PCI-M512/M512U

User Manual

Warranty

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

Warning

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1. Introduction

The PCI-M512/PCI-M512U provides battery-backup 512 KB SRAM, 12-bit DI and 16-bit DO. In addition, the PCI-M512U supports both 5 V and 3.3 V PCI bus, while the PCI-M512 supports 5 V PCI bus only. The PCI-M512U (Universal PCI version) is designed as a drop-in replacement for the PCI-M512 (PCI version), so users can replace a PCI-M512 by a PCI-M512U directly without any software or driver modification.

Users can use the DB-16P to connect the input ports (CN2) for isolation purpose, or use DB-16R to interface to the output ports (CN1) for relay control.

The PCI-M512/PCI-M512U is equipped with two Li-batteries to maintain the content of the 512 KB SRAM when PC power loss occurs. The two Li-batteries can continue supplying power to the SRAM to retain the important data for 10 years. The two-battery design also makes it safe to replace new batteries without losing data; when one battery is taken out for replacing a new one, the other continues to provide power to the SRAM.

4 LED indicators on the board are provided for giving clear understanding of the battery states such as normal, low voltage or fault. The PCI-M512/PCI-M512U is an ideal solution for improving system reliability.

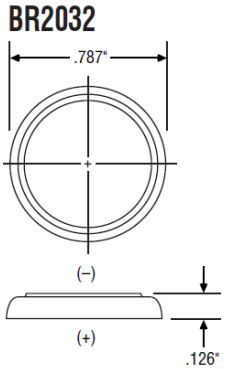
1.1 Features

- On-board 512 KB SRAM
- Two Li-batteries, BT1 & BT2, for battery-backup the data of SRAM
- LED indicators for Li-batteries states: normal, low voltage, fault
- 16-bit general purpose TTL-compatible D/O
- 12-bit general propose TTL-compatible D/I (DI4 ~ 15)
- 4-bit battery status read back(DI0 ~ 3)
  [PCI-M512 only]
- PCI card, supports 5 V PCI bus.
  [PCI-M512U only]
- Universal PCI card, supports both 5 V and 3.3 V PCI bus.

1.2 Specifications

Model Name	PCI-M512	PCI-M512U
Digital Input		
Channels	12	
Compatibility	5 V/TTL	
Input Voltage	Logic 0: 0.8 V max. Logic 1: 2.0 V min.	
Response Speed	1.4 MHz(Typical)	
Digital Output		
Channels	16	
Compatibility	5 V/TTL	
Output Voltage	Logic 0: 0.4 V max. Logic 1: 2.4 V min.	
Output Capability	Sink: 2.4 mA @ 0.8 V Source: 0.8 mA @ 2.0 V	
Response Speed	1.4 MHz(Typical)	
Special		
SRAM Size	512 KB	
Li-Battery	BT1 & BT2	
Battery Status bits	BT1 Low, BT1 Bad, BT2 Low, BT2 Bad(low voltage=2.3 V, bad voltage=2.1 V)	
LED Indicators	BT1 Low (Green), BT1 Bad (Red) BT2 Low (Green), BT2 Bad (Red)	
General		
Bus Type	5 V PCI, 32-bit, 33 MHz	3.3 V / 5 V Universal PCI, 32-bit, 33 MHz
Data Bus	16-bit(DI/DO) ,32-bit(Memory)	
I/O Connector	Male 20-bit ribbon x 2	
Dimensions (L x W x H)	140 mm x 90 mm x 22 mm	
Power Consumption	420 mA @ +5 V	
Operating Temperature	-20 ~ 60 °C	
Storage Temperature	-40 ~ 85 °C	
Humidity	0 ~ 90% RH, non-condensing	

Cell Model Name	BR2032
Max. Voltage (V)	3.0
Max. Current (mA)	195.0
Type	Lithium Coin Cells
Dimensions (D x H)	7.87 mm x 1.26 mm



1.3 Product Check List

The shipping package includes the following items:

- One PCI-M512/PCI-M512U board
- One companion CD for software driver
- One Quick Start Guide

It is recommended to read the Quick Start Guide first. All the necessary and essential information are given in the Quick Start Guide as follows:

- Where to get the software driver, demo programs and other resources.
- How to install the software.
- How to test the card.

Attention!

If any of these items are 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.

1.4 Installation Quick Start

The PCI-M512 software supports Windows 98/NT/2000/XP/2003/Vista/7/2008 32/64-bit.

1.4.1 Software Installation

Step 1: insert the companion CD into the CD-ROM driver. It will auto run as follows:

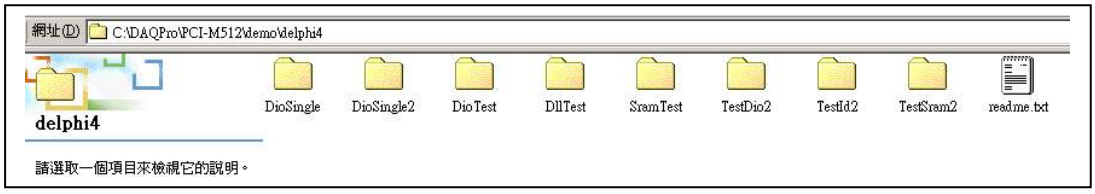
Step 2: click the first item, **PCI Bus DAQ Card**

Step 3: click the item, **PCI-M512**

1.4.2 get demo software and manual

Now you had installed the driver and rebooted your PC. The Plug and Play had run automatically and you see the PCI-M512 installation information in “Device Manager”.

You also got the demo programs already. For example, after running self-extracting archive “dll_Delphi4_yymmdd.exe”, the demo programs will show as follows:

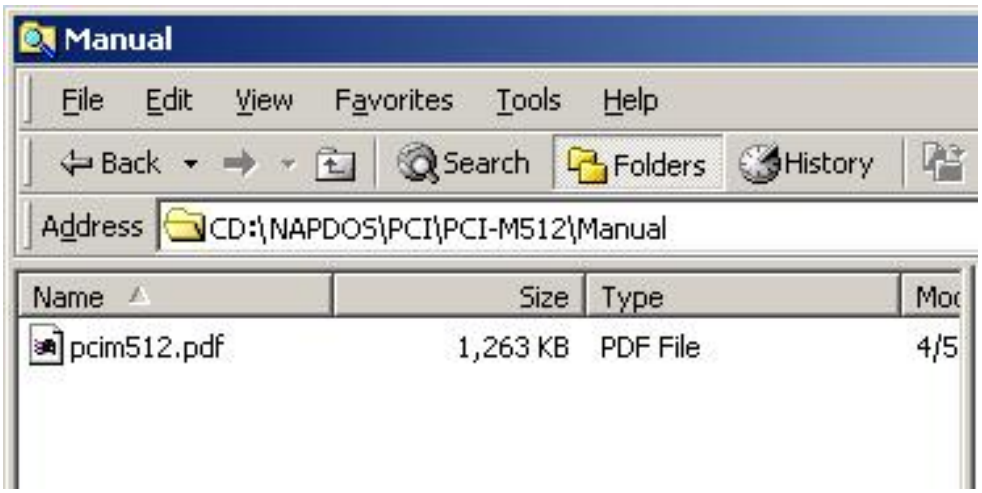


DioSingle → Test DIO of the PCI-M512 (only one program can access this board)
DioSingle2→ Test DIO of the PCI-M512
DioTest → Test DIO of the PCI-M512
DllTest → Test DLL driver & detect the PCI-M512/M512U

SramTest → Test NVSRAM of the PCI-M512
TestDio2 → Write DO then read DI of two PCI-M512 boards
TestId2 → Show IDs of two PCI-M512 boards
TestSram2 → Show SRAM of two PCI-M512 boards

Get the PCI-M512 hardware manual:

The hardware manual “pcim512.pdf” is in the companion CD
CD:\NAPDOS\PCI\PCI-M512\Manual



Get the FAQ documentation:

If you have any problem about install hardware, driver and software, please refer to the companion CD:\NAPDOS\PCI\Manual. Those documentations include "Software Installation Guide", "Trouble Shooting in Win32 Resource Conflict" and solutions of frequently asked software questions.

1.4.3 Hardware Installation

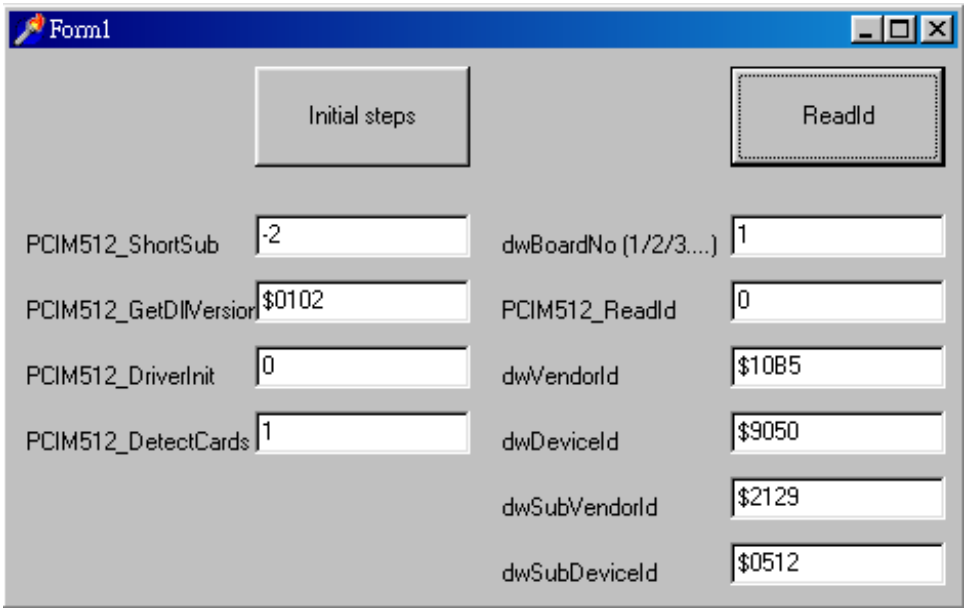
Step 1: Install your PCI-M512/M512U to PC

Step 2: Power on your PC

Step 3: Now Windows 98/2000/XP will find a PCI-M512/M512U card & ask you to provide a software driver. Refer to **"PCI_ISA_PnP_Driver_Installation_in_Win9x_2K_XP.pdf "** for more information. You can find the documentation in the companion CD:\NAPDOS\PCI\Manual

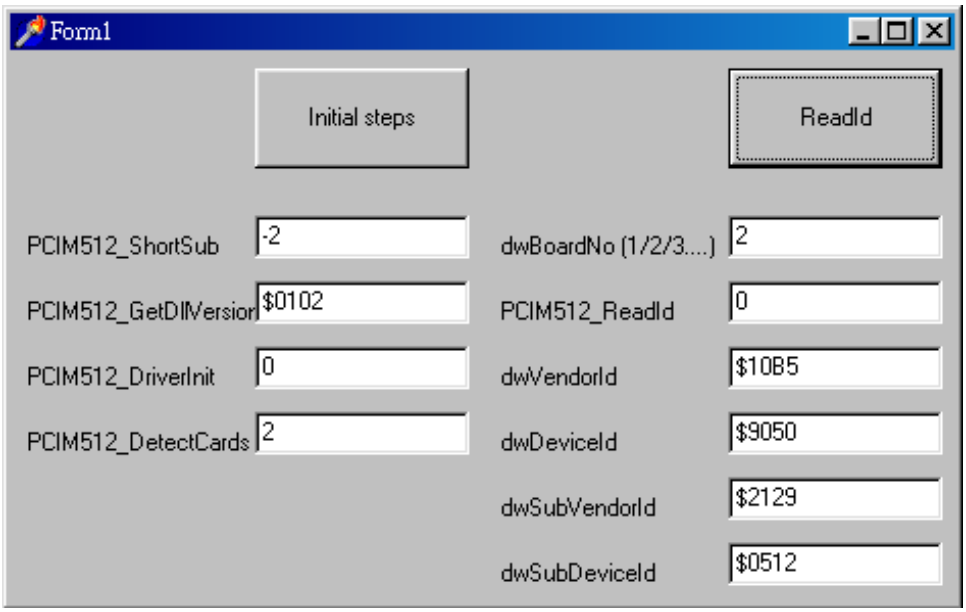
1.4.4 Hardware Diagnostic

Step 1: run **DllTest** of Delphi demo program as follows: (**Sec. 1.4.2**)



- Click ***Initial Steps*** first to check the kernel driver, DLL & PCIM512-DetectBoards()
- Check that the value of ***PCIM512_DriverInit*** is 0
- Click ***ReadBoardId*** to show the IDs of selected PCI-M512 in this PC

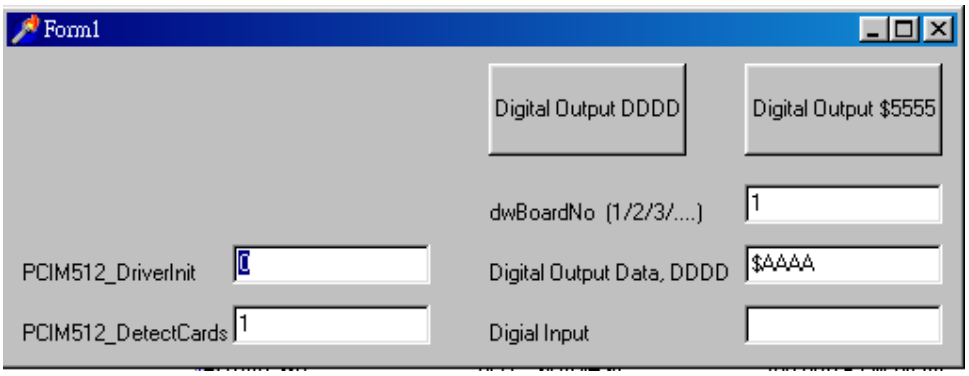
- Key-in new ***dwBoardNo*** to show IDs of another PCI-M512 as follows:.



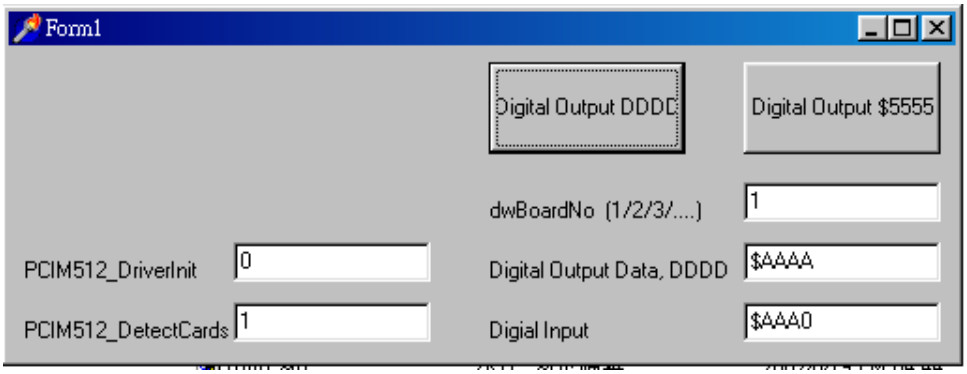
Refer to Sec. 2.2 for more information about IDs of PCI-M512 as follows:

- **Vendor ID = 10B5**
- **Device ID = 9050**
- **Sub-vendor ID = 2129**
- **Sub-device ID = 0512**

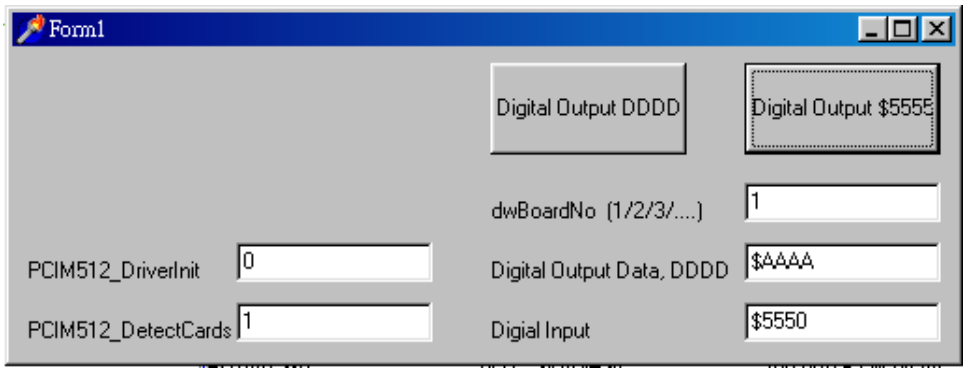
Step 2: run **DioTest** of Delphi demo program as follows: (**Sec. 1.4.2**)



- Click ***Digital Output 0xDDDD*** to write to D/O & Read D/I as follows: (write-data is given in ***Digital Output Data 0xDDDD***)

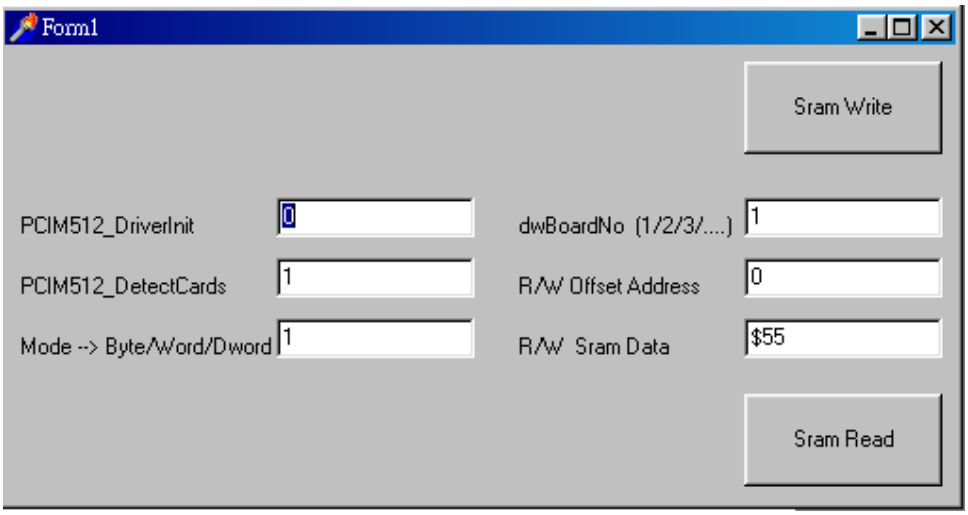


- Check that lowest 4 bits are equal 0. These 4 bits are battery status bits. Refer to Sec. 2.4 for more information.
- Click ***Digital Output $5555*** to write 0x5555 to D/O & Read D/I as follows:



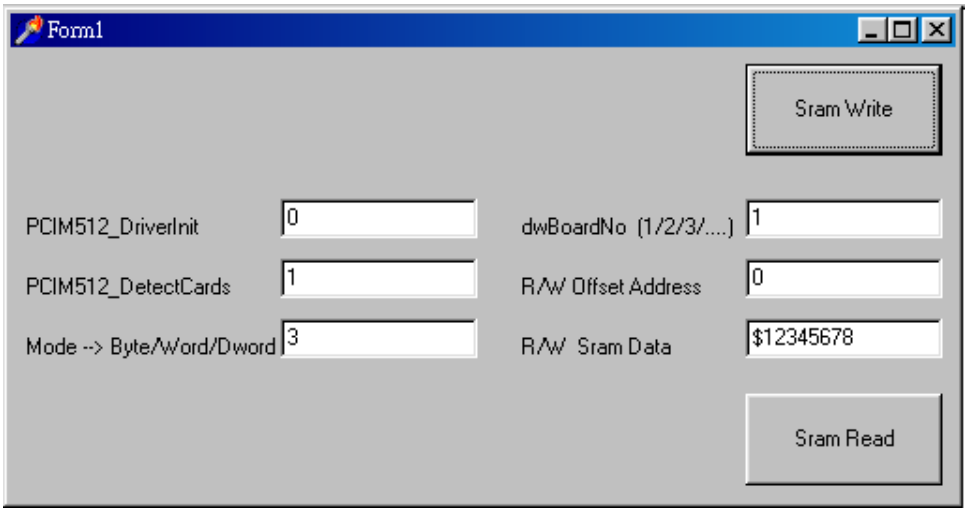
- Key-in new ***dwBoardNo*** to read/write to other PCI-M512.
  Refer to Sec. 3.1 for more information.

Step 3: run **SramTest** of Delphi demo program as follows: (**Sec. 1.4.2**)

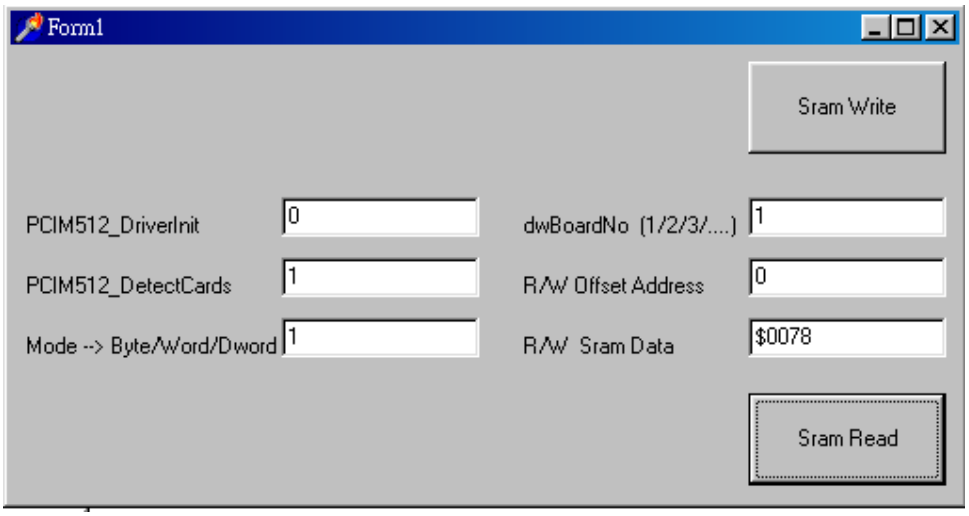


- Click ***Sram Write*** to write data to SRAM (offset address of SRAM is given in ***R/W Offset Address***, byte/word/dword read/write is given in ***Mode → Byte/Word/Dword***)
- Click ***Sram Read*** to read data from SRAM (offset address of SRAM is given in ***R/W Offset Address***, byte/word/dword read/write is given in ***Mode → Byte/Word/Dword***)
- Key-in new ***dwBoardNo*** to read/write to other PCI-M512/M512U.
  Refer to Sec. 3.1 for more information.

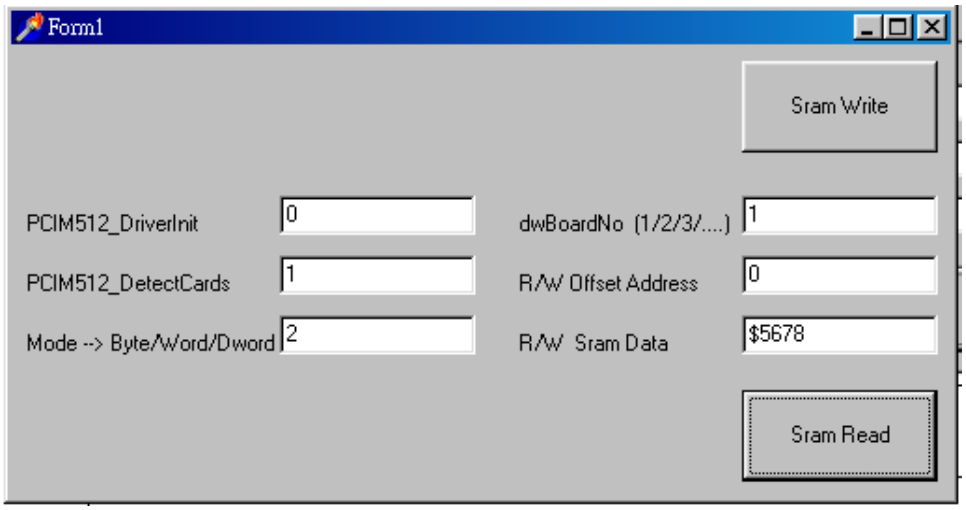
- Write 0x12345678 to offset address 0 of SRAM as follows:



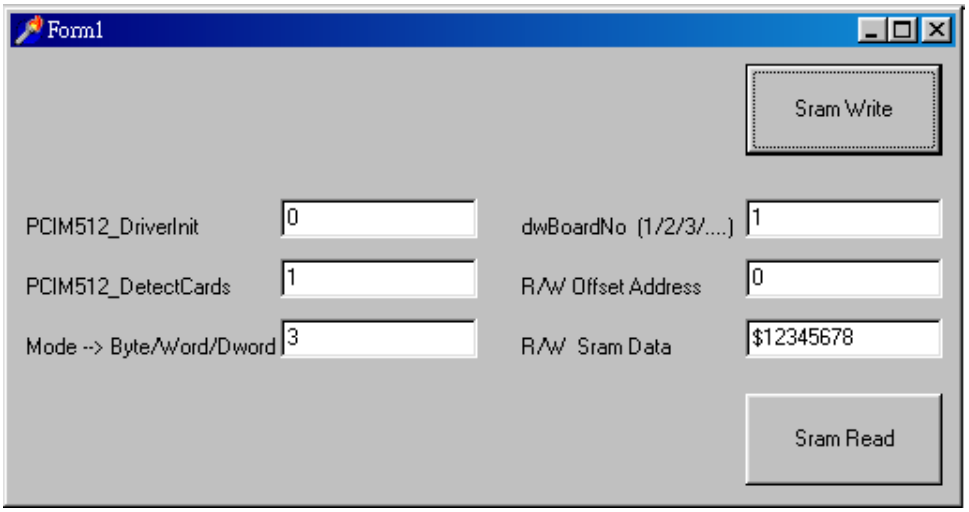
- Read one byte of SRAM at offset address 0 as follows:



- Read one word of SRAM at offset address 0 as follows:

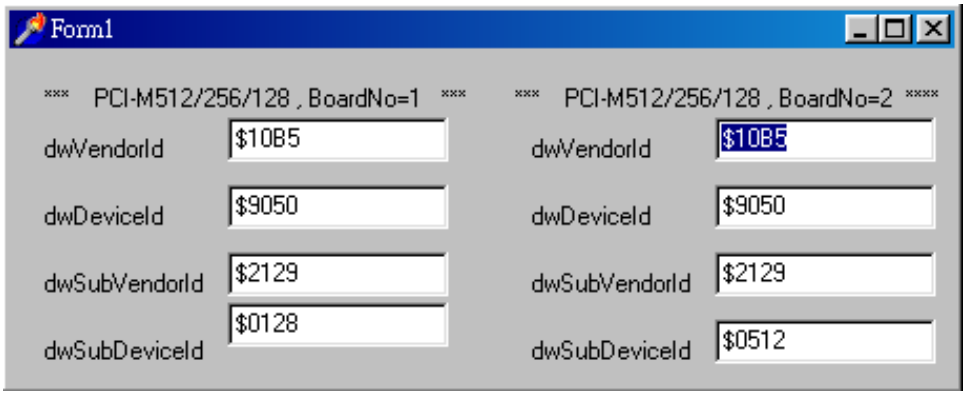


- Read one dword of SRAM at offset address 0 as follows:

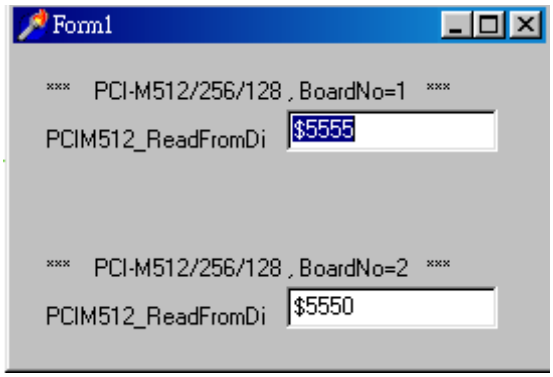


1.4.5 Multi-Board Diagnostic

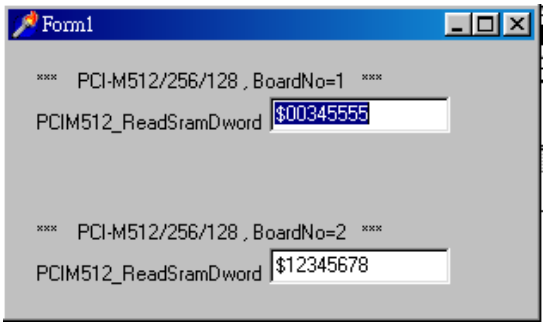
Step 1: Run **TestId2** of Delphi demo program to read & show IDs of two PCI-M512s as follows:



Step 2: Run **TestDIO2** of Delphi demo program to read/write D/I/O of two PCI-M512s as follows:

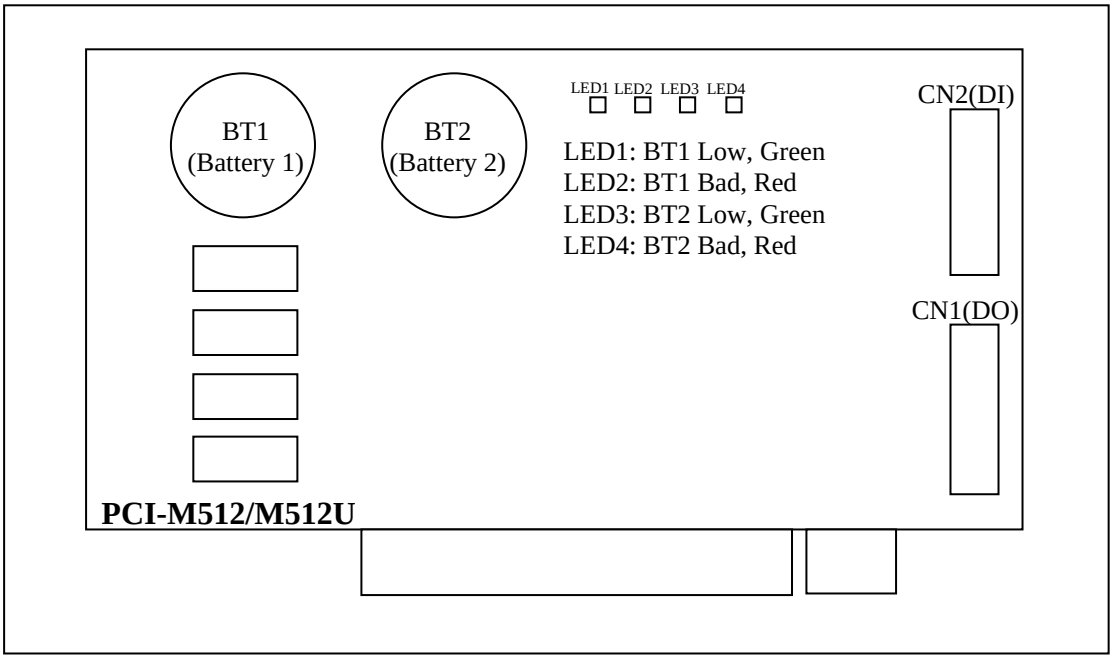


Step 3: Run **TestSram2** of Delphi demo program to read/write SRAM of two PCI-M512s as follows:



2. Hardware configuration

2.1 Board Layout



Note:

1. If BT1& BT2 are both OK, LED1 ~ LED4 will be OFF.
2. If BT1 is lower than 2.3 V, the green LED1 will be ON.
3. If BT1 is lower than 2.1 V, the green LED1 & red LED2 will be ON.
4. If BT2 is lower than 2.3 V, the green LED3 will be ON.
5. If BT2 is lower than 2.1 V, the green LED3 & red LED4 will be ON.
6. If the PC power is off, the power control circuit will **select the battery with the higher voltage** to backup SRAM. If both BT1 & BT2 are bad, the data stored in SRAM may be lost.
7. SRAM can keep all stored data if either BT1 or BT2 is higher then 2 V.
8. **If either BT1 or BT2 is bad, it is recommended to replace both BT1 & BT2 with new batteries.**

2.2 IDs of PCI-M512

The IDs of the PCI-M512/M512U are given as follows:

- **Vendor ID = 10B5**
- **Device ID = 9050**
- **Sub-vendor ID= 2129**
- **Sub-device ID = 0512**

The plug&play BIOS will assign proper resources to every PCI-M512 card in the power-on stage. The software driver of the PCI-M512 will use these resources to access the hardware.

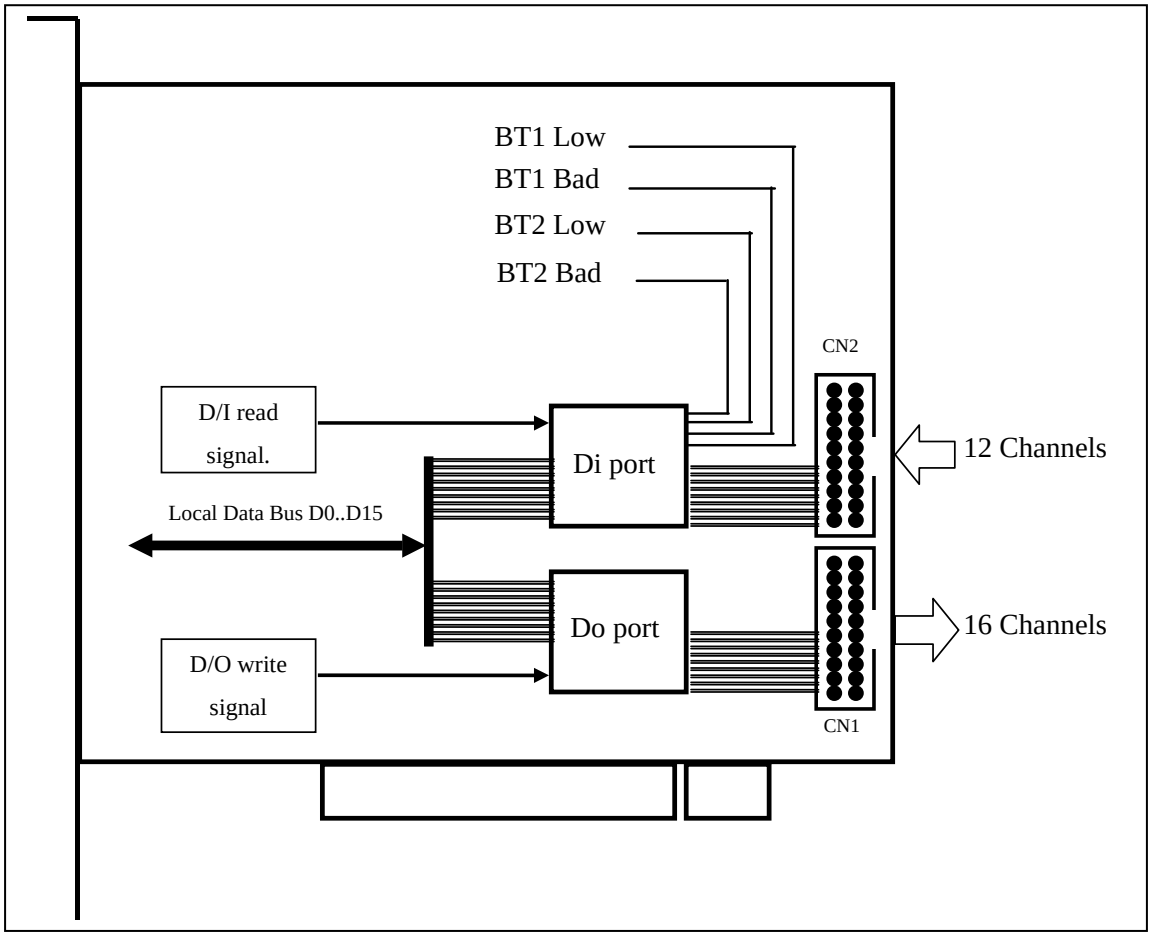
Users must use **PCIM512_DetectBoards()** to detect all PCI-M512 boards first. Then user can use the following commands to access SRAM or DIO of detected board.

	Read Function	Write Function
SRAM R/W Byte	PCIM512_ReadSramByte(…)	PCIM512_WriteSramByte(…)
SRAM R/W Word	PCIM512_ReadSramWord(…)	PCIM512_WriteSramWord(…)
SRAM R/W DWord	PCIM512_ReadSramDword(…)	PCIM512_WriteSramDword(…)
DIO R/W Word	PCIM512_ReadFrom Di(…)	PCIM512_WriteToDo(…)

PCIM512_ReadIBoardId(dwBoardNo,*dwVendorId, *dwDeviceId, *dwSubVendorId, *dwSubDeviceId) is designed to read back the IDs of detected PCI-M512/M512U boards.

2.3 Block Diagram of DIO

The PCI-M512/M512U provides 16 channels of digital input and 16 channels of digital output. All levels are TTL compatible. The connections diagram and block diagram are given as follows:

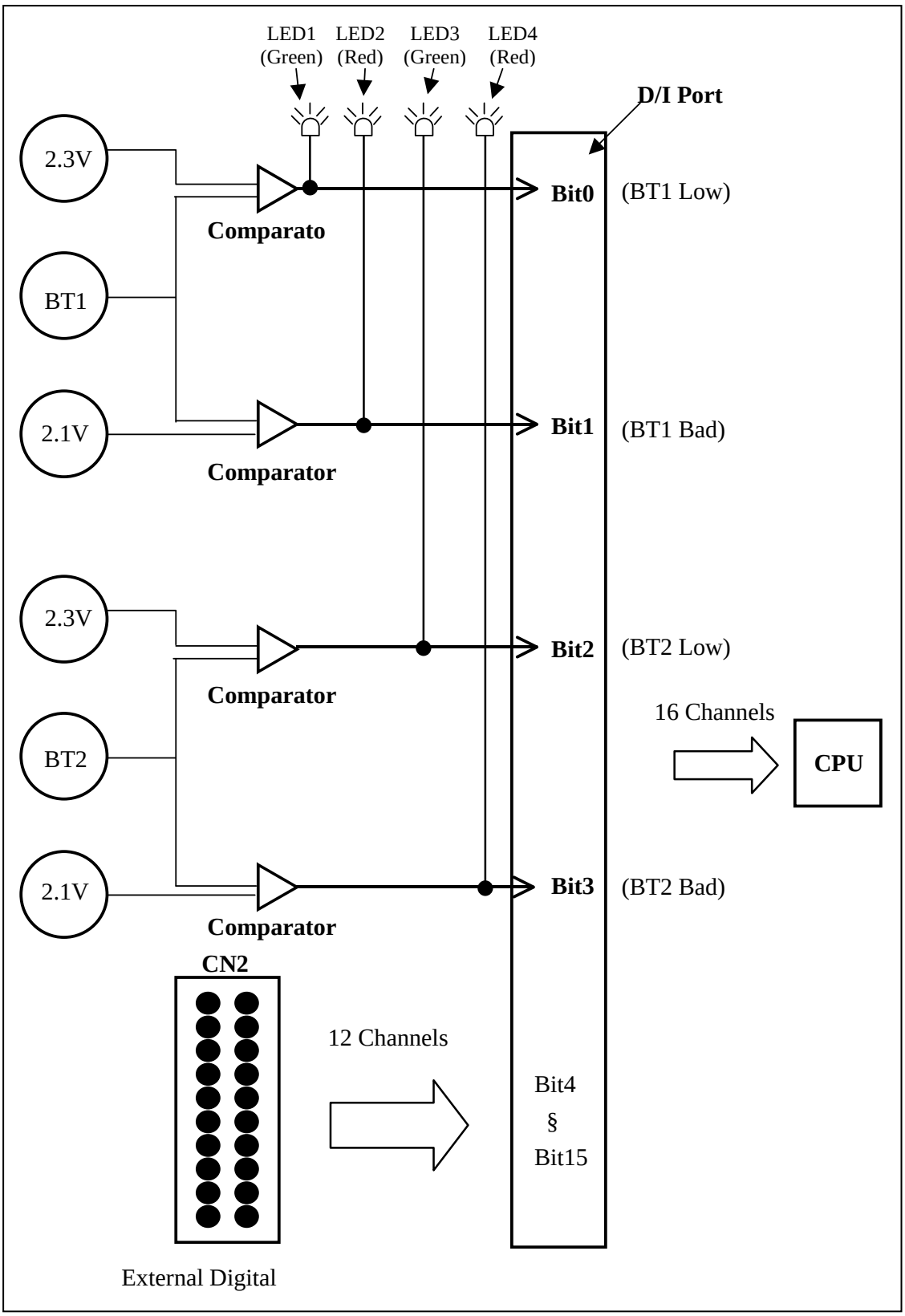


The D/O port can be connected to the DB-16R or DB-24PR. The DB-16R is a 16-channel relay output board. The DB-24R is a 24-channel power relay output board. (Note: Only 16 channels of these 24 channels are valid).

The D/I port can be connected to the DB-16P. The DB-16P is a 16-channel isolated digital input daughter board. **Note: starting 4 channels are used by battery status bits as the above diagram shown.**

All DI & DO are TTL compatible.

2.4 Battery Status Indicators



The initial voltage of BT1 will be larger then 3.0 V. If this voltage drops to 2.3 V, BT1 can still keep the stored data in SRAM for months. **It is recommended to replace both BT1 & BT2 when either BT1 or BT2 drops to 2.3 V.** If this voltage drops to 2.1 V, the BT1 can still keep the stored data in SRAM for weeks. **You should replace both BT1 & BT2 a.s.a.p. if either BT1 or BT2 drops to 2.1 V.**

The action table is given as follows:

Battery voltage status	LED status	D/I port status
BT1 > 2.3 V	LED1 OFF, LED2 OFF	Bit0=0, Bit1=0
2.3 V>BT1>2.1 V	LED1 ON, LED2 OFF	Bit0=1, Bit1=0
2.1 V>BT1	LED1 ON, LED2 ON	Bit0=1, Bit1=1
BT2 > 2.3 V	LED3 OFF, LED4 OFF	Bit2=0, Bit3=0
2.3 V>BT2>2.1 V	LED3 ON, LED4 OFF	Bit2=1, Bit3=0
2.1 V>BT2	LED3 ON, LED4 ON	Bit2=1, Bit3=1

You can call ***PCIM512_ReadFromDi(DWORD dwBoardNo, WORD *Data)*** to read the 16-bit data. Refer to Sec. 3.6 for more information.

```
    The lowest 4 bits, Bit0 ~ Bit3, are battery status bits. The
other 12 bits, Bit4 ~ Bit15, are external D/I signals. You can
connect a DB-16P to CN2 for sensor input. Refer to Sec. 2.5.1 for
more information.
```

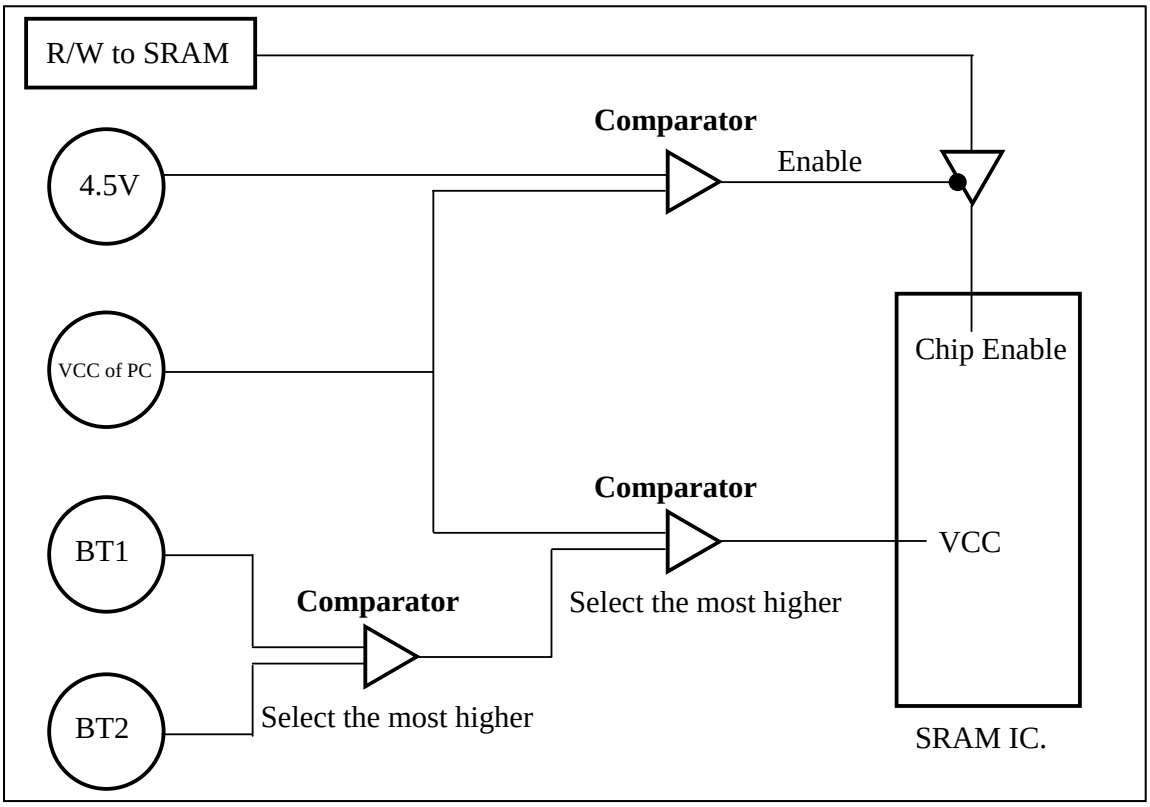
If you find that either BT1 or BT2 is in low-battery state, it is recommended to replace both BT1 & BT2 as follows:

1. Prepare 2 new batteries for new BT1 & new BT2
2. **Power on PC (not power off)**
3. Replace the old BT1 with the new BT1
4. Replace the old BT2 with the new BT2

Note: it is recommended to replace both BT1 & BT2 at the same time, one by one.

The two-battery design also makes it safe to replace new batteries without losing data; when one battery is taken out for replacing a new one, the other continues to provide power to the SRAM.

2.5 Block Diagram of SRAM



The power supply of SRAM is selected from the highest voltage of PC-VCC, BT1 & BT2. The initial voltage of BT1 & BT2 is about 3 V. If the PC is power on, the PC-VCC will be about 5 V. If the PC is off, the PC-VCC will be about 0 V. So when the PC is power on, the PC-VCC will supply power to SRAM. In this condition, BT1 & BT2 will preserve their battery for later usage.

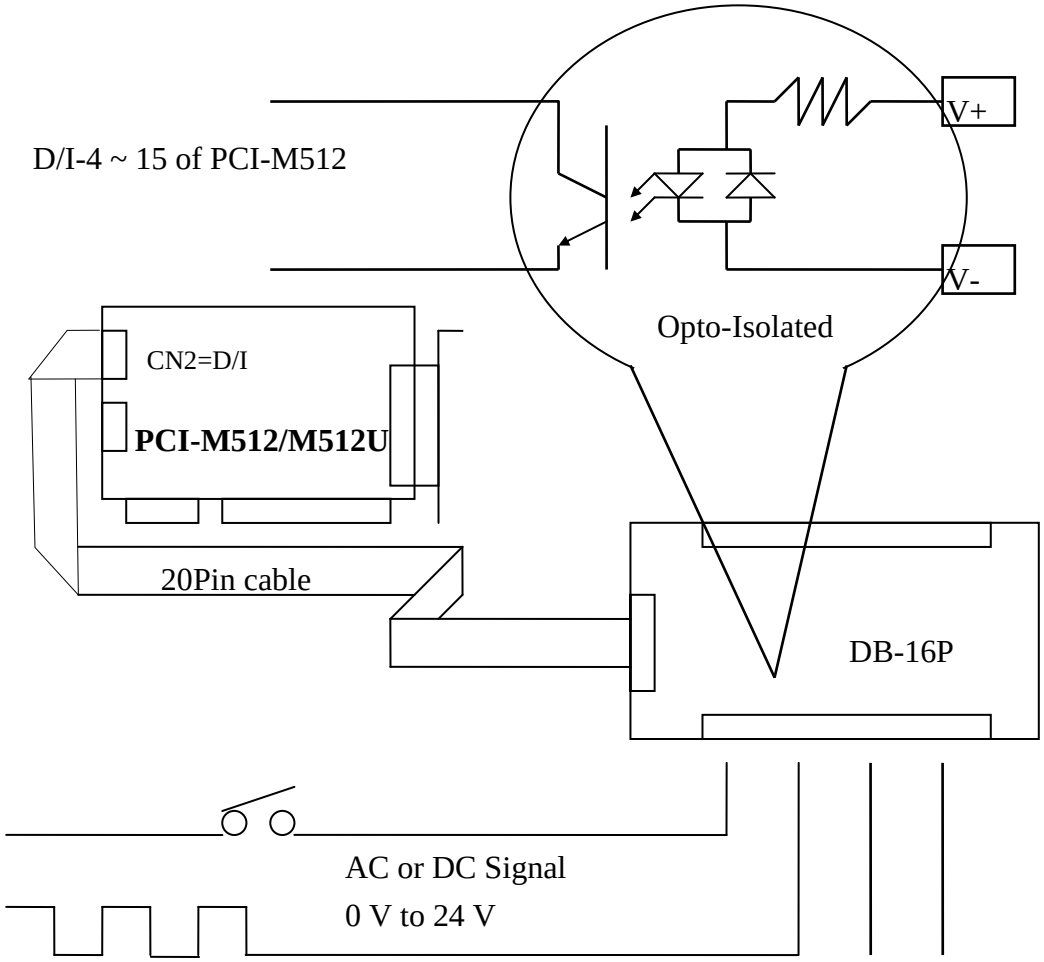
If PC's power is off, the battery with higher voltage will supply power to SRAM. The stored data of SRAM will remain if the power is larger than 2.0 V. So, either BT1 or BT2 must higher than 2.0 V to keep the SRAM data.

There is one low-battery indicator & one bad-battery indicator for both BT1 & BT2. Refer to Sec. 2.3 for more information.

2.6 Daughter Boards

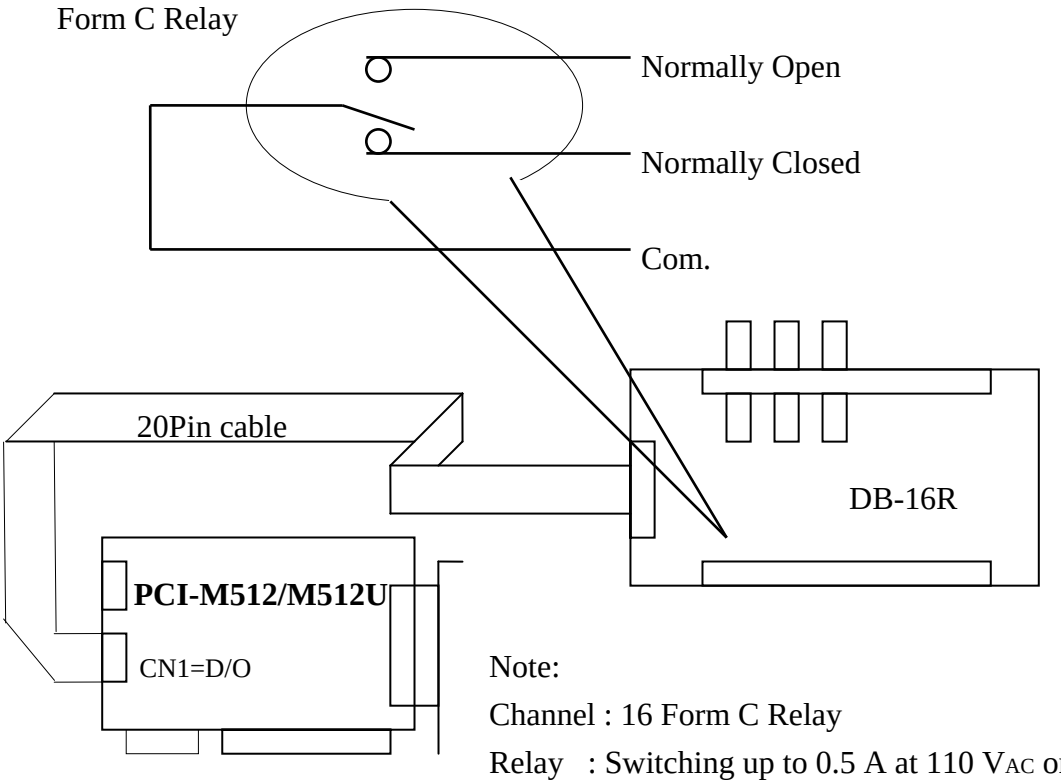
2.6.1 DB-16P Isolated Input Board

The DB-16P is a 16-channel isolated digital input daughter board. The optically isolated inputs of the DB-16P consist of a bi-directional optocoupler with a resistor for current sensing. You can use the DB-16P to sense DC signal from TTL levels up to 24 V or use the DB-16P to sense a wide range of AC signals. You can use this board to isolate the computer from large common-mode voltage, ground loops and transient voltage spike that often occur in industrial environments. **Note: The lowest nibbles, bit_0 to bit_3, are used by PCI-M512, so only the highest 12-bits, bit_4 to bit_15, are available.**



2.6.2 DB-16R Relay Board

The DB-16R, 16-channel relay output board, consists of 16 Form C relays for efficient switching of loads by programmed control. It is a connector and functionally compatible with 785 series boards with industrial type terminal blocks. The relays are energized by applying a 5 volt signal to the appropriate relay channel on the 20-pin flat connector. There are 16 enunciator LEDs for each relay, they light when their associated relay is activated. To avoid overloading your PC' s power supply, this board provides a screw terminal for external power supply.

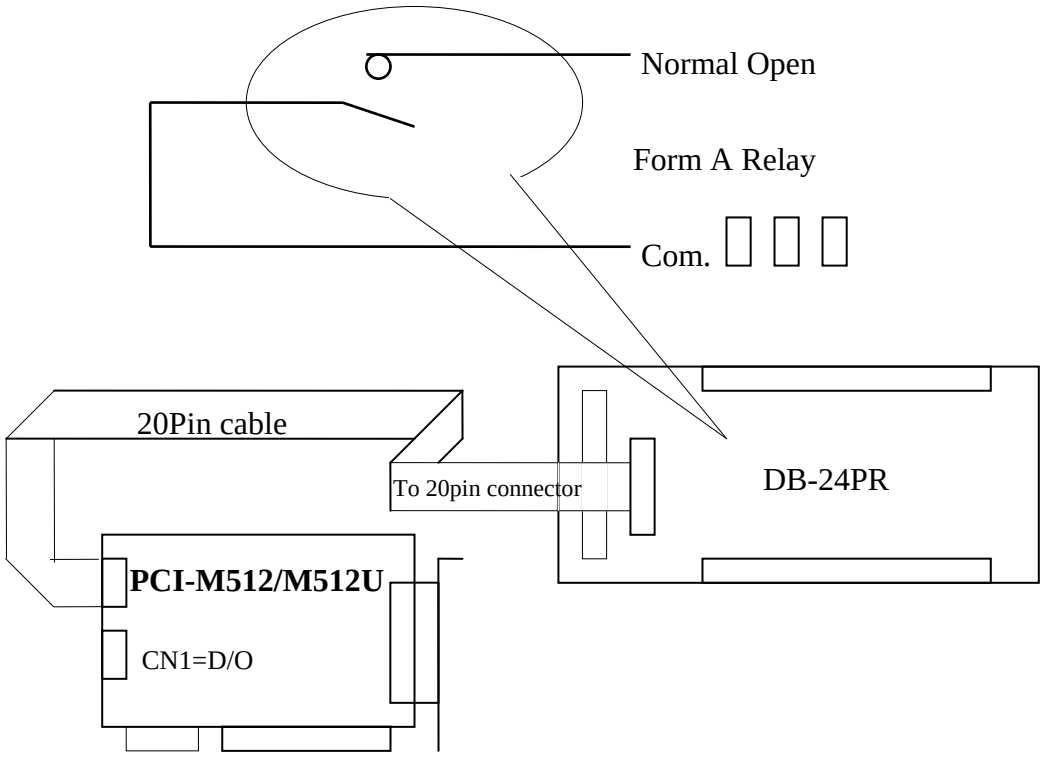


Note:
Channel : 16 Form C Relay
Relay : Switching up to 0.5 A at 110 V_{AC} or
1 A at 24 V_{DC}

2.6.3 DB-24PR, DB-24POR, DB-24C

DB-24PR	24*power relay, 5 A/250 V
DB-24POR	24*photo MOS relay, 0.1 A/350 V_{AC}
DB-24C	24*open collector, 100 mA per channel, 30 V max.

The DB-24PR, 24-channel power relay output board, consists of 8 Form C and 16 Form A electromechanical relays for efficient switching of loads by programmed control. The contact of each relay can control a 5 A load at 250 V_{AC}/30 V_{DC}. The relay is energized by applying a 5 volt signal to the appropriate relay channel on the 20-pin flat cable connector(just uses 16 relays) or 50-pin flat cable connector.(OPTO-22 compatible, for DIO-24 series). Twenty - four enunciator LEDs, one for each relay, light when their associated relay is activated. To avoid overloading your PC's power supply, this board needs a +12 V_{DC} or +24 V_{DC} external power supply.



Note:

50-Pin connector(OPTO-22 compatible), for DIO-24, DIO-48, DIO-144

20-Pin connector for 16 channel digital output, A-82X, A-62X, DIO-64, ISO-DA16/DA8

Channel : 16 From A Relay , 8 From C Relay

Relay : switching up to 5 A at 110 V_{AC} / 5 A at 30 V_{DC}

2.7 Pin Assignment

CN2: **pin** assignment of digital input connector.

Pin	Name	Pin	Name
1	**-**	***2***	**-**
3	**-**	***4***	**-**
5	Digital input 4	6	Digital input 5
17	Digital input 6	8	Digital input 7
9	Digital input 8	10	Digital input 9
11	Digital input 10	12	Digital input 11
13	Digital input 12	14	Digital input 13
15	Digital input 14	16	Digital input 15
17	PCB ground	18	PCB ground
19	PCB +5 V	20	PCB +12 V

Note: The DI 0 ~ 3 are reserved for internal batteries status.

CN1: **pin** assignment of the digital output connector.

Pin	Name	Pin	Name
1	Digital output 0	2	Digital output 1
3	Digital output 2	4	Digital output 3
5	Digital output 4	6	Digital output 5
17	Digital output 6	8	Digital output 7
9	Digital output 8	10	Digital output 9
11	Digital output 10	12	Digital output 11
13	Digital output 12	14	Digital output 13
15	Digital output 14	16	Digital output 15
17	PCB ground	18	PCB ground
19	PCB +5 V	20	PCB +12 V

3. DLL Driver

The included software is a collection of subroutines for PCI-M512/M512U cards for Windows 95/98/NT/2000/XP applications. These subroutines are written with C language and perform a variety of digital I/O operations.

The subroutines in PCIM512.DLL are easy to understand as its name suggests for. It provides powerful, easy-to-use subroutines for developing your data acquisition application. Your program can easily call these DLL functions by VC++ VB, Delphi, and BORLAND C++ Builder. To speed-up your developing process, some demonstration source programs are provided.

Please refer to the following user manuals, you could fine them in the companion CD:\NAPDOS\PCI\Manual.

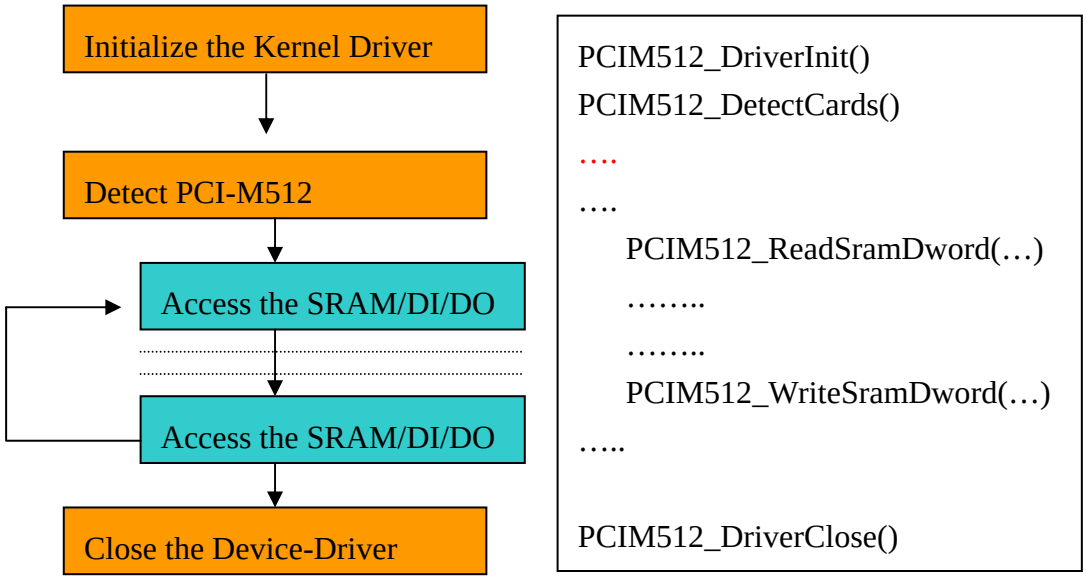
- **PCI_ISA_PnP_Driver_Installation_in_Win9x_2K_XP.pdf**
  Install the PnP (Plug and Play) driver for PCI card under Windows 95/98.

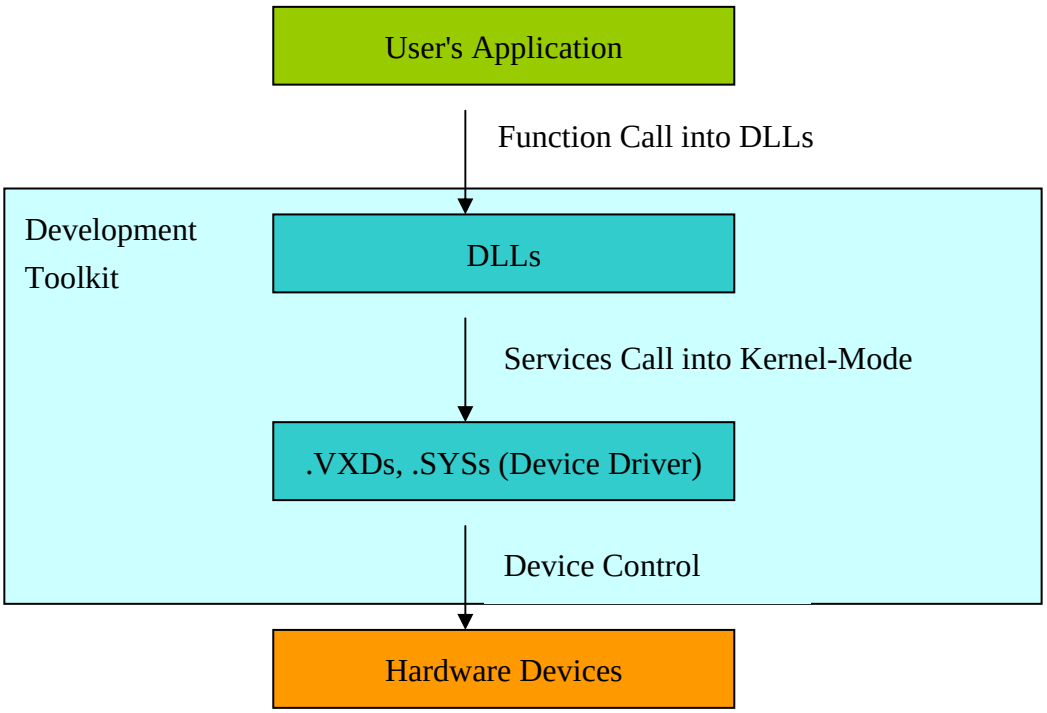
- **Software_Installation_Guide_in_Win32.pdf**
  Install the software package under Windows 95/98/NT/XP.

- **Calling_DLL_functions_in_VB_VC_Delphi_BCB.pdf**
  Call the DLL functions with VC++6, VB6, Delphi3 and Borland C++ Builder 3.

- **TroubleShooting_PCI_ISA_in_Win32_Resource_Conflict.pdf**
  Check the resources I/O Port address, IRQ number and DMA number for add-on cards under Windows 95/98/NT.

3.0 Program Architecture





In this chapter, we use some keywords to indicate the attribute of Parameters.

Keyword	Set parameter by user before calling this function ?	Get the data/value from this parameter after calling this function ?
[Input]	Yes	No
[Output]	No	Yes
[Input, Output]	Yes	Yes

Note: All space of the parameters needs to be allocated first by user's program.

The return codes of DLL are defined as follows:

```
// return code
#define PCI_NoError                     0
#define PCI_DriverOpenError             1
#define PCI_DriverNoOpen                2
#define PCI_GetDriverVersionError       3
#define PCI_InstallIrqError             4
#define PCI_ClearIntCountError          5
#define PCI_GetIntCountError            6
#define PCI_RegisterApcError            7
#define PCI_RemoveIrqError              8
#define PCI_FindBoardError              9
#define PCI_ExceedBoardNumber           10
#define PCI_ResetError                  11
#define PCI_IrqMaskError                12
#define PCI_ActiveModeError             13
#define PCI_GetActiveFlagError          14
#define PCI_ActiveFlagEndOfQueue        15
#define PCI_BoardNoIsZero               16
#define PCI_BoardNoExceedFindBoards     17
```

The defined DLL functions are given as follows:

Functions of test, Refer to Sec. 3.2

- float CALLBACK PCIM512_FloatSub(float fA, float fB);
- short CALLBACK PCIM512_ShortSub(short nA, short nB);
- int CALLBACK PCIM512_IntSub(int iA,int iB);
- DWORD CALLBACK PCIM512_GetDllVersion(void);

Functions of Driver Initialization, Refer to Sec. 3.3

- DWORD CALLBACK PCIM512_DriverInit(void);
- DWORD CALLBACK PCIM512_CloseBoard(DWORD dwBoardNo);
- DWORD CALLBACK PCIM512_DetectBoards(void);
- DWORD CALLBACK PCIM512_OpenBoard(DWORD dwBoardNo, DWORD dwIntEnable);
- DWORD CALLBACK PCIM512_ReadBoardStatus(DWORD dwBoardNo);
- DWORD CALLBACK PCIM512_CloseAll(void);

Functions of SRAM Read/Write, Refer to Sec. 3.4

- DWORD CALLBACK PCIM512_WriteSramByte(DWORD dwBoardNo, DWORD dwOffset, BYTE Data);
- DWORD CALLBACK PCIM512_WriteSramWord(DWORD dwBoardNo, DWORD dwOffset, WORD Data);
- DWORD CALLBACK PCIM512_WriteSramDword(DWORD dwBoardNo, DWORD dwOffset, DWORD Data);
- DWORD CALLBACK PCIM512_ReadSramByte(DWORD dwBoardNo, DWORD dwOffset, BYTE *Data);
- DWORD CALLBACK PCIM512_ReadSramWord(DWORD dwBoardNo, DWORD dwOffset, WORD *Data);
- DWORD CALLBACK PCIM512_ReadSramDword(DWORD dwBoardNo, DWORD dwOffset, DWORD *Data);

Functions of DIO Read/Write, Refer to Sec. 3.5

- DWORD CALLBACK PCIM512_WriteToDo(DWORD dwBoardNo, WORD Data);
- DWORD CALLBACK PCIM512_ReadFromDi(DWORD dwBoardNo, WORD *Data);

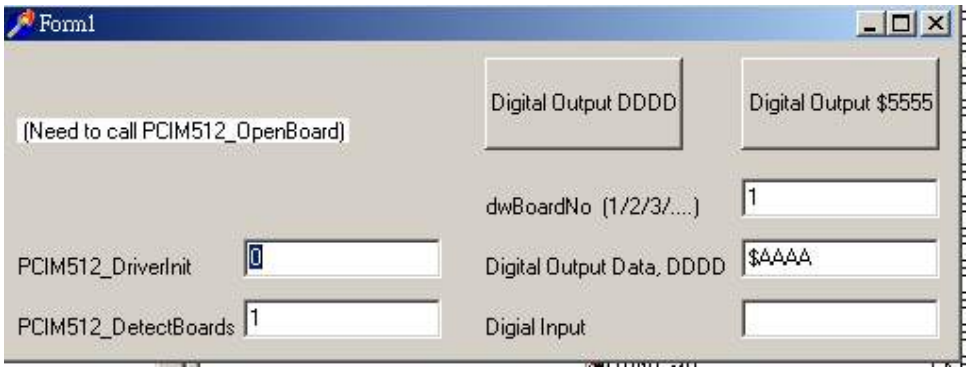
3.1 Find the Board Number

The plug&play BIOS will assign the proper base address to PCI-M512/M512U. If there is only one PCI-M512, users can identify this board as board_1. If there are two PCI-M512 boards in the system, it will be very difficult to identify which board is board_1. Our software driver can support 20 boards max. Therefore user can install 20 boards of PCI-M512 in one PC system.

The simplest way to find the board number is to use DioTest in Delphi4 demo program. This demo program will send a value to D/O and read back from D/I. The low 4 bits of D/I are battery status bits, they can be used as an indicator as follows:

Insert one piece of paper to BT1 of one PCI-M512
Install all PCI-M512 cards into this PC system
Power-on PC
You will find only one PCI-M512's LED1 & LED2 are ON
Run **DioTest of Delphi4**
Key-in ***board number*** to 1
Click ***Digital Output 0xDD***
Check the value in ***Digital Input***, if the LSB is 1, we find the target PCI-M512.

DioTest



3.2 Functions of Test

3.2.1 PCIM512_FloatSub

- **Description:**

  To perform the subtraction as fA - fB in float data type. This function is provided for testing DLL linkage purpose.

- **Syntax:**

  float PCIM512_FloatSub(float fA, float fB)

- **Parameter:**

  fA : [Input] 4 bytes floating point value

  fB : [Input] 4 bytes floating point value

- **Return:**

  The value of fA - fB

3.2.2 PCIM512_ShortSub

- **Description:**

  To perform the subtraction as nA - nB in short data type. This function is provided for testing DLL linkage purpose.

- **Syntax:**

  short PCIM512_ShortSub(short nA, short nB)

- **Parameter:**

  nA :[Input] 2 bytes short data type value

  nB :[Input] 2 bytes short data type value

- **Return:**

  The value of nA – nB.

3.2.3 PCIM512_IntSub

- **Description:**

  To perform the subtraction as iA - iB in int data type. This function is provided for testing DLL linkage purpose.

- **Syntax:**

  short PCIM512_IntSub(int iA, int iB)

- **Parameter:**

  iA :[Input] 4 bytes int data type value

  iB :[Input] 4 bytes int data type value

- **Return:**

  The value of iA – iB

3.2.4 PCIM512_GetDllVersion

- **Description:**

  To get the version number of PCIM512.DLL

- **Syntax:**

  DWORD PCIM512_GetDllVersion(void)

- **Parameter:**

  None

- **Return:**

  Return the DLL's version number.

  For example: 102(hex) for version 1.02

3.3Functions of Driver Initialization

3.3.1 PCIM512_DriverInit

- **Description :**

  This subroutine will allocate resources for the WinDriver. This function must be called before using the DLL functions given in Sec 3.3 ~ Sec. 3.5.

- **Syntax :**

  DWORD PCIM512_DriverInit();

- **Parameter :**

  None

- **Return:**

  PCI_NoError : OK

  PCI_DriverOpenError: WinDriver kernel not find, refer to Sec. 1.2.1 for more information.

3.3.2 PCIM512_OpenBoard

- **Description :**

  This subroutine will open the PCI-M512 kernel driver and allocate resource for the device. This function must be called before using other I/O functions

- **Syntax :**

  void PCIM512_OpenBoard(DWORD dwBoardNo, DWORD dwIntEnable);

- **Parameter :**

  dwBoardNo [Input] PCI-M512 board number

  dwIntEnable [Input] PCI-M512 board interrupt enable/disable(1/0)

- **Return:**

  PCI_NoError : OK

  PCI_BoardOpenError : Board open kernel driver error

  PCI_BoardNoExceedFindBoards : Not find the Board.

3.3.3 PCIM512_DetectBoards

- **Description :**

  This subroutine will detect all installed PCI-M512/M512U boards. **This function must be called before using other I/O functions given in Sec 3.4 & Sec. 3.5.**

- **Syntax :**

  DWORD PCIM512_DetectBoards();

- **Parameter :**

  None

- **Return:**

  0: No PCI-M512 is installed in this PC

  1: Only one PCI-M512/M512U is installed in this PC(board no.=1)

  2: There are 2 PCI-M512/M512U installed in this PC(board no.=1/2)

  N: Number of PCI-M512 installed in this PC

- **Note:**

  1. Call **PCIM512_DriverInit()** before calling this function
  2. Call **PCIM512_OpenBoard()** before calling this function
  3. Call **PCIM512_DetectBoards()** to detect all PCI-M512 boards.
  4. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512 boards. Refer to Sec. 2.2 for more information.

3.3.4 PCIM512_ReadBoardId

- **Description :**

  This subroutine will show the IDs of detected PCI-M512/M512U boards. It is designed to identify PCI-M512/M512U.

- **Syntax :**

  DWORD PCIM512_ReadBoardId(dwBoardNo, *dwVendorId, *dwDeviceId, *dwSubVendorId, *dwSubdeviceId);

- **Parameter :**

  dwBoardNo : [Input] PCI-M512/M512U board number(start from 1)
  dwVendorID : [output] vendor ID of this board
  dwDeviceID : [output] device ID of this board
  dwSubVendorID : [output] sub-vendor ID of this board
  dwSubDeviceID : [output] sub-device ID of this board

- **Return:**

  0: This is a valid board no. → All return IDs are valid
  Others: This is not a valid board no. → All return IDs are invalid

- **Note:**

  1. Call **PCIM512_DriverInit()** before calling this function
  2. Call **PCIM512_OpenBoard()** before calling this function
  3. Call **PCIM512_DetectBoards()** to detect all PCI-M512 boards.
  4. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512/M512U boards. Refer to Sec. 2.2 for more information.

3.3.5 PCIM512_ReadBoardStatus

- **Description :**

  This subroutine will detect the DLL open status of PCI-M512/M512U boards.

- **Syntax :**

  DWORD PCIM512_ReadBoardStatus(DWORD dwBoardNo);

- **Parameter :**

  dwBoardNo [Input] PCI-M512/M512U board number

- **Return:**

  0: The DLL of the board dwBoardNo is not opened.

  1: The DLL of the board dwBoardNo is opened.

- **Note:**

  1. Call **PCIM512_DriverInit()** before calling this function

3.3.6 PCIM512_CloseBoard

- **Description :**

  This subroutine will close the PCI-M512/M512U kernel driver and release the resource for the device.

- **Syntax :**

  DWORD PCIM512_CloseBoard(DWORD dwBoardNo);

- **Parameter :**

  dwBoardNo [Input] PCI-M512/M512U board number

- **Return:**

  PCI_NoError : OK.
  PCI_BoardIsNotOpen: This board is not opened.
  PCI_BoardNoExceedFindBoards Not fined the board

3.3.7 PCIM512_CloseAll

- **Description :**

  This subroutine will close all of PCI-M512/M512U kernel driver and release the resource for the device.

- **Syntax :**

  DWORD PCIM512_CloseAll();

- **Parameter :**

  None

- **Return:**

  PCI_NoError : OK.

3.4 Functions of Sram Read/Write

3.4.1 PCIM512_WriteSramByte

- **Description:**

  Write one byte, 8-bit data to SRAM of PCI-M512/M512U.

- **Syntax:**

  DWORD PCIM512_WriteSramByte(dwBoardNo, dwOffset, Data)

- **Parameter:**

  dwBoardNo : [Input] board number, from 1 to N
  dwOffset : [Input] offset address of SRAM, from 0 to 0x7ffff
  Data : [Input] one byte of data (8-bit)

- **Return:**

  0: Write OK
  PCI_DriverNoOpen: Kernel driver not found
  PCI_BoardNoIsZero: dwBoardNo is 0, it must be in the range of 1 ~ N
  PCI_BoardNoExceedFindBoards: dwBoardNo > N

- **Note:**

  1. Call **PCIM512_DetectBoards()** before calling this function
  2. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512/M512U boards. Refer to Sec. 2.2 for more information.

3.4.2 PCIM512_WriteSramWord

- **Description:**

  Write one word, 16-bit, of data to SRAM of PCI-M512/M512U.

- **Syntax:**

  DWORD PCIM512_WriteSramWord(dwBoardNo, dwOffset, Data)

- **Parameter:**

  dwBoardNo : [Input] Board number, from 1 to N
  dwOffset : [Input] Offset address of SRAM, from 0 to 0x7fffe
  Data : [Input] One word of data (16-bit)

- **Return:**

  0: Write OK
  PCI_DriverNoOpen: Kernel driver not found
  PCI_BoardNoIsZero: dwBoardNo is 0, it must be in the range of 1 ~ N
  PCI_BoardNoExceedFindBoards: dwBoardNo > N

- **Note:**

  1. Call **PCIM512_DetectBoards()** before calling this function
  2. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512/M512U boards. Refer to Sec. 2.2 for more information.

3.4.3 PCIM512_WriteSramDword

- **Description:**

  Write one dword, 32-bit data to SRAM of PCI-M512/M512U.

- **Syntax:**

  DWORD PCIM512_WriteSramDword(dwBoardNo, dwOffset, Data)

- **Parameter:**

  dwBoardNo : [Input] Board number, from 1 to N
  dwOffset : [Input] Offset address of SRAM, from 0 to 0x7fffc
  Data : [Input] One dword of data (32-bit)

- **Return:**

  0: Write OK
  PCI_DriverNoOpen: Kernel driver not found
  PCI_BoardNoIsZero: dwBoardNo is 0, it must be in the range of 1 ~ N
  PCI_BoardNoExceedFindBoards: dwBoardNo > N

- **Note:**

  1. Call **PCIM512_DetectBoards()** before calling this function
  2. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512/M512U boards. Refer to Sec. 2.2 for more information.

3.4.4 PCIM512_ReadSramByte

- **Description:**

  Read one byte, 8-bit data from SRAM of PCI-M512/M512U.

- **Syntax:**

  DWORD PCIM512_ReadSramByte(dwBoardNo, dwOffset, *Data)

- **Parameter:**

  dwBoardNo : [Input] Board number, from 1 to N
  dwOffset : [Input] Offset address of SRAM, from 0 to 0x7ffff
  Data : [output] One byte of data (8-bit)

- **Return:**

  0: Write OK
  PCI_DriverNoOpen: Kernel driver not found
  PCI_BoardNoIsZero: dwBoardNo is 0, it must be in the range of 1 ~ N
  PCI_BoardNoExceedFindBoards: dwBoardNo > N

- **Note:**

  1. Call **PCIM512_DetectBoard()** before calling this function
  2. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512/M512U boards. Refer to Sec. 2.2 for more information.

3.4.5 PCIM512_ReadSramWord

- **Description:**

  Read one word, 16-bit data from SRAM of PCI-M512/M512U.

- **Syntax:**

  DWORD PCIM512_ReadSramWord(dwBoardNo, dwOffset, *Data)

- **Parameter:**

  dwBoardNo : [Input] Board number, from 1 to N
  dwOffset : [Input] Offset address of SRAM, from 0 to 0x7fffe
  Data : [output] One word of data (16-bit)

- **Return:**

  0: Write OK
  PCI_DriverNoOpen: Kernel driver not found
  PCI_BoardNoIsZero: dwBoardNo is 0, it must be in the range of 1 ~ N
  PCI_BoardNoExceedFindBoards: dwBoardNo > N

- **Note:**

  1. Call **PCIM512_DetectBoards()** before calling this function
  2. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512/M512U boards. Refer to Sec. 2.2 for more information.

3.4.6 PCIM512_ReadSramDword

- **Description:**

  Read one dword, 32-bit data from SRAM of PCI-M512/M512U.

- **Syntax:**

  DWORD PCIM512_ReadSramDword(dwBoardNo, dwOffset, *Data)

- **Parameter:**

  dwBoardNo : [Input] Board number, from 1 to N
  dwOffset : [Input] Offset address of SRAM, from 0 to 0x7fffc
  Data : [output] One dword of data (32-bit)

- **Return:**

  0: Write OK
  PCI_DriverNoOpen: Kernel driver not found
  PCI_BoardNoIsZero: dwBoardNo is 0, it must be in the range of 1 ~ N
  PCI_BoardNoExceedFindBoards: dwBoardNo > N

- **Note:**

  1. Call **PCIM512_DetectBoards()** before calling this function
  2. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512/M512U boards. Refer to Sec. 2.2 for more information.

3.5 Functions of D/I/O Read/Write

3.5.1 PCIM512_WriteToDo

- **Description:**

  Write one word, 16-bit, of data to D/O of PCI-M512/M512U.

- **Syntax:**

  DWORD PCIM512_WriteToDo(dwBoardNo, Data)

- **Parameter:**

  dwBoardNo : [Input] Board number, from 1 to N
  Data : [Input] One word of data (16-bit)

- **Return:**

  0: Write OK
  PCI_DriverNoOpen: Kernel driver no found
  PCI_BoardNoIsZero: dwBoardNo is 0, it must be in the range of 1 ~ N
  PCI_BoardNoExceedFindBoards: dwBoardNo > N

- **Note:**

  1. Call **PCIM512_DetectBoards()** before calling this function
  2. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512 /M512U boards. Refer to Sec. 2.2 for more information.

3.5.2 PCIM512_ReadFromDi

- **Description:**

  Read one word, 16-bit, of data from D/I & battery status bits of PCI-M512/M512U.

- **Syntax:**

  DWORD PCIM512_ReadFromDi(dwBoardNo, *Data)

- **Parameter:**

  dwBoardNo : [Input] Board number, from 1 to N

  Data: [output] One word of data (16-bit), Bit0 ~ Bit3 are battery status bits and Bit4 ~ Bit15 are external D/I bits as follows:

  Bit0=1 → BT1 is low battery

  Bit1=1 → BT1 is bad battery

  Bit2=1 → BT2 is low battery

  Bit3=1 → BT3 is bad battery

  (refer to Sec. S.4 for more information)

- **Return:**

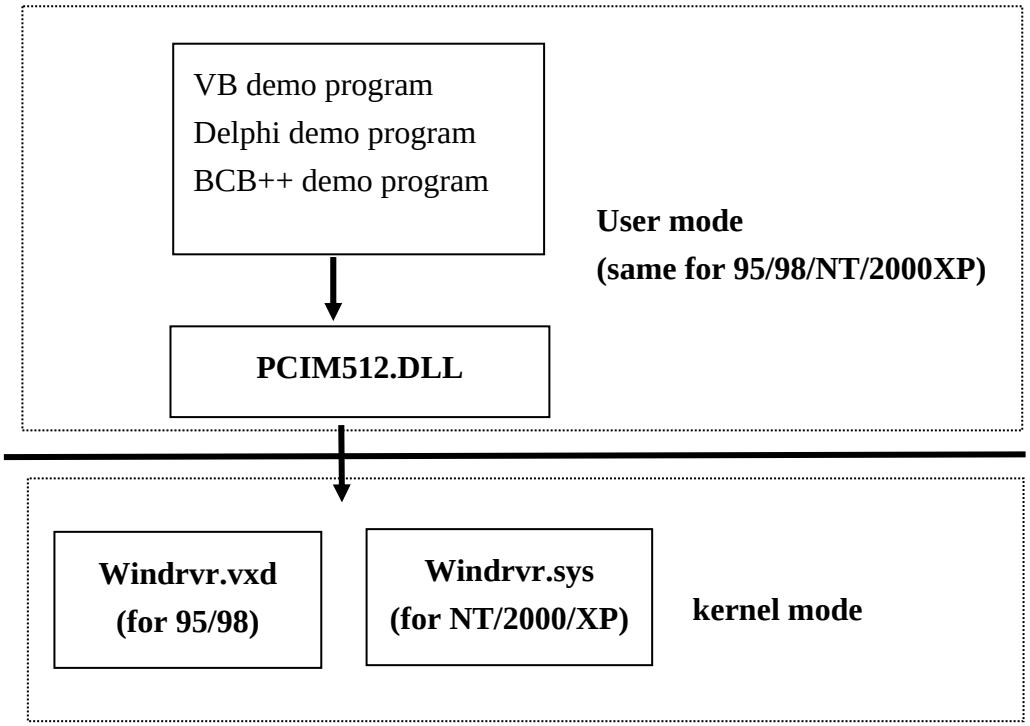
0:	Write OK
PCI_DriverNoOpen:	Kernel driver not found
PCI_BoardNoIsZero:	dwBoardNo is 0, it must be in the range of 1 ~ N
PCI_BoardNoExceedFindBoards:	dwBoardNo > N

- **Note:**

  1. Call **PCIM512_DetectBoards()** before calling this function
  2. Call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512/M512U boards. Refer to Sec. 2.2 for more information.

4. Demo Program

There are many demo program, written in VC++, VB, Delphi, and BCB++, given in the companion CD. These demo programs will call the DLL, PCIM512.DLL, to access the hardware of PCI-M512/M512U. The PCIM512.DLL will call the kernel driver, Windrvr.vxd or Windrvr.sys as follows:



Refer to **Calling_DLL_functions_in_VB_VC_Delphi_BCB.pdf** in the companion CD:\NAPDOS\PCI\Manual for more information about how to call the DLL functions with VC++5, VB5, Delphi3 and Borland C++ Builder 3

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4.1 Problems Report

Technical support is available at no charge as described below. The best way to report problems is to send electronic mail to

Service@icpdas.com

When reporting problems, please include the following information:

1) Is the problem reproducible? If so, how?
2) What kind and version of **platform** that you using? For example, Windows 3.1, Windows 95, or Windows NT 4.0, etc.
3) What kinds of our **products** are you using? Please see the product's manual.
4) If a dialog box with an **error message** was displayed, please include the full text of the dialog box, including the text in the title bar.
5) If the problem involves **other programs** or **hardware devices**, what devices or version of the failing programs are you using?
6) **Other comments** relative to this problem or **any suggestions** will be welcomed.

After we had received your comments, we will take about two business days to test the problems that you reported. Then will reply as soon as possible to you. Please keep in contact with us.

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