



## E5CC

### QUICK START INSTRUCTION



OMRON

## 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:**

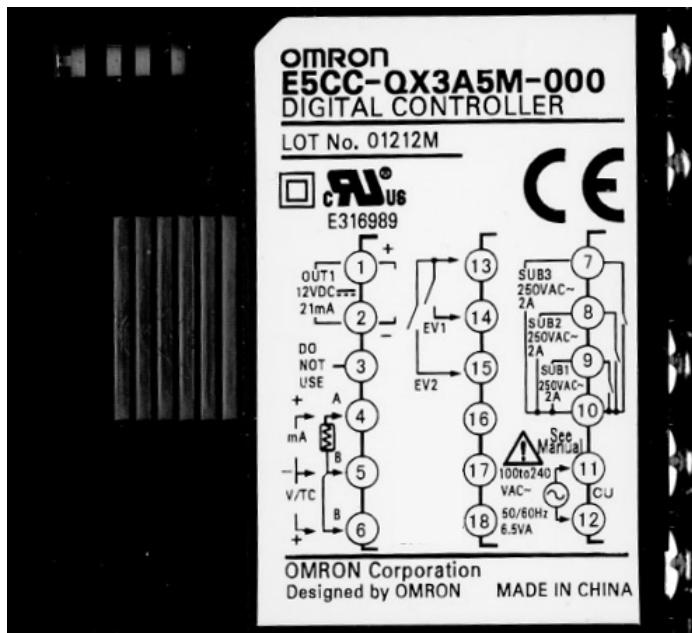
Increase or decrease the value of the selected parameter.

## 1. Connections & Settings

This chapter 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.



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

### 1.1.1 Connecting sensor

#### Pt100

If a Pt100 is used, connect it to clamps 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 clamps 5 and 6, the different color under clamp 4.

If you have a 2-wire Pt100, then connect the reader between 4 and 5, with a bridging wire between connection 5 and 6.

#### Thermocouple

If you use a thermocouple, connect it to clamps 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 clamps 4&5 and 5&6, respectively.

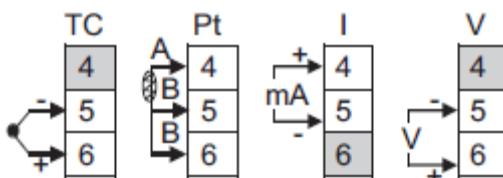


Figure 2: connecting sensor.

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 [Chapter 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 confirmed 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

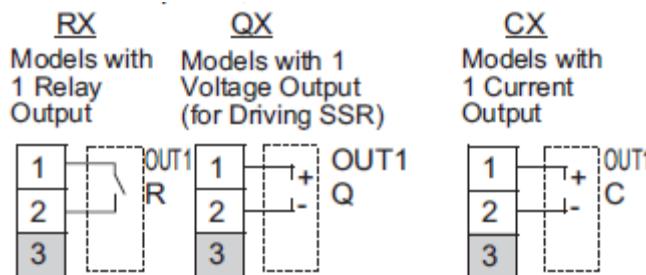
Solid-state relays are extremely suitable for frequent switching of high capacities and PID controls. The solid-state relay is controlled with a voltage of 12 Volts. This voltage is delivered by the controller. So the solid-state relay can be connected directly to the controller. Please note the polarity

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.*

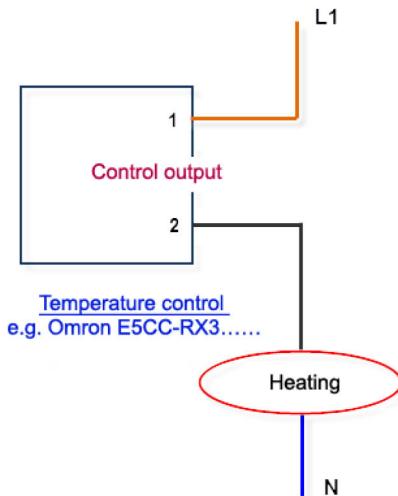


Figure 4: Controlling through relay output.

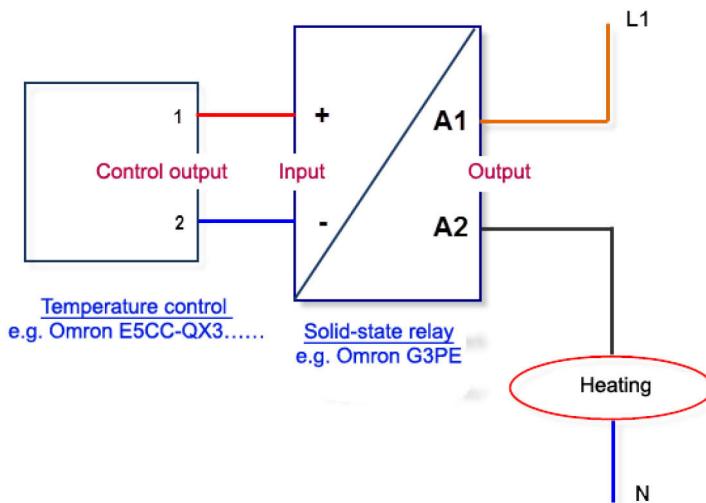


Figure 5: Controlling through solid-state relay.

## 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 chapters.

### 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	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)
		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	5	-200 to 1300 (°C) / -300 to 2300 (°F)
		6	-20.0 to 500.0 (°C) / 0.0 to 900.0 (°F)
		7	-100 to 850 (°C) / -100 to 1500 (°F)
		8	-20.0 to 400.0 (°C) / 0.0 to 750.0 (°F)
		9	-200 to 400 (°C) / -300 to 700 (°F)
	Infrared Thermosensor ES1B	10	-199.9 to 400.0 (°C) / -199.9 to 700.0 (°F)
		11	-200 to 600 (°C) / -300 to 1100 (°F)
		12	-100 to 850 (°C) / -100 to 1500 (°F)
		13	-200 to 400 (°C) / -300 to 700 (°F)
		14	-199.9 to 400.0 (°C) / -199.9 to 700.0 (°F)
		15	-200 to 1300 (°C) / -300 to 2300 (°F)
		16	0 to 1700 (°C) / 0 to 3000 (°F)
		17	0 to 1700 (°C) / 0 to 3000 (°F)
		18	100 to 1800 (°C) / 300 to 3200 (°F)
		19	0 to 2300 (°C) / 0 to 3200 (°F)
Analog input type	Current input	20	0 to 1300 (°C) / 0 to 2300 (°F)
		21	0 to 90 (°C) / 0 to 190 (°F)
	Voltage input	22	0 to 120 (°C) / 0 to 240 (°F)
		23	0 to 165 (°C) / 0 to 320 (°F)
		24	0 to 260 (°C) / 0 to 500 (°F)
	Voltage input	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
		26	
		27	
		28	
		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  $\bar{N}-E$  (input-type). Do this as follows:

1. Press the 1<sup>st</sup> button (level button) at least 3 seconds until  $\bar{N}-E$  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. [Chapter 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 [Chapter 1.2.3.](#).)



### 1.2.3 Hide or show decimals

To show or hide decimals, first change the sensor type, see Figure 6 in [Chapter 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 Chapter 1.3.1 When the controller is set as PID controller, *autotune* must be run to get the correct PID values. For autotune, see Chapter 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.

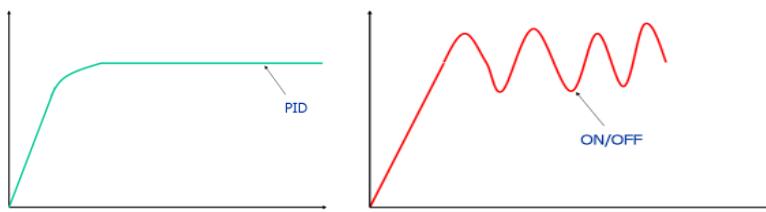


Figure 7: PID vs ON-OFF

### 1.3.1 Setting up as PID controller

To set the controller as PID controller, adjust the  $\text{ENEL}$  (control) parameter.

1. Press the 1st button (level button) for 3 seconds until  $\text{ENEL}$  is displayed.
2. Then briefly press the 2nd button (mode button) several times until  $\text{ENEL}$  is displayed.
3. As you can see, this parameter reads  $\text{ONOFF}$  (ON-OFF). With the arrow up button change this to  $\text{PID}$  (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 Chapter 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.RdU* is displayed
3. Then press the 2nd button until the *Rt* parameter is displayed.
4. Using the up button, select *Rt -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 *Rt - 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 *EN-*E** is displayed.
2. With the 2nd button scroll through the parameters until you reach *AL<sub>E</sub> 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 [Chapter 1.4.1](#)

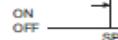
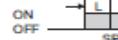
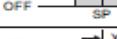
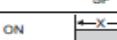
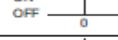
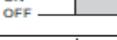
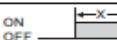
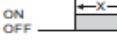
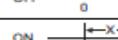
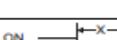
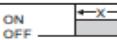
Set value	Alarm type	Alarm output operation	
		When alarm value X is positive	When alarm value X is negative
0	Alarm function OFF	Output OFF	
1	Upper- and lower-limit *1		*2
2	Upper-limit		
3	Lower-limit		
4	Upper- and lower-limit range *1		*3
5	Upper- and lower-limit with standby sequence *1		*4
6	Upper-limit 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 chapter, 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  $RL - 1$  is displayed. This is the setting for alarm 1.
2.  $RL - 2$  is the setting for alarm 2 (in some controllers  $RL - 1$  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  $RL - 1$  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  $RL - 1$  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 *LNS* (input shift) parameter.

1. Press the 1st button briefly until *L.RdU* is displayed.
2. Then press the second button briefly several times until *LNS* 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.RdU* 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 [Chapter 2.1](#) and then [Chapter 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 *oRPT* is displayed.
2. Press the 2nd button once until *ICPE* (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.

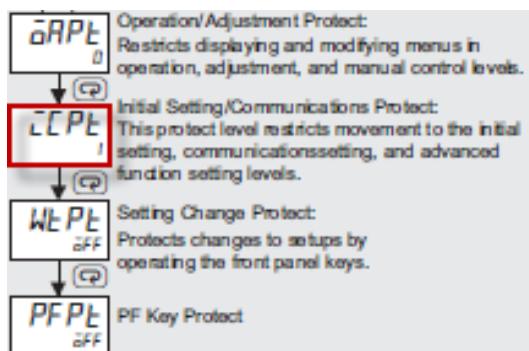


Figure 9: security or protect level

### 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  $\bar{o}RPL$  is displayed.
2. The default value is 0. Increase it to 3.
3. Then press the 2nd button until  $\bar{C}PL$  (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  $RMOV$  (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 [Chapter 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

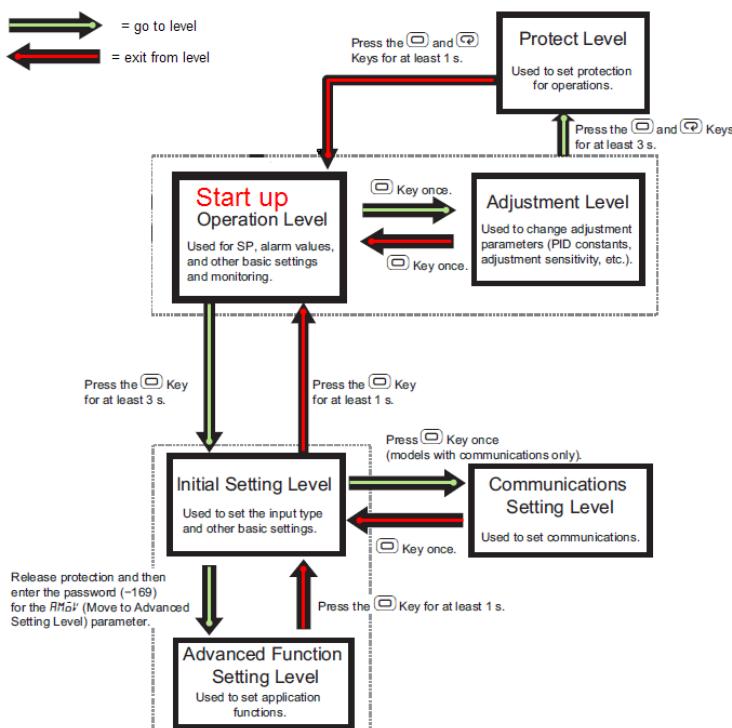
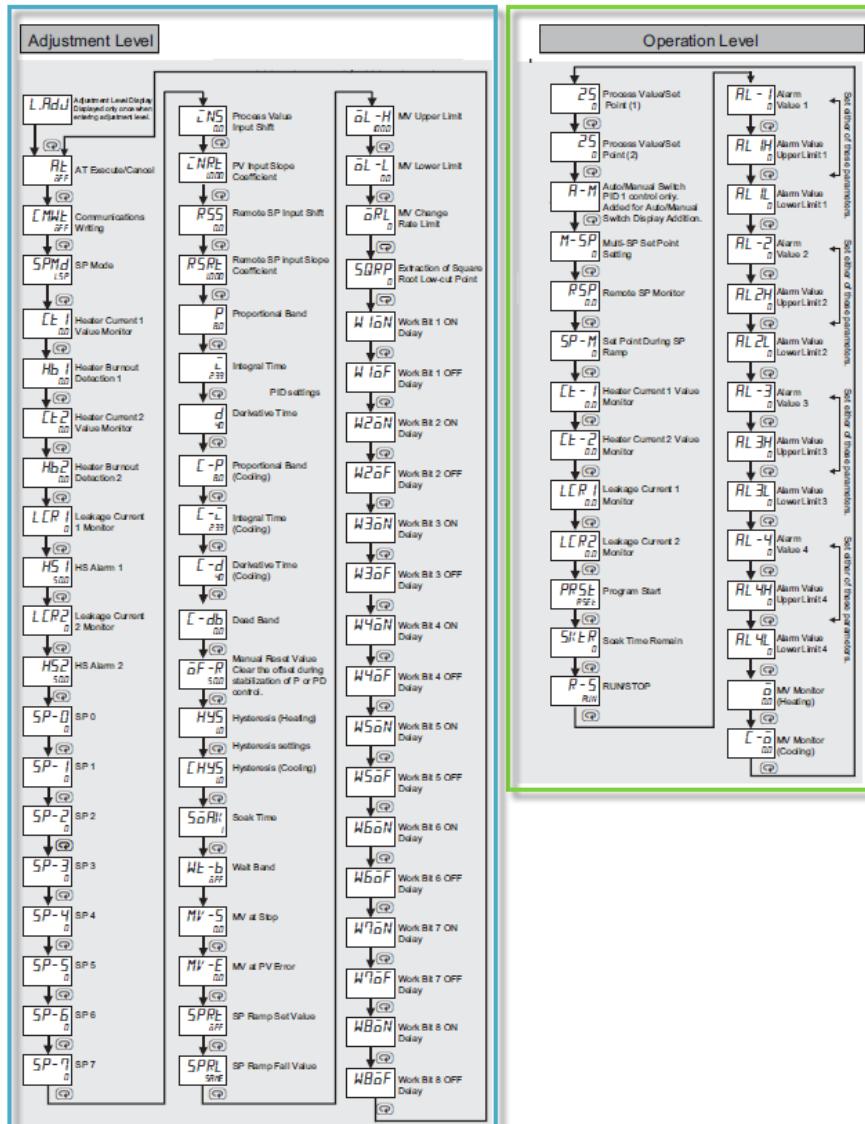
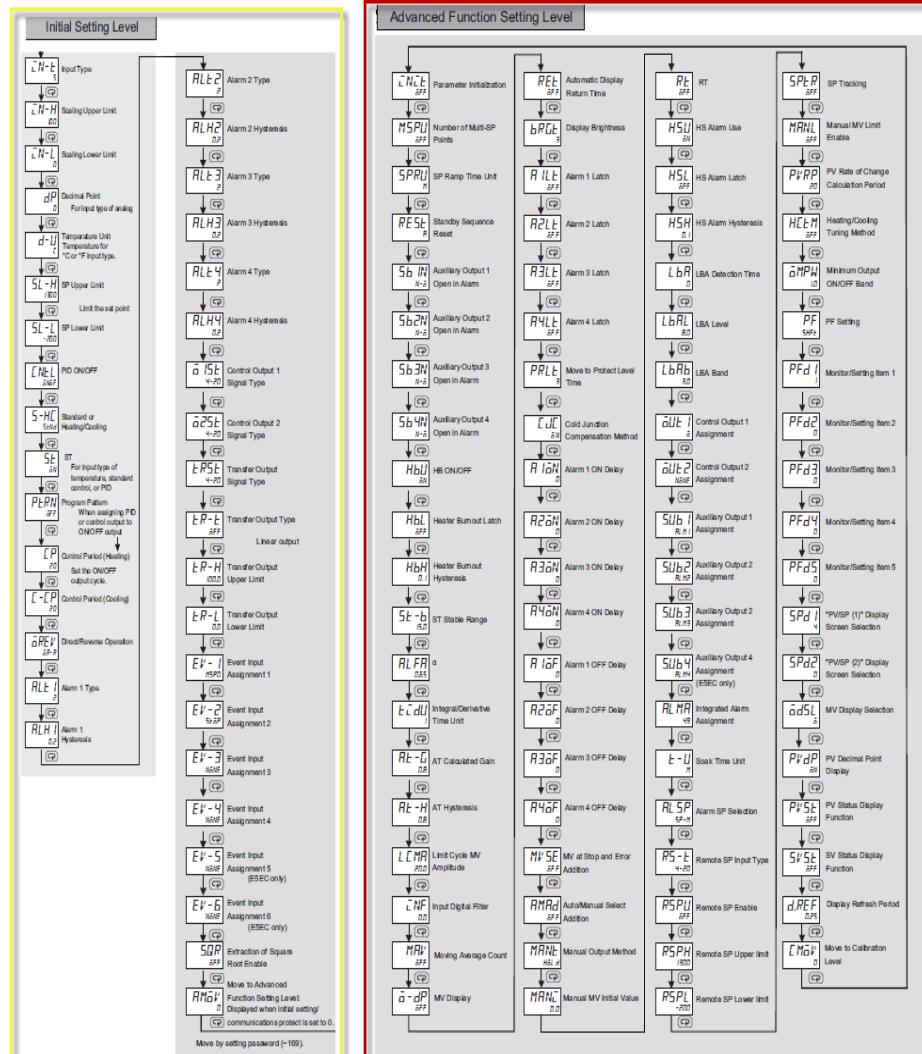


Figure 10: Settings level diagram

## 2.4 Parameter list

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





### 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 [Chapter 1.2.1 and Chapter 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 [Chapters 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 [Chapters 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 [Chapter 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 [Chapter 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 [Chapter 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 [Chapter 1.4](#)

#### I cannot open the advanced settings menu.

Answer: This level is hidden by default. Decrease the protect level, as described in [Chapters 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 [Chapter 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 [Chapter 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 [Chapter 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.

<b>On-Off:</b>	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"
<b>Thermocouple:</b>	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
<b>Solid-state relay:</b>	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.
<b>Control output:</b>	The control output is the output that controls the process. This output is switched on when temperature needs to be controlled
<b>Overshoot:</b>	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.
<b>Undershoot:</b>	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.
<b>AT or AutoTune:</b>	Autotune allows you to easily calculate and set the correct P, I, and D parameters. The process is learnt by the controller itself
<b>Hysteresis:</b>	Hysteresis is the value at which an output must be switched on or off. It is used in alarm contacts and ON-OFF controllers.
<b>Decimals:</b>	Decimals are the numbers after the decimal point, e.g. 10.8 degrees.