

AO422FMC

4/5 Channel Simultaneous Analog Output Module

Product Description

- Standard LPC FMC Module or D-TACQ ELF Module
- 4/5 Channels of Simultaneous Analog output
- Up to 1 MSPS/channel update rate
- Standard configuration: 18-bit resolution, 20-bit option
- High SNR typical > 95 dB

Module Key Features

- Ideal for control applications
- Compatible with all D-TACQ Carriers
- Fully compliant with VITA-57, FMC-LPC
- Range of output modes. DC, AWG

Platform Key Features

D-TACQ supplies a complete working Intelligent DAQ Appliance providing:

- FPGA based system with a range of flexible and customisable features
- Microprocessor system running open source Linux
- Comprehensive API provided in Python
- Onboard EPICS IOC for rapid integration

Please contact info@d-tacq.com for details on the above system integration options.

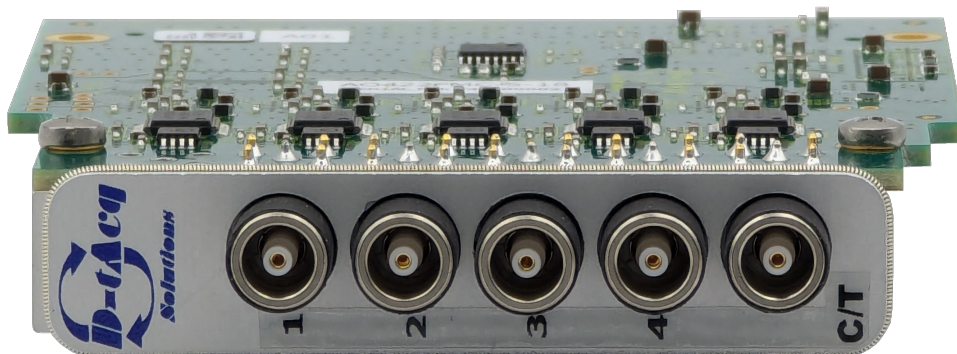


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1 Product Description

1. AO422FMC is a 4/5 channel simultaneous analog output module.
2. Standard configuration: 4 channels, 18-bit resolution, 1 MSPS/channel.
3. Analog voltage outputs on single pin LEMO Connectors with 20 mA/channel drive.
4. Per channel programmable output range, see Section 3.1.
 - $\pm 10V$
 - $\pm 5V$
 - $\pm 2.5V$ is available when used with D-TACQ Carriers.
5. Standard reconstruction filter at 40 kHz.
6. DC and AWG modes.

1.1 Product Variants

- AO422FMC/ELF-4-18 : 4 channels, 18-bit resolution.
 - AO422FMC/ELF-4-20* : 4 channels, 20-bit resolution.
 - AO422FMC/ELF-5-18* : 5 channels, 18-bit resolution.
 - AO422FMC/ELF-5-20* : 5 channels, 20-bit resolution.
- * Special Build : MOQ and/or longer lead time may apply.

Note: FMC versions of the module include an additional connector to be used as an External Clock for the module see Section 2.3 for details.

Contact info@d-tacq.com for custom configurations.

1.2 Applications

- Instrumentation applications, control and monitoring.

1.3 Carrier Compatibility

The FMC module standard, adds user IO to carrier modules fitted with FPGA resource. D-TACQ recommends carriers based on the Xilinx ZYNQ system on chip, combining FPGA resource with a dual-core ARM Cortex A9 and gigabit Ethernet see [Module Carriers](#) on the D-TACQ website.

Compatible carriers include:

- D-TACQ ACQ1001 : D-TACQ single site FMC/ELF carrier, ZYNQ Z7020
- D-TACQ ACQ1002 : D-TACQ dual site FMC/ELF carrier, ZYNQ Z7020
- D-TACQ ACQ2106 : D-TACQ 6 site ELF carrier, ZYNQ Z7030
- D-TACQ ACQ2206 : D-TACQ 6 site ELF carrier, ZYNQ Z7030
- D-TACQ ACQ1102 : D-TACQ 2 site FMC/ELF carrier, Z7030
- DAMC-FMC1Z7IO + D-TACQ ACQ400-MTCA-RTM-2 : 2 site ELF + 1 site FMC carrier, ZYNQ Z7030/7035
- Quantum Detectors PandABox, ZYNQ 7030 with single ELF site. Please contact info@d-tacq.com for details

D-TACQ supplies a complete working Intelligent DAQ Appliance including programmable logic and microprocessor system running Linux.

2 Physical

2.1 Module Outline

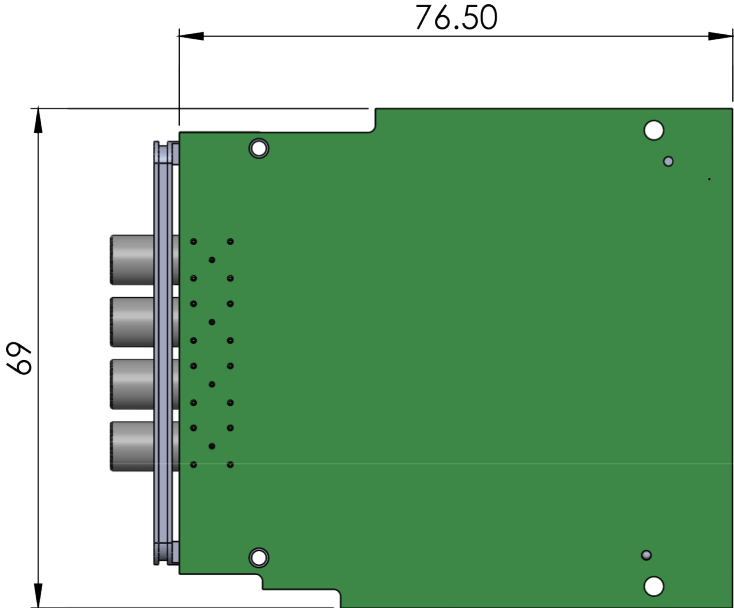


Figure 1: Module Outline

2.2 Appearance

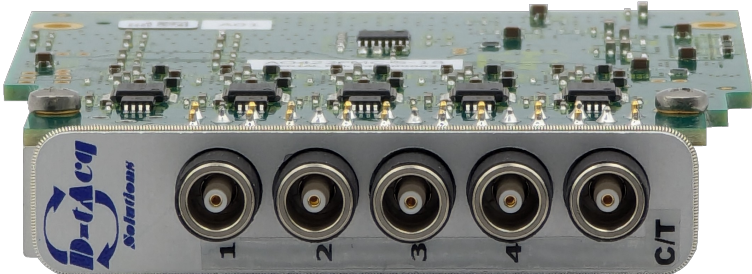


Figure 2: AO422FMC Module Outline

2.3 Front Panel LEMO Connectors

- Single Pin LEMO per channel output, 4 or 5 connectors fitted.
- On FMC Modules Single Pin LEMO Front panel CLK input (Use dedicated External Clock on D-TACQ Carriers).

LEMO Analog Output connectors are centre-output/shield 0V.

LEMO Digital Input connector is centre-input/shield 0V.

All connectors are single-pin LEMO 00 Series Mini Coax connector part EPL.00.250.NTN. Mating plugs should be compatible with this part.

Contact info@d-tacq.com for alternative front panel connectors.

3 Electrical Specification

3.1 Gain Ranges

3.1.1 FMC Version

The FMC variant has an onboard 5V master reference voltage.

Each channel has soft-selectable x1 or x2 multipliers, therefore each channel may be either:

- $\pm 5V$ range
- $\pm 10V$ range

3.1.2 ELF Version

The D-TACQ ELF variant takes its master references from the carrier and is able to switch between 2.5V or 5V providing an additional output range.

Each channel has soft-selectable x1 or x2 multipliers, therefore each channel may be either:

- Master reference 2.5V:
 - $\pm 2.5V$ range.
 - $\pm 5V$ range.
- Master reference 5V:
 - $\pm 5V$ range.
 - $\pm 10V$ range.

3.2 Analog Output Specification

#	Parameter	Value
1	Number of Channels	4/5
2	Update Rate	Up to 1 MSPS, per channel simultaneous
3	Resolution	18-bit, 20-bit build option available
4	Coupling	DC, Single-ended Output
5	Maximum Output current	20 mA Per-Channel
6	Output Voltage Range ¹	±10V ±5V ±2.5V
7	Output Impedance	33 Ω
8	Offset Error	0.01% FS with numerical calibration
9	Gain Error	0.01% FS with numerical calibration
10	INL	±4 LSB (18-bit)
11	DNL	±1 LSB
12	THD	98 dB
13	SINAD	95 dB
14	SFDR	105 dBc
15	SNR	97 dB
16	Full Power BW	40 kHz Standard
17	Crosstalk	< 110 dB @ 1 kHz FS
18	Temperature Stability	< 25 ppm/°C

¹ Available with D-TACQ Carriers. Please contact info@d-tacq.com for details.

Table 1: AO422FMC Output Performance

3.3 LEMO Clock Input

The Clock Input has the following properties

Parameter	Value
TTL Input Low Voltage ¹	< 1.5V
TTL Input High Voltage ¹	> 3.5V
Minimum Input Voltage ²	-0.5V
Maximum Input Voltage ²	5.5V
TTL Output Low Voltage ³	< 0.55V
TTL Output High Voltage ³	> 3.8V
TTL Max Output Current	24 mA

¹ Input hysteresis at least 700mV

² Inputs have under/over voltage protection up to 100mA

³ Output Voltages at specified Max Current

Table 2: LEMO TTL Input/Output Characteristics

4 Mechanical & Environmental Specification

#	Parameter	Value
1	Form Factor	Standard FMC
2	Power Consumption	12V, 500 mA 4 Channels 12V, 600 mA 5 Channels 3.3V, 10 mA
3	Supported VADJ	Min 1.8V, Max 3.3V
4	Environmental	0 °C - 50 °C Operational -10 °C - 85 °C Non-Operational
5	Mezzanine Socket	Standard FMC, Low Pin Count LPC
6	Digital Signal I/O	CLK input 5V TTL

Table 3: Mechanical & Environmental Specification

Revision History

Revision	Date	Author(s)	Description
1	06/06/2023	JMcL	Initial Version For Review
2	15/09/2023	JMcL	Updated with configuration options, additional performance details and connector pin out
3	25/09/2024	JMcL	Updated to latest format
4	24/12/2024	SR	Updating Analog Output specification after further test



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Rev 4 December 2024