DIGITAL CONTROLLER

CB / CD / CH SERIES
INSTRUCTION MANUAL

IMCX01-E1

Before operating this instrumen, 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 critcal 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.
- Use this instrument within the scope of its specificatons. Otherwise 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 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 ass screwdrivers or ball pen to touch the buttons on the panel, in case of any scratch or damage.

1. PRODUCT CHECK

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

```
CB□00
CD□01    □□□□-□□*□□-□
CH□02    ①②  ③  ④⑤  ⑥⑦  ⑧
```

① **Control action**
  F: PID action with autotuning (Reverse action)
  D: PID action with autotuning (Direct action)
  W:Heat/cool PID action with autotuning (Water cooling)
  A: Heat/cool PID 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
  8: Current (4to20mA DC) G: Trigger (for triac driving)
⑤ **Second control output[OUT2](heat-side)**
  No symbol: When control action is F or D.   M: Relay contact
  T:Triac   V: Voltage pulse
⑥ **First alarm[ALM1],** ⑦ **Second alarm[ALM2]**
  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
  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 lold action
⑧ **Communication function**
  N: no communication function   5: RS-485(2-wire system)

<Accessories>
- **Mounting bracket:** 2 pieces *1
- **Mounting screws (with hexagon nuts) :** 2 pieces *1
- **Instruction manual [IMCX01-E1]** (1 copy)
  *1 CB100,CD101,CH102 Mounting bracket: 1 pieces
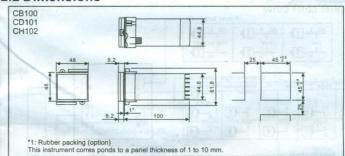
2. MOUNTING

2.1 Mounting cautions
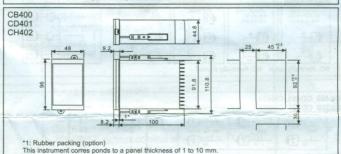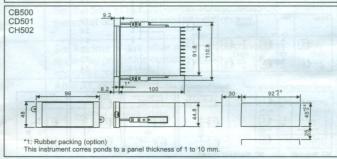(1) This instrument is intended to be used under the following environmental c Onditions. (Iec1010)
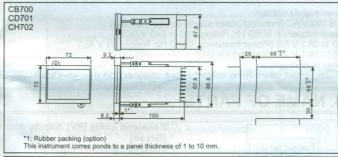 *OVERVOLTAGE CATEGORY II   *POLLUTION DEGREE-2
(2) Avoid the following when selecting the mounting location.
- Ambient temperature of less than 0℃ or more than 50℃.
- Ambient humidity of less than 45% or more than 85% RH.
- Rapid changes in ambient temperature which may cuse condensation.
- Corrosive 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

CB100
CD101
CH102

*1: Rubber packing (option)
This instrument corres ponds to a panel thickness of 1 to 10 mm.

CB400
CD401
CH402

*1: Rubber packing (option)
This instrument corres ponds to a panel thickness of 1 to 10 mm.

CB500
CD501
CH502

*1: Rubber packing (option)
This instrument corres ponds to a panel thickness of 1 to 10 mm.

CB700
CD701
CH702

*1: Rubber packing (option)
This instrument corres ponds to a panel thickness of 1 to 10 mm.

CB900
CD901
CH902

*1: Rubber packing (option)
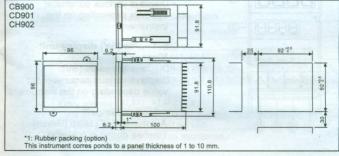This instrument corres ponds to a panel thickness of 1 to 10 mm.

3. WRING

3.1 Wiring cautions

(1) For thermocouple input, use the specified compensation wire.
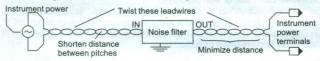(2) For RTD input, use low resistance and having no resistance differences among the 3 leads.
(3) Conduct input signal wiring away from instrument power, electric equipment power and load lines to avoid noise induction.
(4) Conduct instrument power wiring so as not to be influenced by noise from the electric equipment power. If the instrument may be affected by external noise, a noise filter should be used.
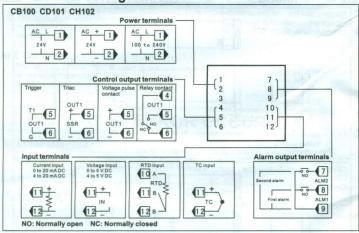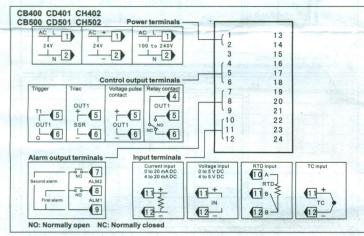 • reduce the distance of power source wire
 • install the filter at controller`s panel ,then into earth.
 • don`t set the protection and switch at the output side of filter.

(5) For wiring, use wires conforming to the domestic standard of each country.
(6) About 5 to 6 sec are required as the preparation time for comtact output after power on. Use a delay relay when the output line is used for an external interlock circuti.
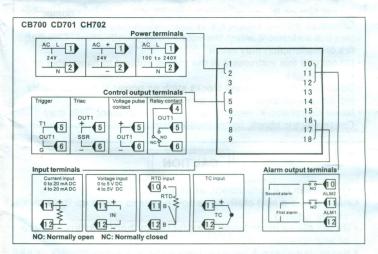(7) This instrument has no power supply switch nor fuses. Therefore, install the fuse to the instrument and the switch, if requirde.
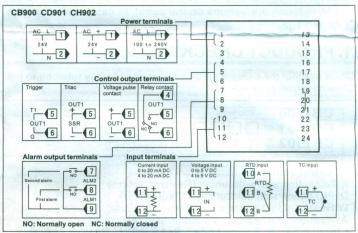 • Recommended fuse rating: Ratde voltage: 250V   Ratde current: 1A
 • Fuse tybe: Time-lag fuse
(8) For the current input specification, a resistor of 250Ω ($\pm 0.02\% \pm 10$ppnm, 0.25W or more) must be provided by the input rerminals. This resistor must be provided by the customer.
(9) Do not excessively tighten the terminal screws. In addition, use the solderless terminal appropriate to the screw size.
(Screw size: M3X6, recommended tinghtening torque: 0.4N*m[4kgf*cm])
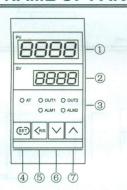(10) To the instrument with power supply of 24V, please be sure to supply the power from SELV circuit.

3.2 Terminal configuration

Power supply voltage:
90 to 264 V AC [Including power supply voltage variation]
(Power frequency: 50/60 Hz, Rating: 100 to 240 V AC)
21.6 to 26.2 V AC (Power frequency: 50/60 Hz, Rating: 24 V AC)
21.6 to 26.2 V DC (Rating: 24 V DC)
Power consumption: 7VA max.(at 100 V AC) 10 VA max.(at 240 V AC)
Almarm output rated: Relay contact output: 250 V AC, 1A (Resistive load)

Control output rated:
Relay contact output: 250 V AC, 3 A (Resistive load)
Voltage pulse output: 0/12 V DC (Load resistance 600Ω or more)
Current output: 4 to 20 mA DC (Load resistance 600Ω or less)
Trigger output (for triac driving): Zero cross method for medium capacity triac driving (100 A or less)
Triac output: 0.5 A (Ambient temperature 40℃ or less)

4. NAME OF PARTS

①**Measured value (PV) display unit [Green]**
 • Displays measured vaiue (PV).
 • Displays various parameter symbols depending on the instrument.

②**Set value (SV) display unit [Orange]**
 • Displays set vaiue (SV).
 • Displays various parameter set value depending on the instrument.

③**ndication 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 ‹R/S**
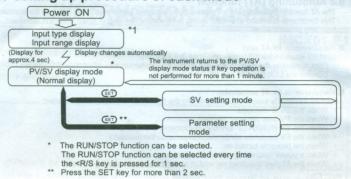 • Used to shift the digit when the setting is changed. (Shift key).
 • Used to select the RUN/STOP Functinion. (R/S key).

⑥**DOWM key ∨**
Used to decrease numerals.

⑥**UP key ∧**
Used to increase numerals.

5. SETTING

5.1 Calling up procedure of each mode

```
        Power  ON
           ⇩
   Input type display      *1
   Input range display
 (Display for    Display changes automatically
 approx.4 sec)   ⚡
   PV/SV display mode          The instrument returns to the PV/SV
   (Normal display)            display mode status if key operation is
                               not performed for more than 1 minute.
        ┌─(SET)──────────┐
        │                │    SV  setting mode
        │                │
        │─(SET) **───────┐
                         │    Parameter setting
                         │    mode
```

*   The RUN/STOP function can be selected.
    The RUN/STOP function can be selected every time
    the <R/S key is pressed for 1 sec.
** Press the SET key for more than 2 sec.

*1. Input type and input range display

This instrument immediately confirms input tybe and range following power on.
Example: For a controller with the K thermocouple input type and range from 0 to 1372℃.

```
①  PV    I nP      ① Input type display
    SV    ℃ ʁ          I nP : Indicates input abbreviation
                        ℃ : Indicates engineering unit
②  PV   1372 ─a        ʁ : Indicates input type (See table **A)
    SV     0  ─b    ② Input range display
                        a : Input range high
                        b : Input range low
```

**A: Input tybe table

Display	ʁ	J	r	S	b	E	Γ	n	P	ū	U	L	JPPΓ	ʁ
Input type	K	J	R	S	B	E	T	N	P	W5Re/W26Re	U	L	JPT 100 / -PT 100	Voltage (Current)
		Thermocouple(TC)											RTD	

5.2 Detail of each mode

■ PV/SV display mode
Display measured vaiue (PV) on the PV display unit and set value (SV) onthe SV sidplay unit. Usually the control is set to this mode excepting that the Set value (SV) and/or the parameter set value are changed. Inaddition, 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℃ or 0.0℃

■ Parameter setting mode
This is the mode used to set various parametes 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
AL1	Almarm (ALM1)	Deviation alarm, Process alarm, SV alarm: -1999 to +1999℃ or -199.9 to +999.9℃	Set the alarm set value. Alarm differential gap: 2 or 2.0℃.	50 (50.0)
AL2	Almarm (ALM2)	Deviation alarm, Process alarm, SV alarm: -1999 to +1999℃ or -199.9 to +999.9℃	Set the alarm set value. Alarm differential gap: 2 or 2.0℃.	50 (50.0)
ArU	Autotuning (AT)	0: AT end or AT suspension 1: AT start	Turns the autotuning ON/OFF.	0
SrU	Self-tuning (ST)	0: ST suspension 1: AT start	Turns the self-tuning ON/OFF.	0
P	Proportional band (P)	1 (0.1) to span or 9999 (999.9) ℃	Set when PI, PD or PID control is performed. *ON/OFF action control when set to 0 (0.0). Differential gap: 2 (0.0) ℃	30 (30.0)
I	Integral time (I)	1 to 3600 secretary *PD control when set to 0 secretary	Set the time of integral action which eliminates the offset occurring in proprotional control.	240
d	Derivative time (D)	1 to 3600 secretary *PI control when set to 0 secretary	Set the time of derivative action which prevents ripples by predicting output changes and thus improves control stability.	60
Ar	Reference value (Ar)	0 to 100 % *1	After AT, set automatical.	25
r	Heat-reset Proportioning cycle (T)	1 to 100 sec (0 can not be set) *2	Set control output cycle.	20
Pc	Cool-side Proportional band (Pc)	1 to 1000 % 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 to +10 ℃ or -10.0 to +10.0 ℃	Set control action deadband between hate-side and cool-side proportional bands.	0 or 0.0
t	Cool-side Proportioning cycle (t)	1 to 100 se c (0 can not be set) *2	Set control cool-side output cycle for heat/cool PID action.	20
Pb	PV bias (Pb)	-1999 to +9999℃ or -199.9 to +999.9℃	Sensor correction is made by adding bias value to measured value (PV).	0 or 0.0
LCʁ	Set data lock function (LCK)	See *3	Performs set data change endble/disable.	0000

*1: The reference value can`t be manually setted within PID, after "AT" auto-tuning, set the value automatical.

*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 sec ond.

*3: Details of set data lock level selection

Settiong	Details of lock levels
0000	SV and parameter can be set.
0001	Only SV and almarm (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 that SV and alarms (ALM1, ALM2) can be set.
0111	SV and parameter cannot be set.

● Each locked setting item can only be monitored.

6. OPERATIONS

6.1 Operation procedures

CAUTIONS

- Connect the input signal wiring, and then turn on the power. Lf the inout signal wiring opens, the instrument judges the input is disconnectde.
  - Upscale *1 : TC input, RTD input (Downscale when the input is shorted)
  - Downscale *1 : TC input (To be specified when ordering), Voltage input (Current input) *2
  - *1 : Alarm output ON (However, for the W or A control action tybe, the control output on both heat-side and cool-side is turned off.)
  - *2 : For 0 to 5 V DC or 0 to 20 mA DC, both control and alarm outputs are indefinite
- No influence is sxerted upon the instrument for power failure of 20 ms or less. For power failure of more than 20 ms, the insttument performs thesame operation as that at the time of power on after power recovery (This applies only when alarm action is turned off).
- The alarm hold action is activated when not only the power is turned on, but also the SV is changed.

(1) Prior to starting operation, check that the mounting and wiring have been finished, and that the SV and various parmeters have been set.
(2) As this instrument does not have apower supply switch, it is ready to operate as soon as the power is turned on. Prior or factory 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 SⲅⲟP (STOP).
  - Output: Control output OFF, Alarm output OFF
  - Supended 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 mode, the instrument stars is STOP mode when the power is turned on again.

6.2 Set data lock (LOCK) function

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

6.3 Autotuning (AT) function

The AT function automatically measures, computes and sets the optimun PID and lba constants. This function is activated after-ON, during temperature rise and/or when control is atabilized 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 lba.
- Confirm the LCK function has not been engaged.

■ Requirements for AT suspension

Start AT function is suspended if any of any the following conditions is established:
- 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 ifunction does not end in about 9 hours after tuning started.

NOTES

- If the AT suspension condition is established, the AT function is immediately suspended to be changed to PID control.
  The PID and lba constants at this time are the same as before starting AT. In addition, even if the AT iscompleted, 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.

7. DISPLAY AT ERROR OCCURRENCE

■ Error display

Err	RAM failure (Incorrect set data write, etc.)	Please contact us or your nearest RKC agent.

■ Overscale and Underscale

Measured value (PV) (Flashing)	Measured value (PV) exceeds the input range.	
⊓⊓⊓⊓ (Flashing)	**Overscale** Measured value (PV) exceeds the high input display range limit.	⚠ **WARNING** In order to prevent electric shock, porior to replacing the sensor, always turn off the power.
⊔⊔⊔⊔ (Flashing)	**Underscale** Measured value (PV) exceeds the low input display range limit.	Sensor input lead check.

8. INPUT RANGE TABLE

Input type			Comde		Input type			Comde		Input type		Comde		Input type		Comde	
	0 to 200 ℃	K	01	S	*1	0 to 1600 ℃	S	01		-199.9 to +649.0℃	D	01	0 to 5 V DC		4	01
	0 to 400 ℃	K	02		*1	0 to 1769 ℃	S	02		-199.9 to +200.0℃	D	02	1 to 5 V DC	-1999	5	01
	0 to 600 ℃	K	03	B	*1	0 to 1800 ℃	B	01		-100.0 to + 50.0℃	D	03	0 to 20 mA DC	to	6	01
	0 to 800 ℃	K	04		*1	0 to 1820 ℃	B	02		-100.0 to +100.0℃	D	04	4 to 20 mA DC	9999	7	01
	0 to 1000 ℃	K	05	E		0 to 1800 ℃	E	01		-100.0 to +200.0℃	D	05				
K	0 to 1200 ℃	K	06			0 to 1000 ℃	E	02	Pt100	0.0 to 50.0℃	D	06				
	0 to 1372 ℃	K	07	N		0 to 1200 ℃	N	01		0.0 to 100.0℃	D	07				
	0 to 100 ℃	K	13			0 to 1300 ℃	N	01		0.0 to 200.0℃	D	08				
	0 to 200 ℃	K	14		*2	-199.9 to +400.0℃	T	01		0.0 to 300.0℃	D	09				
	0 to 450 ℃	K	17	T	*2	-199.9 to +100.0℃	T	02		0.0 to 500.0℃	D	10				
	0 to 500 ℃	K	20			-100.0 to +200.0℃	T	03		0.0 to 400.0℃	D	20				
	0 to 200 ℃	J	01			0.0 to 350.0 ℃	T	04		-199.9 to +649.0℃	P	01				
	0 to 400 ℃	J	02	W5Re/		0 to 2000 ℃	W	01		-199.9 to +200.0℃	P	02				
	0 to 600 ℃	J	03	W26Re		0 to 2320 ℃	W	02		-100.0 to + 50.0℃	P	03				
	0 to 800 ℃	J	04			0 to 1800 ℃	A	01		-100.0 to +100.0℃	P	04				
J	0 to 1000 ℃	J	05	PLII		0 to 1390 ℃	A	02		-100.0 to +200.0℃	P	05				
	0 to 1200 ℃	J	06			0 to 1200 ℃	A	03	JPT100	0.0 to 50.0℃	P	06				
	0 to 450 ℃	J	10		*2	-199.9 to +600.0℃	U	01		0.0 to 100.0℃	P	07				
	0 to 500 ℃	J	20	U	*2	-199.9 to +100.0℃	U	02		0.0 to 200.0℃	P	08				
	*1 0 to 1600 ℃	R	01			0.0 to 400.0℃	U	03		0.0 to 300.0℃	P	09				
R	*1 0 to 1769 ℃	R	02	L		0 to 400 ℃	L	01		0.0 to 500.0℃	P	10				
	*1 0 to 1350 ℃	R	04			0 to 800 ℃	L	02		0.0 to 400.0℃	P	20				

*1 0 to 399℃ : Accuracy is guaranteed.　　*1 -199.9 to -100.0℃ : Accuracy is not guaranteed.