



## Application Note: RS485 Network Wiring

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This application note provides guidance on wiring an RS485 network and how the North RS485 Coupler can simplify complex wiring.

Please read the appropriate driver manual for connected RS485 devices alongside this document, available from [www.northbt.com](http://www.northbt.com)

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# Introduction to RS485

Think of an RS485 network as a long ‘conversation’ wire that connects several devices together over long distances. It is the standard way that many building systems talk to each other. Whether you are using protocols like Zip, Modbus or BACnet, they all rely on this same basic wiring method.

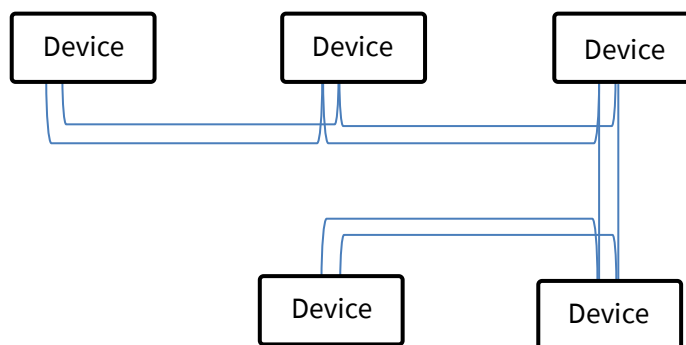
## A bus network

To keep the conversation clear, RS485 devices must be connected in a single, continuous line with only two ends. This is called a bus or ‘daisy chain’.

Because all devices share the same two wires, they take turns speaking. Imagine a group of people on a conference call: everyone can hear everything, but only one person can talk clearly at a time.

## How to wire it

You will typically use a twisted pair cable (two wires twisted together). Each device has two terminals, usually labelled ‘+’ and ‘-’. To build your chain, you simply connect the ‘+’ from one device to the ‘+’ of the next, and the ‘-’ to the ‘-’.



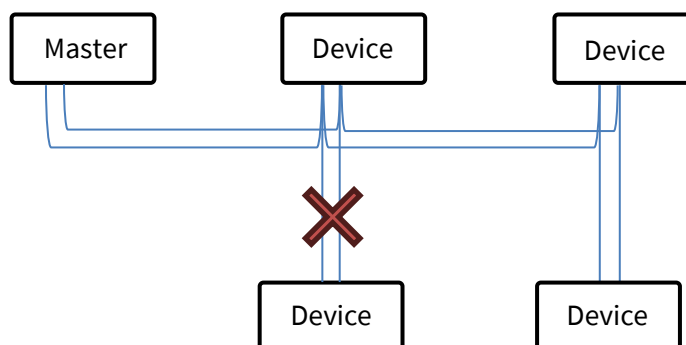
Note that not all manufacturers use ‘+’ and ‘-’. You might see labels like ‘A/B’ or ‘D+/D-’.

Usually ‘A’ is negative (-) and ‘B’ is positive (+). But watch out, some manufacturers swap these! Always double-check your product manual to ensure you’re not crossing the wires.

## What to avoid

For the signal to travel reliably, its path must be a single line. You should avoid two common mistakes:

- Stubs (T-junctions): This is when you try to tap into the main bus with a long branch wire.
- Star patterns: This is when multiple wires meet at one central point like a hub.



These layouts cause signal reflections – electronic echoes that garble the data and cause communication errors. Always stick to the daisy chain.

# Maintaining the bus: How the RS485 Coupler simplifies complex wiring

## When a daisy chain isn't practical

In a perfect world, every device sits in a neat line. But in the real world, it is often much easier and cheaper to run all your wires back to one central panel – a layout known as star wiring.

Normally, star wiring must be avoided for RS485 networks because it causes the signal echoes we mentioned earlier. Engineers sometimes try to work-around this by using a 4-core cable to send the signal out to a device and then immediately back to the hub to continue the chain. While this works, it can create a 'birds nest' of wires and terminal strips that are a nightmare to maintain. If you unwire one device to test it, you break the entire network.

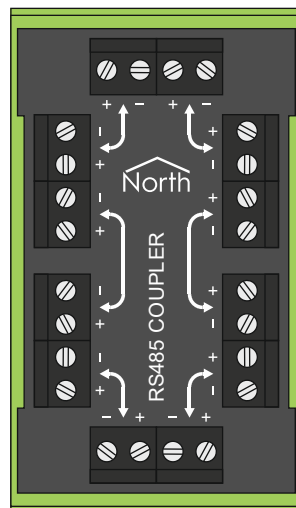
## The North RS485 Coupler

North designed the RS485 Coupler to give you the best of both worlds: the ease of star wiring with the reliability of a daisy chain.

The Coupler acts as a hub for your network. It handles the out-and-back loop for you.

- Plug-and-play simplicity: Connect a North controller plus up to five RS485 devices into a single Coupler using simple removable terminal connectors.
- No more rewiring: Because each connection is independent, you can unplug a device for testing or maintenance, then reposition other connectors to restore the network chain.
- Clean installations: It replaces messy terminal strips with a single, compact unit, saving space and reducing the chance of wiring errors.

By using the RS485 Coupler, you can wire your network in the way that makes the most sense for your building, while ensuring your data network remains reliable.



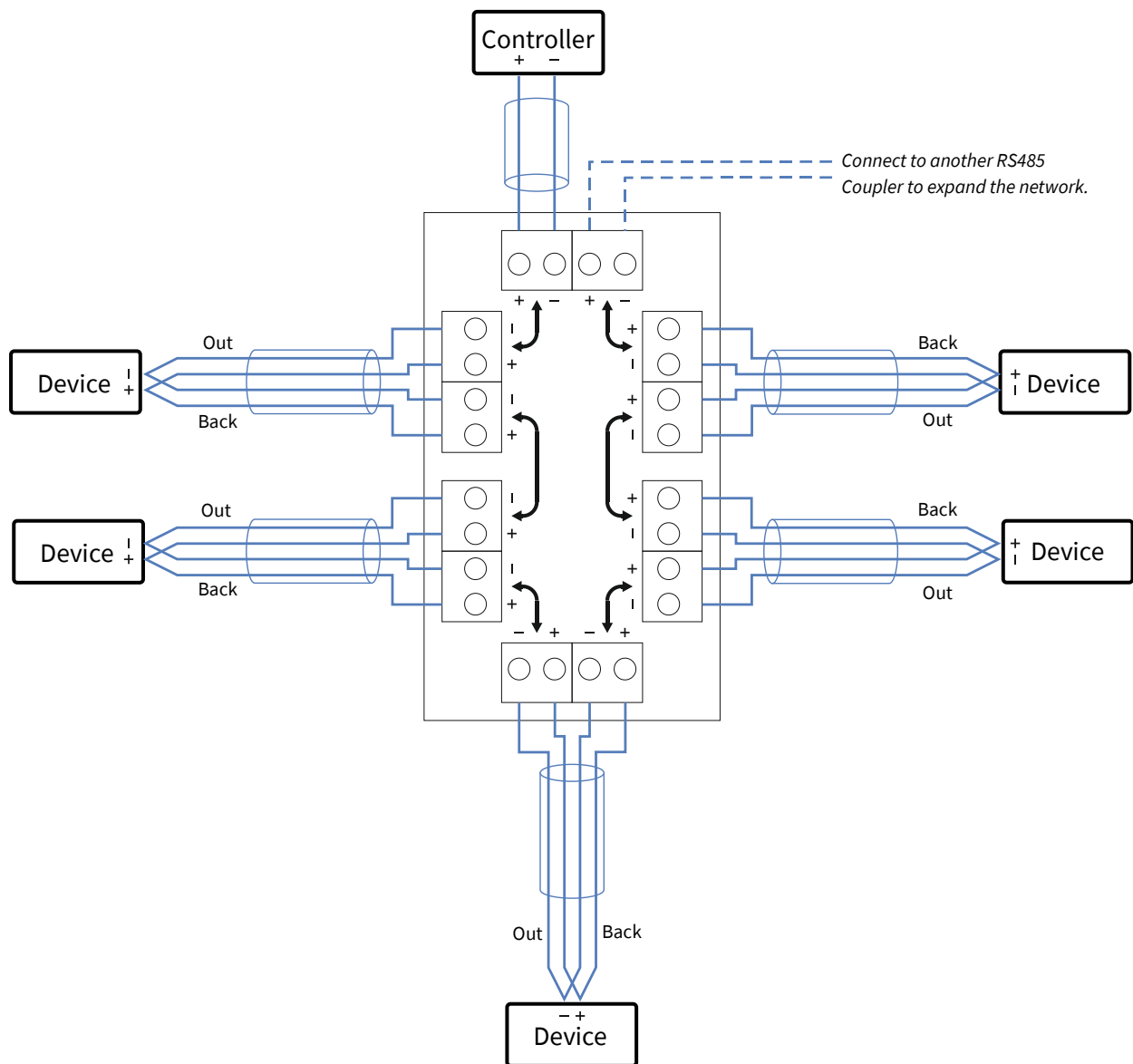
# Using the RS485 Coupler

## Step 1: Connect the controller

Start by connecting your main controller (via a Zip Network card or RS232/485 Converter) to the first pair of '+' and '-' terminals on the Coupler using standard twisted-pair cable.

## Step 2: Follow the flow

Look for the arrow printed on the Coupler's circuit board. This indicates the order in which you should use the connectors. Always connect the ports in the direction of the arrow to ensure the chain stays connected.



### Step 3: Connect your devices

For each device on your network, use 4-core cable (which contains two twisted pairs) to connect it to one removable connector on the Coupler. Here is how you create the loop:

- Out to the Device: Use the first pair of wires to connect the '+' and '-' terminals on the Coupler connector to the '+' and '-' on your device.
- Back to the Coupler: Use the remaining pair of wires to connect the same terminals on your device back to the next set of '+' and '-' terminals on the Coupler connector.

### Step 4: Continue the Chain

Repeat this process for each device in your star layout. By wiring this way, the signal travels out to a device and immediately returns to the Coupler to start its journey to the next one.

**Tip:** Label everything. It sounds simple, but labelling both ends of your cable saves hours of 'which wire is which?' when you're standing on a ladder later.

# Frequently asked questions

## What cable should I use?

Always use shielded twisted pair cable, with a minimum thickness of 22AWG. The twists in the wire are what cancel out electrical noise from nearby power cables or lights. Non-twisted wire might work for short distances but may cause trouble on larger jobs. While Ethernet cable contains twisted pairs, it is usually too thin and not suitable for long RS485 network runs.

Use a cable specifically designed for RS485 (like Belden 8761 or equivalent).

## What is the maximum network distance?

Using high-quality shielded twisted pair cable, an RS485 network can reach up to 1,200 meters.

When using the RS485 Coupler, remember that every meter of physical (4-core) cable counts as two meters of network distance. This is because the signal must travel out to the device and then all the way back to the Coupler to continue the chain.

## Can I connect more than five devices?

While one RS485 Coupler has six ports, you can easily connect Couplers together. Simply use one port to connect to the next Coupler, allowing you to expand your network.

Typically, RS485 networks can support a maximum of 32 devices (sometimes more). However, some specific systems like North Zip may have their own limit, so always check the product manual.

## Do I still need termination resistors?

To keep the data clear, you sometimes need to stop the signal from echoing back down the wire once it reaches the end. Think of a resistor like a heavy curtain at the end of a hallway – it absorbs the sound, so you don't hear a confusing echo.

Both the North Zip RS232 network card (ZIP/NC12B) and North RS232/485 converter (CONV/232/485) have a 120  $\Omega$  resistor built-in. Simply position one of these North devices at one end of your bus. Then, you only need to add a single 120  $\Omega$  resistor at the very opposite end of the chain.

# Specification

|                    |                                                                       |
|--------------------|-----------------------------------------------------------------------|
| Order code         | CONV/485/CPLR                                                         |
| Connectors         | 6 x removable 4-pole 5.08mm pitch. Up to 2.5mm <sup>2</sup> conductor |
| Power supply       | None required                                                         |
| Dimensions (W x H) | 43 x 77 mm                                                            |
| Mounting           | Standard 35mm DIN-rail, 'top hat' compatible                          |

## Document Versions

| Issue Date | Details           |
|------------|-------------------|
| 01/02/2026 | Document released |
|            |                   |
|            |                   |
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## Next Steps...

If you require help, contact support on 01273 694422 or visit [www.northbt.com/support](http://www.northbt.com/support)



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