



4-channel 20-bit 1-MSPS  
FMC Bipolar Floating  
Picoammeter Series



## FMC-PICO-1M4

- The FMC-PICO-1M4 is a FPGA Mezzanine Card compatible with standard VITA 57.1 to be mounted on LPC and HPC carrier boards
- Four independent high-speed bipolar current-input channels with 20-bit resolution and dual-range
  - Input channels are capable of floating up to  $\pm 300$  V respect to chassis ground

### FEATURES

- 4-channel simultaneous sampling
- Up to 1 MSPS sampling frequency
- 20-bit ADC conversion
- Two independent full-scale ranges per channel
- FPGA Mezzanine Card - VITA 57.1
- Floating up to  $\pm 300$  V
- Low conversion time delay
- External Trigger/Gate and Interlock
- On-board EEPROM
- Readout board for the AMC-PICO-8 by CAEN ELS

### APPLICATIONS

- Detector readout
- Multi-channel fast current acquisition
- Photon beam position monitoring
- Radiation Monitoring

**FMC-PICO-1M4.** The FMC-PICO-1M4 series is composed of a set of Low Pin Count (LPC) FPGA Mezzanine Cards that allows monitoring bipolar current with high sampling rate (1 MSPS) and high resolution (20 bit).

Each picoammeter board has four (4) independent simultaneous-sampling channels and low delay Analog-to-Digital Converters (ADCs).

Each channel has two full-scale measuring ranges and the current source can be floating up to  $\pm 300$  V respect to the FMC ground. The floating capability of the inputs is perfectly suitable for applications where the detector or current source needs to be biased.

The analog front-end is designed in order to achieve low noise, low temperature dependence and very

little unbalance between channels. The channels are factory-calibrated and data are stored in the on-board EEPROM that can be read via a I2C bus on the FMC connector. A metallic EMI shield, housed in a plastic cover, has the dual function of shielding the analog front end from external noise sources and also insulates the internal electronics that is capable of floating up to  $\pm 300$  V respect to the chassis ground potential.





A trigger signal can be fed to the FMC connector in order to start conversion of data samples: this feature allows synchronization of the board to an external event - e.g. a machine trigger signal in accelerators.

Data readout can be performed via separate SPI links - i.e. one for each channel, sharing the same clock



### About Us

ELS Instruments (formerly CAEN ELS) is a leading company in the design of power supplies and state-of-the-art complete electronic systems for the Physics research world, having its main focus on dedicated solutions for the particle accelerator community and high-end industrial applications.

-  Power Supply Systems
-  Precision Current Measurements
-  Beamline Electronics Instrumentation
-  FMC and MicroTCA

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FMC-PICO-1M4 on an AMC-PICO-8

signal - or can be daisy-chained thus requiring less signals to be handled (adding some readout delay to the entire conversion chain).

Different versions are commercially available, differing by full-scale ranges and bandwidth. Some

versions have a form factor that is a little larger than the VITA 57.1 standard. Please check the user's manuals for detailed information on the mechanical dimensions. Main technical specifications for the different commercially available versions are listed hereafter.

### Technical Specifications

### FMC-PICO-1M4

		"C1"	"C3"	"C4"	"C5"	"C6"	"C7"
<b>Input Channels</b>		4					
<b>Current Polarity</b>		Bipolar					
<b>Input Channel Potential</b>		±300 V respect to chassis ground (continuous)					
<b>Current Measuring Ranges</b>	<b>RNG0</b>	±110 µA	±10 mA	±1 mA	±10 mA	±1 mA	±500 µA
	<b>RNG1</b>	±3 µA	±500 µA	±20 µA	±2.5 µA	±1 µA	±20 µA
<b>Sampling Resolution</b>		20-bit					
<b>Analog Bandwidth (-3 dB)</b>	<b>RNG0</b>	35 kHz	300 kHz	200 kHz	300 kHz	25 kHz	25 kHz
	<b>RNG1</b>			160 kHz	20 kHz		
<b>Rise Time (10-90%)</b>	<b>RNG0</b>	10 µs	1.2 µs	1.8 µs	1.2 µs	15 µs	15 µs
	<b>RNG1</b>			2.2 µs	18 µs		
<b>Sampling Rate</b>		up to 1 MSPS					
<b>Conversion Time</b>		650 ns					
<b>Equivalent Input Noise (@ 1 MSPS)</b>	<b>RNG0</b>	1.8 nA	230 nA	25 nA	250 nA	12 nA	10 nA
	<b>RNG1</b>	150 pA	15 nA	1.5 nA	500 pA	50 pA	500 pA
<b>Absolute Temperature Coefficient</b>	<b>RNG0</b>	10 ppm/K					
	<b>RNG1</b>						
<b>Additional Features</b>		- Trigger / SOC signal present on the FMC connector - Range selection on the FMC connector - Factory calibration					
<b>Mechanical Dimensions</b>		FMC - VITA 57.1					
<b>Input Connectors</b>		Triaxial - LEMO 00.650 Series					

### Ordering Codes

Ordering Code	Acronym	Description
FMCPICO1M4C1	FMC-PICO-1M4-C1	4-channel FMC Bipolar Floating Picoammeter (±110 uA, ±3 uA, BW=35 kHz)
FMCPICO1M4C3	FMC-PICO-1M4-C3	4-channel FMC Bipolar Floating Picoammeter (±10 mA, ±500 uA, BW=300 kHz)
FMCPICO1M4C4	FMC-PICO-1M4-C4	4-channel FMC Bipolar Floating Picoammeter (±1 mA BW=200 kHz, ±20 uA BW=160 kHz)
FMCPICO1M4C5	FMC-PICO-1M4-C5	4-channel FMC Bipolar Floating Picoammeter (±10 mA BW=300 kHz, ±2.5 uA BW=20 kHz)
FMCPICO1M4C6	FMC-PICO-1M4-C6	4-channel FMC Bipolar Floating Picoammeter (±1 mA, ±1 uA BW=25 kHz)
FMCPICO1M4C7	FMC-PICO-1M4-C7	4-channel FMC Floating Picoammeter (±500 µA, ±20 µA, BW=25 kHz)