

DDA-06  
External DAS Driver

**USER'S GUIDE**

# **DDA-06 External DAS Driver User's Guide**

Revision B - November 1994  
Part Number: 53121

## **New Contact Information**

Keithley Instruments, Inc.  
28775 Aurora Road  
Cleveland, OH 44139

Technical Support: 1-888-KEITHLEY  
Monday – Friday 8:00 a.m. to 5:00 p.m (EST)  
Fax: (440) 248-6168

Visit our website at <http://www.keithley.com>

The information contained in this manual is believed to be accurate and reliable. However, Keithley Instruments, Inc., assumes no responsibility for its use or for any infringements of patents or other rights of third parties that may result from its use. No license is granted by implication or otherwise under any patent rights of Keithley Instruments, Inc.

KEITHLEY INSTRUMENTS, INC., SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RELATED TO THE USE OF THIS PRODUCT. THIS PRODUCT IS NOT DESIGNED WITH COMPONENTS OF A LEVEL OF RELIABILITY SUITABLE FOR USE IN LIFE SUPPORT OR CRITICAL APPLICATIONS.

Refer to your Keithley Instruments license agreement for specific warranty and liability information.

MetraByte and EASYEST AG are trademarks of Keithley Instruments, Inc. VIEWDAC, EASYEST LX, and ASYST are registered trademarks of Keithley Instruments, Inc. All other brand and product names are trademarks or registered trademarks of their respective companies.

© Copyright Keithley Instruments, Inc., 1991, 1994.

All rights reserved. Reproduction or adaptation of any part of this documentation beyond that permitted by Section 117 of the 1976 United States Copyright Act without permission of the Copyright owner is unlawful.

**Keithley MetraByte Division**

**Keithley Instruments, Inc.**

440 Myles Standish Blvd. Taunton, MA 02780

Telephone: (508) 880-3000 • FAX: (508) 880-0179

# Preface

The DDA-06 External DAS Driver allows you to use Keithley MetraByte DDA-06 and  $\mu$ CDDA-04 boards with the following Keithley MetraByte data acquisition and analysis software:

- VIEWDAC<sup>®</sup>
- EASYEST LX<sup>®</sup>
- EASYEST AG<sup>™</sup>
- ASYST<sup>®</sup>

This manual provides the information needed to use the DDA-06 External DAS Driver with data acquisition and analysis software. Use this manual in conjunction with your board user's guide and with the documentation for the data acquisition software you are using.

---

**Note:** The DDA-06 External DAS Driver may support options your software does not; likewise, your software may support options this external driver does not.

---

If you need help, contact your local sales office or the Keithley MetraByte Applications Engineering Department between 8 am and 6 pm (Eastern Time), Monday through Friday:

**Keithley MetraByte**  
Applications Engineering  
440 Myles Standish Boulevard  
Taunton, Massachusetts 02780

**Telephone 508/880-3000**  
Telex 503989  
FAX 508/880-0179

# Table of Contents

## Preface

Supported Hardware . . . . .	1
Options Supported . . . . .	1
Files on Disk . . . . .	2
Quick Start . . . . .	2
Setting up the Board . . . . .	2
Running the Configuration Program . . . . .	2
Loading the DDA-06 External DAS Driver . . . . .	4
Accessing the DDA-06 External DAS Driver . . . . .	5
Using the Configuration Program . . . . .	5
Menu Items . . . . .	5
Special Purpose Keys . . . . .	7
Exiting the DDA-06 Configuration Program . . . . .	8
Configuring the DDA-06 External DAS Driver from DOS . . . . .	8
DDA-06 External DAS Driver Characteristics . . . . .	10
Analog Output . . . . .	10
Multiple-Point Data Transfers . . . . .	10
Digital I/O Port/Channel Numbering . . . . .	10
Software Interrupt Vectors . . . . .	12
DDA-06 External DAS Driver Error Messages . . . . .	12

## List of Tables

Table 1.	Configuration Program Menu Items . . . . .	6
Table 2.	Digital I/O Port Configuration Modes . . . . .	6
Table 3.	Configuration Menu Special Keys . . . . .	7
Table 4.	Command Line Options . . . . .	9
Table 5.	Digital I/O Port/Channel Configuration Numbering . . . . .	11
Table 6.	Example of a Port/Channel Configuration Mode 2	11
Table 7.	Interrupts and Environment Strings . . . . .	12
Table 8.	Error Messages from the DDA-06 External DAS Driver . . . . .	13

Table 1.	Configuration Program Menu Items . . . . .	6
Table 2.	Digital I/O Port Configuration Modes . . . . .	6
Table 3.	Configuration Menu Special Keys . . . . .	7
Table 4.	Command Line Options . . . . .	9
Table 5.	Digital I/O Port/Channel Configuration Numbering .	11
Table 6.	Example of a Port/Channel Configuration Mode 2	11
Table 7.	Interrupts and Environment Strings . . . . .	12
Table 8.	Error Messages from the DDA-06 External DAS	
Driver		13



# Using the DDA-06 External DAS Driver

The DDA-06 External DAS Driver allows your VIEWDAC, EASYEST LX, EASYEST AG, or ASYST application program to exchange data with the DDA-06 boards. This document describes how to use the DDA-06 External DAS Driver.

## Supported Hardware

---

The DDA-06 External DAS Driver supports the following Keithley MetraByte data acquisition (DAS) boards:

- DDA-06 (standard architecture)
- $\mu$ CDDA-04 (Micro Channel™ architecture)

## Options Supported

---

The DDA-06 External DAS Driver supports the following options:

- Analog output operations
  - Six 12-bit analog output channels on the DDA-06
  - Four 12-bit analog output channels on the  $\mu$ CDDA-04
  - Internal clocking
  - Internal triggering
- Digital I/O operation
  - 24 bits of digital I/O
  - Internal clocking
  - Internal triggering

## Files on Disk

---

The driver disk contains the file DDA06.EXE. DDA06.EXE controls the boards and allows communication between an application program and the DDA-06 and  $\mu$ CDDA-04 boards. DDA06.EXE executes as a terminate-and-stay-resident (TSR) program that occupies a small amount of memory in your computer.

## Quick Start

---

This section briefly describes how to configure, load, and access the DDA-06 External DAS Driver.

## Setting up the Board

Refer to your board user's guide for information on setting the jumpers/switches for the base address and the DAC (digital-to-analog converter) output ranges. Remember these settings when you use the DDA-06 External DAS Driver configuration program.

## Running the Configuration Program

The DDA-06 External DAS Driver is set up for the following default configuration:

- Base address = 300h
- DAC output range =  $\pm 10$  V
- Digital I/O port configuration mode = three 8-bit digital input channels; no digital output channels
- Number of boards = 1
- Board type = DDA-06

You must run the configuration program or configure the driver from DOS if your board's settings differ from these default settings. In addition, whenever you change the hardware or software settings, you must run the configuration program or reconfigure the driver from DOS in order for the external DAS driver to function properly.

---

**Notes:** For the  $\mu$ CDDA-04 board, you must run this configuration program in addition to the PS/2 configuration program for the board.

Each memory resident image of the DDA-06 External DAS Driver can support two DDA-06 or  $\mu$ CDDA-04 boards. If you are using more than one DDA-06 or  $\mu$ CDDA-04 board, you must configure the parameters for each board, ensuring that the base address does not conflict between the two boards.

---

Perform the following steps to run the configuration program:

1. Create a DDA06 subdirectory on your hard disk. For example, at the DOS prompt, enter the following:

```
MKDIR DDA06
```

2. Copy DDA06.EXE from the driver disk into the DDA06 directory.
3. Enter the following at the DOS prompt:

```
CD \DDA06  
DDA06 -MENU
```

Configure the board parameters using the configuration program, as described in "Using the Configuration Program" on page 5.

---

**Note:** If you wish, you can also configure the DDA-06 External DAS Driver from DOS instead of using the configuration program; refer to page 8 for more information.

---

## Loading the DDA-06 External DAS Driver

You must load the DDA-06 External DAS Driver each time you start up your computer in order for an application program to recognize it. The external DAS driver remains in memory until the computer is turned off or rebooted.

To load the DDA-06 External DAS Driver, access the directory containing DDA06.EXE and enter the following at the DOS prompt:

```
DDA06
```

---

**Notes:** You can also load the DDA-06 External DAS Driver automatically whenever you start the computer by adding the preceding line to your AUTOEXEC.BAT file.

If you want to access more than two boards, load the driver multiple times and use configuration files to recall the configurations.

For example, to access three DDA-06 boards you could create two configuration files: DDA061.CFG and DDA062.CFG. DDA061.CFG contains the configuration data for two boards at addresses 300h and 310h, and DDA062.CFG contains the configuration data for a single DDA-06 board at address 340h. To load these drivers, use the @ command line option, as follows:

```
DDA06 @DDA061.CFG  
DDA06 @DDA062.CFG
```

---

## Accessing the DDA-06 External DAS Driver

Some application programs access the DDA-06 External DAS Driver automatically. For information on accessing external DAS drivers, see the documentation for your application program.

If you are using the ASYST program, perform the following steps to access the DDA-06 External DAS Driver.

1. After loading the DDA-06 External DAS Driver, boot *ASYST* 2.10 or greater and permanently load the *Ext DAS Driver Support* system overlay from the Data Acquisition menu. *ASYST* automatically searches for and creates a DAS device called DDA06.
2. Enter the following at the OK prompt to make DDA-06 the current device:

```
DDA06
```

## Using the Configuration Program

---

This section describes the configuration program's menu items and special purpose keys, and how to exit from the configuration program.

### Menu Items

When you run the configuration program, the configuration menu is displayed. The menu options, choices, and default values are listed in Table 1.

**Table 1. Configuration Program Menu Items**

Menu Item	Choices	Default Value
Base I/O Address	200h to 3F0h (in multiples of 10h)	300h
DAC Output Range	0 = $\pm 10$ V	0 ( $\pm 10$ V)
	1 = $\pm 5$ V	
	2 = $\pm 2.5$ V	
	3 = 0 to 10 V	
	4 = 0 to 5 V	
	5 = 4 to 20 mA	
Digital I/O Port Configuration Mode	0 to 12; see Table 2 for a description of the available digital I/O port configuration modes	0 (three 8-bit digital input channels; no digital output channels)
Number of Boards	1, 2	1
Board Type	DDA-06, $\mu$ CDDA-04	DDA-06

Table 2 lists the the digital I/O port configuration modes available.

**Table 2. Digital I/O Port Configuration Modes**

Mode	Input	Output
0	three 8-bit channels	—
1	two 8-bit channels	one 8-bit channel
2	one 8-bit channels	two 8-bit channels
3	—	three 8-bit channels
4	two 12-bit channels	—
5	one 12-bit channel	one 12-bit channel
6	—	two 12-bit channels
7	one 16-bit channel	one 8-bit channel
8	one 8-bit channel	one 16-bit channel

**Table 2. Digital I/O Port Configuration Modes (cont.)**

<b>Mode</b>	<b>Input</b>	<b>Output</b>
9	one 20-bit channel	one 4-bit channel
10	one 4-bit channel	one 20-bit channel
11	one 24-bit channel	—
12	—	one 24-bit channel

## Special Purpose Keys

Table 3 describes the keys used for special purposes in the configuration program.

**Table 3. Configuration Menu Special Keys**

<b>Keys</b>	<b>Description</b>
[w]	Write a response file. A response file is an ASCII file containing the command line options for the current configuration of the driver.
[q]	Quit the configuration program without loading the driver.
[d]	Reset the driver settings to their default values.
[Esc]	Exit the configuration menu with the option of saving the current settings and loading the driver into memory.
[Tab]	Toggle between boards 1 and 2 when two boards are being configured.
[?]	Invoke help on the current menu item.

## Exiting the DDA-06 Configuration Program

To exit the configuration program without saving any changes, press [q]. Otherwise, to exit the configuration program press [Esc]. The following prompt is displayed:

```
Do you want to permanently save this configuration?  
[Y/N]
```

Type [Y] to save the configuration; type [N] if you do not want to save the configuration settings. If the configuration is saved, the program displays the message:

```
Remembering...
```

Then, you are prompted with the following message:

```
Exit Configuration Program? [Y/N]
```

Type [Y] to exit from the configuration program; type [N] to remain in the configuration program.

## Configuring the DDA-06 External DAS Driver from DOS

If you wish, you can also change the configuration of the DDA-06 External DAS Driver using DOS command line options instead of using the configuration program. The command line syntax is as follows:

```
DDA06 [bd #1 options],[bd #2 options] [-menu ]
```

The command line options are described in Table 4.



**Table 4. Command Line Options**

<b>Option</b>	<b>Function</b>
-a###	Board I/O address = ### (in hexadecimal); see Table 1 on page 6
-dio#	Digital I/O Port Configuration Mode = # ; see Table 2 on page 6
-DAC0#	DAC 0 output range = #; see Table 1 on page 6
-DAC1#	DAC 1 output range = # ; see Table 1 on page 6
-DAC2#	DAC 2 output range = #; see Table 1 on page 6
-DAC3#	DAC 3 output range = #; see Table 1 on page 6
-DAC4#	DAC 4 output range = # ; see Table 1 on page 6
-DAC5#	DAC 5 output range = #; see Table 1 on page 6
-4	Specify board type as $\mu$ CDDA-04
-6	Specify board type as DDA-06
?	Help
-def	Recall default driver settings
-menu	Invoke menu-driven setup
@ <i>filename</i>	Indicates use of response file <i>filename</i> . A response file is an ASCII file containing the command line options for the driver.

## **DDA-06 External DAS Driver Characteristics**

---

The following sections describe the various attributes of the DDA-06 External DAS Driver and the restrictions imposed by the external DAS driver on various modes of operations and resources.

### **Analog Output**

The DDA-06 external DAS driver supports simultaneous update of any or all of the analog output channels.

For the DDA-06, set the jumper block marked “X” and “N” in the “X” position for simultaneous update. For the  $\mu$ CDDA-04, you select simultaneous update through the PS/2 configuration program.

The maximum number of scans for this driver is one.

### **Multiple-Point Data Transfers**

The DDA-06 External DAS Driver does not support clocked, multiple-point data transfers. The driver can input or output only one point per channel each time it is called. The driver returns an error if it receives a request for more than one conversion per channel.

### **Digital I/O Port/Channel Numbering**

Table 5 shows the possible port/channel configurations as well as the assignment of digital channel numbers to the hardware digital ports.

**Table 5. Digital I/O Port/Channel Configuration Numbering**

Mode	Input			Output		
	Channel 0	Channel 1	Channel 2	Channel 0	Channel 1	Channel 2
0	A	B	C	–	–	–
1	B	C	–	A	–	–
2	C	–	–	A	B	–
3	–	–	–	A	B	C
4	A,C(0-3)	B,C(4-7)	–	–	–	–
5	A,C(0-3)	–	–	B,C(4-7)	–	–
6	–	–	–	B,C(4-7)	A,C(0-3)	–
7	A,C	–	–	B	–	–
8	A	–	–	B,C	–	–
9	A,B,C(0-3)	–	–	C(4-7)	–	–
10	C(4-7)	–	–	A,B,C(0-3)	–	–
11	A,B,C	–	–	–	–	–
12	–	–	–	A,B,C	–	–

For example, consider the configuration shown in Table 6 using configuration mode 2.

**Table 6. Example of a Port/Channel Configuration Mode 2**

Port	Input/Output Configuration	Input Channel#	Output Channel#
A	Output	–	0
B	Output	–	1
C	Input	0	–

When configured as shown in Table 6, a request to the driver to perform a digital output operation on channel 0 means that the value is written to port A. Writing to digital output channel 1 means that the value is written to port B. A request to the driver to perform a digital input operation on channel 0 means that the value is read from port C.

## Software Interrupt Vectors

The DDA-06 External DAS Driver uses two software interrupt vectors to communicate with the application program. The interrupt vectors used are two of the MS-DOS “user interrupts” (interrupts 60h to 67h). To ensure that conflicts with other devices, hardware, or programs do not exist, you can set each of the interrupt vectors to use an interrupt number that is different than from the default.

You can change the interrupt vector numbers by using the SET command from DOS. This command saves a string in the DOS environment that the driver searches for on loading. These strings are specified in Table 7.

**Table 7. Interrupts and Environment Strings**

Interrupt	Default Interrupt Number	Environment String <sup>1</sup>
Device linking vector	66h	DAS DS= <i>xx</i>
Critical error vector	65h	DAS CE= <i>xx</i>

**Notes**

<sup>1</sup> *xx* is between 60h and 67h.

## DDA-06 External DAS Driver Error Messages

---

Table 8 lists the error messages that may occur during operation of the DDA-06 External DAS Driver.

**Table 8. Error Messages from the DDA-06 External DAS Driver**

<b>Error Number</b>	<b>Error Message</b>	<b>Description</b>
0	No error	No error message.
1	Function not supported	A function was requested that is not supported by the DDA-06 External DAS Driver.
2	Function out of bounds	A function number not defined by the DDA-06 External DAS Driver was requested.
3	Non-valid board number	A board number that is out of the range of configured boards was requested. This driver supports a maximum of two boards.
4	Non-valid error number	A non-valid error number was detected by the external DAS driver function "REPORT ERROR MESSAGE." A request was made for an error message string that is not defined.
5	D/A not initialized	An analog output conversion was requested before the DAC was initialized.
6	Digital input not initialized	A digital I/O process was started before the digital ports were initialized.
7	Digital output not initialized	A digital I/O process was started before the digital ports were initialized.
8	Too many conversions requested	More than one conversion per channel was requested.