

# AutoSim Pro

## User manual

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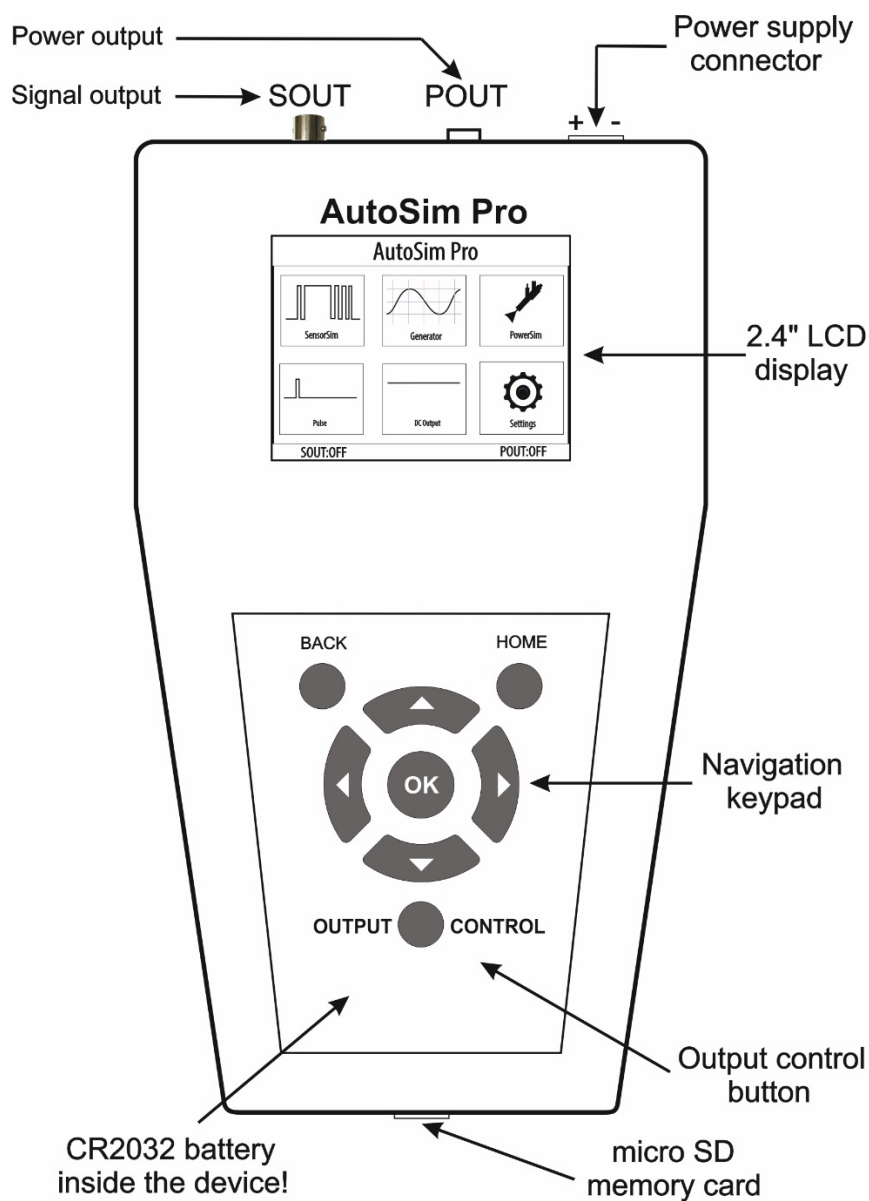
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## 1. Introduction and main screen

The AutoSim Pro is a smart testing device, designed to simulate the output signal from automotive sensors, generate various signal waveforms with adjustable parameters and drive power solenoid actuators.

There are 5 operating modes:

- SensorSim
- Generator
- PowerSim
- Pulse
- DC Output



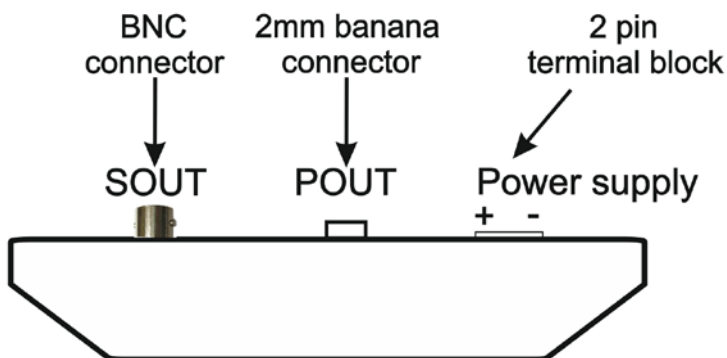
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## 2. Key features

- 2.4" TFT LCD 320x240;
- 2 independent outputs;
- Ultra-fast boot time;
- Outputs are completely galvanically isolated from each other;
- Signal output (Sout) is galvanically isolated from the power supply;
- Simple to use and connect, easy to use keyboard;
- Protection against reverse polarity connection;
- Internal Micro SD card to save and review signals;
- No external power adapter needed;
- Excellent industrial design.

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## 3. Connectors and Outputs



AutoSim Pro has two outputs – Sout and Pout.

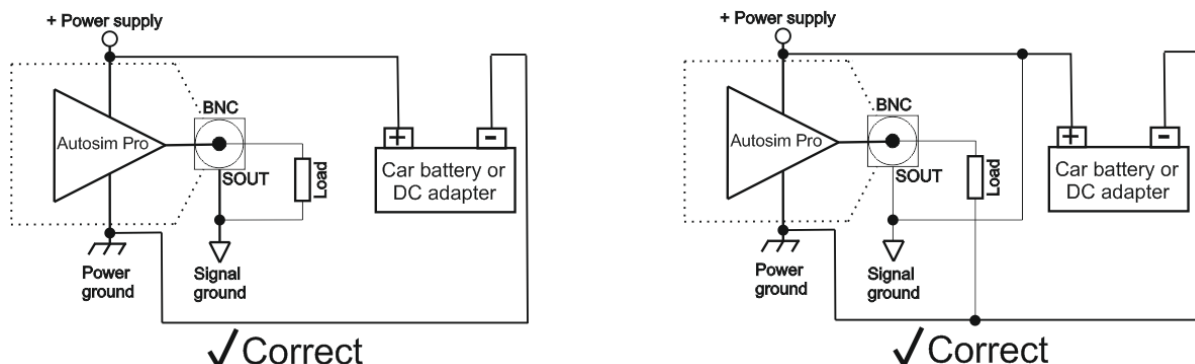
**Note:** Both outputs are completely galvanically isolated from each other and the signal output (Sout) is isolated from the power supply connector.

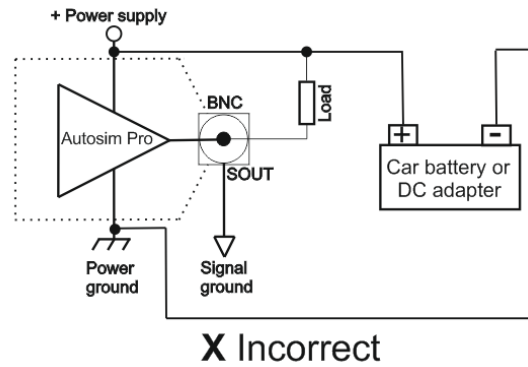
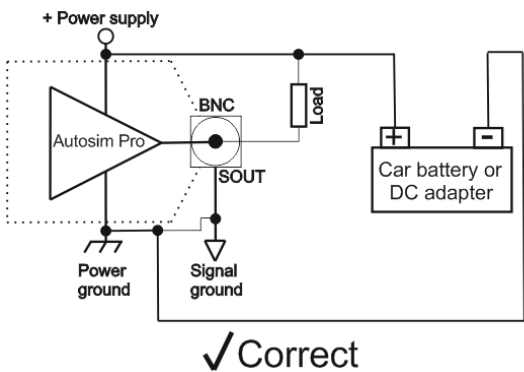
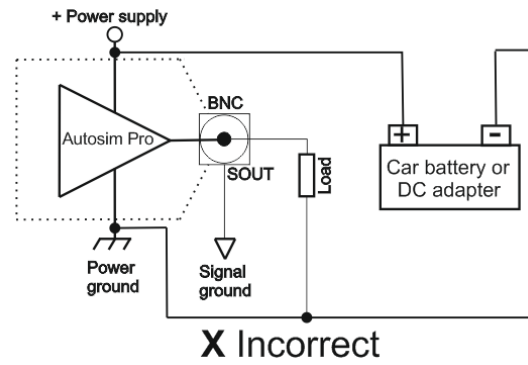
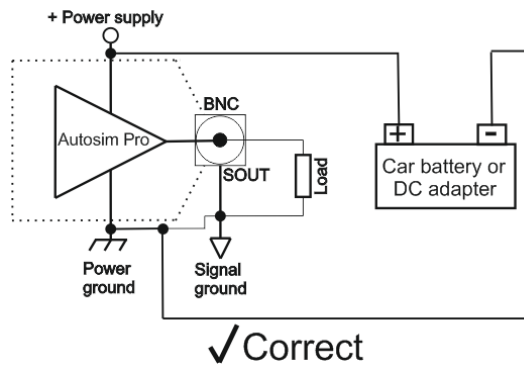
**Note:** Both outputs can be simultaneously activated. For example, Pout can be activated in Pulse mode and at the same time, Sout can produce a sine wave in “Generator-Sine” mode.

### Signal output “Sout” with BNC connector

The Sout signal output is used in "SensorSim", "Generator", "Pulse" and "DC Output" modes. Sout signal output has a maximum output current of  $\pm 33\text{mA}$ !

How to properly connect the load to the Sout output:



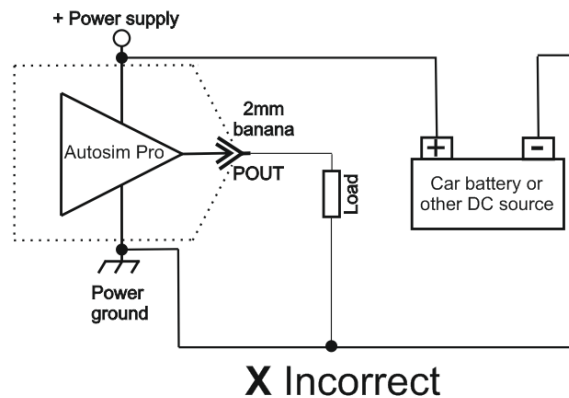
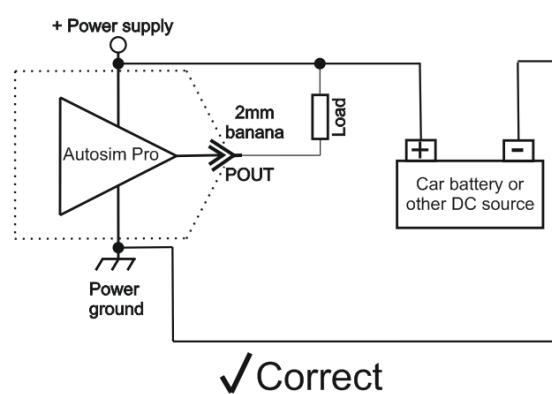


**Power output “Pout” with 2mm banana connector**

This output can be activated only in "PowerSim" and “Pulse” modes!

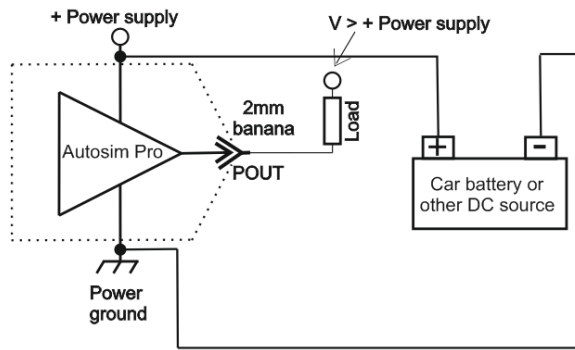
**Important note:** This is a ground-controlled output which means that one of the wires of the load should be connected to +12V in order to be controlled by the Pout output! The other wire is connected to the Pout output!

How to properly connect the load to the Pout output:



**!!! IMPORTANT!!!**

**Device power supply voltage must be greater or equal to the positive load terminal!**



**NOT ALLOWED!!!**

Pout power output has a maximum output current of 4A!

**Note:** Maximum load current 4 Ampere is limited in time and should be less than 10 minutes!

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#### 4. Navigation keypad and buttons



You can select the mode (icon) in focus with ▲ ▼ and ◀ ▶

Confirmation is with <OK>.

The other three buttons are:

##### <Back>

Go one-step back or dismiss editing parameter value.

##### <Home>

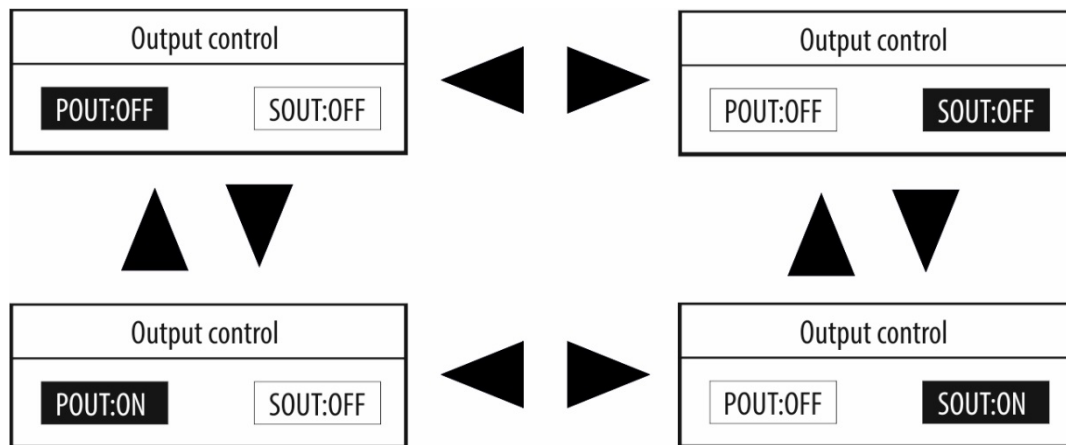
Go back to the Home screen and switch off all outputs.

##### <Output control>

Pressing this button, regardless of the current operation mode, disables all other navigation operations and each of the two outputs can be enabled / disabled.

You can choose the output in focus with ◀ and ▶ arrow buttons.

By using ▲ and ▼ arrow buttons, you can change the state for the output in focus.



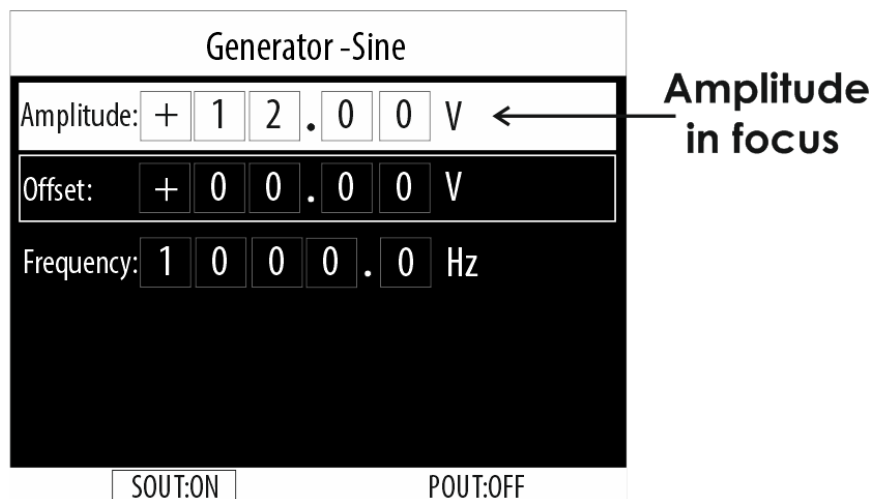
You can always exit this window with the <Output control> button.

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## 5. General operating instructions

### 5.1. Menu structure description

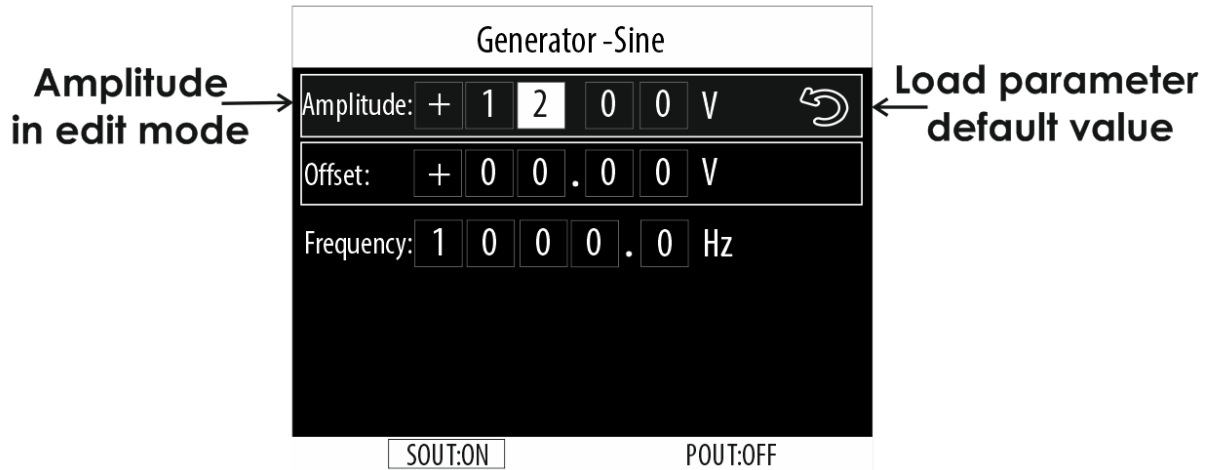
As an example, we will focus on a typical internal menu, in this case “Generator-Sine”. When you enter an internal menu, automatically the first parameter goes in focus – in our case “Amplitude”.



You can change the parameter in focus with ▲ and ▼ arrow buttons. Select the parameter to edit with the <OK> button.

If, for example, the "Amplitude" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.



In edit mode, choosing the back arrow for each parameter loads the default value for the selected parameter!

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

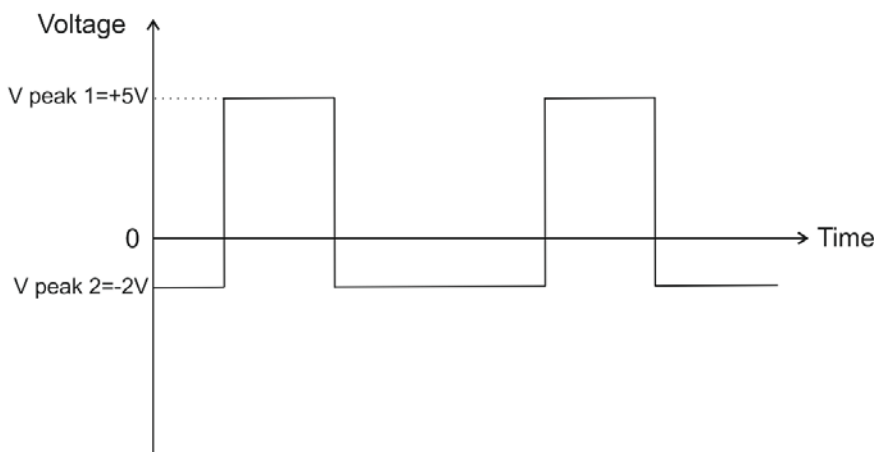
If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

## 5.2. Terminology and signal parameters

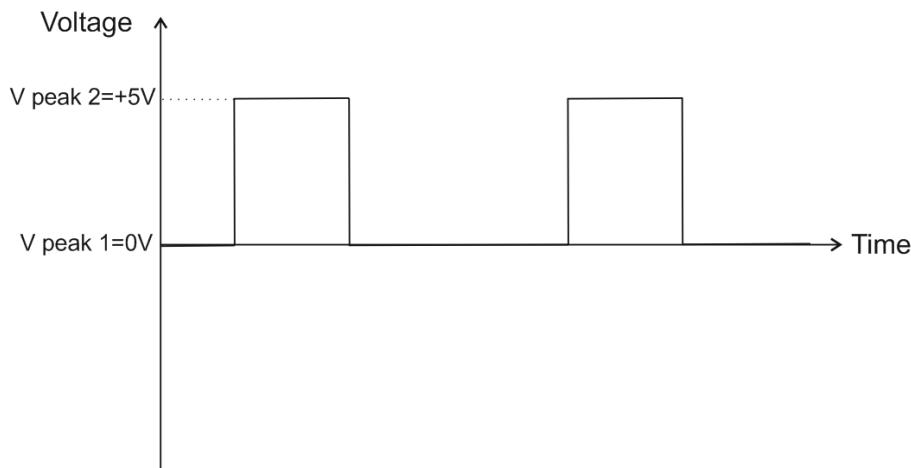
### ***V peak 1 and V peak 2***

- Both V peak 1 and V peak 2 can be from -12V to +12V.
- Setting V peak 1 = V peak 2, will produce a DC output signal!

Let's see some examples from "Generator-Square" mode:



Example 1: V peak 1 = +5V, V peak 2 = -2V

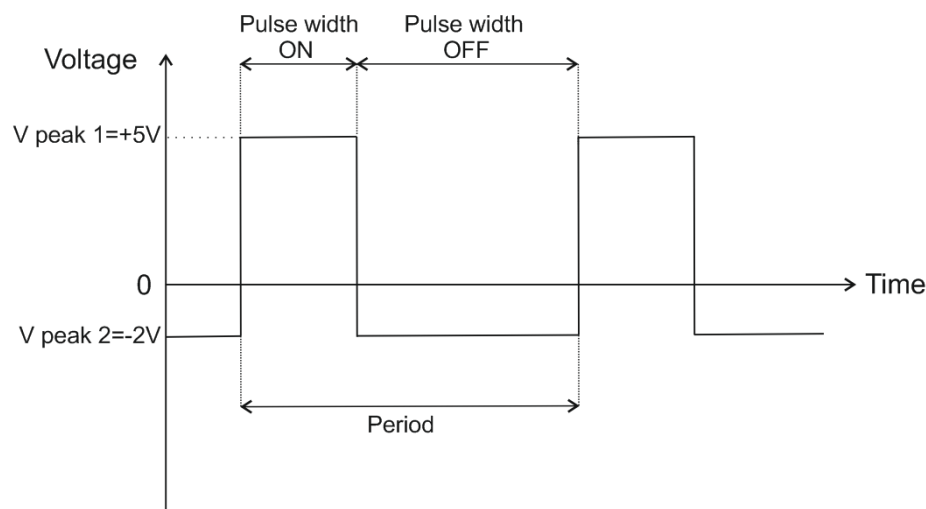


Example 2:  $V_{\text{peak 1}} = +5V$ ,  $V_{\text{peak 2}} = 0V$

### ***Duty, pulse width, frequency and period***

Duty cycle is the ratio of time a load is ON compared to the time the load is OFF. Duty cycle is expressed as a percentage of the ON time. A 60% duty cycle is a signal that is ON 60% of the time and OFF the other 40%.

Note: Duty is active only in mode "Generator-Square"! If the "ON" time is equal to the "OFF" time, the duty cycle is exactly 50% (half of the period).



$$\text{Duty [\%]} = 100 \times \frac{\text{Pulse width ON}}{\text{Period}}$$

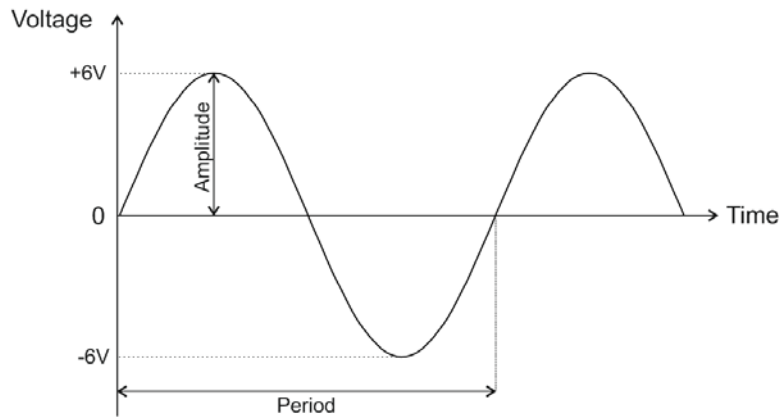
$$\text{Frequency [Hz]} = \frac{1}{\text{Period [S]}}$$

Pulse width is a measure of the actual ON time. The OFF time does not affect signal pulse width. The only value being measured is how long the signal is ON (ground-controlled).

### ***Amplitude***

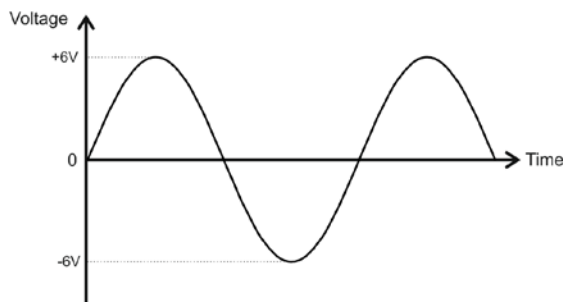
Amplitude parameter is applicable only in "Generator-Sine" and "CKP Inductive Sinusoidal" modes.



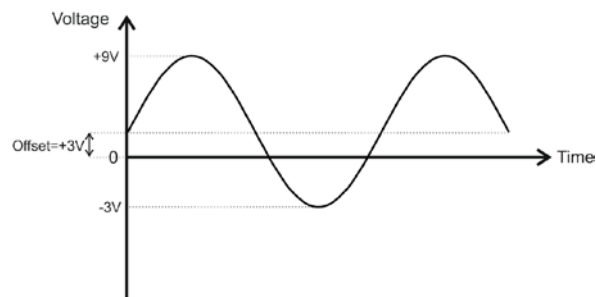


### **Offset**

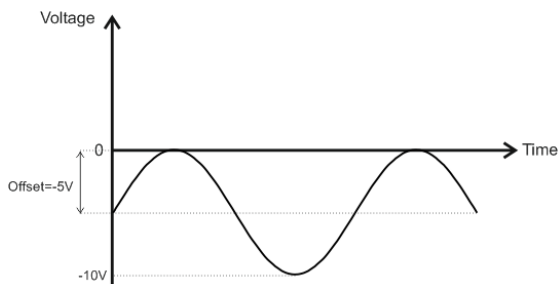
Offset is the vertical displacement (in volts) of a waveform from its zero or ground level. You can set the offset to zero, or to a desired value within a certain limit in each mode.



Offset = 0V



Offset = +3V



Offset = -5V

Offset can be set this way only in “Generator-Sine” and “CKP Inductive Sinusoidal” modes. In all other modes, offset is also possible by setting suitable values for V peak 1 and V peak 2.

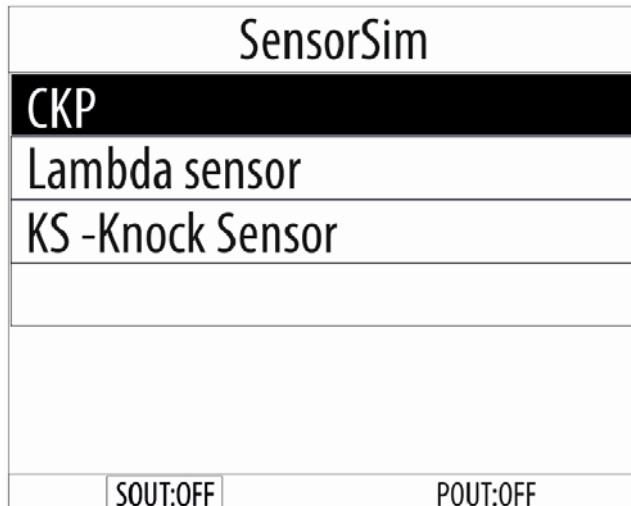
### **RPM**

This parameter is applicable in the CKP modes only. It represents the engine rpm's which corresponds to a certain signal frequency. Changing the rpm parameter will change the signal frequency.

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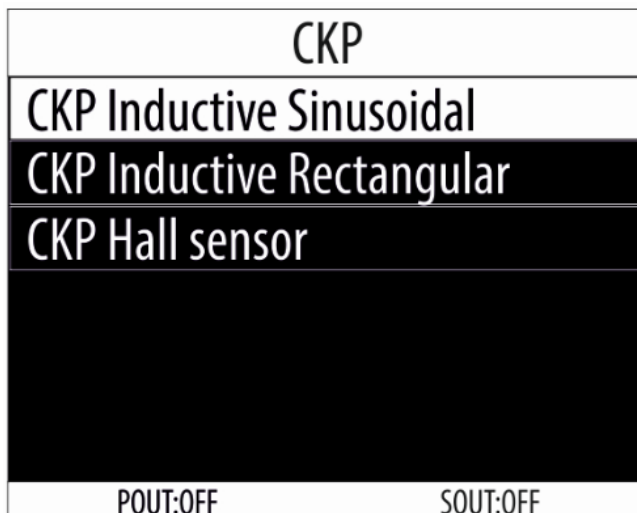
## 6. Mode “SensorSim”

In this mode, AutoSim Pro simulates the output signals from various automotive sensors such as Crankshaft Position Sensor (CKP), Lambda Sensor (O2) and Knock Sensor (KS). Each of these sensors has a specific output signal, which you are able to simulate with AutoSim Pro.



Signals in this mode can be both periodic and non-periodic. SensorSim mode uses only the Sout signal output.

### 3.1. SensorSim > CKP



There are several types of CKP sensors according to their output signal and internal construction:

- CKP Inductive Sinusoidal (sinusoidal waveform)
- CKP Inductive Rectangular (square waveform)
- CKP Hall sensor (square waveform)

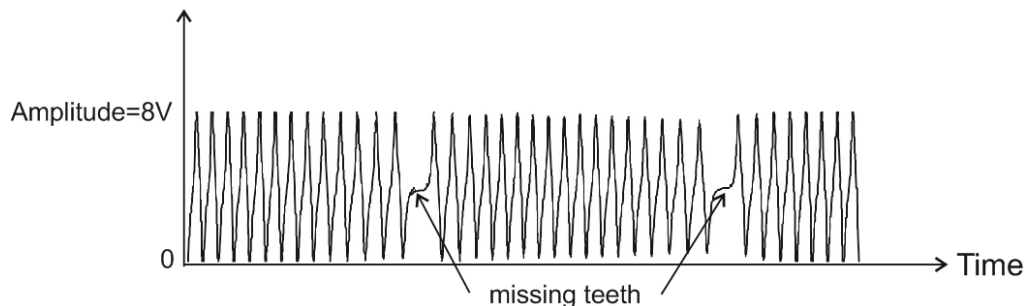
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### 3.1.1. SensorSim > CKP > CKP Inductive Sinusoidal

CKP Inductive Sinusoidal			
Teeth:	1	0	0
Miss. Teeth :	2		
Polarity :	Bipolar		
Amplitude :	2	.	2 2
RPM :	9	9	9
Help			
POUT:OFF		SOUT:ON	

You can adjust the following parameters in this mode:

	Min	Max	Default
Teeth	20	100	58
Miss. Teeth	1	3	2
Amplitude [V]	1	8	8
Offset [V]	-3	3	0
RPM	650	999	900



Focus is on the "Teeth" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "Teeth" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

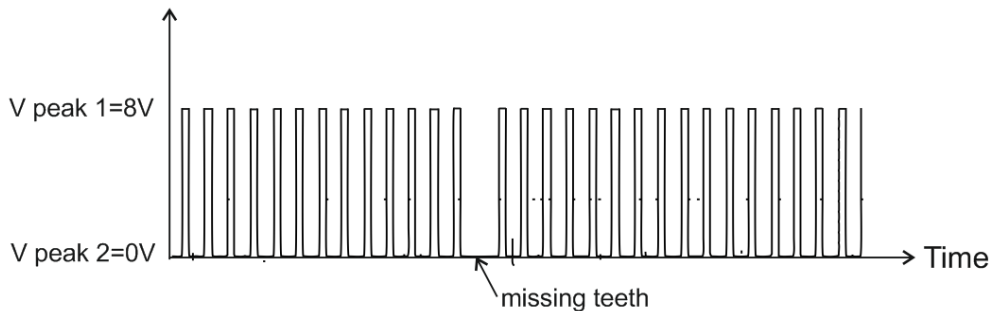
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**3.1.2. SensorSim > CKP > CKP Inductive Rectangular**

<b>CKP Inductive Rectangular</b>				
Teeth:	1	0	0	
Miss. Teeth :	2			
V peak 1 :	8	.	0 0	V
V peak 2 :	+	0	.	0 0 V
RPM :	9	9	9	
SOUT:ON		POUT:OFF		

You can adjust the following parameters in this mode:

	Min	Max	Default	Note
Teeth	20	100	58	
Miss. Teeth	1	3	2	
V peak 1 [V]	1	8	8	Vmax
V peak 2 [V]	-3	+3	0	Vmin
RPM	650	999	900	



Focus is on the "Teeth" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "Teeth" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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3.1.3. SensorSim > CKP > CKP Hall Sensor

**CKP Hall Sensor**

---

Teeth:    1  0  0

---

Miss. Teeth : 2

---

V peak 1 :  8 . 0  0 V

---

V peak 2 : + 0 . 0  0 V

---

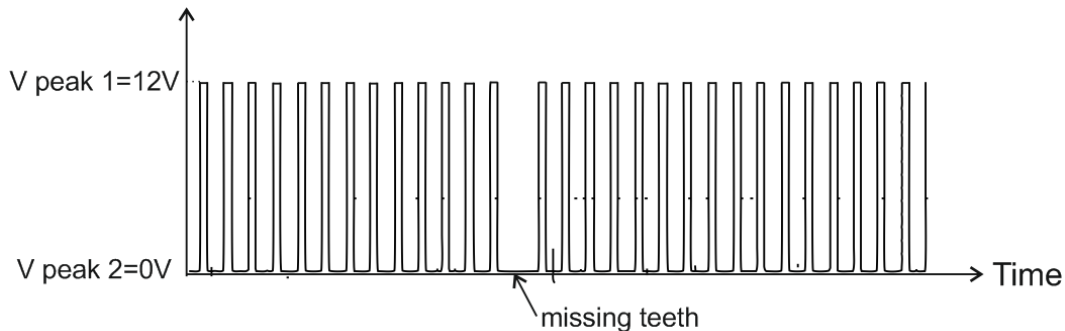
RPM :    9  9  9

---

[ SOUT:ON ]                      POUT:OFF

You can adjust the following parameters in this mode:

	Min	Max	Default	Note
Teeth	20	100	58	
Miss. Teeth	1	3	2	
V peak1 [V]	4	12	12	Vmax
V peak 2[V]	-3	+3	0	Vmin
RPM	650(100??)	999	900	



Focus is on the "Teeth" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "Teeth" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

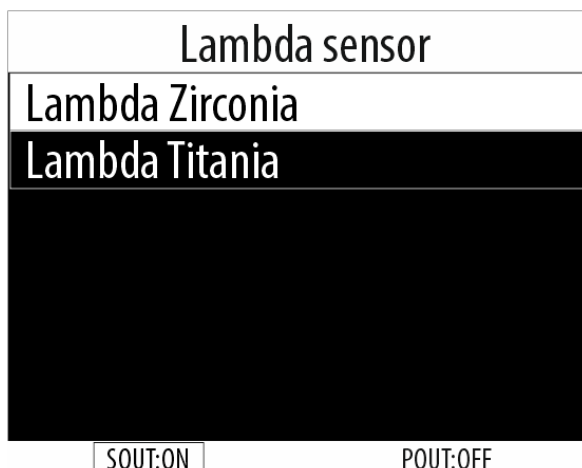
To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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### 3.2. SensorSim > Lambda sensor



Lambda sensors, according to the substance used in their sensitive element, are:

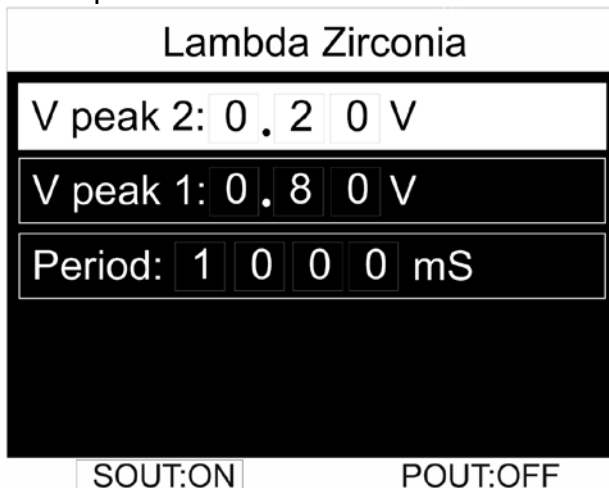
- Zirconium (zirconium oxide)
- Titanium (titanium oxide)

Lambda sensors can have 1, 2, 3 or 4 wires depending on whether they have a heating element and the output type.

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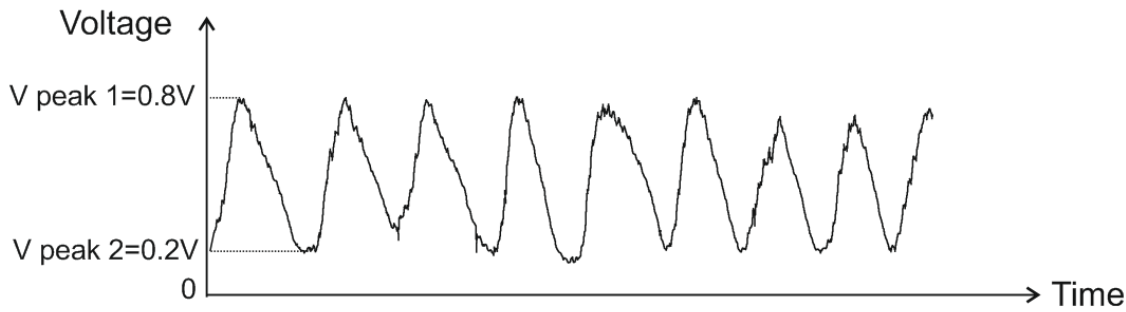
#### 3.2.1. SensorSim > Lambda sensor > Lambda sensor Zirconia

Zirconium lambda sensors produce an output signal from 0.2V to 0.8V (where 0.2V corresponds to lean fuel mixture and 0.8V – to rich fuel mixture).



You can adjust the following parameters in this mode:

	Min	Max	Default	Note
V peak 2 [V]	0.0	0.5	0.2	Vmin
V peak 1 [V]	0.2	1.0	0.8	Vmax
Period [mS]	0.0	3000.0	1000.0	



Focus is on the "V peak 2" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "V peak 2" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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### 3.2.2. SensorSim > Lambda sensor > Lambda sensor Titania

**Lambda Titania**

V peak 2:     V

V peak 1:     V

Period:     mS

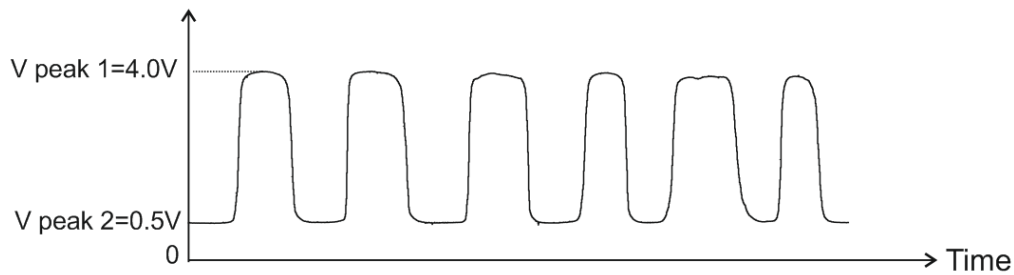
SOUT:ON       POUT:OFF

Titanium lambda sensors produce an output signal from 0.5V to 4V (where 0.5V corresponds to lean fuel mixture and 4V – to rich fuel mixture).

You can adjust the following parameters in this mode:

	Min	Max	Default	Note
V peak 2 [V]	0.0	3.0	0.5	Vmin

V peak 1 [V]	2.0	4.0	4.0	Vmax
Period [mS]	0.0	3000.0	1000.0	



Focus is on the "V peak 2" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "V peak 2" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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### 3.3. SensorSim > KS – Knock Sensor

Knock Sensor (KS) is a piezoelectric sensor mounted on the engine block and reacts to engine sound vibrations (detonations).

**Knock Sensor**

---

V peak 2: - 2 . 0 0 V

---

V peak 1: 4 . 0 0 V

---

Period: 5 0 0 mS

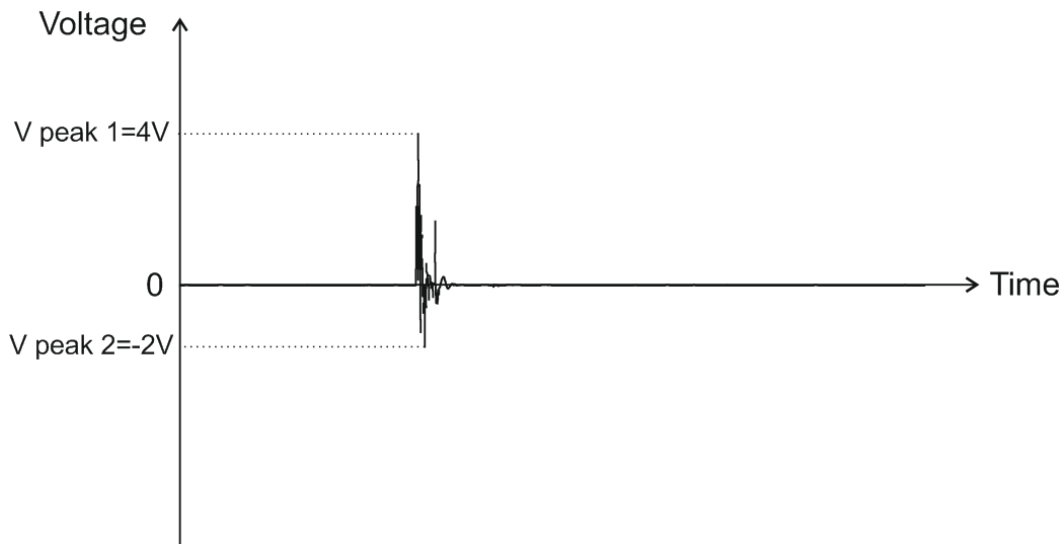
---

SOUT:ON
POUT:OFF



You can adjust the following parameters in this mode:

	<b>Min</b>	<b>Max</b>	<b>Default</b>	<b>Note</b>
V peak 2 [V]	-4.0	1.0	-2.0	Vmin
V peak 1 [V]	2.0	6.0	4.0	Vmax
Period [mS]	20	600	500	



Focus is on the "V peak 2" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "V peak 2" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

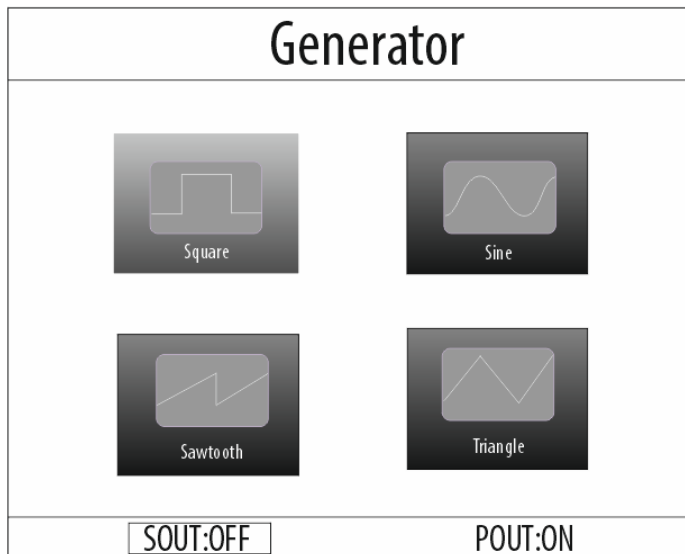
To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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## 4. Mode “Generator”



In this mode, AutoSim Pro lets you easily produce various standard waveform types:

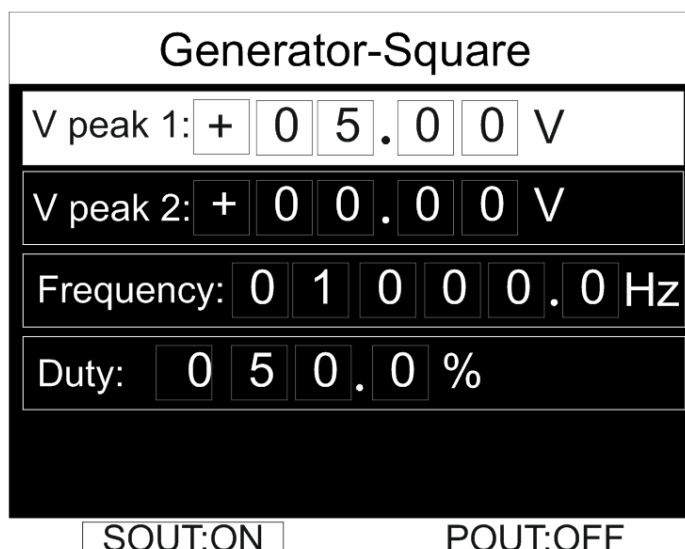
- Square (rectangular)
- Sine (sinusoidal)
- Sawtooth
- Triangle

*Notes:*

1. All signals in this mode are only periodical!
2. Only the “Sout” output can be used in this mode!

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### 4.1. Generator > Square



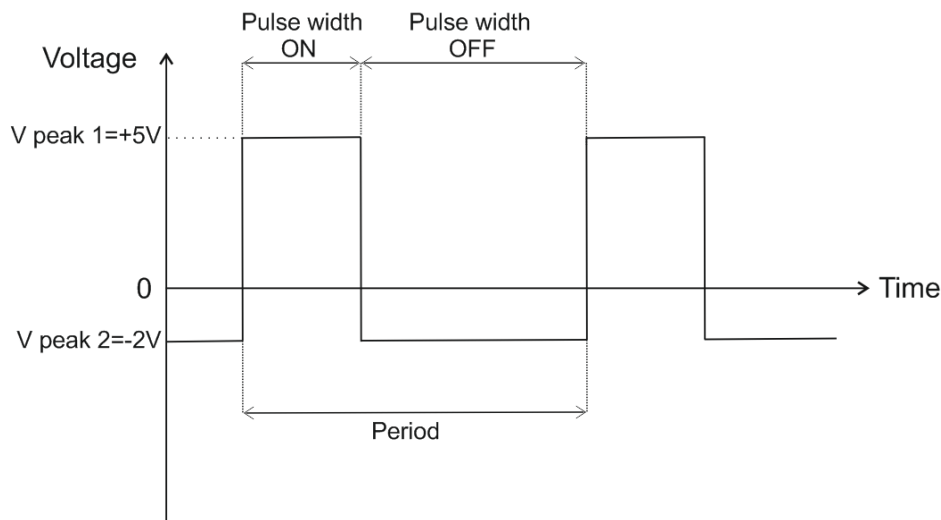
You can adjust the following parameters in this mode:

	Min	Max	Default	Note
V peak 1 [V]	-12.0	+12.0	5.0	Vmax
V peak 2 [V]	-12.0	+12.0	0.0	Vmin
Frequency [Hz]	0.0	10000.0	1000	
Duty [%]	0.0	100.0	50	

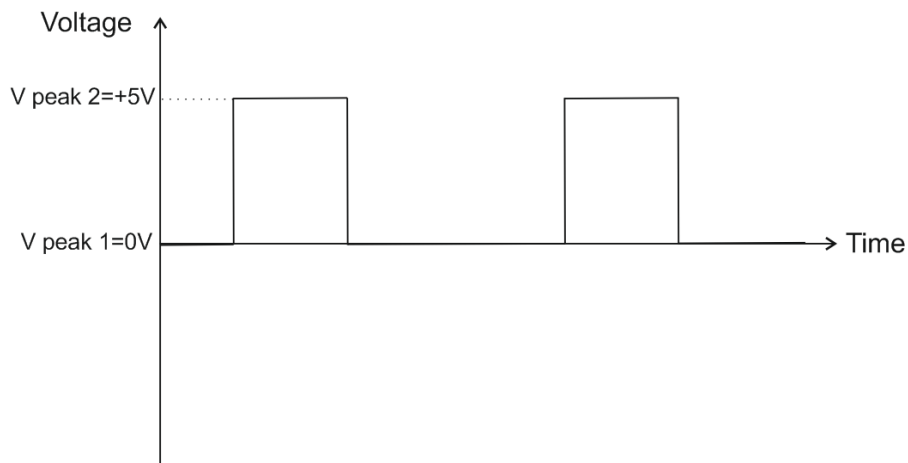
## Notes:

- Both V peak 1 and V peak 2 can be from -12V to +12V.
- Setting V peak 1 = V peak 2, will produce a DC output signal!

See the examples below for more information:



Example 1: V peak 1 = +5V, V peak 2 = -2V



Example 2: V peak 1 = +5V, V peak 2 = 0V

Duty cycle and frequency are as follows:

$$\text{Duty [\%]} = 100 \times \frac{\text{Pulse width ON}}{\text{Period}}$$

$$\text{Frequency [Hz]} = \frac{1}{\text{Period [S]}}$$

Focus is on the "V peak 1" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "V peak 1" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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## 4.2. Generator > Sine

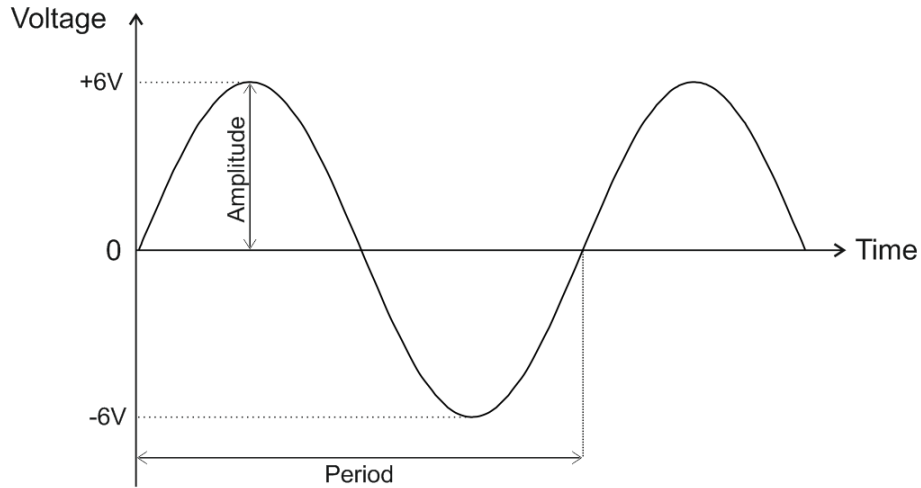
**Generator -Sine**

Amplitude:	+	1	2	.	0	0	V
Offset:	+	0	0	.	0	0	V
Frequency:	1	0	0	0	.	0	Hz

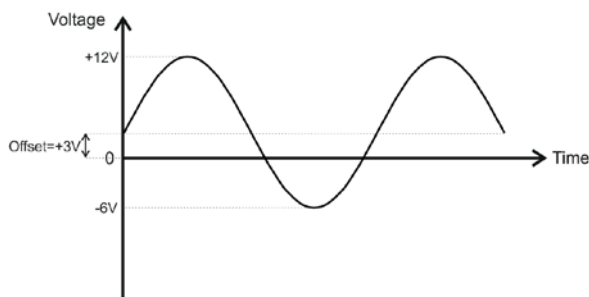
SOUT:ON
POUT:OFF

You can adjust the following parameters in this mode:

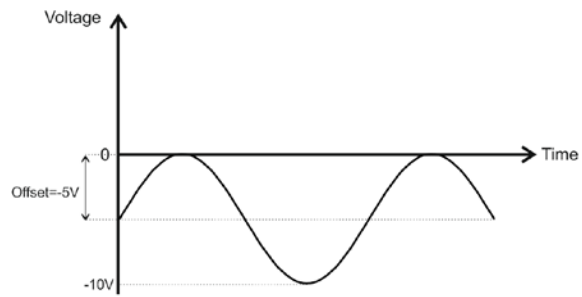
	Min	Max	Default
Amplitude [V]	0.0	12	5.0
Offset [V]	-12	+12	0.0
Frequency [Hz]	0	5000.0	1000



Amplitude = 12V, Offset = 0V



Amplitude = 9V, Offset = +3V



Amplitude = 5V, Offset = -5V

Focus is on the "Amplitude" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "Amplitude" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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### 4.3. Generator > Triangle

**Generator -Triangle**

V peak 1:       V

V peak 2:       V

Frequency:       Hz

You can adjust the following parameters in this mode:

	Min	Max	Default	Note
V peak 1 [V]	-12.0	+12.0	5.0	Vmax
V peak 2 [V]	-12.0	+12.0	0.0	Vmin
Frequency [Hz]	0.0	5000.0	1000	

Notes:

- Both V peak 1 and V peak 2 can be from -12V to +12V.
- Setting V peak 1 = V peak 2, will produce a DC output signal!

Focus is on the "V peak 1" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "V peak 1" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

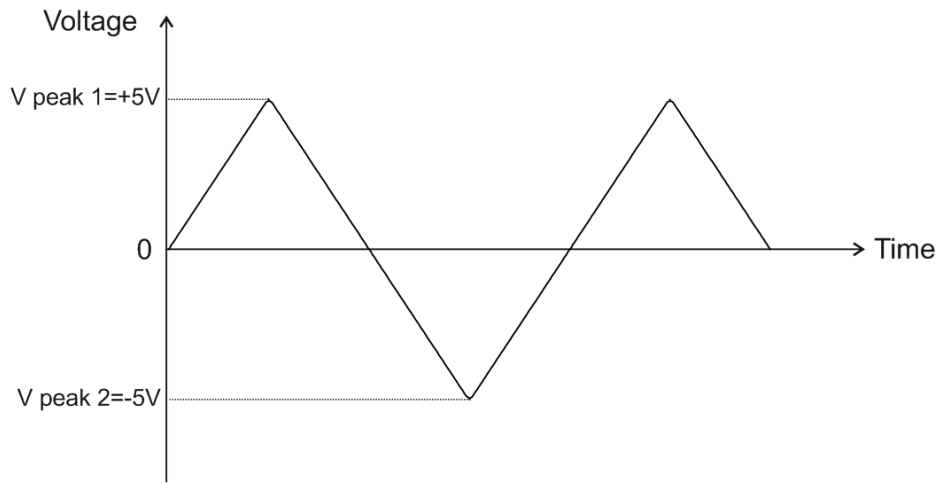
Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

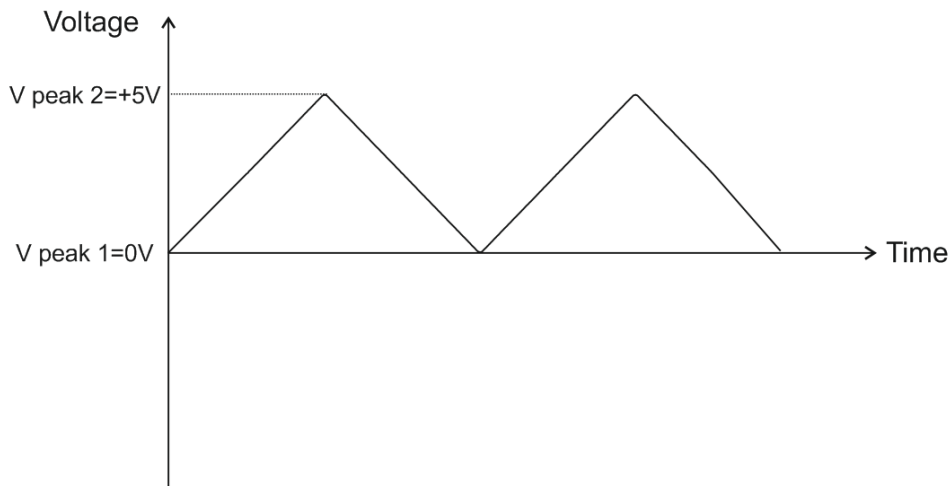
Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

See the examples below for more information:



Example 1: V peak 1 = +5V, V peak 2 = -5V



Example 2: V peak 1 = +5V, V peak 2 = 0V

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### 4.4. Generator > Sawtooth

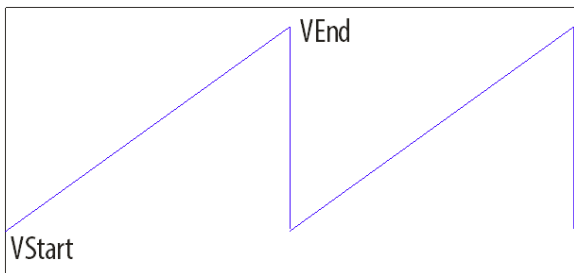
**Generator-SawTooth**

V start : + 0 5 . 0 0 V

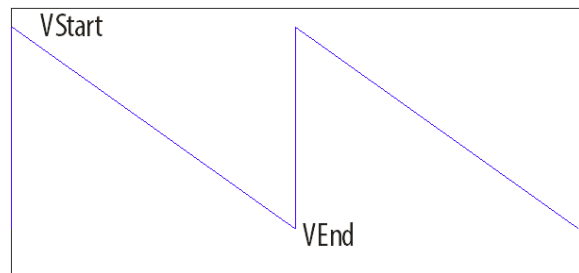
V end : + 0 0 . 0 0 V

Frequency : 1 0 0 0 . 0 Hz

SOUT:ON
POUT:OFF



Positive ramp



Negative ramp

You can adjust the following parameters in this mode:

	Min	Max	Default
V start [V]	-12.0	+12.0	0.0
V end [V]	-12.0	+12.0	5.0
Frequency [Hz]	0	10000.0	1000

Notes:

1. Both V start and V end can be from -12V to +12V.
2. Setting V start = V end, will produce a DC output signal!

Focus is on the "V start" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "V start" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

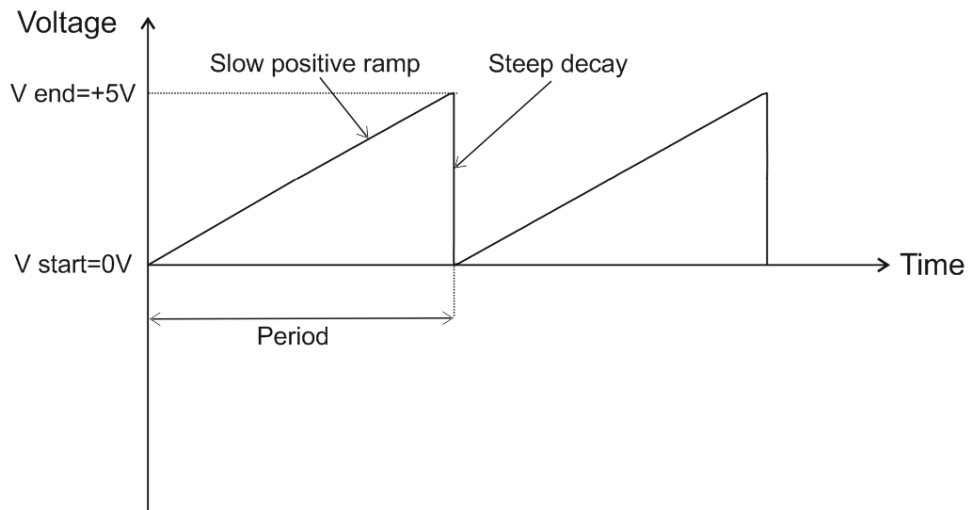
To confirm, you have to press <OK> and return to the selection of a parameter in focus.



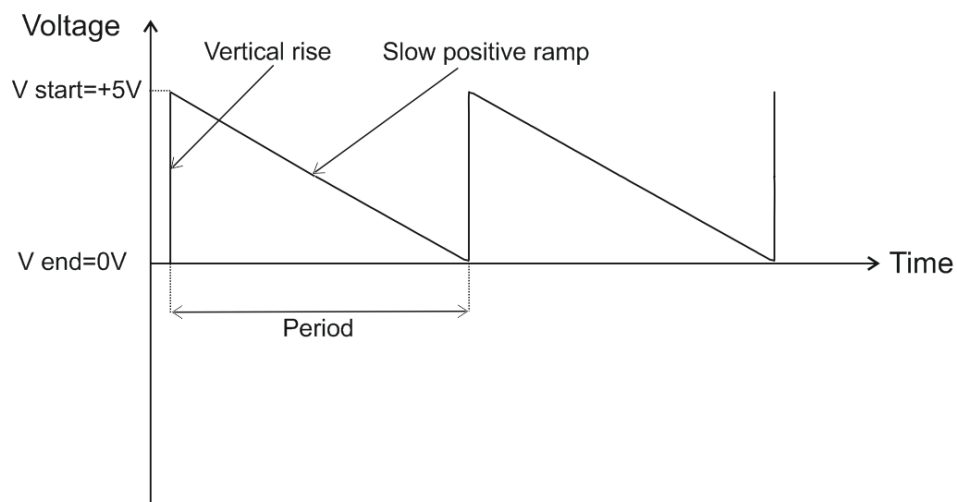
Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

See the examples below for more information:



Positive ramp:  $V_{start} = 0V$ ,  $V_{end} = +5V$



Negative ramp:  $V_{start} = +5V$ ,  $V_{end} = 0V$

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## 5. Mode "PowerSim"

PowerSim

---

Frequency:       Hz

Duty:      %

---

SOUT:OFF
POUT:ON

This mode controls the Pout power output to driver various solenoid actuators: fuel valves, relays, gasoline injectors etc. where the current does not exceed 4 amperes - the maximum value of the Pout output.

**Important note:** This is a ground-controlled output which means that one of the wires of the load should be connected to +12V in order to be controlled by the Pout output! The other wire is connected to the Pout output!

You can adjust the following parameters in this mode:

	Min	Max	Default
Frequency [Hz]	100.0	2000.0	1000.0
Duty [%]	0.0	100.0	50

Focus is on the "Frequency" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "Frequency" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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## 9. Mode "Pulse"

Pulse	
SOut Pulse	
POut Pulse	
SOUT:ON	POUT:OFF

This mode allows generating various pulses with adjustable parameters on a desired output.

You can choose between:

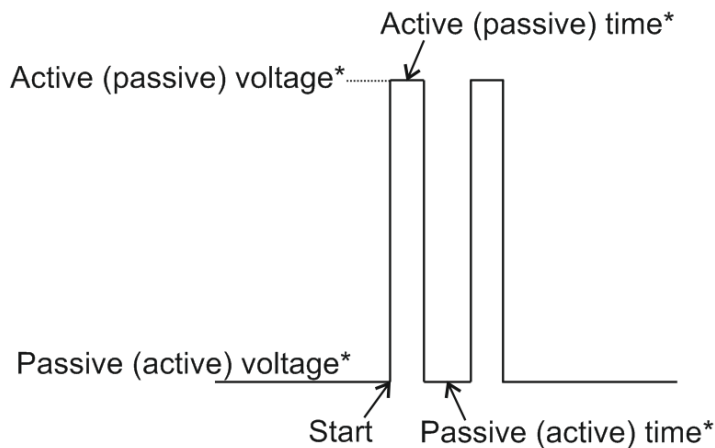
- Sout Pulse (The signal is active on the output Sout)
- POut Pulse (The signal is active on the output Pout)

Note: There are some limitations of the Pout power output which are explained in the Pout Pulse section!

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### 9.1. Pulse > Sout Pulse

SOut Pulse	
Pulses Count :	0 0 1 0
Active Level :	+ 0 5 . 0 0 V
Passive Level :	+ 0 0 . 0 0 V
Active Time :	0 0 0 0 1 . 0 mS
Passive Time :	0 0 0 0 5 . 0 mS
Start	
SOUT:ON	POUT:OFF



\* Active time/voltage and passive time/voltage depend on how the load is connected to the output.

Ground-controlled: if one of the load wires is connected to +12V and the other – to the output.

Feed-controlled: if one of the load wires is connected to ground and the other – to the output.

You can adjust the following parameters in this mode:

	Min	Max	Default
Pulses Count	1	1000	1
Active voltage [V]	-12	+12	5
Passive voltage [V]	-12	+12	0
Active time [mS]	0.5	1000	1.0
Passive time [mS]	0.5	1000	5.0

Focus is on the "Pulses Count" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "Pulses Count" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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**9.2. Pulse > Pout Pulse**

### POut Pulse

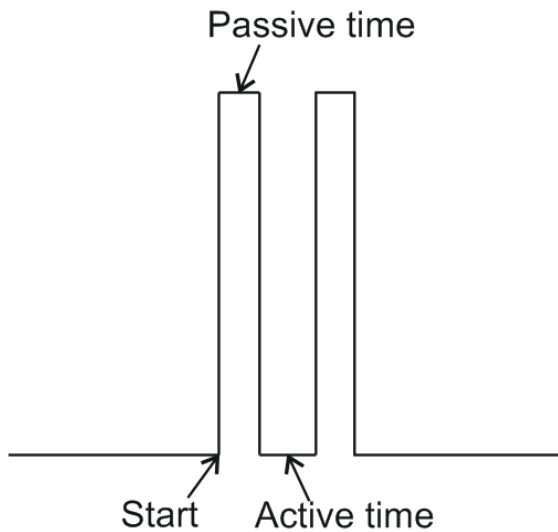
Pulses Count : 0 0 1 0

Active Time : 0 0 0 0 1 . 0 mS

Passive Time : 0 0 0 0 5 . 0 mS

Start

SOUT:OFF
POUT:ON



**Note: Pout power output is ground-controlled and thus one of the load wires must be connected to +12V!**

You can adjust the following parameters in this mode:

	Min	Max	Default
Pulses Count	1	10	1
Active time [mS]	0.5	10	1.0
Passive time [mS]	0.5	10	5.0

Note: "Active voltage" and "Passive voltage" parameters are not available in this mode because the power output Pout goes up to the battery voltage (+12V)!

Focus is on the "Pulses Count" parameter by default. You can change the focus with ▲ and ▼ arrow buttons.

Select the parameter to edit with the <OK> button.

If, for example, the "Pulses Count" parameter is in focus, by pressing <OK>, we enter the edit mode of this parameter.

Now, using ◀ and ▶ arrow buttons, we select the digit to be edited, and with ▲ and ▼ arrow buttons, we change the value.

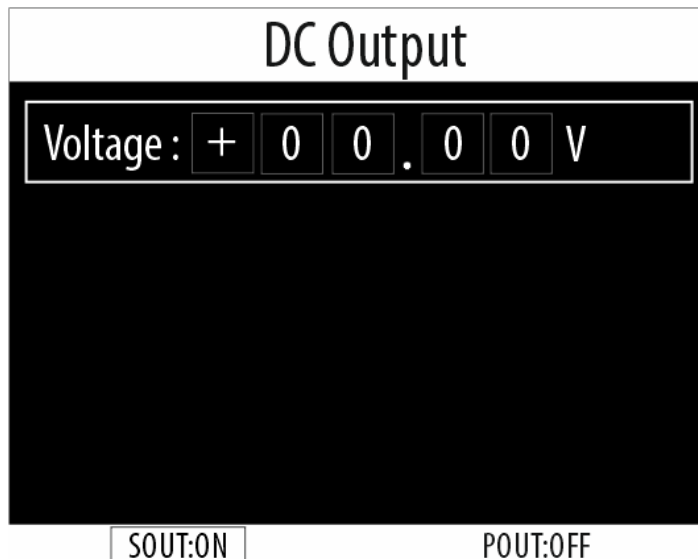
To confirm, you have to press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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## 10. Mode "DC Output"



In this mode, you can get a DC output signal from -12V to +12V with adjustment step of 0.01V (10mV).

You can change the digit in focus with ◀ and ▶ arrow buttons, and with ▲ and ▼ arrow buttons, you change the value.

To confirm, press <OK> and return to the selection of a parameter in focus.

Note: After each change, the output signal changes too!

If you press <BACK>, you will return to the parameter in focus and the parameter value will remain unchanged.

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## 11. Settings menu

Settings	
Language	
Date & Time	
Firmware update	
About	
SOUT:OFF	POUT:OFF

In this menu you are able to:

- Change the device language;
- Set date & time;
- Update the device firmware;
- See details about the device.

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## 12. Technical specifications

### Functional specifications:

Sampling rate	200 KSa/s
Settling Time	4.5 $\mu$ s
Resolution	12 bit
Maximum output frequency	20 kHz
Output channels	2
Signal output	Sout
Power output	Pout
Simultaneous operation of both outputs	Yes
Standart operating modes	Waveforms, DC, Pulse
Built-in automotive presets	Yes
High current PWM control	Yes

**Signal output (Sout) specifications:**

Output polarity	Positive and Negative
Output amplitude	$\pm 10$ mV ~ $\pm 12$ V (10 mV step)
DC voltage output range	$\pm 10$ mV ~ $\pm 12$ V (10 mV step)
Output current	$\pm 30$ mA maximum
Vertical resolution	12 bits
Waveforms	Sine, Square, Triangular, Ramp
Sine wave frequency range	0.1 Hz ~ 5 kHz
Ramp/Triangular frequency range	0.1 Hz ~ 5 kHz
Square wave frequency range	0.1 Hz ~ 20 kHz
Square wave duty cycle range, 20 kHz	20% ~ 80 %, step 0.1%
Square wave duty cycle range, 10 kHz	10% ~ 90 %, step 0.1%
Square wave duty cycle range, to 5 kHz	5% ~ 95 %, step 0.1%
Pulses	1 ~ 100
Pulse width	1 ms ~ 1 sec
Pulse period	2 ms ~ 5 sec

**Power output (Pout) specifications:**

Amplitude	12 V
Max. output current	4 A continuous
Active level	"switched earth"
Output frequency range	up to 2 kHz
PWM duty cycle range	1% ~ 100%
Duty cycle setting accuracy	0,1%
Thermal shutdown	Yes
Over voltage protection	Yes
Current limitation	Yes
Short circuit protection	Yes

**General specifications:**

Power	12V, 24V DC (vehicle battery)
Power supply range	10V DC ~ 28V DC
Power connector	2 pin terminal block
Quiescent power current	$\leq 160$ mA
Ambient temperature	0°C ~ +35°C
Ambient humidity	0%RH ~ 85%RH
Dimensions	160 mm x 94 mm x 25 mm
Weight	500g

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