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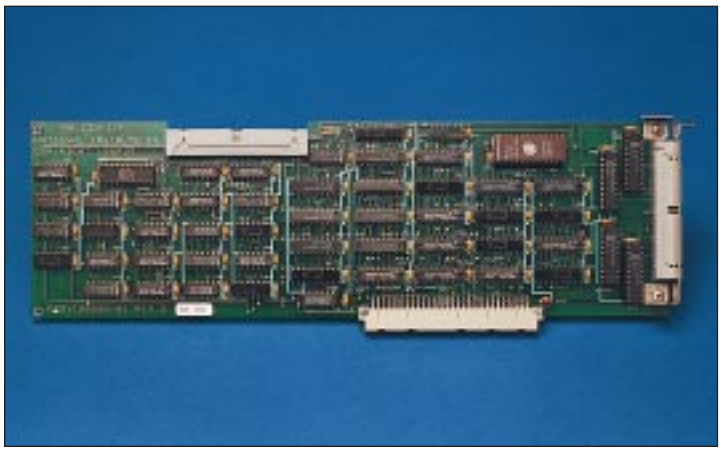
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Digital I/O Board for the Macintosh NuBus

NB-DIO-32F



NB-DIO-32F

Overview

The NB-DIO-32F is a high-speed 32-bit parallel digital I/O interface for the Macintosh NuBus computer. The 32 lines of digital I/O are divided into four bytes. You can program each byte as either an input or an output. The NB-DIO-32F has a variety of digital I/O handshaking options, so it is compatible with a wide range of peripheral devices and other computers.

The NB-DIO-32F is interfaced to the National Instruments RTSI bus so that DMA, interrupt, and digital I/O handshaking signal information can be transferred to other NB Series boards.

Applications

The NB-DIO-32F interfaces the Macintosh NuBus to:

- Other computers with a parallel digital I/O interface
- Centronics-compatible printers and plotters
- BCD-compatible panel meters and test equipment
- SC-206X Series optically isolated I/O and electromechanical relays
- SSR Series solid-state relays

The NB-DIO-32F can also monitor and control digital signals in process and control applications, or function as a high-speed pattern generator in ATE systems.

The Macintosh NuBus equipped with an NB-DIO-32F can serve as a system controller with high-speed digital I/O capabilities. System applications include laboratory testing, production testing, and industrial process monitoring and control.

Hardware

Figure 1 of the NB-DIO-32F illustrates the key functional components of the hardware. The following paragraphs describe these components.

Address Decoder – This circuitry monitors the NuBus address lines to recognize the I/O addresses for the components on the board. The base address for the NB-DIO-32F is dependent upon the I/O slot in which the board is located. For this reason, there are no switches that you need to set.

Data Buffers – The address and data lines for the NuBus are multiplexed on a single address/data bus (AD*). These data buffers capture the 32-bit data information during the data bus cycle of a transaction. Each byte of data corresponds to one byte of digital I/O.

NuBus Control – This circuitry controls sending and receiving Nubus signals. These signals indicate if the current bus cycle is a read or write cycle and how many data bytes to transfer. Each data byte from the NuBus corresponds to one byte of digital

Features

- 32 TTL digital I/O lines organized into four 8-bit ports
- Transfer rates up to 350 kwords/s
- Variety of I/O handshaking options for interfacing to almost any peripheral with a parallel interface
- Dual sets of handshaking control lines, each of which can control an independent 8, 16, or 32-bit data transfer
- 50-pin digital I/O connector compatible with our 32-channel SSR backplane
- Interrupt generation
- High-performance RTSI bus interface
  – DMA operation with an NB-DMA2800
- Programmed with LabVIEW

Software Included

- NI-DAQ for Macintosh

RELATED PRODUCTS

Hardware 3-119, 3-143, 3-147
Software 1-11, 1-89
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NB-DIO-32F

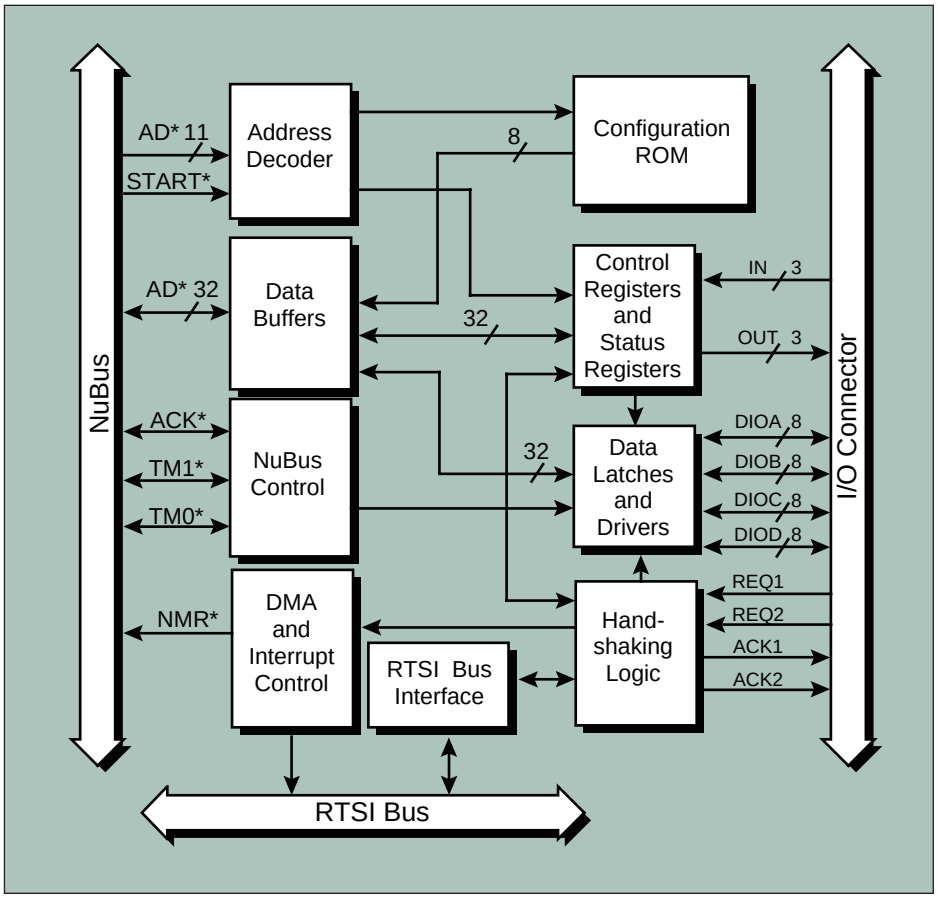


Figure 1. NB-DIO-32F Block Diagram

I/O, and the NuBus control signals indicate which byte or bytes are included in each data transfer.

Configuration ROM – The configuration ROM has board identification information for the operating system.

Control Status Registers – One 16-bit and one 32-bit control register contain all the bits required to program the digital I/O modes of the NB-DIO-32F. One 16-bit status register contains DMA, interrupt, and extra I/O line status. There are three extra input lines and three extra output lines on the digital I/O connector. You can read the status of the input lines from the status register. The output lines are controlled by writing to the 16-bit control register.

Data Latches and Drivers – This circuitry individually drives or buffers each byte of digital I/O, depending upon whether it is programmed as an input or an output.

Handshaking Logic – This circuitry synchronizes the transfer of data on the digital I/O lines according to program control. You can program the NB-DIO-32F to handshake with many different peripherals and computers. Dual sets of handshaking request and acknowledge lines on the digital I/O connector control the transfer of data. These signals can be positive or negative logic and you can program them to operate in one of six I/O timing modes. This flexibility makes the NB-DIO-32F compatible with almost any parallel interface.

DMA and Interrupt Circuitry – This circuitry controls DMA and interrupt requests generated by the handshaking circuitry. DMA and interrupt requests are enabled by bits in the onboard control registers. The board can direct interrupts to either the NuBus non-master request (NMRQ*) line or to one of the interrupt lines on the RTSI bus. The RTSI interrupt line used is dependent upon the I/O slot location of the NB-DIO-32F. Because high-speed DAQ operations require much of the processor's time, an NB-DMA2800 board is recommended whenever timed data acquisition or waveform generation is used.

The NB-DIO-32F can request DMA transfers from the NB-DMA2800 over the RTSI bus. By using DMA, data is transferred in the background at high speeds without using the Macintosh CPU.

RTSI Bus Interface – The NB-DIO-32F is interfaced to the National Instruments RTSI bus through a custom cross matrix gate array, which can send and receive timing signals between NB Series boards. RTSI gives the acquisition and control system the ability to synchronize multiple NB Series boards, and therefore, coordinates simultaneous analog input, analog output, digital input, and digital output.

Digital I/O Connector – All digital I/O is through a 50-pin male ribbon cable connector, diagrammed in Figure 2. The pin assignments for this connector are compatible with the DEC DRV11-J parallel interface and with our 32-channel SSR Series solid-state relays. The 8-bit digital I/O ports are labeled DIOA, DIOB, DIOC, and DIOD. The dual sets of handshaking lines are REQ1 and ACK1, REQ2 and ACK2. The extra output lines, which are controlled by writing to the onboard configuration registers, are labeled OUT1, OUT2, and OUT3. The extra input lines, whose status you can read from the onboard status register, are labeled IN1, IN2, and IN3.

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Specifications

Typical for 25° C unless otherwise noted.

Digital I/O

Number of channels ..... 32 I/O
Compatibility..... TTL
Digital logic levels

Level	Minimum	Maximum
Input low voltage	0.0 V	0.8 V
Input high voltage	2.0 V	5.5 V
Input high current (V_{in}=5.5 V		0.1mA
Output low voltage		
(I_{out}=12 mA)	---	0.4 V
(I_{out}=24 mA)	---	0.5 V
Output high voltage		
(I_{out}=-3 mA)	2.4 V	---
(I_{out}=-15 mA)	2.0 V	---

Transfer rate* (1 word = 32 bits)
Absolute maximum
Programmed I/O ..... 350 kwords/s
DMA (DMA board required)..... 300 kwords/s
Handshaking 2-wire
Power-on state..... Configured as inputs
Data transfers..... DMA, interrupts, programmed I/O

* *Transfer rate depends on the computer and software. These tests were made using Assembly language programs running on a Macintosh IIx computer using an NB-DMA2800.*

RTSI

Trigger lines..... 7
DMA channels 7

Power Requirement

+5 VDC (±5%) from NuBus..... 1.6 A typical
2.2 A maximum

Physical

Dimensions..... 32.5 by10.2 cm (12.8 by 4.0 in.)
I/O connector ..... 50-pin male

Environment

Operating temperature ..... 0° to 50° C
Storage temperature..... -40° to 100° C
Relative humidity..... 5% to 95% noncondensing

Noise Emission

FCC Class A verified, only with shielded-ribbon cable

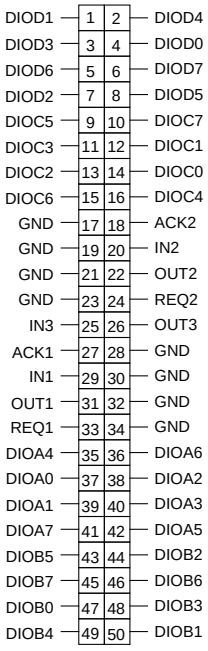


Figure 2. NB-DIO-32F I/O Connector

Software

National Instruments has developed several software packages to control data acquisition functions on the NB Series boards. The following software is included with the NB-DIO-32F:

• NI-DAQ for Macintosh

The following software is available separately:

• LabVIEW for Macintosh

Part Numbers

NB-DIO-32F and software† 0776157-01
Type NB4 digital I/O shielded-ribbon cable
0.5 m 180554-05
1.0 m 180554-10
CB-50 I/O connector block
(50-pin screw terminal)
with 0.5 m ribbon cable 776164-01
with 1.0 m ribbon cable 776164-02
For NB Series RTSI bus cables refer to page 3-223.

† *Includes NI-DAQ software for Macintosh on 1.44 MB 3.5 in. disks.*

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