

## RS485 Shield

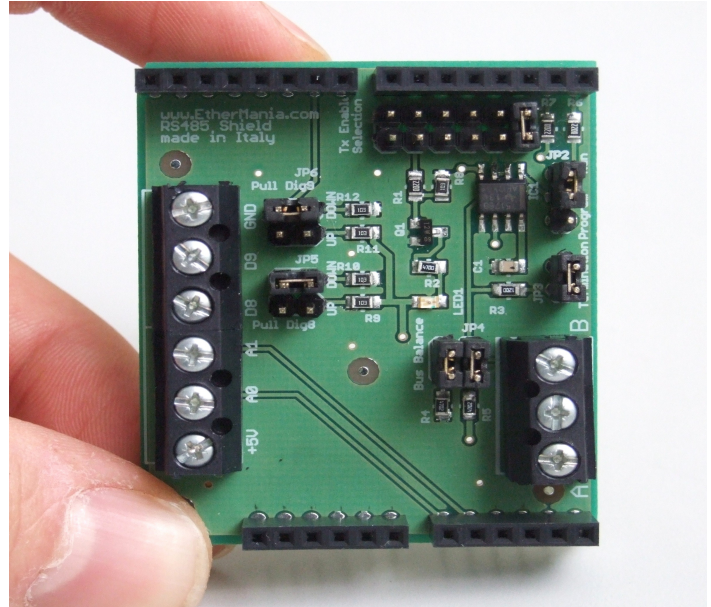
### Introduction

The RS485 Shield is a shield for Arduino and Netduino compatible boards. It features an half duplex RS485 BUS transceiver with on board dip-switches for BUS termination and BUS balance. A set of screw type terminals are provided to easily accommodate digital and analog input/output connections. Each digital input could be optionally configured with pull-up or pull-down resistors through a set of dip-switches.

Transmission over the BUS is controlled by a user selectable pin. An on-board LED turn on each time the transceiver is set as transmitter.

### Connections

The RS485 Shield is equipped with two screw type connectors as visible on the picture on the right side of this page. Connections are detailed below.



The connection to the RS485 BUS is performed through a three poles black screw-type connector shown on the very right side of the picture. The RS485 defines a pair of twisted cables named A and B as reported on the labels present on the Shield. The center pole could be used for shielded cables and is connected to the electrical ground of the board.

The six poles black screw-type connector located on the left of the board could be used for solder-less connection to push buttons, LEDs and/or other low voltage/current (20mA @ 5V maximum) equipments. The lines provided are directly connected to the host board standard I/O pins as reported on the table below.

Pin Label	Line name	Type
+5V	5V Power supply	Power
A0	Analog Pin 0	Analog input
A1	Analog Pin 1	Analog input
D8	Digital Pin 8	Digital In/Out
D9	Digital Pin 9	Digital In/Out
GND	System Ground	Power

Digital In/Out pins could be optionally connected to the on-board pull-up or pull-down resistors by mean of dip-switches.

## How to use it

Before connecting the RS485 Shield to the BUS and to the host board, a set of jumper selection is required. These jumpers are used to configure the RS485 BUS parameters like termination and bus balancing, and/or to define the idle status for the two digital lines connected to the screw type connector. A set of dip-switches is used for selecting the Tx enable pin. More details are reported on the following paragraphs.

### RS485 BUS related configuration

The RS485 BUS specifications defines that each node placed at the end of the BUS should be terminated by a resistor. The RS485 Shield is equipped with an on-board resistor acting as terminator. The connection of the termination resistor is defined by the JP3 dip switch.

JP3 Switch status	Function
Closed (dip in)	Termination connected to the BUS
Open (dip left out)	Termination not connected to the BUS

An RS485 bus should never be left floating but when all nodes in the BUS act as receivers and no one is transmitting, the BUS twisted pair is left in the high impedance. Without a proper balancing the voltages on the BUS could reach values out of specifications and could permanently damage one or more nodes in the BUS. Balancing the BUS avoids this problem. The RS485 BUS specifies that **only ONE node** in the BUS should perform balancing. The JP4 switch pair is used to enable/disable this feature.

JP4 Switch status	Function
Closed (dips in)	BUS Balance is performed by the Shield
Open (dips lefts out)	BUS Balance is not performed by the Shield

The RS485 transceiver installed on the RS485 Shield has half duplex capabilities: each time the host needs to transmit something to the BUS it needs to setup the transceiver to be a transmitter. All other nodes should be receivers at the same time. There is no way to have more than one node transmitting concurrently on the BUS; if this happens the data on the BUS will be corrupted. TX/RX selection modality should be performed by the software present on the host. The Shield acts as transmitter if a high logic status is set to the Tx Enable Pin but acts as receiver when a low logic is applied to this pin. In order to provide the best versatility the RS485 Shield allows to select what host line is used to drive the Tx Enable Pin of the transceiver. The selection is made through the Tx Enable Selection dip-switches as reported by the table below.

Tx Enable Selection switch	Associated host line
D2 (near to the R7 resistor)	Digital output line D2
D3	Digital output line D3
D4	Digital output line D4
D5	Digital output line D5
D6	Digital output line D6
D7	Digital output line D7

Data flowing on the RS485 BUS is a serial type data. Each byte is sent sequentially through the transceivers to/from the host boards. The RS485 Shield provides serial In and Out lines on the D0 and D1 pin headers. This easily matches the serial lines normally found on the Arduino compatible headers. **The dip-switch JP2 is used to temporarily disconnect the RX**

**line when programming sketches to Arduino.** This is required by a limitation on the Arduino boards where the on-board programmer shares the unique serial interface present on Arduino UNO. The JP2 switch **should be set to PROGRAM** position each time the sketch is downloaded to the host board, then **placed to the RUN position** as soon as the programming procedure terminates.

**NOTE:** This is not required for Netduino boards. With these platforms the JP2 switch should be always set to the RUN position.

JP2 Switch position	Function
RUN	Normal operating mode
PROGRAM	Download Arduino Sketches

#### *Input/Output lines related configuration*

The RS485 shield is equipped with a screw-connector useful for solder-less install of input/output devices. Two of this poles are directly connected to the D8 and D9 digital lines present on the host board headers.

To easily accommodate momentary push-buttons and/or switches, a set of pull-up and pull-down resistors could be optionally enabled by means of appropriated dip-switch selections as reported below.

JP5 Switch position	Function
UP inserted, DOWN open	10k ohm pull up resistor is enabled for the line D8
UP open, DOWN inserted	10k ohm pull down resistor is enabled for the line D8
Up open, DOWN open	Line D8 is left in high impedance state
UP inserted, DOWN inserted	Not admitted. Even if no damage occurs we suggest to not use this configuration in order to avoid unwanted current drawn by power supply

JP6 Switch position	Function
UP inserted, DOWN open	10k ohm pull up resistor is enabled for the line D9
UP open, DOWN inserted	10k ohm pull down resistor is enabled for the line D9
Up open, DOWN open	Line D9 is left in high impedance state
UP inserted, DOWN inserted	Not admitted. Even if no damage occurs we suggest to not use this configuration in order to avoid unwanted current drawn by power supply

#### **Code Sample and library**

A set of libraries and code example could be found on the EtherMania public repository on GitHub. Please refer to <https://github.com/ethermania>

#### **Disclaimer**

For Feasibility Evaluation Only, in Laboratory and/or Development Environments. The RS485 Shield is not a complete product. It is intended solely for use for preliminary feasibility evaluation in laboratory and/or development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all of part of finished end product. You agree to defend, indemnify and hold the Supplier, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities arising out of or in connection with any use of the RS485 shield and software that is not in accordance with the previous statements. This obligation shall apply whether Claims arise under law of tort or any other legal theory, and even if the RS485 shield and software fail to perform as described or expected