BONNEL TECHNOLOGIE

Catalog

Water Treatment & Processing

Control Units

Accessories

Telemetry solutions and Apps

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Content

Preface

BONNEL TECHNOLOGIE s.r.o. is a **Czech, family-owned company**. It is active **in the field of control units** for decentralized water treatment and processing **since more than twelve years**. About **60 employees, 12 of them developers**, are inventing, creating, and **manufacturing the products**.

BONNEL is a **world market leader** in this field and presents a wide range of control units for decentralized sewage treatment and pump stations.

The control units are **free programmable** with the help of BONNEL's easy to use PC programming tools (*MenuMaker*, *DataBuilder*). That allows BONNEL, and partly even the customer (plant manufacturer), to **create bespoke menus and processes in a fast and efficient way**.

Moreover, **accessories** like communication (2/3/4G) modules or strobe beacons are part of the lineup.

But BONNEL is not only a hardware manufacturer. The company offers different telemetry systems (**remote monitoring and remote control**) under the brand of *Aquavisor®* (free *Aquavisor®* App up to cloud-based *Aquavisor®* telemetry system). The systems are **developed in-house** which enables BONNEL to provide full support and short reaction times.

In case you are looking for a **tailor-made or OEM solution**, please do not hesitate to contact BONNEL at sales@bonnel.cz.

Control unit Overview and Comparison

Please find here an overview of BONNEL's control unit portfolio.

Sequetrol IoT maxi, mega, midi and mini

	Sequetrol IoT maxi	***Sequetrol IoT mega***	***Sequetrol IoT midi***	***Sequetrol IoT mini***
				
Plant type	***SBR & Continuous plants (MBBR, Fixed Bed, …)*** **Complex (Air) (SBR) plants with UV and P-elimination**	***SBR & Continuous plants (MBBR, Fixed Bed, …)*** **Complex (Pump) (SBR) plants with direct switching of higher loads and UV and P-elimination**	***SBR & Continuous plants (MBBR, Fixed Bed, …)*** **Different (Air and Pump) (SBR) plants – very versatile**	***SBR & Continuous plants (MBBR, Fixed Bed, …)*** **Pump SBR, One Tank SBR and continuous (MBBR, fixed bed) plants**
suitable for **E-Pump SBR**	With contactor relay or for small pumps	✓	✓*	✓*
suitable for **air-SBR**	✓	✓	✓	- (One-Tank Air SBR possible)
suitable for **continuous plants (with submersible pumps)**	✓ (with contactor relay or for small pumps)	✓ (✓)	✓ (✓*)	✓ (✓*)
Number of **Valves**	0 - 7 solenoid valves or *BonAir* (+blower)	0 - 4 solenoid valves or *BonAir* (+blower)	0 - 4 solenoid valves or *BonAir* (+blower)	0 - 3 solenoid valves or *BonAir* (+blower)

	Sequetrol IoT maxi	***Sequetrol IoT mega***	***Sequetrol IoT midi***	***Sequetrol IoT mini***
Relays (max. no.) - 5A nominal (350W real) - 16A nominal (800W real) - pot. free relay - digital signal output	8 8 0 0 1	6 0 5 0 0	5 3 2 0 0	4 3 1 0 0
Prepared for *BonFlash* and *BonAlarm*	✓	✓	✓	✓
Buttons to change step times or navigate the menu	3 buttons	3 buttons	3 buttons	3 buttons
Display	graphical LCD (128*64)	graphical LCD (128*64)	graphical LCD (128*64)	graphical LCD (128*64)
Water-level by (float-switch / pressure sensing)	yes / yes (more tanks as well)	yes / yes (more tanks as well)	yes / yes (more tanks as well)	yes / yes (more tanks as well)
max no. of **inputs** (digital / analog 4-20mA)	3 / 1	4 / 1	2 / 1	2 / 0
pressure sensor	500mbar / 1,000mbar *	500mbar / 1,000mbar *	500mbar / 1,000mbar *	500mbar
current sensor (all outputs shared / particular output can be selected (number of output))	on request / on request	yes / no	yes / no	yes / no
Wi-Fi and integrated **webserver**	✓	✓	✓	✓
GSM Option - 2G SMS + *Aquavisor App* - Telemetry + *Aquavisor telemetry system* (2G / NB IoT / LTE Cat. M1 / 4G)	✓ - ✓ (yes / Q4 2021 / Q4 2021/ Q4 2021)*	✓ - ✓ (yes / Q4 2021 / Q4 2021/ Q4 2021)*	✓ - ✓ (yes / Q4 2021 / Q4 2021/ Q4 2021)*	✓ - ✓ (yes / Q4 2021 / Q4 2021/ Q4 2021)*

	Sequetrol IoT maxi	***Sequetrol IoT mega***	***Sequetrol IoT midi***	***Sequetrol IoT mini***
Different programs - yes but only linked programs (e.g. normal & eco) with together max. 30 steps - yes	- ✓	- ✓	- ✓	- ✓
Different sub-programs controlled by - manual switch - float switch - buttons	 ✓ ✓ ✓	 ✓ ✓ ✓	 ✓ ✓ ✓	 ✓ ✓ ✓
Operating hours (permanently stored) (total / blower / all outputs)	✓ / ✓ / ✓	✓ / ✓ / ✓	✓ / ✓ / ✓	✓ / ✓ / ✓
Event protocol (alarms are stored together with time and program)	✓	✓	✓	✓
Alarms - Mains Failure - Fuse error - Digital input - Service - Overfill (flooding) - Pressure - Current - Monitoring of valve function (open and close) - User defined	 ✓ ✓ ✓ ✓ ✓ ✓ on request ✓ ✓	 ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	 ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	 ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Event protocol can be transferred	Wi-Fi	Wi-Fi	Wi-Fi	Wi-Fi
Different languages	-	-	-	-

	Sequetrol IoT maxi	***Sequetrol IoT mega***	***Sequetrol IoT midi***	***Sequetrol IoT mini***
- one language per firmware - can be switched on site	✓	✓	✓	✓
Software creation in - Excel® - *MenuMaker* - *DataBuilder*	 - ✓ -	 - ✓ -	 - ✓ -	 - ✓ -

BonBloc IoT, BonBloc compact, Sequetrol compact LCD, Sequetrol compact LED

	BonBloc IoT	***BonBloc compact***	***Sequetrol compact LCD***	***Sequetrol compact LED***
				
Plant type	***SBR & Continuous plants (MBBR, Fixed Bed, …)*** **Complex Air SBR or continuous plants with UV and P-elimination**	***SBR*** **Air SBR plants, also with UV and P-elimination**	***SBR*** **Simple Air or Pump SBR plants**	***SBR*** **Simple Air or Pump SBR plants**
suitable for **E-Pump SBR**	-	-	✓	✓
suitable for **air-SBR**	✓	✓	✓	✓
suitable for **continuous plants with submersible pumps**	-	-	-	-
Number of **Valves**	3 - 4 (+blower) 3 additional solenoid valves possible	3 - 4 (+blower) 2 additional solenoid valves possible	0 - 4 solenoid valves or *BonAir* (+blower)	0 - 4 solenoid valves or *BonAir* (+blower)
Relays (max. no.) - 5A nominal (350W real) - 16A nominal (800W real) - pot. free relay - digital signal output	4 4 0 0 0	4 3 0 1 0	5 5 0 0 0	5 5 0 0 0
Prepared for *BonFlash* and *BonAlarm*	✓	✓	no	no

	BonBloc IoT	***BonBloc compact***	***Sequetrol compact LCD***	***Sequetrol compact LED***
Buttons to change step times or navigate the menu	3 buttons	3 buttons	3 buttons *inside* the casing	3 buttons *inside* the casing
Display	graphical LCD (128*64)	alphanumeric LCD (2 x 16)	alphanumeric LCD (2 x 16)	6-digit LED display
Water-level by (float-switch / pressure sensing)	yes / yes (more tanks as well)	yes / yes	yes / no	yes / no
max no. of **inputs** (digital / analog 4-20mA)	3 / 0	3 / 0	1 / 0	1 / 0
pressure sensor	500mbar	500mbar	500mbar	no
current sensor (all outputs shared / particular output can be selected (number of output))	no / no	no / no	no / no	no / no
Wi-Fi and integrated **webserver**	✓	-	-	-
GSM Option - 2G SMS + *Aquavisor App* - Telemetry + *Aquavisor telemetry system* (2G / NB IoT / LTE Cat. M1 / 4G)	✓ - ✓ (yes / Q4 2021 / Q4 2021/ Q4 2021)*	✓ ✓ -	-	-
Different programs - yes but only linked programs (e.g. normal & eco) with together max. 30 steps - yes	- ✓	✓ -	✓ -	✓ -
Different sub-programs controlled by - manual switch - float switch - buttons	✓ ✓ ✓	✓ ✓ -	- ✓ -	- ✓ -

	BonBloc IoT	***BonBloc compact***	***Sequetrol compact LCD***	***Sequetrol compact LED***
Operating hours (permanently stored) (total / blower / all outputs)	✓ / ✓ / ✓	✓ / ✓ / ✓	✓ / ✓ / -	✓ / ✓ / -
Event protocol (alarms are stored together with time and program)	✓	-	-	-
Alarms				
- Mains Failure	✓	✓	✓	✓
- Fuse error	✓	✓	-	✓
- Digital input	✓	✓	✓	✓
- Service	✓	✓	✓	✓
- Overfill (flooding)	✓	✓	✓	✓
- Pressure	✓	✓	✓	-
- Current	-	-	-	-
- Monitoring of valve function (open and close)	✓	-	-	-
- User defined	✓	✓	-	-
Event protocol can be transferred	Wi-Fi	-	-	-
Different languages				-
- one language per firmware	-	✓	✓	
- can be switched on site	✓	-	-	
Software creation in				
- Excel®	-	✓	✓	✓
- *MenuMaker*	✓	-	-	-
- *DataBuilder*	-	-	-	-

Sequetrol® starter and Sequetrol® starter plus

	Sequetrol starter	***Sequetrol starter plus***
		
Plant type	***continuous*** **MBBR, fixed-bed plants with membrane (<u>not</u> piston / NITTO) blowers**	***continuous*** **MBBR, fixed-bed plants and (aerated) wetlands as well as One-Tank SBR plants with only one cycle per day**
suitable for **E-Pump SBR**	-	-
suitable for **air-SBR**	-	One-Tank SBR plants with only one cycle per day
suitable for **continuous plants with submersible pumps**	✓	✓
Number of **Valves**	Blower + 1 valve	Blower + 2 outputs
Relays (max. no.) - 5A nominal (350W real) - 16A nominal (800W real) - pot. free relay digital signal output	2 2 0 0 0	3 3 0 0 0
Prepared for *BonFlash* and *BonAlarm*	✓	✓
Buttons to change step times or navigate the menu	4 buttons	4 buttons

	Sequetrol starter	***Sequetrol starter plus***
Display	alphanumeric LCD (2 x 16)	alphanumeric LCD (2 x 16)
Water-level by (float-switch / pressure sensing)	1 / no ***	1 / no
max no. of **inputs** (digital / analog 4-20mA)	1 / 0	1 / 0
pressure sensor	- ****	500mbar *****
current sensor (all outputs shared / particular output can be selected (number of output))	no / no ****	yes * / yes *
Wi-Fi and integrated **webserver**	-	-
GSM Option - 2G SMS + *Aquavisor* App - Telemetry + *Aquavisor* telemetry system (2G / NB IoT / LTE Cat. M1 / 4G)	✓ ✓ -	✓ ✓ (including remote control) -
Different programs - yes but only linked programs (e.g. normal & eco) with together max. 30 steps - yes	- -	- ✓ (up to 5)
Different sub-programs controlled by - manual switch - float switch - buttons	 ✓ ✓ ✓	 ✓ ✓ ✓
Operating hours (permanently stored)	✓ / ✓ / ✓	✓ / ✓ / ✓

	Sequetrol starter	***Sequetrol starter plus***
(total / blower / all out-puts)		
Event protocol (alarms are stored together with time and program)	-	✓
Alarms - Mains Failure - Fuse error - Digital input - Service - Overfill (flooding) - Pressure - Current - Monitoring of valve function (open and close) User defined	 ✓ ✓ ✓ - ✓ ✓ (via power metering) - - -	 ✓ ✓ ✓ - ✓ ✓* ✓* ✓* -
Event protocol can be transferred	-	-
Different languages - one language per firmware - can be switched on site	 - ✓	 - ✓
Software creation in - Excel® - *MenuMaker* - *DataBuilder*	 - - ✓ (version 1)	 - - ✓ (version 5)

* = depending on equipment
** = only if "Biology Build-Up" timer is not used (= if sludge removal shall not be suppressed for a certain amount of time)
*** = only alarm float switch
**** = power measurement
***** = version with pressure sensor available

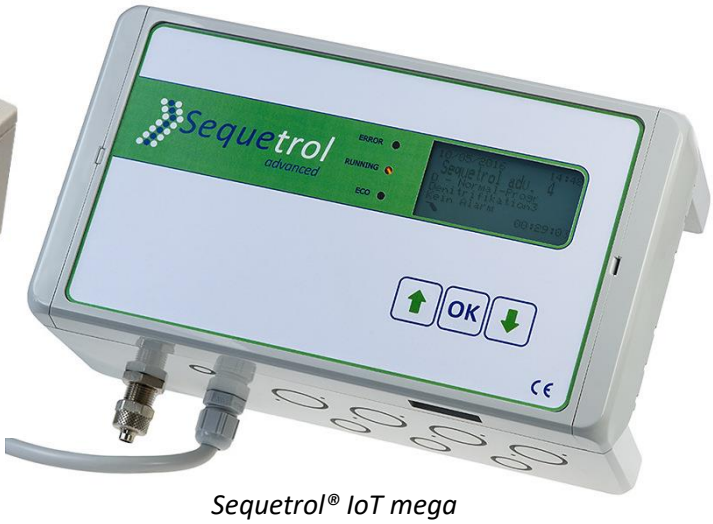
Sequetrol® IoT range

Powerful control units (SBR & continuous plants) with on-board Wi-Fi connectivity and GSM as module – different hardware versions / casings available

Sequetrol® IoT mini

Sequetrol® IoT midi

Sequetrol® IoT maxi



Sequetrol® IoT mega

- ✓ Wi-Fi and webserver on-board, 2/4G and LTE Cat M1 / NB IoT as option
- ✓ Water-level control for multiple tanks at multiple levels using pressure sensor
- ✓ Up to 8 relay outputs, up to 4 digital inputs
- ✓ 4-20mA analogue input
- ✓ Graphical LCD
- ✓ Different hardware versions

Why use the Sequetrol® IoT?

- ➢ Operate controller by phone / tablet / touchscreen via browser (no app installation required)
- ➢ Connect into the world of PLC / SCADA via HTTP-REST
- ➢ Receive an email in case of any problems
- ➢ Run SBR and continuous processes parallel in one control unit, e.g. for duplex buffer-pump operation
- ➢ Measure water level by pressure sensing via different airlifts / diffusor / bubbling-in

- Build even a complex wwtp: 8 relay outputs, 3 digital inputs, a 4-20mA analogue input pressure sensing and optional current measurement.

Sequetrol® IoT details

The *Sequetrol® IoT* belongs to a new generation of control units developed to meet the requirements of *Internet of Things* (IoT) and *Smart Home*. It combines the possibility to handle even the most complex sewage treatment processes with connectivity and remote operability.

Integrated webserver

The integrated webserver of the *IoT* controller series allows you to operate the treatment plant and to access all information with any browser.

Imagine, you'd like to service a plant and the owner of the building is not at home—simply access via Wi-Fi without entering the building.

Imagine you would like to operate a big plant "SCADA-like" with a touchscreen—simply add a standard tablet to the control cabinet and connect via Wi-Fi.

Imagine, your plant has some troubles, and you don't like to go hundreds of kilometers—simply connect via GSM and operate and analyze the plant.

HTTP-REST interface

REST using JSON over HTTP is a widely used standard for M2M[1] communication. The control unit can thus be integrated into any code base that can communicate over HTTP, including .NET, Java, Python, scripting environments like PHP or JavaScript, and more! Like this, an efficient data exchange between the control unit and telemetry servers, PLC and SCADA devices are possible.

- Analyze your plant using the detailed event log showing all relevant parameters, including pressure, in– and output states, remaining times etc.

Create sophisticated processes

With the *Sequetrol® IoT* there are no restrictions to your ideas. BONNEL's PC software *MenuMaker* allows programming even the most complex processes and menus efficiently. The *IoT* controller supports multiple, connected programs, calculations within the process, analogue water level evaluation, automatic switching-off of airlifts, user defined alarm conditions, timers, counters and much more. Once programmed, even you can modify and adopt the software yourself.
It is even possible to combine SBR and continuous processes within one control unit to design innovative cleaning processes or to run your buffer pump in duplex mode while cleaning the sewage.

Create new business models

The *IoT* platform can help you to create new business models.

You want to rent your plants? Block the plant automatically when no payment is arriving.

You want to compete with big plants? Connect to SCADA and offer touchscreens.

You want to reach remote areas? Control and monitor your plant remotely.

You want to do PPP[2] or provide cleaning as service? Prove your plant is running well connecting sensors to the analogue input and transfer all data to telemetry servers in the cloud.

[1] M2M: Machine to machine communication

[2] Public-private-partnership

Technical data

SBR and continuous runtime / process logic programmable (see chapter *Process logic – SBR logic or continuous logic?* on p.70).

Attribute	Value
Dimensions (l x w x h); weight	*Sequetrol® IoT maxi / midi*: 166mm x 182mm x 83mm; 1.2kg *Sequetrol® IoT mini*: 151mm x 125mm x 91 or 61mm; 0.9kg
Ambient temperature	-20°C to +55°C
Protection classification / UV-Resistance (casing)	IP 52 to 55 (depending on version) / UV-resistant casing as option
Functions, process, alarms, display messages, web pages	All according to customer request and requirement Processes are designed and adapted by means of a clear and easy-to-use PC-software *MenuMaker*
Display / LED	Backlit graphical LCD (128 x 64); 3 LED (colors as requested)
Outputs / Inputs	*IoT maxi:* See chapter *Sequetrol® IoT maxi*, p.23 *IoT midi:* See chapter *Sequetrol® IoT midi,* p.21 *IoT mini:* See chapter *Sequetrol® IoT mini*, p.20 *IoT mega:* See chapter *Air-SBR* *Clearwater removal* via airlift ○ Clearwater removal via submersible pump ○ Output for Phosphorus removal including load-based dosing and low precipitation liquid level warning ○ Measurement of amount of treated water - One-Tank SBR plant ○ Clearwater removal via airlift ○ Clearwater removal via submersible pump - MBBR / fixed bed / SAF / continuous plant ○ No Filling / Feeding ○ Filling / Feeding via submersible filling pump ○ Filling / Feeding via airlift pump ○ No Clearwater removal ○ Clearwater removal via airlift ○ Clearwater removal via submersible pump - Trickling filter / biological filter plants (D: Tropfkörper-Anlage) ○ 2-Pump version

	○ 3-Pump version *Sequetrol® IoT mega,* p.24
Data interface	USB; Wi-Fi* (AP and/or STA mode); mobile/cellular data* (2/3/4G, LTE Cat M1/NB IoT)
Power backup during mains failure	2x AA rechargeable battery or* alkaline battery plus gold-cap for RTC
Power supply	230VAC, 6W max.

* According to selected equipment

Standard models and software

Standard models are available in any quantity. Besides the standard models, customer specific versions / configurations are available at a MOQ of 100 units per year.

On request and at reasonable quantities, customer specific control units based on this control unit can be derived. For example, another casing, a different I/O configuration, no LCD, other communication technologies like LoRa® and similar changes can be realized.

Normally, the control units are delivered with a menu, web pages and a process, which were developed according to the particular requirements of a sewage treatment plant manufacturer. As the development is time consuming and thus not efficient at low quantities, BONNEL offers some standard processes which can be slightly modified according to customer requirements to lower the development costs. Please mind, that there are only dummy step times programmed. The preprogrammed processes do not replace know-how about decentralized sewage treatment at BONNEL's customers. BONNEL is a market leader in control units, not in sewage treatment processes. BONNEL does not guarantee that plants with these standard processes will have good treatment results. BONNEL does not copy any processes or features that have been realized for a customer into its standard processes.

Sequetrol® IoT mini

Standard models

Order Reference		**SQ-IoT-mini Wi-Fi**	**SQ-IoT-mini Wi-Fi + GSM *)**
General	Valves	-	-
	Alarm Buzzer	●	●
	230V relay outputs	4 (1 x 16A + 3 x 5A nominal)	4 (1 x 16A + 3 x 5A nominal)
	Low voltage digital output	●	●
	Output for *BonFlash* alarm lamp / *BonAlarm* alarm forwarder	●	●
Inputs	Digital inputs	2	2
	Analog input	-	-
Pressure measurement		internal sensor 0-500mbar, 0,8m tube	internal sensor 0-500mbar, 0,8m tube
Current measurement		●	●
Connec-tions	Relays 1-4 e.g. valves, pump	Terminals + cable glands, no cables	Terminals + cable glands, no cables
	Mains 230VAC	1m + CEE 7/7 plug	1m + CEE 7/7 plug
Wi-Fi		●	●
GSM		no	●*)
USB interface		●	●
Equipment components		2xAA NiMH rech. Batteries	2xAA NiMH rech. Batteries

* GSM + WIFI can run only under certain conditions, this solution is available only individually at request

Standard web pages, menu, and processes

Currently there are no standard processes available for the *Sequetrol® IoT mini*. Please refer to the *Sequetrol® IoT midi* (p.21).

Sequetrol® IoT midi

Standard models

Order Reference		SQ-IoT-midi Wi-Fi	SQ-IoT-midi Wi-Fi + GSM
General	Valves	-	-
	Alarm Buzzer	●	●
	230V relay outputs	5 (3 x 16A + 2 x 5A nominal)	5 (3 x 16A + 2 x 5A nominal)
	Low voltage digital output	-	-
	Output for *BonFlash* alarm lamp / *BonAlarm* alarm forwarder	●	●
Inputs	Digital inputs	2	2
	Analog input	1 x 4-20mA	1 x 4-20mA
Pressure measurement		internal sensor 0-500mbar, 0,8m tube	internal sensor 0-500mbar, 0,8m tube
Current measurement		●	●
Connec-tions	Relays 1-4 e.g. valves, pump	Terminals + cable glands, no cables	Terminals + cable glands, no cables
	Relay 5, e.g. blower	CEE 7/4 socket	CEE 7/4 socket

Order Reference		**SQ-IoT-midi Wi-Fi**	**SQ-IoT-midi Wi-Fi + GSM**
	Mains 230VAC	1.9m + CEE 7/7 plug	1.9m + CEE 7/7 plug
Wi-Fi		●	●
GSM		Preparation for GSM retrofit-ting, GSM itself as option	●
USB interface		●	●
Equipment components		2xAA NiMH rech. Batteries	2xAA NiMH rech. Batteries

Standard web pages, menu, and processes

- Air-SBR
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
  - Measurement of amount of treated water
- One-Tank SBR plant
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
- MBBR / fixed bed / SAF / continuous plant
  - No Filling / Feeding
  - Filling / Feeding via submersible filling pump
  - Filling / Feeding via airlift pump
  - No Clearwater removal
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
- Trickling filter / biological filter plants (D: Tropfkörper-Anlage)
  - 2-Pump version
  - 3-Pump version

Sequetrol® IoT maxi

Standard models

Order Reference		**SQ-IoT-maxi Wi-Fi**	**SQ-IoT-maxi Wi-Fi + GSM**
General	Valves	-	-
	Alarm Buzzer	●	●
	230V relay outputs	8 x 5A nominal	8 x 5A nominal
	Low voltage digital output	●	●
	Output for *BonFlash* alarm lamp / *BonAlarm* alarm forwarder	●	●
Inputs	Digital inputs	3 + 1 (one DI can work as a counter)	3 + 1 (one DI can work as a counter)
	Analog input	1 x 4-20mA	1 x 4-20mA
Pressure measurement		internal sensor 0-500mbar, 0.8m tube	internal sensor 0-500mbar, 0.8m tube
Current measurement		on request at MOQ 250pcs.	on request at MOQ 250pcs.
Connec-tions	Relays 1-4 & 6 e.g. valves, pump	Terminals + cable glands, no cables	Terminals + cable glands, no cables
	Relay 5, e.g. blower	CEE 7/4 socket	CEE 7/4 socket
	Relay 7-8, e.g. dosing, UV	7-pole BINDER connector	7-pole BINDER connector
	Mains 230VAC	1.9m + CEE 7/7 plug	1.9m + CEE 7/7 plug
Wi-Fi		●	●
GSM		Preparation for GSM retrofit-ting, GSM itself as option	●

Order Reference	SQ-IoT-maxi Wi-Fi	SQ-IoT-maxi Wi-Fi + GSM
USB interface	●	●
Equipment components	2xAA NiMH rech. Batteries	2xAA NiMH rech. Batteries

Standard web menu, and processes

- Air-SBR
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
  - Output for Phosphorus removal including load-based dosing and low precipitation liquid level warning
  - Measurement of amount of treated water
- One-Tank SBR plant
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
- MBBR / fixed bed / SAF / continuous plant
  - No Filling / Feeding
  - Filling / Feeding via submersible filling pump
  - Filling / Feeding via airlift pump
  - No Clearwater removal
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
- Trickling filter / biological filter plants (D: Tropfkörper-Anlage)
  - 2-Pump version
  - 3-Pump version

Sequetrol® IoT mega

Standard models

Order Reference		**SQ-IoT-mega Wi-Fi**	**SQ-IoT-mega Wi-Fi + GSM**
General	Valves	-	-
	Alarm Buzzer	●	●
	230V relay outputs	5 x 16A nominal	5 x 16A nominal
	Low voltage relay contact	-	-
	Output for *BonFlash* alarm lamp / *BonAlarm* alarm forwarder	●	●
Inputs	Digital inputs	4	4
	Analog input	1 x 4-20mA	1 x 4-20mA
Pressure measurement		internal sensor 0-500mbar	internal sensor 0-500mbar
Current measurement		shared for all outputs	shared for all outputs
Connec-tions	Relays 1-5 e.g. valves, pump, dosing,…	Terminals + cable glands, no cables	Terminals + cable glands, no cables
	Mains 230VAC	Terminals + cable glands, no cables	Terminals + cable glands, no cables
Wi-Fi		●	●

Order Reference	SQ-IoT-mega Wi-Fi	SQ-IoT-mega Wi-Fi + GSM
GSM	Preparation for GSM retrofit-ting, GSM itself as option	●
USB interface	●	●
Equipment components	2xAA NiMH rech. Batteries	2xAA NiMH rech. Batteries

Standard web pages, menu, and processes

- Air-SBR
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
  - Measurement of amount of treated water
- Air-SBR
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
- One-Tank SBR plant
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
- MBBR / fixed bed / SAF / continuous plant
  - No Filling ‘/ Feeding
  - Filling / Feeding via submersible filling pump
  - Filling / Feeding via airlift pump
  - No Clearwater removal
  - Clearwater removal via airlift
  - Clearwater removal via submersible pump
- Trickling filter / biological filter plants (D: Tropfkörper-Anlage)
  - 2-Pump version
  - 3-Pump version

BonBloc® IoT

Powerful programmable controller for small SBR sewage treatment plants with an integrated valve unit and an onboard webserver

- ✓ 4 stepper-motor valves
- ✓ Wi-Fi and webserver on-board, 2/3/4G and LTE Cat M1 / NB IoT as option
- ✓ Water-level control for multiple tanks at multiple levels using pressure sensor
- ✓ Up to 4 relay outputs
- ✓ Easy to install and connect
- ✓ IP53 casing, optionally UV–resistant for outdoor installation

Why use the BonBloc® IoT?

- ➢ Cost efficient, reliable, and quiet solution thanks to the integration of the control unit and stepper motor valves
- ➢ Operate the control unit by phone / tablet / touchscreen via browser (no application needed) and Wi-Fi or GSM
- ➢ Receive an email in case of any alarms
- ➢ Analyze your plant using the detailed event log showing all relevant parameters, including pressure, in– and output states, remaining times etc.
- ➢ Control the water level in multiple tanks at different levels using the integrated pressure sensor plus an airlift or a diffusor
- ➢ Program your process and menu on your own with the user-friendly PC tool MenuMaker and update it via USB, Wi-Fi, or GSM
- ➢ Store and select multiple programs for different plant types and sizes

BonBloc® IoT details

The *BonBloc® IoT* integrates both, a powerful controller, and quiet and reliable valves into a compact and easy to install device at a competitive price. It belongs to a new

generation of control units developed to meet the requirements of the Internet of Things (*IoT*) and Smart Home.

The *BonBloc® IoT* comes with features as acoustic signaling of predefined conditions, USB, Wi-Fi or GSM for updates and non-volatile memory for event-logs. To ensure continuous acoustic and optical signaling during power outage, a set of NiMH rechargeable batteries powers the alarm buzzer and the optional *BonFlash* LED alarm beacon or *BonAlarm* alarm forwarder. All electrical connections are implemented using cost-effective and universally compatible screw type terminals.

Instead of conventional solenoid valves the *BonBloc®* uses reliable stepper motors from the automotive industry. Why stepper motors? First, they are saving 95% of energy when compared to conventional valves. Secondly, our valves are much quieter than solenoid actuated valves.

Integrated webserver

The integrated webserver of the *IoT* controller series allows you to operate the treatment plant and to access all information with any browser.

Imagine, you'd like to service a plant and the owner of the building is not at home—simply access via Wi-Fi without entering the building.

Imagine, your plant has some troubles, and you don't like to go hundreds of kilometers—simply connect via GSM and operate, analyze, and update the plant.

Design sophisticated processes

With the *BonBloc® IoT* there are no restrictions to your ideas. BONNEL's PC software *MenuMaker* allows programming even the most complex processes and menus efficiently. The *IoT* controller supports multiple, connected programs, calculations within the process, analogue water level evaluation, automatic switching-off of airlifts, user defined alarm conditions, timers, counters and much more. Once programmed, even you can modify and adopt the software yourself.

It is even possible to combine SBR and continuous processes within one control unit to design innovative cleaning processes or to run your buffer pump in duplex mode while cleaning the sewage.

Create creative business models

The IoT platform can help you to create new business models.

Do you want to rent your plants? Block the plant automatically when no payment is arriving.

Do you want to reach remote areas? Control and monitor your plant remotely.

Do you want to do PPP or provide water treatment as service? Prove your plant is running well connecting sensors to the analogue input and transfer all data to telemetry servers in the cloud.

Technical data

SBR and continuous runtime / process logic programmable (see chapter *Process logic – SBR logic or continuous logic?* on p.70).

Attribute	Value
Dimensions (l x w x h); weight	118mm x 214mm x 181mm; 1.9kg
Ambient temperature	-20°C to +50°C
Protection classification / UV-Resistance (casing)	IP 53 (outdoor installation) / UV-resistant casing as option
Functions, sequence program, alarms, GSM-communication, display messages (also multilanguage)	All according to customer request and requirement.

	Processes are designed and adapted by means of a clear and easy-to-use PC-software *MenuMaker*
Display / LED	Backlit graphical LCD (128 x 64); 3 LED (red, yellow, green
Outputs	4x valves: Air inlet 3/4”, air outlets 1/2” Up to 4x 230VAC, 350VA relay outputs (max. total current 3.15A) Digital output for alarm forwarding or communication 5VDC alarm lamp output for *BonFlash* alarm lamp or *BonAlarm* alarm forwarder (battery-backed)
Inputs	3x digital inputs; pressure sensor 0-500mbar; current sensor*
Data interface	USB; Wi-Fi (AP and/or STA mode); GSM* (2G); 2/3/4G*; NB IoT / LTE Cat M1*
Power backup during mains failure	2x AA rechargeable battery plus gold-cap for RTC
Power supply	230VAC, 15W max.

* According to selected equipment

Standard models

Standard models are available in any quantity. Besides the standard models, customer specific versions / configurations are available at a MOQ of 100 units per year.

On request and at reasonable quantities, customer specific control units based on this control unit can be derived. For example, a different I/O configuration, a version without LCD, other communication technologies like LoRa® and similar changes can be performed.

Order Reference		**BB-IoT GENERAL Wi-Fi**	**BB-IoT GENERAL Wi-Fi + GSM**
General	Valves	4	4
	Alarm Buzzer	●	●
Outputs	Blower Relay	●	●
	Aux relay outputs	3	3
	Low voltage relay contact	-	-
	Output for *BonFlash* alarm lamp or *BonAlarm* alarm forwarder	●	●
Inputs	Digital inputs	3	3
	Analog input	-	-
Pressure measurement		internal sensor 0-500mbar	internal sensor 0-500mbar
Current measurement		no*	no*
Wi-Fi		●	●
GSM (2G)		Preparation for GSM retrofitting, GSM itself as option	●

Order Reference	BB-IoT GENERAL Wi-Fi	BB-IoT GENERAL Wi-Fi + GSM
USB interface	●	●
Equipment components	Mains cable: 1m + CEE 7/7 plug Blower: 0.3 meter + CEE 7/4 socket 2xAA NiMH rech. Batteries	Mains cable: 1m + CEE 7/7 plug Blower: 0.3 meter + CEE 7/4 socket 2xAA NiMH rech. Batteries
Hose connectors	1/2" hose outputs 3/4" input	1/2" hose outputs 3/4" input

Standard web pages, menu, and processes

Normally, the control units are delivered with a menu, web pages and a process, which were developed according to the particular requirements of a sewage treatment plant manufacturer. As the development is time consuming and thus not efficient at low quantities, BONNEL offers some standard processes which can be slightly modified according to customer requirements to lower the development costs. Please mind, that there are only dummy step times programmed. The preprogrammed processes do not replace know-how about decentralized sewage treatment at BONNEL's customers. BONNEL is a market leader in control units, not in sewage treatment processes. BONNEL does not guarantee that plants with these standard processes will have good treatment results. BONNEL does not copy any processes or features that have been realized for a customer into its standard processes.

The following standard process are be available:

- Air-SBR
    - Clearwater removal via airlift
    - Clearwater removal via submersible pump
    - Output for Phosphorus removal including load-based dosing and low precipitation liquid level warning
    - Measurement of amount of treated water

BonBloc® compact

Reasonably priced programmable controller for small wastewater treatment plants with integrated energy-saving valve unit

- ✓ All relevant control functions within a compact casing
- ✓ 4 motor-driven valves
- ✓ Water-level sensing by pressure measurement
- ✓ Easily programmable via Excel®-Sheet
- ✓ Up to 4 relay outputs
- ✓ GSM (2G) module as option

Why use the BonBloc® compact?

- ➢ Outstanding price-performance ratio due to the integrated design and absence of 230V solenoid valves
- ➢ Up to two water levels can be evaluated by pressure sensing
- ➢ Easy to install and connect
- ➢ Quiet valve operation
- ➢ Saves approx. 95% energy compared to units using standard solenoid valves
- ➢ Up to 4 relay outputs offer a comfortable connection of accessory devices
- ➢ Process can be easily created and modified using Excel® table
- ➢ Password protected system-menu provides access to manual control and easy changing of step times
- ➢ IP54 casing, optionally UV-resistant for outdoor installation

BonBloc® compact details

Idea

SBR wastewater treatment plants normally use a control unit and a valve module. These are installed separately and have to be connected using costly cables and connectors.

The *BonBloc® compact* integrates both, the controller, and the valves into a single compact and easy to install device. No more cable spaghetti, all the comfort you need at a very competitive price.

Valves

Instead of conventional solenoid valves we use reliable stepper motors from the automotive industry.

Why stepper motors?

First, they consume energy only during opening or closing of the valve, therefore saving 95% of energy when compared to conventional valves. That is about 90kWh per year or 15€, and the trend is rising.

Secondly, our valves are, due to the smoother and slower movement, much quieter than solenoid actuated valves.

Water-level sensing by pressure measurement

The *BonBloc® compact* is equipped with a pressure sensor and an evaluation logic to determine the water level during aeration or pumping. This level sensing can be used instead of failure-prone and costly float-switches.

Control unit

Three buttons, three LEDs, an alphanumeric LCD display - regarding its operability our *BonBloc® compact* leaves nothing to be desired.

The device is equipped with pressure sensing to monitor the compressor.

Using the digital inputs up to three float switches or other signal sources can be connected (depending on equipment version). Up to four reliable relays can control the compressor and other devices (e.g. UV-lamp, dosing of chemicals).

The GSM-module will send SMS if any alarm occurs. The *BonBloc® compact* can even be remotely controlled and recalled by GSM.

The *BonBloc® compact* is also equipped with features, such as acoustic signaling of predefined conditions, a sequence program permanently saved in the EEPROM and a set of NiMH rechargeable batteries to ensure continuous signaling during power outage or the function of the GSM-module.

All electrical connections are implemented using cost-effective and universally compatible screw type terminals.

Technical data

SBR process logic programmable (see chapter *Process logic – SBR logic or continuous logic?* on p.70).

Attribute	Value
Dimensions (l x w x h); weight	118mm x 241mm x 181mm; 1.9kg
Ambient temperature	-20°C to +50°C
Protection classification / UV-Resistance (casing)	IP 53 / UV-resistant casing as option
Functions, sequence program, alarms, GSM-communication, display messages (also multi-lingual)	All according to customer request and requirement. Sequence programs are designed and adapted by the wastewater treatment plant manufacturer by means of an Excel®-sheet.

Display / LED	Illuminated (backlit) alphanumeric LCD Additionally up to 3 LED (colors as requested)
Signal-inputs	Up to 3 x digital inputs Pressure sensor 0-400mbar
Data interface	RS-232 (using adapter-cable)
Electrical output	According to customer request, up to 4 relays e.g. 230V / 300VA
Power supply during mains failure	2x NiMH rechargeable batteries (size AA), optionally mignon batteries
Compressed air inlet	3/4" fittings
Compressed air outlet	1/2" fittings
Maximum pressure	450mbar
Power supply	230VAC, 12W max.

* According to selected equipment

Standard models

Standard models are available in any quantity. Besides the standard models, customer specific versions / configurations are available at a MOQ of 100 units per year.

Order Reference		**BC-ABB N BBB**	**BC-EBB N BBB-2**	**BC-FDB N BBB-2**	**BC-FDB P BBB-2**	**BC-FDB G BBB-2**
General	Valves	4	4	4	4	4
	Alarm Buzzer	●	●	●	●	●
Outputs	Blower Relay	●	●	●	●	●
	Aux relay outputs	-	1	2	2	2
	Low voltage relay contact	-	●	●	●	●
	Output for *Bon-Flash* alarm lamp or *BonAlarm* alarm forwarder	-	●	●	●	●
Inputs	Digital inputs	1	1	3	3	3
	Analog input	-	-	-	-	-
Pressure measurement		internal sensor 0-500mbar	internal sensor 0-500mbar	internal sensor 0-500mbar	internal sensor 0-500mbar	internal sensor 0-500mbar
Current measurement		-	-	-	-	-
Wi-Fi		-	-	-	-	-
GSM					Preparation GSM ret-rofitting *)	●
USB interface		-	-	-	-	-
Equipment components		Mains cable: 1m + CEE 7/7 plug; Blower: 0.3 meter + CEE 7/4 socket; 2xAA NiMH rech. Batteries				
Hose connectors		1/2" hose outputs; 3/4" input				

Order reference table

For customer specific models (MOQ 100pcs p.a.) please inquire according to the following order reference creation table.

Relay outputs	**Inputs**	**Sensors**	**GSM / Wi-Fi**	**Mains cable**	**Blower cable**	**Batteries**	**Low voltage contact config**
3rd digit	4th digit	5th digit	6th digit	7th digit	8th digit	9th digit	11th digit
A: **1 blower relay and** **0 auxiliary relay (i.e. alarm, dosing)** **0 low voltage contact**	A: 0 digital inputs no analog input	A: no pressure sensor no current measurement	N: no	A: no screw terminals inside unit only	A: no screw terminals inside unit only	A: no	blank: Pot. free output normally opened (NO contact)
B: **1 blower relay and** **1 auxiliary relay (i.e. alarm, dosing)** **0 low voltage contact**	B: 1 digital input no analog input	B: internal pressure sensor no current measurement	G: GSM for alarm SMS sending	B: 1 meter long CEE 7/7 plug	B: 0.3 meter long socket	B: yes 2x AA NiMH rechargeable Batteries	1: Pot. free output normally closed (NC contact)
C: **1 blower relay and** **2 auxiliary relay (i.e. alarm, dosing)** **0 low voltage contact**	C: 2 digital input no analog input		P: HW preparation for later GSM upgrade	C: 1 meter long no plug	C: 0.3 meter long no socket		2: +5V DC output (50mA max.) => BonFlash or *Bon-Alarm*
D: **1 blower relay and** **0 auxiliary relay (i.e. alarm, dosing)** **1 low voltage contact**	D: 3 digital input no analog input				D: 0.4 meter long no socket		3: +12V DC output (50mA max.) => 12VDC
E: **1 blower relay and** **1 auxiliary relay (i.e. alarm, dosing)** **1 low voltage contact**					E: 0.7 meter long no socket		
F: **1 blower relay and** **2 auxiliary relay (i.e. alarm, dosing)** **1 low voltage contact**					F: 0.3 meter long CEE 7/5 socket		

Standard processes

Normally, the control units are delivered with a menu, web pages and a process, which were developed according to the particular requirements of a sewage treatment plant manufacturer. As the development is time consuming and thus not efficient at low quantities, BONNEL offers some standard processes which can be slightly modified according to customer requirements to lower the development costs. Please mind, that there are only dummy step times programmed. The preprogrammed processes do not replace know-how about decentralized sewage treatment at BONNEL's customers. BONNEL is a market leader in control units, not in sewage treatment processes. BONNEL does not guarantee that plants with these standard processes will have good treatment results. BONNEL does not copy any processes or features that have been realized for a customer into its standard processes.

Currently, the following standard process are available:

- Air-SBR
    - German
        - Eco-Mode via Filling airlift
        - Eco-Mode and Overfill Alarm via float switch
        - No Eco-Mode, optional Overfill Alarm via Float switch
    - English
        - Eco-Mode via Filling airlift
        - Eco-Mode and Overfill Alarm via float switch
        - No Eco-Mode, optional Overfill Alarm via Float switch

Sequetrol® compact LED

Compact and reasonably priced controller for small SBR wastewater treatment plants

- ✓ Easily programmable
- ✓ Adjusting of the step times can be done on-site using three buttons on the printed circuit board
- ✓ Keeps record of last performed step in an event of mains failure
- ✓ 5 relay switches (230V)
- ✓ Acoustic alarm and mains failure signalization

Why use the Sequetrol® compact LED?

- ➢ The compact control unit stands out due to its price performance ratio
- ➢ Reliable technology proven in thousands of installations
- ➢ Even people without programming experience can easily create a program by editing an Excel® table
- ➢ Individually equipped (display, keypad, connectors) according to customer requirements

- Integrated operating hours counter
- Automatic release of residual pressure in the valve unit
- Updateable firmware and software
- Design of the front-panel according to customer preference

Sequetrol® compact LED details

The *Sequetrol® compact* has been developed as a comfortable but economically priced control unit.

Equipment

The *Sequetrol compact LED* is offers features like acoustic signaling of predefined conditions, a process permanently stored in the EEPROM, and a set of batteries to ensure continuous signaling during power outage.

When the control sequence is interrupted due to mains failure, the unit will automatically resume operation with the last unfinished step instead of restarting the program.

Utilizing the three buttons on the circuit board, the sequence timing can be readjusted at the installation site, resulting in an increased flexibility in adapting the *Sequetrol compact LED* to the individual requirements of the particular plant.

Build-up of residual pressure in the valve unit is prevented by stopping the compressor before closing the valves. Timing is individually adjustable for each program step (0 - 14s).

Connections

Available digital input can be used to connect a float-switch or another sensor.

Up to 5 relay outputs for 230VAC offer a comfortable connection of solenoid valves, diaphragm compressors or other loads.

Programming

The programming process was developed especially with regard to the demands of a real application.

The control unit will be delivered ex-factory already pre-programmed according to customer requirements. Firmware updates and sequence program changes can be performed with the aid of an inexpensive programming device. This also makes the *Sequetrol® compact LED* "future-proof" and ready for possible changes of the legal situation.

No programming experience or any special software is needed.

The sequence program can be easily created or modified using a ready-made spreadsheet table (Excel®).

Technical data

SBR runtime / process logic programmable (see chapter *Process logic – SBR logic or continuous logic?* on p.70).

Attribute	Value
Dimensions (l x w x h)	155mm x 113mm x 76mm
Weight	0,70kg
Ambient temperature	-20°C to +55°C
Protection classification	IP 55

Functions, sequence program, alarms	All according to customer request and requirement. Processes are designed and adapted by the wastewater treatment plant manufacturer by means of an Excel®-chart
Display	Bright LED-display, 6 digits
Signal-input	Digital input for float switch or other sensors
Data interface	RS-232
Electrical output	According to customer request, up to 5 relays e.g. 230V / 300VA
Power supply during mains failure	Standard camera battery
Power supply	230VAC / 1,5VA max.

Standard models

Standard models are available in any quantity. Besides the standard models, customer specific versions / configurations are available at a MOQ of 100 units per year.

On request and at reasonable quantities, customer specific control units based on this control unit can be derived. For example, another casing, a different I/O configuration or similar changes, can be performed.

Order Reference		**SD-EBA CCB**
General	Valves	-
	Alarm Buzzer	●
Outputs	Blower Relay	1 0.35m cable without connector
	Valve relay outputs	4 1m cables, GDM connectors
	Low voltage relay contact	-
	Output for *BonFlash* alarm lamp or *BonAlarm* alarm forwarder	-
Inputs	Digital input	1
	Analog input	-
Pressure monitoring		-
Current measurement		-
Wi-Fi		-
GSM		-
USB interface		-
Equipment components		Mains cable: 1m + CEE 7/7 plug 1x non-rechargeable battery (mains failure signalization)

Order reference table

For customer specific models (MOQ 100pcs p.a.) please inquire according to the following order reference creation table.

Relay outputs 230V	**Digital input**	**Sensors**	**Mains connection**	**Output connections**	**Battery**
3rd digit	4th digit	5th digit	6th digit	7th digit	8th digit
A: **1 blower (max. 300VA)** **0 valve/aux**	A: no DI	N: no pressure sensor no current sensor	A: no screw terminals inside unit only	A: no screw terminals inside unit only	A: no
B: **1 blower (max. 300VA)** **1 valve/aux**	B: 1x DI		B: 190cm + CEE 7/7 plug	B: blower 0.35m cable w/o connector Valve/Aux 180cm cables+GDM connectors	B: non-rechargeable battery for mains failure signalization
C: **1 blower (max. 300VA)** **2 valve/aux**			C: 90cm + CEE 7/7 plug	C: blower 0.35m cable w/o connector Valve/Aux 100cm cables+GDM connectors	
D: **1 blower (max. 300VA)** **3 valve/aux**				D: blower 0.3m cable + CEE 7/3 socket NO Valve/Aux cables	
E: **1 blower (max. 300VA)** **4 valve/aux**				Z: cable lengths and connectors upon customer request	

Standard processes

Normally, the control units are delivered with a menu, web pages and a process, which were developed according to the particular requirements of a sewage treatment plant manufacturer. As the development is time consuming and thus not efficient at low quantities, BONNEL offers some standard processes which can be slightly modified according to customer requirements to lower the development costs. Please mind, that there are only dummy step times programmed. The preprogrammed processes do not replace know-how about decentralized sewage treatment at BONNEL's customers. BONNEL is a market leader in control units, not in sewage treatment processes. BONNEL does not guarantee that plants with these standard processes will have good treatment results. BONNEL does not copy any processes or features that have been realized for a customer into its standard processes.

Currently, the following standard process are available:

- Air-SBR
    - Eco-Mode and Overfill Alarm via float switch
    - No Eco-Mode, optional Overfill Alarm via Float switch
    - Eco-Mode and Overfill Alarm via float switch + submersible pump for clearwater removal.

Sequetrol® starter plus

Easy to use control unit for MBBR sewage treatment plants- available with GSM alarm forwarding and remote control

- ✓ 3 outputs 230V + output for *BonFlash* alarm beacon or *BonAlarm* alarm forwarder; digital input
- ✓ Day-, night-, and holiday-mode helps to save energy expenses
- ✓ Innovative valve monitoring
- ✓ Blower monitoring by pressure and / or current sensing

Why use the Sequetrol® starter plus control unit?

- ➢ Outstanding price-performance ratio
- ➢ *Sequetrol® starter plus* monitors the proper function of connected valves
- ➢ Blower monitoring by pressure and / or current
- ➢ Submersible pumps or similar consumers can be monitored by current sensing
- ➢ Detailed event log eases servicing
- ➢ "Cash-Lock" function - the control unit stops the plant after a predefined number of days if no PIN is entered. The PIN is

provided to the customer as soon as the payment is fulfilled.
- Special eco-mode can be easily activated during night / weekend / holiday

Sequetrol® starter plus details

The *Sequetrol® starter plus* is designed as a highly comfortable and adaptable control unit with the price of an entry level device. The innovative valve monitoring function, that meets even future versions of the EN 12566-3 European standard, as well as the detailed event log, qualify the *starter plus* as a perfect control unit for fixed bed and MBBR plants.

Versatile monitoring functions

The *Sequetrol® starter plus* offers a unique, reliable, self-learning monitoring for solenoid valves. This is realized by the accurate, in-build pressure sensor. The control unit will detect both, a valve that does not open and a valve that does not close. Even if two 3/2 valves are operated.

The blower can be either monitored by an accurate pressure sensor or by current measurement.

Connected pumps or other consumers, where pressure measurement does not make sense, can be monitored by the current measurement sensor.

Event log

The *Sequetrol® starter plus* contains a detailed event log, that stores the events together with the time & date of the occurrence, the in- and output state and the measured pressure.

The logged events are: Mains failure, low battery, high water level (via float switch and digital input), low and high pressure, valve function (opening and closing), and Cash-Lock (see next paragraph).

- Menu structure adaptable to customer needs
- Acoustic mains failure alarm according to special German requirements

"Cash-Lock" function to enhance payment behavior

Most customers pay in time – but some don't. If you want to avoid time and trouble solving these issues, you can use the so-called "Cash-Lock" function. If no payment is received, the control unit stops the plant after a predefined number of days. As soon as you receive payment, you send the customer a unlock PIN. If the unlock PIN is entered within the due date, the control unit won't stop the plant. Simple and efficient!

Output timing parameters and ECO-modes

To save blower runtime and thus energy, it's possible to distinguish between reduced, normal and holiday load. For example, during holidays or weekends the blower ON times can be reduced. This ECO-mode can be programmed for nighttime or weekends respective weekdays. Moreover, for holidays the length of the absence can be entered to keep the ECO-mode active during this period.

Menu structure

The menu structure is adaptable according to your needs.

Some examples: It's up to you if the serviceman can delete the operating hours of the particular outputs. You decide if the end customer can operate the outputs manually. Do you want to allow servicemen to change the ON/OFF times of the outputs?

Like this, every sewage treatment plant manufacturer will get the control unit he needs.

Technical data

Continuous runtime / process logic programmable (see chapter *Process logic – SBR logic or continuous logic?* on p.70).

Attribute	Value
Dimensions (l x w x h); weight	150 x 145 x 62mm; 0.75kg
Ambient temperature	-15°C to +50°C
Protection classification	IP32 without mains plug plugged into electrical socket; IP43 with mains plug plugged into electrical socket
Display / LED	Illuminated (backlit) alphanumeric LCD / 2 LED
Signal-input	1x digital input for float switch
Pressure / current sensor	0 - 500mbar / 20 - 3,000mA
Electrical output	Max. 3x relay 230V; max. 320VA (blower) or 550VA (resistive load) Max. 700VA total (outputs 1 + 2 + 3) 1x low voltage alarm (5V / 50mA max.) for *BonFlash* or *BonAlarm*
Power supply during mains failure	1x NiMH rechargeable battery (size AA) or Lithium rechargeable battery at GSM version 1x CR2032 3V Lithium battery for RTC backup
Power consumption control unit	230VAC, 3.5W

Standard models

Standard models are available in any quantity. Besides the standard models, customer specific versions / configurations are available at a MOQ of 100 units per year.

On request and at reasonable quantities, customer specific control units based on this control unit can be derived. For example, another casing, a different I/O configuration, another electric socket type or no electric socket, other communication technologies like LoRa® and similar changes can be performed.

Order Reference		**SP-3ACNN**	**SP-3APNN**	**SP-3ABNN**	**SP-3ACGN**	**SP-3APGN**	**SP-3ABGN**
General	Alarm Buzzer	●	●	●	●	●	●
Event log		●	●	●	●	●	●
Outputs	Blower Relay	1 Electric socket (Type E*) in casing					
	Aux relay outputs	2 via screw-type terminals + cable glands					
	Low voltage relay contact	-	-	-	-	-	-
	Output for *BonFlash* alarm lamp or	●	●	●	●	●	●

	BonAlarm alarm forwarder (5V DC)						
Inputs	Digital input	●	●	●	●	●	●
	Analog input	-	-	-	-	-	-
Monitoring options		Current monitoring on output 1	Pressure monitoring	Pressure monitoring and Current monitoring on output 2	Current monitoring on output 1	Pressure monitoring	Pressure monitoring and Current monitoring on output 2
Current measurement		-	-	-	-	-	-
Wi-Fi		-	-	-	-	-	-
GSM		-	-	-	● Buffered by Li-Ion	● Buffered by Li-Ion	● Buffered by Li-Ion
USB interface		-	-	-	-	-	-

Order reference table

For customer specific models (MOQ 100pcs p.a.) please inquire according to the following order reference creation table.

Relay outputs 230V	**Inputs**	**Monitoring options**	**GSM**	**Valve/Aux connections**
3rd digit	4th digit	5th digit	6th digit	7th digit
3: 1 blower (max. 300VA) 2 valve/aux	N: no	N: no monitoring	N: no	N: screw-type terminals inside unit only
2: 1 blower (max. 300VA) 1 valve/aux	A: 1x digital input no analog inputs	C: Current monitoring on Output 1	G: GSM (2G, SMS)	A: 50cm with GDM connector on Out 2
1: 1 blower (max. 300VA) / aux		D: Current monitoring on Output 2		B: 50cm with GDM connector on Out 3
		P: Pressure monitoring		C: 50cm with GDM connector on Out 2 and Out 3
		B: Pressure monitoring and Current monitoring on Output 2		

Standard processes

Here, no standard processes are required. The creation of processes for the *Sequetrol® starter plus* is so simple, that preparing predefined processes is not necessary.

Sequetrol® starter

Budget-price control unit for fixed bed and floating vortex bed sewage treatment plants - available with GSM alarm forwarding

- ✓ 2 outputs 230V +output for *BonFlash* alarm beacon or *BonAlarm* alarm forwarder
- ✓ 1 alarm input (e.g., for float switch)
- ✓ Day-, night-, and holiday-mode helps to save energy expenses
- ✓ Integrated operating hours counter
- ✓ Self-learning blower monitoring and protection

Why use the Sequetrol® starter control unit?

- ➢ Outstanding price-performance ratio
- ➢ World first self-learning membrane blower monitoring and protection by power monitoring (no pressure measurement needed to monitor the pressure high / low levels of a membrane blower)
- ➢ Suitable for fixed-bed, vortex floating-bed and continuous sewage treatment plants
- ➢ Pulsed blower operation helps to save energy compared to 24 / 7 operation
- ➢ Special eco-mode can be easily activated during night / weekend / holiday

- Menu structure adaptable to customer needs
- Acoustic mains failure alarm according to special German requirements
- Installation and connection possible without opening the casing
- GSM-SMS alarm forwarding as option

Sequetrol® starter details

The *Sequetrol® starter* is designed as a highly comfortable and adaptable control unit with the price of an entry level device. The unique blower monitoring and protection function as well as adjustable timing parameters for the particular outputs, qualify the *starter* as a perfect control unit for fixed bed and floating vortex bed plants.

Blower monitoring and protection function

To monitor the function of the blower is of vital interest for every sewage treatment plant owner -the blower is the heart of the plant. In case the diffuser or the tubes are jammed, the plant owner can save money if the blower is turned off *before* it gets destroyed.

Normally a small tube has to be installed between a relatively expensive pressure sensor and the air hose of the blower to monitor the pressure and the blower. *Sequetrol® starter* does not need all this. It monitors the energy consumption of the particular membrane blower, learns its “fingerprint” and can thus detect any malfunction or overload of the blower.

Output timing parameters and ECO-modes

The ON and OFF times for each output can be preset and later changed in the menu. The outputs can be coupled for sludge removal: In this case the blower will be switched on when the valve to the sludge removal is open. Another option is, to activate the second (e.g. sludge) output at a certain time, for example at 6 am and 11 pm.

To save blower runtime and thus energy, it’s possible to distinguish between reduced and normal load. For example, during holidays or weekends the blower ON times can be reduced. This ECO-mode can be programmed for nighttime or weekends respective weekdays. Moreover, for holidays the length of the absence can be entered to keep the ECO-mode active during this period.

Menu structure

The full menu structure is adaptable according to your needs.

Some examples: It’s up to you if the serviceman can delete the operating hours of the particular outputs. You decide if the end customer can operate the outputs manually. Do you want to allow servicemen to change the ON/OFF times of the outputs?

Like this, every sewage treatment plant manufacturer will get the control unit he needs.

Outputs and Inputs

The *Sequetrol® starter* is equipped with three outputs and one digital input. The blower output is lead out to the mains socket. Thus, the blower can be easily connected by end customers. The valve output can be connected by a screw-type terminal inside the plant and lead out through a cable grommet. The third output is a low-voltage (5VDC) alarm output suitable for our *BonFlash* alarm lamp or *BonAlarm* alarm forwarder.

Moreover, one alarm float switch can be connected. Thus, a flooding of the tanks can be detected.

Technical data

Continuous runtime / process logic programmable (see chapter *Process logic – SBR logic or continuous logic?* on p.70).

Attribute	Value
Dimensions (l x w x h); weight	150 x 145 x 62mm; 0.75kg
Ambient temperature	-15°C to +50°C
Protection classification	IP32 without mains plug plugged into electrical socket IP43 with mains plug plugged into electrical socket
Display / LED	Illuminated (backlit) alphanumeric LCD / 2 LED
Signal-input	1x digital input for float switch
Data interface	RS-232 (using adapter-cable)
Electrical output	3x relay 230V; max. 320VA (blower) or 550VA (resistive load) Max. 700VA total (outputs 1 + 2 +3) 1x low voltage alarm (5V / 50mA max.) for *BonFlash* or *BonAlarm*
Power supply during mains failure	1x NiMH rechargeable battery (size AA) 1x CR2032 3V Lithium battery for RTC backup lithium rechargeable battery for GSM
Power consumption control unit	230VAC, 3.5W

Standard models

Standard models are available in any quantity. Besides the standard models, customer specific versions / configurations are available at a MOQ of 100 units per year.

On request and at reasonable quantities, customer specific control units based on this control unit can be derived. For example, another casing, a different I/O configuration, another electric socket type or no electric socket, other communication technologies like LoRa® and similar changes can be performed.

Order Reference		**SS-1ABANAAA**	**SS-1ABAGAAA**
General	Valves	-	-
	Alarm Buzzer	●	●
Outputs	Blower Relay	1 Electric socket (Type E*) in casing	
	Aux relay outputs	1 via screw-type terminal + cable gland	
	Low voltage relay contact	-	-
	Output for *BonFlash* alarm lamp or *BonAlarm* alarm forwarder	●	●

Order Reference		**SS-1ABANAAA**	**SS-1ABAGAAA**
Inputs	Digital inputs	●	●
	Analog input	-	-
Blower pressure monitoring via power consumption		●	●
Current measurement		-	-
Wi-Fi		-	-
GSM		-	●
USB interface		-	-
Equipment components		Mains cable: 1m + CEE 7/7 plug 2xAA NiMH rech. Batteries	Mains cable: 1m + CEE 7/7 plug 1x 3.7V Li-Ion rech. Battery

Order reference table

For customer specific models (MOQ 100pcs p.a.) please inquire according to the following order reference creation table.

Relay outputs 230V	***BonFlash*-C output**	**Inputs**	**Sensors**	**GSM**	**Valve/Aux connections**	**Mains connection**	**Batteries**
3rd digit	4th digit	5th digit	6th digit	7th digit	8th digit	9th digit	11th digit
1: 1 blower (max. 300VA) 1 valve/aux	N: no	A: no digital inputs no analog inputs	A: special power measurement	N: no	A: no screw terminals inside unit only	A: 100cm + CEE 7/7 plug	A: yes, 1xAA NiMH respective 3.7V Li-Ion rech. batt.
2: 1 blower (max. 300VA) no valve/aux	A: 5V DC output for *BonFlash or BonAlarm*	B: 1x digital input no analog inputs		G: GSM (2G, SMS)	B: 50cm with GDM connector	B: 50cm + CEE 7/7 plug	
					C: 190cm with GDM connector		
					D: 80cm with CEE 7/4 socket		

Standard processes

Here, no standard processes are required. The creation of processes for the *Sequetrol® starter* is so simple, that preparing predefined processes is not necessary.

PumpGuard control unit for pump stations

Control unit for Pump Stations with single or duplex pumps, 12A each, 1- or 3-phase

- ✓ Compact & modular design (battery and input module)
- ✓ Digital 3-phase current monitoring
- ✓ Thermal protection inputs
- ✓ Operating hours counter
- ✓ Alarm outputs (pot. free & 230VAC)
- ✓ Level measurement inputs compatible with common Zener barriers

Why use the PumpGuard control unit?

- ➢ Outstanding price-performance ratio
- ➢ Level detection by
  - ▪ Diver's bell / pressure (see *Level measurement by divers' bell)*
  - ▪ Pressure measurement with air-bubble introduction and blower monitoring
  - ▪ Float switch
  - ▪ Level probe / analogue input 4-20mA
- ➢ Single and duplex pump version

- Up to 72h mains failure alarm with 4xAA rechargeable battery module and Bon-Flash alarm lamp or *BonAlarm* alarm forwarder.
- Durable LED display for working-life far more than 10 years
- All settings can be done comfortable in the menu
- ATEX mode

PumpGuard details

The *PumpGuard* is designed as a compact control unit with the features of a "big" pump controller for the price of a small one. Therefore, a lot of handy features, that are normally not available at this price range, have been integrated.

Level measurement possibilities

As standard option, level measurement is performed by diver's bell / pressure sensing. This is a very efficient and reliable way to detect the preset switching levels. This measurement can be combined with one alarm float switch. A second option is, to use float switches. Two float switches for the single-pump operation can be connected in the standard package, a third float switch can be added using the input module. Another possibility is, to use an analogue pressure probe (4-20mA). The probe can be connected to the additional input module.

Pump monitoring options

The pump current consumption is evaluated digitally on all three phases according to applicable standards. Moreover, the reversible temperature sensor and he irreversible temperature sensor are monitored. As a third security level, the maximal pump runtime can be checked.

Special pump behavior settings

To enhance functionality and comfort, the following functions have been added:

- Startup timeout: Delay after mains recovery
- Overcurrent retry delay: Time in minutes for a retry of the pump after detecting overcurrent
- Overtravel duration: A time in seconds can be set to run a pump after detecting the Off level
- Forced pumping: Each X days the pumps are started for 3s to destroy possible fat crusts
- Forced operation timeout: To prevent smelling, pump to Off-level each X hours
- Single pump operation: Restrict to max. one pump, even at high level

ATEX mode

One way to reach ATEX conformity is, to connect a mini blower to the diver's bell measurement. The *PumpGuard* is capable of a minimal pressure monitoring to reach the required security level for this air-bubble introduction measurement.

The digital inputs for the float switches are compatible with common Zener barriers, which limit the max. energy to ensure ATEX compatibility.

Also, the analogue input can be combined with common Zener barriers.

Mains failure signaling

The *PumpGuard* can be equipped with a cost-effective rechargeable battery module containing four AA rechargeable batteries. Together with BONNEL's low energy LED alarm beacon *BonFlash*, the *PumpGuard* can signalize mains failures of more than 72h.

Technical data

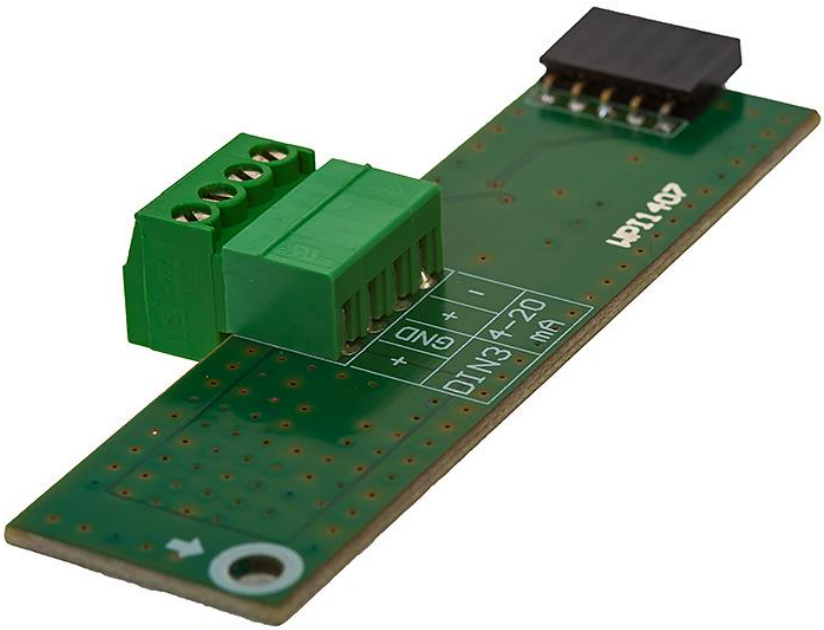
Attribute	Value
Dimensions (l x w x h); weight	210 x 200 x 110mm; solo: 1.5kg, duo: 1.7kg
Ambient temperature and humidity	-20°C to +50°C; 0-90% rel. humidity, not condensing
Protection classification	IP54
Display / LED	LED display, 6-digit / 7 LED
Pressure sensor	0 - 99mbar measurement range, 400mbar max. pressure
Electrical outputs	1-2x contactor relay 1-/3-phase; max. 5kW potential-free changeover alarm contact (max. 250VAC; 3A; required fuse max. 3A) alarm relay output 230VAC (max. 250VAC; 1A) low voltage alarm output (5V / 50mA max.) for *BonFlash* or *BonAlarm* alarm forwarder
Inputs	All inputs suited for Zener barriers with internal resistance of up to 20kΩ 2x digital input 5VDC / 5mA max. On input module: 1x digital input 5VDC / 0.3mA max. 1x analogue input 4 – 20mA (two wire), range: 0-100mbar, resolution 40µA, processed resolution: 1mbar

On request and at reasonable quantities, customer specific control units based on this control unit can be derived. For example, another casing, a different I/O configuration or similar changes, can be performed.

PumpGuard add-on modules

BONNEL offers an Input Module and a Battery Modul for the *PumpGuard*.

Input Module for *PumpGuard*



The Input Module is required for connecting:

- 3rd float switch (= at duplex pump stations that are controlled via float switches)
- 4-20mA pressure probe (100mbar probe)

Battery Module for *PumpGuard*

The Battery Module is required for a mains failure alarm.

The alarm can be signalized via buzzer, the *BonFlash* alarm beacon or the or *BonAlarm* alarm forwarder.

When signalizing via the *BonFlash* alarm beacon, only, a **signalization of >72h can be achieved**.

Accessories

Communication modules

These communication modules are required for the remote monitoring or remote control of BONNEL's control units.

Here, an overview of the different communication modules and compatible control units.

	Wi-Fi module	**2G (GSM) module**	**LTE Cat M1 + NB IoT module**	**2/3/4G module**
***IoT* controller range**	available no retrofit possible	available can be retrofitted if preparation exists 2G data connection, no VPN SIM for telemetry required	available in Q1/2022 can be retrofitted if preparation exists LTE based Cat M1 or NB IoT data connection (2G fallback), no VPN SIM for telemetry required	available in Q4/2021 can be retrofitted if preparation exists 2/3/4G data connection, no VPN SIM for telemetry required
BonBloc® compact	n/a[3]	available can be retrofitted if preparation exists GSM / 2G SMS command transfer and status request by giving plant a ring	n/a	n/a
Sequetrol® compact LCD	n/a	n/a	n/a	n/a
Sequetrol® compact LED	n/a	n/a	n/a	n/a
Sequetrol® starter	n/a	available as on-board assembly no retrofit possible GSM / 2G SMS command transfer and status request by giving plant a ring	n/a	n/a
Sequetrol® starter plus	n/a	available as on-board assembly no retrofit possible GSM / 2G SMS command transfer and status request by giving plant a ring	n/a	n/a

More information about the different communication technologies can be found in the Knowledge base, chapter *2G, 3G, 4G, LTE Cat M1 or NB IoT?* on page 68.

[3] not available

In addition to these batch production modules, customer specific modules can be offered. These can be for example LoRa® modules[4].

Wi-Fi modules

The Wi-Fi modules cannot be retrofitted.

Wi-Fi modules can be used at any controller from the IoT controller range (*Sequetrol® IoT mini, midi, maxi, mega* and *BonBloc® IoT*).

GSM / 2G modules

GSM / 2G modules can be retrofitted, given that the particular control unit was ordered with a GSM preparation. That means, that the connector for the GSM module is already assembled (soldered) to the PCB[5], the opening in the casing for the antenna is prepared and the device was tested within the factory end test at BONNEL with the communication module.

The modules allow a connection to the GSM / 2G network. 3/4G is not supported (pls. refer to the other modules below).

GSM module for the use in control units of the platforms *BonBloc® compact* and *IoT*
Consisting of

- GSM module with nano-SIM holder and Li-Ion rechargeable battery
- Antenna cable with HF connector
- Antenna with magnetic base, 3m cable and HF connector

LTE Cat M1 + NB IoT modules

LTE Cat M1 + NB IoT modules can be retrofitted, given that the particular control unit was ordered with a communication module preparation. That means, that the connector for the communication module is already assembled (soldered) to the PCB, the opening in the casing for the antenna is prepared and the device was tested within the factory end test at BONNEL with the communication module.

The modules allow a connection to the (LTE based) Cat M1 or NB IoT network. 2G can be used as fallback. “Normal” 3/4G is not supported (pls. refer to the other modules below).

Communication module for the use in control units of the platforms *BonBloc® compact* and *IoT*
Consisting of

- LTE Cat M1 + NB IoT module with nano-SIM holder and Li-Ion rechargeable battery
- Antenna cable with HF connector
- Antenna with magnetic base, approx. 3m cable and HF connector

2/3/4G modules

2G + 3G + 4G modules can be retrofitted, given that the particular control unit was ordered with a communication module preparation. That means, that the connector for the communication module is already assembled (soldered) to the PCB, the opening in the casing for the antenna is prepared and the device was tested within the factory end test at BONNEL with the communication module.

The modules allow a connection to the 4G or 3G or 2G network.

Communication module for the use in control units of the platforms *BonBloc® compact* and *IoT*
Consisting of

- LTE Cat M1 + NB IoT module with nano-SIM holder and Li-Ion rechargeable battery
- Antenna cable with HF connector
- Antenna with magnetic base, approx. 3m cable and HF connector

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[4] LoRa® modules have been already successfully supplied as OEM product.
[5] PCB: Printed Circuit Board

BonAir valve unit

The *BonAir* valve manifold was designed for domestic SBR sewage treatment plants.

It has 1 air input (3/4”) and 4 air outputs (1/2”). Other configurations are available on request.

The valves are driven by stepper motors. Due to the use of stepper motors instead of solenoids as actuators, the *BonAir* valve unit needs only energy for opening or closing the valve (approx. 1s). Normal solenoid valves need some 8W during all the time one of the valves is open.

Thus they open quiet and smooth, are very reliable and consume less energy than solenoid valves (<70%).

Technical data

Attribute	Value
Number of valve outlets	4
Input	3/4“ thread without fitting
Outputs	1/2“ thread without fitting
Maximum valve switching frequency (per valve)	continuous operation: 2 valve movements per minute Non-continuous operation (once every 5min.): Up to 4 valve movements per minute
Valve Cycle Lifetime	Approx. 300.000+

Gas Type	clean air only (no relevant gas residuals, especially sulfur compounds)
Maximum Air Pressure	400 mbar
Maximum Air Temperature (input)	60°C
Ingress Protection	IP 54
Ambient Temperature	-20°C to +60 °C
Supply voltage	AC 230V +/-15%
Power Consumption	Max. 3.5W during operation Max. 0.23A peak for loading the capacitor
Dimensions	83 x 181 x 111 mm (without hose connectors)
Weight	0.97kg

BonFlash alarm beacon

The *BonFlash* was developed as a durable and reasonable-priced alarm beacon with the ability to signalize mains-failure alarms out of the 1-4 AA rechargeable batteries of BONNEL's control unit portfolio. Of course, all other alarms will be signalized, as well.

Why use the *BonFlash* strobe beacon?

- Outstanding price-performance ratio
- Suitable for any alarm indication including mains failure
- No extra (rechargeable) battery necessary. Due to the very low power consumption, the strobe beacon can be powered by the internal batteries of the control unit at mains failure.
- Easy to connect via two wires (reverse-polarity protected)
- IP 66 – suitable for outdoor installation (sealed with potting compound)
- Solid and easy mounting with a metal hollow screw for fixation Outstanding price-performance ratio

Technical data

Attribute	Value
Dimensions (l x w x h)	102x46x30mm
Ambient temperature	-20°C to +50°C
Protection classification	IP 66
Flash rate	0.05s on - 1.0s off
Luminous color	Red
External power supply	From control unit: 5VDC ±10%; 20mA max.; 7mA avg.
Cable length	1.5m
Fixation / Mounting	Bolted on bottom

BonAlarm optic and acoustic alarm forwarder

The *BonAlarm* is a great solution for all those, who have their controller installed in the garden and are afraid they will not notice the alarm, there. Or for people, who do not want to annoy their neighbors with the integrated buzzer of the controller when there is an alarm at the plant. All alarms including mains failure will be signalized with the buzzer and LED of the *BonAlarm* out of the 1-4 AA rechargeable batteries of BONNEL's control unit portfolio.

Why use the *BonAlarm*?

- Forward all alarms inside the house - so that they are easily noticed
- Optic (flashing) and acoustic (beeping) alarm - acoustic alarm mutable
- Suitable for any alarm indication including mains failure
- Easy to connect via two wires Easy to connect via two wires (reverse-polarity protected)
- No extra (rechargeable) battery necessary. Due to the very low power consumption, the BonAlarm can be powered by the internal batteries of the control unit at mains failure
- Solid and easy mounting

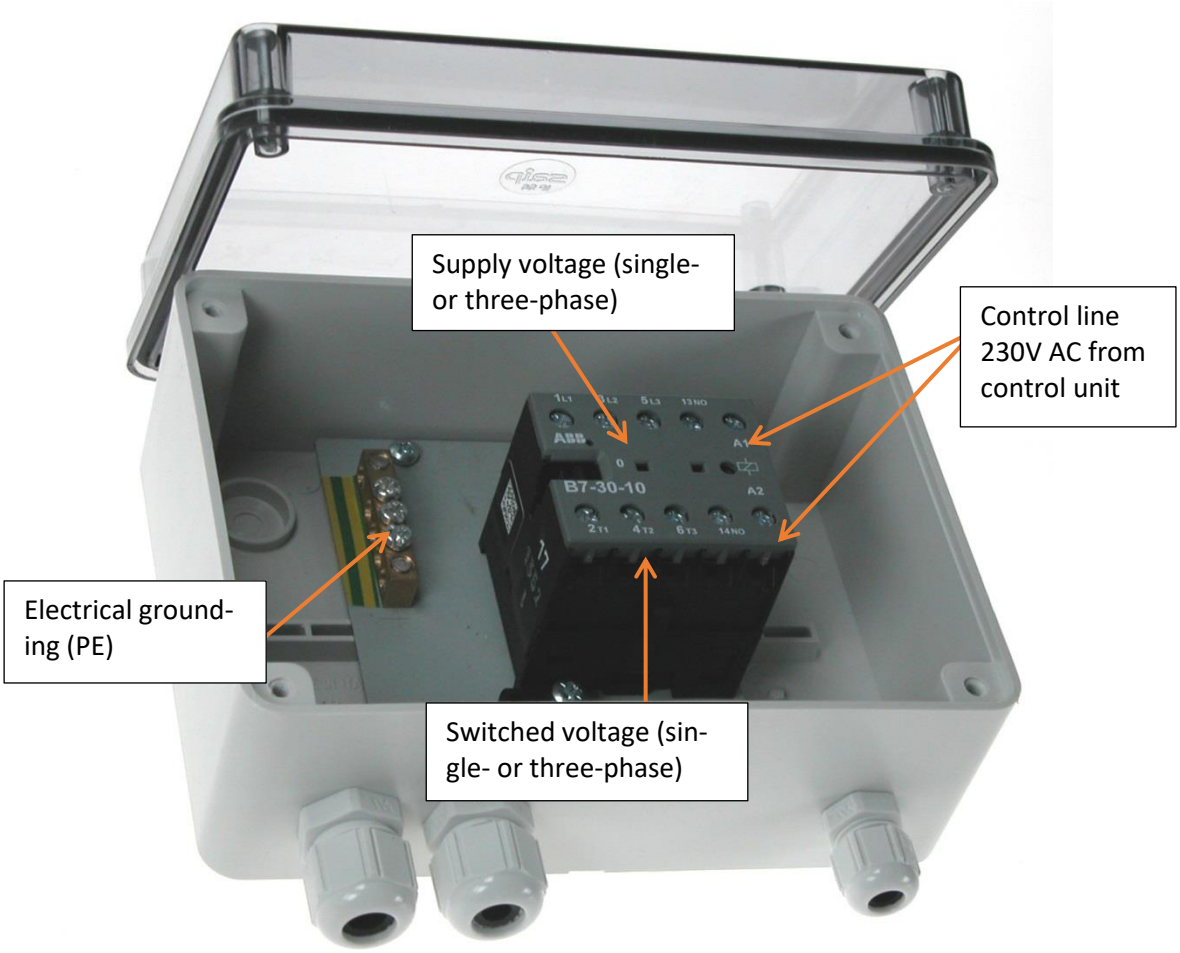
Technical data

Attribute	Value
Dimensions (l x w x h)	35x65x20mm
Ambient temperature	-20°C to +50°C
Protection classification	IP 40
Flash and beep rate	0.2s beep -> 0.05s flash -> 0.75s pause -> 0.2s beep -> ...
Luminous color	Red
External power supply	From control unit: 5VDC ±10%; 30mA max.; 8.5mA avg.
Connection	Spring-type cable terminal for rigid and flexible wires 0.2-1.5mm² Cable gland M12 for 3.5-7mm diameter cables
Fixation / Mounting	Slots for max. 3.5mm diameter screws

BonRelay auxiliary relay switch

The *BonRelay* was developed to connect electrical devices with high electrical power consumption and/or 3-phase connection with BONNEL's control units for wastewater treatment systems. It enables the use of big side channel blowers or submersible pumps or similar equipment with the control unit and ensures a high lifetime of the relays of the control unit.

The contactor relay (=auxiliary relay switch) is protected by a stable housing with IP 54 and screw cable glands and can thus be easily connected with the control unit.



Why use the *BonRelay* auxiliary contactor?

- Delivery with a stable housing with prepared cable grommets and clamps
- Compatible with all BONNEL and other control units for small wastewater treatment systems
- Controlled by the 230V output (relay) of the control unit
- Pumps/blowers up to 5,5 kW power consumption can be controlled
- IP54 protection – outdoor installation is possible

Technical data

Attribute	Value
Dimensions (l x w x h); weight	160x120x80mm; 0.46kg
Contactor relay	3-phase relay, from brand suppliers (e.g. ABB)
Switching power	Controls up to 5.5 kW (3-phase) or 2.2 kW (1-phase)

I_e	12A @ AC-3
Protection classification	IP 54
Coil relay	220-240VAC; 40-50Hz

BonMon blower current monitoring device

An easy-to-use acoustic blower monitoring device with great price performance ratio.

Why use the BonMon blower monitoring?

- Cost-efficient solution for blower monitoring
- Versatile: can be used with different blower models (piston and membrane)
- Can also be used to monitor pumps, UV lamps and other devices
- Can be used together with timers and control units
- Plug and play—can be easily connected by end users
- Easy to understand—equipped with LEDs for mains indication and alarm
- Loud (62dB) buzzer for a clear alarm sound
- Buzzer muting button
- Front foil can be customized

Technical data

Attribute	Value
Monitored current limits	Alarm below 65mA (15VA (~ Watt) —can be adapted to customer requirements at higher quantities)
Max. current of monitored consumer	max. 4A / 920VA
LED	2 LED (red, green)
Loudness	62dB
Dimensions (d x w x h)	74mm x 52mm x 75mm
Ambient temperature	-20 ... +50°C
Relative humidity	80% RH, non-condensing
Protection classification	IP20 (no water protection)
Voltage	230V AC +/- 10 %, 50/60Hz
Consumption	0.3W

Potential-free relay for BonFlash output

Most BONNEL control units have a battery-backed 5V DC output for alarms, which is usually used to connect the *BonFlash* alarm lamp. Anyhow, sometimes there is a requirement to connect higher loads or other voltages.

Typical applications

- Connect a 230V alarm lamp
- Adding a potential-free output, for example, to connect the control unit to smart-home devices
- Replacing the *BonFlash* output by a “normal” relay output for special plant configurations

Description

Therefore, BONNEL offers a potential-free relay for 5V with low energy consumption, so that it can be connected to the *BonFlash* output, which has a limited current output (not all pot. free relays can be connected). Like this, anything up to 230V AC, max. 3A can be connected. Anyhow, please mind, that it is a potential free output, so it is necessary to bring an external electricity source into the circuit.

Technical data

Output	NO (normally open) contact
Switched voltage and current	Max. 230V AC; max. 3A
Supply voltage and connection	5V DC 20mA Brown cable: +5V White cable: Minus (*GND*)
Ingress Protection	IP 42

Aquavisor® telemetry

Under the common brand *Aquavisor®* BONNEL offers three types of telemetry services for different requirements and control units. There are the

- free *Aquavisor®* Android App for individuals and service companies
- the *Aquavisor®* SMS telemetry PC version, that was developed mainly to meet the requirements for the Czech subsidies for decentralized wwtp and
- the *Aquavisor®* server-based telemetry

Here, a short comparison of the offered systems:

	***Aquavisor®* Android App**	***Aquavisor®* SMS telemetry PC version**	***Aquavisor®* server-based telemetry**
Compatible with control unit	*BonBloc® compact* *Sequetrol® starter* *Sequetrol® starter plus*	*BonBloc® compact*	*IoT* controller range (*Sequetrol® IoT* and *BonBloc® IoT*)
Communication technology	SMS (2G)	SMS (2G)	TCP/IP[6] (“mobile data”, “internet”)
Remote monitoring	yes	yes	yes
Remote control	full remote control at *Sequetrol® starter plus* limited remote control on *BonBloc® compact* and *Sequetrol® starter*	limited remote control on *BonBloc® compact*	full remote control
Plant and customer database	yes	yes	yes
Can also be used for service organization without connected control unit[7]	yes	yes	yes
Cost	free (only SMS must by paid)	On premise + costs for hosting and SMS	SaaS (Software as a Service = monthly fee)
Regular updates	yes	no	yes

[6] Currently Wi-Fi, 2/3/4G, NB-IoT and LTE Cat M1 are available or soon available technologies. LoRa® / Sigfox (LPWAN) or other technologies could be added by extending BONNEL’s data gateway.
[7] For example for treatment plants with control units that are not connected to GSM/internet.

Aquavisor® server-based telemetry

Cloud-based plant management including a remote monitoring and remote-control system

- ✓ Plant monitoring via 2G, 2/3/4G or LTE Cat M1/NB IoT (LoRa®/Sigfox® on request)
- ✓ Full remote control
- ✓ Access via web browser
- ✓ Scalable from 1 - ∞ plants
- ✓ Error notification via e-mail
- ✓ Different access levels to the plant data

Why use the *Aquavisor® telemetry system*?

- ➢ With the clear-text error messages you know what you can expect on-site
- ➢ Remote control allows you to solve problems without leaving your office
- ➢ Service planning and digital maps helps you to optimize your service trips
- ➢ Digital service reports enable your automatic invoicing
- ➢ Plant and customer database with photo and GPS coordinates will help you to find the plant
- ➢ Telemetry facilitates various operator models (BOT, BOOT,…)
- ➢ Telemetry provides evidence to water authorities of proper plant functioning

Aquavisor® cloud-based telemetry details

Aquavisor® is a scalable telemetry platform that can be adopted to your particular requirements and IT infrastructure.

Basic functions

Remote monitoring

Plants are monitored remotely via 2G networks. On request, 4G and *LoRa®*/*Sigfox®* are available, as well.

Alarms and events can be forwarded by mail to the service company and/or plant owner.

Data storage

All data will be stored in SQL databases on a server. This can be either your server, a BONNEL server or cloud servers.

Stored data contains alarms and events, as well as all plant data (e.g. address, GPS coordinates), customer contact data and service company data.

Data access

You can view and modify the data via the *Aquavisor®* webpages, that you can access with any browser from your PC, tablet, or mobile

phone. Different user levels for the plant owner, the service company and the portal owner are available.

Service reports

Your service reports can be stored into the database as pdf files. Like this, your service history remains transparent, and you can easily review it.

Remote control

The plant can be fully remote-controlled. You can change all parameters and acknowledge alarms. Perform manual operation and even monitor the pressure or current values during these tests.

Firmware and software updates

Firmware and software can be updated remotely, either on particular plants or on all plants. Like this you can keep all control units up to date.

Functions on request

Extended Service Reporting

On request, digital service reports can be added. The reports are designed for your fast and simple completion on-site using prefilled fields, combo-boxes and similar. The design and scope of the report can be agreed individually.

Connection to your ERP/CRM/accounting system

An interface to your ERP can be created, to synchronize data between the *Aquavisor®* telemetry database and your ERP system. This empowers you to transfer various data, as customer data and data about performed works, worktimes, and distances to other systems. This data is vital for automatic invoicing systems, which can generate relevant savings at the administrative costs for you.

Reporting functions

Reporting can be necessary for different legal requirements. In some countries, subsidies for plants will only be granted, if periodic reports about the operation of the plant are provided. Also operator models like Public Private Partnership (PPP) mostly require reporting.

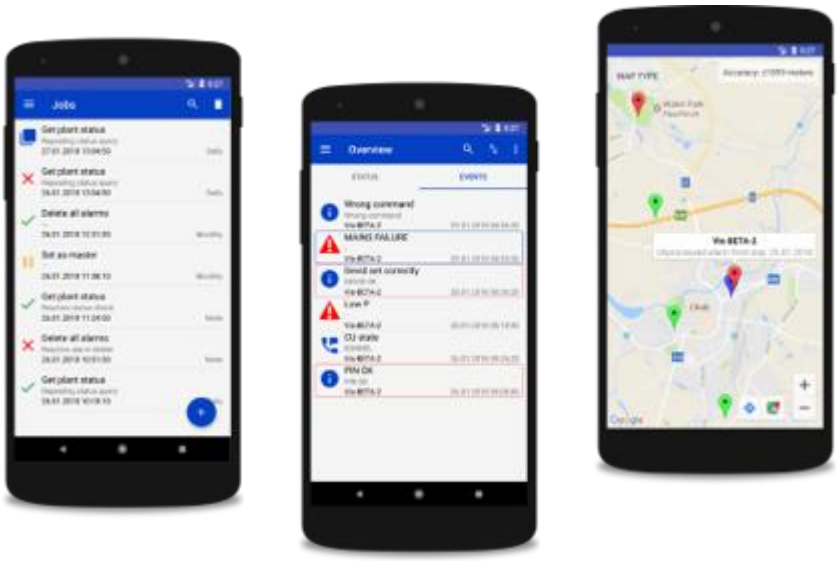
But reporting can also help you to analyze processes and products by means of statistical approaches like SPC.

Automatic service-trip planning & optimization

According to planned service dates, incoming alarm messages, and average times for regular services and troubleshooting, the *Aquavisor®* telemetry system can be extended on request to suggest or to optimize service trips. You can save administrative costs and use the shift time of your servicemen to full potential.

Aquavisor® SMS telemetry App

Android App for smart monitoring, organization, and administration of sewage treatment plants via GSM (SMS).



- ✓ Plant details containing address, contact and coordinates
- ✓ Event history for each plant
- ✓ Map view with plant status
- ✓ Export / backup function
- ✓ Multilanguage user interface
- ✓ Free of charge use with BONNEL control units

Why use the *Aquavisor®* mobile App?

- ➢ Have a transparent overview of the whole event and operating hours history of each plant
- ➢ Receive alarm and event messages in a clear and easy to understand form
- ➢ Separate your private communication clearly from event text messages
- ➢ Send commands and inquire the status of a plant without having to compose complex SMS
- ➢ Organize all serviced or installed plants in one database
- ➢ See the status and location of the plants on the Aquavisor® map and plan your service trip
- ➢ Plan jobs that are automatically performed in the background and synchronize with your device calendar
- ➢ Export all plant and event data - as backup, to transfer data to another mobile or for further processing

Aquavisor® SMS telemetry App details

The *Aquavisor® Telemetry SMS App* was designed to meet the requirements of service companies, that would like to benefit from telemetry, but don't want to invest into telemetry servers, VPN GSM cards and IT.

The *Android* App can be downloaded free of charge on bonnel.cz and instead of a manual we recommend the videos on *YouTube* - search for BONNEL *Aquavisor®*. In-App manuals will help you to become familiar with the App very fast.

In case of interest, the App can be adopted on the particular needs of any other telemetry control units - just ask!

Event overview and query

Servicing a plant, an overview over the history of a plant containing all events, statuses and operating hours is helpful. You can

- filter events
- rename events in a way that suites you
- query the current status of the plant

Plant organization

Enter the address of a plant, its properties contact person and phone number. Call the contact person directly from the App. Organize plants into groups. Add a photo of the installation location, the GPS coordinates to locate the control unit even on larger sites using the map feature. Enter notes describing special properties of the plant to take the right spare parts with you. Like this, you have all relevant data for an efficient service trip in your pocket.

Map feature

The map feature of the *Aquavisor®* App gives you a quick and detailed overview of the status of your plants. Four different states are distinguished by color, a click on the icon provides more details.

Imagine you have serviced a remote plant and would like to check other plants in that region. Just start the map feature, check what's going on nearby and select a plant to start the GPS navigation via *Google Maps*!

Job planning

Plan future jobs / tasks for each plant and store the reminders in the connected calendar of your mobile device. Like this, you won't forget any services, filter changes and similar.

You can also schedule automatic queries of SMS commands for the plants like automatic operating hours queries and logging.

Export and backup function

Having new colleagues who do not know the plants, yet? You can quickly share your data by exporting them and importing them to any other device.

Being aware of data security? Backup your data from your mobile, using the export function and move them into the cloud.

Aquavisor® SMS telemetry PC version

PC software for smart monitoring, organization, and administration of sewage treatment plants via GSM (SMS) – specially designed for the Czech market.

Further details on request.

Knowledge base

Here, some basic information is aggregated, that can be handy when selecting the right technologies for your project.

2G, 3G, 4G, LTE Cat M1 or NB IoT?

Telemetry via 2G/GSM, 3G or 4G? Or NB IoT? What about LTE Cat M1? – A short case study about different cellular technologies.

Often customers are asking which cellular technology they shall use. This question cannot be answered easily, especially because many technologies are currently "under development" and it's hard, to have the right "crystal ball" to look into the feature.

Still, here some hints for selecting the right technology:

2G:

In most European countries, 2G (GSM) is the cellular technology that still offers the best coverage. Moreover, the prices for 2G cellular modules are lower than those of any other technology. As BONNEL's devices are mostly connected to mains, the energy consumption, which is higher than at the new "Low-Power" technologies (LP-WAN) as NB-IoT and LTE Cat M1, is not a problem.

But 2G will not remain available forever. In some countries like Norway, 2G is already switched off by most operators. Switzerland will follow, soon. In other countries like Germany, at least some providers will keep 2G "for some more years". Nobody will tell you, what it means. If you look at the number of devices that are still depending on 2G, it is likely that "for some more years" means something like five to ten years.

2G cellular modules are nicely priced, but the technology behind is simple and mostly outdated. Do not expect the same comfort as at your smartphone ;)

3G:

Well, no. 3G will be switched of in the next one to three years or is already switched off.

Therefore, BONNEL does not offer any 3G (plus 2G) solutions.

4G:

Although 5G is hot in all news, it is expected that 4G will remain available for the next 10-20 years in most regions. Therefore, this technology is surely future proof.

The challenge at 4G is the cellular module price. The speed of 4G is not required or cannot be used due to other hardware limitations for most IoT applications. But still customers must pay about twice the price for the 4/3/2G module compared to a 2G module. At least, the current 4/3/2G modules are much more "intelligent" and offer a look and feel almost like at a normal cell phone. That means network preferences can be set, the APN can be retrieved automatically, and similar nice-to-haves are available.

NB-IoT:

Narrow-Band IoT is a technology based on the 4G network. As the used frequencies are not required for 5G, it is said that NB IoT will be supported even if 4G is turned off one day.

Currently the problem on NB IoT is, that the coverage is available more in theory than in reality. Look at the coverage maps of the providers and you will get the feeling that you can start using it tomorrow. Test it, especially in more European countries, and you will notice that the coverage and easy roaming is rather a marketing claim than the reality. Perhaps it will change in two years...

Moreover, NB-IoT is planned rather for IoT sensors than for IoT devices like BONNEL's control units for decentralized sewage treatment plants. For example, contracts of T-Mobile (German Telekom) are limited to max. 1MB / month.

The cellular module hardware is fine. Modern and energy saving with a fallback option to 2G. They are more expensive than simple 2G, but only by an acceptable amount. The best thing on NB-IoT cellular modules is, that they mostly support LTE Cat M1, as well ;)

LTE Cat M1:

Like NB-IoT, LTE Cat M1 is a technology based on the 4G network. As the used frequencies are not required for 5G, it is said that NB IoT will be supported even if 4G is turned off one day.

The current coverage and roaming issues are quite similar to NB-IoT. Therefore, I copy the paragraph from there: The coverage is available more in theory than in reality. Look at the coverage maps of the providers and you will get the feeling that you can start using it tomorrow. Test it, especially in more European countries, and you will notice that the coverage and easy roaming is rather a marketing claim than the reality. Perhaps it will change in two years...

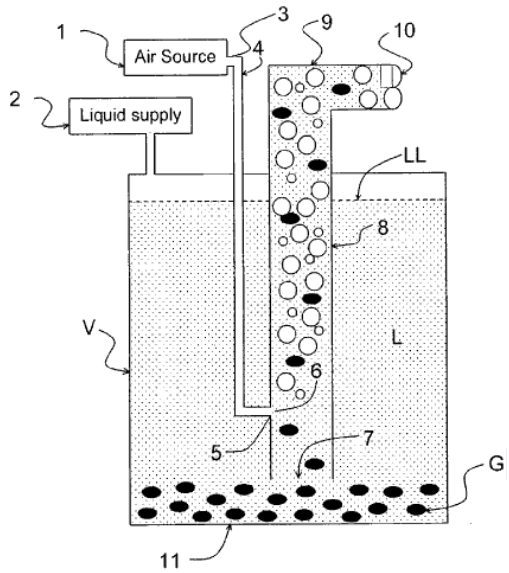
Besides that, LTE Cat M1 can be a great technology for countries, where the coverage is already solved and when roaming is not required respectively where you have a provider that can really solve it. Compared to NB-IoT the transfer rates are much better, even faster than 2G, which is mostly fine for IoT applications. Usual data volumes that are offered by the providers are more than sufficient and the technology is future proof.

As mentioned at NB-IoT, the cellular module price is higher than at 2G, but still acceptable. And there is mostly a fallback to 2G integrated, so if some regions are not covered with LTE Cat M1, you will be able to run on 2G until the network is upgraded.

Conclusion:

BONNEL mostly recommends 2/3/4G modules where the customer asks for a universal and future proof solution. If the price is important and the deployment countries are known and covered, LTE Cat M1 is becoming more and more the right solution.

What is an Airlift Pump?



An Airlift, also called Mammoth Pump, is a pump that is driven by air. It is very cheap to construct an airlift Pump and the Pump is very reliable and it is hard to jam it .

The limitation of an airlift is its low delivery height.

Airlifts are widely used at small, decentralized sewage treatment plants for pumping the sewage, sludge or clearwater from one tank to another or into the drain field.

Process logic – SBR logic or continuous logic?

As mentioned in the previous chapters at the control units for decentralized sewage treatment plants, there are two main logics, how the process can be defined. One is used mainly at SBR[8] plants, the other mainly at continuous plants like MBBR, fixed bed, SAF and similar.

SBR logic

As the process in SBR plants is, as the name says, sequential, the programming must be divided into subsequent steps. for each process step or function, a discrete step is programmed.

Example:

1) Filling: Blower and Valve 1 are ON for 10min. *After that (not parallel)*
2) Aeration: Blower and Valve 2 are intermittently ON for 3.5h. For example 20min ON, 10min OFF for a total time of 3.5h. *After that (not parallel)*
3) Settling: Blower is OFF for 1.5h. *After that (not parallel)*
4) Clearwater Removal: Blower and Valve 3 are ON for 12min. *After that (not parallel)*
5) Sludge Return: Blower and Valve 4 are ON for 1min. *Return to step 1)*

Continuous logic

Here, each output is controlled by its own timer. There is a timer for the blower and there are timers for the valves or pumps. At valves, the valve time must also activate the blower output. Mostly, a synchronization with the RTC[9] is required to save energy during times of low inflow.

Example:

- Blower output: Runs 20min ON / 10min OFF during daytime and 10min ON / 20min OFF during nighttime. Moreover, the output is switched ON when the Sludge Airlift output is ON.
- Sludge Airlift output: Runs 1min ON / 239min OFF during daytime and 1min ON / 179min OFF during nighttime. Moreover, the output switches the blower output ON when it is ON (it does not make sense to open a valve when the blower is not running…).

Possibilities for software creation

As mentioned in the chapter *Control unit Overview and Comparison* (p.6), there are three different tools for the programming of the process, and if necessary menu and web pages.

	Excel sheet	***DataBuilder***	***MenuMaker***
For control unit platforms	*BonBloc® compact* *Sequetrol® compact* *LED & LCD*	*Sequetrol® starter* *Sequetrol® starter plus*	*IoT* platform (*Sequetrol® IoT* & *BonBloc® IoT*)
Creating menu	No, menu is contained in FW of the control unit	The menu scope can be adjusted	The menu can be created according to customer requirements
Creating process	Yes, SBR logic with up to 30 process steps	Yes, continuous logic	Yes, SBR and continuous logic
Creating web pages	-	-	No, web pages must be created by BONNEL
Software can be created by plant manufacturer	Yes (3-24h)	Yes (1-3h)	No, but the software can be modified after the creation at

[8] *Sequential Batch Reactor*, see https://en.wikipedia.org/wiki/Sequencing_batch_reactor
[9] *Real Time Clock*, clock that shows the time, for example 2:45pm

	BONNEL, the plant manufacturer can "play around" and test by himself new processes and similar.

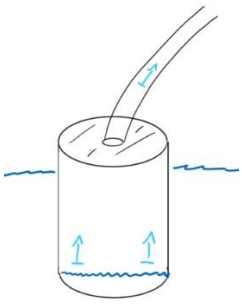
Level measurement by divers' bell [10]

The *PumpGuard* control unit for pump stations is equipped with a pressure sensor which is used for measuring the water level in the pump station via a so-called "divers' bell". The pressure value is proportional to the water level.
A divers' bell, which is nothing more but a turned upside-down "bell" (often a simple PP tube as used for home sewage) is set inside the pump station and mounted / fixed to one of its walls.
Below sample pictures; information on how to build a divers' bell and how to install it can be found in the latter chapters of this document.



On the top of the divers' bell there is a hose which is connected to the *PumpGuard* pressure sensor. The lower side of the tube is open. The pressure inside the divers' bell will equal the pressure in the water around it.

How it works.



The divers' bell is installed inside a pump dwell, slightly above the minimal water level that shall be reached.
When the water level rises, it will only rise around the bell, not inside the bell. But it will compress the air inside the bell a bit and this air pressure is transferred to the pressure sensor of the *PumpGuard*.
The higher the water level rises, the higher the pressure will be. The proportionality is linear.
Like this, the water level in a pump dwell can be measured easily in an analog way – without the need for an (expensive) 4-20mA pressure probe.

Benefits of the analog level measurement:

- **Low price:** A simple plastic tube and a hose replace 1-2 float switches
- **High reliability and robustness:** Far more reliable than float switches
- **Avoid smell from the pump station:** Analog measurement enables the *PumpGuard* to run the pump even though the ON-level was not reached, yet. The *PumpGuard* knows that

[10] Convenient analog level measurement in pump stations

there is water in the pump dwell and can pump it out down to the OFF level[11]. Thus, the pump can be run for example once a day to empty the pump dwell to avoid smells.

- **Easy installation and effortless maintenance:** Changing level settings can be done simply by changing the values on the *PumpGuard* – no climbing into the dwell…

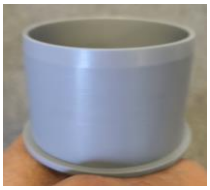
How to build divers' bell

There are different ways how to build a divers' bell. Here, a convenient way using sewage tubes that are mostly available in DIY stores / building supply stores, is described.

You will need:

- 50mm or 75mm diameter tube, approx. 150mm high

- Lid for the tube – you will have to drill a hole for the bulkhead fitting into it – see below.



- Hose for the connection between the divers' bell and the *PumpGuard* with inner diameter 6mm outer diameter approx. 8mm; length equals distance between the ground of the pump station and the *PumpGuard*.

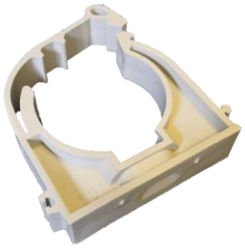
[11] With a float switch the *PumpGuard* would not know if there is 0cm, 1cm or any level below the ON level in the pump dwell.

The hose should not buckle easily, as the system only works if the hose does not buckle in the bends (the buckles must not be airtight).

- A suitable bulkhead fitting (try to search pictures in *Google* – there are a lot of them on the market).

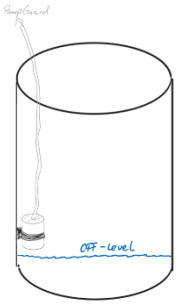
One side:  The other side: 

- Something to fix the divers' bell to the wall of the pump dwell. Please mind either to glue the tube to the wall holder or to make some rubber between the holder / clamp and the tube to avoid that the tube slips out upwards when the water level rises.



How to install divers' bell

The divers' bell must be mounted inside the pump dwell.



The installation height is crucial. It must be installed in a way, that the lower end of the tube is located some 1-3cm above the desired minimal level in the dwell.
The reason why the divers' bell must be installed above the minimal level is, that fresh air must be able to enter the bell[12].
The process than works like this:

- Off-level (pressure) set at the *PumpGuard* to for example to 4mbar; divers' bell installed 3cm above desired minimal water level in the tank
- When the OFF-level pressure of 3mbar is reached, a so-called "overtravel duration" timer is started. It makes the pump to continue to run for the preset overtravel duration, for example 30s.
- This additional 30s of pumping after reaching the OFF-level pressure leads to a decrease of the water level below the divers' bell.

One side of the hose is connected to the divers' bell, the other one to the bulkhead fitting of the *PumpGuard*:

- Put the hose over the coupling.

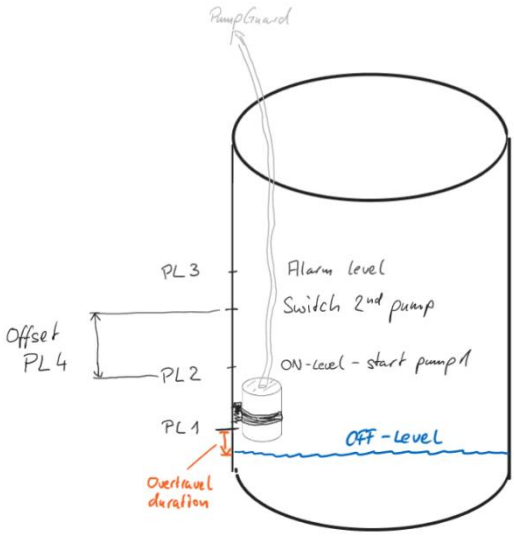
[12] Else the air from the bell would slowly dissolve in the water and the measurement would not work anymore.

- Secure with nut.

How to enter the settings for the divers' bell at the *PumpGuard*

The following settings must be entered:

- Pressure value for OFF-Level: Parameter *PL1* in the settings, typically about 1-4mbar
  Please also see chapter *How to install divers' bell*, above.
- Pressure value for ON-Level (start level for pump 1): Parameter *PL2* in the settings
- Pressure value for Alarm-Level: Parameter *PL3* in the settings
- Offset from ON-Level for switching second pump (at dual pump installations) = pressure / level (cm) difference between *ON-level first pump* and *ON-level second pump*.
- Overtravel duration *Ot*, which should be long enough to bring the bell out of the water after reaching the pressure value of the OFF-level *PL1*



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