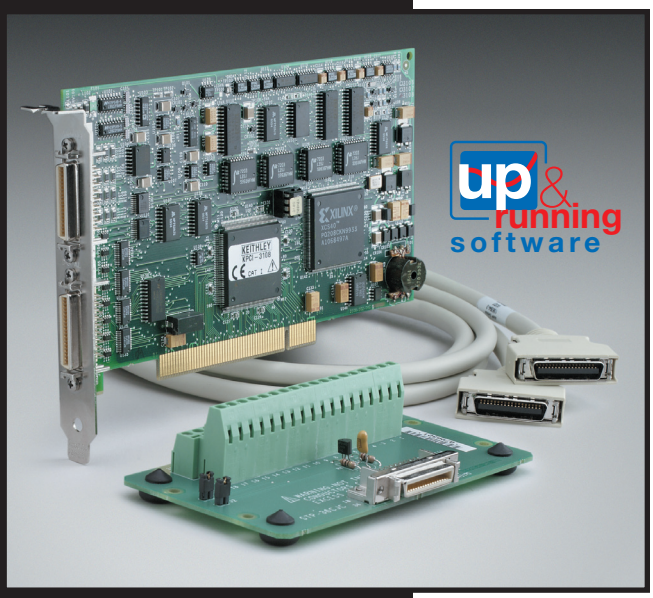
KPCI-3107
KPCI-3108

100kHz, 16-Bit Wide Gain Multifunctional Boards



- 16 bit resolution
- 16 single-ended or 8 differential channels
- Maximum sample rate up to 100kSamples/s
- High gain capability for thermocouples with the STP-36CJC
- Autozero capabilities
- 24 programmable software ranges
- Programmable features per channel:
  – Differential or single ended
  – Range
  – Bipolar or unipolar
- 2 waveform-quality analog outputs (KPCI-3108 only)
- 32 digital I/O lines
- Pre-, post-, and about-trigger
- Separate 2K sample FIFOs on analog input and analog output
- 32-bit DriverLINX drivers plus a suite of bundled software including ExceLINX, VisualSCOPE, TestPoint, and LabVIEW drivers

The KPCI-3107/3108 offers all the functions you need to address your measurement tasks, from high and low gains to digital control and event-counting capability, from fully flexible channel programming to waveform-quality outputs. Its high-gain capabilities allow direct thermocouple measurement, and its autozero capabilities eliminate undesired measurement drifts.

Functional Description

The multifunction KPCI-3107/3108 data acquisition boards provide high resolution and a wide gain range. Each board provides 12 gains (1, 2, 4, 8, 10, 20, 40, 80, 100, 200, 400, and 800) in both bipolar and unipolar modes, providing a total of 24 ranges on one board. The gain for each channel can be programmed separately, allowing a wide variety of sensors to be used with each board.

The two analog outputs on the KPCI-3108 produce waveform quality outputs suitable for use as general-purpose audio sources. Both boards provide high-current digital outputs for sinking (64mA) and sourcing (15mA), allowing the KPCI-3107/3108 to drive indicators and relays directly without the need for interface circuitry.

Hardware

These boards feature high speed data acquisition, even when channels are set at different gains and in non-sequential order using DMA or interrupt-based data transfer modes. (Also, each channel in the gain queue can be individually programmed as bipolar or unipolar and differential or single ended.) Because the channel-gain queue is implemented in hardware, channels on expansion boards can be selected at full speed. The KPCI-3107/3108 support bus mastering, interrupt, or target mode data transfer methods.

The programmable burst mode capability allows you to acquire data from a series of channel scans at high speed with a programmed interval between scans. This mode also emulates a simultaneous sample-and-hold function in lower speed applications.

These boards feature flexible clocking, triggering, and gating modes. The boards can be configured to accept external pacer clock input or to use the onboard time base to provide a conversion rate from 4.32 Samples/hour to 100kSamples/s. Any single channel can be sampled at any gain at up to 100kSamples/s. In addition, multiple channels can be sampled at aggregate rates of up to 100kSamples/s. External hardware trigger and gate inputs allow precise control over when data is acquired, and flexible trigger modes allow the acquisition of data in relationship to a specific event. An event that starts or stops acquisition can be either an internal or an external digital trigger.

ACCESSORIES AVAILABLE

C2600	26-inch Ribbon Cable for MB Series Signal Conditioning Rack
CAB-1284CC-.5, CAB-1284CC-2	IEEE 1284C-C Standard Shielded Cable with 18 twisted pairs. Use for analog and digital connections to KPCI-3107 and KPCI-3108 boards. CAB-1284CC-.5 is a half meter long and CAB-1284CC-2 is 2 meters long.
MB-01*	16-Channel Direct-Connection Module Mounting Rack
MB-02*	16-Channel Multiplexed Module Mounting Rack
MB-05*	8-Channel Direct-Connection Module Mounting Rack
STA-3108-A1	Connector/Cable Adapter for use with EXP-1800 Channel Expander
STA-3108-A2	Connector/Cable Adapter for use with MB-01 and MB05 Module Backplane
STA-3108-A3	Connector/Cable Adapter for use with MB-02 Multiplexed Module Backplane
STA-3108-D1	Connector/Cable Adapter for use with digital I/O accessories
STP-36	36-pin Screw Terminal Panel
STP-36CJC	36-pin Screw Terminal Panel with CJC for Thermocouples
STP-ENCL	General purpose enclosure for STP-36CJC and STA-3108-A1/A2/D1
TESTPOINT	TestPoint Software Package

*Signal conditioning modules for the MB-01, MB-02, and MB-05 can be found in the Signal Conditioning and Accessories section.

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KPCI-3107
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100kHz, 16-Bit Wide Gain Multifunctional Boards

Wide gain range, high resolution

PCI/ISA/PCMCIA

Ordering Information

KPCI-3107 Wide gain range, analog and digital I/O board

KPCI-3108 Wide gain range, analog and digital I/O board with analog outputs

CAPABILITIES

- Temperature and voltage measurement
- Vibration, pressure, and strain measurements
- Analog stimulus response testing
- Relay control and switching

APPLICATIONS

- Burn-in testing—QA/QC
- Process monitoring and control
- Audio analysis
- Production testing
- Laboratory and factory automation

up & running software

The user can configure the boards for several triggering modes, including: start, stop, pre-trigger, post-trigger, and about-trigger.

- 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 is collected.
- About-trigger mode allows acquisition to occur both before and after an external trigger.

Analog triggering is also supported in About-triggering mode.

Thermocouple

These boards feature high gain capabilities (up to 800) that allow direct thermocouple measurements without signal conditioning. The STP-36CJC accessory provides the onboard CJC sensor for accurate cold junction compensation. This CJC is powered by the KPCI-3107/3108 and provides a 10mV/°C output. Our "Up & Running" suite of software such as ExceLINX provides the thermocouple linearization algorithms for automatic CJC leading to the final temperature readings. In addition, the DriverLINX thermocouple COM object allows programmers to use the linearization algorithms directly in their programs.

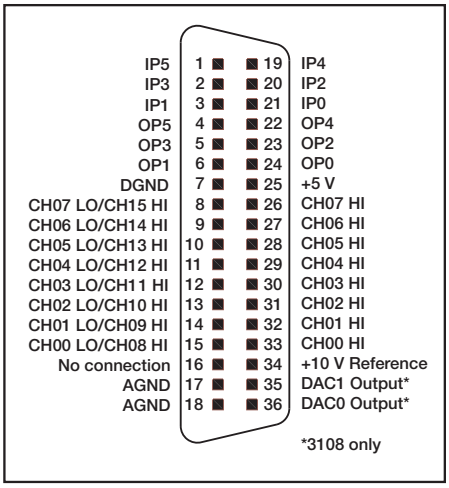
Calibration

The KPCI-3107/3108 boards have 24 ranges (12 unipolar and 12 bipolar). To ensure maximum accuracy, each range is calibrated separately. This is accomplished by storing two offsets and one gain correction for each range in onboard memory and writing the appropriate values to each of three A/D calibration DACs whenever the range is changed during the process of scanning channels. This process occurs automatically, faster than the main input circuit settles. This system allows the user to enjoy the best possible calibration on each range, even when ranges are mixed in the channel-gain queue, with no speed penalty.

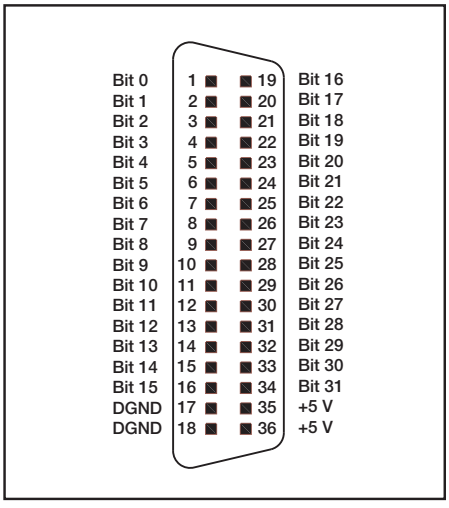
Appropriate correction factors are pre-programmed into each KPCI-3107/3108 at the factory using NIST-traceable systems. The offset change due to temperature effects on amplifiers can be corrected using the Auto Zero function in DriverLINX. This function computes new offset correction factors that will be used automatically until the board is reset or until Auto Zero is executed again.

Connector Pin Assignments

The analog input, analog output, digital input, and digital output connections are made using 2 CAB-1284CC (36-pin, IEEE-1284C-C-type) cables.



Upper I/O connector (ANALOG)
Analog I/O and auxiliary digital I/O



Lower I/O connector (DIGITAL)
High-current digital I/O

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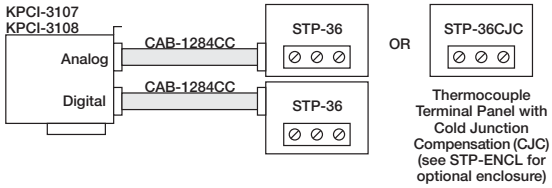
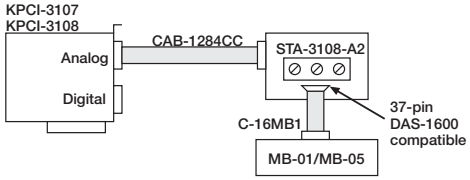
Configuration Guide

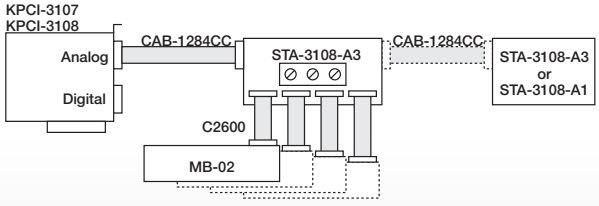
Thermocouple & Voltage Measurement
Simple straight through connection:



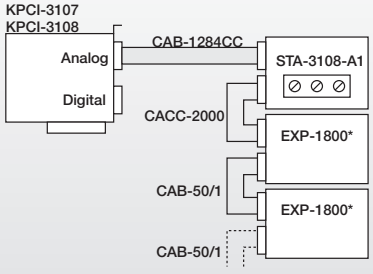
Signal Conditioning and Isolation
MB-01/MB-05 connection:



Signal Conditioning w/Channel Expansion
MB-02 connection:
Up to four MB-02 racks are supported per STA-3108-A3.
Up to four STA-3108-A3 adapters can be daisy-chained.



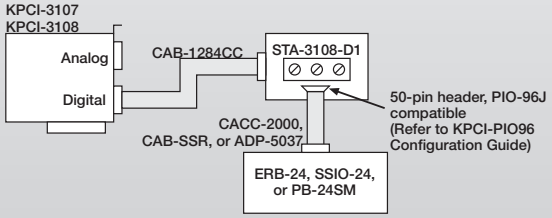
Channel Expansion
EXP-1800 connection: Up to 4 EXP-1800s are supported per STA-3108-A1.



Adding EXP-1800 will degrade the accuracy and noise specifications of the KPCI board. (System specifications are not available and depend on the configuration and environment.) Refer to the Model 2700/2750 for high channel count and high accuracy systems.

*When using the EXP-1800, a PWR-5V must be used in conjunction with a PG408A DC-DC converter.

Relay Monitoring and Control
Digital I/O accessories:



Analog Inputs

ACCURACY

RANGE (V) Bipolar	25°C ±1°C, Auto Zero On, Bipolar	1 Year, ±(% Reading + Offset) Unipolar
±10	0.0125% ± 500 µV	0.0125% ± 350 µV
±5	0.0125% ± 250 µV	0.0125% ± 175 µV
±2.5	0.0125% ± 120 µV	0.0125% ± 75 µV
±1.25	0.0125% ± 75 µV	0.0125% ± 50 µV
±1.0	0.015 % ± 50 µV	0.015 % ± 40 µV
±0.5	0.015 % ± 30 µV	0.015 % ± 25 µV
±0.25	0.015 % ± 15 µV	0.015 % ± 15 µV
±0.125	0.015 % ± 14 µV	0.015 % ± 13 µV
±0.100	0.020 % ± 13 µV	0.020 % ± 13 µV
±0.050	0.020 % ± 10 µV	0.020 % ± 10 µV
±0.025	0.020 % ± 10 µV	0.020 % ± 10 µV
±0.0125	0.020 % ± 10 µV	0.020 % ± 10 µV

NOTE: Accuracies are based on an average of 10000 samples. Add noise to get maximum uncertainty of a single sample.

SCANNING THROUGHPUT: Typical scanning rate at which switching introduces less than 0.015% of difference between adjacent readings, and typical % of difference between channels added at full speed.

COMMON MODE REJECTION: Typical analog circuit rejection ratio with 10V p-p sine wave excitation at 60Hz. Gain dependent 82dB @ Gain 1, 110dB @ Gain 800.

NUMBER OF CHANNELS: 8 differential or 16 single ended; software configurable in gain queue. Differential and single-ended readings may be mixed.

A/D FIFO BUFFER SIZE: 2048 samples.

CHANNEL GAIN QUEUE LENGTH: 256 entries.

A/D RESOLUTION: 16 bits.

INPUT RANGE SELECTION: Software selectable via channel gain queue entry. Unipolar and bipolar readings may be mixed.

INPUT OVERVOLTAGE: ±35V continuous, powered; ±15V continuous, unpowered.

INPUT BIAS CURRENT: ±1nA typical per channel @ 25°C

INPUT IMPEDANCE: >1GΩ or greater in parallel with 200pF or less, all gains.

SINGLE CHANNEL THROUGHPUT: 100kS/s (not always sustainable under Windows).

LINEARITY: Integral: ±1.5 LSB max. **Differential:** ±1 LSB max.

DATA TRANSFER MODES: DMA (PCI Bus Master), Interrupt (Target-mode transfer), Polled (Target-mode transfer).

Analog Outputs

NUMBER OF CHANNELS: 2.

RESOLUTION: 16 bits.

MAXIMUM UPDATE RATE: 100kS/s.

MONOTONICITY: 16 bits, guaranteed.

RANGE: ±10V, ±5V, 0–10V, 0–5V

ACCURACY: 0.021% of reading ±1.540mV @ 23°C.

TEMPERATURE COEFFICIENTS: Offset: 310µV/°C (typical). **Gain:** 60ppm/°C (typical).

SLEW RATE: 5V/µs.

OUTPUT CURRENT: ±5mA max.

PROTECTION: Short circuit to ground.

MAXIMUM CAPACITIVE LOAD: 100pF for 100kHz operation, typical, dependent upon ESR.

POWER UP: 0V (±75mV).

DATA TRANSFER MODES: DMA (PCI Bus Master), Interrupt (Target-mode transfer), Polled (Target-mode transfer).

D/A FIFO BUFFER SIZE: 2048 samples.

D/A CONTROL MODES:
Target Mode: Update either D/A.
Paced Mode: Update D/A converters in sequence.
Burst Mode: Update converters in sequence timed by burst counter.
Worst Case Intra-Burst Skew: 2µs (typical).

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High-Current Digital I/O

NUMBER OF BITS: 32 bits; 4 bi-directional 8-bit registers. Each byte register is separately configurable as input or output.

DATA TRANSFER MODE: Target mode.

INPUT LOW: V_{IL} = 0.8V max.; I_{IL} = –0.2mA max.

INPUT HIGH: V_{IH} = 2.0V min.; I_{IH} = 20μA max.

OUTPUT LOW: V_{OL} = 0.55V max.; I_{OL} = 64mA max.

OUTPUT HIGH: V_{OH} = 2.4V min.; I_{OH} = –8mA max.

V_{OH} = 2.0V min.; I_{OH} = –15mA max.

POWER ON STATE: Input (High-Z).

Thermocouple Inputs

NUMBER OF CHANNELS: 7 differential or 15 single-ended. CJC occupies one channel on the board.

T/C TYPE: J, K, N, T, E, R, S, B, C supported in software.

FILTERING: Moving, repeating, and weighted average supported in ExceLINX.

STP-36CJC ACCESSORY:

CJC Output: 10mV/°C.

CJC Accuracy*: ±0.5°C at 25°C; ±1.5°C over full temperature range.

CJC Channel: Channel 0 on the board.

RMS Noise: 0.05°C.

Operating Temperature: 0° to 85°C.

Power: +5V from the board.

Jumper Selection: CJC Enable/Disable, CJC Single/Differential Ended.

Dimensions: 133mm high × 72mm wide × 32mm high (5¼″ × 2¾″ × 1¼″).

Maximum Voltage: 30V rms, 42.4V peak, or 60VDC (safety rating).

Maximum Current: 1A (safety rating).

* Final thermocouple accuracy = board accuracy + CJC accuracy. Based on the volts accuracy above and degrees vs. volts lookup tables, the system accuracy is ±1°C for type J, K, T, N, and E thermocouples.

GENERAL

CONNECTORS: **Board Connector:** 3M P/N N10236-S2E2VC.
Mating Connector: 3M P/N 10136-6000ECD.

POWER INPUT:
+5V: 430mA typ., 870mA max.
+12V: 400mA typ., 500 mA max.

POWER OUTPUT: 5V; 1.0A max. (May also be limited by computer or bus capability.)

ENVIRONMENT:
Operating Temperature: 0°C to 50°C.
Nonoperating Temperature: –20°C to 70°C.
Humidity: 0 to 90% relative humidity (non-condensing), operating or nonoperating.

EMC: Conforms to European Union directive 89/336/EEC.

SAFETY: Conforms to European Union directive 73/23/ EEC (meets EN61010-1/IEC 1010).

DIMENSIONS: Standard-size PCI short card, 175mm long × 108mm wide × 19mm high (6⅞″ × 4¼″ × ¾″).

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