Raspberry Pi Expansion Card
Thermocouple Board
CPI-SSI-4C

This product is an expansion card that adds a thermocouple interface to the Raspberry Pi.
Four channels of differential inputs are provided for one card.
Linux device driver is supported with this product.

* Specifications, color and design of the products are subject to change without notice.
*The contents in this document are subject to change without notice.
*Visit the CONTEC website to check the latest details in the document.
*The information in the data sheets is as of May, 2025.

Features

Compatible with various types of thermocouple inputs
This product is compatible with a wide range of thermocouple input types such as J(IEC60584-1), K(IEC60584-1), E(IEC60584-1), N(IEC60584-1), R(IEC60584-1), S(IEC60584-1), and T(IEC60584-1).

Cold junction compensation function within
As cold junction compensation is integrated in the product, there is no need to install a temperature sensor for cold junction compensation externally, and temperature can be measured simply by connecting a thermocouple.

Connectivity for up to 8 cards
Connect up to 8 expansion cards of the same series. Use the Board ID setting switch on the main body to identify connected expansion cards.
* The Board ID setting switch cannot be set to 4 when using the CPI-RAS, CPI-PS10CM4, or CPI-MS10CM4.

Adaptable to a wide range of temperature between -20 and +60°C
The product is capable of operating in the temperature between -20 and + 60°C. It can be installed in the various environments.

No electrolytic capacitor
Without an electrolytic capacitor, which has a limited life, we are creating the product with a longer life.

Linux compatible driver software
Using the sensor input API-SSI(LNX) makes it possible to create applications of Linux.

List of Option

Product Name	Model type	Description
Raspberry Pi Controller CM4 RAM 2GB eMMC 16GB CODESYS Model	CPI-PS10CM4	
Raspberry Pi Controller CM4 RAM 2GB eMMC 16GB	CPI-MS10CM4	
RAS card	CPI-RAS	RAS/RTC function, 8 to 28 VDC input function expansion.
DIN RAIL ADAPTER	CPI-DIN01	
SPACER SET (x2) for Raspberry Pi 5	CPI-SPA01-2	

*   Information about the option products, see the Contec's website.

Packing List

Product [CPI-SSI-4C] ...1
10-pin Connector ...1 (Attached to the product)
40-pin Pin-header...1
Plastic Spacer for CPU Card...1
Hexagonal Spacers...4 (Height 12.5mm)
Three-point Sems Screw...4
Nuts...4
Please read the following...1

Specifications

Function specification

Item	Description
Input type	Differential input
Input channel	4ch
Resolution	24-bit
Conversion speed*1	251ms (Conversion speed per thermocouple per channel)
Buffer memory	None
Compatible thermocouple sensor	J, K, E, N, R, S, T (IEC 60584-1, JIS C1602)

Conversion tolerance	Thermocouple type J, K, E, N, T:
	    Within ± [0.3°C + Measured temperature×0.12% (0°C or higher) or 1% (0°C or lower)
	Thermocouple type R, S:
	    Within ± [1.2°C + Measured temperature×0.12%]

Allowable signal source resistance	300Ω or less *3 *4
Cold junction sensor	Integrated
Cold junction tolerance *2	Within 3.6°C
Isolation	Bus isolation
Isolation withstand voltage	500VDC
Bus specification	I2C Bus (I2C1)
Boards in one system	Maximum of 8 boards *5
Connector	2 pieces 3.81mm pitch 10-pin terminal
Applicable wire	AWG28 - 16
Electricity consumption	5VDC 150mA 3.3VDC 1mA
Physical dimensions (mm)	65.0(W) x 56.5(D) (No protrusions) Spacer height : 12.5mm
Weight	50g

*1   It is the conversion time of the measurement value.
*2   It is the measured value under the condition of wind speed of 0-0.5m/s in the thermostatic bath.
*3   If the resistance value of the wiring distance (round trip) exceeds the allowable signal source resistance value, an error exceeding the conversion error specification may occur.
*4   If the cable length exceeds 30 m, it is not CE (EMC standard) compliant.
*5   The Board ID setting switch cannot be set to 4 when using the CPI-RAS, CPI-PS10CM4 or CPI-MS10CM4.

Installation Environment Requirements

Item		Description
Operating Temperature		-20 - +60°C
Storage Temperature		-20 - +60°C
Humidity		10 - 90%RH (No condensation)
Floating dust particles		Not to be excessive
Corrosive gases		None
Line-noise resistance *1	Line noise	Signal Line /±1kV (IEC61000-4-4 Level 3, EN61000-4-4 Level 3)
	Static electricity resistance	Indirect discharge /±4kV (IEC61000-4-2 Level 2, EN61000-4-2 Level 2)
Vibration resistance	Sweep resistance	10 - 57Hz/semi-amplitude vibration 0.15mm, 57 - 150Hz/2.0G 40minutes each in X, Y, and Z directions (JIS C60068-2-6-compliant, IEC60068-2-6-compliant)
Shock resistance		15G half-sine shock for 11ms in X, Y, and Z directions (JIS C 60068-2-27 -compliant, IEC 60068-2-27 -compliant)
Standard		VCCI Class A, FCC Class A, CE Marking (EMC Directive Class A, RoHS Directive), UKCA

Physical Dimensions

Main body only

[mm]
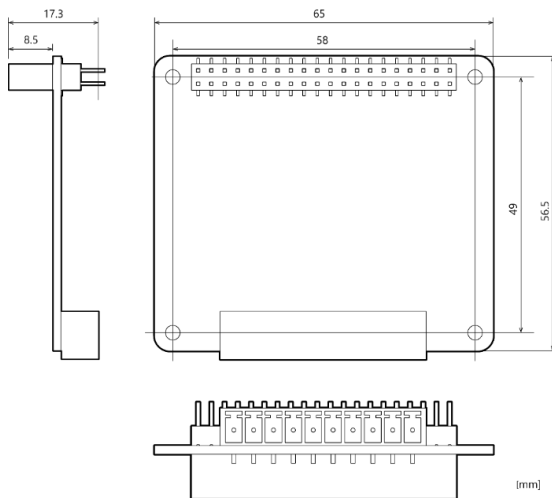
With connector attached

[mm]
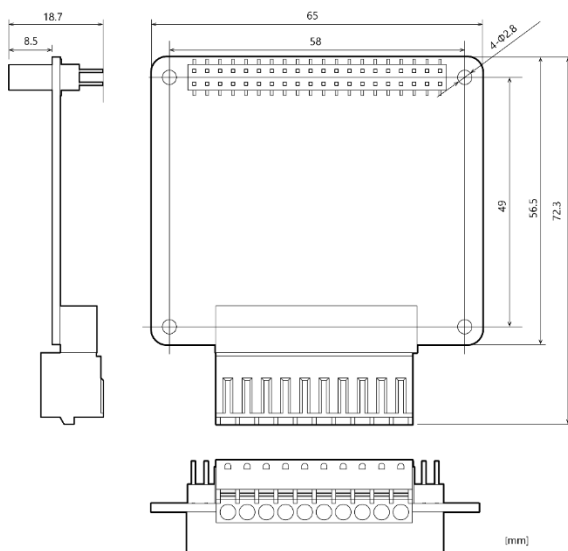
Support Software

You can use CONTEC support software according to your purpose and development environment. For more details on the supported OS, applicable languages, or to download the latest version of software, visit the CONTEC Web site.

| Name	Contents	How to get
Driver software API-SSI(LNX)	The Linux device driver is provided as a shared library. The software includes various sample programs such as gcc (C, C++) and Python programs, as well as a configuration tool to configure the device settings.	Download from the CONTEC website

Download the files from the following URL.　https://www.contec.com/download/

Component Name
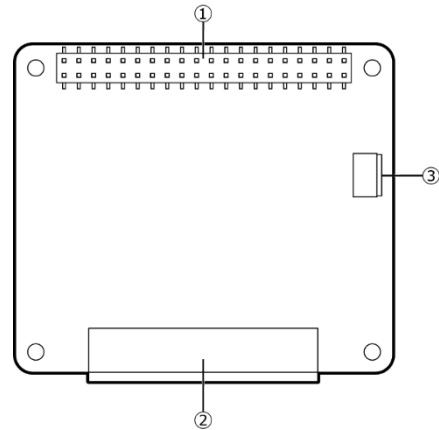
No.	Name	Function
1	GPIO 40 pin connector	This connector is used to connect to a Raspberry Pi or an expansion card.
2	Interface connector	This is a connector for thermocouple. Use the 10-pin connector included in the package.
3	Board ID setting switch	This setting switch is used to identify I2C communication expansion cards. The switch is used to change the I2C address.

Connection to external devices

GPIO 40 pin connector
This connector is used to connect to a Raspberry Pi or an expansion card.
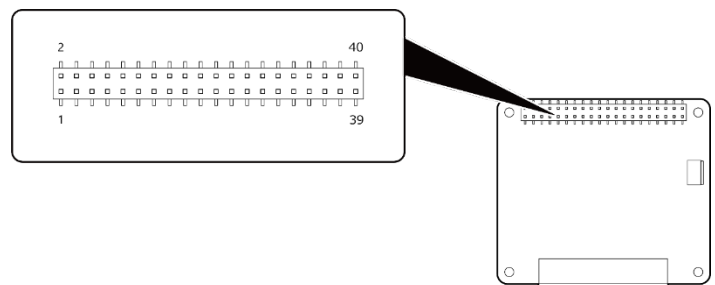
Pin Assignment

Pin No.	Signal Name	Description	Pin No.	Signal Name	Description
1	3.3V Power	3.3V power supply	2	5V Power	5V power supply
3	GPIO 2(I2C1 SDA)	I2C1 SDA	4	5V Power	5V power supply
5	GPIO 3(I2C1 SCL)	I2C1 SCL	6	Ground	GND
7	GPIO 4(GPCLK0)	(Don't use)	8	GPIO 14(UART TX)	(Don't use)
9	Ground	GND	10	GPIO 15(UART RX)	(Don't use)
11	GPIO 17	(Don't use)	12	GPIO 18(PCM CLK)	(Don't use)
13	GPIO 27	(Don't use)	14	Ground	GND
15	GPIO 22	(Don't use)	16	GPIO 23	(Don't use)
17	3.3V Power	3.3V power supply	18	GPIO 24	(Don't use)
19	GPIO 10(SPI0 MOSI)	(Don't use)	20	Ground	GND
21	GPIO 9(SPI0 MISO)	(Don't use)	22	GPIO 25	(Don't use)
23	GPIO 11(SPI0 SCLK)	(Don't use)	24	GPIO 8(SPI0 CE0)	(Don't use)
25	Ground	GND	26	GPIO 7(SPI0 CE1)	(Don't use)
27	GPIO 0(EEPROM SDA)	I2C0 SDA	28	GPIO 1(EEPROM SCL)	I2C0 SCL
29	GPIO 5	(Don't use)	30	Ground	GND
31	GPIO 6	(Don't use)	32	GPIO 12(PWM0)	(Don't use)
33	GPIO 13(PWM1)	(Don't use)	34	Ground	GND
35	GPIO 19(PCM FS)	(Don't use)	36	GPIO 16	(Don't use)
37	GPIO 26	(Don't use)	38	GPIO 20(PCM DIN)	(Don't use)
39	Ground	GND	40	GPIO 21(PCM DOUT)	(Don't use)

Interface connector

This connector is used for thermocouple. It uses the included 10-pin connector.
Connector type: PHOENIX CONTACT FK-MCP 1.5/10-ST-3.81
(or equivalent)
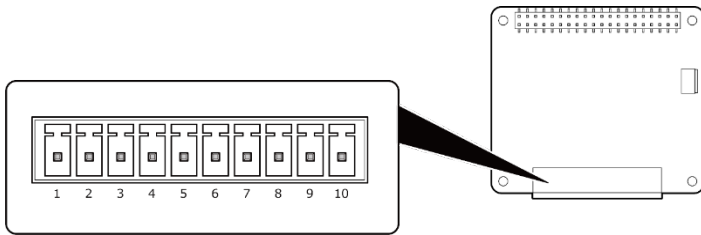
Pin Assignment

Pin No.	Signal Name	Description
1	AGND	This is an analog ground and shares channels of analog input signals.
2	TC3-	Thermocouple input terminal (negative side) of channel 3.
3	TC3+	Thermocouple input terminal (positive side) of channel 3.
4	TC2-	Thermocouple input terminal (negative side) of channel 2.
5	TC2+	Thermocouple input terminal (positive side) of channel 2.
6	AGND	This is an analog ground and shares channels of analog input signals.
7	TC1-	Thermocouple input terminal (negative side) of channel 1.
8	TC1+	Thermocouple input terminal (positive side) of channel 1.
9	TC0-	Thermocouple input terminal (negative side) of channel 0.
10	TC0+	Thermocouple input terminal (positive side) of channel 0.

Board ID setting switch

This setting switch is used to identify I2C communication expansion cards. The Board ID setting switch can be used to switch I2C addresses. The following table shows the switch settings and the corresponding I2C addresses.
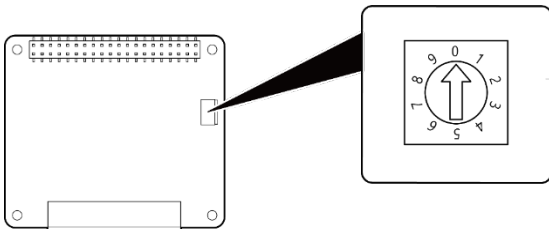
Switch settings and the corresponding I2C addresses

Setting the Board ID	Extended I/O (I2C1) I2C address	EEPROM(I2C0) I2C address
0	0x28 (Factory setting)	0x50 (Factory setting)
1	0x29	0x51
2	0x2A	0x52
3	0x2B	0x53
4 *	0x2C	0x54
5	0x2D	0x55
6	0x2E	0x56
7	0x2F	0x57
8	Do not use this setting.	
9		

*   The Board ID setting switch cannot be set to 4 when using the CPI-RAS because the I2C address (0x2C) with this setting will overlap with the I2C address of the CPI-RAS, CPI-PS10CM4, CPI-MS10CM4.

Thermocouple Input

Input type of thermocouple is differential input and four channels are provided for the product.
Compatible thermocouple types are J, K, E, N, R, S, and T.
Setting thermocouples type requires software command. (Default :K type)

The measuring temperature range per thermocouples type is listed below. Even if the measuring temperature range is exceeded, it is possible to measure up to the measuring temperature limit, however the temperature tolerance may exceed the specified value.

Measuring temperature range

Thermocouples type	Measuring temperature range
J	-100℃ - 1200℃
K	-100℃ - 1372℃
E	-100℃ - 1000℃
N	-100℃ - 1300℃
R	0℃ - 1768℃
S	0℃ - 1768℃
T	-100℃ - 400℃

Measuring temperature limit

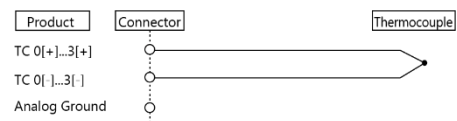| Thermocouples type	Measuring temperature limit	
	Lower-limit temperature	Upper-limit temperature
J	-210℃	1200℃
K	-265℃	1372℃
E	-265℃	1000℃
N	-265℃	1300℃
R	-50℃	1768℃
S	-50℃	1768℃
T	-265℃	400℃

CAUTION

- When adjusting the temperature, take measures to prevent the product from being exposed directly to the air.
- Right after the product is started, the measuring temperature may exceed the specified tolerance. Warm up the product for at least 30 minutes before use.

[Example of thermocouple connection]

The following figure shows an example of thermocouple connection. Connect the positive and negative terminals of each thermocouple to the positive and negative sides of each thermocouple input channel.

[Example of shielded thermocouple connection]

The following figure shows an example of shielded thermocouple connection. Use shielded thermocouple cable if the distance between the temperature measuring place and the product is long or if you want to provide better protection from noise. Connect the positive and negative terminals of each thermocouple to the positive and negative sides of each thermocouple input channel. Then, connect the analog ground of this product to the shielded braid and earth ground the shielded braid.
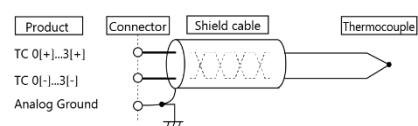
CAUTION

- When using the product in an overly noisy environment, use a shielded thermocouple and earth ground the shield.

Block Diagram