

User Manual

Version February 22, 2015

Laboratory Mortar Mixer (Testing)

1 Introduction

The Laboratory Mortar Mixer is a combination of mixing and measuring tool to assess the behavior of cementitious mortar during the mixing process. The software supports normal mixing and water dosing according to EN-Standards, but gives also the possibility to assess the exact water demand of the mortar to reach a specific flow characteristic or workability (comparable to viscosity). These mixers are typically used in cement / concrete laboratories of cement / concrete manufacturing plants.



1.1 Safety

Consult the following documents:
(Included in delivery)

- Testing Mixer Manual
- Grundfos Pump Manual

1.2 Special Feature: Consistency based water demand (CBWD)

The Laboratory Mortar Mixer is equipped with a torque sensor, a control unit and a water dosing system.

A specific amount of standardized sand and cement are put into the bowl.

After some time of dry mixing, a precise amount of water is added, which increases the force for mixing significantly.

The mixing force is constantly measured by the torque sensor.

More water is added to the mortar and the torque starts to decrease.

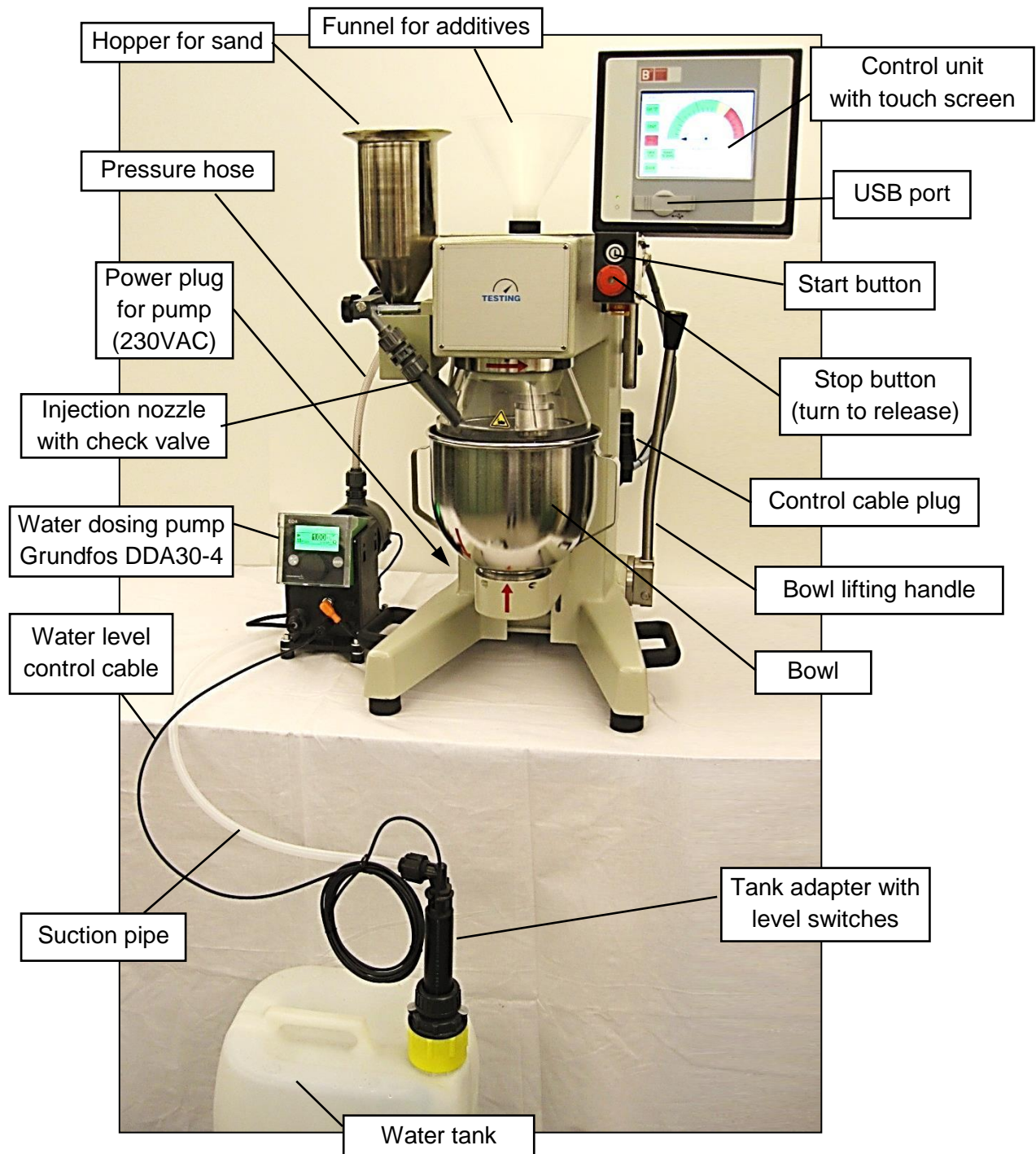
The so called **Water Demand**, which is the main result of this measurement, is the total amount of water, which has to be added until the torque comes down to the specified torque value.

Table of content

- 1 Introduction 1
 - 1.1 Safety..... 1
 - 1.2 Special Feature: Consistency based water demand (CBWD)..... 1
 - 1.3 Main Components 3
- 2 Assembling / Installation..... 4
- 3 Sand Specification..... 5
- 4 Control Unit 6
 - 4.0 Home Window..... 6
 - 4.1 Manual Mode Window..... 6
 - 4.2 Consistency Based Water Demand (CBWD) Window 7
 - 4.3 Program 1 EN 196-Part 1 and EN 413-Part 2..... 8
 - 4.4 Program 2 EN 480-Part 1 8
 - 4.5 Program 3 EN 196-Part 3 and EN 459-Part 2..... 9
 - 4.6 Program 4 EN 196-Part 9.....10
 - 4.7 Setup Windows10
- 5 Calibration of Mixer for CBWD Measurement12
 - 5.1 Adjust the gap between the paddle and the bow12
 - 5.2 Fine Tune the Reference Value.....13
- 6 Calibration of Water Dosing Unit14
 - 6.1 Deaeration, Get the air out of the system14
 - 6.2 Pump settings (DDA30-4)14
 - 6.3 Pump Calibration.....15
 - 6.4 200ml Test on Mixer.....15
- 7 Spare Parts16

1.3 Main Components

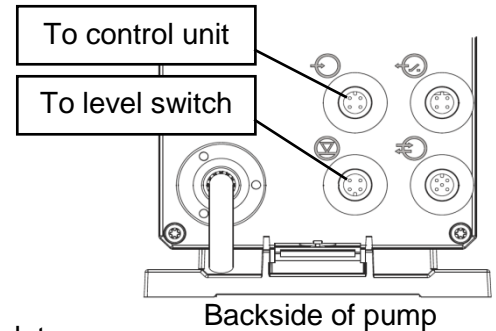
The following picture shows the typical arrangement of the mixer with the water dosing unit.



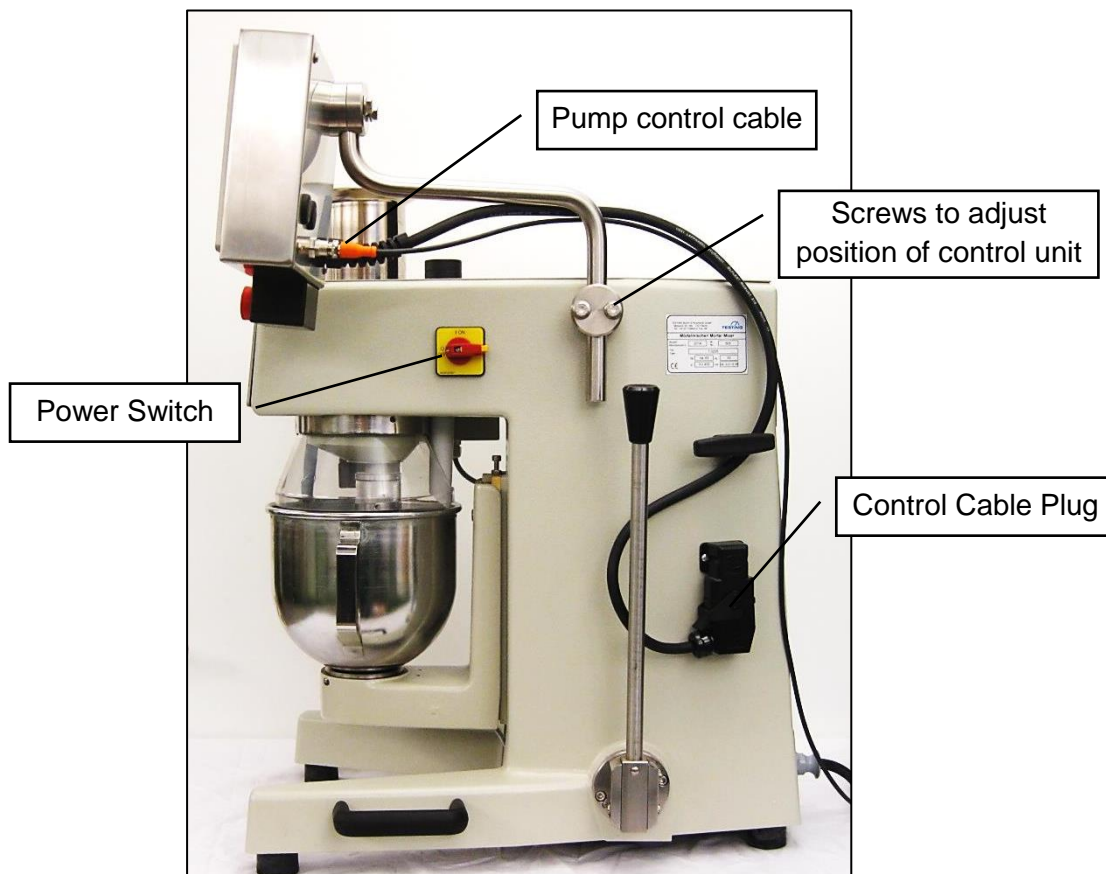
2 Assembling / Installation

Assemble and install the mixer unit as shown in the picture above.

- Place the mixer on a firm table.
- The control unit is delivered separately and has to be fixed on the adjustable arm on the mixer (Use spanner 13mm for the hexagonal bolts)
- Connect the control cable to the socket at the side of the mixer body
- *Place the dosing pump near the mixer (see mounting options in the pump manual)
- *Connect the dosing pump with the control unit (see sketch, where to connect the cable)
- *Place the water tank near the pump (preferable under the table)
- *Fill distilled (or comparable) water into the tank
- *Insert the tank adapter into the tank
- *Connect the cable of the level switch to the pump
- *Connect the suction pipe to tank adapter and pump inlet
- *Connect the pressure hose to pump outlet and nozzle (pay attention to the flow direction of check valve, indicated by arrow)
- *Plug pump to the mixer (230VAC socket at the left side of the mixer body)
- Plug mixer (3x400VAC+N+PE, CEE-16A-plug)



** For Mixer in combination with pump unit*



3 Sand Specification

The mixer is designed to be used in the combination with the following sand.

CEN Natural Standard Sand DIN EN196-1

(conforms to ISO 679)

Bag content: **1350g ±5g**

Origin: Beckum, Germany



Sand with smaller grain size can also be used, but the mixing procedure might need to be adjusted.

! Attention !

Sand with bigger grain size can seriously damage the mixer!

Big particles get caught between the paddle and the bowl. It results in torque peaks, which can damage the gears.

Special designed paddle and bowl combinations are available.

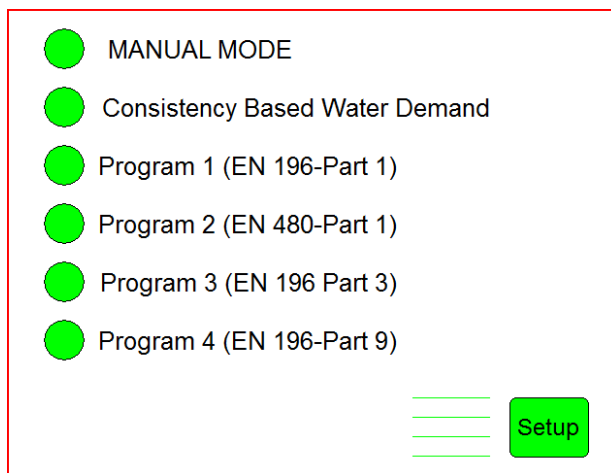
4 Control Unit

The Control unit consists mainly of a PLC (programmable logic controller) with a touch screen. The program in the PLC has the following main functions:

- Controlling the mixer
- Guiding the user through the process of making mortar samples
- Controlling the water dosing pump (optional)
- Measure the resistance / flowability of the mortar sample

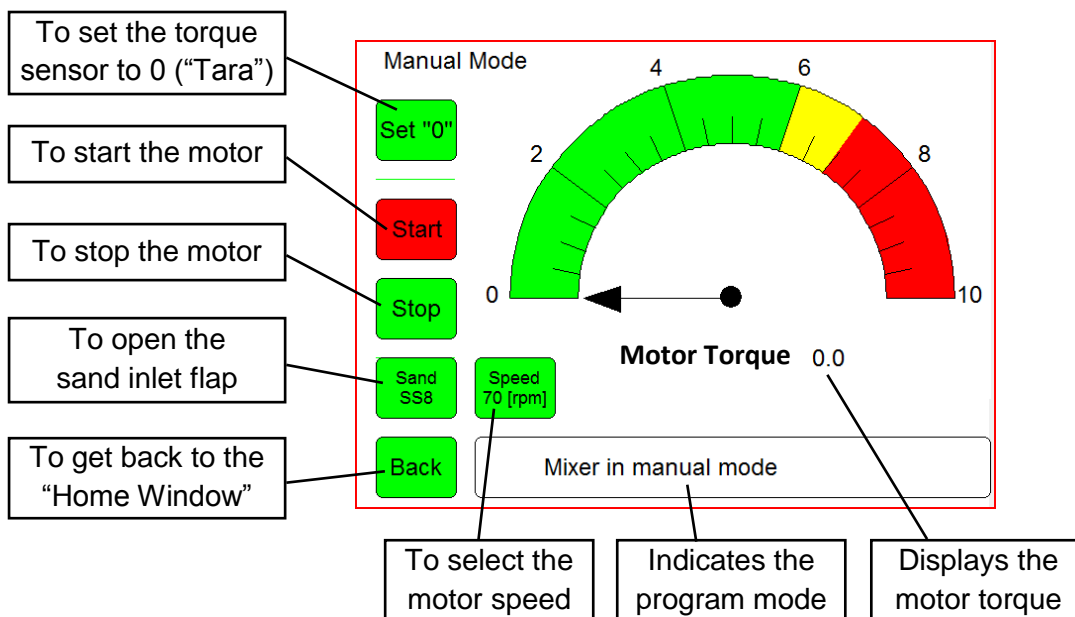
4.0 Home Window

When the mixer starts, the **Home Window** will be displayed, where all the different working programs or the setup can be reached.



4.1 Manual Mode Window

In the manual mode, all functions of the mixer can be activated manually.



4.2 Consistency Based Water Demand (CBWD) Window

The CBWD mode is used to measure the required amount of water to reach a specific flow characteristic or workability (comparable to viscosity). Based on the motor torque value, the dosing pump is adding water until the torque set point is reached.

The sequences are the following:

To get here:

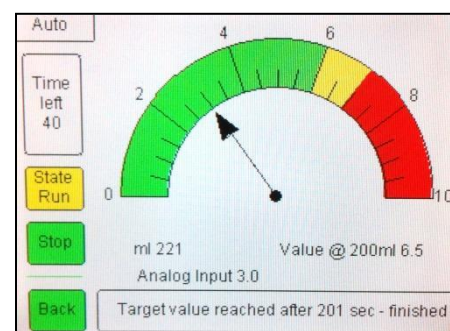
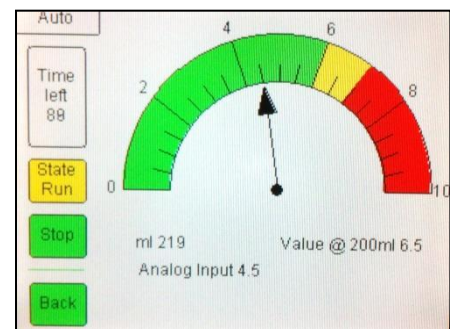
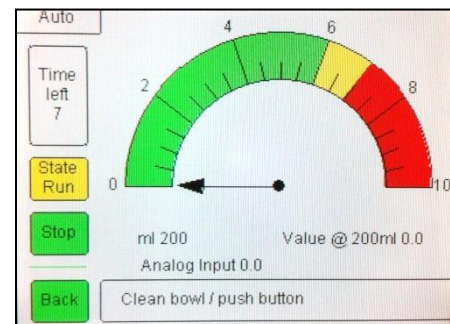
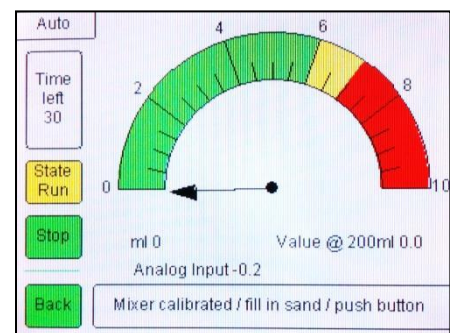
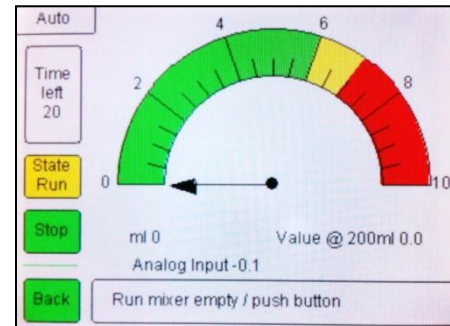
→ Click on “Consistency Based Water Demand”

→ Click on “Start”

→ Push Start button

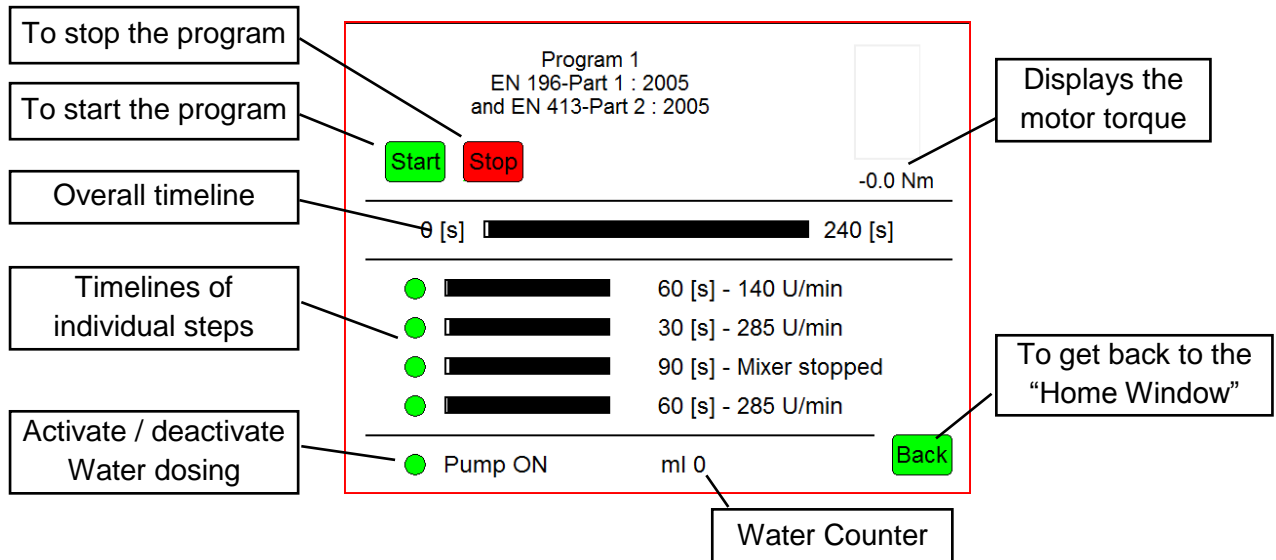
Note: Pump must be in “RUN” Mode (Start/Stop key)

1. 20 sec
Mixer runs with empty bowl to set the torque sensor to “0”
2. Fill 1 bag (1350g) of standard sand together with cement into the bowl
3. 30 sec
Dry mixing of sand and cement
4. 60 sec
Dosing Pump is adding 200ml water
5. 20 sec
Clean the bowl
(bring material from the walls back down)
6. Press “Start” button to re-start the motor
7. 180 sec
Mixing while water is constantly added until the torque comes down to the pre-set target value
→ Result: Water Demand [ml]



4.3 Program 1 EN 196-Part 1 and EN 413-Part 2

This program is mixing mortar according to European Norm (EN). For details, please consult the respective EN description.

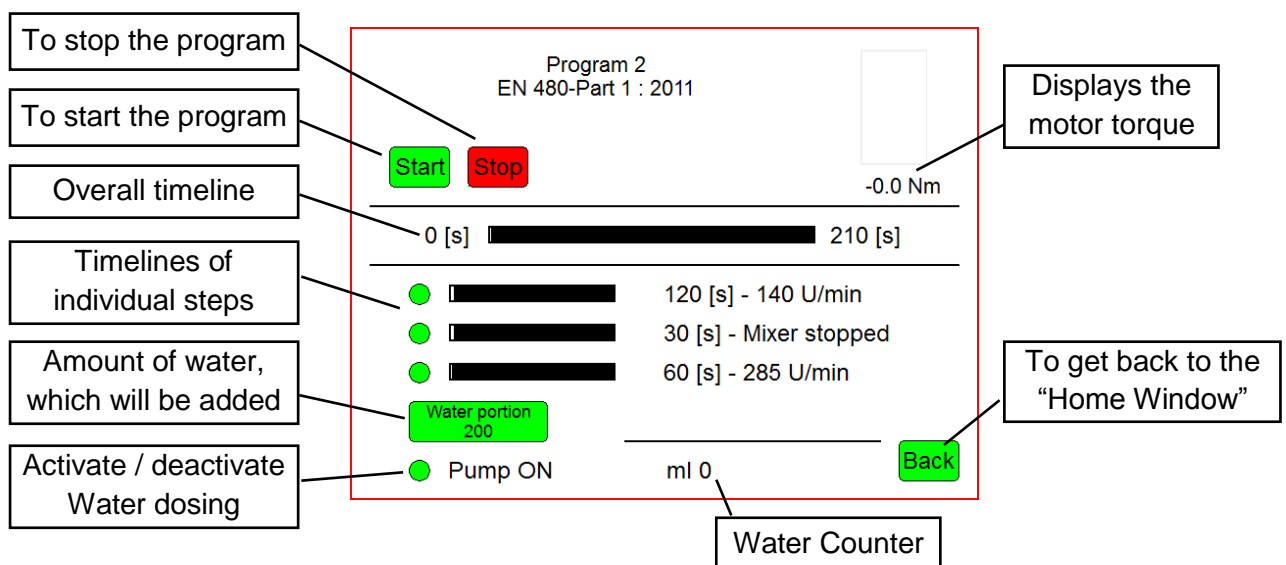


Note:

The 90 sec. mixer stop is foreseen to clean possible sticking mortar pieces from the side walls of the bowl and bring them back to the area where the mortar is mixed. Losses of mortar have to be avoided, as they will impact the accuracy of the mixing process. When the stop sequence is elapsing, please press the **"Start"** button to re-start the motor.

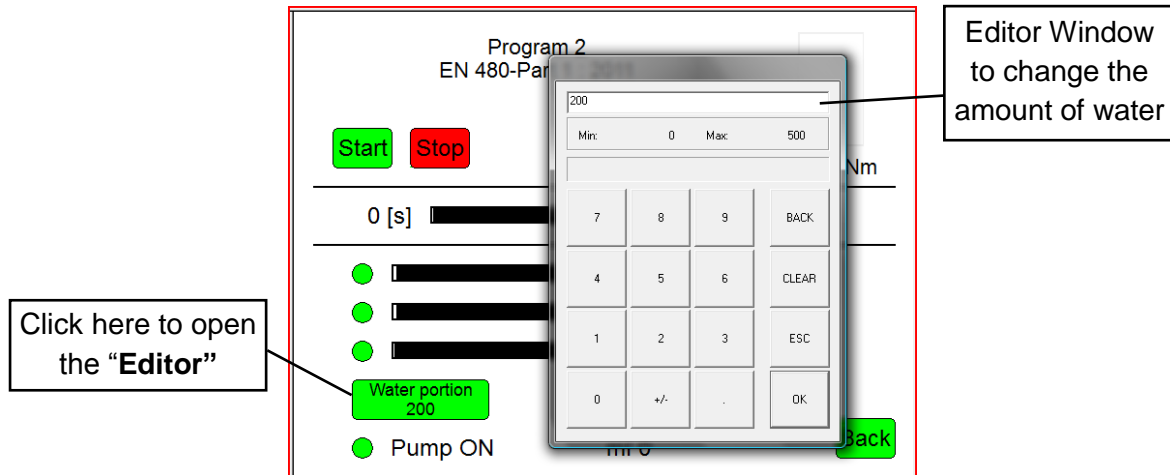
4.4 Program 2 EN 480-Part 1

This program is mixing mortar according to European Norm (EN). For details, please consult the respective EN description.



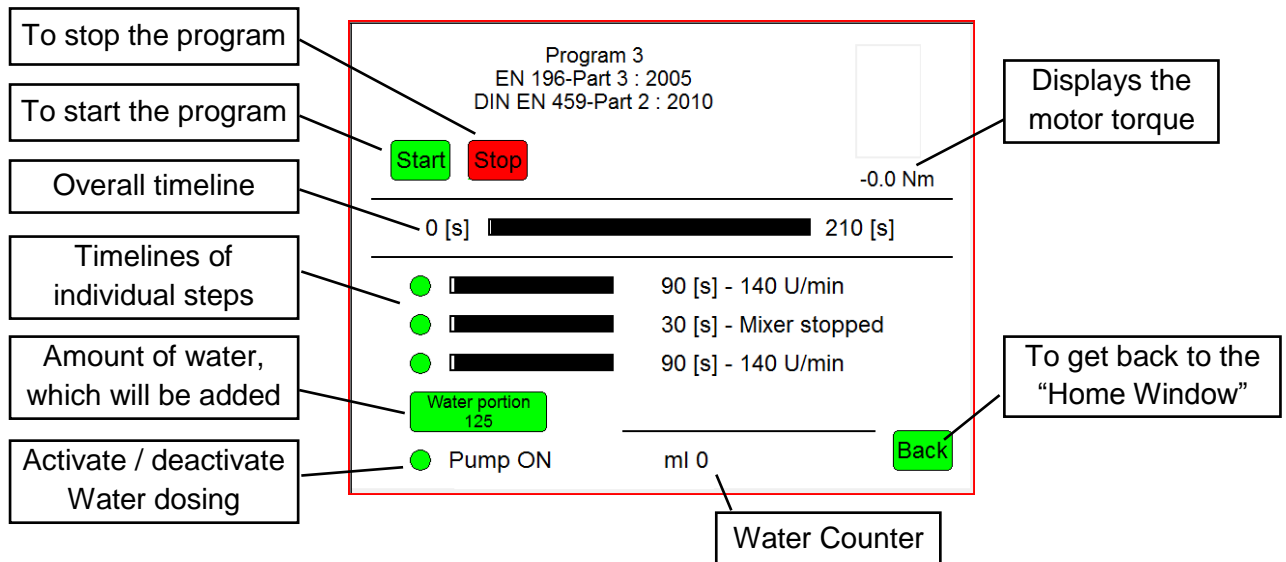
Note:

To change the amount of water, which will be added to the mortar, click the button **“Water Portion”** and enter the required value.



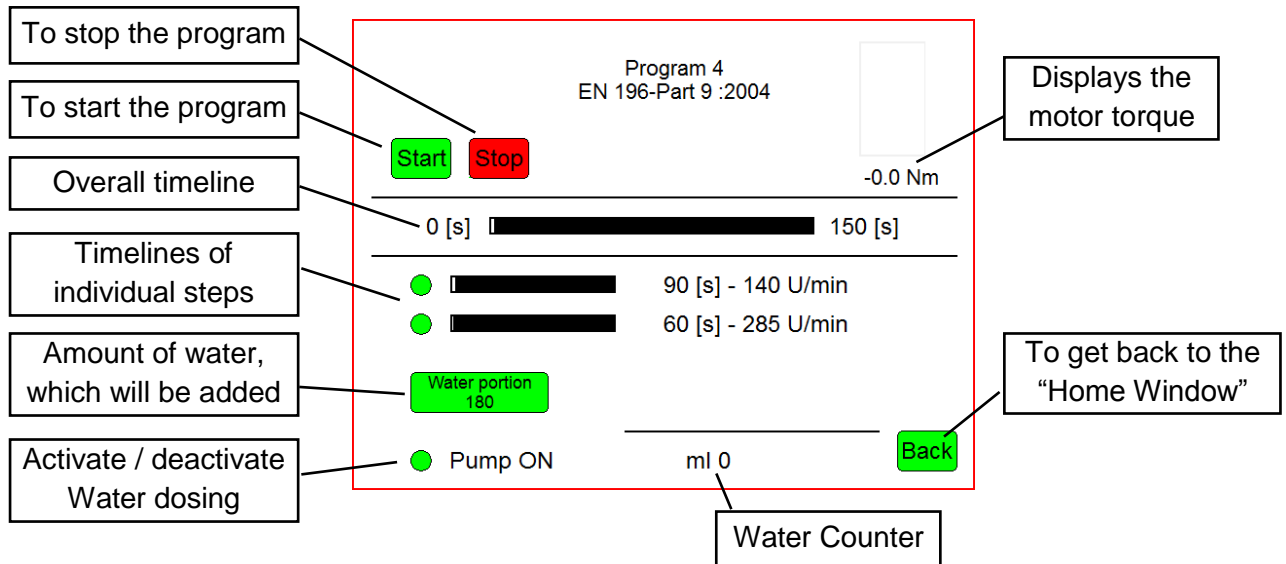
4.5 Program 3
EN 196-Part 3 and EN 459-Part 2

This program is mixing mortar according to European Norm (EN). For details, please consult the respective EN description.



4.6 Program 4 EN 196-Part 9

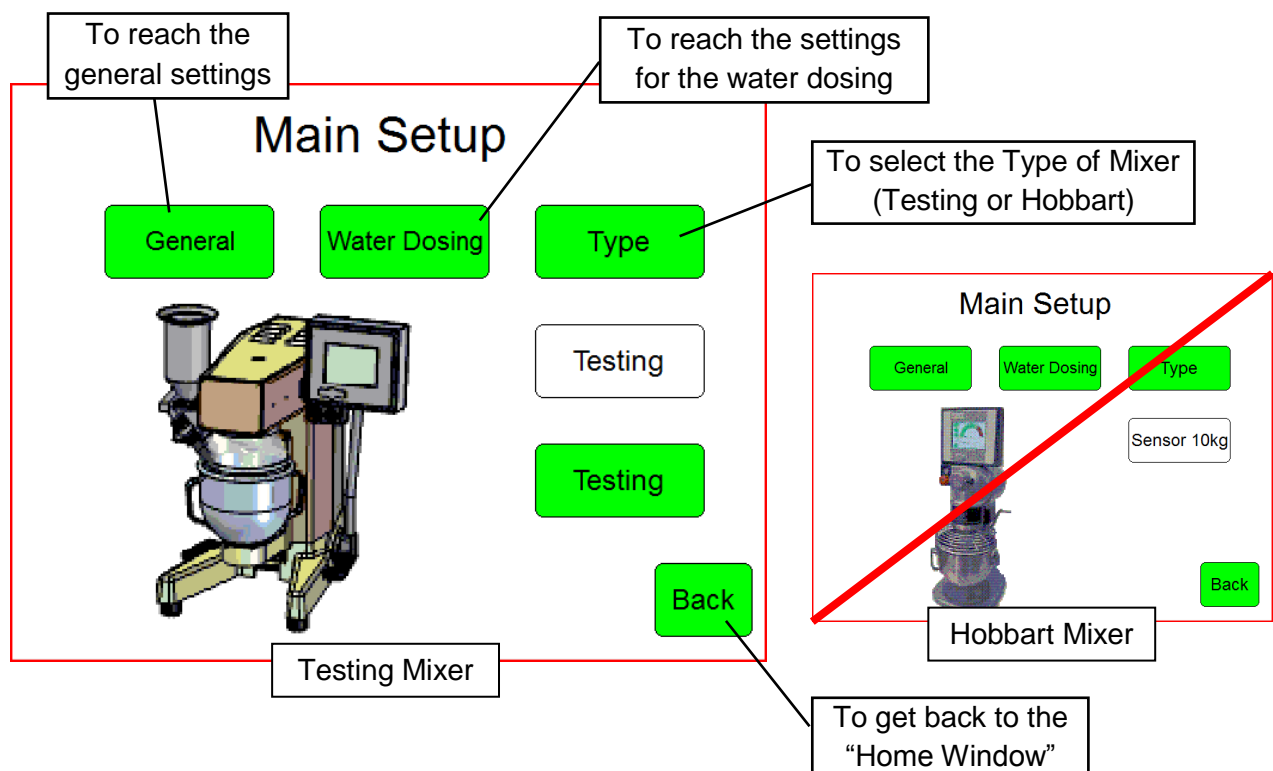
This program is mixing mortar according to European Norm (EN). For details, please consult the respective EN description.



4.7 Setup Windows

The Main Setup Window can be reached from the Home Window by clicking the "Setup" button.

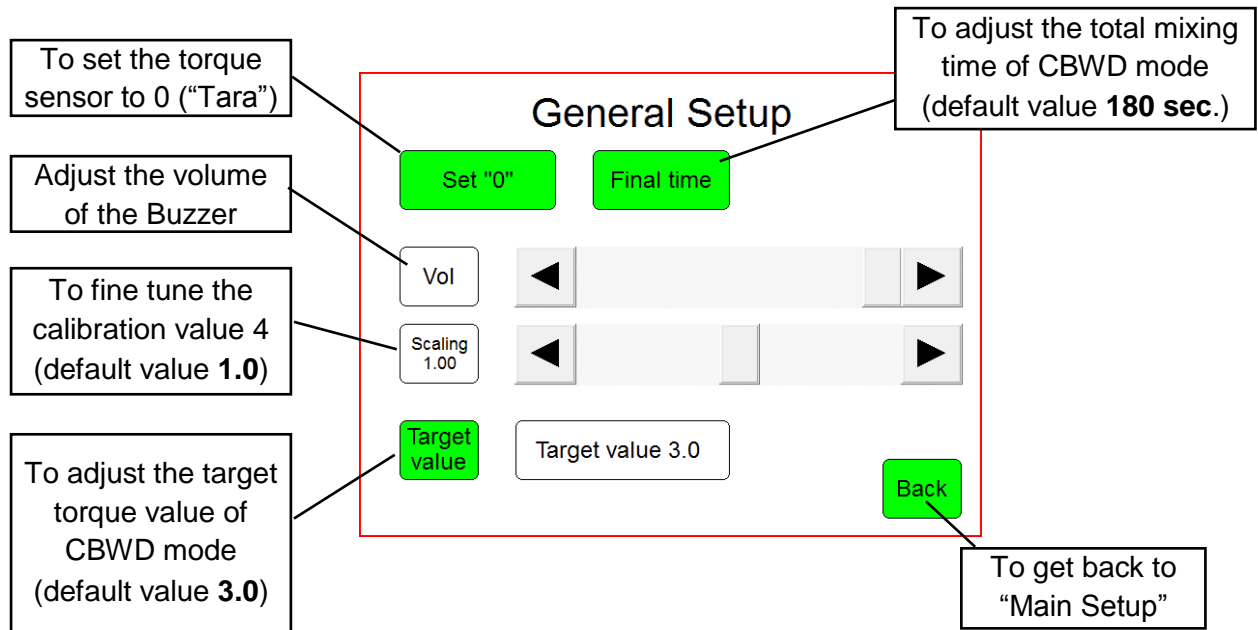
The software is designed to work also with another type of mixer (Hobart Mixer from TomTom-Tools GmbH). Make sure, "Testing" is selected.



4.7.1 General Setup Window

In this window, different mixer parameter can be adjusted.

There is also the possibility to compensate, to a certain extent, the wear on bowl and paddle.

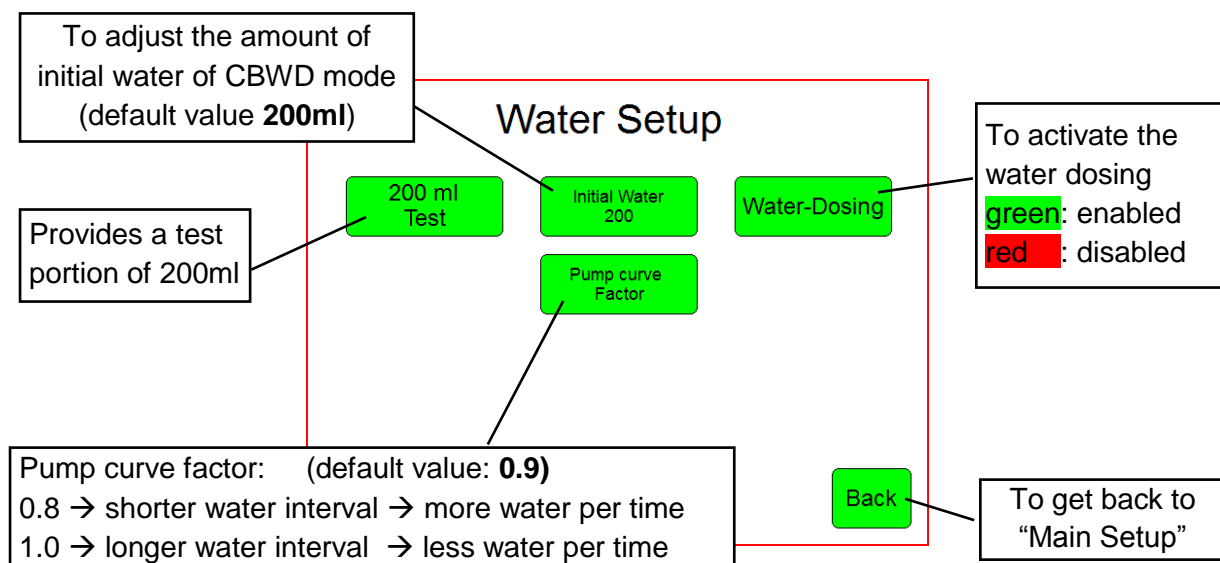


4.7.2 Water Setup Window

In this window, the set points of the water dosing system can be adjusted and tested. Some cement types have extreme behaviors regarding the water - consistency relation during the given mixing time. Hence it can happen that the mixing time elapses before the torque target value can be reached. In this case, the amount of **Initial Water** has to be increased.

In case the required amount of water is close to 200ml or even below, the amount of **Initial Water** has to be lowered.

To have additional possibilities to adjust the water dosing to extreme cement types, the Pump Curve Factor can be changed.



5 Calibration of Mixer for CBWD Measurement

For the Consistency Based Water Demand (CBWD) measurement, the Mixer is calibrated before dispatch. Nevertheless in order to get consistent readings, the calibration has to be verified from time to time and to be re-adjusted if required.

This is done the following way:

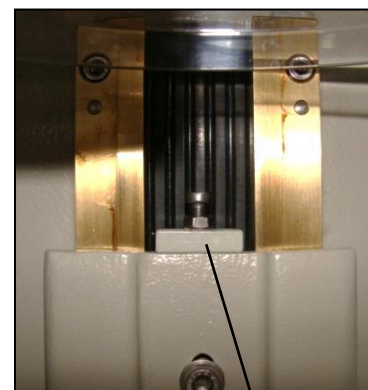
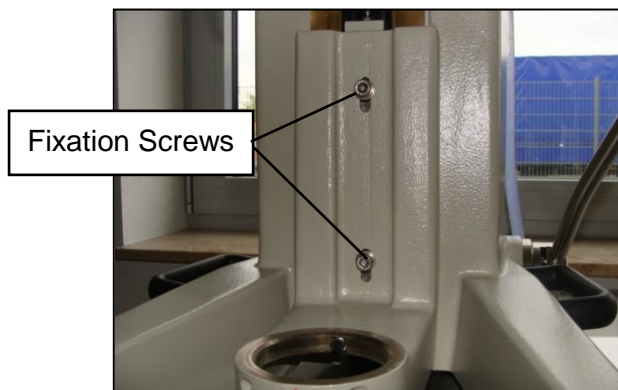
- Run The mixer empty for a few minutes and set the torque value to 0 (by pushing “set 0” button)
- Stop the mixer
- Put 2 Bags of Standard Sand into the bowl (without Cement, without water)
- Run the mixer again
→ the value at the display has to be **4.0** (± 0.1)
- In case the value is out of range, there are two possibilities:

5.1 Adjust the gap between the paddle and the bow

To reach a proper mixing and the required accuracy of the consistency measurement, the gap between the bowl and the paddle has to be 3mm (according EN). The gap to the bottom of the bowl can be adjusted by lifting or lowering the bowl carrier.

- Loose slightly the Fixation screws and turn on the Adjustment Screw until the gap has the required size
- Re-tighten the Fixation Screws

Adjustment Screw in → bowl goes higher → gap **increases**
Adjustment Screw out → bowl remain lower → gap **decreases**



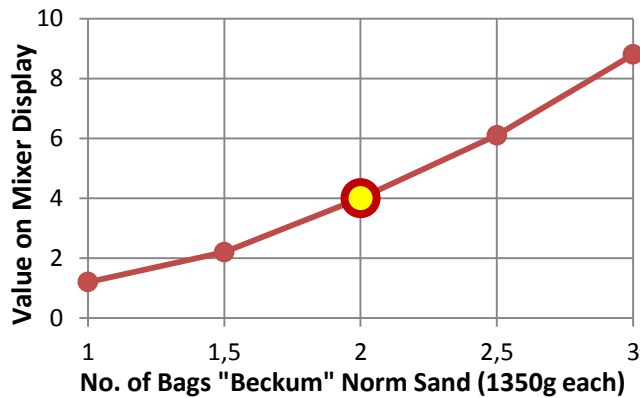
Note:

The sand is abrasive; hence beater (paddle) and the bowl are exposed to wear. The torque resistance decreases with the wear of the beater and re-adjustment is required as explained above. **In case, the gab becomes too big or the torque value of 4 cannot be reached with 2 bags of “Beckum” Norm Sand. The paddle and bow have to be replaced.**

5.2 Fine Tune the Reference Value

In case the gap between bowl and paddle are within the limits, but the calibration value on the torque sensor is slightly below or above 4, there is the possibility to fine tune the value. Adjust the **Scaling Factor** in the **General Setting Window**. (see 4.7.1)

The following graph shows the relation between number of bags (“Beckum” Norm Sand) and the torque sensor value. The yellow point shows that 2 bags have to give a torque value of 4.



General Setup

Set "0"
Final time

Vol

◀
▶

Scaling
1.00

◀
▶

Target
value

Target value 3.0

Back

To fine tune the calibration value 4 (default value 1.0)

6 Calibration of Water Dosing Unit

6.1 Deaeration, Get the air out of the system

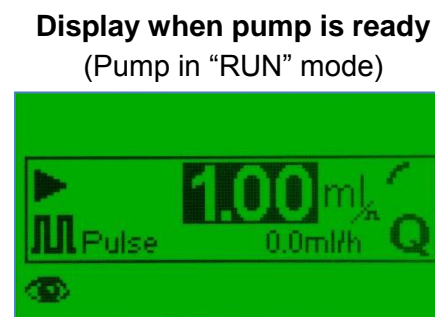
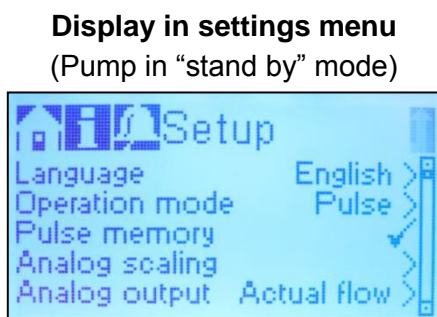
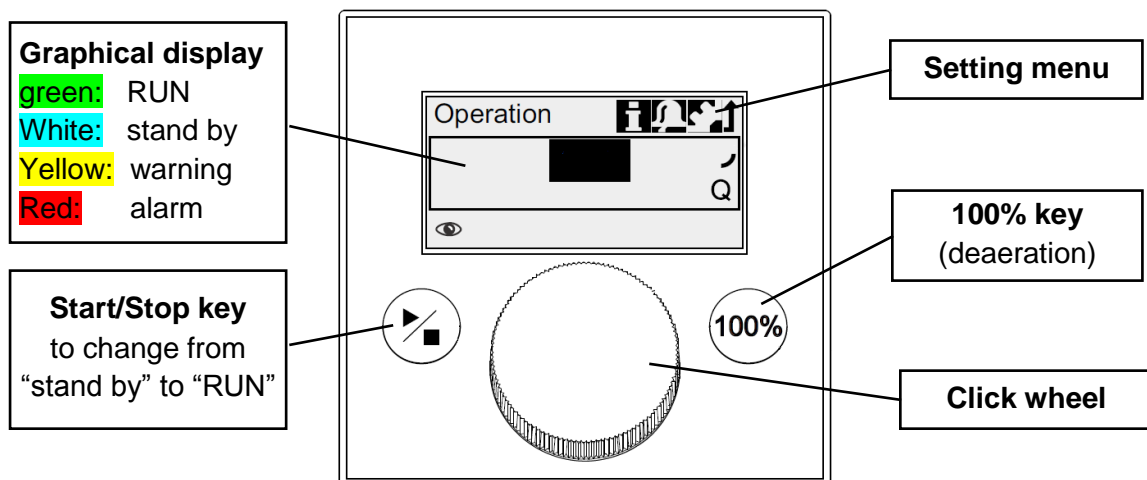
The installation of the water dosing unit is preferable done in a way that the pipes (especially suction pipe) are inclined in the flow direction, which allows the air to escape automatically. Due to the application, it cannot be avoided to have some “air traps” (e.g. in front of the pressure regulator). To get the air out easier, the pressure regulator can be removed from the controller housing and held manually higher during the first pump run. Check visually through the transparent houses, that all air is out (special attention to suction pipe) At the pump is a button (100%) to run it manually for deaeration.

6.2 Pump settings (DDA30-4)

To be able to control the pump via the mixer controller, the following settings have to be made (normally already done before delivery):

Note:

- Turn on the Click Wheel until the setting icon is blinking
- Enter the settings menu by clicking the wheel
- Select “Operation mode: Pulse”
- Set the flag on “Pulse memory”
- Leave the setting menu by clicking on the back arrow
- Adjust the volume per pulse to 1.00ml



(For more details, see also the pump manual)

6.3 Pump Calibration

The pump is calibrated in the factory, nevertheless small deviation might occur due to changes on height above sea level, which requires a new calibration.

Follow these steps:

- Make sure there is no air in the system and the pump is set up as mentioned above
- Switch the pump to “OFF” mode (blue display) by pushing the Start/Stop key
- Place a measuring beaker under the injection nozzle ($\geq 250\text{ml}$)
- Start the calibration process in the "Setup > Calibration" menu
- Click “START” (pump starts to run and each stroke gets counted)
- After 60...70 strokes click “STOP”
- Measure the amount of water in the beaker (by weight on a precision scale)
- Adjust the “Calibrat. volume:ml” according to the measured weight of water
- Click the wheel and store the value
→ calibration complete

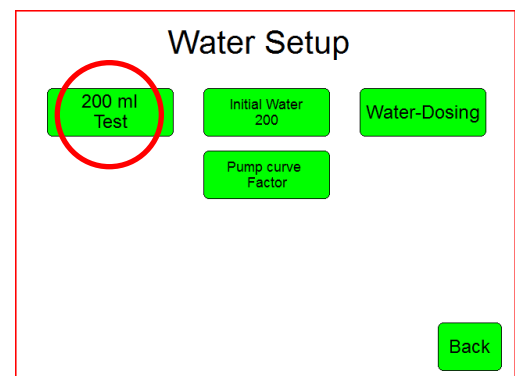


6.4 200ml Test on Mixer

This test shows quickly if the pump unit is working properly:

Note: Pump must be in “RUN” Mode (Start/Stop key)

- Switch ON the mixer and go to the menu “manual”
- Click on button “200ml Test”
The pump starts and delivers 200ml
- Verify the amount on a precision scale
- Repeat the abovementioned calibration if the delivered amount is out of the range of **199...201ml**



7 Spare Parts

- **Paddle (Stainless Steel)**



- **Bowl (Stainless Steel)**

