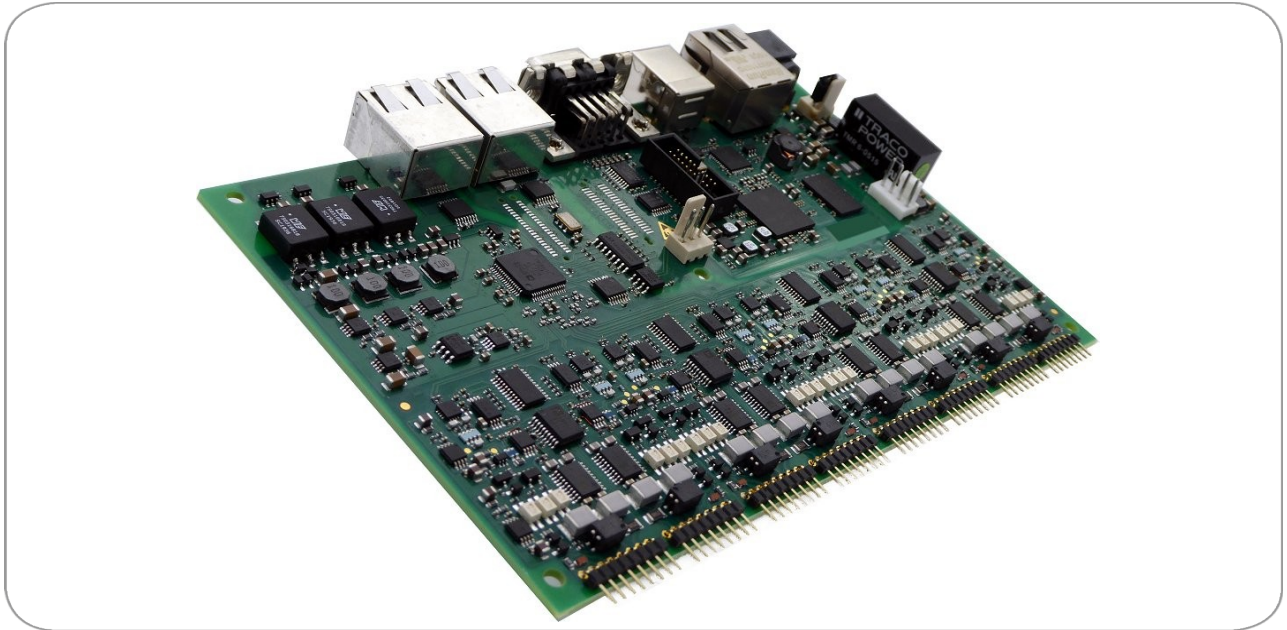


UniDAQ4.DSP-AD

Board Revision 1.0

Document Revision 1.0

10/20



Key Features

- 8 simultaneous sampling analog input channels, 24-bit resolution
- Sampling rate programmable 0.5 to 256 kS/s
Synchronization via dedicated SYNC signals or IEEE1588 Precision Time Protocol
- $\pm 1.2V$ and $\pm 12V$ Voltage Input Ranges, DC and AC (1Hz and 150Hz) coupling, single-ended and differential input configurations. Integrated 250Ω precision shunts for current measurements to acquire data from temperature and pressure sensors with a 4/20mA interface
- 4mA IEPE constant current and 24V sensor excitation supply
- Analog inputs are isolated from power supply and digital circuits
- 4 TTL inputs (trigger, tacho, position sensors and rotary encoders)
- 2 TTL outputs (trigger and PWM)
- 456 MHz TMS320C6746 DSP with 32 Mbytes DRAM
- 100-Base-T Ethernet and USB2.0 Ports
- Expansion port with GPIO, SPI, and SD/MMC/SDIO Interface, supports
 - SD-card or eMMC mass storage for data logging
 - Wireless Communication Modules via SDIO or SPI
 - Digital-I/O expansion, isolation and interface conversion
 - Industrial Network Controller
 - Micro-Controller for user interface
- 9 to 36V single-supply
Multiple power saving modes for battery-powered portable applications
- Compact Euro-Card size
- Memory-resident utility programs for field maintenance and software updates

Supported Sensors

- Voltage Source, differential and single-ended
- Current Transducer
- IEPE Acceleration Sensors, Microphones and Hydrophones
- 4-20mA and 0-20mA Current Loops, 2-, 3- and 4-wire configuration

Applications

- General Vibration Analysis
- Machine Condition Monitoring
- Grid Monitoring for Renewable Energy Systems
- Underwater Structural Inspection
- Stand-alone Data Logger
- Mobile Vehicle Vibration and Acoustic Measurements

Description

UniDAQ4 is a full-featured OEM data acquisition board for high-precision dynamic analog measurements. The user only needs to provide a power supply and a customized connector front panel to complete the system.

The analog circuits are isolated from digital circuits and power supply. Combined with over-voltage protection, this facilitates system integration and guarantees excellent performance and reliability even in harsh environments.

USB and Ethernet ports provide the interface to a

production environment and a link to visualization and simulation tools.

The expansion interface supports an SD-Card mass storage device for data logging, WiFi interface, a micro-controller running a human machine interface, Industrial Fieldbus connectivity, and additional Digital-I/O Ports

The Texas Instruments TMS320C6746 floating-point processor provides a rich set of real-time signal processing capabilities for data pre-processing, filtering, and analysis.

Input Characteristics

Number of Channels	: 8, voltage or current
ADC Architecture	: 24-bit Delta-Sigma, wideband brickwall or low-latency Sinc5 filter
Sampling rate	: 0.5 - 256 kS/s programmable, resolution 0.026ppb
Timebase	: internal ± 50 ppm, external synchronization via dedicated SYNC signals or IEEE 1588 PTP-synchronized
Sampling Mode	: simultaneous sampling
Sampling Delay	: $34 / f_{\text{samp}} + 8\mu\text{s}$ (wideband filter), $3 / f_{\text{samp}} + 8\mu\text{s}$ (Sinc5 filter),
Input Range	: voltage: $\pm 1.2 V_{\text{pk}}$ and $\pm 12 V_{\text{pk}}$, programmable current: $\pm 4.8 \text{ mA}_{\text{pk}}$ and $\pm 32 \text{ mA}_{\text{pk}}$ (limited to 32mA by 0.25W shunt resistor dissipation)
Input Coupling	: DC, AC 1Hz, AC 150Hz, GND, single-ended or differential, programmable
Input Impedance	: $1.8 \text{ M}\Omega \parallel 30\text{pF}$ differential, $900\text{k}\Omega \parallel 50\text{pF}$ single-ended
Current Shunt Resistor	: 250Ω , 0.01%, externally connect to IN+ for current measurements
Overvoltage Protection	: $\pm 42 V_{\text{pk}}$, Input current during over-voltage conditions max 500 μA
Frequency Range	: -3dB: DC / 1Hz / 150Hz to $0.433 * \text{sampling frequency}$ (wideband filter) -0.1dB: DC / 7Hz / 1.2kHz to $0.409 * \text{sampling frequency}$ (wideband filter)

Phase Mismatch	: max. between channels: 1° at 35 kHz, 0.1° at 5 kHz with AC 1Hz coupling 1° at 7Hz, 0.1° at 70Hz
Alias Rejection	: > 105dB
Common Mode Range	: differential : max. ±7.5V (between IN+, IN- and GND) : single-ended: max. ±0.5V (between IN- and GND)
CMRR	: 1kHz : 67dB (12V range), 86dB (1.2V range) 10kHz: 67dB (12V range), 84dB (1.2V range)
Input Leakage	: ±50nA max.
Zero Error	: < ± 500 µV (0 to +50°C ambient temperature)
Gain Error	: < ± 0.05% of fullscale (0 to +50°C ambient temperature)
Crosstalk	: -130dB (10 kHz -1dBFS signal applied to neighbor channel, channel under test terminated with 50Ω)
IEPE supply	: 4mA ±5%, 22V compliance, cable fault detection
EXC sensor supply	: 24V ±5%, max. 50mA per channel, 200mA total

Dynamic Characteristics

All measurements made with wideband brickwall digital filter, ADC in median power mode except 204.8 kS/s in highspeed mode.

	204.8 kS/s	102.4 kS/s	51.2 kS/s	25.6 kS/s
Noise Floor 12V range ¹	-110 dBFS 40 µV	-110 dBFS 40 µV	-113 dBFS 27 µV	-116 dBFS 19 µV
Noise Floor 1.2V range ¹	-109 dBFS 4.3 µV	-109 dBFS 4.3 µV	-112 dBFS 3.0 µV	-115 dBFS 2.1 µV
SNR 12V range ²	107 dB	107 dB	110 dB	113 dB
SNR 1.2V range ²	106 dB	106 dB	109 dB	112 dB
SNR 12V range, IEPE supply ³	106 dB	106 dB	109 dB	112 dB
THD 12V range, differential ⁴	1 kHz: -119 dB 10 kHz: -111 dB		1 kHz: -127 dB 10 kHz: -111 dB	
THD 12V range, single-ended ⁴	1 kHz: -112 dB 10 kHz: -95 dB		1 kHz: -112 dB 10 kHz: -96 dB	
THD 1.2V range, differential ⁴	1 kHz: -115 dB 10 kHz: 102 dB		1 kHz: -115 dB 10 kHz: -103 dB	
THD 1.2V range, single-ended ⁴	1 kHz: -108 dB 10 kHz: -98 dB		1 kHz: -108 dB 10 kHz: -99 dB	
SFDR 12V range ⁵		138 dB		140 dB
SFDR 1.2V range ⁵		137 dB		140 dB

1 Input terminated with 50 Ω

2 Measured with 1kHz -60dBFS input signal, SNR = 20*log (RMS Fullscale Sinewave Input / RMS Noise)

3 Measured with IEPE sensor equivalent input termination (DC: 3 kΩ, AC 100Ω)

4 Input Signal = -1dBFS (21.4V_{pp} in 12V range, 2.14 V_{pp} in 1.2V range)

5 Input Signal = 1kHz sine wave, -1dBFS, measured with 65536 pt. FFT, excluding signal harmonics

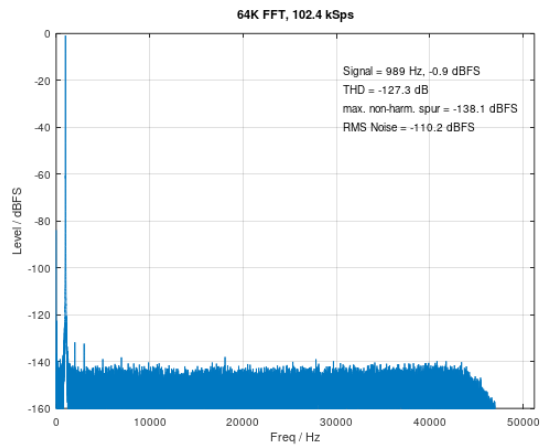


Figure 1: 12V range, differential input, 1kHz -1dBFS

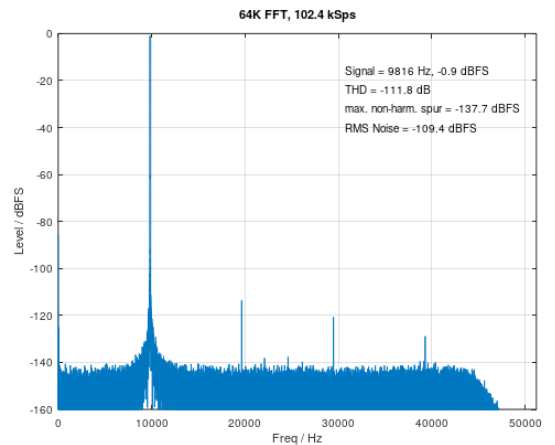


Figure 2: 12V range, differential input, 10kHz -1dBFS

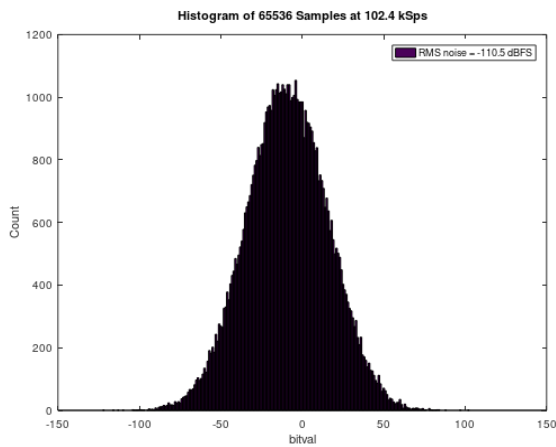


Figure 3: 12V range, differential input, idle channel noise

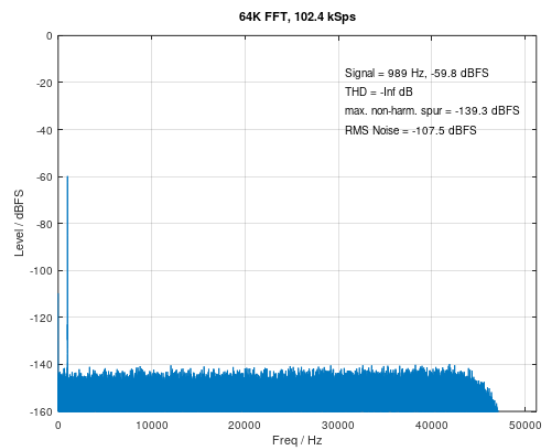


Figure 4: 12V range, differential input, 1kHz -60dBFS

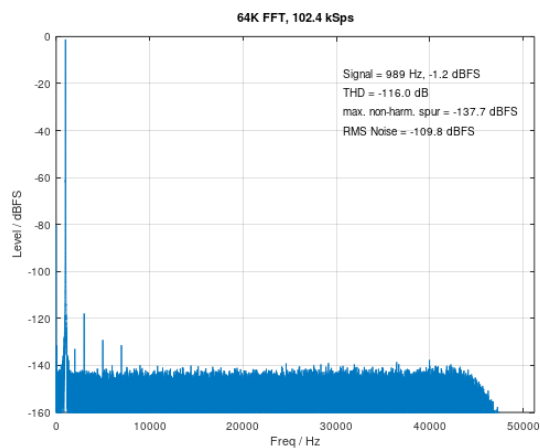


Figure 5: 1.2V range, differential input, 1kHz -1dBFS

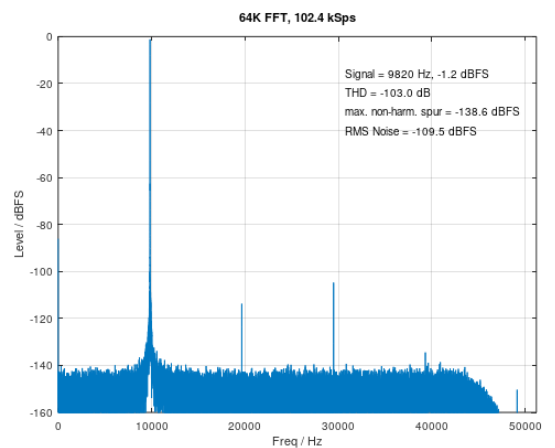


Figure 6: 1.2V range, differential input, 10kHz -1dBFS

Digital I/O

Connector	: D-Sub 9pin female
Inputs	: 4, 3.3V and 5V TTL/CMOS compatible, max. input frequency 5 MHz, Overvoltage Protection: -0.5 to +6.5V
Input Impedance	: 10 k Ω
Usage	: Pre- or post trigger event to DSP, Capture inputs (frequency, pulse width, duty cycle), Quadrature input (rotation angle and speed), GPIO
Outputs	: 2, 3.3V LVTTTL, 5V TTL/CMOS compatible
Output Impedance	: 50 Ω
Usage	: Trigger event from DSP, PWM, GPIO
Power Supply Output	: +5V, max. 100mA

Communication Ports

Ethernet	: 1 Port, 100 MBit/s, full-duplex, RJ45
USB2.0	: 1 Port, 480 MBit/s, Device-Mode, USB-B type

Signal Processing

DSP	: Texas Instruments TMS320C6746, 456 MHz
Memory	: 32 Kbytes L1 Program RAM/Cache 32 Kbytes L1 Data RAM/Cache 256 Kbytes L2 RAM/Cache 32 Mbytes DDR2 8 Mbytes non-volatile Flash Memory

Debugging Ports

JTAG	: XDS100, 200 and 560 class emulators, 20-pin CTI header
Debug UART	: RS232, TxD and RxD, 3pin KK-type connector 2.54mm pitch

Expansion Port

Signals	: SD/SDIO/MMC (1 and 4-bit mode, up to 52 MHz), alternatively 6 x GPIO, 3 x dedicated GPIO, 1 x SPI (up to 50 Mbit/s), 4 Digital Inputs and 2 Digital Outputs (alternative to D-Sub Digital I/O connector) USB OTG port (alternative to B-type USB connector) Power Supply 5V max. 500mA and 3.3V max. 100mA
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Power Supply

Supply Voltage	: 9 to 36V \pm 10%, reverse-polarity protected
Power Consumption	: 4.5W typical (IEPE and EXC supply off) 6.5W typical (IEPE activated on all channels, EXC supply off) 12.5W max. peak power

Mechanics

Size	: Eurocard, 160 x 100 x 15 mm
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Operating Conditions

Ambient Temperature	: 0-50 $^{\circ}$ C
Humidity	: max. 95% rel., non condensing

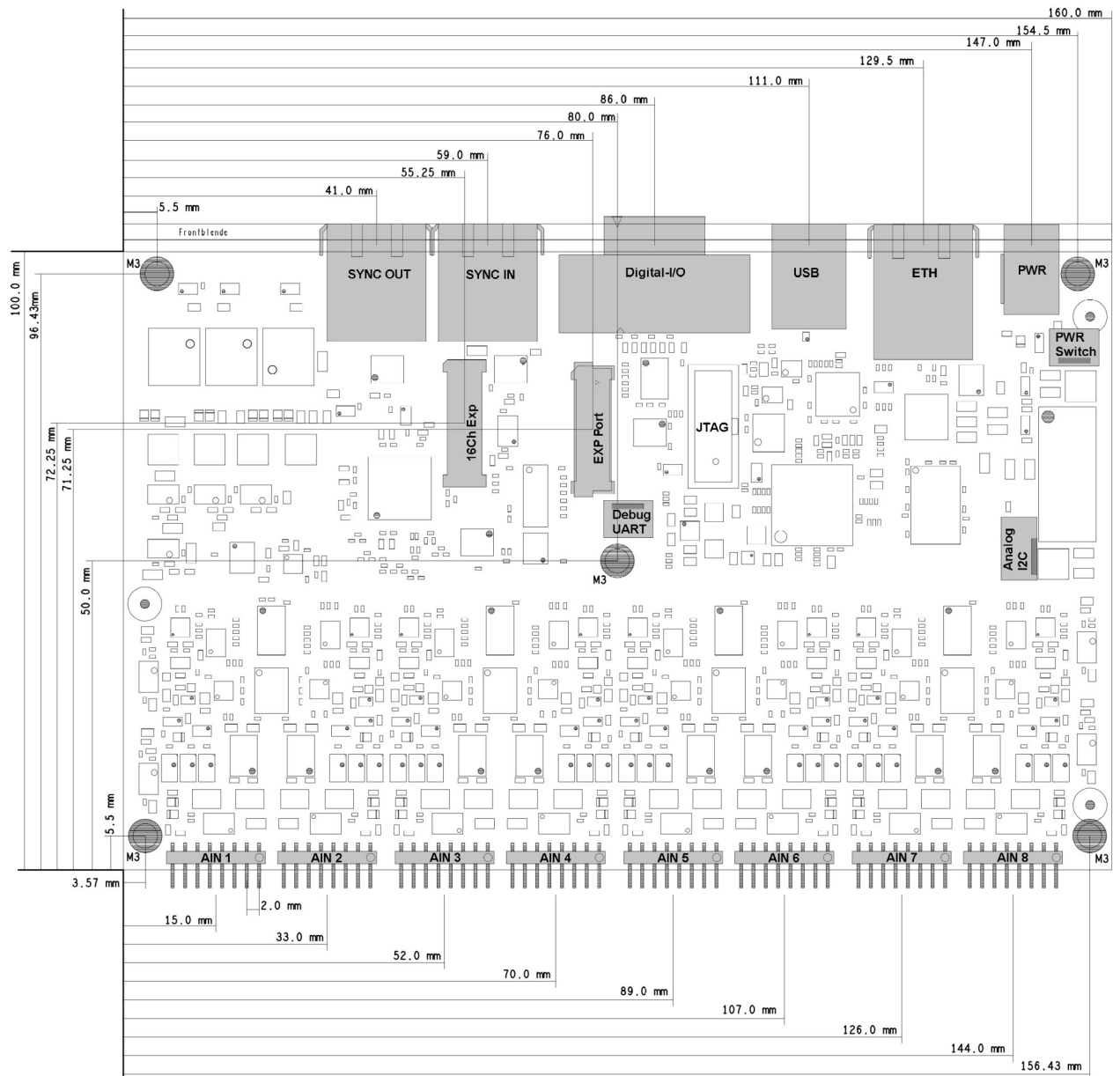


Figure 7: Outline Dimensions

Ordering Information

UniDAQ4.DSP-AD UniDAQ4 board



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