



# SmarPID M5 PRO

Quick Start Guide (V2)



<https://smartpid.com>

smartpid@arzaman.com

# 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.

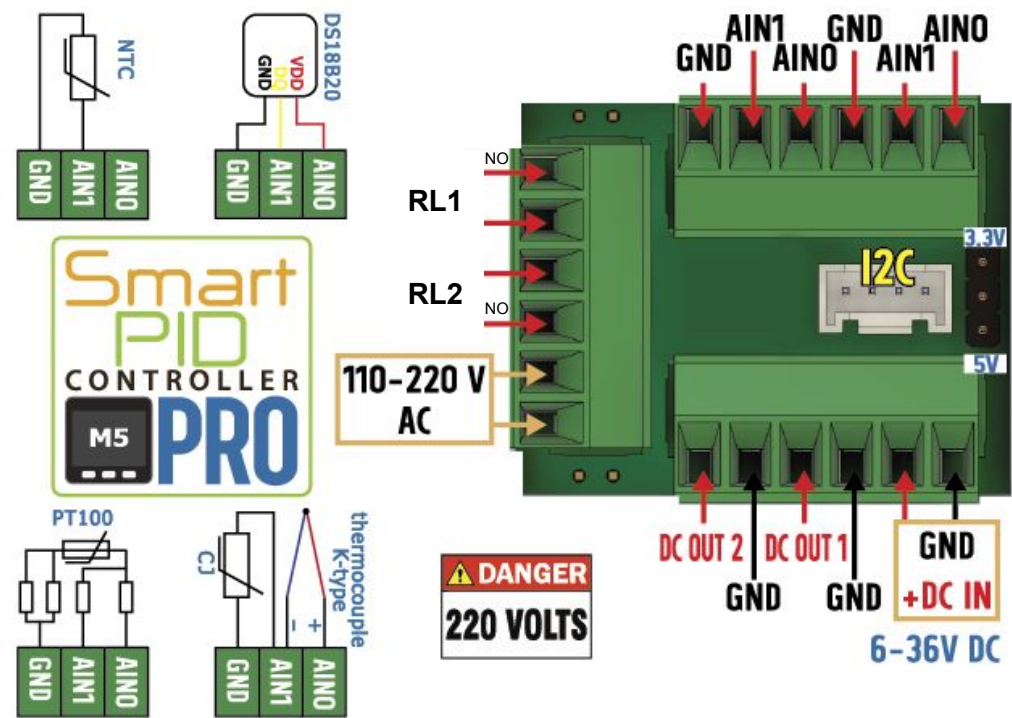
The flexibility, feature richness and smartness make smartPID M5 PRO a unique product on the market that can replace legacy thermostat and manage any application in a smart way !



# SmartPID M5 PRO characteristics

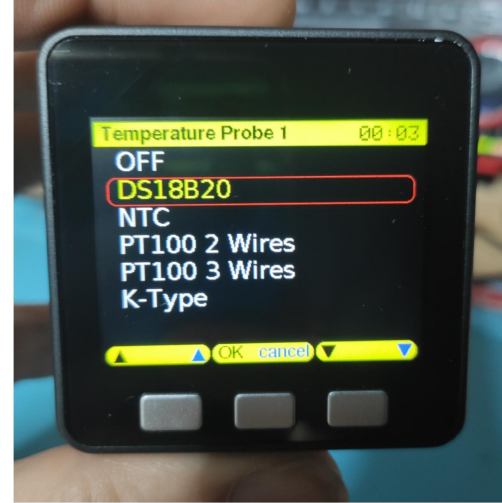
- Dual Independent control channels (2 in 1 controller)
- Fully configurable PID-PWM control or ON/OFF control with hysteresis
- DIN 1/16" 48×48 compact enclosure
- Graphical 320×240 TFT colour display with interactive menu and GUI
- 3 push buttons for GUI interaction
- DC 5-36V power supply OR 110/220 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 relay
- 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



# Temperature probes selection

Temperature probe selection need is do done via the SW menu



**NTC 10K**



**DS18B20**

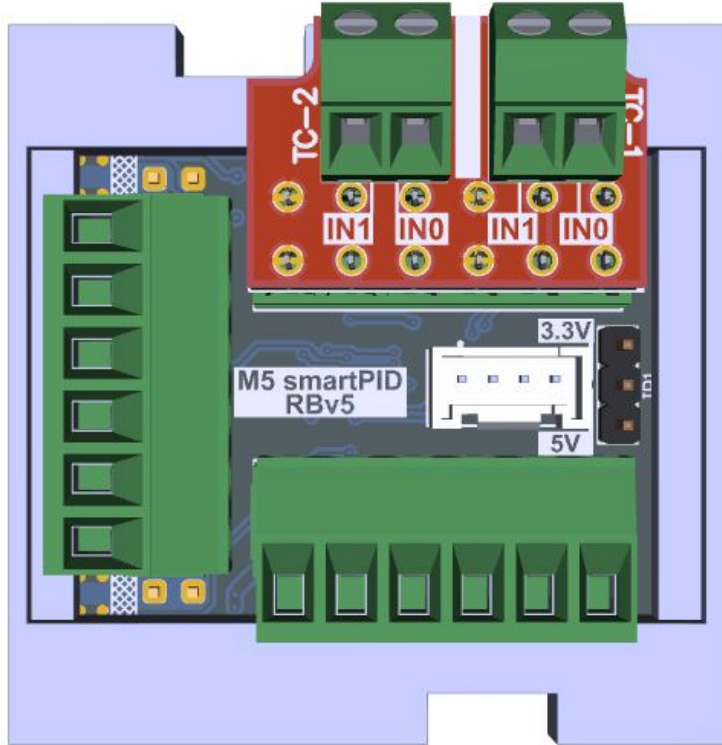


**K-type**

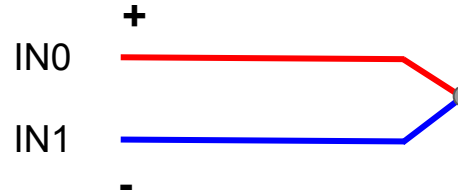
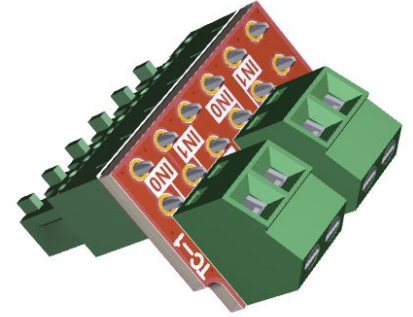


**Wireless**

# ThermoCouple Adapter



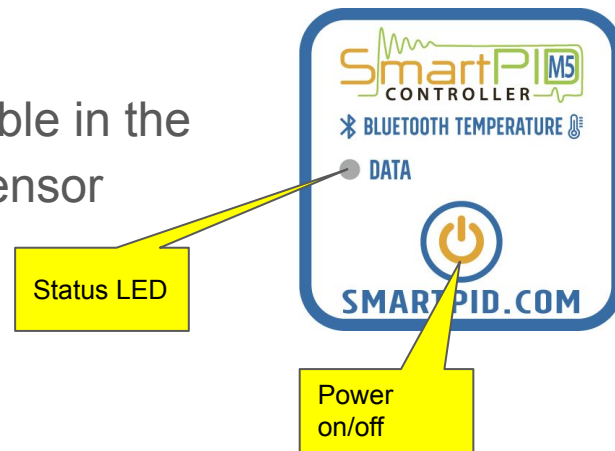
connect the adapter in the M5 pro temperature probe socket



connect thermocouple to the adapter terminal block

# 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



# 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  $K_p$ ,  $K_i$ ,  $K_d$  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         | <i>Select Heating/Cooling/Thermostatic mode</i>   |
| Heating/Cooling mode | <i>Select control algorithm PID or ON/OFF</i>   |
| Multi control        | <i>Select number of control channels</i>  |
| Out1 Heating/Cooling | <i>Assign to CH1 control process output resources (relay or DC)</i>                             |
| Out2 Heating/Cooling | <i>Assign to CH1 control process output resources (relay or DC)</i>                             |
| BT sensor config     | <i>Configure Bluetooth temperature sensor</i>   |
| T. probe 1 & 2       | <i>Select temperature probe for CH1 and CH2<br/>(NTC/DSD18B20/PT100/thermocouple/bluetooth)</i> |

# SmartPID M5 PRO - unit parameters



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

# SmartPID M5 PRO - process parameter



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

# 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:

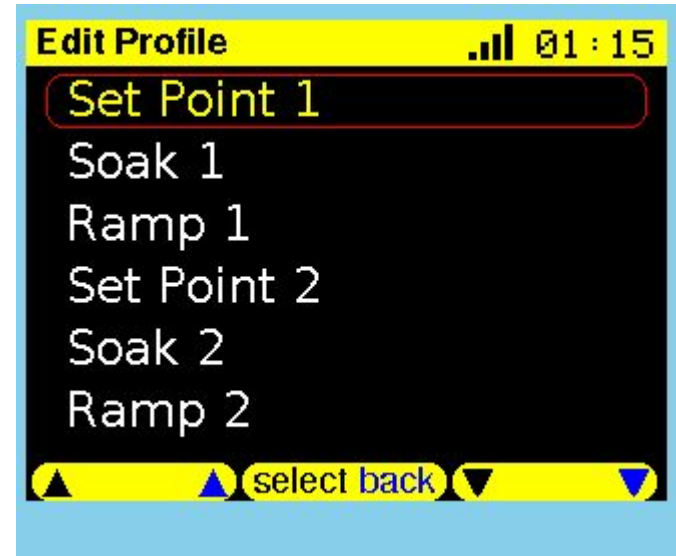
SP X that is the starting set point temperature

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

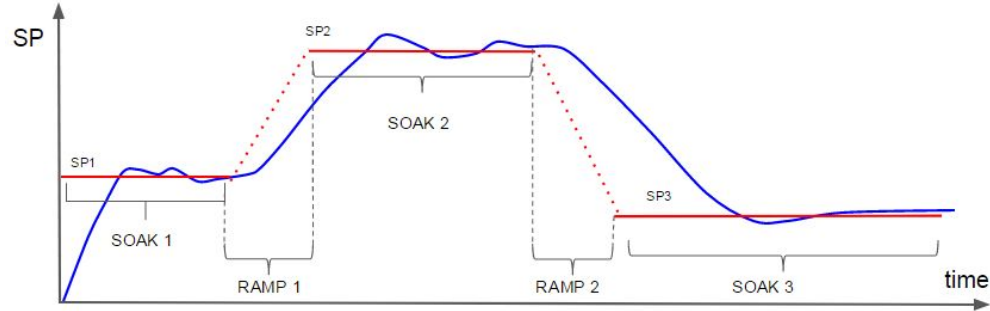


## Ramp/soak = STATIC

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.

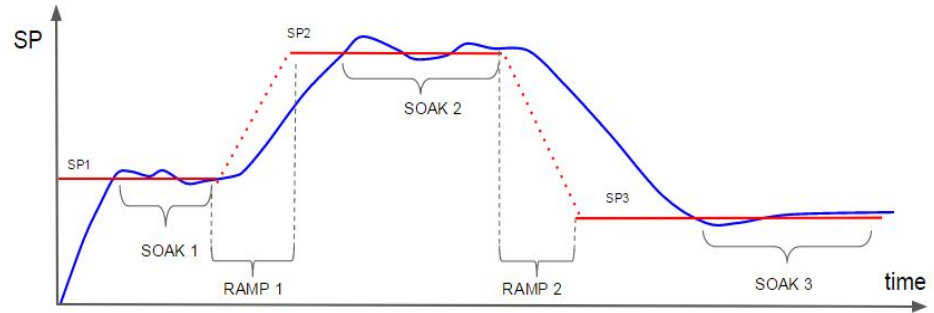
After each soak period a new set point is defined and a RAMP time defines the time needed to reach the new set point. SP is moved linearly from  $SP_x$  to  $SP_{x+1}$  with increment of  $1c/40f$

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



## Ramp/soak = DYNAMIC

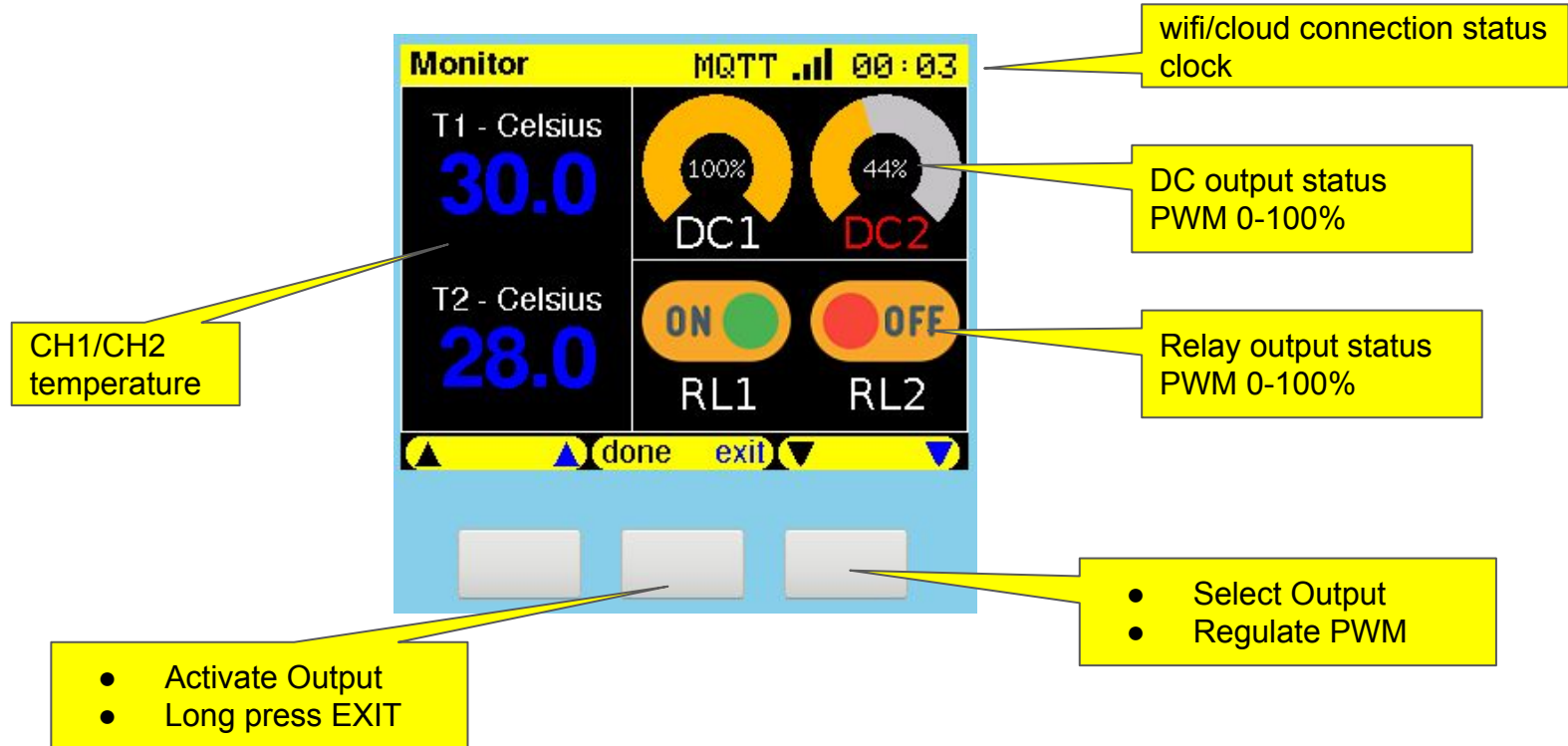
Soak time start when temperature reach the set point. When the temperature reached the  $SP_x$  the soak period is started. After each soak period a new set point is defined and a RAMP time defines the time needed to reach the new set point. SP is moved linearly from  $SP_x$  to  $SP_{x+1}$  with increment of  $1c/40f$ . 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 - monitor mode



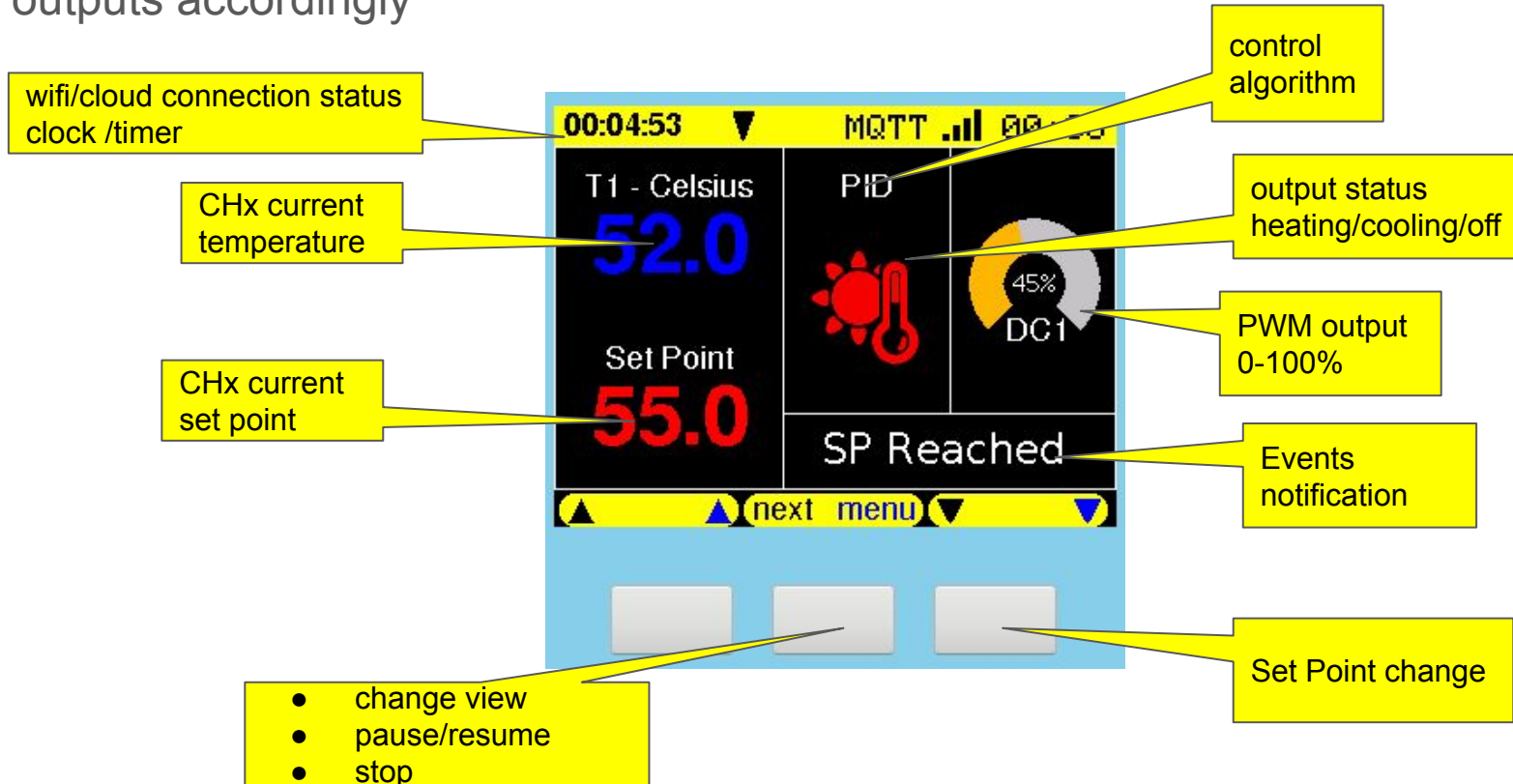
Monitor mode allows to measure temperature of both channels and activate manually the output (relay or DC)



# SmartPID M5 PRO - run mode



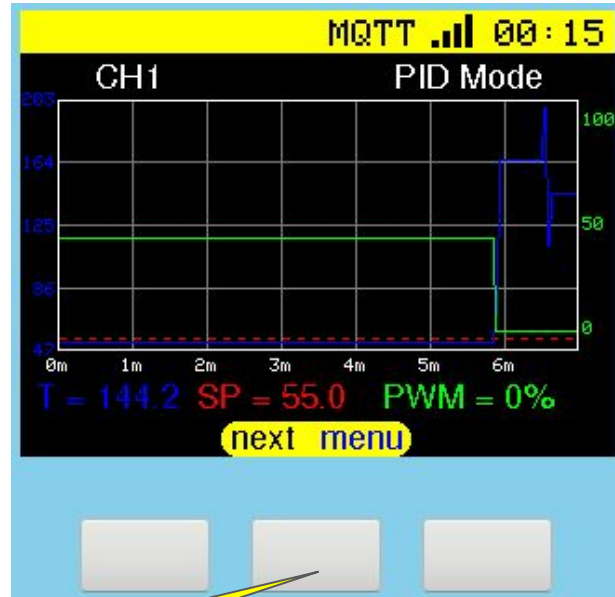
In run mode smartPID execute the control loop (PID or ON/OFF) and drives the outputs accordingly



# 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 systemsys of both channel status and output is reported

