DIGITAL TEMPERATURE CONTROLLER USER'S MANUAL

2007.3 (The 1st edition)

* Thank you for purchasing Digital Temperature Controller. Please go through this Instruction Manual carefully and use the unit in proper manner.

NOTICE/WARNING BEFORE OPERATION USE

The following symbol $\Delta$ is provided to prevent incident or damage. Kindly refer to the details of the WARNING/CAUTION when using for the first time.

<table>
<thead>
<tr>
<th>WARNING</th>
<th>Due to mishandling, serious dangers may occur to the operator such as death, electrocution and a skin burn.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAUTION</td>
<td>Due to mishandling, it may cause some damage to the unit or the operator getting slight injury.</td>
</tr>
</tbody>
</table>

WARNING

- Make sure the correct wiring connection before turning on electricity. Miss-Wiring may cause malfunction of the unit and fire.
- Never modify the unit to prevent damage or incident such as malfunction and fire etc.

CAUTION

- For prevention of its malfunction, do not push the front key with sharp points.
- Spare terminal must not be used for other purposes.
- Please put this user's manual aside for your reference, when operating the unit.
- Copy or reprint of this manual, wholly or partially, is not allowed.
- The contents of this manual may change without notice in future.

OPERATING ENVIRONMENT

Never use in the following environments. It may cause fire and break the wire.
1) Around explosive gases, inflammable gases or corrosive gases
2) In either sunshine or ambient temperature (above 50℃) remarkably increases
3) In very low ambient temperature (below 0℃), such as outdoors in cold areas
4) In very high humidity (85%RH or higher)
5) Around splashing of water or chemicals
6) Under severe vibration or shocks
7) Around dust, iron powder, black smoke
8) Around external noise, induction trouble, vibration, large shocks, and others such that can have damaging effects to the electric circuit.
9) Under violent temperature change

SPECIFICATIONS

<table>
<thead>
<tr>
<th>Type</th>
<th>MTCTR : Relay contact</th>
<th>MTCTS : SSR drive voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage</td>
<td>100 to 240V AC, 50/60Hz</td>
<td></td>
</tr>
<tr>
<td>Power Consumption</td>
<td>Below 10 VA</td>
<td></td>
</tr>
<tr>
<td>Memory Element</td>
<td>EEPROM</td>
<td></td>
</tr>
<tr>
<td>Input of Sensor</td>
<td>Thermocouple, R.T.D./0-5V, 1-5V, 4-20mA (Changeable by front key)</td>
<td></td>
</tr>
<tr>
<td>Control Output</td>
<td>Relay contact, SSR drive voltage, Current</td>
<td></td>
</tr>
<tr>
<td>Control Method</td>
<td>Two kinds of PID, ON/OFF</td>
<td></td>
</tr>
<tr>
<td>Operation Environment</td>
<td>0 to 50℃, 20 to 90%RH (Avoid making dew)</td>
<td></td>
</tr>
<tr>
<td>Storage Environment</td>
<td>-25 to 70℃, 5 to 95%RH (Avoid making dew)</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Less than 180g</td>
<td></td>
</tr>
<tr>
<td>Location of the Unit Setting</td>
<td>Keep away from the followings. Gas of corrosion, dust and oily smoke. The influence of electromagnetic field. The direct sunlight.</td>
<td></td>
</tr>
<tr>
<td>Installation condition</td>
<td>Installation category □</td>
<td></td>
</tr>
</tbody>
</table>

Due to mishandling, serious dangers may occur to the operator such as death, electrocution and a skin burn.

Due to mishandling, it may cause some damage to the unit or the operator getting slight injury.

Due to mishandling, it may cause some damage to the unit or the operator getting slight injury.
CAUTION BEFORE CONTROL

- Set-up program is stored operation, as non-volatile memory, is equipped with the controllers.
- Either thermocouple or R.T.D.(Pt 100) Pt100 is selectable input type, but Current/Voltage input needs to be selected individually. For suitable application, please select most appropriate input type and adjust input setup.
  (Thermocouple at the time of shipment (K))
- PID or ON/OFF control is selective for the optimal perform and each detail of features is specified in the table below.

<table>
<thead>
<tr>
<th>PID Control</th>
<th>ON/OFF Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merit</td>
<td>Life span of relay is generally longer, as it is ON when SV and it is OFF when temperature is over SV (For heating control).</td>
</tr>
<tr>
<td>Demerit</td>
<td>Control value is worse in comparison with that of PID control.</td>
</tr>
</tbody>
</table>

PARTS INDICATION

- PV: Process value, character for setting mode display.
- SV: Setting value, input value for setting mode display.
- OUT1: Lights ON when output 1 turn ON
- OUT2: Lights ON when output 2 turn ON
- AL1: Lights ON when Event output 1 turn ON
- AL2: Lights ON when Event output 2 turn ON
- COM: Flash ON and OFF when communicating. Lights ON when communication is selected as an option.
- RDY: Lights ON under Ready
- DI: Lights ON when DI turn ON
- MODE KEY: For change of display
- FUNC KEY: For action of function setting
- ▲▼ KEY: Up down key for change of setting value.
  Holding the up down keys are the value at a rapid rate.

INSTALLTION AND WIRING

1) Outer Dimensions

2) Panel Cutout

A : 45mm tolerance : +0.6 -0
3) Wiring

CAUTION
For prevention of electric shock, please connect wiring only after turning power off and don't touch the terminal part when powered on.

PRECAUTIONS ON WIRE CONNECTION

1) When connecting wires, be sure to turn off the power supply in advance, or electric shock may result.
2) This unit will not perform control operation for approx. 4 seconds after turning on the power. Note this point when using the unit as an interlock circuit, because no output is issued during this period.
3) Use the crimping terminal for wire connection that fits M3.5 thread. (Tighten the wire directly at the center portion)
4) Use wire with line resistance 5Ω or lower (per line) for connection between the temperature measuring resistor and the temperature controller, and use the specified compensation copper wire or strand itself for connection between the thermocouple and temperature controller.
5) When using the unit in the vicinity of a noise source, use shielded wire. Do not lay input and output lines together in the same duct or conduit tube.
6) Separate the input and output signal lines 50 cm or more from the power supply line and load line.
SET-UP PARAMETERS BEFORE USAGE

- Follow the instructions below to set-up parameters
  *If advanced set-up is required, refer to “Operation Flow and Setting” screen.

Parameter No

1. Refer to [Table1. Input Sensor Selection/Setting Range] and set to the input settings of the sensor you are using (Refer to Default settings)  SET1 2. Input type setting

2. Set Yes/No of decimal requirements. (Refer to Default settings)  SET1 6. Position of decimal point

3. Refer to “Caution before Flow” and set the control alternatives available for Output 1.
   - Recommended settings
     Main Unit: SSR output  PID Control
     Main Unit: Relay contact output ON-OFF control (Refer to Default settings)  SET2 13. Selection of control type setting

4. Set according to Heating control (0:Reverse) or -Cooling Control(1:Normal) (Refer to Default settings)  SET2 14. Change of normal or reverse

5. If alarm output is required, set Upper and Lower limit setting values. Refer to “Alarm Operating Range” table shown on P5.
   The Alarm Operating Range compares the measured value and present value to turn the event on or off. It is effective for monitoring abnormalities or starting/stopping of other systems.  SET3 38. / SET4 48. Function setting for EV 1
   Function setting for EV 2 (Refer to Ex.5.)

6. Set SV Operate mode display
   Primary displays

7. Set A T (Auto Tuning) *When using PID control Default values are pre-set for PID. Default values can be used, but in order to stabilize controls, please perform AT.
   AT Calculations depend on the kind of control.
   Select 1, and press FUNC key to start AT.
   Press the FUNC key once more during operation to stop. (Refer to Default settings)  SET2 16. Setting for PID tuning type

8. Other Check each movement. (Stable temperature/Alarm)
   Setting of mis-operation (SV limiter/ Keylock)

Table1. To select input sensors and setting range. (unit: ℃)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Low limit</th>
<th>High limit</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>00: K Thermocouple</td>
<td>-200~1372</td>
<td>-99.9~990.0</td>
<td>00: K Thermocouple</td>
</tr>
<tr>
<td>01: J</td>
<td>-200~850</td>
<td>-99.9~850.0</td>
<td></td>
</tr>
<tr>
<td>02: R</td>
<td>0~1700</td>
<td>0~1700</td>
<td></td>
</tr>
<tr>
<td>03: T</td>
<td>-200~400</td>
<td>-99.9~390.0</td>
<td></td>
</tr>
<tr>
<td>04: N</td>
<td>-200~1300</td>
<td>-99.9~990.0</td>
<td></td>
</tr>
<tr>
<td>05: S</td>
<td>0~1700</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>06: B</td>
<td>0~1800</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>10: Rt100</td>
<td>-199~500</td>
<td>-99.9~500.0</td>
<td></td>
</tr>
<tr>
<td>11: J Pt100</td>
<td>-199~500</td>
<td>-99.9~500.0</td>
<td></td>
</tr>
</tbody>
</table>

Setting of shipment

<table>
<thead>
<tr>
<th>SET1 2. Input type setting</th>
<th>00 : K Thermocouple</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET1 6. Position of decimal point</td>
<td>0 : Not required</td>
</tr>
<tr>
<td>SET2 14. Change of normal or reverse</td>
<td>0 : Reverse</td>
</tr>
<tr>
<td>SET3 38. / SET4 48. Function setting for EV 1</td>
<td>00 : None</td>
</tr>
<tr>
<td>SET3 38. / SET4 48. Function setting for EV 2</td>
<td>00 : None</td>
</tr>
<tr>
<td>SET2 16. Setting for PID tuning type</td>
<td>1 : Auto-tuning output 1</td>
</tr>
</tbody>
</table>
### ALARM OPERATING RANGE

<table>
<thead>
<tr>
<th>Deviation</th>
<th>AL1L</th>
<th>AL1H</th>
<th>Absolute value</th>
<th>AL1H</th>
</tr>
</thead>
<tbody>
<tr>
<td>high and low limit</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>low limit</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>high and low limit range</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
</tbody>
</table>

- **AL1L**: Lower limit setting value
- **AL1H**: Upper limit setting value

\[\Delta: \text{Position of Setting value}\]

* The above alarm settings (AL1L, AL1H) apply for when positive values are set.

### How to release BLIND Function

1. **Power ON**
   - Automatically

2. **Initial Display**
   - Automatically

3. **Operation Mode**
   - Press MODE Key (10sec)

4. **Immediately after the “Blink”, press FUNC Key, and quickly press MODE Key.**

5. **Press MODE Key (3 sec)**

6. **Press UP Key (△) for 1 → 7**

7. **Press FUNC Key**

8. **Power OFF**

9. **Power ON**
   - Automatically

10. **Initial Display**
    - Press MODE Key consecutively

11. **TIMER Setting Mode (OPERATION Mode)**

12. **Press UP Key (△) for 1 → 7**

13. **Go on TIMER Setting**

**1 Please select an appropriate character (eg. Timer Setting etc) being of BLIND Function effect for the demanding release.**

**2 Character selected for TIMER Setting.**

**3 BLIND Function for “SELECTION DISPLAY (Timer Setting Mode)” is released.**
OPERATION FLOW AND SETTING MENU

- Power ON
  Shows for 4 seconds (Warming up)

- Operate mode display
  A. Primary displays
    - Process value PV
    - Setting value SV
    - Set the temperature required
  B. Priority displays. Refer to Ex.1.
    SET0: Priority displays by setting and shows max.9 displays by setting.
  - MODE key, return to A

- FUNC key
  FUNK key operates on the selected setting mode 7. Refer to Ex.2.

Ex.1. Priority displays & its setting
This function is to shift the most essential screens on setting mode into operation mode as a priority. Please select priority displays through priority display setting.

eg: Basic display → Output 1 manipulated value → Setting high limit for event Output 1
* Screen is shifted when pressing mode key each time.

Ex.2. FUNC key work
This function is to enable FUNC key to use as a specific key, for the following actions selected in FUNC key setting belonged to setting mode.
1. Digit shift
   Setting digit shift is enabled when setting value is changed.
2. RUN/READY
   Control stop (READY) and control performance (RUN) are alternately switched every FUNC key is pressed. (READY lamp is ON during control stop)
3. Auto-Tuning (AT)
   AT starts instantly after pressing FUNC key. (Start/Reset operation is available, each time FUNC key is pressed)
4. Timer
   Available for start/reset.

Ex.3. To select PID
Feature of type A and B

<table>
<thead>
<tr>
<th>Feature</th>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ordinary PID</td>
<td>Over shoot protection PID</td>
</tr>
</tbody>
</table>

If control is unstable under self-tuning, please change to type A or B and also to ON/OFF-control.

Ex.4. ARW
Anti-reset wind-up take effect for overshooting by over-integral of PID control action.

- ARW controls integral action (PV accords with SV).
- If integral value goes down, it takes effects.
- If integral value is set "0", it stops integral action.
<table>
<thead>
<tr>
<th>Setting Mode</th>
<th>Setting Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0: Type A</td>
<td>0~100%</td>
<td>Default type</td>
</tr>
<tr>
<td>0: Type B</td>
<td>0~100%</td>
<td>Alternate type</td>
</tr>
<tr>
<td>0: Type C</td>
<td>0~100%</td>
<td>Special type</td>
</tr>
</tbody>
</table>

**Control Performance**
- **SV Normal open**
- **SV Normal close**
- **SV Manual control**
- **SV Auto-tuning**
- **SV Self-tuning**

**Operation Mode**
- **Operation mode lock only**
- **All lock (Not available)**
- **None**

**Timer Mode**
- **M ODE key**
- **RU N/READY**

**Input Type Setting**
- **PuS**
- **PuG**
- **AtG**
- **P1**

**Event Output Setting**
- **EV 1**
- **EV 2**
- **EV 3**
- **EV 4**

**Event Setting**
- **Type**
- **Action**
- **Level**

**Setting Table**

**Note:** The numerical value of display is an initial value.
<table>
<thead>
<tr>
<th><strong>Display</strong></th>
<th><strong>Description</strong></th>
<th><strong>Trouble Shooting</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Err 0</strong></td>
<td>Display of memory error.</td>
<td>Check the snapping of thermocouple and R.T.D. input.</td>
</tr>
<tr>
<td><strong>Err 1</strong></td>
<td>Display of A/D converter error or incorrect sensor connection with selectable input.</td>
<td>Ditto</td>
</tr>
<tr>
<td><strong>Err 2</strong></td>
<td>Display of auto-tuning error.</td>
<td>Check sensor connection or change to other tuning.</td>
</tr>
<tr>
<td><strong>Loc</strong></td>
<td>Display when parameter is changed in key-lock condition.</td>
<td>Discontinue to change parameter.</td>
</tr>
<tr>
<td><strong>At</strong></td>
<td>Alternately this SV/PV display are shown.</td>
<td>Normality</td>
</tr>
<tr>
<td><strong>Su 2</strong></td>
<td>Display when setting value is changed on SV2 control.</td>
<td>Discontinue to change setting value (during control of SV2)</td>
</tr>
<tr>
<td><strong>DI</strong></td>
<td>Display when changing setting value of shift on DI.</td>
<td>Discontinue to change setting value of the self on digital input</td>
</tr>
<tr>
<td><strong>FUnK</strong></td>
<td>Display when making setting value change in control display while function key is on RUN/READY.</td>
<td>Discontinue to change setting value of the self on digital input</td>
</tr>
<tr>
<td><strong>TIME</strong></td>
<td>Display when altering setting value in control display while being on timer.</td>
<td>Discontinue to change setting value of the self on digital input</td>
</tr>
</tbody>
</table>
MISUMI Corporation
FA Mechanical Division
4-43, Toyo 2-chome, Koto-ku,
Tokyo, 135-8458 Japan
Phone: (81)3-3647-7173 Telfax: (81)3-3647-7481