DATA TRANSLATION

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DT340 User's Manual

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Radio and Television Interference

This equipment has been tested and found to comply with CISPR EN55022 Class A and EN50082-1 (CE) requirements and also 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 which case the user will be required to correct the interference at his own expense.

Changes or modifications to this equipment not expressly approved by Data Translation could void your authority to operate the equipment under Part 15 of the FCC Rules.

Note: This product was verified to meet FCC requirements under test conditions that included use of shielded cables and connectors between system components. It is important that you use shielded cables and connectors to reduce the possibility of causing interference to radio, television, and other electronic devices.

Canadian Department of Communications Statement

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la class A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

Table of Contents

About this Manual

This manual describes how to set up and install the following components:

- DT340 software
- DT340 board
- DT340 Device Driver
- STP340 screw terminal panel

It describes how to wire signals to the board and how to verify the board's operation using the Quick DataAcq application.

This manual also describes the features of the DT340 board, the capabilities of the DT340 Device Driver, and how to program the DT340 board using DT-Open Layers for .NET Class Library™ software. Troubleshooting information is also provided.

Note: For information on checking system requirements, installing the software, and viewing the documentation, refer to the README file on the OMNI CD.

For more information on the class library, refer to the *DT-Open Layers for .NET Class Library User's Manual*. If you are using the DataAcq SDK or a software application to program your device, refer to the documentation for that software for more information.

Intended Audience

This document is intended for engineers, scientists, technicians, or others responsible for using and/or programming a DT340 board for data acquisition operations in Microsoft® Windows® XP, Windows Vista®, or Windows 7. It is assumed that you have some familiarity with data acquisition principles, and that you understand your application.

How this Manual is Organized

This manual is organized as follows:

- Chapter 1, "Overview," describes the major features of the board, as well as the supported software and accessories for the board. It provides an overview of the DT340 getting started procedure.
- Chapter 2, "Installing a DT340 Board and Loading the Device Driver," describes how to install the DT340 board and load the DT340 Device Driver.
- Chapter 3, "Attaching and Configuring the Screw Terminal Panel," describes how to configure the STP340 screw terminal panel.
- Chapter 4, "Wiring Signals," describes how to wire signals to a DT340 board.

- Chapter 5, "Verifying the Operation of a DT340 Board," describes how to verify the operation of a DT340 board with the Quick DataAcq application
- Chapter 6, "Principles of Operation," describes all of the board's features and how to use them in your application.
- Chapter 7, "Supported Device Driver Capabilities," lists the data acquisition subsystems and the associated features accessible using the DT340 Device Driver.
- Chapter 8, "Troubleshooting," provides information that you can use to resolve problems with the board and the device driver, should they occur.
- Appendix A, "Specifications," lists the specifications of the board.
- Appendix B, "Connector Pin Assignments," shows the pin assignments for the J1 connector on the DT340 board, on the STP340 screw terminal panel, and on the STP68 screw terminal panel.
- Appendix C, "Using Your Own Screw Terminal Panel," describes additional considerations to keep in mind when designing your own screw terminal panel for use with a DT340 board.
- An index completes this manual.

Conventions Used in this Manual

The following conventions are used in this manual:

- Notes provide useful information or information that requires special emphasis, cautions provide information to help you avoid losing data or damaging your equipment, and warnings provide information to help you avoid catastrophic damage to yourself or your equipment.
- Items that you select or type are shown in **bold**.

Related Information

Refer to the following documents for more information on using the DT340 board:

- *Measure Foundry Manual* (UM-19298) and online help. These documents describe how to use Measure Foundry™ to build drag-and-drop test and measurement applications for Data Translation® data acquisition devices.
- DT-Open Layers for .NET User's Manual (UM-22161). For programmers who are developing their own application programs using Visual C# or Visual Basic .NET, this manual describes how to use the DT-Open Layers for .NET Class Library to access the capabilities of Data Translation data acquisition devices.
- *DataAcq SDK User's Manual* (UM-18326). For programmers who are developing their own application programs using the Microsoft C compiler, this manual describes how to use the DT-Open Layers™ Data Acq SDK to access the capabilities of Data Translation data acquisition boards. This manual is included on the Data Acquisition OMNI CD.
- *DTx-EZ Getting Started Manual* (UM-15428). This manual describes how to use the ActiveX controls provided in DTx-EZ™ to access the capabilities of Data Translation data acquisition boards in Microsoft® Visual Basic™ or Visual C++.

- *LV-Link Online Help*. This help file describes how to use LV-Link™ with the LabVIEW™ graphical programming language to access the capabilities of Data Translation data acquisition devices.
- *PCI Specification:* PCI Local Bus Specification, PCI Special Interest Group, Portland, OR. (Revision 2.1, June 1, 1995).
- Microsoft Windows XP, Windows Vista, or Windows 7 documentation.

Where To Get Help

Should you run into problems installing or using a DT340 board, our Technical Support Department is available to provide prompt, technical assistance. Refer to Chapter 8 for more information. If you are outside the U.S. or Canada, call your local distributor, whose number is listed on our web site (www.datatranslation.com).

1

Overview

Features

The DT340 is a low-cost counter/timer and digital I/O board for the PCI bus. The DT340 consists of the following major features:

- Eight 16-bit counter/timers programmable for event counting, frequency measurement, rate generation (continuous pulse output), one-shot pulse output, and repetitive one-shot pulse output
- Four 24-bit interval timers
- Interrupt capability for each counter/timer and interval timer (interrupts can be individually enabled for the eight counter/timers, and are always enabled for the four interval timers)
- Programmable gate types
- Programmable pulse output polarities (output types) and duty cycles
- Four 8-bit digital ports programmable as inputs or outputs on a per-port basis
- Digital outputs capable of driving external solid-state relays (15 mA)
- Change on interrupt capability for one 8-bit digital port

For a discussion of these features in detail, refer to Chapter 6 starting on page 59.

Supported Software

The following software is available for use with the DT340 board and is shipped on the Data Acquisition OMNI CD:

- **DT340 Device Driver –** The device driver is installed automatically when you install the software from the Data Acquisition OMNI CD. You need the device driver to use the DT340 board with any of the supported software packages or utilities.
- **The Quick DataAcq application –** This application provides a quick way to get a DT340 board up and running. Using the Quick DataAcq application, you can verify the features of the board, display data on the screen, and save data to disk.
- **Measure Foundry –** An evaluation version of this software is included on the Data Acquisition OMNI CD. Measure Foundry is drag-and-drop test and measurement application builder designed to give you top performance with ease-of-use development. Order the full development version of this software package to develop your own application using real hardware.
- **DT-Open Layers for .NET Class Library** – Use this class library if you want to use Visual C# or Visual Basic for .NET to develop your own application software for the DT340 board using Visual Studio 2003 or Visual Studio 2005; the class library complies with the DT-Open Layers standard.
- **DataAcq SDK** – Use the Data Acq SDK if you want to use Visual Studio 6.0 and Microsoft C or C++ to develop your own application software for the DT340 board using Windows XP, Windows Vista, or Windows 7; the DataAcq SDK complies with the DT-Open Layers standard.
- **DTx-EZ –** DTx-EZ provides ActiveX controls, which allow you to access the capabilities of the DT340 boards using Microsoft Visual Basic or Visual C++; DTx-EZ complies with the DT-Open Layers standard.
- **LV-Link –** An evaluation version of LV-Link is included on the Data Acquisition OMNI CD. Use LV-Link if you want to use the LabVIEW graphical programming language to access the capabilities of the DT340 boards.

Refer to the Data Translation web site (www.datatranslation.com) for information about selecting the right software package for your needs.

Accessories

The following optional accessories are available for the DT340 board:

- **STP340 screw terminal panel –** A screw terminal panel designed specifically for the DT340 board, and used in the CE configuration of the board. It measures 3 15/16 inches by 3 15/16 inches (100 mm x 100 mm), and has one connector to accommodate the counter/timer and digital I/O signals provided by the DT340 board.
- **STP68 screw terminal panel –** A generic, 68-pin screw terminal panel that has one connector to accommodate the counter/timer and digital I/O signals provided by the DT340 board.
- **EP305 cable –** A 2-meter, twisted-pair, shielded cable that connects the 68-pin connector (J1) on the DT340 board to the J1 connector on the STP340 or STP68 screw terminal panel.
- **STP340 shielded box –** A shielded box for use with the STP340 screw terminal panel. The box measures 5.28 inches by 5.31 inches by 1.96 inches (134 mm x 135 mm x 50 mm). The aluminum end plates measure 5.04 inches by 1.77 inches by 0.064 inches (128 mm x 45 mm x 1.6 mm). The part number for the box is 1598RBGY (gray) or 1598RBBK (black). You can purchase this box from Hammond Manufacturing directly, using the following information:

  Hammond Manufacturing Co, Ltd.
  394 Edinburgh Road North
  Guelph, Ontario N1H 1E5 Canada
  Phone: (519) 822-2960 Canada; (716) 631-5700 USA
  Web address: www.hammondmfg.com

Getting Started Procedure

The flow diagram shown in Figure 1 illustrates the steps needed to get started using a DT340 board. This diagram is repeated in each getting started chapter; the shaded area in the diagram shows you where you are in the getting started procedure.

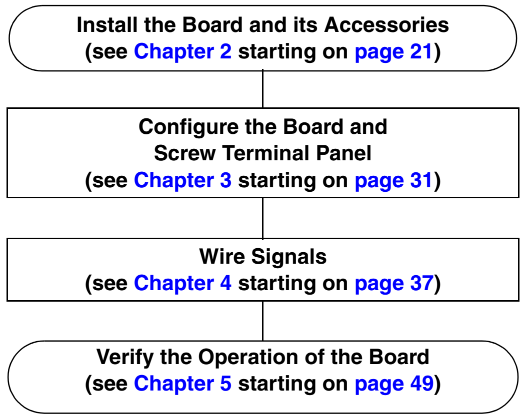
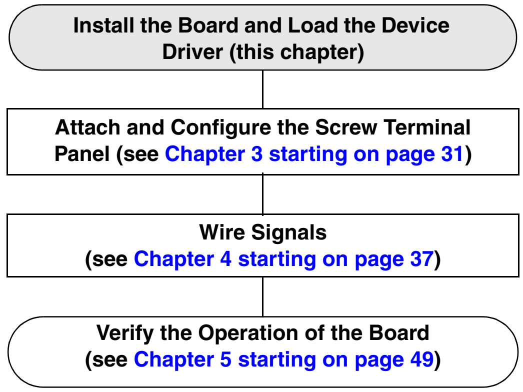


Figure 1: Getting Started Flow Diagram

Part 1: Getting Started

2

Installing a DT340 Board and Loading the Device Driver



Note: All DT340 boards are factory-calibrated and require no further adjustment prior to installation.

Unpacking

Open the shipping box and remove the wrapped DT340 board.

CAUTION:

Keep the board in its protective antistatic bag until you are ready to install it; this minimizes the likelihood of electrostatic damage.

Verify that the following items are present:

- DT340 data acquisition board
- Data Acquisition OMNI CD

If an item is missing or damaged, contact Data Translation. If you are in the United States, call the Customer Service Department at (508) 481-3700, ext 1323. An application engineer will guide you through the appropriate steps for replacing missing or damaged items. If you are located outside the United States, call your local distributor, listed on Data Translation's web site (www.datatranslation.com).

Setting up the Computer

> **CAUTION:**
>
> **To prevent electrostatic damage that can occur when handling electronic equipment, use a ground strap or similar device when performing this installation procedure.**

To set up the computer, do the following:

1. Install the software from the Data Acquisition OMNI CD or Data Translation web site.

Note: If you are using Windows 7, you **must** install the device driver before installing the board in the computer.

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2. Turn off the computer.
3. Turn off all peripherals (printer, modem, monitor, and so on) connected to the computer.
4. Unplug the computer and all peripherals.
5. Remove the cover from you computer. Refer to your computer's user manual for instructions.

Setting up an Expansion Slot

Once you have set up the computer, set up an expansion slot as follows:

1. Select a 32-bit or 64-bit PCI expansion slot.

   PCI slots are shorter than ISA or EISA slots and are usually white or ivory. Commonly, three PCI slots (one of which may be a shared ISA/PCI slot) are available. If an ISA board exists in the shared slot, you cannot use the slot for a PCI board; if a PCI board exists in the shared slot, you cannot use the slot for an ISA board.

2. Remove the cover plate from the selected expansion slot. Retain the screw that held it in place; you will use it later to install the board.

Configuring the DT340 Board

The DT340 board has eight resistor locations that correspond to the eight clock input signals on the board. Figure 2 shows the location of the resistors on the DT340 board.

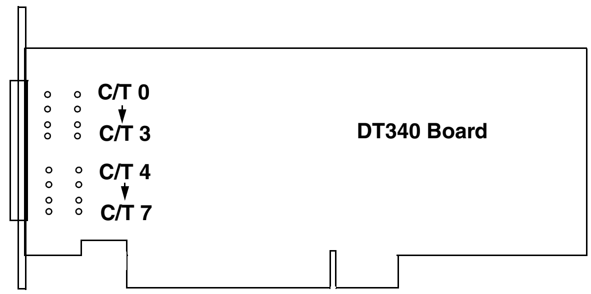

Figure 2: User-Resistor Locations on the DT340 Board

Table 1 lists the clock input signals and the resistors to which they correspond.

Table 1: Clock Input Signals and Resistor Use

Clock Input Signal	Resistor
Clock Input 0	R1
Clock Input 1	R2
Clock Input 2	R3
Clock Input 3	R4
Clock Input 4	R5
Clock Input 5	R6
Clock Input 6	R7
Clock Input 7	R8

If you are using high-frequency external clock input signals (greater than 1 MHz), do the following:

1. Insert a resistor to ground for the corresponding counter/timer clock input signal on the DT340 board. This resistor is used in parallel with the 1 kΩ resistor on the board. The appropriate value for the user-supplied resistor depends on your application, the frequency of the clock input signal, and the cable length.

Note: When using clock sources greater than 1 MHz, it is recommended that you use counter/timers 0 to 3. This is the CE configuration of the board.

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2. Terminate the corresponding signal on the STP340 panel by replacing the 0 Ω resistor on the STP340 with a resistor of an appropriate matching value (page 34 for more information).

For example, if you are connecting an external clock signal to clock input signal 0 on the DT340 board and running the board at its maximum clock input frequency, it is recommended that you insert a 110 Ω resistor to ground on the board for the clock input signal 0, and replace the 0 Ω resistor in location R1 on the STP340 panel with a 100 Ω resistor for proper termination.

Inserting the Board into the Computer

Once you have set up an expansion slot and configured the DT340 board, do the following to insert the DT340 board into the computer:

1. Discharge any static electricity by holding the wrapped board in one hand while placing your other hand firmly on a metal portion of the computer chassis.
2. Carefully remove the antistatic packing material from the board. (Save the original packing material in the unlikely event that your board requires servicing in the future.)
3. Hold the board by its edges and do not touch any of the components on the board.
4. Position the board so that the cable connectors are facing the rear of the computer, as shown in Figure 3.

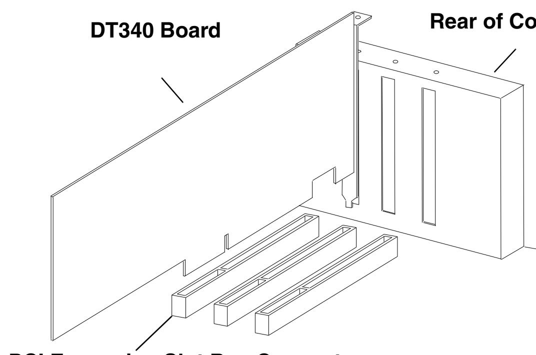


Figure 3: Inserting the DT340 Board in the Computer

5. Carefully lower the board into the PCI expansion slot using the card guide to properly align the board in the slot.
6. When the bottom of the board contacts the bus connector, gently press down on the board until it clicks into place.

CAUTION:

Do not force the board into place. Moving the board from side to side during installation may damage the bus connector. If you encounter resistance when inserting the board, remove the board and try again.

7. Secure the board in place at the rear panel of the system unit using the screw removed from the slot cover.
8. Power up the computer.
   If you installed the DT340 software, the DT340 device driver is loaded automatically. If you have not installed the software, do so now.

Loading the Device Driver

To load the DT340 Device Driver in

- Windows XP, follow the steps on page 29.
- Windows Vista, follow the steps on page 29.
- Windows 7, follow the steps on page 30.

Windows XP

Once you have installed the software from the Data Acquisition OMNI CD, installed a DT340 board, and powered up the host computer, the New Hardware Found dialog box appears. Do the following to load the device driver in Windows XP:

1. Click **Next**.
2. Click **Search for a suitable driver for my device (recommended)**.
3. Click **Specify a location**, and click **Next**.
4. Browse to Windows\Inf\DT340.Inf, and then click **Open**.
5. Click **OK**.
6. Click **Next**.
   The files are copied.
7. Click **Finish**.
8. Open the Control Panel.
9. Double-click the **Open Layers Control Panel** icon.
10. Select the DT340 board to configure, and then click **Advanced**.
11. Select the appropriate boxes to enable interrupts for lines (bits) 0 to 7 on digital port D, user counter/timers 0 to 7, and interval timers 8 to 11.
12. When you are finished, click **Close.**
13. If you wish to change the name of the board, click **Edit Name** and enter a new name for the board. Otherwise, exit from the Control Panel.

Once the driver is loaded, perform the steps in Chapter 3 to attach and configure the screw terminal panel for use with the DT340 board.

Windows Vista

Once you have installed the software from the Data Acquisition OMNI CD, installed a DT340 board, and powered up the host computer, the New Hardware Found dialog box appears. Do the following to load the device driver in Windows Vista:

1. Click **Locate and install driver software (recommended)**.
   The popup message "Windows needs your permission to continue" appears.
2. Click **Continue**.
   The Windows Security dialog box appears.

3. Click **Install this driver software anyway**.
   The driver files are installed.
4. Open the Control Panel.
5. Double-click the **Open Layers Control Panel** icon.
6. Select the DT340 board to configure, and then click **Advanced**.
7. Select the appropriate boxes to enable interrupts for lines (bits) 0 to 7 on digital port D, user counter/timers 0 to 7, and interval timers 8 to 11.
8. When you are finished, click **Close.**
9. If you wish to change the name of the board, click **Edit Name** and enter a new name for the board. Otherwise, exit from the Control Panel.

Once the driver is loaded, perform the steps in Chapter 3 to attach and configure the screw terminal panel for use with the DT340 board.

Windows 7

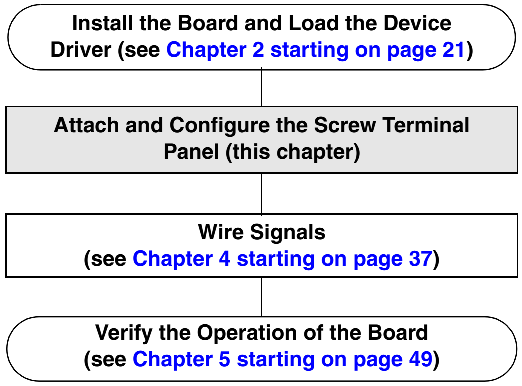
Once you have installed the software from the Data Acquisition OMNI CD, installed a DT340 board, and powered up the host computer, the hardware is found automatically. Perform the following steps to configure the device driver.

1. Open the Control Panel.
2. Double-click the **Open Layers Control Panel** icon.
3. Select the DT340 board to configure, and then click **Advanced**.
4. Select the appropriate boxes to enable interrupts for lines (bits) 0 to 7 on digital port D, user counter/timers 0 to 7, and interval timers 8 to 11.
5. When you are finished, click **Close.**
6. If you wish to change the name of the board, click **Edit Name** and enter a new name for the board. Otherwise, exit from the Control Panel.

Once the driver is loaded, perform the steps in Chapter 3 to attach and configure the screw terminal panel for use with the DT340 board.

3

Attaching and Configuring the Screw Terminal Panel


Install the Board and Load the Device Driver (see Chapter 2 starting on page 21)
Attach and Configure the Screw Terminal Panel (this chapter)
Wire Signals (see Chapter 4 starting on page 37)
Verify the Operation of the Board (see Chapter 5 starting on page 49)

Attaching the STP340 Screw Terminal Panel

Connector J1 on the screw terminal panel provides all of the digital and counter/timer signals from connector J1 on the DT340 board. Cable EP305 connects connector J1 on the screw terminal panel to the DT340 board.

Figure 4 illustrates how to attach the STP340 screw terminal panel to the DT340 board.

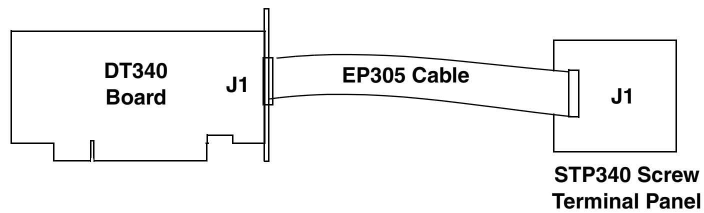


Figure 4: Attaching the STP340 Screw Terminal Panel to the DT340 Board

Configuring the STP340

The STP340 screw terminal panel has eight resistor locations which correspond to the eight clock input signals. Figure 5 shows the location of the resistors on the STP340 screw terminal panel.

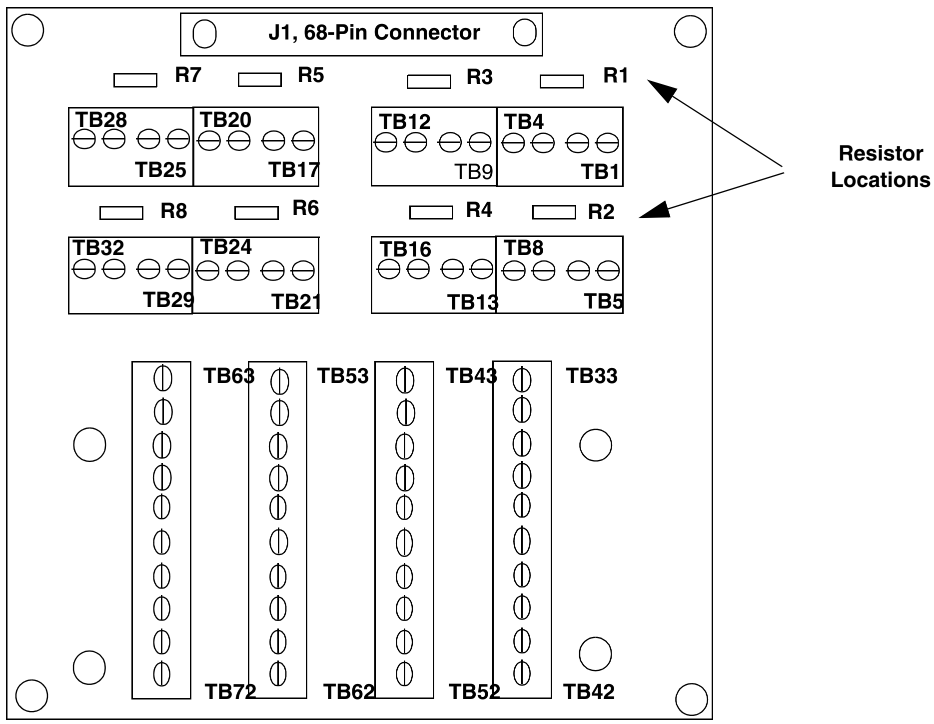


Figure 5: Resistor Locations on the STP340 Screw Terminal Panel

Table 2 lists the clock input signals and the resistors to which they correspond.

Table 2: Clock Input Signals and Resistor Use

Clock Input Signal	Resistor
Clock Input 0	R1
Clock Input 1	R2
Clock Input 2	R3
Clock Input 3	R4
Clock Input 4	R5
Clock Input 5	R6
Clock Input 6	R7
Clock Input 7	R8

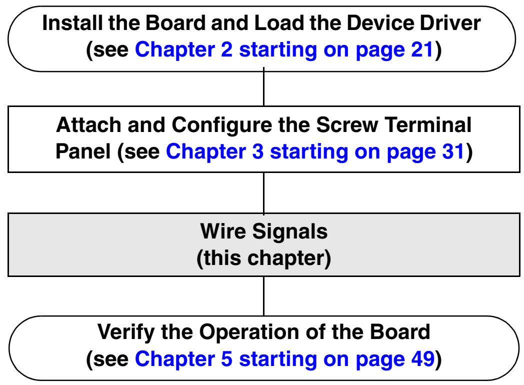
By default, the STP340 is shipped with 0 Ω resistors in these resistor locations.

If you changed the resistor values on the board (), ensure that you terminate the corresponding signal on the STP340 panel by replacing the 0 Ω resistor on the STP340 with a resistor of an appropriate matching value.

For example, if you are connecting an external clock signal to clock input signal 0 on the DT340 board and running the board at its maximum clock input frequency, it is recommended that you insert a 110 Ω resistor to ground on the board for the clock input signal 0, and replace the 0 Ω resistor in location R1 on the STP340 panel with a 100 Ω resistor for proper termination.

4

Wiring Signals



This chapter describes how to wire signals to the STP340 screw terminal panel.

Note: If you are using a screw terminal panel other than the STP340, refer to page 115 for additional wiring considerations.

Before Wiring

This section describes wiring recommendations and the pin assignments of the STP340 screw terminal panel.

Wiring Recommendations

Keep the following recommendations in mind when wiring signals to the STP340 screw terminal panel:

- Follow standard ESD procedures when wiring signals to the board.
- When using clock sources greater than 1 MHz, use counter/timers 0 to 3. This is the CE configuration of the board.
- Use individually shielded twisted-pair wire (size 14 to 26 AWG) when using the DT340 board in highly noisy electrical environments.
- Separate power and signal lines by using physically different wiring paths or conduits.
- To avoid noise, do not locate the STP340 screw terminal panel and cabling next to sources that produce high electro-magnetic fields, such as large electric motors, power lines, solenoids, and electric arcs, unless the signals are enclosed in a mumetal shield.
- Connect the shields to one end only (either at the STP340 or at the signal source).

STP340 Screw Terminal Assignments

Table 3 lists the screw terminal assignments for the STP340 screw terminal panel.

Table 3: Screw Terminal Assignments on the STP340 Screw Terminal Panel

TB	J1 Pin	Signal Description	TB	J1 Pin	Signal Description
1	68	Digital Ground	2	67	C/T Clock Input 0
3	66	C/T Clock Output 0	4	65	C/T Gate Input 0
5	34	Digital Ground	6	33	C/T Clock Input 1
7	32	C/T Clock Output 1	8	31	C/T Gate Input 1
9	64	C/T Gate Input 2	10	63	C/T Clock Output 2
11	62	C/T Clock Input 2	12	61	Digital Ground
13	30	C/T Gate Input 3	14	29	C/T Clock Output 3
15	28	C/T Clock Input 3	16	27	Digital Ground
17	42	Digital Ground	18	41	C/T Clock Input 4
19	40	C/T Clock Output 4	20	39	C/T Gate Input 4
21	8	Digital Ground	22	7	C/T Clock Input 5
23	6	C/T Clock Output 5	24	5	C/T Gate Input 5

Table 3: Screw Terminal Assignments on the STP340 Screw Terminal Panel (cont.)

TB	J1 Pin	Signal Description	TB	J1 Pin	Signal Description
25	38	C/T Gate Input 6	26	37	C/T Clock Output 6
27	36	C/T Clock Input 6	28	35	Power Ground
29	4	C/T Gate Input 7	30	3	C/T Clock Output 7
31	2	C/T Clock Input 7	32	1	+5 V Output
33	-	Shield	34	60	Digital I/O Port A, Line 0
35	26	Digital I/O Port A, Line 1	36	59	Digital I/O Port A, Line 2
37	25	Digital I/O Port A, Line 3	38	58	Digital I/O Port A, Line 4
39	24	Digital I/O Port A, Line 5	40	57	Digital I/O Port A, Line 6
41	23	Digital I/O Port A, Line 7	42	56	Digital Ground
43	-	Shield	44	55	Digital I/O Port B, Line 0
45	21	Digital I/O Port B, Line 1	46	54	Digital I/O Port B, Line 2
47	20	Digital I/O Port B, Line 3	48	53	Digital I/O Port B, Line 4
49	19	Digital I/O Port B, Line 5	50	52	Digital I/O Port B, Line 6
51	18	Digital I/O Port B, Line 7	52	22	Digital Ground
53	-	Shield	54	51	Digital I/O Port C, Line 0
55	17	Digital I/O Port C, Line 1	56	50	Digital I/O Port C, Line 2
57	16	Digital I/O Port C, Line 3	58	49	Digital I/O Port C, Line 4
59	15	Digital I/O Port C, Line 5	60	48	Digital I/O Port C, Line 6
61	14	Digital I/O Port C, Line 7	62	47	Digital Ground
63	-	Shield	64	46	Digital I/O Port D, Line 0
65	12	Digital I/O Port D, Line 1	66	45	Digital I/O Port D, Line 2
67	11	Digital I/O Port D, Line 3	68	44	Digital I/O Port D, Line 4
69	10	Digital I/O Port D, Line 5	70	43	Digital I/O Port D, Line 6
71	9	Digital I/O Port D, Line 7	72	13	Digital Ground

Connecting Counter/Timer Signals

The DT340 board with the STP340 screw terminal panel provides user counter/timers that you can use to perform the following operations:

- Event counting
- Frequency measurement
- Pulse output (rate generation, one-shot, and repetitive one-shot)

Connecting Event Counting Signals

Figure 6 shows one example of connecting event counting signals to the STP340 screw terminal panel using user counter 0. In this example, rising clock edges are counted while the gate is active.

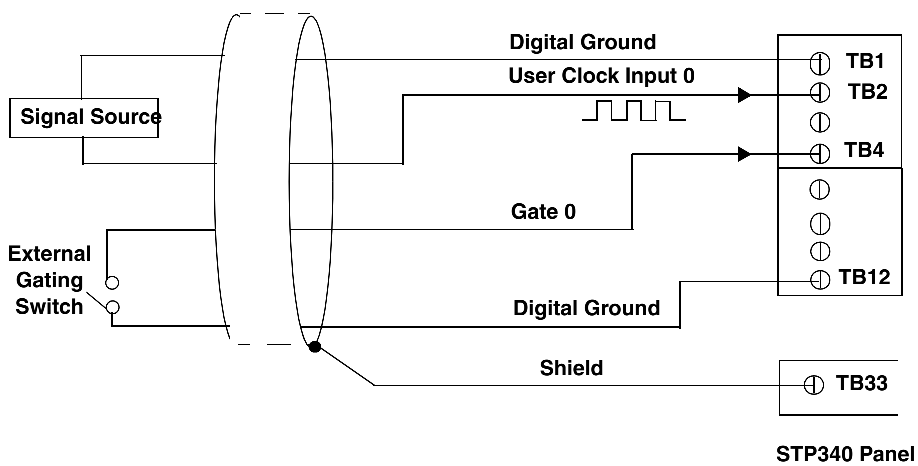


Figure 6: Connecting Event Counting Applications to the STP340 Screw Terminal Panel (Shown for Clock Input 0 and External Gate 0)

Figure 7 shows another example of connecting an event counting application to the STP340 screw terminal panel using user counter 0. In this example, a software gate is used to start the event counting operation.

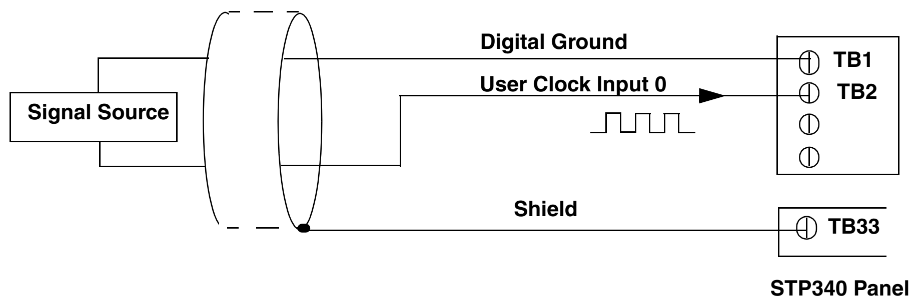


Figure 7: Connecting Event Counting Applications to the STP340 Screw Terminal Panel without an External Gate Input (Shown for Clock Input 0)

Figure 8 shows an example of how to externally cascade two counters to perform an event counting operation using user counters 0 and 2. Note that you can also internally cascade counters using software; if you internally cascade the counters, you do not have to make the external cascading connections. Note also that this example shows the use of an external gate; however, this connection is not required.

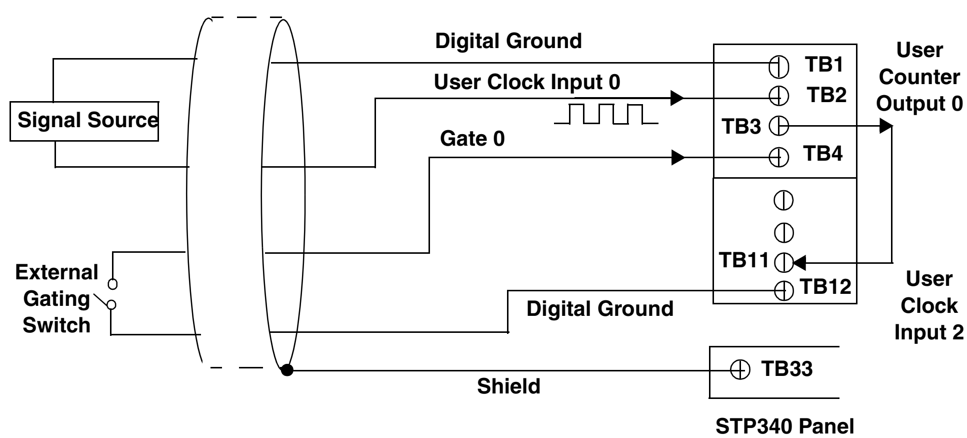


Figure 8: Cascading Counters (Shown for Event Counting Using Counters 0 and 2 and External Gate 0

Connecting Frequency Measurement Signals

This section shows two examples of how to connect a frequency measurement application to the STP340 screw terminal panel.

The first configuration uses the same wiring as an event counting application that does not use an external gate signal (see Figure 7 on page 42); the software uses the Windows timer to specify the duration of the frequency measurement. In this configuration, the frequency of the clock input is the number of counts divided by the duration of the Windows timer.

If you need more accuracy than the Windows timer provides, you can connect a pulse of a known duration (such as a one-shot output of another user counter) to the external gate input, as shown in Figure 9. In this configuration, the frequency of the clock input is the number of counts divided by the period of the external gate input.

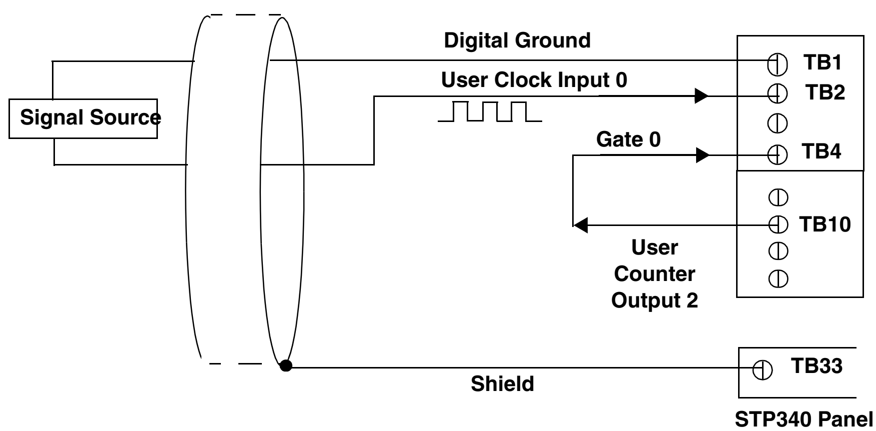


Figure 9: Connecting Frequency Measurement Applications to the STP340 Screw Terminal Panel (Shown for Clock Input 0 and External Gate 0)

Connecting Pulse Output Signals

Figure 10 shows one example of connecting a pulse output application to the STP340 screw terminal panel using user counter 0. Other combinations of signals can be used.

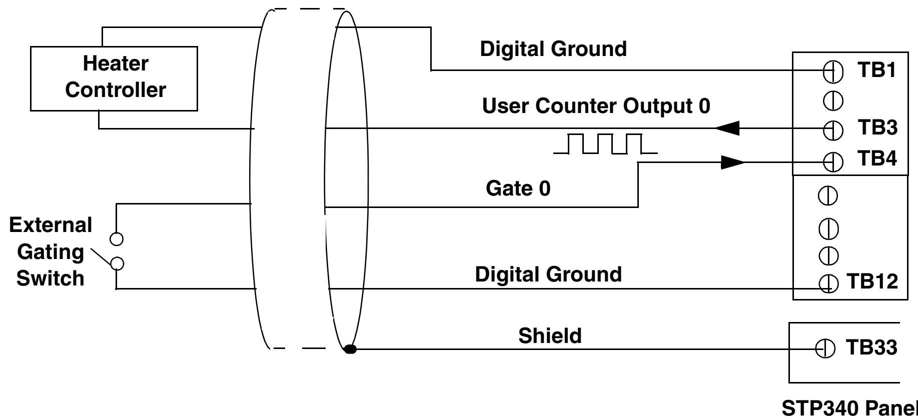


Figure 10: Connecting Pulse Output Applications to the STP340 Screw Terminal Panel (Shown for Counter Output 0 and Gate 0)

Figure 11 shows an example of how to externally cascade two counters to perform a rate generation operation using user counters 0 and 2. Note that you can also internally cascade counters using software; if you internally cascade the counters, you do not have to make the external cascading connections. In this example, counter 2 gate is logic high.

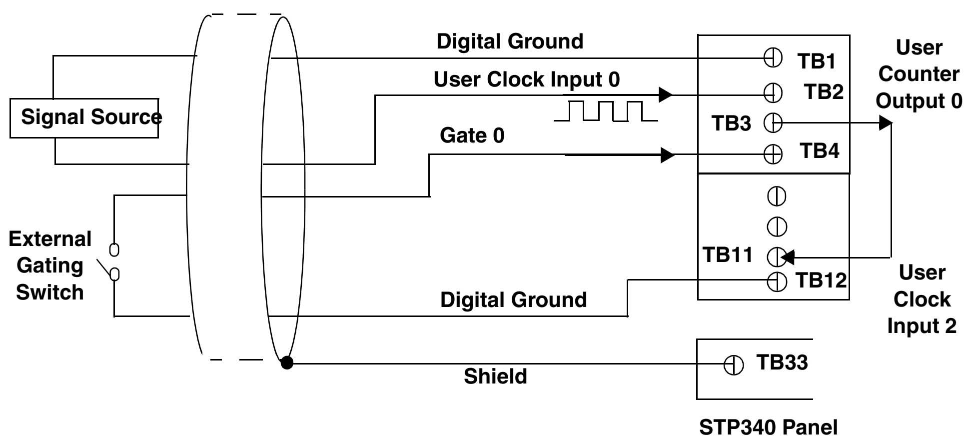


Figure 11: Cascading Counters (Shown for Rate Generation Using Counters 0 and 2 and External Gate 0)

Figure 12 shows an example of how to externally cascade two counters to perform a one-shot operation using user counters 0 and 2. Note that you can also internally cascade counters using software; if you internally cascade the counters, you do not have to make the external cascading connections. In this example, counter 0 gate is logic high.

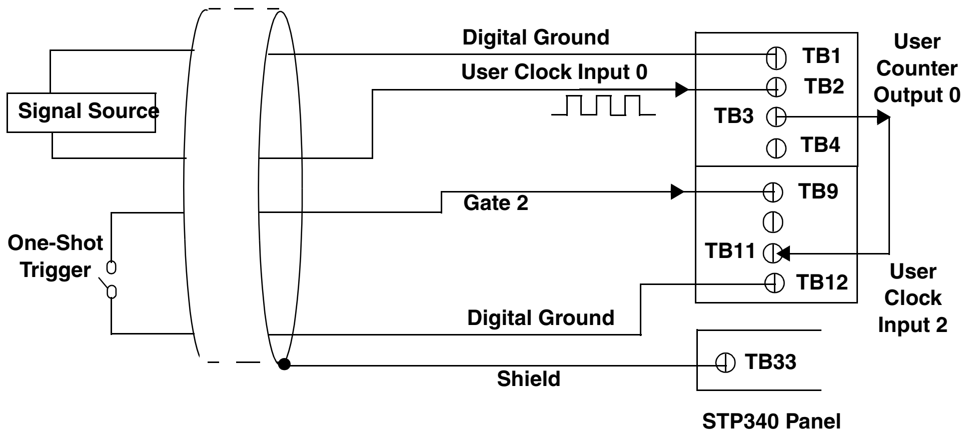


Figure 12: Cascading Counters (Shown for One-Shot Using Counters 0 and 2 and External Gate 2)

Connecting Digital Input Signals

Figure 13 shows how to connect a digital input signal (lines 0 and 1 of digital Port A, in this case) to the STP340 screw terminal panel.

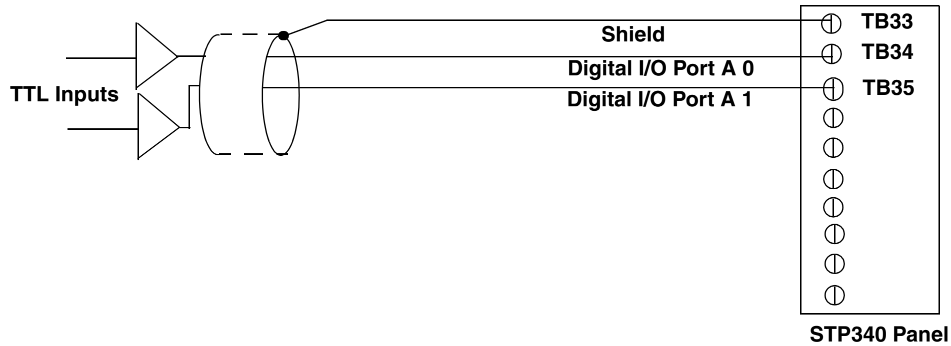


Figure 13: Connecting Digital Inputs to the STP340 Screw Terminal Panel (Lines 0 and 1, Port A Shown)

Connecting Digital Output Signals

Figure 14 shows how to connect a digital output signal (line 0 of digital Port B, in this case) to the STP340 screw terminal panel.

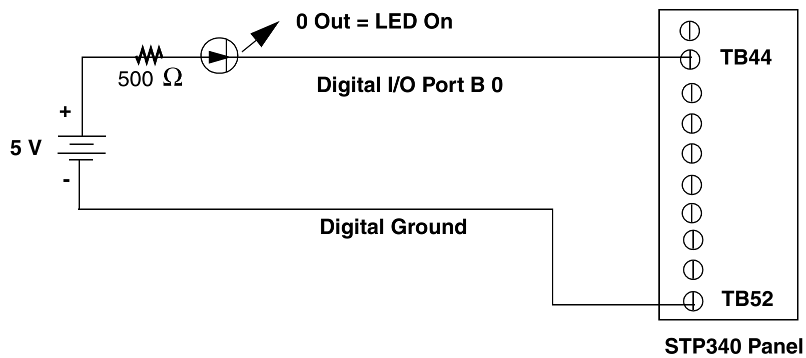
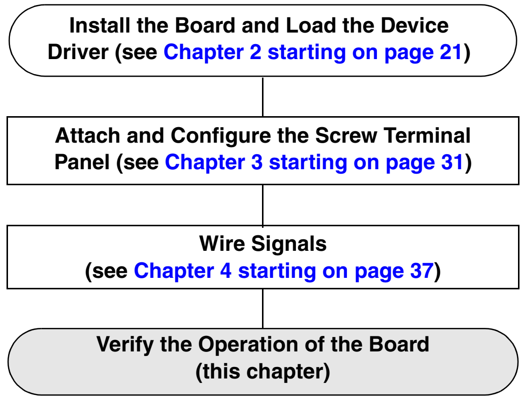


Figure 14: Connecting Digital Outputs to the STP340 Screw Terminal Panel (Line 0, Port B Shown)

5

Verifying the Operation of a DT340 Board



You can verify the operation of a DT340 board using the Quick DataAcq application. Quick DataAcq lets you do the following:

- Acquire data from a single digital input port
- Measure the frequency of events
- Output data from a single analog output channel or digital output port
- Output pulses either continuously or as a one-shot

This chapter describes how to run the Quick DataAcq application.

Running the Quick DataAcq Application

The Quick DataAcq application is installed automatically when you install the driver software.

To run the Quick DataAcq application, do the following:

1. If you have not already done so, power up your computer and any attached peripherals.
2. Click **Start** from the Task Bar.
3. Browse to **Programs | Data Translation, Inc | DT-Open Layers for Win32 | QuickDataAcq**.
   The main menu appears.

Note: The Quick DataAcq application allows you to verify basic operations on the board; however, it may not support all of the board's features.

For information on each of the features provided, use the online help for the Quick DataAcq application by pressing F1 from any view or selecting the **Help** menu. If the system has trouble finding the help file, navigate to C:\Program Files\Data Translation\Win32\dtdataacq.hlp, where C: is the letter of your hard disk drive.

Testing Single-Value Digital Input

To verify that the board can read a single digital input value, do the following:

1. Connect a digital input to digital input line 0 of port A on the DT340 board. Refer to page 46 for an example of how to connect a digital input.
2. In the Quick DataAcq application, choose **Digital Input** from the **Acquisition** menu.
3. Select the appropriate DT340 board from the Board list box.
4. Select digital input port A by clicking **Port A**.
5. Click **Get**.
   The application displays the value of each digital input line in port A on the screen in both text and graphical form.

Testing Single-Value Digital Output

To verify that the board can output a single digital output value, perform the following steps:

1. Connect a digital output to digital output line 0 of port B on the DT340 board. Refer to page 47 for an example of how to connect a digital output.
2. In the Quick DataAcq application, choose **Digital Output** from the **Control** menu.
3. Select the appropriate DT340 board from the Board list box.
4. Select digital output port B by clicking **Port B**.
5. Click the appropriate bits to select the digital output lines to write to. If the bit is selected, a high-level signal is output to the digital output line; if the bit is not selected, a low-level signal is output to the digital output line. Optionally, you can enter an output value in the Hex text box.
6. Click **Send**.
   The application displays the value of each digital output line of digital port B on the screen in both text and graphical form.

Testing Frequency Measurement

To verify that the board can perform a frequency measurement operation, do the following:

1. Wire an external clock source to counter/timer 0 on the DT340 board. Refer to page 43 for an example of how to connect a an external clock for a frequency measurement operation.

Note: The Quick DataAcq application works only with counter/timer 0.

---

2. In the Quick DataAcq application, choose **Frequency Counter** from the **Acquisition** menu.
3. Select the appropriate DT340 board from the Board list box.
4. In the Count Duration text box, enter the number of seconds during which events will be counted.
5. Click **Start** to start the frequency measurement operation.
   The operation automatically stops after the number of seconds you specified has elapsed, and the application displays the frequency on the screen.

If you want to stop the frequency measurement operation when it is in progress, click **Stop**.

Testing Pulse Output

To verify that the board can perform a pulse output operation, do the following:

1. Connect a scope to counter/timer 0 on the DT340 board. Refer to page 44 for an example of how to connect a scope (a pulse output) to counter/timer 0.

Note: The Quick DataAcq application works only with counter/timer 0.

---

2. In the Quick DataAcq application, choose **Pulse Generator** from the **Control** menu.
3. Select the appropriate DT340 board from the Board list box.
4. Select either **Continuous** to output a continuous pulse stream or **One Shot** to output one pulse.
5. Select either **Low-to-high** to output a rising-edge pulse (the high portion of the total pulse output period is the active portion of the signal) or **High-to-low** to output a falling-edge pulse (the low portion of the total pulse output period is the active portion of the signal).
6. Enter a percentage or use the slider to select a percentage for the pulse width. The pulse width determines the duty cycle of the pulse.
7. Click **Start** to generate the pulse(s).
   The application displays the results both in text and graphical form.
8. Click **Stop** to stop a continuous pulse output operation. One-shot pulse output operations stop automatically.

Part 2: Using Your Board

6

Principles of Operation

This chapter describes the counter/timer and digital I/O features of the DT340 board. To frame the discussions, refer to the block diagram shown in Figure 15. Note that bold entries indicate signals you can access.

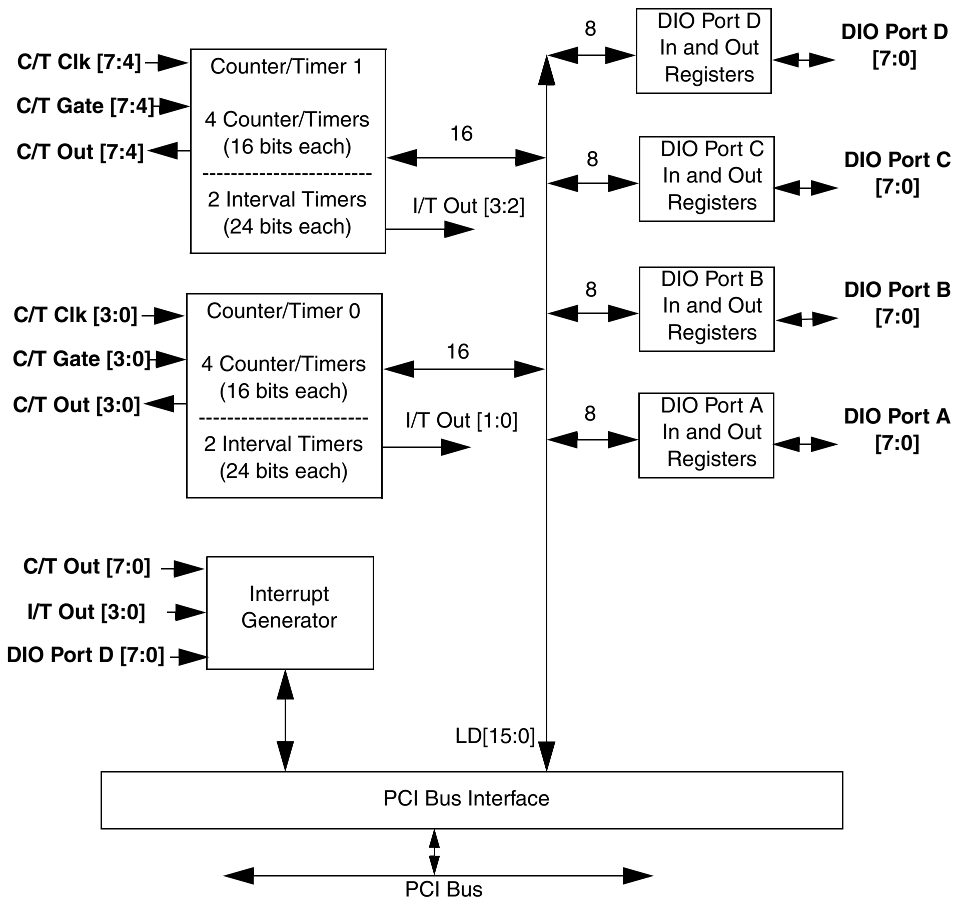


Figure 15: Block Diagram of the DT340 Board

Counter/Timer Features

This section describes the following user counter/timer features:

- Units
- Clock sources
- Gate types
- Pulse types and duty cycles
- Operation modes

Units

DT340 boards support eight 16-bit user counter/timer units (numbered 0 to 7). Each unit accepts a clock input signal and gate input signal, and outputs a clock output signal (also called a pulse output signal), as shown in Figure 16.

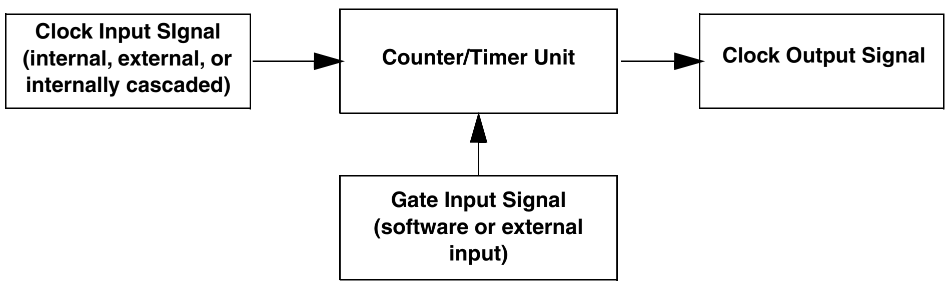


Figure 16: Counter/Timers

Each counter/timer unit corresponds to a counter/timer (C/T) subsystem. To select the unit to use in software, specify the corresponding C/T subsystem. For example, to select counter/timer 0, specify C/T subsystem element 0; to select counter/timer 7, specify C/T subsystem element 7.

Clock Sources

The following clock sources are available for the counter/timers:

- Internal C/T clock
- External C/T clock
- Internally cascaded clock

Refer to the following subsections for more information on these clock sources.

Note: When using clock sources greater than 1 MHz, it is recommended that you use counter/timers 0 to 3. This is the CE configuration of the board.

Internal C/T Clock

The internal C/T clock uses a 40 MHz time base. Counter/timer operations start on the rising edge of the clock input signal.

Through software, specify the clock source as internal and the frequency at which to pace the counter/timer operation (this is the frequency of the clock output signal). Using the internal clock source, the maximum frequency that you can specify for the clock output signal is 20 MHz. The minimum frequency that you can specify for the clock output signal is 610 Hz.

External C/T Clock

The external C/T clock is useful when you want to pace counter/timer operations at rates not available with the internal C/T clock, or if you want to pace at uneven intervals. The rising edge of the external C/T clock input signal is the active edge.

Using software, specify the clock source as external and the clock divider used to determine the frequency at which to pace the operation (this is the frequency of the clock output signal). The minimum clock divider that you can specify is 2.0; the maximum clock divider that you can specify is 65,536. For example, assume that you want to generate a continuous rate and you supplied an external C/T clock with a frequency of 5 MHz. If you specify a clock divider of 5, the resulting frequency of the external C/T clock output signal is 1 MHz.

You can use an external C/T clock source with an input frequency of up to 20 MHz; however, the resulting frequency of the external C/T clock output signal must not exceed 10 MHz.

Connect the external C/T clock to the board through the STP340 screw terminal panel. Table 4 lists the screw terminals that correspond to the external C/T clock signals of each counter/timer.

Table 4: External C/T Clock Signals

Counter/Timer	Screw Terminal on STP340	Pin on Connector J1
0	TB2	67
1	TB6	33
2	TB11	62
3	TB15	28
4	TB18	41

Table 4: External C/T Clock Signals (cont.)

Counter/Timer	Screw Terminal on STP340	Pin on Connector J1
5	TB22	7
6	TB27	36
7	TB31	2

Internally Cascaded Clock

You can also internally route the clock output signal from one counter/timer to the clock input signal of the next counter/timer to internally cascade the counter/timers. In this way, you can create a 32-bit counter/timer without externally connecting two counter/timers together. DT340 boards support internal (software) cascading on the following counter/timers:

- 0 and 1
- 1 and 2
- 2 and 3
- 4 and 5
- 5 and 6
- 6 and 7

Specify internal cascade mode in software. The rising edge of the clock input signal is active.

Through software, specify the clock source as internal and the frequency at which to pace the counter/timer operation (this is the frequency of the clock output signal). The maximum frequency that you can specify for the clock output signal is 10 MHz. For a 32-bit cascaded counter, the minimum frequency that you can specify for the clock output signal is 0.00931 Hz, which corresponds to a rate of once every 107 seconds.

Note: In software, specify the clock input and gate input for the first counter/timer in the cascaded pair. For example, if counter/timers 1 and 2 are cascaded, specify the clock input and gate input for counter/timer 1.

Gate Types

The active edge or level of the gate input to the counter enables counter/timer operations. The operation starts when the clock input signal is received. DT340 boards provide the following gate input types:

- **None** – A software command enables any specified counter/timer operation immediately after execution. This gate type is useful for all counter/timer modes.

- **Logic-low level external gate input** – Enables a counter/timer operation when the external gate signal is low, and disables the counter/timer operation when the external gate signal is high. Note that this gate type is used only for event counting, frequency measurement, and rate generation; refer to page 66 for more information on these modes.
- **Logic-high level external gate input** – Enables a counter/timer operation when the external gate signal is high, and disables a counter/timer operation when the external gate signal is low. Note that this gate type is used only for event counting, frequency measurement, and rate generation; refer to page 66 for more information on these modes.
- **Falling-edge external gate input** – Enables a counter/timer operation on the transition from the high level to the low level (falling edge). In software, this is called a low-edge gate type. Note that this gate type is used only for one-shot and repetitive one-shot mode; refer to page 66 for more information on these modes.
- **Rising-edge external gate input** – Enables a counter/timer operation on the transition from the low level to the high level (rising edge). In software, this is called a high-edge gate type. Note that this gate type is used only for one-shot and repetitive one-shot mode; refer to page 66 for more information on these modes.

Specify the gate type in software.

Table 5 lists the screw terminals that correspond to the gate input signals of each counter/timer.

Table 5: Gate Input Signals

Counter/Timer	Screw Terminal on STP340	Pin on Connector J1
0	TB4	65
1	TB8	31
2	TB9	64
3	TB13	30
4	TB20	39
5	TB24	5
6	TB25	38
7	TB29	4

Pulse Output Types and Duty Cycles

DT340 boards can output pulses from each user counter/timer.
Table 6 lists the screw terminals that correspond to the pulse output signals of each counter/timer.

Table 6: Pulse Output Signals

Counter/Timer	Screw Terminal on STP340	Pin on Connector J1
0	TB3	66
1	TB7	32
2	TB10	63
3	TB14	29
4	TB19	40
5	TB23	6
6	TB26	37
7	TB30	3

DT340 boards support the following pulse output types on the clock output signal:

- **High-to-low transitions** – The low portion of the total pulse output period is the active portion of the counter/timer clock output signal.
- **Low-to-high transitions** – The high portion of the total pulse output period is the active portion of the counter/timer pulse output signal.

You specify the pulse output type in software.

The duty cycle (or pulse width) indicates the percentage of the total pulse output period that is active. A duty cycle of 50, then, indicates that half of the total pulse is low and half of the total pulse output is high. You specify the duty cycle in software.

Figure 17 illustrates a low-to-high pulse with a duty cycle of approximately 30%.

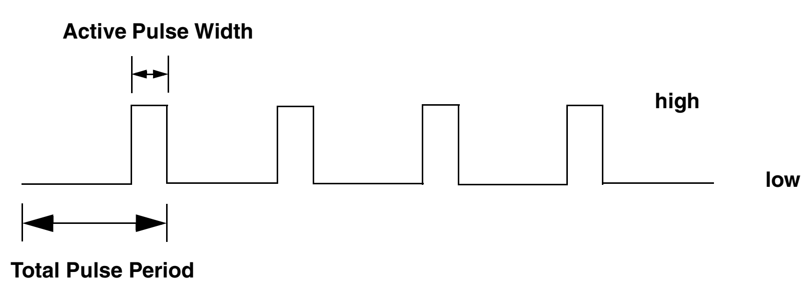


Figure 17: Example of a Low-to-High Pulse Output Type

Interrupts

You can use any of the eight user counter/timers to generate an interrupt to the host computer. You enable the interrupts during DT340 driver configuration. The interrupt occurs when the pulse output of the counter/timer changes from a low to a high state.

In a typical pulse output application where you want an interrupt to occur, it is recommended that you specify the pulse output type as high-to-low. When the pulse output changes from a low to high state (based on the frequency and duty cycle of the pulse), the interrupt occurs. If the pulse output type is low-to-high, you can use the duty cycle to generate an interrupt whenever the pulse output changes from a low to high state.

In a typical event counting application where you want an interrupt to occur, the pulse output falls sometime before the terminal count is reached, then rises when the counter rolls over from the terminal count to the initial count. The terminal count is 2^{16} for a non-cascaded counter/timer or 2^{32} for a cascaded counter/timer.

In a typical event notification application where you want an interrupt to occur after a specified number of external events has occurred, use an external clock and specify an external clock divider. In this case, the value for the external clock divider determines the number of events that are counted before an interrupt is generated.

Operation Modes

DT340 boards support the following counter/timer operation modes:

- Event counting
- Frequency measurement
- Rate generation
- One-shot
- Repetitive one-shot

The following subsections describe these modes in more detail.

Event Counting

Use event counting mode to count events from the counter's external clock input source.

If you are using one counter/timer, you can count a maximum of 65,536 events before the counter rolls over to 0 and starts counting again. If you are using a cascaded 32-bit counter, you can count a maximum of 4,294,967,296 events before the counter rolls over to 0 and starts counting again.

Note: If interrupts are enabled for a C/T subsystem operating in event counting mode, the interrupt occurs when the maximum number of counts is reached (before the counter rolls over to 0). An event is generated with the interrupt occurs.

In event counting mode, use an external C/T clock source; refer to page 61 for more information on the external C/T clock source.

Note: An external clock divider is not used when counting events.

Using software, specify the counter/timer mode as event counting (count), the C/T clock source as external, and the gate type that enables the operation. Refer to page 63 for information on gates.

Ensure that the signals are wired appropriately. Figure 18 shows one example of connecting an event counting application to the STP340 screw terminal panel using user counter 0. In this example, rising clock edges are counted while the gate is active.

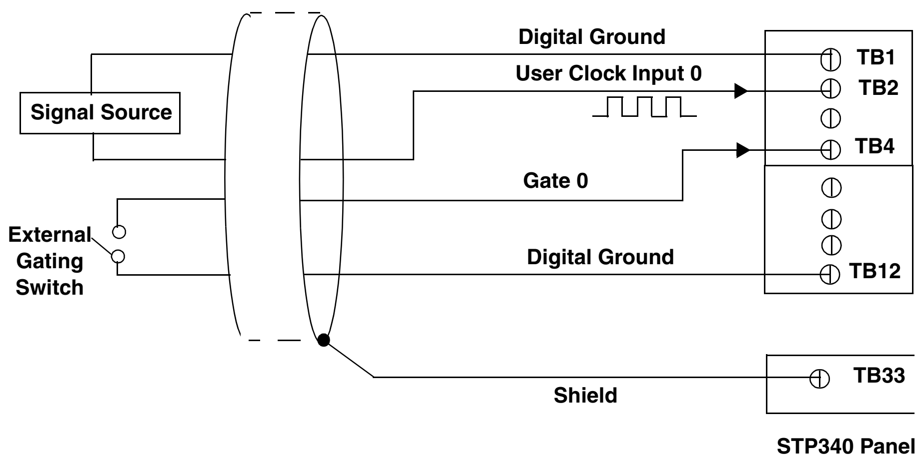


Figure 18: Connecting Event Counting Signals (Shown for Clock Input 0 and External Gate 0)

Figure 19 shows an example of an event counting operation. In this example, the gate type is low level.

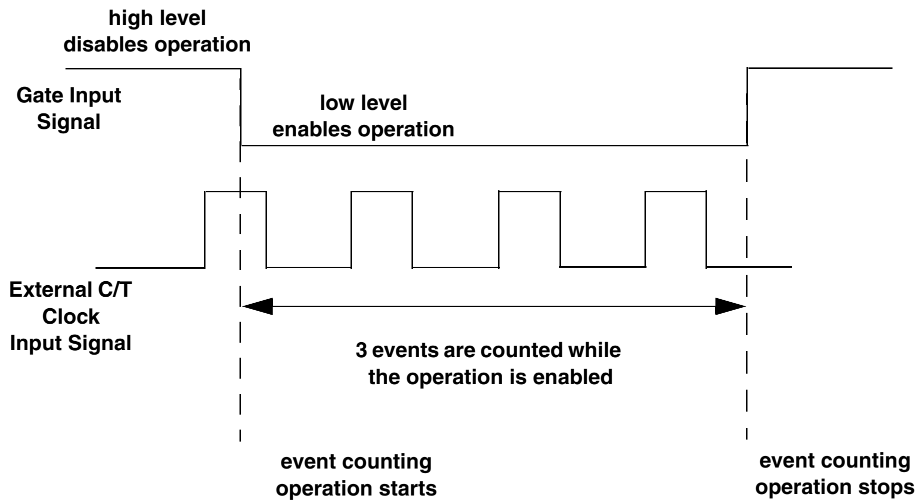


Figure 19: Example of Event Counting

Frequency Measurement

Use frequency measurement mode to measure the frequency of the signal from counter's external clock input source over a specified duration. In this mode, use an external C/T clock source; refer to page 61 for more information on the external C/T clock source.

One way to perform a frequency measurement is to use the same wiring as an event counting application that does not use an external gate signal, as shown in Figure 20.

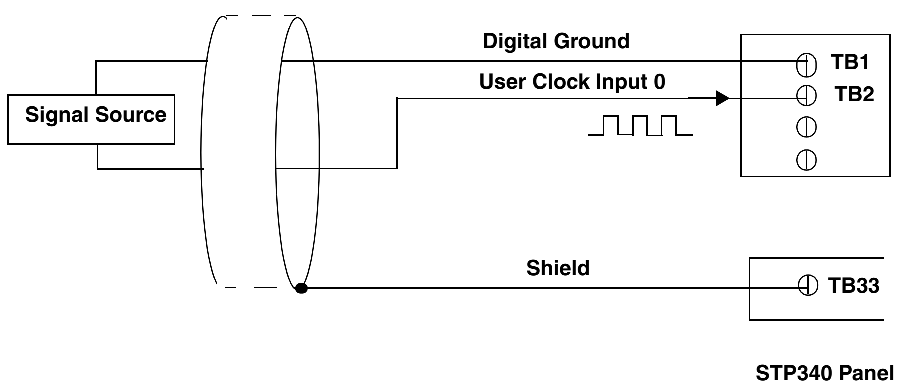


Figure 20: Connecting Frequency Measurement Signals without an External Gate Input (Shown for Clock Input 0)

In this configuration, use software to specify the counter/timer mode as frequency measurement or event counting, and the duration of the Windows timer over which to measure the frequency. (The Windows timer uses a resolution of 1 ms.) In this configuration, frequency is determined using the following equation:

$$\text{Frequency Measurement} = \frac{\text{Number of Events}}{\text{Duration of the Windows Timer}}$$

If you need more accuracy than the Windows timer provides, you can connect a pulse of a known duration (such as a one-shot output of another counter/timer) to the external gate input, as shown in
Figure 21.

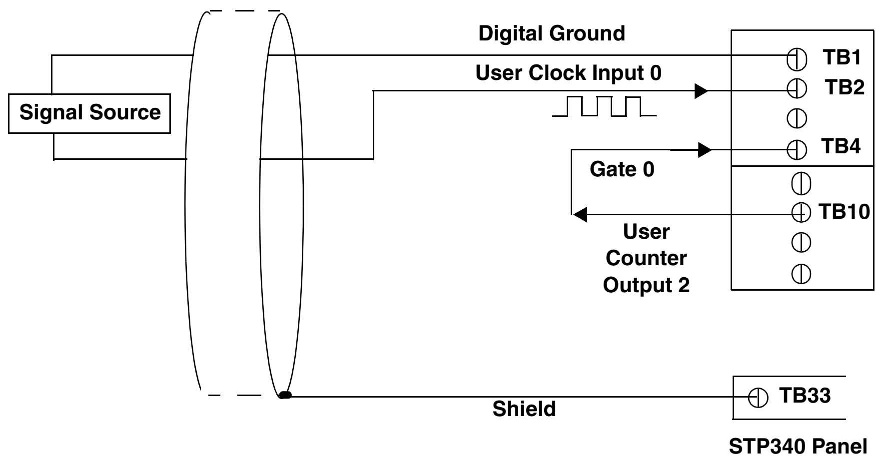


Figure 21: Connecting Frequency Measurement Signals (Shown for Clock Input 0 and External Gate 0)

In this configuration, use software to set up the counter/timers as follows:

1. Set up one of the counter/timers for one-shot mode, specifying the clock source, clock frequency, gate type, and type of output pulse (high or low).
2. Set up the counter/timer that will measure the frequency for event counting mode, specifying the clock source to count, and the gate type (this should match the pulse output type of the counter/timer set up for one-shot mode).
3. Start both counters (events are not counted until the active period of the one-shot pulse is generated).
4. Read the number of events counted. (Allow enough time to ensure that the active period of the one-shot occurred and that events have been counted.)
5. Determine the measurement period using the following equation:

$$\text{Measurement period} = \frac{1}{\text{Clock Frequency}} * \text{Active Pulse Width}$$

6. Determine the frequency of the clock input signal using the following equation:

$$\text{Frequency Measurement} = \frac{\text{Number of Events}}{\text{Measurement Period}}$$

Figure 22 shows an example of a frequency measurement operation. In this example, three events are counted during a duration of 300 ms. The frequency, then, is 10 Hz, since 10 Hz = 3/(.3 s).

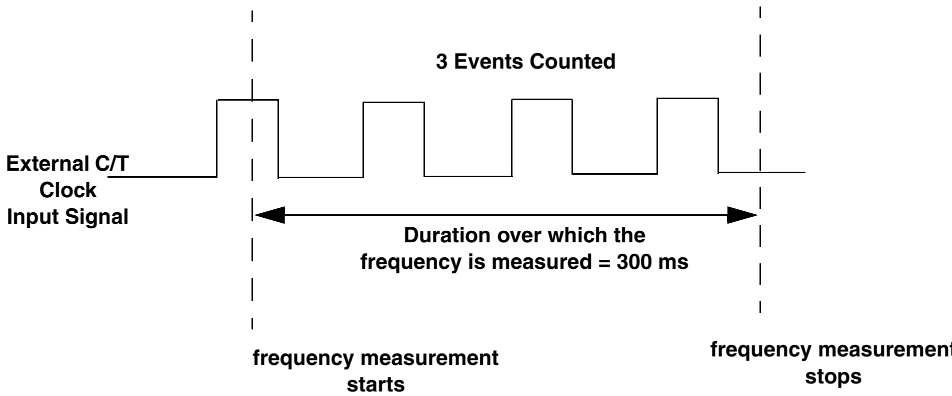


Figure 22: Example of Frequency Measurement

Rate Generation

Use rate generation mode to generate a continuous pulse output signal from the counter; this mode is sometimes referred to as continuous pulse output or pulse train output. You can use this pulse output signal as an external clock to pace other operations.

While the pulse output operation is enabled, the counter outputs a pulse of the specified type and frequency continuously. As soon as the operation is disabled, rate generation stops.

Note: If interrupts are enabled for a C/T subsystem operating in rate generation mode, the interrupt occurs when the pulse output signal changes from a low to a high state. An event is generated when the interrupt occurs.

The period of the output pulse is determined by the clock input signal and the external clock divider. If you are using one counter (not cascaded), you can output pulses using a maximum frequency of 20 MHz (this is the frequency of the clock output signal). In rate generation mode, either the internal or external C/T clock input source is appropriate depending on your application; refer to page 61 for more information on the C/T clock source.

Using software, specify the counter/timer mode as rate generation (rate), the C/T clock source as either internal or external, the polarity of the output pulses (high-to-low transitions or low-to-high transitions), the duty cycle of the output pulses, and the gate type that enables the operation. Refer to page 65 for more information on pulse output signals and to page 63 for more information on gate types.

Note: If you want to use interrupts, we recommend that you specify the output pulse type as high to low. The interrupt occurs when the output pulse completes.

For rate generation operations, use a duty cycle as close to 100% as possible to output a pulse immediately. Using a duty cycle closer to 0% acts as a pulse output delay.

Ensure that the signals are wired appropriately. Figure 23 shows one example of connecting a pulse output operation to the STP340 screw terminal panel using user counter 0. In this example, a software gate type is used.

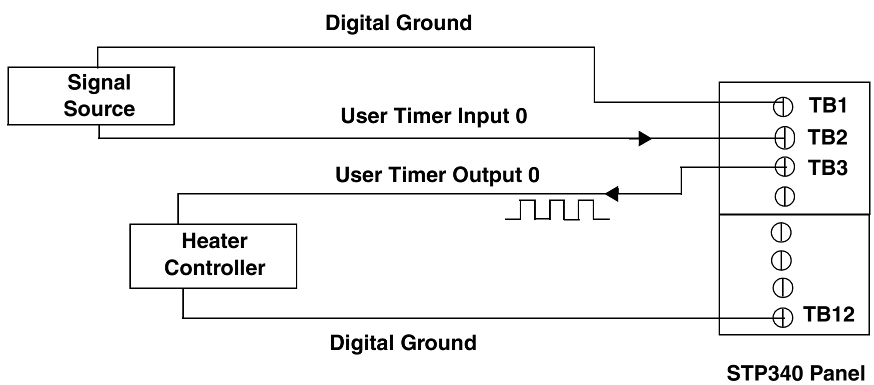


Figure 23: Connecting Rate Generation Signals (Shown for Counter Output 0; a Software Gate is Used)

Figure 24 shows an example of an enabled rate generation operation using an external C/T clock source with an input frequency of 4 kHz, a clock divider of 4, a high-to-low pulse type, and a duty cycle of 75%. (The gate type does not matter for this example.) A 1 kHz square wave is the generated output. Figure 25 shows the same example using a duty cycle of 25%.

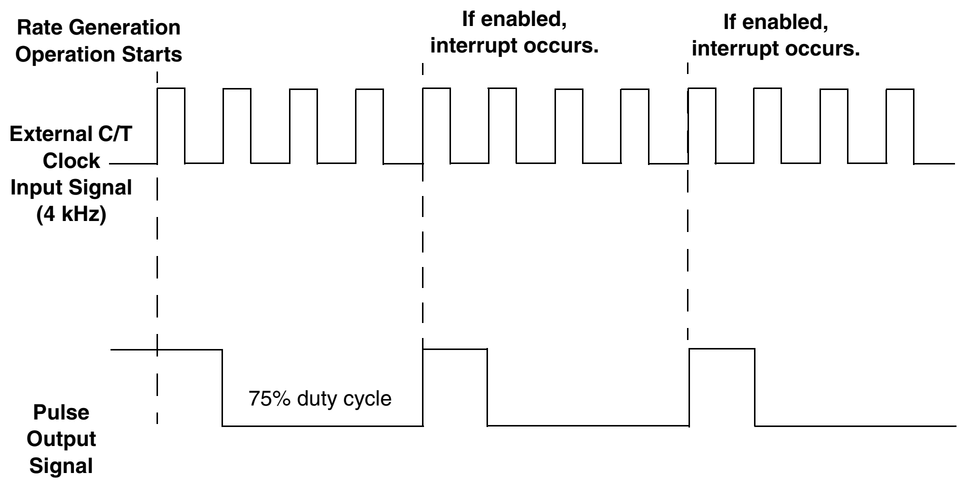


Figure 24: Example of Rate Generation Mode with a 75% Duty Cycle

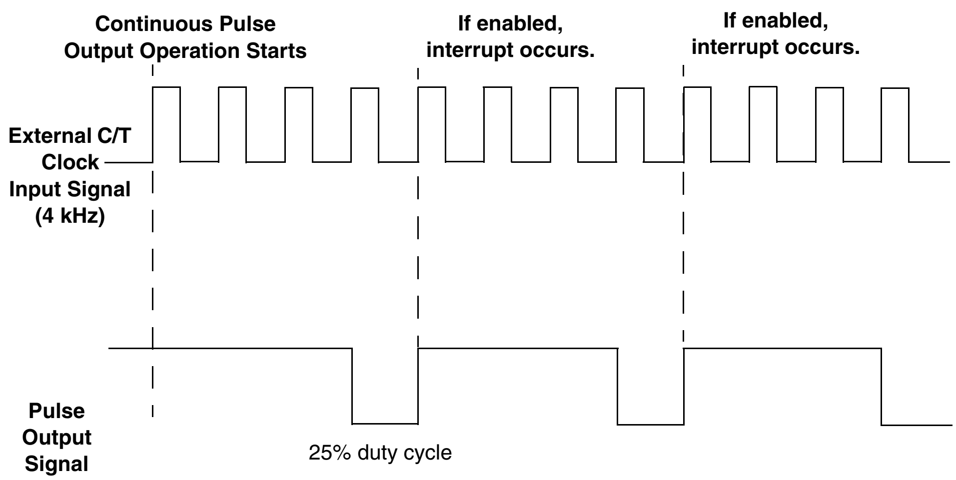


Figure 25: Example of Rate Generation Mode with a 25% Duty Cycle

One-Shot

Use one-shot mode to generate a single pulse output signal from the counter when the operation is triggered (determined by the gate input signal). You can use this pulse output signal as an external gate to start other operations.

When the one-shot operation is triggered, a single pulse is output; then, the one-shot operation stops. All subsequent clock input signals and gate input signals are ignored.

Note: If interrupts are enabled for a C/T subsystem operating in one-shot mode, the interrupt occurs when the pulse output signal changes from a low to a high state. An event is generated when the interrupt occurs.

The period of the output pulse is determined by the clock input signal. In one-shot mode, generally the internal C/T clock source is more useful than an external C/T clock source. However, if you want to be notified after a number of external events occurs, specify an external clock source; in this case, the external clock divider specifies the number of events that occur before the interrupt is generated. Refer to page 61 for more information on the C/T clock sources.

Using software, specify the counter/timer mode as one-shot, the clock source, the frequency of the output signal or the number of events that occur before the interrupt, the polarity of the output pulse (high-to-low transition or low-to-high transition), and the gate type to trigger the operation. Refer to page 65 for more information on pulse output types and to page 63 for more information on gate types.

Note: If you want to use interrupts, we recommend that you specify the output pulse type as high to low. The interrupt occurs when the one-shot pulse completes. An event is generated when the interrupt occurs.

In the case of a one-shot operation, the pulse width is automatically set to 100%.

Ensure that the signals are wired appropriately. Figure 26 shows one example of connecting a pulse output operation to the STP340 screw terminal panel using user counter 0.

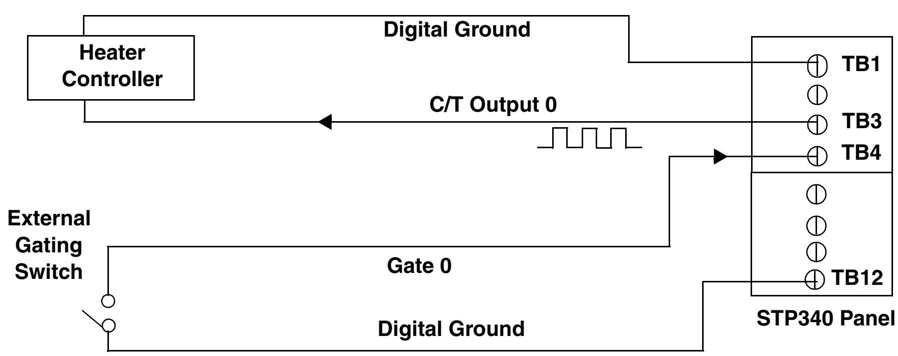


Figure 26: Connecting One-Shot Signals (Shown for Counter Output 0 and Gate 0)

Figure 27 shows an example of a one-shot operation using an external gate input (rising edge), a clock output frequency of 1 kHz (pulse period of 1 ms), and a high-to-low pulse type.

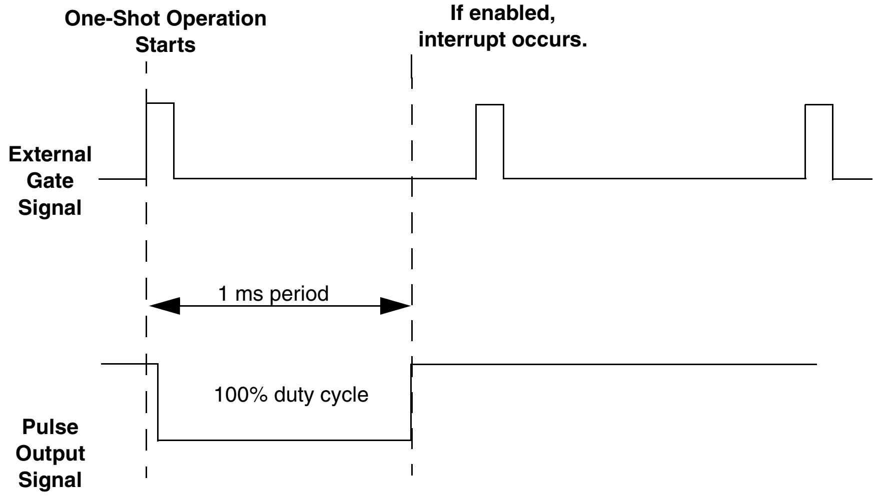


Figure 27: Example of One-Shot Mode

Repetitive One-Shot

Use repetitive one-shot mode to generate a pulse output signal each time the board detects a trigger (determined by the gate input signal). You can use this mode to clean up a poor clock input signal by changing its pulse width, then outputting it.

Note: If interrupts are enabled for a C/T subsystem operating in repetitive one-shot mode, the interrupt occurs each time the pulse output signal changes from a low to a high state. An event is generated when the interrupt occurs.

The period of the output pulse is determined by the clock input signal. In one-shot mode, generally the internal C/T clock source is more useful than an external C/T clock source. However, if you want to be notified after a number of external events occurs, specify an external clock source; in this case, the external clock divider specifies the number of events that occur before the interrupt is generated. Refer to page 61 for more information on the C/T clock sources.

Use software to specify the counter/timer mode as repetitive one-shot, the C/T clock source, the frequency of the output signal or that number of events that occur before the interrupt, the polarity of the output pulses (high-to-low transitions or low-to-high transitions), and the gate type to trigger the operation. Refer to page 65 for more information on pulse output types and to page 63 for more information on gates.

Note: If you want to use interrupts, we recommend that you specify the output pulse type as high to low. The interrupt occurs when each one-shot pulse completes.

In the case of a repetitive one-shot operation, the pulse width is automatically set to 100%.

When the one-shot operation is triggered (determined by the gate input signal), a pulse is output. When the board detects the next trigger, another pulse is output. This operation continues until you stop the operation.

Note: Triggers that occur while the pulse is being output are not detected by the board.

Figure 28 shows an example of a repetitive one-shot operation using an external gate (rising edge); a clock output frequency of 1 kHz (one pulse every 1 ms), and a high-to-low pulse type.

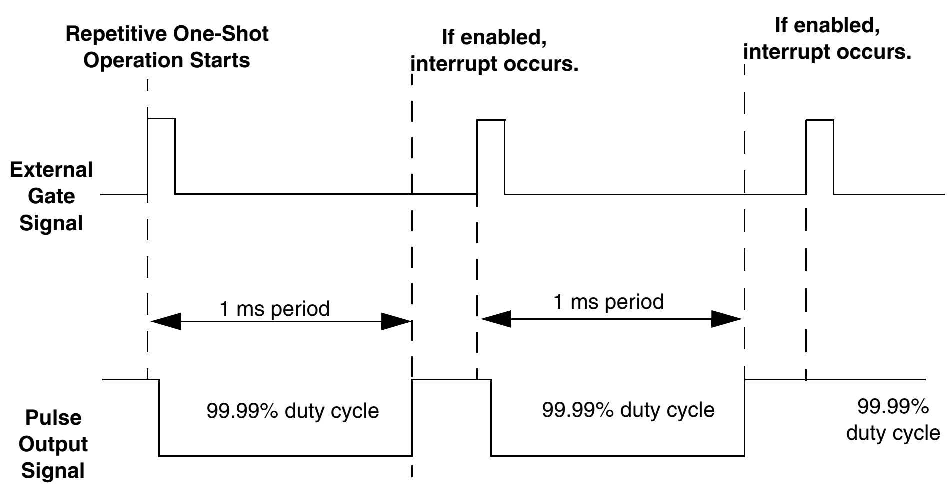


Figure 28: Example of Repetitive One-Shot Mode

Interval Timer Features

This section describes the following user interval timer features:

- Units
- Clock sources
- Gate types
- Pulse types and duty cycles
- Operation modes

Units

DT340 boards support four 24-bit interval timer units (numbered 8 to 11).

Interval timers use an internal clock input signal and internal gate input signal, and generate an internal clock output signal. No external connections are supported.

Each interval timer corresponds to a counter/timer (C/T) subsystem. Select the interval timer to use in software by specifying its corresponding C/T subsystem. For example, to select interval timer 9, specify C/T subsystem 9.

Clock Sources

Interval timers are clocked by the internal 40 MHz clock. In software, specify the clock source as internal. Specify the frequency of the interval timer from 2.39 Hz to 20 MHz.

Gate Types

For interval timers, use software to specify the gate type as none (software). Only a software gate can enable an interval timer operation.

Pulse Output Types and Duty Cycles

For interval timer operations, the DT340 board generates a clock output signal that the board uses internally to generate an interrupt condition; it is not brought out for user connection.

The pulse output type is high-to-low; it is not programmable. The pulse output signal is active (low) for one clock pulse (25 ns); the duty cycle (pulse width) is not programmable.

Interrupts

Each of the four interval timers can generate a periodic interrupt to the host computer on each low-to-high transition of the pulse output signal. Interrupts are always enabled for interval timers. The interrupt frequency is equal to the frequency of the internal clock source.

Operation Modes

To generate an interrupt using an interval timer, set up the interval timer as follows in software:

- Specify the interval timer for one-shot or rate generation mode. In one-shot mode, a single interrupt is generated after the first pulse output changes from a low to a high state. In rate generation mode, a interrupt occurs every time the pulse output changes from a low to a high state.
- Specify the interval timer clock source as internal and the frequency of the clock source. The period of the output pulse (the interval) is 1/clock frequency. Refer to page 76 for more information on the interval timer clock source.
- Specify the gate type as none (software).

Figure 29 shows an example of an interval timer set up for one-shot mode, using a software gate, and a clock frequency of 1 kHz (one pulse every 1 ms).

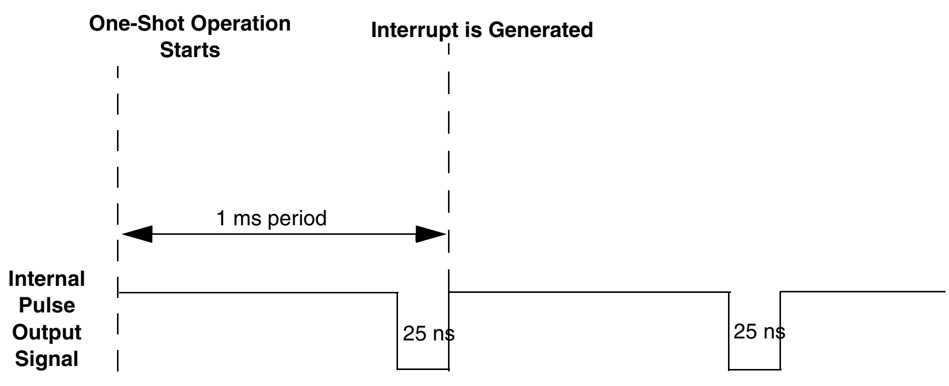


Figure 29: Example of an Interval Timer Operation Using One-Shot Mode

Figure 30 shows an example of an interval timer set up for rate generation mode, using a software gate, and a clock frequency of 1 kHz (one pulse every 1 ms).

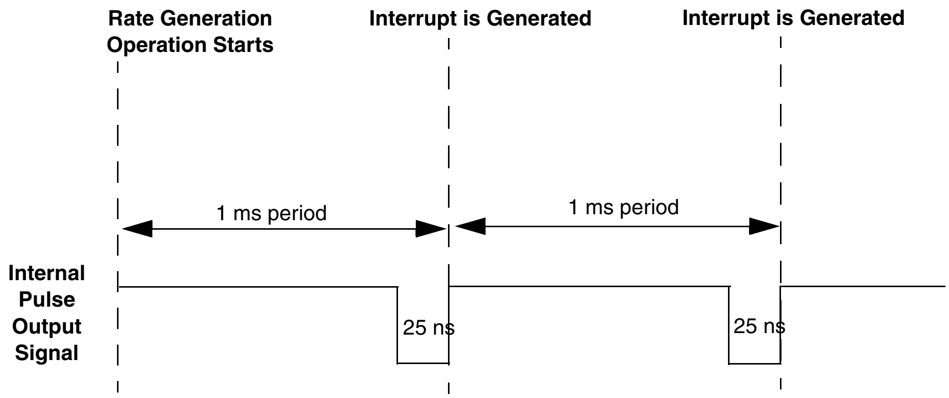


Figure 30: Example of an Interval Timer Operation Using Rate Generation Mode

Digital I/O Features

This section describes the following features of the digital I/O subsystem:

- Digital I/O lines
- Resolution
- Operation modes
- Interrupts

Digital I/O Lines

DT340 boards support 32 digital I/O lines through the digital input (DIN) and output (DOUT) subsystems; the DIN and DOUT subsystems use the same digital I/O lines.

These lines are divided into four ports of eight: Port A, lines 0 to 7; Port B, lines 0 to 7; Port C, lines 0 to 7; and Port D, lines 0 to 7. You can use each port for either input or output; all eight lines within a port have the same configuration. For example, if you use Port A for input, lines 0 to 7 of Port A are configured as inputs. Likewise, if you use Port B for output, lines 0 to 7 of Port B are configured as outputs.

Specify the digital I/O line to read or write in a single-value digital I/O operation or a continuous digital input operation; refer to page 80 for more information on digital I/O operation modes.

On power up or reset, no digital data is output from the board.

Resolution

Using software, specify the number of digital I/O lines to read or write at once by specifying the resolution as 8, 16, 24, or 32. Choosing a resolution greater than 8 effectively combines the digital I/O ports.

Table 7 shows the effect of resolution on the number of digital I/O lines available for each DIN or DOUT subsystem.

Table 7: Resolution, Digital I/O Lines, and Number of Subsystems

Resolution	Digital I/O Lines	DIN or DOUT Subsystem
8	Port A, lines 0 to 7	Element 0
	Port B, lines 0 to 7	Element 1
	Port C, lines 0 to 7	Element 2
	Port D, lines 0 to 7	Element 3

Table 7: Resolution, Digital I/O Lines, and Number of Subsystems

Resolution	Digital I/O Lines	DIN or DOUT Subsystem
16	Port A and B, lines 0 to 15 combined	Element 0
	Port C and D, lines 0 to 15 combined	Element 2
24	Port A, B, and C, lines 0 to 23 combined	Element 0
32	Ports A, B, C, and D, lines 0 to 31 combined	Element 0

Note: When the resolution is greater than 8, the bit value represents the combined number of digital I/O lines. For example, if the resolution is 32, digital I/O lines 0 to 7 of Port A are represented as bits 0 to 7 of the digital value, digital I/O lines 0 to 7 of Port B are represented as bits 8 to 15 of the digital value, digital I/O lines 0 to 7 of Port C are represented as bits 16 to 23 of the digital value, and digital I/O lines 0 to 7 of Port D are represented as bits 24 to 31 of the digital value.

Interrupts

The DT340 board can generate a PCI-bus interrupt when any of the eight digital input lines corresponding to digital Port D (DIN element 3) changes state. This feature is useful when you want to monitor critical signals or when you want to signal the host computer to transfer data to or from the board. You enable the interrupts on a line-by-line basis during DT340 driver configuration; refer to page 29 for more information.

In software, an event is generated when the interrupt occurs. Use software to determine which digital line changed state; refer to page 81 for more information.

Operation Modes

DT340 boards support the following digital I/O operation modes:

- **Single-value operations** are the simplest to use but do not allow you to check the interrupt status. Use software to specify the DIN or DOUT subsystem, and the resolution of the subsystem. Data is then read from or written to the appropriate digital I/O lines. For a single-value operation, you cannot specify a clock or trigger source.

  Single-value operations stop automatically when finished; you cannot stop a single-value operation.

- **Continuous digital input** allows you to read digital input values as well as check the interrupt status of digital Port D only.

  Use software to specify DIN subsystem element 3, continuous mode, a resolution of 8, and the trigger source as software. Once the operation is configured and started, an event is generated when the interrupt occurs. You can then read the value and determine which digital I/O line changed state to cause the interrupt.

Note: If you are using the DataAcq SDK to perform a continuous digital input operation, use the *lParam* parameter of the **olDaSetWndHandle** or **olDaSetNotificationProcedure** function to determine which digital input line changed state and the status of the digital input port when the interrupt occurred.

The low word of *lParam* contains the digital lines (bits) that changed state, where bit 0 corresponds to digital input line 0 and bit 7 corresponds to digital input line 0.

The high word of *lParam* contains the state of the digital input subsystem, where the bits represent the digital input lines.

The resolution reflects the number of significant bits in *lParam.*

7

Supported Device Driver Capabilities

The DT340 Device Driver provides support for the digital input (DIN), digital output (DOUT), and counter/timer (C/T) subsystems. For information on how to configure the device driver, refer to page 29.

Table 8: DT340 Subsystems

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Total Subsystems on Board	0	0	4[a]	4[a]	12[b]	0

a. DIN and DOUT subsystems use the same DIO lines.
b. C/T subsystems 0 to 7 support counter/timer features only. C/T subsystems 8 to 11 support interval timer features only.

The tables in this chapter summarize the features available for use with the DT-Open Layers for .NET Class Library and the DT340 board. The DT-Open Layers for .NET Class Library provides properties that return support information for specified subsystem capabilities.

The first row in each table lists the subsystem types. The first column in each table lists all possible subsystem capabilities. A description of each capability is followed by the property used to describe that capability in the DT-Open Layers for .NET Class Library.

Note: Blank fields represent unsupported options.

For more information, refer to the description of these properties in the DT-Open Layers for .NET Class Library online help or *DT-Open Layers for .NET Class Library User's Manual*.

Data Flow and Operation Options

Table 9: DT340 Data Flow and Operation Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Single-Value Operation Support **SupportsSingleValue**			Yes	Yes		
Simultaneous Single-Value Output Operations **SupportsSetSingleValues**						
Continuous Operation Support **SupportsContinuous**			Yes[a]		Yes	
Continuous Operation until Trigger **SupportsContinuousPreTrigger**						
Continuous Operation before & after Trigger **SupportsContinuousPrePostTrigger**						
Waveform Operations Using FIFO Only **SupportsWaveformModeOnly**						
Simultaneous Start List Support **SupportsSimultaneousStart**						
Supports Programmable Synchronization Modes **SupportsSynchronization**						
Synchronization Modes **SynchronizationMode**						
Interrupt Support **SupportsInterruptOnChange**			Yes[a]			
Output FIFO Size **FifoSize**						
Auto-Calibrate Support **SupportsAutoCalibrate**						

a. Only Port D when configured for 8-bit resolution can operate in continuous digital input mode and only if you enabled interrupt usage for this port in the driver configuration dialog box. The driver posts an event done message when a digital line in this port changes state. Refer to page 29 for more information on configuring the driver. If you are using the DataAcq SDK, refer to page 80 for more information on determining which digital input lines changed state.

Buffering

Table 10: DT340 Buffering Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Buffer Support **SupportsBuffering**						
Single Buffer Wrap Mode Support **SupportsWrapSingle**						
Inprocess Buffer Flush Support **SupportsInProcessFlush**						

Triggered Scan Mode

Table 11: DT340 Triggered Scan Mode Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Triggered Scan Support **SupportsTriggeredScan**						
Maximum Number of CGL Scans per Trigger **MaxMultiScanCount**			0	0	0	
Maximum Retrigger Frequency **MaxRetriggerFreq**			0	0	0	
Minimum Retrigger Frequency **MinRetriggerFreq**			0	0	0	

Data Encoding

Table 12: DT340 Data Encoding Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Binary Encoding Support **SupportsBinaryEncoding**			Yes	Yes	Yes	
Twos Complement Support **SupportsTwosCompEncoding**						
Returns Floating-Point Values ReturnsFloats						

Channels

Table 13: DT340 Channel Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Number of Channels **NumberOfChannels**			1	1	1	
SE Support **SupportsSingleEnded**						
SE Channels **MaxSingleEndedChannels**			0	0	0	
DI Support **SupportsDifferential**			Yes	Yes	Yes	
DI Channels **MaxDifferentialChannels**			1	1	1	
Maximum Channel-Gain List Depth **CGLDepth**			0	0	0	
Simultaneous Sample-and-Hold Support **SupportsSimultaneousSampleHold**						
Channel-List Inhibit **SupportsChannelListInhibit**						

Gain

Table 14: DT340 Gain Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Programmable Gain Support **SupportsProgrammableGain**						
Number of Gains **NumberOfSupportedGains**			1	1	0	
Gains Available **SupportedGains**			1	1		

Ranges

Table 15: DT340 Range Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Number of Voltage Ranges **NumberOfRanges**			0	0	0	
Available Ranges **SupportedVoltageRanges**						
Current Output Support **SupportsCurrentOutput**						

Resolution

Table 16: DT340 Resolution Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Software Programmable Resolution **SupportsSoftwareResolution**			Yes[a]	Yes[a]		
Number of Resolutions **NumberOfResolutions**			4[a]	4[a]	1	
Available Resolutions **SupportedResolutions**			8, 16, 24, 32[a]	8, 16, 24, 32[a]	16[b]	

a. When configured for 8 bits of resolution, element 0 uses bits 7 to 0 (Port A), element 1 uses bits 15 to 8 (Port B), element 2 uses bits 23 to 16 (Port C), and element 3 uses bits 31 to 24 (Port D). When configured for 16 bits of resolution, element 0 uses bits 15 to 0 (Ports A and B), and element 2 uses bits 31 to 15 (Ports C and D). When configured for 24 bits of resolution, element 0 uses bits 23 to 0 (Ports A, B, and C). When configured for 32 bits of resolution, element 0 uses DIO bits 31 to 0 (Ports A, B, C, and D).

b. You can also cascade two 16-bit counter/timers together to create a 32-bit counter/timer.

Thermocouple and RTD Support

Table 17: DT340 Thermocouple and RTD Support Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Thermocouple Support **SupportsThernocouple**						
RTD Support **SupportsRTD**						
Resistance Support **ReturnsOhms**						
Voltage Converted to Temperature in Hardware **SupportsTemperatureDataInStream**						
Supported Thermocouple Types **ThermocoupleType**						
Supported RTD Types **RTDType**						
Supports CJC Source Internally in Hardware **SupportsCjcSourceInternal**						
Supports CJC Channel **SupportsCjcSourceChannel**						
Available CJC Channels **CjcChannel**						
Supports Interleaved CJC Values in Data Stream **SupportsInterleavedCjcTemperaturesInStream**						
Supports Programmable Filters **SupportsTemperatureFilters**						
Programmable Filter Types **TemperatureFilterType**						

IEPE Support

Table 18: DT340 IEPE Support Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Software Programmable AC Coupling **SupportsACCoupling**						
Software Programmable DC Coupling **SupportsDCCoupling**						
Software Programmable External Excitation Current Source **SupportsExternalExcitationCurrentSrc**						
Software Programmable Internal Excitation Current Source **SupportsInternalExcitationCurrentSrc**						
Available Excitation Current Source Values **SupportedExcitationCurrentValues**						

Triggers

Table 19: DT340 Trigger Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Software Trigger Support **SupportsSoftwareTrigger**						
External Positive TTL Trigger Support **SupportsPosExternalTTLTrigger**						
External Negative TTL Trigger Support **SupportsNegExternalTTLTrigger**						
External Positive TTL Trigger Support for Single-Value Operations **SupportsSvPosExternalTTLTrigger**						
External Negative TTL Trigger Support for Single-Value Operations **SupportsSvNegExternalTTLTrigger**						
Positive Threshold Trigger Support **SupportsPosThresholdTrigger**						
Negative Threshold Trigger Support **SupportsNegThresholdTrigger**						
Digital Event Trigger Support **SupportsDigitalEventTrigger**						

Clocks

Table 20: DT340 Clock Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Internal Clock Support **SupportsInternalClock**					Yes[a]	
External Clock Support **SupportsExternalClock**					Yes[b]	
Simultaneous Input/Output on a Single Clock Signal **SupportsSimultaneousClocking**						
Base Clock Frequency **BaseClockFrequency**			0	0	40 MHz	
Maximum Clock Divider **MaxExtClockDivider**			1.0	1,0	65536	
Minimum Clock Divider **MinExtClockDivider**			1.0	1.0	2.0	
Maximum Frequency **MaxFrequency**			0	0	20 MHz[c]	
Minimum Frequency **MinFrequency**			0	0	0.009 Hz[d]	

a. An internal clock source is not supported for event counting and frequency measurement operations.
b. C/T subsystems 0 to 7 support an external clock. C/T subsystems 8 to 11 do not support an external clock; the clock source must be internal for interval timer operations.
c. If using cascaded timers, this value is 10 MHz.
d. If not using cascaded timers, this value is approximately 610 Hz for the counter/timers, and 2.39 Hz for the interval timers.

Counter/Timers

Table 21: DT340 Counter/Timer Options

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Cascading Support **SupportsCascading**					Yes[a]	
Event Count Mode Support **SupportsCount**					Yes[b,c]	
Generate Rate Mode Support **SupportsRateGenerate**					Yes[b]	
One-Shot Mode Support **SupportsOneShot**					Yes	
Repetitive One-Shot Mode Support **SupportsOneShotRepeat**					Yes	
Up/Down Counting Mode Support **SupportsUpDown**						
Edge-to-Edge Measurement Mode Support **SupportsMeasure**						
Continuous Edge-to-Edge Measurement Mode Support **SupportsContinuousMeasure**						
High to Low Output Pulse Support **SupportsHighToLowPulse**					Yes[d]	
Low to High Output Pulse Support **SupportsLowToHighPulse**					Yes[d]	
Variable Pulse Width Support **SupportsVariablePulseWidth**					Yes[e]	
None (internal) Gate Type Support SupportsGateNone					Yes	
High Level Gate Type Support **SupportsGateHighLevel**					Yes[f,g]	
Low Level Gate Type Support **SupportsGateLowLevel**					Yes[f,g]	
High Edge Gate Type Support **SupportsGateHighEdge**					Yes[f,g]	
Low Edge Gate Type Support **SupportsGateLowEdge**					Yes[f,g]	
Level Change Gate Type Support **SupportsGateLevel**						
Clock-Falling Edge Type **SupportsClockFalling**						
Clock-Rising Edge Type **SupportsClockRising**						
Gate-Falling Edge Type **SupportsGateFalling**						

Table 21: DT340 Counter/Timer Options (cont.)

DT340	A/D	D/A	DIN	DOUT	C/T	QUAD
Gate-Rising Edge Type **SupportsGateRising**						
Interrupt-Driven Operations **SupportsInterrupt**					Yes	

a. Only C/T subsystems 0 to 7 support internal cascading. The following adjacent counter/timers can be cascaded in software: 0 and 1, 1 and 2, 2 and 3, 4 and 5, 5 and 6, and 6 and 7.
b. Only C/T subsystems 0 to 7 support this mode.
c. An external clock divider is not support for event counting operations.
d. Only C/T subsystems 0 to 7 support this pulse output type. The pulse output type is not programmable for interval timers (C/T subsystems 8 to 11).
e. Interval timers (C/T subsystems 8 to 11) do not support programmable pulse widths.
f. For C/T subsystems 0 to 7, high-edge and low-edge are supported for one-shot and repetitive one-shot modes only; high-level and low-level are supported for event counting and rate generation modes only.
g. C/T subsystems 8 to 11 support a software (none) gate type only.

8

Troubleshooting

General Checklist

Should you experience problems using the DT340 board, follow these steps:

1. Read all the documentation provided for your product. Make sure that you have added any "Read This First" information to your manual and that you have used this information.
2. Check the OMNI CD for any README files and ensure that you have used the latest installation and configuration information available.
3. Check that your system meets the requirements stated in the README file on the OMNI CD.
4. Check that you have installed your hardware properly using the instructions in Chapter 2.
5. Check that you have installed and configured the device driver properly using the instructions in Chapter 2.
6. Search the DT Knowledgebase in the Support section of the Data Translation web site (at www.datatranslation.com) for an answer to your problem.

If you still experience problems, try using the information in Table 22 to isolate and solve the problem. If you cannot identify the problem, refer to page 98.

Table 22: Troubleshooting Problems

Symptom	Possible Cause	Possible Solution
Board does not respond.	The board configuration is incorrect.	Check the configuration of your device driver to ensure that the board name and type are correct.
	The board is incorrectly aligned in a PCI expansion slot.	Check that the slot in which your DT340 board is located is a PCI slot and that the board is correctly seated in the slot.
	The board is damaged.	Contact Data Translation for technical support; refer to page 98.
	The interrupt level is unacceptable.	An interrupt conflict exists in your system. The most common interrupt conflict occurs with a PCI device and a device that is plugged into the ISA bus. To resolve this problem, change the interrupt setting (usually by changing a jumper) on the ISA device. An interrupt conflict can also occur if a PCI device was not designed to share interrupts. To resolve this problem, select a different interrupt for each PCI slot in the PCI BIOS. To do this, enter the system BIOS program; this is usually done by pressing the DEL key when rebooting your system. Once in the system BIOS, enter the PCI/PnP BIOS setup, and select a unique interrupt for each PCI slot. The PCI BIOS assigns the interrupt; the device on the PCI bus does not have control over the interrupt assignment.

Table 22: Troubleshooting Problems (cont.)

Symptom	Possible Cause	Possible Solution
Board does not respond (cont.)	The interrupt level is unacceptable (cont.)	Some network devices do not share interrupts. If you still have an interrupt conflict, try removing the network device, installing the DT340 board and rebooting the system, then reinserting the network device.
Intermittent operation.	Loose connections or vibrations exist.	Check your wiring and tighten any loose connections or cushion vibration sources.
	The board is overheating.	Check environmental and ambient temperature; consult the board's specifications on page 104 of this manual and the documentation provided by your computer manufacturer for more information.
	Electrical noise exists.	Check your wiring and either provide better shielding or reroute unshielded wiring.
Data appears to be invalid.	An open connection exists.	Check your wiring and fix any open connections.
Computer does not boot.	Board is not seated properly.	Check that the slot in which your DT340 board is located is a PCI slot, that the board is correctly seated in the slot, and that the board is secured in the slot with a screw.
	The power supply of the computer is too small to handle all the system resources.	Check the power requirements of your system resources and, if needed, get a larger power supply; consult the board's specifications on page 104 of this manual.
Board does not interrupt.	Counter/timer, interval timer, or digital I/O port is not configured properly.	Check the properties of the device driver configuration using the instructions in Chapter 2.
System lockup.	Board is not seated properly.	Check that the slot in which your DT340 board is located is a PCI slot, that the board is correctly seated in the slot, and that the board is secured in the slot with a screw. An interrupt conflict exists in your system. The most common interrupt conflict occurs with a PCI device and a device that is plugged into the ISA bus. To correct this problem, change the interrupt setting (usually by changing a jumper) on the ISA device.
	Interrupt level is unacceptable.	An interrupt conflict can also occur if a PCI device was not designed to share interrupts. To resolve this problem, select a different interrupt for each PCI slot in the PCI BIOS. To do this, enter the system BIOS program; this is usually done by pressing the DEL key when rebooting your system. Once in the system BIOS, enter the PCI/PnP BIOS setup, and select a unique interrupt for each PCI slot. The PCI BIOS assigns the interrupt; the device on the PCI bus does not have control over the interrupt assignment. Some network devices do not share interrupts. If you still have an interrupt conflict, try removing the network device, installing the DT340 board and rebooting the system, then reinserting the network device.
Test button grayed out.	Vdtdad VxD is not installed.	Load the DT340 Support Software or the Data Acq SDK.

Technical Support

If you have difficulty using a DT340 board, Data Translation's Technical Support Department is available to provide technical assistance.

To request technical support, go to our web site at http://www.datatranslation.com and click on the Support link.

When requesting technical support, be prepared to provide the following information:

- Your product serial number
- The hardware/software product you need help on
- The version of the OMNI CD you are using
- Your contract number, if applicable

If you are located outside the USA, contact your local distributor; see our web site (www.datatranslation.com) for the name and telephone number of your nearest distributor.

If Your Board Needs Factory Service

If your board must be returned to Data Translation, do the following:

1. Record the board's serial number, and then contact the Customer Service Department at (508) 481-3700, ext. 1323 (if you are in the USA) and obtain a Return Material Authorization (RMA).

   If you are located outside the USA, call your local distributor for authorization and shipping instructions; see our web site (www.datatranslation.com) for the name and telephone number of your nearest distributor. All return shipments to Data Translation must be marked with the correct RMA number to ensure proper processing.

2. Using the original packing materials, if available, package the module as follows:

   – Wrap the board in an electrically conductive plastic material. Handle with ground protection. A static discharge can destroy components on the module.

   – Place in a secure shipping container.

3. Return the board to the following address, making sure the RMA number is visible on the outside of the box.

   Customer Service Dept.
   Data Translation, Inc.
   100 Locke Drive
   Marlboro, MA 01752-1192

A

Specifications

Counter/Timer Specifications

Table 23 lists the specifications for the C/T subsystems on the DT340 boards.

Table 23: C/T Subsystem Specifications

Feature	Specifications
Number of counter/timers	8
Clock Inputs	
Input type:	Pseudo-differential, rising-edge sensitive
Input load:	1 AM26C32
Threshold voltage	
Counter/Timers 0, 1, 2, 3:	0.5 V[a]
Counter/Timers 4, 5, 6, 7:	0.98 V
Input sensitivity:	±200 mV
Input hysteresis:	60 mV
Input current (V_{in} = 0 V):	0
Input current (V_{in} = 5 V):	1 kΩ
Minimum pulse width:	25 ns high and low (sampled by 40 MHz)
Maximum frequency:	19.9 MHz typical
Termination	
Counter/Timers 0, 1, 2, 3:	100 Ω[a,b]
Counter/Timers 4, 5, 6, 7:	1 kΩ resistor to ground[c]
Gate Inputs	
Input type:	Schmitt trigger, level sensitive
Input load:	1 HCT14 (TTL)
High-level input voltage:	2.0 V minimum
Low-level input voltage:	0.8 V maximum
Hysteresis:	0.4 V (minimum); 1.5 V (maximum)
High-level input current:	1.0 µA
Low-level input current:	–1.0 µA
Minimum pulse width:	25 ns high and low (sampled by 40 MHz)
Termination:	22 kΩ resistor pullup to +5 V
Counter Outputs for Channels 0, 1, 2, 3	
Output driver:	1.2 V peak-to-peak[a]
Termination:	100 Ω[a]
Output driver high voltage:	2.6 V maximum at 100 Ω
Output driver low voltage:	1.2 V maximum at 100 Ω
Counter Outputs for Channels 4, 5, 6, 7	
Output driver:	ALS244 (TTL)
Output driver high voltage:	3.0 V maximum at 100 Ω
Output driver low voltage:	1.6 V maximum at 100 Ω
Termination:	100 Ω series resistor; 301 Ω pull-down resistor to ground (75 Ω)

a. This value accommodates high-frequency clock signals.
b. If you want to use low-frequency clock signals you can clip the 100 Ω resistors in locations R9 (counter/timer 0), R14 (counter/timer 1), R19 (counter/timer 2), and R27 (counter/timer 3).
c. You can install a 110 Ω resistor to ground on the board in parallel with the 1 kΩ resistor to give 100 Ω termination.

Digital I/O Specifications

Table 24 lists the specifications for the DIN/DOUT subsystems on the DT340 boards.

Table 24: DIN/DOUT Subsystem Specifications

Feature	Ports A, B, and C Specifications	Port D Specifications
Number of lines	8 per port	8
Direction	bidirectional	
Termination	22 kΩ resistor pullup to +5 V; 22 Ω series resistor	
Inputs Input type: Input load: High-level input voltage: Low-level input voltage: High-level input current: Low-level input current:	 Level sensitive 2 FCT2574 (TTL) 2.0 V minimum 0.8 V maximum 3 µA –3 µA	 Level sensitive 3 FCT2574 (TTL) 2.0 V minimum 0.8 V maximum 4.5 µA 4.5 µA
Minimum Pulse Width High: Low:	 Not Applicable Not Applicable	 66 ns (2 PCI clocks)[a] 66 ns (2 PCI clocks)[a]
Outputs Output driver: Output driver high voltage: Output driver low voltage:	 FCT2574 (TTL) 2.4 V minimum (IOH = –15 mA); 0.5 V maximum (IOL = 12 mA)	

a. The minimum pulse width applies only to interrupt-on-change detection. Pulses less than the minimum may not be detected as a change.

Power, Physical, and Environmental Specifications

Table 25 lists the power, physical, and environmental specifications for the DT340 boards.

Table 25: Power, Physical, and Environmental Specifications

Feature	Specifications
Power +5 V (±0.25 V) −5 V +12 V −12 V	 405 mA + output current nominal not used not used not used
Physical Dimensions: Weight:	 PCI short card 6.875 inches (length) by 4.2 inches (height); 174 mm (length) by 106 mm (height) 4 ounces (113.4 grams)
Environmental Operating temperature range: Storage temperature range: Relative humidity:	 0° C to 70° C –25° C to 85° C To 95%, noncondensing

Connector Specifications

Table 26 lists the specifications for the 68-pin connector on the board.

Table 26: 68-Pin Connector Specifications

Feature	Specifications
Connector part number On board connector: Mating connector:	 AMP 68-pin, 0.05 Subminiature D, #749621-7 AMP #749621-7
Shielded enclosure with jack screws:	AMP #750752-1
Recommended shielded cable:	Madison, 28 GA, Twisted Pair, #68KDK00029

B

Connector Pin Assignments

Connector J1 on the DT340 Board

Table 27 lists the pin assignments of connector J1 on the DT340 board.

Table 27: Connector J1 Pin Assignments on the DT340 Board

Pin	Signal Description	Pin	Signal Description
1	+5 V Output	2	C/T Clock Input 7
3	C/T Clock Output 7	4	C/T Gate Input 7
5	C/T Gate Input 5	6	C/T Clock Output 5
7	C/T Clock Input 5	8	Digital Ground
9	Digital I/O Port D, Line 7	10	Digital I/O Port D, Line 5
11	Digital I/O Port D, Line 3	12	Digital I/O Port D, Line 1
13	Digital Ground	14	Digital I/O Port C, Line 7
15	Digital I/O Port C, Line 5	16	Digital I/O Port C, Line 3
17	Digital I/O Port C, Line 1	18	Digital I/O Port B, Line 7
19	Digital I/O Port B, Line 5	20	Digital I/O Port B, Line 3
21	Digital I/O Port B, Line 1	22	Digital Ground
23	Digital I/O Port A, Line 7	24	Digital I/O Port A, Line 5
25	Digital I/O Port A, Line 3	26	Digital I/O Port A, Line 1
27	Digital Ground	28	C/T Clock Input 3
29	C/T Clock Output 3	30	C/T Gate Input 3
31	C/T Gate Input 1	32	C/T Clock Output 1
33	C/T Clock Input 1	34	Digital Ground
35	Power Ground	36	C/T Clock Input 6
37	C/T Clock Output 6	38	C/T Gate Input 6
39	C/T Gate Input 4	40	C/T Clock Output 4
41	C/T Clock Input 4	42	Digital Ground
43	Digital I/O Port D, Line 6	44	Digital I/O Port D, Line 4
45	Digital I/O Port D, Line 2	46	Digital I/O Port D, Line 0
47	Digital Ground	48	Digital I/O Port C, Line 6
49	Digital I/O Port C, Line 4	50	Digital I/O Port C, Line 2
51	Digital I/O Port C, Line 0	52	Digital I/O Port B, Line 6
53	Digital I/O Port B, Line 4	54	Digital I/O Port B, Line 2
55	Digital I/O Port B, Line 0	56	Digital Ground
57	Digital I/O Port A, Line 6	58	Digital I/O Port A, Line 4

Table 27: Connector J1 Pin Assignments on the DT340 Board (cont.)

Pin	Signal Description	Pin	Signal Description
59	Digital I/O Port A, Line 2	60	Digital I/O Port A, Line 0
61	Digital Ground	62	C/T Clock Input 2
63	C/T Clock Output 2	64	C/T Gate Input 2
65	C/T Gate Input 0	66	C/T Clock Output 0
67	C/T Clock Input 0	68	Digital Ground

Screw Terminal Assignments on the STP340

Table 28 lists the screw terminal assignments on the STP340 screw terminal panel.

Table 28: Screw Terminal Assignments on the STP340 Screw Terminal Panel

TB	J1 Pin	Signal Description	TB	J1 Pin	Signal Description
1	68	Digital Ground	2	67	C/T Clock Input 0
3	66	C/T Clock Output 0	4	65	C/T Gate Input 0
5	34	Digital Ground	6	33	C/T Clock Input 1
7	32	C/T Clock Output 1	8	31	C/T Gate Input 1
9	64	C/T Gate Input 2	10	63	C/T Clock Output 2
11	62	C/T Clock Input 2	12	61	Digital Ground
13	30	C/T Gate Input 3	14	29	C/T Clock Output 3
15	28	C/T Clock Input 3	16	27	Digital Ground
17	42	Digital Ground	18	41	C/T Clock Input 4
19	40	C/T Clock Output 4	20	39	C/T Gate Input 4
21	8	Digital Ground	22	7	C/T Clock Input 5
23	6	C/T Clock Output 5	24	5	C/T Gate Input 5
25	38	C/T Gate Input 6	26	37	C/T Clock Output 6
27	36	C/T Clock Input 6	28	35	Power Ground
29	4	C/T Gate Input 7	30	3	C/T Clock Output 7
31	2	C/T Clock Input 7	32	1	+5 V Output
33	-	Shield	34	60	Digital I/O Port A, Line 0
35	26	Digital I/O Port A, Line 1	36	59	Digital I/O Port A, Line 2
37	25	Digital I/O Port A, Line 3	38	58	Digital I/O Port A, Line 4
39	24	Digital I/O Port A, Line 5	40	57	Digital I/O Port A, Line 6
41	23	Digital I/O Port A, Line 7	42	56	Digital Ground
43	-	Shield	44	55	Digital I/O Port B, Line 0
45	21	Digital I/O Port B, Line 1	46	54	Digital I/O Port B, Line 2
47	20	Digital I/O Port B, Line 3	48	53	Digital I/O Port B, Line 4
49	19	Digital I/O Port B, Line 5	50	52	Digital I/O Port B, Line 6
51	18	Digital I/O Port B, Line 7	52	22	Digital Ground
53	-	Shield	54	51	Digital I/O Port C, Line 0
55	17	Digital I/O Port C, Line 1	56	50	Digital I/O Port C, Line 2
57	16	Digital I/O Port C, Line 3	58	49	Digital I/O Port C, Line 4

Table 28: Screw Terminal Assignments on the STP340 Screw Terminal Panel (cont.)

TB	J1 Pin	Signal Description	TB	J1 Pin	Signal Description
59	15	Digital I/O Port C, Line 5	60	48	Digital I/O Port C, Line 6
61	14	Digital I/O Port C, Line 7	62	47	Digital Ground
63	-	Shield	64	46	Digital I/O Port D, Line 0
65	12	Digital I/O Port D, Line 1	66	45	Digital I/O Port D, Line 2
67	11	Digital I/O Port D, Line 3	68	44	Digital I/O Port D, Line 4
69	10	Digital I/O Port D, Line 5	70	43	Digital I/O Port D, Line 6
71	9	Digital I/O Port D, Line 7	72	13	Digital Ground

Screw Terminal Assignments for the STP68

Table 29 lists the screw terminal assignments for the STP68 screw terminal panel.

Table 29: Screw Terminal Assignments for the STP-68 Screw Terminal Panel

TB	J1 Pin	Signal Description	TB	J1 Pin	Signal Description
1	1	+5 V Output	2	2	C/T Clock Input 7
3	3	C/T Clock Output 7	4	4	C/T Gate Input 7
5	5	C/T Gate Input 5	6	6	C/T Clock Output 5
7	7	C/T Clock Input 5	8	8	Digital Ground
9	9	Digital I/O Port D, Line 7	10	10	Digital I/O Port D, Line 5
11	11	Digital I/O Port D, Line 3	12	12	Digital I/O Port D, Line 1
13	13	Digital Ground	14	14	Digital I/O Port C, Line 7
15	15	Digital I/O Port C, Line 5	16	16	Digital I/O Port C, Line 3
17	17	Digital I/O Port C, Line 1	18	18	Digital I/O Port B, Line 7
19	19	Digital I/O Port B, Line 5	20	20	Digital I/O Port B, Line 3
21	21	Digital I/O Port B, Line 1	22	22	Digital Ground
23	23	Digital I/O Port A, Line 7	24	24	Digital I/O Port A, Line 5
25	25	Digital I/O Port A, Line 3	26	26	Digital I/O Port A, Line 1
27	27	Digital Ground	28	28	C/T Clock Input 3
29	29	C/T Clock Output 3	30	30	C/T Gate Input 3
31	31	C/T Gate Input 1	32	32	C/T Clock Output 1
33	33	C/T Clock Input 1	34	34	Digital Ground
35	35	Power Ground	36	36	C/T Clock Input 6
37	37	C/T Clock Output 6	38	38	C/T Gate Input 6
39	39	C/T Gate Input 4	40	40	C/T Clock Output 4
41	41	C/T Clock Input 4	42	42	Digital Ground
43	43	Digital I/O Port D, Line 6	44	44	Digital I/O Port D, Line 4
45	45	Digital I/O Port D, Line 2	46	46	Digital I/O Port D, Line 0
47	47	Digital Ground	48	48	Digital I/O Port C, Line 6
49	49	Digital I/O Port C, Line 4	50	50	Digital I/O Port C, Line 2
51	51	Digital I/O Port C, Line 0	52	52	Digital I/O Port B, Line 6
53	53	Digital I/O Port B, Line 4	54	54	Digital I/O Port B, Line 2
55	55	Digital I/O Port B, Line 0	56	56	Digital Ground
57	57	Digital I/O Port A, Line 6	58	58	Digital I/O Port A, Line 4

Table 29: Screw Terminal Assignments for the STP-68 Screw Terminal Panel (cont.)

TB	J1 Pin	Signal Description	TB	J1 Pin	Signal Description
59	59	Digital I/O Port A, Line 2	60	60	Digital I/O Port A, Line 0
61	61	Digital Ground	62	62	C/T Clock Input 2
63	63	C/T Clock Output 2	64	64	C/T Gate Input 2
65	65	C/T Gate Input 0	66	66	C/T Clock Output 0
67	67	C/T Clock Input 0	68	68	Digital Ground

C

Using Your Own Screw Terminal Panel

Data acquisition boards can perform only as well as the input connections and signal integrity you provide. If you choose not to use the STP340 screw terminal panel, you can use the STP-68 screw terminal panel provided by Data Translation, or you can design your own screw terminal panel. If you design your own screw terminal panel, you must consider how the signals interact in the real world as well as how they interact with each other.

This appendix describes additional considerations to keep in mind when designing your own screw terminal panel for use with the DT340 board.

Digital Inputs and Counter/Timer Inputs

TTL-type inputs must have current limiting so that circuitry is not damaged when power is removed. On all Data Translation PCI boards, current limiting is used to prevent damage in this fault condition.

On high-speed clock inputs, a ground that is located in the connector next to the clock must be connected as a twisted pair with the high-speed clock input.

Digital Outputs

If you are using the high drive capability of any of the PCI boards, ensure that the load is returned to the digital ground provided in the connector next to the outputs.

If just eight of the digital outputs are switching 16 mA per output, then 128 mA of current flows. To minimize problems with ringing, loading, and EMI, a 22 Ω resistor is used in series with all digital outputs. You must consider this 22 Ω resistor if you are matching cable impedance to the far end.

Cabling Information

If you are building your own cable, the following information may be useful:

- Conductors: 34 twisted pairs, shielded, #28 AWG
- Onboard connector: (1) 68-pin AMP, receptacle, self-locking, AMP# 787170-7
- Mating connector: AMP# 749621-7

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