DITEL

SW series
Digital Temperature Controller

MICRO-CONTROLLER (48 × 48 mm)

MICRO-CONTROLLER SW48

DATA SHEET SW48

SW48 is an extremely compact temperature controller which has 48 x 48 mm front panel with a large, white LCD and 58-mm depth behind panel.
Developed as a successor to the standard model SY, **SW48** features fast sampling speed (50 ms), highly accurate input indication, and universal input, in addition to various functions of SZ, while achieving a competitive price.
Equipped with multiple input/output and sophisticated control functions, SW48 serves as a suitable temperature controller for a wide range of use.

FEATURES

1. Enhanced control performance which makes **SW48** suitable for a wide range of application
   - Fast sampling speed of 50 ms (SY48: 500 ms)
   - Improved input indication accuracy
     For example: indication accuracy when measuring around 0.0°C by using type K thermocouple of which measuring range 0.0 to 400.0°C: ±1.1°C (cf. SY48: ±3.1°C)
   - Freely configurable control cycle (100 ms to 99 s)
   - Control method selectable among 7 types
     (ON/OFF control, PID control, fuzzy PID control, self-tuning control, PID2 control, 2-degrees-of-freedom PID control, motorized valve control)
2. Any type of input can be accepted
   - Universal input is supported (thermocouple, RTD, voltage, current)
   - Control output is selectable among 4 types (Relay contact, SSR drive, current linear, voltage linear)

   The following optional functions can be incorporated:
   - 1 digital input (up to 3 digital inputs for motorized valve control version), and up to 3 digital outputs
   - Remote SV input, analog re-transmission output
   - Motorized valve control output
   - Current monitoring using CT
3. Easy-to-see clear display and user-friendly interface
   - Wide viewing angle, high luminance white LED backlit LCD
   - Large PV display (with character height of 15.3 mm which is the highest in the market)
   - Easy-to-distinguish parameter display with screen numbers
   - Easy-to-identify 11 segment alphanumeric display
   - Digit select key for easier value-setting (5 keys)
4. Most compact design in the market
   - Approx. 30% reduction in size compared to conventional models.
     (58 mm depth behind panel)
5. A variety of functions extending the possibility of temperature controller
   - 64 steps ramp/soak function
   - 8 PID setting pallets, 8 SV pallets, zone PID facilitate frequent change of control conditions
   - Loader interface provided as standard (Power can be supplied via loader cable. Loader software is available from our web site)
   - RS485 communication (optional) capable of cooperative operation, programless communication

SPECIFICATIONS

1. General specifications

Power supply:
100 V (-15%) to 240 V (+10%) AC, 50/60 Hz;
24 V (±10%) DC/AC

Power consumption:
10 VA MAX. (100 to 240 V AC), 3 VA MAX. (24 V DC/AC)

Insulation resistance:
20 MΩ or more (at 500 V DC)

Withstand voltage:
Power source ↔ all terminals: 1500 V AC for 1 min
Relay contact output ↔ all terminals: 1500 V AC for 1 min
Between others 500 V AC for 1 min

2. Input section

2.1 Process value input

Number of input: 1

Input setting:
Programmable scale

Input signal: See Table 1
(Universal input: thermocouple, RTD, voltage, current)

Standard measurement range and input type:
See Table 1

Indication accuracy (at Ta = 23°C):
- Thermocouple input: either ±1°C ±1 digit or ±0.3% ±1

digit of indicated value, whichever is larger
*except:
Thermocouple B: 0 to 400°C: no accuracy assurance
Thermocouple R: 0 to 500°C: ±3°C ±1 digit
Thermocouples K, T, E, U, or N: -200 to -100°C: ±2°C ±1 digit

- RTD input: ±0.8°C ±1 digit or ±0.2% ±1 digit of indicated value, whichever is larger
- mV input, voltage input, current input: ±0.3%FS ±1 digit

Temperature effect on sensitivity:
±0.3%FS/10°C
Indication resolution:
See Table 1
Input sampling rate:
50 ms
Input impedance:

- Thermocouple, mV input: 1 MΩ or more
- Current input: 150 Ω or less (built-in diode)
- Voltage input: About 1 MΩ

Variation by signal source resistance:

- Thermocouple, mV input: ±0.3%FS ±1 digit per 100 Ω
- Voltage input: ±0.3%FS ±1 digit per 500 Ω

Allowable wiring resistance:
RTD: 10 Ω or less (per wire)
Allowable input voltage:

- DC voltage input: within ±35V
- Current input: within ±25 mA
- Thermocouple, RTD, mV input: within ±5 V

Noise reduction ratio:

- Normal mode: 40 dB (50/60 Hz)
- Common mode: 120 dB (50/60 Hz)
- Between input and power supply: ±1°C at 220 V AC, 50/60 Hz

Input correction:
(a) User adjustment: ±50%FS for each of zero and span point
(b) Process value shift: ±10%FS
(c) Input filter: 0.0 to 120.0 sec (filter OFF if set at 0.0)
(d) Square root extraction: -0.1 to 105% (OFF if set to -0.1%)
Overrange, underrange:
Beyond range of -5 to 105% (accuracy not guaranteed between -5 and 0, and between 100 and 105%FS)
*Pt (-200 to 850°C) input: out of the range between -2 to 105%
0 to 10 V DC input: out of the range between -2 to 105%
Thermocouple E input: out of the range between -5 to 102%

2.2 Remote SV input (optional)

Number of inputs:
1
Input signal:
Voltage: 0 to 5 V DC /1 to 5 V DC/0 to 10 V DC,
Current: 0 to 20 mA DC/4 to 20 mA DC (a 250Ω resistor is required for current input)
Input impedance:
About 1 MΩ
Sampling rate:
50 ms

2.3 Current transformer (CT) input (optional)

Input type:
Single phase CT, 1 point
For 1 A to 30 A: 40800018
For 20 A to 100 A: 40800019
Range of detected current:
1 A to 100 A
Detected current accuracy:
Setpoint ±5% FS
Detected current resolution:
0.1 A
ON time necessary for detection:
300 ms MIN.

2.4 Digital input (DI) (optional)

Number of points:
Up to 1 (Up to 3 digital inputs for motorized valve control version)
Specifications:
No-voltage contact or transistor input
Contact capacity:
5 V DC, about 2 mA (per point)
Input judgment:
ON voltage: 2 V DC or lower
OFF voltage: 3 V DC or higher
Sampling pulse width:
50 ms MIN.
Functions:
Remote mode selection, SV changeover, control standby, AT startup, timer startup, alarm unlatch, program selection, start/stop/reset, PID switching (normal/reverse), etc.

3. Output section

3.1 Control output

Number of points:
Up to 2 (2 points: Heating/cooling control)
Type:
selected among (1) to (6) below
(1) Relay contact output (SPST)

- Proportional cycle: 1 to 150 sec
- Contact structure: SPST (single pole single throw)
- Contact capacity: 250 V AC/30 V DC, 3 A (resistive load)
- Minimum ON/OFF current: 10 mA (5 V DC)
- Mechanical life: 20 million operations MIN. (100 operations/min)
- Electrical life: 100,000 operations MIN. (rated load)

(2) Relay contact output (SPDT)

- Proportional cycle: 1 to 150 seconds
- Contact structure: SPDT (single pole double throw)
- Contact capacity: 250 V AC/30 V DC, 5 A (resistive load)
- Mechanial life: 50 million operations MIN. (100 operations/min)
- Electrical life: 100,000 operations MIN. (rated load)

(3) SSR/SSC drive output

- Proportional cycle: 1 to 150 sec
- ON voltage: 12 V DC (between 10.7 and 13.2V DC)
- OFF voltage: 0.5 V DC or lower
- Maximum current: 20 mA DC
- Load resistance: 600 Ω MIN.

(4) Current output (0 to 20 mA DC/4 to 20 mA DC)

- Accuracy: ±5%FS
- Load resistance: 500 Ω MAX.

(5) Voltage output (0 to 5 V DC/1 to 5 V DC/0 to 10 V DC/2 to 10 V DC)

- Accuracy: ±5%FS
- Load resistance: 10 kΩ MIN.

(6) Motorized valve control output

- Contact structure: 2 SPST contacts without interlock

circuit
*SPST: Single Pole Single Throw
- Contact capacity: 250 V AC/30 V DC, 3A (resistive load)
- Mechanical life: 20 million operations MIN. (100 operations/min)
- Electrical life: 100,000 operations MIN. (rated load)

3.2 Alam output (optional)

Number of outputs:
Relay contact output: Up to 3 (shared common)
Up to 2 (independent common)
Output specifications:
Relay contact output
Contact structure: SPST (single pole single throw)
Contact capacity: 250 V AC/30 V DC, 1 A (resistive load)
Minimum ON/OFF current: 10 mA (5 V DC)
Mechanical life: 20 million operations MIN.
(100 operations/min)
Electrical life: 100,000 operations MIN. (rated load)
Output functions:
Alarm output (see "Alarm function"), main unit control mode output, program status output, control output 1 and 2, etc.
Output cycle:
100 ms

3.3 Re-transmission output (optional)

Number of points:
1
Type:
Current/voltage output (0 to 20 mA DC/4 to 20 mA DC/0 to 5 V DC/1 to 5 V DC/ 0 to 10 V DC/2 to 10 V DC)
- Guaranteed output range: 0 to 21.0 mA DC/0 to 10.5 V DC
- Accuracy: ±0.2%FS (±5%FS at 1 mA or smaller)
- Resolution: 10,000 MIN.
- Load resistance: 500 Ω MAX. (current), 10 kΩ MIN. (voltage)

Output cycle:
100 ms
Output contents:
PV, SV, DV, MV
Additional function:
Scaling function

4. Indication/setting section

4.1 Display unit

Type:
LCD (with backlight)
Indication contents:
Process value indication: 11-segment, 4-digit [white]
Setpoint indication: 11-segment, 4-digit [green]
Screen No. indication: 7-segment, 3-digit [orange]
Indication status: 23 indicator lamps
Luminance setting:
possible (4 steps)

4.2 Setting section

Type:
Sheet type keys (with emboss)
Number of keys:
5 keys

5. Control functions

5.1 Control types

ON/OFF control
PID control
- Dual control (heating/cooling)
- PID parameters determination: Auto tuning

Fuzzy PID control
- Dual control (heating/cooling)
- PID parameters determination: Auto tuning

Self tuning control
PID2 control
- Dual control (heating/cooling)
- PID parameters determination: Auto tuning

2-degrees-of-freedom PID
- PID parameters determination: Auto tuning

Position proportional PID (servo) control without position feedback
- Full stroke time: 30 seconds MIN.

5.2 Control parameters

- Proportional band (P): 0.1 to 999.9%
- Integral time (I): 0 to 3200 sec.
  Integral time control invalidated when I = 0.
- Differential time (D): 0.0 to 999.9 sec.
  Differential time control invalidated when D = 0.
- Control cycle: 100 to 900 ms (in 100 ms), 1 to 99 s (in seconds)
- Anti-reset windup:
  0 to 100% of measurement range
- Hysteresis band: 50% of measurement range
  (at 2-position control only)
- Number of SV and PID combinations: 8 combinations. Changed by any of parameter setting, digital input, communication, user function keying, zone change.

5.3 Control mode

Mode type:
Auto, Manual, Remote
* During 2-position control in Manual mode, 2-position manual operation with MV = 100% or 0% is operated.
Mode switching:
- Auto↔Manual: Balanceless·bumpless
- Auto/Manual → Remote: Balance·bumpless
- Auto/Manual ← Remote: Balance·bumpless

6. Alarm function

6.1 Number of alarm setting points

3 points

6.2 Alarm type

Process value (upper limit/lower limit, absolute/deviation, range), main unit error, etc.
(non-excitation, delay, latch, timer function option provided)

6.3 Heater current alarm function (optional)

*Current detector (CT) is to be prepared separately
(see page 7.)
Detectable range:
1 A to 100 A
Detected current resolution:
0.1 A
Setting resolution:
0.1 A
Hysteresis:
0.0 A to 100.0 A

7. Communication function

7.1 RS-485 interface (optional)

Number of points:
1 point
Physical specifications:
EIA-485
Protocol:
Modbus-RTU
Communication method:
Half duplex bit serial, Asynchronous communication
Code type:
Data length: 8 data bits. Parity: Odd, even, none.
Communication rate:
9600 bps, 19200 bps, 38.4 kbps, 115.2 kbps
Connection status:
Up to 32 units connectable including multidrop master function
Communication distance:
Up to 500 m (total connect extension)
Additional functions:
- Cooperative operation
  The function in which several temperature controllers (as slave devices) can be operated by a master temperature controller.
- Programless communication
  The function in which a temperature controller can communicate with a PLC without program.
  Supported PLCs: Mitsubishi PLC Q series
  Siemens PLC S7 series

8. Processing at power failure

Memory protection: Protect by non-volatile memory

9. Self-diagnosis

Method: Program error supervision by watchdog timer

10. Operation and storage conditions

Operating ambient temperature:
-10 to 50°C
Storage temperature:
-20 to 60°C
Operating/storage ambient humidity:
90%RH MAX. (no condensing)
Warm-up time:
30 min MIN
Vibration:
During transportation 9.8 m/s^2 (1G) or less
Impact:
During transportation: 294 m/s^2 (30G) or less

11. Structure

Mounting method:
Panel mount
External terminals:
Screw terminals, M3
Case: material:
- ABS, PPO
- Non-combustibility grade: UL94V-0 equivalent
- Color: Black

Protection structure:
- Panel front side: IP66, NEMA-4X equivalent
  (When the panel is mounted using our genuine packing. Not water-proof if mounted closely together.)
- Body: IP20 equivalent (slits on top and bottom)
- Terminals: IP00 equivalent. Terminal cover can be mounted optionally.

Dimensions:
48 (W) × 48 (H) × 58 (D) mm

Weight:
approx. 100g

12. User customize function

12.1 Program (ramp/soak) function

Number of program steps:
64 steps x 1 pattern,
32 steps x 2 pattern,
16 steps x 4 pattern
8 steps x 8 pattern
(1 step = 2 segments)
Control option:
Operation control by digital input
Status output by digital output
Basic functions:
(1) Segment time can be set in “Hour, Minutes” or “Minutes, Seconds”
(2) Guarantee soak
(3) Repeat action
(4) PV start
(5) Delay start
(6) Power restoring function
Memory backup:
EEPROM

12.2 User functions

Pressing the user key can perform Auto/Manual change, Standby ON/OFF change, local SV/remote SV change, ramp/soak change or other functions as assigned.

12.3 Password function

3-level password function

13. Simple power-monitoring function and operating days alarm

13.1 Simple power-monitoring function

- By connecting a current transformer (to be prepared separately), electric power consumption of a heater can be displayed.
  (Electric power is calculated with the fixed voltage value.)
- Current detector (CT) is to be prepared separately (see page 7.)
- Current detection range: 1 A to 100 A

13.2 Operating days alarm

- Displays the operating days and activates alarm output (optional) when it exceeds the setpoint.
- This function is useful for preventive maintenance because it let you know the appropriate time for maintenance work.

Table 1 Measurement range

Input type		Code (PvT)	Measurement range [°C]	Minimum input increment [°C]
	Pt100	PT1	0.0 to 150.0	0.1
		PT2	0.0 to 300.0	0.1
		PT3	0.0 to 500.0	0.1
		PT4	0.0 to 600.0	0.1
		PT5	-50.0 to 100.0	0.1
		PT6	-100.0 to 200.0	0.1
		PT7	-199.9 to 600.0	0.1
		PT8	-200 to 850	1
Thermocouple	J	J1	0.0 to 400.0	0.1
		J2	-20.0 to 400.0	0.1
		J3	0.0 to 800.0	0.1
		J4	-100 to 1000	1
	K	K1	0 to 400	0.1
		K2	-20.0 to 500.0	0.1
		K3	0.0 to 800.0	0.1
		K4	-200 to 1300	1
	R	R	0 to 1700	1
	B	B	0 to 1800	1
	S	S	0 to 1700	1
	T	T1	-199.9 to 200.0	0.1
		T2	-199.9 to 400.0	0.1
	E	E1	0.0 to 800.0	0.1
		E2	-150.0 to 800.0	0.1
		E3	-200 to 800	1
	L	L	-100 to 850	1
	U	U1	-199.9 to 400.0	0.1
		U2	-200 to 400	1
	N	N	-200 to 1300	1
	W	W	0 to 2300	1
	PL-II	PL-2	0 to 1300	1
DC voltage	0 to 5 V	0-5V	"-1999 to 9999 (Scaling range)"	-
	1 to 5 V	1-5V		
	0 to 10 V	0-10		
	2 to 10 V	2-10		
	0 to 100 mV	MV		
DC current	0 to 20 mA	0-20		
	4 to 20 mA	4-20		

* Input signal, measurement range, and set value at the time of delivery are as follows:

Thermocouple K, Measurement range from 0 through 400C, Set value 0 C.
Switching the input signal among thermocouple, RTD, current, and voltage is available by key operation on the front panel.

CODE SYMBOLS

	TYPE	SYROS										
	Front panel size W x H 48 x 48 mm	SW48				A	B	C	D	E	F	G
A	**CONTROL OUTPUT 1**											
	Relay contact SPST - Note 1					1						
	Relay contact SPDT - Note 1					2						
	SSR drive control					3						
	Current output (0-20 mADC / 4-20 mADC)					4						
	Voltage output (0-5 VDC / 1-5 VDC/ 0-10 VDC / 2-10 VDC					5						
B	**CONTROL OUTPUT 2**											
	None						0					
	Relay contact SPST						1					
	SSR drive control						2					
	Current output (0-20 mADC / 4-20 mADC)						3					
	Voltage output (0-5 VDC / 1-5 VDC/ 0-10 VDC / 2-10 VDC)						4					
	Re-transmission output (current)						5					
	Re-transmission output (voltage)						6					
C	**ALARM OUTPUT**											
	None							0				
	1 point							1				
	2 points							2				
	3 points							3				
	2 points (independent common)							4				
D	**POWER SUPPLY**											
	100-240 VAC								1			
	24 VDC / 24 VAC								2			
E	**OPTIONS**											
	None									0		
	RS485 Communication									1		
	Digital input (DI1)									2		
	RS485 Communication + Digital input (DI1)									3		
	RS485 Communication + Remote SV input - Note 3									4		
	RS485 Communication + CT input - Note 2									5		
F	**SPECIAL VERSION**										0	
G	**SPECIAL VERSION**											0

NOTES;

1- Not available for the (B) code "2", "3", "4", "5", "6". however, if you want to order (A) code "1" (SPST relay contact for the control output 1) and the (B) code "5" o "6" (current/voltage output for the control output 2) specify the model as follows

SW4815XXX**02**

SW4816XXX**02**

2- When using the CT input as a heather burnout alarm, add one alarm output in the (C) code.

3- When using the current input for the remote SV input, add a 250 Ohm resistor to the input terminal

SCOPE OF DELIVERY

- Controller × 1
- Instruction manual × 1
- Panel mounting frame × 1
- Watertight packing × 1

	TYPE (MOTORIZED VALVE CONTROL)	SYROS									
	Front panel size W x H 48 x 48 mm	SW48				A	B	C	D	E	F	G
A	**CONTROL OUTPUT 1**											
	Motorized valve control output					S						
B	**CONTROL OUTPUT 2**											
	None						0					
C	**ALARM OUTPUT**											
	None							0				
	1 point							1				
	2 points							2				
	2 points (independent common)							3				
D	**POWER SUPPLY**											
	100 - 240 VAC								1			
	24 VDC / 24 VAC								2			
E	**OPTIONS**											
	None									0		
	Digital input (DI1, 2 & 3)									1		
	RS485 Communication + Digital input (DI1)									2		
F	**SPECIAL VERSION**										0	
G	**SPECIAL VERSION**											0

NOTES

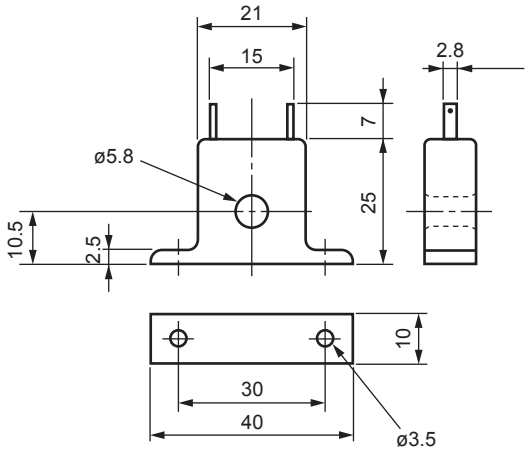
1- The position control function (PFB input) is not available in the **SW48S** series

OPTIONAL ITEMS

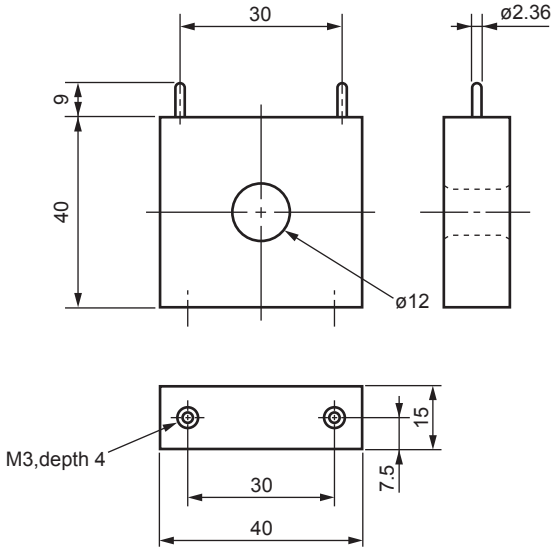
Current detector (CT) 1 to 30 A	Type: 40800018
20 to 100 A	Type: 40800019
Terminal cover	Type: 14000211
Shunt resistor (250Ω ± 0.1%)	Type: 40800032

Current detector (CT)

• Specification : 1 to 30 A



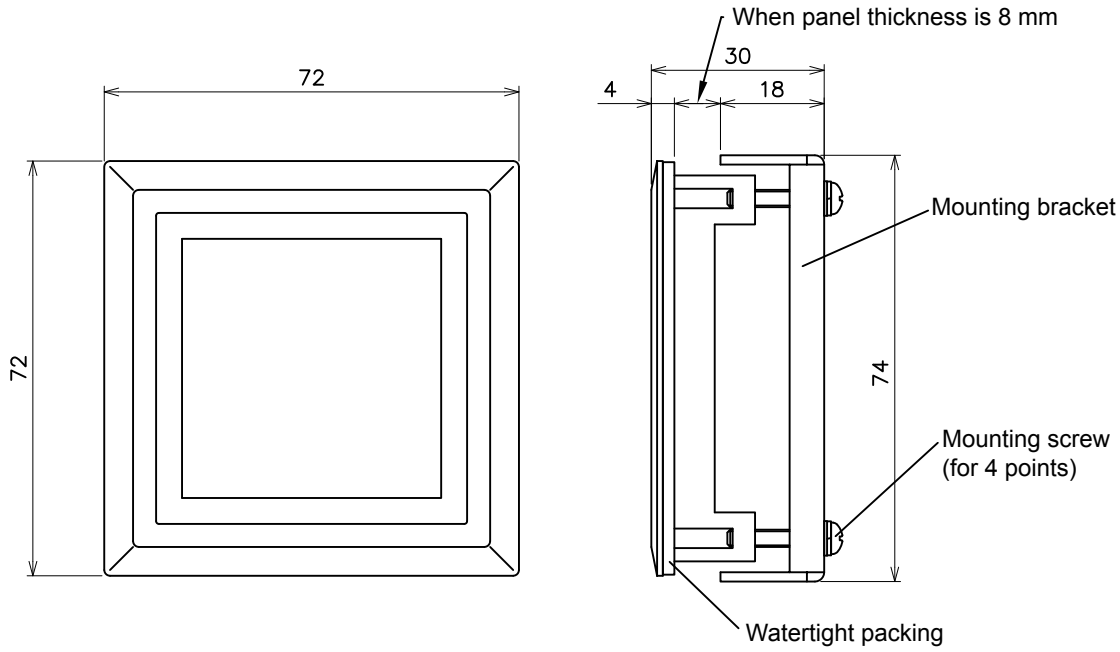
• Specification : 20 to 100 A



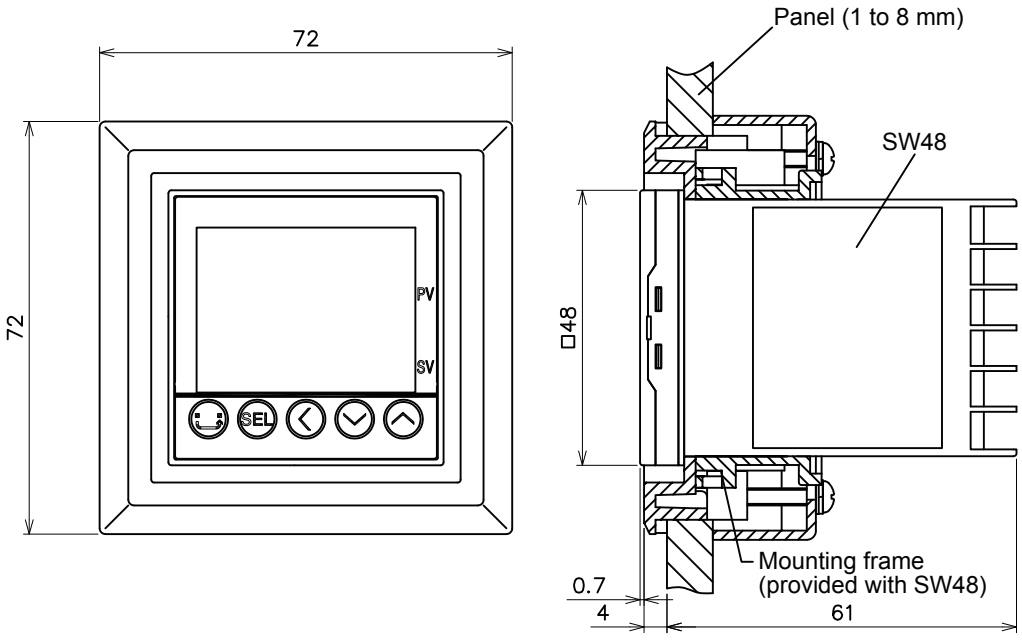
Note 1) Detection is available only for single phase heater.
Note 2) Unusable for heater control by thyristor phase angle control.

Panel mounting adapter for hole 72x72mm

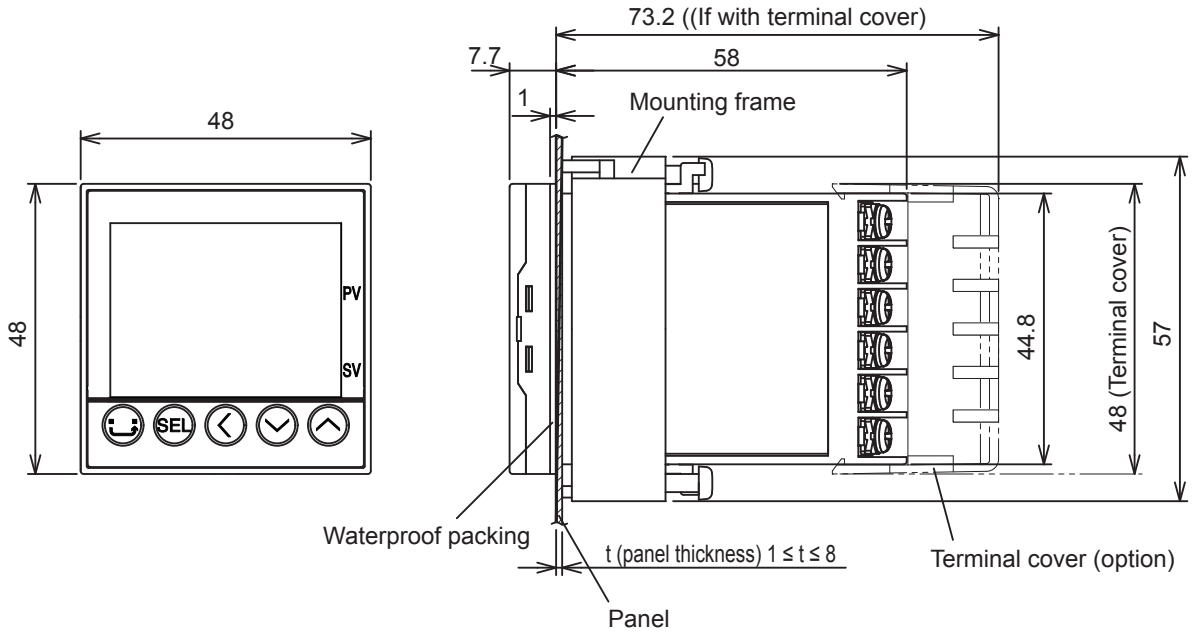
Outline diagram



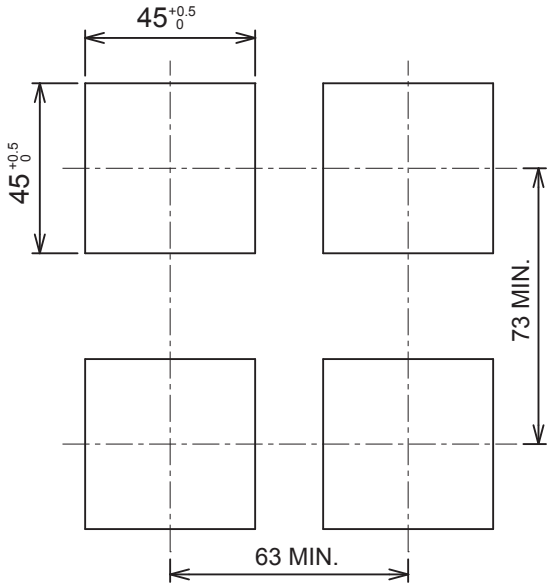
How to install SW48 with the adapter

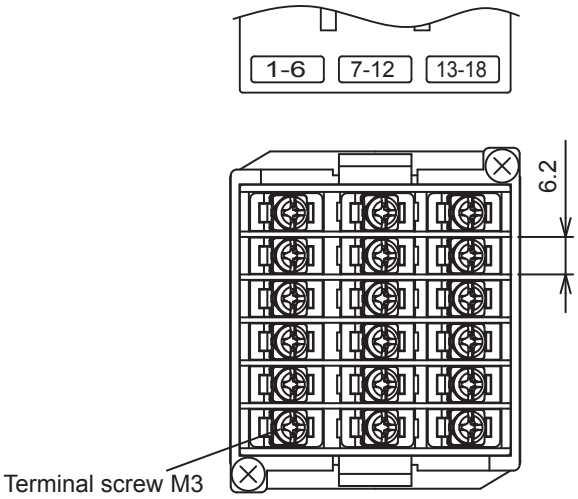


OUTLINE DIAGRAM (Unit : mm)



PANEL CUTOUT SIZE (Unit : mm)



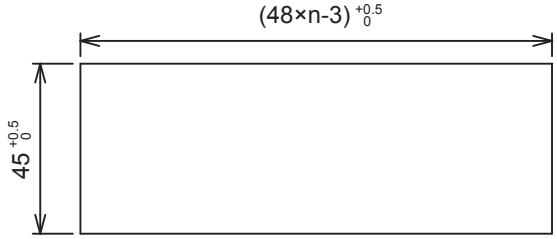


Rear view

Terminal block is not attached to unused terminals (terminal 7 to 12) according to the model.

Side stick mounting (n units)

Waterproof is not available in stick mounting.



TERMINAL ALLOCATION

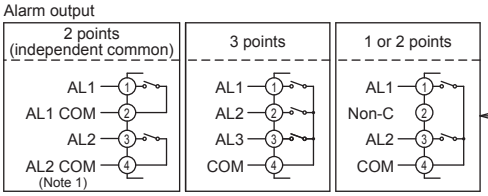
Standard type

Standard type

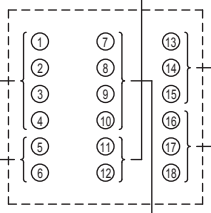
Control output 1	Relay output (SPST)	Relay output (SPDT)	SSR	Current	Voltage	Relay output (SPST)	Relay output (SPDT)	SSR	Current	Voltage
Control output 2	None	None	None	None	None	Relay output (SPST)	Relay output (SPST)	Relay output (SPST)	Relay output (SPST)	Relay output (SPST)
	13 14 OUT1	13 OUT1 NC 14 COM 15 NO	13 + OUT1 14 − COM	13 + OUT1 14 − COM	13 + OUT1 14 − COM	13 14 OUT1	13 OUT1 NC 14 COM 15 NO	13 + OUT1 14 − COM	13 + OUT1 14 − COM	13 + OUT1 14 − COM
						11 12 OUT2	11 12 OUT2	11 12 OUT2	11 12 OUT2	11 12 OUT2

Control output 1	SSR	Current	Voltage	SSR	Current	Voltage	SSR	Current	Voltage
Control output 2	SSR	SSR	SSR	Current or re-transmission output (current)	Current or re-transmission output (current)	Current or re-transmission output (current)	Voltage or re-transmission output (voltage)	Voltage or re-transmission output (voltage)	Voltage or re-transmission output (voltage)
	13 + OUT1 14 − COM 15 + OUT2	13 + OUT1 14 − COM 15 + OUT2	13 + OUT1 14 − COM 15 + OUT2	13 + OUT1 14 − COM 15 + OUT2 or re-transmission output	13 + OUT1 14 − COM 15 + OUT2 or re-transmission output	13 + OUT1 14 − COM 15 + OUT2 or re-transmission output	13 + OUT1 14 − COM 15 + OUT2 or re-transmission output	13 + OUT1 14 − COM 15 + OUT2 or re-transmission output	13 + OUT1 14 − COM 15 + OUT2 or re-transmission output

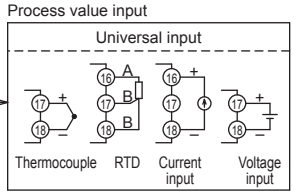
Alarm output



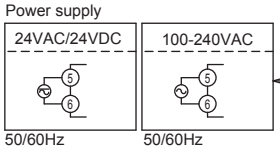
Note 1: Power supplies for AL1 and AL2 must be of the same type, either AC or DC.



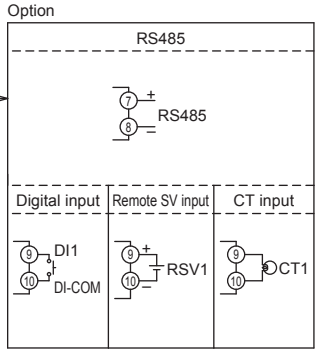
Process value input



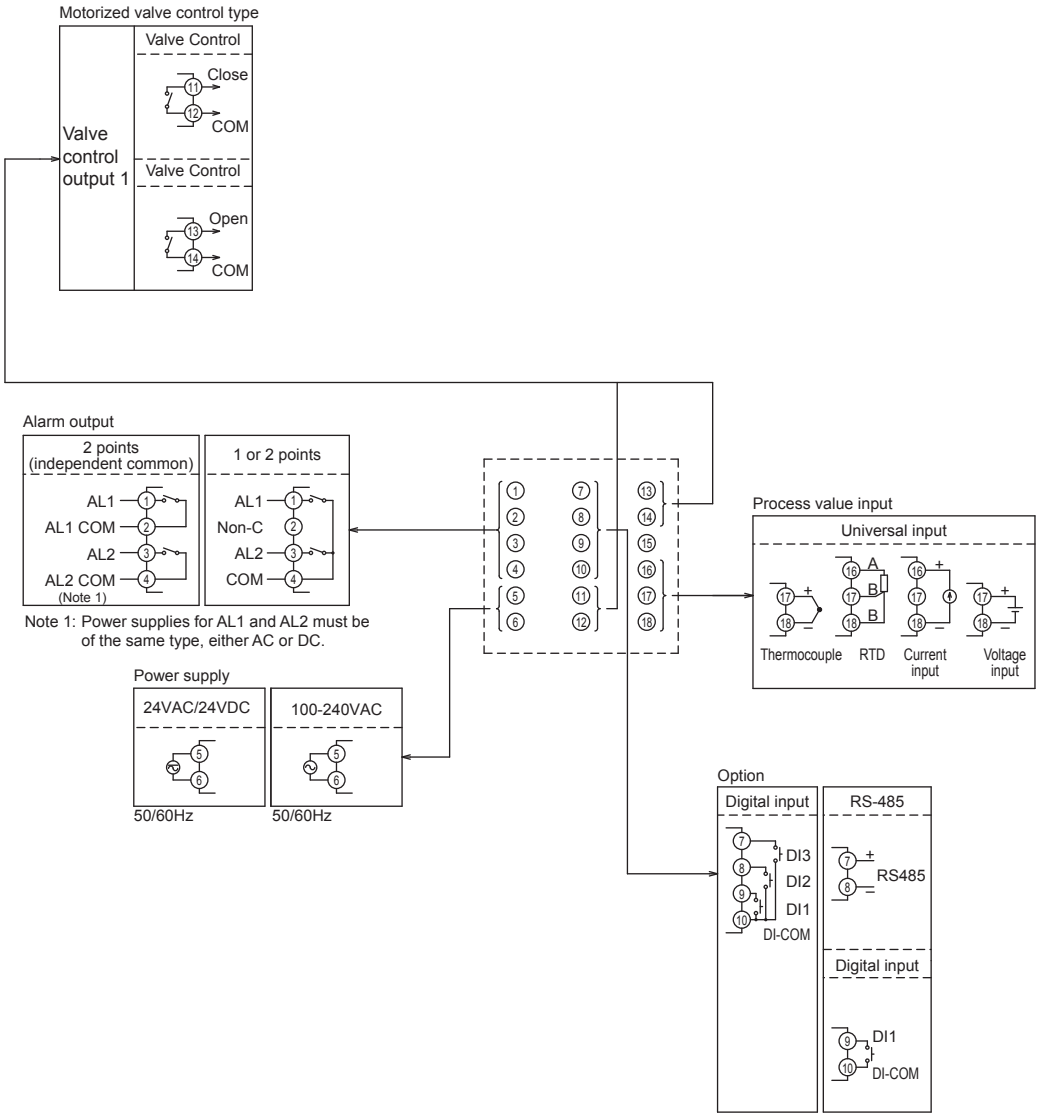
Power supply



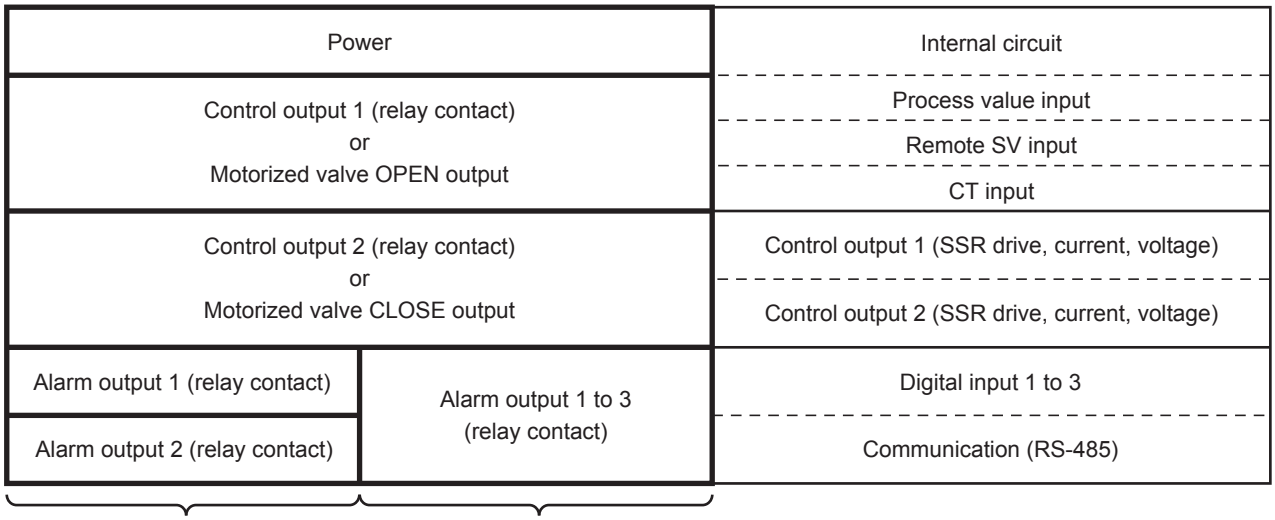
Option



Motorized valve control type



INSULATION BLOCK DIAGRAM



• When the C code is "4"
AL 1 and 2:
independent common

• When the C code is other than "4"
AL 1 to 3:
shared common

: Basic insulation
: Functional insulation
: No insulation

30738326B
DS-SW48_ES_070917

DISEÑOS Y TECNOLOGIA S.A.
Xarol, 6B P.I. Les Guixeres
08915 BADALONA
ESPAÑA
T: +34 933 394 758 F: +34 934 903 145 mail: dtl@ditel.es
www.ditel.es