammrückführ	01m00s
1. Absetzphase	00h30m
2. Absetzphase	01h00m
[← ins Menü	

Here, the set operating parameters are displayed and can also be adjusted.

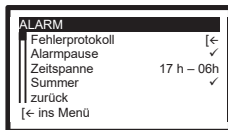
8.2.7 MONITORING PARAMETERS Menu



UBERWACHUNGS-PARAM.	
Stromüberwachung	✓
min. Strom	200mA
Drucküberwachung	✓
min. Druck	20mbar
max. Druck	350mbar
[← ins Menü	

Here, the set monitoring parameters are displayed and can also be adjusted.

8.2.8 ALARM Menu

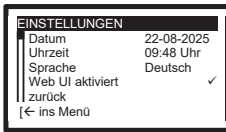


This menu contains the following items:

- Display of the error log
- Switching the alarm pause on or off
- Adjustment of the alarm pause duration
- Switching the buzzer off/on

However, the buzzer should only be switched off temporarily in an emergency.

8.2.9 SETTINGS Menu



The following data can be adjusted/corrected in this menu:

- Date and time
- Language

Access to the WEB user interface can be switched on and off.

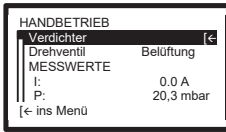
8.2.10 SERVICE Menu



The following submenus can be accessed in this menu:

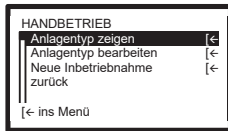
- Manual operation
- System type
- Relay outputs
- Switching inputs
- Factory setting

8.2.10.1 Manual Operation



In manual mode of the K-Pilot 2.4 controller, the individual units and functions can be tested separately. The exact display depends on the parameters set during commissioning.

8.2.10.2 System Type



In the System Type menu, the individual units and functions can be checked separately. The exact display depends on the parameters set during commissioning.

9 Fehlermeldung und Fehlerbehebung

Display	Possible Cause	Remedy
I Bel. The compressor has not drawn any current	- Compressor defective - Fuse defective	- Replace compressor - Replace fuse
I Clearw. The clear water pump / additional pump has not drawn any current	- Clear water pump defective - Fuse defective - Additional pump defective	- Replace clear water pump - Replace fuse - Replace additional pump
I Sludge The sludge pump has not drawn any current	- Sludge pump defective - Fuse defective	- Replace sludge pump - Replace fuse
I_P1 Pump P1 has not drawn any current	- Pump P1 defective - Fuse defective	- Replace pump P1 - Replace fuse
I_P2 Pump P2 has not drawn any current	- Pump P2 defective - Float switch stuck or defective - Fuse defective	- Replace pump P2 - Test / replace float switch - Replace fuse
I_P3 Pump P3 has not drawn any current	- Pump P3 defective - Fuse defective	- Replace pump P3 - Replace fuse
I_P4 Pump P4 has not drawn any current	- Pump P4 defective - Fuse defective	- Replace pump P4 - Replace fuse
p min Permissible pressure has fallen below the minimum value	- Hoses not connected or connected incorrectly - Hose connections or hose leaking / defective	- Check hose connections and hoses
p max Permissible pressure has been exceeded	- Water level too high - Hose kinked - Aeration element dirty	- Check water level - Check hoses - Clean / replace aeration element
Battery	- Battery empty, defective or not inserted	- Insert new battery
Clock	- Clock not set	- Set clock

Display	Possible Cause	Remedy
HW High water: after the clear water discharge has ended, the float switch has not fallen below the switching point; high-water warning with control type "Float Switch"	<ul style="list-style-type: none"> - Infiltration water inflow - Backwater from receiving watercourse - Power failure - Float switch defective - Clear water pump clogged - Clear water hose defective 	<ul style="list-style-type: none"> - Locate and eliminate the inflow - Possibly a one-off event - Establish a permanent power supply - Replace float switch - Remove blockage - Replace clear water hose
HW ++ High water: float switch has floated up, temporary error, high-water warning with control type "Time"	<ul style="list-style-type: none"> - Infiltration water inflow - Backwater from receiving watercourse - Power failure - Float switch defective - Clear water pump clogged - Clear water hose defective 	<ul style="list-style-type: none"> - Locate and eliminate the inflow - Possibly a one-off event - Establish a permanent power supply - Replace float switch - Remove blockage - Replace clear water hose
No float switch change	<ul style="list-style-type: none"> - Float switch has not switched for the preset number of days; the time period can be adjusted manually 	<ul style="list-style-type: none"> - Check float switch - Possibly due to holiday mode
MAINS ON	<ul style="list-style-type: none"> - Mains power was switched on 	
MAINS OFF > 15 min: Restart of the cycle	<ul style="list-style-type: none"> - Mains power was switched off - Power failure - Fuse has tripped 	<ul style="list-style-type: none"> - Switch on power - Check fuse
Mains interruption < 15 min and > 1 min: Restart of the cycle < 1 min: Cycle is continued	<ul style="list-style-type: none"> - Mains power was switched off - Power failure - Fuse has tripped 	<ul style="list-style-type: none"> - Switch on power - Check fuse

If the above measures do not remedy the fault, please contact your maintenance service or installation company.



When working on the compressor and pumps and before opening the control unit, the mains plug must be disconnected. Secure the system against being switched on again during the work.

10 Technical Data

Temperature range (device function)	0 °C ... + 50 °C
Temperature range (operation and storage)	-20 °C ... + 50 °C
Humidity (operation and storage)	0 ... 75 % RH <i>nicht non-condensing</i>
Protection class	IP 54 double-insulated
Mains connection (L1, N, PE), cable approx. 1.5 m long with molded protective contact plug	230 V~ 50 Hz ± 10 %
Power consumption of control unit	approx. 5 VA
Buzzer	70 dB(A) at a distance of 10 cm
Display	LCD display, 128 x 64 pixels
LEDs	1 x green 1 x red
Buttons	3
Approx. dimensions (without cable glands, socket)	W x H x D: 200 mm x 120 mm x 80 mm
Installation	Wall mounting with screws
Housing material	Plastic, light grey
Units (compressor / pumps), max. power (with 3.15 A fuse)	230 V / 50 Hz P < 0,7 kVA
Internal fuse (max. 1.5 W)	1 x 5 AT, max. 5 AT
Overtemperature protection of the pumps	Via thermal contact in the motor in series with motor
Current monitoring via a current transformer	Max. 10 A, type 10 % of final value (10 A)
Float input (switches against N)	Control voltage 230 V~, I < 10 mA
Required backup fuse(s)	Max. 1 x 16 A G
Cable cross-section	1,5 mm ² with wire end ferrule
Alarm relay	max. contact voltage: 230 V~ max. contact current: 8 A; AC1

11 Operating Logbook

In order to ensure the smooth long-term operation of your small wastewater treatment plant, the following checks by the operator are prescribed.

Operation of the system, fault messages	daily
Reading of operating hours * Check of inlets and outlets for blockages Visual inspection of the outlet for sludge discharge Removal of floating sludge, if necessary Visual inspection of the trickling filter surface for puddle formation Inspection of the distribution device on/above the trickling filter If subsequent infiltration is used, the requirements according to DIN 4261-5 for operation must be observed.	monthly
Drinking water consumption	annually

* The written entry of the operating hours in the operating logbook may be omitted for AQUATO systems, as the control unit records the operating hours in an electronic logbook.

Detected defects or faults must be recorded in the operating logbook supplied with the system, reported to the maintenance service and remedied immediately.

The data you record is important for the maintenance of your small wastewater treatment plant. The more carefully you carry out these checks, the easier it will be for the specialist company you trust.

12 Decommissioning and Disposal



Ensure that only qualified specialist personnel with suitable safety equipment have access. Make sure that the general safety regulations as well as the safety regulations at the installation site are observed.

Before starting temporary decommissioning and final dismantling, switch off the system by disconnecting the mains plug. Secure the system against being switched on again.

12.1 Temporary Decommissioning

Temporary decommissioning is required for maintenance work or replacement of the following components:

- Control unit
- Compressor
- Rotary valve
- Wear parts, e.g. membrane aerators, pumps

12.2 Dismantling the Complete System

Complete dismantling of the entire system may only be carried out by qualified specialist personnel.

Before starting dismantling, disconnect the system from the power supply.

Disconnect the hoses and cables from the control unit/control cabinet.

Pull the hoses and, if present, the float switch cable out towards the tank.

Remove the tank.

Remove the control unit/control cabinet.

12.3 Disposal

Ensure proper disposal of the system.

13 Addresses

Manufacturer	
Company	AQUATO® Umwelttechnologien GmbH
Address	Ernstmeierstr. 24
	32052 Herford
Telephone	+49(0)5221 / 10 21 9-0
Website	www.aquato.de
E-mail	info@aquato.de

Purchase / installation of the system from	
Company	
Address	
Telephone	
Fax	
Website	
E-mail	

Your maintenance company	
Company	
Address	
Telephone	
Fax	
Website	
E-mail	

The warranty will void if operation and maintenance of the sewage treatment plant are not carried out in accordance with the instructions and specifications of the operating instructions.

VERSION 06.2026

Installation Company:

AQUATO® Umwelttechnologien GmbH

Ernstmeierstr. 24 fon +49 5221 10219-0 www.aquato.de
32052 Herford fax +49 5221 10219-20 info@aquato.de