DITEL

# SX48 TEMPERATURE CONTROLLER

## INSTRUCTION MANUAL

## Safety Precautions

Before using this product, the user is requested to read the following precautions carefully to ensure the safety. Safety precautions must be taken by every user to prevent accidents.
Failure to comply with the instructions contained in this manual may reduce the safety of the instrument.
The safety requirements are classified into "Warning" and "Caution" according to the following interpretations :

| | |
|---|---|
| ⚠ Warning | Suggesting that the user's mishandling can result in personal death or serious injury. |
| ⚠ Caution | Suggesting that the user's mishandling can result in personal injury or damage to the property. |

### 1. ⚠Warning

#### 1.1 Installation and wiring

• This controller designed to be installed at the following conditions.

| | | |
|---|---|---|
| Operating temperature | –10 to +50 [°C] | |
| Operating humidity | 90%RH or less (Non condensation) | |
| Installation category | II | Conforming to IEC61010-1 |
| Pollution degree | 2 | |

• The controller must be installed such that with the exception of the connection to the mains, creepage and clearance distances shown in the table below are maintained between the temperature probe and any other assemblies which use or generate a voltage shown in the table below.
Failure to maintain these minimum distances would invalidate the EN 61010 safety approval.

| Voltage used or generated by any assemblies | Clearance (mm) | Creepage (mm) |
|---|---|---|
| Up to 50Vrms or Vdc | 0.2 | 1.2 |
| Up to 100Vrms or Vdc | 0.2 | 1.4 |
| Up to 150Vrms or Vdc | 0.5 | 1.6 |
| Up to 300Vrms or Vdc | 1.5 | 3.0 |
| Above 300Vrms or Vdc | Contact with our sales office. | |

• If the voltage shown above exceeds 50Vdc (i.e. hazardous voltage), the basic insulation is required between all terminals of this controller and the ground, and supplementary insulation is required for the alarm output.
Isolation class of this controller is as shown below. Be sure to check that the isolation class of the controller satisfies your requirements before installation.

==== Basic insulation---- Non-insulation

| | |
|---|---|
| Mains (Power source) | Measured value input |
| Control output (relay output) | Internal circuit |
| Alarm output (AL1) | SSR/SSC driving output |
| Alarm output (AL2) | Loader |

• If there is a danger of a serious accident resulting from a failure or a defect in this unit, provide the unit with an appropriate external protective circuit to prevent an accident.
• The unit is normally supplied without a power switch and fuses.
Make wiring so that the fuse is placed between the main power supply switch and this controller. (Main power supply: 2 pole breaker, fuse rating: 250V, 1A)
• A switch (or a circuit-breaker) must be included in the installation.
• A switch (or a circuit-breaker) must be suitably located and easily reached.
• A switch (or a circuit-breaker) must be marked as the disconnecting device for this equipment.
• Supply wiring shall be prepared by installers in accordance with national regulations.
• When wiring the power supply terminal, use vinyl insulated 600 volt cable or equivalent.
• To avoid the damage and failure of controller, supply the power voltage fitting to the rating.
• To avoid an electric shock and controller failure, do not turn ON the power before all wiring is completed.
• Be sure to check that the distance is kept to avoid electric shock or firing before turning the power ON.
• Keep away from terminals while the circuit is energized in order to avoid an electric shock and a malfunction.
• Never attempt to disassemble, fabricate, modify, or repair this unit because tampering with the unit may result in a malfunction, electric shock, or a fire.
• Output relay is the part has a limited life.
• When output relay contact comes to the end of its life, it might remain on-state, or off-state. For safety, use a protective circuit outside.

#### 1.2 Maintenance precautions

• Be sure to turn off the power before this controller is installed or removed in order to avoid an electric shock, malfunction, and fault.
• Regular maintenance is recommended a longer service life of this controller. Some parts of this controller have a limited life span, or they will be deterio-rated with the lapse of time.
• One-year warranty is guaranteed for this unit including accessories, provided that the controller is properly used.

### 2. ⚠Caution

#### 2.1 Cautions on installation

Avoid the following places for installation.
• a place where the ambient temperature may reach beyond the range of from 0 to 50°C while in operation.
• a place where the ambient humidity may reach beyond the range of from 45 to 85% RH while in operation.
• a place where a change in the ambient temperature is so rapid as to cause condensation.
• a place where corrosive gases (sulfide gas and ammonia gas, in particular) or combustible gases are emitted.
• a place where the unit is subject directly to vibration or shock.
(Vibration or shock may cause output relay malfunction.)
• a place exposed to water, oil, chemicals, steam and vapor.
(if immersed with water, take the inspection by sales office to avoid an electr-ical leakage and firing)
• a place where the unit is exposed to dust, salt air, or air containing iron par-ticles.
• a place where the unit is subject to intereference with static electricity, mag-netism, and noise.
• a place where the unit is exposed to direct sunlight.
• a place where the heat may be accumulated due to the radiation of heat.

#### 2.2 Caution on installation on panel

• Insert the mounting bracket (accessory) from the rear side until the main unit is securely fit into the panel. If there are some gaps, tighten two screws until the gaps are eliminated. (Do not tighten the screws excessively because the mounting bracket can be removed from the stopper by the force.)
• The front side of this controller conforms to NEMA4X (equivalent with IP66). To ensure the waterproofness between the instrument and the panel, use packings that are provided as accessories in the following manner: (The improper fitting of packings will ruin the waterproofness.)
• As shown in Figure 1, fit a packing to the case of the unit and then insert it in the panel.
• Tighten screws on the fixing frame or fixtures so that no gaps are given between the front of controller and packing and between panels. Check that there are no deformation of packing as shown in Fig.3.
• If panel strength is weak, it may causes a gap between the packing and the panel, thus impairing water resistance.

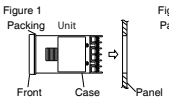
Figure 1


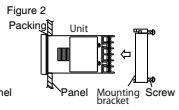
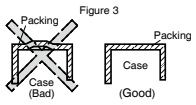

Figure 2


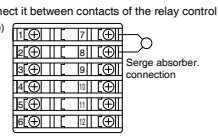

Figure 3



#### 2.3 Precautions in wiring connection

• For the thermocouple sensor type, use thermocouple compensation wires for wiring.
For the RTD type, use a wiring material with a small lead wire resistance and no resistance differentials among three wires.
• Keep input lines away from power line and load line to avoid the influence from noise induced.
• For the input and output signal lines, be sure to use shielded wires and keep them away from each other.
• If a noise level is excessive in the power supply, the additional installation of an insulating transformer and the use of a noise filter are recommended.
Make sure that the noise filter is installed to a place such as a panel that is properly grounded. The wiring between the noise filter output terminal and the instrument power supply terminal should be made as short as possible. None of fuses or switches should be installed to the wiring on the noise filter output side because the filter effect will be degraded by such a installation.
• A better anti-noise effect can be expected by using stranded power supply cable for the instrument. (The shorter the stranding pitch is, the better the anti-noise effect can be expected.)
• A setup time is required for the contact output when the power is turned on. If the contact output is used as a signal for an external interlock circuit, use a delay relay at the same time.
• Use the auxiliary relay since the life is shortened if full capacity load is connected to the output relay. SSR/SSC drive output type is preferred if the output operations occur frequently.
[Proportional interval] relay output: 30 seconds or more, SSR/SSC: one second or more
• If inductive load such as magnetic switches connected as a relay output load, it is recommended to use serge absorber to protect a contact from switching serge and keep a longer life.
Recommended spec · of serge absorber

| | | Varistor voltage |
|---|---|---|
| Voltage | 100V | 240V |
| | 200V | 470V |

Where to install: Connect it between contacts of the relay control output.

Example)



#### 2.4 Requirement for key operation/operation in abnormalities

• Prior to the operation, be sure to check alarm functions, since a failure in the proper setting will result in a failure in the proper output of an alarm in case of an abnormality.
• A display of UUUU or LLLL will appear in case of a break in the input. Be sure to turn off the power when a sensor is replaced.

#### 2.5 Others

• Do not use organic solvents such as alcohol and benzine to wipe this controller. Use a neutral detergent for wiping the controller.

## 1. Model Code Configuration

**SX48-1_11**

→ **1- RELAY OUTPUT**
**2- PULSE OUTPUT**

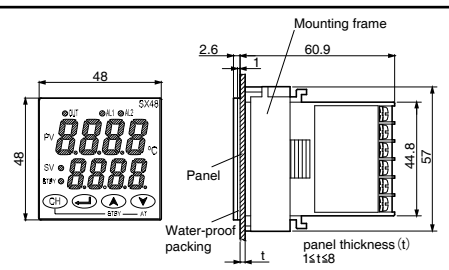
Input signal, measurement range, and set value at the time of deliver are as follows.
Thermocouple K, Measurement range; 0 to 400°C, Set value; 0C
Input signal of the thermocouple and the resistance bulb can be switched by key operation on the front panel.

## 2. Scope of Delivery

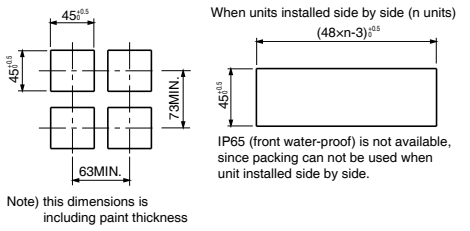
Temperature controller ....1 unit
Instruction manual .....1 copy
Mounting bracket .....1 pcs
Watertight packing .....1 pcs

## 3. Outline and Panel Cutout Dimensions

Outline dimensions




Panel cut



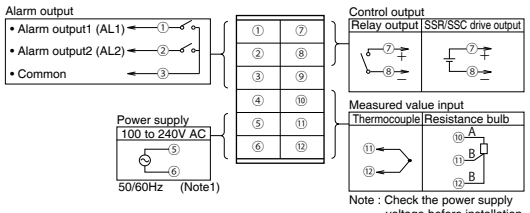

Note) this dimensions is including paint thickness

Note) Panel coating procedure must be taken into account, for the panel cutout dimension should still conform with the dimensions listed.

Caution on side-by-side installation:
• Maximum ambient temperature is at 45°C when the power supply is at 200VAC or more. When the SX48 controller is tightly fixed in vertical and upright direction, the use of 100V AC power supply is recommended .
(Installation of fan is recommended as a heat release measure)
• Make sure the controller is installed more than 30mm away, when there is an instrument of more than 70mm depth or a wall on the right side of the controller.
• Side-by-side installation may sacrifice the controller's waterproof property.

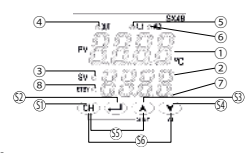
Caution on wiring
• Terminals at the left hand side (from No.1 to 6) should be used first.
• Crimp terminals with matching screw size should be used. Tightening torque value should be approx. 0.8N · m.
• Do not connect anything to the terminals that are not used. (Do not use as relay terminal)

## 4. Terminal Connection Diagram




Note : Check the power supply voltage before installation.

## 5. Name of Functional Parts and Functions




Operation section

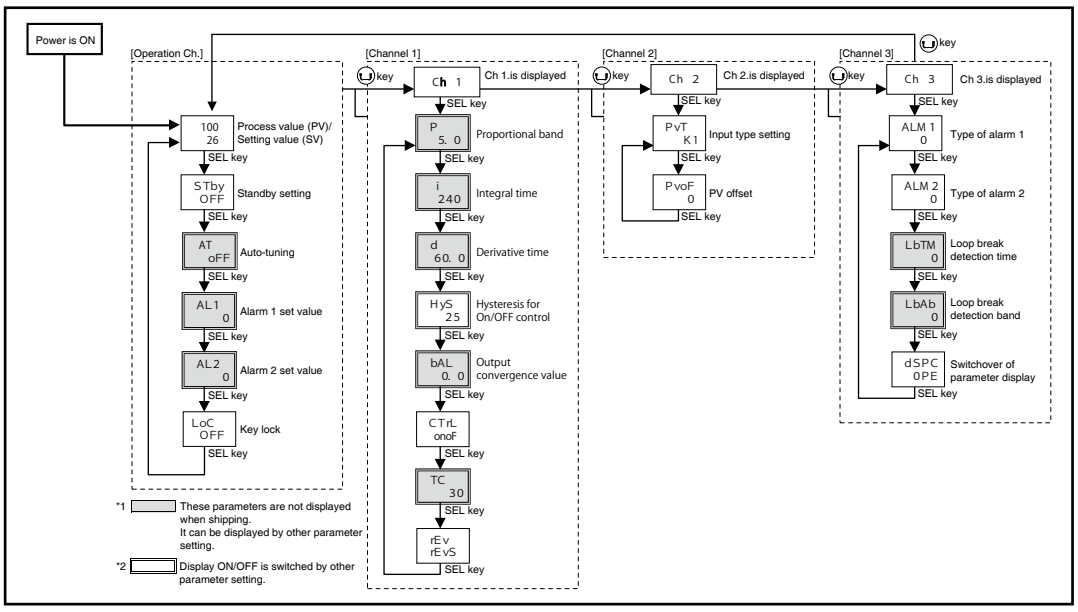
| | Name | Function |
|---|---|---|
| S1 | Block key | Switches parameter block |
| S2 | Select key | Switches the parameters |
| S3 | Up key | Changes the setting value and increases numerical value |
| S4 | Down key | Changes the setting value and decreases numerical value |
| S5 | Block+Up key | Switches RUN/Stand-by with holding down for 3 seconds |
| S6 | Block+Down key | Executes the auto-tuning Start/Stop with holding down for 3 seconds |

Operation section

| | Name | Function |
|---|---|---|
| 1 | Process value (PV) | Displays a process value (PV) or the parameter symbols. |
| 2 | Setting value (SV) | Displays a set value (SV) or a parameter set value. |
| 3 | SV lamp | Lamp is lit when a set value is displayed at lower line. |
| 4 | Output lamp | Lamp is lit while control output is ON.<br>Lamp is OFF while control output is OFF. |
| 5 | Alarm 1 lamp | Lamp is lit while alarm is ON. |
| 6 | Alarm 2 lamp | Lamp is OFF while alarm is OFF. |
| 7 | Auto-tuning lamp | Lamp is brink during auto-tuning<br>Lamp is OFF while control is being operated. Note 1 |
| 8 | Standby lamp | Lamp is lit while control is standby (or stop)<br>Lamp is OFF while control is being operated. |

Note1) Alarm 2 function is optional

## 6. Operation Flow Diagram

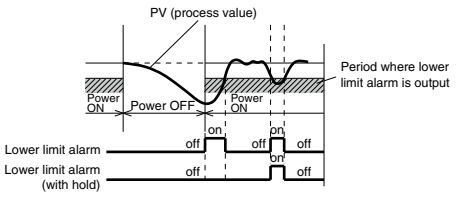



## 7. List of Alarm Type

| Type | Alarm Nº | Alarm type | Action diagram |
|---|---|---|---|
| | 0 | No alarm | PV |
| Absolute value alarm | 1 | Upper limit | ALn, PV |
| | 2 | Lower limit | ALn, PV |
| | 3 | Upper limit (with hold) | ALn, PV |
| | 4 | Lower limit (with hold) | ALn, PV |
| Deviation alarm | 5 | Upper limit | ALn, SV, PV |
| | 6 | Lower limit | ALn, SV, PV |
| | 7 | Upper/Lower limit | ALn ALn, SV, PV |
| | 8 | Upper limit (with hold) | ALn, SV, PV |
| | 9 | Lower limit (with hold) | ALn, SV, PV |
| | 10 | Upper/Lower limit (with hold) | ALn ALn, SV, PV |
| Zone alarm | 11 | Upper/Lower limit | ALn ALn, SV, PV |
| Break | 12 | Loop break alarm | |

Point What is alarm with hold?

The alarm is not turned ON immediately even when the process value is in the alarm band. It turns ON when it goes out the alarm band and enters again.




Note) • When alarm action type code is changed, alarm set value may also become different from previous settings.
Please check these parameters, turn off the power once, and then re-start the controller, before starting control.
• ALn means alarm set value (AL1, AL2).

## 8. List of Setting Parameter

Operation parameter

| | Parameter display symbol | Parameter | Description of contents | Default setting | Note |
|---|---|---|---|---|---|
| 1 | – | PV/SV display | Displays a process value/setting value. | – | |
| 2 | SrbY | Standby settings | Switches RUN or Standby of the control<br>ON : Control standby (output: OFF, alarm: OFF)<br>OFF: Control RUN (output of control/alarm is normal operation) | OFF | |
| 3 | AT | Auto-tuning | Starts and stops the auto-tuning<br>oFF : Stop<br>on : normal auto-tuning<br>L-on : Low PV auto-tuning | OFF | a |
| 4 | AL1 | Alarm 1 set value | Sets the operation point for alarm 1. Setting is available within input ranges | 2.5% of the range | b1,e |
| 5 | AL2 | Alarm 2 set value | Sets the operation point for alarm 2. Setting is available within input ranges | 2.5% of the range | b2,e |
| 6 | LoC | Key lock | Specifies whether or not parameter setting can be changed.<br>OFF : Change of setting is available.<br>ALL : All parameters can not be changed.<br>Invalid of AT (Block key + Down key) and standby switchover (Block key + Up key)<br>PArA : Only SV setting can be changed.<br>Invalid of AT (Block key + Down key) and standby switchover (Block key + Up key) | OFF | |

Channel 1 parameter

| | Parameter display symbol | Parameter | Description of contents | Default setting | Note |
|---|---|---|---|---|---|
| 7 | P | Proportional band | Sets the proportional band (setting range: 0.1 to 999.9%) | 5.0% | a |
| 8 | i | Integral time | Sets the integral time (setting range: 0 to 3200 seconds) | 240 seconds | a |
| 9 | d | Derivative time | Sets the derivative time (setting range: 0.0 to 999.9 seconds) | 60.0 seconds | a |
| 10 | HyS | Hysteresis for ON/OFF control | Setting range : 0.00 to 50.00%FS | 0.25% of the range | c |
| 11 | bAL | Output convergence value | Setting range : –100.0 to 100.0% | 0.00% | a |
| 12 | CTrL | Control method | Selects the control method.<br>onoF : ON/OFF control<br>PId : Normal PID operation<br>FUZZY: Fuzzy control | onoF | |
| 13 | tC | Cycle time (control output) | Sets the cycle time of control output.<br>(setting range: 1 to 150 seconds) | Relay: 30 seconds<br>SSR: 2 seconds | a |
| 14 | rEv | Setting of Normal /Reverse action | Sets the control action.<br>revS : Reverse action<br>normal: Normal action | revS | |

Channel 2 parameter

| | Parameter display symbol | Parameter | Description of contents | Default setting | Note |
|---|---|---|---|---|---|
| 15 | PvT | Setting of input type | Type of input | K1 | h |
| 16 | PvoF | PV offset | Shifts the display of process value(PV).<br>(setting range: –10.00 to 10.00%FS) | 0.00% of the range | |

Channel 3 parameter

| | Parameter display symbol | Parameter | Description of contents | Default setting | Note |
|---|---|---|---|---|---|
| 17 | ALM1 | Type of alarm 1 | Setting type of alarm action.<br>(setting range: 0 to 12) | 5 | g |
| 18 | ALM2 | Type of alarm 2 | Setting type of alarm action.<br>(setting range: 0 to 12) | No alarm output: 0<br>Alarm output 2points: 9 | g |
| 19 | LbTM | Loop break detection time | Specifies the time until control loop break is detected.<br>(setting range: 0 to 9999 seconds) | 0 second | d |
| 20 | LbAb | Loop break detection band | Sets the temperature range to detect the loop break.<br>(setting range: 0.00 to 100.00%FS ) | 2.50% of the range | d |
| 21 | dSPC | Changeover of parameter display | Detailed setting parameter of the temperature controller can be displayed. Refer to Operation manual for details.<br>oPE : Operator level<br>ENG : Engineer level | oPE<br>(everytime power is turned on, operator level is always set as default ) | f |

Note: a Displayed when control method (CTrL) is PID, Fuzzy.
b1 not displayed when alarm type 1 (ALM1) is set to "0".
b2 not displayed when alarm type 2 (ALM2) is set to "0".
c Displayed when control method (CTrL) is set to "onoF"
d Displayed when Loop break alarm is selected at alarm type 1 or 2 (ALM1/ALM2).
e Setting range: 0 to 100%FS (when absolute value alarm) , –100 to 100%FS (when deviation alarm)
f Returns to operator level,everytime power is turned OFF.
g Refer to item7. List of alarm type.
h Refer to item10. Measuring input signal.

## 9. Error Indications

This controller has a display function to indicate several types of error code shown below.
If any of the error codes is displayed, please eliminate the cause of error immediately.
After the cause is eliminated, turn off the power once, and then re-start the controller.

| Error code | Possible cause | Control output |
|---|---|---|
| UUUU | ①Thermocouple burnt out.<br>②RTD (A) line burnt out.<br>③PV value exceeds P-SU by 5% FS. | OFF |
| LLLL | ①The RTD line (B or C) burnt out.<br>②The RTD line (between A and B or A and C) short.<br>③PV value is below P-SL by 5% FS. | |
| LLLL | ①PV value < –199.9<br>Note) In case of RTD input, "LLLL" is not displayed even if the temperature becomes below –150° C. | Control is continued until the value reaches –5% FS or less, after turn OFF. |
| Err (SV indication flickers) | Incorrect range setting (P-SL/P-SU). | OFF |

## 10. Measuring Input Signal

| Input signal type | | Setting value | Range [°C] | Range [°F] |
|---|---|---|---|---|
| RTD (IEC) | JPt100 | JPT1 | –200 to 600 [°C] | –300 to 1100 [°F] |
| | | JPT2 | –199.9 to 500.0 [°C] | –199.9 to 800.0 [°F] |
| | Pt100 | PT1 | –200 to 850 [°C] | –300 to 1500 [°F] |
| | | PT2 | –199.9 to 500.0 [°C] | –199.9 to 800.0 [°F] |
| Thermocouple | J | J1 | 0 to 800 [°C] | 0 to 1500 [°F] |
| | | J2 | 0.0 to 400.0 [°C] | 0.0 to 700.0 [°F] |
| | K | K1 | 0 to 400 [°C] | 0 to 700 [°F] |
| | | K2 | –200 to 1200 [°C] | –300 to 2200 [°F] |
| | | K3 | 0.0 to 400.0 [°C] | 0.0 to 700.0 [°F] |
| | T | T1 | –200 to 400 [°C] | –300 to 700 [°F] |
| | | T2 | –199.9 to 400.0 [°C] | –199.9 to 700.0 [°F] |
| | R | R | 0 to 1600 [°C] | 0 to 2900 [°F] |
| | B | B | 0 to 1800 [°C] | 0 to 3200 [°F] |
| | S | S | 0 to 1600 [°C] | 0 to 2900 [°F] |
| | E | E | –200 to 800 [°C] | –300 to 1400 [°F] |
| | N | N | 0 to 1300 [°C] | 0 to 2300 [°F] |
| | PL-II | PL-2 | 0 to 1300 [°C] | 0 to 2300 [°F] |

(±0.5% of process value or 1°C whichever is greater ±1digit±1°C
Thermocouple -100°C or less : (±2% of process value) 1digit±1°C
Correct indication is not ensured within a range from 0 to 500°C for R type thermocouple and from 0 to 400°C for B type thermocouple.

## 11. Specification

| | |
|---|---|
| Power voltage | 100 (–15%) to 240V AC (+10%), 50/60Hz |
| Power consumption | 5VA or less (at 100V AC), 6VA or less (at 220V AC) |
| Relay contact output | SPST contact 220V AC/30V DC 3A (resistive load) |
| SSR/SSC driving output | ON: 10.2 to 15V DC 20mA or less |
| (Voltage pulse output) | OFF: 0.5V DC or less |
| Alarm output (up to 2 outputs) | SPST contact 220V AC/30V DC 1A (resistive load) |
| Preservation temperature | –10 to 60° 90%RH or less |
| Operating ambient temperature | |
| | –10 to 50° 90%RH or less (1year warranty if used under normal conditions) |
| | –10 to 45° 90%RH or less (when side by side installation) |

DITEL

**DISEÑOS Y TECNOLOGÍA S.A.**
c/Xarol 8-C P.I. Les Guixeres
08915 Badalona (Spain)
**www.ditel.es**

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