SANM*O*TION

MOTION CONTROLLER

C

SMC200-A，SMC200-B

Motion Controller

Hardware Manual

SANYO DENKI

1 Preface

1.1 Introduction

Thank you for purchasing the SANMOTION C motion control "SMC 200" series. This manual "Motion controller SMC200-A/SMC200-B" (hereinafter referred to as controller) describes the specifications, installation, wiring, and maintenance policy including the important matters that must be aware of when using this product to protect customers' safety. Before using the product, please read the instruction manual and related documentations carefully and make sure to fully understand the function and performance to use it properly.

The Products presented in this manual are meant to be used for general industrial applications. Therefore, the following equipment and systems for special applications are excluded.

- The medical devices and other equipment affecting people's lives.

- The devices that have significant effects on society and the public.

- The products in an environment with vibration, such as in a car or ship.

- The special applications related to aviation and space, nuclear power, electric power, submarine repeaters.

However, even in the above-mentioned applications, we may allow products to be applied on conditions for such cases that limited specific usage or require no special quality (Quality no beyond general specification etc.). Please contact us beforehand.

- CODESYS® is a registered trademark of 3S-Smart Software Solutions GmbH.

- Ethernet is a registered trademark of FUJIFILM Business Innovation Corp.

- 1-wire is a registered trademark of Analog Devices, Inc.

- EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.2 Precautions related to these Instructions

To fully understand the functions and the performance of this product, please read this instruction manual thoroughly before using the product. After thoroughly reading the manual, keep it handy for reference. When the owner or user of the product takes over, give this manual that must be delivered to the end user.

Although the manufacturer has taken all possible measures to ensure the veracity of the contents of this manual, should you notice any error or omission, please notify nearest branch office or head office written in back cover.

This document may not be copied, reproduced, or redistributed in whole or part without permission.

Carefully and completely follow the safety instructions in this manual. Note that safety is not guaranteed for usage methods other than those described in this manual or those methods intended for the original product.

Actual product may differ from the illustration or display window in this manual.
The contents of this manual may be modified without prior notice as revisions or additions are created regarding the usage method of the product. Modifications are performed as per the revisions of this manual.

1.3 Documentation for further reading

The controller SMC200-A / B is designed with various interfaces for configuring systems by combining necessary peripheral devices according to your functional requirements. For the details of the function, please refer to the instruction manual of the software as well.

No.	Title
M0020965	SMC200-A, SMC200-B Motion Controller Software manual
M0020996	SMC-USBW-01 Wireless adapter 3A Instruction Manual Combination with S200 series

2 Safety notes

2.1 Representation

The following symbols are used to indicate precautionary warnings regarding possible hazards in this instruction manual. The meaning of each symbol is as follows.

DANGER!

- indicates an imminently hazardous situation which will result in death or serious bodily injury if the corresponding precautions are not taken.

WARNING!

- indicates a potentially hazardous situation which can result in death or serious bodily injury if the corresponding precautions are not taken.

CAUTION!

- means that if the corresponding safety measures are not taken, a potentially hazardous situation can occur that may result in property injury or slight bodily injury.

CAUTION

- CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

- This symbol reminds you of the possible consequences of touching electrostatically sensitive components.

2.2 General safety instructions

Before using the product, please carefully read this manual and the related instruction manual, handle the product properly with paying attention to your safety.

⚠️ **WARNING !**

The following precautions must be taken when using this product to reduce the risk of electric shock and injury.

- Do not use in areas where there is a risk of explosion or fire

- Do not carry out operations such as transportation, installation, wiring, maintenance, inspection in energized state. Always work with the power cut off.

- Ground the control panel with a wire of 100 ohm or less to strengthen the noise resistance of the functional grounding terminal.

- Never touch the inside of the product.

- Do not damage the wiring cables, apply excessive stress, place heavy objects, or pinch them.

- Never touch the rotating parts of the servomotor during operation.

- Set up a safety circuit externally so that the entire system works on the safety side in case of product malfunction or failure.

- This product is classified as "Open equipment" in EN 61131-2. Please install that in the control panel.

- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be configured in external control circuits.

2.3 Safety instructions for personal safety

Since there is a risk of electric shock or fire, be sure to observe the following.

⚠️ **WARNING !**

- The power supply must use SELV/LIM or SELV/Class 2 specification power supply.

  According to UL 61010-2-201 standard, SELV is a circuit defined that with no risk of electric shock, and LIM is a circuit with no risk of fire.

  Class 2 is the standard for "Power supply whose output current and output voltage are both limited to a certain level" and its detailed conditions are specified in UL 1310.

2.4 Safety instructions for device maintenance

WARNING !

- Do not continue to use the product when it fails. The device must be taken out of commission and repaired or replaced by qualified personnel.

Cautions on storage !

Do not store the product in the following environment. Operation may stop or malfunction.

- Environment exposed to direct sunlight.
- Environment where the ambient temperature and relative humidity exceeds the range of specification values.
- Environment with rapid changes in humidity that causes condensation.
- Environment with corrosive gas, a flammable gas.
- Environment with a large amount of dust, salt, and iron powder.
- Environment with splashing of the water, oil, and chemicals.
- Environment where direct vibration or shock is applied to the module.

3 Hardware overview

The SMC200-A/B controller can be used in a wide variety of industrial equipment applications.

It comes standard with various interfaces for configuring systems by combining necessary peripheral devices according to your functional requirements.

3.1 Front view

No.	Name
1	Diagnostic display (7 segment LED)
2	MicroSD slot
3	USB port (Type A)
4	USB port (Mini B)
5	Serial Interface (1-Wire, RS485A)
6	ETHERNET Interface
7	EtherCAT Interface
8	Status LED
9	Control button
10	I/O display change-over switch
11	I/O Connector
12	DIN rail lock (Unlocked state Fig. 3-1)
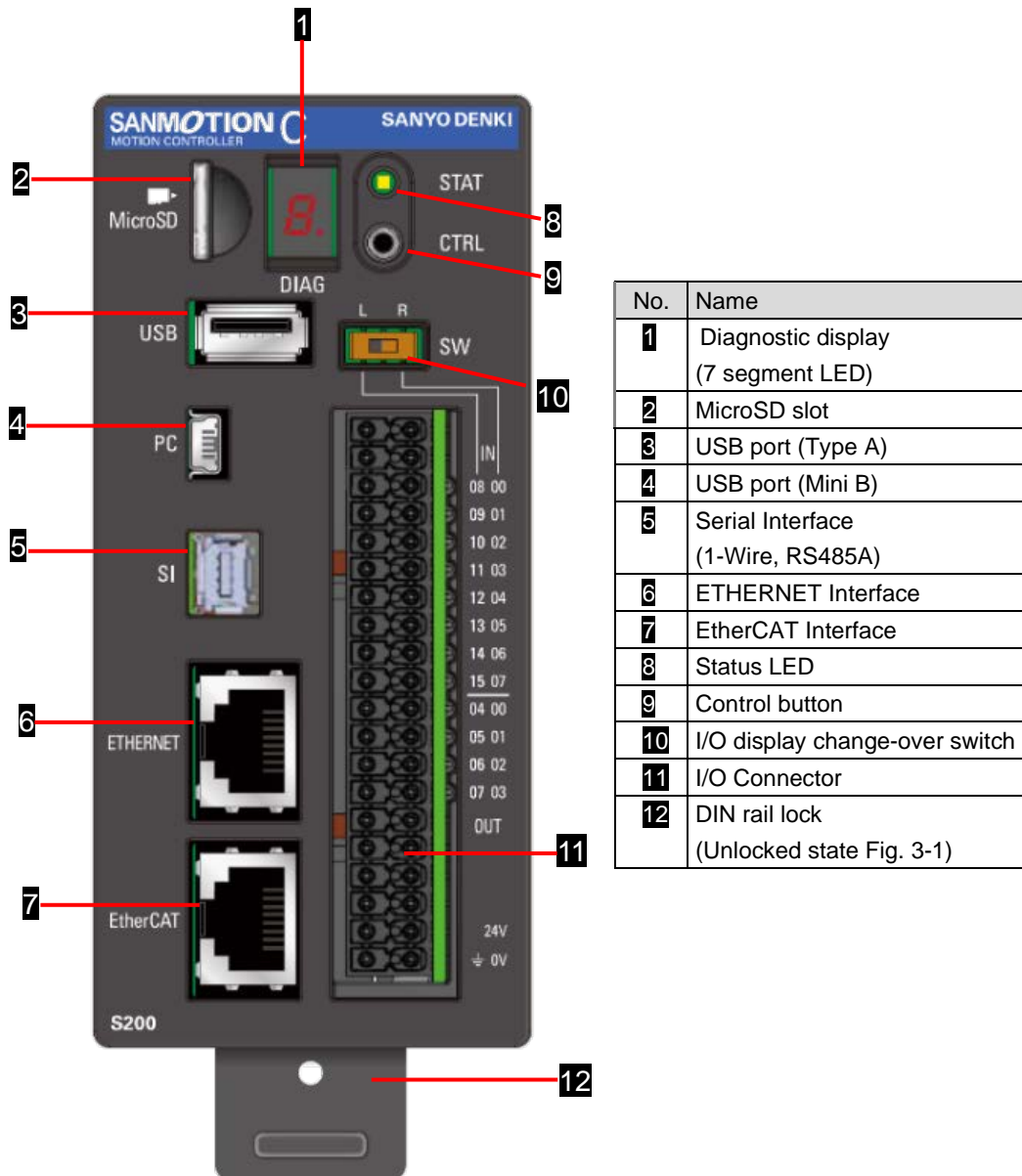
Fig 3.1: S200 Front view

3.2 Nameplate

The S200 has the nameplate on the left side when viewed from the front.

No.	Name
1	Product model number
2	Input voltage range / Rated current
3	serial number + revision [☆☆□□△△○○○○ B] 10 digits number + alphabet ・☆☆： manufacturing month (01, 02···12) ・□□： last two digits of the year ・△△： Production date (01~31) ・○○○○： serial number ・Alphabet: product revision 　　　　(A is not listed)
4	CE mark
5	UKCA mark
6	Company information
7	Precautions for use
8	QR code ・When read, [Product model number//Serial number + Revision] is displayed.
9	KC mark
10	UL mark
11	Company website URL

Fig 3.2: S200 nameplate drawing

3.3 Accessories

3.3.1 Power and I/O connector

The following connectors can be used for the controller's Power and I/O connector. Wiring connector is not included in the product. Please be prepared separately with reference to the following tables.

Connector	Sanyo Denki Model No.	Fenix contact Model No.
Power and I/O connector	AL-01174555-01 ※1	DFMC 1,5/20-ST-3,5 ※1
	AL-01174555-02 ※2	

※1   Without printed Number of the pin assignments
※2   With printed Number of the pin assignments

3.3.2 Serial, 1-Wire interface connector

The following plugs can be used for the serial and 1-Wire interface connectors. A wiring connector is not attached to the product. Please prepare separately.

Name	manufacturer	Manufacturer model number
Industrial Mini I/O Connectors	TE Connectivity	2040008-2

For technical data of the plugs used, please refer to the manufacturer's technical data sheet.

The following options are available. When ordering from us, please specify the Sanyo Denki model number below.

Sanyo Denki Model No.	quantity	Manufacturer model number
AL-01139898-03	1 piece	2040008-2 (manufactured by TE Connectivity)

3.3.3 Cable with Industrial Mini I/O Plug

A cable with an industrial mini I/O plug assembled on one side is available. When ordering from us, please specify the Sanyo Denki model number below.

Name	Length	Sanyo Denki Model No.
Cable with industrial mini I/O plug for RS-485, 1-Wire	3m	AL-01119298-03
	5m	AL-01119298-05
	10m	AL-01119298-10

- When using a commercially available product, refer to the cable type and plug type described in "6.4 Serial Interface (SI)".
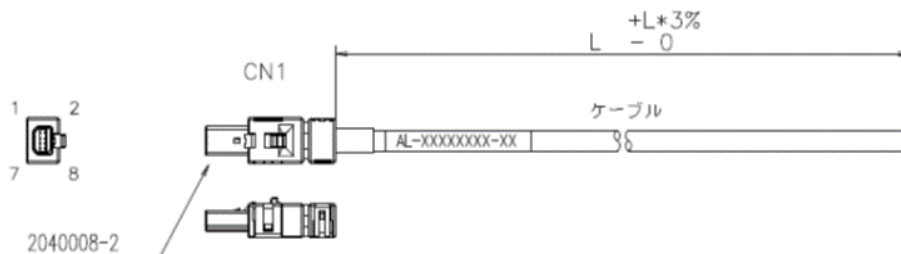
CN1 pin number	line color
1	green/pair 1
2	white/pair 1
3	blue/pair 2
4	yellow/pair 3
5	brown/pair 3
6	ash/pair 2
7	red/pair 4
8	black/pair 4
shield cover	aluminum tape/drain wire

Fig 3.3: Cable with Industrial Mini I/O Plug

3.3.4 Cable with RJ45 plug for ETHERNET/EtherCAT

A cable with RJ-45 plugs assembled on both ends of the cable is available. When ordering from us, please specify the Sanyo Denki model number below.

Name	Length	Sanyo Denki Model No.
Cable with RJ45 plug for ETHERNET Boot color: yellow	1m	AL-01111556-01
	3m	AL-01111556-03
	5m	AL-01111556-05
	10m	AL-01111556-10
Cable with RJ45 plug for EtherCAT Boot color: black	0.5m	AL-01109322-R50
	1m	AL-01109322-01
	3m	AL-01109322-03
	5m	AL-01109322-05
	10m	AL-01109322-10

When using commercially available products, refer to the cable types and plug types described in "6.5 ETHERNET Interface and EtherCAT Interface".
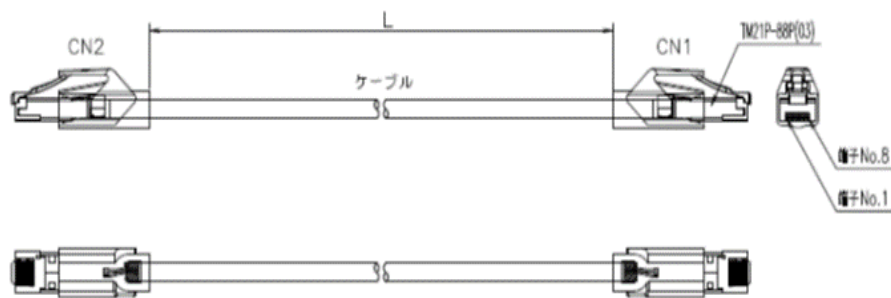
CN1/CN2 pin number	line color
1	white/orange
2	orange
3	white/green
4	blue
5	white/blue
6	green
7	white/brown
8	brown
shield cover	Shielded wire

Fig 3.4: Cable with RJ45 plug for ETHERNET/EtherCAT

4　Displays and Control button

4.1　Diagnostic display (DIAG)

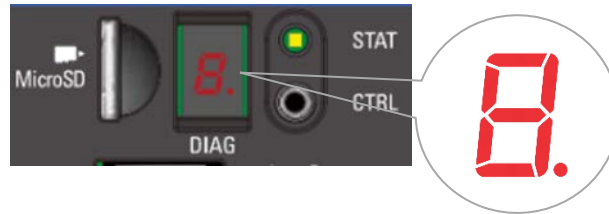A seven-segment LED is on the front of the device showing status at startup and operation.

Fig 4.1:　Diagnostic display with control button and status LED

The diagnostic display (DIAG) indicates as follows.

- At startup, denote the progress such as 1...2...3...as the system status.

- Displays operating status by characters such as ☐, I I, after start-up.

- Blinking of dots indicate access to ROM.

- If an error occurs, the error code is displayed

- An error is displayed with a combination of error status (E), hyphen (-), and 3-digit error information. (For example, "E, -, 0, 0, 1"). Each letter is displayed for 0.5 seconds each.

- Refer to "8　Diagnosis Display" for the details of that.

4.2　Status LED（STAT）

The status LED is on the right side of the diagnostic display (7 segment LED). The status LED shows the status at startup and operation as well as 7-segment LED.

Refer to "8　Diagnosis Display" for the details of that.

4.3　Control button（CTRL）

The control button is on the right side of the diagnostic display (7 segment LED) below Status LED. By operating the control button (CTRL), operating status can be switched or commands can be executed.

Refer to "8.3　Command switching between operating states (Control button operation)" for the detail of that.

4.4 ETHERNET / EtherCAT Status LEDs

The ETHERNET/EtherCAT connector (RJ-45) has an activity LED and a link status LED. The contents of the LED display are shown below.

Display	Meaning
Activity LED(Orange）	Blinking: Indicates sending or receiving data
Link status LED (Green)	Lighting up: Indicates that the link is established

5 Installation of the controller

5.1 DIN rail

The controller should be hooked at the DIN rail TS 35 × 7.5 that must be installed horizontal direction to the ground. The interval between the screws to attach the DIN rail should be approximately 40 to 50 mm as shown below. Customers should purchase DIN rail separately. ※ 5.1.
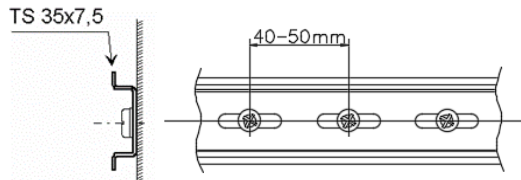
※5.1.···Depending on a prepared DIN rail, rattling may occur on the controller after installing.

Fig 5.1: Interval diagram of screw when attaching DIN rail TS 35 x 7.5
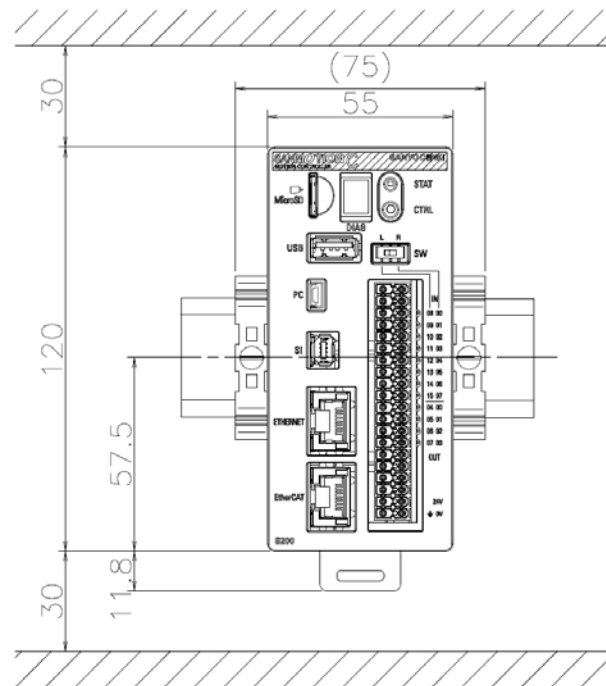
5.2 Space requirements

Fig 5.2: Installation completed

CAUTION

• At least 30mm of space for air circulation is required for above and below of the controller unit.

• When installing other modules or peripheral equipment to the DIN rail, please consider enough space to allow for their use before mounting.

5.3 Installing the controller

CAUTION

- The DIN rail must be mounted in the horizontal direction to the ground.

- To avoid heat accumulation, the front side of the controller must be straightly aligned with the DIN rail and directed ahead, the ventilation hole on the top board should be facing the ceiling, and the ventilation holes of the bottom side face toward the ground. (See Figure 5.3)
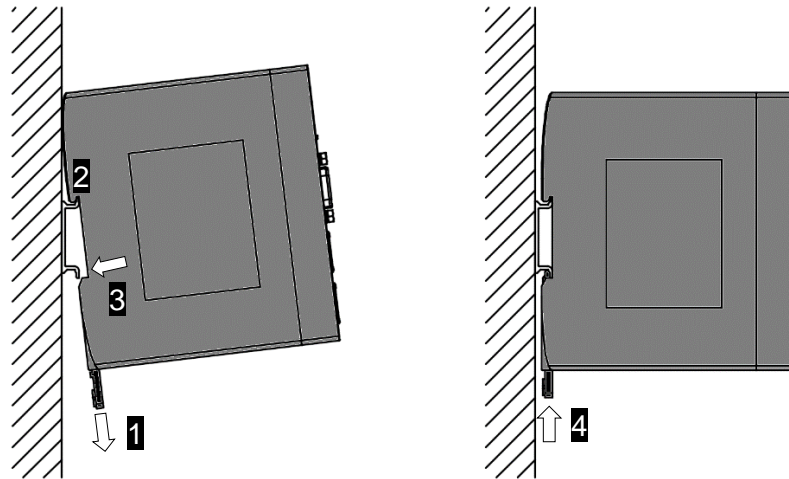
Fig 5.3: Orientation and order for mounting the controller to the DIN rail

1) Pull out the claw (DIN rail lock) from the bottom of the back side of the controller（**1**）
   A small round hole of claw (DIN rail lock) can be seen.
2) Tilt the controller unit slightly and fit the recess on the back into the DIN rail（**2**）
3) Push the bottom side of the back groove against the DIN rail（**3**）
4) Push up on the claw (DIN rail lock) and return to the original position（**4**）
5) Place the end plates on the right and the left side of the controller to fix that on the DIN rail.

5.3.1 End plate

To prevent the modules from slipping or loosening through vibration, an end plate must be mounted on the left and right side of the mounting rail. End plates are not included with the controller. Customers should prepare separately.
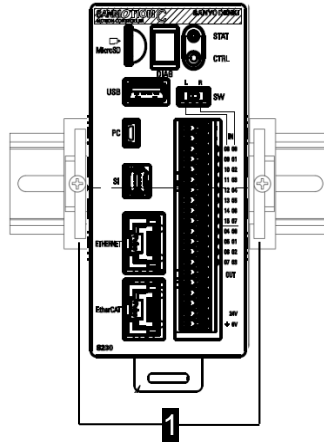

Fig 5.4:   End plates （**1**）

5.4 Removing the controller

CAUTION

- When doing the removal work, please follow the procedure below. Wrong procedure may cause damage to the controller.

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1) Turn off the power.
2) Disconnect all cable connections on the controller.
3) Pull out the claws (DIN rail lock) from the main unit.
4) Remove the controller from the DIN rail.

5.5 Measure against heat and ventilation

Ventilation holes for dissipating the heat are placed at the top and underside of the controller. Do not exceed the permissible ambient temperature in the environment of the controller operation. Do not cover the ventilation hole. At least 30 mm or more space on the upper side and the bottom side of the controller must be required.

CAUTION !

The operating temperature inside of the control cabinet must not exceed the permissible ambient temperature range. If this cannot be guaranteed, consider other cooling methods such as installing a heat exchanger on the control panel. If there are easily affected devices such as a thermocouple, its temperature change may not be accurately measured.

5.5.1 Use of air filters

To ensure that the contamination does not exceed contamination level 2 (according to EN 61131-2), the device must be installed in a dustproof, closed control cabinet. Fan openings of the control cabinet must be equipped with air filters. The filter elements must be cleaned or replaced regularly.

6 Connections and wiring

6.1 Power-input

Connect a 24VDC power supply to the A19 pin (24V) and A20 pin (GND) terminals of the Power and I/O connector.

⚠ **WARNING !**

- For using as the UL standard compliant product, a 24 VDC power supply must be SELV / LIM or SELV / Class 2 specification.

- To prevent the risk of fire, electric shock and malfunction, carefully follow the precautions listed below for wiring.

- Use wire and cable with rated temperature 80 ° C or higher.

- When stripping cable, a length of copper wire at the end should be about 10 mm.

- Twist copper wires tightly not to come out separately.

- Do not solder plating the terminals of copper wires.

- Do not connect copper wires other than specified size or wires exceeding the prescribed number to a power connector.

- Secure the wires not to apply external force directly to the connected parts.

6.1.1 Pin assignment, connection example

CAUTION

- Refer to the connection example for the wiring of the power supply and wire it correctly. Incorrect wiring may cause damage to the controller.
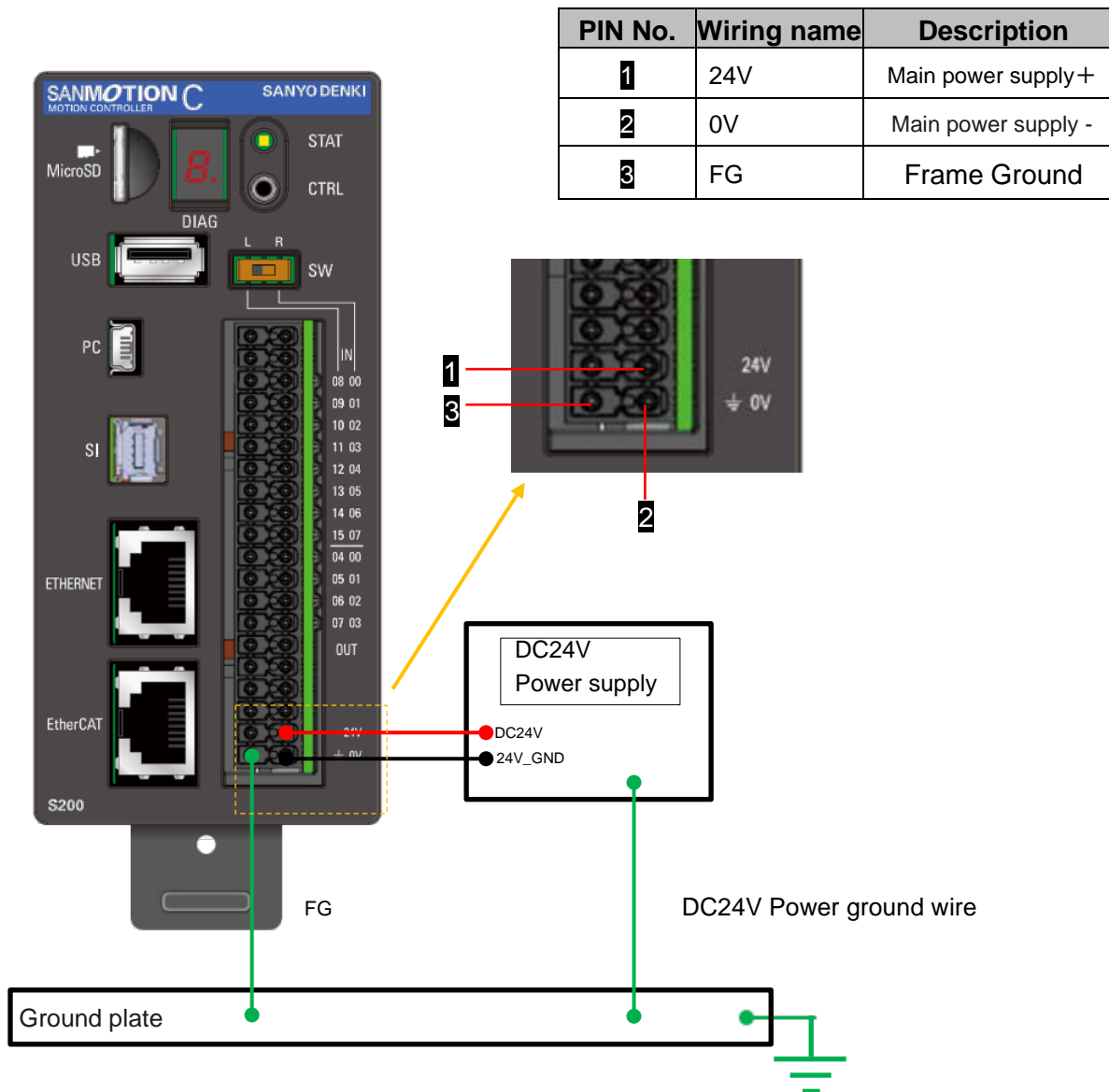
PIN No.	Wiring name	Description
1	24V	Main power supply＋
2	0V	Main power supply -
3	FG	Frame Ground

Fig 6.1:   Power and I/O connector pin arrangement and power supply connection example

6.1.2 Applicable wire size

- Minimum connection wire size：AWG24
- Maximum connection wire size：AWG16

Refer to the Phoenix Contact data sheet for the detailed specifications of the connectors.
Refer to [3.3 Accessories] for more information of the model number of the connectors on wiring side.
Please consider the following conditions in actual wiring.

- The maximum load current and the ambient temperature of the place that the electric wire will be laid, and the method of laying the electric wire.

- Allowable voltage drop for error-free operation of the connected equipment.

6.2 I/O

Equipped with 16 digital inputs, 8 digital outputs, and 2 analog current outputs. Digital I/O status is indicated by LEDs to the right of the connector.

WARNING !

- For using as the UL standard compliant product, the connector pins for I/O power supply, digital I/O signal must be connected to circuits with SELV / LIM or SELV / Class 2 specification.

- To prevent the risk of fire, electric shock and malfunction, carefully follow the precautions listed below for wiring.

- Use wire and cable with rated temperature 80 ° C or higher.

- When stripping cable, a length of copper wire at the end should be about 10 mm.

- Twist copper wires tightly not to come out separately.

- Do not solder plating the terminals of copper wires.

- Do not connect copper wires other than specified size or wires exceeding the prescribed number to a power connector.

- Secure the wires not to apply external force directly to the connected parts.

6.2.1 Pin assignment

CAUTION

- Carefully refer to the Fig.6-2 to Fig.6-9, for wiring I/O correctly. Incorrect wiring may cause damage to the controller.

| Pin No.	Signal	Detail	Pin No.	Signal	Detail
B1	INCOM	Digital input Common	A1	IO24V	I/O Power supply + 24V
B2	IOGND	I/O Power supply GND	A2	IOGND	I/O Power supply GND
B3	IN08	Digital input 8	A3	IN00	Digital input 0
B4	IN09	Digital input 9	A4	IN01	Digital input 1
B5	IN10	Digital input 10	A5	IN02	Digital input 2
B6	IN11	Digital input 11	A6	IN03	Digital input 3
B7	IN12	Digital input 12	A7	IN04	Digital input 4
B8	IN13	Digital input 13	A8	IN05	Digital input 5
B9	IN14	Digital input 14	A9	IN06	Digital input 6
B10	IN15	Digital input 15	A10	IN07	Digital input 7
B11	OUT04	Digital output 4	A11	OUT00	Digital output 0
B12	OUT05	Digital output 5	A12	OUT01	Digital output 1
B13	OUT06	Digital output 6	A13	OUT02	Digital output 2
B14	OUT07	Digital output 7	A14	OUT03	Digital output 3
B15	AO0－	Analog current output 0-	A15	AO0＋	Analog current output 0+
B16	AO1－	Analog current output 1-	A16	AO1＋	Analog current output 1+
B17	NC	－	A17	NC	－
B18	NC	－	A18	NC	－
B19	NC	－	A19	24V	Main Power supply ＋24V
B20	FG	Frame ground	A20	0V	Main Power supply GND
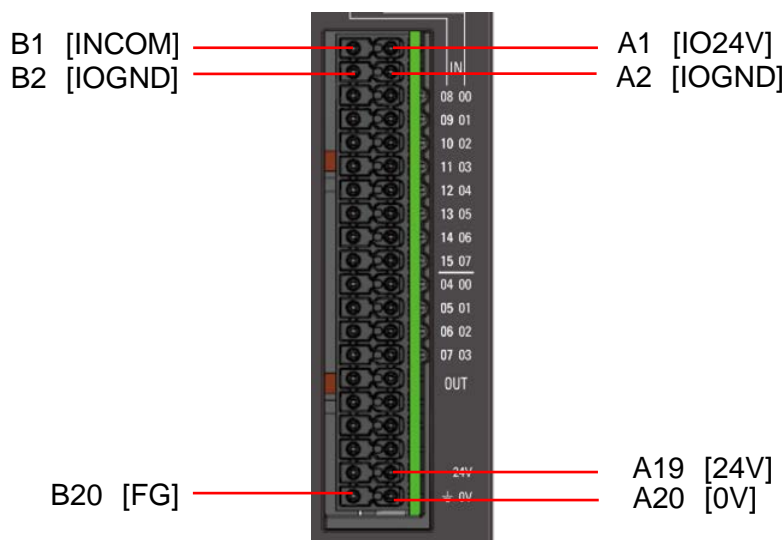
Fig 6.2: Power and I/O connector pin assignment

6.2.2 Connection example (Digital input)

The digital input is shared with positive common and negative common. Also, the input common terminal is the B1 pin. For specifications, see "12.5 General purpose digital input".

The following shows a connection example when using digital inputs for sink input (IOGND common) and source input (IO24V common).
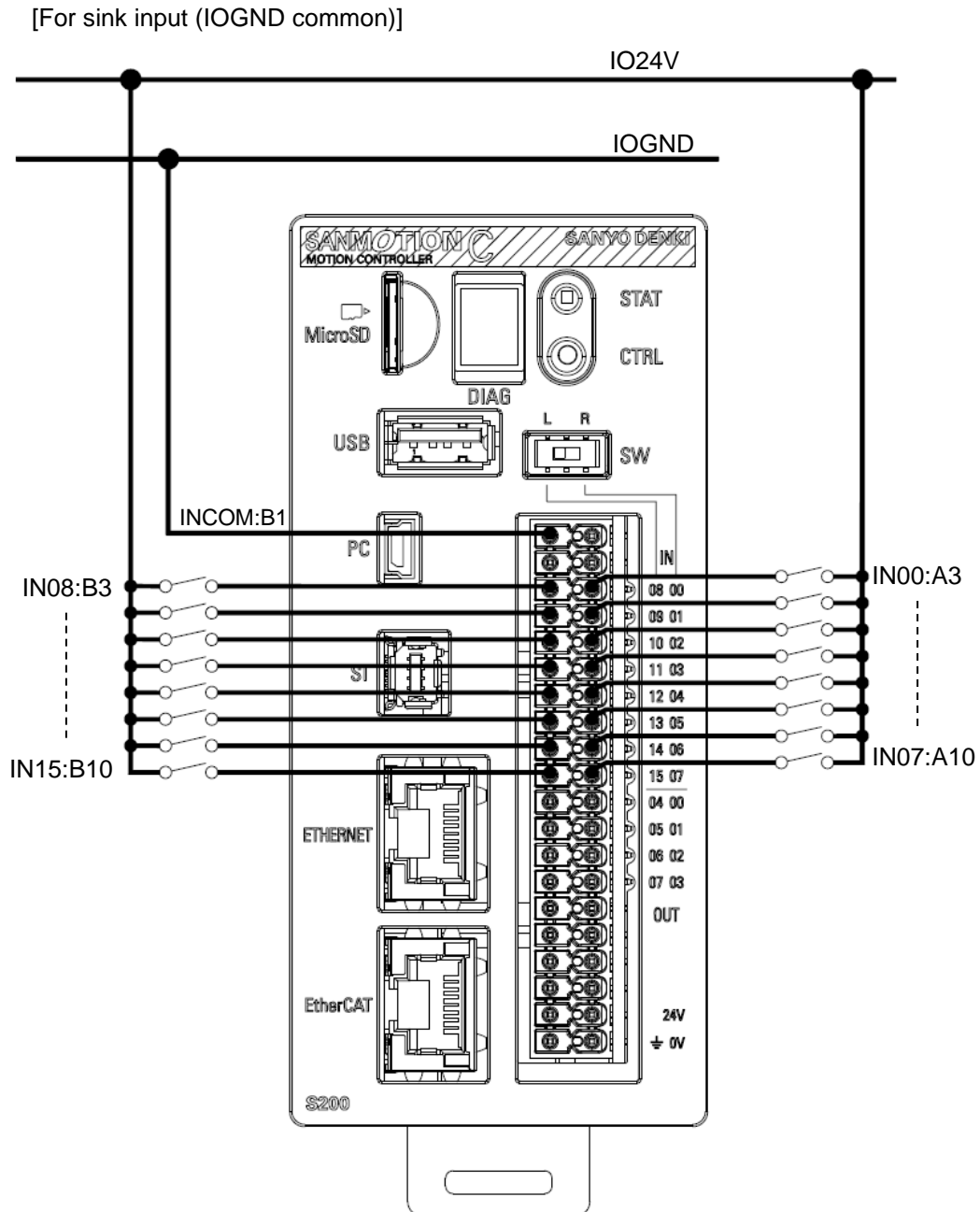
[For sink input (IOGND common)]

Fig 6.3: Digital input connection example (IOGND common)
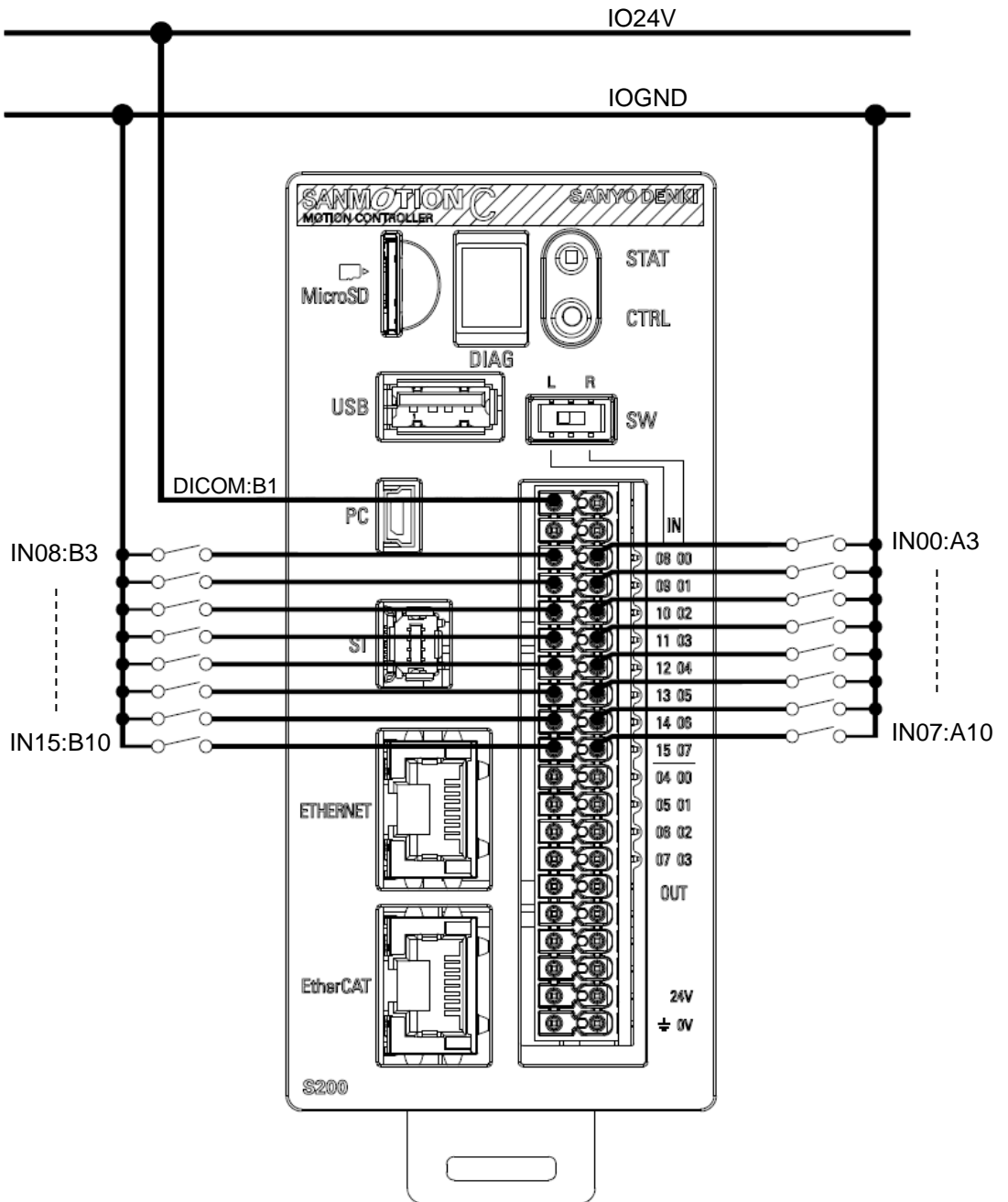
[For source input (IO24V common)]

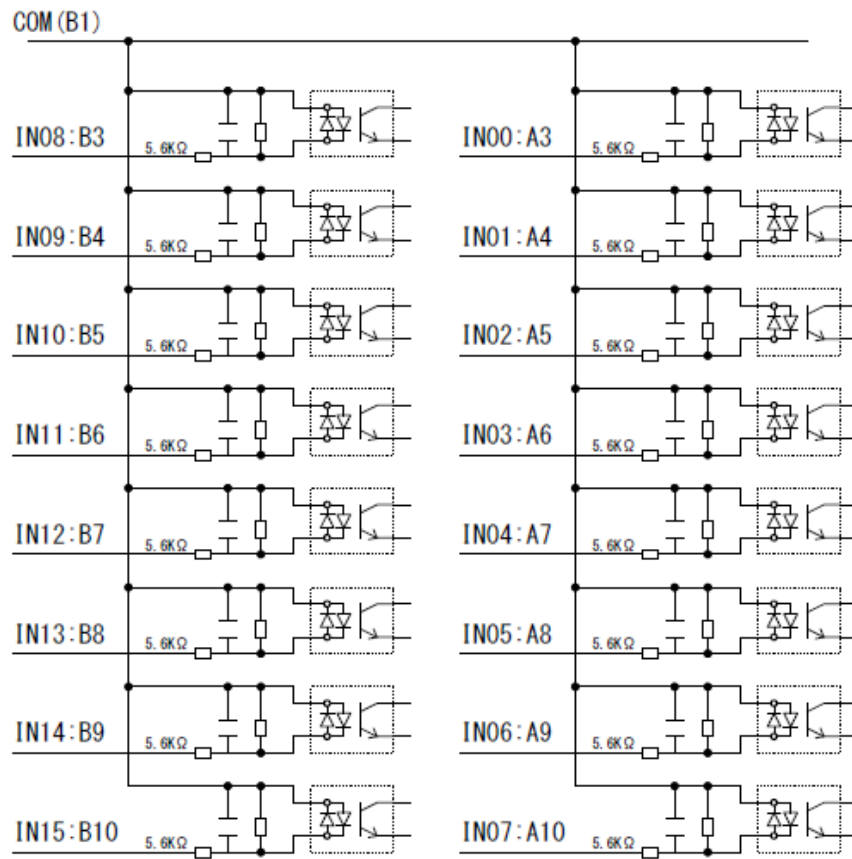Fig 6.4: Digital input connection example (IO24V common)

Fig 6.5: Digital input internal circuit

6.2.3 Connection example (Digital output)

The digital output is a sink output (IO24G common). The common terminal for output is the A2/B2 pin. The A2 and B2 pins are internally connected. For specifications, see "12.6 General purpose digital output"
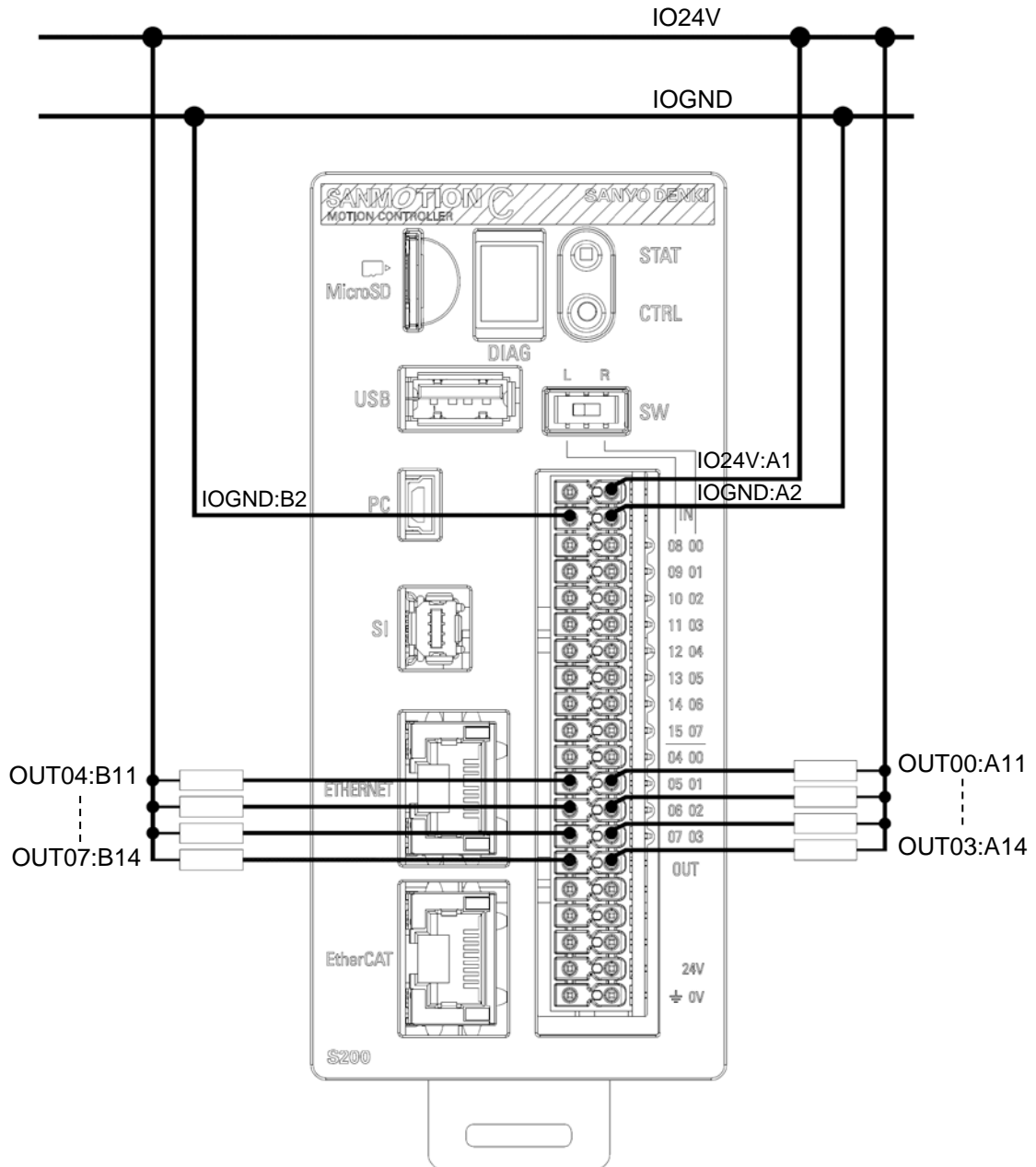
.

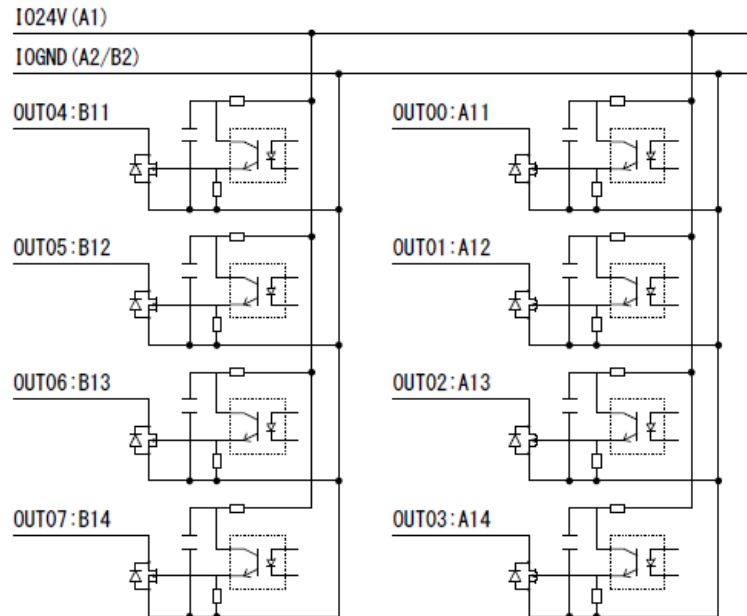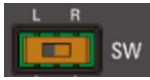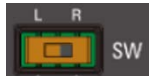Fig 6.6: Digital output connection example

Fig 6.7:   Digital output internal circuit

6.2.4 Switching I/O LED display with switch (SW)

The LED lights for I/O status display are available for input 8 points and output 4 points. By switching the L-R switch [SW] at the top of the Power and I/O connectors, each of input/output status can be recognized with allocated display numbers. (See the table below.)

SW state		Display No.
R		IN 00-07
		OUT 00-03
L		IN 08-15
		OUT 04-07

6.2.5 Cable and connector specifications

Types of cables

・Minimum wire size：AWG24
・Maximum wire size：AWG16

Unshielded cables must be used. Select the cable from the above wire sizes considering the load current to be connected.

Types of connectors

For detailed connector specifications, please refer to the datasheets from Phoenix Contact.
Refer to "3.3 Accessories" for information on the wiring side connector.

CAUTION

• Wire the cable connected to the power I/O connector excluding the analog current output signals (AO0±, AO1±) at 30m or less.

6.2.6 Connection example (analog current output)

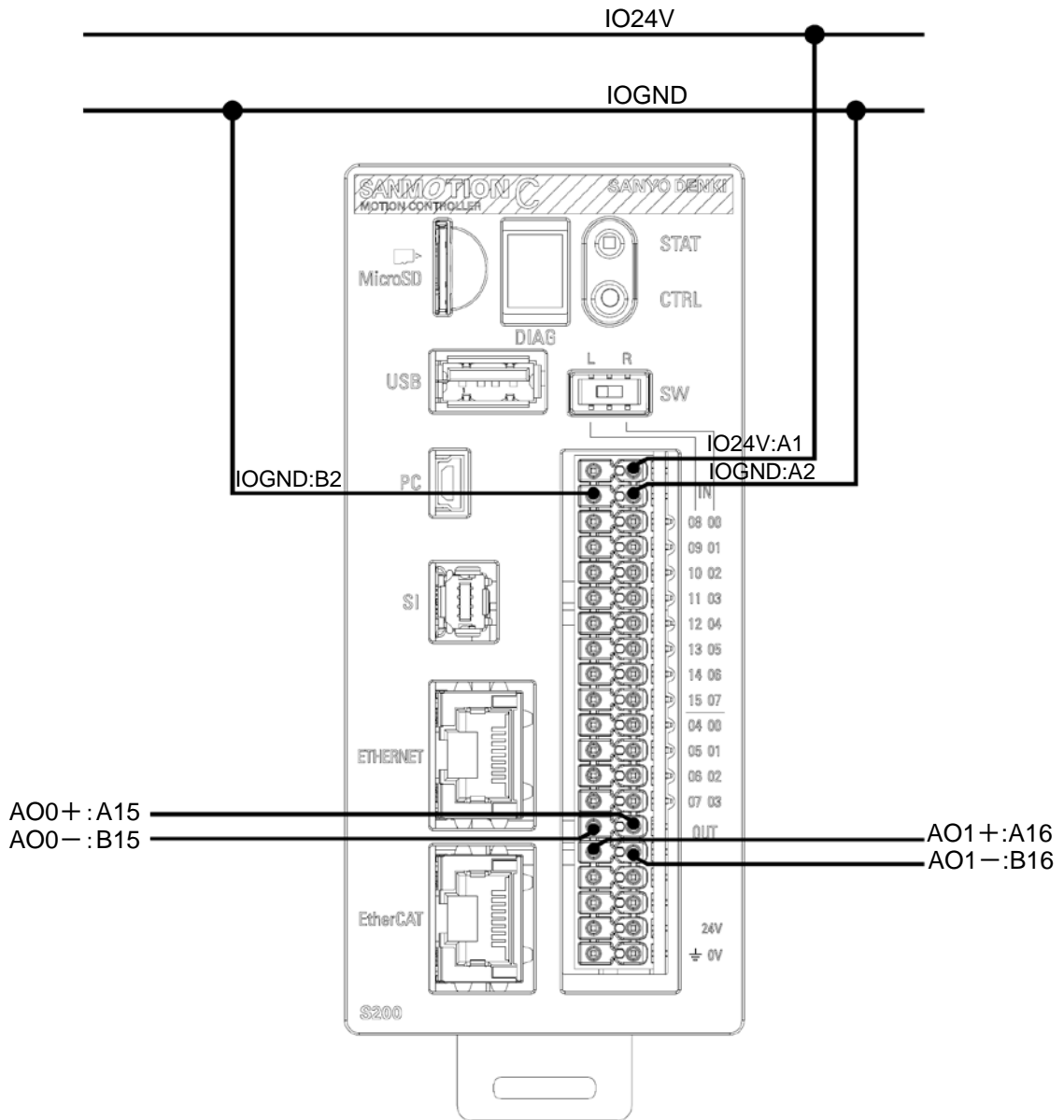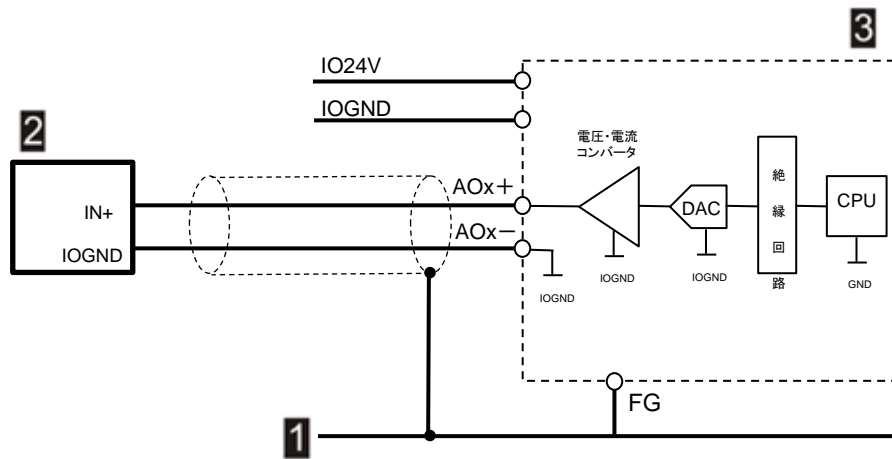For specifications, see 12.7 General-purpose analog output..

Fig 6.8: Analog current output connection example

1…	shield	3…	internal logic
2…	Current input device		

Fig 6.9:   Analog current output internal circuit

6.2.7 Cable and connector specifications for analog current output signals

Types of cables

- Minimum wire size：AWG24
- Maximum wire size：AWG16

Shielded twisted pair cable.

Types of connectors

For detailed connector specifications, please refer to the datasheets from Phoenix Contact. Refer to "3.3 Accessories" for information on the wiring side connector.

CAUTION

- Wire the cable connected to the power supply I/O connector excluding analog current output signals (AO0±, AO1±) at 30 m or less.

- Use a shielded twisted pair cable for the + and - signals of the analog current output signal.

6.3 USB ports (PC, USB)

It is equipped with two ports that can use USB devices (USB 2.0 High Speed). PC (Mini-B) is used for connection with the development PC, and USB (Type-A) is used for connection with USB devices (USB memory, camera, wireless adapter 3A).
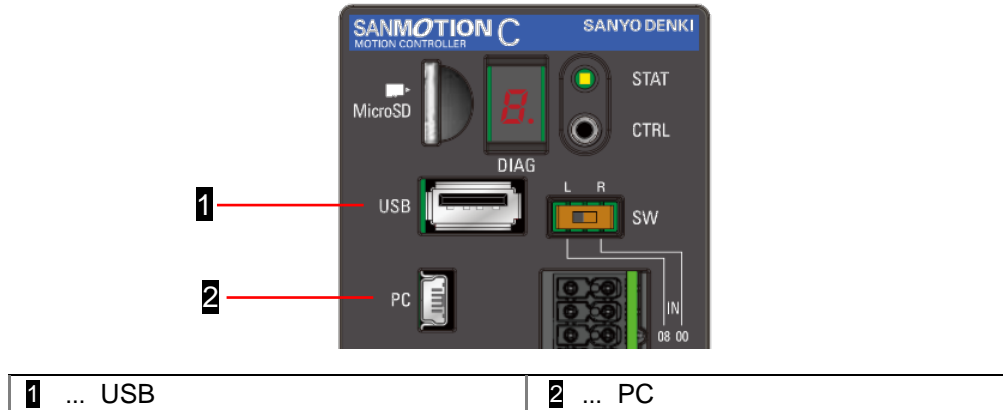

1 ... USB	2 ... PC

Fig 6.10: USB ports location

6.3.1 Cable and plug specification

CAUTION

- Use a USB device that suitable for industrial environment with wide range of operating temperature and high durability for industrial use.
- Never keep USB-devices constantly connected, as the USB-ports are not operationally reliable (danger of unplugging). Take preventive measures.

Cable type (Connection with PC)

The connector for [PC] is USB mini-B type. To connect to the development PC, use a cable with specification of that one side is for USB Mini-B and the other side should be connectable to development PC.

You can also purchase a cable with USB Mini-B on one end and USB Type-A on the other from us. When ordering, please specify the Sanyo Denki model number below.

Product name	Length	Sanyo Denki Model No.
USB communication cable	L=1m	AL-00896515-01
	L=2m	AL-00896515-02

USB communication cable outline
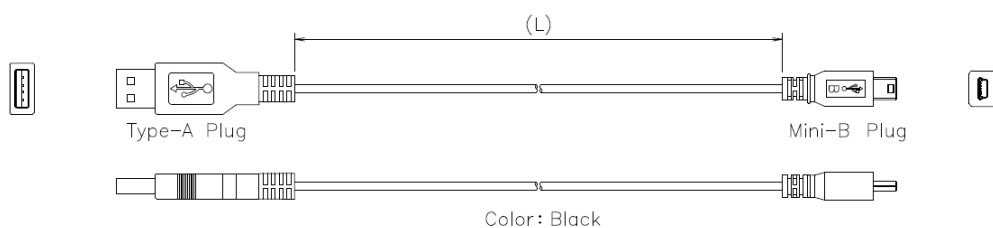
6.4 Serial interface (SI)

SI is for connecting with peripheral devices. (RS485A/1-Wire interface).

6.4.1 Pin assignment

Pin 7   Pin 8

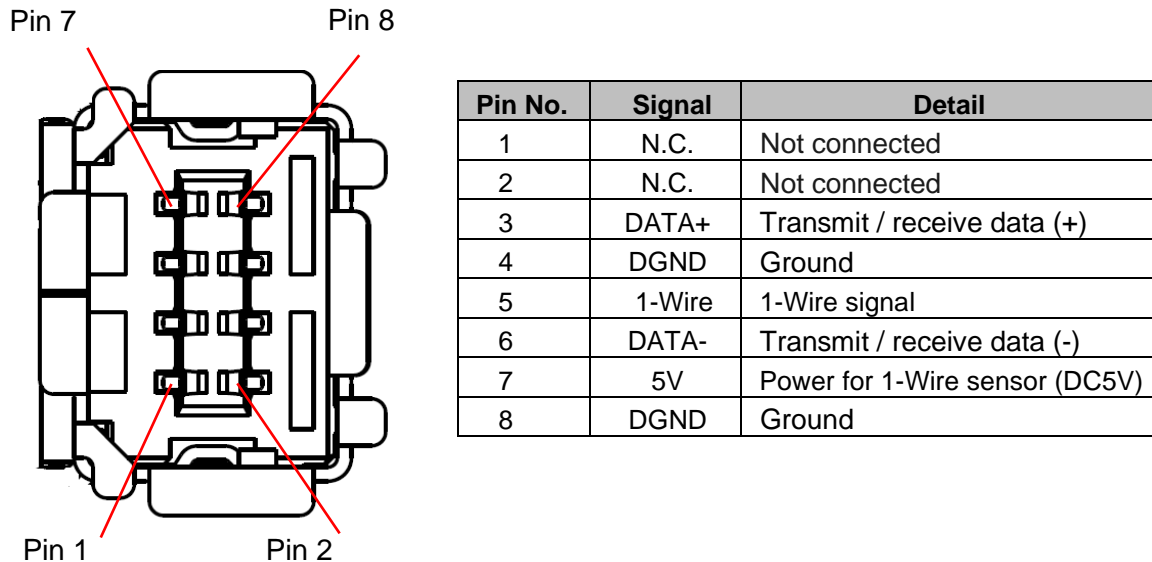| Pin No.	Signal	Detail
1	N.C.	Not connected
2	N.C.	Not connected
3	DATA+	Transmit / receive data (+)
4	DGND	Ground
5	1-Wire	1-Wire signal
6	DATA-	Transmit / receive data (-)
7	5V	Power for 1-Wire sensor (DC5V)
8	DGND	Ground

Pin 1   Pin 2

Fig. 6.10: SI Connector

6.4.2 RS485A interface

The RS485A interface can communicate with up to 32 devices.

6.4.2.1 Bus termination

Bus termination should be done at the ends of the bus (first and last device on the bus). The S200 has a built-in 120Ω termination resistor between pin 3 and pin 6. When connecting three or more devices to the RS485 interface, wire so that the S200 is at the end of the bus.

6.4.2.2 Cable and connector specifications

Cable type

Shielded twisted pair data cable (Characteristic impedance 100 to 120 Ω)

Type of plug

Please use TE Connectivity Industrial Mini I/O Plug Connector Type II (2040008-2). The wiring connector is not included, so please prepare it separately.

Cable length

The maximum cable length depends on the communication speed.

115200bps : Maximum 1,200m

6.4.3 1-Wire interface

The 1-Wire interface can acquire sensor information such as temperature, humidity, and barometric pressure through serial communication from a connected 1-Wire compatible device. The system configuration when using this function is shown below.
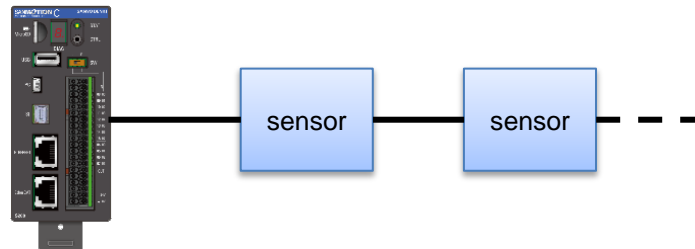

Fig.6.11: 1-Wire communication system configuration

6.4.3.1   San Ace sensor that can be connected to S200

The San Ace sensors that support acquisition of measurement data via the S200's 1-Wire communication are listed below. A maximum of seven 1-Wire devices can be connected.

Sanyo Denki Model No.	1-Wire Family Code	product name
9CT1-T	0x19	San Ace temperature and humidity sensor
9CT1-P	0x19	San Ace pressure sensor

6.4.3.2   1-Wire Interface Communication Overview

1-Wire, a registered trademark of Analog Devices, Inc, is a serial interface standard for low-speed data transfer using only a ground wire and a single signal wire (also a power supply wire). There is one master on the bus, controlling communication with the 1-Wire slaves. The S200 acts as a 1-Wire master. The advantage of 1-Wire communication is that multiple 1-Wire slaves can be connected on the bus. The communication method is half-duplex two-way communication, and the communication speed is 15400bps.
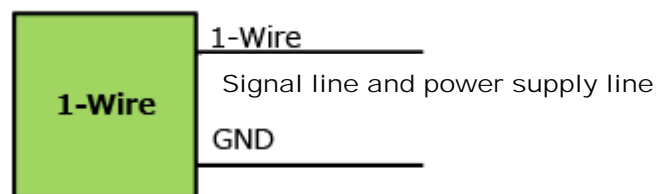

Fig.6.12: 1-Wire Communication Overview

6.4.3.3   Cable and connector specifications
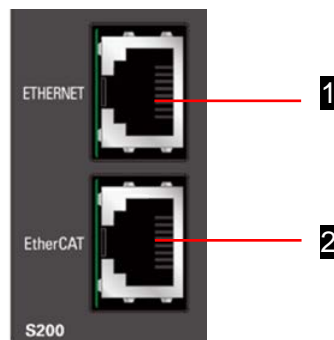
Cable type

Shielded data cable.

Type of plug

Please use TE Connectivity Industrial Mini I/O Plug Connector Type II (2040008-2). The wiring connector is not included, so please prepare it separately.

Cable length

Maximum 200m

6.5 ETHERNET interface and EtherCAT interface

1 ... ETHERNET	2 ... EtherCAT

Fig. 6.13: Location of ETHERNET and EtherCAT connectors

6.5.1 ETHERNET Pin assignment

Fig. 6.14: ETHERNET connector

PIN No.	Signal name	Description
1	TRD0+	Transmit/Receive data 0 +
2	TRD0-	Transmit/Receive data 0-
3	TRD1+	Transmit/Receive data 1+
4	TRD2+	Transmit/Receive data 2+
5	TRD2-	Transmit/Receive data 2-
6	TRD1-	Transmit/Receive data 1-
7	TRD3+	Transmit/Receive data 3+
8	TRD3-	Transmit/Receive data 3-

6.5.2 EtherCAT Pin assignment

Fig. 6.15: EtherCAT connector

PIN No.	Signal name	Description
1	TX+	Transmission data +
2	TX-	Transmission data -
3	RX+	Receive data +
4	N.C.	Not connected
5	N.C.	Not connected
6	RX-	Receive data -
7	N.C.	Not connected
8	N.C.	Not connected

6.5.3 Cable and connector specifications

Cable type

A connected cable must be twisted pair cable that meets "category 5e" or more.

Type of plug

RJ45 shielded connector with EMI countermeasure type. To connect the cables, follow the manufacturer's wiring and assembly procedure.

Cable length

The maximum cable length in 100Mbit/s in Ethernet communication is specified as the maximum 100m (standard value) by IEEE802.3. However, it is not considered for use in industrial environments with many EMC interference. It is recommended to connect the cable as short as possible. Do not extend unnecessarily long.

6.6 Wiring with EMC measures

Resistant immunity of the electrical system is largely dependent on the installation method and shielding process of the cable. From our experience of field service, most of the problems are due to improper cable laying and shielding process.

Failure caused by EMC becomes very difficult to investigate the cause compared to "normal obstacle" for the reasons described below.

- Depending on the symptoms, it is difficult to be able to recognize as an impairment caused by EMC.

- In most cases, failures occur intermittently, so it is difficult to reproduce them.

Troubleshooting related to EMC is often complicated. Therefore, it tends to be cost expensive to investigate the cause. To avoid that situation, follow the guidelines below to lay the appropriate cables and shield process.

6.6.1 EMC measures

The main items of EMC measures are listed below.

- Shielding

- Same potential of between the devices

More specifically, to take such measures described below would be important. The primary cause of a failure is insufficient ground connection and shield connection. Please be aware of all the following points that are generally understood.

Notes on the ground and shield connection

- Connect with low impedance. Note that the following points to obtain good conductivity especially at high frequencies.

    - Secure the connection surface as wide as possible

    - Shortest possible connection

    - Earth ground with the thickest possible line

- To ensure electrical conduction, peel off paint etc. at the connection part and expose the metal surface.

- To prevent corrosion, apply anti-rust treatment at the connection.

- It is also effective to use a toothed washer when connecting to a painted part or a rough surface part.

6.6.2 EMC measures check list

Communication system line (RS485, ETHERNET, EtherCAT, USB)

- Are both ends of the cable correctly shielded using a metal shell?

- If the wiring is long, is the cable shield grounded using such as FG clamps on the way?

- Are that parts suitable for use in industrial environments?

7 Status at time of failure or error

7.1 Failure of power supply

- In the event of a power supply failure, the S200 is in reset state and all signals are initialized.
- If a momentary power failure of the power supply continues for 10 ms or more, a reset is applied. S200 enters the reset state and all signals are initialized.

7.2 Other power supply anomalies

- When the USB port detects an overload (500mA or more), the power supply from the USB port is turned off. It remains off as long as the overload continues.
- The maximum allowable output current for the 1-Wire sensor power supply (DC5V, SI connector pin 7) is 0.2A. When the allowable current value is exceeded or shorted to GND, the S200 enters reset state and all signals are initialized. It remains off as long as the overload continues.

7.3 In case of error

- If an error occurs, the error content is displayed on the diagnostic display on the front of the S200. (Refer to "8.6 Error Display" for error display contents.)

CAUTION

If error code "E" is displayed, the failure of controller is suspected.

Please check whether the ambient temperature of the controller does not exceed the operating temperature range 55℃.

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8 Diagnosis Display

8.1 Display during startup

The progress status of each stage is displayed on the 7 segment LED. If an error is detected during startup, the error message is displayed. If the control button is pressed when the status display is "6", the application is stopped (STOP state).

Display	Status LED color	Description
8.	Orange 🟠	Initializing the controller since power is turned on
1.	Orange 🟠	Initializing the hardware and checking the boot block
2.	Orange 🟠	Loading and booting the boot system
3.	Orange 🟠	Load the firmware into DRAM
4.	Orange 🟠	Firmware activation
5.	Orange 🟠	Loading and starting the operating system
6.	Orange 🟠	Start of the various firmware components
o.	Orange 🟠	Move to the application program load processing. (Because the display time is short, it may not be possible to check visually.)
0	Green 🟢	Application program running

8.2 Operating states

The operating status has the following states, and the display states of the 7-segment LED and status LED in each state are described below.

Status	Description	7-segment LED	Status LED
ERR	State in which a structural abnormality in the user area is detected	E	Orange
READY	The application control system has not yet started	6	Orange
INIT	State that the application program is not loaded.	o	Orange
STOP	Application program has been loaded, but the state in which the program is stopped.	II	Red
RUN	Application runs state.	0	Green

8.3 Command switching between operating states (Control button operation)

The controller monitors the state of the control button every cycle and executes the following process.

Control button operation	Controller execution process
No operation	Indicates the current status of the controller (INIT, STOP, RUN)It returns to the original status in 10 seconds even if any of function is selected with short keystroke
Short keystroke	Select a function what you want to excecute. See the table below for status transitions.
Long keystroke (more than 1 second)	Execute the process assigned to the displayed status. See the table below for status transitions.
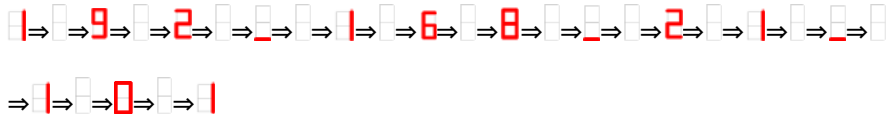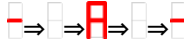
Function can be selected by pressing the control button with short keystroke.

Refer to the table below for state transitions.

Operating status	Status LED display color						
	7 segment display (state transition order ⇒)						
ERR	Orange	Orange	Orange	Orange	Orange	Orange	Orange
READY	Orange	Orange	Orange	Orange	Orange	Orange	Orange
INIT	Orange	Orange	Orange	Orange	Orange	Orange	Orange
STOP	Red	Green	Orange	Orange	Orange	Orange	Orange	Red
RUN	Green	Red	Orange	Orange	Orange	Green	

Status at time of failure or errorCommand switching between operating states (Control button operation)

Refer to the table below for the functions executed by long keystroke.

7 segment display	Function to be executed
A	Starting the application
S	Stop control the application
r	Write status report. 　※The status report will be referred to when working on maintenance. 　※The controller state does not transition
n	Display IP address. The controller state does not transition. ※If the IP address setting cannot be obtained, "-non-" is displayed. Example: The display contents of the IP address [192.168.21.101] are as follows. l⇒ ⇒9⇒ ⇒2⇒ ⇒_⇒ ⇒ l⇒ ⇒6⇒ ⇒8⇒ ⇒_⇒ ⇒2⇒ ⇒ l⇒ ⇒_⇒ ⇒ l⇒ ⇒0⇒ ⇒ l
u	Display unit type. ※Controller state does not transition Display contents of unit type (eg Type A) are as follows. -⇒ ⇒A⇒ ⇒-
C	Reboot.
F	Initializes the user area and various settings to the factory default and restarts. （Refer to "9 Factory default settings" for the initialization contents.）

During the execution of each function, LED segment lights in the following order.
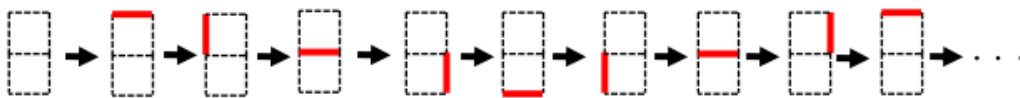
8.4 Status display (Battery power)

When the battery level falls below a certain level, a battery warning is displayed after rebooting. Battery level is performed by 7 segments LED as follows.

Operating status	7 Segments LED display	Status LED
INIT	$\Box \Rightarrow \boldsymbol{b} \Rightarrow \Box$ Repeat those blinks at 1 second intervals	Blinking orange ● ⇒ 🟡 ⇒ ●
STOP	$\boldsymbol{II} \Rightarrow \boldsymbol{b} \Rightarrow \boldsymbol{II}$ Repeat those blinks at 1 second intervals	Blinking red ● ⇒ 🔴 ⇒ ●
RUN	$\boldsymbol{0} \Rightarrow \boldsymbol{b} \Rightarrow \boldsymbol{0}$ Repeat those blinks at 1 second interval	Blinking gree ● ⇒ 🟢 ⇒ ●

Caution
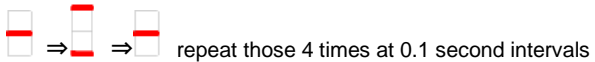
- When a battery warning is displayed, please contact our sales office for replacement.
- No battery warning is displayed in ERR or READY status.
  When the battery runs out, the RTC (real time clock) is reset (January 1, 2000). The battery is only used for RTC backup. Retentive variables are stored in non-volatile memory and are not affected by batteries.

8.5 Wink display

There is a "Wink" button in the target device search window in the integrated development environment.
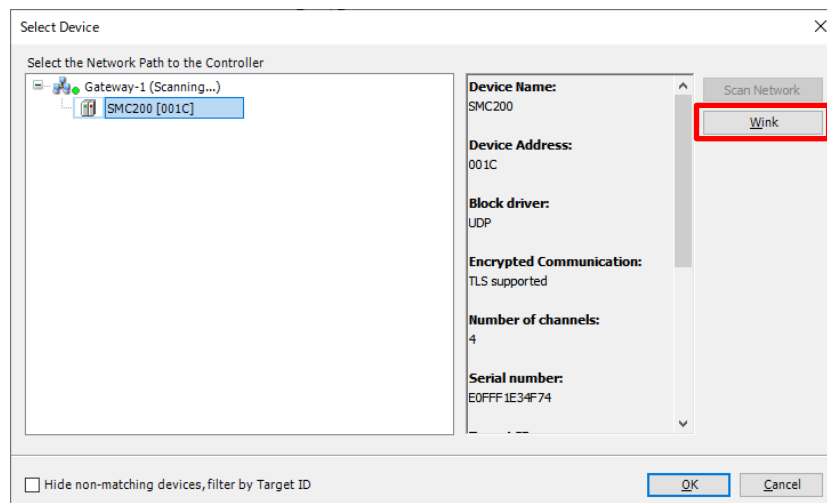
If a controller with the same host name exists on the same network when the "Wink" button is clicked, the display of the selected controller will change. This allows you to determine which controller you have selected. The states of the 7-segment LED and status LED when the "Wink" button is clicked are described below.

Operating status	7 Segments LED display	Status LED
Other than ERR and READY	⇒ ⇒ repeat those 4 times at 0.1 second intervals	Blinking current state

8.6 Error display

An error is indicated by 7 segment LED. It displays in a form that connects the first letter of E with the three digit error identifier (eg E - 001). Error display content is switched flashing one by one in the 0.5-second intervals.

Error identifier	Error description	Occurrence factor
E-001	Failed to start application	application does not exist
E-002	Failed to start application	Stop command does not work due to excessive application load
E-009	Failed to publish report	Failed to publish report due to excessive application load
E-010〜255	Factory reset failed	internal anomaly
E-901	System error	There is an abnormality in the firmware
E-902	System error	There is an abnormality in the firmware

Errors E-001 to E-009 occur when an error occurs during process execution when executing a process by operating a control button. After displaying the error number once, it returns to the controller status display state.

If any other error occurs, please contact us.

9 Factory settings

The factory settings are shown below.

Item	Value
Host name	SMC200
Ethernet port	DHCP：Inactive IP address：192.168.21.101 Subnet mask：255.255.255.0
USB port	IP address：169.254.21.101 Subnet mask：255.255.0.0
Wireless LAN	DHCP：Inactive IP address：192.168.100.101 Subnet mask：255.255.255.0 Mode：AP SSID：SMC200-AP Security：Personal Password：123456789 Country code：US
Date and time	2001-01-01 00:00:00
Time zone	UTC
Web app password	User：Administrator Password：sanyodenki
Samba password	User：sanmotion Password：sanmotion
FTP password	User：ftp Password：ftp
Auto start	Active：plc, samba Inactive：ntp, ftp

10   Maintenance

10.1   Inspection

Perform inspections regularly to use the controller "SANMOTION C" series in the best condition.

10.1.1   Inspection interval

The motion controller routine inspection is not required. However, mechanical wear and aging occur inside electrical and electronic components. Therefore, perform the following inspections at least once a year. Also, shorten the inspection interval according to the surrounding operating environment. When the inspection result shows outside of the standard level conditions, take the necessary measures to keep it within the standard.

10.1.2   Inspection items

Inspection items	Methods	Evaluation criteria	Solution if abnormal
Controller power supply	Check the voltage of the power supply terminal	Voltage range DC19.2 ~ 30V	Set the voltage within the specified range
Environment	Check the ambient temperature (Temperature within the control panel should be appropriate range.)	+0 ℃～+55 ℃	Set the ambient temperature within the specified range +0 ℃ ～+55 ℃
	Check the ambient humidity (Humidity within the control panel should be appropriate rage.)	10 %～95 %（Non-condensing）	Set the ambient humidity within the specified range10 %～95 % Make sure that there is no condensation due to rapid temperature change.
	Check that direct sunlight does not hit	No direct sunlight	Shield the sunlight
	Check for dirt, dust, salt, and iron powder.	None of them should be attached	Clean with cloth or air.
	Check for water, oil, the chemicals	None of them should be attached	Clean with cloth or air.
	Check for corrosive or flammable gas drifting	No detected	Check in the smell or gas sensor
	Check for any noise generation source nearby	No noise source nearby	Move the noise source away or take shielding measures.
Mounting and wiring	Check that there is no looseness in connector coupling, DIN rail lock, end plate	Should not be loose	Fully inserted, please tighten
	Check that the connector is fully inserted	Should not be loose	Fully inserted, please tighten
	Check the screws on the external wiring	Should not be loose	Fasten the screws properly
	Check the crimp terminal for external wiring	Proper spacing	Visually check, correct the terminal
	Check the external wiring cable	There is no abnormality on the surface	Visually check, replace the cable
Life parts	Did the life of the battery (CR 2450) exceed?	Standard replacement period: 10 years	Please contact us if 10 years over.

Tools required: driver, testers, temperature and humidity meter

10.2   Maintenance parts

This product includes consumables and parts with a limited life.

For preventive maintenance, replacement is required based on the following standard replacement years.

10.2.1   Battery type and service life

Battery type: CR2450 (Manganese dioxide lithium battery, 3 V / 600 mAh)

A battery replacement cycle is determined by the balance of the following two factors. By using the line chart below, a battery replacement cycle can be determined based on an average annual hours of operation. Please contact our sales office if a replacement battery is determined to be necessary.

Caution

- In order to replace the battery, it is necessary to disassemble the main unit once, so please be sure to ask us to replace the battery.

【Factors】

- Battery consumption due to backup operation

- Constraint on the total chargeable electricity of a primary battery

Approximate time for battery replacement

━━━ Battery replacement indication due to consumption of backup operation (year)

━━━ Battery replacement indication due to constraint on total charge permissible electricity (year)
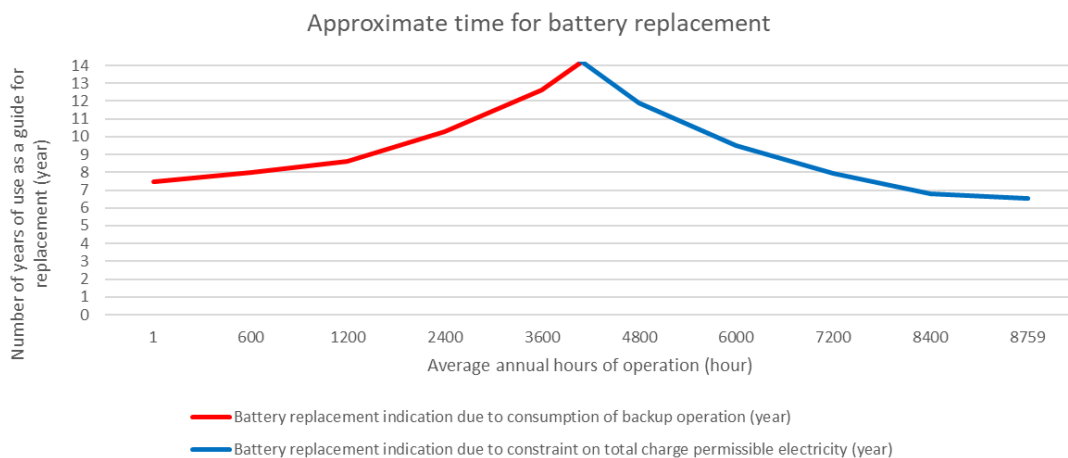
10.2.2   Other parts

There is a big difference in progress of wear and deterioration depending on frequency of use, environment and elapsed time.

The parts are selected such that the standard replacement period is 10 years or more assuming the annual use time to be 4,800 hours.

If you find abnormality during periodic inspection, please stop using it promptly and contact us for repair.。

Caution

- Please contact our sales office when the replacement of parts is required.

11 Disposal

11.1   Disposal of the controller

CAUTION

Please observe the regulations regarding disposal of electric appliances and electronic devices!
- Electrical and electronic devices including their accessories must not be disposed of in the household garbage.
- The materials are recyclable in accordance with their labeling. You can make an important contribution to protecting our environment by reusing, renewing and recycling materials and old appliances.

11.2   Disposal of the battery

CAUTION

- Pay attention to hazardous waste regulations when disposing of batteries.

- Although batteries have a low voltage, they can provide enough current when short-circuited to ignite flammable material. They should not be disposed of together with conductive material (e.g. iron filings, wire wool contaminated with oil, etc.)

12   Technical data

12.1   In general

Rated supply voltage (Main power)	24 V DC
Operating voltage range (Main power)	19.2 V DC ～ 30 V DC
Rated input current (Main power)	0.9 A
Max. switch-on current (Main power)	20 A
Overvoltage category	II
Equipment class	III
Power consumption	Max. 22 W
Cooling method	Natural air cooling
IP Protection Rating	IP20
Pollution Degree	2
External power supply (IO power)	19.2 V DC ~ 30 V DC 140mA or higher

12.2   Environmental conditions

Operating temperature	+0 °C ～ +55 °C
Storage temperature	-40 °C ～ +70 °C
Relative humidity of air	10 % ～ 95 %（non condensing）
Elevation	Max. 2000m
Vibration resistance	Compliant with JIS B 3502:2011 5～8.4Hz：Constant Amplitude 3.5mm, 8.4～150Hz：Constant Acceleration 10m/s^2
Shock resistance	Compliant with JIS B 3502:2011 Peak Acceleration：147m/s^2 Working Time：11ms

12.3   CPU, memory, RAM

CPU clock	SMC200-A(1.0GHz) / SMC200-B(1.0GHz)
memory	1GB DDR3L SDRAM
FRAM	512KB

12.4   Interfaces

USB port (Mini-B)	USB2.0 device function
USB port (Type-A)	USB2.0 host function
Serial interface (RS485)	Max.115,200 bps Half duplex asynchronous
ETHERNET	10/100/1000 Mbps
EtherCAT	100 Mbps
MicroSD card slot	Max.32GB
1-Wire interface	15,400 bps Half duplex two-way communication

12.5   General purpose digital input

Rated input voltage	24 V DC
Allowable input voltage range	19.2V DC ～ 30V DC
Input impedance	5.6 kΩ
Input current	4.1m A/point (24V DC)
Input type	Positive common / Negative common shared
OFF・ON Voltage	OFF…DC5V or less ON・・・DC15V or higher
Number of inputs	16

12.6   General purpose digital output

Rated load voltage	24 V DC
Operating load voltage range	19.2V DC ~ 30V DC
Max. load current	0.5 A/point (4 A/common)
ON voltage drop	3.0 V or less
Output type	Sink output
Number of outputs	8
Overcurrent protection	0.7 A or higher

12.7   General purpose analog output

Number of analog output points	2
Output type	current output
Output signal range	4mA ~ 20mA
Maximum allowable load resistance	600Ω
Resolution	4,000
Accuracy	±0.5% FSR

12.8   Dimensions, weight

Module height※1	120mm
Mounting width	55mm
Module depth	110mm
Weight	300g

※1 ･･･ Exclude the part the lock of the DIN rail protrudes

13   EC directives and standards

13.1   EC directives

Directive 2004/108/EC	EMC directive
Directive 2011/65/EU	RoHS directive

13.2   Standards

The confirmation of the integrity of the system with respect to the command, has been subject to the following European standards.

13.2.1 EMC guideline

EN 61131-2:2007	Programmable controllers - Part 2
KS C 9610-6-4:2017	EMC Emission Testing of Industrial Environments
KS C 9610-6-2:2019	EMC Immunity Testing of Industrial Environments

13.2.2 EMC Compatibility test (CE Mark)

EMI	Radiated disturbance	EN IEC 61000-6-4:2019
EMS	Electrostatic discharge	EN61000-4-2:2009
	Radio-frequency electromagnetic field	EN IEC 61000-4-3:2020
	Electrical fast transient/burst	EN61000-4-4:2012
	Surge	EN61000-4-5:2014/A1:2017
	Radio-frequency conducted disturbances	EN61000-4-6:2014
	Power frequency magnetic field	EN61000-4-8:2010

13.2.3 EMC Compatibility test (KC Mark)

EMI	Radiated disturbance	KS C 9610-6-4:2017
EMS	Electrostatic discharge	KS C 9610-4-2:2017
	Radio-frequency electromagnetic field	KS C 9610-4-3:2017
	Electrical fast transient/burst	KS C 9610-4-4:2020
	Surge	KS C 9610-4-5:2020
	Radio-frequency conducted disturbances	KS C 9610-4-6:2020
	Power frequency magnetic field	KS C 9610-4-8:2017

13.3   UL Standard

UL/cUL standards	UL 61010 Listed
UL file Number	E302733

■ECO PRODUCTS
Sanyo Denki's ECO PRODUCTS are designed with the concept of lessening impact on the environment in the process from product development to waste. The product units and packaging materials are designed for reduced environmental impact.
We have established our own assessment criteria on the environmental impacts applicable to all processes, ranging from design to manufacture.

ECO PRODUCTS

⚠ Cautions

■Precautions For Adoption

Failure to follow the precautions on the right may cause moderate injury and property damage, or in some circumstances, could lead to a serious accident.
Always follow all listed precautions.

● Read the accompanying Instruction Manual carefully prior to using the product.
● If applying to medical devices and other equipment affecting people's lives please contact us beforehand and take appropriate safety measures.
● If applying to equipment that can have significant effects on society and the general public, please contact us beforehand.
● Do not use this product in an environment where vibration is present, such as in a moving vehicle or shipping vessel.
● Do not perform any retrofitting, re-engineering, or modification to this equipment.
● The Products presented in this Instruction Manual are meant to be used for general industrial applications. If using for special applications related to aviation and space, nuclear power, electric power, submarine repeaters, etc., please contact us beforehand.

* For any question or inquiry regarding the above, contact our Sales Department.

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