PCI-M512

User's 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

ICP DAS assume no liability for damages consequent to the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, nor for any infringements of patents or other rights of third parties resulting from its use.

Copyright

Trademark

The names used for identification only may be registered trademarks of their respective companies.

Tables of Contents

1. INTRODUCTION....4

1.1 PRODUCT CHECK LIST....6
1.2 INSTALLATION QUICK START....7
1.2.1 Step 1: Software Installation....7
1.2.2 Step 2: Check the installed software....9
1.2.3 Step 3: Hardware Installation....11
1.2.4 Step 4: Hardware Diagnostic....11
1.2.5 Step 5: Muti-Board Diagnostic....16

2. HARDWARE CONFIGURATION....17

2.1 BOARD LAYOUT....17
2.2 IDS OF PCI-M512....18
2.3 BLOCK DIAGRAM OF D/I/O....19
2.4 BATTERY STATUS INDICATORS....20
2.5 BLOCK DIAGRAM OF SRAM....22
2.6 DAUGHTER BOARDS....23
2.6.1 DB-16P Isolated Input Board....23
2.6.2 DB-16R Relay Board....24
2.6.3 DB-24PR, DB-24POR, DB-24C....25
2.7 PIN ASSIGNMENT....26

3. DLL DRIVER....27

3.1 FIND THE BOARD NUMBER....31
3.2 FUNCTIONS OF TEST....32
3.2.1 PCIM512_FloatSub....32
3.2.2 PCIM512_ShortSub....32
3.2.3 PCIM512_IntSub....33
3.2.4 PCIM512_GetDllVersion....33
3.3 FUNCTIONS OF DRIVER INITIALIZATION....34
3.3.1 PCIM512_DriverInit....34
3.3.2 PCIM512_OpenBoard....34
3.3.3 PCIM512_DetectBoards....35
3.3.4 PCIM512_ReadBoardId....36
3.3.5 PCIM512_ReadBoardStatus....37
3.3.6 PCIM512_CloseBoard....38
3.3.7 PCIM512_CloseAll....38

3.4 FUNCTIONS OF SRAM READ/WRITE 39
3.4.1 PCIM512_WriteSramByte 39
3.4.2 PCIM512_WriteSramWord 40
3.4.3 PCIM512_WriteSramDword 41
3.4.4 PCIM512_ReadSramByte 42
3.4.5 PCIM512_ReadSramWord 43
3.4.6 PCIM512_ReadSramDword 44
3.5 FUNCTIONS OF D/I/O READ/WRITE 45
3.5.1 PCIM512_WriteToDo 45
3.5.2 PCIM512_ReadFromDi 46
4. DEMO PROGRAM 47
4.1 PROGRAM ARCHITECTURE 48
4.2 PROBLEMS REPORT 49

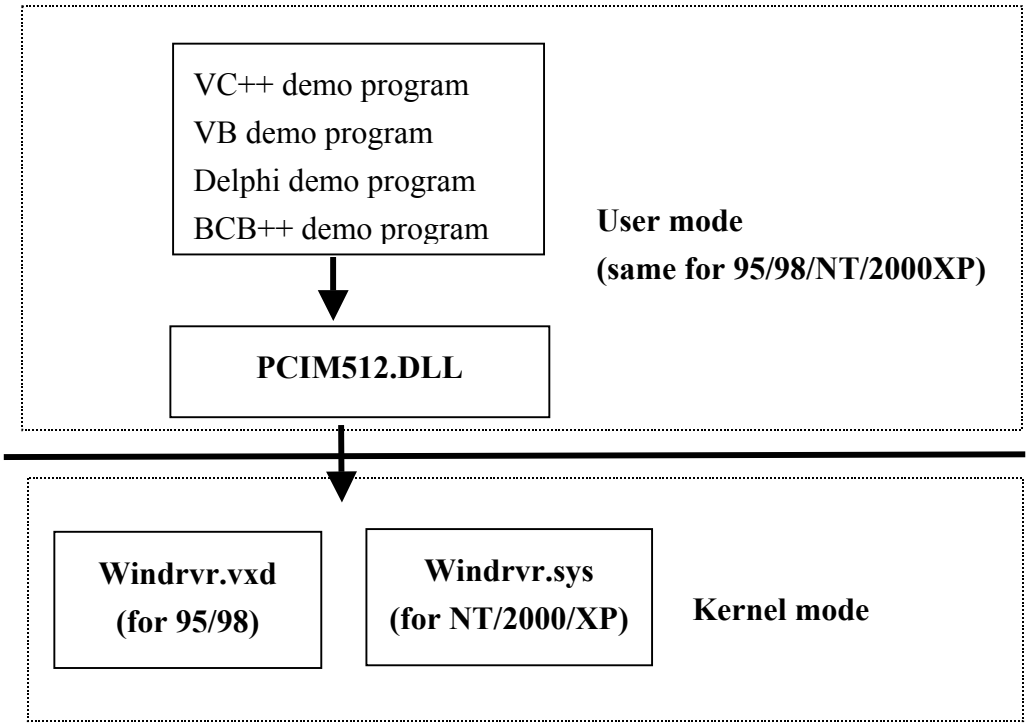
1. Introduction

The PCI-M512 is a battery-backup SRAM and digital I/O card.

- PCI bus, specification 2.1
- On-board 512K bytes SRAM
- Two Li-batteries, BT1 & BT2, for battery-backup the data of SRAM
- Two indicators, low-battery & bad-battery, for battery BT1.
- Another two indicators, low-battery & bad-battery, for battery BT2.
- 16 bits general purpose TTL-compatible D/O or relay (with daughter board DB-16R or DB-24PR)
- 12 bits general propose TTL-compatible D/I or isolated input (with daughter board DB-16P)
- DLL library for windows 95/98/NT/2000/XP
- Demo Program for VC, VC++, VB, Delphi, BCB++
- Operating Temperature: -20°C to 70°C
- Storage Temperature: -40°C to 85°C
- Humility: 0 to 90% non-condensing
- Dimension: 140mm X 90mm
- Power Consumption: 430mA @ +5V

	PCI-M512
SRAM Size	512K bytes
Memory Access	32-bit
Sub-device ID for auto detection	0x0512
I/O Access	16-bit
Li-Battery	BT1 & BT2
Battery Status bits	BT1 Low, BT1 Bad, BT2 Low, BT2 Bad (low voltage=2.3V, bad voltage=2.1V)
LED indicators	BT1 Low(Green), BT1 Bad(Red) BT2 Low(Green), BT2 Bad(Red)
D/I	12 channels, TTL compatible
D/O	16 channels, TTL compatible

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



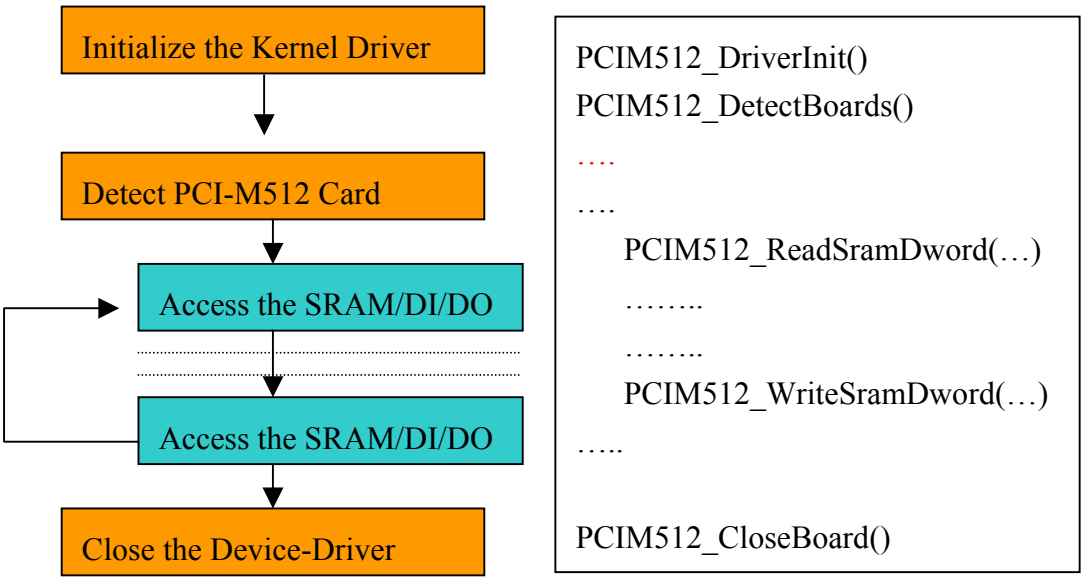
The install shields installs kernel driver, DLL driver & application demo program to system. **All demo program & DLL are the same for 95/98/NT/2000/XP.** However, the kernel driver is different for different system as follows:

- for windows 95/98 → will copy ***WINDRVR.VXD*** to C:\WIN95\SYSTEM\VMM32
- for windows NT/2000/XP → will copy ***WINDRVR.SYS*** to C:\WINNT\SYSTEM32\DRIVERS

All DLL & demo program will not work if the kernel driver is not installed correctly. The install shields will copy the correct kernel driver to the correct position if you select the correct O.S.(95/98, NT, 2000, XP).

Refer to **CallDll.pdf** for more information about how to call the DLL functions with VC++6, VB6, Delphi3 and Borland C++ Builder 3. Refer to **step5 of Sec. 1.2.2** for more information.

The software architecture is given as follows:



1.1 Product Check List

In addition to this manual, the package includes the following items:

- One PCI-M512 card
- One companion CD for software driver

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.

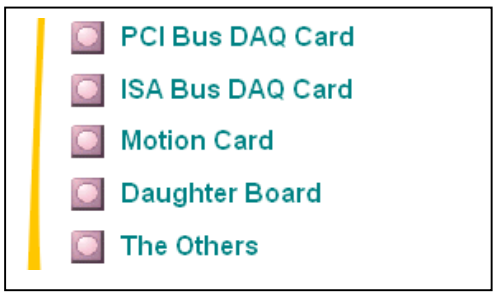
1.2 Installation Quick Start

The PCI-M512 can be used in Windows 95/98/NT/2000/XP. The recommended installation steps are given in Sec 1.2.1 ~ Sec. 1.2.4

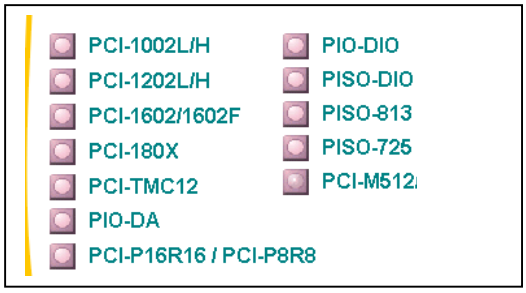
1.2.1 Step 1: Software Installation

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

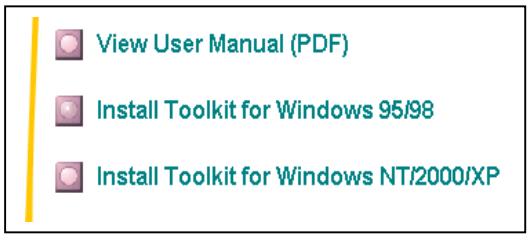
Step 2: click the first item, **Toolkits (Softwares)/Manuals**



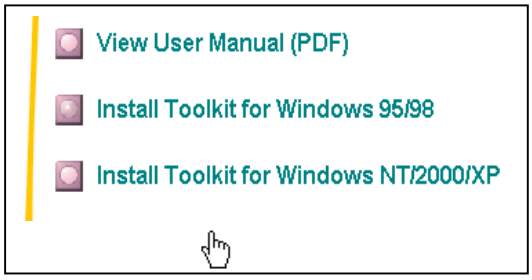
Step 3: click the first item, **PCI Bus DAQ Card**



Step 4: click the last item, **PCI-M512**



Step 5: click the third item, **Install Toolkit for Windows NT (Or 98, 2000, XP)**



Then the install shields will install the kernel driver, DLL driver & application demo program to system. **All demo programs & DLL are the same for 95/98/NT/2000/XP.** However, the kernel driver is different for different systems as follows:

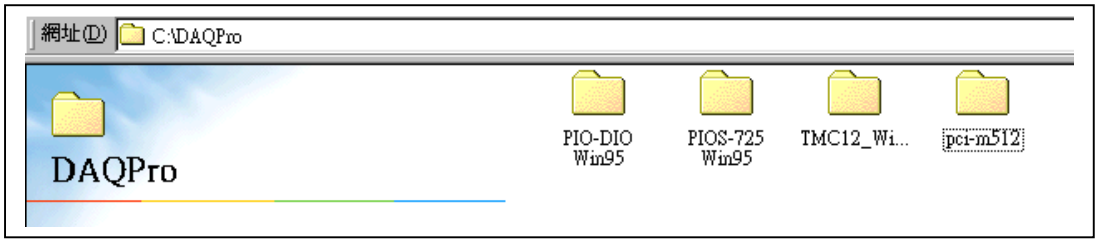
- for windows 95/98 → will copy ***WINDRVR.VXD*** to C:\WIN95\SYSTEM\VMM32
- for windows NT/2000/XP → will copy ***WINDRVR.SYS*** to C:\WINNT\SYSTEM32\DRIVERS

All DLL & demo programs will not work if the kernel driver is not installed correctly. The install shields will copy the correct kernel driver to the correct position if you select the correct O.S. (95/98, NT, 2000, XP).

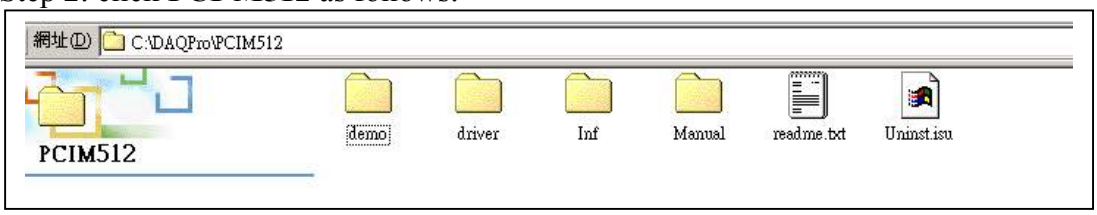
1.2.2 Step 2: Check the installed software

Assume you use the default directory & name of install shields, the software will be installed in C:\DAQPRO as follows:

Step 1: click **C:\DAQPro** as follow:

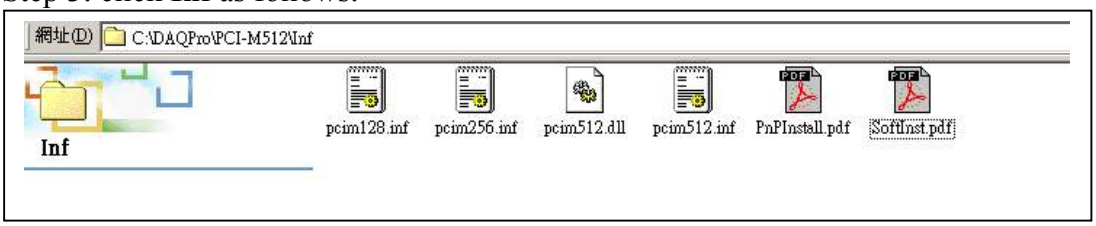


Step 2: click **PCI-M512** as follows:



Demo → demo program
Driver → DLL
Inf → for plug & play → windows 98/2000/XP needs this information
Manual → user's manual & other literature, refer to chapter 3 for more information
ReadMe → Read this file for more information

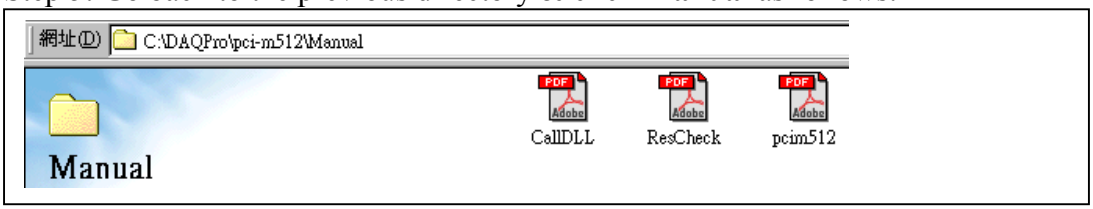
Step 3: click **Inf** as follows:



pci-m512.inf → Inf file for windows 98/2000/XP.
PnPInstall → Read this file for plug & play installation steps.
Note: 95 & NT 4.0 do not need this file.

Step 4: Click **PnPInstall** to read this PDF file for plug & play installation. For Windows 98/2000/XP, the system will auto detect the PCI-M512 & ask you to install software driver. **Read this PDF file carefully if you are not familiar with plug & play installation. You will need it in the next steps.**

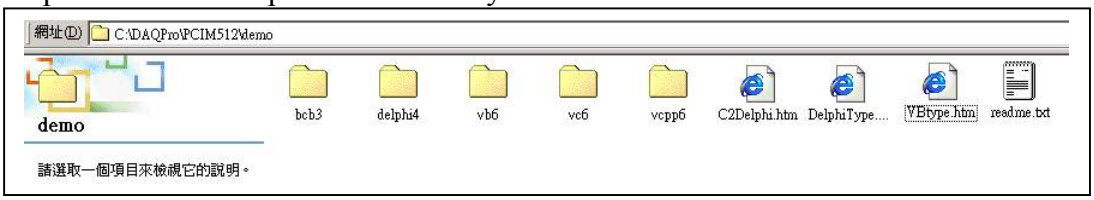
Step 5: Go back to the previous directory & click **Manual** as follows:



CallDll.pdf → how to call DLL by VC, VB, Delphi & BCB++

ResCheck → how to check the allocated system resource of PCI-M512

Step 6: Go Back the previous directory & click **Demo** as follows:



Bcb3 → demo program for BCB 3.0

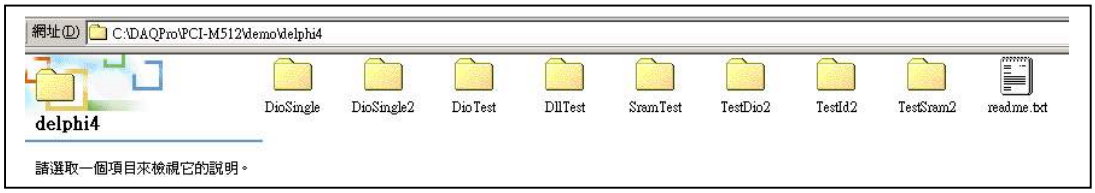
Delphi4 → demo program for Delphi 4.0

VB6 → demo program for VB 6.0

VC6 → demo program for VC 6.0, C language

VCPP → demo program for VC 6.0, C++ language

Step 7: click **Delphi4** as follows:



DioSingle → Test D/I/O of PCI-M512 (only one program can access this board)

DioSingle2→ Test D/I/O of PCI-M512 (one time only one program can occupy one board)

DioTest → Test D/I/O of PCI-M512

DllTest → Test DLL driver & detect PCI-M512

SramTest → Test NVSRAM of PCI-M512

TestDio2 → Write D/O then read D/I of two PCI-M512

TestId2 → Show IDs of two PCI-M512

TestSram2 → Show Sram of two PCI-M512

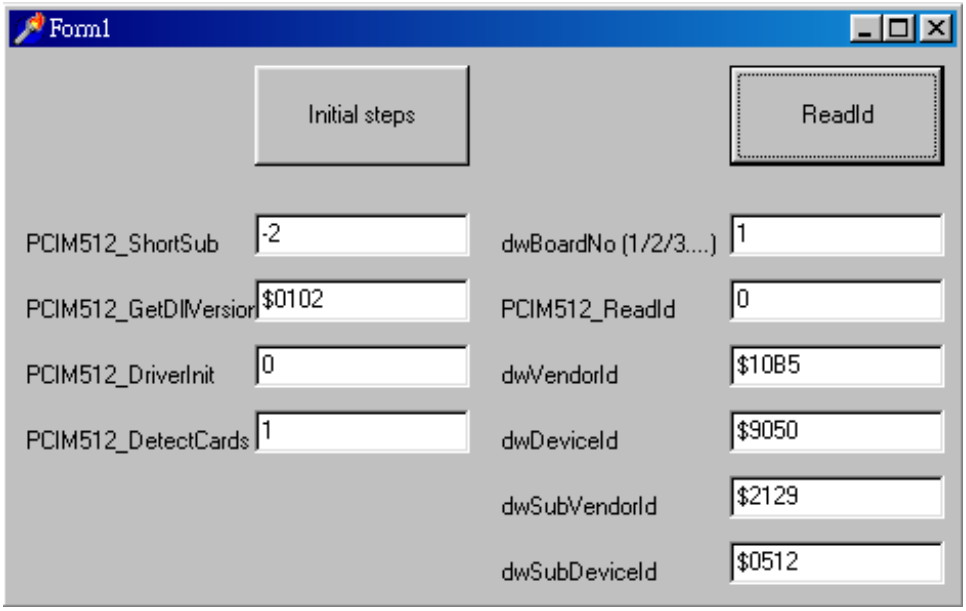
Step 8: shutdown & power off your PC

1.2.3 Step 3: Hardware Installation

Step 1: Install your PCI-M512 to PC
Step 2: power on your PC
Step 3: Now 98/2000/XP will find a PCI-M512 card & ask user to provide a software driver. Refer to **PnPInstall.pdf**, step3 of Sec. 1.2.2, for more information.

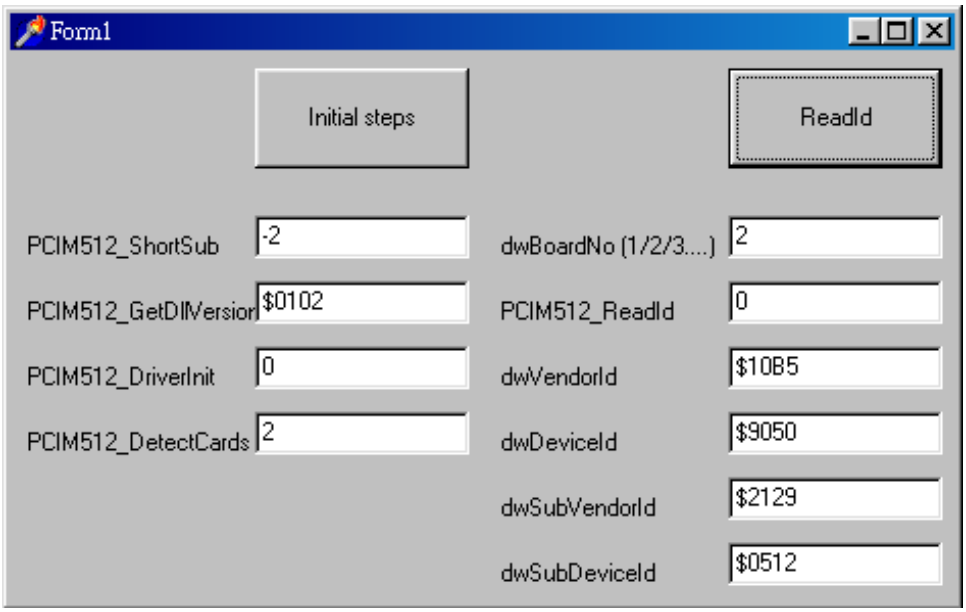
1.2.4 Step 4: Hardware Diagnostic

Step 1: run **DllTest** of Delphi demo program as follows: (**step7 of Sec. 1.2.2**)



- 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

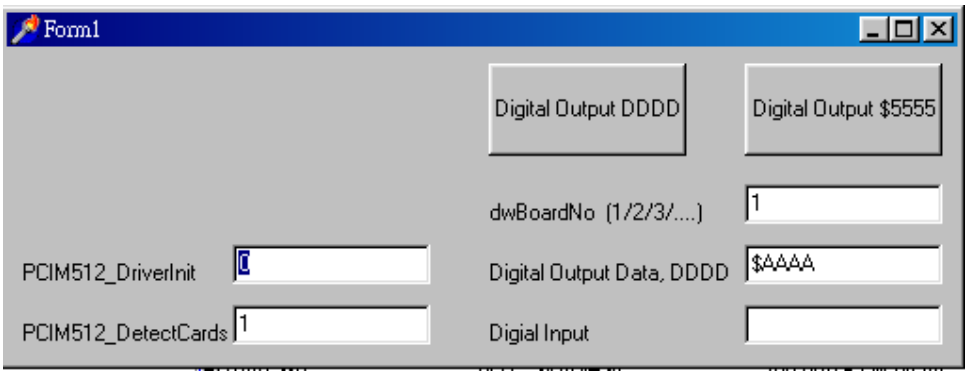
- Key-in new ***dwBoardNo*** to show IDs of another PCI-M512 as follows:.



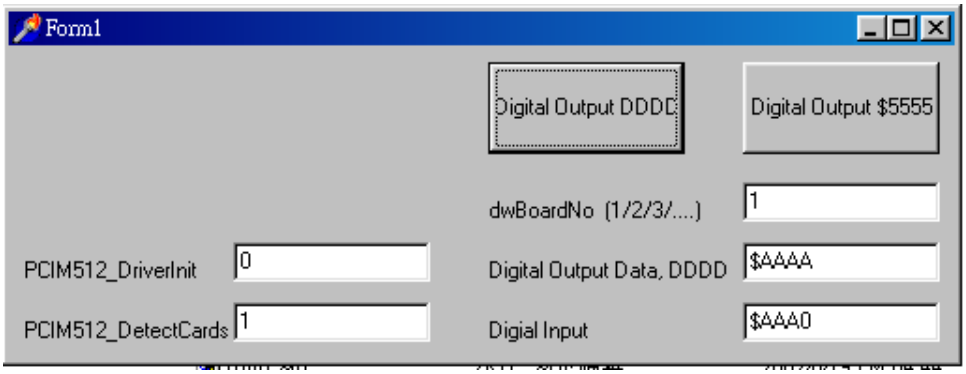
Refer to Sec. 2.2 for more information about IDs of PCI-M512 as follows:

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

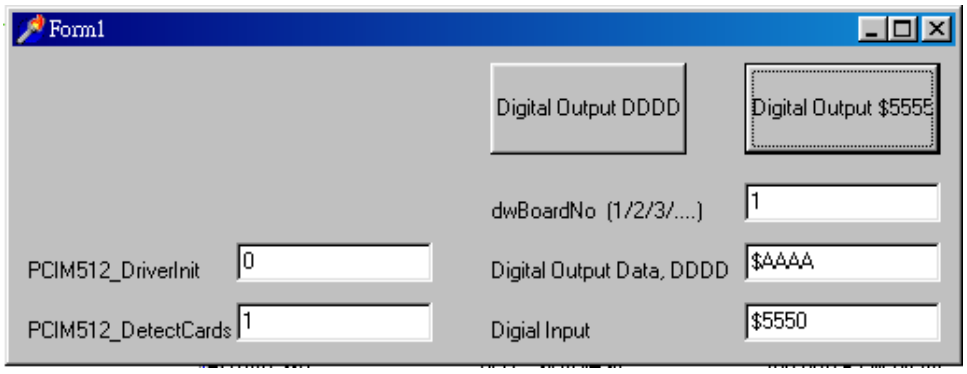
Step 2: run **DioTest** of Delphi demo program as follows: (**step7 of Sec. 1.2.2**)



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

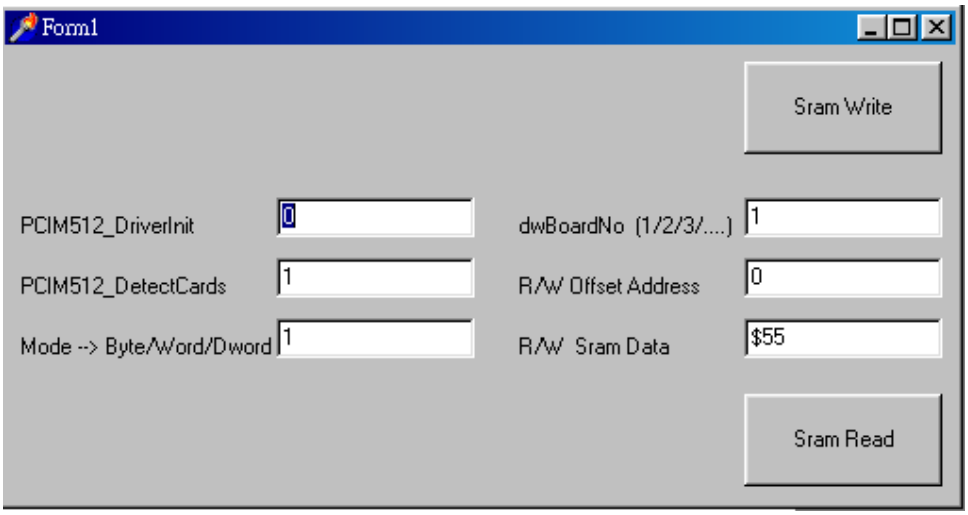


- Check that lowest 4-bits equal 0. These 4-bits are battery status bits. Refer to Sec. 2.4 for more information.
- Click ***Digital Output $5555*** to write 0x5555 to D/O & Read D/I as follows:



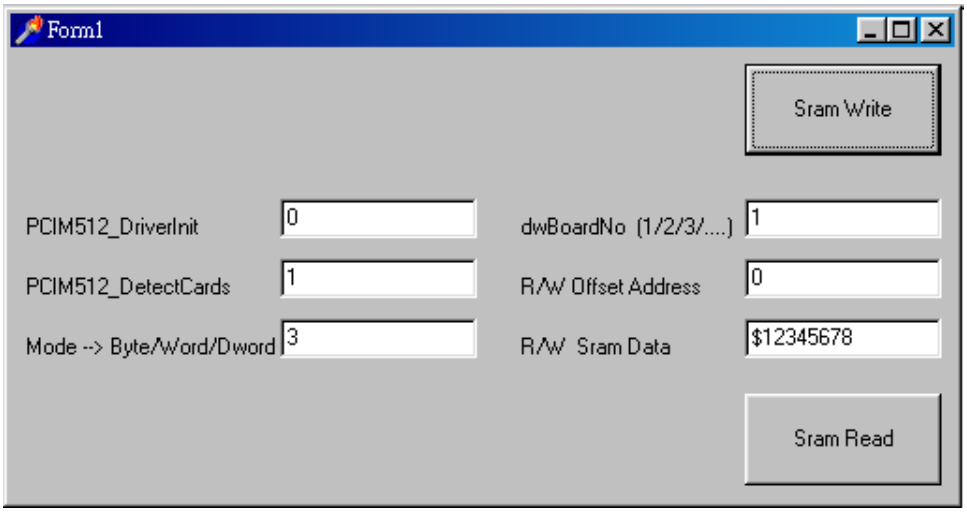
- Key-in new ***dwBoardNo*** to read/write to other PCI-M512.
  Refer to Sec. 3.1 for more information.

Step 3: run **SramTest** of Delphi demo program as follows: (**step7 of Sec. 1.2.2**)

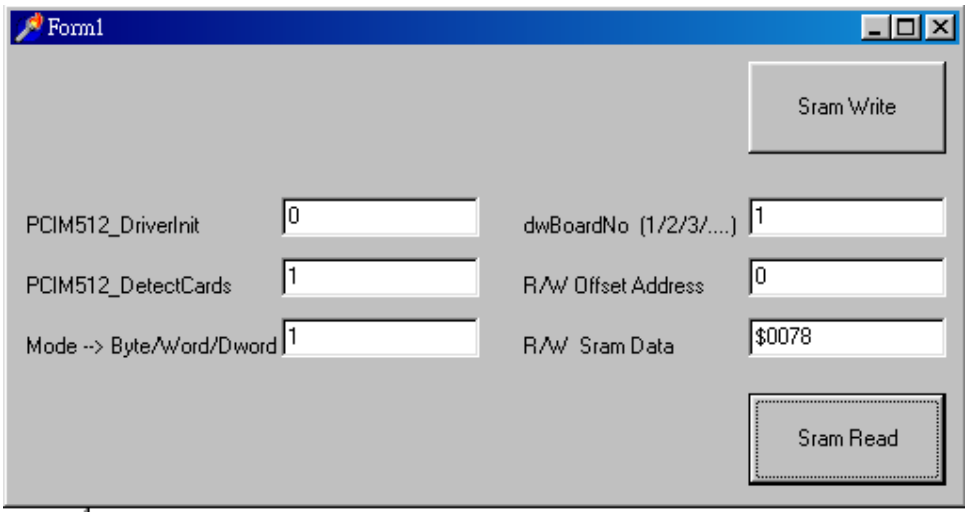


- Click ***Sram Write*** to write to SRAM (write-data is given in ***R/W Sram Data***, offset address of SRAM is given in ***R/W Offset Address***, byte/word/dword read/write is given in ***Mode → Byte/Word/Dword***)
- Click ***Sram Read*** to read SRAM (read-data is given in ***R/W Sram Data***, offset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

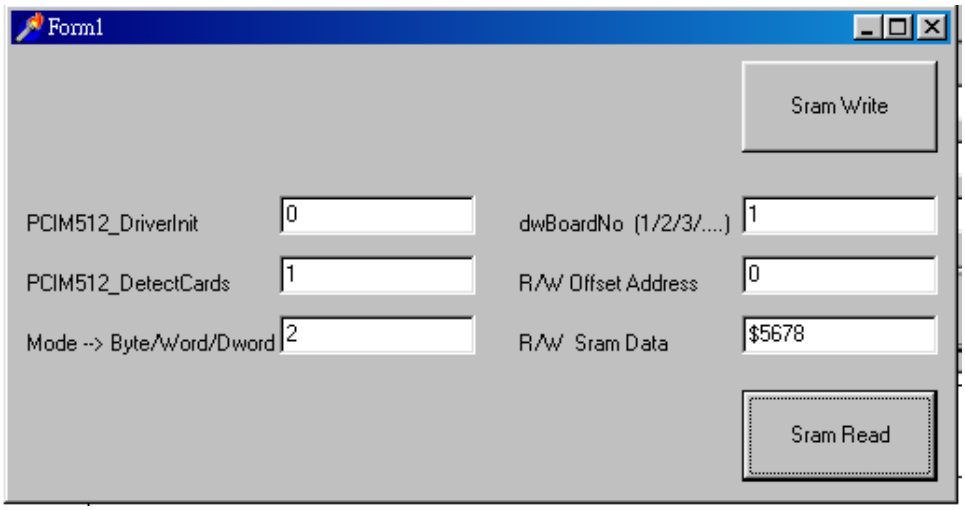
- Write 0x12345678 to offset address 0 of SRAM as follows:



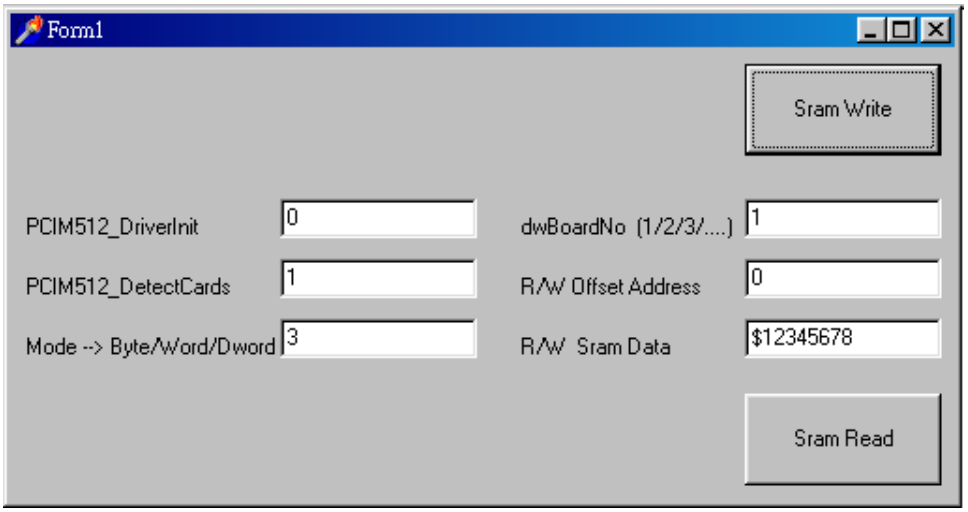
- Read one byte of SRAM at offset address 0 as follows:



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

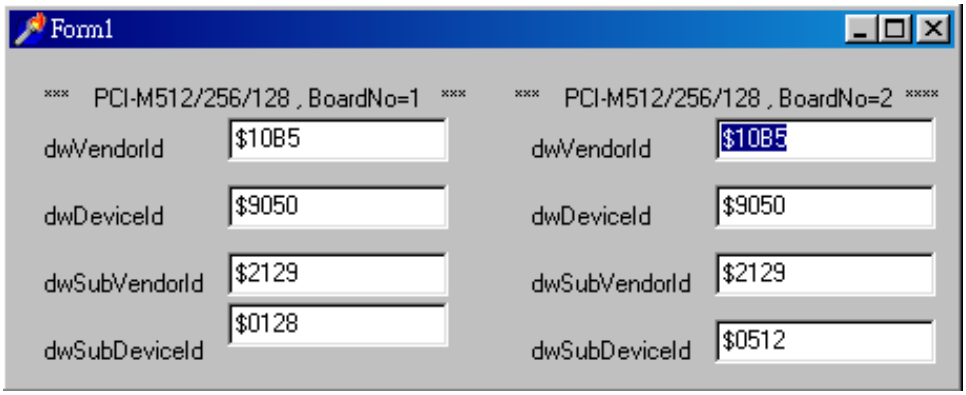


- Read one dword of SRAM at offset address 0 as follows:

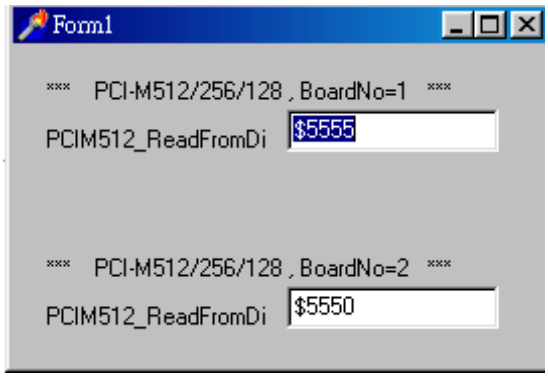


1.2.5 Step 5: Muti-Board Diagnostic

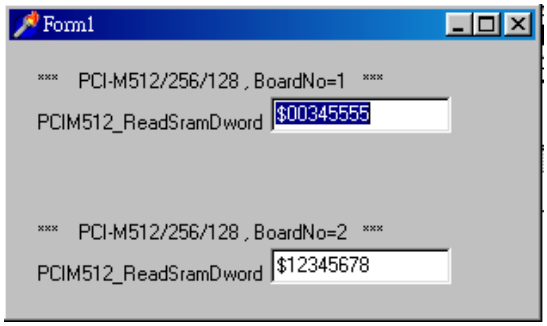
Step 1: run **TestId2** of Delphi demo program to read & show IDs of two PCI-M512 as follows: (**step7 of Sec. 1.2.2**)



Step 2: run **TestDIO2** of Delphi demo program to read/write D/I/O of two PCI-M512 as follows: (**step7 of Sec. 1.2.2**)

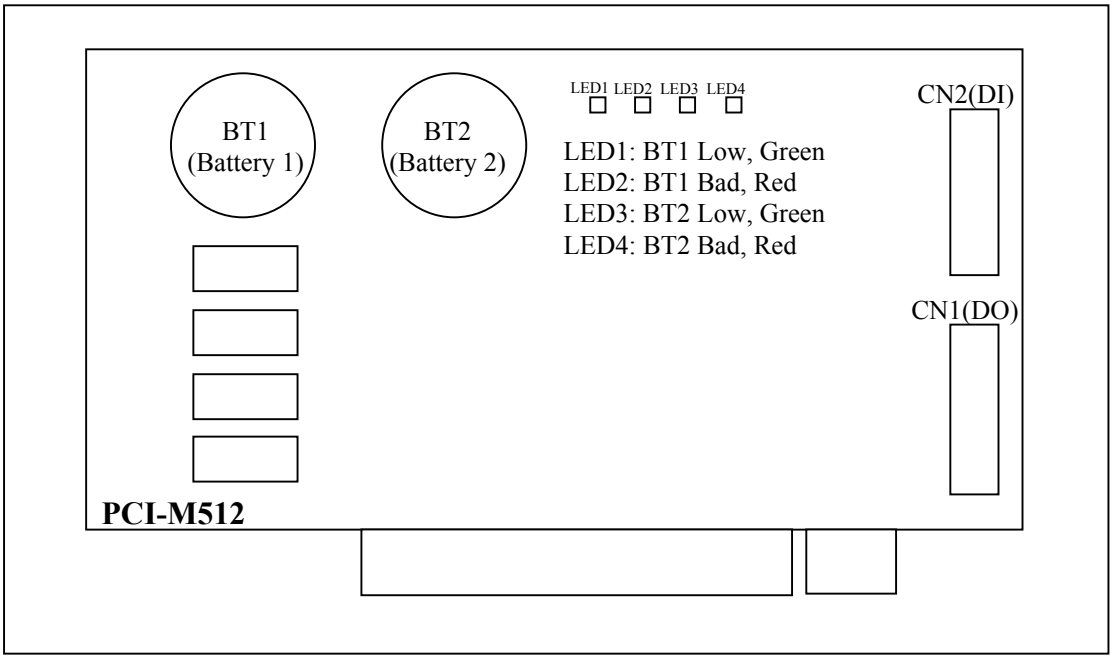


Step 3: run **TestSram2** of Delphi demo program to read/write SRAM of two PCI-M512 as follows: (**step7 of Sec. 1.2.2**)



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 then 2.3V, the green LED1 will be ON.
3. If BT1 is lower then 2.1V, the green LED1 & red LED2 will be ON.
4. If BT2 is lower then 2.3V, the green LED3 will be ON.
5. If BT2 is lower then 2.1V, 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 2V.
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 PCI-M512 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 IDs to access the hardware on PCI-M512.

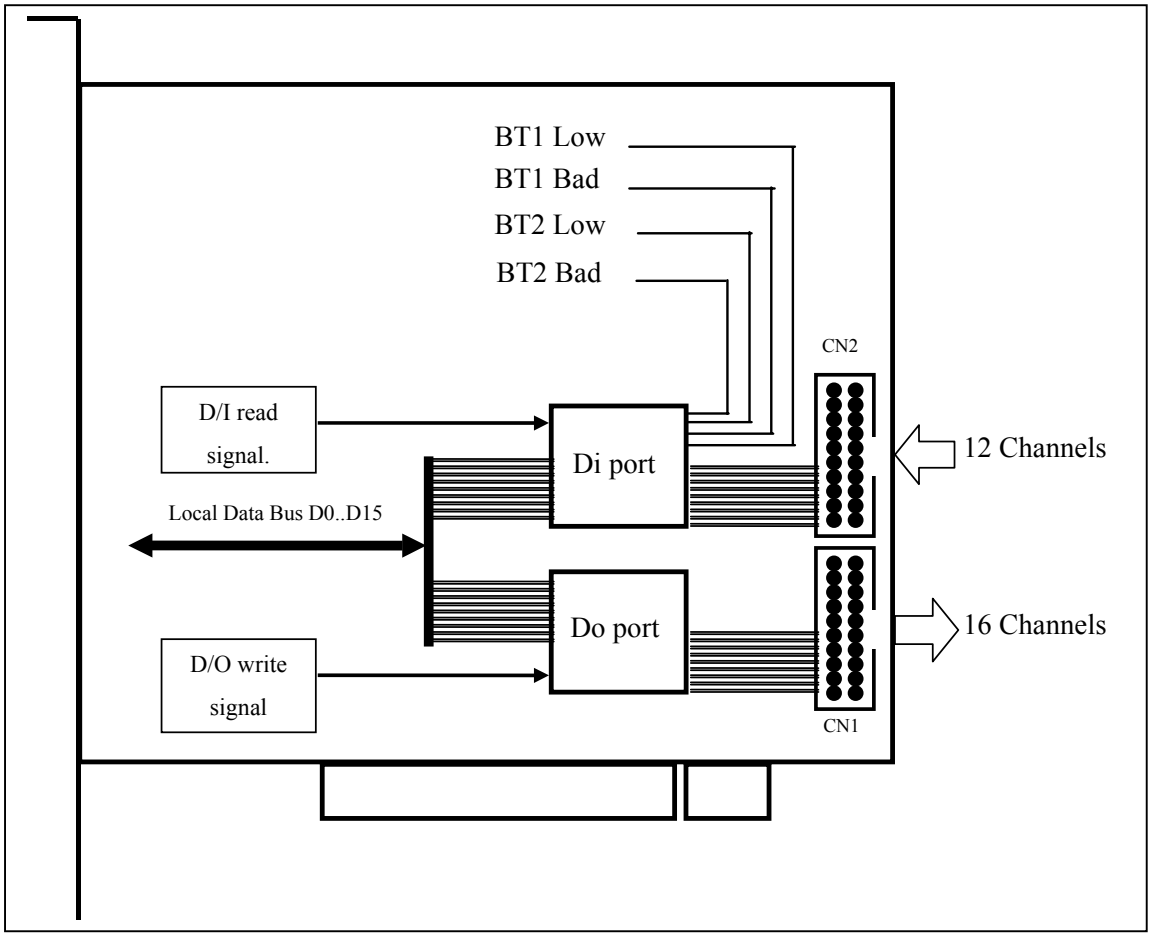
User must use **PCIM512_DetectBoards()** to detect all PCI-M512 boards first. Then user can use the following commands to access SRAM or D/I/O of detected board.

	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(…)
D/I/O 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 boards.

2.3 Block Diagram of D/I/O

The PCI-M512 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:

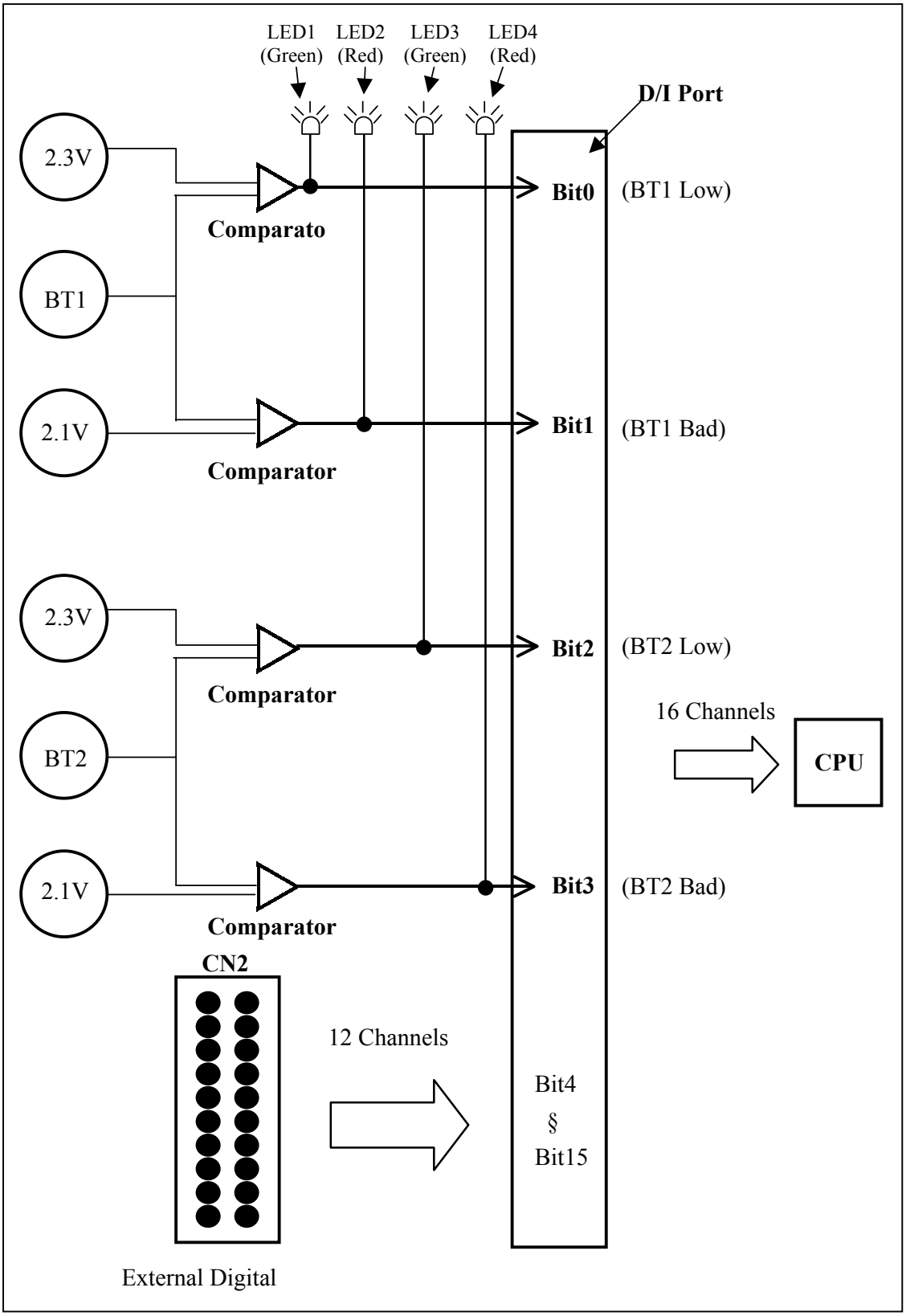


The D/O port can be connected to the DB-16R or DB-24PR. The DB-16R is a 16 channel Relay output board. The DB-24R is a 24 channel Power Relay output board. (note: only 16 channels of these 24 channels are valid).

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

All D/I & D/O are TTL compatible.

2.4 Battery Status Indicators



The initial voltage of BT1 will be larger then 3.0V. If this voltage drops to 2.3V, 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 2.3V.** If this voltage drops to 2.1V, 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 2.1V.**

The action table is given as follows:

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

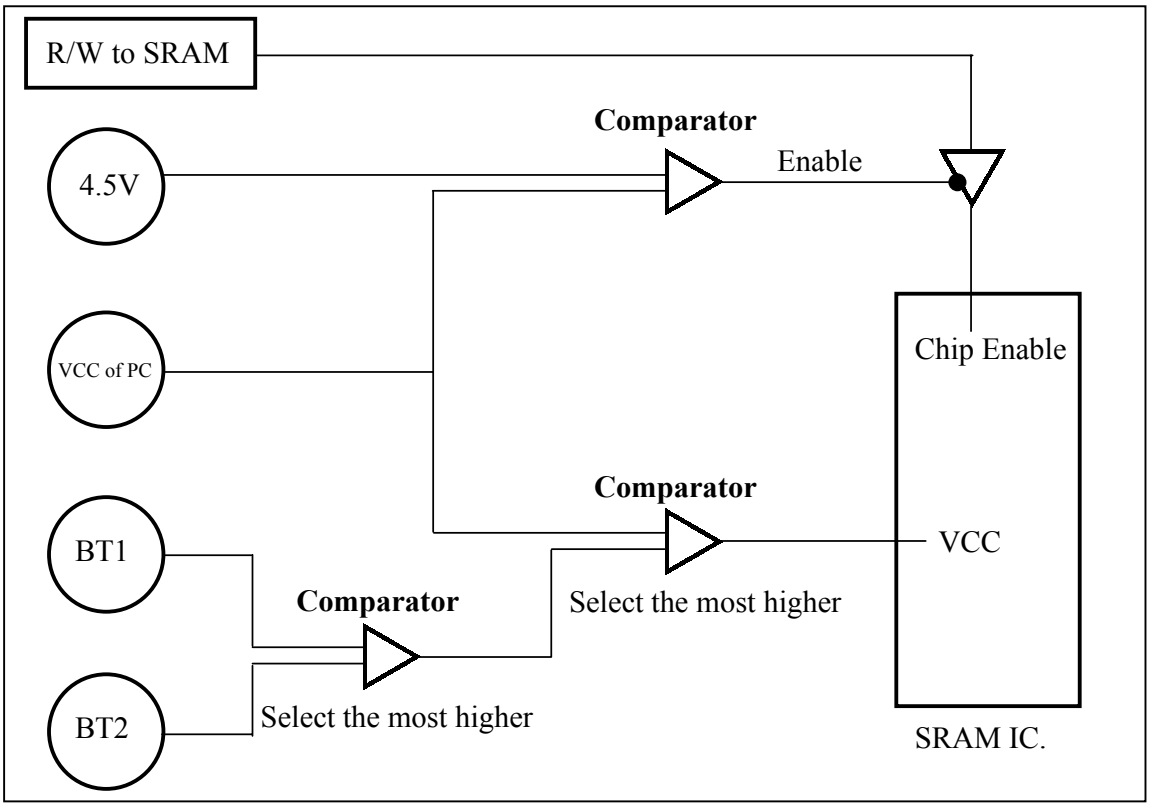
```
    The lowest 4 bits, Bit0 ~ Bit3, are battery status bits. The
other 12 bits, Bit4 ~ Bit15, are external D/I signals. You can
connect a DB-16P to CN2 for sensor input. Refer to Sec. 2.5.1 for
more information.
```

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 up PC (not power off)**
3. replace the old BT1 with the new BT1
4. replace the old BT2 with the old BT2

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

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 3V. If the PC is power on, the PC-VCC will be about 5V. If the PC is off, the PC-VCC will be about 0V. 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 then 2.0V. So, either BT1 or BT2 must higher then 2.0V to keep the SRAM data.

There is one low-battery indicator & one bad-battery indicator for both BT1 & BT2. Refer to Sec. Sec. 2.3 for more information. If you find that one of BT1 or BT2 is in low-battery state, it is recommended to replace both BT1 & BT2 as follows:

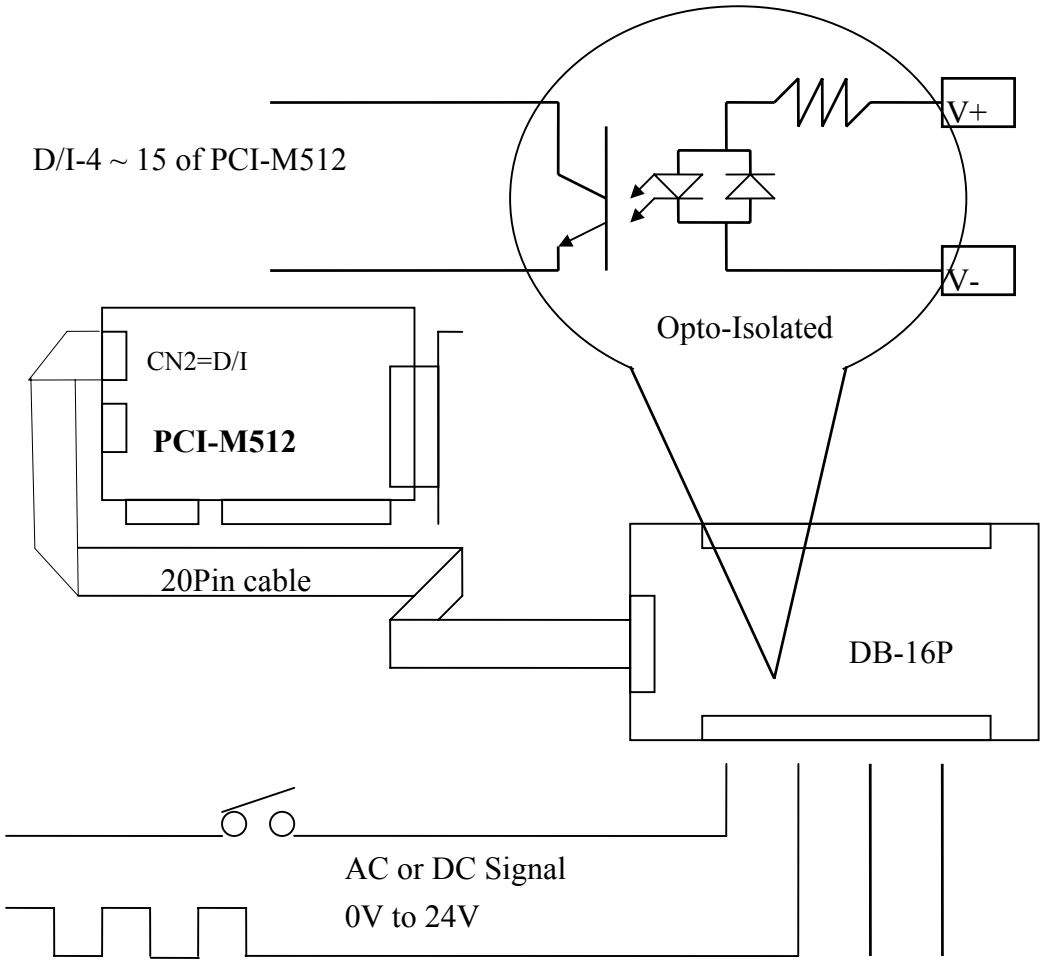
1. prepare 2 new batteries for new BT1 & new BT2
2. power up PC (not power off)
3. replace the old BT1 with the new BT1
4. replace the old BT2 with the old BT2

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

2.6 Daughter Boards

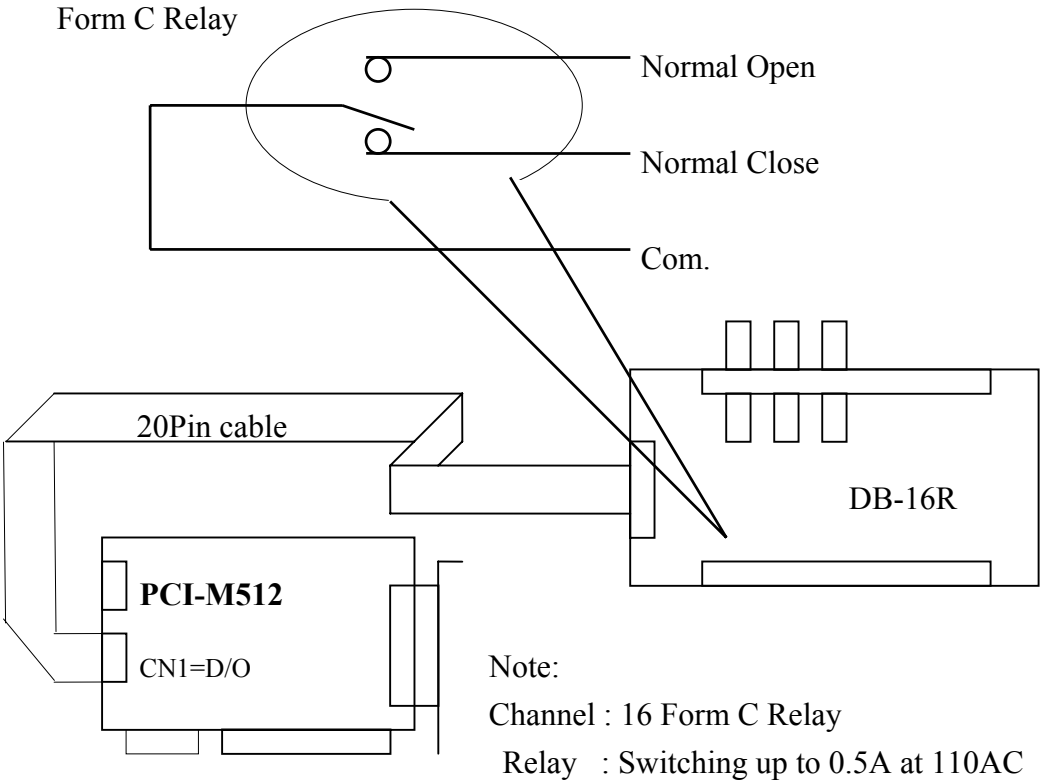
2.6.1 DB-16P Isolated Input Board

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 24V 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 nibble, 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.

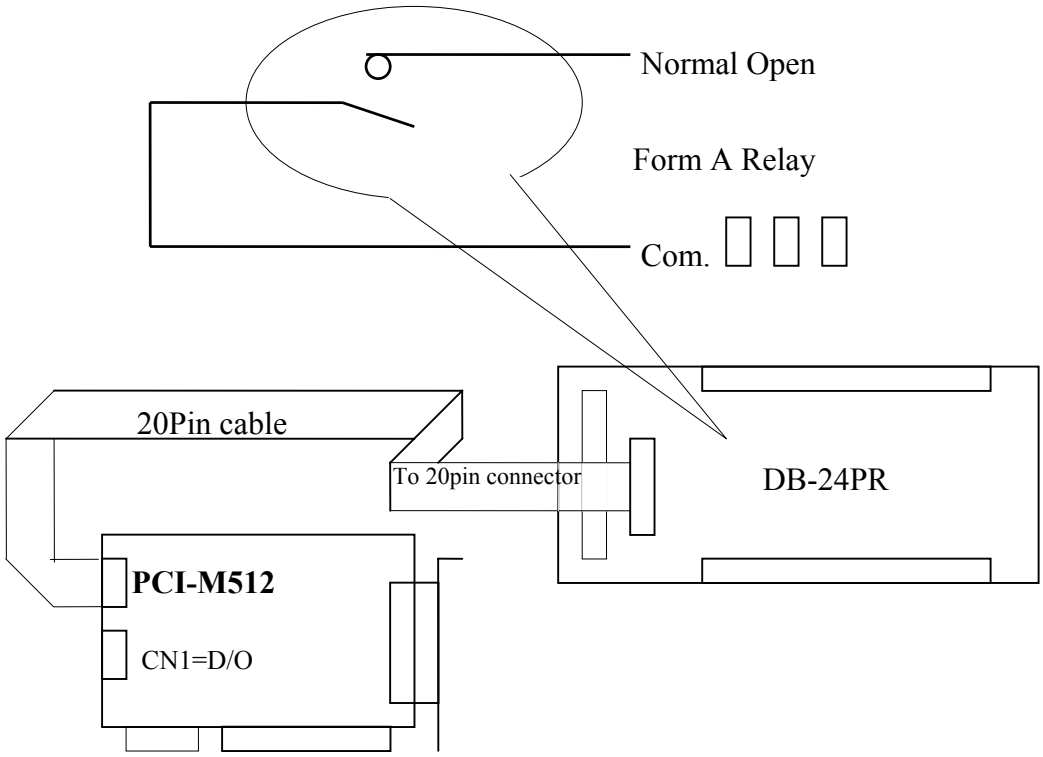


Note:
Channel : 16 Form C Relay
Relay : Switching up to 0.5A at 110AC
or 1A at 24DCV

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

DB-24PR	24*power relay, 5A/250V
DB-24POR	24*photo MOS relay, 0.1A/350VAC
DB-24C	24*open collector, 100mA per channel, 30V 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 5A load at 250ACV/30VDCV. 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 +12VDC or +24VDC 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 5A at 110ACV / 5A at 30DCV

2.7 Pin Assignment

CN2: pin assignment of digital input connector.

Pin	Name	Pin	Name
1	***No Connection***	***2***	***No Connection***
3	***No Connection***	***4***	***No Connection***
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 +5V	20	PCB +12V

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 +5V	20	PCB +12V

3. DLL Driver

The included software is a collection of subroutines for PCI-M512 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: (refer to step2 of Sec. 1.2.2 for more information)

- **PnPInstall.pdf: (Step 3 of Sec. 1.2.2)**

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

- **SoftInst.pdf: (Step 3 of Sec. 1.2.2)**

  Install the software package under Windows 95/98/NT/XP.

- **CallDll.pdf: (Step 5 of Sec. 1.2.2)**

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

- **ResCheck.pdf: (Step 5 of Sec. 1.2.2)**

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

The install shields will install kernel driver, DLL driver & application demo program to system. **All DLL driver & demo program are the same for all windows systems.** That is to say, the same DLL & demo program are same for 95/98/NT/2000/XP, but the kernel driver are different for different system as follows:

- for windows 95/98 → will copy ***WINDRVR.VXD*** to C:\WIN95\SYSTEM\VMM32
- for windows NT/2000/XP → will copy ***WINDRVR.SYS*** to C:\WINNT\SYSTEM32\DRIVERS

All DLL & demo program will not work if the kernel driver is not installed correctly. The install shields will copy the correct kernel driver to the correct position if you select the correct O.S.(95/98, NT, 2000, XP).

After the software driver is finished installing, the related header file & declaration files will be as follows:

```
|--\Demo                    ← demo program
   |--\BCB3                 ← for Borland C++ Builder 3
   |    |--\PCIM512.H       ← Header file
   |    +--\PCIM512.LIB     ← Linkage library for BCB3 only
   |
   |--\Delphi4              ← for Delphi 4
   |    +--\PCIM512.PAS     ← Declaration file
   |
   |--\VB6                  ← for Visual Basic 6
   |    +--\PCIM512.BAS     ← Declaration file
   |
   |--\VC6                  ← for Visual C6
   |    |--\PCIM512.H       ← Header file
   |    +--\PCIM512.LIB     ← Linkage library for VC6 only
   |
   |--\VCPP6                ← for Visual C++ 6
        |--\PCIM512.H       ← Header file
        +--\PCIM512.LIB     ← Linkage library for VC++6 only
```

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 of the parameters need to be allocated spaces by the user.

The return codes of DLLs 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 DLLs 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 D/I/O 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

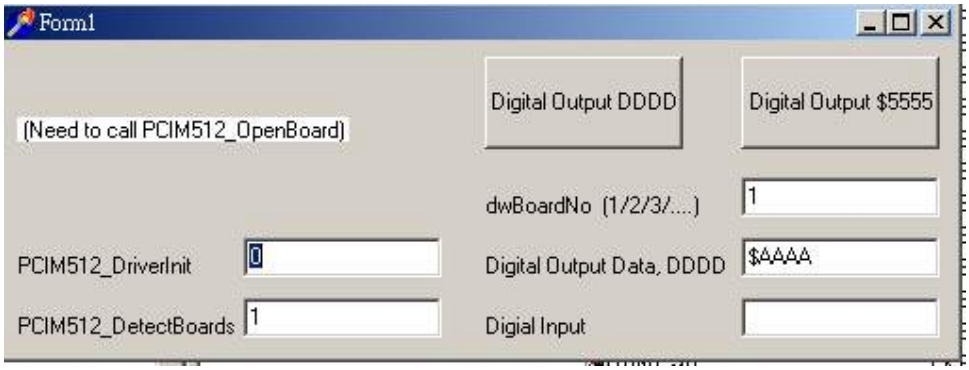
The plug&play BIOS will assign the proper base address to PCI-M512. If there is only one PCI-M512, users can identify this board as board_1. If there are two PCI-M512 boards in the system, it will be very difficult to identify which board is board_1. Our software driver can support 20 boards max. Therefore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

1. Insert one piece of paper to BT1 of one PCI-M512
2. Install all PCI-M512 cards into this PC system
3. Power-on PC
4. You will find only one PCI-M512's LED1 & LED2 are ON
5. Run **DioTest of Delphi4 (Sec. 1.2.2)**
6. Key-in ***board number*** to 1
7. Click ***Digital Output DD***

8. Check the value in ***Digital Input***, if the LSB is 1, we find the target PCI-M512. Otherwise you can go to step 6 for next **board number.**

DioTest



Note: only one PCI-M512, the board number will be 1.

3.2 Functions of Test

Note: All DLL libraries given in Sec 3.3 can be used before the kernel driver is installed. Refer to Sec. 1.2.1 for more information.

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

3.3 Functions of Driver Initialization

3.3.1 PCIM512_DriverInit

- **Description :**

  This subroutine will allocate the resources for the Windriver. This function must be called first before calling 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 PCIM512 kernel driver and allocate the resource from the device. This function must be called first before calling the DLL 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 boards. **This function must be called first before calling the DLL 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 is installed in this PC(board no.=1)

  2: there are 2 PCI-M512 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 boards. It is designed to identify PCI-M512.

- **Syntax :**

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

- **Parameter :**

  dwBoardNo : [Input] PCI-M512 board number
  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 boards. Refer to Sec. 2.2 for more information.

3.3.5 PCIM512_ReadBoardStatus

- **Description :**

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

- **Syntax :**

  DWORD PCIM512_ReadBoardStatus(DWORD dwBoardNo);

- **Parameter :**

  dwBoardNo [Input] PCI-M512 board number

- **Return:**

  0: The PCI-M512 board DLL is not opened.

  1: The PCI-M512 board DLL is opened.

- **Note:**

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

3.3.6 PCIM512_CloseBoard

- **Description :**

  This subroutine will close the PCI-M512 kernel driver and release the resource from the device.

- **Syntax :**

  DWORD PCIM512_CloseBoard(DWORD dwBoardNo);

- **Parameter :**

  dwBoardNo [Input] PCI-M512 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 kernel driver and release the resource from 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, of data to SRAM of PCI-M512.

- **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 no. find
  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 boards. Refer to Sec. 2.2 for more information.
  3. This function can be used for PCI-M512.

3.4.2 PCIM512_WriteSramWord

- **Description:**

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

- **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 no find
  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 boards. Refer to Sec. 2.2 for more information.

3.4.3 PCIM512_WriteSramDword

- **Description:**

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

- **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 no find
  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 boards. Refer to Sec. 2.2 for more information.

3.4.4 PCIM512_ReadSramByte

- **Description:**

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

- **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 no find
  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 boards. Refer to Sec. 2.2 for more information.

3.4.5 PCIM512_ReadSramWord

- **Description:**

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

- **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 no find
  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 boards. Refer to Sec. 2.2 for more information.

3.4.6 PCIM512_ReadSramDword

- **Description:**

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

- **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 no find
  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 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.

- **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 find
  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 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.

- **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:**

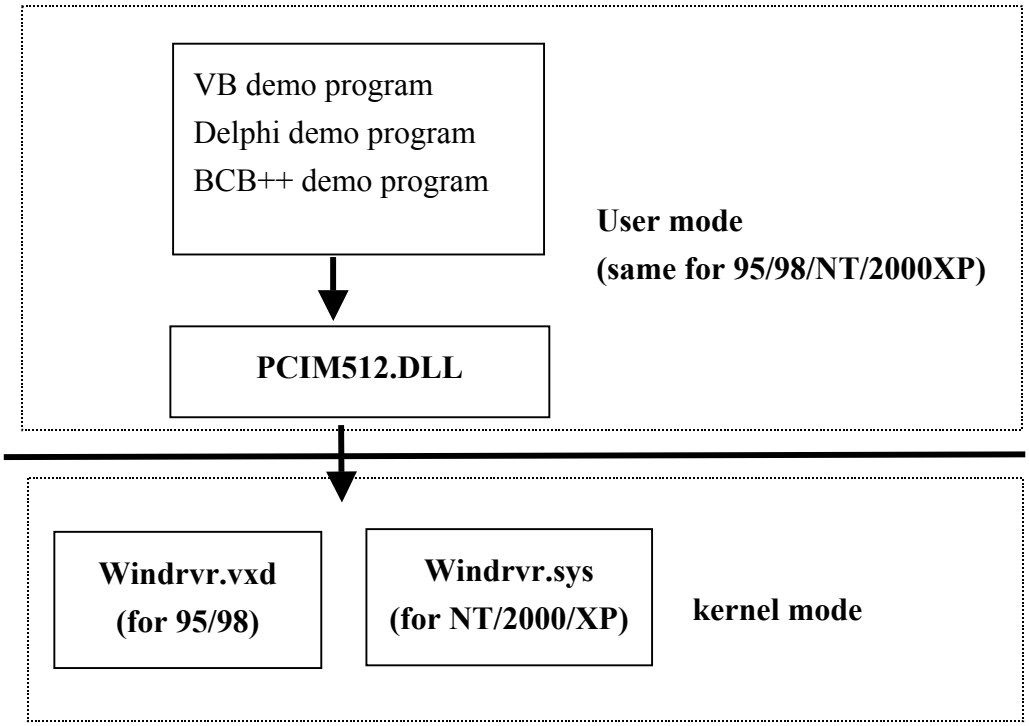
0:	Write OK
PCI_DriverNoOpen:	kernel driver no find
PCI_BoardNoIsZero:	dwBoardNo is 0, it must be in the range of 1 ~ N
PCI_BoardNoExceedFindBoards:	dwBoardNo > N

- **Note:**

  1. call **PCIM512_DetectBoards()** before calling this function
  2. call **PCIM512_ReadBoardId(…)** to identify the detected PCI-M512 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. The PCIM512.DLL will call the kernel driver, Windrvr.vxd or Windrvr.sys as follows:



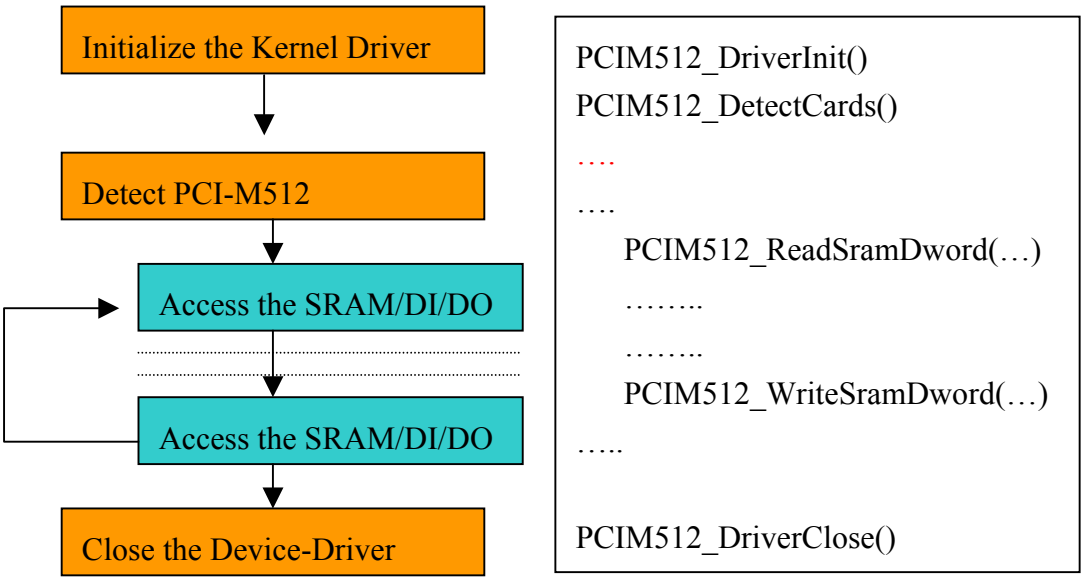
The install shields will install kernel driver, DLL driver & application demo programs to system. **All demo program & DLL are same for 95/98/NT/2000/XP,** but the kernel driver is different for different system as follows:

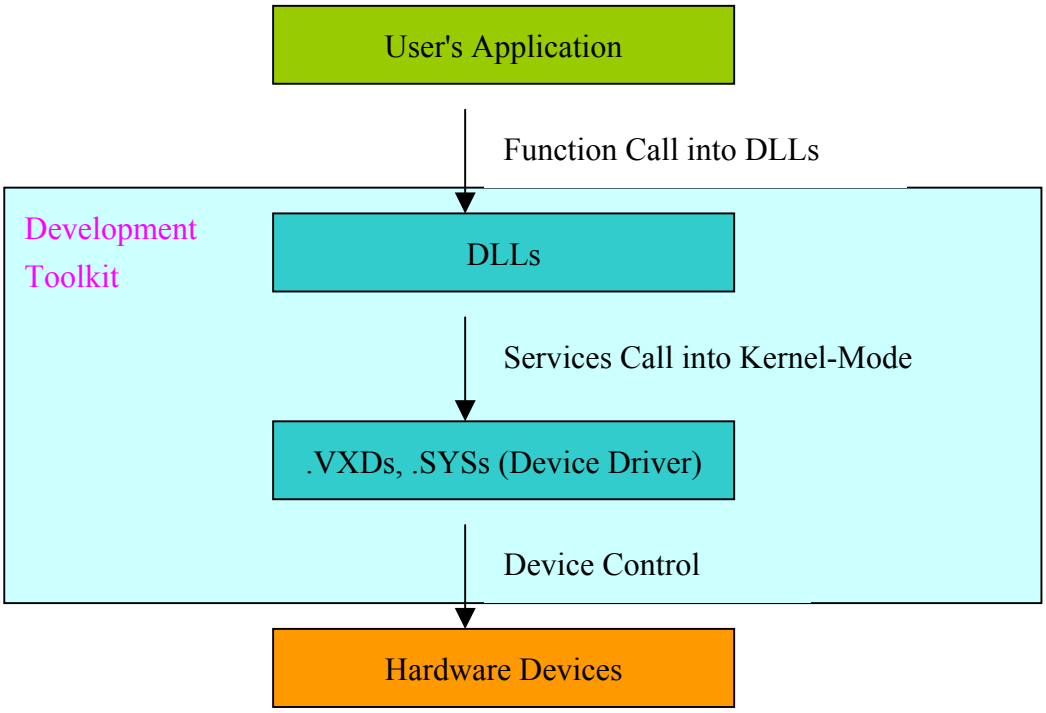
- for windows 95/98 → will copy ***WINDRVR.VXD*** to C:\WIN95\SYSTEM\VMM32
- for windows NT/2000/XP → will copy ***WINDRVR.SYS*** to C:\WINNT\SYSTEM32\DRIVERS

All DLL & demo program will not work if the kernel driver is not installed correctly. The install shields will copy the correct kernel driver to the correct position if you select the correct O.S.(95/98/ME, NT, 2000, XP).

Refer to **CallDll.pdf** for more information about how to call the DLL functions with VC++5, VB5, Delphi3 and Borland C++ Builder 3. Refer to **step5 of Sec. 1.2.2** for more information.

4.1 Program Architecture





4.2 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

on the Internet.

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 related. Then will reply as soon as possible to you. Please check that we had received your comments. And please keep in contact with us.

ICP DAS
E-mail: Service@icpdas.com
Web Site: http://www.icpdas.com
http://www.icpdas.com.tw