

# ACQ1102 Installation Guide



*High Performance Simultaneous Data Acquisition*

## ACQ1102 2-Site D-TACQ ELF/FMC Carrier

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# 1 Overview

## 1.1 Product Description

ACQ1102 is designed to accommodate up to two D-TACQ ELF modules allowing up to 64 simultaneous analog data acquisition channels in one enclosure. As standard the ACQ1102 is configured to support two D-TACQ ELF modules but may also be configured to support a mixture of VITA 57 LPC FMC and D-TACQ ELF modules.

The system uses a Xilinx Zynq-7000 All Programmable SoC Z-7030 running Linux. Connectivity is provided by multiple high-speed comms links for high data throughput as well as Gigabit Ethernet or USB 2.0 options. External Clock and Trigger inputs are also provided, and multiple units may be synchronised together.

ACQ1102 is designed to fit up to 2 units within a 1U, 19" rack. Please see Section 8 for rack-mount options and Section 9 for dimensions.

## 1.2 Variations and Options

ACQ1102 comes in the following configurations.

Product Name	Compatibility	
	VITA 57 LPC FMC	D-TACQ ELF
ACQ1102		2x
ACQ1102-FE	1x	1x
ACQ1102-FF	2x	

Table 1: ACQ1102 Configurations

The ACQ1102 analog voltage is programmable and set automatically to suit the Module payload on boot. There should be no need at all to change this, but if required (eg to reduce power consumption) please contact [support@d-tacq.com](mailto:support@d-tacq.com) for instructions on whether and how to change it.

Third-party FMC modules must only be used in sites that are designated for FMC.

D-TACQ FMC modules can be used in either FMC or ELF sites.

D-TACQ ELF modules must only be used in ELF Sites

Contact [support@d-tacq.com](mailto:support@d-tacq.com) for details on compatibility.

### 1.3 Glossary

- FMC : VITA57.1 FPGA Mezzanine Card
- ELF : Electrically Extended FMC, implies ULPC or DULPC (only compatible with D-TACQ carriers)
- LPC : FMC Low Pin Count standard as per VITA57.1
- ULPC : Subset by D-TACQ, Ultra Low Pin Count
- DULPC : Subset by D-TACQ, Differential Ultra Low Pin Count (ULPC with extra differential signalling)
- Xilinx ZYNQ System on Chip (SoC)
- FPGA : Field Programmable Gate Array
- WR : White Rabbit Timing System for precise Network Timing

## 2 Front Panel

The standard front panel is shown below. Other front panels are available, please contact [support@d-tacq.com](mailto:support@d-tacq.com) for more details.

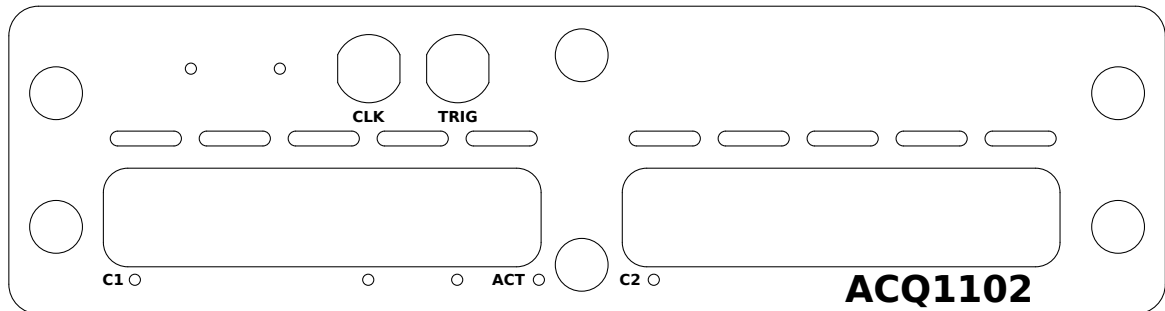


Figure 1: ACQ1102 Front Panel

### 2.1 D-TACQ ELF/FMC Sites

ACQ1102 has space for 2 D-TACQ ELF/FMC modules. Only FMC sites can be used for third-party FMC modules see Section 1.2 for ACQ1102 FMC support . Please contact [support@d-tacq.com](mailto:support@d-tacq.com) for details on our range of data acquisition modules, see Section 6 for details on field replacement.

### 2.2 LEDs

Upon power-up, the POWER LED (on the rear panel) should light, followed 20s later by LOADED (also on the rear panel) to indicate successful FPGA load. When Linux boots, an LED test sequence will be shown, displaying red and green on each LED.

LED	Description	
C1-C2	Green	Card present, valid configuration. Analog power enabled if all cards are valid.
	Red	Card present, invalid configuration. Analog Power disabled if any card is invalid.
CLK	Green	Lit when a valid clock signal is in use <i>Overridden in a WR system to indicate valid PPS</i>
	Red	Unused at present.
TRIG	Green	Lit when a valid trigger signal is being received.
	Red	Unused at present.
ACT	Green	Heartbeat – flashes to indicate Linux activity.

Table 2: Front Panel LEDs

## 3 Front Panel Features

### 3.1 Clock [CLK]

The ACQ1102 accepts a clock input signal via a centre-positive single-pin LEMO 00 Series Mini Coax connector (part EPL.00.250.NTN). Mating plugs should be compatible with this part.

### 3.2 Trigger [TRG]

The ACQ1102 accepts a trigger input signal via a centre-positive single-pin LEMO 00 Series Mini Coax connector (part EPL.00.250.NTN). Mating plugs should be compatible with this part.

### 3.3 Optional LEMO connections

The ACQ1102 can be fitted with up to two extra front panel LEMO connectors on request. These are bidirectional digital I/O signals.. Please contact [support@d-tacq.com](mailto:support@d-tacq.com) for more details.

### 3.4 TTL or Opto-Coupled Signals

The Front Panel LEMO input signals can be configured as either 5V TTL inputs or Opto-Coupled inputs. The Opto-Coupled inputs are of type TLP2367. See Table 5 below for the Opto-Coupler characteristics; if higher input voltages are required a user in-line resistor may be used to reduce the input voltage at the connector. Contact [support@d-tacq.com](mailto:support@d-tacq.com) to verify any setup.

The factory shipping settings on the Switches are as follows

Signal	Default Setting
Clock	Opto-Coupled Input
Trigger	Opto-Coupled Input
AUX1	TTL Input/Output
AUX2	TTL Input/Output

Table 3: Front Panel I/O Default Switch Positions

When configured as TTL inputs or outputs the signals have the following electrical specification. Note Clock and Trigger are input only

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

<sup>1</sup> Trigger Input has a guaranteed hysteresis of 700mV

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

<sup>3</sup> Output Voltages at specified Max Current

Table 4: TTL Input and Output Characteristics

When configured as Opto-Coupled inputs the signals have the following electrical specification

Parameter	Value
Input Low Voltage	< 0.6V
Input High Voltage	> 4V
Minimum Input Voltage	-5V
Maximum Input Voltage	9V
Min ON LED Current	4 mA
Max LED Current	15 mA

Table 5: Opto-Coupled Input Characteristics

Each signal is independently selected for TTL or Opto-coupled using individual switches on the ACQ1102 mainboard. This board is accessed by removing the top cover of the ACQ1102 and is located on the front left of the mainboard with the front panel towards the user.

Selecting the signalling type for each signal requires two switches to be set as follows

Setting	SWAn	SWBn
Opto-Coupled Input	B	B
Bypass/TTL Input/Output	A	A

Table 6: Front Panel TTL / Opto Switch Positions

The Switches are shown in the picture below, These are accessed by removing the top cover on the box see Section 6.1

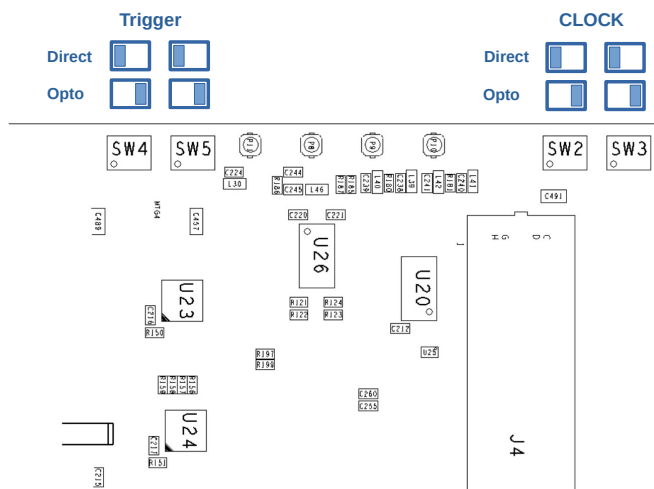


Figure 2: Opto-Coupler Switches

### 3.5 Air Inlets

The row of slots on the front panel allow air to enter ACQ1102. Air is drawn across the cards by fans at the rear of the box. Do not cover the air inlets.

ACQ1102 dissipates some heat through the baseplate and therefore should not be placed on a hot or thermally insulating surface. A steel shelf in normal airflow is ideal.

## 4 Rear Panel

The ACQ1102 rear panel is shown below.

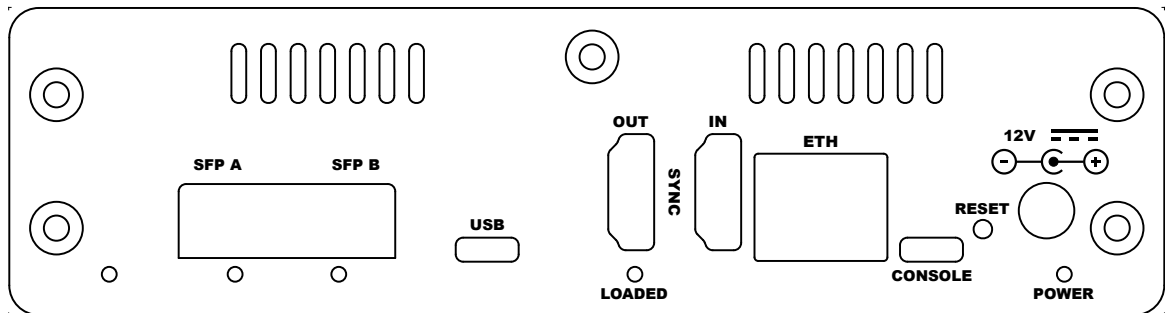


Figure 3: ACQ1102 Rear Panel

## 5 Rear Panel Features

### 5.1 Power

Power is provided to ACQ1102 by an external 12V regulated DC supply capable of outputting approximately 45W, although a supply capable of a minimum of 20W may be used depending on payload. The socket accepts a standard DC barrel connector, centre-positive, 2.5mm internal diameter, 5.5mm external diameter, with a minimum length of 10.5mm. The power supply's input earth should be connected to the output 0V.

**The ACQ1102 must be powered from the D-TACQ supplied Power Supply.**

### 5.2 LEDs

The rear panel provides extra LEDs for system information.

LED	Description
LOADED	Green Lights approximately 20s after power-up to indicate FPGA loaded. If unlit after this, check the validity of the SD card image or check the console for error messages.
POWER	Green Lit when digital power supplies are all valid.

Table 7: Rear Panel LEDs

### 5.3 Console [CONSOLE]

ACQ1102 uses an FTDI FT232R USB-Serial converter for console access via a Micro USB port. Serial Console settings are as follows.

Name	Setting
Baud Rate	115200
Data Bits	8
Parity	No
Stop Bits	1
Flow Control	None

Table 8: Serial Console Settings

### 5.4 Ethernet [ETH]

A single Gigabit Ethernet port is provided that accepts standard RJ45 connectors.



## 5.5 Reset [RESET]

The Reset push button is recessed. Use a paper clip or pin to push the reset button if required.

## 5.6 Sync Bus [SYNC OUT] [SYNC IN]

ACQ1102 provides 2 Sync Bus connectors allowing multiple units to be chained together. The bus uses standard HDMI cables (typically provided by the customer) and has one input port and one output port. These are labelled SYNC IN and SYNC OUT.

The Sync Bus uses +3.3V CMOS logic and is compatible with other D-TACQ carriers. Breakout modules (TERM05, TERM10, TERM11; see [Termination Modules](#)) providing various connector and signal options are also available.

The sync ports may also be used for digital I/O in some customer applications. Please contact [support@d-tacq.com](mailto:support@d-tacq.com) for details.

**Please note the system is not capable of video output - do not connect to a monitor – the ports may only be used for digital I/O.**

The pinouts and functionality are described as follows.

Pin	Name	Description	
		Output Connector	Input Connector
1	Sync	Synchronisation Output	Synchronisation Input
4	Trigger	Trigger Output	Trigger Input
7	GPIO	General Purpose Output	General Purpose Input
10	CLK	Clock Output	Clock Input
19	Cable Detect	Allows master to detect the presence of a slave device.	Ground (0VD)
18	+3.3V	+3.3V input from slave to power output signals	+3.3V output to master to power output signals
13,14,15,16	NC	Not connected	
2,3,5,6,8,9,11,12,17	GND	Ground (0VD)	

Table 9: HDMI Connector Pin Out

## 5.7 High-speed Comms [SFP+]

ACQ1102 has 2 SFP+ Ports available capable of providing multiple high-speed comms options. The available modules are summarised below, contact [support@d-tacq.com](mailto:support@d-tacq.com) for more details.

- 2x High Speed Aurora Comms Modules
  - 2 x Xilinx Aurora Ports for connection to a Host Computer with D-TACQ [AFHBA404](#). Uses Ports A & B by default.
- 2x Network Comms Modules
  - 1 x Fibre Gigabit Ethernet 1000Base-X or HUDP (Hardware UDP) Gigabit Ethernet Port. Uses Port A by default.
  - 1 x White Rabbit Gigabit Ethernet Port. Uses Port B by default.

## 5.8 Fan Outlets

Fan outlets help keep ACQ1102 cool, drawing air across the modules from front to back. Do not cover the fan outlets.

## 6 D-TACQ ELF/FMC Module Replacement

The ELF or FMC modules may be replaced by the user. Contact [support@d-tacq.com](mailto:support@d-tacq.com) for more detailed instructions.

### WARNING

**The system should be disconnected from the mains supply and ESD precautions taken before attempting to open the ACQ1102 Assembly.**

VITA 57 LPC FMC modules may only be used in the FMC sites of ACQ1102. Do not attempt to fit to any ELF sites.

ACQ1102 is a complex electronic assembly. Special care should be taken in handling. The cards are susceptible to damage by ESD and improper power connections or FPGA configurations.

1. Ensure the correct FPGA image is available for the new module configuration.
2. Ensure the system is disconnected from the mains.
3. Ensure ESD precautions (chassis and body grounding) are taken before and during the opening of the case.
4. Please be extremely careful to ensure correct module alignment when plugging in the modules to avoid mezzanine module pin damage.

### 6.1 Case Opening

1. Remove the 6 screws on the top panel
2. Remove the screw in the middle of the top on each of the front and rear panels.
3. Lift the lid off.

### 6.2 Mezzanine Module Removal

1. Remove the 2 screws on the underside at the front. The 2 on the top at the front may be left attached.
2. Remove the 2 screws on top at the rear of the module. Remove the 2 screws in the centre of D-TACQ Extended Length modules.
3. Carefully lift the card away from the mezzanine connector. Note that limited force is required to do this and the module should not bend.
4. Jog the module out from the front panel.

### 6.3 Card replacement and Case Closing

1. Follow the above instructions in reverse order.
2. Ensure the correct FPGA and Software images are installed prior to powering up.

## 7 Specifications

### 7.1 Electrical and Environmental

Parameter	Description
Form Factor	Stand alone, or Rack Mounted on a Tray
Power Source	Standard 12V DC power inlet 2.5mm Int Diameter, 5.5mm Ext diameter
Power Consumption	Dependent on payload but typically 15-25W + 10W per site. Maximum 45W
Environmental	0°C - 50°C Operational -10°C - 85°C Non-Operational
Case Dimensions ACQ1102	Width 156 mm x 227 mm Depth x 1U High

Table 10: Specifications

### 7.2 Declaration of Conformity

The ACQ1102 complies with International safety and EMC requirements.

Declarations of Conformity for this product and for other D-TACQ products can be found on the website:

#### Declarations of Conformity

[ACQ400 EC Declaration of Conformity](#)

[ACQ400 FCC Declaration of Conformity](#)

See the [Product Certification](#) page

### 7.3 Warranty

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## 8 Mounting Options

There are several different mounting options for ACQ1102. The cases can be mounted on their own via integrated fixing points – shown in the image belows, referenced to the bottom and front panels. Alternatively, different options may be attached to D-TACQ’s 19” Mounting Tray.

### 8.1 Mounting

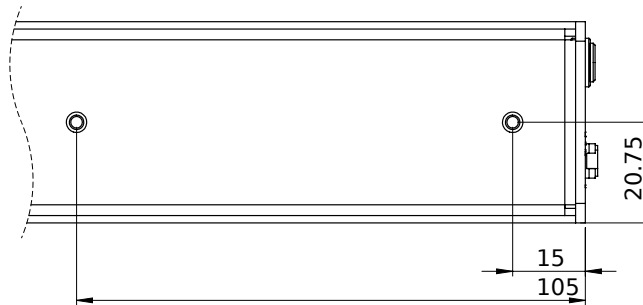


Figure 4: Mounting points for ACQ1102 Case

### 8.2 Mounting Tray

Configurations using the ACQ1102 19” Mounting Tray are shown below. Please contact [support@d-tacq.com](mailto:support@d-tacq.com) for any specific requirements.

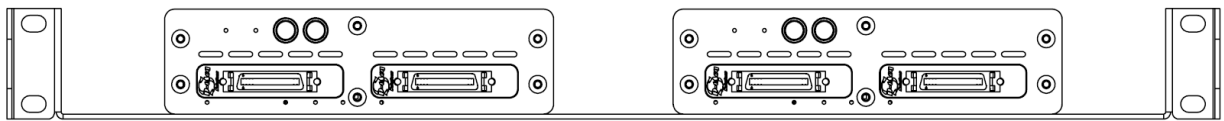


Figure 5: Example of 1U 19” mounting bracket with ACQ1102R

## 9 Dimensions

The dimensions of the case are shown below

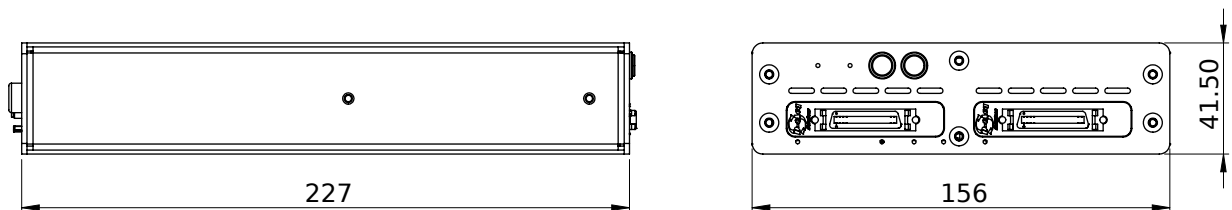


Figure 6: Case Dimensions of ACQ1102)

## 10 Changelog

### Revision History

Revision	Date	Author(s)	Description
1	May 2024	JMcL	Initial Version
2	February 2025	JMcL	Updated Declaration of Conformity