

**NuDAQ<sup>®</sup>**

**ACL-6128A**

2-CH 12-bit

Isolated Analog Output Card

**User's Guide**



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# Table of Contents

<b>Chapter 1 Introduction .....</b>	<b>1</b>
1.1 Features .....	2
1.2 Applications .....	2
1.3 Specifications .....	3
1.4 Software Support .....	4
1.4.1 <i>Programming Library</i> .....	4
1.4.2 <i>LabView Driver</i> .....	4
<b>Chapter 2 Installation .....</b>	<b>5</b>
2.1 What's Included .....	5
2.2 Unpacking .....	6
2.3 ACL-6128A's Layout .....	7
2.4 Jumper and DIP Switch Description .....	7
2.5 Base Address Setting .....	8
2.6 Selecting D/A Range and Functions .....	10
2.6.1 <i>Reference Source Setting</i> .....	10
2.6.2 <i>Output Range Setting</i> .....	11
2.6.3 <i>Summary</i> .....	13
2.7 Current Sink Range Setting .....	15
2.8 Connector Pin Assignment .....	16
2.9 Signal Connection .....	17
2.9.1 <i>Voltage Output Connection</i> .....	17
2.9.2 <i>Current Sink Connection</i> .....	17
2.9.3 <i>Floating Load without external power supply</i> .....	18
<b>Chapter 3 Low-Level Programming .....</b>	<b>19</b>
3.1 I/O Port Address Map .....	19
3.2 D/A Data Format .....	20
3.3 Converted Data Representation .....	21
3.3.1 <i>Unipolar Numbering</i> .....	21
3.3.2 <i>Bipolar Numbering</i> .....	21
3.4 D/A Conversion Sequence .....	22
<b>Chapter 4 High-Level Programming.....</b>	<b>23</b>
4.1 Installation .....	24
4.3 C Language Library .....	25
<b>Chapter 5 Calibration .....</b>	<b>27</b>

5.1	What is Needed .....	27
5.2	VR Assignment .....	28
5.3	Internal Reference Source Adjustment.....	28
5.4	Unipolar Output Calibration .....	29
5.5	Bipolar Output Calibration.....	30
5.6	Current Sink Calibration.....	30
<b>Warranty Policy.....</b>		<b>31</b>

# How to Use This Guide

This manual is written to help users understand the ACL-6128A. Descriptions of how to modify various settings on the ACL-6128A are provided in the chapters below to meet your application specific requirements.

Chapter 1 **Introduction**

Overview of product features, applications, and specifications.

Chapter 2 **Installation**

Installation instructions of the ACL-6128A with layout jumper settings, reference voltage source, D/A output ranges, pin assignments, and signal connections.

Chapter 3 **Low-Level Programming**

Details register structure and programming for analog output in basic I/O primitive functions.

Chapter 4 **High-Level Programming**

Describes programming for analog output using a high-level C language library.

Chapter 5 **Calibration**

Explains how calibration procedures for the ACL-6128A.





# Introduction

The ACL-6128A is an ideal cost effective analog output card with two separate D/A converters. In addition to 12-bit resolution and 16kHz throughput on each DAC, supporting both voltage and current outputs for industrial applications.

The ACL-6128A provides high voltage isolation on each analog output channel. Opto-isolators give 2500 V<sub>RMS</sub> isolation to protect both the PC and peripherals from damage due to high voltages on the inputs. After powering on or resetting the PC system, both channels will reset the output voltage to 0V in unipolar or bipolar output range.

The ACL-6128A is fully compatible with the Advantech PCL-728, ensuring an easy learning curve for customers familiar with Advantech products as well as an easy replacement with additional functionality. Extra enhancements include remarkable reliability and performance, surface mount components design, and single +5V power consumption.

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## 1.1 Features

The ACL-6128A 2-channel Isolated D/A Card provides the following advanced features:

- Fully compatible with ADLINK ACL-6128 and AdvantechPCL-728
- Two independent 12-bit analog output channels
- 2500 V<sub>RMS</sub> Isolation (channel-to-channel, input-to-output)
- 12-bit resolution, multiplying D/A converter
- Multiple output ranges
- Bipolar:  $\pm 10V$ ,  $\pm 5V$
- Unipolar: 0-10V, 0-5V
- Sink: 0-20mA, 4-20mA current loop
- Integral DC-to-DC converter for stable output operations
- Compact, half-size PCB
- 4-layer PCB with an integral ground plane

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## 1.2 Applications

- Arbitrary waveform generation
- Control of valves, switches, relays
- Programmable voltage source
- Servo Control
- Programmable current sink

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## 1.3 Specifications

The ACL-6128A provides the following specifications:

### ◆ Analog Output (D/A)

- **Output Channel:** 2 Isolated channels
- **Resolution:** 12-bit, multiplying D/A converter
- **Settling Time:**  $\leq 30 \mu\text{s}$
- **Output Range:** (Jumper selectable)
- **Bipolar Voltage:**  $\pm 10\text{V}$ ,  $\pm 5\text{V}$
- **Unipolar Voltage:** 0-10V, 0-5V
- **Current Loop (sink) :** 0-20mA, 4-20mA
- **Reference voltages**
  - **Internal:** -5V and -10V
  - **External:** DC or AC,  $\pm 10\text{V}$  (max.)
- **Output Drive Current:**  $\pm 5\text{mA}$
- **Current Loop Excitation Voltage:** +8V min, 36V max for 0-20mA or 4-20mA.
- **Isolation Voltage:**  $2500V_{\text{RMS}}$
- **Accuracy:**  $\pm 0.012\%$  of FSR
- **Linearity:**  $\pm 1/2$  LSB
- **Data Transfer:** Programmable I/O
- **Temperature coefficient** 5ppm typical, 15ppm maximum

### ◆ General Specifications

- **Bus Type:** PC/AT Bus
- **Connector:** Two 9-pin D-sub female connector
- **Operating Temperature:**  $0^{\circ}\text{C}$  -  $55^{\circ}\text{C}$
- **Storage Temperature:**  $-20^{\circ}\text{C}$  -  $70^{\circ}\text{C}$
- **Humidity:** 5 - 95%, non-condensing
- **Power Consumption:** +5V @ 780mA typical, 1A max
- **Dimension:** 163 mm (L) x 107 mm (M)

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## **1.4 Software Support**

### **1.4.1 Programming Library**

A MS-DOS Borland C/C++ programming library is included for customers writing application specific programs,

ACLS-DLL2 is a Development Kit for NuDAQ ISA bus cards with analog I/O for Windows 3.1/9x/NT/2000. ACLS-DLL2 can be used with most programming environments, such as Visual C++, Visual Basic, and Delphi. ACLS-DLL2 is included in the ADLINK CD and requires a license.

### **1.4.2 LabView Driver**

The ACLS-LVIEW LabView driver includes the ACL-6128A VIs to interface with LabView. ACLS-LVIEW supports Windows 9x/NT/2000/XP. ACLS-LVIEW is included in the ADLINK CD and requires a license.

# 2

## Installation

This chapter describes how to unpack and install the ACL-6128A. Package contents and unpacking information should be carefully reviewed. Jumper and switch settings for the ACL-6128A's base address, reference voltage sources, and output voltage range are also specified.

---

### 2.1 What's Included

In addition to this *User's Manual*, the package includes:

- ACL-6128A 2-channel Isolated Analog Output Card
- ADLINK CD

If the card is missing or damaged, contact an ADLINK dealer. Save the shipping materials and carton to ship or store the product in the future.

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## 2.2 Unpacking

The ACL-6128A card contains sensitive electronic components that can be easily damaged by static electricity.

Prepare a grounded anti-static mat. The operator should be wearing an anti-static wristband, grounded at the same point as the anti-static mat.

Inspect the card module carton for obvious damage. Shipping and handling may cause damage to the module. Be sure there is no obvious damage due to shipping and handling by examining the shipping box.

After opening the card module carton, extract the system module and place it only on a grounded anti-static surface, component side up.

Again inspecting the module for damage. Press down on all the docketed IC's to make sure they are properly seated. Do this only with the module place on a firm flat surface.

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**Note:** DO NOT APPLY POWER TO THE CARD IF IT HAS BEEN DAMAGED.

---

***You are now ready to install your ACL-6128A.***

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## 2.3 ACL-6128A's Layout

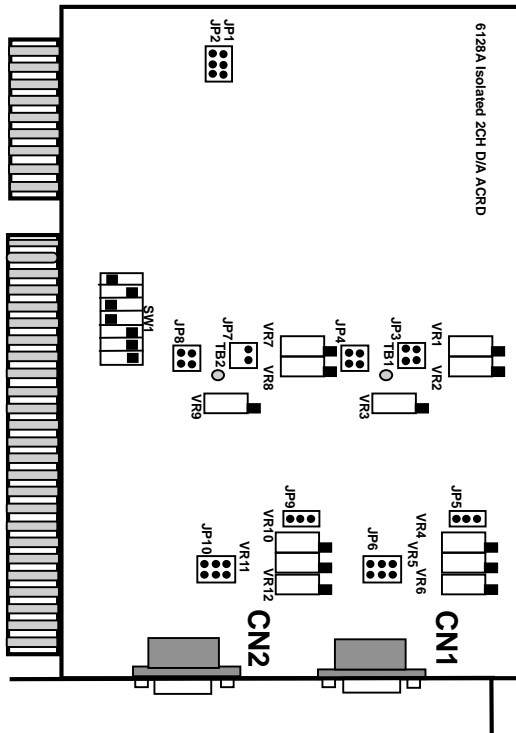


Figure 2.1 ACL-6128A's Layout

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## 2.4 Jumper and DIP Switch Description

You can change the ACL-6128A's channels and base address by setting jumpers and DIP switches on the card. The card's jumpers and switches are preset at the factory. Under normal circumstances, these settings should not need to be changed.

A jumper switch is closed or "shorted" with the plastic cap inserted over two pins of the jumper. A jumper is open when the plastic cap inserted over one or no pin(s) of the jumper.

## 2.5 Base Address Setting

The ACL-6128A requires 16 consecutive address locations in I/O address space. The base address of the ACL-6128A is restricted by the following conditions:

1. The base address must be within the range 200hex to 3F0hex.
2. The base address should not conflict with any PC reserved I/O address (see Appendix A).

The ACL-6128A I/O port base address is selectable by an 8 position DIP switch SW1 (refer to Figure 2.1). The address setting for the I/O port is from Hex 200 to Hex 3F0 is described in Table 2.1 below. The default base address (Hex 2C0) of the is illustrated in the Figure 2.2 below.

SW1 : Base Address = 2C0H

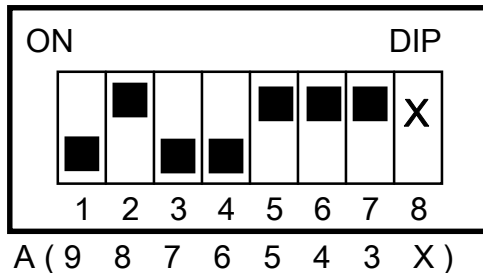


Figure 2.2 Default Base Address Setting

I/O port address(hex)	1 A9	2 A8	3 A7	4 A6	5 A5	6 A4	7 A3	8 X
200-20F	OFF (1)	ON (0)	ON (0)	ON (0)	ON (0)	ON (0)	ON (0)	X
210-21F	OFF (1)	ON (0)	ON (0)	ON (0)	ON (0)	OFF (1)	ON (0)	X
:								
(*) 2C0-2CF	OFF (1)	ON (0)	OFF (1)	OFF (1)	ON (0)	ON (0)	ON (0)	X
:								
300-30F	OFF (1)	OFF (1)	ON (0)	ON (0)	ON (0)	ON (0)	ON (0)	X
:								
3F0-3FF	OFF (1)	OFF (1)	OFF (1)	OFF (1)	OFF (1)	OFF (1)	ON (0)	X

Table 2.1



(\*) : default setting      ON : 0  
X : don't care              OFF : 1

---

**Note :** A3-A9 correspond to PC bus address lines.

---

**How to Define a Base Address for the ACL-6128A ?**

DIP1 to DIP7 in switch SW1 are one-to-one corresponding to the PC bus address lines A9 through A3. A0, A1, and A2 are always 0. To change the base address, change the values of A9 to A3 (shadow area of below diagram). The following table shows how to define the base address as *Hex 2C0*.

Base Address : **Hex 2C0**

<b>2</b>			<b>C</b>					<b>0</b>			
1	0		1	1	0	0		0	0	0	0
A9	A8		A7	A6	A5	A4		A3	A2	A1	A0

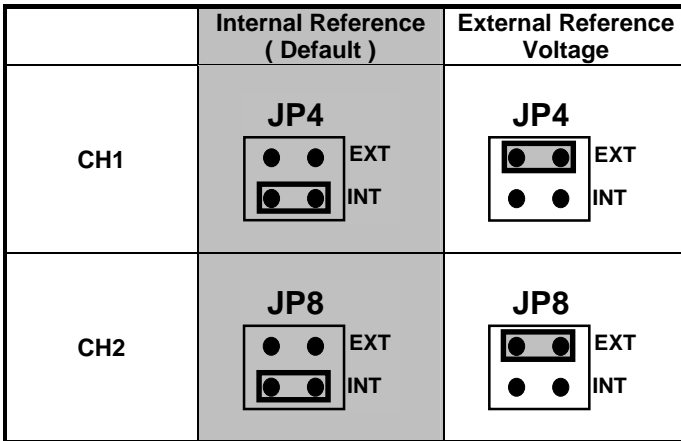
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## 2.6 Selecting D/A Range and Functions

There are two factors will effect the output voltage of ACL-6128A: **reference source** and **output range**.

### 2.6.1 Reference Source Setting

The ACL-6128A D/A converter reference voltage source can be internally generated or an external reference voltage from the Reference Voltage Input (REF.IN) of connectors CN1 and CN2. The settings of the reference sources for CH1 and CH2 are controlled by jumpers JP4 and JP8, respectively. The default setting is Internal Reference for both CH1 and CH2, and is illustrated below.



**Figure 2.3 Reference Source Setting**

After setting as internal reference source, two fixed precision internal -5V and -10V reference sources are provided by ACL-6128A. The source selection is set by JP3 (CH1) and JP7 (CH2), and the default setting of internal reference voltage is -5V, which is illustrated as Figure 2.4 below:

Channel No.	Internal -5V ( Default)	Internal -10V
CH1	<p><b>JP3</b></p>	<p><b>JP3</b></p>
CH2	<p><b>JP7</b></p>	<p><b>JP7</b></p>

**Figure 2.4 Internal Reference Voltage Setting**

If users choose the external reference, both AC and DC voltage sources can be used by the external reference. The maximum input voltage is +/- 10V. The voltage sources can be input through Pin 3 of the CN1 and CN2 connectors.

### 2.6.2 Output Range Setting

The output voltage range of ACL-6128A can be set either *Bipolar* or *Unipolar*. The jumpers, JP1 and JP5 (for CH1), and JP2 and JP9 (for CH2) are used for the settings as illustrated in Figure 2.5 below (ACL-6128A and ACL-6128 respectively):

ACL-6128A settings (**Note:** These settings are for the **ACL-6128A** only. Jumper settings for the older ACL-6128 are slightly different—see below.)

Channel No.	Unipolar ( Default )	Bipolar
CH1	<p><b>JP1 JP5</b></p>	<p><b>JP1 JP5</b></p>
CH2	<p><b>JP2 JP9</b></p>	<p><b>JP2 JP9</b></p>

ACL-6128 settings (**Note:** These settings are for the older **ACL-6128** only. Jumper settings for the newer ACL-6128 are slightly different—see above. Also, JP9 on the PCB of the older **ACL-6128 ONLY** is mislabeled. “BP” is the top pin and “UP” is the bottom pin.)









Channel No.	Unipolar ( Default )	Bipolar
CH1	<p style="text-align: center;"><b>JP1</b>      <b>JP5</b></p>  	<p style="text-align: center;"><b>JP1</b>      <b>JP5</b></p>  
CH2	<p style="text-align: center;"><b>JP2</b>      <b>JP9</b></p>  	<p style="text-align: center;"><b>JP2</b>      <b>JP9</b></p>  

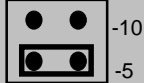

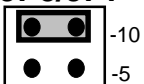



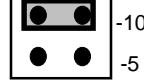

Figure 2.5 Output Range Setting

## 2.6.3 Summary

Users can configure the output voltage of CH1 and CH2 for application specific needs according to the reference source and output range settings. can follow the below table to. Settings are listed in two separate tables for the ACL-6128A and ACL-6128, respectively.

(JP1, JP3, and JP5 are for CH1. JP2, JP7, and JP9 are for CH2)

**ACL-6128A settings (Note: this table is for the ACL-6128A ONLY.)**

Jumper Output Range	JP3 for CH1 JP7 for CH2	JP1 & JP5 for CH1 JP2 & JP9 for CH2
0 to +5V Unipolar (Default)	<b>JP3/JP7</b> 	<b>JP1/JP2</b> <b>JP5/JP9</b> 
0V to +10V Unipolar	<b>JP3/JP7</b> 	<b>JP1/JP2</b> <b>JP5/JP9</b> 
-5V to +5V Bipolar	<b>JP3/JP7</b> 	<b>JP1/JP2</b> <b>JP5/JP9</b> 
-10V to +10V Bipolar	<b>JP3/JP7</b> 	<b>JP1/JP2</b> <b>JP5/JP9</b> 

**ACL-6128** settings (Note: this table is for the older **ACL-6128 ONLY**. The ACL-6128 PCB has misprints. Please refer to the chart below for correct jumper placement.)

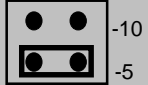


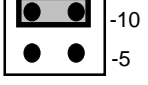


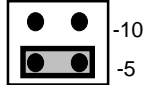


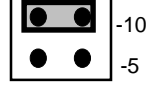


Jumper Output Range	JP3 for CH1 JP7 for CH2	JP1 & JP5 for CH1 JP2 & JP9 for CH2
0 to +5V Unipolar (Default)	<b>JP3/JP7</b>  -10 -5	<b>JP1/JP2</b> <b>JP5/JP9</b>  UP    BP  BP UP    UP
0V to +10V Unipolar	<b>JP3/JP7</b>  -10 -5	<b>JP1/JP2</b> <b>JP5/JP9</b>  UP    BP  BP UP    UP
-5V to +5V Bipolar	<b>JP3/JP7</b>  -10 -5	<b>JP1/JP2</b> <b>JP5/JP9</b>  UP    BP  BP UP    UP
-10V to +10V Bipolar	<b>JP3/JP7</b>  -10 -5	<b>JP1/JP2</b> <b>JP5/JP9</b>  UP    BP  BP UP    UP

Figure 2.6 Output Range Summary

## 2.7 Current Sink Range Setting

In addition to voltage output, the ACL-6128A also provides either 0-20mA or 4-20mA current sink. In order to use the current sink range, set the output voltage to **unipolar**. Jumper JP6 corresponds to CH1 and JP10 is used with CH2. Figure 2.7 shows the settings for the ACL-6128A current sink range.

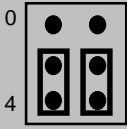
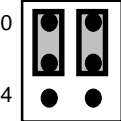
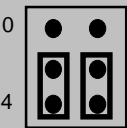
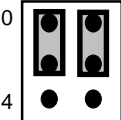
Channel No.	4-20mA ( Default )	0-20mA
CH1	<p><b>JP6</b></p> 	<p><b>JP6</b></p> 
CH2	<p><b>JP10</b></p> 	<p><b>JP10</b></p> 

Figure 2.7 Current Sink Setting

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**Note :** The current sink can **ONLY** be used when the output voltage range set as **internal reference with -5V** and **unipolar mode**.

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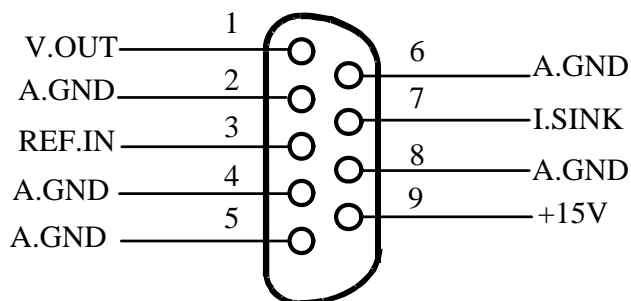
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## 2.8 Connector Pin Assignment

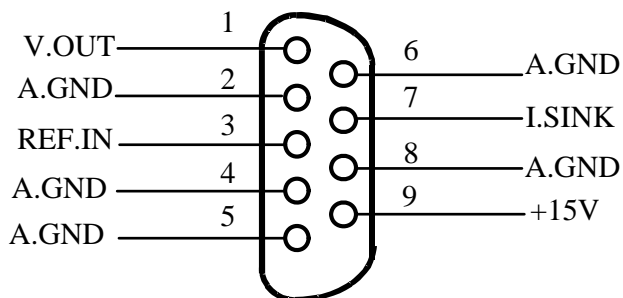
The ACL-6128A is equipped with two D-9 female connectors: CN1 and CN2. Both CN1 and CN2 are located on the rear plate. CN1 and CN2 are the outputs of CH1 and CH2, respectively. Each connector's pin assignment is specified as follows:

**Legend :** V.OUT: Analog Voltage Output  
I.SINK: Current Sink  
A.GND: Analog Ground  
REF.IN: Reference Voltage Input  
+15V: +15V output

◆ **CN 1: Analog Output for Channel 1**



◆ **CN2 : Analog Output for Channel 2**



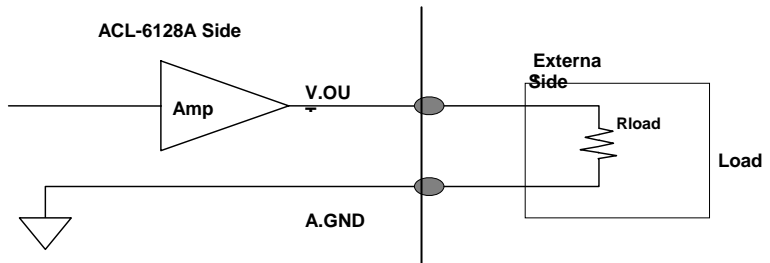


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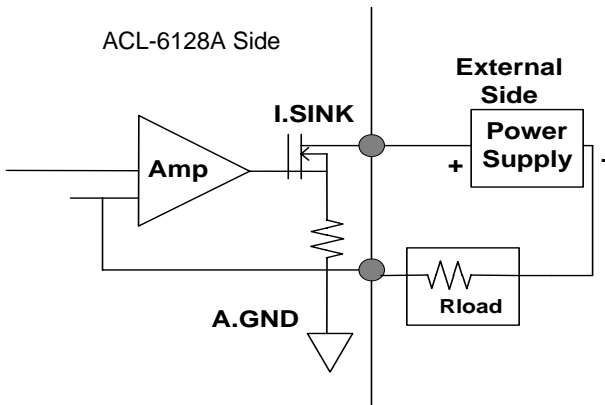
## 2.9 Signal Connection

A correct signal connection is vital to send data accuracy. This section illustrates proper signal connection when the ACL-6128A is used.

### 2.9.1 Voltage Output Connection



### 2.9.2 Current Sink Connection



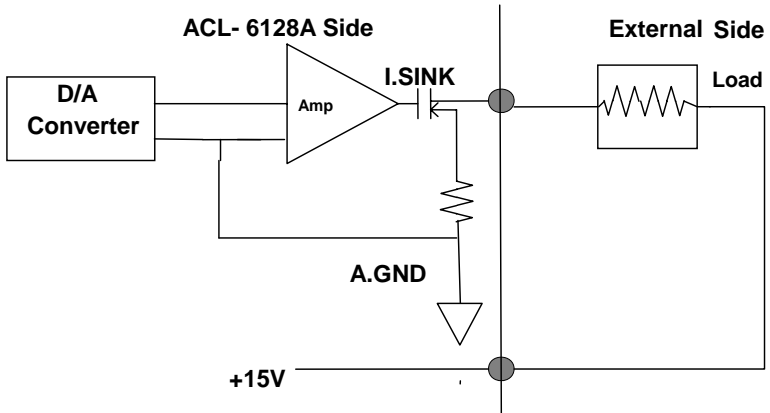
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**Note :** For 4-20mA current sink mode, the output range should be set as **Internal Reference with -5V and Unipolar mode.**

---

### 2.9.3 Floating Load without external power supply

The ACL-6128A provides a +15V power source for systems that do not offer external power supplies. The connection is as follows:



# 3

## Low-Level Programming

This chapter describes low-level programming of the ACL-6128A and details the register format and control procedures. To write applications based on primitive I/O functions (*inportb* and *outportb*) instead of using the ACL-6128A library, be careful to fully understand the register structure.

---

### 3.1 I/O Port Address Map

The ACL-6128A requires only 4 consecutive addresses in the PC I/O address space. The following table (Table 3.1) shows the location of each register and driver relative to the base address.

Location	Write	Read
Base + 0	CH1 High Byte Data	Not Used
Base + 1	CH1 Low Byte Data	Not Used
Base + 2	CH2 High Byte Data	Not Used
Base + 3	CH2 Low Byte Data	Not Used

Table 3.1 I/O Register Map

---

## 3.2 D/A Data Format

The base address from Base+0 to Base+3 is used for D/A conversion. The analog output channels and its corresponding registers are specified by table 3.2.

CH NO.	CHANNEL 1	CHANNEL 2
High byte	Base+0	Base+2
Low byte	Base+1	Base+3

**Table 3.2**

**Address: BASE + 0 & BASE + 1**

**Attribute:** write only

**Data Format : (for D/A Channel 1)**

Bit	7	6	5	4	3	2	1	0
Base + 0	X	X	X	X	DA11	DA10	DA9	DA8
Base + 1	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0

**Address: BASE + 2 & BASE + 3**

**Attribute:** write only

**Data Format: (for D/A Channel 2)**

Bit	7	6	5	4	3	2	1	0
Base + 2	X	X	X	X	DA11	DA10	DA9	DA8
Base + 3	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0

**DA11 .. DA0:** Digital to Analog data.

**DA0** is the Least Significant Bit, and **DA11** is the Most Significant Bit.

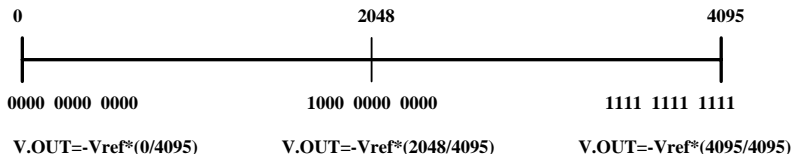
**X:** Don't care.

---

### 3.3 Converted Data Representation

Two analog output range alternatives are provided by the ACL-6128A: Unipolar and Bipolar. The numbering of the converted data will have different presentations for different output ranges.

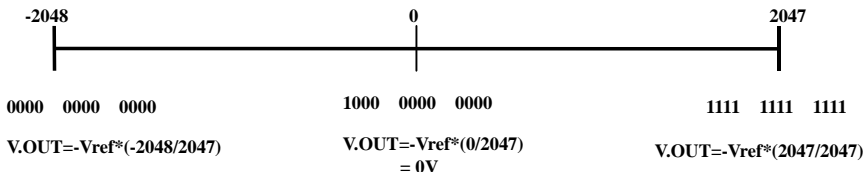
#### 3.3.1 Unipolar Numbering



#### Example:

Converted Data =2047  
Binary Code =0111 1111 1111  
Vref =-5V  
V.OUT =-(-5 V) \* ( 2047/4095) = 2.499 V

#### 3.3.2 Bipolar Numbering



#### Example:

Converted Data =500  
Binary Code =1001 1111 0100  
Vref =-5V  
V.OUT =-(-5 V) \* ( 500/2047) = 1.221 V

---

### 3.4 D/A Conversion Sequence

In the ACL-6128A, the A/D conversion can only be controlled by software using the *double buffering concept*. That is, the converted data should be stored in High Byte Register first, and then stored the Low Byte Register.

The procedure of how to initiate and convert digital data to analog output is listed below:

1. Define the base address of the ACL-6128A card:

**Base\_Addr = 0x2C0;**

2. Extract the most signification 4 bits from the converted data then write to Base\_Addr + 0:

**High\_Byte = Data & 0f00;**  
**outportb( Base\_Addr + 0, High\_Byte);**

3. Extract the least signification 8 bits from the converted data then write to Base\_Addr + 1:

**Low\_Byte = Data & 00ff;**  
**outportb( Base\_Addr + 1, Low\_Byte);**

An example program in low-level programming style called 6128IO.C is included in the Utility and Software Library CD for your reference.

# 4

## High-Level Programming

A high-level C language programming interface for the ACL-6128A is described in this chapter. Use the C library to easily and quickly develop customized applications.

Only three C-language functions are supported by the software library. The functionality of these function calls can be classified into the following capabilities:

1. **Initialization:** Initializes the hardware base I/O address and switches between cards.
2. **D/A conversion:** performs digital to analog conversion.

In addition to the library, some sample programs are also provided. Refer to them to save programming time.

---

## 4.1 Installation

To install the DOS library software and utilities, please follow the following installation procedures:

1. Put the *ADLINK CD* into an appropriate CD-ROM drive.
2. Type the following commands to change to the card's directory (*x* indicates the CD-ROM drive):

```
X:\>CD \NuDAQISA\6128
```

3. Execute the setup batch program to install the software:

```
X:\NuDAQISA\6128>SETUP
```

After installation, all the files for the *ACL-6128A Library & Utility for DOS* are stored in the C:\ADLINK\6128\DOS directory.



---

## 4.3 C Language Library

The ACL-6128A digital-to-analog conversion library was constructed to provide a simple programming interface for communicating with the ACL-6128A card. The library provides easy to use functions which allow programmers to use the features of the card in a high-level way.

The version of this library included in the CD is DOS only.

The detailed function description is specified in the following sections:

### 4.3.1 `_6128_Initial`

#### **@ Description**

An ACL-6128A card is initialized according to the card number and its corresponding base address. Every ACL-6128A has to be initialized by this function before calling other functions.

#### **@ Syntax**

```
int _6128_Initial(int card_number, int base_address)
```

#### **@ Argument**

`card_number`: The card number to be initialized, up to 8 cards can be initialized, the card number must be within the range of 0 and 7.

`base_address`: The I/O port base address of the card.

#### **@ Return Code**

```
ERR_NoError  
ERR_InvalidBoardNumber  
ERR_BaseAddressError
```

### 4.3.2 `_6128_Switch_Card_No`

#### **@ Description**

This function is used on multi-cards systems. After the ACL-6128A cards are initialized by the `_6128_Initial` function, you can use this function to select which card to operate.

#### **@ Syntax**

```
int _6128_Switch_Card_No(int card_number)
```

#### **@ Argument**

`card_number`: The card number to be initialized, up to 8 cards can be initialized, the card number must be within the range of 0 and 7.

#### **@ Return Code**

```
ERR_NoError  
ERR_InvalidBoardNumber
```

### 4.3.3 `_6128_DA`

#### **@ Description**

This function is used to write data to D/A converters. There are two Digital-to-Analog conversion channel in the ACL-6128A. The resolution of each channel is 12 bits, providing a range from 0 to 4095.

#### **@ Syntax**

```
int _6128_DA( int da_ch_no, unsigned int da_data )
```

#### **@ Argument**

`da_ch_no` : The DA channel number, the value has to be set a 0 or 1.  
`da_data` : D/A converted value, if the value is greater than 4095, the upper 4 bits are negligent.

#### **@ Return Code**

```
ERR_NoError  
ERR_BoardNoInit  
ERR_InvalidDAChannel
```

# 5

## Calibration

In data acquisition process, how to calibrate your measurement devices to maintain its accuracy is very important. This chapter will guide you to calibrate your ACL-6128A to an accurate condition.

---

### 5.1 What is Needed

Before calibrating the ACL-6128A card, please prepare the following:

1. Calibration program: executing this program will walk users through the calibration steps. The calibration program is located in the directory: C:\ADLINK\6128\dos\driver\util\6128av.exe
2. Digital multimeter.

---

## 5.2 VR Assignment

There are twelve variable resistors (VR) on the ACL-6128A board to allow users to make accurate adjustment on two D/A channels. VR1 to VR6 belong to CH1, and VR7 to VR12 belongs to CH2. The detailed functionality of each VR is listed below:

### CH1's VR

<b>VR1</b>	(-10V) Internal reference	<b>VR2</b>	(-5V) Internal reference
<b>VR3</b>	Gain Adjustment	<b>VR4</b>	Unipolar Offset
<b>VR5</b>	Current Sink Offset (4mA)	<b>VR6</b>	Bipolar Offset

### CH2's VR

<b>VR7</b>	(-10V) Internal reference	<b>VR8</b>	(-5V) Internal reference
<b>VR9</b>	Gain Adjustment	<b>VR10</b>	Unipolar Offset
<b>VR11</b>	Current Sink Offset (4mA)	<b>VR12</b>	Bipolar Offset

There are two testing points (TP1 and TP2) on the board, which are used for calibration the ACL-6128A. TP1 is for CH1, and TP2 is for CH2.

---

## 5.3 Internal Reference Source Adjustment

The Internal Reference Source adjustment can ensure that the internal reference voltages of the ACL-6128A can offer very accurate voltage source—5V and -10V.

1. Ground the black probe of the voltmeter.
2. Connect the other probe to TP1 (for testing CH1), or TP2 (for testing CH2).

Change the jumper to JP3 (for CH1) or JP7 (for CH2), trim **VR1** (for CH1) until the voltmeter reads **-10V**, trim **VR7** (for CH2) until the voltmeter also reads **-10V**.

3. Change the jumper to JP3 (for CH1) or JP7 (for CH2), trim **VR2** (for CH1) until the voltmeter reads **-5V**, trim **VR8** (for CH2) until the voltmeter also reads **-5V**.

---

## 5.4 Unipolar Output Calibration

If you choose Unipolar mode for analog output, you have to go through the Unipolar Output Calibration. There are two steps: Gain Calibration and Offset Calibration.

### ***Gain Calibration:***

1. Set jumpers JP1 and JP5 (for CH1) or JP2 and JP9 (for CH2) to **unipolar**, and choose an internal reference as **-5V**.
2. Set the digital data as (0000 0000 0000)<sub>B</sub>, trim VR4 (for CH1) or VR10 (for CH2) until the voltmeter reading is **0V**.

### ***Offset Calibration:***

1. Set jumpers JP1 and JP5 (for CH1) or JP2 and JP9 (for CH2) to **unipolar**, and choose an internal reference as **-5V**.
2. Set the digital data as (1111 1111 1111)<sub>B</sub>, trim VR3 (for CH1) or VR9 (for CH2) until the voltmeter reading is **5V**.

---

## 5.5 Bipolar Output Calibration

If Bipolar mode for analog output is used, use Bipolar Output Calibration to correctly calibrate. There are two steps involved: Gain Calibration and Offset Calibration.

### ***Gain Calibration:***

1. Set jumpers **JP1** and **JP5** (for **CH1**) or **JP2** and **JP9** (for **CH2**) as **bipolar**, and choose an internal reference as **-5V**.
2. Set the digital data as (1000 0000 0000)<sub>B</sub>, trim VR4 (for CH1) or VR10 (for CH2) until the voltmeter reading is **0V**.

### ***Offset Calibration:***

1. Set the internal reference to **-5V**.
2. Set the digital data as (0000 0000 0000)<sub>B</sub>, trim VR6 (for CH1) or VR12 (for CH2) until the voltmeter reading is **-5V**.

---

## 5.6 Current Sink Calibration

If using current sink output, please do the following:

Use **-5V** for internal reference and its reference voltage.

Follow the below procedures to calibrate the current sink output.

1. Set the digital data as (0000 0000 0000)<sub>B</sub>, and internal reference as **-5V**, using unipolar output range.
2. Trim VR5 (for CH1) or VR11 (for CH2) until there is a constant current of **4mA**.

# Warranty Policy

Thank you for choosing ADLINK. To understand your rights and enjoy all the after-sales services we offer, please read the following carefully.

1. Before using ADLINK's products please read the user manual and follow the instructions exactly. When sending in damaged products for repair, please attach an RMA application form which can be downloaded from: <http://rma.adlinktech.com/policy/>.
2. All ADLINK products come with a limited two-year warranty, one year for products bought in China.
  - The warranty period starts on the day the product is shipped from ADLINK's factory.
  - Peripherals and third-party products not manufactured by ADLINK will be covered by the original manufacturers' warranty.
  - For products containing storage devices (hard drives, flash cards, etc.), please back up your data before sending them for repair. ADLINK is not responsible for any loss of data.
  - Please ensure the use of properly licensed software with our systems. ADLINK does not condone the use of pirated software and will not service systems using such software. ADLINK will not be held legally responsible for products shipped with unlicensed software installed by the user.
  - For general repairs, please do not include peripheral accessories. If peripherals need to be included, be certain to specify which items you sent on the RMA Request & Confirmation Form. ADLINK is not responsible for items not listed on the RMA Request & Confirmation Form.
3. Our repair service is not covered by ADLINK's guarantee in the following situations:
  - Damage caused by not following instructions in the User's Manual.
  - Damage caused by carelessness on the user's part during product transportation.
  - Damage caused by fire, earthquakes, floods, lightening, pollution, other acts of God, and/or incorrect usage of voltage transformers.

- Damage caused by inappropriate storage environments such as with high temperatures, high humidity, or volatile chemicals.
  - Damage caused by leakage of battery fluid during or after change of batteries by customer/user.
  - Damage from improper repair by unauthorized ADLINK technicians.
  - Products with altered and/or damaged serial numbers are not entitled to our service.
  - This warranty is not transferable or extendible.
  - Other categories not protected under our warranty.
4. Customers are responsible for all fees necessary to transport damaged products to ADLINK.

For further questions, please e-mail our FAE staff: [service@adlinktech.com](mailto:service@adlinktech.com)