EX-94133
**Isolated
32 channel D/O**

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Chapter 1
Introduction

1.1   Introduction

The EX-94133 is 32-CH high-density isolated digital output product. This digital output card is isolated up-to 5000 Vdc (excluding cables) for channel-to-computer isolation. It protects your computer against damage caused by accidental contact with high external voltage and eliminates troublesome ground loops.

The EX-94133 fully implements the PCI local bus specification Rev 2.1. All bus relative configurations, such as base memory and interrupt assignment, are automatically controlled by BIOS software.

1.2   Features

The EX-94133 Isolated digital I/O card provide the following advanced features:

- 32 Isolated digital output channels

- High output driving capability, 500mA sink current on isolated output

- 5000 Vrms high voltage isolation

- External interrupt signal on DI channels

- 37-pin D-type connector (Pin compatible to EX-9837)(see page 26)

1.3   Applications

- Laboratory and Industrial automation

- Relay driving

- On-Off control

- Low level pulse generator

- LED control

1.4   Specifications

- **Optical Isolated Output Channel**

    Numbers of Channel: 32 digital outputs

    Output type: Darlington transistors with common ground

    Output voltage: 5$_{VDC}$ min, 90$_{VDC}$ maximum

    Output Device: ULN2803 (common ground)

    Sink Current: Max. 500mA/ch for only one of the ULN2803 transistor is ON

    Power Dissipation: 1.47W per ULN2803 device (8 channels)

    Isolated voltage: 5000 $_{VDC}$

⬥ **General Specifications**

Connector: 37-pin D-type connector

Operating temperature: 0°C ~ 60°C

Storage temperature: -20°C ~ 80°C

Humidity: 5 ~ 95%, non-condensing

Power Consumption: +5V @ 530 mA typical

Dimension: 144mm(W) x110mm (H)

1.5 Software Supporting

Topsccc provides versatile software drivers and packages for users' different approach to built-up a system. We not only provide programming library such as DLL for many Windows systems, but also provide drivers for many software package such as LabVIEW™ ,Intouch™ and so on. All the software options are included in the provided CD.

1.6 Programming Library

The provided CD includes the function libraries for many different operating systems, including:

⬥ **DOS Library:** BorlandC/C++ and Microsoft C++, the functions descriptions are included in this user's guide.

⬥ **Windows 98/2000/NT/Me/XP DLL:** For VB, VC++, BC5, the functions descriptions are included in this user's guide.

⬥ Windows 98/2000/NT/Me/XP ActiveX: For Windows's applications

⬥ **LabVIEW ® Driver:** Contains the VIs, which are used to interface with NI's LabVIEW ® software package. Supporting Windows 95/98/NT/2000. The LabVIEW ® drivers are free shipped with the board.

⬥ **InTouch Driver:** Contains the InTouch driver which support the Windows 98/2000/NT/XP. The The InTouch ® drivers are free shipped with the board.

Chapter 2
Installation

This chapter describes how to install the EX-94133 card. Please follow the follow steps to install the EX-94133 card.

2.1 What You Have

In addition to this *User's Manual*, the package includes the following items:

⬥ EX-94133 board

⬥ Driver/utilities CD

⬥ This user's manual

If any of these items is missing or damaged, contact the dealer from whom you purchased the product. Save the shipping materials and carton in case you want to ship or store the product in the future

2.2 Unpacking

Your EX-94133 card contains sensitive electronic components that can be easily damaged by static electricity. The operator should be wearing an anti-static wristband, grounded at the same point as the anti-static mat. Inspect the card module carton for obvious damage. Shipping and handling may cause damage to your module. Be sure there are no shipping and handing damages on the module before processing.

After opening the card module carton, extract the system module and place it only on a grounded anti-static surface component side up. Again inspect the module for damage. Press down on all the socketed IC's to make sure that they are properly seated. Do this only with the module place on a firm flat surface.

2.3 Hardware Installation Outline

⬥ **PCI configuration**

The PCI cards are equipped with plug and play PCI controller, it can request base addresses and interrupt according to PCI standard. The system BIOS will install the system resource based on the PCI cards' configuration registers and system parameters (which are set by system BIOS). Interrupt assignment and memory usage (I/O port locations) of the PCI cards can be assigned by system BIOS only. These system resource assignments are done on a board-by-board basis. It is not suggested to assign the system resource by any other methods.

⬥ **PCI slot selection**

The PCI card can be inserted to any PCI slot without any configuration for system resource.

2.4 PCB Layout
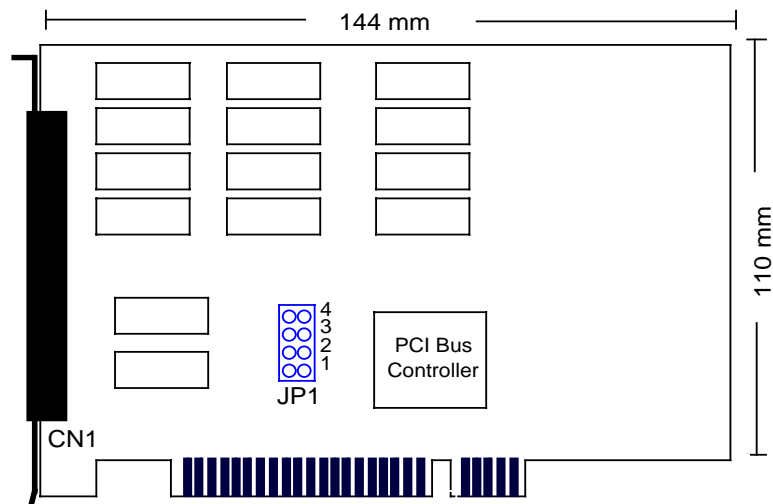
Where

CN1: Digital output connector

JP1: Card number jumper

2.5 Installation Procedures

1. Turn off your computer.
2. Turn off all accessories (printer, modem, monitor, etc.) connected to your computer.
3. Remove the cover from your computer.
4. Setup jumpers on the card.
5. Before handling the PCI cards, discharge any static buildup on your body by touching the metal case of the computer. Hold the edge and do not touch the components.
6. Position the board into the PCI slot you selected.
7. Secure the card in place at the rear panel of the system.

2.6 Device Installation for Windows Systems

Once Windows 95/98/2000 has started, the Plug and Play function of Windows system will find the new Expert cards. If this is the first time to install Expert cards in your Windows system, you will be informed to input the device information source.

2.7 **Connector Pin Assignment of EX-94133**

The pin assignment of the 37-pins D-type connector is an isolated signal connector, EX-94133's pin assignment is as shown in Figure 2.7

Pin	Signal	Pin	Signal
1	DO_0	20	DO_19
2	DO_1	21	DO_20
3	DO_2	22	DO_21
4	DO_3	23	DO_22
5	DO_4	24	DO_23
6	DO_5	25	DO_24
7	DO_6	26	DO_25
8	DO_7	27	DO_26
9	DO_8	28	DO_27
10	DO_9	29	DO_28
11	DO_10	30	DO_29
12	DO_11	31	DO_30
13	DO_12	32	DO_31
14	DO_13	33	DO_COM
15	DO_14	34	DO_COM
16	DO_15	35	ISOGND
17	DO_16	36	ISOGND
18	DO_17	37	ISOGND
19	DO_18		
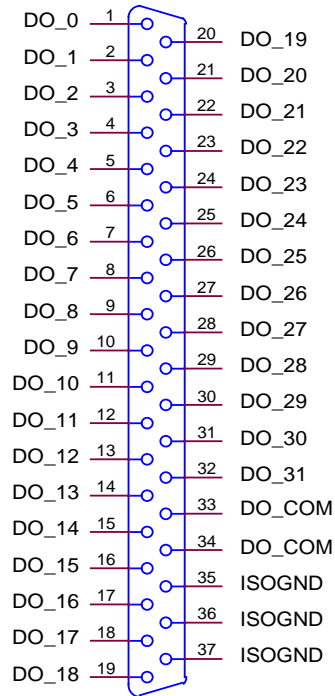
Figure 2.7 Pin Assignment of EX-94133 connector CN1

Legend:

- **DO_n**: Isolated digital output channel #n
- **DO_COM**: Power input signal for fly-wheel diode of DO channels
- **ISOGND**: Ground return path of isolated input and output channels

2.8 **Card number setting**

Maximum four EX-94133 cards can be installed in system simultaneously with each has a unique card number.

A jumper called "JP1" (see page 7) on the card is used to set the card number starts from 1 to 4

JP1	Card number
(jumper on position 1)	1 (default setting)
(jumper on position 2)	2
(jumper on position 3)	3
(jumper on position 4)	4

Chapter 3
Registers Format

3.1 PCI PnP Registers

There are two types of registers: PCI Configuration Registers (PCR) and Peripheral Interface Bus (PIB). The PCR, which is compliant to the PCI-bus specifications, is initialized and controlled by the plug & play (PnP) PCI BIOS..

The PCI bus controller Tiger 100/320 is provided by Tigerjet Network Inc. (www.tjnet.com). For more detailed information of PIB, please visit Tigerjet technology's web site to download relative information. It is not necessary for users to understand the details of the PIB if you use the software library. The PCI PnP BIOS assigns the base address of the PIB. The assigned address is located at offset 14h of PIB .

The EX-94133 board registers are in 32-bit width. But only lowest byte (bit0~bit7) is used. The users can access these registers by only 32-bit I/O or 8-bit I/O instructions. The following sections show the address map, including descriptions and their offset addresses relative to the base address.

3.2 Reset control registers

The EX-94133 is in inactive state when the system power on, and should be activated by set bit o of this register to "1" state

Address: Base + 0x00

Attribute: Write only

Value:

Bit	7	6	5	4	3	2	1	0	State
Base+0x00	0	0	0	0	0	0	0	0	Inactive (reset) state (Default)
Base+0x00	0	0	0	0	0	0	0	1	Active state

⬥ Bit 0 of this register should be set to "1" before using EX-94133

3.3 Digital Output Register

There are total 32 digital output channels on the EX-94133. each bit of based address is corresponding to a signal on the digital output channel.

Address: BASE + 0C0H ~ BASE +0CCH (port 0 ~ port 3)

Attribute: write /read

Value:

Bit	Port	7	6	5	4	3	2	1	0
Base+0C0H	0	DO_7	DO_6	DO_5	DO_5	DO_3	DO_2	DO_1	DO_0
Base+0C4H	1	DO_15	DO_14	DO_13	DO_12	DO_11	DO_10	DO_9	DO_8
Base+0C8H	2	DO_23	DO_22	DO_21	DO_20	DO_19	DO_18	DO_17	DO_16
Base+0CCH	3	DO_31	DO_30	DO_29	DO_28	DO_27	DO_26	DO_25	DO_24

Note: Each output port can be read back by the same I/O address

Chapter 4
Operation Theorem

4.1 Isolated Digital Output Channels

On EX-94133, the DO_COM pin is used as "fly-wheel" diode, which can protect the driver if the loading is inductance loading such as relay, motor or solenoid. If the loading is resistance loading such as resistor or LED, the connection to fly-wheel diode is not necessary.
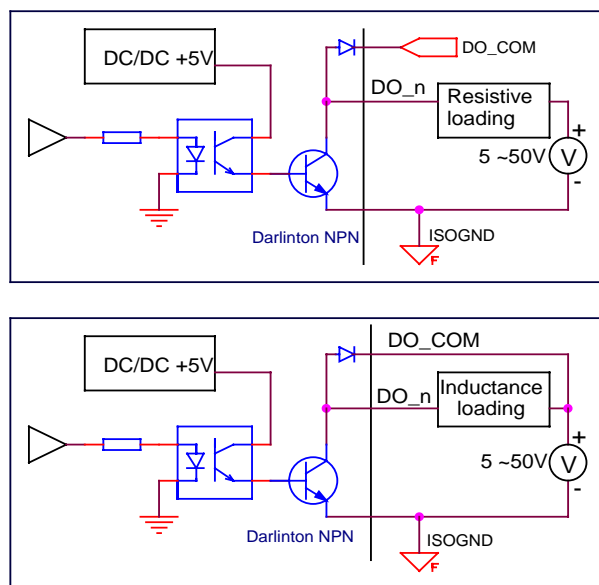

Figure 4-1 isolated digital outputs

Please note that when the loading is as "inductance type loading" such as relay, coil or motor, the DO_COM pin must be connected to the external power source. The extra connection is to utilize the 'fly-wheel diode' to form a current-release closed loop, so that the transistor won't be destroyed by the reverse high voltage which is generated by the inductance load when the output switches from "ON" to "OFF".

Chapter 5
Libraries

This chapter describes the software library for operating this card. Only the functions in DOS library and Windows DLL are described. Please refer to the PCIDAQ function reference manual, which included in Expert CD, for the descriptions of the Windows 98/NT/2000 DLL functions.

5.1 Libraries Installation

This section will show you how to install the software libraries DOSDAQH.LIB for DOS, or Windows 98 DLL, or PCIDAQ for Windows 98/NT/2000.

The device drivers and DLL functions of Windows 98/NT/2000 are included in the PCIDAQ. The Expert CD also includes the detail examples and readme files

5.1.1 How to use the DOSDAQH.LIB in DOS

◆ **For BC compiler**
   1. Large mode: Add   ..\LIB\BC\DOSDAQL.LIB in your project
   2. Huge mode: Add   ..\LIB\BC\DOSDAQH.LIB in your project
   3. Include DOSDAQ.H in your source file

◆ **For MSC compiler**
   1. Large mode: Add   ..\LIB\MSC\DOSDAQL.LIB in your project
   2. Huge mode: Add   ..\LIB\MSC\DOSDAQH.LIB in your project
   3. Include DOSDAQ.H in your source file

◆ **For TC compiler**
   1. Large mode: Add   ..\LIB\TC\DOSDAQL.LIB in your project
   2. Huge mode: Add   ..\LIB\TC\DOSDAQH.LIB in your project
   3. Include DOSDAQ.H in your source file

5.1.2 **How to use the PCIDAQ.DLL s in Windows**

◆ **VC++6.0:**
1. Add file '../Include/PCIDAQ.H' in your project
2. In link page of menu project| setting, add '../LIB/PCIDAQ.LIB' in the blank of Objects/Library Modules
3. Add this sentence "#include '../Include/PCIDAQ.H' " to the head of your main file.

◆ **Visual BASIC:**
1. Add file '../Include/Declare.bas' in your project.

◆ **Delphi:**
1. Add file '../Include/Declare.pas' in your project
2. Add this sentence "uses Declare;" in the head of your unit.pas

◆ **C++Builder:**
1. Add file '../Include/PCIDAQ.H' and '../Lib/PCIDAQ_CB.lib' to your project
2. Add this sentence "#include '../Include/PCIDAQ.H' " to head of your main file.

Note: For more information, please refer to program in directory '../Example/'

5.2 **Summary of function calls**

Function	Description	page
Open card	Initial EX-94133 card before using	17
Get Card's ID	Get PCI ID code of EX-94133	18
Get Driver Version	Get version number of PCIDAQ.DLL	19
Close card	Close EX-94133 card before terminating program	20
Get PCI Bus and Slot number	Get PCI bus and slot number occupied by EX-94133	21
Write data to digital output port	Write data (8-bit) to digital output port	22
Read back digital output data	Read back current value of digital output port	23
Set bit of digital output port	Activate a bit of digital output port (output transistor ON)	24
Reset bit of digital output port	De-activate a bit of digital output port (output transistor OFF)	25

5.3 **Open card**

Description:

Because the EX-94133 is PCI bus architecture and meets the plug and play design, the IRQ and base address are assigned by system BIOS directly. EX-94133 cards have to be initialized by this function before calling other functions.

Syntax:

C/C++(DOS)

```
WORD D_4133_Open (WORD cardNo);
```

C/C++ (Windows)

```
WORD W_4133_Open (WORD *ExistedCards);
```

Visual BASIC (Windows)

```
Function W_4133_Open (ByRef ExistedCards As Long) As Long
```

Delphi

```
Function W_4133_Open (var ExistedCards:Integer):Integer;
```

Argument:

cardNo: Card number set by jumper on card (DOS only)

existCards: This pointer return a value shows how many EX-94133 cards installed in your system. (Windows only)

Return Code:

Error code (Please refer to PCIDAQ.H or DOSDAQ.H)

5.4 **Get Card's ID:**

Description:

Get the cards number that is set by jumper on cards.

Syntax:

C/C++(DOS)

```
void D_4133_GetCardsID (WORD *CardsIDArray);
```

C/C++(Windows)

```
WORD W _4133_GetCardsID (WORD *CardsIDArray);
```

Visual BASIC (Windows)

```
Function W_4133_GetCardsID (ByRef CardsIDArray As Long)
          As Integer
```

Delphi

```
Function W_4133_GetCardsID (var CardsIDArray:Word):Word;
```

Argument:

CardsIDArray: This array return card number (1,2,3,4), which is set by jumper on card. You should define a 4 elements array, and then pass the array's pointer to this function.

Return Code:

Error code (Please refer to PCIDAQ.H or DOSDAQ.H)

5.5 **Get Driver Version**

Description:

The EX-94133 card is driven by PCIDAQ. DLL driver. This function returns the version of PCIDAQ.DLL driver

Syntax:

C/C++(DOS):

```
void D_4133 _Version (char *version);
```

C/C++ (Windows)

```
Int W_4133_Version (void);
```

Visual BASIC (Windows)

```
Function W_4133_Version () As Long
```

Delphi

```
Function W_4133_Version ():Integer;
```

Argument:

Version: This string return the version of DOSDAQ.DLL (DOS only)

Return Code:

Return the version number (Windows only)

5.6 **Close card**

Description:

The IRQ and base address of EX-94133 (pass-through address) are assigned by system BIOS directly. This function should be called to release all system resource before terminate application program

Syntax:

C/C++(DOS)

```
WORD D_4133 _Close (WORD cardNo);
```

C/C++ (Windows)

```
Void W_4133_Close (void);
```

Visual BASIC (Windows)

```
Function W_4133_Close ()
```

Delphi

```
Function W_4133_Close ();
```

Argument:

cardNo: Card number (1,2,3,4),It's set by jumper on card

Return Code:

Error code (Please refer to PCIDAQ.H or DOSDAQ.H)

5.7 **Get PCI Bus and Slot number**

Description:

Get the PCI bus and slot number occupied by EX-94133 card

Syntax:

C/C++(DOS)

WORD D_4133_GetBusSlot (WORD cardNo, WORD *bus,WORD *slot);

C/C++ (Windows)

WORD W_4133_GetBusSlot (WORD cardNo, WORD *bus,WORD *slot);

Visual BASIC (Windows)

Function W_4133_GetBusSlot (ByVal cardNo As Long,
        ByRef bus As Long, ByRef slot As Long) As Long

Delphi

Function W_4133_GetBusSlot (cardNo:Integer;
        var bus:Integer;var slot:Integer):Integer;

Argument:

cardNo: Card number (1,2,3,4),It's set by jumper on card

bus: Return PCI bus Number

slot: Return PCI slot Number of the bus

Return Code:

Error code (Please refer to PCIDAQ.H or DOSDAQ.H)

5.8 **Write data to digital output port**

Description:

This function is used to write data (byte) to output port. You can send 8-bit output data to EX-94133 by calling this function.

Syntax:

C/C++(DOS)

WORD D_4133_Write_Do (WORD cardNo,WORD portNo,WORD Data);

C/C++ (Windows)

WORD W_4133_Write_Do (WORD cardNo,WORD portNo,WORD Data);

Visual BASIC (Windows)

Function W_4133_Write_Do (ByVal cardNo As Long,
        ByVal portNo As Long, ByVal Data As Long) As Long

Delphi

Function W_4133_Write_Do (cardNo:Integer;portNo:Integer;
        Data:Integer):Integer;

Argument:

cardNo: Card number (1,2,3,4),It's set by jumper on card

portNo: Digital port number (0 ~ 3)

        Port #0: DO_0~DO_7,   port #1:DO_8~DO_15

        Port #2: DO_16~DO_23,   port #3:DO_24~DO_31

Data: Data be written to output port

Return Code:

Error code (Please refer to PCIDAQ.H or DOSDAQ.H)

5.9 **Read back digital output data**

Description:

This function is used to read current data of output port. You can read back 8-bit output data of EX-94133 by calling this function.

Syntax:

C/C++(DOS)

WORD D_4133_Read_Do (WORD cardNo,WORD portNo,WORD *DoData);

C/C++ (Windows)

WORD W_4133_Read_Do (WORD cardNo,WORD portNo,WORD *DoData);

Visual BASIC (Windows)

Function W_4133_Read_Do (ByVal cardNo As Long,
        ByVal portNo As Long, ByRef DoData As Long) As Long

Delphi

Function W_4133_Read_Do (cardNo:Integer;portNo:Integer;
        var DoData:Integer):Integer;

Argument:

cardNo : card number (1,2,3,4),It's set by jumper on card

portNo : Do port number (0 ~ 3)

        Port #0: DO_0~DO_7,   port #1:DO_8~DO_15

        Port #2: DO_16~DO_23,   port #3:DO_24~DO_31

DoData: return current output value

Return Code:

Error code (Please refer to PCIDAQ.H or DOSDAQ.H)

5.10 **Set bit of digital output port**

Description:

Set one digital output bit to *short* state (output transistor ON).

Syntax:

C/C++(DOS)

WORD D_4133_Set_Do_Bit (WORD cardNo,WORD portNo, WORDbitNo);

C/C++ (Windows)

WORD W_4133_Set_Do_Bit (WORD cardNo,WORD portNo, WORDbitNo);

Visual BASIC (Windows)

Function W_4133_Set_Do_Bit (ByVal cardNo As Long,
        ByVal portNo As Long, ByVal bitNo As Long) As Long

Delphi

Function W_4133_Set_Do_Bit (cardNo:Integer;portNo:Integer;
        bitNo:Integer):Integer;

Argument:

cardNo: Card number (1,2,3,4),It's set by jumper on card

portNo: Digital output port number (0 ~ 3)

bitNo: Bit number(0 to 7)

Return Code:

Error code (Please refer to PCIDAQ.H or DOSDAQ.H)

5.11 **Reset bit of digital output port**

Description:

Set one digital output bit to *open* state (output transistor OFF)

Syntax:

C/C++ (DOS)

```
WORD D_4133_Reset_Do_Bit (WORD cardNo,WORD portNo,
    WORD bitNo);
```

C/C++ (Windows)

```
WORD W_4133_Reset_Do_Bit (WORD cardNo,WORD portNo,
    WORD bitNo);
```

Visual BASIC (Windows)

```
Function W_4133_Reset_Do_Bit (ByVal cardNo As Long,
        ByVal portNo As Long, ByVal bitNo As Long) As Long
```

Delphi

```
Function W_4133_Reset_Do_Bit (cardNo:Integer;
        portNo:Integer; bitNo:Integer):Integer;
```

Argument:

cardNo: Card number to select borad (1,2,3,4),It's set by jumper on card

portNo: Output port number (0 ~ 3)

bitNo: Channel number(0 to 7)

Return Code:

Error code (Please refer to PCIDAQ.H or DOSDAQ.H)

Chapter 6
EX-9837 Terminal board

EX-9837 Screw-terminal termination board features one 37-pin D-type connector for easy maintenance, wiring, and installation. It provides 37 channels that are accessed through a 37-pin D-type connector.

6.1 **Main features**

- Low-cost screw-terminal board for the all Expert series with 37-pin D-type connector
- Reserved space for signal-conditioning circuits such as low-pass filter, voltage attenuator and current shunt
- Industrial type termination blocks permit heavy-duty and reliable signal connections
- Table-top mounting using nylon standoffs. Screws and washers provided for panel or wall mounting
- Dimensions: 80mm (W) x 181mm (H)