FOURSTAR PROFIBUS Repeater

FS-PBHUB-2

User Manual

Deyang FOURSTAR Electronic Technology Co., Ltd.

Contents

Preface

Thank you for using Fieldbus Network Products released by Deyang FOURSTAR Electronic Technology Co., Ltd.

Before use, make sure to carefully read the User Manual, where you will find brief operation methods and perfect functions of this product.

The manual will offer detailed information about the operation methods of FOURSTAR PROFIBUS Repeater, FS-PBHUB-2 (also called two-port PROFIBUS Hub). "FS" in the modell No. is short for the registered trade mark of Deyang FOURSTAR Electronic Technology Co., Ltd.

The product is mainly used in Fieldbus Network, like PROFIBUS, MPI, PPI, etc. It isolates, repeats, and amplifies Signal RS485, in order to prolong the communication distance and increase the number of stations, or change the topological structure of PROFIBUS/MPI/PPI Network. Such device aims to bring convenience to the field's wiring installation, prolong the network's transmission distance, and increase the quantity of stations. Meanwhile, it can isolate network and diagnose signal indication.

Please do follow the technical and functional specifications in the manual. The company does not assume the property loss or personal injury caused by user's improper handling.

The company has the right to modify the manual's contents and product function if the technical development requires before announcement.

Copyright Statement

Version Information

Document Name: A User Manual for FOURSTAR PROFIBUS Repeater

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Packaging List

1. A FS-PBHUB-2

2. A CD-ROM (include User Manual etc. No software or driver is needed for the product.)

I. Basic Features of PROFIBUS Network

RS485 interface technique is used in the physical layer of Fieldbus PROFIBUS, which is the most common way in application. It is hard for RS485 Network to maintain rather high reliability and stabilization when the rate of data signaling reaches as high as 12MbpS. Hence, further strict definition and supplement for RS485 technique are added to PROFIBUS Standards, including concepts like network topology, segment, terminal, repeat, branch, etc. Besides, detailed technical specifications are given about the used network components, such as cables, connectors, repeaters, etc.

1. As regulated in PROFIBUS Standards, bus network topology is adopted when RS485 is signaled. Network components like repeater and connector, and concepts like network segment, terminal, etc, are also presented in the Standards. As shown in Figure 1-1, when the cable is longer than the standard-length, or stations in the network are more than that regulated in the specifications, a repeater is needed to cut the bus into Segment 1 and Segment 2, the head and end of each segment are called terminals.

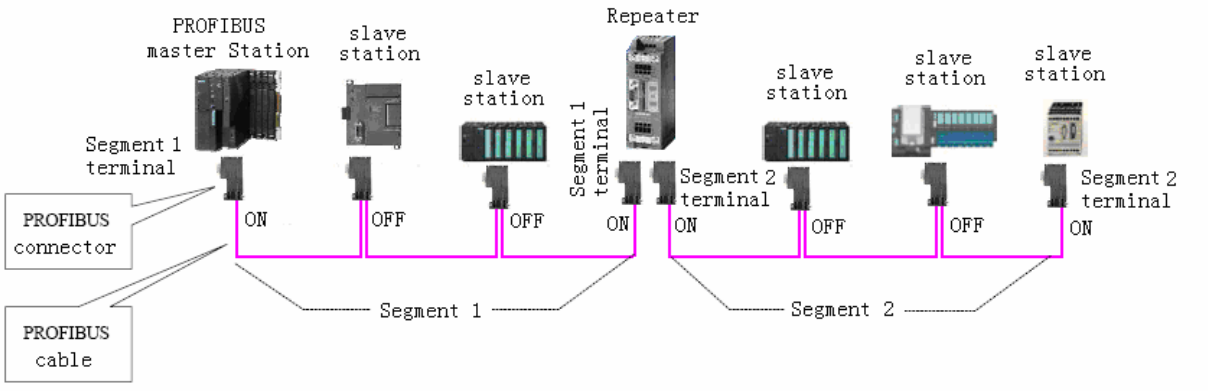


Fig.1-1 PROFIBUS fieldbus adopts bus network topological structure

2. Terminal resistor has to be set at two terminal stations of each PROFIBUS network segment, and the

power is never off at the two stations during network operation (if there's no uninterrupted power, an active terminal resistor with uninterrupted power has to be installed at the terminal. The active terminal resistor produced by Fourstar is Model PB-TR485.) Set terminal resistor at terminal stations means moving the switch of terminal resistor in the bus connector plug of PROFIBUS to ON, while switches in other stations' bus connector plugs have to be moved to OFF. So, it is crucial to determine which station is the segment's terminal.

3. Logically, PROFIBUS Standards regulates that the number of stations can be 126 (station address 0~125 can be used in general master/slave station). No more than 32 stations can appear in one PROFIBUS network segment. If more than 32 stations are needed to be connected to PFOFIBUS bus, such devices as repeaters or hubs are required to amplify the bus into several segments.

4. The communication media for PROFIBUS has to be the special cable that meets the PROFIBUS Standards (Siemens Product No. 6XV1 830-0EH10). Such cable has the following features as shown in Table 1-1:

Table 1-1 Features of Special Cables for PROFIBUS

General Features	Specification
Type	Shielded Twisted-Pair
Cross Section Area of Conductor	24AWG（0.35mm^2）or thicker
Cable Capacitance	<60pf/m
Characteristic Impedance	100Ω～120Ω

The max length of the communication cable in each PROFIBUS network segment is closely related to the baud rate, as shown in the following Table 1-2. The max transmission rate of the whole PROFIBUS network depends on the network segment which has the longest cable.

Table 1-2 The Max Cable Length of A PROFIBUS Segment under Different Transmission Rate

Transmission Rate（bit/s）	9.6K	19.2K	45.45K	93.75K	187.5K	500K	1.5M	3M	6M	12M
Max Cable Length (Meter)	1200				1000	400	200	100		

II Main Applications and Features of Mini PROFIBUS Repeater

PROFIBUS Repeater has following Main Applications:

1. Bus branching (functions of a hub): PROFIBUS network is of bus topology, not allowing branches which makes wiring difficult. Installing a repeater at the junction can amplify one more bus since the repeater can change PROFIBUS bus topology, and achieve other network structures like star structure and mixed pattern, which are convenient for wiring. See Figure 2-1.

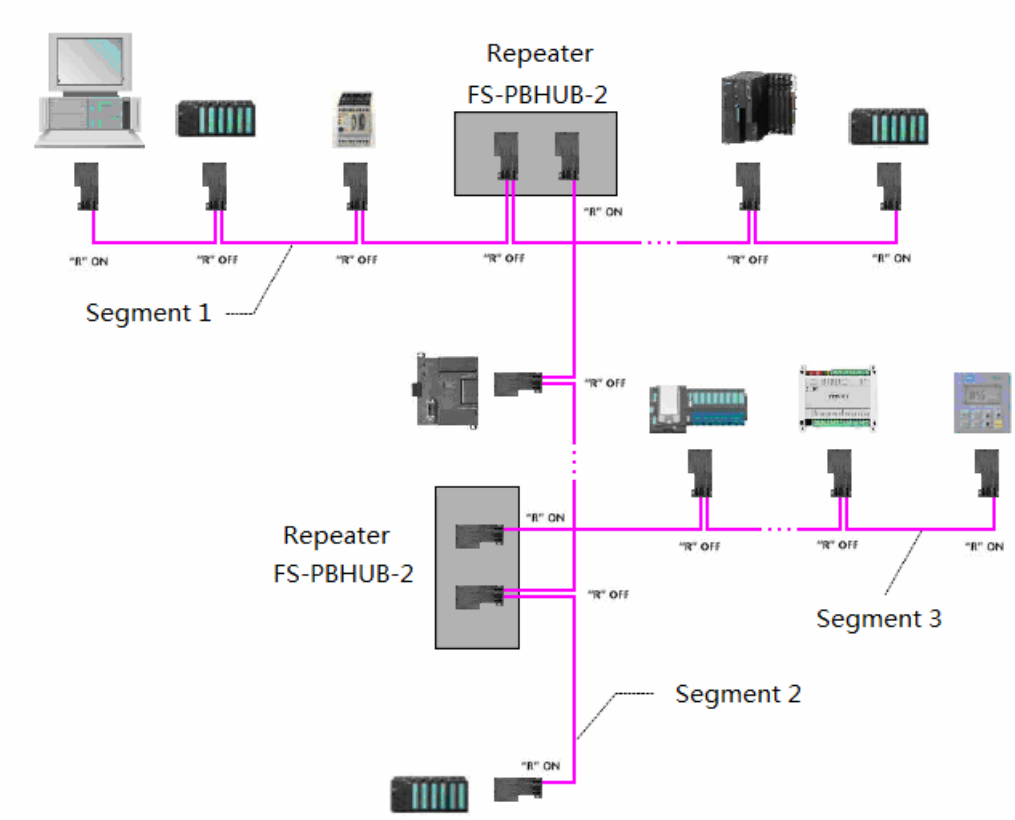


Fig.2-1 Bus branching achieved through the repeater

2. Functions of the repeater: PROFIBUS Repeater has two pair of interfaces. Each of the two drive one PROFIBUS network segment respectively, which means another 31 station interfaces can be connected, and the max transmission distance under corresponding transmission rate can be prolonged. Moreover, cascade connection can also be realized. Consequently, PROFIBUS network of mixed pattern is constituted through the repeater, and the stations can be as many as 126. The transmission distance can be as long as several kilometers based on the number of cascade connection (related to the used transmission baud rate).

3. Functions of the isolator: Each interface of PROFIBUS Repeater can be extended into a "PROFIBUS segment" (can be called "segment interface"). Electrical isolation exists between each interface segment, which means the segment is isolated from each other. Such conditions are necessary for protecting interface, interference suppression, and improving the network system's stabilization.

4. Monitor and diagnose: Through the LED indicator on PROFIBUS Repeater, one can monitor the working condition of PROFIBUS network and provide references for network diagnostic and troubleshooting.

FOURSTAR PROFIBUS Repeater has following features:

1. Transparent transmission in the physical layer: PROFIBUS Repeater adopts bit transparent transmission in the physical layer, having nothing to do with the upper-layer protocol. So it is applicable to all PROFIBUS protocols based on RS485, including PROFIBUS-DP/V0, V1, V2, and various application rules including PROFIsafe (safety), Redundancy, and Ident Systems (identification system) etc. It is able to connect to multi master-station for communication, such as S7 FUNCTION Protocol, secondary-type master station communication; it is also applicable to MPI Protocol, PPI Protocol, RS485 Free Port Protocol, and other fieldbus or network, such as MODBUS.

2. Master-station configuration not required: It needs no master-station configuration, and has no GSD File.

3. No division of master or slave interface; no division of input or output interface; no division of terminal or non-terminal node: no matter master station or slave station can be plugged into any PROFIBUS interface, and each interface can be either terminal node or non-terminal node.

4. Self-adapting under baud rate 0~12Mbps: No switch or software configuration is needed.

5. Segment isolation: Each segment is isolated from each other.

6. The ability to cascade connection: Each interface segment can realize cascade connection through PROFIBUS Repeater, so as to increase the number of interface segment. The quantity of cascade connection is related to the baud rate. When the baud rate ≥187.5K, the quantity of cascade connection is 3-cascade; when the baud rate <187.5K, the quantity of cascade connection can be 5-cascade to the most.

III. Features and Specifications

- Isolation voltage: 1000VDC. Power isolated from R485; R485 fully isolated from R485.
- Power: 9~40VDC wide voltage, not influenced by the voltage fluctuation, with power reversed polarity protection and surge protection.
- Power dissipation: the power dissipation of FS-PBHUB-2 is about 1W.
- Communication speed: automatic adaption without delay under 0~12Mbps.
- PROFIBUS interface: DBF9 (hole) socket; pin signal definitions meet the PROFIBUS Standards.
- Each segment's max communication distance under each transmission speed meets PROFIBUS Standards.

Transmission Rate（bit/s）	9.6K	19.2K	45.45K	93.75K	187.5K	500K	1.5M	3M	6M	12M
Max. cable length (m)	1200				1000	400	200	100		

- Each R485 interface is integrated with anti- lightning SPD with repeatable surge capacity: Ipp=100A (10/700us, 4KV) meet the standard: ITU-TK20/21, VDE 0433. ±15KV ESD (static) Protection
- Self-recovery overcurrent protection. RS485 port is able to withstand the sustained overcurrent caused by as high voltage as 60V.
- Each RS485 interface has its own data reception indication light
- Working temperature: -40~+85℃
- Outline size: FS-PBHUB-2: 93mm×99mm×28mm (L/W/H), weight: 200g
- Installation means: backboard installation, mounting screw 2×M4

IV. External Structure and Pin Definition

1. Product appearance :

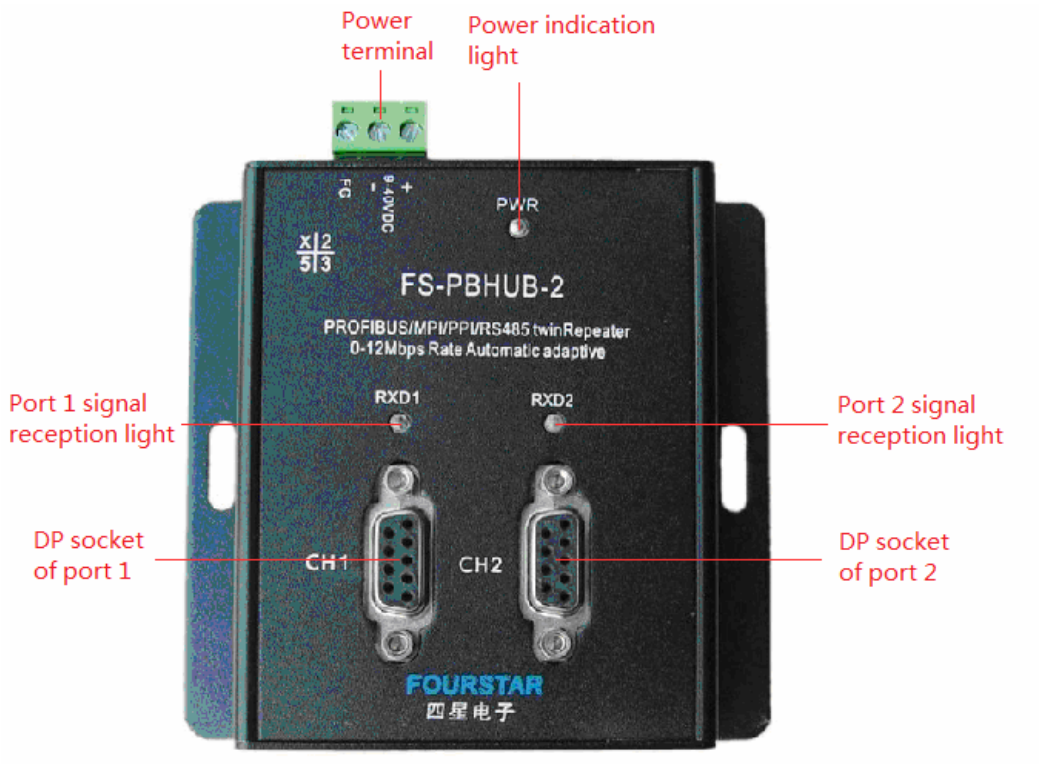


Figure 4-1 Outline Drawing of Repeater FS-PBHUB-2

2. Mounting size:

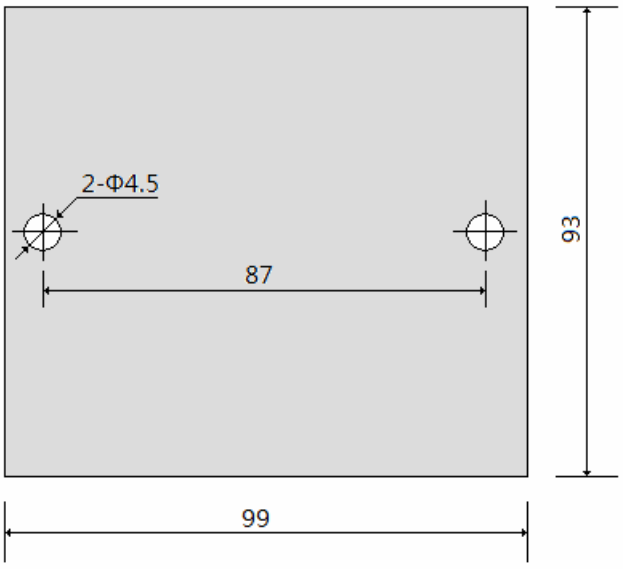
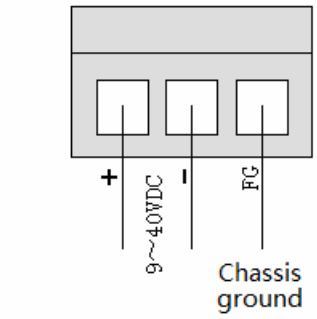


Figure 4-2 Mounting Size Drawing of Repeater FS-PBHUB-2

3. Power terminal: the power port is provided with power reverse electrode protection and surge protection; the input voltage is any volts D.C. between 9V and 40V; the power dissipation is about 1W. External power supply is isolated from internal circuit by DC/DC isolation module inside the product, which makes the product able to get power supply from any device without considering common-ground interference.



Wiring diagram of power terminal

4. Indication light: the name and function of each emitting diode in the panel

Name of the Light	Status of the Light		
	constant ON	blink	flameout
PWR	hub's power supply works well	hardware failure	no power or hardware failure
RXD1	hardware failure	Port CH1 is receiving data	Port CH1 receives no data
RXD2	hardware failure	Port CH2 is receiving data	Port CH2 receives no data

5. Signal definition of PROFIBUS interface DB9F socket:

The pin signal definitions of each PROFIBUS interface DB9F (hole socket) of the repeater meet the PROFIBUS Standards.

Pin No. of DB9F	Signal Name	Function	Signal Direction
3	DB (+)	RS485 Signal Positive	Input/output
8	DA (-)	RS485 Signal Negative	Input/output
6	+5VDC	Supply the terminal resistor inside the bus connector socket with power, 5VDC，60mA	Output
5	GND	Signal Ground	Output
1, 2, 4, 7, 9	Not used	Not used	Not used

V. Internal Functional Block Diagram

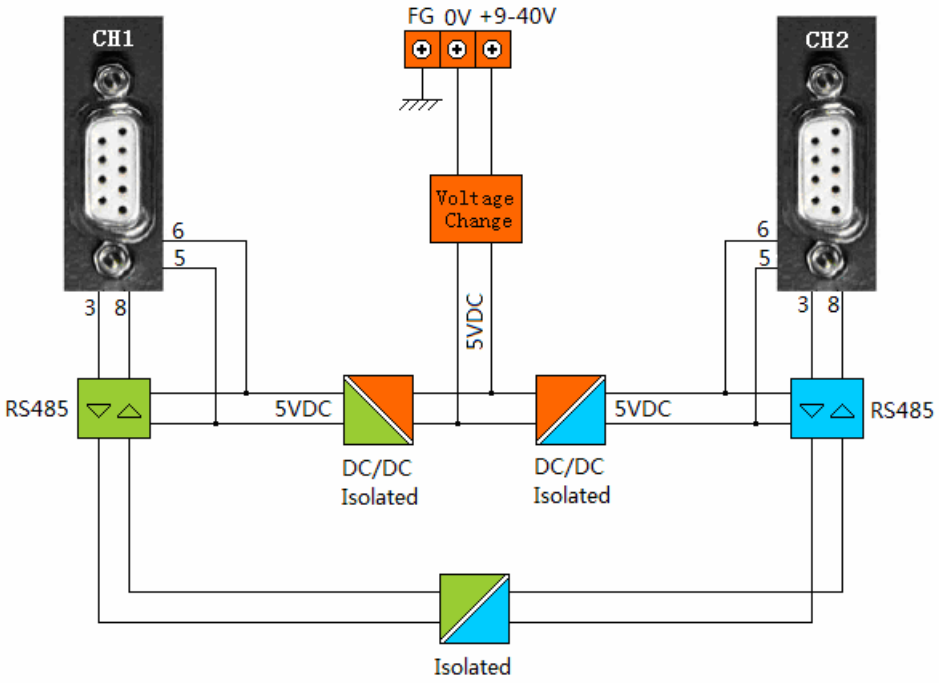


Fig. 5-1 Internal functional block diagram of PROFIBUS Repeater

VI. Application Solution for PROFIBUS Repeater

The usage of FOURSTAR PROFIBUS Repeater is versatile and flexible. It can achieve bus network, star network, tree network and mixed network topological structure. Each application solution is followed.

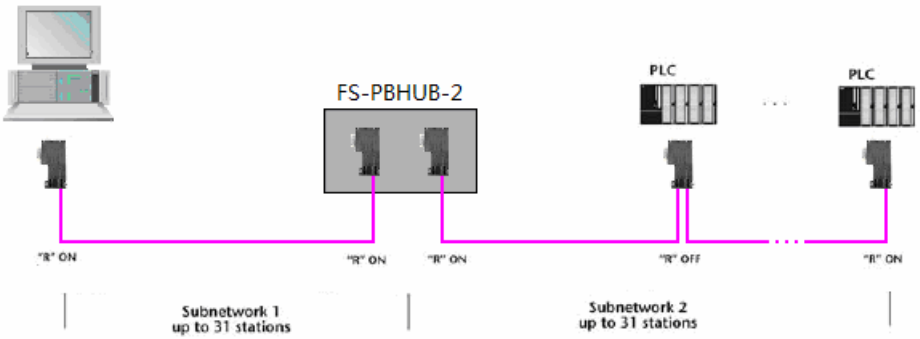


Fig. 6-1 Working as the repeater to prolong the communication distance and increase the quantity of stations

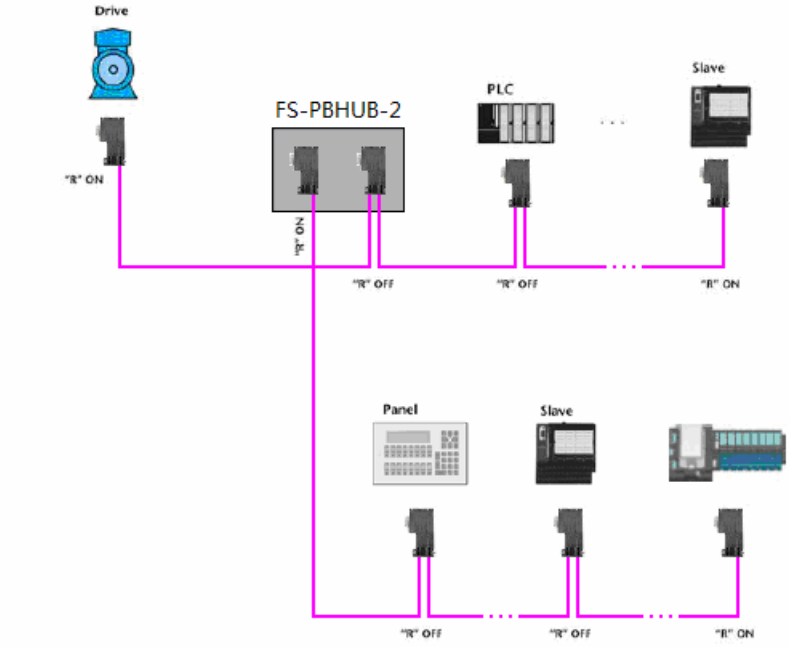


Fig.6-2 Tree branch network topological structure through FS-PBHUB-2

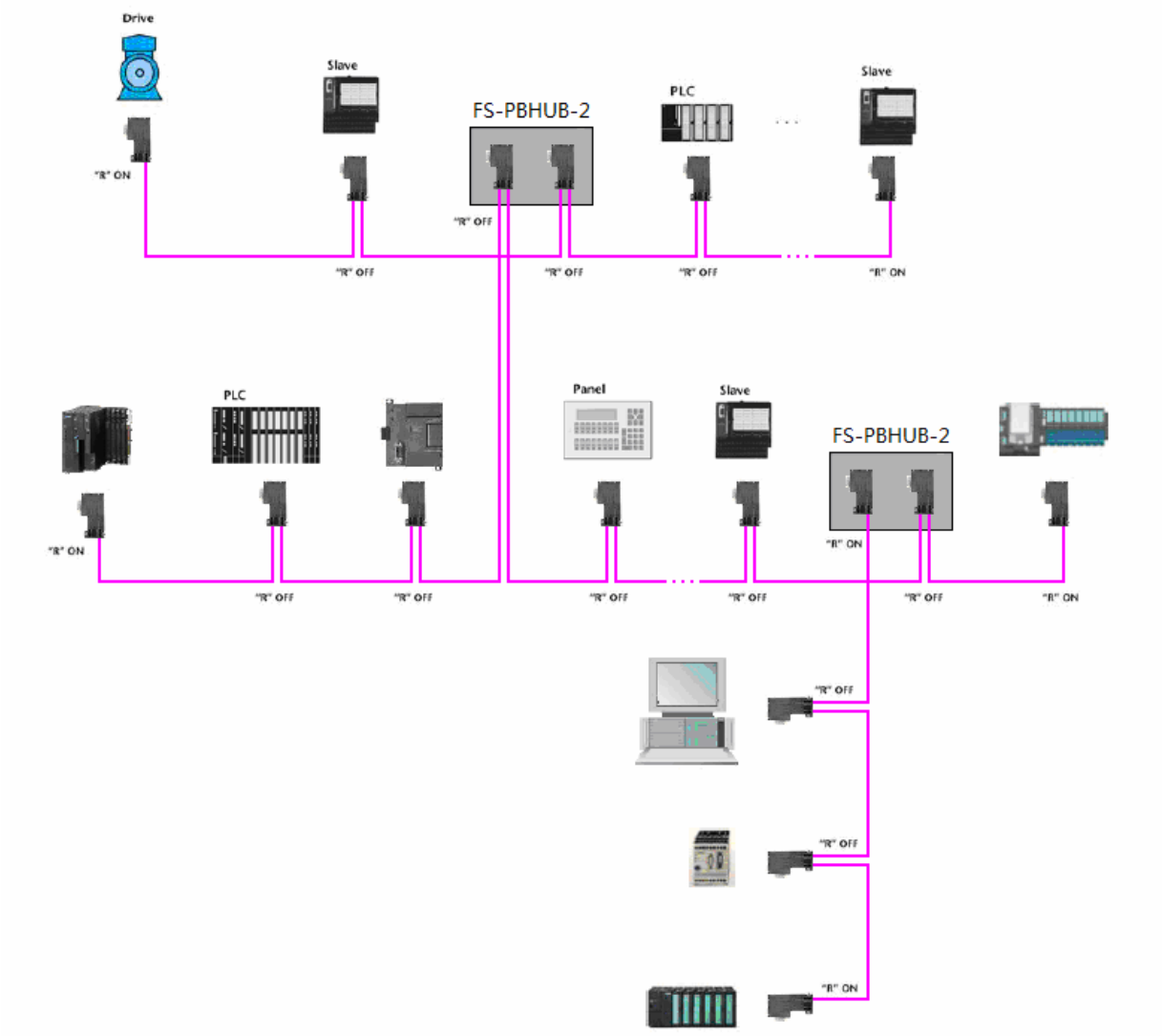


Fig.6-3 Mixed network topological structure through FS-PBHUB-2

VII. FAQ

1.The power of the terminal station in the network segment cannot be cut off. Why?

The head and end of PROFIBUS network segment are called terminals. To suppress the reflection and distortion of RS485, the terminal cable has to be connected to A1, B1 of the bus connector, and the switch of terminal resistor in the bus connector plug has to be moved to ON, as a result of which, the terminal

interface is integrated with a terminal resistor of 220 Ω, a pull-up resistor of 390 Ω, and a pull-down resistor of 390 Ω, so as to ensure the network's stable operation. The pull-up and pull-down resistor needs 5VDC power supply from foot 6 and foot 5 of DP socket. When the power of terminal station is off, the pull-up and pull-down resistor also lose their power supply, which will cause network communication error or no communication.

The diagram below explains the internal schematic diagram of PROFIBUS bus connector plug.

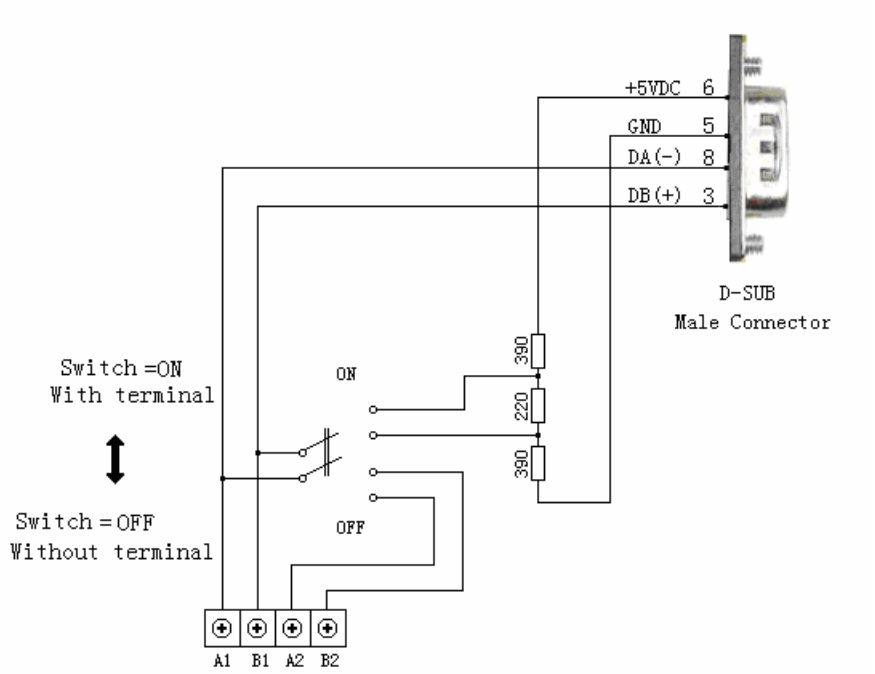


Fig. 7-1 Internal functional block diagram of PROFIBUS bus connector plug

2. What is to be done if the terminal stations are inevitably or possibly powered off?

If by any chance, one has to cut the power of terminal stations, then active terminal resistors (with uninterrupted power) have to be installed at the segment's terminals as the network segment's terminal to guarantee normal network communication. The product No of active terminal resistor from Siemens is: 6ES7 972-0DA00-0AA0. The one produced by Fourstar is: PB-TR485.

With the active terminal resistor, PROFIBUS network terminal is able to maintain the bus voltage at the standard level. Hence, for each station in the bus, losing the connection will never cause network error. Power failure in each segment terminal will affect other segments' communication. So terminals that may

suffer power failure have to integrate with active terminal resistors (with uninterrupted power) for replacement.

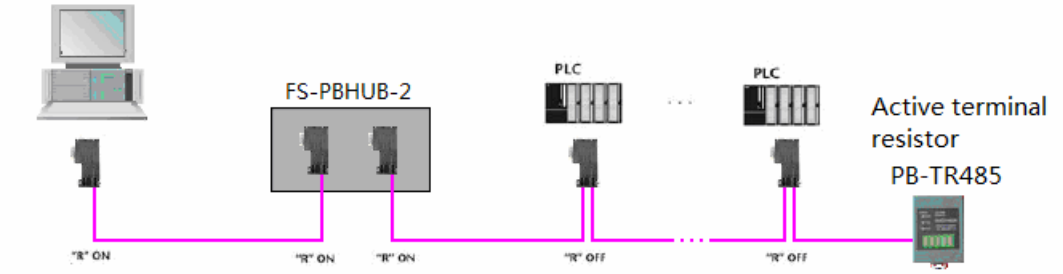


Fig. 7-2 Active terminal resistor installed at the network terminal

3. How to determine the whole network has reached the max communication speed?

Using PROFIBUS hub can constitute a complicated network of mixed pattern. Each segment has its own length. Whether the whole network can reach the max communication speed or not is determined by the longest segment. If higher communication speed is required, you can use the repeater or hub to break up the longer segment to meet your needs.

4. How to achieve PROFIBUS high-speed remote communication?

When PROFIBUS is in high-speed communication, like higher than 3Mbps, the cable cannot be longer than 100 meters. The installation of various repeaters or hubs will result in worse signal delay, higher cost, and power trouble, etc. The optical fiber is currently of the best performance price ratio for communication, for example, the optical-fiber-switch module FS-OLM-S and FS-OLM-M, produced by Fourstar.

VIII. Ordering Information

Product Name: PROFIBUS Repeater

Product Model: FS-PBHUB-2

Announcement: This document aims to give instructions for users of PROFIBUS Repeater, FS-PBHUB-2, and PROFIBUS Hub, FS-PBHUB-4 and FS-PBHUB-6. Since the technique develops rapidly, the product's functions change according to the actual items. Deyang FOURSTAR Electronic Technology Co., Ltd. preserves the rights to modify the document before announcement.

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