DESCRIPTION

The SCM TTL to RS-485 Interface module provides a robust automatic bi-directional interface from TTL to long-line RS-485.

PACKAGE INCLUDES:

- SCM TTL to RS-485 Interface Module
- 4-pin male header
- 3-pin screw terminal block

KEY FEATURES OF SCM TTL TO RS-485 INTERFACE MODULE:

- Automatic bi-directional transmission control
- Uses differential signaling for noise immunity
- Distances up to 1200 meters
- Speeds up to 2.5Mbit/Sec
- Multi-drop supports up to 32 devices on same bus
- Built-in poly fuses for over-current protection
- Built-in transient surge protection diodes for over-voltage protection
- Transmit and receive indicator LEDs
- Comes with connectors and headers for easy hookup
- 3.3V & 5V operation

RS-485 provides for robust serial communications over long distances of up to 1200 meters (4000′) or in electrically noisy environments and is commonly used in industrial environments. It supports up to 2.5MBit/Sec data rates, but as distance goes up, the maximum data rate that can be supported comes down.

You can think of RS-485 as RS232 on steroids. The data starts out as typical TTL level serial as far as the microcontroller is concerned while the RS-485 module takes care of converting the electrical signals between TTL and the differential signaling used by RS-485.

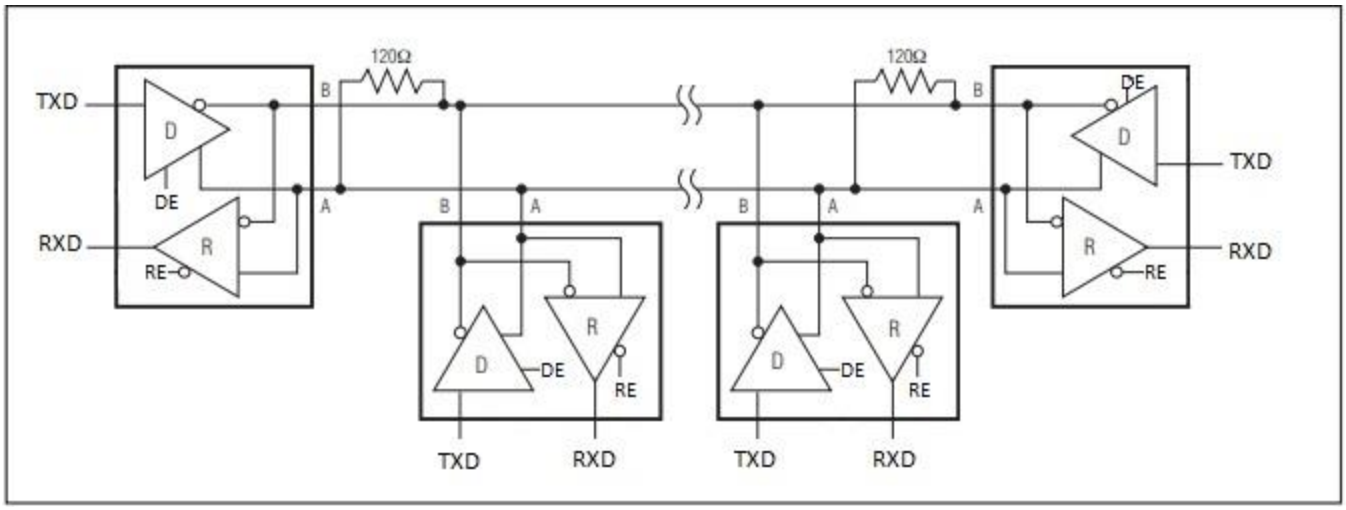
This module is fairly unique in that it automatically takes care of data transmission direction control which makes it easy to use and it also has significant protection circuitry built-in to prevent damage in case of lightning strikes and similar electrical disturbances.

Multi-Drop Support for Multiple Devices

A significant benefit of RS-485 is that it supports multiple devices (up to 32) on the same cable, commonly referred to as ‘multi-drop’.

This works by passing the bus through each device where it picks off the signal as it passes through as shown below.

These devices are typically setup in a Master / Slave configuration with one Master and one or more Slave devices. Since they all share the same bus, to avoid conflict the Slave devices only talk when they are asked for something by the Master such as requesting a temperature reading.



Differential Signaling

The RS-485 uses differential signaling and requires only 2 wires and a common ground.

Differential signals operate by putting the signal on 1 wire and the inverse of the signal on the other wire. This improves the signals noise immunity and the ability to recover the signal at the far end of the cable as noise tends to couple into both lines equally and therefore cancels out at the receiving end.

Wiring RS-485

These two differential data lines are labeled as A & B. On the module, these are available on the screw terminal block end of the board at the solder pads labeled A+ & B-.

When connecting the modules together, the wiring is straight through, so A on one end should be connected to A on the other end and B connects to B.

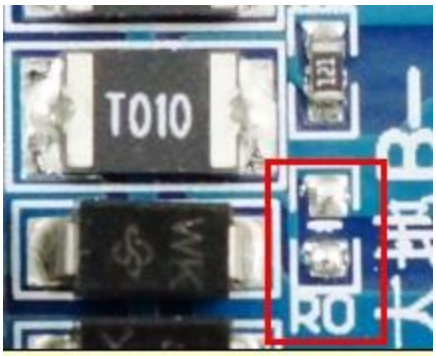
The wires should ideally be twisted pair. Using twisted pair becomes more important for longer runs or where there is a lot of electrical noise. For simple breadboard testing or other short runs, it is not necessary.

A common ground is needed, but this can often be provided by the earth ground at each end when dealing with shorter runs or bench testing. Network cable is often used for connecting RS-485 as it provides twisted pair, plus it can provide a ground wire as well.

If a shielded cable is used, the shield should be grounded on one end only.

Pull-up and Termination Resistors

There are 4.7K pull-up resistors on the A/B differential lines. These pull the lines to a known state when data is not being transmitted.



Bridge to put 120 ohm termination resistor in-circuit

Finally there is a single 120 ohm termination resistor. This resistor goes between the A & B differential lines on the modules at each end of the cable to prevent reflections. As shipped, the resistor is not in-circuit. To put the resistor in-circuit, the solder pads at location R0 should be shorted with solder or a wire. If using in a multi-drop configuration, the modules on the two ends of the line should add these resistors. Modules in the middle of the line should not use these resistors to prevent loading the lines too heavily as shown in the pic above.

For benchtop testing with short cables, this resistor can usually be ignored.

Module Assembly

These modules have castellated (half holes) at the edges of the board along with a full hole. This allows the module to be used as a platform board by soldering the edges of it down to solder pads on a board under it.

The modules also come with a strip of male headers and a screw terminal block which can be soldered on either side of the board depending on intended usage. The holes can also be used for direct soldering to wiring.

Module Connections

The module has a 4-pin header on the assembly for connections to the MCU. Because this module has auto direction control, it does not require the extra DE/RE pins required by most other RS-485 modules.

1 x 4 Header (TTL Side)

- **VCC** = Vcc – Connect to 3.3V or 5V to match MCU power
- **RXD** = Receive Data – Connects to RXD TTL input on MCU
- **TXD** = Transmit Data – Connects to TXD TTL output on MCU
- **GND =** Ground. Connects to ground on MCU

1 x 3 Screw Terminal Block (RS-485 Side)

- **A+** = Data 'A' Non-Inverted Line. Connects to A+ on other modules
- **B-** = Data 'B' Inverted Line. Connects to B- on other modules

- **GND** = Ground

OUR EVALUATION RESULTS:

The attached schematic is our effort to document this module. The chip markings are removed, so there is a little guesswork as to the exact chips used, but the functionality should be correct.

You will need RS-485 on both ends, so typically you will need two of these modules to implement a basic link unless you are trying to interface with a device that already has RS-485 implemented.

When working with these devices, keep in mind that they are basically just level translators. From the MCUs perspective, the functionality is the same as if two RS-232 serial ports are connected for communicating between the devices. If there is difficulty in using the devices, they can often be temporarily removed from the setup to see if the issue is with the RS-485 or something more basic in the setup. If they are removed from the setup, the RX/TX lines between the microcontrollers need to be crossed i.e. TX1 to RX2 and RX1 to TX2.

Because these devices include automatic direction control, the software is more straightforward than most RS-485 adapter modules.