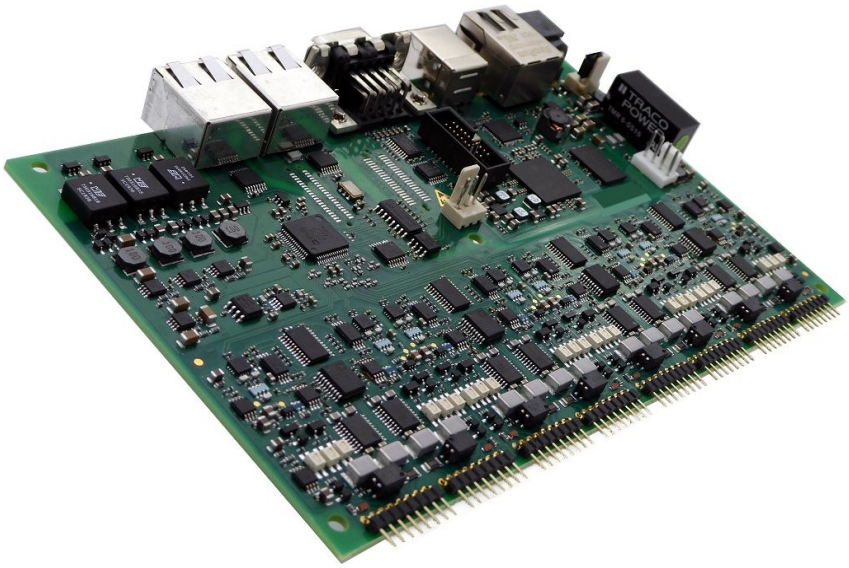
# UniDAQ4.DSP-AD

**Board Revision 1.1** **Document Revision 1.1** **08/21**



## 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
- ±1.2V and ±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 auxiliary sensors such as temperature, flow, or pressure 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 (GPIO, trigger, tacho, position sensors and rotary encoders)
- 2 TTL outputs (trigger, GPIO and PWM)
- 456 MHz TMS320C6746 DSP with 32 Mbytes DRAM
- 100-Base-T Ethernet and USB2.0 high-speed 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
- TCP/IP and USB API and library packages allow access from MATLAB®, GNU-Octave, Python, or C, C++, C# programs running on a host PC without DSP programming.
- Web-Frontend with time-domain and spectrum display for convenient evaluation of UniDAQ4 features

## 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 TCP and USB APIs enable extensive configuration and data acquisition without any DSP programming.

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 ±50ppm, external synchronization via dedicated SYNC signals or IEEE 1588 PTP-synchronized |
| Sampling Mode | : simultaneous sampling |
| Sampling Delay | : 34 / $f_{samp}$ + 8µs (wideband filter), 3 / $f_{samp}$ + 8µs (Sinc5 filter), |
| Input Range | : voltage: ±1.2 $V_{pk}$ and ±12 $V_{pk}$, programmable<br>current: ±4.8 $mA_{pk}$ and ±32 $mA_{pk}$ (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 MΩ \|\| 30pF differential, 900kΩ \|\| 50pF single-ended |
| Current Shunt Resistor | : 250Ω, 0.01%, externally connect to IN+ for current measurements |
| Overvoltage Protection | : ±42 $V_{pk}$, Input current during over-voltage conditions max 500µA |

Frequency Range : -3dB: DC / 1Hz / 150Hz to 0.433 * sampling frequency (wideband filter)
-0.1dB: DC / 7Hz / 1.2kHz to 0.409 * 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<br>40 µV | -110 dBFS<br>40 µV | -113 dBFS<br>27 µV | -116 dBFS<br>19 µV |
| Noise Floor 1.2V range [1] | -109 dBFS<br>4.3 µV | -109 dBFS<br>4.3 µV | -112 dBFS<br>3.0 µV | - 115 dBFS<br>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<br>10 kHz: -111 dB | 1 kHz: -127 dB<br>10 kHz: -111 dB | | |
| THD 12V range, single-ended [4] | 1 kHz: -112 dB<br>10 kHz: -95 dB | 1 kHz: -112 dB<br>10 kHz: -96 dB | | |
| THD 1.2V range, differential [4] | 1 kHz: -115 dB<br>10 kHz: 102 dB | 1 kHz: -115 dB<br>10 kHz: -103 dB | | |
| THD 1.2V range, single-ended [4] | 1 kHz: -108 dB<br>10 kHz: -98 dB | 1 kHz: -108 dB<br>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 (21.4$V_{pp}$ 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

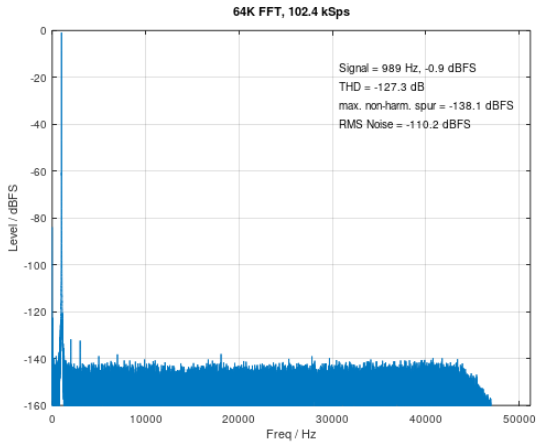



*Figure 1: 12V range, differential input, 1kHz -1dBFS*

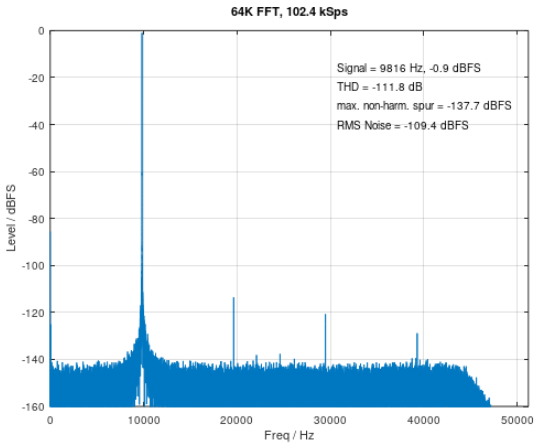



*Figure 2: 12V range, differential input, 10kHz -1dBFS*

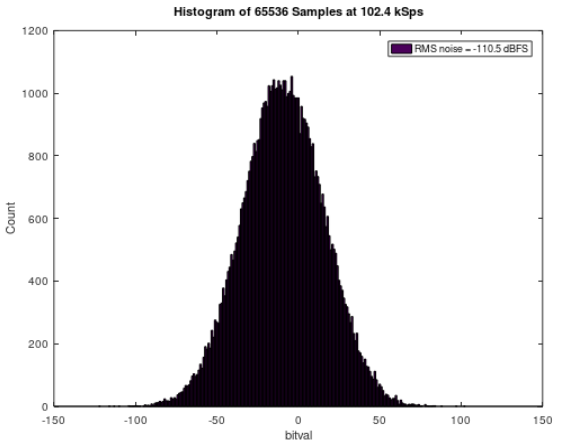



*Figure 3: 12V range, differential input, idle channel noise*

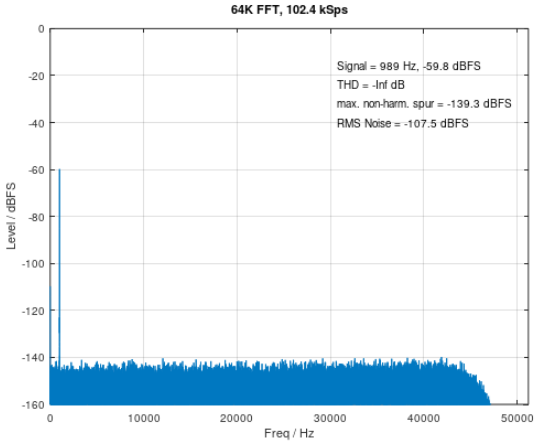



*Figure 4: 12V range, differential input, 1kHz -60dBFS*

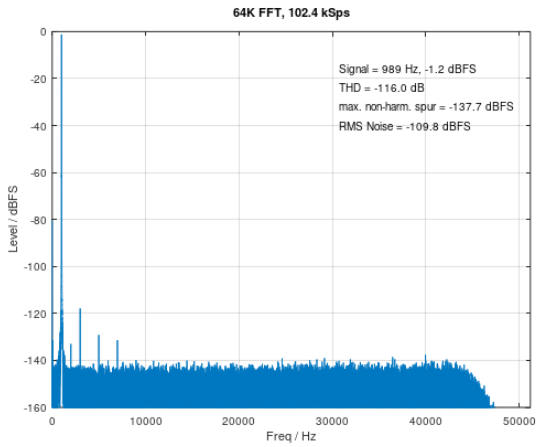



*Figure 5: 1.2V range, differential input, 1kHz -1dBFS*

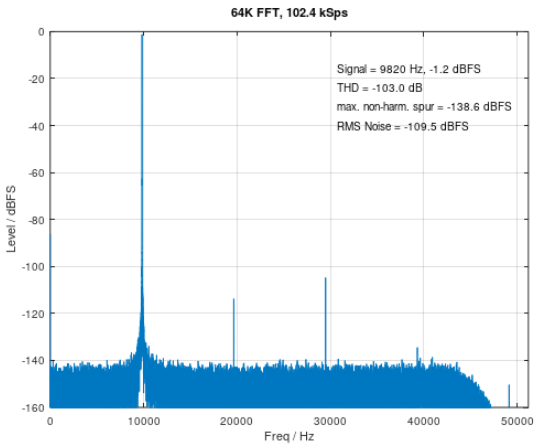



*Figure 6: 1.2V range, differential input, 10kHz -1dBFS*

## 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 kΩ |
| 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 LVTTL, 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<br>32 Kbytes L1 Data RAM/Cache<br>256 Kbytes L2 RAM/Cache<br>32 Mbytes DDR2<br>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,<br>3 x dedicated GPIO, 1 x SPI (up to 50 Mbit/s),<br>4 Digital Inputs and 2 Digital Outputs (alternative to D-Sub Digital I/O connector)<br>USB OTG port (alternative to B-type USB connector)<br>Power Supply 5V max. 500mA and 3.3V max. 100mA |

## Power Supply

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

## Mechanics

| | |
|---|---|
| Size | : Eurocard, 160 x 100 x 15 mm |

## Operating Conditions

| | |
|---|---|
| Ambient Temperature | : 0-50°C |
| Humidity | : max. 95% rel., non condensing |

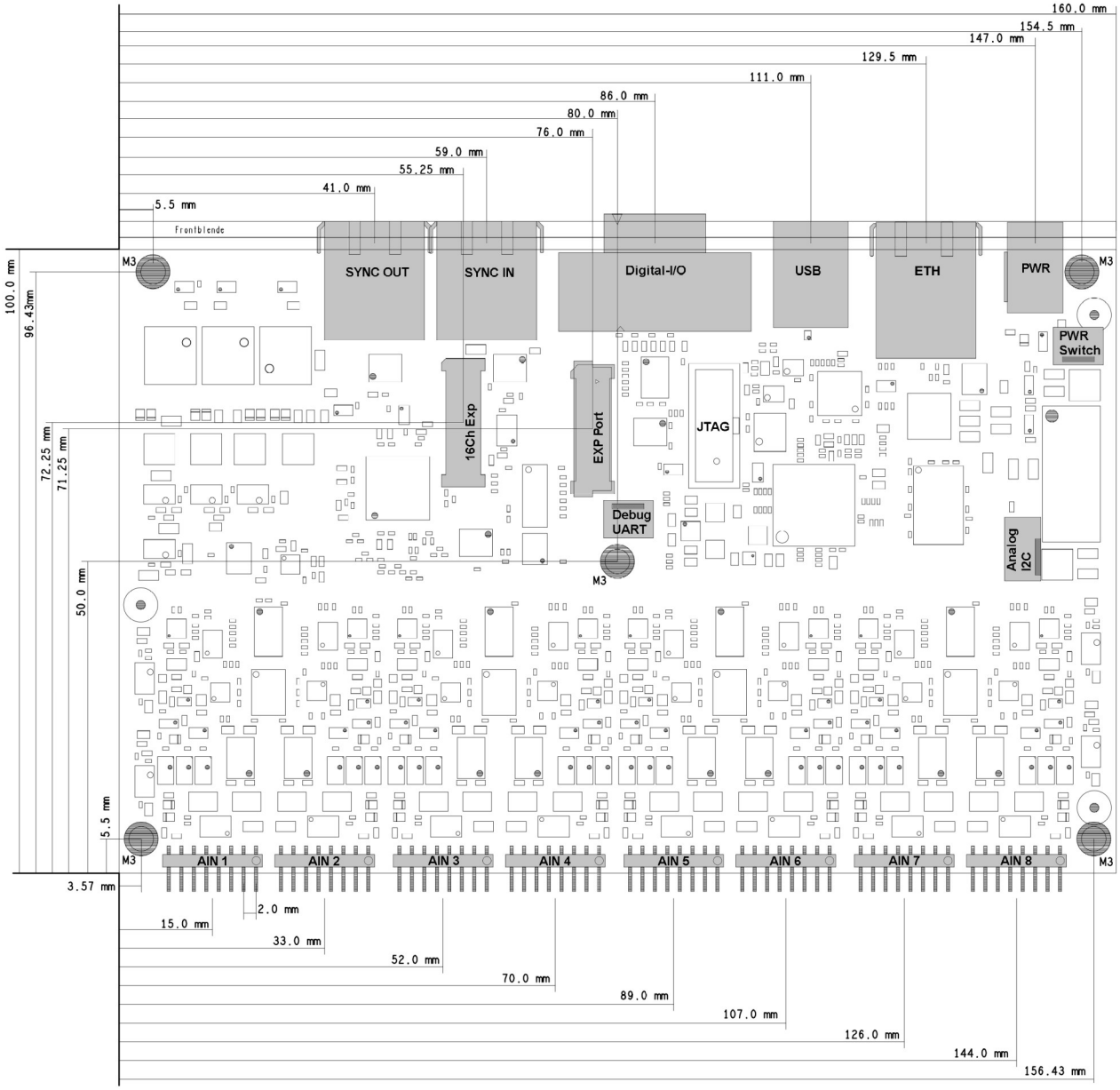



*Figure 7: Outline Dimensions*

## Ordering Information

UniDAQ4.DSP-AD UniDAQ4 board

**D.SignT GmbH & Co. KG**
Marktstraße 10 ▪ 47647 Kerken ▪ Germany
phone +49 (0)2833 / 570 976 ▪ fax +49 (0)2833 / 3328
info@dsignt.de