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Datasheet –
TEC Controller TEC-1092 (±1.2 A / ±9.6 V)

Support / First Steps

Meerstetter Engineering provides technical support for all products and helps you to integrate a product into your solution. Most of your questions should be solved by reading the provided user manuals of the corresponding product or the FAQ (frequently asked questions).
For further help or if you have any other questions, please do not hesitate to contact us. We are happy to help you. You can contact us by email support@meerstetter.ch.

Meerstetter's Product Family Compatibility

The Meerstetter LDD- and TEC-Families have been developed to work along with each other. They share the same platform bus, communication protocol and hardware architecture. See the following table for an overview of the LDD- and TEC-Families.

LDD-Family		
LDD-1321	0-1.5 A / 0-14 V	CW, Add on TEC Controller available
LDD-1301	0-20 A / 0.5-45 V	1 ms - CW
LDD-1303	0-20 A / 1-120 V	1 ms - CW
LDD-1137	0-75 A / 0-70 V	0.5 µs - CW, modulated, QCW and pulsed modes
LDD-1124-SV	0-1.5 A / 0-15 V	1 µs - CW, modulated, QCW and pulsed modes
LDD-1121-SV	0-15 A / 0-15 V	1 µs - CW, modulated, QCW and pulsed modes
LDD-1125-HV	0-30 A / 0-27 V	1 µs - CW, modulated, QCW and pulsed modes
TEC-Family		
TEC-1092	±1.2 A / ±9.6 V	Micro, single channel
TEC-1091	±4 A / ±21 V	Small, single channel
TEC-1089-SV	±10 A / ±21 V	Medium, single channel
TEC-1162	±5 A / ±56 V	Medium-high, single channel
TEC-1090-HV	±16 A / ±30 V	Large, single channel
TEC-1163	±25 A / ±56 V	Extra-large, single channel
TEC-1161-4A	2 x (±4 A / ±21 V)	Small, dual channel
TEC-1161-10A	2 x (±10 A / ±21 V)	Medium, dual channel
TEC-1122-SV	2 x (±10 A / ±21 V)	Medium, dual channel
TEC-1166	2 x (±5 A / ±56 V)	Medium-high, dual channel
TEC-1123-HV	2 x (±16 A / ±30 V)	Large, dual channel
TEC-1167	2 x (±25 A / ±56 V)	Extra-large, dual channel

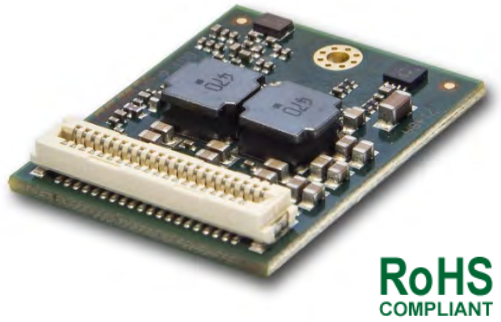
Thermoelectric Cooling Temperature Controller

TEC Controller / Peltier Driver up to ±1.2 A / up to ±9.6 V

TEC-1092

HW v1.00

Miniature OEM TEC Controller



RoHS COMPLIANT

General Description:

The TEC-1092 is a very small, PCB mountable Peltier Controller module, especially designed to meet the requirements for small thermoelectric applications.

Product Highlights:

- High current resolution
- Temperature control rate from 1 Hz to 90 Hz
- Very small dimensions
- High efficient TEC Controller (DC output)

Applications:

- Telecom grade TEC modules
- Cooling of thermally fast objects
- Infrared detectors / sensors
- Gas sensor applications

- The TEC-1092 can be mounted on the EVL-1093 Evaluation Board (See page 5 for more information)

Features

Input Characteristics:

- DC Input Voltage: 5 to 12 V

Output Stage TEC Controller:

- Voltage: 0 to ±9.6 V
- Current: 0 to ±1.2 A

Main Features:

- Print mountable TEC Controller
- Temperature Sensor Types: Pt100, Pt1000, NTC, Voltage
- Temperature Precision / Stability: <0.01 °C
- Temperature Control & Measurement Frequency: 1 Hz, 10 Hz, 90 Hz
- No cooling required (natural convection)
- Communication bus compatible
- Configuration / Diagnosis over all communication interfaces with PC Software
- Measurement Inputs freely assignable to any Output Channel
- Bipolar output channel can be split into unipolar channels

Operation Modes:

- Stand-alone operation
- Remote-controlled over RS232 TTL, RS485, I/O
- Script-controlled over lookup table (thermal cycling)

Driver Modes:

- DC power supply (bipolar)
- Temperature control: PID settings, auto tuning, optional cool/heat-only or resistor heating modes

Data Interfaces:

- RS232 TTL
- RS485 (Half-Duplex)

General Purpose I/O Features:

- Configurable as input to control TEC-1092 (Enable, Temperature up / down etc.)
- Configurable as output to monitor TEC-1092 (Error Indication, Temperature Stable Indication etc.)

Special Requirements / More Information:

- Please contact us for additional information or customization.

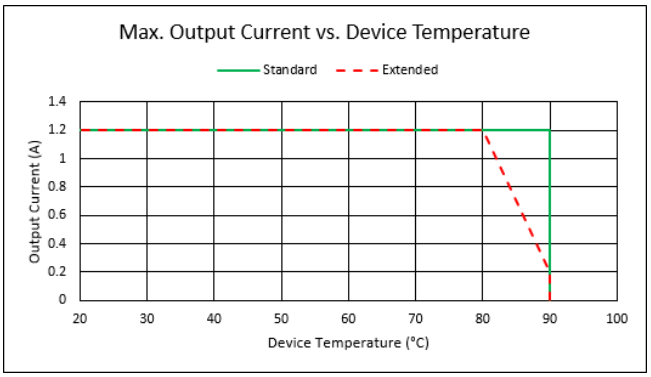
Document Number: 5208J (14 October 2024)

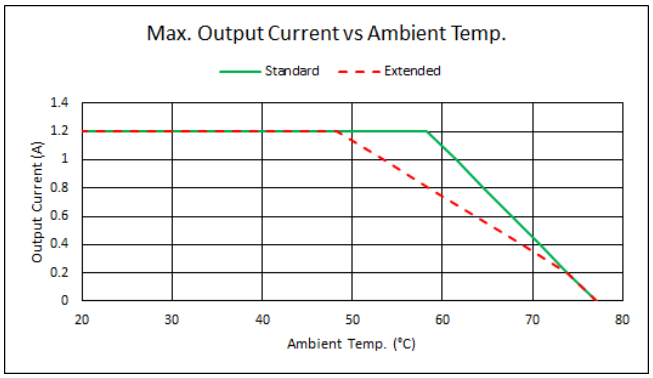
Absolute Maximum Ratings

Supply voltage (DC)	20 V

Operating Characteristics

Temperature	-40°C to 90°C
Humidity	5 – 95%, non-condensing





Standard or Extended Device Temperature Mode can be set as software setting.
The right Diagram shows the situation with an external 7.5Ω resistor. TEC Controller mounted on the EVL-1093 and supplied with 12V. No forced air flow was present.

Electrical Characteristics

Unless otherwise noted: T_A = 25 °C, U_{IN} = 12 V, R_{load} = 7.5 Ω

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
DC Power Supply Input:						
U_{IN}	Supply voltage	Measured directly on power input terminals	4.9		12.5	V
I_{IN}	Max input current	Hint: Software limitation			1.5	A
Output (per Channel):						
I_{OUT}	Bipolar current				±1.2	A
U_{OUT}	Bipolar voltage	U_{OUT} is maximum ~0.9 * U_{IN}			±9.6	V
I_{OUT}	Unipolar current [1]				1.2	A
U_{OUT}	Unipolar voltage [1]	U_{OUT} is maximum ~0.9 * U_{IN}			9.6	V
U_{OUT} Ripple	Voltage ripple	@ 1.2 A		25		mV_{PP}
I_{OUT} Drift	Output current temperature drift			0.1		mA/°C
System Characteristics:						
$\eta_{50\%}$	Power efficiency	@ 50% load		85		%
$\eta_{90\%}$	Power efficiency	@ 90% load		88		%
Output Monitoring: (I_{OUT} resolution is 732uA; U_{OUT} resolution is 4.15 mV)						
I_{OUT} Read	Precision	@ 1.2 A		1	5	%
U_{OUT} Read	Precision	@ 9.6 V		1	3	%

[1] In unipolar mode, the total output power is doubled in comparison to the bipolar mode, but the controller input current is limited to I_{IN}, which limits the total available output power. The controller limits the output current for each channel dynamically if the max input current limit is reached.

Output Safety Characteristics

Unless otherwise noted: T_A = 25°C, U_{IN} = 12 V

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
Output Stage Protection Delays:						
t_{OFF} Short circuit		Full load condition		10	30	µs
t_{OFF} Power system limits		Current and voltage limits			200	µs
Output Stage Current Supervision: (If the OUT+ and OUT- currents differ too much, an error is generated)						
I_{OUT_DIFF}	Error threshold			120		mA

High Resolution Temperature Measurement Characteristics (NTC Probes)

NTC thermistor resistive input characteristics translate into temperature ranges valid for only one type of NTC probe. Below example is given in the case of an NTC $B_{25/100}$ 3988K R_{25} 10k temperature sensor.

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
$R_{HR, RANGE}$	ADC Auto Gain PGA = 1 or 8 or 32	Very Low-°T Configuration NTC	73		1M	Ω
		Corresponding temperature range	194.3 to -55.5			°C

$R_{HR, RANGE}$ is the resistance range of the NTC sensor

High Resolution Temperature Measurement Characteristics (Pt100 and Pt1000 Probes)

Measurement configuration = 23 bit / 4-wire / unshielded cable <50 mm

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
$T_{HR, RANGE}$	Range	Range is extendable upon request Default measurement range is -220°C … +200°C Extended measurement range is -193°C … +787°C	-100		+200	°C
$T_{HR, PREC}$	Precision	(EN 60751 / IEC 751)		0.005	0.01	°C
$T_{HR, COEFF}$	Temp. Coefficient	Relative to device temperature			1.6m	°C/K
$T_{HR, NOISE}$	Value Noise	Reference measurement fluctuations while output stage operating @70% load		0.003		°C
$T_{HR, REP}$	Repeatability	Repeated measurements of reference resistors after up to 3 days		0.005		°C

High Resolution Temperature Measurement Characteristics (Voltage Measurement VIN1)

Sensors with linear Voltage/Temperature output.

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
$V_{SENS, DIFF}$	Range	Differential input voltage Temperature range depends on sensor used	-2.039		2.039	V
$V_{HRUx, ABS}$	Range	Absolute input voltage	-0.1		5.1	V

Low Resolution Temperature Measurement Characteristics (NTC only)

T_A = 25 °C, measurement configuration = 12 bit / 2-wire / unshielded cable <50 mm, °T probe = NTC $B_{25/100}$ 3988K R_{25} 10k

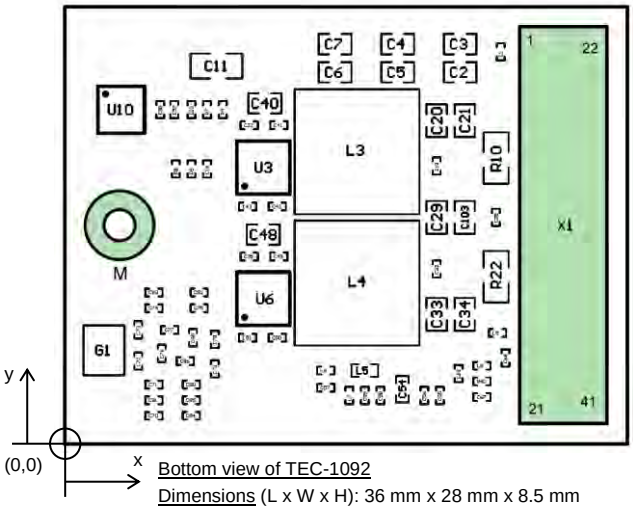
Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
$R_{LR, RANGE}$	Range		180		44600	Ω
		Corresponding temperature range	150 to -6.0			°C

RS232 TTL and General Purpose Digital I/O Characteristics (GPIO1 … GPIO8, RX, TX)

Unless otherwise noted: T_A = 25°C, U_{IN} = 12 V

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
Input Characteristics:						
U_{IH}	Logic high input threshold		2.38			V
U_{IL}	Logic low input threshold				0.93	V
U_{IMAX}	Maximum input voltage		-0.5		5.5	V
Output Characteristics: (Microprocessor)						
U_{OH}	Logic high output voltage	Output current 8mA	2.8			V
U_{OL}	Logic low output voltage	Input current 8mA			0.4	V

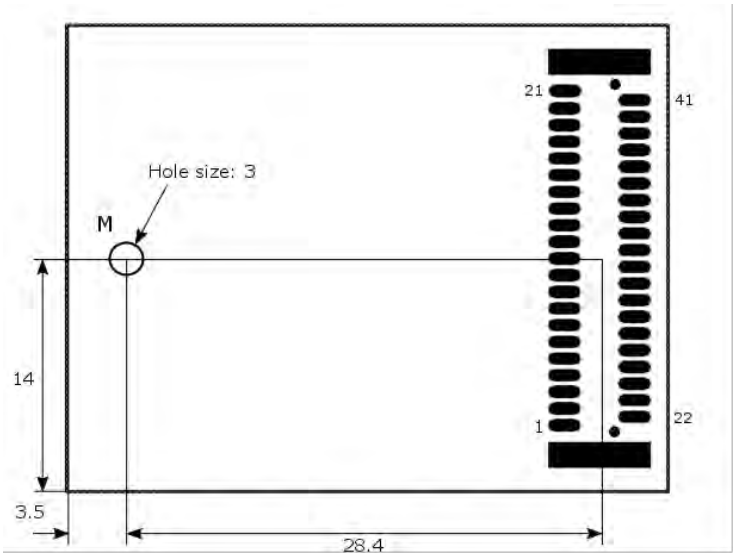
Pin Configuration and Mechanical Data



Bottom view of TEC-1092

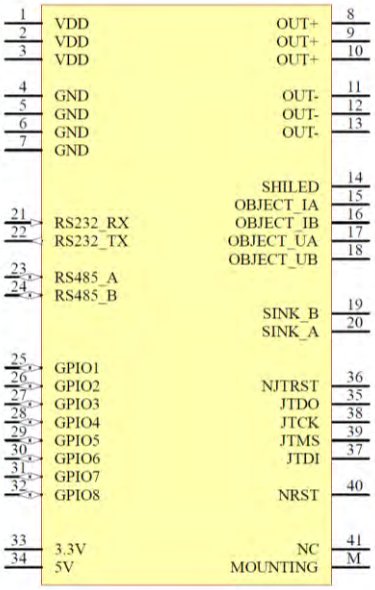
Dimensions (L x W x H): 36 mm x 28 mm x 8.5 mm

- For direct PCB mounting: The PCB should be mounted at the mounting bore M using an M2 screw
  Receptacle height when mated: 5.00 mm
- X1 connector type: Amphenol FCI, 41 Position Connector Receptacle, manufacturer P/N 91930-21141LF,
  Digi-Key P/N 609-1594-ND
- Mating connector type: Amphenol FCI, 41 Position Connector Header, manufacturer P/N 91911-31341LF,
  Digi-Key P/N 609-3427-1-ND
- PCB SMD threaded standoff (for bore hole M on host PCB):
  Würth Electronics, M2, manufacturer P/N 9774050243R,
  Digi-Key P/N 732-7097-1-ND

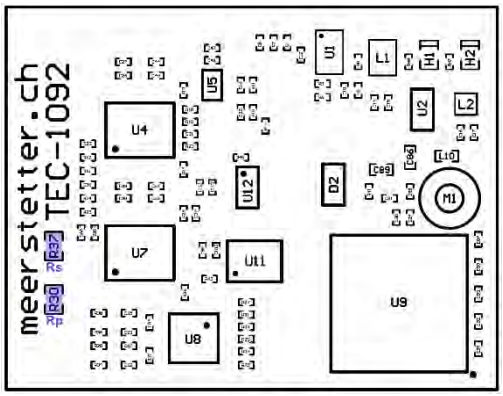


Footprint on host PCB (top view). All dimensions in mm

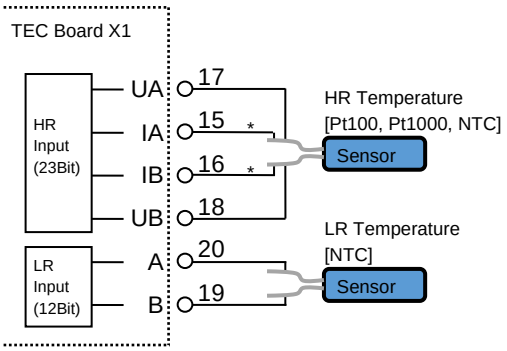
Pin Description X1:



- Pin 35-40: JTAG programming signals (do not connect) or may be used for DPY-111x displays.
- Pin 33 (3.3V) outputs up to 200mA for external loads
- Pin 34 (5V) outputs up to 100mA for external loads



Top view of TEC-1092



* The TEC-1092 always uses 4 wires to sense the High Resolution temperature. There are no bridge jumpers on board. For NTC, please make a bridge on the mother board close by the X1 connector.

Operating-Modes / Theory of Operation

The TEC-1092 is an OEM precision TEC Controller that is primarily designed as a PCB mountable device. However, the TEC-1092 can be mounted on the EVL-1093 Evaluation Board. This allows the connection to a host by USB and usage of a DPY-111x TEC Status Display Kit.

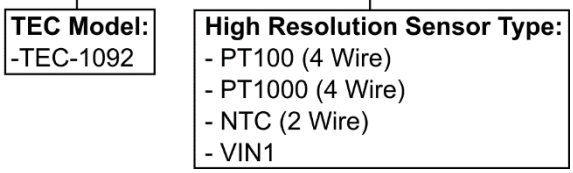
Status information can be polled at any time by industry standard RS485 / RS232 TTL connection or by USB (see box below). The TEC-1092 can also operate in a remote-controlled manner, with parameters adjusted on the fly. Scripting capability by sequential lookup table read-out is supported.

Configured as a DC power-supply, the TEC-1092 can handle current and voltage settings. In the remote-control case, temperature data may be passed on to be processed by the host.

Configurable parameters further include: sensor linearization (Pt100 / Pt1000) and Steinhart-Hart modeling (NTC), temperature acquisition hardware calibration, Peltier element modeling, PID controller auto tuning, nominal temperature ramping, current, voltage and temperature limits, error thresholds, etc. Please refer to the TEC Controller User Manual (Document 5216) for further information.

TEC-1092 Ordering Information, Hardware Configuration

Example Configuration: **TEC-1092-PT100**



High Resolution Sensor Type:
NTC: By default, we mount an NTC1M. If you require an older version (NTC18K, NTC39K or NTC56K), please write which one you need in the comment section of your order or contact us: contact@meerstetter.ch.

Thermocouple:
To use our TEC Controllers with thermocouples type K, you need a TCI-1181 in addition to the TEC Controller with a VIN1 High Resolution Sensor Type configuration.

Customization:
Many hardware and software features of the TEC-1092 are customizable upon request. Please contact Meerstetter Engineering with your enquiry.

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Change History

Date of change	Version	Changed/ Approved	HW-Version	Change / Reason
14 October 2024	J	XF / ML	v1.00	• Add: Change History • Add: New Main Feature: Measurement Inputs are freely assignable to any Output Channel • Add: New Main Feature: Bipolar output channels can be split into unipolar channels • Add: "Unipolar current per channel" and "Unipolar voltage per channel" specifications in "Electrical Characteristics" section • Add: Max Input Current (I_{IN}) specification in Electrical Characteristics section • Add: Top view image of the TEC-1092 • Mod: Specified that the RS485 Data Interface only supports Half-Duplex communication • Del: "TEC Service Software" section removed