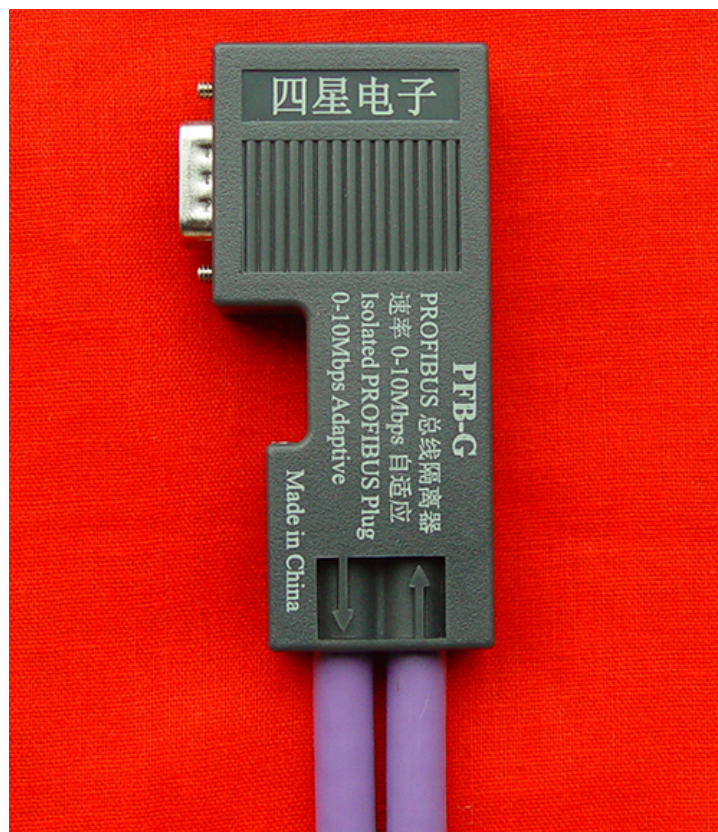


User's Manual of PFB-G Isolated PROFIBUS Bus Connector with LED Diagnosis Indicators



Deyang FOURSTAR Electronic Technology Co., Ltd.

All rights reserved

Contents

Foreword.....	- 3 -
Copyright statement.....	- 3 -
Version information	- 4 -
Product list.....	- 4 -
1 Main applications and characteristics of PFB-G	- 4 -
2 Features and main technical data of product	- 7 -
3 External structure and pin definitions.....	- 8 -
4 Internal functional block diagram.....	- 12 -
5 Installation method and operating method of PFB-G.....	- 13 -
6 FAQ	- 18 -
7 Ordering information	- 21 -
8 Relevant products	- 22 -

Foreword

Thank you for using our PROFIBUS network component products. Please read this User's Manual carefully before using the product so that you can experience its excellent anti-interference function and interface protection function as well as easy operation.

The isolated PROFIBUS bus connector (also called PROFIBUS isolator) developed and produced by us has a model of PFB-G. For easier statement, we will directly use its model below. We have another product (PFB-GP) related to this product. PFB-GP is an isolated PROFIBUS bus connector with a programming interface. Except for its programming interface, PFB-GP has the same functions as that of PFB-G.

The product is mainly used on the PROFIBUS interfaces, MPI interfaces and PPI interfaces of industrial control devices to isolate RS485 signals, realize lightning surge protection, suppress the interference in communication and protect device interfaces. It is particularly suitable for the places with serious interference. It solves problems such as communication interface damage and communication interference due to an earth potential difference. Furthermore, its four LED indicators enable users to judge network or device faults easily and intuitively. With an operating method exactly the same as that of non-isolated PROFIBUS bus connectors, the product can be used as a substitute for conventional bus connectors directly.

Please operate according to the technical specification and performance parameters introduced in this User's Manual. We shall not be responsible for any property losses or personal injuries due to improper operation of the product by users.

We shall have the right to change both content of his User's Manual and the functions of the product in line with the need of technical development and without declaration.

Copyright statement

We are owner of the copyright of this User's Manual. Any persons or organizations copying all or partial content of it without our written permission shall assume the corresponding legal responsibilities.

All the other trademarks or registered trademarks mentioned in this document are owned by their own trademark owners.

Version information

Document name: User's Manual of PFB-G Isolated PROFIBUS Bus Connector with LED Diagnosis Indicators

Version: V3.1

Document and Product Revision History

Version	Revision date	Reason of revision
V1.0	2004.07	To create a document for a newly launched product.
V2.0	2006.08	To revise the User's Manual after the first upgrade of the product.
V3.0	2013.05	Rewrite the User's Manual after the second upgrade of the product.
V3.1	2013.09	Revise and add some figures and FAQ.

Product list

1. PFB-G: 1pcs
2. User's Manual on a CD: 1pcs (this product needs no driver software because it is a plug-and-play one)

1 Main applications and characteristics of PFB-G

Main applications:

- Suppressing the interference of communication interfaces: Usually, many devices with a PROFIBUS, MPI or PPI interface, such as PLCs, PROFIBUS remote I/O, inverters and field instruments, have non-isolated RS485 communication interfaces. When multiple stations form a PROFIBUS network, the earth potential differences of the stations will generate vertical interference at the communication

interfaces due to the difference earth potentials of the stations. The communication interference is the most serious when the network is connected with inverter(s). As a result, communication becomes discontinuous, have wrong data, etc. After a PFB-G is installed on the communication interfaces, the earth potential differences can be eliminated, thus avoiding or weakening the communication interference.

- Solving the problem of communication interface damage due to too large earth potential differences of stations: PROFIBUS interfaces, MPI interfaces and PPI interfaces all use RS485 interface chips. According to the EIA/TIA-RS485 standard, RS485 interface chips can bear a maximum signal voltage of -7V to +12V. If the actual signal voltages are not within the range, the RS485 interface chips will be damaged, or the communication will be abnormal. Due to construction cabling, power distribution or other unknown abnormal factors, the earth potential difference of two stations is often tens of volts larger than the range, which is enough to damage RS485 interfaces.
- Avoiding communication interface damage due to surge or lightning: When cables have sensed lightnings, or communication cables are very close to strong-current power cables, or high-power devices are started or stopped, communication interfaces may be damaged by the surge voltages generated in relevant communication cables. The lightning surge protective components in PFB-G in compliance with the ITU-TK20/21 standard can limit surge voltages in the safe range, thus preventing communication interfaces from damage. Even if the surge or lightning energy goes beyond the protective range of the components, only the PFB-G rather than the devices will be damaged and replacing the damaged PFB-G can resume production quickly and minimize the idling period due to lightning.
- Repairing communication interfaces: Sometimes, some strange soft failures may happen in communication due to factors such as design or manufacturing defects or communication interface faults (not complete damage). Usually, PFB-G can avoid these failures.
- Searching network faults or device faults easily and quickly through the LED diagnosis indicators

Main characteristics:

- It has the same appearance and operating method as conventional non-isolated PROFIBUS Bus Connector plugs, small land occupation because of a small volume and easy installation and needs no external power supply. It can replace non-isolated bus connectors directly and be used after being plugged onto the PROFIBUS-DP sockets or MPI/PPI sockets of devices. Technical development and high integration of chips make it a reality to install such complicated-circuit devices as PFB-G into the small plugs.
- Its physical layer can realize transparent transmission. PFB-G realizes transparent bit transmission on its physical layer, which has nothing to do with the upper layer protocol, so PFB-G is applicable to all the RS485 based PROFIBUS protocols, including PROFIBUS-DP/V0, V1, V2 and various application guild regulations. PFB-G supports the connection for multi-main-station communication, such as the S7 FUNCTION protocol and Cat.2 main station communication. In addition, it supports the MPI protocol, the PPI protocol and the RS485 freeport protocol based communication and is suitable for other field buses or networks based on other RS485 transmission technologies.
- PFB-G of the V3.1 version is designed with a PWR (power) diagnosis indicator, a TXD (transmitting data) diagnosis indicator, RXD (receiving data) diagnosis indicator and a Term (terminating resistor) diagnosis indicator for easy diagnosis of network faults and device faults and convenient and quick judgment and handling of the faults by field engineers.
- With an adaptive Baud rate of 0 Mbps to 10 Mbps, it needs neither switch setup nor any software.
- The power interfaces and the RS485 are completely isolated, so are the RS485 interfaces, thus eliminating the earth potential differences of the stations and avoiding or weakening the communication interference.
- The lightning surge protective components in PFB-G in compliance with the ITU-TK20/21 standard

can limit surge or lightning voltages in the safe range, thus preventing communication interfaces from damage.

2 Features and main technical data of product

- Isolation voltage: 1500VDC (The power interfaces and the RS485 interfaces are completely isolated, so are the RS485 interfaces themselves.)
- Power supply: It automatically chooses the 24VDC±10% power supply provided by the positive pole of pin 7 and the negative pole of pin 2 on the PLC's programming interface or PROFIBUS-DP socket (DB9F socket), or the 5VDC±10% power supply provided by the positive pole of pin 6 and the negative pole of pin 5.
- Power consumption: About 0.7W
- Communication rate: 0~10Mbps (no delay, self-reacting)
- It is internally integrated with a terminating resistor and a biasing resistor. Switching between the resistors can be realized through a switch.
- It has a PWR (power) diagnosis indicator, a TXD (transmitting data) diagnosis indicator, RXD (receiving data) diagnosis indicator and a Term (terminating resistor) diagnosis indicator.
- The maximum cable lengths at different transmission rates comply with the PROFIBUS standard.

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

- At most 32 PFB-Gs can be installed on a bus segment. The number may be up to hundreds with the help of a PROFIBUS repeater or a concentrator.
- The isolated RS485 interfaces have lightning surge protectors and repeatable surge capacity (Ipp) of 100A (10/700us, 4KV), which complies with ITU-TK20/21 and VDE 0433. Furthermore, the product has a function of ±15KV ESD (electrostatic) protection.
- It has a function of self-recovering overcurrent protection. The isolated RS485 interfaces can withstand

the continuous overcurrent generated by a continuous voltage up to 60 V.

- Operating temperature: -40~+85°C (industrial-level)
- External dimensions: 80mm×17mm×40mm (L×W×H) Weight: 50 g
- Installation method: Inserting it into the standard PROFIBUS/MPI/PPI socket (DB9F socket) of a device directly

3 External structure and pin definitions

3.1 External structure

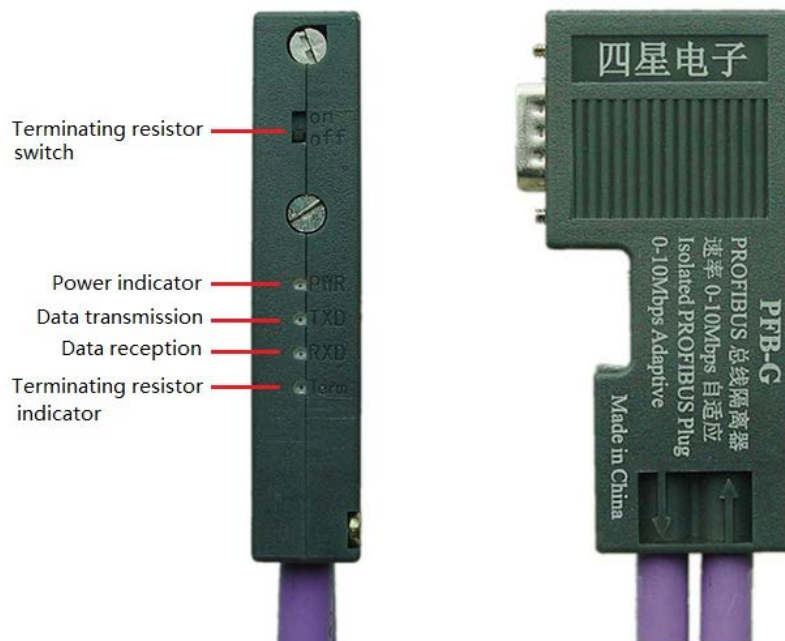


Fig.3-1 Outside View of PFB-G

3.2 Internal structure

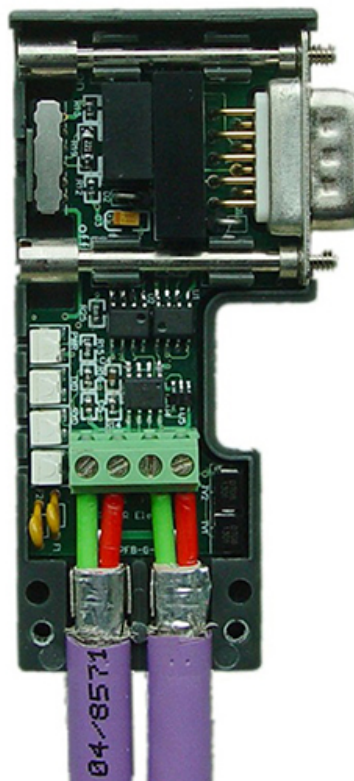
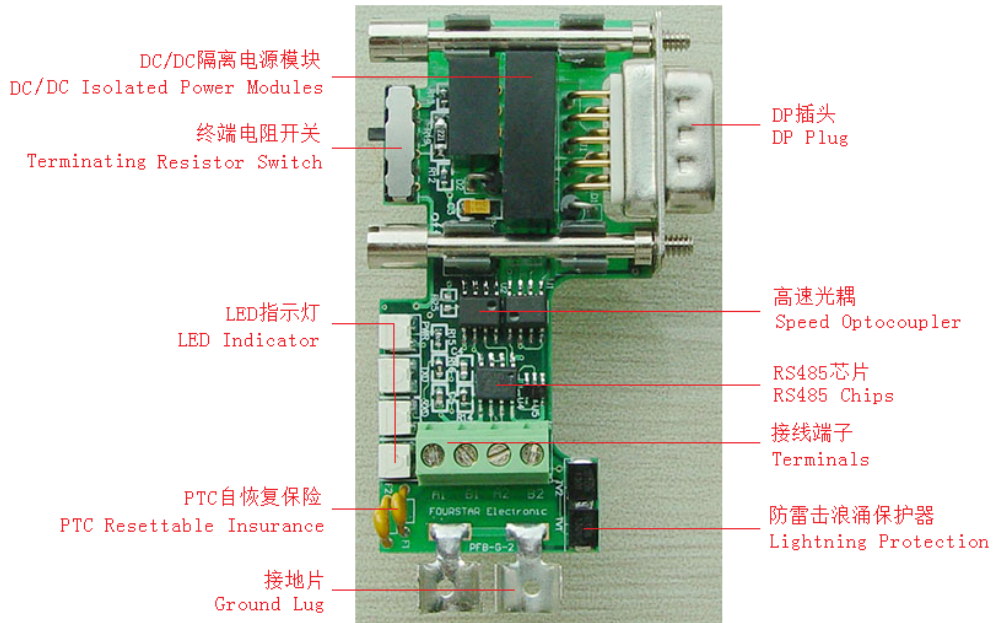


Fig.3-2 Inside View of PFB-G

3.3 Indicators: PFB-G has four LED diagnosis indicators, including a PWR (power) diagnosis indicator, a TXD (transmitting data) diagnosis indicator, a RXD (receiving data) diagnosis indicator and a Term (terminating resistor) diagnosis indicator. See the table below for statuses of the indicators.

LED diagnosis indicator	Remaining lit	Flickering (5Hz)	Out
PWR (green)	The power supply is normal.	There is a fault.	There is no power input, or the product has failed.
TXD (yellow)	There is a fault.	It is transmitting data to a bus cable.	There is no data transmission.
RXD (green)	There is a fault.	It is receiving data from a bus cable.	No data have been received.
Term (yellow)	The interior is connected with the terminating resistor.	There is a fault.	The interior is not connected with the terminating resistor.

3.4 Signal definitions of the DB9M pins of the PROFIBUS interface of PFB-G

DB9M pin No.	Signal name	Function	Signal direction
3	DB (+)	RS485 signal (+)	Input/output
8	DA (-)	RS485 signal (-)	Input/output
6	+5VDC	Positive pole at the input end of the 5VDC power supply	Input
5	GND	Negative pole at the input end of the 5VDC power supply	Input
7	+24V	Positive pole at the input end of the 24VDC power supply	Input
2	0V	Negative pole at the input end of the 24VDC power supply	Input
1, 4, 9	Not used	Not used	

Note: As long as pins 6 and 5 of the PROFIBUS/MPI/PPI socket (DB9F socket) of the device output a 5VDC voltage, or pins 7 and 2 output a 24VDC voltage, PFB-G can obtain a normal operating voltage and the PWR diagnosis indicator will be lit.

3.5 RS485 signal terminals of PFB-G

Signal terminal	Function	Color of the cable connected	Description
A1	Isolated RS485 signal (-)	Green	The signal terminal is disconnected from A2 when the switch is on the “on” position and connected with A2 when the switch is on the “off” position.
B1	Isolated RS485 signal (+)	Red	The signal terminal is disconnected from B2 when the switch is on the “on” position and connected with B2 when the switch is on the “off” position.
A2	Isolated RS485 signal (-)	Green	The signal terminal is disconnected from A1 when the switch is on the “on” position and connected with A1 when the switch is on the “off” position.
B2	Isolated RS485 signal (+)	Red	The signal terminal is disconnected from B1 when the switch is on the “on” position and connected with B1 when the switch is on the “off” position.
Ground lug	Chassis ground	Shield	The signal terminal is communicated with the device's chassis.

3.6 Terminating resistor switch of PFB-G

Switch position	Description
on	Interiors of terminals A1 and B1 are connected with a 220 Ω terminating resistor, a 390 Ω pull-up resistor and a 390 Ω pull-down resistor and terminals A1 and A2 and terminals B1 and B2 are disconnected, respectively.
off	Interiors of terminals A1 and B1 are not connected with a 220 Ω terminating resistor, a 390 Ω pull-up resistor and a 390 Ω pull-down resistor and terminals A1 and A2 and terminals B1 and B2 are connected, respectively.

4 Internal functional block diagram

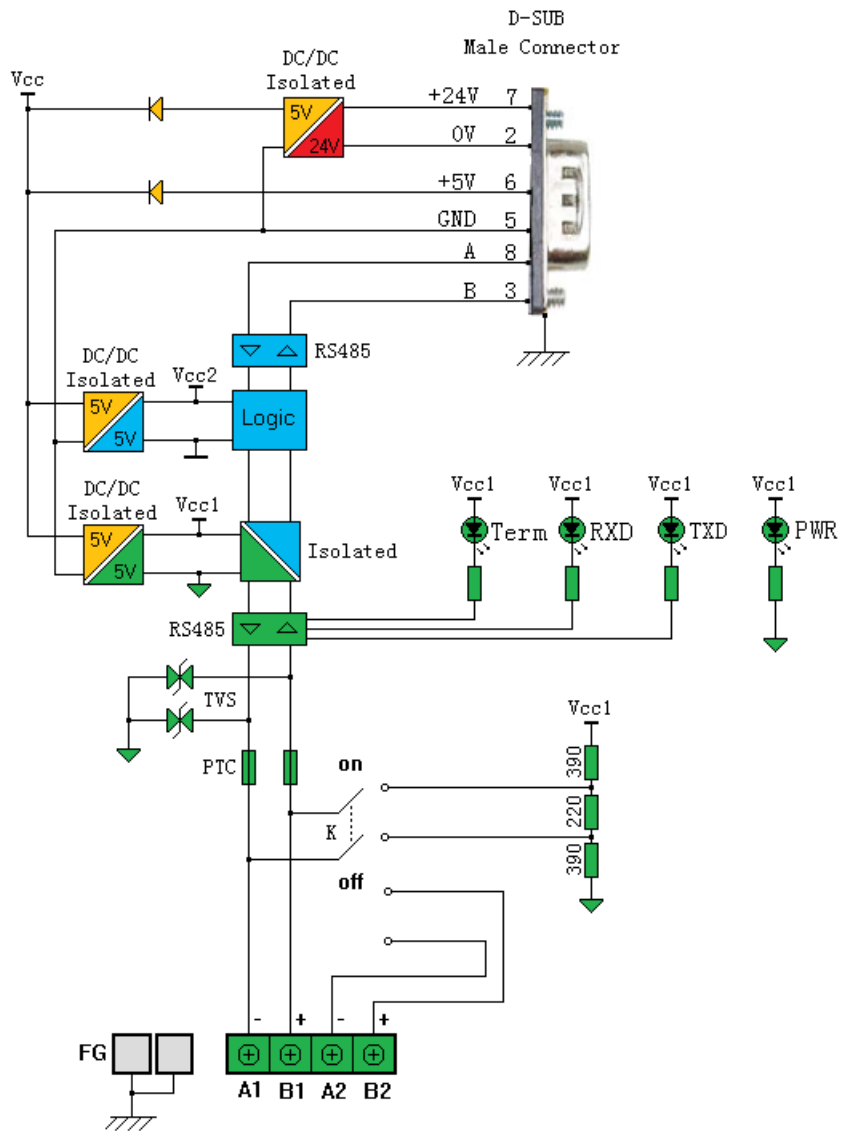


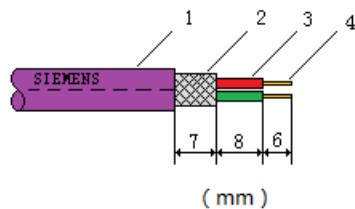
Fig.4-1 Internal Functional Block Diagram of PFB-G

5 Installation method and operating method of PFB-G

The communication cable in connection with PFB-G must be a special cable (product S/N of Siemens: 6XV1 830-0EH10) in line with the PROFIBUS standard, which is the same as conventional non-isolated PROFIBUS bus connectors. See Table 5-1 for general features of the communication cable.

Table 5-1 Features of PROFIBUS Special Cable

General features	Standard
Type	Shielded twisted pair
Sectional area of conductor	24AWG (0.35mm ²) or thicker
Cable capacitance	<60pf/m
Characteristic impedance	100Ω~120Ω



- 1、电缆护套 (Cable sheath)
- 2、屏蔽层 (Shield)
- 3、塑料绝缘体 (Plastic insulator)
- 4、铜芯导体 (Copper conductor)

PROFIBUS专用电缆剥线尺寸
PROFIBUS cable stripping dimensions

Note: PFB-G must be inserted into the DB9F socket of the PROFIBUS/MPI/PPI socket of a device. There should be no extension cable or other bus plugs or devices between PFB-G and the DB9F socket.

5.1 Wiring when PFB-G is installed on a bus terminal

The head and tail of a PROFIBUS cable are called terminators. When PFB-G is installed on a terminator, the PROFIBUS cable should be connected with terminals A1 and B1 only and the terminating resistor switch should be put on the “on” position.

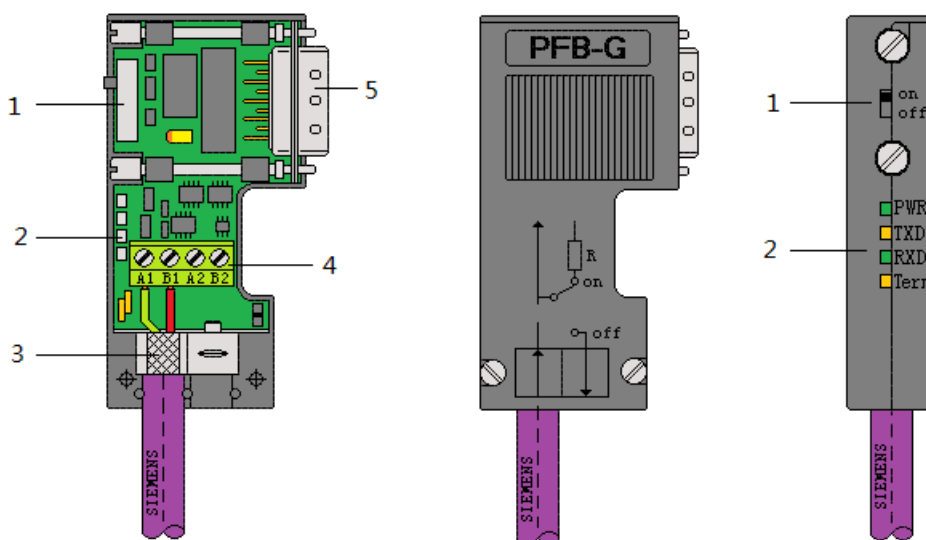


Fig.5-1 Wiring When PFB-G PFB-G is Installed on a Bus Terminal

In the figure:

1. Terminating resistor switch: The PFB-Gs at two terminals of the network are put the “on” position.
2. LED indicator: The switch is put on the “on” position, so the Term LED diagnosis indicator is lit.
3. PROFIBUS bus cable
4. RS485 terminals: Two terminals A1 (RS485 signal (-), green) and B1 (RS485 signal (+), red) of the network
5. DB9M plug: It is inserted into the PROFIBUS/MPI/PPI socket of the device directly.

5.2 Wiring when PFB-G is installed between buses

At most 30 PFB-Gs can be installed between the two terminals of a bus. The cable should be connected with terminals A1 and B1 and terminals A2 and B2 and the terminating resistor switch should be put on the “off” position.

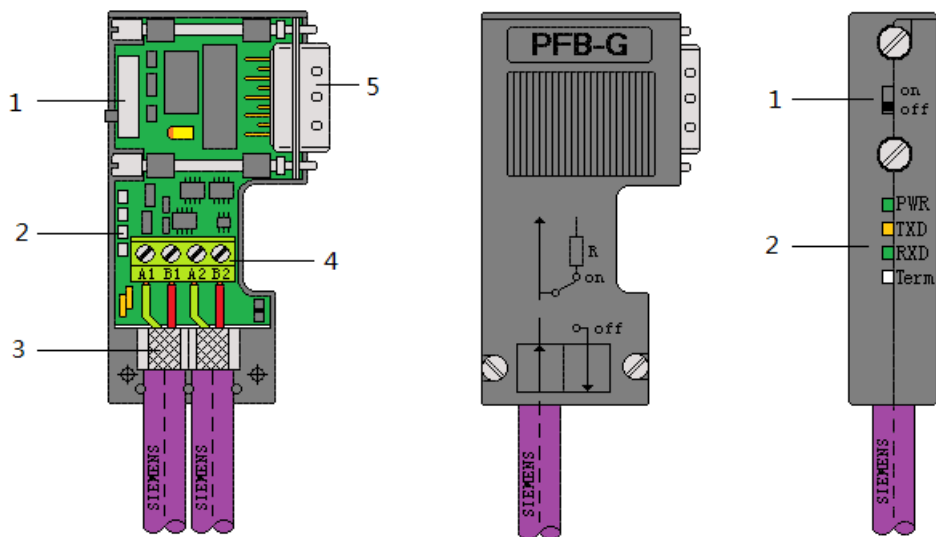


Fig.5-2 Wiring When PFB-G is Installed Between Buses

In the figure:

1. Terminating resistor switch: All the PFB-Gs in the network are put on the “off” position.
2. LED indicator: The switch is put on the “on” position, so the Term LED diagnosis indicator is out.
3. PROFIBUS bus cable
4. RS485 terminals: The PFB-Gs in the network are connected with terminals A1 (RS485 signal (-), green), B1 (RS485 signal (+), red), A2 (RS485 signal (-), green) and B2 (RS485 signal (+), red).
5. DB9M plug: It is inserted into the PROFIBUS/MPI/PPI socket of the device directly.

5.3 Network topology based on PFB-G

PFB-G also has a bus network topology; branching are not allowed for its bus; if branching are necessary, PROFIBUS repeaters or concentrators should be installed at the branches, which is the same as conventional non-isolated PROFIBUS bus connectors. The mini PROFIBUS repeater PFB-R developed by

us can realize branching for buses easily and conveniently.

If there are more than 32 stations in a bus, or the total length is larger than the maximum length allowed for the corresponding transmission rate specified in the PROFIBUS standard, PROFIBUS repeaters or concentrators need to be installed for bus branching too.

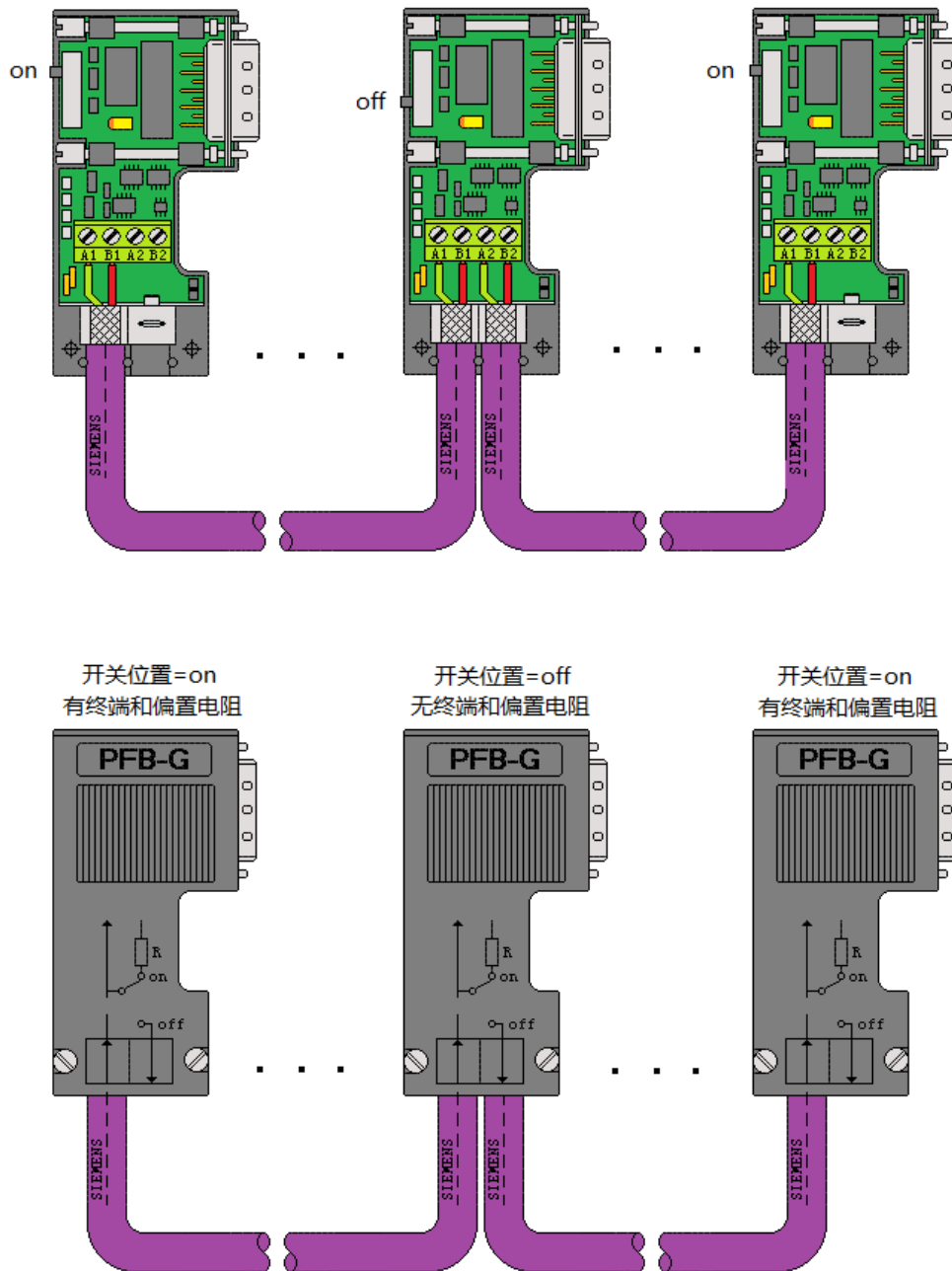


Fig.5-3 Network Topology Based on PFB-G

When the switch is put on the “on” position, there is a terminating resistor and a biasing resistor.

When the switch is put on the “off” position, there is no terminating resistor or a biasing resistor.

When the switch is put on the “on” position, there is a terminating resistor and a biasing resistor.

5.4 Diagram of application of PFB-G

PFB-G may be used with PFB-GP with a programming interface. Install PFB-GPS at a station needing access of a programming device or a human-machine interface and PFB-G at a station without such a need to save engineering costs. Of course, all the stations may be installed with PFB-GPs so that debugging personnel can access a programming device debugging system at any station.

The RS485 interfaces of such devices such as inverters are not convenient for PFB-G installation due to a terminal shape. In this case, user may choose BH-485G or E485GP, another isolator of us with an external structure made up of standard rails and terminals.

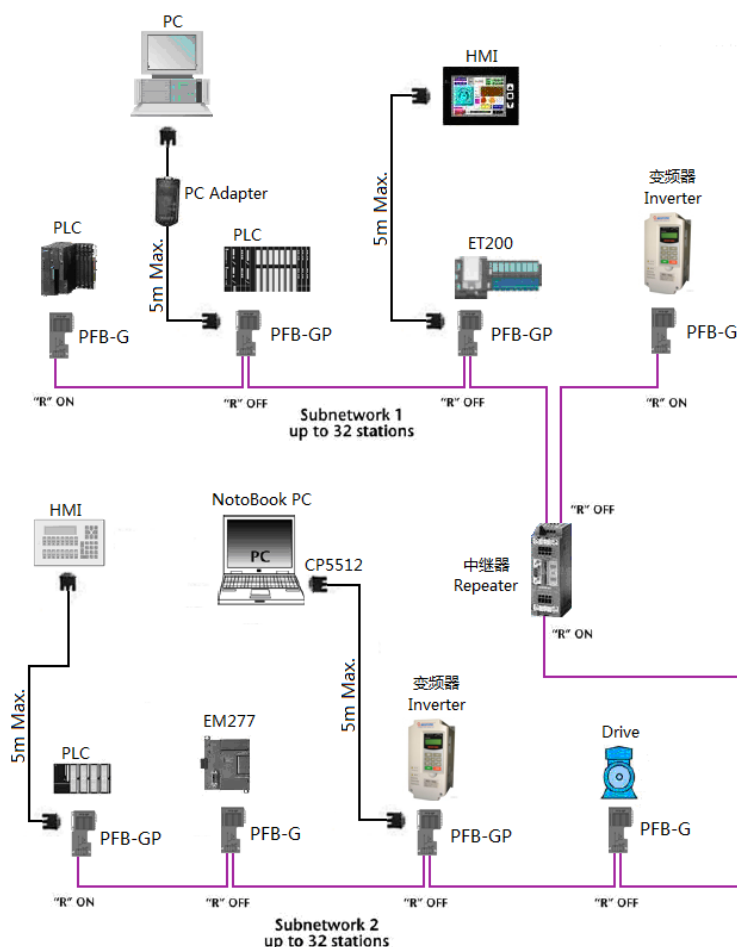


Fig.5-4 Diagram of Application of PFB-G

6 FAQ

6.1 Where the operational power supply of PFB-G is obtained?

As long as pins 6 and 5 of the PROFIBUS/MPI/PPI socket (DB9F socket) of the device output a 5VDC voltage, or pins 7 and 2 output a 24VDC voltage, PFB-G can obtain a normal operating voltage. The power consumption of PFB-G is about 0.7 W which can be met as long as the PROFIBUS/MPI/PPI socket (DB9F socket) is designed according to relevant standard.

6.2 Can PFB-G be used for some devices such as Siemens S7-1200PLC? For the DB9F socket of the RS485 interface on the RS485 module CM1241 of such a device, there is no 24VDC output voltage between pins 7 and 2 or 5VDC output voltage between pins 6 and 5; however, a 100 Ω resistor connected in series in the device.

In this case, PFB-G should not be used. There is a 100 Ω resistor connected in series in the device, so no load is allowed for the space between pins 6 and 5 on the DB9F socket (although an open-circuit voltage of 5VDC is measured between pins 6 and 5 by a multimeter; the measured voltage is less than 2 V after a 50 Ω resistor is installed between the two pins). BH-485G, another isolator of us, may be used for isolating the RS485 interfaces of these devices. BH-485G is a general RS485 isolator in line with standard rail installation and with an external power supply and performance the same as that of PFB-G.

For the DP module CM1242/ CM1243 of Siemens S7-1200PLC, the 5VDC output voltage between pins 6 and 5 on the DP socket can provide a 15mA output current only; only a BH-485G RS485 isolator with an external power supply rather than PFB-G can be used.

6.3 Power failure is not allowed for the stations serving as terminals in network segments. Why?

The head and tail of a PROFIBUS network segment are called terminators. To suppress the reflection and distortion of RS485 signals, the terminal cable needs to be connected to terminals A1 and B1 of the bus connector and the terminating resistor switch on the bus connector plug of the terminal interface must be put on the "ON" position. Thus, a 220 Ω terminating resistor, a 390 Ω pull-up resistor and a 390 Ω pull-down

resistor are accessed to the terminal interface for stable running of the network. The 390 Ω pull-up resistor and the pull-down resistor need a 5VDC operational power supply provided by pins 6 and 5 on the DP socket. In the case of a power failure of a terminal station, the 5VDC will no longer exist, thus resulting in a communication abnormality or failure of the network.

The figure below is the schematic diagram of interior of a conventional non-isolated PROFIBUS bus connector plug.

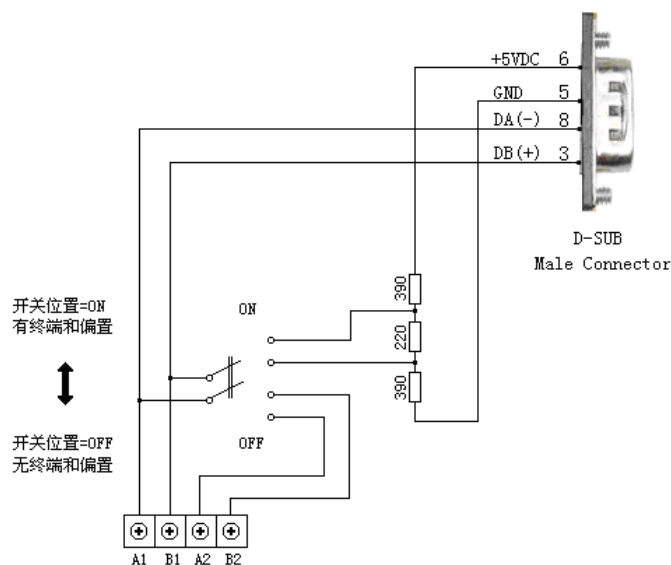


Fig.6-3 Schematic Diagram of Interior of a PROFIBUS Bus Connector Plug

When the switch is put on the “on” position, there is a terminating resistor and a biasing resistor.

When the switch is put on the “off” position, there is no terminating resistor or a biasing resistor.

6.4 Power failure cannot be absolutely avoided for terminal stations. Why?

If a terminal station needs a power failure due to site condition limitation, or a bus connector cannot be installed on it because its DP interface is a connection terminal, terminals of the network segment should be installed with active terminating resistors (keep them from power failure) to serve as terminals of the network segment to ensure normal communication for the network. The active terminating resistor product S/N of Siemens is 6ES7 972-0DA00-0AA0 and that of us is PB-TR485.

After being installed with active terminating resistors, terminals of a PROFIBUS network segment can maintain a standard bus voltage, so disconnection of any station on the bus from the network will not result

in network faults. Power failure of any terminal of the network segment will affect communication of the whole network segment, making it necessary to replace all the terminals with possible power failure by active terminating resistors and to keep the active terminating resistors from power failure.

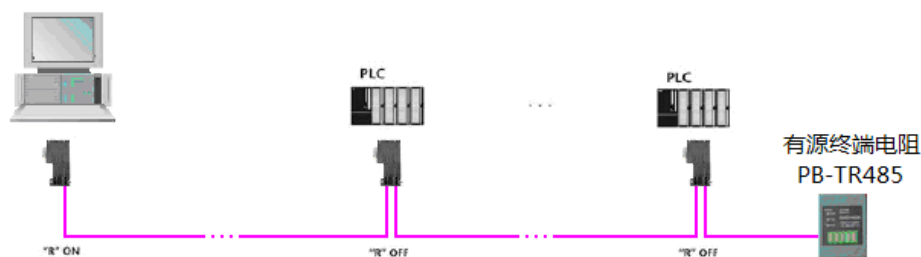


Fig.6-4 Installation of an Active Terminating Resistor for a Terminal with Possible Power Failure

Active terminating resistor

6.5 How to realize high-speed long-distance communication for PROFIBUS?

High-speed communication is an advantage of PROFIBUS compared with ordinary RS485; however, in PROFIBUS communication at a high transmission rate, the cable transmission distance is very short. For example, the cable transmission distance corresponding to a transmission rate higher than 3Mbps is 100 meters at most. If multiple repeaters or concentrators are installed to solve this problem, there will be new problems such as more serious signal delay, higher cost and difficult power supply. Optical fiber transmission is the currently best solution for the problem. Our PROFIBUS converter optical fiber modules FS-OLM-S and FS-OLM-M, or mini PROFIBUS optical fiber link adapters PFB-FIB-M and PFB-FIB-S are embodiments of the best solution.

6.6 Can PFB-G be inserted into your PROFIBUS concentrator FS-PBHUB-6 for use?

Each DP interface of our PROFIBUS concentrator FS-PBHUB-6 is separately isolated, so it is not necessary to use an isolated bus connector but a cheap non-isolated bus connector. However, if you think it is necessary to use an isolated bus connector, you may use a PFB-G or PFB-GP isolated bus connector. After PFB-G or PFB-GP isolated bus connectors are installed on a PROFIBUS concentrator, the maximum communication rate will be 3Mbps. After the PROFIBUS concentrator is inserted with six PFB-G or PFB-GP isolated bus connectors, it will generate a certain amount of heat because the six PFB-G or

PFB-GP isolated bus connectors will have a rough power consumption of above 4W. The heat of the PROFIBUS concentrator is in the permissible range and will not affect its normal running.

6.7 Is it allowed to insert a bus connector with a programming interface into the PROFIBUS/MPI/PPI socket of a device and then insert PFB-G into the bus connector?

It is not allowed. PFB-G must be inserted into the DB9F socket of the PROFIBUS/MPI/PPI socket of a device directly. There should be no extension cable or other bus plugs or devices between PFB-G and the DB9F socket.





7 Ordering information

Product name: Isolated PROFIBUS bus connector with LED diagnosis indicators

Product model: PFB-G

8 Relevant products

You may get information about the following products related to PFB-G from our official website.

Model	Description
<p>PFB-GP</p> 	<p>Isolated PROFIBUS bus connector with a programming interface: It has a programming interface for easy insertion of various programming cables and diversified communication cards, touch screens, etc. Its other functions, applications and technical data are the same as that of PFB-G. It can be used as a substitute for conventional non-isolated bus connectors directly.</p> <p>Website: http://www.fourstar-dy.com/product.asp?m=8</p>
<p>PFB-R</p> 	<p>Mini PROFIBUS/MPI/PP repeater: With an appearance the same as that of a PROFIBUS bus connector plug and an adaptive rate of 0 Mbps to 12 Mbps, it needs no external power supply and should be inserted into the PROFIBUS or MPI/PPI socket of a device directly. The two-way extended communication distance and the number of the added stations both comply with the PROFIBUS standard. It can realize a bus network topology, a hybrid network topology, etc. It adopts a power supply- RS485-RS485 complete isolation mode and has a lightning surge protection function and communication indicators.</p> <p>Website: http://www.fourstar-dy.com/product.asp?m=8</p>
<p>PFB-FIB-M</p> 	<p>Mini PROFIBUS multimode optical fiber link adapter: Also called optical fiber bus connector, it has the same size as that of a PROFIBUS bus connector plug and an adaptive rate of 0 Mbps to 12 Mbps. It needs no external power supply and should be directly inserted into the PROFIBUS/MPI/PPI socket of a device or into the bus connector that is installed on a bus and has a programming interface. It can form a bus type, star type or hybrid type PROFIBUS optical fiber network and realize convenient and flexible use. With a standard ST optical fiber interface, it is applicable to the multimode 62.5/125um or 50/125um optical fiber and has a transmission distance of 0 km to 4 km.</p> <p>Website: http://www.fourstar-dy.com/product.asp?m=9</p>
<p>PFB-FIB-S</p> 	<p>Mini PROFIBUS singlemode optical fiber link adapter: Also called optical fiber bus connector, it has the same size as that of a PROFIBUS bus connector plug and an adaptive rate of 0 Mbps to 12 Mbps. It needs no external power supply and should be directly inserted into the PROFIBUS/MPI/PPI socket of a device or into the bus connector that is installed on a bus and has a programming interface. It can form a bus type, star type or hybrid type PROFIBUS optical fiber network and realize convenient and flexible use. With a standard ST optical fiber interface, it is applicable to the singlemode 9/125um, 10/125um or 8.3/125um optical fiber and has a transmission distance of 0 km to 12 km.</p> <p>Website: http://www.fourstar-dy.com/product.asp?m=9</p>

Declaration: This document is prepared to guide users to use PFB-G isolated PROFIBUS bus connectors. In consideration of rapid development of new technologies, please refer to the real product for its functions. We reserve the right to revise this document without declaration.

Deyang FOURSTAR Electronic Technology Co., Ltd.

Add: 2F, Building H, 88 Sec. 2, South Lushan Road, Deyang City, Sichuan

Tel: +86-838-2515543 2515549

Fax: +86-838-2515546

Website: <http://www.fourstar-dy.com>