Gaggia Classic (2004) with GaggiMate Pro: How It Works

What changes with a GaggiMate Pro; valves as in the factory diagram. Firmware v1.10.0.

Water · Pressure release · 230 V · Low voltage · Valve · Electrics · Water · (6) Gaggia part no.

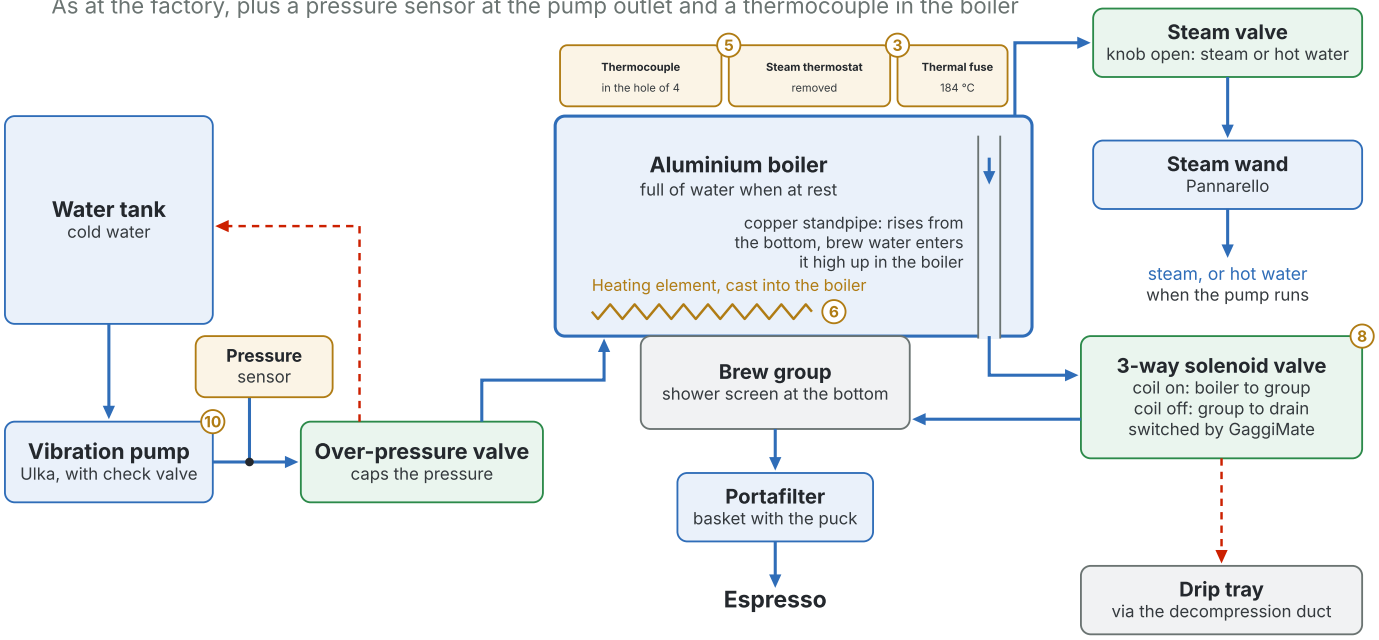
1 What happens when

Each state with the GaggiMate Pro. The switches no longer switch power, they tell the controller what to do

State	Started by	Heater	Pump	Solenoid valve	Water
Standby	15 min idle (default)	off	off	off: boiler shut	no flow
Heating, ready	touch the display, or the brew switch	PID holds target + offset	off	off: boiler shut, group to drain	stays in the boiler
Brewing	brew switch on	PID; Kff adds heat while water flows	follows the profile: pressure or flow	on: boiler to group, drain shut	tank > pump > boiler > group > cup
Shot ends	end of the profile, or brew switch off	PID	off	off: group to drain	the “pfft” into the drip tray
Steam	steam switch on	PID to the steam target, 145 °C	near target: 0.4 ml/s, up to 2 bar	off	steam out of the wand, knob open
Hot water	Water on the display, then brew switch on	PID to 80 °C	full power, 2 min at most	off	boiler > steam valve > wand, knob open

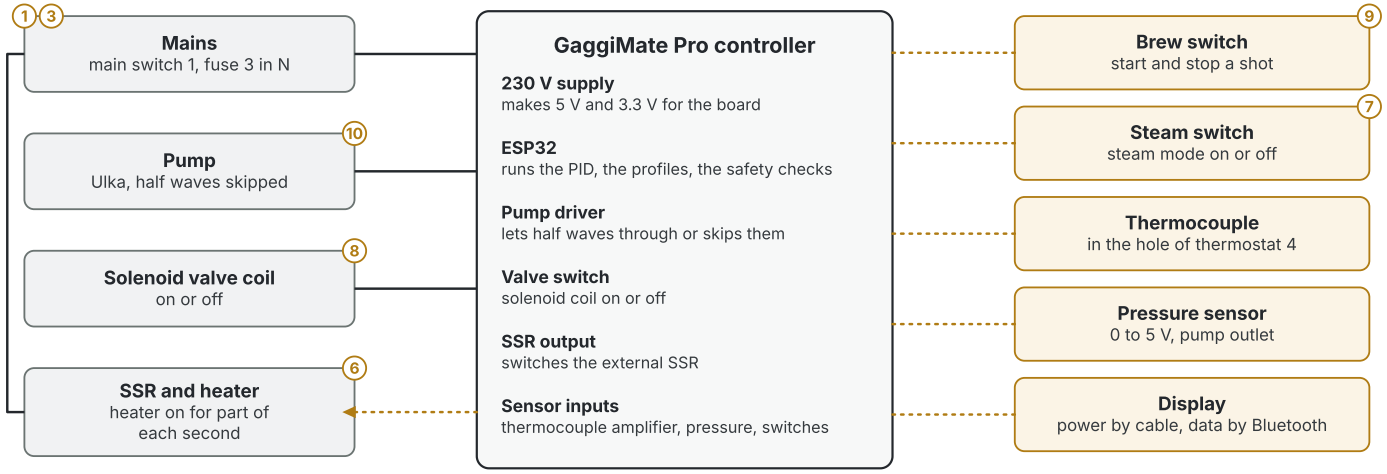
2 Water path

As at the factory, plus a pressure sensor at the pump outlet and a thermocouple in the boiler



3 Wiring with the GaggiMate Pro

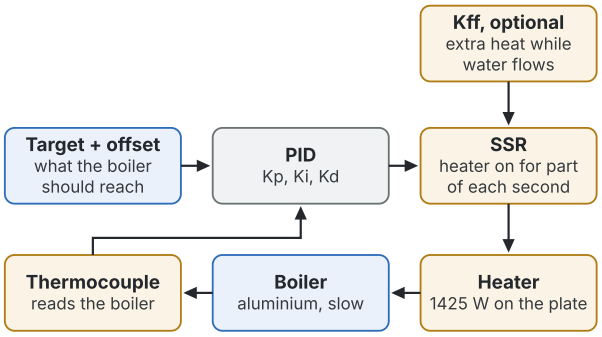
Functional view after the GaggiMate guide for the Classic (1991 to 2014). Black: 230 V, amber dotted: low voltage



Simplified, not to scale

4 Temperature: PID instead of thermostats

The controller measures the boiler and doses the heater, instead of switching it fully on and off



Target: set on the display; it is the brew temperature.

Offset: the boiler runs hotter than the water at the puck, so the controller holds target + offset (Classic preset 8 °C).

PID: reacts to the gap (Kp), to its history (Ki) and to its trend (Kd). Autotune sets all three; panel 5 shows what each one does.

SSR: a solid-state relay; it switches the heater on for 0 to 1000 ms of every second.

Kff: adds heat in step with the pump flow while the valve is open; off once the boiler is 1 °C above target.

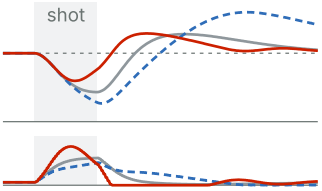
Steam and hot water: the same loop with other targets: 145 °C and 80 °C by default.

5 Tuning: what Kp, Ki, Kd and Kff change

Every second the heater power is the sum of four parts. Each chart turns one up or down (simulated, shape only)

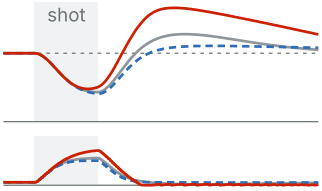
balanced — higher — lower (Kff: 0) Top: boiler temperature (dotted: target). Bottom: heater power

Kp × gap
the present: how far off now



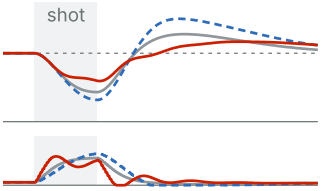
Higher: smaller dip, swings.
Lower: deep dip, slow rise.

+ Ki × gaps added up
the past: off for how long



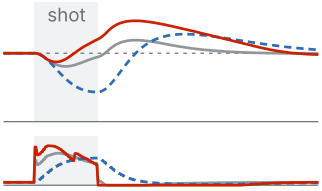
Higher: overshoots for long.
Lower: calm, slow to settle.

+ Kd × change of gap
the trend: how fast it moves



Higher: calmer, jumpy power.
Lower: more overshoot.

+ Kff × inflow heat
ahead: heat the inflow needs

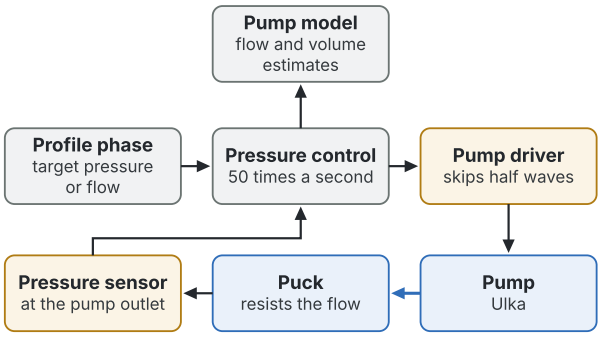


Higher: hotter in the shot.
Lower: dips during the shot.

Rule of thumb: dip in the shot → more Kff or Kp; hot after it → less Ki; swings → less Kp, more Kd. One change at a time.

6 Pressure: the pump follows the profile

The pressure sensor closes the loop; the over-pressure valve stays in place as the upper limit



Pressure target: the controller sets the pump power so the sensor reading follows the profile.

Flow target: the controller holds the flow its pump model predicts, with a pressure limit.

Pump driver: lets each half wave of the mains through to the Ulka, or skips it.

OPV: still caps the pressure; set it above the highest pressure of your profiles.

Estimates: flow and volume come from the pump model, not a flow meter; without a scale they are approximate.

Phases: each phase ends after a time, a pressure, a flow or a volume, whichever the profile sets.

7 Fault finding with GaggiMate

Typical messages and symptoms. Pull the plug before working inside

Symptom	Likely cause	What to do
Display: control inhibited	display and controller on different firmware	update the controller too
Heater and pump stop (error 5)	no sign of life from the display for 20 s	check the link; restart both
Pressure stuck near 14.5 bar	black wire of the pressure sensor loose	reseat the sensor wiring
Pressure near 16 bar	red and black sensor wires swapped	swap them back
Temperature climbs in the shot	Kff on, shot started near target	Kff 0, or start hotter
Autotune fails or hangs	not started from a cold machine	start it cold, as the guide says
Pressure test under 10 bar	solenoid valve leaks with the coil off	water at the exhaust? clean it
No heat, SSR LED dark	SSR signal cable, or no heat request	check the cable in warm-up

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