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# PCI236

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24 LINE  
PROGRAMMABLE  
DIGITAL  
INPUT/OUTPUT  
BOARD

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This Instruction Manual is supplied with the PCI236 board to provide the user with sufficient information to properly utilise the product as purchased. The information contained has been reviewed and is believed to be accurate and reliable, however **Amplicon Liveline Limited** accepts no responsibility for any problems caused by errors or omissions. Specifications and instructions are subject to change without notice.

**PCI236 Instruction Manual Part N° 9099 3664 Issue B4**

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## DECLARATION OF CONFORMITY

**AMPLICON LIVELINE LIMITED  
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HOLLINGDEAN ROAD  
BRIGHTON BN2 4AW UK**

We declare that the product(s) described in this Instruction Manual are manufactured by Amplicon Liveline Limited and perform in conformity with the following standards or standardisation documents:

Electro Magnetic Compatibility (EMC):

EMC Directive	89/336/EEC
LVD Directive	73/23/EEC
CE Directive	93/68/EEC



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**CONTENTS**

<b>1</b>	<b>INTRODUCTION</b> .....	<b>5</b>
1.1	The Amplicon 200 Series.....	5
1.2	Features of the PCI236.....	5
1.3	General Description.....	5
1.3.1	Enhanced Features.....	5
1.3.2	The Software.....	5
1.4	What the Package Contains.....	6
1.5	The Amplicon Warranty Covering the PCI236.....	6
1.6	Contacting Amplicon Liveline Limited for Support or Service.....	6
1.6.1	Technical Support.....	6
1.6.2	Repairs.....	7
<b>2</b>	<b>GETTING STARTED</b> .....	<b>8</b>
2.1	General Information.....	8
2.2	Host Computer Requirements.....	8
2.3	Installing the Board.....	8
2.4	Software Installation.....	9
2.5	Application Software.....	9
2.6	Digital I/O.....	9
2.7	Digital I/O Conditions.....	10
2.8	Intersil 82C55 differences from Oki 82C55.....	10
2.9	I/O Signal conditioning.....	11
2.10	I/O Signal Conditioning Modules.....	12
2.10.1	Opto-isolated input.....	13
2.10.2	Common Ground Default Configuration.....	13
2.10.3	Common Supply Configuration.....	14
2.10.4	Opto-isolated output.....	14
2.11	Digital I/O Connections.....	15
2.12	The PCI Interface.....	16
2.12.1	IER Interrupts Enable / Status Register.....	17
<b>3</b>	<b>ELECTRICAL CONNECTIONS</b> .....	<b>18</b>
3.1	37 way D-type Connector (PL1 - User I/O).....	18
3.2	Voltage Outputs Available on PL1.....	19
3.3	Use of Shielded Cables.....	19
<b>4</b>	<b>PROGRAMMING THE PCI236</b> .....	<b>20</b>
4.1	Copyright.....	20
4.2	Guide to User Programming.....	20
4.3	Interfacing with Commercial Software Packages.....	21
<b>A</b>	<b>TECHNICAL SPECIFICATIONS</b> .....	<b>22</b>
A.1	Electrical Specification.....	22
A.2	Software Specification.....	22
A.3	Environmental Conditions.....	23
A.4	Opto-isolated I/O Modules.....	24
<b>B</b>	<b>CIRCUIT LAYOUT AND SCHEMATIC DRAWINGS</b> .....	<b>25</b>
B.1	ASSEMBLY DETAIL.....	25

**TABLE OF FIGURES**

FIGURE 2.1 SIGNAL CONDITIONING MODULE PORT IDENTIFICATION ..... 11

FIGURE 2.2 I/O MODULE CONNECTIONS..... 12

FIGURE 2.3 OPTO-ISOLATED INPUT COMMON GROUND ..... 13

FIGURE 2.4 OPTO-ISOLATED INPUT COMMON GROUND PULL DOWN..... 13

FIGURE 2.5 SOLDER BRIDGE CONFIGURATION FOR COMMON SUPPLY..... 14

FIGURE 2.6 OPTO-ISOLATED INPUT COMMON SUPPLY ..... 14

FIGURE 2.7 PCI236 REGISTER ASSIGNMENTS..... 16

FIGURE 3.1 I/O CONNECTOR ..... 18

FIGURE B.1 PRINTED CIRCUIT LAYOUT..... 25

FIGURE B.2 PCI236 CIRCUIT DIAGRAM (SHEET 1) ..... 26

FIGURE B.3 PCI236 CIRCUIT DIAGRAM (SHEET 2) ..... 27

## 1 INTRODUCTION

### 1.1 The Amplicon 200 Series

The **Amplicon 200 Series** of Personal Computer based data acquisition products provides high performance, affordable hardware with user sympathetic software. The 200 Series is designed for users requiring fast or complex data I/O to the host PC and comprises a range of boards and software to handle most analog and digital signal types.

When a large scale system is required, multiple boards can be added from the 200 Series without conflict. For analog input systems, the capacity of the PC mounted hardware can be extended by external expansion panels to provide a convenient to use system with low cost per channel and maintained high performance.

### 1.2 Features of the PCI236

The PCI236 board is designed to meet stringent performance requirements and ease of use.

- 24 bit flexible, programmable digital I/O.
- Provision for digital I/O conditioning to be added as required.
- Interrupt controlled operations, with the facility for interrupts to be generated from one external signal.
- PCI Bus version 2.1 Plug and play interface.
- Device driver software compatible with Windows 95, 98, NT, 2000, XP and Vista
- Linux drivers.
- Agilent/HP VEE, Visual Basic, VB.Net, C#.Net and Delphi example software.

### 1.3 General Description

The PCI236 is a PCI plug-in board which provides 24 bits of parallel digital I/O. The board can be used on any PC that supports the PCI bus version 2.1. The card is supplied with Windows 95, 98, NT, 2000, XP and Vista compatible device drivers. Linux Comedi drivers are available from [www.comedi.org](http://www.comedi.org)

#### 1.3.1 Enhanced Features

The PCI236 supports all relevant features of the earlier ISA bus product, the PC36AT. In addition the PCI236 includes provision for input/output signal conditioning modules to be mounted on the board including opto-isolation input modules and output modules.

#### 1.3.2 The Software

The PCI236 is supplied with the SOFTMAN CD-ROM. This contains all the software for the card, and is documented in the Amplicon ADIO software manual. This manual can be accessed when the software is installed from the CD.

## 1.4 What the Package Contains

### CAUTION

Some of the components on the board are susceptible to electrostatic discharge, and proper handling precautions should be observed. As a minimum, an earthed wrist strap must be worn when handling the PCI236 outside its protective bag. Full static handling procedures are defined in British Standards Publication BSEN100015/BSEN100015-1:1992.

When removed from the bag, inspect the board for any obvious signs of damage and notify Amplicon if such damage is apparent. Do not plug a damaged board into the host computer. Keep the protective bag for possible future use in transporting the board.

The package as delivered from **Amplicon Liveline Ltd.** contains:-

1. The plug-in card as ordered, in a protective bag. The PCI236 is identified by the type number printed on the board.

**PCI236**    PCI Bus Digital I/O card    Part N° 9099 3663

2. Distribution software and manual on CD    Part N° 8698 6559 v2.2 or later

Any additional accessories (mating connectors, software etc.) may be packed separately.

## 1.5 The Amplicon Warranty Covering the PCI236

This product is covered by the warranty as detailed in the Terms and Conditions stated on the web site at [www.amplicon.co.uk](http://www.amplicon.co.uk).

## 1.6 Contacting Amplicon Liveline Limited for Support or Service

The PCI236 boards are designed and manufactured by Amplicon Liveline Ltd and maintenance is available throughout the supported life of the product.

### 1.6.1 Technical Support

Should this product appear defective, please check the information in this manual and the Ampdio32manual appropriate to the program in use to ensure that the product is being correctly applied.

If a problem persists, please request Technical Support in one of the following ways:

Telephone: UK	0844 324 0617
Calls cost 5p per min from a BT landline. Calls from other services may vary	
Fax: UK	01273 570 215
Email:	<a href="mailto:support@amplicon.com">support@amplicon.com</a>
Web:	<a href="http://www.amplicon.com">www.amplicon.com</a>

It will assist the support engineer if you have the following information available when you call:

Date of purchase  
Your account number or postcode  
The Operating System you are running under  
The specification of your computer  
The nature of your problem and the results of any tests you have conducted  
The version number of your Softman CD.

### 1.6.2 Repairs

If the PCI236 requires repair then please return the goods enclosing a repair order detailing the nature of the fault. If the PCI236 is still under warranty, there will be no repair charge unless any damage is a consequence of improper use.

For traceability when processing returned goods, a Returned Materials Authorisation (RMA) procedure is in operation. Before returning the goods, please request an individual RMA number by contacting Amplicon Technical Support by telephone or fax on the above numbers. Give the reason for the return and, if the goods are still under warranty, the original invoice number and date. Repair turnaround time is normally five working days but the Service Engineers will always try to co-operate if there is a particular problem of time pressure.

Please mark the RMA number on the outside of the packaging to ensure that the package is accepted by the Goods Inwards Department.

Address repairs to:           The Service Department  
  AMPLICON LIVELINE LIMITED  
  Centenary Industrial Estate  
  Brighton, East Sussex  
  BN2 4AW  
  England

## 2 GETTING STARTED

### 2.1 General Information

The PCI236 cards are Plug and Play compatible and come complete with all the software required to install and operate the card in any PCI version 2.1 compliant host PC running under Windows 95, 98, NT, 2000, or XP and allow full card functionality.

### 2.2 Host Computer Requirements

When installing one or more PCI236 series boards, ensure that the host computer has sufficient capacity. Take into account other boards or adapters that may be installed in the computer when assessing physical space, address space in the I/O map, interrupt levels and the power requirements.

This board is suitable for use in any PC compatible computer that can provide a single PCI Bus version 2.1 slot, with sufficient space for a half-length card.

The computer must run under one of the following operating systems. Windows 95, Windows 98, Windows NT 4.0, Windows 2000, Windows XP or Vista.

### 2.3 Installing the Board

**ENSURE THAT THE POWER TO THE COMPUTER IS SWITCHED OFF BEFORE INSTALLING OR REMOVING ANY EXPANSION BOARD. OBSERVE HANDLING PRECAUTIONS NOTED IN SECTION 1.4.**

**REPAIR OF DAMAGE CAUSED BY MIS-HANDLING IS NOT COVERED UNDER THE AMPLICON WARRANTY.**

**DO NOT MAKE ANY MODIFICATIONS TO A BOARD THAT IS ON EVALUATION**

Please refer to the manufacturer's hardware manual supplied with the PC for instructions on how to remove the cover and install devices into a PCI slot. The PCI236 may be installed in any available position in the machine provided that there is no restriction specified for that location by the computer manufacturer.

The PCI236 board is a Plug and Play device. The installation software supplied will handle the configuration of the card.

When the board is physically installed in the PC, and the PC is rebooted, The Windows operating system will detect new hardware and prompt for installation of the device drivers. Windows NT 4.0 will not be aware of the board until the drivers have been installed.

## 2.4 Software Installation

Please refer to the ADIO software manual, [ampdio.pdf](#), for the latest Windows 32-bit driver installation information.

## 2.5 Application Software

Example application software, including source code for the applications and the DLL are supplied in the self-extracting archive AMPDIO.EXE along with the SETUP program. When the self-extracting archive is run and software is extracted to a suitable directory (e.g. C:\AMPLICON\AMPDIO), the examples and DLL source code can be found in subdirectories off this directory.

## 2.6 Digital I/O

This digital I/O board features an uncommitted 82C55 CMOS Programmable Peripheral Interface (PPI) which can be configured in a variety of operating modes.

The digital I/O facility of the PCI236 provides all 24 lines on three 8 bit ports, labeled DIO Port A0 - A7, DIO Port B0 - B7 and DIO Port C0 - C7. These ports are further divided into two groups of 12 bits each, group A comprising the 8 bits of port A and the high order 4 bits of port C, and Group B comprising the 8 bits of port B and the low order 4 bits of port C. When port C is split in this mode, note that when a half byte of data is being read from or written to port C, those four bits occupy the appropriate high or low end of a full byte, the other four bits not being used.

Full details of programming the 82C55 PPI at register level, in its various modes, are shown in the device specification in Appendix **App82C55.pdf** in the \MANUAL subdirectory on the Amplicon SOFTMAN CD-ROM. The three basic operating modes are summarized below.

### Mode 0 (Basic I/O)

This mode is the power-up default with all ports set as input (i.e. high impedance).

In mode 0, the PPI provides simple I/O operations. No control signals are required and the ports defined as input reflect the current state of digital signals on the lines (no latching). The lines of output defined ports are set to zero on the mode change, and when a port is loaded, the outputs are latched to that value

All 24 bits can be used for input or output arranged as any combination of two 8 bit ports and two 4 bit ports.

### Mode 1 (Strobed I/O)

Mode 1 provides I/O operations on Group A and/or Group B each with a simple handshake protocol. In either group, the 4-bit port is used for status and control of the associated 8-bit port. An IRQ facility in this mode is available on the PCI236.

Each 8-bit port can be used uni-directionally for either input or output operations, both being latched.

### Mode 2 (Strobed Bi-directional I/O)

This mode of operation can be applied to group A only, and provides one 8 bit bi-directional data port and one 5 bit control and status port with IRQ facility. Both input and output operations are latched. Port B can be used in mode 0 or 1 while port A is in mode 2.

### Mixed Mode

The ports of the PPI can be programmed to operate in a mixed combination of modes that in some cases leave bits of port C unused for control or status purposes. These unused bits can be programmed for use as inputs or outputs.

## 2.7 Digital I/O Conditions

The digital I/O lines on ports A, B and C are TTL compatible.

When an input line is left open circuit, its high input impedance makes it susceptible to static charge and interference and the state may be indeterminate. Ensure that signals to any inputs are within specified limits, and that any unused input lines are grounded or masked out in software.

## 2.8 Intersil 82C55 differences from Oki 82C55

In order to meet RoHS compliance, the OKI 82C55 chip originally fitted on non RoHS compliant revisions of this board has been replaced with an Intersil 82C55 chip. The Intersil 82C55 has an added feature to the I/O buffer called Bus Hold which can hold either a 0 or 1 depending on the circuitry attached.

The bus hold feature affects the behavior of the device when its data lines are configured as inputs. When a digital I/O line is configured as input, its value is normally defined by the driver driving that line. When there is no driver, then the value can be defined using pull resistors (a pull up will define a '1' value, and a pull down resistor will define a '0' value). The boards with the Intersil part have additionally a feature called "bus hold". This element will remember the last value that line was driven to and will try to hold that value by driving the line weakly (similar to a pull resistor).

Users of the PCI236 need to review their input drive circuits to ensure they can source / sink sufficient current to overcome the 'bus hold current' of the 82C55.

If users need to ensure that any of the I/O pins are low at power up, (e.g. when the I/O pin will later be defined as an output that needs to be low at power up) they need to provide the means to ensure that the line is pulled down low with enough resistance to overcome the bus hold current.

Because the bus hold currents are quite strong, existing pull downs may not be strong enough to overcome the bus hold feature.

The PCI236 'module header' area described in the 'I/O signal conditioning' section is suitable for fitting pull up or pull down resistors to overcome the effects of 'bus hold'.

The bus hold feature may have unwanted effects on your implementation, if:

- At power up the I/O lines need to be in a low state
- Pull down resistors are used to hold the I/O line in a known state.
- Input driving circuits have insufficient current source / sink capability.

In all other cases, the application should NOT be affected by this specification change.

The bus hold implementation on Port A is different to that used on ports B and C.

**Port A Bus Hold**

The bus hold circuit on Port A of the Intersil 82C55 can hold a high or low state and is active as long as the line is configured as an input. When the line changes direction from output to input, the last value written to the line will determine whether the bus hold circuit pulls the line high or low. If the last value written was a high voltage, the bus hold will try to keep the high value. If the last value written was a low, the bus hold will try to keep the low value.

**Port B and C Bus Hold**

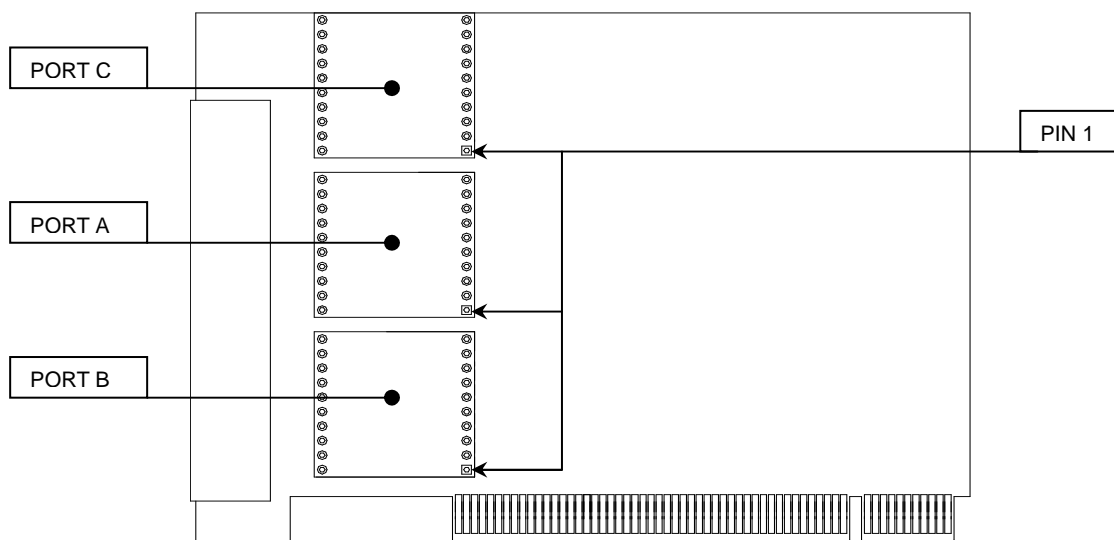
The bus hold circuit on ports B and C of the Intersil part can only hold a high state ('1') and is only active from the time the line is configured as an input until the line recognizes a low value on the input. Once the line is driven to a low value (by some external device), the bus hold for that line is disabled and will not be enabled again until the port is reconfigured as an input. If the last value driven to the line was high, the bus hold will try to keep the value high, so the line will remain high when no driver is actively driving it.

As this is a new feature of the 82C55, both new and existing users of the PCI236 need to review their input drive circuits to ensure they can source / sink sufficient current to overcome the 'bus hold current' of the 82C55.

**2.9 I/O Signal conditioning**

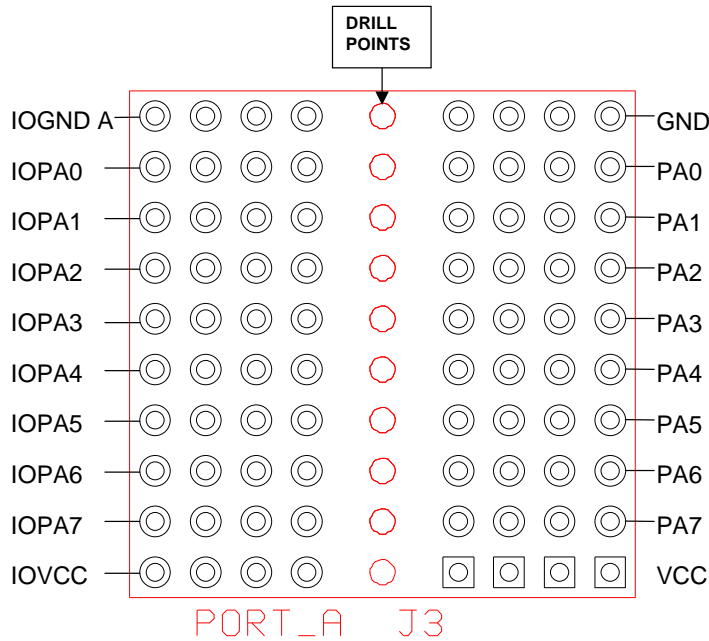
Environments where digital I/O cards are used are often electrically noisy. Provision is therefore made for addition of I/O signal conditioning. This is made by way 'module header areas' consisting of holes for a 20 pin DIL Header of 0.3 to 0.9 inch pitch.

The PCI236 has module header areas, one each for ports PA0-7, PB0-7 & PC0-7.



**FIGURE 2.1 SIGNAL CONDITIONING MODULE PORT IDENTIFICATION**

The diagram below shows the module header associated with PA0-7.



**FIGURE 2.2 I/O MODULE CONNECTIONS**

Under normal conditions the I/O signals pass straight through the header. Individual I/O signal paths may be broken across the header, to allow series elements to be inserted in the I/O port signal path. To do this drill the corresponding drill point for that I/O Port. The drill points are situated down the centre of the module header area and must be drilled out using a 1.0mm drill.

Each of the three module header areas has its own dedicated IOGND pin on the PCI236 37 way D-type connector (PL1). These are connected to the PCI236 digital GND plane as default. They can be isolated from the PCI236 GND by drilling the respective drill point.

All three module header areas share a connection to IOVCC which is available on one pin of the PCI236 37 way D-type connector (PL1). This is connected to the PCI236 VCC (digital +5V) as default. **N.B.** If it is required to connect an external power supply to IOVCC pin on the D type then the pin must be isolated from the PCI236 +5V by drilling out the IOVCC drill points on **all three** module header areas.

**2.10 I/O Signal Conditioning Modules**

If more complex signal conditioning is required, complete modules may be fitted. These will affect all lines on an eight bit port and will require all associated drill points to be drilled before they can be fitted.

The range of possible modules includes:

- High current output
- Resistor capacitor filtered input
- Schmitt input
- Opto-isolated input
- Opto-isolated output

2.10.1 Opto-isolated input

2.10.2 Common Ground Default Configuration

The input module requires an external power source to drive the opto-isolator. In the default configuration the module will accept a common ground input. The ground for the external supply is connected to the IOGND pin on the input as in the diagram.

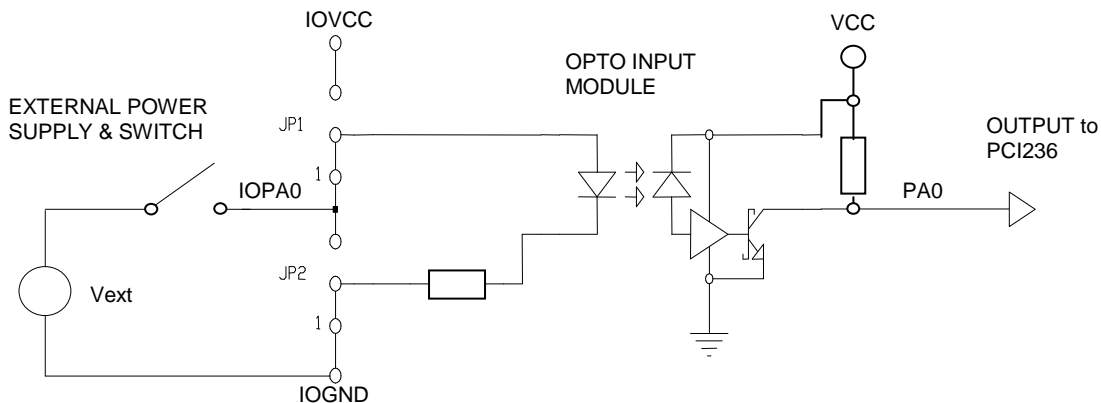


FIGURE 2.3 OPTO-ISOLATED INPUT COMMON GROUND

The external input control is represented by a switch and could equally well be a relay or semiconductor device. With the switch open the input to the PCI236 will be high (logic '1'). When the switch is closed the opto will be activated to pull the input to the PCI236 low (logic '0').

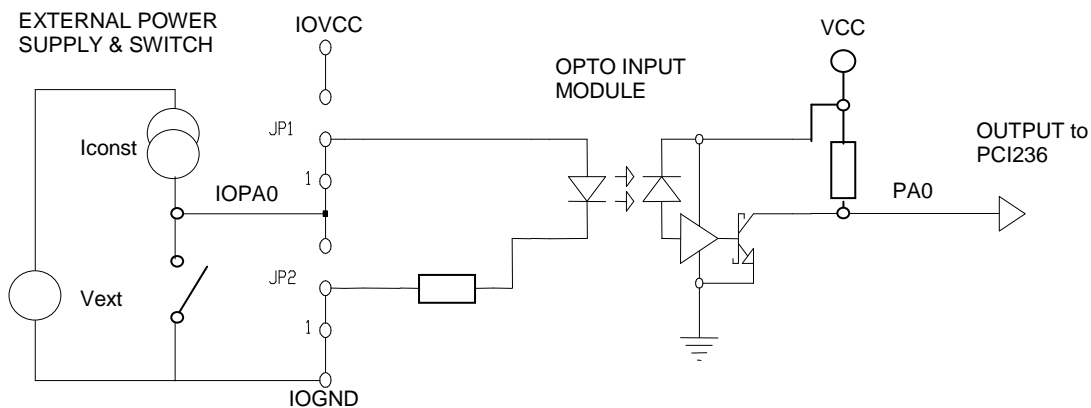


FIGURE 2.4 OPTO-ISOLATED INPUT COMMON GROUND PULL DOWN

It is also possible to accept active pull down inputs as in the figure above. In this example a current source such as a pull up resistor is used to pull the input to the opto high. The input to the PCI236 will then be low (logic '0'). When the switch is closed the opto will be turned off and the input to the PCI236 will go high (logic '1').

### 2.10.3 Common Supply Configuration

It is also possible to use the opto input module in a common supply configuration. To do this the module must have the solder bridges on the input module re-configured as in the diagram below.

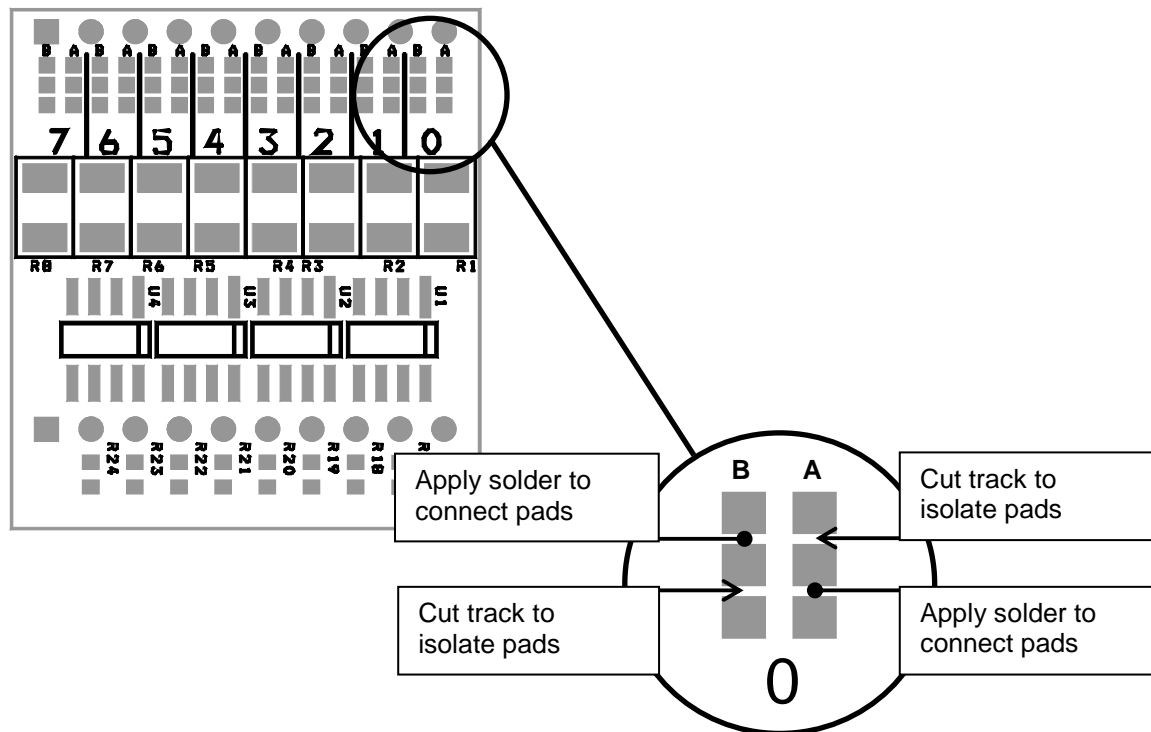


FIGURE 2.5 SOLDER BRIDGE CONFIGURATION FOR COMMON SUPPLY

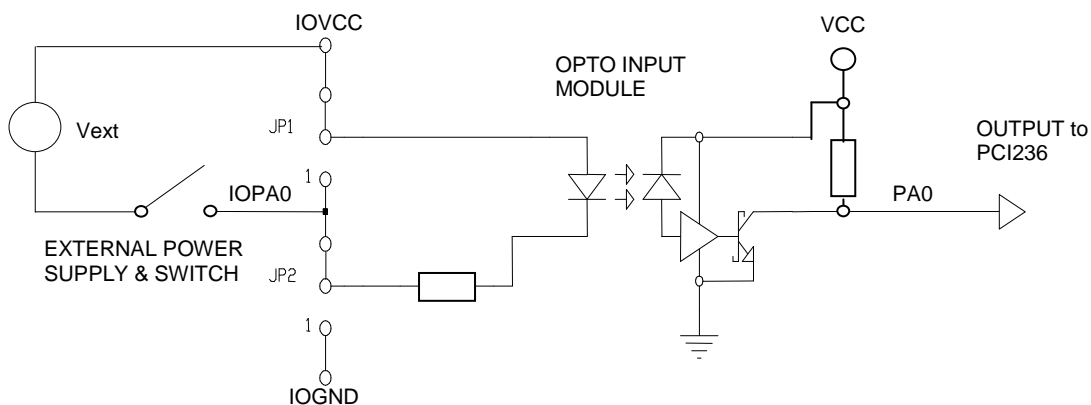


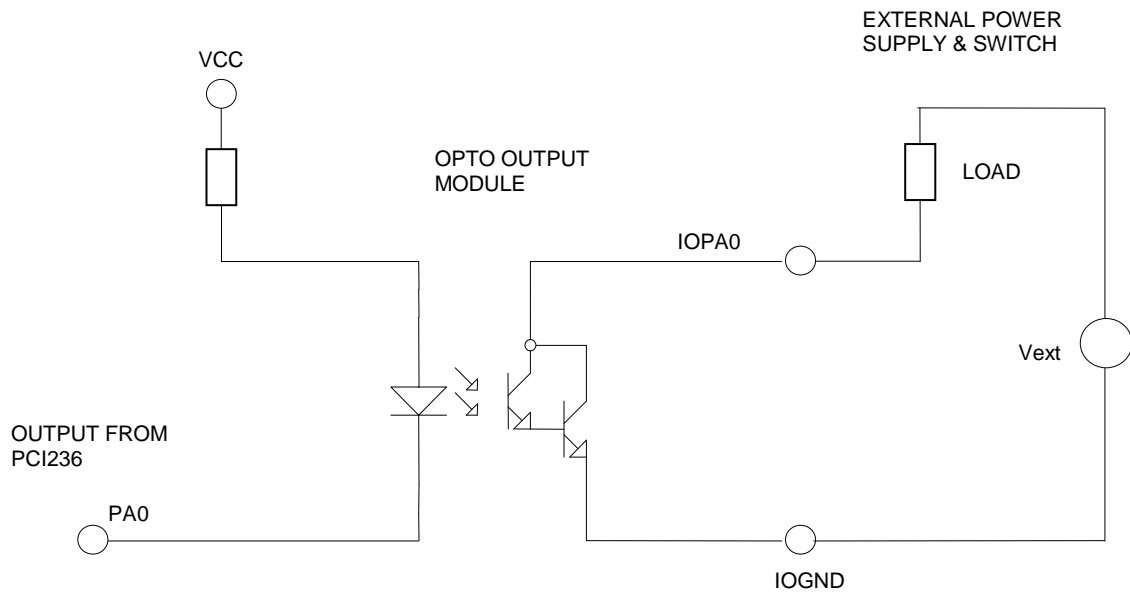
FIGURE 2.6 OPTO-ISOLATED INPUT COMMON SUPPLY

**N.B.** In this mode it is required to connect an external power supply to IOVCC pin on the D type. The IOVCC pin must be isolated from the PCI236 +5V by drilling out the IOVCC drill points on **all three** module header areas.

With the switch open the opto is off and the input to the PCI236 is high (logic '1'). When the switch is closed the opto turns on and the input to the PCI236 is low (logic '0').

### 2.10.4 Opto-isolated output

The opto-isolated output module allows a wide range of digital output signals to be driven to a maximum of 30V.



When the PCI236 powers up, the ports default to inputs and are seen as a high (logic '1') at the input to the opto output module. The opto isolator will be off. In the example circuit above no current will flow in the load and the voltage at IOPA0 will be Vext. When the PCI236 drives the port, as an output, low, the opto will turn on, current will flow in the load and the voltage at IOPA0 will go low.

### 2.11 Digital I/O Connections

The three ports of the PPI are all terminated on the rear 37 way D type connector PL1, and use pin-37 for the digital ground connection. Alternatively the individual digital ground connections provided for Port A, Port B & Port C on pins 28, 31 & 3 respectively. Pin-outs are shown in Figure 3.1. A mating D - type connector part number 7087 0392 is available from Amplicon.

**2.12 The PCI Interface**

The PCI236 is a PCI bus slave card. Communication between the host PC and the PCI236 digital I/O board is via the PCI bus. This bus provides data, address, interrupt and control lines together with the power supply for the PCI236.

The PCI236 is allocated two Base addresses in the available I/O space. Base Address 1 (BA1) is the PCI236 Local Bus configuration register access space. We use this to access the interrupt control and status register only. BA2 is the local bus. For the PCI236 the 82C55 PPI is the only device in this space.

The board base address and PC IRQ are set up by the PCI enumerator software during installation. Interrupt sources are classified by the position in an interrupt source register and each source is maskable by a bit in an interrupt mask register.

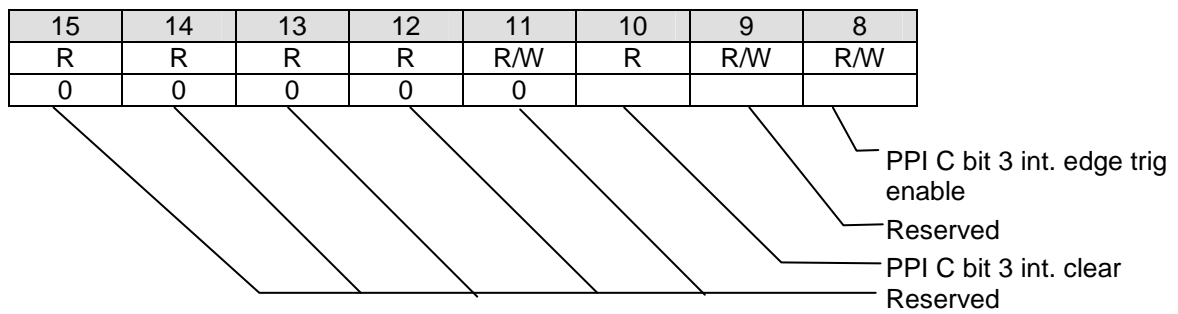
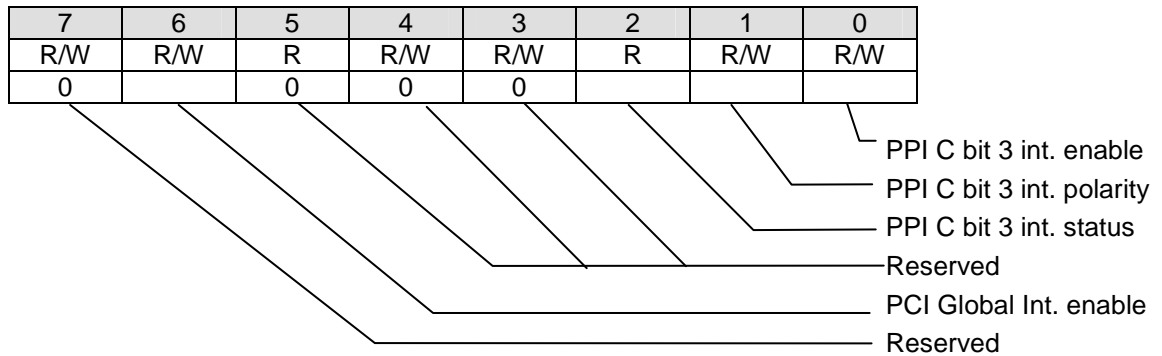
The PCI236 uses only the +5 V supply from the host PC and this supply rail is also available for external use via the I/O connector.

PC I/O PORT ADDRESS (Base + Offset)	FUNCTION	8/16 bit	IN/ OUT	CHIP SELECT Mnemonic
BA2 + 00 <sub>16</sub>	Data to/from port A of PPI	8	In/out	<b>PPICS</b>
BA2 + 01 <sub>16</sub>	Data to/from port B of PPI	8	In/out	<b>PPICS</b>
BA2 + 02 <sub>16</sub>	Data to/from port C of PPI	8	In/out	<b>PPICS</b>
BA2 + 03 <sub>16</sub>	Control word for PPI	8	Out	<b>PPICS</b>
BA1 + 4C <sub>16</sub>	ISR Interrupt source mask register / Interrupt status register	16	In/out	

**FIGURE 2.7 PCI236 REGISTER ASSIGNMENTS**

2.12.1 IER Interrupts Enable / Status Register

This is a read and write register. When written to, it is an interrupt enable / mask register.



Notes:

- To enable the PPI C bit 3 interrupt, the register should be set to 0143<sub>16</sub>.
- To disable the interrupt again, the register should be set to 0102<sub>16</sub>.
- In the interrupt routine, check bit 2 (read register and bit-wise-AND with 0004<sub>16</sub>) to determine whether the card has raised an interrupt. A non-zero bit indicates that the card has raised an interrupt. N.B. the IRQ may be shared with other PCI cards.
- If the card has raised an interrupt, the interrupt must be cleared on the card by setting bit 10 to '1'. If the interrupt is to remain enabled, write the value 0543<sub>16</sub> to the register. If the interrupt is to be disabled, write the value 0502<sub>16</sub>.

### 3 ELECTRICAL CONNECTIONS

This chapter describes the signal and control connections that the user must make between the PCI236 and any external devices. These I/O connections are made through the D-type connector protruding from the PC adapter slot corresponding to the chosen board position. The metal shell connected to the local PC chassis ground. All signals are referred to the relevant signal ground.

#### 3.1 37 way D-type Connector (PL1 - User I/O)

Connections from the PCI236 to the user devices are made via a 37 way D-type connector. The pin assignments for this connector are shown in figure 3.1.

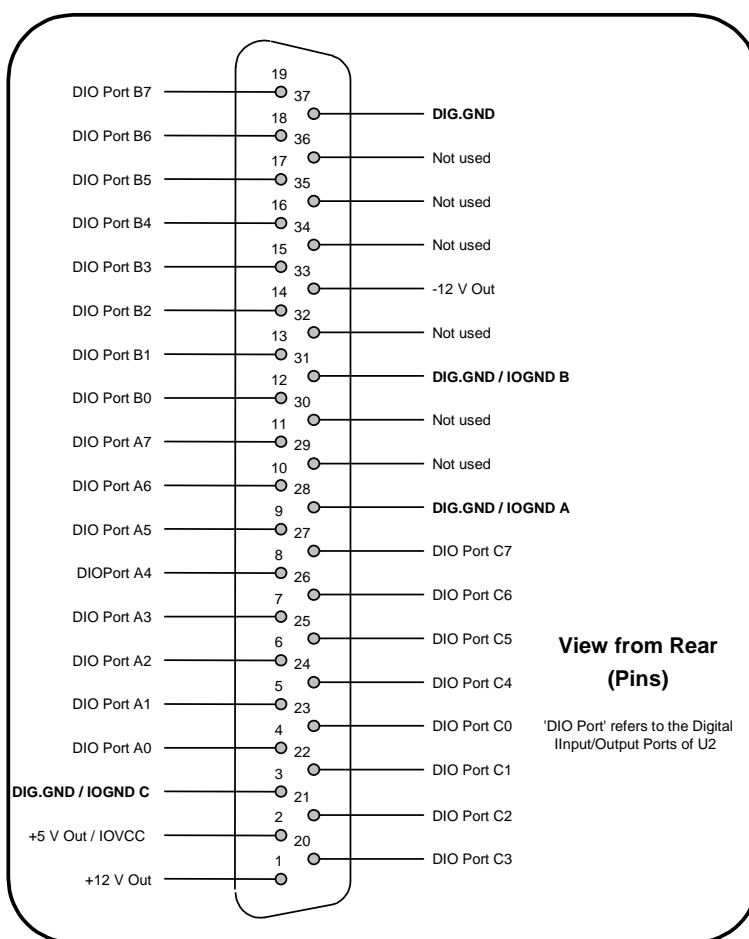


FIGURE 3.1 I/O CONNECTOR

A mating 37 way female connector is available as a separate item. D-sub connector part number 7087 0392, available from Amplicon.

### **3.2 Voltage Outputs Available on PL1**

In addition to the 24 digital I/O lines, the PC voltage rails are brought out on PL1, the I/O connector. These rails are +5, +12 and -12 VDC. No more than 1.0 A should be drawn from the +5 V rail and no more than 100 mA from either of the other rails. Refer to the computer technical reference manual for total current availability from the source power supplies. Some portable computers do not have the  $\pm 12$  V power supplies available.

### **3.3 Use of Shielded Cables**

In order to maintain compliance with the EMC directive, 89/336/EEC, it is mandatory that the final system integrator uses good quality screened cables for external connections. It is up to the final system integrator to ensure that compliance with the Directive is maintained. Amplicon Liveline offers a series of good quality screened cables for this purpose. Please contact our sales staff.

## 4 PROGRAMMING THE PCI236

The PCI236 is supplied with Windows 95, Windows NT and Windows 2000 specific drivers. The Windows 95 driver is also compatible with Windows 98. Programming for use under other operating systems is beyond the scope of this manual. A Dynamic Link Library (DLL) is supplied to provide an Application Programming Interface (API) for user programs.

### 4.1 Copyright

Software supplied with the PCI236 is **Amplicon** copyright. Permission is granted for the purchaser of the PCI236 to incorporate any part of the **Amplicon** copyright software into related application programs, and to use, resell or otherwise distribute such application programs for operation with PCI236 hardware purchased from **Amplicon Liveline Limited**.

### 4.2 Guide to User Programming

When developing an application specific program, it is advised that the supplied driver and dynamic link library functions be used for 32-bit Windows applications. Please refer to the ADIO software manual, **ampdio32manual.pdf**, for details of programming using the functions in the DLL.

The relevant sections in the Win32 Drivers manual are as follows:

- 1 INTRODUCTION
- 2 GETTING STARTED
- 3 DRIVER FUNCTIONS AND CONCEPTS, introductory section
- 3.2 Digital I/O Functions
- 3.4 Using Interrupts
- 4 SOFTWARE INSTALLED WITH THE DRIVER
- 5 STRUCTURE AND ASSIGNMENTS OF THE REGISTERS
- 5.4.1 82C55 Programmable Peripheral Interface Registers
- 6 PROGRAMMING WITH THE ADIO DRIVER
- 6.3 Using the Dynamic Link Library
- 6.4 Windows 32 Library Functions
- 6.4.1 Initialization Functions
- 6.4.2 Interrupt Control Functions
- 6.4.3 Thread Priority Functions
- 6.4.11 Digital Input/Output Functions
- 6.4.12 Switch Scanner Matrix Functions
- 6.4.13 Basic User Interrupt Callbacks
- 6.4.14 Buffered User Interrupt Callbacks
- 6.4.15 Non-Callback Buffered User Interrupts
- 6.4.23 Driver Interface Functions
- 6.5 Library Error Codes
- 7 IOCTL Interface

For programming at register level, reference should be made to section 2 describing the assignments of each I/O register in the PCI236. Reference should also be made to the 82C55 Appendix **App82C55.pdf** in the \MANUAL subdirectory on the Amplicon SOFTMAN CD-ROM for details of programming the 82C55 at register level. Support is not available for this method of programming.

### 4.3 Interfacing with Commercial Software Packages

The supplied software examples are not intended to be stand alone applications programs, other than for demonstration and test purposes. To meet most user requirements, either a dedicated program must be written using the functions and examples provided or the PCI236 can be interfaced to a commercial applications package.

#### Other Applications Packages

Further interface packages to commercial software will be made available as requirements expand. Check the 'README' files on the distribution CD, and/or the **Amplicon Product Catalogue** or Sales Department for the latest information.



**A.3 Environmental Conditions**

Environment

The PCI236 is designed to operate in a PC. Particular attention is paid at the design stage to minimise emission of noise and susceptibility to external radiated noise.

**Specific conditions**

<b>I/O Positions Required</b>	One PCI bus version 2.1 I/O adapter slot with room for half-length card.
<b>Board Dimensions</b>	Length 125 mm Height 102 mm
<b>Temperature Range</b>	Operating 0°C to +60°C Storage -20 to +70°C
<b>Humidity Range</b>	5% to 95% non-condensing
<b>Power Requirements</b>	5 Vdc from host computer power supply.  130 mA PCI236 typical operating  Excluding power supplied to external system via user connector.
<b>Dissipation</b>	Each PCI236 will dissipate typically 1.0 Watts of heat excluding any isolation modules fitted
<b>Handling</b>	Normal static handling precautions apply. Damage could result if not observed

**A.4 Opto-isolated I/O Modules**

Opto Isolated input module.

Number of inputs	= 8.
Input voltage range	= 12-24V nominal.
Maximum low voltage	= 1.8v
Maximum low current	= 1mA
Minimum hi voltage	= 9.25v
Maximum hi voltage	= 26.75v
Minimum hi current	= 5mA
Maximum hi current	= 15mA
Isolation Voltage	= 1000V (note1)
Maximum input frequency	= 10kHz

Opto Isolated output module.

Number of outputs	= 8
Type	= Photodarlington transistor
Output on/off time	= 15 / 30us.
Output Frequency	= 10kHz
Isolation Voltage	= 1000V (note1)
Photodarlington output CTR	= 500%
Max output Voltage	= 30V
Maximum output current	= 150mA (continuous all channels) 300mA (50% duty cycle)
Output Saturation voltage	= 1.2V

**Note. In order to comply with the Low Voltage Directive the isolation modules are designed to operate at common mode voltages not exceeding 75 volts with respect to the PC digital ground. Larger common mode voltages may appear under fault conditions. When installed in a PCI236, the modules have been tested to withstand common mode voltages of 1000Vdc applied to the PCI236 i/o connector .**

**Order Codes**

9099 3663	PCI236	Digital I/O board, 24 channels
9707 2898	PCI236i-I-O-O	PCI236 with 8 isolated inputs, 16 isolated outputs
9707 2900	PCI236i-I-I-O	PCI236 with 16 isolated inputs, 8 isolated outputs
9707 2901	PCI236i-I-I-I	PCI236 with 24 isolated inputs
9707 2904	PCI236i-O-O-O	PCI236 with 24 isolated outputs

**Optional Accessories**

<b>Amplicon Order Code</b>	<b>Description</b>
7087 0392	37 way 'D' socket with solder buckets
9089 1950	37 way screw terminal assembly
9101 4890	37 way, 1 metre screened cable

## B CIRCUIT LAYOUT AND SCHEMATIC DRAWINGS

Full circuit diagrams and layout drawings of the PCI236 are given in this appendix.

### B.1 ASSEMBLY DETAIL

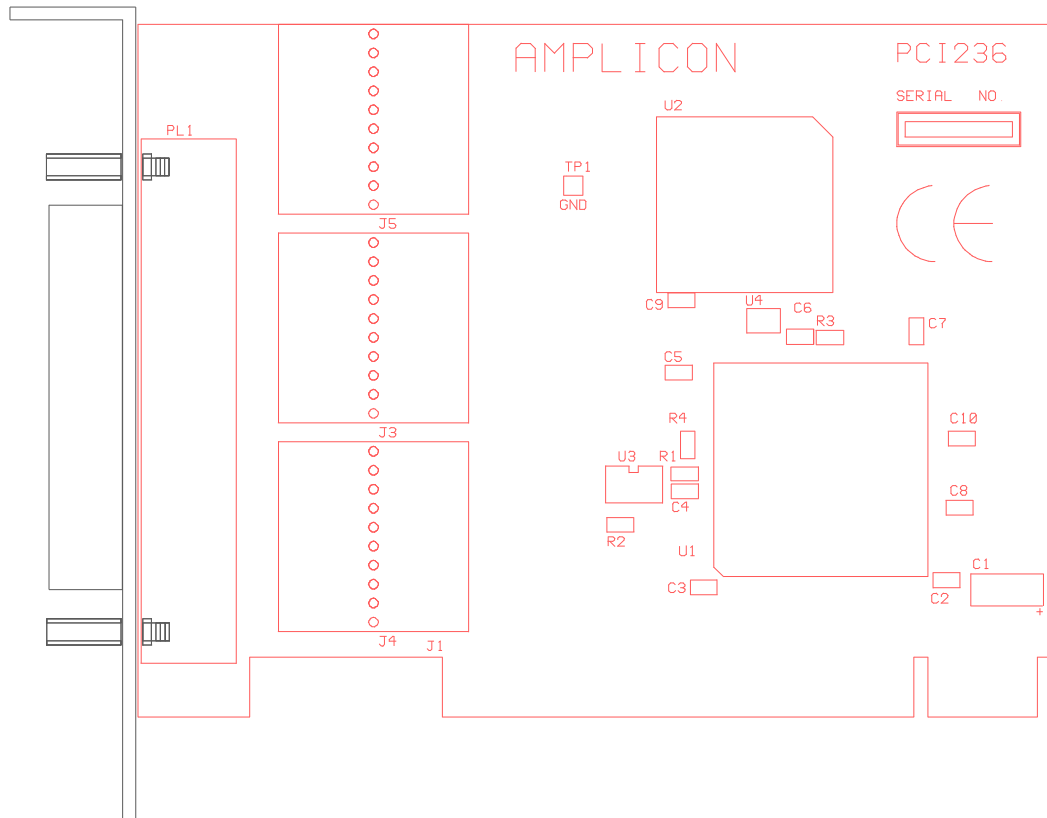


FIGURE B.1 PRINTED CIRCUIT LAYOUT



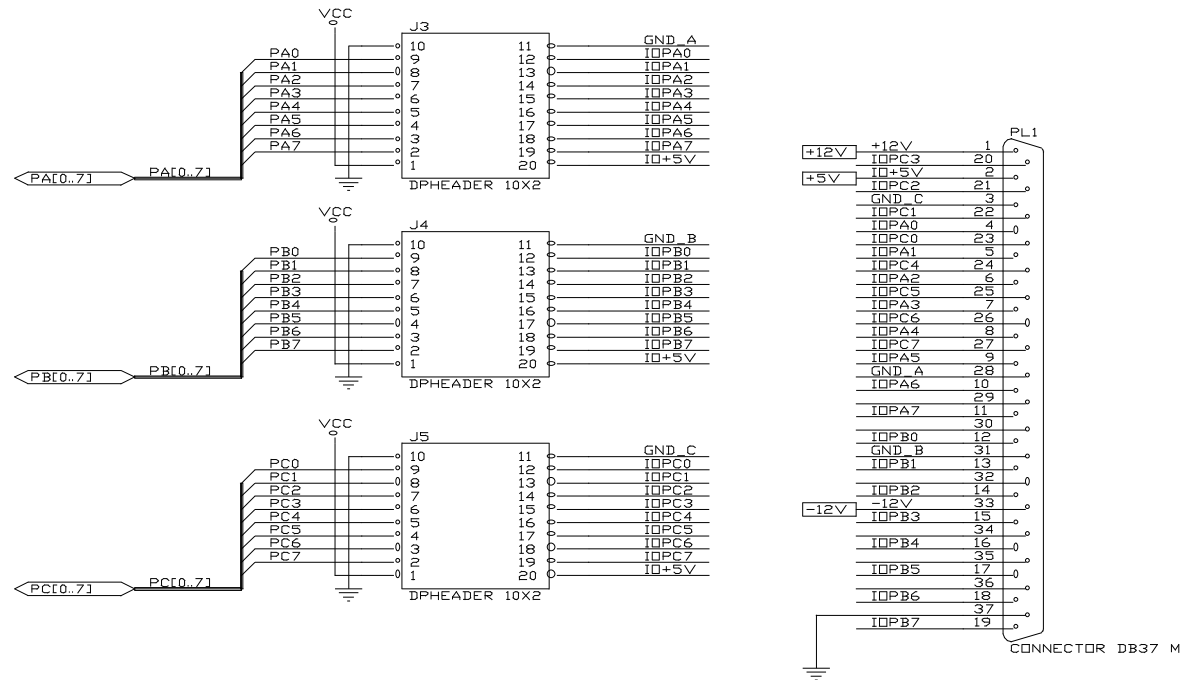


FIGURE B.3 PCI236 CIRCUIT DIAGRAM (SHEET 2)