# High Performance
Modular
Data Acquisition

Create cost-effective customized systems to match your IO requirement:

• *Fit anything from 4 to 192 analog channels in one enclosure using ..*

• A range of high performance simultaneous IO modules with programmable clock and trigger.

• A range of networked and standalone carrier appliances to support up to 6 modules

• Appliances feature a low power but powerful ARM system on chip and embedded Linux OS.

• Connectivity is Gigabit Ethernet, 1000-T, 1000-LX USB, and fiber-optic links to PCI-express.

• Modules based on VITA-57 FMC standard (FMC) and extended (ELF)
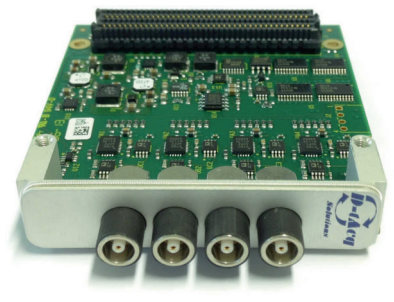
Module Range

Model	Simultaneous Channels			Comment
	No.	Rate	Bits	
AO420FMC	4	1 MSPS	16/18/20	DAC
AO424ELF	32	500kSPS	16	DAC, high channel count
ACQ420FMC	4	2 MSPS	16/18	4 input ranges, **SNR 94dB**
ACQ424ELF	32	1 MSPS	16	Fixed range, SAR, Hi Density
ACQ425ELF	16	2 MSPS	16	4 input ranges, **SNR 94dB**
ACQ430FMC	8	128 kSPS	24	Fixed range Voltage input
ACQ435ELF	32	128 KSPS	24	Fixed range Voltage input
ACQ436ELF	32	128 KSPS	24	Current Mode Input
ACQ437ELF	16	128 KSPS	24	Variable range Voltage Input
ACQ480FMC	8	80MSPS	14	Variable range Voltage Input
ACQ482ELF	16	80MSPS	14	Fast, wide range Differential.
DIO432/482FMC	8	1/20 MSPS	32	32 bit clocked DIO

Carrier/Appliance Range

Model	Sites	Size		Comment
ACQ1001	1	70 mm	x 1U	Minimum Size
ACQ1002R	2	150 mm	x 1U	Rack mount
ACQ1002S	2	70 mm	x 1.5U	Stacking: use inTube / Down Hole
ACQ1014	2	19"	x 1U	16 channels, 80MSPS, BNC connectors
ACQ2106	6	19"	x 1U	SSD, Fiber, PCIe connectivity, DSP
KMCU/ACQ400RTM	2	AMC		Micro TCA .4

Appliance: ACQ1001, ACQ1002R/T

Low cost applications, 4 to 64 channels. Small, Rack and Stack.

ACQ1001Q

ACQ1002R
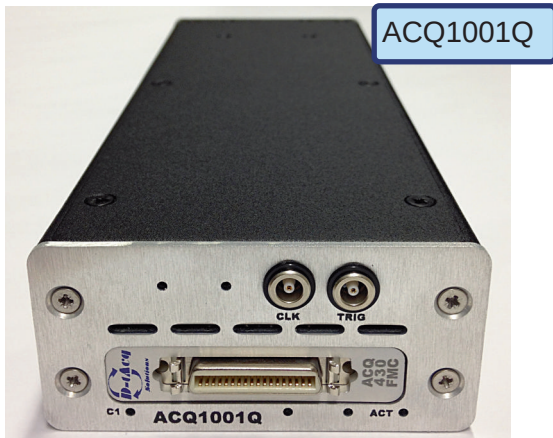
• Minimum size appliance, DC12V power, external PSU

• 1 or 2 sites for D-TACQ FMC or ELF modules.

       FMC Site 1 fully compliant VITA-57 compliant FMC LPC

      ELF Site 2 not recommended for 3rd party FMC modules.

• Shape optimised smallest single (Q), dual Rack mount (R) or dual Stack (S) to fit in a tube.

• Xilinx Z7020 SOC, Embedded Linux, Gigabit Ethernet, USB2 expansion.

• PMOD expansion, external CLK and TRG options.

• Synchronized between units using HDMI cable bus.

• Rackmount options allow for very high density if required.

• OEM version with no case.

ACQ1002S

Appliance: ACQ1014

High Rate: 16 channels x 80 MSPS in 1U

Connect signals direct to BNC

- 19", 1U appliance, Single DC12V power, external PSU

- Customised unit fitted internally with 2 x AC1001, 2 x ACQ480 modules.
- Simple Clock and trigger fanout, easily create 80 channel islands with perfect simultaneity.
- 16 channels, 80MSPS, 1280MB memory : capture for 0.5s
- Fast short transients for live scope.
- Oversampling FIR filters for lower rate, bandlimited capture down to 1MSPS
- Built-in transient overvoltage protection on inputs.

Comprehensive Remote UI
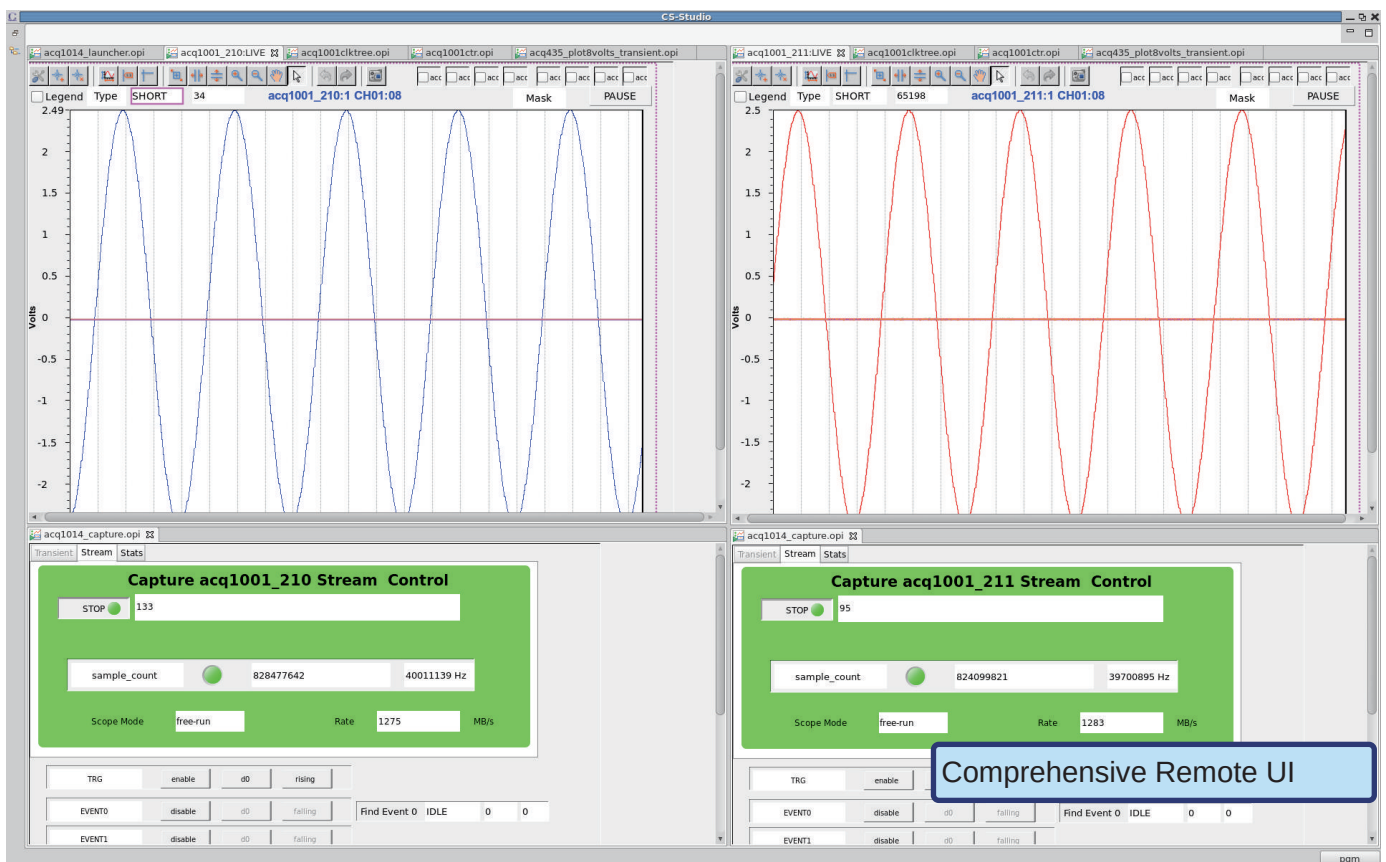
Appliance: ACQ2106

High Density: up to 192 channels in 1U,

High Bandwidth Streaming to SFP Fiber Optic

• 19", 1U appliance, DC12V power, external PSU

• 6 sites for D-TACQ FMC or ELF modules.

 Not recommended for 3rd party FMC modules

• Xilinx Z7030 SOC running Linux,

• connectivity on gigabit Ethernet, 1000T and 1000LX

• Quad SFP fiber optic links , 5Gbps

• DRAM Expansion: 8GB, fills at 1920MB/s..

• Quad Port, PCI-Express 4x host bus adapter available.

• Stream to HOSTPC at 400MB/s per link with AFHBA404, PCIe 4x.

• LOW Latency control loops with HOSTPC to 500kSPS.

• Streaming data with "data copy" duplicate fanout.

• Network control TCP socket, HTTPD, SNMP, EPICS CA

• White Rabbit capable. Sample clock phase locked to TAI.

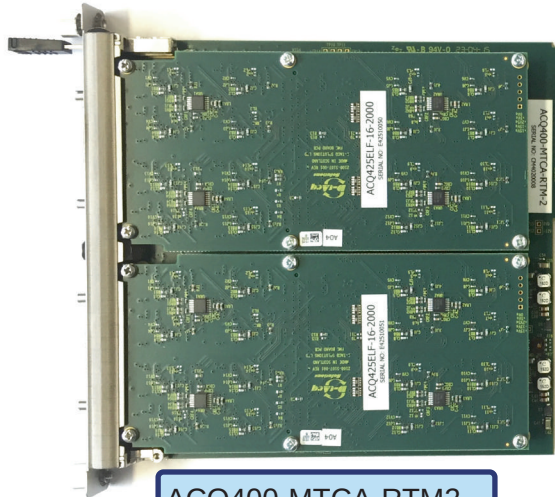• WRTD Trigger system subset.

ACQ2106 TOP
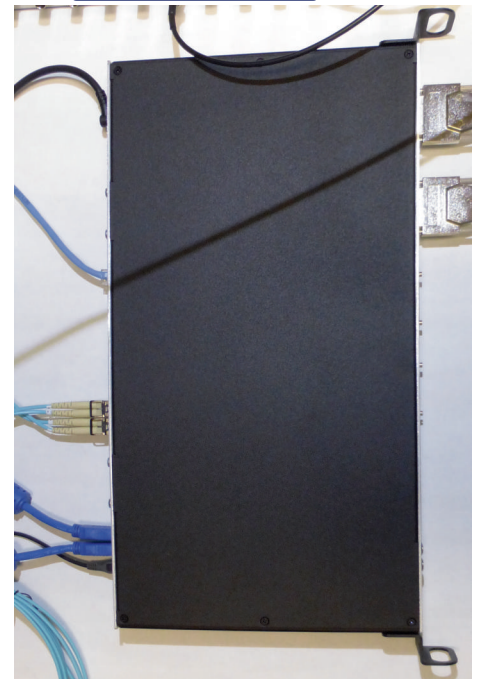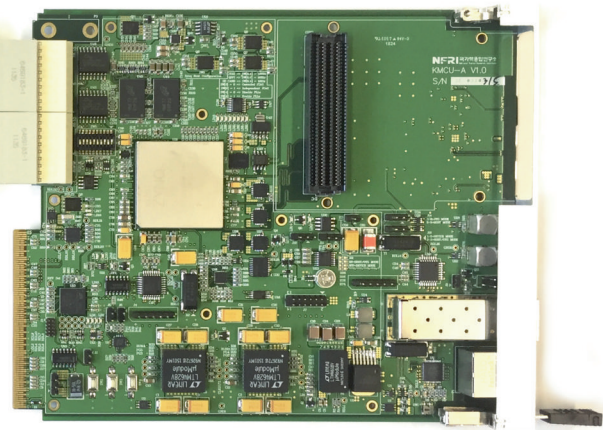
Front panel detail
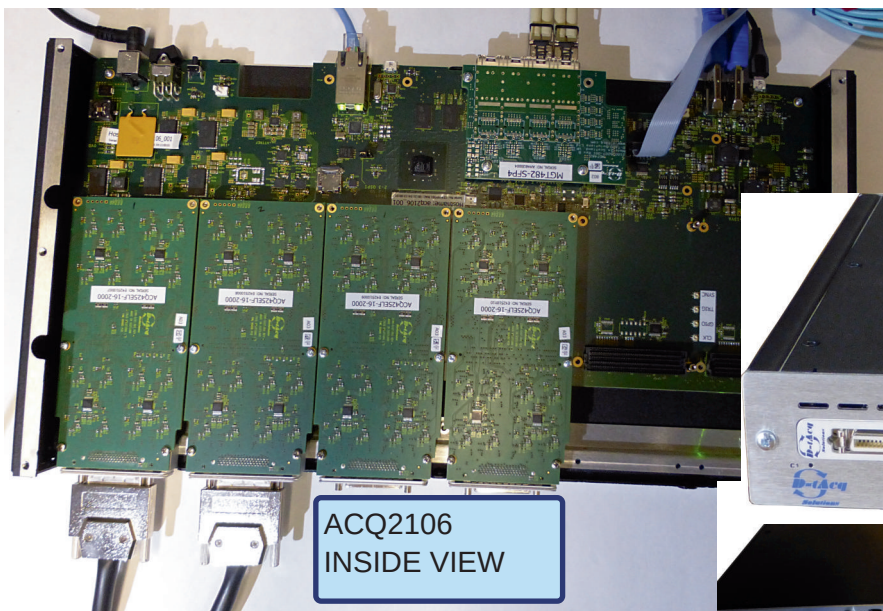
ACQ2106 INSIDE VIEW

ACQ2106 REAR

Micro TCA.4 : KMCU/ACQ400RTM
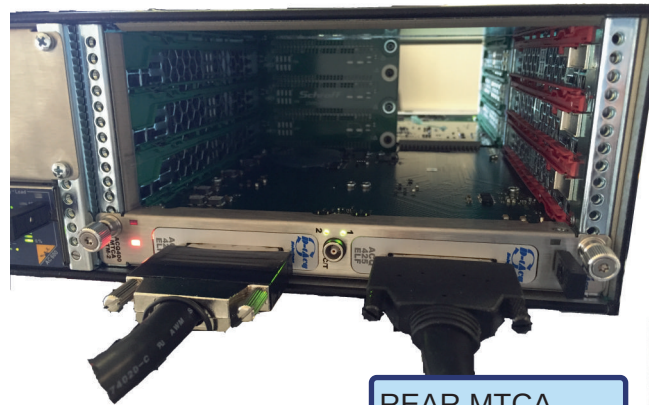
Integrated Control Systems, 4 to 64 channels.

ACQ400-MTCA-RTM2

KMCU

• MicroTCA Compliant AMC module

(designed by NFRI, Korea)

• Single FMC site on the AMC

• MicroTCA.4 Compliant RTM with two full ELF sites.

ELF Site not recommended for 3rd party FMC modules.

• PCI-Express x8 to backplane.

• External CLK and TRG options.

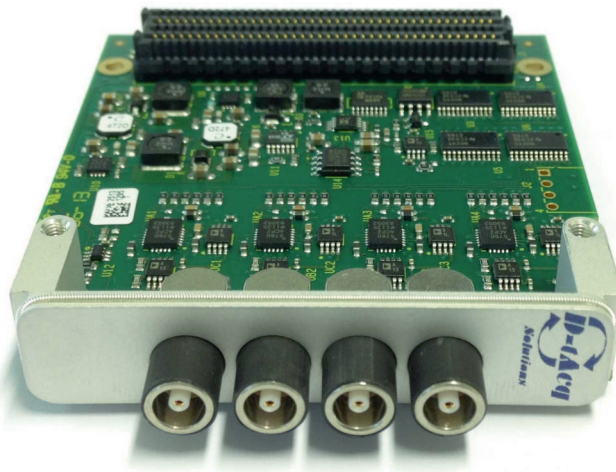• Front Panel Gigabit Ethernet and Fiber SFP.

REAR MTCA

FRONT MTCA

Module: AO420FMC

• 4 channels simultaneous Analog Output.

• 16 bit resolution, 1MSPS update rate. -18, -20 bit options available.

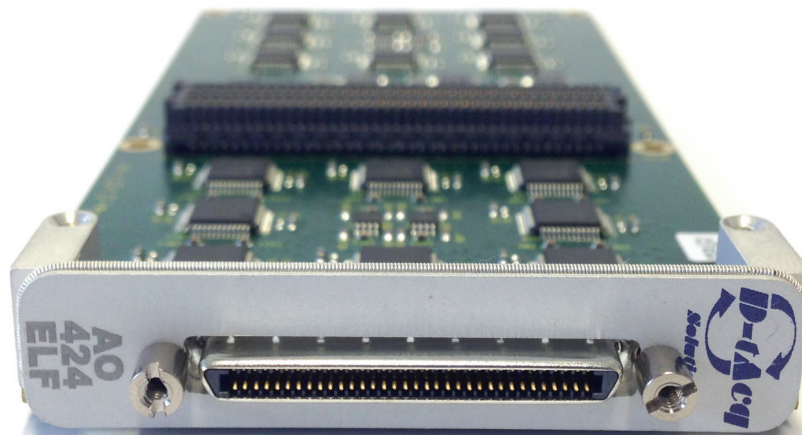• DC, repetitive and continuous AWG functions.

• VITA-57 Compliant FMC module

Specifications

Parameter	Value	Comment
Output Type	DC, 20mA max current	
Sample Rate	1MSPS	per channel, simultaneous
Output Voltage Range	±10V	
Output Impedance	10 Ω	
Offset Error	0.01% FS	
Gain Error	0.1% FS	
INL	±2 LSB	
DNL	±1 LSB	
CMR		FS, at 1kHz
THD	> 80dB	
SINAD	-74 dB	
SFDR	85 dBc	
SNR	72 dB	
Full Power BW	1 MHz	
Small Signal BW	2 MHz	
Crosstalk	< 80 dB	@ 1kHz FS Input
Temperature Stability	< 25 ppm / C	
Front panel connectors	4 x "LEMO" NIM 00	

Module: AO424ELF-32

- 32 channels simultaneous Analog Output.

- 16 bit resolution, 500kSPS update rate.

- DC, repetitive and continuous AWG functions.

- AO424-ELF 32 channels, 500kSPS output in ELF formfactor.

- AO424-ELF 16 channels, 1MSPS output. (Software select)

Specifications

Parameter	Value	Comment
Output Type	DC, 20mA max current	
Sample Rate	500kSPS	per channel, simultaneous
Output Voltage Range	±10V	
Output Impedance	10 Ω	
Offset Error	0.01% FS	
Gain Error	0.1% FS	
INL	±2 LSB	
DNL	±1 LSB	
CMR		FS, at 1kHz
THD	> 80dB	
SINAD	-74 dB	
SFDR	85 dBc	
SNR	72 dB	
Full Power BW	1 MHz	
Small Signal BW	2 MHz	
Crosstalk	< 80 dB	@ 1kHz FS Input
Temperature Stability	< 25 ppm / C	
Front panel connectors	VHDCI	

Module: ACQ420FMC

• 4 channels Simultaneous Analog Input.

• Extremely high quality.

• 16, 18 bit resolution, 500k to 2MSPS sample rate

• High impedance differential input, PGA with 4 switched ranges

• Internal and External Clock

• VITA-57 Compliant FMC module
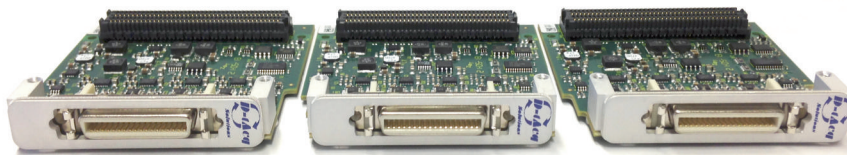
Module Range

Model	Channels		
	No.	Bits	Sample Rate
ACQ420-FMC-4-500	4	16	500 kSPS
ACQ420FMC-4-1000	4	16	1 MSPS
ACQ420FMC-4-2000	4	16	2 MSPS
ACQ420FMC-4-1000-18	4	18	1 MSPS
ACQ420-TERM01	DIN Rail accessory, 4 x Signal, CLK, TRG		

Specifications

Parameter	Value	Comment
Input Type	DC, Differential Input	High Impedance
Input Impedance	100K	
Input Voltage Range	±10, ±5, ±2.5 ±1.25V +0, +20, +40, +60 dB	Software Selectable, per channel High Gain option
Input Voltage Withstand	±30V	
Offset Error	0.01% FS	
Gain Error	0.01% FS	
INL	±0.5 LSB	
DNL	±0.5 LSB	
CMRR	>80dB	FS, at 1kHz
THD	-100dB	
SINAD	-93 dB	
SFDR	100 dBc	
SNR	**94 dB**	Exceptional SNR

Module: ACQ424ELF

• 32 channels simultaneous Analog Input

• High Quality, but low cost. Very high channel counts possible.

• 16 bit resolution, 500kSPS or 1MSPS maximum sample rate

• High impedance differential input, factory fixed input range

• Internal and External Clock
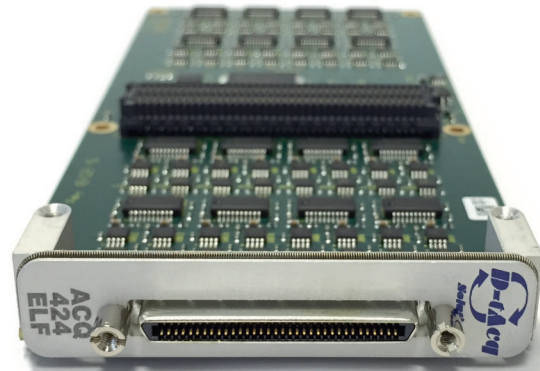
• Extended module, fits D-TACQ Appliances only.

Specifications

Parameter	Value	Comment
Input Type	DC, Differential Input	High Impedance
Input Impedance	100K	
Input Voltage Range	±10, ±5, ±2.5 ±1.25V	Factory build time option
Input Voltage Withstand	±30V	
Offset Error	0.01% FS	
Gain Error	0.01% FS	
INL	±3 LSB	
DNL	±1 LSB	
CMRR	>60dB	FS, at 1kHz
THD	-85 dB	
SINAD	-84 dB	
SFDR	100 dBc	
SNR	86 dB	Typical measured at FS with 9.76 kHz input
Full Power BW	500 kHz	
Cross Talk	<90 dB	Typical 1 kHz FS input
Front panel connector	VHDCI	Pinout compatible with ACQ200 series panels

Module: ACQ425ELF

• 16 channels simultaneous Analog Input

• Extremely high quality. High channel counts possible.

• 16 bit resolution, 2MSPS sample rate, 18 bit 1MSPS

• High impedance differential input, PGA with 4 switched ranges

• Internal and External Clock

• Extended module, fits D-TACQ Appliances only. Scaled up ACQ420FMC.

• Also available : ACQ425-BLF : Quad RJ45, twisted pair differential inputs, transil overvoltage suppression.

• Also available : ACQ427-ELF : Multifunction: 8AI as per ACQ425, 4AO as per AO420, one module.

Specifications

Parameter	Value	Comment
Input Type	DC, Differential Input	High Impedance
Input Impedance	100K	
Input Voltage Range	±10, ±5, ±2.5 ±1.25V alt ±10, ±5, ±2 ±1V	Software Selectable, per channel Factory fit option.
Input Voltage Withstand	±30V	
Offset Error	0.01% FS	
Gain Error	0.01% FS	
INL	±0.5 LSB	
DNL	±0.5 LSB	
CMRR	>80dB	FS, at 1kHz
THD	-100dB	
SINAD	-93 dB	
SFDR	100 dBc	
SNR	94 dB	Exceptional SNR
Full Power BW	1Mhz	
Cross Talk	<90 dB	Typical 1 kHz FS input
Front panel connector	VHDCI	Pinout compatible with ACQ200 series panels

Module: ACQ430FMC, ACQ435/6/7 ELF

- Up to 32 channels simultaneous Analog Input
- 24 bit resolution, 128kSPS sample rate
- Delta Sigma converter with high order LP filter.
- Internal and External Clock

Model	Channels			Characteristics
	No.	Bits	SR	
ACQ430-FMC	4	24	128k	Factory Fixed Voltage Input
ACQ435ELF-32	32	24	128k	Factory Fixed Voltage Input
ACQ436ELF-24	24	24	128k	Factory Fixed Current Input
ACQ437ELF-16	16	24	128k	Programmable Input Voltage
ACQ435ELF-32-16	32	16	50k	Low Cost

Specifications

Parameter	Value	Comment
Input Type	DC, Differential Input	High Impedance
Input Impedance	100K	
Input Voltage Range	±10V (options: ±5V ±2.5V ±1mA ±0.5,1,2,5V	ACQ430/ACQ435 Voltage Input ACQ436 Current Input, Transimpedance amp. ACQ437 Voltage input with PGA
Input Voltage Withstand	±30V	
Offset Error	0.01% FS	
Gain Error	0.01% FS	
INL	±0.002% FS	
CMRR	>60dB	FS @ 1kHz
THD	-100dB	
SINAD	102 dB	
SFDR	-107 dBc	
SNR	104 dB	
Analog Input BW	80 kHz	Digital Filter passband 0.453 F_s
Crosstalk	< 90dB	1kHz FS Input
Front Panel Connector	MDR36 / VHDCI	

Module: ACQ480FMC/ACQ482ELF

• 8 channels simultaneous Analog Input.

• 14 bit resolution, to 80MSPS sample rate

• Compatible with ACQ1001/ACQ1014/ACQ2106

• Internal and External Clock available from carrier.

• VITA-57 Compliant FMC module, with MMCX connectors.

• ACQ480ELF-8-LFP : input on 8 NIM-00 "LEMO" style connectors.

• Includes oversampling FIR filters, noise suppression options, switched termination and programmable gain.

• ACQ482-16 : double width, 16 channels, DIFFERENTIAL input, flex front panel - VHDCI or LEMO-00
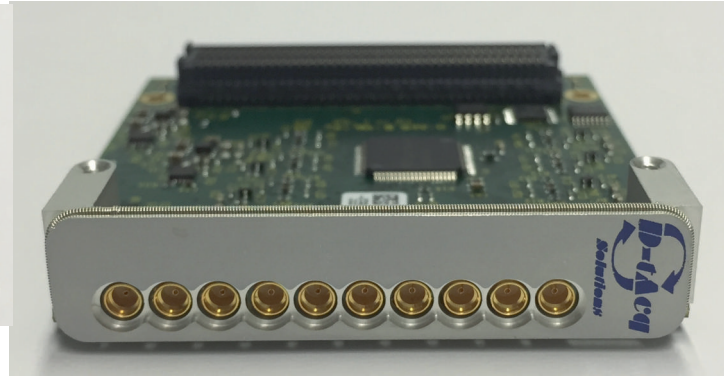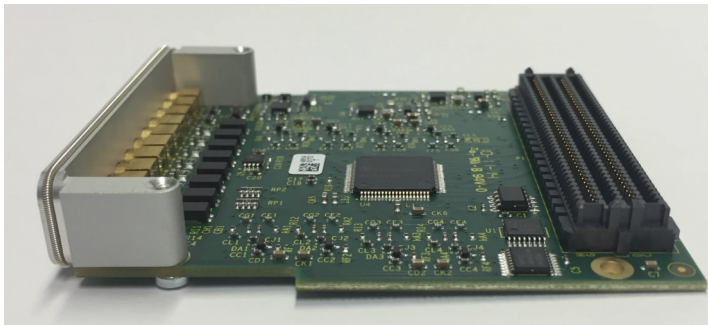
Specifications

Parameter	Value	Comment
Input Type	DC, Single Ended Input	High Impedance
Sample Rate	50 MSPS, 80 MSPS	ACQ2106, ACQ1001/ACQ1014
Resolution	14 bit	
Input Impedance	1M	soft switched 50 Ω termination.
Input Voltage Range	±2.5V	Factory set, x2 gain option in 6 steps
Input Voltage Withstand	±30V	
Offset Error	±3 mV	
Gain Error	±2 mV	
INL	±1 LSB	
DNL	±0.5 LSB	
CMRR	>80dB	FS, at 1kHz
THD	-72 dB	
SINAD	-71 dB	typical
SFDR	85 dBc	typical
SNR	72 dB	typical
Full Power Bandwidth	40 MHz	
Front panel connector	MMCX x 10	Floating inputs, CLK, TRG

Customisation Available

DIO432FMC:
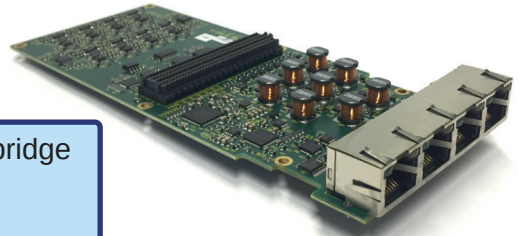also available as
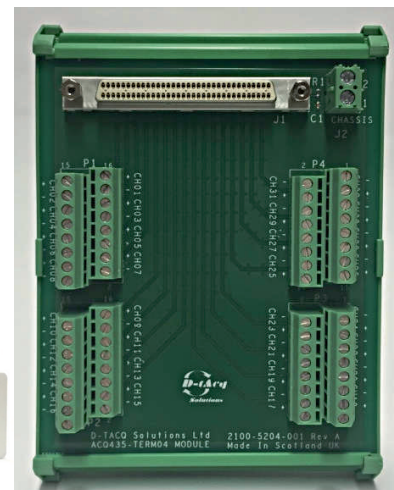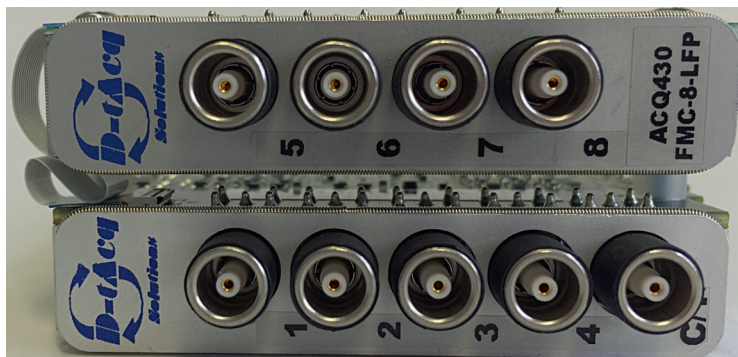PMOD - enables 3-site
HIL tester
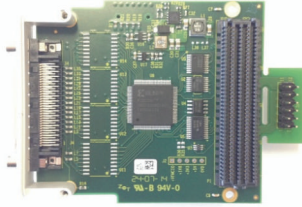
ACQ1002S :
OEM version.
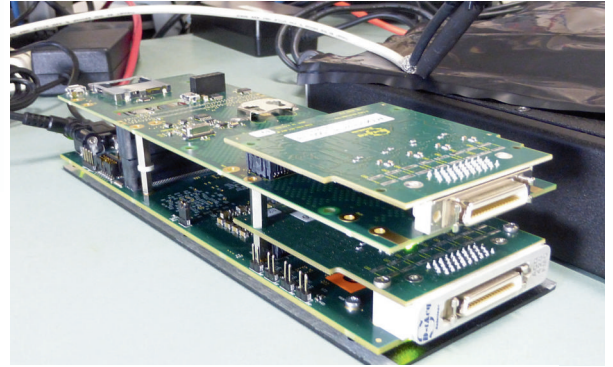
Ask about custom modules;
custom designs include DDS
and high power LIA amplifier
output.

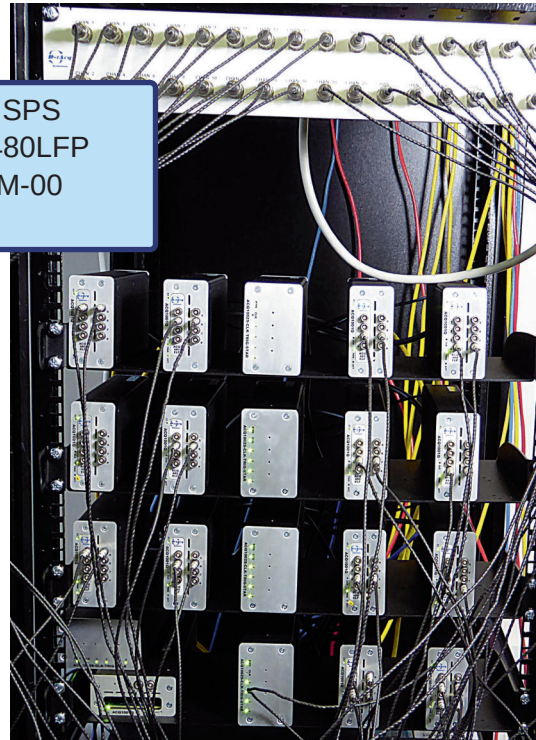BOLO8 : 8 channel AC bridge
input. Fits customised
ACQ2106 chassis

Signal Termination Examples

Example Systems

128 channels x 50MSPS
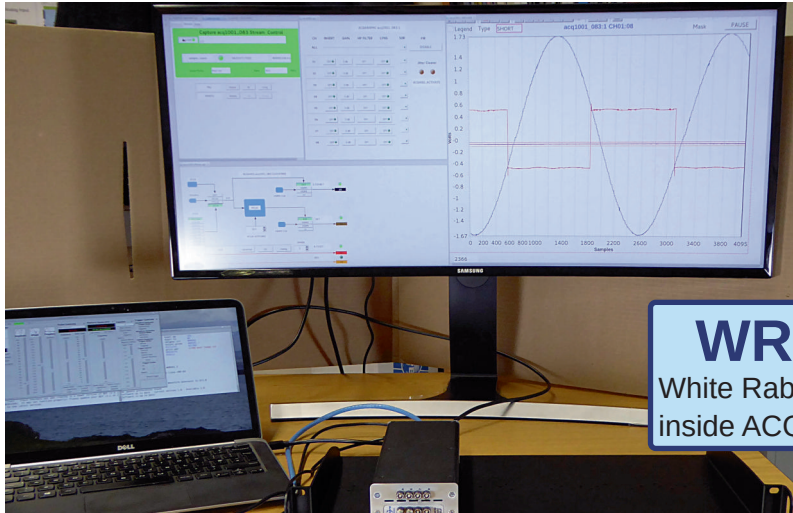ACQ1001Q + ACQ480LFP
Robust push/pull NIM-00
connector

Example 3 x 64 channel
system in 3 boxes with
external sync

ACQ2106+ACQ482-LFP
32AI, 32x30MSPS , 1920MB/s
stored to local 8GB DRAM,
4s continuous full-rate shot.

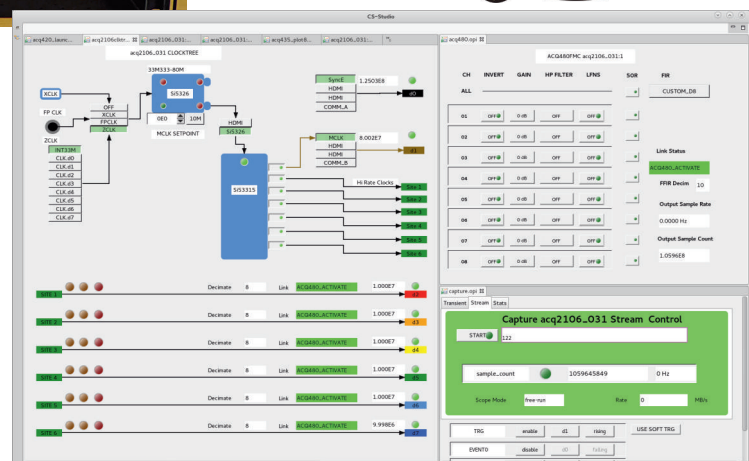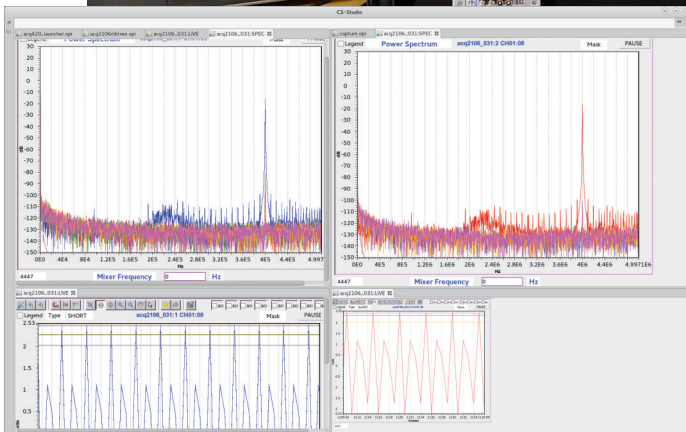# Powerful Embedded Control System

EPICS Inside!
Embedded controller supports remote network GUI clients.
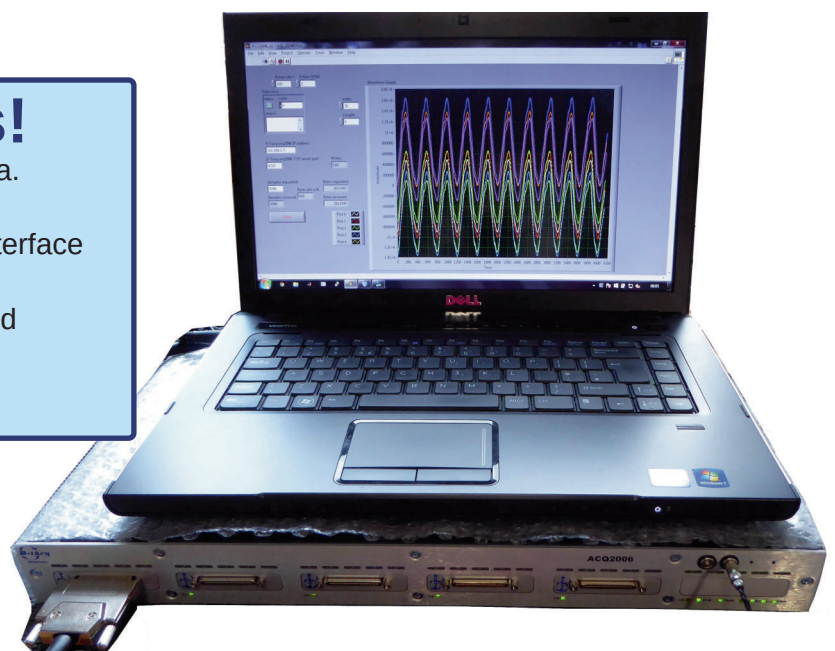Local processing waveforms, power spectra, clock and signal mimics.

WR Inside!
White Rabbit endpoint inside ACQ2106

TCP/IP Scales!
Simple socket server for control and data.
Labview(R) example provided.
Also works with Matlab(R). Published interface and open source examples.
Networked DAQ appliances use standard networking, no device driver required.

Common Product Features

FMC Module Compatibility

The VITA 57 FMC standard combines a robust front panel design with an interface designed for FPGA's. D-TACQ FMC modules achieve very high analog performance in part by providing local clean power. D-TACQ ELF modules make use of the same interface connector but extend the module size to increase payload; D-TACQ appliance motherboards provide clean analog power rails for the ELF modules.

Xilinx ZYNQ System on Chip

The ZYNQ SOC combines dual-core ARM Cortex A9 at 800MHz, dual Ethernet and a high performance FPGA fabric. Z7020 is fitted to ACQ1001 series carriers, Z7030 is specified as standard on ACQ2106 to provide fast serial connectivity - SATA, SFP fiber optic, Ethernet 1000LZ, CERN White Rabbit timing. Standard functionality includes control on Ethernet, External Clock / Trg, programmable delay generator, multi-box synchronization.

DSP Capability

Functionality available off the shelf - Digital Downconverter DDC, Lock-in Amplifier LIA, Voltage To Frequency V2F and Analog Threshold Detect ATD. D-TACQ welcomes opportunities to implement new generic and custom DSP solutions.

1U Appliance formfactor

Both ACQ2106 and ACQ10xx are available in 1U formfactor, for maximum rackmount simplicity with minimum space. The enclosure is a black painted aluminium finish. ACQ1001 may also be deployed in non-rack situations, and it's easy to mount anywhere thanks to a full set of tapped fixing holes. Both units require an external 12V supply (provided).

Embedded Linux on board

Appliances boot Linux. This provides for maximum connectivity, and flexibility and ease of programming. The cards feature a comprehensive web interface, easy scriptable socket interface, and an EPICS IOC is provided as standard. All D-TACQ software is released under GPL and the full source code is provided to end-users.

Turnkey Systems, ready to work

Intelligent units make for extremely simple integration. Power up and point a web browser at it to view data. Make use of the comprehensive EPICS controller, with client GUI applications provided. Easy to extend with a network-scriptable interface, and data transfer using standard networking. Stream to disk and plot live data. No device driver required!.

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High Performance Simultaneous Data Acquisition