USB-2500 Series

USB 1 MHz, 16-Bit Data Acquisition Boards

MEASUREMENT COMPUTING

Features

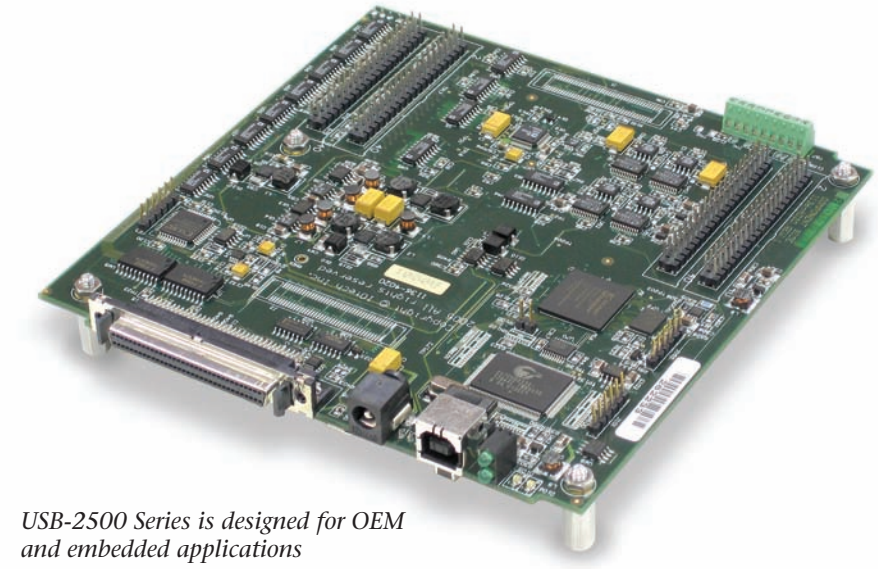
- Designed for OEM and embedded applications
- Custom versions available for OEMs (contact factory)
- 16-bit, 1 MHz A/D converter
- Up to 32 differential or 64 single-ended analog inputs, four of which can accept thermocouples
- Up to four 16-bit, 1 MHz analog outputs
- 24 high-speed digital I/O lines
- Four 32-bit counters with quadrature encoding support
- Low-latency set point control output mode
- Small, compact design (6" x 5.93")

Software

- TracerDAQ® software included for acquiring and displaying data and generating signals
- Universal Library includes support for Visual Studio® and Visual Studio® .NET, including examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET
- Comprehensive drivers for DASYLab® and NI LabVIEW™
- Supported by MATLAB® Data Acquisition Toolbox™
- InstaCal software utility for installation, calibration, and testing
- Supported Operating Systems: Windows 7/Vista/XP SP2, 32-bit or 64-bit

The USB-2500 Series offers high-speed, multifunction data acquisition in a low-cost, board-only design. Each board offers synchronous and concurrent voltage input, temperature input, waveform output, counter input, quadrature encoder input, timer output, and digital I/O. Everything necessary to begin acquiring, viewing, and storing data is included with the USB-2500, including comprehensive software support.

The USB-2500 Series feature a 16-bit/1 MHz A/D converter, up to 64 analog inputs, up to four 16-bit/1 MHz analog outputs, 24 high-speed digital I/O, 2 timer outputs, and four 32-bit counters.

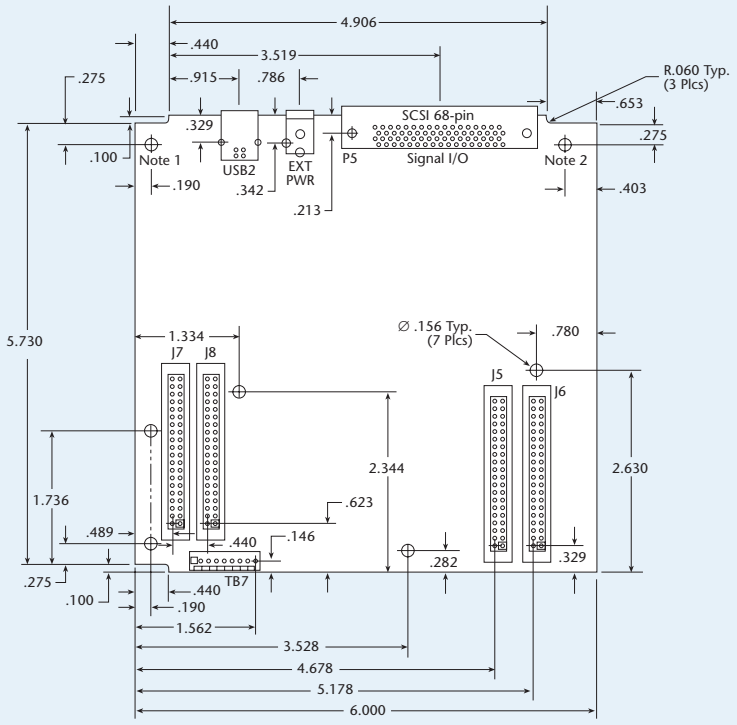


USB-2500 Series is designed for OEM and embedded applications

USB-2500 Series Selection Chart					
Model	Analog Inputs	Analog Outputs	Digital I/O	Counters	Timers
USB-2523	16 SE/8 DE	0	24	4	2
USB-2527	16 SE/8 DE	4	24	4	2
USB-2533	64 SE/32 DE	0	24	4	2
USB-2537	64 SE/32 DE	4	24	4	2

Note: Up to 4 of the analog inputs can be used to measure thermocouples

USB-2500 Physical Dimensions



In general, all standoffs should be used to mount the board to a metal frame.
Note 1: The standoff at this location connects to the USB chassis for shunting electrostatic discharge.
Note 2: The standoff at this location connects to the USB-2500 board's internal chassis plane for shunting electrostatic discharge.

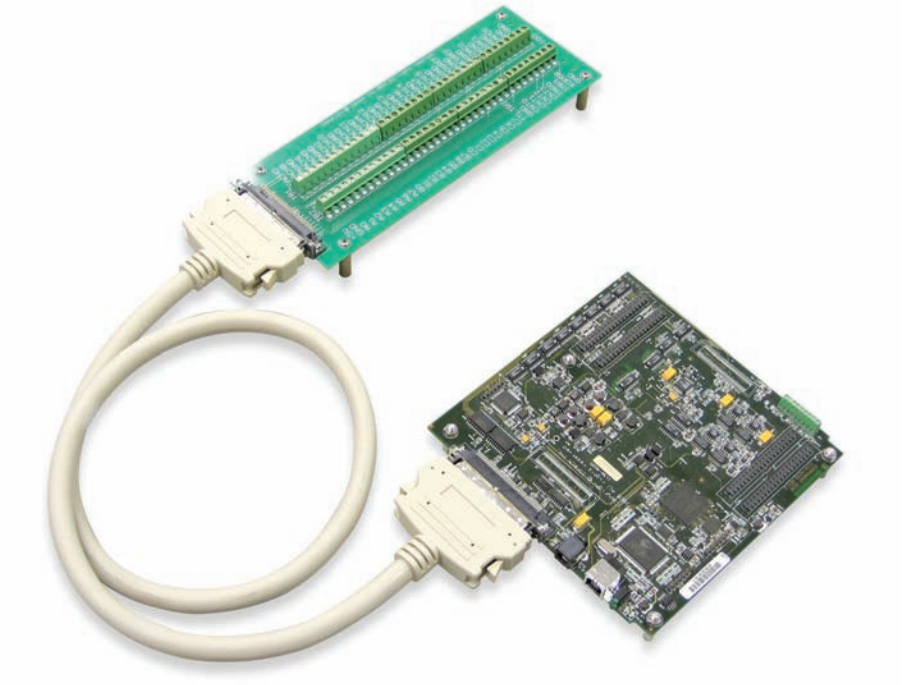
USB-2500 Series
General Information

All analog I/O, digital I/O, and counter/timer I/O can operate synchronously and simultaneously, guaranteeing deterministic I/O among all signal types.

Unique to the USB-2500 Series is a low-latency, highly deterministic control output mode that operates independent of the PC. In this mode digital, analog, and timer outputs can respond to analog, digital, and counter inputs as fast as 2 µs; at least 1,000 times faster than other products that rely on the PC for decision making.

Other Hardware Features Include:

- Encoder measurements up to 20 MHz, including Z-channel zeroing
- Frequency and pulse-width measurements with 20.83 ns resolution
- Timing mode that can measure the time between two counter inputs to 20.83 ns resolution
- Self-calibration



USB-2527 attached to a TB-100 screw-terminal board

Signal Connections

A 68-pin SCSI connector provides access to 16SE/8DE analog inputs, up to 4 analog outputs, 24 digital I/O, counters and timers. Each board is also equipped with four sets of header connectors that also provide connection to the signals on the 68-pin connector as well as an additional 48 SE/24 DE analog inputs (on the USB-2533 and USB-2537 models). These headers can be used to connect to the CA-248 cable or to custom, user-provided cables. A 4-channel screw-terminal connector is provided for using the four thermocouple inputs on the USB-2500 Series.

The TB-101 is a screw terminal board that connects directly to the 40-pin headers on the back on each board. It is secured to the board with included stand-offs. The TB-101 provides screw terminal access to up to 64 SE/32 DE analog inputs (when using a USB-2533 or USB-2537 model), up to 4 analog outputs, 24 digital I/O and all counters/timers.

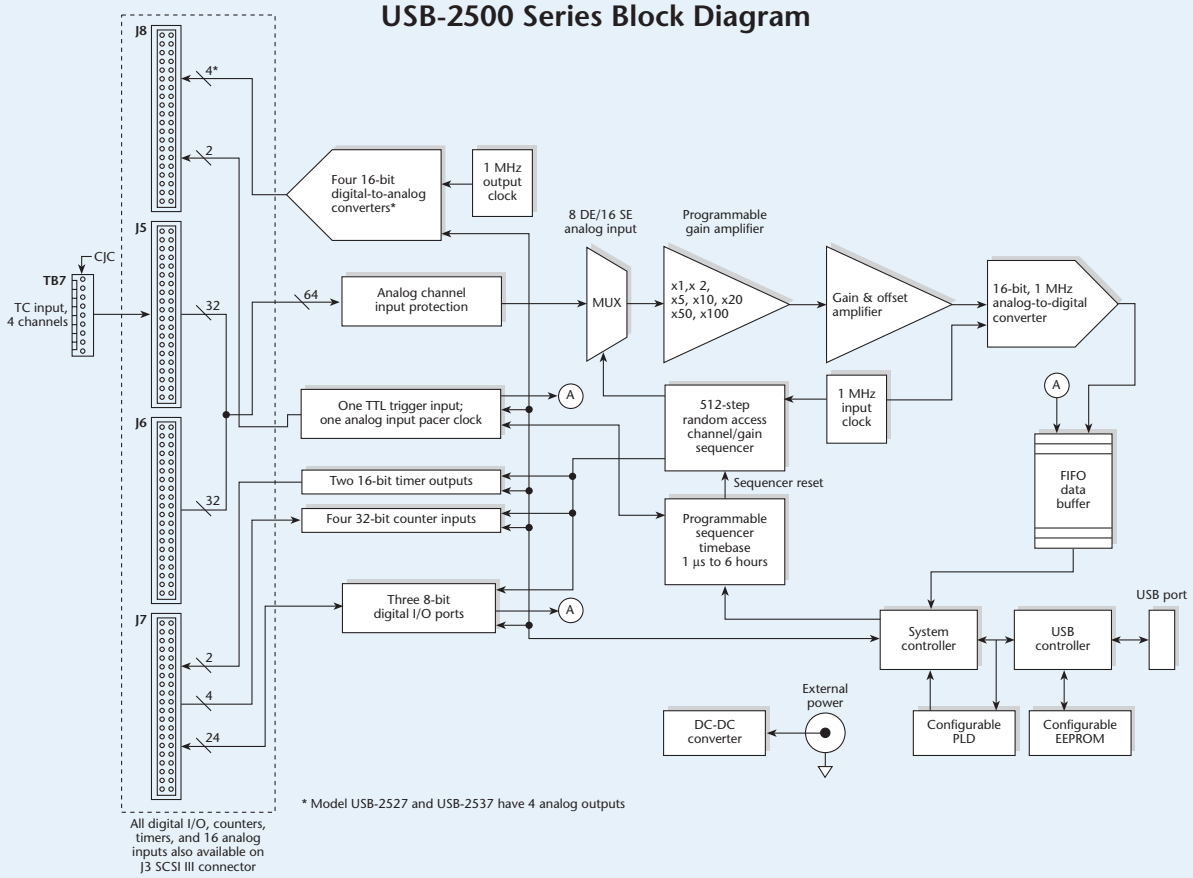
The TB-100 screw-terminal board is attached via a CA-68-xx cable to the 68-pin SCSI connector on a USB-2500 Series board. The TB-100 provides screw-terminal access to 16 SE/8 DE analog inputs, up to 4 analog outputs, 24 digital I/O, and all counters/timers. When using the TB-100 with the USB-2533 or USB-2537 models, the remaining 48 SE/24 DE analog inputs are accessed through the 40-pin headers.

USB-2527 with TB-101 screw-terminal board attached

Analog Input

The USB-2500 Series has a 16-bit, 1 MHz A/D coupled with 16 single-ended, 8 differential analog inputs (USB-2523 and USB-2527 models), 64 single-ended, or 32 differential analog inputs (USB-2533 and USB-2537 models). Four of the analog inputs can be configured as four differential thermocouple inputs (all models). Seven software programmable ranges provide inputs from ±10 V to ±100 mV full scale. Each channel can be software-configured for a different range, as well as for single-ended or differential bipolar input, or thermocouple input.

USB-2500 Series Block Diagram



Four analog inputs on the USB-2500 can accept a thermocouple (TC) input. Built-in cold-junction sensors are provided for each of the screw-terminal connectors, and any TC type can be attached to any channel. When measuring TCs the board operates in an over-sample mode, where multiple readings are taken on each TC channel, digitally filtered, cold-junction compensated, and converted to temperature. As a result, channels with TCs attached are measured at a rate from 50 Hz to 10 kHz, depending on how much over sampling is selected. In-line cycle rejection mode, over sampling occurs during one cycle of either 50 Hz or 60 Hz, providing a high level of 50 Hz or 60 Hz rejection.

Synchronous I/O

The USB-2500 Series can make analog measurements and read digital and counter inputs, while synchronously generating up to four analog outputs as well as digital pattern outputs. Digital and counter inputs do not affect the overall A/D rate because they use no time slot in the scanning sequencer. For example, an analog input channel can be scanned at the full 1 MHz A/D rate along with digital and counter input channels. The 1 MHz A/D rate is unaffected by the additional digital and counter channels. Other data acquisition devices provide no capability to scan digital/counter channels concurrent with analog channels, in which case digital and counter channels must be read asynchronously, which leads to a non-deterministic collection of data.

Input Scanning

The USB-2500 has several scanning modes to address a wide variety of applications. A 512 location scan buffer can be loaded by the user with any combination of analog input channels. All analog input channels in the scan buffer are measured sequentially at 1 µs per channel. The user can also specify that the sequence repeat immediately, or repeat after a programmable delay from 0 to 19 hours, with 20.83 ns resolution. For example, in the fastest mode, with a 0 delay, a single analog channel can be scanned continuously at 1 MS/s; two analog channels can be scanned at 500 kS/s each; 16 analog input channels can be scanned at 62.5 kS/s.

USB-2500 digital inputs and counter inputs can be read in several modes. First, via software the digital inputs, or counter inputs can be read asynchronously at anytime before, during, or after an analog input scan sequence. This mode is not deterministic as to exactly when the digital or counter input is read relative to an analog input channel.

In either of the two synchronous modes, the digital inputs and/or counter inputs are read with deterministic time correlation to the analog inputs. In the once-per-scan mode, all of the enabled digital inputs and counter inputs are read during the first analog measurement of an analog input scan sequence. The advantage of this mode as compared to most other devices is the digital and counter inputs do not consume an analog input time slot, and therefore do not reduce the available bandwidth for analog input measurements. For example, presume all 24 bits of digital input are enabled, and all four 32-bit counters are enabled, and eight channels of analog inputs are in the scan sequence at the full 1 µs/channel rate. At the beginning of each analog input scan sequence, which would be 8 µs in total duration, all digital inputs and counter inputs will be measured and transferred to the PC during the first µs of the analog scan sequence.

Another synchronous mode scans the digital inputs every time an analog input channel is scanned. For example, if eight analog inputs are scanned at 1 µs per channel continuously, and 24 bits of digital inputs are enabled, then the 24 bits of digital inputs will be scanned at 24 bits per 1 µs. If counters are enabled in this mode, they will be scanned at once per scan, in the same manner as in the prior example.

Output Timing

The digital and analog outputs on the USB-2500 can be updated asynchronously or synchronously in several modes. In the asynchronous mode, digital and analog outputs can be updated at anytime before, during, or subsequent to an analog input sequence. The maximum update rate in this mode is non-deterministic and entirely dependent on the PC processor speed, the operating system, and programming environment.

In the synchronous output modes, the outputs can be updated continuously from the PC, or as the direct result of an input from either an analog channel, digital channel, or counter channel. When updated from the PC, the user can specify the rate by which the output is updated in 20.83 ns intervals, and outputs are updated synchronously at a maximum rate of 1 µs. For example, all four 16-bit analog outputs can be generating different waveforms from PC memory, while up to 16 bits of digital pattern could be generated from PC memory concurrently. The maximum rate of output is dependent on a number of factors, including the speed of the USB implementation on the PC. Typically, a total output bandwidth of 16-bits/µs can easily be achieved.

Low-Latency Setpoint Control Mode

The other synchronous method of output associates a digital, analog, or timer output is with any input – analog, digital, or counter. The state or level of the output is determined by the level or state of an associated input. For example, a digital output can be programmed to be a logic 1 when an analog input exceeds a certain value, or when a frequency input exceeds a certain rate. In addition, hysteresis can be programmed for each limit to insure the output is stable near the transition point. Up to 8 digital outputs, 4 analog outputs, and 2 timer outputs can be programmed to respond to any analog, digital,or counter input. When analog or digital outputs are used in this mode, the user can specify two output values, determined by whether the input is above or below the limit.

The slowest rate by which an output can respond to an input is 2 µs plus the time period of a scan sequence. For example, if 4 channels of analog input are scanned continuously at 4 µs per scan, then the maximum latency between an analog input satisfying a limit, and the output responding, is 4 + 2 or 6 µs max. The worst-case response time can also be improved in several ways. For example, if a digital output is correlated to a digital input, then the worst-case latency can be reduced to 2 µs total if all digital inputs are scanned at the 1 µs rate without a delay period at the end of each scan.

In addition, an output status channel can be specified in the input scan sequence buffer so that users can correlate output state changes to their respective input channels within their data buffers and files. Adding the status channel takes no additional scan time and has no effect on the overall acquisition rate. The status channel can also be read asynchronously at any time during an acquisition for monitoring of the control outputs.

The advantage of this mode as compared to other boards is the response time can be in the range of 2 to 20 µs, vs. 1000 or more microseconds when using boards from other suppliers.

Analog Output
(USB-2527 and USB-2537 Only)

Four 16-bit, 1 MHz analog output channels are built into the USB-2500 Series with an output range from -10 V to +10 V. The maximum rate at which analog outputs can be updated is dependent on several factors, including the speed of your USB port. Typically, with the A/D operating at full 1 Mreading/s rates, one analog output can be updated continuously from PC memory at 1 MHz, or two analog outputs at 500 kHz, and four analog outputs at 250 kHz*. In addition, a program can asynchronously output a value to any of the D/As for non-waveform applications, presuming that the D/A is not already being used in the waveform output mode. Lastly, each of the analog outputs can be used in a control mode, where their output level is dependent on whether an associated analog, digital, or counter input is above or below a user-specified limit condition.

When used to generate waveforms, the D/As can be clocked in several different modes. Each D/A can be separately selected to be clocked from one of the sources described as follows.

Asynchronous Internal Clock. The on-board programmable clock can generate updates ranging from 1 MHz to once every 19 hours, independent of acquisition rate.

Synchronous Internal Clock. The rate of analog output update can be synchronized to the acquisition rate derived from 1 MHz to once every 19 hours.

Asynchronous External Clock. A user-supplied external input clock can be used to pace the D/A, entirely independent of analog inputs.

Synchronous External Clock. A user-supplied external input clock can pace both the D/A and the analog input.

Digital I/O

Twenty-four TTL-level digital I/O lines are included in the USB-2500 Series. Digital I/O can be programmed in 8-bit groups as either inputs or outputs, and can be scanned in several modes (see Input Scanning). Ports programmed as inputs can be part of the scan group and scanned along with analog input channels, or can be asynchronously accessed via the PC at any time, including when a scanned acquisition is occurring. Two synchronous modes are supported when scanned along with analog inputs. One mode is where the digital inputs are scanned at the start of each scan sequence, which means the rate at which they are scanned is dependent on the number of analog input channels, and the delay period. For example, if eight analog inputs are enabled with 0 delay period, then the digital inputs in this mode would be scanned at once per 8 µs, which is 125 kHz.

In the other synchronous mode, the enabled digital inputs are scanned synchronously with every analog input channel. So in the example above, the digital inputs would be scanned at once per µs, or 1 MHz.

If no analog inputs are being scanned, the digital inputs can be scanned at up to 12 Msamples/s.

The low-latency digital output mode allows a digital output to be updated based on the level of an analog, digital, or counter input. In this mode, the user associates a digital output bit with a specific input, and specifies the level of the input where the digital output changes state. The response time in this mode is dependent on the number of input channels being scanned, and can typically be in the range of 2 to 6 µs.

Pattern Generation

Two of the 8-bit ports can be used to generate a 16-bit digital pattern at up to 1 MHz. The digital pattern can be read from PC RAM or a file on the hard disk. Digital pattern generation is clocked in the same four modes as described with analog output.

Counter Inputs

Four 32-bit counters are built into the USB-2500 Series. Each of the four counters will accept frequency inputs up to 20 MHz, and each counter channel can be configured in a variety of modes including counter, period, pulse width, time between edges, or multi-axis quadrature encoder. The counters can concurrently monitor time periods, frequencies, pulses, and other event-driven incremental occurrences from encoders, pulse generators, limit switches, proximity switches, and magnetic pick-ups. As with all other inputs to the USB-2500 Series, the counter inputs can be read asynchronously under program control, or synchronously as part of an analog and digital scan group based either on an internal programmable timer, or an external clock source. The use of Z-channel encoders or usage of mapped channels requires that these channels need to be read synchronously.

The USB-2500 supports quadrature encoders with up to 2 billion pulses per revolution, 20 MHz input frequencies, and x1, x2, x4 count modes. With only A phase and B phase signals, 2 channels are supported. With A phase, B phase, and Z index signals, 1 channel is supported. Each input can be debounced from 500 ns to 25.5 ms (total of 16 selections) to eliminate extraneous noise or switch induced transients. Encoder input signals must be within -15 V to +15 V and the switching threshold is TTL (1.3 V).

Timer Outputs

Two 16-bit timer outputs are built into the USB-2500, each capable of generating different square waves with a programmable frequency range from 16 Hz to 1 MHz.

* If waveform output throughput is critical to your application, contact factory for the most recent update on multi-channel DAC output rates

USB-2500 Series
Specifications

Voltage Range*	Accuracy ±(% of reading + % Range) 23 °C ±10 °C, 1 year	Temperature Coefficient ±(ppm of reading + ppm Range)/°C -30 °C to 13 °C and 33 °C to 70 °C	Noise** (cts RMS)
-10 V to 10 V	0.031% + 0.008%	14 + 8	2.0
-5 V to 5 V	0.031% + 0.009%	14 + 9	3.0
-2 V to 2 V	0.031% + 0.010%	14 + 10	2.0
-1 V to 1 V	0.031% + 0.02%	14 + 12	3.5
-500 mV to 500 mV	0.031% + 0.04%	14 + 18	5.5
-200 mV to 200 mV	0.036% + 0.05%	14 + 12	8.0
-100 mV to 100 mV	0.042% + 0.10%	14 + 18	14.0

* Specifications assume differential input single channel scan, 1 MHz scan rate, unfiltered, CMV=0.0 V, 30 minute warm-up, exclusive of noise, range -FS to +FS

** Noise reflects 10,000 samples at 1 MHz, typical, differential short

Specifications

General

Power Consumption (per board)	
Model	Power Consumption (Typical)†
USB-2527	3000 mW
USB-2523	2000 mW
USB-2537	3400 mW
USB-2533	2400 mW

† An optional power supply (MCC p/n PS-9V1AEPS-2500) is required if the USB port cannot supply adequate power. USB 2.0 ports are, by USB 2.0 standards, required to supply 2500 mW (nominal at 5 V, 500 mA).

Environment
Operating Temperature: -30 to +70 ˚C; Storage **Temperature:** -40 to +80 ˚C
Relative Humidity: 0 to 95% non-condensing
Communications Speed: USB 2.0 high-speed mode (480 Mbps) if available, otherwise, USB 1.1 full-speed mode (12 Mbps)
Acquisition Data Buffer: 1 MSample
Vibration: MIL STD 810E Category 1 and 10
Signal I/O Connectors: 68-pin standard "SCSI type III" female connector (P5); four 40-pin headers (J5, J6, J7, J8), AMP# 2-103328-0
Temperature Measurement Connector: 4-channel TC screw-terminal block (TB7); Phoenix # MPT 0.5/9-2.54
External Power
Connector: Switchcraft#RAPC-712
Power Range: 6 to 16 VDC (used when USB port supplies insufficient power, or when an independent power supply is desired)
Over-Voltage: 200 V for 10 seconds, max
Dimensions: 152.4 mm W x 150.62 mm D (6.0" x 5.93")
Weight: 147 g (0.32 lbs)

Analog Inputs

Channels: 16 single-ended or 8 differential, programmable on a per-channel basis as single-ended or differential; 4 differential channels can be assigned to thermocouples
Over-Voltage Protection: ±30 V without damage
Voltage Measurement Speed: 1 µs per channel
Ranges: Software or sequencer selectable on a per-channel basis, ±10 V, ±5 V, ±2 V, ±1 V, ±0.5 V, ±0.2 V, ±0.1 V
Input Impedance: 10 MOhm single-ended; 20 MOhm differential
Total Harmonic Distortion: -80 dB, typ for ±10 V range, 1 kHz fundamental
Signal to Noise and Distortion: 72 dB, typ for ±10 V range, 1 kHz fundamental
Bias Current: 40 pA typ (0 to 35 ˚C)
Crosstalk: -67 dB typ DC to 10 kHz
Common Mode Rejection: -70 dB typ DC to 1 kHz

Maximum Usable Input Voltage + Common Mode Voltage††	
Ranges	Maximum (CMV + Vin)
5, 10 V	10.5 V
0.1, 0.2, 0.5, 1, 2 V	6.0 V

†† USB-2533 and USB-2537 each support a total of 64 SE (or 32 DE) channels

TC Types and Accuracy[1]

TC Type	Temperature Range (˚C)	Accuracy (±˚C)	Noise, Typical (±˚C)
J	-200 to +760	1.7	0.2
K	-200 to +1200	1.8	0.2
T	-200 to +400	1.8	0.2
E	-270 to +650	1.7	0.2
R	-50 to +1768	4.8	1.5
S	-50 to +1768	4.7	1.5
N	-270 to +1300	2.7	0.3
B	+300 to +1400	3.0	1.0

1. Assumes 16384 oversampling applied, CMV = 0.0 V, 60 minute warm-up, still environment, and 25 ˚C ambient temperature; excludes thermocouple error; TC_{IN} = 0 ˚C for all types except B (1000 ˚C), PS-9VIAEPS-2500 for External Power.

A/D Specifications

Type: Successive approximation
Resolution: 16 bit
Maximum Sample Rate: 1 MHz
Nonlinearity (Integral): ±2 LSB max
Nonlinearity (Differential): ±1 LSB max

Input Sequencer

Analog, digital, and counter inputs can be scanned synchronously, based on either an internal programmable timer, or an external clock source. Analog and digital outputs can be synchronized to either of these clocks.

Scan Clock Sources: 2
Note: The maximum scan clock rate is the inverse of the minimum scan period. The minimum scan period is equal to 1 µs times the number of analog channels. If a scan contains only digital channels then the minimum scan period is 250 ns.
1. Internal, programmable
Analog Channels from 1 µs to 19 hours in 20.83 ns steps
Digital Channels and Counters from 250 ns to 19 hours in 20.83 ns steps
2. External, TTL level input
Analog Channels down to 1 µs min
Digital Channels and counters down to 250 ns min
Programmable Parameters per Scan: Channel (random order), gain
Depth: 512 locations
On-Board Channel-to-Channel Scan Rate:
Analog: 1 MHz max
Digital: 4 MHz if no analog channels are enabled, 1 MHz with analog channels enabled

External Acquisition Scan Clock Input

Maximum Rate: 990 kHz
Clock Signal Range: Logical zero 0 V to 0.8 V; logical one 2.4 V to 5.0 V
Minimum Pulse Width: 50 ns high, 50 ns low

Triggering

Trigger Sources: 7, individually selectable for starting and stopping an acquisition. Stop acquisition can occur on a different channel than start acquisition; stop acquisition can be triggered via modes 2, 4, 5, or 6 described below.
1. Single-Channel Analog Hardware Trigger
Any analog input channel can be software programmed as the analog trigger channel, including any of the analog expansion channels.
Input Signal Range: -10 to +10 V max
Trigger Level: Programmable; 12-bit resolution
Hysteresis: Programmable; 12-bit resolution
Latency: 350 ns typ, 1.3 µs max
Accuracy: ±0.5% of reading, ±2 mV offset
Noise: 2 mV RMS
2. Single-Channel Analog Software Trigger
Any analog input channel, including any of the analog expansion channels, can be selected as the software trigger channel. If the trigger channel involves a calculation, such as temperature, then the driver automatically compensates for the delay required to obtain the reading, resulting in a maximum latency of one scan period.
Input Signal Range: Anywhere within the range of the selected trigger channel
Trigger Level: Programmable; 16-bit resolution, including "window triggering"
Latency: One scan period max
3. Single-Channel Digital Trigger
A separate digital input is provided for digital triggering.
Input Signal Range: -15 V to +15 V
Trigger Level: TTL
Minimum Pulse Width: 50 ns high, 50 ns low
Latency: 100 ns typ, 1.1 µs max

4. **Digital Pattern Triggering**
   8- or 16-bit pattern triggering on any of the digital input ports. Programmable for trigger on equal, above, below, or within/outside of a window. Individual bits can be masked for "don't care" condition.
   Latency: One scan period max
5. **Counter/Totalizer Triggering**
   Counter/totalizer inputs can trigger an acquisition. User can select to trigger on a frequency or on total counts that are equal, above, below, or within/outside of a window.
   Latency: One scan period, max
6. **Software Triggering**
   Trigger can be initiated under program control.
7. **Multi-Channel Triggering**
   Up to 16 channels can be used to generate a trigger condition for any combination of analog, digital, or counter inputs. Multiple channels can either be combined in a logical "or" or "and" condition, with hysteresis programmable per channel. Maximum latency in this mode is one scan period.

Analog Outputs (USB-2527 and USB-2537 models only)

Analog output channels are updated synchronously relative to scanned inputs, and clocked from either an internal clock, or an external clock source. Analog outputs can also be updated asynchronously, independent of any other scanning in the system. Streaming from disk or memory is supported, allowing continuous waveform outputs (limited only by available PC system resources).

Channels: 4 DAC channels (DAC0, DAC1, DAC2, DAC3)
Resolution: 16 bits
Data Buffer: PC-based memory
Output Voltage Range: ±10 V
Output Current: ±1 mA max; sourcing more current (1 to 10 mA) may require a PS-9VIAEPS-2500 power adapter option
Offset Error: ±0.0045 V max
Digital Feedthrough: <10 mV when updated
DAC Analog Glitch: <12 mV typ at major carry
Gain Error: ±0.01%
Update Rate: 1 MHz max, 19 hours min (no minimum with external clock); resolution 20.83 ns
Settling Time: 2 µs to rated accuracy
Clock Sources: 4 programmable
1. Onboard D/A clock, independent of scanning input clock
2. Onboard scanning input clock
3. External D/A input clock, independent of external scanning input clock
4. External scanning input clock

Digital I/O

Channels: 24
Ports: 3 x 8-bit, each port is programmable as input or output
Input Scanning Modes: 2 programmable
1. Asynchronous, under program control at any time relative to input scanning
2. Synchronous with input scanning

Input Characteristics: 220 Ohm series resistor, 20 pF to common
Logic Keeper Circuit: Holds the logic value to 0 or 1 when there is no external driver
Input Protection: ±15 kV ESD clamp diodes parallel
Input Levels
Low: 0 to 0.8 V
High: +2.0 V to +5.0 V
Output Levels
Low: < 0.8 V
High: >2.0 V
Output Characteristics: Output 1.0 mA per pin; sourcing more current may require a PS-9VIAEPS-2500 power adapter option
Sampling: 4 MHz max
Update Rate: 4 MHz max, 19 hours min (no min with external clock); resolution 20.83 ns

Pattern Generation Output

Two of the 8-bit ports can be configured for 16-bit pattern generation. The pattern can also be updated synchronously with an acquisition at up to 4 MHz.

Counter

Each of the four high-speed, 32-bit counter channels can be configured for counter, period, pulse width, time between edges, or multi-axis quadrature encoder modes. Counter inputs can be scanned synchronously along with analog and digital scanned inputs, based on an internal programmable timer, or an external clock source.

Channels: 4 x 32-bit
Input Frequency: 20 MHz max
Input Signal Range: -5 V to +10 V
Input Characteristics: 10 kOhm pull-up, 200 Ohm series resistor, ±15 kV ESD protection
Trigger Level: TTL
Minimum Pulse Width: 25 ns high, 25 ns low
Debounce Times: 16 selections from 500 ns to 25.5 ms; positive or negative edge sensitive; glitch detect mode or debounce mode
Time Base Accuracy: 50 ppm (0 to 50 ˚C)
Five Programmable Modes: Counter, Period, Pulsewidth, Timing, Encoder
Counter Mode Options: Totalize, Clear on Read, Rollover, Stop at all Fs, 16- or 32-bit, any other channel can gate or decrement the counter
Period Mode Options: Measure x1, 10, 100, or 1000 periods, 16- or 32-bit, time bases to choose from: 20.83 ns, 208.3 ns, 2.083 µs, 20.83 µs, any other channel can gate the period measurement
Pulsewidth Mode Options: 16- or 32-bit values, 4 time bases to choose from: 20.83 ns, 208.3 ns, 2.083 µs, 20.83 µs, any other channel can gate the pulsewidth measurement
Timing Mode Options: 16- or 32-bit values, 4 time bases to choose from: 20.83 ns, 208.3 ns, 2.083 µs, 20.83 µs
Encoder Mode Options: x1, 2, 4 options, 16- or 32-bit values, Z-channel clearing of counter, any other channel can gate the counter
Multi-axis Quadrature Encoder Inputs:
- 1 channel with A (phase), B (phase), and Z (index)
- 2 channel with A (phase) and B (phase)
- x1, x2, and x4 count modes
- Single-ended TTL

Frequency/Pulse Generators

Channels: 2 x 16-bit
Output Waveform: Square wave
Output Rate: 1 MHz base rate divided by 1 to 65,535 (programmable)
High-Level Output Voltage: 2.0 V min @ -1.0 mA; 2.9 V min @ -400 µA
Low-Level Output Voltage: 0.4 V max @ 400 µA

Calibration

2 years recommended.

USB-2500 Series
Ordering Information

Ordering Information

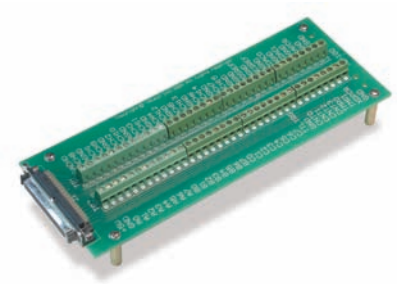
Description	Part No.
USB-based DAQ device with 16 SE/8 DE analog inputs, 1 MS/s throughput; 24 digital I/O lines; four 32-bit counter input channels; and four thermocouple inputs	USB-2523
USB-based 16-channel analog input device, 1 MS/s throughput; 24 digital I/O lines; four 32-bit counter input channels; and four 16-bit, 1 MS/s analog outputs	USB-2527
USB-based 64 single-ended/32 differential analog inputs, 1 MS/s throughput; 24 digital I/O lines; four 32-bit counter input channels and 4 thermocouple inputs	USB-2533
USB-based 64 SE/32 DE analog inputs; 1 MS/s throughput; 24 digital I/O lines; four 32-bit counter inputs; four 16-bit, 1 MS/s analog output channels; and 4 thermocouple inputs	USB-2537

Accessories & Cables

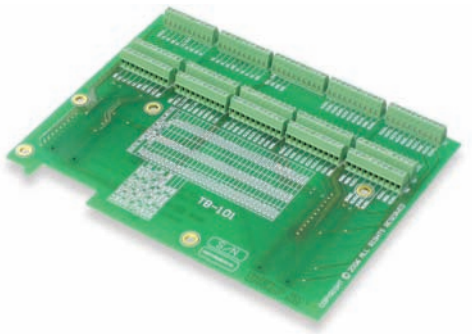
Termination board with screw-terminals for access to USB-2500 Series I/O; connects via a CA-68-3R, CA-68-3S, or CA-68-6S cable	TB-100
Termination board with screw terminals for access to USB-2500 Series I/O; mates directly with board and includes mounting stand-offs	TB-101
External power supply, 90 to 264 VAC	PS-9VIAEPS-2500
68-conductor ribbon expansion cable from USB-2500 Series boards to TB-100, 3 ft.	CA-68-3R
68-conductor shielded cable from USB-2500 Series boards to TB-100, 3 ft.	CA-68-3S
68-conductor shielded cable from USB-2500 Series boards to TB-100, 6 ft.	CA-68-6S
Ribbon cable, 40-pin header to 37-pin DSUB, 9 in.	CA-248

Software

Icon-based data acquisition, graphics, control, and analysis software	DASYLab



TB-100, termination board with screw terminals, provides access to USB-2500 Series I/O.



TB-101, termination board with screw terminals, provides access to all USB-2500 Series I/O. The TB-101 mounts directly onto the board with included hardware.