



**Digital Controller
CD Series Instruction Manual
User's Guide**

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Digital Controller CD Series Instruction Manual

NOTES:

Product Version : **Ver 1.0**

Document Version : **Ver 1.1**

Before operation this instrument, please carefully read this manual and fully understand its contents. And always keep it around you to make it available easily anytime.

WARNING

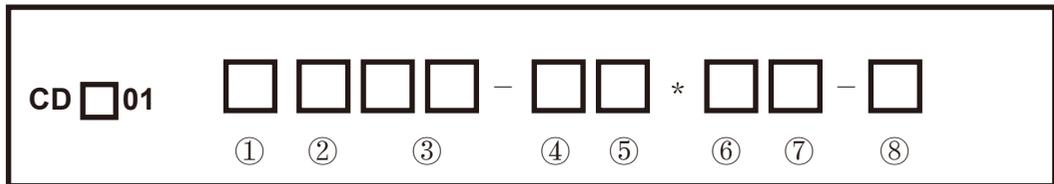
- If failure or error of this instrument could result in a critical accident of the system. Install an external protection circuit to prevent such an accident.
- Do not turn on the power supply until all of the wiring is completed. Otherwise electric shock, fire or malfunction may result.
- Do not use this instrument in the places subject to flammable or explosive gas.
- Do not touch high-voltage blocks such as power supply terminals, etc. Otherwise electric shock may be result.
- Never disassemble, repair or modify the instrument. This may cause electric shock, fire or malfunction.

CAUTION

- Only clean the instrument when power off.
- Please use a soft cloth or cotton paper to clean up the stain on the display.
- Do not clean up or touch the display by hard matters in case of any scratch.
- Never use sharp & hard matters such as screw drivers or ball pen to touch the buttons on the panel, in case of any scratch or damage.

Chapter1. Product Check

Check whether the delivered product is as specified by referring to the following model code list.



① Control action

- F:** PID action with autotuning (Reverse action)
- D:** PID action with autotuning (Direct action)
- W:** Heat/cool action with autotuning (Water cooling)
- A:** Heat/cool action with autotuning (Air cooling)

② Input type

③ Range code: See 8. INPUT RANGE TABLE.

④ First control output [OUT1] (heat-side)

- M:** Relay output **T:** Triac **V:** Voltage pulse
- G:** Trigger (for triac driving)

⑤ Second control output [OUT2] (heat-side)

- No symbol:** When control action is F or D. **M:** Relay output
- T:** Triac **V:** Voltage pulse

⑥ First alarm [ALM1]

⑦ Second alarm [ALM2]

- | | |
|--|---|
| <ul style="list-style-type: none"> N: No alarm A: Deviation high alarm B: Deviation low alarm C: Deviation high/low alarm D: Band alarm E: Deviation high alarm with hold action F: Deviation low alarm with hold action | <ul style="list-style-type: none"> G: Deviation high/low alarm with hold action H: Process high alarm J: Process low alarm K: Process high alarm with hold action L: Process low alarm with hold action |
|--|---|

⑧ Communication function

- N:** no communication function **5:** RS-485 (2-wire system)

Chapter2. Mounting

2.1 Mounting Cautions

(1) This instrument is intended to be used under the following environmental conditions.
(les1010)

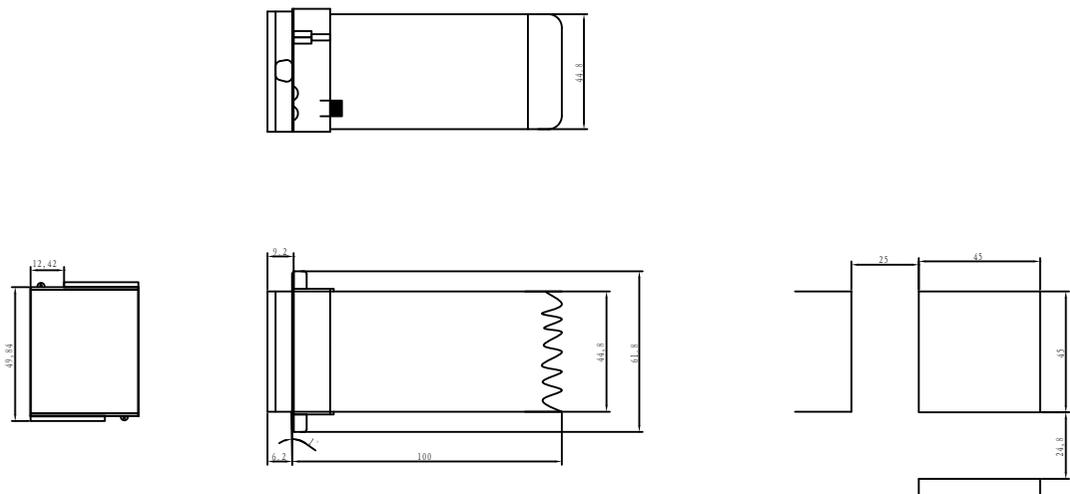
*OVERVOLTAGE CATEGORY II *POLLUTION DEGREE-2

(2) Avoid the following when selecting the mounting location.

- Ambient temperature of less than 0°C or more than 50°C.
- Ambient humidity of less than 45% or more than 85% RH.
- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the mainframe.
- Water, oil, chemicals, vapor or steam splashes.
- Excessive dust, salt or iron particles.
- Excessive induction noise, static electricity, magnetic fields or noise.
- Direct air flow from an air conditioner.
- Should be used indoors where the system is not exposed to direct sunlight.
- Heat to be accumulated radiation heat.

2.2 Dimensions

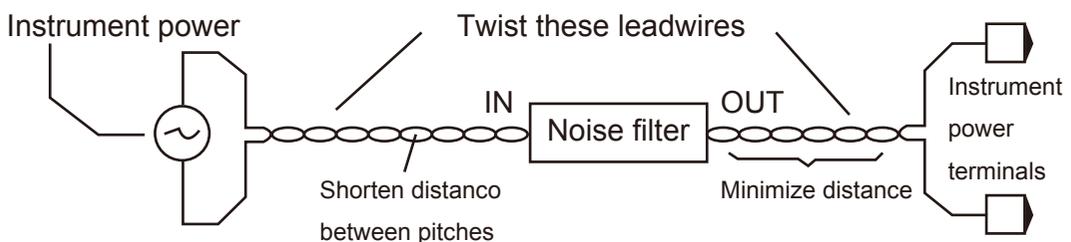
CD101



Chapter3. Wiring

3.1 Wiring cautions

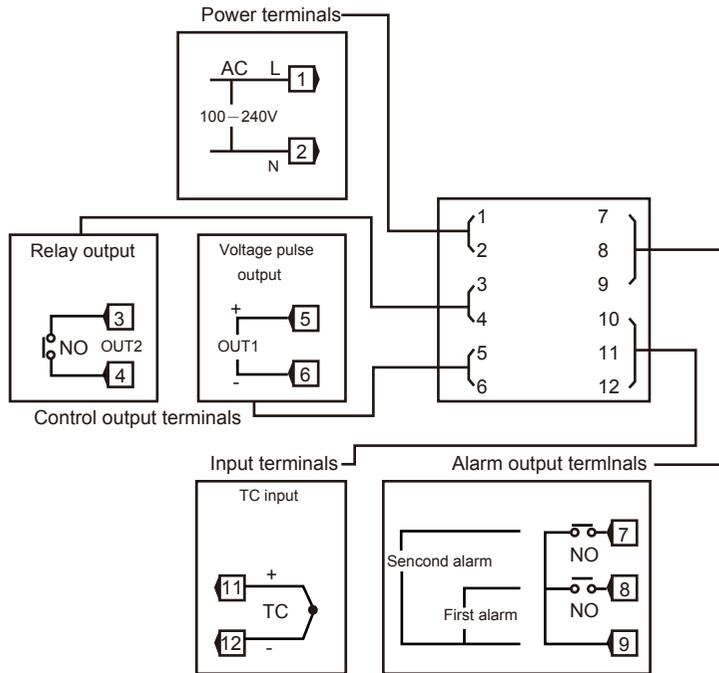
- (1) For thermocouple input, use the specified compensation wire.
- (2) For RTD input, use low resistance and having no resistance differences among the 3 leads.
- (3) Conduct input signal wiring away from instrument power, electric equipment power and load lines to avoid noise induction.
- (4) Conduct instrument power wiring so as not to be influenced by noise from the electric equipment power. If the instrument may be affected by external noise, a noise filter should be used.
 - Reduce the distance of power source wire.
 - Install the filter at controller's panel, then into earth.
 - Don't set the protection and switch at the output side of filter.
- (5) For wiring, use wires conforming to the domestic standard of each country.
- (6) About 5 or 6 sec are required as the preparation time for contact output after power on. Use a delay relay when the output line is used for an external interlock circuit.
- (7) This instrument has no power supply switch nor fuses. Therefore, install the fuse to the instrument and the switch. If required.
 - Recommended fuse rating: Rated voltage:250V Rated current:1A
 - Fuse type: Time-lag fuse.
- (8) For the current input specification, a resistor of 250Ω ($\pm 0.02\% \pm 10\text{ppm}$, 0.25W or more) must be provided by the input terminals. This resistor must be provided by the customer.
- (9) Do not excessively tighten the terminal screws. In addition, use the solderless terminal appropriate to the screw size. (Screw size: M3X6, recommended tightening torque: $0.4\text{N}\cdot\text{m}$ [$4\text{kgf}\cdot\text{cm}$])
- (10) To the instrument with power supply of 24V, please be sure to supply the power from SELV circuit.



Wiring

3.2 Terminal configuration

CD101



NO:Normally open NC:Normally closed

Power supply voltage:

90-264V AC [Including power supply voltage variation]

(Power frequency: 50/60Hz, Rating: 100-240V AC)

Power consumption: 7VA max. (At 100V AC), 10VA max. (At 240V AC)

Alarm output rated: Relay contact output: 250V AC. 1A (Resistor load)

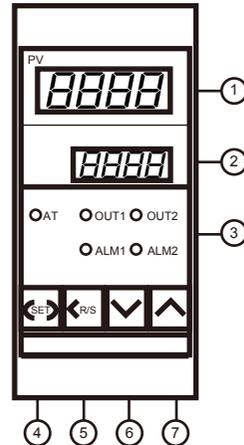
Control output rated:

Relay contact output: 250V AC, 3A (Resistor load)

Voltage pulse output: 0/12V DC (Load resistance 600Ω or more)

Current output: 4-20mA DC (Load resistance 600Ω or less)

Chapter4. Name Parts



① **Measured value (PV) display unit [Green]**

- Displays measured value (PV)
- Displays various parameter symbols depending on the instrument.

② **Set value (SV) display unit [Orange]**

- Display set value (SV).
- Displays various parameter symbols depending on the instrument.

③ **Indication lamps****

Autotuning (AT) lamp [Green]

Flashes during autotuning execution.

Control output lamp (OUT1) [Green]

Lights when control output is turned on..

Alarm output lamp (ALM1) [Red]

Lights when alarm output is turned on.

** No OUT2 lamp is used.

④ **Set key (SET)**

Used for parameter registration /calling up.

⑤ **Shift & R/S key**

- Used to shift the digit when the setting is changed. (Shift key)
- Used to select the RUN/STOP function.

⑥ **DOWM key**

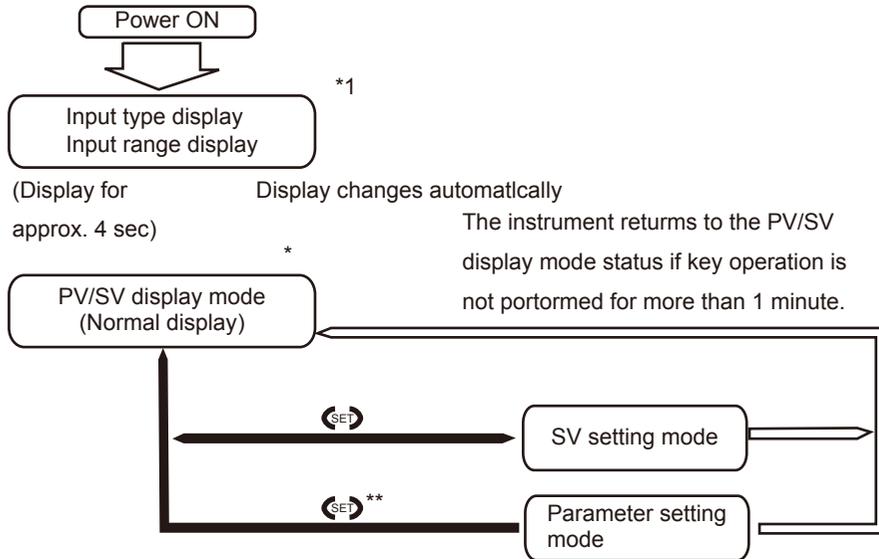
Used to decrease numbers.

⑦ **UP key**

Used to increase numbers.

Chapter5. Setting

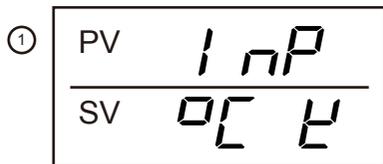
5.1 Calling up procedure of each mode



*1. Input type and input range display

This instrument immediately confirms input type and range following power on.

Example: For a controller with the K thermocouple input type and range from 0 to 1372°C.



① Input type display

1nP: Indicates input abbreviation

°C: Indicates engineering unit

: Indicates input type (See table **A)

② Input range display

a: Input range high

b: Input range low

**A: Input type table

Display	H	J	r	S	b	E	r	n	P	ō	U	L	JP	PF	H
Input type	Thermocouple(TC)														Voltage (Current)
	K	J	R	S	B	E	T	N	P	W5Re/ W26Re	U	L	JPT 100	PT 100	

5.2 Details of each mode

■ PV/SV display mode

Display measured value (PV) on the PV display unit and set value (SV) on the SV display unit. Usually the control is set to this mode excepting that the Set Value (SV) and/or the parameter set value are changed. In addition, in this mode, RUN/STOP can be selected.

■ SV setting mode

This is the mode used to set the set value (SV). Factory set value: 0°C or 0.0°C

■ Parameter setting mode

This is the mode used to set various parameters such as alarms, PID constants, etc.

The following parameter symbols are displayed one by one every time the SET key is pressed.

#1 Factory set value

Symbol	Name	Setting range	Description	#1
<i>AL1</i>	Alarm (ALM1)	Deviation alarm. Process alarm. SV alarm: -1999 to +1999 °C or -199.9 to +199.9 °C	Set the alarm set value. Alarm differential gap: 2-20°C	50(50.0)
<i>AL2</i>	Alarm (ALM2)	Deviation alarm. Process alarm. SV alarm: -1999 to +1999 °C or -199.9 to +199.9 °C	Set the alarm set value. Alarm differential gap: 2-20°C	50(50.0)

Setting

<p><i>ATU</i></p>	<p>Autotuning(AT)</p>	<p>0: AT end or AT suspension 1:AT start</p>	<p>Turns the autotuning ON/OFF.</p>	<p>0</p>
<p><i>STU</i></p>	<p>Self-tuning(ST)</p>	<p>0: ST suspension 1:AT start</p>	<p>Turns the self-tuning ON/OFF.</p>	<p>0</p>
<p><i>P</i></p>	<p>Proportional band (P)</p>	<p>1(0.1) to span or 9999(999.9) °C</p>	<p>Set when PI, PD or PID control is performed. *ON/OFF action control when set to 0(0.0). Differential gap: 2(2.0)°C</p>	<p>30(30.0)</p>
<p><i>I</i></p>	<p>Integral time (I)</p>	<p>1-3600 sec *PD control when set to 0 sec</p>	<p>Set the time of integral action which eliminates the offset occurring in proportional control.</p>	<p>240</p>
<p><i>d</i></p>	<p>Derivative time (D)</p>	<p>1-3600 sec *PI control when set to 0 sec</p>	<p>Set the time of derivative action which prevents ripples by predicting output changes and thus improves control stability.</p>	<p>60</p>
<p><i>Ar</i></p>	<p>Reference value (AR)</p>	<p>0-100% *1</p>	<p>After AT, set automatically</p>	<p>25</p>

T	Heat-reset Proportioning cycle (T)	1-100 sec (0 can not be set) *2	Set control output cycle	20
Pc	Cool-side proportional band (Pc)	1-100% of heat-side proportional band (0 can not be set)	Set cool-side proportional band when heat/cool PID action.	100
db	Deadband (db)	Temperature input: -10 - +10°C or -10.0 - +10.0°C	Set control action deadband between heat-side and cool-side proportional bands.	0(0.0)
t	Cool-side Proportioning cycle (t)	1-100 sec (0 can not be set) *2	Set control cool-side output cycle for heat/cool ID action.	20
Pb	PV bias (Pb)	-1999 - +9999°C or -199.9 - +999.9°C	Sensor correction is made by adding bias value to measured value (PV)	0(0.0)
LCK	Set data lock function (LCK)	See *3	Performs set data change enable/disable.	0000

*1: The reference value can not be manually set with PID, after "AT" autotuning, set the value automatically.

*2: Relay contact output 20 sec the voltage pulse output/valve control the tube by Trigger output/the valve control the tube output for 2 seconds.

Setting

*3: Details of set data lock level selection

Setting	Details of lock levels
0000	SV and parameter can be set.
0001	Only SV and alarms (ALM1, ALM2) can be set.
0010	Only setting items other than alarms (ALM1, ALM2) can be set.
0011	Only setting items other than SV can be set.
0100	Only SV can set.
0101	Only alarms (ALM1, ALM2) can be set.
0110	Only setting items other than SV and alarms (ALM1, ALM2) can be set.
0111	SV and parameter can not be set.

- Each locked setting item can only be monitored.

Chapter 6. Operations

6.1 Operation procedures

- (1) Prior to starting operating, check that the mounting and wiring have been finished, and that the SV and various parameters have been set.
- (2) As this instrument does not have a power supply switch, it is read to operate as soon as the power is turned on. Prior shipment, the instrument is set to RUN (operation start).

NOTES

- If the instrument is switched to operation stop (STOP), its display output, etc. Become as follows.
 - Display: The PV display unit shows (STOP).
 - Output: Control output OFF. Alarm output OFF.
 - Suspended when the AT function is activated. (The PID constants are not updated.)
- This instrument holds the conditions that exist just before the power is turned on. For example, if the power is turned off in STOP modes, the instrument starts in STOP mode when the power is turned on again.

6.2 Set data lock (LCK) function

The set data lock function is used to prevent misoperation by not setting any parameter which is not used frequently. There are 8 lock levels, and the parameter is locked, but can only be monitored.

6.3 Auto tuning (AT) function

The AT function automatically measured, computes and sets the optimum PID and Iba constants. This function is activated after-ON, during temperature rise and/or when control is stabilized from any process state.

■ Requirements for AT start

Start AT when all the following conditions are satisfied:

- Prior to starting the AT function, end all the parameter settings other than PID and Iba.
- Confirm the LCK function has not been engaged.

■ Requirements for AT suspension

Start AT function is suspended if any of the following conditions are satisfied:

- When the SV is changed.
- When the PV bias value is changed.
- When the SV RUN/STOP function is changed to the STOP.
- When the PV becomes abnormal. (According to the burnout.)
- When the power is turned on.
- When a power failure longer than 20 ms occurs.
- When the AT function does not end in about 9 hours after tuning started.

Operations

NOTES

- If the AT suspension condition is established, the AT function is immediately suspended to be changed to PID control.
The PID and Iba constants at this time are the same as before starting AT. In addition, even if the AT is completed, it is automatically transferred to PID control.
- If any problems arise due to hunting exists in the control system, do not use the AT function. In this case, set each value to match the controlled object.

Chapter7. Display At error Occurrence

■ Error display

	RAM failure (Incorrect data write, etc.)	Please contact us
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■ Overscale and underscale

Measured value (PV) (Flashing)	Measured value (PV) exceeds the input range.	<div style="text-align: center;">  WARNING </div> <p>In order to prevent electric shock, prior to replacing the sensor, always turn off the power.</p> <p>Sensor input lead check</p>
 (Flashing)	Overscale Measured value (PV) exceeds the high input display range limit.	
 (Flashing)	Underscale Measured value (PV) exceeds the low input display range limit.	

Chapter8. Input Range Table

Input type		Code	
K	0—200℃	K	01
	0—400℃	K	02
	0—600℃	K	03
	0—800℃	K	04
	0—1000℃	K	05
	0—1200℃	K	06
	0—1372℃	K	07
	0—100℃	K	13
	0—200℃	K	14
	0—450℃	K	17
	0—500℃	K	20
J	0—200℃	J	01
	0—400℃	J	02
	0—600℃	J	03
	0—800℃	J	04
	0—1000℃	J	05
	0—1200℃	J	06
	0—450℃	J	10
	0—500℃	J	20
R *1	0—1600℃	R	01
	0—1769℃	R	02
	0—1350℃	R	04

Input Range Table

Input type		Code	
S	*1	0—1600°C	S 01
	*1	0—1769°C	S 02
B	*1	0—1800°C	B 01
	*1	0—1820°C	B 02
E		0—800°C	E 01
		0—1000°C	E 02
N		0—1200°C	N 01
		0—1300°C	N 02
T	*2	-199.9 — +400.0°C	T 01
	*2	-199.9 — +100.0°C	T 02
		-100.0 — +200.0°C	T 03
		0.0—350°C	T 04
W5Re/ W26Re		0—2000°C	W 01
		0—2320°C	W 02
PLII		0—1300°C	A 01
		0—1390°C	A 02
		0—1200°C	A 03
U *2		-199.9 — +600.0°C	U 01
		-199.9 — +100.0°C	U 02
		0.0—400.0°C	U 03
L		0—400°C	L 01
		0—800°C	L 02

Input Range Table

Input type		Code	
Pt100	-199.9 — +649.0°C	D	01
	-199.9 — +200.0°C	D	02
	-100.0 — +50.0°C	D	03
	-100.0 — +100°C	D	04
	-100.0 — +200°C	D	05
	0.0—50.0°C	D	06
	0.0—100.0°C	D	07
	0.0—200.0°C	D	08
	0.0—300.0°C	D	09
	0.0—500.0°C	D	10
	0.0—400.0°C	D	20
JPT100	-199.9 — +649.0°C	P	01
	-199.9 — +200.0°C	P	02
	-100.0 — +50.0°C	P	03
	-100.0 — +100°C	P	04
	-100.0 — +200°C	P	05
	0.0—50.0°C	P	06
	0.0—100.0°C	P	07
	0.0—200.0°C	P	08
	0.0—300.0°C	P	09
	0.0—500.0°C	P	10
	0.0—400.0°C	P	20

Input type		Code	
0—5V DC	-1999 — 9999	4	01
1—5V DC		5	01
0—20mA DC		6	01
4—20mA DC		7	01

*1 0—399°C: Accuracy is guaranteed

*2 -199.9 — -100.0°C: Accuracy is not guaranteed.

Chapter9. Contact Us

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