

# DB600 SERIES DIGITAL INDICATING CONTROLLER



The DB600 series is a digital indicating controller with the indicating accuracy of  $\pm 0.1\%$  and the control cycle of approximately 0.1 seconds.

Various functions including universal input and multiple setting values (8 types) are provided as standard.

There are three types of size.

DB670 --- 96 x 96mm, DB650 --- 48 x 96mm,

DB630 --- 48 x 48mm



## FEATURES

### ● Excellent control performance

PID control algorithm and Z control algorithm are selectable according to the application.

PID control algorithm: Conventional control method

Z control algorithm: Our new algorithm (patent pending) which has evolved the PID control method. Especially, the effect can be expected such as overshoot suppression and speedy recovery in the event of disturbance control (during opening and closing of the electric furnace).

### ● Large easy-to-view 5-digit 11 segments display

Process value (PV) and set value (SV) are displayed by large easy-to-view 5-digit display indicators. The resolution of  $0.1^{\circ}\text{C}$  is enabled for more than  $1000^{\circ}\text{C}$ .

### ● Highly-functional operation screen and settings screen

The controller inherits the operation screen and the settings screen adopting the LCD (liquid-crystal-display) which has been familiarized for long time. Furthermore, the screens have become high-definition and highly sophisticated.

### ● Operability inheriting previous models

The controller inherits the settings screen which has been familiarized for long time. You can set up it with operation which is not different from previous models. The performance of touch-keys has been improved and the outstanding operability has been realized.

### ● 24V power supply voltage type available

The power supply voltage 24V (AC/DC) type, which is advantageous in respect of safe, is available.

### ● Various operating status in one glance

Operating condition

Setting value ramp (option for program model)

Analog bar output

### ● Universal input

Various measurement ranges of DC voltage (up to maximum 10V) inputs, DC current input, thermocouple inputs and resistance thermometer inputs have been built-in.

### ● Program Operation (option)

Set 4 patterns, 12 steps.

### ● Conforming to international safety standards and European directives (CE) (conformity pending)

The controller is in conformity with European directives (CE), and is UL and c-UL approved.

### ● Engineering Software (Standard attached)

By connecting to PC with exclusive USB engineering cable (RZ-EC3) (sold separately), you can load / save parameter data and acquisition.

## What is Z control?

Z Control is applied from control algorithm of skunk cabbage (white arum).

Skunk cabbage is a plant that generates heat to maintain body temperature at about  $20^{\circ}\text{C}$  in spite of changes in the outside temperature.

Incorporating system of heating control by minimum energy to the controller.



## Excellent control

Control algorithm (PID control, Z control)

You can choose the control algorithm PID control and Z control depending on the controlled object or application.

### PID control

Conventional control algorithm

### Z control

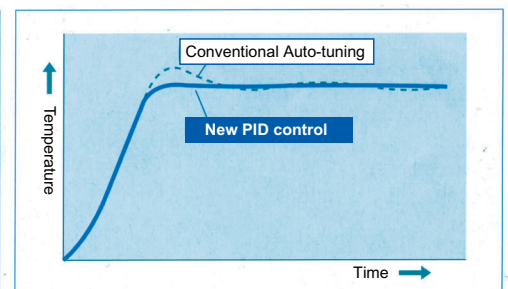
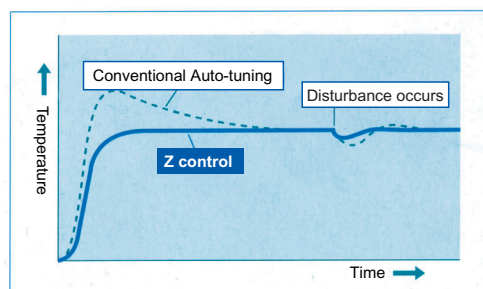
It is our original control algorithm which we evolved from general PID control.

Especially during heating control, it can suppress overshoot effect, shortening stabilization time, speed up of returning speed from disturbance (ex. the opening and closing of the oven door).

### Achieve better control condition by new auto-tuning

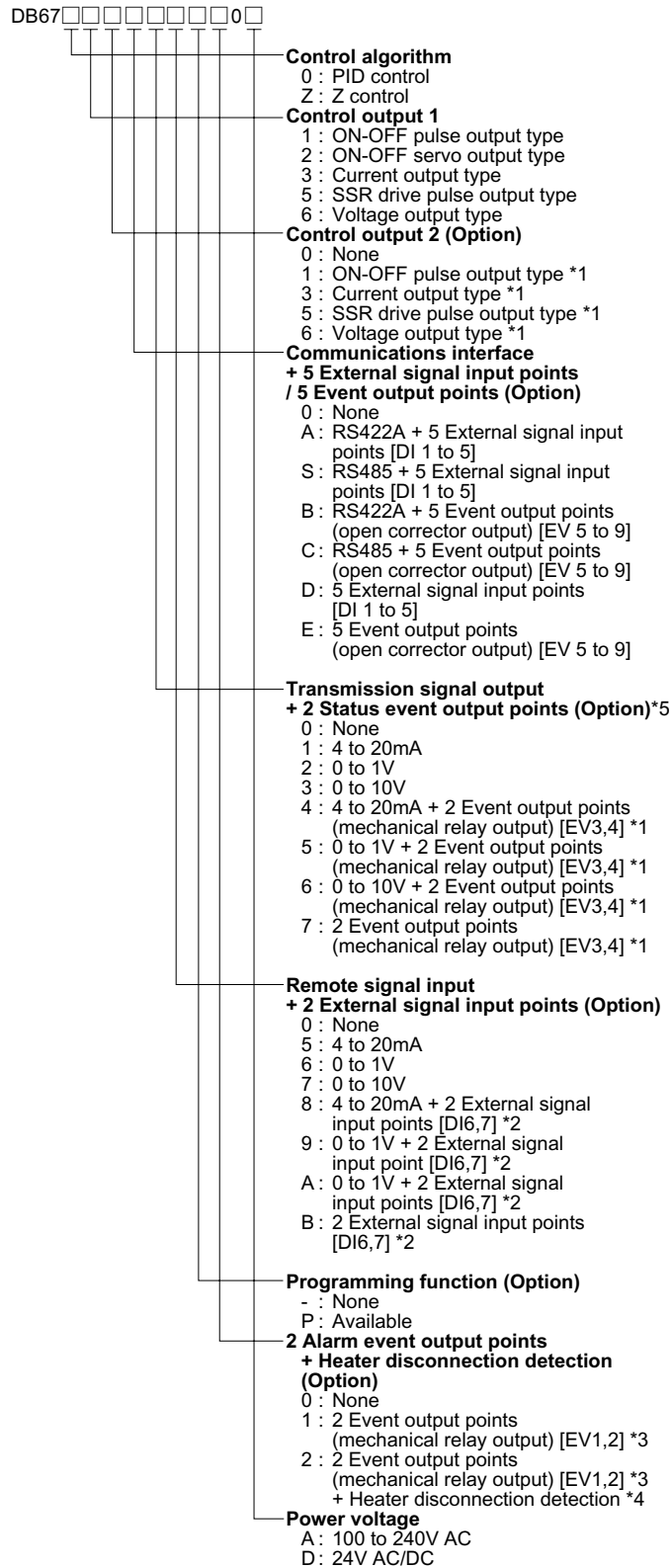
Improved conventional auto-tuning and determine more appropriate control parameter setting.

Compared to the conventional method, it can suppress overshooting and deduct of the settling time.

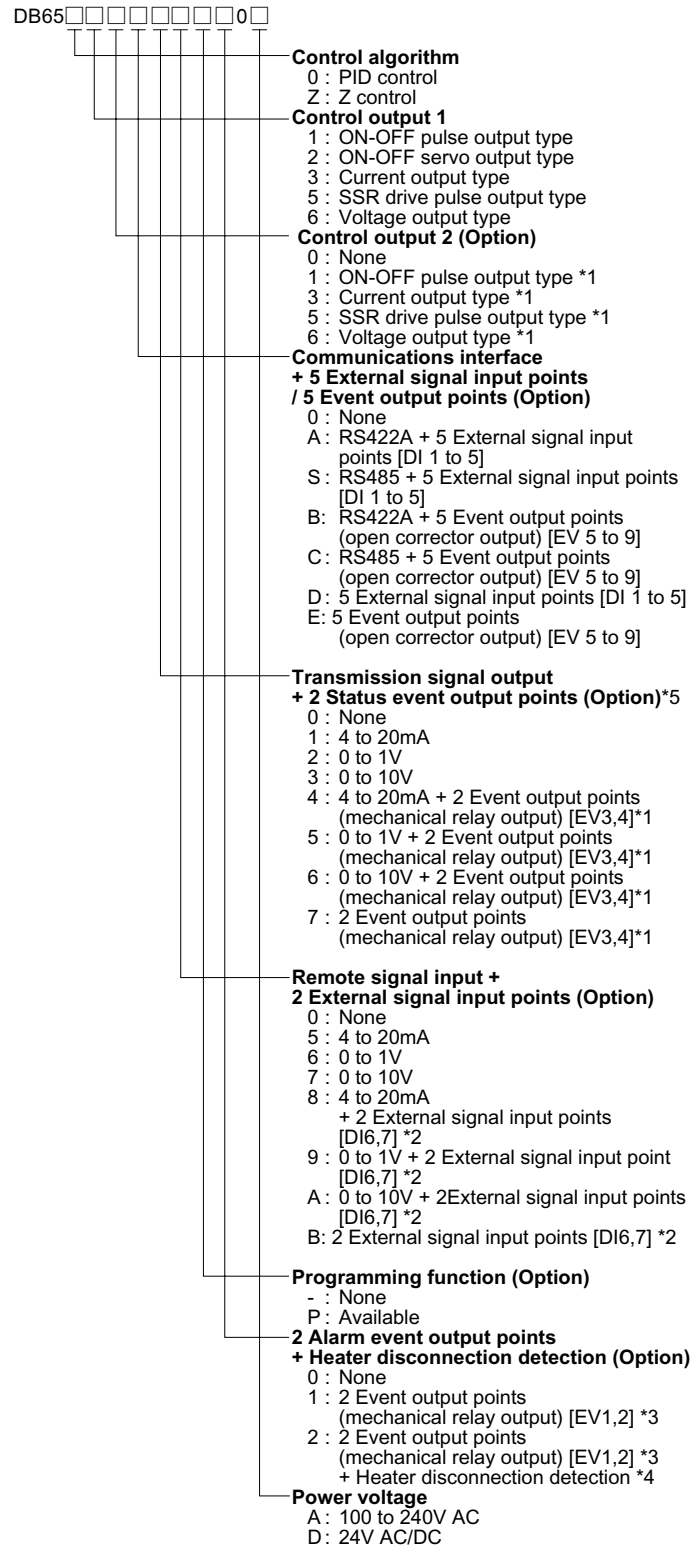


MODELS

DB670



DB650

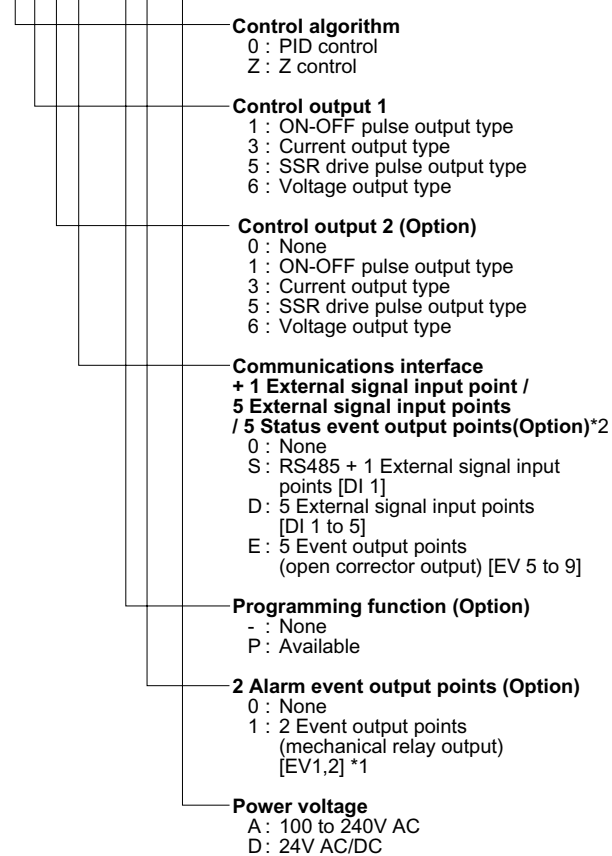


\*1 It can be specified when Control output 1 is "1", "3", "5" or "6".  
\*2 It can be specified when 2 Event output points + Heater disconnection detection is "0" or "1".  
\*3 When specification with Control output 2, number of event output points is only 1 point [EV2]  
\*4 It can be specified when Control output 1 and Control output 2 are "1" or "5" and Remote signal input + 2 External signal input points is "0", "5", "6" or "7".  
However, if Control output 1 and Control output 2 are both "1" or "5", it can be operated with Control output 1.  
\*5 Does not operate at alarm event.

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**DB630**

DB63□□□00□□0□



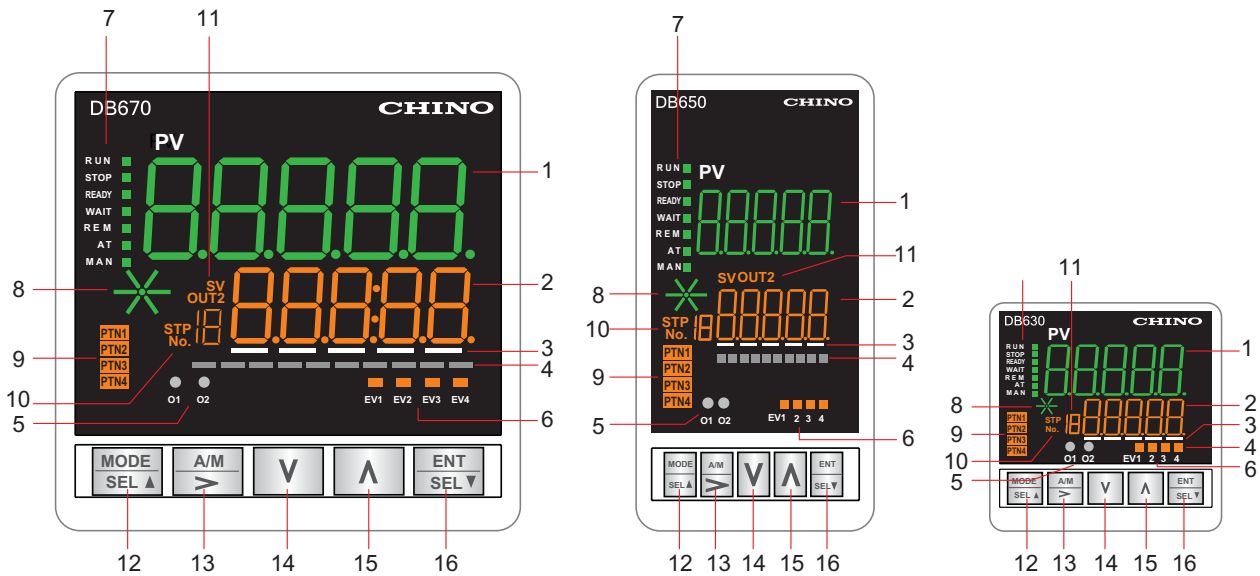
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 \*2 Does not operate at alarm event.

**MEASURING RANGES**

Input type		Measuring ranges	Measuring accuracy	
Thermocouple	B	0.0 to 1820.0°C	±0.1% of FS ±1digit For below 0°C, ±0.2% of FS ±1digit	Below 400°C: Out of specifications 400 to 800°C: ±0.2%FS±1digit
	R	0.0 to 1760.0°C		Below 400°C: ±0.2%±FS1digit
	S	0.0 to 1760.0°C		
	N	0.0 to 1760.0°C		
	K1	-200.0 to 1370.0°C		
	K2	-200.0 to 500.0°C		
	E	-200.0 to 900.0°C		
	J	-200.0 to 1200.0°C		
	T	-200.0 to 400.0°C		
	U	-200.0 to 400.0°C		
	L	-200.0 to 900.0°C		
	WRe5-WRe26	0.0 to 2310.0°C		
	W-WRe26	0.0 to 2310.0°C		
	PlatineII	0.0 to 1390.0°C		
RTD	PtRh40-PtRh20	0.0 to 1880.0°C	±0.3% of FS ±1digit	Below 400°C: ±1.5%FS±1digit 400 to 800°C: ±0.8%FS±1digit
	Au-Pt	0.0 to 1000°C	±0.1% of FS ±1digit	
	Pt100	-200.0 to 850.0°C -200.0 to 200.0°C	±0.1% of FS ±1digit	
	JPt100	-200.0 to 649.0°C -200.0 to 200.0°C		
	Pt50	-200.0 to 649.0°C		
DC voltage	20mV	-20.00 to 20.00mV	±0.1% of FS ±1digit	
	100mV	-100.00 to 100.00mV		
	5V	-5.000 to 5.000mV		
	10V	-10.00 to 10.00mV		

\* Accuracy indicates the performance under reference operating condition.  
 \* For thermocouple, the reference junction compensation accuracy is added to the above measured accuracy.  
 \* To measure DC current, ranges is converted to DC voltage by optional shunt resistor [250 Ω]

■ NAMES OF VARIOUS PARTS



Display

1. Measured value (PV)/ Parameter setting title
2. Setting value (SV)/ operating condition/ parameter setting value
3. Cursor for setting parameter
4. Analog bar
5. Output
6. Event
7. Operating condition display
  - Constant value operation (program operation OFF)
  - Program operation (program operation ON)
  - \*Option model only
8. Setting value ramp display
  - Constant value operation (program operation OFF)
  - Program operation (program operation ON)
  - \*Option model only
9. Pattern No. (program operation ON)
  - \*Option model only
10. Execution No./ Step No.
  - Constant value operation (program operation OFF)
  - Program operation (program operation ON)
  - \*Option model only
11. Operation screen display
  - Lights when displaying [PV/SV], [PV/OUT], [PV/OUT2]

Function keys

12. [MODE] key : Depending on the screen of which key is pressed at, following screen is displayed.
  - Displays operation initial screen, when displaying operation screen expect for operation initial screen.
  - Displays initial screen of MODE0, when displaying operation initial screen of operation screen.
  - Displays operation initial screen, when displaying initial screen of setting screen.
  - Displays initial screen of setting screen, when displaying setting screen expect for initial screen.
- [SELECT] key (REVERSE) : Switches operation screen or MODE screen in reverse direction
- [CANCEL] key : While setting/changing of parameter (dot at first digit of setting value blinks), setting/changing can be canceled. After the cancelation, dot blinking of setting value turns OFF.
13. [A/M] key : Switches AUTO/MAN of output 1/output 2. Operates while displaying operation screen. It cannot be operated while displaying setting screen.
  - [>] key : Moves cursor for setting parameter to the right when setting numeric value on the parameter setting screen. It cannot be operated while displaying operation screen.
14. [V] key : Decreases (decrement/changing of parameter) setting parameter and initial screen of each setting screen.
15. [^] key : Increases (increment/changing of parameter) setting parameter and initial screen of each setting screen.
16. [ENTER] key : Registers setting / changing parameter. After the registration , dot blinking of setting value of setting/ changing parameter turns OFF.
  - [SELECT] key: Switches operation screen and MODE screen to the forward direction.

## INPUT SPECIFICATIONS

Input type:	Thermocouple B, R, S, N, K, E, J, T, U, L, WRe5-WRe26, W-WRe26, Platine II, PtRh40-PtRh20, Au-Pt DC voltage $\pm 20\text{mV}$ , $\pm 100\text{mV}$ , $\pm 5\text{V}$ , $\pm 10\text{V}$ Resistance thermometer Pt100, JPt100, Pt50
Measuring range:	Thermocouple 16 ranges, DC voltage 4 ranges, DC voltage 1 range Resistance thermometer 5 ranges
Temperature unit:	$^{\circ}\text{C}$
Accuracy rating:	$\pm 0.1\%$ of FS $\pm 1$ digit of measuring range For details, refer to "measuring ranges and accuracy ratings"
Reference junction compensation accuracy:	$\pm 1.0^{\circ}\text{C}$ (ambient temperature $23^{\circ}\text{C} \pm 10^{\circ}$ ) $\pm 2.0^{\circ}\text{C}$ (temperatures other than above)
Sampling rate:	Approx. 0.1 seconds
Burnout:	Upper limit burnout is provided for thermocouple, resistance thermometer and DC voltage (20mA) only as standard. Output 1 produces PV abnormal output and output 2 is fixed to 0% when burnout occurs. Upper limit alarm event is output.
Input impedance:	Thermocouple $1\text{M}\Omega$ or more DC voltage Approx. $1\text{M}\Omega$
Allowable signal source resistance:	Thermocouple $100\Omega$ or less DC voltage (mV) $100\Omega$ or less DC voltage (V) $300\Omega$ or less
Allowable wire resistance:	Resistance thermometer $10\Omega/1$ wire or less (resistance of 3 wires should be equal to one another)
Resistance thermometer measurement current:	Approx. 1mA
Maximum allowable input:	Thermocouple $\pm 10\text{VDC}$ DC Voltage (mV) $\pm 10\text{V DC}$ DC Voltage (V) $\pm 20\text{V DC}$ Resistance thermometer $\pm 5\text{V DC}$
Maximum common mode voltage:	30VAC
Common mode rejection ratio:	130dB or more (50/60Hz)
Series mode rejection ratio:	50dB or more (50/60Hz)

## CONTROL SPECIFICATIONS

Control interval:	Approx. 0.1 seconds
Output type:	ON-OFF pulse output, ON-OFF servo output (DB650 and DB670 only), Current output, SSR drive pulse output, Voltage output
ON-OFF pulse type:	
Contact type	1a contact
Pulse cycle	Approx. 1 to 180 seconds
Contact capacity	Resistive load 240VAC 3A 30VDC 3A Inductive load 240VAC 1.5A 30VDC 1.5A Minimum load 5VDC 10mA
ON-OFF servo output type:	
Contact type	1a contact
Feedback resistance	$100\Omega$ to $2\text{K}\Omega$
Contact capacity	Resistive load 240VAC 3A 30VDC 3A Inductive load 40VAC 1.5A 30VDC 1.5A Minimum load 5VDC 10mA
Current output type:	
Output specification	4 to 20mA DC
Load resistance	$600\Omega$ or less
SSR drive pulse output type:	
Pulse cycle	Approx. 1 to 180 seconds
Output specification	ON 12V DC $\pm 20\%$ (load current 21mA or less) OFF 0.8V DC or less
Voltage output type:	
Output specification	0 to 10V DC
Output resistance	Approx. $10\Omega$
Load resistance	$50\text{K}\Omega$ or more
Specification with 2 outputs:	
Output type	Any combination between ON-OFF pulse, output, current output, SSR drive pulse output and voltage output is possible.
Insulation	Non-isolated between 2 outputs (ON-OFF pulse output type excluded)
Control system	Z, PID

## DISPLAY SPECIFICATIONS

Display: Segment type LCD (LED backlight)

## GENERAL SPECIFICATIONS

Rated power voltage:	100 to 240V AC ( $\pm 10\%$ ) 24V AC/DC ( $\pm 10\%$ )
Rated power supply frequency:	50/60Hz ( $\pm 2\%$ )
Maximum power consumption:	
100 to 240V AC (without option)	DB630 100V AC 4VA 240V AC 5VA DB650 100V AC 4VA 240V AC 6VA DB670 100V AC 4VA 240V AC 6VA
100 to 240V AC (with option)	DB630 100V AC 5VA 240V AC 7VA DB650 100V AC 7VA 240V AC 10VA DB670 100V AC 9VA 240V AC 12VA
24V AC/DC (without option)	DB630 24V AC 3VA 24V DC 2W DB650 24V AC 4VA 24V DC 3W DB670 24V AC 4VA 24V DC 3W
24V AC/DC (with option)	DB630 24V AC 4VA 24V DC 3W DB650 24V AC 7VA 24V DC 5W DB670 24V AC 8VA 24V DC 6W
Countermeasure against power failure:	Store setting contents in non-volatile memory. (Rewrite: 1 million times)
Insulation resistance:	Between the primary and secondary terminals $20\text{M}\Omega$ or more (500V DC) *Primary terminal: Power terminal (100 to 240V AC) EV1 to 4 output terminals (relay output), ON-OFF pulse output terminal (relay output), ON-OFF servo output terminal (M3,M2,M1) Secondary terminal: Power terminal (24V AC/DC), all terminals expect primary terminals
Withstand voltage:	Between the primary and secondary terminals 1500V AC (1 minute) *See "Insulation resistance" for the primary and secondary terminals.
Casing:	Fire-retardant polycarbonate (UL94V-2)
Color:	Gray
Mounting:	Panel mounting type
External dimensions:	
DB630	48(W) x 48(H) x 88(D)mm Depth from panel surface is 80mm
DB650	48(W) x 96(H) x 73(D)mm Depth from panel surface is 65mm
DB670	96(W) x 96(H) x 73(D)mm Depth from panel surface is 65mm
Weight:	
DB630	(Without option) Approx. 120g (With option) Approx. 135g
DB650	(Without option) Approx. 150g (With option) Approx. 230g
DB670	(Without option) Approx. 240g (With option) Approx. 330g
Terminal screw:	M3.0
Engineering port:	DB630 At the bottom of the case DB650 At the top of the case DB670 At the top of the case



## REFERENCE OPERATING CONDITIONS

Ambient temperature: 23°C ± 2°C

Ambient humidity: 55%RH ± 5% (no condensation)

Power voltage: 100VAC ± 1%

Power supply frequency: 50/60Hz ± 0.5%

Mounting orientation: Backward / forward ±3°, laterally ±3°

Installation height: Below 2000m

Vibration: 0m/s<sup>2</sup>

Shock: 0m/s<sup>2</sup>

Installation condition: Single panel mounting (space required around)

Wind: None

External noise: None

Warm up time: At least 30 minutes

## NORMAL OPERATING CONDITIONS

Ambient temperature: -10°C to 50°C (-10°C to 40°C for close installation)

Maximum ambient humidity (ambient temperature -10 to 31°C): 90%RH (no condensation)

Maximum ambient humidity (ambient temperature 31 to 50°C): 90 to 50%RH (no condensation)  
\*Decreases linearly from 90% RH at 31°C, or to 50% RH at 50°C.

Minimum ambient humidity: 20%RH

Power voltage: 100 to 240V AC 90 to 264V AC  
24V AC/DC 21.6 to 26.4V AC/DC

Power supply frequency: 50/60Hz ± 2%

Mounting orientation: Backward/forward ±10°, laterally ±10°

Installation height: Below 2000m

Vibration: 0m/s<sup>2</sup>

Shock: 0m/s<sup>2</sup>

Installation condition: Panel mounting(space above and below)

External noise: None

Ambient temperature variation ratio: 10°C/hour or less

## TRANSPORT CONDITIONS

Ambient temperature: -20°C to 60°C

Ambient humidity: 5 to 95%RH (no condensation)

Vibration: 4.9m/s<sup>2</sup> or less (10 to 60Hz)

Shock: 392m/s<sup>2</sup> or less (under factory packing condition)

## STORAGE CONDITIONS

Ambient temperature: -20°C to 60°C  
\*10 to 30°C for long-term storage

Ambient humidity: 5 to 95%RH (no condensation)

Vibration: 0m/s<sup>2</sup>

Shock: 0m/s<sup>2</sup> (under factory packing condition)

## STANDARD

Safety: EN61010-1 (CE marking)  
UL61010-1 2nd edition (UL)  
CAN/CSA C22.2 No.61010-1(c-UL)  
Setup category: CAT.II, pollution degree: 2

EMC applicable: EN61326-1 ClassA Table2  
CE marking EN5011 ClassA Group1  
EN61000-3-2 ClassA  
EN61000-3-3  
\*Indication or output value varies by the amount equivalent to ±10% of FS or ±2mV, whichever is larger, during testing.

Structure: Casing protection  
IEC60529 IP65 equivalent  
(Unapplied for close installation)

## OPTIONS

### ●Programming Function (option)

Output point: 1 point

Patterns: 4 patterns (Max. 9,999 times repeatable)

Steps: 12 steps /1pattern

Step setup range: Target value --- Input scale range  
Ramp rate --- -99.999 to 99.999  
Time --- 0 to 999 hours 59 minutes or 0 to 999 minutes 59 seconds

Start temperature: Select either PV start or SV start (arbitrary value settable)

End output: Select either constant value control (setting: -5 to 105%)

### ●Transmission signal output (option for DB630/670)

Output point: 1 point

Output signal: 4 to 20mA DC (load resistance 400Ω or less)  
0 to 1V DC (load resistance 50kΩ or more)  
0 to 10V DC (load resistance 50kΩ or more)

Accuracy: ±0.3% of full scale

Output updating interval: Approx. 0.1 seconds

Insulation: Non-isolated between the adjustment output 1 and 2 (ON-OFF pulse output type excluded)

### ●Remote signal input (option for DB630/670)

Input point: 1 point

Input signal: 4 to 20mA DC (Input impedance Approx. 50Ω)  
0 to 1V DC (Input impedance Approx. 500kΩ)  
0 to 10V DC (Input impedance Approx. 100kΩ)

Maximum allowable input: DC current ±30mA or less  
±1.5V DC or less  
DC voltage ±20V DC or less

Accuracy: ±0.3% of full scale ± 1digit

Sampling rate: Approx. 0.1 seconds

External signal switch: R/L (Remote/Local)

### ●Communications interface (option)

Type: DB630 RS485  
DB650 } RS422A,RS485  
DB670 }

Protocol: MODBUS-RTU, MODBUS-ASCII, Private (used for digital transmission/digital remote input)

Function: Host communication/digital transmission/digital remote input

### ●Alarm specifications (option)

Number of alarm points: Mechanical Relay : DB630 2 points  
DB650/670 4 points

Open collector: 5 points

Alarm event (EV1 to 4): Absolute value alarm, deviation alarm, absolute value deviation alarm, set point alarm, heater disconnection alarm (only for the case adjustment output 1 uses ON-OFF pulse output or SSR drive pulse output), timer1, timer2, FAIL

Status event (EV1 to 9): Constant value operation RUN, preset manual, remote input, SV rise, SV fail  
Program function: Step switching, step 4 to 12, RUN, STOP, ADVANCE, RESET, END, SV keep

### ●Heater disconnection detection (option)

Functions: Measure heater current using an external current transformer (CT) to detect disconnection.

Input points: 1 point

Input signals: 5.0-50.0A (50 / 60Hz)  
\*Specified external current transformer (CT) required.

Accuracy: ±5.0% of FS ±1digit

### ●External signal input (option)

Input point: DB630 5 points maximum, COM shared  
DB650 7 points maximum, COM shared  
DB670 7 points maximum, COM shared

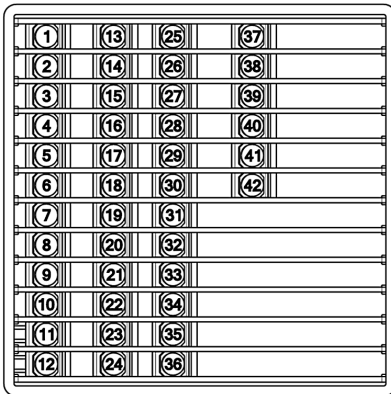
Input signal: No voltage contact

External contact capacity: 5V DC 2mA

Function: Constant value operation RUN/READY switch, AUTO/MAN switch, preset manual, timer 1, timer 2, alarm event reset, execution No. selection, program/constant value operation switch, program operation RUN/STOP switch, program operation ADVANCE, program operation RESET, program pattern selection

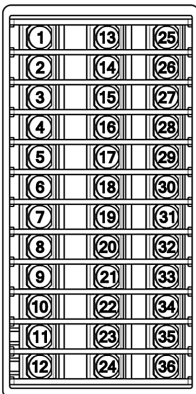
## ■ TERMINAL ARRANGEMENT

### ● DB670



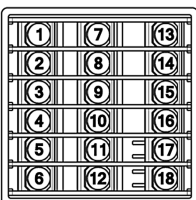
1	Measuring input +	13	Communication RDA	SA	25	EV3	37	Servo M3
2	Measuring input A+	14	Communication RDB	SB	26	EV3 COM	38	Servo M2
3	Measuring input B+	15	Communication SDA		27	EV4	39	Servo M1
4	Measuring input b	16	Communication SDB		28	EV4 COM	40	Servo R1
5	Control output 1+	17	Communication SG	SG	29	Transmission output +	41	Servo RC
6	Control output 1-	18	R/L(digital)DI		30	Transmission output -	42	Servo R2
7	Control output 2+	EV1	19	DI1	EV5	31	Remote input +	
8	Control output 2-	EV1 COM	20	DI2	EV6	32	Remote input -	
9	EV2	21	DI3	EV7	33	R/L(analog)DI		
10	EV2 COM	22	DI4	EV8	34	CT	DI6	
11	Power L	23	DI5	EV9	35	CT	DI7	
12	Power N/-	24	R/L & DI COM	R/L & EV COM	36	R/L & DI COM		

### ● DB650



1	Measuring input +	13	Communication RDA	SA	25	EV3		Servo M3
2	Measuring input A+	14	Communication RDB	SB	26	EV3 COM		Servo M2
3	Measuring input B+	15	Communication SDA		27	EV4		Servo M1
4	Measuring input b	16	Communication SDB		28	EV4 COM		Servo R1
5	Control output 1+	17	Communication SG	SG	29	Transmission output +		Servo RC
6	Control output 1-	18	R/L(digital)DI		30	Transmission output -		Servo R2
7	Control output 2+	EV1	19	DI1	EV5	31	Remote input +	Transmission output +
8	Control output 2-	EV1 COM	20	DI2	EV6	32	Remote input -	Transmission output -
9	EV2	21	DI3	EV7	33	R/L(analog)DI		Remote input +
10	EV2 COM	22	DI4	EV8	34	CT	DI6	Remote input +
11	Power L/-	23	DI5	EV9	35	CT	DI7	R/L(analog)DI
12	Power N/-	24	R/L & DI COM	R/L & EV COM	36	R/L & DI COM		R/L COM

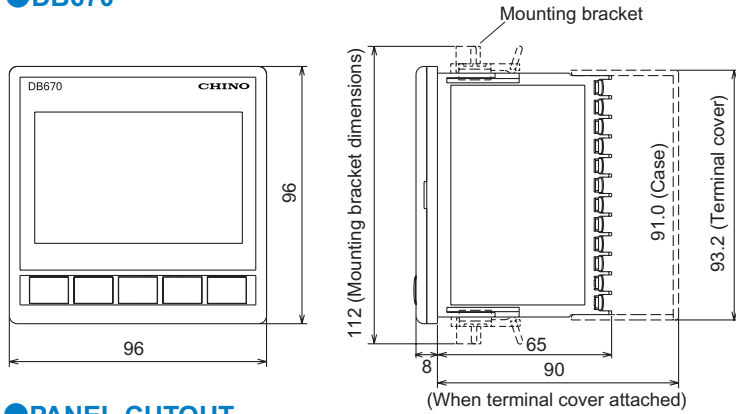
### ● DB630



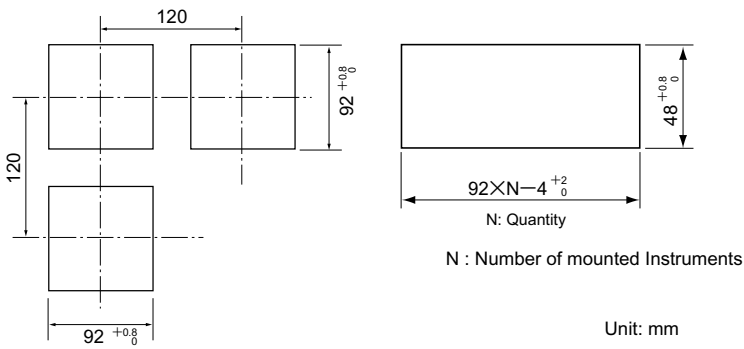
1	Control output 1+	7	Communication SA	DI1	EV5	13	Control output 2+	EV1
2	Control output 1-	8	Communication SB	DI2	EV6	14	Control output 2-	EV1 COM
3	Measuring input +	9	Communication SG	DI3	EV7	15	EV2	
4	Measuring input A+	10	R/L(digital)	DI4	EV8	16	EV2 COM	
5	Measuring input B+	11	DI1	DI5	EV9	17	Power L/-	
6	Measuring input b	12	R/L & DI COM	DI COM	EV COM	18	Power N/-	

**EXTERNAL DIMENSIONS**

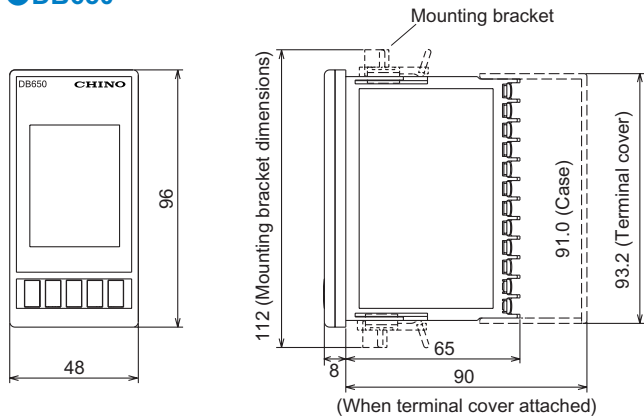
**DB670**



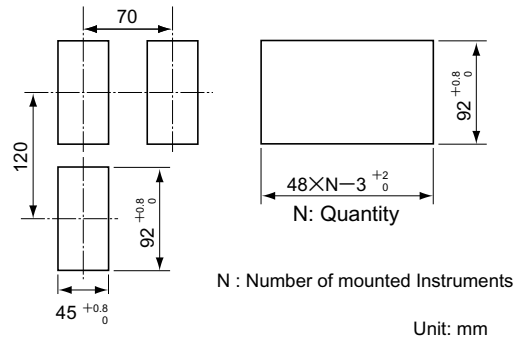
**PANEL CUTOUT**



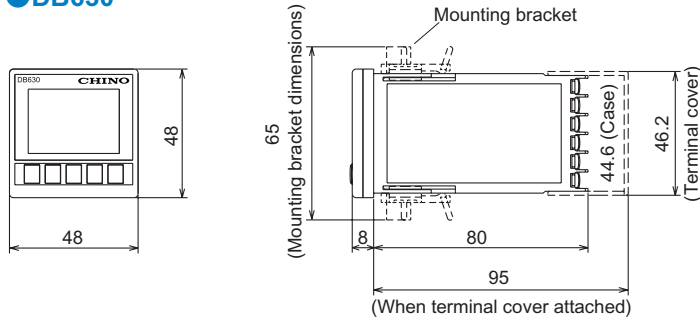
**DB650**



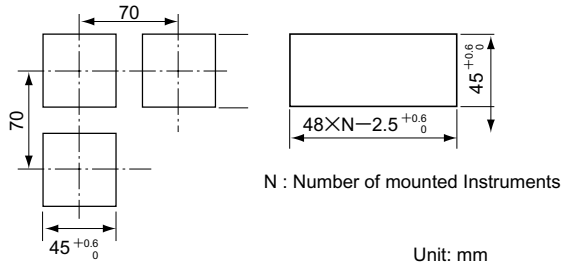
**PANEL CUTOUT**



**DB630**



**PANEL CUTOUT**



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