Datasheet

HomeMaster Thermostat for OpenTherm



Part No. OTT-R1 · Hardware V1.0 · Firmware 1.1.3 Document No.: DS-OTT-R1-V1.0 · November 2026

ISYSTEMS AUTOMATION S.R.L. · HomeMaster®

1. Description

Wall-mounted ESP32 room thermostat that acts as an **OpenTherm master** for modulating boilers. 2.8″ colour display, rotary encoder and four keys, 24 GHz presence radar, on-board temperature, humidity and ambient-light sensors.

The heating control loop — schedule, room hysteresis, weather-compensated flow setpoint — runs on the device. Home Assistant is used for visibility and remote control, not as a dependency: with the network down the room keeps being heated to the stored schedule.

The outside temperature and the room temperature can each be taken from the device's own source — the boiler's outside sensor, the on-board SHT40 — or from a Home Assistant entity, selected per temperature. Weather compensation can also be switched off entirely, in which case the boiler is asked for a fixed flow setpoint.

ESPHome is pre-installed. The device appears in Home Assistant over the native ESPHome API, with no MQTT and no register mapping.

2. Key features

- OpenTherm master, full boiler telemetry and modulating control
- Local control loop — no cloud, no internet, no Home Assistant required
- 2.8″ IPS colour display, 320 × 240, ST7789V
- Rotary encoder and four perimeter keys
- HLK-LD2410C 24 GHz presence radar, UART plus instant GPIO output
- SHT40 temperature and humidity sensor on a thermally isolated tab
- BH1750 ambient light sensor
- Improv Wi-Fi onboarding over Bluetooth and USB serial
- OTA updates over HTTP (vendor-managed) and over the ESPHome API
- Open hardware (CERN-OHL-W v2) and firmware (MIT)

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3. Absolute maximum ratings

Parameter	Min	Max	Unit
Supply voltage at +V / 0V	−30	+30	V DC
Operating ambient temperature	0	+40	°C
Storage temperature	−20	+70	°C
Relative humidity, non-condensing	0	90	%

Stresses beyond those listed may cause permanent damage. The supply input is reverse-polarity protected by a series Schottky diode.

4. Electrical characteristics

Parameter	Value
Nominal supply	24 V DC, SELV, **not supplied with the device**
Supply current, measured across operating states	50–100 mA
Input power, maximum	2.4 W
Energy source classification	ES1 throughout; PS1
Equipment class	Class III, no protective earth
OpenTherm interface	Master, 2-wire, polarity-insensitive
OpenTherm cable length	50 m max., twisted pair
USB	USB-C, serial only, CP2102

Current and power figures are those measured on the assembled unit at 24 V DC with the backlight at 100 % and both radios active, as recorded in safety assessment SAFETY-OTT-R1-2026-001.

5. Radio

	Wi-Fi / Bluetooth	Presence radar
Module	ESP32-WROOM-32U-N16	HLK-LD2410C
Band	2402–2480 MHz	24.00–24.25 GHz
Max. radiated power	≤ 20 dBm EIRP	−5.70 dBm e.i.r.p., measured
Antenna	U.FL, fitted inside the enclosure	On-module
Standards	802.11 b/g/n, BLE	FMCW presence detection

Detection range of the radar is configurable per gate from Home Assistant (**Radar Max Move Gate**, **Radar Max Still Gate**, **Radar Timeout**).

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6. Display and controls

Item	Value
Panel	2.8″ IPS, 320 × 240, ST7789V, SPI
Backlight	LEDC PWM at 25 kHz, above the audible range
Backlight level, awake	85 %
Encoder	Quadrature, 2 counts per detent
Keys	Four: ◀ ▶ ▲ ▼
Screen refresh	Every 2 s, and immediately on any input
Screen blanking	Radar-driven, 45 s after the room empties

Four pages — Climate, Boiler, Schedule, System — each with a menu reached with ▲ or ▼. Every setting the heating loop uses, the comfort windows included, can be set from the glass without Home Assistant. Colour carries one meaning each: amber a running circuit, red a fault or a lost link, green a healthy state where a word says so, white a measurement, dim grey no reading. The interface is described in full in Chapter 6 of the user manual.

7. Sensors

Sensor	Part	Interface	Address
Temperature and humidity	SHT40	I²C	0x44
Ambient light	BH1750	I²C	0x23

8. GPIO map

Function	GPIO
OpenTherm in / out	21 / 26
Display SCK / MOSI	5 / 23
Display CS / DC / RST	17 / 19 / 13
Display backlight PWM	25
I²C SDA / SCL	18 / 22
Radar UART TX / RX	14 / 16
Radar presence output	4
Encoder A / B	32 / 33
Key ▶ / ▲ / ▼ / ◀	34 / 35 / 36 / 39

GPIO5 is a strapping pin, used here as the display clock. It is driven only after boot and carries no external pull resistor. GPIO34/35/36/39 are input-only; each key has an external 10 kΩ pull-up to 3V3 and a 100 nF debounce capacitor.

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9. Terminals

Terminal	Function
+V	24 V DC supply
0V	0 V
OT+	OpenTherm bus, boiler terminal 1
OT−	OpenTherm bus, boiler terminal 2

10. Mechanical

Enclosure: Italtronic EYE BOX, ABS to UL94 V-0, white (RAL 9003), wall mounted.

Dimension	Value	Italtronic part
Body outer diameter	Ø 94.6 mm	P61610001G
Front aperture	Ø 82.2 mm	P61610001G
Ring height	20.5 mm	P61610001G
Wall base, round	Ø 88.7 mm, 10.5 mm deep, keyhole centres 58 mm	P61610002B
Wall plate, rectangular	140 × 80 mm, 9 mm thick, aperture 45 × 30 mm, fixings 83.5 / 60 mm	P61610014A
PCB carrier	Ø 90.3 mm, 7.5 mm deep; PCB holes 58 × 36 mm, Ø 2.4 mm	P61610001V

Assembled unit: base plate 152 × 107 mm, round body Ø 95 mm, total height from base to screen 47 mm.

Mounting: the round base takes two screws into the wall at 58 mm centres. The rectangular plate screws onto a flush-mounting box, with fixing holes at both **60 mm** — the round European device box, bore Ø 68 mm — and **83.5 mm** — the Italian three-module box, 503. Cable aperture 45 × 30 mm. What decides whether a box fits is the distance between its device screws, not the shape of the box.

11. Default entity set

Sensors: Room Temperature, Room Temperature Raw, Room Humidity, Ambient Light, Heating Target, Flow Setpoint By Curve, Boiler Water Temperature, Boiler Return Temperature, Boiler DHW Temperature, Boiler CH Pressure, Boiler Relative Modulation Level, Outside Temperature, Outside Temperature In Use, Uptime, WiFi Signal, Radar distances.

Binary sensors: Boiler Flame On, Boiler CH Active, Boiler DHW Active, Boiler Fault Indication, Boiler Low Water Pressure, Boiler Flame Fault, Boiler Service Request, Comfort Window, Heat Demand, Presence, Radar Target.

Numbers: Comfort Temperature, Eco Temperature, Boost Offset, Room Hysteresis, Room Sensor Offset, Curve Cold/Warm Outside, Curve Cold/Warm Flow, Fixed Flow Setpoint, Boiler DHW Setpoint, Boiler Max CH Setpoint, UTC Offset, Radar gates and timeout.

Selects: Outside Temperature Source, Room Temperature Source, Summer Time.

Written from Home Assistant: Room Temperature Input, Room Humidity Input, Outside Temperature Input. A value written to any of them is ignored once it is older than 30 minutes.

Datetimes: Weekday and Weekend Comfort Start and End.

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Room Temperature Raw, Room Humidity Raw, Boiler Return Temperature and Boiler DHW Temperature are created disabled in Home Assistant and have to be enabled on the device page before they record.

Switches: Heating Automatic, Weather Compensation, Boost Until Next Change, Boiler CH Enable, Boiler DHW Enable.

Other: Backlight (light), Firmware Update (update), IP Address and ESPHome Version (text sensors).

12. Defaults

Setting	Default
Comfort Temperature	21.5 °C
Eco Temperature	19.0 °C
Boost Offset	1.0 °C
Room Hysteresis	0.3 °C
Weekday comfort window	17:00 – 23:00
Weekend comfort window	09:00 – 23:00
Weather curve	−15 °C → 65 °C, +15 °C → 35 °C
Weather Compensation	On
Fixed Flow Setpoint	55 °C
Boiler DHW Setpoint	50 °C
Boiler Max CH Setpoint	80 °C
Outside Temperature Source	Boiler, then Home Assistant
UTC Offset	+1 h
Summer Time	Europe
Room Temperature Source	Built-in sensor
Control interval	30 s
Screen timeout	45 s

13. Compliance

Directive 2014/53/EU (RED), Directive 2011/65/EU and (EU) 2015/863 (RoHS), Directive 2012/19/EU (WEEE), Regulation (EU) 2023/988 (GPSR). See DoC-OTT-R1-V1.0 and Chapter 12 of the user manual.

14. Ordering information

Part number	Description
OTT-R1	HomeMaster Thermostat for OpenTherm, wall mount, 24 V DC

The thermostat ships with its enclosure and mounting parts. A 24 V DC supply is not included and is ordered separately — a DIN-rail unit in the distribution board or the boiler cabinet, or a module rated for installation inside a

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deep flush box.

15. Manufacturer

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