TpB-PW-W123
TpB-PW-M123
TpB-PW-L123

TapBus Power

Datasheet

23 April 2024
Version 1.2

Contents

1 Introduction

TapBus Power provides:

- Power for external slaves modules.
- Wire connection via RS485 (Modbus-RTU) to TapBus slaves.
- Wire connection via Ethernet to any host devices.
- Wireless connection via NFC, Bluetooth Smart "Low Energy" (BLE), and Wi-Fi (IEE 802.11 b/g/n)
- LoRa and LTE-M/NBIOT through optional extension boards.

Part Numbers

Part Number	Wireless protocol	Wire protocol	Prefix	Security	Casing	Power
TpB-PW-W123	NFC-BLE-Wi-Fi	Ethernet RS-485	12	Software	DIN Rail	85 ~ 305 VAC 5V-12V
TpB-PW-M123	NFC-BLE-Wi-Fi and LTE-M / NB-IOT	Ethernet RS-485	12	Software	DIN Rail	85 ~ 305 VAC 5V-12V
TpB-PW-L123	NFC-BLE-Wi-Fi and LoRa	Ethernet RS-485	12	Software	DIN Rail	85 ~ 305 VAC 5V-12V

Radio channels

NFC and BLE channels allow direct, local connection between TapBus Power and a mobile app that can be automatically generated.

Wi-Fi can be configured for either local connection to mobile apps or connection to networks to send data or alarms to a cloud-based platform using the MQTT protocol.

Long-range, low power RF channels allow to send data or alarms to a cloud-based platform using the MQTT or the LoRaWAN protocol. For connection to cloud platforms, messages and data can easily be formatted using the embedded virtual machine.

- Near Field Communication (NFC) Type5 tag (ISO/IEC 15693)
- Bluetooth Low Energy (BLE 4.2)
- Wi-Fi (IEEE 802.11 b/g/n)
- LoRa (LoRaWAN 1.0.3) *(optional extension board)*
- LTE-M/NBIOT *(optional extension board)*

Modbus RTU (over RS485)

TapBus Power module acts as a Modbus RTU client (master) and accesses specific addresses or address ranges in the memory space of the servers (slaves) that are available on the bus.

Ethernet

Ethernet (802.3) can be used either to communicate through a Modbus-TCP link (as Server), or to send requests to the lwM2M.

Security features

- Users management
- Configurable access profiles
- Configurable, encrypted passwords
- AES-128/256 module-level data encryption
- Configurable secure pairing with NFC

Casing

- Din Rail case (size4).

Electrical characteristics

- Input voltages:
  - AC: 85VAC to 305VAC (50 or 60Hz)
  - DC: 24V
- Output voltages: 5V or 12V (selectable by physical switch)
- Max output power: 8.8W
- Power consumption: from 8.5 to 47 mA at 24VDC
- Standby mode: 3.6 mA at 24VDC

Temperature ranges

- Operating temperature: [-30°C, +70°C] ([-30°C, +50°C] for maximum power)
- Storage temperature: [-30°C, +70°C]

Acceptance

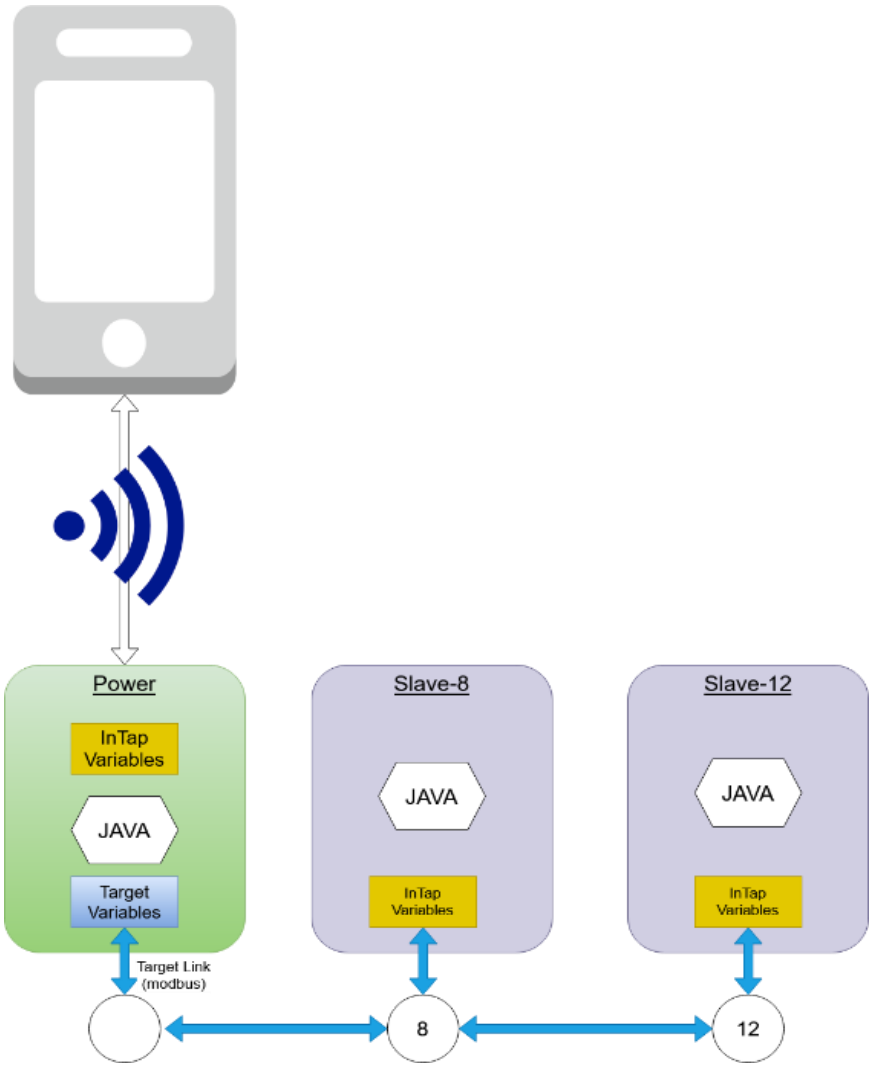
- RF certification: *(In testing)* CE (Europe), FCC (USA), IC (Canada).
- Green certification: REACH and RoHS compliant

2 Architecture

A TapBus-Power module is supposed to be one element among others in a complete TapBus system. But, thanks to its high flexibility, it could be also used outside such a system.

2.1 Typical application diagram

The TapBus system acquires, processes and transmits data to a mobile application or to a server on the Cloud. In this architecture, TapBus Power can be considered as a gateway for a complete system that comprises several acquisition modules connected together by a Modbus-RTU link.



This configuration is the most common, but not the only solution. For example, we could also consider:

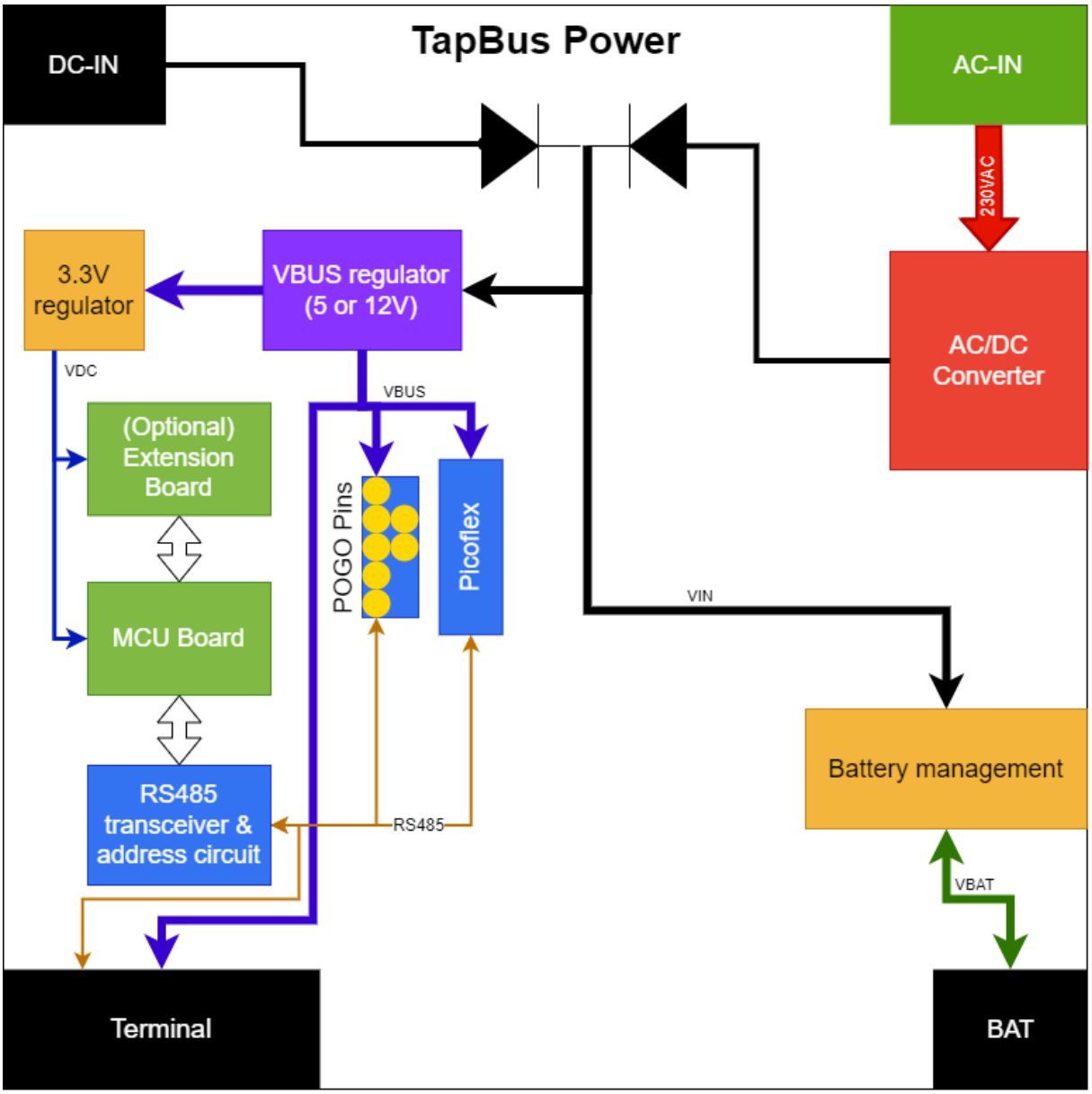
- A single acquisition module (with its NFC interface). Note that a single module would require a power source (either 5V or 12V).
- On the contrary, a TapBus Power module could be used a simple gateway (like a Tapioca) connected, for example, to various sensors via Modbus, without any TapBus acquisition modules.

But in most cases, the above configuration will be the preferred one. In this case, we distinguish two types of modules:

- TapBus Power module: it is the central unit that manages:
  - power supply (DC 24V or AC 230V input),
  - relations with the Cloud and/or mobile applications (via wireless connectivity)
  - an optional backup battery (12V).
- TapBus IO input/output modules (acquisition and control). Different types of TapBus IO modules will be developed according to demand. The modules below are already available:

Reference	Features	Description
TpB-IO-LI12LO4	12 logic inputs 4 logic outputs	Inputs: state, counters, timers or frequency meter. Outputs: state, pulses or PWM.
TpB-IO-LI4LO8TC	4 logic inputs 8 logic outputs 1 TIC	Inputs: state, counters, timers or frequency meter. Outputs: state, pulses or PWM. TIC = Enedis Information Signal (Enedis is the French Electricity Network operator)
TpB-IO-AI16	16 analog inputs	Inputs: 4-20mA, 0-10V, 0-2V, 2 or 3 wires resistances (Pt100, Pt1000 …).
TpB-IO-W6	6 current inputs 1 voltage input	Single-phase power/energy measurement
TpB-IO-WT6	3x2 current inputs 3 voltage inputs	Three-phase power/energy measurement

2.2 Power management



2.3 Wire connectivity

2.3.1 RS485 (Modbus RTU)

In the standard Embedded code, TapBus Power acts as ModBUS master. In other words, variables can be considered as being on the target systems (TapBus IOs). The API provides high level functions such as “ReadVariable” or “WriteVariable”. A standard CSV file can be used to import the list of the available Modbus RTU registers.

2.3.2 Ethernet (Modbus TCP or lwM2M control)

Two uses can be considered for Ethernet communication:

- **Socket communication to the lwM2M:** By default, the TapBus Power socket server is available on the Ethernet port. This socket server is the one that handles lwm2m requests (as for Wi-Fi). If needed, the Ethernet port can replace the Wi-Fi to access the lwm2m.

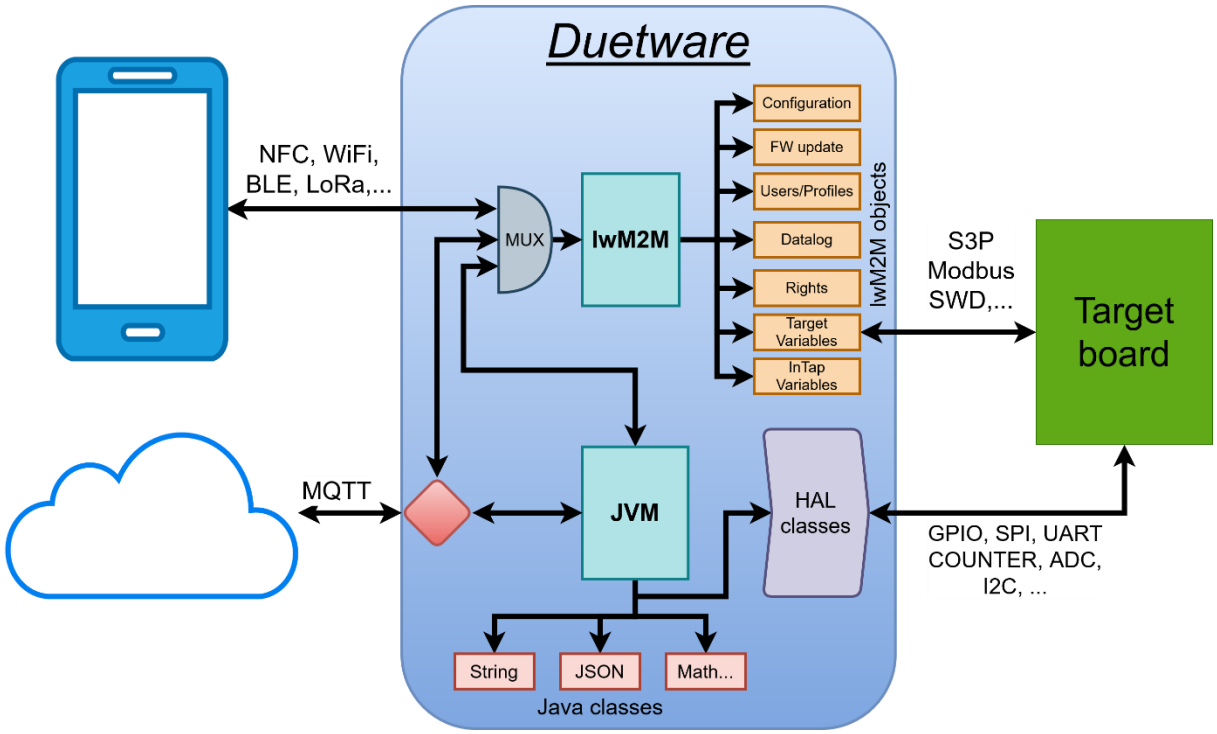
- **Modbus TCP with access to variables:** In this mode, the TapBus Power can be considered as a Modbus server. In other words, variables can be considered either as being on the TapBus Power (InTap variables) or on the target system. The API provides high level functions such as “ReadVariable” or “WriteVariable”. A standard CSV file can be used to import the list of the available Modbus RTU registers.

Note: For now, it is not possible to address multiple slaves in client mode using Modbus TCP.

2.4 Duetware architecture

TapBus-Power contains the embedded software 'Duetware'. This software is essentially composed of two 'engines':

- The lwM2M which executes queries from the outside (such as reading the modbus registers of the slaves),
- The JVM that provides flexibility and decision-making power: it is the JVM that will ensure the control of the battery, or that will manage the alarm or datalog functions.



3 Description

In addition to the power function, TapBus-Power also acts as a communication gateway to a mobile app or the cloud.

It can communicate directly with mobiles, tablets, and PCs via NFC, BLE or Wi-Fi. Users can use IoTize's app or their own custom apps to read/write target system data. In this case, the local information appliance can also serve as a network gateway to exchange data with the cloud using the MQTT protocol.

The Wi-Fi or LPWAN channels (with optional LoRa, LTE-M/NBIOT extensions) can be configured to send data via MQTT to a cloud platform. The LPWAN extensions and the internal Virtual Machine allow the module to send alarms to the cloud at any time.

Refer to the TapBus Systems User Guide to use the communication features.

3.1 Radio communication channels

3.1.1 Near Field Communication (NFC)

- Data transmission rate[1]: 2 kilobytes per second
- Range[2]: up to 4 centimeters
- Supports use of NFC for dynamic wakeup and pairing of the BLE interface.

3.1.2 Bluetooth Low Energy (BLE)

- Max power: +9 dBm (conducted power)
- Data transmission rate: *In testing, to be completed.*
- Range[2]: up to 20 meters

3.1.3 Wi-Fi (IEEE 802.11b/g/n)

- Max power: +20 dBm (conducted power)
- Data transmission rate: *In testing, to be completed.*
- Range[2]: up to 100 meters

3.1.4 LoRa

- Max power: +22 dBm at 868/915MHz
- Data transmission rate[3]: up to 21.9 kbits/s (SF7, bandwidth 500)
- Range[2]: up 10 kilometers

3.1.5 LTE-M/NBIOT

- Max power: +23 dBm in each band
- Data transmission rate: *to be completed.*
- Range[2]: *to be completed.*

Notes:

1. *Average speed while acquiring 1000 times 220 bytes from the target.*
2. *Measure line-of-site in an environment free of obstructions and rebound effects.*
3. *Data transmission rate from module specification.*

3.2 Wired communication channel

For TapBus Power the following wired communication channels are available.

3.2.1 Ethernet

- Baud rate: up to 10 Mbps
- ESD Protection: Class 3A
  - Contact Discharge: +/-8kV
  - Air-Gap Discharge: +/-15kV

3.2.1.1 Communication cable

The communication cable is not included.

Following are the main characteristics for the cable:

Type: RJ45 Cable

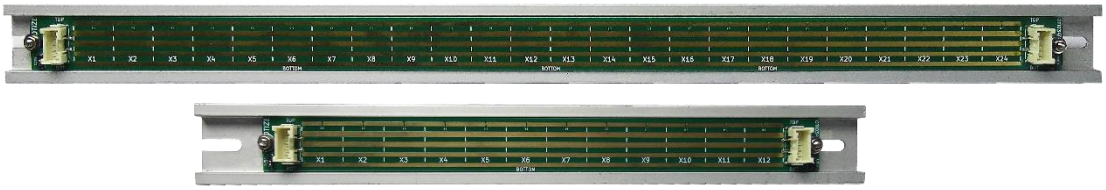
Ethernet: Straight-Through RJ45 Cable

RJ45 pin number	Ethernet signal
1	Tx+
2	Tx-
3	Rx+
4	NC
5	NC
6	Rx-
7	NC
8	NC

Important Note: *It is requested to only use shielded cables to connect the TapBus Power to the Ethernet network.*

3.2.2 RS485 (modbus)

The communication between TapBus-Power and the IO modules can be carried either by ribbon cables or by RailBus PCBs that are installed (screw fastening or gluing) directly at the bottom of a DIN rail. These modules are available in two lengths (250mm for 3 modules or 475mm for 6 modules). They can be easily chained:

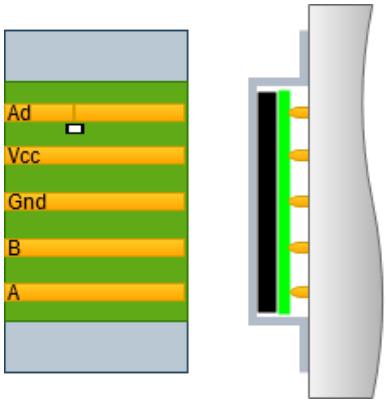


The RS-485 interface of the TapBus-Power module has the following characteristics:

- Baud rate: up to 250 kbps (default: 115 kbps)
- Input Hysteresis: 100mV
- ESD protection:
  - Human-Body Model: +/-15kV
  - Air-gap discharge (IEC 61000-4-2): +/-15kV
  - Contact discharge (IEC 61000-4-2): +/-8kV

3.2.2.1 POGO pins

The POGO pins allows automatic connection to the TapBus fieldbus when a RailBus PCB is used. Double pins are used for the power supply at the TapBus-Power side.

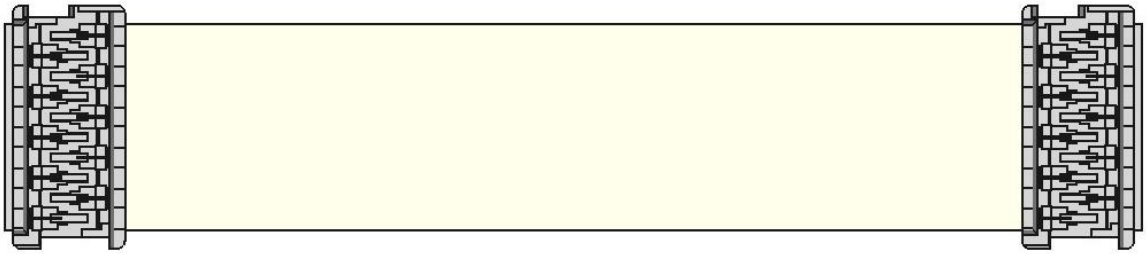


POGO pin number	RailBus signal
1	RS485_ADDR
2 (double pin)	VBUS
3 (double pin)	GND
4	RS485_B-
5	RS485_A+

3.2.2.2 Ribbon cable

This cable is an alternative to the RailBus PCB:

Type: Picoflex® PF-50 Standard Cable Harness
10 pos 1.27mm ribbon cable
Recommended P/N: 0923151010

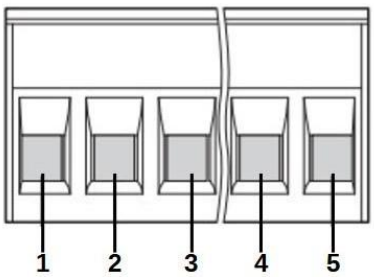


Picoflex pin number	RailBus signal
1	GND
2	GND
3	RS485_A+
4	RS485_B-
5	VBUS
6	VBUS
7	NC
8	NC
9	RS485_ADDR
10	NC

3.2.2.3 Terminal block plug

The terminal block plug is included. It can be used to connect external devices (others than TapBus-IOs modules).

Type: Terminal block plug 5 pos 5.0mm



Plug pin number	RailBus signal
1	GND
2	VBUS
3	RS485_A+
4	RS485_B-
5	RS485_ADDR

3.3 Electrical characteristics

3.3.1 Power supply

The TapBus Power can be powered either with AC or DC sources (exclusively one or the other, not both).

3.3.1.1 AC power supply

- Maximum AC supply voltage: 305VAC
- Minimum AC supply voltage: 85VAC
- Standard AC supply voltage: 230VAC or 110VAC
- Standard AC supply frequency: 50 or 60Hz

3.3.1.2 DC power supply

- Maximum DC supply voltage: 30V
- Minimum DC supply voltage: 13V
- Standard DC supply voltage: 24V

Important Note: *For safety reasons, the TapBus Power must be powered by a circuit breaker.*

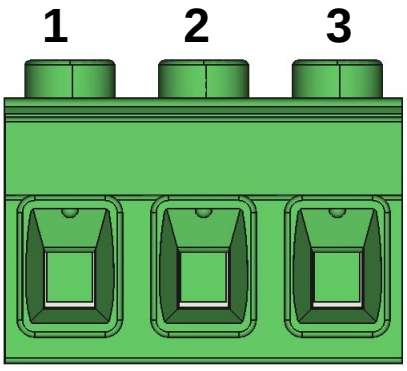
3.3.1.3 Terminal block plugs

The terminal block plugs are included.

Following are the main characteristics for the power supply terminal block plugs:

Type: Terminal block plugs
AC-IN: Terminal block plug 3 pos 7.62mm
DC-IN: Terminal block plug 2 pos 5.0mm

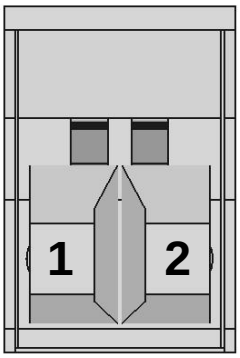
AC-IN terminal block plug



Plug pin number	AC-IN signal
1	LINE
2	NEUTRAL
3	EARTH

DC-IN terminal block plug

Type: Terminal block plug 2 pos 5.0mm



Plug pin number	DC-IN signal
1	DCIN+
2	GND

3.3.2 TapBus-Power: a power supply unit

TapBus-Power can power up to 8.8W to a set of TapBus-IOs modules (typically up to 30 modules).

A switch located on the back side of the module allows to select the output voltage:

- 5V (2A)
- 12V (0.8A)

Both voltages are accepted by all the TpB-IOs modules (the ‘slaves’). The voltage generated can also be used by external sensors if necessary, or to control relays or actuators compatible with these voltages.

The consumption of the TapBus IOs modules depends on the nature of the IOs. In general, the outputs can require higher currents, but the average power consumption of these modules is of the order of 300mW.

3.3.3 Battery management

The TapBus Power module can support a 12V lead-acid external battery (capacity between 1Ah and 5Ah) which will serve as a backup in the event of a break of the external power supply.

The module therefore allows:

- To switch ON/OFF the connection to this battery when necessary.
- To automatically recharge the battery to ensure an optimal state of charge.
- To monitor and test periodically this battery to prevent possible wear.

The battery unit is designed to support a 12V lead-acid battery with a capacity of at least 1Ah. The guaranteed autonomy will of course depend on the number of IO modules but will always be sufficient to properly stop the activity of the modules and send warning alarms if necessary.

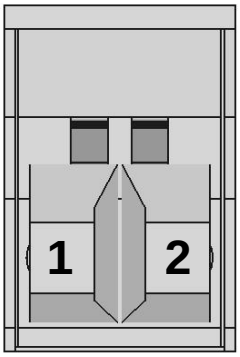
Important Note: *The battery is used for backup only (switchable when the module is already powered), it is not possible to power up the TapBus with the battery.*

3.3.3.1 Terminal block plug

The terminal block plug is included.

Following are the main characteristics for the power supply terminal block plug:

Type: Terminal block plug 2 pos 5.0mm



Plug pin number	Battery signal
1	GND
2	VBAT

3.3.4 Power consumption

The power consumption depends on the CPU Frequency, three different frequencies can be set: Normal, Fast and Slow. The default is the normal frequency, if needed the frequency can be lowered to minimize the power consumption of the TapBus Power. Please note that the CPU Frequency must be carefully changed because it will affect the performance of the CPU.

Please note that the power consumption values below are average values and that brief power consumption peaks of several mA are expected during radio communications.

3.3.4.1 Power consumption with no Extension Board

The tables below indicate the current consumption for these 3 modes, considering a fixed, stable power Supply of 24VDC (without extension board, without slave module):

Slow CPU Frequency				
Operating Mode	NFC Only[1]	Wi-Fi Off[2]	Wi-Fi Hotspot[3]	Wi-Fi Station[3]
RS485 Only				
Standby	3.6 mA	3.6 mA	3.6 mA	3.6 mA
Idle[4]	8.5 mA	9.5 mA	22 mA	9.5 mA
NFC Tx/Rx	8.5 mA	9.3 ~9.5 mA	22 mA	9.5 mA
BLE Tx/Rx	-	11.5 ~ 13.5 mA	22.5 mA	11 ~ 13 mA
Wi-Fi Tx/Rx	-	-	24 ~ 29 mA	13 ~ 15 mA
RS485 & Ethernet				
Standby	3.6 mA	3.6 mA	3.6 mA	3.6 mA
Idle[4]	25 mA	26 mA	39 mA	27.5 ~ 29 mA
NFC Tx/Rx	24.8 ~ 25 mA	26 mA	39 mA	27.5 ~ 29 mA
BLE Tx/Rx	-	27 ~ 29.5 mA	39 ~ 40 mA	28 ~ 30 mA
Wi-Fi Tx/Rx	-	-	39.5 ~ 40.5 mA	31 ~ 32.5 mA

Normal CPU Frequency				
Operating Mode	NFC Only[1]	Wi-Fi Off[2]	Wi-Fi Hotspot[3]	Wi-Fi Station[3]
RS485 Only				
Standby	3.6 mA	3.6 mA	3.6 mA	3.6 mA
Idle[4]	10 mA	11 mA	21 ~ 22.5 mA	11 ~ 12 mA
NFC Tx/Rx	10 mA	10.6 ~ 11 mA	22.5 mA	11 ~ 12 mA
BLE Tx/Rx	-	13 ~ 15 mA	22.5 mA	12 ~ 13.5 mA
Wi-Fi Tx/Rx	-	-	25 ~ 30.5 mA	15.5 ~ 16.5 mA
RS485 & Ethernet				
Standby	3.6 mA	3.6 mA	3.6 mA	3.6 mA
Idle[4]	26.6 mA	27.7 mA	40.7 ~ 41.2 mA	28.5 mA
NFC Tx/Rx	26.5 mA	27.7 mA	40.7 ~ 41.2 mA	28.5 mA
BLE Tx/Rx	-	28.5 ~ 31.5 mA	40.7 ~ 41.2 mA	30 ~ 32 mA
Wi-Fi Tx/Rx	-	-	41 ~ 42.5 mA	32.5 ~ 34 mA

Fast CPU Frequency				
Operating Mode	NFC Only[1]	Wi-Fi Off[2]	Wi-Fi Hotspot[3]	Wi-Fi Station[3]
RS485 Only				
Standby	3.6 mA	3.6 mA	3.6 mA	3.6 mA
Idle[4]	12.5 mA	13.5 mA	27 mA	13.5 ~ 14.5 mA
NFC Tx/Rx	12.5 mA	13.5 mA	27 mA	13.5 ~ 14.5 mA
BLE Tx/Rx	-	15 ~16.5 mA	28 mA	14.5 ~ 17 mA
Wi-Fi Tx/Rx	-	-	27 ~ 31.5 mA	17 ~ 20mA
RS485 & Ethernet				
Standby	3.6 mA	3.6 mA	3.6 mA	3.6 mA
Idle[4]	29 mA	30.5 mA	43.8 mA	31.5 ~ 33 mA
NFC Tx/Rx	29 mA	30.5 mA	43.7 ~ 43.8 mA	31.5 ~ 33 mA
BLE Tx/Rx	-	31 ~ 34 mA	43.8 ~ 44.3 mA	32 ~ 33.5 mA
Wi-Fi Tx/Rx	-	-	44 ~ 47 mA[5]	36 ~ 37.5 mA

Notes:

1. *BLE and Wi-Fi disabled by configuration, only NFC available.*
2. *Wi-Fi disabled by conf, NFC and BLE available.*
3. *NFC and BLE are also activated.*
4. *BLE and Wi-Fi in advertising mode.*
5. *The max power to be considered is 1.2W (Fast CPU, Ethernet ON, Wi-Fi in hot spot mode).*

3.3.4.2 Power consumption with LoRa Extension Board

to be completed.

3.3.4.3 Power consumption with LTE-M/NBIOT Extension Board

to be completed.

3.4 Radio specifications

3.4.1 Bluetooth Low Energy (BLE 4.2) and Wi-Fi (IEEE 802.11 b/g/n)

For details, see ESP32 specifications.

Parameter	Min	Typ	Max	Unit
Wi-Fi Center frequency range of operating channels	2412	-	2484	MHz
Wi-Fi Rx sensitivity[1]	-70	-93	-98	dBm
Wi-Fi Tx power[1]	+10	-	+20	dBm
BLE RX Sensitivity @30.8% PER	-94	-93	-92	dBm
BLE Tx power	-12	0	+9	dBm

Notes:

1. *Typical value, it depends on the type of modulation.*

3.4.2 **LoRa (LoRaWAN 1.0.3)**

For details, see LoRa-E5-HF specifications.

Parameter	Min	Typ	Max	Unit
Frequency range	868	-	915	MHz
LoRa Rx sensitivity at 868MHz	-	-135	-137	dBm
LoRa Tx max power at 868MHz @SF12, BW125kHz	-	+22	-	dBm

3.4.3 LTE-M/NBIOT

For details, see Monarch 2 GM02S specifications.

Parameter	Min	Typ	Max	Unit
Frequency bands	B1, B2, B3, B4, B5, B8, B12, B13, B14, B17, B18, B19, B20, B25, B26, B28, B66, B71, B85			
LTE-M/NBIOT Low Bands[1] Rx sensitivity	-	-105	-	dBm
LTE-M/NBIOT High Bands[2] Rx sensitivity	-	-106	-	dBm
LTE-M/NBIOT max power for each band	+22	+23	+24	dBm

Notes:

1. *Low Bands: B5, B8, B12, B13, B14, B17, B18, B19, B20, B26, B28, B71, B85.*
2. *High Bands: B1, B2, B3, B4, B25, B66.*

3.4.4 Radio coexistence

Radio coexistence					
Radio protocols	NFC	BLE	Wi-Fi	LoRa (LoRaWAN)	LTE-M or NBIOT
NFC	-	Yes	Yes	Yes	Yes
BLE	Yes	-	Yes[1]	Partially[2]	Partially[2]
Wi-Fi	Yes	Yes[1]	-	Partially[2]	Partially[2]
LoRa (LoRaWAN)	Yes	Partially[2]	Partially[2]	-	No[3]
LTE-M or NBIOT	Yes	Partially[2]	Partially[2]	No[3]	-

Notes:

1. *BLE and WiFi coexistence is ensured by the main microcontroller.*
2. *BLE/WiFi are switched off for LoraWAN or LTE-M/NBIOT communications, automatically switched on after the LPWAN communication.*
3. *It is only possible to install one expansion board on TapBus Power.*

3.5 Security features

The communication chain is fully secured using classic techniques based on SCRAM (Salted Challenge Response Authentication Mechanism):

- Authentication: secured passwords or signed tokens
- Encryption: AES-128/256

When communicating over TCP-IP, TLS is also available.

3.6 Embedded user's memory

Configuration including access control data is stored into a 16KB of FLASH.

Java program and volatile data used for Java must be both smaller than 64KB.

3.7 Low power modes

TapBus Power can be switched to low power mode. For now, only standby mode is available.

When in standby mode, wake-up of the TapBus Power is possible by NFC or by a configurable periodic timer.

3.8 Temperature constraints

3.8.1 Operating temperature

The behavior and the radio characteristics have been tested to guarantee a correct operation in the range: **[-30°C, +70°C]**.

All the components used for this device are industrial grade components ([-40°C, +85°C] or better), moreover the main microcontroller has an operating temperature range of [-40°C, +105°C].

The AC DC converter in the TapBus Power has an operating temperature range of [-30°C, +70°C] but the full load max temperature is **+50°C**. Above +50°C the load decrease linearly to 50% (5W). Please take this this decreasing into account for complex buses. All TapBus IOs power consumption avec available in TapBus IOs datasheets.

3.8.2 Storage temperature

The storage temperature range for the TapBus Power is: **[-30°C, +70°C]**.

4 Software environment

Please refer to the 'user guide' available online on the IoTize online documentation. In this guide, you'll find:

- Information dedicated to the 'IoTize Studio' configuration,
- Information specific to the 'TapBus-App' starter application.
- Useful information to create your own mobile application dedicated to a particular environment.
- The information needed to connect a TapBus-Power module with a Cloud platform.

5 Hardware Description

5.1 Overview

Below is a presentation photo of the TapBus Power electronic boards and casing:

5.2 Electronic boards

Like all the modules, this one has three printed circuits, plus an optional one:

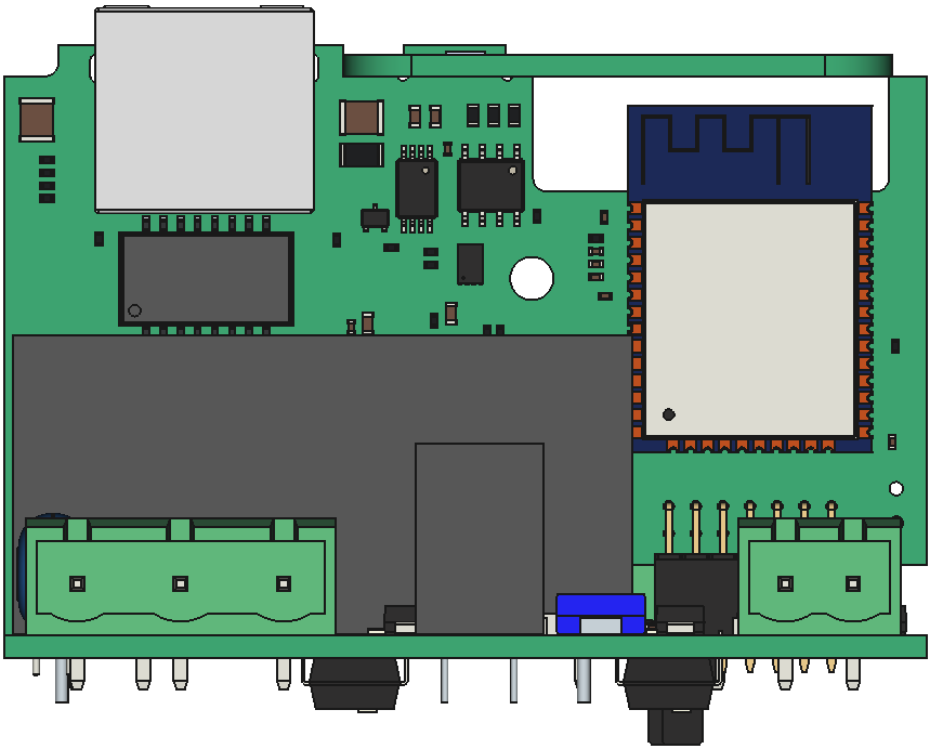
- A backplane board that manages all the power supply as well as the distribution connectors (excluding ethernet).
- A “micro” card which includes an NFC/BLE/WiFi module as well as an Ethernet interface and a three-colour LED.
- A 'front panel' card whose function is limited to supporting an NFC antenna.
- An optional extension modem card: two modems are currently available:
  - A LoRa modem (LoRaWAN compatible or adaptable to any proprietary protocol via Java).
  - An LTE-M / NB-IoT modem.

5.2.1 Electronic boards size

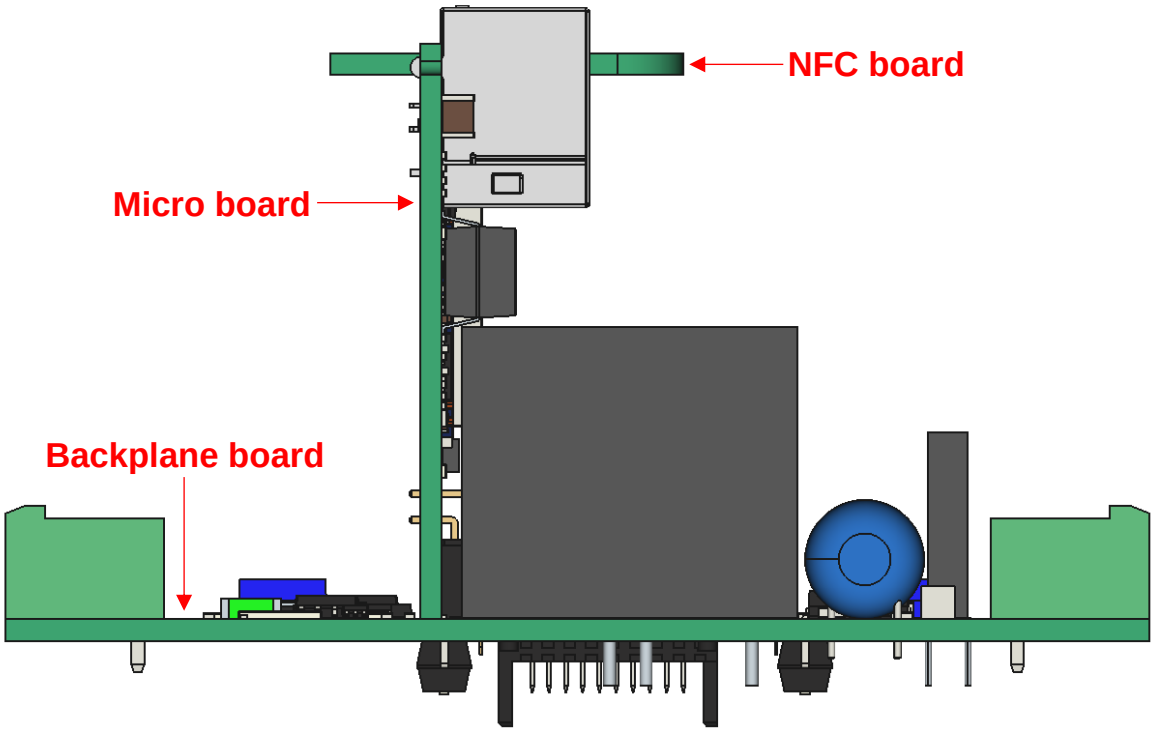
Backplane board:	L = 86.5 mm x W = 68 mm
“Micro” board:	L = 43.5 mm x W = 68 mm
NFC board:	L = 26.70 mm x W = 40.5 mm

5.2.2 Electronic boards placement

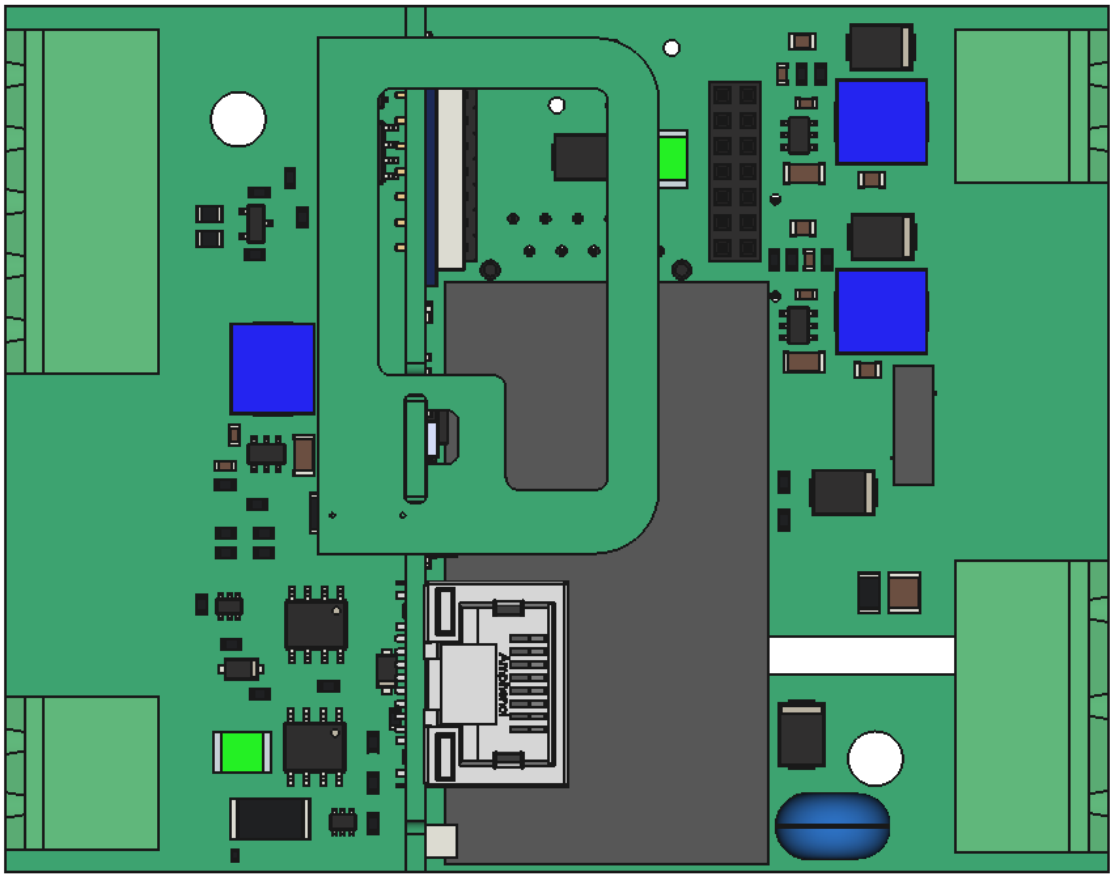
5.2.2.1 Front view



5.2.2.2 Side view



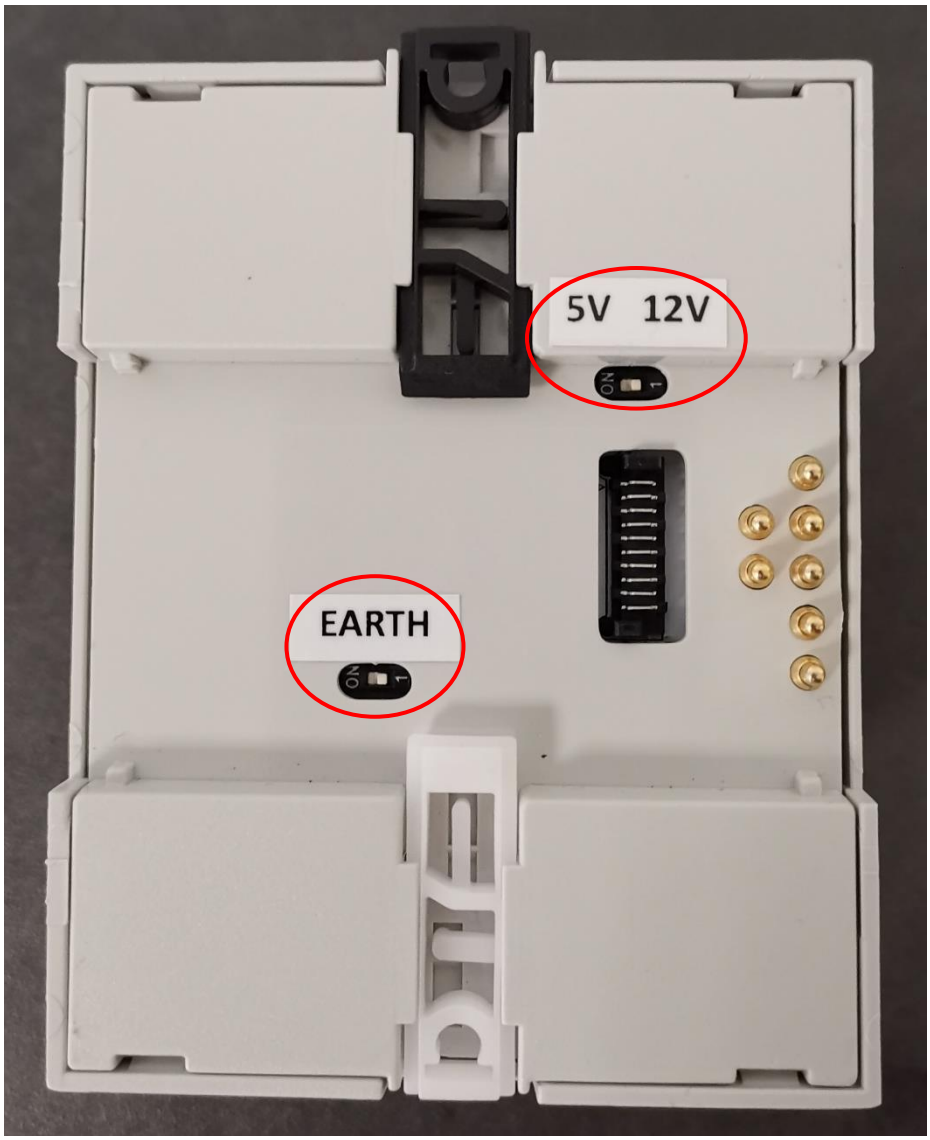
5.2.2.3 Top view



5.3 Hardware switches

Two hardware switches are available on the back of the TapBus Power.

Both switches are marked by a label:



5.3.1 Power generation voltage

This switch is used to select the TapBus Power output voltage to power the bus:

- Switch OFF (Default): VBUS = 12V
- Switch ON: VBUS = 5V

5.3.2 Earth to ground connection

This switch is used to connect the ground of the TapBus Power and therefore of all the bus to the Earth of AC power supply.

- Switch OFF (Default): Earth is NOT connected to TapBus ground (0V)
- Switch ON: Earth is connected to TapBus ground (0V)

5.4 Hardware factory reset

WARNING: 'Factory Reset' hereafter means the complete erasure of the Duetware configuration. In particular, the file containing the Java code will also be deleted. You will then have to apply a new configuration generated from Iotize Studio.

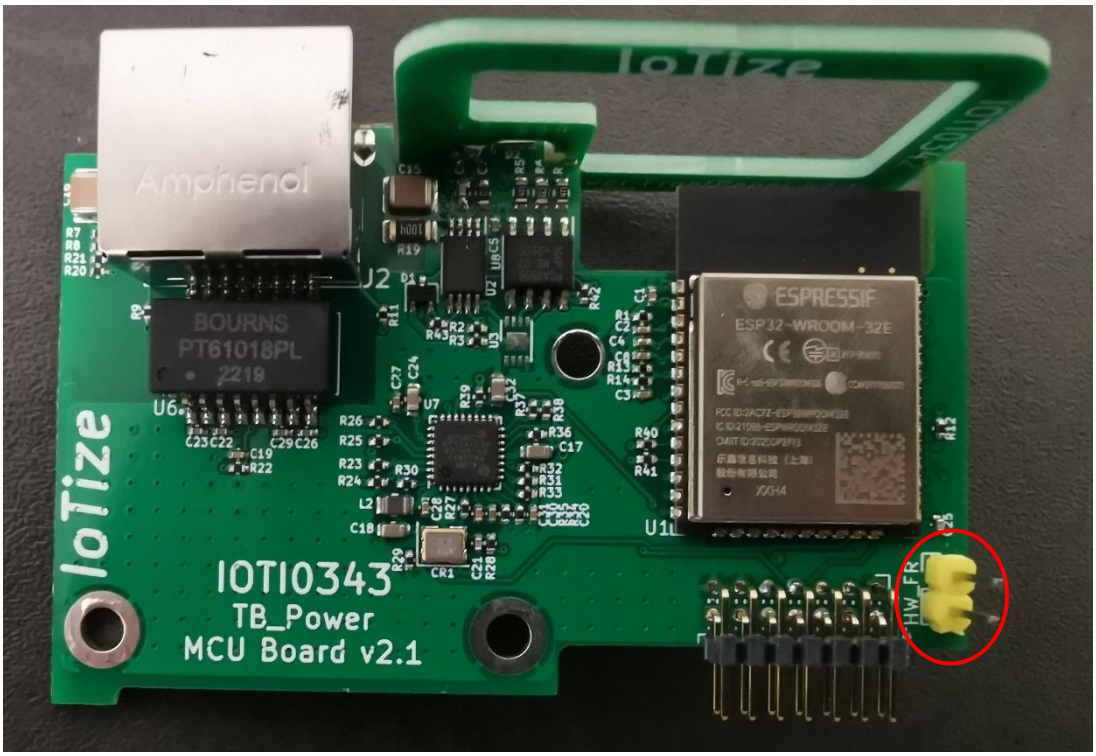
How to proceed?

A jumper is available on TapBus Power “MCU Board”, by default this jumper is not soldered and must be added if needed. The jumper is marked “HW_FR” on both sides of the PCB.

The instructions for resetting to factory settings are available on the technical documentation.

Note: *The hardware factory reset can be disabled by configuration.*

Below are zoomed-in photos of the “HW_FR” jumper on both sides of the TapBus Power “**MCU Board**”:



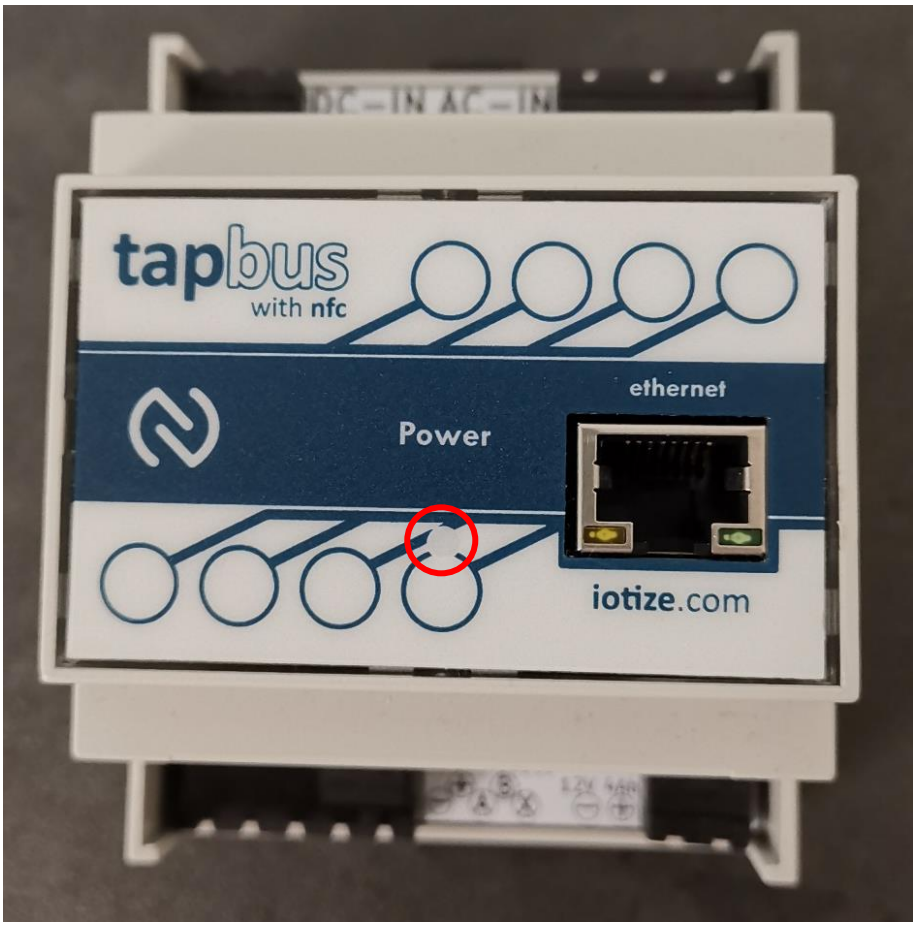
5.5 Configurable RGB LED

A RGB LED is available on the TapBus Power. This LED is controlled by by the embedded Java Virtual Machine.

The default IoTize Studio & Java project for TapBus Power manage this led. Moreover, it is possible to customize its behaviour.

By default, the LED is illuminated green when the module is not connected, and then blue when the module is connected. In transition phases, the blue LED flashes.

Below is a picture highlighting the location of the led on the **TapBus Power**:



6 Mechanical characteristics

This case is UL94-V0.

Dimensions:	L = 98.0 mm x W = 71.2 mm x H = 58.0 mm
Weight (without terminal plugs):	135 g

7 Regulatory compliance

7.1 CE certification (Europe)

The communication module used in TapBus Power is tested for the following standards:

- EN 300 328 (V2.2.2)
- EN 301 489-1 (V2.2.3)
- EN 62368-1 (2014+A11/2017
- EN 62311 (2008)

TapBus Power has been tested for the following standards:

- *In testing, to be completed.*

7.2 RoHS and WEEE

TapBus Power complies with:

- Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances (ROHS) in electrical and electronic equipment.
- Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).

7.3 FCC (USA)

This product contains a transmitter module **FCCID: 2AC7Z-ESP32WROOM32E**.

To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must not be collocated or operating in conjunction with any other antenna or transmitter.

LoRa and LTE-M variants are in testing, to be completed.

7.4 IC (CANADA)

This product contains a transmitter module **IC: 21098-ESPWROOM32E**.

Ce produit contient un module transmetteur **IC: 21098-ESPWROOM32E**.

LoRa and LTE-M variants are in testing, to be completed.

8 Ordering information

Example part number: **TpB-PW-W123**[1]

Product Line	Product Type	Radio Interface	Product Prefix	Security
TpB	**PW**	**W**	**12**	**3**

Product Line: **TpB = TapBus**

Product Type: **PW = Power**
IO = Input/Output

Radio interface[2]**:** *T*[3] *= NFC Only*
R[3] *= BLE*
W = Wi-Fi, BLE
L = LoRa, Wi-Fi, BLE
M = LTE-M, NBIOT, Wi-Fi, BLE

Security: **3 = software-based security**
5[4] *= hardware-based security with embedded secure element*

Notes:

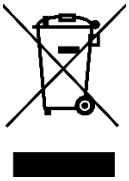
1. *The features of the part number shown in the table are indicated in bold.*
2. *All products include NFC by default for advanced functionalities such as secure wake-up and pairing.*
3. *These radio interfaces are not available for TapBus Power.*
4. *Secure element management is not implemented on TapBus Power.*

9 Appendices

9.1 EU Declaration of Conformity (DoC)

In testing, to be completed.

9.2 Recycling

	This symbol of the crossed out wheeled bin indicates that the product (electrical and electronic equipment) should not be placed in municipal waste. Check local regulation for disposal of electronic products.

10 History

Date	Version	Author	Modification
Mar. 2024	1.0	ES, FL	Document creation.
Avr. 2024	1.1	ES	Update Ordering information.
Avr. 2024	1.2	ES	Add weblink to Software environment. Add recommended P/N to Ribbon cable. Update TapBus IO P/N table in Typical application diagram.

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