PCL-728

2-ch Isolated Analog Output ISA Card

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.

Declaration of Conformity

CE

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

FCC Class A

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

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

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User's Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:

a. The power cord or plug is damaged.

b. Liquid has penetrated into the equipment.

c. The equipment has been exposed to moisture.

d. The equipment does not work well, or you cannot get it to work according to the user's manual.

e. The equipment has been dropped and damaged.

f. The equipment has obvious signs of breakage.

15. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAM-

AGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.

16. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.

The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

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 contains information on the PCL-728 and instruction on card configuration in order to match your application and prepare it for installation on your system.

Sections include:

- Features
- Specifications
- Applications
- Installation Guide
- Software Overview

Chapter 1 Introduction

The PCL-728 provides 2 isolated analog output channels on a single PC-BUS add-on card. Each channel is fully isolated, and independent from the system's ground, and can be set to the following ranges: 0 to 5V, 0 to 10V, +/-5V, +/-10V, 4 to 20mA, and 0 to 20mA current output.

Designed for rugged environment, the PCL-728 is an ideal and economical solution for industrial application requiring multiple analog voltage and/or current output channels.

1.1 Features

- 2 Independent analog output channels
- 12-bit resolution double-buffered D/A converter
- Multiple voltage ranges: ±10 V, ±5 V, 0 ~ +5 V, 0 ~ +10 V, 4 ~ 20 mA and 0 ~ 20 mA current loop (sink)
- Two DB9 connectors for easy wiring

1.2 Specifications

1.2.1 Analog Output

Channels: 2 channels

Resolution: 12 Bits. Double buffered

Output range: 0 to +5V (unipolar)
0 to +10V (unipolar)
+/- 5V (bipolar)
+/- 10V (bipolar)
0 to 20mA current loop (sink)
4 to 20mA current loop (sink)

Reference voltage:

Internal: -5V (+/- 0.05V)
-10v (+/- 0.05V)

External: DC or AC, +/- 10V max.

Conversion type: 12 bit monolithic multiplying

Isolation voltage: 2500V_{DC}

Analog devices: AD7541AKN or equivalent

Linearity: +/- 1/2 bit

Accuracy: +/- 0.012% full scale range

Temperature draft: 5PPM/deg C full scale range

Settling time: 60 us max. with AD8677 output amplifiers

Current loop: 4 to 20 mA and 0 to 20mA constant current sink

Voltage output drive: +/- 5mA max.

Current loop excitation voltage: Minimum +8V, maximum 36V for 4 to 20mA and 0 to 20mA current loop

Reset (power-on status): All D/A channels will be at 0 volt output after reset or power-on, either bipolar or unipolar mode

1.2.2 General Specifications

Power consumption: 5V @ 800 mA max.

I/O connector: 2 x DB9 female connector

Operating Temp.: 0 to +50°C (0 to +122°F)

Storage Temp.: -20 to +65°C (-4 to +149°F)

Weight: 120 gms

1.3 Applications

- Process control
- Programmable voltage source
- Programmable current sink
- Servo control
- Multiple loop PID control

1.4 Installation Guide

Before you install your PCL-728 card, please make sure you have the following necessary components:

- PCL-728 DA&C card
- PCL-728 User Manual
- Driver software Advantech DLL drivers (in the companion CD-ROM)
- PC or workstation with a ISA-bus slot

Some other optional components are also available for enhanced operation: ActiveDAQ, ActiveDAQ Pro, LabView or other 3rd-party software packages.

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 gives users an overview of the software and hardware installation procedure:

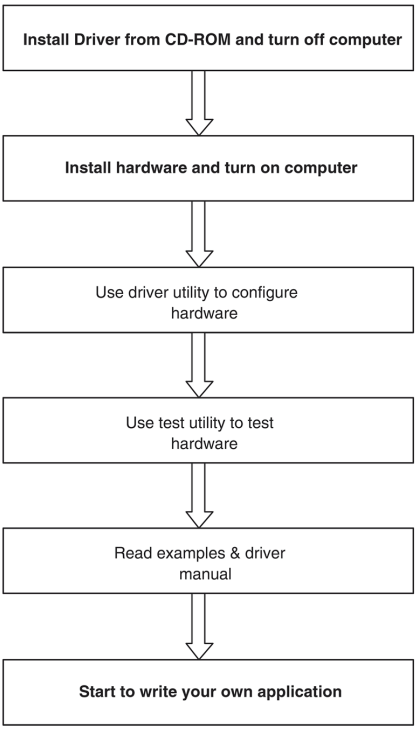


Figure 1.1: Installation Flow Chart

1.5 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 PCL-728 card:

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

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 Win 2000/XP works seamlessly with development tools such as Visual C++, Visual Basic, Borland C++ Builder and Borland Delphi.

Register-level Programming

Register-level programming is available for experienced programmers who find it necessary to write code directly at the level of the device register. But since register-level programming requires much effort and time, it is strongly recommend to use the Advantech Device Drivers instead.

CHAPTER 2

Installation

This chapter contains a package item checklist, proper instructions for unpacking and step-by-step procedures for card installation.

Sections include:

- Unpacking
- Driver Installation
- Hardware Installation
- Device Configuration

Chapter 2 Installation

2.1 Unpacking

After receiving your PCL-728 package, please inspect its contents first. The package should contain the following items:

- PCL-728 card
- Companion CD-ROM (Device Drivers included)
- User Manual

The PCL-728 cards 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.

Note: Keep the anti-static bag for future use. You might need the original bag to store the card I 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 plug the PCL-728 into your system, since this will guarantee a smooth installation process.

The Advantech Device Drivers Setup program for the PCL-728 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, the Setup Screen will appear.

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: Advantech Automation Software Setup

3. First, install the Advantech Device Manager.
4. Select the "**Individual Drivers**" to install the specific device driver then just follow the installation instructions step by step to complete your device driver installation and setup.

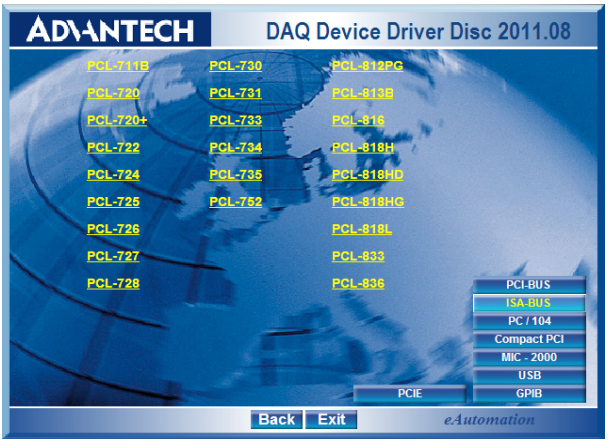


Figure 2.2: Different Options for Driver Setup

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

Start/Advantech Automation/Device Manager/Device Driver's Manual

2.3 Hardware Installation

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

After the Device Drivers installation is completed you can install the PCL-728 card into any ISA slot on your computer. 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. 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.

1. Turn off your computer and unplug the power cord and cables.
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 PCL-728 card into a ISA slot. Hold the card only by its edges and carefully align it with the slot. Insert the card firmly into place.
6. Fasten the bracket of the ISA card on the back panel rail of the computer with screws.
7. Connect appropriate accessories (DB 9-pin cable wiring terminals, etc. if necessary) to the ISA card.
8. Replace the cover of your computer chassis. Re-connect the cables you removed in step 2.
9. 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.

CHAPTER 3

Signal Connections

This chapter provides useful information about how to connect input and output signals to the PCL-728 via the I/O connector.

Sections include:

- Overview
- Switch & Jumper Settings
- Signal Connections

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 on how to connect input and output signals to the PCL-728 via the I/O connector.

3.2 Switch & Jumper Settings

The PCL-728 uses ten sets of jumper pins (five sets for each channel) to configure its reference source, voltage output, and current sink range selections to your applications requirements. It also uses an 8-position DIP switch for selecting an appropriate I/O address for its firmware to occupy. Below figure shows the positions of connectors, jumpers and switches.

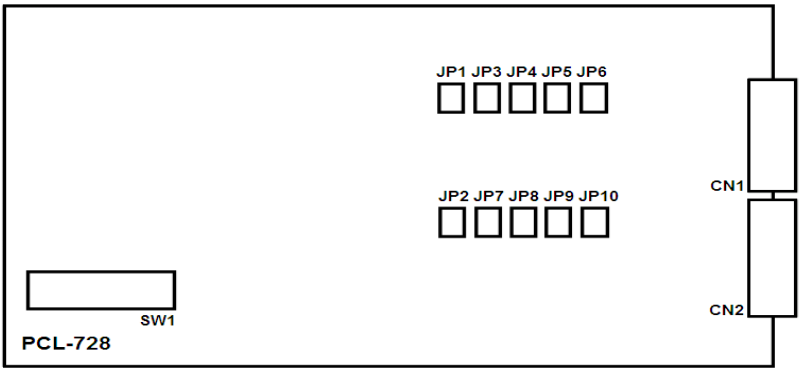


Figure 3.1: Card Connectors, Jumpers & Switches

Location	Description
CN1	DB 9-pin connector for analog output channel 1
CN2	DB 9-pin connector for analog output channel 2
JP3, JP4, JP7, JP8	Reference Source Selection
JP1, JP2, JP5, JP9	Voltage Output Selection
JP6, JP10	Current Sink Range Selection
SW1	Base Address setting

3.2.1 Base Address Selection

Switch name: SW1 position 1 to 8

Most PC peripheral devices and interface cards are controlled through the input/output (I/O) ports. These ports are addressed using the I/O 5 port address space. Appendix C provides a PC I/O port address map to help you locate appropriate addresses for different devices.

The I/O port base address for the PCL-728 is selectable via an 8 position DIP switch. Valid addresses are from hex 200 to hex 3F0, however you might have used some of these addresses for other devices. Your PCL-728 base address switch setting is set to hex 2C0 in the factory. If you need to adjust it to some other address range, the switch settings for various base addresses are illustrated as below:

Table 3.1: Switch Position Summary

I/O Address Range (Hex)	Switch Position							
	1	2	3	4	5	6	7	8
	A9	A8	A7	A6	A5	A4	A3	X
200-207	OFF	ON	ON	ON	ON	ON	ON	X
210-21F	OFF	ON	ON	ON	ON	OFF	ON	X
. . .								
2C0-2CF*	OFF	ON	OFF	OFF	ON	ON	ON	X
300-30F	OFF	OFF	ON	ON	ON	ON	ON	X

Note: *- X = Non specific*

- A3...A9 corresponds to PC bus address lines

*- * means factory setting*

3.2.2 Reference Source Selection

Jumper name: JP3, JP4, JP7, JP8

Before setting the PCL-728's reference source, you must decide which type of source, internal or external (JP4 for channel 1, and JP8 for channel 2), you want to use with your application. External reference voltage may be selected for AC or DC sources. The maximum external reference voltage is +/- 10V, and the maximum D/A output range is +/- 10V. See the illustration below:

JP4 & JP8	JP4 & JP8
	
Internal*	External

Note: ** denotes factory setting*

A fixed, precision internal -5 and -10V reference is provides by the PCL-728. Setting channel 1 and 2's internal reference source is accomplished by closing JP3 (for channel 1), and JP7 (for channel 2). The internal reference source can be set to -10V or -5V. The following illustration pertains to both of these jumpers.

JP3 & JP7	JP3 & JP7
	
Internal -5V*	External -10V

3.2.3 Voltage Output Selection

Jumper name: JP1, JP2, JP5, JP9

Jumpers, JP1 and JP5 (for channel 1), and JP2 and JP9 (for channel 2), are all used to select each channel's voltage output as either unipolar or bipolar. The following illustration shows the voltage output selection for both channels.

UNIPOLAR OUTPUT*	
JP1 & JP2	JP5 & JP9
	
BIPOLAR OUTPUT	
JP1 & JP2	JP5 & JP9
	

Note: ** denotes factory setting*

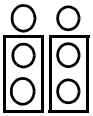
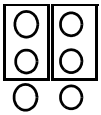
Some typical reference source and output range configurations are illustrated below:

Table 3.2: Summary of Jumper Settings		
Output Range	**JP3 (JP7)**	**JP1 & JP5 (JP2 & JP9)**
0 to +5V Unipolar		
0 to 10V Unipolar		
+/-5V Bipolar		
+/-10V Bipolar		

3.2.4 Current Sink Range Selection

Jumper name: JP6, JP10

JP6 and JP10 are used to select each channels' current sink range of either 4 - 20mA or 0 -20mA. JP6 corresponds with channel 1, and JP10 is used with channel 2. In order to use the current sink range, you must set the PCL-728's output voltage to unipolar. You must also use the internal reference source set to -5V. The diagram below shows the correct jumper settings for the PCL-728's current sink range.

JP6 & JP10	JP6 & JP10
	
4-20mA*	0-20mA

Note: ** denotes factory setting*

Note: *In order to maintain an accurate output during your application, it is important that you keep the PCL-728's variable resistors (VRs) be calibrated from time to time. Calibration instructions are provided in Appendix.*

3.3 Signal Connections

The PCL-728 is equipped with two DB9 pin female connectors, located on the card at CN1 and CN2. Use these connectors for outputting a D/A signal to an external device. CN1 is used as an output connection for channel 1, and CN2 is used for channel 2.

The following diagrams illustrate the pin assignment of each connector.

Legend:

V OUT: Analog voltage output

EXT. REF: External reference source voltage input

I. SINK: Current sink

A.GND: Analog ground

+15V: +15V outputt

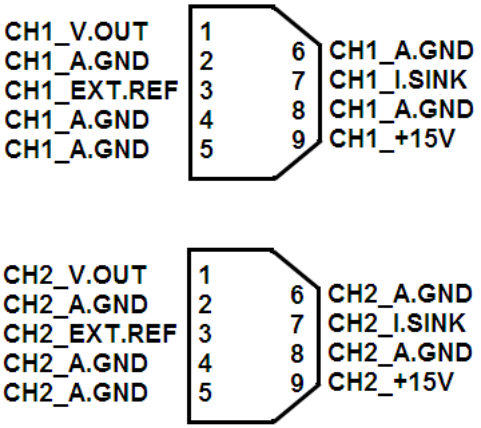


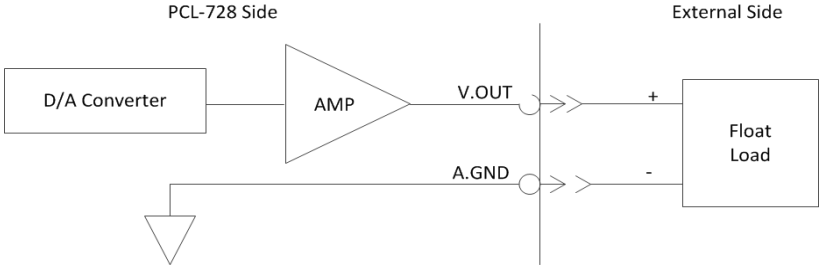
Figure 3.2: Connectors CN1 and CN2

Voltage Output Connections

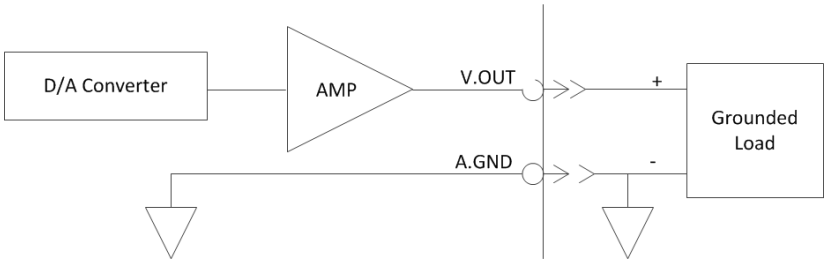
Voltage Connections

The PCL-728 supports isolated channels of D/A voltage output. There is only one output signal wire for each channel. The voltage is referred to the common ground. It is fairly simple to connect a voltage output channel to a floating load.

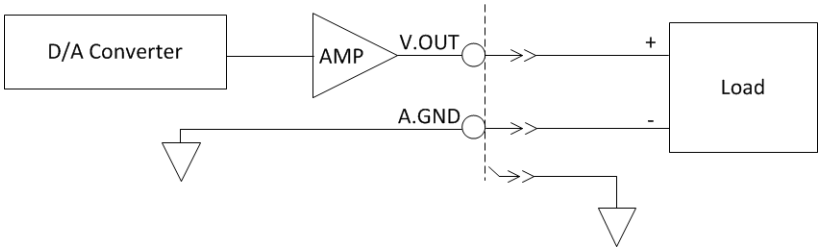
A standard wiring diagram is illustrated below:



For grounded load, the signal should be connected as:

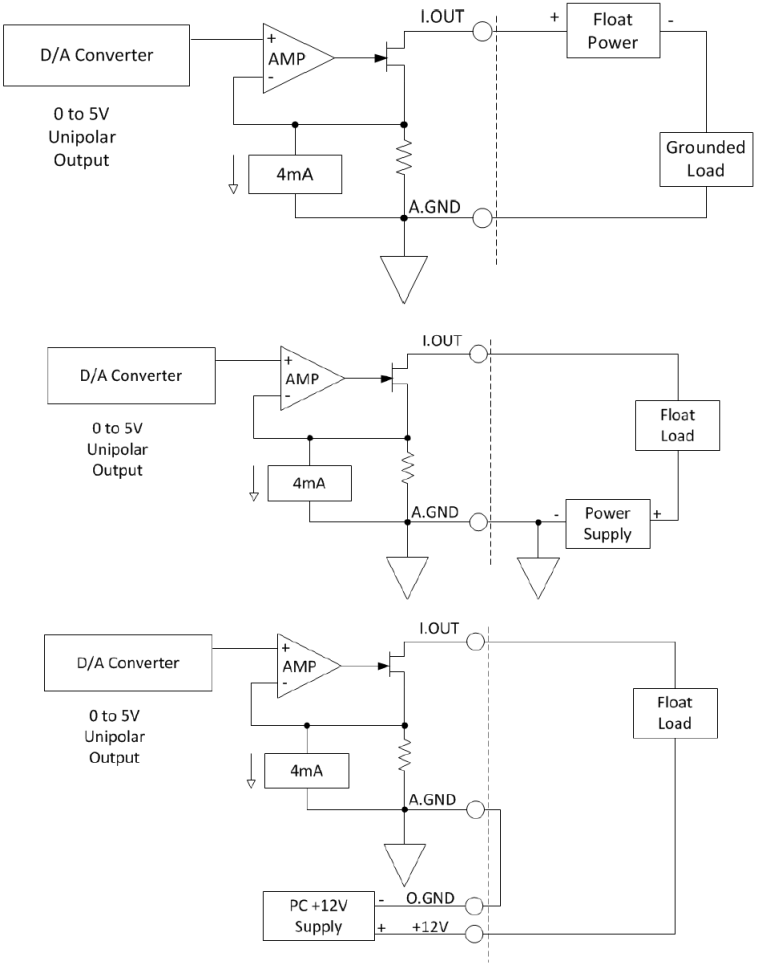


For some differential input loads, an external ground wire is needed and the signal connection is recommended as following:



4 to 20 mA and 0 to 20mA Current Sink Connections

The PCL-728 provides 2 channels of 4 to 20mA and 0 to 20mA current output. The current loop output utilizes the 0 to 5V(unipolar) voltage output as the driving source and a current drive circuit consists of a power FET, reverse protection diode and a constant current source. The voltage bias of this current output should be within 8 to 36 volts to insure correct operation. The card also provides an internal 15V power source for current loop sources which can be implemented via Pin 9, located on connectors CN1 and CN2. As shown below there are three ways of connecting: grounded load with a floating supply, floating load with a grounded power supply and floating load with internal 15 volt supply:



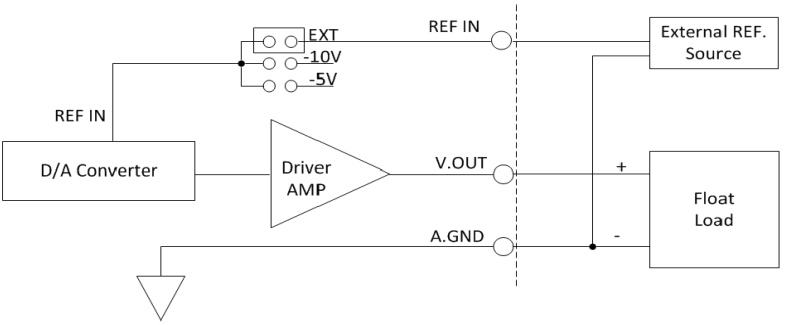
Programmable Attenuator Connection

A variety of D/A operations can be supported by your PCL-728. For example, the PCL-728 can function as a digital attenuator by inputting variable AC or DC references, or can be used to generate arbitrary waveform outputs. If you want to use this function, please set jumpers, JP4 for channel 1, and JP8 for channel 2, to the external setting. The attenuation factor between the reference input and analog output is:

ATTENUATION FACTOR = G/4096

where G is the data written to the PCL-728's D/A registers, and the value is between 0 and 4095. For example, if G represents 2048, then the attenuation factor will be 0.5. A sine wave amplitude of 10V applied to the external reference input will generate a sine wave amplitude of 5V from the card's output pin.

And illustration of an attenuator connection used in these applications is shown below.



APPENDIX A

Register Format

Appendix A Register Format

Introduction

The following sections provide information about the PCL-728's register structure and format. This consists of the card's I/O address map, and its data format. You may use this information to write your own software driver. Programming examples are provides for your convenience as well.

I/O Port Address Map

The PCL-728 uses four consecutive output (write-only) address, Base+0, Base+1, Base+2, and Base+3, for your programming and application requirements. The table below outlines each of these addresses according to how they are used.

Address	R/W	Usage
BASE +0	W	CH1 high byte data
BASE +1	W	CH1 low byte data
BASE +2	W	CH2 high byte data
BASE +3	W	CH2 low byte data

Note: *When programming the PCL-728, the high byte data is sent first. Once this has been done, it will be temporarily held in the card's register, and the high data will be combined to the low byte data, and then passed on to the D/A converter. This double buffering process protects the PCL-728's D/A data integrity by using a single step update.*

BASE+0 High Byte Data

The following table pertains to channels 1's high byte data bits from base address BASE+0.

D7	D6	D5	D4	D3	D2	D1	D0
X	X	X	X	DA11	DA10	DA9	DA8

Legend:

X = Non-specific

DA11 to DA8 = Digital to analog data. DA11 is the Most Significant Bit (MSB).

BASE+1 Low Byte Data

The following table pertains to channels 1's low byte data bits from base address BASE+1.

D7	D6	D5	D4	D3	D2	D1	D0
DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0

Legend:

X = Non-specific

DA7 to DA0 = Digital to analog data. DA0 is the Least Significant Bit (LSB).

BASE+2 High Byte Data

The following table pertains to channel; 2's high byte data bits from base address Base+2.

D7	D6	D5	D4	D3	D2	D1	D0
X	X	X	X	DA11	DA10	DA9	DA8

Legend:

X = Non-specific

DA11 to DA8 = Digital to analog data. DA11 is the Most Significant Bit (MSB).

BASE+3 Low Byte Data

The following table pertains to channels 2's low byte data bits from base address BASE+3:

D7	D6	D5	D4	D3	D2	D1	D0
DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0

Legend:

X = Non-specific

DA7 to DA0 = Digital to analog data. DA0 is the Least Significant Bit (LSB).

Unipolar and Bipolar Binary Code Tables

Table A.1: Unipolar Binary Code Table			
Digital Input Code			
MSB		LSB	Nominal Analog Output
1111	1111	1111	$-V_{REF}$* (4095/4096)
1000	0000	0001	$-V_{REF}$* (2049/4096)
1000	0000	0000	$-V_{REF}$* (2048/4096) =$-V_{REF}$/2
0111	1111	1111	$-V_{REF}$* (2047/4096)
0000	0000	0001	$-V_{REF}$* (1/4096)
0000	0000	0000	$-V_{REF}$* (0/4096) = 0

Note: *1. V_{REF} is the reference source voltage that you selected.*

2. Normal full scale is given by FS = $-V_{REF}$(4095/4096).*

3. Nominal LSB magnitude is given by LSB = $-V_{REF}$(1/4096).*

Table A.2: Bipolar Binary Code Table			
Digital Input Code			
MSB		LSB	Nominal Analog Output
1111	1111	1111	$-V_{REF}$* (2047/2048)
1000	0000	0001	$-V_{REF}$* (1/2048)
1000	0000	0000	0
0111	1111	1111	$+V_{REF}$* (1/2048)
0000	0000	0001	$+V_{REF}$* (2047/2048)
0000	0000	0000	$+V_{REF}$* (2048/2048)

Note: *1. V_{REF} is the reference source voltage that you selected.*

2. Normal full scale is given by FS = $-V_{REF}$(2047/2048).*

3. Nominal LSB magnitude is given by LSB = $-V_{REF}$(1/2048).*

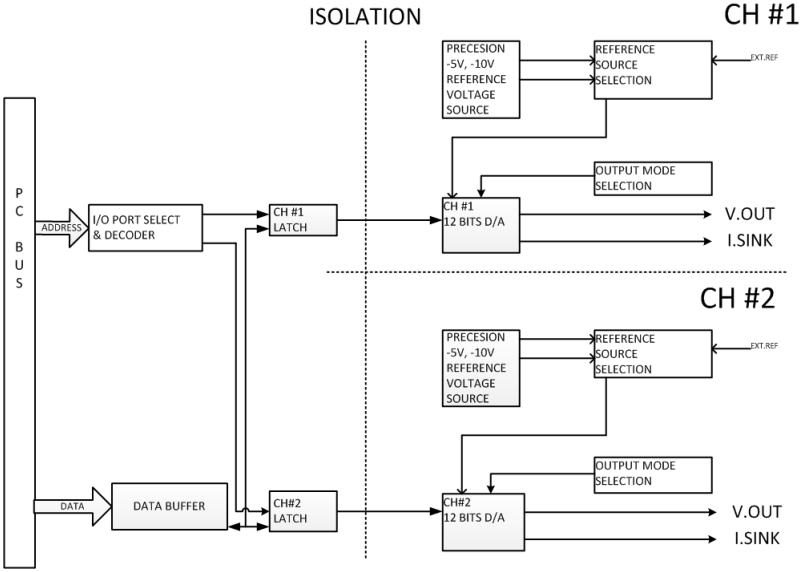
Programming Examples

The PCL-728's utility diskette has two files containing demonstration programs. The files are named DEMO728.C, and TESTPROG.EXE. Use these file to run programs which demonstrate various PCLO-728 functions and commands.

APPENDIX B

Block Diagram

Appendix B Block Diagram



APPENDIX C

PC I/O PORT ADDRESS MAP

Appendix C PC I/O Port Address Map

I/O Address Range (Hex)	Function
000-1FF	Base system
200	Reserved
201	Came control
202-277	Reserved
278-27F	Second printer port
280-2F7	Reserved
2F8-2FF	COM2
300-377	Reserved
3713-37F	First printer port
380-3AF	Reserved
3B0-3BF	Mono Disp/Print adapter
3C0-3CF	Reserved
3D0-3DF	Color/Graphics
3E0-3EF	Reserved
3F0-3F7	Floppy disk drive
3F8-3FF	COM1

APPENDIX D

Calibration

Appendix D Calibration

In the application of data acquisition and control, it is important to constantly calibrate your measurement device to maintain its accuracy. A calibration program, CALB728.BAS, is provided on the PCL-728 software diskette to assist your calibration work.

D.1 VR Assignment

The PCL-728 uses 12 variable resistors (VR), six for each channel, which allow you to calibrate each of its two output channels. The following information outlines each VR as it relates to its function.

VR1: CH1's internal -10V reference source adjustment

VR2: CH1's internal -5V reference source adjustment

VR3: CH1's gain adjustment

VR4: CH1's unipolar offset adjustment

VR5: CH1's bipolar offset adjustment

VR6: CH1's current sink offset adjustment (4mA to 20mA)

VR7: CH2's internal -5V reference source adjustment

VR8: CH2's internal -10V reference source adjustment

VR9: CH2's gain adjustment

VR10: CH2's bipolar offset adjustment

VR11: CH2's unipolar offset adjustment

VR12: CH2's current sink offset adjustment (4mA to 20mA)

In order to calibrate the PCL-728, you should use a precision voltmeter to obtain accurate readings. Standard procedures for performing a calibration are given below.

Internal Reference Source Calibration

When calibrating the PCL-728's internal reference source, you ground one of your voltmeter's probe, while the other probe is connected to TP1 (Test Point 1 for channel 1), or TP2 (Test Point 2 for channel 2).

A. Use VR2 and/or VR7 to adjust each channel's -5V reference source to obtain a voltage of -5V.

B. VR1 and/or VR8 are used to calibrate each channels's -10V reference source to obtain a voltage of -10V.

Unipolar Output Offset Calibration

A. Select an appropriate reference voltage source for each channels to be calibrated.

B. Set all digital input codes to 0. Then adjust VR4 and/or VR11 (depending on what channels are to be calibrated) until your voltmeter reads 0 volts.

Unipolar Output Gain Calibration

A. Select an appropriate reference voltage source for the channels to be calibrated.

B. Set all digital input codes to 1. Now, adjust VR3 and/or VR9 until your voltmeter shows a reading equal to the output voltage.

4mA Constant Current Calibration

A. Set the digital output code to 000000000000, and set each channel's reference voltage to -5V, and unipolar output.

B. Adjust VR6 and/or VR12 to maintain a constant current of 4mA.

Bipolar Output Offset Calibration

A. Select a reference voltage source for the channels you will calibrate.

B. Set the digital input code to 100000000000. Adjust VR5 and/or VR10 until your voltmeter reads 0 volts.

Bipolar Output Gain Calibration

A. Select a reference voltage source for the channels you will calibrate.

B. Set the digital input code to 0. Then adjust VR3 and/or VR9 until your voltmeter shows a reading equal to the output voltage.

C. Now, set all digital input codes to 1. Adjust VR3 and/or VR9 until your voltmeter shows a reading equal to the output voltage.