OMRON
AUTOMATION & SAFETY

E5CC TEMPERATURE CONTROLLER

Quick Start Guide



Introduction

This Quick Start Instruction is designed to set your Omron controller so that you can connect it, parameterize it and get it started quickly. This Quick Start Instruction contains only recommendations and does not substitute thorough study the user manual. It is aimed at technically skilled persons with knowledge of the hazards involved in handling electronic devices in terms of electric shocks and other effects caused by incorrect settings.

A comprehensive guide and data sheet for our controllers is on our web site:

www.omron247.com

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Preparation

To follow this guide it is important that you have the following hardware.

Hardware

- Temperature control
  - E5CC
  - E5EC
  - E5……..
- Reader
  - Temperature sensor: Pt100 or Thermocouple
  - Sensor with process value 4-20mA or 0-10V
- Heating and/or cooling element
  - control through Relay,
  - control through Solid-state relay
  - control through 4-20mA









Front E5CC



PV:	Process Value = Actual and measured value.
SV:	Set Value = Set and desired value.
Outputs:	Activated outputs.
Level button:	Level setting selection.
Mode button:	Parameter selection.
Shift button:	Programmable function button or number scrolling.
UP/Down button:	Increase or decrease the value of the selected parameter.

1. Connections & Settings

This section discusses the basic settings and connections. Before contacting the help desk, please be sure to go through these.

1.1 Connecting the E5CC

A connection diagram is displayed on the side of each controller. (See Figure 1.) The picture below is an example, the type you purchased may deviate from this. Most connections and numbers are identical, however.

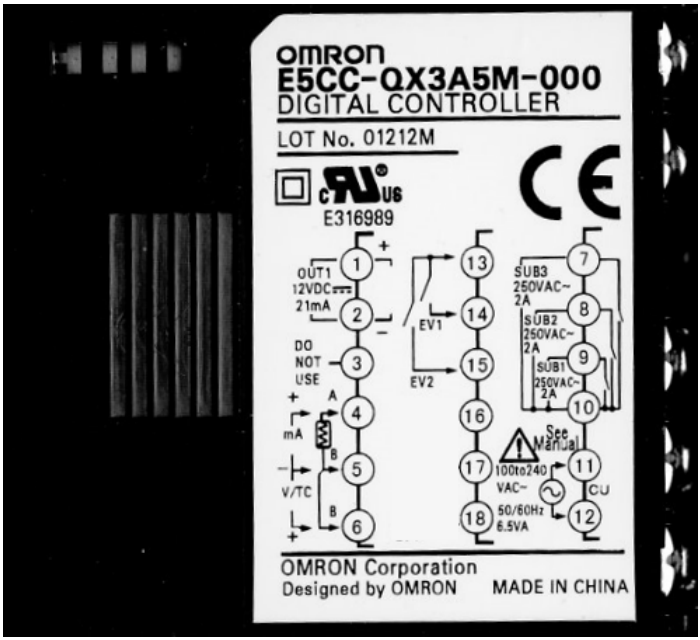


Figure 1: Connection diagram.

Terminal(s) 1 - 2 are the control output for heating / cooling unit
Terminal(s) 4 - 5 - 6 are for the sensor, such as thermocouple or Pt100
Terminal(s) 7 - 8 - 9 - 10 are the alarm / help connections
Terminal(s) 11 - 12 are the power voltage CAUTION! 24V or 100-240V
Terminal(s)13 through 18 are for options

1.1.1 Connecting sensor

Pt100

If a Pt100 temperature sensor is used, connect it to terminals 4, 5, & 6. The controller expects a 3-wire Pt100, which generally has 2 identical colors and 1 different color. The identical colors go under terminals 5 and 6, the different color under terminal 4.
If you have a 2-wire Pt100, then connect the temperature sensor between 4 and 5, with a bridging wire between connection 5 and 6.

Thermocouple

If you use a thermocouple, connect it to terminals 5 & 6
Caution! A thermocouple has a + and – Incorrect connection may result in a negative or an incorrect value.

4-20 mA or 0-10 V

A process value such as 4-20 mA or 0-10 V may be connected to terminals 4 & 5 and 5 & 6, respectively.

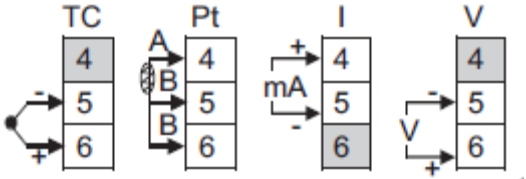


Figure 2: connecting sensor.

For correct operation of the controller, please always indicate which type of sensor is connected.

If this is not done correctly, the controller will display an S-ERR (sensor-error) message, or the incorrect value.

For the correct settings, please see Section 1.2.1

1.1.2 Connecting control output

Relay output

If a controller with a relay as control output is used, then this relay will be energized if there is a heating demand (or cooling in a cooling installation).
The relay can switch a maximum of 3 amps; if more current is demanded, a more powerful relay must be switched.
You may also choose to use a controller with solid-state control output in combination with a solid-state relay with the correct power.
See Figure 4 for connection diagram.

Solid-State Relay

Solid-state relays are extremely suitable for frequent switching of high capacities and PID controls. The solid-state relay is controlled with a voltage of 12 Volts. This voltage is delivered by the controller. So the solid-state relay can be connected directly to the controller. Please note the polarity
See Figure 5 for connection diagram.
Omron has a comprehensive package of solid-state relays

4-20mA

Some processes need to be controlled by a 4-20mA signal. In this case, you also need a controller with this type of control output.

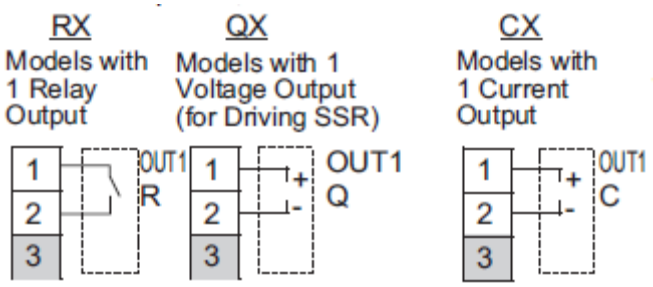


Figure 3: Several control outputs.

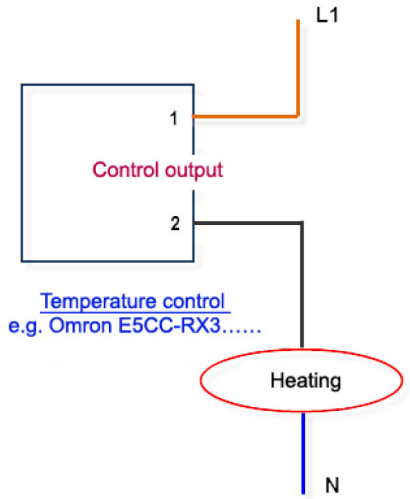


Figure 4: Controlling through relay output.

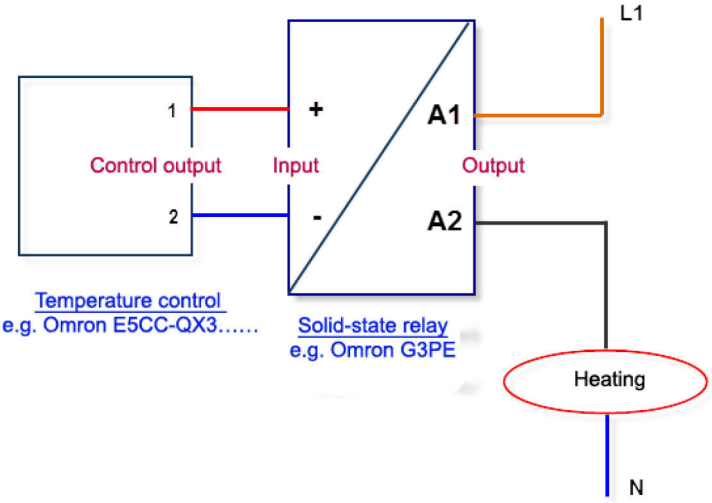


Figure 5: Controlling through solid-state relay.

1.2 Setting up the controller

For the correct operation of the controller, specific parameters need to be set. The most important settings are discussed in the following sections.

1.2.1 Determining the sensor type

At the factory, the controller is set to a type-K thermocouple. If you are using a different sensor type (for instance Pt100), you will find the correct setting in the table below (Figure 6). Next to the type number is a number (1 through 29).

	Input type	Input	Setting	Setting range
Temperature inputs	Platinum resistance thermometer	Pt100	0	-200 to 850 (°C) /-300 to 1500 (°F)
			1	-199.9 to 500.0 (°C) /-199.9 to 900.0 (°F)
			2	0.0 to 100.0 (°C) /0.0 to 210.0 (°F)
		JPt100	3	-199.9 to 500.0 (°C) /-199.9 to 900.0 (°F)
			4	0.0 to 100.0 (°C) /0.0 to 210.0 (°F)
	Thermocouple	K	5	-200 to 1300 (°C) /-300 to 2300 (°F)
			6	-20.0 to 500.0 (°C) /0.0 to 900.0 (°F)
		J	7	-100 to 850 (°C) /-100 to 1500 (°F)
			8	-20.0 to 400.0 (°C) /0.0 to 750.0 (°F)
		T	9	-200 to 400 (°C) /-300 to 700 (°F)
			10	-199.9 to 400.0 (°C) /-199.9 to 700.0 (°F)
		E	11	-200 to 600 (°C) /-300 to 1100 (°F)
		L	12	-100 to 850 (°C) /-100 to 1500 (°F)
		U	13	-200 to 400 (°C) /-300 to 700 (°F)
			14	-199.9 to 400.0 (°C) /-199.9 to 700.0 (°F)
		N	15	-200 to 1300 (°C) /-300 to 2300 (°F)
		R	16	0 to 1700 (°C) /0 to 3000 (°F)
		S	17	0 to 1700 (°C) /0 to 3000 (°F)
		B	18	100 to 1800 (°C) /300 to 3200 (°F)
		W	19	0 to 2300 (°C) /0 to 3200 (°F)
		PL II	20	0 to 1300 (°C) /0 to 2300 (°F)
	Infrared Thermosenso ES1B	10 -70°C	21	0 to 90 (°C) /0 to 190 (°F)
		60 -120°C	22	0 to 120 (°C) /0 to 240 (°F)
		115 -165°C	23	0 to 165 (°C) /0 to 320 (°F)
		140- 260°C	24	0 to 260 (°C) /0 to 500 (°F)
Analog input type	Current input	4 to 20mA	25	Use the following ranges for scaling: -1999 to 9999, -199.9 to 999.9, -19.99 to 99.99, -1.999 to 9.999
		0 to 20mA	26	
	Voltage inpu	1 to 5V	27	
		0 to 5V	28	
		0 to 10V	29	

Figure 6: Sensor type and its settings.

1.2.2 Setting the sensor type

To set the sensor type, you need to change the parameter INTYP (input-type). Do this as follows:

1. Press the 1st button (level button) at least 3 seconds until INTYP is displayed.
2. The set value is indicated green and will default to 5.
3. If you are using a different sensor type, please enter the number next to the type used. Section 1.2.1
4. You can change the value with the up / down button.
5. After changing the value, press the level button for 3 seconds again.

If S-ERR is displayed on the controller, then the sensor has not been connected properly, the incorrect type has been selected, or the sensor has a malfunction.

Example: If you are using a Pt100, then you will see in the table on page 9 that you can select either the value 0.1 or 2. The difference between these settings is the range and the decimal point (see also Section 1.2.3.)



1.2.3 Hide or show decimals

To show or hide decimals, first change the sensor type, see Figure 6 in Section 1.2.1. Next to Pt100 in the table is setting 0.1 or 2. If we indicate the number **0**, then the range is -200 to 850 degrees WITHOUT decimals; number **1** ranges from -199.9 to 500.0, WITH decimals.

1.3 Selecting PID / ON-OFF

Do you want accurate controls without the temperature overshooting?
This is easily achieved by setting your controller as **PID** instead of ON-OFF. See Section 1.3.1 When the controller is set as PID controller, *autotune* must be run to get the correct PID values. For autotune, see Section 1.3.2.

If accurate temperature control is not imperative, then you may set the controller to ON-OFF.

Figure 7 illustrates the results of different regulation algorithms.

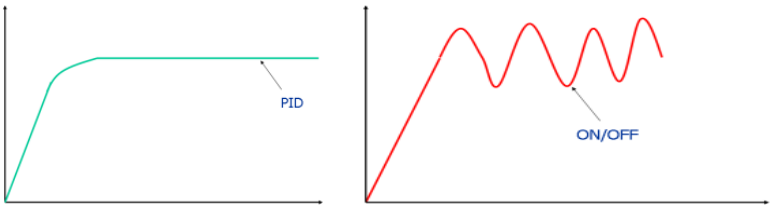


Figure 7: PID vs ON-OFF

1.3.1 Setting up as PID controller

To set the controller as PID controller, adjust the CNTL (control) parameter.

1. Press the 1st button (level button) for 3 seconds until C-M is displayed.
2. Then briefly press the 2nd button (mode button) several times until CNTL is displayed.
3. As you can see, this parameter reads ONOF (ON-OFF). With the arrow up button change this to PID (PID).
4. Then press the 1st button again until the controller resets.

The controller is now set as PID controller. We recommend changing the PID values. As mentioned earlier, the simplest way to do this is by using autotune See Section 1.3.2.

1.3.2 Run Autotune

For accurate controlling the correct PID parameters are important. These can be calculated by using the autotune function.

1. Using the up and down buttons, set the desired temperature (set value).
2. Press the 1st button briefly until L.AdJ is displayed
3. Then press the 2nd button until the AT parameter is displayed.
4. Using the up button, select AT -2
5. After a few seconds the tune message lights up. As long as this message is lit, the controller is learning the process to configure the correct parameters.
6. Then briefly press the 1st button again. The temperature will be displayed again and the tune message will remain lit.
7. As long as the *tune* message is lit, the controller is tuning. During this process the temperature will vary. Do not interrupt the tuning process.

When the message is no longer displayed, the parameters have been set correctly and controlling will be stable and economical.

Caution: Running autotune may take some time, depending on your process. To guarantee the correct settings, do not interrupt this process.

If autotune still has not completed after 2 hours, please contact the Omron help desk.

During tuning the temperature may rise above the set value. If this is not desirable, then you may also select AT - 1. The controller will now commence tuning at 40% of its capacity, which will cause tuning to be slower and less excessive.

1.4 Change alarm type

The E5CC has 3 alarm outputs. These can be used to switch to an output when a specific value is reached.

Some options:
Option 1: Alarm when the temperature rises 5 degrees above the set value.
Option 2: Alarm at fixed value, for instance 150 degrees.

These are two different alarm types. There are 19 alarm types in total, see Figure 8.

For instance, if you want an alarm to activate at a fixed temperature (absolute value), then change the *alarm type*. An absolute upper limit is found at value 8. In Figure 8 all alarm types are organized in a table.

If you wish to change the alarm type, follow these steps:

1. Press and hold the 1st button for 3 seconds until $\overline{C}N\text{-}E$ is displayed.
2. With the 2nd button scroll through the parameters until you reach $AL\,E\,1$ (Alarm type 1).
3. Enter a number with the arrow buttons, referring to Figure 8. This will be the desired alarm type.

Caution: You have not set an alarm value yet. This is covered in Section 1.4.1

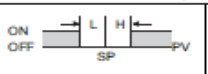
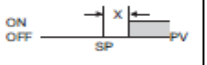
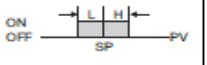
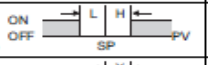
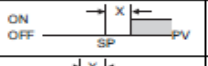
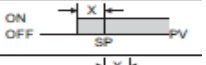
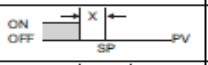
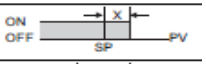
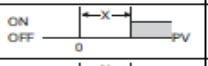
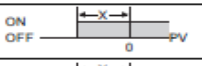
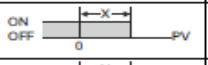
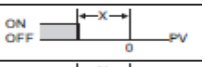
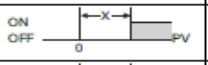
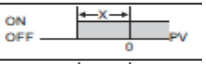
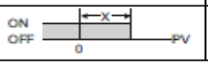
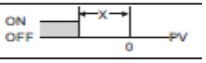
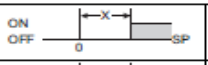
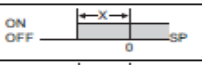
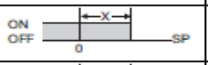
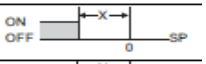
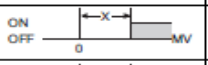
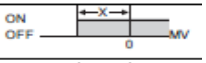
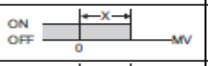
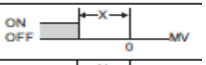
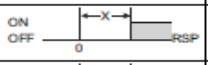
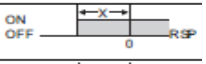
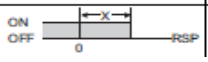
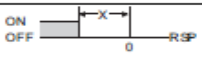
Set value	Alarm type	Alarm output operation	
		When alarm value X is positive	When alarm value X is negative
0	Alarm function OFF	Output OFF	
1	Upper- and lower-limit *1		*2
2	Upper-limit		
3	Lower-limit		
4	Upper- and lower-limit range *1		*3
5	Upper- and lower-limit with standby sequence *1	*5 	*4
6	Upper-limit with standby sequence		
7	Lower-limit with standby sequence		
8	Absolute-value upper-limit		
9	Absolute-value lower-limit		
10	Absolute-value upper-limit with standby sequence		
11	Absolute-value lower-limit with standby sequence		
12	LBA (alarm 1 type only)	-	
13	PV change rate alarm	-	
14	SP absolute value upper limit		
15	SP absolute value lower limit		
16	MV absolute value upper limit *9		
17	MV absolute value lower limit *9		
18	RSP absolute value upper limit *10		
19	RSP absolute value lower limit *10		

Figure 8: Alarm types

1.4.1 Setting the alarm

In the previous section, the type of alarm was discussed. After setting the alarm type, you will set an alarm value. Do this as follows.

1. To set the alarms, press the 2nd button several times until AL-1 is displayed. This is the setting for alarm 1.
2. AL-2 is the setting for alarm 2 (in some controllers AL-1 is not visible. This has already been assigned to a different function)
3. You can change the alarm value with the up and down button.

Example 1: On your controller, you want to activate an alarm when the temperature rises 10 degrees above the set value. The alarm type is set to 2. The SV is set to 40 degrees. The value for the alarm output AL-1 then becomes 10. If SV is exceeded by 10 degrees, the alarm output is activated

Example 2: On your controller with factory settings you want to activate an alarm when the temperature rises above 150 degrees. The alarm type is set to 8. The value for the alarm output AL-1 then becomes 150.
If SV rises above 150 degrees, the alarm output is activated

1.5 Setting temperature shift

If the temperature on the controller display deviates from your measured value (for instance due to ageing of the sensor), you can set a temperature shift. Enter the shift using the $\overline{in5}$ (input shift) parameter.

1. Press the 1st button briefly until $L.Adj$ is displayed.
2. Then press the second button briefly several times until $\overline{in5}$ is displayed.
3. The value entered here shifts the temperature up or down. If you enter -10, the measured temperature is decreased by 10 degrees.

1.6 Hysteresis

If the controller is set to ON-OFF, you can change the hysteresis.
The hysteresis is a switching point above and under the set point. A higher value limits the number of switches, but leads to less accuracy in temperature readings.

1. Go to the HYS parameter by briefly pressing the 1st button once until $L.Adj$ is displayed.
2. Then press and hold the 2nd button until HYS is displayed.
3. The default value is 1.0. You may increase or decrease this value.

Caution! Hysteresis is not available if the controller is set to PID.

Example: Suppose the desired temperature (set point) is set to 50 degrees. The controller heats to 50 degrees and then stops. The temperature will fall below 50 degrees before the controller switches on again. Suppose the hysteresis is set to 2 degrees; the controller will then switch on at 48 degrees.

2. Advanced features

The Omron E5CC has very powerful and advanced parameters. These are normally hidden, as they may severely disrupt the process. If you wish to change advanced parameters in the *advanced setting level*, lower the *protect level* to make them accessible. First follow the instructions in Section 2.1 and then Section 2.2

2.1 Releasing advanced setting level / Decrease protect level

To decrease the protect level, change the following settings.

1. Press the 1st and 2nd buttons simultaneously for 3 seconds until oapt is displayed.
2. Press the 2nd button once until icpt (Initial Setting Communication Protect) is displayed.
3. The default value is 1. Decrease it to 0
4. Now press the 1st and 2nd buttons again until the main screen reappears. The *protect level* is now decreased.

The advanced parameters are now accessible. Figure 9 shows the different protect levels. All shielding options are discussed in the manual which you can download from our web site.

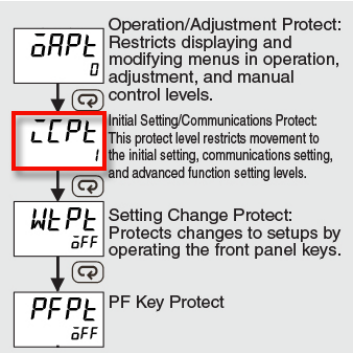


Figure 9: security or protect level

2.1.1 Hiding parameters / Increasing protect level

You can shield parameters from users or operators. In this example, we scroll through the settings so only the temperature can be changed.
To increase the protect level, change the following settings.

1. Press the 1st and 2nd buttons simultaneously for 3 seconds until $\bar{o}APt$ is displayed.
2. The default value is 0. Increase it to 3.
3. Then press the 2nd button until $\bar{I}CPt$ (Initial Setting Communication Protect) is displayed.
4. The default value is 1. Increase it to 2.
5. Now press the 1st and 2nd buttons again until the main screen reappears.

The *protect level* is now increased. You can only change the set value. Figure 7 shows the different protect levels. Other shielding options are discussed in the manual which you can download from our web site.

2.2 Advanced settings menu

In the initial parameter settings at the $AMo\bar{v}$ (move to advanced level) parameter, change the value to -169. After a few seconds, the controller automatically changes to the advanced settings level.
The value -169 is fixed and cannot be changed.

2.3 Menu structure / Settings level diagram

The following diagram (Figure 10) shows the different levels. In Section 2.4 you will find the complete parameter list. You can find a description of all levels and parameters in the manual which you can download from our web site.

Operation level: Basic level, desired value, alarm, etc.
Adjustment level: Changing P, I , D value, etc.
Protect level: Hiding buttons and levels
Initial level: Setting the sensor, alarm types, etc.
Advanced function level: Advanced settings
Communications level: Parameters for data communication

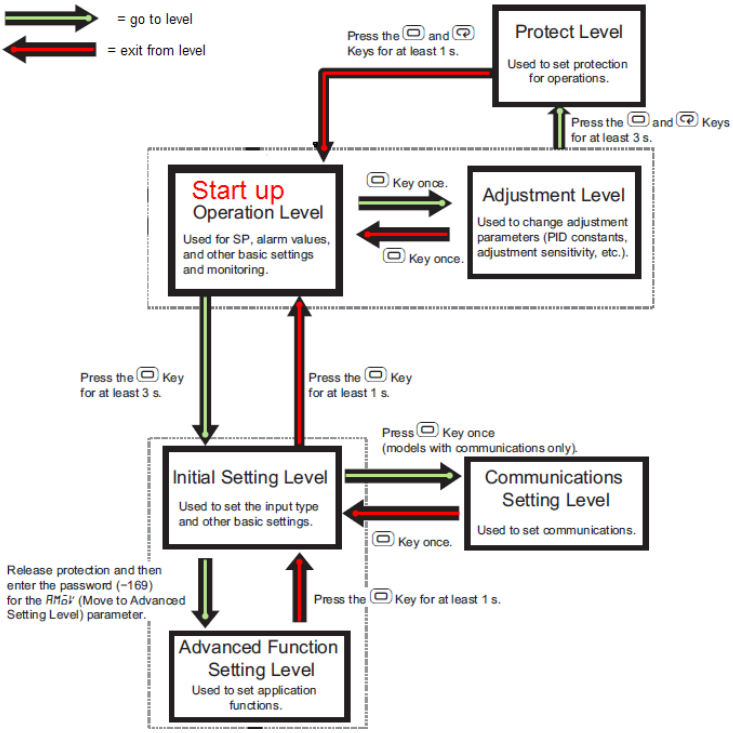
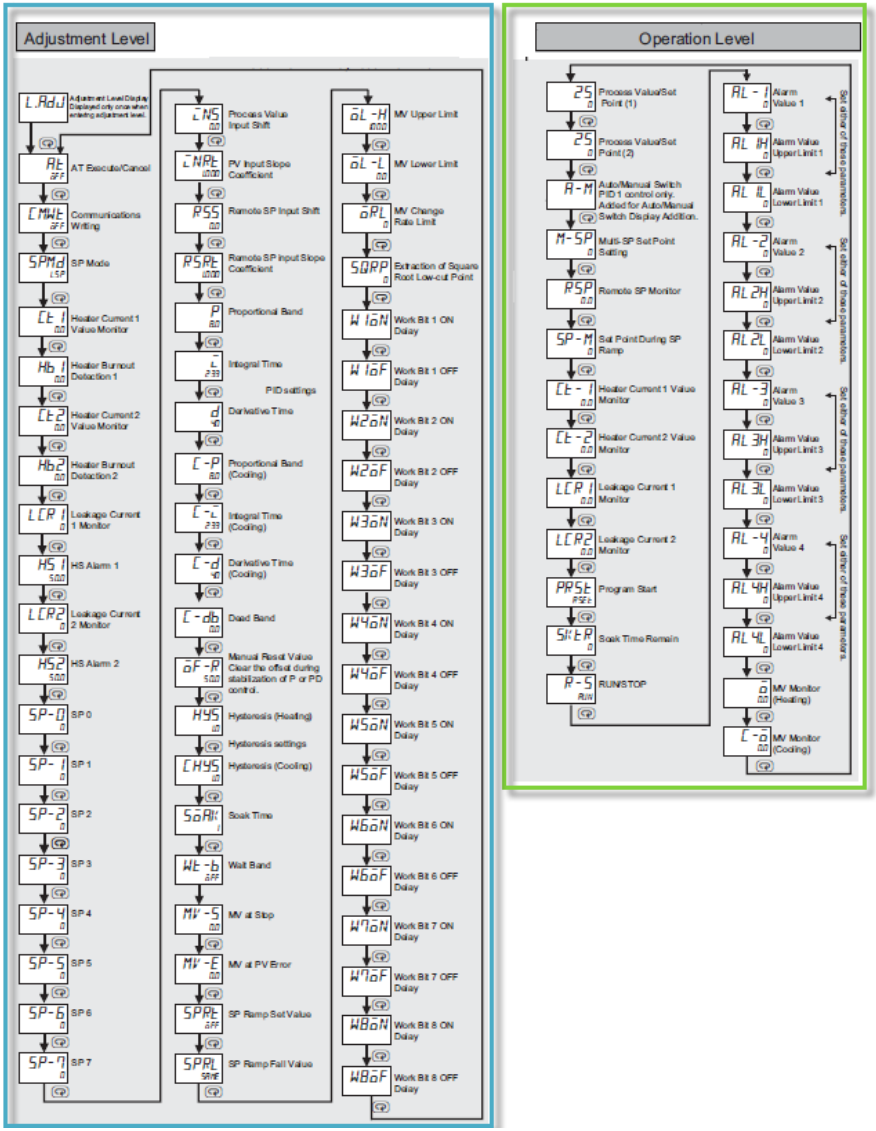
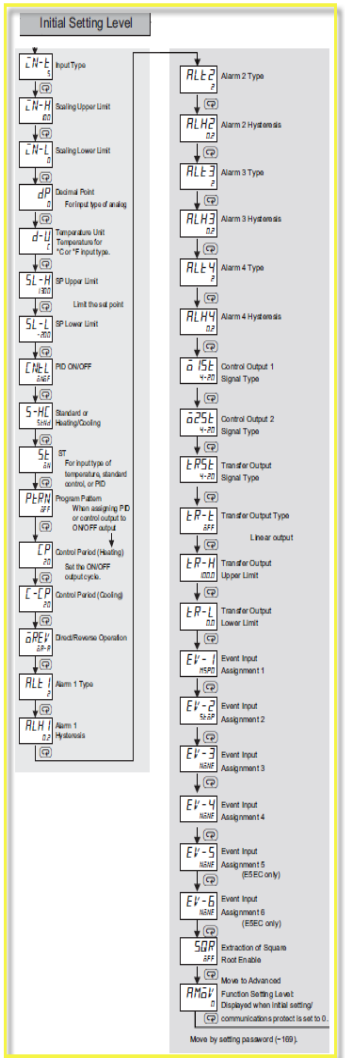


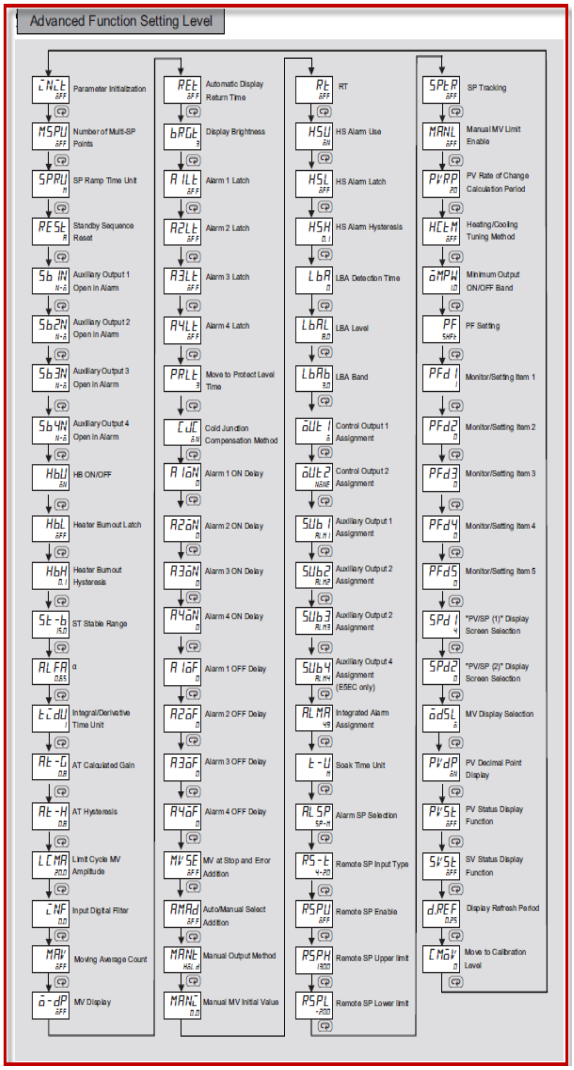
Figure 10: Settings level diagram

2.4 Parameter list

A comprehensive description of all levels and parameters is in the manual which you can download from our web site.




Initial Setting Level
Input Type
Scaling Upper Limit
Scaling Lower Limit
Decimal Point
For input type of analog
Temperature Unit
Temperature for °C or °F input type.
SP Upper Limit
Limit the set point
SP Lower Limit
PID ON/OFF
Standard or Heating/Cooling
ST
For input type of temperature, standard control, or PID
Program Pattern
When assigning PID or control output to ON/OFF output
Control Period (Heating)
Set the ON/OFF output cycle.
Control Period (Cooling)
Direct/Reverse Operation
Alarm 1 Type
Alarm 1 Hysteresis
Alarm 2 Type
Alarm 2 Hysteresis
Alarm 3 Type
Alarm 3 Hysteresis
Alarm 4 Type
Alarm 4 Hysteresis
Control Output 1 Signal Type
Control Output 2 Signal Type
Transfer Output Signal Type
Transfer Output Type
Linear output
Transfer Output Upper Limit
Transfer Output Lower Limit
Event Input Assignment 1
Event Input Assignment 2
Event Input Assignment 3
Event Input Assignment 4
Event Input Assignment 5 (E5EC Only)
Event Input Assignment 6 (E5EC only)
Extraction of Square Root Enable
Move to Advanced Function Setting Level
Displayed when Initial setting/ communications protect is set to 0.
Move by setting password (–169).


Advanced Function Setting Level
Parameter Initialization
Number of Multi-SP Points
SP Ramp Time Unit
Standby Sequence Reset
Auxiliary Output 1 Open in Alarm
Auxiliary Output 2 Open in Alarm
Auxiliary Output 3 Open in Alarm
Auxiliary Output 4 Open in Alarm
HB ON/OFF
Heater Burnout Latch
Heater Burnout Hysteresis
ST Stable Range
α
Integral/Derivative Time Unit
AT Calculated Gain
AT Hysteresis
Limit Cycle MV Amplitude
Input Digital Filter
Moving Average Count
MV Display
Automatic Display Return Time
Display Brightness
Alarm 1 Latch
Alarm 2 Latch
Alarm 3 Latch
Alarm 4 Latch
Move to Protect Level Time
Cold Junction Compensation Method
Alarm 1 ON Delay
Alarm 2 ON Delay
Alarm 3 ON Delay
Alarm 4 ON Delay
Alarm 1 OFF Delay
Alarm 2 OFF Delay
Alarm 3 OFF Delay
Alarm 4 OFF Delay
MV at Stop and Error Addition
Auto/Manual Select Addition
Manual Output Method
Manual MV Initial Value
RT
HS Alarm Use
HS Alarm Latch
HS Alarm Hysteresis
LBA Detection Time
LBA Level
LBA Band
Control Output 1 Assignment
Control Output 2 Assignment
Auxiliary Output 1 Assignment
Auxiliary Output 2 Assignment
Auxiliary Output 3 Assignment
Auxiliary Output 4 Assignment (E5EC only)
Integrated Alarm Assignment
Soak Time Unit
Alarm SP Selection
Remote SP Input Type
Remote SP Enable
Remote SP Upper limit
Remote SP Lower limit
SP Tracking
Manual MV Limit Enable
PV Rate of Change Calculation Period
Heating/Cooling Tuning Method
Minimum Output ON/OFF Band
PF Setting
Monitor/Setting Item 1
Monitor/Setting Item 2
Monitor/Setting Item 3
Monitor/Setting Item 4
Monitor/Setting Item 5
PV/SP (1) Display Screen Selection
PV/SP (2) Display Screen Selection
MV Display Selection
PV Decimal Point Display
PV Status Display Function
SV Status Display Function
Display Refresh Period
Move to Calibration Level

3. Q & A

I get the message 5-ERR.

Answer: This is because the reader has been connected incorrectly, the controller has been set incorrectly, or the reader has a malfunction, see Section 1.2.1 and Section 1.2.2

The temperature varies.

Answer: A controller set to ON-OFF has over and undershoot. If necessary, set the controller to PID, see Sections 1.3 through 1.3.2

The temperature overshoots.

Answer: A controller set to ON-OFF has over and undershoot. If necessary, set the controller to PID, see Sections 1.3 through 1.3.2

There is a discrepancy between measured and actual value.

Answer: The reader may not show the correct temperature, possibly due to ageing. This can be resolved by setting a shift, see Section 1.5

What is hysteresis and how do I set it?

Answer: Hysteresis is used in an ON-OFF controller, and it ensures that the controller does not “jump” around the set value (SV). For an explanation, see Section 1.6

How do I use alarm / help connections? It does not work as expected

Answer: The alarm type may not have been set correctly. The operation of the alarm types is explained in Section 1.4

The alarm does not switch to the set value

Answer: The alarm type may not have been set correctly. The operation of the alarm types is explained in Section 1.4

I cannot open the advanced settings menu.

Answer: This level is hidden by default. Decrease the protect level, as described in Sections 2.1 and 2.2

I want to block the buttons, so the controller cannot be operated by everyone.

Answer: At the protect level you can assign user change rights. For an explanation, see Section 2.1.1

The user only has a right to change the temperature.

Answer: At the protect level you can assign user change rights. For an explanation, see Section 2.1.1

I want to hide or show the decimal values of the temperature.

Answer: You can show or hide decimals by setting the number associated with the reader. See Section 1.2.3

4. Abbreviations and names

SV: Set Value is the set and desired temperature

PV: Process Value is the current, measured temperature

MV: Manipulated Variable is the “power” the controller transmits to reach the desired temperature

Set point: Also called set value or SV

Sensor: External temperature measuring device

Pt100: The Pt100 is a frequently used temperature reader. The reader has a resistance value of 100 Ohms at 0 degrees; Pt100s can be tested for continuity, and must have a value of around 106 Ohms at room temperature. For the Pt100 normal extension cables can be used

4-20mA: 4-20mA is a signal that is transmitted from certain sensors (for instance hygrometers), or which is used specifically to control a device, such as a steam valve

Alarm: An output that is switched on at a certain temperature is often referred to as an alarm. An alarm output may also be used for other purposes, depending on its settings.

Heat: This control is used for heating

Cool: This control is used for cooling

Heat/cool: This control is used for heating as well as cooling; therefore, two control outputs are used.

PID: Correct PID parameters ensure accurate and stable control. PID parameters are values that can be changed manually, but are mostly achieved by running Autotune. PID is the abbreviation of Proportional, Integration and Differentiation.

On-Off: The default setting of the controller as an ON-OFF controller. This ensures a limited extent of switching on the output, but results in less accurate control. This control does not take disturbances into account and is not ¨intelligent¨

Thermocouple: A thermocouple is a sensor that transmits a millivolt signal, which cannot be tested for continuity. Caution: a thermocouple can only be extended by specially designed couple extension cables

Solid-state relay: Also called SSR. This relay is specifically developed for frequent switching. It has no moving parts or mechanical contacts but can also break or short-circuit. SSRs are often used in temperature controls set as PIDs.

Control output: The control output is the output that controls the process. This output is switched on when temperature needs to be controlled

Overshoot: Temperature overshoot occurs when the temperature rises above the set value when the controller stops heating too late. In an ON-OFF control the overshoot will be larger than in a PID controller.

Undershoot: Temperature undershoot occurs when the temperature falls below the set value when the controller starts heating too late. In an ON-OFF controller the undershoot will be larger than in a PID controller.

AT or AutoTune: Autotune allows you to easily calculate and set the correct P, I, and D parameters. The process is learnt by the controller itself

Hysteresis: Hysteresis is the value at which an output must be switched on or off. It is used in alarm contacts and ON-OFF controllers.

Decimals: Decimals are the numbers after the decimal point, e.g. 10.8 degrees.

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