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DAQ

NI 6703/6704 User Manual

DC Analog Output Devices
for PCI/PXI/CompactPCI Bus Computers

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Contents

About This Manual

Conventions vii
Related Documentation viii

Chapter 1
Introduction

About the NI 6703/6704 1-1
Using PXI with CompactPCI 1-2
What You Need to Get Started 1-2
Optional Equipment 1-3
Custom Cabling 1-3

Chapter 2
Signal Connections

I/O Connector Pin Assignments 2-1
Signal Connection Descriptions 2-3
Analog Output Signal Connections 2-4
Voltage Output 2-4
Power-on State 2-4
NI 6704 Current Output 2-5
Power-on State 2-6
Digital I/O Signal Connections 2-6
Power-on State 2-7
Power Connections 2-7

Chapter 3
Hardware Overview

Bus Interface Circuitry 3-2
Nonvolatile RAM/DAC Control 3-2
Digital I/O Control 3-2
Temperature Sensor 3-2

Chapter 4
Calibration

Internal or Self-Calibration 4-1
External Calibration 4-1

Appendix A
Specifications

Appendix B
Common Questions

Appendix C
Technical Support and Professional Services

Glossary

Index

About This Manual

This manual contains information about using the NI PCI/PXI-6703/6704 devices. The NI 6703/6704 devices are designed for precise DC setpoint applications and provide general-purpose digital I/O.

If you are using NI-DAQ 7.4 or later, refer to the *DAQ Quick Start Guide*, which you can download at `ni.com/manuals`. The *DAQ Quick Start Guide* offers NI-DAQ users step-by-step instructions for installing software and hardware, configuring channels and tasks, and getting started developing an application.

The NI 6703/6704 family includes the following devices:

- NI PCI-6703
- NI PCI-6704
- NI PXI-6704

Conventions

The following conventions appear in this manual:

<> — Angle brackets that contain numbers separated by an ellipsis represent a range of values associated with a bit or signal name—for example, P0.<3..0>.

» — The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.

 — This icon denotes a note, which alerts you to important information.

 — This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

bold — Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

italic — Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.

`monospace`	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.
NI 6703/6704	This phrase refers to any device in the NI 6703/6704 family.
NI-DAQ	NI-DAQ refers to the NI-DAQ driver software.

Related Documentation

The following documents contain information you may find helpful:

- *DAQ Quick Start Guide*, located at `ni.com/manuals`
- *DAQ-STC Technical Reference Manual*, located at `ni.com/manuals`
- *NI 6703/6704 Calibration Procedure for DAQmx*, located at `ni.com/manuals`
- NI Developer Zone tutorial, *Field Wiring and Noise Considerations for Analog Signals*, located at `ni.com/zone`
- *NI-DAQ User Manual for PC Compatibles*, located at `ni.com/manuals`
- *NI-DAQ Function Reference Help*. You can access this help file by clicking **Start»Programs»National Instruments»NI-DAQ» NI-DAQ Help**.
- *PCI Local Bus Specification Revision 2.2*
- *PICMG 2.0 R3.0, CompactPCI Core Specification*
- *PXI Specification Revision 2.0*, available from `www.pxisa.org`

1 Introduction

This chapter describes the NI 6703/6704 devices, lists what you need to get started, describes optional software, equipment, and custom cables, and explains how to unpack your device.

For information about installing and configuring your device, refer to the *DAQ Quick Start Guide* at `ni.com/manuals`.

About the NI 6703/6704

The NI 6703/6704 devices are precise DC setpoint devices for PCI and PXI. The NI 6703 devices have 16 voltage output channels. The NI 6704 devices have 16 voltage output channels and 16 current output channels for a total of 32 analog output channels. The NI 6703/6704 devices have eight digital I/O lines.

You can use the NI 6703/6704 devices in a wide variety of DC setpoint and digital I/O applications. With the NI 6703/6704 devices, your PC system can serve as a digital I/O system controller for laboratory testing, production testing, and industrial process monitoring and control. These devices can do the following:

- Generate experimental stimuli
- Generate analog functions
- Connect to a variety of signal types, including:
  - Electromechanical relays
  - LEDs
  - Optically isolated, solid-state relays and I/O module mounting racks
  - Voltage and current excitation for precision transducers
  - Current excitation for precision transducers (NI 6704 only)

Detailed specifications for the NI 6703/6704 devices are in Appendix A, *Specifications*.

Using PXI with CompactPCI

The ability to use PXI-compatible products with standard CompactPCI products is an important feature of *PXI Specification Revision 2.0*. If you use a PXI-compatible plug-in device in a standard CompactPCI chassis, you are unable to use PXI-specific functions, but you can still use the basic plug-in device functions.

The CompactPCI specification permits vendors to develop sub-buses that coexist with the basic PCI interface on the CompactPCI bus. Compatible operation is not guaranteed between CompactPCI devices with different sub-buses nor between CompactPCI devices with sub-buses and PXI devices. The standard implementation for CompactPCI does not include these sub-buses. The NI PXI-6704 works in any standard CompactPCI chassis adhering to the *PICMG CompactPCI 2.0 R3.0* core specification.

What You Need to Get Started

To set up and use your NI 6703/6704 device, you will need the following:

- ❑ One of the following devices:
  - NI PCI-6703
  - NI PCI-6704
  - NI PXI-6704
- ❑ One of the following software packages and documentation:
  - NI-DAQ 7.4 or later
  - LabVIEW for Windows
  - LabWindows™/CVI™ for Windows
  - Measurement Studio
  - ANSI C without NI Application Software
  - .NET Languages without NI Application Software
- ❑ PC with a free PCI slot or PXI chassis with a free slot
- ❑ 68-pin cable (SH68-68-D1)
- ❑ 68-pin terminal block (CB-68)

Optional Equipment

National Instruments offers a variety of products to use with your NI 6703/6704, including cables, connector blocks, and other accessories, as follows:

- Cables and cable assemblies, shielded and ribbon
- Connector blocks, shielded and unshielded screw terminals

For more specific information about these products, refer to the NI catalog at `ni.com/catalog`.

Custom Cabling

Follow these guidelines if you want to develop your own cable:

- Route the analog lines separately from the digital lines.
- When using a cable shield, use separate shields for the analog and digital halves of the cable. Failure to do so results in noise coupling into the analog signals from transient digital signals.

National Instruments offers cables and accessories for you to prototype your application or to use if you frequently change module interconnections. For more specific information about these products, refer to the NI catalog at `ni.com/catalog`.

For more information on the connectors used for DAQ devices, refer to the KnowledgeBase document, *Specifications and Manufacturers for Board Mating Connectors* at `ni.com`.

2

Signal Connections

This chapter provides connection instructions for the signals on your NI 6703/6704 device I/O connector.

Caution Connections that exceed any of the maximum ratings of input or output signals on the NI 6703/6704 device can damage the device and the computer. Maximum input ratings for each signal are given in this chapter under the discussion of that signal. National Instruments is *not* liable for any damages resulting from any incorrect signal connections.

I/O Connector Pin Assignments

Figure 2-1 shows the I/O connector pin assignments for the NI 6703/6704 devices.

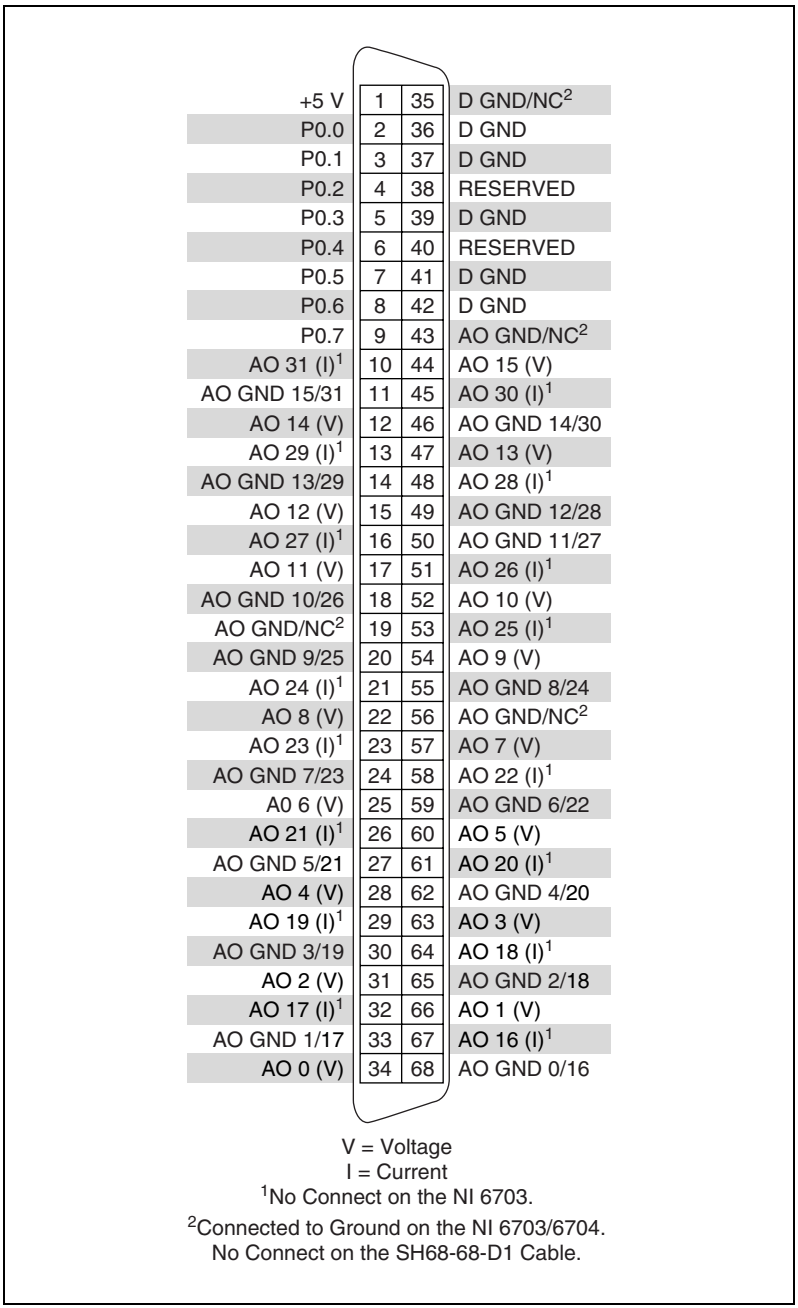


Figure 2-1. I/O Connector Pin Assignments

Signal Connection Descriptions

Signal Name	Reference	Direction	Description
P0.<0..7>	D GND	Input or Output	Digital I/O lines—Line 7 is the MSB and Line 0 is the LSB.
AO <0..15> (V)	AO GND	Output	Voltage output channels.
AO <16..31> (I)	AO GND	Output	Current output channels on the NI 6704. No connects on the NI 6703.
AO GND <0/16..15/31>	—	—	Analog Output Grounds—Each ground pin is shared between one voltage and one current channel. These pins are connected to the NI 6703/6704 device analog ground plane. All NI 6703/6704 device ground planes connect to the computer system's ground signal.
AO GND	—	—	Additional pins connected to analog output ground. If you are using a SH68-68-D1 cable, these signals are not connected.
D GND	—	—	Digital Ground—These pins are connected to the NI 6703/6704 device digital ground plane. All NI 6703/6704 device ground planes connect to the computer system's ground signal.
+5 V	D GND	Output	+5 V—This pin is connected to the computer system's +5 VDC supply through a self-resetting circuit breaker.
RESERVED	—	—	Reserved for future use.

Analog Output Signal Connections

This section describes how to make connections for voltage and current outputs. The NI 6704 has both voltage and current outputs. The NI 6703 has voltage outputs only. A 68-pin cable such as the SH68-68-D1 cable is required. Figure 2-2 shows how to connect the voltage channel as a voltage output.

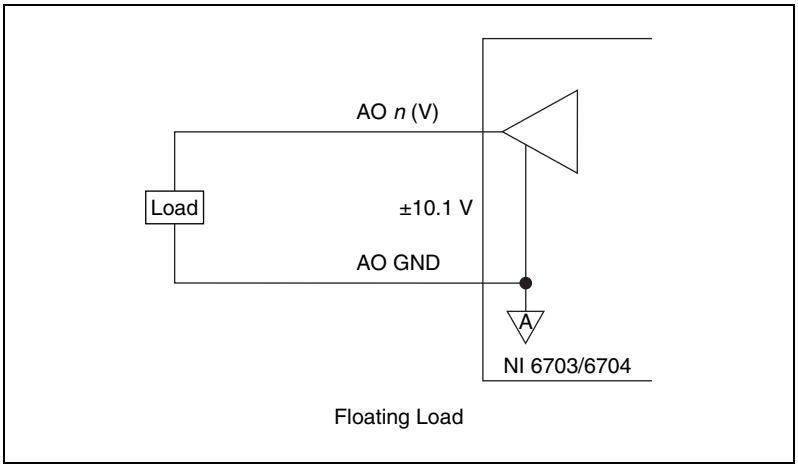


Figure 2-2. Voltage Output Connections

Voltage Output

You can connect a floating load to your NI 6703/6704 device at the voltage output channel.

Caution Because NI 6703/6704 devices are not electrically isolated from high voltages, a load with high common-mode voltages can damage the devices. National Instruments is *not* liable for any damages resulting from any such signal connections.

The NI 6703/6704 device has a bipolar voltage range of –10.1 to +10.1 V. Maximum load current is ±10 mA for 16-bit linearity.

Power-on State

All voltage outputs are at their user-defined values to full accuracy within 1 s of power-on board reset. Before this time, the voltage outputs can float to unspecified values. Take this behavior into account when connecting external devices to the NI 6703/6704.

NI 6704 Current Output

You can connect a floating or grounded load to your NI 6704 device at the current output channel. You do not need an external floating power supply to complete the controlled current loop. You can control the current loop from 0.1 to 20.2 mA. The compliance for the current loop is 0 V to 10 VDC.

Note The voltage is not clamped at 10 V. If the current supplied to the load generates a voltage greater than 10 V, the device will generate a voltage greater than 10 V.

Caution Because the NI 6704 is not electrically isolated from high voltages, a load with high common-mode voltages can damage the NI 6704. National Instruments is *not* liable for any damages resulting from any such signal connections.

Figure 2-3 shows how to connect a current channel as a current output.

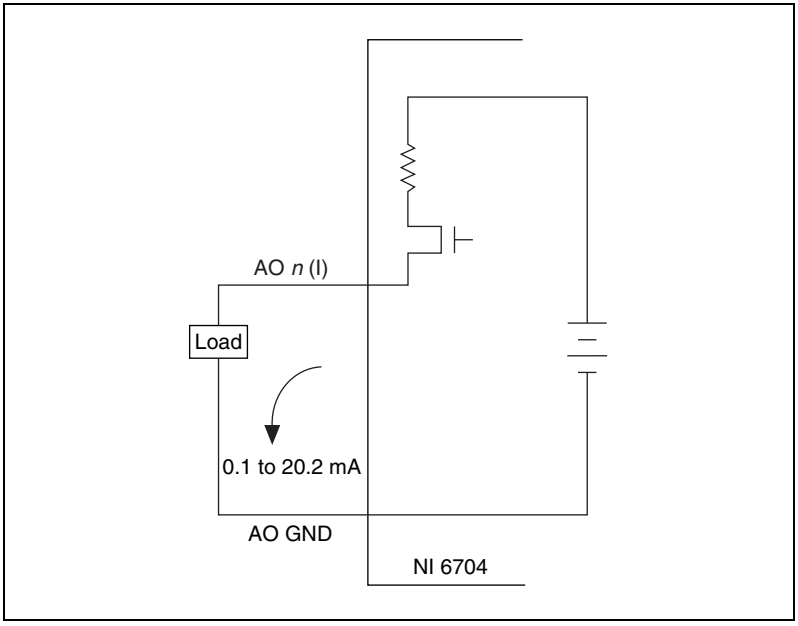


Figure 2-3. Current Output Connections

Because each current channel shares a ground line with a voltage channel, try to minimize the effect of the return current from your current channel on the voltage that you are outputting on your voltage channel. For example, if you output 20 mA on a current channel and return that current to the NI 6704 device along the shared ground line in a cable with an

impedance of 0.1 Ω, the voltage output with drop 2 mV by the voltage channel sharing the ground line. You can avoid this problem in the following ways:

- Use a shorter cable to minimize the impedance of the shared ground line.
- Use separate wiring for voltage channel and current channel ground lines return to minimize common ground impedance.
- Use different pairs of voltage and current channels to keep your sensitive voltage outputs separate from your higher output current channels.

Power-on State

All current outputs are within ± 1.1 mA maximum of their user-defined values within 0.5 s of power-on board reset. The current outputs will settle to their user-defined values to full accuracy within 7 s of power-on board reset. Take this behavior into account when connecting external devices to the NI 6704.

Digital I/O Signal Connections

Figure 2-4 illustrates example signal connections for three typical digital I/O applications.

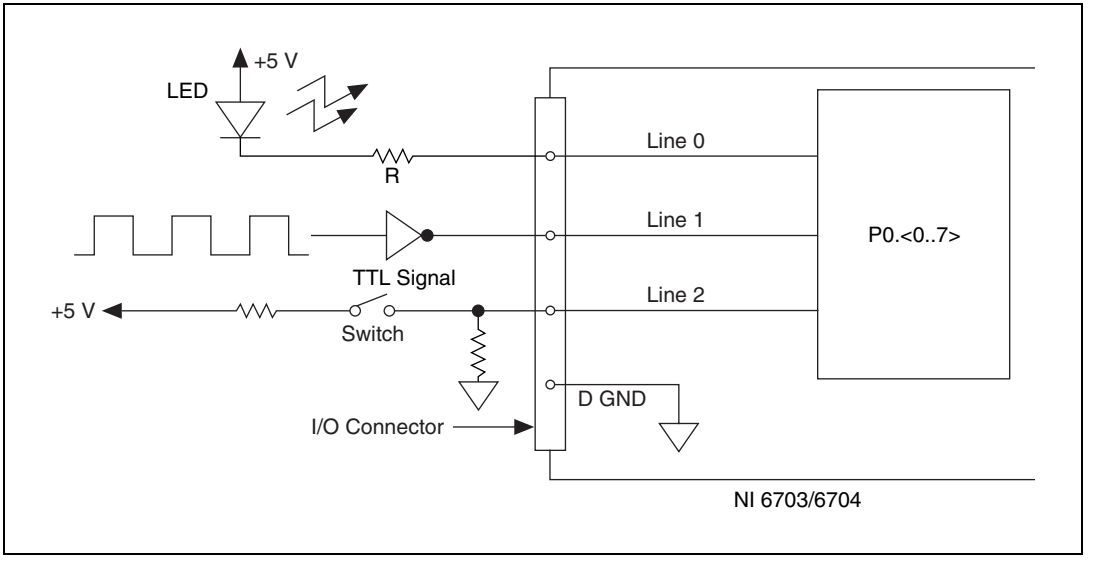


Figure 2-4. Example Digital I/O Connections

In Figure 2-4, Line 0 is configured for digital output; Lines 1 and 2 are configured for digital input.

Digital input applications include receiving TTL signals and sensing external device states such as the switch in Figure 2-4. Digital output applications include sending TTL signals and driving external devices such as the LED shown in Figure 2-4.

Note The NI 6703/6704 devices allow line-by-line direction control of digital I/O connections.

Refer to Appendix A, *Specifications*, for a list of the digital I/O signal ratings.

Power-on State

At power on, all of the DIO lines on the NI 6703/6704 devices are configured as input lines.

Power Connections

Pin 1 on the I/O connector is connected to the +5 V supply from the PCI or PXI bus power supply. This pin is referenced to D GND and can supply power to external circuitry. The +5 V supply has a total of 0.75 A available.

The +5 V power supply has a self-resetting protection circuit breaker in series. If the circuit breaker protection is activated, remove the circuit causing the heavy current load and the circuit breaker will reset itself. For more information on these output pins, refer to the *Digital I/O* section and *Power Requirement* section in Appendix A, *Specifications*.

Power rating ..... 0.75 A at +5 V ±10%,
+4.55 to +5.25 VDC at 0.75 A

Caution Never connect these +5 V power pins directly to ground or to any other voltage source on your NI 6703/6704 device or any other device. Doing so can damage your device and your computer system. National Instruments is *not* liable for damage resulting from such a connection.

3

Hardware Overview

This chapter contains an overview of the hardware functions on the NI 6703/6704. The block diagram in Figure 3-1 illustrates the key functional components of the NI 6703/6704.

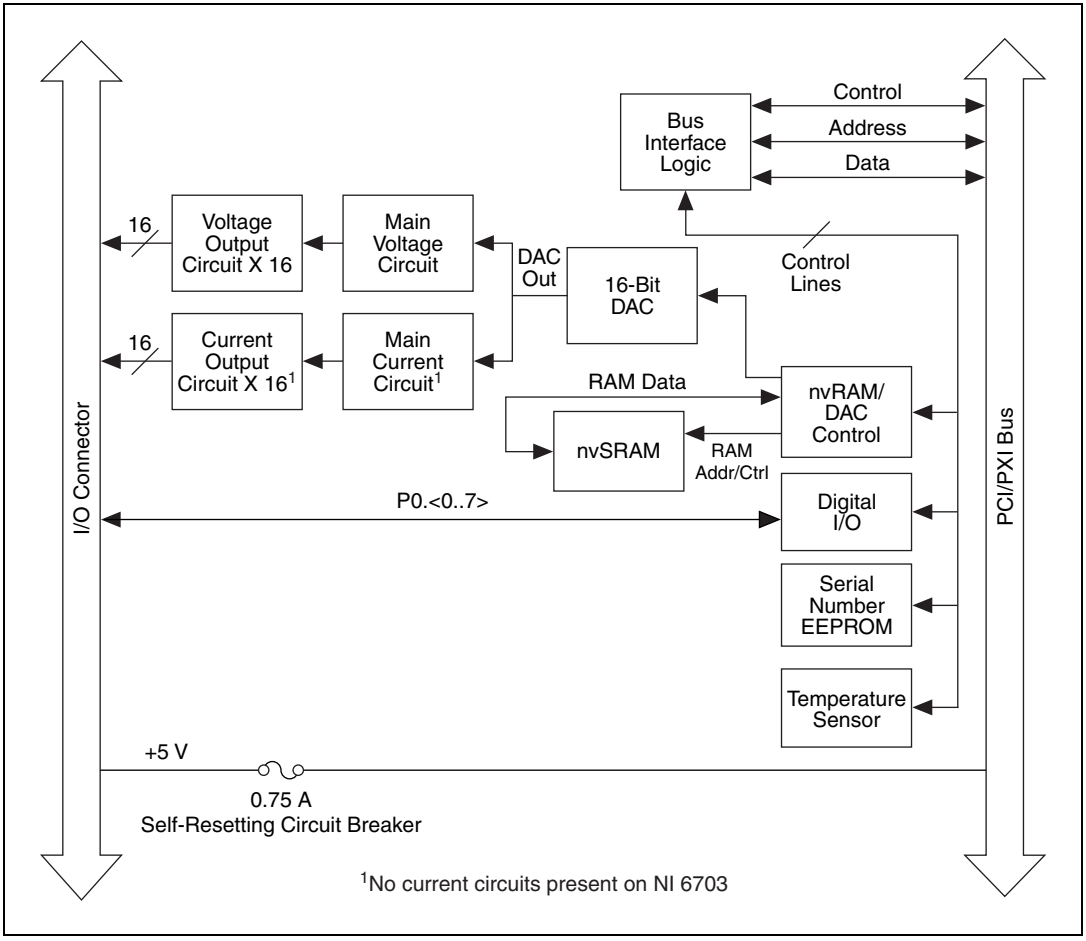


Figure 3-1. NI 6703/6704 Block Diagram

Bus Interface Circuitry

The bus interface circuitry monitors the PCI or PXI bus. If the bus address matches the NI 6703/6704 device's address, the board is enabled and the corresponding register on the NI 6703/6704 is accessed.

Nonvolatile RAM/DAC Control

The NI 6703/6704 devices have one 16-bit DAC that is time-division multiplexed to create all the output channels. Each channel has a track-and-hold circuit to maintain the channel value between DAC updates. On the NI 6703, the DAC is multiplexed to create 16 voltage outputs and two calibration channels. On the NI 6704, the DAC is multiplexed to create 16 voltage outputs, 16 current outputs, and four calibration channels.

Data is stored in a nonvolatile RAM (nvRAM). The nvRAM/DAC control reads the DAC channel data stored in the nvRAM and updates the DAC periodically. The nvRAM/DAC control also controls the analog demultiplexing circuits to route the DAC output to the correct analog output channel. You can choose to save nvRAM data so that the current output values will become the power-on states. For information about how to set the power-on states, refer to the *Setting the Power-On States for Software-Timed Digital I/O Devices* topic in the *NI-DAQmx Help*.

Digital I/O Control

The NI 6703/6704 devices have eight digital I/O lines configured as one 8-bit port. You can configure each line independently as an input or output. The DIO lines have 16 mA of sink capability and 16 mA of source capability. All digital lines are TTL-compatible. At power on, all digital lines are configured as inputs.

Temperature Sensor

The onboard temperature sensor measures the air temperature flowing over the board. This sensor is positioned near the onboard precision voltage reference, which can be affected by extreme temperatures. This sensor has a serial digital interface.

4

Calibration

This chapter discusses the calibration options for the NI 6703/6704. Calibration is the process of minimizing output errors by making small circuit adjustments. There are two calibration channels used to make adjustments to the voltage channels on the NI 6703/6704. The NI 6704 has two additional channels used to make adjustments to the current channels.

Internal or Self-Calibration

The NI 6703/6704 devices perform continuous self-calibration. In addition to the accessible analog output channels, there are internal calibration channels that are scanned and refreshed with all the output channels. There are two of these calibration channels for the voltage outputs: the voltage offset channel and the voltage gain channel.

There are also two calibration channels for the current outputs on the NI 6704: the current offset channel and the current gain channel. The outputs of these calibration channels are continuously compared to onboard references, and the 16-bit DAC offset and gain are adjusted to minimize the errors in the calibration channels. Since NI 6703/6704 devices have excellent channel-to-channel matching of offset and gain errors, minimizing the errors in the calibration channels also minimizes the errors for all the voltage and current outputs.

External Calibration

The only calibration adjustment you must make is to adjust the values of the calibration channels to account for time- or temperature-related drift of the onboard reference. These calibration values are loaded into nvRAM at factory calibration. You do not need to adjust them for at least one year after the date of factory calibration unless you are operating your device at an extreme temperature.

To perform an external calibration, refer to the *NI 6703/6704 Calibration Procedure for NI-DAQmx*.

A

Specifications

This appendix lists specifications for the NI 6703/6704. These specifications are valid for an ambient temperature of 0 to 55 °C, unless otherwise noted.

Analog Output

Number of voltage channels 16

Number of current channels on the NI 6704..... 16

Resolution 16-bit

Recommended warm-up time ..... 15 minutes

Transfer Characteristics

INL ..... ±1 LSB max

DNL ..... ±1 LSB max

Monotonicity ..... 16 bits, guaranteed

Voltage Output

Range ..... ±10.1 V

Output coupling..... DC

Output impedance ..... 0.1 Ω max

Current drive ..... ±10 mA max

Load capacitance..... 10,000 pF max

Protection ..... Short-circuit to ground

Absolute accuracy ..... ±1 mV max

Noise.....100 µV rms, DC to 1 MHz

Power-on state .....Independent, user-defined values

Current Output (NI 6704 Only)

Range.....0.1 to 20.2 mA

Type.....Source, does not require external excitation source

Output impedance.....1 GΩ min

Output compliance.....0 to 10 V, not clamped

Absolute accuracy.....±2 µA max

Noise.....1 μA_{rms}, DC to 1 MHz

Protection.....Short-circuit and open circuit

Power-up state .....Independent, user-defined values

Dynamic Characteristics

Settling time (including channel latency)

Accuracy	Time
±0.1%	1.8 ms typ, 5.6 ms max
±0.01%	3.6 ms typ, 11.2 ms max
±0.001%	14.4 ms typ, 48.8 ms max

Stability

Offset temperature coefficient

Voltage .....5 µV/ ºC

Current (NI 6704 only).....10 nA/ ºC

Gain temperature coefficient

Voltage .....1 ppm/ ºC

Current (NI 6704 only).....2 ppm/ ºC

Digital I/O

Number of channels 8

Compatibility ..... TTL

Power-on state..... Input (high impedance)

Digital logic levels

Level	Min	Max
Input low voltage	—	0.8 V
Input high voltage	2.0 V	—
Output low voltage	—	0.45 V, I_{OL} = 16 mA
Output high voltage	2.4 V, I_{OH} = 16 mA	—
Input leakage current	—	10 µA

Bus Interface

Type ..... Slave

Power Requirement

+5 V

NI 6703 ..... 1.1 A

NI 6704 ..... 1.8 A

+12 V..... 70 mA

–12 V..... 70 mA

Note These power usage figures do not include the power used by external devices that are connected to the fused supply present on the I/O connector. They assume that all voltage and current outputs are fully loaded.

Physical

Dimensions (not including connectors)

NI PCI-6703/6704 .....9.9 × 17.5 cm (3.9 × 6.9 in.)

NI PXI-6703/6704 .....10 × 16 cm (3.9 × 6.3 in.)

I/O connector .....68-pin male

Maximum Working Voltage

Maximum working voltage refers to the signal voltage plus the common-mode voltage.

Channel-to-earth .....11 V, Installation Category I

Environmental

Operating temperature .....0 to 55 °C

Storage temperature .....–20 to 70 °C

Humidity .....5 to 90% RH, noncondensing

Maximum altitude.....2,000 m

Pollution Degree (indoor use only) 2

Note Clean the device with a soft, non-metallic brush. Make sure that the device is completely dry and free from contaminants before returning it to service.

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1
- CAN/CSA-C22.2 No. 61010-1

Note For UL and other safety certifications, refer to the product label, or visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

Emissions ..... EN 55011 Class A at 10 m
FCC Part 15A above 1 GHz

Immunity ..... EN 61326:1997 + A2:2001, Table 1

EMC/EMI..... CE, C-Tick, and FCC Part 15 (Class A) Compliant

Note For EMC compliance, operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety) 73/23/EEC

Electromagnetic Compatibility Directive (EMC) 89/336/EEC

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

B

Common Questions

This appendix contains commonly asked questions and their answers relating to usage and special features of the NI 6703/6704.

Analog Output

How fast does the NI 6703 sample channels?

The NI 6703 devices have one 16-bit DAC that is time-division multiplexed to create 16 voltage output and two calibration channels. The channels are sampled at a rate of 50 µs per channel, meaning a channel can change value a maximum of 0.9 ms after it has been updated by software.

How fast does the NI 6704 sample channels?

The NI 6704 devices have one 16-bit DAC that is time-division multiplexed to create 16 voltage output, 16 current output, and four calibration channels. The channels are sampled at a rate of 50 µs per channel, meaning a channel can change value a maximum of 1.8 ms after it has been updated by software.

C

Technical Support and Professional Services

Visit the following sections of the National Instruments Web site at ni.com for technical support and professional services:

- **Support**—Online technical support resources at ni.com/support include the following:
  - **Self-Help Resources**—For answers and solutions, visit the award-winning National Instruments Web site for software drivers and updates, a searchable KnowledgeBase, product manuals, step-by-step troubleshooting wizards, thousands of example programs, tutorials, application notes, instrument drivers, and so on.
  - **Free Technical Support**—All registered users receive free Basic Service, which includes access to hundreds of Application Engineers worldwide in the NI Developer Exchange at ni.com/exchange. National Instruments Application Engineers make sure every question receives an answer.

    For information about other technical support options in your area, visit ni.com/services or contact your local office at ni.com/contact.
- **Training and Certification**—Visit ni.com/training for self-paced training, eLearning virtual classrooms, interactive CDs, and Certification program information. You also can register for instructor-led, hands-on courses at locations around the world.
- **System Integration**—If you have time constraints, limited in-house technical resources, or other project challenges, National Instruments Alliance Partner members can help. To learn more, call your local NI office or visit ni.com/alliance.
- **Declaration of Conformity (DoC)**—A DoC is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electronic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/certification.

- **Calibration Certificate**—If your product supports calibration, you can obtain the calibration certificate for your product at `ni.com/calibration`.

If you searched `ni.com` and could not find the answers you need, contact your local office or NI corporate headquarters. Phone numbers for our worldwide offices are listed at the front of this manual. You also can visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Glossary

Symbol	Prefix	Value
n	nano	10^{-9}
μ	micro	10^{-6}
m	milli	10^{-3}
k	kilo	10^{3}
M	mega	10^{6}
G	giga	10^{9}

Symbols

°	Degrees.
–	Negative of, or minus.
Ω	Ohms.
/	Per.
%	Percent.
±	Plus or minus.
+	Positive of, or plus.

A

A	Amperes.
A/D	Analog-to-digital.
ANSI	American National Standards Institute.
AO GND	Analog output ground signal.

B

bit	One binary digit, either 0 or 1.
bus	The group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected.

C

C	Celsius.
channel	Pin or wire lead to which you apply or from which you read the analog or digital signal. Analog signals can be single-ended or differential. For digital signals, you group channels to form ports. Ports usually consist of either four or eight digital channels.

D

D/A	Digital-to-analog.
DAC	D/A converter.
DAQ	Data acquisition—(1) Collecting and measuring electrical signals from sensors, transducers, and test probes or fixtures and inputting them to a computer for processing. (2) Collecting and measuring the same kinds of electrical signals with A/D and/or DIO boards plugged into a computer, and possibly generating control signals with D/A and/or DIO boards in the same computer.
DC	Direct current.
device	A plug-in data acquisition board, card, or pad that can contain multiple channels and conversion devices. Plug-in boards, PCMCIA cards, and devices such as the DAQPad-1200, which connects to your computer parallel port, are all examples of DAQ devices.
DIO	Digital input/output.

DLL	Dynamic Link Library—A software module in Microsoft Windows containing executable code and data that can be called or used by Windows applications or by other DLLs. Functions and data in a DLL are loaded and linked at run time when they are referenced by a Windows application or other DLLs.
drivers/driver software	Software that controls a specific hardware device such as a DAQ board.

E

EEPROM	Electrically Erasable Programmable Read-Only Memory (ROM) that can be erased (usually by ultraviolet light exposure) and reprogrammed.

F

function	A set of software instructions executed by a single line of code that may have input and/or output parameters and returns a value when executed.

G

GND	Ground signal or bit.

H

hardware	The physical components of a computer system, such as the circuit boards, plug-in boards, chassis, enclosures, peripherals, cables, and so on.
hex	Hexadecimal.
Hz	Hertz—The number of scans read or updates written per second.

I

I/O	Input/output—The transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces.
IC	Integrated circuit.

in.	Inches.
INL	Integral Nonlinearity—A measure in LSB of the worst-case deviation from the ideal A/D or D/A transfer characteristic of the analog I/O circuitry.
interrupt	A computer signal indicating that the CPU should suspend its current task to service a designated activity.
interrupt level	The relative priority at which a device can interrupt.
I_{OH}	Current, output high.
I_{OL}	Current, output low.

K

KB	Kilobytes—1,024 bytes when referring to memory.

L

LED	Light-emitting diode.
LSB	Least significant bit.

M

m	Meters.
max	Maximum.
min	Minimum.
MSB	Most significant bit.

N

NC	Not connected.
NI-DAQ	National Instruments driver software for DAQ hardware.
noise	An undesirable electrical signal—Noise comes from external sources such as the AC power line, motors, generators, transformers, fluorescent lights, soldering irons, CRT displays, computers, electrical storms, welders, radio transmitters, and internal sources such as semiconductors, resistors, and capacitors. Noise corrupts signals you are trying to send or receive.
nvRAM	Nonvolatile RAM.

O

operating system	Base-level software that controls a computer, runs programs, interacts with users, and communicates with installed hardware or peripheral devices.

P

PC	Personal computer.
PCI	Peripheral Component Interconnect—A high-performance expansion bus architecture originally developed by Intel to replace ISA and EISA. It has achieved widespread acceptance as a standard for PCs and workstations, and offers a theoretical maximum transfer rate of 132 Mbytes/s.
port	(1) A communications connection on a computer or a remote controller. (2) A digital port, consisting of four or eight lines of digital input and/or output.
ppm	Parts per million.
PXI	PCI eXtensions for Instrumentation—A rugged, open system for modular instrumentation based on CompactPCI, with special mechanical, electrical, and software features.

R

RAM	Random access memory.
resolution	The smallest signal increment that can be detected by a measurement system. Resolution can be expressed in bits, in proportions, or in percent of full scale. For example, a system has 12-bit resolution, one part in 4,096 resolution, and 0.0244% of full scale.
RTSI	Real-Time System Integration.

S

s	Seconds.
settling time	The amount of time required for a voltage to reach its final value within specified limits.
slot	A position where a module can be inserted into the PCI bus.
system RAM	RAM installed on a personal computer and used by the operating system, as contrasted with onboard RAM.

T

transfer rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and set up operations; the maximum rate at which the hardware can operate.
TTL	Transistor-transistor logic.
typ	Typical.

U

update	The output equivalent of a scan. One or more analog or digital output samples. Typically, the number of output samples in an update is equal to the number of channels in the output group. For example, one pulse from the update clock produces one update which sends one new sample to every analog output channel in the group.

V

V	Volts.
VDC	Volts direct current.
VI	Virtual Instrument—(1) A combination of hardware and/or software elements, typically used with a PC, that has the functionality of a classic stand-alone instrument. (2) A LabVIEW software module (VI), which consists of a front panel user interface and a block diagram program.

W

W	Watts.

Index

Numerics

+5 V signal
    description (table), 2-3
    power connections, 2-7
    self-resetting protection circuit breaker, 2-7

A

analog output signal connections
    common questions, B-1
    current output for NI 6704, 2-5
    voltage output, 2-4
    voltage output connections (figure), 2-4
analog output specifications
    current output, NI 6704 only, A-2
    dynamic characteristics, A-2
    stability, A-2
    transfer characteristics, A-1
    voltage output, A-1
AO <0..15> (V) signals (table), 2-3
AO <16..31> (I) signals (table), 2-3
AO GND <0/16..15/31> signals (table), 2-3
AO GND signal (table), 2-3
AO *n* (I) connection as current output (figure), 2-5

B

bus interface
    circuitry, 3-2
    specifications, A-3

C

calibration
    external calibration, 4-1
    self-calibration, 4-1
calibration certificate (NI resources), C-2
CE compliance specifications, A-5
common questions. *See* questions about NI 6703/6704
conventions used in the manual, *vii*
current output for NI 6704
    current output connections (figure), 2-5
    power-on state, 2-6
    signal connections, 2-5
    specifications, A-2
custom cabling, 1-3

D

D GND signal (table), 2-3
Declaration of Conformity (NI resources), C-1
diagnostic tools (NI resources), C-1
digital I/O
    example connections (figure), 2-6
    hardware overview, 3-2
    power-on state, 2-7
    signal connections, 2-6
    specifications, A-3
documentation
    conventions used in manual, *vii*
    NI resources, C-1
    related documentation, *viii*
drivers (NI resources), C-1

E

electromagnetic compatibility specifications, A-5
equipment, optional, 1-3
examples (NI resources), C-1

F

frequently asked questions. *See* questions about NI 6703/6704

H

hardware overview, 3-1
help, technical support, C-1

I

I/O connector
    pin assignments (figure), 2-2
    signal connection descriptions (table), 2-3
instrument drivers (NI resources), C-1

K

KnowledgeBase, C-1

N

National Instruments, support and services, C-1
NI 6703/6704
    block diagram, 3-1
    common questions, B-1
    custom cabling, 1-3
    features, 1-1
    hardware overview, 3-1
    optional equipment, 1-3
    requirements for getting started, 1-2
NI support and services, C-1
nonvolatile RAM/DAC control, 3-2

O

optional equipment, 1-3

P

P0.<0..7> signals (table), 2-3
physical specifications, A-4
pin assignments for I/O connector (figure), 2-2
power connections, 2-7
power requirement specifications, A-3
power-on state
    current output for NI 6704 device, 2-6
    digital I/O, 2-7
    voltage output, 2-4
programming examples (NI resources), C-1

Q

questions about NI 6703/6704, analog output, B-1

R

related documentation, *viii*
requirements for getting started, 1-2

S

safety specifications, A-4
self-resetting protection circuit breaker, 2-7
signal connections, 2-1
    analog output
        current output for NI 6704, 2-5
        voltage channel outputs (figure), 2-4
        voltage outputs, 2-4
    digital I/O, 2-6
    I/O connector
        pin assignments (figure), 2-2
        signal connection descriptions (table), 2-3
    power connections, 2-7

software (NI resources), C-1
specifications
    analog output
        current output, NI 6704 only, A-2
        dynamic characteristics, A-2
        stability, A-2
        transfer characteristics, A-1
        voltage output, A-1
    bus interface, A-3
    CE compliance, A-5
    digital I/O, A-3
    electromagnetic compatibility, A-5
    physical, A-4
    power requirements, A-3
    safety, A-4

T

technical support, C-1
temperature sensor, 3-2
training and certification (NI resources), C-1
troubleshooting (NI resources), C-1

V

voltage output
    power-up condition, 2-4
    signal connections, 2-4
    specifications, A-1
voltage output connections (figure), 2-4

W

Web resources, C-1

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