National Instruments I/O Device for V+ User Manual

REVISION HISTORY

Version	Description	Date
1.0	Initial Release	September 27, 2002
1.1	Corrected grammar in introduction.	February 6, 2003

C O N T E N T S

PREFACE

This document represents SimPhonics' User Manual for the National Instruments I/O Device for using with our **V+ Development System** or **V+ Run-time System** licenses. **V+**, pronounced "V - Plus", is a completely new way of programming systems that interact with real-world signals in real-time.   This I/O device is an add-on to **V+** that allows the user to install and interface National Instruments hardware to the **V+** software.

Please note that this manual is a *living* document and is revised frequently as more enhancements are added to the system. Therefore, ensure you have the latest version of this document.

Before Using this Document
You must be familiar with **V+** in order to use this document. Be sure to read the **V+** User Manual before proceeding. See: http://www.simphonics.com/products/software/V+/. This I/O device may also be downloaded at: http://www.simphonics.com/support/downloads/software/

INTRODUCTION

The National Instrument I/O Driver for **V+** allows access to National Instruments hardware via **V+** ports. There are 3 National Instruments cards currently used and test within SimPhonics products.

The most current National Instruments is the **PCI-DIO-96,** a 96-bit, parallel, digital I/O interface for PCI bus computers. Older cards, **PC-1200AI** and **PC-DIO96** are members of the National Instruments PC Series of I/O channel expansion cards for ISA computers.

- **PCI-DIO-96**
- **PC-1200AI**
- **PC-DIO96**

INSTALLATION

PCI-DIO-96 Card

Installing the National Instruments I/O Device for V+

To install the National Instruments I/O Device CD:
1. Insert the disk labeled *National Instruments I/O Device for V+.*
2. The installation program will begin automatically. (Note: If the installation does not begin automatically, select **Start/Run** and enter `d:\setup`)
3. Click **Next**.
4. Click **Finish**.
5. Remove the disk from the drive.

Installing the NI-DAQ Software
Each National Instruments card is delivered with a CD-ROM that contains the NI-DAQ software drivers needed to use your card.

To install the NI-DAQ drivers:
1. Insert the CD-ROM labelled *NI-DAQ Software for Windows,* into the drive.
2. The CD installation program will start automatically.
3. Click **Next**.
4. Select "**I accept the license agreement.**"
5. Click **Next**.
6. Click **Next**.
7. Click **Next**.
8. Click **Finish**.
9. Click **Yes** to reboot the computer.
10. Click **Next**.
11. Select **PCI-DIO-96** from the list of cards.
12. Click **Next**.
13. Click **Next**.
14. Click **Next**.
15. Click **Next**.
16. Click **Next**.
17. Click **Finish**.
18. Select **Configure Measurement and Automation System**.
19. Click **Finish**.
20. Click **OK**.
21. Close all open windows.
22. Right click **My Computer**.
23. Select Properties > Hardware > Device Manager > Other Devices.
24. Right click **PCI Device**.
25. Select **Properties** > **Reinstall Driver**.

26. Click **Next**.
27. Click **Finish**.
28. Close all open windows.
29. Remove the CD-ROM from drive.
30. Restart the Computer.

PC-DIO96 and PC-1200AI Cards

Installing the NI-DAQ Software
Each National Instruments card is delivered with a CD-ROM that *contains* the *NI-DAQ* software. This software must be installed on the target machine before any hardware is installed and before installing the **National Instruments I/O Device for V+** software. By installing the *NI-DAQ* software, all of the drivers and utilities that will be needed will be available on the target system. The **National Instruments I/O Device for V+** software is compatible with NI-DAQ software version 6.0 and higher.

The *NI-DAQ* installation program will run automatically whenever you insert the CD into the CD-ROM drive. If it does not run automatically, you can run setup.exe from the root CD-ROM drive. Once the installation program has launched, follow the instructions given in the program and for most typical installations, use the default settings. Only the driver files are required for the **V+** I/O driver.

Installing the Hardware
After the *NI-DAQ* software has been installed, you may now insert the hardware into the system's expansion bus. Make note of any address, DMA, or interrupt jumper/switch settings on the cards before installing them. In the case of cards like the **PC-DIO96**, it will be necessary to manually configure the card by selecting a base I/O address and an interrupt. Other cards, like the **PC-1200AI** are fully plug-and-play and require no manual jumper/switch settings. Refer to the User Manual for the particular card you are using for detailed information on configuring the hardware.

During boot-up, Windows will attempt to plug-and-play the National Instruments cards and install the proper drivers for each card. In cases like the **PC-1200AI**, the driver should be loaded by the plug-and-play software with no further user action. In cases like the **PC-DIO96**, the driver will need to be loaded manually by opening the Window's Control Panel and selecting Add New Hardware. The driver for the card should appear in the list of drivers given for Data Acquisition Devices. When installing or removing National Instruments cards, it is a good idea to double-check the loaded drivers by looking at the Device Manager tab of the System Properties window. A driver for each installed National Instruments card should appear below the Data Acquisition Devices heading.

Installing the V+/National Instruments I/O Driver
Insert the **National Instruments I/O Device for V+** disk into associated drive and run setup.exe from the root directory of the diskette. This will launch the installation program to copy the files and configure the system settings for this driver. In typical cases, it will not be necessary to change any of the default settings in the installation program. Once the installation program has completed, the I/O driver is ready to use.

PCI-DIO-96

The **PCI-DIO-96** is a 96-bit, parallel, digital I/O interface for PCI bus computers. Four 82C55A programmable peripheral interface (PPI) chips control the 96 bits of TTL-compatible digital I/O on the **PCI-DIO-96**. The OKI Semiconductor 82C55A PPI chips can operate in unidirectional mode, bidirectional mode, or handshaking mode and can generate interrupt requests to your computer. All the digital I/O lines are accessible through a 100-pin female connector.

The **National Instruments I/O Device for V+** provides the interface software between **V+** and the **PCI-DIO-96**. The user is able to configure the **PCI-DIO-96** in a number of input/output combinations and have those inputs and outputs automatically available as I/O ports in a **V+** design (see below).
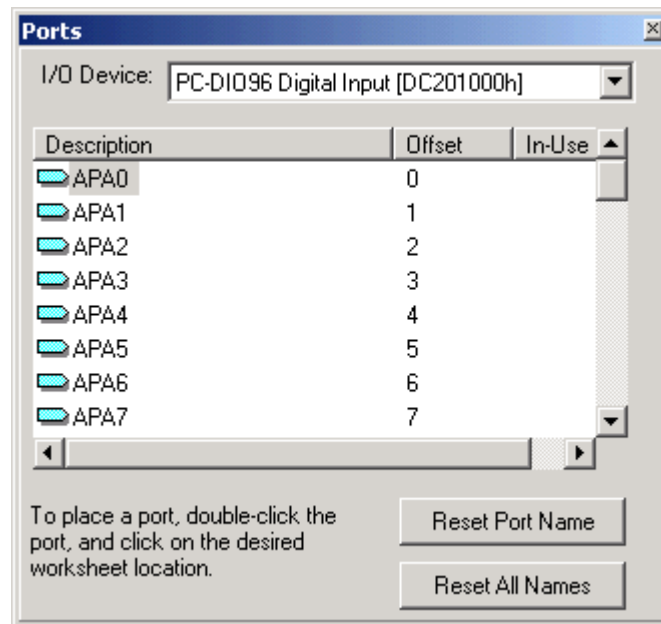
Figure 1 - PCI-DIO-96 V+ Ports

Minimum Requirements
- **PCI-DIO-96** board
- NI-DAQ for PC Compatibles software
- National Instruments I/O Driver for **V+** Build 130 or later
- Windows NT/2000/XP
- **V+** Visual Programming Language, Build 203 or later

Configuration

To configure the device:
1. Select **Start** > **Programs** > **V+** > **V+ Run-Time System**.
2. Select **Configure** to open the Platform Configure dialog box.
3. Double click National Instruments; the icon to left of the name should change to green indicating the operation was successful (see below). If the icon remains red, the operation failed and the device did not load properly. Refer to the V+ Help system for more details.

Figure 2 - Platform Configure Dialog Box

4. Select the **Configure** button to open the **National Instruments Configuration** dialog box.

Figure 3 - National Instruments Configuration Dialog Box

Port Naming Convention
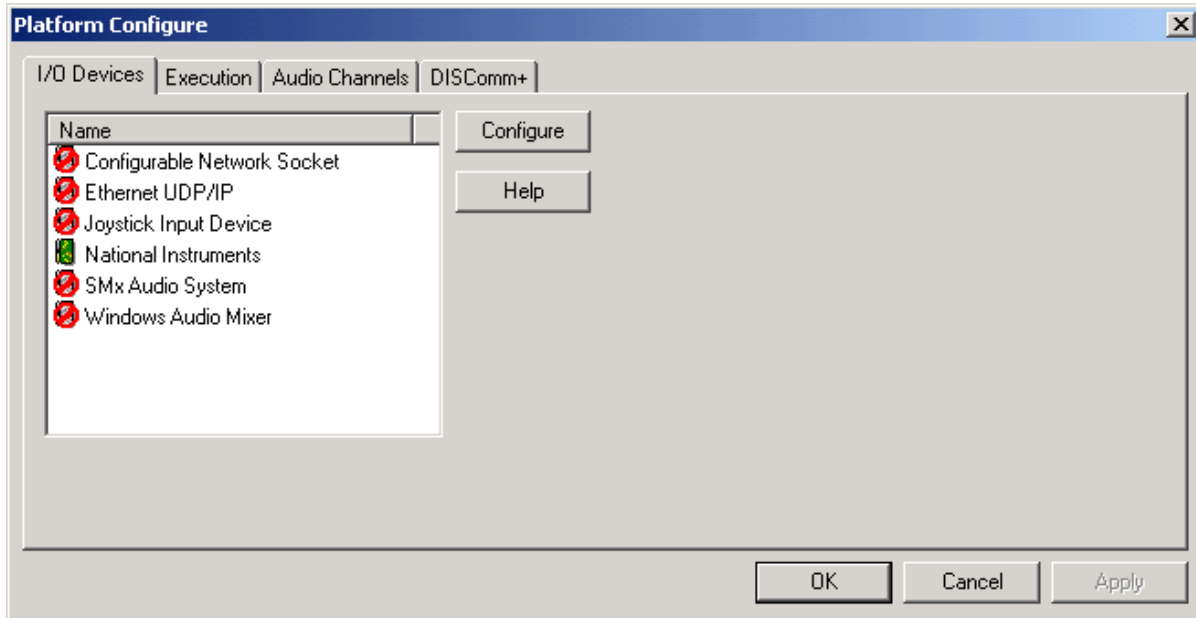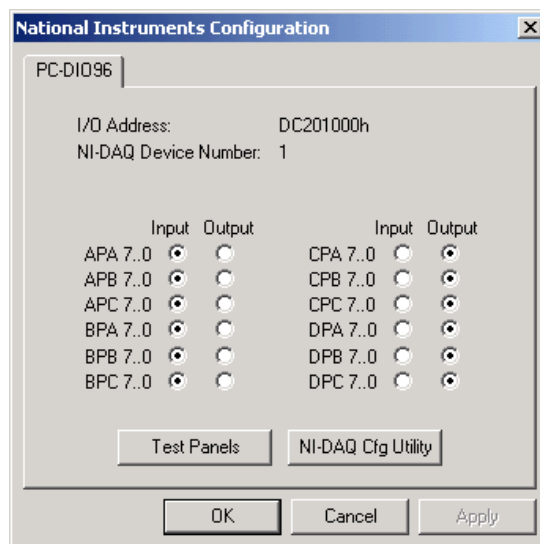The default port names for the **PCI-DIO-96** align with the naming convention used in the "**PCI-DIO-96**/PXI™-6508/PCI-6503 User Manual." The following illustration shows the pinout of the 100 pin external connector of the card. Each name that is assigned to each pin are the same names that will be assigned to the I/O ports on the **V+** design worksheet. For example, the digital line connected to pin 15 of the 100 pin connector will correspond to the I/O port labeled "APC0".

Name	Pin	Pin	Name
APC7	1	51	CPC7
BPC7	2	52	DPC7
APC6	3	53	CPC6
BPC6	4	54	DPC6
APC5	5	55	CPC5
BPC5	6	56	DPC5
APC4	7	57	CPC4
BPC4	8	58	DPC4
APC3	9	59	CPC3
BPC3	10	60	DPC3
APC2	11	61	CPC2
BPC2	12	62	DPC2
APC1	13	63	CPC1
BPC1	14	64	DPC1
APC0	15	65	CPC0
BPC0	16	66	DPC0
APB7	17	67	CPB7
BPB7	18	68	DPB7
APB6	19	69	CPB6
BPB6	20	70	DPB6
APB5	21	71	CPB5
BPB5	22	72	DPB5
APB4	23	73	CPB4
BPB4	24	74	DPB4
APB3	25	75	CPB3
BPB3	26	76	DPB3
APB2	27	77	CPB2
BPB2	28	78	DPB2
APB1	29	79	CPB1
BPB1	30	80	DPB1
APB0	31	81	CPB0
BPB0	32	82	DPB0
APA7	33	83	CPA7
BPA7	34	84	DPA7
APA6	35	85	CPA6
BPA6	36	86	DPA6
APA5	37	87	CPA5
BPA5	38	88	DPA5
APA4	39	89	CPA4
BPA4	40	90	DPA4
APA3	41	91	CPA3
BPA3	42	92	DPA3
APA2	43	93	CPA2
BPA2	44	94	DPA2
APA1	45	95	CPA1
BPA1	46	96	DPA1
APA0	47	97	CPA0
BPA0	48	98	DPA0
+5 V	49	99	+5 V
GND	50	100	GND

Figure 4 - PCI-DIO-96 Digital I/O Connector Pin Assignments

PC-1200AI

This section is applicable to National Instruments card **PC-1200AI**. The **PC-1200AI** is a member of the National Instruments PC Series of I/O channel expansion cards for ISA computers. These cards are designed for high-performance data acquisition and control for many types of applications. The **PC-1200AI** has eight analog input channels that can be configured as eight single-ended or four differential inputs, a 12-bit successive-approximation ADC, and 24 lines of TTL-compatible digital I/O.

The **_National Instruments I/O Device for V+_** software provides the interface software between **V+** and the **PC-1200AI**. The user is able to configure the **PC-1200AI** in a number of combinations and have those analog and digital inputs and outputs automatically available as I/O ports in a **V+** design.

Configuration

To configure the PC-1200AI card
1. Select **Start** > **Programs** > **V+** > **V+ Run-Time System**.
2. Select the **Configure** menu selection from the Platform Shell.
3. Click the **I/O Drivers** tab at the top of the dialog box.
4. Double-click the National Instruments device in the list box (see below). The icon to left of the name should change to green indicating the operation was successful. If the icon remains red, the operation failed and the device did not load properly. Refer to the V+ Help system for more details.
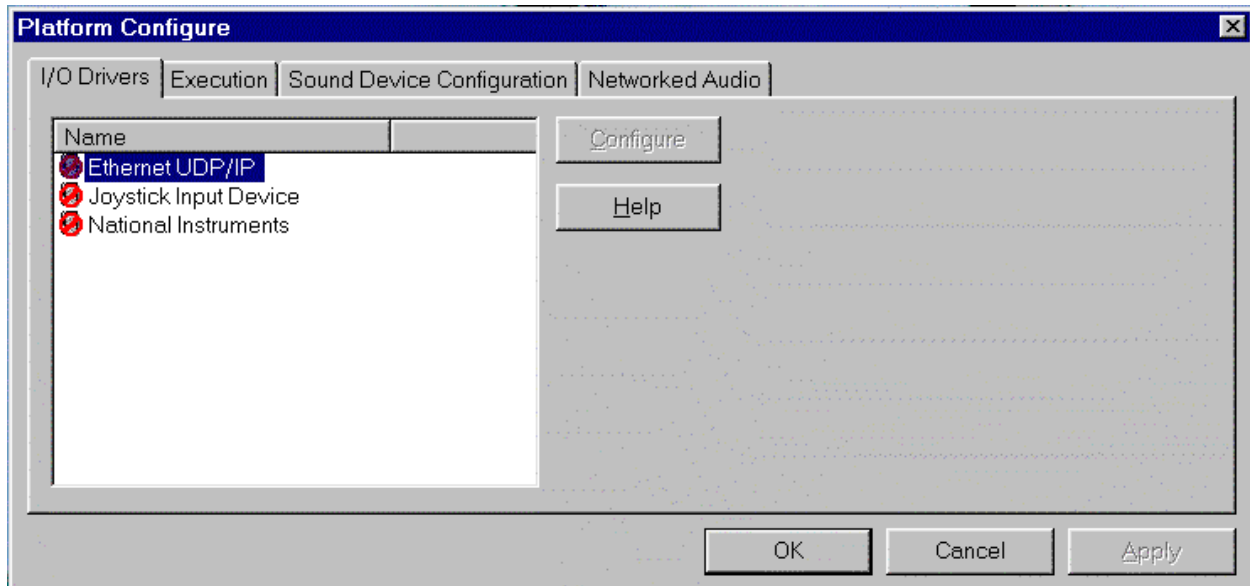

Figure 5 - Platform Configure Dialog Box

5. Select the **Configure** button to open the **National Instruments Configuration** dialog box. Clicking the Configure button in the Platform Configure dialog box opens a property sheet dialog box with one or more tabbed property pages. Each property page corresponds to a National Instruments card in the system.
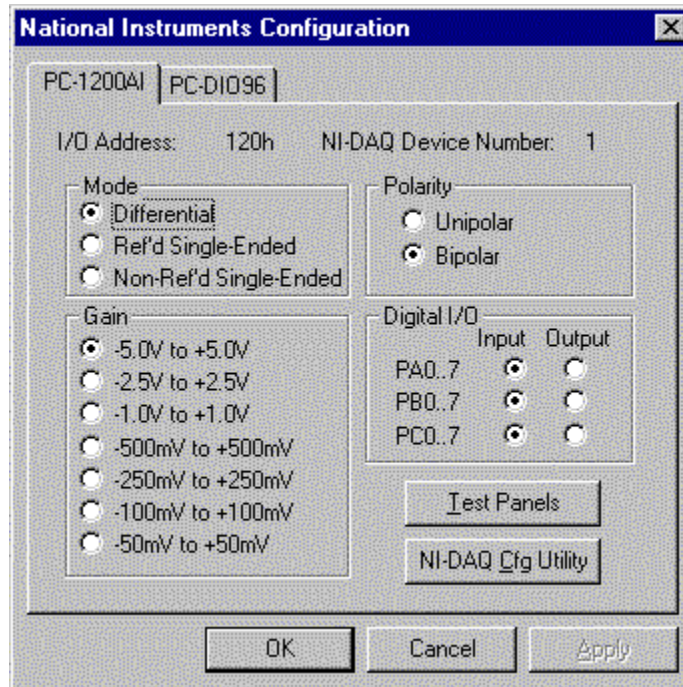6. Select the PC-1200AI tab.

Figure 6 - PC-1200A1 Configuration Dialog Box

I/O Address
Displays the I/O base address of the National Instruments card. This is a hardware setting that was selected by the Windows Plug-and Play software.

NI-DAQ Device Number
Displays the device number that was assigned by the *NI-DAQ* configuration utility. This is a software setting that can be changed by running the *NI-DAQ* configuration utility.

Mode
Selects one of three possible input modes for all incoming analog signals:

Table 1 - Incoming Analog Signal Input Modes

Mode	Description
Differential	This mode provides four differential inputs with the positive (+) input of the instrumentation amplifier tied to channels 0, 2, 4, or 6 and the negative (-) input tied to channels 1, 3, 5, or 7, respectively, thus choosing channel pairs (0, 1), (2, 3), (4, 5), or (6, 7).
Ref'd Single-Ended	This mode provides eight single-ended inputs with the negative input of the instrumentation amplifier referenced to analog ground.
Non-Ref'd Single-Ended	This mode provides eight single-ended inputs with the negative input of the instrumentation amplifier tied to AISENSE/AIGND and not connected to ground. This mode allows the analog inputs to be referenced to an external signal that is not tied to the card's analog ground.

Polarity
Selects the polarity of the incoming analog signal for all inputs – unipolar or bipolar.

Gain
Selects the voltage range of the incoming analog signal for all inputs.

Digital I/O
This card provides 24 bits of bi-directional digital I/O. The digital lines are arranged in three banks, each containing eight bits. Each pair of radio buttons in the **PC-1200AI** configuration page correspond to one of the banks. The radio button allows the user to select the direction of each bank of I/O.

Test Panels
Launches the NI-DAQ Test Panels program. This program allows you to test all of the functionality of the card through a graphical user interface. This program can be used to test the hardware before running **V+**. The NI-DAQ software must be installed before this option will work.

NI-DAQ Cfg Utility
Launches the NI-DAQ Configuration Utility program. This program assigns a device number to each National Instruments card in the system and prepares it for use with **V+**.   This program only needs to be run whenever a card has been added or removed.   Also keep in mind that any settings like polarity, gain, etc. are local settings to the NI-DAQ utility program and will be overwritten by the **V+** settings. The NI-DAQ software must be installed before this option will work.

Port Naming Convention

The default port names for the **PC-1200AI** align with the naming convention used in the Lab-PC-1200/AI User Manual. The following illustration shows the pinout of the 50 pin external connector of the card. The names that are assigned to each pin are the same names that will be assigned to the I/O ports on the **V+** design worksheet. For example, the analog line connected to pin 5 of the 50 pin connector will correspond to the I/O port labeled "ACH4".

ACH0	1		2	ACH1
ACH2	3		4	ACH3
ACH4	5		6	ACH5
ACH6	7		8	ACH7
AISENSE/AIGND	9		10	N/C
AGND	11		12	N/C
DGND	13		14	PA0
PA1	15		16	PA2
PA3	17		18	PA4
PA5	19		20	PA6
PA7	21		22	PB0
PB1	23		24	PB2
PB3	25		26	PB4
PB5	27		28	PB6
PB7	29		30	PC0
PC1	31		32	PC2
PC3	33		34	PC4
PC5	35		36	PC6
PC7	37		38	EXTTRIG
N/C	39		40	EXTCONV
OUTB0	41		42	GATB0
OUTB1	43		44	GATB1
CLKB1	45		46	OUTB2
GATB2	47		48	CLKB2
+5 V	49		50	DGND

Figure 7 - PC-1200AI I/O Connector Pin Assignments

PC-DIO96

This section is applicable to National Instruments card **PC-DIO96** and PC-DIO96PnP. The cards are identical except for the Plug-and-Play capability of the PC-DIO96PnP. For the sake of this help file and the I/O driver itself, references to **PC-DIO96** shall apply to the PC-DIO96PnP as well.

The **PC-DIO96** is a member of the National Instruments PC Series of I/O channel expansion cards for ISA computers. These cards are designed for high-performance data acquisition and control for many types of applications. The **PC-DIO96** is a 96 bit, parallel, digital I/O interface for ISA computers. Four 82C55A programmable peripheral interface (PPI) chips control the 96 bits of digital I/O. The 82C55A can operate in either input or output mode. All digital I/O communication is through a standard, 100 pin, male connector.

The **V+**/National Instruments I/O Driver provides the interface software between **V+** and the **PC-DIO96**. The user is able to configure the **PC-DIO96** in a number of input/output combinations and have those inputs and outputs automatically available as I/O ports in a **V+** design.

Configuration

> **To configure the PC-DIO96 card:**
> 1. Select **Start** > **Programs** > **V+** > **V+ Run-Time System**.
> 2. Select the **Configure** menu selection from the Platform Shell.
> 3. Click the **I/O Drivers** tab at the top of the dialog box.
> 4. Double-click the National Instruments device in the list box (see below). The icon to left of the name should change to green indicating the operation was successful. If the icon remains red, the operation failed and the device did not load properly. Refer to the V+ Help system for more details.
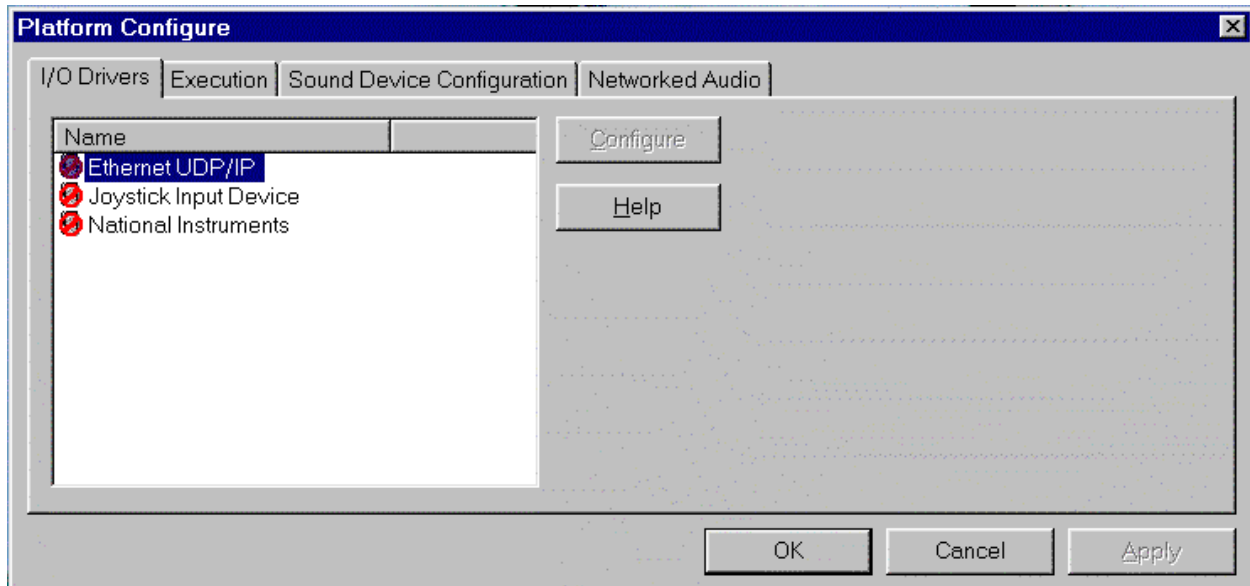

Figure 8 - Platform Configure Dialog Box

> 5. Select the **Configure** button to open the **National Instruments Configuration** dialog box. Clicking the Configure button in the Platform Configure dialog box opens a property sheet dialog

box with one or more tabbed property pages. Each property page corresponds to a National Instruments card in the system.

6. Select the PC-DIO96 tab.
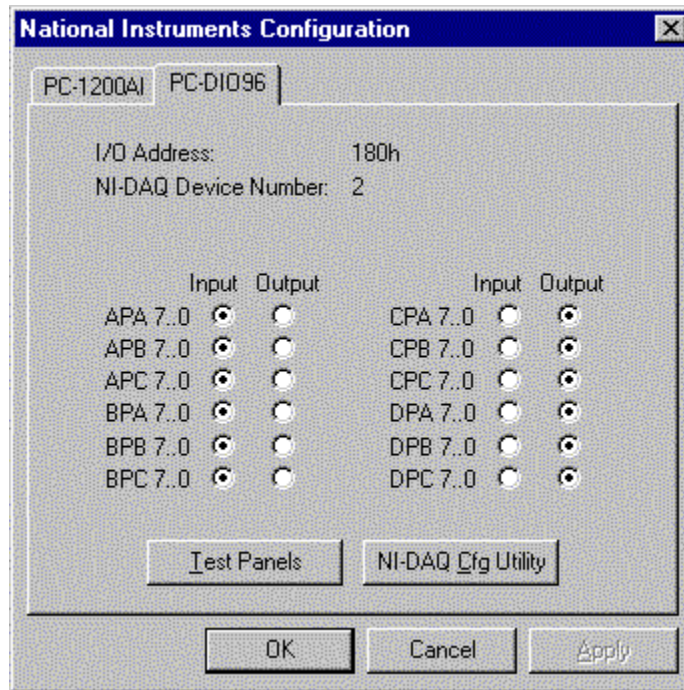
Figure 9 - PC-DIO96 Configuration Dialog Box

I/O Address
Displays the I/O base address of the National Instruments card. This is a hardware setting that can be manually changed on the card by selecting different switch settings.

NI-DAQ Device Number
Displays the device number that was assigned by the NI-DAQ configuration utility. This is a software setting that can be changed by running the NI-DAQ configuration utility.

Digital I/O
This card provides 96 bits of bi-directional digital I/O. The digital lines are arranged in 12 banks, each containing eight bits. Each pair of radio buttons in the **PC-DIO96** configuration page correspond to one of the banks. The radio button allows the user to select the direction of each bank of I/O.

Test Panels
Launches the NI-DAQ Test Panels program. This program allows you to test all of the functionality of the card through a graphical user interface. This program can be used to test the hardware before running **V+**. The NI-DAQ software must be installed before this option will work.

NI-DAQ Cfg Utility

Launches the NI-DAQ Configuration Utility program. This program assigns a device number to each National Instruments card in the system and prepares it for use with **V+**.   This program only needs to be run whenever a card has been added or removed.   Also keep in mind that any settings like polarity, gain, etc. are local settings to the NI-DAQ utility program and will be overwritten by the **V+** settings. The NI-DAQ software must be installed before this option will work.

PC-DIO96 Cable Assembly Pinout

The following diagrams below show the pin assignments for the breakout cable assembly for the **PC-DIO96**:

Table 2 - Cable Assembly Connector Pin Assignments for the PC-DIO96 I/O Connector

pins 1 through 50	pins 51 through 100

APC7	1	2	BPC7		CPC7	1	2	DPC7
APC6	3	4	BPC6		CPC6	3	4	DPC6
APC5	5	6	BPC5		CPC5	5	6	DPC5
APC4	7	8	BPC4		CPC4	7	8	DPC4
APC3	9	10	BPC3		CPC3	9	10	DPC3
APC2	11	12	BPC2		CPC2	11	12	DPC2
APC1	13	14	BPC1		CPC1	13	14	DPC1
APC0	15	16	BPC0		CPC0	15	16	DPC0
APB7	17	18	BPB7		CPB7	17	18	DPB7
APB6	19	20	BPB6		CPB6	19	20	DPB6
APB5	21	22	BPB5		CPB5	21	22	DPB5
APB4	23	24	BPB4		CPB4	23	24	DPB4
APB3	25	26	BPB3		CPB3	25	26	DPB3
APB2	27	28	BPB2		CPB2	27	28	DPB2
APB1	29	30	BPB1		CPB1	29	30	DPB1
APB0	31	32	BPB0		CPB0	31	32	DPB0
APA7	33	34	BPA7		CPA7	33	34	DPA7
APA6	35	36	BPA6		CPA6	35	36	DPA6
APA5	37	38	BPA5		CPA5	37	38	DPA5
APA4	39	40	BPA4		CPA4	39	40	DPA4
APA3	41	42	BPA3		CPA3	41	42	DPA3
APA2	43	44	BPA2		CPA2	43	44	DPA2
APA1	45	46	BPA1		CPA1	45	46	DPA1
APA0	47	48	BPA0		CPA0	47	48	DPA0
+5 V	49	50	GND		+5 V	49	50	GND

Figure 10 - PC-DIO96 for Pins 1-50   **Figure 11 - PC-DIO96 for Pins 51-100**

Port Naming Convention

Default port names for the **PC-DIO96** align with the naming convention used in the PC-DIO96/PnP User Manual. The following illustration shows the pinout of the 100 pin external connector of the card. Each of the names are assigned to each pin are the same names that will be assigned to the I/O ports on the **V+** design worksheet. For example, the digital line connected to pin 15 of the 100 pin connector will correspond to the I/O port labeled "APC0". If you are using the breakout cable assembly, refer to the pinout diagram for the **PC-DIO96** cable assembly.

APC7	1	51	CPC7
BPC7	2	52	DPC7
APC6	3	53	CPC6
BPC6	4	54	DPC6
APC5	5	55	CPC5
BPC5	6	56	DPC5
APC4	7	57	CPC4
BPC4	8	58	DPC4
APC3	9	59	CPC3
BPC3	10	60	DPC3
APC2	11	61	CPC2
BPC2	12	62	DPC2
APC1	13	63	CPC1
BPC1	14	64	DPC1
APC0	15	65	CPC0
BPC0	16	66	DPC0
APB7	17	67	CPB7
BPB7	18	68	DPB7
APB6	19	69	CPB6
BPB6	20	70	DPB6
APB5	21	71	CPB5
BPB5	22	72	DPB5
APB4	23	73	CPB4
BPB4	24	74	DPB4
APB3	25	75	CPB3
BPB3	26	76	DPB3
APB2	27	77	CPB2
BPB2	28	78	DPB2
APB1	29	79	CPB1
BPB1	30	80	DPB1
APB0	31	81	CPB0
BPB0	32	82	DPB0
APA7	33	83	CPA7
BPA7	34	84	DPA7
APA6	35	85	CPA6
BPA6	36	86	DPA6
APA5	37	87	CPA5
BPA5	38	88	DPA5
APA4	39	89	CPA4
BPA4	40	90	DPA4
APA3	41	91	CPA3
BPA3	42	92	DPA3
APA2	43	93	CPA2
BPA2	44	94	DPA2
APA1	45	95	CPA1
BPA1	46	96	DPA1
APA0	47	97	CPA0
BPA0	48	98	DPA0
+5 V	49	99	+5 V
GND	50	100	GND

Figure 12 - PC-DIO96 Digital I/O Connector Pin Assignments

Testing the PC-DIO96 CARD

1. Double-click the **Measurement & Automation** icon on the desktop.
2. Double-click the **Devices and Interfaces** item in the folders section on the left.
3. Click the **PC-DIO-96** item.
4. Double-click the **Device Number** item on the right side under the Name column.
5. Click the **Test Resources** button.
6. Click **Yes**.
7. Verify the device passes test.
8. Click **OK**.
9. Click **OK**.

APPENDIX

List of Figures

List of Tables

REFERENCES

For more information, refer to the SimPhonics web site:

SimPhonics Home Page: http://www.simphonics.com

SimPhonics V+ I/O Devices Page: http://www.simphonics.com/products/software/iodevices/

SimPhonics Software Downloads: http://www.simphonics.com/support/downloads/software/

SimPhonics Visual Programming System Page: http://www.simphonics.com/products/software/V+/

Trademark Acknowledgments

- **V+**, V+ and National Instruments I/O Device for **V+** are trademarks of V+, Incorporated.
- NI-DAQ™ is a trademark of National Instruments Corporation.