

Economical PID Temperature Controller For General Use AiFUZZY-903

Technical Manual
Version number: EN-V9-01

Contact Us

Coiliot LLC
8 THE GRN STE B,
Dover, DE, 19901
(+1)857-565-5912
info@coiliot.com
<https://coiliot.com>



Thank you for choosing Coiliot products.
To ensure optimal use of this product, please read the following instructions before use.

■ Safety Instructions

Attention

Do not touch the terminals while the power is on, as this may result in minor injuries from electric shock.



Do not allow metal objects, conductors, debris (such as installation cuttings), moisture, or other foreign matter to enter the digital controller, setup tool ports, or the pins on the Setup Tool cable connectors.
Failure to do so may result in electric shock, short circuits, or malfunction of the equipment.



Do not use the product in environments exposed to flammable or explosive gases, as this may lead to injury due to explosion.



Do not disassemble, modify, or repair the product, or touch any internal components. Failure to follow this may result in electric shock, fire, or equipment failure.



This equipment is an open processing controller. Do not use it in a control cabinet where a fire hazard may exist.

When using more than two open-circuit switches, ensure all switches are turned off before performing maintenance or inspections to keep the product powered off.



If the output relays are used beyond their life expectancy, contact welding or burning may occur.

Always ensure the application conditions are considered, and use the output relays within their rated load and electrical life expectancy.

The life span of the output relays can vary significantly depending on the load and switching conditions.



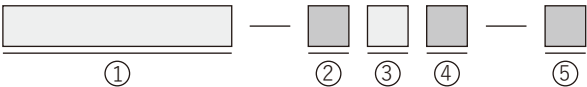
■ 1. Main features

- The color LCD display features white PV text for easy readability from a distance. The side-illuminated backlight, combined with the advanced LCD screen, ensures a soft and clear display.
- The ultra-thin panel and large LCD screen are paired with a sleek, modern industrial design, providing a more advanced and refined appearance.
- The plastic handle includes a waterproof button with a durable, wear-resistant surface, offering a clear and smooth operating feel.
- Measurement accuracy reaches 0.25 level, with further upgraded resolution for more accurate and stable readings.
- The AiFUZZY artificial intelligence adjustment algorithm combines fuzzy control and adaptive PID control, with AT self-setting and self-learning functions. It automatically learns and optimizes features of the controlled object, eliminating overshoot and undershoot for excellent control, even with complex systems.
- Supports a variety of thermocouples and thermal resistance inputs, with parameter-based switching for flexibility.
- Supports multiple output specifications: relay contact switch, SSR solid-state relay drive voltage, and SCR no-contact switch.
- Features decimal point adjustment and the ability to select between Celsius and Fahrenheit.
- Enhanced anti-interference performance ensures stable operation in environments with high electromagnetic interference.
- Utilizes a high-performance switching power supply design, with strong load capacity, wide temperature range, and high internal pressure components, making it suitable for various harsh environments.

■ 2. Technical Parameter

Type	G - type panel	D - type panel	A - type panel	E - type panel	F - type panel
Panel Size (Width * Height)	48*48 mm 1.89*1.89 in	72*72 mm 2.83*2.83 in	96*96 mm 3.78*3.78 in	48*96 mm 1.89*3.78 in	96*48 mm 3.62*1.77 in
Drill Gap (Width * Height)	45*45 mm 1.77*1.77 in	68*68 mm 2.68*2.68 in	92*92 mm 3.62*3.62 in	45*92 mm 1.77*3.62 in	92*45 mm 3.62*1.77 in
Mounting Type	Built-in panel mounting				
Power supply	AC100~240V 50/60Hz; or DC12~24V				
Voltage Range	85%~ 110%of the rated power voltage				
Power consumption	AC100~240V: 5VA OR DC12~24V: 3.5VA				
Display	LCD display (white for PV, green for SV, light orange for indicator)				
Measurement Range	K: (-50~1300°C / -58~2372°F) S: (-50~1700°C / -58~3092°F) R: (-50~1700°C / -58~3092°F) T: (-200~350°C / -328~662°F) E: (0~800°C / 32~1472°F) J: (0~1000°C / 32~1832°F) B: (200~1800°C / 392~3272°F) N: (0~1300°C / 32~2372°F) Cu50: (-50~150°C / -58~302°F) Pt100: (-200~600°C / -328~1112°F) Linear Scale: -9999~32000 (user defined)				
Decimal Point Positioning	0000, 000.0, 00.00, 0.000 (adjustable based on parameters)				
Sampling Accuracy	±0.25%FS				
Sampling Frequency	10 times per second; when digital filtering is set to INF=0, response time is 0.5 seconds				
Control Method	ON/OFF control, AI FUZZY algorithm, PV tracking and SV value setting				
Control Range	0.1~300.0 seconds				
Relay Output	5A/250VAC OR 5A/30VDC				
SSR Drive Voltage Output	12VDC 50mA max (used to drive SSR relay)				
SCR Non-contact Output	0.2A (continuous), 2A (20ms pulse, 5s period) 100-240VAC				
Electromagnetic Compatibility	Electromagnetic compatibility complies with IEC61000-4-4 (electrical fast transient burst) at 6KV/5KHz, IEC61000-4-5 (surge immunity) at 6KV and 10V/m high-frequency electromagnetic field interference. Under these conditions, the instrument does not experience crashes or incorrect I/O operations, and the measurement value fluctuations do not exceed ±5% of the measured range.				
Isolation Voltage	Input/output, power output/control module: ≥2300VDC; signal terminals between phase-to-phase signals ≥600VDC				
Operating Temperature	-10~55°C (14~131°F) (no condensation, no ice formation), humidity: 25~85%RH				
Storage Temperature	25~65°C (-13~149°F) (no condensation, no ice formation), humidity: 25~85%RH				

3.Model definition



①	②	③	④	⑤
Model	Panel size	OUTP Control output	ALM Alarm output	Power supply
AiFUZZY903	G	N	N	N
	D	R1	R1	D
	E	Q1	R2	
	F	W1	R3	
	A	W2	R4	
		Q7		

① Model

Code	Description
AiFUZZY903	Economical LCD Display PID Temperature Controller For General Use

② Size of the meter

Code	Description
G	Panel size 48*48mm/1.89*1.89 in (width*height), drill gap 45*45mm/1.77*1.77 in
D	Panel size 72*72 mm/2.83*2.83 in (width*height), drill gap 68*68 mm/2.68*2.68 in
E	Panel size 48*48mm/1.89*1.89 in (width*height), drill gap 45*45mm/1.77*1.77 in
F	Panel size 48*48mm/1.89*1.89 in (width*height), drill gap 45*45mm/1.77*1.77 in
A	Panel size 48*48mm/1.89*1.89 in (width*height), drill gap 45*45mm/1.77*1.77 in

③ Indicates the installable module for OUTP control output

Code	Description
N	None selected
R1	Single-circuit relay normally open contact switch output module. Module capacity: 30VDC/3A, 250VAC/3A.
Q1	SSR Solid-state relay drive voltage output module, 12VDC/50mA
W1	Normally open isolated non-contact voltage output module, capacity: 100-240VAC/0.2A
W2	Normally closed isolated non-contact voltage output module, capacity: 100-240VAC/0.2A
Q7	Built-in SSR solid-state relay, interconnected with the meter's power supply, directly outputs the power supply voltage module (e.g., if the power supply is 220V, the output will be 220V; if the power supply is 110V, the output will be 110V). Suitable for small power loads of 1.5A/220V (customizable).

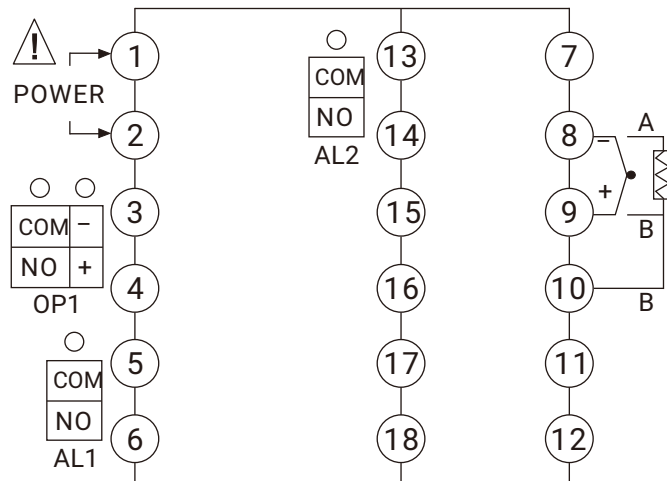


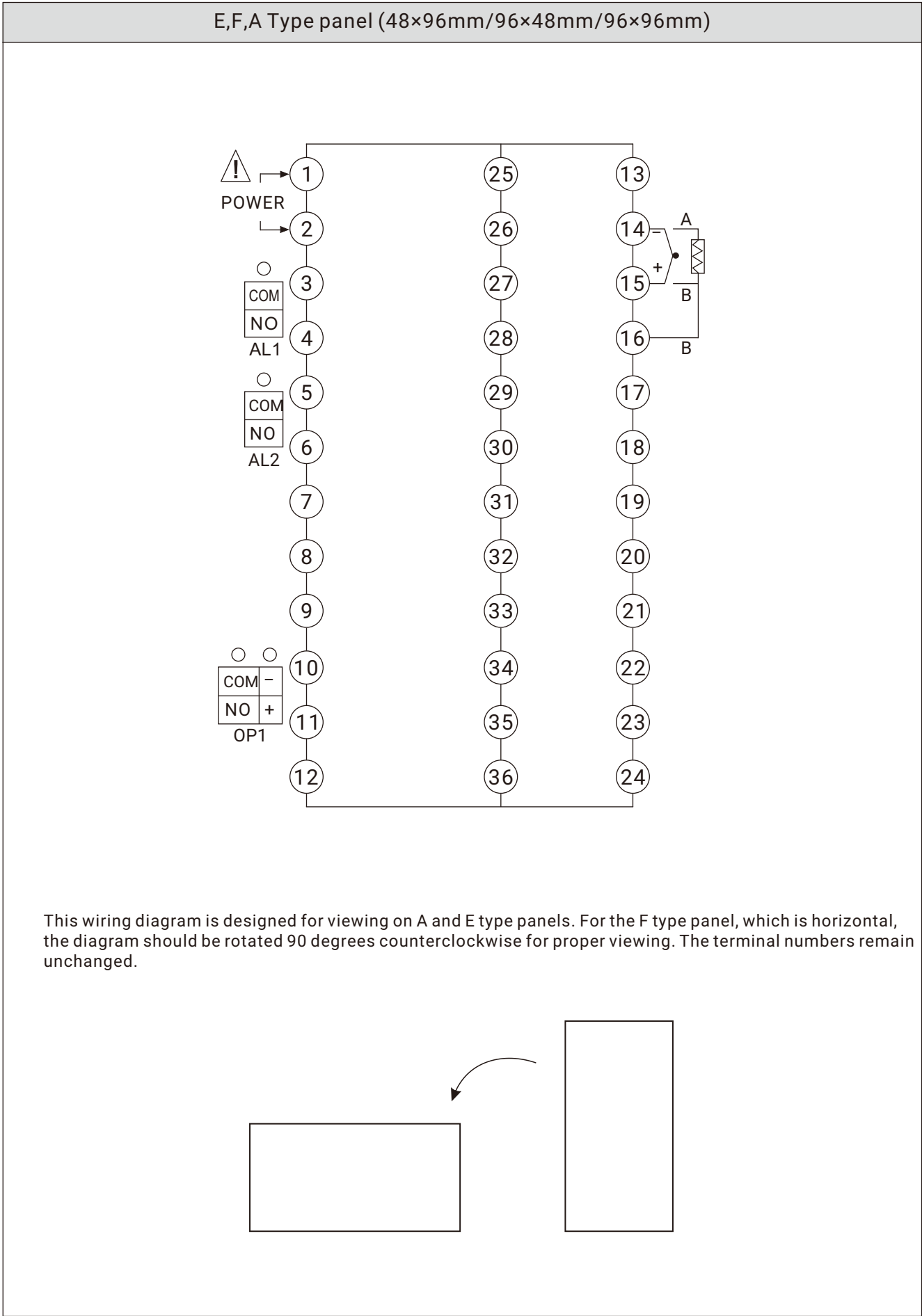
④ ALM alarm output

Code	Description
N	None selected
R1	Single output, AL1 alarm output (relay normally open contact output module), contact capacity: 30VDC/3A, 250VAC/3A
R2	Dual output, AL1+AL2 alarm output (relay normally open contact output module), contact capacity: 30VDC/3A, 250VAC/3A
R3	Single output, AL2 alarm output (relay normally open + normally closed contact output module), contact capacity: 30VDC/3A, 250VAC/3A
R4	Dual output, AL1 (relay normally open contact output module)+AL2 (relay normally open + normally closed contact output module) contact capacity: 30VDC/3A, 250VAC/3A

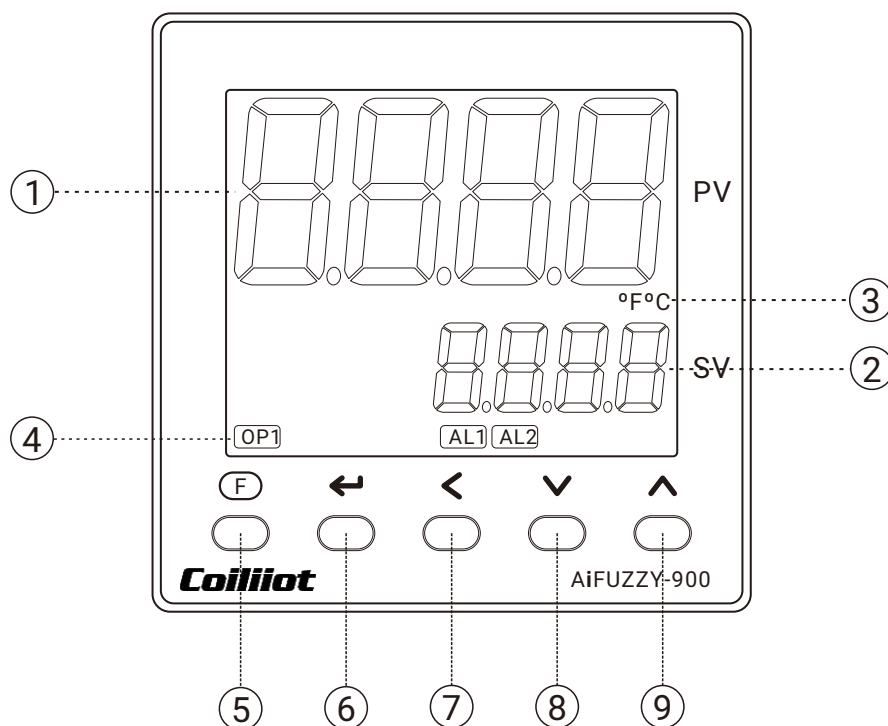
⑤ Power supply

Code	Description
N	100~240VAC power supply
D	12-24VDC power supply



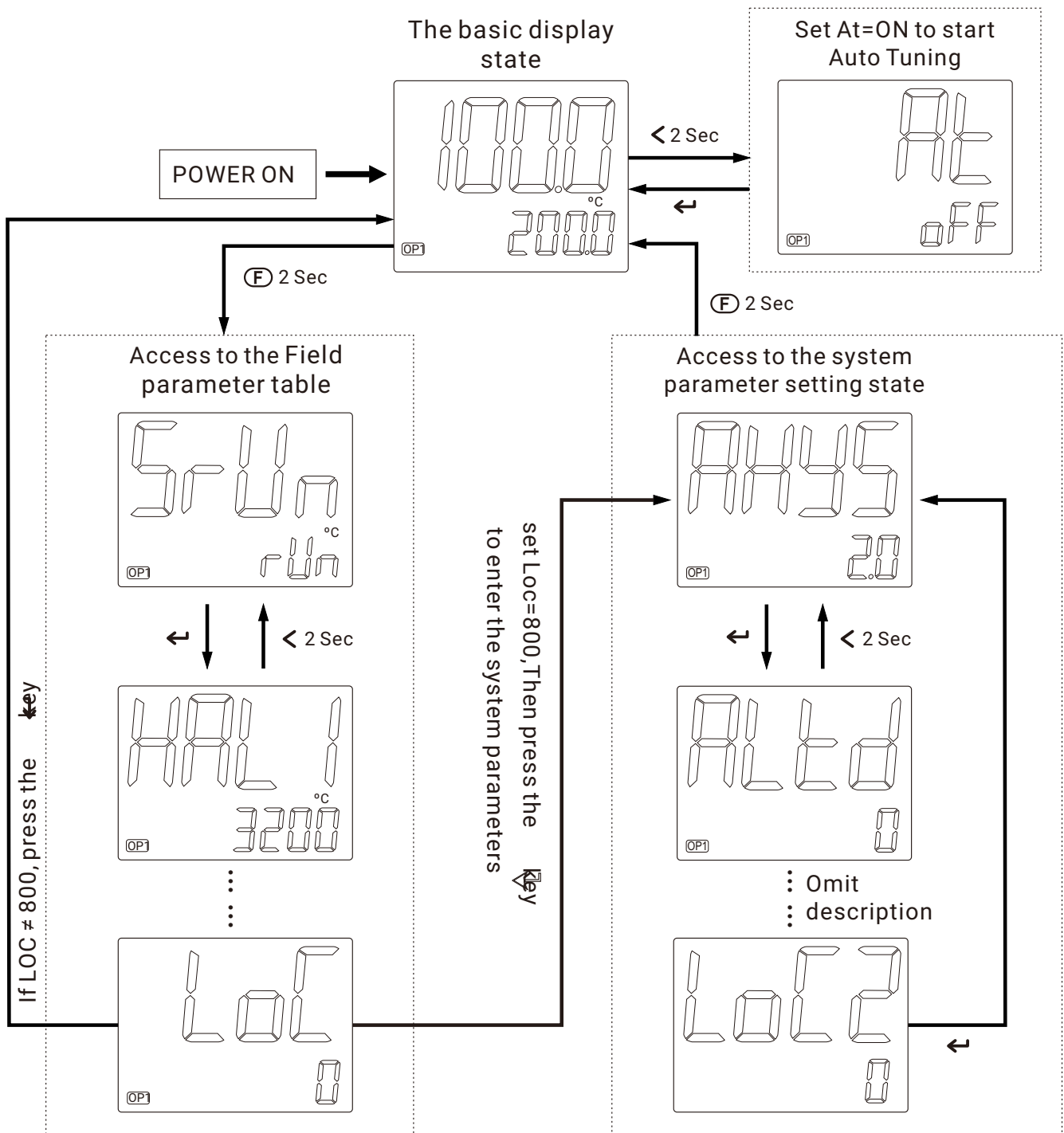


■ 5. Panel description



- ① PV first display window (displays measured values, parameter names, etc.).
- ② SV second display window (displays setpoint values, parameter values, etc.).
- ③ Temperature Unit .
- ④ Output indicators:OP1,AL1,AL2 indicators.
- ⑤ Parameter key: Enter/ exit parameter settings.
- ⑥ Return key: confirm and switch to the next parameter.
- ⑦ Data shift key.
- ⑧ Data decrease key.
- ⑨ Data increase key.

■ 6. Display status and operation flowchart



■ 7. Instrument operation method description

7.1 Parameter Setting

In the basic display state:

- Press and hold the **(F)** key for about 2 seconds to enter the parameter setting mode.
- If LOC=800, press the **←** key to access the function parameter settings.
- Use the **<**, **↓**, **↑**, etc., keys to directly modify parameter values.
- Press **↓** to decrease and **↑** to increase values. Holding the keys enables faster adjustments.
- To navigate directly to a specific digit for editing, press the **<** key, then adjust as needed.
- Press the **←** key to save changes and move to the next parameter.
- To return to the previous parameter, press and hold the **<** key for over 2 seconds.
- Exit to the basic display state by holding the **(F)** key for 2 seconds.

7.2 Setting the given value

In the basic display state: Use the **<**, **↓**, or **↑** keys to modify the given value directly.

7.3 Stop Control

In the basic display state:

Press and hold the **(F)** key for about 2 seconds to enter the on-site parameter setting mode.

Use the **↑** key to set the **SrUn** (SrUn) parameter to Stop.

Hold the **(F)** key for about 2 seconds to exit the parameter setting mode. At this point, the second display window will show "Stop" and flash, indicating that the instrument has stopped output control.

7.4 Run control

If the instrument is in a stop control state:

The second display window will flash "Stop". Press and hold the **(F)** key for about 2 seconds to enter the on-site parameter setting mode.

Use the **↓** key to set the **SrUn** (SrUn) parameter to rUn.

Hold the **(F)** key for about 2 seconds to exit the parameter setting mode.

At this point, the second display window will briefly display "rUn", and the instrument will resume normal operation.

7.5 Auto Tuning

When the FUZZY+PID control method is selected (CntL=FPId), optimal PID parameters can be obtained by running auto-tuning, achieving precise control without overshoot. Auto-tuning (AT): Press and hold **<** for 2 seconds to display the AT parameter. Press **↑** to change the "OFF" in the lower display window to "ON," then press **←** to confirm and start the self-tuning function. The lower display will flash and show "AT," while the instrument automatically calculates the PID parameters after 2 oscillation cycles of ON-OFF control. To cancel auto-tuning before completion, press **<** again and hold it for about 2 seconds to call up the AT parameter, set "ON" to "OFF," and then press **←** to confirm.

Notes:

The AiFUZZY algorithm combines fuzzy logic and proportional-integral-derivative (PID) control, offering strong adaptability and robustness for stable performance in uncertain environments. When used for the first time, the self-tuning function can assist in determining optimal PID parameters.

Results may vary based on system conditions. Before tuning, set the given value (SV) to a commonly used or middle value. For systems like electric furnaces, use the maximum working value. Do not modify the SV during the tuning process. The tuning duration may range from seconds to hours, depending on the system.

The best results may not be immediate after tuning. Due to the self-learning feature, performance improves over time.

■ 8. Parameter list and function

8.1 Field parameter

In the basic display state, press and hold **Ⓢ** key 2 seconds, enter the field parameters.

Code	Name	Description	Range
<i>SrUn</i>	Operating Status	Run: The instrument is in normal operating control status. Stop: The instrument is in a stopped control output status, with the SV window flashing.	
<i>HAL1</i>	AI1 max alarm value	"HAL1" refers to the absolute value alarm or deviation value alarm, defined by the "ALtd" parameter. When the value is set to the maximum (3200), this function will be disabled.	-999 to 3200 (Factory default values: HAL1 and HAL2 are set to 3200, LAL1 and LAL2 are set to -999)
<i>LAL1</i>	AI1 min alarm value	"LAL1" refers to the absolute value alarm or deviation value alarm, defined by the "ALtd" parameter. When the value is set to the minimum (-999), this function will be disabled.	
<i>HAL2</i>	AI2 max alarm value	"HAL2" refers to the absolute value alarm or deviation value alarm, defined by the "ALtd" parameter. When the value is set to the maximum (3200), this function will be disabled.	
<i>LAL2</i>	AI2 min alarm value	"LAL2" refers to the absolute value alarm or deviation value alarm, defined by the "ALtd" parameter. When the value is set to the minimum (-999), this function will be disabled.	
<i>Loc</i>	System Parameter Lock	Set LOC=800, then press the ← key to enter the system parameters.	0~9999

8.2 System parameter

In the field parameters, set Loc=800, then press **←** key to enter the system parameters.

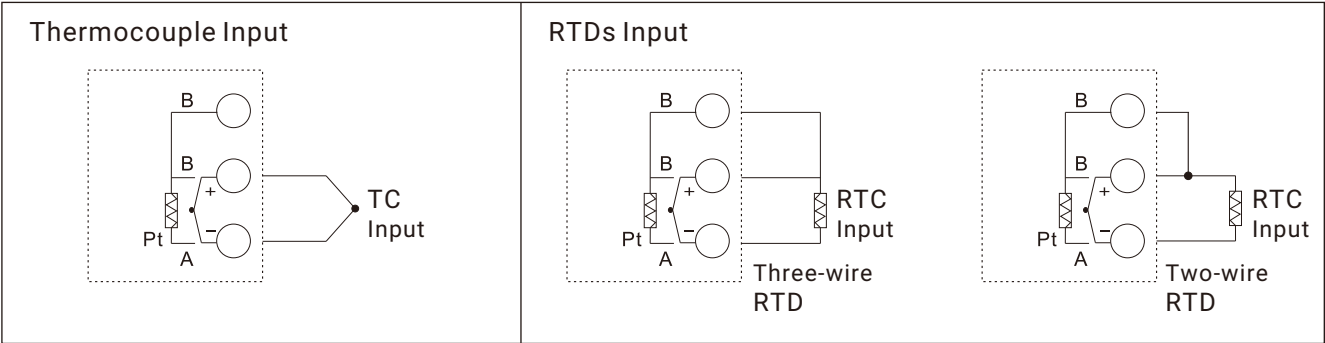
Code	Name	Description	Range
<i>ALYS</i>	Alarm Hysteresis	Also known as alarm hysteresis or dead zone, this feature is used to prevent the alarm relay from frequently activating at the alarm threshold. It introduces a delay between the alarm output turning ON and OFF to ensure stable operation.	0~200.0 (default value: 2)
<i>ALtd</i>	Alarm mode	ALtd=0: AL1 is the deviation value alarm, and AL2 is the absolute value alarm. ALtd=1: Both AL1 and AL2 are absolute value alarms. ALtd=2: Both AL1 and AL2 are deviation value alarms.	0~9999 (default value: 0)
<i>Ctrl</i>	Control mode	onoF: On-off control, suitable for situations that do not require high precision. FPId: Advanced artificial intelligence AiFUZZY (FUZZY+PID) control (Recommended for use).	default value: FPId
<i>orEu</i>	Direct/Reverse Action	onr: Reverse acting. An increase in the measured variable causes a decrease in the output, such as in heating control. ond: Direct acting. An increase in the measured variable causes an increase in the output, such as in cooling control.	default value: onr

P	Proportional band	The proportional band for FPID control is expressed in the same units as the PV value, rather than as a percentage of the range. Generally, optimal P, I, D, and CP values can be obtained through auto-tuning. Alternatively, they can be manually entered if the correct values are already known.	1~3200 default value: 25
I	Integral Time	The integral time for FPID control is measured in seconds. When I=0, the integral action is disabled.	1~9999 default value: 200
d	Derivative Time	The derivative time for FPID control is measured in 0.1-second units. When d=0, the derivative action is disabled.	1~3200 (default value: 50.0)
CP	Control cycle	CP reflects the speed at which the instrument operator adjusts the control. The size of the CP affects the control accuracy. For SSR and SCR output control, a shorter control cycle is preferred, typically between 0.5 to 3.0 seconds. For relay switch outputs, a cycle time of 15 to 40 seconds is generally used. When the output relay switches, the CP is limited to 3 seconds. The self-tuning (AT) function will automatically adjust the CP to the appropriate value, optimizing control accuracy and prolonging the mechanical switch life. When the control mode is set to CntL = onOF, the CP acts as the output disconnect or power-on delay time.	0.2~300.0 (default value: Relay output is 15.0, SSR output is 2.0)
HYS	Control hysteresis	HYS (Hysteresis) is used in ON-OFF control to prevent the relay from frequently switching on and off. For a reverse acting (heating) system: When PV > SV, the output turns off. When PV < SV - HYS, the output turns on. For a direct acting (cooling) system: When PV < SV, the output turns off. When PV > SV + HYS, the output turns on.	0~200.0 (default value 2.0)
Int	Input Signal	Selection of input Types for thermocouples or RTD: K,E,J,N,Pt (Pt100)	default value: K
dP	Decimal point	0 :no decimal. 0.0:one decimal place.	default value: 0.0
Sc	Input correction	SC is used to adjust the input signal to compensate for errors caused by the transducer, input signal, or automatic cold junction compensation of the thermocouple. PV after compensation = PV before compensation + SC. It is generally set to 0. An incorrect setting may result in inaccurate measurements.	-199.9~+400.0 (default value: 0.0)
InF	PV input filter	The value of InF determines the ability to filter noise from the input signal. - When a large value is set, the measurement input stabilizes, but the response speed slows down. Typically, it can be set between 1 and 3. - If significant interference is present, gradually increasing the InF value can help reduce momentary fluctuations in the measured value, keeping them within 2 to 5 units. - During metrological verification of the instrument, set InF to 0 or 1 to shorten the response time.	0~40 (default value: 2)

<i>du</i>	Temperature unit	°C: celsius °F: fahrenheit	default value: ° C
<i>SPL</i>	Min of SV	Minimum value that SV is allowed to be.	-999~3200 (default value: SPL is -99, SPH is 999)
<i>SPH</i>	Max of SV	Maximum value that SV is allowed to be.	

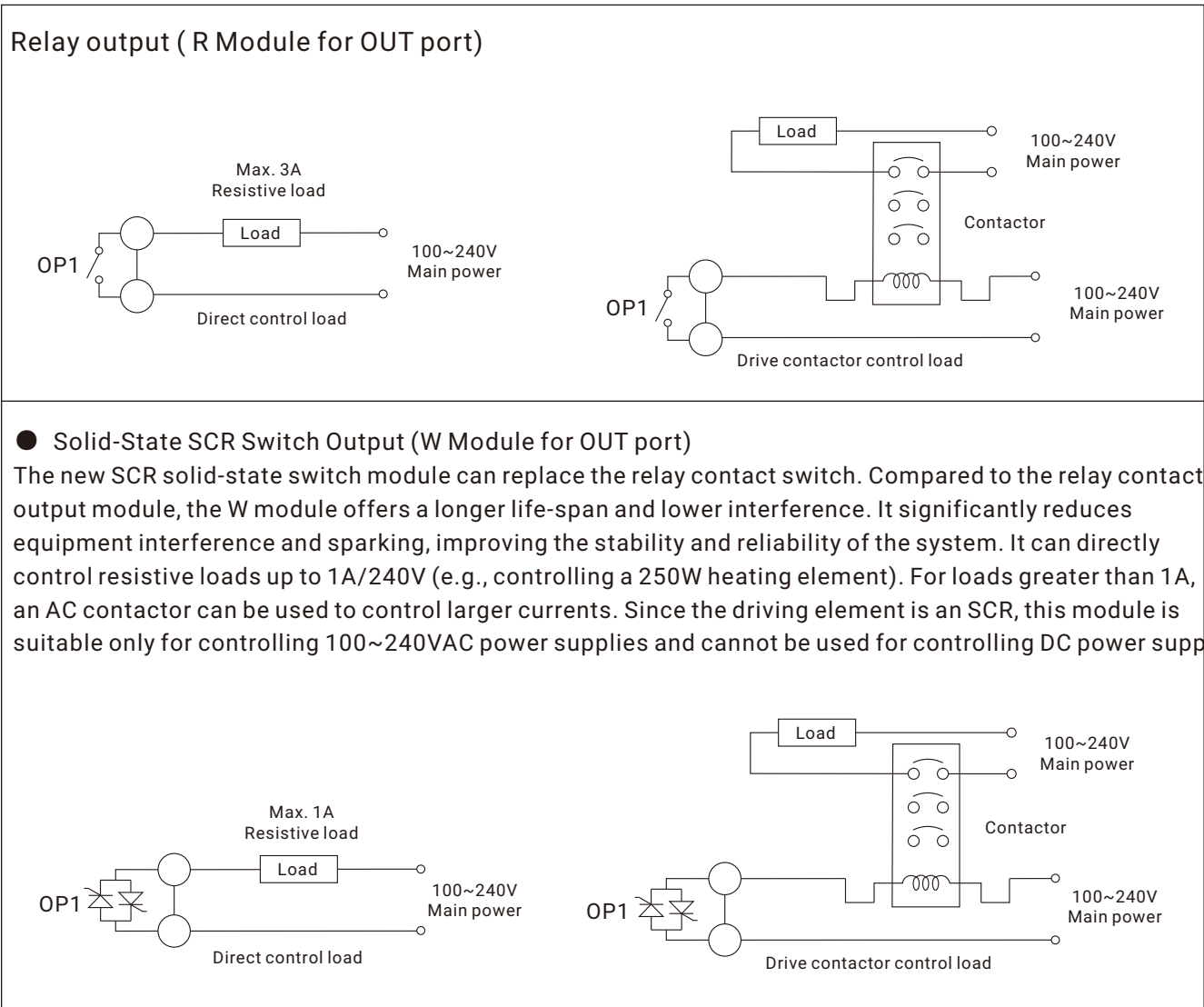
9. Partial application wiring methods

9.1 The wiring method of the input signal

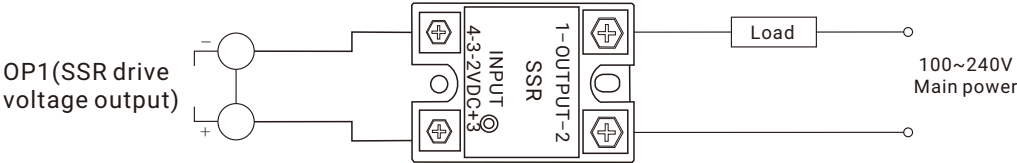


If the input wiring is incorrect, the sensor is damaged or out of range, or the Int setting does not match the input sensor type, the second display window will show a flashing "orAL" warning. Once these issues are resolved, the instrument will return to displaying the measured values normally.

9.2 Main control output wiring method

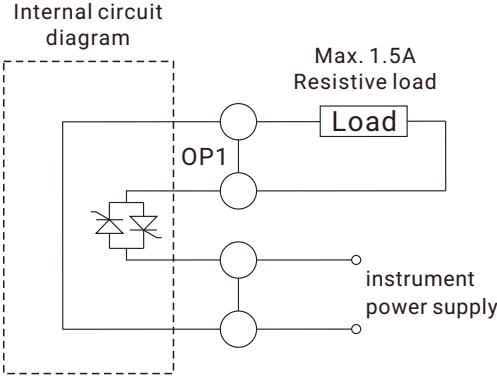


12V SSR drive voltage output(Q module for OUT port)



● Built-in SSR for Direct Load Power Output (Q7 Module for OUT port)

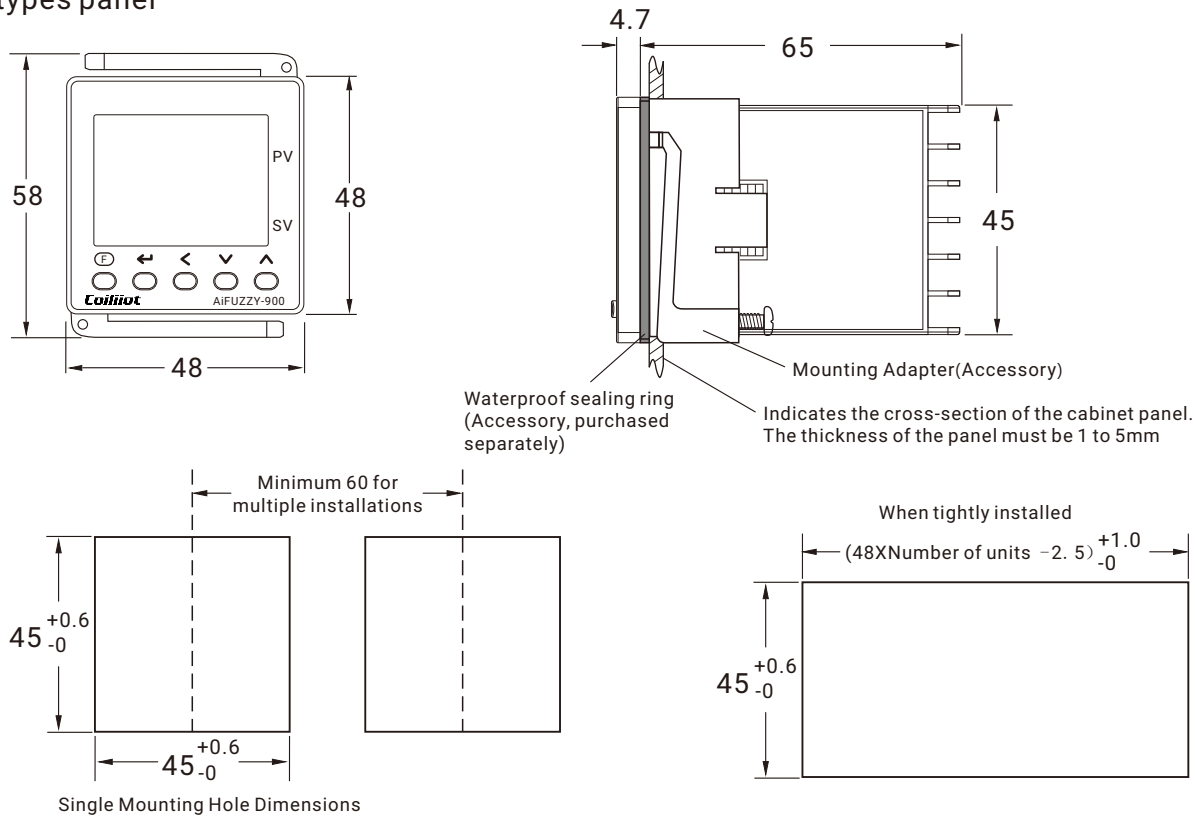
The built-in SSR (Solid-State Relay) is internally connected to the instrument's power supply, allowing for direct load power output. For example, if the instrument is powered by 220V, the output will be 220V; if the instrument is powered by 110V, the output will be 110V. This is suitable for small power loads up to 1.5A/220V (needs customization)



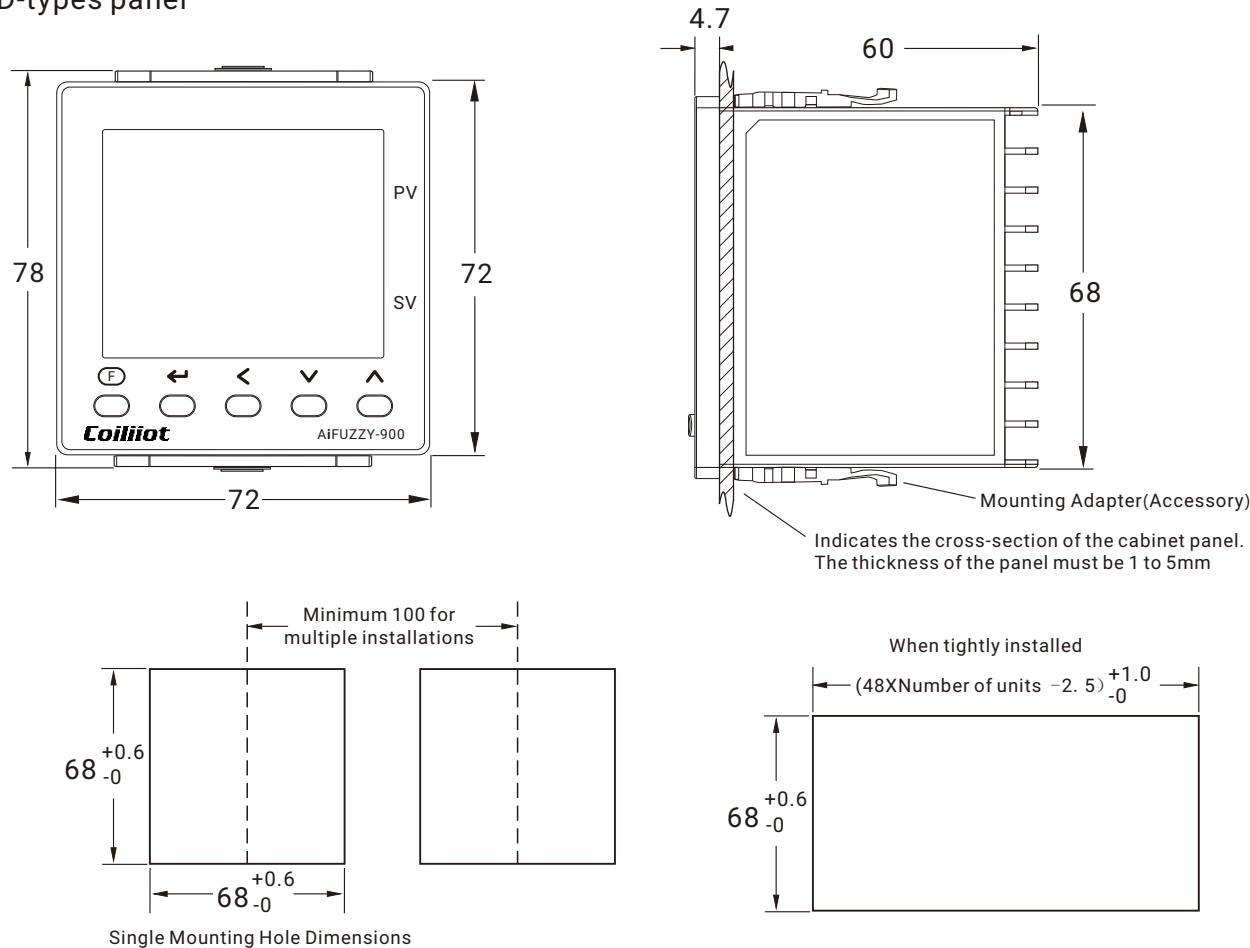


10.Dimensions and installation instructions(mm)

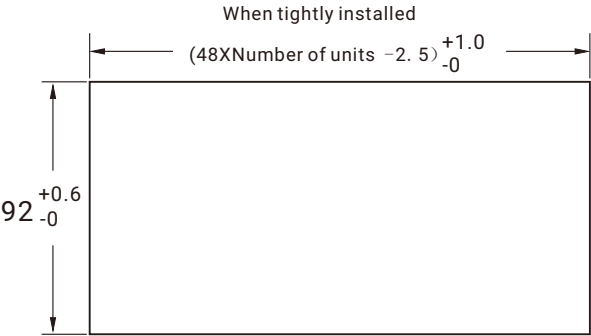
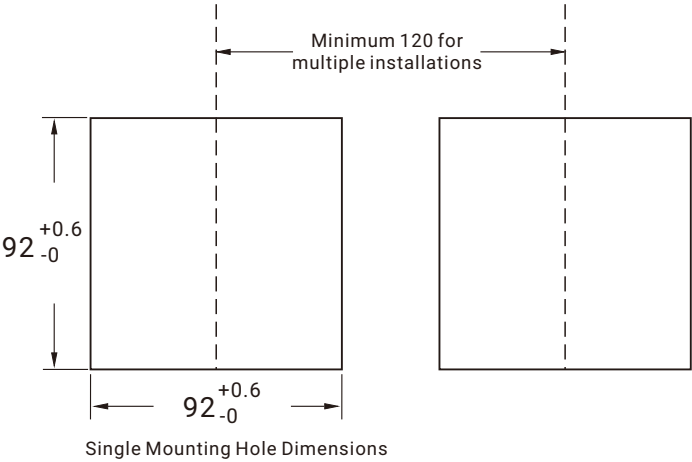
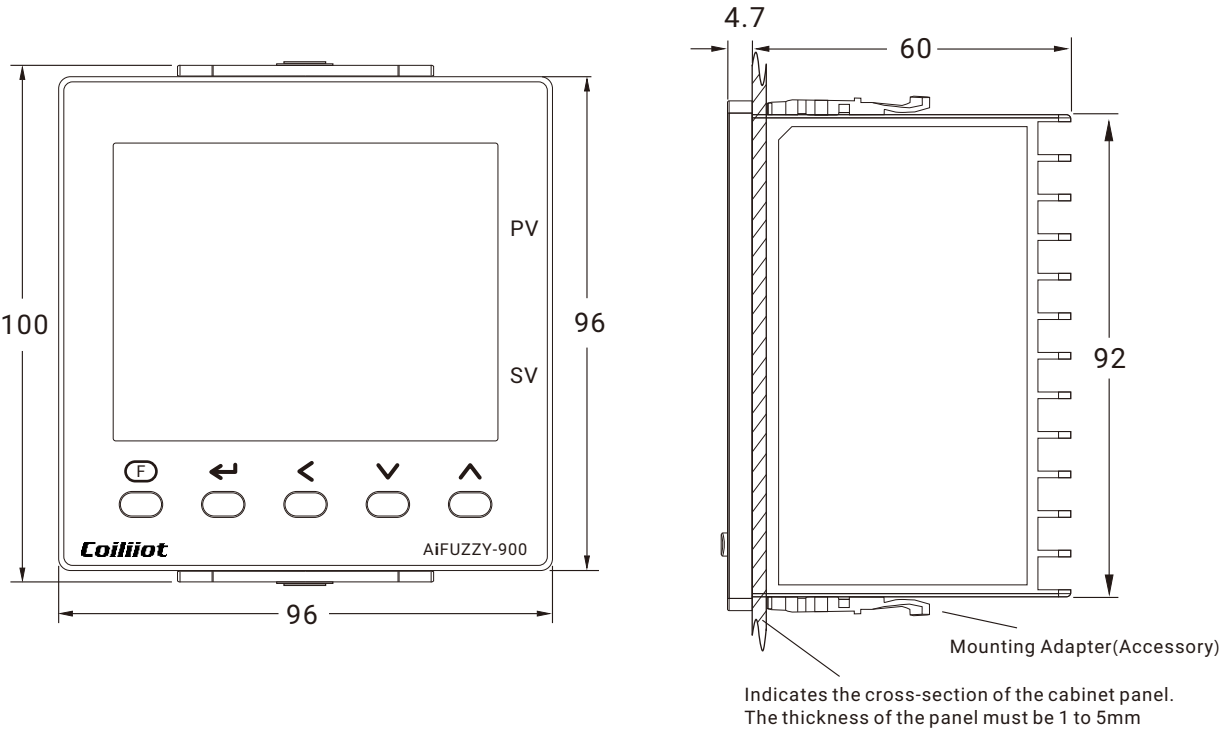
G-types panel



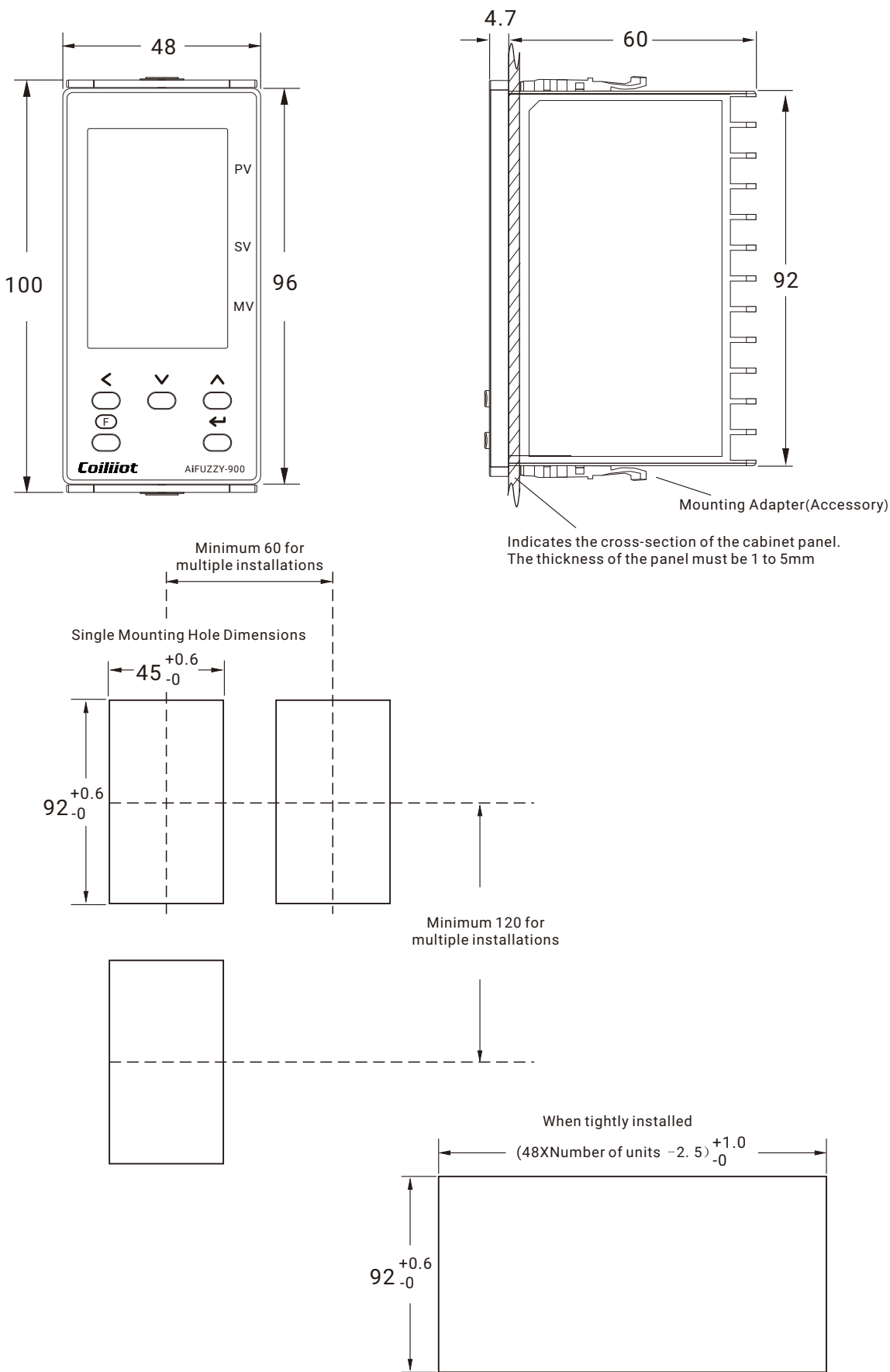
D-types panel



A-types panel



E-types panel



F-types panel

