

# Medical Computer Systems

## KARDIOVISOR

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## General information

**CardioVisor-06c®** is designed for operative detection of deviations in the work of a heart which manifest the above dispersion characteristics and can be related to developing pathology.

General procedure of operating **CardioVisor-06c®** includes the following :

1. applying electrodes in accordance with the standard diagram of ECG limb leads.
2. pressing the button "New examination".  
in 40 ... 60 sec. a two- aspect portrait of the heart is formed on the screen. At the same time an automatic conclusion and integral heart indexes are formed. The quasi- epicardium of the portrait in the norm is greenish-blue. With different deviations from the norm the color in the area turns yellow or red. The larger the red area of the quasi-epicardium, the bigger the degree of expressiveness of deviation. If dispersion changes go with great positive amplitudes of myocardial repolarization of ventricles (keen peak T in ECG ), red of the corresponding sections of the myocardium acquires purple hue.

## Model of ideal heart

**CardioVisor-06c®** compares dispersion characteristics of ECG low-amplitude fluctuations of the patient under examination with the model of similar dispersions of "the ideal heart". This model corresponds to the heart of a young healthy man at the age of above 20. In case of complete coincidence with the model of the ideal heart the quasi-epicardium in the portrait of the patient under examination is green along the entire surface of the heart.

**CardioVisor-06c®** is intended for screening analysis of ECG signal only with adult people. **CardioVisor-06c®** is not suitable for children at the age under 12. For children and teenagers 12 to 18 this device can be used only to control trends in dispersion characteristics which are determined by doctor in each particular case.

## Visual structure of the heart portrait

The heart portrait is "a snap shot" on display as a result of calculating mean dispersion characteristics of low-amplitude fluctuations during ECG input. The heart portrait in the area of ventricles reflects a picture of dispersion changes calculated both for depolarization and repolarization of the myocardium. Dispersion changes in the portrait in the area of auricles correspond only to the phase of depolarization. The colors in the portrait change with deviations of amplitude dispersion characteristics and with changes in phase dispersion characteristics relative with integral values P-Q-, Q-T. The location of amplitude and phase color indications in the portrait are shown in Fig. 1 and. Fig. 2. The amplitude indicators correspond to the anatomic structure of the heart, while the location of phase indicators reflect the projection of the corresponding fronts of excitement on the epicardium.

Examples of heart portraits with different states are given in p.3.

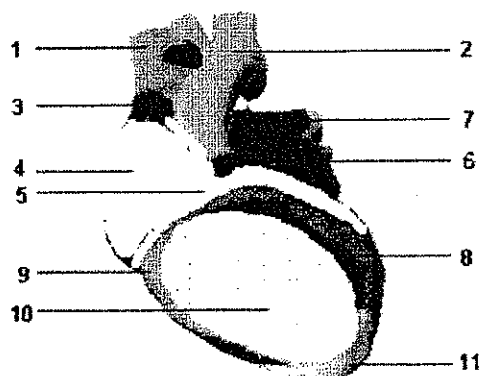


Fig. 1 Visual structure of a heart portrait  
(right sections)

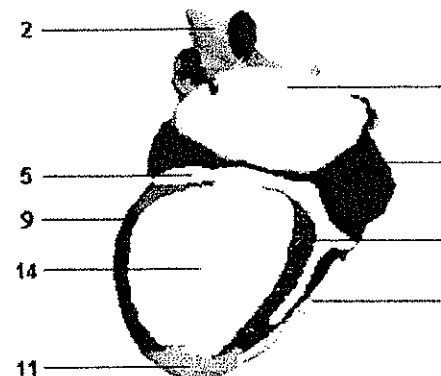


Fig. 2 Visual structure of a heart portrait  
(left sections)

- 1 – vena cava superior
- 2 – aorta
- 3 – integral indicator of rhythm
- 4 – indicator of state of the myocardium of the right auricle
- 5 – indicator of anomalies in interval P – Q
- 6 – integral indicator of AB – conduction
- 7 – integral indicator of the state of two auricles (general characteristics caused by common source excitation)
- 8 – indicator of the final phase of the right ventricle depolarization (projection in the area of the interventricular septum)
- 9 – indicator of the length of repolarization of ventricles (Q- T)
- 10 – indicator of the state of the right ventricle myocardium
- 11 - indicator of the length of depolarization of ventricles (QRS length)
- 12 – indicator of the state of the left ventricle myocardium
- 13 – indicator of the final phase of the left ventricle depolarization
- 14 - indicator of the state of the left ventricle myocardium
- 15 – indicator of the final phase of the right ventricle depolarization (projection on the back wall)

## Structure of text messages

The main function of the device is to form a heart portrait ensuring an effective solution of screen control tasks. Text messages accompanying each portrait *are not diagnosis*. These messages give doctor screening estimation (four gradations of deviation from the norm) which is the main part of conclusion and ensures additional recommended information about the possible type of pathology recommended information being not a diagnosis has a probability character and makes it possible more precise and effective way to plan further clinic-instrumental examination or other operative si according to the results of screen estimation.

Text messages include three main groups of data:

- integral indicators
- conclusion
- detailing

## Integral indicators

These include four indicators : " Myocardium", " Rhythm", " Pulse " and "Detailing code" ( Fig.3).

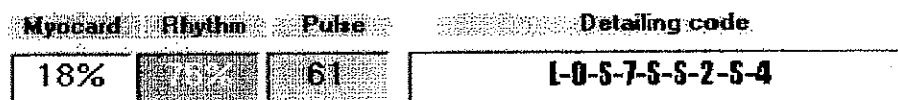


Fig.3 Integral indicators of CardioVisor-06c ®

"Myocardium" and "Rhythm" are relative indicators which characterize summary value of dispersion deviations from the norm and vary in the range 0% ... 100%. The higher the value of the indicator, greater deviation from the norm. Physically "Myocardium" = 100% corresponds to a pathologic cor related to *manifest deviations from the norm practically in all heart chambers*. "Myocardium" = 0% corresponds to absolute absence of any significant deviations from the model of the ideal heart.

Similarly "Rhythm" = 100% corresponds to the most expressed changes in characteristics of R-R i variability which are characteristic of manifest arrhythmias or high stress.

"Detailing code" gives information about the resemblance of the present portrait with portraits of sc typical frequent pathologies. The indicator "Detailing code" contains 9 characters. A character can figure or one of the letters : "L" or "S". The number of symbols in the code depends on the number pathology groups which are used by the automatic classifier when analyzing fluctuations.

These groups are as follows:

- G 1: depolarization of the right auricle
- G 2: depolarization of the left auricle
- G 3 : depolarization of the right ventricle
- G 4 : depolarization of the left ventricle
- G 5 : repolarization of the right ventricle
- G 6 : repolarization of the left ventricle
- G 7 : symmetry of ventricles depolarization
- G 8 : intraventricular blocks
- G 9 : ventricular hypertrophy

"0" in the code means that in the present group the portrait is in the norm. Appearance of any figur except 0 in any of the groups G1 – G9 is evidence that dispersion characteristics of the present pc this group resembles a certain pathology, (in this case the figure is equal to the conventional index pathology). The higher the figure, the clearer the expression of the deviation. The number of stand pathologies in each group is determined by the following values: G1 – 17 standards, G2 – 10 stan; G3 – 16 standards, G4 – 22 standards, G5 – 3 standards, G6 – 14 standards, G7 - 21 standards, standards, G9 – 21 standards. The number of standards is selected so as to ensure difference of enlarged variants of deviation and on this basis to form recommendation messages about the pos: type of pathology. **The main purpose of detailing code is to give the user explicit qualitative information about probable pathologies with similar dispersion characteristics.** A small num indexes in the code, equal to 1 or 2, is evidence of insignificant dispersion deviations, for instance: 0-000-1".

Contrary to that, the appearance of high indexes, equal or close to the number of standards in a g evidence of significant deviations, for instance: "0-8-10-19-1-4-20-2-12". The name of probable pa corresponding to the code index of the conclusion is given in the group of "Detailing" messages (s further). The code "L" means the border state when the changes are very close to any of the pathc gradations. The code "S" is evidence of the beginning of changes within the norm, i.e. the codes "L" "S" are indicators of border values of dispersion characteristics.

## Conclusion

The conclusion contains general screening estimation which is determined by resemblance of the portrait with pathology portraits (Fig.4) The text of the conclusion contains screening estimation as additional information about the degree of expressiveness and the type of probable pathology whic recommendable for taking further steps. Screening estimation differs from additional information b the screening estimation is colored while the additional text is white and black.

