PWM Control Specifications

For ESP32 / ESPHome / Home Assistant Integration

Our circulation pumps support PWM speed control and can, in principle, be integrated with an ESP32-based system using ESPHome and Home Assistant. The following describes the pumps' PWM control functions and our interface recommendations for integration with an ESP32-based smart control system.

1. Available PWM Control Profiles

Our pumps support two selectable PWM control modes. Please select the mode that matches your control requirements.

GTPWM Mode (Heating PWM Mode)

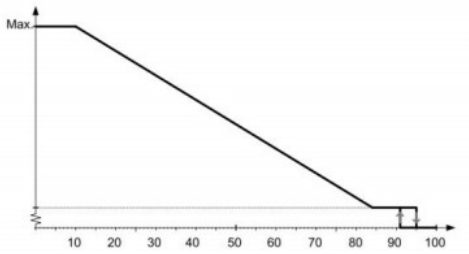
The relationship between duty cycle and pump speed is inverse: the lower the duty cycle, the higher the pump speed.

5. PWM Mode Technical Specifications

Signal Connection

Signal Input Wire (PWM) – Black、Ground Wire (GND) – Brown、Feedback Wire (FG) – Blue

GTPWM Mode (Heating PWM Mode)



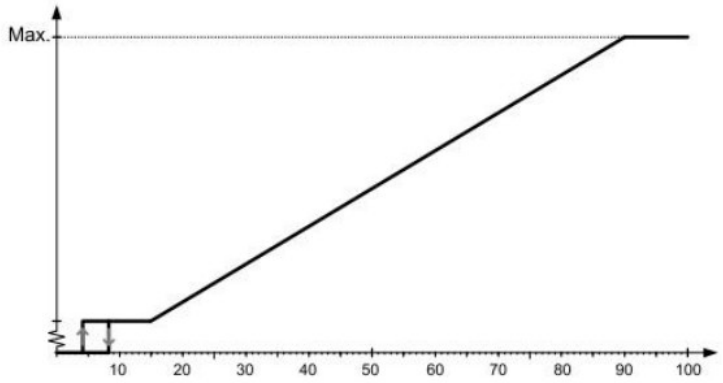
PWM Input Signal (%)	Pump State
[0, 5]	Pump runs at maximum speed.
[6, 85]	Pump speed decreases linearly from maximum to minimum.
[86, 88]	Pump runs at minimum speed.
[89, 93]	If the input signal fluctuates near the setpoint, hysteresis logic prevents the pump from starting/stopping frequently.
[94, 100]	Pump stops and enters standby mode.

PWM Input Duty Cycle	Pump State
0–5%	Pump runs at maximum speed.
6–85%	Speed decreases linearly from maximum to minimum.
86–88%	Pump runs at minimum speed.
89–93%	Hysteresis range helps prevent frequent starting and stopping.
94–100%	Pump stops and enters standby mode.

STPWM Mode (Solar PWM Mode)

The relationship between duty cycle and pump speed is direct: the higher the duty cycle, the higher the pump speed.

STPWM Mode (Solar PWM Mode)



PWM Input Signal (%)	Pump State
[0, 7]	Standby, pump stopped.
[8, 12]	If the input signal fluctuates near the setpoint, hysteresis logic prevents the pump from starting/stopping frequently.
[13, 15]	Pump runs at minimum speed.
[16, 95]	Pump speed increases linearly from minimum to maximum.
[96, 100]	Pump runs at maximum speed.

PWM Input Duty Cycle	Pump State
0–7%	Pump stops and enters standby mode.
8–12%	Hysteresis range helps prevent frequent starting and stopping.
13–15%	Pump runs at minimum speed.
16–95%	Speed increases linearly from minimum to maximum.
96–100%	Pump runs at maximum speed.

2. PWM Signal Parameters

Parameter	Specification
PWM frequency range	40 Hz–4 kHz
Recommended PWM frequency	1 kHz
Permitted PWM signal voltage range	5–25 V
Recommended PWM signal voltage range	5–15 V

3. ESP32 System Compatibility and Interface Recommendation

An ESP32 running ESPHome can generate the PWM control signal, while Home Assistant can provide the user interface for setting pump operation. Based on the available PWM specifications, integration is feasible in principle.

Electrical interface recommendation:

The ESP32 normally operates with a 3.3 V logic output. To ensure compatibility with the pump's PWM input, we recommend using a suitable external signal-level conversion circuit. Although the pump's PWM input voltage range is 5–25 V, with 5–15 V recommended, we recommend converting the ESP32's 3.3 V PWM output to 5 V. A 5 V signal level is the preferred and safer option for this application. Please do not connect the ESP32 GPIO directly to the pump's PWM input without a suitable interface circuit.

4. Pump Behaviour When the PWM Signal Is Lost

According to the information provided by our R&D team, a lost or interrupted PWM signal is treated as a 0% duty cycle:
GTPWM mode: the pump runs at maximum speed.
STPWM mode: the pump stops and enters standby mode.

Important: The response to a physically disconnected signal, controller power loss, or an open input should be verified under the actual wiring and operating conditions.

5. Integration and Testing

We recommend using a 1 kHz PWM frequency, selecting the appropriate PWM profile, and using a suitable level-shifting circuit to convert the ESP32's 3.3 V output to 5 V. Final compatibility should be verified through connection and sample testing.