

# Scientific Solutions<sup>®</sup> LabMaster<sup>®</sup> DPCI User's Guide



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# Scientific Solutions<sup>®</sup> LabMaster<sup>®</sup> DPCI User's Guide

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## AGENCY APPROVALS

### FCC-A Notice- Warning

This equipment generates and uses radio frequency energy and if not installed and used in accordance with the instructions, may cause interference to radio or television reception. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his/her own expense will be required to take whatever measures may be required to correct the interference.

### Canadian Radio Interference Instructions

This Equipment is a Class A digital apparatus which complies with the Radio Interference Regulations, CRC c. 1374.

### CE-Mark Declaration of Conformity

This product meets the essential health and safety requirements and is in conformity with the relevant EC directives herein listed using the relevant section of the following EC standards or normative documents:

Application of Council Directives:

89/336/EEC, 92/31/EEC, 73/23/EEC and 93/68/EEC Article 5

Standards for which conformity is declared:

EN55022, EN50082-1, EN60950 (IEC 801-2, 801-3, 801-4)

The CE marking has been affixed on the device according to Article 5 and 13 of the council directive 93/68/EEC.

<i>Manufacturer</i>	<i>Scientific Solutions - www.LabMaster.com - USA</i>
<i>Equipment Type</i>	<i>Data Acquisition Equipment</i>
<i>Model</i>	<i>LabMaster DPCI</i>

### RoHS Compliant

This Equipment is compliant with RoHS mandate for the reduction and elimination of hazardous substances in the design and manufacturing.

## CHECKLIST

The standard product contains the following items:

- ✓ LabMaster DPCI card for the PCI slot
- ✓ LabMaster DPCI external DeskTop unit
- ✓ Cable connects PCI card to DeskTop unit
- ✓ DeskTop Power Supply
- ✓ LabMaster DPCI User's Guide
- ✓ Scientific Solutions Software CDROM

If any of these items are missing or damaged, or if problems are encountered with this product, please notify your point of sale contact.

If you purchased additional items, these items may also be included in your package.

Keep the packaging for convenience of returning any product should the need arise.

### Static Precautions

When working with electronic equipment it is important to control static in the work area. Before unpacking the Lab Master or installing it in the computer, take measures to insure that the work area is static free or that static can be discharged before touching any electronic equipment. While this product as a whole is stable, it is always best to minimize contact with the interface.

The following suggestions, if followed, will help control static.

- 1). Never carry the interface around when it is not placed in or on anti-static material.
- 2). Before handling the interface, discharge any static on the body by touching the computer chassis.



## INTRODUCTION

Congratulations on your purchase of the Scientific Solutions' LabMaster DPCI. The LabMaster DPCI combines the features of several high-performance products into a single PCI card and a convenient DeskTop unit. With a full range of features such as Analog Input, Analog Output, Digital I/O and Precision Timer/Counters, the LabMaster DPCI provides the functionality required for a wide range of test and measurement applications.

Great care is taken in the design and manufacturing of the LabMaster DPCI to insure a quality product that provides accuracy and stability for demanding applications. Its unique features, rugged design and reliability make it ideal for acquiring and analyzing data in industrial, scientific and educational fields.

Scientific Solutions has been providing data acquisition products since 1974. Many of the first products were for mini-computers and S-100 micro-computers. In 1981, Scientific Solutions created the PC based data acquisition industry by introducing the world's first PC based data acquisition products. These products included a family of multi-functional Data Acquisition, Digital I/O, IEEE 488 and Analog Output cards. Not only were these the world's first PC based data acquisition products, the original LabMaster was also the world's first add-in card of any type for the IBM PC and continues to be sold today, upholding its title as the longest selling data acquisition product in history!

Since that time, Scientific Solutions has created a number of PC based products, and has always taken great pride in protecting our customers investment by providing backward compatibility.

The features of the Scientific Solutions Lab Master DPCI are contained on two boards. One board installs directly into a single slot in the PC. The other board is external to the PC and connects to the PC board with a cable. The board in the computer - the PC interface - interfaces to the high-speed PCI bus and also controls the external board functions. The external board contains all of the Analog-to-Digital and Digital-to-Analog conversion - keeping the analog signals outside of the typically noisy PC environment. This external ADC design first introduced by Scientific Solutions in the mid 1970s, provides access to remote analog sources while insulating the sensitive analog electronics from possible electrical interference generated by the PC. This arrangement permits ultra-low noise measurements.

## INTRODUCTION

The LabMaster DPCI is a very versatile data acquisition product and as such there are many different options available. It is available in several models that vary according to A/D resolution, speed, and programmable amplifier gain settings.

Many options are available for the LabMaster DPCI DeskTop unit including screw termination modules for convenient connecting of discrete wires, BNC units for a handy desktop BNC arrangement, 3.5mm MiniJack units and specialty desktop units with a variety of available connectors. Contact Scientific Solutions regarding more information on any of these options or any special configurations you may need.

This manual contains sections with specific information about the DeskTop unit that you have.

The LabMaster DPCI is 100% hardware register level compatible with the original LabMaster introduced in 1981. This means the most software originally written for the ISA card will run on this PCI version without any modification required.

The LabMaster DPCI card is a powerful addition to Scientific Solutions well established family of data acquisition products.

Whether your applications are laboratory research, product development or production testing, the Lab Master DPCI is up to the task and should provide you with years of reliable and trusted service.



## PRODUCT DESCRIPTION AND FEATURES

Boasting a full range of capabilities including Analog Input, Analog Output, Digital I/O and Precision Timer/Counters, the LabMaster DPCI provides functionality required for a wide range of test, measurement and control applications. The LabMaster installs into a PCI expansion slot of a computer. A DeskTop unit provides convenient signal connection using a variety of methods including header connections, screw terminals, MiniJack and BNC. Scientific Solutions' device drivers and LabPac32 library provides a powerful software environment.

### Features

- High-speed PCI interface for today's faster computers.
- Software compatible with the original 1981 "ISA" LabMaster
- Easy cable from the PC Interface to the convenient DeskTop unit
- Small short PCI card for modern Slim-Line Computers
- Variety of connection options using DeskTop units.

### Analog to Digital

- 16 Single-Ended or 8 Differential Inputs with fast signal conditioning
- External Analog-to-Digital circuitry for ultra-low noise measurements
- Accurate timed A/D conversions with auto-increment
- Programmable Gain Amplifier to handle wide input signal levels.

### Digital to Analog

- 2 Analog Output Channels with seven selectable output ranges
- 12 bit (compatible with original) and 16 bit (enhancement) data
- External Digital-to-Analog circuitry for clean noise-free signal generation

### Digital I/O

- 24 Digital I/O lines programmable in groups of 8 or 12
- Increased Current Drive with Advanced Dynamic Digital Buffering
- Three modes of operation for maximum flexibility
- Full Interrupt Support
- ESD/Over-voltage protection with fast 2nsec protection kick-in

### Timing/Counting

- 5 Independent Timer/Counters
- Each Counter is 16 bit and can be cascaded to 80bits!
- Internal Timing to 1 uSec resolution, Event Counting up to 6.25Mhz
- Complex duty cycle and Frequency Shift Keying Outputs
- Can start A/D Conversions, or used for general event counting

## PRODUCT DESCRIPTION AND FEATURES

### Analog to Digital

The Analog-to-Digital converter (ADC) is modular and located in the DeskTop unit. The resolution and acquisition speed of the converter depends upon the particular ADC module that you have. Typical configurations are 12, 14 or 16 bit resolutions with 50Khz to 160Khz conversion speeds. The analog inputs (single-ended or true-differential) pass thru a programmable, precision gain amplifier prior to the analog-to-digital conversion. The Gain settings of this amplifier are again dependent upon the particular ADC module that you have. Typical Gain options are HGE (Hardware Gain = 1, but can be set to any gain using an External precision resistor), PGH (Programmable Gain High with gains of 1, 2, 4 or 8) or PGL (Programmable Gain Low with gains of 1, 10, 100).

A conversion can be started by a software command, a trigger signal from an on-board pacer clock or a rising edge from an external source. Channels can be selected for conversion one at a time or as a set of consecutive inputs. The software enabled auto-scan feature automatically increments the channel number with each conversion. Both the starting and ending channel in the sequence are selectable.

The end of a conversion can be detected by using an interrupt or polling the status register. Data is transferred by reading the converted data from the LabMaster DPCI to the computer memory.

### Digital to Analog

Two independent 16-bit Digital-to-Analog converters (DAC) can be accurately updated at a 500KHz rate. The DACs output range can be selected from several available settings. Each output value is latched and remains constant until the next digital value is presented to the DAC. The DACs can operate in 12 bit mode to be fully compatible with software written for the LabMaster ISA products (LabMaster 20009, LabMaster DMA).



## PRODUCT DESCRIPTION AND FEATURES

### Timing / Counting

Five independent 16-bit counters count TTL compatible pulses (rising or falling edge) generated from a wide range of equipment and sensors. Six separate source and gate input lines are provided on the external connector for signals that can be used by any counter. A TTL compatible pulse/level output signal is available from three counters for the user application.

Each gateable counter counts up or down (binary or BCD). The accumulated count may be read at any time without disturbing the counting process. Each of the counters can be connected to others to form a counter with resolution up to 80 bits. The counters provide a resolution of 250nSec. to 2.5mSec. External events can be counted at speeds to 6.25MHz.

### Digital I/O

Digital Input/Output is supported by 24 lines that can be programmed as Input, Output or Bi-directional with full support for 8255 Modes 0, 1 and 2. Dynamic Digital Buffering (TM) is incorporated in the design that provides for high sink/source current in all operating modes.

### PCI Plug and Play with full Interrupt Support

Hardware interrupts (IRQs) allow the computer to react to special events when they occur. The LabMaster DPCI fully supports automatic Plug-and-Play resource allocation to select an available interrupt. Internal interrupt sources include counter output, A/D conversion DONE, A/D data overrun, and Digital I/O handshaking.

### Options

Many options are available for the LabMaster PRO including desktop and LabRack rack mount units with screw terminals, BNC, or 3.5mm MiniJack connectors. Consult [www.Labmaster.com](http://www.Labmaster.com) for the availability of other options or to request custom configurations.

## CONFIGURING THE LABMASTER DPCI

### Lab Master DPCI - Product Configuration

Before installing the Lab Master DPCI verify that the options for its functions are set correctly for the desired application. The information contained in this manual assists in checking the different features.

Unpack the Lab Master DPCI. The product consists of a small board that is to be installed inside the computer, and an external DeskTop unit. All of the options (except computer resources) are configured by opening the DeskTop unit and selecting various jumpers and switches. If you are familiar with the setup of the LabMaster DMA ISA product, then you will see that the DPCI version has much the same settings and options. There are no user configurable jumpers or switches on the PCI interface.

### Computer Resource Allocation

The LabMaster DPCI is a PCI based product that uses some computer resources in order to operate. These resources include I/O mapped locations and an interrupt channel. The LabMaster DPCI fully conforms to the PCI plug-and-play automatic configuration. This means that there are no jumpers or switches that need to be set by the user to select these computer resources.

All computer resources required by the LabMaster DPCI are configured by the computer on power-up. Normally this all occurs with no user interaction required. In some rare cases, a conflict may occur. This means that more than one card in the computer is trying to use the same resource (i.e., same address space or interrupt).

If after installing the LabMaster DPCI you are having any difficulties, first check to see if the card has any resource conflicts. The method of checking may vary from one operating system to the next, so you should consult your operating system and computer system documentation for the correct method of finding and resolving conflicts.



## CONFIGURING THE LABMASTER DPCI

### LabMaster DPCI vs. LabMaster ISA products

The LabMaster DPCI is designed to be fully compatible with the register set of the original LabMaster ISA products. This is to allow software written for the ISA cards to run on the PCI cards with no or minor modifications.

The ISA versions of the LabMaster used switch and jumper settings to configure the computer resources whereas this PCI version uses Plug-and-Play. Some software written for the ISA cards have the computer resources “hard-coded” in the software. For example, the I/O address of 0710h is the default address of the LabMaster ISA cards and is often required by the software. In order to accommodate this requirement, Scientific Solutions has a method of configuring the PCI card to the same address as the ISA card. Please refer to the software section in this manual regarding this.

The LabMaster DPCI is configured from the factory as indicated in the table on a following page, unless you had Scientific Solutions pre-configure it differently for you. If these settings are appropriate to your needs, then you do not have to modify any of the jumper or switch settings and you can proceed to the section in this manual regarding installation and cable connection.

If you need to modify any of the settings you will have to open the DeskTop enclosure as detailed on the following pages. Inside the DeskTop unit will be various jumper and switch locations that are used to configure the features of the LabMaster DPCI. The configuration options are described in this manual. As previously mentioned, these jumper/switch settings are very much like those of the LabMaster ISA products to make it easy for existing customers to migrate to the PCI product.

After you have configured the LabMaster DPCI, you can proceed to installing the PC interface.

## CONFIGURING THE LABMASTER DPCI

### Opening the LabMaster DPCI DeskTop Enclosure

The signal processing circuitry (Analog-to-Digital, Digital-to-Analog, Digital I/O, and Timer/Counter) is located in the LabMaster DPCI External DeskTop unit which is connected to the LabMaster PC Interface with a cable. All configurable options are located in the DeskTop unit. You may need to refer to your particular software documentation for any required settings.

The cover of the DeskTop enclosure must be removed to inspect the settings of the switch and jumpers that select the various options. Any cables or connectors to the various signals can also be installed when the cover is off.

Use the supplied flat-blade screw driver to remove the tabs in the four corners of the box top as shown. Remove the four screws now visible at the tab locations and lift the cover straight up. Note that your DeskTop unit may appear different from those in the pictures as there are several different models available.



Normally, on the Lab Master DPCI External Board is a module that contains the analog to digital conversion (ADC) circuitry. Scientific Solutions manufactures a number of different ADC modules. The module should be identified with a label. ADC modules vary according to resolution, sample rate and analog input gain. Some modules have hardware gain, while others have software programmable gain. A/D resolution is typically 12-bit or 16-bit. Common sampling rates include 50 Khz or 160 Khz. Gain selections generally include HGE (hardware gain set by external components), PGL (gain = 1, 10, 100) and PGH (gain = 1, 2, 4, 8). Note that some versions of the LabMaster DPCI DeskTop unit do not have a module installed and is for customers who are going to use an external module that is already installed in their equipment.

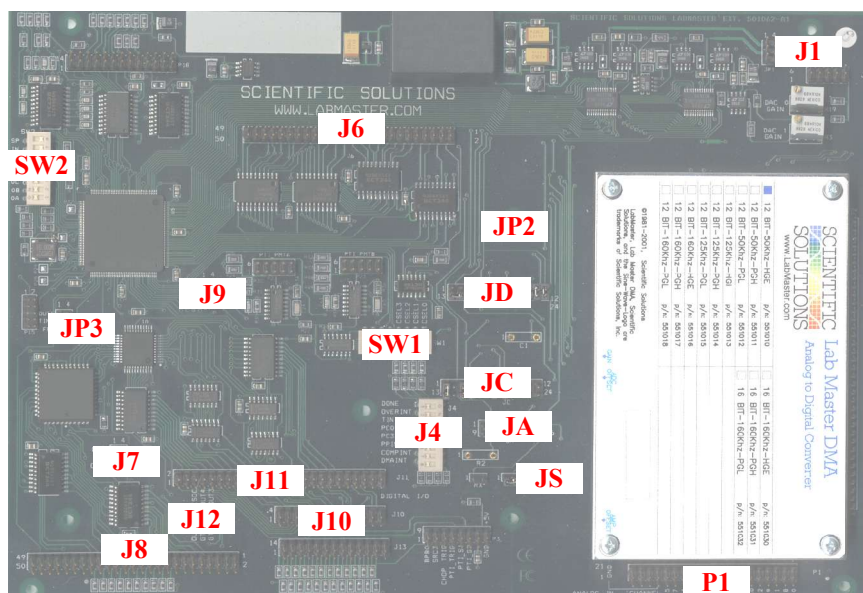
Diagrams on the following pages show the location on the Lab Master DPCI External Board of the various jumpers and connectors. Also shown are the default settings. Refer to these diagrams to verify or change the various configuration options to match the requirements or your particular software.



## CONFIGURING THE LABMASTER DPCI

### Lab Master DPCI - External DeskTop Board Layout

The LabMaster DPCI DeskTop unit's internal circuit board contains the various configuration jumpers and switches. Additionally the board has the header connectors for connecting the various input/output signals to external devices. The diagram on this page shows the DeskTop's board layout. The location of the jumpers, switches, and connectors are indicated.



*LabMaster DMA/PCI DeskTop Board Layout*

### Identify Pin 1 of Ribbon Cables

Normally ribbon cables are connected to the signal connectors. Ribbon cables generally have a colored stripe down one edge indicating the location of pin 1. When connecting ribbon cables, always be sure the colored stripe on the cable corresponds with pin 1 of the connectors the cable is attaching to. This manual uses a red color to identify pin one on connector drawings.



## CONFIGURING THE LABMASTER DPCI

### Lab Master DPCI - Signal Connectors

The Lab Master DPCI DeskTop unit has six connectors to connect signals to external devices. The External Desktop Board Layout indicates the location of these connectors. The specific pin out are described on the following pages.

<i>Name</i>	<i>No. of Pins</i>	<i>Description</i>
J1	10	Analog Output
P1	40	Analog input
J6	50	External Module Interface
J8	50	Timer/ Counter
J10	26	Digital I/O
J11	50	Digital I/O

The diagrams in this manual use a Red Pin to indicate Pin #1 Position



## CONFIGURING THE LABMASTER DPCI

### Lab Master DPCI - Default Configuration

The LabMaster DPCI DeskTop uses several jumpers and switches to configure the numerous features. The External DeskTop Board Layout indicates the location of these jumper/switches. The configuration options are described in this manual. The following table indicates the default settings.

<i><b>Function</b></i>	<i><b>Switch / Jumper</b></i>	<i><b>Default Setting</b></i>
I/O Address Resource	PCI PnP	Set by BIOS
Interrupt Resource	PCI PnP	Set by BIOS
Interrupt Source	Switch J4	None Selected
Timer Interrupt Source (TINT)	Jumper JP3	None Selected
Timer Interrupt Latch Source	Jumper J7	None Selected
Timer / Counter Connections	Jumper J12	None Selected
Count A/D Conversions (DONE)	Jumper JP3	Disabled
Digital I/O Handshaking	Jumper J9	Non-Inverting
Analog out (DAC) Range	Switch SW2	-10v to +10v
Analog Input Mode Differential or Single-Ended	Jumper JS	Single-Ended
Analog Input Mode Unipolar or Bipolar	Jumper JA	Bipolar
Analog Input mode Normal or Overlap	Jumper JC	Normal
Analog Input Last Channel	Switch SW1	Channel 15
Analog Input Data Format Binary or Two's Complement	Jumper JD	Two's Complement
Internal Module Presence	Jumper JP2	IN = Module Installed OUT = Not Installed

## SYSTEM RESOURCES

### Base Address Selection

The LabMaster DMA ISA product used switches to select the particular computer address that the LabMaster product used. The LabMaster DPCI card uses the PCI plug-and-play standard to automatically assign computer resources. The Installation Instructions (described later in this manual) has a discussion pertaining to computer Base Address selection.

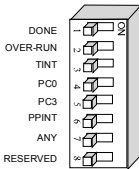
### Interrupt Sources - Switch J4

The LabMaster DMA ISA product used Jumper J4 to perform two tasks:

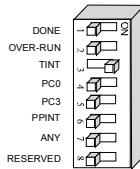
- (1). Select a particular interrupt resource (IRQ) of the computer
- (2). Select a particular interrupt source from the LabMaster card

The LabMaster DPCI card uses the PCI plug-and-play standard to automatically assign computer resources. The LabMaster DPCI internal PC card installation (described later in this manual) discusses computer Interrupt (IRQ) selection.

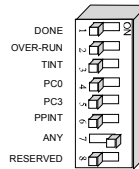
The LabMaster DPCI uses switch labeled J4 to select the particular interrupt source from the LabMaster that will be used to generate an interrupt. The default setting is for no interrupt sources selected. A particular interrupt resource is selected by turning on the corresponding switch location as demonstrated in the following examples:



No Interrupt  
Sources  
(DEFAULT)



Timer  
Interrupt  
(Example)



Any Interrupt  
(Example)

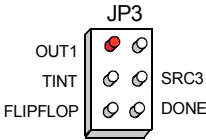
If your software is not using interrupts, then leave the setting as No Interrupt Sources (DEFAULT).

## TIMER / COUNTER

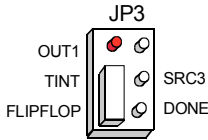
### Timer/Counter Timer Interrupt (TINT) Source - Jumper JP3

Jumper JP3 performs two independent functions:

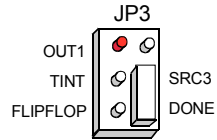
- (1). Selects the TINT interrupt source as either OUT1 or FlipFlop
- (2). Permits connection of the DONE signal to Source-3



No TINT Source  
No SRC3 to DONE  
(DEFAULT)



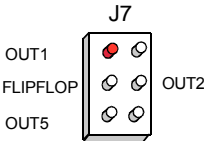
FlipFlop as TINT  
Source  
(Example)



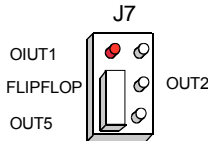
SRC3 to DONE  
(Example)

### Timer/Counter FlipFlop Selection - Jumper J7

Jumper J7 selects the particular counter OUT signal for the FlipFlop signal that is used by JP3. Choices are OUT1, OUT2 or OUT5 as demonstrated in the following example:



No Selection  
(DEFAULT)

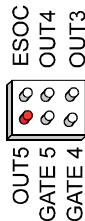


OUT 5 Selected  
(Example)

### Timer/Counter Configurations- Jumper J12

Jumper J12 permits easy connection of Timer/Counter signals which some software may require.

ESOC is the External Start of Conversion signal and it is popular with some software to connect this to the Timer 5 OUT signal.



No Selection  
(DEFAULT)

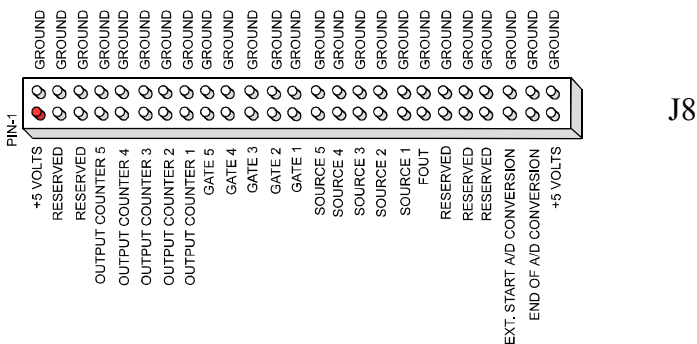


All Connected  
(Example)

## TIMER / COUNTER

### Counter/Timer Signals - Header Connector J8

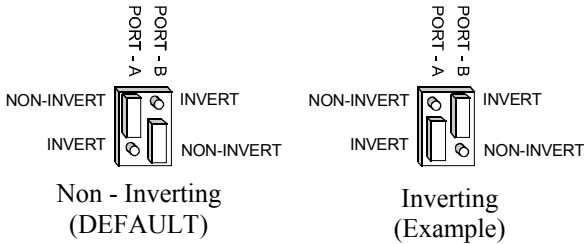
The Timer/Counter signals of the LabMaster can be interfaced to external devices thru connector J8, which is a 50pin header connector with 0.1” spacing between the pins.



## DIGITAL I/O

### Digital I/O Handshaking - Jumper J9

Jumper J9 selects either INVERTING or NON-INVERTING handshaking for the Digital I/O. Normally non-inverting is used unless your particular software requires inverting. This only has effect on the “handshake” signals, not the Data.

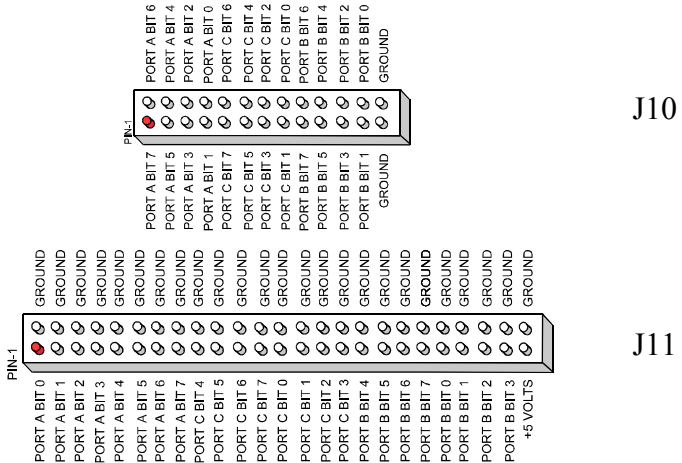


### Note about Digital I/O Buffering

The ISA version of the LabMaster DMA has six Universal Socket Sites (USS) so that input or output buffering can be installed between the on-board Digital I/O circuitry and an external device. The LabMaster DPCI has automatic Dynamic Digital Buffering (DDB). The buffering is always Non-Inverting.

### Digital I/O Signals - Header Connector J10 and J11

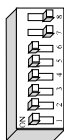
The Digital I/O signals of the LabMaster can be interfaced to external devices thru connector J10 or J11, which are 26 pin and 50pin header connectors (respectively) with 0.1” spacing between the pins.



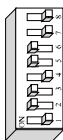
## ANALOG OUTPUT

### Analog Output Range Select - Switch SW2

Switch SW2 is used to select the Analog Output (DAC) range as follows:



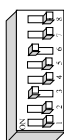
-10v to +10v  
(DEFAULT)



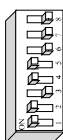
-5v to +5v



-2.5v to +2.5v

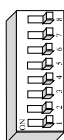


0v to +10v

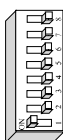


0v to +5v

First five modes are 12 bit using Two's Complement data – same as LabMaster DMA Format.



Two's Complement



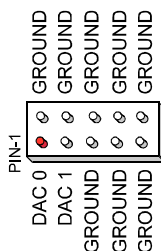
Offset Binary

These two modes are 16 bit and can bet set for either Two's Complement or Offset Binary.

16 bit Modes: -10v to +10v

### Analog Output Signals - Header Connector J1

The Analog Out signals of the LabMaster can be interfaced to external devices thru connector J1, which is a 10 pin header connector with 0.1” pin spacing..



J1



## ANALOG INPUT

### ADC Module

Most users of the LabMaster DPCI will have an A/D module inside the DeskTop unit. Like the LabMaster DMA / ISA product, the LabMaster DPCI has many different features and options that are set using various jumper and switch settings. The following pages detail the various possible configurations.

If there is an A/D module installed in the DeskTop unit, then the 40 pin P1 connector will be used to connect your Analog Input signals.

Some installations will not have an A/D module installed in the DeskTop unit, but will instead use an external LabMaster ADC. An example would be an installation that has the External LabMaster ADC (AD-221) installed in a piece of equipment.

If there is not an A/D module installed in the DeskTop unit, then the 50 pin J6 connector will be used to connect the External LabMaster ADC to the DeskTop unit.

### Module Internal / External - JP2 Jumper

Jumper JP2 needs to be installed if the DPCI DeskTop unit contains an A/D module. If the DeskTop unit is connected to an external module (thru the J6 connector), then JP2 should not have a jumper installed.



JP2 – Module Installed in DeskTop Unit



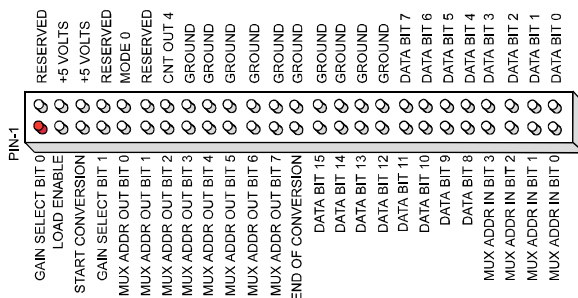
JP2 – Module NOT in DeskTop Unit

Note: If an external module is being used, then all jumpers on location JD need to be removed.

## ANALOG INPUT

### External Module Signals - Header Connector J6

An External LabMaster ADC (AD-221) can be interfaced to the LabMaster DPCI DeskTop Unit thru J6, a 50 pin header connector with 0.1” pin spacing.



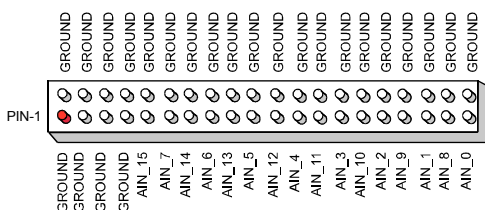
P6

#### Note: If using J6 Then

- (a). A module must NOT be installed in the DeskTop unit
- (b). JP2 Jumper must NOT be installed
- (c). JD Jumper must have NO jumpers
- (d). Analog Inputs will connect to the External LabMaster ADC

### Analog Input Signals - Header Connector P1

The Analog Input can be interfaced from external devices to the LabMaster thru connector P1, which is a 40 pin header connector with 0.1” pin spacing.



P1

#### Note: If using P1 Then

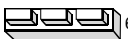
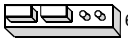
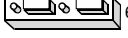
- (a). A module MUST to be installed in the DeskTop unit
- (b). JP2 Jumper MUST be installed
- (c). JD Jumper MUST be configured for Binary or Two’s Complement
- (d). Analog Inputs will connect to P1



## ANALOG INPUT

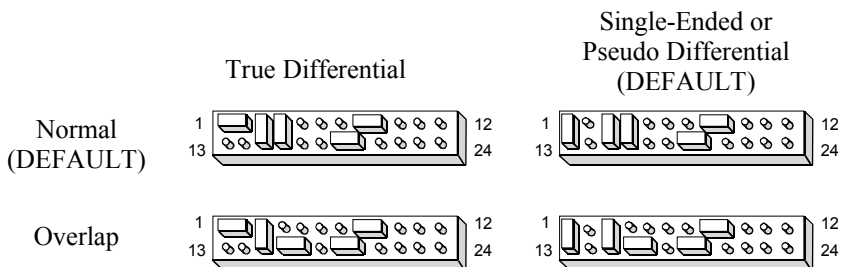
### Analog Input Mode, Differential or Single-Ended - JS Jumper

Jumper JS Selects the analog inputs to be either Differential or Single-Ended for the internal A/D module.

- |   |                        |
|---|------------------------|
|  | Single Ended (DEFAULT) |
|  | Pseudo-Differential    |
|  | True Differential      |

### Analog Input Mode, Normal or Overlap - Jumper JC

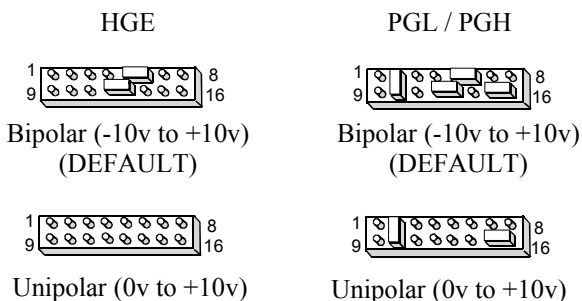
Jumper JC Selects the mode of operation for the A/D conversion of the internal A/D module. Normal mode cycles the three processes of channel selection, sample and hold settling, and A/D conversion in sequential order. Overlap mode dovetails the sample/hold and conversion process, i.e. the next channel is settling while the current channel is being digitized. Normal mode operating with Single-Ended inputs is the most common and is the default mode.



## ANALOG INPUT

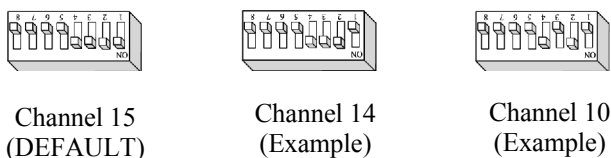
### Analog Input Range, Bipolar or Unipolar - Jumper JA

Jumper JA Selects the analog input range of the internal A/D module as either Unipolar (0v to +10v) or Bipolar (-10v to +10v). The HGE and the PGL/PGH have different settings, so be sure the settings match your particular A/D module.



### Analog Input Last Channel - Switch SW1

SW1 selects the last channel that is used with the internal A/D module when A/D conversions use auto-increment mode. When sweeping thru channels and the channel selected by SW1 is reached, the next channel is channel 0 and the sweeping continues.



## ANALOG INPUT

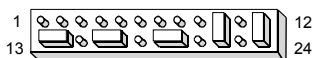
### ADC Data Format, Binary or Two's Complement - Jumper JD

Jumper JD selects the A/D data format for data from the internal A/D module. There are two sets of settings depending upon if you have a 12-bit module or a 16-bit module. Two's complement is normally used with bipolar inputs, whereas binary is normally used with unipolar analog inputs.

#### 12-bit Modules

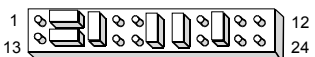


Two's Complement (DEFAULT)



Binary

#### 16-bit Modules



Two's Complement (DEFAULT)



Binary

### Jumper JD Note:

If the DPCI DeskTop unit DOES NOT have an internal module, but is instead using an external module connected to J6, then ALL of the jumpers on JD need to be removed.

## INSTALLATION INSTRUCTIONS

### Installing LabMaster DPCI Hardware

The installation of the LabMaster DPCI in your computer is a very straightforward process.

*Some applications or operating system drivers requires that you install the software first, and then the card second - while others may require the opposite. Refer to the software documentation for specific instructions.*

To install the LabMaster DPCI card in the computer follow these steps.

- 1). Turn off the power to the system and all external options. It is important that power is not applied to any unit while the card is being installed. Serious damage could result to the computer or the LabMaster DPCI interface.
- 2). Remove the cover of the computer.
- 3). Install the LabMaster interface in a 5volt PCI expansion slot. Make sure the card sets firmly down in the slot. Some computers have both 5volt and 3.3volt slots. The LabMaster DPCI card is made for the 5volt slot. The location of the notch on the PCI connector in your computer allows for only 5volt cards to be plugged into 5volt slots, and 3.3volt cards in 3.3volt slots. Be sure you are not trying to plug the card into a 3.3volt slot.
- 4). Tighten the retaining screw on the bracket. Proper grounding of the bracket is important for noise reduction and proper operation.
- 5). Replace the cover of the computer.
- 6). The LabMaster DPCI comes with a DeskTop cable. The connectors on the cable and on the LabMaster DPCI are designed for only one correct alignment and have thumb screws to lock the cable to the mating connector.
- 7). Attach one end of the cable to the external connector on the LabMaster DPCI. Be sure you have the correct alignment when attaching the cable. Tighten the thumb screws to lock the cable in place.
- 8). Attach the other end of the cable to the LabMaster DPCI DeskTop Unit
- 9). Attach the included power supply to your AC mains power and then to the DeskTop Unit.



## INSTALLATION INSTRUCTIONS

### Installing LabMaster DPCI Hardware



*DeskTop Power Supply and LabMaster DPCI DeskTop Cable shown*

Note: Desktop power supply may vary from the one shown in the picture

#### Connect your Signal Cables

Attach your signal cables to the DeskTop unit. Scientific Solutions offers several different DeskTop units. Refer to the DeskTop sections of this manual for specific information about connecting to the DeskTop unit.

#### Power up the Computer

With all the cables attached (Power supply, LabMaster Connection, Signal cables) you can then power up your computer. Some DeskTop units have lights that will illuminate when power is applied.

The DeskTop unit does not have a power on/off switch but instead it is automatically powered on/off with the computer.

**CAUTION:** If you ever have the need to open the DeskTop unit, be sure that the power cable and the LabMaster Cable are NOT connected. If you are going to run the system with the DeskTop unit opened, be sure your wires are secured and that nothing can fall into the unit. These precautions are to try and protect the unit from unintentional damage.

## INSTALLATION INSTRUCTIONS

### Dealing with Interrupt Requirements

Normally, interrupt levels (IRQ) used by a PCI card are automatically assigned by the computer. If you need to assign a particular interrupt (like IRQ-5) to the PCI interface, then you will have to access your computer's BIOS setup. This is typically accessed by pressing the DEL key upon power-up. The setup menus should include a screen for configuring PCI and PNP devices. Some computer systems have the ability to assign a particular interrupt to a PCI slot. If your computer has this ability then you should be able to select the slot where you installed the PCI interface and set its interrupt level - sometimes also called interrupt priority. PCI slots are normally numbered starting with '1' (the first slot) closest to the power supply. If your computer does not provide you with the ability to manually set the PCI interrupt for a particular slot, then you will have to configure your software to use the interrupt automatically assigned by the computer - or use another computer.

### DOS Software Notes

If you are using the LabMaster DPCI to replace a LabMaster ISA card, and you want to use your existing software without modification then you will need to run the PCICFG program supplied with the included software in the DOS directory. You should put this program in the AUTOEXEC.BAT file.

Normally a PCI card is automatically "assigned" an address by the computer. The PCICFG program allows you to "specify" a particular address. This allows you to configure the LabMaster DPCI to the address required by your DOS software. The PCICFG.TXT file in the DOS directory of the diskette has complete information on the usage of the PCICFG.EXE program. Example:

```
PCICFG 5353 4321 1 710
```

- (a). It sets the Base Address of the LabMaster to 0710h (1808d)
- (b). It responds back with the interrupt level (IRQ) assigned to the card. If your software uses interrupts, you should make sure that the interrupt level assigned to the card is used by the software.
- (c). It indicates if the DeskTop unit can be found.

Note: PCICFG is intended for users who wish to run their DOS applications under true DOS. To run a DOS program on Win, refer to the next section.





## INSTALLATION INSTRUCTIONS

### Windows Software Notes

The included software CDROM contains the Windows Device Drivers. The INSTALL.TXT file on the CD contains specific information about installing drivers for a particular version of windows.

#### Windows 98, 2000, XP:

When you start Windows 98, 2000 or XP, it should automatically find the hardware and prompt for the device driver which is located on the CDROM.

#### DOS Session of Win95, Win98:

If you are going to run DOS software under a DOS session of Win95 or 98, you should use the Windows Device Manager to change the address of the card to match your software requirements and do not use PCICFG.EXE

Note: Win NT, 2000 and XP do not have the capability of running DOS software, i.e. they do not have a true DOS compatibility session. This is why it is referred to as a “Command Prompt” instead of a “DOS Prompt”. So although you can change the address of the PCI card, the operating system will not allow DOS software to access the hardware. This is a limitation of the operating system and not of the hardware.

Scientific Solutions windows drivers are true 32-bit kernel mode drivers. The Application Programming Interface (API) for the windows driver is Scientific Solutions LabPac32.DLL (Dynamic Link Library). The LabPac32.DLL is a function library that is installed with the driver. The functions are callable from languages such as C/C++, VisualC, VisualBasic and other programming languages. Programming documentation for LabPac32 is available on the CDROM and also at [www.Scientific-Solutions.com](http://www.Scientific-Solutions.com).

## INSTALLATION INSTRUCTIONS

### Testing

Many of Scientific Solutions' products are used with third party software packages. These packages often contain test routines to verify the hardware is operational and is configured correctly for the specific requirements of the application software. Refer to your third party software manual for additional information about their particular tests.

Scientific Solutions also offers a number of different options for creating programs and testing products. All documentation regarding software toolkits, drivers, test software and example code is provided on the included CDROM.

### Troubleshooting

If you are having problems, you may want to consider the following:

- (1). The allocation of Interrupt channels to PCI cards varies greatly from one computer to the next and is highly dependent on the design of the computer motherboard. Some computer motherboards have a unique interrupt per slot, while others hard-wire several slots to the same interrupt line, while some even have all of the PCI slots hard-wired together. If you have an Interrupt sharing conflict that is causing difficulties, then try moving the cards to different PCI slots.
- (2). Make sure the cable is firmly attached to the back of the LabMaster PCI card and also to the DeskTop or LabRack unit you are using.
- (3). If you are trying to run your older DOS software originally written for the LabMaster 20009 or LabMaster DMA (ISA cards), then be sure you have the PCI card set to the correct Base Address (either using PCICFG for DOS, or the Device Manager of windows) and that the jumper and switch settings of the DeskTop unit are configured correctly for your software.

### Creating Programs

The included CDROM includes Scientific Solutions development tools for creating your own custom programs. Device Drivers, LabPac32 library, documentation, and even some open source compilers are on the CDROM. If you have questions regarding creating your own application you are encouraged to contact Scientific Solutions for assistance.



## DESKTOP UNITS

### DeskTop unit - Ribbon Cable Version

This unit has two lights in the front that provide an indication of the power-on status. Under normal operating conditions, both the blue (power supply “on”) and the red (computer “on”) lights on the front of the DeskTop unit will illuminate.

When neither is on, either the power supply is not plugged into your AC electrical outlet and/or the power supply is not plugged into the back of the DeskTop unit.

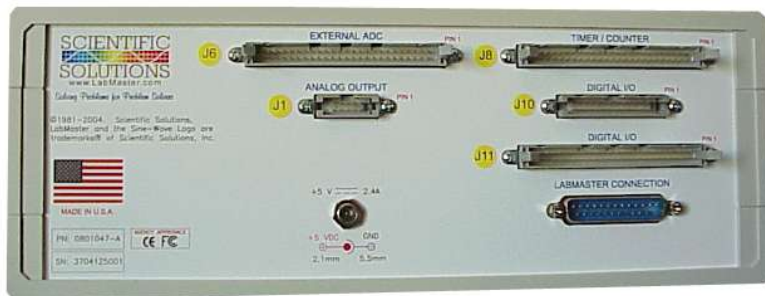
When the computer is turned “off”, the blue light indicating the power supply is connected will still stay illuminated. With just the blue light, the unit is in stand-by mode and consuming very little power.



## DESKTOP UNITS

### Desktop unit - Ribbon Cable Version

The back of this Desktop unit is where all of your signal connections are located in addition to the power connector and the data connector for the PCI card. Note the location of PIN 1 of your signal connections as you will want to be sure that your cable connections are oriented correctly.



*Note: Your Desktop unit will either have J6 (50 pin) or P1 (40 pin) as the upper left connector when viewing the Desktop unit from the back.*

J6 - External ADC, 50 pin header for connection to a LabMaster External ADC board. This is for installations that have the ADC circuitry installed in another piece of equipment remote from the Desktop unit.

P1 - Analog Input, 40 pin header for connection of your Analog Input signals

J1 - Analog Output, 10 pin header that provides the Analog Output signals

2.1mm Power Input Jack for the power supply

J8 - Timer / Counter, 50 pin header

J10 - Digital I/O, 10 pin header

J11 - Digital I/O, 50 pin header

DB25 LabMaster Connector for connection to the LabMaster DPCI card

## DESKTOP UNITS

### DeskTop unit - Screw Terminal Version

The front of this unit has two slots for signal wires to enter the unit.



Inside the DeskTop unit are the various Screw Terminal connectors that you will use to attach your signal cables. To open the unit and gain access to the screw terminals, refer to the appropriate section earlier in this manual.



## DESKTOP UNITS

### Desktop unit - Screw Terminal Version

The back of this Desktop unit is where you make connections to the Desktop power supply and to the PCI card.



## DESKTOP UNITS

### DeskTop unit - MiniJack Version

This DeskTop unit has 3.5mm MiniJack connectors in the front for convenient signal connections. Each MiniJack connection provides for the signal and the ground signals. You can use either MONO or STEREO signal connections as follows:

MONO: Signal on the Tip, Ground on the Ring

STEREO: Signal on the Tip, Center Ring not used, Ground on the outer Ring.

Each Analog Input signal is automatically connected to ground when there is not a connection to its corresponding MiniJack.

A light in the lower left of the front indicates power. The light will only illuminate when the DeskTop power supply is connected with AC power **and** the computer is connected and also powered on.



### The signals on the front include:

- Digital I/O Port B - 8 connections\*
- Digital I/O Port A - 8 connections\*
- Analog Input - 16 connections
- Analog Output - 2 connections
- Expansion - 2 connections\*\*

\*Note: The Digital I/O signal buffering is automatic and does not require changing plug-in devices like the LabMaster ISA. Also, the Digital I/O signals of the LabMaster DPCI are ALWAYS non-inverting whereas the LabMaster ISA could be inverting or non-inverting depending upon the type of buffers used.

\*\*Note: These two signals can be used to provide two additional signal connections such as counter/timer, Start-of-Conversion, End-of-Conversion, or Digital Port C signals.

## DESKTOP UNITS

### DeskTop unit - MiniJack Version

The back of this DeskTop unit is where you make connections to the DeskTop power supply and to the PCI card.





## DESKTOP UNITS

### DeskTop unit - BNC Version

This DeskTop unit has BNC connectors in the front for convenient signal connections. Each BNC connection provides for Signal and Ground connections. Unused Analog Inputs should be connected ground. An easy way to make this connection is by using a BNC shorting plug. For this purpose, you can use a direct shorting plug or a 75ohm (popular with video) or 50ohm (popular with networks) termination plug.



## DESKTOP UNITS

### DeskTop unit - BNC Version

The back of this DeskTop unit is where you make connections to the DeskTop power supply and to the PCI card.



## TECHNICAL SPECIFICATIONS

### Analog-to-Digital Characteristics:

Input Range	Selectable Unipolar or Bipolar: 0v to +10v or -10 volts to +10 volts (gain =1) +/-1mv to +/- 10v using Input Gain.
Resolution	Module Dependent, 12, 14 or 16 bit
Conversion Time	Module Dependent, 50Khz to 160Khz
Input Channel Count	16 Single-Ended, 8 Differential Input
Input Current	100 pAmps
Input Source Impedance	< 1Kohm
S / (N+D)	90 dB Typical
THD	-100 dB Typical
No Missing Codes over Temperature	
Dedicated ADC Voltage Reference	2ppm / C high-precision, low tempco
Integral Linearity	+/- 1/2 LSB
Analog Input Gains: Hardware Gain External (HGE) Programmable Gain High (PGH) Programmable Gain Low (PGL)	HGE: Gain set by precision resistor PGH: 1, 2, 4, 8 PGL: 1, 10, 100
Input Protection	+/- 35 volts
Gain Switching Time	500 nSec
Gain Nonlinearity vs. Temperature	+/- 3ppm / deg C FSR

### Digital-to-Analog Characteristics:

Output Range	Selectable: -10v to +10v, -5v to +5v, -2.5v to +2.5v, 0 to +5v, 0 to +10v
Resolution	True 12 or 16-bit over Temperature Range
DNL and INL	1 LSB max
Power-on / Reset Condition	DAC outputs initialized to zero volts
Glitch Impulse	< 2 nV - Sec
Output Current	5 ma
Update Rate	500 KHz

## TECHNICAL SPECIFICATIONS

### Counter / Timer:

Number of 16-bit Counters	16
Logic Thresholds	TTL
Interval Timing Counting Resolution	250nSec
Event Counting	6.25MHz
On-board precision frequency sources	5
Each Counter has individual signals	Input, Output, Gating

### Digital I/O Characteristics:

Digital I/O	24 bits
8255 Modes Supported	Mode 0 - Basic I/O Mode 1 - Strobed I/O Mode 2 - Bi-Directional
Dynamic Digital Buffering	All bits in All modes
Logic Thresholds	TTL
Current sink/source (ma)	Port A: 64 / 15 Port B: 64 / 15 Port C: 24 / 24

### System Resources:

BUS Interface	Single PCI 32-bit, 5v slot
IRQ Resources	Plug-and-Play Selected
Data Transfer Resource	Advanced PCI I/O
Address Resource	Plug-and-Play Selected

### Mechanical:

Computer Interface	PCI, 32-bit, 5 volt slot
Board Size	Short card, 2" x 4" (51mm x 102mm)
External Signal Connector	DB25M
Standard Cable	Double Shielded 6 foot
DeskTop Power Supply	5v, 2.4 amp, center positive, 2.1 or 2.5mm (varies)



## SERVICE INFORMATION

Your product should provide you with trouble free performance. However, if you have any questions about the installation or operation, or you encounter any problems, the following information will be helpful.

### Scientific Solutions - Technical Support (Requires Product Registration)

Phone: (440) 357-1400  
Fax: (440) 357-1416  
E-mail: [support@LabMaster.com](mailto:support@LabMaster.com)  
Internet: <http://www.LabMaster.com>

Should your product require factory service, the following guidelines must be followed and will help you get the fastest service.

- 1) Save your sales receipt. The product you purchased is covered under the limited warranty from the date of purchase, but you must submit proof of purchase for in-warranty repair.
- 2) Contact Scientific Solutions. You must obtain a Return Material Authorization (RMA) number prior to sending the unit to Scientific Solutions. This number must be displayed on the packing box.
- 3) Return all the components with your RMA. Complete troubleshooting is impossible if all components are not included. For protection against damage in transit, repack the system in its original packing.
- 4) Damaged and abused products will be repaired out of warranty only. Unauthorized attempts to repair, dropping, submitting to electrical surges, etc. will void the warranty.
- 5) Ship the unit to Scientific Solutions freight prepaid. After in-warranty service, the unit will be returned freight prepaid by a carrier designated by Scientific Solutions. Use of any other method will be freight collect or imposed shipping charge. Out-of-warranty service, will be returned freight collect or imposed shipping charge.
- 6) Cosmetic damage will not be repaired in warranty.

*Note: Policies may change without notice.*

## LIMITED WARRANTY

**Definitions:**

Scientific Solutions means Scientific Solutions Inc., USA ([www.LabMaster.com](http://www.LabMaster.com))

**Warranty:**

With respect to the product(s) delivered with this Limited Warranty, Scientific Solutions warrants to the original purchaser that:

- i) The product manufactured by Scientific Solutions will be free from defects in materials and workmanship for two (2) years from the date of delivery to such original purchaser
- ii) Any software/firmware is provided "as is" without warranty of any kind by Scientific Solutions
- iii) Any items not originally supplied by Scientific Solutions are without warranty of any kind. Use of components and accessories that do not conform to product specifications may void the warranty.

THE FOREGOING WARRANTIES ARE THE ONLY WARRANTIES PROVIDED BY SCIENTIFIC SOLUTIONS IN CONNECTION WITH THE PRODUCTS COVERED BY THIS LIMITED WARRANTY AND ARE IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED. SCIENTIFIC SOLUTIONS HEREBY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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If Scientific Solutions determines that any product which has been returned to Scientific Solutions in accordance with the provisions of the preceding paragraph is not under warranty, it will be repaired using Scientific Solutions' standard rates for parts and labor. Scientific Solutions will use its best efforts to repair the product after receipt thereof. Scientific Solutions shall not be responsible, however, for delays caused by shipping or non-availability of replacement components or other similar or dissimilar causes, events or conditions beyond its reasonable control.

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