Cat. No. HO69-E1-2

# ES100P
# Digital Controller

# USER MANUAL

OMRON®

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# Preface

Thank you for your purchase of your ES100. This digital controller has been achieved as a result of three development concepts:

- Friendly
- Intelligent
- User-oriented

This User's Manual has been designed specifically for the ES100P programmable type ES100, and explains its features and mode of use.
Before using your ES100P, thoroughly read and understand this manual in order to ensure correct use.

# How to Read this Manual

## ■ ES100P manuals

A total of three manuals are provided for the ES100P series digital controller as follows:

● When using the general features of the ES100P series digital controller:

ES100P Digital Controller
User's Manual (Cat. No. H069-E1-2)

● When using the communications features:

ES100 Digital Controller
User's Manual (Communications Guide) (Cat. No. H072-E1-2)

● When using the support software:

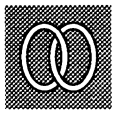
ES100 Support Software
ES/TOOLS Support Software
User's Manual (Cat. No. H071-E1-1)

## ■ The meaning of icons used in this manual

Icons are used in this manual in addition to explanatory text. Icons are used in order to visually represent information and facilitate understanding as you read through this manual. The three icons shown below are used throughout this manual. However, you will find some icons specific to certain chapters of the manual. For details on these icons, read the explanation at the beginning of the relevant chapter.
The following icons are used throughout this manual, and mean the following:

"Caution" mark
This mark indicates that the caution that follows must be heeded at all times.

"Reference" mark
This mark indicates that extra, useful information follows, such as supplementary explanations and how to apply functions.



"See" mark
This mark indicates that you can refer to additional information relating to the preceding explanation.

## ■ How this Manual is Organized

| Purpose | Title | Description |
|---|---|---|
| ● **Learning about the general features of the ES100P** | Chapter 1 What is the ES100P? | This chapter describes the features of the ES100P, names of parts, and typical functions. |
| ● **Setting up the ES100P** | Chapter 2 Preparations | This chapter describes the operations that you must carry out (e.g. installation, wiring and switch settings) before you can use the ES100P. |
| ● **ES100P operations** | Chapter 3 Basic Operation | This chapter describes how to use the front panel keys and how to view the display when setting the parameters of the major functions of the ES100P. |
| ● **How to use parameters** | Chapter 3 Basic Operation<br>Chapter 4 Applied Operation<br>Chapter 5 Parameters | Chapter 4 describes more advanced ways of utilizing the major functions described in Chapter 3.<br>Chapter 5 describes in detail the parameters related to these functions when setting parameters. |
| ● **Learning about control using on the ES100P** | Chapter 6 Typical Examples | This chapter gives typical examples of control that can be achieved on the ES100P, and the key points to remember in each of the control methods. |
| ● **Troubleshooting** | Chapter 7 Troubleshooting | This chapter describes what to do if any problems occur. |

# Caution in Installing this Controller

- When connecting input or output lines to your controller, keep the following points in mind to reduce the influence from external noise: Avoid parallel or common wiring with high voltage sources and power lines carrying large currents. Allow adequate space between the high voltage/ current lines and the input/output lines. Using separating pipes, duct work, and line shields is also useful in protecting the controller and its lines from external noise.
- Allow as much space as possible between the controller (including input/output cables) and devices that generate a powerful, high frequency (high-frequency welders, high-frequency sewing machines, and so forth). These devices may cause power surges and other malfunctions.
- If there is a large power-generating device near the controller and any of its lines, attach a surface absorber or noise filter to the device to stop the noise from affecting the controller system. In particular, motors, transformers, solenoids, and magnetic coils have an inductance component, and therefore can generate very strong noises.
- 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. You can also sometimes improve the controller's resistance to noise by grounding the controller to the control board.
- To reduce radiation nose and the influence of radiation noise, be sure to ground the control board. Also, be sure to ground the FG terminal of the external power supply.
- Do not use the controller in places where icing, condensation, dust, corrosive gas (especially sulfide gas or ammonia gas), shock, vibration, splashing liquid, or oil atmosphere occur. Also, avoid places where the controller can be subjected to intense heat radiation (like from a furnace) or sudden temperature changes.
- Ambient temperature must be kept between -10°C to 55°C. Ambient humidity must be kept between 35%RH to 85%RH (with no ice or condensation). If the controller is installed inside a control board, the ambient temperature must be kept under 55°C, 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 at an ambient temperature between -25°C to 65°C. The ambient humidity must be between 35%RH to 85%RH (with no ice or condensation).
- Never place heavy objects on, or apply pressure to the controller that may cause it to deform during use or storage.
- Avoid using the controller in places near a radio, television set, or wireless installation—these devices can cause radio disturbances which adversely affect the performance of the controller.
- Use a stable voltage (100 to 240 V AC at 50 to 60 Hz). At power ON, the prescribed voltage level must be attained within two seconds.
- If you remove the controller from its case, never touch the electronic parts inside, nor allow static or any other kind of electrical source to contact the controller components.

# Table of Contents

# CHAPTER 1
# WHAT IS THE ES100P?

# 1.1 Features

## ● Easy Operation

- You can easily set and adjust parameter settings using the support software (*1).
- You can quickly set operating instructions or frequently used parameters using programmable function keys.
- You can easily make optimum adjustments to control using the auto-tuning and fine tuning functions.

## ● Almost All Types of Control are Possible on a Single Unit.

- Control is facilitated by using the parameters provided exclusively for heating-cooling control.
- You can choose between floating and closed control on a position-proportional control system.
- Control is facilitated by using the cascade control parameters on a 2-input controller. Operation assignment functions are also supported for ratio control and feed-forward control.

## ● A Wide Range of I/O Functions

- Two inputs are available for analog input: analog input 1 and analog input 2. You can choose from thermocouple, platinum resistance thermometer, current input and voltage and input for analog input 1. You can choose from current input and voltage input for analog input 2.
- Two control outputs and one transfer output are available for analog output. Control outputs are configured in modules so that you can choose the electrical interface matched to the control target.
- A maximum of eight digital inputs and ten digital outputs are provided.
- Two communications functions are available: serial communications and BCD communications. (*2)

## ● I/O Functions Can be Re-assigned

- Digital and analog I/O are not fixed; you can use the digital operation assignment and analog operation assignment functions to assign the optimum I/O functions to the desired control target.
- Digital I/O signals can be assigned by the digital operation assignment function.
- You can use the analog operation assignment function to process data to achieve control operation for analog input. You can also use the analog operation assignment function to process control operation in order to output the control operation results as analog output.

## ● Enhanced Programming Functions

- You can set up to 99 program patterns consisting of up to 100 steps (a maximum of 400 steps) in a single pattern.
- You can not only use the pattern by switching, but can also run the same programs using the repeat function and linking patterns together.

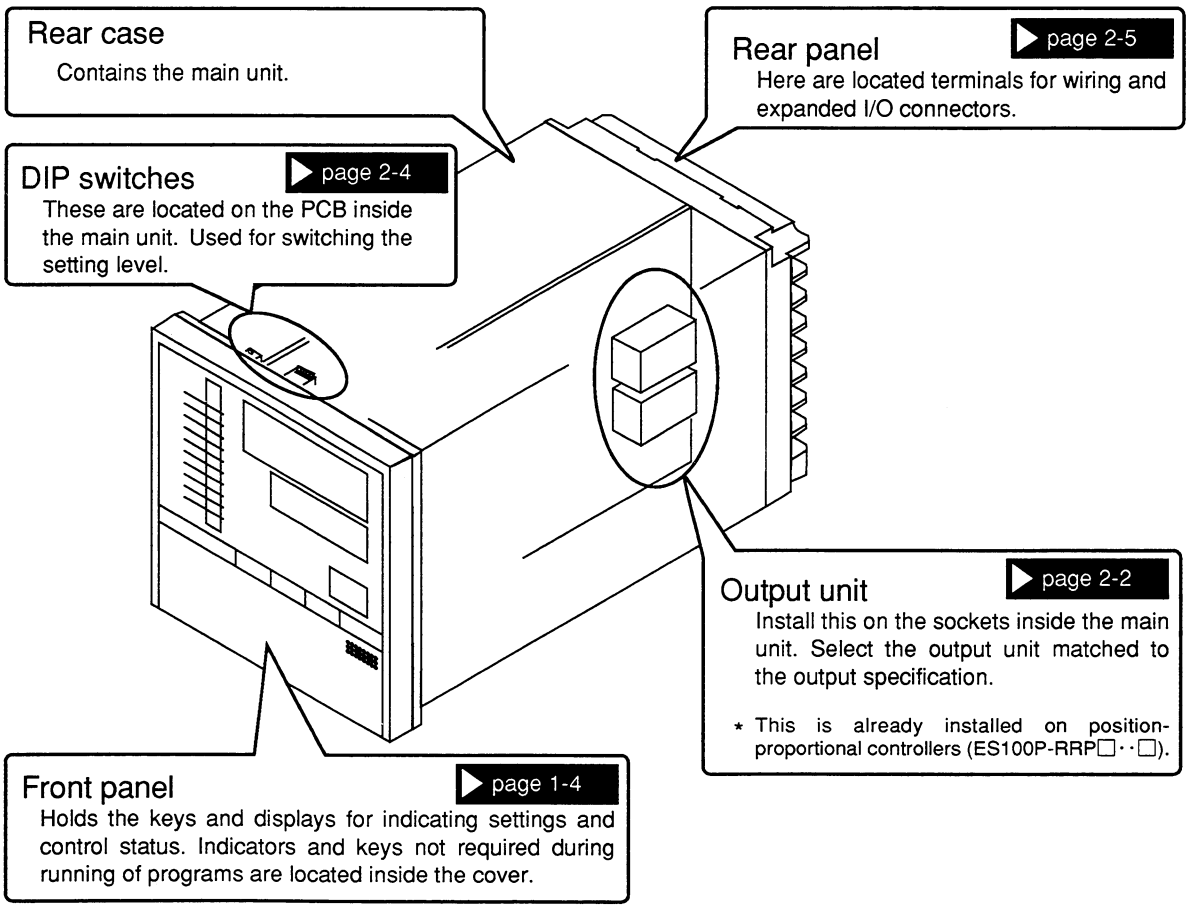
*1 ES/TOOLS Support Software is sold separately.
*2 See the ES100 Digital Controller User's Manual, Communications Guide.

# 1.2 Names of Parts

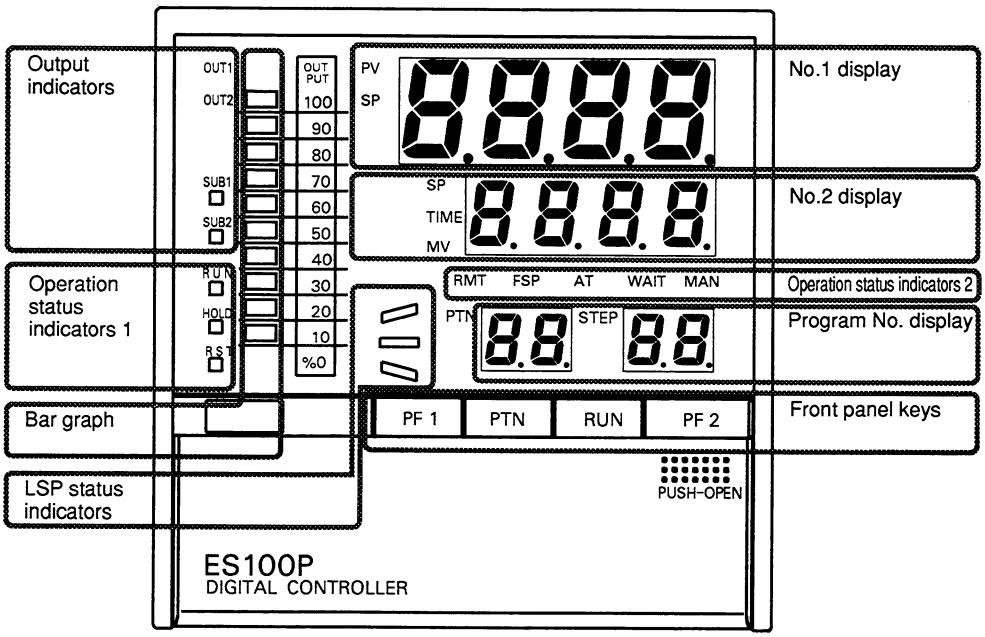
## ■ Main parts

The figure below shows the main parts of the ES100P, and describes each of their functions.
For more details on these main parts, see the page numbers for each description.





## ■ Front panel




**No.1 display**

Displays parameter symbols when setting parameters. During setting of parameters, the PV and SP LEDs do not light.
Displays the process value (PV) or the set point (SP) during monitoring. Either of the PV or SP LEDs lights according to the display content.

**No.2 display**

Displays settings when setting parameters. During setting of parameters, the SP and MV LEDs do not light.
Displays the process value (PV), elapsed time and the manipulated variable (MV) during monitoring. One of the SP or MV LEDs lights according to the display content.

**Bar graph**

This bar graph indicates the manipulated variable, valve opening position, elapsed-time%, and deviation. The user can designate in parameters which items are displayed on the bar graph.

**Output indicators**

The corresponding LEDs lights depending on which control outputs (OUT1, OUT2) and auxiliary outputs (SUB1, SUB2) are ON.

**Operation status indicators 1**

These indicators display the operation status.
RUN lights when the program is running.
HOLD lights when the program is in hold status.
RST lights when the control is in reset status.

**Operation status indicators 2**

These indicators display the current control status.
- RMT LED : Lights when the current mode is set to remote or external.
- FSP LED : Lights when the SP mode is set to a fixed value.
- AT LED : Flashes when auto-tuning is being executed.
- WAIT LED : Lights when the program is in wait status, and flashes when a wait alarm occurs.
- MAN LED : Lights when the current mode is the manual mode.

**Program No. display**

When setting and running the program, the PTN display indicates the pattern No. and the STEP display indicates the step No. When setting table parameters, the STEP display indicates the table No.

**LSP status indicators**

These indicators display the status of the local SP during execution of the program for the currently executing step.

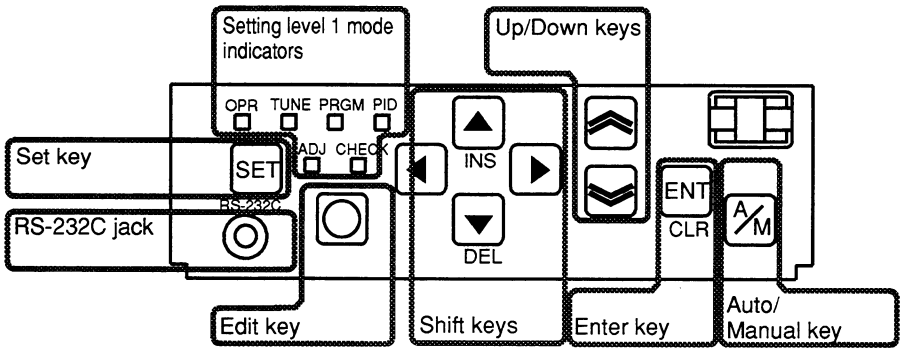
- : Lights when the running program step is ramp up.
- : Lights when the running program step is soak.
- : Lights when the running program step is ramp down.

**Front panel keys**

The PF1 and PF2 keys are programmable function keys. The user can assign functions to these keys.
The PTN key advances patterns.
The RUN key starts execution of a program.

## ■ Front panel (inside cover)






**Setting level 1 mode indicators**

The LED corresponding to the mode set in setting level 1 lights. Correspondence between the LED and setting mode is as follows:

OPR LED : Operation mode
TUNE LED : Tuning mode
PRGM LED : Program setting mode
PID LED : PID set setting mode
ADJ LED : Adjustment mode
CHECK LED: Check mode

**Set key**

Designates the first parameter in each setting mode.

**Shift keys**

Pressing the ▼ key designates the next parameter.
Pressing the ▲ key designates the previous parameter.
Pressing the ▶ key designates the next table No.
Pressing the ◀ key designates the previous table No.

**Up/Down keys**

Each press of the ⩓ key increments values by 1, and each press of the ⩔ key decrements values by 1. The display remains dim until the ENT key is pressed.

**Enter key**

This key is used to enter a setting. When pressed, the dim display changes to a lit display.

**Edit key**

This key is used for editing programs.

**Auto/Manual key**

Each press of this key switches between auto and manual modes.

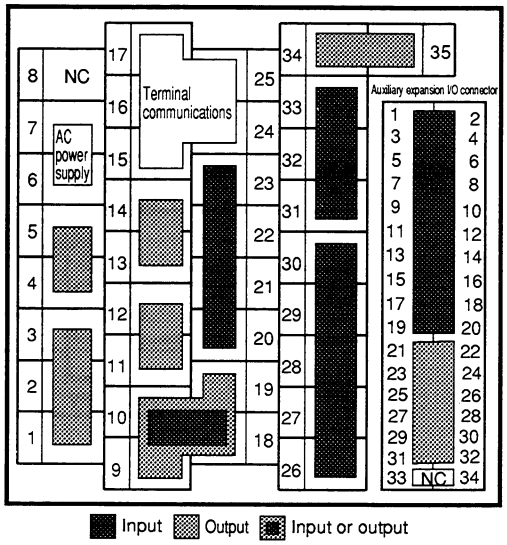
**RS-232C jack**

This RS-232C interface jack is for communicating with the ES/TOOLS support software (sold separately). Cables other than the dedicated cable (sold separately) cannot be used with the ES/Tools support software.

# 1.3 Input and Output

## ■ Layout of I/O terminals

The ES100P rear panel is provided with terminals and expanded I/O connectors. Input and output terminals are arranged in groups as shown in the figure below. The rear panel can be configured in a variety of ways depending on the model you have purchased.




## ■ Input

### ● Analog input 1

- A total of 26 analog input terminals are available: 17 temperature sensor inputs (thermocouple and platinum resistance thermometer), seven voltage inputs, and two current inputs. You can choose one of these 26 analog inputs in the "analog input 1 type" parameter.

### ● Analog input 2

- These terminals are available only on 2-input ES100P. You can choose either of voltage input or current input in parameter settings.

### ● CT input

- Terminals are provided on standard ES100P (including heating-cooling models) for CT input for use in heater current detection.

### ● Potentiometer input

- Terminals are provided on position-proportional ES100P for potentiomenter input for use in valve opening measurement.

### ● Auxiliary input (digital input)

- Of the ES100P on which auxiliary inputs can be used, up to eight auxiliary input terminals can be used on models provided with expanded I/O connectors, and up to three auxiliary input terminals can be used on models not provided with expanded I/O connectors.
- The application of the auxiliary input terminals can be designated by the digital operation assignment function. Before shipment from the factory, switch inputs for run, reset and advance are assigned to the auxiliary input terminals
- On ES100P provided with expanded I/O connectors, the auxiliary input terminals cannot be used when using BCD communications. BCD communications is switched to in parameter settings.

## ■ Output

### ● Control output (analog output)

- Two control output terminals are provided: control output 1 and control output 2. You can choose between relay output, SSR output, voltage output and current output for each of these terminals depending on the type of output unit installed on the main unit.
- In position-proportional control systems, control output 1 is used for open output and control output 2 is used for closed output. So, a relay output unit is used as the output unit. This output unit is already installed in position-proportional controllers before shipment from the factory, so the user need not to obtain a separate output unit.



### ● Transfer output (current output)

- This terminal is exclusively for current output. Output data can be designated to this terminal by the analog operation assignment function. PV is assigned to this terminal before shipment from the factory.

### ● Auxiliary output (digital output)

- Ten auxiliary output terminals are provided: auxiliary outputs 1 to 10.
- Auxiliary outputs 1 and 2 are for relay output, and auxiliary outputs 3 to 10 are for open-collector output.
- Auxiliary outputs 3 to 10 sometimes cannot be used depending on the model of ES100P.
- Output data can be designated to auxiliary outputs by the digital operation assignment function. Event output is assigned to auxiliary outputs 1 and 2 before shipment from the factory.
- When using BCD communications on ES100P provided with expanded I/O connectors, auxiliary outputs 3 to 10 cannot be used.

**Terminal names and operation assignments**

On the ES100P, the functions of I/O terminals are determined by the "operation assignment function." That is, inputs correspond to arguments, and outputs correspond to assignment destinations. Sometimes, however, the terminal name differs from the name used in operation assignment. The purpose of this is to match the terminology used in conventional temperature controllers and digital controllers. The following table shows the correspondence between terminal names and the name used in operation assignment.

| Terminal Name | Argument or Assignment Destination | Terminal Name | Argument or Assignment Destination |
|---|---|---|---|
| Control output 1 | Analog output 1 | Transfer output | Analog output 3 |
| Control output 2 | Analog output 2 | Auxiliary input 1 | Digital input 1 |
| Auxiliary output 1 | Digital output 1 | Auxiliary input 2 | Digital input 2 |
| Auxiliary output 2 | Digital output 2 | Auxiliary input 3 | Digital input 3 |

For details on the operation assignment function, see page 1-10.

# 1.4 Parameters and Setting Levels

The ES100P has two setting levels, setting level 1 and setting level 2. These two setting levels support different parameters.

### ● Setting level 2

This setting level is for determining the specifications of the controller. Running of programs is stopped when this setting level is entered.
Of the parameters in setting level 2, unit or reference information used in setting level 1 parameters must be set before the related setting level 1 parameter is accessed.
In setting level 2, parameters are distributed among the following setting modes:

Specification setting mode
Event setting mode
ON/OFF timer setting mode
Digital operation assignment setting mode
Analog operation assignment setting mode
Setting level 2 technical mode

### ● Setting level 1

This setting level is for setting performance or operating conditions.
In setting level 1, parameters are distributed among the following setting modes:

Manual mode parameter setting mode (available only in the manual mode)
Operation mode
Tuning mode
Program setting mode
PID set setting mode
Adjustment mode
Check mode
(Setting level 1 technical mode)

Each of these modes except setting level 1 technical mode can be verified by lighting of their respective LEDs.

### ● Switching between setting levels

To switch between setting levels 1 and 2, you need to change the settings of the DIP switches located inside the main unit of the ES100P.
Setting levels 1 and 2 are each provided with a technical mode to set the technical parameters. You can enable (and disable) access and display of the technical modes by changing the DIP switch settings.

# 1.5 SP Mode

On the ES100P, you can use one of local SP (LSP), remote SP (RSP) and fixed (FSP) as the set point (SP). Each of these SPs is designated in an "SP mode."



### ● Local SP mode

Execution of programs is started in the local SP mode. In the local SP mode, the SP is calculated from the "local SP" parameter set for each of the programmed steps.
When another mode is switched to from the local SP mode during program execution, the SP changes. The program, however, continues to advance as instructed.

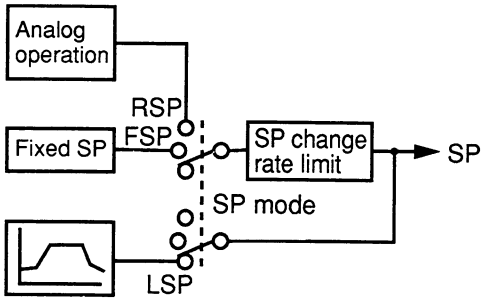
### ● Remote SP mode

In the remote SP mode, the result of analog operations that takes the assignment destination as the "RSP" is used as the SP. This SP is called the "remote SP."
The remote SP mode is set, for example, when controlling external analog input data (using analog input 2) as the SP.

### ● Fixed SP mode

In the fixed SP mode, the setting of the "fixed SP" parameter is used as the SP. The fixed SP mode is set when performing control by a fixed value.

The SP change rate can be limited in the remote SP and fixed SP modes.




About setting modes

You can choose between settings made on the front panel, by serial communication and by BCD communications for use in parameter settings. Settings made on the front panel are called "local settings", serial communications (serial and BCD) settings are called "remote settings", and BCD communication settings are called "external settings".
Note that the terms "local" and "remote" differ from "local" and "remote" used in the SP modes. Remember this when setting the SP mode and parameters.

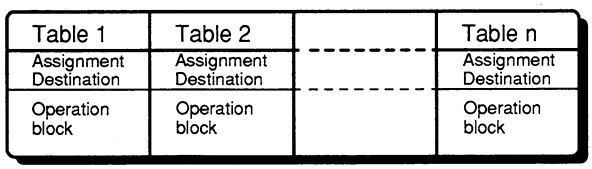
# 1.6 Operation Assignment Function

## ■ What is an "operation assignment"?

- ES100P I/O data is used according to the values set to tables. These tables describe how I/O data are is to be handled. Accordingly, you can use I/O data as it is as control data in the same way as on conventional digital controllers. Data can be further manipulated by "operations," so the optimum I/O functions can be achieved for the control target. This is referred to as the "operation assignment function."
  Tables describing how I/O data is to be handled are called "operation assignment tables."
- There are two operation assignment functions: the "digital operation assignment function" and "analog operation assignment function." The function to be used depends on the type of data that is to be handled.
- Moreover, "mixed analog/digital operation" for exchanging data between analog and digital operations also is possible.

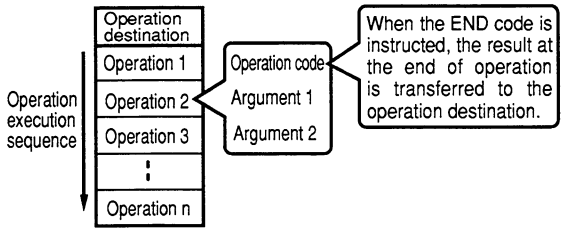
### ● Operation assignment table

- The content of operation assignment tables are described in the "digital/analog operation assignment" parameters.
- Operation assignment tables are made up of "operation blocks" and "assignment destinations."




### ● About operations

- At the operation block, an operation that is executed using two arguments is handled as the basic unit. Each of these operations is given a No.
- Operations are executed from the smallest operation No. upwards, and end when the program reaches the operation END code.
- The result of each operation is output to the assignment destination.
- Table settings are executed in table No. order.



## ■ Digital operation assignments

- The digital operation processes external digital inputs, flags for internal ON/OFF timers, events and control status as arguments "1" or "0," and outputs to assignment destinations such as digital outputs, operating instructions and the digital user buffers.
- The ES100P is provided with 30 operation assignment tables. The settings of assignment destinations in unused tables should be set to "0" (disabled). The results of digital operations can also be used as the arguments for the subsequent operation.
- The operation block is made up of operations 1 to 4. This is shown in the following diagram.

| Table 1 | Table 2 | | Table 30 |
|---|---|---|---|
| Assignment destination | Assignment destination | | Assignment destination |
| Operations 1 to 4 | Operations 1 to 4 | | Operations 1 to 4 |

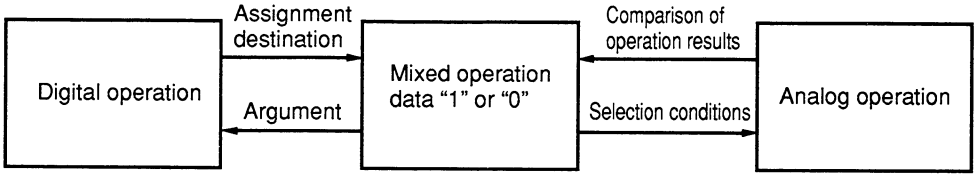
## ■ Analog operation assignments

- The analog operation process external analog inputs, SP, PV and control operation data as arguments, and assigns the external results of operations to assignment destinations such as control outputs, transfer outputs and the analog user buffers.
- The ES100P is provided with 15 operation assignment tables. The settings of assignment destinations in unused tables should be set to "0" (disabled).
- The operation block is made up of operations 1 to 15. This is shown in the following diagram.

| Table 1 | Table 2 | | Table 15 |
|---|---|---|---|
| Assignment destination | Assignment destination | | Assignment destination |
| Operations 1 to 15 | Operations 1 to 15 | | Operations 1 to 15 |

## ■ Mixed analog/digital operation

- The ES100P is provided with a common data area for sharing the results of digital and analog operations.
- Up to eight sets of data for expressing the states "0" and "1" can be set to this data area.
- In digital operations, this area can be used for arguments or assignment destinations.
- In analog operations, the results of comparing the sizes of arguments are set as data "1" or "0". Also, arguments can be selected according to the value set to this data.
- Accordingly, you can select either of two sets of analog data using the results of digital operation, and assign the results of comparing the analog data to digital outputs.



# 1.7 Fine Tuning

Fine tuning is executed in the following cases:

- If you are not satisfied with the control performance of the ES100P after executing A.T. (auto-tuning)
- When PV disturbance or control cancellation caused by A.T. is not allowed in the system

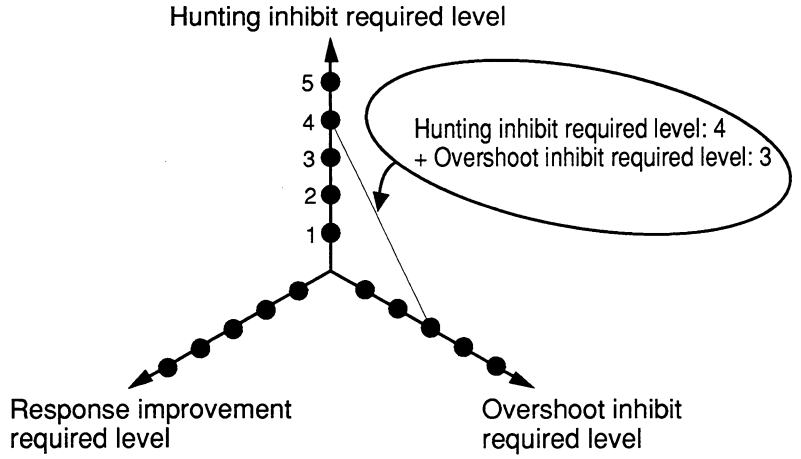
With the fine tuning function, three improvement required levels are set for improvement of control performance. Fuzzy logic inference is executed from the improvement requirements and the control state up to that point to automatically correct PID parameters.

There are three improvement required levels:

Hunting inhibit required level
Overshoot inhibit required level
Response improvement required level

The strength of each of these required levels can be designated in five stages.

If two levels of control are required for a control target, two required levels can be set simultaneously. For example, you can set the required level for the "hunting inhibit" and "overshoot inhibit" parameters if both hunting and overshoot need to be improved. You cannot set three levels of control simultaneously for a control target.



# CHAPTER 2 PREPARATIONS

# 2.1 Installing the ES100P

## ■ Output unit

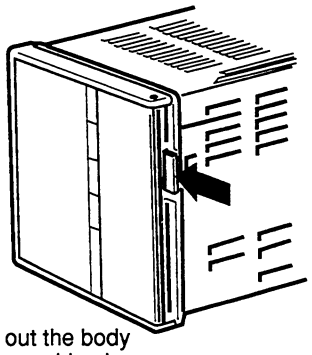
Four types of output unit are available for the ES100P. Select the output unit appropriate for how your ES100P is applied.

### ● Types of output unit

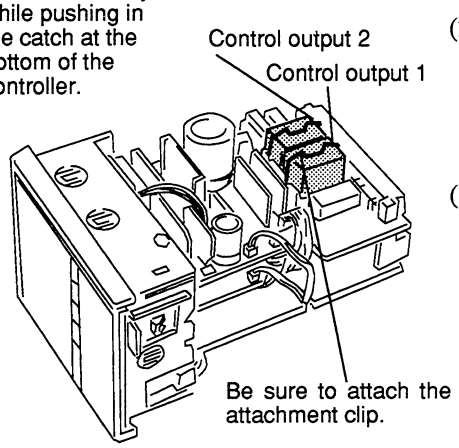
The following table shows the output units and their ratings.

| Unit Type | Model | Rating |
|---|---|---|
| Relay Output Unit | E53-R | 1c 250 V AC, 5 A (resistive load)<br>Mechanical life: 1,000,000 uses or more<br>Electrical life: 100,000 uses or more |
| SSR Output Unit | E53-S | 1a 75 to 250 V AC, 1 A (resistive load) |
| Voltage Output Unit | E53-Q<br>E53-Q3<br>E53-Q4 | NPN type 12 V DC, 40 mA<br>NPN type 24 V DC, 20 mA<br>PNP type 24 V DC, 20 mA |
| Linear Output Unit | E53-C3 | 4 to 20 mA DC (load 600 Ω or less)<br>Possible for approx. 2600 resolution |
| | E53-C3D | 0 to 20 mA DC (load 600Ω or less)<br>Possible for approx. 2600 resolution |
| | E53-V34 | 0 to 10 VDC (load 1 kΩ or more)<br>Possible for approx. 2600 resolution |
| | E53-V35 | 0 to 5 VDC (load 1 kΩ or more)<br>Possible for approx. 2600 resolution |

### ● Mounting the output unit



Pull out the body while pushing in the catch at the bottom of the controller.




Insert the output unit into the on-board socket following the procedure below.

(1) Pull out the controller body.
Push in the catch at the bottom of the controller to unlock the front panel from the rear panel. Pull out the body with the catch pushed in.

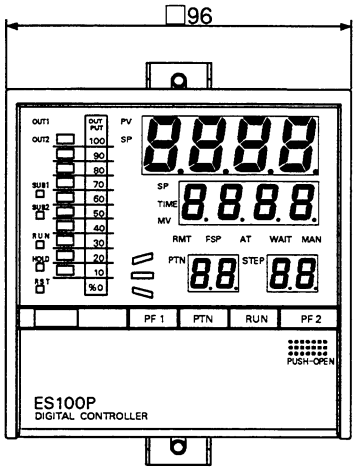
(2) Mount the output unit.
Insert the output unit for control output 1 into the on-board socket marked "OUTPUT1" and the output unit for control output 2 into the on-board socket marked "OUTPUT2."

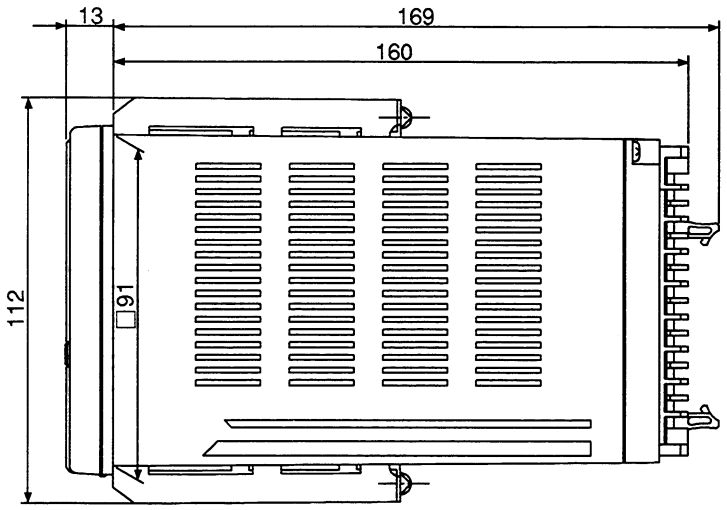
(3) Snap in the attachment clips to hold the output unit firmly in place.

**Output unit of position-proportional controllers**

With position-proportional controllers (model ES100P-RRP), a relay output unit is provided at purchase. Therefore, this relay output unit does not need to be purchased separately.

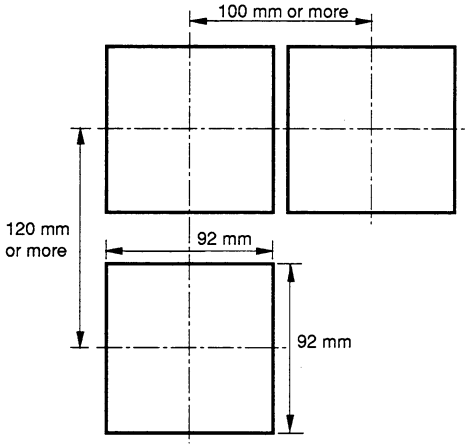
## ■ External dimensions






## ■ Drilling mounting panels

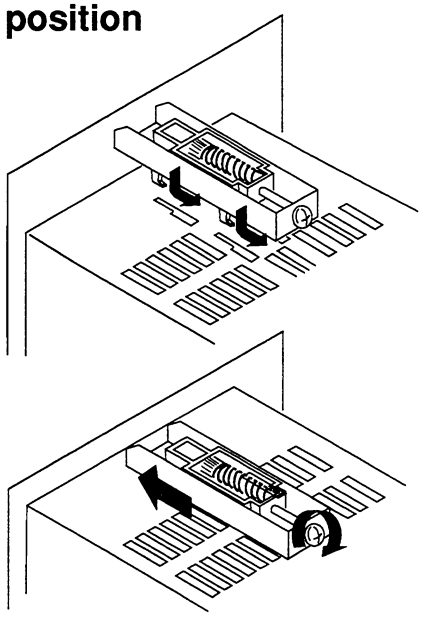



Recommended thickness of mounting panel: 1 to 8 mm

Mounting cutout: 92 mm square

When mounting two or more ES100P, mount the controllers at intervals of at least 100 mm in the horizontal direction and at least 120 mm in the vertical direction.

## ■ Securing the ES100P in position

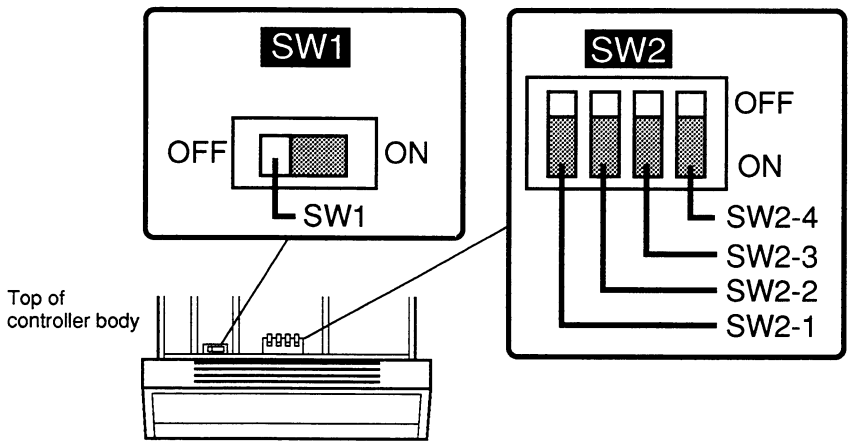


Slot the two fixtures (supplied) into the fixing slot on the rear case with the ES100P pushed into the mounting hole.
The fixing slots are located on the top and bottom of the rear case.

Tighten the fixture screw until the ratchet turns idly.

# 2.2 Setting the Switches

## ■ Switch names




## ■ Switch functions

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

| Function | Switch Positions | | | | |
|---|---|---|---|---|---|
| | SW1 | SW2-1 | SW2-2 | SW2-3 | SW2-4 |
| Setting level 2 Technical mode (enabled) | ○ | – | ○ | × | × |
| Setting level 2 Technical mode (disabled) | ○ | – | × | × | × |
| Setting level 1 Technical mode (enabled) | × | ○ | – | – | – |
| Setting level 1 Technical mode (disabled) | × | × | – | – | – |
| Communications test (disabled/enabled) | ○ | – | – | – | ○ |
| Initialization mode | ○ | – | – | ○ | × |

○ : ON ×: OFF –: ON/OFF

- All DIP switches are set to OFF before shipment from the factory.
- The "initialization mode" returns parameter settings to factory defaults.
- Set items marked "-" to the more frequently used switch setting. For example, if both switches SW2-1 and SW2-2 are set to ON, both the setting level 2 and 1 technical modes are enabled just by switching SW1.

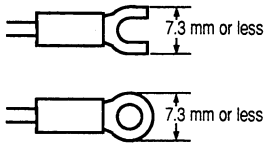
● Executing the switch functions
Switch functions excluding the communications test can be executed in the ES/TOOLS Support Software. However, note that when you execute a switch function from the ES/TOOLS Support Software, the switch settings may differ from the function (e.g. setting level) set on the switch.
To execute the function set on the switch as instructed in the switch settings, turn the power supply OFF then back ON again.

● Operation limitations
Note that regular functions such as setting operations and communications do not work when executing the communications test and when in the initialization mode.

# 2.3 Wiring Terminals

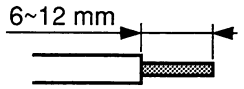
## ■ Precautions when wiring

- Use ducts to separate input leads and power lines in order to protect the controller and its lines from external noise.
- We recommend using solderless terminals when wiring the controller.
- Tighten the terminal screws using a torque no greater than 78 N/cm (8 kgf/cm). Take care not to tighten the terminal screws too tightly.
- Use solderless terminals applicable to M3.5 screws.



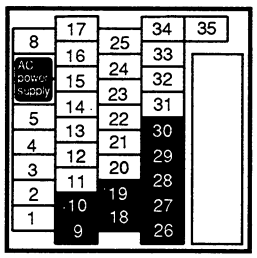



- When using soldered terminals, strip back the tip of the lead about 6 to 12 mm, and solder the tips of the exposed lead wire.

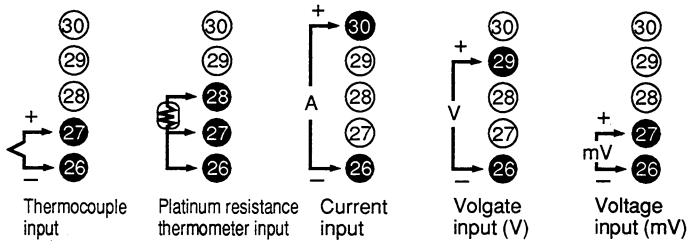



## ■ Input wiring

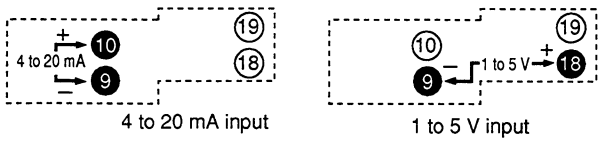
### ● Analog input




- Connect analog input 1 to terminal Nos. 26 to 30.
  The input type determines how terminals are wired.

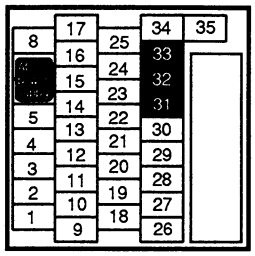



- Terminal Nos. 9, 10, 18 and 19 can be used for analog input only on 2-input type ES100P. So, check the model type before wiring inputs.
  Connect analog input 2 to terminal Nos. 9, 10, 18 and 19.
  The input type determines how terminals are wired.



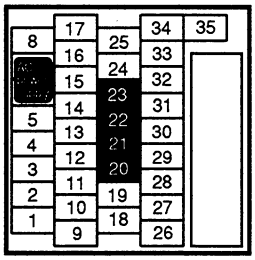

- Analog input 2 is insulated from internal circuits.

### ● CT input
### ● Potentiometer input

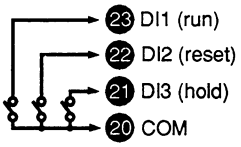


- On position-proportional controllers, connect the potentiometer input to terminal Nos. 31 to 33. On other types of controllers, connect CT input (heater current detection) to these terminals.
  The functions of these terminals are fixed, and cannot be changed by operation assignment, for example.


### ● Auxiliary input



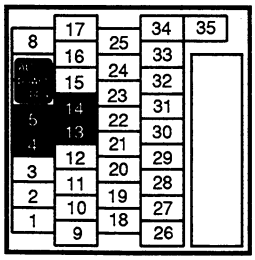
- Connect auxiliary inputs 1 to 3 (including COM terminal) to terminal Nos. 20 to 23. Run (DI1), reset (DI2) and hold (DI3) are assigned as switch inputs to these terminals before shipment from the factory. These terminals are enabled only on models ES100P-□□□D.



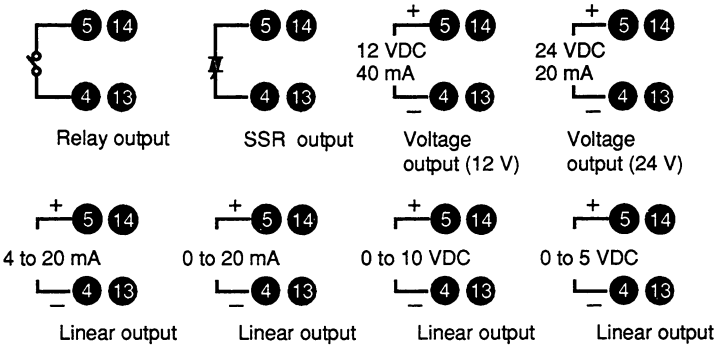

- Auxiliary inputs are insulated from internal circuits. However, note that auxiliary inputs are not insulated from transfer output and control output when a current or voltage output unit is installed.

## ■ Output wiring

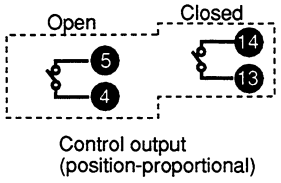
### ● Control output



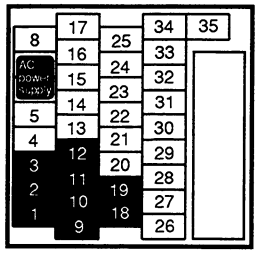
- Connect control outputs 1 to terminal Nos.4 and 5, and control outputs 2 to terminal Nos.13 and 14. Connect the control outputs to suit the output unit mounted on the ES100P. When connecting voltage or current output, check the polarity of the connection before wiring.
  For details on output units, see page 2-2.



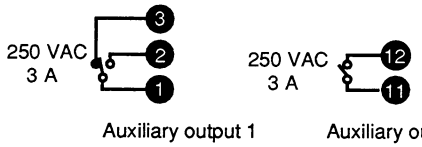

- When carrying out heating-cooling control, use control output 1 as heating output, and control output 2 as cooling output.



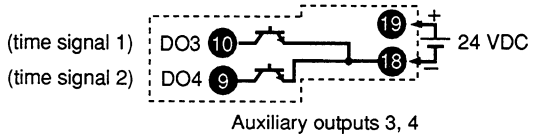
## ● Auxiliary output




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

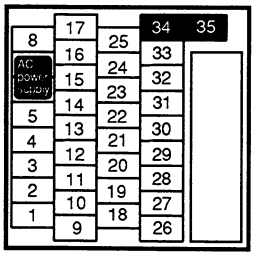



- Terminal Nos. 9, 10, 18 and 19 can be used for auxiliary output only on ES100P-□□□D models. So, check the model type before wiring outputs. Connect auxiliary outputs 3 and 4 to terminal Nos.9 and 10. The +24 V power supply should be connected to terminal Nos.18 and 19. These terminals are assigned as time signals 1 (DO3) and 2 (DO4) before shipment from the factory.

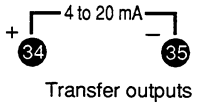



- Auxiliary outputs are insulated from internal circuits.

## ● Transfer outputs

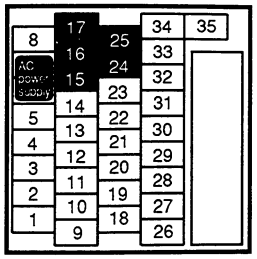



- Connect transfer output to terminal Nos.34 and 35. These terminals are enabled only on models ES100P-□□F□.

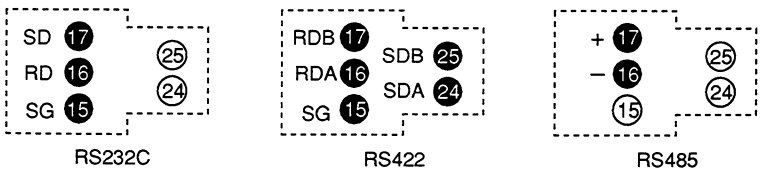



- Transfer outputs are insulated from internal circuits. However, note that transfer outputs are not insulated from control output and auxiliary input when a current or voltage output unit is installed.

## ■ Wiring communication terminals




- Terminal Nos. 15 to 17, 24 and 25 are used for wiring communication terminal. The terminals of models ES100P-□□01□ are arranged for RS-232C communication, and the terminals of models ES100P-□□04□ are arranged for RS-422/485 communication. Check which model communication terminals are to be wired to before wiring.



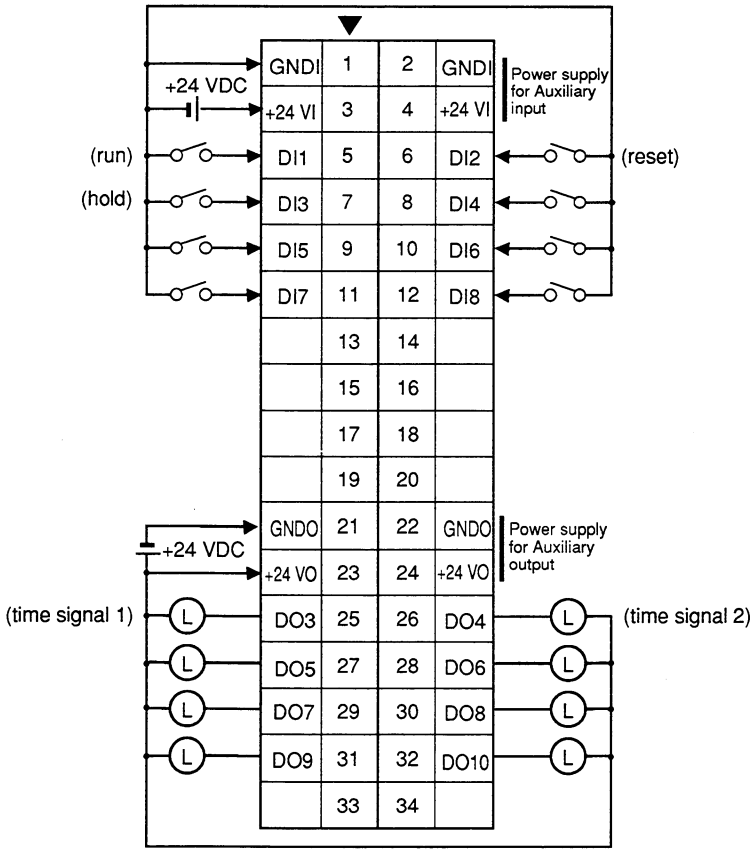
# 2.4 Wiring Expanded I/O Connectors

Expanded I/O connectors can be used on models ES100P-□□□□E. Either of the digital I/O terminals or BCD communications terminals can be selected for use in the parameter settings. (The ES100P is set for digital I/O before shipment from the factory.)

The following description assumes that the ES100P has been set for digital I/O. For details on using the ES100P for BCD communications, see the ES100 Digital Controller User's Manual (Communications Guide) (Cat. No. H072-E1-1).

Digital inputs 1 to 8 and digital outputs 3 to 10 are provided for expanded I/O connectors. External 24 V DC power supplies are required for each of digital input and output.

## ■ Connections




- The following pins are connected to each other internally.
  1-2, 3-4, 21-22 and 23-24
- Items in parentheses ( ) indicate the defaults assigned to terminals before shipment from the factory.

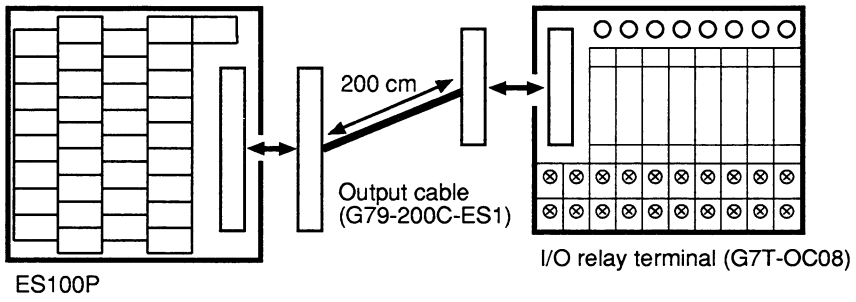
## ■ Compatible connectors

Use an OMRON XG4M-3430 connector or equivalent product as the connector for the cable for connecting to the expanded I/O connectors.

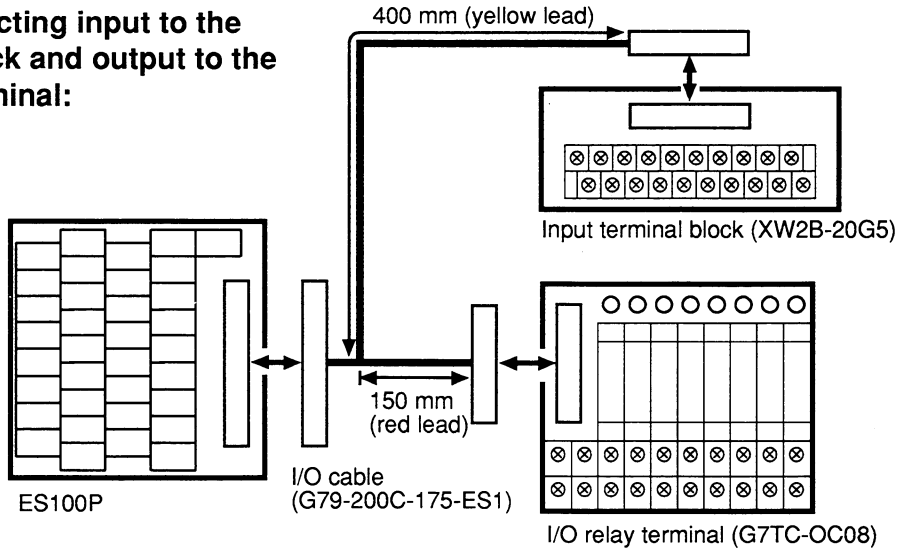
## ■ Connecting to I/O terminal block

We recommend the following connection configurations when connecting I/O of the expanded I/O connectors to a terminal block.

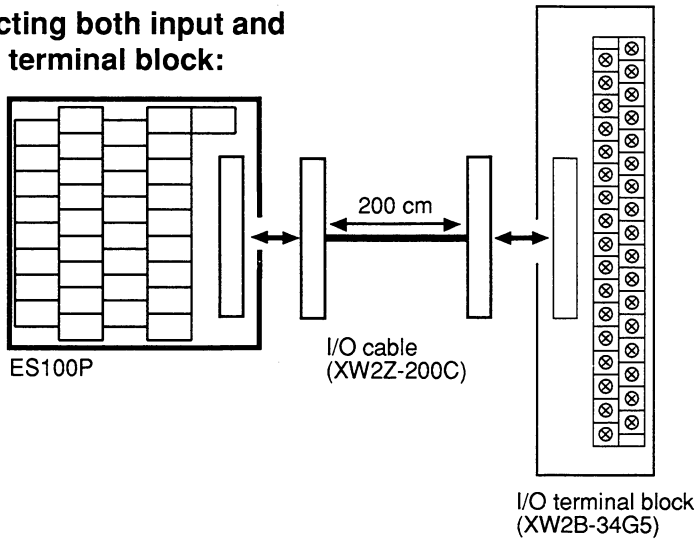
### ● When connecting output to the I/O relay terminal:




### ● When connecting input to the terminal block and output to the I/O relay terminal:




### ● When connecting both input and output to the terminal block:



## ● Terminal block wiring diagram

When using one of the above recommended connection configurations, the wiring at the terminal block is as follows.

I/O terminal block (XW2B-34G5)

| GNDI | +24 VI | DI1 | DI3 | DI5 | DI7 | | | | | GNDO | +24 VO | 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 | +24 VI | DI2 | DI4 | DI6 | DI8 | | | | | GNDO | +24 VO | DO4 | DO6 | DO8 | D10 | |

Input terminal block (XW2B-20G5)

| +24 VI | 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 |
| +24 VI | GNDI | DI2 | DI4 | DI6 | DI8 | | | | |

I/O Relay Terminal (G7TC-OC08)

| 24 VO | | 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 | | | | | | | | | |

# CHAPTER 3
# BASIC OPERATION

# 3.1 Operation Flow

**Set the specifications.**

Designate the input type, and set scaling, event specifications settings and other parameters matched to how the ES100P is to be applied.
Note that the setting level must be switched between setting level 1 and 2 by the parameters.

**Set up the program.**

Various patterns are available on the ES100P. These patterns can be switched and linked. Set up the program using the desired patterns.

**Start control.**

When you have finished setting the specifications and operating conditions, start operation.

**Check control operation. Make adjustments.**

Change and adjust settings such as SP and events while monitoring the control status. If necessary, switch to manual control.

**Stop control.**

When the program has stopped running, control stops.
To forcibly stop operation, reset the ES100P.

Initializing parameters

Follow the procedure below to restore the ES100P parameter settings to the defaults set before shipment from the factory.

(1) Set switches SW1 and SW2-3 to ON.
(2) The No.1 display indicates CLEr.
(3) Press the ENT key. This executes initialization of the ES100P.
(4) When the No.1 display indicates CEnd this indicates that initialization has ended.
(5) Restore the switches to their original positions.