

# SenseFuture TEC103 Single Channel Temperature Controller **Instruction Manual**

Home » SenseFuture » SenseFuture TEC103 Single Channel Temperature Controller Instruction Manual



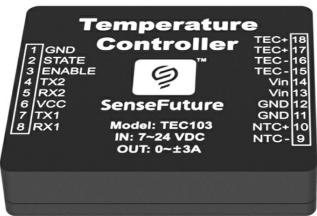
#### **Contents**

- 1 SenseFuture TEC103 Single Channel Temperature **Controller**
- **2 Product Functions**
- **3 Product Features 4 Product Parameters**
- **5 Interface Introduction**
- **6 Dimensional Drawing**
- 7 Computer Software
- **8 Instructional Video**
- 9 Selection Guide
- 10 Customized Temperature Control System Services
- 11 Typical Application Cases
- 12 Partners
- 13 Documents / Resources
  - 13.1 References
- **14 Related Posts**



SenseFuture TEC103 Single Channel Temperature Controller





## **Product Functions**

TEC103 is primarily used for temperature measurement and control in optical components, such as lasers, detectors, and small sample chambers.

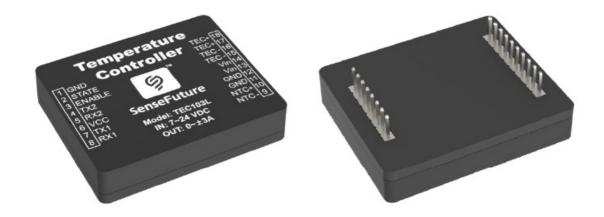


Figure1 TEC103

## **Product Features**

- Thermal measurement sensitivity of 0.1 mK, long-term drift (over 24 hours) less than 1 mK.
- Temperature control stability of ±0.001°C (dependent on the controlled object and parameters), is suitable for most scenarios, including the stringent temperature control requirements for semiconductor lasers.
- Optional bipolar or unipolar output.
- Capable of limiting the maximum rate of temperature change.
- Supports NTC (Negative Temperature Coefficient) thermistor temperature sensors.
- Chip-level design, facilitating integration into circuit board designs.
- Features overheat protection for the circuit board, ensuring reliable performance.

- Allows direct parameter setting via the display control module, with settings retained in memory after power loss, simplifying production operations.
- Provides a comprehensive set of serial port control commands, offering an open platform for customization and integration.

## **Product Parameters**

Table 1 Basic Parameters of TEC103

	MODEL				
PARAMETERS	TEC103L TEC103		TEC130 (Pending Launch)	UNIT	
24-hour Temperature Measuremen t Stability					
(with the matched thermistor)	<0.001@20°C		<0.001@20°C	°C	
Temperature drift caused by ambie nt temperature	0.0001		0.0001	°C/°C	
Optimal Temperature Control Stabil ity					
(related to the overall system)	±0.01	±0.001	±0.001	°C	
Temperature Change Limit Setting Range	0.01~2.5		0.01~2.5	°C/s	
			UART		
Temperature Setting Method	UART		Analog Voltage: 1V =1 0kΩ		
Power Supply Voltage (Short-term Maximum Voltage: 28V)	7~24		7~24	V	
Output Polarity	Bipolar Unipolar		Bipolar Unipolar	V	
Number of Channels	1		1		
Maximum Output Voltage	±90%Vin (Settable)		±90%Vin (Settable)		
Output Current Range	0~±3		0~±30	Α	
Ambient Temperature	-55~60		-55~60	°C	
Ambient Humidity	0~98		0~98	%RH	
Thermal Dissipation Requirements	No Additional Thermal Dissipation Needed Within Rated Operatin g Range				
Circuit Board Overheat Protection	Yes				
Power Loss Memory	Yes				
PID Parameters	arameters User Adjustable				
Size	46.5*39.0*9.6			mm <sup>3</sup>	
Weight	≈30		<u> </u>	g	

## **Interface Introduction**

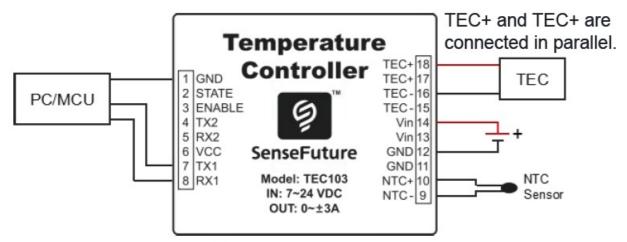


Figure 2 Wiring Diagram of TEC103/TEC103L

## Table 2 Pin Definition Table for TEC103/TEC103L

Pin Num ber	Pin Name	Pin Ty pe	Pin Definition (High Level: 3.3V, Low Level: 0V)
1	GND	Input	Power Input Negative Pole (Low Current).
2	STATE	Output	Temperature Control Status Output. High Level: Temperature control is functioning normally (temperature control error < 0.01°C). Low Level: Temperature control anomaly detected (temperature control error ≥ 0.01°C).  The temperature control standard of 0.01°C can be set.
3	ENABLE	Input	Output Enable Pin. High Level (Default): Enables temperature control output. Low Level: Disables temperature control output.
4	TX2	Output	Serial Port 2 Receiver, TTL Level, used for connecting to the Screen Display Control Module.
5	RX2	Input	Serial Port 2 Receiver, TTL Level, used for connecting to the Screen Display Control Module.
6	vcc	Output	3.3V Output, intended for connection to the screen display control module and not recommended for other uses.
7	TX1	Output	Serial Port 1 Receive End, TTL level, used for connecting to PC control softw are. Data bits: 8 bits, Stop bits: 1 bit, Parity: None, Baud Rate: 38400.
8	RX1	Input	Serial Port 1 Receive End, TTL level, used for connecting to PC control softw are. Data bits: 8 bits, Stop bits: 1 bit, Parity: None, Baud Rate: 38400.
9	NTC-	Input	Thermistor (NTC) Interface, compatible with different resistance values of NT C thermistors, with wiring polarity not required.
10	NTC+	Input	Thermistor (NTC) Interface, compatible with different resistance values of NT C thermistors, with wiring polarity not required.
11	GND	Input	Power Input Negative Pole (High Current).
12	GND	Input	Power Input Negative Pole (High Current).

13	Vin	Input	Power Input Positive Pole, with an input voltage range of 7 to 24V.
14	Vin	Input	Power Input Positive Pole, with an input voltage range of 7 to 24V.
15	TEC-	Output	The negative terminal of the temperature control current output is usually con nected to the negative terminal of the Thermoelectric Cooler (TEC).
16	TEC-	Output	The negative terminal of the temperature control current output is usually con nected to the negative terminal of the Thermoelectric Cooler (TEC).
17	TEC+	Output	The positive terminal of the temperature control current output is typically connected to the positive terminal of the Thermoelectric Cooler (TEC).
18	TEC+	Output	The positive terminal of the temperature control current output is typically connected to the positive terminal of the Thermoelectric Cooler (TEC).



Figure3 TEC103/TEC103L Adapter Board Wiring Diagram

## **Dimensional Drawing**

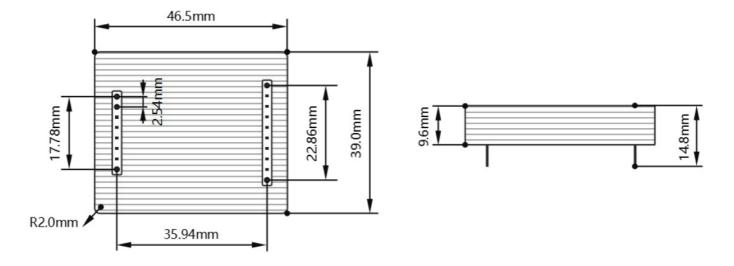


Figure4 Dimensional drawing of TEC103/TEC103L

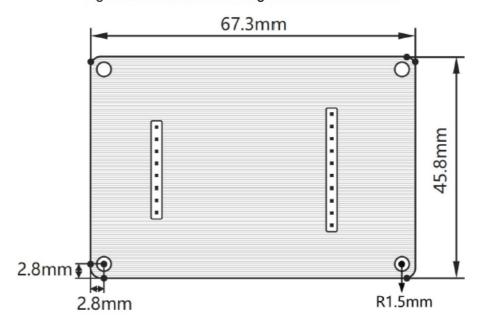


Figure 5 Dimensional drawing of TEC103/TEC103L Evaluation Board

## **Computer Software**

**Computer Software (Communication Protocol Refer to Attachment)** 



Figure6 Computer Software

### Instructional Video

SenseFuture ±0.001°C Temperature Controller (TEC103 Series) Instructions for Use DFB Laser Temperature Control <a href="https://www.youtube.com/watch?v=1Zbd7IOfTXo">https://www.youtube.com/watch?v=1Zbd7IOfTXo</a>.

## **Selection Guide**

Table 3 Temperature Controllers Selection Guide

MODEL	STABILITY (°C)@20°C	SENSOR TYP ES	CHANNELS	DRIVING C APACITY @ 24V	POWER SUPP LY VOLTAGE( V)	FEATURES
TEC103L	±0.01	NTC	1	±3A	7-24	Single-channel, Compact
TEC103	±0.001	1110				
TEC207L	±0.01		2	±7A each ch annel		Dual-channel, Medium Current
<b>TEC207</b>	±0.001	NTC PT1000				
TEC215L	±0.01			±15A each c hannel		Dual-channel, High -current, Solid Stat e Relay
TEC215	±0.001					
TEC215 pro	±0.001	NTC PT1000 CCR Low-Te mperature Re sistor				Dual-channel, High -current, Solid Stat e Relay, Polynomia I Temperature Calib ration

## **Customized Temperature Control System Services**

We offer complete temperature control solutions, providing custom temperature control systems for institutions such as the National Institute of Metrology of China, the Anhui Institute of Optics and Fine Mechanics, Nanjing University, and Shenzhen University.

For customized temperature control systems, please contact our technical support at +86 191 2054 5883 WhatsApp ID same as phone number

## **Typical Application Cases**

### **DFB Semiconductor Laser Temperature Control Case Study**

- Temperature Control Object Information: A domestically manufactured Distributed Feedback (DFB) laser diode operating at a wavelength of 1370nm and a power output of 10mW.
- Temperature Sensor Specification: The laser module incorporates an NTC 10K B3950 thermistor internally.
- Heating/Cooling Device: The laser features an integrated thermoelectric cooler (TEC) capable of 1.5A at 2.6V.
- Temperature Controller Brand and Model: SenseFuture™ TEC103.
- Target Temperature: 25°C.
- Temperature Controller Settings: Power supply voltage is 12V, with a maximum output voltage percentage set at 20% (i.e., 12V × 20% = 2.4V); PID parameters configured as P = 200, I = 100, D = 0, with a positive hysteresis duty cycle of 0.005%, and a negative hysteresis duty cycle also at 0.005%.
- Measured Results: The actual temperature stability achieved is ±0.0005°C after 5 hours of testing under ambient conditions of 25±1.5°C, and ±0.0005°C maintained over 24 hours, again within an ambient range of 25±1.5°C.

(Need a specific solution? Please consult technical support for a quotation at +86 191 2054 5883)

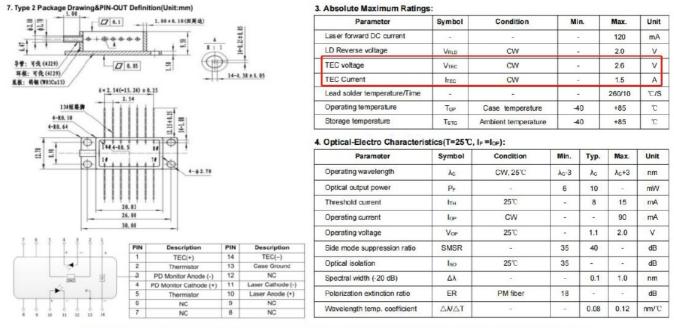


Figure Attached 1.1 Dimensions and Basic Parameter Information for the DFB Laser

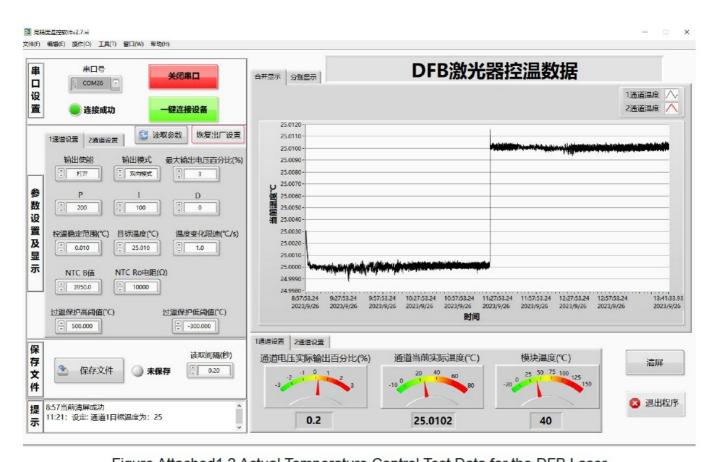


Figure Attached 1.2 Actual Temperature Control Test Data for the DFB Laser

#### **ICL Semiconductor Laser Temperature Control Case Study**

- Performance is similar to 01, with specific details to be shared upon update.
- (Need a specific solution? Please consult technical support for a quotation at +86 191 2054 5883)

## **LD Laser Diode Temperature Control Case Study**

• Performance is similar to 01, with specific details to be shared upon update.

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## **QCL Temperature Control Case Study**

- Temperature Control Object Details: QCL (Quantum Cascade Laser) with a wavelength of 4332nm and a power output of 100mW.
- Temperature Sensor: An internal NTC 10K B3950 thermistor is built into the laser.
- Heating/Cooling Device: An integrated thermoelectric cooler (TEC) within the laser operating at 7V.
- Temperature Controller Brand and Model: SenseFuture™ TEC103.
- Target Temperature: 47°C.
- Temperature Controller Settings: Supply voltage is 12V, with a maximum output voltage setting of 20% (corresponding to 12V x 20% = 2.4V), PID parameters configured as P = 5000, I = 500, and D = 0.
- Actual Test Results: Achieved temperature stability was ±0.001°C over a 1-hour test period.

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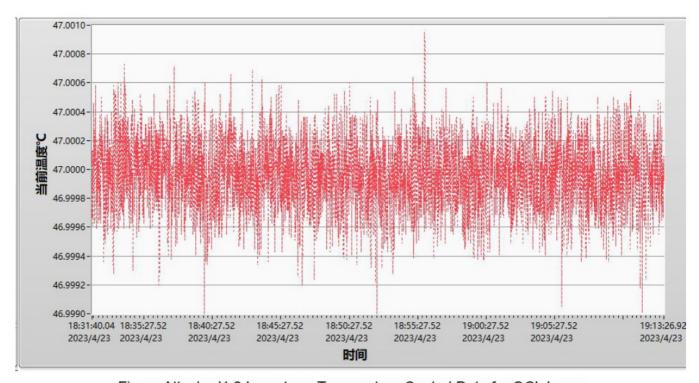


Figure Attached 1.3 Long-term Temperature Control Data for QCL Laser

**MCT Detector Temperature Control Case Study** 



Figure Attached 1.4 MCT Detector

- Temperature Control Object Information: MCT Detector from brand VIGO.
- Temperature Sensor: Built-in NTC 2K B3950 thermistor inside the detector.
- Heating/Cooling Element: Integrated thermoelectric cooler (TEC) within the detector rated at 1V and 100mA.
- Temperature Controller Brand and Model: SenseFuture™ TEC103.
- Target Temperature: 25°C.
- Temperature Controller Settings: The power supply voltage is 9V with a maximum output voltage percentage of 3% (which translates to  $9V \times 3\% = 0.27V$ ), PID parameters set to P = 15, I = 5, and D = 0.
- Measured Results: Achieved temperature stability of ±0.0025°C over a 14-hour test period.

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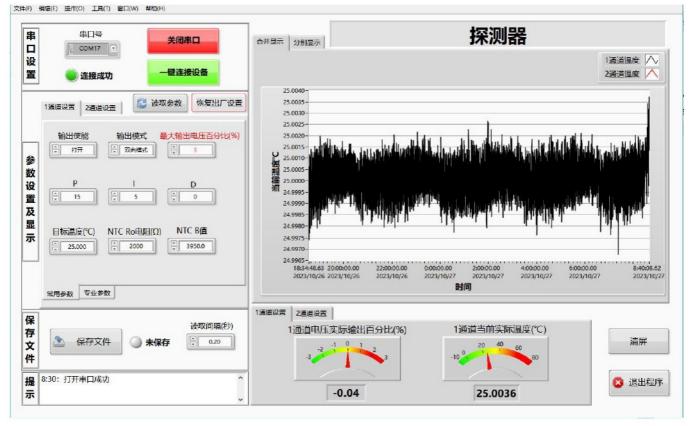


Figure Attached 1.5 Temperature Control Data for MCT Detector

#### **Partners**

### **Universities and Research Institutes**





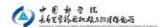














**Optical Instrument Technology Company** 



















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Original Aspiration Determines the Future, Innovation Creates Value, and Sharing Unites Hearts. Looking forward to achieving win-win cooperation with you!

#### **Download**



SenseFuture Technologies Co., Ltd.

### **Documents / Resources**



<u>SenseFuture TEC103 Single Channel Temperature Controller</u> [pdf] Instruction Manual TEC103, TEC103 Single Channel Temperature Controller, Single Channel Temperature Controller, Temperature Controller, Controller

#### References

SenseFuture

- <u>\$</u>
- User Manual

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