

Summary

Features

- Connects to one AB4 series 4-channel SiPM base
- Wideband DC-coupled signal path
- Buffers 4 SiPM position signals for use with an oscilloscope or ADC
- Sums 4 SiPM position signals with gain and offset adjust, for use by a system trigger
- Requires external amplifier voltage and external bias voltage

Standard accessories

- 16-conductor micro-pitch cable assembly, 3ft. length
- 4 threaded standoffs with 4 #4-40 screws

Part numbers

SiPMIB4	BNC receptacles
SiPMIB4-LEMO	LEMO EP.00 receptacles

SiPM signals

- 4 buffered SiPM position signals
- 1 sum of 4 SiPM position signals

Controls

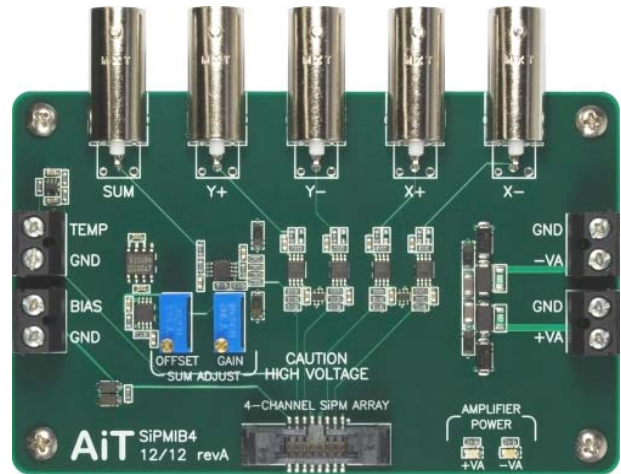
- SiPM position signal sum gain & offset adjust

Monitor signals

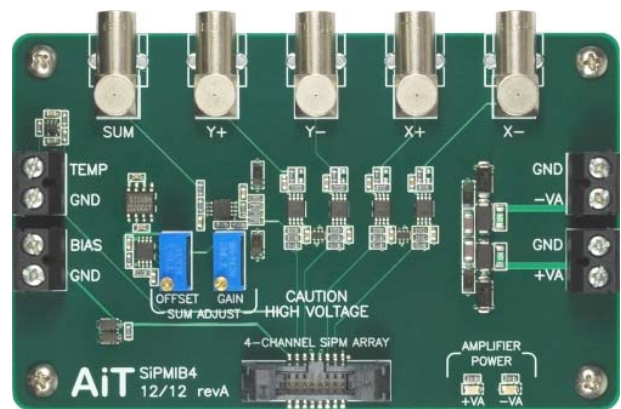
- SiPM Base temperature

Base signals

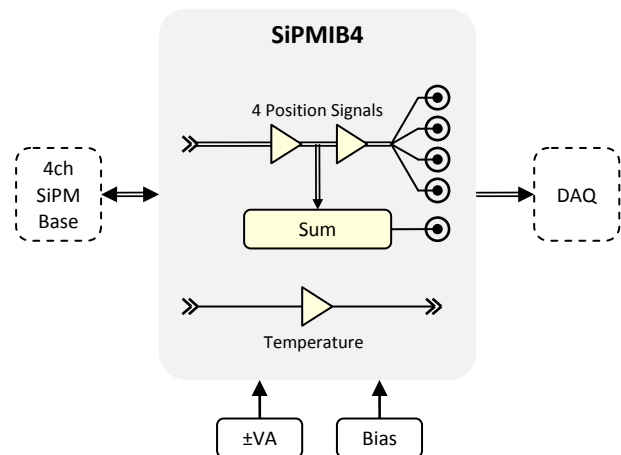
- 4 SiPM position signals
- Bias voltage
- Amplifier power
- Base temperature



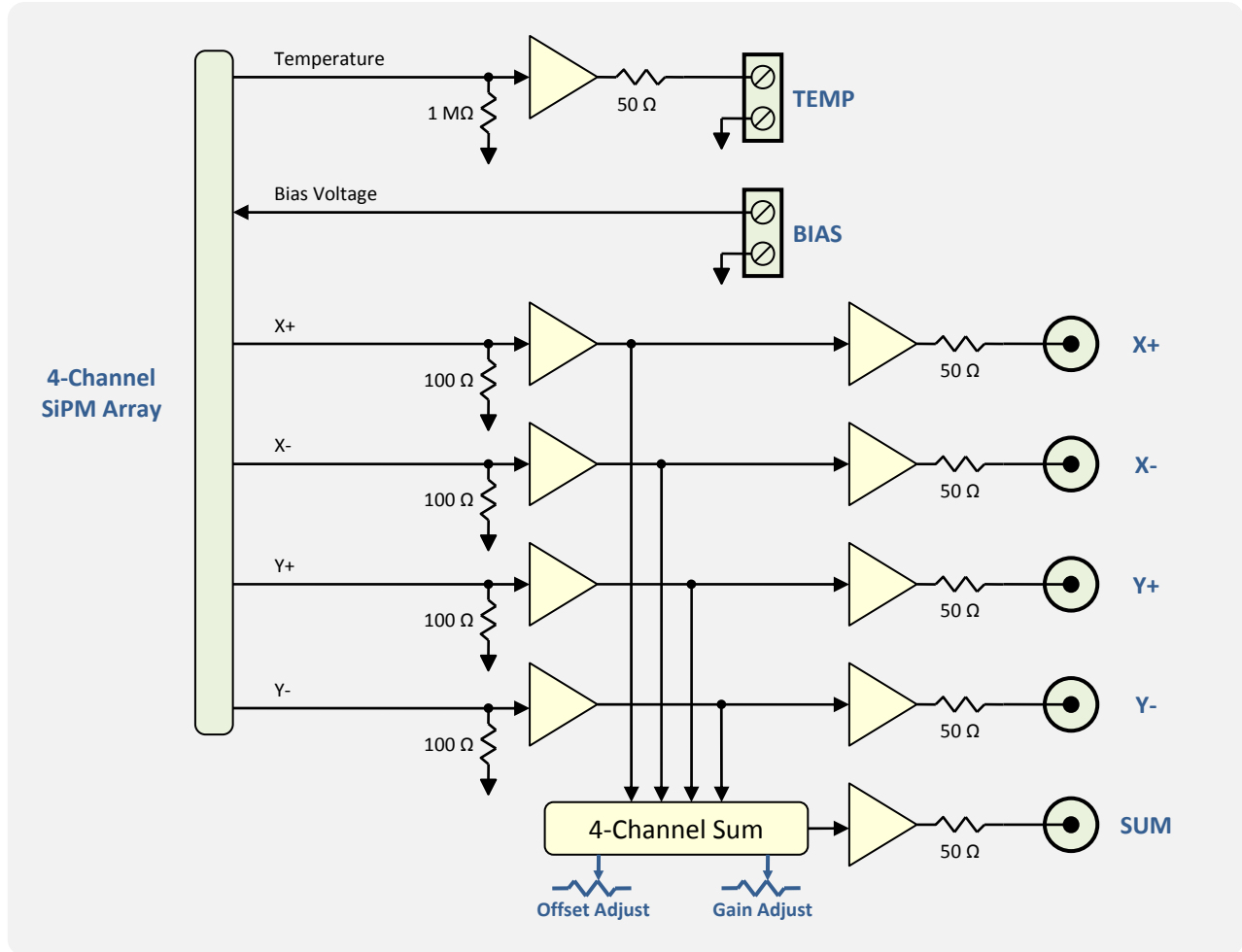
BNC Connectors



LEMO Connectors



Architecture



Specifications

Test conditions: $V_A = \pm 5.0V$

Amplifier Voltage
 Current $\pm V_A = \pm 3.0V \rightarrow \pm 5.5V$ DC
 $< \pm 50mA$ at 5.0V (I_q , no base, no load)
 Protection Reverse polarity, 0.25A resettable fuses, 5.5V voltage limit

Bias Voltage
 Over-voltage Zener shunt $0V \rightarrow \pm 80V$ (refer to SiPM array requirements)
WARNING $\pm 78V$ min.
This device does not limit bias current

SiPM Position Signal Buffers
 Rise time < 3 ns
 Bandwidth (in \rightarrow out) 120 MHz
 Gain (in \rightarrow out) 0.25 (100 Ω source, 50 Ω load)
 Input voltage $\pm 2V$ max.
 Input impedance 100 Ω
 Output voltage $\pm 1V$ max. (50 Ω load), 50mA max.
 Output impedance 50 Ω

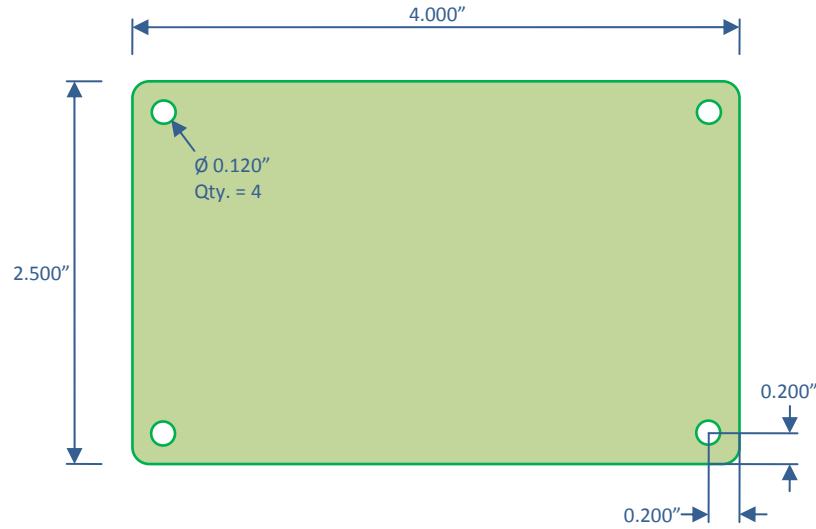
SiPM Position Signal Sum
 Rise time < 4 ns
 Bandwidth 80 MHz at min. gain, 50 MHz at max. gain
 Gain adjust 0.25 \rightarrow 2.5 (25-turn potentiometer)
 Input offset adjust $\pm 700mV$, with in \rightarrow sum gain = 1 (25-turn potentiometer)
 Coupling DC
 Output voltage $\pm 1V$ max. (50 Ω load), 50mA max.
 Output impedance 50 Ω

Temperature Monitor
 Input voltage +3V max., 1 M Ω input impedance
 Output voltage +3V max., 20mA max.
 Output impedance 50 Ω
 Gain 1

LEDs
 V+ Green = Positive amplifier voltage on
 V- Green = Negative amplifier voltage on

Mechanical
 PCB overall dimensions 4.0" x 2.5"
 PCB mounting holes, 4 each 0.12" diameter, accepts #4 hardware
 Do not exceed 0.25" dia. mounting hardware
 Connectors
 4-CHANNEL SiPM ARRAY 16 pin, 2 row latch-eject header, 0.050" pin pitch
 Mating assembly = Samtec FFSD-08-D-XX.XX-01-N
 XX.XX = length in inches
 X+, X-, Y+, Y-, SUM BNC or LEMO EP.00 coaxial receptacles
 +VA, -VA, BIAS, TEMP 2-terminal screw terminal block

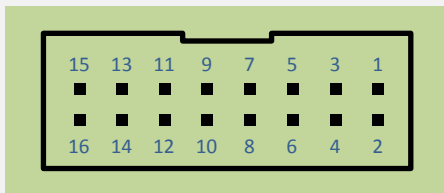
Mechanical



Connectors

4-Channel SiPM Array

16-pin 0.050" latch-eject header



PCB Top View

Pin	Function	Pin	Function
1	Temperature	2	GND
3	X-	4	GND
5	X+	6	GND
7	-VA	8	GND
9	+VA	10	GND
11	Y-	12	GND
13	Y+	14	GND
15	Bias	16	GND

Operation

Typical Setup for Normal Operation

1. Connect the Base with the Interface Board power off
2. Optionally connect an oscilloscope to the SUM output and one or more position signals
3. Power the Interface Board
4. With SiPM signals present, adjust the external SiPM bias voltage, *SUM Offset*, and *SUM Gain* as needed
 - a. Adjust external SiPM bias until SiPM signals appear, typically at 50 μ A-150 μ A bias current
 - b. Adjust the *SUM Offset* until the SUM signal baseline is zero
 - c. Adjust the *SUM Gain* to the desired level
 - d. After adjusting *SUM Gain*, adjust *SUM Offset* as needed
5. Changes in bias voltage may require offset adjustment
6. The SUM signal may be used to trigger an oscilloscope, discriminator, or data acquisition system

Input Power Requirements

- The interface board requires external amplifier voltage and bias voltage
- Normal amplifier voltage is $\pm 5.0V$ (provides $\pm 4.3V$ base amplifier voltage)
- Low-power amplifier voltage is $\pm 3.5V$ (provides $\pm 2.8V$ base amplifier voltage)
- Green LEDs labeled +VA and -VA indicate amplifier voltage
- Amplifier voltage inputs have reverse polarity protection, resettable fuses for short-circuit current protection, and over-voltage protection

Bias Voltage

- The bias voltage input is protected against voltages exceeding $\pm 78V$ by a Zener diode. Excessive bias voltages may damage the Zener diode.
- **WARNING:** This device does not limit bias current. Take precautions to limit bias current to prevent equipment damage and personnel injury.

Temperature Monitor

- The base temperature is buffered for external use

System Assembly Guidelines

SiPM Base Cable Assembly

The SiPM micro-pitch cable connector must be inserted firmly into the header. Correct orientation results in the cable exiting directly away from the Interface Board without interference, and the red index conductor is located on the right side of the connector as seen when facing the back of the unit.

High Voltage

This device must be used only by personnel trained and qualified in safe handling, installation, and operation of high voltage equipment. The optional enclosure does not protect against high voltage exposure.

During operation, high voltage will normally be present in the following components:

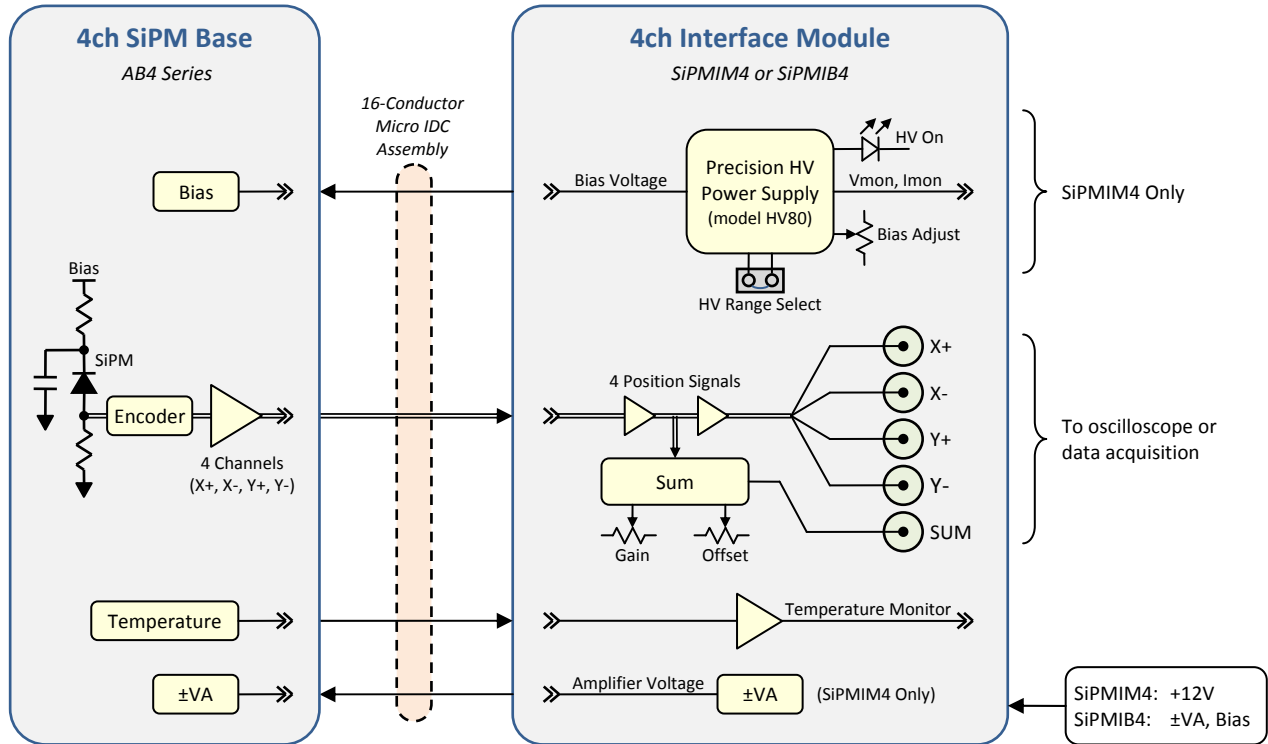
- Interface Board
- SiPM Port signal connector pins
- Exposed base of the SiPM Port signal connector
- SiPM signal cable
- SiPM Base

WARNING: This device does not limit bias current. Take precautions to limit bias current to prevent equipment damage and personnel injury.

PCB Mounting

This device is intended to be incorporated into another system or product. The circuit board may be mounted using standard #4 hardware. Mounting hardware should not exceed 0.25" diameter contact area with the circuit board. Allow for adequate ventilation space around the circuit board.

AB4 Series 4-Channel SiPM Evaluation System



Summary

A 4-channel SiPM array evaluation system consists of an AB4 series 4-channel SiPM Base plus a SiPMIM4 (“IM4”) Interface Module or SiPMIB4 (“IB4”) Interface Board. The AB4 connects to the IM4 or IB4 through a micro-pitch ribbon cable that permits versatile placement of the Base.

The IM4 and IB4 buffers four SiPM position signals and forms an analog sum of all SiPM position signals. The position signals and the sum are provided on five BNC receptacles or optional LEMO EP.00 coaxial receptacles for use with an oscilloscope or external data acquisition. The sum may be used to form a trigger.

SiPMIM4 and SiPMIB4 Differences

The IM4 is provided in an aluminum enclosure and requires only an external 12V power supply to operate. It internally generates amplifier voltages and bias voltage required by the Base. The IB4 is a low-cost unenclosed circuit board. It requires external amplifier voltages and bias voltage to be provided through screw terminals.

Safety Information



WARNING – High Voltage

- High voltage may be present during operation
- High voltage stored on capacitors may be present after power is removed
- Improper handling may result in personnel injury or equipment damage

This high-voltage device must be used only by personnel trained and qualified in safe handling, installation, and operation of high-voltage equipment.



CAUTION – Electrostatic Discharge (ESD) Sensitivity

The circuit board can be damaged by electrostatic discharge. Observe precautions for handling electrostatic sensitive devices. Handle only at static-safe workstations.

High-Gain Photodetectors

High-gain photodetectors such as silicon photomultipliers may conduct damaging currents if exposed to high optical signal levels while the bias voltage is applied, or if the bias voltage exceeds the recommended operating range. These devices must be operated only in low-light conditions, and only within the manufacturer's recommended bias voltage range.

Handling and Disassembly

This product may be provided with or without a protective enclosure. Disassembled enclosure components and circuit boards may contain sharp edges. Take appropriate safety precautions while assembling or disassembling the enclosure and handling disassembled components.

Indoor Use Only

Do not operate this product in a wet/damp environment. Do not operate in an explosive atmosphere.

Use of this product, and AiT Instruments' liability related to use of this product, is further governed by AiT Instruments' standard terms and conditions of sale, which were provided upon purchase of this product.