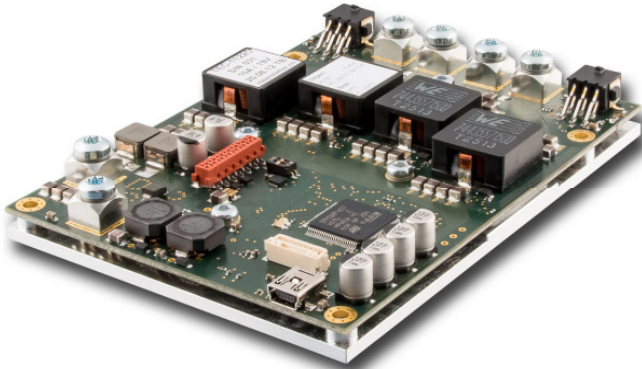


## OEM Dual-Channel TEC Controller



The TEC-1123 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-1123 is fully digitally controlled, its hardware 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-1123. After power-up the unit will operate according to pre-configured values. (In stand-alone mode no control interface is needed.)

The TEC-1123 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-1123'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:

- DC Input Voltage: 12 – 24 V
- Output Voltage / Channel: 0 to  $\pm 22$  V (max.  $U_{IN} - 3.5$  V)
- Output Current / Channel: 0 to  $\pm 16$  A, <1.5% Ripple (Dual 0 to  $\pm 10$  A available as TEC-1122)

### HV (High Voltage) Version:

- DC Input Voltage: 12 – 36 V Nominal
- Output Voltage / Channel: 0 to  $\pm 31$  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: > 92 % (@ 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-1123 (Enable, Temperature Up / Down etc.)
- Configurable as output to monitor TEC-1123 (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-1123 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)    | 32 A                |
| Bipolar output voltage | ±26 V (HV: ±35 V)   |
| Bipolar output current | ±22 A (per channel) |

## Operating Ratings

|                       |                         |
|-----------------------|-------------------------|
| System base plate     | < 50 °C (HV: < 40 °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:  $T_A = 25\text{ °C}$ ,  $U_{IN} = 24\text{ V}$ ,  $R_{load} = 0.85\text{ }\Omega$

| Symbol                                                                                    | Parameter             | Test Conditions                                | Min  | Typ | Max                          | Units            |
|-------------------------------------------------------------------------------------------|-----------------------|------------------------------------------------|------|-----|------------------------------|------------------|
| <b>DC Power Supply Input:</b>                                                             |                       |                                                |      |     |                              |                  |
| $U_{IN}$                                                                                  | Supply voltage        |                                                | 11.5 | 24  | 26.5                         | V                |
| $U_{IN}$ Ripple                                                                           | Ripple tolerance      |                                                |      |     | 300                          | mV <sub>PP</sub> |
| <b>Output (per Channel):</b>                                                              |                       |                                                |      |     |                              |                  |
| $I_{OUT}$                                                                                 | Bipolar current swing |                                                |      |     | ±16                          | A                |
| $U_{OUT}$                                                                                 | Bipolar voltage swing | $U_{IN}$ at least 3.5 V greater than $U_{OUT}$ |      |     | ±22                          | V                |
| $U_{OUT}$ Ripple                                                                          | Voltage ripple        | $R_{load} = 1.13\text{ }\Omega$ , 16 A         |      | 145 |                              | mV <sub>PP</sub> |
| <b>System Characteristics:</b>                                                            |                       |                                                |      |     |                              |                  |
| $\eta_{50\%}$                                                                             | Power efficiency      | @ 50% load                                     |      | 94  |                              | %                |
| $\eta_{90\%}$                                                                             | Power efficiency      | @ 90% load                                     |      | 95  |                              | %                |
| <b>Output Monitoring</b> ( $I_{OUT}$ Resolution is 14.6mA; $U_{OUT}$ Resolution is 8.8mV) |                       |                                                |      |     |                              |                  |
| $I_{OUT}$ Read                                                                            | Precision             | @ 0 A, 16.0 A                                  |      | 1   | 3                            | %                |
| $U_{OUT}$ Read                                                                            | Precision             | @ 0 V, 15.0 V                                  |      | 1   | 3                            | %                |
| <b>Input Transient Overvoltage and Reverse Polarity Protection:</b>                       |                       |                                                |      |     |                              |                  |
| $U_{IN}$ Trans.                                                                           | Transients            |                                                |      |     | 28.2                         | V                |
| $U_{IN}$ Pol.                                                                             | Reverse polarity      |                                                |      |     | -0.7                         | V                |
|                                                                                           |                       |                                                |      |     | available option: -28.2 max. | V                |

## Electrical Characteristics for HV (High Voltage) Version

Unless otherwise noted:  $T_A = 25\text{ °C}$ ,  $U_{IN} = 36\text{ V}$ ,  $R_{load} = 2\text{ }\Omega$

| Symbol                                                                                      | Parameter             | Test Conditions                                | Min  | Typ | Max                        | Units            |
|---------------------------------------------------------------------------------------------|-----------------------|------------------------------------------------|------|-----|----------------------------|------------------|
| <b>DC Power Supply Input:</b>                                                               |                       |                                                |      |     |                            |                  |
| $U_{IN}$                                                                                    | Supply voltage        |                                                | 11.5 | 36  | 36.5                       | V                |
| $U_{IN}$ Ripple                                                                             | Ripple tolerance      |                                                |      |     | 300                        | mV <sub>PP</sub> |
| <b>Output (per Channel):</b>                                                                |                       |                                                |      |     |                            |                  |
| $I_{OUT}$                                                                                   | Bipolar current swing |                                                |      |     | ±16                        | 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 <sub>PP</sub> |
| <b>System Characteristics:</b>                                                              |                       |                                                |      |     |                            |                  |
| $\eta_{50\%}$                                                                               | Power efficiency      | @ 50% load                                     |      | 92  |                            | %                |
| $\eta_{90\%}$                                                                               | Power efficiency      | @ 90% load                                     |      | 94  |                            | %                |
| <b>Output Monitoring</b> ( $I_{OUT}$ Resolution is 12.2mA; $U_{OUT}$ Resolution is 10.25mV) |                       |                                                |      |     |                            |                  |
| $I_{OUT}$ Read                                                                              | Precision             | @ 0 A, 16.0 A                                  |      | 1   | 3                          | %                |
| $U_{OUT}$ Read                                                                              | Precision             | @ 0 V, 30.0 V                                  |      | 1   | 3                          | %                |
| <b>Input Transient Overvoltage and Reverse Polarity Protection:</b>                         |                       |                                                |      |     |                            |                  |
| $U_{IN}$ Trans.                                                                             | Transients            |                                                |      |     | 39                         | V                |
| $U_{IN}$ Pol.                                                                               | Reverse polarity      |                                                |      |     | -0.7                       | V                |
|                                                                                             |                       |                                                |      |     | available option: -39 max. | V                |

## Output Safety Characteristics

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

| Symbol                                                                 | Parameter                   | Test Conditions                           | Min | Typ | Max | Units         |
|------------------------------------------------------------------------|-----------------------------|-------------------------------------------|-----|-----|-----|---------------|
| <b>Output Stage Protection Delays:</b>                                 |                             |                                           |     |     |     |               |
| $t_{OFF}$                                                              | Short circuit               | Full load condition                       |     | 10  | 30  | $\mu\text{s}$ |
| $t_{OFF}$                                                              | Power system limits         | Current and voltage limits                |     |     | 200 | $\mu\text{s}$ |
| $t_{OFF}$                                                              | System failure              | System status or temperature faults       |     | 100 |     | ms            |
| $t_{IMMUN}$                                                            | Immunity to transient noise | Duration of noise on temperature monitors | 300 |     |     | ms            |
| <b>Output Stage Current Supervision:</b>                               |                             |                                           |     |     |     |               |
| (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)

$T_A = 25^\circ\text{C}$ , measurement configuration = 23bit / 4-wire / unshielded cable <50mm

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

## 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> |                                                           |                                                                                                    |      |               |       |                              |
| $R_{NTC, calibrated}$                                      | Calibrated<br>resistance range<br>(PGA = 1)               | High- $^\circ\text{T}$ Configuration ( $R_s=18\text{k}\Omega$ )<br>Corresponding temperature range | 1080 | 84.7 to 12.2  | 17910 | $\Omega$<br>$^\circ\text{C}$ |
|                                                            |                                                           | Mid- $^\circ\text{T}$ Configuration ( $R_s=39\text{k}\Omega$ )<br>Corresponding temperature range  | 2340 | 61.7 to -3.4  | 38805 | $\Omega$<br>$^\circ\text{C}$ |
|                                                            |                                                           | Low- $^\circ\text{T}$ Configuration ( $R_s=56\text{k}\Omega$ )<br>Corresponding temperature range  | 3360 | 51.8 to -10.1 | 55720 | $\Omega$<br>$^\circ\text{C}$ |
| $R_{NTC, extended}$                                        | Extended resistance<br>range. Auto Gain<br>(PGA = 1 or 8) | High- $^\circ\text{T}$ Configuration ( $R_s=18\text{k}\Omega$ )<br>Corresponding temperature range | 135  | 164.0 to 12.2 | 17910 | $\Omega$<br>$^\circ\text{C}$ |
|                                                            |                                                           | Mid- $^\circ\text{T}$ Configuration ( $R_s=39\text{k}\Omega$ )<br>Corresponding temperature range  | 293  | 130.9 to -3.4 | 38805 | $\Omega$<br>$^\circ\text{C}$ |

## Sink Temperature Measuring Characteristics (NTC only)

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

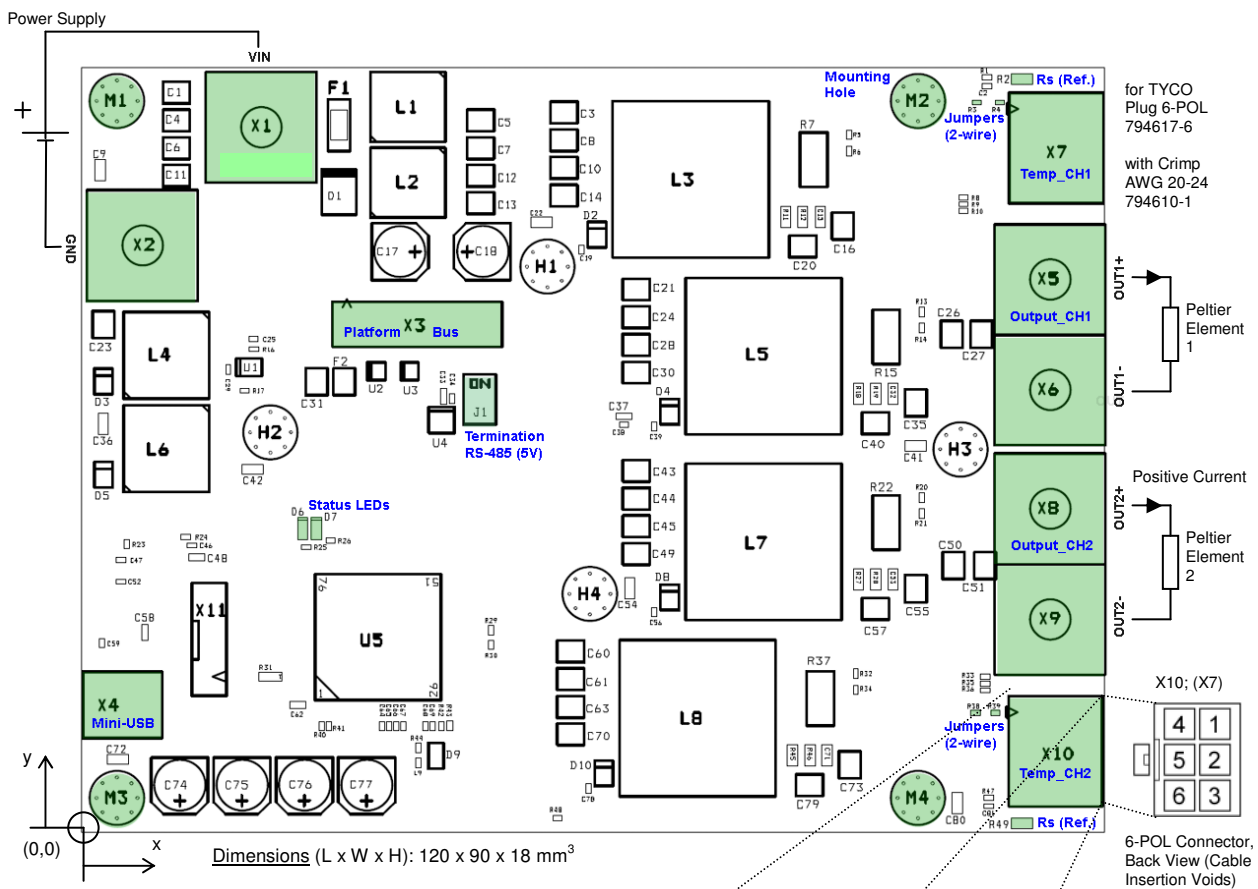
| Symbol            | Parameter | Test Conditions / Hints         | Min | Typ         | Max   | Units                        |
|-------------------|-----------|---------------------------------|-----|-------------|-------|------------------------------|
| $R_{SINK, RANGE}$ | Range     | Corresponding temperature range | 180 | 150 to -6.0 | 44600 | $\Omega$<br>$^\circ\text{C}$ |

## General Purpose Digital I/O Characteristics (RES1 ... RES8)

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

| Symbol                            | Parameter                  | Comments           | Min  | Typ | Max  | Units    |
|-----------------------------------|----------------------------|--------------------|------|-----|------|----------|
| <b>Input Characteristics:</b>     |                            |                    |      |     |      |          |
| $U_{IH}$                          | 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        |
| <b>Output Characteristics:</b>    |                            |                    |      |     |      |          |
| (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        |
| <b>ESD Protection:</b>            |                            |                    |      |     |      |          |
| (Between Processor and Connector) |                            |                    |      |     |      |          |
| $V_{PP}$                          | ESD discharge              | IEC61000-4-2       |      |     | 100  | kV       |
| $R_A$                             | Series resistance          |                    | 170  | 200 | 230  | $\Omega$ |

## Package Outline and Pin Configuration



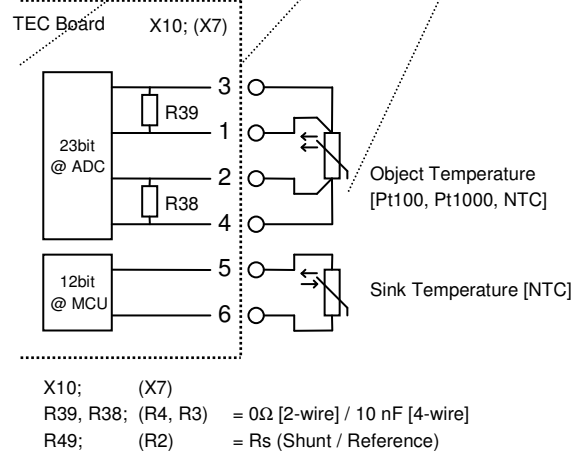
### Mounting (M3-size Bores, 7.5 mm in Length):

- 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:

- 1: GND (fused, PTC) for TYCO Plug 14-POL 8-215083-4
- 2: RES1
- 3: RES2
- 4: RES3
- 5: RES4
- 6: RES5
- 7: RES6
- 8: RES7 [used by LDD-Family devices as PULSE]
- 9: RES8 [used by LDD-Family devices as ENABLE]
- 10: GND (fused, PTC)
- 11: RS485\_A1 [120Ω Termination, DIP-Switch J1, 1]
- 12: RS485\_B1
- 13: RS485\_A2 [120Ω Termination, DIP-Switch J1, 2]
- 14: RS485\_B2



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

## Operation-Modes and Communication Options

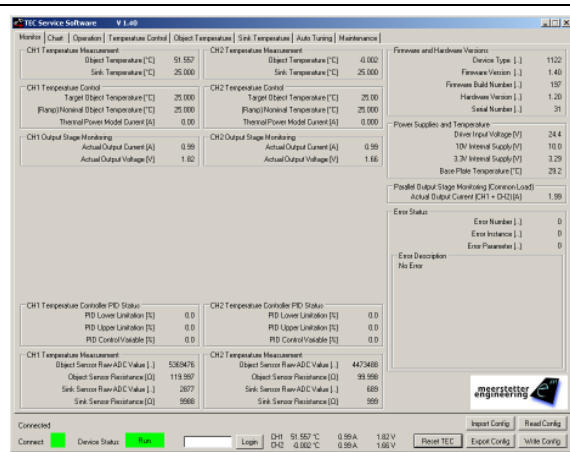
The TEC-1123 is an OEM two-channel TEC controller that is primarily designed to operate as a stand-alone device. Its basic operation status is visually indicated by on-board green and red LEDs and their blinking pattern. More detailed status information can be polled at any time by industry-standard RS485 connection or by USB (see box below). The TEC-1123 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-1123 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



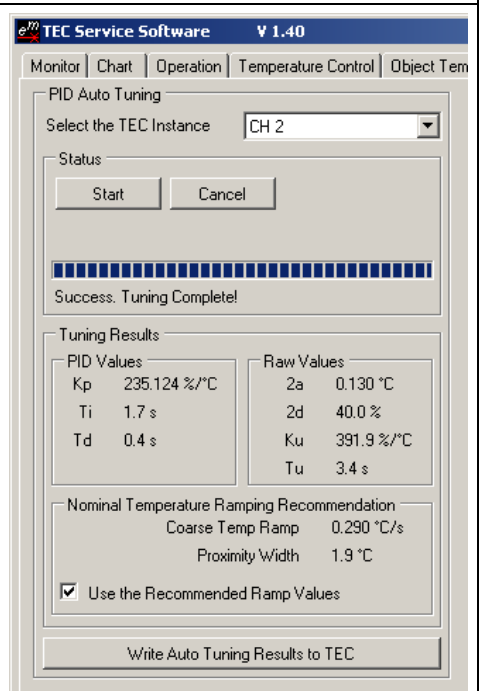
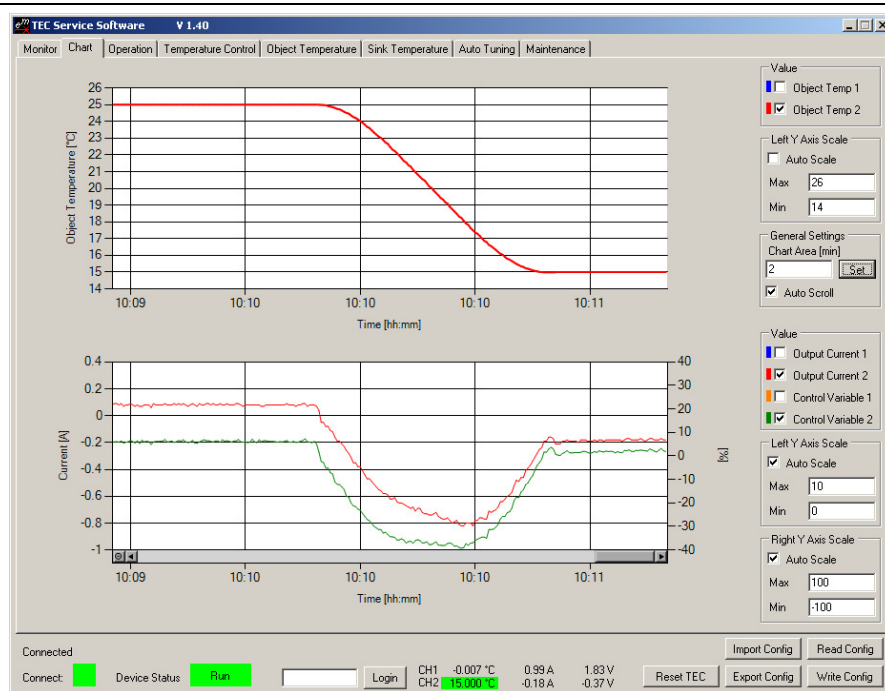
The included TEC Service Software is a powerful tool that allows monitoring, data logging and full configuration of the TEC-1123 via a standard USB or an RS485 connection from a PC running Windows.

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.

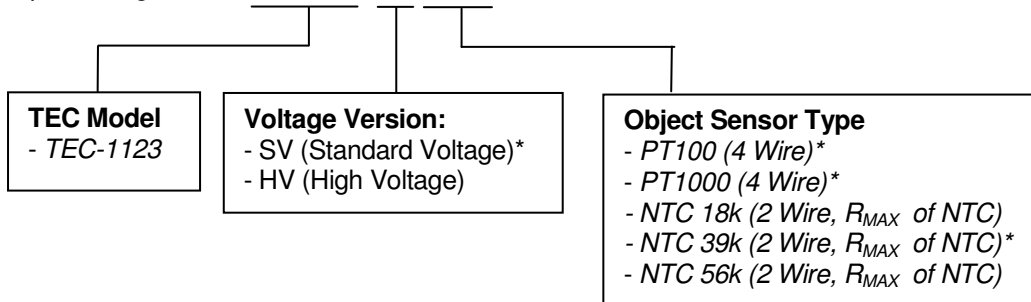
Please refer to the user manual for more information on features and system requirements.

## Temperature Control (Autotuned PID)



## TEC-1123 Ordering Information, Hardware Configuration

Example Configuration: **TEC-1123-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-1123 are customizable upon request. Please contact Meerstetter Engineering with your enquiry.

Meerstetter Engineering GmbH  
Schulhausgasse 12  
3113 Rubigen, Switzerland



Phone: +41 31 712 01 01  
Email: [contact@meerstetter.ch](mailto:contact@meerstetter.ch)  
Website: [www.meerstetter.ch](http://www.meerstetter.ch)

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