

# PIO-D144/D168

Digital I/O Card

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## Linux Software Manual

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# 1 Linux Software Installation

The PIO-D144/D168 can be used in linux kernel 2.4.X and 2.6.X. For Linux O.S, the recommended installation and uninstall steps are given in Sec 1.1 ~ 1.2

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## 1.1 Linux Driver Installing Procedure

- Step 1: Copy the linux driver "ixpio-0.20.15.tar.gz" (or the later driver version) in the directory "NAPDOS\Linux" of the companion CD or download the latest driver from our website to the linux host.
  - Step 2: You must use the '**root**' identity to compile and install PIO/PISO linux driver.
  - Step 3: Decompress the tarball "ixpio.tar.gz".
  - Step 4: Type '**cd**' to the directory containing the package's source code and type '**./configure**' to configure the package for your linux system.
  - Step 5: Type '**make**' to compile the package.
  - Step 6: You can type '**./ixpio.inst**' to install the PIO/PISO driver module and build the device file "ixpioX" in the device directory "/dev" automatically.
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## 1.2 Linux Driver Uninstalling Procedure

- Step 1: Type '**cd**' to the directory containing the package's source code.
- Step 2: Type '**./ixpio.remove**' to remove the PIO/PISO driver module.

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## 2. Static Library Function Description

The static library is the collection of function calls of the PIO-DIO cards for linux kernel 2.4.x and 2.6.x system. The application structure is presented as following figure. The user application program developed by C(C++) language can call library "libpio.a" in user mode. And then static library will call the module ixpio to access the hardware system.

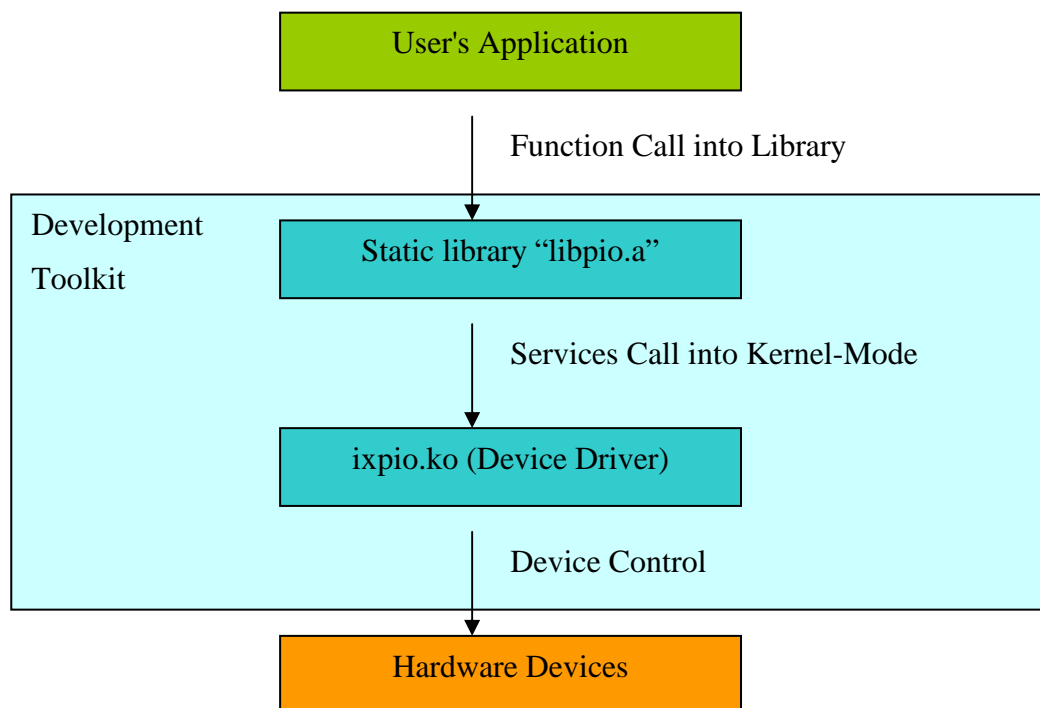


Figure 2.1

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## 2.1 Table of ErrorCode and ErrorString

Table 2.1

Error Code	Error ID	Error String
0	PIODA_NOERROR	OK ( No error !)
1	PIODA_MODULE_NAME_GET_ERROR	Module name can't get from file /proc/ixpio/ixpio
2	PIODA_DEVICE_DIO_INIT_ERROR	Configure port DI/O error
3	PIODA_ACTIVE_PORT_ERROR	Select I/O port error
4	PIODA_PORT_DEFINED_ERROR	Port number out of range
5	PIODA_DIGITAL_OUTPUT_ERROR	Digital output error
6	PIODA_DIGITAL_INPUT_ERROR	Digital input error
7	PIODA_INT_SOURCE_DEFINED_ERROR	Interrupt source defined error
8	PIODA_CONFIGURE_INTERRUPT_ERROR	Configure interrupt error
9	PIODA_ACTIVEMODE_DEFINED_ERROR	Defined Interrupt active mode error
10	PIODA_ADD_SIGNAL_ERROR	Add signal condition error

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## 2.2 Function Descriptions

Table 2.2

Function Definition
char * PIODA_GetDriverVersion(void);
char * PIODA_GetLibraryVersion(void);
int PIODA_Open(char *dev_file);
WORD PIODA_Close(WORD fd);
WORD PIODA_DriverInit(WORD);
WORD PIODA_DeviceInit(WORD fd);
WORD PIODA_PortDirCfs(WORD, WORD, boolean);
WORD PIODA_Digital_Output(WORD, WORD, byte);
WORD PIODA_Digital_Input(WORD, WORD, WORD *);
WORD PIODA_IntInstall(WORD, HANDLE, WORD, WORD, WORD);
WORD PIODA_IntRemove(WORD, WORD);

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## 2.3 Digital I/O FUNCTIONS

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### 2.3.1 PIODA\_GetDriverVersion

- **Description:**  
To get the version of PIO/PISO linux driver.
- **Syntax:**  
char\* PIODIO\_GetDriverVersion(Void)
- **Parameter:**  
None
- **Return:**  
The version of PIO/PISO linux driver.

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### 2.3.2 PIODA\_GetLibraryVersion

- **Description:**  
To get the version of PIO/PISO linux static library.
- **Syntax:**  
char\* PIODIO\_GetLibraryVersion(void)
- **Parameter:**  
None
- **Return:**  
The version of PIO/PISO linux static library.

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### 2.3.3 PIODA\_Open

- **Description:**  
To open device file.
- **Syntax:**  
int PIODIO\_Open(char \*dev\_file)
- **Parameter:**

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dev\_file : The path of device file

- **Return:**  
The file descriptor of device file. If the file descriptor < 0, it means that open device file failure.

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#### 2.3.4 PIODA\_Close

- **Description :**  
To close device file.
- **Syntax :**  
Word PIODIO\_Close(WORD fd)
- **Parameter :**  
fd : The file descriptor of device file that get from function PIODIO\_Open
- **Return:**  
"PIODA\_NOERROR"  
(Please refer to "Section 2.1 Error Code").

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#### 2.3.5 PIODA\_DriverInit

- **Description :**  
To allocates the computer resource for the device. This function must be called once before applying other PIODA functions.
- **Syntax :**  
WORD PIODA\_DriverInit(WORD fd)
- **Parameter :**  
fd : The file descriptor of device file that get from function PIODIO\_Open
- **Return:**  
"PIODA\_MODULE\_NAME\_GET\_ERROR",  
"PIODA\_NOERROR",  
(Please refer to "Section 2.1 Error Code").

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### 2.3.6 PIODA\_DeviceInit

- **Description :**  
To send initial-value to the D/O latch register of active port.
- **Syntax :**  
WORD PIODA\_DeviceInit(WORD fd)
- **Parameter :**  
fd : The file descriptor of device file that get from function PIODIO\_Open.
- **Return :**  
"PIODA\_DEVICE\_DIO\_INIT\_ERROR",  
"PIODA\_NOERROR".  
(Please refer to "Section 2.1 Error Code").

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### 2.3.7 PIODA\_PortDirCfs

- **Description :**  
To change Digital I/O port. status(DI or DO).
- **Syntax :**  
WORD PIODA\_PortDirCfs(WORD fd, WORD port, boolean io)
- **Parameter :**  
fd : The file descriptor of device file that get from function PIODIO\_Open.  
port : The port number that want to change status(DI or DO)  
io : The value 0 means digital output. The value 1 means digital input.
- **Return:**  
"PIODA\_DEVICE\_DIO\_INIT\_ERROR",  
"PIODA\_NOERROR",  
(Please refer to "Section 2.1 Error Code").



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### 2.3.8 PIODA\_Digital\_Output

- **Description :**  
This subroutine sends the 8 bits data to the specified I/O port.
- **Syntax :**  
WORD PIODA\_Digital\_Output(WORD fd, WORD port, byte data);
- **Parameter :**  
fd : The file descriptor of device file that get from function PIODIO\_Open.  
port : The.output port number.  
data : 8 bits data.
- **Return:**  
"PIODA\_DIGITAL\_OUTPUT\_ERROR",  
"PIODA\_NOERROR",  
(Please refer to "Section 2.1 Error Code").

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### 2.3.9 PIODA\_Digital\_Input

- **Description :**  
This subroutine reads the 8 bits data from the specified I/O port.
- **Syntax :**  
WORD PIODA\_Digital\_Input(WORD fd, WORD port, WORD \*di\_data);
- **Parameter :**  
fd : The file descriptor of device file that get from function PIODIO\_Open.  
port : The.input port number.  
di\_data : A variable address used to storage the 8 bits input data.
- **Return:**  
"PIODA\_DIGITAL\_INPUT\_ERROR"  
"PIODA\_NOERROR"  
(Please refer to "Section 2.1 Error Code").

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## 2.3.10 PIODA\_IntInstall

- **Description :**

This subroutine installs the IRQ service routine.

- **Syntax :**

WORD PIODA\_IntInstall(WORD fd, HANDLE hisr, WORD signal, WORD int\_source, WORD activemode);

- **Parameter :**

fd : The file descriptor of device file that get from function PIODIO\_Open.

hisr : Address of a Event handle. The handle function will be called when the interrupt happened.

signal : The number of signal is defined by user.

Int\_source : Please refer to the following table 2.3

Table 2.3

Card No.	Int_source	Description
PIO-D144/D168	PIOD144_168_P2C0	Enable P2C0
	PIOD144_168_P2C1	Enable P2C1
	PIOD144_168_P2C2	Enable P2C2
	PIOD144_168_P2C3	Enable P2C3
	PIOD144_168_ALL_INT	Enable All Int Source

activemode : The value 0 means interrupt happened when signal is low. The value 1 means interrupt happened when signal is high. The value 2 means interrupt happened when signal is low or high.

- **Return:**

“PIODA\_CONFIGURE\_INTERRUPT\_ERROR”,

“PIODA\_INT\_SOURCE\_DEFINED\_ERROR”,

“PIODA\_ACTIVE\_PORT\_ERROR”,

“PIODA\_ACTIVEMODE\_DEFINED\_ERROR”,

“PIODA\_ADD\_SIGNAL\_ERROR”,

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“PIODA\_NOERROR”.

(Please refer to "Section 2.1 Error Code").

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### 2.3.11 PIODA\_IntRemove

- **Description :**

This subroutine removes the IRQ service routine.

- **Syntax :**

WORD PIODA\_IntRemove(WORD fd, WORD sig\_id)

- **Parameter :**

fd : The file descriptor of device file that get from function  
PIODIO\_Open.

sig\_id : The number of signal is defined by user.

- **Return:**

“PIODA\_CONFIGURE\_INTERRUPT\_ERROR”,

“PIODA\_NOERROR”.

(Please refer to "Section 2.1 Error Code").

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### 3. PIO-D144/D168 Linux Demo

All of demo programs will not work normally if PIO/PISO linux driver would not be installed correctly. During the installation process of PIO/PISO linux driver, the install-scripts “ixpio.inst” will setup the correct kernel driver. After driver(version 0.20.15 or the later driver version) compiled and installation, the related demo programs, development library and declaration header files for different development environments are presented as follows.

Table 3.1

Driver Name	Directory Path	File Name	Description
ixpio-0.20.15	Include	piodio.h	PIO/PISO library header
	Lib	libpio.a	PIO/PISO static library
	examples/piod144 examples/piod168	port.c	Digital input demo
		port2.c	Digital input and output demo
		port_a.c	DI and DO demo with library
		int.c	Interrupt demo
int2.c		Interrupt demo	
	Int_a.c	Interrupt demo with library	

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#### 3.1 Demo code “port.c”

This demo program is used to read data from port 2, and get out if read data error or port 2 bit 7 = 0.

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#### 3.2 Demo code “port2.c”

This demo program is used to output digital from port 1 and input digital data from port 0.

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### **3.3 Demo code “port\_a.c”**

This demo program coded by using the static library “libpio.a”. It is used to output digital from port 1 and input digital data from port 0.

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### **3.4 Demo code “int.c”**

This demo program uses P2C0, P2C1, P2C2, P2C3 as interrupt source. The interrupt will be triggered according to the argument “sig.bedge”(if value = 1, then the interrupt triggered at high signal and low signal) or “sig.edge”(if value = 1, then interrupt triggered at high signal. Otherwise, the interrupt triggered at low signal).

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### **3.5 Demo code “int2.c”**

This program configures driver to send signals in different signal id for the four interrupt channels.

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### **3.6 Demo code “int\_a.c”**

This demo program coded by using the static library “libpio.a” to enable P2C0, as interrupt source. The interrupt will be triggered when the signal is low.