Technical Information

DAQSTATION CX1000/CX2000
Control and Measurement Station
Installation Guidance

TI 04L31C01-01E

YOKOGAWA

TI 04L31C01-01E
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Foreword

This user's manual provides installation and wiring instructions, as well as safety precautions that must be observed when handling or operating the CX1000/CX2000 Control and Measurement Station.

■ Notes

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Safety Precautions

This is an IEC safety class I instrument (it is equipped with a protective ground terminal), installation category II, and meets the EMC standard EN61326-1 class A for commercial or industrial use. The general safety precautions listed in this manual must be taken during all phases of operation. If the instrument is used in a manner not specified by this manual, the protective features provided by the instrument may be impaired. Yokogawa Electric Corporation assumes no liability for the customer's failure to comply with these requirements.

The following symbols are used on this instrument.

Danger. Refer to the user's manual. This symbol appears on dangerous locations on the instrument which require special instructions for proper handling or use. The same symbol appears in the corresponding place in the manual to identify those instructions.

Danger. Hot surface.

Functional grounding terminal (not to be used as a protective grounding terminal).

Protective grounding terminal.

Alternating current.

ON (power)

OFF (power)

Calls attention to actions or conditions that could cause serious injury or death to the user, and precautions that can be taken to prevent such occurrences.

Calls attention to actions or conditions that could cause damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

Note

Calls attention to information that is important for proper operation of the instrument.

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Failure to take the following precautions might result in shock, injury, or death of personnel.

- **Use the Correct Power Supply**

  Ensure that the source voltage matches the voltage of the power supply before turning ON the power.

- **Connect the Protective Grounding Terminal**

  To prevent electric shock, be sure to connect the protective grounding before turning on the power.

- **Do Not Impair the Protective Grounding**

  Never cut off the internal or external protective grounding wire or disconnect the wiring from the protective grounding terminal. Doing so might disable the protective features of the instrument thereby creating a safety hazard.

- **Do Not Operate with Defective Protective Grounding or Fuse**

  Never operate the instrument if you suspect the protective grounding, fuse, or other protective features might be defective.

- **Do Not Operate Near Flammable Materials**

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

- **Do Not Remove Any Covers**

  Only qualified personnel should remove the cover. Some areas inside the instrument carry high voltages.

- **Connect to Ground before Making External Connection**

  Securely connect the protective grounding before connecting to the item under measurement or the control unit.

- **Do Not Mishandle the Instrument**

  Operating the instrument in a way not described herein may impair its protective features.

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Overview of the CX1000/CX2000

The CX1000/CX2000 features “control functions” that allow the user to perform PID control and ON/OFF control, and “measurement functions” through which measurement data and control output data can be displayed or recorded.

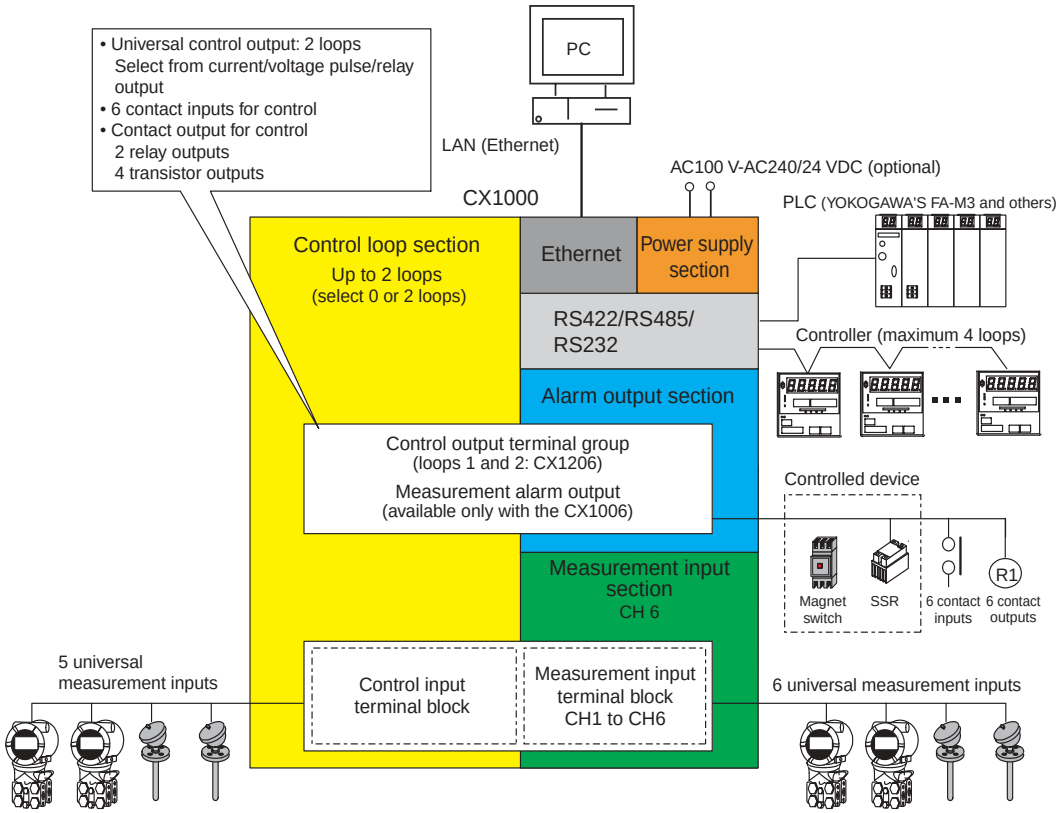
■ Control Functions

The instrument offers single loop, cascade, or loop control with PV switching, with up to 2 PID control loops on the CX1000, and up to 6 on the CX2000. Also, by connecting a UT or UP series controller from YOKOGAWA M&C Corporation, you can perform simultaneous control of external loops (up to 4 loops with the CX1000 or up to 16 with the CX2000). In addition to being able to observe the control status on a general display such as a controller or faceplate display, and a hybrid screen for a combination of both controller or faceplate displays, and an overview display allowing observation of all control loops including external loops. The CX1000/CX2000 features PID constant autotuning, and manual tuning is available to allow adjustment of such things as the control parameters of the PID constant while confirming the control status.

■ Measurement Functions

In addition to using measured data for the control functions, a maximum of 20 channels of measurement data can be read in and displayed as waveforms, as numerical values, or in bar graphs. Also, both measured data and control data can be copied from the built-in hard disk to a floppy disk, ZIP disk, or ATA flash memory card.

■ Input/Output Configuration of the CX1000



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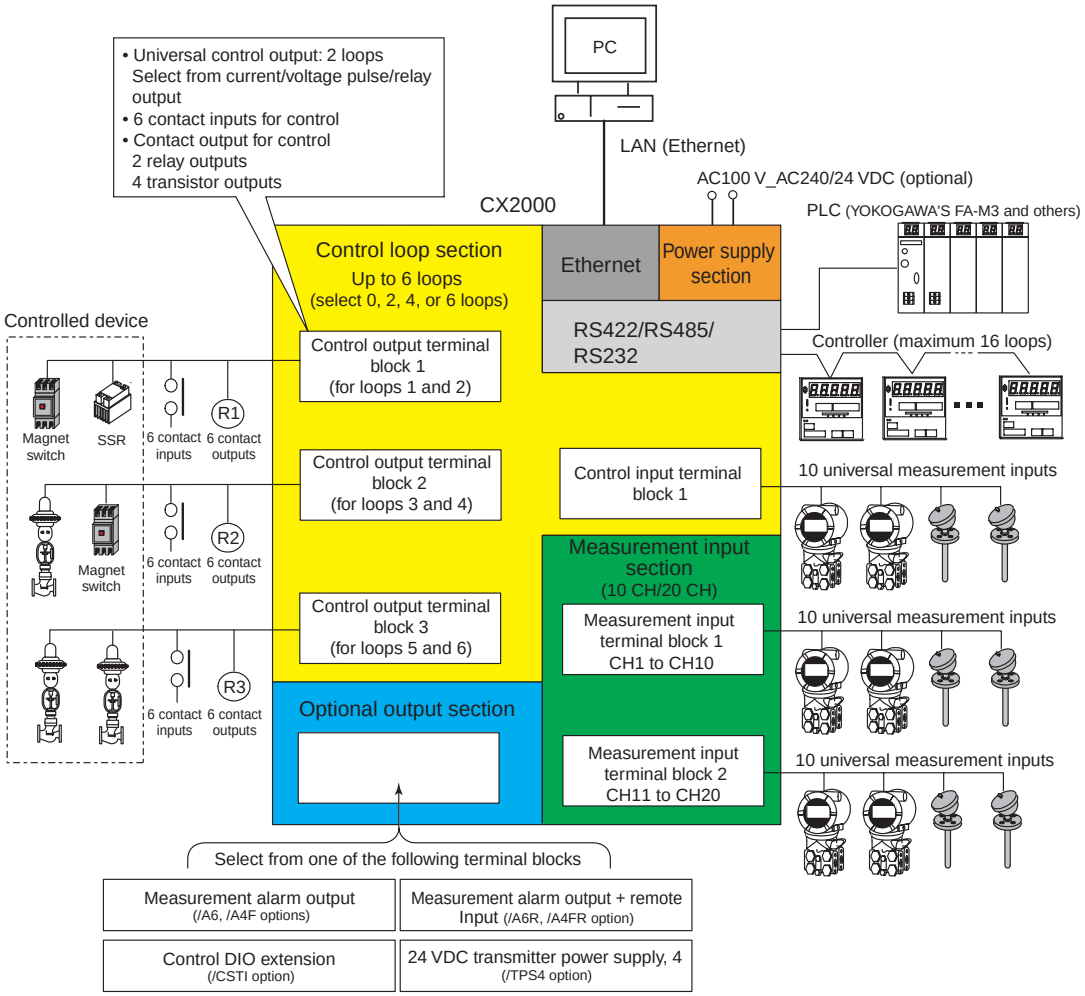
■ Input/Output Configuration of the CX2000



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TI 04L31C01-01E 1st Edition

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1. Product Information

1.1 Model and Suffix Codes

DAQSTATION CX1000

	Suffix code			Option code	Description
CX1006					CX1000 internal control loops: 0 loop, measurement channels: 6 ch*1
CX1206					CX1000 internal control loops: 2 loops, measurement channels: 6 ch
External memory medium	-1				Floppy disk (3.5 inch)
	-2				Zip disk (with medium)
	-3				ATA flash memory card (with medium)
Communications interface		-0			Ethernet only
		-1			RS-232 communications interface
		-2			RS-422A/485 communications interface
Displayed language			-1		Japanese
			-2		English
Option specifications				/A6	Measurement alarm (DO 6) *2
				/A6R	Measurement alarm (DO 6, DI 8 (remote inputs)) *2
				/A4F	Measurement alarm (DO 4, FAIL/memory end output relay) *2
				/A4FR	Measurement alarm (DO 4, DI 8 (remote inputs), FAIL/memory end output relay) *2
				/CM1	Green series communication*3
				/CM2	Ladder communication *3
				/M1	Mathematical function (including report function)
				/N2	3 legs isolated RTD *4
				/P1	DC/AC 24 V power supply
				/PG1	Program control (4 program patterns) *5
				/PG2	Program control (30 program patterns) *5

*1: If RS-232 or RS-422/485 is specified, /CM1 must also be specified.
*2: If the CX1006 is specified, only 1 measurement alarm can be specified.
*3: Either RS-232 or RS-422/485 must be specified.
Only one or the other can be selected.
*4: For measurement input. All control input is isolated.
*5: Only effective for internal loops. One or the other can be selected.

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DAQSTATION CX2000

	Suffix code			Option code	Description
CX2010					CX2000 internal control loops: 0 loop, measurement channels: 10 ch *1
CX2020					CX2000 internal control loops: 0 loop, measurement channels: 20 ch *1
CX2210					CX2000 internal control loops: 2 loops, measurement channels: 10 ch
CX2220					CX2000 internal control loops: 2 loops, measurement channels: 20 ch
CX2410					CX2000 internal control loops: 4 loops, measurement channels: 10 ch
CX2420					CX2000 internal control loops: 4 loops, measurement channels: 20 ch
CX2610					CX2000 internal control loops: 6 loops, measurement channels: 10 ch
CX2620					CX2000 internal control loops: 6 loops, measurement channels: 20 ch
External memory medium	-1				Floppy disk (3.5 inch)
	-2				Zip disk (with medium)
	-3				ATA flash memory card (with medium)
Communications interface		-0			Ethernet only
		-1			RS-232 communications interface
		-2			RS-422A/485 communications interface
Displayed language			-1		Japanese
			-1		English
Option				/A6	Measurement alarm (DO 6) *2
				/A6R	Measurement alarm (DO 6, DI 8 (remote inputs) *2
				/A4F	Measurement alarm (DO 4, FAIL/memory end output relay) *2
				/A4FR	Measurement alarm (DO 4, DI 8 (remote inputs), FAIL/memory end output relay) *2
				/CM1	Green series communications *3
				/CM2	Ladder communications *3
				/CST1	Control DIO extension (DO 12, DI 12) *2 *3
				/D5	VGA output
				/M1	Mathematical function (including report function)
				/N2	3 legs isolated RTD *5
				/P1	DC/AC 24 V power supply
				/TPS4	24 VDC transmitter power supply (4 loops) *2
				/PG1	Program control (4 program patterns) *6
				/PG2	Program control (30 program patterns) *6

*1: If RS-232 or RS-422/485 is specified, /CM1 must also be specified.
*2: Only one can be specified at a time.
*3: /CST1 cannot be specified for CX20xx
*4: Either RS-232 or RS-422/485 must be specified.
Only one or the other can be selected.
*5: For measurement input. All control input is isolated
*6: Only effective for internal loops. Only one or the other can be selected.

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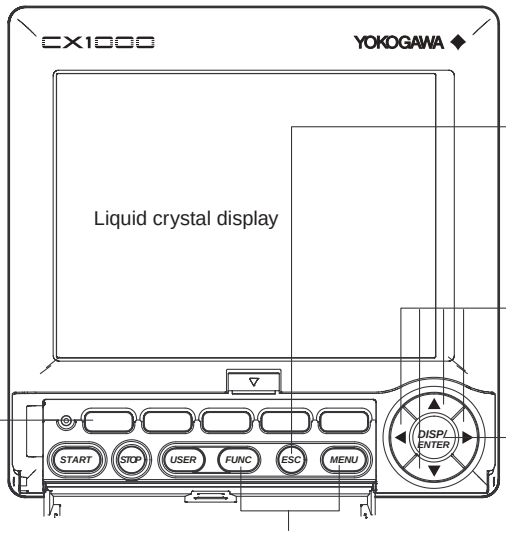
1.2 Names and Uses of Parts

■ Front Panel

CX1000



ESC key
Press this key to return to the previous screen, or to cancel the current setting changes.

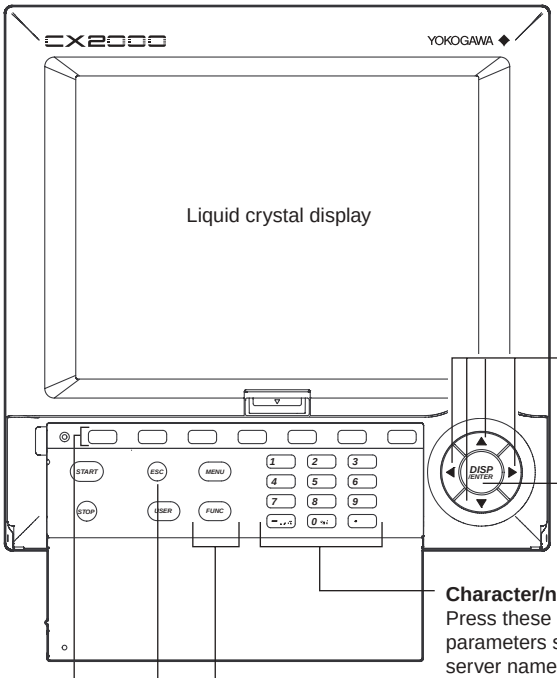
Arrow keys
Press these keys to move between the setting items displayed on the screen.

The DISP/ENTER key
Press this key to enter a setting or to close an entry box.

Soft keys
Press these keys to select the menu displayed on the screen.

MENU and FUNC keys
If you press the MENU key then press the FUNC key for about 3 seconds, the basic setting menu is displayed, and you can view the communications functions setting menu.

CX2000



Arrow keys
Press these keys to move between the setting items displayed on the screen.

The DISP/ENTER key
Press this key to enter a setting or to close an input box.

Character/number input key
Press these keys to enter alphanumeric characters for parameters such as the IP address, domain name, or server name.

MENU and FUNC keys
If you press the MENU key then press the FUNC key for about 3 seconds, the basic setting menu is displayed, and you can view the communications functions setting menu.

ESC key
Press this key to return to the previous screen, or to cancel the current setting changes.

Soft keys
Press these keys to select the menu displayed on the screen.

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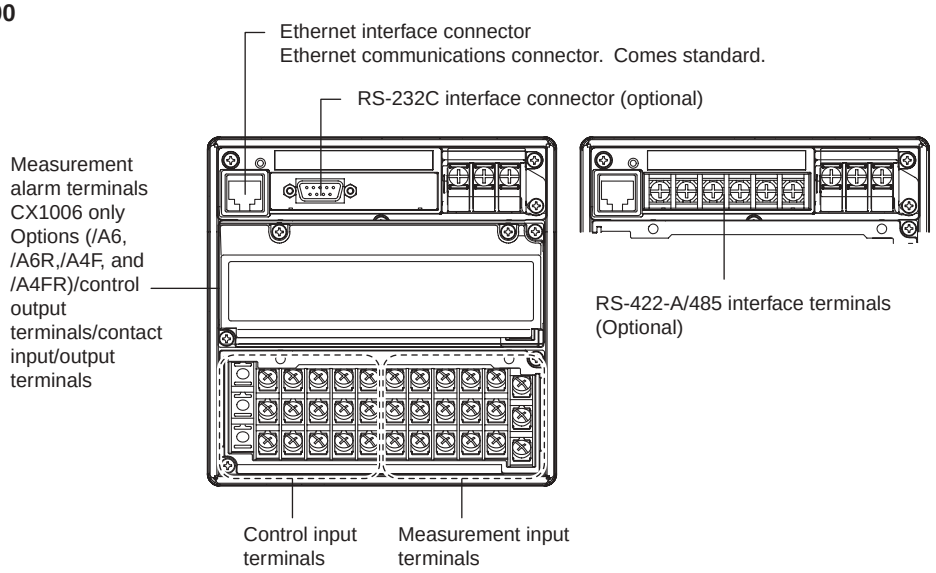
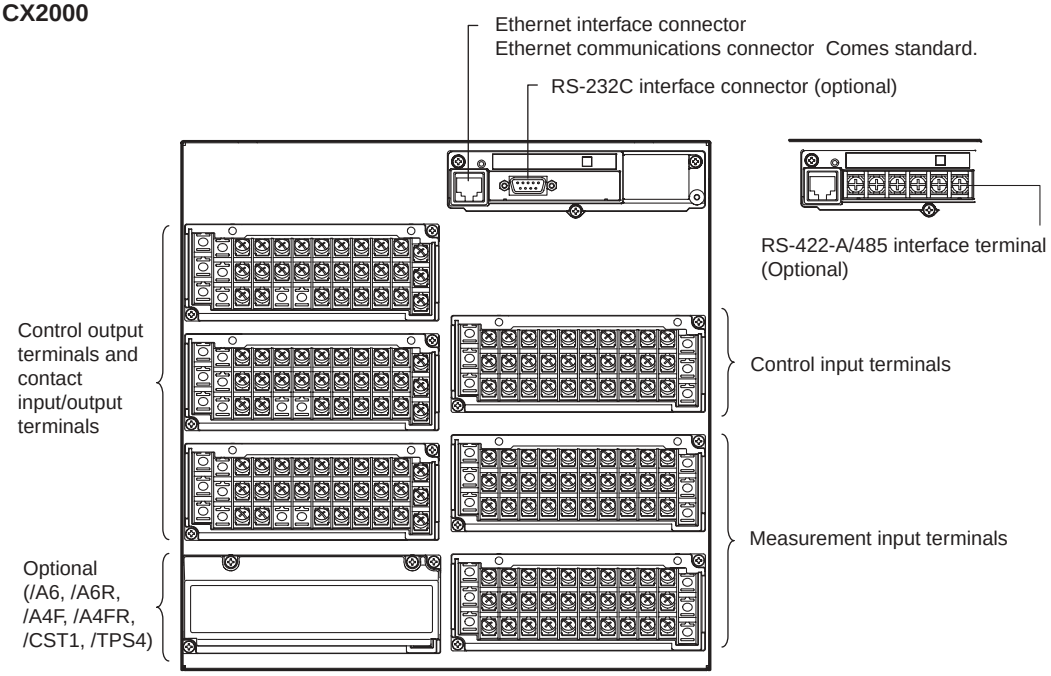
■ Rear Panel

CX1000



CX2000



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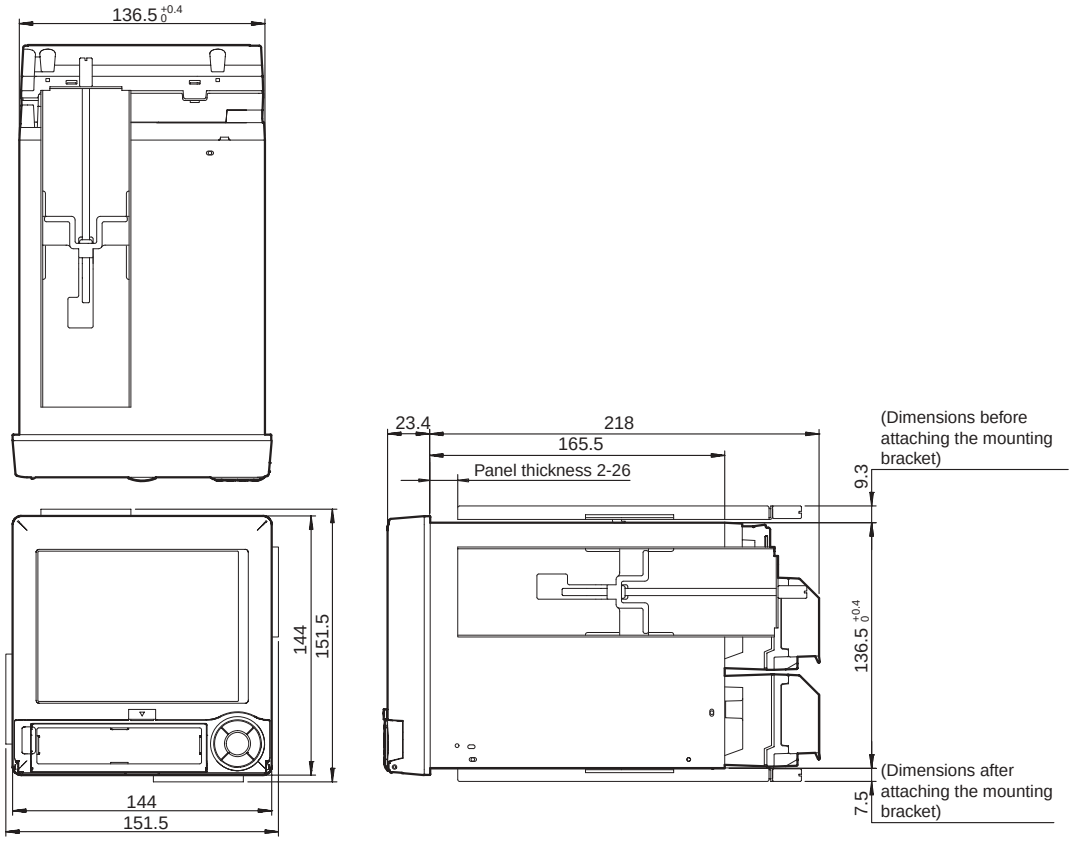
2. Installation

2.1 Dimensions

■ External Dimensions of the CX1000



Note

- When mounting the instrument in a panel, use two brackets.
- Use one bracket each for the top and bottom or left and right of the instrument.

The dimensional tolerance f or dimensions less than 10 mm is ±0.3 mm.

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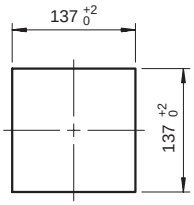
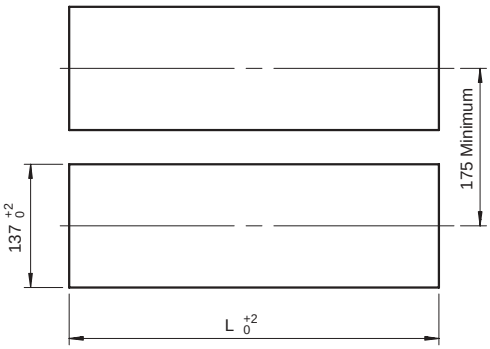
■ Panel Cut-Out Dimensions for the CX1000

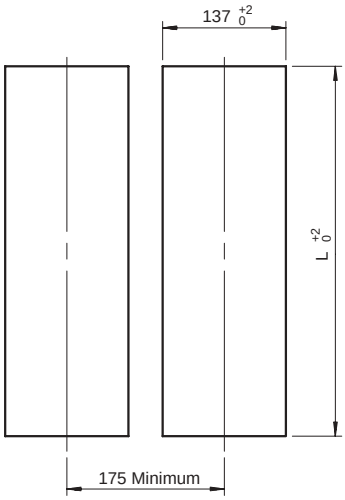
Mounting a Single Unit



Mounting Side-to-Side (Horizontally)



Mounting Top-to-Bottom
(Vertically, Maximum 3 Units)



Number of units	L +2 0 (mm)
2	282
3	426
4	570
5	714
6	858
7	1002
8	1146
9	1290
10	1434
n	(144xn)-6

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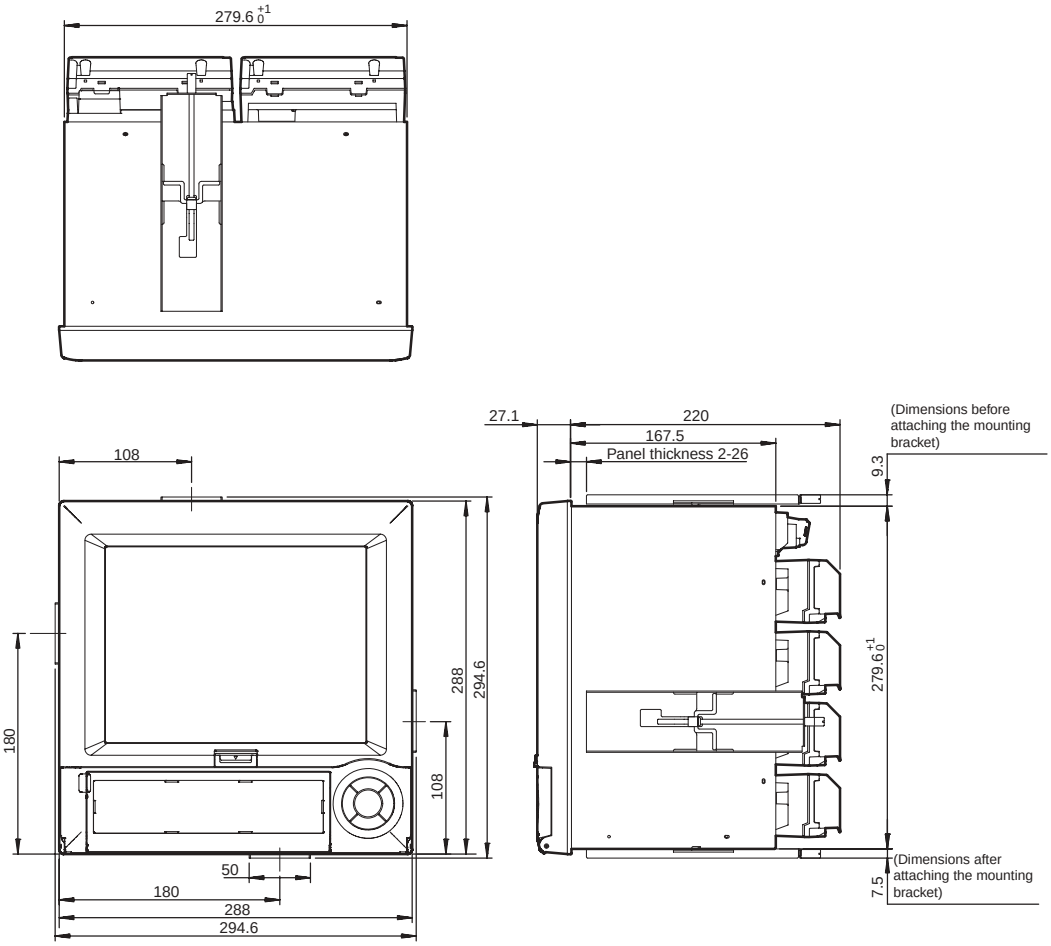
■ External Dimensions of the CX2000

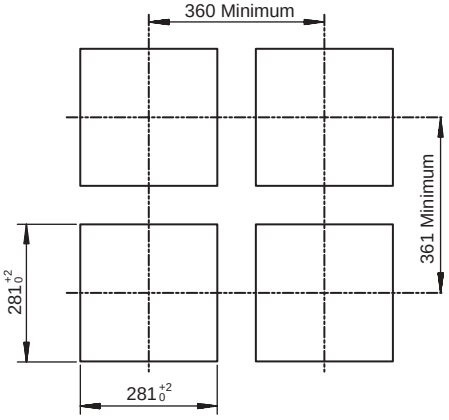


Note

- When mounting the instrument in a panel, use two brackets.
- Use one bracket each for the top and bottom or left and right of the instrument.

The dimensional tolerance f or dimensions less than 10 mm is ±0.3 mm.

■ Panel Cut-Out Dimensions for the CX2000



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2.2 Installation

■ Installation Location and Environment

Install the instrument in a location that meets the conditions below. For specific information on the installation environment, see chapter 3, "Installation Environment."

- **Mount in a Panel**

  The instrument is designed for panel mounting.

- **Place in a Well-Ventilated Location**

  To prevent overheating, install the instrument in a well-ventilated location.

- **Minimize Mechanical Vibrations**

  Choose an installation location with minimal mechanical vibration.

- **Install Horizontally**

  Install the instrument horizontally (but note that the instrument can be inclined up to 30 degrees backwards for panel mounting).

Note

- Condensation may occur if the instrument is moved to another place where both the ambient temperature and humidity are higher, or if the temperature changes rapidly. In addition, measurement errors will result when using thermocouples. Therefore you should allow the instrument to acclimatize for at least one hour before starting operation.
- The lifetime of the LCD may be shortened if the instrument is used in a high-temperature environment over a long period of time. When installing the instrument in a high-temperature environment (greater than 40°C), we recommend the backlight brightness of the LCD be set to a low setting.

Do not install the instrument in any of the following places.

- **In direct sunlight or near heat sources**

  Install the instrument in a place where the temperature fluctuates only slightly from room temperature (23 °C). Placing the instrument in direct sunlight or near heat sources can have adverse effects on it.

- **Where an excessive amount of soot, steam, moisture, dust, or corrosive gases are present**

  Soot, steam, moisture, dust, and corrosive gases will adversely affect the instrument. Avoid such locations.

- **Near strong magnetic field sources**

  Do not bring magnets or instruments that produce electromagnetic fields close to the instrument. Operating the instrument near strong magnetic fields can cause errors in the measurements.

- **Where the angle for viewing the screen is not optimal**

  Because the instrument uses a TFT color LCD, it is difficult to view the display from an extreme angle. Install the instrument so that the monitor can be easily viewed from the front.

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■ Installation Instructions

The instrument should be mounted on a steel panel of thic kness 2 mm to 26 mm.

1. Inser t the instrument into the panel fr ont-side-out.
2. Attac h the mounting brac kets that came with the instrument to the panel accor ding to the figure on the ne xt pa ge.
   - Remo ve the seals co vering the case' s mounting brac ket holes, then use tw o brac kets to suppor t the upper and lo wer or right and left sides of the case .
   - The pr oper tor que f or tightening the mounting scre ws is 0.8 to 1.2 Nm.

Tightening the scre ws too m uch can def orm the case or dama ge the brac ket.

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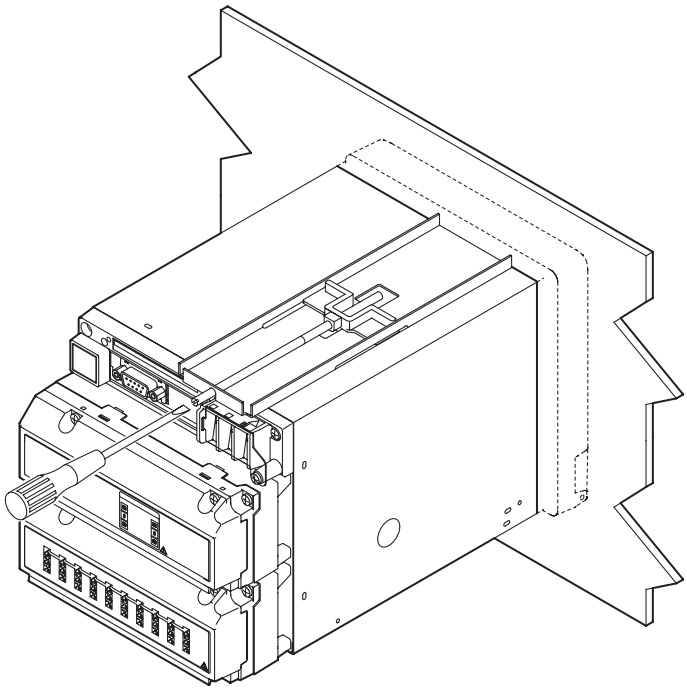
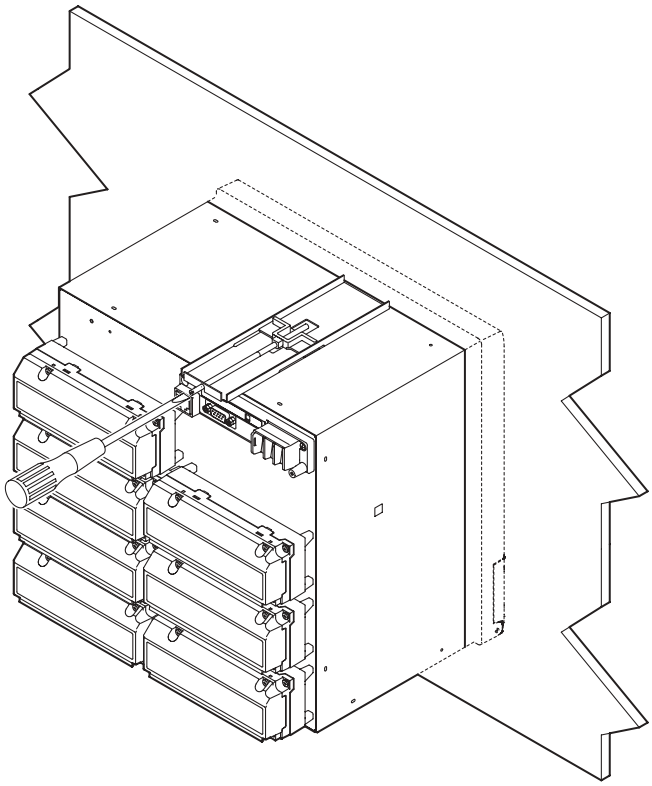
● **Panel Mounting the CX1000**



● **Panel Mounting the CX2000**



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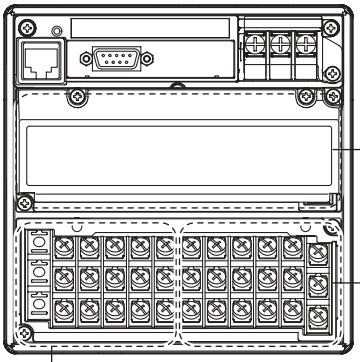
2.3 Wiring

■ Position of the Input/Output Terminals on the CX1000

The rear panel of the CX1206, with 2 control loops and 6 measurement channels, is laid out as shown in the figure below. On the CX1006, the optional measurement alarm terminals are located in the upper block.



CX1206: Control output terminals for loops 1 and 2
CX1006: For measurement alarms (optional)

Measurement input terminals (CH1 to CH6)

5 analog input terminals for control

Note

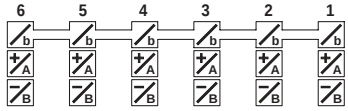
For connections for serial communications and Ethernet, see "CX100/CX2000 Communications Interface User's Manual (IM 04L31A01-17)."

● Signal Assignments on the Control and Measurement Input Terminal Blocks

The 5 points control input terminals (measurement input, remote input) and 6 points measurement input terminals are assigned as shown in the figure below. Note that among the 12 columns of terminals, 1 column is unused so their terminal screws are not attached.

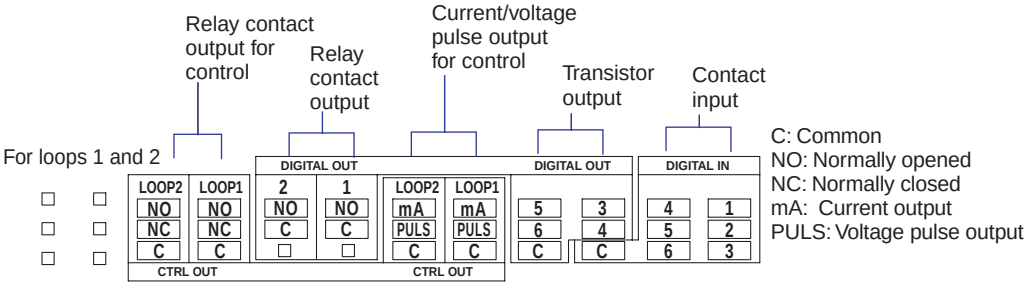
PV, PV1, PV2: measurement input, (RSP): remote input (not available for program control), □: unused terminals

Control mode settings		LOOP2		LOOP1		
		2	1	3	2	1
For single loop control →	SNGL	(RSP)	PV	□	(RSP)	PV
For cascade control →	CAS	□	PV	□	(RSP)	PV
For loop control with PV switching →	PVSW	PV2	PV1	(RSP)	PV2	PV1



● Arrangement of Terminals on the Control Output Terminal Block

As shown in the figure below, in one terminal block there are 6 contact inputs, 2 relay contact outputs, and 4 transistor output terminals in addition to 2 loops each of current/voltage pulse output and relay contact output for control. Wire the terminals according to the settings entered for your specific application.



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DIGITAL OUT terminals 1-6 are displa yed as the f ollo wing n umber s in the contact (rela y) output registration settings.

DO001-DO006 (contr ol output terminal b loc k for loops 1 and 2)

DIGITAL IN terminals 1-6 are displa yed as the f ollo wing n umber s in the contact (rela y) output registration settings.

DI001-DI006 (contr ol output terminal b loc k for loops 1 and 2)

Note

When registering contact (relay) output settings, the relay contact output numbers (DO001, DO002, DO101, DO102, DO201, DO202) are indistinguishable from the other numbers for transistor output. Be aware of this before registering output signals.

● Arrangement of the Terminals on the Optional Measurement Alarm Terminal Block (for the CX1006)

The optional measurement alarm terminal b loc k is inc luded if specified at the time of pur chase. The follo wing f our types are a vailab le.

/A6: 6 DO (alarm outputs)

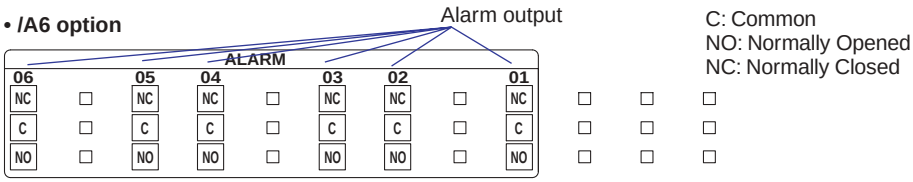
/A6R: 8 DI (remote inputs) + 6 DO (alarm outputs)

/A4F: 4 DO (alarm outputs) + 1 F AIL/memor y end output

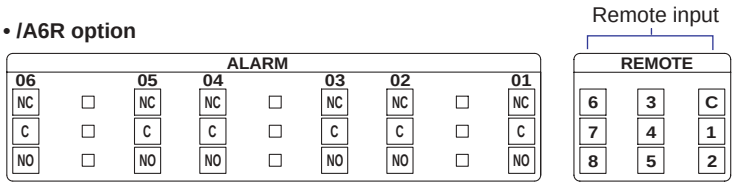
/A4FR: 8 DI (remote inputs) + 4 DO (alarm outputs) + 1 F AIL/memor y end output

The terminals on eac h optional measurement alarm terminal b loc k are arrang ed as sho wn in the figure belo w. Wire the terminals accor ding to the settings entered f or y our specific application.

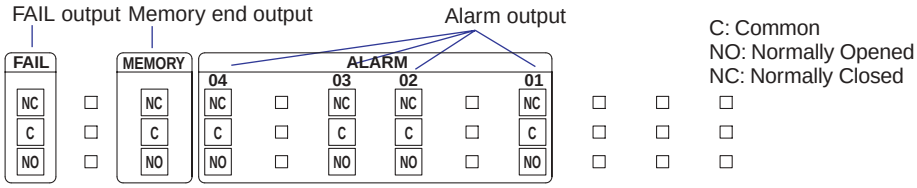
• /A6 option



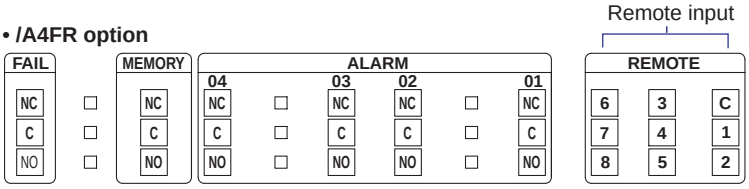
• /A6R option



• /A4F option



• /A4FR option



ALARM terminals 01-06 are sho wn as the f ollo wing n umber s when entering the alarm output settings.

I01-I06

REMOTE terminals 1-8 are sho wn simpl y as 1-8 when entering the alarm output settings.

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Note

There are no output registration settings for the FAIL and MEMORY terminals. However the Memory Alarm Time setting (the conditions for memory end output) is not available. Also, FAIL output can be assigned to the DIGITAL OUT terminals on the control output terminal block for loops 1 and 2, and in this case registration settings are required.

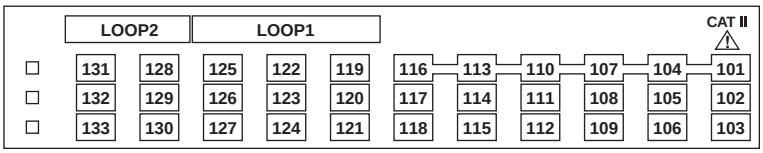
● Terminal Cover Labels

A label showing the terminal assignments is affixed to the front and back sides of the cover on each of the CX1000's terminal blocks.

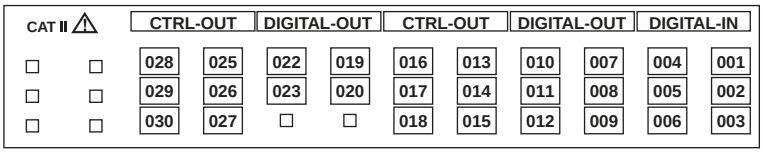
Label on the Front of the Cover

The terminal numbers used to set up connections (not the numbers used for entering settings) are printed on the label of the front side of the cover as shown in the figure below.

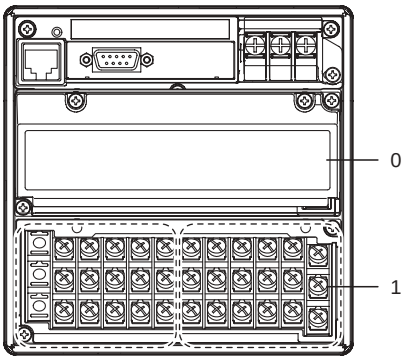
For an analog input and measurement input terminal block with 2 control loops.



For a digital output terminal block with 2 control loops.



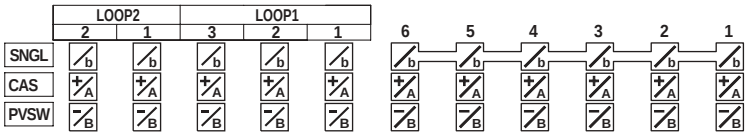
The terminal number is a unique, three-digit number, with the value of the first digit indicating the terminal block, and the value of the second digit indicating the position within the terminal block, starting with 01 in the upper right all the way to 36 in the lower left. Unused terminals are indicated by a square [□].



Label on the Back of the Cover

Codes indicating the input/output signal types are printed on the label on the back side of the cover as shown in the figure below. The diagram is for a terminal block with 2 loops of analog input for controls, and measurement input. For instructions on the wiring corresponding to each symbol, see pages 2-16 through 2-18.

PV, PV1, PV2: Measurement input, (RSP): Remote Input (not available for program control), □: unused terminals



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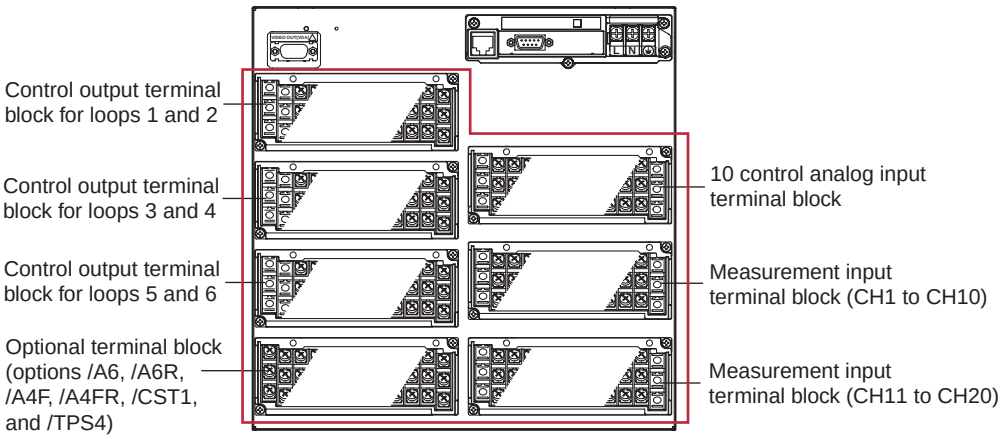
■ Position of the Input/Output Terminals on the CX2000

The rear panel of the CX2620 with 6 control loops, 20 measurement channels, and the optional measurement alarm terminal block is laid out as shown in the figure below. The terminals on the specific instrument you ordered may differ from those shown here. The optional measurement alarm terminal block is installed in the lower left position. Depending the specified options, the 24 VDC transmitter power supply output terminal block or the control DIO extension terminal block may be installed in this position instead of the optional measurement alarm terminal block.



Note

For connections for serial communications and Ethernet, see "CX100/CX2000 Communications Interface User's Manual (IM 04L31A01-17)."

● Input/Output Assignments on the Analog Input Terminal Block for Control

This is a 10 points input terminal input, and measurement input (PV) and remote input (RSP) are assigned depending on the settings for the number of used loops and control mode as shown in the figure below. Each cell in the figure corresponds to the /b, +/A, and -/B terminals from one column. The input terminal assignments change if the control mode is switched. Also, among the 12 columns of terminals, the 2 columns on the ends of the block are unused so their terminal screws are not attached.

• 6 loops

PV, PV1, PV2: Measurement input, (RSP): Remote Input (not available for program control): unused terminals

LOOP4		LOOP6	LOOP3		LOOP2		LOOP5	LOOP1		
2	1	1	2	1	2	1	1	2	1	[Control mode setting]
(RSP)	PV	PV	(RSP)	PV	(RSP)	PV	PV	(RSP)	PV	SNGL ← For single loop control
□	PV	□	(RSP)	PV	□	PV	□	(RSP)	PV	CAS ← For cascade control
PV2	PV1	□	PV2	PV1	PV2	PV1	□	PV2	PV1	PVSW ← For loop control with PV switching

• 4 loops

PV, PV1, PV2: measurement input, (RSP): remote input (not available for program control): unused terminals

LOOP4		LOOP3			LOOP2		LOOP1			
2	1	3	2	1	2	1	3	2	1	[Control mode setting]
(RSP)	PV	□	(RSP)	PV	(RSP)	PV	□	(RSP)	PV	← For single loop control
□	PV	□	(RSP)	PV	□	PV	□	(RSP)	PV	← For cascade control
PV2	PV1	(RSP)	PV2	PV1	PV2	PV1	(RSP)	PV2	PV1	← For loop control with PV switching

• 2 loops

PV, PV1, PV2: measurement input, (RSP): remote input (not available for program control): unsaid terminals

					LOOP2		LOOP1			
					2	1	3	2	1	[Control mode setting]
□	□	□	□	□	(RSP)	PV	□	(RSP)	PV	← For single loop control
□	□	□	□	□	□	PV	□	(RSP)	PV	← For cascade control
□	□	□	□	□	PV2	PV1	(RSP)	PV2	PV1	← For loop control with PV switching

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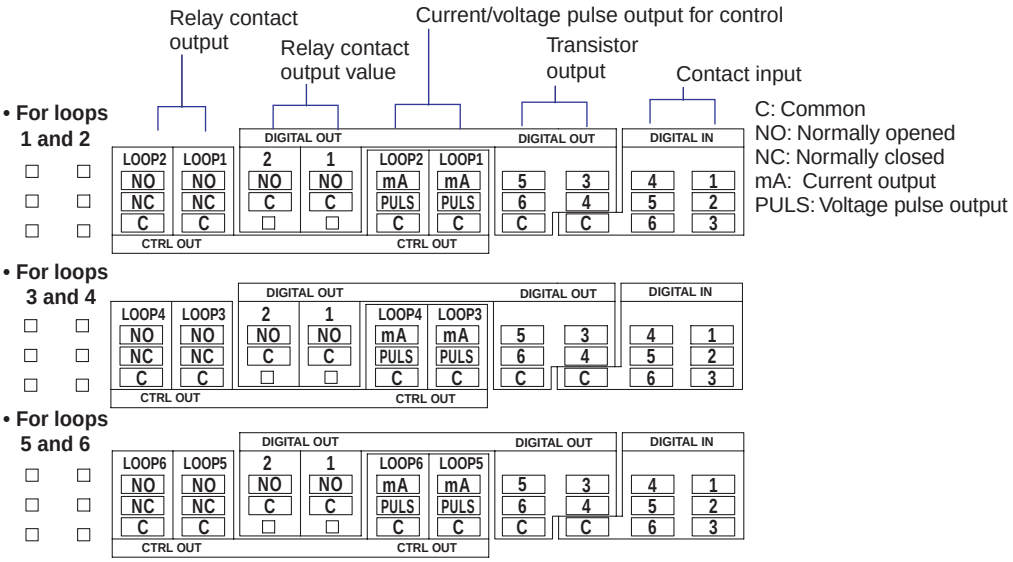
● Arrangement of Terminals on the Control Output Terminal Block

As shown in the figure below, in one terminal block there are 6 contact inputs, 2 relay contact outputs, and 4 transistor output terminals in addition to 2 control loops each of current/voltage pulse output and relay contact output. Wire the terminals according to the settings entered for your specific application.



DIGITAL OUT terminals 1-6 are displayed as the following numbers in the contact (relay) output registration settings.

- DO001-DO006 (contact output terminal block for loops 1 and 2)
- DO101-DO006 (contact output terminal block for loops 3 and 4)
- DO201-DO206 (contact output terminal block for loops 5 and 6)

DIGITAL IN terminals 1-6 are displayed as the following numbers in the contact input registration settings

- DI001-DI006 (control input terminal block for loops 1 and 2)
- DI101-DI106 (control input terminal block for loops 3 and 4)
- DI201-DI206 (control input terminal block for loops 5 and 6)

Note

When registering contact (relay) output settings, the relay contact output numbers (DO001, DO002, DO101, DO102, DO201, DO202) are not distinguished from other numbers which are used for transistor output. Be aware of this before registering output signals.

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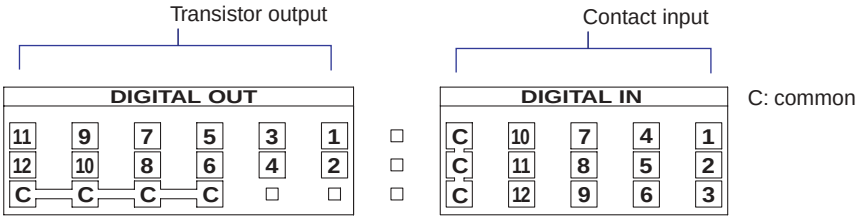
● Arrangement of Terminals on the Control DIO Extension Terminal Block

The 12 point contact input and 12 point transistor contact output terminals are arranged as shown in the figure below. Wire the terminals according to the settings entered for your specific application.



DIGITAL OUT terminals 1-12 are displayed as the following numbers in the contact (relay) output registration settings.

RO001-RO012

DIGITAL IN terminals 1-12 are displayed as the following numbers in the contact input registration settings.

RI001-RI012

● Arrangement of Terminals on the Optional Measurement Alarm Terminal Block

The optional measurement alarm terminal block is included if specified at the time of purchase. The following four types are available.

/A6: 6 DO (alarm outputs)

/A6R: 8 DI (remote inputs) + 6 DO (alarm output)

/A4F: 4 DO (alarm outputs) + 1 FAIL/memory end output

/A4FR: 8 DI (remote inputs) + 4 DO (alarm outputs) + 1 FAIL/memory end output

The terminals on each optional measurement alarm terminal block are arranged as shown in the figure on page 2-8. Wire the terminals according to the settings entered for your specific application.

See page 2-8 for the arrangement of the terminals on the optional measurement alarm terminal block.

ALARM terminals 01-06 are shown as the following numbers when entering the alarm output settings.

I01-I06

REMOTE terminals 1-8 are shown simply as 1-8 when entering the alarm output settings.

Note

There are no output registration settings for the FAIL and MEMORY terminals. However the Memory Alarm Time setting (the conditions for memory end output) is not available. Also, FAIL output can be assigned to the DIGITAL OUT terminals on the control output terminal block for loops 1 and 2, and in this case registration settings are required.

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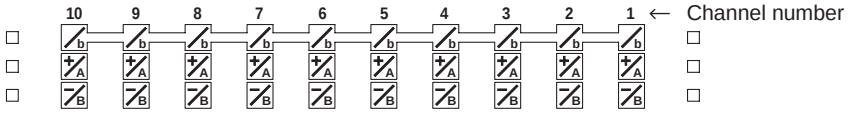
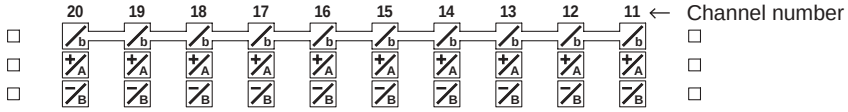
● Arrangement of Terminals on the Measurement Input Terminal Block

There are 10 points of measurement input terminals in each terminal block as shown in the figure below.

• For CH1-10



• For CH11-20



Note

The figure above shows the terminal arrangement in a standard terminal block, and each terminal is shorted across b, but with the 3 wire system isolated RTD option (/N2), each terminal b is not isolated.

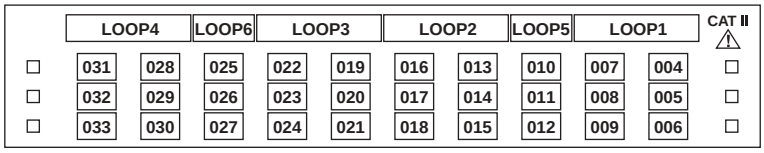
● Terminal Cover Label

A label showing the terminal arrangement is affixed to the front and back sides of the cover on each of the CX2000's terminal blocks.

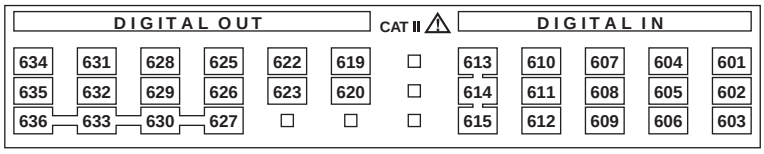
Label on the Front of the Cover

The terminal numbers used to set up connections (not the numbers used for each setting) are printed on the label on the front side of the cover as shown in the figure below.

• For a terminal block with a 6 loop analog input terminal block for control.



• For control DIO extension terminal block



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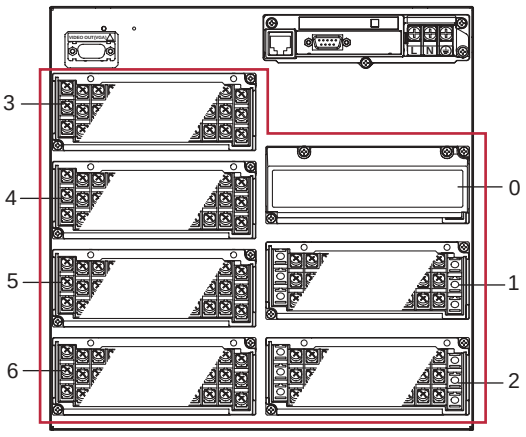
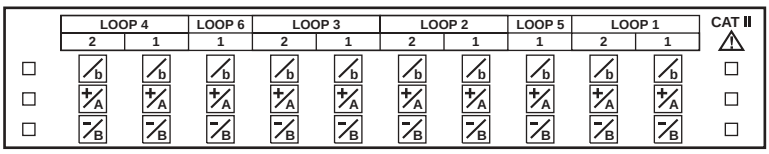
The terminal number is a unique, three-digit number, with the value of the first digit indicating the terminal block, and the value of the second digit indicating the position within the terminal block, starting with 01 in the upper right all the way to 36 in the lower left. Unused terminals are indicated by a square [□].



Label on the Back of the Cover

Codes indicating the input/output signal types are printed on the label on the back side of the cover as shown in the figure below. The diagram is for a terminal block with 6 loops of analog input terminals for control. For instructions on the wiring corresponding to each symbol, see pages 2-16 through 2-18.



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■ General Precautions When Wiring Input/Output Signals

- To prevent electric shock when connecting wires, ensure the main power supply is turned OFF.
- If a voltage of more than 30 VAC or 60 VDC is to be applied, use ring-tongue crimp-on lugs with insulation sleeves on all the output terminals to prevent the wires from slipping out when the screws become loose. Furthermore, use double-insulated wires (dielectric strength of 2300 VAC or more) for the signal wires on which a voltage of more than 30 VAC or 60 VDC is to be applied. For all other wires, use basic insulated wires (dielectric strength of 1350 VAC). To prevent electric shock, attach the terminal cover after wiring and make sure not to touch the terminals.

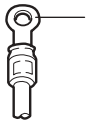
- If strong tension is applied to the input/output signal cable, the terminals and/or the cable can be damaged. In order to prevent tension from being applied directly on the terminals, fasten all wired cables to the rear of the mounting panel.
- Do not apply a voltage to any of the input terminals exceeding the levels below. This can damage the instrument.
  - Maximum input voltage

    Voltage range of 2 VDC or less or thermocouples: ±10 VDC

    Voltage range between 6 and 50 VDC: ±60 VDC
  - Maximum common mode noise voltage

    250 VACrms (50/60Hz)
- The instrument is an installation category II product.

● **It is recommended that crimp-on lugs (designed for 4 mm screws) with insulation sleeves be used on the input/output signal wires.**



● **Take measures to prevent noise from entering the measurement circuit.**

- Move the measurement circuit away from the power cable (power circuit) and ground cable.
- The item being measured should not generate noise. However, if this is unavoidable, isolate the measurement circuit from the item. Also, ground the item being measured.
- Shielded wires should be used to minimize noise caused by electrostatic induction. Connect the shield to the ground terminal of the instrument as necessary (make sure you are not grounding at two points).
- To minimize noise caused by electromagnetic induction, twist the measurement circuit wires at short, equal intervals.
- Make sure to earth ground the protective ground terminal through minimum resistance (less than 100 Ω).

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- **When using internal reference junction compensation on the thermocouple input, take measures to stabilize the temperature at the input terminals.**
  - Always use the terminal covers.
  - Do not use thick wires which may cause large heat dissipation (wires with a cross sectional area of 0.5 mm ^{2} or less are recommended).
  - Make sure that the ambient temperature remains reasonably stable. Large temperature fluctuations can occur if a nearby fan turns ON or OFF.

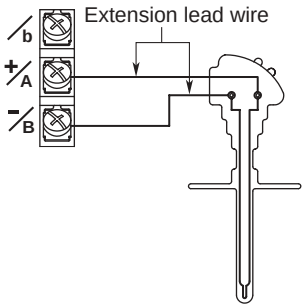
- **Connecting the input wires in parallel with other devices can cause signal degradation, affecting all connected devices. If you need to make a parallel connection, do the following:**
  - Turn the burnout setting OFF.
  - Ground the instruments to the same point.
  - Do not turn ON or OFF other instruments during operation. This can have adverse effects on nearby devices.
  - Refrain from wiring RTDs in parallel.

■ Wiring Procedure

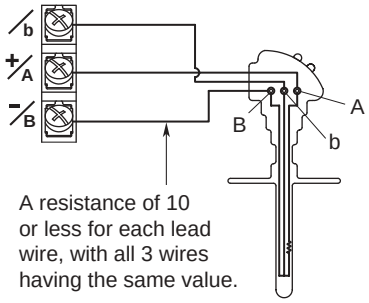
1. Turn OFF the power switch on the instrument and remove the terminal cover.
2. Connect the signal wires to the terminals.
3. Replace the terminal cover and fasten it with screws.

■ Wiring Measurement Input

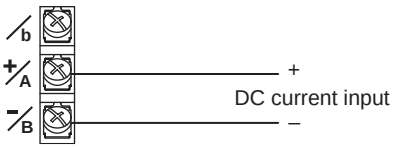
• Thermocouple input



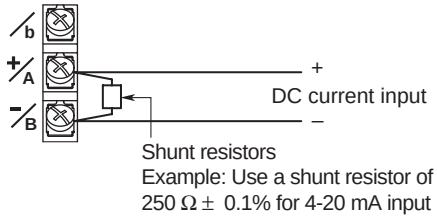
• Resistance temperature detector input



• DC voltage input



• DC voltage input



Note

RTD input terminals A and B are isolated on each channel. Terminal b is shorted internally across all channels.

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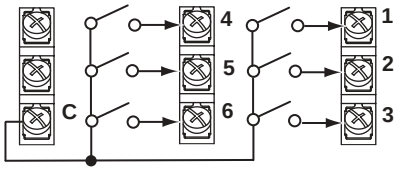
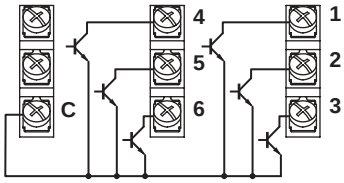
■ Wiring the Contact input (DIGITAL IN/REMOTE)

Control output terminals (DIGITAL IN)

• Relay contact input

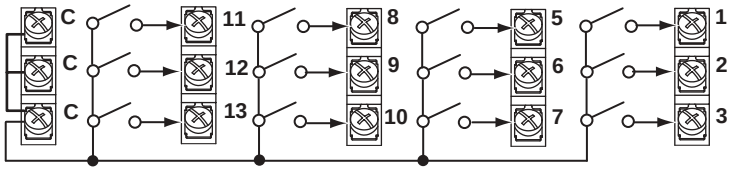


• Transistor input

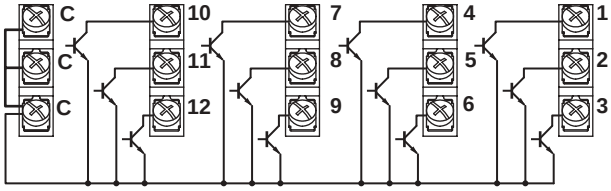


Control DIO extension terminals (DIGITAL IN)

• Relay contact input

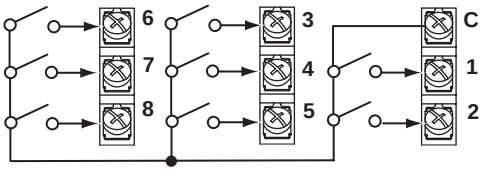


• Transistor input

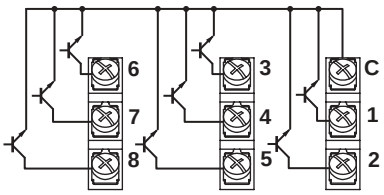


Alarm terminals control remote (REMOTE)

• Relay contact input



• Transistor input



● Relay Contact Input/Transistor Input Specifications

Input Signal: Voltage-free (dry) contact, open-collector (TTL or transistor)

Input Conditions: 0.5 V or less (30 mADC) when ON, 0.25 mA or less current leakage when OFF.

Input Format: Photocoupler isolation (common)

Withstanding Voltage: 500 VDC, 1 min. (between input terminal and earth)

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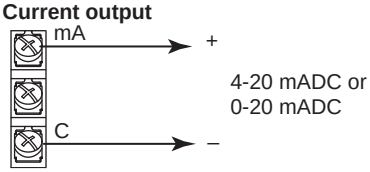
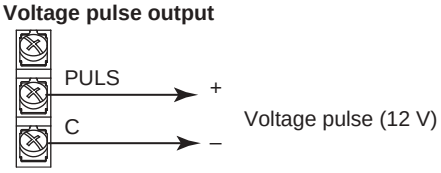
■ Wiring the Control Output (LOOPS 1-6)

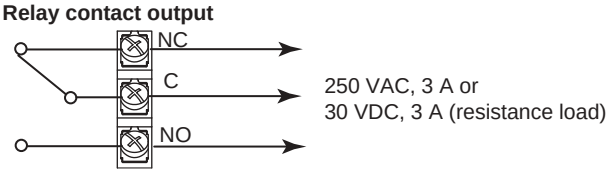
• **Current output**



• **Voltage pulse output**



• **Relay contact output**



● Current Output Specifications

Output Signal: 4-20 mADC or 0-20 mADC

Load Resistance: 600 Ω or more

● Voltage Pulse Output Specifications

Output Signal: ON voltage = 12 VDC

Load Resistance: 600 Ω or more

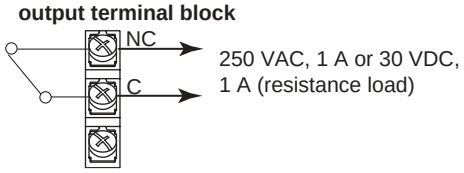
● Relay Contact Output Specifications

Output Signal: NC, NO, COM

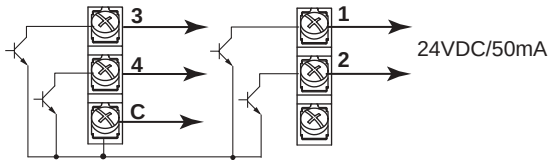
Contact Rating: 250 VAC (50/60 Hz)/3 A or 30 VDC/3 A (resistance load)

■ Wiring the Contact Output (DIGITAL OUT)

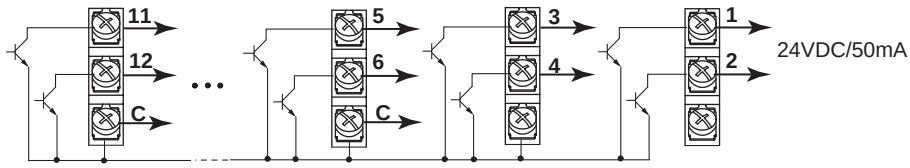
• **Relay contact output from the control output terminal block**



• **Transistor output from the control output terminal block**



• **Transistor output on the control DIO extension terminal block**



● Relay Output Specifications

Output Format: Relay transfer contact

Contact Rating: 250 VAC (50/60 Hz)/1 A or 30 VDC/1 A (resistance load)

● Transistor Output Specifications

Output Format: Open collector output

Contact Rating: 24 VDC/50 mA

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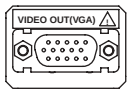
2.4 Connecting a Monitor to the VGA Output Terminal (/D5 Option)

- Before connecting the monitor to the instrument, be sure to turn OFF the power to both monitor and instrument.
- Never short the VIDEO OUT terminal or apply an external voltage to it. Doing so may damage the instrument.

■ Location of the VGA Output Terminal

The VGA output terminal is the D-Sub connector on the upper left of the CX2000's rear panel, and is marked VIDEO OUT(VGA).

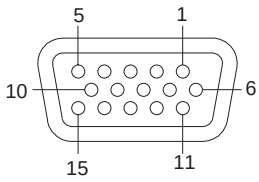


■ Functions and Specifications of the VGA Output Terminal

The instrument's screen can be displayed on a monitor via RGB output. Only a VGA monitor or a multi-synchronous monitor which is capable of displaying VGA can be used.

● Pin Assignments and Specifications of the VGA Output Terminal

Pin No.	Signal Name	Specification
1	Red	0.7 Vp-p
2	Green	0.7 Vp-p
3	Blue	0.7 Vp-p
4	-	
5	-	
6	GND	
7	GND	
8	GND	
9	-	
10	GND	
11	-	
12	-	
13	Horizontal synchronous signal	Approx. 31.5 kHz, TTL negative
14	Vertical synchronous signal	Approx. 60 Hz, TTL negative
15	-	



D-Sub 15 pin receptacle

■ Connecting the Monitor

1. Turn OFF the power both the monitor and the instrument.
2. Connect the monitor to the instrument using an analog RGB cable.
3. Turn ON both the monitor and the instrument. The instrument's screen is displayed in the monitor.

Note

- When the power to the instrument is ON, the video signal is always output from the VGA output terminal.
- The picture on the monitor may become unstable if the instrument or other equipment is brought too close to the monitor.
- Some monitors may display a picture with the sides cut off.

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2.5 Wiring the Transmitter Power Supply Output (/TPS4 Option)

To prevent electric shock, ensure the main power supply is turned OFF.

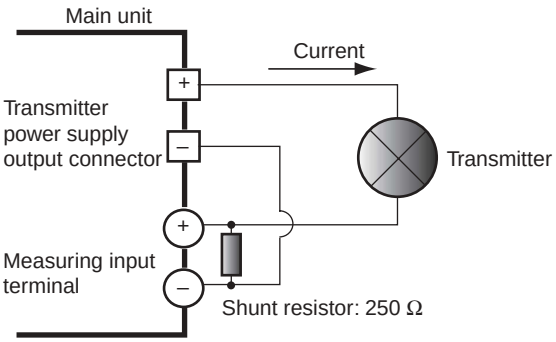
- Never short the transmitter power supply output terminal or apply an external voltage to it. Doing so may damage the instrument.
- Do not use current that exceeds the maximum output current (25 mADC). Doing so may damage the instrument.

■ Output Specifications

Number of Groups:	4
Output Voltage:	22.8-25.2 VDC (for rated load current)
Rated Output Current:	4-20 mADC
Max. Output Current:	25 mADC (overcurrent protection operation current: approximately 68 mADC)
Max. Cable Length:	2 km (when using CEV cable)

■ Wiring Diagram

When inputting the transmitter output to the measurement input, connect the instrument and the transmitter as shown below.



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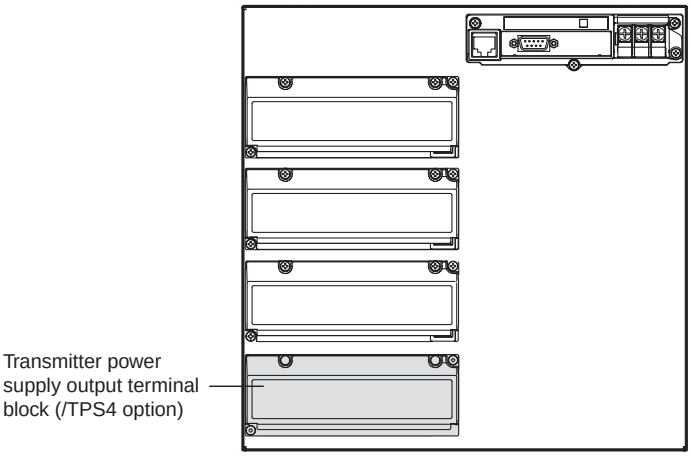
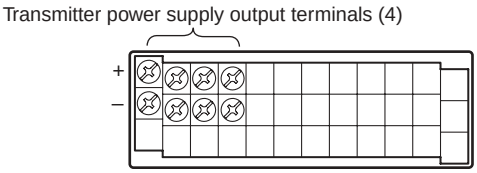
■ Location of the Terminals

● Position of the Terminal Block



● Location of the Terminals



■ Wiring Procedure

1. Turn OFF the instrument and remove the cover for the option terminal.
2. Connect the transmitter power supply output wire to one of the transmitter power supply output terminals.
3. Replace the terminal cover and fasten it with screws.

Note

Use shielded wires to reduce the effects of noise. Connect the shield to the ground terminal of the instrument.

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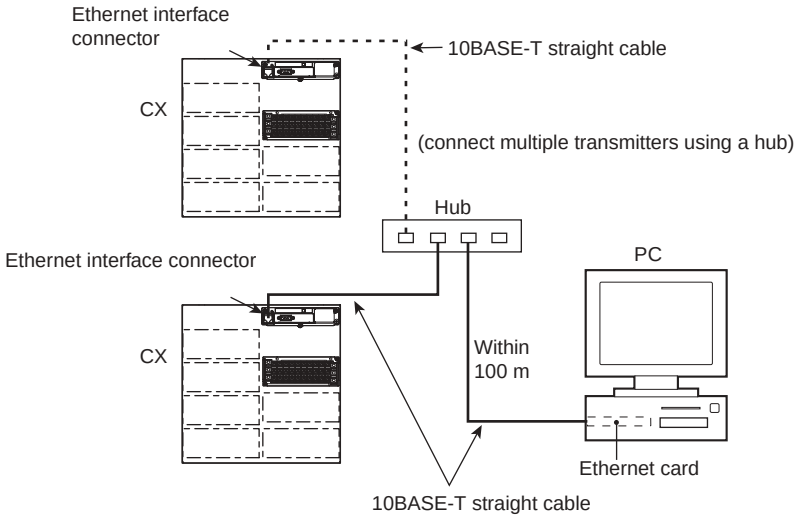
2.6 Connecting the Ethernet Interface

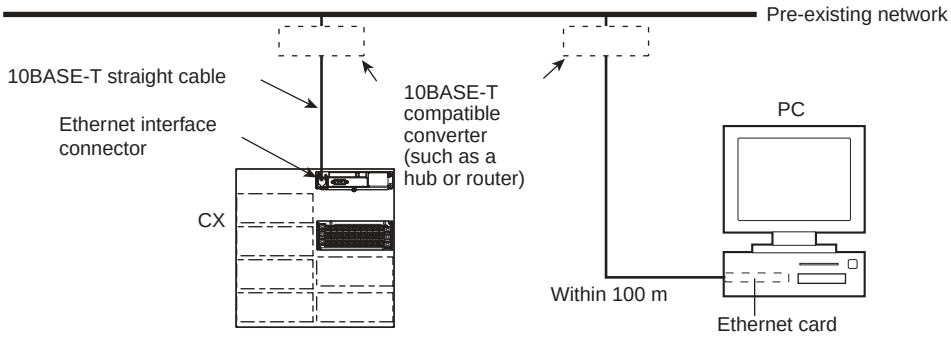
■ Connecting the Instrument to a PC via Hub

Connect the instrument and the PC via a HUB as shown in the following figure.



■ Connecting the Instrument to a PC via Network

The figure below illustrates an example in which the instrument and a PC are connected to a pre-existing network. When connecting the instrument or the PC to a network, such things as the transfer rate and connector type must be matched. For details, consult your system or network administrator.



Note

- Depending on the reliability of the network or the volume of network traffic, all the transferred data may not be retrieved by the PC.
- Communication performance deteriorates if multiple PCs access the recorder simultaneously.

■ Basic Specifications

Electrical, mechanical	Conforms to IEEE 802.3 (Ethernet frames conform to the DIX specifications.)
Transmission medium type	10BASE-T

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2.7 Serial Interface Specifications

The specifications for the two types of serial interfaces (RS-232 and RS-422-A/485) on the instrument are given below.

■ RS-232 Interface Specifications

Connector type	D-Sub 9 pin plug
Electrical, mechanical	Complies with EIA-574 Standard (EIA-232 (RS-232) Standard for 9 pin)
Connection	Point-to-point
Communication	Half-duplex
Synchronization	Start-stop synchronization
Baud Rate	Select from 1200, 2400, 4800, 9600, 19200, or 38400 bps
Start bit	1 bit (fixed)
Data length	Select 7 or 8 bits (Select 8 bits when outputting data in binary format.)
Parity	Odd, Even, None
Stop bit	1 bit (fixed)
Hardware handshaking	Select whether to fix the RS and CS signals to TRUE or to use the control wire.
Software handshaking	Select whether to use the X-ON and X-OFF signals to control the transmitted data only or both the transmitted and received data. X-ON (ASCII 11H), X-OFF (ASCII 13H)
Receive buffer length	2047 bytes

■ RS-422-A/485 Interface Specifications

Terminal block type	6 point, terminal block, terminal screws: ISO M4/nominal length 6 mm		
Electrical, mechanical	Conforms to EIA-422-A (RS-422-A) and EIA-485 (RS-485) standards		
Connection	Multidrop	Four-wire type Two-wire type	1:32 1:31
Communication	Half-duplex		
Synchronization	Start-stop synchronization		
Baud Rate	Select from 1200, 2400, 4800, 9600, 19200, or 38400 bps		
Start bit	1 bit (fixed)		
Data length	Select 7 or 8 bits		
Parity	Odd, Even, None		
Stop bit	1 bit (fixed)		
Receive buffer length	2047 bytes		
Escape sequence	Open, close		
Electric characteristics	FG, SG, SDB, SDA, RDB, RDA (six points)SG, SDB, SDA, RDB, and RDA terminals and the internal circuit of the instrument is functionally isolated. FG terminal is the frame ground.		
Communication distance	Up to 1.2 km		
Terminator	External: recommended resistance 120 Ω, 1/2 W		

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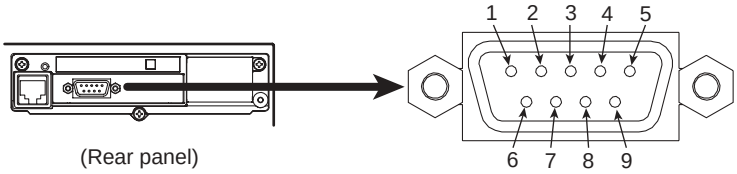
■ RS-232 Interface Connector Pin Assignments and Signal Names

● Connector Pin Assignments



Pin No.	Signal Name	Signal Meaning
2	RD (Received Data)	Received data from the PC. Input signal.
3	SD (Send Data)	Send data to the PC. Output signal.
5	SG (Signal Ground)	Signal ground.
7	RS (Request to Send)	Handshaking signal used when receiving data from the PC.
8	CS (Clear to Send)	Handshaking signal used when sending data to the PC.

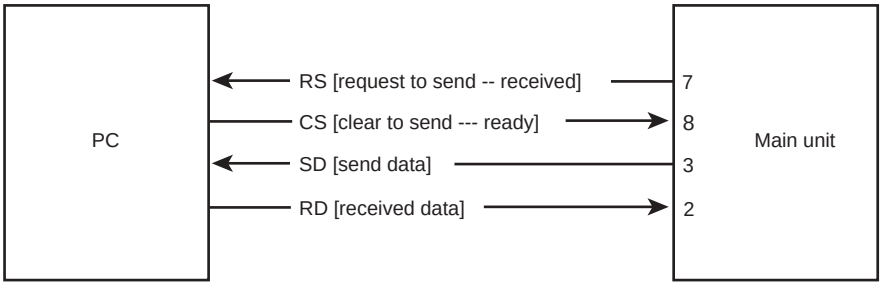
* Pins 1, 4, 6, and 9 are not used.

● Table of RS-232 Standard Signals and Their JIS and ITU-T Abbreviations

Pin No. (9-pin connector)	Abbreviation			Name
	RS-232	ITU-T	JIS	
5	AB(GND)	102	SG	Signal ground
3	BA(TXD)	103	SD	Sent data
2	BB(RXD)	104	RD	Received data
7	CA(RTS)	105	RS	Send request
8	CB(CTS)	106	CS	Clear to send

■ Connecting the RS-232C Interface

● Signal Direction



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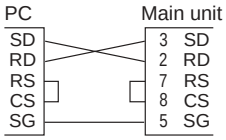
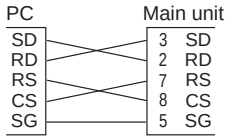
● Connection Example

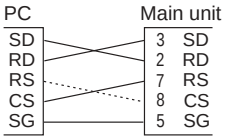
• OFF-OFF/XON-XON



• CS-RS(CTS-RTS)



• XON-RS(XON-RTS)



It is not necessary to connect RS on the PC side and CS on the main unit side for control, but in order to maintain reversability of the signals we recommend you wire it as shown.

■ RS-232 Interface Handshaking Method

When using the RS-232 interface f or transf erring data, it is necessar y for equipment on both sides to a gree on a set of rules to ensure the pr oper transf er of data. That set of rules is called hand-shaking. Because there are man y handshaking methods that can be used between the instru-ment and the PC, you m ust make sure that the same method is c hosen f or both.

You can c hoose an y of the f our methods sho wn in the f ollo wing tab le.

Table of Handshaking Methods (○ = Function Available)

Handshaking	Data sending control (when sending data to the PC)			Data receiving control (when sending data to the PC)		
	Software handshake	Hardware handshake	No handshake	Software handshake	Hardware handshake	No handshake
	Sending stops when X-off received, and resumes when X-on is received.	Sending stops when CB(CTS) is False,and resumes when CB is True.		Sends the X-OFF command when the receive buffer is 3/4 full, and the X-ON command when	CA(RTS) is set to False when the receive buffer is 3/4 full, and is set to True when the buffer is 1/4 full.	
OFF-OFF			○			○
XON-XON	○			○		
XON-RS	○				○	
CS-RS		○			○	

● OFF-OFF

- Data sending control

  There is no handshaking between the instrument and the PC. The X-OFF and X-ON signals are treated as data, and the CS signal is ignored.

- Data receiving control

  There is no handshaking between the instrument and the PC. After the instrument' s receive buff er becomes FULL, excess data is discar ded.

  The RS signal is fix ed to True .

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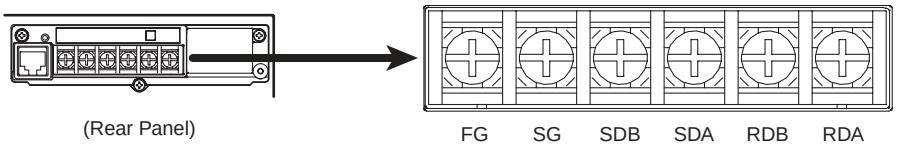
■ RS-422-A/485 Interface Terminal Assignments and Signal Names



FG (Frame Ground)	Case ground of the instrument.
SG (Signal Ground)	Signal ground.
SDB (Send Data B)	Send data B (+).
SDA (Send Data A)	Send data A (–).
RDB (Received Data B)	Received data B (+).
RDA (Received Data A)	Received data A (–).

■ Connecting the RS-422-A/485 Interface

● Cable

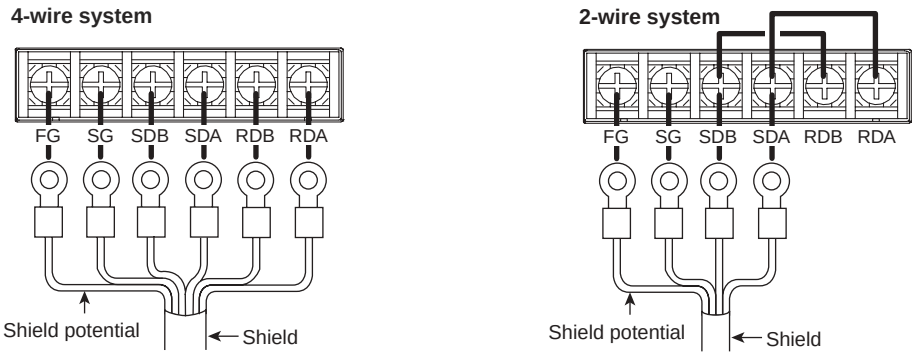
There are two types of cables available, the four-wire cable and the two-wire cable (used only for the Modbus protocol). The cable should meet the following specifications.

Cable	Twisted-pair cable 3 pairs 24 AWG or more (four-wire), 2 pair 24AWG or more (two- wire)
Characteristic impedance	100 Ω
Capacitance	50 pF/m
Cable length	Up to 1.2 km*

* The transmission distance of the RS-422-A/485 interface is not the straight-line distance, but rather the total length of the (twisted-pair shielded) cable.

● Cable Connection Procedure

As shown in the figure below, attach a crimp-style terminal with an isolating sleeve for 4-mm screws to the end of the cable. Keep the section that is exposed from the shielded cable to 5 cm or less.



Note

- As shown on the next page, connect the RD pin to the SD(TD) pin on the PC (converter) side and the SD pin to the RD pin on the PC side.
- The two-wire system can be used only when using the Modbus protocol.

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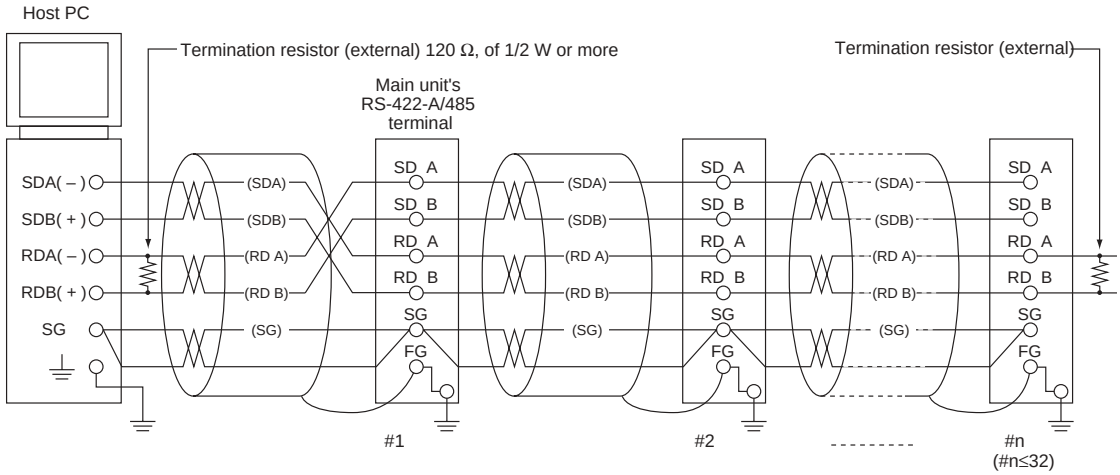
■ An Example of a Connection to a Host Computer

The instrument can be connected to a host computer that has an RS-232, RS-422-A, or RS-485 port.

- For RS-232, use the converter.
- For recommended converters, see page 2-29, "• Serial Interface Converter."
- The two-wire system can be used only when using the Modbus protocol.

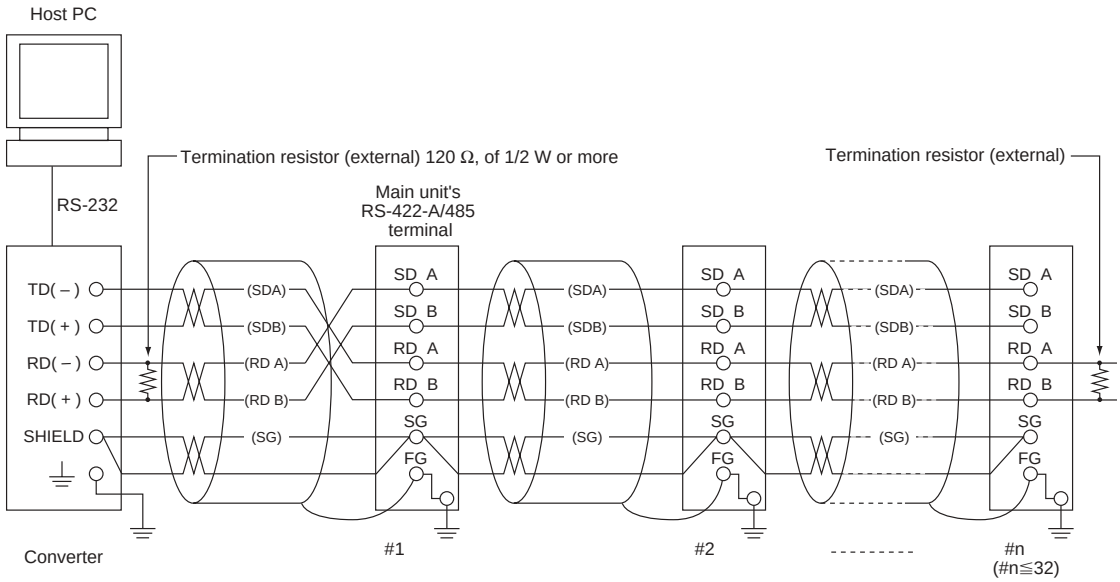
● Four-Wire System

In general, the instrument and the host computer are connected using a four-wire cable. For the four-wire system, the transmission and reception lines must be crossed.



Do not connect a termination resistor to #1-#n-1.

(The following diagram illustrates a case in which the host computer's interface is RS-232)



Do not connect a termination resistor to #1-#n-1.

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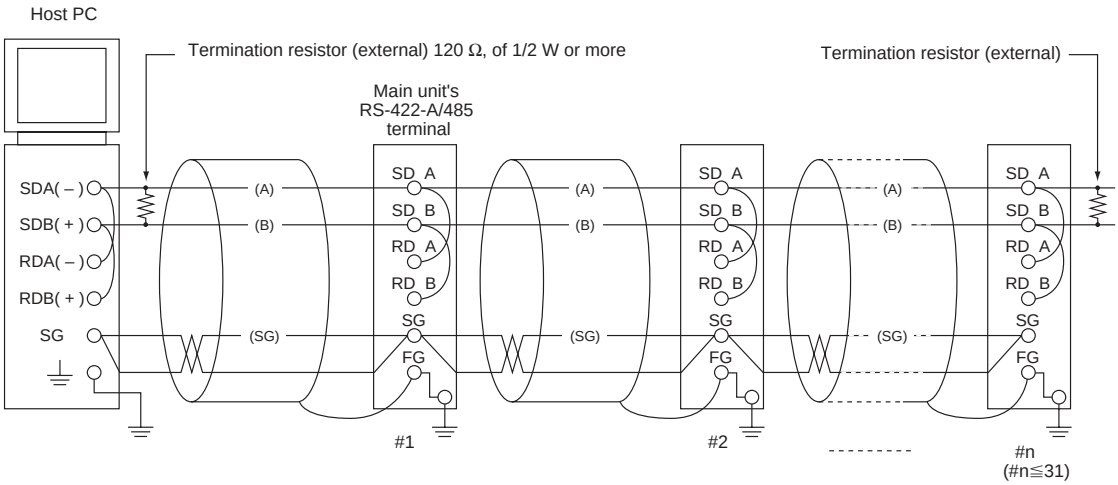
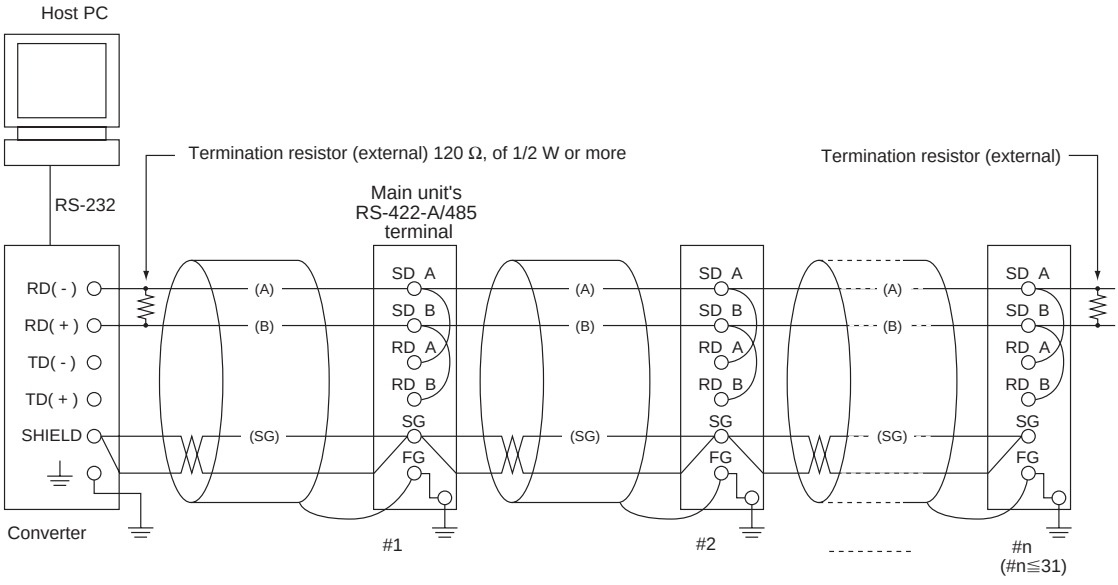
● Two-Wire System

Connect the transmission and reception signals with the same polarity on the RS-422-A/485 terminal block. The two-wire system can be used only when using the Modbus protocol.



Do not connect a termination resistor to #1-#n-1.

(The following diagram illustrates a case in which the host computer's interface is RS-232)



Do not connect a termination resistor to #1-#n-1.

Note

- The method used to eliminate noise varies depending on the situation. In the connection example, only the cable shield on the instrument side is connected to ground (one-sided grounding). This is effective when there is a difference in the electric potential between the PC's ground and the instrument's ground. This may be the case for long distance communications. If there is no difference in the electric potential between the PC and the instrument, two-sided grounding, in which the PC side is also grounded, may be effective. Furthermore, using two-sided grounding and connecting a serial capacitance on one-side may be effective. Consider these possibilities to eliminate noise.
- When using the two-wire type interface (Modbus protocol), the 485 driver must be set to high impedance within 3.5 characters after the last data byte is sent by the host computer.

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● Serial Interface Converter

Recommended converter:

MODEL RC-57 by RA SYSTEMS CORP., or Z-101HE by Sharp

Some converters not recommended by YOKOGAWA have FG and SG pins that are not isolated. When using such a converter, do not connect anything to the FG and SG pins as shown in the diagram on the previous page. This can generate a potential difference, especially for long distance communications, and can damage the instrument or cause communication abnormalities. For converters that do not have the SG pin, they can be used without using the signal ground. For details, see the manual that came with the converter.

On some non-recommended converters, the signal polarity may be reversed (A/B or +/_ indication). In this case, reverse the connection.

For a two-wire system, the host computer must control the transmission driver of the converter in order to prevent collisions of transmitted and received data. When using the recommended converter, the driver is controlled using the RS (RTS) signal on the RS-232.

● When Using Any Instrument That Supports Only the RS-422-A Interface

When using the four-wire type interface, up to 32 instruments can be connected to a single host computer. However, this may not be true if the instrument that support only the RS-422-A interface exists in the system.

● When Using YOKOGAWA's Recorders That Support Only the RS-422-A Interface

The maximum number of connections is 16. Some of YOKOGAWA's conventional recorders (HR2400 and mR, for example) only support the RS-422-A driver. In this case, up to only 16 units can be connected.

Note

In the RS-422-A standard, 10 is the maximum number of connections that are allowed on one port (for a four-wire system).

● Terminator

When using a multidrop connection (including a point-to-point connection), connect a terminal resistance to the instrument on the end of the chain. Do not connect a terminal resistance to a instrument in the middle of the chain. In addition, turn the terminator on the host computer ON (see the computer's manual). If a converter is being used, turn ON its terminator. An external terminator must be attached to the recommended converter. However, there are converters that have built-in terminations.

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2.8 Connecting the Power Supply

■ Cautions When Wiring the Power Supply

Take the following precautions when wiring the power supply. Failure to do so may cause electric shock or damage to the instrument.

- To prevent electric shock, ensure the main power supply is turned OFF.
- To prevent the possibility of fire, use 600 V PVC insulated wire (AWG18) or an equivalent wire for power wiring.
- Make sure to ground the protective earth terminal with a grounding resistance of less than 100 Ω before turning ON the power.
- Use crimp-on lugs (designed for 4 mm screws) for power and ground wiring termination. See page 2-15.
- To prevent electric shock, make sure to attach the transparent terminal cover.
- Make sure to provide a power switch on the power supply line in order to separate the instrument from the main power supply. Put an indication on this switch as the breaker on the power supply line for the instrument.

  Switch Specification — Steady-State Current Rating: 1 A or more (except for the /P1 model), 3 A or more (for the /P1 model).

  Inrush Current Rating: 60 A or more (except for the /P1 model), 70 A or more (for the /P1 model)
- Connect a fuse (between 2 A and 15 A) to the power line.

● For the CX1000

Use a power supply that meets the following conditions.

Item	Non-/P1	/P1
Rated power supply voltage:	100-240 VAC	24 VDC/AC
Allowable power supply voltage range:	90 to 132 or 180 to 264 VAC	21.6 to 26.4 VDC/AC
Rated power supply frequency:	50/60 Hz	50/60 Hz (for AC)
Allowable power supply frequency range:	50/60 Hz ±2%	50/60 Hz ±2% (for AC)
Maximum power consumption:	45 VA (100 V), 62 VA (240 V)	30 VA (for DC), 45 VA (for AC)

Note

Do not use a supply voltage in the range 132 to 180 VAC, as this may have adverse effects on the measurement accuracy (applies to all models except the ones with the /P1 option).

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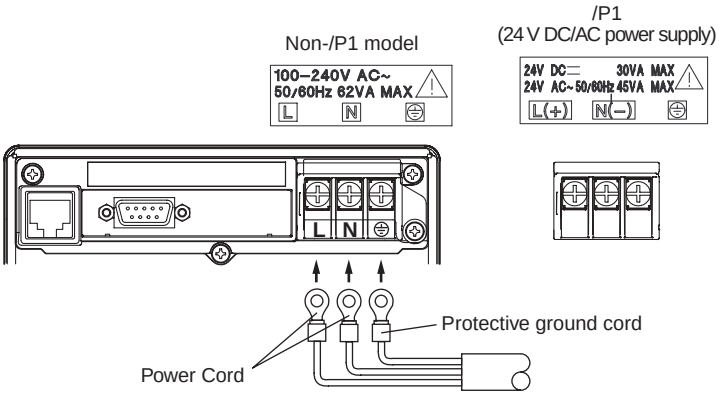
Wiring Procedure

1. Turn OFF the instrument and remove the transparent power terminal cover.
2. Connect the power supply wires and the protective ground wire to the power terminals.



3. Replace the power terminal cover, and fasten it with screws.

● For the CX2000

Use a power supply that meets the following conditions.

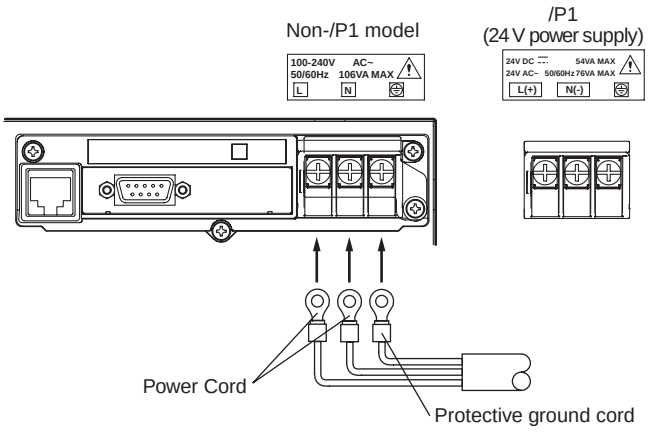
Item	Non-/P1	/P1
Rated power supply:	100-120 VAC	24 VDC/AC
Allowable power supply voltage range:	90 to 132 or 180 to 264 VAC	21.6 to 26.4 VDC/AC
Rated power supply frequency:	50/60 Hz	50/60 Hz (for AC)
Allowable power supply frequency range:	50/60 Hz ±2%	50/60 Hz ±2% (for AC)
Maximum power consumption:	65 VA (100 V), 105 VA (240 V)	54 VA (for DC) 76 VA (for AC)

Note

Do not use a supply voltage in the range 132 to 180 VAC, as this may have adverse effects on the measurement accuracy (applies to all models except the ones with the /P1 option).

Wiring Procedure

1. Turn OFF the instrument and remove the transparent power terminal cover.
2. Connect the power supply wires and the protective ground wire to the power terminals.



3. Replace the power terminal cover, and fasten it with screws.

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3. Installation Environment

For extended and safe use of this instrument, it must be installed in a suitable environment. This chapter gives an overview of environmental specifications. For complete details, refer to the CX1000 and CX2000 general specifications (GS 04L31A01-01 and GS 04L31A01-02).

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Item		CX1000	CX2000	Other
Temperature	Normal operating conditio	0 to 50°C		*1
	Shipping requirements	–25 to 60°C		
Humidity	Normal operating conditions	20 to 80% RH		At 5 to 40°C
	Transport and storage conditions	5 to 95% RH		No condensation allowed
Effects of operating conditions	Ambient temperature: (temperature variations of 10°C)	±(0.1% of rdg +1 digits) or less (voltage/TC range) ±(0.1% of rdg +2 digits) or less (RTD range)		Excluding the reference junction compensation
Supply current		100 to 110 V AC ±10% 200 to 220 V AC ± 10%		
	Frequency	50/60Hz ± 2%		
	Power consumption	*2	*3	
Dielectric strength		1500 V AC, 1 minute/1 minute (50/60 Hz)		Power supply to ground terminal
				Contact output terminal to ground terminal
				Measurement input terminal to ground terminal
		1000 V AC/minute C (50/60 Hz)		Between measuring input terminals
Insulation resistance		20 MΩ or more, 30 or more		Between each terminal and ground terminal
Grounding		D type ground		
Noise	Normal model (50/60 Hz)	DC voltage: The peak value including the signal must be less than 1.2 times the measuring range. Thermocouple: The peak value including the signal must be less than 1.2 times the measuring range. RTD: 50 mV or less		
	Common mode noise voltage (50/60 Hz)	250 V ACrms or less for all ranges		
	Maximum noise between channels voltage (50/60 Hz)	250 V ACrms or lower		
Dustproof and waterproof		IEC529-IP65, NEMANo.250 Type 4 compliant (excluding ice-forming tests)		
Vibration	Normal operating conditions	Not acceptable		
	Transport and storage conditions	392 m/s2 or less (while packed)		
Safety and EMC standards		CSA22.2No.1010. 1 acquisition, EN61010-1 Installation category conformity (overvoltage category) 1 *4 pollution degree 2 *5 Conforms to EMC standard: EN61326-1		

*1: When floppy or zip disk are in operation: 5-40°C

*2: CX1000 power consumption

Power supply	With LCD saver ON	Normal operation	Maximum
100 V AC	Approx. 30 VA	Approx. 32 VA	45 VA
240 V AC	Approx. 42 VA	Approx. 47 VA	62 VA

*3: CX2000 power consumption:

Power supply	With LCD saver ON	Normal operation	Maximum
100 V AC	Approx. 43 VA	Approx. 45 VA	65 VA
240 V AC	Approx. 62 VA	Approx. 65 VA	105 VA

*4: nstallation Category (Overvoltage Category): Value defining an excessive voltage (including the impulse withstand voltage rating, applies to electronic devices powered from fixed installations such as switchboards).

*5: Pollution Degree: Applies to the degree of adhesion of a solid, liquid, or gas which deteriorates withstand voltage or surface resistivity (usually only applies to atmospheric conditions in the room (non-conductive pollution)).

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