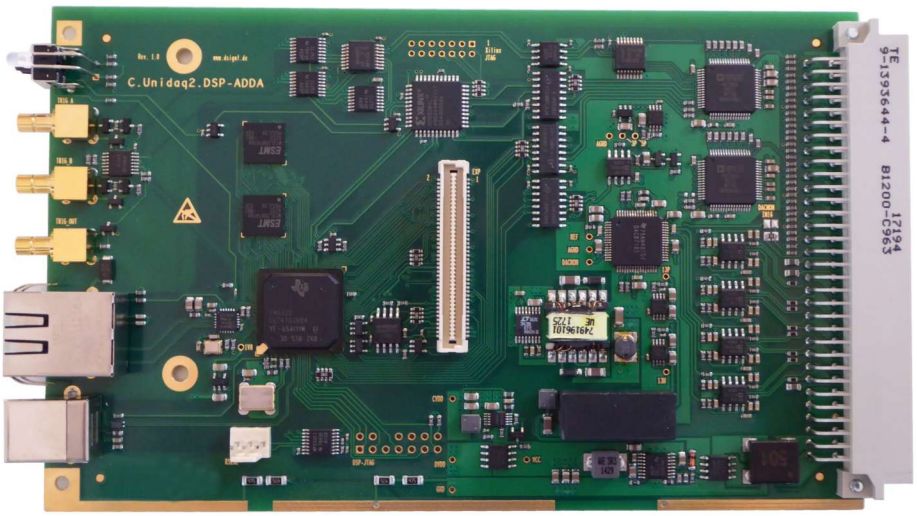
UniDAQ2.DSP-ADDA

Board Revision 1.0 **Document Revision 1.2** **Jun 6, 2018**



Key Features

- 16 simultaneous sampling analog input channels, 16-bit resolution
- 8 analog output channels, 16-bit resolution
- Sampling rate up to 175 kS/s (ADC) and 105 kS/s (DAC)
- Analog inputs and outputs isolated from power supply and digital circuits
- Multiple internal and external trigger options
- 456 MHz TMS320C6747 DSP with 64 Mbytes SDRAM
- 100-Base-T Ethernet and USB2.0 Device Ports
- Expansion port for GPIO, Mass-Storage, User Interface, external controllers and FPGAs
- 5..18V single-supply
- Resident Setup and Test Programs for field maintenance and software updates via USB

Applications

- Vibration and Condition Monitoring
- Process Control and Automation
- Multiphase motor control
- Multiaxis positioning systems
- Power-line monitoring
- Microphone array processing
- Manufacturing and Quality Test Equipment
- Hardware-in-the-Loop test system
- Research and Analysis
- Education (Signal Processing Classrooms, Controls and Mechatronics, Robotics, Speech Processing)

Description

The UniDAQ2.DSP-ADDA is a versatile data acquisition and signal processing platform for industrial applications, scientific research, and education.

16 synchronously sampled analog input channels with excellent static and dynamic parameters qualify the UniDAQ2 for grid monitoring, multi-axis positioning, motor control, vibration and condition monitoring, process control and automation, and many more. Eight analog outputs drive actuators, generate stimuli, or can be used to monitor internal processing states.

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

USB and Ethernet ports are used to interface to the production environment, log data, and provide a link to visualization and simulation tools for research, design verification, hardware-in-the-loop tests, and education.

The Texas Instruments TMS320C6747 floating-point processor provides ample real-time signal processing capabilities. An Expansion Port is provided to assist the DSP with an FPGA or controller for fieldbuses and encoder interfaces, add GPIO, mass-storage capabilities, or a user-interface. The UniDAQ.EXP1 for example adds a TFT LCD interface, SD-Card slot, a real-time-clock with alarm and timestamp functions, and an I2C expansion to connect push-buttons or a touch screen.

Input Characteristics

Number of Channels	: 16 single-ended (8 differential), simultaneous sampling
ADC Resolution	: 16 bits
Type of ADC	: Successive approximation register (SAR)
Sampling rate	: 0 - 175 kS/s, internal or external sampling clock
Input Range	: ±5 V and ±10 V, programmable
Input Coupling	: DC
Input Impedance	: 1 MOhm || 10pF
Input Leakage	: 1.5µA typ.
Overvoltage Protection	: ±36 V, Input current during overvoltage conditions max ±10mA
Antialias Filter	: 2nd order Butterworth, -3dB cutoff 15 kHz (±5V Range), 23 kHz (±10V Range)
DNL	: ±0.5 LSB typ, < ±1 LSB max
INL	: ±0.5 LSB typ, ±2 LSB max
Zero Error	: < 2 mV
Full Scale Error	: < 0.3%
Channel to channel Phase Mismatch	: <0.1° at 1kHz, <0.5° at 10kHz input frequency
Crosstalk	: -115dB to adjacent channel, 10kHz full-scale input signal
Latency	: 6 µs from sampling clock to ADC1,5,9,13 data available in DSP 10µs until all ADC channels are available in DSP

Dynamic Characteristics (input 1kHz sine, -1dB full scale, 100kS/s, no oversampling)

SINAD	: 87 dB
THD	: -100 dB
SFDR	: 108 dB

Output Characteristics

Number of Channels	: 8 single-ended, simultaneous sampling or single-DAC update mode,
DAC Resolution	: 16 bits
Type of DAC	: String DAC, inherently monotonic
Sampling Rate	: 0 - 105 kS/s, internal or external sampling clock. Simultaneous sampling synchronized to ADC or triggered by an independent clock source.
Settling Time	: full scale step: 10us to 0.03%, 15us to 1LSB
Output Range	: ±5 V and ±10 V, programmable unipolar and asymmetric output range by programming the DAC offset register. Gain and zero calibration registers per channel.
Startup Voltage	: 0V
Output Coupling	: DC
Output Impedance	: 50 Ohms
Current Drive	: ±5mA, short-circuit limited to 70mA
Capacitive Drive	: 20000pF
Antialias Filter	: 2nd order Butterworth, -3dB at 50kHz
DNL	: ±0.5 LSB typ, ±1 LSB max
INL	: ±1.5 LSB typ, ±4 LSB max
Zero Error	: < 3 mV uncalibrated
Full Scale Error	: < 0.3% uncalibrated
Crosstalk	: -105dB to adjacent channel, 10kHz full-scale output signal

Dynamic Characteristics (output 1kHz sine, -1dB full scale, 100kS/s)

SINAD	: 74 dB
THD	: -74 dB
SFDR	: 75 dB

Trigger Inputs

Number of Channels	: 2
Input Range	: 3.3V and 5V TTL/CMOS compatible, Overvoltage Protection: ±36 V, Input current during overvoltage conditions max ±10mA
Usage	: ADC conversion start DAC update Pre- or post trigger event to DSP and/or Expansion Board Capture inputs (frequency, pulse width, duty cycle) Quadrature input (relative rotation angle and speed)

Trigger Outputs

Number of Channels	: 1
Output Range	: 3.3V LVTTL, 5V TTL/CMOS compatible
Output Impedance	: 50 Ohms
Usage	: ADC sampling clock output Trigger event or clock output from DSP and/or Expansion Board

Communication Ports

Ethernet	: 1 Port, 100 MBit/s, full-duplex, RJ45
USB2.0	: 1 Port, 480 MBit/s, Typ B (device)

Signal Processing

DSP	: Texas Instruments TMS320C6747, 456 MHz, optional: OMAP-L137 DSP + ARM9
Memory	: 32 Kbytes L1 Program RAM/Cache
	32 Kbytes L1 Data RAM/Cache
	256 Kbytes L2 RAM/Cache
	128 Kbytes L3 RAM
	64 Mbytes SDRAM, 133 MHz
	8 Mbytes non-volatile Flash Memory

Debugging Ports

JTAG	: TI in-circuit emulator, 14-pin header, 2.54mm pitch
Debug UART	: 1 x RS232, TxD and RxD, 3pin KK-connector 2.54mm pitch

Expansion Port

Connector	: 80-pin, 0.8mm pitch
Signals	: DSP EMIFA * (asynchronous parallel bus and NAND-Flash support)
	DSP UHPI * (parallel host processor interface)
	DSP SD/MMC * (eMMC or SD-Card expansion)
	DSP LCDC * (LCD Controller)
	** These signals share the same pins. With the exception of the LCD + SD/MMC combination, usage is mutually exclusive.*
	4 x GPIO, unused signals of the above interfaces can be used as additional GPIO
	1 x SPI
	1 x I2C
	Trigger Signals (2 x in, 3 x out)
	Power Supply 3.3V and VIN (5 to 18V)

Power Supply

Supply Voltage	: 5 - 18V ±5%, reverse-polarity protected
Power Consumption	: 3W typical

Isolation

max. Voltage	: 350VAC / 500VDC between analog GND and digital GND / power supply

Mechanics

Size	: Eurocard, 160 x 100 x 15 mm

Operating Conditions

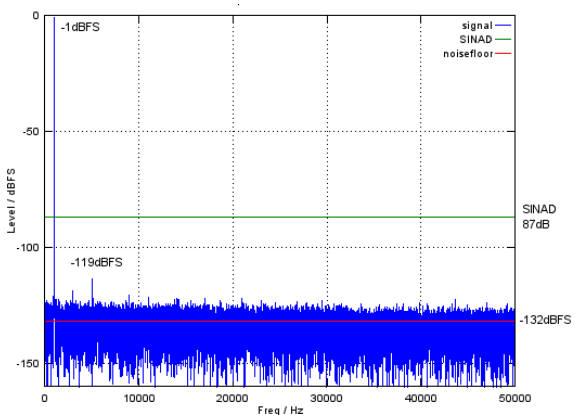
Ambient Temperature	: 0-70°C
Humidity	: max. 95% rel., non condensing

Miscellaneous

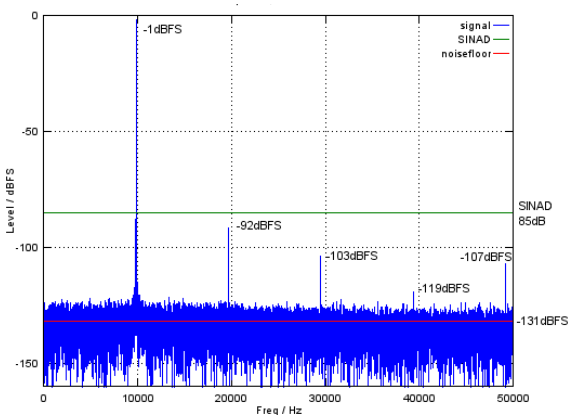
- Reset and User Pushbuttons
- Bi-color LED
- On-board temperature sensor
- Isolated ±13V/50mA and ±3.3V/50mA supplies to power external signal conditioning and I2C circuits.
- Isolated I2C port to control external signal conditioning multiplexers, PGAs, etc.
- Memory-resident setup and test programs for maintenance and software updates via USB Virtual-COM port.
- Extensive support software, demo programs, and configurations for Texas Instruments Code Composer Studio and SYS/BIOS RTOS.
- Analog I/O and power supply on 64-pin DIN 41612 connector, compatible with 19" 3U rack systems and IDC ribbon cable connectors

Typical Performance Diagrams

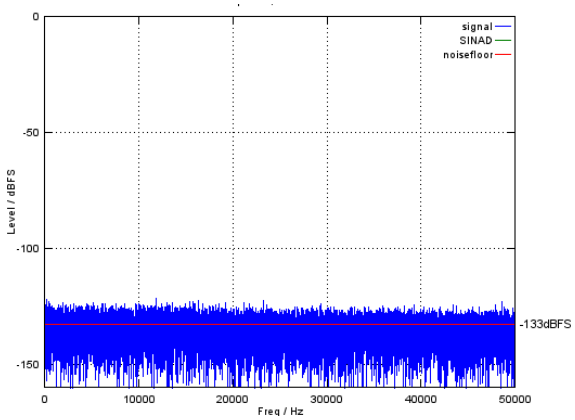
All measurements taken with 100kS/s, no oversampling, ±5V range, unless otherwise noted



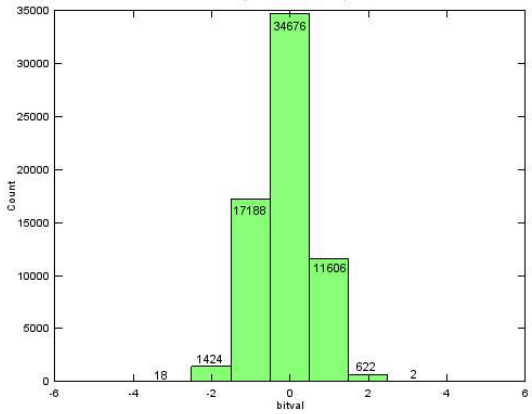
ADC 1 kHz input signal, 64K pt. FFT



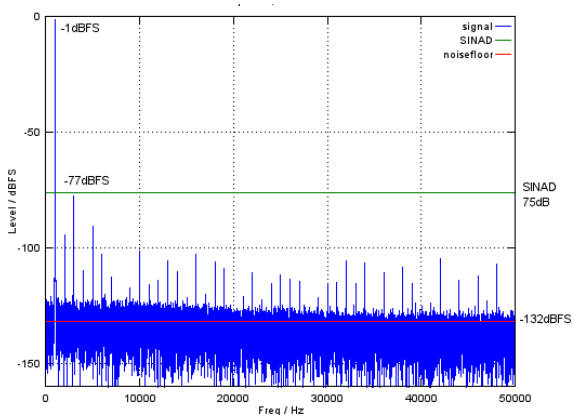
ADC 10kHz input signal, 64K pt. FFT



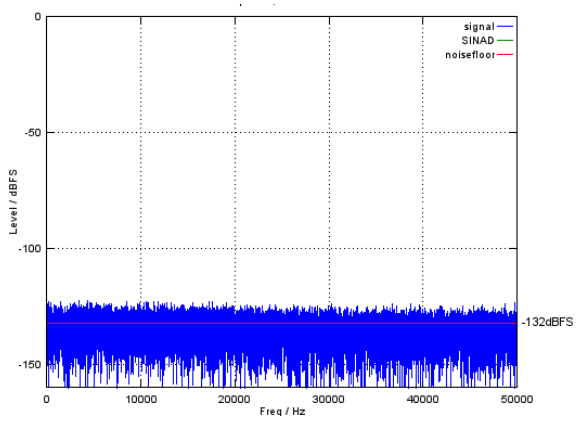
ADC idle channel noise, 64K pt. FFT



ADC idle channel histogram 65536 samples



DAC 1kHz digitally generated sine wave, 64K pt. FFT



DAC idle channel noise, 64K pt. FFT

Application Notes

The UniDAQ2 forms a highly versatile signal processing core. However, in many applications additional signal conditioning frontends and/or user interfaces are required. Various options exist to add these extensions:

- 19” Rack Mount System:
  A 160x100mm Eurocard with signal conditioning frontends and analog I/O connectors is mounted next to the UniDAQ2. The interconnections between the two cards are integrated into a backplane or via fly-by connections.
- Stand-Alone Tabletop Measurement System:
  A Eurocard with analog frontend circuits and I/O connectors is mounted below or above the UniDAQ2. The UniDAQ DIN41612 backplane connector is replaced with a straight board-to board header.
- Handheld Device:
  A UniDAQ.EXP1 board is mounted on the UniDAQ2, providing SD-Card, real-time-clock, and a LCD interface. LCD and pushbuttons are mounted on top of this assembly. Analog I/O connectors may be placed on the top cover or on one of the sides.

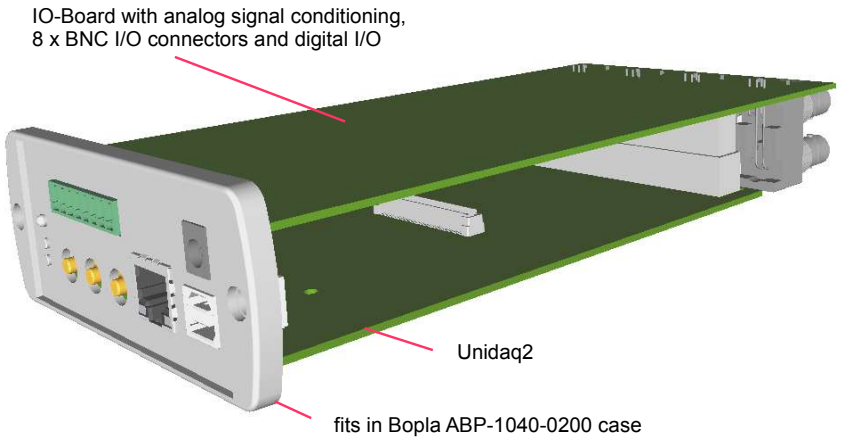


Figure 1: Tabletop Measuring Device Example

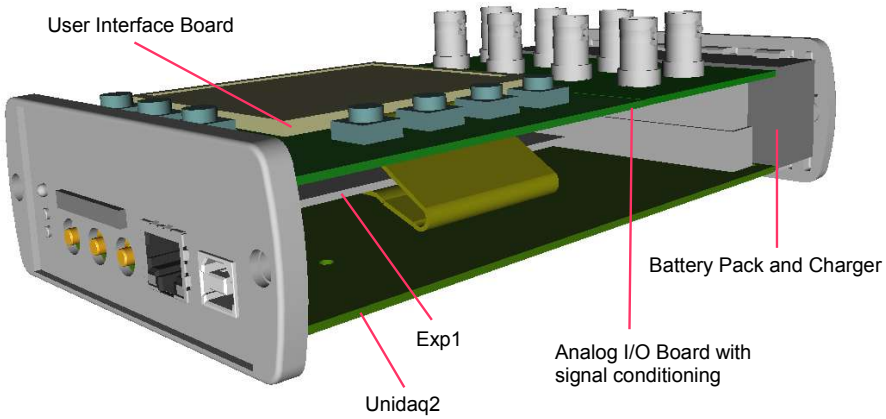


Figure 2: Handheld Device Example

Signal Conditioning and I/O connectivity will vary with each application. D.SignT offers assistance and development services for your specific needs and also provides ready-made tried-and-tested solutions. Please contact your local distributor or D.SignT. Some typical examples are

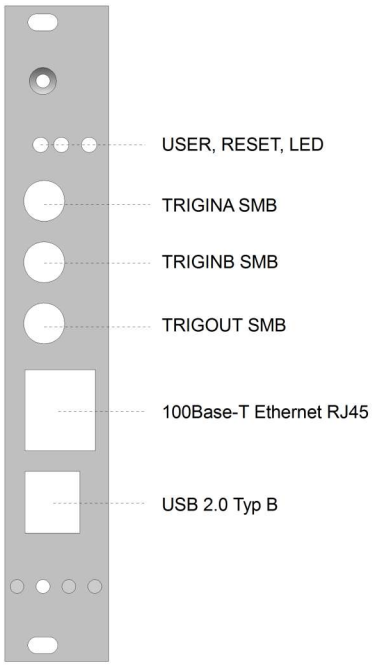
- microphone pre-amplifiers for acoustic measurements, beam-forming and active noise cancellation
- frontends for piezo-electric acceleration sensors with IEPE supply and TEDS
- strain-gauge bridge transducer inputs and bridge excitation
- RTD and TC inputs

Connector Pinout

mating receptacles: Rear-panel I/O extensions: Type R, female, 64 positions A+C, right angle
Backplane: Type C, female, 64 positions A+C, straight
Ribbon Cable: Type C IDC, 64 positions A+C

Pin	Row	Signal	Signal	Row
1	a	ADC1 IN	ADC2 GND	c
2	a	ADC1 GND	ADC2 IN	c
3	a	ADC3 IN	ADC4 GND	c
4	a	ADC3 GND	ADC4 IN	c
5	a	ADC5 IN	ADC6 GND	c
6	a	ADC5 GND	ADC6 IN	c
7	a	ADC7 IN	ADC8 GND	c
8	a	ADC7 GND	ADC8 IN	c
9	a	ADC9 IN	ADC10 GND	c
10	a	ADC9 GND	ADC10 IN	c
11	a	ADC11 IN	ADC12 GND	c
12	a	ADC11 GND	ADC12 IN	c
13	a	ADC13 IN	ADC14 GND	c
14	a	ADC13 GND	ADC14 IN	c
15	a	ADC15 IN	ADC16 GND	c
16	a	ADC15 GND	ADC16 IN	c
17	a	+13V AVCCP out	0V AGND out	c
18	a	-13V AVCCM out	0V AGND out	c
19	a	DAC1 OUT	DAC2 GND	c
20	a	DAC1 GND	DAC2 OUT	c
21	a	DAC3 OUT	DAC4 GND	c
22	a	DAC3 GND	DAC4 OUT	c
23	a	DAC5 OUT	DAC6 GND	c
24	a	DAC5 GND	DAC6 OUT	c
25	a	DAC7 OUT	DAC8 GND	c
26	a	DAC7 GND	DAC8 OUT	c
27	a	+3.3V AVDD out	0V AGND out	c
28	a	SCL	SDA_GND	c
29	a	SCL_GND	SDA	c
30	a			c
31	a	GND_SUPPLY	GND_SUPPLY	c
32	a	V_SUPPLY	V_SUPPLY	c

Frontpanel Layout



Board Dimensions