TTL to RS485 Converter — NDE-1001

MAX485 · Automatic direction control · JST-XH & screw terminals · Enclosed · Product information, pinout & wiring guide

A ready-to-wire converter between a standard TTL serial (UART) port and a half-duplex RS485 bus. It lets a microcontroller, single-board computer or USB-serial adapter talk to RS485 devices such as Modbus sensors, VFDs, energy meters, industrial controllers and long-distance serial links — over distances a plain TTL connection could never reach.

Unlike bare breakout modules, this unit uses **automatic direction control**, so there is no DE/RE pin to drive and no transmit-enable code to write. It is supplied with a **4-way JST-XH connector** on the TTL side, a **3-way screw terminal** on the bus side, and a **protective enclosure** — ready to install rather than ready to solder.

Also searched as: TTL to RS485 module, UART to RS485 converter, MAX485 module, RS485 automatic flow control, Arduino RS485 adapter, ESP32 RS485 interface, Modbus RTU converter.

Key features

- **Automatic direction control** — no DE/RE pin, no transmit-enable code. Connect four wires and use the serial port normally.
- **MAX485 transceiver** — the industry-standard RS485 device, rated −40 to +85 °C.
- **Works with 3.3 V and 5 V logic** — suits ESP32, Raspberry Pi, Pico, STM32, Arduino and USB-serial adapters.
- **JST-XH 4-way connector** on the TTL side — secure, keyed, and no soldering required.
- **3-way screw terminal** on the bus side, including a proper ground reference.
- **120 Ω bus termination fitted** — correct for an end-of-line node straight out of the box.
- **Supplied in an enclosure** — nothing exposed, nothing to short against a panel or a cable tray.
- **Tested before packing** — every unit is functionally tested on our own bench and carries a TESTED OK mark.
- **Up to 32 devices** on one bus, and up to 1200 m of cable at lower baud rates.

Specifications

Part number	NDE-1001
Function	TTL / UART to RS485, half duplex
Transceiver	MAX485ESA (SOIC-8)
Direction control	Automatic — no DE/RE signal required
Supply voltage	3.3 V or 5 V DC (see *Choosing your supply voltage* below)
TTL logic levels	Follows the supply voltage; accepts 3.3 V and 5 V logic inputs
Data rate	Tested 9600 to 115200 baud
Bus loading	Up to 32 standard unit loads (devices) per bus
Bus termination	120 Ω fitted on board
Common-mode range	−7 V to +12 V
Maximum cable length	Up to 1200 m at lower baud rates; less as baud rate rises
Operating temperature	−40 to +85 °C (transceiver rating)
TTL connector	JST-XH, 4-way, 2.54 mm pitch
RS485 connector	Screw terminal, 3-way, 5.08 mm pitch
Enclosure	69 × 24 × 15 mm

Connections

Pin order shown as counted from the top of each connector

Connector layout and pin order

TTL side — JST-XH 4-way

Pin	Signal	Direction	Connect to
1 (top)	**GND**	—	Ground / 0 V of your controller
2	**RXD**	Into the module	The **TX** pin of your controller
3	**TXD**	Out of the module	The **RX** pin of your controller
4	**VCC**	—	3.3 V or 5 V supply

> **Note:** Serial connections always cross over — the module's **RXD** goes to your controller's **TX**, and its **TXD** goes to your controller's **RX**. If the link stays silent, swapping these two wires is the first thing to try; naming conventions differ between manufacturers and it damages nothing.

RS485 side — 3-way screw terminal

Terminal	Signal	Also labelled	Function
1 (top)	**GND**	SG, COM, 0V	Bus signal ground reference
2	**B−**	D−, TR−, RxTx−	Inverting data line
3	**A+**	D+, TR+, RxTx+	Non-inverting data line

> **A and B labelling:** the RS485 standard is poorly observed on this point and some manufacturers label their terminals the other way round. If a device will not communicate, swap A and B. RS485 receivers are differential and no damage results from having them reversed — you simply get no valid data.

Choosing your supply voltage

The module runs from either 3.3 V or 5 V, and the choice matters more than it first appears.

> **Important:** the TXD output swings to whatever you supply on VCC. If you power the module from **5 V** and connect TXD directly to an **ESP32, Raspberry Pi, Pico or STM32**, you are applying 5 V to a pin that is **not 5 V tolerant**, and you may damage it. Either power the module from 3.3 V, or fit a level shifter or resistive divider on the TXD line.

Powering from 3.3 V

The simplest and safest choice for 3.3 V controllers such as the ESP32, Pico, STM32 and Raspberry Pi. Every signal on the TTL side stays within 3.3 V, so nothing needs level shifting in either direction. The differential voltage on the bus is lower than it would be at 5 V, which slightly reduces noise margin, so this is the better choice for short and medium runs in ordinary environments.

Powering from 5 V

The right choice for 5 V controllers (classic Arduino boards, many USB-serial adapters), and for long cable runs or electrically noisy sites, because it gives the MAX485 its full drive capability and the best noise immunity. Only use 5 V with a 5 V-tolerant controller, or add a divider on TXD as described above.

Bus wiring

Always connect the ground

RS485 is a differential system, and it is often assumed that only the A and B wires matter. That assumption is behind a large proportion of unreliable RS485 installations.

The receivers only work correctly while both data lines sit within −7 V to +12 V of the receiver's own ground. Two pieces of equipment on separate mains supplies, or at opposite ends of a building, can easily sit several volts apart — and once that difference exceeds the common-mode range, communication becomes intermittent or fails altogether, usually in a way that looks like a software problem.

Run a third conductor between the ground terminals of every device on the bus. Screened cable with a twisted pair for A/B and the screen or a third core for ground is ideal.

Termination — and when to remove it

An RS485 bus should be terminated with approximately 120 Ω at **each of its two physical ends, and nowhere else**. This module has a **120 Ω resistor fitted**, which makes it correct as supplied for an end-of-line device.

> **Multi-drop installations:** if you place three or more of these modules on one bus, the units in the *middle* of the run must have their 120 Ω resistor removed. Leaving every module terminated loads the bus far below what the drivers can pull, and the result is weak signals, short range and unreliable communication. Two terminators, one at each end, and no others.

Cable and topology

Use twisted-pair cable and wire the bus as a single line from one end to the other, with devices connected by the shortest possible stubs. Star and tree layouts cause reflections and should be avoided. Up to 32 devices are supported on one segment, and cable runs of up to 1200 m are achievable at lower baud rates — the usable distance falls as baud rate rises.

Automatic direction control

On a half-duplex RS485 bus only one device may transmit at a time, so the transceiver must be switched between sending and receiving. Basic modules expose a DE/RE pin for this and expect your software to drive it around every transmission — a common source of bugs, because the pin must be released at exactly the right moment or the last character is lost.

This module handles that switching in hardware. It detects activity on the RXD line, enables the driver for the duration of the transmission, and returns to receive automatically. Your code simply writes to the serial port as it would for any other device.

> **Note:** automatic direction circuits are timing based, and very high baud rates can begin to clip the end of a transmission. This module has been used successfully from 9600 through 115200 baud, which covers Modbus RTU and the overwhelming majority of RS485 equipment. If you intend to run substantially faster, test before committing to an installation.

Typical connection

```
Controller (3.3 V)             NDE-1001               RS485 bus
------------------          --------------        --------------
     GND  ------------------  GND
     TX   ------------------  RXD          A+  ----------  A+  (device)
     RX   ------------------  TXD          B-  ----------  B-  (device)
     3V3  ------------------  VCC          GND ----------  GND (device)
```

Applications

- **Modbus RTU** — energy meters, PLCs, temperature controllers, inverters and VFDs
- **Long-distance serial** — where a TTL or RS232 link would be far too short
- **Industrial sensors** — soil, weather, level, flow and pressure transmitters
- **Building systems** — access control, lighting, HVAC and irrigation controllers
- **Multi-drop networks** — one controller addressing many devices over a single pair
- **Noisy environments** — differential signalling rejects the interference that defeats single-ended serial

Mechanical

Enclosure size	69 × 24 × 15 mm
TTL connector	JST-XH 4-way, 2.54 mm pitch (mating fly lead supplied)
RS485 connector	3-way screw terminal, 5.08 mm pitch
Mounting	Free-standing; suitable for panel, DIN rail clip or cable-tie mounting

Troubleshooting

Symptom	Check
No data at all	Swap RXD and TXD on the TTL side. Confirm VCC and GND are present.
No data from the bus device	Swap A+ and B−. Labelling conventions vary between manufacturers.
Works on the bench, fails when installed	Almost always a missing ground between devices. Run the third conductor.
Intermittent or corrupted data	Check termination — exactly two 120 Ω terminators, at the two ends of the bus only.
Last character of each message lost	Baud rate too high for the automatic direction circuit. Try a lower rate.
Controller stopped responding after wiring up	Check whether 5 V was applied to a 3.3 V input. See *Choosing your supply voltage*.

Testing

Every unit is functionally tested before it is packed. Each one is checked for correct data transfer in both directions across its rated baud range, for correct bus termination resistance, and for correct operation on both 3.3 V and 5 V supplies. Units that pass carry a **TESTED OK** mark on the enclosure.

Support

Sold and supported by **NDE3D**. For questions, please contact us via nde3d.co.za.

Specifications are based on the transceiver manufacturer's data and on bench verification of the supplied units, and are provided in good faith; minor variations between production batches are possible. Tested baud range is stated as tested, not as a maximum limit.