ACLS-DLL2

Software Driver for
Windows 3.11, Win-95/98, Win-NT/2000

User's Guide

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Product Model	
Environment to Use	? OS_____ ? Computer Brand _____ ? M/B: ? CPU: ? Chipset: ? Bios: ? Video Card: ? Network Interface Card: ? Other:
Challenge Description	
Suggestions for ADLINK	

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How to Use This Guide

This manual is designed to help you use the ACLS-DLL2 software driver for NuDAQ ISA-bus multi-function cards ACL-6126, ACL-6128, ACL-8216, ACL-8316, ACL-8111, ACL-8113, ACL-8113A, and ACL-8112 series. The manual describes how to install and use the library to meet your requirements and help you program your own software application. When you are familiar with the material in this manual, you can begin to use the *ACLS-DLL2 Function Reference Manual*. The ACLS-DLL2 Function Reference Manual contains detailed descriptions of the ACLS-DLL2 functions. You also can use the help file *ACL-DLL2.HLP*, located in your ACLS-DLL2 software, which contains all of the function reference material.

The *ACLS-DLL2 User's Guide* is organized as follows:

- Chapter 1, "Introduction to ACLS-DLL2" gives an overview of the contents included in the software package and describes how to install the software and create your applications by using ACLS-DLL2.
- Chapter 2, "Software Overview" briefly describes the function calls ACLS-DLL2 provides.
- Chapter 3, "Sample Programs" describes the sample programs in the software diskette.

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1

Introduction to ACLS-DLL2

1.1 What is ACLS-DLL2

ACLS-DLL2 is the Microsoft Windows drivers for NuDAQ ISA-bus multi-function cards ACL-6126, ACL-6128, ACL-8111, ACL-8113, ACL-8113A, ACL-8112DG/HG, ACL-8112PG, ACL-8216 and ACL-8316/12. They are high performance data acquisition drivers for developing custom applications under Windows 3.1, Windows 95/98, Win-NT 4.0 and Windows 2000. These drivers are DLLs (Dynamic-Link Library) for using under Windows. They can work with any Windows programming language that allows calls to a DLL, such as Microsoft C/C++, Microsoft Visual Basic.

Built into these DLLs are sophisticated memory and data buffer management capabilities that free developers from having to deal with those complex issues.

Using these DLLs lets you take advantage of the power and features of Microsoft Windows 3.11, Win-NT 4.0, Windows 95/98 and Windows 2000 for your data acquisition application. These include running multiple applications and using extended memory. Also, Visual Basic and ACLS-DLL2' s DLLs make it easy to create custom user interfaces and graphics.

In addition to the DLL drivers, some sample programs are also provided; you can refer to it and save a lot of programming time and get some other benefits as well.

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1.2 Installing ACLS-DLL2

1.2.1 System Requirements

ACLS-DLL2 requires the following minimum configuration:

- An IBM PC/AT or 100% compatible with an 80386 or higher processor
- 4MB of available memory
- A hard disk with enough disk space to install ACLS-DLL2
- A 1.44-MB, 3.5-inch floppy disk drive or CD-ROM drive
- Microsoft Windows 3.11, Windows 95/98, Win-NT 4.0 or Windows 2000
- Application development system: Microsoft C/C++ and Windows SDK, Microsoft Visual C/C++, or Microsoft Visual Basic.
- ACL-6126, ACL-6128, ACL-8111, ACL-8113, ACL-8113A, ACL-8112DG/HG, 8112PG, ACL-8216, or ACL-8316/12 multi-function card

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1.2.2 ACLS-DLL2 Installation

The Setup program provided by ACLS-DLL2 performs all the tasks necessary for installing the ACLS-DLL2 components.

To install ACLS-DLL2:

With "ACLS-DLL2 Library & Utility" diskette:

step 1. Place the diskette in the appropriate 3.5" floppy drive (A: or B:).

step 2. If Windows is loaded, choose Run from the Start Menu.

step 3. Typing the A:\SETUP or B:\SETUP in the Run dialog box.

With "Manual & Software Utility" CD:

step 1 Place ADLink All-in-one CD into the appropriate CD-ROM drive.

step 2 If autorun setup program is not invoked automatically, please click the Start button on the Taskbar, and then choose Run. Type x:\setup (x identifies the drive that contains the compact disc) in Open text box, and then click OK.

Step 3 Setup first displays the main screen. Select Software Package.

Step 4 Setup then displays the ADLink software product screen. Select NuDAQ ISA Software.

Step 5 In NuDAQ ISA Software screen select ACLS-DLL2. Then select the platform option.

Setup first displays a Welcome dialog box. Please click **Next** button to go on installation.

Setup then prompts a *user information* dialog box including *Name, Company* and *Serial Number* text fields. The "Serial Number" field must be filled in correctly, otherwise the ACLS-DLL2 will run in 120-minute demo mode.

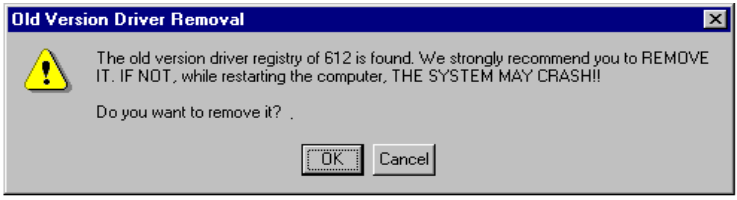
Setup then prompts a dialog box for you to specify the destination directory for ACLS-DLL2. The default path is C:\ADLink\ACL-DLL2. If you want to install ACLS-DLL2 in another directory, please click **Browse** button to change the destination directory. Then you can click **Next** to begin installing ACLS-DLL2.

[Windows NT/2000 version]

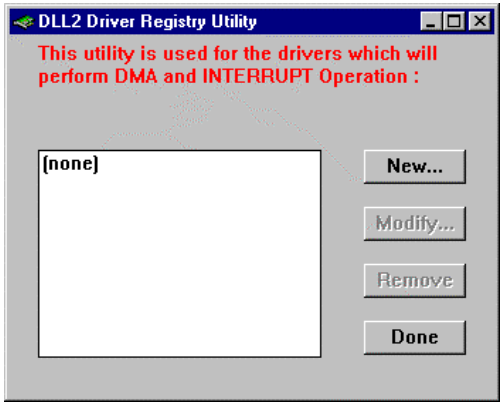
When the software component installation process is completed, Setup will launch the *DLL2 Driver Registry Utility* for you to make the registry of the drivers that you want to perform DMA or *interrupt operation*.

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The *DLL2 Driver Registry Utility* first checks the system for the old version of DLL2 driver registry. If there any old version of DLL2 driver registry exists in the system, an old registry removal message box will appear as the figure below. For the new version of DLL2 working properly, click "OK" button. If the old version of DLL2 driver registry is not removed, when you re-start the Windows NT system, the system may crash.



After the check of old version of DLL2 driver, the *DLL2 Driver Registry Utility* shows the following window. If any DLL2 driver has been registered, it will be shown on the *Registerer Driver* list.



If the card you wish to operate **DOES NOT** want to perform interrupt or DMA operation, please click **Done** button to exit this utility.

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To register one of DLL2 drivers, click **New…** button and a *Device Configuration* window appears.



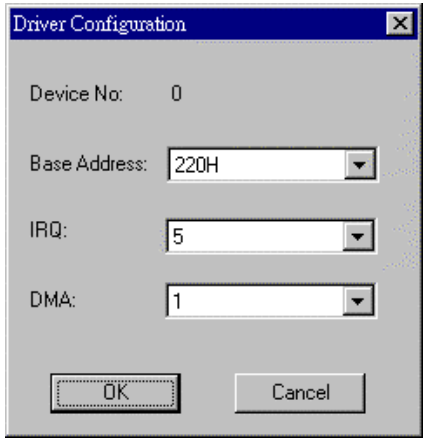
From this window you can select the driver you want to register. Since Dll2 drivers for Windows NT/2000 can support more than one device, you can configure more than one device for each Dll2 driver. The maximum number of device that each driver supports is as the following table.

Driver Name	Number of Device (Valid Device Name)
6126	2 (Device0, Device1)
8111	2 (Device0, Device1)
8112	2 (Device0, Device1)
8216	2 (Device0, Device1)
8316	3 (Device0, Device1, Deivce2)

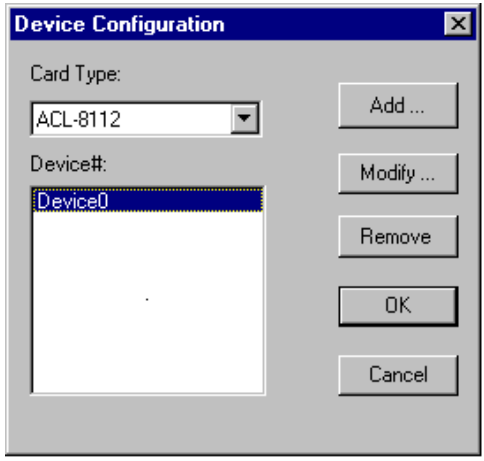
If the driver you select has been registered, the "Device#" list gives the device names of the devices configured.

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To add a device, click **Add…** button and a *Driver Configuration* window appears for you to set DMA channel, IRQ level and base address. The *Driver Configuration* window is as the following figure:

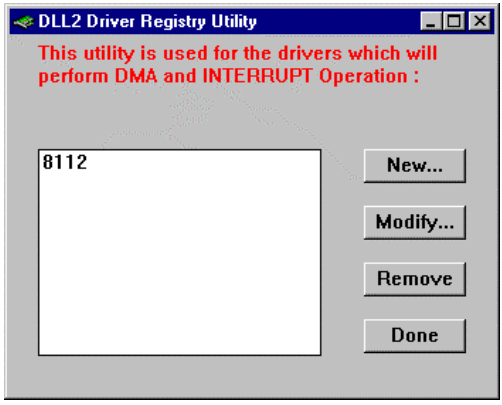


After the setting for DMA channel, IRQ level and base address, click **OK** and *Device Configuration* window re-appears. The device you just added is shown on "*Device#"* list as the following figure.



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After the device configurations of the driver you select is finished, click **OK** button to register the driver and return to *Driver Registry Utility* main window. The driver you just registered will be shown on the registered driver list as the following figure:

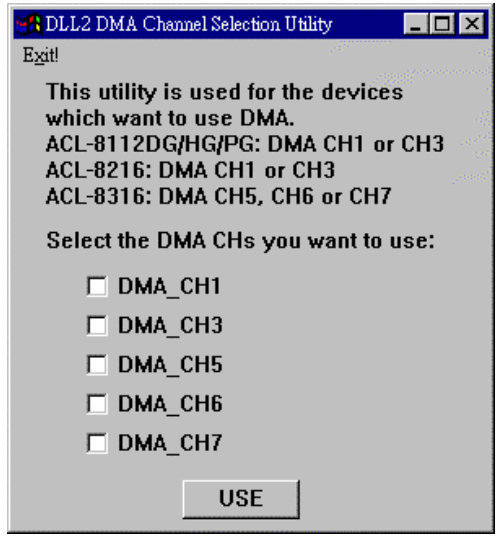


When you finish the driver registries, select **Done** button to exit this utility. To make the registered drivers work, you have to re-start Windows NT/2000 system.

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[Window 95/98 version]

For DLL2 driver performs DMA operation properly, the system should know the DMA channels the devices will use. When the software component installation process is completed, Setup will launch the *DLL2 DMA Channel Selection Utility* for you to select the DMA channels. The *DLL2 DMA Channel Selection Utility* is shown as the following figure:



Check the desired DMA channels and then click **USE** button to inform the system that the DMA channels the DLL2 devices will use. Then you select **Exit!** command in the menu bar to exit *DLL2 DMA Channel Selection Utility*. Re-start Windows 95/98 system to make the system DMA channels selection effective.

[Window 95/98 , Window NT/2000 versions]

When you have completed the installation process, the DLL2 directory should contain the following files and sub-directories:

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File/Subdirectory	Description
LIB <DIR>	ACLS-DLL2 import libraries and DLLs Note: *.*lib* for Microsoft C/C++ and Visual C/C++ programming, e.g. 8111.lib **_bc.lib* for Borland C++ programming, e.g. 8111_bc.lib
INCLUDE <DIR>	Include files for application programming. DLL2.H for Microsoft C/C++ and Visual C/C++ programming. DLL2.BAS for Visual Basic Programming. *DLL2.PAS* for Delphi programming
UTIL<DIR>	Registry utility of DLL2's device drivers (Windows NT only) System DMA Selection utility (Windows 95 only)
SAMPLES\SDK\6126 <DIR>	ACL-6126 Visual C/C++ sample program
SAMPLES\SDK\6126INT <DIR>	ACL-6126 Interrupt AO Visual C/C++ sample program
SAMPLES\SDK\6128 <DIR>	ACL-6128 Visual C/C++ sample program
SAMPLES\SDK\8111 <DIR>	ACL-8111 Visual C/C++ sample program
SAMPLES\SDK\8111INT <DIR>	ACL-8111 Interrupt AI Visual C/C++ sample program
SAMPLES\SDK\8111SCAN <DIR>	ACL-8111 Interrupt AI with AutoScan mode , Visual C/C++ sample program
SAMPLES\SDK\8111DBINT <DIR>	ACL-8111 Continuous Interrupt AI Visual C/C++ sample program
SAMPLES\SDK\8111DBSCAN <DIR>	ACL-8111 Continuous Interrupt AI with AutoScan mode , Visual C/C++ sample program
SAMPLES\SDK\8112 <DIR>	ACL-8112 Visual C/C++ sample program
SAMPLES\SDK\8112DMA <DIR>	ACL-8112 DMA AI Visual C/C++ sample program
SAMPLES\SDK\8112INT <DIR>	ACL-8112 Interrupt AI Visual C/C++ sample program

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SAMPLES\SDK\8112SCAN <DIR>	ACL-8112 Interrupt AI wit AutoScan mode , Visual C/C++ sample program
SAMPLES\SDK\8112DBINT <DIR>	ACL-8112 Continuous Interrupt AI Visual C/C++ sample program
SAMPLES\SDK\8112DBSCAN <DIR>	ACL-8112 Continuous Interrupt AI wit AutoScan mode , Visual C/C++ sample program
SAMPLES\SDK\8112DBDMA <DIR>	ACL-8112 Continuous DMA AI Visual C/C++ sample program
SAMPLES\SDK\8113 <DIR>	ACL-8113 Visual C/C++ sample program
SAMPLES\SDK\8113A <DIR>	ACL-8113A Visual C/C++ sample program
SAMPLES\SDK\8112PG <DIR>	ACL-8112PG Visual C/C++ sample program
SAMPLES\SDK\812PGDMA <DIR>	ACL-8112PG DMA AI Visual C/C++ sample program
SAMPLES\SDK\812PGINT <DIR>	ACL-8112PG Interrupt AI Visual C/C++ sample program
SAMPLES\SDK\812PGSCAN <DIR>	ACL-8112PG Interrupt AI with AutoScan mode,Visual C/C++ sample program
SAMPLES\SDK\812PGDBINT <DIR>	ACL-8112PG Continuous Interrupt AI Visual C/C++ sample program
SAMPLES\SDK\812PGDBDMA <DIR>	ACL-8112PG Continuous DMA AI Visual C/C++ sample program
SAMPLES\SDK\8216 <DIR>	ACL-8216 Visual C/C++ sample program
SAMPLES\SDK\8216DMA <DIR>	ACL-8216 DMA AI Visual C/C++ sample program
SAMPLES\SDK\8216INT <DIR>	ACL-8216 Interrupt AI Visual C/C++ sample program
SAMPLES\SDK\8216SCAN <DIR>	ACL-8216 Interrupt AI with AutoScan mode ,Visual C/C++ sample program
SAMPLES\SDK\8216DBINT <DIR>	ACL-8216 Continuous Interrupt AI Visual C/C++ sample program
SAMPLES\SDK\8216DBDMA <DIR>	ACL-8216 Continuous DMA AI Visual C/C++ sample program
SAMPLES\SDK\8316 <DIR>	ACL-8316 Visual C/C++ sample program
SAMPLES\SDK\8316DMA <DIR>	ACL-8316 DMA AI Visual C/C++ sample program

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SAMPLES\SDK\8316INT <DIR>	ACL-8316 Interrupt AI Visual C/C++ sample program
SAMPLES\SDK\8316DBSCAN <DIR>	ACL-8316 Continuous Interrupt AI with AutoScan mode ,Visual C/C++ sample program
SAMPLES\SDK\8316DBINT <DIR>	ACL-8316 Continuous Interrupt AI Visual C/C++ sample program
SAMPLES\SDK\8316DBDMA <DIR>	ACL-8316 Continuous DMA AI Visual C/C++ sample program
SAMPLES\VB\6126 <DIR>	ACL-6126 Visual Basic sample program
SAMPLES\VB\6128 <DIR>	ACL-6128 Visual Basic sample program
SAMPLES\VB\8111 <DIR>	ACL-8111 Visual Basic sample program
SAMPLES\VB\8112 <DIR>	ACL-8112 Visual Basic sample program
SAMPLES\VB\8112DMA <DIR>	ACL-8112 DMA AI Visual Basic sample program
SAMPLES\VB\8112INT <DIR>	ACL-8112 Interrupt AI Visual Basic sample program
SAMPLES\VB\8112CINT <DIR>	ACL-8112 Continuous Interrupt AI Visual Basic sample program
SAMPLES\VB\8112SCAN <DIR>	ACL-8112 Interrupt AI with AutoScan mode , Visual Basic sample program
SAMPLES \VB\8112CDMA <DIR>	ACL-8112 Continuous DMA AI Visual Basic sample program
SAMPLES\VB\8112PG <DIR>	ACL-8112PG Visual Basic sample program
SAMPLES\VB\8113 <DIR>	ACL-8113 Visual Basic sample program
SAMPLES\VB\8216 <DIR>	ACL-8216 Visual Basic sample program
SAMPLES\VB\8216DMA <DIR>	ACL-8216 DMA AI Visual Basic sample program
SAMPLES\VB\8216INT <DIR>	ACL-8216 Interrupt AI Visual Basic sample program
SAMPLES\VB\8316 <DIR>	ACL-8316 Visual Basic sample program
SAMPLES\VB\8316DMA <DIR>	ACL-8316 DMA AI Visual Basic sample program
SAMPLES\VB\8316INT <DIR>	ACL-8316 Interrupt AI Visual Basic sample program

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All ACLS-DLL2's DLLs are also copied to Windows System directory (default is C:\WINDOWS\SYSTEM for Windows 3.11 or Win-95/98, C:\Winnt\System32 for Windows NT/2000).

The driver files are also copied to the appropriate directory:

- Windows 3.11 Version: ACLVDMA1.386 and ACLVDMA3.386 are copied to Windows System directory.
- Win-95/98 Version: ACLVDMA1.386, ACLVDMA3.386, ACLVDMA5.386, ACLVDMA6.386, ACLVDMA7.386, W95_DLL2.VXD, W95_DL22.VXD, and W95_8316.VXD are copied to Win-95/98 System directory.
- Windows NT/2000 Version: DIO.SYS, 6126.SYS, 8111.SYS, 8112.SYS, 8216.SYS, and 8316.SYS are copied to Win-NT/2000 System Drivers directory (default is C:\Winnt\System32\Drivers).

1.2.4 ACLS-DLL2 Un-installation

ACLS-DLL2 software has the capability of automatic un-installation.

To un-install ACLS-DLL2, open the " Control Panel" , double-click " Add/Remove Programs" , select ACLS-DLL2 to un-install it.

1.3 ACLS-DLL2 Hardware Support

The ACLS-DLL2 supports the following hardware:

ACL-6126 : 6 Channels, 12-bit Voltage & Current Outputs Card
ACL-6128 : Isolated 2 Channels Analog Output Card
ACL-8111 : Multi-function Data Acquisition Card
ACL-8112DG/HG : Enhanced Multi-function Data Acquisition Card
ACL-8112PG : Enhanced Multi-function Data Acquisition Card
ACL-8113/8113A : 32 Channels Signal-ended Isolated A/D Card
ACL-8216 : 16-bit High Resolution Multi-function DAS Card
ACL-8312/8316 : 12/16-bit High Resolution/Performance DAS Card with FIFO

1.4 ACLS-DLL2 Language Support

ACLS-DLL2 is DLLs (Dynamic-Link Library) for use under Windows 3.1/95/98/NT/2000. It can work with any Windows programming language that allows calls to a DLL, such as Microsoft Visual C/C++ (4.0 or above), Borland C++ (5.0 or above), or Microsoft Visual Basic (4.0 or above), etc.

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1.5 System Architecture

The following diagram shows the interface between your applications and ACLS-DLL2 drivers:

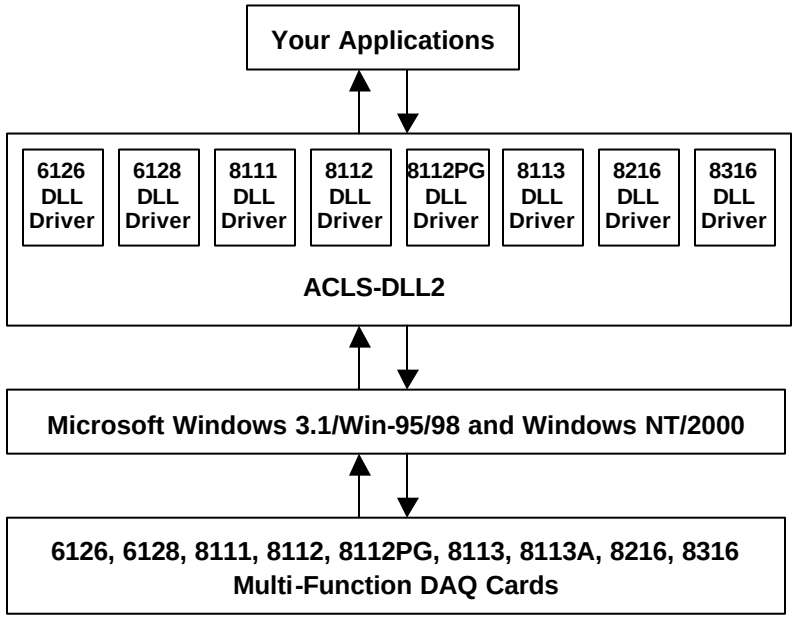


Figure 1.1

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1.6 ACLS-DLL2 Device Driver Handling in Win-NT/2000

[Under Win-NT 4.0]

When you completed the ACLS-DLL2 installation in Win-NT, please be careful of the following issue:

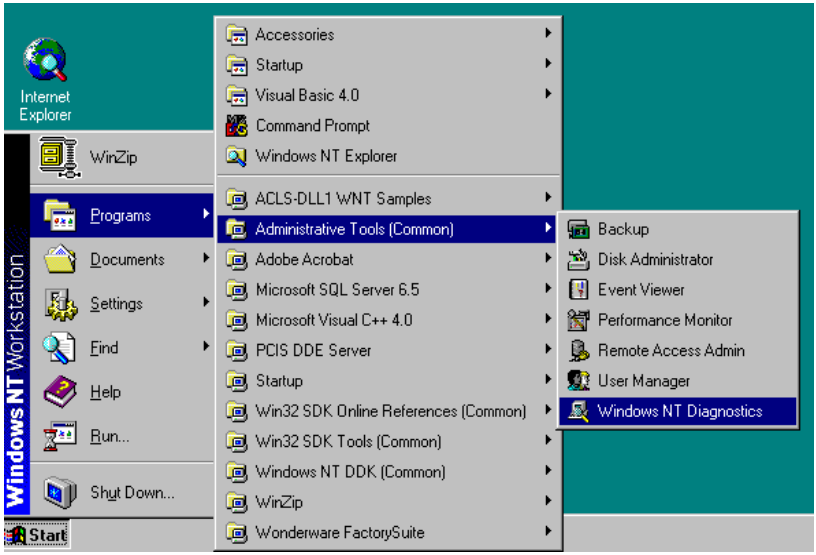
Make sure the ACLS-DLL2 device drivers (6126, 8111, 8112, 8216, 8316 or Dio) are already started. You can open the "Control Panel", double-click "Devices", and a Devices windows will be shown as below.

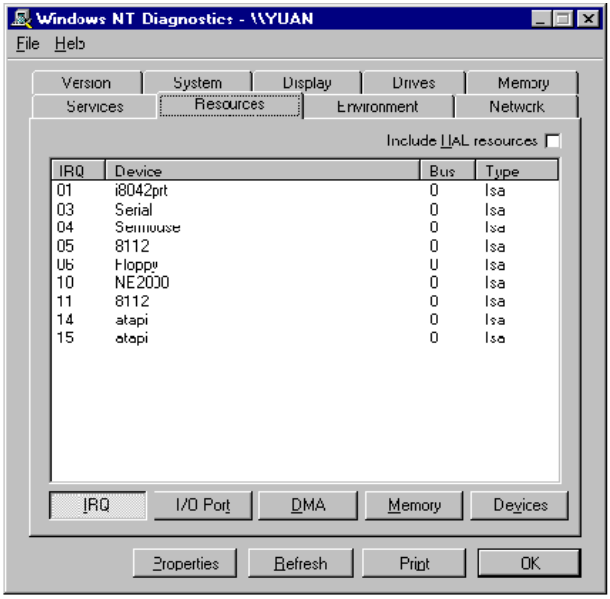


If the device status is none, you have to select the 6126, 8111, 8112, 8216, 8316 or Dio device and press the **Start** button.

If your device driver can not be started, please check if the resources (I/O Port Address, IRQ Level, or DMA Channel) of all the devices of this driver conflict with other hardware device. (*Note: If at least one device of this driver is loaded successfully, the device status will be "Started"*). You can use a Windows NT built-in program *"Windows NT Diagnostics"* to get the resource information in your system. To evoke this program, select *Programs* from *Start* menu, choose *"Administration Tools"*, and then a *Windows NT Diagnostics* window will be shown as below:

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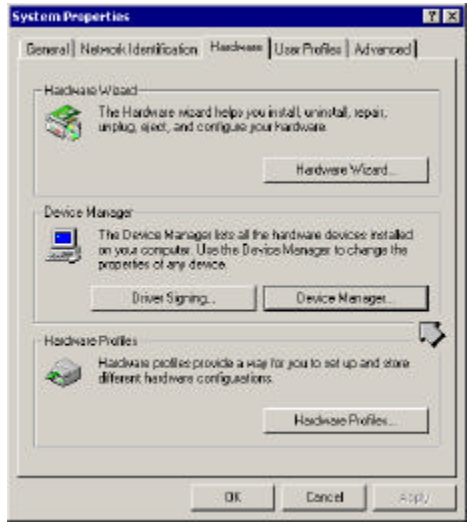
Each button in this window links to the corresponding hardware information. Therefore you can get the resource allocation information in your system and check if your DLL2 devices are loaded successfully. Please refer to Windows NT user's manual for the details about this program. The resource setting modification of DLL2 devices is described in following section.

Note : The resource usage information Windows NT Diagnostics program provides is only the information the hardware drivers which have made registry in NT system. If some devices set their resource request in CMOS (e.g. LPT1), but don't make registry in NT system, you can't get their resource information from Windows NT Diagnostics program. Please refer to Appendix A for the general I/O port address map and IRQ settings.

[Under Win-2000]

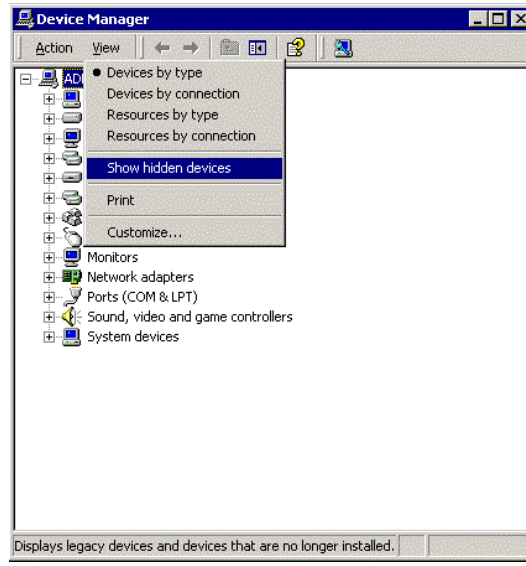
When you completed the ACLS-DLL2 installation in Win-2000, please be careful of the following issue:

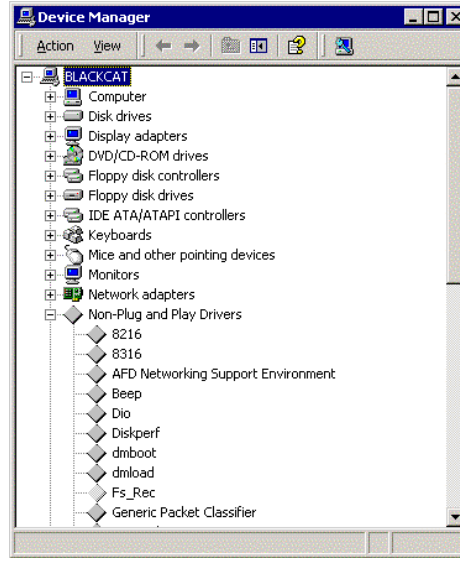
Make sure the ACLS-DLL2 device drivers (6126, 8111, 8112, 8216, 8316 or Dio) are already started. You can open the Device Manager in Start>>Settings>>Control Panel>>System, and then select the Hardware tab.



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In Device Manager, you should select ***Show hidden devices*** item to display the **Non-Plug and Play Drivers.**

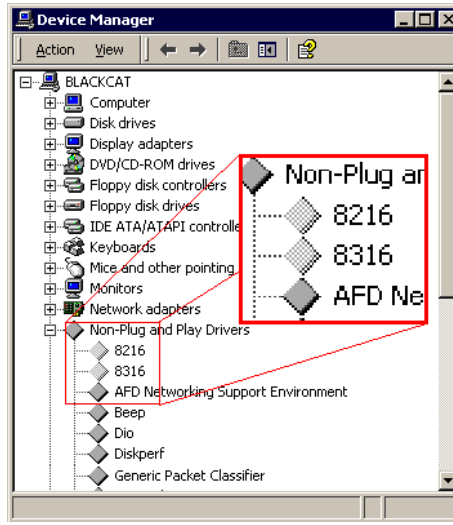




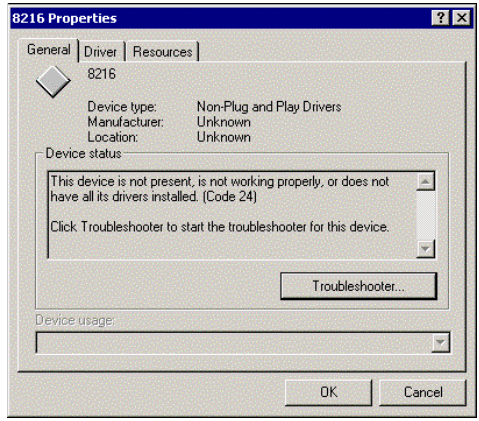
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And then you can double-click the device and select the **Resources** tab to check if I/O port and IRQ resources for the device are allocated successfully.

If your DLL2 devices are not loaded successfully, you will get the *GRAY* icons in **Device Manager** as follows:

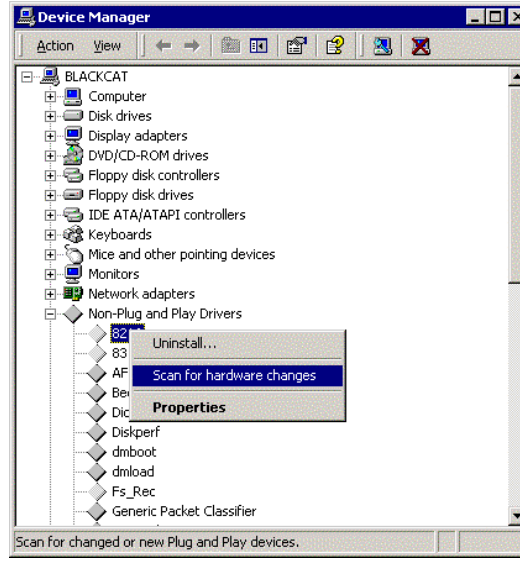


Double-click the icon, the Device Status will show the error massage as the following figure:



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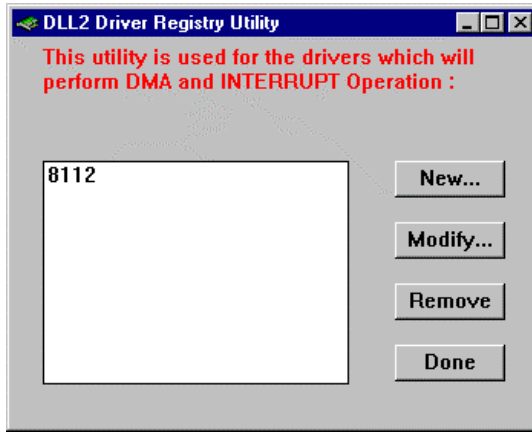
To solve this problem, you can *right-click* the device icon, and select the **Scan for hardware changes** item in pop-up menu. The system will re-load the device drivers with the resource registered in system registry.



1.6.1 ACLS-DLL2 Device Driver Configuration

ACLS-DLL2 provides a utility, *DLL2 Driver Registry Utility*. This utility is used for users to ***make the registry*** of new DLL2 drivers (the drivers you want to perform DMA or interrupt operation), ***remove*** installed drivers and ***modify*** the base address, DMA channel and IRQ level settings of installed drivers. The *DLL2 Driver Registry Utility* main window is as the following figure. The *DLL2 Driver Registry Utility* is installed with ACLS-DLL2 and located in <InstallDir>\Util directory.

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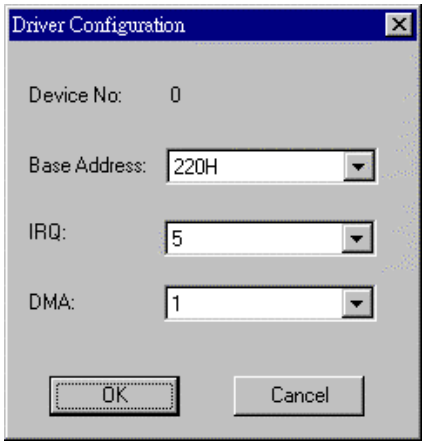
Using this utility to ***install*** a new driver, please refer to section 2.1.3.

Using *DLL2 Driver Registry Utility* to ***change the settings of one device*** of one of the ACLS-DLL2 drivers, select the driver from the *Registered Driver* list and click "Modify…" button and then a "Driver Configuration" window is shown as below. The "Device#" list gives the device names of the devices configured.



To modify the settings of IRQ level, DMA channel and Base Address of a device, click "Modify…" button and a *Driver Configuration* window appears for you to modify DMA channel, IRQ level and base address.

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Inside the Base Address, DMA and IRQ fields are the originally set values. Modify the values and then click "OK" button. The settings for the device will be changed as you modified and return to *Device Configuration* window. Then you can click 'OK" button in *Device Configuration* window and the settings for the driver will be modified.

To ***remove*** a registered driver, select the driver from the *Registered Driver* list in The *DLL2 Driver Registry Utility* main window and click "Remove" button. The selected driver will be deleted from the registry table.

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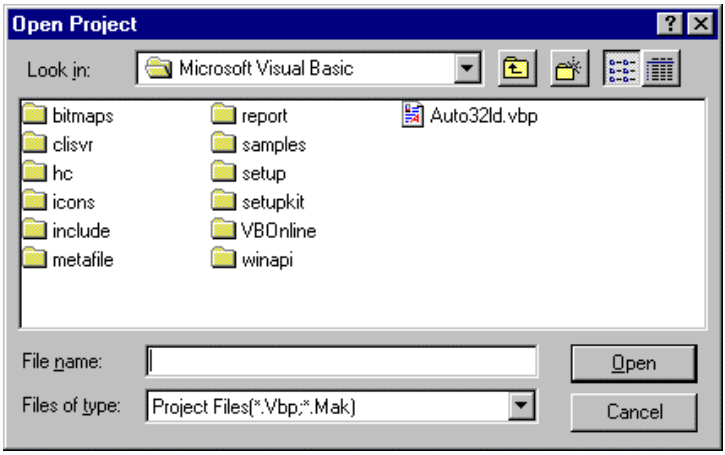
1.7 Using ACLS-DLL2

1.7.1 Creating An Application Using Visual Basic and ACLS-DLL2

To create a data acquisition application using ACLS-DLL2 and Visual Basic, follow these steps after entering Visual Basic:

step 1. Open the project in which you want to use ACLS-DLL2. This can be a new or existing project

Open a new project by selecting the New Project command from the File menu. If it is an existing project, open it by selecting the Open Project command from the File menu. Then the Open Project dialog box appears.

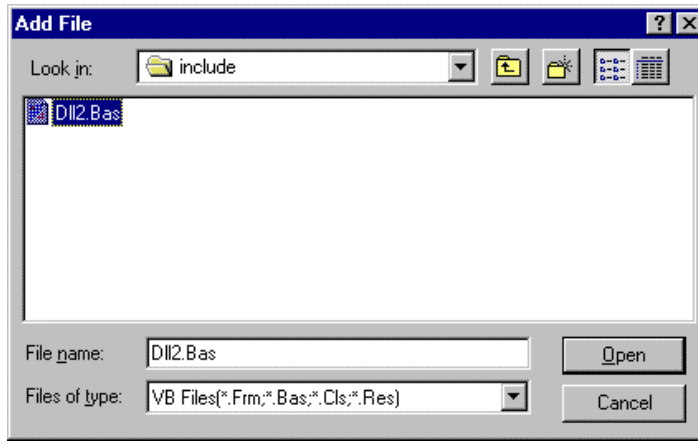


Changed directory to the place the project file located. Double-click the project file name in the File Name list to load the project.

step 2. Add file DLL2.BAS into the project if this file is not included in the project. This file contains all the procedure declarations and constants that you can use to develop your data acquisition application.

From the File menu, select the Add File command. The Add File window appears, displaying a list of files in the current directory.

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Select DLL2.BAS from the Files list by double clicking on it. If you can't find this file in the list, make sure the list is displaying files from the correct directory. By default, DLL2.BAS is installed in C:\ACL-DLL2\INCLUDE.

step 3. Design the interface for the application.

To design the interface, you place the desired elements, such as command button, list box, text box, etc., on the Visual Basic form. These are standard controls from the Visual Basic Toolbox. To place a control on a form, you just move pointer to Toolbox, select the desired control and draw it on the form. Or you can double-click the control icon in the Toolbox to place it on the form.

step 4. Set properties for the controls.

To view the property list, click the desired control and then choose the Properties command from the View menu or press F4, or you can also click the Properties button  on the toolbar.

step 5. Write the event code.

The event code defines the action you want to perform when an event occurs. To write the event code, double-click the desired control or form to view the code module and then add code you want. You can call the functions that declared in the file DLL2.BAS to perform data acquisition operations.

step 6. Run your application.

To run the application, choose Start from the Run menu, or click the Start icon  on the toolbar (you can also press F5).

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step 7. Distribute your application.

Once you have finished a project, you can save the application as an executable (.EXE) file by using the Make EXE File command on the File menu. And once you have saved your application as an executable file, you've ready to distribute it. When you distribute your application, remember also to include the ACLS-DLL2's DLL and driver files. These files should be copied to their appropriate directory as section 2.1.3 described.

1.7.2 Creating An Application Using Microsoft Visual C/C++ and ACLS-DLL2

To create a data acquisition application using ACLS-DLL2 and Microsoft Visual C/C++, follow these steps after entering Visual C/C++:

step 1. Open the project in which you want to use ACLS-DLL2. This can be a new or existing project

step 2. Include header file DLL2.H in the C/C++ source files that call ACLS-DLL2 functions. DLL2.H contains all the function declarations and constants that you can use to develop your data acquisition application. Incorporate the following statement in your code to include the header file.

#include "DLL2.H"

step 3. Build your application.

Setting the appropriate compile and link options, then build your application by selecting the Build command from Build menu (Visual C/C++ 4.0) or Project menu (Visual C/C++ 1.52). Remember to link appropriate ACLS-DLL2's import libraries.

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2

Software Overview

Each NuDAQ ISA-bus multi-function card has its own DLL driver. How to use these DLL to build your own application has been described in section 1.7. The function calls in these DLLs use intuitive names that reflect the operations they perform. For example,

W_8111_AD_Set_Channel sets the A/D reading channel.

The functionality of these function calls can be classified to the following capabilities,

1. Initialization : setup the hardware base I/O address
2. A/D conversion : performs analog to digital conversion
3. D/A conversion : performs digital to analog conversion
4. Digital I/O : input or output digital signals
5. Timer/Counter : Timer/Counter operation

In addition, some sample programs are also included in this disk. They help you to understand how to use the driver more quickly.

We defined some data types in DLL2.H. These data types are used by ACLS-DLL2 library. We suggest you to use these data types in your application programs. The following table shows the data type names and their ranges.

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Type Name	Description	Range
U8	8-bit ASCII character	0 to 255
I16	16-bit signed integer	-32768 to 32767
U16	16-bit unsigned integer	0 to 65535
I32	32-bit signed integer	-2147483648 to 2147483647
U32	32-bit unsigned integer	0 to 4294967295
F32	32-bit single-precision floating-point	-3.402823E38 to 3.402823E38
F64	64-bit double-precision floating-point	-1.797683134862315E308 to 1.797683134862315E309
Boolean	Boolean logic value	TRUE, FALSE

The ACLS-DLL2 contains eight multi-function cards' DLL drivers. They are 6126.DLL, 6128.DLL, 8111.DLL, 8112.DLL, 8112PG.DLL, 8113.DLL, 8113A.DLL, 8216.DLL and 8316.DLL.

2.1 Software Driver Naming Convention

The functions of ACL-DLL2 use full-names to represent the real meaning of the functions. The naming convention rules are:

W_{hardware_model}_{action_name}. e.g. **W_8111_Initial ()**.

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2.2 Initialization and General Configuration Functions

W_{hardware_model}_Initial	Initializes the hardware and the software status of a NuDAQ ISA-Based multi-function card according to the card number and the corresponding base address.
W_{hardware_model}_Switch_Card_No W_{hardware_model}_ActCard_Set	Sets the status of the card you want to operate to be active in a multi-cards system.

2.3 A/D Conversion Functions

W_{hardware_model}_AD_Input_Mode	Informs ACLS-DLL2 of the A/D input mode (single-ended or differential).
W_{hardware_model}_AD_Set_Channel W_{hardware_model}_AD_Channel_Select	Selects the specified analog input channel.
W_{hardware_model}_AD_Channel_Deselect	Removes the specified analog input channel from the list of selected channels (This function is only available for ACL-8113/8113A card).
W_{hardware_model}_AD_Channel_Clear	Clears all of the analog input channels from the list of selected channels, and no channel is selected (This function is only available for ACL-8113/8113A card).
W_{hardware_model}_AD_ChannelNo_Get	Gets the number of the selected channels (This function is only available for ACL-8113/8113A card).
W_{hardware_model}_AD_Set_Gain W_{hardware_model}_Gain_Select W_{hardware_model}_AD_Set_Range	Informs ACLS-DLL2 of the A/D analog input range.

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W_{hardware_model}_AD_Set_Mode	Informs ACLS-DLL2 of the A/D trigger and data transfer mode.
W_8316_AD_Set_Autoscan	Enables automatic channel scan for A/D conversion (This function is only available for ACL-8316/12 card).
W_8316_AD_Set_FIFO	Enables the FIFO on the ACL-8316/12 (This function is only available for ACL-8316/12 card).
W_8316_AD_Read_FIFO	Gets the A/D conversion data stored in the FIFO on the ACL-8316/12 card (This function is only available for ACL-8316/12 card).
W_{hardware_model}_AD_Soft_Trig	Triggers the A/D conversion by software.
W_{hardware_model}_AD_Aquire	Polls the A/D conversion data
W_{hardware_model}_MAD_Aquire	Polls the A/D conversion datum from the selected channels and puts the datum in a specified array (This function is only available for ACL-8113/8113A card).
W_{hardware_model}_Get_MAD_Data	Gets the datum from a specified data array (This function is only available for ACL-8113/8113A card).
W_{hardware_model}_AD_Set_INT_Source	Informs ACLS-DLL2 of the interrupt trigger source for the A/D analog input.
W_{hardware_model}_CLR_IRQ	Clear an interrupt request

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W_{hardware_model}_AD_INT_Start	Performs A/D analog input N times with interrupt data transfer by using external/internal interrupt trigger.
W_{hardware_model}_AD_ContINT_Start	Performs continuous A/D analog input with interrupt data transfer by using external/internal interrupt trigger.
W_{hardware_model}_AD_SCANINT_Start	Performs automatic channel scan for A/D conversion with interrupt data transfer by using external/internal interrupt trigger.
W_{hardware_model}_AD_INT_Staus	Checks the current status of the interrupt operation.
W_{hardware_model}_AD_INT_Stop	Stops the interrupt data transfer.
W_{hardware_model}_AD_DMA_Start	Performs A/D analog input N times with DMA data transfer by using external/internal interrupt trigger.
W_{hardware_model}_AD_ContDMA_Start	Performs continuous A/D analog input with DMA data transfer by using external/internal interrupt trigger.
W_{hardware_model}_ AD_DMA_Status	Checks the current status of A/D analog input with DMA data transfer.
W_{hardware_model}_ AD_DMA_Stop	Stops A/D analog input with DMA data transfer.
W_{hardware_model}_ AD_DblBufferHalfReady	Check whether data half full or not in circular buffer.

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W_{hardware_model}_ AD_DblBufferTransfer	Copy the converted A/D data from circular buffer to user buffer.

2.4 D/A Conversion Functions

W_{hardware_model}_DA_Set_Mode	Informs ACLS-DLL2 of the D/A output mode (This function is only available for ACL-8316/12 card).
W_{hardware_model}_DA	Writes data to one of the analog output channels, changing the voltage produced at the channel.
Set_INT_Op	Informs ACLS-DLL2 of the D/A channel and the data buffer that will be used to perform D/A conversion with interrupt data transfer (This function is only available for ACL-6126 card).
Reset_INT_Op	Reset the D/A channel and data buffer settings of D/A conversion with interrupt data transfer (This function is only available for ACL-6126 card).
W_6126_INT_Start	Initializes and starts up the D/A conversion with interrupt control of ACL-6126 card (This function is only available for ACL-6126 card).
W_6126_INT_Status	Checks the current status of D/A conversion with interrupt operation of ACL-6126 card (This function is only available for ACL-6126 card).

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W_6126_INT_Stop	Stops the D/A conversion with interrupt operation of ACL-6126 card (This function is only available for ACL-6126 card).

2.6 Digital I/O Functions

W_{hardware_model}_DI	Reads the digital data from the specified input port.
W_{hardware_model}_DI_Channel	Reads the digital data from the specified input channel.
W_{hardware_model}_DO	Writes the digital data to the specified output port.
W_{hardware_model}_DO_Channel	Writes the digital data to the specified output line.

2.7 Timer/Counter Operation Functions

W_{hardware_model}_AD_Timer	Starts up internal Timers for generating constant A/D trigger signal dedicatedly.
W_{hardware_model}_Timer_Start	Start up Timer #0 to operate in the specified mode.
W_{hardware_model}_Timer_Stop	Stop Timer #0.
W_{hardware_model}_Timer_Read	Reads the current contents of Timer #0.

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3

Sample Programs

3.1 Sample Programs Included

There are several sample programs provided in this software diskette. They could help you to program your own applications by using ACLS-DLL2 easily. The brief descriptions of these programs are specified as follows:

SDK 6126	D/A conversion, D/I, and D/O of ACL-6126 Microsoft C/C++ Program
SDK 6126INT	D/A conversion of ACL-6126 through Interrupt operation Microsoft C/C++ Program
SDK 6128	D/A conversion of ACL-6128 Microsoft C/C++ Program
SDK 8111 / VB 8111	A/D conversion, D/A conversion, D/I, and D/O of ACL-8111 Microsoft C/C++ Program Visual Basic Program
SDK 8111INT	A/D conversion of ACL-8111 through Interrupt operation Microsoft C/C++ Program
SDK 8111 AutoScan	A/D conversion of ACL-8111 AutoScan mode through Interrupt operation Microsoft C/C++ Program

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SDK 8111 ContINT	Continuous A/D conversion of ACL-8111 through Interrupt operation Microsoft C/C++ Program
SDK 8111 ContAutoScan	Continuous A/D conversion of ACL-8111 AutoScan mode through Interrupt operation Microsoft C/C++ Program
SDK 8112 / VB 8112	A/D conversion, D/A conversion, D/I, and D/O of ACL-8112DG/HG Microsoft C/C++ Program Visual Basic Program
SDK 8112DMA / VB 8112DMA	A/D conversion of ACL-8112DG/HG through DMA data transfer Microsoft C/C++ Program Visual Basic Program
SDK 8112INT / VB 8112INT	A/D conversion of ACL-8112DG/HG through Interrupt operation Microsoft C/C++ Program Visual Basic Program
SDK 8112AutoScan/ VB 8112AutoScan	A/D conversion of ACL-8112DG/HG AutoScan mode through Interrupt operation Microsoft C/C++ Program Visual Basic Program
SDK 8112 ContINT/ VB 8112 ContINT	Continuous A/D conversion of ACL-8112DG/HG through Interrupt operation Microsoft C/C++ Program Visual Basic Program
SDK 8112 ContAutoScan	Continuous A/D conversion of ACL-8112DG/HG AutoScan mode through Interrupt operation Microsoft C/C++ Program Visual Basic Program
SDK8112ContDMA/ VB 8112 ContDMA	Continuous A/D conversion of ACL-8112DG/HG through DMA data transfer Microsoft C/C++ Program Visual Basic Program
SDK 8112PG / VB 8112PG	A/D conversion, D/A conversion, D/I, and D/O of ACL-8112PG Microsoft C/C++ Program Visual Basic Program
SDK 812PGINT	A/D conversion of ACL-8112PG through Interrupt operation Microsoft C/C++ Program

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SDK 812PGDMA	A/D conversion of ACL-8112PG through DMA data transfer operation Microsoft C/C++ Program
SDK 812PG AutoScan	A/D conversion of ACL-8112PG AutoScan mode through Interrupt operation Microsoft C/C++ Program
SDK 812PG ContINT	Continuous A/D conversion of ACL-8112PG through Interrupt operation Microsoft C/C++ Program
SDK 812PG ContDMA	Continuous A/D conversion of ACL-8112PG through DMA data transfer operation Microsoft C/C++ Program
SDK 8113	A/D conversion of ACL-8113 Microsoft C/C++ Program
SDK 8113A	A/D conversion of ACL-8113A Microsoft C/C++ Program
SDK 8216/ VB 8216	A/D conversion, D/A conversion, D/I, and D/O of ACL-8216 Microsoft C/C++ Program Visual Basic Program
SDK 8216DMA/ VB 8216DMA	A/D conversion of ACL-8216 through DMA data transfer Microsoft C/C++ Program Visual Basic Program
SDK 8216INT/ VB 8216INT	A/D conversion of ACL-8216 through Interrupt operation Microsoft C/C++ Program Visual Basic Program
SDK 8216 AutoScan	A/D conversion of ACL-8216 AutoScan mode through Interrupt operation Microsoft C/C++ Program
SDK 8216 ContINT	Continuous A/D conversion of ACL-8216 through Interrupt operation Microsoft C/C++ Program
SDK 8216ContDMA	Continuous A/D conversion of ACL-8216 through DMA data transfer Microsoft C/C++ Program

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SDK 8316/ VB 8316	A/D conversion, D/A conversion, D/I, and D/O of ACL-8316 Microsoft C/C++ Program Visual Basic Program
SDK 8316DMA/ VB 8316DMA	A/D conversion of ACL-8316 through DMA data transfer Microsoft C/C++ Program Visual Basic Program
SDK 8316INT/ VB 8316INT	A/D conversion of ACL-8316 through Interrupt operation Microsoft C/C++ Program Visual Basic Program
SDK 8316 ContINT	Continuous A/D conversion of ACL-8316 through Interrupt operation Microsoft C/C++ Program
SDK 8316 ContAutoScan	Continuous A/D conversion of ACL-8316 AutoScan mode through Interrupt operation Microsoft C/C++ Program
SDK 8316ContDMA	Continuous A/D conversion of ACL-8316 through DMA data transfer Microsoft C/C++ Program

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3.2 Sample Programs Developed Environment

3.2.1 Visual Basic Sample Programs

There are eight Visual Basic sample programs provided in this software package. By default, they are located in directory C:\ACL-DLL2\SAMPLES\VB. The following files are included in each sample program (Using VB 8112int as an example):

- VB project file --- 8112INT.VBP
- VB form files --- 8112INT.FRM, FRMADDR.FRM
- Executable file --- 8112INT.EXE

You must have Microsoft Visual Basic 4.0 Professional Edition or above to deal with these sample programs. Please refer to Visual Basic Manual or related reference books to get the information about how to use Visual Basic 4.0.

3.2.2 Microsoft C/C++ Sample Programs

We provide nine Microsoft C/C++ sample programs in this package. By default, they are located in directory C:\ACL-DLL2\SAMPLES\SDK. The following files are included in each sample program (Using SDK 8112 as an example):

- C source file --- UTIL8112.C
- Workspace file --- UTIL8112.MDP
- Resource script file --- UTIL8112.RC, RESOURCE.H
- Make file --- UTIL8112.MAK
- Executable file --- UTIL8112.EXE

You can use any editor or Microsoft Visual C++ 4.0 to view or modify these source files. However, to build the executable UTIL8112.EXE, you must have Microsoft Visual C++ 4.0 or above. Please refer to Visual C++ Manual or related reference books to get the information about how to use Visual C++ 4.0.

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3.3 Execute Sample Programs

To run the sample programs, please follow these step (Using SDK8112/VB8112 as example):

step 1. Open the sample program

You can use Microsoft Visual C++ 4.0 or Visual Basic 4.0 to open and execute the sample programs. Or you can run the executable files directly.

step 2. Configuration Setting

According to the configuration setting on your NuDAQ card, input the related Base Address, IRQ, DMA Channel number (only support DMA channel 1) and Input Mode of the card in "setup" dialog box (Figure 3.1).



Figure 3.1

Note: If your environment is Windows NT and your irq level is not the same as the default value, please refer to section 2.4 to learn how to change irq level.

step 3. Option Setting

According to your requirements, select the testing functions, e.g. A/D, D/A, ..etc., testing channels, sampling rate and data value (transfer count).

step 4. Push "start" button to run the program.

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3.4 The Detailed Descriptions of these Sample Programs

There are three kinds of sample programs provided in this software package. The descriptions of these three types are the following (Using the screens of VB 8112, SDK 8112DMA and SDK 8112INT as the figure examples) :

3.4.1 A/D conversion, D/A conversion, D/I, and D/O

This kind of samples are used to demonstrate how to use ACLS-DLL2 to operate software trigger with program polling data mode and Read/Write data from digital input/output channels. The main screen of this kind of programs is shown below (Figure 3.2):

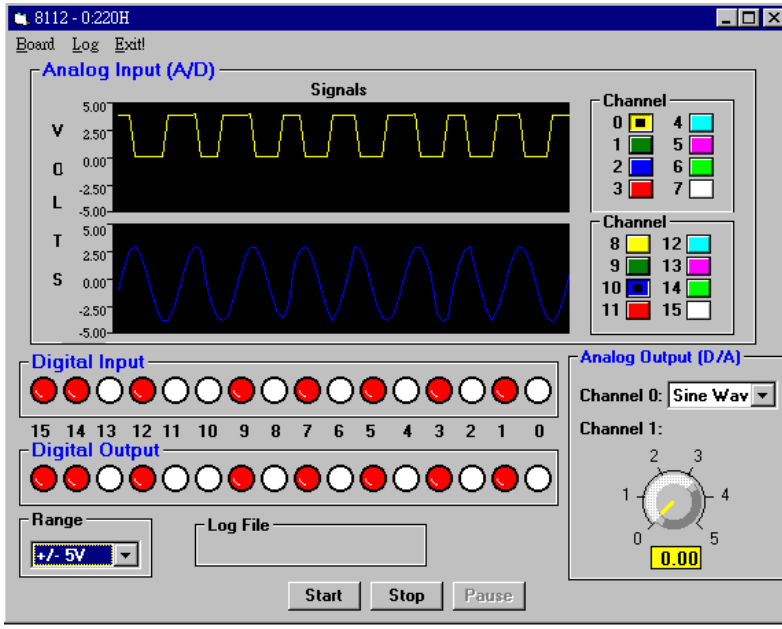


Figure 3.2

Analog Input (A/D) : This is used to show the results of A/D conversion. You can select the Input channels (multi-channels) and the input range(gain) you want from the main screen.

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Analog output (D/A): This is used to show the results of D/A conversion. Dragging the scroll bar (SDK sample) or turning the knob (VB sample) to set the output voltage. In VB program, you can also choose the output waveform (sine or square).

D/I and D/O: This is used to show the results of Read/Write data from/to digital input/output channels. To set the output value, click the channel lights. The red light means "on" and the white light means "off".

3.4.2 A/D conversion through DMA Data Transfer

This kind of programs is used to demonstrate how to use ACLS-DLL2 to operate A/D conversion through DMA data transfer. The main screen of this kind of programs is shown below (Figure 3.3):

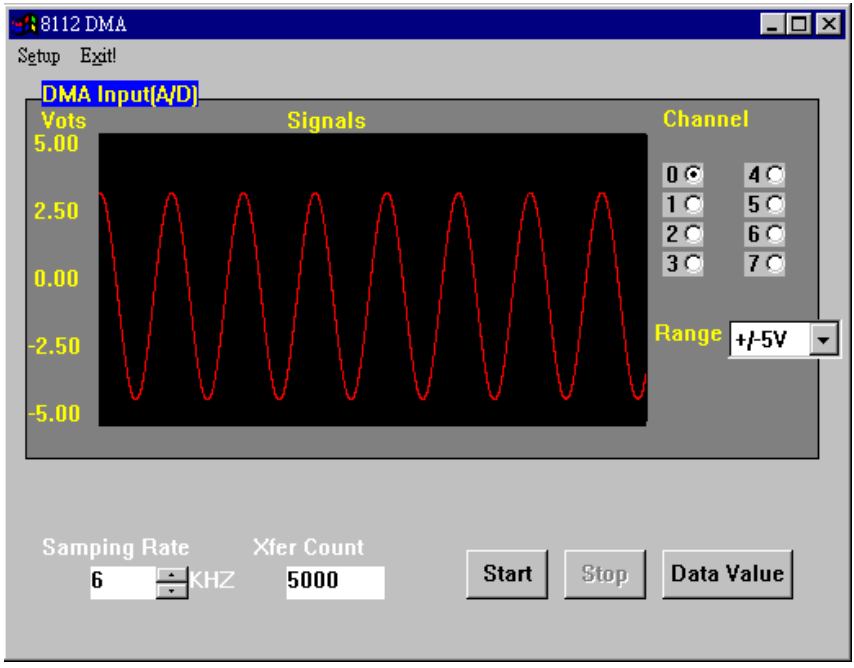


Figure 3.3

In this kind of programs you can select Input channels (Multi-channels), Sampling Rate, Input range and data size (Transfer count) as you wish. To view the input data, push "Data Value" button in the main screen as data transfer is finished (Figure 3.4).

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Note: These DMA sample programs only support DMA channel 1.

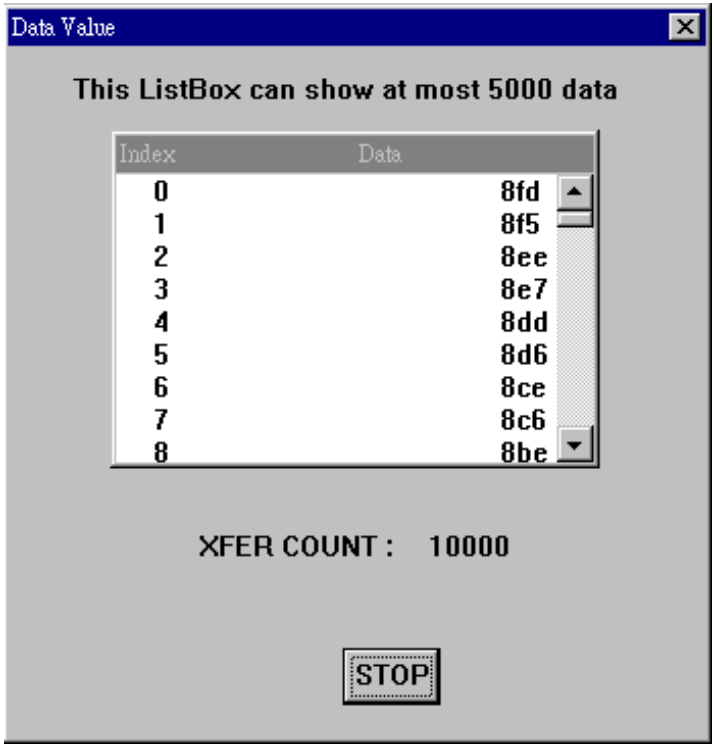


Figure 3.4

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3.4.3 A/D conversion through Interrupt

This kind of programs is used to demonstrate how to use ACLS-DLL2 to operate A/D conversion through Interrupt operation. The screen of this kind of programs is shown below (Figure 3.5) :

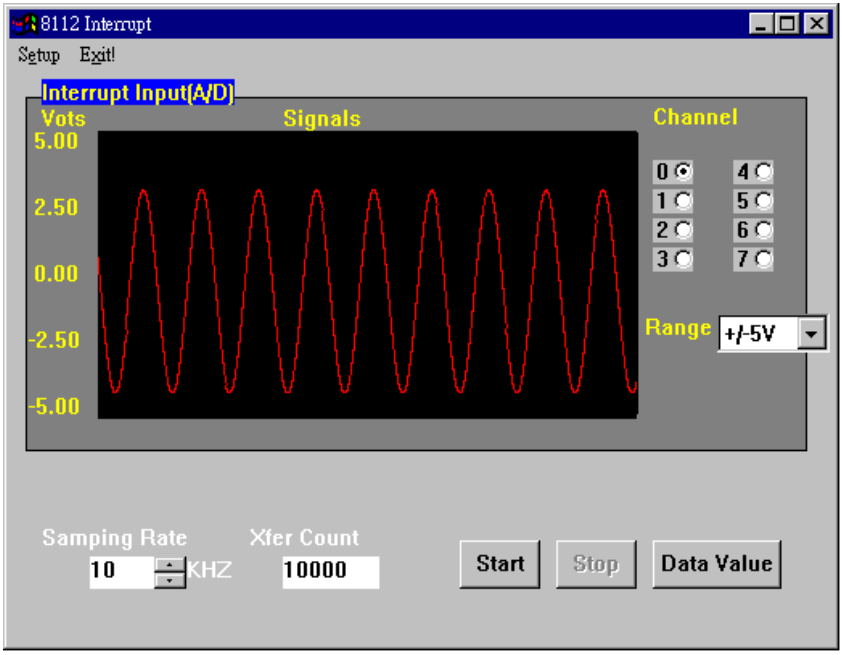


Figure 3.5

In this kind of programs you can select Input channels (Multi-channels), Sampling Rate, input range and data size (Transfer count) as you wish. To view the input data, push "Data Value" button in the main screen as data transfer operation is finished.

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4

Distribution of Applications

4.1 Files And Registries

To install an application using ACLS-DLL2 on another computer, you also must install the necessary driver files and supporting libraries on the target machine. You can redistribute the related files located in \Software\Acls-dll2\W95\redist or \Software\Acls-dll2\Wnt\redist on ADLink All-In-One CD. You can create an automatic installer to install your program and all of the files needed to run that program or you can manually install the program and program files. Whichever installation method you choose, you must install the following files:

4.1.1 Files

Windows 95/98

The corresponding library files in \Software\Acls-dll2\W95\redist\lib, e.g. 8112.dll for ACL-8112DG/HG. These files should be copied to Windows\system directory.

The corresponding driver files in \Software\Acls-dll2\W95\redist\drivers. These files should be copied to Windows\system directory. The required driver file for each Dll2 device is as the following table:

Device	Driver file
Acl-6126	W95_dll2.vxd
Acl-6128	Not needed
Acl-8111	W95_dll2.vxd
Acl-8112DG/HG/PG	w95_dl22.vxd, Aclvdma1.386, Aclvdma3.386
Acl-8113	Not needed

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Acl-8216	w95_dl22.vxd, Aclvdma1.386, Aclvdma3.386
Acl-8316	w95_8316.vxd, Aclvdma5.386, Aclvdma6.386, Aclvdma7.386

DLL2 DMA Channel Selection Utility in \Software\Acls-dll2\W95\redist\Util.

Windows NT 4.0 / 2000

The corresponding library files in \Software\Acls-dll2\Wnt\redist\lib, e.g. 8112.dll for ACL-8112DG/HG. These files should be copied to Winnt\system32 directory.

dio.sys in \Software\Acls-dll2\Wnt\redist\drivers. This file should be copied to Winnt\system32\drivers directory.

The corresponding interrupt/DMA driver files in \Software\Acls-dll2\Wnt\redist\drivers, e.g. 8112.sys for ACL-8112DG/HG/PG. These files should be copied to Winnt\system32\drivers directory. (There is no 8113.sys since ACL-8113 card has no interrupt or DMA functionality.)

Device configuration utility in \Software\Acls-dll2\Wnt\redist\Util. You have to run this utility on the target system to register the drivers.

4.1.2 Registries

In addition to install the above files, you have to register the correct ACLS-DLL2 serial number on the target machine. You have to make the following registry value (string type) on the target machine:

Windows 95/98

```
HKEY_LOCAL_MACHINE\Software\ADLink\ACLS-DLL2/95\CurrentVersion\Serial
```

Windows NT 4.0 / 2000

```
HKEY_LOCAL_MACHINE\Software\ADLink\ACLS-DLL2/NT\CurrentVersion\Serial
```

And set the value of this string to your ACLS-DLL2 serial number.

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4.2 Automatic Installers

Many programming environments include some form of setup or distribution kit tool. This tool automatically creates an installation program for your program so that you can easily install it on another computer. To function successfully, this tool must recognize which control files and supporting libraries are required by your program and include these in the installation program it creates.

Some of these tools, such as the Visual Basic 5 Setup Wizard, use dependency files to determine which libraries are required by a VB application.

Some setup tools might not automatically recognize which files are required by a program but provide an option to add additional files to the installation program. In this case, verify that all the necessary files described in the previous section are included. You also should verify that the resulting installation program does not copy older versions of a file over a newer version on the target computer.

Most of the tools can let you make the registry to the system. You can use it to make the registry mentioned above. If it does not have the capability, you can use the registry file dll2.reg in \Software\Acls-dll2\W95\redist\Util or \Software\Acls-dll2\Wnt\redist\Util to make the registry.

Please edit the file dll2.reg. Add your ACLS-DLL2 serial number to the last line

```
"Serial"=""
```

For example

```
"Serial"="A02-12345678"
```

Then you can make the registry of the serial number by opening the registry file.

If your programming environment does not provide a tool or wizard for building an installation program, you can use third-party tools such as InstallShield. Some programming environments provide simplified or trial versions of third-party installer creation tools on their installation CDs.

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4.3 Manual Installation

If your programming environment does not include a setup or distribution kit tool, you can perform the installation task manually. To install your program on another computer, follow these steps:

1. Copy the program executable to the target computer.
2. Copy all the required files described in the section 4.1.1 to the appropriate directory on the target computer.

Note: Do not replace any files on the target computer if the file on the target computer has a newer version than the file you are installing.

Please use the registry file dll2.reg in \Software\Acls-dll2\W95\redist\Util or \Software\Acls-dll2\Wnt\redist\Util to make the registry. Add your ACLS-DLL2 serial number to the last line

```
"Serial"=""
```

For example

```
"Serial"="A02-12345678"
```

Then you can make the registry of the serial number by opening the registry file.

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Appendix A. General Hardware Resource Allocation information

1 I/O Port Address Map

I/O Address (Hex.)	Device
000-01F	DMA Controller
020-03F	Interrupt controller
040-05F	Timer
060-06F	Keyboard
070-07F	Real-time clock
080-09F	DMA page register
0A0-0B0	Interrupt Controller 2
0C0-0DF	DMA controller
0F0-0FF	Math corprocessor
100-1EF	Not usable
1F0-1F8	Fixed disk
200-207	Game I/O
278-27F	LPT2
2F8-2FF	COM2
300-31F	Prototype card
360-36F	Reserved
378-37F	LPT1
3B0-3BF	Monochrome display
SC0-3CF	Reserved
3D0-3DF	Color graphics display
3F0-3F7	Floppy disk controller
3F8-3FF	COM1

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2 IRQ Settings

IRQ	Device
0	Timer
1	Keyboard
2	Interrupt controller
3	COM2
4	COM1
6	Floppy disk controller
7	LPT1
8	CMOS/Real timer clock
9	Cascaded
13	Math coprocessor
14	Primary IDE controller
15	Secondary IDE controller

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