OMRON

Model **ES100X**
Digital Controller

INSTRUCTION MANUAL
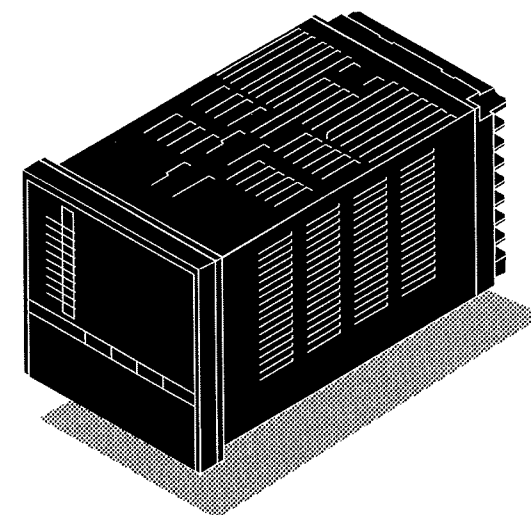
Notice

Thank you for purchasing your ES100X.

Before operating the product, read this manual thoroughly to acquire sufficient knowledge of the controller. Keep this manual for future reference.

Precautions on Safety

● Safety indications and definitions for safe usage.

This instruction manual describes precautions required in using the ES100X safely.

Precautions described here are very serious.

Make sure that you obey them.

Precautions are described by indications and symbols shown below.

● **Definition of Safety Indications**

⚠ WARNING	Incorrect product handling may cause serious injury or death.

● **Explanation of graphic symbols.**

⚠	Explosion Hazard. To signify the danger of explosion under certain circumstances.

● **Safety Indications**

⚠ WARNING
Never disassemble, deform, subject to heat over 100°C or dispose in fire. ⚠ The product has a built-in lithium battery. Fire, Explosion and Burn Hazard.

Precautions

● When wiring the connector and terminals, please allow adequate space between high voltage sources and power lines carrying large currents and the controller to reduce the influence from external noise and also avoid parallel and common wiring with these lines. Using separating pipes, duct work and line shields are also useful in protecting the controller and its lines from external noise.

● Allow as much space as possible between the controller and devices that generate a powerful, high-frequency (high frequency welders, high frequency sewing machines) or surge. These devices may cause malfunction.

● If there is a noise generating device near the controller or any of its lines, attach a surge absorber or noise filter to the device to stop the noise from affecting the controller system. In particular, pay great attention to motors, transformers, solenoids and magnetic coils which have an inductance component.

● When mounting a noise filter, be sure to first check the filter's voltage and current capacity, then mount the filter as close as possible to the controller.

● Be sure to ground the panel which ES100X shall be mounted and the FG terminal of the external power supply.

● Do not use the controller under environment shown below.

• Icing, condensation, dust, corrosive gas (especially sulfide gas or ammonia gas)

• Strong shock and vibration

• Splashing liquid and oily atmosphere

• Frequent temperature change

• Heat radiation from a furnace

● Use the controller under the ambient temperature/humidity range shown below.

• Temperature: –10 to 55°C

Humidity: 35 to 85% RH (with no icing or condensation)

If the ES100X is installed inside the control board, the ambient temperature must be kept 55 °C max., including the temperature inside the control board. If the controller is subjected to heat radiation, use a fan to cool the surface of the controller to under 55°C.

● Store the controller under the ambient temperature/humidity range shown below.

• Temperature: –25 to 65°C

Humidity: 35 to 85% RH (with no icing or condensation)

● Never place heavy objects on, or apply pressure to the controller that may cause it to deform.

● Avoid using the controller in places near a radio, television set, or wireless installation. These devices can cause radio disturbances which affect performance of the controller.

● Use a stable voltage (100 to 200 VAC at 50/60 Hz). At power ON, the prescribed voltage level must be attained within two seconds.

● When you remove the controller from its case, never touch nor apply shock to the electric parts inside.

Manuals

This instruction manual describes setup of the ES100X.

The manuals shown below are available at your request for parameter setting and operation.

● ES100X Digital Controller USER'S MANUAL (Cat. No. H070-E1-1)

　　Knowledge about ES100X operation.

● ES100 Digital Controller USER'S MANUAL (Communication Guide) (Cat. No. H072-E1-1)

　　When ES100X communication function is used.

● ES100 Support Software

　　ES/TOOLS Support Software USER'S MANUAL Ver. 2.0 (Cat. No. H071-E1-1)

　　　Knowledge about capabilities and operations of ES/TOOLS Support Software.

Contents in the box

Make sure that the box contains all the following items.

If you find something missing or damaged, please let us know.

● ES100X 1

● Fixture 2

● Post card for user's registration 1

● Label for scale 1

● Label for bar graph 1

● Instruction manual 1

┌─ Support software ─────────────────────────────────┐
│ ES/TOOLS Support Software, which provides more functions on a DOS computer, is provided │
│ separately by OMRON. │
└──┘
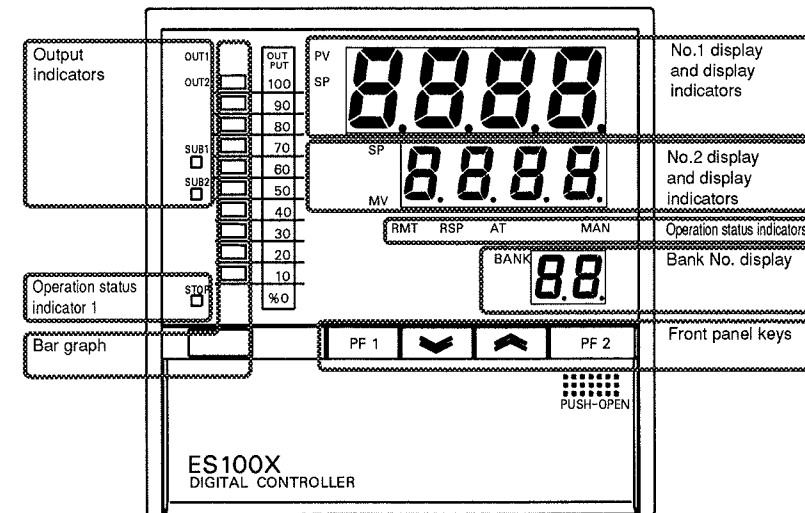
Table of Contents

■ Main Parts

The figure below shows the main parts of the ES100X, and describes their functions.
For more details on these parts, see the page numbers for each description.

Selector switches ▶ See page 8

These are located on PCB inside the main unit and used for switching the setting levels and communication interface.

Rear case

Retains the draw-out main unit.

Rear panel ▶ See page 10

Here are located the terminals for wiring and expansion auxiliary connectors.

Output units ▶ See page 5

Insert the output unit into the on-board socket located inside.
Select the output unit matched to the output specification.

* With position-proportional controllers (ES100X-RRP□·□), a relay output unit is factory set.

Front panel ▶ See page 2

Holds the keys and displays for indicating settings and control status.
The indicators and keys which are not used at operation are located inside the cover.

■ Front Panel

No.1 display and display indicators

The No.1 display indicates the parameter No. when setting and indicates "PV" or "SP" during operation.
PV indicator : Lights when the No.1 display indicates "PV" during operation.
SP indicator : Lights when the No.1 display indicates "SP" during operation.

No.2 display and display indicators

Displays settings when setting parameters.
During setting parameters, the SP and MV LEDs do not light.
Displays the target value (SP) or manipulated variable (MV) during monitoring. Either of the SP or MV LED lights according to the display.

Bar graph

The bar graph indicates the "manipulated variable", "valve opening position", "elapsed-time" or "deviation".
Display items are chosen by the parameters.

Output indicators

OUT1: Lights when control output 1 is ON.
OUT2: Lights when control output 2 is ON.
SUB1 : Lights when auxiliary output 1 is ON.
SUB2 : Lights when auxiliary output 2 is ON.

Operation status indicator 1

STOP LED lights when in stop status.

Operation status indicators 2

These indicators display the current control status.
• RMT : Lights when the setting mode is set to Remote or External.
• RSP : Lights when the program is in remote SP mode.
• AT : Flashes when auto-tuning is being executed.
• MAN : Lights when manual mode is selected.

Bank No. display

Displays bank No. when setting bank No. or operating.
When setting table parameters, the BANK No. display indicates the table No.

Front panel keys

PF1 / PF2 : Executes the functions assigned in parameters.
Each press of the ⊼ key increments setting values by 1, and each press of the ⊻ key decrements setting values by 1.
The display remains dim until the ENT key is pressed.

■ Front Panel (inside cover)
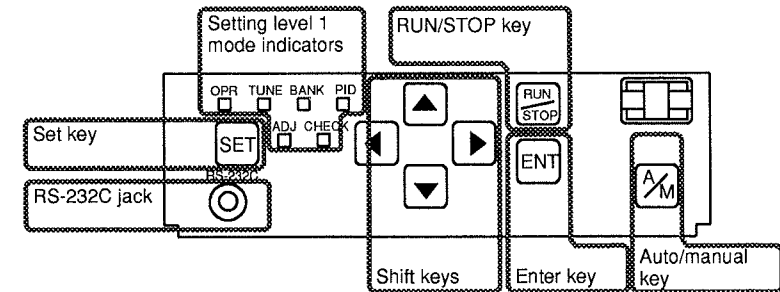
Setting level 1 mode indicators

- OPR   : Lights while in the operation mode.
- TUNE : Lights while in the tuning mode.
- BANK : Lights while in the bank mode
- PID   : Lights while in the PID control parameter setting mode.
- ADJ   : Lights while in the adjustment mode.
- CHECK : Lights while in the check mode.

Set key

Specify the first parameter of each mode.

Shift keys

▼ : Each time this key is pressed, the next parameter is specified.
▲ : Each time this key is pressed, the previous parameter is specified.
► : Each time this key is pressed, the next table No. is specified.
◄ : Each time this key is pressed, the previous table No. is specified.

Enter key

The setting value of each parameter is settled.
Display status changes from flushing to lights.

Auto/manual key

This key switches between auto and manual modes.

RUN/STOP key

RUN (operation start) and STOP (operation stop) is switched by pressing this key.

RS-232C jack

This jack communicates with the ES/TOOLS support software (sold separately). Only the cable provided with the support software can be used.

■ Types of Output Unit

Select the most suitable output unit for the controlled device from the below table.

Unit Type	Model	Rating
Relay Output Unit	E53-R	1 c 250 VAC, 5 A (resistive load) Mechanical life: 10000 K uses min. Electrical life: 100 K uses min.
SSR Output Unit	E53-S	1 a 75 to 250 VAC, 1 A (resistive load)
Voltage Output Unit	E53-Q E53-Q3 E53-Q4	NPN type 12 VDC, 40 mA NPN type 24 VDC, 20 mA PNP type 24 VDC, 20 mA
Current Output Unit	E53-C3	4 to 20 mA DC (load 600Ω or less) Possible for approx. 2600 resolution.

■ Installing the Output Unit
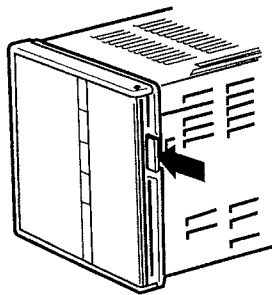
Insert the output unit on the on-board socket.

Pull the front panel toward you, while pushing the hook at the bottom of the housing in the direction indicated by the arrow.


Control output 2
Control output 1

Be sure to attach the attachment clip.
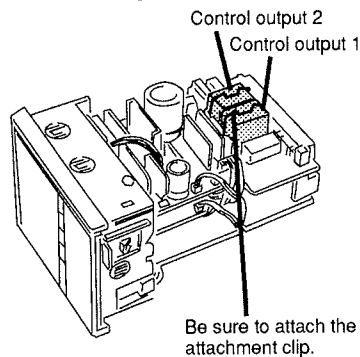
Insert the output unit for control output 1 on "OUT-PUT1" and the output unit for control output 2 on "OUTPUT2". Be sure to attach the output unit attachment clip after inserting the output units.

★ With position-proportional controllers (ES100X-RRP□···□), a relay output unit is factory set and does not need to be purchased separately.
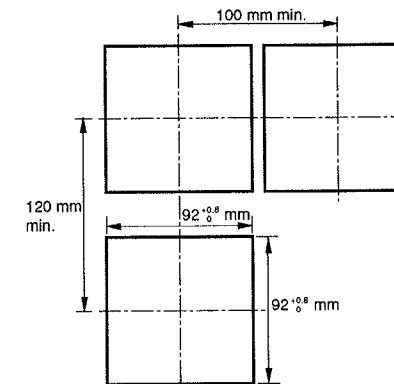
■ Dimensions
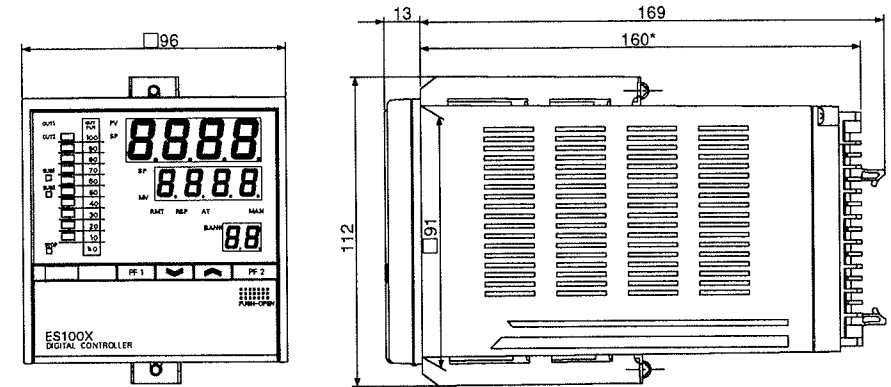
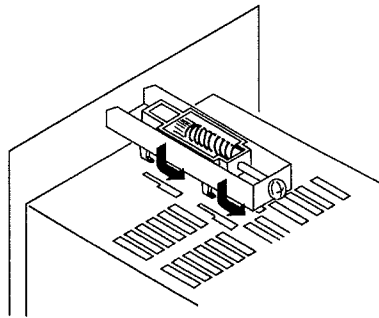* When the terminal cover is installed, the depth is 175 mm.

■ Panel Cutouts

Recommended panel thickness is 1 to 8 mm.
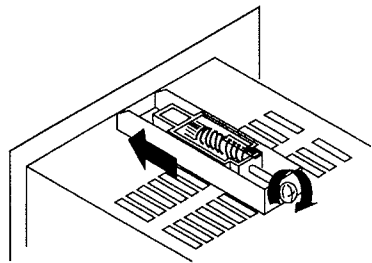
Mounting holes are 92 mm square.

When mounting two or more controllers, provide a center-to-center distance 100 mm min. when horizontally mounted and 120 mm min. when vertically mounted.

4 Switch Settings

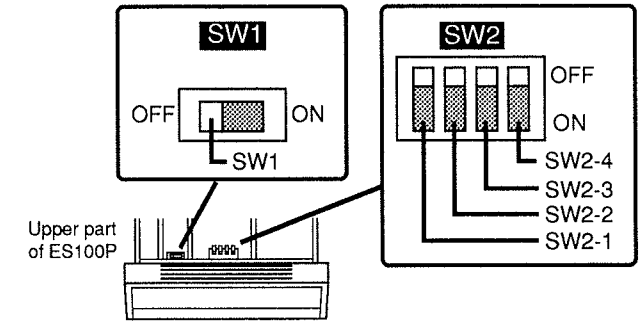## ■ Mounting on the Panel

Slot the two fixtures supplied into the fixing slot on the top and the bottom, pushing ES100X into the mounting holes.

Tighten the fixture screw until the ratchet becomes idle.

■ Switching between Setting Levels

● Switch names

● Switch functions

The table below shows the combination of DIP switch settings for achieving the following six functions.

Functions	Switch positions				
	SW1	SW2-1	SW2-2	SW2-3	SW2-4
Setting level 2 Technical mode (enabled)	ON	—	ON	OFF	OFF
Setting level 2 Technical mode (disabled)	ON	—	OFF	OFF	OFF
Setting level 1 Technical mode (enabled)	OFF	ON	—	—	—
Setting level 1 Technical mode (disabled)	OFF	OFF	—	—	—
Communication test	ON	—	—	—	ON
Initialization mode	ON	—	—	ON	OFF

'—' : ON/OFF available

- All switches are set to OFF before shipment from the factory.
- The "initialization mode" returns parameter settings to factory defaults.
- Select ON or OFF for the application for the switches described with '—'. For example, when both SW2-1 and SW2-2 are ON, setting levels 1 and 2 technical modes become available by only switching SW1.

■ Communications Switch

The ES100X-□□01□ (RS232C) is not provided with a switch.

For ES100X-□□04□ (RS422/485), set both the switch for interface switching and switch for terminator setting.
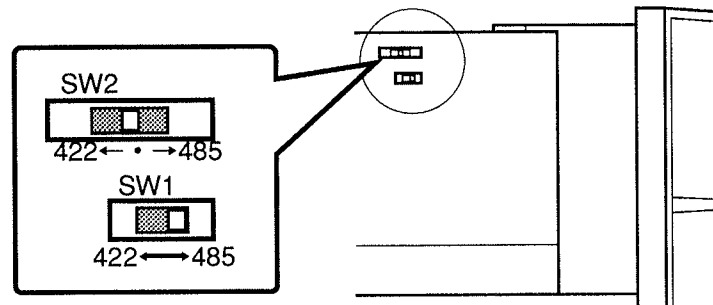These are located the left inside PCB.

SW1 is for interface switching between RS-422 and RS-485.
Set to the appropriate side for the interface.
SW2 is for RS-422/RS-485 terminator setting.
Set to the selected interface side when ES100X-□□04□ is the terminator, and set to the central position when ES100X-□□04□ is not the terminator.


■ Precautions when wiring

• Use ducts to separate input lines and power lines to protect the controller and its lines from electrical noise.
• Solderless terminals are recommended for wiring the controller.
• When installing terminal screws, adjust the torque to 78 N·cm (8 kgf·cm) or less and be sure not to tighten them too much.
• Use solderless terminals which conform to M 3.5 screws.

Fork shape applicable solderless terminals

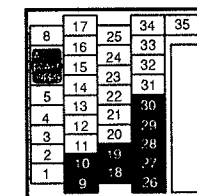| Maker	Type	Applicable electric
Japan Solderless Terminals	1.25-YS3A	0.25 to 1.65 mm²
Japan Terminals	VD1.25-3.5	
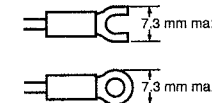
• When wiring with solder-dipped leads, strip the tip of the lead wire 6 to 12 mm and carefully soldes the tips of the exposed lead wire.
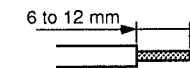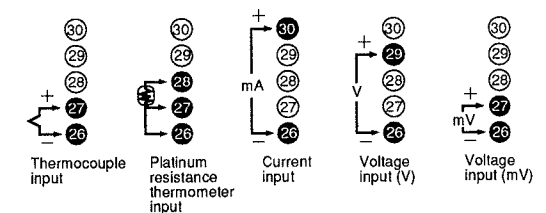

■ Input Wiring

● Analog input

• Terminal Nos. 26, 27, 28, 29 and 30 are for analog input 1.
There are 5 terminal arrangements depending on the input types.

Thermocouple input   Platinum resistance thermometer input   Current input   Voltage input (V)   Voltage input (mV)

• Terminal Nos. 9, 10, 18 and 19 can be used as analog input only on 2-input controllers and check the type name when wiring.
These terminals are for analog input 2.
There are 2 types of terminal arrangement depending on the input types.

4 to 20 mA input   1 to 5 V input
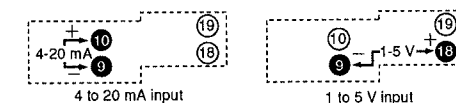
• Analog input 2 is insulated from internal circuits.

● CT input/ potentiometer input

- Terminal Nos. 31, 32 and 33 are used for potentiometer input with position-proportional controllers and used for CT (current transformer) input with other types of controllers.
  The functions of these terminals are fixed and cannot be changed by operation assignment.

CT input   Potentiometer input

● Auxiliary input

- Connect auxiliary inputs 1 to 3 (including COM terminal) to terminal Nos. 20 to 23.
  These are assigned as external setting inputs of bank No. before shipment from factory.
  Bank No. is designated by the combination of 3 inputs.
  For instance, bank No. 5 is combination of DI1=ON, DI2=OFF and DI3=ON.
  These terminals are enabled only on models ES100X-□□□B and ES100X-□□□D.

DI1 (Bank 2^0)
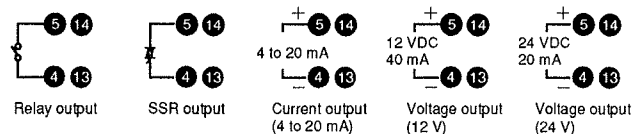DI2 (Bank 2^1)
DI3 (Bank 2^2)
COM
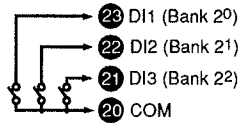
- Auxiliary inputs are insulated from internal circuits.
  However, note that auxiliary inputs are not insulated from transfer output and control output when a current or voltage output unit is installed.

■ Output Wiring

● Control outputs 1/2

- Terminal Nos. 4 and 5 are for control output 1, and Nos. 13 and 14 are for control output 2.
  Connect the control outputs of suit the mounted on the ES100X.
  When connecting voltage or current output, verify polarity of terminals when check the polarity of the connection before wiring.
- Refer to page 5 for details on the output unit.

Relay output	SSR output	Current output (4 to 20 mA)	Voltage output (12 V)	Voltage output (24 V)

- In position-proportional control, control output 1 becomes open output and control output 2 becomes closed output.
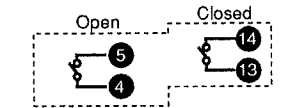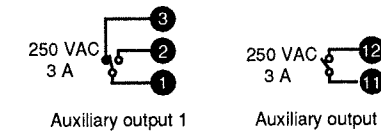

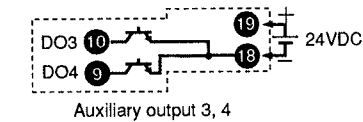Control output (position proportional)

- Control outputs are insulated from internal circuits. However, note that control outputs are not insulated from auxiliary input and transfer output when a current or voltage output unit is installed.

● Auxiliary outputs

- Terminal Nos. 1, 2 and 3 are for auxiliary output 1 and Nos. 11 and 12 are for auxiliary output 2.
  These terminals are assigned as deviation upper limit alarm output before shipment from the factory.

Auxiliary output 1   Auxiliary output 2

- Terminal Nos. 9, 10, 18, and 19 can be used for auxiliary output only on ES100X-□□□D models. So, check the model type before wiring outputs.
  Connect auxiliary outputs 3 and 4 to terminal Nos. 9 and 10.
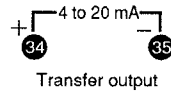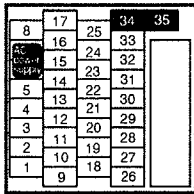 The +24 V power supply should be connected to terminal Nos. 18 and 19.

Auxiliary output 3, 4

- Auxiliary outputs are insulated from internal circuits.

●Transfer output

- Terminal Nos. 34 and 35 are for transfer output.
  These terminals are available only for ES100X-□□F□.


Transfer output

- Transfer outputs are insulated from internal circuits.
  However, note that these are not insulated from control output and transfer input when a current or voltage output unit is installed.

■ Wiring Communication Terminals
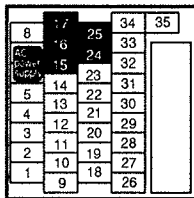
- Terminal Nos. 15, 16, 17, 24 and 25 are for terminal communication.
  There are 2 terminals (terminal arrangement); RS232C (ES100X-□□01□) and RS422/485 (ES100X-□□04□).
  Check which model communication terminals are to be wired to before wiring.

RS-232C   RS-422   RS-485
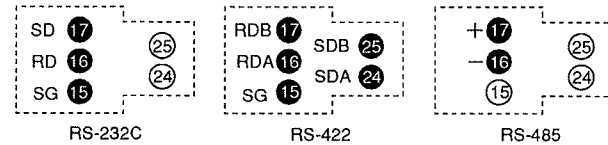
Expansion auxiliary I/O connectors can be used with ES100X-□□□□E. Either of digital I/O or BCD communication can be selected for use in the parameter settings.

■ Connector Wiring

●Digital inputs/outputs

Digital inputs 1 to 8 and digital outputs 3 to 10 are provided for expansion auxiliary I/O connectors.
External 24 VDC power supply should be provided for each digital inputs and digital outputs.
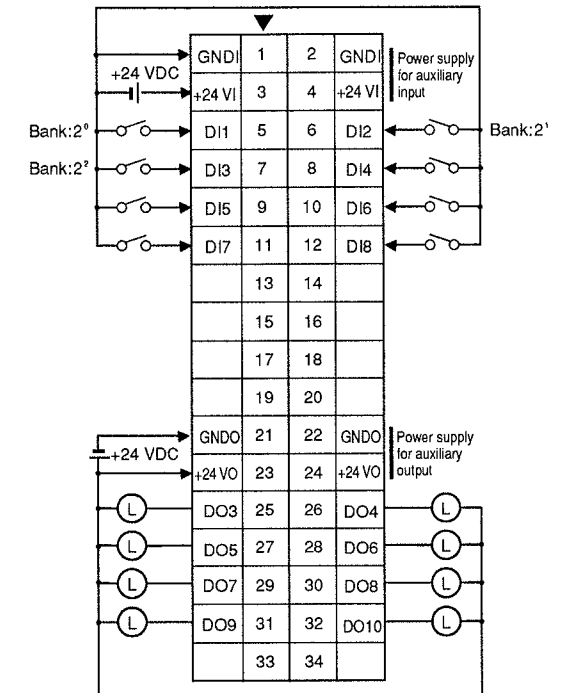
- The following pins (power supply) are connected to each other internally.
  1-2, 3-4, 21-22, 23-24
- Items in parentheses ( ) indicate the defaults assigned to terminals before shipment from the factory.

● **BCD communications**

Refer to "ES100 Digital Controller USER'S MANUAL (Communication Guide)" for the meaning and timing of each signal.

▼

GNDI	1	2	GNDI
+24 VI	3	4	+24 VI
DSL1	5	6	DSL2
DSL3	7	8	DSL4
DSL5	9	10	DSL6
DSL7	11	12	DSL8
WD1	13	14	WD2
WD3	15	16	WD4
WD5	17	18	STRB
VAL	19	20	
GNDO	21	22	GNDO
+24 VO	23	24	+24 VO
RD1	25	26	RD2
RD3	27	28	RD4
RD5	29	30	RSP1
RSP2	31	32	RDY
	33	34	

• The following pins (power supply) are connected to each other internally.
  1-2, 3-4, 21-22, 23-24
• Connect +24 VI and +24 VO, GNDI and GNDO at the host computer.

■ Compatible Connectors

Use XG4M-3430 (OMRON) or equivalent product as the connector for the cable connected to expansion auxiliary I/O connector.

■ Connecting to I/O Terminal Block

Combination examples of expansion auxiliary I/O connector and terminal block are shown below.

● When connecting digital output to output relay terminal

ES100

200 cm

G79-200C-ES1
Output cable

G7TC-OC08
Output relay terminal
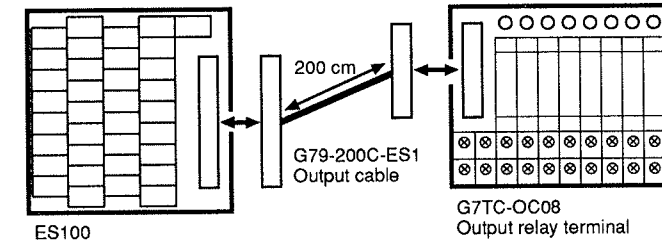
● When connecting digital input to input terminal block and digital output to output relay terminal

200 cm
40 cm (Yellow)

XW2B-20G5
Input terminal block

ES100

15 cm
(Red)

G79-200C-175-ES1
I/O cable

G7TC-OC08
Output relay terminal
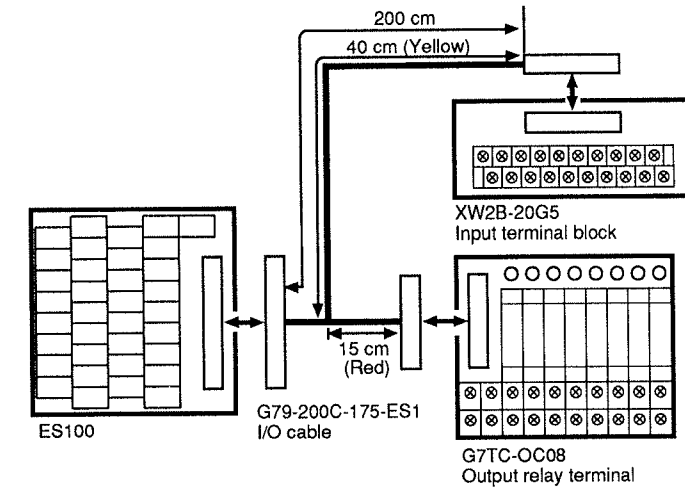
● **When connecting digital I/O or BCD signal to I/O terminal block**

ES100

XW2Z-200C
I/O cable

200 cm

XW2B-34G5
I/O terminal block

■ Signal Allocations of Terminal Block

● Digital I/O

XW2B-34G5 (I/O terminal block)

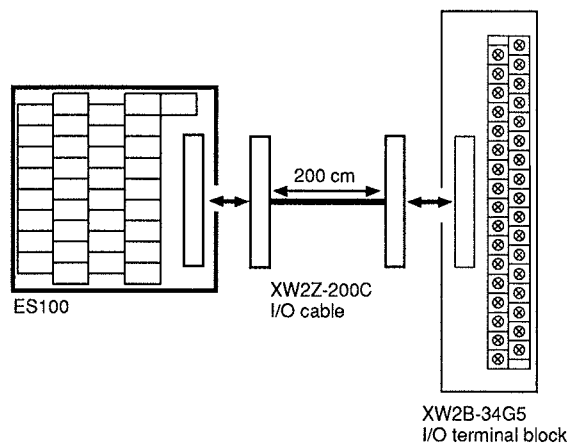| GNDI	+24VI	DI1	DI3	DI5	DI7					GNDO	+24VO	DO3	DO5	DO7	DO9	
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
GNDI	+24VI	DI2	DI4	DI6	DI8					GNDO	+24VO	DO4	DO6	DO8	D10	

XW2B-20G5 (Input terminal block)

+24VI	GNDI	DI1	DI3	DI5	DI7				
1	3	5	7	9	11	13	15	17	19
2	4	6	8	10	12	14	16	18	20
+24VI	GNDI	DI2	DI4	DI6	DI8				

G7TC-OC08 (Output relay terminal)

24VO		DO3	DO4	DO5	DO6	DO7	DO8	DO9	DO10
+		0	1	2	3	4	5	6	7
—		C0	C1	C2	C3	C4	C5	C6	C7
GNDO									

● BCD communication

XW2B-34G5 (I/O terminal block)

GNDI	+24VI	DSL1	DSL3	DSL5	DSL7	DSL1	WD3	WD5	VAL	GNDO	+24VO	RD1	RD3	RD5	RSP2	
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
GNDI	+24VI	DSL2	DSL4	DSL6	DSL8	WD2	WD4	STRB		GNDO	+24VO	RD2	RD4	RSP1	RDY	