KPCI-3110A

1.25MHz, 12-Bit, High Speed Multifunction Board

- 12-bit resolution
- Maximum sampling rate of 1.25MS/s
- 32 single-ended or 16 differential analog inputs
- 2 analog outputs, waveform quality, up to 500kS/s
- 16 high speed digital I/O lines, up to 3MHz
- 4 counter/timers
- Low gain (1, 2, 4, 8)
- Pre-, post-, and about-triggering
- 1024-location channel-gain queue
- 32-bit DriverLINX® drivers plus a suite of bundled software including ExceLINX™, VisualSCOPE™, and LabVIEW® drivers
- Not supported in Microsoft Windows 7 64-bit

ACCESSORIES AVAILABLE

CAB-307	50-pin, 1-meter Shielded Cable for Analog Signals
CAB-307-3	50-pin, 3-meter Shielded Cable for Analog Signals
CAB-308	68-pin, 1-meter Shielded Cable for Digital Signals
CAB-308-3	68-pin, 3-meter Shielded Cable for Digital Signals
STP-3110	Screw Terminal Panel

The KPCI-3110A is the perfect solution for demanding measurements, offering a combination of speed, resolution, high channel count, and quality that few other boards can match. Whether you're developing a new product or simply trying to understand and interpret physical phenomena, the KPCI-3110A provides the capability you need at a great price.

Functional Description

The multifunction KPCI-3110A board combines high speed analog inputs and analog outputs. This data acquisition board provides input speeds of up to 1.25MHz and output speeds of up to 500kS/s. The KPCI-3110A also features 16 digital I/O lines and four counter/timers. In addition, this multifunction board includes 32-bit DriverLINX software drivers and LabVIEW VIs. Keithley's new start-up software is also included at no charge.

High Speed Analog Inputs

The KPCI-3110A's high speed analog inputs enable the user to sample data at speeds up to 1.25MS/s. Some typical high speed applications include high speed data acquisition and statistical sampling, testing of electrical components and subassemblies, continuous process monitoring, and industrial control and automation.

The KPCI-3110A data acquisition board is ideally suited to any application requiring accurate, high speed measurement of analog inputs. The analog inputs are software configurable for single-ended or differential inputs and bipolar or unipolar input ranges. An Amp Low connection allows single-ended inputs to be referenced to a common point other than ground to provide 32 pseudo-differential inputs.

For added flexibility, a 1024-location channel-gain queue allows you to sample non-sequential channels and channels with different gains.

The Calibration utility allows both manual and automatic software calibrations.

Analog Input Acquisition Modes

The KPCI-3110A can acquire a single value from any channel or a number of samples from multiple channels. To acquire data from multiple channels, the KPCI-3110A board provides two scan modes: continuously paced and triggered. Both scan modes can be paced using an internal or an external clock.

The Continuously Paced mode allows a board to continuously scan the channel-gain queue and acquire data until stopped or until a specific number of samples are acquired. The Triggered Scan mode allows a board to scan the channel-gain queue at high speeds with a programmed interval between scans, emulating a simultaneous sample-and-hold operation. Use an external trigger or an internal clock to retrigger a Triggered Scan operation to cycle through the channel-gain queue up to 256 times per trigger. This allows the acquisition of a waveform of data per channel for each trigger (up to 256kSamples per trigger).

The KPCI-3110A provides several triggering modes, including pre-trigger, post-trigger, and about-trigger modes. The trigger source can be an analog or digital signal. The level of the analog trigger can be from –10V to +10V.

- Pre-trigger mode allows acquisition to occur until an external trigger occurs.
- Post-trigger is the standard acquisition mode; acquisition begins after an internal or external trigger event and continues until an end condition occurs or the specified number of samples are collected.
- About-trigger mode allows acquisition to occur both before and after an external trigger.

Use an internal or an external clock to pace the analog inputs. The internal clock can be set to acquire data from one or more channels from 1S/s up to 1.25MS/s. To acquire data at slower rates, use an external source, or cascade two or more of the counter/timers and connect the output to the external clock input. The external A/D sample clock and the digital trigger input signals are accessible through the connector.

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Ordering Information

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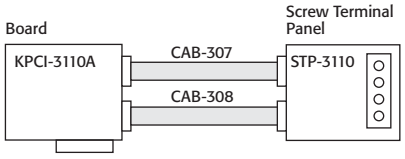
APPLICATIONS

- **High speed measurement and data acquisition**
- **Monitoring and control of production testing equipment**
- **Continuous monitoring of process variables**
- **On-line monitoring of quality specifications**

Configuration Guide



Analog Outputs

The KPCI-3110A features two 12-bit analog output channels with an output range of +10V. The analog outputs can be used concurrently with the analog inputs to perform gap-free simultaneous stimulus and response. The analog outputs can be triggered synchronously with, or independently of, the analog inputs using the analog threshold trigger or the dedicated digital trigger input. An internal or external source clocks the analog outputs. The analog outputs can be updated simultaneously at a rate of *up to 500kS/s each* (system dependent), and are set to 0V at power-up.

The onboard FIFO can contain from two to 4096 waveforms samples with update rates at a *guaranteed* 500kS/s. Repetitive waveforms can be loaded into the onboard FIFO, and the data in this FIFO can be continuously cycled through.

Digital I/O

This board features 16 digital I/O lines that can be programmed into two banks of eight lines for input or output. The status of the digital inputs can be read at high speeds by including the digital input lines as a channel in the analog channel-gain queue. This dynamic digital input feature time stamps the digital inputs in relation to the analog inputs. In this mode, all digital input lines are read as one word. The digital outputs can drive external solid-state relay modules with its 12mA sink and 15mA source.

The board also supplies two auxiliary digital outputs. These digital outputs change state when a specified analog input is read, providing a triggering source or a synchronization source for external circuitry or other data acquisition boards.

Counter/Timers

These boards provide four 16-bit counter/timers for use in many purposes, including: counting events, creating a one-shot or frequency output, and measuring frequency input. They can also be used to set the duty cycle, frequency, and output polarity of the output pulse.

These counter/timers can be cascaded. Cascade two counter/timers internally through software. Cascade three or four counter/timers externally on a screw terminal accessory.

Digital Input and Output Connector

Analog Trigger Return	68	34	Analog Trigger
Shield Ground	67	33	Shield Ground
Reserved	66	32	Reserved
Reserved	65	31	Reserved
Digital Ground	64	30	Dynamic Digital Output 0
Digital Ground	63	29	Dynamic Digital Output 1
Digital Ground	62	28	Digital Ground
Digital I/O Bank A 4	61	27	Digital I/O Bank A 0
Digital I/O Bank A 5	60	26	Digital I/O Bank A 1
Digital I/O Bank A 6	59	25	Digital I/O Bank A 2
Digital I/O Bank A 7	58	24	Digital I/O Bank A 3
Digital Ground	57	23	Digital Ground
Digital I/O Bank B 4	56	22	Digital I/O Bank B 0
Digital I/O Bank B 5	55	21	Digital I/O Bank B 1
Digital I/O Bank B 6	54	20	Digital I/O Bank B 2
Digital I/O Bank B 7	53	19	Digital I/O Bank B 3
Digital Ground	52	18	Digital Ground
Digital Ground	51	17	User Clock Input 0
External Gate 0	50	16	User Counter Output 0
Digital Ground	49	15	User Clock Input 1
External Gate 1	48	14	User Counter Output 1
Digital Ground	47	13	User Clock Input 2
External Gate 2	46	12	User Counter Output 2
Digital Ground	45	11	User Clock Input 3
External Gate 3	44	10	User Counter Output 3
Digital Ground	43	9	External D/A Clock Input
Digital Ground	42	8	External D/A TTL Trigger
Digital Ground	41	7	External A/D Sample Clock Input
Digital Ground	40	6	External A/D TTL Trigger
Digital Ground	39	5	A/D Trigger Output
Digital Ground	38	4	A/D Sample Clock Output
Reserved	37	3	Reserved
Digital Ground	36	2	+5V Output
Digital Ground	35	1	+5V Output

Connector Pin Assignments

The analog input and output connections are made with a 50-pin connector. The digital input and output connections are made with a 68-pin connector.

Analog Input and Output Connector

Analog Input 8/0 Return	50	25	Analog Input 0
Analog Input 9/1 Return	49	24	Analog Input 1
Analog Input 10/2 Return	48	23	Analog Input 2
Analog Input 11/3 Return	47	22	Analog Input 3
Analog Input 12/4 Return	46	21	Analog Input 4
Analog Input 13/5 Return	45	20	Analog Input 5
Analog Input 14/6 Return	44	19	Analog Input 6
Analog Input 15/7 Return	43	18	Analog Input 7
Analog Input 24/8 Return	42	17	Analog Input 16/8
Analog Input 25/9 Return	41	16	Analog Input 17/9
Analog Input 26/10 Return	40	15	Analog Input 18/10
Analog Input 27/11 Return	39	14	Analog Input 19/11
Analog Input 28/12 Return	38	13	Analog Input 20/12
Analog Input 29/13 Return	37	12	Analog Input 21/13
Analog Input 30/14 Return	36	11	Analog Input 22/14
Analog Input 31/15 Return	35	10	Analog Input 23/15
Analog Ground	34	9	Amp Low
Shield Ground	33	8	Shield Ground
Power Ground	32	7	+15V output
Reserved	31	6	−15V output
Analog Output 0 Return	30	5	Analog Output 0+
Analog Output 1 Return	29	4	Analog Output 1+
Reserved	28	3	Reserved
Reserved	27	2	Reserved
Analog Ground	26	1	+5V Ref_Out

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Analog Inputs

GENERAL

RESOLUTION: 12 bits.

DATA THROUGHPUT (GAIN = 1): Single Channel: 1.25 MSamples/s, 0.03% accuracy.
Multiple Channel (Scan): 1.0 MSamples/s, 0.05% accuracy; 750 kSamples/s, 0.03% accuracy.

CHANNEL-GAIN LIST: 1024 locations.

INPUT FIFO SIZE: 1024 locations.

INPUTS

NUMBER OF ANALOG INPUT CHANNELS: Single-Ended/Pseudo-Differential: 32. **Differential:** 16.

INPUT GAINS: 1, 2, 4, 8.

INPUT RANGE: Bipolar: ±10, ±5, ±2.5, ±1.25V. **Unipolar:** 0–10, 0–5, 0–2.5, 0–1.25V.

DRIFT: Zero: ±30μV + (+15μV * Gain)/°C. **Gain:** ±30 ppm/°C.

INPUT IMPEDANCE: 100MΩ, 10pF, Off. 100MΩ, 100pF, On.

INPUT BIAS CURRENT: ±20nA.

COMMON MODE VOLTAGE: ±11V maximum (operational).

MAXIMUM INPUT VOLTAGE: ±20V maximum (protection).

CHANNEL ACQUISITION TIME: 1μs to 0.05%.

A/D CONVERSION TIME: 0.8μs.

ACCURACY

NONLINEARITY (integral): ±1.0 LSB.

DIFFERENTIAL NONLINEARITY: ±0.75 LSB (no missing codes).

SYSTEM NOISE: 0.2 LSB rms, typical.

CHANNEL-TO-CHANNEL OFFSET: ±40.0μV.

SYSTEM ACCURACY (FULL SCALE):
Gain = 1: 0.01%.
Gain = 2: 0.02%.
Gain = 4: 0.02%.
Gain = 8: 0.03%.

CLOCKING AND TRIGGER INPUTS

MAXIMUM A/D PACER CLOCK: 1.25MHz.

MINIMUM A/D PACER CLOCK: 1.19Hz.

EXTERNAL A/D SAMPLE CLOCK:
Minimum Pulse Width: 100ns (high); 150ns (low).
Maximum Frequency: 1.25MHz.

EXTERNAL A/D DIGITAL (TTL) TRIGGER:
High-Level Input Voltage: 2.0V minimum.
Low-Level Input Voltage: 0.8V maximum.
Minimum Pulse Width: 100ns (high); 100ns (low).

EXTERNAL ANALOG TRIGGER
Input Type: Threshold sensitive.
Threshold Voltage: Programmable.
Threshold Range: –10V to +10V.
Threshold Resolution: 8 bits/78mV per LSB.
Hysteresis: 50mV typical.
Input Impedance: 12kΩ/20pF typical.
Maximum Input Voltage: ±20V (power on or off).
Minimum Pulse Width: 100ns (high); 100ns (low).

A/D SAMPLE CLOCK OUTPUT SIGNAL AND A/D TRIGGER OUTPUT SIGNAL:
Output Driver High Voltage: 2.0V minimum (I_{OH} = –15mA); 2.4V minimum (I_{OH} = –3mA).
Output Driver Low Voltage: 0.5V maximum (I_{OL} = 24mA); 0.4V maximum (I_{OL} = 12mA).

Analog Outputs

NUMBER OF ANALOG OUTPUT CHANNELS: 2 (voltage output).

RESOLUTION: 12 bits.

OUTPUT RANGE: ±10V (bipolar).

ERROR: Zero: Adjustable to 0. **Gain:** Adjustable to 0.

THROUGHPUT:
Full Scale: 200kHz maximum per channel.
100mV Step, continuously paced: 500kHz maximum per channel (system dependent).
100mV step, waveform mode: 500kHz maximum per channel (guaranteed).

FIFO BUFFER SIZE: 4096 locations.

CURRENT OUTPUT: ±5mA maximum load.

OUTPUT IMPEDANCE: 0.1Ω maximum.

CAPACITIVE DRIVE CAPABILITY: 0.004μF (no oscillators).

NONLINEARITY (integral): ±1.0 LSB.

DIFFERENTIAL LINEARITY: ±0.75 LSB (monotonic).

PROTECTION: Short circuit to Analog Common.

POWER-ON VOLTAGE: ±10mV.

SETTLING TIME TO 0.01% OF FSR: 5μs, 20V step; 2.0μs, 100mV step.

SLEW RATE: 10V/μs.

EXTERNAL D/A SAMPLE CLOCK: **Minimum Pulse Width:** 200ns (high); 150ns (low).
Maximum Frequency: 500kHz.

EXTERNAL D/A DIGITAL TRIGGER: **High-Level Input Voltage:** 2.0V minimum.
Low-Level Input Voltage: 0.8V maximum.
Minimum Pulse Width: 100ns (high); 100ns (low).

Digital I/O

NUMBER OF LINES: 16 (bidirectional).

NUMBER OF PORTS: 2 (8 bits each).

INPUTS: **High-Level Input Voltage:** 2.0V minimum. **Low-Level Input Voltage:** 0.8V maximum.
High-level Input Current: 20μA. **Low-Level Input Current:** –0.2mA.

MAXIMUM INTERNAL PACER CLOCK RATE: 1.25MHz.

MAXIMUM EXTERNAL PACER CLOCK RATE: 3MHz.

OUTPUTS:
Output Driver High Voltage: 2.0V minimum (I_{OH} = –15mA). 2.4V minimum (I_{OH} = –3mA).
Output Driver Low Voltage: 0.5V maximum (I_{OL} = 24mA). 0.4V maximum (I_{OL} = 12mA).

Counter/Timer

NUMBER OF COUNTER/TIMER CHANNELS: 4.

CLOCK INPUTS: **High-Level Input Voltage:** 2.0V minimum.
Low-Level Input Voltage: 0.8V maximum.
Minimum Pulse Width: 100ns (high); 100ns (low).
Maximum Frequency: 5.0MHz.

GATE INPUTS: **High-Level Input Voltage:** 2.0V minimum.
Low-Level Input Voltage: 0.8V maximum.
Minimum Pulse Width: 100ns (high); 100ns (low).

COUNTER OUTPUTS:
Output Driver High Voltage: 2.0V minimum (I_{OH} = –15mA). 2.4V minimum (I_{OH} = –3mA).
Output Driver Low Voltage: 0.5V maximum (I_{OL} = 24mA). 0.4V maximum (I_{OL} = 12mA).

Physical and Environmental Specifications

PHYSICAL: Dimensions: 8.5 inches (length) by 4.2 inches (width). **Analog I/O Connector:** 50 pin Amp. **Digital I/O Connector:** 68 pin Amp.

CERTIFICATION AND COMPLIANCE: FCC Class A verified; will not compromise FCC compliance of host computer CE.

COMPLIANCE: Conforms to European Union directive 89/336/EEC (EMC directive), EN55022, and EN50082-1. (Product is CE marked.)

ENVIRONMENTAL: Operating Temperature Range: 0°C to 70°C. **Storage Temperature Range:** –25°C to 85°C. **Relative Humidity:** To 95%, noncondensing.