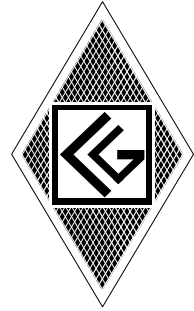




Modular

# Add 1

## Dual Precision Adder/Comparator with each 3 Inputs



### 1. Description

2 Precision adders/comparators each with 3 inputs suitable for audio and/or CV signals. The switch position decides which mode is selected. In 'Σ' mode, the circuit functions as an adder with amplification = 1,00. By patching one signal to 2 or 3 inputs, amplification factors of · 2,00 or · 3,00 can be set.

In 'Comp' mode, the circuit works as a comparator with a slightly schmitt-trigger-like characteristic. Depending on the level of the inputs, the output voltage is switched between either +5V or -5V, suitable as gate/trigger, squarewave/pulse audio signal etc. The threshold level of switching between these voltages is ≈0V; e.g. for an input sum signal > 0V, the output signal will be +5V, for an input sum < 0V it will be -5V. So, the threshold level can be shifted by applying an offset or control voltage on one of the inputs.

Applications such as pulse width modulation or +/- voltage detection can be easily realized.

### 2. Applications and Features

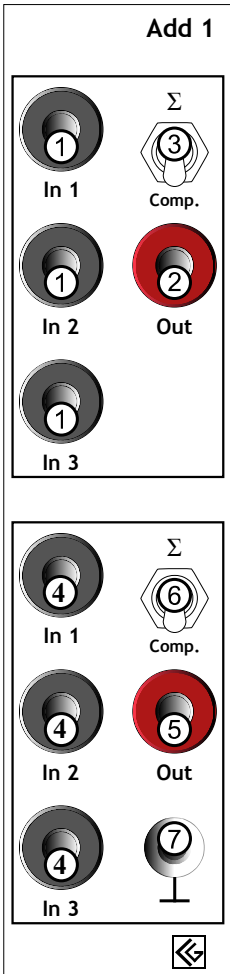
- Audio signal mixing
- CV signal mixing
- High precision, suitable for frequency CVs
- Switchable comparator mode
- Signal-to-squarewave conversion
- Available with banana or 3,5mm minijacks
- Eurorack module
- Width: 6 HP
- Dimensions: 128,5 x 30,2 mm
- Depth: 30mm
- Supply voltage: ±12V
- Power consumption: ≈ 10-20mA

		
Banana jack version	Minijack version	Drawing





### 3. Functions



- ① **In1-3 (1<sup>st</sup> Adder)** Inputs for the 1<sup>st</sup> Adder. Each input has the same weighting (multiplication factor) of 1,00. Input resistance is  $\approx 100k\Omega$ .
- ② **Output (1<sup>st</sup> Adder)** Output mode can be selected with switch ③. In Sum mode 'Σ' (switch ③ in upper position), the output voltage on this socket is the sum of the 3 inputs,  $\Sigma = In1 + In2 + In3$ . *Please note:* Maximum output voltage is  $\approx \pm 10,5V$ ; to avoid distortion take care to keep the inputs in the desired range!  
In 'Comp.' mode (switch ③ in lower position), the output voltage will be either +5V or -5V depending on whether the sum of the inputs are above or below 0V.  
In other words, if the sum of In1, In2 & In3 is positive, the output will be +5V; if the sum is negative, the output will be -5V.
- ③ **Mode (1<sup>st</sup> Adder)** With this switch in the upper position, the circuit adds the inputs ① and provides the sum  $\Sigma = In1 + In2 + In3$  on output socket ②. In lower position 'Comp.' the device works as a comparator: The output will be +5V for a sum signal larger than 0V (positive) or -5V for a sum signal lower than 0V (negative).  

$$\Sigma_{In1+In2+In3} > 0V \Rightarrow V_{out} = +5V$$

$$\Sigma_{In1+In2+In3} < 0V \Rightarrow V_{out} = -5V$$
 Thus, a signal-to-squarewave conversion is realized, allowing applications like pulse-width modulation or signal-to-gate conversion.  
To make the comparator react to signals lying in only the positive or negative range (e.g. envelope CVs), a small negative/positive offset voltage is required to shift the threshold range off 0V.

**Note:** The threshold level is not exactly 0V; to avoid undefined states by noise there is a little difference (hysteresis) between switching to the positive and switching to the negative state. The hysteresis is  $\approx \pm 50mV$  ('Schmitt-trigger'); please also read chapter *4.Examples&settings:*  
**2.Schmitt-trigger**

- ④ **In1-3 (2<sup>nd</sup> Adder)** Inputs for the 2<sup>nd</sup> Adder. Functionality is identical to ①
- ⑤ **Output (2<sup>nd</sup> Adder)** Output of the 2<sup>nd</sup> Adder. Functionality is identical to ②
- ⑥ **Mode (2<sup>nd</sup> Adder)** Mode switch for the 2<sup>nd</sup> Adder. Functionality is identical to ③
- ⑦ **Ground** This socket only exists in the *banana* version of the **Add1**. The ground connection is required if the module is connected to external equipment, e.g. a mixer. Within the eurorack modular system the module is grounded by its power supply.





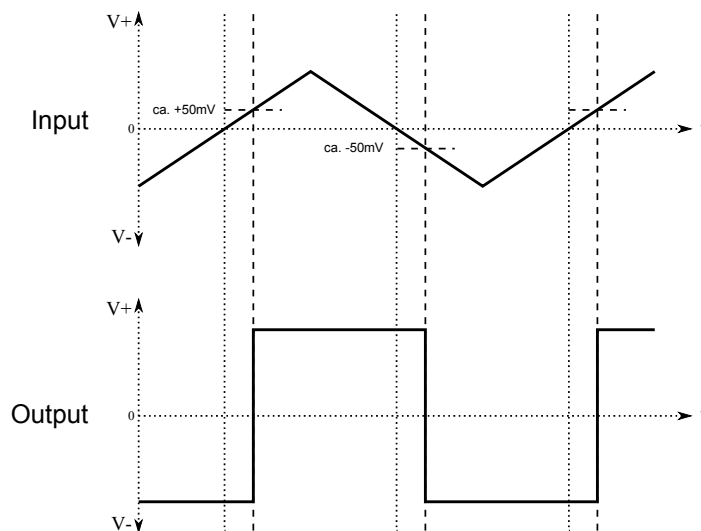
## 4. Examples & settings

### 1. Output behaviour depending on the switch state ③/⑥

	1 Input	2 Inputs	3 Inputs
<b>INPUTs</b> ①/④ Input Waveform: Triangle			
<b>OUT 'Σ'</b> ②/⑤ Switch ③/⑥ in upper position			
<b>OUT 'Comp.'</b> ②/⑤ Switch ③/⑥ in lower position			

### 2. Schmitt-trigger

The comparator's switching threshold is not exactly at 0V; to avoid undefined states caused by noise (or even with very small input signals), the switching threshold to 'High' (+5V) is shifted a little bit into the positive voltage range, while the switching to 'Low' (-5V) is shifted into the negative range ('Schmitt-trigger'). The switching threshold is at ca.  $\pm 50\text{mV}$  (Hysteresis =  $100\text{mV}$ ).





### 3.Patches

#### a) Audio Signal or CV Mixing

The small tolerance components used in the *Add1* guarantee high precision when processing frequency-sensitive CVs such as from keyboards or from MIDI-to-CV converters.

#### b) Signal-to-Squarewave Conversion and Pulsewidth Modulation

In 'Comp' mode, any waveform (for pulsewidth modulation: ideally triangle or sawtooth) can be converted into a squarewave signal. Its pulsewidth can be modulated with a 2<sup>nd</sup> applied CV signal.

Note: For signals lying in only the positive range, a negative control voltage is required for modulation!

## 5. Contact & Support

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