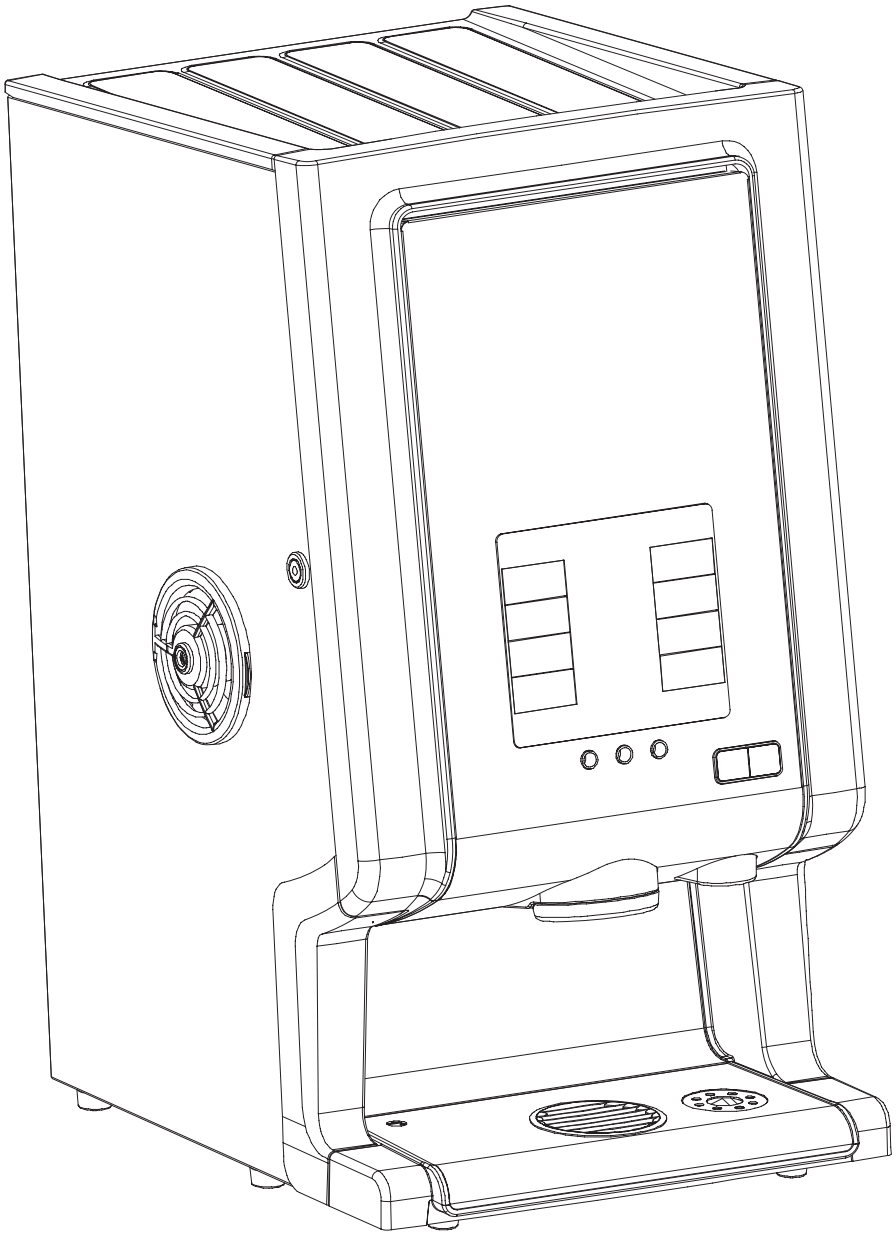
BRAVILOR BONAMAT



Operating principle

Bolero XL (2008)

BRAVILOR BONAMAT

Table of contents

BRAVILOR BONAMAT

Table of figures

1. OPERATING PRINCIPLE

1.1 General operation

The machine works according to a pump system developed by Bravilor Bonamat. This system has the following advantages:

- The components that are responsible for the correct dosing of the water are housed in a cold water unit. As a result, the largest cause of faults with machines, the formation of scale on the dosing valves, is limited to a minimum.
- The float that regulates the water level is also located in the cold–water circuit. This is another reason why the formation of scale is limited to a minimum.

1.2 Water dosing system

After a selection key is pressed, the pump motor is driven with a controlled time and speed. The pump rotor displaces a certain amount of cold water from the cold water reservoir to the bottom of the boiler. As a result, the hot water in the boiler is pushed upwards towards a water selector. This selector uses a rotating movement to select its position (beverage–dependent). Depending on the selected beverage, an ingredient is dosed which, together with the dosed water, is or is not mixed and poured into a cup.

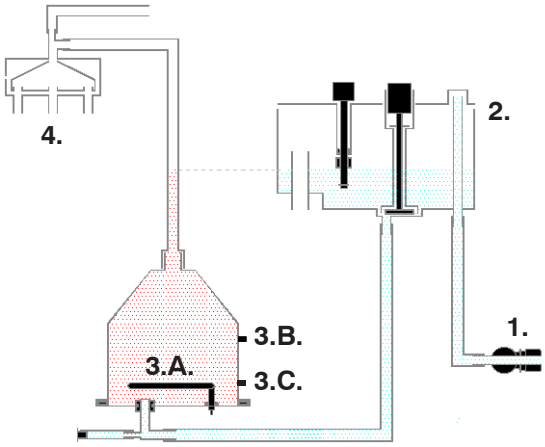


Fig. 1 The water dosing system

The water dosing system consists of the following main components:

1. Magnetic valve
2. Float tank, complete
   - A. Float
   - B. Pump motor
   - C. Pump rotor
   - D. Pump housing
   - E. Encoder

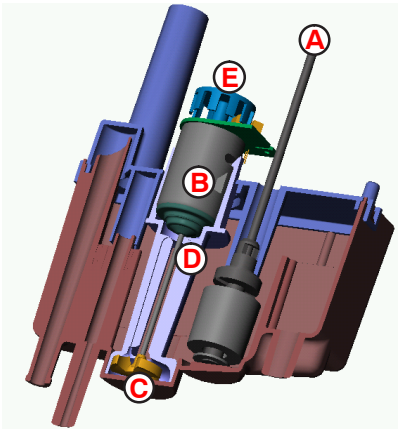


Fig. 2 Float tank, complete

3. Element complete (boiler)
   - A. Element
   - B. Temperature sensor (NTC)
   - C. Temperature sensor (NTC)

4. Water selector, complete
   - A. Water selector motor
   - B. Top cover of water selector
   - C. Light sensor
   - D. Water rotation disk
   - E. Water distributor

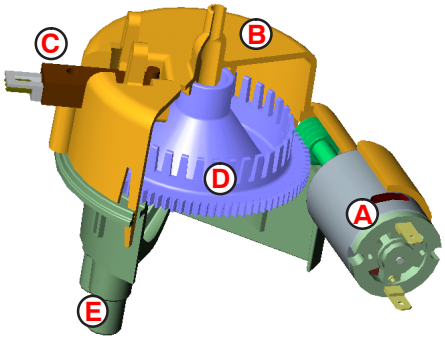


Fig. 3 Water selector, complete

1.2.1 Initialisation

The machine is switched on with the main switch. On the LCD (Liquid Crystal Display) the following appear in succession:

- all symbols that the display can show.
- the version number of the software (microprocessor) loaded from the factory.
- the version of the software table (Eeprom), also loaded from the factory.

This process takes approx. 3 seconds and ends with the steaming cup in the LCD display to show that this phase has successfully finished.

1.2.2 Filling

The float tank and the boiler are connected by a siphon hose. Together, they form a communicating vessel. When the machine is switched on for the first time, the float tank (fig.2) will be empty and the float (fig.2 A.) will be low.

- The magnetic valve (fig.1 ,1.) is opened and fills water in the float tank with a speed of 2 litres per minute, depending on the pressure.
- The water in the float tank flows to the boiler through the hose under the float tank.
- After the water level has pushed the float upwards, the water level in the float tank is the same as that of the boiler. The magnetic valve is switched off.

Please note:

Because the float tank is filled faster than the water ”drops” to the boiler, the filling process will be made with short intervals.

1.2.3 Heating

After the system is completely filled with water, element (fig.1 ,3.A.) is switched on by means of an electronic relay (solid–state relay) in the machine.

The temperature sensor (fig.1 ,3.B.), which is mounted on the outside of the boiler, measures the actual temperature of the water. This ensures that the water in the boiler is heated to the desired final temperature.

During the heating, a thermometer flashes in the LCD display. This indicates that the machine is not yet ready for use.

The temperature sensor is of the type NTC (Negative Temperature Coefficient). The higher the measured temperature the lower the resistance of the sensor.

Hot water has a lower specific weight than cold water. As a result, the hot water in the boiler will not want to flow back to the float tank through the siphon hose at the bottom. That part of the system will therefore remain cold. The latter is very important because precisely the parts of the float tank are sensitive for scale.

The temperature sensor is mounted on the outside of the boiler. As a result, there is no feed–through in the wall and therefore there cannot be any long–term leakage.

This measurement is less direct. This is why the temperature is regulated proportionally. The heating switches on for a certain time and off for a certain time.

After the period that the heating has been off, a measurement is made. The next time, the heating will be on for longer or shorter.

The higher the temperature in the boiler, the shorter the moments become that the element is on, and the longer the intermediate time becomes. In this way, an accurate temperature is obtained in the boiler.

There is a second temperature sensor on the boiler (fig.1 ,3.C.). This sensor monitors the outlet temperature of the dosed water. If this sensor measures a too low temperature, the machine is blocked. No more water is dosed.

1.2.4 Dosing

Dosing is allowed when:

- The float is in the top position.
- The second temperature sensor measures a temperature higher than the blocking temperature.
- After a selection key is pressed, the pump motor (fig.4) is driven for a certain time, depending on the programmed amount, with a certain speed (number of revolutions).

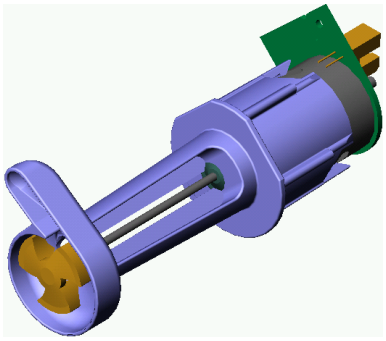


Fig. 4 Pump motor + rotor

- The pump rotor rotates in the pump chamber, which is filled with water. This is formed by the bottom of the float tank and the underneath of the pump housing (fig.5).

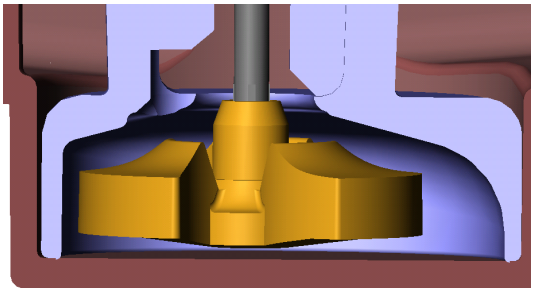


Fig. 5 Pump housing

- The pump rotor pumps the water out of the pump chamber, through the siphon hose in the bottom of the boiler.
- As a result, the hot water in the boiler is pushed out of the boiler.
- The float and the magnetic valve ensure that the level in the float tank is maintained and that water remains in the pump chamber.

The volume of the displaced liquid (yield) is mainly determined by the time and speed of the pump motor.

The time that the motor is on is regulated from the software and is very accurate.

The number of revolutions of the motor is measured with an active revolution counter.

Figure 6 shows that a disc is mounted on the shaft of the pump motor (A = Encoder). This disc rotates at the same speed as the pump rotor.

The encoder rotates between a light sensor (B) and interrupts a light beam. The interruption of the light beam is converted to pulses that can be read by the electronics.

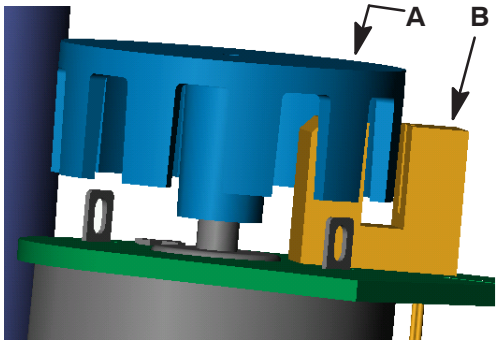


Fig. 6 Encoder

This forms an active revolution regulation that guarantees that, during the time that the pump motor is on, the speed and thus the water yield remain constant.

Selection of the dosed hot water:
This machine is fitted with a hot water selector. This component (fig.7) is responsible for the dosed water from the boiler being dosed in a minimum of 3 and a maximum of 6 directions (type–dependent).

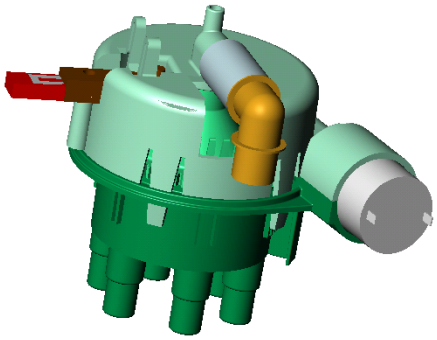


Fig. 7 Water selector

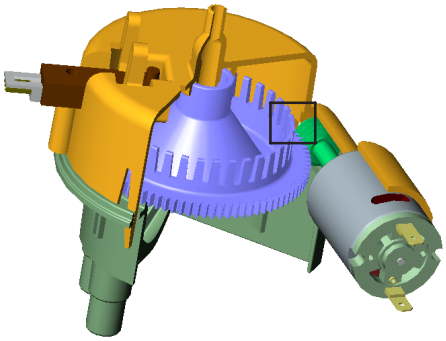


Fig. 8 Water selector internal

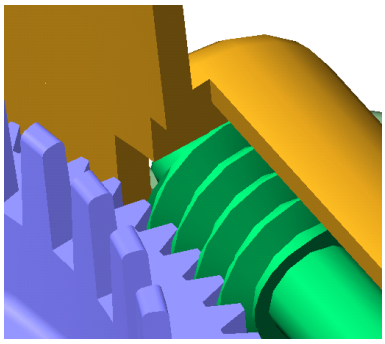


Fig. 9 Water distribution disc

After the machine is switched on, the water selector goes to the stand–by position according to the following procedure:

- The water selector motor is driven.
- This motor uses a plastic worm to drive the water distribution disc (fig.8 / 9).
- The cams on the distribution disc interrupt the light beam of the light sensor and pass these pulses to the control (fig.10).
- When the light sensor observes the wide cam on the distribution disc (fig.10 / 11), the initial position is determined.

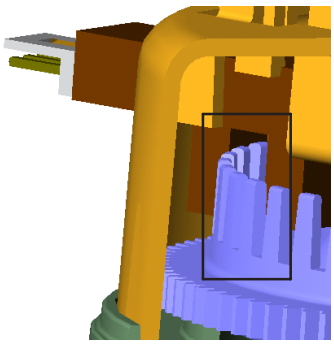


Fig. 10 Water distribution disc

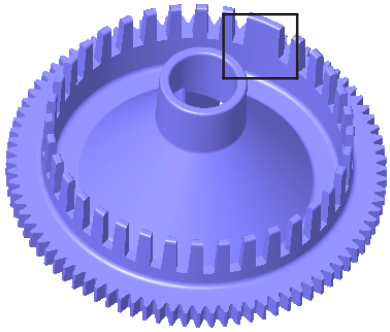


Fig. 11 Water distribution disc with wide cam

Operation of the water selector after a selection key is pressed:

- Depending on the selected beverage, the water selector determines its position.
- After the position is determined, the pump motor is driven.
- The dosed hot water is pumped into the top of the water selector (fig.12 A).
- The water runs through the central hole of the distribution disc (fig.12 B). It comes out through the slanted hole at the bottom (fig.12 C).
- After this, the water falls into one of the chambers in the bottom of the water selector (fig.12 D).
- The water runs to the relevant part through the hoses that are connected to the water selector.
- The water selector rotates back to its initial position.

Please note:

The arrow in fig.12 A shows a small hole on the top of the water selector cover. This is an aeration hole, which prevents siphoning. A hose, which goes to the top of the float tank, is connected to the tulle.

Please note:

Depending on the selected beverage, the water selector can also rotate during the pumping. This is done if water has to go to several mixing systems.

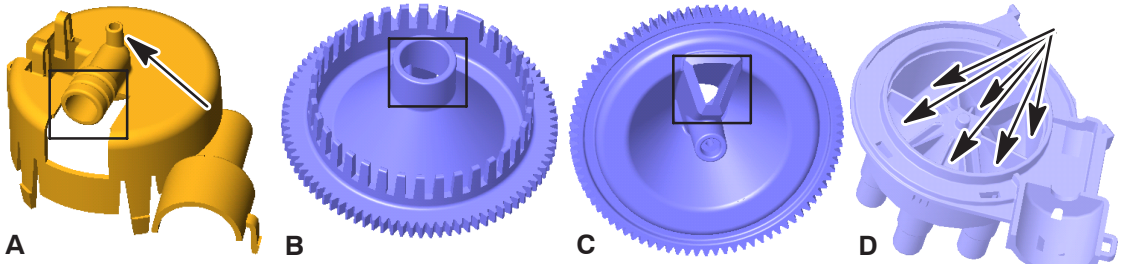


Fig. 12 Water selector components

1.3 Powder dosing system

The powder dosing system consists of an ingredient holder (canister) that is driven by a motor (canister motor).

After the start key is pressed, the canister motor will rotate after a certain delay. This motor drives a worm, which transports the ingredient to the canister outlet.

The control of the canister motor makes it possible to regulate timing and dosing speed independently. As a result, the ingredient can be poured into the mixer at the same time that the water flows out. However, the canister motor will stop slightly earlier than the water, to rinse the mixing jug clean.

Depending on the type of ingredient, “beater springs” are used in the canister. These springs ensure that less tunnel formation occurs. This is the caking of ingredient against the walls.

Fig. 13 Outlet canister

1.4 Mixing system

The mixing unit (fig.15) mixes the hot water and the ingredient. After a selection key is pressed, the water will be dosed in the mixing chamber after a certain delay. The product falls into the mixing chamber from above. Depending on the selected beverage, the mixer will start to rotate with a certain number of revolutions.

An exhaust opening is mounted on top of the mixing chamber (fig.14). This cover has an opening at the rear, which is pressed into an exhaust opening through the sheet–metal work. The function of this exhaust system is to ensure that vapour from the mixing chamber does not get the chance to reach the ingredient holder outlet. Figure 16 shows an example of an exhaust system suited for three mixing systems.

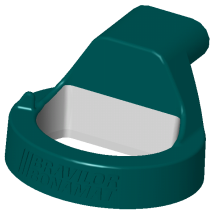


Fig. 14 Exhaust hood

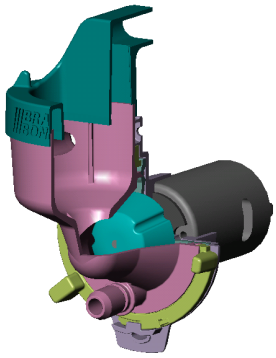


Fig. 15 Mixing unit

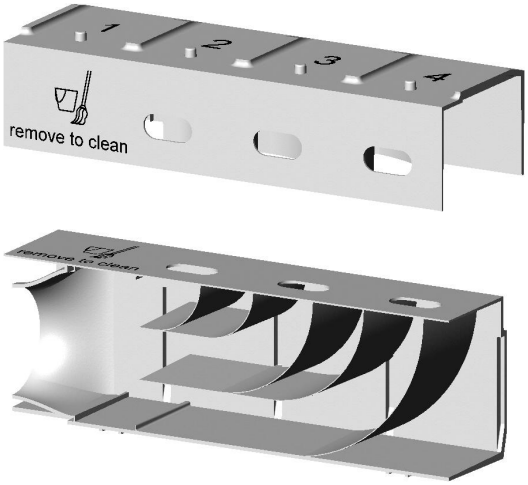


Fig. 16 Exhaust system for three mixing systems

1.5 Ventilation system

The ventilation system (fig.17) removes the steam, that developes during dosing. So the settling of warm steam and condensation in the mixing chamber will be prevented. Therefore the mixing chamber will get less dirty.

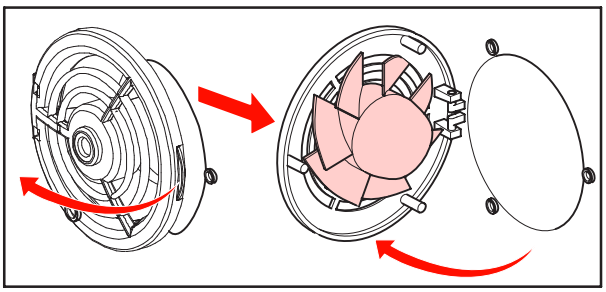


Fig. 17 Ventilation system

1.6 Operating system

The operating system consists of a:

- Keyboard
- Main board

1.6.1 Keyboard

The keyboard is the printed circuit board with selection keys. Settings that can be changed in the programming menu are also saved in the Eeprom of this printed circuit board. When the keyboard is replaced, the machine will therefore have the factory settings.

1.6.2 Main board

The main board is located in the machine and is fitted with electronics to drive the machine. The power supply for the low–voltage current components is regulated from this board, as well as the temperature regulation. On this board, there are one or more relays and semiconductors that can switch the electrical components on or off.The main board is also fitted with a microprocessor that regulates the boiler routine.

1.7 Hardware protections

The machine is equipped with a number of hardware protections. These protections ensure that no dangerous situations can arise, such as overheating and/or water in the machine.

1.7.1 Overflow protection

This protection is in the float tank and ensures that, if the water becomes too high, excess water is passed through the overflow and hose to the bottom of the machine.

1.7.2 Back–flow protection

The water from the magnetic valve is sprayed against the cover of the float tank, via a pipe in the float tank. Then, it goes into the float tank itself. In this way, water is prevented from flowing back into the system and getting into the water system if the water pressure is released from the magnetic valve.

1.7.3 Boiling protection

The boiling protection consists of a relay on the main board (printed circuit relay) and a temperature sensor against the boiler. This protection ensures that the machine can not boil. The separate electronic relay (solid–state relay) in the machine is connected in series to a mechanical printed circuit relay on the main board. This printed circuit relay is switched on when the machine is switched on and contains water, and switched off when the machine is switched off. The solid–state relay is regularly switched on and off to keep the water in the boiler at the right temperature. The printed circuit relay does not switch much. If the solid–state relay becomes defective, this can make a direct connection. This is why the heating element is permanently switched on. The temperature sensor constantly measures the temperature of the water. When the water temperature is too high, the operating system switches the printed circuit relay off. Thus, the heating element will also be switched off. This prevents the water from boiling.

1.7.4 High temperature safety switch

The high temperature safety switch is mounted on the outside of the boiler by means of two Klixons. If, for whatever reason, the operating system does not switch the boiler off, the Klixons ensure that the voltage on the element is mechanically switched off.

During the boiling dry process, evaporation escapes from the boiler. This vapour enters the water selector and can possibly exit between the cover and distributor. To prevent a few drops from entering the machine, a drip tray for the water selector has been made (fig.18).

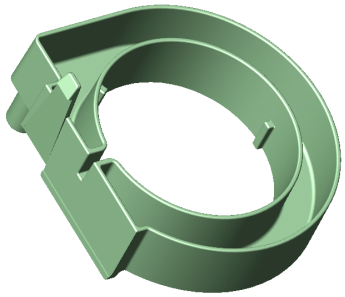


Fig. 18 Drip tray water selector

1.8 Software protection

Depending on the type of machine, it is provided with a number of software protections. The software looks at all inputs and outputs of the machine during the entire process. If situations arise that are not allowed, the software intervenes. This intervention usually results in the machine being switched off and an Error message in the LCD display. For possible solutions to these Error messages, see the Error list underneath.

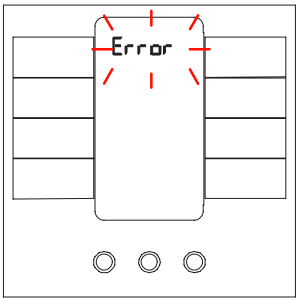


Fig. 19 LCD display with error message

ERROR LIST

Error 1 *Not applicable*

Error 2 *Temperature in boiler too high:*
- If the temperature sensor (NTC) measures a value that is outside its range (0 Ohm or infinity), the machine is switched off and 'Error 2' appears in the LCD display. This also applies if the boiling protection (see hardware protection) is activated.

Error 3 *Magnetic valve open without selection:*
- When the start key is pressed, the magnetic valve is activated. If this valve is activated without the start key being pressed, a timer is switched on. If the magnetic valve is activated again within this time without the start key being pressed, this indicates a leakage in the water system or that the water is boiling. The machine is switched off and 'Error 3' appears in the LCD display.

Error 4 *Not applicable*

Error 5 *Water selector in wrong position:*
- The water selector returns to its initial position during start–up and after each dosing. If the selector cannot find its position during the execution of this routine, it switches off and 'Error 5' appears in the LCD display.

Error 6 *Magnetic valve opened too long:*
- If, for whatever reason, the process of filling the float tank takes too long, the machine is switched off and 'Error 6' appears in the LCD display.

Error 7 *Wrong Chip card:*
- In a number of cases, it is possible to place a chip card in a chip card reader. This is present on the keyboard. Any data present can be downloaded or uploaded. If the software on this chip card does not correspond with the software in the machine, 'Error 7' appears in the LCD display.

Error 8 *Communication error between both prints:*
- There is constant communication during machine start–up and during use. This is done via the flatcable between the keyboard and the main board. If communication is impossible, 'Error 8' appears in the LCD display.

Error 9 *Pump motor rotates too slow or does not rotate at all:*
- The pump motor is rotating during machine start–up and during use. The light sensor detects no or too little pulses and 'Error 9' will appear in the LCD display.

1.9 Programming

The programming is built up by means of a simple programming carrousel. Have the user instructions open next to this text. After the programming is activated by means of the programming key, settings can be simply activated or changed. By pressing the programming key again, the settings are saved the machine returns to the standby mode.

1. Open the door with the key.

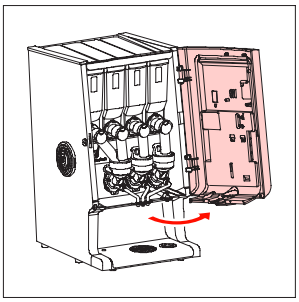


Fig. 20 Door open

2. Press the programming key (P) to start the programming sequence.

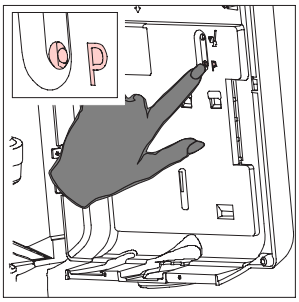


Fig. 21 Programming key

3. Counter contents read–out of all beverages at the same time. The display shows a 3– and 6–digit number alternately:
   - The 3–digit number denotes the total number of **cups, mugs** or **decanters** that were poured since the counter settings were last reset to zero (day counter).
   - The 6–digit number denotes the total number of **cups, mugs** or **decanters** that were poured since the machine was put into operation (total counter).

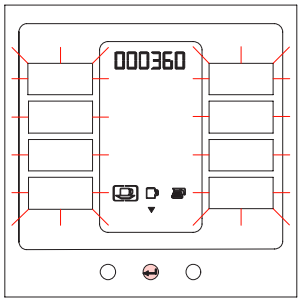


Fig. 22 Total counter

3.1 Separate read–out of counter contents of poured beverages:
   - Select the desired beverage with one of the selection buttons and determine your choice with the **cup, mug** or **decanter** setting key. The relevant counter contents will appear in the LCD display. After a few seconds, the counter contents return to the counter of all beverages at the same time.

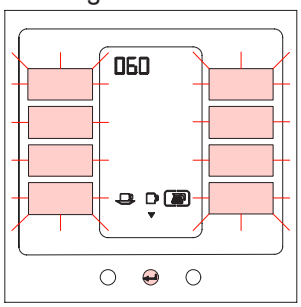


Fig. 23 Separate counter contents

3.2 Resetting day counter:
   - Select any beverage using one of the selection buttons.
   - Keep the desired selection button pressed until the day counter is set at 0.

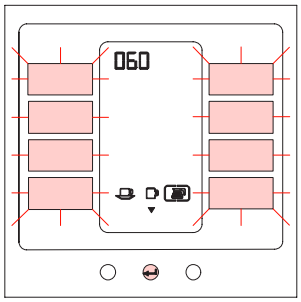


Fig. 24 Day counter

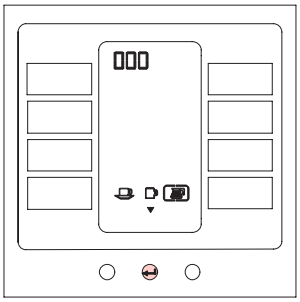


Fig. 25 Day counter to zero

– Press the Enter key to go to the general selection screen (fig.26).

4. General selection screen:
   – *General programming:* press the Enter key and continue with point 5.
   – *Beverage–dependent settings:* press the selection key and continue with point 21.

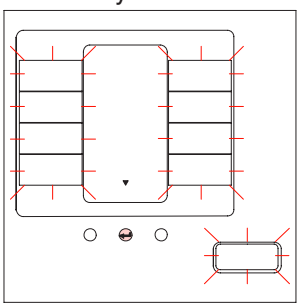


Fig. 26 General selection screen

5. Descaling program:
   – This machine is fitted with a descaling program. After the START key is pressed in this state of the LCD display, the de–scaling program is started. *(For this purpose, read the relevant section of the user instructions.)*
   – Press CANCEL within 5 seconds if you decide **not** to start the de–scaling program.
6. Boiler temperature:
   – Set the maximum temperature of the water in the boiler.
7. Descaling signal:
   – Ask your local water company about the hardness of the water supply. Always select the right setting. The default setting of the machine is position 3 (1000L). The machine continuously registers the time that the **inlet valve** is open and therefore the number of litres of water that has passed through the system. When the number of registered litres is greater than or equal to the programmed value, the descaling symbol in the LCD display starts to flash.

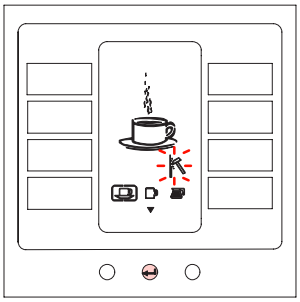


Fig. 27 Descaling symbol

8. Energy–saving mode:
   – Setting the number of minutes/hours, after which the machine must switch over to the ECO mode. All functions such as boiler, ventilator and display illumination switch off and [ECO] appears in the LCD display. The next time that a selection key is pressed, the machine switches on again. Depending on the switch–off time, it can take a few minutes before the machine is ready for use again.
9. Coin mechanism:
   – Only activate this setting if the machine has a coin mechanism (*optional*) and you want to use it. The default setting of the machine is OFF.

   Please note:

   - Settings 10. to 15. are only available if the coin mechanism is activated (9.).
   - The currency is depended of the coin mechanism type.
   - The price can be set in the programming menu (drink dependent, see point 26./hot water, see point 32.).
10. Coins rejection/acceptance (0.05):
    – Indicate if the coin must be refused (left key) or accepted (Enter key).
11. Coins rejection/acceptance (0.10):
    – See point 10.
12. Coins rejection/acceptance (0.20):
    – See point 10.
13. Coins rejection/acceptance (0.50):
    – See point 10.
14. Coins rejection/acceptance (1.00):
    – See point 10.
15. Coins rejection/acceptance (2.00):
    – See point 10.

    Please note:

    - At the standard coin mechanism point 10. till 15. will start hereafter for the Pound.
16. Token rejection/acceptance (”Freedom Eagle”):
    – See point 10.

17. Token rejection/acceptance (free programmable):
  - See“Azkoyen validator §1.4.7.1 en §1.4.7.2”.
18. Copy Card:
  - Customer specific settings can be copied on the chipcard, whereupon these can be downloaded to other equivalent machines.
    - The procedure can be found on the extranet “Special Codes”.
19. General selection screen (all keys that are now lit can be selected).
20. Amount per **cup**.
  - Setting the amount of water in ml. The software will convert a larger amount to a longer pumping time. If the amount of water is changed, the basic strength is automatically adapted, so that the strength increases or decreases proportionally.
21. Programming (drink dependent).
22. Amount per **cup** (drink dependent):
  - Setting the amount of water in ml. The software will convert a larger amount to a longer pumping time. If the amount of water is changed, the basic strength is automatically adapted, so that the strength increases or decreases proportionally.
23. Amount per **mug** (drink dependent):
  - See ”amount for **mug** (drink dependent)”.

  23.1 Blocking mugs:
    - Decrease the value set for **mug** to the minimum. The display will show ’OFF’.
    - If the machine has been set to paid delivery, it is not possible to pour a **mug**.
24. Amount per **decanter** (drink dependent):
  - See ”amount for **cup** (drink dependent)”.
  - With a number of beverages, the **decanter** function is blocked in the factory.

  24.1 Blocking decanters:
    - Decrease the value set per **decanter** to the minimum. The display will show ’OFF’.
    - If the machine has been set to paid delivery, it is not possible to pour a **decanter**.
25. Basic strength (drink dependent):
  - Setting amount of ingredient (in %). The software translates the programmed percentage to the speed of the canister motor and therefore the strength of the ingredient. (See ingredient sheet).
26. Price–fixing (drink dependent) (*optional*):
  - Set the desired price.
27. General selection screen.
28. Programming (hot water):
29. Amount per **cup** (hot water):
  - Here, the amount of water can be set in ml. The software will convert a larger amount to a longer pumping time.
30. Amount for **mug** (hot water):
  - See ”amount for **cup** (hot water)”.

  30.1 Manually blocking **mugs**:
    - Decrease the value set for **mug** to the minimum. The display will show ’OFF’.
    - If the machine has been set to paid delivery, it is not possible to pour a **mug**.
31. Amount per **decanter** (hot water):
  - See ”amount for **cup** (hot water)”.

  31.1 Manually blocking **decanters**:
    - Decrease the value set per **decanter** to the minimum. The display will show ’OFF’.
    - If the machine has been set to paid delivery, it is not possible to pour a **decanter**.
32. Price–fixing (hot water) (*optional*):
  - Set the desired price.
33. General selection screen.

By pressing the programming key (P) again, the settings are saved and the machine returns to the standby mode.

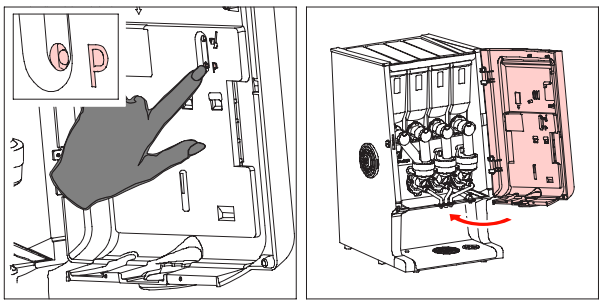


Fig. 28 Programming key / Door closed

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