PCM-3810I

PCI-104 12-bit Multifunction Module

User Manual

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Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

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

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

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

CE

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

Technical Support and Assistance

Step 1. Visit the Advantech web site at **www.advantech.com/support** where you can find the latest information about the product.

Step 2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
- Product name and serial number
- Description of your peripheral attachments
- Description of your software (operating system, version, application software, etc.)
- A complete description of the problem
- The exact wording of any error messages

Packing List

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

- PCM-3810I DA&C card
- PCM-3810I User Manual
- Companion CD-ROM with DLL drivers

Safety Precaution - Static Electricity

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

1. To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
2. Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

Contents

CHAPTER 1

Introduction

This chapter introduces the PCM-3810I card and its typical applications.

Sections include:

- Features
- Applications
- Installation Guide
- Software Overview
- Device Driver Roadmap
- Accessories

Chapter 1 Introduction

The PCM-3810I is a PCI-104 multifunction card for IBM PC/XT/AT or compatible computers. It offers the five most desired measurement and control functions:

- 12-bit A/D conversion
- 12-bit D/A conversion
- Digital input
- Digital output
- Timer/counter.

A programmable-gain instrument amplifier lets you acquire different input signals without external signal conditioning. An onboard 4k word FIFO buffer provides high-speed data transfer and predictable performance under Windows. Automatic channel scanning circuitry and onboard SRAM let you perform multiple-channel A/D conversion and individual gains for each channel.

The following sections of this chapter will provide further information about features of the multifunction cards, a Quick Start for installation, together with some brief information on software and accessories for the PCM-3810I cards.

1.1 Features

- 16 single-ended or 8 differential A/D inputs, switch selectable
- 12-bit A/D converter, up to 250 kHz sampling rate
- Programmable gain for each input channel
- Automatic channel/gain scanning
- Onboard ring buffer for analog input and output
- Software selectable Bipolar/Unipolar analog input ranges
- 16 digital inputs and 16 digital outputs, TTL compatible
- Two 12-bit analog output channels
- Onboard programmable counter
- Three 24-bit event counters
- BoardID switch

PCM-3810I offers the following main features:

PCI-Bus Plug & Play

The PCM-3810I card uses a PCI controller to interface the card to the PCI-104 bus. The controller fully implements the PCI bus specification Rev 2.2. All configurations related to the bus, such as base address and interrupt assignment, are automatically controlled by software. No jumper or switch is required for user configuration.

Automatic Channel/Gain Scanning

PCM-3810I features an automatic channel/gain scanning circuit. This circuit, instead of your software, controls multiplexer switching during sampling. On-board SRAM stores different gain values for each channel. This combination lets user perform multi-channel high-speed sampling (up to 250 kHz) for each channel.

Onboard Ring Buffer Memory

There are 4k samples ring buffer for A/D and D/A on PCM-3810I. This is an important feature for faster data transfer and more predictable performance under Windows system.

Onboard Programmable Timer/Counter

PCM-3810I features three 24-bit timer/counters to provide one shot output, PWM output, periodic interrupt output, time-delay output, and the measurement of frequency and pulse width.

BoardID Switch

PCM-3810I has a built-in DIP switch that helps define each card's ID when multiple PCM-3810I cards have been installed on the same PC chassis. The BoardID setting function is very useful when building a system with multiple PCM-3810I cards. With the correct BoardID settings, you can easily identify and access each card during hardware configuration and software programming.

Note: For detailed specifications of the PCM-3810I, please refer to Appendix A.

1.2 Applications

- Transducer and sensor measurements
- Waveform acquisition and analysis
- Process control and monitoring
- Vibration and transient analysis

1.3 Installation Guide

Before you install your PCM-3810I card, please make sure you have the following necessary components:

- PCM-3810I DA&C card
- PCM-3810I User Manual
- Driver software Advantech DLL drivers (included in the companion CD-ROM)
- Personal computer or workstation with a PCI-104 interface (running Windows 2000/XP/Vista)
- 50-pin/26-pin Flat Cable (optional)
- Wiring board (optional)

Other optional components are also available for enhanced operation:

- ActiveDAQ Pro, LabView or other 3rd-party software

After you get the necessary components and maybe some of the accessories for enhanced operation of your multifunction card, you can then begin the installation procedure. Figure 1.1 on the next page provides a concise flow chart to give users a broad picture of the software and hardware installation procedures:

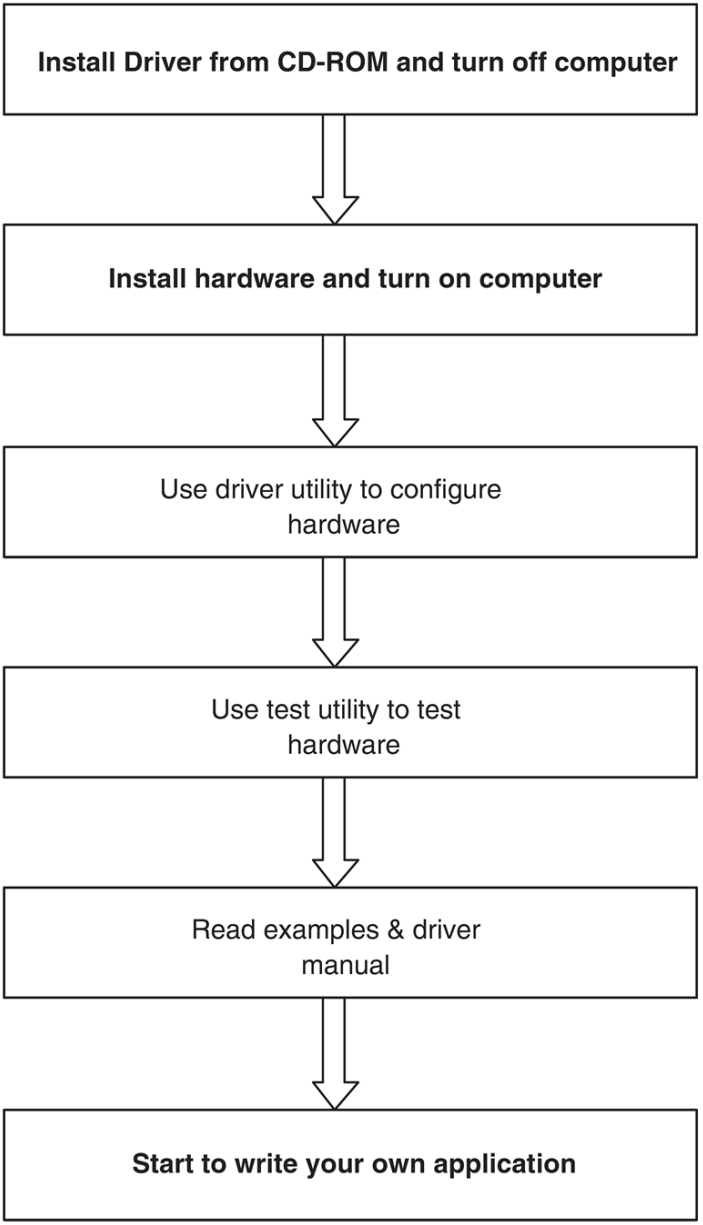

Figure 1.1: Installation Flow Chart

1.4 Software Overview

Advantech offers a rich set of DLL drivers, third-party driver support and application software to help fully exploit the functions of your PCM-3810I card:

- Device Drivers (on the companion CD-ROM)
- LabVIEW driver
- Advantech ActiveDAQ Pro
- WaveScan

Programming choices for DA&C cards

You may use Advantech application software such as Advantech Device Drivers. On the other hand, advanced users can use register-level programming, although this is not recommended due to its laborious and time-consuming nature.

Device Drivers

Advantech Device Driver software is included on the companion CD-ROM at no extra charge. It also comes with all Advantech DA&C cards. Advantech's Device Drivers features a complete I/O function library to help boost your application performance. Advantech Device Drivers for Windows 2000/XP/Vista works seamlessly with development tools such as Visual Studio .Net, Visual C++, Visual Basic, Borland C++ Builder and Borland Delphi.

1.5 Device Driver Programming Roadmap

This section will provide you a roadmap to demonstrate how to build an application from scratch using Advantech Device Drivers with your favorite development tools such as Visual Studio .Net, Visual C++, Visual Basic, Delphi and C++ Builder. The step-by-step instructions on how to build your own applications using each development tool will be given in the *Device Drivers Manual*. Moreover, a rich set of example source code is also given for your reference.

Programming Tools

Programmers can develop application programs with their favorite development tools:

- Visual Studio .Net
- Visual C++ and Visual Basic
- Delphi
- C++ Builder

For instructions on how to begin programming works in each development tool, Advantech offers a *Tutorial* Chapter in the *Device Drivers Manual* for your reference. Please refer to the corresponding sections in this chapter on the *Device Drivers Manual* to begin your programming efforts. You can also look at the example source code provided for each programming tool, since they can get you very well oriented.

The *Device Drivers Manual* can be found on the companion CD-ROM. Alternatively, if you have already installed the Device Drivers on your system, The *Device Drivers Manual* can be readily accessed through the Start button:

Start/Programs/Advantech Automation/Device Manager/ Device Drivers Manual

The example source code could be found under the corresponding installation folder such as the default installation path:

\Program Files\Advantech\ADSAPI\Examples

For information about using other function groups or other development tools, please refer to the *Creating Windows 2000/XP/Vista Application with Device Drivers* chapter and the *Function Overview* chapter on the *Device Drivers Manual*.

Programming with Device Drivers Function Library

Advantech Device Drivers offer a rich function library that can be utilized in various application programs. This function library consists of numerous APIs that support many development tools, such as Visual Studio .Net, Visual C++, Visual Basic, Delphi and C++ Builder.

According to their specific functions or services, APIs can be categorized into several function groups:

- Analog Input Function Group
- Analog Output Function Group
- Digital Input/Output Function Group
- Counter Function Group
- Port Function Group (direct I/O)
- Event Function Group

For the usage and parameters of each function, please refer to the *Function Overview* chapter in the *Device Drivers Manual*.

Troubleshooting Device Drivers Error

Driver functions will return a status code when they are called to perform a certain task for the application. When a function returns a code that is not zero, it means the function has failed to perform its designated function. To troubleshoot the Device Drivers error, you can pass the error code to DRV_GetErrorMessage function to return the error message. Alternatively, you can refer to the *Device Drivers Error Codes* Appendix in the *Device Drivers Manual* for a detailed listing of Error Codes, Error IDs and Error Messages.

1.6 Accessories

Advantech offers a complete set of accessory products to support the PCM-3810I card. These accessories include:

Wiring Cables

- PCL-10150 IDC-50 Flat Cable
- PCL-10126 IDC-26 to DB-25 Cable

Wiring Boards

- **ADAM-3950** 50-pin Flat Cable Wiring Terminal
- **ADAM-3925** DB-25 Wiring Terminal

CHAPTER 2

Installation

This chapter provides a packaged item checklist, proper instructions for unpacking and step-by-step procedures for both driver and card installation..

Sections include:

- Unpacking
- Driver Installation
- Hardware Installation
- Device Setup & Configuration

Chapter 2 Installation

2.1 Unpacking

After receiving your PCM-3810I package, please inspect its contents first. The package should contain the following items:

- PCM-3810I card
- Companion CD-ROM (Device Drivers included)
- User Manual

The PCM-3810I card harbor certain electronic components vulnerable to *electrostatic discharge* (ESD). ESD can easily damage the integrated circuits and certain components if preventive measures are ignored.

Before removing the card from the antistatic plastic bag, you should take the following precautions to ward off possible ESD damage:

- Touch the metal part of your computer chassis with your hand to discharge the static electricity accumulated on your body. Alternatively, one can also use a grounding strap.
- Touch the anti-static bag to a metal part of your computer chassis before opening the bag.
- Take hold of the card only by the metal bracket when removing it out of the bag.

After taking out the card, you should first:

- Inspect the card for any possible signs of external damage (loose or damaged components, etc.). If the card is visibly damaged, please notify our service department or our local sales representative immediately. Do not install a damaged card into your system.

Also, pay extra caution to the following aspects during installation:

- Avoid physical contact with materials that could hold static electricity such as plastic, vinyl and Styrofoam.
- Whenever you handle the card, grasp it only by its edges. DO NOT TOUCH the exposed metal pins of the connector or the electronic components.

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Note: *Keep the anti-static bag for future use. You might need the original bag to store the card if you have to remove the card from a PC or transport it elsewhere.*

2.2 Driver Installation

We recommend you install the driver before you install the PCM-3810I card into your system, since this will guarantee a smooth installation process.

The Advantech Device Drivers Setup program for the PCM-3810I card is included in the companion CD-ROM that is shipped with your DA&C card package. Please follow the steps below to install the driver software:

1. Insert the companion CD-ROM into your CD-ROM drive.
2. The Setup program will be launched automatically if you have the autoplay function enabled on your system. When the Setup Program is launched, you will see the following Setup Screen.

Note: *If the autoplay function is not enabled on your computer, use Windows Explorer or Windows Run command to execute autorun.exe on the companion CD-ROM.*

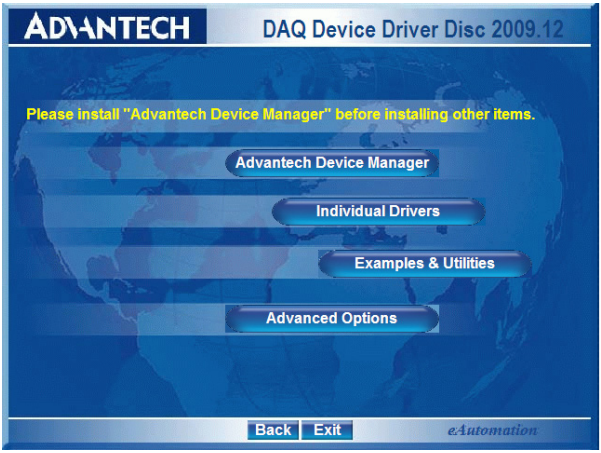


Figure 2.1: Setup Screen of Advantech Automation Software

3. Select the Device Manager option to install.
4. Select the *Individual Driver* option.
5. Select the specific device then follow the installation instructions step by step to complete your device driver installation and setup.

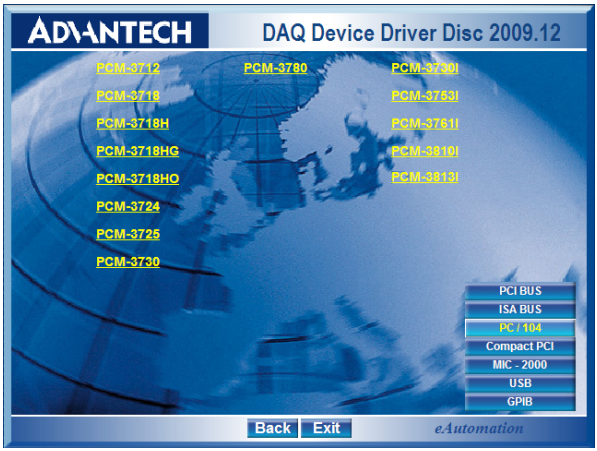


Figure 2.2: Different Options for Driver Setup

For further information on driver-related issues, an online version of the *Device Drivers Manual* is available by accessing the following path:

Start/Programs/Advantech Automation/Device Manager/Device Drivers Manual

2.3 Hardware Installation

Note: Make sure you have installed the driver before you install the card (please refer to chapter 2.2 Driver Installation)

After the Device Drivers installation is completed you can install the PCM-3810I card on your computer. However, it is suggested that you refer to the computer's user manual or related documentation if you have any doubts. Please follow the steps below to install the card onto your system.

1. Turn off your computer and unplug the power cord and cables. TURN OFF your computer before installing or removing any components on the computer.
2. Remove the cover of your computer.
3. Remove the slot cover on the back panel of your computer.
4. Touch the metal part on the surface of your computer to neutralize the static electricity that might be on your body.
5. Insert the PCM-3810I card into the PCI-104 interface. Hold the card only by its edges and carefully align it with the slot. Insert the card firmly into place. Use of excessive force must be avoided; otherwise, the card might be damaged.
6. Connect appropriate accessories (50-pin cable, wiring terminals, etc. if necessary) to the card.
7. Replace the cover of your computer chassis. Re-connect the cables you removed in step 2.
8. Plug in the power cord and turn on the computer.

After your card is properly installed on your system, you can now configure your device using the *Advantech Device Manager* Program that has itself already been installed on your system during driver setup. A complete device installation procedure should include *device setup*, *configuration* and *testing*. The following sections will guide you through the Setup, Configuration and Testing of your device.

2.4 Device Setup & Configuration

The *Advantech Device Manager* program is a utility that allows you to set up, configure and test your device, and later stores your settings on the system registry. These settings will be used when you call the APIs of Advantech Device Drivers.

Setting Up the Device

1. To install the I/O device for your card, you must first run the *Device Manager* program (by accessing *Start/Programs/Advantech Automation/Device Manager/Advantech Device Manager*).
2. You can then view the device(s) already installed on your system (if any) on the *Installed Devices* list box. If the software and hardware installation are completed, you will see PCM-3810I card in the Installed Devices list.

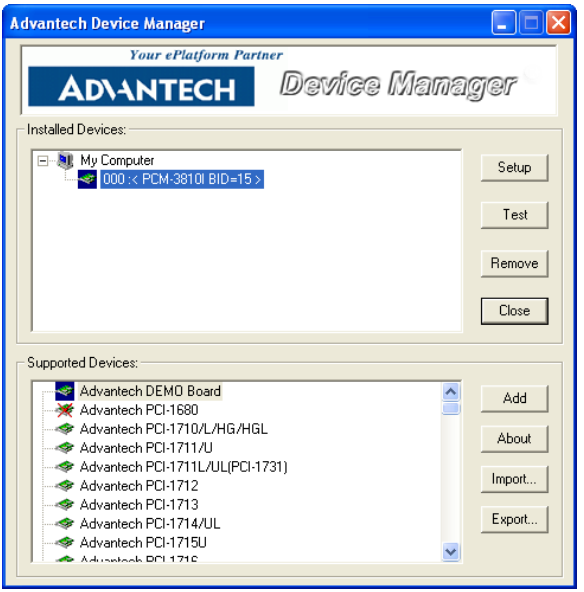


Figure 2.3: The Device Manager Dialog Box

Configuring the Device

3. Please click the Setup button to configure your device. On the *Device Setting* dialog box (Fig. 2-4), you can configure the Analog Input (Fig. 2-5), Analog Output (Fig. 2-6) and Digital Input/Output (Fig. 2-7) of PCM-3810I.

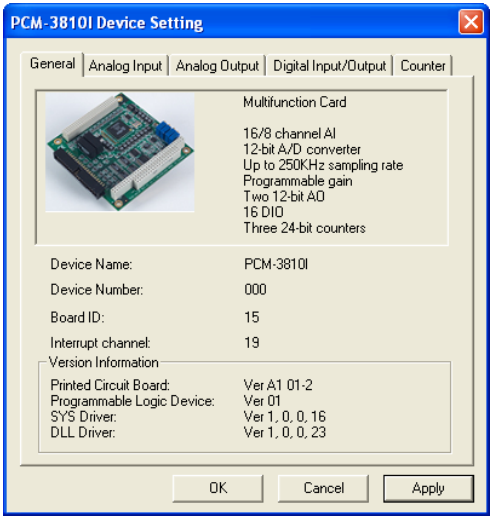


Figure 2.4: The Device Setting Dialog Box

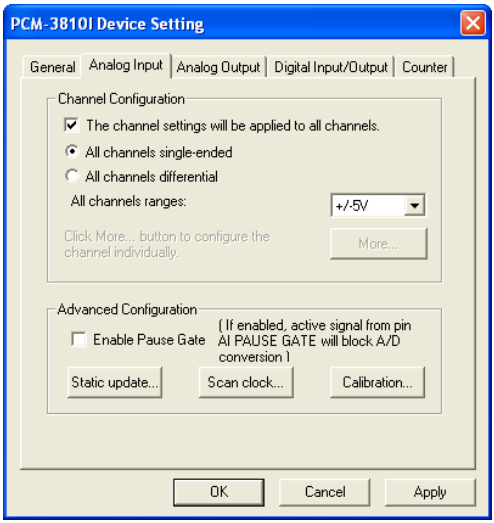


Figure 2.5: Analog Input Configuration

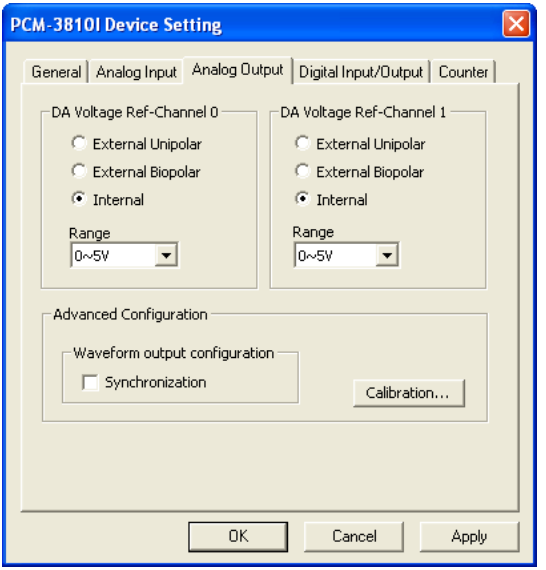


Figure 2.6: Analog Output Configuration

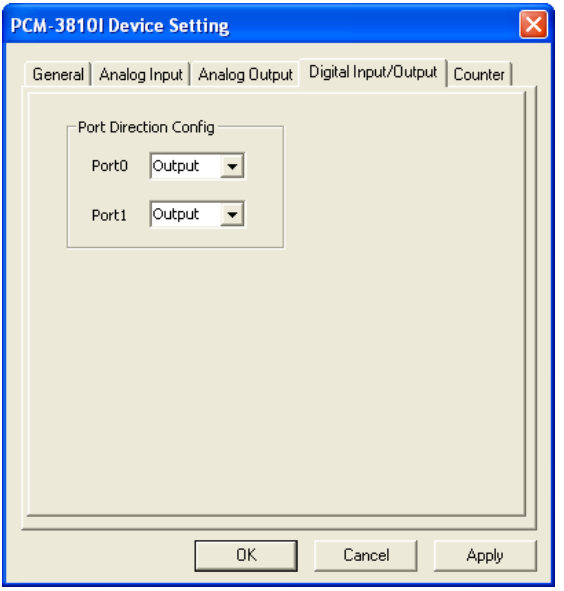


Figure 2.7: Digital Input/Output Configuration

4. After your card is properly installed and configured, you can click the *Test…* button to test your hardware by using the testing utility supplied.

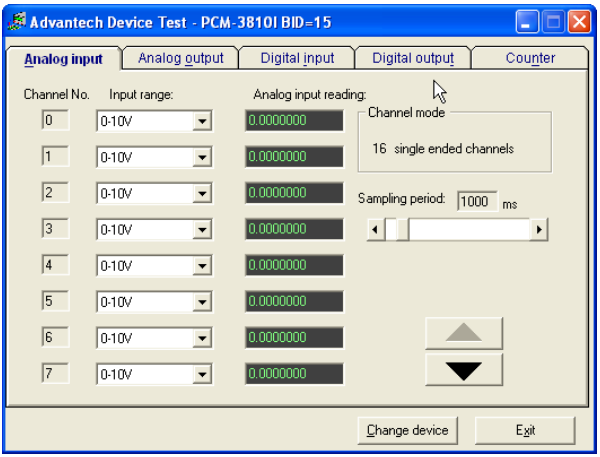


Figure 2.8: The Test Utility Dialog Box

For more detailed information, please refer to *Chapter 2* of the *Device Drivers Manual*. You can also find rich examples on the CD-ROM to speed up your programming.

CHAPTER 3

Signal Connections

This chapter provides useful information about how to connect input and output signals to the PCM-3810I card via the I/O connector.

Sections include:

- Overview
- BoardID Settings
- Signal Connections
- Field Wiring Considerations

Chapter 3 Signal Connections

3.1 Overview

Maintaining signal connections is one of the most important factors in ensuring that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices. This chapter provides useful information about how to connect input and output signals to the PCM-3810I card via the I/O connector.

3.2 Switch and Jumper Settings

The following figure will show you the locations for switches and connectors for PCM-3810I.

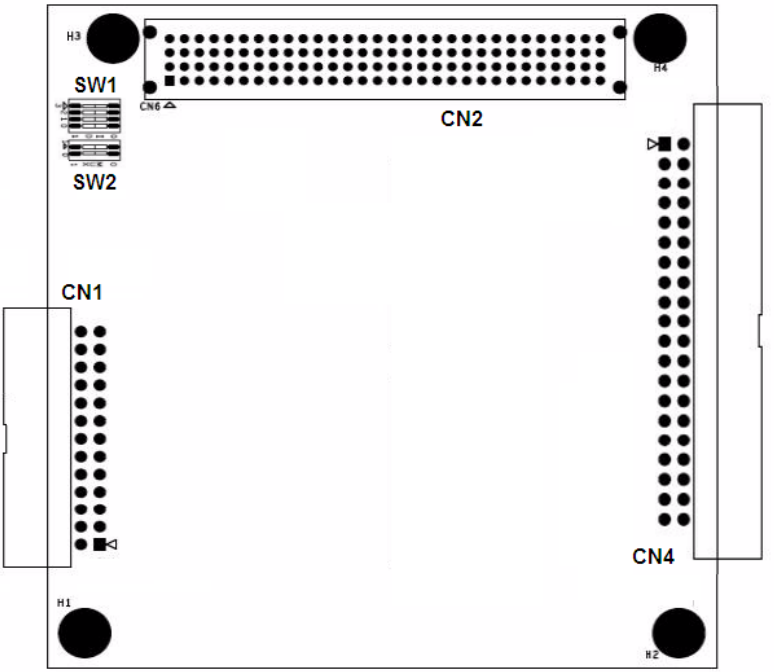


Figure 3.1: Connector and Switch Locations

BoardID settings are used to set a board's unique identifier when multiple identical cards are installed in the same system.

PCM-3810I card has a built-in DIP switch (SW1), which is used to define each card's unique identifier. You can determine the unique identifier in the register as shown in Table 3.1. If there are multiple identical cards in the same chassis, the BoardID switch helps differentiate the boards by identifying each card's device number with the switch setting. The BoardID switch's unique identifier has been set to 0 at the factory.

If you need to adjust it to other numbers, set SW1 by referring to DIP switch settings below.

Table 3.1: Board ID Setting (SW1)

SW1	Position 1	Position 2	Position 3	Position 4
BoardID	**ID3**	**ID2**	**ID1**	**ID0**
0	ON	ON	ON	ON
1	ON	ON	ON	OFF
2	ON	ON	OFF	ON
3	ON	ON	OFF	OFF
4	ON	OFF	ON	ON
5	ON	OFF	ON	OFF
6	ON	OFF	OFF	ON
7	ON	OFF	OFF	OFF
8	OFF	ON	ON	ON
9	OFF	ON	ON	OFF
10	OFF	ON	OFF	ON
11	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON
13	OFF	OFF	ON	OFF
14	OFF	OFF	OFF	ON
15	OFF	OFF	OFF	OFF

Default Setting is 0

3.2.1 CLK and INT Setting (SW2)

If multiple PCM-3810I cards are installed in the system, different CLK and INT signals must be set. SW2 is used for the setting of IDSEL, CLK and INT. One system can support up to 4 PCM-3810I cards.

Table 3.2: CLK and INT Setting

Position 1	Position 2	CLK	INT #
ON	ON	CLK0	INT A#
ON	OFF	CLK1	INT B#
OFF	ON	CLK2	INT C#
OFF	OFF	CLK3	INT D#

3.3 Signal Connections

Pin Assignments

There are two I/O connectors on the PCM-3810I. Figure 3-2 and Figure 3-3 show the ping assignments for the 50-pin I/O connector (CN4) and the 26-pin I/O connector (CN3).

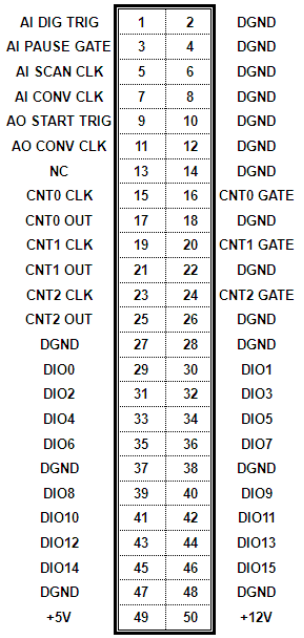


Figure 3.2: 50-pin I/O Connector Pin Assignments

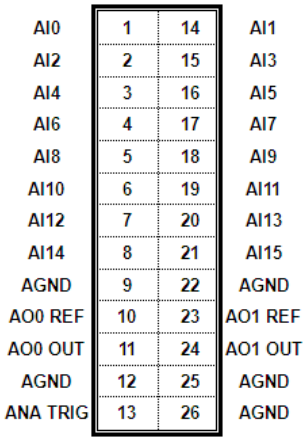


Figure 3.3: 26-pin I/O Connector Pin Assignments

If PCL-10126 is connected to the 26-pin I/O connector (CN3), the pin assignment for PCL-10126's DB-25 is shown in Figure 3-4.

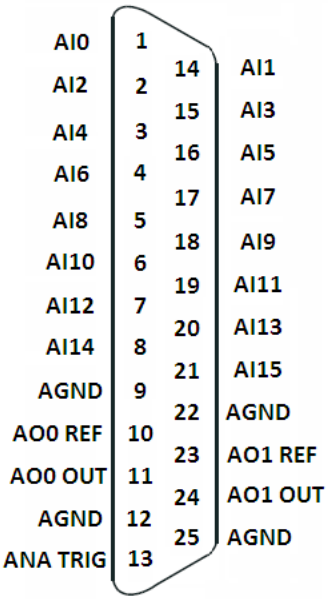


Figure 3.4: PCL-10126 DB-25 I/O Connector Pin Assignments

3.3.1 I/O Connector Signal Description

Table 3.3: I/O Connector Signal Descriptions

Signal Name	Reference	Direction	Description
AI<0…15>	AGND	Input	**Analog Input Channels 0 to 15.** Each channel pair, AI<i, i+1> (i = 0, 2, 4...14), can be configured as either two single-ended inputs or one differential input.
AGND	-	-	**Analog Ground.** These pins are the reference points for single-ended measurements and the bias current return point for differential measurement. The ground references (AGND and DGND) are connected together on the PCM-3810I.
ANA TRIG	AGND	Input	**Analog threshold Trigger.** This pin is the analog input threshold trigger input.
AI DIG TRIG	DGND	Input	**Analog Input Digital Trigger.** This pin is used to execute a specific data acquisition mode - an acquisition which consists of one or more scans.
AI PAUSE GATE	DGND	Input	**Analog Input Pause GATE.** This pin is used to pause and resume a data acquisition. The *AI Conversion Clock* pauses while the *AI Pause Gate* signal is active and resumes when the signal is inactive. The active level of the pause gate could be programmed to be high or low.
AI SCAN CLK	DGND	Input	**Analog Input Scan Clock.** This pin is used to initiate a set of data acquisition. The card samples the AI signals of every channel in the scan list once for every *AI Scan Clock*.
AI CONV CLK	DGND	Input	**Analog Input Conversion Clock.** This pin is to initiate a single A/D conversion on a single channel. A Scan (controlled by the *AI Scan Clock*) consists of one or more conversions.

AO0 REF AO1_REF	AGND	Input	**Analog Output Channel 0/1 External Reference.** This is the external reference input for the analog output channel 0/1.
AO0_OUT AO1_OUT	AGND	Output	**Analog Output Channels 0/1.** This pin supplies the voltage output of analog output channel 0/1.
AO START TRIG	DGND	Input	**Analog Output Start Trigger.** This pin is to initiate a waveform generation. If you do not use triggers, you can begin a generation with a software command.
AO CONV CLK	DGND	Input	**Analog Output Convert Clock.** This pin is to initiate AO conversion. Each sample updates the outputs of all of the DACs. You can specify an internal or external source for AO Convert Clock.
DIO<0..15>	DGND	Input	**Digital Input/ Output Channel 0 to 15.** These pins are digital input/ output which could be configured as general purpose digital inputs or outputs.
DGND	-	-	**Digital Ground.** This pin supplies the reference for the digital channels at the I/O connector as well as the +5 V and +12 V DC supply. The ground references (AGND and DGND) are connected together on the PCM-3810I.
CNT0 CLK CNT1 CLK CNT2 CLK	DGND	Input	**Counter 0/1/2 External Clock Input.** The clock input of counters can be either external (up to 10 MHz) or internal (1 MHz), as set by software.
CNT0 OUT CNT1 OUT CNT2 OUT	DGND	Output	Counter 0/1/2 Output.

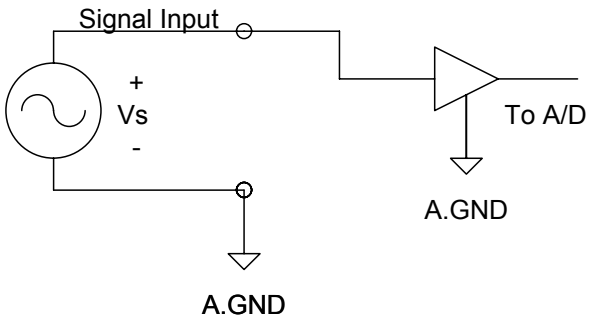
CNT0 GATE CNT1 GATE CNT2 GATE	DGND	Input	Counter 0/1/2 Gate Control.
+12V	DGND	Output	**+12 VDC Source.** This pin is +12V DC power supply for external use. (1A maximum)
+5V	DGND	Output	**+5 VDC Source.** This pin is +5V DC power supply for external use. (1A maximum)
NC	-	-	**Not Connected.** These pins serve no connection. Do not connect signals to these pins for future compatibility.

3.3.2 Analog Input Connections

PCM-3810I supports either 16 single-ended or 8 differential analog inputs.

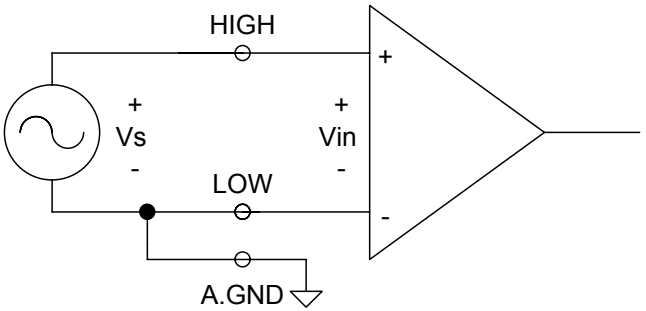
Single-ended Channel Connections

Single-ended connections use only one signal wire per channel. The voltage on the line references to the common ground on the card. A signal source without a local ground is called a "floating" source. It is fairly simple to connect a single ended channel to a floating signal source. A standard wiring diagram looks like this:



Differential Channel Connections

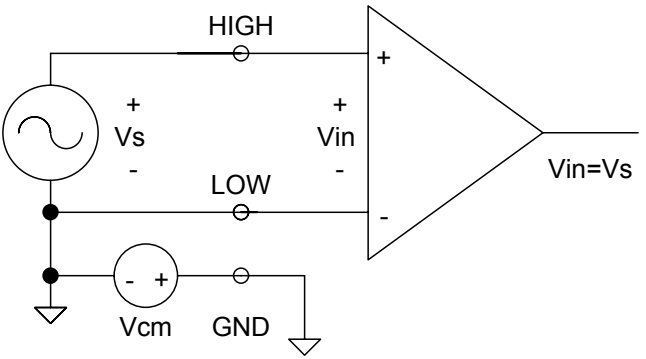
Differential input connections use two signal wires per channel. The card measures only the voltage difference between these two wires, the HIGH wire and the LOW wire. If the signal source has no connection to ground, it is called a "floating" source. A connection must exist between LOW and ground to define a common reference point for floating signal sources. To measure a floating sources connect the input channels as shown below:



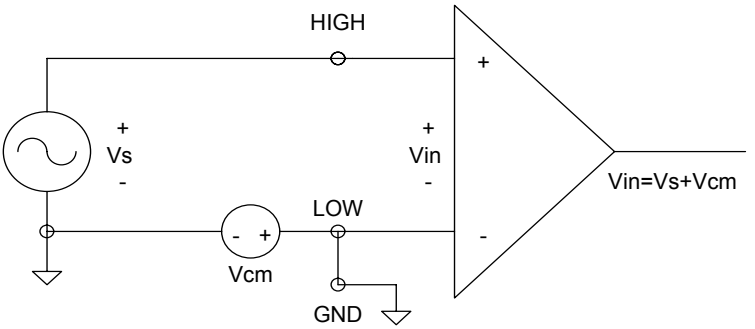
If the signal source has one side connected to a local ground, the signal source ground and the PCM-3810I ground will not be at exactly the same voltage, as they are connected through the ground return of the equipment and building wiring. The difference between the ground voltages forms a common-mode voltage.

To avoid the ground loop noise effect caused by common-mode voltages, connect the signal ground to the LOW input. Do not connect the LOW input to the PCM-3810I ground directly. In some cases you may also need a wire connection between the PCM-3810I ground and the signal source ground for better grounding. The following two diagrams show correct and incorrect connections for a differential input with local ground:

Correct Connection



Incorrect Connection



Analog Output Connection

The PCM-3810I provides two D/A output channels. You can use the internal precision -5 V or -10 V reference to generate 0 to +5 V or 0 to +10 V D/A output. Use an external reference for other D/A output ranges. The maximum reference input voltage is ±10 V and maximum output scaling is ±10 V. Loading current for D/A outputs should not exceed 5 mA.

Fig. 3-5 shows how to make analog output and external reference input connections on the PCM-3810I.

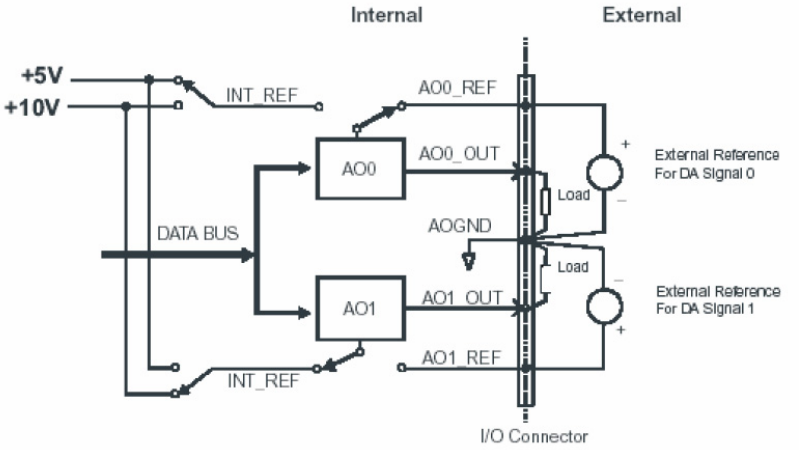
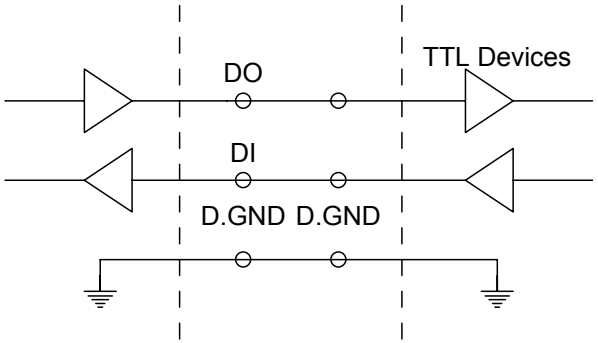


Figure 3.5: Analog Output Connections

3.3.3 Digital Signal Connections

The PCM-3810I has 16 digital input/output channels and they can be configured as input or output channels. The digital I/O levels are TTL compatible. The following figure shows connections to exchange digital signals with other TTL devices:



3.4 Field Wiring Considerations

When you use PCM-3810I cards to acquire data from outside, noises in the environment might significantly affect the accuracy of your measurements if due cautions are not taken. The following measures will be helpful to reduce possible interference running signal wires between signal sources and the PCM-3810I card.

- The signal cables must be kept away from strong electromagnetic sources such as power lines, large electric motors, circuit breakers or welding machines, since they may cause strong electromagnetic interference. Keep the analog signal cables away from any video monitor, since it can significantly affect a data acquisition system.
- If the cable travels through an area with significant electromagnetic interference, you should adopt individually shielded, twisted-pair wires as the analog input cable. This type of cable has its signal wires twisted together and shielded with a metal mesh. The metal mesh should only be connected to one point at the signal source ground.
- Avoid running the signal cables through any conduit that might have power lines in it.
- If you have to place your signal cable parallel to a power line that has a high voltage or high current running through it, try to keep a safe distance between them. Alternatively, you can place the signal cable at a right angle to the power line to minimize the undesirable effect.
- The signals transmitted on the cable will be directly affected by the quality of the cable. In order to ensure better signal quality, we recommend that you use the PCL-10150 and PCL-10126 cables.

APPENDIX A

Specifications

Appendix A Specifications

A.1 Analog Input

Channels	16 single-ended or 8 differential or combination					
Resolution	12-bit					
FIFO Size	4k samples					
Max. Sampling Rate	250 kS/s					
Input Range and Gain List	Gain	0.5	1	2	4	8
	Unipolar	N/A	0~10	0~5	0~2.5	0~1.25
	Bipolar	±10	±5	±2.5	±1.25	±0.625
Drift	Gain	0.5	1	2	4	8
	Zero	15 ppm/°C				
	Span	25 ppm/°C				
Small Signal BW for PGA	Gain	0.5	1	2	4	8
	Bandwidth	1MHz	3.3MHz	3.3MHz	2.8MHz	1.8MHz
Max. Input Voltage	±15 V					
Input Impedance	300 M / 5pF					
Sampling Mode	Software, on-board programmable pacer or external					
Trigger Mode	Pre-trigger, post-trigger, delay-trigger, about-trigger					
Accuracy	DC	INLE: ±1 LSB				
		DNLE: ±1 LSB				
		Offset error<1LSB				
		Gain	0.5	1	2	4	8
		Gain Error (% FSR)	0.1	0.1	0.2	0.2	0.4
		Channel Type	SE/ DIFF	SE/ DIFF	DIFF	DIFF	DIFF
	AC	SNR: 68dB					
		ENOB: 10.5 bits					
External TTL Trigger Input	Low	0.8 V max.					
	High	2.4 V min.					

A.2 Analog Output

Channels	2	
Resolution	12-bit	
Output Range	Using Internal Reference	0~5, 0~10, ±5, ±10 V
	Using External Reference	0 ~ +x V @ +x V (-10 ≤x ≤10) -x ~ +x V @ +x V (-10 ≤x ≤10
Accuracy	Relative	±1 LSB
	Differential Non-linearity	±1 LSB (monotonic)
Gain Error	Adjustable to zero	
Drift	10 ppm / °C	
Driving Capability	10 mA	
Update Rate	Static update, waveform	
Output Impedance	0.1 ohm max.	

A.3 Digital Input/Output

Channels	16 (shared)	
Input Voltage	Low	0.8V max.
	High	2.4 V min.
Output Voltage	Low	0.8 V max.@ +8.0mA (sink)
	High	2.4 V min.@ -0.4mA(source)

A.4 Counter/Timer

Channels	3 (independent)	
Resolution	24-bit	
Compatibility	TTL level	
Base Clock	Internal 20 MHz or external clock (10 MHz max.), selected by software	
Max. Input Frequency	10 MHz	
Clock Input	Low	0.8 V max.
	High	2.4 V min.
Gate Input	Low	0.8 V max.
	High	2.4 V min.
Counter Output	Low	0.5 V max.@+24 mA
	High	2.4 V min.@-15 mA

A.5 General

I/O Connector Type	50-pin and 26-pin box header	
Dimensions	96 x 90 mm (3.8" x 3.5")	
Power Consumption	**Typical**	+5 V @ 850 mA
	Max.	+5 V @ 1 A
Temperature	**Operating**	0~60° C (32~140° F) (refer to *IEC 68-2-1,2)*
	Storage	-20~ 70° C (-4~158° F)
Relative Humidity	**Operating**	5~85%RH non-condensing (refer to *IEC 68-1,-2,-3*)
	Storage	5~95%RH non-condensing (refer to *IEC 68-1,-2,-3*)
Certifications	CE certified	