I2C-TC9604KP, I2C-TC9604JP, I2C-TC9604TP, I2C-TC9604NP,
I2C-TC9604SP, I2C-TC9604EP, I2C-TC9604BP, I2C-TC9604RP

4-Channel Panel-Mounted I2C Bus Thermocouple EMF-to-Temperature Converter

1 Features

The I2C-TC9604XP temperature measurement board is engineered to deliver accurate and dependable temperature monitoring through a comprehensive set of features. The following sections provide an in-depth look at the main attributes of the board:

- **Single-Chip Solution**

Utilizing the MCP9604 chip, the board incorporates all the necessary functions for temperature measurement within a single integrated circuit. This approach simplifies the overall design, ensuring uniformity and reducing the complexity associated with system integration.

- **Thermocouple EMF Conversion**

The board converts the electromotive force (EMF) generated by a thermocouple directly into temperature readings, expressed in degrees Celsius. This direct conversion streamlines the process of temperature measurement across a variety of applications.

- **Cold-Junction Compensation**

The MCP9604 chip includes cold-junction compensation, which maintains the accuracy of temperature readings even as ambient conditions change. This feature addresses a common source of error in thermocouple measurements, providing stable and reliable data.

- **Four Independent Channels**

Equipped with four separate input channels, the board enables the concurrent monitoring of multiple temperature points, all with a single board.

- **Error Detection**

To enhance operational safety and reliability, the I2C-TC9604XP is capable of detecting both open-circuit and short-circuit faults in the thermocouple sensor. This proactive detection helps to prevent inaccuracies and potential failures in temperature monitoring systems.

- **Wide Thermocouple Compatibility**

The board is compatible with a broad range of thermocouple types, including K, J, T, N, S, E, B, and R. This flexibility makes it suitable for diverse measurement environments and requirements.

- **High Measurement Accuracy**

Offering a typical accuracy of ±0.5°C, the board ensures precise temperature control, which is crucial for applications where exact measurements are required.

- **Fine Temperature Resolution**

With a resolution of 0.0625°C, the device allows for detailed temperature monitoring and provides precise control in sensitive environments.

- **Easy Sensor Connectivity**

A thermocouple plug connector is provided, making sensor attachment simple and reliable, which facilitates quick setup.

- **I2C Bus Communication**

The board communicates with microcontrollers via the I2C bus protocol and supports a bus speed of 100 kHz, enabling efficient and reliable data transfer between the board and system controllers.

- **Selectable I2C Addresses**

To support multiple devices on a single I2C bus, the board offers eight selectable addresses, which can be configured using jumpers. This feature helps prevent address conflicts and supports easy expansion of the system.

- **Integrated Pull-Up Resistors for I2C Bus SCL and SDA Lines**

The board includes 10Kohm pull-up resistors for SCL and SDA lines, which can be activated using jumpers.

- **Wide Operating Voltage Range**

The board operates over a voltage range of 2.7V to 5.5V, allowing it to adapt to various power supply conditions and system requirements.

- **Power Polarity Protection**

A polarity protection circuit is built into the board to protect against accidental reverse power connections, thereby improving the overall reliability and durability of the system.

- **Alarm Connectors for MCP9604 Chip Signals**

The board is equipped with a 7-pin connector featuring a 2.54mm pin pitch, designed to transmit alarm signals from the MCP9604 chip.

- **Designed for Panel Installation**

The board is purpose-built for panel mounting, which makes it straightforward to integrate into instrument enclosures or industrial systems for a wide range of temperature measurement uses.

2 Overview of the I2C-TC9604XP Temperature Measurement Board

The I2C-TC9604XP is a specialized electronics board engineered for accurate temperature measurement through conversion of the electromotive force (EMF) generated by a thermocouple into precise Celsius readings. Central to its design is the MCP9604 chip from Microchip, which incorporates an integrated cold-junction compensation unit to enhance measurement accuracy.

A key feature of the I2C-TC9604XP is its robust error detection capability, allowing it to identify both open-circuit and short-circuit conditions in thermocouple sensors. This functionality significantly enhances reliability and safety during temperature monitoring processes.

The device supports four independent channels for thermocouple inputs. Each model within the I2C-TC9604XP series is optimized for compatibility with specific thermocouple types, ensuring high performance and measurement fidelity. The board delivers exceptional accuracy, with a typical error margin of only ±0.5°C, and provides results at a fine resolution of 0.0625°C, enabling precise control and monitoring.

For user convenience, the board features a dedicated thermocouple plug connector, facilitating straightforward sensor connection. Communication with host microcontrollers is established via the I2C bus protocol, operating at a standard speed of 100 kHz. The I2C-TC9604XP accommodates a wide operating voltage range from 2.7V to 5.5V, offering flexibility for integration into diverse system architectures. Its design also supports easy mounting on electronic case panels, making it well-suited for integration into various instrument enclosures and industrial environments.

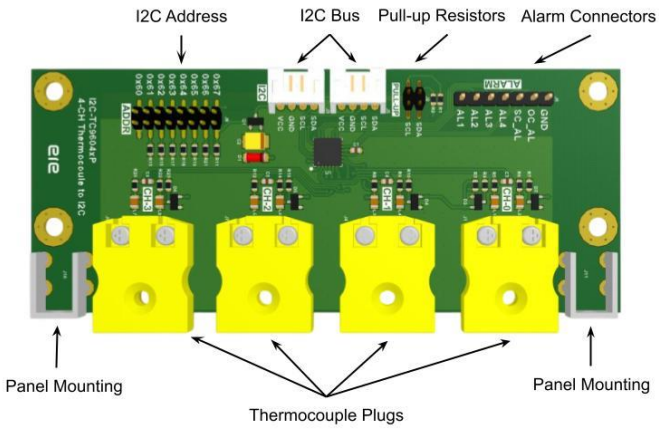


Figure 1: Board Diagram

3 I2C Bus Pull-Up Resistor Requirement

The I2C-TC9600XP board is equipped with integrated 10KΩ pull-up resistors on both the SDA (Serial Data) and SCL (Serial Clock) lines. Therefore, it is not necessary to add external pull-up resistors to the I2C bus. These resistors are crucial for ensuring that the SDA and SCL lines return to a logic high state when not actively driven low, which supports reliable data transmission and reception between the board and any connected microcontroller or peripheral devices. When configuring the I2C-TC9604XP in your system, ensure that pull-up resistors are enabled for both the SDA and SCL lines.

Figure 2: Pull-up resistors

4 I2C Bus Address Configuration

The I2C-TC9604XP interfaces with a microcontroller via the I2C bus, facilitating communication among multiple devices on a shared bus. To prevent conflicts and ensure proper functionality, each device must possess a distinct address. The I2C-TC9604XP offers eight configurable I2C addresses, enabling users to select the board's address as required. This adaptability is managed through jumpers located on the board. By modifying the jumper settings, users can assign any of the eight available addresses to the I2C-TC9604XP, thereby streamlining the integration of several boards within a single system and eliminating address conflicts.

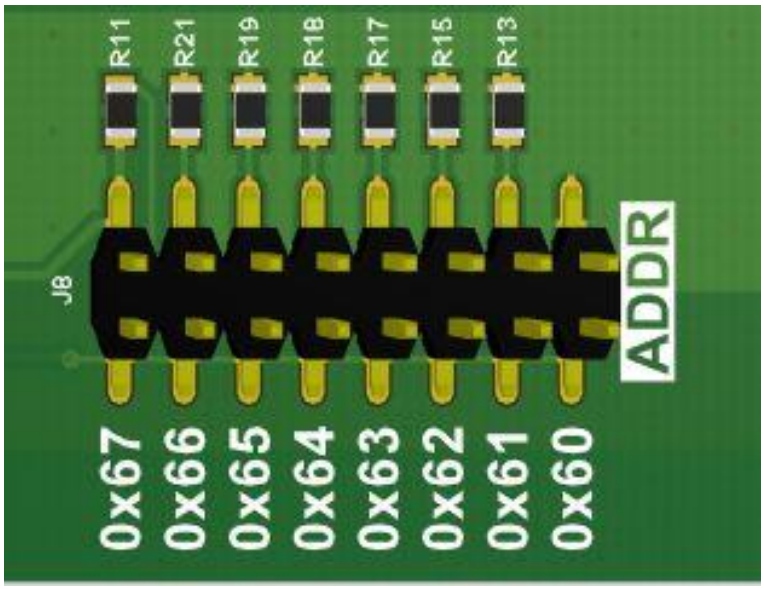


Figure 3: Jumpers of I2C address

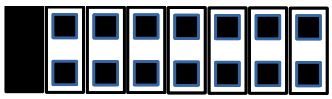
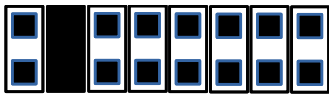
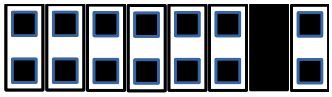
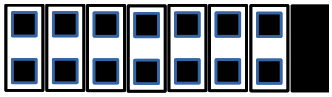
Jumper Setting	I2C Addresses
	0x67
	0x66
	0x65
	0x64
	0x63
	0x62
	0x61
	0x60

Table 1: Address jumper setting

5 Flexible Mounting Options

The I2C-TC9604XP is designed to support a wide range of installation scenarios. It may be securely mounted to the enclosure base, providing robust stability and straightforward access to internal connections. Alternatively, it can be affixed directly to a panel, facilitating seamless integration with external interfaces. These versatile mounting options allow the I2C-TC9604XP to adapt to various configuration requirements for different applications.

5.1 Attach the board to the panel

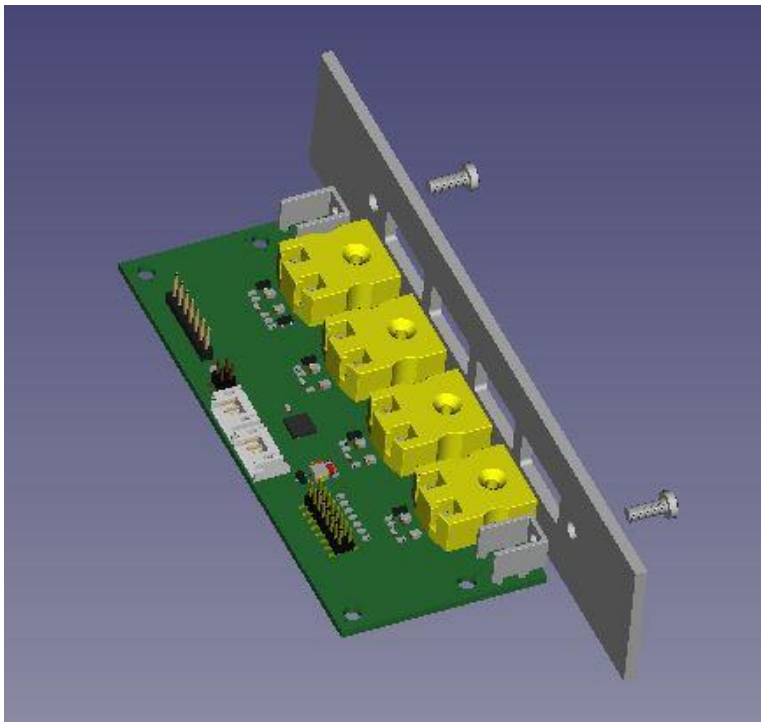


Figure 3: Bolt the I2C-TC9600XP to the panel.

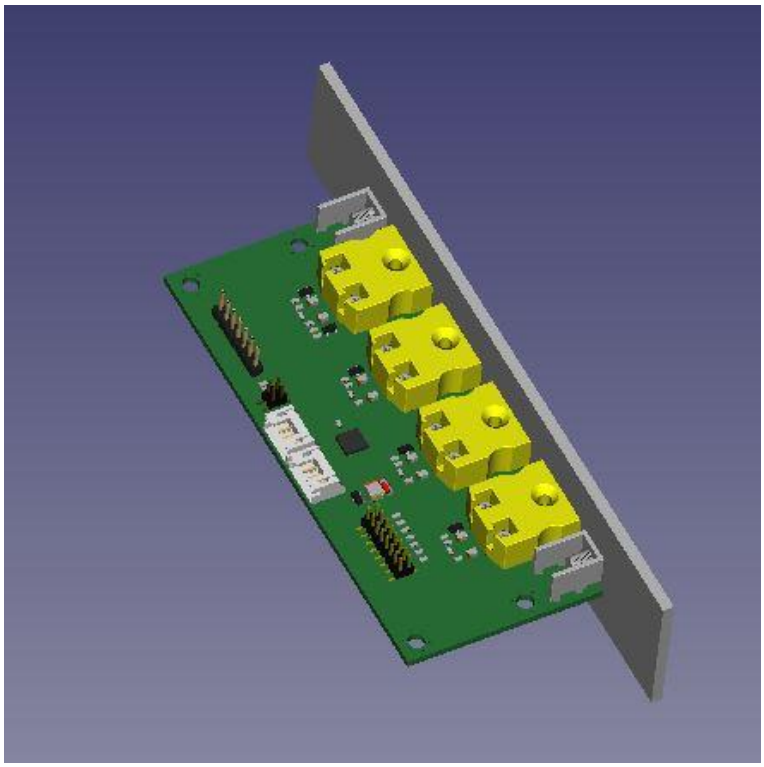


Figure 4: Secure the I2C-TC9600XP module to the panel.

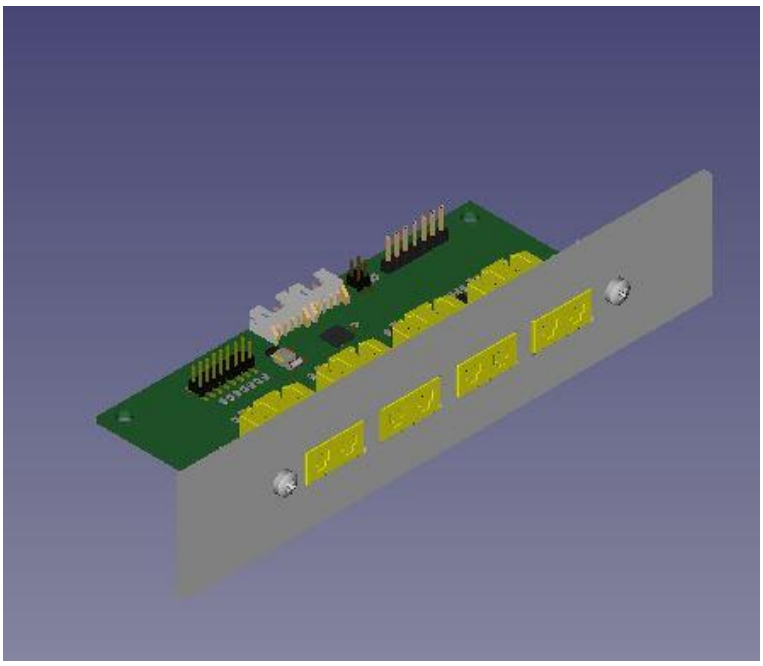


Figure 5: TC-9600XP front panel.

5.2 Mount the on the base of an enclosure

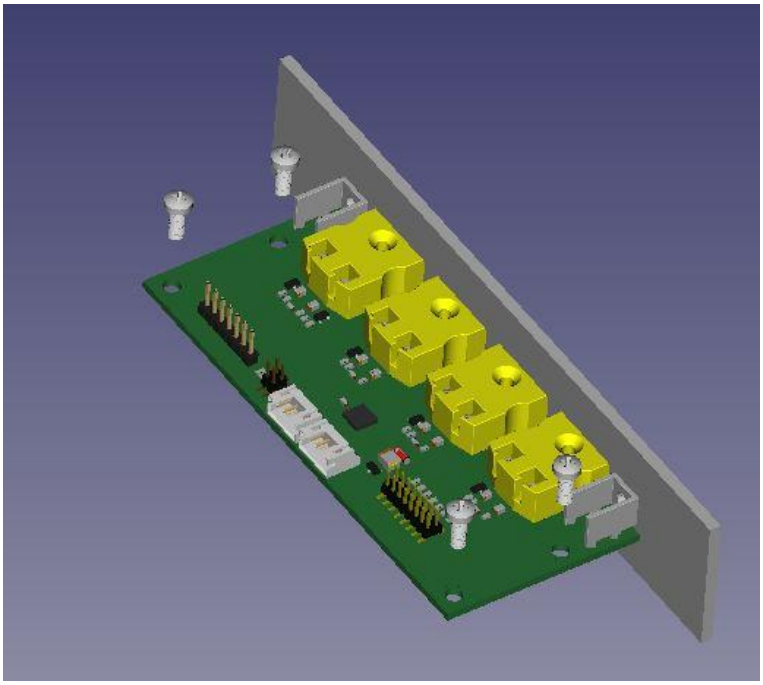


Figure 6: Attach the I2C-TC9600XP PCB to the bottom of the enclosure.

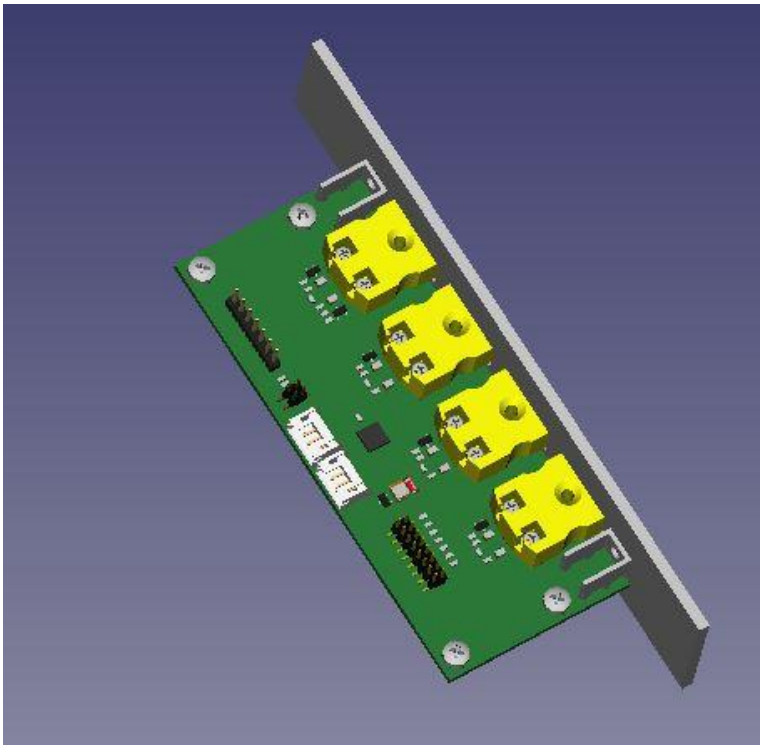


Figure 7: The PCB mounts to the base; the connector attaches to the panel.

6 Specifications

Parameters	Values
Operating voltage (VCC)	2.7V – 5.5V
I2C Bus frequency (Maximum)	100kHz
I2C bus pull-up resistance	10 KOhm
I2C bus connectors	Pin-count: 4-pin Pin-pitch: 2.00mm
Alarm connector	Pin-count: 7-pin Pin-pitch: 2.54mm
Board Models	**Thermocouple Types**
I2C-TC9600KP	Thermocouple Type: K
I2C-TC9600JP	Thermocouple Type: J
I2C-TC9600TP	Thermocouple Type: T
I2C-TC9600NP	Thermocouple Type: N
I2C-TC9600SP	Thermocouple Type: S
I2C-TC9600EP	Thermocouple Type: E
I2C-TC9600BP	Thermocouple Type: B
I2C-TC9600RP	Thermocouple Type: R

Table 2: Specifications

7 Dimensions

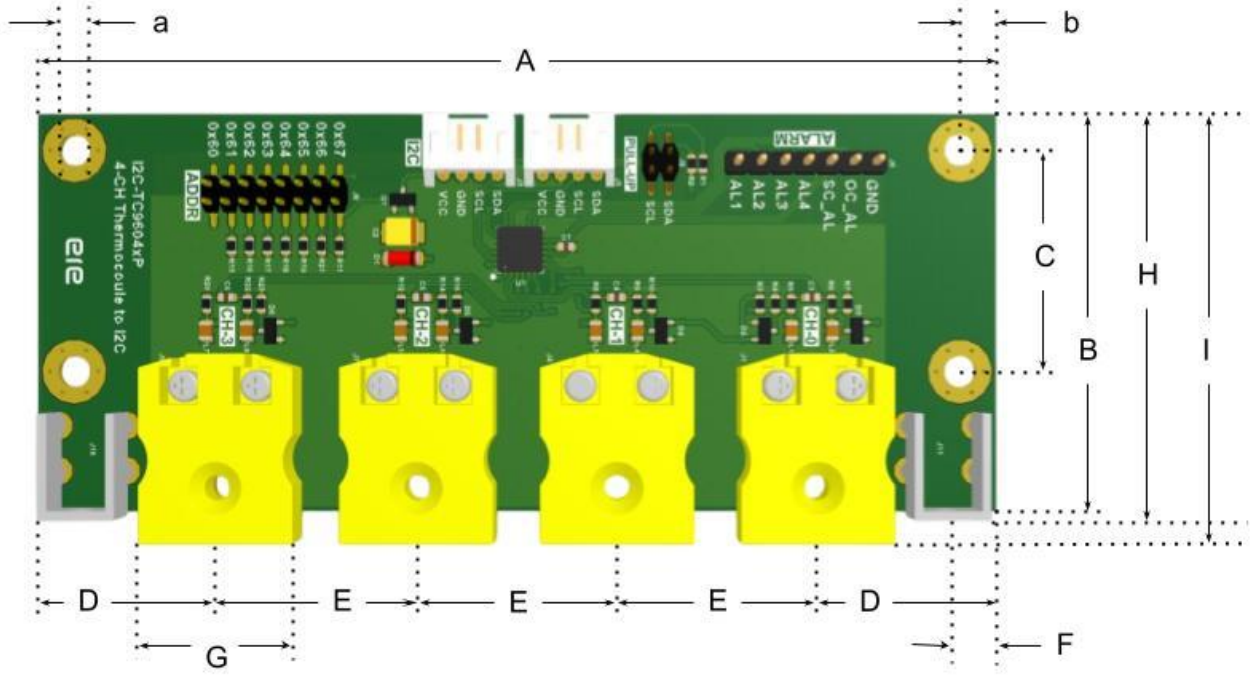


Figure 4: Dimensions

	Inch	mm
A	4.1929	106.5
B	1.7322	44.00
C	0.9645	24.50
D	0.5905	15.00
E	0.8464	21.50
F	0.2362	6.00
G	0.6692	17.00
H	1.7519	44.50
I	1.8503	47.00
a	0.1417	3.60
b	0.1574	4.00

Table 3: Dimensions

Declaration
ERE Company Limited is committed to continuously improving its products. Therefore, we reserve the right to change specifications at any time without prior notice.