WB-CARRIER-BOARD is an evaluation and development board for WHITE-beet modules.
It contains WHITE-BEET module populated on the carrier board and protected with a plastic cover.

Available for purchase from CODICO GmbH

WHITE-beet carrier board (WB-CARRIER-BOARD) can be used for both the vehicle side (EV) and the charging station side (EVSE), but particular application depends on particular WHITE-beet module installed on the WB-CARRIER-BOARD.

WHITE-beet carrier board contains the WHITE-beet module with an STM32F745 microcontroller which may run ISO15118 stack firmware or SLAC/Bridging software or be open for own development using Open SDK.

The carrier board can be powered either by using USB-C cable or +5V DC input.
WHITE-beet carrier board dimensions are 115 mm x 135 mm.

Main elements of WHITE-beet carrier board (WB-CARRIER-BOARD) are shown on the image below and described in the Table 1.
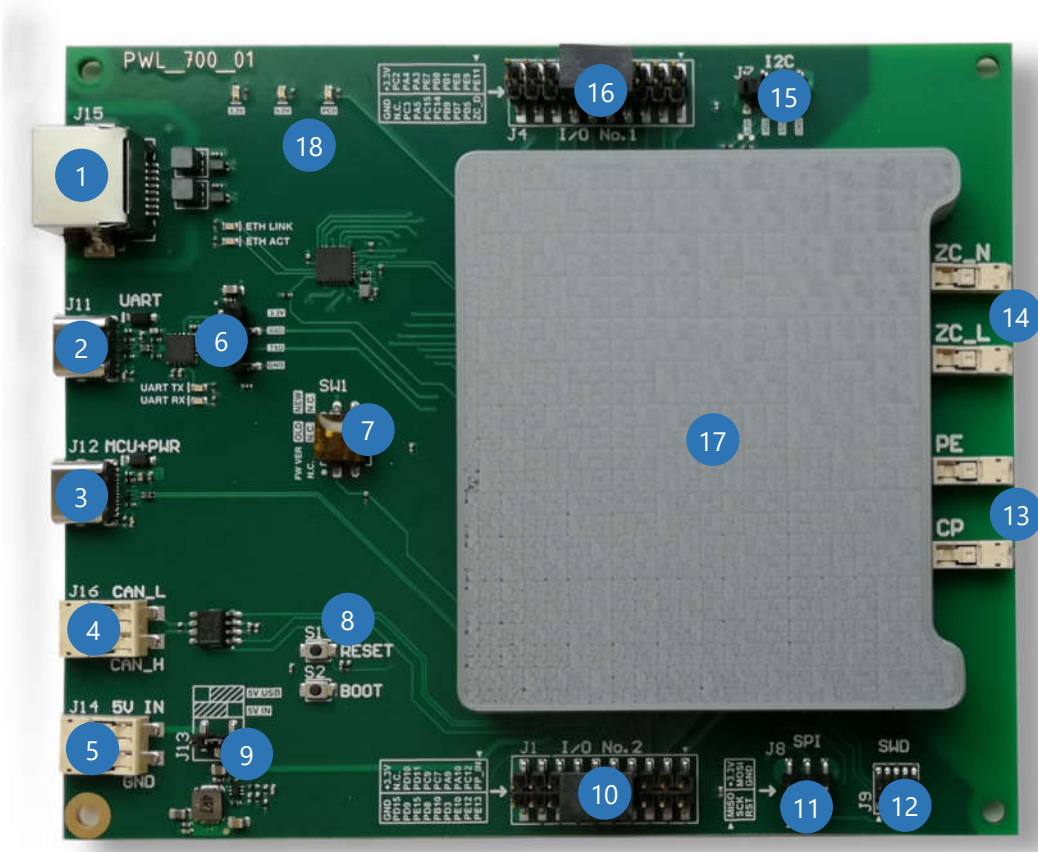

TABLE 1. WB-CARRIER-BOARD MAIN ELEMENTS

Item number	Description
1	J15 Ethernet interface RJ45 connector
2	J11 USB-C connector for UART debugging console
3	J12 USB-C connector for +5V DC power supply and USB communication
4	J16 CAN interface connector
5	J5 Alternative +5V DC power supply connector
6	J10 4-pin UART debugging console header
7	SW1 Micro switch to select active QCA7005 firmware version
8	S1 RESET button and (S2) Boot button (required for software development)
9	J13 Jumper for +5V DC power supply source selection
10	J1 20-pin GPIOs header #2
11	J8 6-pin SPI interface header
12	J9 10-pin SWD interface header for programming and debugging
13	Control Pilot (CP) and Protected Earth (PE) connectors
14	Zero-cross input (ZC_L / ZC_N) connectors
15	J7 4-pin I2C interface header
16	J4 20-pin GPIOs header #1
17	Plastic cover for WHITE BEET module (placed for a safety reasons)
18	J15 Ethernet interface RJ45 connector

The carrier board can be powered either by using J12 (**#3**) USB-C port or connector J14 (**#5**) +5V DC power input. Jumper J13 (**#9**) is used to select power supply source.

TABLE 2. J13 JUMPER - POWER SUPPLY SOURCE SELECTION

J13 jumper position	Description
1-2	+5V DC input J14 is used for power supply
2-3	USB-C connector J12 is used for power supply

Ethernet connector J15 (**#1**) provides 10/100 Mbps Ethernet connection (based on KSZ8081R ETH PHY). Used as one of major communication interfaces to control WHITE beet module software and FW updates.
Ethernet PHY utilizes WHITE beet pins 3, 4, 5, 6, 7, 8, 9, 10, 11, 13.

USB-C connector J11 (**#2**) could be used for debug output and control purpose. It connected to FTDI FT230X UART-to-USB converter.
It is also possible to use the UART directly on 4-pin header (**#6**), utilizes WHITE beet pins 75, 76.

USB-C connector J12 (**#3**) also has a connection to USB port of STM32F745, utilizes WHITE beet pins 46, 47.

CAN interface is found on J16 (**#4**) and based on TCAN330D transceiver (utilizes WHITE beet pins 40, 41, 42).

Micro switch SW1 (**#7**) is used to switch between QCA7005 firmware versions OLD (FW v1.1.0-02) and NEW (the latest FW v3.0). Connected to WHITE beet pin 32.

Button S1 (**#8**) is RESET button, it connected to WHITE beet pin 31.
Button S2 has no use with exiting software and connected to BOOT pin of SFM32F745 MCU (WHITE beet pin 51).

Pin header J1 (**#10**) has connection to WHITE beet modules shown in the Table 3.

TABLE 3. J1 HEADER PINS CONNECTION

J1 pin	WHITE beet module pin	**J1** pin	WHITE beet module pin
1	55 (PP_IN)	2	21 (PE13)
3	54 (PC12)	4	22 (PE12)
5	50 (PA10)	6	23 (PE10)
7	49 (PA9)	8	24 (PD3)
9	44 (PC7)	10	25 (PB10)
11	43 (PC9)	12	26 (PD8)
13	38 (PD11 / SPI_TX_PENDING)	14	27 (PE15)
15	29 (PD10)	16	28 (PD9)
17	N.C.	18	30 (PD15)
19	+3.3V	20	GND

Pin header J4 (**#16**) has connection to WHITE beet modules shown in the Table 4.

TABLE 4. J4 HEADER PINS CONNECTION

J4 pin	WHITE beet module pin	J4 pin	WHITE beet module pin
1	20 (PE11 / HCI_GPIO20)	2	71 (ZC_DIGITAL)
3	19 (PE9 / HCI_GPIO21)	4	73 (PD5 / HCI_GPIO22)
5	18 (PE8)	6	74 (PD7 / HCI_GPIO23)
7	17 (PB1 / HCI_GPIO24)	8	79 (PC13 / HCI_GPIO25)
9	16 (PB0 / HCI_GPIO26)	10	80 (PC14)
11	15 (PE7)	12	81 (PC15)
13	14 (PA3 / HCI_GPIO27)	14	82 (PA5 / AIN_0)
15	84 (PA4 / IF_SELECT_1)	16	83 (PC3)
17	85 (PC2 / IF_SELECT_0)	18	31 (RESETN)
19	+3.3V	20	GND

Pin header J8 (**#11**), also marked as SPI, gives access to STM32F745 SPI bus (internal SPI2) and has pinout shown in the Table 5.

TABLE 5. J8 HEADER SPI BUS PINS

J8 pin	WHITE beet module pin	J8 pin	WHITE beet module pin
1	35 (MISO / PB14)	2	+3.3V
3	37 (SCK / PD4)	4	36 (MOSI / PB15)
5	77 (RST or NSS / PB9)	6	GND

Pin header J9 (**#12**), also marked as SWD, provides access to Serial Wire Debug interface and could be used for programming STM32F745 and 32Mbit NOR flash on WHITE-beet module (e.g. using programmer ST-Link/V2). J9 pin header has 1.25 mm pitch unlike the other pin header on the board with 2.54 mm pitch. Pinouts is shown in the Table 6.

TABLE 6. J9 HEADER SWD PINS

J8 pin	Description	J8 pin	WHITE beet module pin
1	+3.3V	2	52 (SWDIO)
3	GND	4	53 (SWCLK)
5	GND	6	N.C.
7	N.C.	8	N.C.
9	GND	10	31 (RESETN)

Connectors marked as CP and PE (**#13**) have to be connected to Control Pilot and Protected Earth lines and used for HomePlug AV/GreenPHY powerline communication in EV-charging applications (for WHITE-beet-P and WHITE-beet-E modules).

When WHITE-beet-H module is populated on the carrier board CP and PE connectors could be attached to AC mains, DC line or "dead wires" for HomePlug AV/GreenPHY PLC communication.

Connectors marked as ZC_L and ZC_N (**#14**) could be connected to AC mains to provide zero-cross detector input in necessary (used for WHITE-beet-E and WHITE-beet-H modules).

Pin header J7 (**#15**), also marked as I2C, provides access to I2C bus of STM32F745 and has pinout shown in the Table 7. Please note that SDA and SCL lines are pulled-up to +3.3V with 5.1k Ohm resistors on the carrier board.

TABLE 7. J7 HEADER I2C PINS

J7 pin	WHITE beet module pin
1	+3.3V
2	78 (SCL / PB8)
3	72 (SDA / PB7)
4	GND

There are 3 LED populated on the carrier board (**#17**). They are marked as 3.3V (to indicate +3.3V DC presence), 5V (to indicate +5V DC presence) and PC0 (it is connected to pin 1 of WHITE-beet module and used for SW Heartbeat function).

WHITE-beet carrier boards have 7 hardware options (dependent on WHITE-beet module configuration) and could be ordered using the part numbers in the Table 8.

TABLE 8. WB-CARRIER-BOARD ORDERING OPTIONS

Part number	Description
WB-CARRIER-BOARD-ES #298820	Carrier board contains WHITE-beet-E module with EVSE side e-mobility HW with transparent bridging / SLAC software
WB-CARRIER-BOARD-EI #298821	Carrier board contains WHITE-beet-E module with EVSE side e-mobility HW with ISO 15118 / DIN 70121 / SAE J2847/2 software stack (support of V2G, EMI, PnC, BPT)
WB-CARRIER-BOARD-EO #298819	Carrier board contains WHITE-beet-E module without embedded software included, SDK open option
WB-CARRIER-BOARD-PS #298823	Carrier board contains WHITE-beet-P module with PEV side e-mobility HW with transparent bridging / SLAC software
WB-CARRIER-BOARD-PI #298825	Carrier board contains WHITE-beet-P module with PEV side e-mobility HW with ISO 15118 / DIN 70121 / SAE J2847/2 software stack (support of V2G, EMI, PnC, BPT)
WB-CARRIER-BOARD-PO #298822	Carrier board contains WHITE-beet-P module without embedded software included, SDK open option
WB-CARRIER-BOARD-H #298828	Carrier board contains WHITE-beet-H module with Home control / smart grid HW with transparent bridging software

More PEV / EVSE - configured eMobility related products can be found in CODICO Sample Shop:
https://www.codico.com/en/products/powerline-communication