

Raspberry Pi Expansion Card Isolated 32-bit Up/Down Counter Card CPI-CNT-3201I



Features

32-bit up-and-down counter

The 32 bit up-and-down counter could have four channels and up to 500kHz maximum speed pulse input. Moreover, it can count 2-phase signals and mono-phase signals such as a rotary encoder and a linear scale.

Opto-coupler bus isolation

As the GPIO 40PIN connector on Raspberry Pi is isolated from the input and output interfaces by opto-couplers, this product has excellent noise performance.

Built-in interrupt notification signal

This product can output a signal to a Raspberry Pi's GPIO pins to notify of changes in the input signal (pin selection possible). This signal can be used as an interrupt notification signal for notifying of input signal changes without the need for I2C communication.

Control input/output signals

One control input signal and one control output signal are provided. This product can generate an interrupt, output an external signal, preset the counter, and clear it to zero when the count value matches the arbitrary value that is set.

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.

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 counter input driver API-CNT(LNX) makes it possible to create applications of Linux.

List of Option

Product Name	Model type	Description
RAS card	CPI-RAS	RAS/RTC function, 8 to 28 VDC input function expansion.
DIN RAIL ADAPTER	CPI-DIN01	

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

This product is an expansion card that adds an counts input interface to the Raspberry Pi.

It has one channel of 32-bit up/down counters, allowing external devices such as a rotary encoder and a linear scale to be connected. The pulse signal interface is an opto-coupler isolated input.

* 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 October, 2021.

Specifications

Function specification

Item	Description
Input	
Counter	
Channel count	1 channel
Count system	Up/down counting (2-phase/Single-phase/Single-phase Input with Gate Control Attached)
Max. count	FFFFFFFFh (binary data, 32Bit)
Input type	Optocoupler isolated input
Input signal	Phase-A/UP 1 x 1 channel, Phase-B/DOWN 1 x 1 channel Phase-Z/CLR 1 x 1 channel
Input resistance	220 Ω (5V external power supply), 690 Ω (12V external power supply)
Response frequency	500kHz 50% duty
External Power	5VDC±10% or 12VDC±10%
Digital filter	0.1μsec - 1.6384msec or not used
Counter start trigger	Software/External start input
Counter stop trigger	Software/External stop input
Control	
Control input signal type	Optocoupler isolated input
Control input channel	1 channel
Control input signal	- Preset (Select Rise or Fall) - Zero-clear (Select Rise or Fall) - Counter start/stop (Select Rise or Fall) - General-purpose input (positive logic) Software-selected from among the above four options
Response time	100μsec (Max)
Interrupt event	Count match (2 points), Counter error (2 points), Carry/Borrow (1 points)
Output	
Control	
Control output signal type	Optocoupler isolated open collector output
Control output channel	1 channel
Control output signal	- Count match 0 output(one-shot pulse output) - Count match 1 output(one-shot pulse output) - Digital filter error output(one-shot pulse output) - Abnormal input error output(one-shot pulse output) - General-purpose output(Level output) Software-selected from among the above five options (Positive/negative logic is selected with the software.)
One shot output signal amplitude	Selected between 10μsec, 100μsec, 1msec, 10msec and 100 msec (within precision + 1μsec)
Response time	5μsec (Max)
Output rating	35VDC, 50mA(MAX)
External Power	5V - 12VDC±10%
Interrupt notification	
Function *1	5 interrupt input signals are arranged into a single output of interrupt signal. An interrupt is generated at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).
Output type	Open collector output (Pull-up: 15kΩ)
Output signal amplitude	2μs (min.)
Notification destination	Select from GPIO 4, 5, 6, or 22 (using DIP switch)

Item	Description
Common section	
Voltage resistance (input/output)	1000VAC
Bus specification	I2C bus (I2C1)
Max. module count for connection	Maximum of 8 cards can be install in a same system. (Excluding RAS cards)
Connector	2 pieces 3.81mm pitch 10-pin terminal
Applicable wire	AWG28 - 16
Electricity consumption	5VDC 100mA 3.3VDC 1mA
Physical dimensions (mm)	65.0(W) x 56.5(D) (No protrusions) Spacer height : 12.5mm
Weight	50g

*1 For details on the interrupt notification function, see Reference Manual.

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)

*1 When using the CPI-RAS.

Packing List

Product [CPI-CNT-3201I] ...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
 Product Guide & Warranty Certificate...1
 Serial Number Label ...1

Support Software

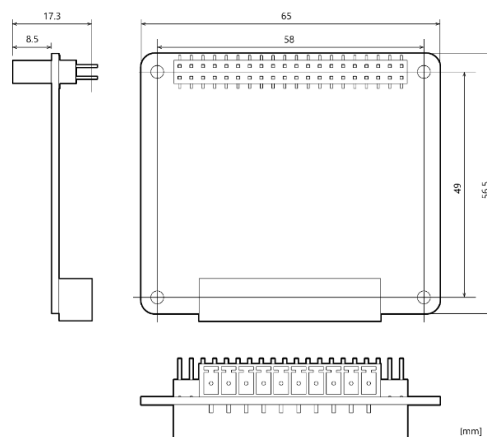
You can use CONTEC support software according to your purpose and development environment. For more details on the supported OS, applicable languages, or to download the latest version of software, visit the CONTEC Web site.

Name	Contents	How to get
Driver software API-CNT(LNX)	This is the Linux version driver software provided in API function formats. The software includes various sample programs such as gcc (C, C++) and Python programs.	Download from the CONTEC website

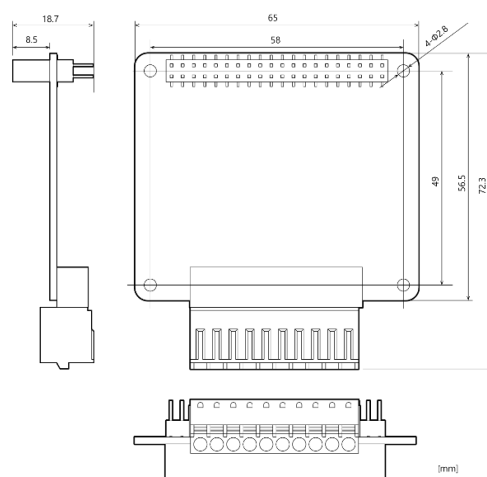
Download the files from the following URL <https://www.contec.com/download/>

Physical Dimensions

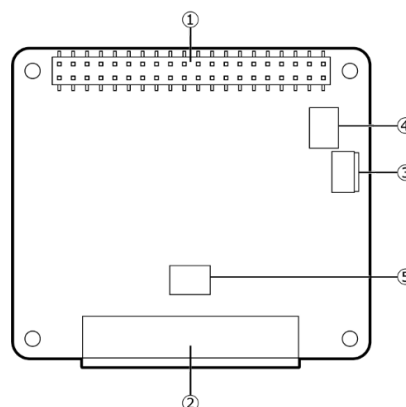
Main body only



With connector attached



Component Name

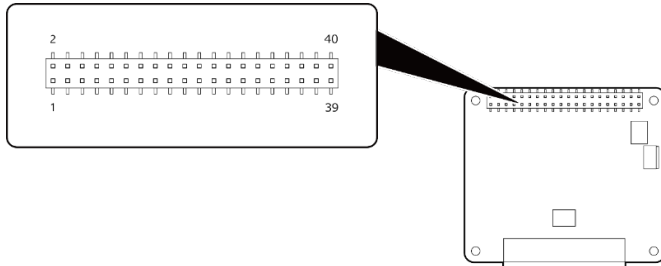


No.	Name	Function
1	GPIO 40 pin connector	This connector is used to connect to a Raspberry Pi or an expansion card.
2	Interface connector	This connector is used for counter input. It uses the included 10-pin connector.
3	Board ID setting switch	This setting switch is used to identify I2C communication expansion cards. The switch is used to change the I2C address.
4	DIP switch	This switch sets the GPIO pins to use for outputting the interrupt notification signal.
5	Input resistance setting switch	This is an input resistance setting switch of counter input signal and control input signal.

Connection to external devices

GPIO 40 pin connector

This connector is used to connect to a Raspberry Pi or an expansion card.



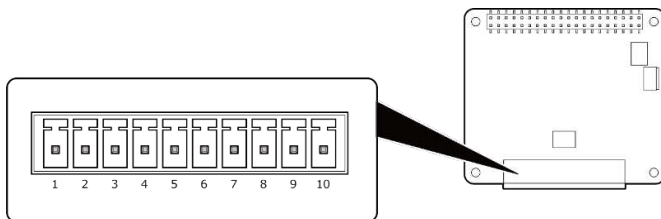
Pin Assignment

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(GCLK0)	INT_1	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(PWM CLK)	(Don't use)
13	GPIO 27	(Don't use)	14	Ground	GND
15	GPIO 22	INT_2	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	INT_3	30	Ground	GND
31	GPIO 6	INT_4	32	GPIO 12(PWM0)	(Don't use)
33	GPIO 13(PWM1)	(Don't use)	34	Ground	GND
35	GPIO 19(PWM FS)	(Don't use)	36	GPIO 16	(Don't use)
37	GPIO 26	(Don't use)	38	GPIO 20(PWM DIN)	(Don't use)
39	Ground	GND	40	GPIO 21(PWM DOUT)	(Don't use)

Interface connector

This connector is used for counter input. It uses the included 10-pin connector.

Connector type: DEGSON 15EDGKD-3.81-10P-13-00A(H)
PHOENIX CONTACT FK-MCP 1.5/10-ST-3.81 (or equivalent)

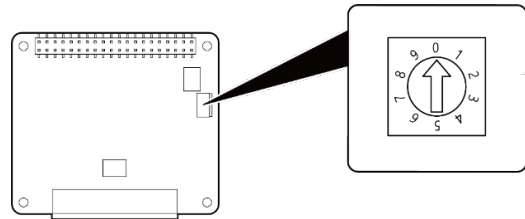


Pin Assignment

Pin No.	Signal Name	Description
1	N.C.	This pin is not connected.
2	N.C.	This pin is not connected.
3	EQN	Negative common of equal output Connect the negative side of external power supply
4	EQ	Count equal output/General-purpose output
5	EQP	Plus common of equal output Connect the positive side of external power supply
6	DI	Control input (this can be used as a general-purpose input/hardware event)
7	Z	Phase-Z input
8	B	Phase-B input
9	A	Phase-A input
10	PCOM	Plus common of input signal Connect the positive side of external power supply

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.

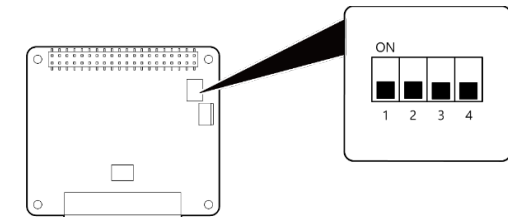


Switch settings and the corresponding I2C addresses

Setting the Board ID	Extended I/O (I2C1) I2C address	EEPROM(I2C0) I2C address
0	0x20 (Factory setting)	0x50 (Factory setting)
1	0x21	0x51
2	0x22	0x52
3	0x23	0x53
4 *	0x24	0x54
5	0x25	0x55
6	0x26	0x56
7	0x27	0x57
8	Do not use this setting.	
9		

DIP switch

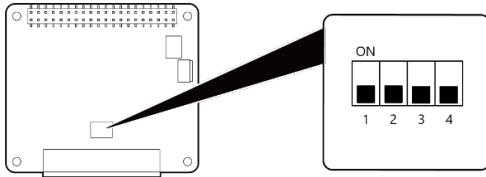
This switch sets the GPIO pins to use for outputting the interrupt notification signal. Use the factory default setting (all OFF) when not using the interrupt function.



Pin No.	Signal Name	Setting	Description
1	INT_1	OFF	Interrupt notification signal not connected to GPIO4 (Pin 7) (Factory setting)
		ON	Interrupt notification signal connected to GPIO4
2	INT_2	OFF	Interrupt notification signal not connected to GPIO22 (Pin 15) (Factory setting)
		ON	Interrupt notification signal connected to GPIO22 (Pin 15)
3	INT_3	OFF	Interrupt notification signal not connected to GPIO5 (Pin 29) (Factory setting)
		ON	Interrupt notification signal connected to GPIO5 (Pin 29)
4	INT_4	OFF	Interrupt notification signal not connected to GPIO6 (Pin 31) (Factory setting)
		ON	Interrupt notification signal connected to GPIO6 (Pin 31)

Input resistance setting switch

Sets the input resistance of the counter input signal and the control input signal. 5V or 12V is available by switching the switch.

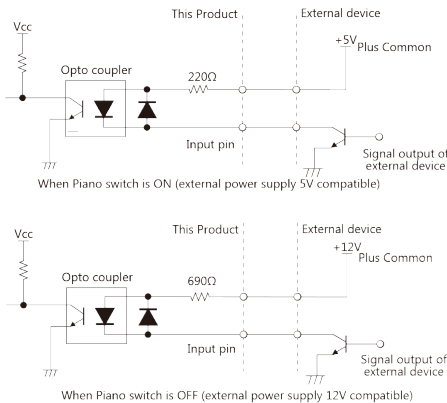


The factory default settings are all OFF.

Switch number	Description
1	Set the input resistance of phase-A. ON: 220Ω (When using 5V) OFF: 690Ω (When using 12V)
2	Set the input resistance of phase-B. ON: 220Ω (When using 5V) OFF: 690Ω (When using 12V)
3	Set the input resistance of phase-Z. ON: 220Ω (When using 5V) OFF: 690Ω (When using 12V)
4	Set the input resistance of control input. ON: 220Ω (When using 5V) OFF: 690Ω (When using 12V)

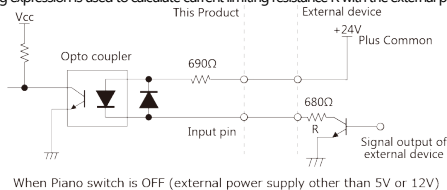
Counter Input Circuit and Control Input Circuit

The figure below shows the equivalent circuit of counter input section and control input section of this product. The signal input section consists of an opto-coupler isolated input (compatible with current sink output). Set an external power voltage and input resistance value according to the output specification of the external device to be connected. As for the counter input section, connect both phase A and phase B for a two-phase input. Connect either phase A or phase B for a single-phase input. If not using the Z phase, this does not need to be connected. In addition, the control input section can also be used as the input section for the start / stop signal of general-purpose input and count operation, preset signal of count value.



CAUTION

To use external power (other than 5V or 12V); insert a current limiting resistor at the R position. The following expression is used to calculate current limiting resistance R with the external power supply as PV:



The expression is as follows:

$$\frac{PV-12}{20} < Rk\Omega < \frac{PV-12}{15}$$

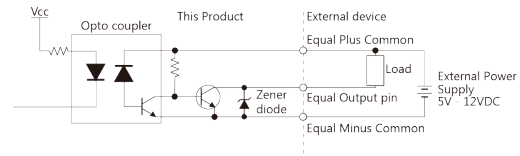
If PV=24V, use a 600Ω < R < 800Ω resistor.

Control Output Circuit

The figure below shows the output circuit of control output section of this product. The signal output section consists of an opto-coupler isolated open collector output (current sink type). An external power supply is therefore required to drive the output section of this product. The maximum output current rating per channel is 50 mA for the product.

Zener diodes are connected to the output transistor to protect against surge voltages.

As for the control output section, it is also possible to output a one-shot pulse signal at the time of hardware event occurs, such as a general-purpose output and count match.



CAUTION

- Negative logic is set as default. (Negative logic is also set when setting is empty)
- When the power is turned on, all output will be OFF.

Block Diagram

