SPEBlox-Long

Tiny 10 Mbps over 1.6km

MPN:
BB-SPL-A-1
BB-SPL-A-2

Datasheet

September 2024

Board revision A

Contents

1 General Information

1.1 Functionality and Features of SPEBlox-Long

SPEBlox-Long is a communication device that provides 10Mbps at extremely long cable runs up to 1600m (1.6km) over simple twisted pair copper cable.

This technology is based around the 10BASE-T1L specification, and this board aims to provide a cheaper and simpler way of achieving reasonably low bandwidth communication over very long cable runs.

SPEBlox-Long is 31mm x 31mm and provides a standard 10BASE-T ethernet connection on Picoblade header. The 10BASE-T1L (single pair ethernet) connection is placed onto a screw terminal for full flexibility of cable types. The board is powered by any voltage from 5 to 60V

1.1.1 Features

- 1 x 10Mbps (10BASE-T) ethernet port
- 1 x 10Mbps (10BASE-T1L) single pair ethernet
- 1 x UART debug port
- Input voltage range from 5 to 60V
- Reverse protected voltage input
- Transient protected voltage input
- -50°C to 110°C Operation Range (View test report)
- 31mm x 31mm board size
- Molex PicoBlade connectors for power and 10BASE-T port
- Screw terminal block for SPE port
- Automatic MDI-X crossover
- Unmanaged (out-the-box) functionality
- Embedded MCU to support customized firmware upload for managed switch functions
- Port Activity Indicators

1.1.2 General Information

Voltage Input	5V to 60V DC (65V absolute max)
Voltage Output	None
Supported Protocols	10BASE-T, 10BASE-T1L
Number of ports	1 x 10BASE-T, 1 x 10BASE-T1
Power Consumption	0.5W at full data rate
Weight	10 grams
Size	31 mm x 31 mm x 17mm
Operating Temperature	-50°C to +110°C [(View test report)](link)
Storage Temperature	-55°C to +125°C

Table 1: General Information

1.1.3 General Operating Instructions

SPEBlox-Long is designed for use in commercial and industrial environments, operating from a nominal supply voltage of 24V, but with the ability to operate from as low as 5V and as high as 60V.
SPEBlox-Long can be operated immediately by following the steps below.

1) Connect two SPEBlox-Long together through the SPE port, using a 2-wire twisted pair cable

2) Connect external devices to the ethernet ports using RJ45 to Picoblade cables.

3) Apply a voltage between 5V to 60V to the voltage input terminals.

SPEBlox-Long will automatically begin auto-negotiation with connected devices and begin receiving and forwarding packets to/from all connected devices.

1.2 Safety Information

- This device can operate on voltages near and above 60V. Please read this manual before operating.
- This device is provided "as is". In-application testing prior to integration is recommended.
- This device is provided as an electronic circuit board, and requires integration into chassis for full ingress protection.
- Do not use this product in wet environments without integrating into a chassis.
- Do not operate this product beyond the rated temperature and voltages.
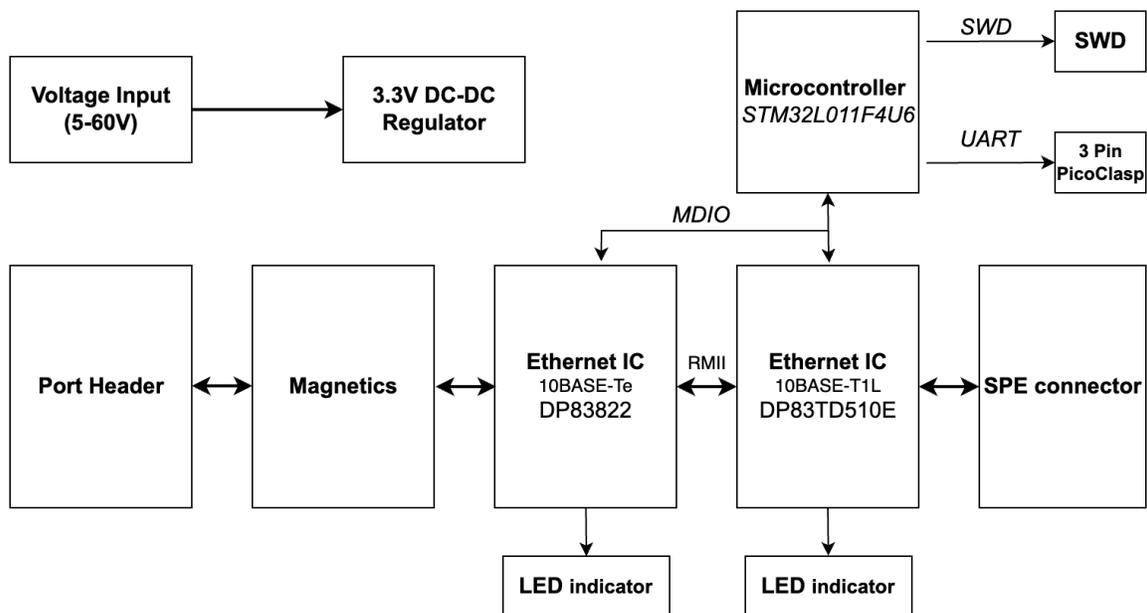
1.3 Block Diagram

Figure 1: SPEBlox-Long Block Diagram

1.4 Included Equipment

The product includes the following:
1 x SPEBlox-Long
1 x PicoBlade to RJ-45 300mm (SKU: BB-PBRJ1-4-0.3)
1 x PicoBlade to Tinned Leads 300mm (SKU: BB-PBTL1-4-0.3)

1.5 RoHS Certification of Compliance

SPEBlox-Long complies with the RoHS (Restriction of Hazardous Substances Directive) Certificate of Compliance.
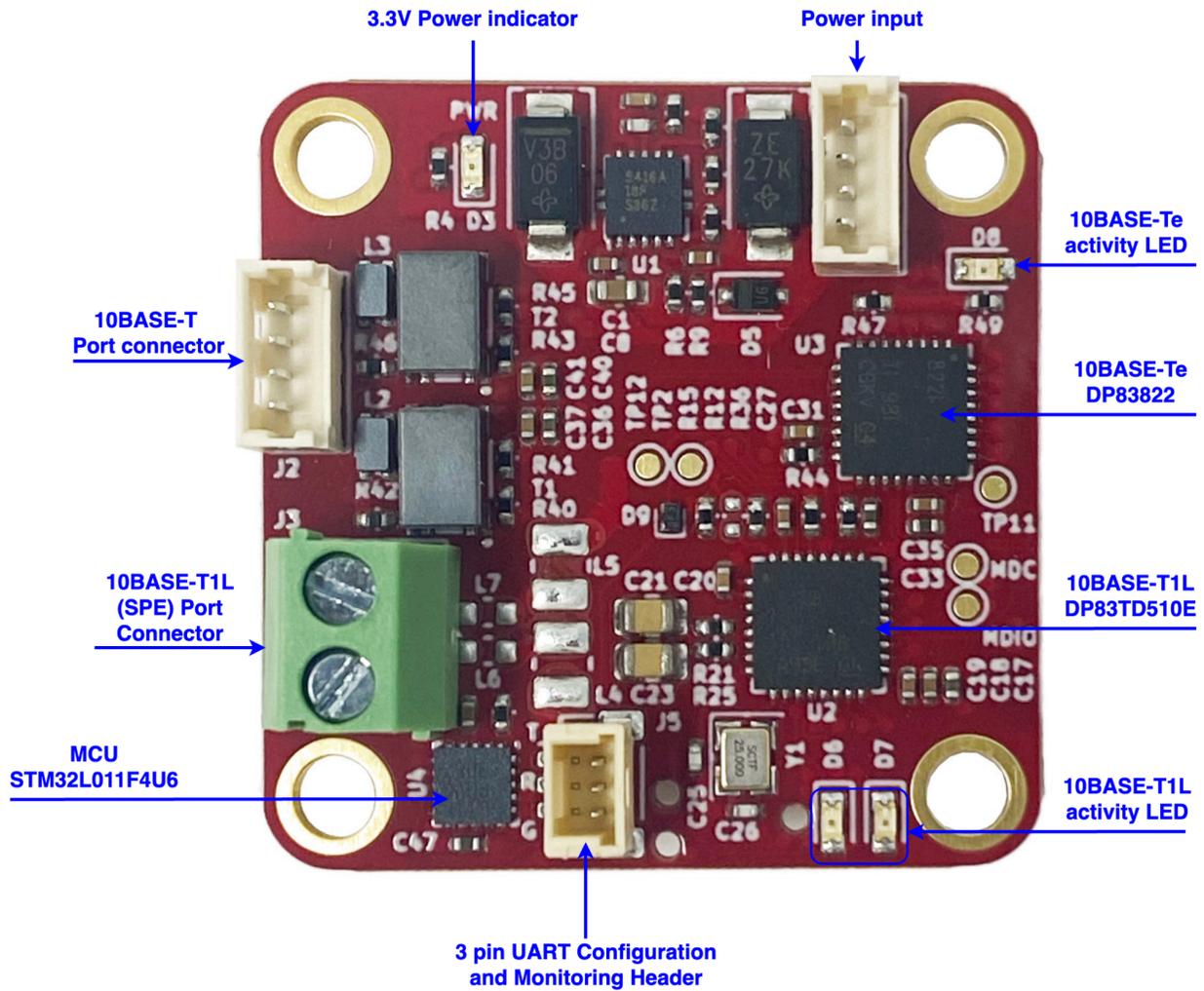
2 Hardware Interfaces

2.1 Board Map

Figure 2: SPEBlox Long Board Map (front)

2.2 Connectors and Pinouts

2.2.1 Voltage Input

The right connector is the voltage input terminal. A four pin connector is used to allow the input voltage to be easily daisy chained between boards (two wires per power rail).

The voltage input has the following features:
- Voltage input can range from 5 to 60V
- Maximum allowable voltage of 65V
- Transient voltage protection above 66.3V
- Reverse polarity protection

The pinout of the voltage input connector is shown in figure 3 below. Note that this pinout is identical to the pinout used on SwitchBlox.
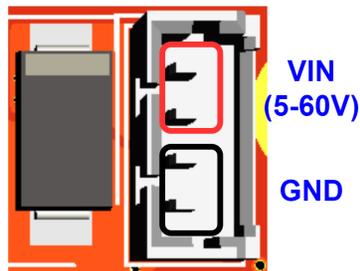

Figure 3: Voltage input header pinout

Connector part numbers

Connector on board	Mating header	Crimp used	Wire used
530470410	0510210400	500798000	UL1061, 28AWG

Table 2: Voltage input connector pinout and part numbers

Cable pinout

Figure 4: Voltage input cable pinout (red = V+, black = GND)

2.2.2 Ethernet Port

There is an ethernet connector on SPEBlox-Long. The connector has four pins corresponding to the four signals required for 10BASE-Te which are R-, R+, T- and T+.
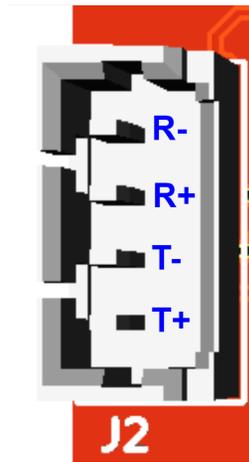Figure 5 below shows the pinout of the signals. Note that this pinout is unified across all our products.

Figure 5: Ethernet port pinout

Connector on board	Mating header	Crimp used	Wire used
530470410	0510210400	500798000	UL1061, 28AWG

Table 3: Ethernet connector pinout and part numbers
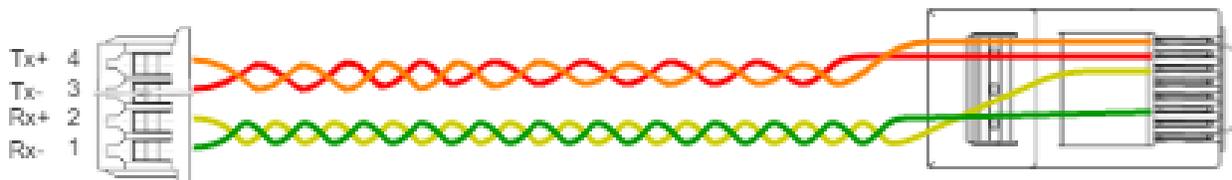
Cable pinout

Figure 6: Ethernet cable pinout

2.2.3 SPE Port

10BASE-T1L (SPE) is on the terminal block on SPEBlox-Long (MPN: 1984617)
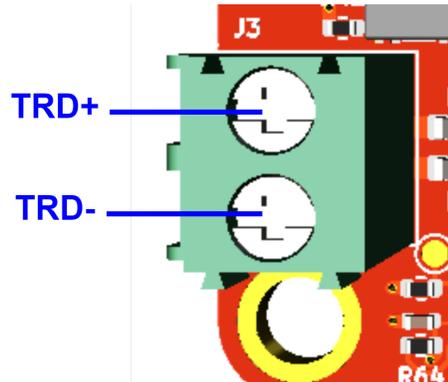Figure 7 below shows the pinout of the signals

Figure 7: SPE Terminal Block pinout

2.2.4 UART Configuration and Monitoring Header

There is a three pin Molex Picoclasp header on the board that contains UART RX and TX, connected directly to the onboard STM32 microcontroller on SPEBlox Long. These signals are 3.3V level and isolated. When combined with management firmware on the STM32, this allows an external device to configure and monitor the 10BASE-T1L and 10BASE-T connections, enabling features such as signal quality indication, port status and controlling signal strength. At time of writing, this feature is not enabled on SPEBlox Long yet, but will be enabled in future versions.
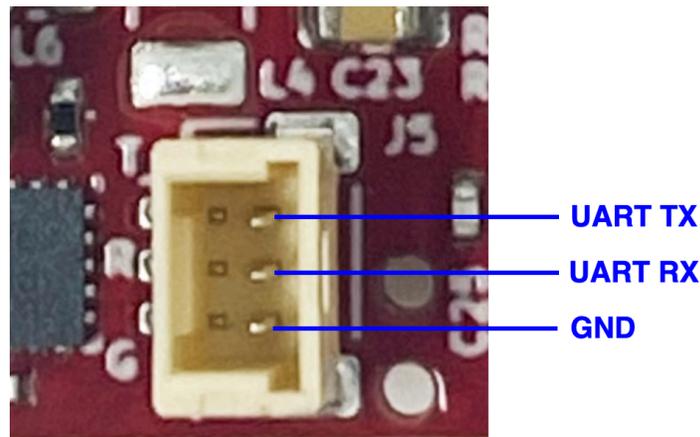

Figure 8: UART Config and Monitoring header pinout

The part on board is a Molex PicoClasp 3 pin header (5013310307). It can be maded with a pre-made cable available from Molex, part number 0151330306.

2.2.5 SWD Programming Header

A programming header on the back of the board allows the STM32L011F4U6 on SPEBlox-Long to be programmed over SWD.
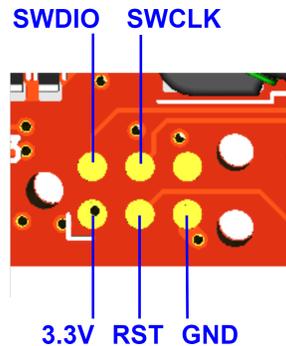

Figure 9: SWD programming header pinout

This header allows access to the SWD port on the onboard STM32 microcontroller, and requires the use of a 6-pin needle adapter such as the J-Link 6-pin needle adapter along with an in-circuit programmer such as the J-Link. We do not recommend the customer use this port unless they are intending to develop a custom application for SPEBlox Long

2.3 Other Interfaces

2.3.1 LEDs

There are four LEDs on SPEBlox-Long in total. None of the LED signals can be taken off board.

The 3.3V Power Indicator LED (**Green**) indicates that voltage is present on the 3.3V line. It should be solid green in normal operation.

Figure 10: Power Indicator LED

SPE LED D6 (**Green**) indicates link status and blinks for TX/RX Activity for the 10BASE-T1L port.

SPE LED D7 solid on **Green** indicates Long Reach mode 10BASE-T1L port.
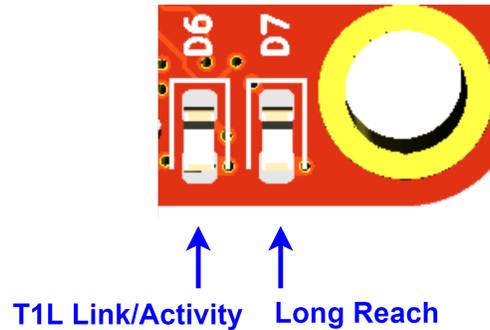

T1L Link/Activity   Long Reach

Figure 11: SPE Indicator LED

LED D8 (**Green**) indicates port Link/Activity on the 10BASE-T port . The LED is ON when the link is good. The LED blinks when the transmitter or receiver is active.

Figure 12: Port Indicator LEDs

3 Device Configuration

3.1 Unmanaged Converter

To use SPEBlox-Long in an unmanaged application requires no configuration, simply connect a voltage to the voltage input, connect two SPEBlox-Long devices via SPE port and connect downstream devices. Configuration and Monitoring firmware, available over the UART 3 pin Molex PicoClasp header, is currently in development, but not active yet.

4 Device Characteristics

4.1 Operating Conditions

4.1.1 Absolute Maximum Ratings

Operating in these ranges will reduce the lifetime of the device.

Voltage Input Maximum	65V
Storage Temperature	-55°C +125°C
Operating Temperature	-50°C +115°C [(View test report)](#)

5 Datasheet Changelog

Date	Datasheet Version	Author	Notes
20/02/2022	A_A	Josh Elijah	Preliminary release
26/10/2023	A_B	Jaclyn Li	Updated Storage Temperature in Table 5.1.1 Absolute Maximum Ratings and section 8.
11/07/2023	A_C	Josh Elijah	Updated title
07/08/2024	A_D	Jaclyn Li	Updated operating temperature range from "-40°C to +85°C" to "-50°C to +110°C"
12/08/2024	A_E	Josh Elijah	Added new information about three pin UART header
06/09/2024	A_F	Jaclyn Li	Updated cables included in 1.4 Included Equipment

6 Contact

If you have any questions regarding this product, please contact us:

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7 Certificate of Conformity

The full text of the Certificate of Conformity of this product is available at the following web address. https://botblox.io/documentation/