

EUL32 — EnOcean interface for USB and Wi-Fi

The EUL32 is a hardware component for DIY use. It connects EnOcean radio in the 868 MHz band to a computer via USB or to an IP network via Wi-Fi; Ethernet is available through an expansion board. The installed firmware determines what the EUL32 does. The device is shipped without firmware; the customer installs it.

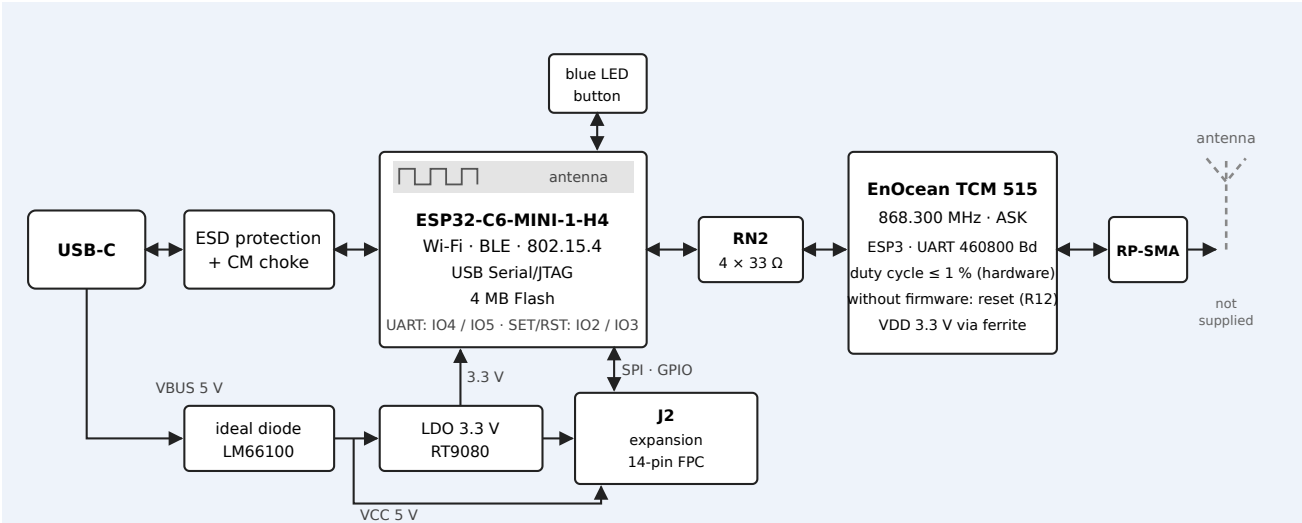


EUL32, circuit board V3.4: RP-SMA socket, EnOcean TCM 515, ESP32-C6-MINI-1, USB-C

Features

- EnOcean radio module EnOcean TCM 515 (868.300 MHz, ASK, ESP3 interface)
- RP-SMA connection for an external 868 MHz antenna (not supplied)
- Espressif ESP32-C6-MINI-1-H4: IEEE 802.11b/g/n/ax (Wi-Fi 6), 2.4 GHz, Bluetooth LE 5.3, IEEE 802.15.4 (Thread, Zigbee)
- USB-C: power, serial port and firmware installation over one cable
- Expansion connector J2 (SPI, GPIO, power), e.g. for the Ethernet expansion W5500EXT (SPI, connector mirrored: pin $n \leftrightarrow$ pin $15-n$)
- LED, push button, firmware installation in the web browser without development tools

Block diagram



Technical data

Power supply	
Supply	5 V DC via USB-C (sink, 5.1 kΩ on CC1/CC2); alternatively 5 V via J2 pin 2 (expansion board); back-feed into USB blocked by LM66100
Current consumption (USB)	approx. 67 mA without Wi-Fi (TCM515 receiving), approx. 110 mA receiving Wi-Fi, up to approx. 410 mA peak when transmitting Wi-Fi (calculated)
Voltage regulator	RT9080-33 (3.3 V)
EnOcean	
Radio module	EnOcean TCM 515 (868.300 MHz, ASK, ESP3 interface)
Frequency, modulation	868.300 MHz; ASK, 125 kbit/s
Frequency band	868.000 – 868.600 MHz: at most 25 mW e.r.p., duty cycle ≤ 1 %
Transmit power	+10 dBm (typical); at most +10.8 dBm
Sensitivity	−93 dBm; receiver blocking class 2 per EN 300 220-1
Duty cycle	1 % per hour, enforced by the TCM515 in hardware
Interface to the processor	ESP3 over UART, 460800 Bd (programming mode 57600 Bd); 33 Ω series resistors (YC124-JR-0733RL) in SET, RST, TX, RX
Current of the radio module	25 mA receive, 25 mA transmit, 5 mA idle
Antenna connection	RP-SMA socket (X1) for an external 868 MHz antenna
Antenna requirements	passive, approx. 50 Ω, for 868 MHz, gain at most 0 dBd; recommended: VSWR ≤ 3:1
USB	
Receptacle	USB Type-C (Molex 105450-0101)
Function	USB device “USB JTAG/serial debug unit” of the ESP32-C6 (serial port + JTAG)

Protection	ESD protection USBLC6-2SC6, common-mode choke DLW21SN900HQ2L
Processor and memory	
Module	Espressif ESP32-C6-MINI-1-H4
Processor	ESP32-C6, 32-bit RISC-V, up to 160 MHz, 512 KB SRAM
Flash	4 MB
EEPROM	not fitted (footprint present)
Radio (ESP32-C6)	
Wi-Fi	IEEE 802.11b/g/n/ax (Wi-Fi 6), 2.4 GHz; 2400 – 2483.5 MHz; max. 19.81 dBm EIRP
Bluetooth	Bluetooth LE 5.3; 2400 – 2483.5 MHz; max. 18.46 dBm EIRP
IEEE 802.15.4	IEEE 802.15.4 (Thread, Zigbee); 2405 – 2480 MHz; max. 10.40 dBm EIRP
Antenna	PCB antenna in the module
Radio module, certificate	EU-type examination certificate SN23C0148 (rev. A, 2023-09-28) for ESP32-C6-MINI-1, RED Annex III module B, notified body Sporton International (USA) Inc., number 2907
Distance to persons	During radio operation keep a distance of at least 20 cm between the device and persons.
Radio as delivered	As delivered, the EUL32 does not transmit: it is supplied without firmware, and without firmware the TCM515 stays in reset. Only firmware installed by the customer can transmit; with “USB-serial emulation” the TCM515 transmits only on command of the software on the computer, and Wi-Fi stays off.
Indicators and controls	
Blue LED	blue LED (IO8, active low), controlled by firmware
Push button	push button “BOOTLOAD” on the bottom side (IO9); hold while plugging in: download mode for firmware installation
Environment and mechanics	
Operating temperature	0 ... +40 °C
Storage temperature	–20 ... +60 °C
Humidity	5 ... 85 % RH, non-condensing
Place of use	dry indoor locations
Design	bare circuit board, no enclosure; degree of protection IP00 (without enclosure)
Circuit board	4 layers, outline 54.0 × 19.0 mm
Overall dimensions	54.0 × 19.0 × 7 mm (L × W × H, height incl. circuit board and RP-SMA socket)
Weight	7 g

Connections

Antenna

RP-SMA socket (X1) for an external 868 MHz antenna. An antenna is not supplied. Use only antennas with these properties: passive, approx. 50 Ω , for 868 MHz, gain at most 0 dBd; recommended: VSWR $\leq 3:1$. EnOcean certified the TCM 515 with a whip antenna (86 mm wire at RF_50, ground plane at least 38 × 18 mm).

USB-C

The EUL32 is powered and accessed through USB-C. The computer sees it as USB device “USB JTAG/serial debug unit” of the ESP32-C6 (serial port + JTAG). The SBU contacts also carry a service UART (ESP32-C6 UART0) on SBU1 (TX) and SBU2 (RX, 499 Ω); ordinary USB 2.0 cables do not connect these contacts.

Expansion connector J2

Hirose FH34SRJ-14S-0.5SH, 14-pin, FPC, 0.5 mm pitch, bottom side. All signals use 3.3 V logic, ground is GND.

Pin	Signal	ESP32-C6	Use
1	GND	—	ground (GND)
2	VCC	—	5 V (output when USB-powered / input from expansion)
3	VDD	—	3.3 V (LDO output)
4	IO0	GPIO0	W5500: INT
5	EN	—	reset (active low)
6	IO20	GPIO20	W5500: MISO
7	IO19	GPIO19	W5500: SCLK
8	IO21	GPIO21	W5500: MOSI
9	IO7	GPIO7	free
10	IO6	GPIO6	free
11	BOOT	GPIO9	parallel to push button
12	TXD0	GPIO16	UART0 TX (also USB-C SBU1)
13	RXD0	GPIO17	UART0 RX; W5500: CS
14	GND	—	ground (GND)

Firmware

The device is shipped without firmware; the customer installs it. It is installed from the web browser (Chrome, Edge or Opera (Web Serial)) at <https://install.busware.de/EUL/>. The following firmware is currently offered for the EUL32:

Firmware	Function
USB-serial emulation	Transparent bridge USB $\leftrightarrow$ TCM515 (ESP3), e.g. for FHEM
EnOcean $\leftrightarrow$ TCP Bridge (cdc2net)	TCM515 reachable over TCP on the network (Wi-Fi or Ethernet)

Functions and operation are described in the documentation of each firmware.

Notes for integration into other products

- Do not cover the antenna area of the ESP radio module with metal, ground planes or metal enclosure parts; Espressif recommends 15 mm clearance around the antenna inside an enclosure.
- For EnOcean radio use only antennas that meet the requirements above. An antenna with higher gain is not covered by the radio approval of the TCM 515.
- J2 supplies expansions with 5 V and 3.3 V; an expansion board may power the EUL32 with 5 V through J2 pin 2, the ideal diode prevents back-feed into the USB port.
- Whoever builds the EUL32 into their own product assesses the conformity of that product themselves.

Ordering information

Type	Article no.	Scope of delivery
EUL32	EUL32-OEM	EUL32 (circuit board EUL V3.4), without antenna
Accessory	309.130L, 309.131L	enclosure for self-assembly, available as an option

Disposal

Waste electrical equipment: do not dispose of with household waste. WEEE reg. no. (Germany) DE 54401172.



Revision history

Rev.	Date	Change
1.0	2026-09-25	First edition
1.1	2026-09-25	Antenna socket corrected: RP-SMA instead of SMA
1.2	2026-09-26	Product photos instead of a rendering from the fabrication data

Manufacturer

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Subject to technical change. This datasheet describes the hardware; the functions depend on the installed firmware.