Hardware Release Notes TEC-Controller Family												
Change	**TEC-1092** HW Version Release Date Corresponding DS	**TEC-1091** HW Version Release Date Corresponding DS	**TEC-1089-SV** HW Version Release Date Corresponding DS	**TEC-1090-HV** HW Version Release Date Corresponding DS	**TEC-1122-SV** HW Version Release Date Corresponding DS	**TEC-1123-HV** HW Version Release Date Corresponding DS	**TEC-1161** HW Version Release Date Corresponding DS	**TEC-1162** HW Version Release Date Corresponding DS	**TEC-1163** HW Version Release Date Corresponding DS	**TEC-1166** HW Version Release Date Corresponding DS	**TEC-1167** HW Version Release Date Corresponding DS	**Detail**
Changes till August 2025												
Changed Power Inductors to increase mechanical robustness of device. Electrical behaviour remains identical	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	HW v1.30 August 2025 5284D	HW v1.30 August 2025 5285D	HW v1.30 August 2025 5286D	HW v1.30 August 2025 5287D	
Changes till April 2025												
Changed Bootstrap Resistor and added Snuber Circuit to improve EMC-Behaviour	Not affected	HW 3.51 April 2025 5175U	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	
Changes till January 2024												
Gap Pad modified to reduce bending of PCB	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	HW v1.21 January 2024 5231F	Not affected	Not affected	Not affected	Not affected	
Changes till March 2023												
Powerstage Layout and Components updated.	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	HW v1.20 April 2022 5284A	HW v1.20 April 2022 5285A	HW v1.20 April 2022 5286A	HW v1.20 April 2022 5287A	
Baseplate thickness increased to by 2mm to reduce bending and improve heat spreading.	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	HW v1.20 April 2022 5285A	Not affected	HW v1.20 April 2022 5287A	
Spacers on bottom side replaced by solder version.	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	Not affected	HW v1.20 April 2022 5284A	HW v1.20 April 2022 5285A	HW v1.20 April 2022 5286A	HW v1.20 April 2022 5287A	
Changes till June 2022												
Removed layout errors, no rework needed after manufacturing	Not affected	HW v3.50 June 2022 5175P	Not affected	Not affected	Not affected	Not affected	Not affected					
Changes till August 2021												
Added Power Stage Snubber Circuit Impact for the customer: None	Not affected	HW v3.40 August 2021 5175P	Not affected	Not affected	Not affected	Not affected	Not affected					
Reduced Size of white Orientation Marker Impact for the customer: Smaller White Stripe	Not affected	HW v3.40 August 2021 5175P	Not affected	Not affected	Not affected	Not affected	Not affected					
Changed filter Capacitors of internal supply voltage measurements to 10nF Impact for the customer: None	Not affected	HW v3.40 August 2021 5175P	Not affected	Not affected	Not affected	Not affected	Not affected					
Changes till June 2020												
Changed Flash Memory to a larger type Impact for the customer: None	Not affected	HW v3.30 June 2020 5175O	Not affected	Not affected	Not affected	Not affected	Not affected					
Added Contact Pads for programming connector Impact for the customer: None	Not affected	HW v3.30 June 2020 5175O	Not affected	Not affected	Not affected	Not affected	Not affected					
Added ESD Protector chip parallel to RS485 1. Impact for the customer: RS485 1 can be converted to RS232 TTL.	Not affected	HW v3.30 June 2020 5175O	Not affected	Not affected	Not affected	Not affected	HW v1.20 June 2020 5231C					
Changes till November 2019												
Silkscreen modified, removed from under solder pads for connectors Impact for the customer: None	Not affected	HW v3.20 November 2019	Not affected	Not affected	Not affected	Not affected						
Changes till October 2019												
Silkscreen added for easier identification of device orientation Impact for the customer: Chance of plugging device in inverted reduced	Not affected	HW v3.15 October 2019	Not affected	Not affected	Not affected	Not affected						
CAN Driver placed in parallel to RS485 Driver Impact for the customer: Hardware is now CAN-Capable.	Not affected	HW v3.15 October 2020	Not affected	Not affected	Not affected	Not affected						
Capacity of filter capacitor in sink temperature measurement decreased from 10uF to 100nF Impact for the customer: Settling time reduced	Not affected	HW v3.15 October 2021	Not affected	Not affected	Not affected	Not affected						
Changes till April 2019												

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Inductor for Object Temperature measurement power filter replaced by an equivalent successor. Impact for the customer: None	Not affected	Not affected	HW v2.10 February 2019 5133V	HW v1.90 End of 2018 5165P	HW v2.00 Mid 2019 5132V	HW v2.00 Mid 2019 5144V						
Power capacitors distance to M4 terminals enlarged to protect capacitors from mechanical stress. Impact for the customer: None	Not affected	Not affected	HW v2.10 February 2019 5133V	HW v1.90 End of 2018 5165O	Not affected	Not affected						
Changes till February 2019												
Sink Temperature Measurement Optimized: -Reference voltage changed to 3.0V -Filter Capacity increased Impact for the customer: Larger sink temperature measurement range, less noise.	Not affected	HW v3.14 January 2019	Not affected	Not affected	Not affected	Not affected						
Analog inputs filter modified Impact for the customer: None	Not affected	HW v3.14 January 2019	Not affected	Not affected	Not affected	Not affected						
Current measurement IC changed Impact for the customer: None	Not affected	HW v3.14 January 2019	Not affected	Not affected	Not affected	Not affected						
ESD Protection added to Object Temperature measurement Impact for the customer: Object temperature measurement more robust	Not affected	HW v3.14 January 2019	Not affected	Not affected	Not affected	Not affected						
Changes till March 2018												
Output Stage optimized to reduce the power dissipation at very high output voltages (high duty cycle). Impact for the customer: None	Not affected	Not affected	HW v2.00 March 2018 5133S	Not affected	HW v2.00 May 2018 5132S	Not affected						
Changes till October 2017												
PCB Silkscreen of EVL-1093 changed: RS232 -> RS232 TTL RX and TX swapped	EVL-1093: v1.01 January 2018 5209B	Not affected	Not affected	Not affected	Not affected	Not affected						
Thermal pad replacement with equivalent successor.	Not affected	Not affected	Not affected	HW v1.90 June 2018 5165M	Not affected	HW v1.90 February 2018 5144R						
Changes till July 2017												
Enhancement of the EMV test burst immunity. Object Temperature measurement circuit GND isolations removed.		HW v1.80 Middle 2018 5175H	HW v1.80 October 2017 5133R	HW v1.80 Nov 2017 5165M	HW v1.80 February 2018 5132R	HW v1.80 February 2018 5132R						Enhancement of the EMV test burst immunity
SPI flash memory alternative added: 100% compatible one from a different manufacturer.		HW v1.80 Middle 2018 5175H	HW v1.80 October 2017 5133R	HW v1.80 Nov 2017 5165M	HW v1.80 February 2018 5132R	HW v1.80 February 2018 5132R						Flash memory replaced
Changes till January 2017												
An additional resistor has been placed between GND and the base plate.	Not affected	Not affected	HW v1.71 10.01.17 5133Q	HW v1.61 15.02.17 5165L	HW v1.51 Middle 2017 5132Q	HW v1.51 Middle 2017 5144Q						Discharge Current between GND and base plate
Changes April 2015 – September 2016												
Lower operating temperature Range enhanced. Changed from 0°C to -40°C.	Not affected	HW v1.10 30.06.16 5175E	HW v1.70 01.03.16 5133N	HW v1.60 01.03.16 5165I	HW v1.50 30.09.16 5132L	HW v1.50 07.04.16 5144K						Lower operating temperature Range enhanced
Lower operating temperature Range enhanced. Changed from 0°C to -40°C. Hand made quick fix for older series.	Not affected	Not affected	Not affected	HW v1.54 02.02.16 5165I	Not affected	Not affected						Lower operating temperature Range enhanced
Input fuse replaced by an UL-248-14 compliant one.	Not affected	From beginning compliant	HW v1.70 01.03.16 5133N	From beginning cor	HW v1.40 11.02.16 5132K	From beginning compliant						

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Power Stage FETs replaced by the direct successor because the old one was discontinued.	Not affected	Not affected	HW v1.70 01.03.16 5133N	Not affected	HW v1.50 30.09.16 5132L	Not affected						
PCB Vias below the big coils insulated. This prevents rarely happened shorts between the coil and the Vias.	Not affected	HW v1.10 30.06.16 5175E	Not affected	Not affected	Not affected	Not affected						
PCB Vias below the big coils insulated. This prevents rarely happened shorts between the coil and the Vias. Hand made quick fix for older series.	Not affected	HW v1.01 27.4.15 5175D	Not affected	Not affected	Not affected	Not affected						

Detail Hardware Release Notes TEC-Controller Family	
Enhancement of the EMV test burst immunity	
Problem	During EMV Burst Test, the TEC Controller threw error 131. (Object Temperature Measurement Circuit failure: Configuration read back failed.)
Cause	The SPI communication between the MCU and the ADS1247 (ADC) has faulted, because the GND of the ADC circuit is decoupled by ferrite beads and a filter coil. The burst caused a voltage shirt between the two grounds.
Solution	Removing the two filter components which decouple the GNDs. The GND is now hard connected.
Impact for the customer	Better EMV immunity, slightly more noise on the object temperature during normal operation. We recommend to connect the GND of the TEC controller directly to the earth to lower the measurement noise.
Flash memory replaced	
Problem	The SPI flash memory which is being used to save all the setting is not available anymore.
Cause	It is discontinued by the manufacturer.
Solution	Assembly alternative added: W25Q16JVSNIQ from Winbond Electronics.
Impact for the customer	None, because its 100% compatible for the used application.
Discharge Current between GND and base plate	
Problem	Depending on the external power supply, a static electric charge may build up between the base plate and the GND if the board is not mounted to a heatsink.
Cause	The 10K Ohm resistor which should prevent from this charging is connected to an optional customer mounting hole.
Solution	An additional 10 KOhm discharging resistor is added to a mounting hole that is directly screwed to the base plate.
Impact for the customer	The resistance between GND and the base plate is lower than before.
Lower operating temperature Range enhanced	
Problem	The device was not compatible for ambient temperatures till -40°C
Cause	The crystal is only specified till -20°C and the input over voltage and reverse polarity protection diode has a too big temperature coefficient and may start to protect the device too early at -40°C.
Solution	Input over voltage and reverse polarity protection diode has been replaced one with a higher protection voltage. Unfortunately, this has the disadvantage that the overvoltage protection is less effective.
Impact for the customer	The device is now compatible till -40° but it has now a little bit less effective over voltage protection.