Pepper C1 PoE User Manual

Manual version: V1.0[1]
08/07/2025

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[1] The newest User manual can be found on our website: https://eccel.co.uk/wp-content/downloads/Pepper_C1/C1_POE_user_manual.pdf

1. Introduction

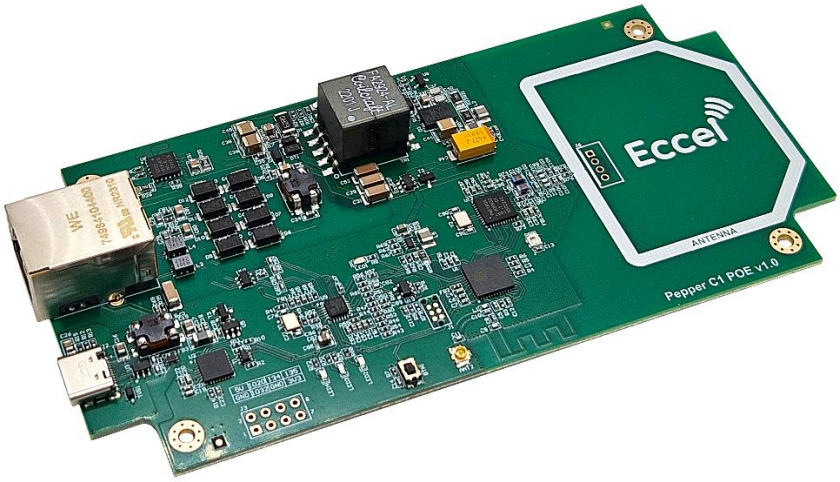
1.1 Device Overview

Features

- Low cost RFID Reader with MIFARE® Classic® in 1K, 4K memory, ICODE, MIFARE Ultralight®, MIFARE DESFire® EV1/EV2, MIFARE Plus® support
- Ethernet + PoE
- USB interface (USB-C socket)
- Wireless connectivity:
  - Wi-Fi: 802.11 b/g/n
  - 2.4GHz wireless communication (BR/EDR and Low Energy)
  - can be disabled by the user
- Built-in Web Interface
- Over-The-Air lifetime updates
- Command interface via UART and TCP sockets
- Configurable RGB LED indicator for RFID events
- 1 configurable IO pin, 2 x input pins
- Stand-alone mode (polling)
- IoT interfaces: MQTT, WebSocket, REST API
- High transponder read and write speed
- -25°C to 85°C operating range
- RoHS compliant
- CE (RED) and UKCA compliant. FCC/ISED/PSE and other approvals easily obtained (see section 7)

Applications

- Access control
- Monitoring goods
- Approval and monitoring consumables
- Pre-payment systems
- Managing resources
- Contact-less data storage systems
- Evaluation and development of RFID systems



Description

The Pepper C1 PoE reader is the first Eccel Technology Ltd product with wired connectivity by Ethernet interface, as well as wireless Wi-Fi 802.11b/g/n and WPAN (BR/EDR + LE). Thanks to this, the customer receives free lifetime Over-the-Air updates, and of course the communication protocol can be used over TCP instead of traditional serial interface. Combining these features with standalone mode provides a ready to use device in many applications "straight out of the box." In standalone mode, the module can be easily integrated with IOT systems thanks to many IOT protocols like MQTT, REST API, TCP sockets and more.

So, this is an ideal design choice if the user wishes to add RFID capability to their design quickly and without requiring extensive RFID and embedded software expertise and time. An advanced and powerful 32-bit microcontroller handles the RFID configuration setup and provides the user with a powerful yet simple command interface to facilitate fast and easy read/write access to the memory and features of the various transponders supported by this module.

2. Electrical specification

2.1 Absolute maximum ratings

Stresses beyond the absolute maximum ratings listed in the table below may cause permanent damage to the device. These are stress ratings only, and do not refer to the functional operation of the device that should follow the recommended operating conditions.

Symbol	Parameter	Min	Max	Unit
T_S	Storage temperature	-40	+125	°C
T_A	Ambient temperature	-40	+85	°C
V_{DDMAX}	USB supply voltage	5	5.5	V

Table 2-1. Absolute maximum ratings

2.2 Operating conditions

Symbol	Parameter	Min	Typ.	Max	Unit
T_S	Operating temperature	-25	25	+85	°C
H	Humidity	5	60	95	%
V_{DD}	USB supply voltage	5	5	5.5	V

Table 2-2. Operating conditions

2.3 DC characteristics (V_{DD} = 5 V, T_S = 25 °C)

Symbol	Parameter	Min	Typ.	Max	Unit
$V_{OUT3.3}$	Output voltage (regulator output, 3V3 pin on the J3 header)	3.23	3.3	3.37	V
V_{OUT5}	Output voltage (regulator output, 5V pin on the J3 header)	4.8	5	5.2	V
V_{IH}	High-level input voltage (J3 header)	0.75 x $V_{OUT3.3}$	-	$V_{OUT3.3}$ + 0.3	V
V_{IL}	Low-level input voltage (J3 header)	0	-	0.3 x $V_{OUT3.3}$	V
V_{OH}	High-level output voltage (J3 header)	0.8 x $V_{OUT3.3}$	-	-	V
V_{OL}	Low-level output voltage (J3 header)	-	-	0.3 x $V_{OUT3.3}$	V

Table 2-3. DC characteristics

2.4 Current consumption (V_{DD} = 5V)

Symbol			Parameter	Typ.	Max	Unit
Wi-Fi enabled	Access Point mode	$I_{PN\_RFOFF\_AP}$	RF field off (AP)	150	170	mA
		$I_{PN\_RFON\_AP}$	RF field on (AP)	190	210	mA
	Station mode	$I_{PN\_RFOFF\_STA}$	RF field off (STA)	75	95	mA
		$I_{PN\_RFON\_STA}$	RF field on (STA)	130	150	mA
Wi-Fi Off	I_{PN_RFOFF}		RF field off	65	70	mA
	I_{PN_RFON}		RF field on	120	140	mA

Table 2-4. Current consumption

3. Getting started

3.1 IO and peripherals

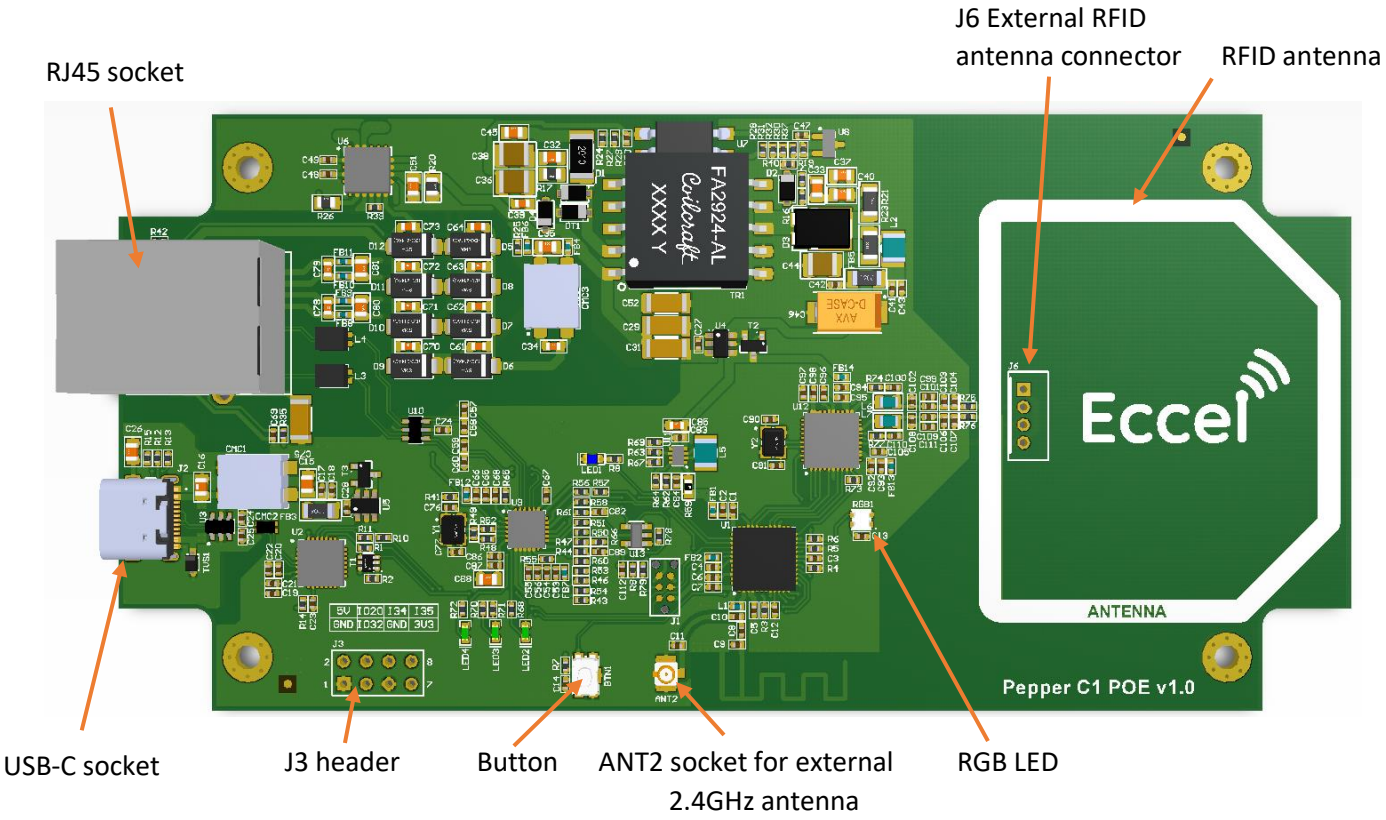
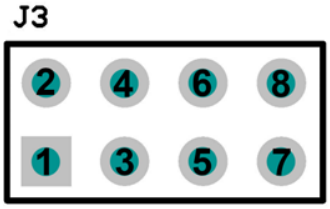


Figure 3-1. Pepper C1 POE PCB

3.1.1 J3 header description



1. Ground
2. +5V output (300mA max.)
3. IO32 – UART2 TX, debug TX, general purpose IO pin
4. IO20 – (NC, RFU)
5. Ground
6. I34 – UART2 RX
7. +3.3V output (500mA max.)
8. I35 – general purpose input pin

3.1.2 J6 External antenna header

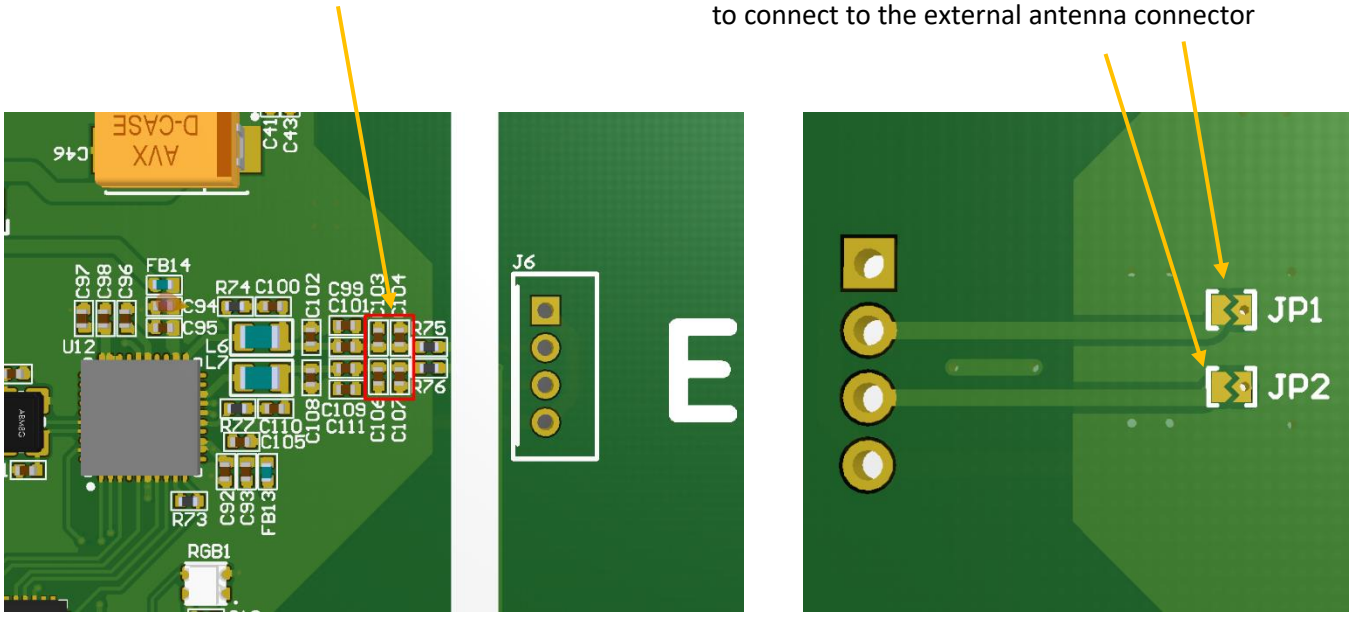
The user has the option to connect an external RFID antenna to the Pepper C1 POE reader. The J6 connector is where to plug in an external antenna, but some soldering shown on the pictures below is required to make it work. Eccel Technology Ltd provides a variety of RFID antennas which the user can use together with this device.

See our range of external PCB antennas (the green ones):
https://eccel.co.uk/product-category/antennas/hf-13-56-mhz-antennas/

1. GND
2. Antenna TX1 – RFID driver output
3. Antenna TX2 – RFID driver output
4. GND

Top view – Remove these four capacitors

Bottom view – Apply solder onto both of these pads to connect to the external antenna connector



3.2 Ethernet + PoE interface

The Pepper C1 PoE reader features a 10/100 Mbps Ethernet interface based on the LAN8720A PHY chip, enabling reliable network communication. Additionally, the device supports Power over Ethernet (PoE) functionality, which supplies both data and power over a single twisted-pair Ethernet cable. This simplifies installation by eliminating the need for a separate power supply.

PoE functionality is implemented using the Si3402-C-GM power management IC, which complies with the IEEE 802.3af standard. The device is fully compatible with IEEE 802.3 Type 1 (Class 3 and below) Powered Device applications, supporting a power budget of up to 15.4 W at the PSE (Power Sourcing Equipment) and up to 12.95 W available at the PD (Powered Device), depending on cable length and quality.

The integrated RJ45 connector (Würth Elektronik 74984104400) includes built-in magnetics and is designed to support both Ethernet data transmission and PoE power delivery, in accordance with IEEE specifications.

For optimal performance and reliability, it is recommended to use standard-compliant PoE switches or injectors. Examples of compatible equipment include:

- **Ubiquiti UniFi Switch (e.g., US-8-60W)** – provides stable 802.3af PoE output and seamless network integration,
- **TP-Link TL-SF1008P** – 8-port switch with 4 PoE ports (IEEE 802.3af compliant),
- **TP-Link TL-POE150S** – standalone PoE injector compliant with IEEE 802.3af.

Using IEEE-compliant PoE equipment ensures proper power negotiation, safe operation, and long-term reliability of the Pepper C1 PoE reader in diverse installation environments.

3.3 Typical connection

The Pepper C1 PoE was developed to use a PoE + LAN circuit to power it and provide network communication with the host server. It can also be connected to a host computer using a standard USB-C cable. In the same way it can be powered to operate as a standalone device by using power sources such as a USB charger or power bank.

The computer operating system should recognize this device as a USB to TTL bridge or a USB to Serial port converter and it should appear in Windows device manager as a COM port. By default this COM port can be used for communication using the binary protocol described below.

The reader also has the UART2 interface (J3 header) where the user can view console logs which contain additional information about temporary executing commands. The default configuration: baud: 115200, Data: 8 bit, Parity: none, Stop bits: 1 bit, Flow Control: none.

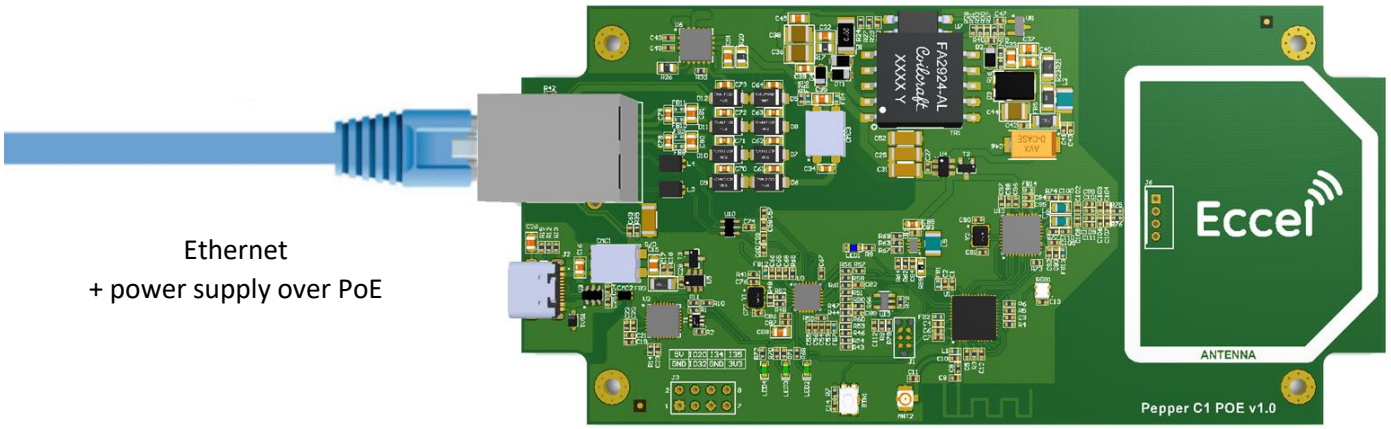


Figure 2. Ethernet + PoE connection

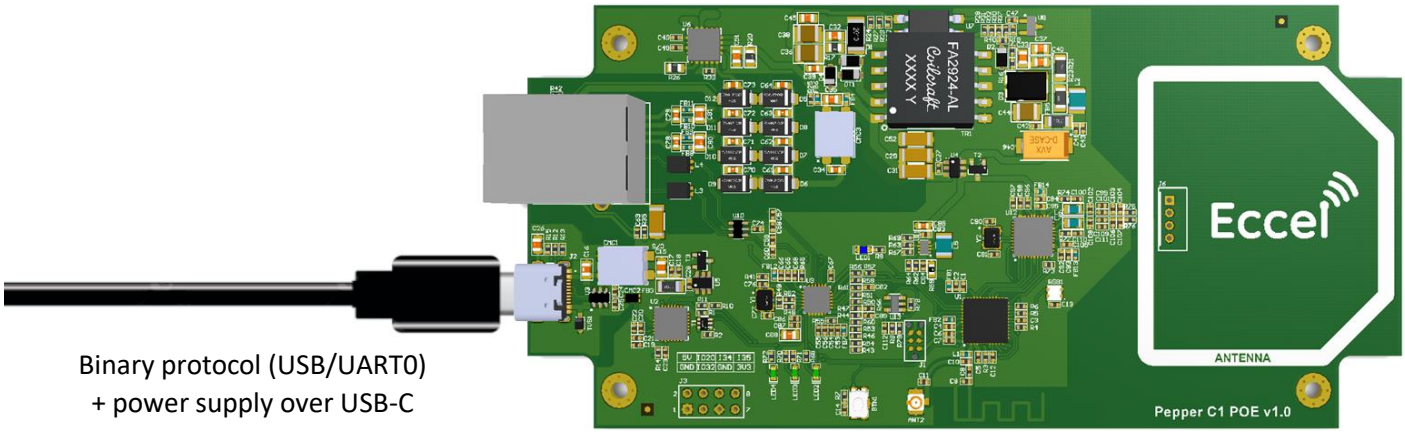


Figure 3. USB-C connection

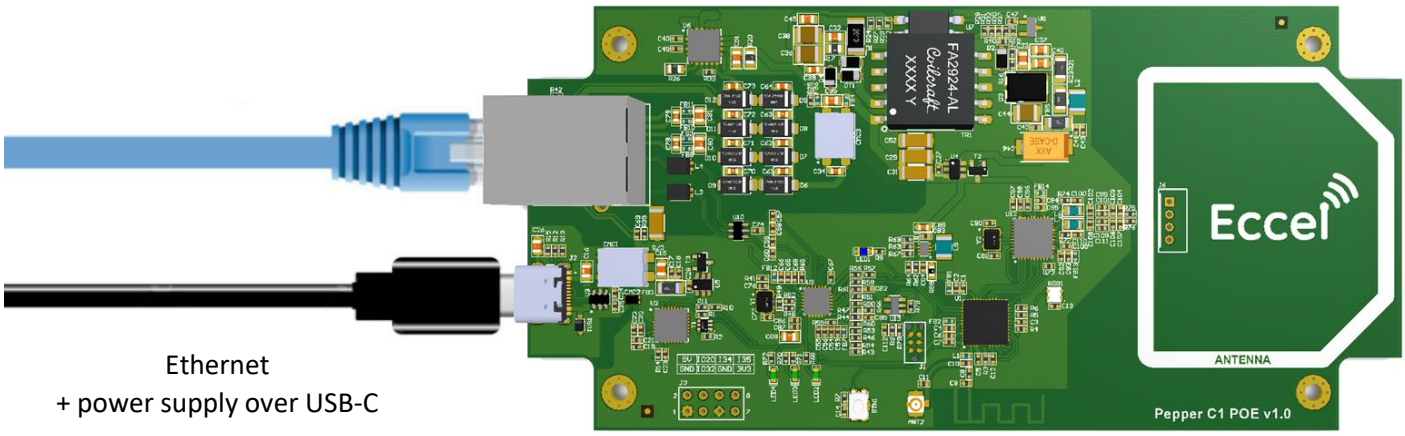


Figure 4. Ethernet (no PoE) + USB power supply

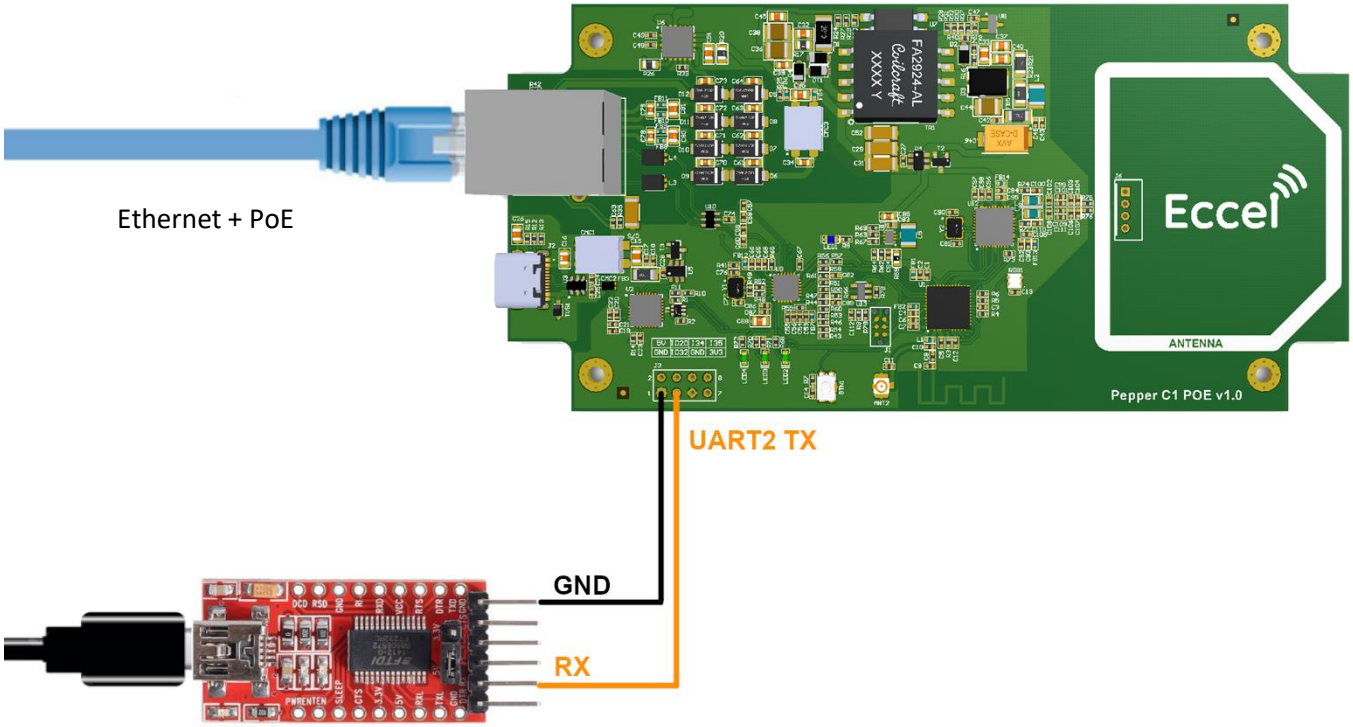


Figure 5. Console/debug logs

***Hint** – If you don't have a USB-UART converter to see the logs on the UART2 (J1 header), you can temporarily change the default log interface from UART2 to UART0 in the Web Interface (Communication->UART tab). Then, the logs should be available on the USB port.*

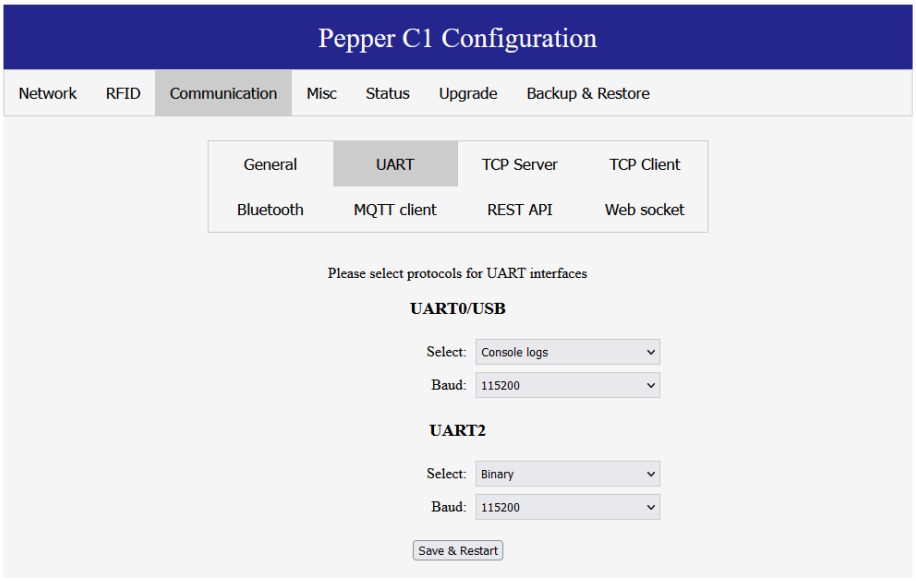
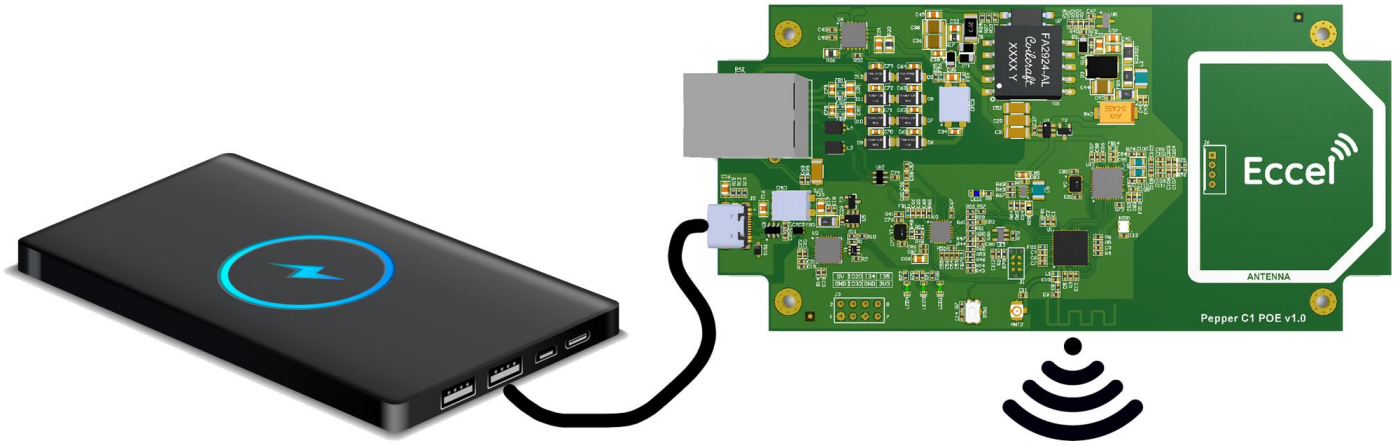


Figure 6. Console logs on the USB/UART0



Power supply from a power bank

Wireless communication

Figure 7. Wireless communication option

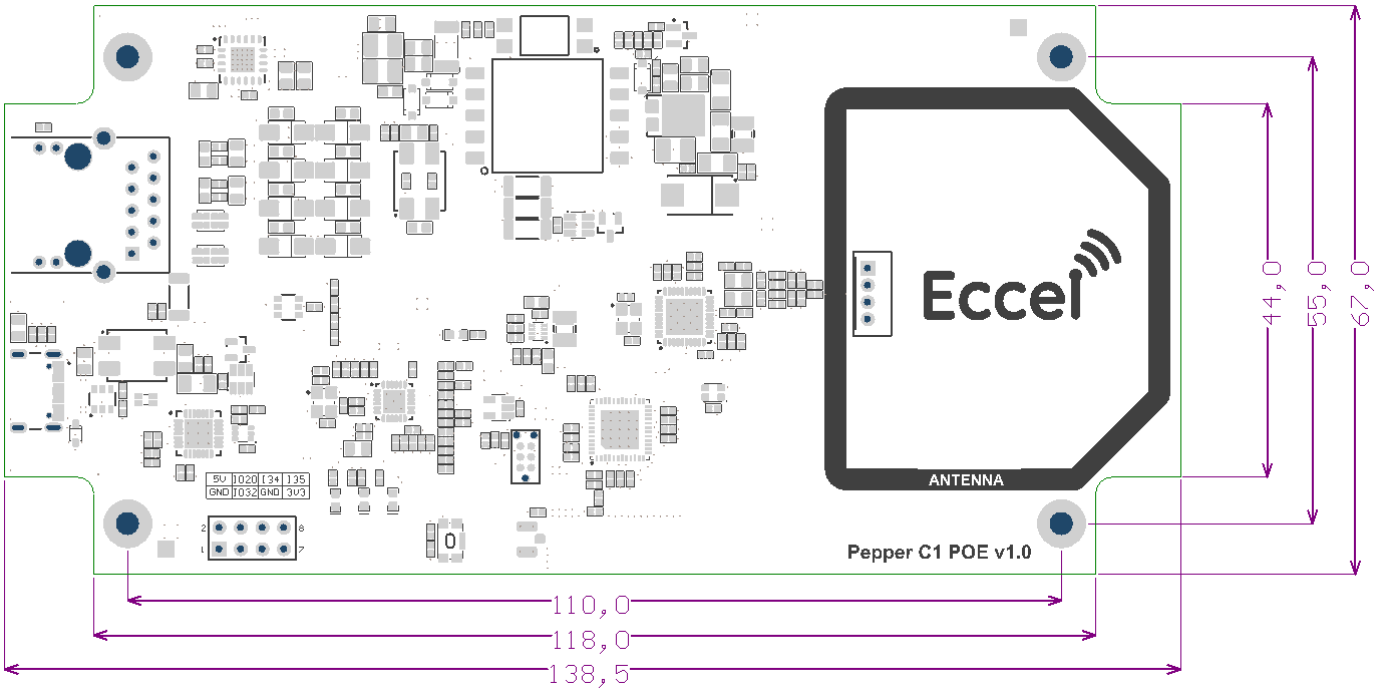
By default, both interfaces (LAN and Wi-Fi) are enabled. If the user connects only the USB-C cable (without the LAN cable), Wi-Fi will be available (Access Point or Client mode depending on the configuration). Each time the LAN cable is inserted, Wi-Fi will be disabled. Unplugging the LAN cable will re-enable Wi-Fi. This way, it will always be possible to connect to the reader via the Web Interface. LAN is always enabled. This can be configured in the Web Interface and saved in the non-volatile memory of the reader. More information can be found in the Pepper C1 software manual.

3.4 Plastic enclosure

Upon request, the Pepper C1 PoE reader can be supplied with a dedicated enclosure, designed to protect the electronics and facilitate easy installation in various environments. Additionally, we offer the option to redesign the PCB to match the customer's specific mechanical requirements, allowing seamless integration of the reader into custom housings or existing device enclosures.

4. Mechanical dimension

All dimensions are in mm.



5. Configuration and functional description

Here is the document describing configuration, communication protocol, commands and all functions of the Pepper C1 POE reader:
https://eccel.co.uk/wp-content/downloads/Pepper_C1/C1_software_manual.pdf

Eccel provides a variety of free tools & libraries ready to be downloaded from this link:
https://eccel.co.uk/support-free-libraries/

6. Custom Integration Services

We offer integration services for embedding our RFID readers into customer end devices or systems. Our engineering team can assist in antenna tunning directly within the target environment to ensure optimal performance and reliability.

Additionally, we provide options for custom firmware development, as well as mechanical modifications – including changes to shape, mounting format or enclosure design – to meet customer specific technical and design requirements.

Please contact us at sales@eccel.co.uk for more information.

7. RF Emissions and Susceptibility Approvals

Eccel have tested and declare that this product meets all the requirements of the relevant RF directives (RED) to be declared CE (European Union) and UKCA (United Kingdom) compliant. Please see our declaration of conformity for this on the downloads tab of the product webpage.

This product is designed to be incorporated into products easily and quickly such that those products can pass any national or regional statutory RF requirements and certifications such as FCC (USA), ISED (Canada) and PSE (Japan) for example.

This product is designed to meet all statutory RF requirements applicable worldwide using the most cost effective but robust design methodology.

Eccel is pleased to offer customers very cost-effective certification for their end equipment that incorporate this product. Prices start from £3K per approval/ certification. Please contact us for more details at sales@eccel.co.uk .

8. Revision history

Revision	Date	Changes
1.0	10/07/2025	First release

No responsibility is taken for the method of integration or final use of the Pepper C1 readers

More information about the Pepper C1 reader and other products can be found at the Internet site:

http://www.eccel.co.uk

or alternatively contact ECCEL Technology by e-mail at:

sales@eccel.co.uk