

FT1A Series

SmartAXIS

Pro/Lite User's Manual



SAFETY PRECAUTIONS

- Read the SmartAXIS Pro/Lite User's Manual to ensure correct operation before starting installation, wiring, operation, maintenance, and inspection of the SmartAXIS.
- All SmartAXIS modules are manufactured under IDEC's rigorous quality control system, but users must add a backup or failsafe provision to the control system when using the SmartAXIS in applications where heavy damage or personal injury may be caused, in case the SmartAXIS should fail.
- In this user's manual, safety precautions are categorized in order of importance:



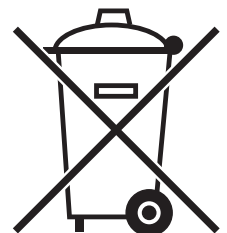
Warning Warning notices are used to emphasize that improper operation may cause severe personal injury or death.

- The SmartAXIS is not designed for use in medical equipment, nuclear power, railways, aviation, passenger vehicle equipment, or similar applications requiring a high degree of reliability and safety. The SmartAXIS should not be used for such applications.
- When using the SmartAXIS in applications (not described above) that require a high degree of reliability in terms of functionality and precision, appropriate measures such as failsafe mechanisms and redundant mechanisms must be taken for the system containing the SmartAXIS.
- Emergency stop and interlocking circuits must be configured outside the SmartAXIS.
- If relays or transistors in the SmartAXIS output circuits should fail, outputs may remain at on or off state. For output signals which may cause serious accidents, configure monitor circuits outside the SmartAXIS.
- The SmartAXIS self-diagnostic function may detect internal circuit or program errors, stop programs, and turn outputs off. Configure circuits so that the system containing the SmartAXIS is not jeopardized when outputs turn off.
- Turn off power to the SmartAXIS before installation, removal, wiring, maintenance, and inspection of the SmartAXIS. Failure to turn power off may cause electrical shocks or fire hazard.
- Special expertise is required to install, wire, program, and operate the SmartAXIS. People without such expertise must not use the SmartAXIS.
- Install the SmartAXIS according to the instructions described in SmartAXIS Pro/Lite user's manual. Improper installation will result in falling, failure, or malfunction of the SmartAXIS.



Caution Caution notices are used where inattention might cause personal injury or damage to equipment.

- The SmartAXIS is designed for installation in a cabinet. Do not install the SmartAXIS outside a cabinet.
- Install the SmartAXIS in environments described in the SmartAXIS Pro/Lite user's manual. If the SmartAXIS is used in places where the SmartAXIS is subjected to high-temperature, high-humidity, condensation, corrosive gases, excessive vibrations, or excessive shocks, then electrical shocks, fire hazard, or malfunction will result.
- The environment for using the SmartAXIS is "Pollution degree 2." Use the SmartAXIS in environments of pollution degree 2 (according to IEC 60664-1).
- Prevent the SmartAXIS from falling while moving or transporting the SmartAXIS, otherwise damage or malfunction of the SmartAXIS will result.
- Wiring must use lead sizes that are appropriate for the applied voltage and current. Terminal screws must be tightened with the prescribed tightening torque.
- Prevent metal fragments and pieces of wire from dropping inside the SmartAXIS housing. Put a cover on the SmartAXIS modules during installation and wiring. Ingress of such fragments and chips may cause fire hazard, damage, or malfunction.
- Use a power supply of the rated value. Use of a wrong power supply may cause fire hazard.
- Use an IEC 60127-approved fuse on the power line outside the SmartAXIS. This is required when equipment containing the SmartAXIS is destined for Europe.
- Use an IEC 60127-approved fuse on the output circuit. This is required when equipment containing the SmartAXIS is destined for Europe.
- Use an EU-approved circuit breaker. This is required when equipment containing the SmartAXIS is destined for Europe.
- Make sure of safety before starting and stopping the SmartAXIS or when operating the SmartAXIS to force outputs on or off. Incorrect operation of the SmartAXIS may cause machine damage or accidents.
- Do not connect the ground wire directly to the SmartAXIS. Connect a protective ground to the cabinet containing the SmartAXIS using an M4 or larger screw. This is required when equipment containing the SmartAXIS is destined for Europe.
- Do not disassemble, repair, or modify the SmartAXIS modules.
- The SmartAXIS contains electronic parts and batteries. When disposing of the SmartAXIS, do so in accordance with national and local regulations.



ABOUT THIS MANUAL

This user's manual describes functions, specifications, installation, and operation basics of the SmartAXIS. Also included is information on the powerful communications tools of the SmartAXIS, as well as troubleshooting procedures.

Chapter 1: General Information

General information about the SmartAXIS, features, brief description on special functions, and various system setup configurations for communication.

Chapter 2: Product Specifications

Specifications of SmartAXIS, optional adapters, and cartridges.

Chapter 3: Installation and Wiring

Methods and precautions for installing and wiring the SmartAXIS.

Chapter 4: Operation Basics

General information about setting up the basic SmartAXIS system for programming, starting and stopping SmartAXIS operation, and simple operating procedures. Everything from creating a user program using WindLDR on a computer to monitoring the SmartAXIS operation.

Chapter 5: Special Functions

Stop/reset inputs, run/stop selection at memory backup error, and keep designation. Also included are high-speed counter, frequency measurement, catch input, interrupt input, timer interrupt, input filter, user program protection, daylight savings time, network settings, and many more special functions.

Chapter 6: HMI Function

HMI function on the SmartAXIS Pro by using the LCD and operation buttons on the SmartAXIS.

Chapter 7: Device Addresses

Device addresses available for the SmartAXIS to program basic and advanced instructions. Special internal relays and special data registers are also described.

Chapter 8: Instructions Reference

List of basic and advanced instructions to program the SmartAXIS.

Chapter 9 through Chapter 11: Maintenance Communication, User Communication Instructions, Modbus Communication

Various communication functions such as user communication and Modbus communication.

Chapter 12: Troubleshooting

Procedures to determine the cause of trouble and actions to be taken when any trouble occurs while operating the SmartAXIS.

Appendix

Additional information about type numbers, system software upgrade, and USB driver installation.

Index

Alphabetical listing of key words.

Publication history

March 2013 First Edition

Trademarks

SmartAXIS is a trademark of IDEC Corporation.

Regarding laws and compatible standards

This product adheres to the laws and compatible standards of all countries involved, as shown below.

European laws and standards

This product complies with the following EU directives.

- Low Voltage Directive (Directive 2006/95/EC)
- EMC Directive (Directive 2004/108/EC)

To comply with these directives, this product has been designed and evaluated on the basis of the following international and European standard.

- IEC/EN 61131-2: 2007 (excluding the Lite digital I/O status indicators)

For details on the compatible standards and EU Directives, contact the distributor from which you purchased this product or visit our web site.

North America laws and standards

This product complies with the following standards.

- UL508

IMPORTANT INFORMATION

Under no circumstances shall IDEC Corporation be held liable or responsible for indirect or consequential damages resulting from the use of or the application of IDEC PLC components, individually or in combination with other equipment.

All persons using these components must be willing to accept responsibility for choosing the correct component to suit their application and for choosing an application appropriate for the component, individually or in combination with other equipment.

All diagrams and examples in this manual are for illustrative purposes only. In no way does including these diagrams and examples in this manual constitute a guarantee as to their suitability for any specific application. To test and approve all programs, prior to installation, is the responsibility of the end user.

RELATED MANUALS

The following manuals related to the SmartAXIS are available. Refer to them in conjunction with this manual.

Type No.	Manual Name	Description
FT9Y-B1378	SmartAXIS Pro/Lite User's Manual (this manual)	Describes product specifications, installation and wiring instructions, instructions for basic programming operations and special functions, device and instruction lists, communication functions, and troubleshooting procedures for the SmartAXIS Pro/Lite series.
FT9Y-B1382	SmartAXIS Ladder Programming Manual	Describes basic operations for ladder programming, instructions for editing and monitoring ladders on the SmartAXIS, available devices and instruction lists, and details of each instruction.
FT9Y-B1390	SmartAXIS Touch User's Manual	Describes product specifications, installation and wiring instructions, instructions for setting basic programming actions and special functions, device and instruction lists, communication functions, and troubleshooting procedures for the Touch series.
WindLDR Help		Describes usage instructions for WindLDR, programming software for the SmartAXIS Pro/Lite series.
WindO/I-NV3 Help		Describes programming for the SmartAXIS Touch series, and usage instructions for the WindO/I-NV3 configuration software.

NAMES AND ABBREVIATIONS USED IN THIS MANUAL

Model Names

Name Used in this Manual	Description (Detailed Type No.)
SmartAXIS	Name for the FT1A programmable logic controllers.
SmartAXIS Lite	Modules without LCD. (FT1A-B12RA, FT1A-B12RC, FT1A-B24RA, FT1A-B24RC, FT1A-B40RKA, FT1A-B40RSA, FT1A-B40RC, FT1A-B48KA, FT1A-B48SA, FT1A-B48KC, FT1A-B48SC)
SmartAXIS Pro	Modules with LCD. (FT1A-H12RA, FT1A-H12RC, FT1A-H24RA, FT1A-H24RC, FT1A-H40RKA, FT1A-H40RSA, FT1A-H40RC, FT1A-H48KA, FT1A-H48SA, FT1A-H48KC, FT1A-H48SC)
SmartAXIS Touch	Modules that extend the functionality of display. (FT1A-M12RA-W, FT1A-M12RA-B, FT1A-M12RA-S, FT1A-C12RA-W, FT1A-C12RA-B, FT1A-C12RA-S)
12-I/O type	SmartAXIS Pro and Lite models with 12 I/O points. (FT1A-B12RA, FT1A-B12RC, FT1A-H12RA, FT1A-H12RC)
24-I/O type	SmartAXIS Pro and Lite models with 24 I/O points. (FT1A-B24RA, FT1A-B24RC, FT1A-H24RA, FT1A-H24RC)
40-I/O type	SmartAXIS Pro and Lite models with 40 I/O points. (FT1A-B40RKA, FT1A-B40RSA, FT1A-B40RC, FT1A-H40RKA, FT1A-H40RSA, FT1A-H40RC)
48-I/O type	SmartAXIS Pro and Lite models with 48 I/O points. (FT1A-B48KA, FT1A-B48SA, FT1A-B48KC, FT1A-B48SC, FT1A-H48KA, FT1A-H48SA, FT1A-H48KC, FT1A-H48SC)
AC power type	SmartAXIS Pro and Lite models with an AC power supply. (FT1A-B12RC, FT1A-H12RC, FT1A-B24RC, FT1A-H24RC, FT1A-B40RC, FT1A-H40RC, FT1A-B48KC, FT1A-B48SC, FT1A-H48KC, FT1A-H48SC)
DC power type	SmartAXIS Pro and Lite models with a DC power supply. (FT1A-B12RA, FT1A-H12RA, FT1A-B24RA, FT1A-H24RA, FT1A-B40RKA, FT1A-H40RKA, FT1A-B40RSA, FT1A-H40RSA, FT1A-B48KA, FT1A-B48SA, FT1A-H48KA, FT1A-H48SA)

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1: GENERAL INFORMATION

Introduction

This chapter describes SmartAXIS functions and system configuration examples. The SmartAXIS is available in three types: the SmartAXIS Lite, the SmartAXIS Pro, and the SmartAXIS Touch. The SmartAXIS Lite is equipped with the same various control and communication functions as a PLC. In addition to the functions of the SmartAXIS Lite, the SmartAXIS Pro is equipped with an LCD and operation buttons on the front of the module. The SmartAXIS Touch is equipped with the HMI functions of an operator interface and PLC control functions.

This document describes the SmartAXIS Lite and Pro. Unless otherwise specified, SmartAXIS refers to the SmartAXIS Lite and Pro. For the SmartAXIS Touch, refer to the SmartAXIS Touch User's Manual.

About the SmartAXIS

The SmartAXIS is a small-size programmable controller that is fully equipped with powerful functions and various communication functions.

You can select the type of SmartAXIS best-suited for your applications, in such ways as the inclusion of the display function, the type of power supply, and the number of inputs and outputs.

The SmartAXIS Lite is equipped with basic functions. The SmartAXIS Pro adds to the functionality of the SmartAXIS Lite and is equipped with an LCD and operation buttons on the module, enabling independent monitor and operation functions.

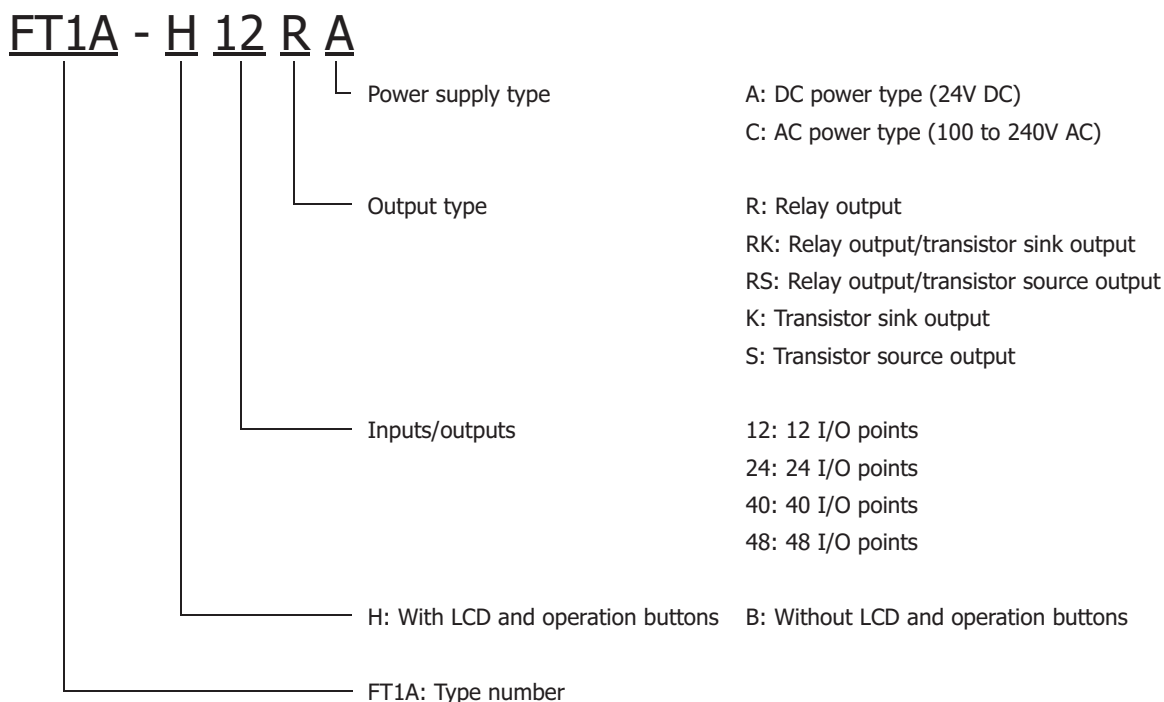
The SmartAXIS supports 100 to 240V AC and 24V DC power supplies. SmartAXIS with Ethernet port (24-, 40-, 48-I/O types) can expand the number of inputs and outputs for a maximum of 90 inputs and a maximum of 54 outputs using the remote I/O function.

User programs can be created using WindLDR, the PLC programming software.

The SmartAXIS supports ladder programs. Ladder programs for FT1A are compatible with other IDEC PLCs including MicroSmart and MicroSmart Pentra, so you can make use of existing software assets.

Type Numbers

The notation for SmartAXIS part numbers is as follows.



Note: For the input specifications, see "Input Specifications" on pages 2-8 to 2-10.

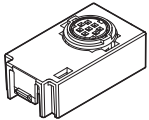
1: GENERAL INFORMATION

Type List

Type Number	Power Supply	Inputs and Outputs (In/Out)	LCD, Operation Buttons	USB Port	Expansion Communication Port	Ethernet Port	SD Memory Card slot		
FT1A-H12RA	24V DC	12 (8/4)	Yes	Yes	—	—	—		
FT1A-H12RC	100 to 240V AC		—						
FT1A-B12RA	24V DC	24 (16/8)	Yes						
FT1A-B12RC	100 to 240V AC		—						
FT1A-H24RA	24V DC	40 (24/16)	Yes		Yes	Yes 1 port	Yes		
FT1A-H24RC	100 to 240V AC		—						
FT1A-B24RA	24V DC	48 (30/18)	Yes			Yes		Yes 2 ports	Yes
FT1A-B24RC	100 to 240V AC		—						
FT1A-H40RKA	24V DC	40 (24/16)	Yes						
FT1A-H40RSA	100 to 240V AC		—						
FT1A-B40RKA	24V DC	48 (30/18)	Yes						
FT1A-B40RSA	100 to 240V AC		—						
FT1A-H48KA	24V DC	48 (30/18)	Yes						
FT1A-H48SA	100 to 240V AC		—						
FT1A-B48KA	24V DC	48 (30/18)	Yes						
FT1A-B48SA	100 to 240V AC		—						
FT1A-B48KC	24V DC	48 (30/18)	Yes						
FT1A-B48SC	100 to 240V AC		—						

Options

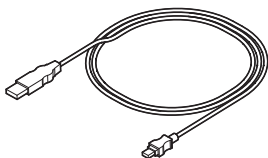
RS232C Communication Cartridge
FT1A-PC1 (Mini-DIN type)



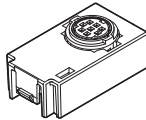
Memory Cartridge
FT1A-PM1



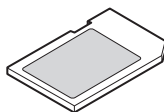
USB Maintenance Cable
HG9Z-XCM42



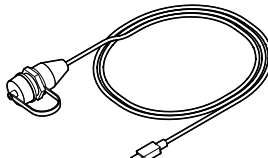
RS485 Communication Cartridge
FT1A-PC2 (Mini-DIN type)



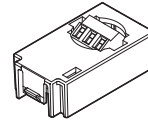
SD Memory Card (2GB)
HG9Z-XMS2



Panel Mount USB Extension Cable
HG9Z-XCE21



RS485 Communication Cartridge
FT1A-PC3 (Terminal block type)



Features

This section describes the features of the SmartAXIS.

The SmartAXIS is high-performance programmable controller in a compact package and is equipped with high speed counters that can be used for positioning control. The SmartAXIS enables you to build optimum systems to automate factories or control production lines.

Powerful HMI Functions

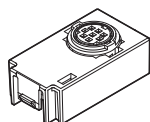
The SmartAXIS Pro is equipped with an LCD on the front of the module, enabling you to monitor the device values and the ladder program. Customized messages can be programmed to display current time, bar charts, scrolling messages, or simple text on the LCD. The operation buttons on the module are used for operations with LCD such as checking and modifying device values.

Powerful Communication Functions

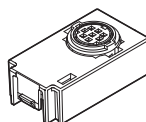
The SmartAXIS supports various communications such as maintenance communication, user communication, Modbus communication, and remote I/O.

The SmartAXIS is equipped with RS232C (optional), RS485 (optional), an Ethernet port, and a USB port, and can be connected to various devices such as computers, operator interfaces, and printers.

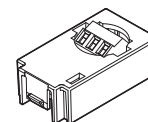
RS232C Communication Cartridge
FT1A-PC1 (Mini-DIN type)



RS485 Communication Cartridge
FT1A-PC2 (Mini-DIN type)



RS485 Communication Cartridge
FT1A-PC3 (Terminal block type)



Memory Cartridge

A user program of SmartAXIS can be stored in a memory cartridge (FT1A-PM1). When a memory cartridge is inserted into a SmartAXIS, the user program in the memory cartridge is executed instead of the user program in the SmartAXIS. You can also download the user program in a memory cartridge to the SmartAXIS.

Memory Cartridge
FT1A-PM1



SD Memory Card

The 40- and 48-I/O types are equipped with an SD memory card slot. The log data of device values can be saved to an optional SD memory card (HG9Z-XMS2) or a commercially available SD memory card (32 GB maximum).

32-bit and Floating Point Data Types

Some advanced instructions can select 32-bit data types from D (double word), L (long), and F (float) in addition to W (word) and I (integer).

Safety and High-Quality Compliant with International Standards

The SmartAXIS is compliant with international standards and can be used all over the world while maintaining safety and high quality.

Supports 9 Languages

The SmartAXIS LCD supports the display of the following nine languages:

Setting Name	Character Set	Supported Languages
European	ISO 8859-1 (Latin-1)	English, German, Italian, Spanish, Dutch (Note), French (Note)
Japanese	Shift-JIS	Japanese (level 1)
Chinese	GB2312	Chinese (simplified)
Cyrillic	ANSI 1251	Russian

Note: Some of the characters cannot be input.

Special Functions

This section describes the functions of the SmartAXIS.

I/O Related Functions

Catch Input

The catch input receives short input pulses from sensors without regard to the scan time. A maximum of 6 catch inputs can be used.

Input Filter

The input filter can be adjusted, according to the width of input signals, to reject input noises. Selectable input filter values to pass input signals are 0ms, and 3 through 15ms in 1ms increments. The input filter rejects inputs shorter than the selected input filter value minus 2ms. This function is useful for eliminating input noises and chatter in limit switches.

Interrupt Input

The interrupt input can be used to call an interrupt program to respond to an external input that requires a response faster than the scan time. A maximum of six interrupt inputs can be used.

Stop and Reset Inputs

Stop input is a function to stop SmartAXIS operation. Reset input is a function to stop SmartAXIS operation and clear device values. Any input terminal on the SmartAXIS can be designated as a stop or reset input to control the SmartAXIS operation.

Remote I/O

When the number of SmartAXIS inputs and outputs is insufficient, the number of inputs and outputs can be expanded to a maximum of 192 points by connecting additional SmartAXIS as remote I/O slaves over Ethernet. With the remote I/O function, the analog inputs on the SmartAXIS that are connected as remote I/O slaves can also be used.

Analog Input

Analog input of 0 to 10V DC can be converted to a digital value of 0 to 1000. A maximum of eight inputs can be used as analog inputs (not including remote I/O slaves analog inputs).

Forced I/O

The inputs and outputs of the SmartAXIS can be forced on or off. This function can be used to check the I/O wiring or the user program operation.

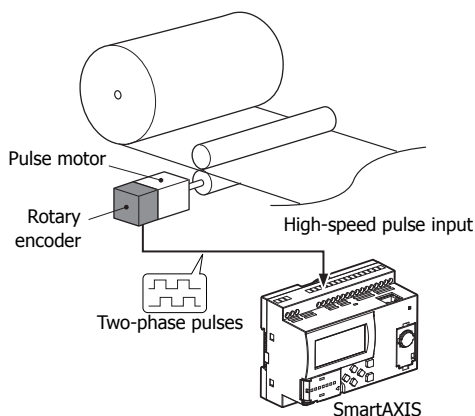
Pulse I/O Functions

High-speed Counter

This function counts high-speed pulse inputs that cannot be measured in normal user program processing.

Use this function for applications such as positioning control with a rotary encoder or motor control. The SmartAXIS can use single-phase high-speed counters and two-phase high-speed counters. A maximum of six single-phase high-speed counters and a maximum of two two-phase high-speed counters can be used simultaneously.

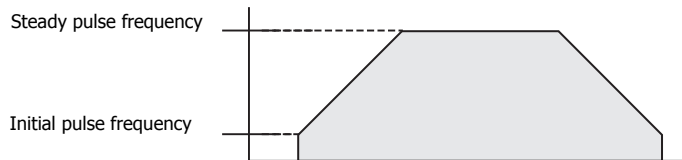
Example: Controlling a motor by counting two-phase pulse input with a high-speed counter



Positioning Control

The SmartAXIS can perform positioning control with pulse outputs. The SmartAXIS features the PULS instructions that can generate pulse outputs with configured frequency at the fixed pulse width ratio, pulse-width modulation (PWM) instructions that can generate pulse outputs with configured pulse width ratio at a fixed frequency, RAMP instructions for trapezoidal control, ZRN instructions for zero return operation, and ARAMP instructions that can generate pulse outputs according to a table in which the changes of the frequency are configured.

Example: Pulse output by the RAMP instruction



Frequency Measurement

This function measures the frequency of pulses input to an input terminal. The frequencies of a maximum of six inputs can be measured.

Convenient Functions

Calendar/Clock

The SmartAXIS features a real-time clock on-board. Using the calendar and clock function, the SmartAXIS can operate according to the current date and time. These functions can be used to control a time schedule for lighting or air conditioning equipments.

User Program Read/Write Protection

The user program in the SmartAXIS can be protected against reading and/or writing by including a password in the user program. This function is effective for security of user programs.

"Keep" or "Clear" Designation of SmartAXIS Data

Internal relays, shift register bits, counter current values, and data register values can be designated to be kept or cleared when the SmartAXIS is powered down. All or a specified range of these devices can be designated as keep or clear types.

RUN/STOP Selection at Startup when "Keep" Data is Lost

When the backup battery is dead, all data to be kept are lost. The user can select whether the SmartAXIS starts to run or not to prevent undesirable operation at the startup.

Log Data

Device values of the SmartAXIS can be saved as CSV files on the SD memory card. The DLOG instruction saves device values to the SD memory card. The TRACE instruction accumulates device values at each scan and saves them to the SD memory card at the desired timing.

Constant Scan Time

The variations in scan time that occur when the user program is running can be made constant.

Timer Interrupt

The timer interrupt can be used to call an interrupt program at a predetermined interval of time without being affected by the scan time.

Communication Functions

The SmartAXIS features a variety of communication functions.

RS232C and RS485 communication of SmartAXIS is possible by installing the RS232C or RS485 communication cartridges into the expansion communication ports on the SmartAXIS module. The 24-, 40-, and 48-I/O types also feature an Ethernet port as standard, enabling communication over Ethernet.

Communication Functions

Maintenance Communication (Chapter 9)	Maintenance communication enables you to check the operating status and I/O status of the SmartAXIS, monitor and change device values, and download and upload user programs using a computer or operator interface.
User Communication (Chapter 10)	The SmartAXIS can communicate with external devices equipped with RS232C, RS485, or Ethernet ports using user communication.
Modbus Communication (Chapter 11)	The SmartAXIS can send and receive data with Modbus compliant devices on RS232C, RS485, or the Ethernet port.

For details on the communications functions, refer to the chapter for each function.

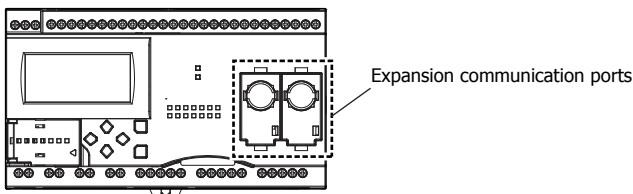
Communication Ports

USB Port	Maintenance communication can be performed by connecting the SmartAXIS and a computer with USB.
Ethernet Port	The SmartAXIS can communicate with Ethernet devices such as computers and operator interfaces. Maintenance communication, user communication, Modbus communication, and remote I/O are possible.
Expansion Communication Ports	Maintenance communication, user communication, and Modbus RTU communication are possible.

Expansion Communication Ports

The SmartAXIS can perform RS232C/RS485 communication by installing RS232C or RS485 communication cartridges to the expansion communication ports on the SmartAXIS. The expansion communication ports are available on 24-, 40-, and 48-I/O types.

Example: 40-I/O type



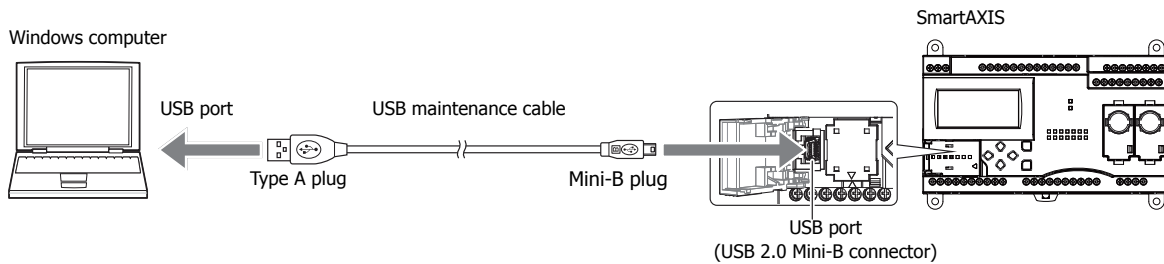
Maintenance Communication

The maintenance communication of the SmartAXIS enables you to check the operating status and I/O status of the SmartAXIS, monitor and change device values, and download and upload user programs with the PLC programming software WindLDR installed on a computer. For details on maintenance communication, see "Maintenance Communication" on page 9-1.

Supported ports: USB port, Ethernet port, and expansion communication ports

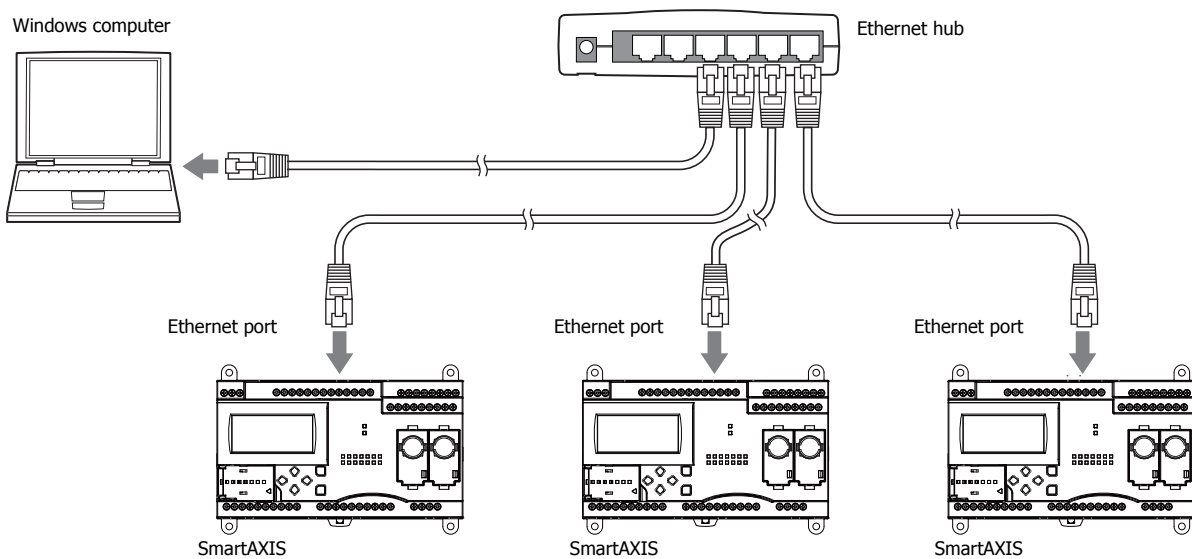
- **1:1 Maintenance Communication System**

This example shows a 1:1 maintenance communication system in which a SmartAXIS and a computer are connected with USB. The USB maintenance cable (HG9Z-XCM42) is used.



- **1:N Maintenance Communication System**

This example shows a 1:N maintenance communication system in which three SmartAXIS and a computer are connected over Ethernet. The Ethernet cables are connected to the Ethernet ports of three SmartAXIS, and those SmartAXIS are connected to the computer via an Ethernet hub.



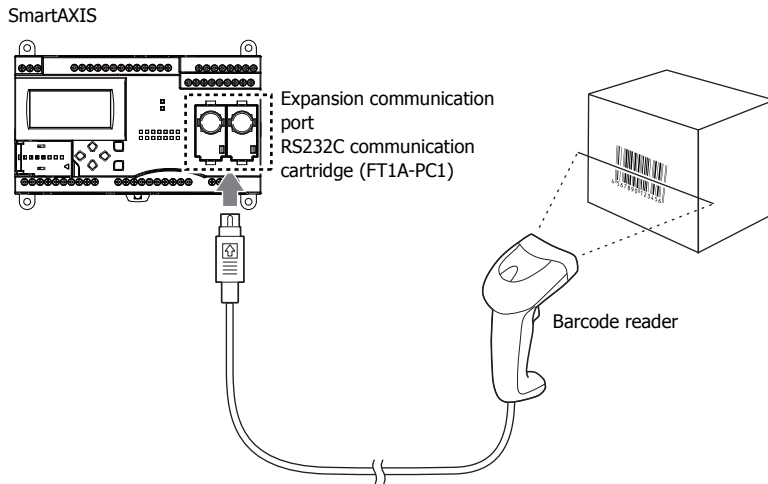
User Communication

The user communication of the SmartAXIS enables you to control external devices such as computers, printers, and barcode readers. For details on user communication, see "User Communication Instructions" on page 10-1.

Supported ports: Ethernet port and expansion communication ports

- **User Communication on RS232C**

This example shows a system in which a SmartAXIS receives the data read by a barcode reader. The RS232C communication cartridge (FT1A-PC1) is installed in a SmartAXIS expansion communication port, and then the barcode reader is connected to the RS232C port.



Modbus Communication

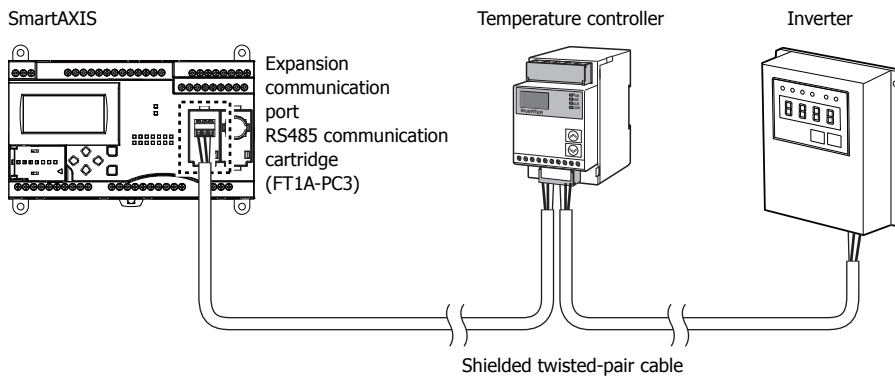
The SmartAXIS is compliant with Modbus protocol and can be used as either a Modbus communication master or slave. When used as a Modbus master, the SmartAXIS can monitor and modify the data of Modbus compliant devices, such as inverters and temperature controllers, using Modbus communication.

For details on Modbus communication, see "Modbus Communication" on page 11-1.

Supported ports: Ethernet port and expansion communication ports

- **Modbus Communication on RS485**

This example shows a system in which a SmartAXIS is communicating with a temperature controller and an inverter that support Modbus RTU. The RS485 communication cartridge (FT1A-PC3) is installed in an expansion communication port on the SmartAXIS.



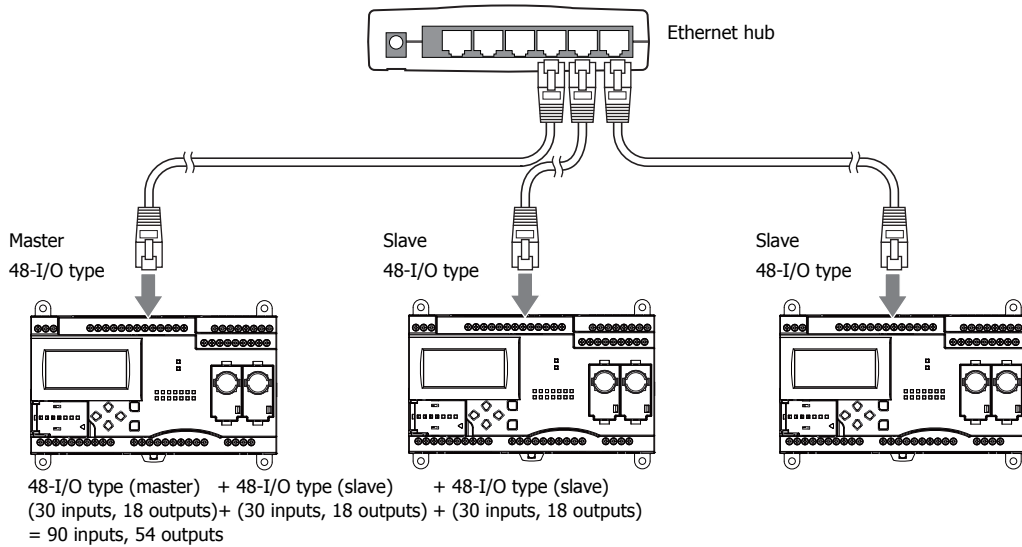
Remote I/O

The remote I/O of the SmartAXIS enables you to expand the number of inputs and outputs by connecting separate SmartAXIS modules over Ethernet as remote I/O slaves when you run out of inputs and outputs. The SmartAXIS remote I/O master can use the digital inputs and outputs and analog inputs on the remote I/O slaves.

This function can be used on the Ethernet port only. Remote I/O cannot be used with the expansion communication ports (RS232C and RS485).

• Remote I/O System Example

A SmartAXIS is connected to an Ethernet network as a remote I/O master. Two other SmartAXIS are used as remote I/O slaves. Up to a maximum of 3 SmartAXIS can be connected to a remote I/O master as remote I/O slaves.

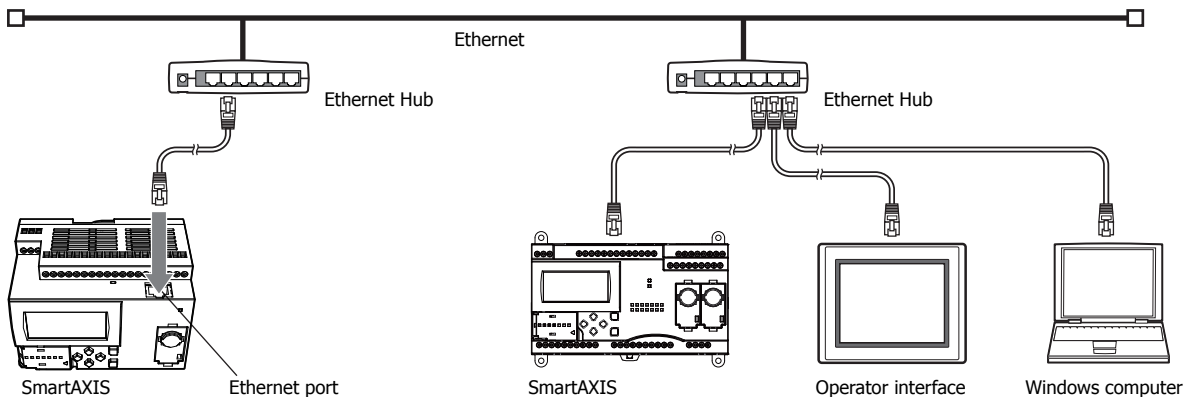


Ethernet Communication

The SmartAXIS can be connected to the Ethernet network via Ethernet port and communicate with network devices over Ethernet. The SmartAXIS has three TCP/IP connections that can be used for Ethernet communication functions. Each of these connections can simultaneously be used for a different communication protocol. Each connection can be configured for maintenance communication, user communication, Modbus TCP, or remote I/O master.

• Ethernet Communication Example

This example shows a system in which a SmartAXIS communicates with another SmartAXIS, an operator interface, and a computer simultaneously over Ethernet. Among the three connections the SmartAXIS has, Connection 1 is configured as maintenance communication for the computer to communicate with the SmartAXIS. Connection 2 is configured as Modbus TCP server for the operator interface to communicate with the SmartAXIS. Connection 3 is configured as the remote I/O master to communicate with another SmartAXIS.



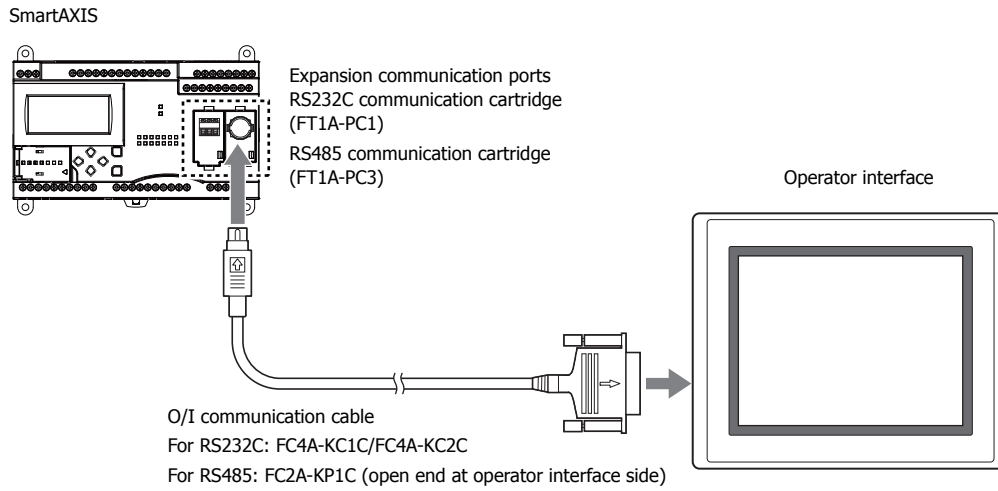
Notes:

- When accessing the SmartAXIS over the Internet, adequate safety measures are required. Be sure to consult your network administrator or Internet service provider. IDEC bears no responsibility for damages or problems caused due to security in Ethernet communication.
- Restrict the access to SmartAXIS with IP addresses and ports by using appropriate measures such as the firewall.

Operator Interface Connectivity

The SmartAXIS can perform maintenance communication with IDEC operator interfaces using the Ethernet port and expansion communication ports. Device values of the SmartAXIS can be monitored and modified with the connected operator interface. An Ethernet cable or an O/I communication cable (see Note) is used to connect the SmartAXIS and the operator interface.

For details on communication settings, refer to the operator interface manuals.



Note: For details on O/I communication cables, see "Cables" on page A-8.

2: PRODUCT SPECIFICATIONS

Introduction

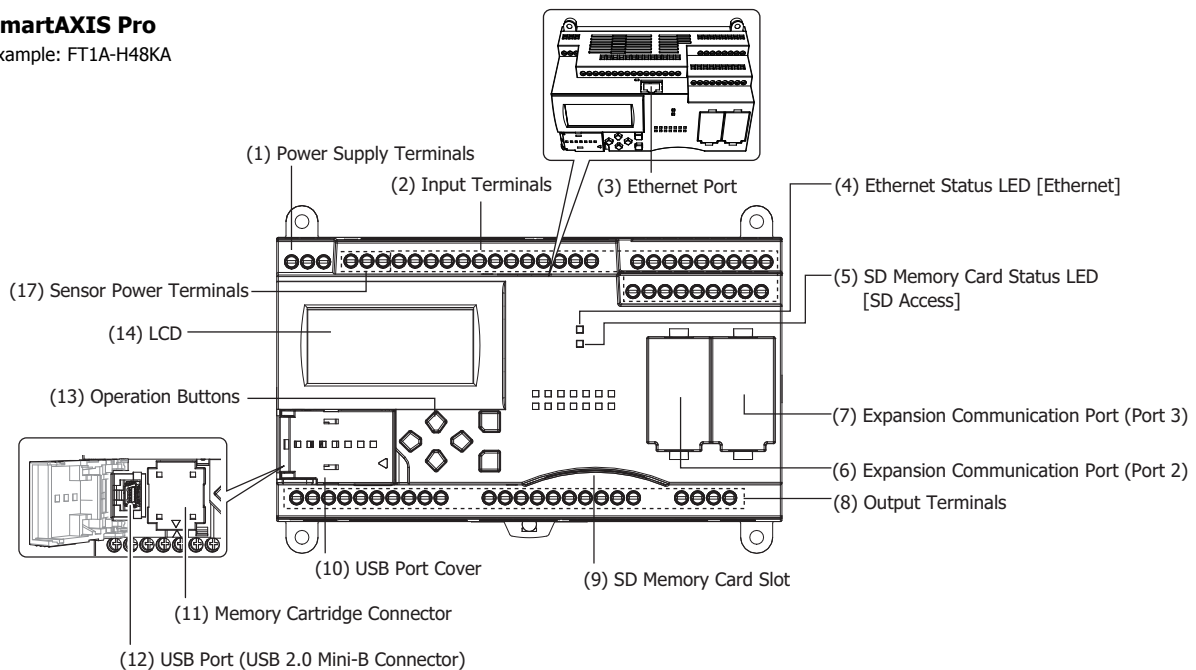
This chapter describes part names and specifications of the SmartAXIS.

SmartAXIS is available in 12-, 24-, 40-, and 48-I/O types. The 12-I/O type has 8 input and 4 output terminals, the 24-I/O type has 16 input and 8 output terminals, the 40-I/O type has 24 input and 16 output terminals, and the 48-I/O type has 30 input and 18 output terminals. The 24-, 40-, and 48-I/O types have 1 or 2 port connectors to install an optional RS232C or RS485 communication cartridge for maintenance communication, user communication, or Modbus RTU communication. The 24-, 40-, and 48-I/O types have built-in Ethernet port for maintenance communication, user communication, Modbus TCP, or Remote I/O. The 40- and 48-I/O types have SD memory card slot to install an SD memory card for logging the device data. Every type of SmartAXIS has a cartridge connector to install an optional memory cartridge.

Parts Description

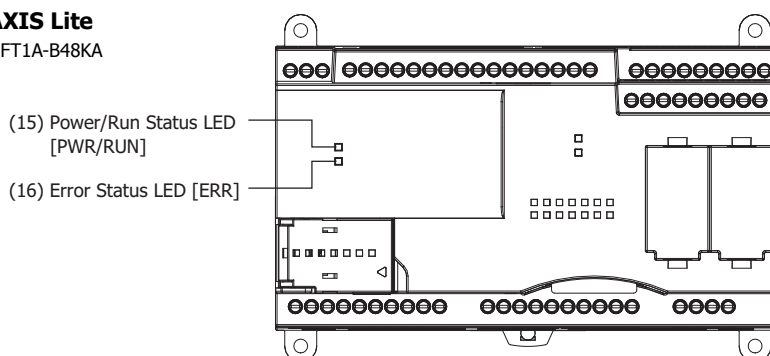
SmartAXIS Pro

Example: FT1A-H48KA



SmartAXIS Lite

Example: FT1A-B48KA



The text in square brackets is printed on the SmartAXIS to describe LED.

(1) Power Supply Terminals

Connect power supply to these terminals.

(2) Input Terminals

For connecting input signals from input devices such as sensors and pushbuttons.

DC power type can use high-speed input of up to 100 kHz and 0 to 10V DC analog input, which is shared with digital input.

2: PRODUCT SPECIFICATIONS

(3) Ethernet Port

This port is used for Ethernet connection. An Ethernet cable can be connected to enable the SmartAXIS to communicate with network devices, such as computers or PLCs. Not available on the 12-I/O type.

(4) Ethernet Status LED [Ethernet]

Turns on or blinks when an Ethernet cable is connected to the SmartAXIS and the SmartAXIS communicates with network devices. Not available on the 12-I/O type.

Ethernet Status LED	Status
OFF	Ethernet cable is not connected.
ON	Ethernet cable is connected and communication is possible.
Flashing	Ethernet cable is connected and data is being sent or received.

(5) SD Memory Card Status LED [SD Access]

Turns on or blinks when the SD memory card is being accessed. Not available on the 12- or 24-I/O type.

SD Memory Card Status LED	Status
OFF	<ul style="list-style-type: none">When the SD memory card is not insertedWhen an unsupported or unformatted SD memory card was insertedWhen access to the SD memory card was stopped by SD memory card access stop flag (M8076)When the SmartAXIS power is off
ON	The standby state where the SD memory card can be written or read
Slow Flash (1-sec interval)	<ul style="list-style-type: none">When the SmartAXIS is recognizing the SD memory cardWhen the SmartAXIS is stopping access due to SD memory card access stop flag (M8076) turning on (slow flashing, then off)
Quick Flash (100ms interval)	Reading or writing to the SD memory card

(6) Expansion Communication Port (Port2)

(7) Expansion Communication Port (Port3)

This port is used to install a communication cartridge for communication with external devices. The 24-I/O type has one expansion communication port while the 40- and 48-I/O types have two. Not available on the 12-I/O type.

(8) Output Terminals

For connecting output signals to output devices such as electromechanical relays and solenoid valves. Relay output (10A and 2A types) and transistor output (sink/source) are available.

(9) SD Memory Card Slot

Insert SD memory card to this slot. Not available on the 12- or 24-I/O type.

(10) USB Port Cover

Protects the USB port and the memory cartridge. If a USB extension cable is connected to the USB port, the cable can be secured to the USB port cover using a cable tie.

(11) Memory Cartridge Connector

For connecting an optional memory cartridge.

(12) USB Port

A Mini-B type USB 2.0 port for connecting a USB maintenance cable or USB extension cable. A user program can be downloaded or uploaded using WindLDR on a computer.

(13) Operation Buttons

For operating the menus displayed on the LCD to access functions. There are six operation buttons: [\triangle], [∇], [\triangleright], [\triangleleft], [OK], and [ESC].

Not available on the SmartAXIS Lite.

(14) LCD

Displays operation menus, status, and setting of the SmartAXIS. Not available on the SmartAXIS Lite.

(15) Power/Run Status LED [PWR/RUN]

A green LED that turns on or flashes to indicate the power supply and operation status.

Power/Run Status LED	Status
OFF	Power is not supplied.
ON	Power is supplied and the user program is being executed.
Slow Flash (1-sec interval)	Power is supplied and the user program is stopped.

Not available on the SmartAXIS Pro.

(16) Error Status LED [ERR]

A red LED that turns on if an error occurs.

Error Status LED	Status
OFF	Normal operation
ON	An error has occurred.
Slow Flash (1-sec interval)	The SmartAXIS is running and the forced I/O function is enabled.
Quick Flash (100 ms interval)	The user program is stopped and the forced I/O function is enabled.

Not available on the SmartAXIS Pro.

(17) Sensor Power Terminals

For supplying power to sensors (24V DC). Not available on the DC power type.

2: PRODUCT SPECIFICATIONS

General Specifications

AC Power Type

Type Number	FT1A-			
	H12RC, B12RC	H24RC, B24RC	H40RC, B40RC	H48KC, H48SC B48KC, B48SC
Normal Operating Conditions				
Operating Temperature	0 to +55°C (operating ambient temperature) (Note 2)			
Storage Temperature	-25 to +70°C (no freezing)			
Relative Humidity	10 to 95% (non-condensing, operating and storage humidity)			
Pollution Degree	2 (IEC60664-1)			
Degree of Protection	IP20 (IEC60529)			
Corrosion Immunity	Atmosphere free from corrosive gases			
Altitude	Operation: 0 to 2,000m (0 to 6,565 feet)			
	Transport: 0 to 3,000m (0 to 9,840 feet)			
Installation Location	Inside cabinet (Note 1)			
Device Class	Open equipment			
Overvoltage Category	II			
Vibration Resistance	When mounted on a DIN rail or panel surface: 5 to 8.4Hz amplitude 3.5mm, 8.4 to 150Hz acceleration 9.8m/s ² (1G) 2 hours per axis on each of three mutually perpendicular axes			
Shock Resistance	147 m/s ² (15G), 11ms duration, 3 shocks per axis on three mutually perpendicular axes			
Power Supply				
Rated Power Voltage	100 to 240V AC			
Allowable Voltage Range	85 to 264V AC			
Rated Power Frequency	50/60Hz (47 to 63Hz)			
Maximum Power Consumption	18VA	41VA	48VA	43VA
Allowable Momentary Power Interruption	10ms maximum (at the rated power voltage)			
Dielectric Strength Voltage	Between power and PE terminals: 1,500V AC, 1 minute			
	Between input and PE terminals: 1,500V AC, 1 minute			
	Between transistor output and PE terminals: 1,500V AC, 1 minute			
	Between relay output and PE terminals: 2,300V AC, 1 minute			
	Between power and input terminals: 1,500V AC, 1 minute			
	Between power and transistor output terminals: 1,500V AC, 1 minute			
	Between power and relay output terminals: 2,300V AC, 1 minute			
	Between input and transistor output terminals: 1,500V AC, 1 minute			
Between input and relay output terminals: 2,300V AC, 1 minute				
EMC Immunity	IEC/EN 61131-2:2007 compliant			
Inrush Current	35A maximum (Cold start with T _a = 25°C, 200V AC)			
Ground	D-type ground (Class 3 ground)			
Grounding Wire	UL1007 AWG16			
Power Supply Wire	UL1015 AWG22, UL1007 AWG18			
Effect of Improper Power Supply Connection	Reverse polarity: Normal operation			
	Improper voltage or frequency: Permanent damage may be caused			
	Improper lead connection: Permanent damage may be caused			
Weight	Approx. 230g	Approx. 400g	Approx. 580g	Approx. 540g

Note 1: Use in environments that satisfy product specifications.

Note 2: UL, c-UL Listed at 0 to +50°C (FT1A Version V110).

DC Power Type

Type Number	FT1A-			
	H12RA, B12RA	H24RA, B24RA	H40RKA, H40RSA B40RKA, B40RSA	H48KA, H48SA B48KA, B48SA
Normal Operating Conditions				
Operating Temperature	0 to +55°C (operating ambient temperature) (Note 2)			
Storage Temperature	-25 to +70°C (no freezing)			
Relative Humidity	10 to 95% (non-condensing, operating and storage humidity)			
Pollution Degree	2 (IEC60664-1)			
Degree of Protection	IP20 (IEC60529)			
Corrosion Immunity	Atmosphere free from corrosive gases			
Altitude	Operation: 0 to 2,000m (0 to 6,565 feet)			
	Transport: 0 to 3,000m (0 to 9,840 feet)			
Installation Location	Inside cabinet (Note 1)			
Device Class	Open equipment			
Overvoltage Category	II			
Vibration Resistance	When mounted on a DIN rail or panel surface: 5 to 8.4Hz amplitude 3.5 mm, 8.4 to 150Hz acceleration 9.8m/s ² (1G) 2 hours per axis on each of three mutually perpendicular axes			
Shock Resistance	147m/s ² (15G), 11 ms duration, 3 shocks per axis on three mutually perpendicular axes			
Power Supply				
Rated Power Voltage	24V DC			
Allowable Voltage Range	20.4 to 28.8V DC (Including ripple voltage)			
Maximum Power Consumption	4.3W	4.8W	7.9W	6.0W
Allowable Momentary Power Interruption	10ms maximum (Rated voltage, PS2)			
Dielectric Strength Voltage	Between power/input and FE terminals: 500V AC, 1 minute			
	Between transistor output and FE terminals: 500V AC, 1 minute			
	Between relay output and FE terminals: 2,300V AC, 1 minute			
	Between power/input and transistor output terminals: 500V AC, 1 minute			
	Between power/input and relay output terminals: 2,300V AC, 1 minute			
EMC Immunity	IEC/EN 61131-2:2007 compliant			
Inrush Current	30A maximum			
Ground	D-type ground (Class 3 ground)			
Grounding Wire	UL1007 AWG16			
Power Supply Wire	UL1015 AWG22, UL1007 AWG18			
Effect of Improper Power Supply Connection	Reverse polarity: No operation, no damage			
	Improper voltage or frequency: Permanent damage may be caused			
	Improper lead connection: Permanent damage may be caused			
Weight	Approx. 190g	Approx. 310g	Approx. 420g	Approx. 380g

Note 1: Use in environments that satisfy product specifications.

Note 2: UL, c-UL Listed at 0 to +50°C (FT1A Version V110).

2: PRODUCT SPECIFICATIONS

Function Specifications

Function Specifications

Type Number	FT1A-								
	H12RA B12RA	H12RC B12RC	H24RA B24RA	H24RC B24RC	H40RKA H40RSA B40RKA B40RSA	H40RC B40RC	H48KA H48SA B48KA B48SA	H48KC H48SC B48KC B48SC	
Program Capacity (Note 1)	12,000 bytes (3,000 steps)			47,400 bytes (11,850 steps)					
Input Points	8		16		24		30		
Digital Input (Terminal No.)	6 (I0 to I5)	8 (I0 to I7)	12 (I0 to I7, I10 to I13)	16 (I0 to I7, I10 to I17)	18 (I0 to I7, I10 to I17, I20, I21)	24 (I0 to I7, I10 to I17, I20 to I27)	22 (I0 to I7, I10 to I17, I20 to I25)	30 (I0 to I7, I10 to I17, I20 to I27, I30 to I35)	
Shared Analog Input (Terminal No.)	2 (I6, I7)	—	4 (I14 to I17)	—	6 (I22 to I27)	—	8 (I26, I27, I30 to I35)	—	
Output Points	4		8		16		18		
10A Relay Output (Terminal No.)	4 (Q0 to Q3)						—		
2A Relay Output (Terminal No.)	—		4 (Q4 to Q7)		8 (Q4 to Q7, Q10 to Q13)	12 (Q4 to Q7, Q10 to Q13, Q14 to Q17)	—		
Transistor Output (Terminal No.)	—		—		4 (Q14 to Q17)	—	18 (Q0 to Q7, Q10 to Q17, Q20, Q21)		
User Program Storage	Flash ROM (10,000 rewriting life)								
Backup Function									
RAM	Backup data: Internal relay, shift register, counter current value, data register (Note 2), clock data (year, month, and day)								
Backup Duration	Approx. 30 days (typical) at 25°C after backup battery fully charged								
Battery	Lithium secondary battery								
Charging Time	Approx. 15 hours for charging from 0% to 90% of full charge								
Battery Life	5 years in cycles of 9-hour charging and 15-hour discharging								
Replaceability	Not possible to replace battery								
Clock Function (Note 3)	Clock accuracy: ±30 sec/month (typical) at 25°C								
Control System	Stored program system								
Instruction Words									
Basic Instructions	42								
Advanced Instructions	99	107			DC type: 125, AC type: 111				
Processing Time									
Basic Instruction	0.95ms (1000 steps)								
END Processing	640μs								
Internal Relay	1024								
Shift Register	128								
Data Register	12-I/O type: 400 24-I/O type, 40-I/O type, 48-I/O type: 2,000								

Note1: 1 step is equivalent to 4 bytes.

Note2: Among data registers D0 to D1999, only D0 to D999 are backed up.

Note3: Set the calendar/clock using WindLDR to use the clock function.

Type Number	FT1A-							
	H12RA B12RA	H12RC B12RC	H24RA B24RA	H24RC B24RC	H40RKA H40RSA B40RKA B40RSA	H40RC B40RC	H48KA H48SA B48KA B48SA	H48KC H48SC B48KC B48SC
Counter (adding, reversible)	100		200					
Timer (1-sec, 100ms, 10ms, 1ms)	100		200					
Input Filter	Without filter, 3 to 15ms (selectable in increments of 1ms)							
Catch Input/Interrupt Input								
Input Points	4		6					
Self-diagnostic Function	Keep data Power failure Clock error Watchdog timer Timer/counter preset value change error User program syntax User program execution System error Memory cartridge transfer error							
High-speed Counter								
Points	Total 4 points	—	Total 6 points	—	Total 6 points	—	Total 6 points	—
Maximum Counter Frequency	Single/two-phase selectable: 100kHz (2 points) Single-phase: 100kHz (2 points)		Single/two-phase selectable: 100kHz (2 points) Single-phase: 100kHz (4 points)					
Counting Range	0 to 4,294,967,295 (32 bits)							
Operation Mode	Rotary encoder mode and adding counter mode							
Pulse Output (Maximum frequency: 100kHz)								
Points	—				2 (Q14, Q15)	—	2 (Q14, Q15)	
Pulse Output (Maximum frequency: 5kHz)								
Points	—				2 (Q16, Q17)	—	2 (Q16, Q17)	
Analog Voltage Input								
Points (Terminal No.)	2 (I6, I7)	—	4 (I14 to I17)	—	6 (I22 to I27)	—	8 (I26, I27, I30 to I35)	—
Input voltage Range	0 to 10V DC							
Digital Resolution	0 to 1000							
USB Port								
Points	1							
USB Standard	USB 2.0							
Connector	Mini-B type							
Expansion Communication Ports								
Points	—		1		2			
Ethernet Port								
Points	—		1					
Memory Cartridge Connectors								
Points	1							
SD Memory Card Slots								
Points	—				1			

2: PRODUCT SPECIFICATIONS

LCD Specifications (SmartAXIS Pro only)

	Description/Specifications
Type	STN monochrome LCD
Resolution	64 x 192 pixels
Number of Characters	24 digits x 8 lines (8 x 8 pixel font) 12 digits x 8 lines (16 x 8 pixel font) 12 digits x 4 lines (16 x 16 pixel font)
Display Content	System menus, messages, operation status monitor
Contrast Adjustment	Not possible
Backlight	Yes (backlight can be turned on and off)

Input Specifications (AC Power Type)

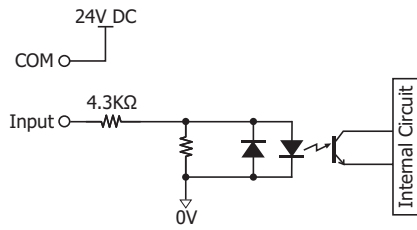
Type Number	FT1A-			
	H12RC B12RC	H24RC B24RC	H40RC B40RC	H48KC H48SC B48KC B48SC
Input Points	8	16	24	30
Rated Input Voltage	24V DC			
Input Voltage Range	0 to 28.8V DC			
Terminal Arrangement	See "Terminal Arrangement" on page 2-16.			
Input External Power Supply Voltage Fluctuation Range/Capacity	—	DC20.4 to 26.4V 250mA	DC20.4 to 26.4V 250mA	DC20.4 to 26.4V 300mA

Digital Input

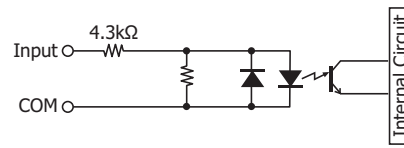
Input Type	Contacts	Sink/Source		
Input Points (Terminal No./ Common Line Name)	8 points in 1 common line (I0 to I7/COM)	16 points in 1 common line (I0 to I7, I10 to I17/COM)	24 points in 1 common line (I0 to I7, I10 to I17, I20 to I27/COM)	30 points in 2 common lines (I0 to I7, I10 to I17, I20 to I25/COMA, I26, I27, I30 to I35/COMB)
Rated Input Current	5.3mA			
Input Impedance	4.3kΩ			
Turn ON Time	40 μs + filter value			
Turn OFF Time	150 μs + filter value			
Isolation	Between input terminals: Not isolated			
	Internal circuit: Photocoupler isolated			
Input Type	Type 1 (IEC61131-2)			
Shared Digital/Analog Inputs	No			
Status Display	Pro	LCD display		
	Lite	—		
External Load for I/O Interconnection	Not needed			
Signal Determination Method	Static			
Cable Length	100m in compliance with electromagnetic immunity			
Effect of Improper Input Connection	No damage. If any input exceeding the rated value is applied, permanent damage may be caused.			

Input Internal Circuit

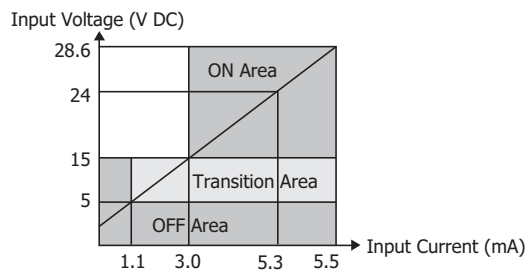
- Contact Input (FT1A-*12RC)



- Sink/Source Input (FT1A-*24/40/48RC)



Input Operating Range



2: PRODUCT SPECIFICATIONS

Input Specifications (DC Power Type)

Type Number	FT1A-					
	H12RA B12RA	H24RA B24RA	H40RKA B40RKA	H40RSA B40RSA	H48KA B48KA	H48SA B48SA
Input Points	12	16	24		30	
Rated Input Voltage	24V DC					
Input Voltage Range	0 to 28.8V DC					
Terminal Arrangement	See "Terminal Arrangement" on page 2-16.					

Digital Input

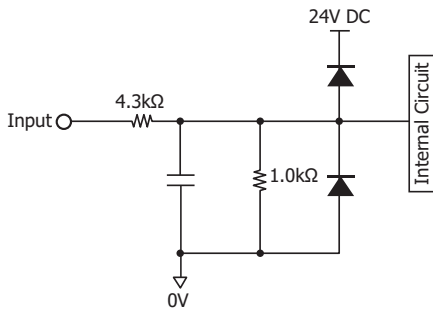
Input Type	Sink	Source	Sink	Source	Sink	
Input Points (Terminal No. /Common Line Name)	6 points in 1 common line (I0 to I5/ Internal "-" terminal)	12 points in 1 common line (I0 to I7, I10 to I13/ Internal "-" terminal)	18 points in 1 common line (I0 to I7, I10 to I17, I20, I21/ Internal "+" terminal)	18 points in 1 common line (I0 to I7, I10 to I17, I20, I21/ Internal "-" terminal)	22 points in 1 common line (I0 to I7, I10 to I17, I20 to I25/ Internal "+" terminal)	22 points in 1 common line (I0 to I7, I10 to I17, I20 to I25/ Internal "-" terminal)
Rated Input Current	4.4mA		5.2mA	4.4mA	5.2mA	4.4mA
Input Impedance	5.5kΩ		4.7kΩ	5.5kΩ	4.7kΩ	5.5kΩ
Turn ON Time	2.5 μs + filter value	I0 to I7: 2.5μs + filter value Others: 40μs + filter value				
Turn OFF Time	5 μs + filter value	I0 to I7: 5μs + filter value Others: 150μs + filter value				
Function Input	High-Speed Counter (Two-phase)	2 systems [System 1] 1-A phase: I0, 1-B phase: I1, 1-Z phase: I2 (for clear input) [System 2] 2-A phase: I3, 2-B phase: I4, 2-Z phase: I5 (for clear input)				
	High-Speed Counter (Single-phase)	4 points (I0, I2, I3, I5)	6 points (I0, I2, I3, I5, I6, I7)			
	Interrupt	4 points (I0, I2, I3, I5)	6 points (I0, I2, I3, I5, I6, I7)			
	Catch	4 points (I0, I2, I3, I5)	6 points (I0, I2, I3, I5, I6, I7)			
	Frequency Measurement	4 points (I0, I2, I3, I5)	6 points (I0, I2, I3, I5, I6, I7)			
Isolation	Between input terminals: Not isolated Internal circuit: Not isolated					
Input Type	Type 1 (IEC61131-2)					
External Load for I/O Interconnection	Not needed					
Signal Determination Method	Static					
Cable Length (in compliance with electromagnetic immunity)	3m (9.84 ft.)	I0 to I7: 3m (9.84 ft.) Others: 100m (328.1 ft.)				

Type Number	FT1A-					
	H12RA B12RA	H24RA B24RA	H40RKA B40RKA	H40RSA B40RSA	H48KA B48KA	H48SA B48SA
Analog Input						
Input Signal Type		Voltage Input				
Input Points (Terminal No. /Common Line Name)		2 points in 1 common line (I6, I7/ Internal "-" terminal)	4 points in 1 common line (I14 to I17 Internal "-" terminal)	6 points in 1 common line (I22 to I27/Internal "-" terminal)		8 points in 1 common line (I26, I27, I30 to I35/Internal "-" terminal)
Input Range		0 to 10.0V DC				
Rated Input Current		0.3mA				
Input Impedance		78.0kΩ				
Digital Resolution		0 to 1000 (10 bits)				
Data Type		Binary data: 0 to 1000				
Input Value of LSB		10mV				
Type of Input		Single-ended input				
AD Conversion	Sample Duration Time	2ms maximum				
	Sample Repetition Time	2ms maximum				
	Total Input System Transfer Time	2ms + filtering time + scan time				
Input Error	Maximum Error at 25°C	±1.5% of full scale				
	Temperature Coefficient	±0.25% of full scale/°C				
	Maximum Error	±5.0% of full scale				
General Characteristics	Operating Mode	Self-scan				
	Conversion Method	Successive Approximation				
Status Display	Pro	"Device Monitor" screen (LCD)				
	Lite	—				
Maximum Temporary Deviation during Electrical Noise Tests		±5.0% of full scale				
Recommended Cable for Noise Immunity		Twisted pair shielded cable				
Calibration or Verification to Maintain Rated Accuracy		Not possible				
Maximum Permanent Allowed Overload (No Damage)		28.8V DC				
Overload Status (Outside Input Range) Detection		Detectable (Stored in special data register D8077)				
Isolation		Between input terminals: Not isolated				
		Between input and internal circuit: Not isolated				
Used as Digital Input	Digital Input Type	— (IEC 61131-2 digital input type is not supported)				
	Input Threshold	ON voltage: 15V minimum (ON current: 0.20mA minimum) OFF voltage: 5V maximum (OFF current: 0.06mA maximum)				
Effect of Improper Input Connection		No damage. If any input exceeding the rated value is applied, permanent damage may be caused.				

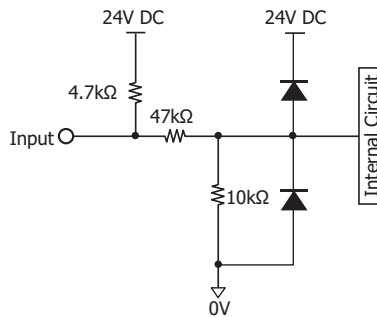
2: PRODUCT SPECIFICATIONS

Digital Input Internal Circuits

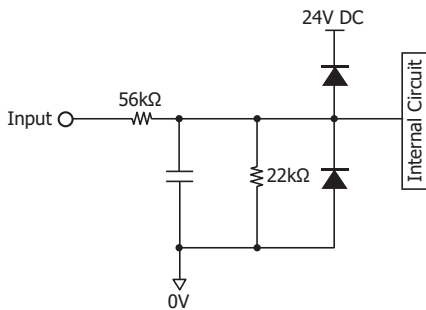
- Sink Input



- Source Input

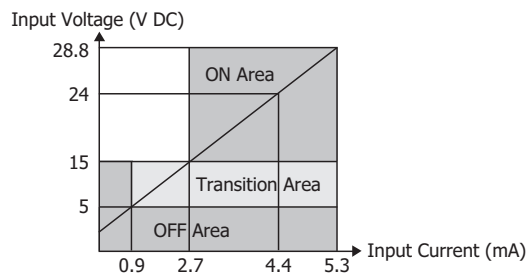


Internal Circuit with Shared Digital/Analog Input

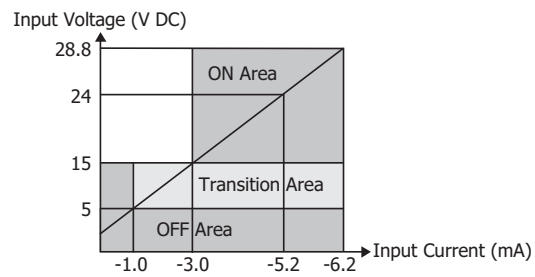


Digital Input Operating Range

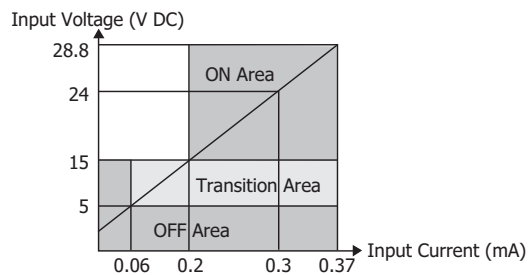
- Sink Input



- Source Input



- Operating Range of Shared Digital/Analog Input

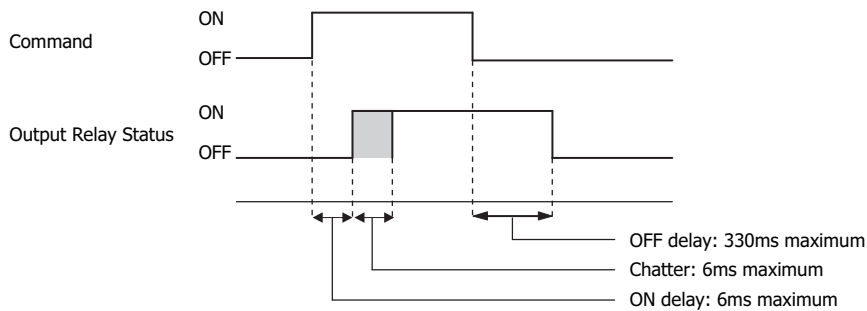


Output Specifications (10A Relay)

Type Number	FT1A-					
	H12RC B12RC	H12RA B12RA	H24RC B24RC	H24RA B24RA	H40RC B40RC	H40RKA H40RSA B40RKA B40RSA
No. of Outputs (Terminal No.)	4 (Q0 to Q3)					
Terminal Arrangement	See "Terminal Arrangement" on page 2-16.					
Output Type	1a contact					
Maximum Load Current (Note)	10A					
Minimum Switching Load	10mA/5V DC (reference value)					
Initial Contact Resistance	100mΩ maximum (1A, 6V DC)					
Electrical Life	100,000 operations minimum (rated load 1,800 operations/hour)					
Mechanical Life	20,000,000 operations minimum (no load 18,000 operations/hour)					
Rated Load (Note)	250V AC/10A, 30V DC/10A					
Dielectric Strength	Between output terminal and internal circuit: 2,300V AC, 1 minute Between output terminals (COMs): 2,300V AC, 1 minute					
Status Display	Pro	LCD display				
	Lite	—				

Note: Values for resistive/inductive load.

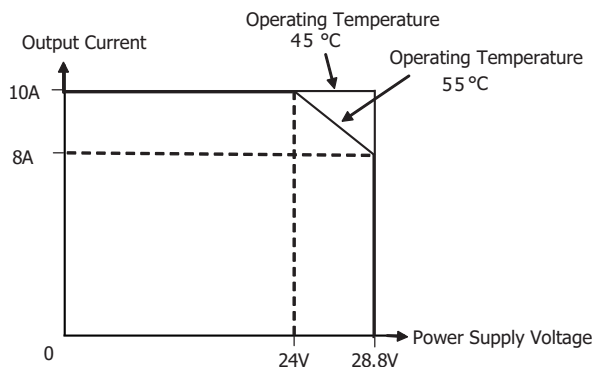
Output Delay



Derating

When using the SmartAXIS at an operating temperature of 45°C or higher, reduce the output current of the 10A relay and power supply voltage as shown in the figure below.

Normal Installation



Note: UL, c-UL Listed at 0 to +50°C (FT1A Version V110).

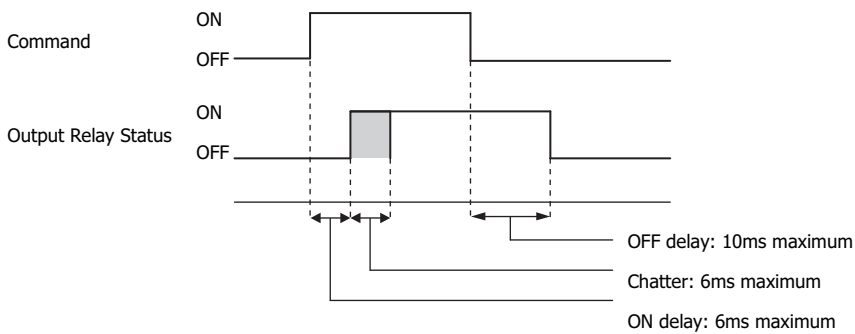
2: PRODUCT SPECIFICATIONS

Output Specifications (2A Relay)

Type Number		FT1A-		
		H24RC B24RC H24RA B24RA	H40RC B40RC	H40RKA H40RSA B40RKA B40RSA
No. of Outputs (Terminal No.)		4 (Q4 to Q7)	12 (Q4 to Q7, Q10 to Q13, Q14 to Q17)	8 (Q4 to Q7, Q10 to Q13)
Output Points per Common Line	COM4	4 (Q4 to Q7)	4 (Q4 to Q7)	4 (Q4 to Q7)
	COM5	—	4 (Q10 to Q13)	4 (Q10 to Q13)
	COM6	—	4 (Q14 to Q17)	—
Terminal Arrangement		See "Terminal Arrangement" on page 2-16.		
Output Type		1a contact		
Maximum Load Current	1 point	2A		
	1 common line	8A maximum		
Minimum Switching Load		0.1 mA/0.1V DC (reference value)		
Initial Contact Resistance		1A, 6V DC		
Electrical Life		100,000 operations minimum (rated load 1,800 operations/hour)		
Mechanical Life		20,000,000 operations minimum (no load 18,000 operations/hour)		
Rated Load (Note)		250V AC/2A, 30V DC/2A		
Dielectric Strength		Between output terminal and internal circuit: 2,300V AC, 1 minute Between output terminals (COMs): 2,300V AC, 1 minute		
Status Display	Pro	LCD display		
	Lite	—		

Note: Values for resistive/inductive load.

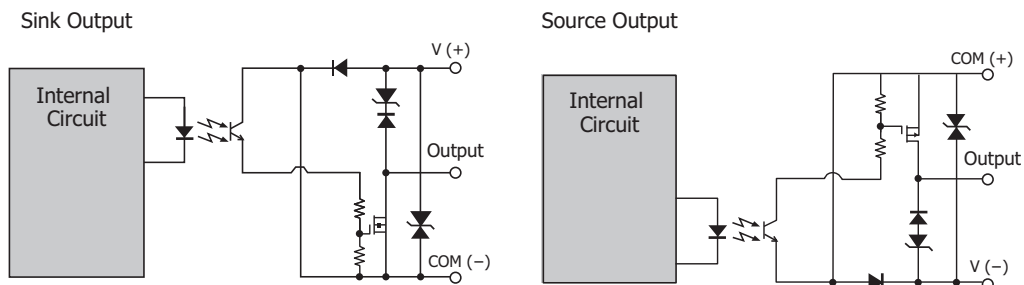
Output Delay



Output Specifications (Transistor)

Type Number			FT1A-					
			H40RKA B40RKA	H40RSA B40RSA	H48KC B48KC	H48SC B48SC	H48KA B48KA	H48SA B48SA
Output	Model/ No. of Point	Sink output	4 (Q14 to Q17)	—	18 (Q0 to Q7, Q10 to Q17, Q20, Q21)	—	18 (Q0 to Q7, Q10 to Q17, Q20, Q21)	—
		Source output	—	4 (Q14 to Q17)	—	18 (Q0 to Q7, Q10 to Q17, Q20, Q21)	—	18 (Q0 to Q7, Q10 to Q17, Q20, Q21)
Output Points per Common Line		COM0	—		8 (Q0 to Q7)			
		COM1	—		8 (Q10 to Q17)			
		COM2	—		2 (Q20, Q21)			
		COM6	4 (Q14 to Q17)		—			
Rated Load Voltage		24V DC						
Operating Load Voltage Range		20.4 to 28.8V DC						
Terminal Arrangement		See "Terminal Arrangement" on page 2-16.						
Maximum Load Current	1 point	0.3A maximum						
	1 common line	1A maximum						
Voltage Drop (ON Voltage)		1V maximum (voltage between COM and output terminals when output is on)						
Inrush Current		1A maximum						
Leakage Current		0.1 mA maximum						
Clamping Voltage		39V±1V						
Maximum Lamp Load		8W						
Inductive Load		L/R = 10ms (28.8V DC, 1 Hz)						
External Current Draw		Sink output: 100mA maximum, 24V DC (power voltage at the +V terminal) Source output: 100mA maximum, 24V DC (power voltage at the +COM terminal)						
Function Input	100kHz output	2 points (Q14, Q15)						
	5kHz output	2 points (Q16, Q17)						
Isolation	Between output terminal and internal circuit	Photocoupler isolated						
	Between output terminals	Same common line: Not isolated Separate common line: Isolated						
Output Delay	Turn ON Time	High-speed output terminal (100 kHz pulse output terminal): 5 µs maximum Normal output terminal (including 5 kHz pulse output terminal): 100 µs maximum						
	Turn OFF Time	High-speed output terminal (100 kHz pulse output terminal): 5 µs maximum Normal output terminal (including 5 kHz pulse output terminal): 100 µs maximum						
Status Display	Pro	LCD display						
	Lite	—						

Output Internal Circuit

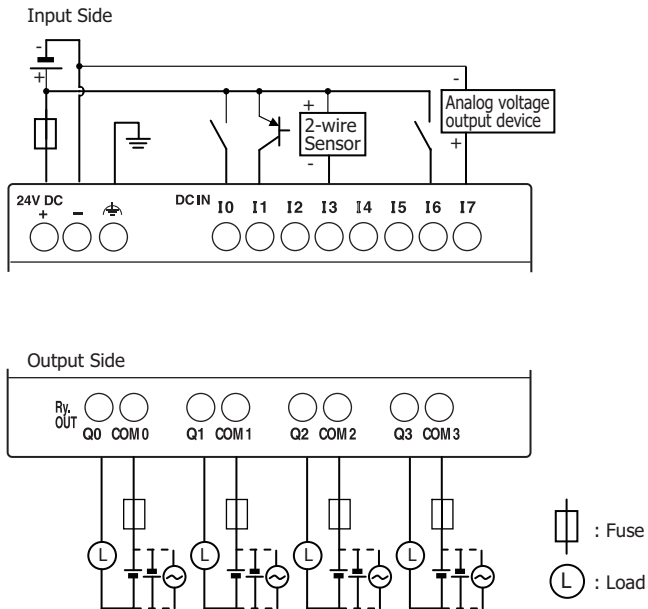


2: PRODUCT SPECIFICATIONS

Terminal Arrangement

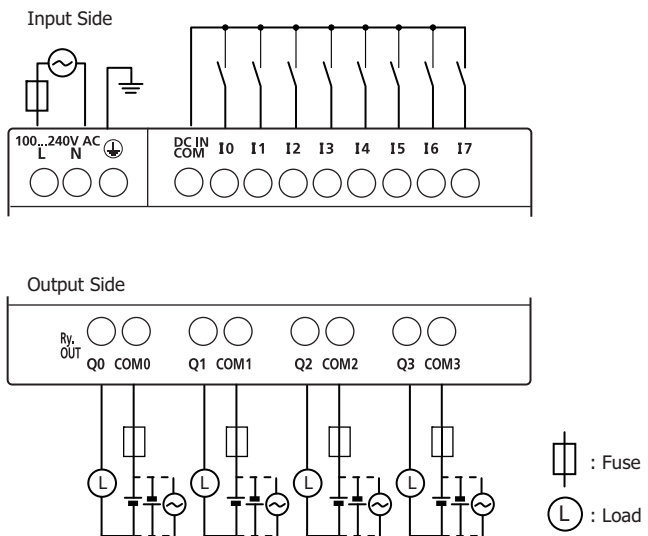
FT1A-H12RA, FT1A-B12RA

Terminal Arrangement and I/O Wiring Diagrams



FT1A-H12RC, FT1A-B12RC

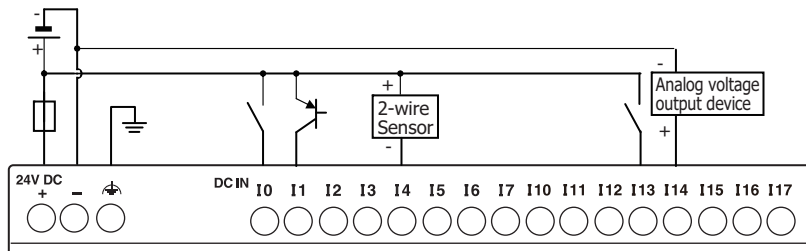
Terminal Arrangement and Wiring I/O Diagrams



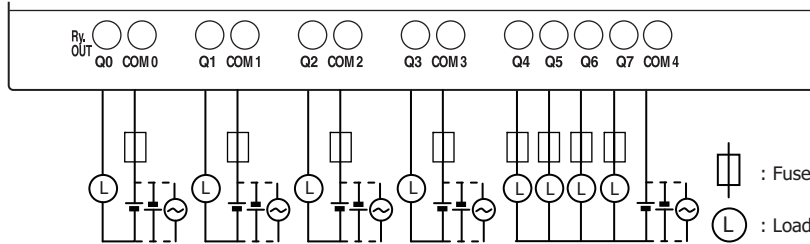
FT1A-H24RA, FT1A-B24RA

Terminal Arrangement and I/O Wiring Diagrams

Input Side



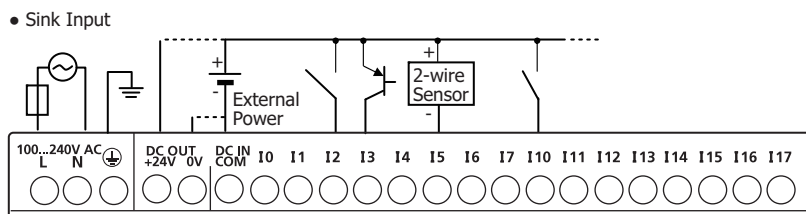
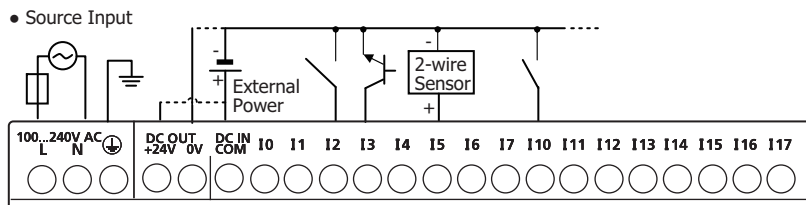
Output Side



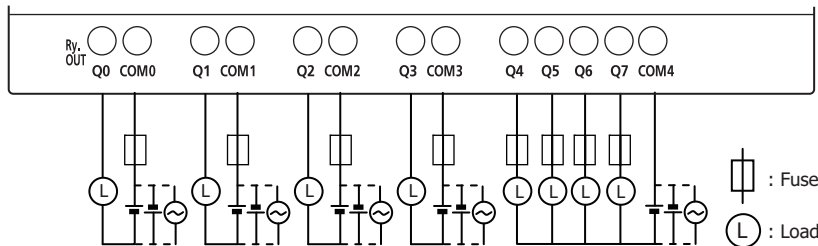
FT1A-H24RC, FT1A-B24RC

Terminal Arrangement and I/O Wiring Diagrams

Input Side



Output Side



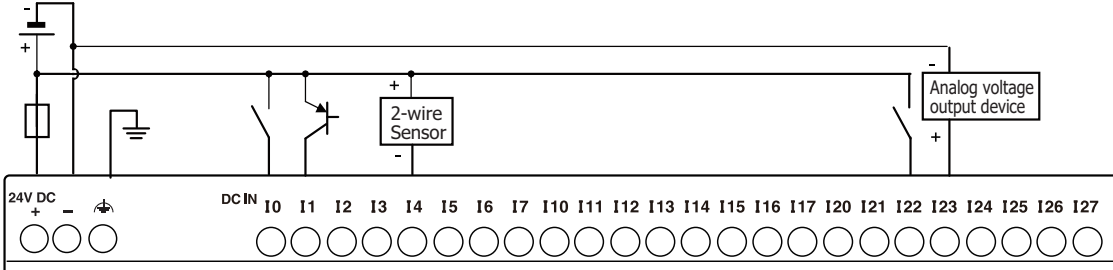
2: PRODUCT SPECIFICATIONS

FT1A-H40RSA, FT1A-B40RSA

Terminal Arrangement and I/O Wiring Diagrams

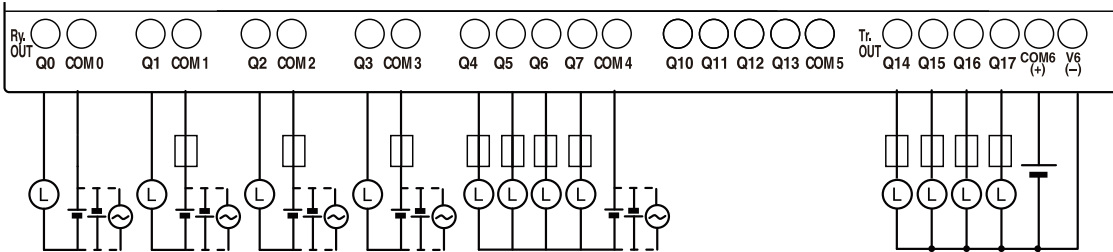
Input Side

- Sink Input



Output Side

- Source Output (Transistor Output)

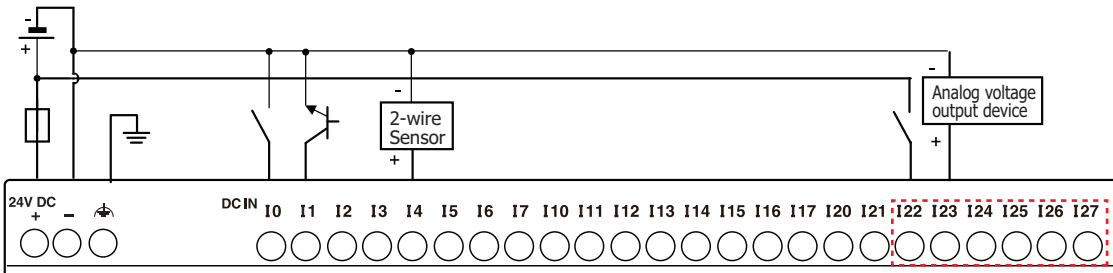


FT1A-H40RKA, FT1A-B40RKA

Terminal Arrangement and I/O Wiring Diagrams

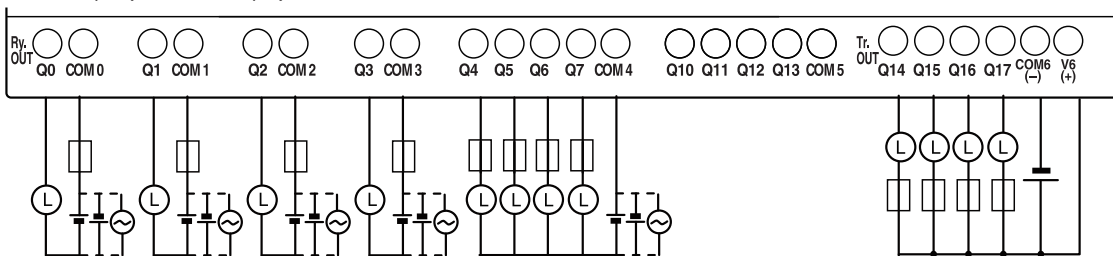
Input Side

- Source Input (Analog/Digital Shared Input I22 is Sink Input)



Output Side

- Sink Output (Transistor Output)



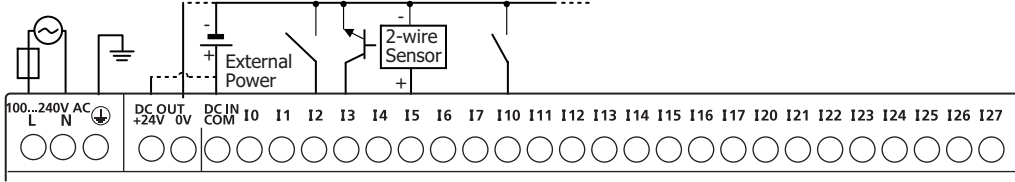
: Fuse : Load

FT1A-H40RC, FT1A-B40RC

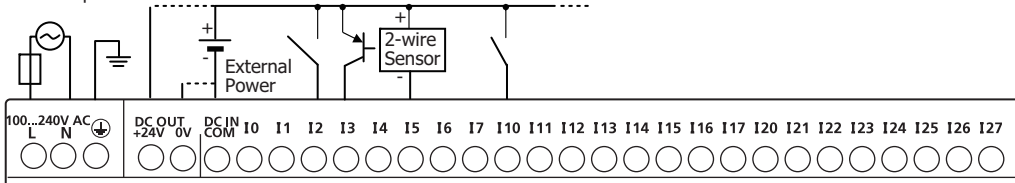
Terminal Arrangement and I/O Wiring Diagrams

Input Side

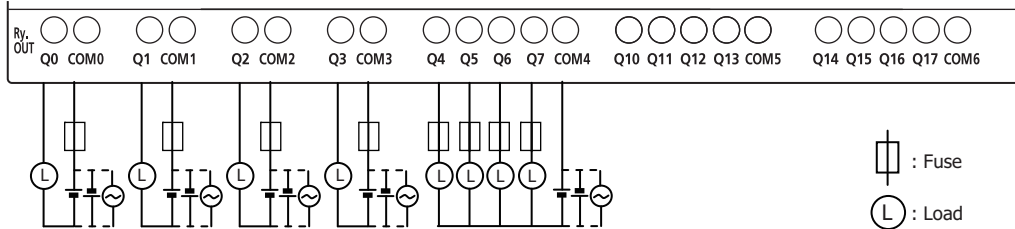
- Source Input



- Sink Input



Output Side



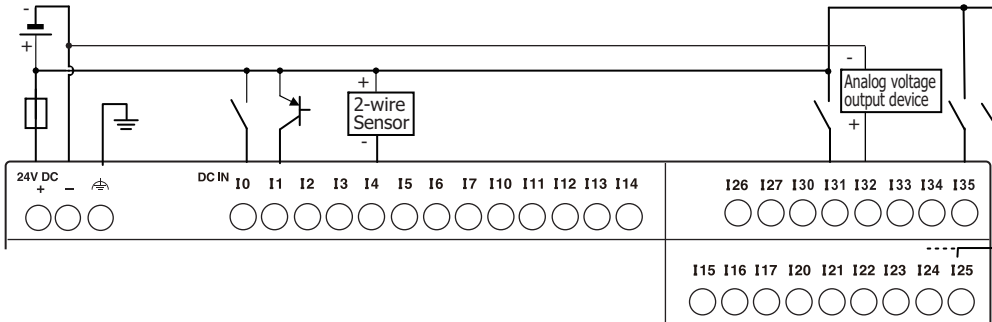
2: PRODUCT SPECIFICATIONS

FT1A-H48SA, FT1A-B48SA

Terminal Arrangement and I/O Wiring Diagrams

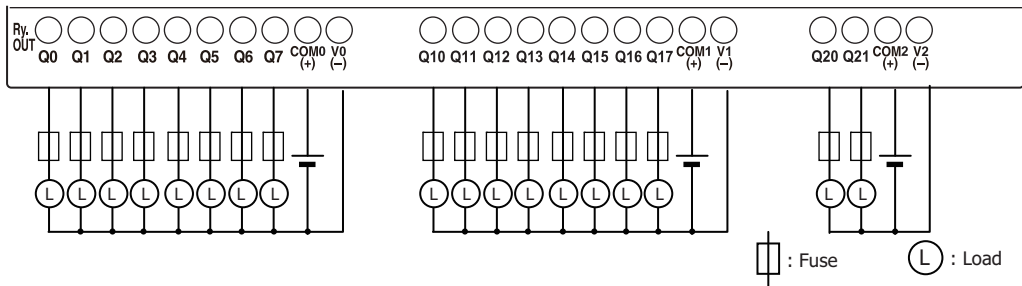
Input Side

- Sink Input



Output Side

- Source Output

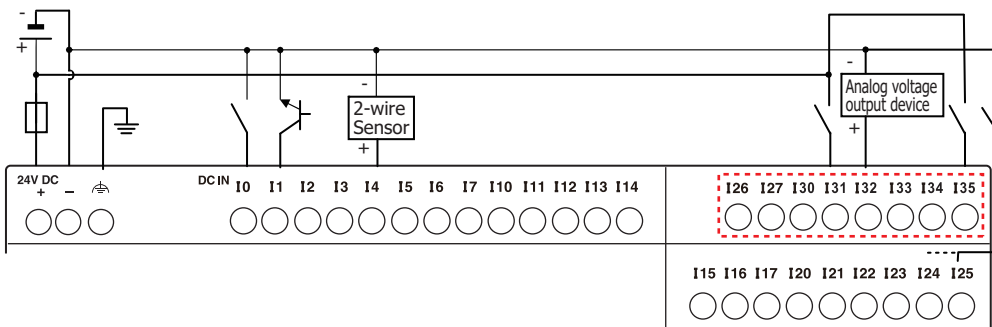


FT1A-H48KA, FT1A-B48KA

Terminal Arrangement and I/O Wiring Diagrams

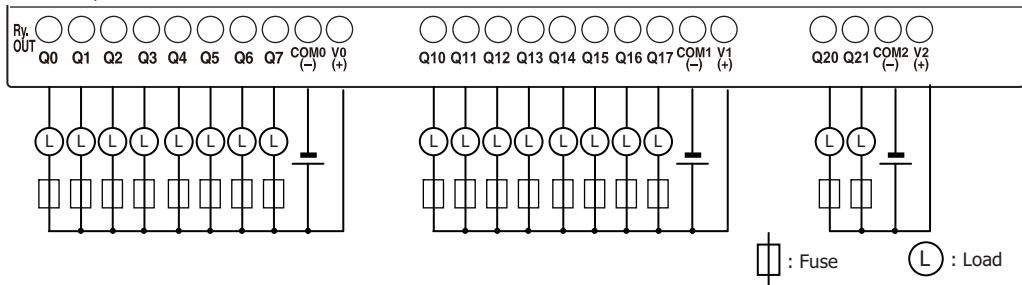
Input Side

- Source Input (Analog/Digital Shared Input I26-I35 is Sink Input)



Output Side

- Sink Output

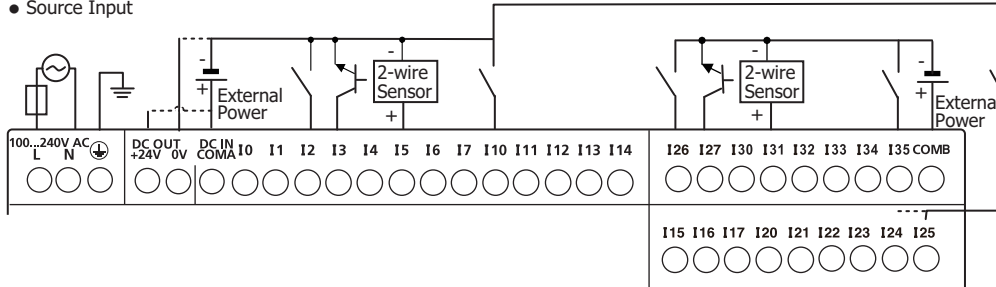


FT1A-B48SC, FT1A-H48SC

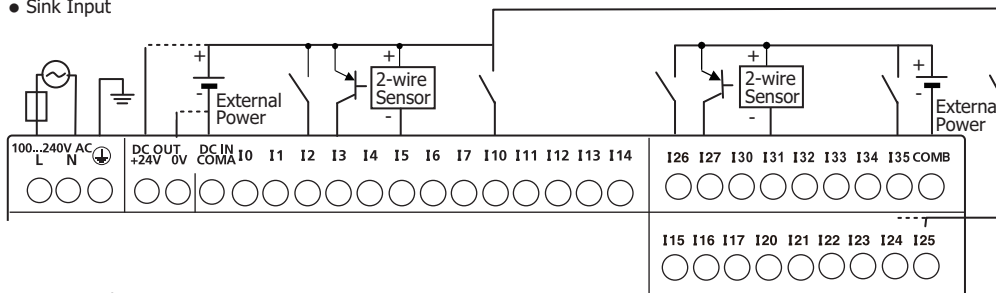
Terminal Arrangement and I/O Wiring Diagrams

Input Side

- Source Input

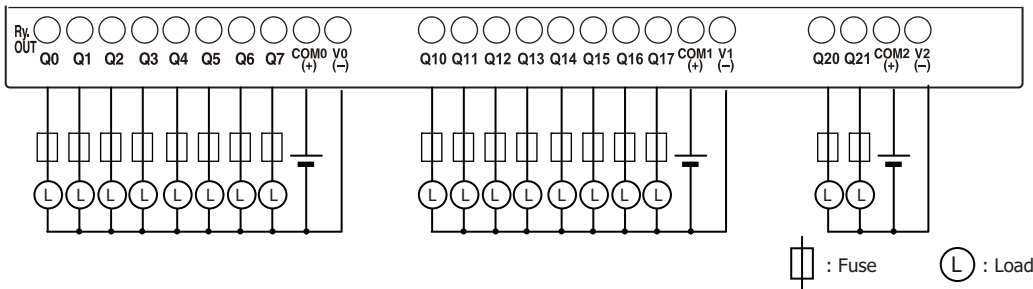


- Sink Input



Output Side

- Source Output



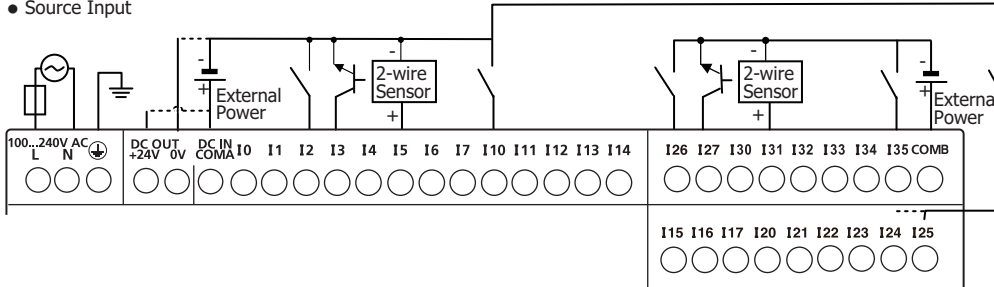
2: PRODUCT SPECIFICATIONS

FT1A-H48KC, FT1A-B48KC

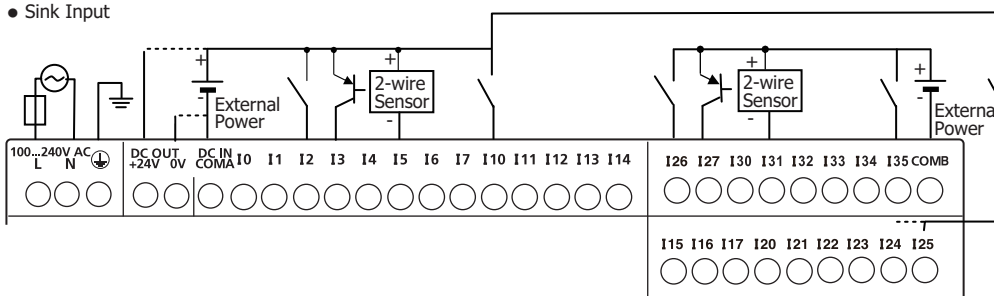
Terminal Arrangement and I/O Wiring Diagrams

Input Side

● Source Input

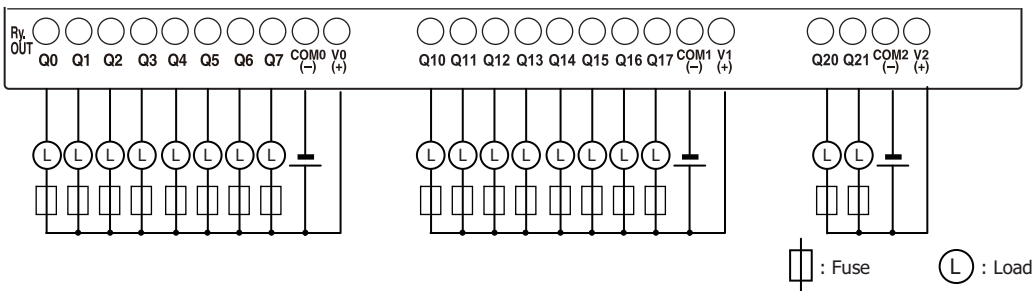


● Sink Input



Output Side

● Sink Output



Communication Cartridge

Functions

By installing a communication cartridge on the SmartAXIS expansion communication port, the SmartAXIS can communicate with communication devices supporting RS232C/RS485, such as Modbus RTU compliant devices, barcode readers, or operator interfaces.

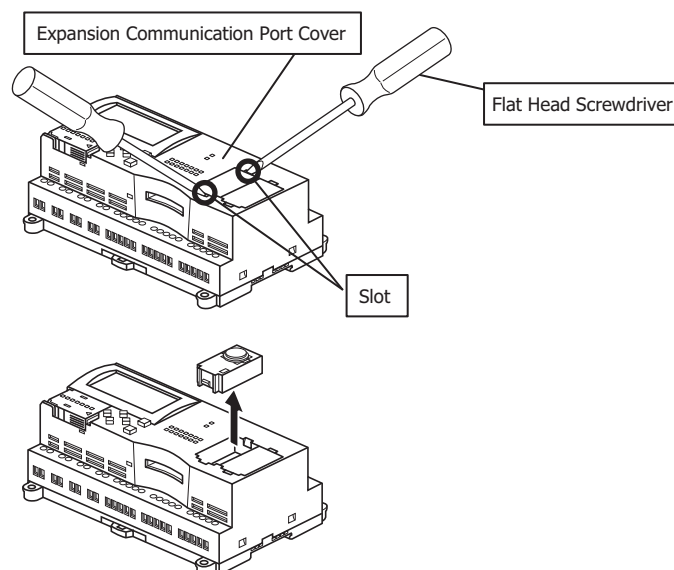
Specifications

Type No.	Item	Specifications
FT1A-PC1	Termination Connector	Mini DIN
	Standards	EIA RS232C
	Maximum Baud Rate	115,200 bps
	Communication Functions	Maintenance communication, User communication, Modbus RTU master/slave
	Isolation between Internal Circuit and Communication Port	Not isolated
	Recommended Communication Cable	Special cable
FT1A-PC2	Termination Connector	Mini DIN
	Standards	EIA RS485
	Maximum Baud Rate	115,200bps
	Communication Functions	Maintenance communication, User communication, Modbus RTU master/slave
	Isolation between Internal Circuit and Communication Port	Not isolated
	Recommended Communication Cable	Special cable
FT1A-PC3	Termination Connector	Screw Terminal block
	Standards	EIA RS485
	Maximum Baud Rate	115,200 bps
	Communication Functions	Maintenance communication, User communication, Modbus RTU master/slave
	Isolation between Internal Circuit and Communication Port	Not isolated
	Recommended Communication Cable	Twisted-pair shielded cable with a minimum core wire of 0.3 mm ² (Conductor resistance 85 Ω/km maximum, shield resistance 20 Ω/km maximum)
	Maximum Cable Length	200m

Note: For details on recommended communication cables, see "Cables" on page A-8.

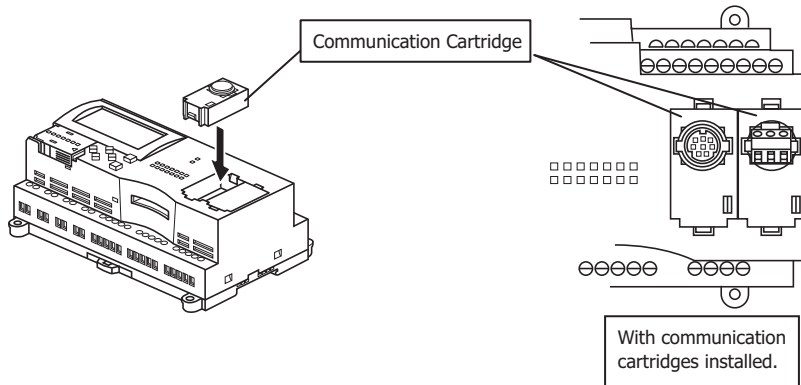
Installation Procedure

Remove the expansion communication port cover by inserting a flat head screwdriver into the slots at the top and bottom of the cover. Press in the tabs at either end of the cover and lift the cover directly upward.



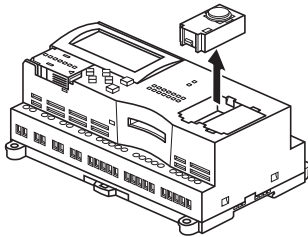
2: PRODUCT SPECIFICATIONS

After removing the expansion communication port cover, carefully install a communication cartridge on the SmartAXIS expansion communication port. Ensure that the cartridge is installed with the correct orientation.



Removal Procedure

As in the procedure to remove the expansion communication port cover, insert a flat head screwdriver into the slots, press in the tabs at either end of the communication cartridge, and lift it directly upward. If the cartridge is removed in a crooked state, the housing of the cartridge or the internal connector may be damaged.



Caution

- Turn off the power to the SmartAXIS before removing or installing a communication cartridge.
- If a communication cartridge is installed while the SmartAXIS is powered, the SmartAXIS or the communication cartridge may be damaged.

Memory Cartridge

Functions

By installing a memory cartridge on which a user program is stored to the SmartAXIS, it is possible to change the user program executed by the SmartAXIS without using WindLDR. It is also possible to download a user program from a memory cartridge to the SmartAXIS. The user program stored in the SmartAXIS ROM can also be uploaded to a memory cartridge.

Memory Cartridge	User Program Execution Priority
Installed on the SmartAXIS	<ul style="list-style-type: none"> When a memory cartridge is installed on the SmartAXIS, the user program stored in the memory cartridge is executed. User programs can be downloaded from memory cartridges to the SmartAXIS using the memory cartridge download function or LCD operation (SmartAXIS Pro only). User programs can be uploaded to memory cartridges from the SmartAXIS ROM using the memory cartridge upload function or LCD operation (SmartAXIS Pro only). For details, see "Memory Cartridge" on page 5-45.
Not installed on the SmartAXIS	The user program stored in the SmartAXIS ROM is executed.


Note: Program capacity when using a memory cartridge is the same as the program capacity of the applicable SmartAXIS model. See "Function Specifications" on page 2-6.

Specifications

Item	Specifications
Type Number	FT1A-PM1
Memory Type	Flash ROM
Hardware for Storing Data	SmartAXIS
Quantity of Stored Programs	One user program per memory cartridge

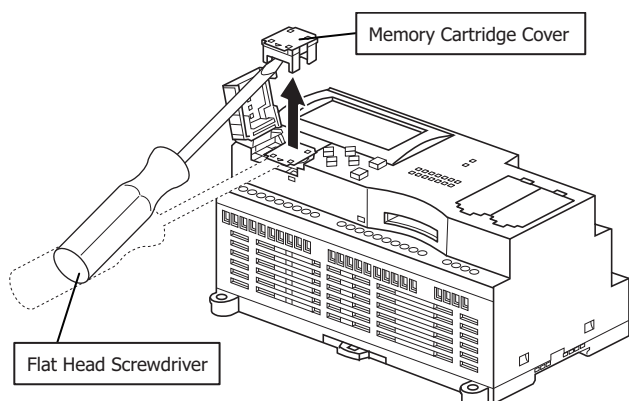
User Program Compatibility

The SmartAXIS can execute only user programs created for the same PLC type. When installing a memory cartridge, make sure that the user program stored on the memory cartridge matches the PLC type. If the user program is not for the same PLC type, a user program syntax error occurs and the PLC cannot run the user program.

 Caution	<ul style="list-style-type: none"> Compatibility of User Program with PLC System Software When a memory cartridge contains a user program for higher functionality, do not install the memory cartridge into PLCs with lower functionality, otherwise the user program syntax error occurs. Upgrade the system software of the PLCs so the PLCs can run the user program in the memory cartridge.
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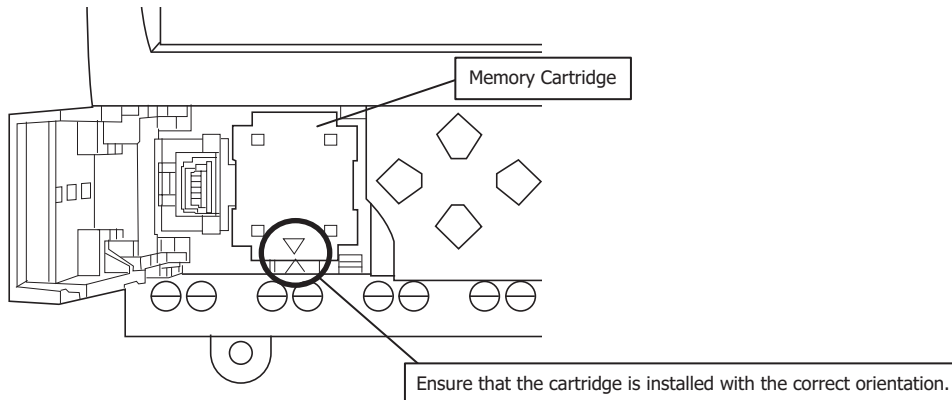
Installation Procedure

Insert a flat head screwdriver under the memory cartridge cover and pull the cover directly upward to remove it.



2: PRODUCT SPECIFICATIONS

After removing the memory cartridge cover, install a memory cartridge. Confirm that the triangular marks on the memory cartridge and on the SmartAXIS point at each other to ensure that the memory cartridge is installed with the correct orientation.



Removal Procedure

As in the procedure to remove the memory cartridge cover, insert a flat head screwdriver under the memory cartridge cover and pull the cover directly upward to remove it. If the cartridge is removed in a crooked state, the housing of the cartridge or the internal connector may be damaged.



Caution

- Turn off the power to the SmartAXIS before removing or installing a memory cartridge. If a memory cartridge is installed while the SmartAXIS is powered, the SmartAXIS or the memory cartridge may be damaged.
- Do not damage the SmartAXIS with the screwdriver.

Ethernet Port

Functions

SmartAXIS with Ethernet port can communicate with other network devices that support Ethernet communications, such as maintenance communication, Modbus TCP (client and server) communication, and user-defined communication (ETXD and ERXD commands).

Applicable Models

An Ethernet port is available on the 24-, 40-, and 48-I/O types.

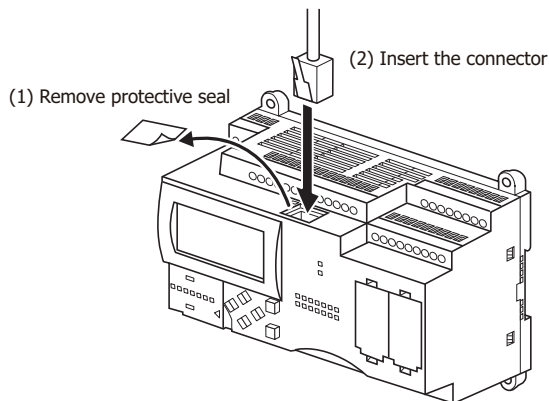
12-I/O type	24-I/O type	40-I/O type	48-I/O type
No	Yes	Yes	Yes

Specifications

Item	Specifications
Transmission Speed	10BASE-T/100BASE-TX
Electrical Characteristics	IEEE 802.3-compliant
Recommended Cable	CAT.5 STP (Category 5 shielded twisted-pair cable)
Connector	RJ45

Installation Procedure

Remove the protective seal covering the Ethernet port and insert the connector of an Ethernet cable securely.



Caution

- Turn off the power to the SmartAXIS before connecting an Ethernet cable to the Ethernet port.
- If an Ethernet cable is connected while the SmartAXIS is powered, electrical shock to the operator or damage to the SmartAXIS may be caused.

2: PRODUCT SPECIFICATIONS

SD Memory Card

Applicable Models

SD memory cards can be used only with the 40- and 48-I/O types.

12-I/O type	24-I/O type	40-I/O type	48-I/O type
No	No	Yes	Yes

SD Memory Card Usage

Specified device values can be saved in CSV files on an SD memory card using the DLOG and TRACE instructions. This makes it possible to save log data or analyze the data when an error occurs.

CSV files saved on an SD memory card can be read out to a computer using WindLDR.

For details on the DLOG and TRACE instructions, see Chapter 25 "Data History Commands" in the "SmartAXIS Ladder Programming Manual".

Specifications

Item	Specifications	
Supported SD Memory Cards	SD memory cards (2GB maximum), SDHC memory cards (32GB maximum)	
File System	FAT16/FAT32 SD memory cards of 2GB or less are only supported in FAT16 format. SD memory cards of 2GB formatted in FAT32 are not recognized.	
File Specifications	Format	CSV
	Size	5MB maximum
	Supported Characters	Single-byte alphanumeric characters The following characters cannot be used in drive names: \" & () * + , . / : ; < > [] = ^ The following characters cannot be used in file and folder names: \\ / : * ? " < >
Maximum Number of Files	Dependant on file system: • FAT16 65,534 maximum per sub-directory • FAT32 65,534 maximum per sub-directory	

Recommended SD Memory Card

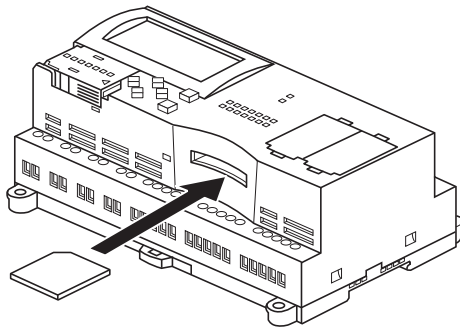
Recommended SD Memory Card	SDHC memory cards (32GB maximum)
-----------------------------------	----------------------------------

Notes:

- It is recommended that SDHC memory cards are formatted on the SmartAXIS before it is used.
- It is recommended that important data is regularly backed up on separate media such as CDs or DVDs.

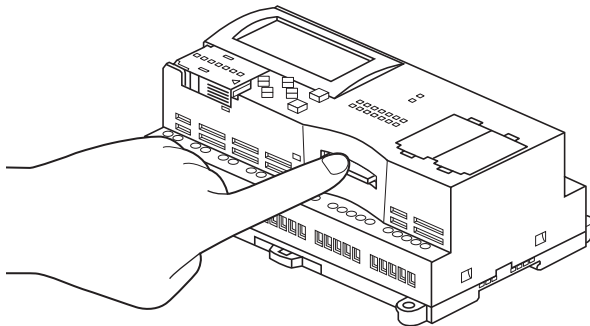
Installation

Follow the indications on the SmartAXIS and insert an SD memory card into the SD memory card slot on the SmartAXIS until you hear a click.

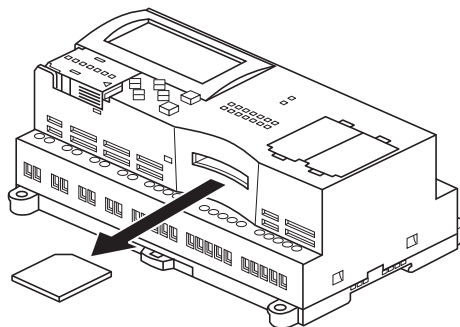


Removal

Press the SD memory card in the SD memory card slot on the SmartAXIS until you hear a click and move your finger back.



The SD memory card will come partially out of the slot. Use your fingers to remove the SD memory card completely.



Notes:

- Insert and remove the SD memory card in the direction indicated on the SmartAXIS.
- Set the write-protect switch of the SD memory card to the OFF position before inserting into the SmartAXIS.



Caution

If any of the actions below are performed while the SD memory card is being accessed, data on the card may be damaged:

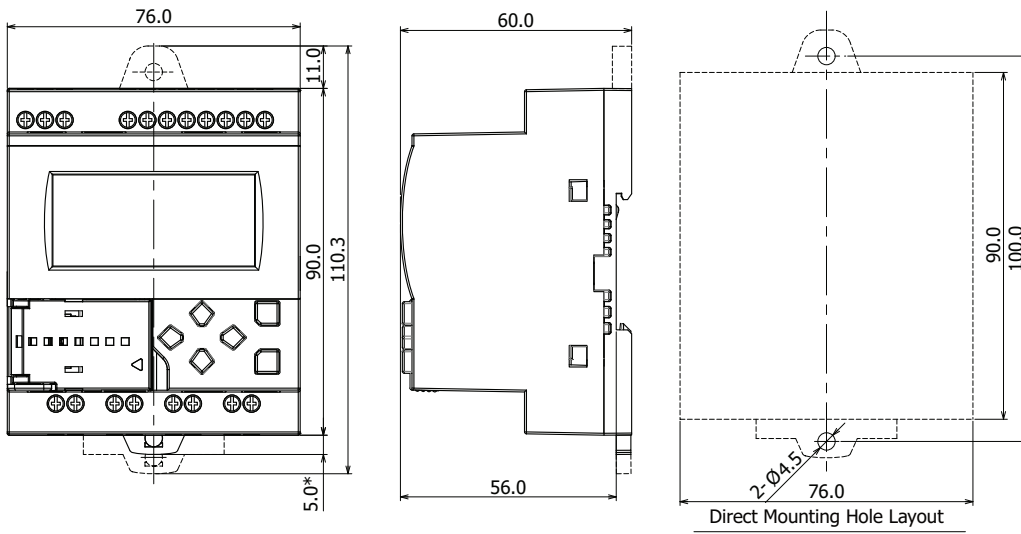
- The SmartAXIS is turned off.
- The SD memory card is removed.

Do not turn off the SmartAXIS while the SD memory card is being accessed (while the SD memory card status LED is flashing). Confirm that the SD memory card status LED is not flashing before removing the card from the SmartAXIS. For details on SD memory card status LED, see "SD Memory Card Maintenance with WindLDR" on page 5-49.

2: PRODUCT SPECIFICATIONS

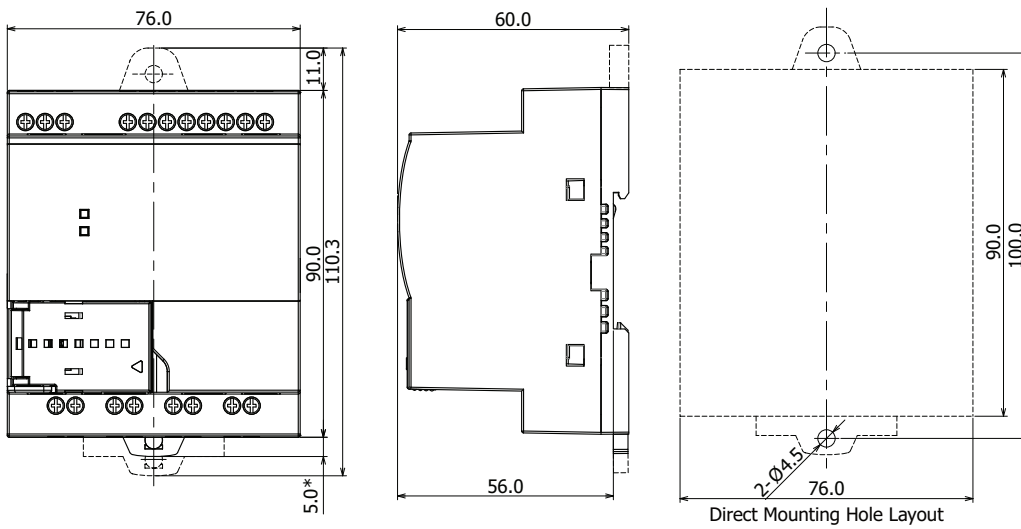
Dimensions

FT1A-H12RA



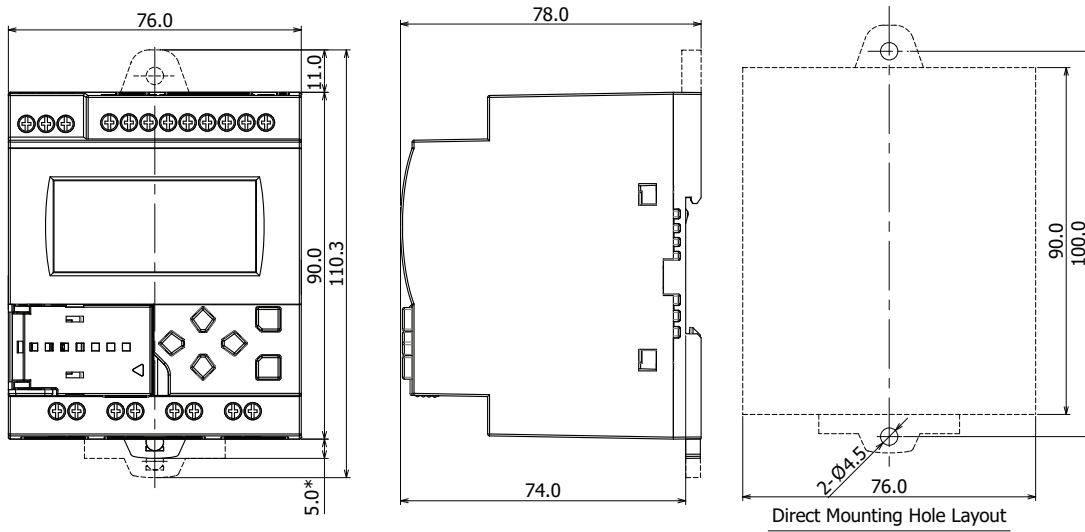
*9.3mm when the clamp is pulled out.

FT1A-B12RA



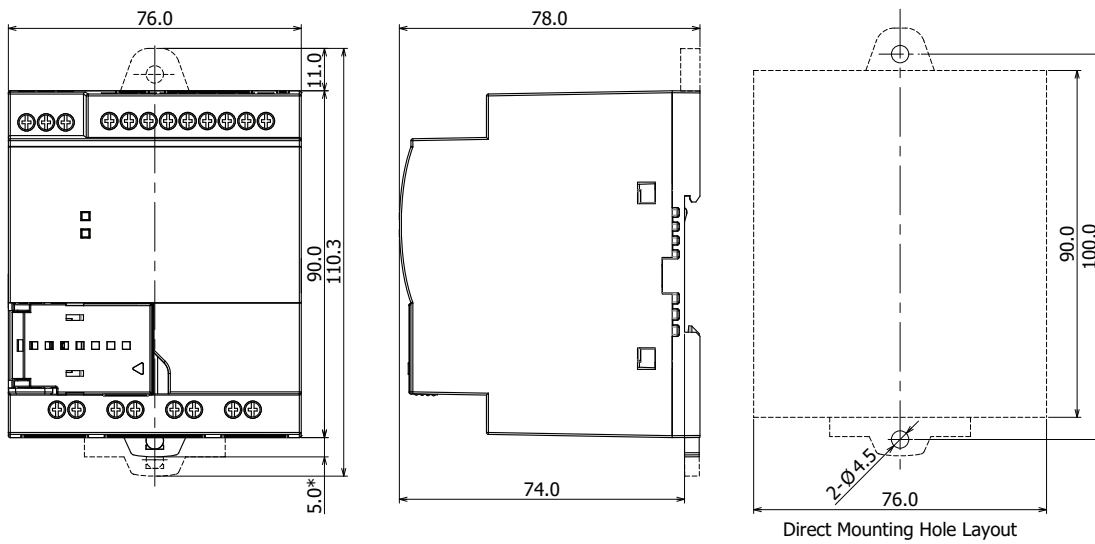
*9.3mm when the clamp is pulled out.

FT1A-H12RC



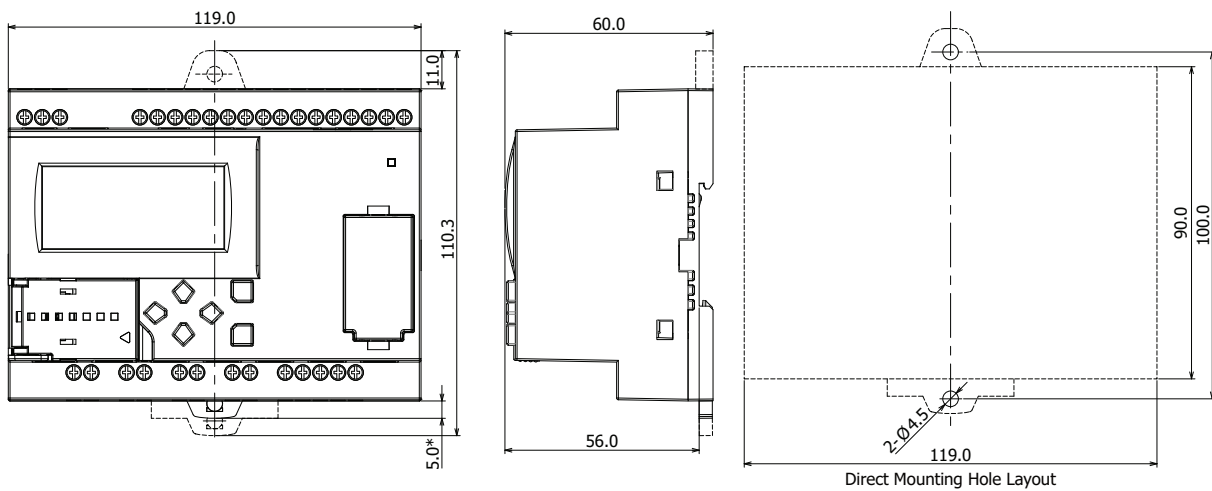
*9.3mm when the clamp is pulled out.

FT1A-B12RC



*9.3mm when the clamp is pulled out.

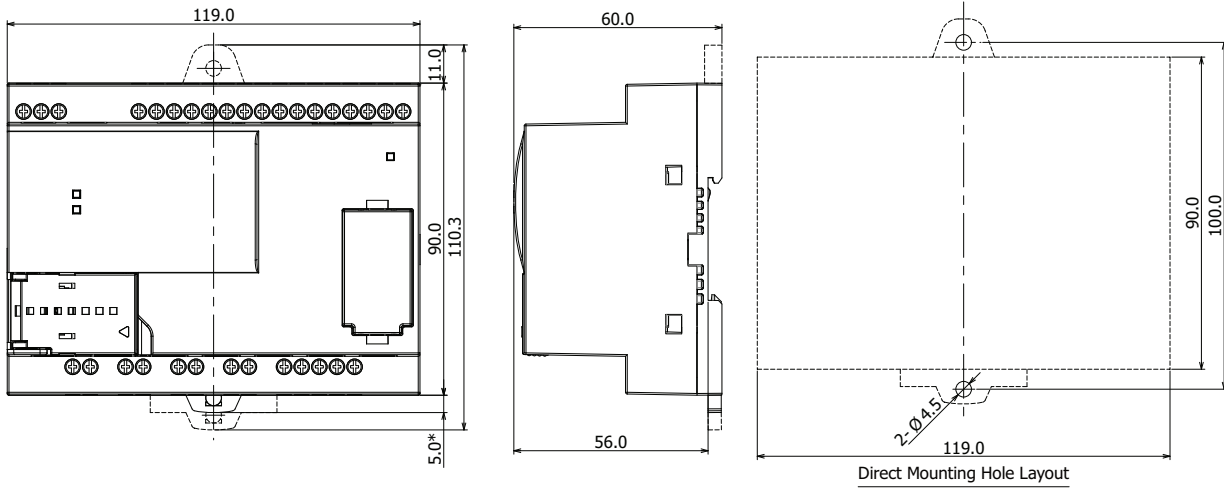
FT1A-H24RA



*9.3mm when the clamp is pulled out.

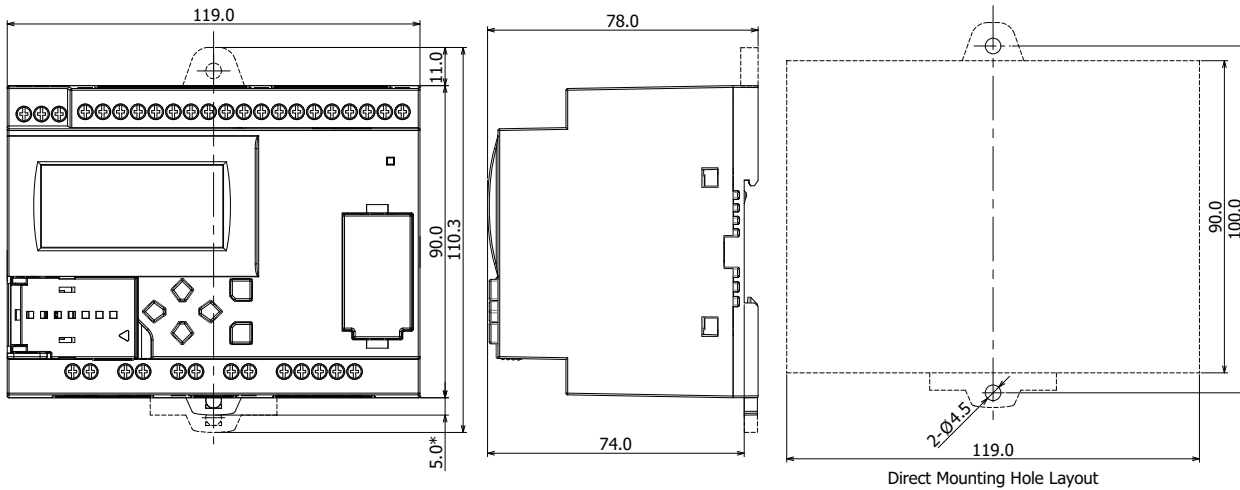
2: PRODUCT SPECIFICATIONS

FT1A-B24RA



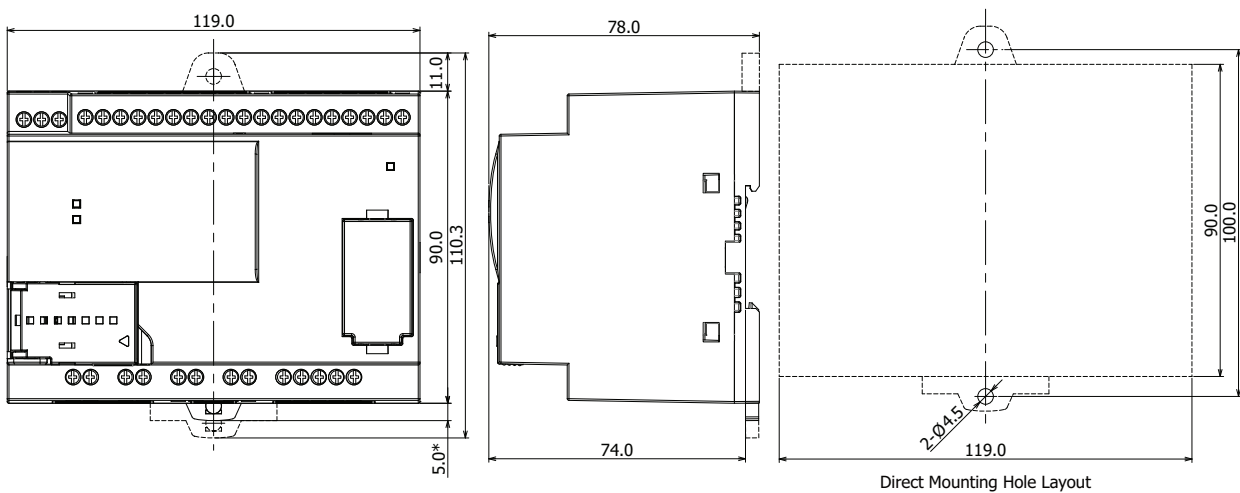
*9.3mm when the clamp is pulled out.

FT1A-H24RC



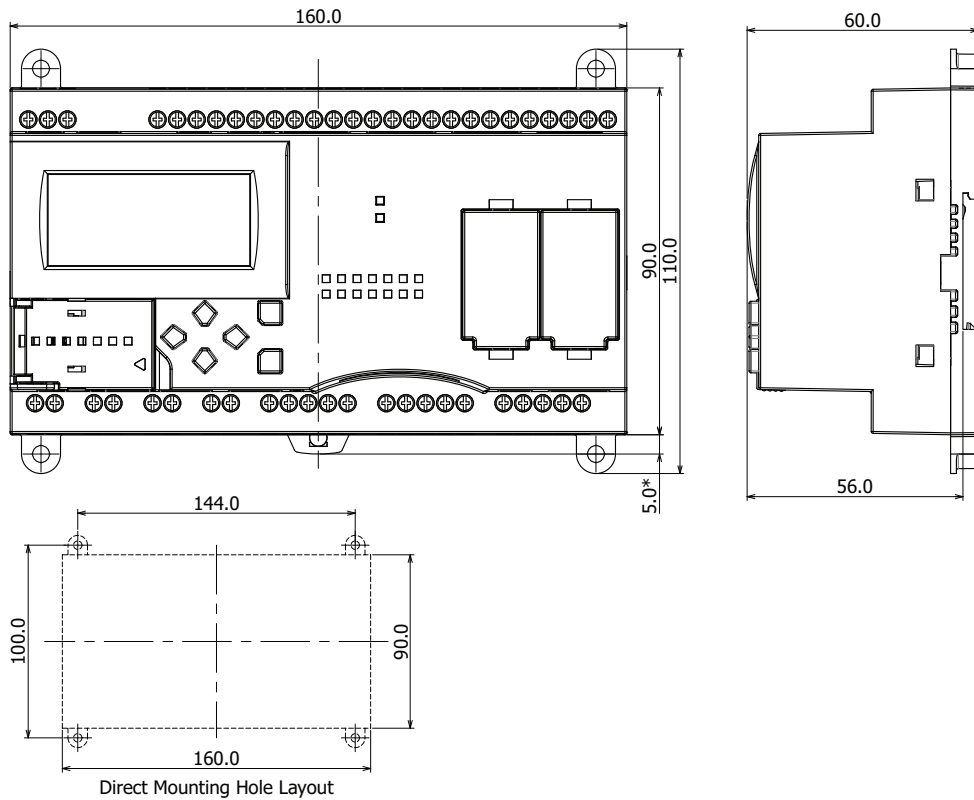
*9.3mm when the clamp is pulled out.

FT1A-B24RC



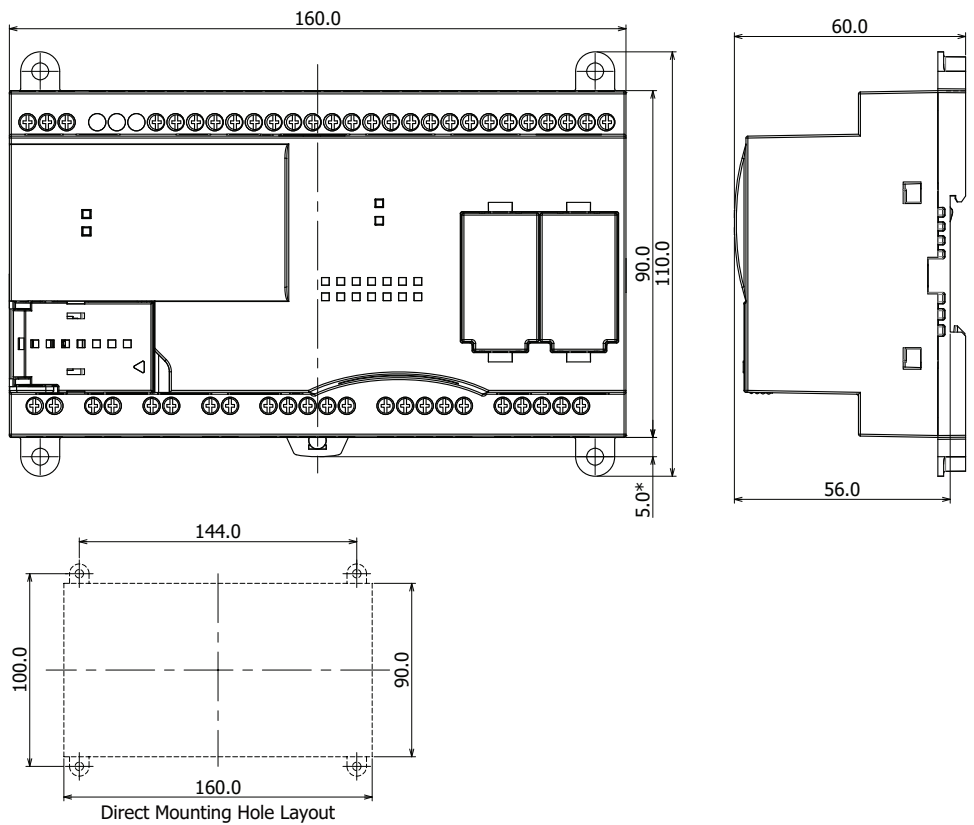
*9.3mm when the clamp is pulled out.

FT1A-H40RSA, FT1A-H40RKA



*9.3mm when the clamp is pulled out.

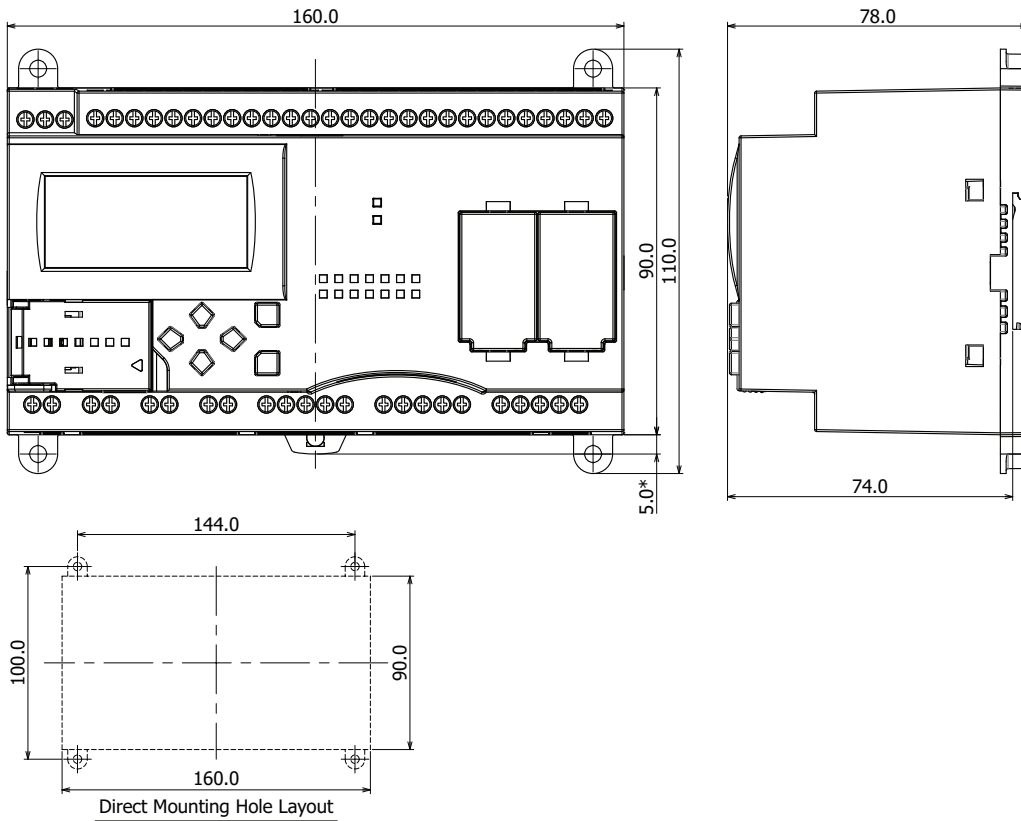
FT1A-B40RSA, FT1A-B40RKA



*9.3mm when the clamp is pulled out.

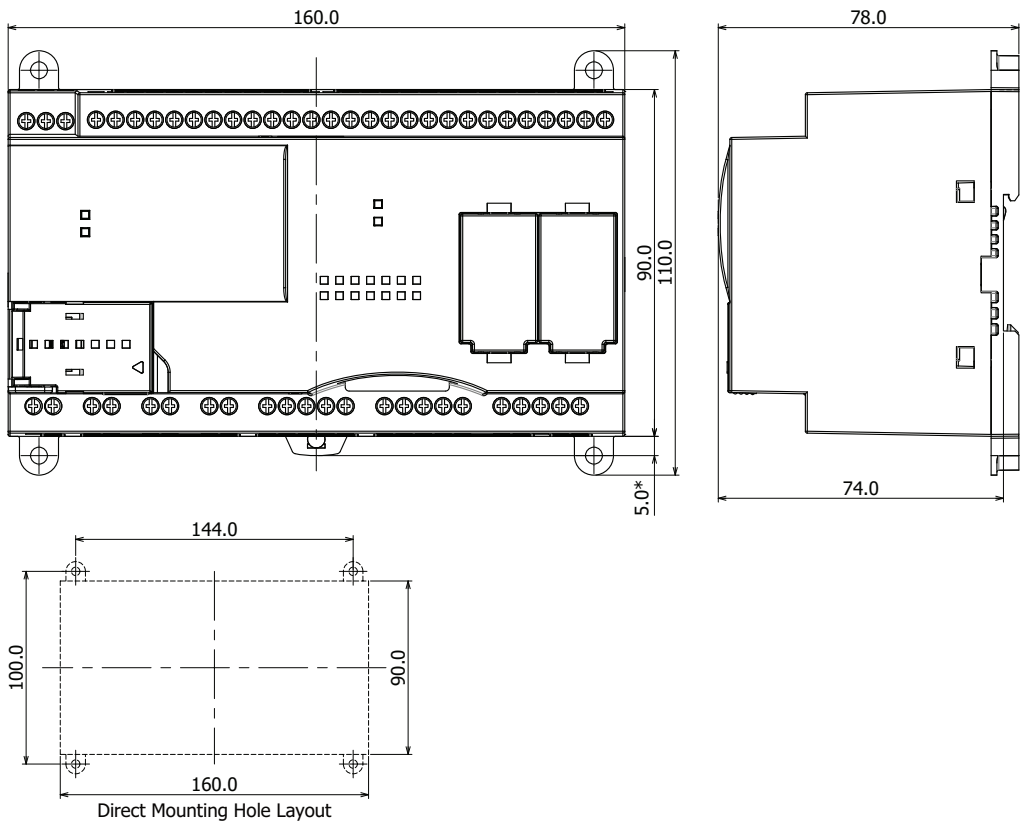
2: PRODUCT SPECIFICATIONS

FT1A-H40RC



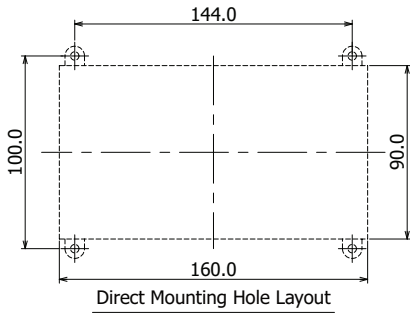
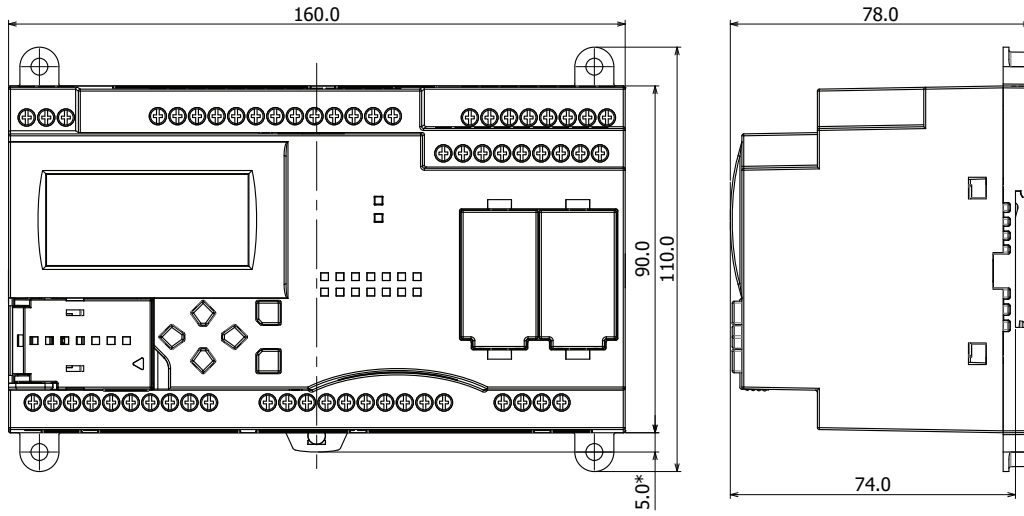
*9.3mm when the clamp is pulled out.

FT1A-B40RC



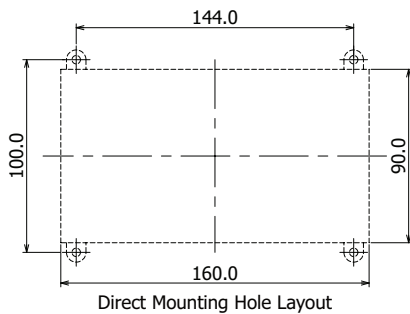
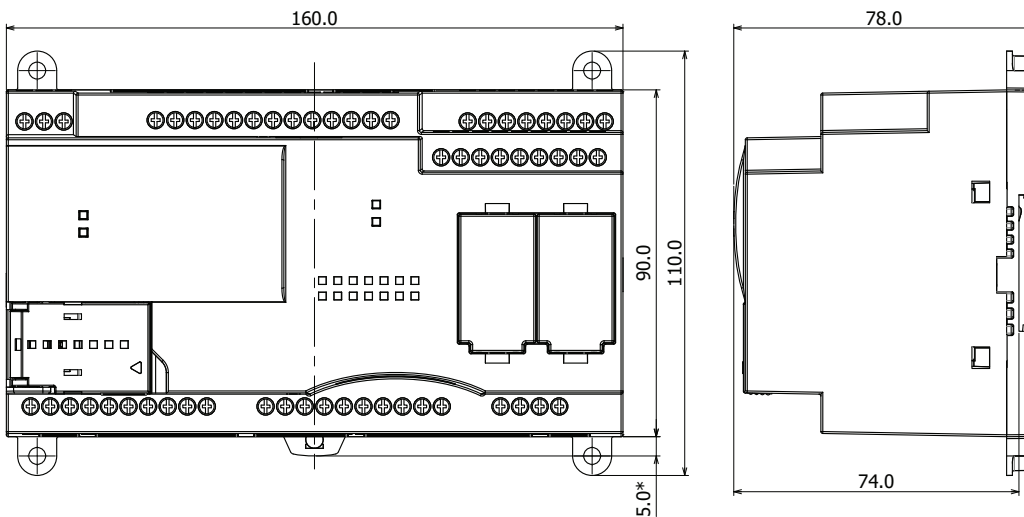
*9.3mm when the clamp is pulled out.

FT1A-H48SA, FT1A-H48KA



*9.3mm when the clamp is pulled out.

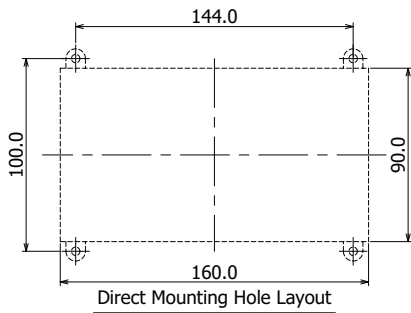
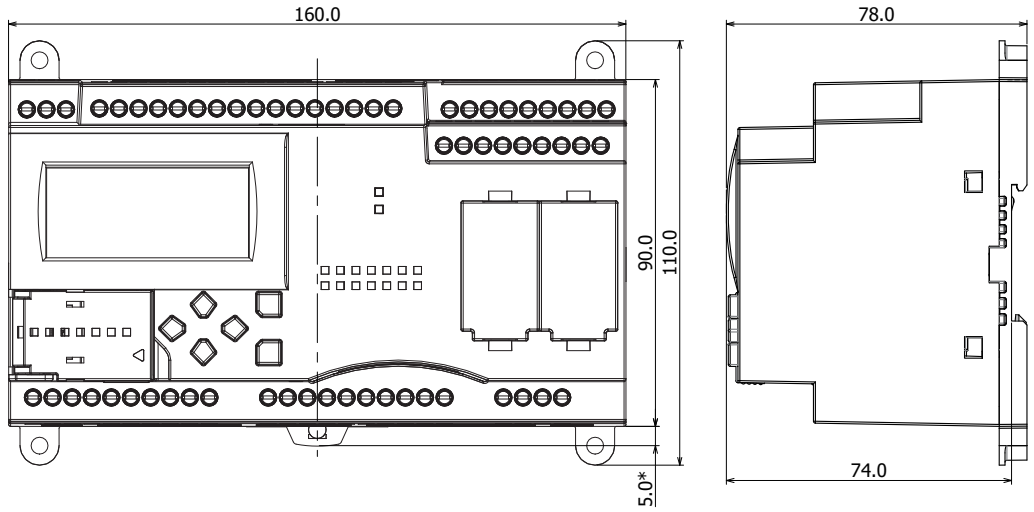
FT1A-B48SA, FT1A-B48KA



*9.3mm when the clamp is pulled out.

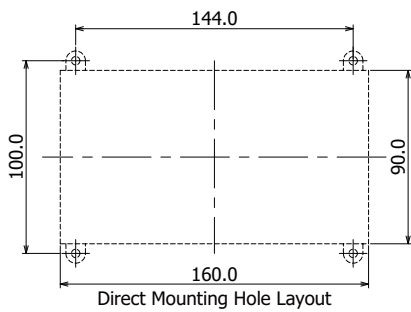
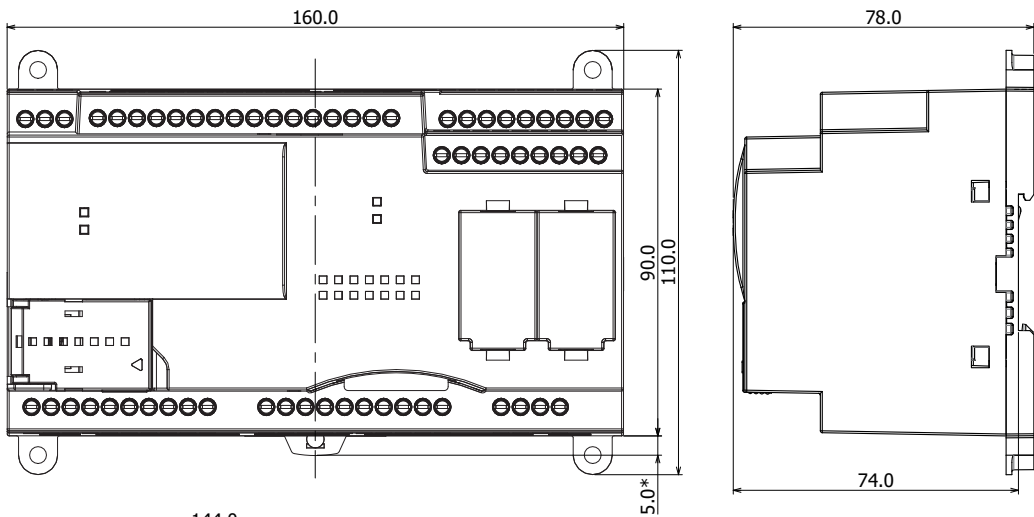
2: PRODUCT SPECIFICATIONS

FT1A-H48SC, FT1A-H48KC



*9.3mm when the clamp is pulled out.

FT1A-B48SC, FT1A-B48KC



*9.3mm when the clamp is pulled out.

3: INSTALLATION AND WIRING

Introduction

This chapter describes the methods and precautions for installing and wiring SmartAXIS modules.

Before starting installation and wiring, be sure to read "Safety Precautions" in the beginning of this manual and understand precautions described under Warning and Caution.



Warning

- Turn off the power to the SmartAXIS before starting installation, removal, wiring, maintenance, and inspection of the SmartAXIS. Failure to turn power off may cause electrical shocks or fire hazard.
- Emergency stop and interlocking circuits must be configured outside the SmartAXIS. If such a circuit is configured inside the SmartAXIS, failure of the SmartAXIS may cause disorder of the control system, damage, or accidents.
- Special expertise is required to install, wire, program, and operate the SmartAXIS. People without such expertise must not use the SmartAXIS.



Caution

- Prevent metal fragments and pieces of wire from dropping inside the SmartAXIS housing. Put a cover on the SmartAXIS modules during installation and wiring. Ingress of such fragments and chips may cause fire hazard, damage, or malfunction.
- Do not touch the connector pins with your hand. Electrostatic discharge may damage the internal elements.
- When handling the SmartAXIS, take measures to discharge static electricity.
- Keep the SmartAXIS wiring away from motor lines.

Installation Location

The SmartAXIS is designed to be installed in control panels and similar locations.

Install the SmartAXIS within product specifications.

Avoid use in the environments below, as doing so may cause electric shock, fire, or malfunction:

Places where there is a lot of dust, salt, iron powder, or soot.

Places exposed to direct sunlight.

Places where the SmartAXIS may be exposed to vibration or shock, either directly or indirectly.

Atmospheres of corrosive or flammable gases.

Places where condensation may form.

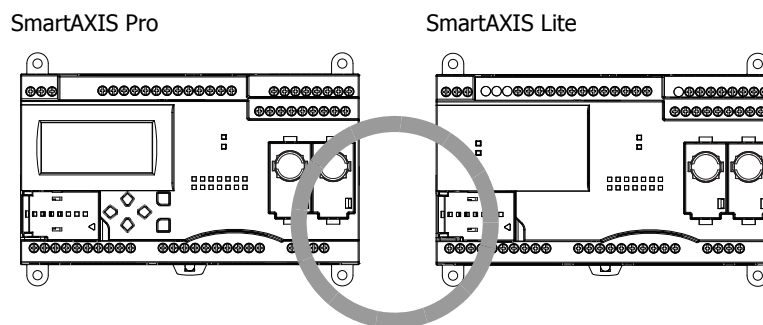
Places where the SmartAXIS may be directly exposed to water.

Around high-voltage lines, high-voltage equipment, motor lines, or motor equipment.

Places near where a large switching surge may occur.

Places subject to a strong magnetic or electrical field.

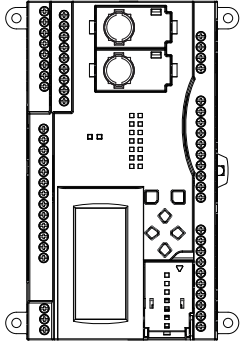
Always mount the SmartAXIS vertically as shown below. To provide ample ventilation, ensure that there is sufficient space between the SmartAXIS and other devices, heat sources, and panel surfaces.



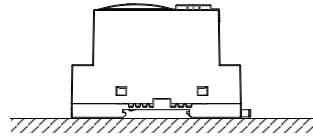
3: INSTALLATION AND WIRING

The SmartAXIS can be mounted face up when the ambient temperature is 35°C or lower, and can be mounted on its side when the ambient operating temperature is 40°C or lower. Do not mount the SmartAXIS on its side when the ambient temperature will exceed 40°C.

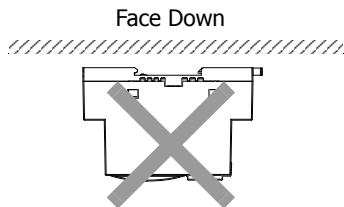
Side Orientation (Use if 40°C or less)



Face Up Orientation (Use if 35°C or less)



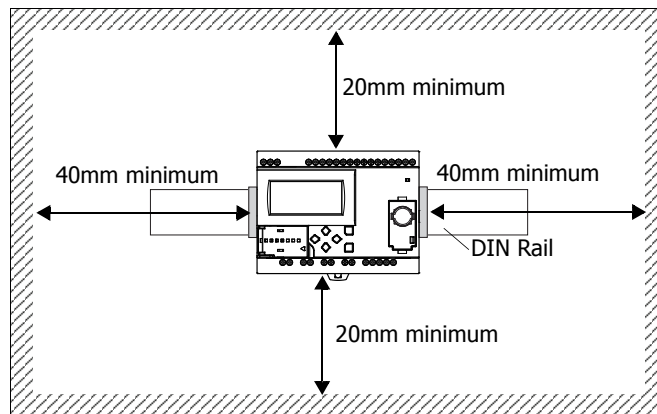
Do not install the SmartAXIS face down.



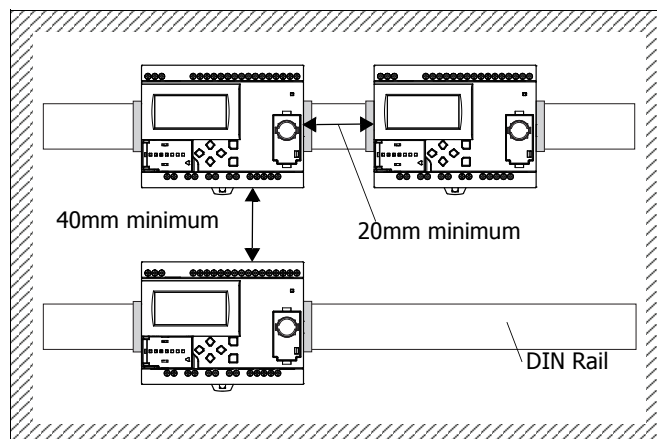
Face Down

Mounting Space

To allow for heat dissipation and facilitate replacement, ensure that there are at least 20 to 40mm between the SmartAXIS and surrounding equipment and ducts.



Mounting Two or More Units



Mounting on DIN Rail



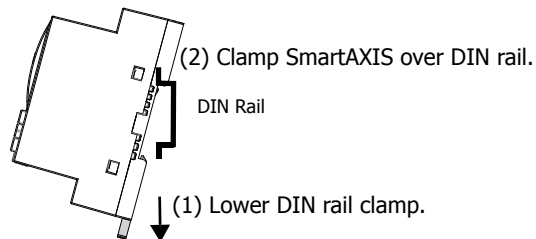
Caution

- Install the SmartAXIS modules according to instructions described in this user’s manual. Improper installation will result in falling, failure, or malfunction of the SmartAXIS.
- Do not install the SmartAXIS when it is powered up. Doing so may result in electric shock and may damage the product.

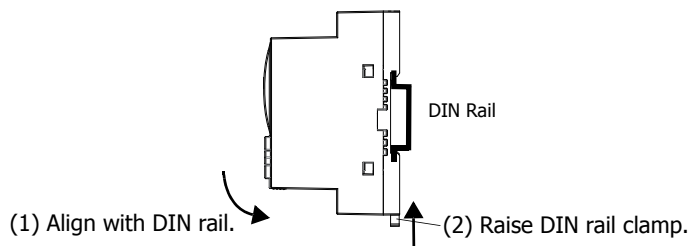
This section describes how to mount the SmartAXIS.

The SmartAXIS can be mounted directly on a DIN rail or in a control panel.

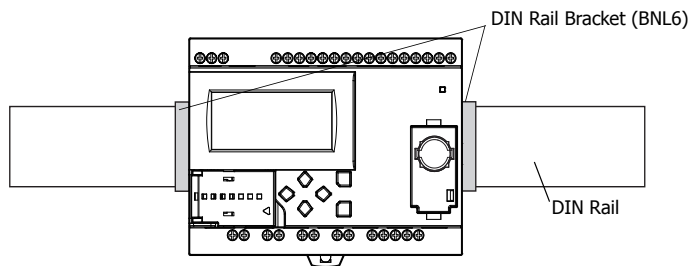
1. Firmly fasten the DIN rail to a panel using screws.
2. Using a flat head screwdriver, lower the DIN rail clamp and hang the SmartAXIS on the DIN rail.



3. Align the SmartAXIS with the DIN rail and raise the DIN rail clamp.

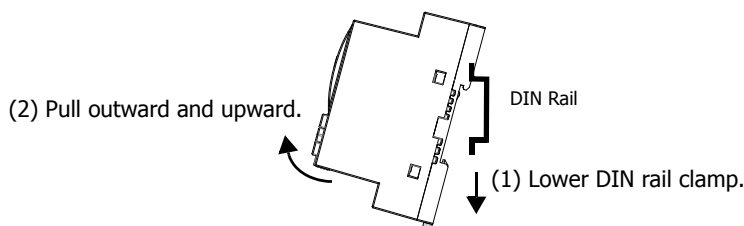


4. Secure both ends of the SmartAXIS using the DIN rail brackets.



Removing from DIN Rail

1. Using a flat head screwdriver, lower the DIN rail clamp on the SmartAXIS.
2. Pull the SmartAXIS outward and upward at the same time.



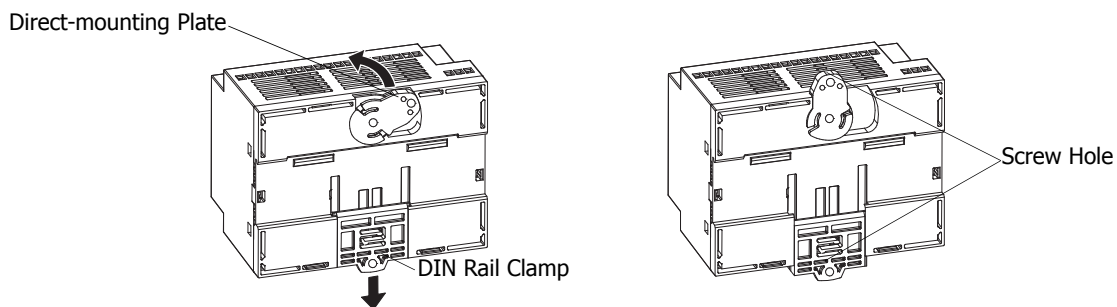
Note: The SmartAXIS supports 35mm wide DIN rails. Supported rails: IDEC BAA1000 (Length: 1000mm)

Direct Mounting on Panel Surface

This section describes how to mount the SmartAXIS directly onto a mounting plate for installation in a control panel. The 12- and 24-I/O types are mounted differently from the 40- and 48-I/O types. To mount the SmartAXIS directly, it may be necessary to make holes in the mounting plate depending on the SmartAXIS model.

Preparations

When directly mounting the 12- and 24-I/O types, pull out the direct-mounting plate and the DIN rail clamp on the back of the SmartAXIS, and attach the SmartAXIS to the mounting plate using the screw holes. Attach the 40- and 48-I/O types to the mounting plate using the screw holes on the back of the SmartAXIS.

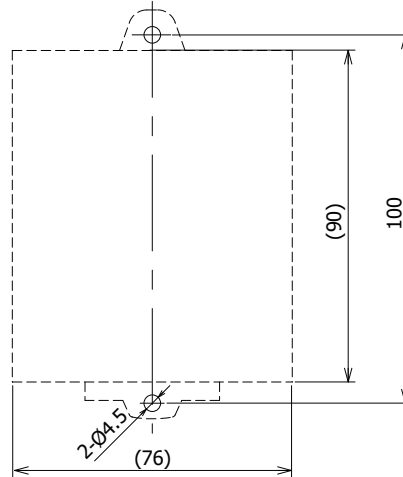


Mounting Hole Layout for Direct Mounting on Panel Surface

Attach the SmartAXIS to the mounting plate using M4 tapping screws, as shown below, or make 5 to 6mm mounting holes and secure the SmartAXIS using M4 pan head screws.

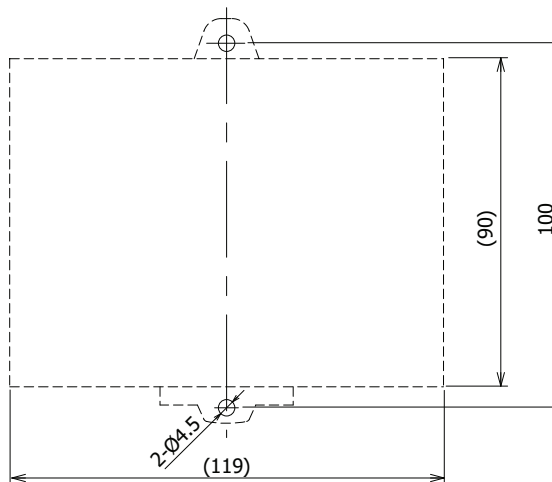
Always give sufficient consideration to operability, ease-of-maintenance, and environmental resistance when deciding on the mounting position.

- **12-I/O type (FT1A-H12RA, FT1A-B12RA, FT1A-H12RC, FT1A-B12RC)**



All dimensions in mm.

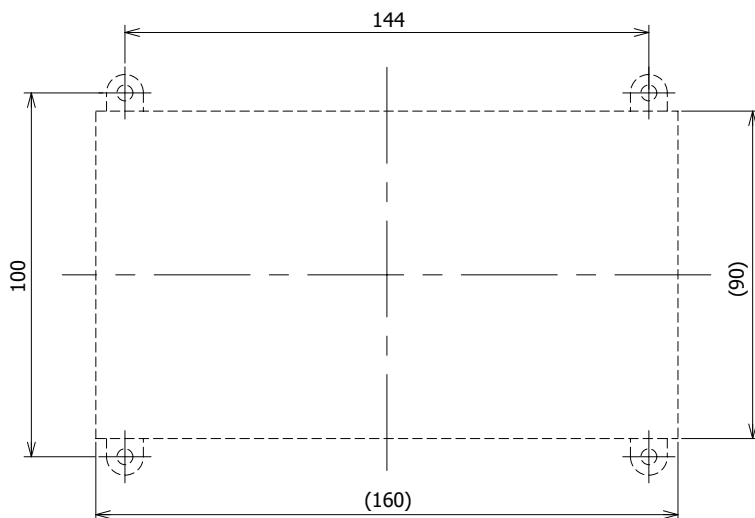
- **24-I/O type (FT1A-H24RA, FT1A-B24RA, FT1A-H24RC, FT1A-B24RC)**



All dimensions in mm.

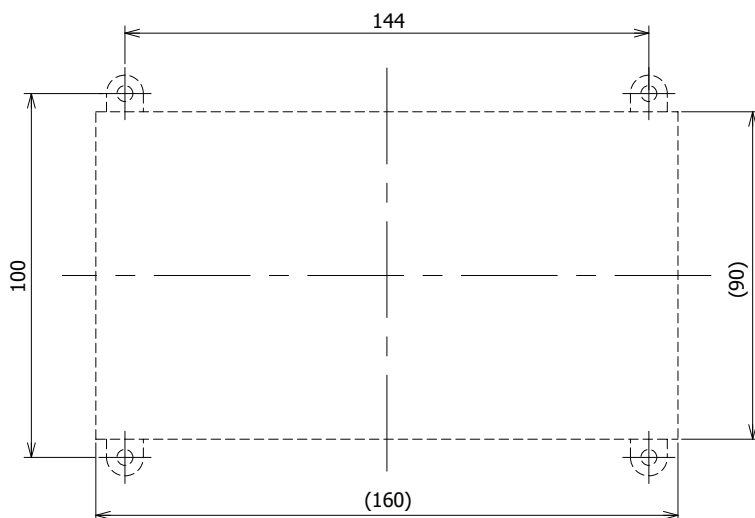
3: INSTALLATION AND WIRING

- 40-I/O type (FT1A-H40RKA, FT1A-H40RSA, FT1A-B40RKA, FT1A-B40RSA, FT1A-H40RC, FT1A-B40RC)



All dimensions in mm.

- 48-I/O type (FT1A-H48KA, FT1A-H48SA, FT1A-B48KA, FT1A-B48SA, FT1A-H48KC, FT1A-H48SC, FT1A-B48KC, FT1A-B48SC)



All dimensions in mm.



Caution

- When directly mounting the SmartAXIS, tighten mounting screws with torque of 1N·m (10kgf·cm).

Input/Output Wiring

This section describes SmartAXIS input/output device wiring.

Precautions for I/O Device Wiring

Input Terminal Wiring

When wiring input devices, separate wiring from power, output, and motor lines.

When using duct for wiring, ground piping using a D-type (type 3) ground.

When wiring DC power type models, keep wiring away from AC power lines.

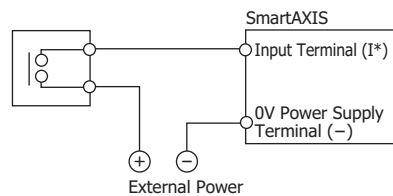
When using shielded cable for wiring, ground the shield on the SmartAXIS side using a D-type (type 3) ground.

Wire input devices you want to connect to the SmartAXIS according to type as shown below.

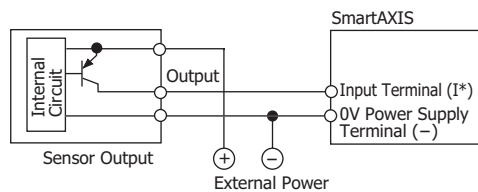
DC Power Type

Digital Input – Sink Input

- Contact Output

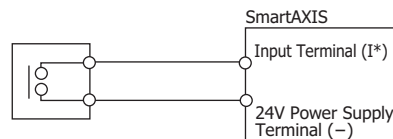


- PNP Output

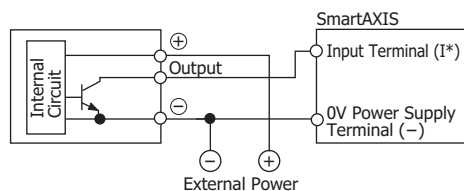


Digital Input – Source Input

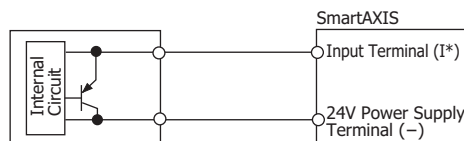
- Contact Output



- NPN Output



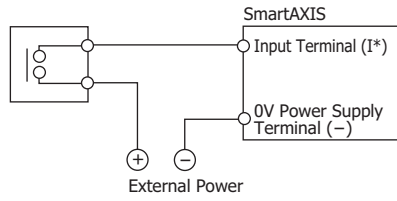
- 2-wire Sensor



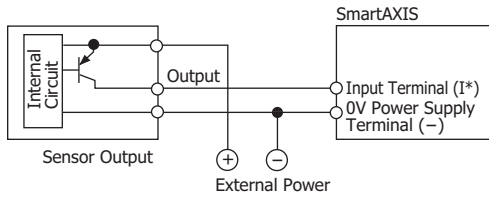
3: INSTALLATION AND WIRING

Shared Analog Input

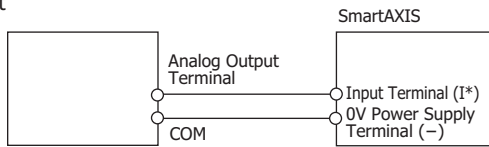
- Contact Output



- PNP Output



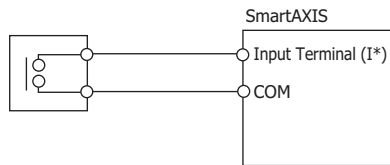
- Analog Output



AC Power Type

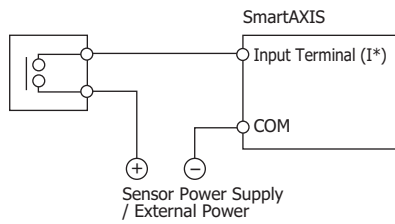
Contact Input

- Contact Output

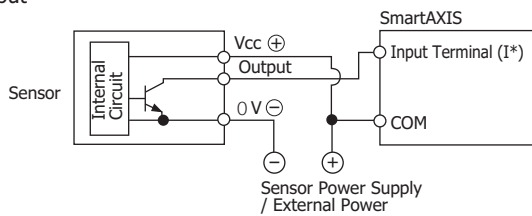


Sink/Source Input

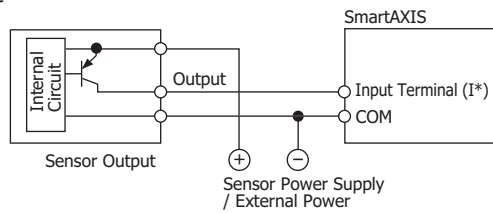
- Contact Output



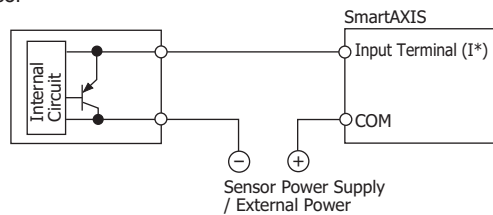
- NPN Output



• PNP Output



• 2-wire Sensor



Output Terminal Wiring



Caution

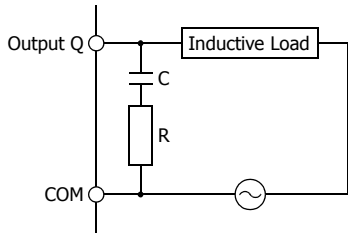
- If output relays or transistors in the SmartAXIS or output modules should fail, outputs may remain on or off. For output signals which may cause heavy accidents, provide a monitor circuit outside the SmartAXIS.
- Connect a fuse to the output module, selecting a fuse appropriate for the load.
- Use proper wires for output wiring.
UL1015 AWG22 or UL1007 AWG18
- When equipment containing the SmartAXIS is intended for use in European countries, insert an IEC 60127-approved fuse to each output of every module for protection against overload or short-circuit. This is required when equipment containing the SmartAXIS is destined for Europe.
- When driving an inductive load that emits noise like a magnet or a valve, to reduce noise and protect circuits, use a diode for the output on DC power type models and a surge absorber for the output on AC power type models.
- Turn off the power to the SmartAXIS when wiring input/output terminals.
- Emergency stop and interlocking circuits must be configured outside the SmartAXIS.
- Use the input/output terminals within the SmartAXIS ratings and specifications.
- Tighten mounting screws with torque of 0.5N·m (5 gf·cm).

Output Protection Circuit

When a motor, solenoid, or similar inductive load is connected, the life of the contact is shortened due to the inrush current and counter-electromotive force acting on the load. Set up a protection circuit to prevent this from happening. Choose a protection circuit from A through D shown below, according to the power supply, and connect the protection circuit to the outside of the SmartAXIS.

For protection of the transistor output of the SmartAXIS modules, connect protection circuit C shown below to the transistor output circuit.

Protection Circuit A

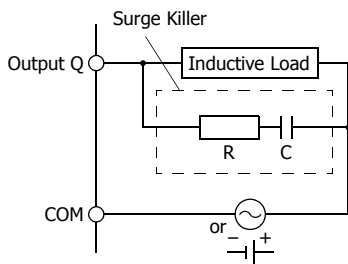


This protection circuit can be used when the load impedance is smaller than the RC impedance in an AC load power circuit.

R: Resistor of approximately the same resistance value as the load

C: 0.1 to 1 μ F

Protection Circuit B

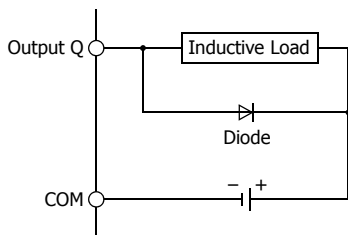


This protection circuit can be used for both AC and DC load power circuits.

R: Resistor of approximately the same resistance value as the load

C: 0.1 to 1 μ F

Protection Circuit C



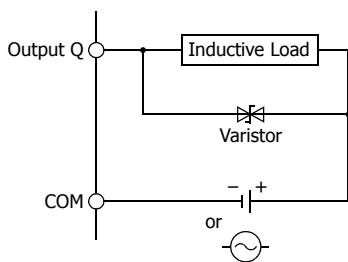
This protection circuit can be used for DC load power circuits.

Use a diode with the following ratings.

Reverse withstand voltage: Power voltage of the load circuit \times 10

Forward current: More than the load current

Protection Circuit D



This protection circuit can be used for both AC and DC load power circuits.

Power Supply

This section describes how to connect a power supply to the SmartAXIS. The SmartAXIS is available in both AC and DC power types.



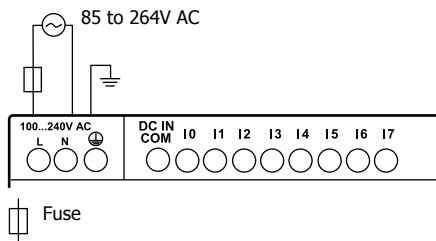
Caution

- Use a power supply of the rated value. Use of the wrong power supply may cause fire or malfunction.
- Ensure that the power voltage to the SmartAXIS does not exceed the allowable power voltage range described in the power supply specifications. The SmartAXIS may run and stop repeatedly within this voltage range, particularly if the power voltage turns on or off very slowly.
- Use an IEC 60127-approved fuse on the power line outside the SmartAXIS. This is required when equipment containing the SmartAXIS is destined for Europe.

AC Power Type

Connect the power supply to the AC power types, as shown below.

Example: **FT1A-*12**C**



When Power Is Turned Off

The AC power types detect a power failure when the power voltage drops below 85V AC.

A momentary power interruption of 10ms or less is not recognized as a power failure when the power voltage is at the rated voltage.

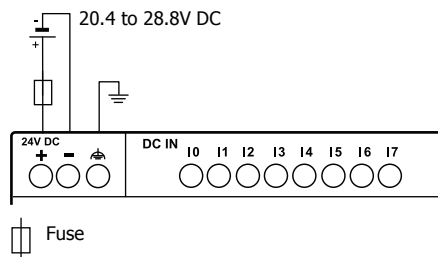
Inrush Current at Powerup

When the SmartAXIS is powered up, there is an inrush current of a maximum of 35A flows. Use a power supply with sufficient capacity.

DC Power Type

Connect the power supply to the DC power types as shown below.

Example: **FT1A-*12**A**



When Power Is Turned Off

The DC power types detect a power failure when the power voltage drops below 20.4V DC.



A momentary power interruption of 10ms or less is not recognized as a power failure when the power voltage is at the rated voltage.

Inrush Current at Powerup

When the SmartAXIS is powered up, there is an inrush current of a maximum of 30A flows. Use a power supply with sufficient capacity.

Power Supply Wiring

When connecting the power supply, be sure to take care of the following:

- Use a stranded wire of UL1015 AWG22 or UL1007 AWG18 for power supply wiring. Make the power supply wiring as short as possible.
- Run the power supply wiring as far away as possible from motor lines.
-  is the protective ground terminal. To prevent electric shocks, ground the terminal with D-type ground (type 3: ground resistance of 100Ω maximum).
-  is the functional ground terminal. To prevent malfunction or breakdown of the SmartAXIS due to noise, ground the terminal with D-type ground (class 3: ground resistance of 100Ω maximum).
- When connecting a stranded wire or multiple wires to a terminal block, use a ferrule.

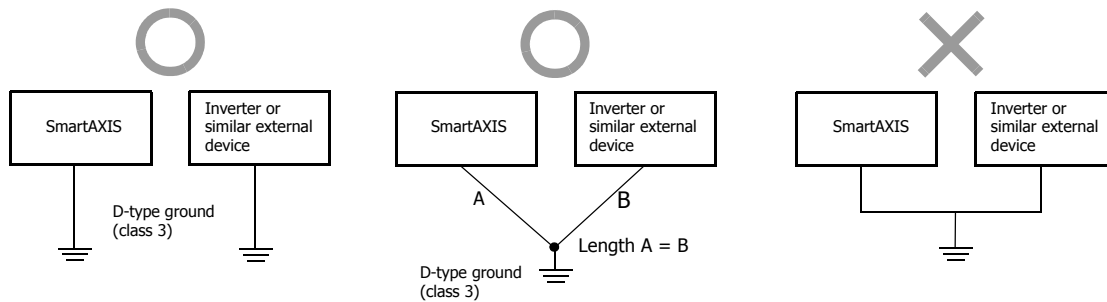
Caution

- Use the SmartAXIS within the specifications of ratings and environmental conditions. Failure to do so may cause the SmartAXIS to break down or reduce product life.
- Be sure to connect the grounding wire to a proper ground, otherwise electrical shocks may be caused.
- Do not touch live terminals, otherwise electrical shocks may be caused.
- When connecting the power supply, tighten the terminal screws with torque of 0.5N·m (5kgf·cm).

Grounding

When grounding the power supply, be sure to take care of the following:


- Do not use the common ground for the SmartAXIS and motor equipment. The common ground can be used only when the length of grounding wires for those devices are the same.
- Use a ground wire of UL1007 AWG16.
- Use a thick wire for grounding the SmartAXIS and make the grounding wire as short as possible to make sure that noises from external devices can be conducted to the ground effectively.
- As shown below, external devices generating noise must be separated from the SmartAXIS and grounded with the D-type ground (class 3).
- Make the length of the grounding wire for the SmartAXIS as short as possible.



Terminal Connection

This section describes types of terminals and how to use them.

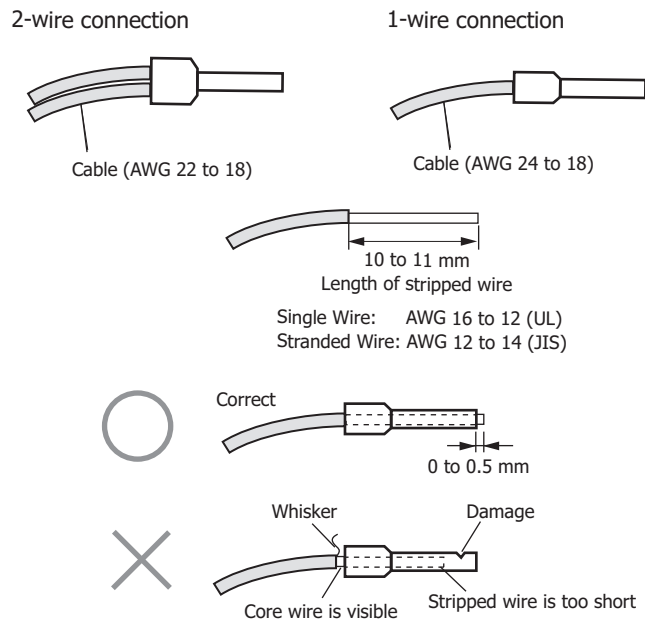
When connecting stranded wire or multiple solid wires to a terminal block, use appropriate ferrule for the terminal block.

 Caution	<ul style="list-style-type: none"> Do not touch live terminals, otherwise electrical shocks may be caused. When the power is on, terminals to which external devices are connected may be heated. Do not touch terminals immediately after the power is turned off. Do not touch terminals immediately after the power is turned off, otherwise electrical shocks may be caused. When connecting a stranded wire or multiple solid wires to a screw terminal block, use a ferrule. Otherwise the wire may slip off the screw terminal block. When using ferrules, insert a wire to the bottom of the ferrule and crimp the ferrule.
--	--

Terminals for Terminal Blocks

Crimp ferrules using an appropriate tool according to the size of ferrules. Cut the end of the wire to the same length or about 0.5 mm longer than the ferrule.

Ensure that the core wire does not protrude at the end of the shield and there are no whiskers.



Ferrules

The ferrules and crimping tools below can be used.

Type numbers of the ferrules and crimping tool are the type numbers of Phoenix Contact.

Ferrule Order No.

Quantity of Cables	Cable Size	Phoenix Type	Order No.	Pcs./Pkt.
For 1-wire connection	UL1007 AWG16	AI 1,5-8 BK	32 00 04 3	100
	UL1007 AWG18	AI 1-8 RD	32 00 03 0	100
	UL1015 AWG22	AI 0,5-8 WH	32 00 01 4	100
	UL2464 AWG24	AI 0,25-8 YE	32 03 03 7	100
For 2-wire connection	UL1007 AWG18	AI-TWIN 2 x 0,75-8 GY	32 00 80 7	100
	UL1015 AWG22	AI-TWIN 2 x 0,5-8 WH	32 00 93 3	100

Crimping Tool Order No.

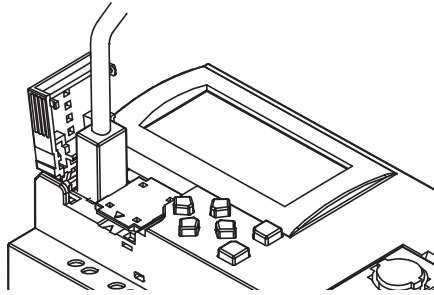
Tool Name	Phoenix Type	Order No.	Pcs./Pkt.
Crimping Tool	CRIMPFOX ZA 3	12 01 88 2	1

Securing USB Extension Cable Using Cable Tie

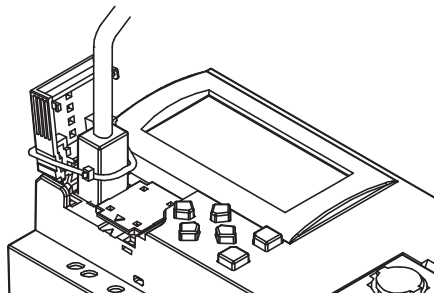
Using a USB extension cable (Note 1) makes it possible to access a SmartAXIS installed in a control cabinet from the surface of the cabinet. When using a USB extension cable, it is recommended that the extension cable is secured to the USB port cover using a cable tie (Note 2) so that the USB extension cable does not come loose from the SmartAXIS.

This section describes the procedure to secure the USB extension cable to the USB cover.

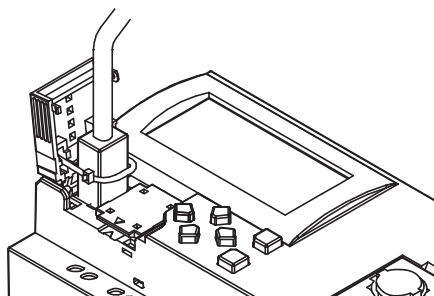
1. Open the USB port cover and insert a USB extension cable into the USB port.



2. Pass a cable tie around the USB port cover and the USB extension cable, taking care to route the cable tie through the notches on the USB cover.



3. The cable tie can also be inserted through the holes on the USB port cover.



4. Tighten the loop until it is the suitable size and trim the excess cable tie using wire cutters.

Note 1: IDEC USB extension cable for USB Mini-B (HG9Z-XCE21) is recommended.

Note 2: HellermanTyton cable tie T18R-1000 is recommended.

4: OPERATION BASICS

Introduction

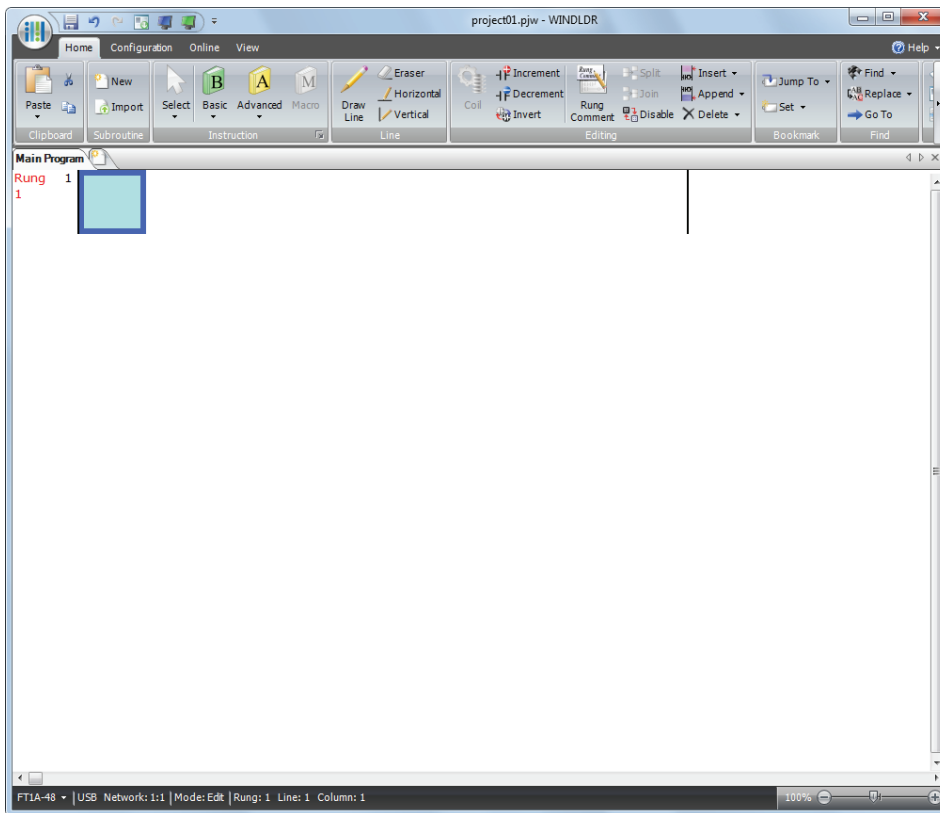
This chapter describes basic procedures for operating WindLDR, software required for programming and maintenance of the SmartAXIS Pro/Lite series.

Note: SmartAXIS Touch series use WindO/I-NV3 software for programming. See the "SmartAXIS Touch User's Manual" for instructions for programming and basic operation of WindO/I-NV3 with the Touch series.

Start WindLDR

From the Start menu of Windows, select **Programs > Automation Organizer > WindLDR > WindLDR**.

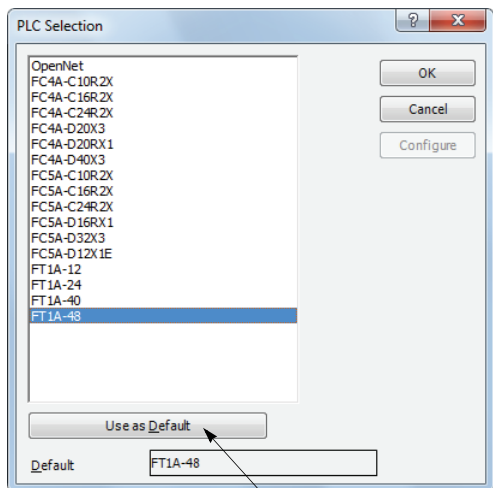
WindLDR starts and a blank ladder editing screen appears with menus and tool bars shown on top of the screen.



PLC Selection

Before programming a user program on WindLDR, select a PLC type.

1. Select **Configuration** from the WindLDR menu bar, then select **PLC Type**.
The PLC Selection dialog box appears.



Press this button, then the same PLC will be selected as default when WindLDR is started next time.

2. Select a PLC type in the selection box.
3. Click **OK**.

PLC Selection Option	SmartAXIS Type No.
FT1A-12	FT1A-H12RA
	FT1A-B12RA
	FT1A-H12RC
	FT1A-B12RC
FT1A-24	FT1A-H24RA
	FT1A-B24RA
	FT1A-H24RC
	FT1A-B24RC
FT1A-40	FT1A-H40RKA
	FT1A-H40RSA
	FT1A-B40RKA
	FT1A-B40RSA
	FT1A-H40RC
FT1A-48	FT1A-B40RC
	FT1A-H48KA
	FT1A-H48SA
	FT1A-B48KA
	FT1A-B48SA
	FT1A-H48KC
FT1A-H48SC	
	FT1A-B48KC
	FT1A-B48SC

Create Ladder Program

This section describes the procedure for creating a simple ladder program in WindLDR.

Note: See SmartAXIS Ladder Programming Manual for details on basic and advanced instructions.

Sample User Program

Create a simple program using WindLDR. The sample program performs the following operation:

When only input I0 is turned on, output Q0 is turned on.

When only input I1 is turned on, output Q1 is turned on.

When both inputs I0 and I1 are turned on, output Q2 flashes in 1-sec increments.

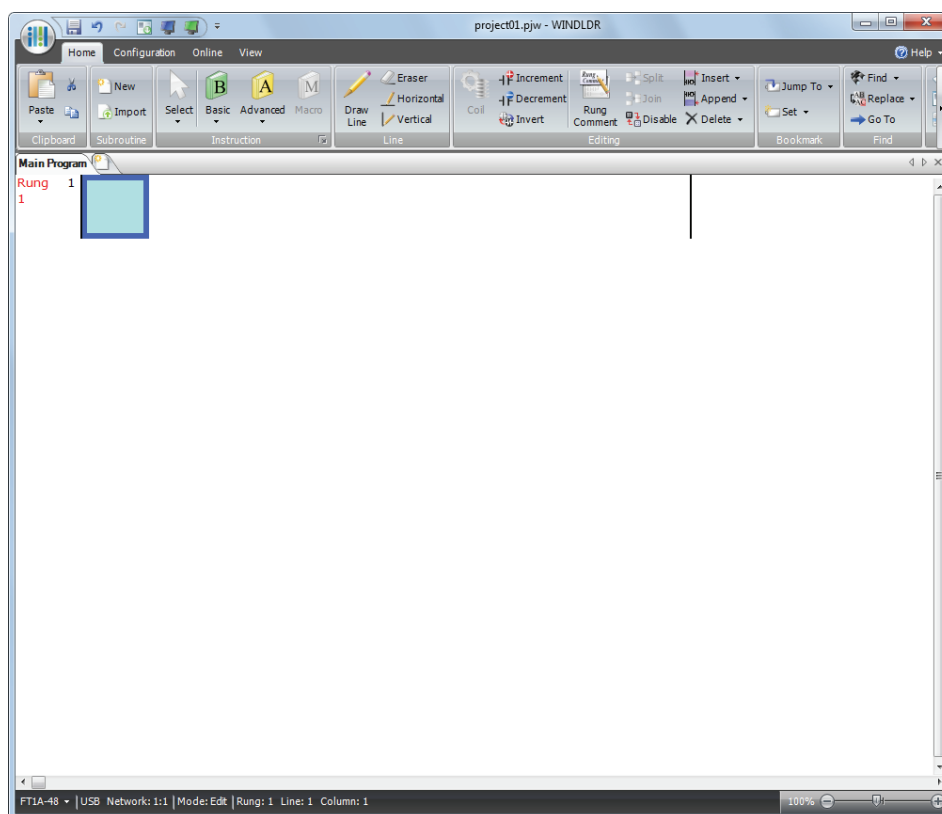
Rung No.	Input I0	Input I1	Output Operation
1	ON	OFF	Output Q0 is turned ON.
2	OFF	ON	Output Q1 is turned ON.
3	ON	ON	Output Q2 flashes in 1-sec increments.

Note: One collection of a group of instructions that control output or advanced instructions is called a rung. WindLDR manages programs in rung units. Function descriptions can be configured as rung comments for individual rungs.

Start WindLDR

From the Start menu of Windows, select **Programs > Automation Organizer > WindLDR > WindLDR**.

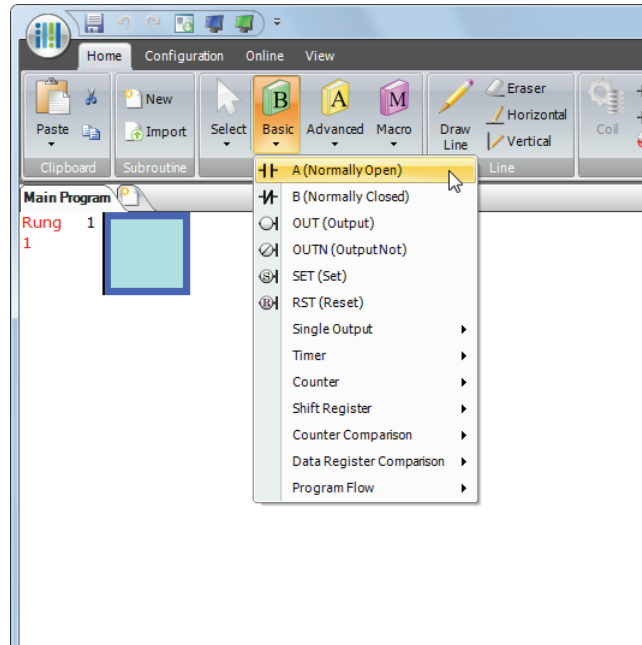
WindLDR starts and a blank ladder editing screen appears with menus and tool bars shown on top of the screen.



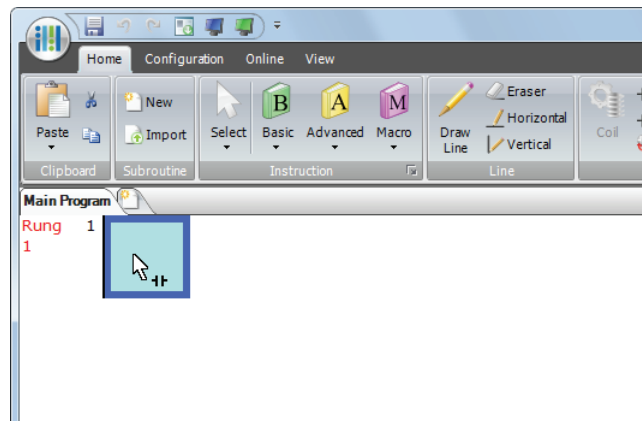
Edit User Program Rung by Rung

Start the user program with the LOD instruction by inserting a NO contact of input I0.

1. From the WindLDR menu bar, select **Home > Basic > A (Normally Open)**.

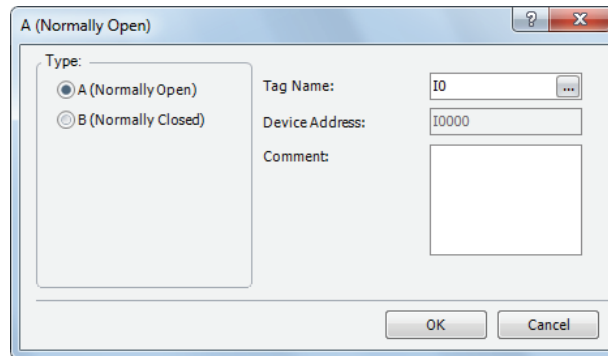


2. Move the mouse pointer to the first column of the first line where you want to insert a NO contact, and click the left mouse button.



Note: Another method to insert a NO (or NC) contact is to move the mouse pointer where you want to insert the contact, and type A (or B). The Normally Open dialog box appears.

- Enter **I0** in the Tag Name field, and click **OK**.



A NO contact of input I0 is programmed in the first column of the first ladder line.

Next, program the ANDN instruction by inserting a NC contact of input I1.

- From the WindLDR menu bar, select **Home > Basic > B (Normally Closed)**.
- Move the mouse pointer to the second column of the first ladder line where you want to insert a NC contact, and click the left mouse button.
The Normally Closed dialog box appears.
- Enter **I1** in the Tag Name field, and click **OK**.

An NC contact of input I1 is programmed in the second column of the first ladder line.

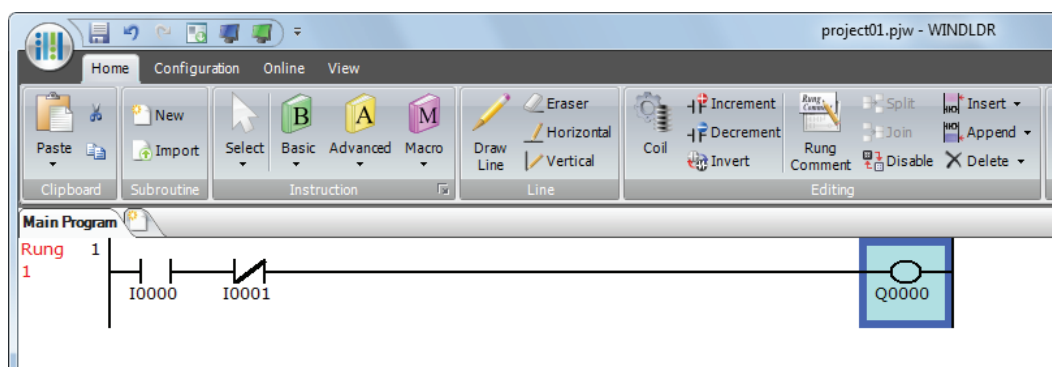
At the end of the first ladder line, program the OUT instruction by inserting a NO coil of output Q0.

- From the WindLDR menu bar, select **Home > Basic > OUT (Output)**.
- Move the mouse pointer to the third column of the first ladder line where you want to insert an output coil, and click the left mouse button.

Note: Another method to insert an instruction (either basic or advanced) is to type the instruction symbol, OUT, where you want to insert the instruction.

The Output dialog box appears.

- Enter **Q0** in the Tag Name field, and click **OK**.
A NO output coil of output Q0 is programmed in the right-most column of the first ladder line. This completes programming for rung 1.

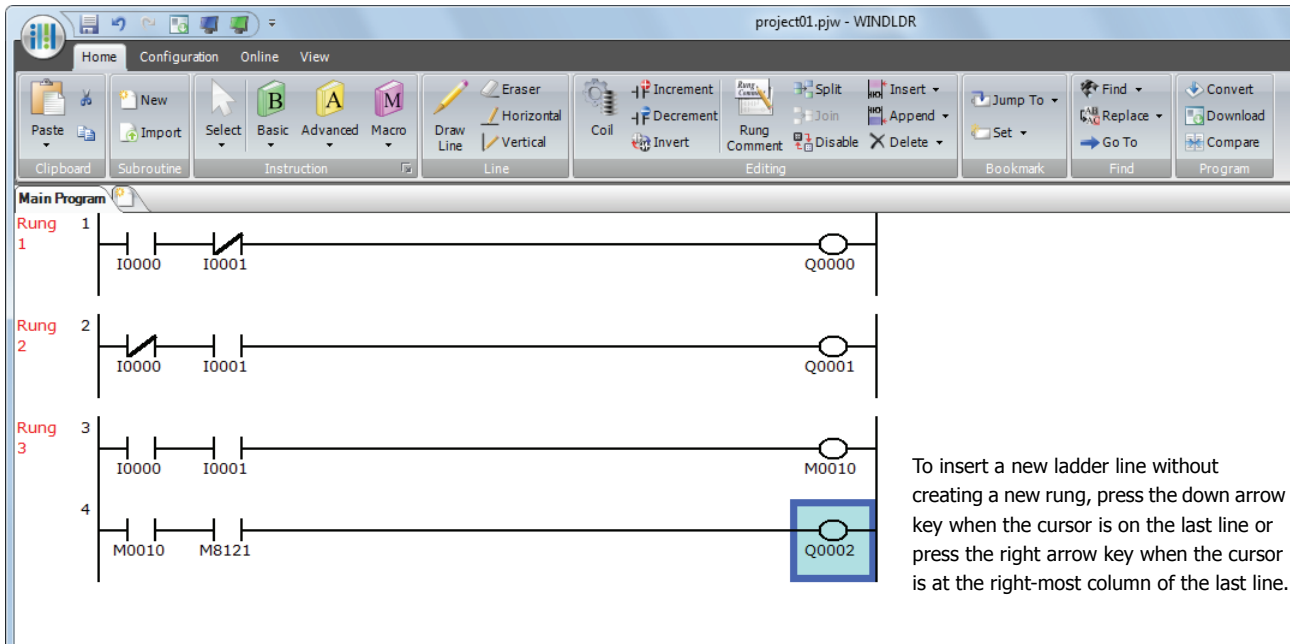


Continue programming for rungs 2 and 3 by repeating similar procedures.

A new rung is inserted by pressing the **Enter** key while the cursor is on the preceding rung. A new rung can also be inserted by selecting **Home > Append > Append a Rung**.

4: OPERATION BASICS

When completed, the ladder program looks like below.



The ladder program can be checked whether it contains any user program syntax error.

10. From the menu bar, select **Home > Convert (above Program)**.

When the instruction symbols are connected correctly, conversion is completed successfully. If any error is found, the errors are listed on the screen. Then, make corrections as necessary.

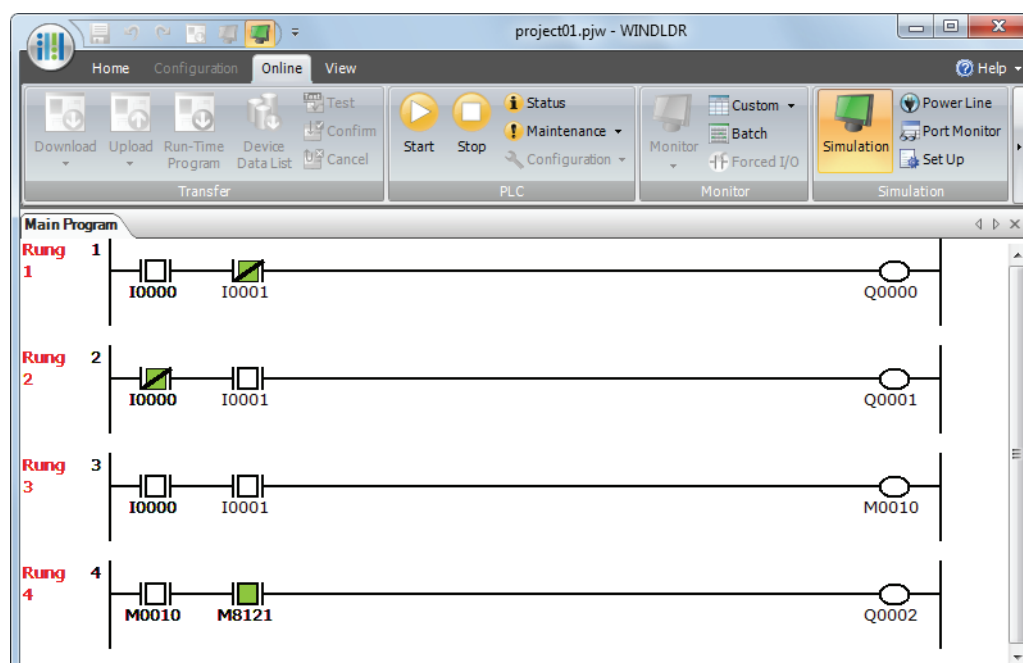
Now, save the file with a new name.

Save Project

1. Select the WindLDR application button at the upper-left corner of the WindLDR screen, followed by **Save**, and type **TEST01** in the File Name field. Change the Folder or Drive as necessary.

Simulate Operation

Before downloading the user program, you can simulate the operation on the WindLDR screen without connecting the SmartAXIS. From the WindLDR menu bar, select **Online > Simulation**. The Simulation screen appears.



To change an input status, place the mouse pointer on the input and right-click the mouse. In the pop-up menu, select Set or Reset to set or reset the input.

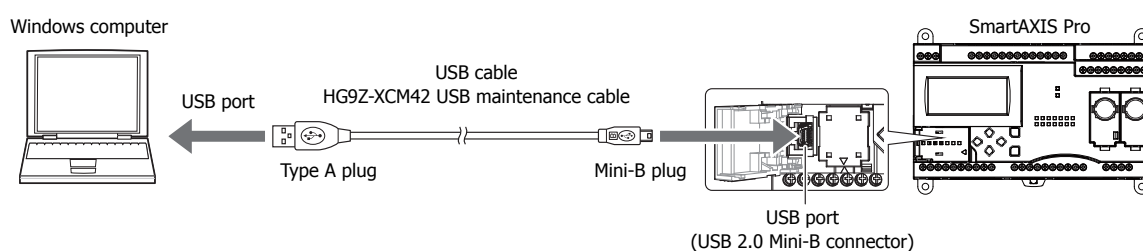
To quit simulation, from the WindLDR menu bar, select **Online > Simulation**.

Download Program

While WindLDR is running on a PLC, you can download the user program to the SmartAXIS.

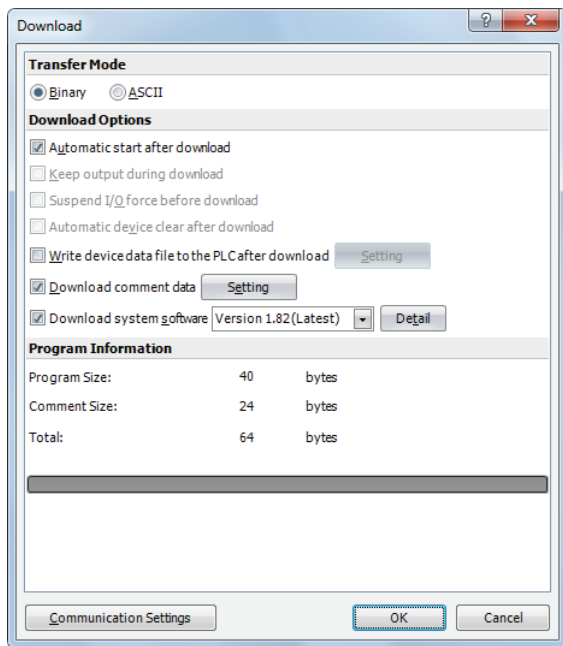
User programs can be downloaded to the SmartAXIS from WindLDR using USB or Ethernet. This section describes the all the procedures from configuring communication settings to downloading a user program to the SmartAXIS via USB.

To use a USB, the SmartAXIS USB port must be connected to a computer using a USB cable.



Note: In order for WindLDR to communicate with the SmartAXIS via USB, a dedicated USB driver must be installed on the computer. See "USB Driver Installation Procedure" on page A-5.

1. From the WindLDR menu bar, select **Online > Set Up**.
2. The Communication Settings dialog box appears. Click the **USB** tab and then click **OK**. The communication method is now set to USB. Next, download a user program.
3. From the WindLDR menu bar, select **Online > Download**. The Download dialog box appears, then click **OK**. The user program is downloaded to the SmartAXIS.



Note: The Download dialog box can also be opened by selecting **Home > Download**.

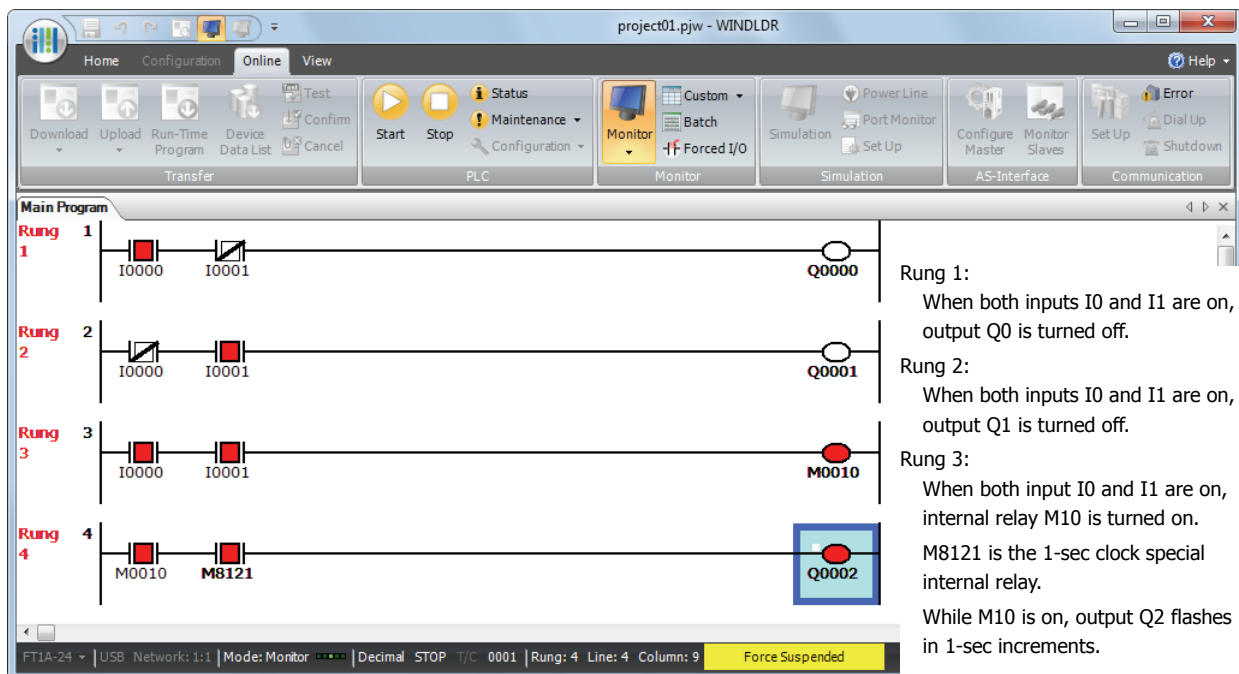
Note: When downloading a user program, all values and selections in the Function Area Settings are also downloaded to the SmartAXIS. For details on function settings, see "Special Functions" on page 5-1.

Monitor Operation

Another powerful function of WindLDR is to monitor the PLC operation on the computer. The input and output statuses of the sample program can be monitored in the ladder diagram.

From the WindLDR menu bar, select **Online > Monitor > Monitor**.

When both inputs I0 and I1 are on, the ladder diagram on the monitor screen looks as follows:



Exit WindLDR

When you have completed monitoring, you can exit WindLDR either directly from the monitor screen or from the editing screen. In both cases, from the WindLDR application button, click **Exit WindLDR**.

Start/Stop Operation

This section describes operations to start and stop the SmartAXIS and to use the stop and reset inputs.

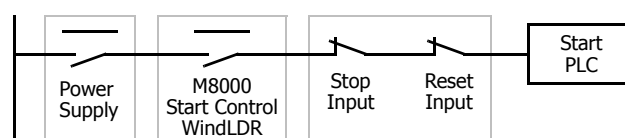


Caution

- Make sure of safety before starting and stopping the SmartAXIS. Incorrect operation of the SmartAXIS may cause machine damage or accidents.

Start/Stop Schematic

The start/stop circuit of the SmartAXIS consists of three blocks; power supply, M8000 (start control special internal relay), and stop/reset inputs. Each block can be used to start and stop the SmartAXIS while the other two blocks are set to run the SmartAXIS.



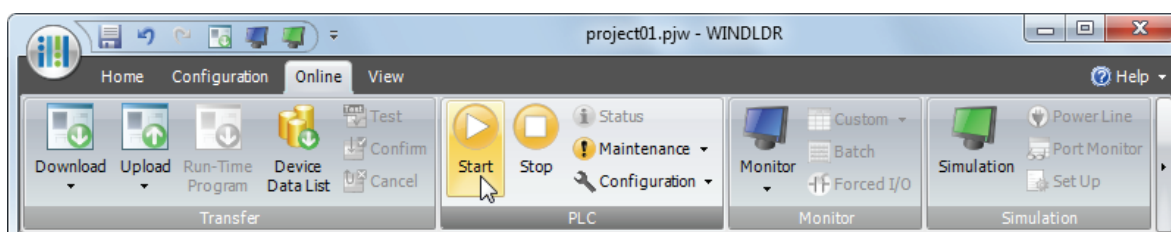
Start/Stop Operation Using WindLDR

The SmartAXIS can be started and stopped using WindLDR run on a Windows computer connected to the SmartAXIS. When the **Start** button is pressed in the menu bar shown below, start control special internal relay M8000 is turned on to start the SmartAXIS. When the **Stop** button is pressed, M8000 is turned off to stop the SmartAXIS.

1. Connect the computer to the SmartAXIS, start WindLDR, and power up the SmartAXIS.
2. Check that a stop input is not designated using **Configuration > Run/Stop Control > Stop and Reset Inputs**. See "Stop Input and Reset Input" on page 5-4.

Note: When a stop input is designated, the SmartAXIS cannot be started or stopped by turning start control special internal relay M8000 on or off.

3. Select **Online** from the WindLDR menu bar.
The Online tab appears.



4. Click the **Start** button to start operation, then the start control special internal relay M8000 is turned on.
5. Click the **Stop** button to stop operation, then the start control special internal relay M8000 is turned off.
The PLC operation can also be started and stopped while WindLDR is in the monitor mode. Select **Online > Monitor > Monitor** and click the **Start** or **Stop** button.

Note: Special internal relay M8000 is a keep type internal relay and stores the status when power is turned off. M8000 retains its previous status when power is turned on again. However, when the backup battery is dead, M8000 loses the stored status, and can be turned on or off as programmed when the SmartAXIS is powered up. The selection is made in **Configuration > Run/Stop Control > Run/Stop Selection at Memory Backup Error**. See "Run/Stop Selection at Memory Backup Error" on page 5-5.

The backup duration is approximately 30 days (typical) at 25°C after the backup battery is fully charged.

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Start/Stop Operation Using the Power Supply

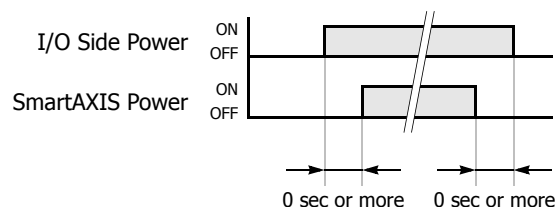
The SmartAXIS can be started and stopped by turning power on and off.

1. Power up the SmartAXIS to start operation.
2. Turn power on and off to start and stop operation.

Order of Powerup and Powerdown

To turn the power on, turn on the SmartAXIS and I/O sides at the same time, or turn on the I/O side first, followed by the SmartAXIS side.

To turn the power off, turn off the SmartAXIS and I/O sides at the same time, or turn off the SmartAXIS side first, followed by the I/O side.



Start/Stop Operation Using Stop Input and Reset Input

Any input terminal available on the SmartAXIS can be designated as a stop or reset input using the Function Area Settings. The procedure for selecting stop and reset inputs is described "Stop Input and Reset Input" on page 5-4.

Note: When using a stop and/or reset input to start and stop operation, make sure that start control special internal relay M8000 is on. If M8000 is off, the SmartAXIS does not start operation when the stop or reset input is turned off. M8000 is not turned on or off when the stop and/or reset input is turned on or off.

When a stop or reset input is turned on during program operation, the SmartAXIS stops operation, and all outputs are turned off. The reset input has priority over the stop input.

System Statuses at Stop, Reset, and Restart

The system statuses during running, stop, reset, and restart after stopping are listed below:

Mode	Output	Internal Relay, Shift Register, Counter, Data Register		Special Internal Relay	Special Data Register	Non-Maintained Data Register	Timer Current Value
		Keep Type	Clear Type				
Run	Operating	Operating	Operating	Operating	Operating	Operating	Operating
Stop	OFF	Unchanged	Unchanged	See Chapter 7	Unchanged	Unchanged	Unchanged
Restart	Unchanged	Unchanged	OFF/ Reset to zero	Unchanged	Unchanged	Unchanged	Reset to preset
Reset (Reset input ON)	OFF	OFF/ Reset to zero	OFF/ Reset to zero	Unchanged	Unchanged	OFF/ Reset to zero	Reset to zero
Power OFF	OFF	Unchanged	Unchanged	See Chapter 7	Unchanged	OFF/ Reset to zero	Reset to zero