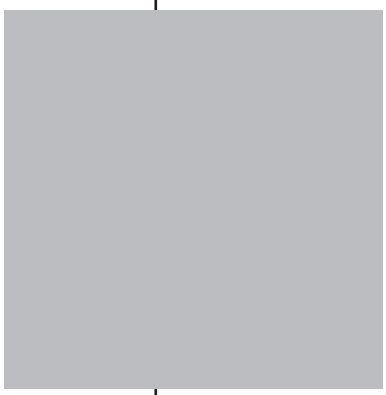
No. CP-UM-1679E

DIGITRONIK Digital Indicating Controller SDC40B

User's Manual

Basic Operations



Thank you for purchasing the SDC40B. This manual contains information for ensuring correct use of the SDC40B. It also provides necessary information for installation, maintenance, and troubleshooting.
This manual should be read by those who design and maintain devices that use the SDC40B.
Be sure to keep this manual nearby for handy reference.

Yamatake Corporation

RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment.
Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

IMPORTANT

COMBINING SDC40B'S COMPUTATIONAL FUNCTIONS CAN BE PERFORMED ONLY WITH A PERSONAL COMPUTER EMPLOYING THE OPTIONAL MASTER LOADER PACKAGE. COMBINING COMPUTATIONAL FUNCTIONS CANNOT BE PERFORMED BY THE SDC40B UNIT ALONE.

REQUEST

Ensure that this User's Manual is handed over to the user before the product is used.

Copying or duplicating this User's Manual in part or in whole is forbidden. The information and specifications in this User's Manual are subject to change without notice.

Considerable effort has been made to ensure that this User's Manual is free from inaccuracies and omissions.
If you should find any inaccuracies or omissions, please contact Yamatake Corporation.

In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

SAFETY PRECAUTIONS

■ About Icons

Safety precautions are for ensuring safe and correct use of this product, and for preventing injury to the operator and other people or damage to property. You must observe these safety precautions. The safety precautions described in this manual are indicated by various icons.
As the following describes the icons and their meanings, be sure to read and understand the descriptions before reading this manual:

⚠WARNING	Warnings are indicated when mishandling this product might result in death or serious injury to the user.
⚠CAUTION	Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to this product.

■ Examples

	Triangles warn the user of a possible danger that may be caused by wrongful operation or misuse of this product. These icons graphically represent the actual danger. (The example on the left warns the user of the danger of electrical shock.)
	White circles with a diagonal bar notify the user that specific actions are prohibited to prevent possible danger. These icons graphically represent the actual prohibited action. (The example on the left notifies the user that disassembly is prohibited.)
	Black filled-in circles instruct the user to carry out a specific obligatory action to prevent possible danger. These icons graphically represent the actual action to be carried out. (The example on the left instructs the user to remove the plug from the outlet.)

⚠WARNING

	**Before wiring, or removing/mounting the SDC40B, be sure to turn the power OFF. Failure to do so might cause electric shock.**
	**Earth the FG terminal with a ground resistance of maximum 100 Ω before connecting to the measurement target and external control circuits. Failure to do so might cause electric shock or fire.**
	**Do not disassemble the SDC40B. Doing so might cause electric shock or faulty operation.**
	**Do not touch electrically charged parts such as the power terminals. Doing so might cause electric shock.**

⚠CAUTION

	**Wire the SDC40B properly according to predetermined standards. Also wire the SDC40B using specified power leads according to recognized installation methods. Failure to do so might cause electric shock, fire or faulty operation.**
	**Do not touch internal components during use or immediately after turning the power OFF. Doing so might cause burns.**
	**Do not use pointed objects such as mechanical pencils or pins to press the keys on the SDC40B. Doing so might cause faulty operation.**
	**Use the SDC40B within the operating ranges recommended in the specifications (temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.). Failure to do so might cause fire or faulty operation.**
	**Do not block ventilation holes. Doing so might cause fire or faulty operation.**
	**Do not allow lead clippings, chips or water to enter this controller case. Failure to do so might cause fire or faulty operation.**
	**Inputs to the current input terminals (㉛・㉝and ㉘・㉙) on the SDC40B should bewithin the current and voltage ranges listed in the specifications. Failure to do so might cause electric shock or faulty operation.**
	**Firmly tighten the terminal screws at the torque listed in the specifications. Insufficient tightening of terminal screws might cause electric shock or fire.**

⚠CAUTION

	**Do not use unused terminals on the SDC40B as relay terminals. Doing so might cause electric shock, fire or faulty operation.**
	**We recommend attaching the terminal cover (sold separately) after wiring the SDC40B. Failure to do so might cause electric shock.**
	**Use the relays on the SDC40B within the service life listed in the specifications. Continued use of the relays after the recommended service life might cause fire or faulty operation.**
	**Use Yamatake's SurgeNon if there is the risk of power surges caused by lightning. Failure to do might cause fire or faulty operation.**

SAFETY REQUIREMENTS

To reduce risk of electrical shock which could cause personal injury, follow all safety notices in this documentation.

This symbol warns the user of a potential shock hazard where hazardous live voltages may be accessible.

- If the equipment is used in a manner not specified by the manufacturer, the protection protection provided by the equipment must be impaired.
- Do not replace any component (or part) not explicity specified as replaceable by your supplier.
- All wiring must be in accordance with local norms and carried out by authorzed experienced personnel.
- The ground terminal must be connected before any other wiring (and disconnected last).
- A switch in the main supply is required near the equipment.
- Mains power supply wiring requires a (T) 2A, 250V fuse(s).

Installation category:Category II(IEC664-1, IEC1010-1)
Specification of common mode voltage:The common mode voltages of all I/O except for main supply are less than 30Vrms, 42.4V peak and 60Vdc.

EQUIPMENT RATINGS

Supply voltages	100 to 240Vac (operation power voltage:90 to 264Vac)
Frequency	50/60Hz
Power or current ratings	30VA maximum

EQUIPMENT CONDITIONS

Do not operate the instrument in the presence of flammable liquids or vapors. Operation of any electrical instrument in such an environment constitutes a safety hazard.

Temperature	0 to 50˚C
Humidity	30 to 90%RH
Installation category	Category II (IEC664-1, EN61010-1)
Pollution degree	2

EQUIPMENT INSTALLATION

- The controller must be mounted into a panel to limit operator access to the rear terminals.
- Specification of common mode voltage: The common mode voltages of all I/O except for main supply and relay outputs are less than 30V rms, 42.4V peak and 60Vdc.

APPLICABLE STANDARDS

EN61010-1, EN50081-2, EN50082-2, EN61326-1

Foreword

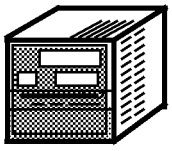
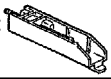
Thank you for purchasing the SDC40B Digital Indicating Controller.
This manual describes how to install and connect lines to the SDC40B, and provides troubleshooting procedures, specifications and other information required to gain an overall understanding of SDC40B operations.
This manual contains the instructions required to properly operate the SDC40B: we strongly urge its reading by all persons responsible for console operation and equipment design utilizing the SDC40B, as well as those involved in its maintenance.

Unpacking

When unpacking the product, check the following:

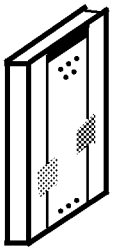
1. Model numbers to ensure that you have received the product you ordered;
2. Unit appearance for damage;
3. That all accessories are included.

If any of the accessories listed in the table below are missing, or the product has been damaged in shipping, immediately contact your dealer.
After unpacking, store any unused accessories in a safe place to prevent loss or damage.

Model	Model number	Qt'y	Remarks
SDC40B 		1	Refer to Section 1-3, "Model Number Table" on page 1-3.
Mounting bracket 	81405411-001	2	
Unit indicating label	N-3132	1	

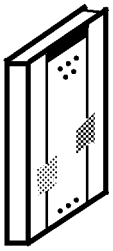
The Role of This Manual

In all, there are four user's manuals describing the SDC40B Digital Indicating Controller. We recommend you select and read those manuals required to perform your work with the SDC40B safely and properly. The following overviews the contents of each manual:



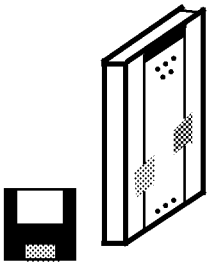
User's Manual : Basic Operations **CP-UM-1679E**

This is the manual you are now reading. It is provided with the SDC40B unit. We strongly urge persons responsible for device design, operations, and maintenance on the SDC40B read this manual.
It describes how to mount the unit to a operation console or other location, wire and configure the unit; it also contains maintenance and inspection information, troubleshooting tips and specifications.



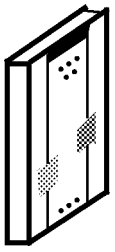
User's Manual : Operation Functions **CP-UM-1680E**

We strongly urge persons responsible for device design and control programming development on the SDC40B read this manual.
Control computation functions can be loaded onto the SDC40B according to the application being used. This manual explains computational expressions in detail. It also serves as an instrumentation design guide in that it contains control computation examples.



User's Manual: Smart Loader Package SLP-C4B
CP-UM-1681E

This manual is provided on a floppy disk that comes with Smart Loader Package. Use a PC for programming to incorporate the computational expressions reqired by the operation processing block of SDC40B.
Operations on a PC are also described in this manual.



User's Manual: DIGITRONIK CPL Communications SDC40B
CP-UM-1683E

We strongly urge persons using the SDC40B CPL Communications functions read this manual.
This manual overviews CPL communications, and explains wiring and communications procedures. It also provides a list of communications data for the SDC40B, troubleshooting measures, and communications specifications.

Organization of This User's Manual

This user's manual consists of the following nine chapters which are outlined below.

Chapter1. GENERAL

This chapter explains the use and features of the SDC40B and overviews its system configuration. It also provides a list of serial numbers of included and related components.

Chapter2. NAMES AND FUNCTIONS OF COMPONENTS

This chapter lists and explains the names and functions of the various SDC40B components. It also contains usable input types and range numbers.

Chapter3. INSTALLATION

This chapter explains how to mount the SDC40B to an operation console.
We strongly urge persons involved in designing hardware using the SDC40B read this chapter.

Chapter4. WIRING

This chapter lists points to note when connecting the SDC40B to other equipment and explains wiring procedures.
We strongly urge persons involved in designing hardware and persons responsible for wiring read this chapter.

Chapter5. FUNCTIONS AND SYSTEM CONFIGURATION

This chapter explains the SDC40B functions in detail.
We strongly urge persons involved in designing control systems utilizing the SDC40B read this chapter.

Chapter6. COMPUTATIONAL EXPRESSIONS

This chapter explains the computational functions provided in the SDC40B.
We strongly urge persons involved in designing control systems utilizing the SDC40B read this chapter.

Chapter7. OPERATING THE SDC40B

This chapter explains the loading of a program developed on the SDC40B smart loader package onto the SDC40B and how to operate the unit thereafter.

Chapter8. TROUBLESHOOTING AND CORRECTIVE MEASURES

This chapter provides check points and corrective measures to take when the SDC40B is not operating properly.

Chapter9. SPECIFICATIONS

This chapter provides general specifications, performance specifications, external dimensions and other technical information on the SDC40B.

Conventions Used in This Manual

This manual uses the following conventions to alert readers to important information:

⚠WARNING — Text preceded with "WARNING" alerts the reader to a hazard. Always heed such an alert!

Handling Precautions — Text preceded with "Handling Precautions" alerts the reader to points of note when operating the unit.

NOTE — Text preceded with "NOTE" alerts the reader to supplementary explanations or reference materials.

Contents

Chapter 5. FUNCTIONS AND SYSTEM CONFIGURATION

Chapter 6. COMPUTATIONAL EXPRESSIONS

Chapter 7 OPERATING THE SDC40B

Chapter. 1 GENERAL

1 - 1 Features

The DIGITRONIK SDC40B is a general-purpose, single-loop controller designed to control temperatures, pressures, flow rates, levels, pH values and other varying physical conditions. Combining PID control and numerous auxiliary functions in a single unit, the SDC40B provides high cost-performance control for your device and instrumentation needs. In addition, a PC loader enables you to design any combination of functions.

- **Unique analog input / output**

  The SDC40B provides three analog inputs. One of these is full multi-input, enabling direct input of a thermocouple, RTD (resistance temperature detector), or other voltage / current device.
  As for analog outputs, the 5G model provides three (4 to 20mA ×3) and the 2G model provides two (a 2G output and a 4 to 20mA output), permitting a motor to be driven directly without use of a converter.

- **A rich endowment of digital I / O**

  In addition to mode changeover, selection setting, event output, etc., the 12 digital inputs and 8 digital outputs (3 relay outputs and five open collector outputs) provided on the SDC40B permit direct connection to internal computations, providing the user the ability to flexibly accommodate automated systems that use controllers such as PLCs.

- **Advanced control functions**

  The SDC40B provides the ability to select one of four provided control modes, including cascade control, enabling the user to perform advanced control with smart-tuning effective for two degrees of freedom PID control, neural network tuning, and overshoot suppression.

- **A host of Computational functions**

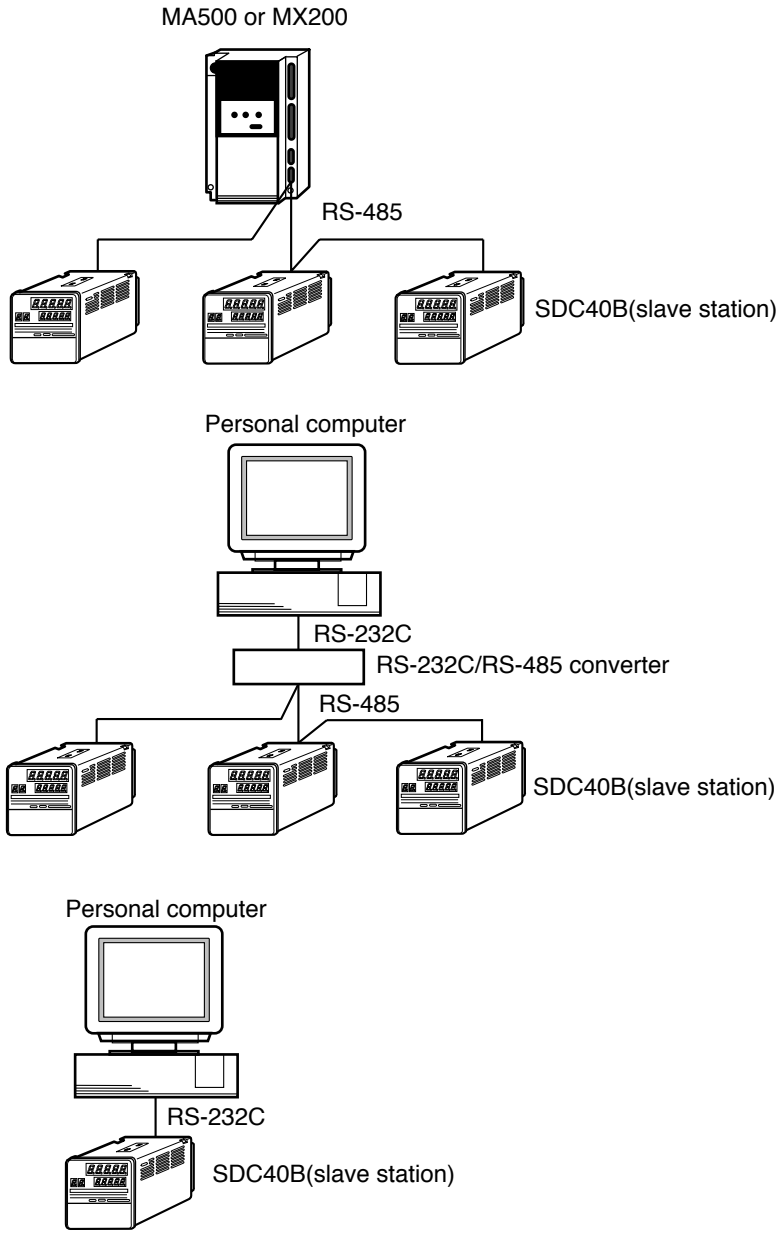
  Roughly 80 computational expressions, including the four arithmetic computation, selectors and linearization tables, can be assigned to as many as 50 computational units and employed in a wide variety of combinations.

- **Simple engineering**

  The PC loader simplifies procedures for combining computational units and selecting other configuration settings.

1 - 2 CPL Communications Network based Configuration

Models equipped with the optional RS-485 communications interface can be connected as a slaved DIGITRONIK's controller to a CPL communications(Controller Peripheral Link:Yamatake host communication protocol) network. In this case, the user can employ as the master station the Yamatake's MA500 FA (Factory Automation) Controller or the MX200 Super Controller.
Models equipped with the optional RS-232C communications interface can be configured in a point-to-point CPL communications network with a personal computer serving as the master station and the SDC40B as the slave station.



1 - 3 Model Number

Basic model No.	Control output	Func-tion	Power supply	Options 1	Options 2	Additional processing	Specifications
C40B							Digital indicating controller
	2G						Position proportional output
	5G						Current output(4 to 20mA DC / 0 to 20mA DC)
		4					Input1: Thermocouples, RTDs, DC current, DC voltage of multi-range Input2: 4 to 20mA DC, 1 to 5V DC Input3: 1 to 5V DC
			AS				AC power supply(90 to 264V AC :Free power supply)
			DS				DC power supply(21.6 to 26.4V DC)
				06*			1 auxiliary output, 12 digital inputs, 8 digital outputs (3 relays, 5 open collectors)
				09*			2 auxiliary outputs, 12 digital inputs, 8 digital outputs (3 relays, 5 open collectors)
					1		No communications interface
					2		RS-485 communication
					3		RS-232C communication
						00	Additional processing not provided
						T0	Tropical treatment
						K0	Antisulfide treatment
						D0	Inspection Certificate provided
						B0	Tropical treatment+Inspection Certificate provided
						L0	Antisulfide treatment+Inspection Certificate provided
						Y0	Complying with the traceability certification

*An option 06 can specify only at the time of control output 2G.
An option 09 can specify only at the time of control output 5G.

1 - 4 Input Types and Range Numbers

■ Input 1

● Thermocouple

Input type	Range number	Code	°C range	°F range
K (CA)	0	K09	0.0 to 1200.0	0 to 2400
K (CA)	1	K08	0.0 to 800.0	0 to 1600
K (CA)	2	K04	0.0 to 400.0	0 to 750
K (CA)	3	K29	-200.0 to +1200.0	-300 to +2400
K (CA)	4	K44	-200.0 to +300.0	-300 to +700
K (CA)	5	K46	-200.0 to +200.0	-300 to +400
E (RC)	6	E08	0.0 to 800.0	0 to 1800
J (IC)	7	J08	0.0 to 800.0	0 to 1600
T (CC)	8	T44	-200.0 to +300.0	-300 to +700
B (PR30-6)	9	B18	0.0 to 1800.0	0 to 3300
R (PR13)	10	R16	0.0 to 1600.0	0 to 3100
S (PR10)	11	S16	0.0 to 1600.0	0 to 3100
W (WRe5-26)	12	W23	0.0 to 2300.0	0 to 4200
W (WRe5-26)	13	W14	0.0 to 1400.0	0 to 2552
PR40-20	14	D19	0.0 to 1900.0	0 to 3400
Ni-Ni•Mo	15	Z13	0.0 to 1300.0	32 to 2372
N	16	U13	0.0 to 1300.0	32 to 2372
PL II	17	Y13	0.0 to 1300.0	32 to 2372
DIN U	18	Z08	-200.0 to +400.0	-300 to +750
DIN L	19	Z07	-200.0 to +800.0	-300 to +1600

● Resistance temperature detector (RTD)

Input type	Range number	Code	°C range	°F range
JIS'89 Pt100 (IEC Pt 100Ω)	32	F50	-200.0 to +500.0	-300.0 to +900.0
	33	F46	-200.0 to +200.0	-300.0 to +400.0
	34	F32	-100.0 to +150.0	-150.0 to +300.0
	35	F36	-50.0 to +200.0	-50.0 to +400.0
	36	F38	-60.00 to +300.0	-76.00 to +104.00
	37	F33	-40.00 to +40.00	-40.00 to +140.00
	38	F05	0.0 to 500.0	0.0 to 900.0
	39	F03	0.0 to 300.0	0.0 to 500.0
	40	F01	0.00 to 100.00	0.00 to 200.00
JIS'89 J Pt100	48	P50	-200.0 to +500.0	-300.0 to +900.0
	49	P46	-200.0 to +200.0	-300.0 to +400.0
	50	P32	-100.0 to +150.0	-150.0 to +300.0
	51	P36	-50.0 to +200.0	-50.0 to +400.0
	52	P38	-60.00 to +40.00	-76.0 to +104.00
	53	P33	-40.00 to +60.00	-40.00 to +140.00
	54	P05	0.0 to 500.0	0.0 to 900.0
	55	P03	0.0 to 300.0	0.0 to 500.0
	56	P01	0.00 to 100.00	0.00 to 200.00

● **DC current/voltage**

Input type	Range number	Code	Range (program mable)
4 to 20mA	64	C01	-19999 to +26000
0 to 20mA	65	C08	
0 to 10mV	66	M01	
10 to +10mV	67	L02	
0 to 100mV	68	L01	
0 to 1V	69	L04	
-1 to +1V	70	L08	
1 to 5V	71	V01	
0 to 5V	72	L05	
0 to 10V	73	L07	

■ Input 2 DC current/voltage

Input type	Range number	Code	Range (program mable)
4 to 20mA	0	C01	-19999 to +26000
1 to 5V	1	V01	

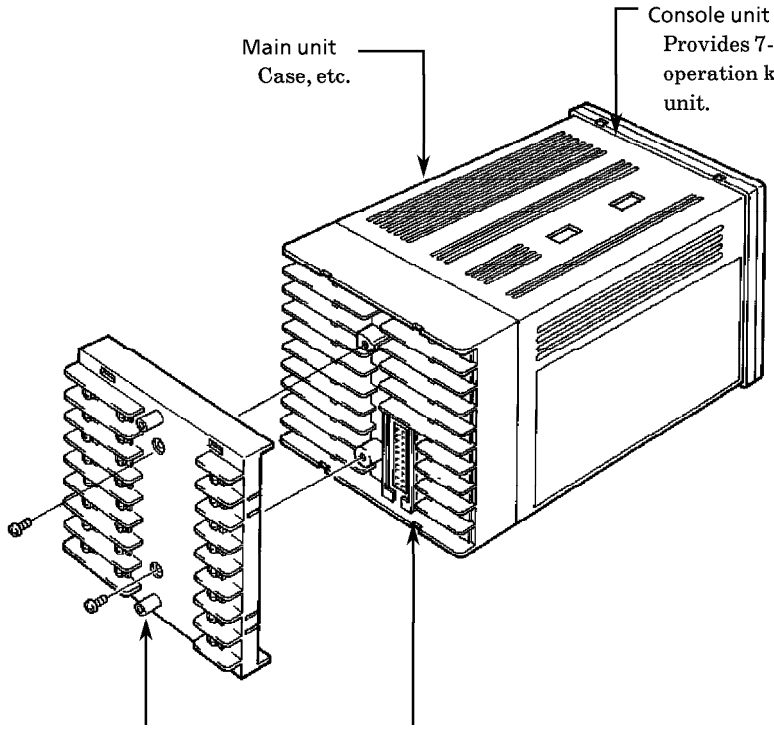
■ Input 3 DC voltage

Input type	Code	Range (program mable)
1 to 5V	V01	-19999 to +26000

Chapter2. NAMES AND FUNCTIONS OF COMPONENTS

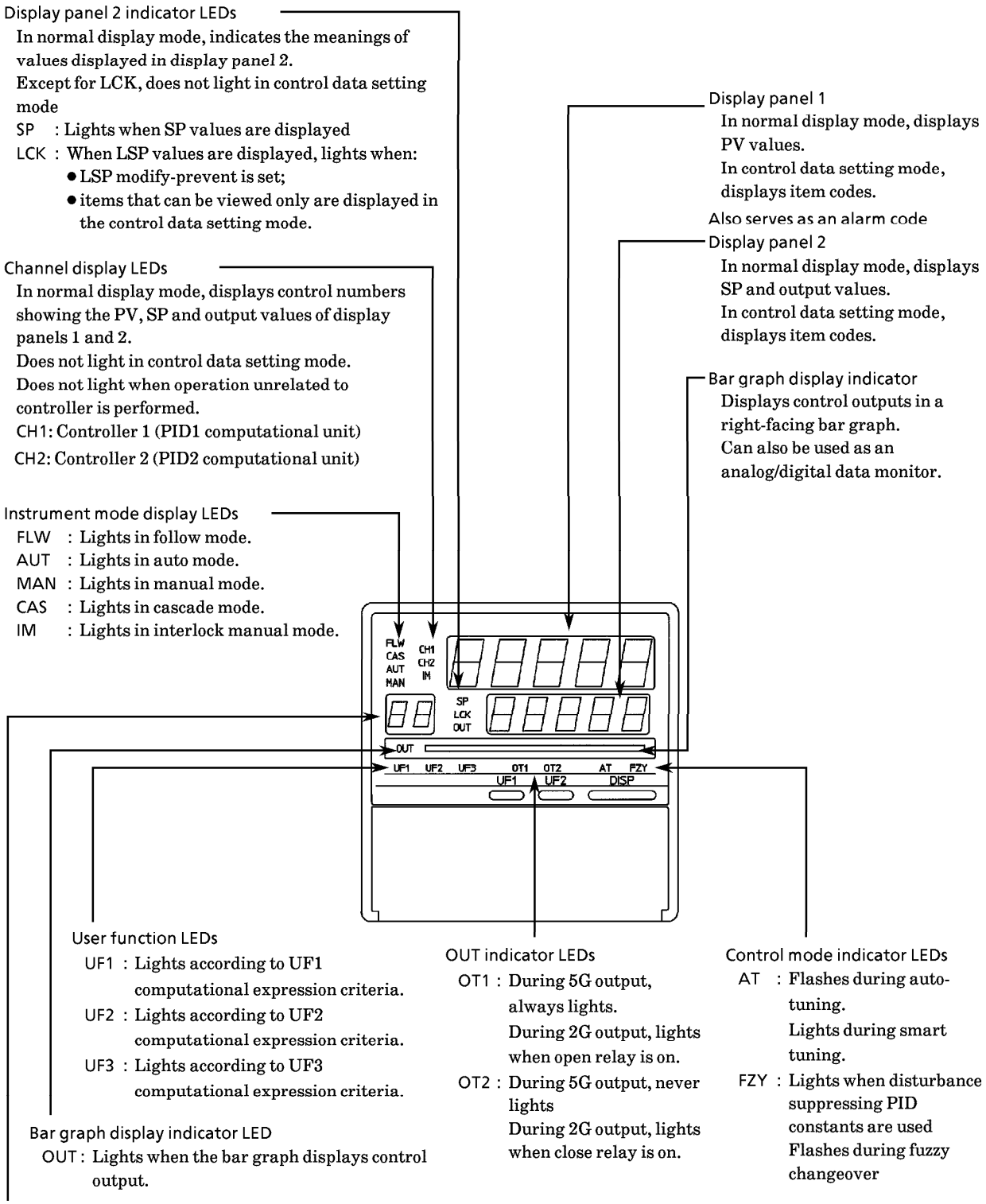
2 - 1 Names of External Components

The SDC40B consists of a console unit, main unit, standard terminal base, and extended terminal base.

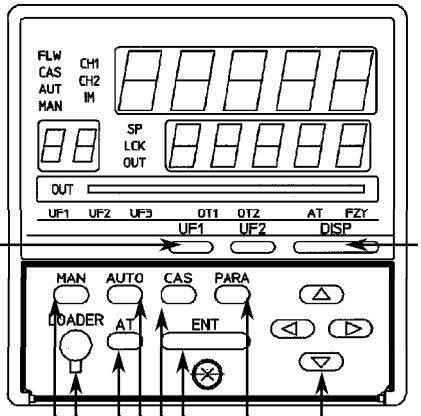


2 - 2 Names and Functions of the Console Unit Display Indicators

Designed to facilitate operations, the SDC40B console unit consists of operation keys, display indicators, and light-emitting diodes (LED), which are described below.



2 - 3 Names and Functions of Console Unit Keys



UF1, UF2 keys
Selects user-specified items (max. 8).
Can be used with internal signals for computation processing.

MAN
Switches SDC40B to manual mode.

Loader jack*
Jack to connect loader.

AT
Starts and stops auto-tuning.

AUTO
Activates auto mode.

CAS
Activates cascade mode.

DISP
In normal display mode, changes displayed items.
In control data setting mode, restores normal display mode.

[←]、[→]
Cycles through setting items
Moves flashing digit of value currently available for modifying.
In normal display mode, activates LSP setting mode.

[↑]、[↓]
Cycles through setting items
Increases or reduces value currently available for modifying.
In normal display mode, activates LSP setting mode.

PARA
In normal display mode, activates control data (parameter) setting mode.
In control data setting mode, makes value available for modifying.

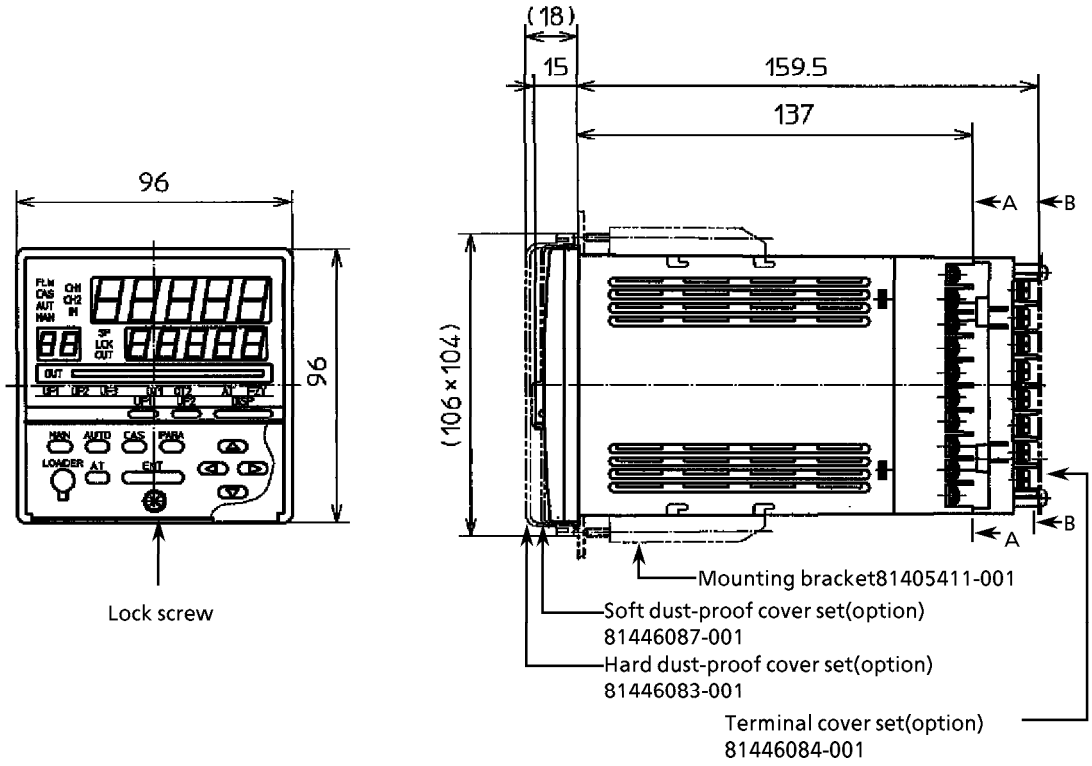
ENT
Activates setting value change
Completes setting value change and writes it to memory.

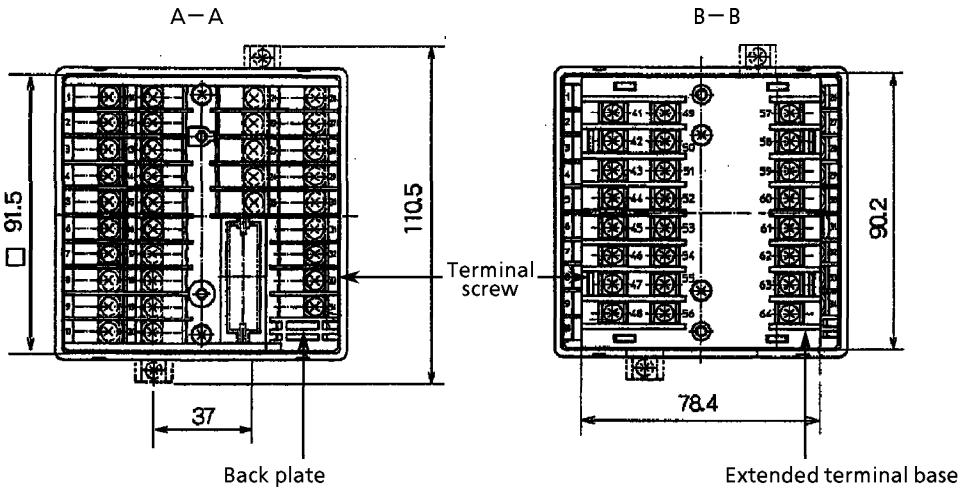
* The loader jack is not isolated from the internal digital circuits. The loader cap must be replaced when the jack is not used.

Chapter3. INSTALLATION

3 - 1 External Dimensions

Unit: mm



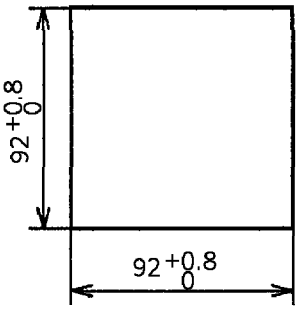


3 - 2 Panel Cutout Dimensions

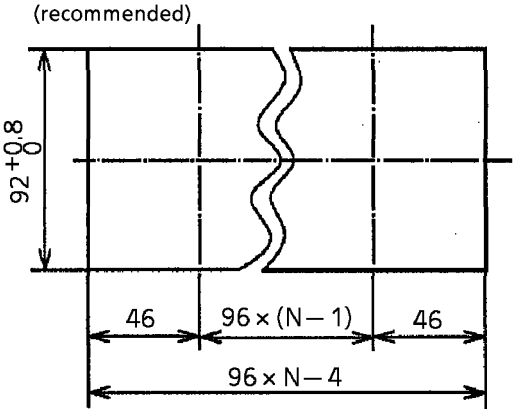
When making the panel, use a steel plate at least 2mm thick.

Unit : mm

Panel cutout dimensions

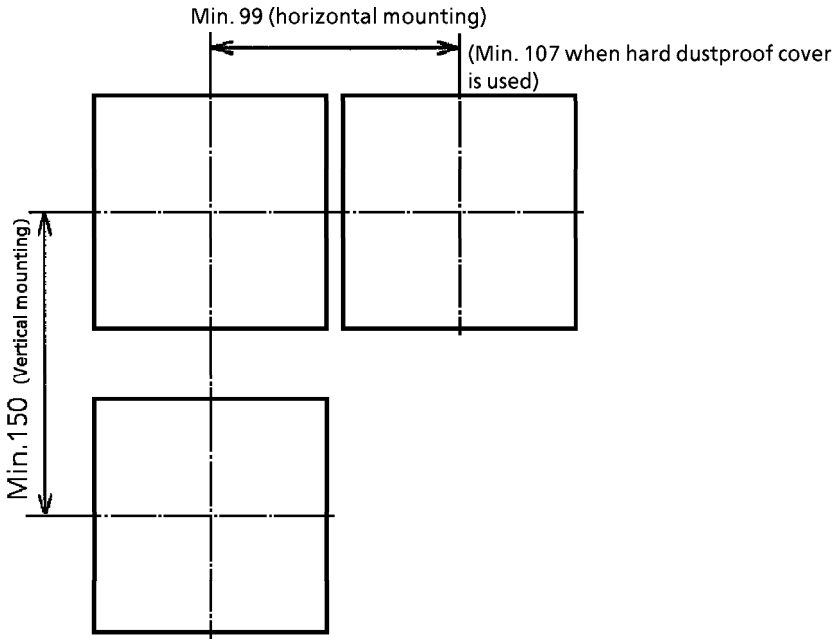


Panel cutout dimensions for contact mounting (recommended)



N = Number of units to be mounted

Panel cutout dimensions for horizontal mounting (recommended)



Handling Precautions When installing, be careful to ensure the operating temperature of the bottom panel of the SDC40B case remains within 0 to 50°C. Be especially careful when performing contact or vertical mounting of unit.

3 - 3 Mounting

⚠WARNING

- Before wiring, or removing/mounting the SDC40B, be sure to turn the power OFF.
  Failure to do so might cause electric shock.
- Do not disassemble the SDC40B.
  Doing so might cause electric shock or faulty operation.

⚠CAUTION

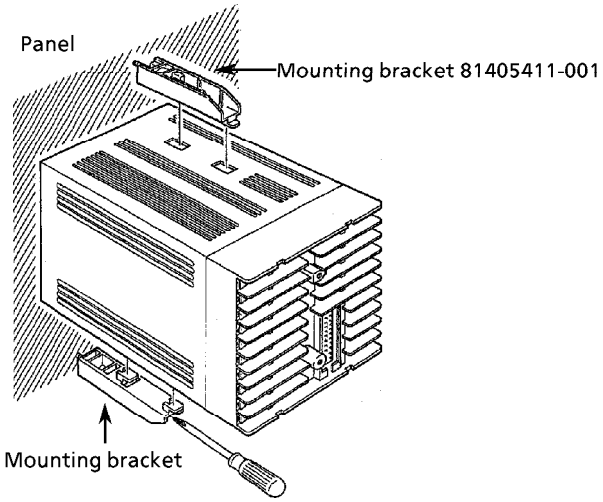
- AUse the SDC40B within the operating ranges recommended in the specifications (temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.).
  Failure to do so might cause fire or faulty operation.
- Do not block ventilation holes.
  Doing so might cause fire or faulty operation.
- Do not allow lead clippings, chips or water to enter this controller case.
  Failure to do so might cause fire or faulty operation.

■ Location

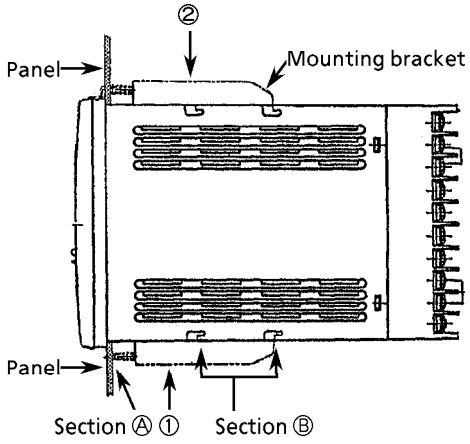
Mount the SDC40B in a location.

- Not subject to extremes in temperature or humidity
- Free of sulfide and other corrosive gases
- With little dust, oily residues, etc
- Not exposed to direct sunlight or weather extremes
- Subject to little mechanical vibration or impact
- Far from high-tension lines, welders, and other electrical noise-generating sources
- 15m or farther from boilers or other equipment with high-voltage ignition devices
- Not subject to strong magnetic fields
- Not subject to flammable liquids or moisture

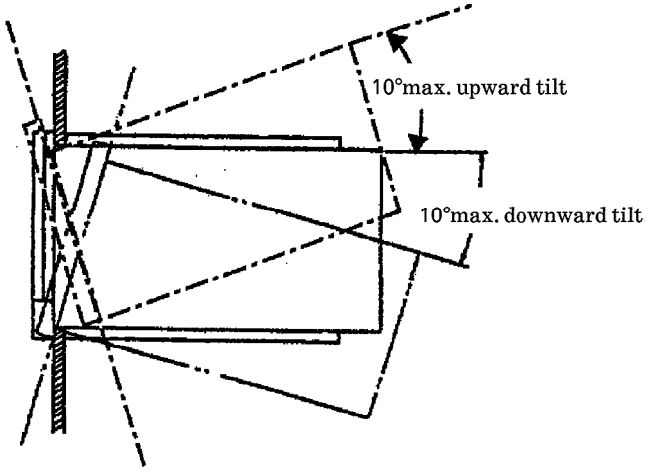
■ Procedure



- Secure top and bottom panels of unit with the provided mounting brackets.
- Mount proceeding from mounting bracket ① on the bottom side.
- Once the sections indicated by Ⓐ and Ⓑ both are snug (no play at front or back of mounting bracket), tighten screws one turn. Be careful: overtightening will deform case.



- Secure unit within 10 of horizontal.



■ Dustproof Cover

Dustproof Cover Use the dustproof cover (option) when using the controller in a dusty or dirty location, and to prevent inadvertent operation.
Two dustproof covers are provided, hard or soft, each with the following differing functions.

Type	Checking of Display	Operation
Hard	○	X
Soft	○	○

○ indicates that a function can be used.

Chapter4. WIRING

4 - 1 Precautions on Wiring

⚠WARNING

- Earth the FG terminal with a ground resistance of maximum 100 Ω before connecting to the measurement target and external control circuits.
  Failure to do so might cause electric shock or fire.
- Before wiring, or removing/mounting the SDC40B, be sure to turn the power OFF.
  Failure to do so might cause electric shock.
- Do not touch electrically charged parts such as the power terminals.
  Doing so might cause electric shock.

⚠CAUTION

- Wire the SDC40B properly according to predetermined standards. Also wire the SDC40B using specified power leads according to recognized installation methods.
  Failure to do so might cause electric shock, fire or faulty operation.
- Do not allow lead clippings, chips or water to enter this controller case.
  Failure to do so might cause fire or faulty operation.
- Inputs to the current input terminals (31·32 and 28·29) on the SDC40B should bewithin the current and voltage ranges listed in the specifications.
  Failure to do so might cause electric shock or faulty operation.
- Firmly tighten the terminal screws at the torque listed in the specifications.
  Insufficient tightening of terminal screws might cause electric shock or fire.
- Do not use unused terminals on the SDC40B as relay terminals.
  Doing so might cause electric shock, fire or faulty operation.
- We recommend attaching the terminal cover (sold separately) after wiring the SDC40B.
  Failure to do so might cause electric shock.
- Use the relays on the SDC40B within the service life listed in the specifications.
  Continued use of the relays after the recommended service life might cause fire or faulty operation.
- Use Yamatake's SurgeNon if there is the risk of power surges caused by lightning.
  Failure to do might cause fire or faulty operation.

- Before connecting the lines, verify the serial number and terminal numbers on the label affixed to the side panel of the SDC40B. After completing, always double check to ensure all wiring has been performed correctly.
- Use power lines of 90 V or greater capacity for the I/O signal lines and the communications lines, and maintain at least 50 cm between them and the power supply line.
- Make sure that no crimp-style solderless wire connectors are touching an adjacent terminal or connector.
- When connecting a thermocouple input of the SDC40B to another instrument, make sure the instrument's input impedance totals at least 1MΩ. If less than 1MΩ, the SDC40B may not be able to detect sensor disconnection.
- Cautions when using data input devices in combination
  Input of the SDC40B input or output (connected in parallel for input) to an A/D converter, analog scanner, etc., may cause dispersion of the read data. To prevent dispersion, take one of the following corrective measures:

  Corrective measures
  1. Use a low-speed integral A/D converter.
  2. Insert an isolator with no switching power supply between the SDC40B and the A/D converter.
  3. Perform averaging with a personal computer when the data is read
  4. If the device permits, insert an input filter.

The following table shows the meaning of the symbols in the terminal wiring label on the instrument side:

Symbol	Description
	Alternating current
	Direct current
	Earth (ground) terminal
	Caution, risk of electric shock
	Caution

4 - 2 Recommended Cables

To perform thermocouple input, connect a thermocouple element to the terminals. When the wiring distance is long or when connecting the thermocouple without the element to the terminals, connect via shielded compensating lead wires.

📖 NOTE

- For I/O other than thermocouple, use polyethylene insulated vinyl sheathed cable for JCS-364 shielded instruments or equivalent. (general name: twisted shield wire for instrument use)
  Recommended wire types.

Fujikura, Ltd.	2-wire	IPEV-S-0.9mm^2×1P
	3-wire	ITEV-S-0.9mm^2×1T
Hitachi Cable, Ltd.	2-wire	KPEV-S-0.9mm^2×1P
	3-wire	KTEV-S-0.9mm^2×1T

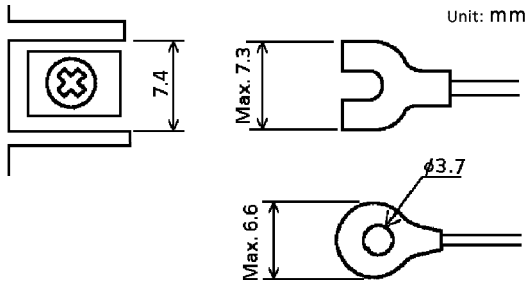
- A shielded multicore microphone cord (MVVS) can be used if electromagnetic induction is low.

4 - 3 Making Terminal Connections

⚠CAUTION

- Firmly tighten the terminal screws at the torque listed in the specifications. Insufficient tightening of terminal screws might cause electric shock or fire.
- Do not use unused terminals on the SDC40B as relay terminals. Doing so might cause electric shock, fire or faulty operation.
- We recommend attaching the terminal cover (sold separately) after wiring the SDC40B. Failure to do so might cause electric shock.

To connect a line to the terminals, use crimp-style solderless wire connectors that fit an M3.5 screw.



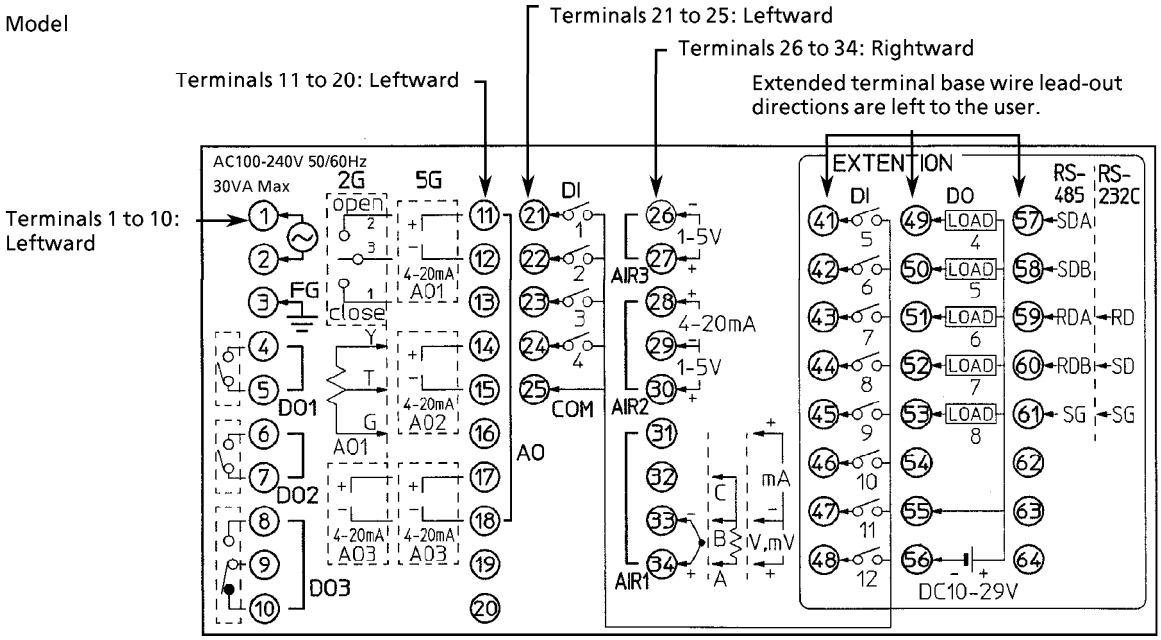
Handling Precautions

- If the SDC40B is mounted in a location subject to noticeable vibration or impact, be sure to use round (closed-end) crimp-style solderless wire connectors to prevent lines from becoming disconnected from the terminals.
- Be careful not to allow any of the crimp-style solderless wire connectors to touch adjacent terminals or connectors.
- The recommended tightening torque for the terminal screws is 0.78 to 0.98N·m.

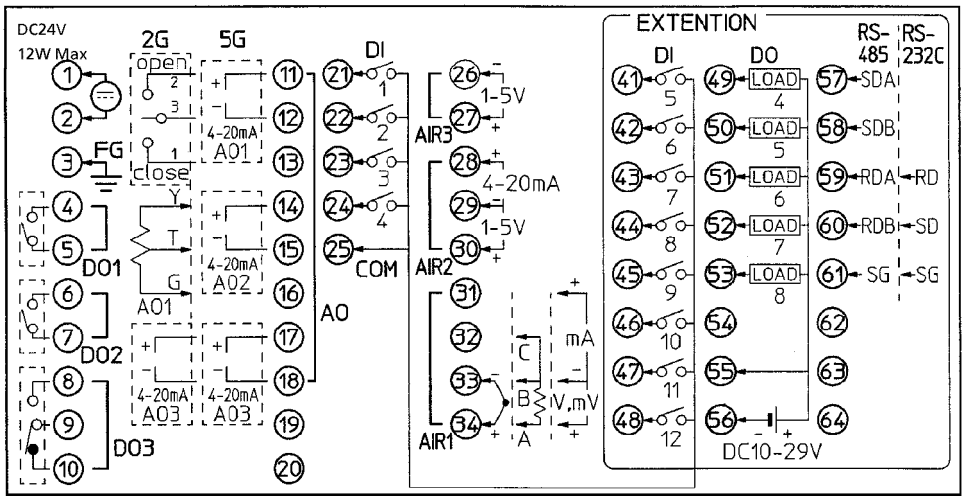
4 - 4 Terminal Layout and Recommended Wire Lead-out Directions

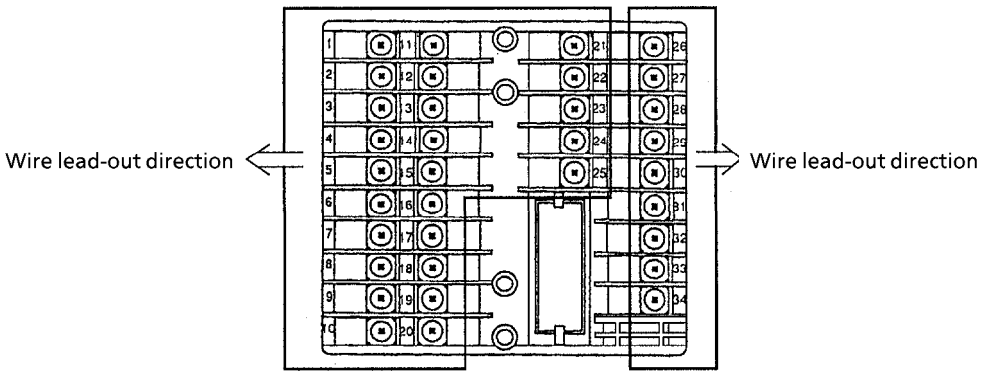
Wires are connected to both the standard terminal base and the extended terminal base. The recommended wire lead-out directions from the standard terminal base are shown below.
Observe these reference standards for wire lead-out directions when using the extended terminal base as well.

● AC Model



● DC Model

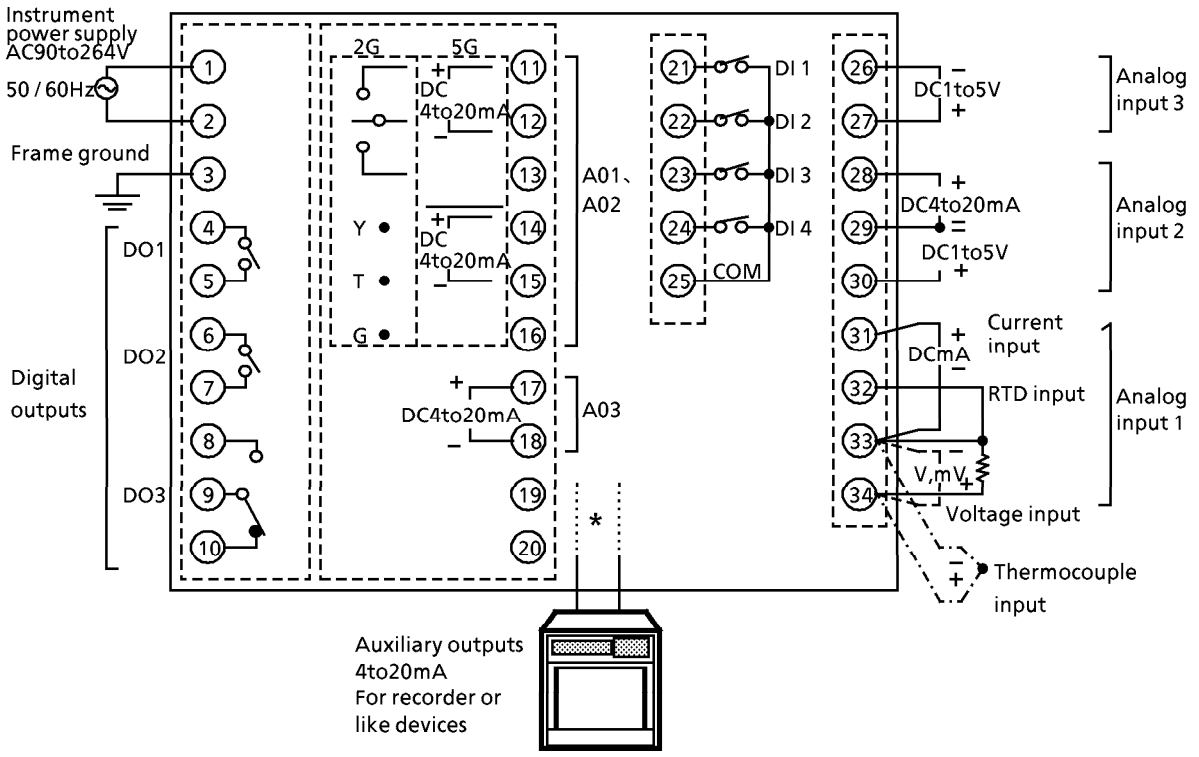




4 - 5 Wiring Diagrams of Standard and Extended Terminal Bases

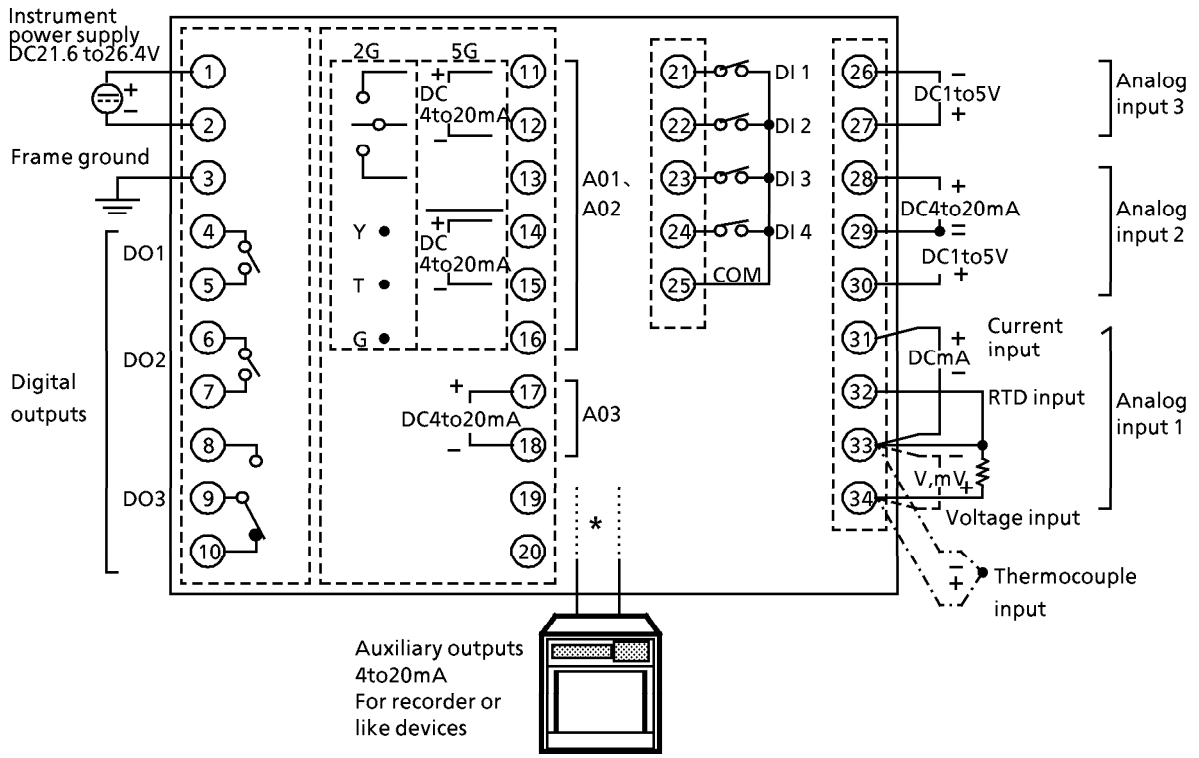
■ Layout of standard terminal

● AC Model



* On the 2G model, the auxiliary output is on terminals 17 and 18.
On the 5G model, the auxiliary outputs are on terminals 14 and 15, and 17 and 18.

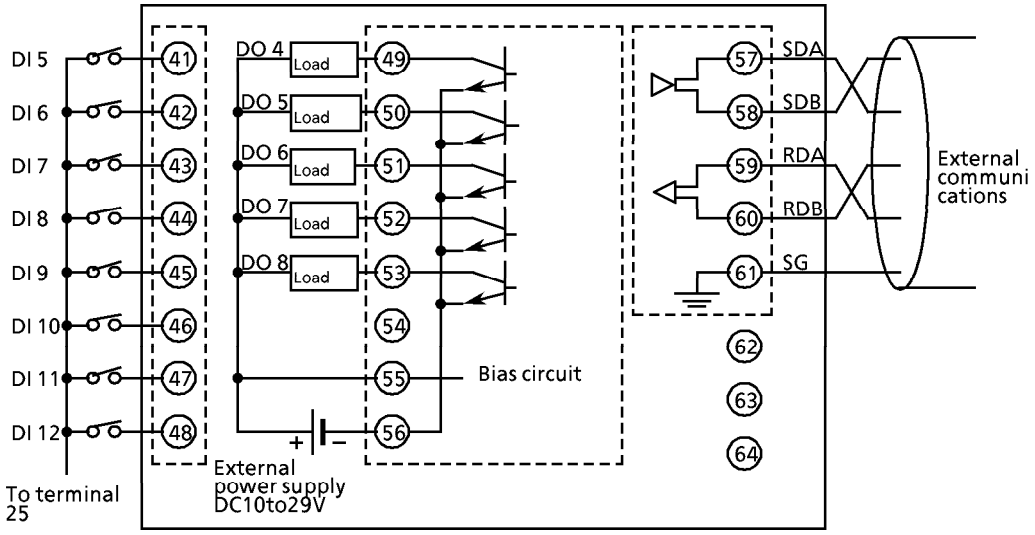
● DC Model



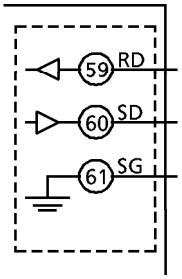
* On the 2G model, the auxiliary output is on terminals 17 and 18.
On the 5G model, the auxiliary outputs are on terminals 14 and 15, and 17 and 18.

■ Layout of extended terminal

●With the RS-485 communications interface



● UsingtheRS-232C communications interface

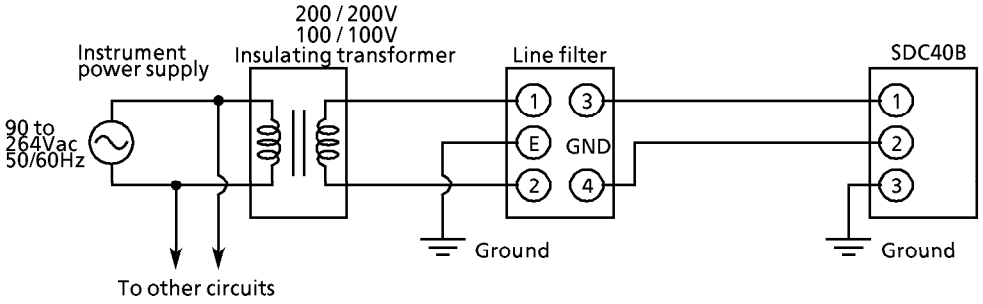


4 - 6 Connecting the Power Supply and Grounding

■ Power supply

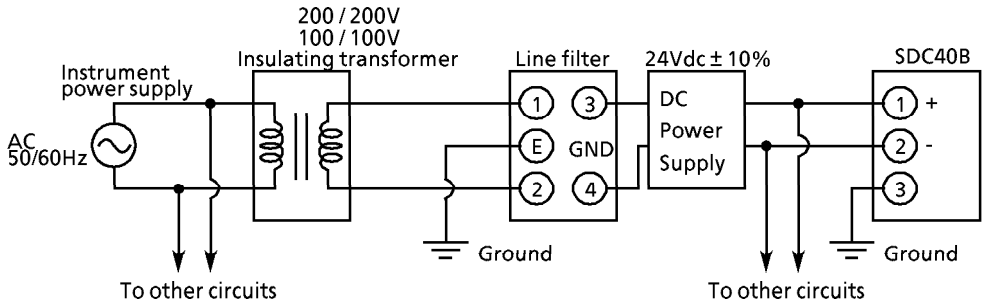
● AC Model

To supply power to the SDC40B, use an instrument-dedicated single-phase power supply subject to minimal electrical interference.



● DC Model

Connect the SDC40B DC model to a 24Vdc ± 10% power source.



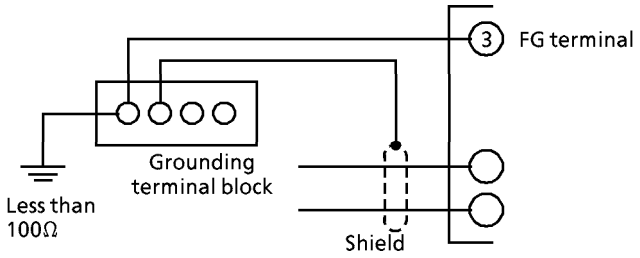
Handling Precautions

- If electrical interference proves excessive, we recommend adding an insulating transformer and / or using a line filter.
  Line filter Yamatake Parts No. 81446364-001
- After carrying out interference reducing measures, do not bundle the primary and secondary power supply coils together or insert them in the same conduit or duct.

■ Grounding

To ground the SDC40B, connect the GND (FG) terminal (terminal 3) to a single ground point without jumpering. If grounding the shield wire or other lines proves difficult, ground them separately to a grounding terminal block.

Type : Less than 100Ω
Conductor : Annealed copper wire, min. 2 mm^2 (AWG14)
Max. Length : 20m



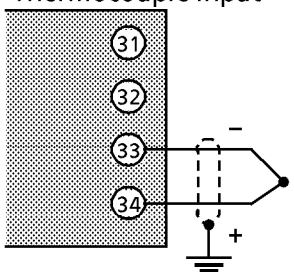
Handling Precautions To ground the SDC40B, connect the GND (FG) terminal (terminal 3) to a single ground point without jumpering.

4 - 7 Connecting the Analog Inputs

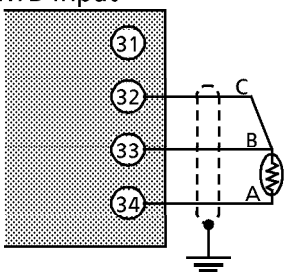
■ Connecting input1

Input 1 is a multi-input type analog input for sensors. Connect as shown below, according to the type of sensor being used.

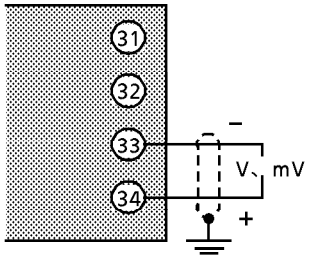
- Thermocouple input



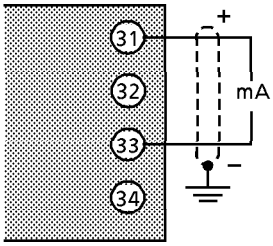
- RTD input



- DC voltage input



- DC current input

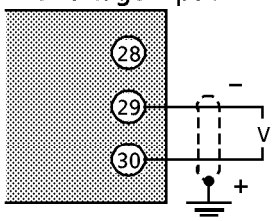


Handling Precautions
- Do not apply voltage across DC current input terminals 31 and 32. Doing so causes the SDC40B to malfunction.
- Be careful to connect the input polarities correctly.
- Use shielded cable to connect the input.

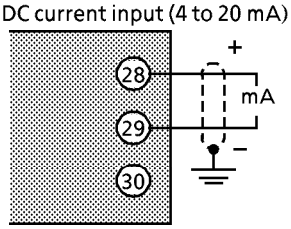
■ Connecting input 2

To connect input 2, connect an input of either 1 to 5 V DC or 4 to 20mA DC to the SDC40B as shown below.

- DC voltage input



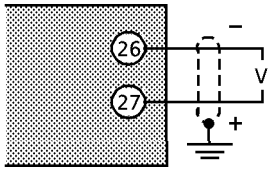
- DC current input (4 to 20 mA)



Handling Precautions
- Do not apply voltage across DC current input terminals 28 and 29. Doing so causes the SDC40B to malfunction.
- Be careful to connect the input polarities correctly.
- Use shielded cable to connect the input.

■ Connecting input 3

To connect input 3, connect an input of 1 to 5V DC to the SDC40B as shown below.



Handling Precautions
- Be careful to connect the input polarities correctly.
- Use shielded cable to connect the input.
- Be aware that inputs 2 and 3 are not isolated.

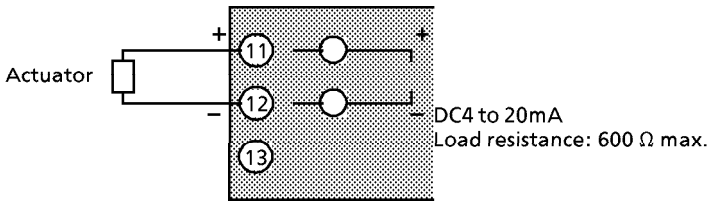
4 - 8 Connecting the Control Output (Analog Output 1)

⚠WARNING

- ALWAYS TURN OFF POWER TO THE SDC40B BEFORE ATTACHING OR REMOVING THE ACTUATOR.

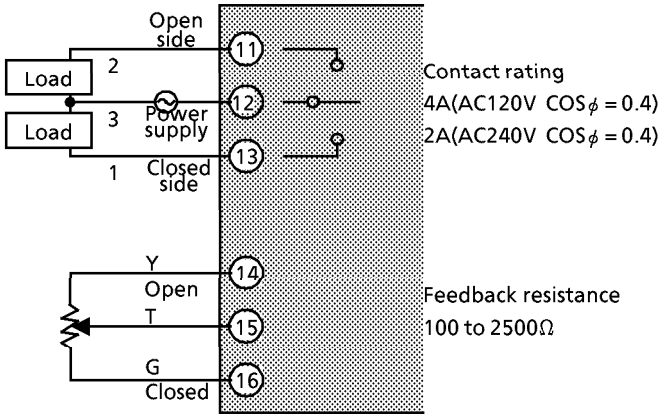
■ Using current output (5G)

Connect the current output 5G as shown below.



■ Using position proportional output (2G)

Paying careful attention to the open/close orientation of the switch, connect as shown below.



Handling Precautions

- The built-in relay has a limited service life. Avoid setting PID constants such that the relay opens and closes repeatedly.
- When using a 100/200 V AC motor, in addition to the contact rating, exercise caution with respect to the inrush current. Use an external auxiliary relay if necessary.
- Maintain at least 30cm between the lines connecting the motor terminals (11, 12, 13) and the feedback resistance terminals (14, 15, 16)
  (Do not insert the lines in the same duct or use six-wire cable. Doing so may cause the SDC40B to malfunction due to electrical interference when starting up the motor.)
- Terminals 14, 15, and 16 need not be connected if there is no feedback resistance.

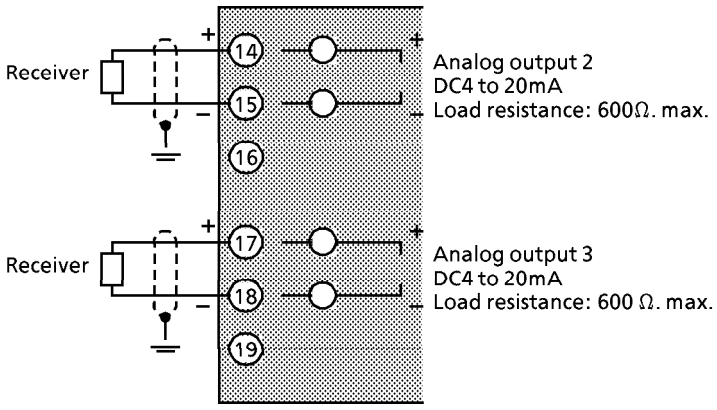
4 - 9 Connecting the Auxiliary Outputs(Analog Output 2,3)

⚠WARNING

- ALWAYS TURN OFF POWER TO THE SDC40B BEFORE ATTACHING OR REMOVING THE ACTUATOR.

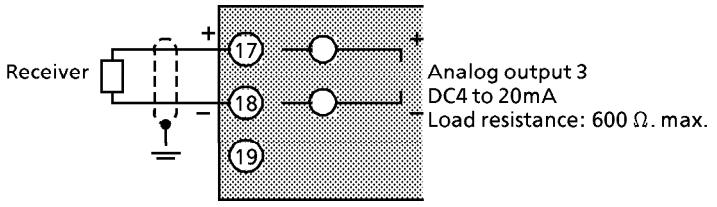
■ Auxiliary output of control output 5G

Handling Precautions Use shielded cable.



■ Auxiliary output of control output 2G

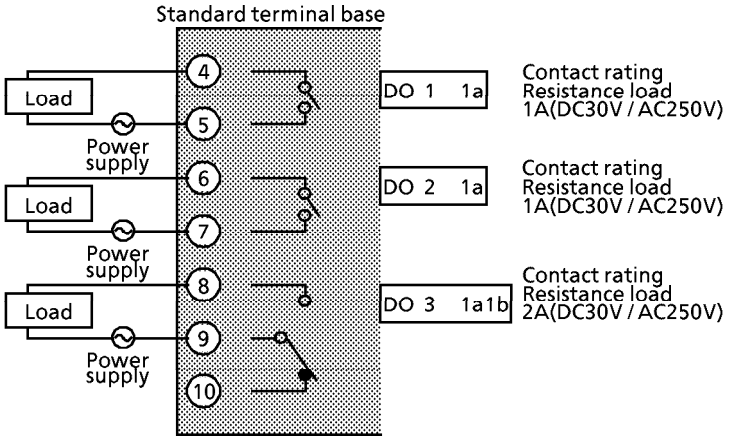
Handling Precautions Use shielded cable.



Control output 2G is not equipped with analog output 2.

4 - 10 Connecting the Relay Digital Outputs

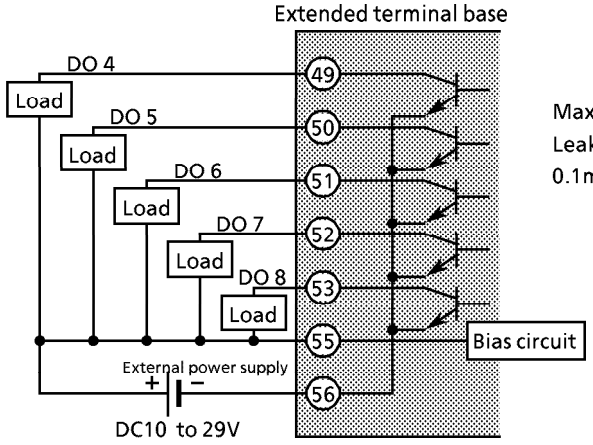
Digital outputs 1 to 3 are relay-type digital outputs: DO1 and DO2 are 1a contact, and DO3 is a 1a1b contact relay. They connect to the standard terminal base.



Handling Precautions When switching a small current, connect a bleeder resistance to obtain a current greater than that of the minimum switching capacity of the relay.

4 - 11 Connecting the Open Collector Digital Outputs

Digital outputs DO4 to DO8 are open collector-type. They connect to the extended terminal base.



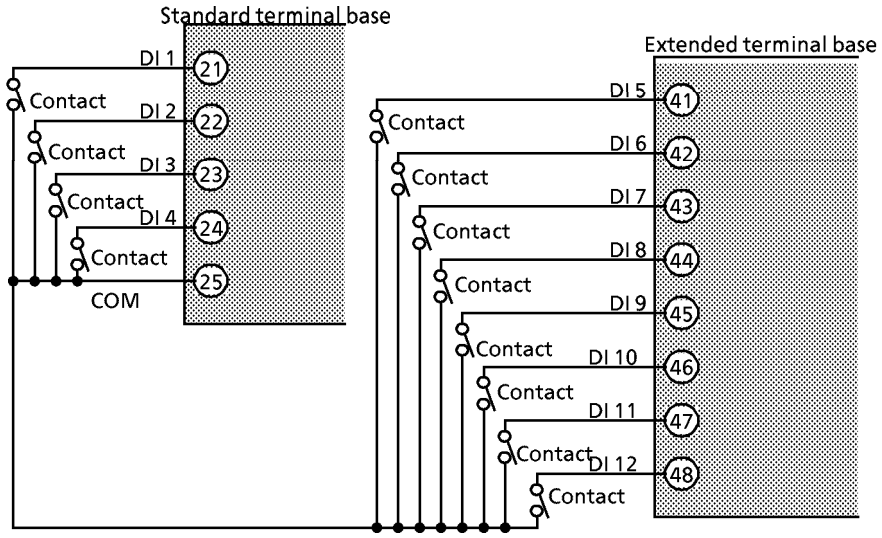
Max. load current: 70mA/output
Leakage current at shutoff:
0.1mA or less

Handling Precautions

- Always connect terminal55 to the positive (+) terminal of the external power supply. Failure to do so renders the open collector digital outputs inoperative.
- Do not short circuit the positive (+) terminal of the external power supply to terminals49 to 53 on the SDC40B. Doing so causes the open collector digital outputs to malfunction.
- When connecting a semiconductor load such as a programmable controller (sequencer), select a module in which the current directions match.
  Use one made inoperative by the leakage current produced when the digital outputs are shut off.

4 - 12 Connecting the Digital Outputs

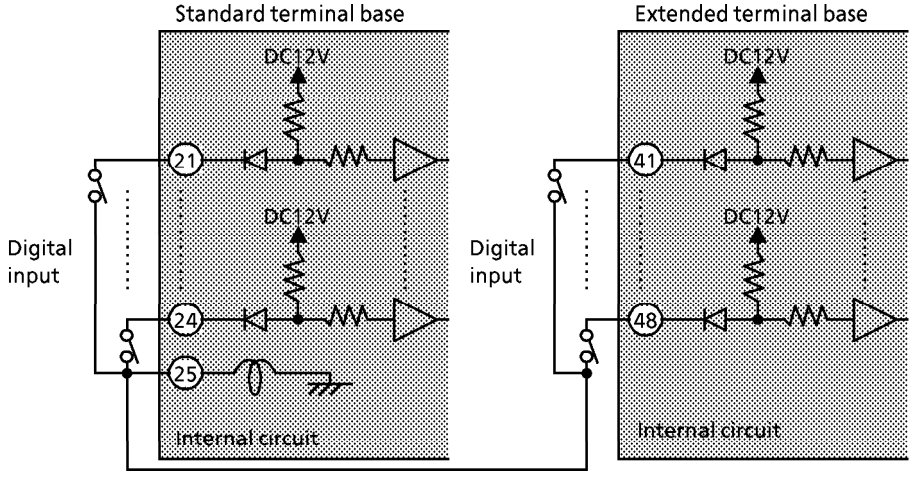
The SDC40B is equipped with 12 digital inputs (DI). Eight of these are provided on the extended terminal base. To wire, connect across both the standard terminal base and the extended terminal base.



Handling Precautions

- The digital inputs on this unit are provided with a built-in power supply (open voltage type, 12V). Always use no-voltage contacts externally.
- For the no-voltage contacts, use gold contacts or other relays that switch on small currents. Other types of relay contacts may not switch. Use contacts that have ample margin over the minimum switching capacity with respect to the current and open voltage ratings of contacts provided on the SDC40B.
- If using semiconductors (open collectors, etc.) as no-voltage contacts, use one that maintains a potential of no more than 3V across the contacts when actuated, and a leakage current of no more than 0.1mA when shut off.
- The digital inputs (remote switch inputs) of all SDC40 series units (SDC40A, SDC40B, and SDC40G) can be connected in parallel. If connecting them in parallel to another instrument, carefully check the requirements of the other instrument before proceeding.

● Cut-out diagram of the SDC40B internal circuits that connects the digital inputs

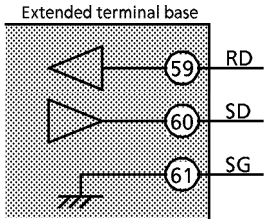


4 - 13 Connecting the Communications Interface

Depending on the model, the SDC40B is equipped with either an RS-232C communications interface or an RS-485 communications interface.

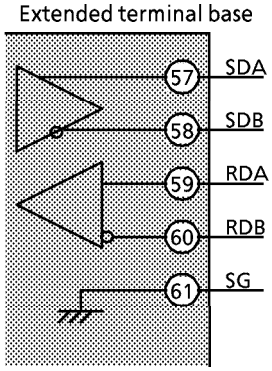
Handling Precautions The SDC40B operates as a slave station.

■ Connecting to an RS-232C communications interface



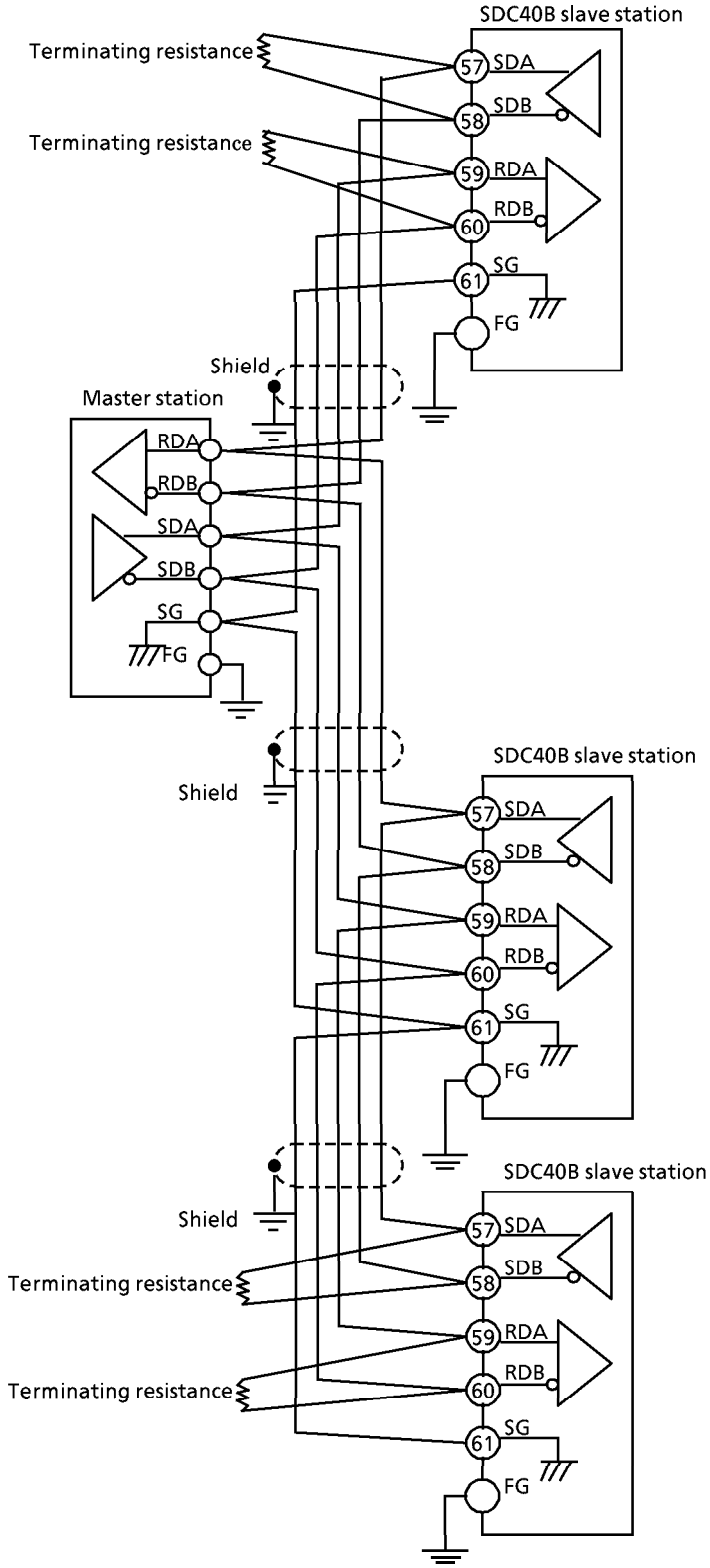
Handling Precautions
- Connect the slave station to the master station in a single-drop (point-to-point) configuration.
- The slave station cannot be connected in a multi-drop configuration.
- Set the slave station address to a number other than 0.

■ Connecting to an RS-485 communications interface



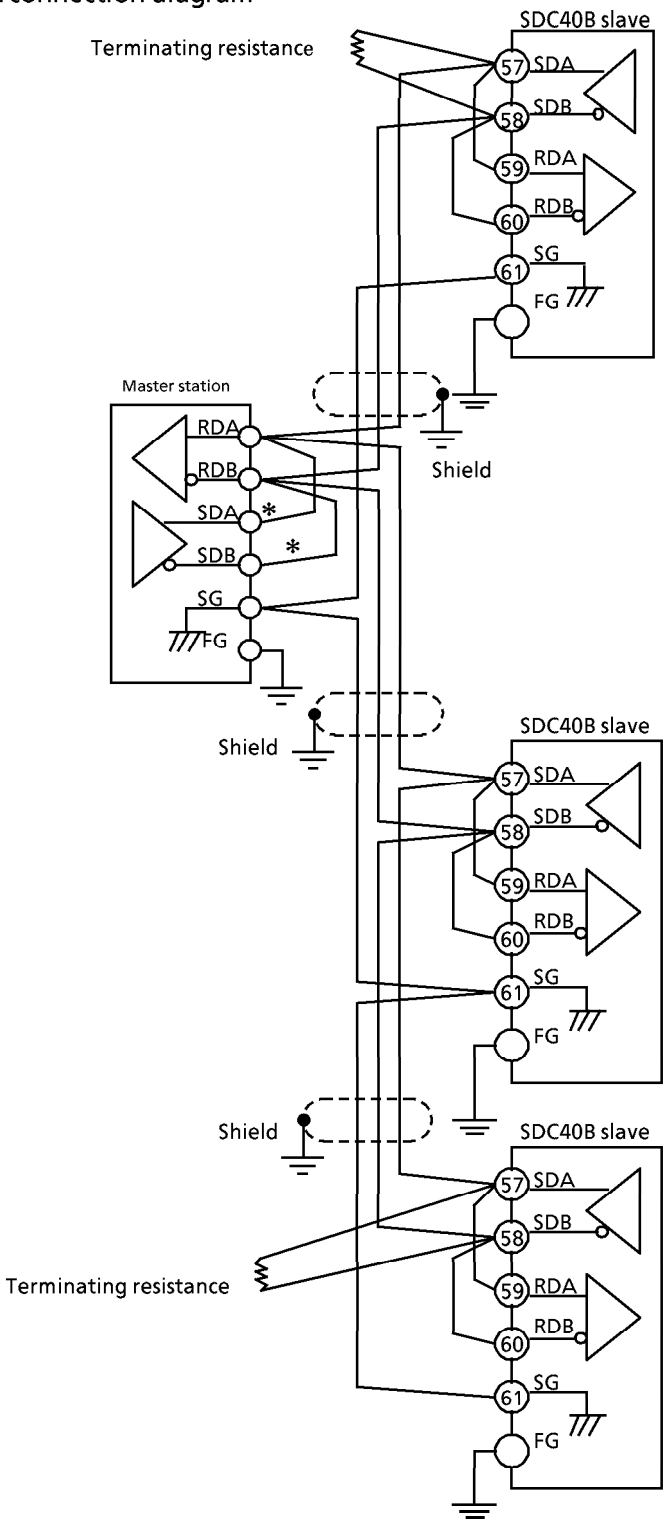
Handling Precautions
- The slave station can be connected in a multi-drop configuration.
- Always set a unique address to each slave station.
- Attach terminating resistances (a total of four when connecting a 5-wire system) to the ends of the communications lines. Use 0.5W or greater terminating resistances of 150Ω ± 5%.
- If connecting three lines, short circuit terminals 57 and 59, and 58 and 60.
- Do not short circuit the RDA to RDB and SDA to SDB terminals.

● RS-485 5-wires system interconnection diagram



Attach 0.5W or greater terminating resistances of 150Ω ±5% at each end of the communications lines. Ground the shield FGs at one end in one location, not at both ends.

● RS-485 3-wires system interconnection diagram



Attach 0.5W or greater terminating resistances of 150Ω±5% at each end of the communications lines. Ground the shield FGs at one end in one location, not at both ends.

4 - 14 Corrective measures

■ Sources of electrical interference

The following list notes common sources of electrical interference.

① Relays and contacts
② Solenoid coils and valves
③ Power lines (esp. those carrying more than 90V)
④ Inductive loads
⑤ Impedances
⑥ Motor commutators
⑦ Phase angle control SCR
⑧ Wireless communications equipment
⑨ Welding irons
⑩ High-voltage ignition devices

■ Electrical interference suppression measures

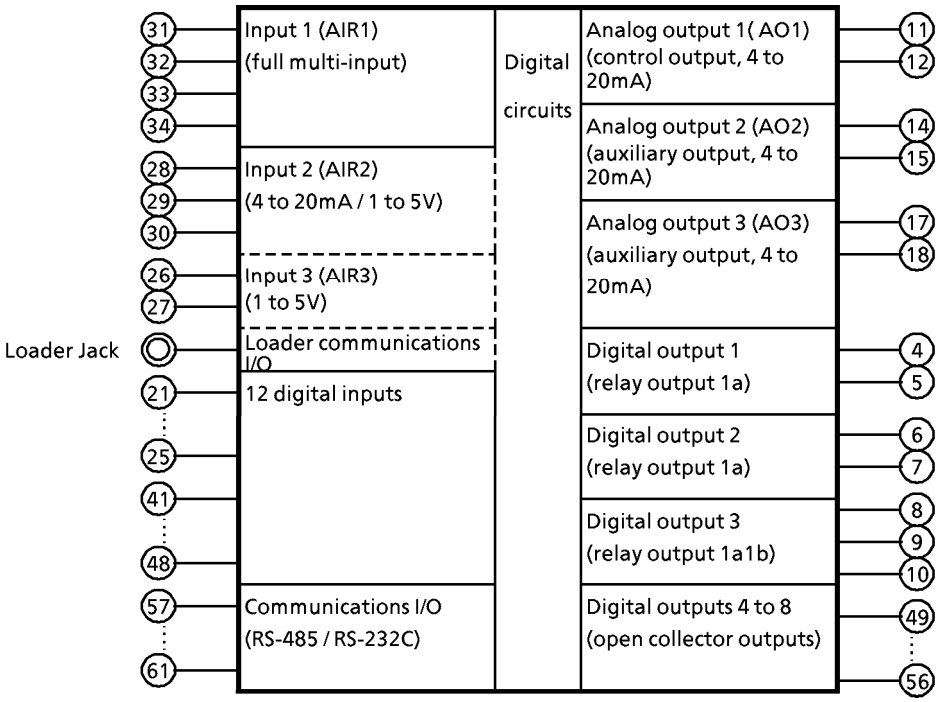
- Use a CR filter to suppress fast-rising interference.
  Recommended CR filter: Yamatake Parts No.81446365-001

- Use a varistor to suppress high-amplitude interference.
  However, exercise caution when using a varistor as it short circuits upon malfunctioning.
  Recommended varistors:
  Yamatake Parts No. 81446366-001 (for 100V)
  81446367-001 (for 200V)

4 - 15 Isolating Inputs and Outputs

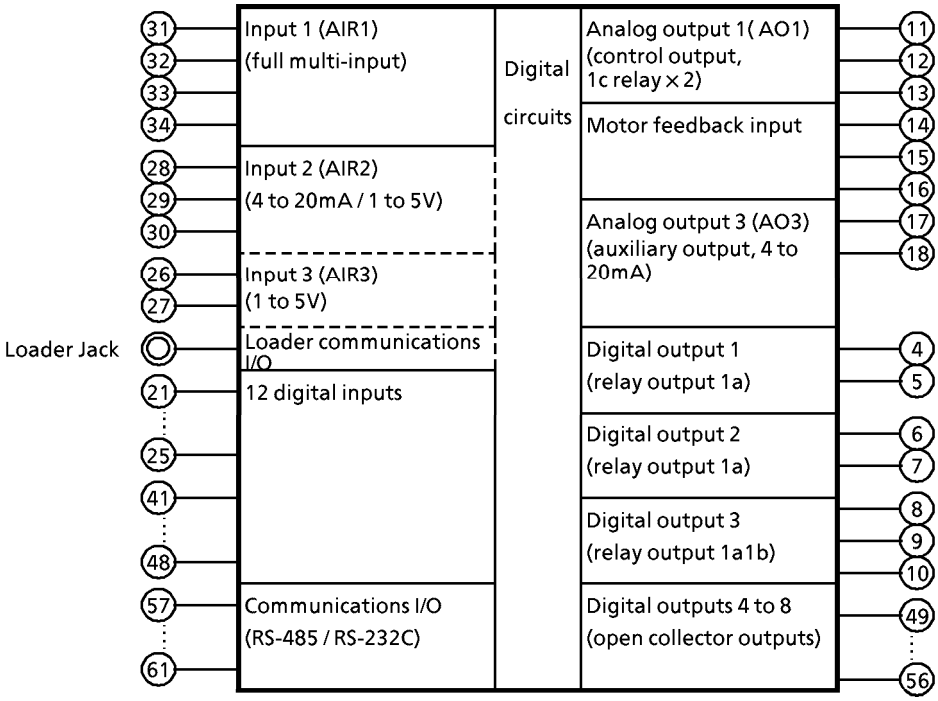
The internal isolation of inputs and outputs on the 5G and 2G models is shown below. In these figures, the solid lines enclose mutually-isolated sections. Those sections bounded by dashed lines are not isolated.

■ Control output 5G



Handling Precautions The loader jack unit is not isolated from the digital circuits. The loader cap must be replaced when the jack is not used.

■ Control output 2G



Handling Precautions The loader jack unit is not isolated from the digital circuits. The loader cap must be replaced when the jack is not used.