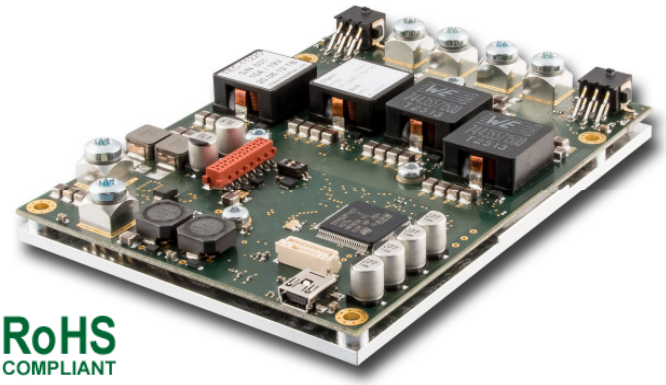
OEM Dual-Channel TEC Controller



RoHS COMPLIANT

The TEC-1122 is a specialized TEC controller / power supply able to precision-drive two independent Peltier elements.

Each channel features a true bipolar DC current source for cooling / heating, two temperature monitoring inputs (1x main, 1x auxiliary) and intelligent PID control with auto tuning. The TEC-1122 is fully digitally controlled, its hard- and firmware offer numerous 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. Saving can be disabled for bus operation.

For the most straightforward applications, only a power supply, Peltier elements and two temperature sensors need to be connected to the TEC-1122. After power-up the unit will operate according to pre-configured values. (In stand-alone mode no control interface is needed.)

The TEC-1122 can handle either Pt100, Pt1000 or NTC temperature probes. For highest precision and stability applications a Pt1000 / 4-wire input configuration is recommended. Analog measurement circuit is factory calibrated.

Auxiliary temperature inputs allow the connection of NTC probes that are located on the heat sinks of the Peltier elements. This additional data is used to compensate for parasitic thermal conduction of Peltier elements. Also, it allows the control of external heat sink cooling fans.

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

The TEC-1122's two independent channels may also be operated in parallel, to either drive two individual or one common load (current doubling).

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.

Features

Output Stage:

- Output Current / Channel: 0 to ±10 A, <1% Ripple
  (Dual 0 to ±16 A available as TEC-1123)

SV (Standard Voltage) Version:

- DC Input Voltage: 12 – 24 V
- Output Voltage / Channel: 0 to ±22 V (max. U_{IN} - 3.5 V)

HV (High Voltage) Version:

- DC Input Voltage: 12 – 36 V Nominal
- Output Voltage / Channel: 0 to ±31 V (max. U_{IN} - 4.5 V)

Main Features:

- Two Independent TEC Controller / Driver Channels
- Temperature Sensor Types: Pt100, Pt1000, NTC
- Temperature Precision / Stability: <0.01 °C
- Performance-optimized PID for Thermal Power Control
- Configuration / Diagn. over USB / RS485 PC Software
- Dimensions (L x W x H): 120 mm x 90 mm x 18 mm
- Efficiency: > 90 % (@ 50% Load)
- Cooling over Base Plate
- Auxiliary Peltier Heat Sink NTC Temp. Sensor Input

Operation Modes:

- Stand-Alone with out Live Control Interface
- Remotely-Controlled over USB, RS485, RS422, I/O
- Script-Controlled over Lookup Table Read-Out

Driver Modes:

- DC Power Supply: Set Current or Voltage
- Temperature Control: PID Settings, Auto Tuning, optional Cool/Heat-Only or Resistor modes

Data Interfaces:

- USB 2.0 1kV isolated (FTDI Chip)
- 2x RS485 / RS422

General Purpose I/O Features:

- 8x Digital I/O Signals (3.3 V / 5 V)
- Configurable as Input to control TEC-1122 (Enable, Temperature Up / Down etc.)
- Configurable as output to monitor TEC-1122 (Error Indication, Temperature Stable Indication etc.)

Optional Components:

- Display Unit: 2x16 Char OLED (DPY-1113)

Further Information:

- Please contact us for additional information, or consult the current TEC Controller User Manual (Document 5134).
- The TEC-1122 is part of the TEC-Family of Meerstetter TEC controllers. It is designed to operate alongside devices of the LDD-Family of laser diode drivers. Both families of drivers share the same system bus, design, technology and physical dimensions.

Absolute Maximum Ratings

Supply voltage (DC)	27 V (HV: 37 V)
Supply current (DC)	20 A
Bipolar output voltage	±26 V (HV: ±35 V)
Bipolar output current	±14 A (per channel)

Operating Ratings

System base plate	< 50°C (HV: < 45°C*)
Operation temperature	0 – 60°C
Storage	-30 – 70°C
Humidity	5 – 95%, non-condensing

* Only relevant for high power operation

Electrical Characteristics for SV (Standard Voltage) Version

Unless otherwise noted: T_A = 25°C, U_{IN} = 24 V, R_{load} = 1.75 Ω

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
DC Power Supply Input:						
U_{IN}	Supply voltage		11.5	24	26.5	V
U_{IN} Ripple	Ripple tolerance				300	mV_{PP}
Output (per Channel):						
I_{OUT}	Bipolar current swing				±10	A
U_{OUT}	Bipolar voltage swing	U_{IN} at least 3.5 V greater than U_{OUT}			±22	V
U_{OUT} Ripple	Voltage ripple	R_{load} = 1.13 Ω, 10 A		90		mV_{PP}
System Characteristics:						
$\eta_{50\%}$	Power efficiency	@ 50% load		91		%
$\eta_{90\%}$	Power efficiency	@ 90% load		93		%
Output Monitoring (I_{OUT} Resolution is 7.3mA; U_{OUT} Resolution is 8.8mV)						
I_{OUT} Read	Precision	@ 0 A, 10.0 A		1	3	%
U_{OUT} Read	Precision	@ 0 V, 15.0 V		1	3	%
Input Transient Overvoltage and Reverse Polarity Protection:						
U_{IN} Trans.	Transients				28.2	V
U_{IN} Pol.	Reverse polarity		available option: -28.2 max.		-0.7	V V

Electrical Characteristics for HV (High Voltage) Version

Unless otherwise noted: T_A = 25°C, U_{IN} = 36 V, R_{load} = 3 Ω

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
DC Power Supply Input:						
U_{IN}	Supply voltage		11.5	36	36.5	V
U_{IN} Ripple	Ripple tolerance				300	mV_{PP}
Output (per Channel):						
I_{OUT}	Bipolar current swing				±10	A
U_{OUT}	Bipolar voltage swing	U_{IN} at least 4.5 V greater than U_{OUT}			±31	V
U_{OUT} Ripple	Voltage ripple			TBD		mV_{PP}
System Characteristics:						
$\eta_{50\%}$	Power efficiency	@ 50% load		TBD		%
$\eta_{90\%}$	Power efficiency	@ 90% load		TBD		%
Output Monitoring (I_{OUT} Resolution is 7.3mA; U_{OUT} Resolution is 10.25mV)						
I_{OUT} Read	Precision	@ 0 A, 10.0 A		1	3	%
U_{OUT} Read	Precision	@ 0 V, 30.0 V		1	3	%
Input Transient Overvoltage and Reverse Polarity Protection:						
U_{IN} Trans.	Transients				39	V
U_{IN} Pol.	Reverse polarity		available option: -39 max.		-0.7	V V

Output Safety Characteristics

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

Symbol	Parameter	Test Conditions	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
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

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 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 $B_{25/100}$ 3988K R_{25} 10k temperature sensor.

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

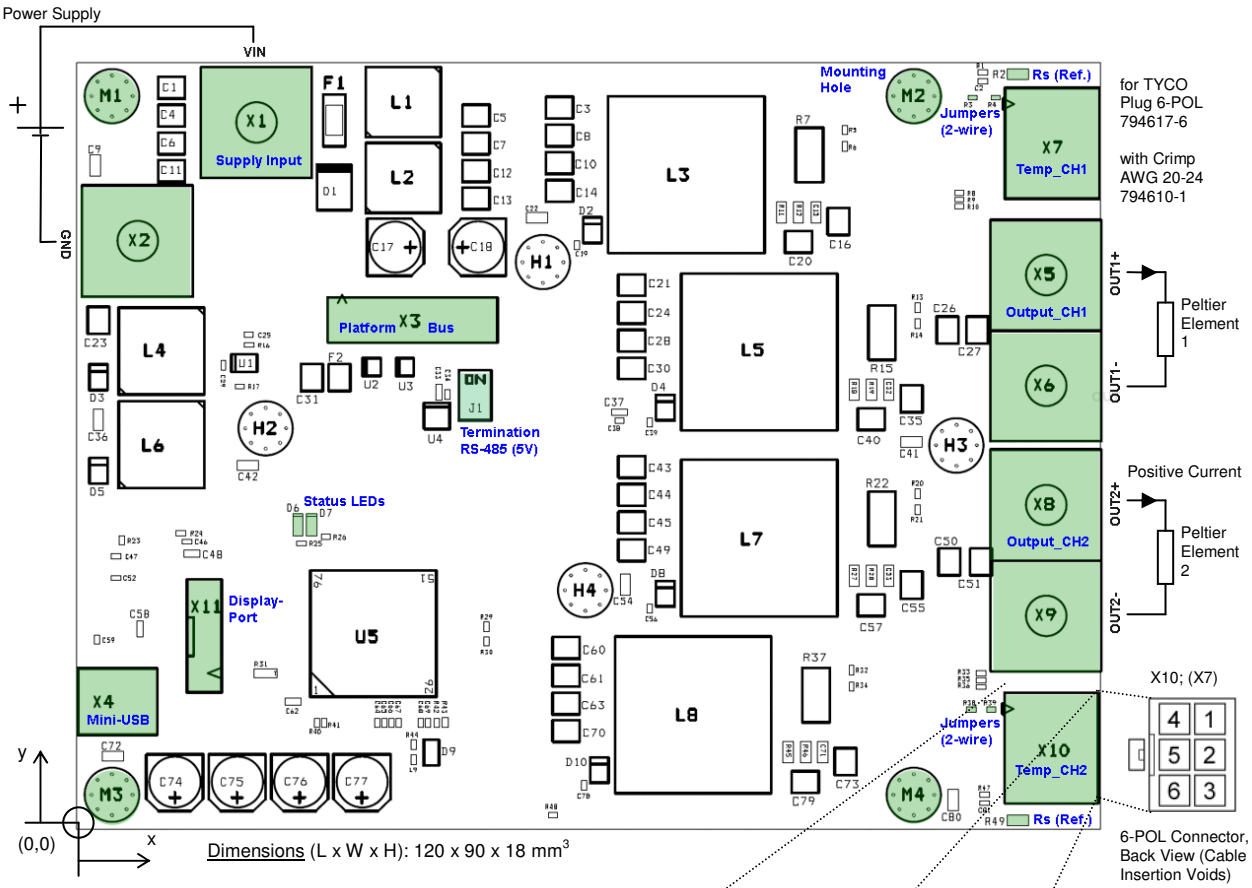
Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Units
$R_{SINK, RANGE}$	Range		180		44600	Ω
		Corresponding temperature range	150 to -6.0			°C

General Purpose Digital I/O Characteristics (RES1 … RES8)

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)						
V_{PP}	ESD discharge	IEC61000–4–2			100	kV
R_A	Series resistance		170	200	230	Ω

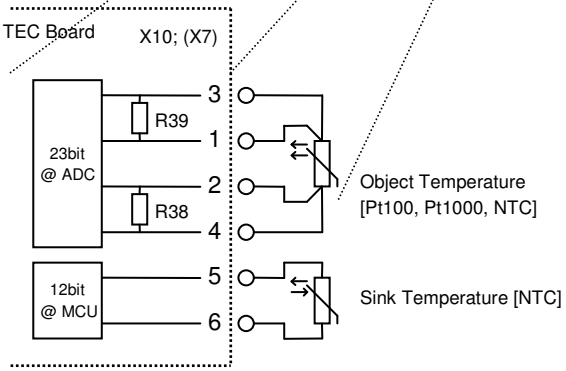
Package Outline and Pin Configuration



Mounting (M3-size Bores, 7.5 mm in Length):
M1: x = 4.0 mm, y = 86.0 mm
M2: x = 98.0 mm, y = 86.0 mm
M3: x = 4.0 mm, y = 4.0 mm
M4: x = 98.0 mm, y = 4.0 mm

Power Terminals: M4-size Screws

Pin Descriptions Platform Bus X3:
TYCO Plug 14-POL: 8-215083-4
1: GND (fused with polyfuse 200mA)
2: RES1
3: RES2
4: RES3
5: RES4
6: RES5
7: RES6
8: RES7
9: RES8
10: GND (fused with polyfuse 200mA)
11: RS485_A1 [120Ω Termination, DIP-Switch J1, 1]
12: RS485_B1
13: RS485_A2 [120Ω Termination, DIP-Switch J1, 2]
14: RS485_B2



X10; (X7)
R39, R38; (R4, R3) = 0Ω [2-wire] / 10 nF [4-wire]
R49; (R2) = Rs (Shunt / Reference)

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

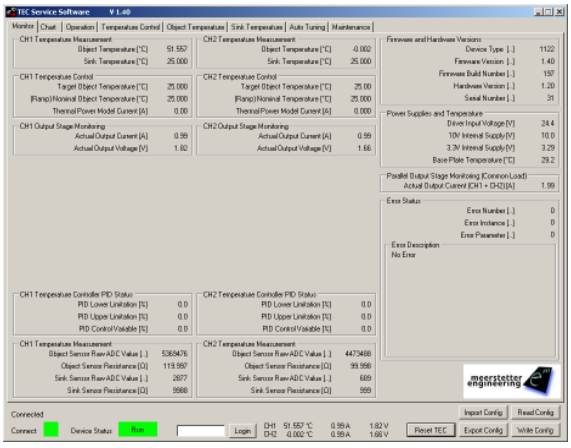
Operation-Modes and Communication Options

The TEC-1122 is an OEM two-channel TEC controller that is primarily designed to operate as a stand-alone device. Its basic operation 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-1122 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-1122 can handle current and voltage settings. In the remote-control case, temperature data may be passed on to be processed by the host.
Also, the TEC's two channels can be configured to operate in a 'parallel' mode to double the output current.

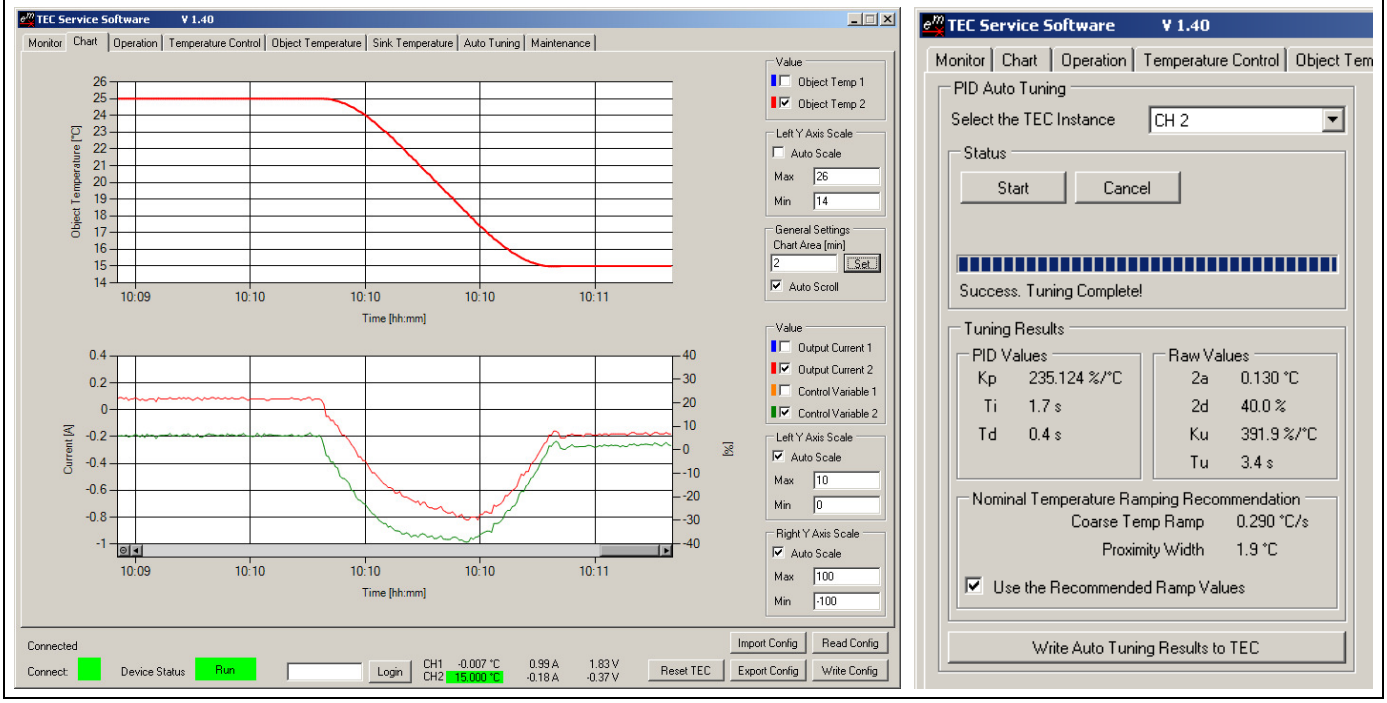
Configurable parameters further include: sensor linearization (Pt100 / Pt1000) and Steinhart-Hart modeling (NTC), temperature acquisition hardware calibration, Peltier element modeling, PID controller auto tuning, nominal temperature ramping, current, voltage and temperature limits, error thresholds,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

TEC Service Software



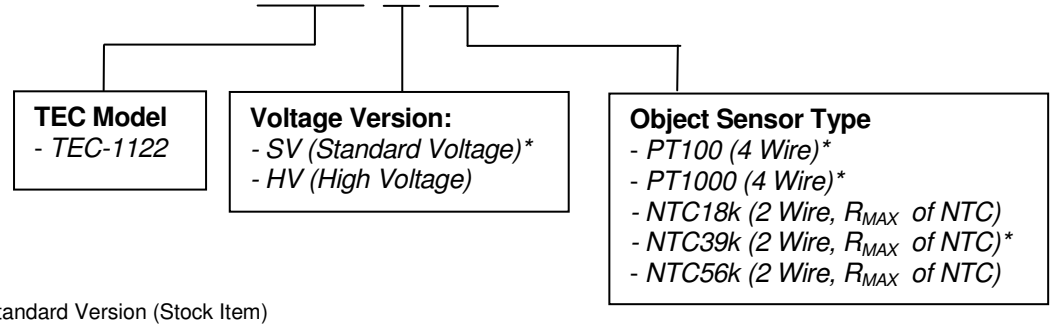
The included TEC Service Software is a powerful tool that allows monitoring, data logging and full configuration of the TEC-1122 via a standard USB or an RS485 connection from a PC running Windows.
This tool is ideal for laboratory setups, product evaluation and commissioning. In conjunction with the 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-1122 Ordering Information, Hardware Configuration

Example Configuration: **TEC-1122-SV-PT100**



* Standard Version (Stock Item)

Display Unit:
It is possible to connect an OLED 2x16 character display directly to the X4 connector. Please visit the DPY-1113 product web page for further information.

Customization:
Many hardware and software features of the TEC-1122 are customizable upon request. Please contact Meerstetter Engineering with your enquiry.

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