Software for screening heart investigations CardioVisor-06c

User's manual

Data	Version	Author	Note	The controller
5.03.2004	1.1		creation	

Statistic

File	CardioVisor - UserGuide.doc
Size:	866 Кбайт
Date of creation:	09.03.2004
Date of editing:	04.06.2004
Date of printing:	19.11.2004

Contents

Introduction

We are pleased to greet you as user of computer screening analyzer CardioVisor–06c®. This device significantly differs from the traditional ECG analyzers as it is based on a new method of analysis of ECG signals which does not control the generally accepted temporary and amplitude electrocardiographic characteristics with subsequent syndrome analysis.

The main structural component of the method is the analysis of dispersion of low-amplitude fluctuations of an ECG signal within certain temporary intervals of the PQRST cardio cycle. Dispersion analysis of low-amplitude fluctuations is made during a 30–60 sec. uninterrupted monitoring of an ECG signal. The in-line ECG signal comes only from the leads from extremities (electrodes R, L, F, N) in the usual transmission band of 0 ... 150 Hz. The mean values of amplitude dispersions correspond to 5 ... 30 mV, i.e. they are significantly smaller than the mean amplitudes of ECG peaks. A special analysis of such low-amplitude signals ensures a reliable manifestation of small disturbances in myocardium depolarization and repolarization. The main purpose of the analysis of such low-amplitude signals consists in reliable detection of slight disturbances in myocardium depolarization and repolarization. With this method it is small disturbances that are effective markers of pathologic changes in the myocardium. The traditional ECG characteristics exclude reliable manifestations. The result of the analysis is presented as a card of deviations of dispersion low-amplitude characteristics from the norm, including the amplitudes of these deviations and parameters of their supposed localization. So that the doctor may have an integral and explicit picture of changes in the myocardium, the dispersion card is projected against the quasi-epicardium of a three-dimensional computer model of the heart reflecting the front and back surfaces of the heart. The manifestation and supposed localization of changes are determined by color changes of the quasi-epicardium which in the norm is evenly green.

As a result the doctor is enabled to directly see the quasi-epicardium on the surface of the three-dimensional computer model of the heart which is reconstructed by ECG low-amplitude fluctuations. This model of quasi-epicardium was named *heart portrait* . With screening examination of a patient direct observation of the topology of low-amplitude fluctuations on the surface of the quasi-epicardium ensures significantly higher accuracy and effectiveness of ECG signal interpretation, while the most important is that it enables the doctor quickly and reliably observe the earliest changes in the heart which do not manifest in the standard ECG characteristics. Differentiation of norms and pathologies is made with the use of standard methodology of clinicostatistic analysis by trained classifier of the program in a control group of healthy people and in a group of patients with seriously verified clinic pathologies including hypertensive disease, various forms of myocardial ischemia, heart disease, etc.

As an additional component of screening estimation this analyzer uses a simplified dynamic integral estimation of the variability of cardiac rhythm calculated by general activity of regulatory systems of cardiac rhythm by the method of R.M. Baevsky.

The screening analyzer can also be used for the standard ECG analysis from six limb leads I ... aVF.

In order to ensure the most effective application of our product we ask you to familiarize yourself with this manual in a very careful manner.

Abbreviations

Abbreviation	Meaning
ECG	Electrocardiogram
CRV	Cardiac rhythm variability
CCF	Cardiac contraction frequency

Reference

1. Medical Computer Systems – www.mks.ru

2. Electrocardiography site - www.ecg.ru

3. Computerized nine-channel Cardioanalyzer KARD. Operation instruction.

4. Galen C. Wagner Practical electrocardiography by Marriott, translated from Eng. – СПб Nevsky Dialect; M.: Publishing House BINOM, 2002 in Russian

5. G.V. Ryabykina, A.V. Sobolev, Variability of cardic rhythm. Manuscript. –M.: Star'co. 1998 (Cardiology) in Russian

6. Patent DE 198 01 240: Soula A., Gillessen W., Kitashine Y. Verfahren und Vorrichtung zur Darstellung und Uberwachung von Funktionsparametern eines physiologischen Systems,1999

7. Patent DE 199 52 645 : Soula A., Kitashine Y., Gillessen W., Verfahren unf Vorrichtung zur visuellen Darstellung und Uberwachung physiologischer Funktionsparameter, 2001.

8. High resolution electrocardiography / edited by G.G. Ivanov, C.B. Grachev, A.L. Syrkin. M.: Triada, 2003. In Russian

9. Cardiology in tables and charts/ edited by M.Frida, C. Grain; translated from Eng. – M.: Pub.House Practica, 1996. In Russian

10. R.M. Baevsky, O.P. Kirillov, S. Z. Kletskin Mathematic analysis of cardic rhythm in stress. – M.: Nauka, 1984. In Russian

1. Purpose and application

Computer screening analyzer CardioVisor–06c® (generator of heart portrait) is designed for *express estimation of the state of a heart by ECG signals coming from extremities* (4 electrodes)

The circumstances in which screening analyzer CardioVisor–06c® can be useful:

- You need a simple and reliable screening instrument which cab be used even by junior medical personnel.

- You have a large flow of patients and it is important for you that the screening conclusion should be more reliable and operative.

- You observe the heart of a patient during hospital treatment and you want quickly and in undisturbed working conditions obtain possibly earliest information about slight changes in the course of electrical excitation of the myocardium. At the same time along with express procedure it is very important for you to have this information right where the patient is, without transferring him to the room of functional diagnosis.

- You observe a patient for a long time and you want within 1 - 2 minutes to see the trends and changes in the heart which do not manifest in electrocardiogram.

The instrument can be used:

- in clinic medicine (operative express estimation of the state of a heart, early detection of progressing changes in the myocardium).

- in prophylactic medicine (screening examination for timely and reliable singling out a group of patients with pre-clinic forms of deviation).

- in prophylactic medical examination

- in sanatoria, preventoria, reabilitation centers (objective express-indicator of the state of the heart and the whole organism).

- in emergency medical service to reliably estimate the current state of a heart.

In addition to visual express analysis of the portrait, the system forms automatic conclusion for the doctor including:

1. Integral index of deviation from the norm of dispersion characteristics of

2. ECG low-amplitude variations in the range 0 ... 100%.

3. Integral index of arrhythmia in the range 0 ... 100% (summary deviation of statistic indexes of rhythm variability from the norm.

4. Text screening estimation.

> (!) CardioVisor–06c ensures a quick and accurate referring of a heart to one of the following groups:
>
> 1.   Norm
>
> 2.   Border state
>
> 3.   Indistinct pathology
>
> 4.   Manifest pathology
>
> At the same time the doctor receives visual information about the degree of expressiveness and the most likely localization of the center of changes.

The length of exposition (length of ECG input) is 30 or 60 sec. A heart portrait can be obtained without unclothing the patient in the sitting position. The period of forming the portrait after the ECG input is about 20 sec., the period of scanning the portrait in two aspects (right and left) does not exceed 60 sec. The portrait is formed in two aspects at a time: right view and left view. In the normal state the epicardium in the portrait is green. With a focus of pathologic changes in the myocardium the corresponding area of the portrait changes from green to red, depending on degree of pathology expression. The heart portrait gives full information about dispersion changes in all heart chambers simultaneously and it is easy to perceive by the doctor in 15 ... 20 sec. **CardioVisor-06c**® gives the doctor a unique facility to control trends of changes in the heart by scanning successive portraits. The length of scanning a gallery of four successive portraits to control the trends is 30-40 sec. The total time of obtaining a conclusion is 1.5 ... 2.5 minutes

The doctor can use the functions of the standard scanning and ECG analysis of six standard extremity leads I ... aVF. The system provides screening examination documentation (conclusion form) and functions of control of the base of patients and the base of heart portraits.

1.1   Limitations

CardioVisor–06c® **DOES NOT DIAGNOSE!** The instrument is designed to detect early dispersion deviations in a group of border state of heart and to warn about manifest pathology. **CardioVisor–06c**® version 1.1 *does not single out <u>acute myocardial infarction</u> among discernible states of myocardial ischemia.* **In these cases the device indicates the necessity (or emergent necessity) of clinic examination to diagnose.**

Drugs can make effect on the view of a heart portrait and the text of screening estimation. In case the analyzer is used in medicamentous treatment of a patient it is obligatory to compare current heart portraits and the portraits obtained before or at the beginning of medicamentous therapy.

CardioVisor–06c® is designed for screening analysis of ECG signals in an adult person. **CardioVisor–06c**® is not to be applied with children under the age of 12. For children at the age of 12-18 this can be used only for control of trends of changes of dispersion characteristics.

1.2   Principle of analysis

Amplitudes of direct, i.e directly measured in electrocardiogram, and those of indirect parameters determined on the basis of the present mathematical model of heart biogenerator in successive PQRST-complexes vary in not great limits. The amplitude and phase characteristics of these variations have high sensitivity to changes in depolarization and repolarisation of the myocardium. It is the dispersions of the above variations that are analyzed by CardioVisor–06c®. The term "dispersion» corresponds to the generally accepted in cardiology definition of difference between maximum and minimum of the varying value. Dispersion changes give integral estimation of changes in a great number of structural characteristics of the myocardium which are dependent on parameters of blood, electrolytic balance, blood pressure and other factors. Dispersion changes are observed in both cases: when there are standard electrocardiographic changes in an electrocardiogram and when they are absent, e.g. in the early stages of structural changes in the myocardium. **CardioVisor–06c®** makes it possible to see on the screen a picture of quasi-epicardial changes on the computer model of the heart, which with a certain accuracy reflects the value and localization of myocardial changes. Information about deviations from the norm of myocardial depolarization and repolarization process is presented by color changes of quasi-epicardium in a three-dimensional picture of the heart – in *the heart portrait. The heart portrait* in the ventricular area reflects an integral picture of dispersion changes rated both for myocardial depolarization and repolarization. Dispersion changes in *the heart portrait* in the area of auricles correspond to depolarization phase only.

⓵ Pay attention to principle methodological peculiarity of the heart portrait in **CardioVisor–06c®**:

Visualization of dispersion characteristics in the heart portrait reflects **integral** (summary) changes in morphologic, electrophysiologic and other structural parameters of the myocardium. Due to this the chart of color changes in the quasi-epicardium in the portrait of the heart of a particular patient has its own stable characteristic individual peculiarities, i.e. the heart portrait is highly specific in respect of individual structural peculiarities of the myocardium. However, due to the same factor in case of one and the same clinic diagnosis portraits with different patients can be significantly different in individual characteristics of localization, area, and degree of expressiveness of changes. And vice versa, similar changes in portraits in some cases can correspond to different pathologies. The above peculiarities can in no way have any effect on sensitivity and specificity of screening estimation, i.e. reliability of differentiation of norm and deviation. This tells only on specificity in relation to certain concrete pathologies, i.e. in solving problems in differential diagnosis which are beyond the possibilities of screening device **CardioVisor–06c®**.

---

2. General information

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

(!) CardioVisor–06 ® **DOES NOT DIAGNOSE!**

The purpose of the device is to detect early dispersion deviations which can precede pathology. In many cases this makes it possible to see pre-clinic stages and to control the dynamics of dispersion deviations with high sensitivity.

CardioVisor–06c® DOES NOT SUBSTITUTE other clinic methods of examining the heart and can be used only in comparison with other clinic data.

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

1. Applying electrodes in accordance with the standard diagram of ECG limb leads (p. 4.3)

2. Pressing the button "New examination" (see further interface description). 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 bigger the red area of the quasi-epicardium, the bigger 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.

2.1 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 (Annex I).

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 from 12 to 18 this device can be used only to control trends in dispersion characteristics which is determined by doctor in each particular case.

2.2 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 an integral 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 correlative 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. 12. 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.

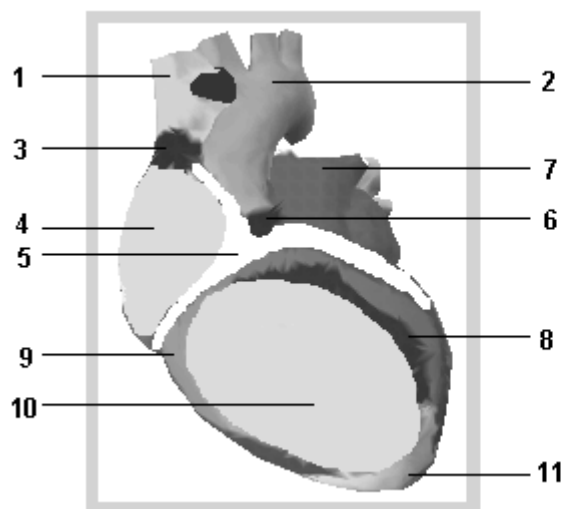Examples of heart portraits with different states are given in Annex I.

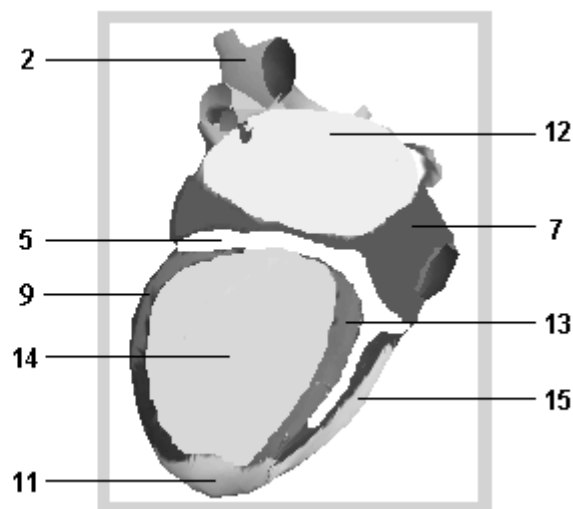Fig. 1 Visual structure of a heart portrait (right sections)   Fig. 2 Visual structure of a heart portrait (left sections)

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 of 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. – ndicator of the final phase of the right ventricle depolarization (projection on the back wall)

2.3   Structure of text messages

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

Text messages include three main groups of data:

- integral indicators
- conclusion
- detailing

2.3.1   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, the greater deviation from the norm. Physically "Myocardium" = 100% corresponds to a pathologic complex 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.

The indicator "Myocardium" is **the main marker of the clinic interpretation** of screening conclusion:

under 15% – no significant deviations are detected. This conclusion requires obligatory comparison with other clinic data.

15% … 19% – border state. It is expedient that dynamics control be made.

20% … 22% – probable pathology. If this deviation is detected for the first time, it is necessary to control dynamics and it is expedient that examination be made.

23% …27% – probable pathology. If this deviation is detected for the first time, it is necessary to control dynamics. Examination is obligatory.

Above 27% – pathology or manifest pathology. If this deviation is detected for the first time and is permanently repeated in subsequent examinations, it is necessary that immediate examination be made.

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

"Detailing code" gives information about the resemblance of the present portrait with portraits of some typical frequent pathologies. The indicator "Detailing code" contains 9 characters. A character can be a figure or one of the letters : "L" or "S". The number of symbols in the code depends on the number of 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 figure except 0 in any of the groups G1 – G9 is evidence that dispersion characteristics of the present portrait in this group resembles a certain pathology, (in this case the figure is equal to the conventional index of pathology). The higher the figure, the clearer the expression of the deviation. The number of standard pathologies in each group is determined by the following values: G1 – 17 standards, G2 – 10 standards, G3 – 16 standards, G4 – 22 standards, G5 – 3 standards, G6 – 14 standards, G7 – 21 standards, G8 – 2 standards, G9 – 21 standards. The number of standards is selected so as to ensure difference of ~ 130 enlarged variants of deviation and on this basis to form recommendation messages about the possible 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 number of indexes in the code, equal to 1 or 2, is evidence of insignificant dispersion deviations, for instance: "0–0–1–0–000–1".

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

2.3.2 Conclusion

The conclusion contains general screening estimation which is determined by resemblance of the present portrait with pathology portraits (Fig. 4). The text of the

conclusion contains screening estimation as well as additional information about the degree of expressiveness and the type of probable pathology which is recommendable for taking further steps. Screening estimation differs from additional information by color: the screening estimation is colored while the additional text is white and black.
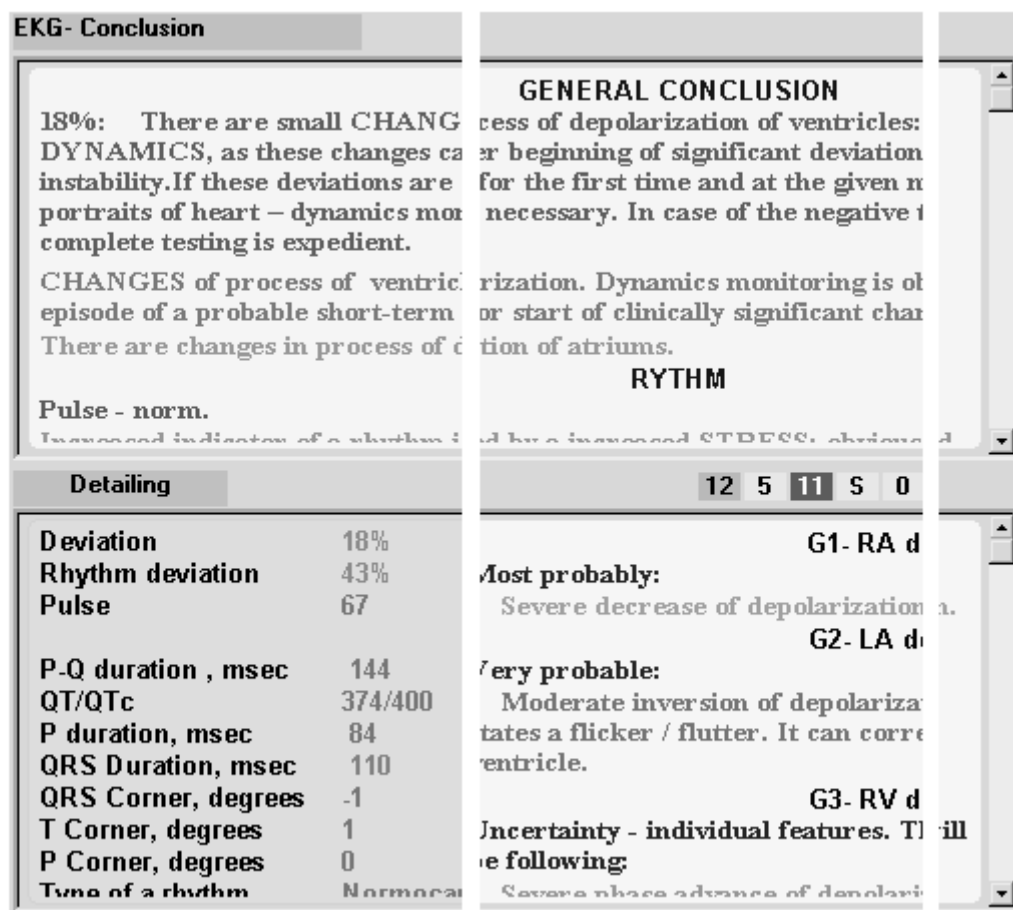
Fig. 4 Location of text information in detailing window.

2.3.3 Detailing

Detailing contains the names of probable pathologies the portraits of which for each group most resemble the present portrait (Fig. 4). Besides, in the left part of the detailing window the doctor can see certain typical quantitative characteristics of peaks and integrals of input ECG.

> ⚠ If you examine a patient with **an electrocardiostimulator**, be cautious: in this case information about rhythm deviation given by **CardioVisor–06c**® can be unauthentic.

2.4 Structure of report

The device provides two documentation forms of the results: complete form and a short form.

Complete form contains:

- Standard fragments of an ECG for leads I, II, III, aVR, aVL, aVF
- heart portrait
- text of the general conclusion.

Short form contains only fragments of input ECG.

3. Installation of screening analyzer

3.1   Computer features

- Recommended video memory – not less than 32 MB
- Recommended RAM – not less than 128 MB
- Recommended free disk capacity – not less 400MB (program core ~ 18 MB)
- Recommended processor frequency – not less than 1000 MHz

With lower computer characteristics CardioVisor–06c can operate. However, in this case the time of forming a portrait can increase to 2 minutes. Disk capacity limits only the number of Patients and examinations which are permanently stored in data base. (See p. 3.2)

1.   **CardioVisor–06c**® Software interface with different screen area and different types of system fonts can vary in design of buttons and some auxiliary graphic elements To achieve the highest quality of screen interface it is recommended after the installation of CardioVisor –06c program to set one of the following display properties:

Screen area: 1024x768

Font – normal. Colors – not lower than High Color (16 bit).

Screen area: 1280x1024

Font – large. Colors – not lower than High Color (16 bit).

Screen area: 1600x1200

Font – large. Colors – not lower than High Color (16 bit).

2.   To ensure high quality of screen design in Windows XP it is necessary to perform the following:

Enter "Screen": *<Start—Settings> -- <Control Panel> <Display>.*

Select tag <Appearance> and on the line "Windows and Buttons" set **"Windows standard".**

Move the cursor to icon CardioVisor–06c on topdesk and click the right key of the mouse. In the opened window select line *<Properties>.* Then in window *<Properties>* set up compatibility mode in position **Windows98/Windows Me.**

3.2   Limitations of the program

- One examination takes 220 KB (30sec.) or 400 KB of disk memory.
- Number of patients not limited*
- Number of examinations not limited*
- input ECG signal – **at rest only**
- CCF operation range: 30 – 160 beats per min. (outside this range the program does not work).
- * The number of examinations and patients is limited only by free disk of the computer.

3.3   Connecting ECG module to the computer

ECG module is connected to the computer according to document [3]: "Nine–channel computer cardioanalyzer KARD. Operation instructions" are supplied at delivery.

3.4   Installation of CardioVisor–06c® Software

1. Switch the computer on. After starting the operation system insert the installation CD in CD-ROM drive. The installation CD has autostart therefore in some time InstallShield® for setting **CardioVisor-06c** ® Software will appear on the screen. This window has two buttons: <KARDi2> and <Exit>. Press <KARDi2 to start installation.

    If before this operation you have already left the installer with <Exit>, for instance when connecting ECG module according to p.3.3 or for other reasons the installer autostart will not operate. In this case it is necessary to withdraw and again insert the installation CD. Besides, if there is no autostart, it is possible to enter CD-ROM drive with system conductor (Explorer), to move to catalog Setup_KARDi2\ and with double-clicking of the mouse to start Setup.exe. At last, it is possible with CD-ROM to start AUTORUN.exe. which is at the rood directory.

    If **CardioVisor-06c**® Software is already installed in the computer, the installer will inquire about the preliminary deinstallation of the previous version. To complete deinstallation, press the button <OK> . After deinstallation is completed press the button <Ready> and repeat the procedure of installation.

2. After that the standard dialog with InstallShield begins. At the beginning of dialog the installer requires about location of **CardioVisor-06c** Software**.** If you are satisfied with the location of the program in C:\Program Files\KARDi2-CV06s, just press <Next> in dialog windows. If you wish another location of the software, indicate it when enquired by InstallShield ® with the keyboard or the button <Review>. When InstallShield ® formed the message about the completion of installation, press the button <Ready>. In case the computer is supplied with a few hard disks C, D …, it is recommended to choose a disk with maximum capacity.

3. After the completion of the above operations the icon of program start will appear on the topdesk, while in the section *<Start>- <Programs>* new extension **KARDi-CV06c** will appear. This extension contains program *"KARDi2"* and autotest program *"Test"* (p. 4.16).

⚠ Installation of only one program copy in the computer is allowed.

---

4. Operation

4.1 Starting the program

CardioVisor–06c® Software is started by double-clicking of the left key of the mouse on the program icon on Windows topdesk. Another way of activating the program : Press the system button *<Start>* in the left part of the screen, enter <Programs> – KARDi2-CV06s and start program *KARDi2*. After the start the main window of the program will appear on the screen of display. The main window on the left includes the patients base, while that on the right – the base of heart portraits (examinations base). At the start the patients base is always formed by the date of registration of patients. In the right window is displayed a base of portraits referred to a particular patient. In the left part of the main window there is a vertical button panel of the main functions of the device (Fig. 5). The buttons are placed in four blocks. The activated button is indicated by lighting while an idle button is dark.

> ⓘ Full activation of all accessible functions is performed only in the main window of the program. If you are in a mode in which the required button does not get activated, press K1 – *Patients base* to return to the main window of activation of all buttons. Function K13 – *Printing a form (full format)* is activated only with *Scanning portrait* only (K9).

4.2 Functions

The user has access to the following functions (Fig. 5):

- **K1** – Patients data base
- **K2** – Registration (new entry)
- **K3** – Correction of the name of a patient
- **K4** – Deleting a patient from the data base
- **K5** – Forming a new portrait
- **K6** – Varying exposition time (30/60 sec.) for ECG input.
- **K7, K8** – Deleting an examination from the base/basket
- **K9** – Scanning a portrait in large scale
- **K10, K12** – Scanning and measuring ECG characteristics in two formats
- **K11** – Scanning portraits in small scale (control of trends)
- **K13, K15** – Printing Report form in two formats
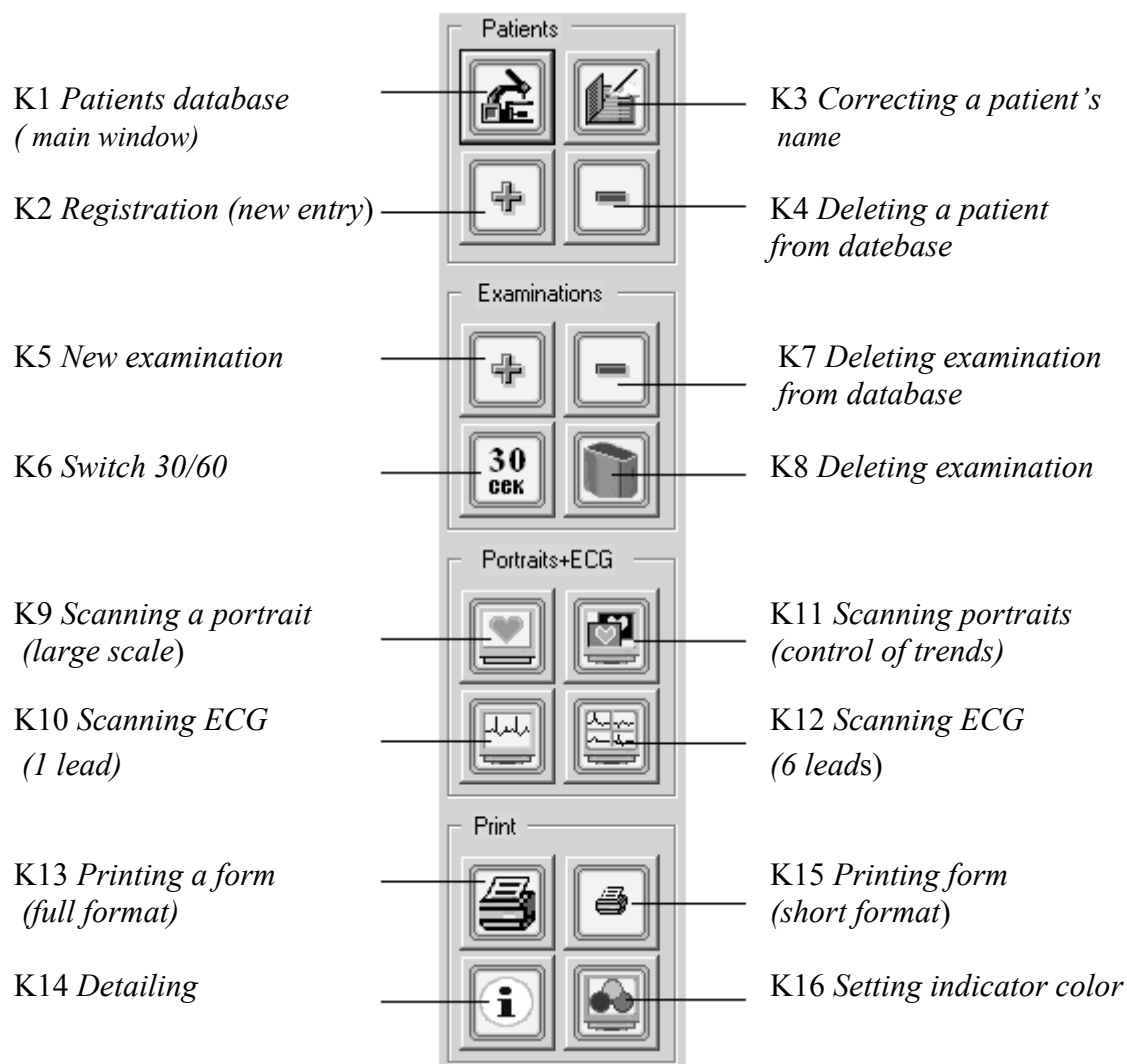- **K14** – Scanning text messages about most probable pathologies

K1 *Patients database*
(main window)

K2 *Registration (new entry)*

K3 *Correcting a patient's*
name

K4 *Deleting a patient*
from datebase

K5 *New examination*

K6 *Switch 30/60*

K7 *Deleting examination*
from database

K8 *Deleting examination*

K9 *Scanning a portrait*
(large scale)

K10 *Scanning ECG*
(1 lead)

K11 *Scanning portraits*
(control of trends)

K12 *Scanning ECG*
(6 leads)

K13 *Printing a form*
(full format)

K14 *Detailing*

K15 *Printing form*
(short format)

K16 *Setting indicator color*

Fig. 5 Panel of the main functions of the device

4.3   Examination : forming a heart portrait

1. Press the button K2 **+** in the block " Patients" to register the name of a new patient in the data base. It is **necessary** to print only the last name of the patient and press OK on the entry panel. You need not give any other details about the patient. After that a line with the new name will appear in the patients data base. If the patient is already registered in the data base, choose the required line with the left key of the mouse. There are two other characteristics in the patients data base: QRS angle (direction of electrical axis) of the last examination and date of the patient's registration in the data base (Fig. 6). If you move the pointer to the field "Name" in the patients' window and press the left key of the mouse you will see the triangle of the list of patients' names in the alphabetical order (figures, Latin letters, Russian letters). If you press the left key again the list of patients' will be in the reversed order (the triangle top downward).

Fig. 6 Table of the patients' base

Check the value of the length of ECG input (exposition) which shown the button K6. To switch it over, click it with the mouse.

> (!) **The main exposition is 30 sec.** It is expedient to use 60 sec. exposition only in case you wish to have a more precise value of the indicator "Rhythm". For instance, with high stress. The quality of portraits practically does not influence the quality of the portrait.

1. Apply electrodes according to the standard diagram of limb leads preliminarily lubricated with gel in application points : red electrode (R) is placed on the right hand, the yellow (L) on the left hand, the green (F) on the left shin, the black (N) on the right shin(Fig. 7). If for some reason application of gel is not desirable moistening with water is sufficient. Make sure that the electrodes are put correctly according to color respectively. If the signal is weak it is desirable before application to remove grease with Nikiforov mixture (spirit and ether, pro rata 1:1).
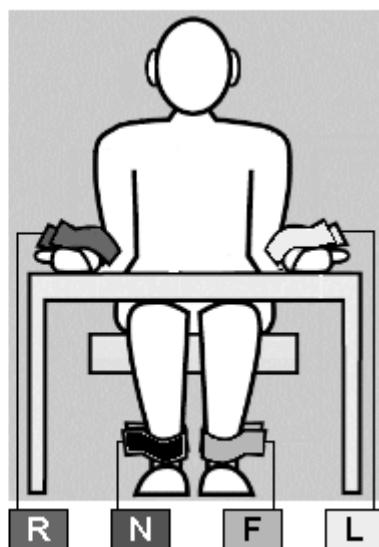

Fig. 7 Diagram of applying electrodes.

Give special attention to the quality of contact in electrode N as it has effect on ECG quality in channels R, L, F.

> (!) The most important factor ensuring the accuracy of the portrait at ECG input is the state of the patient at rest. If the patient is sitting he must take comfortable relaxed position maximally excluding muscular tremor Breathing at the time of ECG input should be usual, preferably without deep breathing in and out. If the patient is in a state of excitement, it can be recommended to him to shut the eyes. At ECG input talking and turning the head are impermissible.

Press the left key of the mouse on K5 ✚ . If the ECG input device is connected with the computer window of ECG signal input and two input control buttons : K17 - *Start* and K18 – *Stop* (Fig. 8) will appear on display.
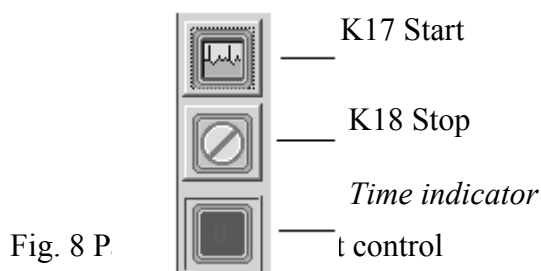

K17 Start

K18 Stop

Time indicator

Fig. 8 P   t control

If the input device is disconnected, the indicator in the lower left part of the main button panel (heart symbol) is dark-red. At the same time the button K5 is blocked.

In this case you must connect ECG input device with the computer (at the first connection make operations as per p.3 of the present manual) and reset the program (exit and activate again).

Tell the patient about the beginning of examination and that he must remain at rest for 30 (60) sec., press the button K17 *Start.* The first 5 seconds are taken by auxiliary procedure of optimal adaptation of the device to the input signal, the time exposition indicator counts backward : "-5, -4,…,0". These five seconds are a relaxation pause for the patient . ECG indication begins from "0". Input of ECG data is completed 35/65 sec. after pressing the button K17 (exposition + 5 sec.).

If during the ECG input it is necessary to interrupt the process, click on Stop (Fig. 8). (If after the interruption with the button Stop you wish to return to the main window of the system, press K1 – *Patients base*) .

When ECG input is completed the screen displays the indicator of generating a portrait ("sand clock") In 10 ~ 40 sec. (depending on the computer speed) the process is completed with the appearance of a large-scale portrait on the screen of display. At the same time, together with the portrait in this window appear integral indicators and text conclusion. In this way in ~ 1 minute after pressing the button K17 with 30 sec.-exposition the user receives the portrait of the patient's heart. If in the process of ECG input there is some interference which caused abrupt changes in ECG insulation, it is expedient to repeat the examination (in this case the incorrect examination should be deleted from the examinations base, see p. 4.10).

4.4   Examination: scanning portraits and text messages

It is expedient to scan the output data of CardioVisor–06c® Software in the following order:

- scanning the portrait
- scanning integral indicators
- scanning the conclusion
- scanning the detailing

4.4.1 Scanning the portrait

The portrait shows the slightest changes in dispersion characteristics of electric excitation. With deviations the color picture of color changing has characteristic individual features therefore the heart portrait retains these individual features for a long time (similar to individual features of a particular face). These individual features are rather significant but they all have a common peculiarity:

(!)   The more expressive red , and the larger the area in which green turns to red, the bigger deviation. Most significant pathological changes cover the left ventricle or both ventricles at a time as well as section 15 of the final phase of ventricular depolarization on the left view of the heart portrait (Fig.). Special attention should be paid to the bright red band in section 15 even though all the other sections of the quasi-epicardium have the normal color. Repeated appearance of the bright red band is correlated with clinically significant changes in the myocardium.
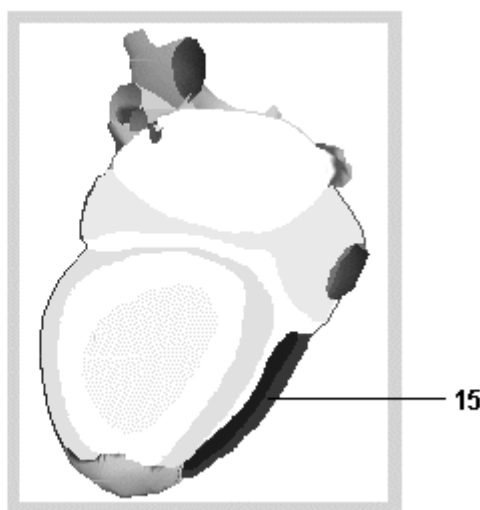

Fig. 9 Red band in section 15 (final phase of depolarization of the right ventricle), correlating with clinically significant changes

The rate of saturation with red in different sections of the quasi-epicardium is not necessarily connected with inauspicious diagnosis. For instance, in some slowly varying states of post-myocardial cardiosclerosis red is more intensive than in some types of acute infarction, probability of relapse of worsening in case of cardiosclerosis, as a rule, is less than with myocardial infraction. Therefore after scanning the portrait it is necessary to familiarize oneself with the conclusion and the values of indicators.

(!)   Please **MIND:** As stated in p.1 of this manual despite high individuality of repeated color changes *in the heart portrait* they are not always highly specific for pathologies of a particular type. **Varying dispersion characteristics have** integral reaction **to morphological, electrophysiological, etc. structural parameters of the myocardium.** Due to this with the same clinical diagnosis with different patients, areas and expressiveness of changes can considerably differ. On the contrary, similar changes in portraits in some cases can correspond to different pathologies. These peculiarities have no effect on the authenticity of screening estimation, i.e. differentiation of norm/pathology states.

On the left of the portraits there are two auxiliary rectangular graphic indicators. The lower one indicates the direction of the electric axis of the heart in front plane (QRS angle).

The sector of the norm is shown green. The upper indicator duplicates the color setting of the indicator "Myocardium": Saturation of red increases with growing deviations.

4.4.2 Scanning integral indicators

The indicators are in the upper part of the portraits window (Fig. 3). The main indicator is "Myocardium" which gives summary estimation of dispersion deviations from the norm in the range 0…100% (p. 2.3). The color background of this indicator informs the doctor of expressivity of revealed deviations according to the following table:

"Myocardium" indicator value	indicator color	State
< 16%	green	No significant deviations. Slight changes in portrait stand for individual peculiarities. Variant of norm
16% …19%	yellow	Border state (transient episode of short-time increase in dispersion characteristics) or initial stage of probable pathology
20% …23%	yellow	Probable indistinct pathology
24% … 47%	brown	Probable pathology
> 47%	red	Probable distinct pathology

The value of the indicator "Myocardium" with successive examinations can vary within slight limits (up to 8%). Fluctuations of this indicator with difference between successive examinations exceeding 8% and simultaneously changing color in the heart portraits is evidence of instability of the myocardium. This necessitates control of dynamics with a higher frequency of examinations (if these fluctuations are not due to ECG inadequacy – bad electrode contact with skin or muscular tremor during ECG input).

(!) If the value "Myocardium" is permanently above 19% and in auxiliary messages of conclusion there is suspicion of probable ischemic changes, it is necessary to have complete clinical diagnosis to differentiate ischemia from ischemic changes.

Variations of "Rhythm are conditioned by arrhythmia or stress, or by joint effect of the above factors. The color background of this indicator is determined by the following conditions:

"Myocardium"	Indicator	State
< 15%	green	No significant deviations
15% … 50%	yellow	Slight deviations
51% … 80%	yellow	Border state or mean value deviations
> 80%	red	Distinct rhythm deviation from norm

The "Rhythm" indicator is a sufficiently dynamic value, especially with short exposition of 30 seconds. Besides, this indicator is fairly critical even to slight disturbances of rest during ECG input. Its values are assuredly stable only at the initial and final points of the

range. If the patient is healthy and sympathetic and parasympathetic effects on the rhythm are optimally balanced, the indicator "Rhythm" is permanently within 0%…20%. With high stress and distinct arrhythmia the indicator is in the range > 70%. With a healthy town-dweller this indicator varies in the range 20%…60% and as a rule increases by the evening. If "Rhythm" constantly exceeds 50% at any time within 24 hours and the patient does not have significant arrhythmia, it means that in the organism there is a permanent source of high strain in the regulatory system (nervous tension, dysfunction of internal organs, inflammation, etc. If high value of "Rhythm" is combined with decreasing variability of cardiac rhythm (VCR) and this combination is permanently repeated, it is a sign of inauspicious prognosis. In this case the section "RHYTHM" in the conclusion will show the following warning:

> **(!)** If in the absence of significant pathological changes in the myocardium you wish to single-mindedly observe the patient's stress, it is recommended to use 60 second exposition. In this case the indicator "Rhythm "will be stable.

Change in color of the indicator "Pulse" corresponds to generally accepted borders of normocardia, bradycardia and tachycardia for an adult person (Annex III). The borders of bradycardia in this device do not differentiate sinus rhythm and manifest arrhythmias. Deviation of rhythm from sinus rhythm is indicated by additional messages in the section "Rhythm" of the conclusion (see further).

The indicator "Detailing code" informs the doctor of similar pathological deviations (see p. 2.3) Their names can be scanned with the button K14 – *Detailing*. Besides, these names can be seen without exit from the portrait window. For this purpose place the cursor on indicator "Detailing code" (the cursor in this case does not change the pictogram) and press the left key of the mouse. The tag window "Deviations classification" will appear. The code of each group corresponds to the number of the listed typical deviations.

4.4.3 Scanning the conclusion

The conclusion is in the upper part of the window with the big portrait and includes the following sections:

1. General conclusion – generalized scanning estimation

2. Rhythm

3. Electrical axis

4. Auricular myocardium

5. Ventricular myocardium

6. Ventricular hypertrophy

To access to all sections of the conclusion use the typical text scanning mechanism which is in the right part of the window. In case of constantly high stress values (stable deviations of some indicators of rhythm variability from the norm in the absence of arrhythmia) section OTHER CHANGES appears. The text of conclusion contains screening estimation as well as additional information about the expressiveness and the type of probable pathology to take subsequent decisions. Screening estimation differs from additional

information by color: the text of screening estimation is colored while additional text is black and white. There are 4 gradations of screening estimation: norm, manifest deviations, distinct deviations. The color of the text indicates the value of deviations from the norm in accordance with the following table.

Color of creening estimation text	Index and name of gradation of deviation from norm
green	1. Norm (no significant deviations) or within limits of norm
bright orange	2. slight deviations from norm
red	3. manifest deviations 4. distinct deviations

Screening estimation texts according to sections of conclusion include the following text messages:

Index of deviation gradation	Screening estimation text
General conclusion	
1 ("Myocardium" – < 15%)	No significant deviations from norm are found. This conclusion CAN be used only in comparison of anamnesis and physical data. If the patient takes DRUGS, this conclusion necessitates verification based on complete clinical examination.
1 – 2*	Slight CHANGES WITHIN LIMITS of the NORM: It is expedient to control DYNAMICS for differentiation of a norm variant from the initial phase of significant deviations.
1 – 2*	Slight CHANGES in stimulation process of ventricles: it is expedient to control DYNAMICS as these changes can be either the beginning of significant deviations or a symptom of temporary functional disorders.
1 – 2*	Probable indistinct symptoms of functional disorders of the left ventricle.
2 ("Myocardium" – *16% ... 19%*)	Moderate myocardial changes of ventricles. Dynamics control is expedient.
2	Probable symptoms of functional disorders of the left ventricle.
3 ("Myocardium" – *20% ... 27%*)	DEVIATIONS. See probable details according to deviation groups.
4 ("Myocardium" – *> 27%*)	DISTINCT DEVIATIONS: probable pathological changes. See details according to deviation groups.
RHYTHM	
1	Norm – sinus rhythm
1 – 2*	Moderate tachycardia

---

* depending on the peculiarities of each particular case this screening estimation can correspond to a few adjacent deviation gradations shown in the first column of the table.

3 – 4*	Distinct tachycardia
1 – 2*	Moderate bradycardia
3 – 4*	Distinct bradycardia
ELECTRICAL AXIS	
1	NORMAL position of the electrical axis of the heart
1	HORISONTAL position of the electrical axis of the heart
1	VERTICAL position of the electrical axis of the heart
2 – 4*	Deviation of the electrical axis TO THE LEFT
2 – 4*	Deviation of the electrical axis TO THE RIGHT

Additional information in the conclusion sections is given in black and white. Additional messages with high clinical significance like massages about probable ischemia are given in black.

If the message "Symptoms of probable dysfunction of the left ventricle" appears, it means there are significant changes in dispersion characteristics of he left ventricle. However, these changes are of diffusion character and detailing the probable deviation is hardly possible, – complete clinical diagnosis is necessary.

Additional information given in black and white is NOT DIAGNOSIS! It is recommendable information about probable pathological states, dispersion characteristics of which resemble dispersion characteristics of the ECG under analysis. Only complete examination can confirm or verify additional text messages.

For convenience the background of conclusion is also in the same color as the indicator "Myocardium". Only in absolute absence of significant deviations the background of the conclusion is bright green.

If screening conclusion is NOTM, there are grounds to verify this conclusion (anamnesis or physical signs of a lesion of the cardiovascular system). Use recommendations of Table 2 (Annex II).

4.4.4 Scanning detailing

If the indicator "Detailing code" contains deviation indexes (other figures accept 0) or if you wish to scan the quantitative values of typical indicators of input ECG, press K14 of D*etailing*. The screen will show the window of detailing (Fig. 4). For convenience the text message of conclusion is repeated in the upper part of this window, while in the left part some standard ECG indicators will appear. In the right part of the window there is a section of text messages about probable pathological portraits bearing most resemblance to each other with indication of corresponding nosologic units. The upper part of this section shows colors of detailing code Fig. 10). Indication color of the code shows the rate of resemblance of

dispersion characteristics of the patient's heart to dispersion characteristics of a certain pathology group according to the table below:

Detailing code color	Detailing text	Rate of resemblance to probable pathology
Bright green	Probable:	Portraits of patient's heart and indicated pathology practically coincide.
Middle (grey – green)	Probable:	The portraits greatly resemble each other
Dark	Uncertainty – individual features. Distinct form of this deviation will be as follows:	The heart portrait has many peculiarities. No complete resemblance but with most probability distinct stages of these changes will coincide with the portrait of the indicated pathology.

Fig. 10 Color indication of detailing code

Detailing is performed by nine groups of automatic classifier: G1,… ,G9 (see p. 2.3). This information makes it possible to verify additional messages of the general conclusion. For instance, if in additional information in the section "VENTRICULAR MYOCARDIUM " there is a message about probable myocardial ischemia and at the same in detailing groups G3 … G7 there is a message about similar ischemic manifestations, it is a clear indication that with most probability a complete diagnostic examination will reveal ischemia.

Automatic classifier of CardioVisor-06c® Software differs from known computer interpreters in principle as it does not require long and time consuming verification of authenticity of ECG conclusion. The portrait is formed by objective dispersion signals irrespective of the conclusion, therefore to estimate the authenticity of the conclusion, it is just sufficient to have a look at the heart portrait.

4.5 Examination: recording comments

In the lower part of the detailing window is the window of comments into which the doctor with the help of the keyboard can enter any necessary information about the examination or his final conclusion. To enter a text, press the button and with the keyboard enter the requires text. To save the text **do not fail to press the button < OK>.**

4.6 Examination: Scanning additional parameters of ECG input

If the doctor finds it necessary to estimate some generalized characteristics of RR-intervals or amplitudes and length of some ECG peaks, he needs to scan the table "Data of the indicatory lead" ("indicatory lead" in this program stands for the lead with maximal amplitude of peak R, i.e. for the lead which is the closest by direction to the electrical axis). This table can be drawn out only in the window of scanning the large-scale portrait (the button K9 –

). When in this window, press the button [image] on the left in the upper part of the window. The table presents the results of measuring a series of amplitude and time quantitative characteristics. These are mean values determined by all PQRST complexes of ECG, which do not contain artifacts.

Character # means low trustfulness of measurement (no estimation). The abbreviation CRV means "cardiac rhythm variability". When calculating mean values by all PQRST complexes, the representative complex is not singled out therefore interface does not contain the traditional representative complex with marked peaks. Accurate measurement of amplitude and time characteristics of a particular PQRST complex, if necessary, can be performed by the user in the window of measuring ECG characteristics (Fig. 10).
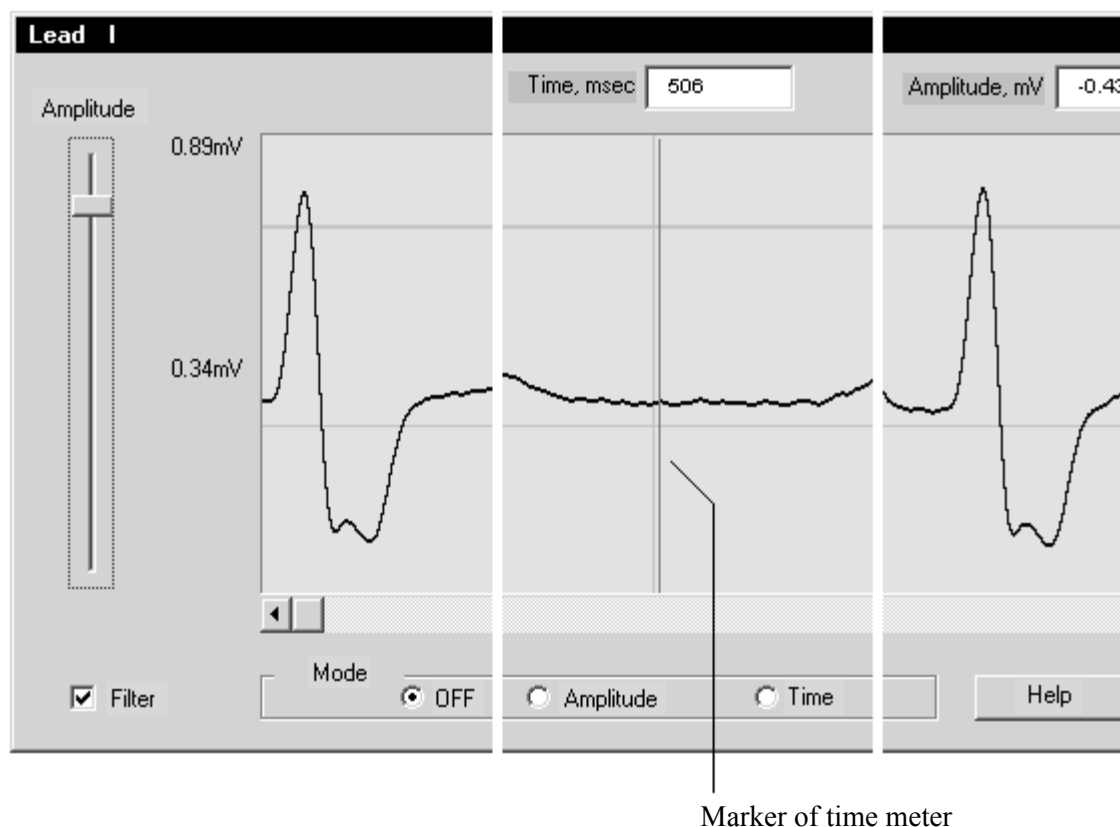

Marker of time meter

Fig. 11 ECG characteristics meter

If there are minimal or maximal limits of the norm, they are given in the corresponding columns of the table. If you wish a more detailed scanning of ECG in large scale and additional measurement of intervals or amplitudes in any lead I … aVF, press "Amplitudes" in the lower part of the table. In the opened window "Mean peak amplitudes of all leads" choose the required lead and press the button "ECG. The window of measuring ECG characteristics will appear (Fig. 11). This window has three functional states: "measuring put off "(initial state), "amplitude measuring" and "time measuring". First in the initial state "measuring put off", the user with the help of vertical and horizontal scroll and setting "Amplitude" should choose the required ECG fragment and a convenient scale for amplitude. If the signal has great noise interference, it is expedient with the left key of the mouse to switch option "Filter". In this case you should remember that amplitudes under measurement with additional filtration will be less authentic by 7% …15%.

> The procedure of scaling with the help of setting " Amplitude" can be performed in the state "measuring put off ". In the process of measuring this setting does not change.

To measure amplitudes with the left key of the mouse switch indicator ⦿ Amplitude . Move the cursor to the ECG field: the horizontal line of the marker of amplitude meter will appear. Place the marker in the position which you choose as beginning of count and press the left key of the mouse: the fixed line of the beginning of count will appear. Now move the meter marker to the required ECG point. In the indicator "Amplitude" read the value of amplitude in mB relating to the beginning of count. If it is necessary to set a new beginning of count, move the cursor to the required value and again click the left key of the mouse. In this way you can measure amplitudes between any two ECG points.

To measure the length of intervals switch indicator ⦿ Time with the left key of the mouse. Move cursor to the ECG field: the vertical line of the marker of the time meter will appear. Set the marker in the position which you choose as beginning of count and press the left key: the fixed line of the beginning of count will appear. Now move the marker to the required point the time scale. In the indicator "Time" read the interval length value in msec. relating to the beginning of count. If it is necessary to set a new beginning of count, move the marker to the required value and again click the left key. In this way you can measure time between any two ECG points.

When measuring, the ECG horizontal and vertical scrolls are in operation.

4.7   Control of trends: scanning the gallery of portraits

CardioVisor–06c is a unique facility to accurately and quickly control trends by scanning successive portraits stored in the examinations base, This makes it possible to reveal pre-clinic forms of pathological changes much more accurately and in a more reliable way to control minor changes in the process of electrical excitation of the myocardium which do not manifest in ECG. For this the device provides scanning of portraits in a small scale.

If you are not in the main window of the system, return to it with the help of button K1 – . Select the required patient and press K11 . The window of scanning four portraits will appear on the screen.

The choice of examinations for scanning is set in such a way that by activating the window portraits of four latest examinations of the chosen patient appear automatically.

However, with control of large lists of examinations it becomes necessary to choose any four portraits from the list. When in the window of scanning a gallery of portraits appears, press "Choice" (Fig. 12).

Fig. 12 Control of a gallery of portraits

With the use of the left key of the mouse mark in the first column of the table +/-examinations which you wish to scan (at a time you can scan up to four examinations). The chosen results will be marked in the first column. To change the choice press once again the choice character for desired examination – the choice character will disappear.

If you completed forming the choice, press the activated button to transfer the result of choice to the window of portraits. If you wish to delete from the gallery the portraits you chose, press **Ошибка! Объект не может быть создан из кодов полей редактирования.**.

If you wish to enlarge the portrait to see it in more detail, just press the left key of the mouse on the required portrait. The window with the enlarged portrait can be shifted if you drag the heading of the window with the left key.

4.8   Scanning ECG input signals

For ECG scanning use the buttons **K10** and **K12. K10** is convenient to use to control rhythm, as this format is for 30 sec. ECG. If it is necessary to scan a certain fragment of recording in more detail, set the cursor at the required point of ECG line and press the right key. ECG meter window will appear (Fig. 11). The beginning of the meter will be set in the chosen ECG point. By default **K10** always displays the indicatory lead (the lead with the peak R maximal amplitude). To change the lead, press the corresponding button in the left part of the scanning window.

The button **K12** is used for simultaneously scanning the initial interval of all leads. If the cursor is on the line of any of the leads and the right key of the mouse is pressed, The ECG meter window will appear bearing the corresponding ECG line.

4.9   Deleting portraits from the examination data base

To delete it is necessary to single out a required line in the examination data base and press K7 – which is in the block of buttons "Examinations". If you whish to delete simultaneously a few examinations singled, press the left key of the mouse and *Shift* on the keyboard. To block accidental deletes the system is provided with a local basket. All deleted portraits are in the basket . If you wish to return some portraits, enter the basket, single these portraits and press the return button .

> **Caution: The files are deleted from the basket by a full list** therefore first it is necessary to perform restoration. The basket gives a list of deleted portraits only for an activated (singled out) patient. It is expedient from time to time to empty these local baskets to save memory.

4.10 Deleting patients from the data base

To delete a patient from the data base single out the required line in the patients' data base and press K4 which is in the block of "Patients". Patients can be deleted only one by

one as it is connected with complete erasing the correspondent data without the basket. To exclude accidental delete there is an intermediate window of confirmation.

(**!**) **Caution: when deleting a patient data concerning this patient is deleted without return.** No basket for intermediate storage of deleted patients is provided.

4.11 Correcting the patient's name

If it is necessary to change the name or other data of a patient, press **K3**. Enter the alteration and exit by <OK>.

4.12 Printing Report form

Short form of Report containing only input ECG is printed with K15 – . Complete form is printed with K13 – . Printing of one form is made from the window of *scanning the portrait,* i.e. first you should press K9 and only after that press K13. After you pressed the printing buttons (K13, K15) the filled- in form in a few seconds is conveyed to the printer to be printed, while CardioVisor–06c Software gets ready for continuing operation ("the sand clock" – indicator of process–disappears). The time of receiving a printed form depends on the speed of the printer. If the printer has a slow printing speed when printing graphic formats, the Windows system will form a printing queue and will slowly print forms and at the same time perform other functions of CardioVisor–06c software. The text of the main message of screening conclusion are given underlined. Additional recommendations are given in italics. The date and time of examination on the form is given in the heading of the form in square brackets.

If the printer is of low capacity, it is expedient to print forms at the end of the working day as in this case you can form a printing queue which will be served by the computer in automatic mode. With this purpose select the first examination for printing and press the printing button K13 or K15.

In ~ 3 sec. the form will be completed ("the sand clock" will disappear). You can without waiting for the end of printing the first form select the next examination to be printed, repeat the above operations etc. The length of the queue is limited only by the digital resources of the computer.

4.13 Setting indicators color

If the user wishes, he can change the color of integral indicators "Myocardium", "Pulse" and "Rhythm "in the list of examinations. This is done by standard means of Widows system with the button K16.

4.14 Exit from the program

To complete the work press the standard button ⊠ in the upper right hand corner of the main window and press *<File>* ➔ *<Exit>* in the menu (Fig. 13).

Fig. 13 Completing work through the menu.

4.15 Servicing the patients database

The only operation which is expedient to perform periodically when working with the program is to empty the basket of examinations of each patient or delete patients who are not served with this device.

Versions of Software 1.* do not stipulate built-in export/import of data. However, with a great number of examinations the user can create a current copy of the data base by use of Explorer.

The operation should be made in the following order:

1. Exit from "CardioVisor–06c" program if it is activated.

2. Using Explorer enter radical catalog of CardioVisor–06c® software. The root directory is always presented as … \KARDi2–CV06s\KARDi2, i.e. it corresponds to the way which was assigned at installation (for instance, if during installation the program is set in the catalog by defaults C:\Program Files\KARDi2-CV06s\, the root directory is C:\Program Files\KARDi2-CV06s\KARDi2. To ensure reliable localization the installer always adds the last subcatalog KARDi2\ the selected way.

3. Single out sub catalog Db_Vis\ in the root directory and copy it in the reserve catalog in which you store archive files.

ⓘ Caution: If you accidentally lose subcatalog Db_Vis\, the data base will be irreversibly destroyed ! Db_Vis\ can be only copied but not shifted.

After the data base is copied it is necessary to activate the program and delete useless records as now they are stored in the current archive copy.

The database of the Program is a standard index list of data therefore no joint operations with catalogs Db_Vis\ are permissible.

If you wish to scan any of the saved archive catalog Db_Vis\, do the following:

1. For some time move the cuarrent working catalog Db_Vis\ from root directory of the program to another buffer catalog.

2. Copy archive catalog Db_Vis\ into root directory radical catalog of the program instead of the shifted working catalog, activate the program and scan the examinations you are interested in(print the forms).

3. After that it is necessary to exit the program and to return current working base Db_Vis\ from the buffer catalog to the previous place.

These irregular manipulations can be performed by only an experienced user and in cases of extreme necessity only. It is NOT PERMISSIBLE to do these operations when the program is activated: in this case the data base will be irreversibly lost.

4.16 Testing the program in operation.

If the computer is in good state and the operative system is adequate the manufacturer guarantees the work of CardioVisor-06c® without faults and conflicts. However, unlikely situations when the integrity of the program, due to some malfunctions of the operation system or the errors of unskilled user in the root directory of the program, are possible. If irregular situation related to malfunction of the program occurs, it is recommended to use utility *Test*, which is automatically set simultaneously with the installation of the main program.

1. To activate the program Test press the system button <Start> in the lower left part of the screen, enter the section <Program> →<KARDi2–CV06s> and activate the program *Test* (the main program "KARDi2–CV06s" ® during the operation of utility *Test* should be switched off. After the analysis is completed the program *Test* in automatic mode will perform analysis of the integrity of the program and will form recommendations for the use.

2. If the previous step failed, deintsall by Windows means the program CardioVisor-06c (<Start>→<Start>→<Setting>→<Control panel>→<Setup and Delete>) and install the program again as in p.4. Before deinstallation it is necessary to save the copy of catalog Db_Vis\ which contains the current data base. After installation the copy should be rewritten in the root directory of the program instead of the initial database.

3. When performing deinstallation only files registered in the system during installation should be deleted.

4.17 Help

The present manual is given in the section <Help>→ <Subjects> in the main menu of the system. The required window is standard window Help–Windows. He required sectionis brought to display by double clicking of the left key of the mouse. Hyperlink in the text are given in green italics. To move over to a new link set the cursor on green italics and press the left key. *The program contains context prompt:* with F1 of the keyboard pressed, the screen shows the help section corresponding to the current state of interface.

---

5. Annex I

5.1   Examples of heart portraits with different pathologies

6. Annex II

6.1 Peculiarities of clinical interpretation of heart portrait

Screening analyzer controls regularity of characteristics of ECG low-amplitude ECG signal fluctuations which always appear with every contraction of the heart. Low-amplitude fluctuations demonstrate deviations from normal course of depolarization/repolarization of the myocardium in a way which is considerably different from the way of control of the traditional ECG deviations. To describe in short the peculiarities of clinical interpretation of low-amplitude ECG fluctuations let us refer to general principles of the technology under survey.

Let us consider the principles of this technology [6,7] on the example of analysis of QRST complex. 30 second- ECG input signals at rest take digital form and demonstrate about 15 successive QRST complexes. Permissible number of analyzed QRST complexes in this technology is 10…20. The singled-out complexes in each of the leads under analysis are synchronized with the starting moment of registration (Fig. A 1). Fig. A 1 a as an example shows one moment of registration in different QRST complexes which is ~ 11 msec. from the beginning of QRS complex. Fig.A1 b shows 6 curves of low-amplitude fluctuations for this moment which correspond to 6 limb leads 1…aVF. Signal values from 1…aVF limb leads are calculated in the standard way by signals from two leads I, III (electrodes L-R, L-F). The whole block of fluctuations includes similar data for 250…300 moments which embrace the whole QRST complex.

This block resembles digital data analyzed in the method of high resolution ECG when data are time-averaged [8]. The principle peculiarity of the block of low-amplitude fluctuations is a small volume of selection for each moment which is ~ 10 … 20 points according to the number of QRST complexes under analysis. This peculiarity calls for special methods of analysis as the traditional statistic estimations with such short selections are not well-founded or impossible. Therefore the digital block of low-amplitude fluctuations is passed through a special weak signal coherent amplification module - information amplifier. This module amplifies slight fluctuations which are repeated in all QRST complexes (i.e. small deviations of high correlation) but weakens deviations which hardly correlate in the complexes under analysis. Dispersion characteristics give integral estimation of changes in many structural myocardial characteristics depending on blood parameters, electrolyte balance, blood pressure and other factors. The final procedure of calculation of dispersion characteristics consists in determining probable localization of sections of the myocardium with changes that became the cause of dispersion changes as well as in determining the integral indicator of deviations of dispersion characteristics from the norm in localized sections. The accuracy of probable localization of dispersion changes is determined by the number of leads under analysis. Screening analyzer registering limb leads provides singling out only the following enlarged types of localization of changes: back or side, side, front septum or side, front septum or lower, lower, lower with a shift to the right. Finally, at the output of the information amplifier a surface map of dispersion characteristics is formed, which reflects only significant deviations of these characteristics from the norm (Fig. A 1 c). This map by determined algorithm is projected on the epicardial surface of the computer three dimensional anatomic model of the heart. The screen shows a digital model of dispersion characteristics on the surface of quasi-epicardium (i.e. on the computer model of the epicardium) which the technology designers called "the heart portrait" (Fig. A 1 d).
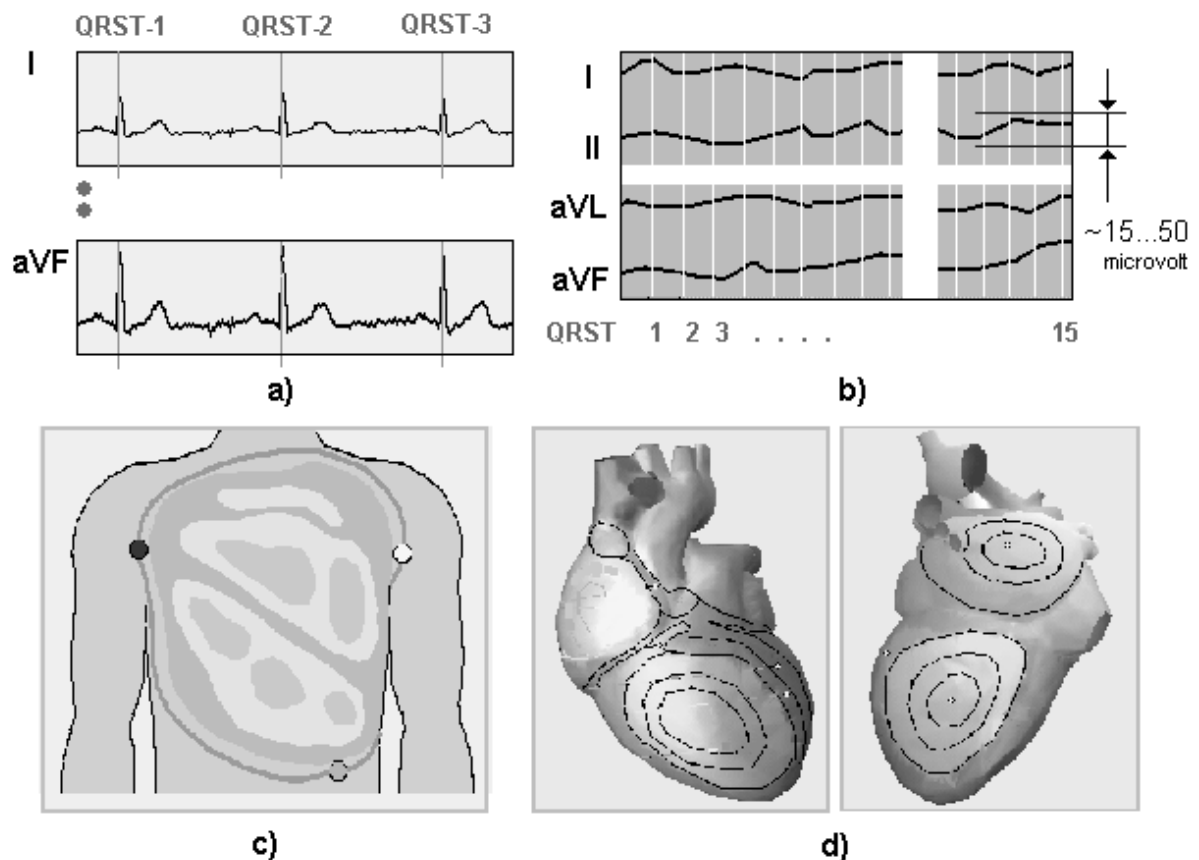
Fig. A 1 Diagram of forming information topology model of low-amplitude ECG fluctuations.

a) Input ECG signals with synchronization marks. b) block of low-amplitude ECG fluctuations for one moment. c) surface map of dispersion characteristics d) information topology model of dispersion characteristics – "heart portrait".

Dispersion characteristics of ECG low-amplitude fluctuations controlled in this way reflect the characteristics of regularity of the movement of depolarization and repolarization fronts in the myocardium with every contraction of the heart calculated during ~ 10 … 20 sec. Verification tests showed: the better the state of the myocardium by generally accepted criteria of the norm, the better regularity(i.e. stability) of dispersion characteristics in the successive cycles of depolarization/repolarization. It should be noted that this position considerably differentiates regularity of dispersion characteristics of electric excitation of the myocardium from regularity of cardiac rhythm characteristics. As known high stability of RR intervals length (low variability of cardiac rhythm) is always evidence of deterioration of functional state of the heart [5]. Contrary to this, functional and organic deviations of the myocardium from the norm practically always increase local heterogeneity of the myocardium and respectively deteriorate the regularity of the corresponding dispersion characteristics. Naturally, the regularity of dispersion characteristics of low-amplitude fluctuations even in a healthy heart is not ideal as in every cardiac cycle the conditions of excitation periodically vary (breath, changing position of diaphragm, local fluctuations of metabolic processes, etc.). However, in any case*, the higher regularity of dispersion characteristics of low-amplitude ECG signal fluctuations, the more stable the electric state of the myocardium. This is the first characteristic of signals under control,* which is the basis of high sensitivity of dispersion characteristics to myocardial changed. To reveal slight

deviations from regularity in early stages of pathologic changes regularity in early stages directly by ECG is impossible.

The most significant changes in dispersion characteristics are observed in myocardial ischemia. As known ischemia is a relative state [4]. Only a certain length of ischemic state of the myocardium without restoration of perfusion can result in irreversible necrosis changes in the myocardium [9]. States of transient ischemia can appear even in a healthy heart with disturbance of optimal ratio of indicators of coronary blood flow and the level of blood oxygenation, indicators of myocardial load and other known factors [4]. The specificity of dispersion changes in dispersion characteristics revealed by screening analyzer, which accompany even moderate ischemia manifestations considerably depends on the number of leads. The more leads, the more accurately one can differentiate dispersion changes caused by ischemia from similar dispersion changes caused by other pathologic changes. For instance, with the use of 12 generally accepted leads the specificity of dispersion changes in relation to ischemia with this technology is ~ 85% …90%. If the number of leads is increased up to 35 …60 it is possible to reach specificity indicators ~ 95%. In this screening device only two ECG signals from extremities are used when average specificity of dispersion deviations in relation to ischemia is 70…76%. Therefore significant dispersion changes which the autoclassifier of screening analyzer cannot precisely refer to nosologic units of the internal base of dispersion standards *are classified as ischemic. This is a second peculiarity of control of dispersion characteristics of low-amplitude fluctuations.* This peculiarity means that the screening analyzer accurately reveals ischemic changes in 75% while in 25% it detects changes that are undifferentiated from ischemic changes but are of another etiology. Therefore some types of heart disease, cardiomyopathy, and some other pathologic changes in the myocardium are classified by the device as ischemic changes. Such low specificity in relation to ischemia is acceptable for a screening device as it is designed to timely reveal the fact of developing pathology and not a type of pathology. Thus 25% of revealed significant changes which the screening analyzer refers to probable ischemic changes will not be of ischemic origin. However, in all these cases it is an absolute fact that significant deviations are evident and require examination. Clinic diagnosis can only be made with a complete examination of the patient in whom the screening analyzer revealed significant deviations from the norm.

The above two methodological peculiarities of the screening analyzer give rise to corresponding peculiarities of clinic interpretation of heart portraits and text conclusions. **These peculiarities consist in the following recommendations which should be taken as guiding lines in practical work with the device.**

1 The screening analyzer does not form diagnosis but indicates the resemblanceof ECG dispersion characteristics of a patient at the time of examination to dispersion characteristics of standard electrocardiograms to some clinically significant pathologies, Due to this, interpretation of clinically significant results of a concrete examination should be based on synthesis of all three output components of the device: the portrait, "Conclusion" and "Detailing" (p. 4.4). The recommended order of such synthesis for probable ischemic manifestations is given in Table A 2 of this Annex.

2 The sensitivity of the screening analyzer to ischemia is ~ 80% (specificity 76%). Practically this sensitivity level is commeasurable with mean sensitivity to ambulatory ischemia and exceeds the monitoring and exceeds mean sensitivity of ECG stress tests by 10%…15%. In this case the above level of sensitivity of the device is reached with ECG

analysis at rest which can be made in ambulatory conditions. In approximately 20% of certain cases of ischemia the device does not find deviations from the norm or finds them insignificant (indicator *Myocardium* is less than 16%). This effect is characteristic of two practically important cases: firstly, with back localization of ischemic changes shifted to basal sections, secondly, with intensive medicamentous treatment. If in these cases there are clinic grounds for a more detailed analysis, it is expedient to make a few portraits at a run after a short mediacamentous or physical load (a 15-25% pulse increase). The type and volume of such load is chosen by the doctor in each particular case. This load which is considerably lower than submaximal can be in some cases easily reached by 10-15 squattings. Dispersion characteristics are very sensitive to even small loads which in such situations makes it possible to considerably raise the sensitivity of the device. Conclusion messages about significant deviations after such moderate load and distinct color changes in the portrait testify to expediency or necessity of complete examination.

3   With deviations from the norm dispersion characteristics begin to change earlier than it is seen on the usual ECG, i.e. the device can react to latent or pre-clinic forms of myocardial changes. Most often it refers to ischemia. There are cases when ECG is in the norm while dispersion characteristics testify to significant probable ischemic deviations in the myocardium. Such situations are not errors of the device. They reflect objective changes in depolarization/ repolarization in the myocardium during the examination. Moreover, there may be cases when probable ischemic manifestations revealed by the device can considerably vary in successive portraits within a few minutes. This is evidence of the fact that the myocardium is in the border state and episodes of transient ischemia interchange by time with the norm. Clinical significance of such manifestations of ischemia can also be verified after a slight load increasing pulse beating by 15% … 25% (Table A 2).

Estimation of clinical significance of <u>additional messages</u>[*] of the conclusion about **probable ischemic changes** is determined by two factors: by the value of revealed deviations from the norm and by their stability in 2–3 successive portraits.

By value of deviations any conclusion of the device belongs with one of the following four groups of screening conclusions:

- Norm:
  indicator *Myocardium* is under or equal to 14% and with no quasi epicardium color changes to red in the heart portrait.

- Border state:
  indicator *Myocardium* is about 15%.. 22% with some changes in the portrait.

- Pathology:
  indicator *Myocardium* is about 23% …27% with some changes in the portrait.

- Manifest pathology:
  indicator *Myocardium* is above 27% with some distinct quasi-epicardium color changes in the heart portrait.

---

[*] Additional massages of the conclusion are shown in screen interface in gray

By stability deviations belong with one of the following three groups:

- Stable groups:
  Fluctuation values of indicator *Myocardium* in successive examinations do not exceed 3% … 7%.

- Moderate fluctuations:
  indicator *Myocardium* fluctuations in successive examinations are 8% … 10%.

- Distinct fluctuations:
  indicator *Myocardium* fluctuations in successive examinations exceed 10%.

If indicator Myocardium less than 15%, there are no quasi-epicardium color changes to red in the portrait and there are no indications of probable deviations in the text messages of *Conclusion* and *Detailing,* this is NORM. **This screening conclusion CAN BE USED only in comparison with other clinic data.** If the patient is under DRUGS, this conclusion requires verification on the basis of complete clinic examination. Two additional factors can be the main criteria verifying screening conclusion NORM:

1. The portrait in a series of a few successive examinations should be stable and indicator *Myocardium* should not exceed 14 %.

2. The portrait obtained after a slight load with increasing frequency of pulse by 15%…25% should not show distinct deviations. For a heart without clinically significant deviations after a slight load only massages of border changes and small local changes in the portrait to pink or yellow are permissible. These changes with a heart without clinically significant deviations return to the initial pre-loaded state in 3-4 minutes. More distinct or long changes after loading can testify to expedience or necessity of complete examination.

If indicator *Myocardium* is more than 27%, and the portrait shows distinct changes, this is manifest PATHOLOGY.

In other cases (indicator *Myocardium* more than 15% and less than 27%) comprising the border group clinical significance of the revealed probable ischemic changes is determined by combination of value and stability of deviations as per Table A 2 "Clinic significance of ischemic manifestations in the border group of this Annex. Table A 2 gives recommendations for the four typical situations.

4 If in *the General conclusion* in the section *Ventricular myocardium* there is suspicion of ischemic changes, this is not evidence of cardiac ischemia. The device due to high sensitivity reacts both to clinically significant forms of ischemia and to short episodes of transient ischemia which may not relate to coronarogenic pathogenesis. In these cases it is information that dispersion characteristics of the myocardium at the time of examinations deviated from the norm to characteristics of ischemic states. Clinic significance of such a message depends on whether it is confirmed by the portrait and detailing information as well as by high regularity of such messages. The more references to probable ischemia in detailing groups G3 … G7 and the more changes in the portrait, the higher probability of clinic form of ischemia (Table A 2). In any case device indication of ischemic changes with absence of other clinic symptoms of ischemia is clear evidence of significant subliminal deviations which are expedient to be periodically controlled by dynamics of the heart portrait and which in unfavorable conditions can manifest in clinic forms.

6.2   Clinical significance of ischemic manifestations in the border group

The present Table contains description of four typical situations which arise in analysis of the screening analyzer autoclassifier in the so-called border group of conclusions. This group embraces myocardial states which can be related either to stable pathology or transient changes in the myocardium caused by functional, metabolic or other transient factors As a rule values of integral indicator *Myocardium* in this group are in the rage 10% … 23%. Each situation in the Table is described in three lines. The first line *"Deviations"* includes description of deviations and changes relating to the portrait obtained and the conclusion concerning ventricular myocardium. The second line *"recommended steps"* recommends to get additional heart portraits to verify the conclusion. The third line *"Synthesis"* includes recommendations concerning the final interpretation of clinical significance of the screening conclusion. It is expedient to use the recommendations cited in Table A 2 in cases when data of anamnesis and physical examination do not correspond to the screening conclusion of the device or when there are other clinic grounds for verification of screening conclusion.

Table A2

• Deviations • Steps • Synthesis	Changes in portrait	Indicator "Myocardium" value Total dispersion deviations	General conclusion messages about ischemic changes	Ventricular myocardium messages about ischemic changes	Detailing messages about ischemic changes in groups G3... G7
Situation 1 → deviations	Weak local changes to red	Less than 15%	Messages about probable primary ischemic changes	No messages initial ischemic changes	No or more than one message with graduate " individual peculiarities " or "most probable"
Situation 1 → Recommended steps	Most probable – norm. If there are clinical grounds for verification of the conclusion it is expedient to increase pulse beating by any loading test by 15-25% and make a series of 2.. 3 portraits. Type and value of loading is determined by doctor in each particular case.				
Synthesis for Situation 1	• If in "General conclusions" successive portraits after loading bear message *"Deviation from norm"*; • or indicator *"Myocardium"* exceeds 18% and time of return of the portrait to initial form is more than 4 minutes – complete examination is expediently or periodic control of dynamics by portraits to verify the conclusion.				
Situation 2 → deviations	Weak or moderate local changes to red	From 15 to 22%	Messages about probable initial ischemic changes or manifest ischemia	Messages about probable initial ischemic changes	1 -2 messages about probable ischemia with gradation "most probable " or "very probable"
Situation 2 → Recommended steps	Most probable - significant deviations. If this state is revealed for the first time it is expedient to make additionally a series of 2-3 portraits. If deviations are steadily repeated - **these are significant deviations**. If indicator *"Myocardium"* decreases and the portrait steps in subsequent examinations becomes better - it is expedient to increase pulse beating by any loading test by 15-25% and make a series of 2... 3 portraits. Type and value of loading is determined by doctor in each particular case.				
Synthesis for Situation 2	• If in the "General conclusion" on consecutive portraits after loading the message *"Deviations from the norm"* has appeared or *"Distinct deviations from the norm"* ; • or fluctuations of indicator *"Myocardium"* exceed 7% - pathological changes are probable. Otherwise the revealed deviations may be episode of short-time transient ischemia. In the latter case for detailing the situation a short time control is expedient.				

Table A2 (continuation)

• Deviations • Steps • Synthesis	Changes in portrait	Indicator "Myocardium" value Total dispersion deviations	General conclusion messages about ischemic changes	Ventricular myocardium messages about ischemic changes	Detailing messages about ischemic changes in groups G3... G7
Situation 3 → deviations	Large or local, but the expressed changes aside red color	From 15 to 25%	Messages about probable primary ischemic changes or manifest ischemia	Messages about probable primary ischemic changes or manifest ischemia	No or not more than one message with gradation " individual characteristics" or most probable"
Situation 3 → Recommended steps	Most probable – significant deviations. There is probability of a short time ischemic episode as in groups G3... G7 unlike in situation 2, there is very indistinct to ischemia. If this state is revealed for the first time it is expedient to make a series of 2-3 portraits. If deviations are repeatedly stable, **they are significant deviations**. If indicator "Myocardium" decreases and the portrait becomes better, - it is expedient to increase by any loading test pulse beating by 15... 25% and again to make 2-3 successive portraits.				
Synthesis for Situation 3	• **If in "General conclusions" successive portraits after loading bear message "Deviation from the norm" or "Distinct deviations from the norm";** • **or *Myocardium* fluctuations exceed 7% –** **pathologic changes are probable. Otherwise revealed deviation may be an episode of short time transient ischemia or have non-coronarogenic etymology. - (Such situation is often observed with smoker).**				
Situation 4 → deviations	Large or local but distinct changes to red	From 22% to 27%	Messages about probable primary ischemic changes or manifest ischemia	Messages about probable primary ischemic changes or manifest ischemia	1-2 messages about probable ischemia with gradation "most probable " or "very probable"
Situation 4 → Recommended steps	Most probable – **the significant deviations** confirmed by detailing text in groups G3... G7.				
Synthesis for Situation 4	**Probable ischemic changes – complete examination is necessary**				

7. Annex III

7.1 Criteria of comparison of dispersion deviations with generally accepted electrocardiographic diagnoses

This annex contains a table of comparative correspondence of ECG fluctuations used in screening analyzer and generally accepted criteria of ECG conclusions when registering limb ECG at rest. This comparative table establishes connection between additional text conclusions of screening analysis and generally accepted methodological recommendations according to ECG analysis which are used by doctor in practical work. Dispersion deviations in many cases reflect processes in early stages of changes which have no direct analogs in practical criteria of ECG conclusions. For the same reason a certain generally accepted criterion of ECG analysis characterizing clinical stages of pathological changes can correspond to several "dispersion" conclusions reflecting changes in early stages which are still not clinical stages. For the same reasons the list of cited generally accepted criteria of ECG conclusions is not complete: it is to be used only for simplified clinical interpretation of additional screening conclusion texts at the beginning of work with the screening analyzer. Finally, the cited comparisons cannot be absolutely strict or categorical as screening analyzer "dispersion" conclusions are not diagnosis and the comparison is always confined to some probability limits. Such tolerance of comparison is inevitable as analogs of many dispersion deviations due to their high sensitivity can only be seen in standard ECG from 12 leads while deviations only in ECG with physical loading. Comparison of "dispersion conclusions and ECG conclusions in Table A3 is made by screening conclusion sections (p. 4.4.3) including: "1. General conclusion", "2. Rhythm", "3. Electrical axis", "4. Auricular myocardium", " 5. Ventricular myocardium", "6. Ventricular hypertrophy ", "7. Other changes". In section "2. Rhythm "the following abbreviations are used: CCF- cardiac contraction frequency, SDDN – standard RR interval length deviation, TI – tension index (unmeasured value) [10]. In the autoclassifier of the screening analyzer the following limits of norm are used: 25 msec.< SDDN<100 msec. TI < 200.

Table   A3

Criteria of comparison of dispersion deviations from generally accepted electrocardiographs diagnoses

№	Screening conclusions of dispersion deviations low-amplitude fluctuations	ECG conclusions corresponding to these dispersion deviations
1. General conclusion		
	• **No significant deviations from the norm.** This conclusion CAN be used only in comparison with other clinical data. If the patient DRUGS this conclusion requires verification on the basis of complete clinical examination.	Normal ECG
	• **Minor CHANGES within the LIMITS of the NORM:** It is expedient to control Dynamics to differentiate variant of norm from primary phase of significant deviations. • **Minor CHANGES** in process of ventricular excitation. It expedient to control DYNAMICS as these changes can be either the beginning of significant deviations or sign of temporary functional instability. • **Indistinct symptoms of dysfunction of the left ventricle** are probable.	Normal ECG (in ECG at rest no changes)
	• **Moderate CHANGES in ventricular myocardium.** Dynamics control is expedient. • **Symptoms of dysfunction of left ventricle** are probable.	ECG is probable, border between norm and pathology
	• **DEVIATIONS** - see probable detailing in deviation groups. • **DISTINCT DEVIATIONS:** pathologic changes are probable. See probable detailing in deviation groups.	Pathological ECG
	• Lengthening of **Q-T** interval. • DISTINCT LENGTHENING of **Q-T** interval.	Interval Q -T is lengthened regarding norm for this FCC value. Q-T exceeds 0. 44 sec.

Table A3 (continuation)

2. Rhythm	
• **NORM** - sinus rhythm	Rhythm with FCC from 60 to 80 per min. arising in sinus knot. Peaks P positive in leads I, II, aVF, negative in aVR.
• Pulse - norm, but there are **Rhythm deviations** from norm.	Rhythm with FCC from 60 to 80 per min. accompanied with falling out of individual peaks P
• Moderate **TACHYCARDIA**	Rhythm with FCC more than 80 but less 110 per min.
• Distinct **TACHYCARDIA**	Rhythm with FCC more than 110 per min.
• Moderate **BRADICARDIA**	Rhythm with FCC less than 60 per min.
• Distinct **BRADICARDIA**	Rhythm with FCC less than 50 per min.
• High rhythm indicator is caused by high **STRESS,** but **NO** signs of arrhythmia are found.	ECG section shows sinus rhythm but rhythm variability parameter SDDN and TI moderately outside norm limits.
• High value of integral rhythm indicator. Insignificant signs of arrhythmia. Most probable cause -high level of **STRESS.**	No manifest disturbances of sinus character of rhythm, but SDDN and TI considerably exceeded norm limits.
• Deviations of variability of a rhythm from norm are probable.	SDDN and IT insignificantly exceeded norm limits. Probable disturbances c connected with blockades of sino-atrial node or blockades of AB-junction.
• Signs of **disturbances in arising or conducting excitation.**	One of arrhythmia types. SDDN and TI significantly exceeds norm limits.
• Distinct **ARRHYTHMIA**	SDDN and TI considerably exceed norm limits. Manifest falling out of ventricular complexes. One of tachyarrhythmia and bradiarythmia types.
3. Electrical axis	
• Deviation of heart electrical axis to **the LEFT**	Electrical a axis -15 degrees left.
• **HORIZONTAL** electrical axis	Electrical axis between +30and -15 degrees.
• **NORMAL** electrical axis	Electrical axis between +75 and +30 degrees.
• **VERTICAL** electrical axis	Electrical axis between +90 and +75 degrees
• Deviation of heart electrical axis to the **RIGHT**	Electrical axis + 90 degrees right.
• **Probable DEXTROCARDIA**	Electrical axis +130 degrees right and -120 degrees left.

Table A3 (continuation)

4. Auricular myocardium (+ changing P-Q)	
• Probable **FIBRILLATION** of auricles	No peaks P Instead of them – irregular low- amplitude waves
• Probable **FLUTTER** of auricles	Saw-like high frequency waves P
• Probable change in **FIBRILLATION/FLUTTER** of auricles	Saw-like peaks P, alternating with irregular or absent waves P
• Probable change in **MIGRATION** of rhythm driver	Variations of form and amplitude of peaks P. If peaks P invert in leads I,II , rhythm driver migrates to AB-junction.
• Probable **disturbance in auricular depolarization**	Unstable form and mall amplitude of peaks P.
• Characteristic **changes** in auricular **repolarization** which can accompany probable ischemic changes in the left ventricle.	Depression of P-Q and ST lines of concave parabola type close to peak P. Line ST of slantwise type with probable slight depression in point J.
• Signs of the left auricle enlargement. Probable left auricle hypertrophy	Peak P length exceeds 20msec. Vector P direction in frontal plane +60 degree left, i.e. Peak P maximal amplitude is shifted to leads I,aVL.
• Signs of the right auricle enlargement.	Peak P amplitude exceeds 2.5 mm (0.25mB). Vector P direction in frontal plane + 60 degrees right, i.e. peak P maximal amplitude is shifted to leads aVF, III.
• **P-Q lengthening**. Watch dynamics. **Short P-Q** interval	P-Q lengthening exceeds the norm. Norm: 200 msec. with CCF 40….50 per min., 120 msec. with CCF 130 …160 . P-Q length < 120 msec.
5. Ventricular myocardium	
• Ventricular myocardial changes resembling **ISCHEMIC** changes. Dynamics control and complete examinations expedient	Moderate depression or elevation ST, decreasing amplitude and peak T distortion.
• QRS length ANOMALLY increased! Probable **symptoms of MYOCARDIUM lesion.** Complete examination necessary. • Probable **DISTINCT ISCHEMIC changes in** ventricular myocardium - complete examination necessary. If these signs in the given patient were not observed earlier while now are repeatedly stable urgent complete examination is necessary • Probable **DISTINCT ISCHEMIC** changes in ventricular myocardium – complete examination NECESSARY. These signs can correlate with cicatricial changes. If these signs in the given patient were not observed earlier but now repeatedly stable – urgent complete examination is necessary.	Distinct elevation of segment ST in point J in one or several leads. At the same time depression ST in other leads. Anomalous peaks Q ~ 40msec with amplitude ~ 25% of amplitude peak P in the same lead. Deep negative peaks T in combination with depression of segment ST. Variants of simultaneous depression of parabola type lines PR and ST or distinct slantwise declining depression ST.

Table A3 (continuation)

• Probable **ISCHEMIC** changes in ventricular myocardium - complete examination is NECESSARY. These signs can correlate with FOCAL CHANGES in the myocardium. • Probable **ISCHEMIC** changes in ventricular myocardium - control of regularity of this sign is necessary. Possible focal changes in the myocardium or temporary transient myocardial ischemia. • Possible ISCHEMIC changes in Ventricular myocardium - complete examination is necessary.	
• DYNAMICS control is EXPEDIENT as there are CHANGES on the BORDER of norm which can be the **beginning of ischemic changes** in the myocardium. CHANGES in depolarization of ventricles: complete examination is expedient as such changes can **correlate with coronary changes.** • Moderate **changes** in **repolarization of ventricles.** Dynamics control is OBLIGATORY: The deviations can be sign of temporary functional instability or sign of the BEGINNING DISTINCT CHANGES.	Non-specific moderate local depression ST in individual leads. Decreasing amplitude And distortion of the form of peak T.
• MODERATE **lengthening** of **QRS.** • DISTINCT **lengthening** of **QRS** – sign of intraventricular	QRS length more than 105 msec. and than 115 msec. QRS length mor than 115 msec. Wide peaks S in leads I, aVL (blockade of right leg of His bundle). Complex qA in leads I,aVL, complex rS in leads II, aVF, deformed peaks R (left leg blockade).