Setup Guide – SKT-1165

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Index

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1 General Information

1.1 Overview

The starter kit consists of the following components:

Components	Description
TEC Controller TEC-1091-NTC-PIN	Controller which drives / controls the Peltier element, the fan, and the display.
Display DPY-1113	Status display.
Peltier Assembly TEA-1145 1. Peltier Element 2. NTC Thermistor 3. NTC Thermistor 4. Heat Sink 5. FAN 6. Power Connector 7. USB Connector	 > Cooling and heating (internally mounted) > Measurement of object temperature (internally mounted) > Measurement of sink temperature (internally mounted) > Removal of heat > Used for increased heat removal and improves the thermal efficiency of the Peltier assembly

Figure 1: Overview SKT-1165

1.2 SKT-1165 vs. TEA-1145

The TEA-1145 (Thermoelectric Cooling Assembly) and the SKT-1165 (Starter Kit) have the same TEC design. The SKT already has a TEC controller, a display and a motherboard that has the connections for the TEA.

The TEA is the Thermoelectric Cooling Assembly and can be seen in Figure 2 at position 1, it is basically the top half of the Starter Kit.

The TEA can also be removed from the SKT by simply removing the four side screws, position 2 in Figure 2.

Figure 2: SKT vs. TEA

1.3 Package Outline and Pin Configuration of TEC-1091

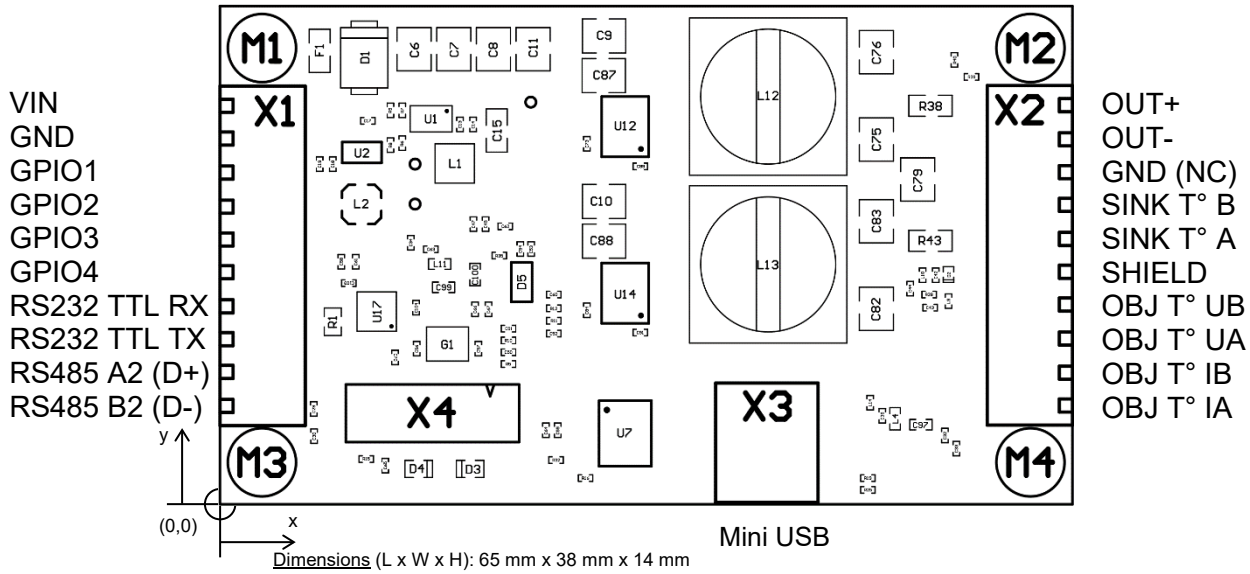


Figure 3: Package Outline and Pin Configuration of TEC-1091

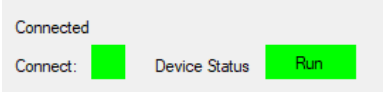
1.4 Additional requirements

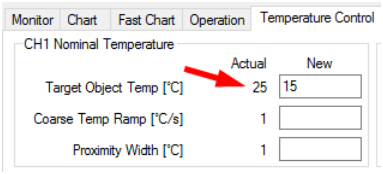
These parts are not included as standard:

- PC with Microsoft Windows 7 or newer
- Cable with Mini-USB-B connector
- Power supply (24 V, 5 A or more); Recommended power supply

The Starter Kit is not tested for CE compliance; it is intended as demonstration unit for laboratory use by trained personnel.

2 Setup

Step	Action	Information / Feedback
1	**Hardware Setup**	
1.1	Unpack your Starter Kit	Your Starter Kit will be delivered fully assembled.
1.2	Be sure that the power supply has the following polarity:  Plug in the power supply.	The power supply must be able to provide enough electric power (24 V, 5 A). A fitting power supply can be ordered from our web shop. We can recommend the following power supply.
1.3	Connect the DC-Jack from the power supply to the X0 connector (number 6 in Figure 1) on the motherboard of the TEC Controller of your Starter Kit.	The green LED (D3, refer to Figure 3) starts flashing continuously on the TEC Controller. The TEC Controller starts to cool / heat to 15°C.
2	**Install and Start the Software**	
2.1	Download the TEC-Family Software Package (.msi). Execute the MSI-file and follow the instructions.	The MSI setup procedure will also provide you with the FTDI USB driver and Microsoft .NET files if you do not have the necessary versions already installed. Two new icons appear on your desktop: “TEC Service Software vX.XX” and “TEC Software vX.XX Additionals” which contains further information. The “… Additionals” folder also contains the firmware upgrade file for the TEC Controller itself and some other helpful stuff.
2.2	Connect the TEC Controller on X3 to your PC using a Mini-USB-B cable (number 7 in Figure 1). Open the Service Software (TEC Service vX.XX).	The Service Software displays “Connected” and the connect status indicator is green. The “Device Status” is green and running. Information about your TEC Controller is displayed in the top right corner of the “Monitor” tab. If an error occurs, the description is displayed in the “Monitor” tab in the lowest box of the rightmost column. 

3	**Temperature Control**	
3.1	In the tab “Temperature Control” →“CH1 Nominal Temperature”, set “Target Object Temp [°C]” to 15. 	Our goal is now to keep an object at a constant temperature. First, we set the target temperature.
3.2	Save the changed settings to the TEC Controller by clicking “Write Config” in the bottom right corner of the window.	Generally, you must set values by typing them into the corresponding fields and by clicking on “Write Config” to save them to the TEC Controller.
3.3	Observe the temperature in the “Chart” tab.	The temperature will converge to 15 °C. In the status bar at the bottom, the CH1 object temperature indicator is amber if the target temperature has not yet been reached. If the measured “Object Temperature” equals the target temperature the indicator is green and the temperature on the display is close to 15 °C. There can be a small difference between the desired target temperature and the measured object temperature.

3 Settings

This chapter deals with the differences between a standard TEC controller and the SKT-1165. The settings are already available in a separate configuration file in our Download Center, but are documented here in a comprehensible way.

If you need to make the settings yourself, you can find more detailed documentation in the Download Center on our website, under Documentation > User Manuals > Latest User Manual, there is the TEC-Family User Manual.

3.1 Operation

In this chapter we will choose the operating mode, these settings should be made at the end after all other settings have been made. These settings are required to use the controller as a temperature controller.

Setting parameters	New Value	Comment
CH1 Output Stage Control Input Selection	Temperature Controller	
CH1 Output Stage Enable	Static ON	Only set at the end when all other settings are made.

3.1.1 CH1 Output Stage Limits

In this chapter we will set the voltage limit of the output stage of the TEC-Controller. These settings are required to use the maximum output power of the controller. A lower voltage can be used, but this will reduce the maximum power of the Peltier element.

Setting parameters	New Value	Comment
Voltage Limitation	21	Max. output voltage of the controller at an input voltage of 24VDC

3.2 Temperature Control

3.2.1 CH1 Nominal Temperature

In this chapter we will set the target temperature of the object, the temperature ramp of the TEC controller and the proximity witdh. These settings are necessary to define the control temperature and the coarse ramp to reach the target temperature.

Setting parameters	New Value	Comment
Target Object Temp.	15	Cool SKT-1165 down to 15°C when plugged in
Coarse Temp. Ramp	0.15	
Proximity Width	1.8	

3.2.2 CH1 Temperature Controller PID Values

In this chapter we will set the Kp, Ti and Td of the internal PID controller. These settings depend on the Peltier and its thermal model. Depending on your required speed, target temperature and the "load" on the cold plate, you will need to choose others. A good reference for these values gives the "Auto Tuning".

Setting parameters	New Value	Comment
Kp	175	
Ti	3	
Td	2	

3.2.3 CH1 Peltier Characteristics

In this chapter we will set the parameters of the Peltier elements, these settings are taken from the data sheet. They are used to calculate the model to adjust the output voltage and current.

Setting parameters	New Value	Comment
Maximum Current Imax	6	From the peltier data sheet
Delta Temp. dTmax	68	From the peltier data sheet

3.3 Object Temperature

3.3.1 CH1 Actual Object Temperature Error Limits

In this chapter we will set the minimum temperature limit, if the temperature on the object side is below this limit, the TEC-Controller will go into error state.

Setting parameters	New Value	Comment
Lower Error Threshold	-20	

3.4 Sink Temperature

3.4.1 CH1 Sink Temperature Control

In this section we will select the source for the sink temperature. This will be used to control the fan to keep the sink temperature at a certain level.

Setting parameters	New Value	Comment
Sink Temperature Selection	External	

3.5 Advanced

3.5.1 Temperature Conversion

In this chapter we will calibrate the NTC sensors used in the SKT-1165. The lowest temperature is the value from "CH1 Actual Object Temperature Error Limits" to ensure that the temperature is accurate over the entire temperature range.

3.5.1.1 CH1 Object NTC Sensor Characteristics

Setting parameters	New Value	Comment
Upper Point – Resistance	2483.8	From the Object NTC data sheet
Lower Point – Temperature	-20	A few degrees Celsius more than our working area
Lower Point – Resistance	96761	From the Object NTC data sheet

3.5.1.2 CH1 Sink NTC Sensor Characteristics

Setting parameters	New Value	Comment
Upper Point – Resistance	2456.6	From the Sink NTC data sheet
Lower Point – Temperature	-20	A few degrees Celsius more than our working area
Lower Point – Resistance	107542.8	From the Sink NTC data sheet

3.5.2 Display

In this chapter we will select the correct display to activate it. these settings are used to use the display.

Setting parameters	New Value	Comment
Display Type	OLED 2x16	

3.5.2.1 Line 2:

In this chapter we will configure the display to show the current target temperature.

Setting parameters	New Value	Comment
Default Text	Target: {1010;1;1;6}°C	

3.5.3 GPIO

3.5.3.1 GPIO General

In this chapter we will configure the GPIOs to control and monitor the fan, these settings will be used to control the fan depending on the heat sink temperature and to check that the fan is spinning correctly.

When the SKT-1165 is used with an AUX-1322, the GPIOs for the encoder are also configured.

Setting parameters	New Value	Comment
GPIO1 – Function	Encoder A	Only need with AUX-1322
GPIO1 – Hardware Configuration	IN WeakUp	Only need with AUX-1322
GPIO2 – Function	Fan Tacho	
GPIO2 – Hardware Configuration	IN WeakUp	
GPIO3 – Function	Fan PWM	
GPIO3 – Hardware Configuration	OUT PushPull	
GPIO4 – Function	Encoder B	Only need with AUX-1322
GPIO4 – Hardware Configuration	IN WeakUp	Only need with AUX-1322

3.5.4 FAN

3.5.4.1 CH1 Fan Control Enable

In this chapter we will enable the fan controller to control the fan speed depending on the heat sink temperature.

Setting parameters	New Value	Comment
Fan Control Enable	Enabled	

3.5.4.2 CH1 Fan Temperature Controller

In this chapter we will set the heat sink target temperature for the fan controller.

Setting parameters	New Value	Comment
Target Temperature	30	Required heat sink temperature for your application

3.5.4.3 CH1 Fan Speed Controller

In this chapter we will set the parameters for the fan, which can be found in the fan's data sheet. These settings optimise the PID controller for the fan.

Setting parameters	New Value	Comment
100% Speed	7400	From the fan data sheet
Min Speed Start	2800	From the fan data sheet
Min Speed Stop	2800	From the fan data sheet
Kp	0.005	
Ti	0.5	

4 Further Information

Component	Link	Reference
TEC Controller	TEC-1091 Datasheet	
	PID Autotuning TEC Family User Manual	Page 21
Display	DPY-1113 Display	
	Display Software Configuration TEC Family User Manual	Page 34
Peltier Element	TE72001-241-060BS	
Object Temperature Sensor	NTCLE305E4103SB	
Sink Temperature Sensor	NTCALUG01A103F161	
Fan	9GA0824P4J001	
Recommended Power Supply	GST120A24-P1M	

A Change history

Date of change	Doc/Version	Changed/ Approved	Change / Reason
15 February 2021	A	LS	• Initial release

19 March 2021	B	XF	• Removed general service software parameter information from annex as it is the same information as can be found in the TEC-Family User Manual
			• Adjusted the document to the new document template:
			  ○ Added index
			  ○ Added Meerstetter disclaimer
			• Fixed various typos and formatting errors

07 July 2021	C	XF	• Added step 3.3 in the Setup > Temperature Control section that explains how to save settings to the TEC Controller.
16 February 2023	D	NZ/RK	General revision and adaptation to Starter Kit v2.00 • Changed all images of the SKT-1165. • Deleted step 1.4 and 1.5, they are obsolete. • Modified step 1.3, because the new Starter Kit has only one plug for the power supply. • Adjusted the temperature in step 1.3 corresponding to the default config.ini. • Adjusted the temperature in step 3.1 and 3.3 so that the temperature is different to that one in step 1.3. • Updated the Links for the new Peltier element, object and sink temperature, the fan and the power supply. • Updated index • Added Package Outline and Pin Configuration
14 September 2023	E	NZ	• Added the chapter 1.2 “SKT-1165 vs. TEA-1145” and 3 “Settings”