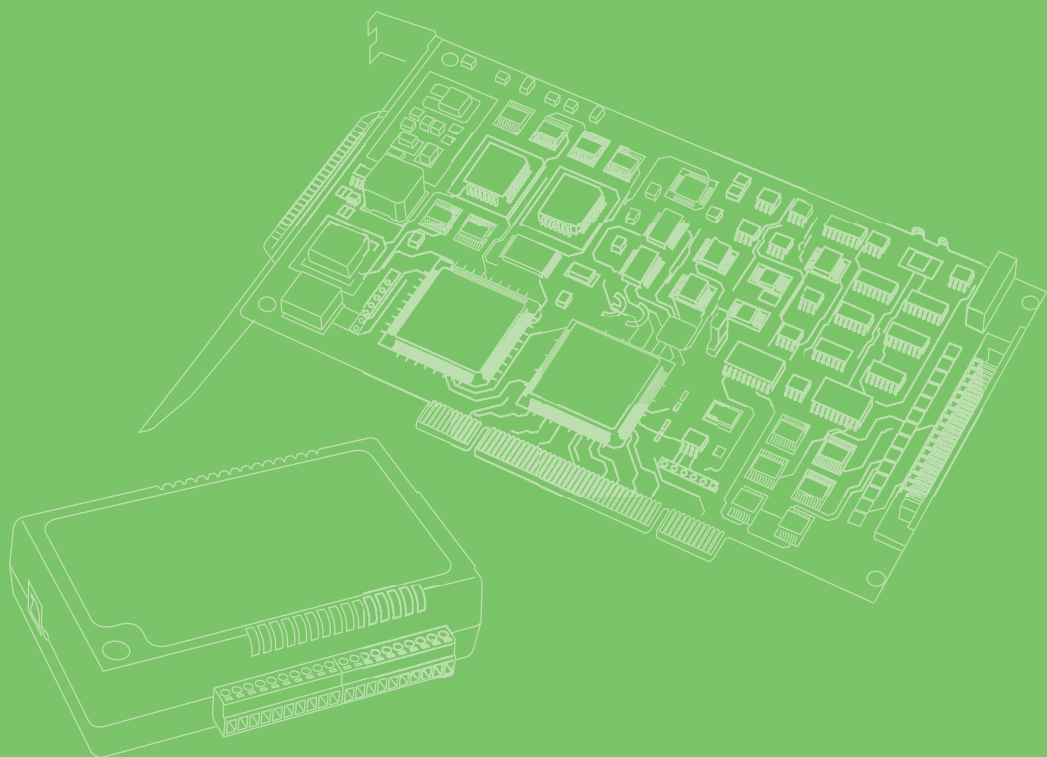


User Manual



PCI-1780U

8-ch Counter/Timer Card

ADVANTECH

Enabling an Intelligent Planet

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Product Warranty (2 years)

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This warranty does not apply to any products that have been repaired or altered by persons other than repair personnel authorized by Advantech, or products that have been subject to misuse, abuse, accident, or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced free of charge during the warranty period. For out-of-warranty repairs, customers will be billed according to the cost of replacement materials, service time, and freight. Please consult your dealer for more details.

If you believe your product to be defective, follow the steps outlined below.

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages displayed when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain a return merchandise authorization (RMA) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and a proof of purchase date (such as a photocopy of your sales receipt) into a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.
5. Write the RMA number clearly on the outside of the package and ship the package prepaid to your dealer.

Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This type of cable is available from Advantech. Please contact your local supplier for ordering information.

FCC Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference. In this event, users are required to correct the interference at their own expense.

Technical Support and Assistance

1. Visit the Advantech website at www.advantech.com/support to obtain the latest product information.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before calling:
 - Product name and serial number
 - Description of your peripheral attachments
 - Description of your software (operating system, version, application software, etc.)
 - A complete description of the problem
 - The exact wording of any error messages

Packing List

Before system installation, check that the items listed below are included and in good condition. If any item does not accord with the list, contact your dealer immediately.

- PCI-1780U DA&C card
- Startup or User Manual
- Companion DVD-ROM with DAQNav drivers included

Safety Precautions - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from the PC chassis before manual handling. Do not touch any components on the CPU card or other cards while the PC is powered on.
- Disconnect the power before making any configuration changes. A sudden rush of power after connecting a jumper or installing a card may damage sensitive electronic components.

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Chapter 1

Start Using PCI-1780U

1.1 Product Overview

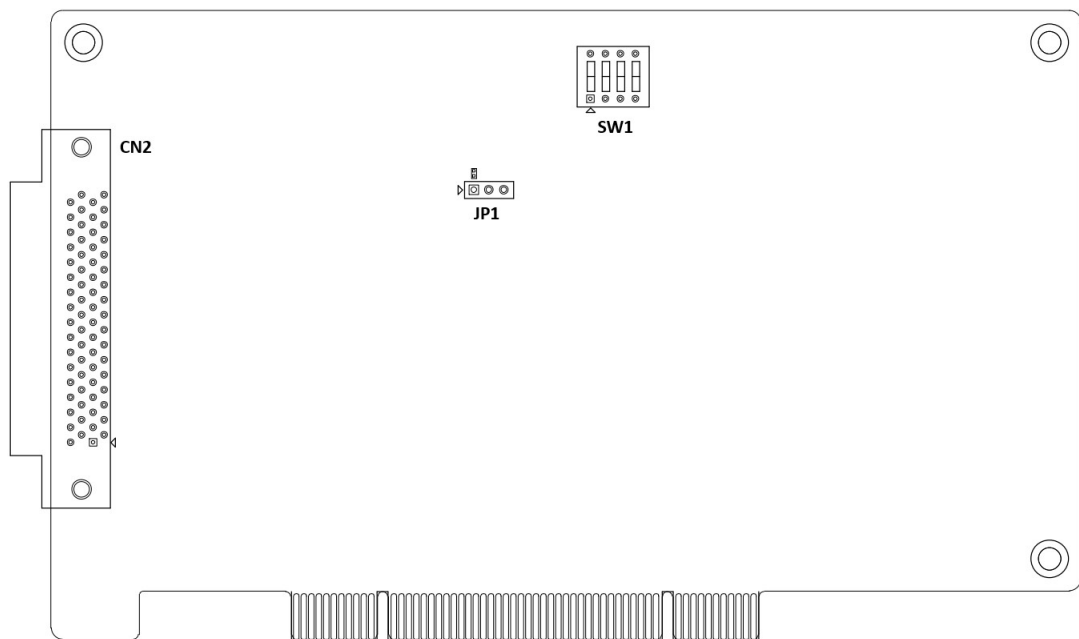


Figure 1.1 Card Layout

Table 1.1: List of connectors and switches

Component	Function
SW1	Board ID
CN2	SCSI-68Pin(F) Connector
JP1	Power-on Configuration

1.2 Products Features

1.2.1 Board ID

A board ID can be assigned through the onboard slide switch for the device. The board ID value in the device description of the software is used to map the device in the software to the actual hardware device. Board ID is useful when there are multiple hardware devices with the same model name in the system. Without the board ID, user cannot recognize which device in the software that the hardware device is related to.

When configured as 0, the board ID is automatically assigned by the device driver software. When configured as value other than 0, the configured value is used. Do not configure the same value (except for 0) for hardware devices with the same model name. Refer to the device specifications for the configuration of the board ID.

If changed, the new board ID value takes effect only after cold resetting the device.

1.3 Driver Installation

The driver package could be found on Advantech Support Portal (<https://www.advantech.com/support>). Search for PCI-1780U on the support portal, then the corresponded driver/SDK package could be found. You'll get the XNavi installer after the download session finishes.

Execute the installer, then it will guide you through the session. You can choose the device and software components you'd like to install in the system (Figure 1. 2). After the selection, click on "start" to begin the installation.

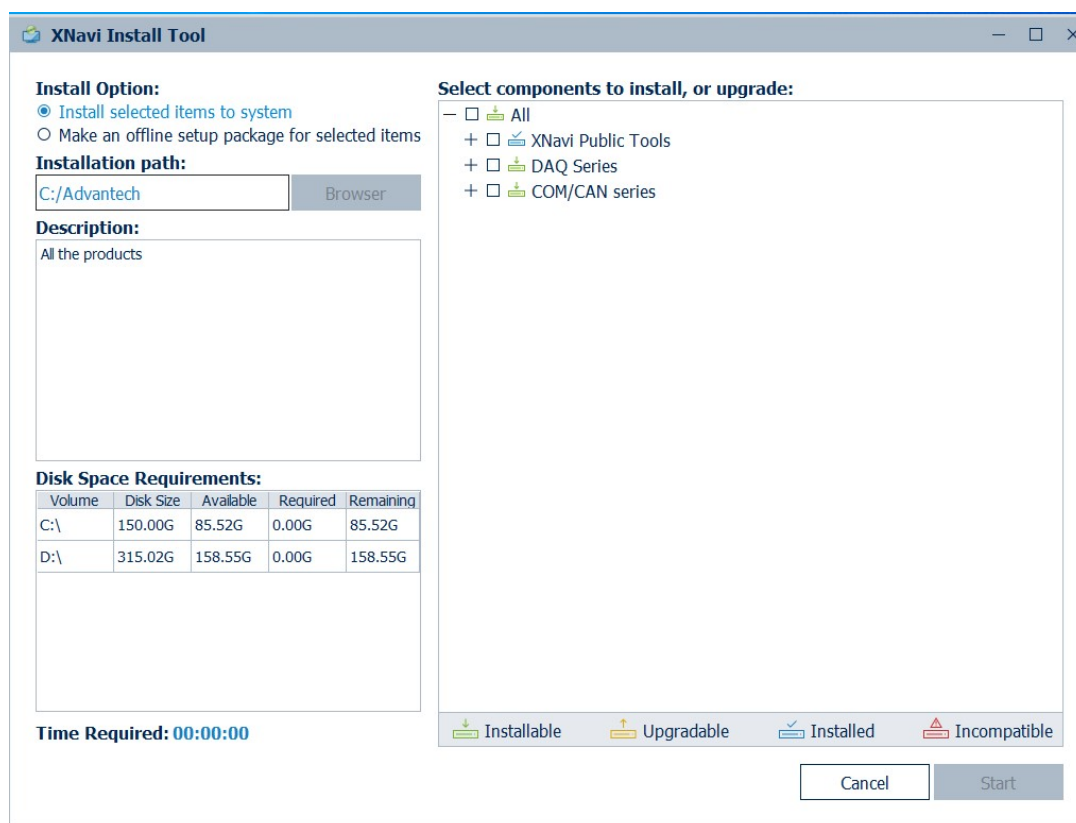


Figure 1.2 XNavi Installation Interface

1.4 Software Utility

Advantech offers device drivers, SDKs, third-party driver support and application software to help fully exploit the functions of your DAQ devices. All these software packages are available on Advantech website: <http://www.advantech.com/>.

The Advantech Navigator is a utility that allows you to set up, configure and test your device, and later stores your settings in a proprietary database.

1. To set up the I/O device for your card, you could first run the Advantech Navigator program (by accessing Start/Programs/Advantech Automation/DAQNavi/ Advantech Navigator). The settings could also be saved.
2. You can then view the device(s) already installed on your system (if any) on the Installed Device tree view. If the software and hardware installation are completed, you will see DAQ devices in the Installed Devices list.

1.5 Software Development Using DAQNav SDK

DAQNav SDK is the software development kit for programming applications with Advantech DAQ products. The necessary runtime DLL, header files, software manual and tutorial videos can be installed via the XNav installer. They can be found under C:\Advantech\DAQNav (default directory) after finishing the installation.

1.6 FPGA Code Updates

The FPGA can also be updated via the interface in Navigator. However, it is not advised to update FPGA without first doing some research. Advantech strongly suggests you consult your technical support before starting an FPGA update.

Chapter 2

Installation Guide

2.1 Initial Unpacking Check

Before setting up the system, check that the items listed below are included and in good condition. If any item does not accord with the table, please contact your dealer immediately.

- PCI-1780U card
- Startup or User Manual

2.2 Hardware Installation and Configuration

2.2.1 Installation

Before you install your PCI-1780U, please make sure you have the following components:

- PCI-1780U-B card.
- PCI-1780U-B User Manual.
- Advantech DAQNav SDK and the corresponding device driver.
- Personal computer or workstation with PCI interface.
- Accessories (optional)
 - PCL-10168-1E 68-pin SCSI shielded cable, 1m
 - PCL-10168-2E 68-pin SCSI shielded cable, 2m
 - ADAM-3968-AE 68-pin DIN rail SCSI wiring board

When the necessary components are prepared, you can begin the installation procedure as follows:

1. Install Advantech DAQNav SDK and the corresponding device driver. They can be downloaded from Advantech website.
2. Turn off the computer. (for PCI or PCIe cards only)
3. Install the hardware device.
4. Turn on the computer. (for PCI or PCIe cards only).
5. Use Navigator to test the functionality of the hardware.
6. Read software manual and examples.
7. Write your own applications.

2.2.2 Configuration - Board ID (SW1)

The PCI-1780U-B has a built-in DIP switch (SW1), which is used to define each card's board ID. When there are multiple cards on the same chassis, this board ID switch is useful for identifying each card's device number.

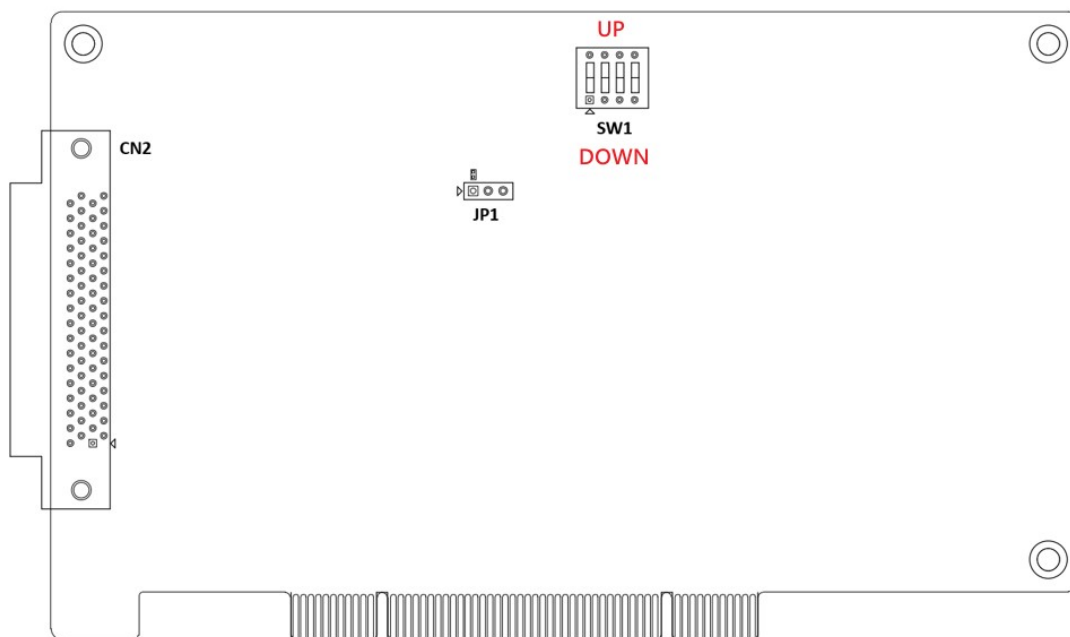


Figure 2.1 Card Layout

Table 2.1: Board ID				
Board ID	Switch Position			
	1	2	3	4
0*	UP	UP	UP	UP
1	UP	UP	UP	DOWN
2	UP	UP	DOWN	UP
3	UP	UP	DOWN	DOWN
4	UP	DOWN	UP	UP
5	UP	DOWN	UP	DOWN
6	UP	DOWN	DOWN	UP
7	UP	DOWN	DOWN	DOWN
8	DOWN	UP	UP	UP
9	DOWN	UP	UP	DOWN
10	DOWN	UP	DOWN	UP
11	DOWN	UP	DOWN	DOWN
12	DOWN	DOWN	UP	UP
13	DOWN	DOWN	UP	DOWN
14	DOWN	DOWN	DOWN	UP
15	DOWN	DOWN	DOWN	DOWN

2.2.3 Configuration - DO Control Selection (JP1)

Table 2.2: Configuration - DO Control Selection (JP1)

Jumper Setting	Description
	Keep last status after hot reset.
	Reset to default status after hot reset.*

* Default setting.

2.3 Signal Connection and Pin Assignment

2.3.1 Digital Input Signal Connection

A digital input/output (DI/O) channel can be configured by software to perform digital input measurement, which is the power-on default configuration, or digital output generation. When configured for digital input measurement, the voltage logic level between the digital input (DI) terminal and the digital ground (GND) terminal is measured. To prevent indeterminate or fluctuating results when the input is floating, the digital input channel is pulled up by default. This is shown in Figure 2.2.

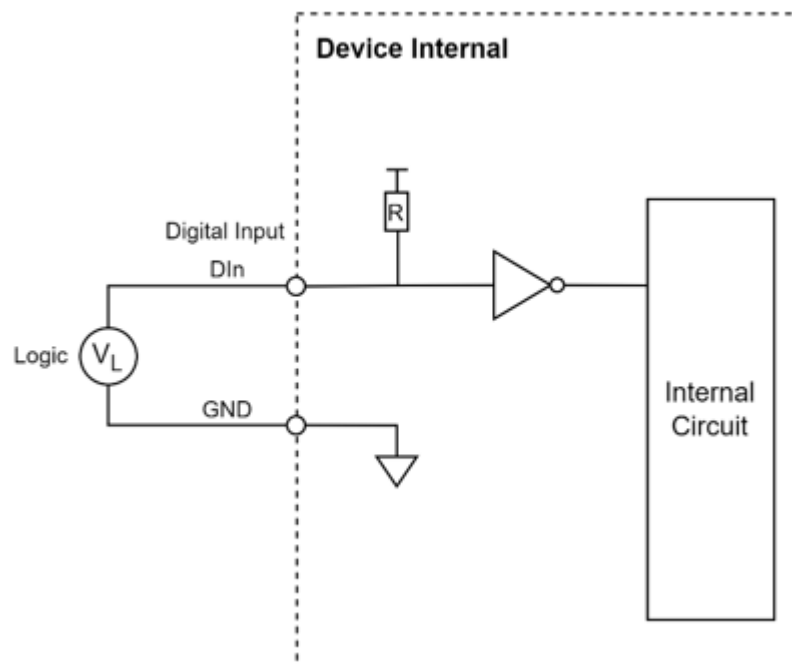


Figure 2.2 Digital input signal connection

2.3.2 Digital Output Signal Connection

A digital input/output (DI/O) channel can be configured by software to perform digital input measurement, which is the power-on default configuration, or digital output generation. When configured for digital output generation, a voltage logic level is produced between the digital output (DO) terminal and the digital ground (GND) terminal. This is shown in Figure 2.5.

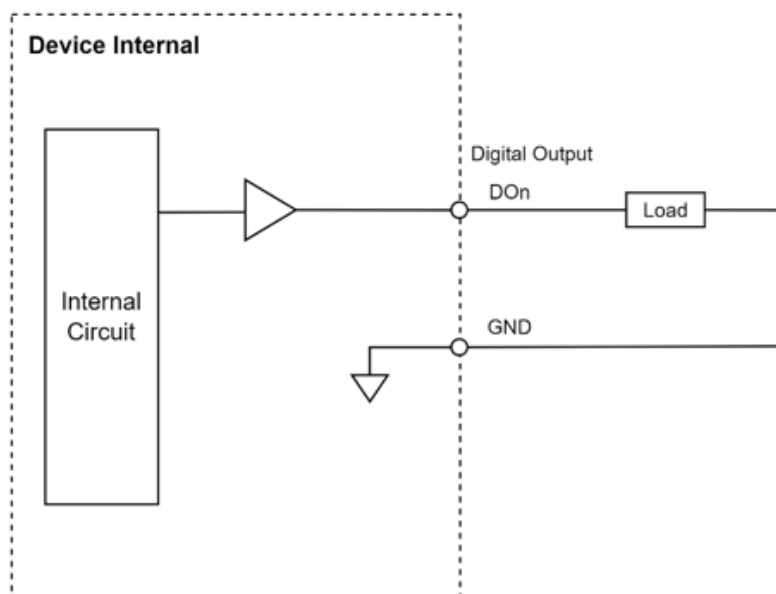


Figure 2.3 Digital output signal connection

2.3.3 Counter Input Signal Connection (TTL, Pull-Up)

The voltage logic level between the counter input terminals (counter clock, counter gate, counter arm, and sample clock) and the ground (GND) terminal is measured. To prevent indeterminate or fluctuating results when the input is floating, the counter input signals are internally pulled up. This is shown in Figure 2.6.

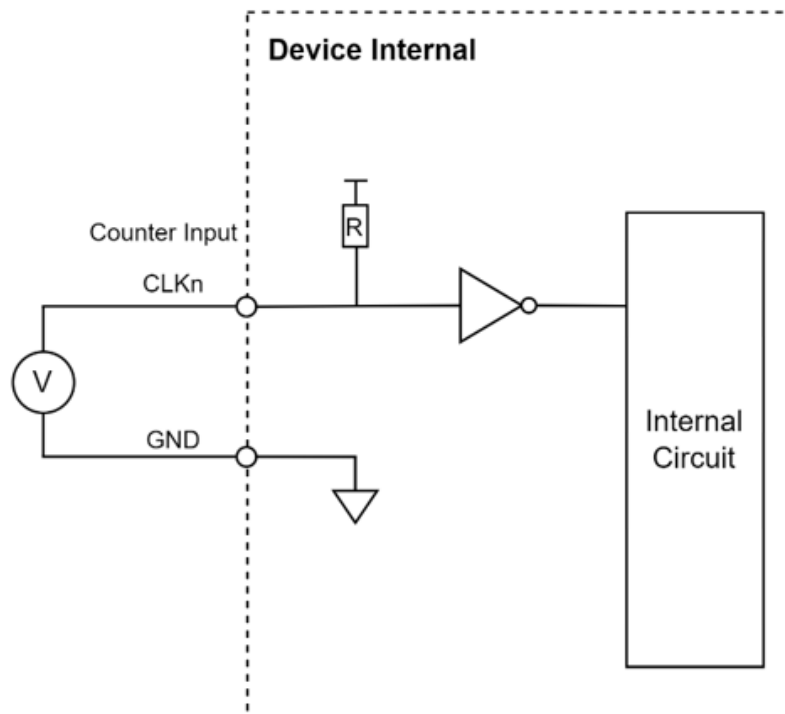


Figure 2.4 Counter input signal connection

The input voltage must be either higher than the minimum ON-state value or lower than the maximum OFF-state value for a deterministic result. If the input voltage falls between these two values, the result is indeterminate and may be either ON or OFF. Additionally, do not apply a voltage higher than the maximum allowable ON-state value or lower than the minimum allowable OFF-state value, as this may damage the device. Refer to the device specifications for ON and OFF-state voltage ranges.

2.3.4 Counter Output Signal Connection (TTL)

A voltage logic level is generated between the counter output terminal and the ground (GND) terminal. This is shown in Figure 2.8.

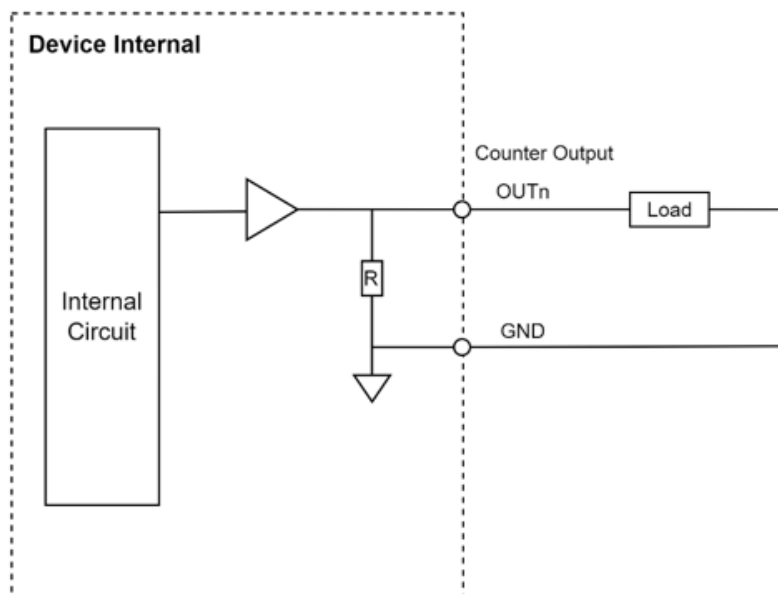


Figure 2.5 Counter output signal connection.

Each counter output channel can source or sink only finite amount of current. If this limit is exceeded, the output voltage will not stay in the specified voltage logic level. Refer to the device specifications for the maximum source and skin current values.

2.3.5 Event Counting

In event counting mode, the counter counts the number of edges the counter clock signal generates. Counting can be paused by the counter gate signal. The gate can be enabled or disabled by software.

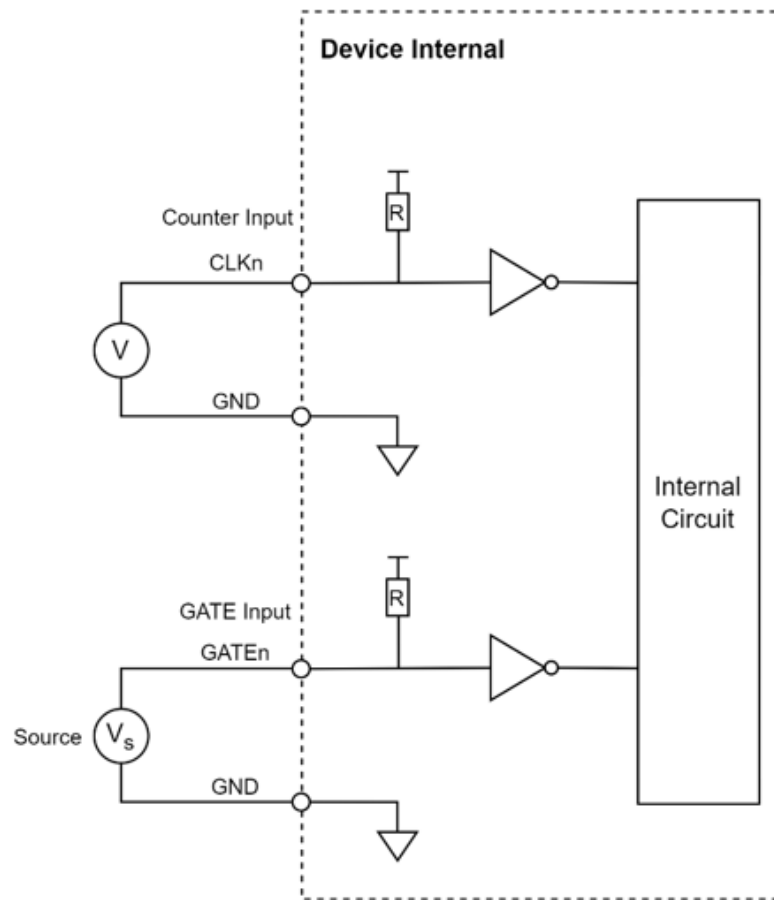


Figure 2.6 Event counting signal connection.

2.3.6 Frequency Measurement

In frequency measurement mode, the frequency of the counter clock signal is measured by one of the two measuring methods: Period inversion or counting number of pulses in fixed duration.

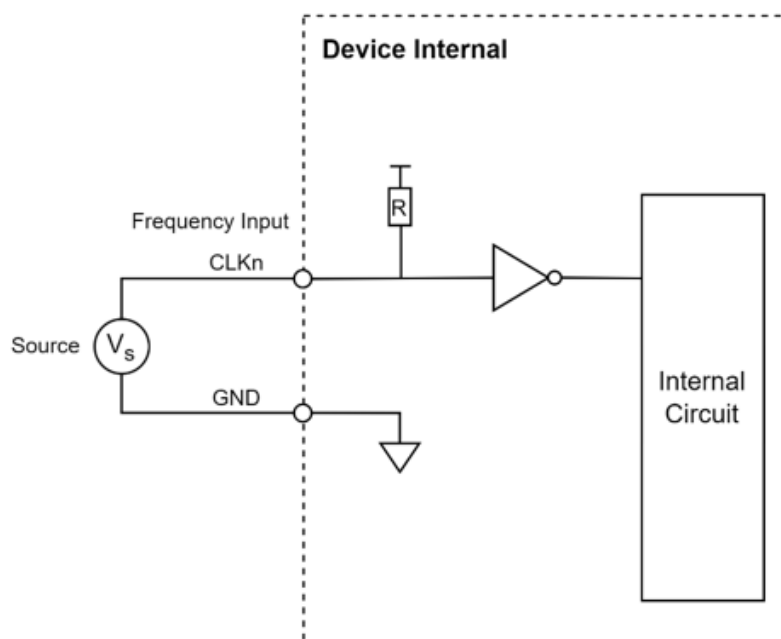


Figure 2.7 Frequency measurement signal connection.

2.3.7 Pulse Width Measurement

In pulse width measurement mode, both the high period and the low period of the counter clock signal are measured.

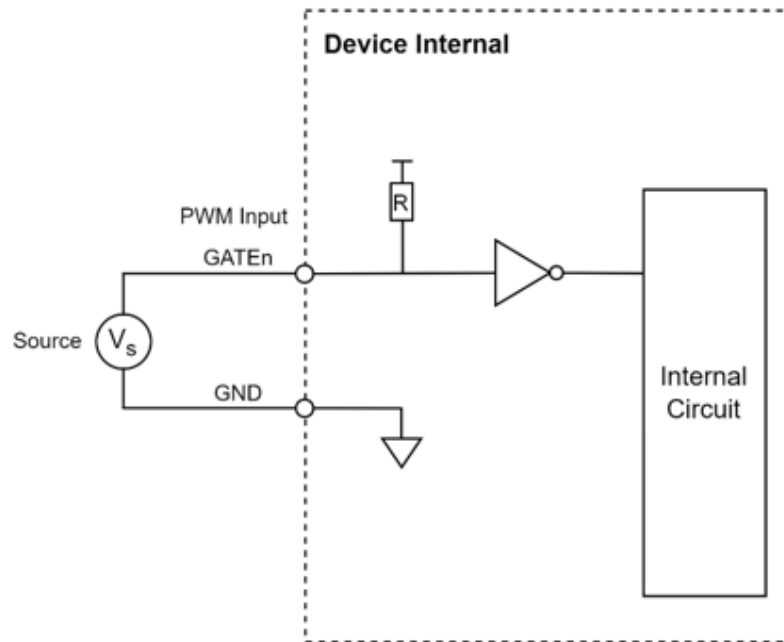


Figure 2.8 Pulse width measurement signal connection

2.3.8 One-shot (Delayed Pulse Generation)

In one-shot mode, when an active edge of gate signal is detected, a pulse will be generated after the specified number source clock counts. The pulse width is one period of source clock.

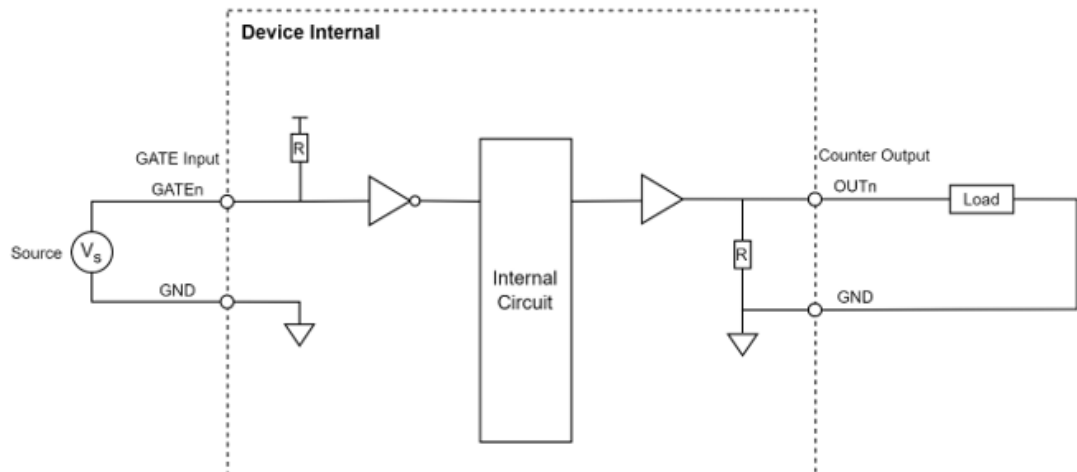


Figure 2.9 One-shot signal connection

2.3.9 Timer/Pulse (with Interrupt)

In timer/pulse mode, continuous pulses with specified frequency are generated at counter output terminal. The output can be gated. The gate can be enabled or disabled by software.

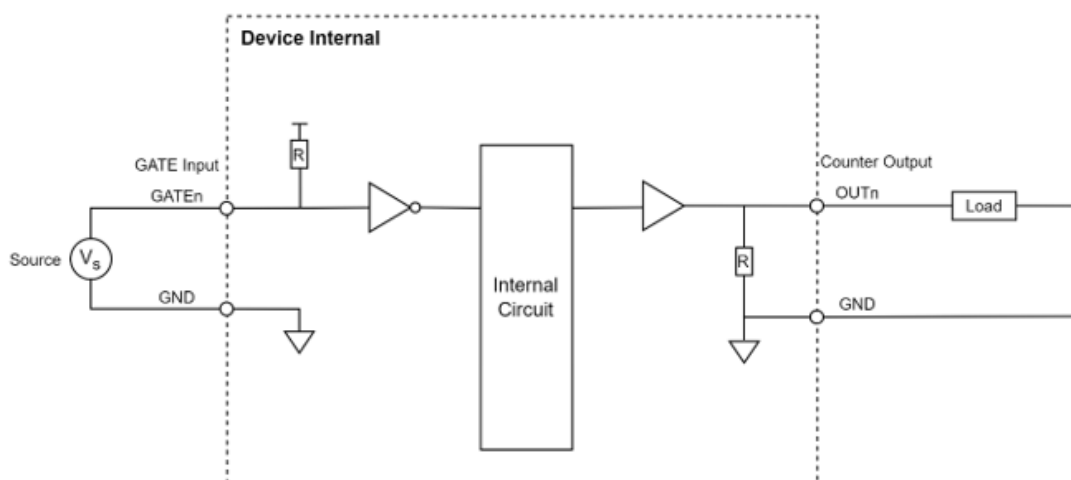


Figure 2.10 Gated timer/pulse output signal connection.

Static (Software-Timed) Timer/Pulse

With static timer/pulse, the software controls the time of updating output pulse frequency, which is thus also called software-timed timer/pulse.

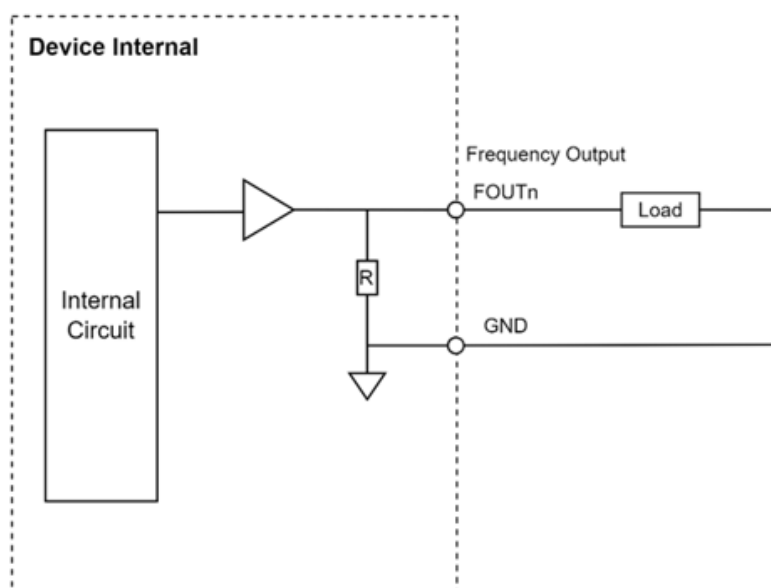


Figure 2.11 Timer/pulse output signal connection

2.3.10 Pulse Width Modulation

In pulse width modulation (PWM) output mode, a pulse waveform with specified high period and low period is output at counter output terminal. The output can be gated. The gate can be enabled or disabled by software.

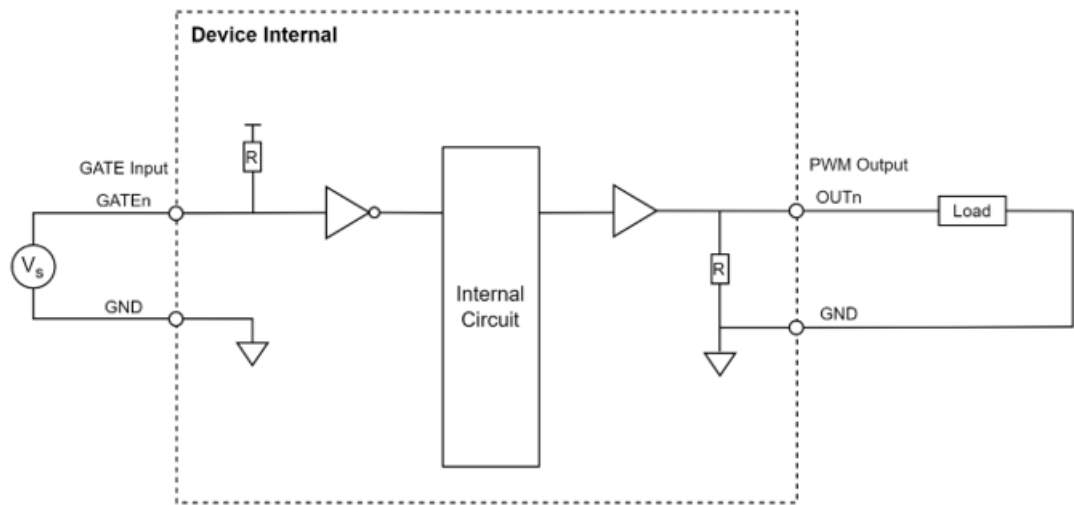


Figure 2.12 Pulse width modulation output signal connection

2.3.11 Pin Assignment (CN4)

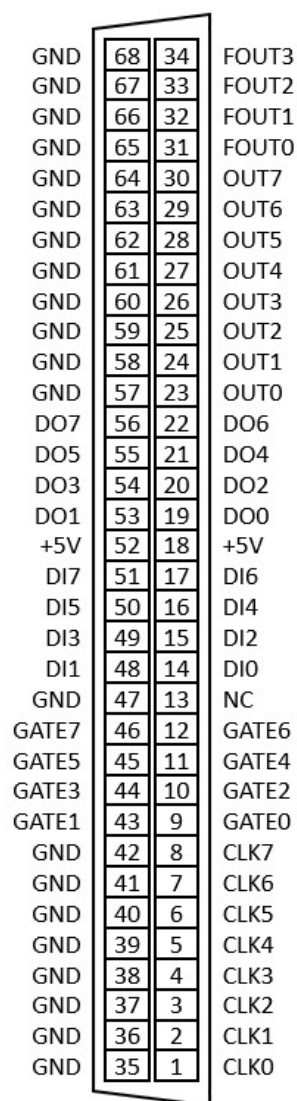


Figure 2.13 Pin assignment

Table 2.3: Pin assignment			
Pin Name	Direction	Description	Pin Number
DI<0..7>	I	Digital input terminals.	14 ~ 17, 48 ~ 51
DO<0..7>	O	Digital output terminals.	19 ~ 22, 53 ~ 56
CLK<0..7>	I	Counter clock input terminals.	1 ~ 8
GATE<0..7>	I	Counter gate input terminals.	9 ~ 12, 43 ~ 46
OUT<0..7>	O	Counter output terminals.	23 ~ 30
FOUT<0..3>	O	Frequency output terminals.	31 ~ 34
NC	-	Not connected.	13
GND	-	Ground terminals.	35 ~ 42, 47, 57 ~ 68
+5V	O	+5 V supply output.	18, 52

2.4 Field Wiring Considerations

When measuring a signal using the device, noises in the environment might significantly affect the performance of the measurement if some cautions are not taken. Follow these recommendations to avoid degradation of the measurement result.

- Make signal lines as short as possible.
- Use shielded, twisted-pair cables.
- Keep signal lines from noisy environment, high-voltage/current cables, or equipment which generates large electromagnetic interference, such as power lines, motors, breakers, or welding equipment.
- Route signal lines at right angles to noise generating cables.
- Use differential input configuration to reduce common-mode noise.
- For externally powered modules, use separate power sources for modules and other noise generating equipment.

Chapter 3

Functions Details

3.1 Digital Input

3.1.1 Instant (Software-Timed) Digital Input Acquisition

With instant acquisition, the software controls the rate and time of acquisition, which is thus also called software-timed acquisition. Whenever the software sends a read command, the current status of digital input ports is returned as shown in Figure 3. 1.

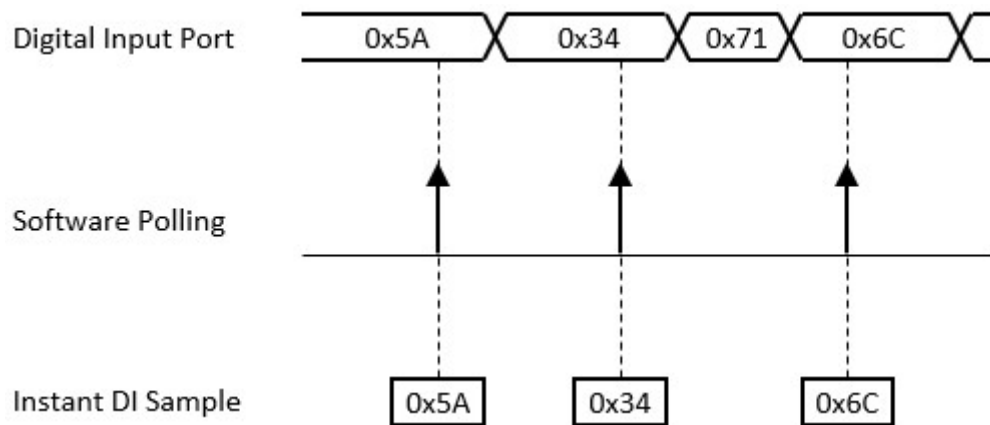


Figure 3.1 Instant (software-timed) digital input acquisition

The advantage of instant acquisition is low latency. It is typically used for reading a single sample of digital input.

3.2 Digital Output

3.2.1 Static (Software-Timed) Digital Output Update

With static update, the software controls the rate and time of date, which is thus also called software-timed update. Whenever the software sends a write command, the state of digital output ports is updated as shown in Figure 3. 2.

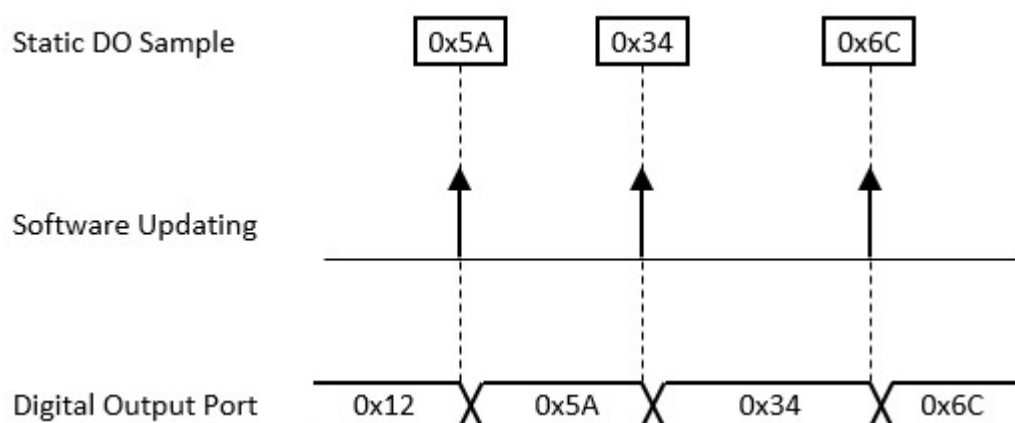


Figure 3.2 Static (software-timed) digital output update

The advantage of state update is low latency. It is typically used for writing a single value of digital output.

3.3 Counter

3.3.1 Event Counting

In event counting mode, the counter counts the number of edges the counter clock signal generates. It can be configured as rising edge active or falling edge active, as shown in Figure 3. 3 and Figure 3. 4, respectively.

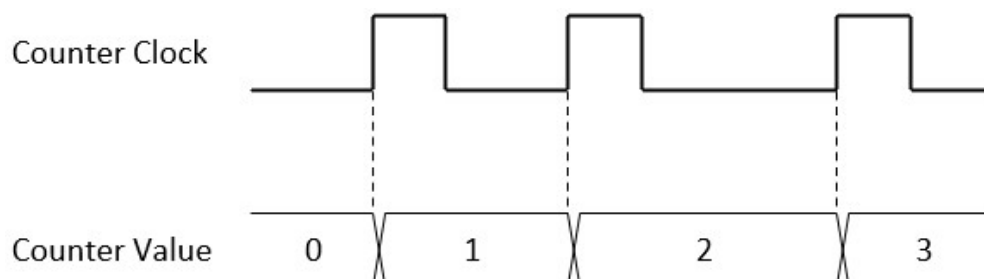


Figure 3.3 Rising edge event counting

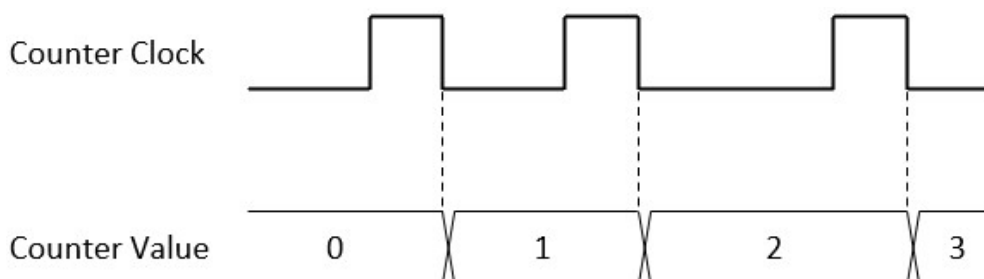


Figure 3.4 Falling edge event counting

Counting may be temporarily paused by the counter gate signal as shown in Figure 3. 5.

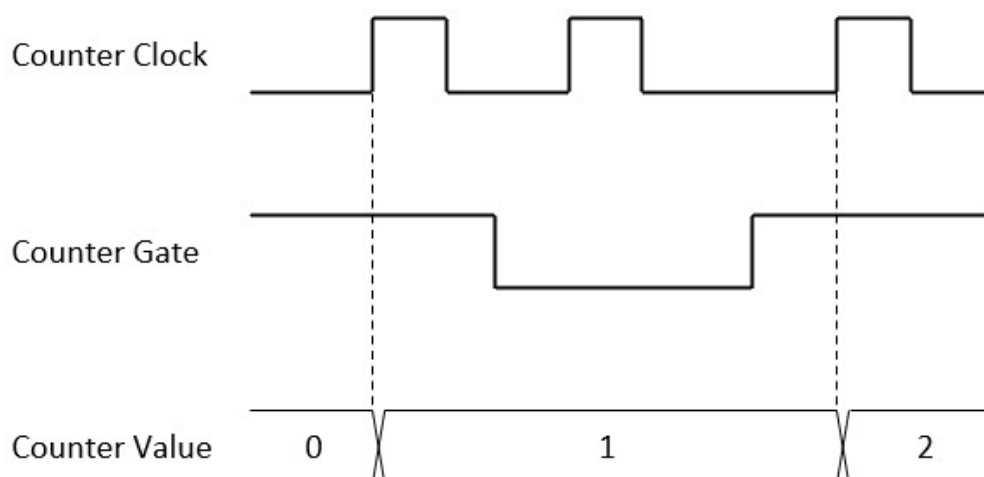


Figure 3.5 Event counting with pause gate

Instant (Software-Timed) Event Counting

With instant event counting, the software controls the rate and time of reading counter value, which is thus also called software-timed event counting. Whenever the software sends a read command, the current value of the counter is returned as shown in Figure 3. 6.

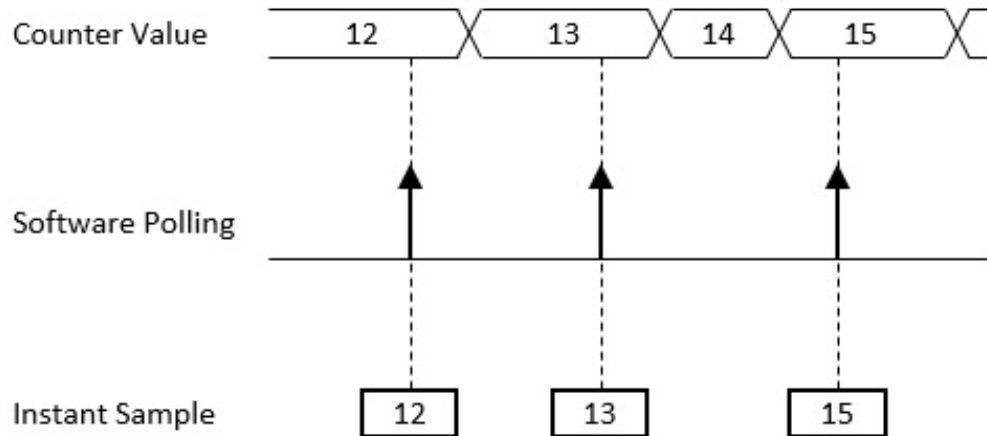


Figure 3.6 Instant (software-timed) event counting

The advantage of instant event counting is low latency. It is typically used for reading a single sample of counter value.

3.3.2 Frequency Measurement

In frequency measurement mode, the frequency of the counter clock signal is measured by one of the two measuring methods: Period inversion or counting number of pulses in fixed duration.

Period Inversion

In this method, the period of the counter clock signal is first measured by an internal high frequency clock. The frequency of the signal is then calculated by inverting the period value. This is shown in Figure 3. 7 and by the following equation.

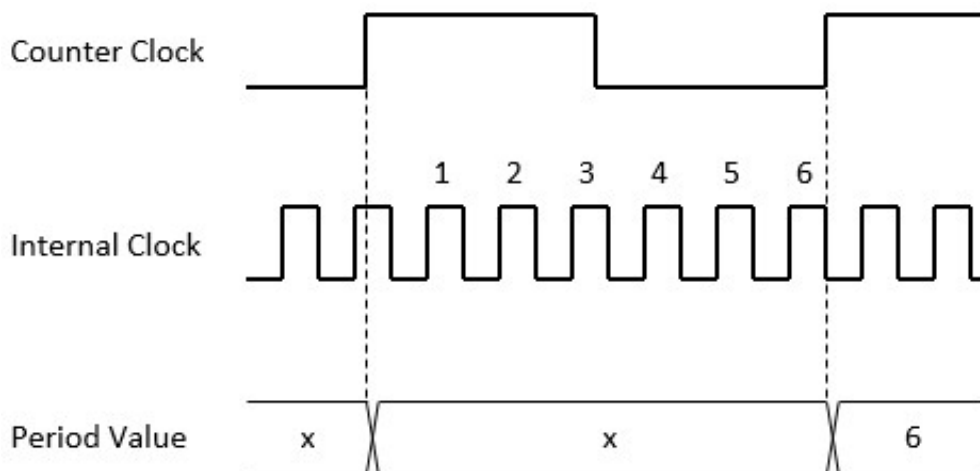


Figure 3.7 Frequency measurement by period inversion

$$Frequency = \frac{1}{Period} = \frac{1}{InternalClockCount \times InternalClockPeriod}$$

This method is suitable if the counter clock signal frequency is much smaller ($< 0.1\%$) than the internal clock frequency. Measuring accuracy degrades as the counter clock signal frequency increases.

Counting Number of Pulses in Fixed Duration

In this method, the pulse number of the counter clock signal is measured in a fixed time duration. The frequency of the signal is then calculated by dividing this number by the time duration. This is shown in Figure 3. 8 and by the following equation.

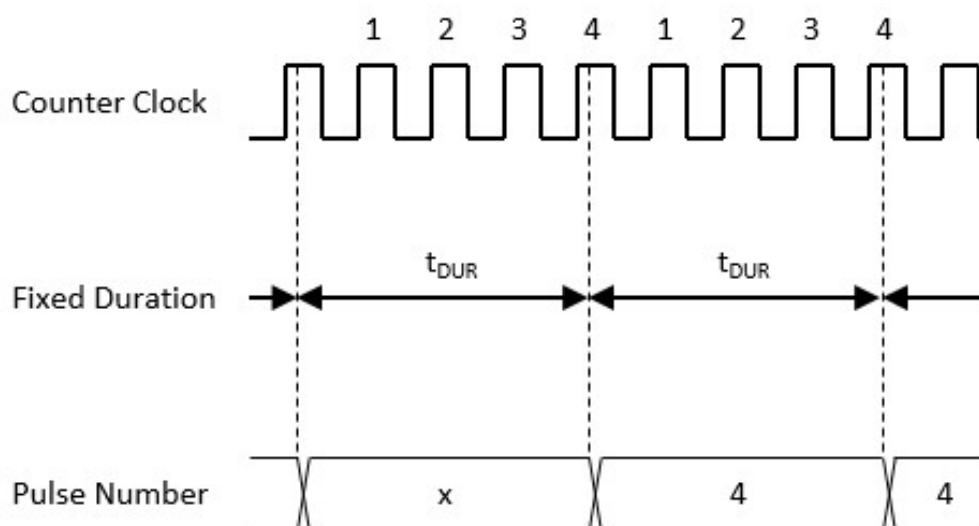


Figure 3.8 Frequency measurement by counting number of pulses in fixed duration

$$Frequency = \frac{PulseNumber}{t_{DUR}}$$

For counter clock signal frequency higher than that specified in the previous section, this method gives a more accurate result.

Instant (Software-Timed) Frequency Measurement

With instant frequency measurement, the software controls the rate and time of reading frequency value, which is thus also called software-timed frequency measurement. Whenever the software sends a read command, the current value of the frequency is returned as shown in Figure 3. 9.

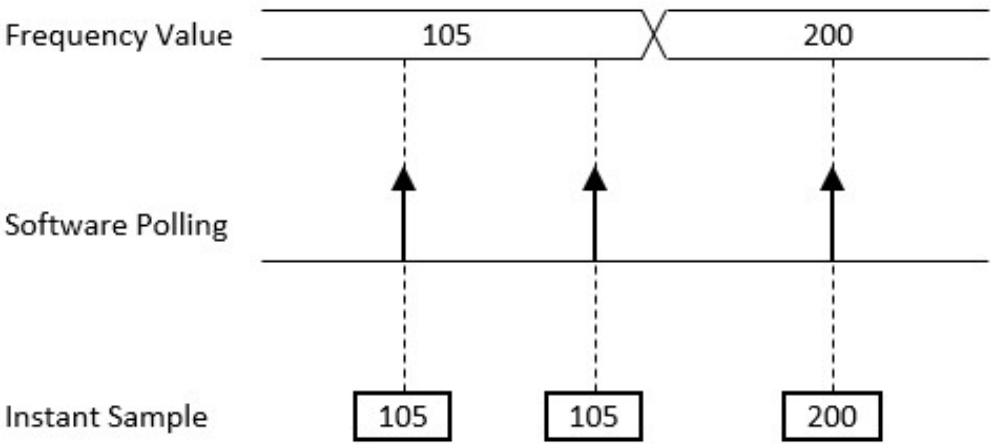


Figure 3.9 Instant (software-timed) frequency measurement

The advantage of instant frequency measurement is low latency. It is typically used for reading a single sample of frequency value.

3.3.3 Pulse Width Measurement

In pulse width measurement mode, both the high period and the low period of the counter clock signal are measured. The measured values are updated when a pulse is completed. This is shown in Figure 3. 10.

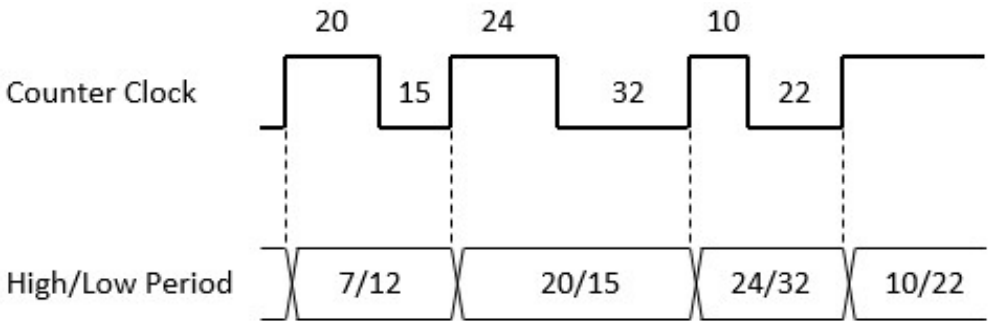


Figure 3.10 Pulse width measurement

Instant (Software-Timed) Pulse Width Measurement

With instant pulse width measurement, the software controls the rate and time of reading counter value, which is thus also called software-timed pulse width measurement. Whenever the software sends a read command, the current value of the counter is returned as shown in Figure 3. 11.

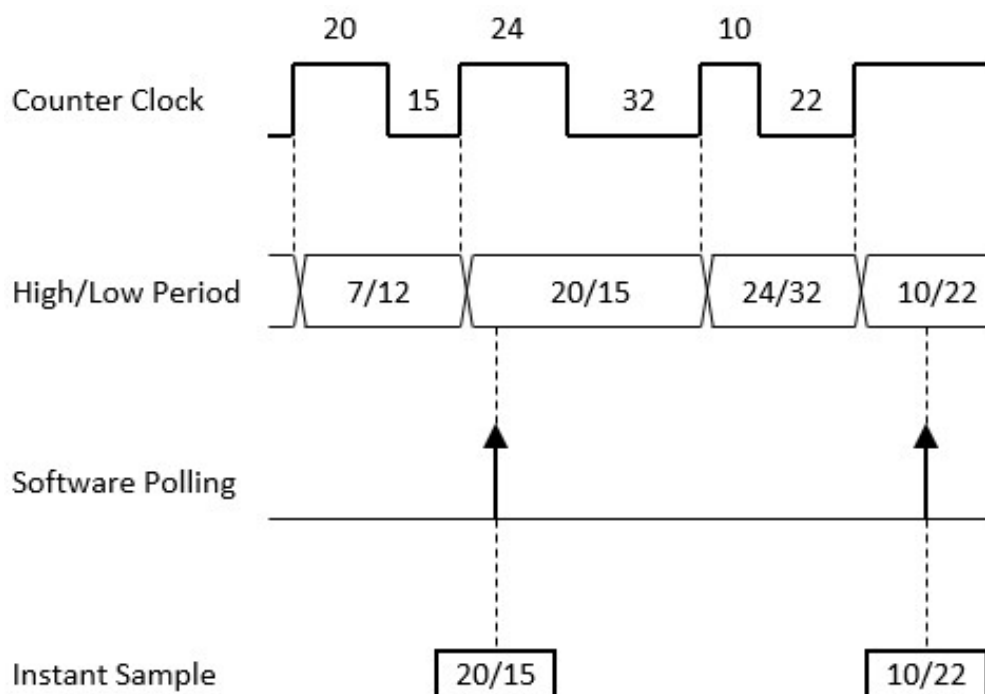


Figure 3.11 Instant (software-timed) pulse width measurement

The advantage of instant pulse width measurement is low latency. It is typically used for reading a single sample of counter value.

3.3.4 One-Shot (Delayed Pulse Generation)

In one-shot mode, when an active edge of gate signal is detected, a pulse will be generated after the specified number source clock counts. The pulse width is one period of source clock. Figure 3. 12 shows an example of high-pulse, 5-clock delay one-shot output.

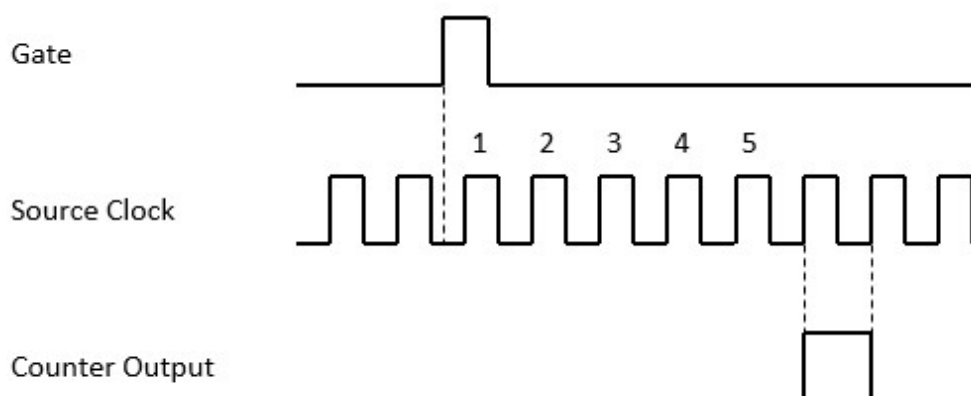


Figure 3.12 One-shot operation

3.3.5 Timer/Pulse

In timer/pulse mode, continuous pulses with specified frequency are generated at counter output terminal, and an interrupt is also generated with each pulse as shown in Figure 3. 13.

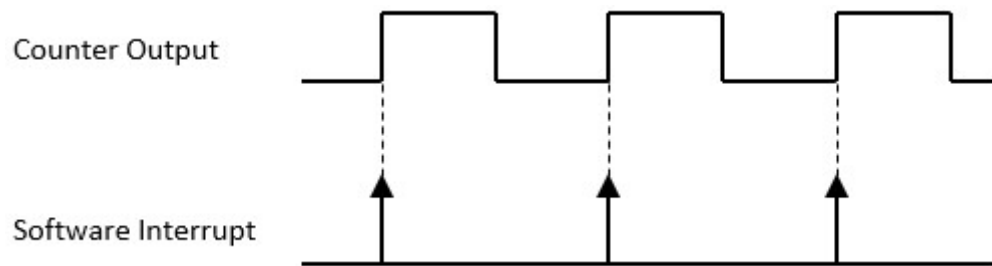


Figure 3.13 Pulse output and timer interrupt

The output can be gated. If counter gate is in active level, pulses are output normally. On the other hand, if counter gate is in inactive level, output is disabled. Figure 3. 14 shows an example of active high gate.

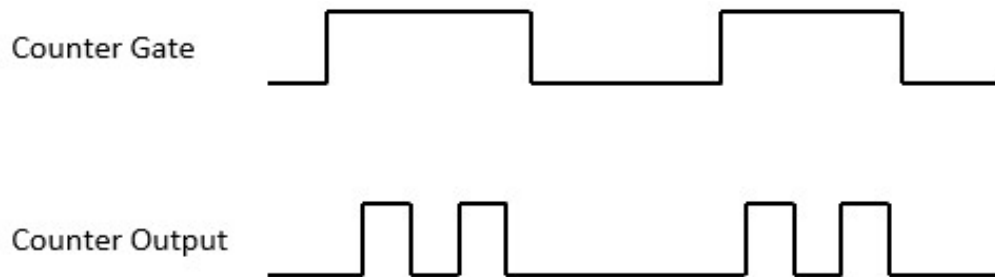


Figure 3.14 Gated timer/pulse output

Static (Software-Timed) Timer/Pulse

With static timer/pulse, the software controls the time of updating output pulse frequency, which is thus also called software-timed timer/pulse. Whenever the software sends an update command, the frequency of output pulse is updated to the specified value after current pulse is completed as shown in Figure 3. 15.

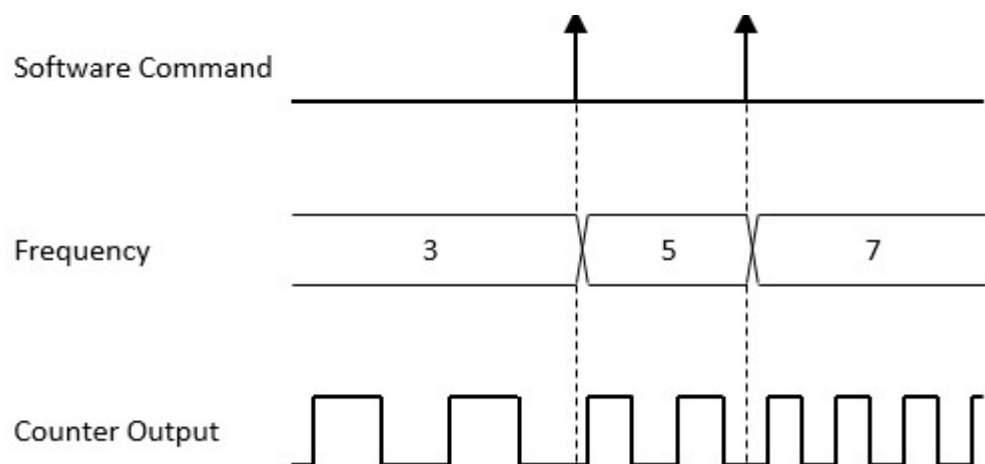


Figure 3.15 Static (software-timed) timer/pulse

3.3.6 Pulse Width Modulation Output

In pulse width modulation (PWM) output mode, a pulse waveform with specified high period (t_{HIGH}) and low period (t_{LOW}) is output at counter output terminal as shown in Figure 3. 16.

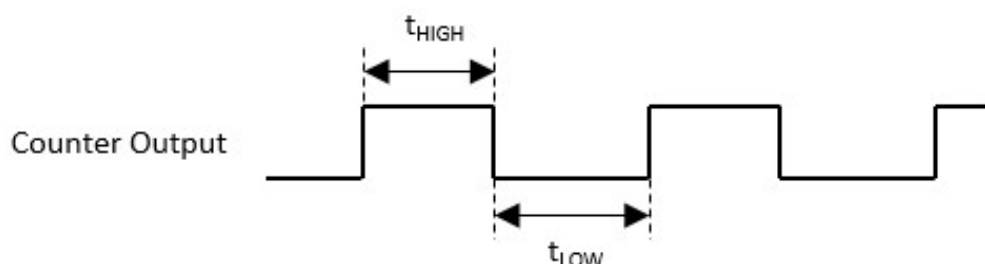


Figure 3.16 Pulse width modulation output

The number of pulses generated can be finite or infinite. For finite pulse generation, the counter output starts generating pulses when armed, and automatically stops after the specified number of pulses has completed. The counter can be re-armed after the previous generation is completed. This is shown in Figure 3. 17.

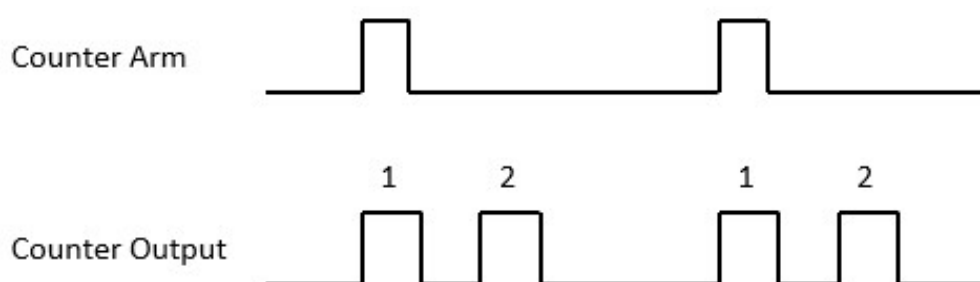


Figure 3.17 Finite pulse generation

For infinite pulse generation, the counter output starts generating pulses when armed and continues until stopped by software. This is shown in Figure 3. 18.

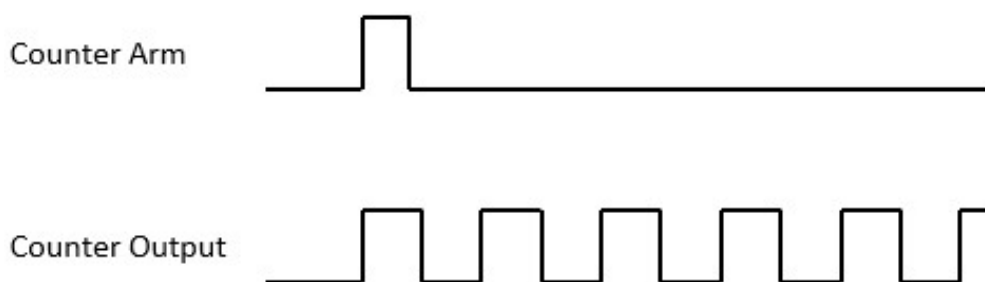


Figure 3.18 Infinite pulse generation

The output can be gated. If counter gate is high, pulses are output normally. On the other hand, if counter gate is low, output is disabled. This is shown in Figure 3. 19.

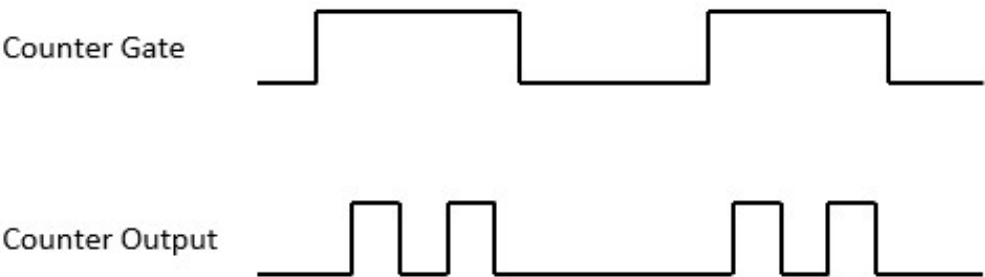


Figure 3.19 Gated pulse width modulation output

Static (Software-Timed) PWM Output

With static PWM output, the software controls the time of updating output pulse width, which is thus also called software-timed timer/pulse. Whenever the software sends an update command, the width of output pulse is updated to the specified value after current pulse is completed as shown in Figure 3. 20.

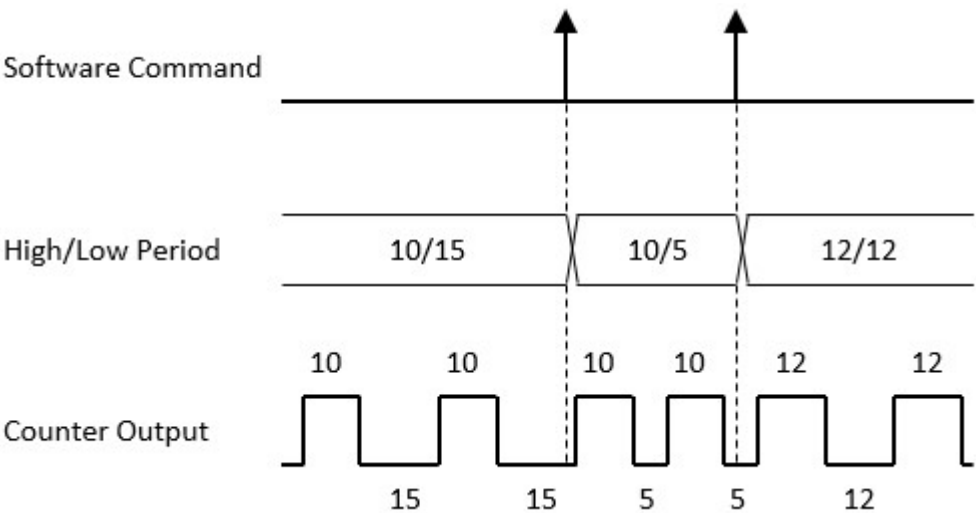


Figure 3.20 Static (software-timed) timer/pulse

Appendix **A**

Specifications

A.1 Function Block Diagram

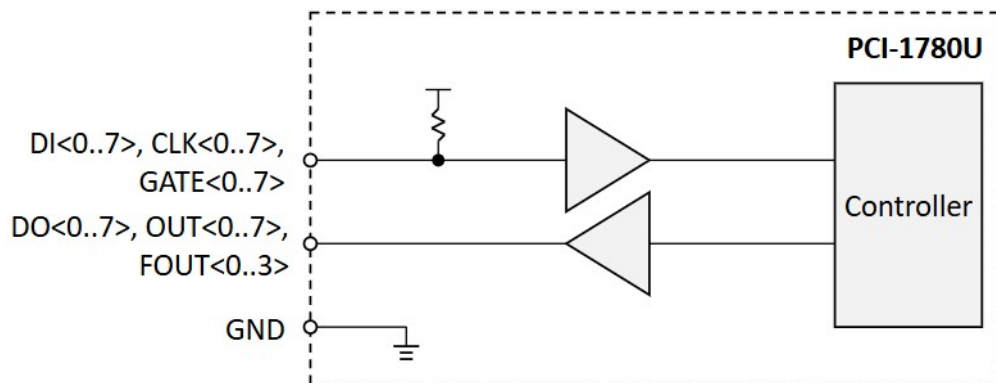


Figure A.1 Function Block

A.2 Digital Input

- **Channels:** 8 (1-port)
- **Acquisition type:** Instant
- **Interrupt:**
 - Supported channel: All channels
 - Edge detection: Rising edge, falling edge, or both edges, software configurable per channel
 - Pattern match detection: By port detection, each channel can be enabled/disabled and set to a high/low pattern independently by software
 - State Latch: The port state is latched when an interrupt occurs for that port

A.3 Digital Output

- **Channels:** 8 (1-port)
- **Power-on state:** Logic low
- **Update type:** Static
- **Initial output value:** Configurable by software. Value is stored in non-volatile memory, and is loaded and applied to output immediately after powering-on by the device.

A.4 Counter

- **Channels:** 8 (full function) + 4 (timer/pulse output only)
- **Resolution:** 32 bits
- **Max. Input Frequency:** 10 MHz
- **Max. Output Frequency:** 10 MHz
- **Debounce filter:** Enabled or disabled, software configurable per channel
- **Filter duration:** 400 ns ~ 104.86 ms, software configurable per port
- **Supported Functions:** Event Counter, Frequency Measurement, Pulse Width Measurement, One Shot, Timer/Pulse, Pulse Width Modulation

Measurement Functions

■ Event Counting

- Input frequency: 10 MHz max.
- Clock polarity: Rising edge or falling edge, software configurable
- Gate function: Enabled or disabled, software configurable
- Gate polarity: High active or low active, software configurable
- Measuring type: Instant

■ Frequency Measurement

- Measuring method: Counting pulse by system time, period inverse, or auto adaptive, software configurable
- Input frequency: 10 MHz max.
- Accuracy: 0.1% max.
- Timeout time: 25 ns ~ 107.3 s
- Measuring type: Instant

■ Pulse width measurement

- Pulse width range: 100 ns ~ 107.3 s
- Pulse width resolution: 25 ns
- Accuracy: 50 ppm
- Timeout time: 25 ns ~ 107.3 s
- Measuring type: Instant

Counter output function

■ One shot

- Internal clock source frequency: 20 MHz, 1 MHz, 100 kHz, 10 kHz, 1 kHz, software configurable
- Internal clock accuracy: 50 ppm
- External clock source frequency: 10 MHz max.
- Delay count: 1 ~ 4,294,967,295, software configurable
- Gate source: External or none, software configurable
- Gate polarity: Rising edge or falling edge, software configurable
- Output signal type: Positive pulse or negative pulse, software configurable
- Interrupt generation: Enabled or disabled, software configurable
- Generation type: Static

■ Timer/pulse

- Output frequency: 0.1 Hz ~ 10 MHz (allowable values are 40 MHz/n, where n is an integer larger than 3)
- Output frequency accuracy: 50 ppm
- Gate function: Enabled or disabled, software configurable
- Gate polarity: High active or low active, software configurable
- Output signal type: Positive pulse or negative pulse, software configurable
- Interrupt generation: Enabled or disabled, software configurable
- Generation type: Static

■ Pulse width modulation

- High/low period range: 100 ns ~ 107.3 s, software configurable
- Period resolution: 25 ns
- Period accuracy: 50 ppm
- Number of pulses: 1 ~ 4,294,967,295 or infinite, software configurable
- Gate function: Enabled or disabled, software configurable
- Gate polarity: High active or low active, software configurable
- Output signal type: Positive pulse or negative pulse, software configurable
- Generation type: Static

A.5 Electric Properties

Table A.1: Electric Property

Properties	DI	DO	CLK	GATE	OUT	FOUT	+5V
Direction	Input	Output	Input	Input	Output	Output	Output
Voltage	Compatibility	5 V TTL	5 V TTL	5 V TTL	5 V TTL	5 V TTL	5 V TTL
Range	High: 2.0 V min. Low: 0.8 V max.	High: 4.0 V min. @ 2 mA source/ 5.2 V max. Low: 0.4 V max. @ 2 mA sink	High: 2.0 V min. Low: 0.8 V max.	High: 2.0 V min. Low: 0.8 V max.	High: 4.0 V min. @ 2 mA source/5.2 V max. Low: 0.4 V max. @ 2 mA sink	High: 4.0 V min. @ 2 mA source/5.2 V max. Low: 0.4 V max. @ 2 mA sink	
Driving Capability		One channel: 8 mA max. Per port summed: 20 mA max.			8 mA max.	8 mA max.	200 mA max.
Working voltage	-0.25 V ~ 5.25 V		-0.25 V ~ 5.25 V	-0.25 V ~ 5.25 V			
Input Protection Voltage	-0.5 V ~ 6.5 V		-0.5 V ~ 6.5 V	-0.5 V ~ 6.5 V			
Pull-up/down resistor	Pull-up 10 kΩ	Pull-up 10 kΩ	Pull-up 10 kΩ	Pull-up 10 kΩ	Pull-up 10 kΩ	Pull-up 10 kΩ	
Debounce Filter	400 ns ~ 104.86 ms, software configurable per port		400 ns ~ 104.86 ms, software configurable per port	400 ns ~ 104.86 ms, software configurable per port			
Minimum width	100 ns		100 ns	100 ns			
Response Time	25 ns max.	25 ns max.					

Table A.2: Signal Connection

Pin	DI	DO	CLK	GATE	OUT	FOUT	+5V
Counter Functions	Event counting		V	V			
	Frequency measurement		V				
	Pulse width measurement			V			
	One shot			V	V		
	Timer/pulse			V	V		
	Static Timer/pulse					V	
	Pulse width modulation			V	V		

A.6 Power Consumption

- **Typical:** +5V @ 200mA
- **Max:** +5V @ 400mA

A.7 FPGA Code Update

- **FPGA code update function:** Yes, through Advantech Navigator utility

A.8 General

- **Form factor:** PCI Universal
- **Dimension:** 175 x 100 x 18 mm (6.9 x 3.9 x 0.7 in.)
- **Weight:** 98 g
- **I/O connector:** Female 68-Pin SCSI (D-Type)
- **Operating temperature:** 0°C to 60°C (32°F to 140°F)
- **Storage temperature:** -20°C to 70°C (-4°F to 158°F)
- **Operating humidity:** Up to 90% RH, non-condensing
- **Storage humidity:** Up to 95% RH, non-condensing
- **Power supply output:** +5 V (±5%) 200 mA max.

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