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User's Guide

ΩE OMEGA®

USB-4751

Portable Data Acquisition Module

48-channel TTL DIO USB Module

USB-4751/USB-4751L
48/24 Channel TTL Digital I/O
USB Data Acquisition Modules

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M4570/0907

USB-4751/4751L

48/24-Channel Digital I/O USB Data Acquisition Module

User Manual

Contents

1

Introduction

Sections include:

- Hardware Features
- Software Overview

Chapter 1   Introduction

Thank you for buying the USB-4751/4751L data acquisition module. The USB-4751/4751L is a powerful data acquisition
(DAS) module for the USB port. It features a unique circuit design and complete functions for data acquisition and control.

1.1   Hardware Features

USB-4751/4751L features excellent measurement & control functions:

- 48/24 TTL digital I/O lines
- 50-pin Opto-22 compatible box header
- Emulates mode 0 of 8255 PPI
- Buffered circuits for higher driving capacity than 8255
- Interrupt handling
- Timer/ Counter interrupt capability
- Supports both dry and wet contact
- 50-pin Opto-22 compatible box header
- Compatible with USB 1.1/2.0
- Bus-powered

Note: *You can install up to sixteen USB-4751/4751L's to a system because of the restriction of device BoardID*

Note: *The power output of an USB port is 500 mA, while the USB-4751/4751L requires 500mA (Max.). This means that if an USB hub is used, it will need an external power supply to support more than one USB-4751/4751L device.*

Note: *For detailed specifications of USB-4751/4751L, please refer to Appendix A, Specifications.*

1.2 Software Overview

Omega offers a rich set of DLL drivers, third-party driver support and application software on the companion CD-ROM to help fully exploit the functions of your device. The Device Drivers feature a complete I/O function library to help boost your application performance and work seamlessly with development tools such as Visual C++, Visual Basic.

1.2.1 More on the CD

For instructions on how to begin programming in each development tool, some tutorial chapters are included in the Device Drivers Manual for your reference. Please refer to the corresponding sections in these chapters on the Device Drivers Manual to begin your programming efforts. You can also look at the example source code provided for each programming tool, since they can get you very well oriented.

The Device Drivers Manual can be found on the companion CD-ROM. Alternatively, if you have already installed the Device Drivers on your system, The Device Drivers Manual can be readily accessed through the Start button:

Start/Programs/Omega USB-4700 Series/ Device Driver's Manual

The example source code can be found under the corresponding installation folder such as the default installation path:

Program Files/Omega/USB-4700/Examples

2

Installation

Sections include:

- Unpacking
- Driver Installation
- Hardware Installation
- Hardware Uninstallation

Chapter 2   Installation

2.1   Unpacking

After receiving your USB-4751/4751L package, please inspect its contents first. The package should contain the following items:

• USB-4751/4751L Module

• Shielded USB 2.0 Cable (1.8 m)

• Companion CD-ROM (DLL driver included)

The USB-4751/4751L Module harbors certain electronic components vulnerable to *electrostatic discharge* (ESD). ESD could easily damage the integrated circuits and certain components if preventive measures are not carefully paid attention to. ***Before removing the module from the antistatic plastic bag, you should take following precautions to ward off possible ESD damage:***

• Touch the metal part of your computer chassis with your hand to discharge static electricity accumulated on your body. One can also use a grounding strap.

• Make contact between the antistatic bag and ground before opening.

After taking out the module, you should first:

Inspect the module for any possible signs of external damage (loose or damaged components, etc.). If the module is visibly damaged, please notify our service department or our local sales representative immediately. Avoid using a damaged module with your system.

• Avoid physical contact with materials that could hold static electricity such as plastic, vinyl and Styrofoam.

2.2 Driver Installation

We recommend you install the software driver before you install the USB-4751/4751L module into your system, since this will guarantee a smooth installation process.

The 32-bit DLL driver Setup program for the USB-4751/4751L module is included on the companion CD-ROM that is shipped with your module package. Please follow the steps on the following page to install the driver software:

```
┌─────────────────────────────┐
│     Insert the DAQ CD       │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│   Install Device Manager    │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│  Install Individual Drivers │
│         PCI Series          │
│         ISA Series          │
│       PC/104 Series         │
│     CompactPCI Series       │
│      MIC-2000 Series        │
│            USB              │
│            GPIB             │
│      Full Installation      │
└─────────────────────────────┘
              │
              ▼
         ◇─────────◇            No
        ╱  If need  ╲ ───────────────────┐
        ╲           ╱                     │
         ◇─────────◇  1                   │
              │ Yes                       │
              ▼                           │
┌─────────────────────────────┐          │
│ Install Examples & Utilities│          │
│   Utilities                 │          │
│                 Visual C++  │          │
│                 Visual Basic│          │
│        Examples  Delphi     │          │
│                 C++ Builder │          │
│                 Console     │          │
└─────────────────────────────┘          │
              │                           │
              ▼                           │
┌─────────────────────────────┐          │
│  Install Advance Options    │          │
│       Linux Drivers         │          │
│    DAQ Vis for LabVIEW      │          │
│    Windows CE Drivers       │          │
│      ActiveDAQ Pro          │          │
│   Dos Driver & Examples     │          │
└─────────────────────────────┘          │
              │                           │
              ▼                           ▼
┌──────────────────────────────────────────┐
│                 Finish                     │
└──────────────────────────────────────────┘
```

For further information on driver-related issues, an online version of the Device Drivers Manual is available by accessing the following path:
Start/Programs/Omega USB-4700 Series/ Device Driver's Manual

2.3　Hardware Installation

After the DLL driver installation is completed, you can now go on to install the USB-4751/4751L module in any USB port that supports the USB 1.1/2.0 standard, on your computer. Please follow the steps below to install the module on your system.

Step 1: Touch the metal part on the surface of your computer to neutralize the static electricity that might be in your body.

Step 2: Plug your USB module into the selected USB port. Use of excessive force must be avoided; otherwise the module might get damaged.

After your module is installed, you can configure it using the Device Manager. The Device Driver's Manual can be found at:
Start/Programs/Omega USB-4700 Series/ Device Driver's Manual
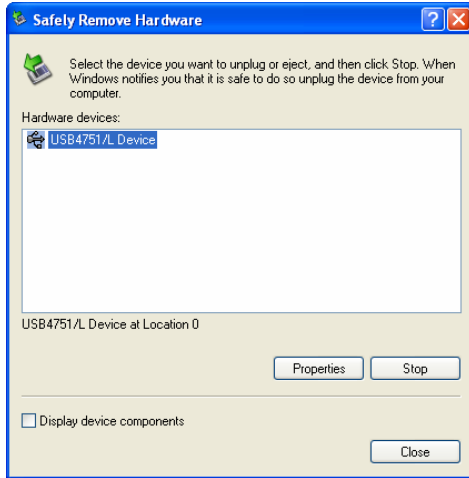
2.4　Hardware Uninstallation

Though the USB modules are hot swappable, we still recom- mend you to follow the hardware un-installation procedure to avoid any unpredictable damages to your device or your system.

Step1: Close the applications of the USB module.

Step2: Right click the "Unplug or Eject Hardware" icon on your task bar.

Figure 2.1: Unplug or Eject Hardware Dialog

Step3: Select "USB-4751/L Device" and press "Stop" Button.

Figure 2.2: Stop a Hardware device dialog box

Step4: Unplug your USB device from the USB port.

Note: *Please make sure that you have closed the application before unplugging the USB device, otherwise unexpected system error or damage may occur.*

3

Signal Connections

Sections include:

- Overview
- Digital I/O Connections
- Field Wiring Considerations

Chapter 3   Signal Connections

3.1   Overview

Maintaining good signal connections is one of the most important factors in ensuring that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices.

3.2   I/O Connectors

USB-4751/4751L is equipped with one plug-in screw-terminal connector and two (one for USB-4751L) standard Opto-22 connectors that can be used with a variety of wiring boards on the market.
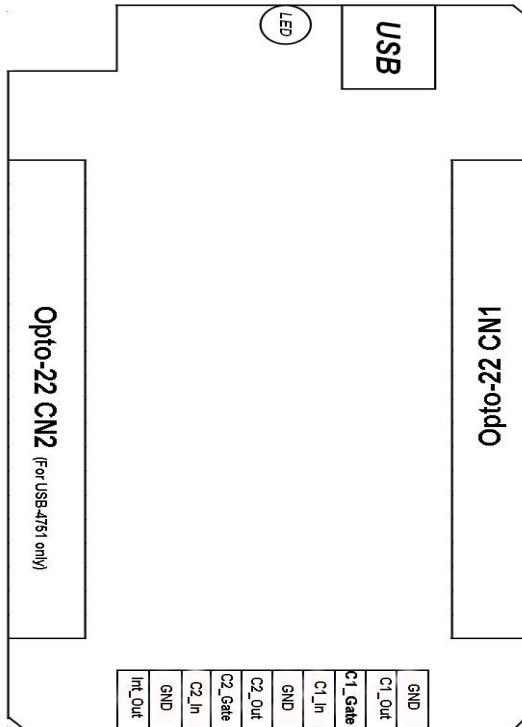
3.2.1 Pin Assignments

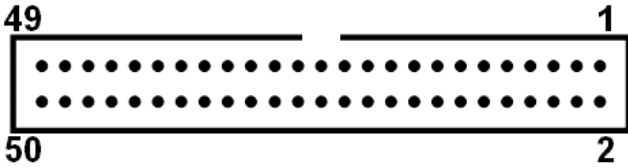*Figure 3.1: I/O Connector Pin Assignment*

Figure 3.2: Opto-22 CN1/CN2

Opto-22 CN1   **Opto-22 CN2 (USB-4751 Only)**

1	PC07	2	GND
3	PC06	4	GND
5	PC05	6	GND
7	PC04	8	GND
9	PC03	10	GND
11	PC02	12	GND
13	PC01	14	GND
15	PC00	16	GND
17	PB07	18	GND
19	PB06	20	GND
21	PB05	22	GND
23	PB04	24	GND
25	PB03	26	GND
27	PB02	28	GND
29	PB01	30	GND
31	PB00	32	GND
33	PA07	34	GND
35	PA06	36	GND
37	PA05	38	GND
39	PA04	40	GND
41	PA03	42	GND
43	PA02	44	GND
45	PA01	46	GND
47	PA00	48	GND
49	+5V_OUT	50	GND

1	PC17	2	GND
3	PC16	4	GND
5	PC15	6	GND
7	PC14	8	GND
9	PC13	10	GND
11	PC12	12	GND
13	PC11	14	GND
15	PC10	16	GND
17	PB17	18	GND
19	PB16	20	GND
21	PB15	22	GND
23	PB14	24	GND
25	PB13	26	GND
27	PB12	28	GND
29	PB11	30	GND
31	PB10	32	GND
33	PA17	34	GND
35	PA16	36	GND
37	PA15	38	GND
39	PA14	40	GND
41	PA13	42	GND
43	PA12	44	GND
45	PA11	46	GND
47	PA10	48	GND
49	+5V_OUT	50	GND

3.2.2 I/O Connector Signal Description

Table 3.1: I/O Connector Signal Description			
Signal	**Ref.**	**Direction**	**Description**
PA<0~7, 10~17>	GND	Input/Output	Digital input/ output port A, channel 0~7 & channel 10~17.
PB<0~7, 10~17>	GND	Input/Output	Digital input/ output port B, channel 0~7 & channel 10~17.
PC<0~7, 10~17>	GND	Input/Output	Digital input/ output port C, channel 0~7 & channel 10~17.
+5V_OUT	GND	Output	+5V DC power
C<1,2>_Out	GND	Output	Output pins of counter/ timer 1 and 2
C<1,2>_Gate	GND	Input	Gate control pins of counter/ timer 1 and 2
C<1,2>_In	GND	Input	External clock source of counter/ timer 1 and 2
INT_Out	GND	Output	Interrupt output. This pin changes to logic 1 whenever the USB-4751 generates an interrupt, and returns to logic 0 when the interrupt is cleared.
GND	-	-	Digital ground

3.2.3 LED Indicator Status Description

The USB Module is equipped with a LED indicator to show the current status of the device. When you plug the USB device into the USB port, the LED indicator will blink five times and then stay lit to indicate that it is on. Please refer to the following table for detailed LED indicator status information.

Table 3.2: LED Indicator Status Description	
LED Status	**Description**
On	Device ready for work
Off	Device not ready to work
Slow Blinking (5 times)	Device initialization
Fast Blinking (Depends on data transfer speed).	Device working

3.3 Digital I/O Connections

3.3.1 Dry Contact Support for Digital Input

Each digital input channel accepts either dry contact or 0 ~ 5 VDC wet contact inputs. Dry contact capability allows the channel to respond to changes in external circuitry (e.g., the closing of a switch in the external circuitry) when no voltage is present in the external circuit. Figure 3-3 shows external circuitry with both wet and dry contact components, connected as an input source to one of the card's digital input channels.
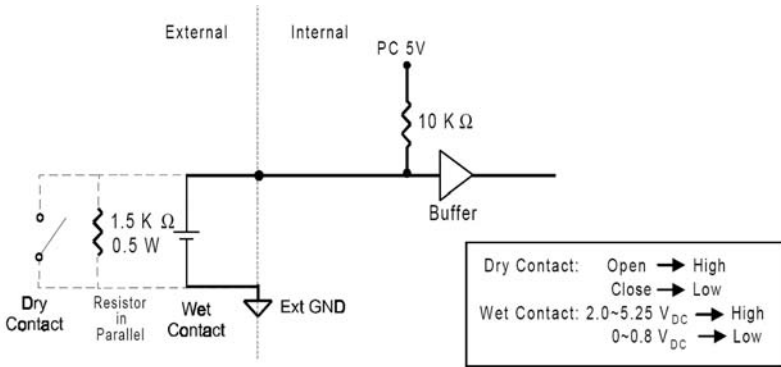
Figure 3.3: Digital Input Connections

3.4 Field Wiring Considerations

- When you use USB-4751/4751L to acquire data from outside, noises in the environment might significantly affect the accuracy of your measurements if due cautions are not taken. The following measures will be helpful to reduce possible interference running signal wires between signal sources and the USB-4751/4751L.

- The signal cables must be kept away from strong electromagnetic sources such as power lines, large electric motors, circuit breakers or welding machines, since they may cause strong electromagnetic interference. Keep the analog signal cables away from any video monitor, since it can significantly affect a data acquisition system.

- If the cable travels through an area with significant electromagnetic interference, you should adopt individually shielded, twisted-pair wires as the analog input cable. This type of cable has its signal wires twisted together and shielded with a metal mesh. The metal mesh should only be connected to one point at the signal source ground.

- Avoid running the signal cables through any conduit that might have power lines in it.

- If you have to place your signal cable parallel to a power line that has a high voltage or high current running through it, try to keep a safe distance between them. Or place the signal cable in a right angle to the power line to minimize the undesirable effect.

A

Specifications

Appendix A   Specifications

A.1   Digital Input/Output

Channels	48 Bi-directional (24 for USB-4751L)	
Programming Mode	8255 PPI Mode0	
Input Voltage	Low	0.8 V max
	High	2.0 V min
Output Voltage	Low	0.5 V max. @ 12mA (sink)
	High	3.8 V min. @ -12mA (source)(each line)
		3.8 V min.@5mA(source)(high of every line)
+5V Output	100mA max.	
Interrupt Mode	PC0 source; PC4 gate/PC0 source	

A.2   Counter

Channels	2 independent		
Resolution	32-bit counters (low 16bit by hardware and high 16bit by ARM)		
Compatibility	TTL compatible logical level input		
Base Clock	External	8MHz max.	2 independent program-mable clock sources
	Internal	20MHz max.	
Frequency measurement	Input frequency from 0.1Hz to 10Mhz		
PWM Generation	2Hz to 10Mhz		
External Input Divide	2 to 65535		

A.3   General

I/O Connector Type	Opto-22 * 2 and 10-pin screw terminal *1	
Dimensions	132 X 80 X 32 mm (5.2" X 3.2" X 1.3")	
Power Consumption	5 V @ 500 mA max.	
Temperature	Operation	0~60° C (32~140° F) (refer to IEC 68-2-1, 2)
	Storage	-20~70° C (-4~158° F)
Relative Humidity	5%~95% RH non-condensing (refer to IEC 68-2-1, 2)	

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