INOVANCE

User Guide

AM600-RTU-DP Communication Module

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1. Preface

Thank you for purchasing the AM600-RTU-DP communication module developed and manufactured independently by Inovance.

AM600-RTU-DP is a PROFIBUS-DP bus slave expansion module used together with AM600 series medium-sized PLC main modules. Each AM600-RTU-DP module can connect up to 16 DI/DO modules, or 8 AI/AO modules.

This guide describes the specifications, characteristics and using of the product. Please read this guide carefully before using to understand the characteristics and ensure more safely usage. Please refer to the AM600 Series PLC Hardware Manual and the AM600 Series PLC Programming Manual to understand the use of the user program development environment and design method of the user program of the product. You can download the latest materials from www.inovance.com.

2. Safety Information and Precautions

Safety information and precautions are identified into two grades: Warning and Caution. Please make sure to operate properly with adequate safety assurance.

WARNING Indicates the improper operation which, if not avoided, may cause death or serious injury;

CAUTION Indicates the improper operation which, if not avoided, may cause moderate or minor injury, as well as equipment damage.

In some cases, even failure to follow “Cautions” may also lead to serious consequences. Please make sure to follow both warnings and cautions; otherwise, it may cause death or serious injury, as well as product and relevant equipment and system damage.

Please keep this guide well so that it can be read when necessary and forward this guide to the end user.

During control system design

WARNING

- Provide a safety circuit outside the PLC so that the control system can still work safely once external power failure or PLC fault occurs.
- Add a fuse or circuit breaker because the module may smoke or catch fire due to long-time overcurrent caused by operation above rated current or load short-circuit.

CAUTION

- An emergency stop circuit, a protection circuit, a forward/reverse operation interlocked circuit, and a upper position limit and lower position limit interlocked circuit must be set in the external circuits of the PLC to prevent damage to the machine.
- To ensure safe operation, for output signals related to critical accidents, please design external protection circuit and safety mechanism;
- Once the PLC CPU detects abnormality in the system, all outputs may be closed; however, when a fault occurs in the controller circuit, the output may not be under control. Therefore, it is necessary to design an appropriate external control circuit to ensure normal operation;
- If the PLC's output units such as relays or transistors are damaged, the output may fail to switch between ON and OFF states according to the commands;
- The PLC is designed to be used in indoor electrical environment (overvoltage category II). The power supply must have a system-level lightning protection device, assuring that overvoltage due to lightning shock can't be applied to the PLC's power supply input terminals, signal input terminals and output terminals and so forth, so as to avoid damage to the equipment.

During installation

WARNING

- Installation must be carried out by the specialists who have received the necessary electrical training and understood enough electrical knowledge.
- Disconnect all external power supplies of the system before module assembly/disassembly and wiring. Failure to do so may result in electric shock, module fault or malfunction.
- Do not use the PLC where there are dust, oil smoke, conductive dust, corrosive or combustible gases, or exposed to high temperature, condensation, wind & rain, or subject to vibration and impact. Electric shock, fire and malfunction may also result in damage or deterioration to the product.
- The PLC is an open-type that must be installed in a control cabinet with lock (cabinet housing must satisfy protection of over IP20). Only the personnel who have the necessary electrical training and experience can open the cabinet.

CAUTION

- Prevent metal filings and wire ends from dropping into ventilation holes of the PLC during installation. Failure to comply may result in fire, fault and malfunction.
- Ensure there are no foreign matters on the ventilation surface. Failure to comply may result in poor ventilation, which may cause fire, fault and malfunction.
- Ensure the module is connected to the respective connector securely and hook the module firmly. Improper installation may result in malfunction, fault or fall-off.

During wiring

WARNING

- Wiring must be carried out by personnel who have the necessary electrical training and experience.
- Disconnect all external power supplies of the system before wiring. Failure to comply may result in electric shock, module fault or malfunction.
- Install the terminal cover attached to the product before power-on or operation after wiring is completed. Failure to comply may result in electric shock.
- Perform good insulation on terminals so that insulation distance between cables will not reduce after cables are connected to terminals. Failure to comply may result in electric shock or damage to the equipment.

CAUTION

- Prevent metal filings and wire ends from dropping into ventilation holes of the PLC at wiring. Failure to comply may result in fire, fault and malfunction.
- The external wiring specification and installation method must comply with local regulations. For details, see the wiring section in this guide.
- To ensure safety of equipment and operator, use cables with sufficient diameter and connect the cables to ground reliably. For details, see the wiring section in this guide.
- Wire the module correctly after making clear of the connector type. Failure to comply may result in module and external equipment fault.
- Tighten bolts on the terminal block in the specified torque range. If the terminal is not tight, short-circuit, fire or malfunction may be caused. If the terminal is too tight, fall-off, short-circuit, fire or malfunction may be caused.
- If the connector is used to connect with external equipment, perform correct crimping or welding with the tool specified by manufacturer. If connection is in poor contact, short-circuit, fire or malfunction may be caused.
- A label on the top of the module is to prevent foreign matters entering the module. Do not remove the label during wiring. Remember to remove it before system operation, facilitating ventilation.
- Do not bundle control wires, communication wires and power cables together. They must be run with distance of more than 100 mm. Otherwise, noise may result in malfunction.
- Select shielded cable for high-frequency signal input/output in applications with serious interference so as to enhance immunity to interference of the system.

During maintenance & inspection

WARNING

- Maintenance & inspection must be carried out by personnel who have the necessary electrical training and experience.
- Do not touch the terminals while the power is on. Failure to comply may result in electric shock or malfunction.
- Disconnect all external power supplies of the system before cleaning the module or re-tightening screws on the terminal block or screws of the connector. Failure to comply may result in electric shock.
- Disconnect all external power supplies of the system before removing the module or connecting/removing the communication wirings. Failure to comply may result in electric shock or malfunction.

CAUTION

- Get acquainted with the guide and ensure safety before online modification, forcible output, and RUN/STOP operation.
- Disconnect the power supply before installing/removing the extension card.

At disposal

CAUTION

- Treat scrapped module as industrial waste. Dispose the battery according to local laws and regulations.

3. Product Information

■ Model and Nameplate

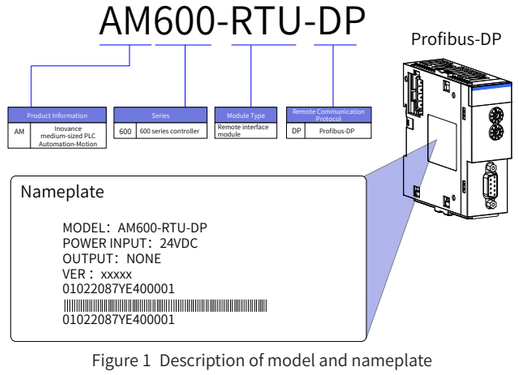


Figure 1 Description of model and nameplate

Model	Classification	Description	Applicable to
AM600-RTU-DP	PROFIBUS-DP communication module	PROFIBUS-DP protocol communication interface module	AM610 series

■ External Interface

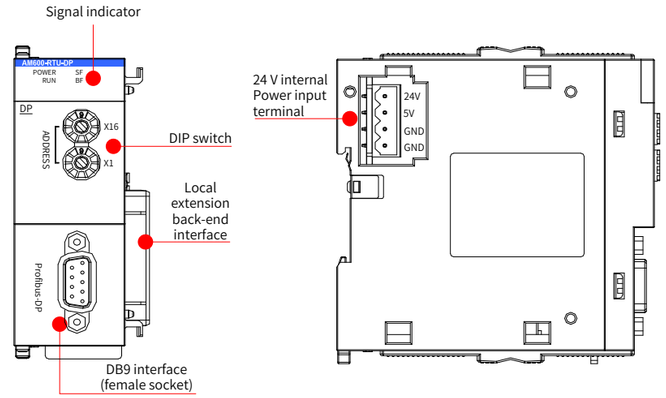


Figure 2 Diagram of PROFIBUS-DP communication module interface

Interface Name	Function			
DB9 interface	PROFIBUS-DP communication interface			
Dialing switch	ADDR1 ADDR0	Station address can be set via 16-bit rotary DIP switch. Decimal slave address = ADDR1*16+ADDR0 (address: 1~125)		
Signal indicators	POWER	Power indicator	Green	ON when power supply is switched on.
	SF	Slave configuration error indicator	Red	ON when a slave expansion module configuration error occurs
	BF	Slave expansion bus error indicator	Red	Flashing if an error occurs on the slave expansion bus
Local expansion module back-end interface	Connect back-end module, not supporting hot plugging			
Internal 24 V power input terminal	Connect to power modules			

■ General Specifications

Item	Specifications
Power supply specifications	24 VDC (20.4 VDC to 28.8 VDC) (–15% to +20%)
Internal 5 V power output current	1,200 mA (rated value)
Protocol for communication with the CPU module	PROFIBUS-DP: a maximum speed of 12 Mbps supported
PROFIBUS-DP communication speed	9.6 Kbps to 12 Mbps, adaptive to the communication speed of the DP master station
Station number range	1 to 125. The station number can be set with 2 dialing switches.
Subsequent expandability of I/O modules	A maximum of 16 I/O modules can be supported. The actual number and configuration depend on each module's power consumption.
PROFIBUS-DP network interface	One DB9 female connector interface

4. Mechanical Design Reference

■ Mounting Dimensions

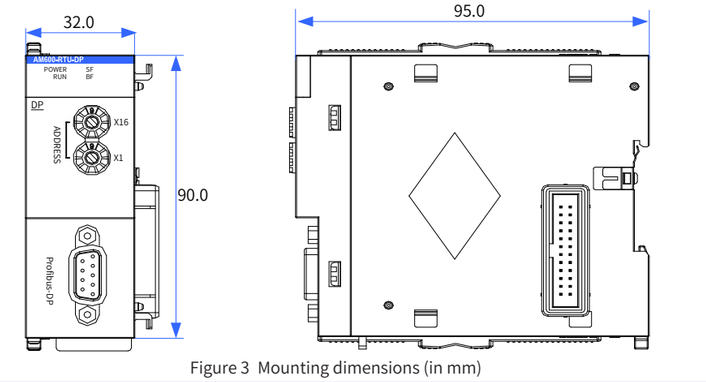


Figure 3 Mounting dimensions (in mm)

5. Electrical Design Reference

1) PROFIBUS-DP Bus Specifications

Item	Specifications
Protocol type	DPV0, and DPV1 (under development)
Number of slave stations	124 (A PROFIBUS-DP relay needs to be added for every 32 stations for extension.)
Communication rate	9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5 Mbps, 3 Mbps, 6 Mbps, or 12 Mbps
Communication data volume per slave station	244 Bytes/Slave
Total network communication data volume	5000 Bytes/Input; 5000 Bytes/Output
Basic functions	Initialization state, parameter configuration state, and data exchange state
Special functions	Diagnosis functions
Error indicators	SF and BF. For details, see "Description of Indicators and MFK Key" below.

2) Diagram of Networking

The PROFIBUS-DP bus networking diagram is shown in the figure below:

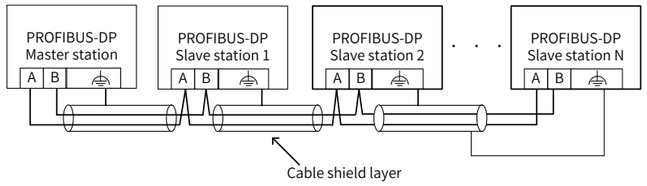


Figure 4 Diagram of PROFIBUS-DP networking connection

To ensure reliable connection of the PROFIBUS-DP bus, connect a terminal matching resistor at the terminal of the PROFIBUS-DP bus. You may select the terminal matching resistor by using the DIP switch according to the marking on the wiring terminal. Ensure that the cable shield layer and the system are reliably grounded.

Location of the DIP switch	Description
ON OFF	The termination resistor is connected.
ON OFF	The termination resistor is not connected.

The length of the PROFIBUS-DP bus communication cable varies according to the communication baud rate setting of the master station. The cable length needs to be restricted in strict accordance with the wiring standard. The transmission distance of the DP bus in the actual environment on-site can reach about 60% the theoretical value due to reasons such as on-site interference or cable errors.

The table below describes the baud rate and the cable length requirement.

Transmission rate	Theoretical Transmission Length (m)	Actual Transmission Length (m)
9.6 to 93.75 Kbps	1000	600
187.5 Kbps	800	480
500 Kbps	400	320
1.5 Mbps	200	160
12 Mbps	100	60

Note: According to PROFIBUS-DP specifications, when there are more than 32 site devices on the network, or the network communication distance corresponding to a baud rate exceeds the specified range, relays need to be used to expand network connections.

3) Communication Interface Description

The PROFIBUS-DP module uses the DB9 connector for data transfer.

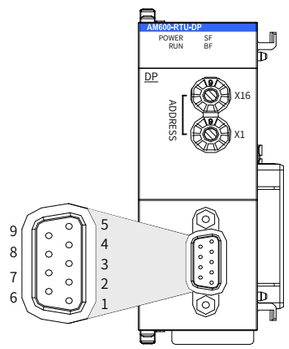
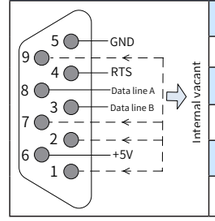


Figure 5 PROFIBUS-DP terminal arrangement

The table below describes the pin signal definitions.

Diagram	Terminal Symbol	Terminal Name	Function
	1, 2, 7, 9	NC	Internal vacant
	3	Data cable B	Positive of data cable
	4	RTS	Request for transmitting signal
	5	GND	Isolated 5 V power ground
	6	+5 V	Isolated 5 V power supply
	8	Data cable A	Negative of data cable

The PROFIBUS-DP communication cable uses the DB9 connector (male connector), and is provided with a termination resistor. The appearance and the internal principle of the recommended terminal are shown in the figure below:

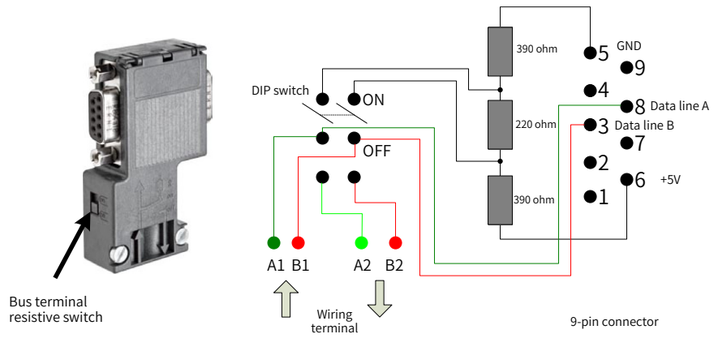


Figure 6 Diagram of the DB9 interface circuit

4) Wiring

A PROFIBUS-DP cable is used to connect the PROFIBUS-DP module and the main module. It is recommended that the Siemens 6XV1830-0EH10 cable be used as the PROFIBUS-DP cable. The connection diagram is shown below:

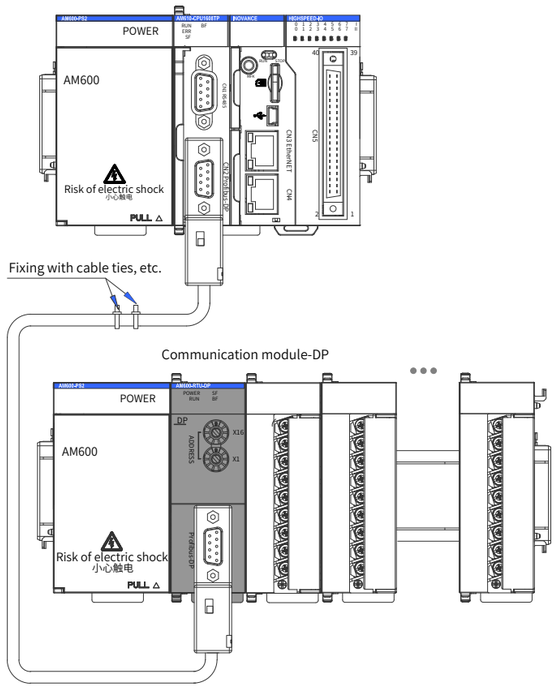


Figure 7 Diagram of connection between the PROFIBUS-DP module and the main module

CAUTION

- To avoid the influence on the communication cable due to other stresses and ensure the stability of communication, secure the cable near the equipment before PROFIBUS-DP communication.

5) Connection of the DB9 connector

- Connect the PROFIBUS-DP cable connected to the main module to the cable inlet of the DB9 connector, and connect the cable to be connected to the next-level expansion rack to the cable outlet of the DB9 connector.
- Plug the DB9 connector with wire into the DB9 plug on the module (pay attention to the connector orientation).
- Tighten the screws on both sides of the DB9 connector.

6. AM600-RTU-DP Slave Station Indicator Description

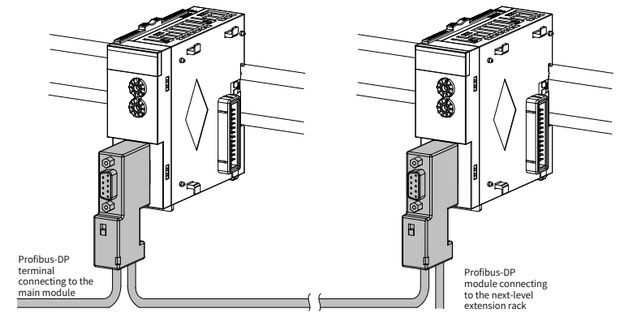


Figure 8 iagram of DB9 connector connection

- Disassembly procedures: Loosen the screws on both sides of the DB9 connector, hold the plastic part of DB9, and pull out the connector along a horizontal direction.

LED			Indicator Definition	Solution
RUN (Green)	SF (Red)	BF (Red)		
ON	OFF	OFF	Module communication is normal, and the configuration is operating normally.	---
OFF	OFF	OFF	There is no power supply to the module, or the hardware is abnormal.	Check whether the power supply is normal. Replace the AM600-RTU-DP module.
OFF	OFF	ON	Communication with the master station is interrupted.	Check whether the communication cables are properly connected. Check whether the bus configuration is correct.
OFF	OFF	Flashing	Communication is interrupted due to configuration errors, parameter address errors, or hardware faults.	Check the configuration and parameter settings. Check whether the address is correct. Check the hardware or cable termination resistor.
OFF	ON	Flashing	The system expansion configuration is inconsistent with the actual hardware configuration.	Check whether the system configuration is consistent with the actual configuration.
Off	ON	Off	Invalid address, module error, or diagnosis alarm.	Check the address, and set a valid address (1 to 125). Replace the faulty module according to background diagnosis information.

INOVANCE Warranty Agreement

1) Inovance provides an 18-month free warranty to the equipment itself from the date of manufacturing for the failure or damage under normal use conditions.
2) Within the warranty period, maintenance will be charged for the damage caused by the following reasons:
   a. Improper use or repair/modification without prior permission
   b. Fire, flood, abnormal voltage, natural disasters and secondary disasters
   c. Hardware damage caused by dropping or transportation after procurement
   d. Operations not following the user instructions
   e. Damage out of the equipment (for example, external device factors)
3) The maintenance fee is charged according to the latest Maintenance Price List of Inovance.
4) If there is any problem during the service, contact Inovance's agent or Inovance directly.
5) Inovance reserves the rights for explanation of this agreement.

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