

VALTORIS ENGINEERING

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Category: Field Installation Guidelines

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RS485 Star Topology & Termination Design Guide

For Large-Scale Solar Inverter Arrays

1. The Native RS485 Star Topology Problem

The RS485 electrical standard (EIA-485) mandates a linear "daisy-chain" topology. When installers attempt to wire RS485 networks in a star or tree configuration by simply twisting multiple wires together at a central point, it creates impedance mismatches.

In a raw star topology, the signal travels down multiple branches simultaneously. When the signal hits the un-terminated end of a branch, it reflects back toward the center, colliding with the primary transmission. This causes waveform distortion, bit errors, and eventually, continuous "Timeout" or "Comm Failure" states on your SCADA system.

CRITICAL RULE

You cannot build an RS485 Star Topology using passive wiring (wire nuts, terminal blocks). You **MUST** use an Active RS485 Isolation Hub to segment the network electrically.

2. The Active Hub Solution (8CH-HUB-RS485)

The **Valtoris 8CH-HUB-RS485** resolves this by acting as an active repeater and isolator. Internally, the hub is not a single bus; it consists of multiple independent RS485 transceivers.

When you connect the Master port to your Data Logger/Gateway, and the Slave ports (CH1 to CH8) to different inverter branches, the Hub creates **nine electrically distinct segments**:

- **Segment 0:** Data Logger ↔ Hub Master Port
- **Segment 1:** Hub Port CH1 ↔ Inverter Array 1
- **Segment 2:** Hub Port CH2 ↔ Inverter Array 2 (and so on...)

Because each branch is an independent point-to-point or daisy-chain segment, signal reflections are isolated to their specific branch and do not corrupt the rest of the star network.

3. 120Ω Termination Placement Rules

The golden rule of RS485 termination applies to each segment individually: **Place a 120Ω resistor across the A (+) and B (-) lines ONLY at the two extreme physical ends of a segment.**

Segment 0 (Uplink): Gateway to Hub

- **End 1:** Turn ON the internal 120Ω dip switch on the Modbus TCP Gateway (or place a resistor at its terminals).
- **End 2:** Place a 120Ω resistor at the Hub's MASTER port (485A / 485B).

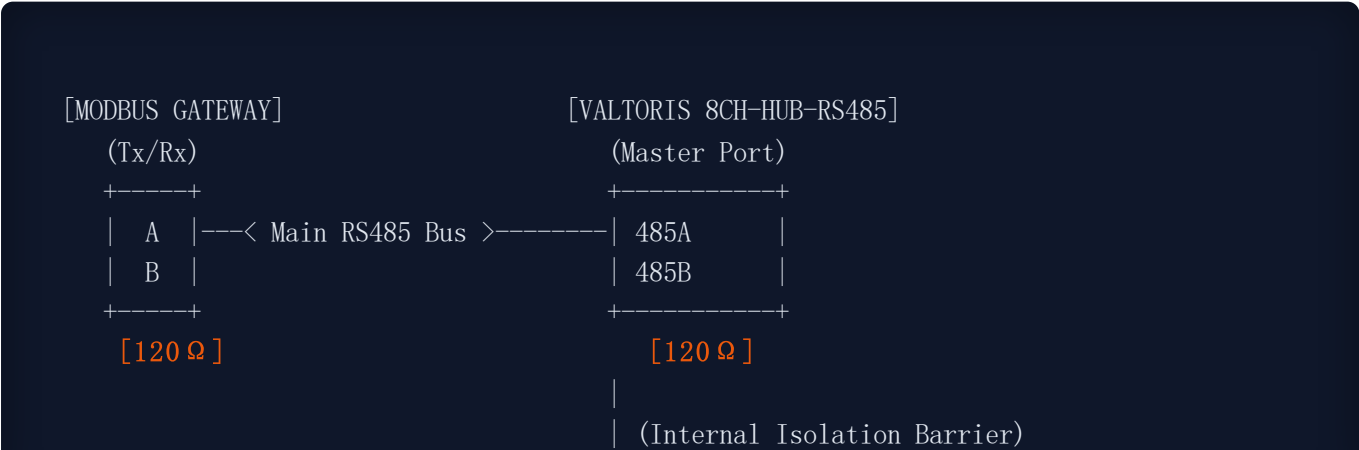
Segments 1 through 8 (Downlinks): Hub to Inverters

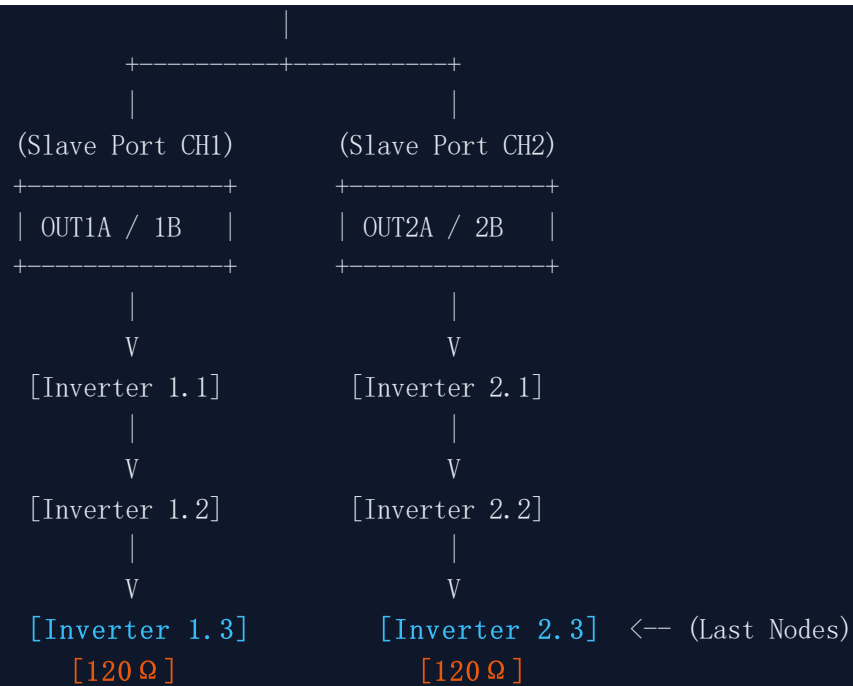
Each output port on the 8CH-HUB acts as the "Head" of that specific daisy-chain branch.

- **End 1 (The Hub):** The Valtoris 8CH-HUB-RS485 slave ports are internally biased. Depending on line length, an external resistor at the Hub's CH(x) terminals may not be necessary, but it is best practice for branches over 500 meters.
- **End 2 (The Last Inverter):** You MUST place a 120Ω resistor across the RS485 terminals of the **very last inverter** on that specific branch. Do not place resistors on the intermediate inverters in the chain.

4. Engineering Schematic

Below is the electrical termination map for an isolated star topology spanning two branches:





Ground Loop Shielding Rule: To prevent ground loops within a specific branch, connect the RS485 cable shield to Earth Ground (EARTH terminal on the Hub) at **ONE END ONLY**. Do not ground the shield at the inverters.