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PS00008837A03

AM500 Series Programmable Logic Controller

User Guide

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Preface

■ Introduction

This product is a new generation of medium-sized programmable logic controller (PLC) independently developed by Inovance. It supports EtherCAT bus control and network switching over dual network ports. It allows process encapsulation and reuse through the Function Block (FB) and Function (FC) features, and supports multi-layer network communication through the RS485, Ethernet, and EtherCAT ports. This product can accommodate a maximum of 16 expansion modules. This product can also provide the RS485, RS232, CAN, digital input (DI), digital output (DO), analog input (AI), analog output (AO), real-time clock (RTC), and trans-flash (TF) card features through expansion cards.

This guide describes the installation and wiring of the product, including product information, mechanical installation, and electrical installation.

■ Compliance

The following table lists the certifications, directives, and standards applicable to this product. For certifications actually acquired for the product you purchased, see the certification marks on the product nameplate.

Certification	Directive		Standard
CE	EMC Directive	2014/30/EU	**24 VDC products:** EN 61131-2 **220 VAC products:** EN 61131-2 EN 61000-3-2 EN 61000-3-3
	LVD	2014/35/EU	EN 61010-1 EN 61010-2-201
	RoHS Directive	2011/65/EU amended by (EU) 2015/863	EN IEC 63000
UL/cUL	-		UL 61010-1 UL 61010-2-201 CAN/CSA-C22.2 No. 61010-1 CSA-C22.2 No. 61010-2-201
KCC	-		-
EAC	-		-
UKCA	Safety Regulations	Electrical Equipment (Safety) Regulations 2016	EN 61010-1 EN 61010-2-201
	EMC Regulations	Electromagnetic Compatibility Regulations 2016	**24 VDC products:** EN 61131-2 **220 VAC products:** EN 61131-2 EN 61000-3-2 EN 61000-3-3
	RoHS Regulations	Directive (RoHS) Regulations 2012	EN IEC 63000

■ More Documents

Doc Name	Data Code	Description
GE20 Series Expansion Card User Guide	PS00006443	Describes the product information, mechanical installation, input connection, output connection, I/O connection, communication connection, and programming examples of the GE20 series expansion card
Medium-Sized PLC Programming Software User Guide	19010980	Describes the basic functions, quick start, network settings, and programming basics of the medium-sized PLC programming software
Medium-Sized PLC Programming Guide (Motion Control)	19012378	Describes the composition of the PLC motion control system, mechanism of the motion control program, motion control (MC) instructions, and simulation and commissioning related operations
Medium-Sized PLC Instruction Guide	19012377	Describes basic instructions of the medium-sized PLC
AM500 Series Programmable Logic Controller User Guide (this guide)	PS00008837	Describes the installation and wiring of the product, including product information, mechanical installation, and electrical installation

■ Revision History

Date	Version	Description
February 2024	A03	• Added the PNP model in *"1.1 Model Number and Nameplate" on page 15* • Updated the descriptions of status indicators in *"1.2 Components" on page 16* • Added the PNP specifications in the pulse input item in *"1.3.1 General Specifications" on page 20* • Updated the power supply specifications in *"1.3.2 Power Supply Specifications" on page 23* • Added the PNP specifications in the high-speed input (X0 to X7) item in *"1.3.3 Input Specifications" on page 24* • Added the PNP specifications in the output type item in *"1.3.4 Output Specifications" on page 25* • Added the PNP output terminal wiring in *"3.3 Output Terminal Wiring" on page 38* • Added the AM52X series programmable controller models and the GL20 series expansion module models in *" Appendix" on page 48*
November 2023	A02	**Addition** • Added the GE20-TF-RTC memory expansion card (with integrated RTC) in *" Appendix" on page 48* • Added the support for the CAN free protocol in CAN specifications in *"1.3.1 General Specifications" on page 20*

Date	Version	Description
September 2023	A01	• Added CAN specifications in *"1.3.1 General Specifications" on page 20* • Added CAN communication descriptions in *"4.1 Communication Networking" on page 40* • Added the GE20-CAN-485 expansion card in *" Appendix" on page 48*
June 2023	A00	First release

■ Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version in the following ways:

- Visit *www.inovance.com*, go to "Support" > "Download", search by keyword, and then download the PDF file.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install the My Inovance app, and search for the file in the app.

■ Warranty

For faults and damage incurred during normal use in the warranty period, Inovance provides free repair service. (For details of the warranty period, see the purchase order.) A maintenance fee will be charged out of the warranty period.

Even in the warranty period, a maintenance fee will be charged for repair of the following damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product

- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance fee will be charged according to our latest Price List if not otherwise agreed upon.

For details, see the Product Warranty Card.

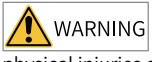
General Safety Precautions

■ Safety Disclaimer

- This chapter presents essential safety instructions for proper use of the equipment. Before operating the equipment, read through the user guide and comprehend all the safety precautions. Failure to comply with the safety precautions may result in equipment damage, severe physical injuries, or even death.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the instructions that need to be followed; they just supplement the safety instructions.
- Use this product in an environment that complies with the design specifications. Malfunctions or component damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any physical injuries or property damage caused by improper use.

■ Safety Categories and Definitions

indicates that failure to comply with the notice will result in severe physical injuries or even death.



indicates that failure to comply with the notice may result in severe physical injuries or even death.

indicates that failure to comply with the notice may result in minor or moderate physical injuries or equipment damage.

■ General Safety Precautions

- Some drawings in this guide show the equipment without covers or protective guards to display more details. Remember to install the covers and protective guards before using the equipment and operate it in accordance with the instructions.
- Drawings in the user guide are for illustration only and may be different from the equipment you purchased.

- Operators must take mechanical protective measures to protect personal safety. For example, wear and use necessary protective equipment, such as crush-resistant shoes, safety clothing, safety glasses, protective gloves, and sleeves.

Unpacking

- Do not install the product if you find damage, rust, or signs of use on it or its accessories upon unpacking.
- Do not install the product if you find water seepage or any components being missing or damaged upon unpacking.
- Do not install the product if the packing list does not match the product you received.

- Before unpacking, check the package for any damage, water seepage, dampness, or deformation.
- Unpack the product layer by layer. Do not strike the package violently.
- Check the surfaces of the equipment and accessories for any damage, rust, and scratches.
- Check the equipment, accessories, and materials in the package against the packing list.

Storage and Transportation

CAUTION

- Handle the equipment with care and mind your steps. Failure to comply may result in physical injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in physical injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storage and transportation in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storage for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the product properly before transportation by vehicle. Use an enclosed box for long-distance transportation.
- Never transport the product with devices or materials that may damage or negatively impact the product.

Installation

DANGER

- Installation must be carried out by technicians who have received relevant training on electrical equipment and have sufficient electrical expertise. Non-professionals are not allowed to operate the equipment.

WARNING

- Read through the user guide and safety precautions before installation.
- Do not install the product in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or fire.
- Do not modify the product.
- When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations.
- If any equipment with strong electromagnetic interference, such as a transformer, is needed, install a shielding device to prevent malfunction of this product.
- Install the equipment on metal or other incombustible objects. Keep the equipment away from combustible objects. Failure to comply will result in fire.

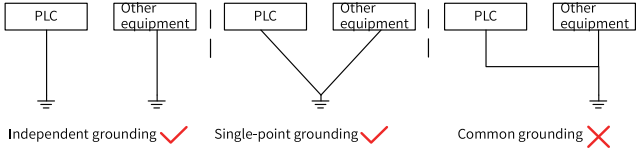
CAUTION

- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when a machine supposed to run at a constant speed is running at variable speeds. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring

DANGER

- Never allow non-skilled personnel to carry out installation, wiring, maintenance, inspection, or part replacement.
- Before wiring, cut off all the power supplies of the equipment. Wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board while power is on. Failure to comply will result in an electric shock.
- Ensure that the equipment is well grounded. Failure to comply will result in an electric shock.Ground the equipment separately or to a single point, rather than to a shared terminal.



WARNING

- Do not connect the input power supply to the output end of the equipment. Failure to comply may result in equipment damage or even fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Use cables with required diameter and shield. Properly ground one end of the shield if a shielded cable is used.
- After wiring is done, check that all cables are connected properly and no screws, washers, or exposed cables are left inside the equipment. Failure to comply may result in an electric shock or equipment damage.

- During wiring, follow the proper electrostatic discharge (ESD) procedures and wear an anti-static wrist strap. Failure to comply will result in damage to the equipment or internal circuits of the product.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-on

- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or fire.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply will result in an electric shock.

- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in physical injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in fire.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in physical injuries or even death.

Operation

- The equipment must be operated only by professionals. Failure to comply will result in physical injuries or even death.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply will result in an electric shock.

- Do not touch the equipment casing, fan, or resistor to check the temperature. Failure to comply may result in burns.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in fire or equipment damage.

Maintenance

- Never allow non-skilled personnel to carry out installation, wiring, maintenance, inspection, or part replacement.
- Do not maintain the equipment while power is on. Failure to comply will result in an electric shock.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock.

- Carry out daily and periodic inspection and maintenance on the equipment according to maintenance requirements and retain a maintenance record.

Repair

- Never allow non-skilled personnel to carry out installation, wiring, maintenance, inspection, or part replacement.
- Do not repair the equipment while power is on. Failure to comply will result in an electric shock.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.

WARNING

- Submit the repair request according to the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in equipment damage, physical injuries, or even death.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the product according to the replacement instructions.
- Do not use damaged equipment. Failure to comply may result in further equipment damage, physical injuries, or even death.
- After equipment replacement, check the wiring and set parameters again.

Disposal

WARNING

- Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, physical injuries, or even death.
- Recycle retired equipment in accordance with waste disposal standards of the industry to avoid environmental pollution.

■ Safety Label

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. The following table describes the safety labels.

Safety Label	Description
	Read through the safety instructions and user guide before operating the equipment. Failure to comply may result in equipment damage, physical injuries, or even death.

1 Product Information

1.1 Model Number and Nameplate

■ Model number

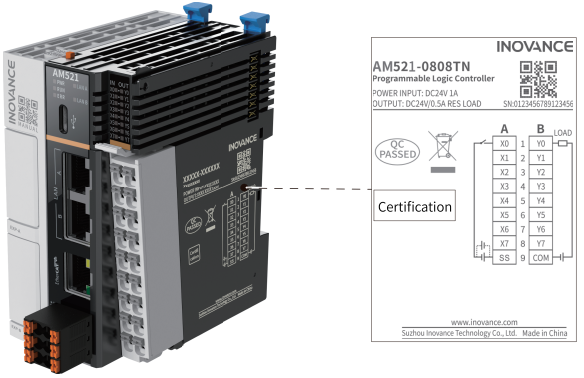
AM ① 52*X* ② – 0808 ③ T*X* ④

① **Product series** AM: AM series programmable logic controller	③ **Input and output channels** 08: 8-channel input 08: 8-channel output
② **Model code** 5: 500 series platform 2: Two Ethernet ports X: Number of EtherCAT axes. "1" means 8 axes and "2" means 16 axes.	④ **Output type** X indicates N or P. TN: Sink transistor TP: Source transistor

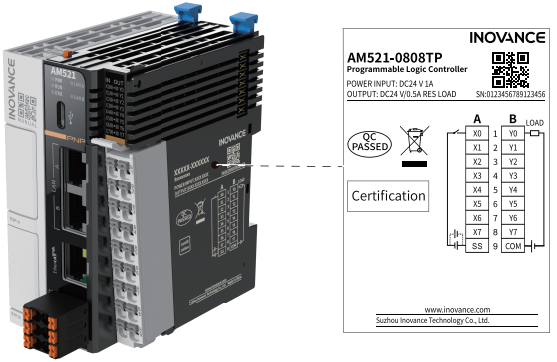
■ Nameplate

The AM52X series have identical nameplates except for the model number and SN code. This section uses the AM521 model as an example.

AM521-0808TN



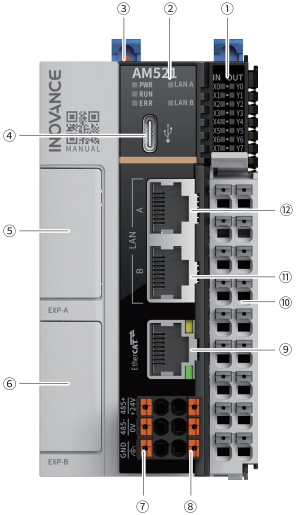
AM521-0808TP



Model	Description	Code
AM521-0808TN	AM500 series 8-input 8-output 8-axis programmable controller	01440477
AM522-0808TN	AM500 series 8-input 8-output 16-axis programmable controller	01440475
AM521-0808TP	AM500 series 8-input 8-output 8-axis programmable controller	01440608
AM522-0808TP	AM500 series 8-input 8-output 16-axis programmable controller	01440610

1.2 Components

Components are identical for the entire AM52X series. This section uses the AM521-0808TN model as an example for illustration.


③
②
①
AM521
PWR
RUN
ERR
LAN A
LAN B
IN
OUT
INOVANCE
MANUAL
④
⑤
⑥
⑫
⑪
⑩
⑨
LAN
A
B
EtherCAT
EXP-A
EXP-B
GND
485-
0V
485+
+24V
⑦
⑧

No.	Port Type	Mark	Meaning	Indicator Color	Description
①	I/O indicator	IN/OUT	I/O status	Yellow-green	• Steady ON: Input or output active • OFF: Input or output inactive
②	Operation status indicator	PWR	Power supply normal	Yellow-green	• Steady ON: Power supply normal • OFF: Power supply off or abnormal
		RUN	Normal running	Yellow-green	• Steady ON: User program running • OFF: User program stopped
		ERR	Running error	Red	• OFF: No major error • Blinking[1]: Major error
		LAN A	LAN A status indicator	Yellow-green	• Steady ON: Connected • Blinking: Communication in progress • OFF: Disconnected
		LAN B	LAN B status indicator	Yellow-green	• Steady ON: Connected • Blinking: Communication in progress • OFF: Disconnected
③	DIP Switch	RUN/STOP	Run/Stop control	-	-
④	Type-C port		Communication with PC	-	-
⑤/-⑥	Expansion card slot	01/02	Expansion card slots, used to expand features	-	For expansion card options, see " *Appendix" on page 48*.

No.	Port Type	Mark	Meaning	Indicator Color	Description
⑦	RS485	RS485+	RS485 communication signal+	-	-
		RS485–	RS485 communication signal–	-	-
		GND	RS485 communication ground	-	-
⑧	Power terminal	+24V	24 VDC power supply+	-	-
		0V	24 VDC power supply–	-	-
		⏚	PE	-	-
⑨	EtherCAT port	EtherCAT	EtherCAT communication	-	-
⑩	I/O terminal	-	8-channel input and 8-channel output	-	For details, see *"3.1 Terminal Arrangement" on page 36*.
⑪/-⑫	Ethernet port	LAN B/A	RJ45 ports used for Ethernet communication	-	-

Caution

[1]: If the product malfunctions and needs to be powered off and restarted, be sure to turn off the power and wait for at least 10 seconds after the power indicator is off before proceeding with the power-on and startup operation.

1.3 Product Specifications

1.3.1 General Specifications

Item		Specifications
Key items	Program capacity	10 MB
	Data capacity	20 MB, including 512 kB retentive at power failure
	EtherCAT	• AM521: 8 axes • AM522: 16 axes
	Axis driving performance	4-axis synchronization in 1 ms (execution time of motion control calculation)
	Electronic cam and interpolation	Supported
	Local expansion	Expansion module: Support for a maximum of 16 GL20 series local expansion modules
		Expansion card: Support for 10 types of expansion cards. A maximum of two expansion cards can be inserted at the same time. For the types of expansion cards supported, see *"Appendix" on page 48*.
Program-ming	Programming platform	InoProShop software programming platform (CODESYS)
	Programming language	IEC 61131-3-compliant programming languages (LD, ST, SFC, and CFC)

Item		Specifications
Communi-cation	EtherCAT	• All-in-one network; support for 127 EtherCAT slaves; minimum synchronization period: 1 ms • Slaves support disabling and scanning.
	Ethernet	Dual Ethernet ports corresponding to one network interface card. The two Ethernet ports share one IP address and support network switching.
		EtherNet/IP master/slave: Can be used as a master and supports 16 slaves, or used as a slave and supports 16 masters
		Modbus TCP master/slave: Can be used as a master and supports 63 slaves, or used as a slave and supports 16 masters
		OPC-UA server; support for 16 clients
		TCP/UDP free protocol; support for 16 connections
	RS485	Channel quantity: Maximum three (one on the PLC itself and two through the expansion cards)
		Hardware interface: Two 3-pin terminals (shared with the power supply)
		Isolation mode: No isolation
		Termination resistor: No termination resistor (The PLC can be used as a master or slave.)
		Number of slaves: Maximum 31 Modbus RTU slaves
		Baud rate: 9,600 bps, 19,200 bps, 38,400 bps, 57,600 bps, 115,200 bps
		Short circuit protection: Protection against mis-connection of the 24 V terminals
		Support for the serial port free protocol

Item		Specifications
Continued	CAN	• CANopen master: Support for one CANopen master and up to 63 slaves through expansion cards • Support for the CAN free protocol
	USB	Channel quantity: 1 USB cable length: 1.5 m USB communication version: USB 2.0, full speed USB interface: Type-C Master/Slave: Can only be used as a slave, not a master Power supply: The USB port can be used to power the PLC and download user programs (but cannot be used to drive local modules).
High-speed I/O	Pulse input	8-channel hardware input
		• AM52X-0808TN: Maximum input frequency of 200 kHz • AM52X-0808TP: Maximum input frequency of 100 kHz
		Maximum four encoder axes
		A/B phase, pulse/direction, CW/CCW, single-phase pulse signals
	Pulse output	8-channel hardware output
		Maximum output frequency: 200 kHz
		Maximum four pulse axes; unified motion control instructions with bus axes
		A/B phase, pulse/direction, CW/CCW, single-phase pulse signals
		Support for the PWM feature (5 Hz to 200 kHz)

Item		Specifications
User program upload and download	Ethernet	Support for Ethernet-based PLC monitoring and user program upload and download
	TF card	Support for user program download through GE20 series memory expansion cards
	Type-C	Support for Type-C-based PLC monitoring and user program upload and download
Firmware programming	SD card	Support for firmware programming through GE20 series memory expansion cards
	Type-C	Connection to a PC through the Type-C port for firmware programming
Firmware Upgrade	Ethernet	Support for firmware upgrade through Ethernet
Dimensions and weight	Dimensions (W x H x D)	53 mm x 100 mm x 80 mm
	Weight	Approx. 197 g
IP rating		IP20

1.3.2 Power Supply Specifications

Item	Specifications
Rated voltage of terminal input power	24 VDC±10% (21.6 VDC to 26.4 VDC)
Rated current of terminal input power	1 A (maximum value at 24 VDC)
Rated voltage of bus output power	5 VDC (4.75 VDC to 5.25 VDC)
Rated current of bus output power[1]	2 A (maximum value at 5 V)
24 V input power protection	Protection against short circuit and reverse connection
Hot swapping	Not supported

Note

[1]: Expansion modules are powered by the AM500 series programmable logic controller. Therefore, the sum of the rated current values of the bus input power for expansion modules must not be greater than the current value specified in the table (⩽ 2 A). For example, the rated current of the bus input power for the GL20-3232ETN-M expansion module is 250 mA, so at most eight such modules can be connected to the AM500 series programmable logic controller (2 A/250 mA = 8).

1.3.3 Input Specifications

Item		Specifications
Input type		Digital input
Number of input channels		8
Input mode		Sink/Source
Input voltage class		24 VDC±10% (21.6 VDC to 26.4 VDC)
High-speed input (X0 to X7)	Input current when input is ON	• AM52X-0808TN: > 4 mA • AM52X-0808TP: > 2.5mA
	Input current when input is OFF	• AM52X-0808TN: < 2.5 mA • AM52X-0808TP: < 1.5mA
	Hardware response time	2 μs (RC time)
	Maximum input frequency	• AM52X-0808TN: 200 kHz • AM52X-0808TP: 100 kHz
	Input impedance	• AM52X-0808TN: 3.4 kΩ • AM52X-0808TP: 5.7 kΩ
ON voltage		⩾ 15 VDC
OFF voltage		⩽ 5 VDC
Software filter time		• Low-speed: 2 ms to 1,000 ms • High-speed: 100 ns to 100 μs

Item	Specifications
Isolation mode	Capacitive isolation for integrated chip
Common terminal mode	8-point/common terminal (positive/ negative polarity of input power being changeable)

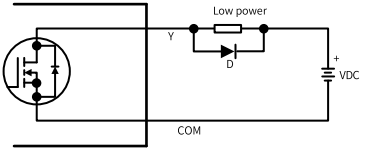
1.3.4 Output Specifications

Item		Specifications
Output type		• TN: Transistor NPN output • TP: Transistor PNP output
Number of output channels		8
Output voltage class		24 VDC±10% (21.6 VDC to 26.4 VDC)
High-speed output (Y0 to Y7)	Output load (resistive load)	0.5 A/point; 2 A/8-point
	Output load (inductive load)	7.2 W/point; 24 W/8-point
	Output load (lamp load)	5 W/point; 18 W/8-point
	Hardware response time (ON/ OFF)	< 1 μs (OFF→ON); < 2 μs (ON→OFF)
	Load current requirements	Load current ⩾ 12 mA when the output is greater than 10 kHz
	Maximum output frequency	200 kHz for resistive load; 0.5 Hz for inductive load; 10 Hz for lamp load
PWM output		Maximum frequency 200 kHz; minimum pulse width 5 μs; minimum resolution 5 μs; adjustable duty cycle 0.01% to 99.99%
Leakage current during OFF		< 30 μA at rated 24 V
Maximum residual voltage during ON		< 0.5 VDC
Isolation mode		Digital isolator
Common terminal mode		8-point/common terminal (polarity of output power supply being negative)
Short circuit protection		Protection against short circuit of each channel, recovered after power-off

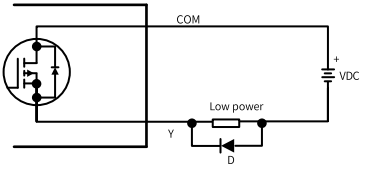
Item	Specifications
External inductive load protection	A flywheel diode[1] is required when an external inductive load is connected.
Output action display	The output indicator lights up (controlled by software) when the output is in drive state.

[1]: Use a 1N4001 (50 V/1 A) or similar diode, as marked by "D" in the following figure.

- **AM52X1-0808TN**



- **AM52X1-0808TP**

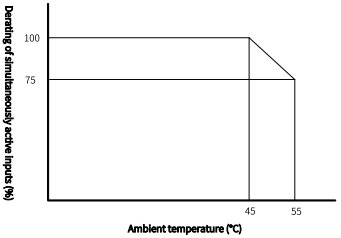


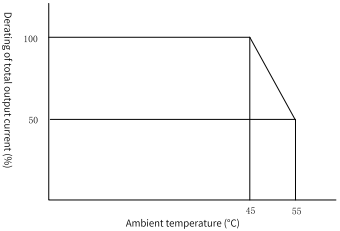
2 Mechanical Installation

2.1 Installation Environment Requirements

When installing the programmable controller on the guide rail, take the operability, maintainability, and environment adaptation into account.

Item	Specifications
Operating environment	Places without corrosive or inflammable gas or severe conductive dust
Altitude	⩽ 2,000 m (80 kPa)
Pollution degree	PD2
Interference immunity	2 kV on power supply line (IEC 61000-4-4)
Overvoltage category	I
EMC immunity level	Zone B, IEC 61131-2
Vibration resistance	IEC 60068-2-6 3.5 mm at 5 Hz to 8.4 Hz; 1 · g at 8.4 Hz to 150 Hz; 10 sweeps in each X, Y, or Z direction
Shock resistance	IEC 60068-2-27 150 m/s^2, 11 ms; six directions: ±X, ±Y, and ±Z; 3 cycles/direction, totaling 18 cycles
Overcurrent protection device	1.5 A fuse
Storage temperature and humidity	• Temperature: –20°C to +60°C • Relative humidity: < 90%, non-condensing
Transportation temperature and humidity	• Temperature: –40°C to +70°C • Relative humidity: < 95%, non-condensing
Ambient temperature and humidity	• Temperature: –20°C to +55°C (for horizontal installation), –20°C to +45°C (for non-horizontal installation) • Relative humidity: < 95%, non-condensing **Note: When the ambient temperature exceeds the upper limit, a forced draft fan or air conditioner must be installed in the heat dissipation hole direction.**

Item	Specifications
Installation position and limit	Installation position: The PLC can be installed in four directions. For details, see *"2.2 Installation Position Requirements" on page 29*. Limit: Horizontal installation: • Input derating: When the ambient temperature is 45°C, the PLC can work at full load. When the ambient temperature is 55°C, the number of simultaneously active inputs shall be reduced to 75% (that is, no more than six inputs), at a derating rate of 2.5% per 1°C of temperature rise.  To be continued

Item	Specifications
Continued	Continued • Output derating: When the ambient temperature is 45°C, the PLC can work at full load (that is, the total current of the eight outputs not higher than 2 A). When the ambient temperature is 55°C, the total current of simultaneously active outputs shall be reduced to 50% (that is, the total current of the eight outputs not higher than 1 A), at a derating rate of 5% per 1°C of temperature rise.  Non-horizontal installation: A maximum of six inputs can be in active state simultaneously, and the maximum allowed output current is 1 A. A maximum of six modules can be installed.

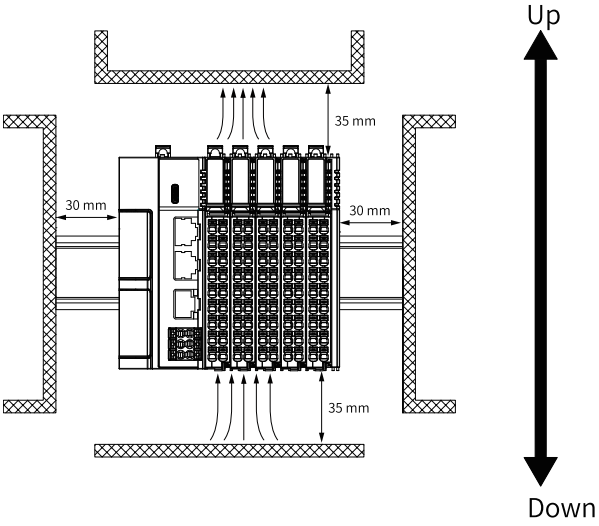
2.2 Installation Position Requirements

This product can be installed in four positions (modes): horizontal (recommended), vertical, cabinet top, and cabinet bottom. Different modes have different ambient temperature requirements. For details, see *"2.1 Installation Environment Requirements" on page 27*.

■ Optimal installation position

The optimal installation mode is horizontal, adopting natural convection for heat dissipation. To ensure normal ventilation and heat dissipation and sufficient wiring

space, sufficient clearance must be reserved around the product, as shown in the following figure.

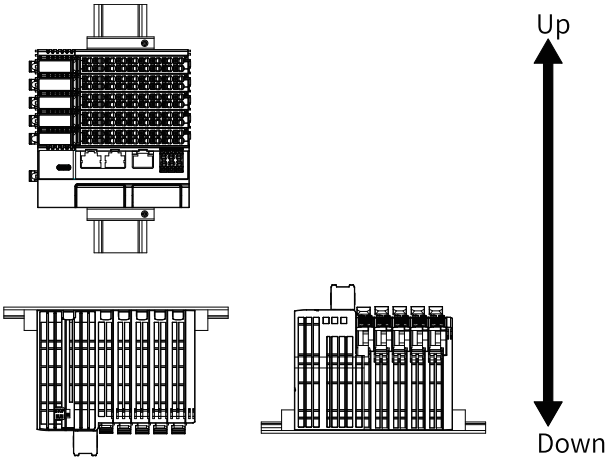


Caution

If there is a high-temperature heat source (heater, transformer, large resistor, etc.) in vicinity of the product, keep the product away from the heat source by at least 100 mm.

■ Other installation positions

For other installation positions, the same clearance requirements as the optimal installation position apply. Other installation positions are shown in the following figure.



Caution

In case of vertical installation:

- PLC must be installed below all I/O modules.
- Hold the cables with a cable duct to prevent the weight of cables being applied to the lower end plate, which may result loose of the PLC from the DIN rail.

2.3 Installation Precautions

- Before installing or removing the PLC and modules, ensure that they are powered off.

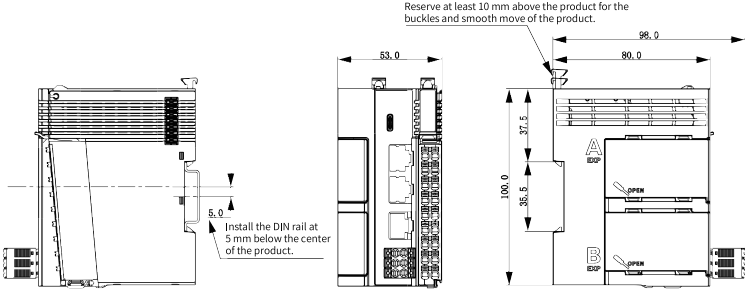
Caution

Do not connect/disconnect the module with power ON. This may lead to master restart or user data loss or damage.

- To avoid damage to the PLC and modules, prevent their enclosures and terminals from falling off or being impacted.

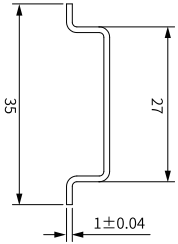
2.4 Installation Dimensions

Installation dimensions are shown below in millimeters (mm).



2.5 Installation Method

The DIN rail in compliance with IEC 60715 is used to install the PLC. The following figure shows the dimensions (width of 35 mm and thickness of 1 mm) of the rail.

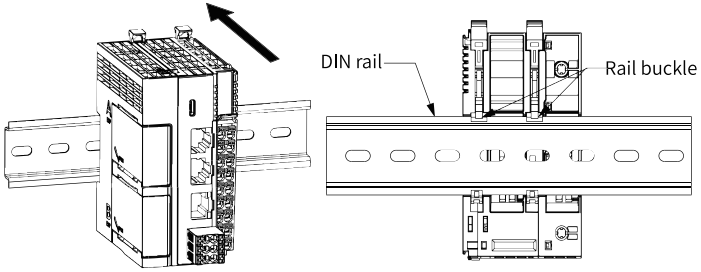


Caution

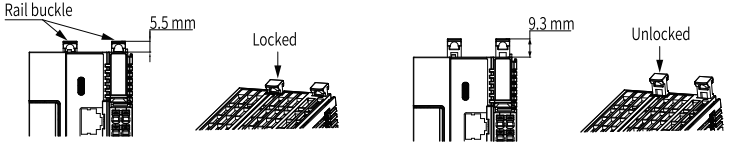
When installed on a DIN rail other than the recommended one (especially the one whose thickness is not 1.0 mm), the product will not fit in place as the mounting hook does not work.

■ Installing the PLC

1. Align the PLC with the DIN rail and push the PLC toward the direction marked by the arrow until you hear a click sound, as shown in the following figure.



2. Confirm that the DIN rail buckles of the PLC are locked. The following figures show the locked and unlocked states of the buckles.



- The buckles are locked when pressed down.
- The buckles are unlocked when lifted up.

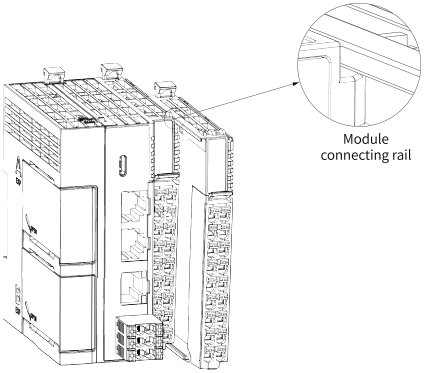
Pressing the buckles locks them.

Caution

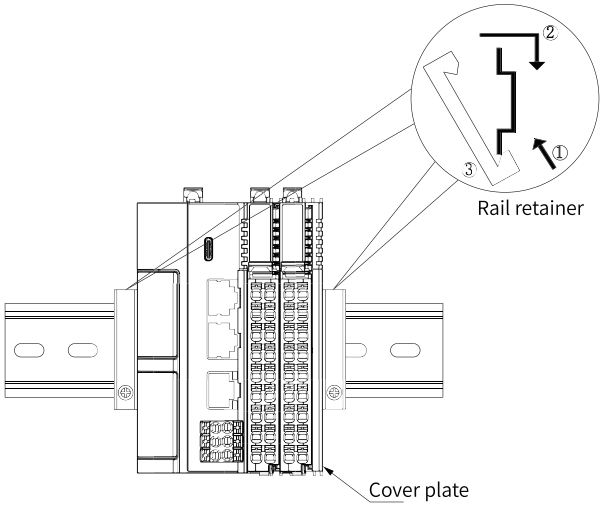
When the PLC is not installed on the rail, keep the mounting hook in the locked state. Keeping the mounting hook unlocked for a prolonged time may cause the hook to fail.

■ Inserting modules to the PLC

Modules are slid onto the PLC through the rails on the top and bottom of the modules, as shown in the following figure.

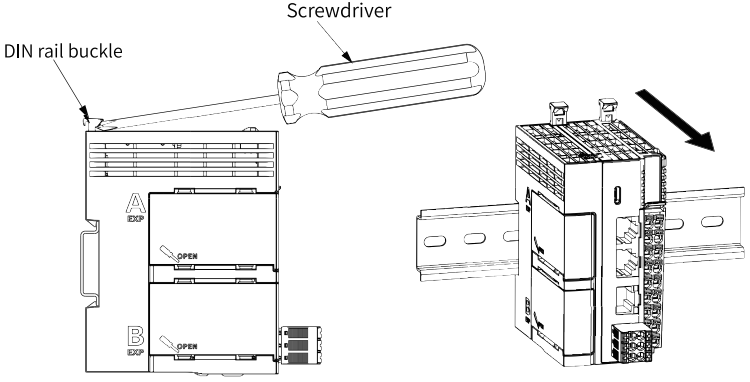


Install a DIN rail retainer on each side of the PLC or the PLC and module assembly. When you install a rail retainer, hook the bottom of the retainer to the bottom of the rail, rotate the retainer to make its top hook the top of the rail, and then tighten the screw to fasten the rail retainer, as shown in the figure below.



■ Removal

Use a straight screwdriver or similar tool to pry up the rail buckles, pull the PLC forward, and press the buckles down after the PLC is pulled out.



3 Electrical Installation

3.1 Terminal Arrangement

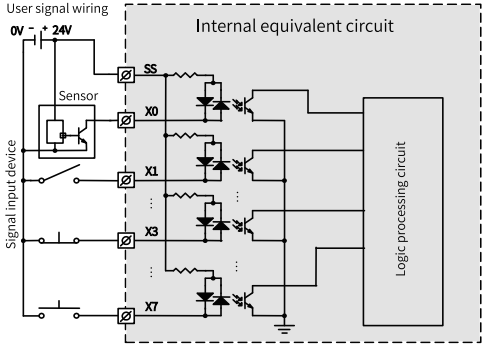
Left Signal	Left Terminal	Right Terminal	Right Signal
X0 input	1A	1B	Y0 output
X1 input	2A	2B	Y1 output
X2 input	3A	3B	Y2 output
X3 input	4A	4B	Y3 output
X4 input	5A	5B	Y4 output
X5 input	6A	6B	Y5 output
X6 input	7A	7B	Y6 output
X7 input	8A	8B	Y7 output
Input common terminal	9A	9B	Output common terminal

Caution

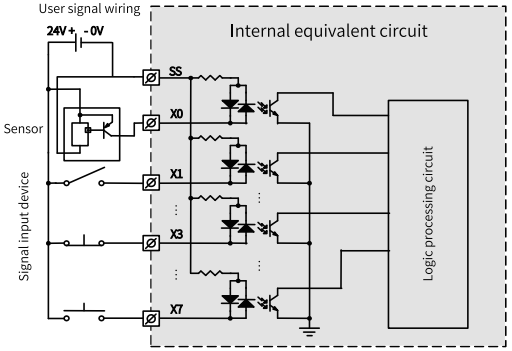
- The length of a high-speed I/O interface extension cable must be within 3.0 m.
- To prevent interference, route the I/O interface extension cable and the power cable (high-voltage/high-current cables) through different non-parallel routes.

3.2 Wiring of Input Terminals

■ Wiring of sink input

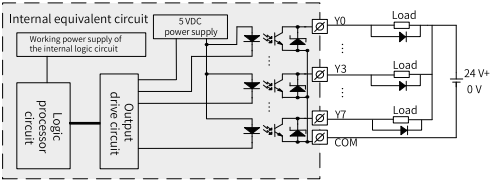


■ Wiring of source input



3.3 Output Terminal Wiring

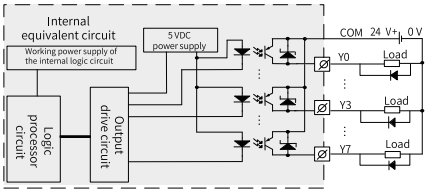
- AM52X-0808TN



Note

An external flywheel diode is required when an inductive load is connected. In this case, use a 1N4001 or similar diode.

- AM52X-0808TP



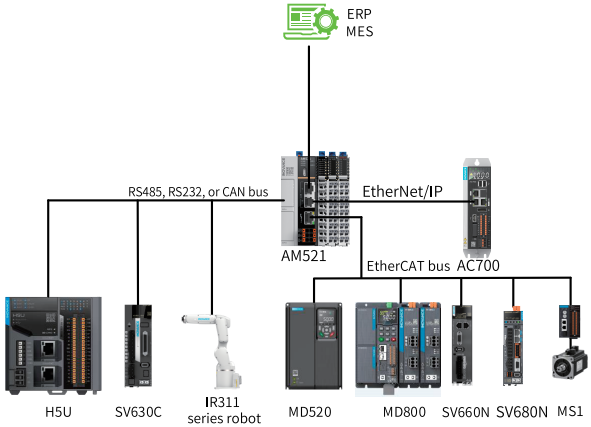
Note

An external flywheel diode is required when an inductive load is connected. In this case, use a 1N4001 or similar diode.

4 Communication Connection

4.1 Communication Networking

This product uses the Ethernet port to connect to other stations or ERP or MES systems. It uses the EtherCAT port to connect to other slaves, such as the MD520 and MD800 series AC drives, SV660N and SV680N series servos, and other EtherCAT-enabled modules. It uses the GE20 series expansion card and RS485, RS232 or CAN communication to connect to the H5U, SV630C, and IR311 series robots. The schematic diagram is shown below.

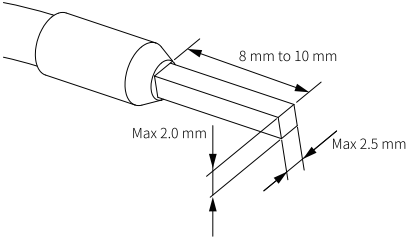


4.2 Cable Selection

The cable lugs and cable sizes in the following table are for reference only. Select proper cables based on actual situations.

Material Name	Applicable Cable Size	
	mm^2	AWG
Tubular lug	0.3	22
	0.5	20
	0.75	18
	1.0	17
	1.5	16

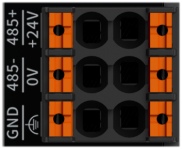
If other tubular lugs are used, crimp them to twisted cables. The following figure shows requirements of the shape and size.



4.3 Cable Connection

■ RS485 communication

The RS485 communication port and power supply port share the same terminal block, with RS485 communication port on the left and 24 V power supply port on the right.



- Terminal definition

Description	Left Terminal	Right Terminal	Description
RS485 differential pair (+)	485+	+24V	24 VDC (+)
RS485 differential pair (-)	485-	0V	24 VDC (-)
RS485 ground	GND		PE

- Wiring
  Select tubular cables referring to *"4.2 Cable Selection" on page 40* and insert the cables into the communication ports.

■ Ethernet communication

To improve the reliability of communication, Cat5 shielded twisted pair cables with an iron shell must be used.

- Insert the registered jack on the cable into the Ethernet port (RJ45 interface) until a click is heard.
- To remove the RJ45 network cable, press and hold the tail of the registered jack, and then pull it out along the direction parallel with the module.

4.4 EtherCAT Communication

■ EtherCAT specifications

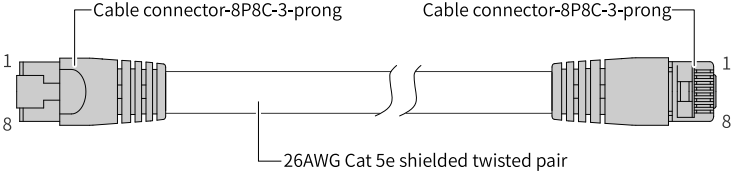
Item	Description
Communication protocol	EtherCAT protocol
Service supported	CoE (PDO, SDO)
Synchronization mode	The servo comes with a distributed clock for synchronized inputs and outputs.
Physical layer	100BASE-TX
Baud rate	100 Mbit/s (100Base-TX)
Duplex mode	Full duplex
Topology	Linear
Transmission medium	Network cables, see the Wring section
Transmission distance	Less than 100 m between two nodes

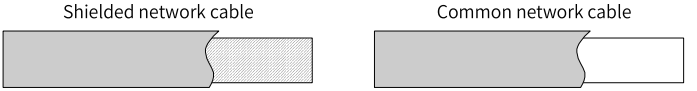
Item	Description
Number of slaves	Up to 127
EtherCAT frame length	44 to 1,498 bytes
Process data	A maximum of 1486 bytes per Ethernet frame

■ Wiring

The PLC provides a CN3 port for EtherCAT bus communication. The communication cable must meet the following requirements:

Communication cable requirements





Signal pin assignment

Pin	Signal	Direction	Description
1	TD+	Output	Data transmission+
2	TD-	Output	Data transmission-
3	RD+	Input	Data reception+
4	-	-	Not used
5	-	-	Not used
6	RD-	Input	Data reception-
7	-	-	Not used
8	-	-	Not used

Length requirements

The cable between devices cannot exceed 100 m when the EtherCAT bus is used, exceeding of which may attenuate the signal and affect normal communication.

Technical requirements

100% continuity test, without occurrence of short circuit, open circuit, misalignment, or poor contact. Cables meeting the following requirements are recommended.

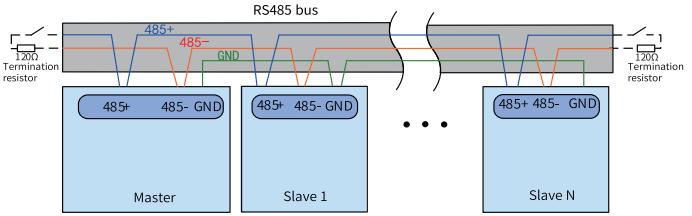
Item	Specification
Cable type	Flexible crossover cable, S-FTP, Cat5e
Standard compliance	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI Abulletin TSB EIA/TIA SB40-A&TSB36
Cross sectional area	AWG26
Cable category	Twisted pair
Number of pairs	4

4.5 RS485 Communication

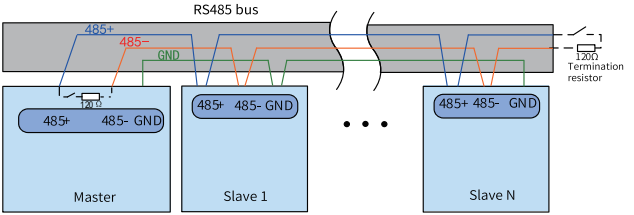
It is recommended to use a shielded twisted pair cable for the RS485 bus. Connect a 120 Ω termination resistor to both ends of the bus to prevent signal reflection. Connect the signal reference grounds of all nodes together. Up to 31 nodes can be connected and the distance between branches must be less than 3 m.

The RS485 bus topology is shown in the figure below.

AM300/500 series PLC
local RS485 communication



GE20 series expansion card
RS485 communication



To avoid interference, do not bundle the cable together with an AC power cable or high voltage cable.

5 Operation and Maintenance

5.1 Start and Stop

After the PLC is programmed, start and stop it as follows.

To run the PLC:

1. Set the system to RUN.
2. Check that the RUN indicator light is solid ON in green
3. To stop the PLC, set the system to STOP. Alternatively, you can stop it in the software tool of the host controller.

5.2 User Program Download with an SD Card

Prerequisites

An SD (TF) card is prepared (requirements: SD card capacity ⩽ 32 GB; FAT32 file system).

Procedure

1. Generate an Application.userprg file with InoProShop (For details, see Section 9.5.2 "Upgrade with an SD Card" in the *Medium-Sized PLC Programming Software User Guide*).
2. Create a "PLCProgram" directory in the root directory of the SD card and copy the Application.userprg file to the "PLCProgram" directory.
3. Insert the SD card into a TF expansion card, and then install the TF expansion card onto the PLC.

Install the TF extension card with power off.

4. Re-power on the PLC. The PLC starts downloading the user program from the SD card, and the RUN indicator blinks fast at 4 Hz during the download process.
5. After successful download, the RUN indicator blinks slowly at 1 Hz and the PLC enters the "STOP" state. Then, remove the SD card.

If the ERR indicator blinks slowly, it is indicated that the download has failed. Check whether the downloaded file is applicable to the PLC model. If all the check items are correct, but the download still fails, contact our technical support for help.

6. Re-power on the PLC and the PLC restores normal operation.

5.3 Firmware Programming with an SD Card

1. Load a firmware programming SD card (maximum capacity of 32 GB, file format of FAT32) onto a TF expansion card and install the TF card onto the PLC.

Install the TF extension card with power off.

2. Re-power on the PLC.

   The RUN and ERR indicators on the PLC blink fast, indicating that the firmware programming is in progress. Then, the RUN indicator blinks slow and the ERR indicator goes off, indicating that the firmware programming is successful. If the RUN indicator goes off and the ERR indicator blinks slow, it is indicated that the firmware programming has failed.

3. After the firmware programming is completed, power off the PLC and remove the SD card.
4. Re-power on the PLC.

6 Appendix

■ AM52X series programmable controllers

Model	Description	Code
AM521-0808TN	AM500 series 8-input 8-output 8-axis programmable controller	01440477
AM522-0808TN	AM500 series 8-input 8-output 16-axis programmable controller	01440475
AM521-0808TP	AM500 series 8-input 8-output 8-axis programmable controller	01440608
AM522-0808TP	AM500 series 8-input 8-output 16-axis programmable controller	01440610

■ GE20 series expansion cards

Type	Model	Description	Code	Slot	ID
Digital input/ output	GE20-4DI	4-channel input 24 VDC input Source/Sink	01480032	A/B	13
	GE20-4DO-TN	4-channel sink transistor output 24 VDC output	01480033	A/B	5
Analog input/ output	GE20-2AD1DA-I	2-channel analog input and 1-channel analog output (current type)	01480027	A/B	11
	GE20-2AD1DA-V	2-channel analog input and 1-channel analog output (voltage type)	01480028	A/B	3
Commu-nication	GE20-CAN-485	CAN and RS485 communication (RJ45)	01480034	A	15
	GE20-232/ 485	RS232 or RS485 communication	01480029	A/B	7
	GE20-232/ 485-RTC	RS232 or RS485 communication (with RTC)	01480035	B	14

Type	Model	Description	Code	Slot	ID
Storage	GE20-TF	TF expansion card	01480030	B	1
	GE20-TF-RTC	Memory expansion card (with integrated RTC)	01480050	B	6
Clock	GE20-RTC	Clock expansion card	01480031	B	9

Note

The ID is "0" when there is no expansion card. For expansion card IDs, see the relevant expansion card user guides.

■ GL20 series expansion modules

Module	Model	Description	Code
Digital	GL20-0016ETP	16-channel digital output (PNP)	01440292
	GL20-1600END	16-channel digital input	01440291
	GL20-0016ETN	16-channel digital output (NPN)	01440293
	GL20-0800END	8-channel digital input	01440381
	GL20-0008ETP	8-channel digital output (PNP)	01440380
	GL20-0008ETN	8-channel digital output (NPN)	01440379
	GL20-0808ETN	8-channel digital input and 8-channel digital output (NPN)	01440339
	GL20-0008ER	8-channel relay output module	01440334
	GL20-3200END	32-channel digital input	01440378
	GL20-0032ETN	32-channel digital output (NPN)	01440377
Analog	GL20-4AD	4-channel analog input	01440288
	GL20-4DA	4-channel analog output	01440287
Temperature	GL20-4PT	4-channel thermistor input type	01440337
Communication	GL20-2SCOM	2-channel serial module (third-party products not supported)	01440463
	GL20-2S485	2-channel RS485 expansion module, currently only supporting EtherCAT couplers (third-party products not supported)	01440398
Power supply	GL20-PS2	Relay power supply module	01440351