

### OEM Precision TEC Controller



### Features

DC Input Voltage:	12 – 24 V nominal
TEC Controller / Driver:	Autonomous Operation
Output Current:	0 to $\pm 10$ A, <1% Ripple (0 to $\pm 16$ A available as TEC-1090)
Output Voltage:	0 to $\pm 19$ V (max. $V_{IN} - 3.5$ V)
Temp. Sensor Types:	Pt100, Pt1000, NTC
Temperature Precision:	<0.01 °C
Temperature Stability:	<0.01 °C
Thermal Power Control:	PID, Performance-optimized
Configuration / Diagnosis:	via USB / RS485 (Software)
Dimensions (L x W x H):	75 mm x 60 mm x 18 mm
Efficiency:	>90% (@ >50% Load)
Cooling:	over Base Plate

### Advanced Operation

Operation Modes:	w/o Live Control Interface
- Stand-Alone	USB; RS485; RS422; I/O
- Remotely-Controlled	Lookup Table Read-Out
- Script-Controlled	
Driver Modes:	
- DC Power Supply	Current / Voltage Settings
- Temperature Control	PID Settings, Auto Tuning
- Heat Only / Cool Only	only Pos. or Neg. Currents
Control Interfaces:	Isolated USB 2.0, 2x RS485 / RS422 4x Digital I/O (3.3 V / 5 V, General Purpose)
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-1089 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-1089 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 and RS485. All parameters are saved to non-volatile memory.

For the most straightforward applications, only a power supply, a Peltier element and one temperature sensor need to be connected to the TEC-1089. After power-up the unit will operate according to pre-configured values. (In stand-alone mode no control interface is needed.)

The TEC-1089 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-1089s 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-1089 is part of the TEC-Family of Meerstetter TEC controllers, which are designed to operate alongside devices of the LDD-Family of laser diode drivers. Both families of drivers share the same system bus protocol, design and technology.

### Applications

Optics (Laser Diodes, Crystals, ...)

Electronics (Detectors, RF References, ...)

Instrumentation (Microscopy, Materials, Biochemistry, ...)

Absolute Maximum Ratings	
Supply voltage (DC)	27 V
Supply current (DC)	10 A
Bipolar output voltage	±26.5 V
Bipolar output current	±14 A

Operating Ratings	
System base plate	< 50 °C
Operation temperature	0 – 60 °C
Storage	-30 – 70 °C
Humidity	5 – 95%, non-condensing

### Electrical Characteristics

Unless otherwise noted:  $T_A = 25\text{ °C}$ ,  $V_{IN} = 24\text{ V}$ ,  $R_{load} = 1.75\ \Omega$

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>DC Power Supply Input:</b>						
$V_{IN}$	Supply voltage		11.5	24	26.5	V
$V_{IN}$ Ripple	Ripple tolerance				300	mV <sub>PP</sub>
<b>Output:</b>						
$I_{OUT}$	Bipolar current swing				±10	A
$V_{OUT}$	Bipolar voltage swing	$V_{IN}$ at least 3.5 V greater than $V_{OUT}$			±19	V
$V_{OUT}$ Ripple	Voltage ripple	@ 10 A		90		mV <sub>PP</sub>
<b>System Characteristics:</b>						
$\eta_{50\%}$	Power efficiency	@ 50% load		91		%
$\eta_{90\%}$	Power efficiency	@ 90% load		92		%
<b>Output Monitoring:</b>						
$I_{OUT}$ Read	Precision	@ 0 A, 5.0 A, 10.0 A		100		mA
$V_{OUT}$ Read	Precision	@ 0 V, 7.5 V, 15.0 V		50		mV

### Object Temperature Monitoring Characteristics (Pt100 and Pt1000 Probes)

$T_A = 25\text{ °C}$ , measurement configuration = 23bit / 4-wire / unshielded cable <50mm, °T probe = Pt100

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Temperature Monitoring Ranges:</b>						
$T_{OBJ}$	°T on object side	Pt100	-50		+200	°C
			extendable upon request			
$T_{OBJ}$	°T on object side	Pt1000	-50		+200	°C
			extendable upon request			
<b>Temperature Monitoring Precision:</b>						
$T_{OBJ}$	°T on object side	Reference measurement fluctuations while output stage operating @70% load		0.002	0.01	°C
<b>Long-term Temperature Monitoring Repeatability:</b>						
$T_{OBJ}$	°T on object side	Repeated measurements of reference resistors after up to 3 days		0.005		°C

### Object Temperature Monitoring Configurations (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<sub>25/100</sub> 3988K R<sub>25</sub> 10k temperature sensor.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Thermistor Input and Temperature Monitoring Ranges:</b>						
$R_{NTC, \text{ calibrated}}$	Calibrated resistance range (PGA = 1)	High-°T Configuration ( $R_s=18k\Omega$ ) Corresponding temperature range	1080		17910	$\Omega$ °C
			84.7 to 12.2			
		Mid-°T Configuration ( $R_s=39k\Omega$ ) Corresponding temperature range	2340		38805	$\Omega$ °C
	61.7 to -3.4					
$R_{NTC, \text{ extended}}$	Extended resistance range. Auto Gain (PGA = 1 or 8)	Low-°T Configuration ( $R_s=56k\Omega$ ) Corresponding temperature range	3360		55720	$\Omega$ °C
			51.8 to -10.1			
		High-°T Configuration ( $R_s=18k\Omega$ ) Corresponding temperature range	135		17910	$\Omega$ °C
	164.0 to 12.2					
$R_{NTC, \text{ extended}}$	Extended resistance range. Auto Gain (PGA = 1 or 8)	Mid-°T Configuration ( $R_s=39k\Omega$ ) Corresponding temperature range	293		38805	$\Omega$ °C
			130.9 to -3.4			

## Sink Temperature Monitoring Characteristics (NTC only)

$T_A = 25^\circ\text{C}$ , measurement configuration = 12bit / 2-wire / unshielded cable <50mm, °T probe = NTC B<sub>25/100</sub> 3988K R<sub>25</sub> 10k

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Sink Temperature Monitoring Range:</b>						
$T_{\text{SINK}}$	°T on heat sink side	NTC B <sub>25/100</sub> 3988K	-6		+150	°C
<b>Sink Temperature Monitoring Precision:</b>						
$T_{\text{SINK}}$	°T on heat sink side	Reference measurement fluctuations while output stage operating @70% load		0.05	0.1	°C
<b>Long-term Sink Temperature Monitoring Repeatability:</b>						
$T_{\text{SINK}}$	°T on heat sink side	Repeated measurements of reference resistors after up to 3 days		0.1		°C

## Safety Characteristics

Unless otherwise noted:  $T_A = 25^\circ\text{C}$ ,  $V_{\text{IN}} = 24\text{ V}$

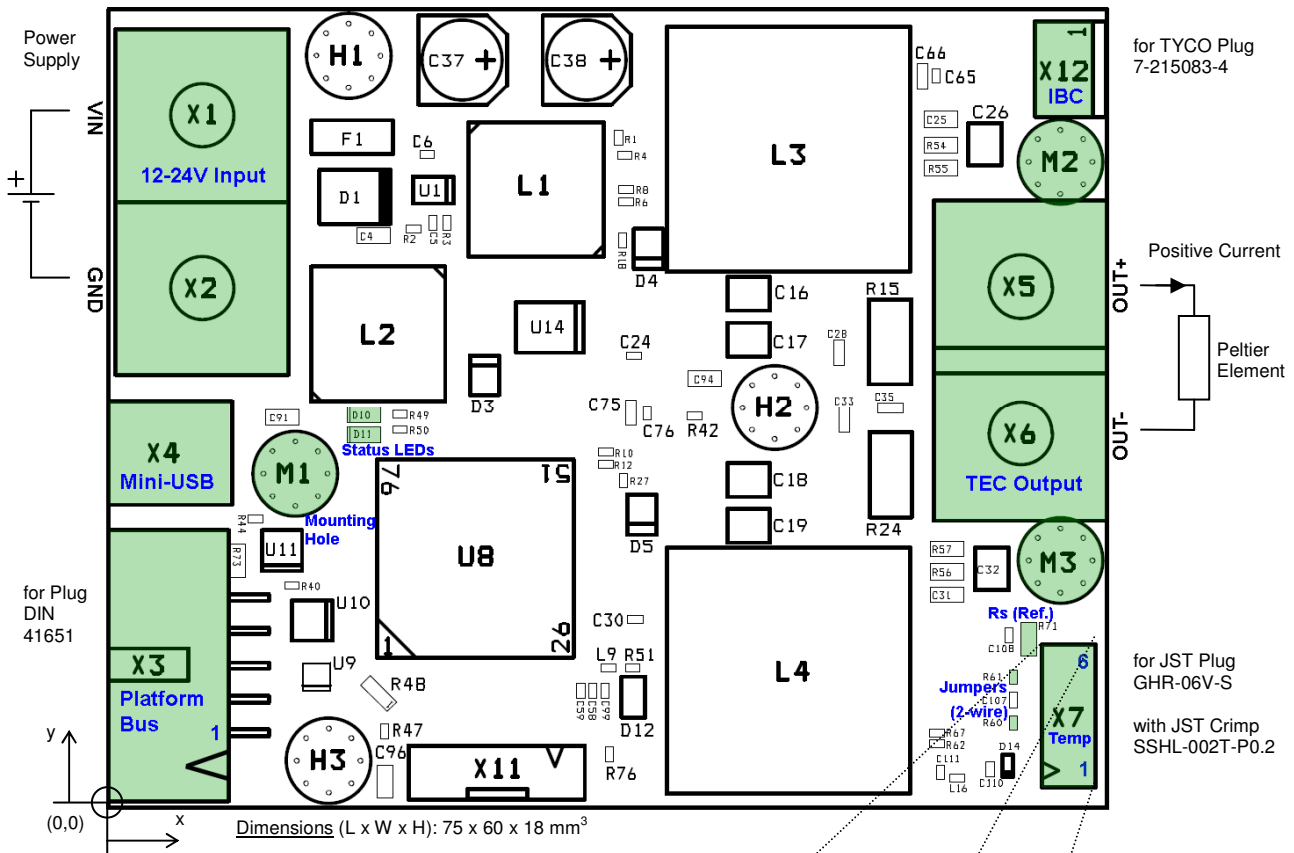
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Input Transient Overvoltage Protection:</b>						
$V_{\text{IN Trans.}}$	Transients				28.2	V
<b>Input Reverse Polarity Protection:</b> (GND input is connected through a Power MOSFET which is not active when reverse polarity is applied to the power supply terminals.)						
$V_{\text{IN Pol.}}$	Reverse polarity				-28.2	V
<b>Output Stage Protection Delays:</b>						
$t_{\text{OFF}}$ Short circuit		Full load condition		10	30	µs
$t_{\text{OFF}}$ Power system limits		Current and voltage limits			200	µs
$t_{\text{OFF}}$ System failure		System status or temperature faults		100		ms
$t_{\text{IMMUN}}$ Immunity to transient noise		Duration of noise on temperature monitors	300			ms
<b>Output Stage Current Supervision:</b> (If the OUT+ and OUT- currents differ too much, an error is generated)						
$I_{\text{OUT DIFF}}$	Error threshold			800		mA

## General Purpose Digital I/O Characteristics (RES1 ... RES4)

Unless otherwise noted:  $T_A = 25^\circ\text{C}$ ,  $V_{\text{IN}} = 24\text{ V}$

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

## Package Outline and Pin Configuration



Mounting (M3-size Bores, 7.5 mm in Length):

M1: x = 14.0 mm, y = 25.0 mm

M2: x = 71.5 mm, y = 48.5 mm

M3: x = 71.5 mm, y = 18.5 mm

Power Terminals: M4-size Screws

Pin Descriptions Platform Bus X3:

1: 24V (optional)

2: GND (fused, PTC)

3: RS485\_A1 [\*R72 = Termination (120Ω), N.A.]

4: RS485\_B1 [\*R72 not accessible from top]

5: RS485\_A2 [R73 = Termination (120Ω), N.A.]

6: RS485\_B2

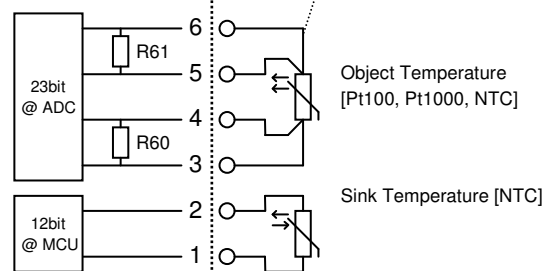
7: RES1

8: RES2

9: RES3

10: RES4

TEC Board



R60, R61 = 0Ω [2-wire] / 10nF [4-wire]  
R71 = Rs (Shunt / Reference)

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

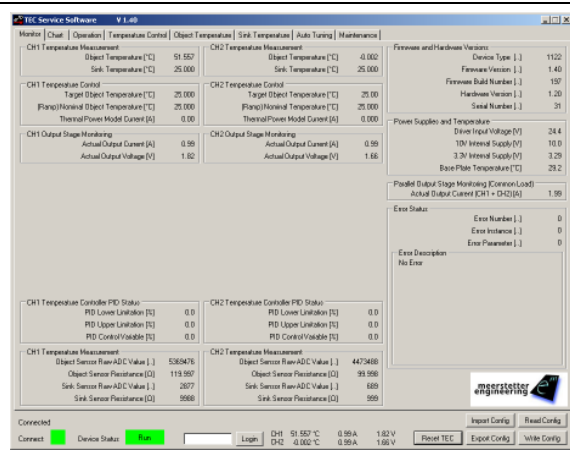
## Operation-Modes and Communication Options

The TEC-1089 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 connection or by USB (see box below). The TEC-1089 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-1089 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



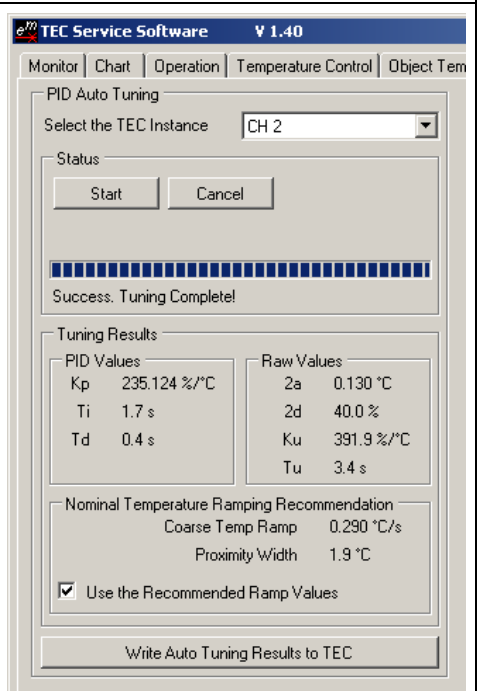
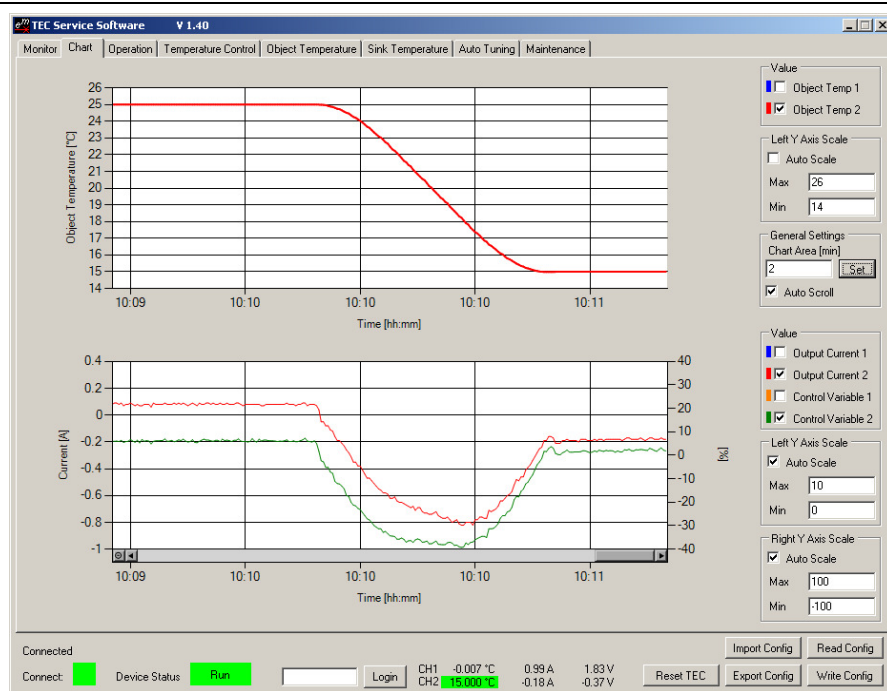
The included TEC Service Software is a powerful tool that allows monitoring, data logging and full configuration of the TEC-1089 via a standard USB or an RS485 connection from a PC running Windows.

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)



**TEC-1089 Ordering Information, Hardware Configuration**

Part number*	Object °T Sensor and Configuration Options	Sink °T Sensor
TEC-1089	Pt100, 4-wire / Pt1000, 4-wire / NTC, 2-wire ( $R_s = 18k\Omega, 39k\Omega$ or $56k\Omega$ )	NTC 3988 10k

*\* Please specify object temperature sensor type when ordering. We recommend the use of Pt1000 sensors. For the case of NTC,  $R_s = 39k\Omega$  (Mid-°T) is standard,  $18k\Omega$  (High-°T) and  $56k\Omega$  (Low-°T) are options.*

Sample Order Numbers:

- TEC-1089-Pt100
- TEC-1089-Pt1000
- TEC-1089-NTC39k

Customization:

Many hardware and software features of the TEC-1089 are customizable upon request. Please contact Meerstetter Engineering with your enquiry.