General Specifications

MODEL UT320
Digital Indicating Controller

NEW GREEN SERIES

GS 05D01D02-02E

■ General

Model UT320 Digital Indicating Controller is a highly accurate 1/8 DIN controller, provided with universal input/output. It has a large display for readings and excellent monitoring operability with the Auto/Man switching key. In addition, heating/cooling control, including PID control with auto-tuning, the "SUPER" overshoot suppressing function and the "SUPER2" hunting suppressing function are available as control functions, and a retransmission of variables or a 15V DC loop power supply are also included as standard. A communication function or 24V DC loop power supply is available optionally. As described above, the UT320 is a controller provided with higher functions and capability than conventional similar-size controllers.

■ Main Features

- The latest in large digital displays has been realized and a large PV display with characters 12 mm in height has been employed to be clearly readable from distant locations.
- 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 20 mA 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.)
- Various communication function are provided. Communication is possible with personal computer, programable logic controller, and other controllers.

■ 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.

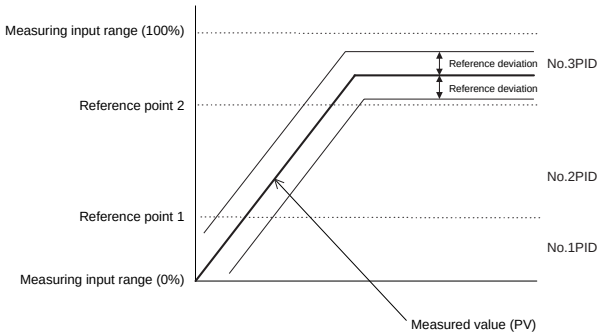
Reference point method:
The measuring input range is divided into a maximum of three zones with up to two reference points, and PID parameters are selected (No. 1 PID to No. 3 PID) for every zone.

Reference point = Measuring input range (0%) ≦ Reference point 1 ≦ Reference point 2 ≦ Measuring input range (100%)

Reference point hysteresis = 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.

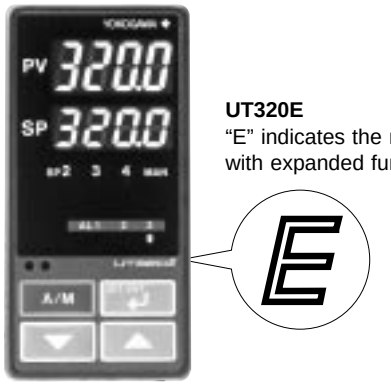
Reference deviation = OFF or 0.1 to 100.0% of measured input range width



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

"SUPER" function:

UT320



UT320E
"E" indicates the model with expanded functions.

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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 6,000 s, or OFF (manual reset)
Derivative time = 1 to 6,000 s, 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 1000 s (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 120 s)
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 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,Heater disconnection alarm, Sensor prounding 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.
Heater disconnection alarm (optional):
two circuits incorporated
A heater disconnection alarm is output if the heater current consumption is the disconnection detection value or less. This alarm can be used for Relay ON/OFF control or time-proportional PID control.
Heater current setting range: 0.0 to 50.0 A
Setting accuracy: ±5% of span ± 1 digit
Heater current detecting resolution: 0.5 A
Time required until disconnection detection is on: 0.2 s minimum
Disconnected sensor model: CTL-6-S (URD Co. Ltd.)
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 compensation error

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

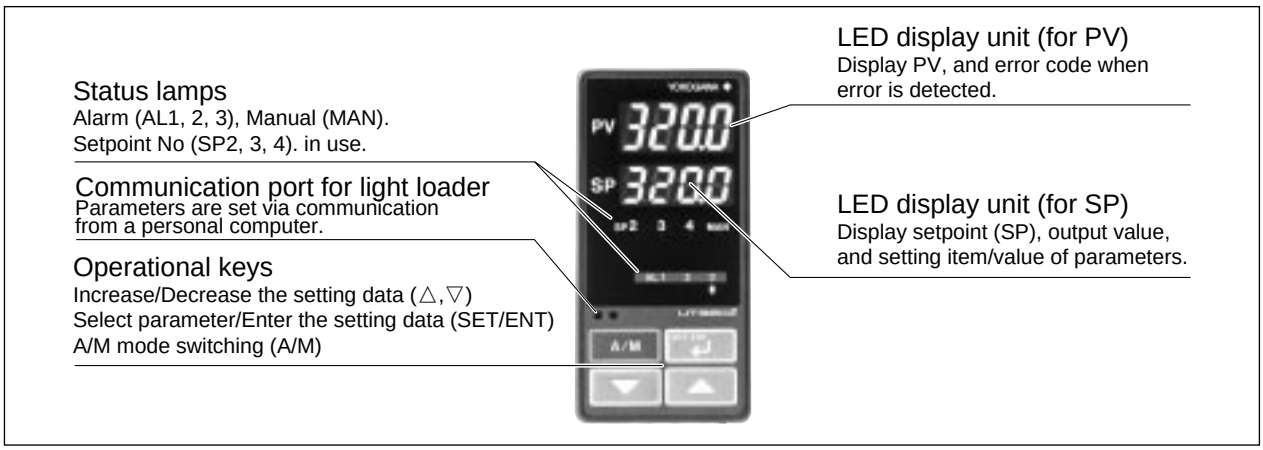
● Display and Operation Function

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.

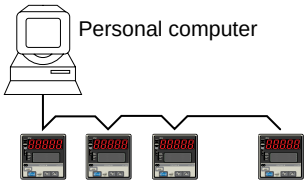
Status indicating lamps:
3 alarm indicator lamps: AL1, AL2, AL3
3 setpoint number indicator lamps:
SP2, SP3, SP4 (Go out when SP1 is selected.)
MAN operation mode lamp: MAN (lit in MAN mode)

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)

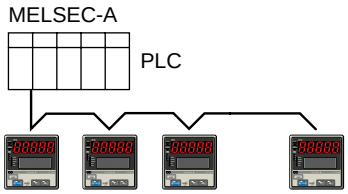


Examples of Communication System Configuration Diagram

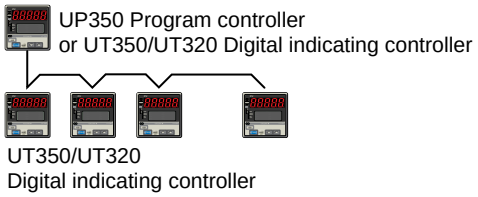
(1) Computer link communication/MODBUS communication



(2) Ladder communication



(3) Coordinated operation



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 (optional)

This controller has a communication function and can be connected to a personal computer, programmable logic controller, or other /GREEN series controllers.

Communication protocol
Computer link communication:
Communication protocol with a personal computer.
Ladder communication:
Communication protocol with programmable logic controller made.
MODBUS communication:
Communication protocol with a personal computer or PCL.

Coordinated operation:
Communication protocol to coordinate operation with two or more GREEN series controllers. The UT320 can be connected as a master station or a slave station.

Communication interface
Communication protocol:
Computer link, ladder communication, MODBUS communication or coordinated operation
Standards: EIA RS485
Maximum number of connectable controllers:
31 GREEN series controllers
Maximum communication distance: 1,200 m
Communication method:
Two-wire half duplex or four-wire half duplex, start-stop synchronization, non-procedural
Communication rate:
600, 1200, 2400, 4800, 9600 bps

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 unspecified		
Thermocouple	K	1	-200 to 1370˚C	-300 to 2500˚F	At or above 0˚C ±0.1% ±1 digit of F.S. Below 0˚C, ±0.2% ±1 digit of F.S.
		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	
	T	5	-199.9 to 400.0˚C	-300 to 750˚F	
		6	0.0 to 400.0˚C	-199.9 to 750.0˚F	
	B	7	0 to 1800˚C	32 to 3300˚F	At or above 400˚C ±0.15% ±1 digit of F.S. Below 400˚C ±5% ±1 digit of F.S.
	S	8	0 to 1700˚C	32 to 3100˚F	±0.15% ±1 digit of F.S.
	R	9	0 to 1700˚C	32 to 3100˚F	
	N	10	-200 to 1300˚C	-300 to 2400˚F	±0.1% ±1 digit of F.S. Below 0˚C ±0.25% ±1 digit of F.S.
	E	11	-199.9 to 999.9˚C	-300 to 1800˚F	At or above 0˚C ±0.1% ±1 digit of F.S. Below 0˚C ±0.2% ±1 digit of F.S.
	L (DIN)	12	-199.9 to 900.0˚C	-300 to 1300˚F	
	U (DIN)	13	-199.9 to 400.0˚C	-300 to 750˚F	
		14	0.0 to 400.0˚C	-199.9 to 750.0˚F	
	W (DIN)	15	0 to 2300˚C	32 to 4200˚F	±0.2% ±1 digit of F.S.
	Platinel 2	16	0 to 1390˚C	32 to 2500˚F	±0.1% ±1 digit of F.S.
	PR20-40	17	0 to 1900˚C	32 to 3400˚F	At or above 800˚C ±0.5% ±1 digit of F.S. Below 800˚C, not guaranteed
	W97Re3-W75Re25	18	0 to 2000˚C	32 to 3600˚F	±0.2% ±1 digit of F.S.
RTD	JPt100	30	-199.9 to 500.0˚C	-199.9 to 999.9˚F	±0.1% ±1 digit of F.S. (Note 1) (Note 2)
		31	-150.0 to 150.0˚C	-199.9 to 300.0˚F	±0.2% ±1 digit of F.S. (Note 1)
	Pt100	35	-199.9 to 850.0˚C	-300 to 1560˚F	±0.1% ±1 digit of F.S. (Note 1) (Note 2)
		36	-199.9 to 500.0˚C	-199.9 to 999.9˚F	
		37	-150.0 to 150.0˚C	-199.9 to 300.0˚F	±0.2% ±1 digit of F.S. (Note 1)
Standard signal	0.4 to 2V	40	0.400 to 2.000	Scaling is enable in the following 4 range. -1999 to 9999 -199.9 to 999.9 -19.99 ro 9999 -1.999 to 9.999	±0.1% ±1 digit of F.S.
	1 to 5V	41	1.000 to 5.000		
DC voltage	0 to 2V	50	0.000 to 2.000		
	0 to 10V	51	0.00 to 10.00		
	-10 to 20mV	55	-10.00 to 20.00		
	0 to 100mV	56	0.0 to 100.0		

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 a temperature range from –100 to 200°C.
*1: Performance in the standard operating conditions (at 23±2°C, 55±10% RH, and 50/60Hz power frequency)

■ 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 on page 4.
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 kΩ 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 permmisible leadwire resistance ±0.1°C/10Ω 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 50°C)
Applicable standards: JIS, IEC, or DIN (ITS-90) for TC and RTD

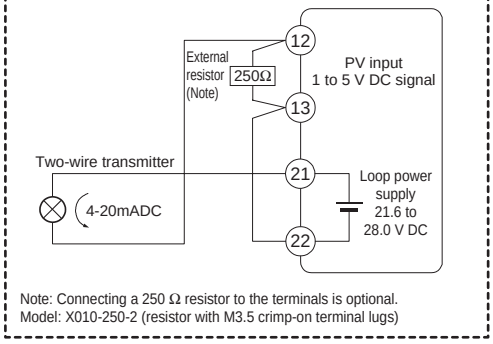
24V DC Loop Power Supply for Sensor

The controller supplies power to a two-wire transmitter. Place a resistor (10 to 250Ω)between the controller and the transmitter, convert a current signal to a voltage signal, and read it from the PV input.

21.6 to 28.0V DC, maximum supply current is about 30mA (only for models with 24V DC loop power supply).

Ambient temperature should be 0 to 40°C when using 24V DC loop power supply for UT320.

■24 V DC Power Supply Wiring to Two-wire Sensor



Note: Connecting a 250 Ω resistor to the terminals is optional.
Model: X010-250-2 (resistor with M3.5 crimp-on terminal lugs)

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: ±0.3% of span
* Performance in the standard operating conditions (at 23± 2°C, 55± 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/15V DC sensor power supply cannot be used.

Current output
Number of output points: 1 or 2 (2 for heating/cooling), Swiched between voltage pulse output and current output.
Output signal: 4 to 20 mA
Load resistance: 600 Ω or less
Output accuracy: ±0.3% of span
Performance in the standard operating conditions (at 23± 2°C, 55± 10% RH, and 50/60 Hz power frequency)
Voltage pulse output
Number of output points: 1 or 2 (2 for heating/cooling type), Swiched between voltage pulse output and current output.
Output signal:
On voltage = 12 V DC (load resistance of 600Ω 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, 3 A (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 kΩ or less,
OFF= contact resistance of 20 kΩ 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 terminals is common for every contact output.)

● Display Specifications

PV display:
4-digit, 7-segment red LED; character height - 12 mm
Setpoint display:
4-digit, 7-segment red LED; character height - 9.3 mm
Status indicating lamps: LEDS

● Conformance to Safety and EMC Standards

Safety:
Conforms to IEC1010-1: 1990 and EN61010-1: 1992. Certified for CSA1010. The overvoltage category of each input is CAT II (IEC1010-1)
Certified for UL508.
EMC standards:
Conforms to the following standards.
During test, the controller continues to operate with the measurement accuracy within ±20% of the range.
EN61326-1:1997+Am1:1998 for EMI (emissions)
EN61326-1:1997+Am1:1998 EMS (immunity)

● Construction, Mounting, and Wiring

Construction: Dust-proof and Drip-proof front panel conforming to IP55.
For side-by-side close installation, 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:
48 (width) × 96 (height) × 100 (depth) mm
Mounting: Direct panel mounting; mounting bracket, one each for upper and lower mounting
Panel cutout dimensions: $45^{+0.6}_{0}$ (width) × $92^{+0.8}_{0}$ (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 (±10%), 50/60 Hz
Power consumption: MAX. 20 VA (MAX. 8.0W)
Memory back-up: Non-volatile memory (Service life approx. 1000,000 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.
500V AC 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)

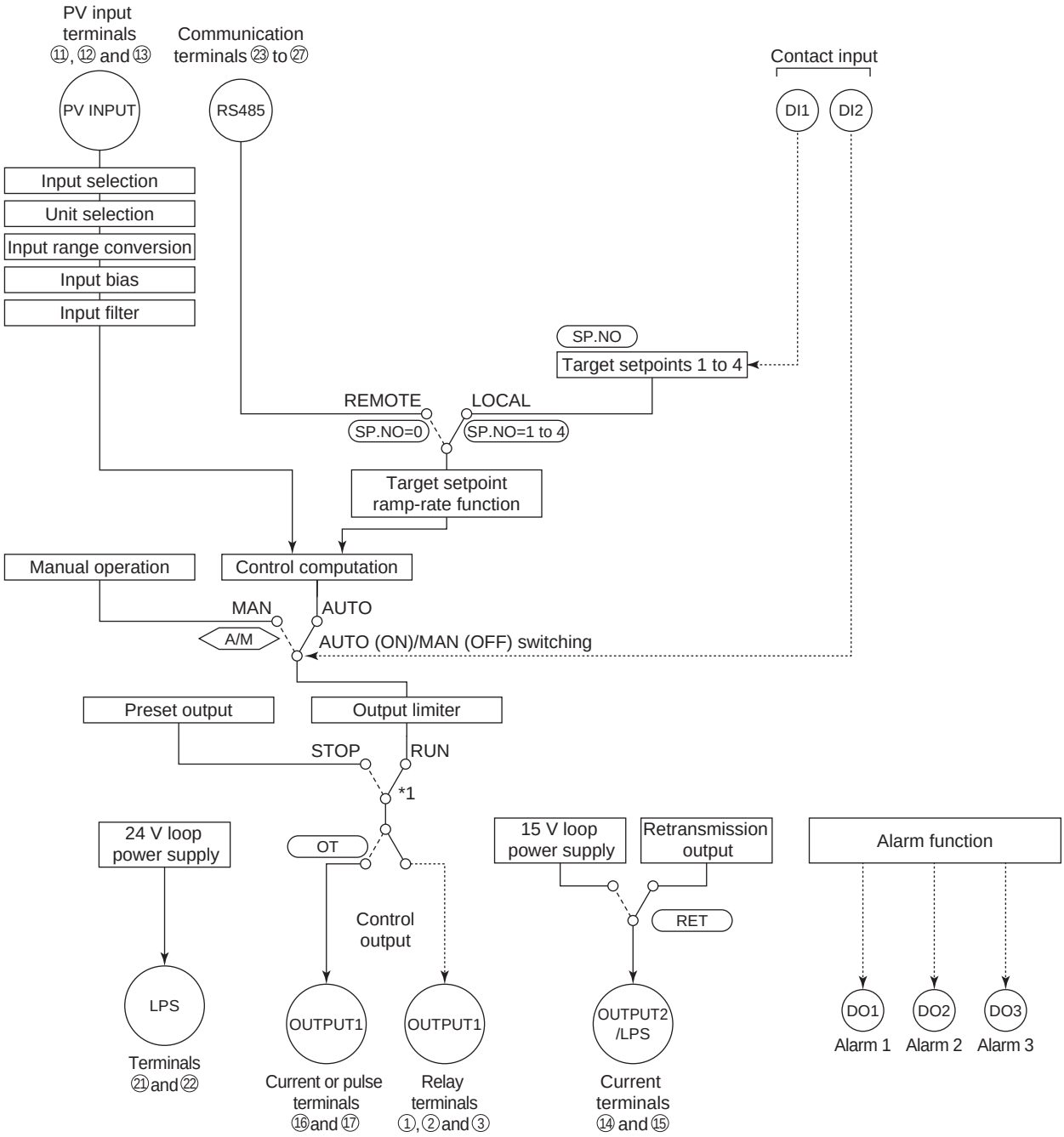
Note. The withstanding voltage is specified as 2300V AC perminute to provide amargin of safety.

Isolation resistance:
20 MΩ or more when 500 V DC voltage is applied between the power terminals and ground terminal.
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.
24V DC loop power supply terminals:
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 terminal. 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.
RS-485 communication terminals:
Not isolated from contact input terminals.
Isolated from other I/O terminals and internal circuits.
Power 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

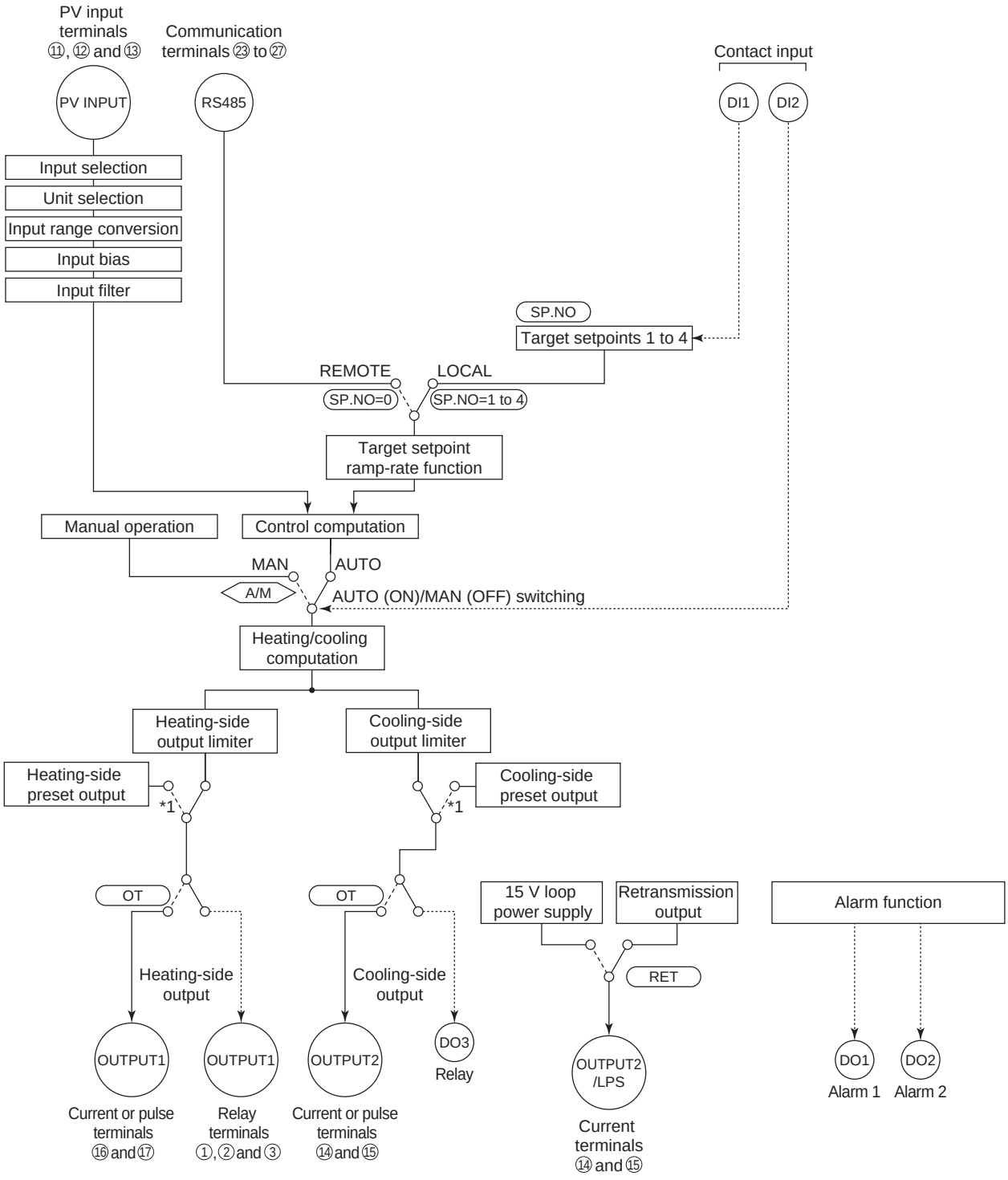
Normal operating conditions:
Ambient temperature: 0 to 50°C (40°C or less for mounting of instruments side-by-side)
Ambient temperature change limit:10°C/h or less
Ambient humidity: 20 to 90% RH (no condensing)
Magnetic field: 400 A/m or less
Continuous vibration (5 to 14 Hz):
Peak-to-peak amplitude of 1.2 mm or less
Continuous vibration (14 to 150 Hz):
4.9 m/s^2 or less
Short-period vibration: 14.7 m/s^2 or less, 15 s
Shock: 147 m/s^2 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
Effect of operating conditions
Effect of ambient temperature:
For voltage or TC inputs:
Whichever is greater, ±1 µV/°C or ±0.01% of F.S./°C
For RTD inputs:
±0.05°C/°C (ambient temperature) or less for RTD input
±0.05% of F.S./°C
For analog output:
±0.05% of F.S./°C or less
Effect of power supply fluctuation (within rated voltage range):
For analog input:
Equal to or less than whichever is greater,
± 1 µV/10 V or
± 0.01% of F.S./10 V
For analog output: ±0.05% of F.S./10 V or less

■ Function Block Diagram for Standard Type

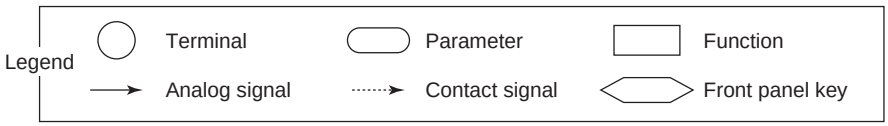


*1: If the setup parameter DIS (DI function selection) is set to 4 , when the contact input 2 is ON (run state), that controller outputs the preset output value.

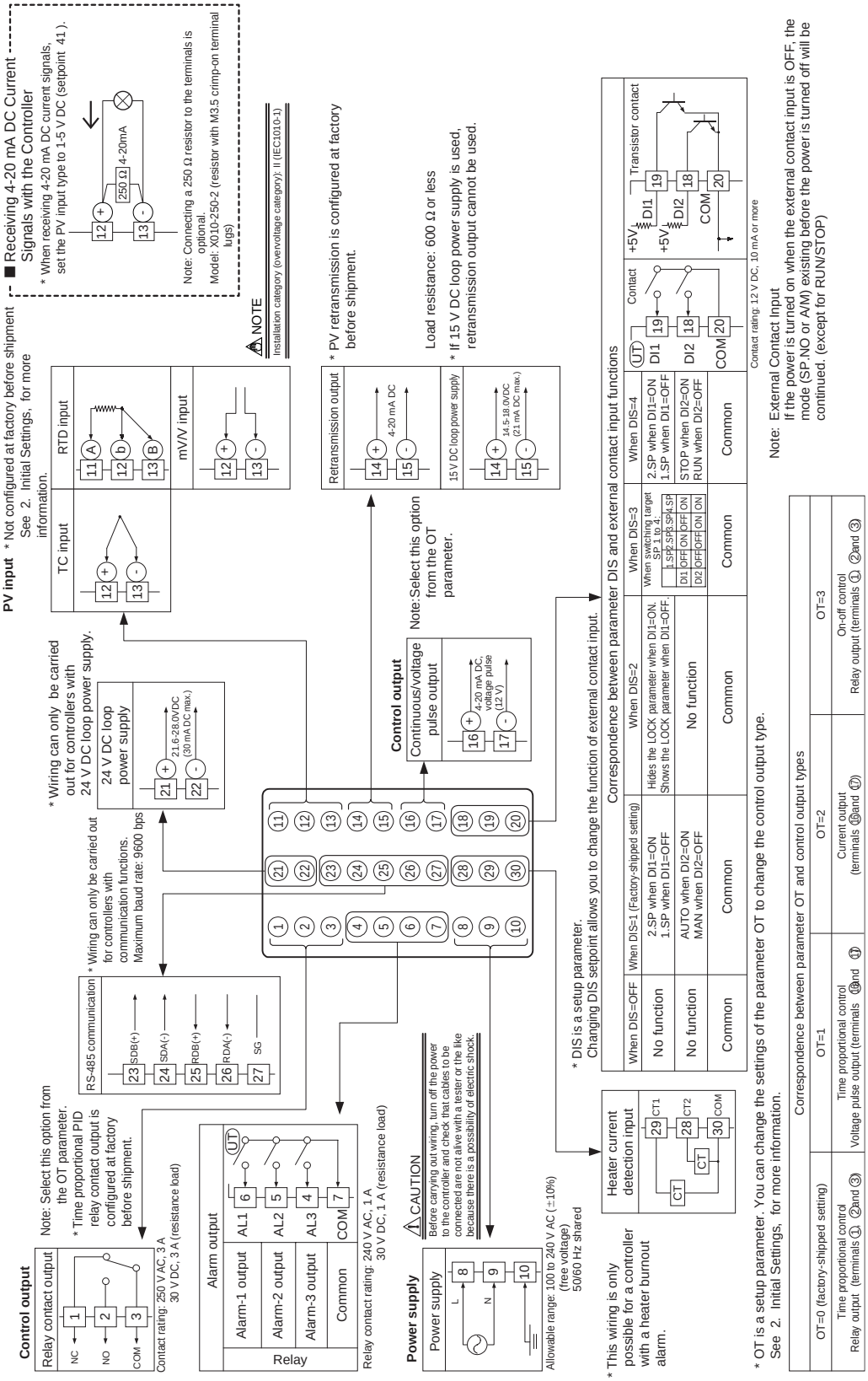
Function Block Diagram for Heating/Cooling Type



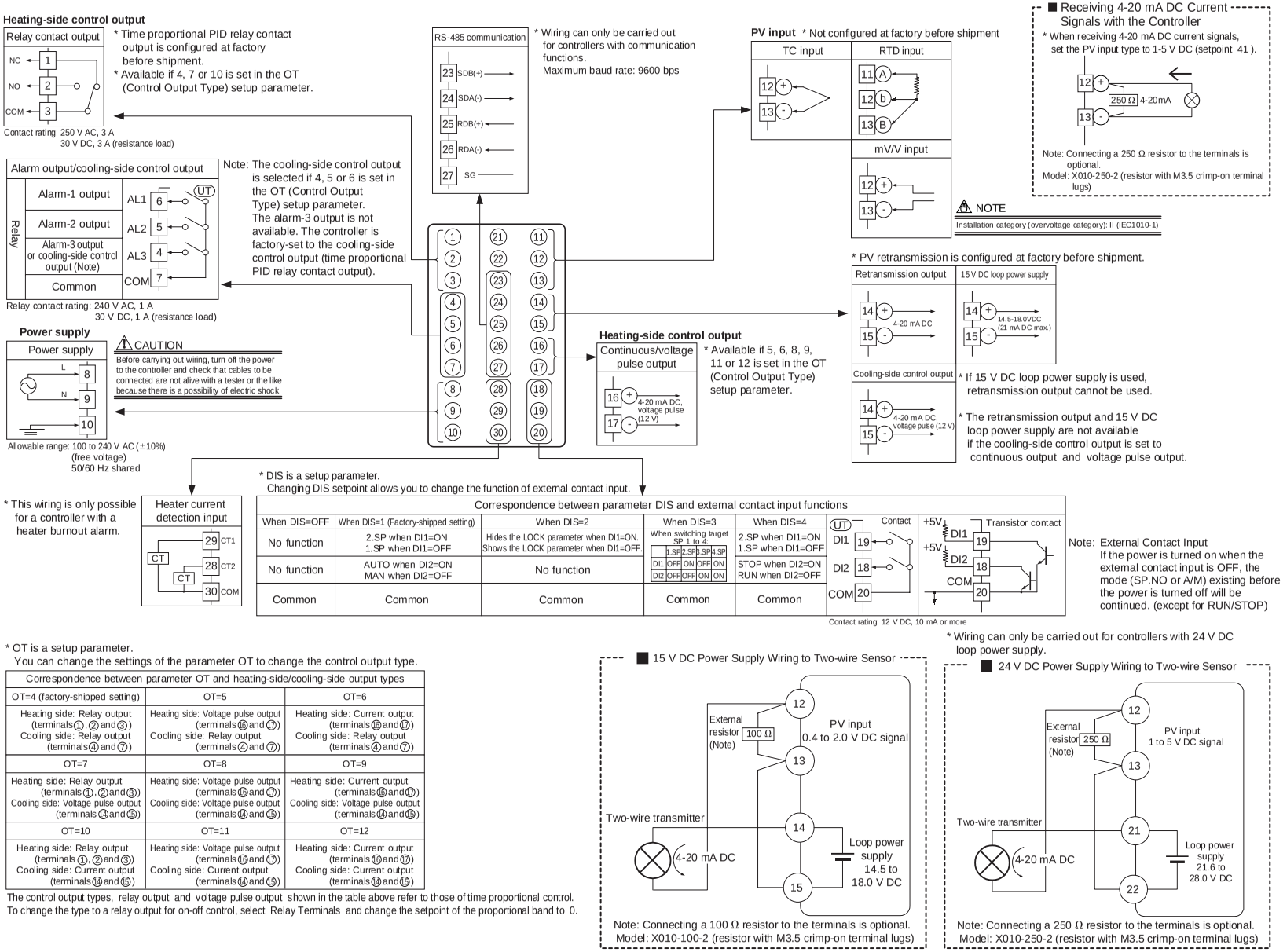
*1: If the setup parameter DIS (DI function selection) is set to 4 , when the contact input 2 is ON (run state), that controller outputs the preset output value.



■ Standard Type, Terminal Arrangements

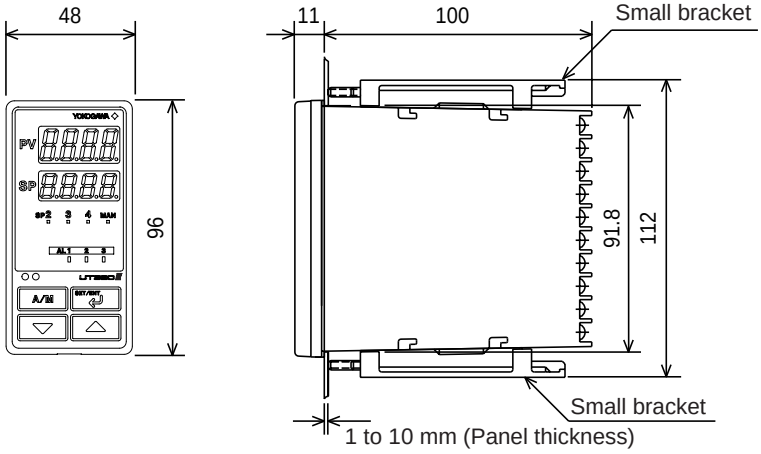


■ Heating/Cooling, Terminal Arrangements

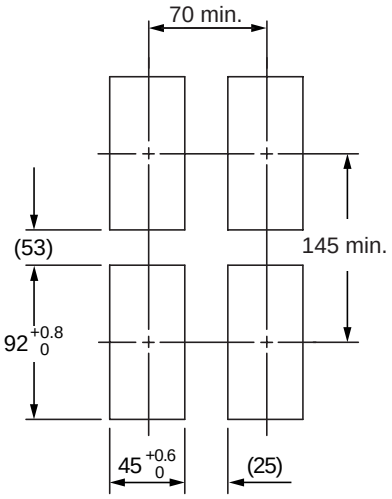


External Dimensions and Panel Cutout Dimensions

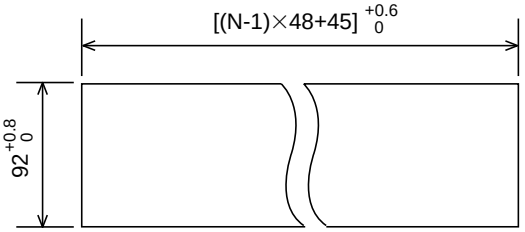
Unit: mm



General installation



Side-by-side close installation



"N" stands for the number of controllers to be installed.
However, the measured value applies if N ≥ 5.

Model and Suffix codes

Model	Suffix Code		Description
UT320			Digital indicating controller (provided with retransmission output and 15 V DC loop power supply as standard)
Type	-0 -2 -3		Standard type Heating/cooling type Standard type (with 24 V DC loop power supply)
Optional functions		0 1 2	None With communication, Heater burnout alarm With heater burnout alarm

Standard accessories: Brackets (mounting hardware), Unit label, User's manuals, and User's Manual (reference) (CD-ROM version)

Items to be specified when ordering

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