3. How to Install

**NOTE**
- Do not apply excessively high electrical stress.
- Terminal connector must be securely tightened (nail tangential, 90° to initial position).
- Gently pull the terminal cover to disconnect it from the controller.
- For conversion of a UT controller to a UT320 controller, refer to the UT320 controller manual.
- Use a terminal cover that corresponds to the number of terminals.
- With the UT320 controller, the terminal cover is provided as standard.

**Installation Position**

Install the controller at an angle within 30° from horizontal with both the front panel facing upward. Do not install facing downward. The position of left and right sides should be used to ensure proper ventilation and to avoid electric shock or other dangers that may result in injury or loss of life.

**NOTE**
Note whether the position of the front panel is reversed using the controller panel. If not reversed, it is not reversed. To install it horizontally, ensure the left and right sides of the controller are not reversed.

**External Dimensions and Panel Cutout Dimensions**

UT320

- Dimensions: 96 (height) x 96 (width) x 22 (depth from panel face)
- Weight: About 1 kg or less

UT350

- Dimensions: 96 (height) x 96 (width) x 28 (depth from panel face)
- Weight: About 1 kg or less

4. How to Connect Wires

**NOTE**
- Use a terminal cover that corresponds to the number of terminals.
- With the UT320 controller, the terminal cover is provided as standard.

**DC Loop Power Supply**

- Terminal connection uses a multipole terminal block. Be sure to perform the following procedure to ensure safety.
- Be sure to turn off the power of the controller before connecting or disconnecting the power supply.
- Be sure to install the controller in a location that is not exposed to water or moisture.
- Be sure to install the controller in a location that is not exposed to direct radiant heat.
- Be sure to install the controller in a location that is not exposed to dust or other hazards.
- Be sure to install the controller in a location that is not exposed to excessive vibrations or shocks.
- Be sure to install the controller in a location that is not exposed to excessive temperatures.
- Be sure to install the controller in a location that is not exposed to excessive pressures.
- Be sure to install the controller in a location that is not exposed to excessive electromagnetic interference.

**CAUTION**
- Be sure to turn off the power of the controller before carrying out wiring.
- Be sure to connect the power supply using the specified power supply terminals.
- Be sure to install the controller in a location that is not exposed to excessive temperatures.
- Be sure to install the controller in a location that is not exposed to excessive pressures.
- Be sure to install the controller in a location that is not exposed to excessive electromagnetic interference.

**Internal Fuse**

- Use a time-lug fuse (1.6 A, 250 V AC).
- Use a time-lug fuse (1.6 A, 250 V AC) for internal fuse.

**Power Supply Specifications**

- Constant voltage DC (14.5 to 18.0 V, max. 21 mA)
- Rated voltage: 100 to 240 V AC
- Power consumption: 10 W
- Power factor: 0.7 (max.)
- Input impedance: 50 kΩ
- Output power: 10 W
- Output current: 0.2 A
- Output voltage: 14.5 to 18.0 V DC
- Output wave form: Square wave
- Output frequency: 50/60 Hz
- Output ripple: 0.3% of output voltage
- Output waveform: Square wave
- Output frequency: 50/60 Hz
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- Output ripple: 0.3% of output voltage
- Output waveform: Square wave
- Output frequency: 50/60 Hz
- Output ripple: 0.3% of output voltage

**Environmental Conditions**

- Temperature: -20 to 60°C (0 to 104°F)
- Humidity: 20% to 90% RH (non-condensing)
- Atmospheric pressure: 86 to 106 kPa (625 to 784 mm Hg)
- Altitude: Up to 2000 m
- Shock: 15 G (for 2 ms)
- Vibration: 0.7 G (sinusoidal, 10 to 550 Hz, 1 cycle)
- Pollution degree: 2 (pollution by non-conductive particles)
- Electrostatic discharge: ESD 8 kV
- Electrostatic charging: ESD 8 kV
- Radiation resistance: ESD 8 kV
### UT350 Standard Type (Model UT350-0 or UT350-3) or Heating/Cooling type (Model UT350-2)

- **Control output**
  - **Heating-side control output**
    - Voltage pulse output
    - Transition time: 500 μs or more
    - Max. open: 21 mA DC max.
    - Load resistance: 600 Ω or less

- **Relay contact output**
  - 1 SP (Single Pole) or 2 SP (Double Pole)
  - Load resistance: 100 Ω or less

- **Alarm output**
  - Common
  - OFF
  - STOP

- **Current output**
  - 4-20 mA DC
  - Max. 21 mA DC max.

- **PV retransmission output**
  - Common
  - OFF
  - STOP

- **Current / voltage output**
  - 4-20 mA DC
  - 0-10 V DC

- **Temperature Proportional Output (PPO)**
  - 4-20 mA DC

- **RS-485 communication**
  - 4-20 mA DC
  - 0-10 V DC

### UT350 Heating/Cooling Type (Model UT350-2)

- **Heating side**
  - Voltage pulse output
  - Transition time: 150 μs or more

- **Cooling side**
  - Voltage pulse output
  - Transition time: 150 μs or more

### UT320 Standard Type (Model UT320-0 or UT320-3) or Heating/Cooling type (Model UT320-2)

- **Control output**
  - **Heating-side control output**
    - Voltage pulse output
    - Transition time: 500 μs or more
    - Max. open: 21 mA DC max.
    - Load resistance: 600 Ω or less

- **Relay contact output**
  - 1 SP (Single Pole) or 2 SP (Double Pole)
  - Load resistance: 100 Ω or less

- **Alarm output**
  - Common
  - OFF
  - STOP

- **Current output**
  - 4-20 mA DC
  - Max. 21 mA DC max.

- **PV retransmission output**
  - Common
  - OFF
  - STOP

- **Current / voltage output**
  - 4-20 mA DC
  - 0-10 V DC

- **Temperature Proportional Output (PPO)**
  - 4-20 mA DC

- **RS-485 communication**
  - 4-20 mA DC
  - 0-10 V DC

### Notes
- OT is a setup parameter. You can change the settings of the parameter OT to change the control output type.
- The control output types are:
  - OT=1: No function
  - OT=2: Voltage pulse output
  - OT=3: Time proportional PPO
  - OT=4 (factory-set default): Time proportional PPO
  - OT=5: Time proportional PPO
  - OT=6: Time proportional PPO

- Changing DIS setpoint allows you to change the function of external contact input.
- Changing DIS setpoint allows you to change the function of external contact input.
- Wiring can only be carried out if the cooling-side control output is set to voltage pulse output.
- Wiring can only be carried out for model UT320-2.
The following operating procedure describes an example of setting the controller to control temperature.

1. Set-up Control Parameters
   - Switch the controller to the SET/ENT (set) mode.
   - Use the SET/ENT key for more than 3 seconds to switch to the operating display.

2. Setpoint Display
   - The display shows the current setpoint (SP) or output value (OUT) during operation.

3. Parameter Setting
   - To set various parameters, press the SET/ENT key once to register the setpoint.

4. Status Display
   - Blinks during alarm or fault conditions.

5. Instrument Input Range Codes
   - N1: 0 - 120
   - N2: 0 - 1000
   - N3: 0 - 2000
   - N4: 0 - 400
   - N5: 0 - 1000
   - N6: 0 - 2000

6. Description of Multiple Setpoints and PID
   - To use multiple target setpoints, see the table below to check the corresponding parameters.

7. Changing PV Input Type
   - Press the SET/ENT key for more than 3 seconds to change the PV input type.

8. Changing Alarm Type
   - Alarm-1 (terminal numbers AL1): PV input high limit
   - Alarm-2 (terminal numbers AL2): PV input low limit
   - Alarm-3 (terminal numbers AL3): PV input high limit

9. Description of Multi-Sensor and PID
   - Alarm output terminals Factory-set defaults
   - Alarm-1 (terminal numbers AL1): PV input high limit
   - Alarm-2 (terminal numbers AL2): PV input low limit
   - Alarm-3 (terminal numbers AL3): PV input high limit

10. Multi-Sensor and PID
    - The controller automatically switches the selected operating parameter setpoint to any changes made by the user.

11. Setpoint Change
    - Press the SET/ENT key for more than 3 seconds to change the setpoint.

12. Parameter Change
    - Press the SET/ENT key for more than 3 seconds to change the parameter.

13. Setting Control Output Type
    - Use the SET/ENT key to display the required parameter.

14. Setpoint Change
    - Press the SET/ENT key for more than 3 seconds to change the setpoint.

15. Parameter Change
    - Press the SET/ENT key for more than 3 seconds to change the parameter.
1. Setting Target Setpoint (SP)

The operating display appears at power on (setting SP123 is a target setpoint). In automatic operation, the controller does not control the setpoint at large increments.

**NOTE**

- The controller does not control the setpoint at large increments.
- If the operating display does not appear after turning on the controller's power, follow the measures in the procedure below.

2. Performing/Canceling Auto-tuning

The controller does not show the correct measured input (PV).

If you hold down the setpoint hold key, you can change the controller's SP value. This helps to change the SP value while the controller is in automatic operation. Press the SET/ENT key to change to RUN.

3. Setting PID Manually

Inversely, if you hold down the SP decimal key, the controller changes to manual operation. Press the SET/ENT key for more than 3 seconds.

4. Setting Alarm Points

If you hold down the SP change key, you can make the switching possible. To make the switching possible, configure the DIS setup parameter as "DIS = 4".

5. Selecting Target Setpoint Numbers (SP.NO)

If you press the key for more than 3 seconds, this brings up the menu display. If you press the key several times, the menu display is changed.

6. Switching between Run and Stop

When the controller is stopped, input and outputs are not reset. When the controller is running, input and outputs are reset. Press the SET/ENT key for more than 3 seconds to display the required point. Press the SET/ENT key for more than 3 seconds to change the required point. Press the SET/ENT key for more than 3 seconds to display the required point.

7. Switching Between AUTO and MAN

A controller output value is linked with a display value changed using the SP key. Press the SET/ENT key for more than 3 seconds. This returns you to the display shown at power-on setting.

**NOTE**

- **Setpoints** are not linked with the display value changed using the SP key.

8. Manipulating the Control Output in Manual Operation

If the alarm function of the controller continues to work normally, you can change the controller's SP value by pressing the SP change key. This helps to change the SP value while the controller is in automatic operation.

9. Troubleshooting

If the controller does not show the correct measured input (PV).

If you hold down the alarm indicator key, you can change the controller's SP value. This helps to change the SP value while the controller is in automatic operation.

10. Possible Errors During Operation

If the controller does not show the correct measured input (PV).

If you hold down the SET/ENT key, you can change the controller's SP value. This helps to change the SP value while the controller is in automatic operation.

**WARNING**

- If you hold down the alarm indicator key, you can change the controller's SP value. This helps to change the SP value while the controller is in automatic operation.

**IMPORTANT**

- **Errors at Power On**

The following table shows errors that may be displayed by the field diagnosis function when the power is turned on:

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E000</td>
<td>System data error</td>
</tr>
<tr>
<td>E001</td>
<td>Parameter error</td>
</tr>
<tr>
<td>E002</td>
<td>Communication error</td>
</tr>
</tbody>
</table>

**Possible Errors during Operation**

The following shows possible errors occurring during operation:

- **Error Code**

The following shows possible errors occurring during operation:

1. **Possible Errors during Operation**

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</tr>
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</table>

**Possible Errors during Operation**

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</tr>
<tr>
<td>E002</td>
<td>Communication error</td>
</tr>
</tbody>
</table>
### 1. Basic Key Operation Sequence and Parameter Map

#### Basic Key Operation Sequence
1. Setting display on the operating display, using the SET/ENT key.
2. A parameter value is selected by:
   - Using the UP, DOWN, or SET/ENT keys to change the value.
   - Setting parameter by pressing the SET/ENT key.
3. Pressing the SET/ENT key on the parameter setting display (for more than 3 seconds) moves you to the operating parameter setting display.
4. Pressing the SET/ENT key on the operating parameter setting display (for more than 3 seconds) returns you to the operating display.

#### Operating Display
- **PV**: Displays the current measurement value.
- **SP**: Displays the setpoint value.
- **MAN**: Displays Manual mode.
- **A/M**: Displays whether the control is in Automatic or Manual mode.
- **Hysteresis**: Displays the hysteresis value.
- **Target SP**: Displays the target setpoint value.
- **PV AL1 2 3**: Displays PV alarm values.
- **SP AL1 2 3**: Displays SP alarm values.
- **PV MIN/MAX**: Displays the minimum and maximum values of PV input range.
- **SP MIN/MAX**: Displays the minimum and maximum values of SP input range.
- **Display**: Displays the current display mode (PV, SP, MAN).

#### Operating Display for Heating/Cooling Control
- **Heating-side**: Displays current and setpoint values for the heating side.
- **Cooling-side**: Displays current and setpoint values for the cooling side.
- **PV**: Displays the current measurement value for the heating and cooling sides.
- **SP**: Displays the setpoint value for the heating and cooling sides.
- **MAN**: Displays Manual mode for the heating and cooling sides.
- **A/M**: Displays whether the control is in Automatic or Manual mode for the heating and cooling sides.
- **Hysteresis**: Displays the hysteresis value for the heating and cooling sides.
- **Target SP**: Displays the target setpoint value for the heating and cooling sides.
- **PV AL1 2 3**: Displays PV alarm values for the heating and cooling sides.
- **SP AL1 2 3**: Displays SP alarm values for the heating and cooling sides.
- **PV MIN/MAX**: Displays the minimum and maximum values of PV input range for the heating and cooling sides.
- **SP MIN/MAX**: Displays the minimum and maximum values of SP input range for the heating and cooling sides.
- **Display**: Displays the current display mode (PV, SP, MAN) for the heating and cooling sides.

#### Setup Parameter Setting Display
- **Setup Parameter Setting Display**: Displays parameters for setup and configuration.
- **Parameter Display**: Displays the current parameter.
- **Parameter Setting**: Allows setting of the current parameter.
- **Parameter Description**: Displays a brief description of the current parameter.
- **Parameter Selection**: Allows selection of parameters.
- **Parameter Range**: Displays the range of the current parameter.

#### List of Alarm Types
- **Close Alarm**: Alarm closure is set to alarm (on) state.
- **Open Alarm**: Alarm opening is set to alarm (off) state.
- **Close Alarm and Open Alarm**: Both alarm states are set to alarm (on) state.

#### Instrument Input Range Codes
- **PV Input**: Displays the current PV input range.
- **SP Input**: Displays the current SP input range.
- **Manual Reset**: Allows manual reset of the control output.

#### Settings in Parameter Map
- **Alarm**: Displays alarm settings, including alarm types and alarm actions.
- **PV Input Type**: Displays PV input type settings, including selection of PV input and PV input unit.
- **Setpoint**: Displays setpoint settings, including selection of setpoint and setpoint range.
- **Control Output**: Displays control output settings, including selection of control output and control output range.
- **Stand-by Action**: Displays stand-by action settings, including selection of stand-by action and stand-by action range.
- **Power-on Time**: Displays power-on time settings, including selection of power-on time and power-on time range.
- **Password**: Displays password settings, including selection of password and password range.
- **Baud Rate**: Displays baud rate settings, including selection of baud rate and baud rate range.
- **Address**: Displays address settings, including selection of address and address range.
- **Baud Rate**: Displays baud rate settings, including selection of baud rate and baud rate range.
- **Address**: Displays address settings, including selection of address and address range.
### List of Parameters

#### Operating Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>Initial Value</th>
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#### Control Function-related Parameters

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#### Setup Parameters

<table>
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<td>SH4</td>
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</tbody>
</table>

#### PID-related Parameters

The following parameters are displayed on the LCD screen in order to display the current status of the controller. In the case of a PID controller with a 1-10V output, the same parameters will be displayed.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting Range and Description</th>
<th>Initial Value</th>
<th>Set by</th>
</tr>
</thead>
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<tr>
<td>T6</td>
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</tbody>
</table>

#### Hysteresis (for Target Setpoints (On-Off Control) and Alarm Setpoints)

Hysteresis can be set to a target setpoint and alarm setpoint to avoid frequent on-off control. With hysteresis settings, it is possible to perform on/off processes in certain conditions.

- For Auto-tuning
  - The parameters are divided into two categories: On-Off control and Alarm points.
  - Parameters can be set according to the type of device and the requirement for on/off control.

#### Target Setpoint Ramp Setting Function

This function allows the user to set the target setpoint ramp function to change the target setpoint automatically. The ramp setting function works as follows:

1. If the target setpoint changes, a ramp function is activated to smoothly change the target value.
2. The ramp function changes the target setpoint over a specified period of time.
3. The ramp function is activated only when the step change in the target setpoint is greater than the specified threshold.

#### PID Switching (Zone PID)

Using a zone PID, you can automatically switch between different PID constants according to the temperature zone. You can set up to four zones, each with its own PID parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting Range and Description</th>
<th>Initial Value</th>
<th>Set by</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP</td>
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<td></td>
</tr>
<tr>
<td>SL</td>
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</tr>
</tbody>
</table>

#### Useful Operating Displays (SELECT Display)

Selecting any of the parameters in the SELECT display will allow you to change or display the current settings.

#### Heating/Cooling Control (for a Heating/Cooling Controller Only)

Information on the control of the controller is displayed on the LCD screen for monitoring and control purposes. It includes the current temperature, setpoint, and alarm conditions.

The controller automatically controls the heating or cooling system based on the setpoint and alarm conditions.

### Cyclic Time

Cyclic time refers to the period during which the controller performs a complete control cycle. It includes the time required for the controller to perform all necessary functions, such as measurement, comparison, and control action.

- **Measurement Time**: The time required to measure the current value of the parameter to be controlled.
- **Comparison Time**: The time required to compare the measured value with the setpoint and alarm conditions.
- **Control Action Time**: The time required to perform the control action, such as heating or cooling.
- **Communication Time**: The time required for communication between the controller and the external devices.

### AL3

AL3 refers to the alarm level for the temperature control system. It is used to set the upper and lower limits of the temperature range to be controlled.

### Parameter Ref.

The following parameters are displayed on the LCD screen in order to display the current status of the controller. In the case of a PID controller with a 1-10V output, the same parameters will be displayed.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting Range and Description</th>
<th>Initial Value</th>
<th>Set by</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPP</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>SPL</td>
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<td></td>
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<tr>
<td>SL1</td>
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<td></td>
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<td>SL2</td>
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<td>SL3</td>
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<tr>
<td>SL4</td>
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<td></td>
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<tr>
<td>SH1</td>
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<td>SH3</td>
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<tr>
<td>SH4</td>
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</tr>
</tbody>
</table>

### Communication

Communication is used to transmit data between the controller and the external devices, such as a computer or a data logger. It includes the following parameters:

- **Communication Type**: The type of communication used, such as RS-232, RS-485, or Ethernet.
- **Communication Protocol**: The protocol used for communication, such as Modbus RTU, Modbus TCP, or OPC-UA.
- **Communication Settings**: The settings required for communication, such as baud rate, data bits, and parity.
- **Transmission Rate**: The rate at which data is transmitted, such as 9600 bps, 19200 bps, or 38400 bps.
- **Data Format**: The format of the data transmitted, such as hexadecimal or ASCII.