

General Specifications

GS 05D01D52-01E

MODEL UT351
Digital Indicating Controller
with Active Color PV Display
and embedded Ethernet



General

Model UT351 Digital Indicating Controller is a highly accurate 1/4 controller, provided with the PV display color changing function "Active Color PV Display." It has a large display for readings, universal input/output and excellent monitoring operability with Auto/Man switching key. In addition, auto-tuning, the overshoot suppressing function "SUPER", the hunting suppressing function "SUPER2" and heating/cooling control are available as control functions, and a retransmission of variable and a 15V DC loop power supply are also equipped as standard. A communication function is available optionally. As described above, the UT351 is a controller provided with higher functions and capability.

Main Features

- Extra-large digital display allows the indicated values to be read even from a long distance. LEDs of 20mm height are used for the process variable display.
- The PV display color changing function "Active Color PV Display" is provided. PV display color is changed from green to red and vice versa when an alarm occurs or deviation becomes large. The color also can be fixed in green or red.
- Universal input and output enable users to set or change freely the type of measured inputs(thermocouple, RTD, or DCV), measurement range, type of control output(4 to 20mA current, voltage pulse, or relay contact), etc from the front panel.
- Parameters can be easily set using a personal computer. ("Parameter setting tool (model LL100)" sold separately is required.)
- Embedded Ethernet communication function is available. Connectivity to upper level instruments is provided by MODBUS/TCP.

Function Specifications

Control Computation Functions

Control computation:

Can be selected from the following types:
Continuous PID control, Time-proportional PID control, Heating/Cooling control (for heating/cooling type only) or Relay ON/OFF control.

Control cycle time: 250 ms

Number of sets of target setpoints and PID parameters: 4

Target setpoint and PID selection:

PID parameters are provided for every target setpoint and the set of PID parameters are selected at the same time that the setpoint number is selected.

Zone PID selection:

PID parameters are selected depending on the value of the PV. For selection, the reference point (PID parameter selection setpoint) or the reference deviation is used.

UT351



Display in green or red color

UT351E

"E" indicates the model with expanded functions.

Reference point method:

The measuring input range is divided into a maximum of three zones with up to two reference points, and PID parameters are selected (No. 1 PID to No. 3 PID) for every zone.

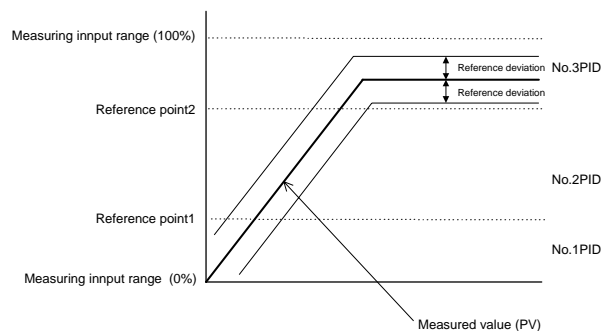
$$\text{Reference point} = \text{Measuring input range (0\%)} \leq \text{Reference point 1} \leq \text{Reference point 2} \leq \text{Measuring input range (100\%)}$$

$$\text{Reference point hysteresis} = \text{Fixed to 0.5\% of the measured input range width.}$$

Reference deviation method:

PID parameters (No. 4 PID) are selected when the deviation exceeds the reference deviation. This process takes precedence over the reference point method.

$$\text{Reference deviation} = \text{OFF or 0.1 to 100.0\% of measured input range width}$$



Auto-tuning:

Available as standard. If auto-tuning is operated, PID parameters are automatically set (limit cycle method).

"SUPER" function:

Overshoots generated by abrupt changes in the target setpoint or by disturbances can be suppressed.

“SUPER2” function:

The function stabilizes the state of control that is unstable due to hunting, etc. without requiring any change in PID constants, when the load and/or gain varies greatly, or when there is a difference between the characteristics of temperature zones.

Control Parameters Setting Range

Proportional band = 0.1 to 999.9%

0.0 to 999.9% (for heating/cooling control,
0.0% for ON/OFF control)

Integral time = 1 to 6,000s, or OFF (manual reset)

Derivative time = 1 to 6,000s, or OFF

Manual reset value = -5.0 to 105.0% of output range
(functions when integral time is off.)

ON/OFF control hysteresis = 0.0 to 100.0% of measured
input range width (0.1 to 0.5% for heating/
cooling control)

Setpoint rate-of-change setting = off, or 0.0 to 100.0%/h or
min. of measured input range width.
A PV tracking function operates automatically
when the setpoint is changed, the power is
turned on, or the mode is changed from
manual to automatic.

Direct/reverse action:

The output increase/decrease direction can be
defined corresponding to a positive or
negative deviation.

For heating/cooling control, it is fixed; for the
heating side output, reverse, for the cooling
side output, direct.

Anti-reset windup:

When controller output is limited, normal
integration is superseded by an anti-reset
windup computation to suppress over-
integration.

Control output cycle time = 1 to 1000s (for Time-
proportional PID control) and (the cooling side
output cycle time is also the same when
heating/cooling control is used).

Preset output value = -5.0 to 105.0% of output range

Output tracking:

Whether the output bump is provided or not
can be selected by changing the PID control
mode.

Output limiter

Upper limit = Lower limit to 105.0% of output
range

Lower limit = -5.0% of output range to upper
limit

Heating/cooling dead band = -100.0 to 50.0% for output
range

● Signal Computation Functions**Measured input computation:**

Bias addition (-100.0 to 100.0% of measured
input range width), and first-order lag filter
(time constant off or 1 to 120s)

Contact input function:

Target setpoint selection, Auto/Man operating
mode switching, key lock parameter display/
non-display switching

Target setpoint selection can be done for
either a 2-setpoint or 4-setpoint selection.

- If the 2-setpoint selection is set, Auto/Man
mode switching can be used as well.

- If the 4-setpoint selection is set, Auto/Man
switching and key lock parameter display/non-
display switching cannot be used together.
If key lock parameter display/non-display
switching is used, target setpoint selection and
Auto/Man mode switching cannot be used.

● Alarm Functions

Eighteen types of alarm functions are provided. The alarm
status is indicated by the alarm lamp on the front panel.
Also, three points among them can be output as relay contact
outputs.

Alarm types:

PV high limit, PV low limit, Deviation high
limit, Deviation low limit, Deenergized on
deviation high limit, Deenergized on deviation
low limit, Deviation high and low limits, High
and low limits within deviation, Deenergized
on PV high limit, Deenergized on PV low
limit, SP high limit, SP low limit, Output high
limit, Output low limit, sensor grounding
alarm, FAIL output.

Alarm output:

3 points. Any three points can be output as
contact outputs among the above alarm. For
heating/cooling control, if cooling side output
is output as a relay contact, up to two alarm
outputs can be used.

Setting ranges for PV, deviation, setpoint and output alarms:**PV/setpoint alarm:**

-100.0 to 100.0% of measured input range

Deviation alarm:

-100.0 to 100.0% of measured input range
width

Output alarm:

-5.0 to 105.0% of output range

Alarm hysteresis width:

0.0 to 100.0% of measured input range
width

Delay timer:

0.00 to 99.59 (minute, second)

An alarm is output when the delay timer
expires after the alarm setpoint is reached.
Setting for each alarm is possible.

Stand-by action:

Stand-by action can be set to make PV/
deviation alarm OFF during start-up or after
SP change until SP reaches the normal region.

Sensor grounding alarm:

An alarm is output after detecting a change in
control output. If the moving average * of
control output is out of the setting range
(between the high and low limits of the on/off
rate) in spite of the deviation being within a
fixed range (on/off rate detection width) and
control being in stable condition, the sensor is
judged to be in a grounding condition.

* Moving average refers to the average value for output
values sampled (five times) in every cycle time.

High- and low-limit setting range of on/off rate:

-5.0 to 105.0% of output range

Detection width of on/off rate:

0.0 to 100.0% of measured input range
width.

Fault diagnostic alarm:
 Input burnout, A/D conversion error,
 thermocouple reference junction compensa-
 tion error

FAIL output:
 Software failure and/or hardware failure
 When in fail, control output, retransmission
 output and alarm output become 0% or OFF.

● **Display and Operation Function**

PV display: In 4-digit digital display for engineering data
 Setpoint display:

Various data, such as the setpoint (SP), are
 displayed by selection on the 4-digit digital
 display.

Status indicating lamps:

3 alarm indicator lamps: AL1, AL2, AL3
 3 setpoint number indicator lamps:
 SP2, SP3, SP4 (Go out when SP1 is
 selected.)
 MAN operation mode lamp:
 MAN (lit in MAN mode)

PV display color changing function “Active Color PV
 Display” :
 (Factory-set default : Fixed in red mode)
 This function automatically changes PV
 display color by the action described below.
 Green-to-red or red-to-green changing action
 is selectable.

Link to alarm 1 mode :

Alarm OFF : green, Alarm ON : red
 Setting of Alarm OFF : red, Alarm ON :
 green is possible.

Link to alarm 1 and 2 mode :

Alarm OFF : green, Alarm ON : red
 Setting of Alarm OFF : red, Alarm ON :
 green is possible.

SP deviation mode :

Within the preset SP deviation : green,
 Out of the preset SP deviation : red
 Setting of within the preset SP deviation :
 red,
 Out of the preset SP deviation : green is
 possible.
 Deviation band is changeable using a
 parameter. The setting of either high limit
 deviation or low limit deviation is also
 possible.

PV limit mode :

Within the preset PV range : green,
 Out of the preset PV range : red
 Setting of within the preset PV range : red,
 Out of the preset PV range : green is
 possible.
 The range (high limit and low limit) is
 changeable using a parameter.

Fixed color mode :

PV display color is fixed in green or red.

Operation keys:

△ and ▽ keys:

Increases or decreases setpoints and various
 parameters.

SET/ENT key:

For data setting or call-up/selection of
 various parameters

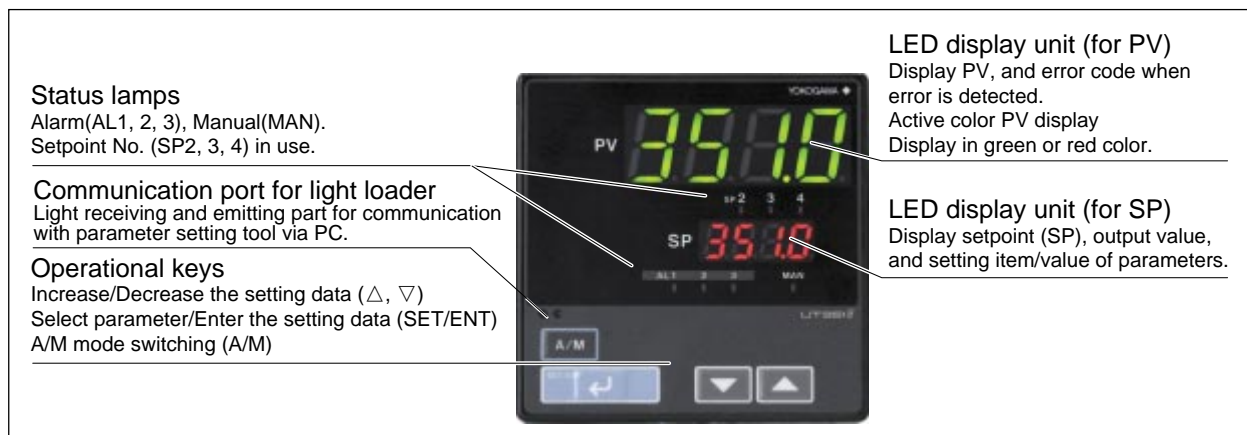
A/M key: Switching of operation mode (Auto/Man)

SELECT display:

A panel where operating parameters that are
 frequently changed during operation can be
 selected and registered. For example, by
 registering the alarm -1 setpoint in the
 SELECT display, the setpoint can easily be
 displayed during operation.

Security function:

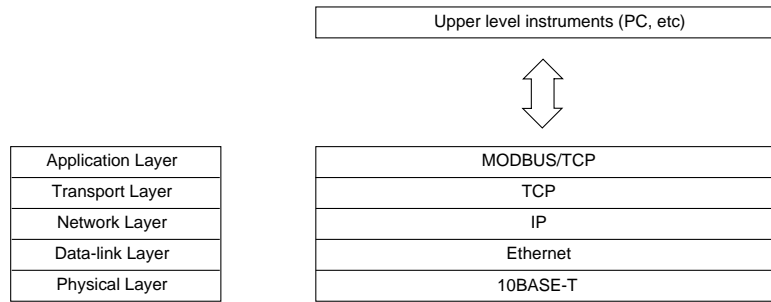
An operation-inhibiting mode using a
 password is provided.



● **Communication Functions**

This controller has the embedded Ethernet to connect IEEE802.3 compliant network (10BASE-T).

As a protocol, ETHERNET/TCP communication function is supported, and be able to access from the upper level instruments.



● **Communication Specifications**

| | |
|-------------------------------|---------------------------------------|
| Item | 10BASE-T |
| Access Control | CSMA/CD |
| Transfer Rate | 10Mbps |
| Max. Segment Length | 100m ^{Note1} |
| Max. Connecting Configuration | Cascade Max. 4 level ^{Note2} |

Note1: The length between Hub and Module.
 Note2: The number of cascade connection of Hub.

● **Setting of IP Address**

IP Address used in Ethernet communication is set by keys on front panel of UT351, as a Setup parameter. Additionally, it is also settable by Light Loader, model LL100 PC-based Parameters Setting Tool (Order by separately).

● **MODBUS/TCP Functions**

Applicable Function Codes and accessible data area of this controller by MODBUS/TCP are as per below table.

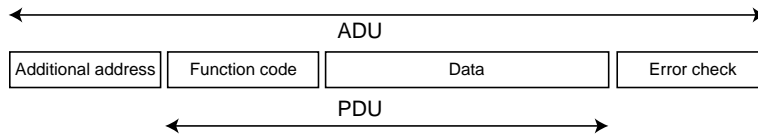
| Function Code | Function | Description |
|---------------|---------------------------------------|--|
| 03 | Reads data from multiple registers | Capable of reading data from a maximum of 64 successive registers. |
| 06 | Writes data into register | Capable of writing data to one register. |
| 08 | performs loop back test | Capable to check communication connection |
| 16 | Writes data into multiple D-registers | Capable of writing data into a maximum of 32 successive registers. |

| D-Register No. | Area data categories | | Description |
|----------------|----------------------|--|------------------------|
| D0001 to D0049 | Process data area | Data displayed for operation | PV,SP,OUT, and others |
| D0201 to D0230 | Operation parameters | Operation mode parameters | A/M, MOUT, and others |
| D0231 to D0300 | | Computation parameters | AT,SC,BS,FL,and others |
| D0301 to D0500 | | PID parameters | P,I,D and others |
| D0901 to D1000 | Setup parameters | Control action parameters | TMU,ALM,C.MD |
| D1001 to D1100 | | Common function parameters | RET,LOC |
| D1101 to D1200 | | SELECT display registration parameters | CS |
| D1201 to D1300 | | PV input, control output, and communication parameters | IN,OUT,PSL |

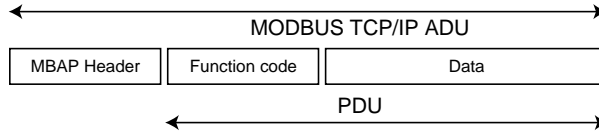
● **Outline of MODBUS/TCP Protocol**

MODBUS/TCP shall be an open-protocol, and the details are provided in URL “http:64.69.103.146/modbus?”. Followings are the brief explanation.

Configuration of the standard MODBUS protocol is as follows. It consists of PDU (simple Protocol Data Unit), and Additional address and Error Check are added in back and forth.



In MODBUS/TCP protocol, PDU part shall be same as the standard MODBUS PDU part, and only added MBAP Header (MODBUS Application Protocol Header) in forth.



MBAP Header (MODBUS Application Protocol Header) consists the following 7 bytes.

| | | | | | | | |
|-------------|----------------|---|-------------|---|--------------|---|---------|
| Byte No | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Description | Transaction ID | | Protocol ID | | Byte numbers | | Unit ID |

Transaction ID: To specify optional value to identify the transaction. Sever replies the data received from clients, as a response.

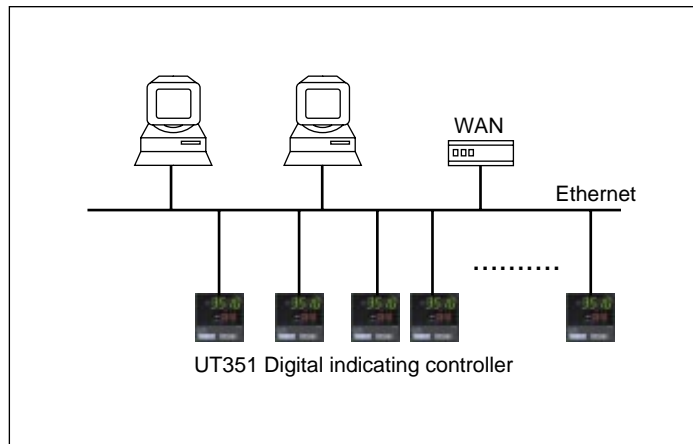
Protocol ID: It is 0 (Zero) in case of MODBUS/TCP.

Byte number: The number of bytes, Unit ID (Byte No.6) or after.

Unit ID: Server replies the data received from clients, as a response.

MODBUS/TCP protocol carry out the communication in Port No.502.

● **Configuration example of the communication system**



Hardware Specifications

Measured Input Signal

Number of input points: 1

Input system:

The types of input/measurement ranges can be set using key operation or software from a list of inputs.

Input type, measurement ranges and measurement accuracy:

Refer to the table below.

| Input Type | | Input range code | Instrument range (°C) | Instrument range (°F) | Measurement accuracy*1 |
|--|----------------|------------------|--|---|--|
| Unspecified(when shipped from the factory) | | OFF | Set the data item PV input Type "IN" to the OFF option to leave the PV input type undefined. | | |
| Thermocouple | K | 1 | -200 to 1370°C | -300 to 2500°F | ±0.1% of instrument range ±1 digit for temperatures equal to or higher than 0 °C, ±0.2% of instrument range ±1 digit for temperatures below 0 °C |
| | | 2 | -199.9 to 999.9°C | 0 to 2300°F | |
| | | 3 | -199.9 to 500.0°C | -199.9 to 999.9°F | |
| | J | 4 | -199.9 to 999.9°C | -300 to 2300°F | |
| | | 5 | -199.9 to 400.0°C | -300 to 750°F | |
| | T | 6 | 0.0 to 400.0°C | -199.9 to 750.0°F | |
| | | 7 | 0 to 1800°C | 32 to 3300°F | ±0.15% of instrument range ±1 digit for temperatures equal to or higher than 400 °C ±5% of instrument range ±1 digit for temperatures below 400 °C |
| | S | 8 | 0 to 1700°C | 32 to 3100°F | ±0.15% of instrument range ±1 digit |
| | R | 9 | 0 to 1700°C | 32 to 3100°F | |
| | N | 10 | -200 to 1300°C | -300 to 2400°F | ±0.1% of instrument range ±1 digit ±0.25% of instrument range ±1 digit for temperature below 0 °C |
| | E | 11 | -199.9 to 999.9°C | -300 to 1800°F | ±0.1% of instrument range ±1 digit for temperatures equal to or higher than 0°C |
| | L (DIN) | 12 | -199.9 to 900.0°C | -300 to 1300°F | ±0.2% of instrument range ±1 digit for temperatures below 0°C |
| | U (DIN) | 13 | -199.9 to 400.0°C | -300 to 750°F | |
| | W (DIN) | 14 | 0.0 to 400.0°C | -199.9 to 750.0°F | ±0.2% of instrument range ±1 digit |
| | | 15 | 0 to 2300°C | 32 to 4200°F | |
| | Platinel 2 | 16 | 0 to 1390°C | 32 to 2500°F | ±0.1% of instrument range ±1 digit |
| | PR20-40 | 17 | 0 to 1900°C | 32 to 3400°F | ±0.5% of instrument range ±1 digit for temperatures equal to or higher than 800°C No guarantee of accuracy for temperatures below 800°C |
| | W97Re3-W75Re25 | 18 | 0 to 2000°C | 32 to 3600°F | ±0.2% of instrument range ±1 digit |
| RTD | JPt100 | 30 | -199.9 to 500.0°C | -199.9 to 999.9°F | ±0.1% of instrument range ±1 digit (Note 1) (Note 2) |
| | | 31 | -150.0 to 150.0°C | -199.9 to 300.0°F | ±0.2% of instrument range ±1 digit (Note 1) |
| | Pt100 | 35 | -199.9 to 850.0°C | -300 to 1560°F | ±0.1% of instrument range ±1 digit (Note 1) (Note 2) |
| | | 36 | -199.9 to 500.0°C | -199.9 to 999.9°F | ±0.2% of instrument range ±1 digit (Note 1) |
| | | 37 | -150.0 to 150.0°C | -199.9 to 300.0°F | |
| Standard signal | 0.4 to 2V | 40 | 0.400 to 2.000 | Scaling is enable in the following 4 range. | ±0.1% of instrument range ±1 digit The read-out range can be scaled between -1999 and 9999. |
| | 1 to 5V | 41 | 1.000 to 5.000 | | |
| DC voltage | 0 to 2V | 50 | 0.000 to 2.000 | -1999 to 9999 | |
| | 0 to 10V | 51 | 0.00 to 10.00 | -199.9 to 999.9 | |
| | -10 to 20mV | 55 | -10.00 to 20.00 | -19.99 to 99.99 | |
| | 0 to 100mV | 56 | 0.0 to 100.0 | -1.999 to 9.999 | |

*1: Performance in the standard operating condition (at 23°C ±2°C, 55±10%RH, and 50/60Hz power frequency)

Note 1: The accuracy is ±0.3°C of instrument range ±1 digit for a temperature range from 0 to 100°C.

Note 2: The accuracy is ±0.5°C of instrument range ±1 digit for an temperature range from -100 to 0°C and 100 to 200°C.

Sampling period: 250 ms

Burnout detection:

Functions with a thermocouple (TC), RTD, standard signal 0.4 to 2 V DC, and 1 to 5 V DC. Can be specified as upscale, downscale, and off. For standard signal, judged as burnout at 0.1 V or less.

Input bias current: 0.05 µA (for TC/RTD b-terminal)

Measuring current(RTD): about 0.13mA

Input resistance:

1 MΩ or more for TC/mV input
About 1 MΩ for DC voltage input

Allowable signal source resistance:

250 Ω or less; effect of permissible signal source resistance 0.1 µV/Ω or less for TC/mV input 2 k Ω or less; effect of permissible signal source resistance 0.01%/100 Ω or less for DC voltage input

Allowable leadwire resistance:

Max. of 150 Ω/wire (resistance in each of three wires must be equal) for RTD input
However, 10 Ω/wire for a maximum range of -150.0 to 150.0°C.
Effect of permissible leadwire resistance ± 0.1°C/10 Ω or less

Allowable input voltage:

± 10 V DC for TC/mV/RTD input
± 20 V DC for DC voltage input

Noise rejection ratio:

Normal mode 40 dB (50/60 Hz) or more
Common mode 120 dB (50/60 Hz) or more

Reference-junction compensation error:

± 1.0°C (15 to 35°C),
± 1.5°C (0 to 15°C, 35 to 40°C)

Applicable standards: JIS, IEC, or DIN(ITS-90) for TC and RTD

Retransmission Output

Either PV, target setpoint, or control output is output. Either the retransmission output or the 15V DC loop power supply can be used.

- Number of output points: 1
- Output signal: 4 to 20 mA DC
- Load resistance: 600 Ω or less
- Output accuracy: $\pm 0.3\%$ of span
 - * Performance in the standard operating conditions (at $23 \pm 2^\circ\text{C}$, $55 \pm 10\%$ RH, and 50/60 Hz power frequency)

15V DC loop power supply:

Supply voltage is 14.5 to 18.0 V DC. Maximum supply current is about 21 mA (with a protection circuit for a field short-circuit).

Control Outputs

The control output is of a universal scheme and can be selected from the following types of outputs. In the case of heating/cooling control, it is also selectable from these outputs. However, if the cooling side output is a relay contact output, the alarm-3 cannot be used, and similarly if the cooling side output is a voltage pulse or current output, the retransmission output/15 V DC sensor power supply cannot be used.

- Current output
 - Number of output points: 1 or 2 (2 for heating/cooling type), switched between voltage pulse output and current output.
 - Output signal: 4 to 20 mA
 - Load resistance: 600 Ω or less
 - Output accuracy: $\pm 0.3\%$ of span
 - * Performance in the standard operating conditions (at $23 \pm 2^\circ\text{C}$, $55 \pm 10\%$ RH, and 50/60 Hz power frequency)
- Voltage pulse output
 - Number of output points: 1 or 2 (2 for heating/cooling type), switched between voltage pulse output and current output.
 - Output signal:
 - On voltage = 12 V DC or more (load resistance of 600 Ω or more; current on short-circuiting about 30 mA)
 - Off voltage = 0.1 V DC or less
 - Resolution: 10 ms
- Relay contact output
 - Number of output points: 1 or 2 (2 for heating/cooling type)
 - Output signal:
 - Three terminals for NC, NO, and Common transfer-contact
 - Contact rating:
 - 250 V AC, 3 A or 30 V DC, 3A (resistive load)
 - Resolution: 10 ms

Contact Inputs

- Usage: Target setpoint selection, Auto/Man mode switching, or Key lock parameter display/non-display switching
- Number of input points: 2
- Input type: Non-voltage contact input or transistor open collector input
- Input contact rating: 12 V DC, 10 mA or more (for non-voltage contact input)
- On/off determination:
 - For non-voltage contact input,
 - ON = contact resistance of 1 k Ω or less,
 - OFF = contact resistance of 20 k Ω or more.
 - For transistor contact input,
 - ON = 2 V or less,
 - OFF = leakage current of 100 μA or less.
- Minimum retention time for status detection: about 1 second

Contact Outputs

- Usage: Alarm output, FAIL output, and others
- Number of relay contact output points: 3
- Relay contact rating: 240 V AC, 1 A or 30 V DC, 1 A (COM terminal is common for every contact output.)

● Display Specifications

- PV display:
 - 4-digit, 7-segment green or red LED; character height - 20 mm
- Setpoint display:
 - 4-digit, 7-segment red LED; character height - 9.3 mm
- Status indicating lamps: LEDs

● Conformance to Safety Standards

- Safety standard: Conforms to IEC1010-1:1990 and EN61010-1:1993:A2:1995
- Certified for CSA1010

● Construction, Mounting, and Wiring

- Construction: Dust-proof and Drip-proof front panel conforming to IP55.
 - For side-by-side close installation, the controller loses its dust-proof and drip-proof protection.
- Material: ABS resin and polycarbonate
- Case color: Black
- Weight: Approx. 1 kg or less
- External dimensions:
 - 96 (width) \times 96 (height) \times 100 (depth) mm
- Mounting : Direct panel mounting; mounting bracket, one each for upper and lower mounting
- Panel cutout dimensions: $92^{+0.8}_0$ (width) \times $92^{+0.8}_0$ (height) mm
- Mounting attitude:
 - Up to 30 degrees above the horizontal. No downward tilting allowed.
- Wiring:
 - M3.5 (ISO 3.5 mm) screw terminals (signal wiring and power/ground wiring as well)

● Power Supply Specifications and Isolation

Power supply: Rated at 100 to 240 V AC ($\pm 10\%$), 50/60 Hz

Power consumption: MAX. 20 VA (MAX. 8.0 W)

Internal fuse rating: 250 VAC, 16.A time-lag fuse

Memory back-up: Non-volatile memory (Service life approx. 100,000 times of writings)

Withstanding voltage:

1500 V AC for 1 minute between primary and secondary terminals. (Note)

1500 V AC for 1 minute between primary and ground terminals. (Note)

1500 V AC for 1 minute between ground and secondary terminals.

500VAC for 1minute between two secondary terminals.

(Primary terminals = Power and relay output terminals)
 (Secondary terminals = Analog I/O signal terminals, voltage pulse output terminals, contact input terminals)

Note. The withstanding voltage is specified as 2300V AC perminute to provide a margin of safety.

Isolation resistance:

20 M Ω or more when 500 V DC voltage is applied between the power terminals and ground terminal.

Grounding:

Class D grounding (Class 3 grounding)
 (grounding resistance of 100 Ω or less)

● Isolation specifications:

Measured input terminal:

Isolated from other I/O terminals. Not isolated from internal circuits.

15 V DC loop power supply terminals:

Not isolated from 4-20mA analog output and voltage pulse control output. Isolated from other I/O terminals and internal circuit.

Control output (current or voltage pulse) and retransmission terminals: Not isolated between control output terminals and retransmission output terminals. Isolated from other I/O terminals and internal circuits.

Relay contact control output terminals:

Isolated from other I/O terminals and internal circuits.

Contact input terminals:

Not isolated from other contact input terminals mutually, and communication terminals. Isolated from other I/O terminals and internal circuits.

Relay contact alarm output terminals:

Isolated from other I/O terminals and internal circuits.

Ethernet communication terminals:

Isolated from contact input terminals, other I/O terminals and internal circuits.

Power supply terminals:

Isolated from other I/O terminals, ground terminal, and internal circuits.

Ground terminal:

Isolated from other I/O terminals, power terminals, and internal circuits.

● Environmental Conditions

Normal operating conditions:

Ambient temperature: 0 to 40°C

Ambient temperature change limit: 10°C /h or less

Ambient humidity: 20 to 90% RH (no condensing)

Magnetic field: 400 A/m or less

Continuous vibration (5 to 14 Hz):

Peak-to-peak amplitude of 1.2 mm or less

Continuous vibration (14 to 150 Hz):

4.9 m/s² or less

Short-period vibration: 14.7 m/s², 15s or less

Shock: 147 m/s² or less, 11 ms

Installation altitude: 2,000 m or less above sea level

Warm-up time 30 minutes or more

Transportation and storage conditions:

Temperature: -25 to 70°C

Temperature change limit: 20°C /h or less

Humidity: 5 to 95% RH

Effects of operating conditions

Effect of ambient temperature:

For voltage or TC inputs:

Whichever is greater, $\pm 1\mu\text{V}/^\circ\text{C}$ or

$\pm 0.01\%$ of F.S./ $^\circ\text{C}$

For RTD inputs:

$\pm 0.05^\circ\text{C}/^\circ\text{C}$ (ambient temperature) or less

for RTD input

For analog output: $\pm 0.05\%$ of F.S./ $^\circ\text{C}$ or less

Effect of power supply fluctuation (within rated voltage range):

For analog input:

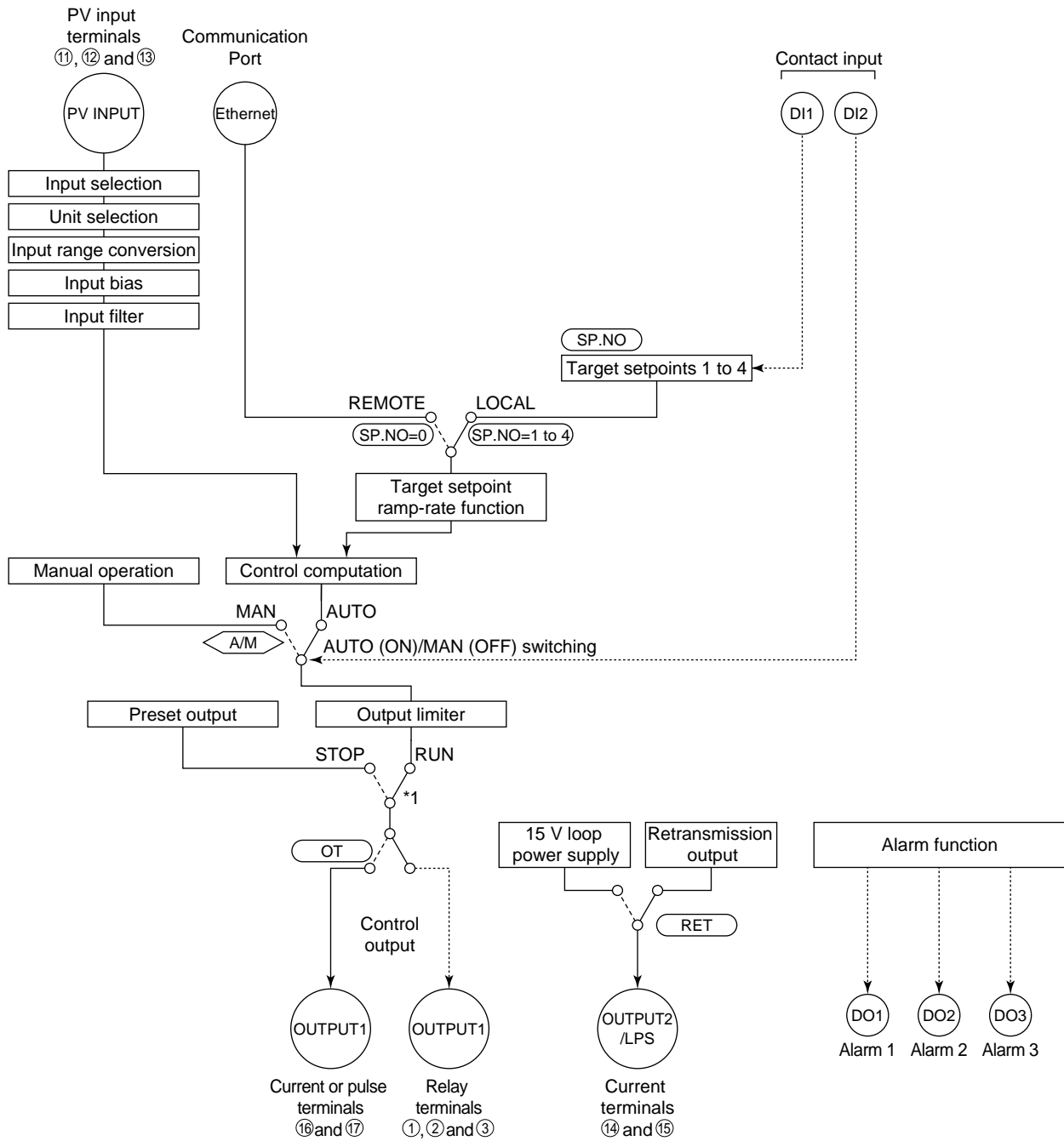
Equal to or less than whichever is greater,

$\pm 1\mu\text{V}/10\text{ V}$ or

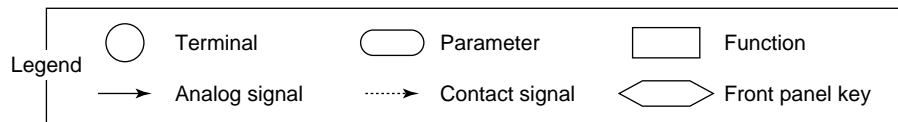
$\pm 0.01\%$ of F.S./10 V

For analog output: $\pm 0.05\%$ of F.S./10 V or less

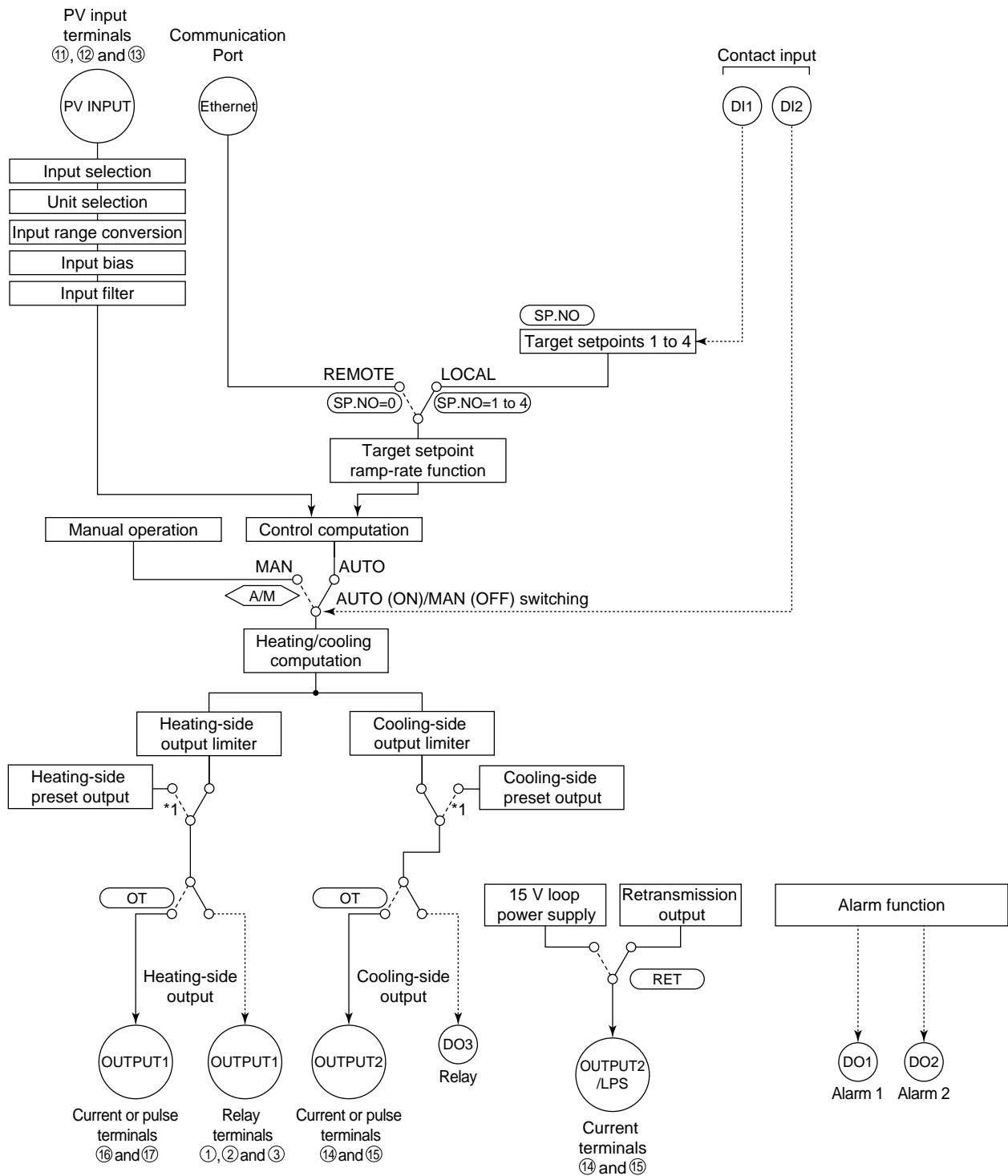
Function Block Diagram for Standard Type



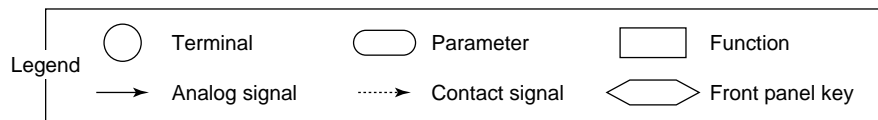
*1: If the setup parameter DIS (DI function selection) is set to "4", when the contact input 2 is ON (run state), that controller outputs the preset output value.



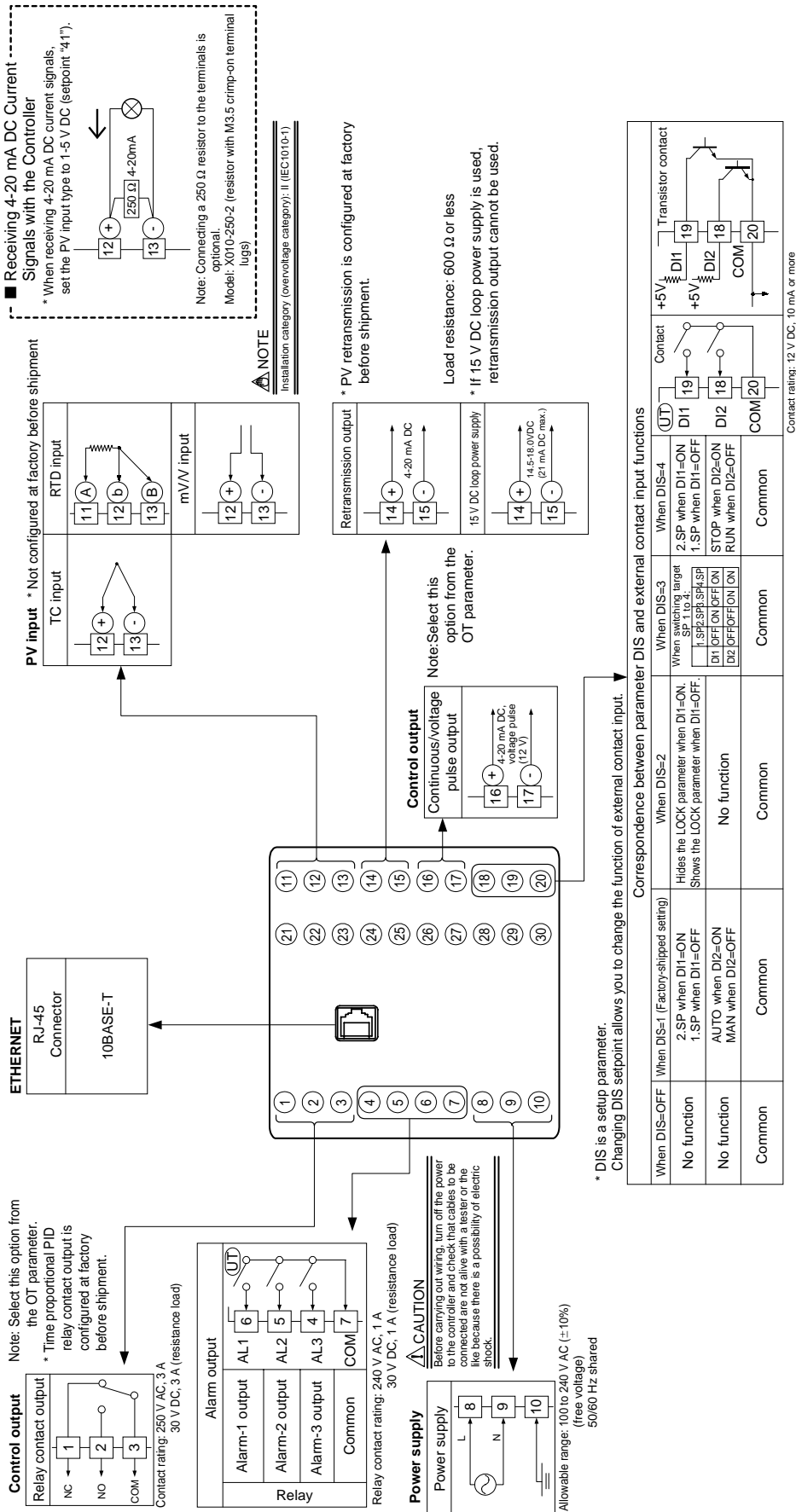
Function Block Diagram for Heating/Cooling Type



*1: If the setup parameter DIS (DI function selection) is set to "4", when the contact input 2 is ON (run state), that controller outputs the preset output value.



Standard Type, Terminal Arrangements



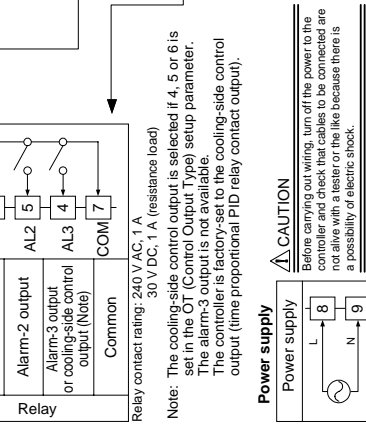
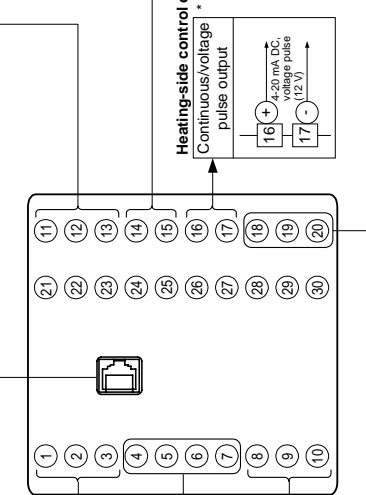
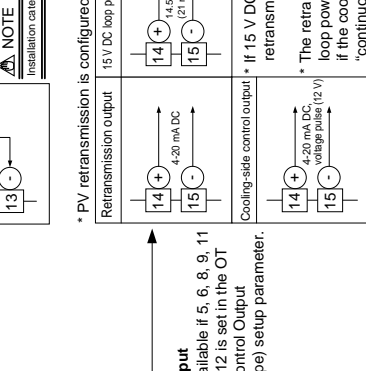
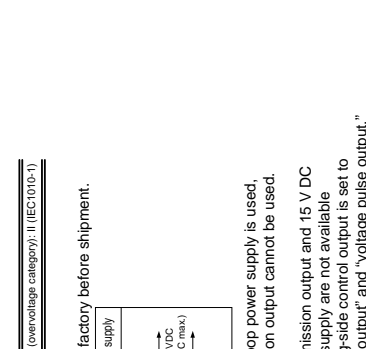
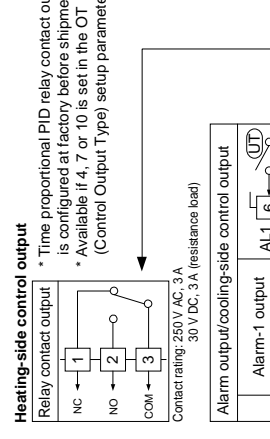
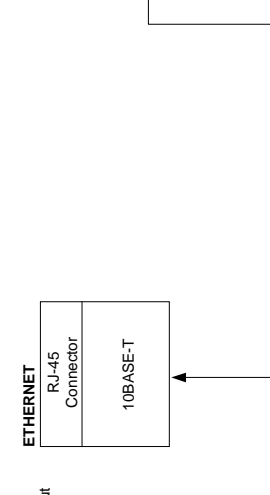
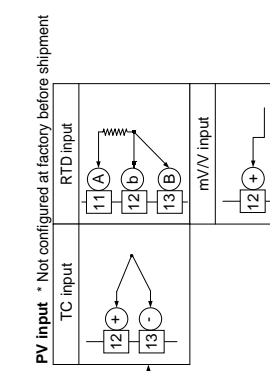
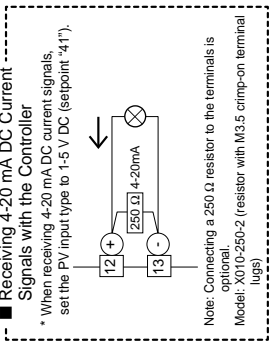
Note: External Contact Input
 If the power is turned on when the external contact input is OFF, the mode (SP.NO or A/M) existing before the power is turned off will be continued.
 (except for RUN/STOP)

* OT is a setup parameter. You can change the settings of the parameter OT to change the control output type.

Correspondence between parameter OT and control output types

| OT=0 (factory-shipped setting) | OT=1 | OT=2 | OT=3 |
|--|---|---------------------------------------|--|
| Time proportional control Relay output (terminals ①, ② and ③) | Time proportional control Voltage pulse output (terminals ⑥ and ⑦) | Current output (terminals ⑧ and ⑩) | One-off control Relay output (terminals ①, ② and ③) |

Heating/Cooling Type, Terminal Arrangements

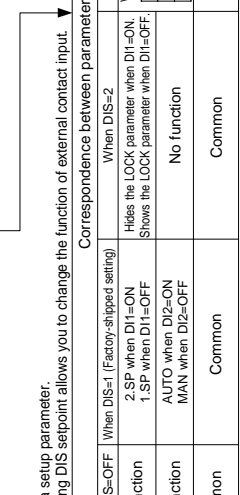
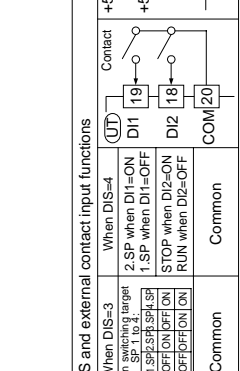
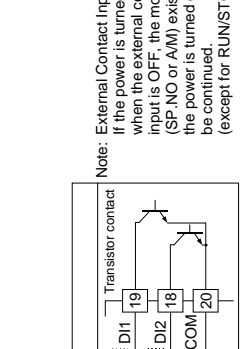


NOTE
 Installation category (over-voltage category): II (IEC 1010-1)

* PV retransmission is configured at factory before shipment.

* If 15 V DC loop power supply is used, retransmission output cannot be used.

* The retransmission output and 15 V DC loop power supply are not available if the cooling-side control output is set to "continuous output" and "voltage pulse output."



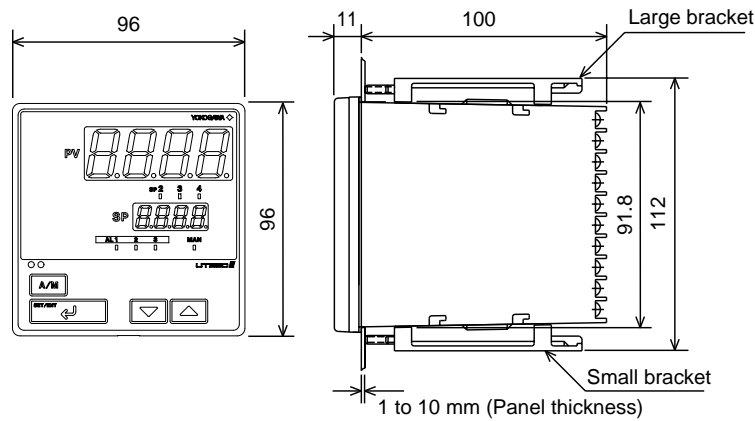
* DIS is a setup parameter. Changing DIS setpoint allows you to change the function of external contact input.

* OT is a setup parameter. You can change the settings of the parameter OT to change the control output type.

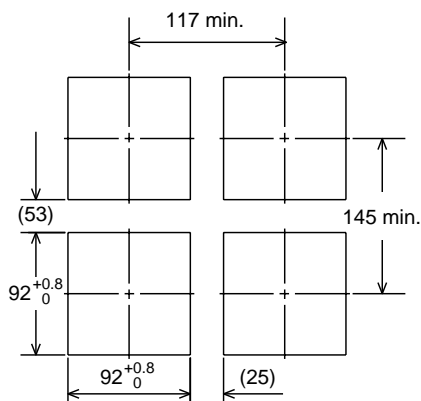
The control output types, "relay output" and "voltage pulse output" shown in the table above refer to those of time proportional control. To change the type to a relay output for on-off control, select "Relay Terminals" and change the setpoint of the proportional band to "0."

External Dimensions and Panel Cutout Dimensions

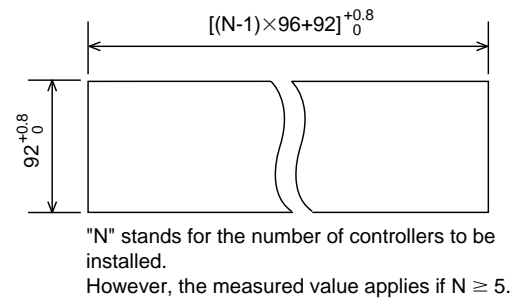
Unit: mm



General installation



Side-by-side close installation



Model and Suffix codes

| Model | Suffix Code | Description |
|--------------------|-------------|---|
| UT351 | | Digital indicating controller (provided with retransmission output and 15 V DC loop power supply as standard) |
| Type | -0 -2 | Standard type Heating/cooling type |
| Optional functions | 3 | With Ethernet communication function |

Standard Accessories: Brackets (mounting hardware), unit label, User's Manuals.

Items to be specified when ordering

Model and suffix codes, necessary/unnecessary of User's Manual.