Digital temperature controller

AX series

HANYOUNG NUX

INSTRUCTION MANUAL

Thank you for purchasing HANYOUNG product.
Please check whether the product is the exactly same as you ordered.
Before using the product, please read this instruction manual carefully.
Please keep this manual where you can view at any time

HANYOUNGNUX CO.,LTD
HEAD OFFICE 28, Gilpa-ro 71beon-gil, Nam-gu, Incheon, Korea
TEL : (82-32)876-4697 FAX : (82-32)876-4696 http://www.hynux.com

Safety information

Alerts declared in the manual are classified to Danger, Warning and Caution by their criticality

⚠ DANGER	DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury
⚠ WARNING	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury
⚠ CAUTION	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury

⚠ DANGER

The electric shock may occur in the input/output terminal so please never let your body and/ or conductive substance to be contacted by the input/output terminal.

⚠ WARNING

- Since this product is not designed as a safely used device the user must install double safety equipment when this product is used for equipment with possible fatal accident or large property damage.
- The power switch and fuse are not installed on this product so users need to install them separately on the outside. (Fuse rating : 250 V 0.5 A)
- Please supply in the rated power supply voltage in order to prevent this product from breaking down or damaged.
- To prevent electric shock and to prevent malfunction, do not supply the power until the wiring is completed.
- This is not designed as explosion-protective structure so avoid using this product at places where gas inflammability and explosive gases exist.
- Do not supply in the power until all wiring is fully completed in order to prevent the product from breaking down and prevent users from getting electric shock.
- Do not disassemble, manufacture, upgrade and repair the product by yourself. Doing so will break down the product, generate the electric shock and cause malfunction to occur.
- Please turn OFF the product and disassemble the product. Not doing so will break down the product, generate the electric shock and cause malfunction to occur.
- Electric shock may occur when operating this product so please install this product to the panel and use it

⚠ CAUTION

- The contents of this manual may be changed without prior notification
- Please check for correct model type and specification
- Please check for any damage or abnormality may caused during shipment.
- Please use this product at following range.
  Ambient temperature : -5 ~ 50 ℃ (when installing them close to each other, max. 40 ℃) / humidity : 35 ~ 85 % R.H (but without dew condensation)
- Please avoid the places where corrosive gas(especially noxious gas, ammonia and etc) and inflammable gas exist
- Please do not use this product at places where the vibration or impact is applied directly.
- Please avoid the places where liquid, oil, medical substances, dust, salt or iron contents exist(avoid place of pollution level 1 or 2)
- Do not clean the product with the organic solvent such as alcohols, benzene and etc. (Use neutral detergents)
- Please avoid the places where huge inductive interference exists and places where static electricity/self noise are generated.
- Display's text cannot be seen due to the light of the sun outside or the bright lightning inside.
- Please avoid the places where heat accumulates due to the direct sunlight, radiation and etc
- We recommend using it at altitude below the 2000 m.
- If the device is touched or contacted by water then short-circuit and fire may occur so please inspect the device carefully.
- With the thermocouple input, please use the stated compensation cable. (Using regular compensation cable will generate the temperature error)
- With the RTD input, please use the cable with less lead-wire resistance and no difference in the resistance among 3-wires. (Using regular cable will generate the temperature error)
- For the input signal wire, please avoid from the power line and load line in order to avoid from the induction noise.
- Separate the input signal wire and output signal wire and if separating them from each other is impossible, then please use the shield wire for the input signal wire.
- For the thermocouple, please use It as the un-grounding type. (When using the grounding type, malfunction may occur due to the electric leakage)
- When there are too much noises generating from the power, we recommend using the insulation Trans and noise filter. Noise filter must be mounted to the panel or etc that is grounded and please try to make the wiring of output and power terminal meter as short as possible.
- Tightly twisting the power line meter will reduce the noise generation
- If alarm function is not set properly, alarm will not be generated when it should so please check for the operation before running the product.
- When replacing the sensor, please turn OFF the power
- If operation frequency is too high (such as proportional operation and etc) and connecting the maximum rated load to output relay will shorten the life expectancy therefore, please use the auxiliary relay. We recommend using the SSR output type in such cases.
  - When using the electrical switch: Set proportional cycle min 20 sec
  - When using the SSR: Set proportional cycle min 1 sec
- Do not wire anything to the un-using terminal
- Please check the polarity of terminal before wiring.
- When installing this product to the panel, please use the authorized switch or circuit breaker (authorized by IEC60947-1 or IEC60947-3)
- Please install the switch or circuit breaker close to the operator for users'convenience
- Because switch or circuit breaker is being installed, please make a note on the panel that operating the switch or circuit breaker will block the power.
- We recommend the continuous inspection and repair in order to use it safely for a long period of time.
- Some parts in this product have life expectancy and gets old as time elapses.
- The warranty period is one year including the parts only under the condition where the product is used properly
- It needs the preparation time for contact output when supplying in the power. When applied as signal to the external interlock circuit and etc, please jointly use the delay relay.
- When changing the instrument or if the product broke down, users can replace with the prepared product but even suffix code stays same, operation may differ due to the parameter difference so please check for the compatibility and perform such action.
- Before using a temperature controller, there could be a temperature difference between PV of the temperature controller and the actual temperature so please operate the temperature controller after compensating the temperature difference appropriately.

Suffix code

Model	Code	Information	
AX	□- □ □	Digital temperature controller	
Dimension	2	AX2 : 48 X 96 ㎜	
	3	AX3 : 96 X 48 ㎜	
	4	AX4 : 48 X 48 ㎜	
	7	AX7 : 72 X 72 ㎜	
	9	AX9 : 96 X 96 ㎜	
Output selection	1	SSR + Relay1 + Relay2	Relay or SSR as control output(selectable in operator setup mode)
	2	SSR + Relay1 + Relay2 + Relay3	
	1B	SSR + Relay1(Form c) + Relay2	Only for AX2, 3, 7, 9
	2B	SSR + Relay1(Form c) + Relay2 + Relay3	
	3	4 - 20 ㎃ + Relay2	Current output as control output
	4	4 - 20 ㎃ + Relay2 + Relay3	
Power supply voltage	A	100 - 240 V AC 50/60 Hz	

※ Form C : Normal close type contact

※ Relay output operates as control output, alarm output and LBA output depending on the internal parameter setting.

Input

Input selection	Multi input (selectable in operator setup mode) • Thermocouple : K, J, R, T (IEC) • RTD : Pt100 Ω(IEC)
Input sampling time	0.1 sec
Input impedance	1 ㏁ max
Allowable wiring resistance	10 Ω/ 1 wire max (RTD). but resistances among 3 wires should be same
Allowable input voltage	10 V DC max

Performance

Display accuracy	±0.3 % of F.S ±1 digit (In case of R type, ±1.0 % of ±1 digit in the 0 ~ 600 ℃ range)
Insulation resistance	More than 20 ㏁, 500 V DC for 1min (Primary terminal-Secondary terminal)
Dielectric strength	2300 V AC 50/60Hz, for 1 min (Primary terminal-Secondary terminal)

Range and input code

Classification	Code	Input type	Range	
			Celsius (℃)	Fahrenheit (℉)
Thermocouple	K1	K	- 100 ~ 1200	-148 ~ 2192
	K2		-100.0 ~ 500.0	-148 ~ 932
	J	J	-100.0 ~ 500.0	-148 ~ 932
	r	R	0 ~ 1700	32 ~ 3092
	t	T	-100.0 ~ 400.0	-148 ~ 752
RTD	Pt	Pt100 Ω	-100.0 ~ 400.0	-148.0 ~ 752.0

Control function and output

- Control type : PID control, P control, ON/OFF control
- Auto-tuning : PID operation by the auto-tuning
- ON/OFF control : When PV 〉 SV, it generates 0 % output.
  When PV 〈 SV, it generates 100 % output. (Only when control hysteresis is 0)
- Manual reset : Users set within the range from 0 % to 100 %.
- Control output operation : Direct action/Reverse action (selected by the parameter setting)
- Control output : Relay output/voltage pulse output (SSR output) * Selected by the parameter setting

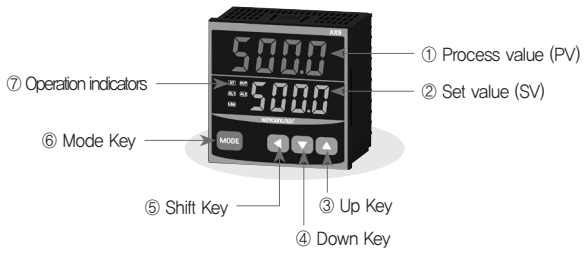
Relay	1a contact, 3 A 240 V AC, 3 A 30 V DC (Resistive load)	
	• Relay output can be selected maximum 3 and relay control output is displayed as RLY1. • Alarm output 2 contacts (AL1, AL2) and LBA output are assigned by the users among RLY1, RLY2 and RLY3	
S.S.R	CYC	12 – 15 V DC pulse voltage (resistive load min 600 Ω)
	PHA	
4 – 20 ㎃	Accuracy : 0.5 % of F.S, Ripple Vp–p : 0.3 % of F.S, Resistive load : Max 600 Ω	

Specification

Model	A X2	A X3	A X4	A X7	A X9
Power supply voltage	100 – 240 V AC 50/60 Hz				
Voltage fluctuation	±10 % of power supply voltage				
Power consumption	5.5 VA max				
Ambient temperature	–5 ~ 50 ℃				
Ambient humidity	35 ~ 85 % R.H (But without dew condensation)				
Vibration (resistance)	10 – 55 Hz, 0.75 ㎜, X Y Z each in X, Y and Z directions for 2 hour				
Shock (resistance)	300 m/s² to 6 directions each 3 times				
Weight	320 g	320 g	180 g	300 g	400 g

※ Weight included the weight of box

Function and name of each part



№	Model		Information
①	Process value (PV)		Display the current temperature in the operation screen
②	Set value (SV)		Display the set temperature in the operation screen
③	▲	Up Key	change the operation screen, increase the set value, move to the parameter setting mode
④	▼	Down Key	Decrease the set value, move to the parameter setting mode
⑤	◀	Shift Key	• Shift to the set value digits • Move from operation screen – users • Move from operator – setting mode
⑥	MODE	Mode Key	• Move from operation screen – users • Move from operator – setting mode
⑦	AT	Operation indicators	Light ON with the PID auto tuning
	OUT		Light ON with the control output operation
	AL1		Light ON with the Alarm1 operation
	AL2		Light ON with the Alarm2 operation
	LBA		Light ON with the Loop break alarm operation

Main function explanation

■ PID auto tuning (A.T) function

Auto tuning function measures, computes and sets the optimum PID or ARW constant automatically. After supplying power in and while temperature is increasing, press the set key MODE and ▲ key synchronously for 2 sec. to begin the auto tuning. When auto tuning is finished, tuning operation will be ended automatically.

■ bOUt display

When input break (sensor break) occurs or exceeds the maximum temperature range, bOUt will be displayed in the measured value displaying unit.

■ Alarm

● Using the alarm

AX series supports 2 independent alarms (AL1 and AL2). These alarms can allocate AL1 or AL2 signal in the RLY1, RLY2 and RLY3 and be used. If alarm signal is not allocated in the RLY1 to RLY3 then the menu related to the alarm will not be displayed.

● Alarm hold action

If there is no standby action function, supply the power in then the LOW alarm will become ON while temperature is increasing.

In order to prevent the low alarm to become ON during temperature is increasing, add the standby action function so from the point when supplying in the power to until the value goes beyond the set value, it can prevent the low alarm to be operated.

● Alarm output LOCK

It the AnoH value is ON, Alarm is not cancelled evenif it becomes the alarm cancel condition. If users want to stop the alarm forcedly, please press the ▲ key for approx 2 sec.

■ LBA (Loop Break Alarm)

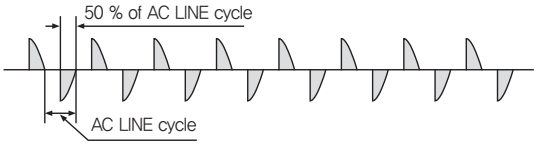
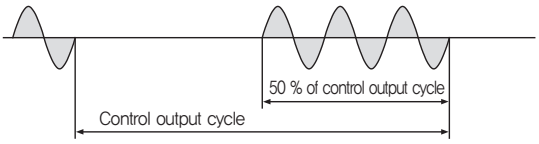
LBA function starts to measure time from the moment when the PID computed value becomes 0 % or 100 %. Also, from this point, this function detects heater break, sensor break manipulator malfunction and etc by comparing the changed amount of measured value in each set time. Also, it can set the LBA dead band in order to prevent any malfunction to happen in the normal control loop.

① When control output value which obtained by PID operation is 100 %,
If the temperature does increase more than LbAu value within the LBA set time, LBA output will become ON

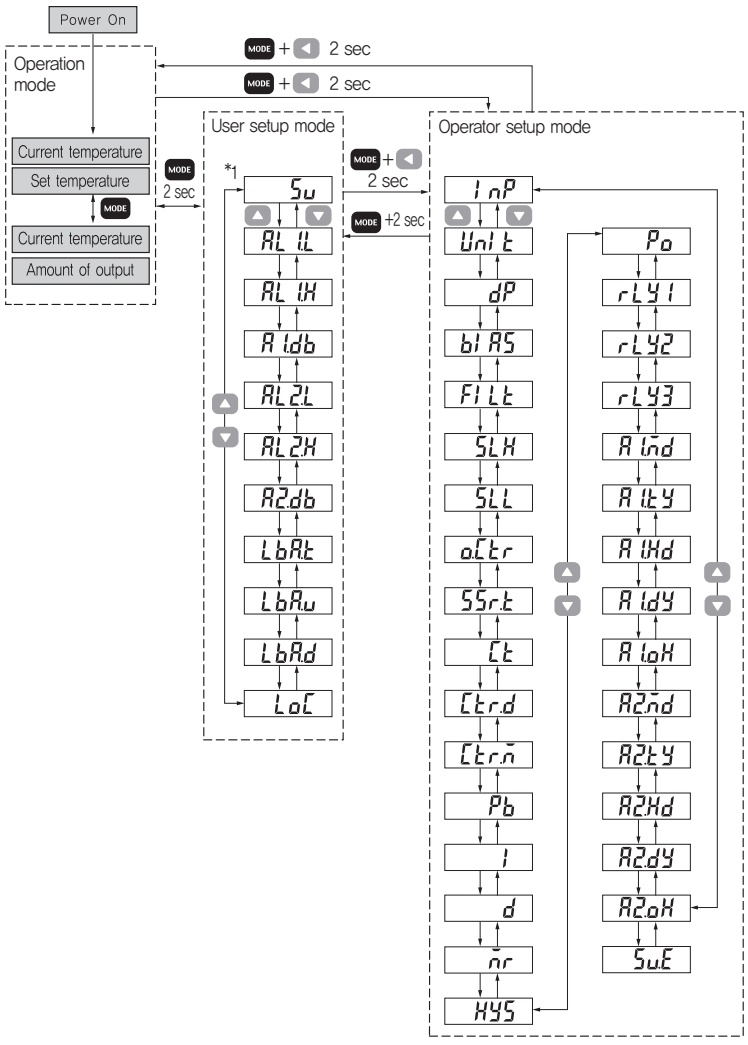
② When control output value which obtained by PID operation is 0 %,
If the temperature does decrease more than LbAu value within the LBA set time, LBA output will become ON

■ Timeshare cycle control and phase control of Voltage pulse output

When selecting the control output type as SSR, users will be able to select the types for voltage pulse output. The timeshare cycle control turns ON/OFF the output by proportioning the certain time to an output amount in cycle. Set the cycle of control output in the Ct parameter.
Within the half cycle of power wave shape, the phase control (depending on an output amount) controls an output amount by computing the output ON phase. However, when using the phase control, users must use the RANDOM ON/OFF type SSR.

Control type	Load current with 50 % of output
Phase control	
Timeshare cycle control	

Parameter composition



■ Operation mode

Supplying in the power after finish wiring will display the current temperature. Pressing the MODE key will display the set temperature and output amount alternatively on the set value (SV) displaying unit.

■ User setup mode

User setup mode is the setting mode that sets the set value that is changed by users frequently such as alarm set value and loop break alarm (LBA). It made the parameter of user setup mode to be displayed on the operator setup mode that allows users to set easily (divided the setting level).

■ SV setting

① In Operator Setup Mode, When the value of SuE parameter is on, you can change the value with ◀, ▼, ▲ and press the MODE key to set up.

② In operator Setup Mode, When the value of SuE is oFF, you can change the value in Su parameter with ◀, ▼, ▲ and Press MODE key to set up.

Symbol (PV)	Lists	Information	Display condition	Default value (SV)
Su	set temperature	EU 0 ~ 100 %	at all times	EU 0%
AL 1L	Alarm 1 low value	EU 0 ~ 100 % or EUS 0 ~ 100 % (temperature unit)	When RLYn ALn is set	EU 0%
AL 1H	Alarm 1 high value			EU 100%
A1db	Alarm 1 dead zone			EUS 0%
AL2L	Alarm 2 low value			EU 0%
AL2H	Alarm 2 high value			EU 100%
A2db	Alarm 2 dead zone			EUS 0%
LbAt	Loop break alarm time	0 ~ 7200 second	When LBA is set in the RLYn	480
LbAu	Loop break alarm temperature	0 ~ 100 ℃ (℉)		2
LbAd	Loop break alarm dead zone	0 ~ 100 ℃ (℉)		2
LoC	KEY LOCK	0 : NO LOCK function	at all times	0
		1 : Operator setup mode LOCK, Auto-tuning prohibited		
		2 : Operator and user setup mode LOCK		

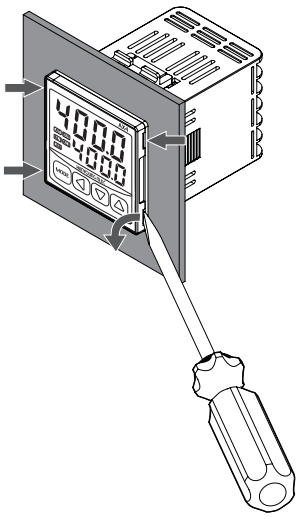
■ Operator setup mode

Operator setup mode is the setting mode that sets the specification of temperature controller when engineer installs it for the first time. Pressing the MODE key and ◀ key synchronously in the operation screen or user setup mode will enter into the operator setup MODE and ◀ keys one more time for 2 sec will return to the operation screen.

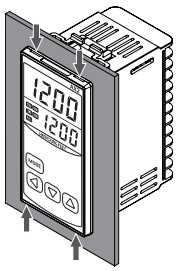
Symbol (PV)	Lists	Information	Display condition	Default value
InP	Input condition	K1 : K thermocouple (Not display the decimal points) K2 : K thermocouple (Not display the decimal points) J : J thermocouple r : R thermocouple t : T thermocouple Pt : RTD Pt100 Ω	At all times	K1
Unit	Temperature unit	℃ / ℉ option	At all times	°C
dP	Decimal point	ON (YES) OFF (NO)	Select decimal point	on
biAS	Input compensation	-100 ~ 100 (sensor input value + BIAS)	At all times	0
FILt	Input filter time	0 ~ 120 sec	At all times	0
SLH	High setting limitation	EU 0 ~100 %	At all times	1200
SLL	Low setting limitation	EU 0 ~100 %	At all times	-100
oCtr	Control output type	SSr : SSR operating voltage pulse output rLY : Relay output	When output selection 1 or 2	SSr
SSrt	Voltage pulse output type	CYC : Timeshare proportional control PHA : SSR phase control (continuously proportioning)	When selected SSR control output	CYC
Ct	Control output cycle	0 ~ 1000 sec	When SSrt is CYC or oCtr is RLY	2
Ctrd	Control output action	rEu : Reverse action (heating control) dir : Direct action (cooling control)	At all times	rEu
Ctrl	Control type	PId : P.I.D control P : P control (proportional control) onoF : ON / OFF control	At all times	PId
Pb	Proportional band	1 (0.1) ~ EUS 100 %	When it is not ON/OFF control	30
I	Integral time	0 ~ 3600 sec	With PID control	240
d	Derivative time	0 ~ 3600 sec	With PID control	60
rst	Manual reset	0.0 ~ 100.0 %	With P control	50.0
HYS	Control hysteresis	EUS 0 ~ 100 % (Temperature unit)	With ON/OFF control	2
Po	Output amount with input break	0 ~ 100 %	At all times	0.0
rLY1	Relay 1 property	non : Not using AL 1 : Alarm 1 output AL2 : Alarm 2 output LbA : LBA output	When output selection is 1 or 2 and oCtr is not RLY	non
rLY2	Relay 2 property	non : Not using AL 1 : Alarm 1 output AL2 : Alarm 2 output LbA : LBA output	At all times	AL 1
rLY3	Relay 3 property	non : Not using AL 1 : Alarm 1 output AL2 : Alarm 2 output LbA : LBA output	At all times (Option)	AL2
A1md	Alarm 1 mode (Alarm 1 or 2)	non : Not using ---[: High alarm]--- : Low alarm -[]- : Alarm within range]-[: Alarm not within range	When AL1 or AL2 is set in RLY 1, 2, 3	---[
A2md	Alarm 2 mode (Alarm 1 or 2)			]---
A1ty	Alarm 1 type	Abs : ABS (Absolute alarm) dEu : DEV (Deviation alarm)		Abs
A2ty	Alarm 2 type			
A1Hd	Alarm 1 standby mode	oFF : OFF (not using the standby mode) on : ON (using the standby mode)		oFF
A2Hd	Alarm 2 standby mode			
A1dy	Alarm 1 delay time	0 ~ 9999 sec		0
A2dy	Alarm 2 delay time			
A1oH	Alarm 1 output LOCK	oFF : Alarm output return action on : Alarm output maintain action		oFF
A2oH	Alarm 2 output LOCK			
SuE	Change SV on the operation	oFF : No change SV on : Change SV	At all times	on

How to disassemble FND from case

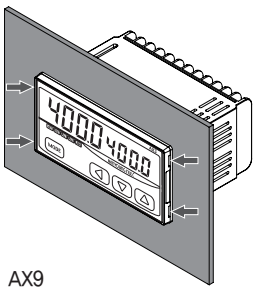
● AX4



● AX2



● AX3



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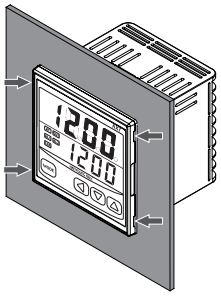
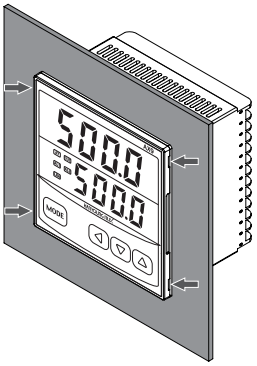


● AX9

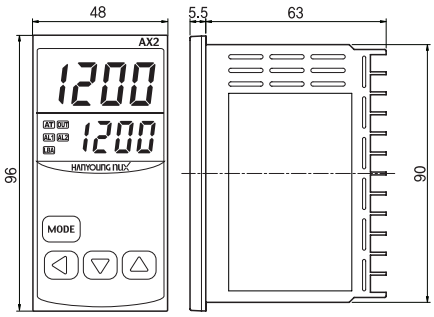


Dimension and panel cutout, connection diagram

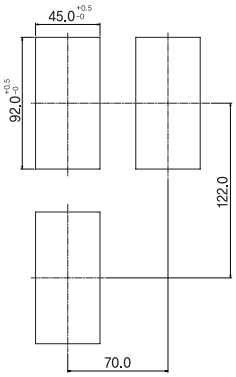
[unit : mm]

AX2

● Dimension

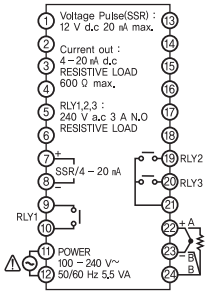


● Panel cutout

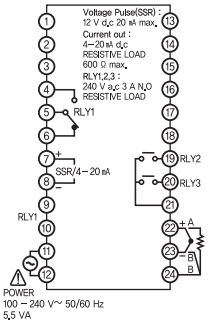


● Connection diagram

AX2

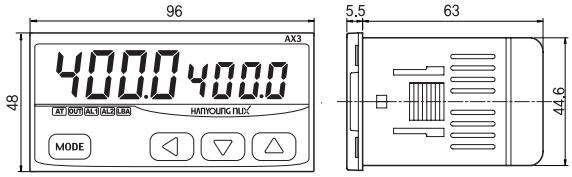


AX2–B

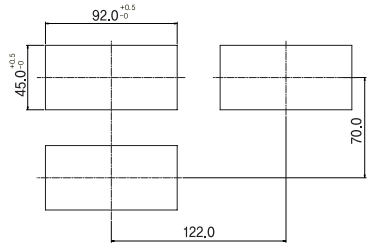


AX3

● Dimension

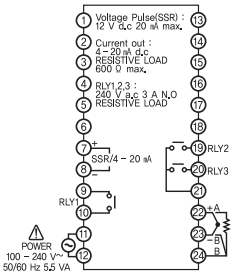


● Panel cutout

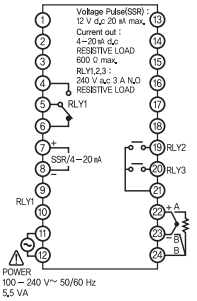


● Connection diagram

AX3

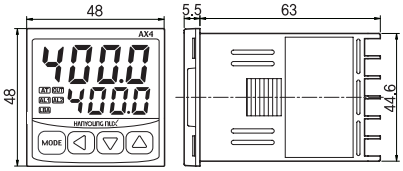


AX3–B

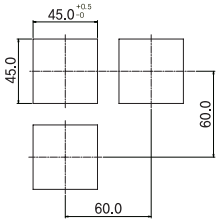


AX4

● Dimension

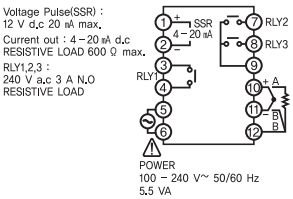


● Panel cutout



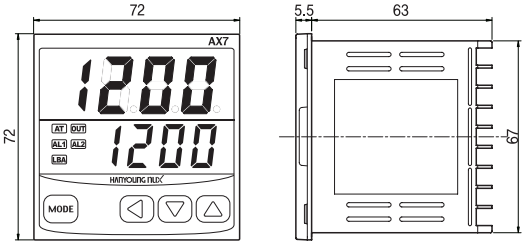
● Connection diagram

AX4

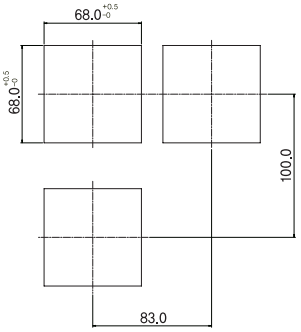


AX7

● Dimension

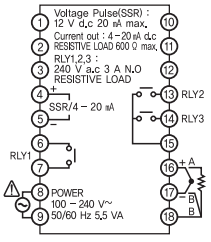


● Panel cutout

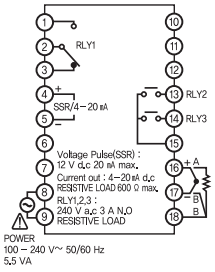


● Connection diagram

AX7

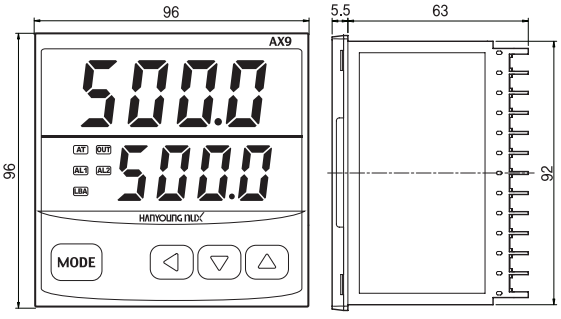


AX7–B

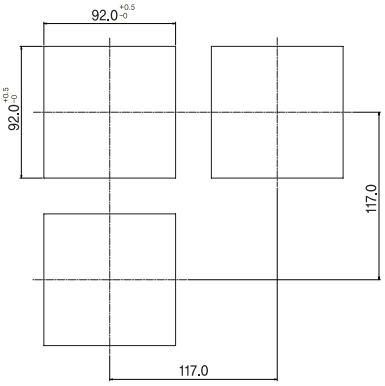


AX9

● Dimension

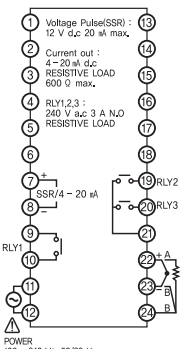
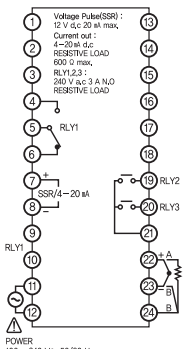


● Panel cutout



● Connection diagram

AX9



AX9–B