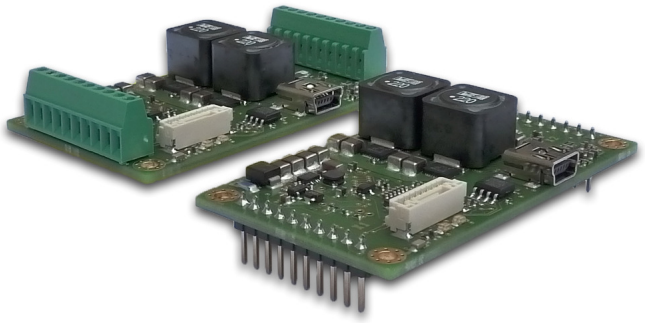
OEM Precision TEC Controller



Features

DC Input Voltage:	12 – 24 V nominal
TEC Controller / Driver:	Autonomous Operation
Output Current:	0 to ±4 A, <1% Ripple
Output Voltage:	0 to ±19 V (max. 0.8 * U_{IN} V)
Temp. Sensor Types:	Pt100, Pt1000, NTC
Temperature Precision:	<0.01 °C T_A = 25°C
Temperature Stability:	<0.01 °C
Thermal Power Control:	PID, Performance-optimized
Configuration / Diagnosis:	via USB / RS485 / RS232
Dimensions (L x W x H):	65 mm x 38 mm x 14 mm
Efficiency:	95% (@ 90% Load)
Cooling:	not required.

Advanced Operation

Operation Modes:	
- Stand-Alone	w/o Live Control Interface
- Remotely-Controlled	USB; RS485; RS232; I/O
- Script-Controlled	Lookup Table Read-Out
Driver Modes:	
- DC Power Supply	Current / Voltage Settings
- Temperature Control	PID Settings, Auto Tuning, optional cool/heat only mode
Control Interfaces:	Isolated USB 2.0, 1x RS485 / 1x RS232 4x Digital I/O (3.3 V / 5 V, General Purpose, Enable, Stable, All OK Signal)
FAN Controller (4 Wire):	Temperature Regulation
Display Unit:	Optional: 2x16 Char OLED
Aux. Temp. Sensor Type:	NTC (on Heat Sink Peltier)

Further Information

Please contact us for additional information, or consult the current TEC Controller User Manual (Document 5134).

General Description

The TEC-1091 is a specialized TEC controller / power supply able to precision-drive Peltier elements.

It features a true bipolar current source for cooling / heating, two temperature monitoring inputs (1x high precision, 1x auxiliary) and intelligent PID control with auto tuning. The TEC-1091 is fully digitally controlled, its hard- and firmware offer various communication and safety options.

The included PC-Software allows configuration, control, monitoring and live diagnosis of the TEC controller via USB / RS485 and RS232. All parameters are saved to non-volatile memory. Saving can be disabled for bus operation.

For the most straightforward applications, only a power supply, a Peltier element and one temperature sensor need to be connected to the TEC-1091. After power-up the unit will operate according to pre-configured values. (In stand-alone mode no control interface is needed.)

The TEC-1091 can handle Pt100, Pt1000 or NTC temperature probes. For highest precision and stability applications a Pt1000 / 4-wire input configuration is recommended. (Temperature acquisition circuitry of each individual device is factory-calibrated to ensure optimal accuracy and repeatability.)

An auxiliary temperature input allows the connection of an NTC probe that is located on the heat sink of the Peltier element. This additional data is used to compensate for parasitic thermal conduction of Peltier elements.

The heating and cooling power is optimized by proprietary thermal management routines based on power balance models (for Peltier elements and resistive heaters).

TEC-1091s function either autonomously (stand-alone) or remotely controlled. Script control is available as well.

Further functionality includes: Smooth temperature ramping, thermal stability indication and auto gain (NTC probes). The PC-Software allows data logging and configuration import/export.

Many features (hardware, software) of this OEM product are customizable upon request.

The TEC-1091 is part of the TEC-Family of Meerstetter TEC controllers, which share the same system bus protocol, design and technology.

The TEC-1091 is designed to be connect through wires or to be soldered on a PCB.

Applications

Optics (Laser Diodes, Crystals, …)

Electronics (Detectors, RF References, …)

Instrumentation (Microscopy, Materials, Biochemistry, …)

Absolute Maximum Ratings	
Supply voltage (DC)	27 V
Supply current (DC)	4 A
Bipolar output voltage	±24 V
Bipolar output current	±6 A

Operating Ratings	
Ambient Operation	0 – 40°C
Storage	-30 – 70°C
Humidity	5 – 95%, non-condensing

Electrical Characteristics

Unless otherwise noted: T_A = 25°C, U_{IN} = 24 V, R_{load} = 3.75 Ω

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
DC Power Supply Input:						
U_{IN}	Supply voltage		4.9		24	V
U_{IN} Ripple	Ripple tolerance	U_{IN} never below $U_{IN\ min}$			300	mV_{PP}
Output:						
I_{OUT}	Bipolar current swing				±4	A
U_{OUT}	Bipolar voltage swing	U_{IN} at least 0.8 * U_{OUT} / see diagram			±19	V
U_{OUT} Ripple	Voltage ripple	@ 4 A		80		mV_{PP}
System Characteristics:						
$\eta_{50\%}$	Power efficiency	@ 50% load		91		%
$\eta_{90\%}$	Power efficiency	@ 90% load		95		%
Output Monitoring (I_{OUT} Resolution is 1.46mA; U_{OUT} Resolution is 6.1mV)						
I_{OUT} Read	Precision	@ 0 A, 4.0 A		1	2.5	%
U_{OUT} Read	Precision	@ 0 V, 15.0 V		1	2.5	%

Object Temperature Measuring Characteristics (Pt100 and Pt1000 Probes)

T_A = 25°C, measurement configuration = 23bit / 4-wire / unshielded cable <50mm

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
$T_{OBJ,\ RANGE}$	Range		-50		+200	°C
$T_{OBJ,\ PREC}$	Precision	Device temperature = 25°C (EN 60571 / IEC 751)		0.005	0.01	°C
$T_{OBJ,\ COEFF}$	Temp. Coefficient	Relative to device temperature			1.6m	°C/K
$T_{OBJ,\ NOISE}$	Value Noise	Reference measurement fluctuations while output stage operating @70% load		0.003		°C
$T_{OBJ,\ REP}$	Repeatability	Repeated measurements of reference resistors after up to 3 days		0.005		°C

Object Temperature Measuring 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
$R_{OBJ,\ RANGE}$	Calibrated range (PGA = 1)	Standard Configuration R_s = 56kΩ	3338		55742	Ω
		Corresponding temperature range	52.0 to -10.1			°C
$R_{OBJ,\ RANGE}$	Extended range (PGA = 1 or 8 or 32)	Standard Configuration R_s = 56kΩ	105		55742	Ω
		Corresponding temperature range	179 to -10.1			°C

Sink Temperature Measuring Characteristics (NTC only)

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

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

Safety Characteristics

Unless otherwise noted: T_A = 25°C, U_{IN} = 24 V

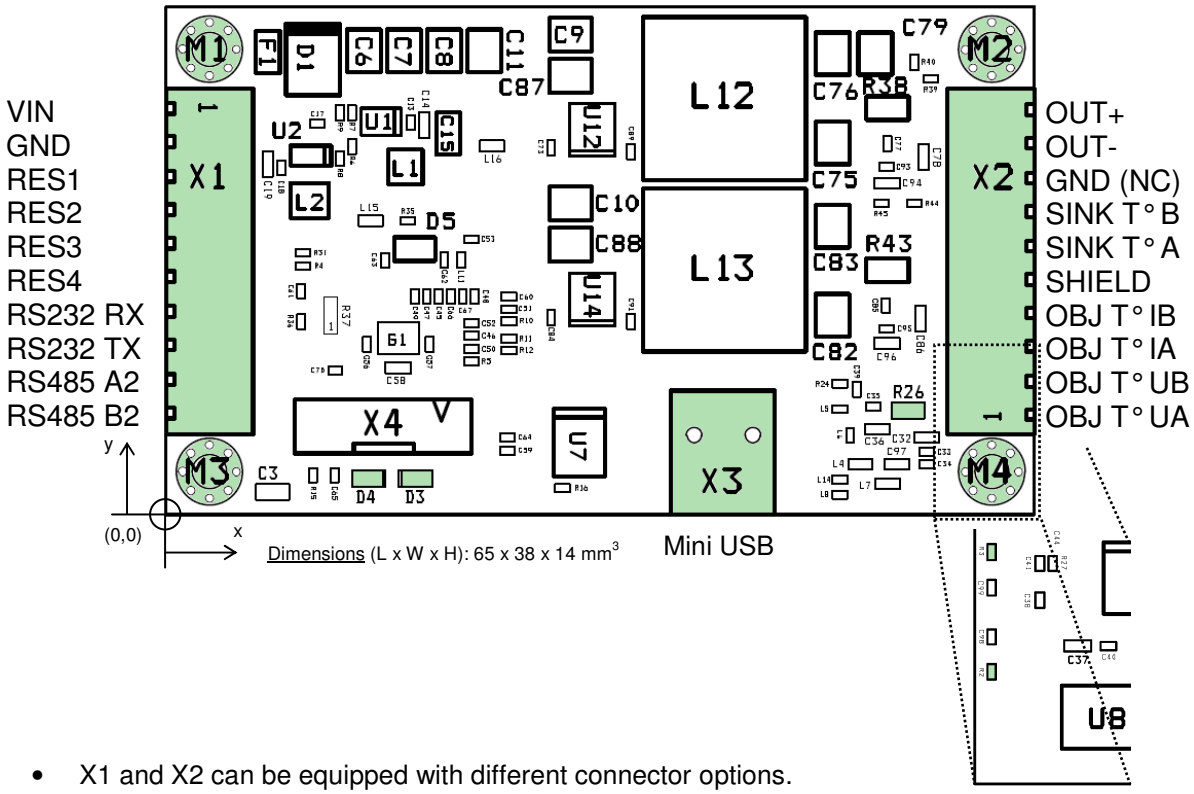
Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
Input Transient Overvoltage Protection:						
U_{IN} Trans.	Transients				27	V
Output Stage Protection Delays:						
t_{OFF} Short circuit		Full load condition		10	30	µs
t_{OFF} Power system limits		Current and voltage limits			200	µs
t_{OFF} System failure		System status or temperature faults		100		ms
t_{IMMUN} Immunity to transient noise		Duration of noise on temperature monitors	300			ms
Output Stage Current Supervision: (If the OUT+ and OUT- currents differ too much, an error is generated)						
I_{OUT_DIFF}	Error threshold			800		mA

RS232 and General Purpose Digital I/O Characteristics (RES1 … RES4, RX, TX)

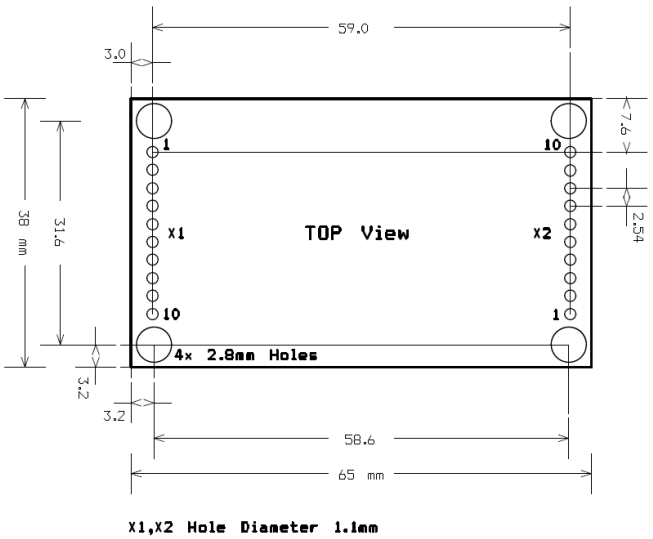
Unless otherwise noted: T_A = 25°C, U_{IN} = 24 V

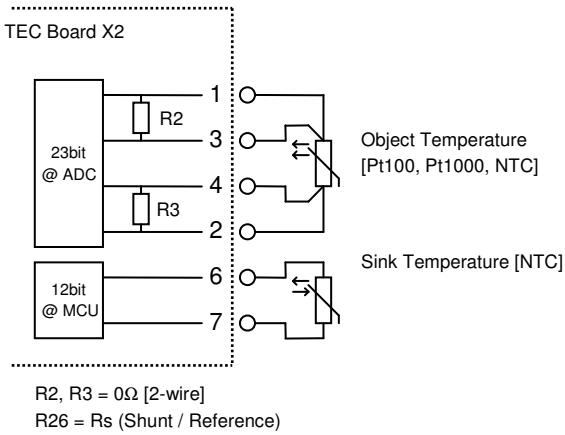
Symbol	Parameter	Comments	Min	Typ	Max	Units
Input Characteristics:						
U_{IH}	Logic high input threshold		2.31			V
U_{IL}	Logic low input threshold				0.99	V
U_{IMAX}	Maximum input voltage		-0.5		5.5	V
Output Characteristics: (Microprocessor)						
U_{OH}	Logic high output voltage	Output current 8mA	2.9	3.3		V
U_{OL}	Logic low output voltage	Input current 8mA		0	0.4	V
ESD Protection: (Between Processor and Connector)						
U_{PP}	ESD discharge	IEC61000–4–2			100	kV
R_A	Series resistance		170	200	230	Ω

Package Outline and Pin Configuration



- X1 and X2 can be equipped with different connector options. Please contact meerstetter engineering with your inquiry.
- For direct PCB mounting: If the TEC-Controller is powered by a sensitive power supply net, it is recommended decouple the TEC-Controller Supply by some filter components. Please contact us for further information.
- For direct PCB mounting: Do not place any component under the TEC-Controller.





R2, R3 = 0Ω [2-wire]
R26 = Rs (Shunt / Reference)

Peltier element, temperature probes, power supply and connectors not included.

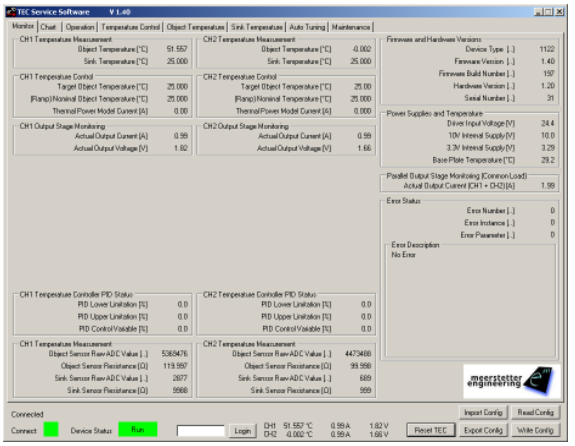
Operation-Modes and Communication Options

The TEC-1091 is an OEM precision TEC controller that is primarily designed to operate as a stand-alone device. Once configured and in operation, its basic status is visually indicated by on-board green and red LEDs and their blinking pattern. More detailed status information can be polled at any time by industry-standard RS485 / RS232 connection or by USB (see box below). The TEC-1091 can also operate in a remotely-controlled manner, with parameters adjusted on the fly. The latest firmware upgrade introduced scripting capability by sequential lookup table read-out.

Configured as a DC power-supply, the TEC-1091 can handle current and voltage settings. In the remote-control case, temperature data may be passed on to be processed by the host.

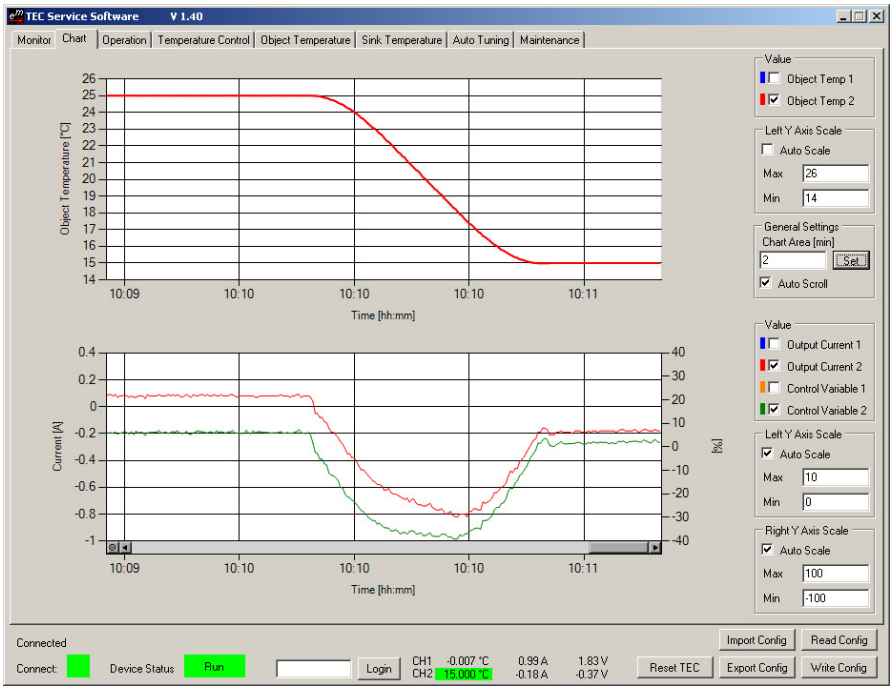
Configurable parameters further include: sensor linearization (Pt100 / Pt1000) and Steinhart-Hart modeling (NTC), temperature acquisition hardware calibration, Peltier element modeling, PID controller auto tuning, nominal temperature ramping, current, voltage and temperature limits, error thresholds, etc. Please refer to the TEC Controller User Manual (Document 5134) for further information.

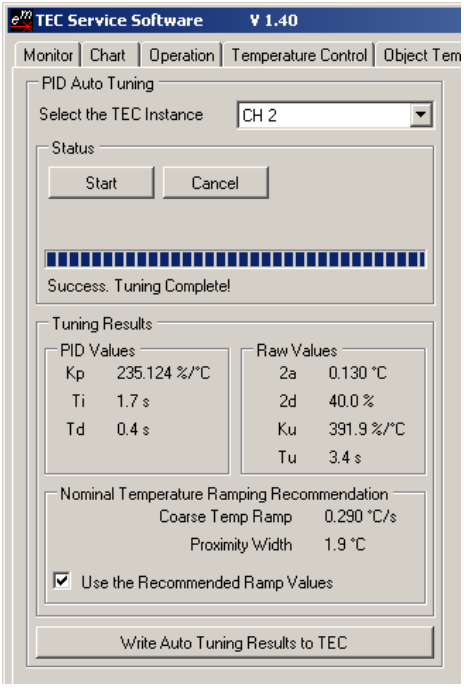
TEC Service Software



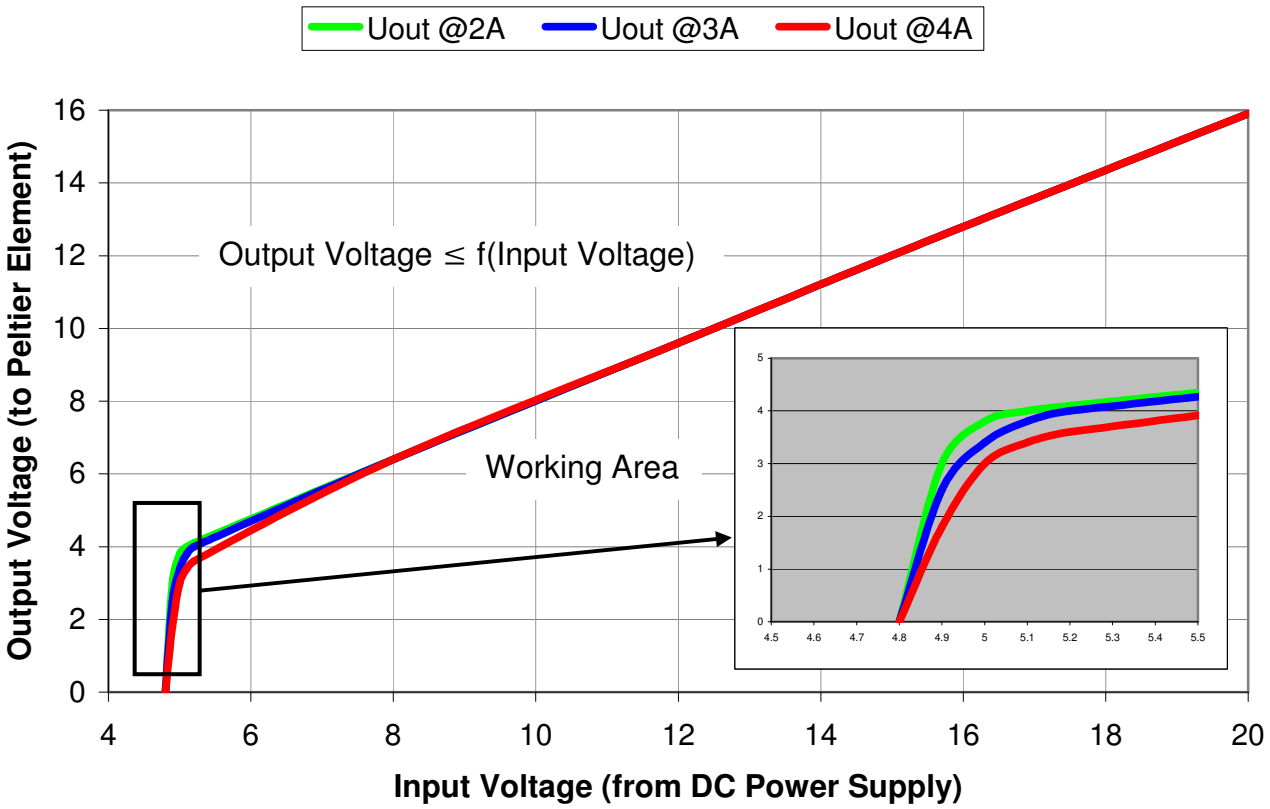
The included TEC Service Software is a powerful tool that allows monitoring, data logging and full configuration of the TEC-1091 via a standard USB or an RS485 / RS232 connection from a PC running Windows.
This tool is ideal for laboratory setups, product evaluation and commissioning. In conjunction with the comprehensive set of error codes and built-in descriptions, it facilitates diagnosis and debugging.
The software also supplies a user-friendly interface for maintenance (*e.g.* firmware upgrades), device calibration and basic data logging.
Please refer to the user manual for more information on features and system requirements.

Temperature Control (Autotuned PID)





Input Voltage vs Output Voltage



TEC-1091 Ordering Information, Hardware Configuration

Example Configuration: **TEC-1091-Pt100-SCREW**

TEC Model
- *TEC-1091*

Object Sensor Type
- *Pt100 (4 Wire)*
- *Pt1000 (4 Wire)*
- *NTC 56k (2 Wire, R_{MAX} of NTC)*

Terminal Configuration
- *SCREW* (2.5mm Screw Terminal)
- *PINHEADER* (2.54mm Pin Header)
- (Special connector on request)

Display Unit:
It is possible to connect a OLED Display 2x16 char directly to the X4 of the TEC-1091. Please visit the DPY-1113 product web page for further information.

Customization:
Many hardware and software features of the TEC-1091 are customizable upon request. Please contact Meerstetter Engineering with your enquiry.

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