

Acoustic Transducers and Measurement Systems

www.benthowave.com



Hydrophone and Ultrasonic Preamplifier

BII's low noise low power preamplifiers (amplifiers) have built-in filters and their gains are fixed or programmable with digital and analog control. These preamplifiers (amplifiers) are custom-fit for use in broadband (wideband) underwater SONAR, ultrasonic (Ultrasound, NDT, AE) system and material study.

Typical Applications

Hydrophone, SONAR, Underwater Communication, Navigation.	Ultrasonic (Ultrasound, AE, NDT) Testing, Material Characterization.
Seafloor-mapping, Sub-bottom/Sediment Profiler, Acoustic Image.	Low Noise Ultrasonic Preamplifier, Instrumentation, Pulse Amplifier.
Target Strength Testing, Towed Array, Sonobuoy, Bottom Moored Systems.	Sonic Cavitation Noise, Hand-held, Portable, Battery-operated Systems.

BII1090 Series Low Noise Programmable Gain Preamplifier: 0.02Hz to 8MHz, 1.0nV/VHz, 0.8fA/VHz, 80dB Gain Variation, 1000m Cable Capacity.

Digitally programmable-gain amplifiers are invaluable components in SONAR (Underwater and Air) and ultrasound systems which detect a variety of sources with varying signal levels. Gain-selection is accomplished by a two-bit (or one-bit) digital word (TTL/CMOS level compatible), or manual setup.

Specification

3.5 mm TRS Jack (TRS35): f Preamplifier	BII1091SE	BII1091DF	BII1092SE	BII1092DF	BII1093	BII1094	BII1098		
Input Type:	Differential, eithe	er single ended	(SE) or different	ial (DF) input signa	als are accepted.				
Input Coupling:	AC		•	, , ,	•				
Input Referred Noise:	e _n : 5.8 nV/vHz		e _n : 12 nV/vH:	Z	e _n : 5.2 nV/VHz	e _n : 20 nV/vHz	e _n : 1.0 nV/vHz		
(f ≥ 1 kHz)	in: 3.1 fA/√Hz		i _n : 1.0 fA/vHz		i _n : 3.1 fA/VHz	i _n : 1.0 fA/VHz	i₁: 1.6 pA/√Hz		
	≤ 44MΩ 4pF (10	0/40dB Gain)					4 F001 O 1 17 - F		
	≤ 44MΩ 4pF (20	0/50dB Gain)	≤5MΩ 4pF		≤ 2MΩ 4pF	≤ 200MΩ 5pF	$\leq 500k\Omega 7pF$ Or $50\Omega 7pF$.		
lancet lucas donos.	≤ 10MΩ 4pF (30	0/60dB Gain)					Οι 50Ω[[/pr.		
Input Impedance:	Ri 50Ω matches 50Ω coax cable impedance and damps down NDT transducer to achieve good transient or pulse response or i						esponse or redu		
	decaying time (or	r ringing) of the	e transducer.						
	To avoid adverse	effects of para	sitic component	s of a resistor, inp	ut impedance ≤ 5kΩ is recor	mmended for MHz a	pplications.		
Maximum Input:	2.4 Vpp or Maxin	num Output Vo	max/Gain, whiche	ver is less.					
	BPF		BPF		BPF	HPF	HPF		
	Customized high	pass or bandpa	ass filters, Specif	y -3dB cut-off freq	uencies when ordering.				
				oot of bandwidth.					
					es of electronic devices deci	•	•		
			• .	•	oises in low frequency range				
				high pass filter of	a preamp with -3dB cut-off	frequency 100 Hz to	o improve signal		
Built-in Filter:	noise ratio of the								
	•	-			es and Standalone Preamps	s.			
	-3dB High Pass Frequency: f-3dBH = 1/(2πR _i C _h). that is, R _i = 1/(2π f _{-3dBH} *C _h). R _i : Input Resistance or Impedance of Preamp. C _h : Capacitance of piezoelectric hydrophone/sensor/transducer at 1 kHz (non								
							er at 1 kHz (no		
	resonance measurement) or f _s (resonance measurement such as NDT pulsing system). For example:								
		(1) hydrophone 10nF at 1kHz and preamp R_i 10M Ω constitute high pass filter with -3dB frequency 1.59Hz.							
	(2) hydrophone 10nF at 1kHz and preamp R _i 200MΩ constitute high pass filter with -3dB frequency 0.08Hz. 10, 40 dB.								
Gain of Pass Band:	20, 50 dB.		0, 20, 40, 60	۸D	20, 40, 60, 80 dB.	20, 60 dB.	30, 70 dB.		
dalli di Pass Dallu.	30, 60 dB.		, 20, 40, 60 dв.		20, 40, 00, 80 db.	20, 00 db.	30, 70 ub.		
	1Hz to 2.2MHz.		≤ 40dB: 1Hz t	-0.1MU-7	≤ 60dB: 1Hz to 1MHz	0.02Hz to			
-3dB Bandwidth:	Refer to Frequen	cy Posnonso	60dB: 1Hz t		80dB: 1Hz to 350kHz	250kHz	1Hz to 8MHz		
	Refer to <u>Frequent</u>	cy Response.	2 μS at Gain		2 μS at Gain < 80dB.	ZJUNIIZ			
Settling Time, 0.01%:	0.12 μS		10 μS at Gain		10 μS at Gain = 80dB.	20 μS	0.4 μS		
Output Type:	SE	DF	SE	DF	DF	SE	SE		
Output Coupling:	AC	<u>ы</u>	J.	DI	D1	31	35		
Output Impedance:	10 Ω	10 Ω	10 Ω	50 Ω	50 Ω	10 Ω	50 Ω		
V _{omax} (Vpp):		Vs – 3.4	Vs – 3.4	Vs – 4.0	Vs – 4.0	Vs - 5.0	Vs – 1.0		
Vomax (VPP).	200 m at 10, 40 c		V3 3.4	V3 4.0	V3 4.0	V3 5.0	V3 1.0		
Cable Driving Capability:	200 m at 20, 50 c		1000 m	1000 m	1000 m	160 m	100 m		
casic zitting capacinty.	40 m at 30, 60 d			2000	1000 111				
	Digitally (CMOS/TTL Compatible, controlled by Digital Outputs) and/or Manually.								
	One-bit Wire: A0 and Digital Common for Two Gain Selections.								
	Two-bit Wires: A1, A0 and Digital Common for Four Gain Selections.								
	I I WO-DIL WITES. A	,			Two-bit Wires	One-bit Wire	One-bit Wire		
			One-bit Wire Two-bit Wires One-bit Wire One-bit Wire Logic Low "0": 0 to +0.8 VDC from digital outputs, or Gain Selection Wire is short to Digital COM.						
Gain Selection:	One-bit Wire	to +0.8 VDC fr		ts, or Gain Selection	on Wire is short to Digital Co	OM.			
Gain Selection:	One-bit Wire Logic Low "0": 0		om digital outpu		on Wire is short to Digital Co ction Wire Opens. Vs : Power				
Gain Selection:	One-bit Wire Logic Low "0": 0 Logic High "1": +:	2.4 VDC to +Vs	om digital outpu from digital out	outs, or Gain Selec	tion Wire Opens. Vs : Power	r Supply Voltage.			
Gain Selection:	One-bit Wire Logic Low "0": 0 Logic High "1": +: Warning: Logic V	2.4 VDC to +Vs oltage is greate	om digital outpu from digital out er than maximun	outs, or Gain Selec n voltage rating or		r Supply Voltage. e the device.	tion rating of the		

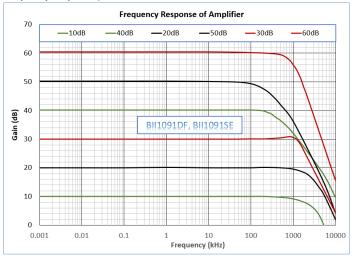


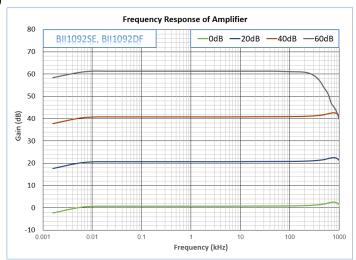
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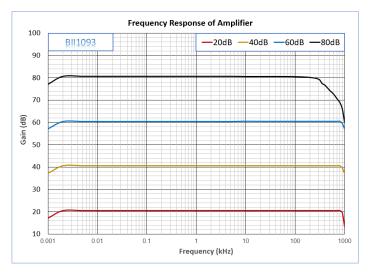
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Supply Vo	oltage Vs:	+8 to +32 V	+8 t	o +32 V	+8.2 to +32 V	+8.2 to +32 V	+8.2 to +32 V	+9.5 to +32 V	+8 to +32 V	
Quiescen	nt Current:	13 or 14 mA	17 0	or 19 mA	9 mA	13 mA	22 mA	3.0 mA	15 mA	
Suggeste	ed DC Supply V _s :	Fixed DC Lin	1.2 V to 12.6 V Batteries (AA, AAA, C, and D, 9V, Coin Cell, Marine and Automobile). Fixed DC Linear Power Supply, Not Included. DO NOT use variable power supply whose maximum supply voltage is higher than the above rated voltage. DO NOT use switching mode DC power supply.							
Service T	emperature:	-40 to 70 °C	-40 to 70 °C or -40 to 158 °F							
Storage T	Temperature:	-40 to 70 °C	or -40 to	158 °F						
Package		Metal Hous	ing with f	our mounti	ng holes					
Input Cor	nnector:	1. BNC Jack 2. 3.5 mm T	` '	U	ed Signal. Differential Signal.					
Output C	Connector:	BNC Jack	TRS	Jack	BNC Jack	TRS Jack	TRS Jack	BNC Jack	BNC Jack	
		BNC Jack	BNC	Jack	TRS Jack	TRS Jack	TRS Jack	BNC Jack	BNC Jack	
Gain Sele	ection:	 3.5 mm TRS Jack on Housing for tow-bit digital signal. Accessories: A3 with 0.9m Cable. BNC Jack on Housing for one-bit digital signal. Gain Selection Cable: Buy uses buyer's own BNC and coax. 								
Power Su	apply:	Power Conn	Power Connector Jack on Housing. Power Supply Cable: <u>DCBP24</u> , <u>DCBS18V</u> .							
Size:		77x50.6x33	77x50.6x33 mm (TRS Jacks) or 77x50.6x43 mm (BNC Jacks), or 95x59x37 mm (TRS Jacks) or 95x59x47 mm (BNC Jacks).							
Weight:		70 to 80.0 g	70 to 80.0 gram							
Accessori	ies:	A1: Bespoke length RG58, RG174, or RG178 Coax with BNC Male to BNC Male. A2: Bespoke length cable with 3.5mm TRS Plug to 3.5mm TRS Plug. A3: Bespoke length cable with 3.5mm TRS Plug to Wire Leads. A4: Cable with 3.5mm TRS Plug to XLR Receptacle with 3 Male Pins.								
Gain Sele	ection Table									
A1	A0	BII1091SE, E	3111091DF		BII1092SE, BII1	092DF.	BII1093	BII1094	BII1098	
0	0	10 dB	20 dB	30 dB	0 dB		20 dB	20 dB	30 dB	
0	1	40 dB	50 dB	60 dB	20 dB	·	40 dB	60 dB	70 dB	
1	0				40 dB		60 dB			
1	1					·	80 dB			

Frequency Response (Illustration ONLY with Customized Gain and Built-in Filters)



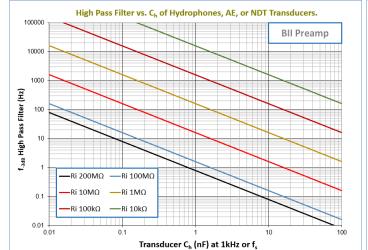




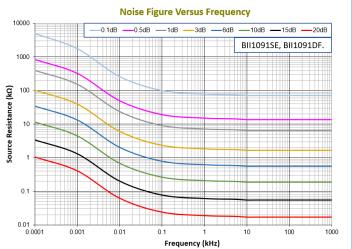
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High Pass Filter vs. Ch of Hydrophone, AE, or NDT Transducer.



Noise Figure



Standard Preamp, Metal Housing. BII keeps standard parts in stock.

Part Number	-Gain	-R _i , Refer to R _i C _h Filter.	-Input Connector	-Accessory Cable Length	- <u>Type</u>
BII1091DF	10/40dB	44 MΩ, 5 MΩ, 500 kΩ.	BNC: BNC Jack.	Disabable Assessment	A1 A2 A2 == A4
	20/50dB	44 MΩ, 5 MΩ, 500 kΩ.		Blank: No Accessories.	A1, A2, A3, or A4.
BII1091SE	30/60dB	10 ΜΩ, 1 ΜΩ, 100 kΩ.	IKS: 3.5IIIIII IKS Jack.	0.6m, 0.9m, 1.8m, 10m, 20m.	DCBP24, DCBS18V.
Example: Description:					
BII1091DF-10/40dB	BII1091DF-10/40dB-44MΩ-BNC-20m-A4-DCBS18V: BII1091DF, Preamp, Gain: 20/50dB, Input Impedance: 44MΩ, Input: BNC Jack, Accessory: 20m A4. Cable: DCBS18V.			ory: 20m A4. DC Supply	
BII1091DF-10/40dB-44MΩ-TRS-20m-A4-DCBS18V: BII1091DF, Preamp, Gain: 20/50dB, Input Impedance: 44MΩ, Input: TRS Jack, Accessory: 20m A Cable: DCBS18V.			ory: 20m A4. DC Supply		
BII1091DF-20/50dB	-44MΩ-BNC-20m-A4-DCBS18V:	BII1091DF, Preamp, Gain: 2 Cable: DCBS18V.	20/50dB, Input Impedance	e: 44MΩ, Input: BNC Jack, Accesso	ory: 20m A4. DC Supply
BII1091DF-30/60dB-10MΩ-BNC-DCBP24: BII1091DF, Preamp, Gain: 30/60dB, Input Impedance: 44MΩ, Input: BNC Jack, DC Supply Cable: DCBP24.				ply Cable: DCBP24.	

How to Order Bespoke Preamplifiers (Metal Housing). Non-stock.

Don't Name have	· · · · · · · · · · · · · · · · · · ·	LDE	Inner Commenter	Assessme Cable Lawath	T		
Part Number	-Ri Input Impedance	- <u>LPF</u>	-Input Connector	-Accessory Cable Length	- <u>Type</u>		
BII1092SE, BII1092DF,		-3dB Low Pass Frequency,	BNC: BNC Jack. TRS: 3.5mm TRS Jack.	Blank: No Accessories.	A1 A2 A2 a= A4		
BII1093.	Refer to RiCh Filter.	in Hz, kHz, MHz.			A1, A2, A3, or A4.		
BII1094, BII1098.		Not Supported.		in meter.	DCBP24, DCBS18V.		
To avoid adverse effects	of parasitic components of	a resistor, input impedance ≤ 5	$k\Omega$ is recommended for M	IHz applications.			
Example:		Description:					
DU1002DE 2MO 100kU-	DUAGOODE OLAG AGOLU, DAG DODDOA		BII1092DF, Preamp, Input Impedance: 2MΩ, -3dB Low Pass Filter: 100kHz, Input: BNC Jack, DC Supply Cable:				
BII1092DF-2MΩ-100kHz-BNC-DCBP24:		DCBP24.					
BII1092DF-2MΩ-100kHz-TRS-DCBP24:		BII1092DF, Preamp, Input Impedance: 2MΩ, -3dB Low Pass Filter: 100kHz, Input: TRS Jack, DC Supply Cable:					
BII1035DE-5M01-100KHZ	-1K5-DCBP24:	DCBP24.					
BII1092DF-2MΩ-100kHz-BNC-100m-A4-DCBS18V:		BII1092DF, Preamp, Input Impedance: 2MΩ, -3dB Low Pass Filter: 100kHz, Input: BNC Jack, Accessory: 100m					
		A4. DC Supply Cable: DCBS18V.					
DU1002DE 2MO 100H-	DU1000DE 0140 400UU TDC 400 A4 D0DC40U		BII1092DF, Preamp, Input Impedance: 2MΩ, -3dB Low Pass Filter: 100kHz, Input: TRS Jack, Accessory: 100m				
BII1092DF-2MΩ-100kHz-TRS-100m-A4-DCBS18V:		A4. DC Supply Cable: DCBS18V.					

Signals and Wiring of Panel-Mount Connectors

Input or Output Sign	als	Gain Selection (BII1090 Serie	es)	Power Supply	
Single Ended (SE)	Differential/Balanced (DF)	Digital Signals, Logic "0" and	Digital Signals, Logic "0" and "1".		
BNC Jack	3.5mm TRS and Cable	3.5mm TRS Jack	3.5mm TRS Jack BNC Jack		
Center: Signal Shield: Common	Tip, White Wire: Signal +. Ring, Black Wire: Signal Sleeve, Shield: Common.	Tip: A1. Ring: A0. Sleeve: Digital COM.	Conductor: A0. Shield: Digital COM.	Center Contact: +VDC. Shell: Common.	
Metal Case is for shielding and grounding.					

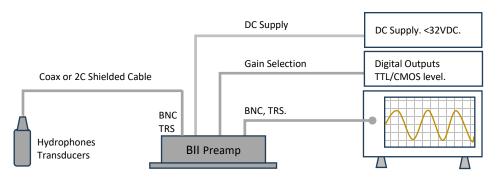
Signals and Wiring of Accessory Cables

Agricus and Trining of Accessory Cables							
Input and Output Signals			Gain Selection (BII1090 Series)		DC Supply Cable		
Single Ended (SE) Differential/Balanced (DF)		Digital Signals Logic "0" and "1"		Single DC Supply.			
BNC and Coax	1/8" TRS and Cable	XLR and Cable	3.5mm TRS and Cable BNC and Coax		Power Plug		
Center: Signal +: White Wire, TRS Tip, XLR Pin 2.			Tip, Yellow Wire: A1.	Conductor: A0.	Red Banana Plug: +VDC.		
Shield: Common Signal -: Black Wire, TRS Ring, X		S Ring, XLR Pin 3.	Ring, Blue Wire: A0.	Shield: Digital COM.	Black Banana Plug: Common.		
Silleiu. Common	Common: Shield, TRS Sleeve, XLR Pin 1.		Sleeve, Black Wire: Digital COM.	Silielu. Digital COM.	Cable Shield: Shielding.		
Warning: "Signal –" is the reverse (180° phase difference) of "Signal +", and "Signal –" can NOT be connected to Common or Ground.							

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System Wirings of Standalone Preamp.



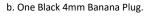
Digital Recorder, Computerized DAQ, Embedded Controller, Oscilloscope, Analyzer/Instrument.

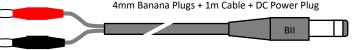
Accessories:

Part Number: DCBP24.

To Terminals of DC Supply:

a. One Red 4mm Banana Plug.





DC Power Plug.
To DC Power Jack of the Device.

Red Banana Plug or Red Wire Lead: +VDC.

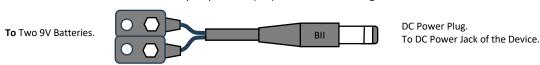
Black Banana Plug or Black Wire Lead: Common.

Cable Shield, if any: Shielding.

One 1m DC supply cable. One end is with Red and Black Banana Plugs, another end of the cable is with DC Power Plug. Depending on output terminals of buyer's DC Supply, buyer may assemble other type of connectors to DC supply cable at buyer's cost.

Part Number: DCBS18V.

Two 9V Battery Snaps + 0.3m (12") Cable + DC Power Plug



One 0.3m (12") DC supply cable. One end is two 9V Battery Snaps which supplies +18VDC to amplifiers, another end of the cable is with DC Power Plug.

A1: Bespoke length RG58, RG174, or RG178 Coax with BNC Male to BNC Male. Default: 0.6m.



A2: Bespoke length cable with 3.5mm TRS Plug to 3.5mm TRS Plug. Default: 1.828m.



A3: Bespoke length cable with 3.5mm TRS Plug to Wire Leads. Default: 0.9m.



A4: Bespoke length cable with 3.5mm TRS Plug to XLR Receptacle with 3 Male Pins. Default: 0.9m.



Most recorders and analyzers use XLR Plug with 3 Female Sockets on front panel as differential/balance input connector and BII's XLR of A4 is compatible to it.

Questions

What if the connector of my transducer/sensor is SMA or SMC Connector? SMA (or SMC) to BNC (Male) adaptors are available from many electronic distributors. BII may sell the adaptor as an accessory of the device upon request. By default, BII does NOT supply the adaptor as accessories.

How do I wire 50Ω transducer/sensor to preamplifiers in high frequency applications? Many BII preamplifiers have non-50Ω input resistances which does NOT match 50Ω in high frequency applications. Therefore, one T type BNC adaptor and one 50Ω BNC terminal are necessary between 50Ω transducer/sensor and the preamplifier to change the impedance of the preamp to be 50Ω. BII may ship T type BNC adaptor and one 50Ω BNC terminal as accessories of the device. Please specify this request



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when ordering. By default, BII does NOT supply these two parts as accessories. By the way it is NOT necessary to do 50Ω matching in low frequency range applications in which electromagnetic wave lengths are much greater than the cable length.

How do I wire BII preamplifiers to audio connectors XLR Plug with 3 Female Sockets (Differential Signal) of my recording devices? BII Preamplifiers have panel mount TRS Jacks as output connectors. Please order accessory A4 with preamplifiers. By default, BII does NOT supply the cable assembly as accessories.

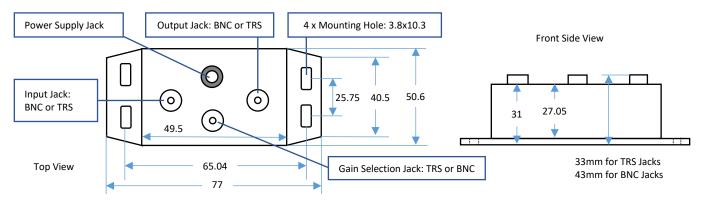
My acoustic sensors generate differential signals in MHz range, are TRS connectors of BII preamps suitable for my applications? Our test shows the TRS connectors (Plug and Jack) of BII preamps can be used up to 20 MHz. Test Conditions: TRS Jack with 0.2m cable and TRS plug with 1m cable. Oscilloscope: $1M\Omega | |30pF$, Signal Source: DDS Signal Generator.

Can 3.5mm (1/8") TRS be configured for single-ended signal of a hydrophone/transducer which does not have built-in preamplifier? Yes, the preamp with differential-input TRS can accept single-ended signals from hydrophones/transducers whose TRS wiring should be like followings: TRS Tip: Signal. TRS Ring and Sleeve: Both terminals are soldered together for Signal Common and Shielding. Common and shielding should be "one-point" contact.

Can BII explain why the capacitance of my hydrophone/transducer affect high pass filtering? (1). Hydrophone/transducer is high impedance devices in low frequency range. Its simplified complex impedance = $j/(2\pi fC_h)$, C_h is the capacitance of hydrophone/transducer, f is frequency in Hz. This impedance is in series with preamp R_i and can reach several $M\Omega$ to hundreds $M\Omega$ depending on C_h and f. (2). Most high-performance operational amplifiers (IC chips) can use input resistors R_i up to 1 to 200 $M\Omega$ to avoid bumping into saturation issue.

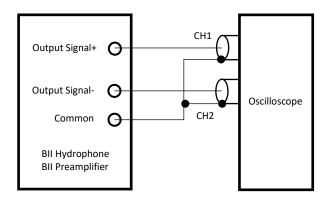
My recorder (or signal processing device) is about 100m away from the hydrophone (or AE Sensor), which type of preamplifiers should I choose? Choose differential-output preamps to drive the 100m cable and ensure that your data acquisition device can accept differential signals.

Programmable Gain Preamplifiers BII1090 Series with Metal Housing LxWxH = 77x50.6x31, Outline Dimensions (mm).

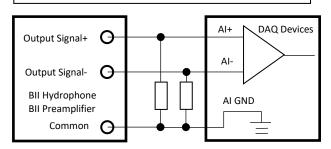


Preamplifier Wirings to DAQ (Data Acquisition) BII: Benthowave Instrument Inc.; DAQ: Data Acquisition Hardware; AI: Analog Input; CH: Channel; GND: Ground. BII's Differential Output to BNC Input of an Oscilloscope

BII's Differential Output to Differential Input of a DAQ



If input impedance of a DAQ device is greater than 100M Ω , use following wiring with one 100k Ω to 1M Ω resistor.



BII's Single-Ended Output to Single-Ended Input of a DAQ

BII's Single-Ended Output to Differential Input of a DAQ

If input impedance of a DAQ device is greater than 100M Ω , use following wiring with one 100k Ω to 1M Ω resistor.

