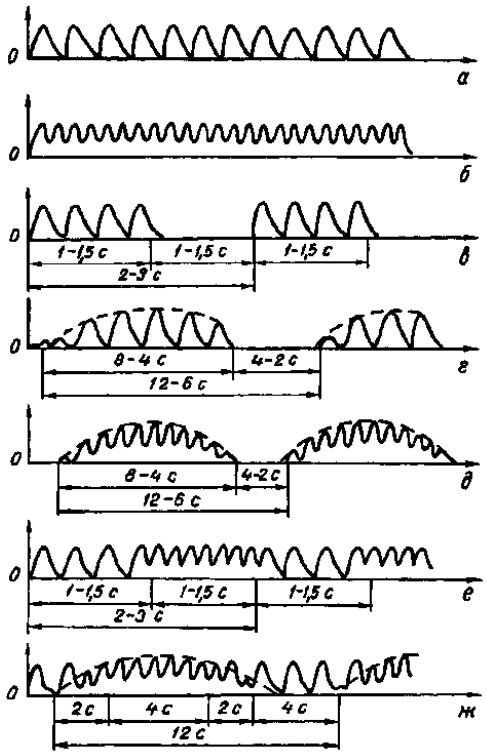
SCENAR: the secrets of effectiveness

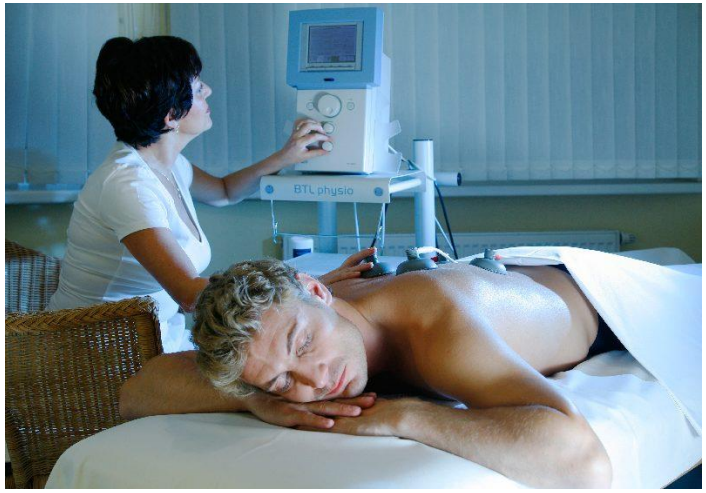
A few words about electrotreatment

Galvanization is low-strength (under 50mA) and low-voltage (30-80V) direct current. Galvanization exists for 200 years.

A few words about electrotreatment



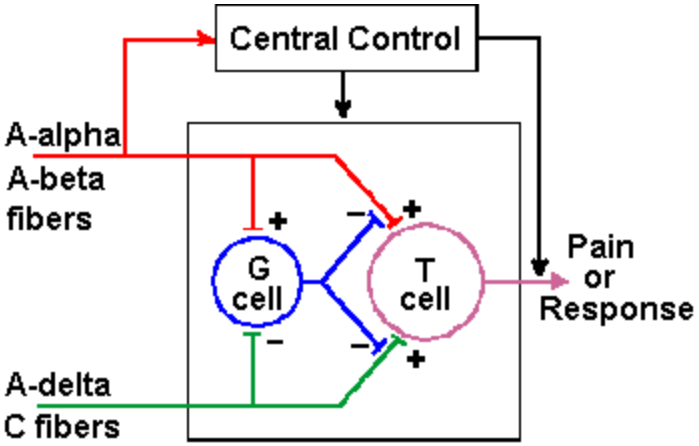
In the 1950s P. Bernard offered the treatment with alternating current (**dia-dynamic currents therapy**).
In 1963 it was offered to use sinusoidal currents with frequency 5000 Hz, modu-lated with frequency from 10 up to 150 Hz (**amplipulse therapy**).



A few words about electrotreatment

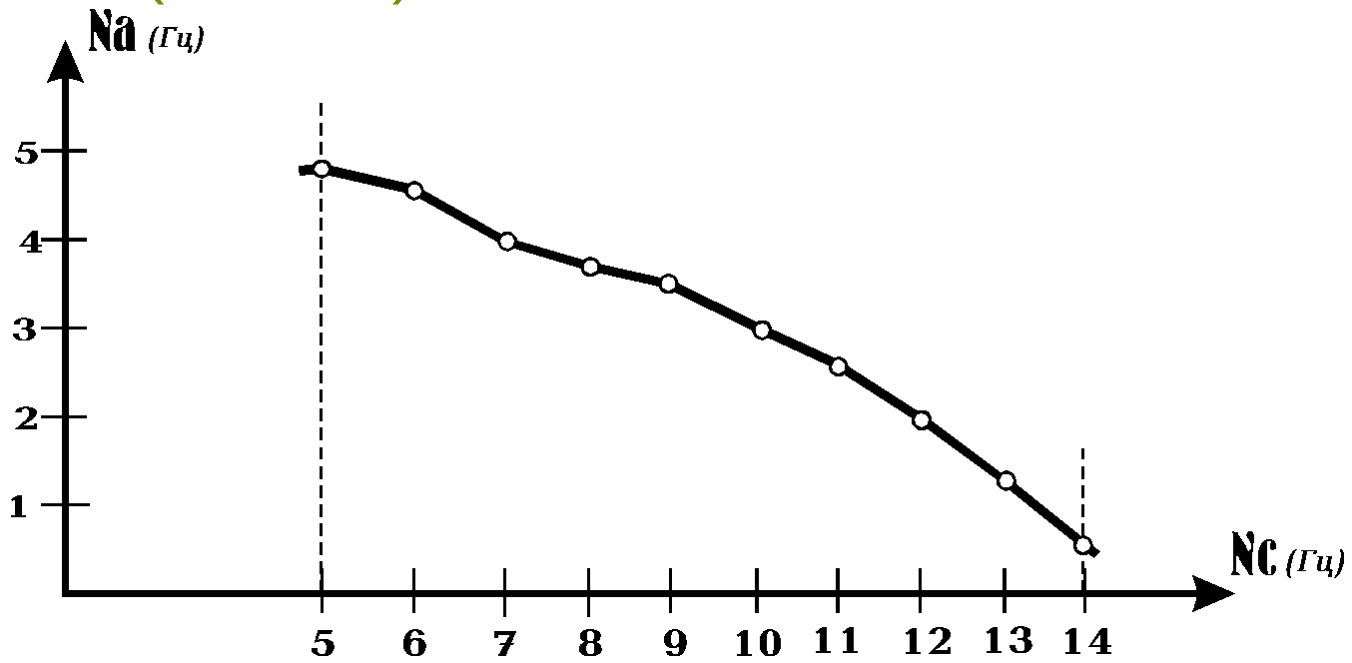
Electropulse therapy was developed basing on ‘The gate control theory’ by Melzack R., Canada, and Wall P., England, 1965.

Photo credit: The Canadian Medical Hall of Fame



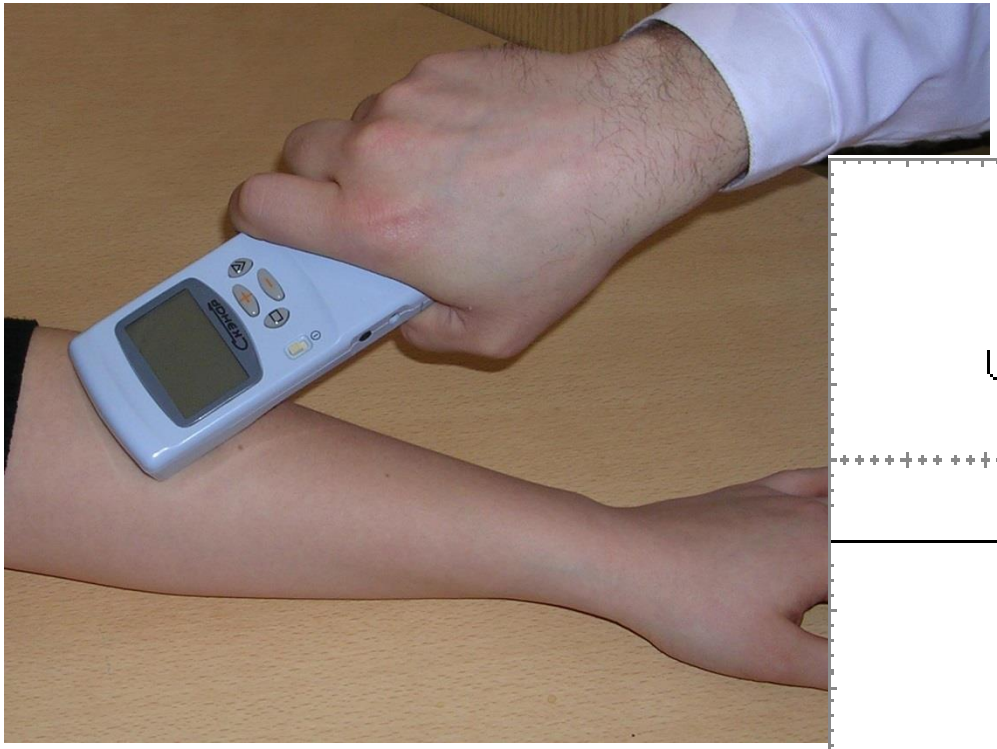
‘Addiction’ and coping with it

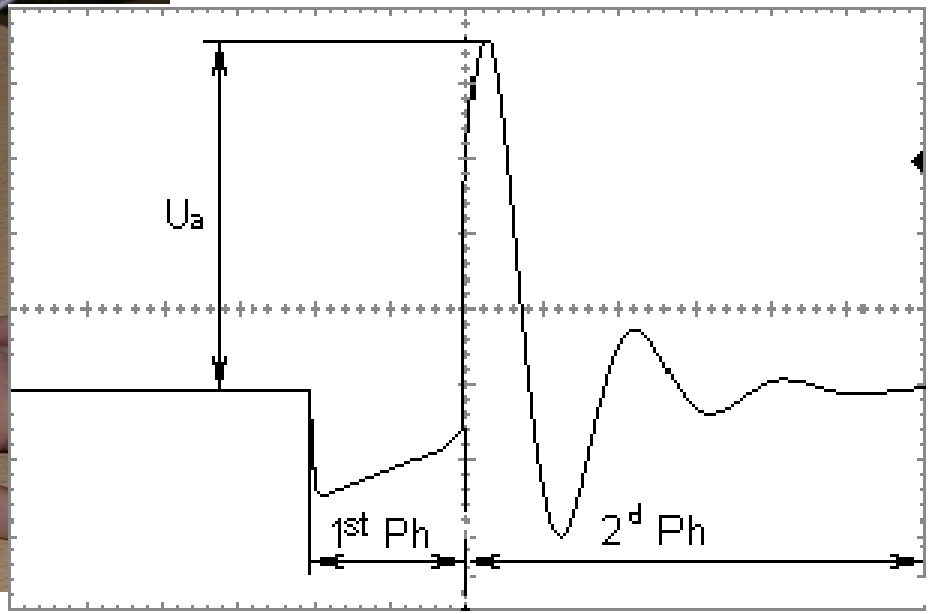
There is a problem of electric influence ‘addiction’ - the effect goes down with the lapse of time. SCENAR copes with this problem successfully. The frequency of caused pulse activity vs the frequency of neuron synaptic stimulation (irritation).



SCENAR pulse features

SCENAR generates two-phase bipolar pulses with insignificant constant component.





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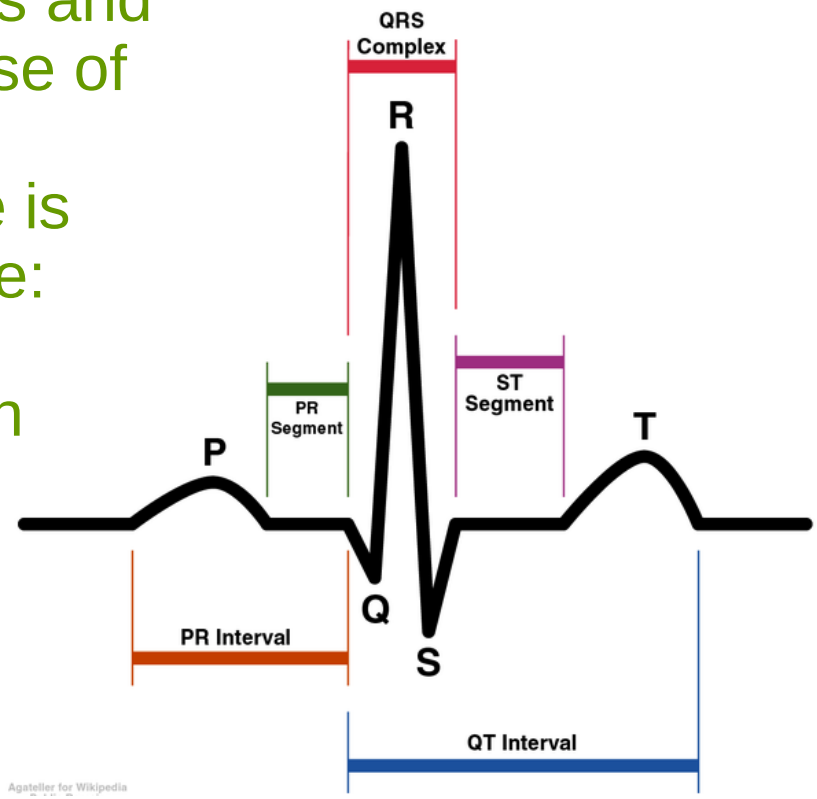
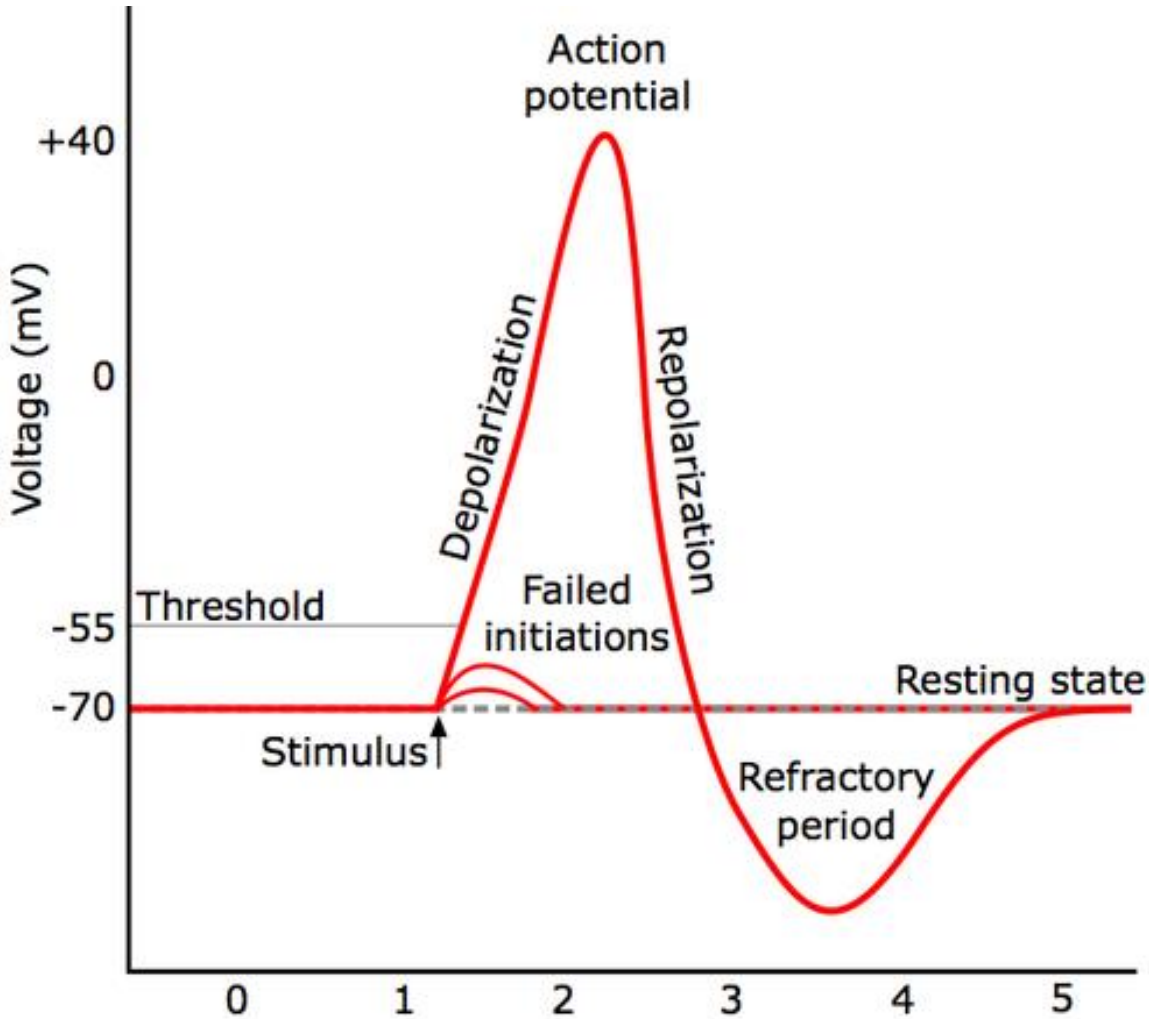
SCENAR pulse features

Such shape is called ‘neural-like’, as it is similar to myopulses and cardiopulses (particular case of myopulses).
Their characteristic feature is exactly two-phase structure:
I-st phase – depolarization
II-nd phase – repolarization

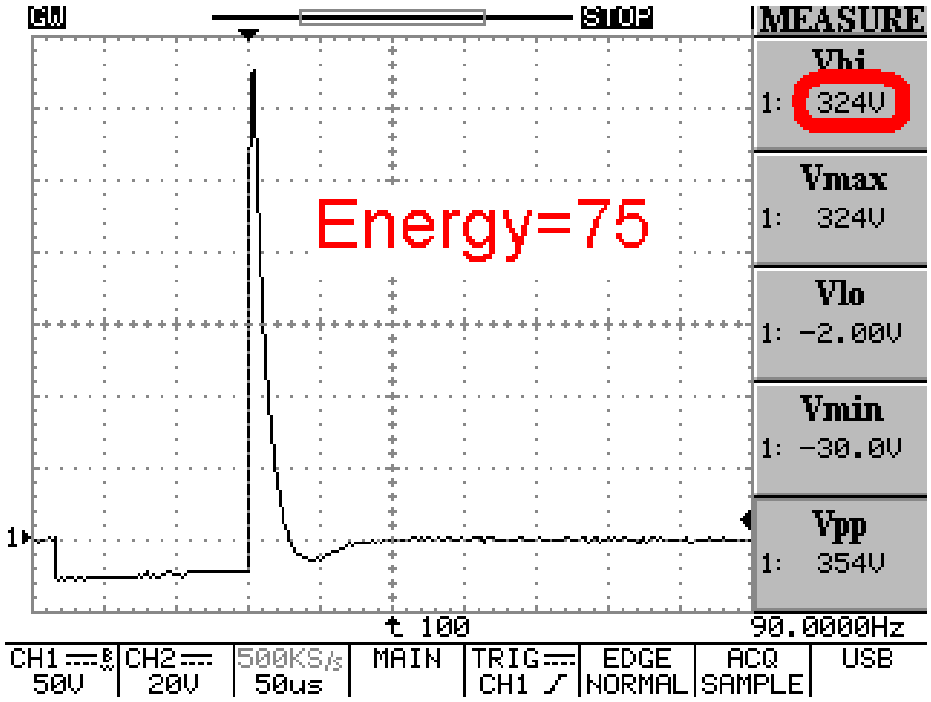


SCENAR pulse features



SCENAR pulse features

High-amplitude



SCENAR pulse features

With limited energy (undamaging)

	500 Ω		2kΩ		10k Ω	
	Measured U_{rms}, V	Average power, W	Measured U_{rms}, V	Average power, W	Measured U_{rms}, V	Average power, W
SCENAR-1-NT	10.3	0.212	14.3	0.102	12.5	0.016
CHANS-01-SCENAR	11.4	0.260	13.9	0.097	12.6	0.016
InterX5000	9.8	0.192	13.5	0.091	13.8	0.019

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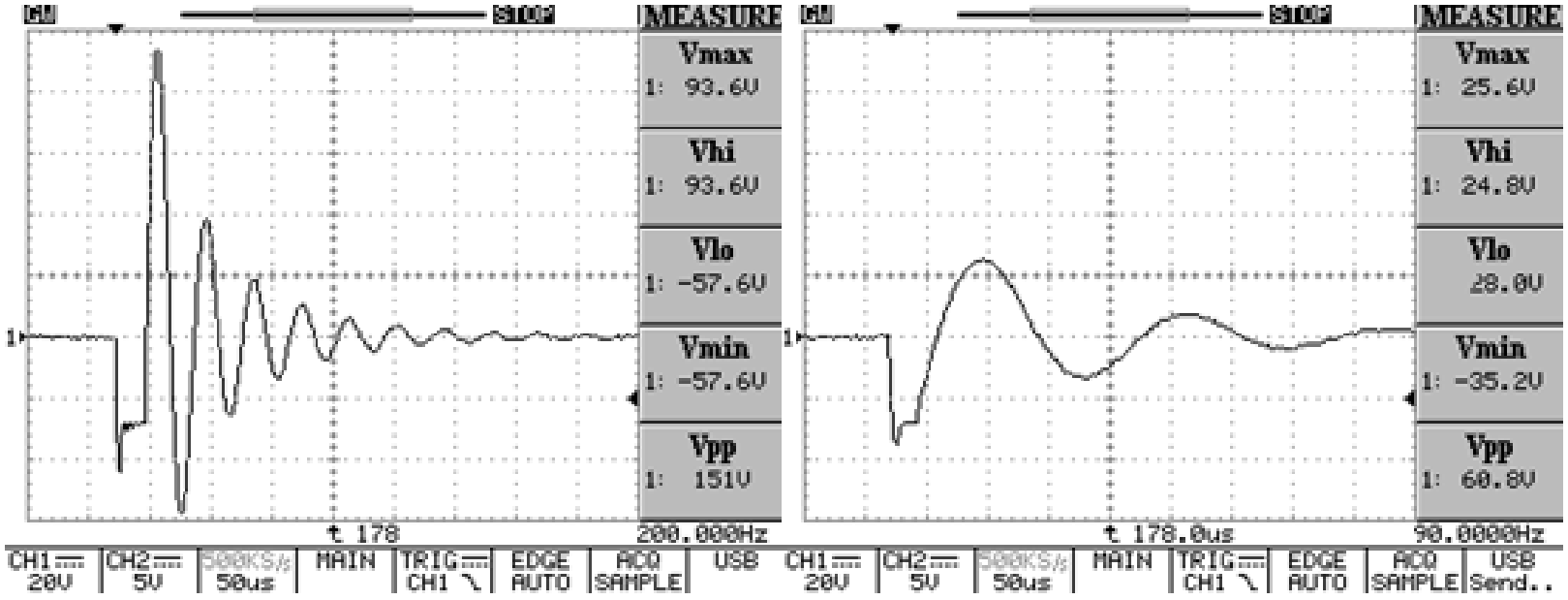
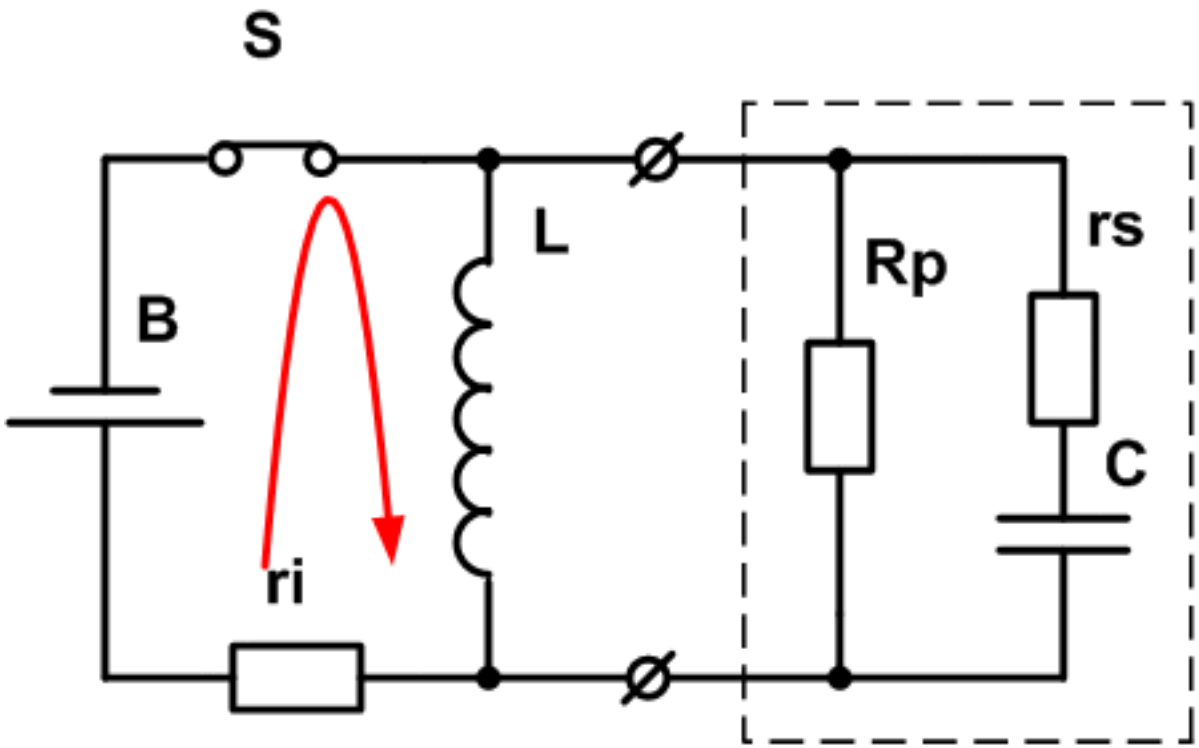
SCENAR pulse features

High-variative (Energy=20, 1st and 30nd sec)



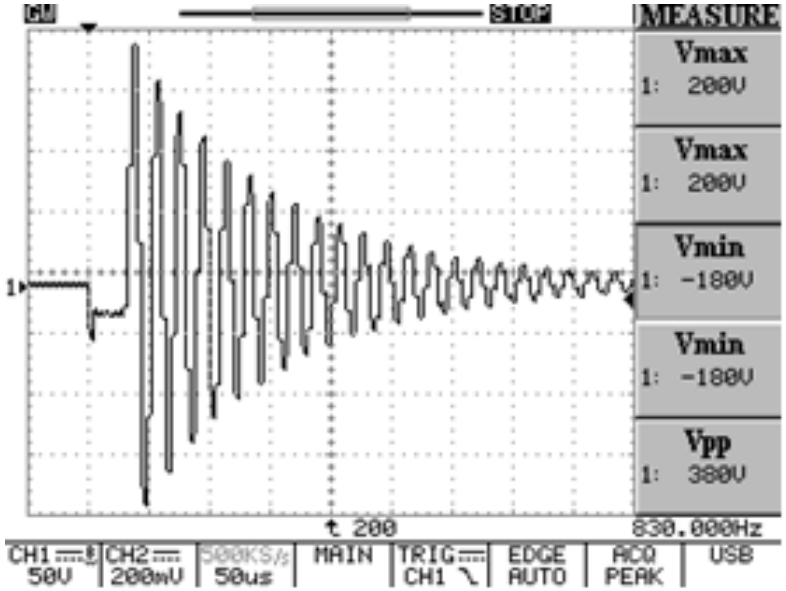
How SCENAR pulse forms?



1st phase

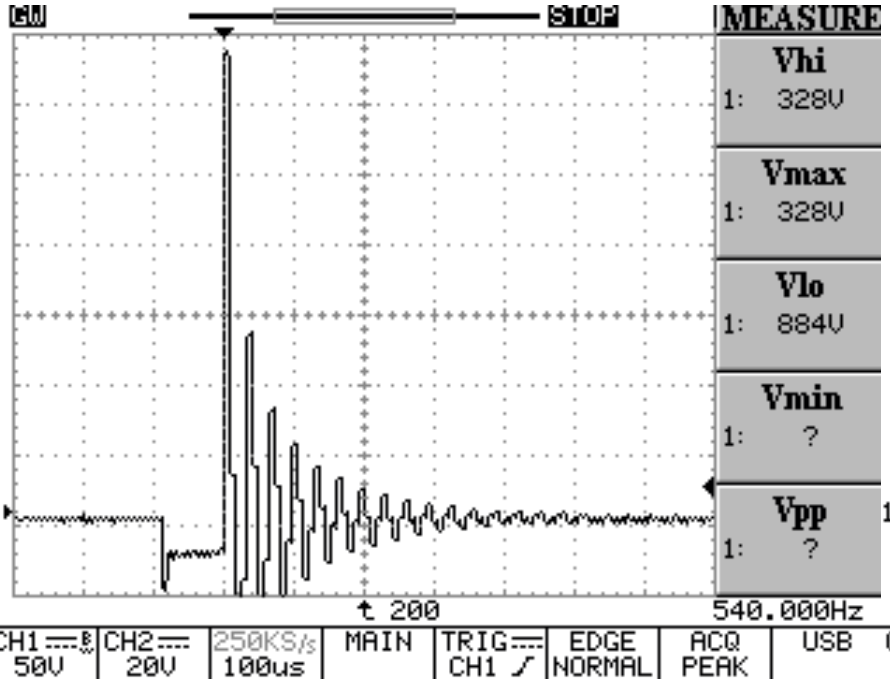
SCENAR pulse vs load

No load

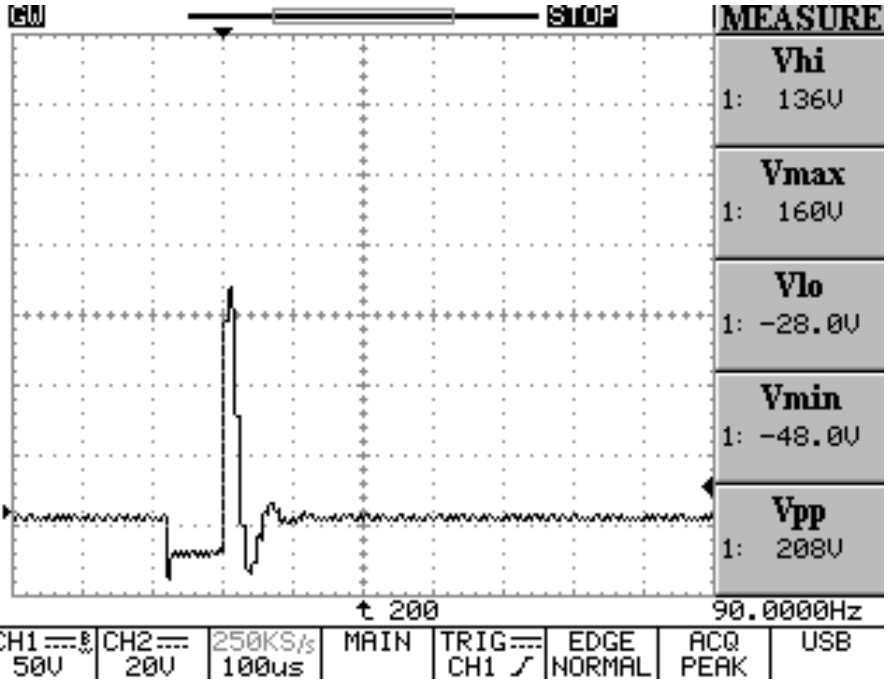


SCENAR pulse vs load

Back of the hand

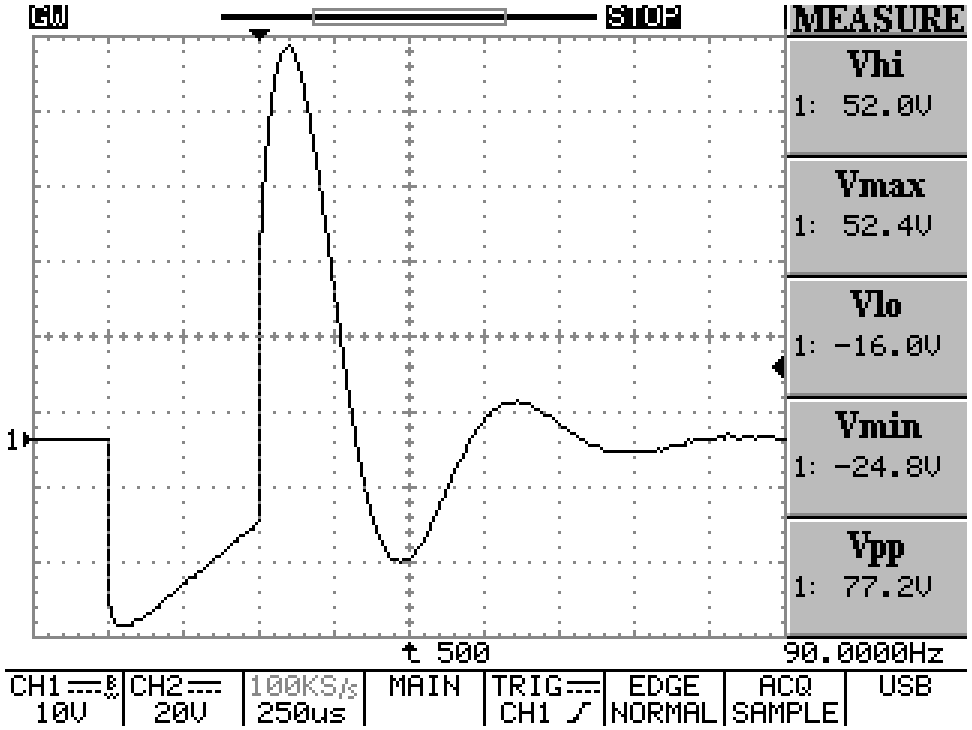


Palm



SCENAR pulse vs load

Self-adhesive electrodes, Energy=250



SCENAR pulse vs load

$$\omega = \frac{1}{\sqrt{LC}}$$

$$T = \sqrt{LC}$$

$$IR = Const \bullet \sqrt{C}$$

$$C = \frac{(IR)^2}{K}; K \sim 1$$

C_{sim}	IR	C_{calc}
	10	140
300	15	320
	20	570
	30	1 300
	50	3 600
10000	75	8 000
220000	400	230 000
	600	510 000
	800	910 000

SCENAR pulse features

Summary:

- two-phase bipolar (neural-like);
- high-amplitude, but undamaging;
- high-variative (no addiction).

SCENAR pulse features

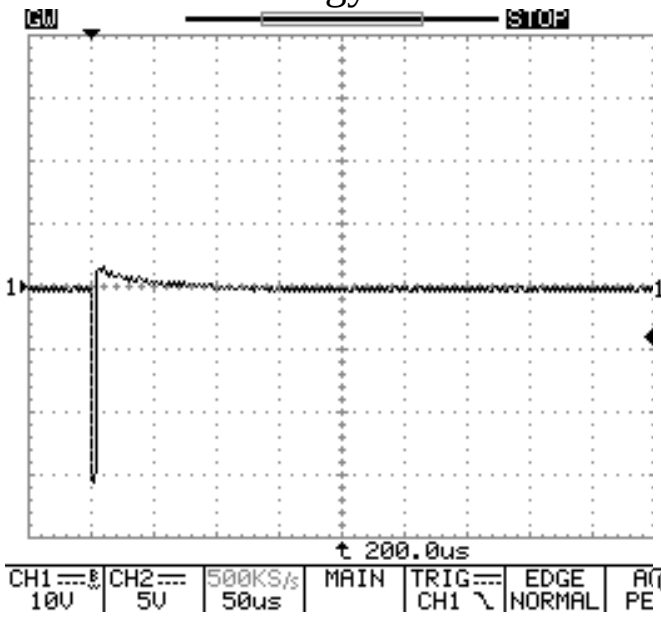
Questions?
Break…

Available settings

Available settings: ‘Energy’

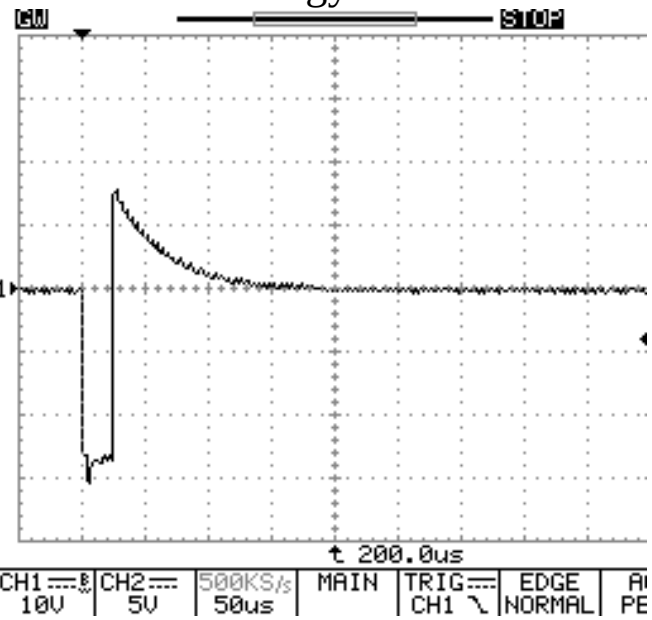
Basic parameter, its regulation is available in all devices and in the same limits. Max/min amplitude rate is from 50 to 100 times. For energy it corresponds to more than 2500 times.

Energy=1



a

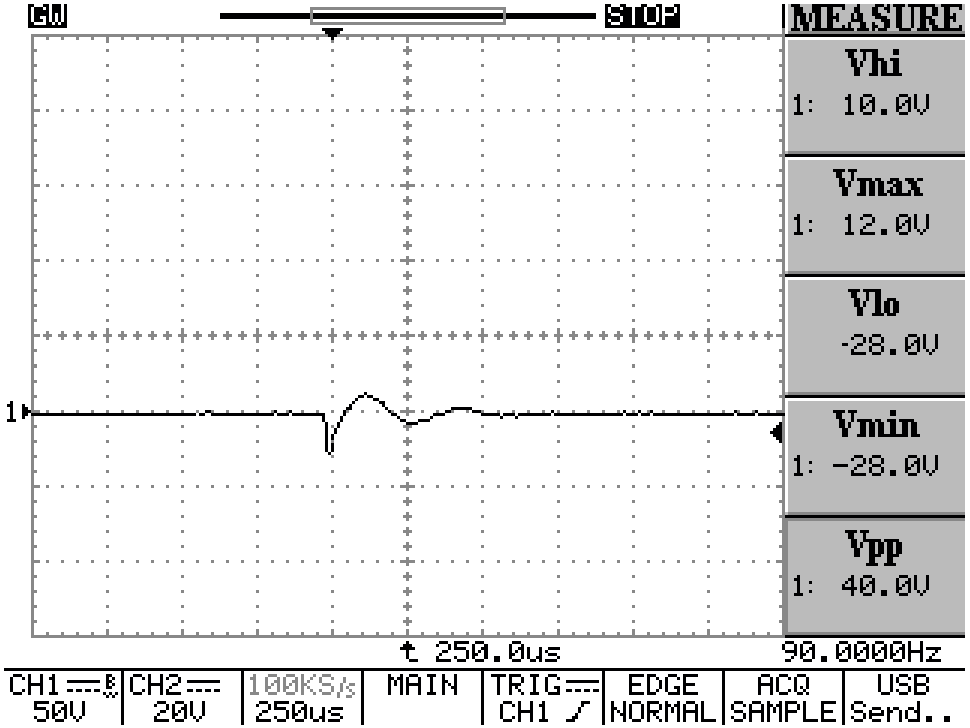
Energy=20



b

Available settings: ‘Energy’

Energy changes from 20 to 250.



Available settings: ‘Energy’

While increasing the energy the sensations are changing from their absence to painful ones.
At comfortable electric influence level it is felt as pulsation, pricking, vibration.

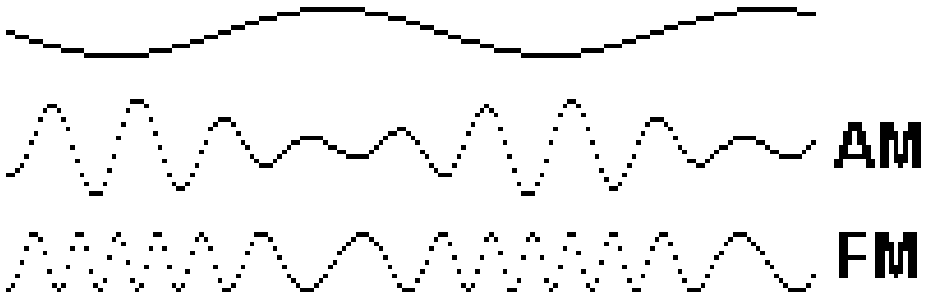
Consequently, there is a scale of influence:

subthreshold level,
threshold level,
comfortable level,
uncomfortable level,
painful level.

Even at subthreshold level the influence goes. The result is not always proportional to the strength of sensations.

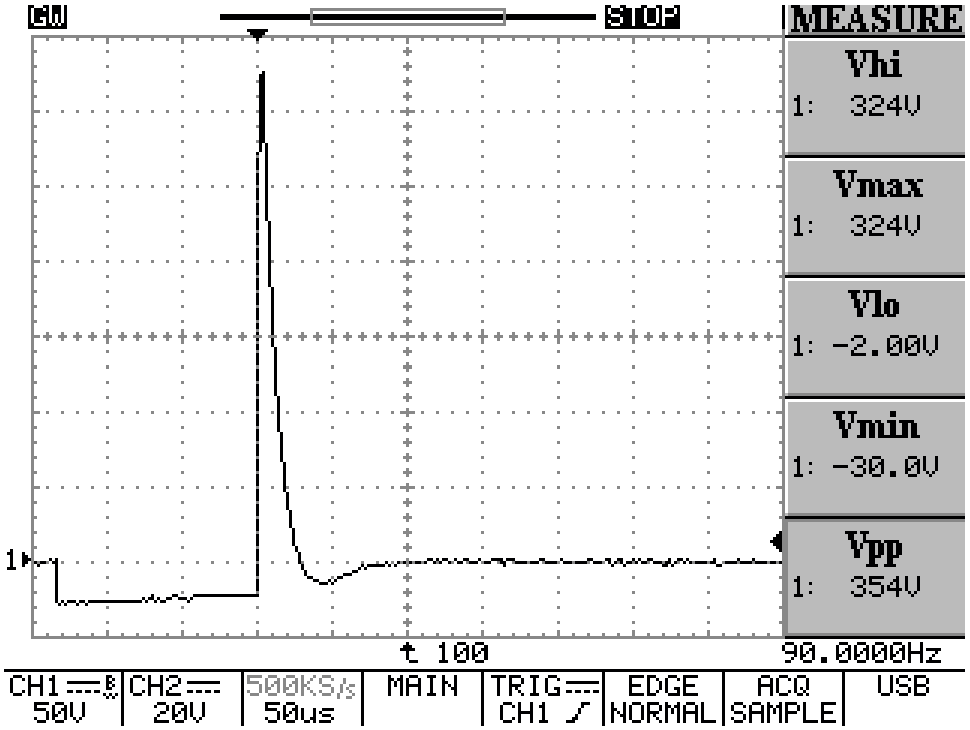
Available settings: ‘AM’

Amplitude modulation (AM) is the influencing pulse amplitude changing during the time according to a rule.
Is available in all devices completely or partially.



Available settings: ‘AM’

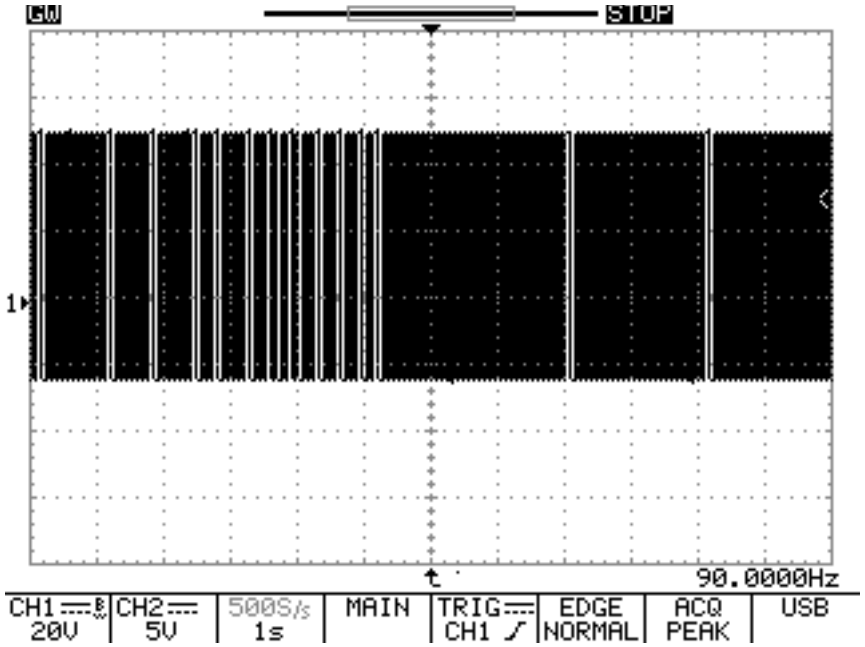
AM: alone pulse



Available settings: ‘AM’

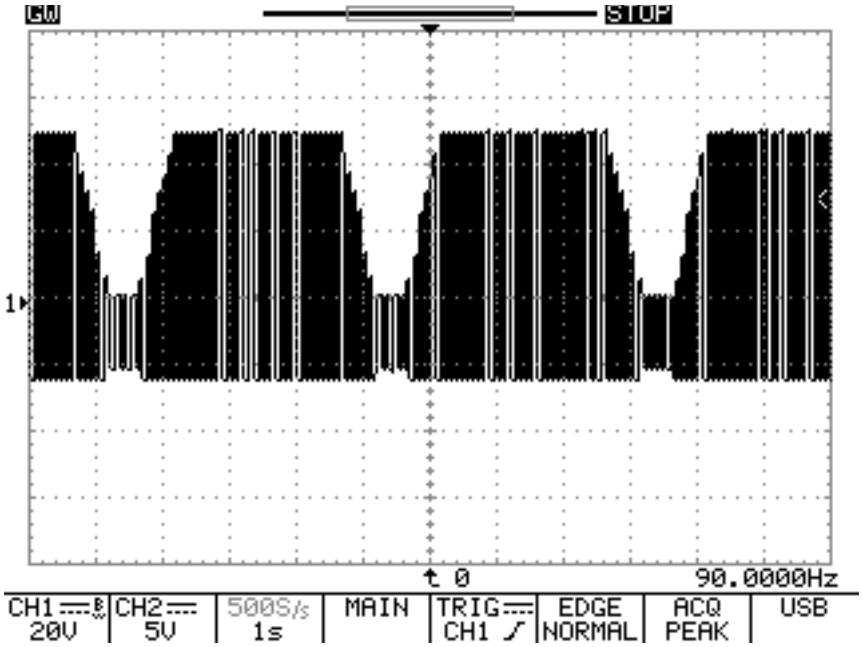
AM: pulses’ bursts

AM=Off



a

AM=3:1



b

Available settings: ‘AM’

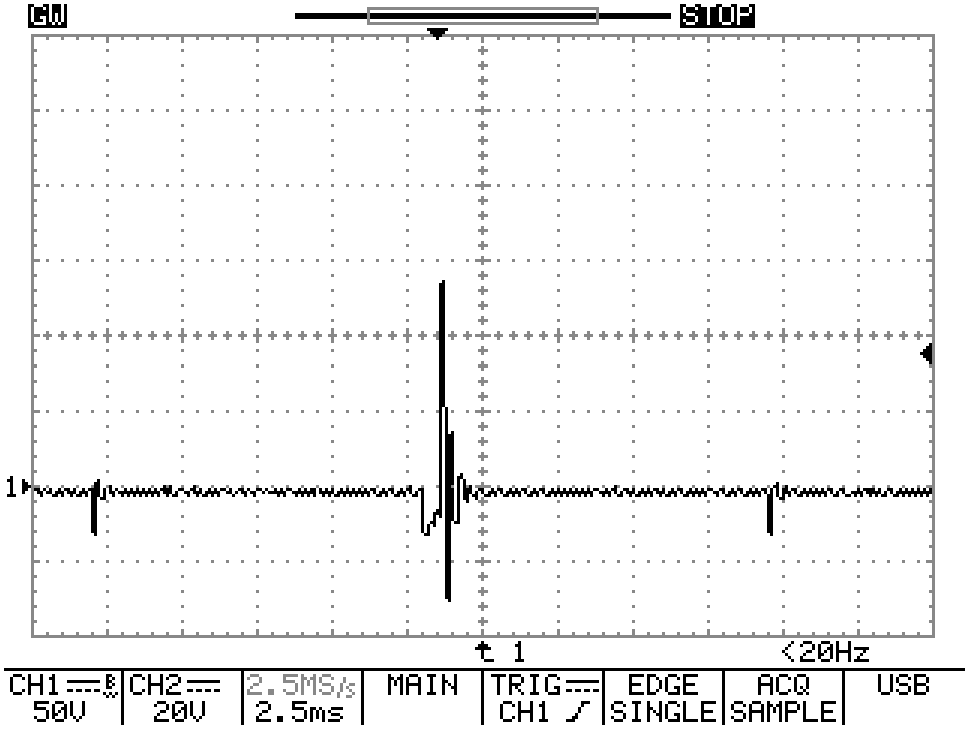
When AM is on it is felt only increasing and decreasing of influence strength.

Available settings: ‘Bee’

‘Bee’ is one of the ‘AM’ modes. The device at minimal energy is waiting for the skin contact. Right after the contact it gives 1 or more pulses with maximal energy.
Is available only in the highest SCENAR device.

Available settings: ‘Bee’

‘Bee’ mode with ‘Int=1’



Available settings: ‘Bee’

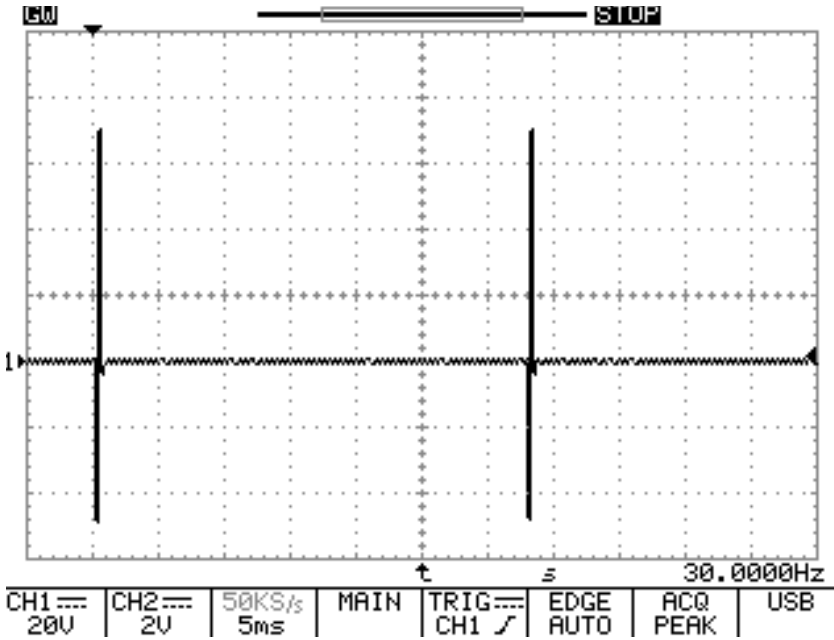
When ‘Bee’ is on, right after the skin contact it is felt high short influence like Bee sting.

‘Energy’ settings does not affect ‘Bee’ strength.
It can be regulated only with ‘Intensity’ settings.

Available settings: ‘Frequency’

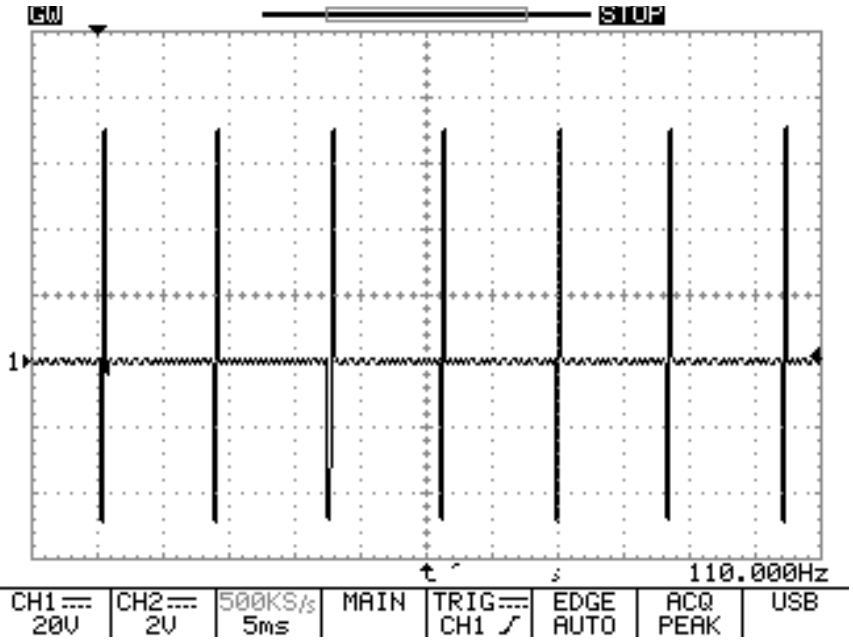
Frequency is quantity of pulses per second.
Is available in all devices completely or partially.

F=30Hz



a

F=120Hz



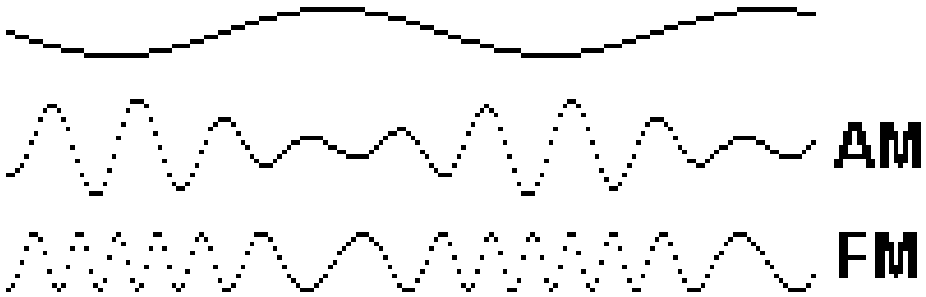
b

Available settings: ‘Frequency’

While changing the frequency the changes of both – the strength and the ‘volume’ of influence are felt.

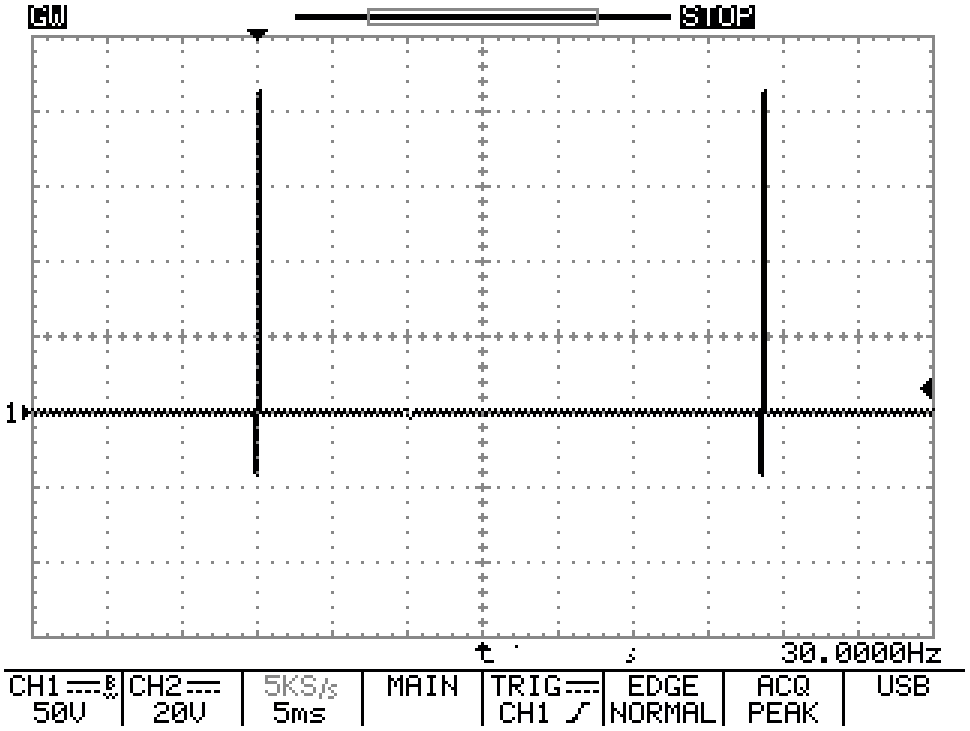
Available settings: ‘FM’

Frequency modulation (FM) is the influencing pulse frequency changing during the time according to a rule.
Is available in all devices except for the lowest CHANCE.



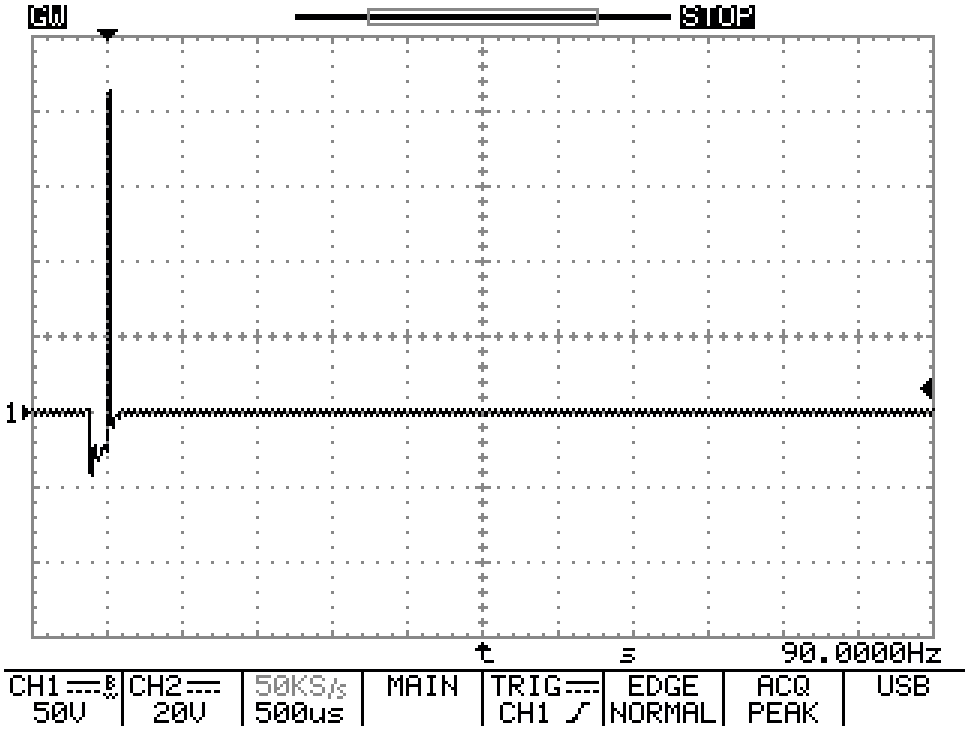
Available settings: ‘FM’

As well as while changing the frequency manually the changes of both – the strength and the ‘volume’ of influence are felt.



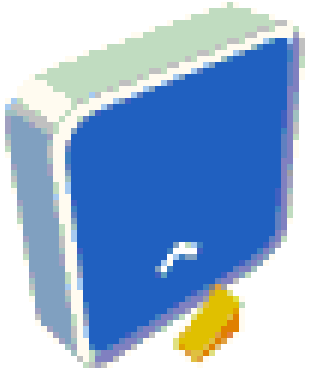
Available settings: ‘Intensity’

The quantity of pulses in a burst. The space between pulses in the burst (gap) is smaller than the space between bursts.
Is available in SCENAR devices except for the lowest one.



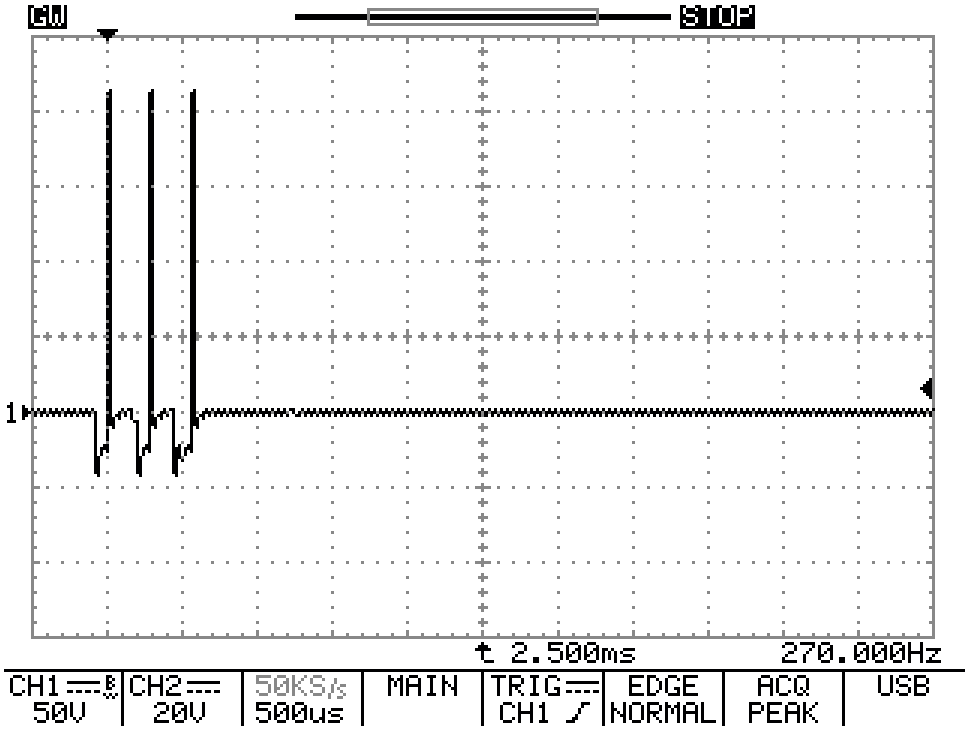
Available settings: ‘Intensity’

While changing the intensity the changes of both – the strength and the ‘depth’ of influence are felt. That’s why there is another name for intensity – ‘depth’.



Available settings: ‘Gap’

The gap is a space between pulses in a burst. It has the sense only for intensity 2 and more.
Is available in SCENAR devices except for the lowest one.



Available settings: ‘Gap’

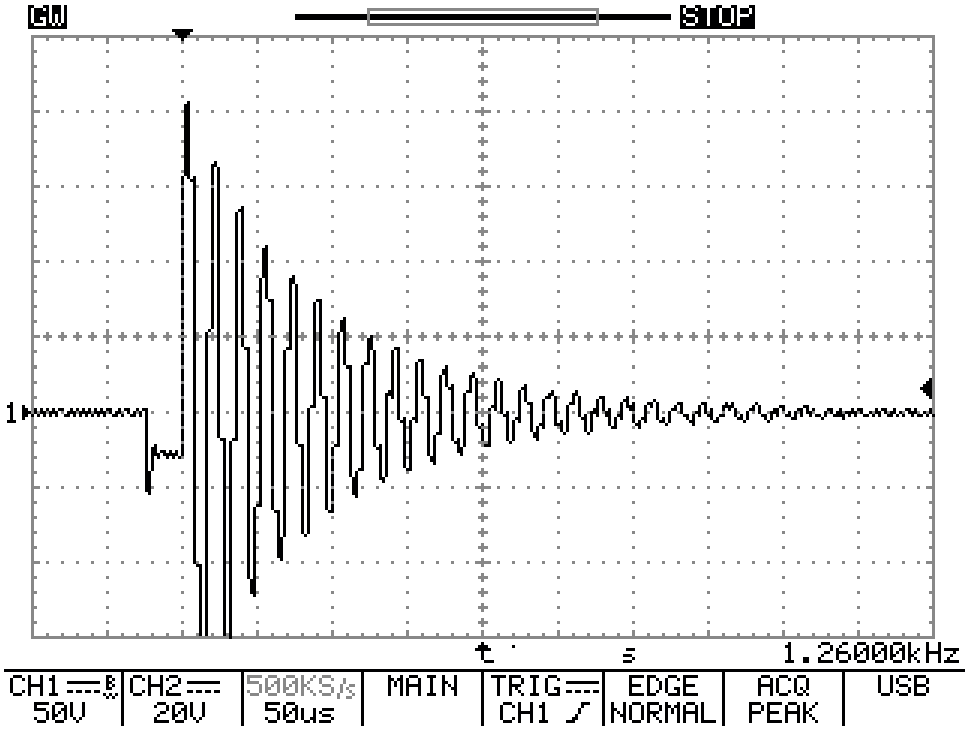
While changing the gap the changes of the ‘depth’ of influence are felt as well as a kind of pulses ‘rotation’.

Available settings: ‘Damping’

It means the pulses initial shape changing and the law of their changing depending on the load.
Is available in SCENAR devices except for the lowest one.

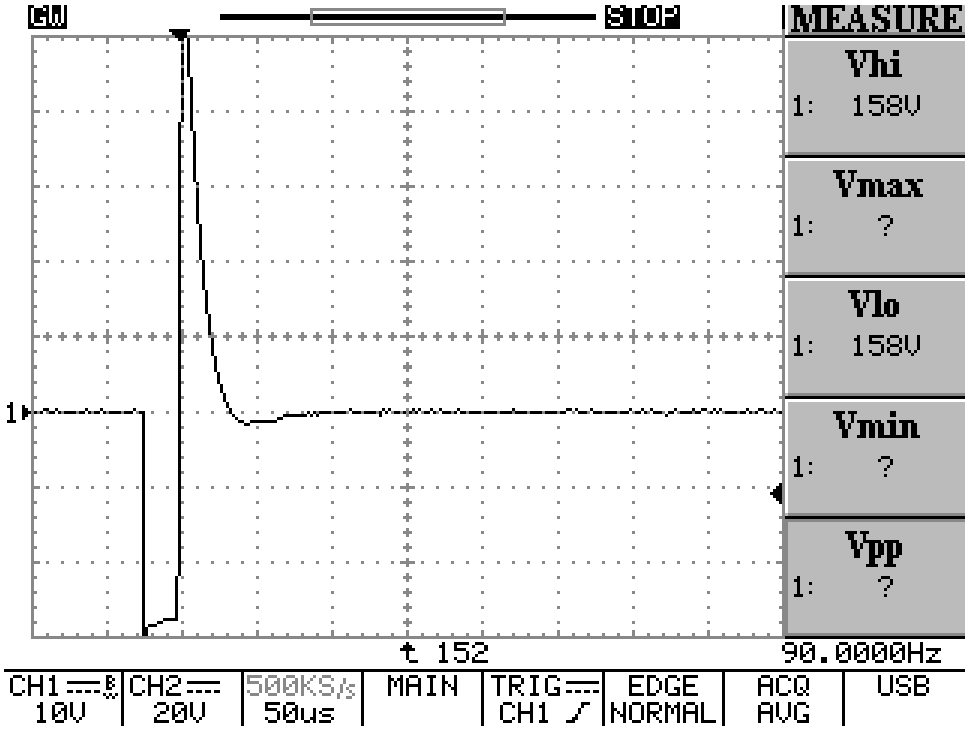
Available settings: ‘Damping’

Without load



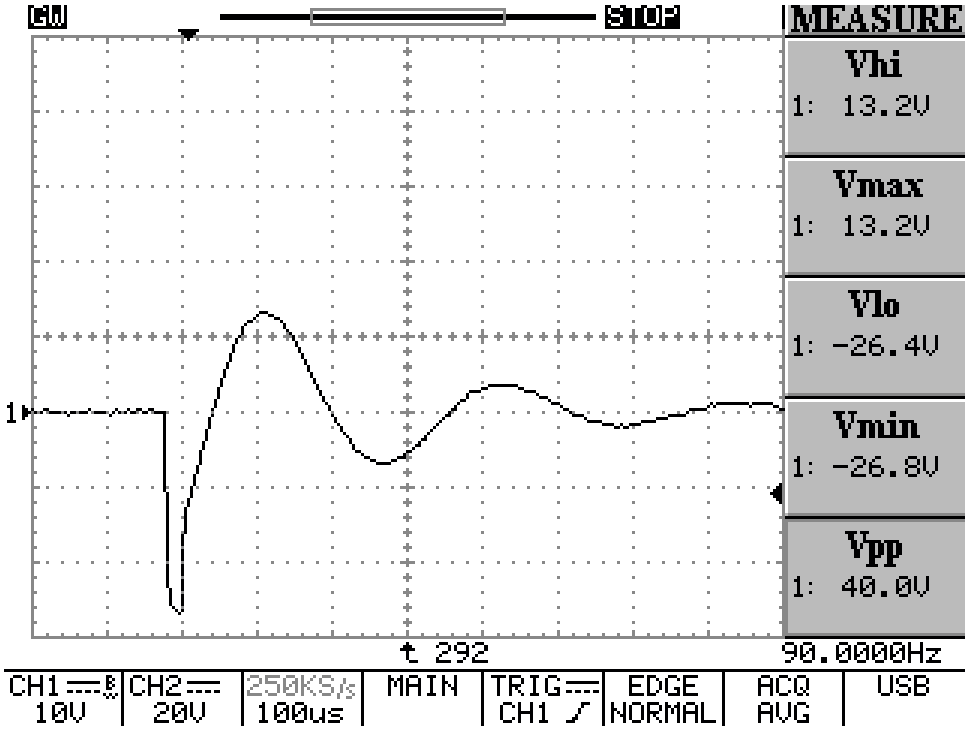
Available settings: ‘Damping’

High resistance of the load



Available settings: ‘Damping’

Load with high capacity



Available settings: ‘Damping’

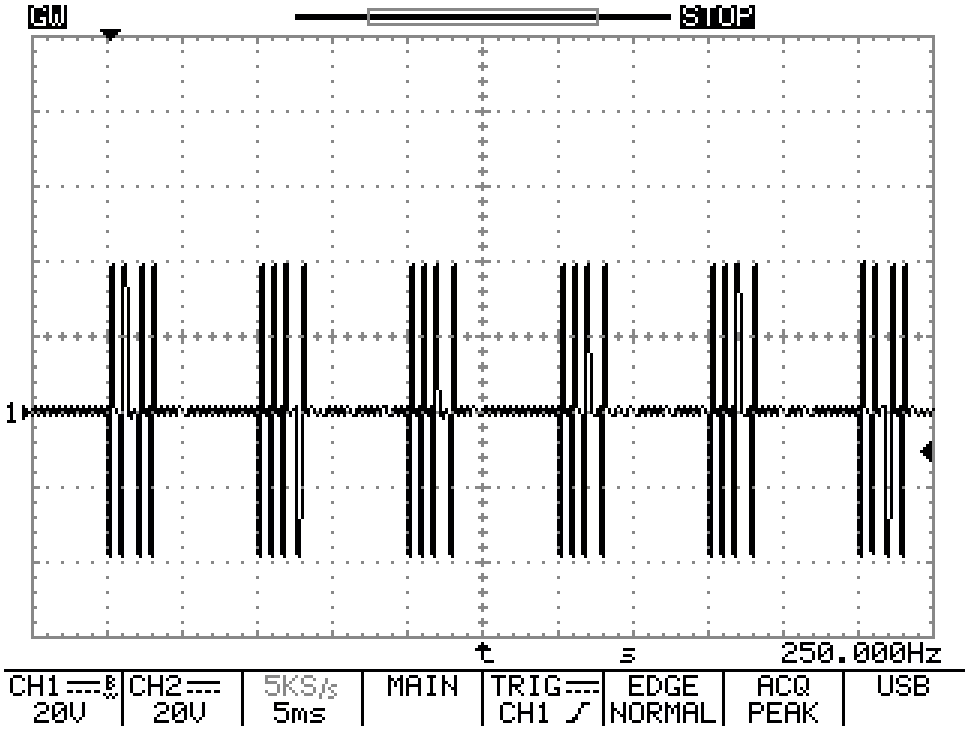
While changing the damping the changes of the ‘softness’ or the ‘sharpness’ of influence are felt.

Available settings: ‘Swings’

Swings are combined modulations. They are simultaneous autochanges of frequency (FM), gap, damping.
In Sw4 mode the intensity is changing too.
They are available in SCENAR devices except for the lowest one.

Available settings: ‘Swings’

Example of Sw4



Available settings: ‘Swings’

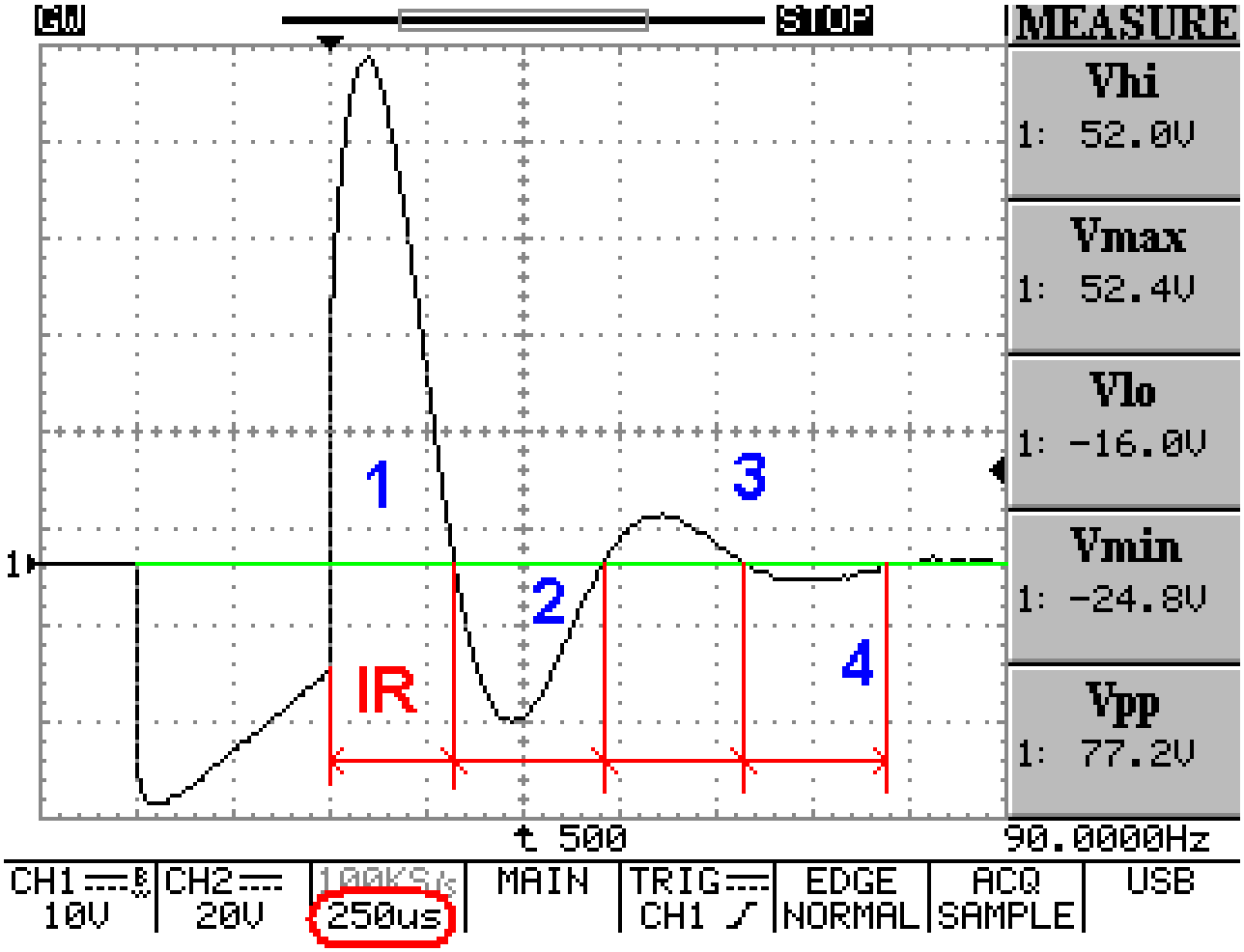
When any Swing is on, the simultaneous changing of ‘softness’, ‘depth’ and ‘volume’ of influence are felt.

Available settings

Questions?
Break…

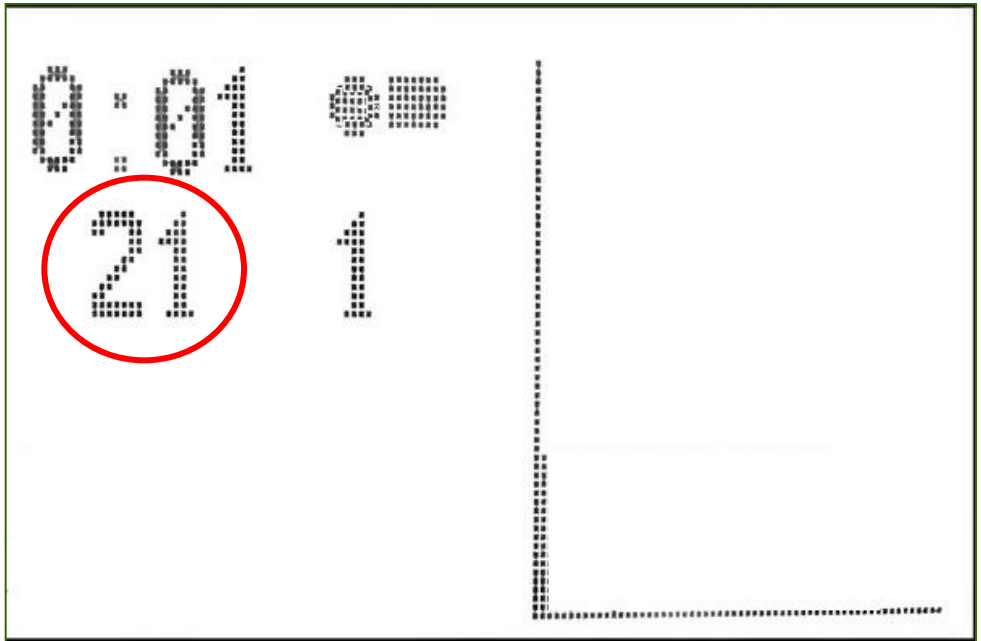
Dose, Zero, Rate…

Dose, Zero, Rate…



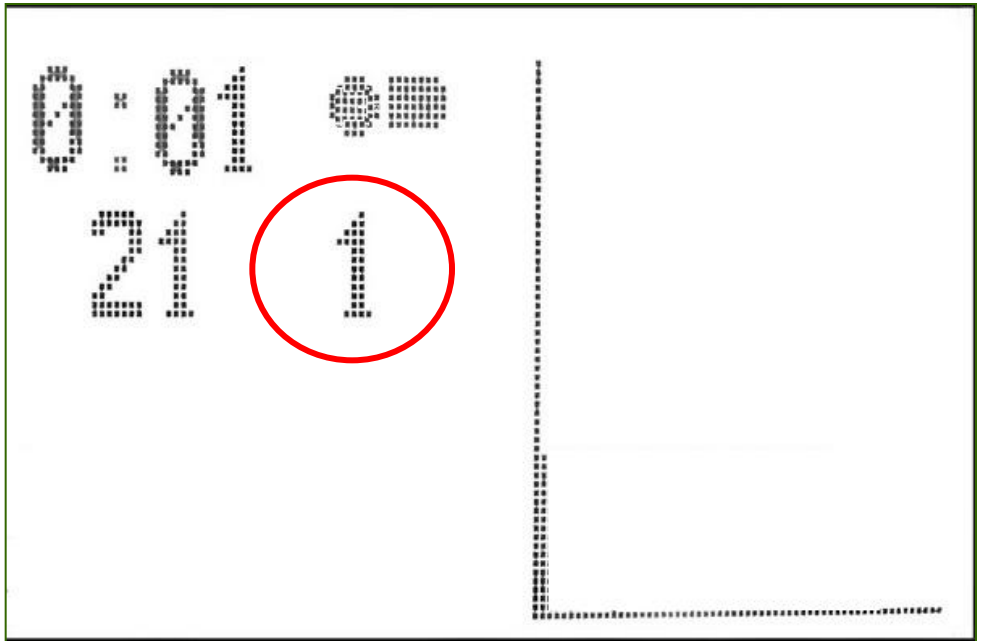
Dose, Zero, Rate…

Initial Reaction (IR) is length of the 2d phase's first pulse.
The difference between **IR** and **current (ongoing) reaction (CR)** is that **IR** is average parameter in 1st second and **CR** is average parameter in current second.



Dose, Zero, Rate…

Shape coefficient (SC) is quantity of oscillation half-phases (or zero crossing) during Phase 2.
Initial Shape coefficient (IS) is average **SC** in first second and **Current Shape coefficient** (**CS**) is average **SC** one in current second.



Dose, Zero, Rate…

Speed is relative speed of current reaction changing in percentage per second.

$$V = \frac{100\% \bullet (R_t - R_0)}{R_0 \bullet t}$$

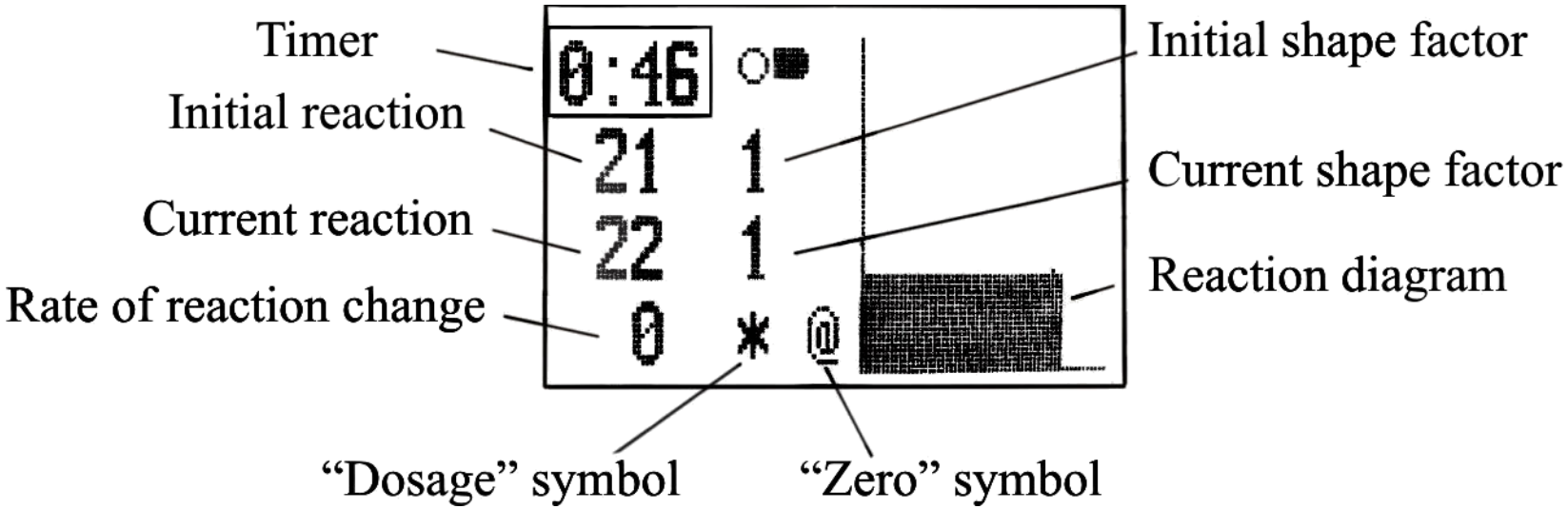
Ro – initial reaction,
Rt – current reaction,
t – time of the point treating,
V – reaction speed.
Exact formula for the speed is

$$V = \frac{128\% \bullet (R_t - R_0)}{R_0 \bullet t}$$

This way is easier to calculate for microcontroller.

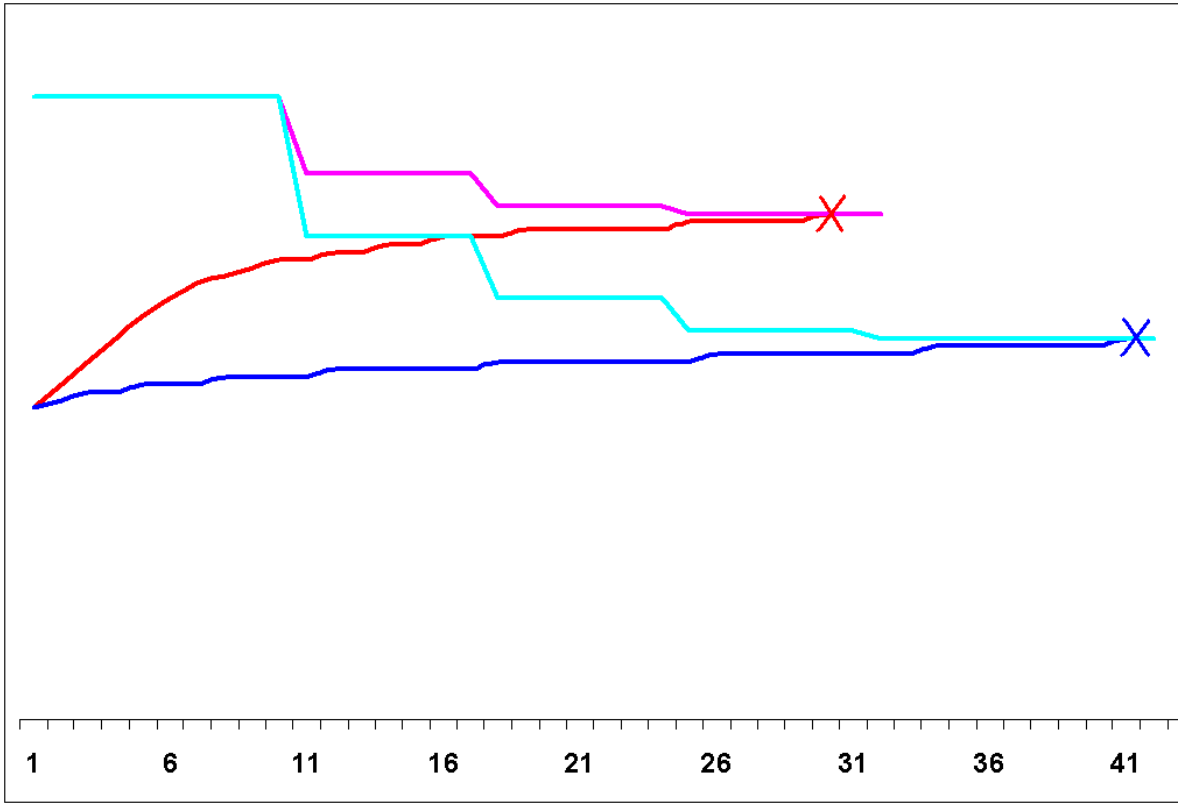
Dose 1

Dose 1 – adaptive dose + integrated zero.
Dose (*) means that over the full time the zone was stimulated, the reaction has changed ENOUGH (according to our criterion).
Zero (@) means the speed became less than 1%/sec.



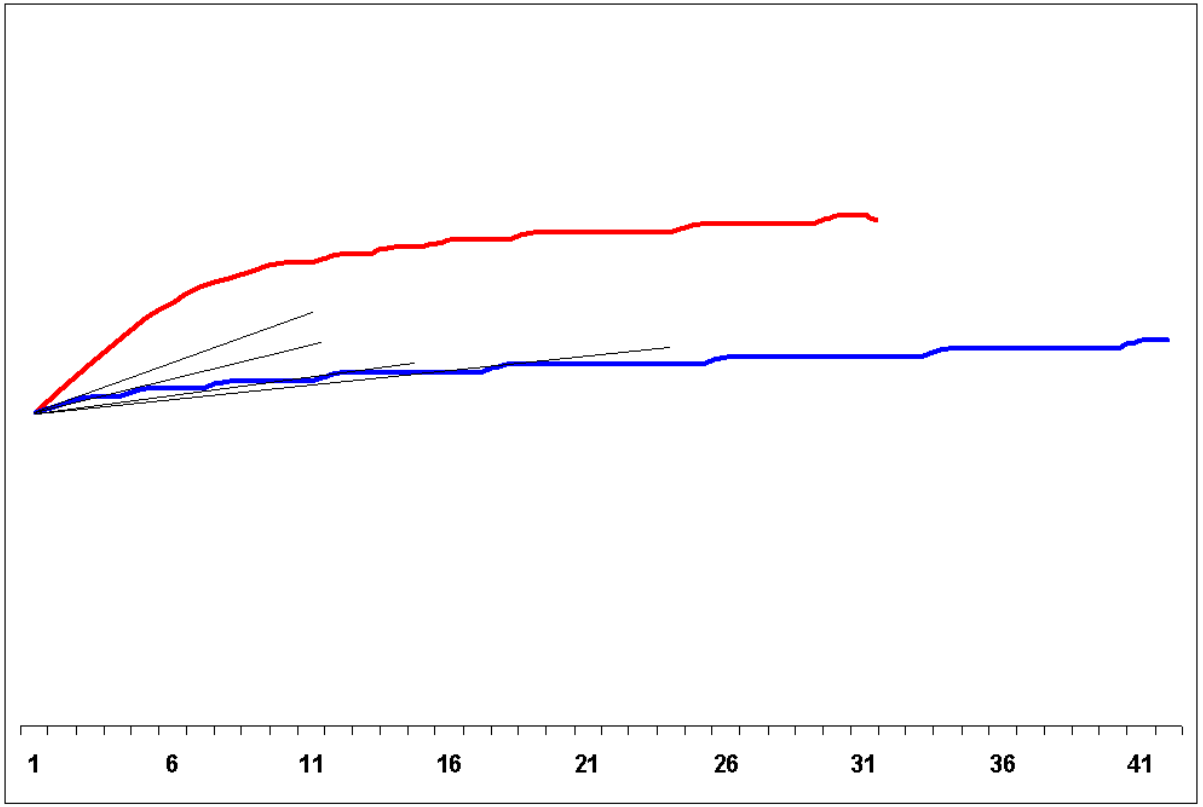
Dose 1

Low dynamics – long dose



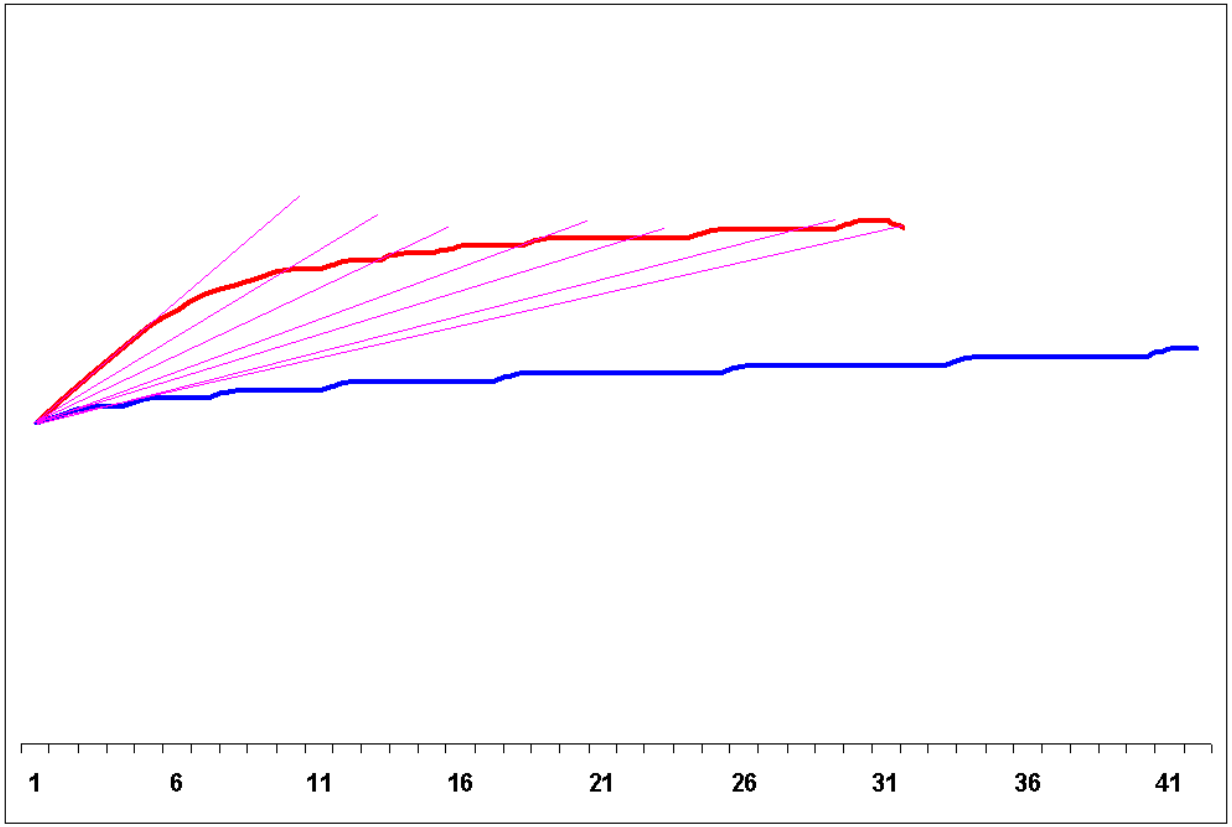
Speed and Zero

Low speed – quick Zero



Speed and Zero

High speed – long Zero

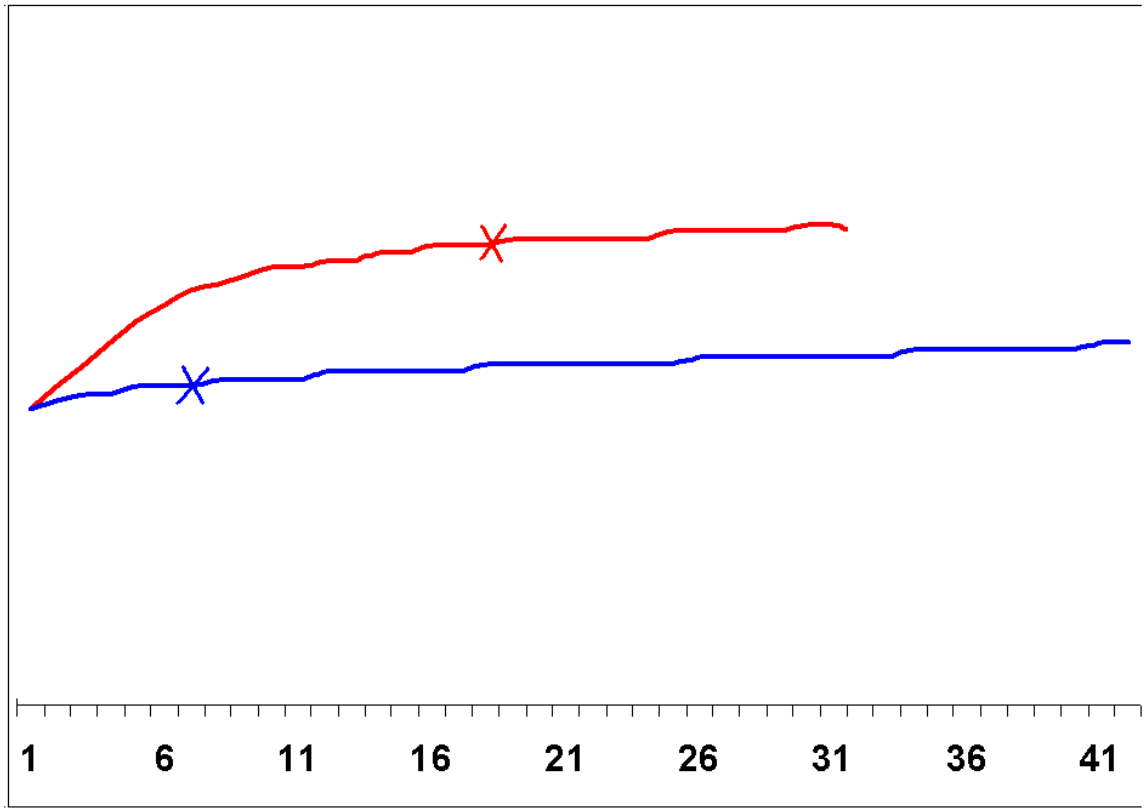


Dose 2

Dose 2 – zero and dose together, differential dose/zero. That is for Dose 2 the speed is counted relatively to the reaction on previous second.
Dose appears after 3 seconds of non-positive speed/ dynamic (zero or negative).

Dose 2

Low dynamics – quick dose



Dose, Zero, Rate…

Questions?

The secrets of effectiveness

RITM OKB ZAO, M. Unakafov

The secrets of effectiveness

We consider SCENAR efficiency is provided with its pulses' features and with additional regulations of its parameters.
There are physical and (bio)chemical effects approved to different degree.

Approved local effects:

- collateral circulation increasing,
- anti-inflammatory,
- analgetic,
- antiedematous,
- genetic…

Energy influence concentration

Right hand: palm – back of the hand.
Left hand: palm – back of the hand.
Right hand, palm – left hand, back of the hand.
Left hand, palm – right hand, back of the hand.

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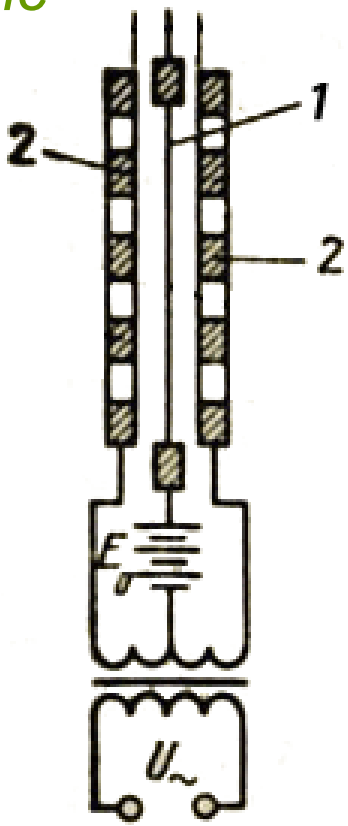
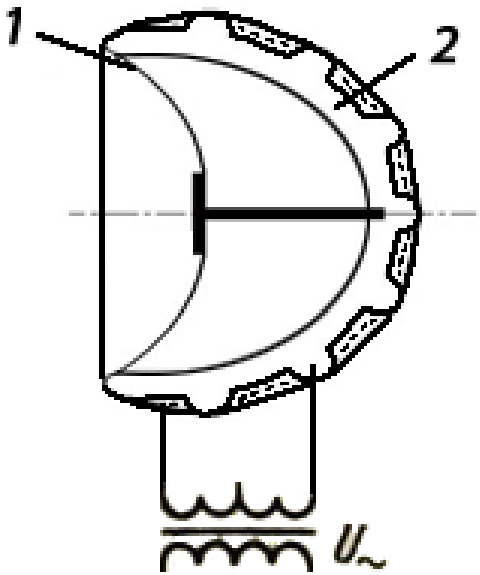
High-frequency massage

Construction of electrostatic loudspeakers

1 – flexible electrode,
2 – fixed electrode

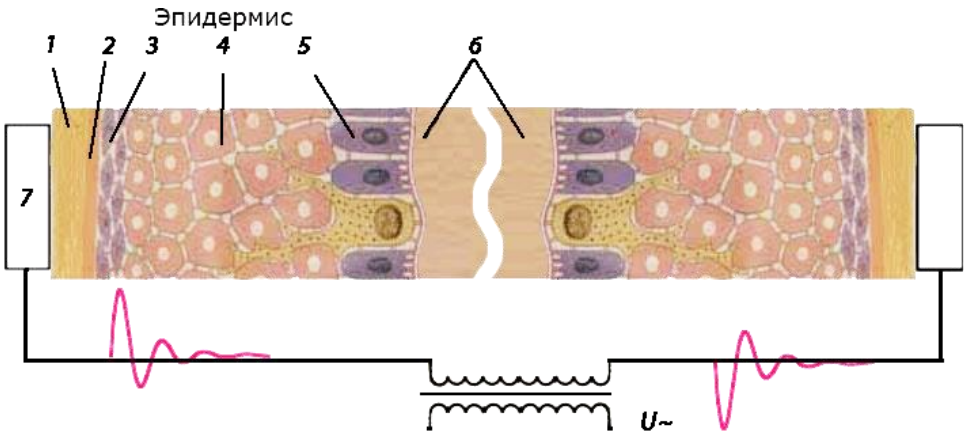


а)



б)

High-frequency massage

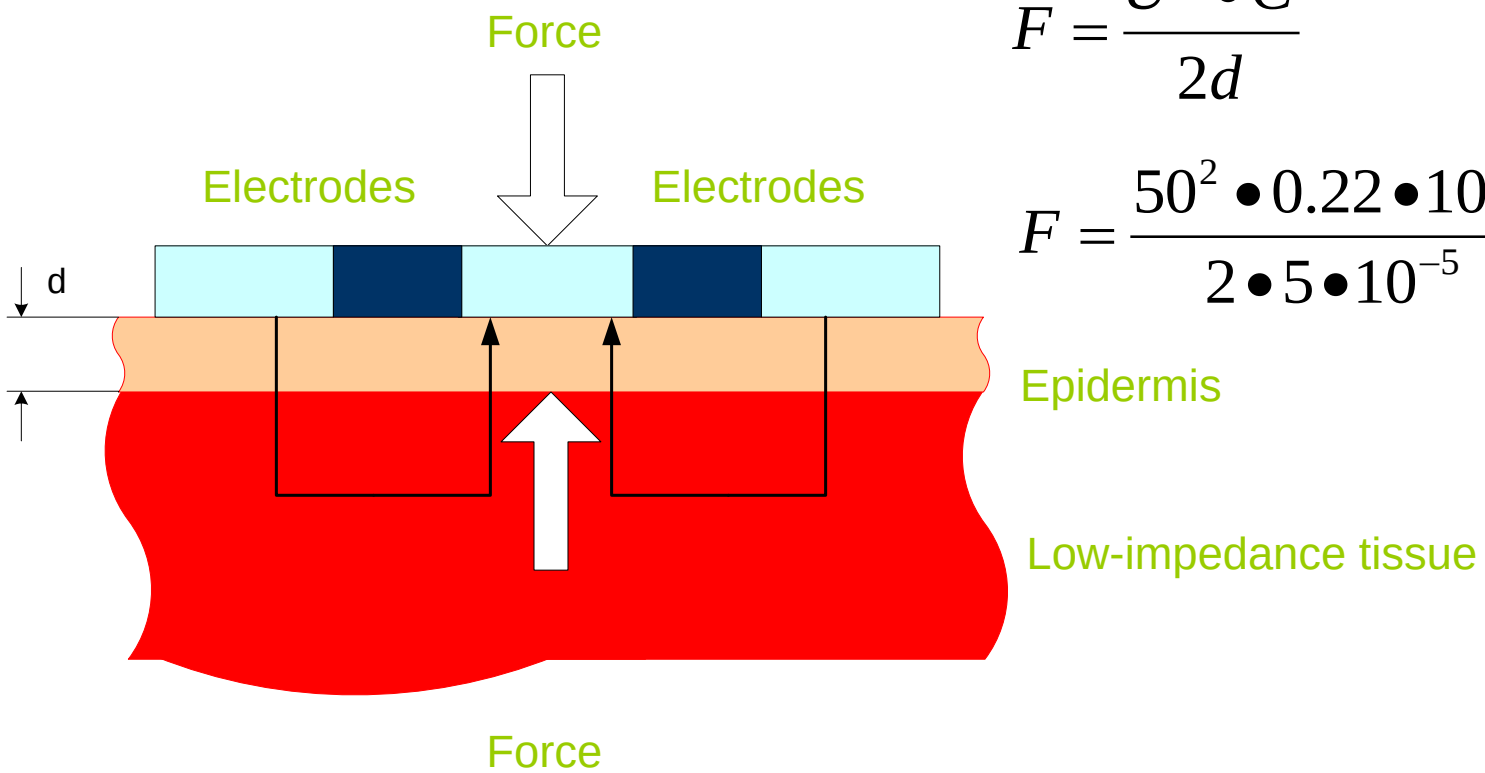


Voltage-to-sound skin conversion

1 – horny layer (corneal layer);
2 – clear layer (lucid layer);
3 – granular layer;
4 – prickly layer;
5 – basal layer;
6 – dermis, hypodermis; subcutaneous tissues;
7 – device electrodes.

High-frequency massage

Influence force estimation



$$F = \frac{U^2 \bullet C}{2d}$$

$$F = \frac{50^2 \bullet 0.22 \bullet 10^{-6}}{2 \bullet 5 \bullet 10^{-5}} = 5(N)$$

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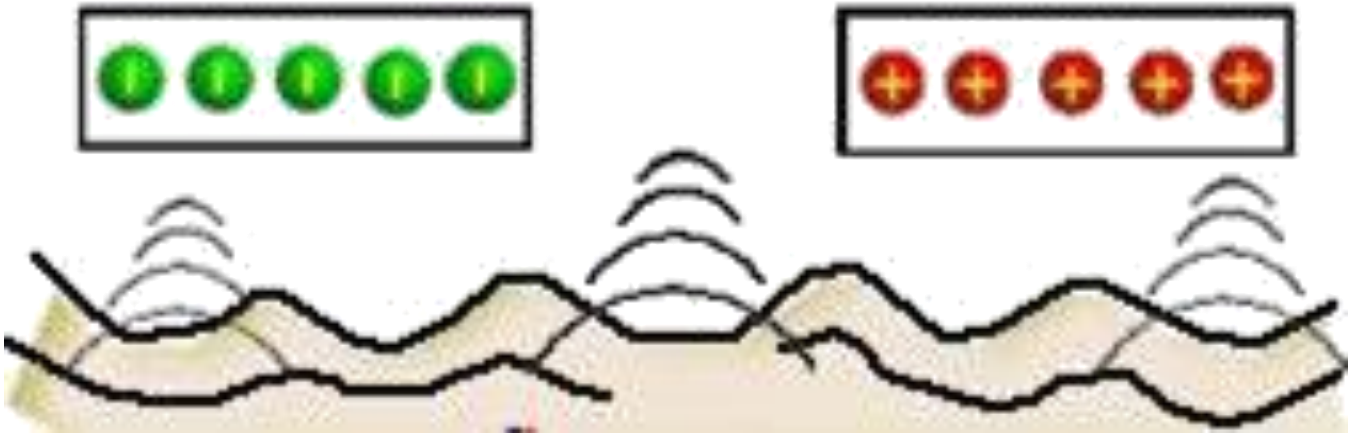
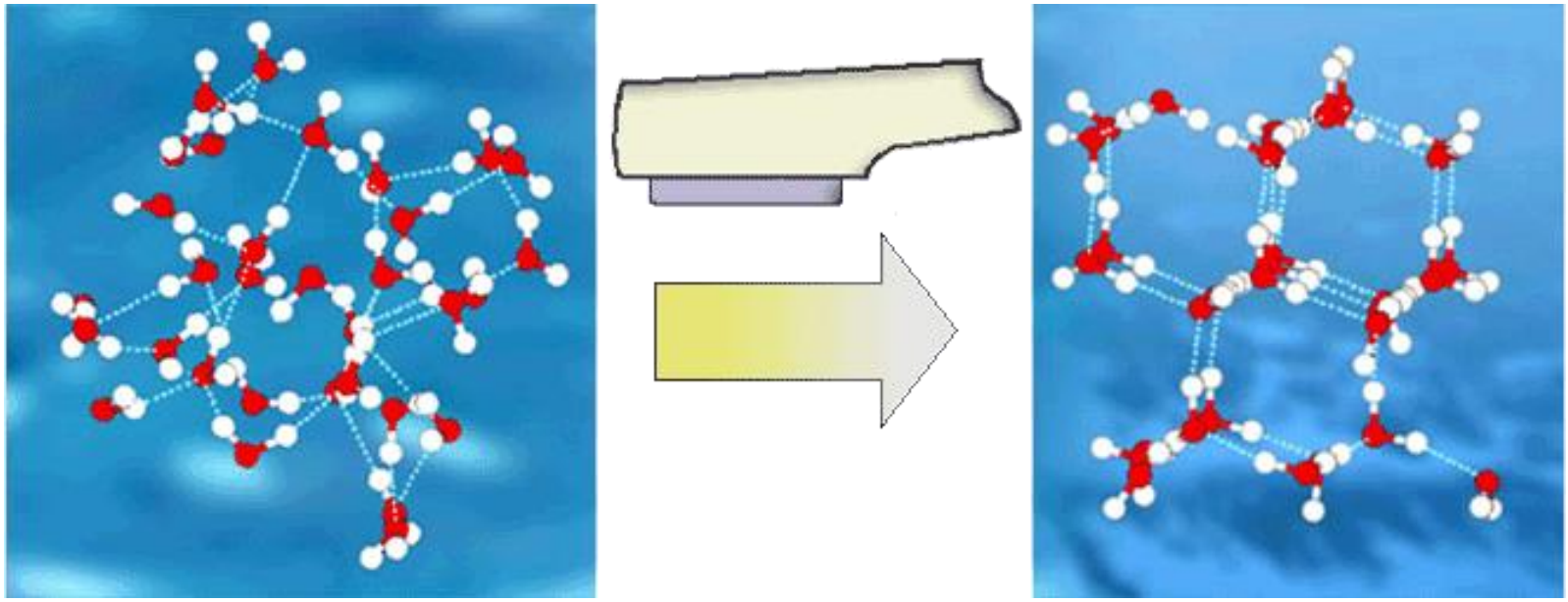
Skin vibration

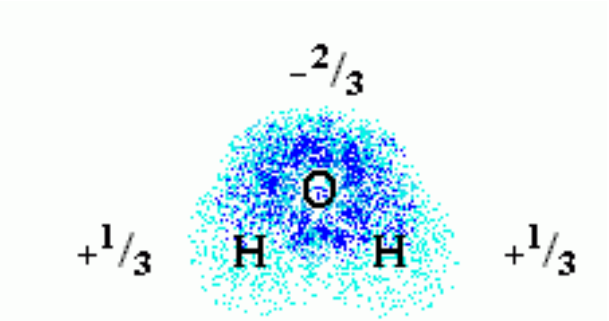
Electric pulses enable the substances to penetrate inside, while vibrations stimulate certain receptors. While preparing competent cells, shaking is ordinary procedure. Therefore, we expect electroporation effect increasing.



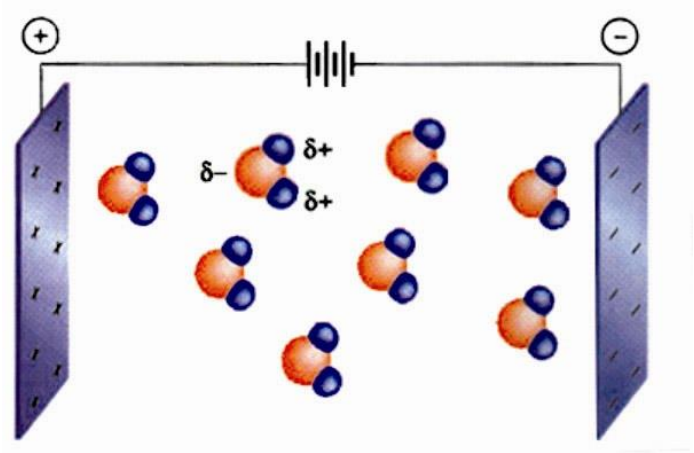
Fluid structuring

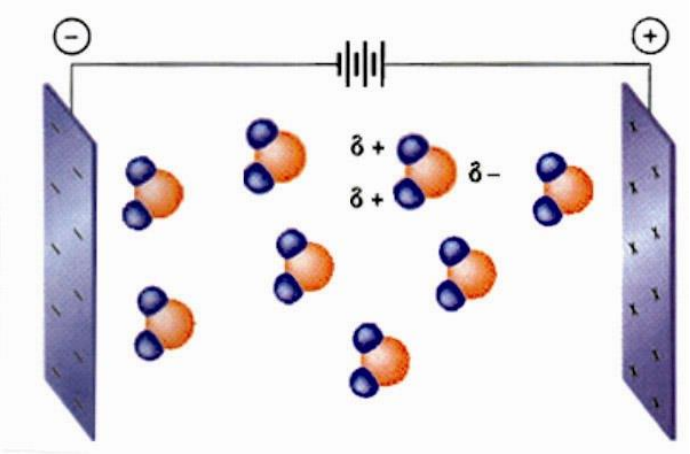


Fluid structuring



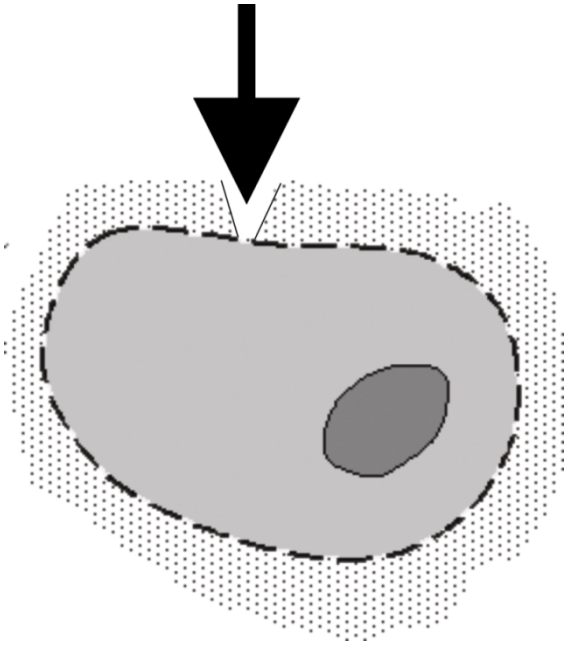
Charge distribution in water atoms





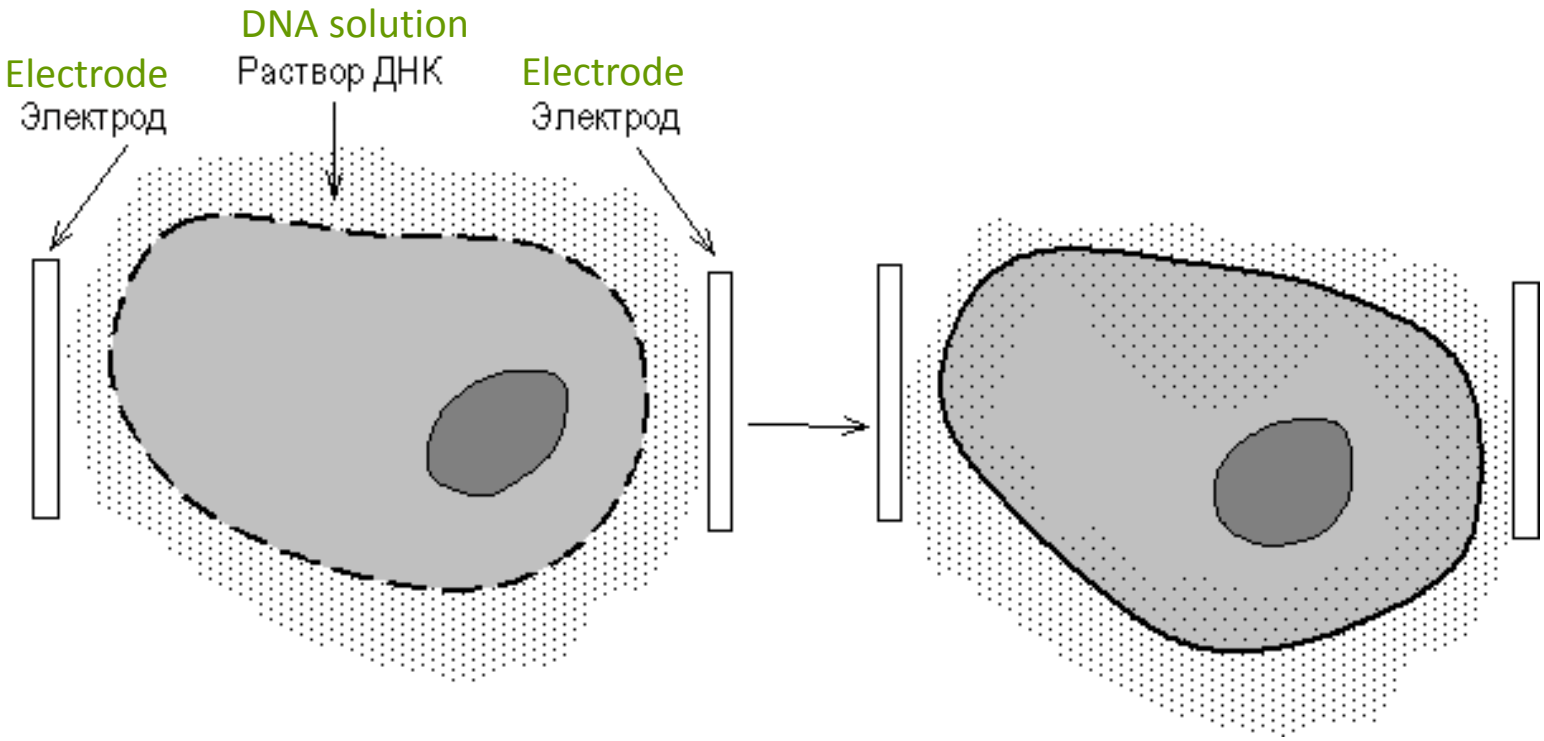
Water molecule arrangement after the voltage sign changed

Electroporation



Electroporation is a significant increase of the cell membrane permeability caused by externally applied electric field of high intensity.

Electroporation



As a result of electroporation the DNA fragments penetrate from tissue liquid into cells.

Electroporation

Physiological effects in ‘soft’ reversible electroporation on cellular level:

- cell metabolism acceleration,
- cells activation,
- increase in production and acceleration of proliferation.

on tissue level

- improves functionality of microvasculature,
- increases the perfusion of tissue fluid,
- accelerates the immune reaction,
- increases the level of antioxidative enzymes,
- decreases the inflammatory process,
- inhibits oxidative stress.

Electroporation

Intensity and duration of electric field for each system of cells is selected empirically, while great variety of SCENAR stimulation modes enables the user to apply this empirical mechanism.

The secrets of efficiency

The SCENAR efficiency sources:

- electroporation and its effects,
- energy influence concentration,
- high-frequency massage,
- skin vibrations…

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РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

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Руководитель Федеральной службы по интеллектуальной собственности, патентам и товарным знакам

Б.П. Симонов

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Good luck!