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# Electronics (PID) for Rancilio Silvia

Buna café

## Electronics for Rancilio Silvia coffee machine

Thank you for your interest about electronics (PID) for one of the most popular coffee machines – Rancilio Silvia. We designed and developed this electronics to increase possibilities for Rancilio Silvia and also to make it more comfortable for home baristas.

The electronics is available in three versions with possible upgrade and there is also possibility of updating the firmware (SW). It can be done via USB.

### Main added value:

- PID regulation for water in the boiler (for espresso) - elimination of mechanical thermostat  
PID – the target temperature is reached slower but it is not so over-regulated.
- Steam regulation with electronic thermostat (for steam purposes the electronic thermostat is better than PID) – elimination of mechanical thermostat  
Electronic thermostat - the target temperature is reached faster but it is over-regulated (it is not a problem for steam purposes). It means that the heating element works continuously unless the target temperature is reached and starts working again once the temperature is 1 °C lower than the target temperature.
- Two temperature sensors – one for the boiler and one for the grouphead
- Well-arranged display
- Showing (counting) the time of extraction
- Regulation (setting) of the pump performance
- Two programmable user profiles
- Pre-infusion option
- Sleep mode and wake-up mode
- LED (RGB) lighting on work surface
- Low water sensor
- Pressure gauge

## Electronics versions:

### Version S

- Two user profiles (programmable profiles – P1, P2) – boiler temperature settings, one pre-defined profile (not programmable – P0)
- PID regulation settings – PID constants
- Time displayed (clock)
- Button backlit
- Showing the time of extraction

### Version M

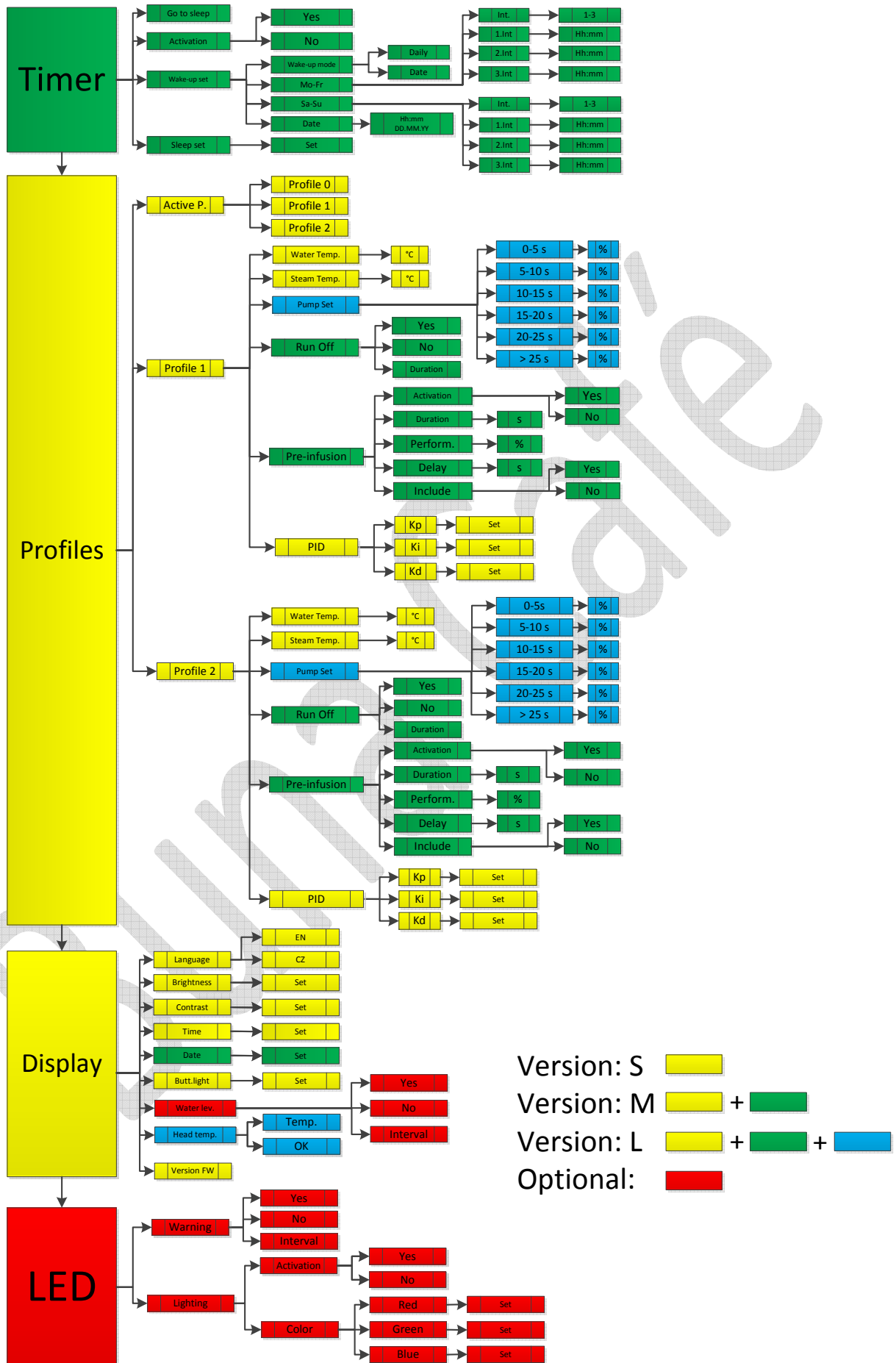
- Same as version S
- Waking-up mode and sleep mode. Waking-up up to three times a day (day, week, weekend cycle or a specific date)
- Pre-infusion option (duration, pump performance, delay between pre-infusion and extraction)

### Version L

- Same as version S and M
- Grouphead temperature sensor
- Regulation of pump pressure (performance)

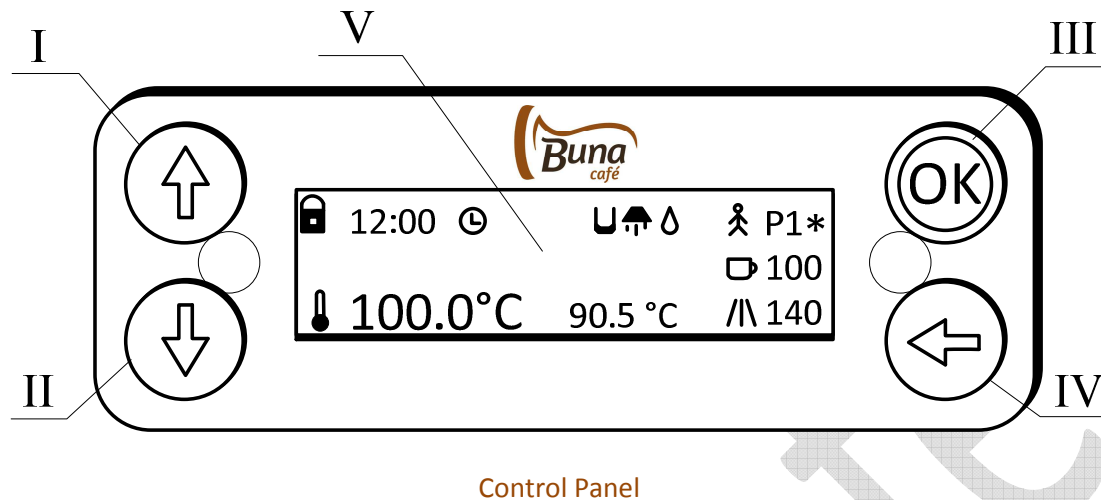
### Optional:

- Water level sensor (low water displayed on the screen and also LED warning can be set)
- LED (RGB) for work surface lighting, different colors can be set, warning light can be set for low water indication
- Pressure gauge



## Electronics use (operating)

Four buttons are used – two for navigation, one for confirmation and one back button.



Control Panel

I – Up/Increase button

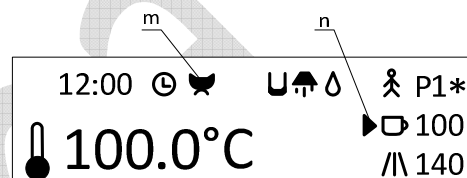
II – Down/Decrease button

III – OK button – it is used for confirmation, enter the menu, waking-up the machine from sleeping mode

IV – Back button – it is used for locking and unlocking the buttons and also for moving back

V – Screen (display)

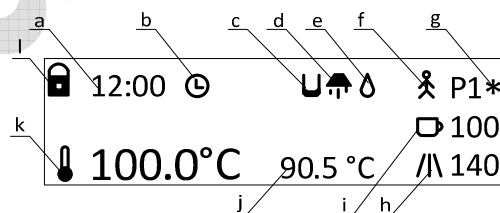
## Screen (Display)



Main screen, version L – unlocked.

(m) – Grouphead is warmed up

(n) – Possible quick changes on the main screen (when unlocked). Quick changes are not saved in memory



Main screen, version L – locked.

(a) – Time displayed (Clock)

(b) – Waking-up or sleeping mode is activated

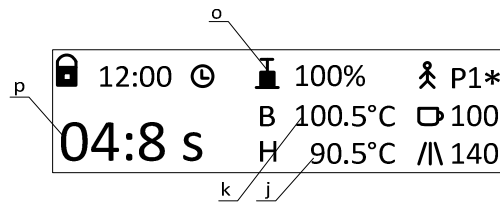
(c) – Low water indication

(d) – Run-off is activated (run-off means to let a bit of water come out from the machine before extraction)

(e) – Pre-infusion is activated

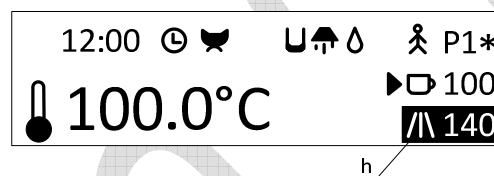
(f) – Activated profile

- (g) – Indication of quick changes on the main screen (quick changes are not saved in memory)
- (h) – steam temperature to be achieved
- (i) – water temperature for espresso to be achieved
- (j) – Grouphead temperature (version L only)
- (k) – Boiler temperature
- (l) – Locked buttons indication



Screen when brewing, version L.

- (j) – Grouphead temperature (version L only)
- (k) – Boiler temperature
- (o) – Current value of pump performance
- (p) – Time passed from beginning of extraction





Screen when steam button is on (getting steam ready)




- (h) – Steam mode on

## Main screen operation

The main screen is locked in default and its function is to show us and inform us about current values. For quick and temporary changes we can change the values on the main screen.

For unlocking the screen press the back button for three seconds. Icon (l)  will disappear when unlocked. Also icon (n)  will appear on the screen next to the value which can be changed.

Changes can be applied for the following:

- Active profile (f)  - quick switching between profiles (no need to go to the menu)
- Water temperature (i)  - quick and temporary change of the water temperature
- Steam temperature (h)  - quick and temporary change of the steam temperature

For moving between these values we use Back button. For changing these values we use up/increase and down/decrease buttons.

All changes on the main screen are just temporary and NOT saved in memory. After switching the machine off and on again the profile is loaded from the memory – active profile is the one activated in the menu.

To lock the screen the Back button has to be pressed for three seconds.

## Menu operation

To enter the menu OK button has to be pressed for 3 seconds.

### Screen of the Menu

MENU	LED
	<b>Timer</b>
	Profiles

MENU	<b>Interval:</b>	1
Timer	1. Int	13:30
Mo-Fr	2. Int	--:--

MENU	<b>Yes</b>	
Pro/P1	No	*
Run Off	Interval	10s

MENU	> 25 s	80%
Profiles	0 - 05 s	<b>100%</b>
P1/Pump	5 - 10 s	100%

Examples of menu screens

Highlighted item can be edited.

## 1. Timer (version M, L)

- Automatic sleep mode setting
- Entering sleep mode manually
- Waking-up mode

### 1.1 Go to sleep (version M, L)

The main switch is ON (the machine is ON) but the heating element is OFF.

Screen backlit, buttons and LED are OFF.

Electricity consumption is 3 W max in this mode. Whatever button is pressed the time is displayed for 2 seconds.

OK button has to be pressed (for about 5 seconds) to exit the sleep mode.

Also the time which is set in the wake-up mode will exit the sleep mode (once the time is achieved).

### 1.2 Activation (version M, L)

Sleep mode can be activated. You can see this sign  on the main screen when activated.

“Yes” option – the machine will follow the sleep mode and the wake-up mode settings.

“No” option – the machine will NOT follow the sleep mode and the wake-up mode settings.

### 1.3 Wake-up set (version M, L)

Wake-up mode option – daily or in a specific date.

Daily

It is possible to set three different times for a day in two cycles - for a week (Mon – Fri) and for a weekend (Sat – Sun). It needs to be set “Daily” in Wake-up mode option.

You can set the number of time intervals during the cycles (Mon – Fri and Sat – Sun). You can choose 1, 2 or 3 intervals a day.

It is also possible to set a specific date. It needs to be set “Date” in Wake-up mode option.

### 1.4 Sleep set (version M, L)

Sleep settings in daily mode.

## 2 Profiles (version S, M, L)

### 2.1 Active P. (version S, M, L)

Active user profile option – P0, P1, P2

P1, P2 – this profile can be modified by the user, P0 – default profile (this profile cannot be modified)

#### P0 settings

Water: 105 °C

Steam: 140 °C

Water regulation: PID (PID constants: Kp = 100, Ki = 0.01, Kd = 1400)

Steam regulation: Electronic thermostat

Pre-infusion: No

P0 can be used for Back-flush or Decalcification. So you do not need to change your profile settings.

### 2.2 Profile 1 (version S, M, L)

#### 2.2.1 Water temperature (version S, M, L)

Water temperature in the boiler for brewing can be set between 80°C – 120°C.

#### 2.2.2 Steam temperature (version S, M, L)

Water temperature in the boiler for steam can be set between 130 °C – 155 °C.

#### 2.2.3 Pump set (version L)

You can set pump performance during extraction in six time intervals.

It can be set between 10 % and 100 % (in step after 10).

It is about vibration of the pump – up and down. This movement (up and down) happens 50 times a second (50x up and 50x down in one second). It corresponds to 100%. 90% corresponds to 45:45 and so on.

There is no stable relation between percentage (pump performance) and bars (pressure during extraction). It also depends on quantity of coffee, grinding and tamping.

#### 2.2.4 Run-off (version M, L)

The process before brewing when you let some water come out from the grouphead we call Run-off. During this Run-off the pump works for 100 %. After Run-off you have 5 to 20 seconds (according to your settings) to start with extraction. In case you do not start with extraction in this time the pump will be again working for 100 % no matter what you have set in the menu (pre-infusion, pressure profile).

It is worthy to use this Run-off in profiles where you have set pre-infusion or lower pump performance in the first time interval.

#### 2.2.5 Pre-infusion (version M, L)

- **Activation** – ON or OFF for pre-infusion. ON setting is displayed on the main screen with this sign ☉ .
- **Duration** – duration of pre-infusion (from 0,5 s to 10 s – in step after 0,5).
- **Performance** – pump pressure setting for pre-infusion from 10 % to 100 % (in step after 10).
- **Delay** – it is a time interval between pre-infusion and brewing from 0 s to 5 s (in step after 0,5 ).
- **Include** – when it is ON it means that the time of pre-infusion is included into extraction time. When it is OFF it means that pre-infusion is NOT included into extraction time.



### 2.2.6 PID (version S, M, L)

PID constants setting (temperature in the boiler for espresso).

## 2.3 Profile 2 (version S, M, L)

Profile 2 has the same setting options as Profile 1.

# 3 Screen (display)

## 3.1 Brightness (version S, M, L)

## 3.2 Contrast (version S, M, L)

## 3.3 Time (version S, M, L)

Current time setting (displayed on the screen). This time is important for wake-up and sleep mode functioning.

## 3.4 Date (version M, L)


Current date setting is important for wake-up and sleep mode functioning.

## 3.5 Backlit (version S, M, L)

It is setting for backlit buttons. Display buttons have LED (white) for possible backlit.

## 3.6 Water level (optional)

You can set type of warning for low water indication (when the water level in reservoir is low).

“YES” option – low water level is indicated by flashing backlit buttons and showing “Low water” on the screen for about 3 seconds. Then there is a sign (c)  on the screen until the water is above low water level again.


“NO” option – low water level is indicated only with the sign (c)  on the screen until the water is above low water level again.

## 3.7 Grouphead temperature (version L)

You can choose between “Temperature” and “OK”.

“Temperature” – current temperature is displayed on the screen. It is temperature of water coming through the grouphead. This temperature is also displayed during extraction so you have water temperature for extraction totally under control.

Also this is a good indication for the machine being ready (warmed-up).

“OK” – if OK is set the temperature is NOT displayed on the screen in °C but after reaching 86 °C and more (the grouphead temperature) there is a sign (m)  displayed on the screen (the machine is warmed-up indication).

# 4 LED (optional)

RGB LED is optional. It is used as work surface lighting and warning indication. And above all it looks good.

## 4.1 Warning

“YES” - red LED warning light will be flashing once low water level is indicated.

In case the water level is still low then the red warning light will be flashing again in defined intervals. You can set the interval between 10 s and 250 s (in step after 10).

Warning light is functioning regardless Lighting setting in 4.2.1.

“NO” – red LED warning light will NOT be flashing once low water level is indicated.

## 4.2 Lighting

Color and intensity setting

### 4.2.1 Activation

You can activate or deactivate the lighting. Deactivation does NOT influence the setting in 4.1.

### 4.2.2 Color

You can set all RGB colors between 0 % and 100 % (in step after 10).

It is possible to achieve 1331 different colors.