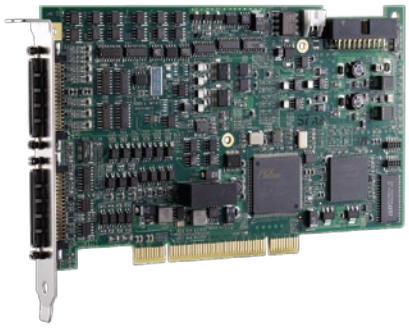
PCI-9524

24-Bit Precision Load Cell Input Card



Introduction

The PCI-9524 is a robust, multi-purpose module designed for turnkey material test systems (MTS). Equipped with four strain gauge-based full-bridge transducer input channels, four general purpose analog input channels, and a 3-axis motion controller, the PCI-9524 delivers a complete hardware solution for MTS manufacturers. The PCI-9524 easily integrates physical quantity measurement and implements strategy of software-based close-loop control in a single module package. For transducer measurement, the PCI-9524 supports sensitivity from 1.0 mV/V to 4.0 mV/V and provides a 1/200000 accuracy of measurement of full scale. These features make the PCI-9524 suitable for precise measurement in large-scale transducers.

The PCI-9524 is also equipped with four, 24-bit general purpose analog input channels that allow accurate measurements of the LVDT (Linear Variable Differential Transducer) and Linear wire potentiometer signals to achieve high-resolution of displacement.

With motion control capability and 16-bit DA channels, the PCI-9524 comes with three stepper/servo motor axes and two channels of hydraulic system control function. The built-in incremental encoder feedback channels enable the PCI-9524 to implement the stratagem of MTS' software-based closed-loop control.

The impressive PCI-9524 features permit easy implementation of required control or measurement functionalities with just a single module, saving precious development and integration time for MTS manufacturers.

Features

- **Transducer Inputs for precise measurement**
  - **4-CH full-bridge load cell transducer inputs**
  - **Accuracy up to 1/200,000 counts at full-scale**
  - **Sensitivity from 1.0 mV/V to 4.0 mV/V**
  - **2.5/10 VDC excitation voltage, software selectable**
  - **Internal 24-bit A/D resolution**
- **Motion control interface for stepper and hydraulic system control**
  - **3-axis PWM output with OUT/DIR and CW/CCW mode**
  - **2-CH 16-bit analog outputs**
  - **A-B phase encoder input with 24-bit counter**
- **General-Purpose Analog Inputs for accurate measurements of LVDT[1] and linear wire potentiometer signals**
  - **4-CH analog input with 24-bit resolution**
  - **Programmable gains of ±1.25 V, ±2.5 V, ±5 V, ±10 V**
  - **Up to 30 kS/s sampling rate (single channel)**

Note 1: LVDT: Linear Variable Differential Transducer

Supported Operating Systems

- Windows 7/VISTA/XP/2000/2003
- Linux

Recommended Application Environments

- VB.NET/VC.NET/VB/VC++/BCB/Delphi

Driver Support

- DAQPilot for Windows
- DAQPilot for LabVIEW™
- PCI-DASK for Windows
- PCI-DASK/X for Linux

Applications

- Material test system

  The combination of these features makes the PCI-9524 an ideal solution for material testing systems, CNC machines, and civil testing equipment. With all the required functions for measurement and control, the PCI-9524 greatly reduces system development and integration time.

Specifications

4-channel Load Cell Transducer Input

- Excitation voltage: 2.5 V/10 VDC
- Internal A/D resolution: 24-bit
- Update speed when Auto-zero Disabled
  - · Up to 30 KSPS (single channel)
  - · Up to 1,638 SPS (multi-channel)
- Update speed when Auto-zero Enabled
  - · Up to 819 SPS (single channel or multi-channel)

  Transducer sensitivity: 1.0 mV/V to 4.0 mV/V
- Number of channels: 1.6
- Accuracy: 1/200000 of full scale

  (with remote sense & auto zero enabled)
- Onboard 256 samples A/D FIFO

PWM Output & Encoder Input

- Number of axis: 3

  Pulse output options: OUT/DIR and CW/CCW

  (26LS31, differential line driver, driving current: up to 20 mA)
- Maximum output frequency: 500 kHz
- Encoder Input: 24-bit up/down counter for incremental encoder feedback

General Purpose Analog Input

- Resolution: 24-bit
- Programmable range: ±1.25 V, ±2.5 V, ±5 V, ±10 V
- Number of channels: 4
- Sampling rate: 30 kS/s (non-multiplexing)
- Onboard 256 samples A/D FIFO

Isolated Digital Input

- Number of channels: 8
- Maximum input range (non-polarity): 0 V to 24 V
- Input resistance: 2.7 KΩ

Isolated Digital Output

- Number of channels: 8
- Output type: Power MOSFET
- Sink current: Up to 300 mA/channel

Analog Output

- Resolution: 16-bit
- Output range: ±10 V
- Number of channels: 2
- Update rate: Up to 5 kS/s
- Onboard 1 K samples D/A FIFO
- Driving capability: 5 mA

Hardware Timer Interrupt

- Base clock: 40 MHz
- Resolution: 32-bit
- Interrupt Frequency: 40MHz / 2^N; N=1~2^{32}

General Specifications

- 5V power output current:
  - · ISO5VDD: max. 160 mA
  - · ISOPWR: max. 16 mA
- I/O connector: Two 68-pin SCSI-VHDCI female
- Operation Temperature: 0 to 45°C
- Power requirements: 5 V @ 2 A
- Dimensions (not including connectors):

  156 mm x 116 mm

How to Get 1/200,000 Accuracy

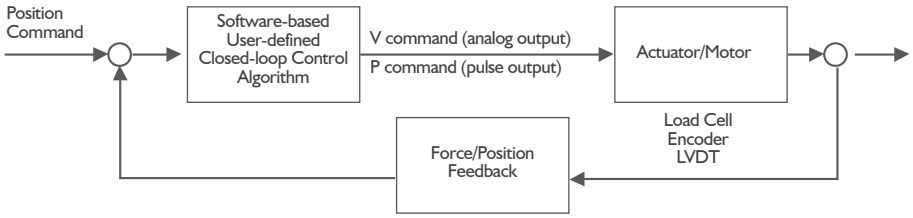
It is common in the weight-scaling or material-testing industries to specify the resolution capability of a measurement device such as the ADLINK PCI-9524, in counts or digits, rather than in bits. For example, a measurement device that is capable of resolving 1 in 1000 counts, can successfully register a 1-gram change on a 1-kg capacity load-cell transducer. Consequently, a measurement device that is capable of resolving 1 in 200,000 counts, can successfully register a 1-gram change on a 200 kg capacity load-cell transducer.

In practical applications, the sensitivity of load-cell transducers vary from model to model (typically from 1 to 4 mV/V), and the full-scale output range of a transducer is usually only a fraction of the full-scale input range of a measurement device. The convenience of using counts rather than bits, is that the specified count achievable by a measurement device is relative to the transducer's full-scale output, rather than the full-scale input range of the analog input amplifier. Thus, theoretically, no matter what the sensitivity of the 200 kg capacity load-cell transducer you are using, a 200,000 count measurement device can always resolve a 1-gram measurement. Please also note, as a weight/force indicator, the displayed counts or digits shall be flicker-free while the applied force is in steady state. Therefore, a measurement device specified to have a 200,000 count resolution, must guarantee peak-to-peak system noise and short-term drift to below 1/200,000, or 5-ppm of the full-scale output range of the transducer.

The specified 200,000 count resolution capacity of ADLINK's PCI-9524 is verified by a precision load-cell simulator utilizing 3 mV/V sensitivity, under 10-V excitation and using a six-wire remote-sense connection. The auto-zero function is enabled throughout the acquisition, while the ADC sampling rate is set to 60 samples-per-second (the equivalent data rate is 29 samples-per-second), and using an IIR post digital filter of 32 taps. Under these conditions, the peak-to-peak system noise and drift are well below 150 nV, the limit of 1 in 200,000 count resolution. The recording duration is 30 minutes, and the ambient temperature fluctuation is within ±1°C throughout.

Software-based Force Feedback Closed-loop Control

Force feedback closed-loop control is common in material test applications. The PCI-9524 supports the necessary control interfaces, including analog/pulse outputs and encoder/analog inputs, as the best single board solution to implement closed-loop control based on user-defined software algorithms following fixed time intervals according to a software timer or built-in hardware timer. Below is the basic control diagram.



Terminal Boards & Cables

■ DIN-68S-01

Terminal Board with One 68-pin SCSI-II Connector and DIN-Rail Mounting (Cables are not included; for information on mating cables, please refer to P2-59/60.)

■ ACL-10568

68-pin SCSI-VHDCI cable (Mating with AMP-787082-7)

Ordering Information

■ **PCI-9524**
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Pin Assignment

CN1

AI0+	34	68	AI0-
VEXEC0+	33	67	VEXEC0-
VEXEC_SEN0+	32	66	VEXEC_SEN0-
N/A	31	65	N/A
AI1+	30	64	AI1-
VEXEC1+	29	63	VEXEC1-
VEXEC_SEN1+	28	62	VEXEC_SEN1-
N/A	27	61	N/A
AI2+	26	60	AI2-
VEXEC2+	25	59	VEXEC2-
VEXEC_SEN2+	24	58	VEXEC_SEN2-
N/A	23	57	N/A
AI3+	22	56	AI1-
VEXEC3+	21	55	VEXEC1-
VEXEC_SEN3+	20	54	VEXEC_SEN1-
N/A	19	53	N/A
AGND	18	52	AGND
AI4+	17	51	AI4-
AI5+	16	50	AI5-
AI6+	15	49	AI6-
AI7+	14	48	AI7-
AGND	13	47	AGND
AGND	12	46	AGND
AGND	11	45	AGND
AGND	10	44	AGND
AGND	9	43	AGND
AGND	8	42	AGND
AGND	7	41	AGND
AGND	6	40	AGND
AGND	5	39	AGND
DA0_OUT	4	38	AGND
AGND	3	37	AGND
DA1_OUT	2	36	AGND
AGND	1	35	AGND

CN2

PULSE0_A+	34	68	PULSE0_A
PULSE0_B+	33	67	PULSE0_B
ISO5VDD	32	66	ISOGND
PULSE1_A+	31	65	PULSE1_A
PULSE1_B+	30	64	PULSE1_B
ISO5VDD	29	63	ISOGND
PULSE2_A+	28	62	PULSE2_A
PULSE2_B+	27	61	PULSE2_B
ISO5VDD	26	60	ISOGND
ENC0_A+	25	59	ENC0_A
ENC0_B+	24	58	ENC0_B
ISOPWR	23	57	ISOGND
ENC1_A+	22	56	ENC1_A
ENC1_B+	21	55	ENC1_B
ISOPWR	20	54	ISOGND
ENC2_A+	19	53	ENC2_A
ENC2_B+	18	52	ENC2_B
ISOPWR	17	51	ISOGND
IDI0+	16	50	IDI0-
IDI1+	15	49	IDI1-
IDI2+	14	48	IDI2-
IDI3+	13	47	IDI3-
ISOPWR	12	46	ISOGND
IDI4+	11	45	IDI4-
IDI5+	10	44	IDI5-
IDI6+	9	43	IDI6-
IDI7+	8	42	IDI7-
ISOPWR	7	41	ISOGND
IDO0	6	40	IDO1
IDO2	5	39	IDO3
EXT_ISOPWR	4	38	ISOGND
ISOPWR	3	37	ISOGND
IDO4	2	36	IDO5
IDO6	1	35	IDO7