

PCI Express-compliant  
High speed Up-down counter board

## CNT-3208M-PE

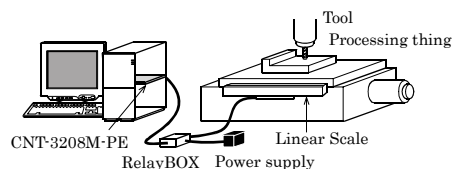


This product is a PCI Express bus compliant counter input board which counts the pulse signal input from an external device. 8 ch 32-bit up/down counter is mounted, and the bus master transfer function makes it possible to transfer data at a high speed by high speed pulse input (unisolated TTL-level input, differential line receiver) up to 10MHz. In addition, 2-phase signals and 1-phase signals such as a rotary encoder or linear scale can be counted.

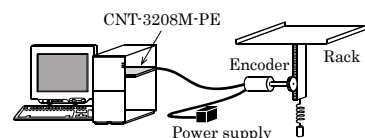
With the driver libraries for Windows supplied as standard, applications with CONTEC hardware features fully utilized can be created.

< Example >

- Detecting a position of the table of a machine tool



- Detecting a change in weight



## Features

### 8ch 32-bit up/down counter, high speed pulse input of 10MHz, and disconnection detection are available.

- A 32-bit up/down counter with 8 channels is mounted on one board, high speed pulse input up to 10MHz (unisolated TTL-level input, differential line receiver) is available, and disconnection detection can be performed for differential line receiver input.

2-phase signals and 1-phase signals such as a rotary encoder or linear scale can be counted. Surge protection is realized by implementing protectors in the input circuit.

In addition, 1pin/ch of control input signal is provided. It can be used as counter start/stop, preset, zero clear, general-purpose input.

### Bus master transfer function is provided.

- Bus master transfer makes it possible to transfer large data at a high speed without extra CPU load at a sampling rate up to 20MHz.

### Digital filter function to prevent wrong recognition of input signals due to noises is provided.

- Digital filter function by which noises of counter input signals (phase-A, phase-B, phase-Z) and control input signals can be prevented is equipped. Digital filter can either be not used or set within the range of 0.1 $\mu$  - 1.6384msec by software.

In addition, as all these input signals are taken into the internal counter via the digital filter, when using the digital filter, these signals are taken in with a delay of a specified duration.

### Windows compatible driver libraries are attached.

- Using the attached driver library API-PAC(W32) makes it possible to create applications of Windows. In addition, a diagnostic program by which the operations of hardware (interrupt, I/O address, I/O status) can be checked is provided.

### The synchronization control connectors are provided

- The synchronization control connectors which can make boards up to 16 pieces synchronously run are provided. In addition, the synchronous operation with CONTEC boards where a synchronization control connector is mounted can be easily realized.

### The input circuit has a built-in varistor for voltage surge protection

- To protect the input circuit from voltage surges, a varistor is connected.

### Functions and connectors are compatible with PCI compatible board CNT32-8M(PCI).

- The functions same with PCI compatible board CNT32-8M(PCI) are provided. In addition, as there is compatibility in terms of connector shape and pin assignments, it is easy to migrate from the existing system. Independent general-purpose timer is provided.

### The timer which can let interrupts occur at a specified interval is provided.

- The timer can be set within the range of 1 - 6553msec (selectable in step of 1 msec).

## Support Software

### Driver Library API-PAC(W32) (Bundled)

Windows version of counter input driver API-CNT(WDM) / API-CNT(98/PC)  
[Stored on the bundled CD-ROM driver library API-PAC(W32)]

The API-CNT(WDM) / API-CNT(98/PC) is the Windows version driver library software that provides products in the form of Win32 API functions (DLL). Various sample programs such as Visual Basic and Visual C++, etc and diagnostic program useful for checking operation is provided.

< Operating environment >

OS Windows Vista, XP, Server 2003, 2000

Adaptation language Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder

You can download the updated version from the CONTEC's Web site (<http://www.contec.com/apipac/>). For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

## Optional cables & connectors

Shielded cable with double-ended connector for 96-pin half-pitch connector (Molded type)

- PCB96PS-0.5P(0.5m)
- PCB96PS-1.5P (1.5m)

Flat Cable with 96-Pin Half-Pitch Connectors at Both Ends

- PCB96P-1.5 (1.5m)

Shielded cables with single-ended connector for 96-pin half-pitch connector (Molded type)

- PCA96PS-0.5P(0.5m)
- PCA96PS-1.5P (1.5m)

Flat Cable with One 96-Pin Half-Pitch Connector

- PCA96P-1.5 (1.5m)

Half Pitch 96-Pin Female Connector Set (5Pieces)

- CN5-H96F

## Accessories

Screw Terminal Unit (M3 x 96P)	:EPD-96A	*1*2
Screw Terminal Unit (M3.5 x 96P)	:EPD-96	*1
Terminal Unit for Cables (M2.5 x 96P)	:DTP-64(PC)	*1

\*1 A PCB96P or PCB96PS optional cable are required separately.

\*2 "Spring-up" type terminal is used to prevent terminal screws from falling off.

\* Check the CONTEC's Web site for more information on these options.

## Packing List

- Board [CNT-3208M-PE] ...1
- First step guide ...1
- CD-ROM \*1 [API-PAC(W32)] ...1
- Synchronization cable (10cm) ...1

\* 1 : The CD-ROM contains the driver software and User's Guide.

## How to synchronize multiple boards

Simultaneous operation or event-synchronous control between boards partly depends on software performance. The synchronization control connectors are provided to eliminate this problem by improving the reliability of the entire system.

This one product can perform synchronous operation with a homogeneous or heterogeneous board by connecting the synchronization control connectors.

For synchronous operation, select one of the boards connected with synchronization control cables as the master board, with the other boards used as slaves. The master board can set the signal to be supplied to the slaves using software. The slaves can set the signal from the master board as the pacer clock operation start or stop factor.

It is possible to stop the operations of all boards in response to the stop signal from the master board at an error or to the request from a slave. Up to 16 boards can be connected, including the master board.

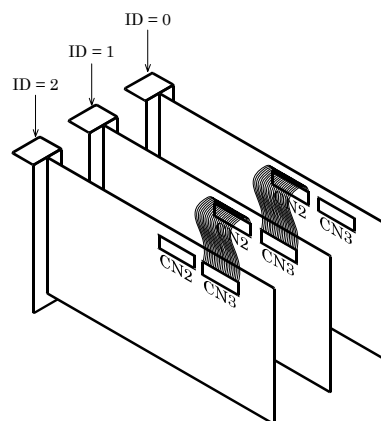
For details on the connection method, refer to the online help for the driver software. When the synchronization control connectors are not used, use the board in the stand-alone configuration.

### Connecting the synchronization control connectors (CN2 and CN3)

The CNT-3208M-PE has synchronization control connectors (CN2 and CN3) to accept synchronization control cables for synchronous operations of two or more boards.

Connection method

- For synchronous operations of two or more boards, connect them with synchronization control cables. Use a synchronization control cable to connect the CN2 of a smaller ID board to the CN3 of the board with a greater board ID number. Do not use any cable other than the supplied one.

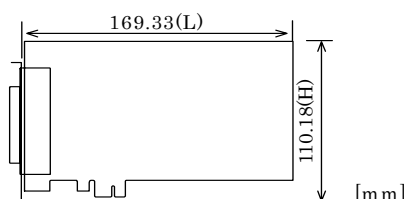


## Specifications

Item	Specification
<b>Input</b>	
<b>Counter</b>	
Channel count	8 ch
Count system	Up / down counting (2-phase / Single-phase / Single-phase Input with Gate Control Attached)
Max. count	FFFFFFFFh (binary data, 32Bit)
Input type	Differential line receiver input or Unisolated TTL level input (Selectable by software)
Input signal	Phase-A/UP One x 8 ch Phase-B/DOWN One x 8 ch Phase-Z/CLR One x 8 ch
Differential line receiver input section	Element in use : Equivalent to AM26LS32 (T.I) Terminating resistance : 150Ω Can be disconnected switch.) Receiver input sensitivity : ±200mV In-phase input voltage range : ±7V Signal extension distance : 1200m (dependent on wiring environment and input frequency) *1
TTL level input section	Element in use : Equivalent to 74ALS541NS (T.I) Signal extension distance : 1.5m (dependent on wiring environment)
Response frequency (Max.)	10MHz 50% duty
Digital filter	0.1μsec - 1.6384msec or not used (can be independently set for each channel.)
Timer	1msec - 6553msec 1msec unit
Counter start trigger	Software / External start input / Sampling start trigger
Counter stop trigger	Software / External start input / Sampling stop trigger
<b>Input</b>	
<b>Sampling</b>	
Sampling start trigger	Software / External start input / Sync control connectors / Count match
Sampling stop trigger	Software / External stop input / Specification number / Bus master transfer error / Sync control connectors / Count match
Sampling clock	Sampling timer / External clock input / Sync control connectors
Sampling timer	50nsec - 107sec 25nsec unit (can not be independently set for each channel.)
External sampling start signal	TTL level (Select Rise or Fall)
External sampling stop signal	TTL level (Select Rise or Fall)
External sampling clock signal	TTL level (Fall)
Response frequency (Max.)	10MHz 50% duty
<b>Control</b>	
Control input signal type	Unisolated TTL level
Control input channel	One x 8 ch
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 (Max.)	100nsec
Interrupt factor	Count match (16 ch), Counter error (2 ch), Sampling factor (6 ch), Sync control connectors error (2 ch), Carry / Borrow (1 ch), Timer (1 ch)

- \*1 The frequency response at an extension of 50 m is about 10 MHz (depending on the wiring environment).  
The frequency response at an extension of 100 m is about 5 MHz (depending on the wiring environment).  
The frequency response at an extension of 150 m is about 1.5 MHz (depending on the wiring environment).  
The frequency response at an extension of 300 m is about 1 MHz (depending on the wiring environment).  
The frequency response at an extension of 600 m is about 500 KHz (depending on the wiring environment).  
The frequency response at an extension of 1200 m is about 80 KHz (depending on the wiring environment)

### Board Dimensions



The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

Item	Specification	
<b>Output</b>		
<b>Control</b>		
Control output channel	One x 8 ch	
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) - Disconnection alarm 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 on-board switch.)	
One shot output signal amplitude	Selected between 10μsec, 100μsec, 1msec, 10msec and 100msec (Can be set for each channel, within precision + 1μsec)	
Element in use	Non-Isolated Open Collector Output : Equivalent to 74LS07NS (T.I)	
Output rating	30VDC 40mA	
Response speed (Max.)	5μsec	
<b>TP</b>		
Test pulse output signal	One line receiver output for each of phases-A and B (For TTL level output, use the positive line receiver output.)	
Element in use	Equivalent to AM26LS31 (T.I)	
Frequency	100kHz	
<b>Bus master</b>		
DMA channel	1 ch	
Transfer bus width	32-Bit width	
Transfer data length	8 PCI Words length (Max.)	
Transfer rate	80MB / sec (Max.133MB / sec)	
FIFO	1K-DWord	
Scatter/Gather function	64MB	
Interrupt factor	Bus master event (7 ch)	
<b>Synchronization</b>		
Control output signal	Select the output signal by software when setting the synchronization master board.	
Control input signal	Select the synchronization factor by software when setting the synchronization slave mode.	
Connectable number of device	16 boards including the master board	
<b>Common</b>		
I/O address	Occupies 2 locations, any 32-bytets and 64-byte boundary	
Additional function	Filter function, count match pulse output, test pulse output, disconnection alarm detection	
Power consumption (Max.)	3.3VDC 1.8A	
Operating condition	0 - 50°C, 10 - 90%RH (No condensation)	
Bus specification	PCI Express Base Specification Rev. 1.0a x1	
Dimension (mm)	169.33(L) x 110.18(H)	
Connector used	CN1 : 96-pin half-pitch connector PCR-E96LMD [mfd by HONDA TSUSHIN KOGYO CO., LTD.] or equivalent to it CN2, CN3 : PS-10PE-D4T1-B1 [JAE] or equivalent to it x 2	
Weight	160g	
<b>Bus master transfer speed</b>		
	Limited	Unlimited
430TX/Pentium233MHz	20	13.4
440BX/PentiumII450MHz	20	13.4
i820/PentiumIII800MHz	20	13.4
i815E/PentiumIII800MHz	20	13.4

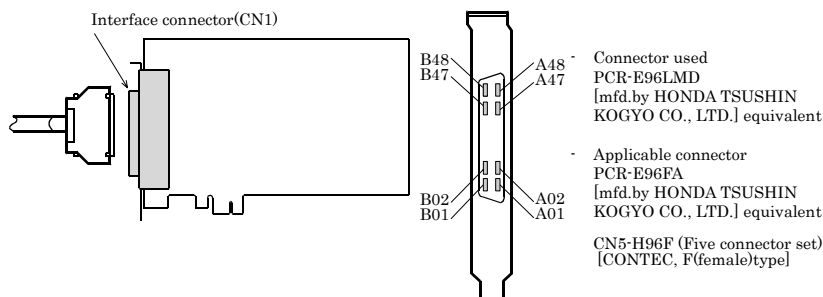
[MHz]

"Limited" indicates that the number of transfers is specified; "Unlimited" specifies that it is not specified. These values may not be satisfied depending on the system configuration including other boards and applications.

## Connector Wiring

### Connector shape

The on-board interface connector (CN1) is used when connecting this product and the external devices.



### Connector Pin Assignment

#### Pin Assignments of Interface Connector (CN1)

	[49]	[1]	
	Ground	GND	B48
	Ground	GND	B47
	CH7 differential Phase-Z input-	D7Z-	B46
	CH7 TTL Phase-Z input/Differential Phase-Z input+	T7Z/D7Z+	B45
	CH7 differential Phase-B input-	D7B-	B44
	CH7 TTL Phase-B input/Differential Phase-B input+	T7B/D7B+	B43
	CH7 differential Phase-A input-	D7A-	B42
	CH7 TTL Phase-A input/Differential Phase-A input+	T7A/D7A+	B41
	Ground	GND	B40
	Ground	GND	B39
	CH6 differential Phase-Z input-	D6Z-	B38
	CH6 TTL Phase-Z input/Differential Phase-Z input+	T6Z/D6Z+	B37
	CH6 differential Phase-B input-	D6B-	B36
	CH6 TTL Phase-B input/Differential Phase-B input+	T6B/D6B+	B35
	CH6 differential Phase-A input-	D6A-	B34
	CH6 TTL Phase-A input/Differential Phase-A input+	T6A/D6A+	B33
	Ground	GND	B32
	Ground	GND	B31
	CH5 differential Phase-Z input-	D5Z-	B30
	CH5 TTL Phase-Z input/Differential Phase-Z input+	T5Z/D5Z+	B29
	CH5 differential Phase-B input-	D5B-	B28
	CH5 TTL Phase-B input/Differential Phase-B input+	T5B/D5B+	B27
	CH5 differential Phase-A input-	D5A-	B26
	CH5 TTL Phase-A input/Differential Phase-A input+	T5A/D5A+	B25
	Ground	GND	B24
	Ground	GND	B23
	CH4 differential Phase-Z input-	D4Z-	B22
	CH4 TTL Phase-Z input/Differential Phase-Z input+	T4Z/D4Z+	B21
	CH4 differential Phase-B input-	D4B-	B20
	CH4 TTL Phase-B input/Differential Phase-B input+	T4B/D4B+	B19
	CH4 differential Phase-A input-	D4A-	B18
	CH4 TTL Phase-A input/Differential Phase-A input+	T4A/D4A+	B17
	Ground	GND	B16
	Ground	GND	B15
	CH7 control input *1	DI7	B14
	CH6 control input *1	DI6	B13
	CH5 control input *1	DI5	B12
	CH4 control input *1	DI4	B11
	External sampling start signal input	EXTSTART	B10
	External sampling stop signal input	EXTSTOP	B09
	Ground	GND	B08
	CH7 control output *2	DO7	B07
	CH6 control output *2	DO6	B06
	CH5 control output *2	DO5	B05
	CH4 control output *2	DO4	B04
	Ground	GND	B03
	Test pulse differential Phase-A output-	TPOA-	B02
	Test pulse TTL Phase-A output/ Differential Phase-A output+	TPOA+	B01
			[96]
			[48]
			A48
			A47
			A46
			A45
			A44
			A43
			A42
			A41
			A40
			A39
			A38
			A37
			A36
			A35
			A34
			A33
			A32
			A31
			A30
			A29
			A28
			A27
			A26
			A25
			A24
			A23
			A22
			A21
			A20
			A19
			A18
			A17
			A16
			A15
			A14
			A13
			A12
			A11
			A10
			A09
			A08
			A07
			A06
			A05
			A04
			A03
			A02
			A01

\* The numbers in square brackets [ ] are pin numbers designated by HONDA TSUSHIN KOGYO CO., LTD.

\*1 The control inputs can serve as the general-purpose, counter start/stop, preset, and zero-clear inputs.

\*2 The control outputs can serve as the general-purpose output, count match, abnormal input error, digital filter error, and discontinuity alarm error outputs.

## How to Connect External Device – Differential level Input -

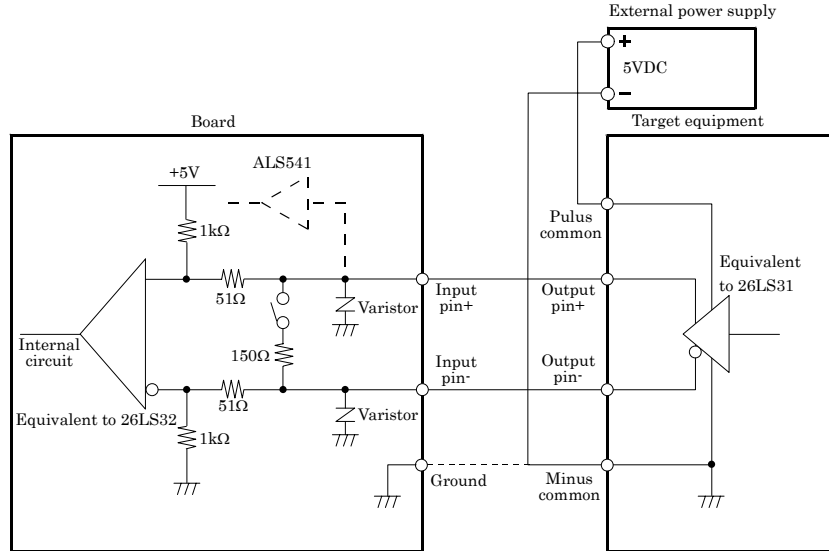
### Connecting the differential line receiver input

Use the differential line receiver input to connect the board to the line receiver output circuit of a rotary encoder or linear scale. The maximum input frequency is 10 MHz.

For use in two-phase input mode, connect both of the phase-A and phase-B inputs. For use in single-phase input mode, connect either of them. If phase-Z is not used, the input need not be connected.

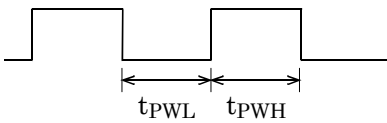
For differential line receiver input mode, you can select whether to insert the terminal resistor.

Detailed description of differential line receiver input circuit



### Input signal

To protect the input circuit from voltage surges, a varistor is connected.



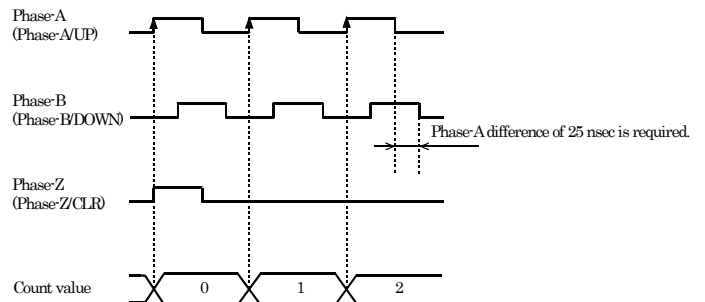
$t_{pWH}$  : High-level count input pulse width 50nsec (Min.)

$t_{pWL}$  : Low-level count input pulse width 50nsec (Min.)

### CAUTION

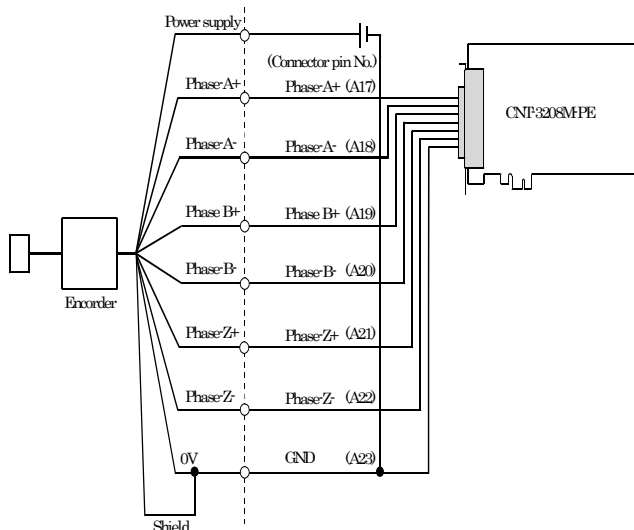
In the input pin+, TTL level input circuit is parallel-connected.

### Example: Counting during 2-phase input

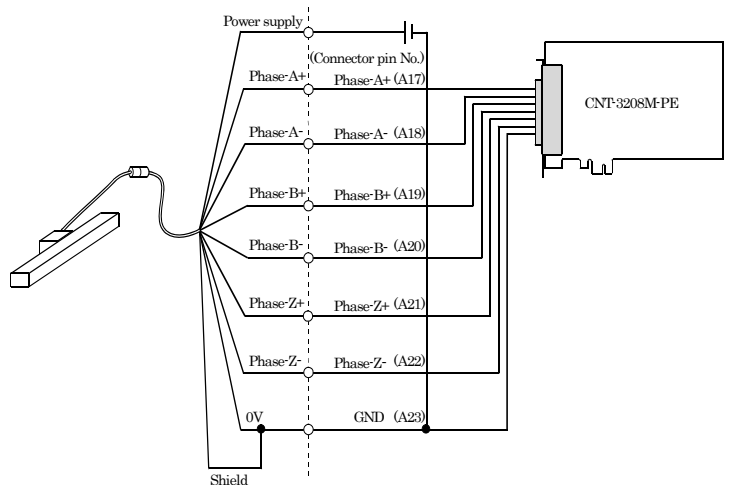


\* Count operation for incremental counting in the CW direction.  
When decremental counting in the CW direction is set, the board performs decremental counting at the rising edge of the phase-A signal.  
\* The minimum phase difference between phases-A and B is 25 nsec.  
Counting is not performed normally if the phase difference is less than 25 nsec.

### Example: Connection with a Rotary Encoder (differential line receiver input, Channel 0)



### Example: Connection with a Linear Scale (differential line receiver input, Channel 0)



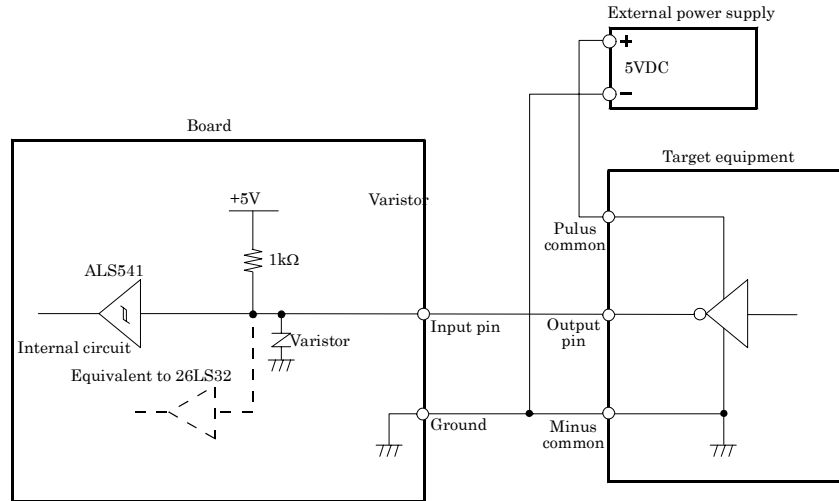
## How to Connect External Device – TTL level Input -

### Connecting the TTL level input

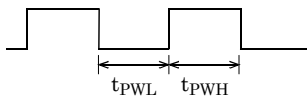
Use the TTL-compatible input to connect the board to the TTL-compatible output circuit of a rotary encoder or linear scale. The maximum input frequency is 10 MHz.

For use in two-phase input mode, connect both of the phase-A and phase-B inputs. For use in single-phase input mode, connect either of them. If phase-Z is not used, the input need not be connected.

### Detailed description of TTL level input circuit



### Input signal



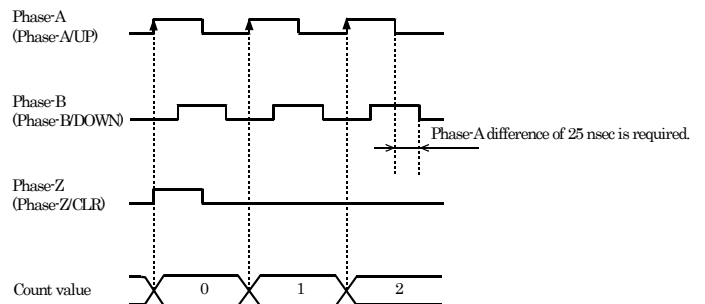
tpWH : High-level count input pulse width 50nsec (Min.)

tpWL : Low-level count input pulse width 50nsec (Min.)

### CAUTION

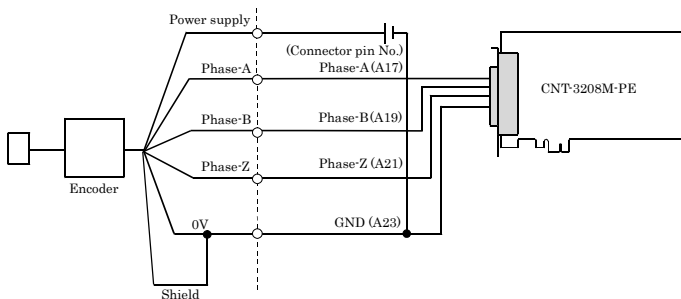
- The connection cable length should be within 1.5 m.
- To prevent noise from causing a malfunction, arrange the connection cable as away from any other signal conductor or noise source as possible.
- In the input pin+, TTL level input circuit is parallel-connected.

### Example: Counting during 2-phase input

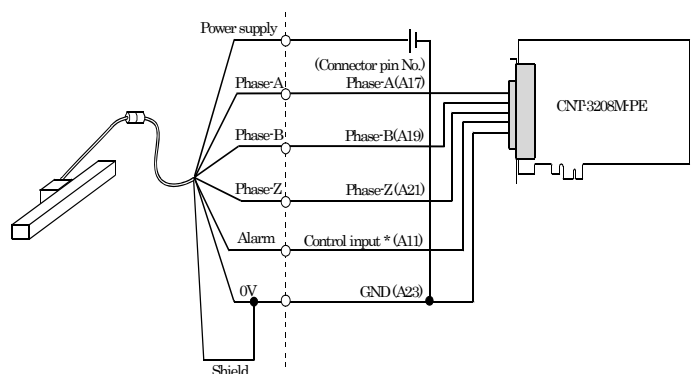


- \* Count operation for incremental counting in the CW direction. When decremental counting in the CW direction is set, the board performs decremental counting at the rising edge of the phase-A signal.
- \* The minimum phase difference between phases-A and B is 25 nsec. Counting is not performed normally if the phase difference is less than 25 nsec.

### Example: Connection with a Rotary Encoder (TTL level input, channel 0)



### Example: Connection with a Linear Scale (TTL level input, channel 0)



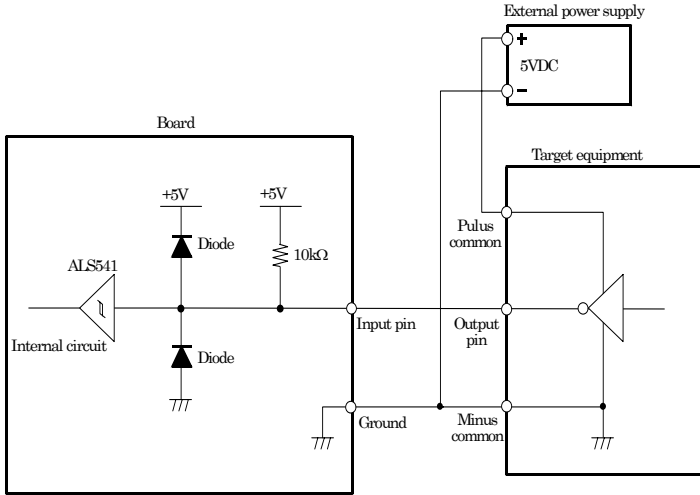
- \* When the control input is set as a general-purpose input, the alarm output state can be checked. When the control input is set as the counter stop input, the counter can be stopped at alarm output.

## How to connect control input/output

### Connection of a control input

For control signal input, the board has one pin per channel to be used to selectively start/stop or preset the counter for the channel and one pin per channel to be used to start or stop the sampling clock.

### Control input circuit (DI0 - DI7, EXTCLK, EXTSTART, EXTSTOP)



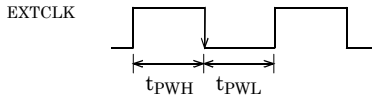
### CAUTION

- The connection cable length should be within 1.5 m.
- To prevent noise from causing a malfunction, arrange the connection cable as away from any other signal conductor or noise source as possible.

### External sampling clock signal (EXTCLK)

This pin feeds the external pacer clock signal. The maximum frequency is 10 MHz.

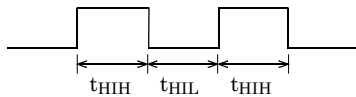
When the sampling clock input has been set to the external clock input, sampling is performed at the falling edge of the signal at this pin.



tPWH : High-level clock pulse width 50nsec (Min.)  
tPWL : Low-level clock pulse width 50nsec (Min.)

### Other control input signals (DI0 - DI7, EXTSTART, EXTSTOP)

Control input signal can be selected with whether to enable rise or fall by software at the TTL level. High- and low-level hold times of at least 50 nsec are required to detect an edge of the signal.

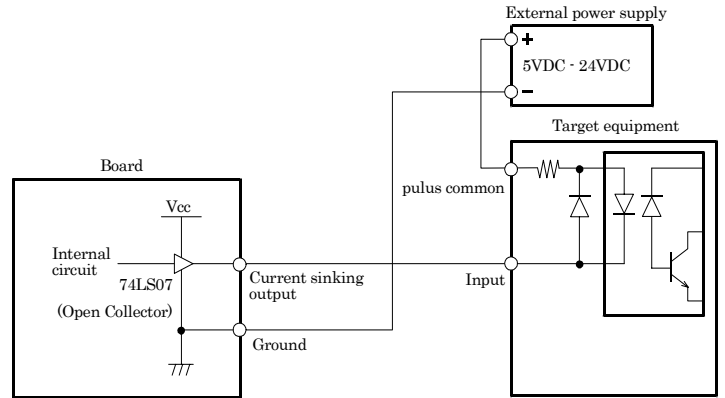


tHIH : High-level hold time 50nsec (Min.)  
tHIL : Low-level hold time 50nsec (Min.)

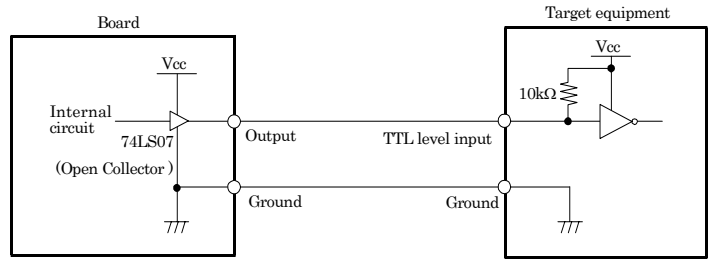
### Connection of a control output

The control output of the board provides the general-purpose output signal (level output) and the one-shot pulse signals that indicate hardware events such as a count match. For the signal output, positive or negative logic can be selected with SW2.

### Sample connection to Isolated output circuit (DO0 - DO7)



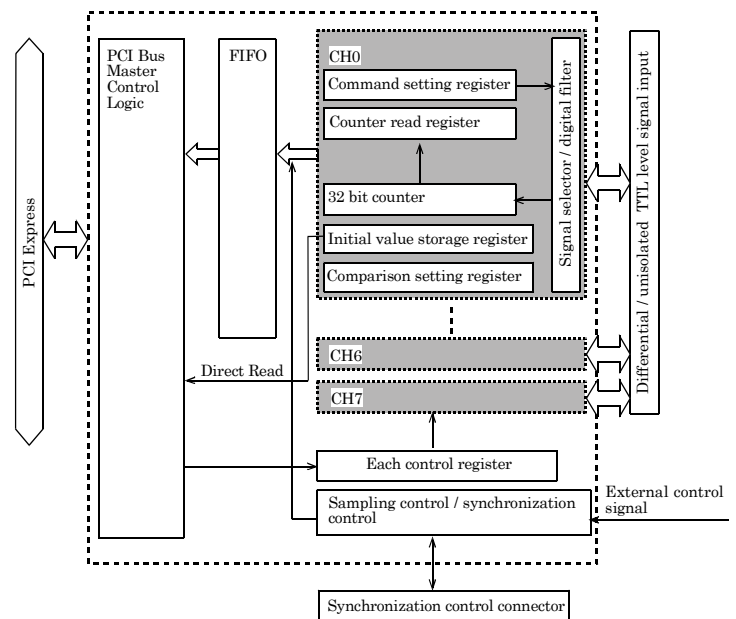
### Sample connection to TTL level input circuit



### CAUTION

The output of this board has no surge voltage protector. To drive an inductive load such as a relay or lamp using this board, apply surge voltage protection to the load side. For surge voltage protection, see "Surge Voltage Countermeasures" in the next section.

## Block Diagram



\*Specification, color and design of the products may be changed without notice.