ClearFox® Control Unit CU-M

Quick Start Guide

Types of plants included:

1. Air-SBR
2. Pump-SBR
3. One-tank SBR
4. Continuous plants

1   TABLE OF CONTENTS

2   MOST IMPORTANT INFORMATION

2.1   SWITCHING THE DEVICE OFF
The ClearFox®Control Unit CU-M must not be switched off by disconnecting mains and batteries. As it works with an operating system and Flash memory, it must be shut down properly.

Shutting down must be done by pressing the OK button for > 10s. On the LCD a message will appear. Now the mains connection can be disconnected. That's it.

2.2   FIRST START
Please mind, that after the first start the plant type must be selected, as the demo software contains different plant types.

The ClearFox®Control Unit CU-M will restart then, which will take some 2-3min.

2.3   LOGIN SERVICE MENU
The Service PIN is 1964.

2.4   CONNECTING VIA WI-FI / INTERNAL WEBPAGES
- SSID: WWTP-Controller
- Wi-Fi password: 12345678
- IP address (must be entered into the browser address line
- e.g.: www.google.com): http://192.168.117.1/
  - o   Username for service login: service
  - o   Password: 1964 (same as service menu PIN)

3   INTRODUCTION

The *ClearFox®Control Unit CU-M* platform is a powerful, free programmable control unit for decentralized STP.

The *IoT* platform is equipped with a Wi-Fi module (access point (AP) and station mode (ST), even parallel) and an integrated webserver. Thus, the *Sequetrol® IoT* can be either operated via the LCD + menu or via any web browser (smartphone, tablet, PC). An internet connection is not required. The Wi-Fi of the control unit creates a local hotspot (in access point mode).

More information about the IoT platform can be found on our webpages.

4   SWITCHING THE DEVICE OFF

The *ClearFox®Control Unit CU-M* must not be switched off by disconnecting mains and batteries. As it works with an operating system and Flash memory, it must be shut down properly.

Shutting down must be done by pressing the OK button for > 10s. On the LCD a message will appear. Now the mains connection can be disconnected. That's it.

5 WARNINGS / OPENING OF THE CASING

To gain access to the screw-type terminals, the service compartment of the casing must be opened by unscrewing the two cross slot screws marked with the red circles in *Figure 1*.
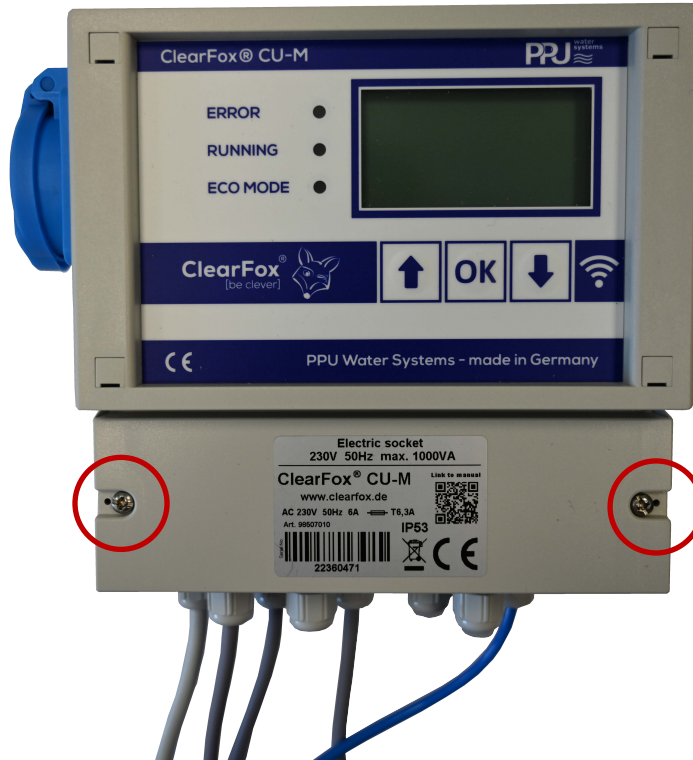

Figure 1: Opening the casing of the Sequetrol® IoT midi

This kind of operation <u>may only be carried out by trained staff</u>, since there are live <u>components carrying 230V</u> mains voltage under the cover (at the underside of the printed circuit board and close to the mains supply connectors and the fuse, mains voltage 230 V.)

Before removing the casing cover, it is necessary to pull the mains supply connector!

6 CONNECTING THE CONSUMERS (BLOWER, HOSES, BEACON)

6.1 AIR-SBR

- **Blower**: Connected to the electric socket of the *ClearFox®Control Unit CU-M.*
- **Valves**:
    - o Filling: Out 2
    - o Clearwater removal / Discharge: Out 3 – either valve or submersible pump (can be selected via the web pages)
    - o Sludge return: Out 4
    - o Aeration / Denitrification: Out 5
- ***BonFlash* alarm beacon** is connected to the terminals marked with *BF-C* (brown cable) and *GND* (white cable), (see chapter 5).

-   **Overfill Float Switch: Optional.** Connected to the digital input terminal *DI1* inside the controller (see chapter 5).

6.2   PUMP-SBR

Output functions can be selected via web pages.

-   **Blower (+Valve) / Injection Aerator**: Connected to the electric socket of the *ClearFox®Control Unit CU-M* (+Out 5) / electric socket*.*
-   **Pumps / Valves**:
    -   Filling: Direct submersible pump - Out 2; using the Sludge Pump – Sludge Pump –Out 4
    -   Clearwater removal: Pump Out 3 / Valve Out 3 (+Blower)
    -   Sludge return: Pump Out 4 / Valve Out 4 (+Blower)
-   *BonFlash* **alarm beacon** is connected to the terminals marked with *BF-C* (brown cable) and *GND* (white cable), (see chapter 5).
-   **Overfill Float Switch: Optional.** Connected to the digital input terminal *DI1* inside the *Sequetrol® IoT* (see chapter 5).

6.3   ONE-TANK SBR

Output functions can be selected via web pages.

-   **Blower (+Valve) / Injection Aerator**: Connected to the electric socket of the *ClearFox®Control Unit CU-M* (+Out 5) / electric socket*.*
-   **Sludge return**: Pump Out 3 / Valve Out 3 (+Blower)
-   *BonFlash* **alarm beacon** is connected to the terminals marked with *BF-C* (brown cable) and *GND* (white cable), (see chapter 5).
-   **Overfill Float Switch: Optional.** Connected to the digital input terminal *DI1* inside the *ClearFox®Control Unit CU-M* (see chapter 5).

6.4   CONTINUOUS PLANTS (MBBR, FIXED-BED, …)

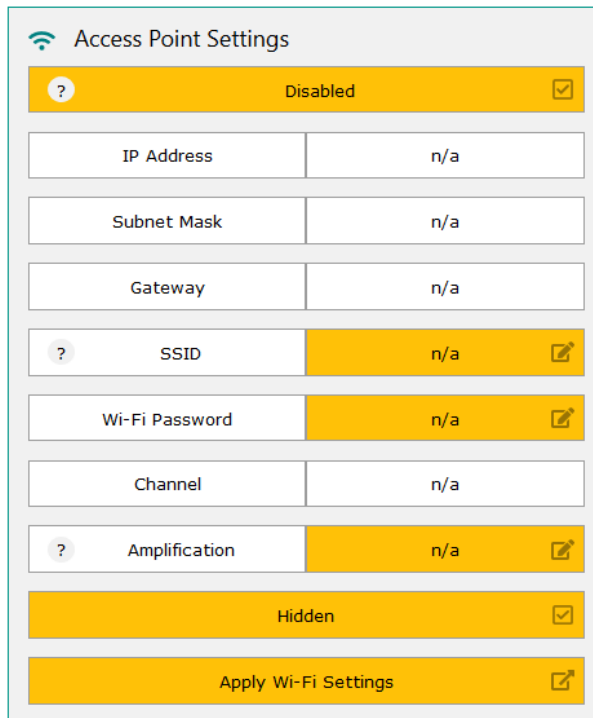Output functions can be selected via web pages.

-   **Blower (+Valve)**: Connected to the electric socket of the *ClearFox®Control Unit CU-M* (+Out 5)
-   **Pumps / Valves**:
    -   Filling: Submersible pump - Out 2 / Airlift – Out 2 (+Blower)
    -   Clearwater removal: Pump Out 3 / Valve Out 3 (+Blower)
    -   Sludge return: Pump Out 4 / Valve Out 4 (+Blower)
-   *BonFlash* **alarm beacon** is connected to the terminals marked with *BF-C* (brown cable) and *GND* (white cable), (see chapter 5).
-   **Overfill Float Switch: Optional.** Connected to the digital input terminal *DI1* inside the *ClearFox®Control Unit CU-M* (see chapter 5).

7 CONNECTING TO WI-FI

The ClearFox®Control Unit CU-M can be operated and monitored via Wi-Fi. All settings can be done comfortably in your browser (smartphone, tablet, PC).

- SSID: WWTP-Controller
- Wi-Fi password: 12345678
- IP address (must be entered into the browser address line
- e.g.: www.google.com): http://192.168.117.1/
  o Username: service
  o Password: 1964 (same as service menu PIN)

In case these parameters shall be changed, please refer to the *Network Settings* page:

Figure 2: Wi-Fi - Access Point settings (example)

Please do not forget to push *Apply Wi-Fi Settings* (control unit restarts).

The *ClearFox®Control Unit CU-M* can run Wi-Fi in Access-Point (AP) and in Station Mode (ST)
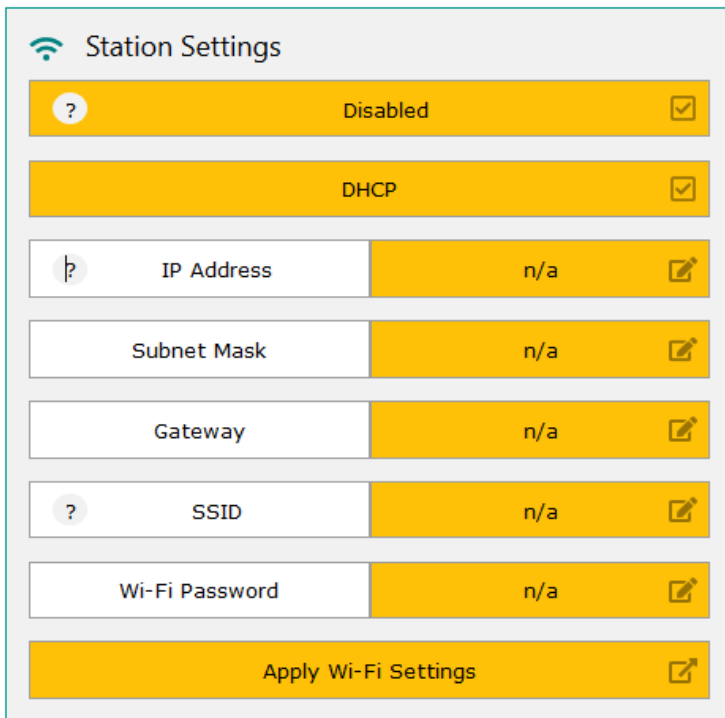
- AP: Wi-Fi hotspot without internet connection (intranet only)"
- ST: Connection to another Wi-Fi hotspot or router (e.g. your company Wi-Fi), often used to connect the *Sequetrol® IoT* to the public internet (e.g. for telemetry)

7.1 CONNECTING THE CONTROL UNIT TO THE INTERNET VIA WI-FI (ST MODE)

The control unit can be run simultaneously in *Access Point* (AP) and *Station* (ST) mode.

- *Access Point* mode means, the control unit behaves as a "Wi-Fi hotspot". You can connect with any device and view the internal webpages.
- *Station mode* means, the control unit connects to another Wi-Fi network (mostly with internet access).

The necessary setting can be set performed on the *Network Settings* page:

Figure 3: Wi-Fi - Station Mode settings (example)

If DHCP is activated (recommended), only the SSID and the Wi-Fi Password must be entered.

Please do not forget to push *Apply Wi-Fi Settings* (control unit restarts).

8 ALARM HANDLING

The *ClearFox®Control Unit CU-M* monitors different alarm states like blower pressure and overfill alarm.

All alarms can be acknowledged by pressing <OK> short. Acknowledging the alarm deactivates the Buzzer and the *BonFlash* output. The red LED remains on, and the last alarm remains in the Status Screen, until the reason for the alarm is gone (e.g. float switch is down again) or until the alarm is deleted.

The alarm will be deleted automatically when the alarm reason disappears. It can also be deleted by pressing <OK> for 1-2s or via the web pages. Please mind that if the alarm reason is still active, the alarm will reappear.

9 PROCESS OVERVIEWS

Please note that these are demo / sample programs. They can either be completely replaced by your process, menu, and web pages. Or we can adopt these programs to your requirements and preferences.

9.1 AIR-SBR

9.1.1 Process steps

- Normal mode

- o Level measurement via Filling. If below switching level 1 => eco
- o Filling
- o Level measurement via Filling. If above switching level 2 => overfill alarm
- o Denitrification (can be deactivated by setting step time to 0s)
- o Aeration
- o Sludge (before Settling, option, can be deactivated by setting step time to 0s) – sludge return will not take place within the first 90 days after bringing into service. This value can be changed, the parameter is called *Biology Build-Up Time*.
- o Settling
- o Sludge (after Settling, option, can be deactivated by setting step time to 0s) – sludge return will not take place within the first 90 days after bringing into service. This value can be changed, the parameter is called *Biology Build-Up Time*.
- o Clearwater removal
- o Option: Check DI1, if closed => overfill alarm (if no float switch is connected, there will not be an alarm)
- Eco mode
  - o Aeration
  - o Level measurement via Filling. If above switching level 1 => normal
  - o Each 6 eco cycles (frequency can be changed) => At least one normal mode

9.1.2 Water level measurement

Water level measurement at this process is performed using the filling airlift in the pretreatment tank.

If the level <u>before filling</u> is higher than the calibrated value plus Offset 1, filling will be performed, and the control unit will follow the normal mode program. If the level is lower, filling will not be performed, and the program follows the eco mode process.

If the level <u>after filling</u> is higher than the calibrated value plus Offset 2, this means, filling could not be performed. Likely the problem was that the reactor is (still) full because clearwater removal did not work and thus the water pumped from the pretreatment to the reactor during filling simply flowed back. An overfill alarm will be signalized in this case.
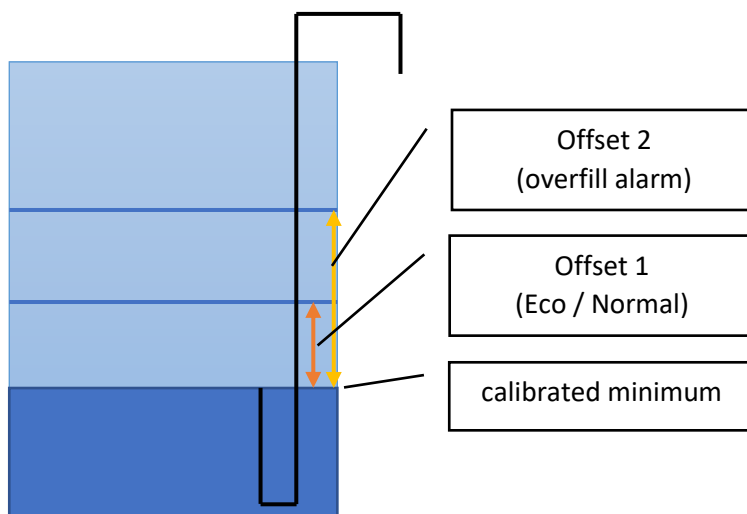
Figure 4: Pretreatment tank with filling airlift and calibrated minimum, Offset 1 and 2

To be able to run the water level measurement, the "calibrated minimum" must be calibrated (takes place automatically **14-days after bringing into operation**, see chapter 9.1.2.1).

9.1.2.1   Automatic calibration

If *ClearFox®Control Unit CU-M* is simply installed to a plant, **the automatic calibration will be performed after 14 days**. This delay shall ensure, that the pretreatment tank is filled at least to the minimal level of the filling airlift and the reactor is filled at least to the minimal level for the sludge return airlift.

After these 14 days, this process will be performed:

1) Clearwater removal
2) Filling with longer filling time to make sure that the level in the pretreatment is pumped down to the minimum that can be reached using the filling airlift. The filling airlift now "slurps" (does not pump properly, anymore, as it cannot suck anymore water).
3) "Sludge return" for some 60s to increase the level in the pretreatment so that the filling airlift can pump properly, again.
4) Filling for 20s – the pressure at this minimal water level will now be stored as "calibrated minimum".

Now the *ClearFox®Control Unit CU-M* is able to measure the water level in the plant.

9.1.2.2   Manual calibration

In case the automatic calibration shall not be used for any reason, for example because the level measurement shall be tested "instantly" (not after 14 days), the calibration can also be performed manually. **The manually entered values will not be overwritten by automatic calibration.**

To do so, the user must empty the water level in the pretreatment until there is only some 0.5-1cm of water above the inlet of the filling airlift (the airlift must still be able to pump properly, no slurping or sucking air). Now the filling airlift is activated in the manual control menu or web page. The displayed pressure must now be noted. This pressure can now be entered in the "Minimum" text field:

Figure 5: Parameters for water level measurement in the web pages of the IoT control unit (example)

9.1.2.3 Changing the levels for Normal- / Eco-Mode and Overfill Alarm

The offsets can be changed in the web pages (*Pressure measurement /* Calibration, see Figure 5) or in the *Service Menu / Pressure*.

9.2 PUMP-SBR

9.2.1 Process steps

- Normal mode
    - o Filling
        - ▪ Via dedicated pump: ON (15min) or until DI1=closed. On timeout (step time over, DI1=open) => Eco
        - ▪ Via Sludge Pump: ON (10s)+OFF (14:50min) or until DI1=closed. On timeout (step time over, DI1=open) => Eco
    - o Denitrification (0:40min ON / 9:20min OFF / 60min Total)
    - o Aeration (8min ON / 12min OFF / 9.5h Total)
    - o Sludge (before Settling) (2min)
    - o Settling (1.5h)
    - o Sludge (after Settling) (0min)
    - o Clearwater removal (20min)
    - o Check DI1, if closed => overfill alarm. Else, continue
- Eco mode
    - o Aeration (2min ON / 8min OFF / 8:45h Total)
    - o Filling (only ON (15min) at "Pump", ON (10s)+OFF (14:50min) at "via Sludge Pump"). If DI1=closed => Normal, on timeout (step time over, DI1=open) => continue Eco
    - o Each 6 cycles => Normal mode

9.2.2 Selectable output assignment
FUNCTION/
SELECTABLE

OPTION AND CONSEQUENCE

FILLING	**Pump** Out 2 Current limits for pump (300/1800mA) applied	**Via sludge pump** (Out 4) Current limits for pump (300/1800mA) applied Instead of pumping only 10s + pause (adjustable)
AERATION	**Blower (+ valve)** Out 1 (+ 5) Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	**Injection aerator** Out 1 Current limits for aerator (300/2500mA) applied
SLUDGE	**Blower + valve** Out 1 + 4 Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	**Via sludge pump** (Out 4) Current limits (300/1800mA) for pump applied
CLEARWATER	**Blower + valve** Out 1 + 3 Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	**Pump** Out 3 Current limits (300/1800mA) for pump applied

9.3 ONE-TANK SBR

9.3.1 Process steps

For the level measurement (overfill alarm) a manual calibration must be performed. In case this calibration was not performed (yet), there will be no overfill alarm.

RTC sync for beginning of settling phase can be set (mostly around 3am).
Number of cycles per day can be set (1-4).

Holiday period (number of days can be entered that is counted down) can be entered, where the controller uses different ON/OFF times for the aeration.

Cycle 1 of the day (also for bringing into operation) has a different Aeration step.

Aeration

- first cycle of the day: Infinite **until RTC sync time reached**
- next cycles of the day: Infinite **until total Aeration Total Time (calculated out of cycles per day and the remaining step times) reached**

Aeration 1 (6min ON / 14min OFF) – via valve on Out 5 – primary aeration of the reactor

after one ON/OFF cycle jump to

Aeration 2 (4min ON / 6min OFF) – via valve on Out 4 – optional aeration of another part of the reactor or the sludge tank.

after one ON/OFF cycle jump to Aeration 1

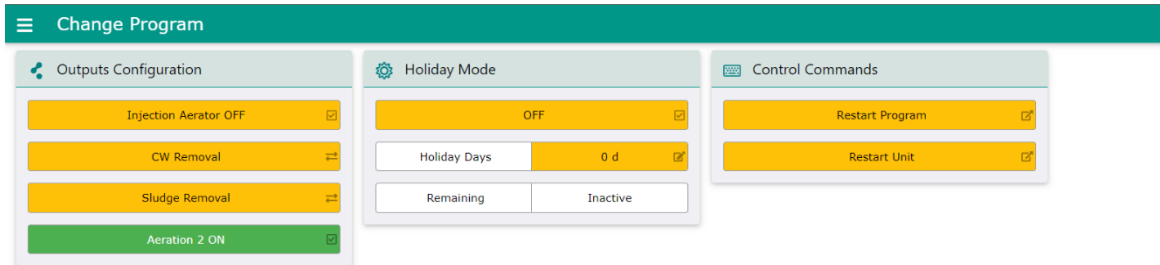**If Aeration 2 shall not be used, it can be deactivated via the web pages:**

Figure 6: One-Tank SBR program individualization via internal web pages (example)

Sludge return

Time taken from the settling time – example: Settling = 2h, sludge = 2min => settling will be 1:58h in reality and sludge 2min – sludge return <u>before settling</u> can be deactivate via a parameter via the Patch file (please ask PPU in case you want to deactivate it). All sludge returns have the same step times.

Max. step duration that can be entered is 30min., default step duration is 0min (!)

Settling (1.5h)

OPTIONAL Sludge return

This sludge return can be activated via a parameter via the Patch file (please ask PPU in case you want to activate it)

Time taken from the settling time – example: Settling = 2h, sludge = 2min => settling will be 1:58h in reality and sludge 2min – sludge return <u>after settling</u> can be deactivate via a parameter via the Patch file. All sludge returns have the same step times.

Max. step duration that can be entered is 30min., default step duration is 0min (!)

Clearwater removal

Max. step duration that can be entered is 1h., default duration is 15min

OPTIONAL Sludge return

This sludge return can be activated via a parameter via the Patch file (please ask PPU in case you want to activate it)

Time taken from the settling time – example: Settling = 2h, sludge = 2min => settling will be 1:58h in reality and sludge 2min – sludge return <u>after clearwater</u> can be deactivate via a parameter via the Patch file. All sludge returns have the same step times.

Max. step duration that can be entered is 30min., default step duration is 0min (!)

Water level measurement

Via CW (only if calibrated!) – must be below "calibrated value + offset". Else overfill alarm.

In parallel via digital input 1 – if up after CW-Rem. => overfill alarm.

9.3.2 Selectable output assignment

FUNCTION/
SELECTABLE OPTION
AND CONSEQUENCE

AERATION	**Blower (+ valve)** Out 1 (+ 5) Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	**Injection aerator** Out 1 Current limits for aerator (300/2500mA) applied Offset and calibrated value for overfill = 0mbar
AERATION 2 (OPTION)	**Blower (+ valve)** Out 1 (+ 4) Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	**NO**
SLUDGE	**Blower + valve** Out 1 + 3 Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	**Via sludge pump** (Out 3) Current limits for pump (300/1800mA) applied
CLEARWATER	**Blower + valve** Out 1 + 2 Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	**Pump** Out 2 Current limits for pump (300/1800mA) applied

9.4 CONTINUOUS PLANTS (MBBR, FIXED BED, …)

9.4.1 Process steps

RTC sync for day/night mode. Beginning and end of the night period can be changed. During night other ON/OFF times can be applied for the particular outputs than during the day.

Holiday period (number of days can be entered that is counted down) can be entered, where the controller uses different ON/OFF times for the particular outputs.

For functions (Filling, Aeration, Sludge, Clearwater) the ON/OFF times for day, night and holiday operation can be set. If ON time = 0s, the output is deactivated. If OFF time = 0s, the output is permanently on.

Overfill alarm via digital input 1 (e.g., float switch).

9.4.2 Selectable output assignment

FUNCTION/ SELECTABLE OPTION AND CONSEQUENCE		
FILLING (ON DAY/OFF DAY // ON NIGHT/OFF NIGHT // ON HOLIDAY / OFF HOLIDAY)	**Pump** Out 2 Current limits for pump (300/1800mA) applied	**Airlift** Out 1 + 2 Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied
AERATION (ON DAY/OFF DAY // ON NIGHT/OFF NIGHT // ON HOLIDAY / OFF HOLIDAY)	**Blower (+ valve)** Out 1 (+ 5) Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	-
SLUDGE (ON DAY/OFF DAY // ON NIGHT/OFF NIGHT // ON HOLIDAY / OFF HOLIDAY)	**Blower + valve** Out 1 + 4 Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	**Via sludge pump** (Out 4) Current limits for pump (300/1800mA) applied
CLEARWATER (ON DAY/OFF DAY // ON NIGHT/OFF NIGHT // ON HOLIDAY / OFF HOLIDAY)	**Blower + valve** Out 1 + 3 Current limits for Blower (250/900mA)+ valve (50/150mA) applied Generic pressure limits (7/350mbar) for Blower applied	**Pump** Out 3 Current limits for pump (300/1800mA) applied

10 MENU

PPU used its "standard menu" for the sample.

PPU assumes, that the menu is mostly self-explaining. For questions, please do not hesitate to contact us via info@clearfox.com.

11 INTERNAL WEBPAGES

PPU used its "standard webpages" for the sample.

PPU assumes, that the webpages are mostly self-explaining. For questions, please do not hesitate to contact us via info@clearfox.com.

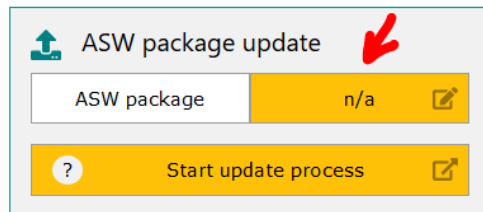# 12 TRANSFERRING THE ASW / FW / WEB-PAGES

The ASW, FW and the web pages can be transferred by USB or Wi-Fi.

14

12.1 TRANSFER VIA WI-FI

Please mind that the batteries must be connected.

Please

- connect to the Wi-fi of the *Sequetrol® IoT*
- open the webpage http://192.168.117.1/
- login as serviceman
- go to *FW & ASW Update*
- select the *.pkg (Pack) file that you have received from PPU here (example):

- click on *Start update process*
- done!

12.2 TRANSFER VIA USB

Please mind that the batteries must be connected.

Please record the *.pkg* (Pack) file into the root folder of a common USB stick formatted with FAT16 or FAT32 (NOT NTFS).

a. Shut-off the control unit (see chapter 0)
b. insert the USB stick
c. connect the control unit to mains and to have the batteries connected.
d. Follow the instructions on the LCD

Some (cheap) USB sticks might not be recognized. In that case please use a brand stick.