SmarPID M5 PRO

Quick Start Guide

SmartPID M5 PRO basic concept

Designed for the industrial and pro market to manage any thermal regulated application bridging the gap between complex and expensive industrial controller (PLC) and simple on/off thermostat.

The flexibility, feature richness and smartness make smartPID M5 PRO a unique product on the market that can replace legacy thermostat and manage any application in a smart way !

SmartPID M5 PRO characteristics

- Dual Independent control channels (2 in 1 controller)
- Fully configurable PID-PWM control or ON/OFF control with hysteresis
- DIN 1/16" 48×48 compact enclosure
- Graphical 320×240 TFT colour display with interactive menu and GUI
- 3 push buttons for GUI interaction
- DC 5-36V power supply OR 110/220 AC power supply
- 5 different temperature probes type selectable
  - NTC 10k
  - RTD (PT100)
  - Digital 1-wire DS18B20 or
  - K-type thermocouple probes (with external adapter)
  - Support of wireless Bluetooth temperature sensors

- 4 different outputs that can be assigned by SW to each control channel
  - 2x DC out 5-36V 2.5A for heavy load driver
  - 2x 10 A realy
- WIFI and Bluetooth connectivity
- Loudspeaker
- uSD card memory support for data logging
- I2C expansion port
- OTA Firmware upgrade
- On Board EEPROM for data persistence and auto recovery after power outage

SmartPID M5 PRO back panel pinout

| TEMP PROBE	SW1 SW3	SW2 SW4
NTC 10K	OPEN	OPEN
PT100	OPEN	CLOSE
DS18B20	CLOSE	OPEN
THERMOCOUPLE MAX31850	CLOSE	OPEN
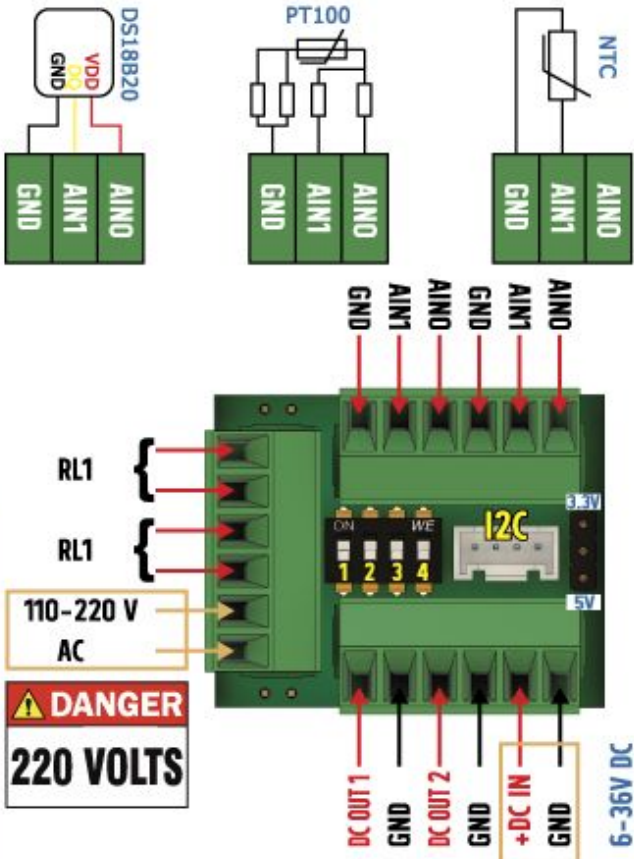
DIP switch configuration for temp probes selection

Temperature probe selection need to be done either via the SW
menu and configuring the back panel dip switch

|	SW1	SW2
NTC 10K	Open	Open
PT100	Open	Close
DS18B20	Close	Open
Thermocouple MAX31850	Close	Open
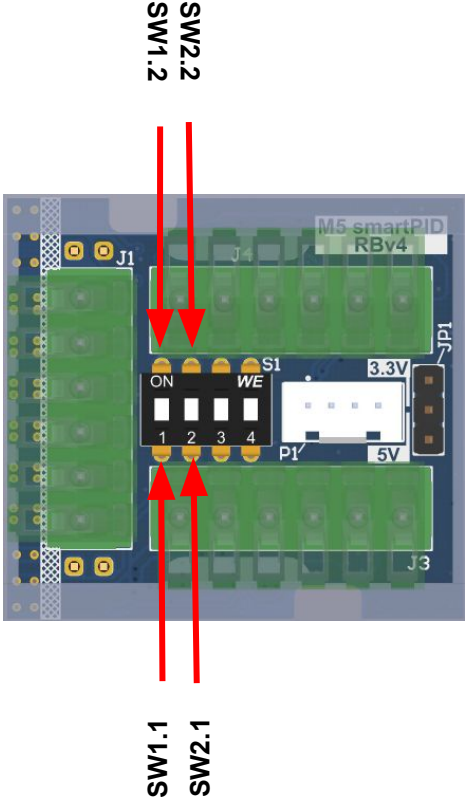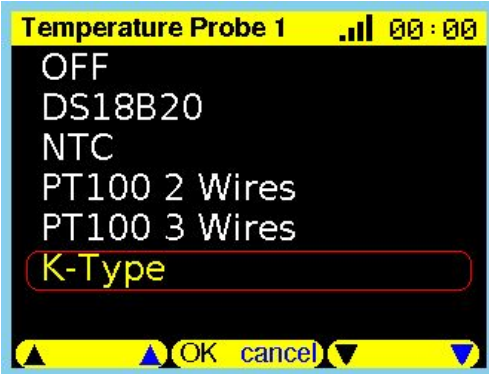
ThermoCouple Adapter (MAX31850)
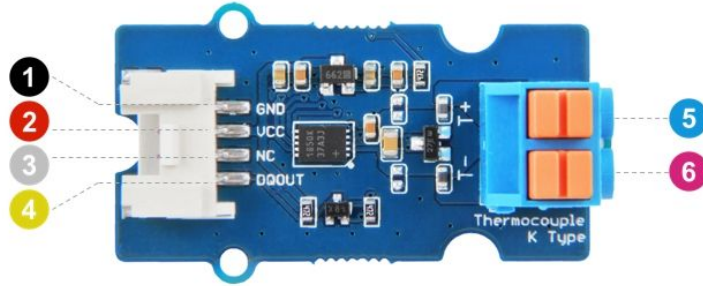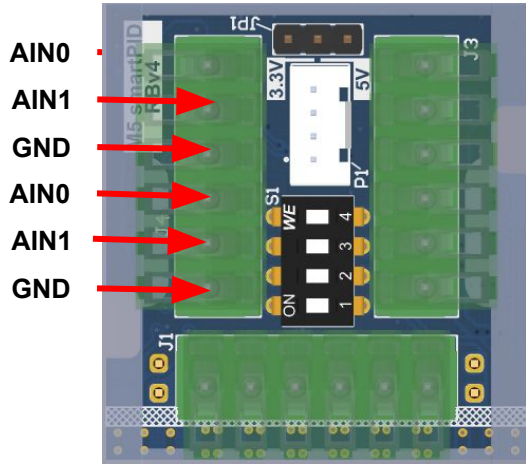
Connect
1) GND ⇒ GND of CH1 or CH2
2) 3V3 ⇒ AIN0 of CH1 or CH2
4) DATA ⇒ AIN1 of CH1 or CH2
5)6) thermocouple

Select DIP switch for K-type (SW1 close, SW2 open)
Select in SW configuration the K-type temp proble

Bluetooth temperature sensor pairing

- Navigate to the BT Sensor config menu (HW setup)
- Select "Pairing" menu then perform sensor scan
- The BT-05 sensors must be powered on (press central button)
- Select the BT05-xxxxx sensor and confirm
- Check the pairing status in the "status" menu
- In the BT config menu you can configure
  - Sample Time
  - Transmission Power
- Once paired the sensor BT05-xxxxxx will be available in the HW config/sensor type menu as any other wired sensor

Status LED

Power on/off
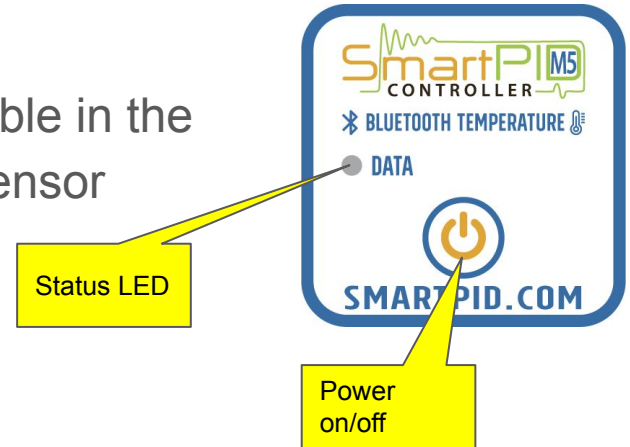
SmartPID M5 PRO main menu

	Start select standard or advanced mode (profiles), select the set point and start the control process
	Monitor temperature on both channel is monitored. With up/down button is possible to select the output (DC or relay) and with SET activate the output
	Setup • **HW setup** --> the HW resources are configured and assigned to I/O process • **Unit Parameter**--> the main parameter that control the PID process behavior are configured in this menu • **Process parameter**--> smart thermostat process specific parameter are configured in this menu • **PID auto tune**--> this is a special section to configure and run the auto tune process to help end user to calculate critical parameters Kp,Ki,Kd that regulate PID behavior

	WIFI • Check wifi connection status • Select WiFi connection mode (AP/client/Auto) • Check WiFi parameters (SSID/PWD/IP) • Check Server parameters (MQTT address/credentials
	Profile • add/edit/delete temperature profiles • up to 10 different profiles with up to 10 ramp/soak valued
	Info • display SW version • start SW upgrade over the air (OTA) • display serial number • display status of various components (wifi,cloud server)

SmartPID M5 PRO - HW set up

Parameter	Description
Control Mode	*Select Heating/Cooling/Thermostatic mode*
Heating/Cooling mode	*Select control algorithm PID or ON/OFF*
Multi control	*Select number of control channels*
Out1 Heating/Cooling	*Assign to CH1 control process output resources (relay or DC)*
Out2 Heating/Cooling	*Assign to CH1 control process output resources (relay or DC)*
BT sensor config	*Configure Bluetooth temperature sensor*
T. probe 1 & 2	*Select temperature probe for CH1 and CH2 (*) (NTC/DSD18B20/PT100/thermocouple/bluetooth)*

(*) user need to configure DIP switch on back plane

SmartPID M5 PRO - unit parameters

Parameter	Description
Temperature Unit	*Select temperature unit visualization Celsius or Fahrenheit*
Probe 1 & 2 calibration	*Adjust temperature probe reading with fixed offset +-5c*
NTC Beta	*Select NTC probe beta factor*
Auto Resume	*Enable/Disable process auto resume function after power supply failure or process crash*
Button beep	*Enable/disable button press sound*
Clock SetUp	*Configure real time clock either manually or via NTP*

SmartPID M5 PRO - process parameter

Parameter	Description
Set Point 1 & 2	*Default temperature set point for CH1 and CH2*
Timer 1 & 2	*Default countdown timer for CH1 and CH2*
PID 1&2 Kp Ki Kd	*Define the proper constant value for the PID algorithm tuning for CH1 /CH2*
Reset DT 1 & 2	*Define temperature variation from set point to reset the count down timer*
Fridge delay 1 & 2	*Define the duration of the fridge protection timer (0 means no delay logic)*
Sample Time	*Define the sample time of temperature in ms*
PWM Period	*Define the PWM period/window size for PWM control in ms*
Ramp/Soak	*Define if the control logic is dynamic or static (see proper section)*
Sound Alarm	*Define for each alarms if the buzzer is activated or not*

SmartPID M5 PRO - profile definition

In the menu "profile" it's possible to create/modify/view/delete temperature profiles to be selected in the advanced running mode.

For each point of the profile user should define:

SP X that is the starting set point temperature

Ramp Time Y that is the time to move set point from X to X+1

Soak time Z that is the time the temperature is kept constant

If the ramp time = 0 the set point is moved instantly (step)

If the next step has soak time=0 (or is the eight steps) the SP is moved to that value and is kept constant until the process abort by user
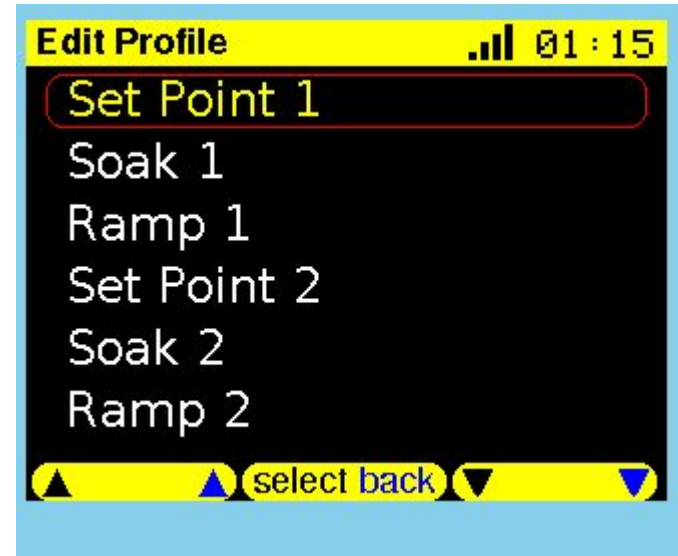
SmartPID M5 PRO - ramp/soak

Ramp/soak = STATIC

Soak time start when ramp time finish independently from temperature. Each soak period is predefined and is independently from the current temperature and set point.

After each soak period a new set point is defined and a RAMP time defines the time needed to reach the new set point. SP is moved linearly from SPx to SPx+1 with increment of 1c/40f

If the next step hast soak time=0 (or is the eight steps) the SP is moved to that value and is kept constant until the process abort by user

Ramp/soak = DYNAMIC

Soak time start when temperature reach the set point. When the temperature reached the SPx the soak period is started. After each soak period a new set point is defined and a RAMP time defines the time needed to reach the new set point. SP is moved linearly from SPx to SPx+1 with increment of 1c/40f. If the next step hast soak time=0 (or is the eight steps) the SP is moved to that value and is kept constant until the process abort by user.

SmartPID M5 PRO - monitor mode

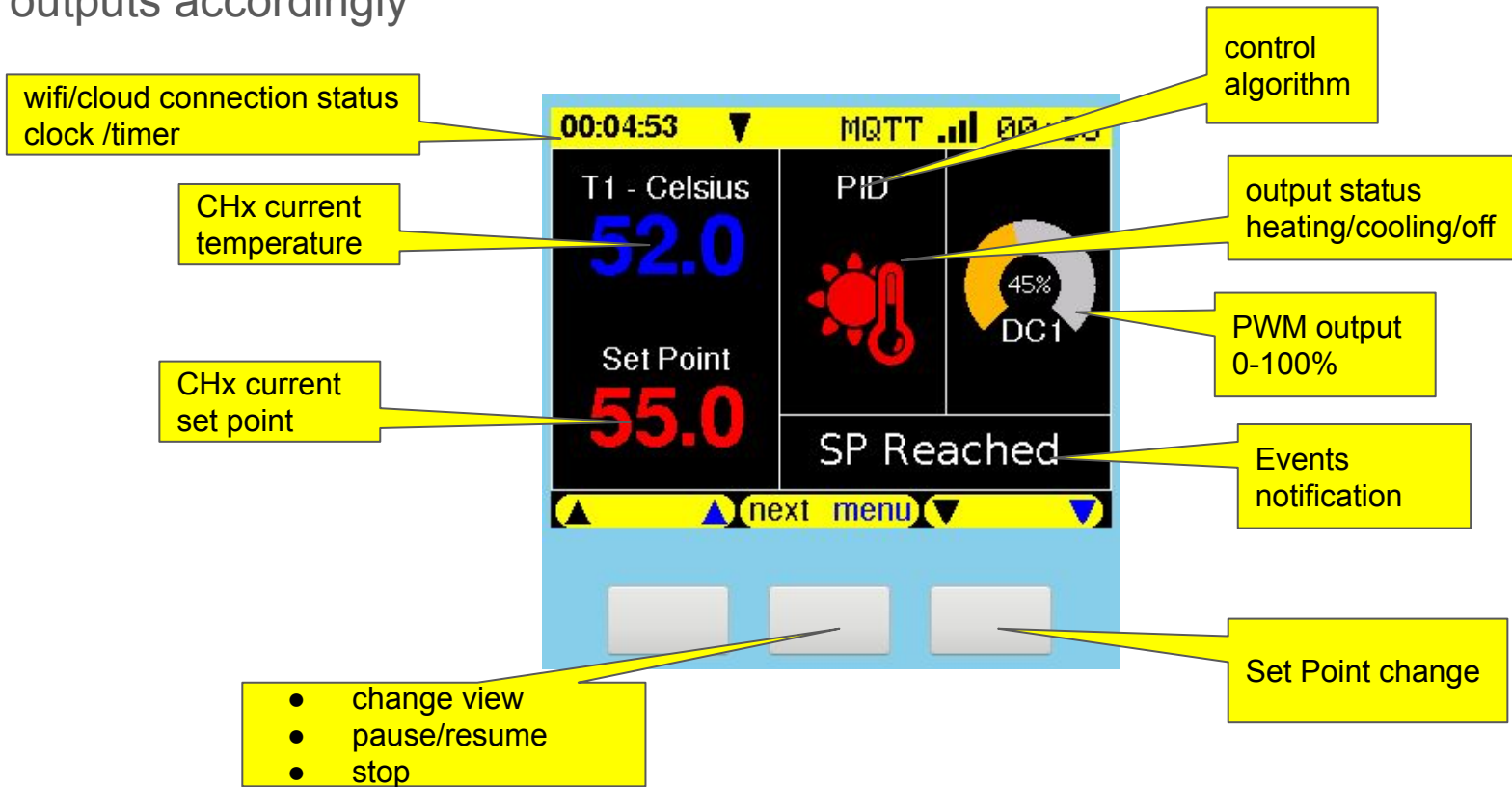Monitor mode allows to measure temperature of both channels and activate manually the output (relay or DC)

Monitor MQTT 00:03

T1 - Celsius
30.0

100% DC1

44% DC2

T2 - Celsius
28.0

ON RL1

OFF RL2

done   exit

- wifi/cloud connection status
- clock

- DC output status PWM 0-100%

- Relay output status PWM 0-100%

CH1/CH2 temperature

- Activate Output
- Long press EXIT

- Select Output
- Regulate PWM

SmartPID M5 PRO - run mode

In run mode smartPID execute the control loop (PID or ON/OFF) and drives the outputs accordingly

control algorithm

wifi/cloud connection status
clock /timer

output status
heating/cooling/off

CHx current
temperature

PWM output
0-100%

CHx current
set point

Events
notification

Set Point change

- change view
- pause/resume
- stop

00:04:53   MQTT   00:00

T1 - Celsius   PID

52.0

Set Point   45%
DC1

55.0

SP Reached

next menu

SmartPID M5 PRO - run mode - graphic view

graphic mode reports the plot of CHx temperature, Set Point , PWM out
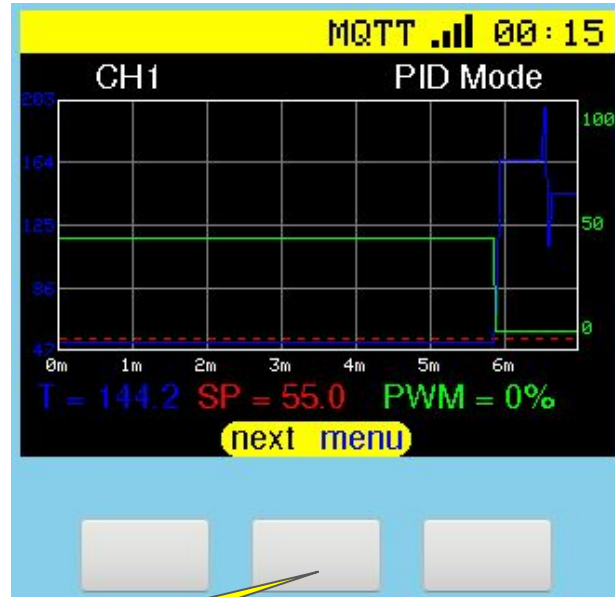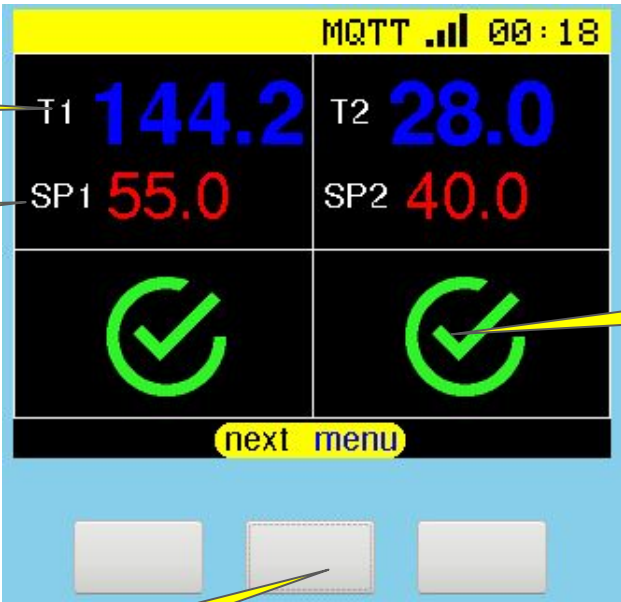
Change view
Stop

SmartPID M5 PRO - run mode - syntetic view

in this mode a systensys of both channel status and output is reported

CHx current temperature

CHx current set point

output status CHx heating/cooling/off

Change view Stop