Low-Cost Multifunction I/O – 50 kS/s, 16-Bit, 8 Analog Inputs

516 Family

516 Family
DAQCard-516
PC-516

Analog Inputs
8 single-ended, 4 differential
50 kS/s sampling rate
16-bit resolution

Digital I/O
8 (5 V/TTL) lines

Counter/Timers
Two, 16-bit resolution

Driver Software
NI-DAQ
    Windows 2000/NT/9x
    Mac OS*
    * Not for all hardware refer to page 192

Application Software
LabVIEW
LabWindows/CVI
ComponentWorks
VirtualBench
Measure
BridgeVIEW
Lookout

Make sure you consider our new low-cost 16-bit E Series products – refer to page 235.

Bus	Analog Inputs	Resolution	Sampling Rate	Input Range	Analog Outputs	Resolution	Output Rate	Output Range	Digital I/O	Counter/ Timers	Triggers
PCMCIA, ISA	8 SE/4 DI	16 bits	50 kS/s	± 5 V	–	–	–	–	8	2, 16-bit	–

Table 1. 516 Family Channel, Speed, and Resolution Specifications (refer to page 319 for more detailed specifications)

Overview

The 516 Family devices are low-cost, multifunction I/O devices. You get up to 50 kS/s, 12-bit performance on 8 single-ended analog inputs. These devices also feature two 16-bit, 10 MHz counter/timers and 8 digital I/O lines.

Hardware

Analog Input

The 516 Family has eight single-ended analog input channels or four differential (software selectable) input channels. The input circuitry has input overvoltage protection of ±25 V powered on or powered off. Voltage input range is ±5 V. The onboard 16-bit ADC has analog signal resolution of 152 µV in the ±5 V range.

The ADC performs 20 µs conversions with single-channel and multichannel aggregate acquisition sampling rates up to 50 kS/s. The devices perform both single A/D conversions and multiple A/D conversions of a fixed number of samples. A 512-word deep FIFO buffers the data during multiple A/D conversions to prevent data loss due to bus latency. During continuous, sustained data acquisition, you can achieve throughput rates of 50 kS/s.

An onboard counter/timer generates the sample interval clock with a resolution of 1 µs and controls the timing of multiple A/D conversions. As an alternative, an external signal can generate timing for the sample interval.

Data acquisition is available in two modes – 1) continuous acquisition of a single channel, or 2) multichannel acquisition with continuous scanning. In both modes, the number of samples must be counted in software.

You can scan any number of channels between 2 and 8 in the multichannel acquisition mode. These channels are scanned in a round-robin sequence, taking one reading per interval. Scanning always occurs in the same order – from the highest channel specified through channel 0.

Digital I/O

Both devices have a 4-bit input and a 4-bit output port. These ports can directly drive Darlington transistors for high-current applications. The digital I/O ports are 5 V/TTL compatible. The output port can source or sink 4 mA on each line.

Counter/Timer

The devices use an 82C54 programmable interval timer (PIT) for counting and timing. The PIT contains three independent 16-bit counter/timers. Counter 0 is dedicated to A/D timing. You can use the

ACH0	2	1	AIGND
ACH1	4	3	ACH4
ACH2	6	5	ACH5
ACH3	8	7	ACH6
+5 V	10	9	ACH7
DIN0	12	11	EXTCONV*
DIN2	14	13	DIN1
DOUT0	16	15	DIN3
DOUT2	18	17	DOUT1
1MHz	20	19	DOUT3
CLK1	22	21	DGND
GATE2	24	23	OUT1
OUT2	26	25	CLK2
NC	28	27	DGND
NC	30	29	NC

Figure 1. 516 Family I/O Connector

Data Acquisition

Low-Cost Multifunction I/O – 50 kS/s, 16-Bit, 8 Analog Inputs
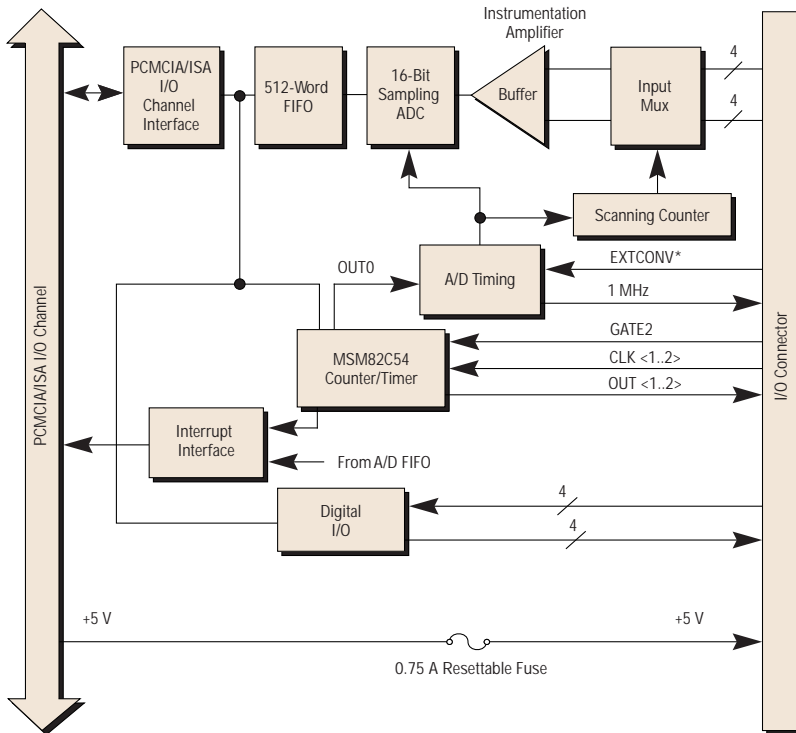
Figure 2. 516 Family for PCMCIA Hardware Block Diagram

other two counter/timers for general time-related functions, such as clock output, pulse output, and event and frequency measurements. The clock source of counter 0 is tied internally to a 1 MHz clock, so that an external clock is not always required. For applications that require an external clock, this 1 MHz clock is available on the I/O connector for use with other counters.

I/O Connector
The DAQCard-516 and PC-516 use the CB-27, a 27-pin screw terminal block. The DAQCard-516 uses the PR27-30F cable and the PC-516 uses the R30-30 cable to connect to the CB-27. ACH<0..7> are eight analog input channels referenced to AIGND. EXTCONV* can control individual A/D conversions externally. CLK<1..2>, GATE<2>, and OUT<1..2> are the counter clock, gate, and output, respectively. DOUT<0..3> are the four digital output lines and DIN<0..3> are the four digital input lines. All digital lines are referenced to digital ground (DGND). The fused +5 VDC line can drive external signal conditioning circuitry.

Refer to page 319 for more detailed specifications.

Ordering Information
516 Family
DAQCard-516 and NI-DAQ for

Windows 2000/NT/9x..................................777228-01

Mac OS 777228-02

PC-516 777229-01

Includes NI-DAQ for Windows 2000/NT/9x on CD unless otherwise noted. See pages 192 and 210 for more details.

Example Configurations

DAQ Board	Cable (page 296-297)	Accessory (page 293)
DAQCard-516	PR27-30F (777131-01)	CB-27 (777100-01)
PC-516	R30-30 (183654-01)	CB-27 (777100-01)

For more detailed cable and accessory options, refer to pages 286-299.

Specifications

516 Family

These specifications are typical for 25 °C unless otherwise noted.

Analog Input

Input Characteristics

Number of channels	8 single-ended/4 differential, software selectable
Type of ADC	Successive approximation
Resolution	16 bits, worst-case code range -32243 to +32242
Maximum sampling rate	50 kS/s
Input signal ranges	±5 V
Input coupling	DC
Overvoltage protection	±25 V powered on, ±25 V powered off
Inputs protected	ACH<0..7>
FIFO buffer size	512 samples
Data transfers	Interrupts, programmed I/O

Transfer Characteristics

Relative accuracy	±4 LSB typical, ±7.5 LSB max
DNL	±2 LSB typical, ±3 LSB max
INL	±2 LSB typical, ±4 LSB max
No missing codes	15 bits, guaranteed
Offset error	±1 LSB
Gain error	±0.045% of reading typical, ±0.09% max

Amplifier Characteristics

Input impedance	10 GΩ in parallel with 20 pF
CMRR	70 dB, DC to 60 Hz

Dynamic Characteristics

Settling time to ±0.0015% (±1 LSB) for full-scale step	20 µs
System noise	1 LSB$_{rms}$ typical

Stability

Recommended warm-up time	15 minutes
Offset temperature coefficient	20 ppm/°C max
Gain temperature coefficient	30 ppm/°C max

Digital I/O

Number of channels	4 input and 4 output
Compatibility	5 V/TTL

Digital logic levels

Level	Minimum	Maximum
Input low voltage	0 V	0.8 V
Input high voltage	2 V	5 V
Output low voltage (I_{out} = 4 mA)	–	0.5 V
Output high voltage (I_{out} = 4 mA)	3.5 V	–

Timing I/O

Number of channels	3 counter/timers (1 dedicated to analog input)
Resolution	16 bits
Compatibility	5 V/TTL, gate and source pulled high with 100 kΩ resistors
Base clocks available	1 MHz
Base clock accuracy	±0.01%
Maximum source frequency	10 MHz
Minimum source pulse duration	50 ns
Minimum gate pulse duration	50 ns
Data transfers	Programmed I/O

Bus Interface

	Slave

Power Requirements

DAQCard-516

+5 VDC (±5%)	60 mA operating

PC-516

+5 VDC (±5%)	80 mA max
±12 VDC (±5%)	20 mA max
Power available at I/O connector	+5 VDC, 500 mA

Physical

Dimensions

DAQCard-516	Type II PC Card
PC-516	10.8 by 10.9 cm (4.25 by 4.3 in.)

I/O connector

DAQCard-516	27-pin male, 30-pin female using PR27-30F
PC-516	30-pin male

Environment

Operating temperature	0 to 55 °C
Storage temperature	-20 to 70 °C
Relative humidity	10% to 90%, noncondensing

Certifications and Compliances

CE Mark Compliance CE