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1-MHz, 16-Bit USB Data Acquisition Modules



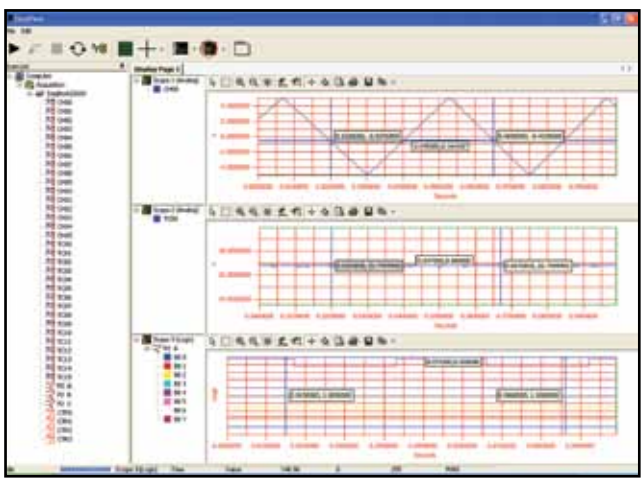
OMB-DAQ-3000 Series

1 YEAR WARRANTY

- 1-MHz, 16-Bit Multifunction USB Modules
- Synchronous Analog Input, Analog Output, Digital I/O, and Counter/Timer I/O
- 8 Differential or 16 Single-Ended Analog Inputs (Software-Selectable per Channel)
- Thermocouple or Voltage Input on Any Analog Channel
- User-Expandable up to 64SE/32DE Analog Inputs, Including Thermocouple Measurements
- Up to four 16-Bit, 1-MHz Analog Outputs
- 24 High-Speed Digital I/O Lines
- Four 32-Bit Counter Input Channels with Quadrature Encoder Capability
- Low-Latency Control Output Capability (as Low as 2 µs Latency)

Software

- Includes DaqView Software for Instant Set-Up, Real-Time Viewing, Data Logging and Frequency Domain Analysis, Compatible with Windows XP/Vista/7 (32-Bit and 64-Bit)
- Support for Visual Studio and Visual Studio .NET, including examples for Visual C++, Visual C#, Visual Basic and Visual Basic .NET



DAQVIEW software included with the OMB-DAQ-3000 Series.

- Comprehensive Drivers for DASYLab and LabVIEW
- DaqCal Software Application for Easy User Calibration

The OMB-DAQ-3000 Series offers high-speed, multifunction data acquisition in a low-cost, portable package. The module offers synchronous and concurrent voltage input, temperature input, waveform output, counter input, quadrature encoder input, timer output and digital I/O. Everything needed to begin acquiring, viewing and storing data is included with the OMB-DAQ-3000 Series, including comprehensive software support.

The OMB-DAQ-3000 features a 16-bit/1-MHz A/D converter, 16 analog input channels user- expandable to 64, up to four 16-bit/1-MHz analog outputs, 24 high-speed digital I/O, 2 timer outputs and four 32-bit counters. 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 OMB-DAQ-3000 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 1000 times faster than other products that rely on the PC for decision making.

Software

Included with the OMB-DAQ-3000 is new DaqView software, a comprehensive application that enables set-up, data logging and real-time data viewing without requiring any programming skills.

The DaqView software also includes additional features such as direct-to-Excel enhancements (compatible with 32-bit operating systems only), FFT analysis, and statistics.

To Order, Call 1-800-327-4333SM or 1-800-DAS-IEEE or Shop Online at omega.comSM



OMB-DAQ-3000 with OMB-PDQ30 shown smaller than actual size.

Also included with the OMB-DAQ-3000 is a complete set of drivers and detailed sample programs for the most popular programming languages and software packages. Driver support includes Visual Basic, C/C++, LabVIEW and DASYLab. DaqCOM provides Windows-based ActiveX/ COM-based programming tools for Microsoft Visual Studio and Visual Studio.NET.

Analog Input

The OMB-DAQ-3000 has a 16-bit, 1-MHz A/D coupled with 16 single-ended inputs, 8 differential analog inputs, or 8 differential thermocouple inputs.

Seven software-programmable ranges provide inputs from 10V 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. The hybrid PGIA on the OMB-DAQ-3000 is guaranteed to settle to the specified accuracy while operating at the full 1 M sample/s rate.

Every analog input on the OMB-DAQ-3000 or on the OMB-PDQ30 expansion option can accept a thermocouple (TC) input. Built-in cold-junction sensors are provided for each of the removable screw-terminal connectors, and any TC type can be attached to any channel. When measuring TCs, the OMB-DAQ-3000 operates in an over-sample mode, where multiple readings 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 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.

Analog Channel Expansion

Adding additional analog input channels for the OMB-DAQ-3000 is easy using the optional OMB-PDQ30 expansion module. The OMB-PDQ30 connects to the OMB-DAQ-3000 by either plugging directly into the expansion connector or via a cable (OMB-CA-96A) if distance is required between the two units.

The OMB-PDQ30 provides an additional 48SE/24DE analog inputs or 24 differential thermocouple inputs, software-configured on a per- channel basis. The total channel capacity with a OMB-PDQ30 attached is 64 single-ended or 32 differential inputs.

Synchronous I/O

The OMB-DAQ-3000 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.

Input Scanning

The OMB-DAQ-3000 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.

Output Timing

The digital and analog outputs on the OMB-DAQ-3000 can be updated asynchronously or synchronously in several modes.

In asynchronous mode, digital and analog outputs can be updated before, during or after an analog input sequence. The maximum update rate in this mode is non-deterministic and is entirely dependent on the PC processor speed, the operating system and programming environment.

In synchronous output modes, outputs can be updated continuously from the PC or in response to an input from an analog channel, digital channel or counter channel.

When updated from the PC, the user can specify the rate at which the output is updated in 20.83 ns intervals. Outputs are updated synchronously at a maximum rate of 1 µs.

OMB-DAQ-3000 Series Selection Chart					
Model Number	**Analog Inputs**	**Input Ranges**	**Digital I/O**	**Analog Outputs**	**Counter/Timers**
OMB-DAQ-3005	16SE/8DE	7	24	0	4/2
OMB-DAQ-3000	16SE/8DE	7	24	2	4/2
OMB-DAQ-3001	16SE/8DE	7	24	4	4/2
OMB-DAQ-3005 & OMB-PDQ30	64SE/32DE	7	24	0	4/2
OMB-DAQ-3000 & OMB-PDQ30	64SE/32DE	7	24	2	4/2
OMB-DAQ-3001 & OMB-PDQ30	64SE/32DE	7	24	4	4/2

Low-Latency Setpoint Control Mode

The other synchronous method of output is where either a digital, analog, or timer output is associated with any analog, digital or counter. The state or level of the output is determined by the level or state of an associated input.

Triggering

The OMB-DAQ-3000 supports a full complement of trigger modes to accommodate any measurement application.

Calibration

Every range on the OMB-DAQ-3000 is calibrated from the factory using a digital NIST traceable calibration method. This method works by storing a correction factor for each range on the unit at the time of calibration.

Included with each OMB-DAQ-3000 is DaqCal sofwtare, an easy-to-operate software package that allows the users to calibrate their OMB-DAQ-3000.

Analog Output (OMB-DAQ-3000 and 3001 Only)

Two or four 16-bit, 1-MHz analog output channels are built into the OMB-DAQ-3000 with an output range from -10 to +10V. The maximum rate at which analog outputs can be updated depends on several factors, including the speed of the USB port. Typically, with the A/D operating at full 1 M reading/s rates, one analog output can be updated continuously from PC memory at 1 MHz, or two analog outputs at 500 kHz or four analog outputs at 250 kHz. If waveform output throughput is critical to your application, contact OMEGA for the most recent update on multi-channel DAC output rates.

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 the 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 following sources.

Asynchronous Internal Clock

The on-board programmable clock can generate updates ranging from once every 19 hours to 1 MHz, independent of any 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

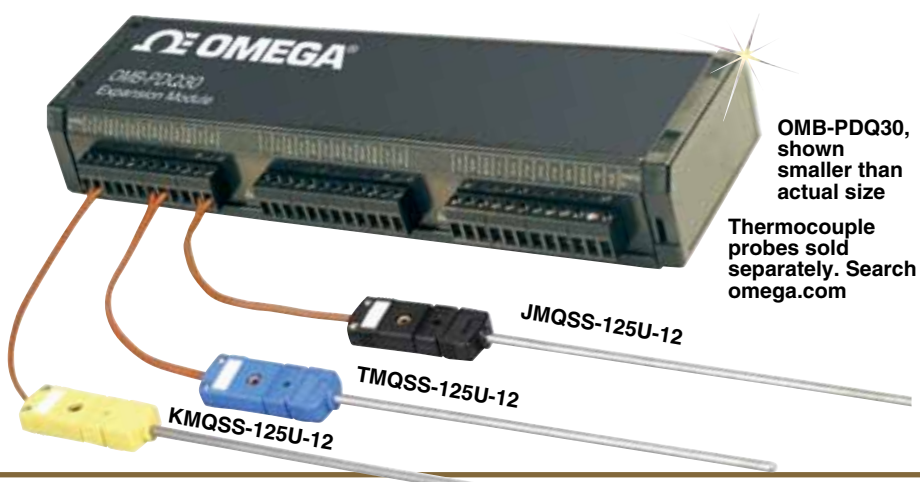
A user-supplied external input clock can pace both the D/A and the analog input.

Digital I/O

Twenty-four TTL-level digital I/O lines are included in the OMB-DAQ-3000. Digital I/O can be programmed in 8-bit groups as either inputs or outputs and they 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 they 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. In one of these modes, 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.

Pattern Generation

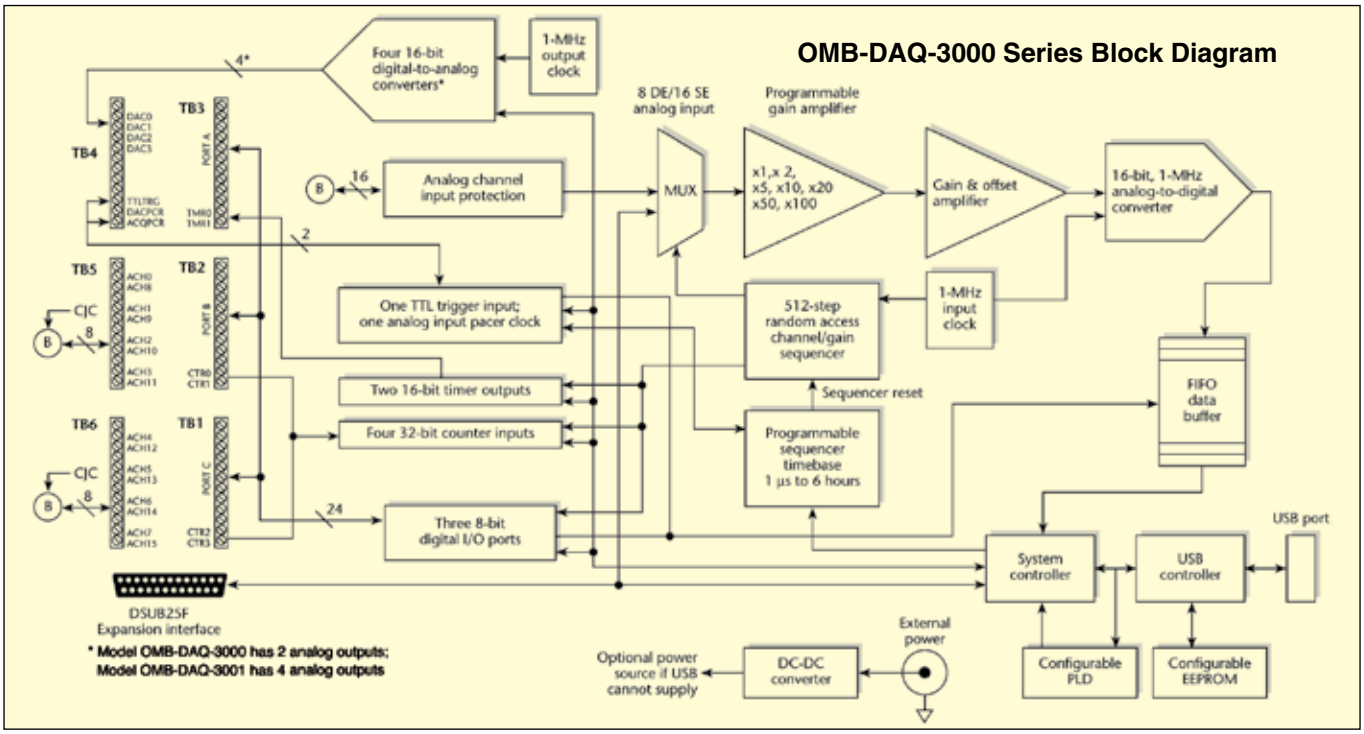
Two of the 8-bit ports can be used to generate a 16-bit digital pattern at up to 1 MHz. The digital pattern can be read from PC RAM or a file on the hard disk. Digital pattern generation is clocked in the same four modes as was described with analog output.



OMB-PDQ30, shown smaller than actual size

Thermocouple probes sold separately. Search omega.com

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Counter Inputs

Four 32-bit counters are built into the OMB-DAQ-3000. Each will accept frequency inputs of 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 OMB-DAQ-3000, 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 on an external clock source.

The OMB-DAQ-3000 supports quadrature encoders with up to 2 billion pulses per revolution, 20 MHz input frequencies, and x1, x2, x4 count modes. Encoder input signals must be within -15 to 15V and the switching threshold is TTL (1.3V).

Timer Outputs

Two 16-bit timer outputs are built into the OMB-DAQ-3000, each capable of generating different square waves with a programmable frequency range from 16 Hz to 1 MHz.

General Specifications

Environment:

Operating Temperature: -30 to 70°C (-54 to 158°F)

Storage Temperature: -40 to 80°C (-40 to 176°F)

Relative Humidity: 0 to 95% non-condensing

Communications: USB 2.0 high-speed mode (480 Mbps), if available, otherwise USB1.1 full-speed mode (12 Mbps)

Acquisition Data Buffer: 1 MSample

Vibration: MIL STD 810E category 1 and 10

Signal I/O Connector: 6 banks of removable screw-terminal blocks

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: 20V for 10 seconds, maximum

Expansion Connector: 25-pin DSUB, female

Dimensions: 269 W x 92 D x 45 mm H (10.6 x 3.6 x 1.6")

Weight: 431 g (0.95 lb)

ANALOG INPUTS

Channels: 16 single-ended or 8 differential, programmable on a per-channel basis as single-ended or differential

Expansion: An additional 48 analog inputs per board via optional OMB-PDQ30 module; expansion channels have identical features as the main board channels

Expansion Connector: 25-pin, DSUB, female

Over-Voltage Protection: ±30 V without damage

Voltage Measurement Speed: 1 µs per channel

Temperature Measurement Speed: Programmable from 100 µs to 20 ms per channel

Ranges: Software or sequencer selectable on a per-channel basis, ±10V, ±5V, ±2V, ±1V, ±0.5V, ±0.2V, ±0.1V

Power Consumption[1]	
Model Number	**Power Consumption Typical)[2]**
OMB-DAQ-3000	2500 mW
OMB-DAQ-3001	3000 mW
OMB-DAQ-3005	2000 mW
OMB-DAQ-3000 and OMB-PDQ30	2900 mW
OMB-DAQ-3001 and OMB-PDQ30	3400 mW
OMB-DAQ-3005 and OMB-PDQ30	2400 mW

1. The power consumption listed is for a single OMB-DAQBOARD-3000 Series device, or for a single device connected to a OMB-PDQ30 expansion module
2. An optional power adapter (OMB-TR-2U) will be required if the USB port cannot supply adequate power. USB2 ports are by USB2 standards, required to supply 2500 mW (nominal at 5V, 500 mA).



OMB-DAQ-3000 shown smaller than actual size

Input Impedance: 10MΩ single-ended; 20 MΩ differential

Total Harmonic Distortion: -80 dB typical for ±10V range, 1 kHz fundamental

Signal-to-Noise and Distortion: 72 dB typ for ±10V range, 1 kHz fundamental

Bias Current: 40 pA typical (0 to 35˚C)

Crosstalk: -75 dB typical DC to 60 Hz; -65 dB typical @10 kHz

Common Mode Rejection: -70 dB typical DC to 1 kHz

A/D SPECIFICATIONS

Type: Successive approximation

Resolution: 16-bit

Maximum Sample Rate: 1 MHz

Nonlinearity (Integral): ±2 LSB maximum

Nonlinearity (Differential): ±1 LSB maximum

INPUT SEQUENCER

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

Programmable Parameters per Scan: Channel (random order), gain

Depth: 512 locations

On-Board Channel-to-Channel Scan Rate:

Analog: 1 MHz maximum

Digital: 4 MHz if no analog channels are enabled, 1 MHz with analog channels enabled

EXTERNAL ACQUISITION SCAN CLOCK INPUT

Maximum Rate: 1.0 MHz

Clock Signal Range: Logical zero 0 to 0.8V; logical one 2.4 to 5.0V

Minimum Pulse Width: 50 ns high, 50 ns low

TRIGGERING

Trigger Sources: 6, 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.

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.

3. Single-Channel Digital Trigger

A separate digital input is provided for digital triggering.

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.

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.

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 inputs, digital inputs or counter inputs.

ANALOG OUTPUTS (OMB-DAQ-3000 and 3001 only)

Analog output channels are updated synchronously relative to scanned inputs, and clocked from either an internal on-board 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, nearly infinite-length waveform outputs (limited only by available PC system resources).

Channels: OMB-DAQ-3000, 2; OMB-DAQ-3001, 4

Resolution: 16-bits

Data Buffer: PC-based memory

Output Voltage Range: ±10V

Output Current: ±1 mA; sourcing more current (1 mA to 10 mA) may require OMB-TR-2 power adaptor)

Offset Error: ±0.0045V max

Digital Feedthrough: <10 mV when updated

DAC Analog Glitch: <12 mV typical at major carry

Gain Error: ±0.01%

Update Rate: 1 MHz max, 19 hrs min (no minimum with external clock), resolution 20.83 ns, 250 kHz if all 4 DACs enabled

Settling Time: 2 µs to rated accuracy

Clock Sources: 4, programmable

1. On-board 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

THERMOCOUPLE TYPES AND ACCURACY [1]

Thermoucouple	Temperature Range °C	Accuracy (±°C)	Noise (±°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
B	300 to 1400	3.0	1.0
N	-270 to 1300	2.7	0.3

1. Assumes 16384 over sampling applied, CMV=0.0V, 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), OMB-TR-2 for external power

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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 to 10V	0.031% + 0.008%	14 + 8	2.0
-5 to 5V	0.031% + 0.009%	14 + 9	3.0
-2 to 2V	0.031% + 0.010%	14 + 10	2.0
-1 to 1V	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=0.0V, 30 minutes warm-up, exclusive of noise, range -FS to +FS ** Noise reflects 10,000 samples at 1-MHz, typical, differential short*

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: 10KΩ pull up to 5V, 20 pF to common
Input Characteristics:
220Ω series resistor, 20 pF to common
Input Protection: ±15 kV ESD clamp diodes
Input Levels:
Low: 0 to 0.8V
High: 2.0 to 5.0V
Output Levels:
Low: <0.8V
High: >2.0V
Output Characteristics:
Output 1.0 mA per pin
Sampling/Update Rate:
4 MHz max

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 1 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: -15 to 15V
Input Characteristics:
10K pull up, ±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

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:
2.0V min @ -1.0 mA; 2.9V min @ -400 µA
Low-Level Output Voltage:
0.4V max @ 400 µA
OMB-PDQ30 Expansion Module
See the OMB-PDQ30 data sheet for complete specifications

Maximum Usable Input Voltage + Common Mode Volage	
Ranges	**Maximum (CMV + Vin)**
0.5, 1, 2, 5, 10V	10.5V
0.1, 0.2V	2.1V

Accessories and Cables

Model Number	Description
OMB-CA-96A	OMB-DAQ-3000 Series to OMB-PDQ30 Cable, 0.6 m (2')
OMB-CA-179-1	USB cable, 1 m (3')
OMB-CA-179-3	USB cable, 3 m (10')
OMB-CA-179-5	USB cable, 5 m (16')
OMB-CN-153-12	Spare terminal block
OMB-TR-2U	External power supply
OMB-PDQ10	DIN rail mounting adaptor for OMB-DAQ-3000

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Model Number	Description
OMB-DAQ-3005	16-bit, 1-MHz USB data acquisition module with 16 analog inputs, 24 digital I/O, four counters, and two timers; includes DaqView software, support for Visual Studio and Visual Studio .NET, with examples for Visual C++, Visual C#, Visual Basic and Visual Basic .NET; drivers for DASYLab and LabVIEW; DaqCal software application.
OMB-DAQ-3000	Same as OMB-DAQ-3005 but with two 16-bit, 1-MHz analog outputs
OMB-DAQ-3001	Same as OMB-DAQ-3005 but with four 16-bit, 1-MHz analog outputs
OMB-PDQ30	Analog input expansion module, adds 48SE/24DE channels to OMB-DAQ-3000 Series

Comes complete with with DaqView software, software drivers and operator's manual on CD ROM.
USB cable required (ordered separately).

***Ordering Example: OMB-DAQ-3000** Personal DAQ USB data acquisition module and **OCW-1** OMEGACARE℠ extends standard 1-year warranty for a total of 2 years, with **OMB-PDQ30** expansion module and **OCW-1** OMEGACARE℠ extends standard 1-year warranty for a total of 2 years, and **OMB-CA-179-1** USB cable.*

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