Manual
1 of 2

Universal Driver Library

CYDAS UDR

Universal Driver Support for CYDAS Series Boards

User's Manual

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Introducing the CYDAS UDR (Universal Driver) Library

Congratulations and thank you for selecting the CYDAS Universal Driver (UDR) Library. We believe it is the most comprehensive and easiest-to-use data acquisition software interface available anywhere. As easy as CYDAS UDR Library is to use, significant documentation and explanation is still required to help new users get going, and to allow previous users to take advantage of all the package's powerful features.

The fast changing nature of the software industry makes it very difficult to provide a totally up to date user guide in written form. Adding to this complexity are the new features and functions that are constantly being added to the library. To provide the most complete information possible and at the same time keep the information current, the CYDAS UDR Library documentation is offered in four parts:

- **CYDAS UDR Library User's Guide:** The User's Guide provides a general description of the UDR Library, offers an overview of the various features and functions, and discusses and how they can be used in different operating systems and languages. The User's Guide also provides board-specific information relating to the features and functions that are included with the CYDAS UDR Library.
- **CYDAS UDR Library Function Reference:** The Function Reference contains detailed information about the CYDAS UDR Library functions, usage, and options. This document is available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed.
- **Example programs:** The examples programs demonstrate the use of many of the most frequently used functions, and are valuable learning tools. They are written for many popular languages. Each example program is fully functional, and provides an ideal starting place for your own programming effort. You can cut and paste from the example programs to create your own programs. It's easier to cut-and-paste pieces from a known, working program than to start writing everything from scratch.
- **Readme files:** The best way to get the latest, most up to date information is through Readme files. We incorporate this information into our documentation as quickly as we can, but for the latest, greatest information, read the Readme file.

CYDAS UDR Library overview

The CYDAS UDR Library is the software that you need to write your own programs for use many of CyberResearch's data acquisition and control boards. The library is universal in three ways:

Universal across boards: The library contains high level functions for all of the common operations for all boards. Each of the boards has different hardware but the CYDAS UDR Library hides these differences from your program. So, for example, a program written for use with one A/D board will work "as is" with a different A/D board.

Universal across languages: The CYDAS UDR Library provides the identical set of functions and arguments for each supported language. If you switch languages, you will not have to learn a new library, with new syntax, and different features.

If you are programming for the .NET framework, you will find that the CYDAS UDR Library for .NET has the same "look and feel" as the CYDAS UDR Library for 32-bit windows applications, and is just as easy to program.

Languages supported by the CYDAS UDR Library, at the time this manual was published, are listed in the following table. Both 16- and 32-bit versions are supported where applicable.

Microsoft Windows Languages	Borland Windows Languages	
Visual Basic	Borland C++	
Visual C/C++	Borland C++ Builder	
Quick C for Windows	Delphi	
Microsoft C		
Microsoft DOS Languages	**Borland DOS Languages**	**Hewlett Packard (Now Agilent)**
QuickBasic 4.5	Turbo C	HP VEE
Professional Basic 7.0	Turbo C++	
Visual Basic for DOS	Borland C++	
Quick C		
.NET Languages		
VB .NET		
C# .NET		

Universal across platforms: The CYDAS UDR Library provides the same sets of functions for DOS, Windows 3.x and 32-bit Windows (95/98/ME/NT/2000/XP). Additionally, these functions have been extended to support the .NET environment.

Installation and Configuration

Installing the CYDAS UDR Library

To install the CYDAS UDR Library, follow the steps below

1. Place the CYDAS UDR Library CD in your CD drive.

The **CyberResearch CD** dialog opens.

If the dialog does not open, use Windows Explorer to run the setup.exe on the root of the CD.

2. From the **CyberResearch CD** dialog, click on the **Install InstaCal and the CYDAS UDR Library** button.

3. Follow the installation instructions as prompted.

4. Leave the CYDAS UDR Library CD in your CD drive, and restart your computer.

*Insta*Cal is a powerful installation, test, and calibration software package that is installed as part of the CYDAS UDR Library package. Refer to the *Quick Start Guide* for examples of using *Insta*Cal with DEMO BOARD

The CB.CFG file and *Insta*Cal

All board-specific information, including current installed options, are stored in the file CB.CFG which is read by CYDAS UDR Library. *Insta*Cal creates and/or modifies this file when board configuration information is added or updated. The CYDAS UDR Library will not function without the CB.CFG file.

For this reason, you must use *Insta*Cal to modify all board setups and configurations as well as to install or remove boards from your system.

Installation – .NET support

CYDAS UDR Library support for .NET requires that the Microsoft .NET framework already be installed on the system before you install the CYDAS UDR Library.

Installation – HP VEE support

Before installing HP VEE support, install the CYDAS UDR Library and *Insta*Cal.

After you install the HP VEE application and drivers, run *Insta*Cal and configure the driver. *Insta*Cal is an installation, calibration, and test program that creates a required configuration file describing the specifics of the hardware installed.

The changes made to your system when installing HP VEE Support are identical to the changes made when installing the CYDAS UDR Library, except for the following:

- The menu bar program VEE.MNU (or CBI.MNN, depending on the version) is written to the VEE directory.

Handling multiple custom menu bars (VEE.MNU)

If you use a custom VEE.MNU, such as the one shipped with DT-VEE, the install program may overwrite it. Contact technical support (203.483.8815) for information on handling multiple custom menu bars.

- Example programs are added to the VEE installation directory. The CYDAS UDR Library sample VEE programs have a .VEE extension. For a list of sample programs, refer to the "Example Programs" chart in Chapter 1, "Functional Overview," of the *CYDAS UDR Library Function Reference*, available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed.

Licensing information

Each original copy of CYDAS UDR Library is licensed for development use on one CPU at a time. It is theft to make copies of this program for simultaneous program development.

Redistributing a custom UDR Library application

The easiest way to distribute an application written with the CYDAS UDR Library is to include a copy of CyberResearch's *Insta*Cal installation package with the application. Instruct the end user to install *Insta*Cal before installing the application.

Some developers may want to integrate the installation of the required CYDAS UDR Library drivers into the custom application's installation. This should only be attempted by developers experienced in installation development.

Following is an overview of the two methods.

Distributing *Insta*Cal in addition to your custom UDR Library application

If you create an application using the CYDAS UDR Library, you may distribute the necessary runtime files (CYDAS UDR Library driver files) with the application royalty free. These files can be installed from CyberResearch's *Insta*Cal installation package. To distribute a custom UDR Library application, provide the end user with two CDs or disks:

- One CD or disk that contains CyberResearch's *Insta*Cal application. *Insta*Cal must be installed before the custom UDR Library application.
- One CD or disk that contains the setup program for their custom VB or C++ application.

You may not distribute any files that give the end user the ability to develop applications using the CYDAS UDR Library.

Integrating *Insta*Cal into your custom UDR Library installation CD or disk

For developers who wish to distribute their application on one CD, refer to the *CYDAS UDR Library Redistribution Guide*. This document contains procedures to merge the setup programs for both *Insta*Cal and the custom UDR Library application into one setup program that you can distribute on one CD or disk. The merging process is complicated — only experienced programmers should attempt to do this.

When you install the software, the *CYDAS UDR Library Redistribution Guide* (ULRedist.pdf) is copied to the default installation directory "C:\MCC\Documents" on your local drive.

Getting Started

The CYDAS UDR Library is callable from many languages and environments, including Visual Basic®, Visual C++, Borland C++ Builder, and Delphi. A list of the languages currently supported by the CYDAS UDR Library is provided on page 1. Additionally, the UDR Library is now callable from any language supported by the .NET framework. This chapter describes how to use the library from each of the languages, as well as several 16-bit environments. The first section of the chapter describes details of the library that apply to all languages. The following sections describe the differences for each language.

Before starting your application, you should perform the following:

- Set up and test your boards with *Insta*Cal. The CYDAS UDR Library will not function until *Insta*Cal has created a configuration file (CB.CFG).
- Run the example programs for the language you program in.

Example programs

Example programs are installed into the Sample32 and Sample16 installation subdirectory for each programming language mentioned above. Note that 16-bit sample programs are only installed when you install the 16-bit library. The names of the installation folders are:

- C
- CWIN
- DELPHI
- VBWIN

All .NET applications run in the 32-bit Windows environment. A complete set of UDR Library for .NET example programs are included in the C# and VB.NET folders of the CYDAS UDR Library installation directory. Each program illustrates the use of CYDAS UDR Library functions from within a .NET program.

For a complete list of example programs, refer to the CYDAS UDR Library Function Reference

The *CYDAS UDR Library Function Reference* contains tables that list the UDR Library and UDR Library for .NET example programs. Each table contains the name of the sample program and the functions that the program demonstrates. This document is available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed.

CYDAS UDR Library Description and Use

The CYDAS UDR Library consists of a set of functions that are callable from your program. These functions are grouped according to their purpose. All of the groups except for *Miscellaneous* are based on which type of device they are used with.

Important - Read the UDR Library documentation, Readme file, and run the example programs

In order to understand the functions, please read the board-specific information section contained in this manual and in the Readme files supplied on the CYDAS UDR Library disk. We also urge you to examine and run one or more of the example programs supplied prior to attempting any programming of your own. Following this advice can save you hours of frustration and wasted time.

General UDR Library language interface description

The interface to all languages is a set of function calls and a set of constants. The list of function calls and constants are identical for each language. All of the functions and constants are defined in a "header" file for each language. Refer to the sections below, and especially to the example programs for each language. This manual is brief with respect to details of language use and syntax. For more detailed information, review the example programs. Example programs for each language are located in the installation directory.

Function arguments

Each library function takes a list of arguments and most return an error code. Some functions also return data via their arguments. For example, one of the arguments to `cbAIn()` is the name of a variable in which the analog input value will be stored. All function arguments that return data are listed in the "**Returns**" section of the function description.

Constants

Many functions take arguments that must be set to one of a small number of choices. These choices are all given symbolic constant names. For example, `cbTIn()` takes an argument called `Scale` that must be set to `CELSIUS`, `FAHRENHEIT` or `KELVIN`. These constant names are defined, and are assigned a value in the "header" file for each language. Although it is possible to use the numbers rather than the symbolic constant names, we strongly recommend that you use the names. Using constant names make your programs more readable and more compatible with future versions of the library. The numbers may change in future versions, but the symbolic names always remain the same.

Options arguments

Some library functions have an argument called `Options`. The `Options` argument is used to turn on and off various optional features associated with the function. If you set `Options = 0`, the function sets all of these options to the default value, or `OFF`.

Some options can have an alternative value, such as `DTCONNECT` and `NODTCONNECT.` If an option can have more than one value, one of the values is designated as the default. Individual options can be turned on by adding them to the `Options` argument. For example:

- `Options = BACKGROUND` will turn on the "background execution" feature.
- `Options = BACKGROUND+CONTINUOUS` will select both the "background execution" and the "continuous execution" feature.

Error handling

Most library functions return an error code. If no errors occurred during a library call, 0 (or `NOERRORS`) is returned as the error code. Otherwise, it is set to one of the codes listed in the *CYDAS UDR Library Function Reference* "Error Codes" chapter. This document is available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed.

If a non-zero error code is returned, you can use `cbGetErrMsg()` to convert the error code to a specific error message. As an alternative to checking the error code after each function call, you can turn on the library's internal error handling with `cbErrHandling()`.

16-bit values using a signed integer data type

When using functions that require 16-bit values, the data is normally in the range of 0 to 65535. However, some programming languages, such as BASIC and Visual Basic only provide signed data types. When using signed integers, reading values above (32767) can be confusing.

The number (32767) in decimal is equivalent to (`0111 1111 1111 1111`) binary. The next increment (`1000 0000 0000 0000`) binary has a decimal value of (-32768). The maximum value (`1111 1111 1111 1111`) binary translates to (-1) decimal. Keep this in mind if you are using Basic, Visual Basic (up to version 6) or other languages that don't support unsigned integers.

There is additional information on this topic in the *CYDAS UDR Library Function Reference*. This document is available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed. Also, refer to the documentation supplied with your language compiler.

Using the CYDAS UDR Library in Windows

All 32-bit applications (including console applications) access the 32-bit Windows Dynamic Link Library (DLL) version of the CYDAS UDR Library (CBW32.DLL). Example programs are provided for MS Visual C++, MS Visual Basic, Borland C++, and Borland Delphi in the Sample32 subdirectories of the installation directory. These sample programs illustrate the use of CBW32.DLL.

For 16-bit Windows applications, or Windows applications running in Windows 3.x, the 16-bit Windows DLL version of the CYDAS UDR Library (CBW.DLL) should be used. Example programs are provided for Visual Basic and both Borland and MS C in the Sample16 subdirectories of the installation directory. These programs illustrate the use of CBW.DLL.

Due to the differences in memory management among DOS, Windows 3.x, and 32-bit Windows (95/98/ME/NT/2000/XP), the scan functions have slightly different argument lists. In DOS libraries, all scan functions take a pointer to a data array as one of their arguments. In Windows 3.x, these functions take a handle to a Windows Global Memory buffer instead of a pointer to an array. In the 32-bit Windows version, these functions take a pointer (a 32-bit virtual address) or a handle returned from `cbWinBufAlloc()`.

The affected functions are:

- `cbAInScan()`
- `cbAOutScan()`
- `cbAPretrig()`
- `cbDInScan()`
- `cbDOutScan()`
- `cbStoreOnInt()`

The Windows library contains four functions for managing these Windows global memory buffers:

- `cbWinBufAlloc()`
- `cbWinBufFree()`
- `cbWinArrayToBuf()`
- `cbWinBufToArray()`

Real-time acquisition under Windows

Real-time acquisition is available for Windows. To operate at full speed in Windows, the A/D board must have an onboard FIFO buffer. All of our advanced designs have FIFO buffers, including our CYDAS xP boards (except for the CYDAS 8P), and many of our ISA boards, such as the CYDAS 80x, CYDAS 160x, CYDAS 140x, and CYDAS 1802ST. All of these data acquisition boards will operate at full speed in Windows.

Applying software calibration factors in real time on a per-sample basis eats up machine cycles. If your CPU is slow, or if processing time is at a premium, withhold calibration until after the acquisition run is complete. Turning off real-time software calibration saves CPU time during a high speed acquisition run.

Processor speed

Processor speed remains a factor for DMA transfers and for real-time software calibration. Processors of less than a 150 megahertz (MHz) Pentium class may impose speed limits below the capability of the board (refer to specific board information.)

If your processor is less than a 150 MHz Pentium and you need an acquisition speed in excess of 200 kilohertz (kHz), use the `NOCALIBRATEDATA` option to a turn off real-time software calibration and save CPU time. After the acquisition is run, calibrate the data with `cbACalibrateData()`.

Visual Basic for Windows

To use the CYDAS UDR Library with Visual Basic, include the CYDAS UDR Library declaration file CBW.BAS in your program. Include the file as a module in the project, or include it by reference inside those Forms which call into the CYDAS UDR Library. Once the declarations for the CYDAS UDR Library have been added to your project, call the library functions from any Form's event handlers.

When using the 32-bit version of Visual Basic, CBW.BAS references CBW32.DLL to call CYDAS UDR Library functions. This is accomplished with conditional compile statements. When using 16-bit versions of the Visual Basic (such as versions 3.0 or older), these conditional compile statements must be deleted.

For Visual Basic 6.0 and older, Windows memory buffers cannot be mapped onto arrays. As a consequence, the `cbWinArrayToBuf()` and `cbWinBufToArray()` functions must be used to copy data between arrays and Windows buffers.

Example:

```
Count = 100
MemHandle = cbWinBufAlloc (Count)
cbAInScan (......,MemHandle,...)
cbWinBufToArray (MemHandle, DataArray(0), 0, Count)
For i = 0 To Count
   Print DataArray(i)
Next i
cbWinBufFree (MemHandle)
```

Visual Basic example programs

A complete set of Visual Basic example programs is included in the VBWIN folder of the CYDAS UDR Library installation directory. Each program illustrates the use of a CYDAS UDR Library function from within a Visual Basic program. The .FRM files contain the programs, and the corresponding .VBP or .MAK files are the project files used to build the programs for Visual Basic.

Microsoft Visual C++

To use the CYDAS UDR Library with MS Visual C++, include the CYDAS UDR Library header file CBW.H in your C/C++ program and add the library file CBW32.LIB to your library modules for linking to the CBW32.DLL. When using a 16-bit version of MS Visual C++, replace the library file CBW32.LIB with CBW.LIB.

Microsoft Visual C++ example programs

The CWIN folder of the CYDAS UDR Library installation directory contains three sample programs - `Wincai01`, `Wincai02` and `Wincai03`. Each program is an example of a simple C program that calls a few of the CYDAS UDR Library functions from a Windows application. These programs contain directives for building 16- OR 32- bit applications. Use the .MAK project files to build a 16-bit application, and the .DSP project files to build a 32-bit application.

The non-Windows C examples in the C folder of the installation directory provide a more complete set of examples. You can compile these programs as 32-bit console applications for Windows by using the MAKEMC32.BAT file.

Borland C /C++ for Windows

For 32-bit Borland (or Inprise) C/C++ compilers, include the CYDAS UDR Library header file CBW.H in your program and link with the import library file CBW32BC.LIB.

When using the 16-bit version of Borland C/C++, use a tool called IMPLIB to generate an OMF-style import library that your application can link with. For 16-bit users, IMPLIB accepts a DLL (CBW.DLL) as input and creates an OMF-style import library (BCBW.LIB). You can run IMPLIB on CBW.DLL to emit a 16-bit OMF-style import library (BCBW.LIB).

Borland C/C++ example programs

The non-Windows C examples provide an extensive set of examples. These can be compiled as 32-bit console applications using the MAKEBC32.BAT file.

Delphi example programs

A complete set of Delphi example programs is included in the DELPHI folder of the CYDAS UDR Library installation directory. Each program illustrates the use of one CYDAS UDR Library function from within a Delphi program. The .PAS files contain the programs. The corresponding .DPR file is the Project file used to build the program in a 16 bit or 32 bit Delphi environment.

In 16-bit Delphi environments, use the `cbw.dll` header. In 32-bit Delphi environments use the `cbw32.dll` header. Conditionals within the example programs determine which of the DLLs is used. Where integers are passed by reference to a CYDAS UDR Library function, use the SmallInt data type in 32-bit environments. The relevant functions are defined this way in the 32-bit header, so if you try to pass an Integer data type you will get a compiler error.

Using the Library with DOS BASIC

Each of the supported versions of BASIC consists of two distinct systems. Programs can be loaded into the BASIC editor and run from within the integrated BASIC environment. Programs can also be compiled by a command line compiler into stand-alone executable programs that can be run on their own without the help of the integrated BASIC environment. The CYDAS UDR Library provides the tools for both methods.

BASIC header file

Every BASIC program that uses the CYDAS UDR Library must have a line which includes the BASIC CYDAS UDR Library header file - CB.BI. The following line should appear near the start of every program, before the first library call is made.

```
'$INCLUDE: 'CB.BI'
```

Using the Library within the integrated BASIC environment

When you start up BASIC, load the "quick library" version of CYDAS UDR Library.

For Quick BASIC, type:

```
qb /l cbqb
```

For Professional BASIC, type:

```
qbx /l cbpb
```

For VisualBasic for DOS, type:

```
vbdos /l cbvb
```

Using the Library with the BASIC command line compiler

To build stand-alone executable files with the command line compiler, you must link your compiled BASIC program with the stand-alone version of the CYDAS UDR Library. To do this, you must supply the linker with the library name. The names of the .lib files are:

▪ QuickBasic:	CBQB.LIB
▪ Professional Basic:	CBPB.LIB
▪ VisualBasic for DOS:	CBVB.LIB

Sample BASIC programs

The sample BASIC programs demonstrate how to call each function in the CYDAS UDR Library. These programs can be run from within the integrated BASIC environment. They can also be compiled using the command line compiler with the batch file supplied. The names of the batch files are:

▪ QuickBasic:	MAKEQB.BAT
▪ Professional BASIC:	MAKEPB.BAT
▪ VisualBasic for DOS:	MAKEVB.BAT

Passing arguments to the CYDAS UDR Library

All functions in the library require that arguments be passed to them. The file CB.BI contains the definition of all the argument types that are passed. In general, there are two classes of arguments: inputs and outputs.

Input arguments

Input arguments to a library function are listed in the CB.BI file definition as `BYVAL`. You can pass these arguments as either a variable or a constant. For example, both of these versions are acceptable:

```
BoardNum% = 0
cbStopBackground (BoardNum%)
```

or

```
cbStopBackground (0)
```

Output arguments

Output arguments pass information back to the calling function. For example, `cbAIn()` returns the value from an A/D to the `DataValue%` argument. Others arguments are both inputs and outputs. For example, the `Rate&` argument specifies the requested sampling rate for `cbAInScan()` (Input).

The actual sampling rate can vary from the requested sampling rate. `cbAInScan()` returns the actual rate to the `Rate&` argument (output). Output and input/output arguments are defined in the CB.BI function definitions as `SEG`. All `SEG` arguments can only be passed via a variable.

The following example is correct:

```
Count& = 1000
Rate& = 15000
cbAInScan (0, 0, 1, Count&, Rate&, BIP5VOLTS, DataArray(0), 0)
```

The following example is NOT correct:

```
cbAInScan (0, 0, 1, 1000, 15000, BIP5VOLTS, DataArray(0), 0)
```

DataArray argument with multiple channels

Some functions have a `DataArray` argument. DataArray either receives the data from an input function, such as `cbAInScan()`, or contains the data to send to an output function, such as `cbAOutScan()`**.**

`DataArray` must be dimensioned to be large enough to contain all of the data. The array can either be dimensioned with one-dimension or two dimensions. When sampling more than one channel, it is often more straightforward to use a two-dimensional array. The code below shows both methods:

```
DIM DataBuffer (1999)        'One-dimensional array. 0 to 1,999 (2,000)
elements.
```

or

```
DIM DataBuffer (1, 999)      'Two-dimensional array. 0 & 1 with 0-999
(1,000) elements each.
LowChan% = 2
HighChan% = 3
Count& = 2000
Rate& = 1000
cbAInScan (0, LowChan%, HighChan%, Count&, Rate&, BIP5VOLTS, DataBuffer(0), 0)
```

or

```
cbAInScan (0, LowChan%, HighChan%, Count&, Rate&, BIP5VOLTS, DataBuffer(0,
0), 0)
```

The advantage of using the two-dimensioned array is that you can directly address the data in the array by channel. Therefore, in the example above, `DataBuffer (0, 99)` addresses the 100th sample for channel 2 (channel 2 was the first element in the array; `LowChan%`).

When running UDR Library for .NET, order Visual Basic arrays as `DataArray` (sample, chan). The above example would be written in UDR Library for .NET as `DataBuffer(99, 0)`.

String arguments

`cbGetErrMsg()` requires that a string variable be passed as an argument. This string variable must have been previously allocated to be large enough to hold the longest error message. To do this, use Quick BASIC's `space$` function as it is done in the example program.

```
ErrStr$ = space$ (ERRSTRLEN)
```

Integer arguments

BASIC does not support unsigned integers (0 to 65,535). Values for the integer data type range from –32,768 to 32,767. When using functions that require unsigned integers, the data must be converted. (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)

BACKGROUND operation

If you use the `BACKGROUND` option with any function, you must declare the associated data array as `'$STATIC`.

Unless you declare an array as `'$STATIC`, BASIC may move the array around in memory as the program is executing. Whenever you use the `BACKGROUND` option, the I/O function reads/writes from the data array in the background while the BASIC program continues executing in the "foreground." If BASIC moves the array while the I/O function is reading/writing to it, it will cause intermittent and unpredictable problems.

`cbStopBackground()` should be executed after normal termination of all background functions to clear variables and flags.

Using the Library with VisualBasic® for DOS

Compiling stand-alone EXE files

Due to a quirk in VisualBasic for DOS, the following message displays if you compile a stand-alone EXE file from within the IDE and set the EXE type to "Stand alone EXE file":

```
"fixup overflow at 334 in the segment -TEXT target external 'B$CEND'".
```

Disregard this error message. The compiled program will run without error.

Using the Library with C for DOS

The C libraries included with the system can be used with either the Microsoft or Borland C compilers.

C header file

Every C program that uses the CYDAS UDR Library must have a line which includes the CYDAS UDR Library C header file, CB.H. The following line should appear near the start of every program, before the first library call is made.

```
#include "cb.h"
```

Memory models

Both Borland and Microsoft C compilers support different memory models. The CYDAS UDR Library comes with the following four versions of the library.

- CBCC.LIB - For use with compact model
- CBCS.LIB - For use with small model
- CBCM.LIB - For use with medium model
- CBCL.LIB - For use with large and huge model

Large data arrays

The CYDAS UDR Library supports input and output from very large (>64K) amounts of data. If your program requires storage and transfer of large single data sets, you must compile it for the "huge" model and use the CBCL.LIB library. If you declare an array to hold the data, it should be declared `__huge`.

If you allocate memory (as is done in the example programs using `malloc`) it should be allocated using `_halloc` (Microsoft) or `halloc` (Borland), the pointer declared as `__huge` and memory freed using `_hfree` (Microsoft) or `hfree` (Borland). Note that you must also include the `malloc.h` header.

Compiling the sample C programs

The example programs demonstrate how to call each of the CYDAS UDR Library functions from a C program. Two batch files are provided that show how to compile and link the sample programs using the Microsoft and Borland compilers.

- MAKEMC16.BAT - compile and link with Microsoft C
- MAKETC16.BAT - compile and link with Borland C

Using the Library with HP VEE

The CYDAS UDR Library with HP VEE includes a complete interface to HP VEE providing a DataAcq-specific menu bar addition and functions as well as complete examples of all the library functions.

To understand how the interface to HP VEE interacts with I/O boards, you need to study both this manual and the example programs. This manual is written for symbolic programming languages such as BASIC and C. VEE is a graphical programming language.

It is very important that you scan the entire manual for information that relates to general performance. Remember, VEE is using the entire CYDAS UDR Library as the interface to the I/O boards. Limitations and performance factors in the library are reflected in VEE programs that use the library. The manual contains related information throughout the contents. We encourage you to review the entire manual.

The CYDAS UDR Library interface to VEE follows the structure of the library as it is used with all other languages. The arguments presented here in symbolic format are the same arguments you will need to specify when using VEE to control an I/O board. The manual explains the functions and each of the arguments. The VEE examples show how the function is interfaced to VEE and show how to use the function to control the I/O boards.

There is one exception to this rule: the programming argument `MemHandle` is replaced in VEE with the argument `DataArray`. VEE allocates data arrays directly. Windows programming languages use another method of pointing to data arrays. In addition to a name change, there is some VEE programming logic done to dimension a two-dimensional data array for all multichannel operations. This logic can be seen by examining the design view of the function.

Each function is implemented as a panel. All the arguments are accessible on the panel and require a value. In the example programs and in simple projects this method of presenting the functions is easiest to use. Each value is hard-coded into the panel.

If more complex projects are undertaken, open the design view of the function and drag certain arguments outside the panel. Dragging an object outside the panel will create a 'pin' to which you can connect constants, variables, or objects such as slider bars. In large projects the ability to supply an argument with a variable that acquires its value elsewhere is especially useful. See the VEE manual for information on how to do this.

See the example program `ULAI06.VEE` for an example of the multiple uses of several arguments, where it is better to specify the argument values globally. In this example, we have brought several arguments out of the panel.

Remember, if you drag an argument outside a panel you must reconnect the program flow (top and bottom pins) of the remaining arguments; the one above to the one below the argument you removed.

New HP VEE functions

Several new functions have been added strictly for use with HP VEE. These functions are listed separately in a section devoted to the VEE-specific functions. All VEE-specific functions begin with the name `cbv`, rather than `cb`. The new functions add VEE style data and array handling to the library.

Using the HP VEE interface is simple, and is a great way to connect your VEE programs to the real world. Read the manual, start with the examples, and then begin working up your own projects. Remember to call us with suggestions!

Installation note

Install the CYDAS UDR Library in the default directory. The HP VEE library import block CBI_UL contains an exact path specification for the library CBV.DLL and its header file CBV.H. If you do not install these files into the default directory suggested by the install program, you will have to edit the library import block CBI_UL to point to the directory where the files are installed.

To edit the library import block CBI_UDR:

1. Click on the **DataAcq** menu item and then click on its `cbLibrary` sub-menu item.
2. Place the mouse cursor at the desired location for the library import block and press the left mouse button once.
3. Double-click on the library import block object. A detailed CBI_UL library block will be displayed.
4. Within the CBI_UL library block, click on the button to the right of **File Name**, then enter the new path with the file name and click **OK**.
5. Click on the button to the right of **Definition File**, then enter the new path with the file name and click **OK**.

Using VEE 3.2 or later

If you are using VEE 3.2 or later, edit the library import block and change the library name from CBV.DLL to CBV32.DLL. Be sure to include the proper path.

CYDAS UDR Library for .NET Description & Use

Programming the CYDAS UDR Library API is now available through the various languages supported by the Microsoft .NET framework. All .NET applications access the 32-bit Windows CYDAS UDR Library (CBW32.DLL) through the MccDaq .NET assembly (MCCDAQ.DLL). The MccDaq assembly provides an interface that exposes each CYDAS UDR Library function that is callable from the .NET language.

The CYDAS UDR Library for .NET is designed to provide the same "look and feel" as the CYDAS UDR Library for 32-bit Windows. This design makes it easier to port over existing data acquisition programs, and minimizes the learning curve for programmers familiar with the CBW32.DLL interface.

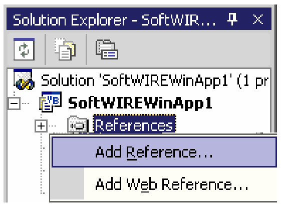
In the CYDAS UDR Library for .NET, each function is exposed as a class method with virtually the same parameter set as their UDR Library counterparts.

Configuring a UDR Library for .NET project

In a .NET application, there are no header files to include in your project. You define methods and constants by adding the MccDaq assembly, or Namespace, as a reference to your project. You access UDR Library for .NET methods through a class that has the CYDAS UDR Library as a member.

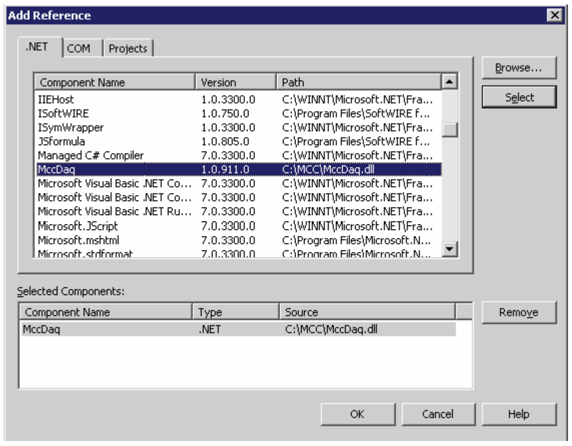
To add the MccDaq Namespace as a reference in a Visual Studio .NET project:

1. Start a new Visual Basic or C# project in Visual Studio .NET.
2. From the Visual Studio .NET Solution Explorer window, right-click on **References** and select **Add Reference**.


Solution Explorer - SoftWIR...
Solution 'SoftWIREWinApp1' (1 pr
SoftWIREWinApp1
References
Add Reference...
Add Web Reference...

   The **Add Reference** window appears.

3. From the **.NET** tab, select the **MccDaq** option from the displayed list of .NET assemblies and click on the **Select** button.



Component Name	Version	Path
IIEHost	1.0.3300.0	C:\WINNT\Microsoft.NET\Fra...
ISoftWIRE	1.0.750.0	C:\Program Files\SoftWIRE f...
ISymWrapper	1.0.3300.0	C:\WINNT\Microsoft.NET\Fra...
JSformula	1.0.805.0	C:\Program Files\SoftWIRE f...
Managed C# Compiler	7.0.3300.0	C:\WINNT\Microsoft.NET\Fra...
MccDaq	1.0.911.0	C:\MCC\MccDaq.dll
Microsoft Visual Basic .NET Co...	7.0.3300.0	C:\WINNT\Microsoft.NET\Fra...
Microsoft Visual Basic .NET Co...	7.0.3300.0	C:\WINNT\Microsoft.NET\Fra...
Microsoft Visual Basic .NET Ru...	7.0.3300.0	C:\WINNT\Microsoft.NET\Fra...
Microsoft.JScript	7.0.3300.0	C:\WINNT\Microsoft.NET\Fra...
Microsoft.mshtml	7.0.3300.0	C:\Program Files\Microsoft.N...
Microsoft.stdformat	7.0.3300.0	C:\Program Files\Microsoft.N...

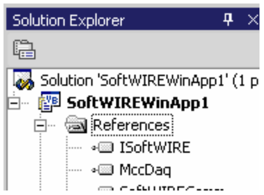
Selected Components:

Component Name	Type	Source
MccDaq	.NET	C:\MCC\MccDaq.dll

   MccDaq displays in the **Selected Components** area on the window.

4. Click on the **OK** button.

MccDaq appears under the **References** folder in the Solution Explorer window.



The MccDaq Namespace is now referenced by your Visual Studio .NET project.

General UDR Library for .NET language interface description

The **MccDaq Namespace** provides an interface that exposes each CYDAS UDR Library for .NET method as a member of a class with virtually the same parameters set as their UDR Library counterparts. The MccDaq Namespace is a logical naming scheme for grouping related types. The .NET Framework uses a hierarchical naming scheme for grouping types into logical categories of related functionality.

When you develop a .NET application that uses the CYDAS UDR Library, you add the MccDaq Namespace as a reference to your project. There are no "header" files in a .NET project.

The MccDaq Namespace contains the classes and enumerated values by which UDR Library for .NET applications access the CYDAS UDR Library data types and functions.

The MccDaq Namespace contains four main classes:

- `MccBoard` class
- `ErrorInfo` class
- `MccService` class
- `GlobalConfig` class

The MccDaq assembly allows you to design Common Language Specification (CLS)-compliant programs. A CLS-compliant program contains methods that can be called from any existing or future language developed for the Microsoft .NET framework. Use CLS-compliant data types to ensure future compatibility.

MccBoard class

The `MccBoard` class provides access to all of the methods for data acquisition and properties providing board information and configuration for a particular board.

Class Constructors

The `MccBoard` class provides two constructors; one which accepts a board number argument and one with no arguments.

The following code examples demonstrate how to create a new instance of the `MccBoard` class using the latter version with a default board number of 0:

Visual Basic	`Private DaqBoard As MccDaq.MccBoard`
	`DaqBoard = New MccDaq.MccBoard()`

C#	`private MccDaq.MccBoard DaqBoard;`
	`DaqBoard = new MccDaq.MccBoard();`

The following code examples demonstrate how to create a new instance of the `MccBoard` class with the board number passed to it:

Visual Basic	`Private DaqBoard As MccDaq.MccBoard`
	`DaqBoard = New MccDaq.MccBoard(BoardNumber)`

C#	`private MccDaq.MccBoard DaqBoard;`
	`DaqBoard = new MccDaq.MccBoard(BoardNumber);`

Class properties

The `MccBoard` class also contains six properties that you can use to examine or change the configuration of your board. The configuration information for all boards is stored in the CB.CFG file, and is loaded from CB.CFG by all programs that use the library.

Properties	**Description**
`BoardName`	Name of the board associated with an instance of the MccBoard class.
`BoardNum`	Number of the board associated with an instance of the MccBoard class.
`BoardConfig`	Gets a reference to a cBoardConfig class object. Use this class reference to get or set various board settings.
`CtrConfig`	Gets a reference to a cCtrConfig class object. Use this class reference to get or set various counter settings.
`DioConfig`	Gets a reference to a cDioConfig class object. Use this class reference to get or set various digital I/O settings.
`ExpansionConfig`	Gets a reference to a cExpansionConfig class object. Use this class reference to get or set various expansion board settings.

Class methods

The `MccBoard` class contains close to 80 methods that are equivalents of the function calls used in the standard CYDAS UDR Library. The `MccBoard` class methods have virtually the same parameters set as their UDR Library counterparts.

The following code examples demonstrate how to call the `AIn()`method of the MccBoard object MccDaq:

Visual Basic	`ULStat = DaqBoard.AIn(Chan, Range, DataValue)`
C#	`ULStat = DaqBoard.AIn(Chan, Range, out DataValue);`

Many of the arguments are MccDaq enumerated values. Enumerated values take settings such as range types or scan options and put them into logical groups. For example, to set a range value, reference a value from the `MCCDaq.Range` enumerated type, such as `Range.Bip5Volts`. Refer to Table 5-1 on page 18 for a list of MccDaq enumerated values.

The *CYDAS UDR Library Function Reference* contains detailed information about all MccBoard class methods. This document is available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed.

ErrorInfo class

Most UDR Library methods return ErrorInfo objects. These objects contain two properties that provide information on the status of the method called:

- `ErrorInfo.Message` property gets the text of the error message associated with a specific error code.
- `ErrorInfo.Value` property gets the named constant value associated with the ErrorInfo object.

The `ErrorInfo` class also includes error code enumerated values, which define the error number and associated message which can be returned when you call a method.

MccService class

The `MccService` class contains all members for calling utility UDR Library functions. This class contains nine static methods (you do not need to create an instance of the `MccService` class to call these methods):

- `DeclareRevision()`
- `WinArrayToBuf()`
- `ErrHandling()`
- `WinBufToArray()`
- `GetRevision()`
- `WinBufAlloc()`
- `FileGetInfo()`
- `WinBufFree()`
- `FileRead()`

The following code examples demonstrate how to call a UDR Library for .NET memory management method from within a CYDAS UDR Library program:

```
WindowHandle=MccService.WinBuffAlloc(1000)
MccService.WinBuffFree(WindowHandle)
```

GlobalConfig class

The `GlobalConfig` class contains all of the members for getting global configuration information. This class contains three properties:

- MccDaq.GlobalConfig.NumBoards property returns the maximum number of boards that you can install at one time. `ConfigGlobal=MccDaq.GlobalConfig.NumBoards`
- MccDaq.GlobalConfig.NumExpBoards property returns the maximum number of expansions boards that are allowed to be installed on the board. `ConfigGlobal=MccDaq.GlobalConfig.NumExpBoards`
- MccDaq.GlobalConfig.Version property is used to determine compatibility with the library version. `ConfigGlobal=MccDaq.GlobalConfig.Version`

Each of these properties is typed as an Integer.

MccDaq enumerations

The MccDaq Namespace contains enumerated values which are used by many of the methods available from the MccDaq classes (see Table 5-1). Refer to specific method descriptions in the CYDAS UDR Library Function Reference for the values of each enumerated type. This document is available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed.

Table 5-1. MccDaq Enumerated Values

Enumeration Name	Description
MccDaq.BCDMode	Lists all of the counting format options.
MccDaq.C8254Mode	Lists all of the operating modes for 8254 counters.
MccDaq.CompareValue	List all options for comparing values while configuring a 9513 counter.
MccDaq.ConnectionPin	Defines the connector pins to associate with the signal type and direction when calling the `SelectSignal()` method.
MccDaq.CounterControl	Defines the possible state of each counter channel (enabled/disabled).

Enumeration Name	**Description**
MccDaq.CountDirection	Defines the count direction when configuring counters.
MccDaq.CountEdge	Defines the edge used for counting.
MccDaq.CounterRegister	Lists all of the register names to load the count to.
MccDaq.CounterSource	Lists all counter input sources.
MccDaq.CountingMode	Lists all valid modes for a C7266 counter configuration.
MccDaq.CtrlOutput	Lists all of the options for linking counter 1 to counter 2.
MccDaq.DACUpdate	Defines the available DAC update modes
MccDaq.DataEncoding	Lists the format of the data that is returned by a counter.
MccDaq.DigitalPortDirection	Configures a digital I/O port as input or output.
MccDaq.DigitalLogicState	Defines all digital logic states.
MccDaq.DigitalPortType	Defines all digital port types.
MccDaq.DTMode	Lists all modes to transfer to/from the memory boards.
MccDaq.ErrorHandling	Defines all error handling options.
MccDaq.ErrorReporting	Defines all error reporting options.
MccDaq.EventType	Lists all available event conditions.
MccDaq.FlagPins	Lists all signals types that can be routed to the FLG1 and FLG2 pins on the 7266 counters.
MccDaq.FunctionType	List all valid function types used with data acquisition methods.
MccDaq.GateControl	List all of the gating modes for configuring a 9513 counter.
MccDaq.IndexMode	List the actions to be taken when the Index signal is received by a 7266 counter.
MccDaq.InfoType	Lists all configuration information to be used with the MccBoard class configuration methods.
MccDaq.OptionState	Enables or disables various options.
MccDaq.C9513OutputControl	List all of the types of output from a 9513 counters.
MccDaq.C8536OutputControl	Lists all of the types of output from an 8536 counters.
MccDaq.Quadrature	Lists all of the resolution multipliers for quadrature input.
MccDaq.Range	Defines the set of ranges within the UDR Library for A/D and D/A operations.
MccDaq.RecycleMode	Lists the recycle mode options for 9513 and 8536 counters.
MccDaq.Reload	Lists the options for reloading the 9513 counter.
MccDaq.ScanOptions	List the available options for paced input/output methods.
MccDaq.SignalType	List all signal types associated with a connector pin on boards supporting ATCC.
MccDaq.SignalDirection	Lists all of the directions available from a specified signal type assigned to a connector pin.
MccDaq.SignalPolarity	List all available polarities for a specified signal.
MccDaq.SignalSource	List all of the signal sources of the signal from which the frequency will be calculated.
MccDaq.StatusBits	List all status bits available when reading counter status.
MccDaq.TempScale	Lists valid temperature scales that the input can be converted to.
MccDaq.TimeOfDay	List all time of day options for initializing a 9513 counter.
MccDaq.TriggerType	List all valid trigger types for the `MccBoard.SetTrigger` method.
MccDaq.ThermocoupleOptions	Specifies whether or not to apply smoothing to temperature readings.

Parameter data types

Many of the CYDAS UDR Library for .NET methods are overloaded to provide for signed or unsigned data types as parameters. The `AConvertData()` method is shown below using both signed and unsigned data types.

VB.NET	`Public Function AConvertData(ByVal numPoints As Integer, ByRef adData As Short, ByRef chanTags As Short) As MccDaq.ErrorInfo`
	`Member of MccDaq.MccBoard`

	`Public Function AConvertData(ByVal numPoints As Integer, ByRef adData As System.UInt16, ByRef chanTags As System.UInt16) As MccDaq.ErrorInfo`
	`Member of MccDaq.MccBoard`

C#
.NET
	`public MccDaq.ErrorInfo AConvertData (System.Int32 numPoints, System.Int16 adData, System.Int16 chanTags)`
	`Member of MccDaq.MccBoard`

	`public MccDaq.ErrorInfo AConvertData (System.Int32 numPoints, System.UInt16 adData, System.UInt16 chanTags)`
	`Member of MccDaq.MccBoard`

For most data acquisition applications, unsigned data values are easier to manage. However, since Visual Basic (version 6 and earlier) does not support unsigned data types, it may be easier to port these programs to .NET if the signed data types are used for the method parameters. For additional information on using signed data types, refer to the section "16-bit values using a signed integer data type" on page 7.

The short (Int16) data type is Common Language Specification (CLS) compliant, is supported in VB, and will be included in any future .NET language developed for the .NET framework. Using CLS-compliant data types ensures future compatibility. Unsigned data types are not CLS compliant, but are still supported by various .NET languages, such as C#.

Differences between the UDR Library and UDR Library for .NET

Table 5-2 lists the differences between the CYDAS UDR Library and the CYDAS UDR Library for .NET.

Table 5-2. Differences between UDR Library and UDR Library for .NET

	CYDAS UDR Library	**CYDAS UDR Library for .NET**
Board Number	The board number is included as a parameter to the board functions.	An MccBoard class is created for each board installed, and the board number is passed to that board class.
Functions	Set of function calls defined in a header.	Set of methods. Methods of MccBoard or MccService classes. To access a method, instantiate a UDR Library for .NET class and call the appropriate method using that class.
Constants	Constants are defined and assigned a value in the "header" file.	Constants are defined as enumerated types.
Return value	The return value is an Error code.	The return value is an ErrorInfo object that contains the error's number and message.

Board number

In a .NET application, multiple boards may be programmed by creating an `MccBoard` Class object for each board installed:

```
Board0 = new MccBoard(0)
Board1 = new MccBoard(1)
Board2 = new MccBoard(2)
```

Note that the board number may be passed into the MccBoard class, which eliminates the need to include the board number as a parameter to the board methods.

MCC classes

To use board-specific CYDAS UDR Library functions inside a .NET application, you use methods of the appropriate class. UDR Library for .NET classes are listed in Table 5-3.

Table 5-3. UDR Library for .NET Board Classes

UDR Library for .NET Class	Description
MccBoard	Access board-related CYDAS UDR Library functions.
ErrorInfo	Utility class for storing and reporting error codes and messages.
BoardConfig	Gets and sets board configuration settings.
CtrConfig	Gets and sets counter board configuration settings.
DioConfig	Gets and sets digital I/O configuration settings.
ExpansionConfig	Gets and sets expansion board configuration settings.
GlobalConfig	Gets and sets global configuration settings.
MccService	Access utility CYDAS UDR Library functions.

Refer to the CYDAS UDR Library Function Reference *(*available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed.) for additional class information.

Methods

Methods are accessed through the class containing them. The following example demonstrates how to call the `AIn()` method from within a 32-bit Windows application and also from a .NET application.

VB Application using CBW32.DLL	VB .NET Application using MCCDAQ.DLL

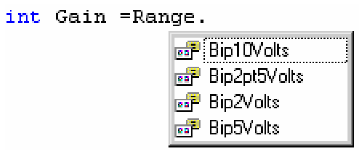
`Dim Board As Integer`
`Dim Channel As Integer`
`Dim Range As Integer`
`Dim ULStat As Integer`
`Dim DataValue As Short`
 	
`Board =0`
`Channel = 0`
`Range =BIP5VOLTS;`
`ULStat =cbAIn(Board, Channel, Range, DataValue)`
	`Dim Board0 As MccBoard`
	`Board0 = new MccDaq.MccBoard(0)`
	`Dim Channel As Integer`
	`Dim Range As MccDaq.Range`
	`Dim ULStat As ErrorInfo`
	`Dim DataValue As UInt16`
	
	`Channel = 0`
	`Range =Range.BIP5VOLTS;`
	`ULStat =Board0.AIn(Channel, Range, DataValue)`

Enumerated types

Instead of using constants such as `BIP5VOLTS`, the CYDAS UDR Library for .NET uses enumerated types. An enumerated type takes settings such as range types, scan options or digital port numbers and puts them into logical groups. Some examples are:

`Range.Bip5Volts`
`Range.Bip10Volts`
`Range.Uni5Volts`
`Range.Uni10Volts`
`ScanOptions.Background`
`ScanOptions.Continuous`
`ScanOptions.BurstMode`

If you are programming inside of Visual Studio .NET, the types that are available for a particular enumerated value display automatically when you type code:



```
int Gain =Range.
```

Error handling

For .NET applications, the return value for the CYDAS UDR Library functions is an object (ErrorInfo), rather than a single integer value. The ErrorInfo object contains both the numeric value for the error that occurred, as well as the associated error message. Within a .NET application, error checking may be performed as follows:

```
ULStat=Board0.AIn(Channel, Range, DataValue)
'check the numeric value of ULStat
If Not ULStat.Value = ErrorInfo.ErrorCode.NoErrors Then
   'if there was an error, then display the error message
   MsgBox ULStat.Message
EndIf
```

Service methods

You can access other CYDAS UDR Library functions that are not board-specific through the MccService class. This class contains a set of static methods you can access directly, without having to instantiate an `MccService` object. The following examples demonstrate library calls to .NET memory management methods:

```
WindowHandle = MccService.WinBuffAlloc(1000)
MccService.WinBuffFree(WindowHandle)
```

Configuration methods

In 32-bit Windows applications, you access board configuration information by calling the `cbGetConfig` and `cbSetConfig` API functions. In .NET applications, you access board configuration information through separate classes, such as `cBoardConfig`, `cCtrConfig`, `cDioConfig`, and `cExpansionConfig`. Each configuration item has a separate get and set method.

Some examples of how to access board configuration within a .NET application are shown below:

- `UlStat = Board0.BoardConfig.GetRange(RangeValue)`
- `UlStat = Board1.DioConfig.GetNumBits(DevNumber, Number)`
- `UlStat = Board2.CtrConfig.GetCtrType(DevNumber, CounterType)`
- `UlStat = Board3.BoardConfig.SetClock(ClockSource)`
- `UlStat = Board4.ExpansionConfig.SetCJCChan(DevNumber, CjcChan)`

How to Use the "Streamer" File Functions

File functions overview

The CYDAS UDR Library can collect very large amounts of data to a "streamer" file. Once all of the data is streamed to a file, your program reads it back into arrays and processes it in chunks. This feature is particularly useful when you are using the CYDAS UDR Library from DOS, where memory is limited. The library contains four functions that are used with "streamer" files:

- `cbFileAInScan()` and `cbFilePretrig()` read the A/D and store the data in a "streamer" file. The equivalent UDR Library for .Net methods are `FileAInScan()` and `FilePretrig()`.
- `cbFileGetInfo()`returns information about the streamer file (the equivalent UDR Library for .Net method is `FileGetInfo()`.)
- `cbFileRead()` reads data from a "streamer" file to an array (the equivalent UDR Library for .Net method is `FileRead()`.)

In addition to these library functions, the library comes with three utility programs for use with the 16-bit version of the library; MAKESTRM.EXE, FRAGTEST.EXE and RDSTREAM.EXE. These utilities are not compatible with the 32-bit version of the library.

MAKESTRM creates a "streamer" file. When using the 16 bit library, this program should be run to allocate a file large enough to hold all of the data that will be later collected with `cbFileAInScan()` or `cbFilePretrig()` / `FileAInScan()` or `FilePretrig()`. The syntax is:

```
C:\MAKESTRM filename # <enter>
```

FRAGTEST checks an existing disk file to see if it is fragmented. In order to run at the faster sampling rates, the "streamer" file must not be fragmented. Refer to "Speeding up Disk Files (De-fragmenting)" on page 24 for more information. The syntax is:

```
C:\FRAGTEST filename <enter>
```

RDSTREAM reads a "streamer" file and prints its contents on the screen. The syntax is:

```
C:\RDSTREAM filename <enter>
```

Hard disk vs. RAM disk files

The simplest type of file to use is a standard DOS file on a hard disk. Hard disk files have the disadvantage of being slower than RAM disks. RAM disk (or virtual disk) files are faster but they are limited in size by the amount of available memory in your computer.

Maximum sampling speed

The maximum sustainable sampling rate that can be specified with the `cbFile` functions is very hard to predict. It depends on the speed of the CPU and the speed of the disk.

In addition to the variation in sampling speed from machine to machine, there can also be variations on the same machine between consecutive operations of the same program. When reading an A/D to memory (non-streaming modes) there is a hard and fast maximum sampling speed that cannot be exceeded. When using the streaming modes the maximum rate is much fuzzier and must be arrived at by trial and error.

A rough guideline of attainable speeds are those on a 33 MHz 80386 machine with a fast hard disk it should be possible to collect a megabyte of data at 200 kHz sampling rate to a disk file. It should also be possible to collect a megabyte of data to a RAM disk at 330 kHz. In general the maximum sustainable speed for `cbFilePretrig()` / `FilePretrig()` will be somewhat less than for `cbFileAInScan()/FileAInScan()`.

Another characteristic of these "streaming" modes is that the more data you collect the lower the maximum speed will be. On any machine with any speed disk, you can collect 32000 samples to a disk file at the maximum A/D speed of 330 kHz. If you are pushing the upper limits of speed you will find that you can collect 100K samples at a faster rate than you can collect 500K samples, etc.

How to determine the maximum sampling speed

The only way to determine the maximum safe speed is to run it repeatedly. The speed may work the first time but may not necessarily work the next time. The only way to be sure that you can reliably run at a particular speed is to try it numerous times. Another method is to increase the speed to the point where it begins to fail every time so that you get some sense of whether or not you are pushing the speed limit on your computer.

To test it, write a program that calls `cbFileAInScan()` or `cbFilePretrig()` / `FileAInScan()` or `FilePretrig()` (depending on whether you need pre-trigger data). Check the returned error code. If you get an `OVERRUN` error (error code of 29), the sampling rate is too high. Whenever you get `OVERRUN` error, some data was collected but not all of it. It is often useful to check how much data was collected to find out whether it was almost fast enough or not even close.

Speeding up disk files (defragmenting)

Because of the way that disks work, the time that it takes to write to them can vary tremendously. A large disk file is made up of many small pieces that are written individually to the disk. If the file is contiguous (each piece is side by side) the speed is very fast. If the file is fragmented (pieces are in different places on the disk) the speed is much slower. If you create a large disk file, it will most likely be fragmented to some degree, and the maximum sampling speed will be much lower than it would be for an unfragmented file.

To get around this problem, you should use a disk optimizer or defragmenter program immediately before creating the streamer file with MAKESTRM. After you create the streamer file, it will remain unfragmented so long as you do not erase and recreate it. The disk optimizer program included with Norton Utilities™, is called Speed Disk, or SD. To run it type:

```
SD /Q
```

This will execute the "Quick" optimize, which works as well as the full optimization.

After de-fragmenting the disk, create a streamer file that is large enough to hold as much data as you plan to collect with `cbFileAInScan()` or `cbFilePretrig()`. To create the disk file, run the standalone MAKESTRM.EXE program. This will create a streamer file of the required size.

After the file is created, run FRAGTEST.EXE to see whether or not the file is fragmented. It is possible that the file may be fragmented even though you just de-fragmented the disk. This is because the disk may contain some bad sectors that could not be moved when the disk was optimized. When you create the new file and it hits one of these bad sectors, it has to skip over it, hence fragmentized.

If FRAGTEST reports that the file is fragmented, create a second file and test that with FRAGTEST. Repeat this until FRAGTEST reports that the file is OK. After you have an unfragmented disk file you can try using it with `cbFileAInScan()` or `cbFilePretrig()` / `FileAInScan()` or `FilePretrig()` to collect data. If the maximum sampling speed is still too slow, you should probably switch to a RAM disk.

RAM disks

A RAM disk is not really a disk. It is a device driver that sets aside some of the computer's memory and makes it appear to DOS as a disk drive. When you install a RAM disk on your computer, it appears exactly as if you have another VERY fast hard disk drive. For example, if you have one hard disk (drive C:) then when you install the RAM disk it will appear as if you have another hard disk, drive D.

After the RAM disk is installed, all DOS commands work exactly the same on the RAM disk as on the hard disk. For example you can COPY, DEL, MKDIR, CD just as you would on a hard disk.

Installing a RAM disk

The RAM disk driver comes with DOS. Refer to your DOS manual for more information. In older versions of DOS it is called either RAMDRIVE.SYS or VDISK.SYS. To install it you must add one line to your \CONFIG.SYS file. Find which directory the DOS files are installed in on your machine. CD to that directory and look for a file called RAMDRIVE.SYS or VDISK.SYS. If it is not there look at the other .SYS files in the directory and refer to your DOS manual to find out if any of them are a RAM Disk driver. After you have located the file add an entry to the \CONFIG.SYS file.

If the RAMDRIVE.SYS file was in a directory called DOS then you would add the following line to the \CONFIG.SYS file.

```
device=c:\dos\ramdrive.sys
```

The default size for the RAM disk is usually 64K. You will almost certainly want to make it larger than that. The larger you make it the more data you can collect but the less memory will be available for other programs.

To set up a 4 megabyte RAM disk, add the following line to your `CONFIG.SYS` file:

```
device=c:\dos\ramdrive.sys 4000
```

If your computer is an 80x86, install the RAM disk in extended memory (above 1M) by specifying the /e option:

```
device=c:\dos\ramdrive.sys 4000 /e
```

After you add the new line to the `\CONFIG.SYS` file, reboot the computer (Press *CTRL-ALT-DEL*) to install the RAM disk. When the machine reboots it should print a message on the screen that describes the RAM disk.

Using the RAM disk

To use the RAM disk, specify the drive letter in the `FileName` argument of `cbFileAInScan()` or `cbFilePretrig()/FileAInScan()` or `FilePretrig()`. For example, if the RAM disk is drive D: on your system, you could set the name of the "streamer" file in your program to "D:TEST.DAT"

This file can be created with the MAKESTRM.EXE program supplied with the CYDAS UDR Library. To set up a file large enough to hold a million samples, include the following line in your AUTOEXEC.BAT file:

```
C:\CB\MAKESTRM D:\TEST.DAT 1000000
```

The name `TEST.DAT` is an example. Use the name of your preference. When you execute `cbFileAInScan()` or `cbFilePreTrig()/FileAInScan()` or `FilePreTrig()`, it will fill up the file on your RAM drive. This file will be lost as soon as the power is switched off, so if you wish to keep the data you must copy it to the hard disk before turning the computer off.

Analog Input Boards

Introduction

All boards that have analog input support the `cbAIn()/AIn()` and `cbAInScan()/AInScan()` functions, except expansion boards, which only support `cbAIn()`. Boards released after the printing of this manual are described in Readme files contained on the CYDAS UDR Library disk.

When hardware-paced A/D conversion is not supported, `cbAInScan()/AInScan()` loops through software paced conversions. The scan will execute at the maximum speed possible. This speed will vary with CPU speed. The only valid option in this case is `CONVERTDATA`.

Concurrent analog input and output for paced analog inputs, paced analog outputs

For boards with both paced analog inputs and paced analog outputs, concurrent analog input and output scans are supported. That is, these boards allow operations with analog input functions (`cbAInScan/AInScan()` and `cbAPretrig/APretrig`) and analog output functions (`cbAOutScan/AOutScan()`) to overlap without having to call `cbStopBackground()/StopBackground()` between the start of input and output scans.

Trigger support

Digital Trigger

If trigger support is "Polled gate" (as opposed to "Hardware"), you implement a trigger by gating the on-board pacer. This disables the on-board pacer. The trigger input is then polled continuously until the trigger occurs. When that happens, the software disables the gate input so that when the trigger returns to its original state, it does not affect the pacer and acquisition continues until the requested number of samples has been acquired. There are two side effects to this type of trigger:

- The polling portion of the function does not occur in the background, even if the `BACKGROUND` option was specified (although the actual data acquisition does).
- The trigger does not necessarily occur on the rising edge. Acquisition can start at any time after the function is called if the trigger input is at "active" level. For this reason, it is best to use a trigger that goes active for a much shorter time than it is inactive.

Similar to 'Polled gate' triggering is 'Polled digital input' triggering, where the pacer is disabled while the state of a digital input is polled. When the state changes to active, the pacer is enabled by the software. The polled digital input trigger type limitations are very similar to the polled gate type explained above.

Analog Trigger

You set up the trigger levels for an analog trigger using the function cbSetTrigger / SetTrigger, passing the appropriate values to the `HighThreshold` and `LowThreshold arguments`.

For most boards that support analog triggering, you can calculate the `HighThreshold` and `LowThreshold` values by passing the required trigger voltage level and the appropriate `Range` to the `cbFromEngUnits`/`FromEngUnits` function.

However, for some boards, you must manually calculate `HighThreshold` and `LowThreshold`. If a board requires manual calculation, that information will be included in the Trigger information for the specific product in this section. The procedure for manually calculating these values is detailed in the CYDAS UDR Library Function Reference in the description of the cbSetTrigger / SetTrigger function.

Sampling rate using SINGLEIO

When using this mode of data transfer, the maximum analog sampling rate is dependent on the speed of the computer in which the board is installed. In general, it is in the range of 5 to 50 kHz. If the requested speed cannot be sustained, an overrun error will occur. Data will be returned, but likely there will be gaps. Some boards, such as the **CYDAS 08**, support only this mode, so the maximum rate attainable with these boards is system-dependent.

CYDAS 4020

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbAPretrig()`, `cbFileAInScan()`, `cbFilePretrig()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `APretrig()`, `FileAInScan()`, `FilePretrig()`

Analog input argument values

`Options`	`BACKGROUND`, `CONTINUOUS`, `EXTCLOCK`, `CONVERTDATA`, `SINGLEIO`, `DMAIO`, `BLOCKIO`, `EXTTRIGGER`	
`HighChan`	3 max (when scanning multiple channels, the number of channels scanned must be even)	
`Rate`	Up to 20000000 (Contiguous memory may be required to achieve maximum performance. Refer to "Memory configuration" on page 30 for details.)	
`Range`	`BIP5VOLTS`	(± 5 V)
	`BIP1VOLTS`	(± 1 V)

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	NONE	
`HighChan`	1 max	
`Count`	2	
`Rate`	Ignored	
`Range`	`BIP10VOLTS`	(± 10 V)
	`BIP5VOLTS`	(± 5 V)
`DataValue`	0 to 4095	
`Pacing`	Software only	

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue`	0 to 255 for `FIRSTPORTA` or `FIRSTPORTB;` 0 to 15 for `FIRSTPORTCL` or `FIRSTPORTCH`
`BitNum`	0 to 23 for `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

None

Triggering

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`	`TRIGPOSEDGE`, `TRIGNEGEDGE`, `TRIGABOVE`, `TRIGBELOW`, `GATEHIGH`, `GATELOW`, `GATENEGHYS`, `GATEPOSHYS`, `GATEABOVE`, `GATEBELOW`, `GATEINWINDOW`, `GATEOUTWINDOW`
`Threshold`	0 to 4095

Event notification

Event notification functions and methods supported

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`

Event notification argument values

`EventType`	`ON_SCAN_ERROR`, `ON_PRETRIGGER`†, `ON_DATA_AVAILABLE`, `ON_END_OF_AI_SCAN`

Hardware considerations

Pacing analog input

Hardware pacing, external or internal clock supported. The clock source can be set via *Insta*Cal to either the "Trig/Ext Clk" BNC input or the "A/D External Clock" input on the 40 pin connector (P3). Configuring for the BNC clock input will disable the clock input (pin 10) on the 40-pin connector. When the `EXTCLOCK` option is used, the clock signal presented to the "Trig/Ext Clk" BNC input or the "A/D External Clock" input is divided by 2 in one or two channel mode and is divided by 4 in four channel mode. If both `EXTCLOCK` and `EXTTRIGGER` are used, both the Trigger BNC and pin 10 on the 40-pin connector require signals. This is further explained in the "Triggering and gating" section below. When using `EXTCLOCK`, the `Rate` argument *is used* by the CYDAS UDR Library to calculate the appropriate chain size. Set the `Rate` argument to the approximate rate used by the external clock to pace acquisitions.

When executing `cbAInScan()`/`AInScan()` with the `EXCLOCK` option, the first three clock pulses are used to set up the CYDAS 4020P, and the first sample is actually taken on the fourth clock pulse.

The packet size varies. See "Memory configuration" on page 30 for more information.

Triggering and gating

Digital (TTL) hardware triggering supported. The trigger source can be set via *Insta*Cal to either the "`Trig/Ext Clk`" BNC input, the "A/D Start Trigger" input on the 40-pin connector (P3) or the "A/D Stop Trigger" input on the 40-pin connector (P3). Use the A/D Start Trigger input for the `cbAInScan()` and `cbFileAInScan()` functions, and `AInScan()` and `FileAInScan()` methods. For the `cbAPretrig()` or `cbFilePretrig()` functions, and the `APretrig()` or `FilePretrig()` method, use the A/D Stop Trigger input.

† The EventData for `ON_PRETRIGGER` events may not be accurate. In general, this value is below the actual number of pretrigger samples available in the buffer.

When using both `EXTCLOCK` and `EXTTRIGGER` options, one of the signals (either clock or trigger) must be assigned to the Trig/Ext Clk BNC input. The function of the Trigger BNC is determined by the setting of "Trig/Ext Clock Mode" in *Insta*Cal. The Trig/Ext Clock BNC can be set to function as either the trigger ("A/D Start Trigger") or the clock ("A/D External Clock"). Pin 10 on the 40-pin connector then assumes the opposite function.

Analog hardware triggering supported. The trigger source can be set via *Insta*Cal to any of the analog BNC inputs. `cbSetTrigger()/SetTrigger()` is supported for `TRIGBELOW` and `TRIGABOVE` trigger types. Analog thresholds are set relative to the voltage range set in the scan. For example, using a range of `BIP1VOLTS` during a `cbAInScan()/AInScan()`, (0) corresponds to –1 volt (V) and 4095 corresponds to +1 V.

When using the `cbAPretrig()` function or the `APretrig()` method, use either the TRIGGER BNC or pin 8 of the 40 pin connector. To use the BNC, set *Insta*Cal "Trig/Ext Clock Mode" to A/D Stop Trigger; otherwise, if not set to this selection, pin 8 of the 40-pin connector is used.

When using `cbAPretrig()/APretrig()` with `EXTCLOCK`, the two inputs are required. The TRIGGER BNC can be set to function as either the pacer clock or the trigger. For the BNC to be setup as the pacer clock, set *Insta*Cal "Trig/Ext Clk Mode" to A/D External Clock. To use the BNC as the trigger, set this *Insta*Cal option to A/D Stop Trigger. If neither of these selections are used, the 40-pin connector will be used for both inputs; pin 8 will be input for A/D Stop Trigger, and pin 10 will be input for the pacer clock signal.

Digital (TTL) hardware gating supported. The gate source can be set via *Insta*Cal to either the "Trig/Ext Clk" BNC input or the "A/D Pacer Gate" input on the 40-pin connector (P3).

Analog hardware gating supported. Analog thresholds are set relative to the voltage range set in the scan. For example, using a range of `BIP1VOLTS` during a `cbAInScan()/AInScan()`, (0) corresponds to (-1V) and 4095 corresponds to +1V.

The gate must be in the active (enabled) state before starting an acquisition.

For `EXTCLOCK` or `EXTTRIGGER` (digital triggering) using the BNC connector, *Insta*Cal provides a configuration setting for thresholds. The selections available are either 0 V or 2.5 V. Use 0 V if the incoming signal is BIPOLAR. Use the 2.5 V option if the signal is UNIPOLAR, for example, standard TTL.

When using both `EXTCLOCK` and `EXTTRIGGER` options, one of the signals (either clock or trigger) must be assigned to the Trig/Ext Clk BNC input.

Memory configuration

In order to achieve the maximum sample rate under some conditions, a contiguous area of memory must be set up. The following is a guide that can be used to determine whether or not you need to set up this memory and how to accomplish it using *Insta*Cal.

If the number of samples you are acquiring is less than 2K (2,048) samples then you do NOT need to set up contiguous memory (leave the **Memory Size** edit box in *Insta*Cal at zero).

If you are acquiring more than 2048 samples, contiguous memory may be required depending on sample rate. Use the table below to determine if contiguous memory is required.

# of Channels	Rate Requiring Contiguous Memory (when sample count > 2048)
1	> 4 MHz
2	>2 MHz
4	>1 MHz

If contiguous memory is required, follow the *Insta*Cal procedures below to set the size of the contiguous memory to reserve:

1. Run *Insta*Cal, select the **CYDAS 4020** board and click the **Configure** tab.

2. In the **Memory Size** edit box for the **Contiguous Memory Settings**, enter the amount of memory in kilobytes that you need for the acquisition.

   To calculate the number of kilobytes required, use the following formula:

   (# of kilobytes (KB)) = {(# of samples) x (2 bytes/sample) x (1 KB/1024 bytes)}

   or

   (# of KB) = {(# of samples)/512}

   Memory is allocated in blocks of 4 KB. As a consequence, *Insta*Cal adjusts the amount entered upward to the nearest integer multiple of 4 KB. For example, the contiguous memory requirements for a 10,000-sample acquisition would be:

      (10,000/512) = 19.5 rounded up to multiple of 4 KB = 20 KB.

   Note that the maximum number of samples allowed for the given contiguous memory size is displayed as the **Sample Count** (displayed below the **Memory Size** edit box).

3. Reboot the computer. The CYDAS UDR Library attempts to reserve the desired amount of contiguous memory at boot up time. If it is unable to reserve all the memory requested, the amount successfully reserved memory displays in the **Memory Size** entry when you run *Insta*Cal.

4. Run *Insta*Cal. In the **Memory Size** entry, verify the size of the contiguous memory that was successfully reserved.

Repeat this procedure to change or free the contiguous memory.

The size of the block shown in *Insta*Cal is the *total contiguous memory* that is available to *all boards installed*. Other installed boards that call the `cbWinBufAlloc()` function or `WinBufAlloc()` method will also use this contiguous memory, so plan the size of the contiguous memory buffer accordingly.

With the following functions and methods, be aware of packet size, and adjust the number of samples acquired accordingly:

- `cbAPretrig()`/`APretrig()`
- `cbAInScan()/AInScan()` with the `CONTINUOUS` scan option.

These functions and methods use a circular buffer. Align the data by packets in the buffer. For these functions, the total number of samples must be greater than one packet (refer to the following table), and must be an integer multiple of packet size. In addition, contiguous memory must be used if noted in the following table. The minimum value for contiguous memory is calculated using the formula from step 2 above:

(# of KB) = {(# of samples) / 512}

For example, to run `cbAInScan` on one channel at 18 MHz with the `CONTINUOUS` option set, determine the minimum sample size from the table to be 262,144 (since the `Rate` is between 14 and 20 MHz). The minimum contiguous memory is calculated as:

(262,144 / 512) = 512 KB

Number of Channels	Rate in MHz	Packet Size in Samples	Minimum Sample Size (two packets)	Contiguous Memory	Min Contiguous Memory (based on Min Sample Size)
1	20 >= Rate >=13.3	131,072	262,144	Required	512 KB
	13.3 > Rate >= 4	65,536	131,072	Required	256 KB
	4 > Rate >= 2	4,096	8,192	Not Required	0 KB
	2 > Rate	2,048	4,096	Not Required	0 KB
2	20 >= Rate >= 6.6	131,072	262,144	Required	512 KB
	6.6 > Rate >= 2	65,536	131,072	Required	256 KB
	2 > Rate >= 1	4,096	8,192	Not Required	0 KB
	1 > Rate	2,048	4,096	Not Required	0 KB
4	20 >= Rate >= 3.3	131,072	262,144	Required	512 KB
	3.3 > Rate >= 1	65,536	131,072	Required	256 KB
	1 > Rate >= 0.5	4,096	8,192	Not Required	0 KB
	0.5 > Rate	2,048	4,096	Not Required	0 KB

*Note that the `EventData` for `ON_PRETRIGGER` events may not be accurate. In general, this value will be below the actual number of pretrigger samples available in the buffer.

CYDAS 64MxHRDAP Series

Analog input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbAPretrig()`, `cbFileAInScan()`, `cbFilePretrig()`, `cbALoadQueue()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `APretrig()`, `FileAInScan()`, `FilePretrig()`, `ALoadQueue()`

Analog input argument values

`Options`	`BACKGROUND`, `CONTINUOUS`, `EXTCLOCK`, `CONVERTDATA`, `SINGLEIO`, `DMAIO`, `BLOCKIO`, `BURSTMODE`, `EXTTRIGGER`
`HighChan`	0 to 63 in single-ended mode, 0 to 31 in differential mode
`Rate`	**CYDAS 64M3HRDAP** Single-channel, Single-range: Up to 3000000 Multi-channel, Single-range: Up to 1500000 Channel/Gain Queue: Up to 750000 **CYDAS 64M2HRDAP** Single-channel, Single-range: Up to 2000000 Multi-channel, Single-range: Up to 1500000 Channel/Gain Queue: Up to 750000 **CYDAS 64M1HRDAP** Single-channel, Single-range: Up to 1000000 Multi-channel, Single-range: Up to 1000000 Channel/Gain Queue: Up to 750000

`Range`	`BIP5VOLTS (±5 V)` `UNI5VOLTS (0-5 V)`
	`BIP2PT5VOLTS (±2.5 V)` `UNI2PT5VOLTS (0-2.5 V)`
	`BIP1PT25VOLTS (±1.25 V)` `UNI1PT25VOLTS (0-1.25 V)`
	`BIPPT625VOLTS (±.625 V)`

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	`BACKGROUND`, `CONTINUOUS`, `EXTCLOCK`, `SIMULTANEOUS`
`HighChan`	1 max
`Rate`	Up to 100000
`Range`	`BIP5VOLTS`
`DataValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	FIRSTPORTA, FIRSTPORTB, FIRSTPORTCL, FIRSTPORTCH, AUXPORT
`DataValue`	0 to 15 for FIRSTPORTCL or FIRSTPORTCH or AUXPORT 0 to 255 for FIRSTPORTA or FIRSTPORTB
`BitNum`	0 to 23 for FIRSTPORTA 0 to 3 for AUXPORT

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1
`Config`	HIGHONLASTCOUNT, ONESHOT, RATEGENERATOR, SQUAREWAVE, SOFTWARESTROBE, HARDWARESTROBE
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)
`RegNum:`	LOADREG1

Triggering

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`	TRIGPOSEDGE, TRIGNEGEDGE, TRIGABOVE, TRIGBELOW, GATEHIGH, GATELOW, GATENEGHYS, GATEPOSHYS, GATEABOVE, GATEBELOW, GATEINWINDOW, GATEOUTWINDOW
`Threshold`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)

Event notification

Event notification functions and methods supported

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`

Event notification argument values

`EventType`	ON_SCAN_ERROR, ON_PRETRIGGER, ON_DATA_AVAILABLE, ON_END_OF_AI_SCAN, ON_END_OF_AO_SCAN

Hardware considerations

Pacing analog input

- Hardware pacing, external or internal clock supported.
- The clock edge used to trigger acquisition for the external pacer may be rising or falling and is selectable using *Insta*Cal.
- The packet size is 512 samples.

Analog Input configuration

The analog input mode may be 32 channel differential or 64 channel single-ended and may be selected using *Insta*Cal.

Analog Input options

Except for `SINGLEIO` transfers, `CONTINUOUS` mode scans require enough memory for half FIFO of memory.

Triggering and gating

Digital (TTL) hardware triggering supported. Use the A/D Start Trigger Input (pin 55) for triggering and gating with `cbAInScan()` and `cbFileAInScan()` / `AInScan()` and `FileAInScan()`. Use the A/D Stop Trigger Input (pin 54) for `cbAPretrig()` and `cbFilePretrig()` / `APretrig()` and `FilePretrig()`.

Analog hardware triggering and gating are supported. `cbSetTrigger()` / `SetTrigger()` are supported for `TRIGABOVE`, `TRIGBELOW`, `GATENEGHYS`, `GATEPOSHYS`, `GATEABOVE`, `GATEBELOW`, `GATEINWINDOW`, `GATEOUTWINDOW`. Use the Analog Trigger Input (pin 56) for analog triggering. Analog thresholds are set relative to the ±5 V range. For example: a threshold of 0 equates to -5 V, and a threshold of 65535 equates to +4.999847 V.

When using analog trigger feature, one or both of the DACs are used to set the threshold and are unavailable for other functions. If the trigger function requires a single reference (`GATEABOVE`, `GATEBELOW`, `TRIGABOVE`, `TRIGBELOW`) then DAC0 is available. If the trigger function requires two references (`GATEINWINDOW`, `GATE OUTWINDOW`, `GATENEGHYS`, `GATEPOSHYS`) then neither DAC is available for other functions.

Caution! Gating should NOT be used with `BURSTMODE` scans.

Pacing analog output

- Hardware pacing, external or internal clock supported.
- The clock edge used to trigger analog output updates for the external pacer may be rising or falling and is selectable using *Insta*Cal.
- `EventData` for `ON_PRETRIGGER` events may not be accurate. In general, this value will be below the actual number of pretrigger samples available in the buffer.

These boards support concurrent analog input and output scans. That is, these boards allow for operations of analog input functions and methods (`cbAInScan()` and `cbAPretrig()` / `AInScan()` and `APretrig()`) and analog output functions and methods (`cbAOutScan()` / `AOutScan()`) to overlap without having to call `cbStopBackground()` between the start of input and output scans.

Output pin 59 configuration

Pin 59 may be configured as the DAC Pacer Output, SSH Output with hold configured as high level, or SSH Output with hold configured as low level. These options are selected via *Insta*Cal

CYDAS 6402 and CYDAS 3202 Series

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbAPretrig()`, `cbFileAInScan()`, `cbFilePretrig()`
	For **PCI Versions**, the following function also applies: `cbALoadQueue()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `APretrig()`, `FileAInScan()`, `FilePretrig()`
	For **PCI Versions**, the following method also applies: `ALoadQueue()`

Analog input argument values

`Options`	`BACKGROUND`, `CONTINUOUS`, `EXTCLOCK`, `CONVERTDATA`, `SINGLEIO`, `BLOCKIO`, `BURSTMODE`, `EXTTRIGGER`		
`HighChan`	**CYDAS 6402** and **CYDAS 6402HR** 0 to 63 in single-ended mode, 0 to 31 in differential mode		
	CYDAS 3202HRDAP 0 to 31		
`Rate`	**CYDAS 6402** Up to 330000	**CYDAS 6402HR** Up to 100000	**All others** Up to 200000

`Range`	`BIP10VOLTS`
	`BIP5VOLTS`
	`BIP2PT5VOLTS`
	`BIP1PT25VOLTS`
		`UNI10VOLTS`
		`UNI5VOLTS`
		`UNI2PT5VOLTS`
		`UNI1PT25VOLTS`	

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	`SIMULTANEOUS`
	For **PCI Versions**, the following argument values are also valid:
	`BACKGROUND`, `EXTCLOCK`, `CONTINUOUS`	

`HighChan`	1 max	
`Rate`	**PCI Versions** Up to 100000	**ISAVersions** Ignored

`Range`	**PCI Versions**, **CYDAS 6402**
	`BIP10VOLTS`
	`BIP5VOLTS`
	`UNI10VOLTS`
	`UNI5VOLTS`
		CYDAS 6402HR
		Ignored

`DataValue`	0 to 4095 For **CYDAS 6402HRDAP, CYDAS 3202HRDAP, CYDAS 6402HR**, the following additional argument values are also valid: 0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()` For **PCI Versions**, the following additional function is also valid: `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()` For **PCI Versions**, the following additional method is also valid: `DConfigPort()`

Digital I/O argument values

`PortNum`	`AUXPORT`*
`DataValue`	0 to 15
`BitNum`	0 to 3

* `AUXPORT` is not configurable for these boards.

For **PCI Versions**, the following additional argument values are also valid:

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue`	0 to 15 for `PORTCL` or `PORTCH`; 0 to 255 for `PORTA` or `PORTB`
`BitNum`	0 to 23 for `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)
`RegNum`:	`LOADREG1`

Triggering

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`	`TRIGPOSEDGE`, `TRIGNEGEDGE`, `GATEHIGH`, `GATELOW` For **PCI versions**, the following additional argument values are also valid: `TRIGABOVE`, `TRIGBELOW`, `GATENEGHYS`, `GATEPOSHYS`, `GATEABOVE`, `GATEBELOW`, `GATEINWINDOW`, `GATEOUTWINDOW`
`Threshold`	0 to 4095 For **HR versions** the following argument values are also valid: 0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers).

Event notification

Event notification functions and methods supported (PCI versions Only)

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`

Event notification argument values

`EventType`	`ON_SCAN_ERROR`, `ON_PRETRIGGER`, `ON_DATA_AVAILABLE`, `ON_END_OF_AI_SCAN`, `ON_END_OF_AO_SCAN`

Hardware considerations

Pacing Analog input

Hardware pacing, external or internal clock supported. The packet size is 512 samples for **ISA versions**, and 2048 for **PCI versions**.

Triggering and gating

Digital (TTL) hardware triggering supported. The **PCI version** also supports analog hardware triggering. Analog thresholds are set relative to the ±10 V range. For example, a threshold of 0 equates to -10 V and a threshold of 65535 equates to +9.999695 V.

When using the UDR Library functions `cbAPretrig()` or `cbFilePretrig()` (or the UDR Library for .NET methods `APretrig()` or `FilePretrig()`) on the **CYDAS 6402HRDAP** or **CYDAS 3202HRDAP**, use the A/D Stop Trigger In (pin 47) input to supply the trigger.

When using both `EXTCLOCK` and `BURSTMODE` on the **CYDAS 6402HRDAP** or **CYDAS 3202HRDAP**, use the A/D Start Trigger In (pin 45) input to supply the clock and not the A/D External Pacer (pin 42). Since `BURSTMODE` is actually paced by the internal burst clock, specifying `EXTCLOCK` when using `BURSTMODE` is equivalent to specifying `EXTTRIGGER`.

When using analog trigger feature, one or both of the DACs are used to set the threshold and are unavailable for other functions. If the trigger function requires a single reference (`GATEABOVE`, `GATEBELOW`, `TRIGABOVE`, `TRIGBELOW`) then DAC0 is available. If the trigger function requires two references (`GATEINWINDOW`, `GATE OUTWINDOW`, `GATENEGHYS`, `GATEPOSHYS`), then neither DAC is available for other functions.

Caution! Gating should NOT be used with `BURSTMODE` scans.

Gain queue

When using the UDR Library function `cbALoadQueue()` or the UDR Library for .NET method `ALoadQueue()` with the **PCI version**, up to 8k elements can be loaded into the queue.

Pacing analog output

ISA Version: Software only

PCI Version: Hardware pacing, external or internal clock supported.

Output pin 49 configuration

On the **PCI version**, pin 49 may be configured as the DAC Pacer Output, SSH Output with hold configured as high level or SSH Output with hold configured as low level. These options are selected via *Insta*Cal

Event notification:

The **PCI versions** of these boards support concurrent analog input and output scans. That is, these boards allow for operations of analog input functions (`cbAInScan()` and `cbAPretrig()`) and analog output functions (`cbAOutScan()`) to overlap without having to call `cbStopBackground()` between the start of input and output scans. Equivalent UDR Library for .NET methods are `AInScan()`, `APretrig()`, `AOutScan()`and `StopBackground()`.

CYDAS 1602, CYDAS 1202 & CYDAS 100x Series

Analog input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbAPretrig()`, `cbFileAInScan()`, `cbFilePretrig()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `APretrig()`, `FileAInScan()`, `FilePretrig()`

Analog input argument values

`Options`	BACKGROUND, CONTINUOUS, EXTCLOCK, CONVERTDATA, SINGLEIO, BLOCKIO, BURSTMODE, EXTTRIGGER
`HighChan`	0 to 15 in single-ended mode, 0 to 7 in differential mode
`Rate`	**CYDAS 1602DAP, CYDAS 1202DAP, CYDAS 1202P** Up to 330000 **CYDAS 1000P** Up to 250000 **CYDAS 1602HRDAP, CYDAS 1002DAP** Up to 200000 **CYDAS 1001DAP** Up to 150000
`Range`	**CYDAS 1602DAP, CYDAS 1602HRDAP, CYDAS 1202DAP, CYDAS 1202P, CYDAS 1002DAP, CYDAS 1000P** BIP10VOLTS UNI10VOLTS BIP5VOLTS UNI5VOLTS BIP2PT5VOLTS UNI2PT5VOLTS BIP1PT25VOLTS UNI1PT25VOLTS **CYDAS 1001DAP** BIP10VOLTS UNI10VOLTS BIP1VOLTS UNI1VOLTS BIPPT1VOLTS UNIPT1VOLTS BIPPT01VOLTS UNIPT01VOLTS

Analog output

Excludes **CYDAS 1202P**

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	SIMULTANEOUS For **CYDAS 1602 Series**, the following argument values are also valid: BACKGROUND, CONTINUOUS, EXTCLOCK
`HighChan`	0 to 1
`Rate`	**CYDAS 1602HRDAP** Up to 100000 **CYDAS 1602DAP** Up to 250000 **All others** Ignored

`Range`	`BIP10VOLTS` `BIP5VOLTS`	`UNI10VOLTS` `UNI5VOLTS`
`DataValue`	0 to 4095 For **CYDAS 1602HRDAP**, the following argument values are also valid: 0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)	

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue`	0 to 15 for `PORTCL` or `PORTCH` 0 to 255 for `PORTA` or `PORTB`
`BitNum`	0 to 23 for `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	4 to 6
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)
`RegNum`:	`LOADREG4`, `LOADREG5`, `LOADREG6`

Triggering

CYDAS 1602HRDAP and **CYDAS 1602DAP** only

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`	`TRIGPOSEDGE`, `TRIGNEGEDGE`, `TRIGABOVE`, `TRIGBELOW`, `GATEHIGH`, `GATELOW`, `GATENEGHYS`, `GATEPOSHYS`, `GATEABOVE`, `GATEBELOW`, `GATEINWINDOW`, `GATEOUTWINDOW`
`Threshold`	**CYDAS 1602HRDAP**: 0 to 65535 **CYDAS 1602DAP**: 0 to 4095

Event notification

Event notification functions and methods supported

PCI Versions Only

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`

Event notification argument values

`EventType`	`ON_SCAN_ERROR`, `ON_PRETRIGGER`, `ON_DATA_AVAILABLE`, `ON_END_OF_AI_SCAN`
	For **CYDAS 1602HRDAP** and **CYDAS 1602DAP** the following argument values are also valid:
	`ON_END_OF_AO_SCAN`

Hardware considerations

Pacing analog input

Hardware pacing, external or internal clock supported.

The clock edge used to trigger acquisition for the external pacer may be *rising* or *falling*, and is selectable using *Insta*Cal.

For the **CYDAS 1602HRDAP**, the packet size is 256 samples. All others in this series have a packet size of 512 samples.

Analog input configuration

The analog input mode is selectable via *Insta*Cal for either 8-channel differential or 16-channel single-ended.

Triggering and gating - CYDAS 1602 Series

Digital (TTL) and analog hardware triggering supported.

Analog thresholds are set relative to the ±10 V range. For example: a threshold of 0 equates to -10 V. Thresholds of 65535 and 4095 correspond to +9.999695 and +9.995116 V for the 16-bit and 12-bit boards, respectively.

When using analog trigger feature, one or both of the DACs are unavailable for other functions. If the trigger function requires a single reference (`GATE_ABOVE`, `GATE_BELOW`, `TRIGABOVE`, and `TRIGBELOW`), DAC0 is available. If the trigger function requires two references (`GATE_IN_WINDOW`, `GATE_ OUT_WINDOW`, `GATE_NEG_HYS` and `GATE_ POS_HYS`), neither DAC is available for other functions.

Triggering and gating – CYDAS 1202, CYDAS 100x Series

Digital (TTL) hardware triggering supported.

Concurrent operations - CYDAS 1602 Series

Concurrent analog input and output scans supported. That is, CYDAS 1602 Series boards allow for operations of analog input functions (`cbAInScan()` and `cbAPretrig()`) and analog output functions (`cbAOutScan()`) to overlap without having to call `cbStopBackground()` between the start of input and output scans. Equivalent UDR Library for .NET methods are `AInScan()`, `APretrig()`, `AOutScan()`, and `StopBackground()`.

Pacing analog output - CYDAS 1602 Series

Hardware pacing, external or internal clock supported.

The clock edge used to trigger analog output updates for the external pacer may be rising or falling and is selectable using *Insta*Cal.

Counters

The source for counter 4 may be internal or external and is selectable using *Insta*Cal.

Although counters 4, 5 and 6 are programmable through the counter functions, the primary purpose for some of these counters may conflict with these functions.

Potential conflicts include:

- **CYDAS 1202**, **CYDAS 100x** Series: Counters 5 and 6 are always available to the user. Counter 4 is used as a residual counter by some of the analog input functions and methods.
- **CYDAS 1602** Series: Counters 5 and 6 are used as DAC pacers by some analog output functions and methods. Counter 4 is used as a residual counter by some of the analog input functions and methods.

CYDAS 1602HDP and CYDAS 16JRHRU Series

Analog input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`,`cbFileAInScan()`, `cbATrig()`
UDR for .NET:	`AIn()`, `AInScan()`,`FileAInScan()`,`ATrig()`

Analog input argument values

`Options`	BACKGROUND, CONTINUOUS, EXTCLOCK, CONVERTDATA, SINGLEIO, BLOCKIO, BURSTMODE, EXTTRIGGER	
`HighChan`	0 to 15 in single-ended mode, 0 to 7 in differential mode	
`Rate`	100000	
`Range`	BIP10VOLTS	UNI10VOLTS
	BIP5VOLTS	UNI5VOLTS
	BIP2PT5VOLTS	UNI2PT5VOLTS
	BIP1PT25VOLTS	UNI1PT25VOLTS

Analog output (CYDAS 1602HDP only)

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	Ignored
`HighChan`	1 max
`Count`	2
`Rate`	Ignored
`Range`	Ignored
`DataValue`	0 to 4095

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

The CYDAS 1602HDP also supports:

UDR:	`cbDConfigPort()`
UDR for .NET:	`DConfigPort()`

Digital I/O argument values

`PortNum:`	`AUXPORT*`

The CYDAS 1602HDP also supports:

`PortNum:`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue:`	0 to 15 `FIRSTPORTCL`, `FIRSTPORTCH` or `AUXPORT*`
	0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum:`	0 to 23 for `FIRSTPORTA`
	0 to 3 for `AUXPORT*`
	*`AUXPORT` is not configurable for these boards.

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 3
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)
`RegNum:`	`LOADREG1`, `LOADREG2`, `LOADREG3`

Event notification

Event notification functions and methods supported

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`

Event notification argument values

`EventType`	`ON_SCAN_ERROR`, `ON_DATA_AVAILABLE`, `ON_END_OF_AI_SCAN`

Triggering

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`	`TRIGPOSEDGE`, `TRIGNEGEDGE`, `GATEHIGH`, `GATELOW`

Hardware considerations

Pacing analog input

Hardware pacing, external or internal clock supported.

Analog input ranges

For the **CYDAS 1602HDP**, the A/D ranges are configured with a combination of a switch (Unipolar / Bipolar) and a programmable gain code. The state of this switch is set in the configuration file using *Insta*Cal. After the UNI/BIP switch setting is selected, only matching ranges can be used in CYDAS UDR Library programs.

Triggering and gating

Digital (TTL) hardware triggering supported.

Pacing analog output

Software pacing only

CYDAS 800 Series

Analog input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `FileAInScan()`

Analog input argument values

`Options` BACKGROUND, CONTINUOUS, EXTCLOCK, CONVERTDATA, SINGLEIO, BLOCKIO, EXTTRIGGER

`HighChan` 0 to 7

`Rate`

CYDAS 802HR
100000

All others in series
50,000

`Range`

CYDAS 800
Range is not programmable so the `Range` argument is ignored.

CYDAS 801 supports the following A/D ranges

BIP10VOLTS	UNI10VOLTS
BIP5VOLTS	UNI1VOLTS
BIP1VOLTS	UNIPT1VOLTS
BIPPT5VOLTS	UNIPT01VOLTS
BIPPT05VOLTS	
BIPPT01VOLTS	

CYDAS 802 supports the following A/D ranges

BIP10VOLTS	UNI10VOLTS
BIP5VOLTS	UNI5VOLTS
BIP2PT5VOLTS	UNI2PT5VOLTS
BIP1PT25VOLTS	UNI1PT25VOLTS
BIPPT625VOLTS	

CYDAS 802HR supports the following A/D ranges

BIP10VOLTS	UNI10VOLTS
BIP5VOLTS	UNI5VOLTS
BIP2PT5VOLTS	UNI2PT5VOLTS
BIP1PT25VOLTS	UNI1PT25VOLTS

Analog Output

These boards do not have D/A converters and do not support analog output functions.

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

Digital I/O argument values

`PortNum` `AUXPORT` (not configurable for these boards)

`DataValue`

`cbDOut()`	`cbDIn()`
0 to 15	0 to 7

`BitNum`	`cbDOut()`	`cbDIn()`
	0 to 3	0 to 2

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 3
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)
`RegNum`:	`LOADREG1`, `LOADREG2`, `LOADREG3`

Hardware considerations

Pacing analog input

Hardware pacing, external or internal clock supported.

The packet size is 128 samples. Note that digital output is not compatible with concurrent `cbAInScan()/AInScan()` operation, since the channel multiplexer control shares the register with the digital output control. Writing to this register during a scan may adversely affect the scan.

Triggering and gating

Digital hardware triggering supported.

CYDAS 08, 08P, and 4CYDAS 08 Series

Analog input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `FileAInScan()`

Analog input argument values

`Options` BACKGROUND, CONTINUOUS, EXTCLOCK, CONVERTDATA, SINGLEIO, EXTTRIGGER

`HighChan` 0 to 7

`Rate` From 63 up to 50000 (Refer to the "Sampling Rate using SINGLEIO" on page 27.)

`Range`

DAS08 series
Since the **DAS08** series does not have programmable gain, the Range arguments for the analog input functions are ignored.

CYDAS 8P
BIP5VOLTS (±5 V)

CYDAS 08 and **4CYDAS 08**

BIP10VOLTS	UNI10VOLTS
BIP5VOLTS	

CYDAS 08PGH and **CYDAS 08AOH**

BIP10VOLTS	UNI10VOLTS
BIP5VOLTS	UNI1VOLTS
BIP1VOLTS	UNIPT1VOLTS
BIPPT5VOLTS	UNIPT01VOLTS
BIPPT1VOLTS	BIPPT01VOLTS
BIPPT05VOLTS	BIPPT005VOLTS

CYDAS 08PGL and **CYDAS 08AOL**

BIP10VOLTS	UNI10VOLTS
BIP5VOLTS	UNI5VOLTS
BIP2PT5VOLTS	UNI2PT5VOLTS
BIP1PT25VOLTS	UNI1PT25VOLTS
BIPPT625VOLTS	

CYDAS 08PGM and **CYDAS 08AOM**

BIP10VOLTS	UNI10VOLTS
BIP5VOLTS	UNI1VOLTS
BIPPT5VOLTS	UNIPT1VOLTS
BIPPT1VOLTS	UNIPT01VOLTS
BIPPT05VOLTS	

Analog output

AO, AOH, AOM, AOL versions only

Analog output functions and methods supported

UDR:	`cbAOut()`, `AOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	SIMULTANEOUS
`HighChan`	1 max
`Rate`	Ignored

`Count`	2 max
`Range`	Ignored
`DataValue`	0 to 4095

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`
	For **CYDAS 08** and **CYDAS 08AOx**, the following function and method is also supported:
UDR:	`cbDConfigPort()`
UDR for .NET:	`DConfigPort()`

Digital I/O argument values

`PortNum`	`AUXPORT`
`DataValue`	0 to 15 using `cbDOut()`or `DOut()`
	0 to 7 using `cbDIn()`or `DIn()`
`BitNum`	0 to 3 using `cbDBitOut()` or `DBitOut()` 0 to 2 using `cbDBitIn()`or `DBitIn()`
	For **CYDAS 08** and **CYDAS 08AOx** the following argument values are also valid:
	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`PortNum`	0 to 15 for `FIRSTPORTCL` or `FIRSTPORTCH` 0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`DataValue`	0 to 15 for `FIRSTPORTCL` or `FIRSTPORTCH` 0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 23 for `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 3
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)
`RegNum`:	`LOADREG1`, `LOADREG2`, `LOADREG3`

Hardware considerations

Pacing analog input

Hardware pacing, external or internal clock supported.

Before using the `cbAInScan()` function or the `AInScan()` method for timed analog input with a **ISA** or **PC104** series board, the output of counter 1 must be wired to the Interrupt input; if you have a **CYDAS 08** board revision 3 or higher, a jumper is provided on the board to accomplish this. An interrupt level must have been selected in *Insta*Cal and the CB.CFG file saved.

Triggering and gating

Digital (TTL) polled digital input triggering supported. Refer to "Trigger support" on page 26.

Pacing analog output

Software pacing only

CYDAS 08JR and CYDAS 08JRHR Series

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `FileAInScan()`

Analog input argument values

`Options`	`CONVERTDATA`
`HighChan`	0 to 7
`Rate`	Ignored
`Range`	Since these boards do not have programmable gain, the `Range` arguments for the analog input functions are ignored.

Analog output

(If optional D/A converters are installed)

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	`SIMULTANEOUS`
`HighChan`	1 max
`Rate`	Ignored
`Count`	2 max
`Range`	Ignored
`DataValue`	0 to 4095 For **CYDAS 08JRHRAO**, the following argument values are also valid: 0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

Digital I/O argument values

`PortNum`	`AUXPORT*`
`DataValue`	0 to 255
`BitNum`	0 to 7

* `AUXPORT` is not configurable for these boards.

Counter I/O

Counter functions and methods supported

None

Hardware considerations

Pacing analog input

Software pacing only

PCYDAS 8

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET	`AIn()`, `AInScan()`, `ATrig()`, `FileAInScan()`

Analog input argument values

`Options`	BACKGROUND, CONTINUOUS, EXTCLOCK, CONVERTDATA, SINGLEIO, NOTODINTS, EXTTRIGGER, NOCALIBRATEDATA
`HighChan`	0 to 7
`Rate`	25000 max. For other restrictions, refer to the PCYDAS 8 User's Manual
`Range`	This board does not have programmable gain so the Range argument to analog input functions is ignored.

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDIn()`, `cbDOut()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DIn()`, `DOut()`, `DBitIn()`, `DBitOut()`

Digital I/O argument values

`PortNum`	AUXPORT
`DataValue`	0 to 7
`BitNum`	0 to 2

Hardware considerations

Pacing analog input

Internal or external clock

Maximizing sampling rates

When paced by the onboard clock, the rate is set by an onboard oscillator running at 25 kHz. The oscillator output may be divided by 2, 4 or 8, resulting in rates of 12.5 kHz, 6.25 kHz or 3.13 kHz. When pacing a single channel from the onboard clock, these are the four choices of rate available. When a rate is requested within the range of 3000 to 25000, the library selects the closest of the four available rates.

Scanning more than one channel divides the rate requested among the number of channels requested. The maximum rate when scanning eight channels is 3130 (25000 divided by eight channels).

Although the **PCYDAS 8** is capable of 25 kHz analog to digital conversions, not all computers in all configurations can transfer the converted samples fast enough to sustain a 25 kHz sample and transfer rate without missing some samples. This is especially true in the windows environment. Unfortunately, there isn't much you can do to improve sampling rates in windows, but in DOS, where you have more control over the process, you may be able to attain the full 25 kHz sampling rate.

Determining the maximum sampling rate in DOS

If you have installed the DOS version of the CYDAS UDR Library, a utility program called `MAXRATE` is installed in the UDR Library installation directory (C:\MCC by default). `MAXRATE` tests your computer and advise you of the maximum sustainable convert and transfer rate.

The maximum rate for your computer is reported for two conditions. The first is with all interrupts enabled, the second is with the time of day interrupt disabled (`TOD`). The convert and transfer rate with `TOD` disabled will usually be faster.

Time of Day interrupt and A/D conversions

Many TSR's and device drivers "hook" into the `TOD` interrupt. Using the `TOD` clock tick guarantees that every 1/18th of a second the routine will be woken up and can check status or do whatever the routine is designed to do. Unfortunately this can create considerable overhead in the `TOD` interrupt service routine and will introduce gaps in your sample data at high rates.

Using the `cbAInScan()` / `AInScan()` option argument to turn off the `TOD` interrupt increases the speed that you can maintain with your **PCYDAS 8**. Turning off the `TOD` prevents your computer's clock from incrementing while `cbAInScan()` / `AInScan()` is running. Your clock will lose time.

Transfer rate

Any rate below 5 kHz is sustainable with or without TOD interrupt enabled. If your maximum required rate is less than 5 kHz, then your computer can handle that. If the required rate is greater that 10K, run `MAXRATE`. Remember, we are discussing the `TOTAL` rate, not the per channel rate. If you want 3 channels at 5 kHz, the total rate is 15 kHz. Run `MAXRATE` to see if your computer is up to the task.

Background operation

`MAXRATE` tests your computer using the `cbAInScan()` / `AInScan()` routine in the foreground. If you choose background operation, it may not sustain the maximum rate returned by `MAXRATE`. For the fastest performance, use `cbAInScan()` / `AInScan()` in the foreground, with the `TOD` interrupt disabled.

PPIO AI08

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `FileAInScan()`

Analog input argument values

`Options`	`CONVERTDATA`
`HighChan`	0 to 7
`Rate`	Ignored
`Range`	This board does not have programmable gain, so the `Range` arguments for the analog input functions are ignored.

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

Digital I/O argument values

`PortNum`	`AUXPORT*`	
`DataValue`	`cbDOut()` 0 to 15	`cbDIn()` 0 to 7
`BitNum`	`cbDOut()` 0 to 3	`cbDIn()` 0 to 2

* `AUXPORT` is not configurable for this board.

Hardware considerations

Pacing analog input

Software pacing only

CYDAS 16 and 4CYDAS 16 Series

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `FileAInScan()`
	The **CYDAS 1802ST**, **CYDAS 1802SI**, **CYDAS 1802M1**, and **CYDAS 1802M1HR** also support:
UDR:	`cbAPretrig()`, `cbFileAInScan()`, `cbFilePretrig()`
UDR for .NET:	`APretrig()`, `FileAInScan()`, `FilePretrig()`
	The **CYDAS 1802STI** and **CYDAS 1802M1** also support:
UDR:	`cbALoadQueue()`
UDR for .NET:	`cbALoadQueue()`

Analog input argument values

`Options` BACKGROUND, CONTINUOUS, EXTCLOCK, CONVERTDATA, EXTTRIGGER

For **CYDAS 1802ST, CYDAS 1802STI, CYDAS 1802M1** and **CYDAS 1802M1HR**, the following argument values are also valid:
DTCONNECT, BLOCKIO (packet size: 512), EXTMEMORY

For **DAS16, CYDAS 16F, CYDAS 16JR, CYDAS 16JRHR** and **4CYDAS 161xJ** series, the following argument values are also valid:
SINGLEIO, DMAIO

For **CYDAS 1802M1HR**, the following argument value is also valid:
BURSTMODE

`HighChan` **CYDAS 1802M1** and **CYDAS 1802M1HR**
0 to 7

All others
0 to 15 in single-ended mode, 0 to 7 in differential mode

`Rate`

CYDAS 1802M1 & **CYDAS 1802M1HR**	**CYDAS 1802ST/I**
Up to 1000000	Up to 330000
4CYDAS 1612J	**CYDAS 16JR**
Up to 160000	Up to 130000
CYDAS 16F & **CYDAS16JRHR**	**CYDAS 16**
Up to 100000	Up to 50000

`Range` **CYDAS 16**
These boards do not have programmable gain so the `Range` argument to analog input functions is ignored.

All other boards in this series support the following ranges:

`BIP5VOLTS`	`UNI10VOLTS`
`BIP2PT5VOLTS`	`UNI5VOLTS`
`BIP1PT25VOLTS`	`UNI2PT5VOLTS`
	`UNI1PT25VOLTS`

For all programmable gain boards in this series **except** the **CYDAS 1802M1HR**, the following argument value is also valid:
`BIP10VOLTS`

For all programmable gain boards in this series **except** the **CYDAS 16JRHR** and **4CYDAS 1616J**, the following argument value is also valid:
`BIPPT625VOLTS`

Analog output

CYDAS 16 & **CYDAS 16F** only

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	`SIMULTANEOUS`
`HighChan`	1 max
`Rate`	Ignored
`Count`	2 max
`Range`	Ignored
`DataValue`	0 to 4095

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

The **CYDAS 16 & 16/F**, **CYDAS 1802M1** and **CYDAS 1802M1HR**, the following function is also supported:

UDR:	`cbDConfigPort()`
UDR for .NET:	`DConfigPort()`

Digital I/O argument values

`PortNum`	`AUXPORT*`
`DataValue`	0 to 15
`BitNum`	0 to 3
	* `AUXPORT` is not configurable for these boards.

For **CYDAS 16 & 16/F, CYDAS 1802M1** and **CYDAS 1802M1HR** the following additional argument values are also valid:

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue`	0 to 15 for `FIRSTPORTCL` or `FIRSTPORTCH` 0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 23 for `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 3 The **CYDAS 1802M1HR** also supports these argument values: 4 to 6
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)
`RegNum`:	`LOADREG1`, `LOADREG2`, `LOADREG3` For **CYDAS 1802M1HR** the following argument values are also valid `LOADREG4`, `LOADREG5`, `LOADREG6`

Triggering (CYDAS 1802M1HR only)

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`	`TRIGPOSEDGE`, `TRIGNEGEDGE`, `GATEHIGH`, `GATELOW`
`Threshold`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)

Hardware considerations

Pacing analog input

- Hardware pacing, external or internal clock supported.
- The packet size is 512 samples
- The `DMAIO` option cannot be used while using the chan/gain queue on the **CYDAS 1802STI** board.

CYDAS 1802M1

If you use the timed analog functions with the **CYDAS 1802M1** board to acquire more than 2048 data points, you may not be able to achieve the full 1 MHz rate. On slow machines, these functions may hang if the scan rate is fast, generally in the range of 500 to 700 kHz.

Determine the maximum rate by passing in different high rates until the maximum rate is achieved without hanging the system. If the full 1.0 MHz rate is required, add a **MEGA FIFO** memory board and specify the `EXTMEMORY` option on the call to `cbAInScan()`or `AInScan()`.

CYDAS 1802M1HR also supports counter numbers 4 through 6, with counter 4 being the only independent user counter.

Triggering and gating

- For the **CYDAS 1802M1HR**, Digital (TTL) and analog hardware triggering is supported.
- For **all others in this series,** digital (TTL) polled gate triggering is supported. Refer to "Trigger support" on page 26

Pacing analog output

Software only

PCYDAS and PCCDAS 16 Series

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `FileAInScan()`

Analog input argument values

`Options` — `BACKGROUND`, `CONTINUOUS*`, `EXTCLOCK`, `CONVERTDATA`, `SINGLEIO`, `BLOCKIO`, `EXTTRIGGER`, `NOTODINTS`, `NOCALIBRATEDATA`

The **PCCDAS 16** series also supports `BURSTMODE.`

`HighChan` — **PCYDAS 1x16S, PCYDAS 1800 and PCCDAS 1800**

0 to 15

PCYDAS 1x08

0 to 7

`Rate` — **PCCDAS 1800**

330000

PCCDAS 1616

200000

All others in series

100000

`Range` — For **PCYDAS xxxx**, the following A/D ranges are valid:

`BIP10VOLTS`	`UNI10VOLTS`
`BIP5VOLTS`	`UNI5VOLTS`
`BIP2PT5VOLTS`	`UNI2PT5VOLTS`
`BIP1PT25VOLTS`	`UNI1PT25VOLTS`

For **PCCDAS 16 & 1800, and PCYDAS 12, 16 & 1800 Series,** the following A/D ranges are valid:

`BIP10VOLTS`	`BIP5VOLTS`
`BIP2PT5VOLTS`	`BIP1PT25VOLTS`

For **PCCDAS 1800**, the following A/D ranges are valid:

`BIP10VOLTS`	`BIP5VOLTS`

Analog output

PCYDAS 1208AO and **PCCDAS 1612AO & PCCDAS 1616AO** only

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options` — `SIMULTANEOUS` (**PCYDAS & PCYDIO** version only)

`HighChan`	1 max
`Rate`	Ignored
`Count`	2 max

`Range`	`BIP10VOLTS`
	For **PCCDAS 1612AO & PCYDAS 1208AO**, the following argument values are also valid:
	`BIP10VOLTS`
	`BIP5VOLTS`

`DataValue`	0 to 4095 For **PCCDAS 1616AO**, the following argument values are also valid: 0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7.)

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	**PCCDAS 161xAO**
	`FIRSTPORTA`
	All others in this series:
	`FIRSTPORTA`, `FIRSTPORTB`

`DataValue`	**PCCDAS 161xAO** 0 to 15 for `FIRSTPORTA` **All others** in this series: 0 to 15 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	**PCCDAS 161xAO** 0 to 3 for `FIRSTPORTA` **All others** in this series 0 to 7 for `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 3
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)

`RegNum:`	`LOADREG1`, `LOADREG2`, `LOADREG3`

Triggering

PC-Card Only

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`	`TRIGPOSEDGE`, `TRIGNEGEDGE`, `GATEHIGH`, `GATELOW` (All at A/D External trigger input)

Hardware considerations

Pacing analog input

- Internal or external clock
- The packet size is 256 samples for **PCYDAS & PCYDIO** boards; 2048 samples for **PCCDAS & PCCDIO** boards.
  For `CONTINUOUS` mode scans, the sample count should be at least one packet size (>=2048 samples) for the **PCCDAS & PCCDIO** boards.

These cards do not have residual counters, so `BLOCKIO` transfers must acquire integer multiples of the packet size before completing the scan. This can be lengthy for **PCCDAS & PCCDIO,** which must acquire 2048 samples between interrupts for `BLOCKIO` transfers. In general, it is best to allow the library to determine the best transfer mode (`SINGLEIO` vs. `BLOCKIO`) for these boards.

Triggering and gating

- External digital (TTL) polled gate trigger supported on **PCYDAS & PCYDIO** versions. Refer to "Trigger support" on page 26.
- External digital (TTL) hardware trigger supported on **PCCDAS & PCCDIO** versions.

CYDAS 1400 and CYDAS 1600 Series

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`,`FileAInScan()`

Analog input argument values

`Options`	BACKGROUND, CONTINUOUS, EXTCLOCK, CONVERTDATA, SINGLEIO, DMAIO, BURSTMODE, EXTTRIGGER For **CYDAS 1600**, the following argument values are also valid: DTCONNECT, EXTMEMORY.
HighChan	0 to 15 in single-ended mode, 0 to 7 in differential mode
Rate	**CYDAS 1401, CYDAS 1402, CYDAS 1601, CYDAS 1602** 160000 **CYDAS 1602HR, CYDAS 1402HR** 100000 **CYDAS 1401, CYDAS 1402, CYDAS 1601, CYDAS 1602** to external memory 330000
Range	**CYDAS 1402, CYDAS 1602, CYDAS 1402HR** and **CYDAS 1602HR** BIP10VOLTS UNI10VOLTS BIP5VOLTS UNI5VOLTS BIP2PT5VOLTS UNI2PT5VOLTS BIP1PT25VOLTS UNI1PT25VOLTS **CYDAS 1401** and **CYDAS 1601** BIP10VOLTS UNI10VOLTS BIP1VOLTS UNI1VOLTS BIPPT1VOLTS UNIPT1VOLTS BIPPT01VOLTS UNIPT01VOLTS

Analog output (CYDAS 1600 series only)

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	`SIMULTANEOUS`
`HighChan`	1 max
`Count`	2 max
`Rate`	Ignored
`Pacing`	Software pacing only
`Range`	Analog output gain is not programmable, so the `Range` argument is ignored.
`DataValue`	0 to 4095

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

For **CYDAS 1600**, the following function and method are also valid:

UDR:	`cbDConfigPort()`
UDR for .NET:	`DConfigPort()`

Digital I/O argument values

`PortNum`	`AUXPORT`*
`DataValue`	0 to 15
`BitNum`	0 to 3

* `AUXPORT` is not configurable for these boards.

For **CYDAS 1600**, the following additional argument values are also valid:

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue`	0 to 15 for `FIRSTPORTCL` or `FIRSTPORTCH`; 0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 23 for `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 3
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)
`RegNum`:	`LOADREG1`, `LOADREG2`, `LOADREG3`

Hardware considerations

Pacing analog input

Hardware pacing, external or internal clock supported.

Specifying `SINGLEIO` while also specifying `BURSTMODE` is not recommended. If this combination is used, the Count value should be set as low as possible, preferably to the number of channels in the scan. Otherwise, overruns may occur.

When `EXTMEMORY` is used with the **CYDAS 1600** the `cbGetStatus()` function or `GetStatus()` method does not return the current count and current index.

Triggering and gating

External digital (TTL) polled gate trigger supported. Refer to "Trigger support" on page 26.

Range

The **CYDAS1400** and **CYDAS 1600** A/D ranges are configured with a combination of a switch (Unipolar / Bipolar) and a programmable gain code. The state of this switch is set in the configuration file using *Insta*Cal. After the UNI/BIP switch setting is selected, only matching ranges can be used in CYDAS UDR Library programs.

CYDAS 48

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `FileAInScan()`

Analog input argument values

`Options`	`CONVERTDATA`
`HighChan`	47 (23 differential)
`Rate`	This board does not have a timer, so the `Rate` argument to the analog scanning functions is ignored.
`Range`	The board may be configured with a jumper for either voltage or current input.

In voltage mode

`BIP10VOLTS`	`UNI10VOLTS`
`BIP5VOLTS`	`UNI5VOLTS`
`BIP2PT5VOLTS`	`UNI2PT5VOLTS`
`BIP1PT25VOLTS`	`UNI1PT25VOLTS`
`BIPPT625VOLTS`	

In current mode

`MA4TO20`	`MA2TO10`
`MA1TO5`	`MAPT5TO2PT5`

Analog output

Analog output functions and methods supported

The **CYDAS 48** board does not support any of the analog output functions.

Digital I/O

Digital I/O functions and methods supported

The **CYDAS 48** does not support any of the digital I/O functions.

Counter I/O

Counter functions and methods supported

The **CYDAS 48** does not support any of the counter I/O functions.

UCDAS TC Series

Temperature Input

Temperature input functions and methods supported

UDR:	`cbTIn()`, `cbTInScan()`
UDR for .NET:	`TIn()`, `TInScan()`

Temperature input argument values

`Options`	`NOFILTER`
`Scale`	`CELSIUS`, `FAHRENHEIT`, `KELVIN`
`HighChan`	0 to 15

Hardware considerations

Pacing input

The rate of measurement is fixed at approximately 25 samples per second.

Selecting thermocouples

J, K, E, T, R, S or B type thermocouples may be selected using *Insta*Cal.

Open thermocouples

When using `cbTInScan()` or `TInScan()` with the **UCDAS TC**, an open thermocouple error (`OPENCONNECTION`) on any of the channels will cause all data to be returned as –9999.0. This is a hardware limitation. If your application requires isolating channels with defective thermocouples attached and returning valid data for the remainder of the channels, use the `cbTIn()` function or `TIn()` method instead.

To read the voltage input of the thermocouple, select `VOLTS` for the `Scale` parameter in `cbTIn()` and `cbTInScan()`, or `TIn()` and `TInScan()`.

CYDAS TEMP

Temperature input

Temperature input functions and methods supported

UDR:	`cbTIn()`, `cbTInScan()`
UDR for .NET:	`TIn()`, `TInScan()`

Temperature input argument values

`Options`	`NOFILTER`
`Scale`	`CELSIUS`, `FAHRENHEIT`, `KELVIN`
`HighChan`	0 to 31

Hardware considerations

Pacing Input

The rate of measurement is fixed at approximately 25 samples per second.

Selecting Thermocouples

J, K, E, T, R, S or B type thermocouples may be selected using *Insta*Cal.

UCDAS TEMP, UCDAS TC

The CyberResearch brand UCDAS TEMP and UCDAS TC support the following UDR Library and UDR Library for .NET features.

Temperature input

Temperature input functions and methods supported

UDR:	`cbTIn()`, `cbTInScan()`
UDR for .NET:	`TIn()`, `TInScan()`

Temperature input argument values

`Options`	`N/A`
`Scale`	`CELSIUS`, `FAHRENHEIT`, `KELVIN`
`HighChan`	0 to 7

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDIn()`,`cbDOut()`,`cbDBitIn()`, `cbDBitOut, cbDConfigBit()`
UDR for .NET:	`DIn()`, `DOut()`, `DBitIn()`, `DBitOut(), DConfigBit()`

Digital I/O argument values

`PortNum`	`AUXPORT`
`DataValue`	0 to 255
`BitNum`	0 to 7

Hardware considerations

Pacing temperature readings

The internal update rate for temperature measurement is a fixed value for these devices. If the UDR Library reads the device faster than the internal update rate, temperature readings "repeat." For example, if using cbTIn() in a loop to measure a rapidly changing temperature, readings do not change for several iterations of the loop, then “jump” when the update occurs internally.

Using single sensors with cbTInScan()

When using single sensors for RTD or thermistor sensors, you should ignore the data for channels that do not have sensors attached. It is best to use cbTIn() for these configurations, since you can select which channels to read. If you use cbTInScan(), however, data for all channels over the entire range of channels are returned. Since some channels are not populated in this configuration, you should filter out the data for channels without sensors.

Saving configuration settings

*Insta*Cal allows you to save UCDAS TEMP and UCDAS TC configuration settings to a file or load a configuration from a previously saved file.

- Each UCDAS TEMP channel can be configured to measure temperature data collected by one of five categories of temperature sensors: thermistors, thermocouples, RTDs, semiconductors, and *Disabled*.
- Each UCDAS TC channel can be configured to measure temperature data collected by one of eight types of thermocouples.

Recommended warm up time (UCDAS TEMP only)

Allow the UCDAS TEMP to warm up for 30 minutes before taking measurements. This warm up time minimizes thermal drift and achieves the specified rated accuracy of measurements.

For RTD or thermistor measurements, this warm-up time is also required to stabilize the internal current reference.

Calibration

Any time the sensor category is changed in the configuration for the UCDAS TEMP, a calibration is automatically performed by *Insta*Cal. If the device has not been warmed up when this occurs, you should re-calibrate after the specified warmup time.

Error codes

- The UDR Library returns -*9999* when a value is out of range or an open connection is detected.
- The UDR Library returns -*9000* when the device is not ready. This usually occurs right after the device is powered up and calibration factors are being loaded.

Miscellaneous functions and methods supported

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the USB LED on a CyberResearch USB module to blink.

When you have several modules connected to the computer, use these functions to identify a particular module by making its LED blink.

UMDAS 08JR8O

The CyberResearch brand UMDAS 08JR8O supports the following UDR Library and UDR Library for .NET features.

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbALoadQueue()`*, `cbFileAInScan()`, `cbATrig()`
UDR for .NET:	`AIn()`, `AInScan()`, `ALoadQueue()`*, `FileAInScan()`, `ATrig()`
	*The channel-gain queues are limited to eight channel-gain pairs.

Analog input argument values

Options	`BACKGROUND`, `BLOCKIO`***, `BURSTIO`**, `CONTINUOUS`, `EXTTRIGGER`, `CONVERTDATA`, and `NOCALIBRATEDATA.`
	**`BURSTIO` cannot be used with the `CONTINOUS` option.
	** `BURSTIO` can only be used with sample count scans of 4096 or less.
	*** The `BLOCKIO` packet size is 64 samples wide.
HighChan	0 to 7 in single-ended mode, 0 to 3 in differential mode.
Rate	8000 maximum for `BURSTIO` mode (1200 maximum for all other modes.)
	When using `cbAInScan()` or `AInScan()`, the minimum rate is 100 S/s aggregate.
Range	**Single-ended mode:**

Single-ended mode:

`BIP10VOLTS`	(± 10 V)

Differential mode:

`BIP20VOLTS`	(± 20 V)	`BIP2PT5VOLTS`	(± 2.5 V)
`BIP10VOLTS`	(± 10 V)	`BIP2VOLTS`	(± 2 V)
`BIP5VOLTS`	(± 5 V)	`BIP1PT25VOLTS`	(± 1.25 V)
`BIP4VOLTS`	(± 4 V)	`BIP1VOLT`	(± 1 V)

`Pacing`	Hardware pacing, internal clock supported.

`Triggering`

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`	`TRIGHIGH`, `TRIGLOW`
	Digital (TTL) hardware triggering supported. The hardware trigger is source selectable via *Insta*Cal (`AUXPORT` inputs 0–3).

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`
UDR for .NET:	`AOut()`

Analog output argument values

`HighChan`	1	
`Range`	`UNI5VOLTS`	(0 to 5 V)
`DataValue`	0 to 1023	

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigBit()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigBit()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`AUXPORT`*, `FIRSTPORTA`
`DataValue`	0 to 15 for `AUXPORT`, `FIRSTPORTCL` or `FIRSTPORTCH` 0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 3 for `AUXPORT` 0 to 23 for `FIRSTPORTA`

*`AUXPORT` is bitwise configurable for this board, and must be configured using `cbDConfigBit()` or `cbDConfigPort()` (or the UDR Library for .NET methods `DConfigBit()` or `DConfigPort()`) before use for output.

Counter I/O

Counter I/O functions and methods supported

UDR:	`cbCIn()`*, `cbCIn32()`, `cbCLoad()`**, `cbCLoad32()`**
UDR for .NET:	`CIn()`*, `CIn32()`, `CLoad()`**, `CLoad32()`**

*Although `cbCIn()` and `CIn()` are valid for use with this counter, `cbCIn32() or CIn32()` may be more appropriate. The values returned may be greater than the data types that are used by `cbCIn()` and `CIn()` can handle.

**`cbCLoad()`, `CLoad32()`, `CLoad()` and `CLoad32()` only accept `Count=0`. These functions are used to reset the counter.

Counter I/O argument values

`CounterNum`	`1`
`Count:`	2^{32}-1 when reading the counter.
`LoadValue`	0 when loading the counter.

`cbCLoad()` and `cbCLoad32()` / `CLoad()` and `CLoad32()`are only used to reset the counter for this board to 0. No other values are valid.

The "Basic signed integers" guidelines on page 93 apply when using `cbCIn() or CIn()` for values greater than 32767, and when using `cbCIn32()` or `CIn32()` for values greater than 2147483647.

`RegNum:`	`LOADREG1`

Event notification

Even notification functions and methods supported

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`
Event types:	`ON_SCAN_ERROR`, `ON_DATA_AVAILABLE`, `ON_END_OF_AI_SCAN`

Hardware considerations

Resolution

When configured for single-ended mode, the resolution of the data is 11 bits (data values between 0 and 2047). However, the CYDAS UDR Library maps this data to 12-bit values, so the range of data is no different from the differential configuration. Consequently, the data returned contains only even numbers between 0 and 4094.

BURSTIO

Allows higher sampling rates (up to 8000 hertz (Hz)) for sample counts up to 4096. Data is collected into the **UMDAS 08JR8O**'s local FIFO. Data is collected into the USB device's local FIFO. Data transfers to the PC don't occur until the scan completes. For `BACKGROUND` scans, the `Count` and `Index` returned by `cbGetStatus()` and `GetStatus()` remain 0, and `Status=RUNNING` until the scan finishes. The `Count` and `Index` are not updated until the scan is completed. When the scan is complete and the data is retrieved, `cbGetStatus()`and `GetStatus()`are updated to the current `Count` and `Index`, and `Status` = `IDLE`.
`BURSTIO` is the default mode for non-`CONTINUOUS` fast scans (aggregate sample rates above 1000 Hz) with sample counts up to 4096. `BURSTIO` mode allows higher sampling rates (up to 8000 Hz) for sample counts up to 4096. Non-`BURSTIO` scans are limited to a maximum of 1200 Hz. To avoid the `BURSTIO` default, specify `BLOCKIO` mode.

Continuous scans

When running cbAInScan() with the CONTINUOUS option, you should consider the packet size and the number of channels being scanned. In order to keep the data aligned properly in the array, make the total number of samples an integer multiple of the packet size and the number of channels.

Concurrent operations

Concurrent operations on a particular USB device are not allowed. If you invoke a UDR Library or UDR Library for .NET function on a USB device while another function is running on that USB device, the **`ALREADYACTIVE`** error is returned.

Miscellaneous functions and methods supported

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the LED on a CyberResearch USB device to blink.

When you have several USB devices connected to the computer, use these functions to identify a particular device by making its LED blink.

UMDAS 0802 Series

The CyberResearch brand UMDAS 0802L and UMDAS 0802 support the following UDR Library and UDR Library for .NET features.

Analog input

Analog input functions and methods supported

UDR: `cbAIn()`, `cbAInScan()`, `cbALoadQueue()`*, `cbFileAInScan()`, `cbATrig()`

UDR for .NET: `AIn()`, `AInScan()`, `ALoadQueue()`, `FileAInScan()`, `ATrig()`

Analog input argument values

`Options`

UMDAS 0802L

`BACKGROUND`, `BLOCKIO`*, `BURSTIO`**, `CONTINUOUS`, `EXTTRIGGER`, `NOCALIBRATEDATA` , and `CONVERTDATA`,

UMDAS 0802

`BACKGROUND`, `BLOCKIO`*, `CONTINUOUS`, `EXTCLOCK`, `EXTTRIGGER`, `NOCALIBRATEDATA`, and `SINGLEIO`

*UMDAS 0802 Series packet size based on `Options` settings are as follows:

Device	Options setting	Packet size
UMDAS 0802L	`BLOCKIO`	64
UMDAS 0802	`BLOCKIO`	31
	`SINGLEIO`	1

** `BURSTIO` can only be used with the number of samples (`Count`) set equal to the size of the FIFO or less. The UMDAS 0802L FIFO holds 4096 samples. `BURSTIO` cannot be used with the `CONTINUOUS` option.

`HighChan`

0 to 7 in single-ended mode

0 to 3 in differential mode.

`Count`

In `CONTINUOUS` mode, `Count` *must* be an integer multiple of the number of channels in the scan.

`Rate`

UMDAS 0802L

8000 Hz maximum for `BURSTIO` mode. The maximum rate is 1200 Hz for all other modes. When using `cbAInScan()` or `AInScan()`, the minimum sample rate is 100 Hz.

UMDAS 0802

50 kHz maximum for `BLOCKIO` mode. The throughput is system dependant. Most systems will be able to achieve 40 kHz aggregate. Best results will be obtained using Windows XP. When using cbAInScan() or AInScan() the minimum sample rate is 1 Hz.

`Range`

Single-ended mode:

`BIP10VOLTS` (± 10 V)

Differential mode:

`BIP20VOLTS`	(± 20 V)	`BIP2PT5VOLTS`	(± 2.5 V)
`BIP10VOLTS`	(± 10 V)	`BIP2VOLTS`	(± 2 V)
`BIP5VOLTS`	(± 5 V)	`BIP1PT25VOLTS`	(± 1.25 V)
`BIP4VOLTS`	(± 4 V)	`BIP1VOLT`	(± 1 V)

Triggering

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`

UMDAS 0802L

`TRIGHIGH` and `TRIGLOW`

UMDAS 0802

`TRIGPOSEDGE` and `TRIGNEGEDGE`

Both products support external digital (TTL) hardware triggering. Use the `Trig_In` input (pin # 18 on the screw terminal) for the external trigger signal.

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`

UMDAS 0802L

Ignored

UMDAS 0802

`BACKGROUND`, `CONTINUOUS`

For the UMDAS 0802, the number of samples (`Count`) in a `CONTINUOUS` scan needs to be an integer multiple of the packet size (32).

`HighChan` 0 to 1

`Count`

UMDAS 0802L
(`HighChan`-`LowChan`) + 1

UMDAS 0802
For the UMDAS 0802, `Count` needs to be an integer multiple of the number of channels in the scan. In a CONTINUOUS scan, `Count` needs to be an integer multiple of the packet size (32).

`Rate`

UMDAS 0802L
Ignored

UMDAS 0802

10 kHz for single channel
5 kHz for two channels

	Performance varies when operating on non-XP systems.
`Range`	**UMDAS 0802L**
	`UNI5VOLTS` (0 to 5 V)
	UMDAS 0802
	`UNI4VOLTS` (0 to 4 V, nominal. Actual range is 0 to 4.096 V)
`DataValue`	**UMDAS 0802L**
	0 to 1023
	UMDAS 0802
	0 to 4095

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`
`DataValue`	0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 15 for `FIRSTPORTA`

Counter I/O

Counter I/O functions and methods supported

UDR:	`cbCIn()`*, `cbCIn32()`, `cbCLoad()`**, `cbCLoad32()`**
UDR for .NET:	`CIn()`*, `CIn32()`, `CLoad()`**, `CLoad32()`**
	*Although `cbCIn()` and `CIn()` are valid for use with this counter, `cbCIn32()` or `CIn32()` may be more appropriate, since the values returned may be greater than the data types used by `cbCIn()` and `CIn()` can handle. **`cbCLoad()`, `cbCLoad32()`, `CLoad()` and `CLoad32()` only accept `Count`=0. These functions are used to reset the counter.

Counter I/O argument values

`CounterNum`	1
`Count`	2^{32}-1 when reading the counter.
	0 when loading the counter.
	`cbCLoad()` and `cbCLoad32()` / `CLoad()` and `CLoad32()`are only used to reset the counter for this board to 0. No other values are valid.
	The "Basic signed integers" guidelines on page 93 apply when using `cbCIn()` or `CIn()` for values greater than 32767, and when using `cbCIn32()` or `CIn32()` for values greater than 2147483647.
`RegNum`	`LOADREG1`

Event notification

Even notification functions and methods supported

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`
Event types:	`ON_SCAN_ERROR` (analog input), `ON_DATA_AVAILABLE`, `ON_END_OF_AI_SCAN`
	The **UMDAS 0802** also supports `ON_END_OF_AO_SCAN` and `ON_SCAN_ERROR` (analog output)

Hardware considerations

Acquisition Rate

When using the **UMDAS 0802**, most systems can sustain rates of 40 kS/s aggregate in `BLOCKIO` mode, and 1 kS/s aggregate in `SINGLEIO` mode.

`BURSTIO` (UMDAS 0802L)

`BURSTIO` mode allows higher sampling rates for sample counts up to the size of the FIFO. The UMDAS 0802L FIFO holds 4096 samples. Data is collected into the device's local FIFO. Data transfers to the PC don't occur until the scan completes. For `BACKGROUND` scans, the `Count` and `Index` returned by `cbGetStatus()` and `GetStatus()` remain 0, and `Status`=`RUNNING` until the scan finishes. The `Count` and `Index` are not updated until the scan is completed. When the scan is complete and the data is retrieved, `cbGetStatus()` and `GetStatus()` are updated to the current `Count` and `Index`, and `Status` = `IDLE`.

The UMDAS 0802L uses `BURSTIO` as the default mode for non-`CONTINUOUS` fast scans with sample counts up to the size of the FIFO (4096 samples). `BURSTIO` mode allows higher sampling rates for sample counts up to the size of the FIFO. Maximum `Rate` values of non-`BURSTIO` scans are limited (see `Rate` on page 75). To avoid the `BURSTIO` default, specify `BLOCKIO` mode.

EXTCLOCK (UMDAS 0802)

By default, the SYNC pin is configured for pacer output and provides the internal pacer A/D clock signal. To configure the pin for pacer input, use the `EXTCLOCK` option.

If you use the `EXTCLOCK` option, make sure that you disconnect from the external clock source when you test or calibrate the device with *Insta*Cal, as the SYNC pin drives the output.

Resolution

When configured for single-ended mode, the resolution of the data is 11 bits (data values between 0 and 2047). However, the CYDAS UDR Library maps this data to 12-bit values, so the range of data is no different from the differential configuration. Consequently, the data returned contains only even numbers between 0 and 4094.

Continuous scans

When running `cbAInScan()` with the `CONTINUOUS` option, consider the packet size and the number of channels being scanned. To keep the data aligned properly in the array, make the total number of samples an integer multiple of the packet size and the number of channels in the scan.

Concurrent operations

UMDAS 0802L: Concurrent operations are not allowed. If you invoke a UDR Library or UDR Library for .NET function on a UMDAS 0802L while another function is running on that same unit, the `ALREADYACTIVE` error is returned.

UMDAS 0802: The following table lists the concurrent operations supported by the UMDAS 0802.

UDR function/method	Can be run with…
`cbAOutScan()/AOutScan()`	▪ `cbDOut()/DOut()` ▪ `cbCLoad()/CLoad()` ▪ `cbFlashLED()/FlashLED()`
`cbAOut()/AOut()`	`cbAInScan()/AInScan()` in `BACKGROUND` mode
`cbAInScan()/AInScan()`	All supported digital I/O functions (`cbDIn()/Din()`, `cbDBitIn()/DBitOut()`, `cbDOut()/DOut(`, `cbDBitOut()/DBitOut()`, `cbDConfigPort()/DConfigPort()`)

Channel-gain queue

When using `cbALoadQueue()/ALoadQueue()` with the UMDAS 0802L, the channel gain queue is limited to eight elements. When using `cbALoadQueue()/ALoadQueue()` with the UMDAS 0802, the channel gain queue is limited to 16 elements.

The queue accepts any combination of valid channels and gains in each element.

Analog output (UMDAS 0802)

When you include both analog output channels in `cbAOutScan()/AOutScan()`, the two channels are updated simultaneously.

Miscellaneous functions and methods supported

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the LED on a USB device to blink.

When you have several USB devices connected to the computer, use these functions to identify a particular device by making its LED blink.

UMDAS 0802HR

The CyberResearch brand UMDAS 0802HR supports the following UDR Library and UDR Library for .NET features.

Analog input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbALoadQueue()`*, `cbFileAInScan()`, `cbATrig()`
UDR for .NET:	`AIn()`, `AInScan()`, `ALoadQueue()`*, `FileAInScan()`, `ATrig()`

*The channel-gain queue is limited to eight elements. The UMDAS 0802HR accepts only unique contiguous channels in each element, but the gains may be any valid value.

Analog input argument values

`Options` — `BACKGROUND`, `BLOCKIO`**, `BURSTIO`***, `CONTINUOUS`, `EXTTRIGGER`, `CONVERTDATA`, `NOCALIBRATEDATA`, `SINGLEIO`**, and `EXTCLOCK`.

**UMDAS 0802 Series packet size based on `Options` settings is as follows:

Device	Options setting	Packet size
UMDAS 0802HR	`BLOCKIO`	31
	`SINGLEIO`	Equals the number of channels being sampled.

*** `BURSTIO` can only be used with the number of samples (`Count`) set equal to the size of the FIFO or less. The UMDAS 0802HR's FIFO holds 32,768 samples. Also, `BURSTIO` cannot be used with the `CONTINUOUS` option.

`HighChan` — 0 to 7 in single-ended mode

`Count` — In BURSTIO mode, `Count` needs to be an integer multiple of the number of channels in the scan.

▪ For three- and six-channel scans, the maximum `Count` is 32766 samples

▪ For five-channel scans, the maximum `Count` is 32765 samples

▪ For seven-channel scans, the maximum `Count` is 32767 samples

▪ For one-, two- , four-, and eight-channel scans, the maximum `Count` is 32768 samples.

`Rate` — 200 kHz maximum for `BURSTIO` mode (50 kHz for any one channel). The maximum rate is 100 kHz for all other modes (50 kHz for any one channel). When using `cbAInScan()` or `AInScan()`, the minimum sample rate is 1 Hz. In `BURSTIO` mode, the minimum sample rate is 20 Hz/channel.

`Range` — **Single-ended mode:**

`BIP10VOLTS` (± 10 V)	`BIP2VOLTS` (± 2 V)
`BIP5VOLTS` (± 5 V)	`BIP1VOLT` (± 1 V)

Triggering

Trigger functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`	`TRIGPOSEDGE` and `TRIGNEGEDGE`. External digital (TTL) hardware triggering supported. You set the hardware trigger source with the `Trig_In` input (pin# 37 on the screw terminal).

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigBit()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigBit()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`AUXPORT`
`DataValue`	0 to 255
`BitNum`	0 to 7 for `AUXPORT`

Counter I/O

Counter I/O functions and methods supported

UDR:	`cbCIn()`*, `cbCIn32()`, `cbCLoad()`**, `cbCLoad32()`**
UDR for .NET:	`CIn()`*, `CIn32()`, `CLoad()`**, `CLoad32()`**

*Although `cbCIn()` and `CIn()` are valid for use with this counter, `cbCIn32()` or `CIn32()` may be more appropriate, since the values returned may be greater than the data types used by `cbCIn()` and `CIn()` can handle.

**`cbCLoad()`, `cbCLoad32()`, `CLoad()` and `CLoad32()` only accept `Count`=0. These functions are used to reset the counter.

Counter I/O argument values

`CounterNum`	1
`Count`	2^{32}-1 when reading the counter.
`LoadValue`	0 when loading the counter.

`cbCLoad()` and `cbCLoad32()` / `CLoad()` and `CLoad32()`are only used to reset the counter for this board to 0. No other values are valid.

The "Basic signed integers" guidelines on page 93 apply when using `cbCIn()` or `CIn()` for values greater than 32767, and when using `cbCIn32()` or `CIn32()` for values greater than 2147483647.

`RegNum`	`LOADREG1`

Event notification

Even notification functions and methods supported

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`
Event types:	`ON_SCAN_ERROR`, `ON_DATA_AVAILABLE`, `ON_END_OF_AI_SCAN`

Hardware considerations

Acquisition rate

Since the maximum data acquisition rate depends on the system connected to the UMDAS 0802HR, it is possible to "lose" data points when scanning at higher rates. The CYDAS UDR Library cannot always detect this data loss.

Most systems can sustain rates of 80 kS/s aggregate. If you need to sample at higher rates than this, consider using the `BURSTIO` option explained above.

BURSTIO

`BURSTIO` mode allows higher sampling rates for sample counts up to the size of the FIFO. The UMDAS 0802HR device's FIFO holds 32,768 samples. Data is collected into the device's local FIFO. Data transfers to the PC don't occur until the scan completes. For `BACKGROUND` scans, the `Count` and `Index` returned by `cbGetStatus()` and `GetStatus()` remain 0, and `Status`=`RUNNING` until the scan finishes. The `Count` and `Index` are not updated until the scan is completed. When the scan is complete and the data is retrieved, `cbGetStatus()` and `GetStatus()` are updated to the current `Count` and `Index`, and `Status` = `IDLE`.

`BURSTIO` is required for aggregate `Rate` settings above 100 kHz, but `Count` is limited to sample counts up to the size of the FIFO (32,768 samples). `Count` settings must be an integer multiple of the number of channels in the scan.

EXTCLOCK

You can set the `SYNC` pin (pin 36) as a pacer input or a pacer output from *Insta*Cal. By default, this pin is set for pacer input. If set for output, using the `cbAInScan` / `AInScan` option, `EXTCLOCK` results in a `BADOPTION` error.

Continuous scans

When running cbAInScan() with the `CONTINUOUS` option, you should consider the packet size and the number of channels being scanned. In order to keep the data aligned properly in the array, make the total number of samples an integer multiple of the packet size and the number of channels.

When running cbAInScan() with the `CONTINUOUS` option, you **must** set the count to an integer multiple of the packet size (31) and the number of channels in the scan.

Miscellaneous functions and methods supported

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the LED on a USB device to blink.

When you have several USB devices connected to the computer, use these functions to identify a particular device by making its LED blink.

UCDAS 1602HRS

The CyberResearch brand UCDAS 1602HRS supports the following UDR and UDR Library for .NET features.

Analog input

Analog input functions and methods supported

UDR: `cbAIn()`, `cbAInScan()`, `cbALoadQueue()`*, `cbFileAInScan()`, `cbATrig()`

UDR for .NET: `AIn()`, `AInScan()`, `ALoadQueue()`*, `FileAInScan()`, `ATrig()`

*The channel-gain queue is limited to 16 elements. The UCDAS 1602HRS accepts only unique contiguous channels in each element, but the gains may be any valid value.

Analog input argument values

`Options`: `BACKGROUND`, `BLOCKIO`**, `BURSTIO`***, `CONTINUOUS`, `EXTTRIGGER`, `SINGLEIO`**, and `EXTCLOCK`

**UCDAS 1602HRS packet size based on `Options` settings

Device	Options setting	Packet size
UCDAS 1602HRS	`BLOCKIO`	62
	`SINGLEIO`	Equals the number of channels being sampled.

*** `BURSTIO` can only be used with the number of samples (`Count`) set equal to the size of the FIFO or less. The UCDAS 1602HRS FIFO holds 32,768 samples. Also, `BURSTIO` cannot be used with the `CONTINUOUS` option.

`HighChan` 0 to 15 in single-ended mode

`Count` In `BURSTIO` mode, `Count` needs to be an integer multiple of the number of channels in the scan.

- For one-, two- , four-, eight-, and 16-channel scans, the maximum `Count` is 32768 samples.
- For three- and six-channel scans, the maximum `Count` is 32766 samples
- For five-channel scans, the maximum `Count` is 32765 samples
- For seven-channel scans, the maximum `Count` is 32767 samples
- For 9-, 10-, 12-, 13-, 14-, and 15-channel scans, the maximum `Count` is 32760 samples
- For 11-channel scans, the maximum `Count` is 32758 samples.

`Rate`: 200 kilohertz (kHz) maximum for `BURSTIO` mode (50 kHz for any one channel). For all other modes, the maximum rate per channel depends on the number of channels being scanned.

No. of channels in scan	Maximum rate
1 or 2	50 kHz
3	36 kHz
4	30 kHz
5	25 kHz
6	22 kHz
7	19 kHz
8	17 kHz
9	15 kHz

No. of channels in scan	Maximum rate
10	14 kHz
11	12.5 kHz
12	12 kHz
13	11.25 kHz
14	10.5 kHz
15	10 kHz
16	9.5 kHz

When using `cbAInScan()` or `AInScan()`, the minimum sample rate is 1 Hz. In `BURSTIO` mode, the minimum sample rate is 20 Hz/channel.

`Range`:	Single-ended:	
	`BIP10VOLTS` (± 10 volts)	`BIP5VOLTS` (± 5 volts)
	`BIP2VOLTS` (± 2 volts)	`BIP1VOLTS` (± 1 volt)
Pacing:	Hardware pacing, internal clock supported.	
	External clock supported via the SYNC pin.	

Triggering

Triggering functions and methods supported

UDR:	`cbSetTrigger()`
UDR for .NET:	`SetTrigger()`

Trigger argument values

`TrigType`:	`TRIGPOSEDGE`, `TRIGNEGEDGE`
	External digital (TTL) hardware triggering supported. You set the hardware trigger source with the TRIG_IN input terminal.

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigBit()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigBit()`, `DConfigPort()`

Digital I/O argument values

`PortNum`:	`AUXPORT` (eight bits, bit-configurable)
`DataValue`:	0 to 255
`BitNum`:	0 to 7

Counter I/O

Counter I/O functions and methods supported

UDR:	`cbCIn()`*, `cbCIn32()`, `cbCLoad()`**, `cbCLoad32()`**
UDR for .NET:	`CIn()`*, `CIn32()`, `CLoad()`**, `CLoad32()`** *
	Although `cbCIn()` and `CIn()` are valid for use with this counter, `cbCIn32()` or `CIn32()` may be more appropriate, since the values returned may be greater than the data types used by `cbCIn()` and `CIn()` can handle. **`cbCLoad()`, `cbCLoad32()`, `CLoad()` and `CLoad32()` only accept `Count`=0. These functions are used to reset the counter.

Counter I/O argument values

`CounterNum`:	1
`Count`	232-1 when reading the counter.
	0 when loading the counter.
	`cbCLoad()` and `cbCLoad32()` / `CLoad()` and `CLoad32()`are only used to reset the counter for this board to 0. No other values are valid.

The "Basic signed integers" guidelines on page 93 apply when using `cbCIn()` or `CIn()` for values greater than 32767, and when using `cbCIn32()` or `CIn32()` for values greater than 2147483647.

Event notification

Even notification functions and methods supported

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`
Event types:	`ON_SCAN_ERROR`, `ON_DATA_AVAILABLE`, `ON_END_OF_AI_SCAN`

Hardware considerations

Acquisition rate

Since the maximum data acquisition rate depends on the system connected to the UCDAS 1602HRS, it is possible to "lose" data points when scanning at higher rates. The CYDAS UDR Library cannot always detect this data loss. Maximum rates may be lower in Windows operating systems that predate Windows XP. Most systems can sustain rates of 80 kS/s aggregate. If you need to sample at higher rates than this, consider using the `BURSTIO` option explained later in this topic.

EXTCLOCK

You can set the SYNC pin as a pacer input or a pacer output from *Insta*Cal. By default, this pin is set for pacer input. If set for output, using the `cbAInScan()`/`AInScan()` option `EXTCLOCK` results in a `BADOPTION` error.

BURSTIO

Allows higher sampling rates up to the size of the FIFO. The UCDAS 1602HRS FIFO holds 32,768 samples. Data is collected into the USB device's local FIFO. Data transfers to the PC don't occur until the scan completes. For `BACKGROUND` scans, the `Count` and `Index` returned by `cbGetStatus`() and `GetStatus()` remain 0, and STATUS=RUNNING until the scan finishes. The `Count` and `Index` are not updated until the scan is completed. When the scan is complete and the data is retrieved, `cbGetStatus()` and `GetStatus()` are updated to the current `Count` and `Index`, and STATUS=IDLE.

`BURSTIO` is required for aggregate `Rate` settings above 100 kHz, but `Count` is limited to sample counts up to the size of the FIFO (32,768 samples). `Count` settings must be an integer multiple of the number of channels in the scan (see `Count` above).

Continuous scans

When running `cbAInScan()`/`AInScan()` with the `CONTINUOUS` option, you should consider the packet size and the number of channels being scanned. In order to keep the data aligned properly in the array, make the total number of samples an integer multiple of the packet size and the number of channels.

When running `cbAInScan()`/`AInScan()` with the `CONTINUOUS` option, you must set the count to an integer multiple of the packet size (62) and the number of channels in the scan.

Miscellaneous functions and methods supported

UDR: `cbFlashLED()`

UDR for .NET: `FlashLED()`

Causes the USB LED on a CyberResearch USB module to blink.

When you have several modules connected to the computer, use these functions to identify a particular module by making its LED blink.

Analog Output Boards

Introduction

All boards with analog outputs support the `cbAOut()` and `cbAOutScan()` functions. Boards released after the printing of this manual are described in Readme files on the CYDAS UDR Library disk.

`cbAOutScan()/AOutScan()` are designed primarily for boards that support hardware-paced analog output, but it is also useful when simultaneous update of all channels is desired. If the hardware is configured for simultaneous update, this function loads each DAC channel with the appropriate value before issuing the update command.

CYDDA 04HS & CYDDA 04HRHS

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	`BACKGROUND`, `CONTINUOUS`, `EXTCLOCK`, `SIMULTANEOUS`
`HighChan`	0 to 3
`Rate`	500000
`DataValue`	0 to 4095

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

Digital I/O argument values

`PortNum`	`AUXPORT`*
`DataValue`	0 to 255
`BitNum`	0 to 7
	* `AUXPORT` is not configurable for these boards.

Hardware considerations

Pacing analog output

Hardware pacing, external or internal clock supported.

The external clock is hardwired to the DAC pacer. If an internal clock is to be used, do not connect a signal to the External Pacer input.

CYDDA & CYDAC Series (Excluding HS Series)

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	`SIMULTANEOUS`	
`HighChan`	**CYDAC 02** 0 to 1	**CYDDA 08** 0 to 7
	CYDDA 06 0 to 5	**CYDDA 16** 0 to 15
`Rate`	Ignored	
`Count`	`HighChan` - `LowChan` + 1 max	
`Range`	Ignored	
`DataValue`	0 to 4095 For the **HR series**, the following argument values are also valid: 0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)	

Hardware considerations

Pacing analog output

Software only

CYDAC 6700 Series

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`HighChan`:	**CYDAC 6702P**: 7	**CYDAC 6703P**: 15
`Count`:	`HighChan` - `LowChan` + 1 max	
`Rate`:	Ignored	
`Range`:	`BIP10VOLTS` (± 10.1 V)	
`DataValue`:	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)	

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`, `cbDConfigBit()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`, `DConfigBit()`

Digital I/O argument values

`PortNum`:	`AUXPORT` is bitwise configurable for these boards, and must be configured using `cbDConfigBit()` or `cbDConfigPort()` before use as output.
`DataValue`	0 to 255
`BitNum`	0 to 7

Configuration

Configuration functions and methods supported

UDR:	`cbGetConfig()`, `cbSetConfig()`
UDR for .NET:	`GetDACStartup()`, `GetDACUpdateMode()`, `SetDACStartup()`, `SetDACUpdateMode()`

Configuration argument values

ConfigItem:	`BIDACSTARTUP`, `BIDACUPDATEMODE`, `BIDACUPDATECMD`

Hardware considerations

Pacing analog output

Software only

PCYDAC & PCCDAC Series

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	**PCYDAC 02** Ignored **PCYDAC 08** and **PCCDAC 08** `SIMULTANEOUS`	
`HighChan`	**PCxDAC 02** 0 to 1	**PCxDAC 08** 0 to 7
`Rate`	Ignored	
`Count`	`HighChan` - `LowChan` + 1 max	

`Range`	**PCYDAC 08** and **PCCDAC 08**
	Ignored
	PCYDAC 02
	`BIP10VOLTS` `BIP5VOLTS`
	`UNI10VOLTS` `UNI5VOLTS`	

`DataValue`	0 to 4095	

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`
`DataValue`	0 to 15 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 7 using `FIRSTPORTA`

Hardware considerations

Pacing analog output

Software only

Digital configuration

Supports two configurable 4-bit ports—`FIRSTPORTA` and `FIRSTPORTB`. Each can be independently configured as either inputs or outputs via `cbDConfigPort()` or `DConfigPort()`.

CYDDA 06H & 06HRP Series

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument values

`Options`	`SIMULTANEOUS` (CYDDA 06 Series only)
`HighChan`	0 to 5
`Rate`	Ignored
`Count`	`HighChan` - `LowChan` + 1 max
`Range`	Ignored
`DataValue`	0 to 4095
	For the **HR series**, the following argument values are also valid 0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7.)

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue`	0 to 15 for `FIRSTPORTC` 0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 23 using `FIRSTPORTA`

Hardware considerations

Pacing analog output
Software only

Initializing the 'zero power-up' state

When using the **CYDDA 06** "zero power-up state" hardware option, use `cbAOutScan()` or `AOutScan()` to set the desired output value and enable the DAC outputs.

CYDDA Series

Analog output

Analog output functions and methods supported

UDR:	`cbAOut()`, `cbAOutScan()`
UDR for .NET:	`AOut()`, `AOutScan()`

Analog output argument ranges

`Options`	`SIMULTANEOUS`	
`HighChan`	**DDA02:** 0 to 1 **DDA04:** 0 to 3 **DDA08:** 0 to 7	
`Rate`	Ignored	
`Count`	`HighChan` - `LowChan` + 1 max	

`Range`	`BIP10VOLTS`
	`BIP5VOLTS`
	`BIP2PT5VOLTS`
		`UNI10VOLTS`
		`UNI5VOLTS`
		`UNI2PT5VOLTS`

`DataValue`	0 to 4095 For the **HR series**, the following argument values are also valid 0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)	

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`, `SECONDPORTA`, `SECONDPORTB`, `SECONDPORTCL`, `SECONDPORTCH`
`DataValue`	0 to 15 for `PORTC;` 0 to 255 for `PORTA` or `PORTB`
`BitNum`	0 to 47 using `FIRSTPORTA`

Hardware considerations

Pacing analog output

Software only.

▪

Digital Input/Output Boards

Introduction

This section has details on using digital I/O boards in conjunction with the CYDAS UDR Library. Boards released after the printing of this manual will be described in Readme files on the CYDAS UDR Library disk.

Basic signed integers

When reading or writing ports that are 16-bits wide, be aware of the following issue using signed integers (as you are forced to do when using Basic):

On some boards, for example the **CPDISO 16/P**, the `AUXPORT` digital ports are set up as one 16-bit port. When using `cbDOut()` or `DOut()`, the digital values are written as a single 16-bit word. Using signed integers, writing values above `0111 1111 1111 1111` (32767 decimal) can be confusing. The next increment, `1000 0000 0000 0000`, has a decimal value of -32768. Using signed integers, this is the value that you would use for turning on the MSB only. The value for all bits on is −1. Keep this in mind if you are using Basic, since Basic does not supply unsigned integers (values from 0 to 65536).

To fully understand and maximize the performance of this and other digital input function calls, refer to the 82C55 data sheet in the Documents subdirectory of the installation. Also refer to the 8536 data sheet (this data sheet file is not available in PDF format).

AC5 Series

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

All boards in this series support:

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue`	0 to 15 using `FIRSTPORTCL or FIRSTPORTCH` 0 to 255 using `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 23 using `FIRSTPORTA`

CYDUAL AC5 and CY**QUAD AC5** boards also support:

`PortNum`	`SECONDPORTA`, `SECONDPORTB`, `SECONDPORTCL`, `SECONDPORTCH`
`DataValue`	0 to 15 using `SECONDPORTCL` or `SECONDPORTCH` 0 to 255 using `SECONDPORTA` or `SECONDPORTB`
`BitNum`	0 to 47 using `FIRSTPORTA`

CYQUAD AC5 boards also support:

`PortNum`	`THIRDPORTA`, `THIRDPORTB`, `THIRDPORTCL`, `THIRDPORTCH`, `FOURTHPORTA`, `FOURTHPORTB`, `FOURTHPORTCL`, `FOURTHPORTCH`
`DataValue`	0 to 15 using `THIRDPORTCL` or `THIRDPORTCH` 0 to 255 using `THIRDPORTA` or `THIRDPORTB`
`BitNum`	0 to 95 using `FIRSTPORTA`

CYDIO Series

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
	For **CYDIO48, CYDIO 48H/P, CYDIO 96/P**, and **CYDIO 192**, the following values are also valid: `SECONDPORTA`, `SECONDPORTB`, `SECONDPORTCL`, `SECONDPORTCH`
	For **CYDIO 96/P**, and **CYDIO 192**, the following argument values are also valid: `THIRDPORTA`, `THIRDPORTB`, `THIRDPORTCL`, `THIRDPORTCH`, `FOURTHPORTA`, `FOURTHPORTB`, `FOURTHPORTCL`, `FOURTHPORTCH`
	For **CYDIO 192**, the following values are also valid: `FIFTHPORTA` through `EIGHTHPORTCH`
`DataValue`	0 to 15 for `PORTCL` or `PORTCH` 0 to 255 for `PORTA` or `PORTB`
`BitNum`	0 to 23 using `FIRSTPORTA`
	For **CYDIO 48, CYDIO 48H/P, CYDIO 96/P**, and **CYDIO 192**, the following values are also valid: 24 to 47 using `FIRSTPORTA`
	For **CYDIO 96/P**, and **CYDIO 192**, the following values are also valid: 48 to 95 using `FIRSTPORTA`
	For **CYDIO 192**, the following values are also valid: 96 to 191

Event notification (CYDIO 24/P and CYDIO 24H/P; CYDIO 24LU and CYDIO 24U-S only)

Event notification functions and methods supported

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`

Event notification argument values

`EventType`	`ON_EXTERNAL_INTERRUPT` (UDR)/`OnExternalInterrupt` (UDR for .NET)

Hardware considerations

Event Notification

DIO Series boards that support event notification only support external rising edge interrupts.

CYDIO 24C and PCCDIO 24C Series

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue`	0 to 15 for `FIRSTPORTCL` or `FIRSTPORTCH` 0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 23 using `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 3
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7.)
`RegNum`:	`LOADREG1`, `LOADREG2`, `LOADREG3`

Event notification

CYDIO 24C and **PCCDIO 24C**

Event notification functions and methods supported

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`

Event notification argument values

`EventType`	`ON_EXTERNAL_INTERRUPT`

Hardware considerations

Counter configuration

Counter source functions are programmable using *Insta*Cal.

CYDIO 48HCP

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`, `SECONDPORTA`, `SECONDPORTB`, `SECONDPORTCL`, `SECONDPORTCH`
`DataValue`	0 to 15 for `FIRSTPORTCL` or `FIRSTPORTCH` 0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 47 using `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 15
`Config`	`HIGHONLASTCOUNT`, `ONESHOT`, `RATEGENERATOR`, `SQUAREWAVE`, `SOFTWARESTROBE`, `HARDWARESTROBE`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.).
`RegNum`:	`LOADREG1 – LOADREG15`

Event notification

Event notification functions and methods supported

UDR:	cbEnableEvent(), cbDisableEvent()
UDR for .NET:	EnableEvent(), DisableEvent()

Event notification argument values

`EventType`	`ON_EXTERNAL_INTERRUPT`

CPDISO 8/P and CPDISO 16/P Series

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

Digital I/O argument values

`PortNum`	`AUXPORT`
`DataValue`	**CPDISO 8/P** 0 to 255 **CPDISO 16/P** 0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.)
`BitNum`	**CPDISO 8/P** 0 to 7 **CPDISO 16/P** 0 to 15

Miscellaneous functions and methods supported (UCPDISO 08, UCPDISO 08-40, and CYPDISO 16E only)

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the USB LED on a CyberResearch USB module to blink. Causes the LINK LED on a CyberResearch Ethernet module to blink.

When you have several USB modules connected to the computer or Ethernet modules on the network, use these functions to identify a particular module by making its LED blink.

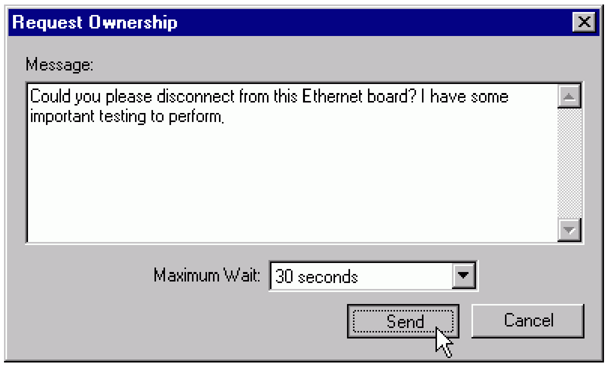
Establishing and requesting control of an CYPDISO 16E

The first computer to establish a TCP socket establishes control over an CYPDISO 16E. Additional computers that contact the device can only query the state of the device and its ports.

Sending a request for control of an CYPDISO 16E

If another computer already has control over CYPDISO 16E when you connect to it, you can send a message to the controlling computer. Do the following.

1. From *Insta*Cal's main window, double-click on the CYPDISO 16E.
2. From the **Ethernet Settings** tab, click on the **Request Ownership** button.
3. On the **Request Ownership** dialog, enter your message (up to 256 characters). Press **Ctrl** and **Enter** to go to a new line.
4. You can set how long the message is displayed on the computer that controls the CYPDISO 16E from the **Maximum Wait** drop-down list box.
5. When you are ready to send the message, click on the **Send** button.



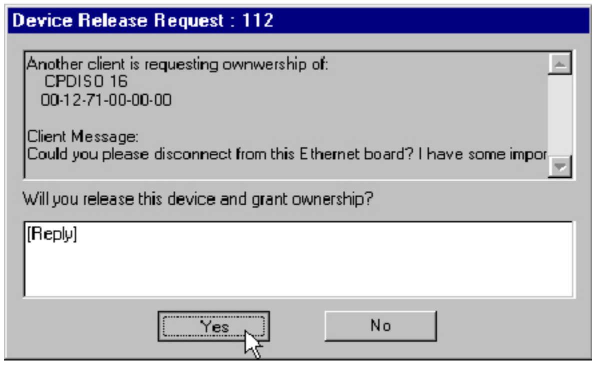
Message:

Could you please disconnect from this Ethernet board? I have some important testing to perform.

Maximum Wait: 30 seconds

Receiving a request for control of an CYPDISO 16E

If your computer controls a CYPDISO 16E and you receive a message from another person requesting control of the device, the message shows on your screen for the time the person set in the **Maximum Wait** drop-down list.



Another client is requesting ownwership of:
CPDISO 16
00-12-71-00-00-00

Client Message:
Could you please disconnect from this Ethernet board? I have some impor

Will you release this device and grant ownership?

[Reply]

- To disconnect and give control of the CYPDISO 16E to the person requesting, click on the **Yes** button.
- To retain control of the CYPDISO 16E, click on the **No** button.

Receiving a message

When a computer sends a message to the computer controlling the device, the message displays on the monitor of the controlling computer for the time specified by the **Time-out** value.

The message box has two buttons used to respond to the message. When you receive a message, enter a response in the message box and click on one of the following buttons.

- **Yes**: Click on **Yes** to give up ownership/control over the network device.

  The computer automatically disconnects from the network connection, and control over the device transfers to the computer that sent the message. The **Device Owner** property in *Insta*Cal updates with the name of the computer that gained control of the device.

- **No**: Click on **No** when you do not agree to give up ownership or control over the network device.

When you click on a button, the message box and selected response displays on the computer that sent the message.

CYPDMA 16 and CYPDMA 32

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOutScan()`, `cbDInScan()`, `cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DOutScan()`, `DInScan()`, `DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `AUXPORT`
`DataValue`	0 to 7 using `AUXPORT` (only `cbDOut()`is supported), 0 to 255 using `FIRSTPORTA` and `FIRSTPORTB`, 0 to 65535 using `WORDXFER FIRSTPORTA`.
`BitNum`	0 to 2 using `AUXPORT` (only `cbDBitOut()` and `DBitOut()`are supported), 0 to 15 using `PORTA`.
`Rate`	**CYPDMA 16**: 125 Kwords
	CYPDMA 32: 750 Kwords
`Options`	`BACKGROUND`, `CONTINUOUS`, `EXTCLOCK`, `WORDXFER`

Hardware considerations

Digital I/O Pacing

Hardware pacing, external or internal clock supported.

UMDIO 24 and UCDIO 24 Series

The CyberResearch brand UMDIO 24L, UMDIO 24LH, UCDIO 24-37, and UCDIO 24H-37 support the following UDR Library and UDR Library for .NET features.

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDIn()`, `cbDOut()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DIn()`, `DOut()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`
`DataValue`	0 to 15 for `FIRSTPORTCL` or `FIRSTPORTCH` 0 to 255 for `FIRSTPORTA` or `FIRSTPORTB`
`BitNum`	0 to 23 for `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbCIn()`*, `cbCIn32()`, `cbCLoad()`**, `cbCLoad32()`**
UDR for .NET:	`CIn()`*, `CIn32()`, `CLoad()`**, `CLoad32()`** *Although `cbCIn()` and `CIn()` are valid for use with this counter, `cbCIn32()` or `CIn32()` may be more appropriate, since the values returned may be greater than the data types used by `cbCIn()` and `CIn()` can handle. **`cbCLoad()`, `cbCLoad32()`, `CLoad()` and `CLoad32()` only accept `Count`=0. These functions are used to reset the counter.

Counter argument values

`CounterNum`	1
`Count`	0 to 2^{32}-1 when reading the counter.
`LoadValue`	0 when loading the counter.
	`cbCLoad()` and `cbCLoad32()` / `CLoad()` and `CLoad32()`are only used to reset the counter for this board to 0. No other values are valid. The "Basic signed integers" guidelines on page 93 apply when using `cbCIn()` or `CIn()` for values greater than 32767, and when using `cbCIn32()` or `CIn32()` for values greater than 2147483647.
`RegNum`	`LOADREG1`

Miscellaneous functions and methods supported

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the LED on a USB device to blink.

When you have several USB devices connected to the computer, use these functions to identify a particular device by making its LED blink.

UCDIO 96 Series

The CyberResearch brand UCDIO 96H, UCDIO 96H-50, and UCIDO 96H support the following UDR Library and UDR Library for .NET features.

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDIn()`, `cbDOut()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DIn()`, `DOut()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O arguments

`PortNum`:	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `FIRSTPORTCH`, `SECONDPORTA`, `SECONDPORTB`, `SECONDPORTCL`, `SECONDPORTCH`, `THIRDPORTA`, `THIRDPORTB`, `THIRDPORTCL`, `THIRDPORTCH`, `FOURTHPORTA`, `FOURTHPORTB`, `FOURTHPORTCL`, `FOURTHPORTCH`
`DataValue`:	0 to 15 for `PORTCL` or `PORTCH`
	0 to 255 for `PORTA` or `PORTB`
`BitNum`:	0 to 95 for `FIRSTPORTA`

Counter I/O

Counter functions and methods supported

UDR:	`cbCIn()`*, `cbCIn32()`, `cbCLoad()`**, `cbCLoad32()`**
UDR for .NET:	`CIn()`*, `CIn32()`, `CLoad()`**, `CLoad32()`**
	*Although `cbCIn()`/`CIn()` are valid for use with this counter, `cbCIn32()` or `CIn32()` may be more appropriate, since the values returned may be greater than the data types used by `cbCIn()` and `CIn()` can handle.
	**`cbCLoad()`, `cbCLoad32()`, `CLoad()` and `CLoad32()` only accept `Count`=0. These functions are used to reset the counter.
`CounterNum`:	1
`Count`	0 to 232-1 when reading the counter.
	The "Basic signed integers" guidelines on page 93 apply when using `cbCIn()` or `CIn()` for values greater than 32767, and when using `cbCIn32()` or `CIn32()` for values greater than 2147483647.
	0 when loading the counter.
	`cbCLoad()` and `cbCLoad32()`/`CLoad()` and `CLoad32()`are only used to reset the counter for this module to 0. No other values are valid.
`RegNum`	`LOADREG1`

Miscellaneous functions and methods supported

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the USB LED on a CyberResearch USB module to blink.

When you have several modules connected to the computer, use these functions to identify a particular module by making its LED blink.

UCSSR Series

The CyberResearch brand UCSSR 24 and UCSSR 08 both support the following UDR Library and UDR Library for .NET features unless noted otherwise.

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDIn()`, `cbDOut()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DIn()`, `DOut()`, `DBitIn()`, `DBitOut()`

Digital I/O arguments

PortNum	`FIRSTPORTCL`, `FIRSTPORTCH`
	For the **UCSSR 24**, the following argument values are also valid:
	`FIRSTPORTA`, `FIRSTPORTB`
`DataValue`	0 to 15 for `FIRSTPORTCL` and `FIRSTPORTCH`
	For the **UCSSR 24**, the following argument values are also valid:
	0 to 255 for `FIRSTPORTA` and `FIRSTPORTB`
BitNum	For the **UCSSR 08**, the following argument values are valid:
	16 to 23 for `FIRSTPORTA`
	For the **UCSSR 24**, the following argument values are valid:
	0 to 23 for `FIRSTPORTA`

Miscellaneous functions and methods supported

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the USB LED on a CyberResearch USB module to blink.

When you have several modules connected to the computer, use these functions to identify a particular module by making its LED blink.

Hardware considerations

Do not change state of switches while program is running

Do not change the state of any switches (labeled S1, S2, and S3) on a UCSSR module while a program is running. UDR Library stores the current state of each switch, and changing a switch setting while a program is running can cause unpredictable results.

UCPDISO 08L

The CyberResearch brand UCPDISO 08L supports the following UDR Library and UDR Library for .NET features.

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`,`cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

Digital I/O argument values

PortNum	`AUXPORT`
`DataValue`	0 to 255
`BitNum`	0 to 7

Miscellaneous functions and methods supported

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the USB LED on a CyberResearch USB module to blink.

When you have several modules connected to the computer, use these functions to identify a particular module by making its LED blink.

Digital Input Boards

Introduction

This section provides details on using digital input boards in conjunction with the CYDAS UDR Library. Boards released after the printing of this document will be described in Readme files on the CYDAS UDR Library disk.

To fully understand and maximize the performance of this and other digital input function calls, refer to the 82C55 data sheet in the *Documents* subdirectory of the installation. This document is available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed. Refer also to the 8536 data sheet (this data sheet file is not available in PDF format).

CYDI Series

Digital I/O

Digital input functions and methods supported

UDR:	`cbDIn`, `cbDBitIn()`
UDR for .NET:	`DIn`, `DBitIn()`

Digital input argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL` and `FIRSTPORTCH`.
	For **4/CYDI 48, CYDI 96**, and **CYDI 192**, the following argument values are also valid:
	`SECONDPORTA`, `SECONDPORTB`, `SECONDPORTCL`, `SECONDPORTCH`
	For **CYDI 96**, and **CYDI 192**, the following argument values are also valid:
	`THIRDPORTA`, `THIRDPORTB`, `THIRDPORTCL`, `THIRDPORTCH`, `FOURTHPORTA`, `FOURTHPORTB`, `FOURTHPORTCL`, `FOURTHPORTCH`
	For **CYDI 192**, the following argument value is also valid:
	`FIFTHPORTA` through `EIGHTHPORTCH`

`DataValue`	0 to 255 for `PORTA` or `PORTB`, 0 to 15 for `PORTCL` or `PORTCH`
`BitNum`	0 to 23 for `FIRSTPORTA` For **4/CYDI 48, CYDI 96**, and **CYDI 192**, the following argument values are also valid: 24 to 47 using `FIRSTPORTA` For **CYDI 96**, and **CYDI 192**, the following argument values are also valid: 48 to 95 using `FIRSTPORTA` For **CYDI 192**, the following argument values are also valid: 96 to 191

CYDIO 48

Digital I/O

Digital input functions and methods supported

UDR:	`cbDIn`, `cbDBitIn()`
UDR for .NET:	`DIn`, `DBitIn()`

Digital input argument values

`PortNum`	`FIRSTPORTA`, `SECONDPORTA`, `THIRDPORTA`, `FOURTHPORTA`, `FIFTHPORTA`, `SIXTHPORTA`
`DataValue`	0 to 255
`BitNum`	0 to 47 using `FIRSTPORTA`

Digital Output Boards

Introduction

This chapter provides details on using digital output boards in conjunction with the CYDAS UDR Library. Boards released after the printing of this document will be described in Readme files on the CYDAS UDR Library disk.

To fully understand and maximize the performance of this and other digital input function calls, refer to the 82C55 data sheet in the *Documents* subdirectory of the installation. This document is available on our website, on this software CD, and C:\MCC\Documents (by default) after software is installed. Refer also to the 8536 data sheet (this data sheet file is not available in PDF format).

CYREL Series

Digital I/O

Digital output functions and methods supported

UDR:	`cbDOut`, `cbDBitOut()`
UDR for .NET:	`DOut`, `DBitOut()`

Digital output argument values

`PortNum`	`FIRSTPORTA`
	For **CYREL 16 & 16/M**, the following argument values are also valid: `FIRSTPORTB`
	For **CYREL 24**, the following argument values are also valid: `SECONDPORTA`
	For **CYREL 32**, the following argument values are also valid: `SECONDPORTB`
`DataValue`	0 to 255
`BitNum`	0 to 7 using `FIRSTPORTA`
	For **CYREL 16 & 16/M**, the following argument values are also valid: 0 to 15 using `FIRSTPORTA`
	For **CYREL 24**, the following argument values are also valid: 0 to 23 using `FIRSTPORTA`
	For **CYREL 32**, the following argument values are also valid: 0 to 31 using `FIRSTPORTA`

UCERB Series

The CyberResearch brand UCERB 08 and UCERB 24 support the following UDR Library and UDR Library for .NET features.

Digital I/O

Digital output functions and methods supported

UDR:	`cbDIn()`, `cbDOut()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DIn()`, `DOut()`, `DBitIn()`, `DBitOut()`

Digital output argument values

PortNum	`FIRSTPORTCL`, `FIRSTPORTCH`
	For the **UCERB 24**, the following argument values are also valid:
	`FIRSTPORTA`, `FIRSTPORTB`
`DataValue`	0 to 15 for `FIRSTPORTCL` and `FIRSTPORTCH`
	For the **UCERB 24**, the following argument values are also valid:
	0 to 255 for `FIRSTPORTA` and `FIRSTPORTB`
BitNum	For the **UCERB 08**, the following argument values are valid:
	16 to 23 for `FIRSTPORTA`
	For the **UCERB 24**, the following argument values are valid:
	0 to 23 for `FIRSTPORTA`

Miscellaneous functions and methods supported

UDR:	`cbFlashLED()`
UDR for .NET:	`FlashLED()`

Causes the USB LED on a CyberResearch USB module to blink.

When you have several modules connected to the computer, use these functions to identify a particular module by making its LED blink.

Do not change state of invert/non-invert switch (S1) while program is running

Do not change the state of the invert/non-invert switch (labeled S1) on a UCERB module while a program is running. UDR Library stores the current state of this switch, and changing the switch setting while a program is running can cause unpredictable results.

4/CYDO Series

Digital I/O

Digital output functions and methods supported

UDR:	`cbDOut`, `cbDBitOut()`
UDR for .NET:	`DOut`, `DBitOut()`

Digital output argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL` and `FIRSTPORTCH`.
	For **4/CYDO 48H, CYDO 48HV, CYDO 96H** and **CYDO 192H**, the following argument values are also valid: `SECONDPORTA`, `SECONDPORTB`, `SECONDPORTCL`, `SECONDPORTCH`
	For **CYDO 96H** and **CYDO 192H**, the following argument values are also valid: `THIRDPORTA`, `THIRDPORTB`, `THIRDPORTCL`, `THIRDPORTCH`, `FOURTHPORTA`, `FOURTHPORTB`, `FOURTHPORTCL`, `FOURTHPORTCH`
	For **CYDO 192H**, the following argument values are also valid: `FIFTHPORTA` through `EIGHTHPORTCH`
`DataValue`	0 to 255 for `PORTA` or `PORTB`, 0 to 15 for `PORTCL` or `PORTCH`
`BitNum`	0 to 23 for `FIRSTPORTA`
	For **4/CYDO 48H, CYDO 48HV, CYDO 96H** and **CYDO 192H** the following argument values are also valid: 24 to 47 using `FIRSTPORTA`
	For **CYDO 96H** and **CYDO 192H**, the following argument values are also valid: 48 to 95 using `FIRSTPORTA`
	For **CYDO 192H**, the following argument values are also valid: 96 to 191

Counter Boards

Introduction

This chapter provides details on using counter/timer boards in conjunction with the CYDAS UDR Library. Boards released after the printing of this user's guide are explained in Readme files on the CYDAS UDR Library installation disk.

Basic signed integers

When reading or writing ports that are 16-bits wide, be aware of the following issue using signed integers (which is required when using Basic):

On some boards, such as the **CYCTM 10** count register or `AUXPORT` digital ports, the ports are 16-bits wide. When accessing the data at these ports, the digital values are arranged as a single 16-bit word. Using signed integers, values above 0111 1111 1111 1111 (32767 decimal) can be confusing. The next increment, 1000 0000 0000 0000 has a decimal value of -32768. Using signed integers, this is the value that is returned from a 16 bit counter at half of maximum count. The value for full count (just before the counter turns over) is -1. Keep this in mind if you are using Basic, since Basic does not supply unsigned integers (values from 0 to 65535) or unsigned longs (values from 0 to 4,294,967,295). Refer to "16-bit values using a signed integer data type" on page 7 for more information.

The CYDAS UDR Library provides functions for the initialization and configuration of counter chips, and can configure a counter for any of the counter operations. However, counter configuration does not include counter-use, such as event counting and pulse width. Counter-use is accomplished by programs which use the counter functions. The CYDAS UDR Library Version 1 and later provides the `cbCFreqIn()` function for counter use, while the CYDAS UDR Library for .NET provides the `CFreqIn()` method. Other functions and methods may be added for counter use to later revisions.

Read the counter chip's data sheet

To use a counter for any but the simplest counting function, you must read, understand, and employ the information contained in the chip manufacturer's data sheet. Technical support of the CYDAS UDR Library does not include providing, interpreting, or explaining the counter chip data sheet.

To fully understand and maximize the performance of the counter/timer boards and their related function calls, review the following related data sheet(s):

Counter/Timer	Data Sheet
82C54	82C54.pdf is located in the Documents installation subdirectory.
AM9513	9513A.pdf is located in the Documents installation subdirectory.
Z8536	The data book for the Z8536 counter chip is included with the product that employs this chip.
LS7266	LS7266R1.pdf is located in the Documents installation subdirectory.

Counter chip variables

UDR Library counter initialization and configuration functions include names for bit patterns, such as `ALEGATE`, which stands for `Active Low Enabled Gate N`. In any case where the UDR Library has a name for a bit pattern, it is allowed to substitute the bit pattern as a numeric. This will work, but your programs will be harder to read and debug.

CYCTM Series

Counter I/O

Counter functions and methods supported

UDR:	`cbC9513Config()`, `cbC9513Init()`, `cbCStoreOnInt()`, `cbCFreqIn()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C9513Config()`, `C9513Init()`, `CStoreOnInt()`, `CFreqIn()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 5 (All boards in this series) **CYCTM 10/P** & **4/CYCTM 10H** also support counters 6 through 10 **CYCTM 20H/U** also supports counters 11 through 20
`RegNum`:	`LOADREG1 – 5`, `HOLDREG1 – 5`, `ALARM1CHIP1`, `ALARM2CHIP1` **CYCTM 10/P** & **4/CYCTM 10H** also support `LOADREG6 – 10`, `HOLDREG6 – 10`, `ALARM1CHIP2`, `ALARM2CHIP2` **CYCTM 20H/U** also supports `LOADREG11 – 20`, `HOLDREG11 – 20`, `ALARM1CHIP3`, `ALARM2CHIP3`, `ALARM1CHIP4`, `ALARM2CHIP4`
`LoadValue`	0 to 65535 (Refer to "16-bit values using a signed integer data type" on page 7 for information on 16-bit values using unsigned integers.).
`ChipNum`	1 (All boards in this series) **CYCTM 10/P** & **4/CYCTM 10H** also support chip 2 **CYCTM 20H/U** also support chips 3 and 4
`FOutSource`	`CTRINPUT1 – 5`, `GATE1 – 5`, `FREQ1 – 5` These values refer to the sources on a particular 9513 chip, so are limited to the sources on that particular chip. For example, to set the source to the input for counter 6, use `CTRINPUT1` (the first counter on the second 9513 chip).
`CountSource`	`TCPREVCTR`, `CTRINPUT1 – 5`, `GATE1 – 5`, `FREQ1 – 5` These values refer to the sources on a particular 9513 chip, so are limited to the sources on that particular chip. For example, to set the source to the input for counter 6, use `CTRINPUT1` (the first counter on the second 9513 chip). Likewise for the `TCPREVCTR` value; when applied to the first counter on a chip (counter 6, for example) the "previous counter" is counter 5 on that chip (for this example, counter 10).

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDOut()`, `cbDIn()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DOut()`, `DIn()`, `DBitIn()`, `DBitOut()`

Digital I/O argument values

`PortNum`	`AUXPORT*`
`DataValue`	**CYCTM 05/P**: 0 to 255 **CYCTM 10/P**: 0 to 65535. Refer to "Basic signed integers" on page 112.
`BitNum`	**CYCTM 05/P**: 0 to 7; **CYCTM 10/P**: 0 to 15 * `AUXPORT` is not configurable for these boards.

Event notification

Event notification functions and methods supported

CYCTM 05P, **CYCTM 10P** and **CYCTM 20HU** only

UDR:	`cbEnableEvent()`, `cbDisableEvent()`
UDR for .NET:	`EnableEvent()`, `DisableEvent()`

Event notification argument values

`EventType`	`ON_EXTERNAL_INTERRUPT` (UDR)/`OnExternalInterrupt` (UDR for .NET)

Hardware considerations

Clock input frequency (PCI boards only)

The clock source for each of the four counters is configurable with *Insta*Cal:

CYCTM 05P, CYCTM 10P:	1 MHz, 1.67 MHz, 3.33 MHz, 5 MHz
CYCTM 20HU:	1 MHz, 1.67 MHz, 3.33 MHz, 5 MHz, or External

Event Notification

`ON_EXTERNAL_INTERRUPT` cannot be used with `cbCStoreOnInt()` or `CStoreOnInt()`.

CYCTM Series boards that support event notification only support external rising edge interrupts.

CYINT 32 Series

Counter I/O

Counter functions and methods supported

UDR:	`cbC8536Config()`, `cbC8536Init()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8536Config()`, `C8536Init()`, `CIn()`, `CLoad()`

Counter argument values

`CounterNum`	1 to 6
`ChipNum`	1 or 2
`RegName`	`LOADREG1` through `LOADREG6`
`LoadValue`	Values up to 65,535 (2^{16}–1) can be used. Refer to "Basic signed integers" on page 112 for more information.

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDIn()`, `cbDOut()`, `cbDBitIn()`, `cbDBitOut()`, `cbDConfigPort()`
UDR for .NET:	`DIn()`, `DOut()`, `DBitIn()`, `DBitOut()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `FIRSTPORTCL`, `SECONDPORTA`, `SECONDPORTB` and `SECONDPORTCL`.
`DataValue`	0 to 255 using `PORTA` or `PORTB` 0 to 15 using `PORTCL`
`BitNum`	0 to 39 using `FIRSTPORTA`

Hardware considerations

Argument Value vs. configuration

These boards have two 8536 chips, which have both counter and digital I/O and interrupt vectoring capabilities. The numbers stated for digital I/O apply when both chips are configured for the maximum number of digital devices. The numbers stated for counter I/O apply when both chips are configured for the maximum number of counter devices.

PPIO CTR06

Counter I/O

Counter functions and methods supported

UDR:	`cbC8254Config()`, `cbCIn()`, `cbCLoad()`
UDR for .NET:	`C8254Config()`, `CIn()`, `CLoad()`

Counter argument values

CounterNum	1 to 6

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDIn()`, `cbDOut()`, `cbDBitIn()`, `cbDBitOut()`
UDR for .NET:	`DIn()`, `DOut()`, `DBitIn()`, `DBitOut()`

Digital I/O argument values

`PortNum`	`AUXPORT*`
`DataValue`	0 to 15, or 0 to 255, depending on jumper setting
`BitNum`	0 to 3, or 0 to 7, depending on jumper setting

* `AUXPORT` is not configurable for this board.

CYQUAD Series

Counter I/O

Counter functions and methods supported

UDR:	`cbC7266Config()`, `cbCIn()`, `cbCIn32()`, `cbCLoad()`, `cbCLoad32()`, `cbCStatus()`
UDR for .NET:	`C7266Config()`, `CIn()`, `CIn32()`, `CLoad()`, `CLoad32()`, `CStatus()`

Counter argument values

`CounterNum`	**PCYQUAD 02**, **CYQUAD 02** 1 to 2 **CYQUAD 04**, **CYQUAD 04P** 1 to 4

`RegName`	UDR:
	`COUNT1`, `COUNT2`, `PRESET1`, `PRESET2`, `PRESCALER1`, `PRESCALER2`
	UDR for .NET:
	`QuadCount1`, `QuadCount2`, `QuadPreset1`, `QuadPreset2`, `QuadPreScaler1`, `QuadPreScaler2`
	CYQUAD 04, **CYQUAD 04P** also support:
	UDR:
	`COUNT3`, `COUNT4`, `PRESET3`, `PRESET4`, `PRESCALER3`, `PRESCALER4`
	UDR for .NET:
	`QuadCount3`, `QuadCount4`, `QuadPreset3`, `QuadPreset4`, `QuadPreScaler3`, `QuadPreScaler4`

`LoadValue`	When using `cbCLoad32()` or `CLoad32()` to load the `COUNT#` or `PRESET#` registers, values up to 16.78 million (2^{24}–1) can be loaded. Values using `cbCLoad()` and `CLoad()`are limited to 65,535 (2^{16}–1). Refer to "Basic signed integers" on page 112 for more information. When loading the `PRESCALER#` register, values can be from 0 to 255. (Digital Filter Clock frequency = 10 MHz/LoadValue + 1.)

Hardware considerations

Loading and Reading 24-bit values

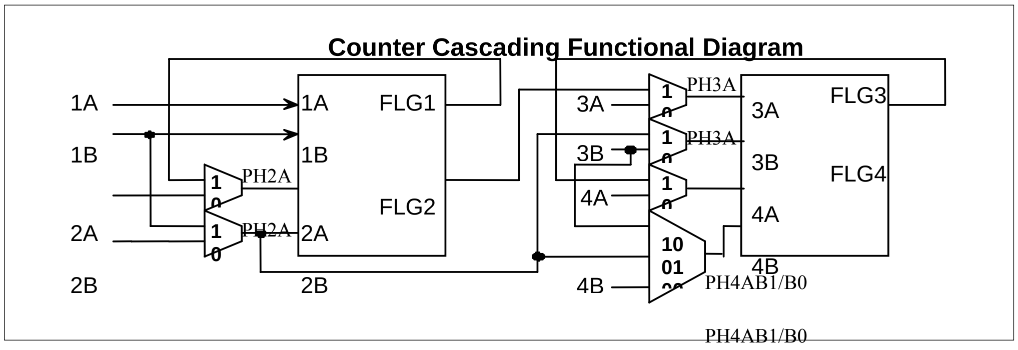
The **CYQUAD** series boards feature a 24-bit counter. For counts of less than 16 bits (65535), you can use the `cbCIn()` and `cbCLoad()` functions, or the `CIn()` and `CLoad()` methods. You can use the `cbCIn32()` and `cbCLoad()` functions, or the `CIn32()` and `CLoad32()` methods for any number supported by the LS7266 counter (24 bits = 16777216).

Cascading counters (CYQUAD 04P only)

The **CYQUAD 04P** can be set up for cascading counters. By setting the appropriate registers, you can have (4) 24-bit counters, (2) 48-bit counters, (1) 24-bit and (1) 72-bit counters, or (1) 96-bit counter. The `OUTPUT` pins of a counter are directed to the next counter by setting the `FLG1` to `CARRY/BORROW` and the `FLG2` to `UP/DOWN`. Bits 3 and 4 of the IOR Register control are set to 1,0 to accomplish this.

You can set these bits by using the functions `cbC7266Config(BoardNum`, `CounterNum`, `Quadrature`, `CountingMode`, `DataEncoding`, `IndexMode`, `InvertIndex`, `FlagPins`, and `GateEnable)`. When using the CYDAS UDR Library for .NET, use the `C7266Config()` method.
The constant `CARRYBORROW_UPDOWN` (value of 3) is used for the parameter `FlagPins`.

The IOR register cannot be read. However, you can read the values of the BADR2+9 register. The value for Base 2 can be determined by looking at the resources used by the board. The 8-bit region is BADR2. The BADR+9 register contains values for PhxA and PhxB, for x = 1 to 4 to identify counters. The diagram below indicates the routing of the FLG pins depending on the value of PhxA and PhxB. The actual values of the BADR2+9 register are shown below:



Register BADR2 + 9 D0-D6

	PH2A	PH2B	PH3A	PH3B	PH4A	PH4B1/PH4B0	Value
Case 1: (4) 24-bit counters (1/2/3/4)	0	0	0	0	0	0,0	00
Case 2: (2) 48-bit counters (1-2/3/4)	1	1	0	0	1	1,0	53
Case 3: (1) 24-bit, (1) 72-bit (1/2-3-4)	0	0	1	1	1	0,1	3C
Case 4: (1) 96-bit counter (1-2-3-4)	1	1	1	1	1	0,1	3F

Defaults to 0x00 (no inter-counter connections).

Examples

Case 1: (4) 24-bit counters (1/2/3/4)

```
cbC7266Config(0,1,0,0,2,0,0,1,0)
cbC7266Config(0,2,0,0,2,0,0,1,0)
cbC7266Config(0,3,0,0,2,0,0,1,0)
cbC7266Config(0,4,0,0,2,0,0,1,0)
```

Case 2: (2) 48-bit counters (1-2/3-4)

```
cbC7266Config(0,1,0,0,2,0,0,3,0)
cbC7266Config(0,2,0,0,2,0,0,1,0)
cbC7266Config(0,3,0,0,2,0,0,3,0)
cbC7266Config(0,4,0,0,2,0,0,1,0)
```

Case 3: (1) 24-bit & (1) 72-bit counter (1/2-3-4)

```
cbC7266Config(0,1,0,0,2,0,0,1,0)
cbC7266Config(0,2,0,0,2,0,0,3,0)
cbC7266Config(0,3,0,0,2,0,0,3,0)
cbC7266Config(0,4,0,0,2,0,0,1,0)
```

Case 4: (1) 96-bit counter (1-2-3-4)

```
cbC7266Config(0,1,0,0,2,0,0,3,0)
cbC7266Config(0,2,0,0,2,0,0,3,0)
cbC7266Config(0,3,0,0,2,0,0,3,0)
cbC7266Config(0,4,0,0,2,0,0,1,0)
```

The actual value of `the` `BADR+9` register is not set until the `cbCLoad()`/`CLoad()` command is called.

Counter4 setting
Setting Counter4 to `CARRYBORROW-UPDOWN` is NOT VALID.

Expansion Boards

Introduction

This chapter provides details on using expansion (CYEXP) boards in conjunction with the CYDAS UDR Library. Boards released after the printing of this user's guide are described in Readme files on the CYDAS UDR Library disk.

You add an expansion board to the *Insta*Cal configuration by selecting the compatible board on the main **InstaCal** form, and selecting the **Add Exp Board…** option from the **Install** menu.

CYEXP Series

Temperature Input

Temperature input functions and methods supported

UDR:	`cbTIn()`, `cbTInScan()`
UDR for .NET:	`TIn()`, `TInScan()`

Temperature input argument values

`Options`	`NOFILTER`
`Scale`	`CELSIUS`, `FAHRENHEIT`, `KELVIN`
`HighChan`	From 16 up to 255 for 16-channel boards, and from 64 up to 303 for 64-channel boards. The value depends on the number of boards connected and the application.

Hardware considerations

CYEXP boards are used only in combination with an A/D board. Channel numbers for accessing the expansion boards begin at 16 for 8-channel and 16-channel boards, and at 64 for 64-channel boards. To calculate the channel number for access to **CYEXP** channels, use the following formula:

```
Chan = (ADChan  * 16) + (16 + MuxChan)
```

`MuxChan` is a number ranging from 0 to 15 that specifies the channel number on a particular bank of the expansion board. An **CYEXP 32** has two banks, so the channel numbers for one **CYEXP 32** connected to an A/D board would range from 16 to 47.

If all A/D channels are not used for **CYEXP** output, direct input to the A/D board is still available at these channels (using channel numbers below 16).

When **CYEXP** boards are used for **temperature input**, set the gain of the A/D board to a specific range. When using A/D boards with programmable gain, the range is set by the CYDAS UDR Library. However, when using boards with switch-selectable gains, you must set the gain to a range that is dependent on the temperature sensor in use. Generally, thermocouple measurements require the A/D board to be set to 5 V bipolar, if available (or 10 V bipolar if not). RTD sensors require a setting of 10 V unipolar, if available. These checks are made when you configure the system for temperature measurement using *Insta*Cal.

CYDAS DT-FIFO

Memory I/O

Memory I/O is only used in combination with a board which has DT-Connect.

Memory functions and methods supported

UDR:	`cbMemSetDTMode()`, `cbMemReset()`, `cbMemRead()`, `cbMemWrite()`, `cbMemReadPretrig()`
UDR for .NET:	`MemSetDTMode()`, `MemReset()`, `MemRead()`, `MemWrite()`, `MemReadPretrig()`

Some of these functions are integrated into the `cbAInScan()` function and `AInScan()` method. For example, if you use **CYDAS DT-FIFO** with an A/D board and select the `EXTMEMORY` option, you would not have to call the `cbMemSetDTMode()` and `cbMemWrite` functions, or the `MemSetDTMode()` and `MemWrite()`methods.

`EXTMEMORY` option

`Continuous` mode can't be used with the `EXTMEMORY/ExtMemory` option.

Other Hardware

Introduction

This chapter provides details on using miscellaneous hardware, such as communications boards in conjunction with the CYDAS UDR Library and CYDAS UDR Library for .NET. Boards released after the printing of this user's guide will be described in Readme files on the CYDAS UDR Library disk.

PCYCOM 422 Series

No library functions are supported for these boards, but *Insta*Cal can be used to configure the serial protocol in conjunction with the `Set422.exe` utility. All other serial communications are handled by DOS or Windows standard serial communications handlers.

PCYCOM 485 Series

The **PCYCOM 485** Series board supports the UDR Library function `cbRS485()` and the UDR Library for .NET method `RS485()` for controlling the transmit and receive enable register. All other serial communications are handled by DOS or Windows standard serial communications handlers.

Demo Board

The **DEMO BOARD** is a software simulation of a data acquisition board that simulates analog input and digital I/O operations.

Analog Input

Analog input functions and methods supported

UDR:	`cbAIn()`, `cbAInScan()`, `cbATrig()`, `cbFileAInScan()`
UDR for .NET:	`AIn()`, `AInScan()`, `ATrig()`, `FileAInScan()`

Analog input argument values

`Options`	`BACKGROUND`, `CONTINUOUS`, `SINGLEIO`, `DMAIO`
`HighChan`	7 max
`Rate`	300000

Digital I/O

Digital I/O functions and methods supported

UDR:	`cbDIn()`, `cbDBitIn()`, `cbDInScan()`, `cbDOut()`, `cbDBitOut()`, `cbDOutScan()`, `cbDConfigPort()`
UDR for .NET:	`DIn()`, `DBitIn()`, `DInScan()`, `DOut()`, `DBitOut()`, `DOutScan()`, `DConfigPort()`

Digital I/O argument values

`PortNum`	`FIRSTPORTA`, `FIRSTPORTB`, `AUXPORT`
`DataValue`	0 to 255 using `FIRSTPORTA`, `FIRSTPORTB`, or `AUXPORT`
`BitNum`	0 to 15 using `FIRSTPORTA` 0 to 7 using `AUXPORT`

Using the Demo Board

Analog input

The **DEMO BOARD** simulates eight channels of 16-bit analog input. *Insta*Cal is used to configure the following waveforms on the analog input channels:

- sine wave
- square wave
- saw-tooth, ramp
- damped sine wave
- input from a data file

The data file is a streamer file, so any data that has been previously saved in a streamer file can be used as a source of demo data by the board. Data files are named `DEMO0.DAT` through `DEMO7.DAT`. When a data file is assigned to a channel, the library tries to extract data for that channel from the streamer file. If data for that channel does not exist, then the first (and possibly only) channel data in the streamer is extracted and used.

For example, `DEMO2.DAT` is assigned as the data source for channel 5 on the demo board. The library will try to extract data from the file that corresponds to channel 5. If `DEMO2.DAT` has scan data that corresponds to channels 0 through 15, then channel 5 data is extracted. If `DEMO2.DAT` only has data for a single channel, the data for that channel is used as the data source for channel 5.

Digital I/O

The **DEMO BOARD** simulates the following:

- One eight-bit `AUXPORT` non-configurable digital input port. Each bit of the `AUXPORT` generates a square wave with a different period.
- One eight-bit `AUXPORT` non-configurable digital output port.
- Two eight-bit configurable digital I/O ports—`FIRSTPORTA`, `FIRSTPORTB`—which can be used for high speed scanning. `FIRSTPORTA` functions like `AUXPORT` in that it generates square waves. Each bit of `FIRSTPORTB` generates a pulse with a different frequency.

Appendix – Device IDs

This Appendix lists the device ID associated with each hardware type. This information is returned by the `BoardName` and `BoardNum` arguments.

Board Name	Device ID
CYDAS 1602HRDAP	1
CYDAS 6402	8
CYDAS 1802M1HR	9
CYDAS 6402HR	10
CYDIO 48HP	11
CYPDISO 8P	12
CYPDISO 16P	13
CYDAS 1202DAP	15
CYDAS 1602DAP	16
CYREL 16M	17
CYPDMA 32	18
CYDDA 04HRHS	19
CYDIO 24HP	20
CYDIO 24HCP	21
CYDIO 48HCP	22
CYDIO 96HP	23
CYCTM 05P	24
CYDAS 1202P	25
CYDAS 1001DAP	26
CYDAS 1002DAP	27
CYDAS 1602	28
CYDAS 6402HRDAP	29
CYDAS 6402DAP	30
CYDDA 02P	32
CYDDA 04P	33
CYDDA 08P	34
CYDDA 02HRP	35
CYDDA 04HRP	36
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Product Service

Diagnosis and Debug

CyberResearch, Inc. maintains technical support lines staffed by experienced Applications Engineers and Technicians. There is no charge to call and we will return your call promptly if it is received while our lines are busy. Most problems encountered with data acquisition products can be solved over the phone. Signal connections and programming are the two most common sources of difficulty. CyberResearch support personnel can help you solve these problems, especially if you are prepared for the call.

To ensure your call’s overall success and expediency:

1) Have the phone close to the PC so you can conveniently and quickly take action that the Applications Engineer might suggest.
2) Be prepared to open your PC, remove boards, report back-switch or jumper settings, and possibly change settings before reinstalling the modules.
3) Have a volt meter handy to take measurements of the signals you are trying to measure as well as the signals on the board, module, or power supply.
4) Isolate problem areas that are not working as you expected.
5) Have the source code to the program you are having trouble with available so that preceding and prerequisite modes can be referenced and discussed.
6) Have the manual at hand. Also have the product’s utility disks and any other relevant disks nearby so programs and version numbers can be checked.

Preparation will facilitate the diagnosis procedure, save you time, and avoid repeated calls. Here are a few preliminary actions you can take before you call which may solve some of the more common problems:

1) Check the PC-bus power and any power supply signals.
2) Check the voltage level of the signal between SIGNAL HIGH and SIGNAL LOW, or SIGNAL+ and SIGNAL– . It CANNOT exceed the full scale range of the board.
3) Check the other boards in your PC or modules on the network for address and interrupt conflicts.
4) Refer to the example programs as a baseline for comparing code.

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Warranty Notice

CyberResearch, Inc. warrants that this equipment as furnished will be free from defects in material and workmanship for a period of one year from the confirmed date of purchase by the original buyer and that upon written notice of any such defect, CyberResearch, Inc. will, at its option, repair or replace the defective item under the terms of this warranty, subject to the provisions and specific exclusions listed herein.

This warranty shall not apply to equipment that has been previously repaired or altered outside our plant in any way which may, in the judgment of the manufacturer, affect its reliability. Nor will it apply if the equipment has been used in a manner exceeding or inconsistent with its specifications or if the serial number has been removed.

CyberResearch, Inc. does not assume any liability for consequential damages as a result from our products uses, and in any event our liability shall not exceed the original selling price of the equipment.

The equipment warranty shall constitute the sole and exclusive remedy of any Buyer of Seller equipment and the sole and exclusive liability of the Seller, its successors or assigns, in connection with equipment purchased and in lieu of all other warranties expressed implied or statutory, including, but not limited to, any implied warranty of merchant ability or fitness and all other obligations or liabilities of seller, its successors or assigns.

The equipment must be returned postage prepaid. Package it securely and insure it. You will be charged for parts and labor if the warranty period has expired.

Returns and RMAs

If a CyberResearch product has been diagnosed as being non-functional, is visibly damaged, or must be returned for any other reason, please call for an assigned RMA number. The RMA number is a key piece of information that lets us track and process returned merchandise with the fastest possible turnaround time.

PLEASE CALL FOR AN RMA NUMBER!

Packages returned without an RMA number will be refused!

In most cases, a returned package will be refused at the receiving dock if its contents are not known. The RMA number allows us to reference the history of returned products and determine if they are meeting your application’s requirements. When you call customer service for your RMA number, you will be asked to provide information about the product you are returning, your address, and a contact person at your organization.

Please make sure that the RMA number is prominently displayed on the outside of the box.

• Thank You •

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