

INTRODUCTION



Figure 1. Photograph of the PICOSCALE Interferometer V2 with the Breakout Box on top.

The PICOSCALE Breakout Box is shown in Figure 1 on top of a PICOSCALE Interferometer Controller. All signals are accessed via the front panel, while the connector for the cable to the Interferometer Controller is at the back panel.

BREAKOUT BOX

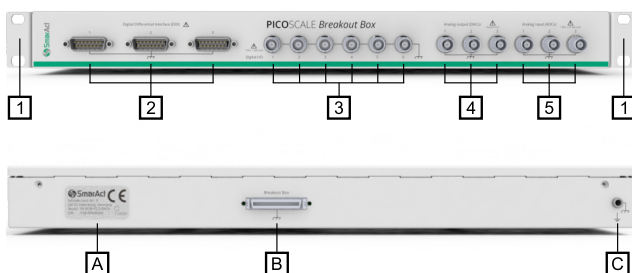


Figure 2. (top) Front side of the BOB: [1] 19" Rack Mount brackets, [2] Digital Differential Interface (DDI) connectors, [3] Digital GPIOs, [4] Analog output (DACs) and [5] Analog inputs (ADCs). (bottom) Back side of the BOB: [A] product label, [B] Breakout Box connector and [C] System ground.



WARNING

The Breakout Box is a low voltage device and the connector shields are connected to system ground. System ground is connected to protective earth (PE) inside the external AC/DC power supply of the PICOSCALE Controller. Do not connect voltages higher than 42 V (peak) referenced to earth ground.

The PICOSCALE Breakout Box (BOB) provides simple and convenient access to the great variety of signals at the mini D ribbon 50 connector. The connectors on the top of the Breakout Box are placed in three groups. A Digital Differential Interface (DDI) is placed on the left hand side, digital GPIOs can be found in the center and analog GPIOs (DACs, ADCs) are on the right hand side (see Figure 2). Analog and digital GPIOs can be connected via BNC connectors while the Digital Differential Interfaces (DDI) are mapped to DSub 15 connectors.

Dimensions

The dimensions of the Breakout Box are given in Figure 3.

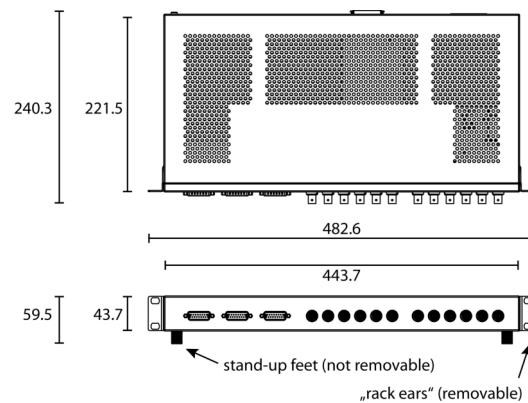


Figure 3. Dimensions of the Breakout Box, weight 2.2 kg.

Interface description

1: Rack mount brackets

The front side exhibits 19" Rack Mount brackets [1] for detailed mounting instructions).

2: Differential Digital Interface (DDI)

The Differential Digital Interface (DDI) provides differential digital signals, which can be used for different digital protocols, e.g. AquadB and Serial Data. With the Breakout Box the signals are distributed to three DSub

15 connectors, one per channel. The pin assignment is shown in Figure 4 and specified in Table 1.

WARNING

Always ensure the connecting element is suitable for the purpose of this connector. Never connect any other device as it may cause permanent damage to the **PICOSCALE** Controller.

B: Breakout Box Interface

The mini ribbon 50 connector interfaces the Breakout Box with the **PICOSCALE** Controller using the included cable.



WARNING

Do not connect any third-party equipment.

The output levels of the specific DDI signals are fully compliant with TIA/EIA RS-485. The differential signals should be terminated with 100 Ω at the differential line ends to ensure best signal integrity. Main performance parameters are listed in Table 3. Maximum ratings are given in Table 2.

C: System ground

This 4 mm banana socket is connected to system ground and can be used to bring several devices to the same electrical potential.

3: Digital GPIOs

The Breakout-Box features 6 digital I/Os. The signals are labeled with Digital I/O 1..6. The overall digital I/O voltage level can be configured as 3.3V or 5.0V. Regardless of this configuration all inputs are 5V tolerant. All digital GPIOs are optimized for a 50 Ω system impedance to ensure best signal integrity. The direction and the voltage level of the digital I/Os can be configured within the **PICOSCALE** GUI. Maximum ratings are given in Table 4. Main performance parameters are listed in Table 5.

The digital I/Os support a maximum frequency of 10MHz, however it is recommended to use the digital GPIOs with a maximum frequency of 1 MHz. Using higher frequencies may cause asymmetries in the duty cycle of the signal. The best signal form can be achieved in a 50 Ω environment. A appropriate coaxial cable with short connections should be used.

4: BOB analog inputs

The Breakout-Box provides three analog input (ADC) and three analog output (DAC) single ended signals with a nominal voltage range of ± 10 V. ADC1 is working with the maximum position signal bandwidth of 2.5 MHz, ADC2 and ADC3 have a limited bandwidth of 100 kHz. Maximum ratings are given in Table 6 For a performance overview see Table 7 and Table 8.

5: BOB analog outputs

The Breakout-Box provides three analog outputs (DAC) single ended signals with a nominal voltage range of ± 10 V. DAC1 is working with the maximum position signal bandwidth of 2.5 MHz, DAC2 and DAC3 have a limited bandwidth of 100 kHz. Maximum ratings are given in Table 9 For a performance overview see Table 10 and Table 11.

A: Product label

This label contains model and serial number, for example.

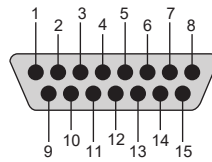


Figure 4. Pin assignment of the DSub 15 connector. The description is given in Table 1.

Table 1. Pin assignment of DSub 15 connectors (DDI 1 to 3)

Pin	General Descr.	Direction	Signal	Direction	Signal	Direction
Hardware properties			Example software configuration			
			AquadB		serial data	
1	DDI[1..3].X+	In/Out	A+	Out	Clock+	Out
2	DDI[1..3].Y+	In/Out	B+	Out	Data+	Out
3	DDI[1..3].Z+	In/Out	unused	Out	unused	Out
4 - 7	not connected					
8	GND		GND		GND	
9	DDI[1..3].X-	In/Out	A-	Out	Clock-	Out
10	DDI[1..3].Y-	In/Out	B-	Out	Data-	Out
11	DDI[1..3].Z-	In/Out	unused	Out	unused	Out
12 - 15	not connected					
Shielding	GND		GND		GND	

Table 2. DDI: absolute maximum ratings

Parameter	Min	Typical	Max	Unit	Comment
$V_{IN_{max}}$	-7.5		13.3	V	Input voltage at any input pin referred to GND

Table 3. DDI: main performance data

Parameter	Min	Typical	Max	Unit	Comment
Transmitter					
$V_{O_{Diff}}$	2.0	2.5	3.3	V	Differential output voltage
V_{OCM}	-	1.6	-	V	Common mode output voltage
Receiver					
V_{TH}	-200	-125	-30	mV	Differential input threshold voltage
V_{HYS}		30		mV	Input voltage hysteresis
V_{ICM}	-7		12	V	Common mode input voltage
General					
R_{IN}		100		Ω	Differential input impedance
f_{max}			50	MHz	Max. frequency per differential pair

Table 4. Absolute maximum ratings - Digital GPIOs 1-6

Parameter	Min	Typical	Max	Unit	Comment
V_I	-0.5		5.5	V	Maximum input voltage range
I_O			± 50	mA	maximum output current

Table 5. Main performance data - Digital GPIOs 1-6

Parameter	Min	Typical	Max	Unit	Comment
$I_{OH_{3V3}}$			24	mA	High level output current at 3.3 V
$I_{OL_{3V3}}$	-24			mA	Low level output current at 3.3 V
$V_{IH_{3V3}}$	2			V	High level input voltage at 3.3 V
$V_{IL_{3V3}}$			0.8	V	Low level input voltage at 3.3 V
$V_{OH_{3V3}}$	2.6		3.3	V	High level output voltage at 3.3 V
$V_{OL_{3V3}}$	0		0.55	V	Low level output voltage at 3.3 V
$I_{OH_{5V}}$			32	mA	High level output current at 5 V
$I_{OL_{5V}}$	-32			mA	Low level output current at 5 V
$V_{IH_{5V}}$	3.5			V	High level input voltage at 5 V
$V_{IL_{5V}}$			1.5	V	Low level input voltage at 5 V
$V_{OH_{5V}}$	4.2		5.0	V	High level output voltage at 5 V
$V_{OL_{5V}}$	0		0.55	V	Low level output voltage at 5 V
R_{OUT}		50		Ω	Output resistance
R_{IN}		1		M Ω	Input resistance
I_I	-7		7	μ A	Input current (I/O configured as Input)
f_{max}			10	MHz	Maximum I/O frequency
t_r, t_f		5		ns	Output edge rise-/falltime
t_{PD}			50	ns	I/O gate propagation delay

Table 6. Absolute maximum ratings - all analog inputs (ADC)

Parameter	Min	Typical	Max	Unit	Comment
V_I	-12		12	V	Maximum input voltage range

Table 7. Main performance data - ADC1

Parameter	Min	Typical	Max	Unit	Comment
$f_{BW_{-3dB}}$			2.5	MHz	Analog input bandwidth
Conversion rate			40	MSa/s	
Resulting data rate			10	MSa/s	Input signal is 4x oversampled
Resolution			16	Bit	
Analog input range	± 9.25	± 10.00	± 10.75	V	
Equiv. input range	0		65535		data type: uint
R_{IN}		1		M Ω	Input resistance
C_{IN}		20		pF	Input capacitance

Table 8. Main performance data - ADC2,3

Parameter	Min	Typical	Max	Unit	Comment
f_{BW-3dB}			100	kHz	Analog input bandwidth
Conversion rate			400	kSa/s	
Resolution			16	Bit	
Analog input range	± 9.5	± 10.0	± 10.5	V	
Equiv. input range	0		65535		data type: uint
R_{IN}		1		M Ω	Input resistance
C_{IN}		20		pF	Input capacitance

Table 9. Absolute maximum ratings - all analog outputs (DAC)

Parameter	Min	Typical	Max	Unit	Comment
I_O	-100		100	mA	maximum output current

Table 10. Main performance data - DAC1

Parameter	Min	Typical	Max	Unit	Comment
f_{BW-3dB}			2.5	MHz	Analog output bandwidth
Conversion rate			20	MSa/s	
Resolution			16	Bit	
Analog output range	± 9.25	± 10.00	± 10.75	V	
Equiv. output range	-1		1		data type: double
R_{OUT}		50		Ω	Output resistance
I_{OUT}	-100		100	mA	Maximum output current

Table 11. Main performance data - DAC2,3

Parameter	Min	Typical	Max	Unit	Comment
f_{BW-3dB}			100	kHz	Analog output bandwidth
Conversion rate			400	kSa/s	
Resolution			16	Bit	
Analog output range	± 9.5	± 10.0	± 10.5	V	
Equiv. output range	-1		1		data type: double
R_{OUT}		50		Ω	Output resistance
I_{OUT}	-100		100	mA	Maximum output current

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