

# Notes on RS485 bus structure

1. What kind of communication line should be used for the 485 bus

The internationally accepted twisted-pair shielded wire must be used. The type of twisted-pair shielded wire we recommend is RVSP2\*0.5 (two-core shielded twisted-pair wire, each core is composed of 16 strands of 0.2mm wires). Shielded twisted-pair The wire helps to reduce and eliminate the distributed capacitance generated between the two 485 communication wires and the common mode interference generated around the communication wire.

Ordinary twisted-pair shielded cable STP-120y (for RS485 & CAN) one pair 20 AWG, the outer diameter of the cable is about 7.7mm. It is suitable for indoor, pipeline and a General industrial environment. When using, one end of the shielding layer is grounded!

Ordinary twisted-pair shielded cable STP-120y (for RS485 & CAN) one pair 18 AWG, the outer diameter of the cable is about 8.2mm. It is suitable for indoor, pipeline and a General industrial environment. When using, one end of the shielding layer is grounded!

Armored twisted-pair shielded cable ASTP-120y (for RS485 & CAN) one pair 18 AWG, the outer diameter of the cable is about 12.3mm. It can be used for severe interference, mice Places with frequent hazards and lightning protection and explosion-proof requirements. When using it, it is recommended that both ends of the armor layer be grounded, and the innermost shielding end be grounded!

Most engineering companies are accustomed to using Category 5 network cables or Category 5e network cables as 485 communication lines, which is wrong. This is because:

(1) Ordinary network cables have no shielding layer and cannot prevent common mode interference. (2) The network cable is only 0.2mm square , the wire diameter is too thin, which will reduce the transmission distance and reduce the number of devices that can be connected. (3) The network wire is a single-strand copper wire, which is easier to break than a multi-core wire.

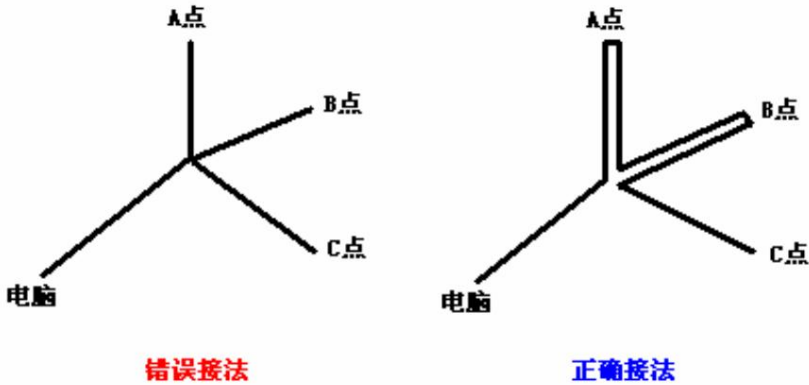
2. Why should it be grounded?

The 485 transceiver can work normally only when the specified common mode voltage is between -7V and +12V. If it exceeds this range, it will affect the communication and seriously damage the communication interface. Common mode interference will increase the above common Mode voltage. One of the effective means to eliminate common mode interference is to use the shielding layer of the 485 communication line as the ground wire, connect the equipment in the network such as machines, computers, etc., and connect them to the ground reliably at one point . 4.485 How should the communication lines be routed?

Communication lines should be kept away from high-voltage wires as much as possible, and should not be paralleled with power lines, let alone bundled together.

5. Why does the 485 bus use a hand-in-hand structure instead of a star structure?

The star structure will generate reflected signals, which will affect 485 communication. The length of the branch line from the bus to each terminal device should be as short as possible, generally not exceeding 5 meters. If the branch line is not connected to the terminal, there will be reflected signals, which will have a greater impact on communication. Strong interference should be removed.



Can there be contacts between devices on the 6.485 bus?

In the same network system, use the same cable to minimize the joints in the line. Make sure that the joints are welded well,

Wrap tightly to avoid loosening and oxidation. Ensure a single, continuous signal channel as a bus. 7. What is common-mode interference and differential-mode interference? How to eliminate interference on the communication line?

The 485 communication line is composed of two twisted-pair lines, and it transmits the signal through the voltage difference between the two communication lines.

No., so it is called differential voltage transmission.

Differential mode interference is transmitted between two signal lines, which belongs to symmetrical interference. The method to eliminate differential mode interference is to add a bias value resistor in the circuit and use twisted pair wires;

Common mode interference is transmitted between the signal line and the ground, which belongs to asymmetric interference. The methods to eliminate common mode interference include: (1) Use shielded twisted pair and effectively ground (2) Places with strong electric fields should also consider using plating Zinc tube shielding (3) Keep away from high-voltage lines when wiring, let alone bundle high-voltage power lines and signal lines together (4) Do not share the same power supply with electric control locks (5) Use linear regulated power supply or high-quality switches Power supply (ripple interference is less than 50mV)

8. Under what circumstances should terminal resistors be added to the 485 bus?

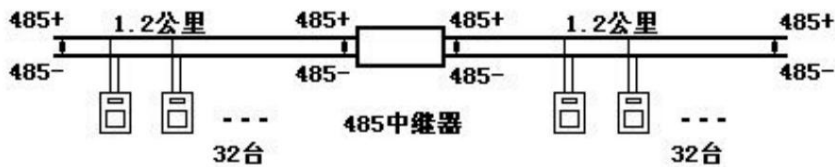
Generally, there is no need to increase the terminal resistance, only when the 485 communication distance exceeds 100 meters, it is necessary to

Add termination resistors at the beginning and end of communication.

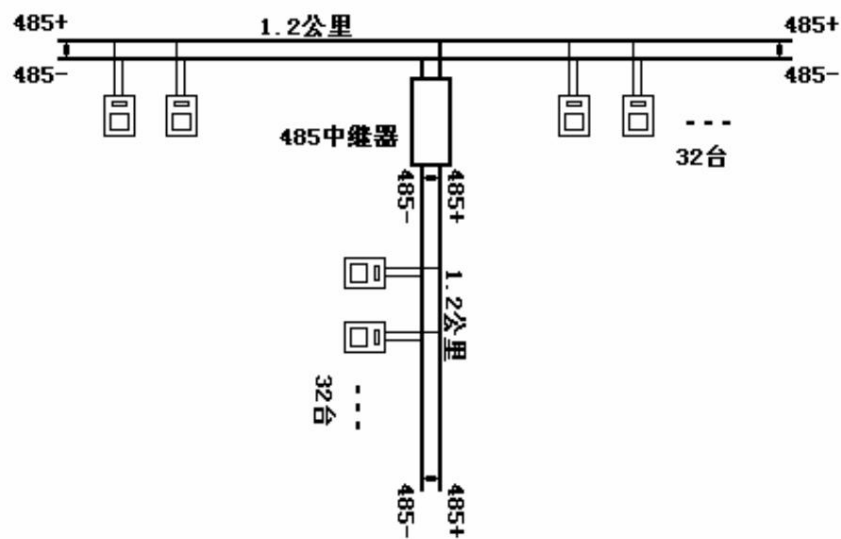
9. How to extend the communication distance of 485

One of the specifications of the 485 network is 1.2 kilometers in length and 32 nodes. If this limit is exceeded, 485 repeaters or 485 hubs must be used to expand the network distance or the number of nodes. Using 485 repeaters or 485 hubs, you can Divide a large 485 network into several network segments. 485 repeaters or 485 hubs are like "bridges" connecting 485 network segments. Of course, each network segment still follows the above 485 specification, that is, 1.2 kilometers in length, 32 number of nodes.

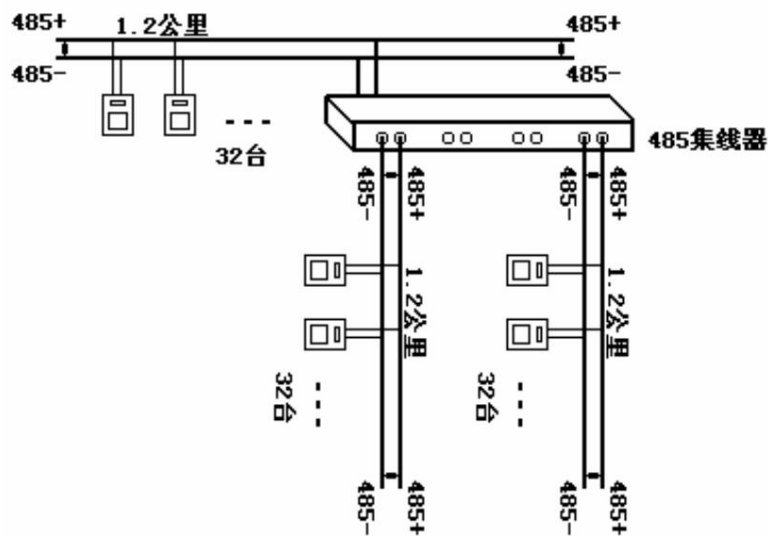
Using 485 repeaters to extend the network distance diagram:



Use the 485 repeater to solve the 485 fork problem, as shown in the figure:



Using 485 hub to construct star 485 network



The 485 hub is an extension of the concept of the 485 repeater. It not only solves the multi-fork problem, but also solves the problem of mutual isolation between network segments, that is, a problem in a certain network segment (such as a short circuit, etc.) will not affect to other network segments, thus greatly improving the security and stability of large-scale networks. We can experience the benefits of star wiring network from the development process of LAN from bus type to star type. Similarly, using 485 The star 485 network composed of hubs will also be a direction of 485 network development.

# Precautions

## 1. Clarify several concepts:

1. The communication distance of 485 bus can reach 1200 meters.

According to the theory of 485 bus structure, under the premise of an ideal environment, the transmission distance of 485 bus can reach 1200 meters. The condition is that the communication wire is of high quality, the baud rate is 9600, and only one 485 device is loaded to make the communication distance reach 1200 meters. , so usually the actual stable communication distance of the 485 bus is often less than 1200 meters. If there are many 485 devices loaded, the wire impedance is not up to the standard, the wire diameter is too thin, the converter is of poor quality, the equipment lightning protection is complicated and the baud rate is increased. Other factors will reduce the communication distance. 2. The 485 bus can carry 128 devices for communication. In fact, not all 485 converters can carry 128 devices. It depends on the model of the chip in the 485 converter and the model of the 485 device chip To judge, the load capacity can only be determined according to the chip with a lower index. Generally, the load capacity of the 485 chip has three levels--32 units, 128 units and 256 units. In addition, the theoretical nominal is often not actually reached. Yes, the longer the communication distance, the higher the baud rate, the thinner the wire diameter, the worse the quality of the wire, the worse the quality of the converter, the insufficient power supply of the converter (passive converter), and the stronger the lightning protection, all of these will reduce Real load quantity. 3. The 485 bus is the simplest, most stable and most mature industrial bus structure. This concept is wrong. The 485 bus is an economical and traditional industrial bus method for equipment networking .. Its communication quality needs to be guaranteed by debugging and testing based on construction experience. Although the 485 bus is simple, it must also be wired in strict accordance with the installation and construction specifications.

Second, the construction must be strictly in accordance with the construction specifications

During the construction of the 485 bus system, the construction must be strictly in accordance with the construction specifications, and special attention should be paid to the following points.

1. The 485+ and 485- data lines must be twisted pairs. 2. The wiring must be multi-strand

shielded twisted-pair wires. The multi-strands are for backup, and the shielding is for debugging in special cases. The communication adopts the principle of differential mode communication, and the anti-interference performance of twisted pair is better. It is wrong not to use twisted pair. 3. The 485 bus must use a hand-in-hand bus structure, and resolutely avoid star connection and bifurcated connection. 4 1. The AC power supply of the equipment and the chassis must be truly grounded and well grounded. In many places there are triangular sockets on the surface, but in fact there is no grounding at all. Good grounding can prevent the equipment from being struck by lightning and surges. When static electricity accumulates, it can cooperate with the equipment's anti Lightning is designed to better release energy and protect 485 bus equipment and related chips from damage.

5. In order to avoid interference from strong electricity, the 485 bus should avoid walking with strong electricity.

## Three, recommend several debugging methods:

Before commissioning, first ensure that the equipment is connected correctly and the construction is in compliance with the specifications. The following debugging methods can be used according to the problems encountered.

1. Common ground method: Use one wire or shielded wire to connect the GND grounds of all 485 devices, so as to avoid potential differences between all devices that affect

communication. 2. Terminal resistance method: In the 485 + and 485- are connected in parallel with 120 ohm terminal resistors

to improve communication quality.

3. Middle segment disconnection method: by disconnecting from the middle to check whether the equipment is overloaded, the communication distance is too long,

The impact of a certain device on the entire communication line, etc.

4. Separate wire pulling method: simply pull a wire to the device separately, so that it can be used to rule out whether the wiring caused the communication failure. The communication quality is affected. 6. Laptop debugging method: first ensure that the computer notebook you carry with you is a device with normal communication, and use it to

Replace the client's computer for communication. If it is normal, it indicates that the serial port of the client's computer may be damaged or injured.

#### 4. Suggestions and Advice

Common communication faults using the 485 bus structure are as follows. 1. No

communication, no response. 2. Data can be uploaded, but not downloaded.

3. The system prompts interference during communication, or communication

without communication The indicator light keeps flashing. 4. Sometimes it can communicate, sometimes it can't. Some

commands can be passed, and some commands can't.

In order to reduce communication faults, the following suggestions and advices are put forward for reference.

1. It is recommended that users use and purchase the 485 converter provided by the access control manufacturer or the 485 of the recommended brand designated by the manufacturer.

converter.

2. Access control manufacturers will do a lot of testing work on the matching 485 converters, and will require 485 converter manufacturers

to conduct production and quality testing according to their fixed performance parameters, so it has better compatibility with access control equipment.

Don't try to buy cheap 485 converters from miscellaneous manufacturers. 3. Strictly install the construction specifications of the 485 bus for construction,

and prevent any luck. 5. If the communication distance is too long, such as over 500 meters, it is recommended to use a repeater or

485HUB to solve the problem. 6. If the number of loads is too large, such as more than 30 on a bus, it is recommended to use 485HUB to

solve the problem 7. Bring all the debugging equipment for on-site debugging. For on-site debugging, you must carry a few cables that can

connect long distances and multiple loads.

Converter, a common computer notebook, a multimeter to test the open circuit of the circuit, and several 120 ohm terminal resistors.