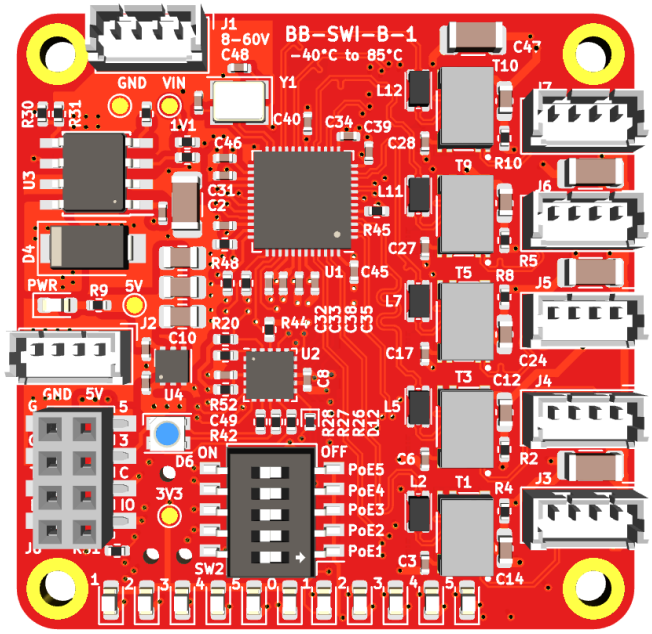
BotBlox



SwitchBlox Industrial

Small 5 port 10/100Mbps Ethernet Switch

Datasheet

Applies to:
MPN: BB-SWI-B-1
MPN: BB-SWI-B-1-NDAA

January 2024

BotBlox

Contents

1 General Information

1.1 Functionality and Features of SwitchBlox Industrial

The BotBlox SwitchBlox Industrial is a small form factor 5 port 10/100Mbps (10BASE-T/100BASE-TX) lightly managed L1 ethernet switch. It has a non-blocking fabric, meaning that 100Mbps speed can be achieved simultaneously on all ports. SwitchBlox Industrial is designed to be a more rugged and more capable upgrade to our SwitchBlox product and is designed for space, weight and price-sensitive (SWaP) industrial, mobile applications.

It runs from a wide input voltage range of 5 to 60V, and provides a 5A, 2A power output. It also features PoE injection onboard, and houses a microcontroller for custom firmware upload.

1.1.1 Features

- 5 x 10/100M (10BASE-T/100BASE-TX) ethernet ports
- Input voltage range from 5 to 60V
- Reverse protected voltage input
- Transient protected voltage input
- -40°C to +85°C operation range
- 38mm x 38mm board size
- Molex Picoblade connectors for power and ports
- 15W PoE injection on each port (selectable via a DIP switch)
- Automatic MDI-X crossover
- Plug and play unmanaged switch functionality
- Pre-configured management functionality onboard via BotBlox ARIES software for VLANs, QoS, Port Mirroring and port monitoring
- LED breakout header for connection of external ethernet activity indication LEDs

1.1.2 General Information

Voltage Input	5V to 60V DC (65V absolute max)
Voltage Output	5V ± 5%, 2A
PoE Maximum Power Output	15W (IEEE 802.3af)
Supported Protocols	10BASE-T, 100BASE-TX
Power Consumption	300mW (idle) to 800mW (full switching)
Weight	15 grams
Size	38mm x 38mm x 9.2mm
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C

Table 1: General Information

1.1.3 General Operating Instructions

SwitchBlox Industrial is designed for use in harsh 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.

In the simplest case of an unmanaged switch application, SwitchBlox Industrial can be operated immediately by following the following steps.

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

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

3) SwitchBlox Industrial will automatically begin auto-negotiation with connected devices and begin receiving and forwarding packets to/from all connected devices.

SwitchBlox Industrial (revision B) can implement VLAN setup, port mirroring and QoS using BotBlox ARIES software.

Revision B of SwitchBlox Industrial (BB-SWI-B-1) ships with the firmware necessary to interact with the BotBlox ARIES GUI software. This firmware does not interfere with using BB-SWI-B-1 in an unmanaged application.

Revision A of SwitchBlox Industrial (BB-SWI-A-1) does not ship with any firmware loaded, and will not work with BotBlox ARIES GUI software.

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.
- The board temperature can reach 40°C above ambient when 2A is drawn from the 5V output. In such cases, passive air cooling or heat sinking should be considered.

1.3 Block Diagram

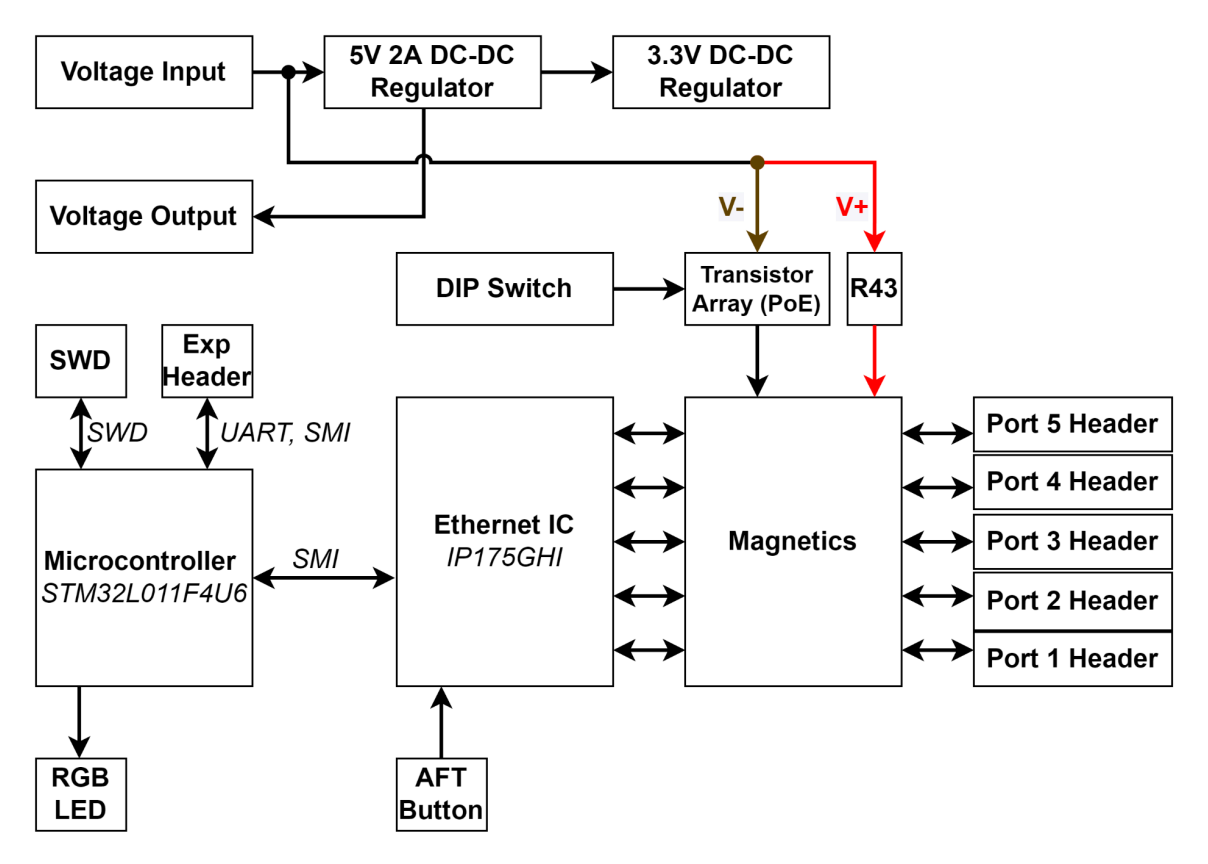


Figure 1: SwitchBlox Industrial Block Diagram

1.4 Included Equipment

The product includes the following:
1 x SwitchBlox Industrial board
5 x Molex Picoblade to RJ45 4-way Unshielded Twisted Pair cables (300mm)
2 x Molex Picoblade to bare, tinned leads (300mm)

1.5 RoHS Certification of Compliance

The BotBlox SwitchBlox Industrial complies with the RoHS (Restriction of Hazardous Substances Directive) Certificate of Compliance.

2 Hardware Interfaces

2.1 Board Map

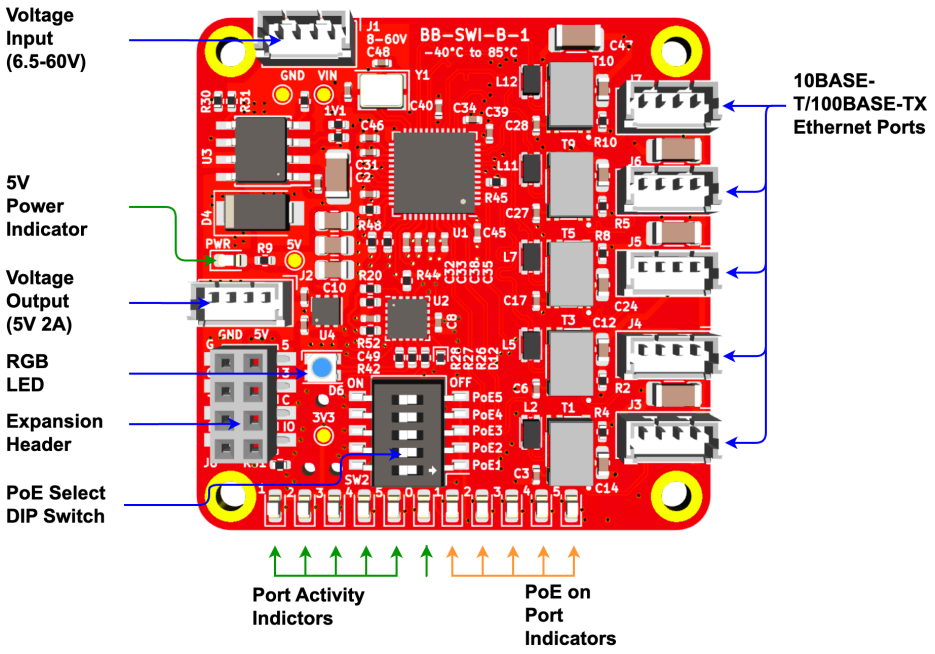


Figure 2: SwitchBlox Industrial Board Map (front)

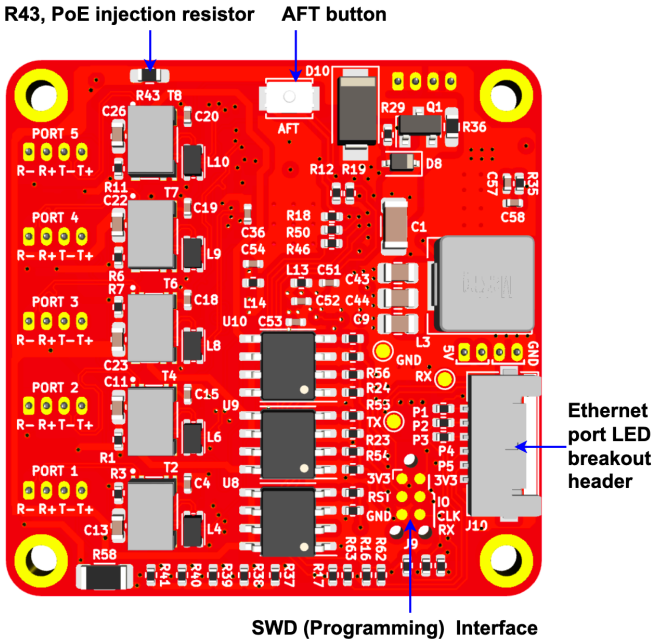


Figure 3: SwitchBlox Industrial Board Map (back)

2.2 Connectors and Pinouts

2.1.1 Voltage Input

The top left 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 4 below.

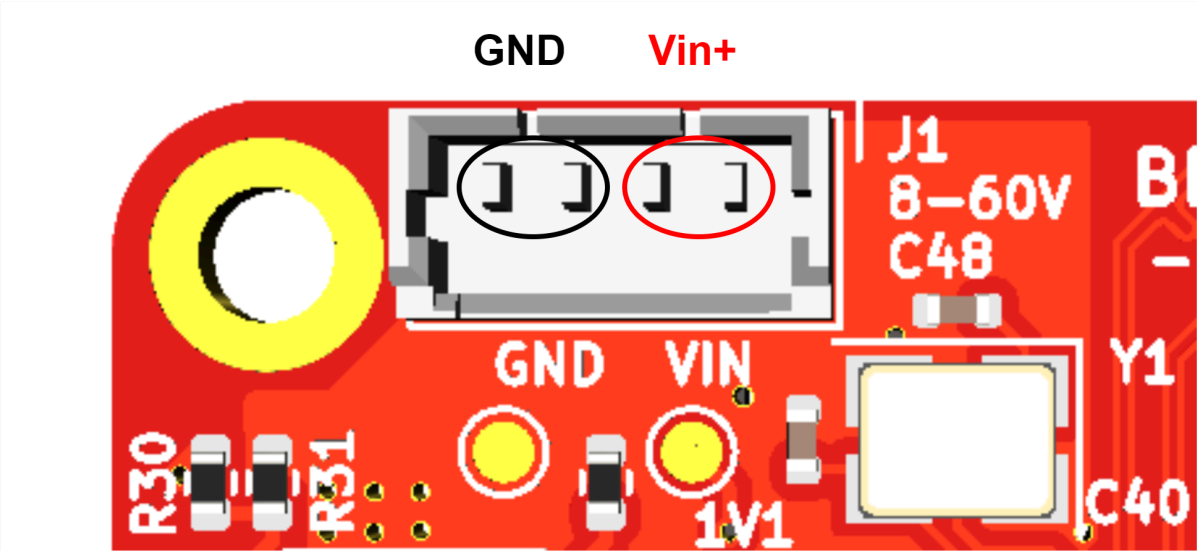


Figure 4: Voltage input header pinout

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

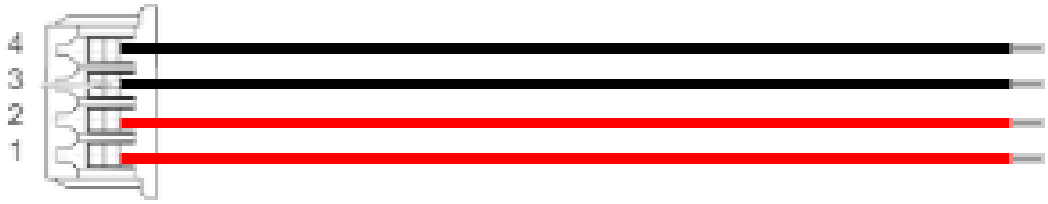


Figure 5: Voltage input cable pinout (red = V+, black = GND)

2.1.2 5V Voltage Output (alternate input)

The middle left connector is the voltage output terminal. A four pin connector is used to increase the maximum output current.

This connector can also be used as an alternative voltage input to power the board. In this case, you must not connect any voltage to the main Voltage Input connector (the connector shown in figure 4). Please note that this input is not overvoltage or transient protected, so make sure to only apply a clean, protected 5V to this connector. The input range for this pin is 4V to 5.5V. Exceeding this range **will** cause permanent damage to the board.

The voltage output has the following features:

- Voltage output is nominally 5V with tolerance of ±5%
- Up to 2A output current
- Around 132uF of capacitance on the 5V rail

The pinout of the voltage output connector is shown in Figure 6 below.

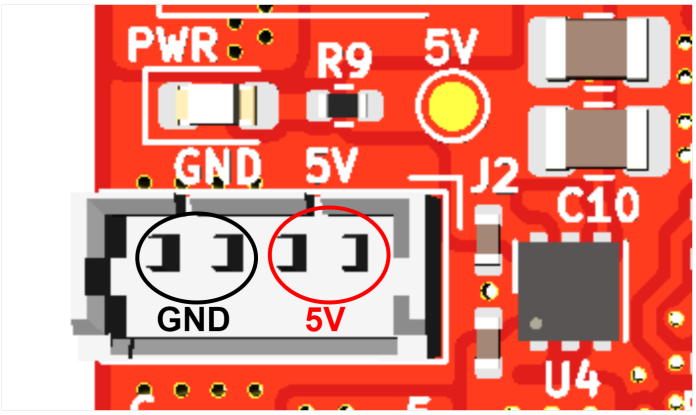


Figure 6: Voltage output header pinout

Cable pinout

Figure 7: Voltage input cable pinout (red = 5V, black = GND)

Connector part numbers

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

Table 3: Voltage output connector pinout and part numbers

2.1.3 Ethernet Ports

There are five ethernet connectors on SwitchBlox Industrial. Each connector has four pins corresponding to the four signals required for 100BASE-TX which are T+, T-, R+ and R-. The pin mapping of all five connectors is identical.

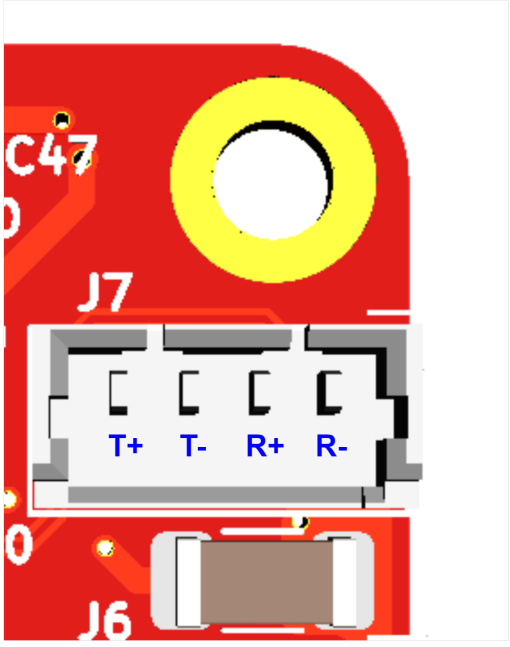


Figure 8: Ethernet port pinout

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

Table 4: Ethernet connector pinout and part numbers

Cable pinout

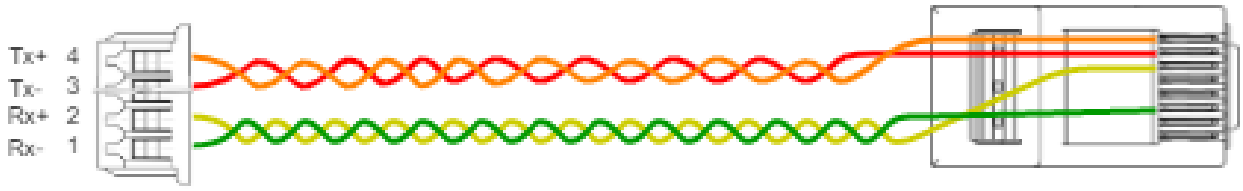


Figure 9: Ethernet cable pinout

2.1.4 Extension header

SwitchBlox Industrial boards have an extension header that an external device can use to communicate with the board via UART and SMI. The extension header provides the following interfaces:

- UART (TX and RX) connected to PA1 (LPUART1_TX) and PA0 (LPUART1_RX) on the STM32 microcontroller. This interface is used by the BotBlox ARIES GUI software.
- SMI/I2C connected to PB6 (MDC) and PB7 (MDIO) on the STM32 microcontroller; also connected to the MDC and MDIO pins on the IP175GHI. This interface should not be used.
- Onboard 5V output rail (can be used to supply power to the board).
- Onboard 3V3 rail (can be used to supply power to the board).

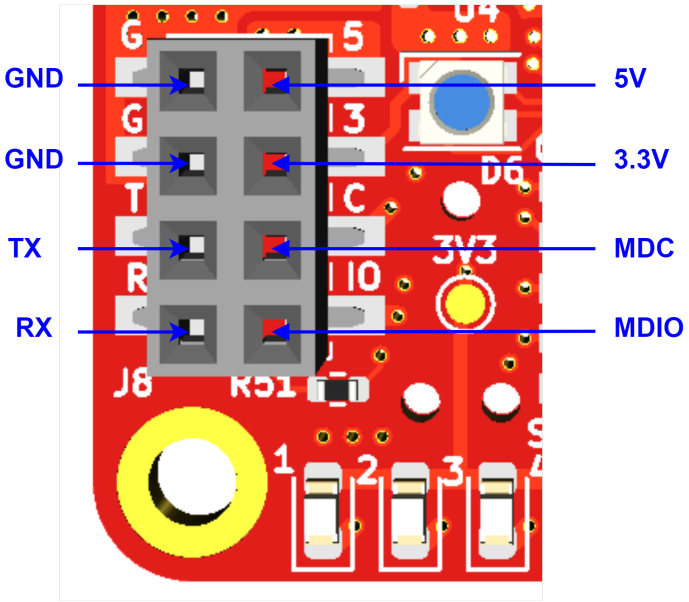


Figure 10: Extension header pinout

The part number for the extension header is NPPN042FFKP-RC, the mating part for this header is NRPN042PAEN-RC.

2.1.5 SWD Programming Header

A programming header on the back of the board allows the STM32L011F4U6 on SwitchBlox Industrial to be programmed over SWD.

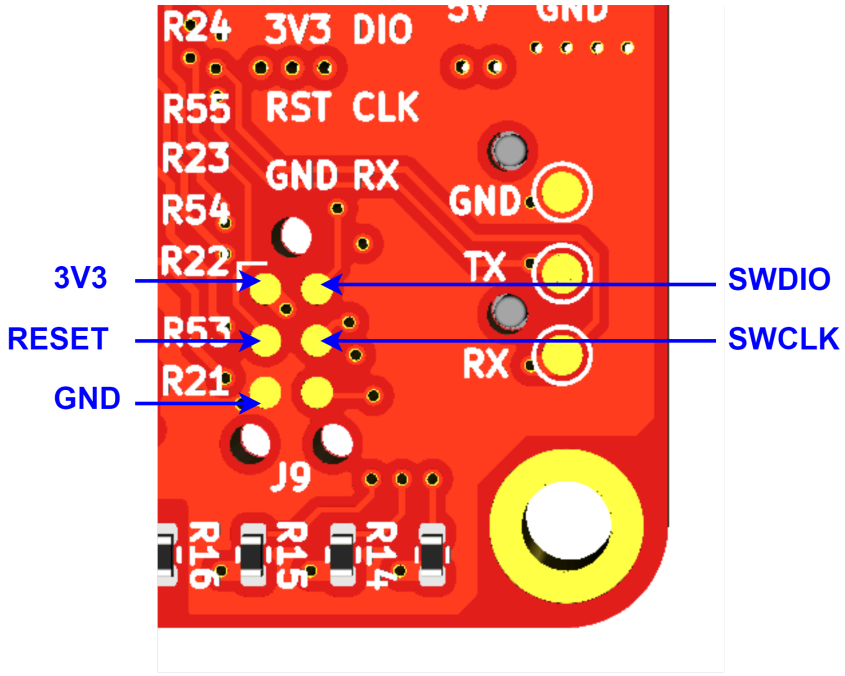


Figure 11: SWD programming header pinout

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.

Unless you have a specific requirement for custom firmware, you should not need to use this header.

2.1.6 LED Breakout Header

Revision B and onwards (BB-SWI-B-1) versions of SwitchBlox Industrial contain a header that allow the LED indication signals for the ethernet ports to be brought off-board. This can be useful when SwitchBlox Industrial is embedded into a larger system where the onboard LEDs may not be easily visible.

The pinout of the LED header is shown below in figure 12.

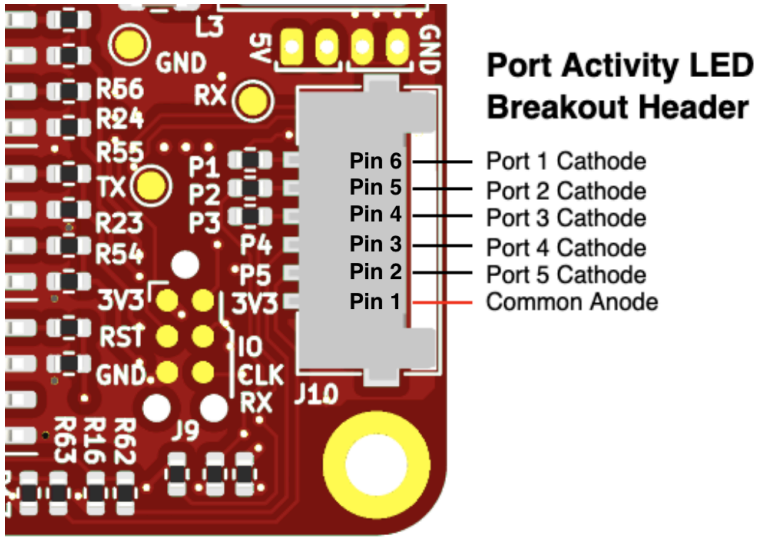


Figure 12: Port Activity LED breakout header pinout

Wiring external LEDs to this header uses a common anode arrangement, meaning that the anode of all external LEDs must be connected to the common anode pin on the breakout header. The individual cathodes of each LED connect to the individual cathode pins on the breakout header.

The LED signals broken out onto these pins are the same as the port activity indicator LEDs onboard. They will blink to show port activity.

1kΩ resistors are placed in series between the LED signal and the breakout header. Depending on the maximum allowed current of your external LED, this means you may not need to use additional external current limiting resistors, and can connect the LEDs directly to the breakout pins. The voltage of the common anode pin is 3.3V.

The connector used on the board is 5037630691 (Molex PicoLock) which mates with 5037640601 using crimp 5037650098. A premade cable, 0151320605 can be purchased to interface with this connector. This cable configuration is identical to the LED breakout header on SwitchBlox Rugged, meaning SwitchBlox Industrial can be used as a drop-in replacement for SwitchBlox Rugged.

2.2 Other Interfaces

2.2.1 DIP Switch for PoE Injection

A DIP switch on the back of SwitchBlox Industrial (see figure 13 below allows the input voltage to be injected onto any of the ports. Once active, each PoE port can deliver a maximum of 300mW. PoE is not enabled by default. To enable PoE, R43 (see figure 14) needs to be populated with a 0603 0 ohm resistor.

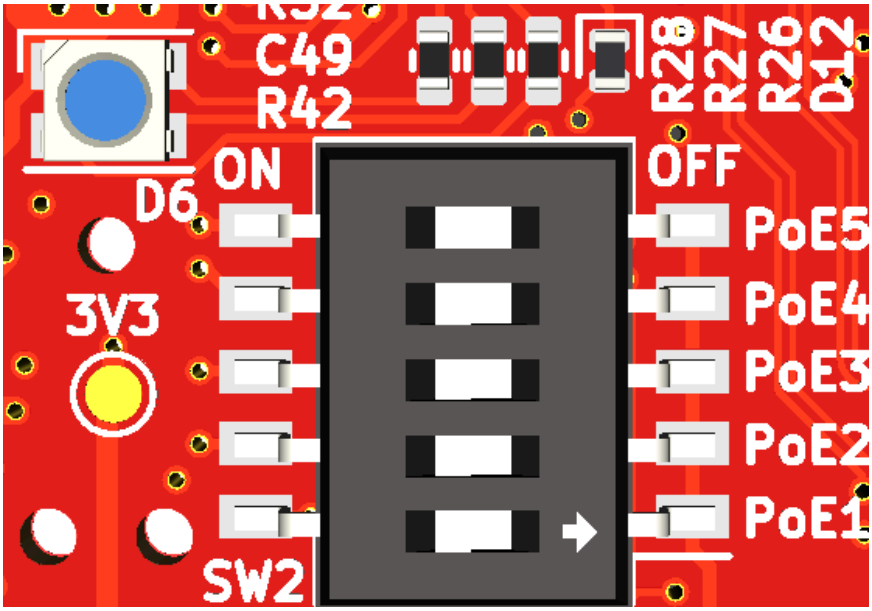


Figure 13: PoE select DIP switch

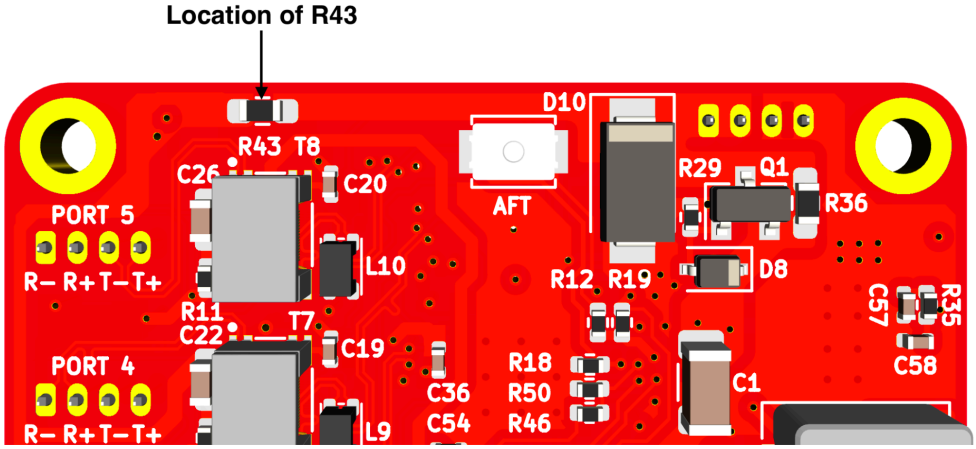


Figure 14: Location of R43, which must be populated with a 0R resistor (or solder bridge) to enable PoE

In the right-most position of the PoE DIP switch, the ethernet ports are not PoE enabled. In the left most position, the input voltage is injected onto the selected port, and the corresponding PoE port LED turns on to indicate PoE voltage on the board.

PoE injection is not a "hot-swappable feature". Only toggle PoE on a port when no load is applied. If PoE is toggled while a load is connected, the PoE will be stuck on.

Drawing 300mW from all PoE ports at the same time can lead to the board overheating. It is best to test this in the application first.

Resistor R43 must be populated with a 0 Ohm resistor to enable the PoE feature. This resistor is depopulated by default.

The PoE transistors onboard have an on-resistance of 500mΩ. This will cause a voltage drop between the input voltage applied to SwitchBlox Industrial, and the load device, based on the current. An example calculation is below:

Vin = 48V
PoE load power = 15W
Nominal required current = 312.5mA
Voltage drop across PoE transistor = 40mV

The pinout of PoE on the port pins is TX+/TX- DC Voltage = 0V, RX+RX- DC Voltage = Vin.

2.2.2 LEDs

There are 12 LEDs on SwitchBlox Industrial in total.

The 5V Power Indicator LED (**Green**) indicates that voltage is present on the 5V line. It should be solid green in normal operation.

The Ethernet IC "ON" Indicator LED (**Green**) indicates that the ethernet IC is powered up and working. It should be solid green in normal operation.

Each Port Activity LED (**Green**) corresponds to a specific port. They indicate activity on each port and will blink when there is traffic on a port. They should be solid off when a port is not connected to any device, and they should blink under normal operation. A solid green LED indicates either constant traffic, or a fault with the port. This signals can be taken off board.

The PoE on Port Indicator LEDs (**Orange**) indicates which of the ports currently has PoE injected onto it. This can be toggled on a port-by-port basis using the PoE Select DIP switch.

3 Software Interfaces

3.1 ARIES GUI Software

SwitchBlox Industrial (revision B, BB-SWI-B-1) runs firmware onboard designed to interact with BotBlox ARIES GUI software for switch management functions.

Please refer to the link below for instructions on how to use this software.

https://botblox.notion.site/BotBlox-ARIES-Software-Documentation-9c7f82d35771463d9bc911bae3d4c0d0

4 Device Configuration

4.1 Unmanaged Switch

To use SwitchBlox Industrial in an unmanaged application requires no configuration. Simply connect a voltage to the voltage input and connect downstream devices.

4.2 Managed Switch

Running SwitchBlox Industrial in a managed switch application requires downloading and running BotBlox ARIES GUI software. Please refer to the documentation on this software for this.

5 Device Characteristics

5.1 Operating Conditions

5.1.1 Absolute Maximum Ratings

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

Voltage Input Maximum	65V
PoE Current Delivery (per port)	350mA
Storage Temperature	-40°C to +85°C
Operating Temperature	-40°C to +85°C
5V Output Current	2.3A

5.1.2 Nominal (Test) Ratings

Voltage Input	65V
PoE Power Delivery (per port)	0mA
5V Output Current	0mA

6 Datasheet Changelog

Date	Datasheet Version	Author	Notes
01/10/2022	A_A	Josh Elijah	Initial release
21/05/2023	A_B	Josh Elijah	Updated voltage input range from 6.5V to 5V minimum
26/10/2023	A_C	Jaclyn Li	Table 1.1.2 General Information updated to be correct values
20/01/2024	B_A	Josh Elijah	• Revised minimum input voltage from 6.5V to 5V • Removed references to custom firmware and replaced with BotBlox ARIES software • Added reference to external breakout LEDs • Added note about 5V output being capable of being used as an alternative low voltage input

7 Contact

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

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8 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/