TRITON - USB Audio Interface

User Manual

Version 2 – July 2018

Package Contents

1. USB audio interface Standard version (grey) or IEPE version (black)
2. CA05 USB-A/C cable
3. Quick Guide
4. LP03 leather pouch
5. Measurement report
6. 2 RCA/BNC socket adapters (standard version) or 2 BNC/RCA socket adapters (IEPE version)

Contents

1 Description

The Triton is a USB/Audio interface intended for acoustical measurements. Several types are available that differ in input. The ***Standard*** type is provided with RCA sockets, while the ***IEPE*** (Integrated Electronics Piezo Electric) type is provided with BNC sockets and constant-current powered inputs (figure 1). IEPE is also known as ICP® (Integrated Circuit Piezoelectric, registered by PCB Group, Inc.) and DeltaTron® (registered by Brüel & Kjær Sound & Vibration Measurement A/S).

a) Standard type: with normal inputs

b) IEPE type: with IEPE (microphone) inputs

Figure 1. Triton types.

Typical applications

- Room acoustics (e.g. concert hall, studio or stage parameters)
- Building acoustics (e.g. sound insulation or loss factor)
- Road acoustics (e.g. road surface or sound barrier absorption or insulation)
- Electronic systems (e.g. transfer functions or spectral impedance)
- Acoustic signals (e.g. sound levels or frequency spectra)
- Electronic signals (e.g. voltage levels or frequency spectra)

The analog inputs and outputs are phase-synchronous, thereby enabling the use of synchronous deconvolution techniques, such as with MLS and sine sweep measurements. USB's Plug & Play architecture and the compatibility with native Microsoft™ Windows™ and Apple Computer™ macOS drivers enable instant use without driver installation.

Features

- USB-bus powered
- Inputs: Standard (unpowered) or IEPE (powered with 4.5 mA per input)
- Input gains: 0, 10, 20 or 30 dB
- Overload indication
- Optional attenuator cable for standard input
- Input and output 1 kHz level measurement report included
- No manual controls, ensuring reproducible measurements
- Compact and robust design
- Uses native Windows and Apple Computer macOS drivers
- Ideal for use with DIRAC room acoustics software

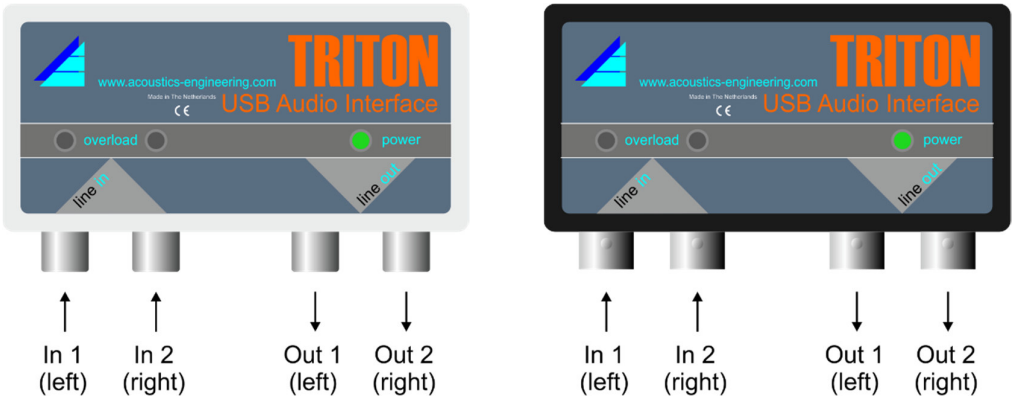
2 Installation

The Triton uses native Microsoft™ Windows™ or Apple Computer™ macOS drivers and does not require separate driver installation. It just has to be plugged into the USB-A socket of a laptop or desktop running Windows or macOS, using the supplied CA05 USB-A/C cable. If the computer is equipped with USB-C sockets only, use a cable with USB-C connectors at both ends (not enclosed). Now the green and red indicators turn on, until the computer establishes a connection with the device, after which the red indicators turn off again. The Triton will then appear as **USB Audio CODEC** in the list of Playback or Recording devices.

3 Operation

3.1 Sockets

The analog input and output sockets are RCA types for the Standard Triton and BNC types for the IEPE Triton (figure 2).



a) Standard type: RCA sockets *b) IEPE type: BNC sockets*

Figure 2. Triton analog input and output sockets.

The Triton USB-C socket at the back (figure 3) is connected to the PC by a USB-A/C cable, such as the one enclosed. When the Triton is recognised by the PC, it will appear as **USB Audio CODEC** in the list of Playback or Recording devices.

a) Standard type: grey enclosure and grey gain label *b) IEPE type: black enclosure and yellow gain label*

Figure 3. Triton back views with USB-C sockets.

3.2 Indicators

The **green** LED lights when the Triton is powered (from the USB bus).

A **red** LED lights in either of the following cases:

- The momentary voltage of the corresponding input exceeds the full scale value.
- At power up, during about 1 second.
- There is no USB communication, e.g. during driver installation or PC start-up.

4 Inputs

4.1 Electrical Characteristics

The equivalent input circuit is depicted in figure 4. The nominal input impedance at 1 kHz is 10 kΩ for standard inputs and > 60 kΩ for IEPE inputs. The +0.1/-0.3 dB re 1 kHz frequency range exceeds 20 Hz … 20 kHz.

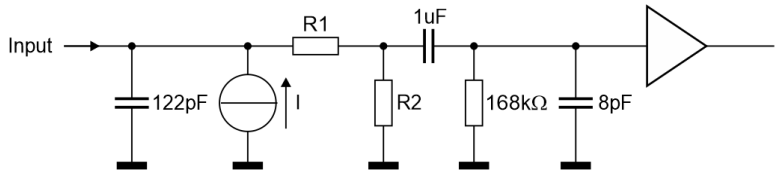


Figure 4. Equivalent analog input circuit.

The input supply current I and voltage divider resistors R1 and R2 depend on the Triton type and gain (see table 1).

Table 1. Input supply current and divider resistor values.

Type	I [mA]	Input Gain [dB]	R1 [kΩ]	R2 [kΩ]
Standard	0	0	5.76	4.31
		10, 20 or 30	1.00	9.53
IEPE	4.5	0	57.6	6.61
		10, 20 or 30	1.19	243

4.2 Gains and Levels

The maximum (full scale) input voltage depends on the gain (see table 2).

Table 2. Input full scale voltages and voltage levels.

Input Gain [dB]	FS Input Voltage [V]	FS Input Voltage Level @ 12 dB headroom [dBV_{rms}]
0	2.0	-6
10	0.63	-16
20	0.20	-26
30	0.063	-36

The input sensitivities at 1 kHz are measured and reported with each individual Triton. The input gains are fixed and cannot be controlled from the PC.

With a microphone connected to an IEPE input, the maximum sound pressure level SPL_{max} (in dB re 20 µPa) that can be measured is given by:

$$SPL_{max} = 94 + 20\log(2000/S) - CF - G$$

where

- S = microphone sensitivity in mV/Pa or mV at 94 dB_{SPL}
- CF = crest factor of the signal to be measured in dB
- G = Triton input gain in dB

Table 3 shows the sine wave SPL measuring ranges for several microphone sensitivities and Triton input gains.

Table 3. SPL measuring ranges for 1 kHz sine wave. All values in dB

Input Gain	S = 20 mV/Pa	S = 30 mV/Pa	S = 40 mV/Pa	S = 50 mV/Pa
0	46 … 131	42 … 127	40 … 125	38 … 123
10	36 … 121	32 … 117	30 … 115	28 … 113
20	26 … 111	22 … 107	20 … 105	18 … 103
30	16 … 101	12 … 97	10 … 95	8 … 93

At the upper range limits, the peaks of a sine wave (having a 3 dB crest factor) will just reach the Triton input limits. Signals with higher crest factors, such as most practical measured response signals, will exceed the input limits at a lower SPL level.

For example, a 20 dB gain Triton would allow the calibration of a Brüel & Kjær Type 4189 microphone (S = 50 mV/Pa) using a 94 dB 1 kHz sine wave calibrator, since the maximum SPL would then be 103 dB. However, a measured noise response signal may have a crest factor of 13 dB, hence 10 dB higher peaks than a sine wave at the same SPL. Therefore, the maximum SPL for this noise response signal would be 93 dB with the same Triton, 103 dB with a 10 dB Triton, and 113 dB with a 0 dB Triton.

4.3 Input Attenuation

With a standard Triton it is possible to attenuate the input voltage or to increase the input impedance using the optional **CA06-AAC** attenuator cable (see figure 5). This cable contains a series resistor, which forms a voltage divider with the 10 kΩ Triton input impedance. It can be ordered using the AAC suffix explained in table 4. The default cable (CA06) is 10 dB black.

Figure 5. Input attenuator cable CA06-AAC for standard Triton.

Table 1. CA06-AAC attenuator cable ordering information.

Attenuation [dB]	Input impedance [kΩ]	AA	Color	C
0	10.0	**00**		
3	14.1	**03**	**Black**	**B**
6	20.0	**06**		
10	31.5	**10**	**Red**	**R**
20	101	**20**		

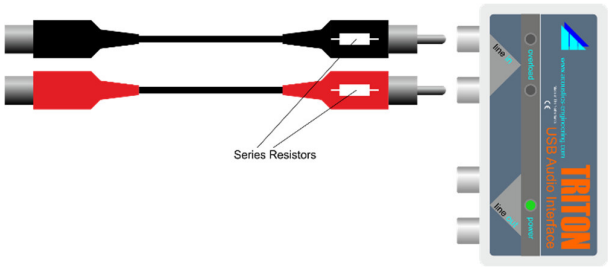


Figure 6. Inserting input attenuator cables (for Standard Triton only).

Note
The CA06-AAC cable cannot be used to attenuate the input voltages of an IEPE Triton.

4.4 Cable Length

The Triton has been tested for immunity from electromagnetic transients (EMT) on the I/O lines in accordance with the EN61000-4-4 standard. This implies that normal operation is guaranteed at cable lengths of up to 30 m. Connecting longer cables is at the user's own risk, but not expected to cause problems in the absence of excessive electrical fields such as during lightning storms.

5 Outputs

5.1 Electrical Characteristics

The equivalent output circuit is depicted in figure 7. The nominal output impedance at 1 kHz is 100 Ω. The +0.1/-0.3 dB re 1 kHz frequency range exceeds 20 Hz … 20 kHz.

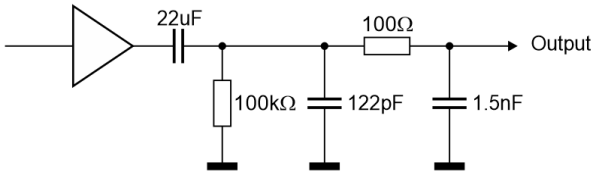


Figure 7. Equivalent analog output circuit.

5.2 Levels

The maximum output voltage is 2 V_{peak} or –6 dBV_{rms} with 12 dB headroom. The output sensitivities at 1 kHz are measured and reported with each individual Triton.

6 Maintenance, Repair and Warranty

To clean the Triton, only use a dry cloth or a soft brush. Never use solvents. There are no user serviceable parts inside the Triton.

For repairs or to order accessories, please contact your local dealer or Acoustics Engineering. You can contact Acoustics Engineering through

e-mail:	support@acoustics-engineering.com
phone:	+31 485 520996
mail:	Acoustics Engineering Groenling 43-45 5831 MZ Boxmeer The Netherlands

Should any defect in manufacture or material appear in the product within 12 months from the date of sale, the dealer from whom the product was purchased, or Acoustics Engineering, will arrange for such defect to be rectified without charge, provided:

1. The product and the accessories are handled in conformance with the instructions in this manual.
2. The defect is not due to excessive signal voltage supplied to the Triton inputs or overloading the Triton outputs.
3. The defect is not due to accidental damage, whether in transit or otherwise.
4. No repairs have been attempted by persons other than Acoustics Engineering qualified service staff.
5. A copy of the invoice is by any means shown prior to sending, and enclosed with the products sent to be serviced.

Products sent for service should be adequately packed. No liability is accepted for damage or loss in transit.

Packing and shipping costs are not included in this warranty, on the understanding that costs for the return of repaired products are paid for by the dealer or Acoustics Engineering, provided:

1. The term of warranty has not expired.
2. A defect has been found by the dealer or Acoustics Engineering.

7 Specifications

7.1 Technical Specifications

All specifications at T_A = 25ºC, f_S = 48 kHz, f_{IN} = 1 kHz, f_{OUT} = 1 kHz, 16 bit data, unless otherwise noted.

Parameter	Condition	Min	Typ	Max	Unit
Inputs (general)					
Full scale voltage	0 dB input gain 10 dB input gain 20 dB input gain 30 dB input gain		2.0 0.63 0.20 0.063		V_p
Full scale RMS voltage [1)]	0 dB input gain 10 dB input gain 20 dB input gain 30 dB input gain		1.4 0.45 0.14 45		V V V mV
Full scale error		-0.2	0	0.2	dB
Overload trigger voltage	re full scale voltage	-0.5	0		dB
Frequency range (see figure 8)	±0.1 dB re 1 kHz level +0.1/-0.3 dB re 1 kHz level +0.1/-3 dB re 1 kHz level: • 0, 10 or 20 dB input gain • 30 dB input gain	40 20 4 6		21 k 22 k 23 k 23 k	Hz
Resolution		8 or 16			bit
Sample frequency		8, 11.025, 16, 22.05, 32, 44.1 or 48			kHz
Standard Inputs					
Allowable AC voltage	0, 10 or 20 dB input gain 30 dB input gain			15 5	Vrms
Allowable DC voltage		-25		25	V
Input impedance		9.9	10.0	10.1	kΩ
IEPE Inputs					
IEPE DC supply current	Input voltage V_{DC} = 0 ... 23 V	4		5	mA
Allowable AC voltage	0, 10 or 20 dB input gain 30 dB input gain			25 5	Vrms
Allowable DC voltage		0		24	V
Input impedance	V_{in} within 0 … 23 V_{DC} range	60			kΩ

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Parameter	Condition	Min	Typ	Max	Unit
Outputs					
Nominal full scale voltage			2		V_p
Full scale RMS voltage [1)]	Load impedance = 10 kΩ		1.4		V
Full scale error		-0.5	0	0.5	dB
Allowable DC voltage		-25		25	V
Output impedance			100		Ω
Load impedance		0			Ω
Frequency range (see **figure 9**)	±0.1 dB re 1 kHz level +0.1/-0.3 dB re 1 kHz level +0.1/-3 dB re 1 kHz level	6 4 1		18 k 21 k 23 k	Hz
Resolution		8 or 16			bit
Sample frequency		32, 44.1 or 48			kHz
Loopback [2)]					
SNR	Full scale / Silence, unweighted 0…24 kHz	86			dB
Crosstalk	Channel 1 to 2, vice versa, 0…24 kHz			-80	dB
THD+N	Full scale, input + output [2)] -5 dB re full scale, input + output			-82 -84	dB
Dynamic Range	Input + output	85			dB
USB					
USB compatibility		USB 1.1 – 2.0			
USB connector		USB-C			
General					
Supply current	Standard IEPE, both inputs loaded		70 130		mA
Audio sockets	Standard IEPE	RCA BNC			
USB cable length		1			m
Dimensions	w x h x d, sockets excluded	82 x 22 x 40			mm^3
Weight	Standard IEPE		111 121		g

Alterations reserved

Notes

1. A measurement report on the input and output full scale voltage levels at 1 kHz is provided with each individual Triton supplied.
2. Because system measurements are often performed by generating an excitation signal at the output, while recording the system response at the input, measurement system quality parameters depend on the Triton input + output chain. Therefore these parameters are given for a loopback configuration where the output signals are fed back to the inputs using a special converter preserving the respective full scale levels.

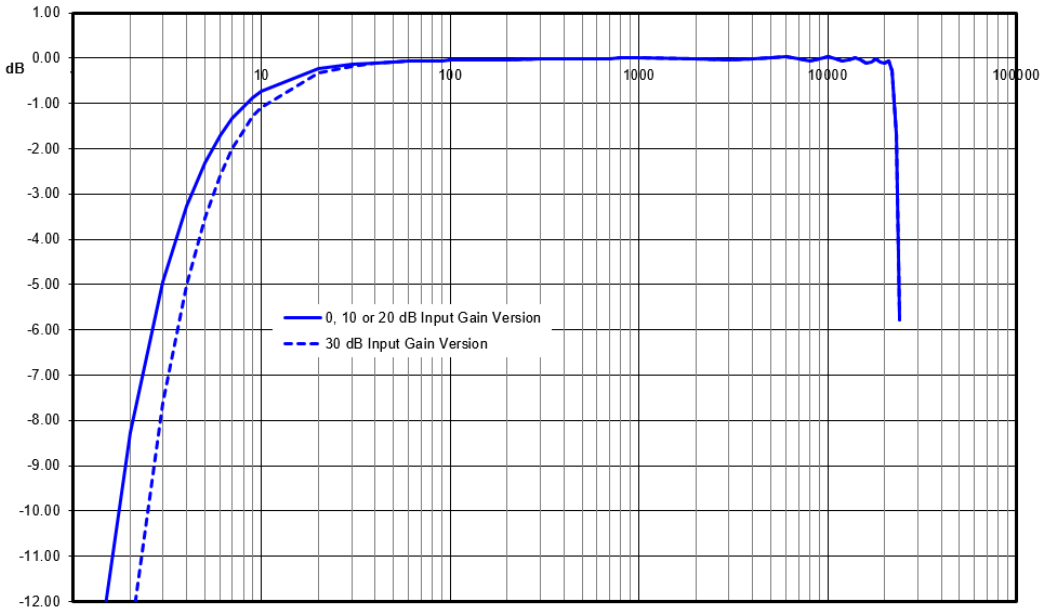

Figure 8. Typical input frequency characteristic.

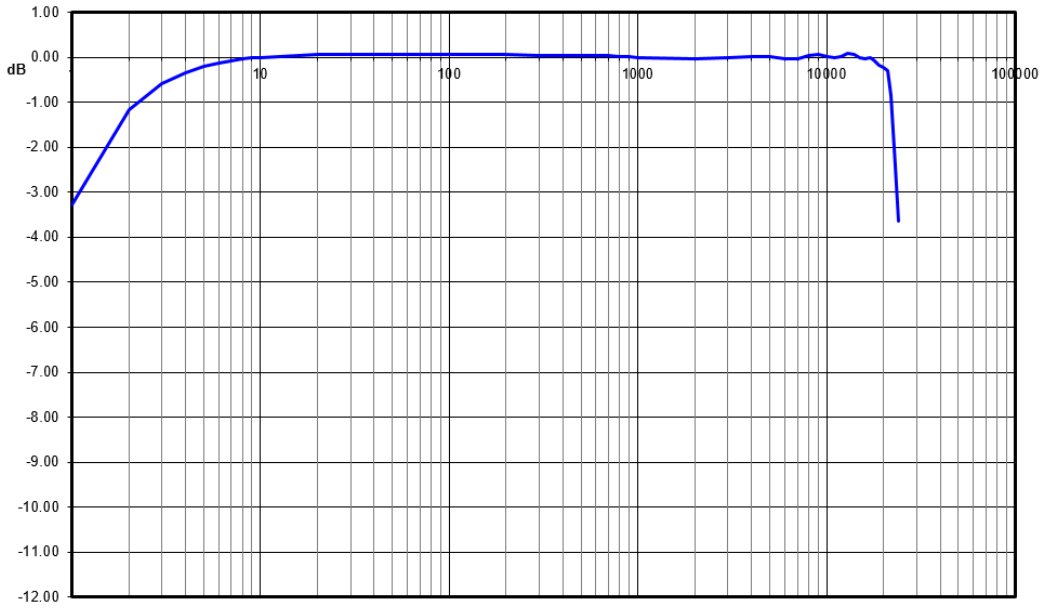

Figure 9. Typical output frequency characteristic.

7.2 Compliance with Standards

EMC Type	Related Standards
Emission	EN/IEC61000-6–3: Generic emission standard for residential, commercial and light-industrial environments. EN/IEC61000-6–4: Generic emission standard for industrial environments. CISPR 16-2: Specification for radio disturbance and immunity measuring apparats and methods - Methods of measurement of disturbance and immunity: 30 MHz – 1GHz EN55011:2009/A1:2010: Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
Immunity	EN/IEC61000–6–1: Generic standards - Immunity for residential, commercial and light-industrial environments. EN/IEC61000–6–2: Generic standards - Immunity for industrial environments. EN/IEC61326–1: Electrical equipment for measurement, control and laboratory use - EMC requirements EN61000-4-2: Electromagnetic Compatibility - Testing and measuring techniques - Electrostatic discharge requirements: up to 4 kV (contact discharge) and 8 kV (air discharge) EN61000-4-3: Electromagnetic Compatibility - Testing and measuring techniques - Radiated, radio-frequency, electromagnetic field immunity test: up to 10 V/m, up to 2.7 GHz EN61000-4-4: Electromagnetic Compatibility - Testing and measuring techniques - Electrical fast transient/burst requirements: up to 1 kV EN61000-4-6: Electromagnetic Compatibility - Testing and measuring techniques - Immunity to conducted disturbances, induced by radio-frequency fields: up to 80 MHz, up to 10 V EN61000-4-8: Electromagnetic Compatibility - Testing and measuring techniques - Power frequency magnetic field immunity test: up to 30 A/m

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