stomdevice

ECG-213
DIGITAL THREE CHANNELS ELECTROCARDIOGRAPH

Operation Manual
Version 2.2



Shenzhen Bestman Instrument CO., LTD.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

Table of contents

1. Notice for operation 2
1.1 Notice for use 2
1.2 Notice for safety 2
1.3 Manufacturer illustration 3
1.4 Design and structure 3
1.5 Icons for safety 4
1.6 Explanation of the symbols 5
1.7 Precautions 6
2. Summary 8
2.1 Features 8
2.2 safety classification 9
3. components and functions 9
3.1 Name of components 9
3.2 Content on LCD as follows 12
3.3 Content on color keyboard as follows 18
4. Operation preparation 20
4.1Connect to power 20
4.2 Paper loading 21
4.3 Connection of patient cable 21
5. Daily maintenance 24
5.1 Battery charging, capacity indicator and replacement 24
5.2 Recording paper 24
5.3 Maintenance Following Operation 25
5.4 Patient cable maintenance 25
5.5 Silicon rubber axis maintenance 26
5.6 Thermal Printer Maintenance 26
5.7 Fuse Replacement 26
6. Troubleshooting and solution 26
6.1 Some lead without waveform 26
6.2 Vertical broken track of printed waveform 27
6.3 Control Panel Failure 27
6.4 AC Interference 27
6.5 EMG interference 28
6.6 Baseline drift 28
7. Specifications 29
8. Accessory List 30
Appendix A 32
Appendix B 39
Information of manufacturer: 42

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

1. Notice for operation

1.1 Notice for use

Thank you for purchasing medical electrical product made by Shenzhen Bestman Instrument Co.,Ltd.

ECG-213 digital three channel three electrocardiograph has its own unique method for use, this manual is provided necessary illumination for your first use of electrocardiograph, andry of this manual which is protected by The People's Republic of copyright law, which is reserved by Shenzhen Bestman Instrument Co.Ltd. All the information can not be copied, amended or translated without permission. The content of this manual is subject to change without notice. Please read the manual carefully before using and get to know how to use the machine correctly.

This manual is along with the device as a guide while operating ECG-213.If this manual is ripped or lost, please connect with our sales department to purchase in time.

Important Note:Must use dedicated ECG cable and electrode chip when apply to defibrillation function.

1.2 Notice for safety

⚠ Danger	**If ignore this symbol, it may cause die or severe injured, otherwise the device would be partly damaged or resulted in fire hazard.**
⚠ Warning	**If ignore this symbol, it may cause human die or severe injured, otherwise the device would be partly or entirely damaged.**
⚠ Attention	**If ignore this symbol, it may cause human injured or the device damaged.**
Notice	**Although it is not indication of warning, it provide the right method of use and operation in order to avoid error operation.**

Example of the symbol

⚠	**Indicating the contents of danger, warning and attention, which are illustrated on the corresponding area.**

- **Warning and Attention**
- Precaution of using thermal paper
  - ✧ Don't exposure thermal paper under the direct sunshine and high temperature.
  - ✧ Don't put into the fluorescence light for a long time.
  - ✧ Don't store thermal paper with PVC.
  - ✧ Don't pile up thermal paper in long period to avoid waveform transfer.
- Notice for device symbol
  - ✧ Don't rip all the icons on the ECG-213 device.
  - ✧ All the icons provide the important information for safety and right operation. Moving or ripping the icons will not ensure to use properly, which may cause danger.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

1.3 Manufacturer illustration

As a specialized manufacturer of production and sale medical electronics, Shenzhen Bestman Instrument Co.,Ltd takes every effort, is dedicating on the precise security and reliability for each device. In order to ensure the reliable operation of the medical device, the user of ECG-213 must take the responsibilities to guarantee the details as follows:

1. For the sake of guarantee the safety of the device, maintenance, repair and replacing the accessories should be operated by our company staff or the person who we have trained.
2. This unit only use or replace the accessories we recommend, which is the requirement for the safety of the device.
3. Insure to use the proper voltage and frequency according to the demand of the icons.
4. The device only can be used according to the user manual, and other purpose cannot be satisfied.
5. Expect the easily broken accessories such as electrode, batteries, we guarantee the main unit for 3 years, in the first year it is repaired for free charge, and maintain the unit during the life time.
6. All the technical data (circuit diagram, list of components etc.) only are provided to the specialized staff that passed our technical training. For improving the technique, we will not notice in advance, and apologize to cause your inconvenience.

1.4 Design and structure

ECG-213 device strictly follows the standardIEC60601-1 that is the electromagnetism compatibility of medical equipment, corresponding to Type CF, Class I.

✧ Preventive maintenance

For the sake of operating the device in the safety to avoid the problems which may occur during application, it is necessary to take preventive maintenance. Normally, adopting the method of preventive maintenance described in the ECG-213 manual. Test the device once a year or according to the requirement of corresponding organizations. Before using the device, once any of the following physical hazards occur, the device must be maintained immediately:

- If the device is exposed to excessive impact, such as heavy fall;
- If solid or liquid falls onto the device;
- The device cannot work normally or work abnormally during operation;
- The shell of the device is partly or entirely damaged;
- If lead cable or power cable or connecting cable is damaged.

✧ Current leakage

The lead cable, amplifier, power supply and fixing components are isolated with ground end of the device, which we called isolating (floating) application part. The purpose of isolating (floating) application part is guaranteeing that the current passes patient less than 10μA.

⚠ **Attention**	**For sake of the patient's safety, please the electrodes connected with the body of patient and other unconnected electrodes don't touch electric conducting products, for example, your hands don't touch the ground.**

⚠ **Attention**	**Connected with other equipments increases leakage current may cause latent danger, please strictly operate according to the requirements. Connect with our company if necessary.**

	While using synchronously with cardiac pacemaker and other electric stimulator, these equipments occur baleful current, should adopting

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

⚠ Attention	**necessary measures to reduce the influence on the diagnosis which are resulted from these devices.**

⚠ Attention	**If non-isolating signal enters from external input, the end of this signal is not connected with protection ground, it will cause malfunction because of difference of is potential point.**
⚠ Attention	**Only the devices under IEC 60601-1 Type I can be connected with the input and output port of this device, please consult to the technical staff if necessary.**

✧ Explosion-proof requirements

⚠ Danger	**Don't use ECG-213 device in the presence of inflammable gas and flammable gas such as anesthesia gas, oxygen, hydrogen, otherwise may be caused explosion and fire hazard.**

✧ Magnetic resonance interference

⚠ Danger	**Don't use ECG-213 device during magnetic resonance imaging. Magnetic conduction can lead burning. ECG-213 device can interfere magnetic resonance equipments meanwhile can be interfered by magnetic resonance equipments.**

✧ Defibrillation protection

Don't touch the device during defibrillation, which may cause electric short circuit for the patient and operator.

When the device is used synchronously with defibrillator, to avoid danger, please confirm the sort of lead cable, electrode fixing condition, and sort of electro cardio-electrodes, conductive gel used for defibrillator and the output energy of defibrillator. Besides, please confirm whether other devices are connected with ground.

1.5 Icons for safety

ECG-213 device have the icons of danger, warning and notice to be pasted, casted on areas easy to see or the areas for using the device.

⚠ **Danger—have explosion hazard while using in the environment contained flammable chemical products.**

⚠ **Warning—please change insurance according to icons to avoid fire**

⚠ **Attention—for decreasing danger of electric shock, please don't open rear cover. Please request help to related service staff if**

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

1.6 Explanation of the symbols

AC power supply


Battery volume


Being recharged


Iso-potential point


Power switch off

Power switch on


Remarks for special attention (see operating instructions for details)


RE 232 port


Output of the analog signal


Input of the analog signal


Type CF equipment equipped with protector against defibrillation


Be careful


Environment: +5℃—+40℃


Waterproof



Up not more than 4 floors

SN Manufacture’s serial number

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice



Waste Electrical and Electronic Equipment

Directive 2002/96/EC –WEEE Directive

1.7 Precautions

- For the sake of improving the quality of product, specifications and design is subject to change without notice.
- AC power cable must be connected to medical three-cord electrical outlet. Using the power cable in the accessories to connect with medical three-cord electrical outlet can insure gounding reliably. Please use suitable sockets which can supply sufficient power to load for this device.
- Upgrading the procedure and maintenance should be operated by our technical staff, error operation may occur error. User doesn't do it without allowance.
- All the accessories must be used the appointed ones. If use other accessories, maybe cannot correspond to the device properly.
- Don't open the shell of the device.
- Must switch off the power while doing connection.
- Don't leak any liquid such as alcohol to the internal of the device and socket.
- Don't use any abstergent and dilution containing organic liquid, methyl benzene, gasoline etc., which is harmful to the BAL shell.
- Don't scrape shell with grinding ointment and chemical detergent.
- Don't touch input signal connector and output signal connector simultaneously, for example RS-232 and patient isn't allowed to touch at the same time.
- Don't apply vapor sterilization to the device and accessories. Don't sterilize with high-temperature or γ-Ray or apply electrical beam.
- While using sprayer of physic liquor to sterilize, please don't spray the liquid to the internal device and socket.
- Don't install the device near to the interfere source such as wireless transistor, hypercator, mobile phone or wireless telephone. Otherwise, the interference will impact on the device.
- After effective life time is over, please deal with the device according to the local law or return to the manufacturer for recycle in order to protect environment.
- **Pay attention to the following ECG measurement and interpretations:**
  (1) AC/EMG Interference might cause mistakes in reading P Wave and Q Wave; baseline drift might cause misunderstanding in reading ST Segment and T Wave.
  (2) Measuring error might occur due to blur endings of S wave and T Wave.
  (3) Low voltage of QRS might cause the measurement result of HR not reliable.
  (4) Low voltage of QRS might cause the ECG coordinate axes calculation or QRS not reliable.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

(5) With frequent ventricular systole, at accidental situation, will be inspected out as heartbeat.

(6) Multi arrhythmia might make it difficult to recognize P Wave and the relative parameters might be unreliable.

(7) **This device has self-interpretation function, which only analyze automatically the obtaining ECG trace, but don't reflect on all the conditions of patient. Maybe the analyzing result is different with the diagnosis by doctor, so the final conclusion must be made out by doctor to combine with patient clinic data and other analysis result.**

- **Precautions for using electrode**
  - Whether clean the axunge on the skin of patient (where connect with electrodes) and wipe conductive gel on it.
  - When electrodes are sterilized and disinfected, please use cotton cloth to wipe and clean with medical alcohol or Glutamyl acetaldehyde disinfection.
  - If the electrodes are too dirty to clean, please use emery-paper to abrade gently, and repeat the above disinfecting method.
  - Whether the assembly of electrodes is loose. If it is too loose, please clamp closer.
  - Whether mix to use together different sorts of electrodes.
  - While the device is used synchronously with defibrillator, there will be super-voltage resulted from defibrillation which causes polarized voltage on the electrodes, so it can't measure in several seconds.
- **Precaution for cable lines**
  - Please use ECG cable line assembled with device.(or the accessories our factory provide)
  - Please use three-cord power line assembled with device, which can connect to the three-cord socket and realize grounding well.
  - When the device is used synchronously with defibrillator, please make sure to use the patient Cable. line which we assembled with defibrillating function.
  - Please check whether the connection of patient cable is loose or not.
  - Please notice whether patient cable is too closed to power cord during measuring. Please check whether the connection between each patient cable end and corresponding electrode is right or not.
  - Periodic inspect patient cable, and clean and disinfect it if it is necessary. Please use cotton with medical alcohol wipe gently, don't drag forcibly patient cable.
- **Precaution for rechargeable batteries**
  - The batteries built in the device are rechargeable batteries specialized for ECG-213.Please don't use for other equipments. Otherwise, maybe cause batteries to weep heat or rupture.
  - Don't throw the batteries into fire.
  - Don't weld directly the batteries to the device.
  - Don't disassemble and reconstruct battery. There is protecting circuit in the batteries to avoid danger. Maybe cause batteries weep or rupture after it is damaged.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

- Batteries contain the structure for discharging internal waste gas, which must be not obstructed, otherwise, will damage of batteries.
- The liquid of batteries is harmful for your eyes. When it is splashed into your eyes, don't knead or wipe, please clean with water and see a doctor immediately.
- Don't contact metal to the "+""-"polar of battery.
- Don't flake or scrape the shell of batteries.
- During charging, the process of charging isn't finish but exceeds rated charging time; please switch off AC power in time. Otherwise the batteries will heat severely until damage.
- Internal liquid of batteries is rubbed to skin, which may cause burn, please clean with cleaner immediately.
- Don't use or put battery in homeothermic places. Otherwise may cause battery weep, decrease life time and function.
- Don't immerge battery into water, and moisten with medical liquid. Otherwise maybe cause battery heat or go moldy.
- If any abnormality is found during using battery, please stop using immediately.
- Don't store battery in the places out of touch by children.
- Don't impact strongly or throw battery.
- While battery is not used for a long period, please switch off the device, and pull out power cable from socket.
- Please paste isolated belt on the ends and connection cable of scrap battery, and hand in them to our service staff to deal with.

2. Summary

ECG-213 electrocardiograph is electrical device, which is mainly designed to record physiological electrical signal, resulted from activities of cordis and analyze rhythm and configuration for clinic diagnose and research.

2.1 Features

Digital isolation technology for minimizing component drifts v/s time& temperature to guarantee high-adaptability of the equipment to the environment.

Digital signal processor for effective inhibition of baseline drift, AC interference filter, EMG interference filter and the heart rate, to guarantee the authenticity and dependability.

Auto-regulation of baseline drift can effectively inhibit baseline drift, optimizing the printing position to achieve high-quality ECG.

Have regular automatically measuring and analyzing function for ECG parameters to lessen doctor's load.

With a high –resolution thermal printer to print out ECG trace, describing the trace clear and accurate, annotation as well as related parameters for diagnostic reference.

Roll recording paper for ECG-213 is 80mm in width, simultaneous 12 lead acquisitions and 3 lead live record, high affectivity of ECG examination, good effect and economic utility.

Function of rhythm lead for observing abnormal ECG trace & heart rate.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

Supported by AC/Rechargeable battery for continuous examination whenever necessary. For Battery operation, ECG-213 is equipped with a battery charger and a system for battery capacity management and protection.

Safety level for ECG-213 corresponds to Type CF, Class I according to the IEC60601-1 criterion. The amplifier is floating input circuit which can examine human cordis directly with safety and reliability.

Compact structure and nice appearance.

2.2 safety classification

- Shock proof type :Class I, internal power device
- Shock proof degree : CF device
- Anti-splash degree :common device
- Safety degree used in the presence of atmosphere(or oxygen, lachgas)mixed with flammable anesthesia gas: not suitable to be used in the presence of atmosphere(or oxygen, lachgas)mixed with flammable anesthesia gas
- Work mode: continuous working device

3. components and functions

3.1 Name of components

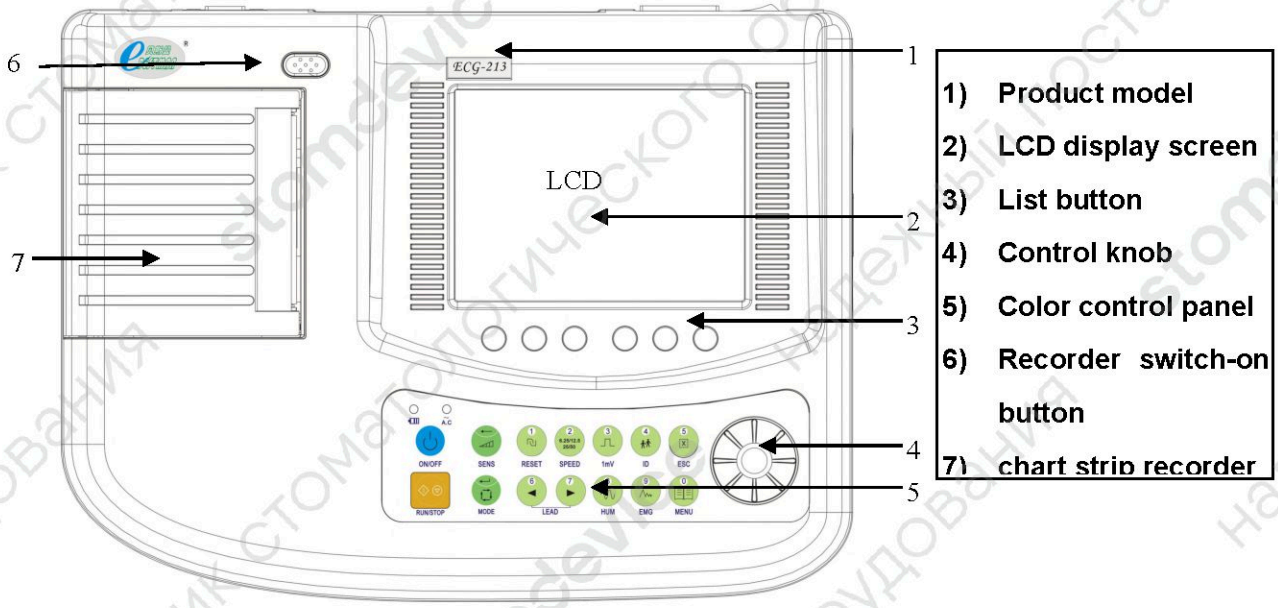
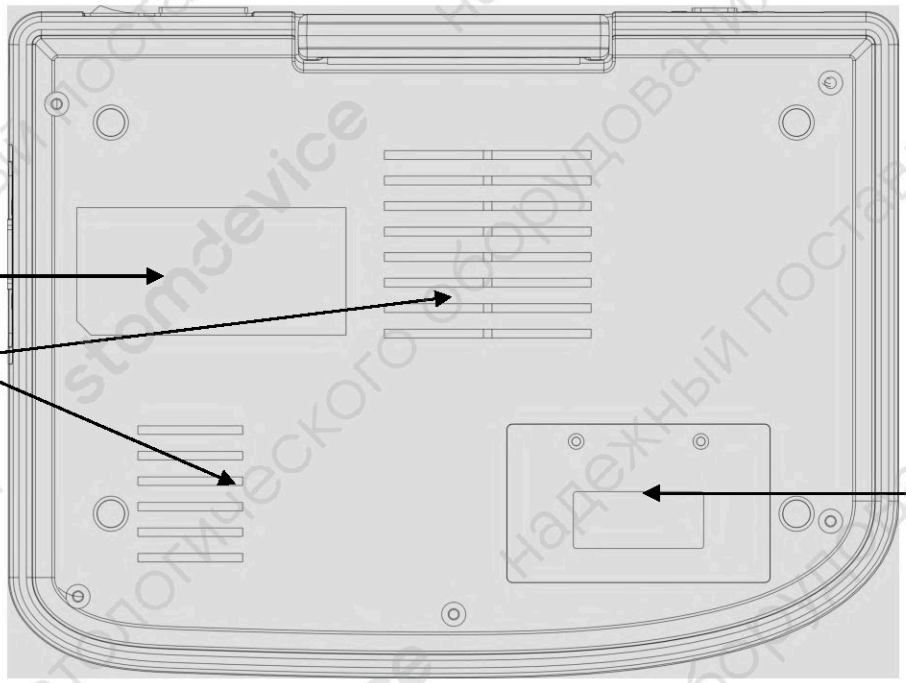


Fig. 1 top panel

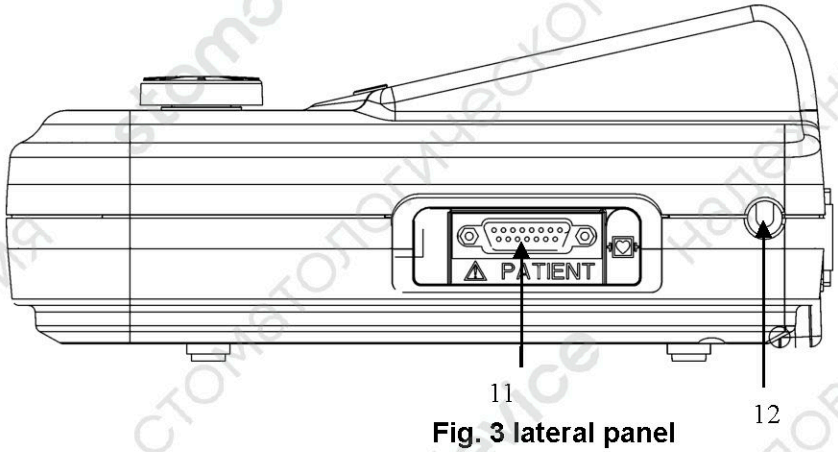
https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice



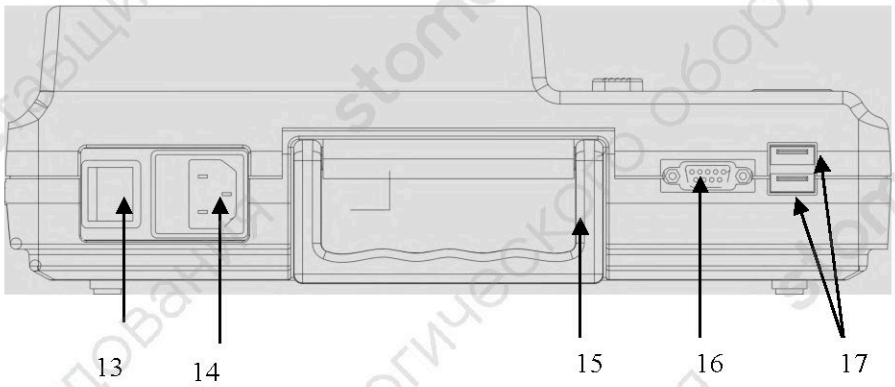
8.bottom label
9.thermovent
10.battery cabinet

Fig. 2 bottom panel



11. patient cable interface
12. grounding end

Fig. 3 lateral panel



13. power switch
14. power socket and fuse peg
15. handle
16. Signal in/out and RE232 interface
17. USB interface

Fig. 4 rear panel

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

1) Product model
2) Display screen: LCD display live record mode, lead, sensitivity, HR, filter etc. are all displayed on the screen.
3) List button
4) Control knob
5) Color control panel
6) Recorder switch-on button
7) Chart strip recorder: enclosed with recorder for printing our ECG trace and character
8) Bottom label
9) Thermovent
10) Battery cabinet: built-in rechargeable battery

⚠ Warning

The batteries built in the device are rechargeable batteries specialized for ECG-213.please refer to related illumination before operation. Please don't use for other equipments. Otherwise, maybe cause batteries to weep heat or rupture.

11) Patient cable interface：connect with patient cable
12) Grounding end
13) Power switch
14) Power socket and fuse peg: input AC voltage and install fuse

⚠Warning

The fuse built in the device is specialized for ECG-213.please refers to related illumination before operation. Please don't use other fuse.

15) Handle: convenient to carry device
16) Signal in/out and RS 232 interface
    * Input and record pulse wave, heartbeat etc. external signal
    * Output electrocardio signal to other oscillograph or other equipment (choose output of)

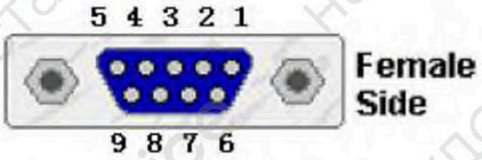
    The pin/Signal definition:

    ① Ext. Output：1V/mV（±5％）

    ② RS232 SEND (optional)

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice



③ RS232 RECEIVE (optional)

⑤ RS232 Common (optional)

⑨ Ext. Input：10mm/V（±5%）

17）LAN/USB interface (optional)

Notification: RS232 and USB interface is optional accessory.

Input method

1）operate by touch screen

Press the corresponding button according to the indication of screen.

If improper fix position of touch screen results in improper Click, and enter the adjustable interface of touch screen of system setup by other ways to adjust the touch screen renewedly.

Note: because the touch screen belongs to shock resistance technical grade, please operate by high pressure, and the light pressure will result in operation mistake.

Please do not use sharp objects to operate, otherwise the surface of screen will be scrathed

Do not use abundant liquid to clean the surface of screen,otherwise, the liquid to permeate the gap will damage the circuit.

2）Operate by manu

The funtion of manu button in the different manu is indicated in the bottom side of screen, and the function corresponds with touch buttons.

3）Operate by code knob

Rotate the code knob toward the left to select the fowarder item of selected button on the screen, and to toward the right to select the backward item of selected button.

Press down to confirm

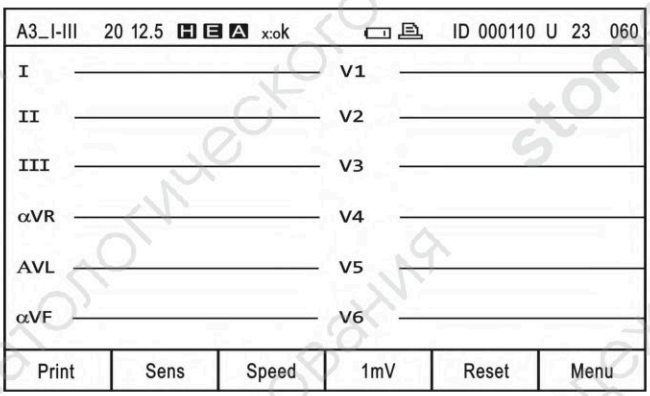
Note: It can't accelerate the selection speed to rotate the code knob fleetly

4）Operate by color keyboard

Frequently-used operation can be operated by color keyboard to browse fleetly, and it needn't to enter manu selection.

3.2 Content on LCD as follows

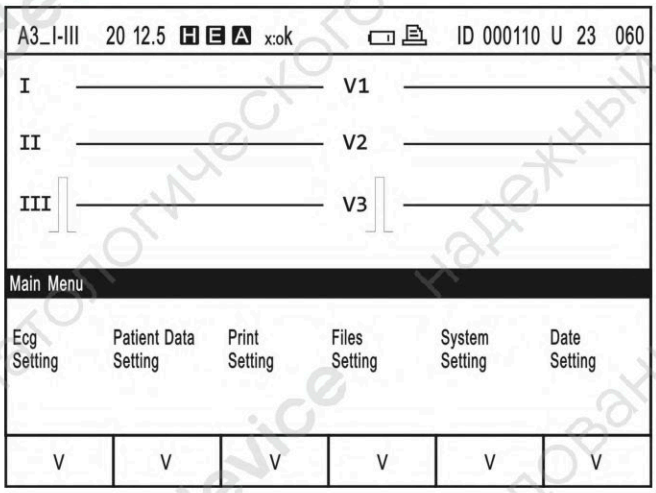
Display on LCD is as follows after power on：



https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

The interface is divided three parts: title bar,lead display and menu bar.
Title bar discription:

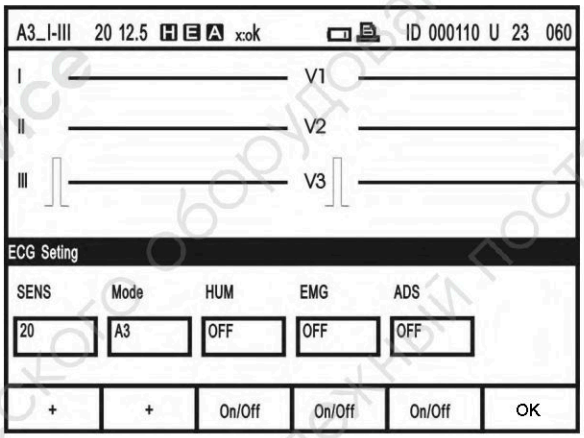
A3： mode A3: Standard three channels; M3: Manual three channels
I-III： lead sequence Select the leads which need to be printed with four groups in total, including I II III ， aVR aVL aVF,V1 V2 V3 and V4 V5 V6
20 sensitivity
12.5： velocity
H-E-A： filter display
x:ok ： patient cable display
： battery icon
： print icon
ID 000110: ID
U gender
23： age
060： heart beat
lead display
I--V6： total 12 traces
Menu bar Print Sens Speed 1mV Reset Menu
1）Press “ESC” of color keyboard to exit all the manu
2）Press menu to enter menu setup



ECG Setting: Includes detailed settings with ECG ralated parameters
Patient Setting: Includes detailed settings about patient information
Print Setting: Includes print related settings
File Setting: Includes detailed settings of data file
System Setting: Includes detailed settings like language selection
Time Setting: Setup system date and time

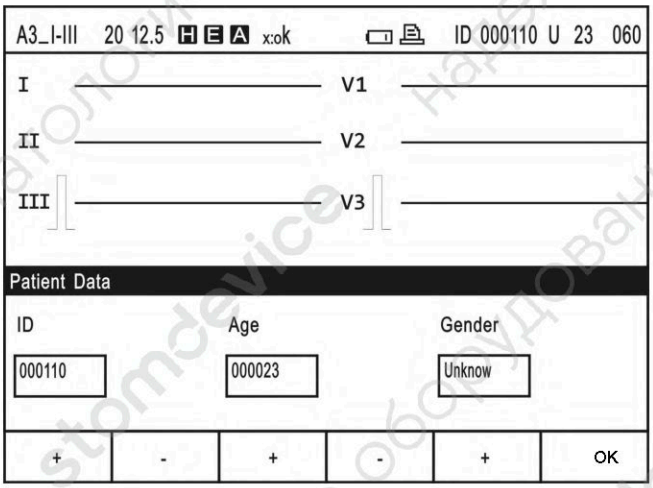
https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

3）ECG can be set as follows:



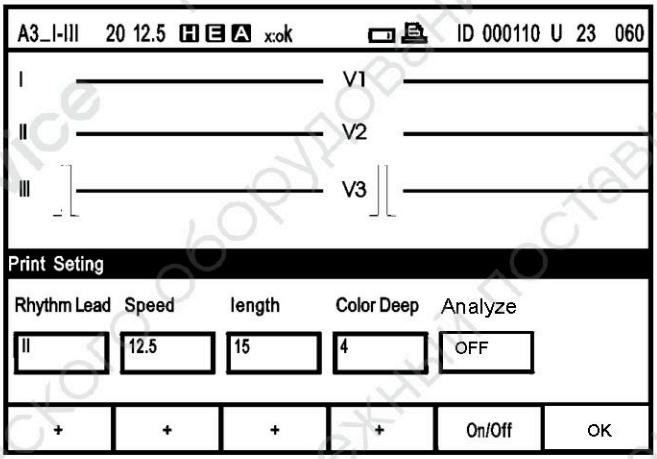
SENS Selection， 2.5、5、10、20 four kinds of sensitivity for option
Mode Selection: A3、M3 two kinds for option
EMG: On and Off for option
HUM: AC filter
ADS:Baseline filter
QRS Beep :Heart rate sound

4）Patient setup
ID: Patient number from 000001 to 999999
Age
Gender :Male, Female,Unisex



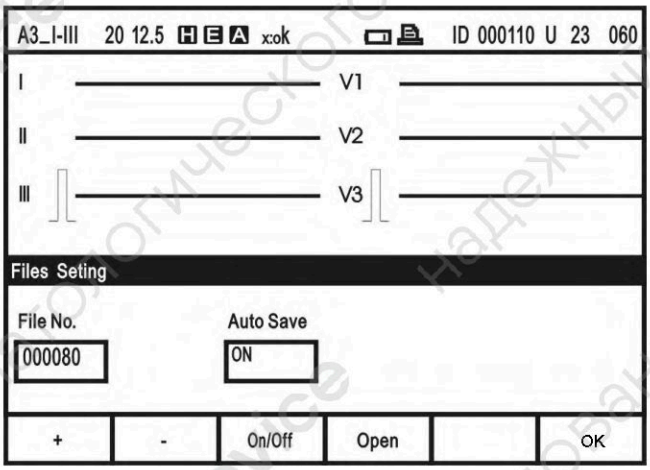
https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

5） Printing speed settings

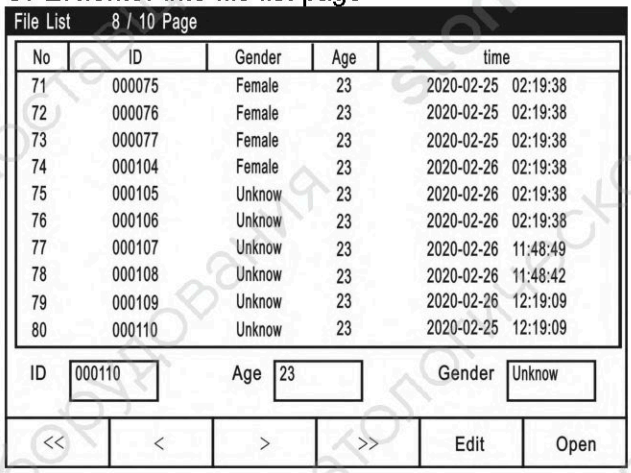


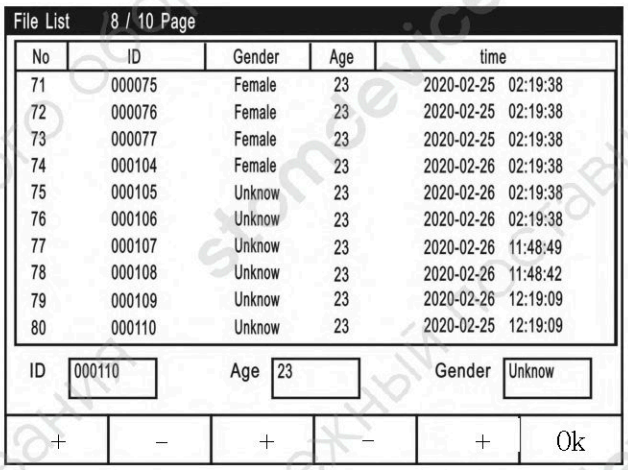
Rhythm Lead ： I、II、III、aVR、aVL、aVF、V1、V2、V3、V4、V5、V6 totally 12 leads;
Printing speed： 6.25cm/min、12.5 cm/min、25 cm/min、50 cm/min
Printing length ： 1.5s、3s、5s 、10s
Color Deep : 1、2、3、4、5
Report: “on” and “ off” are selectable, choose whether to print a report prompt at the end of printing
Analysis: “on” and “ off” are selectable, choose whether to open analysis function

6） File settings



File No. ： from 000001-999999
Auto Save : OFF/ON
OPEN:enter into file list page

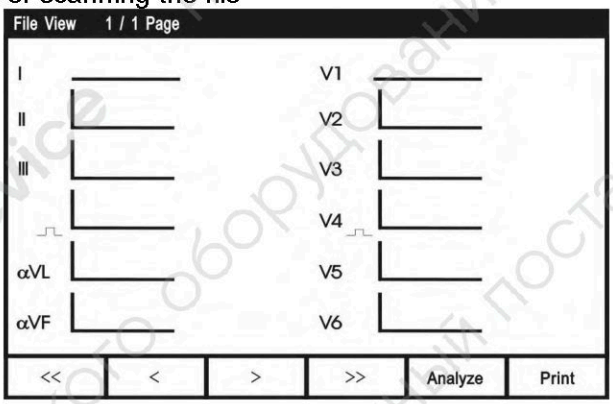




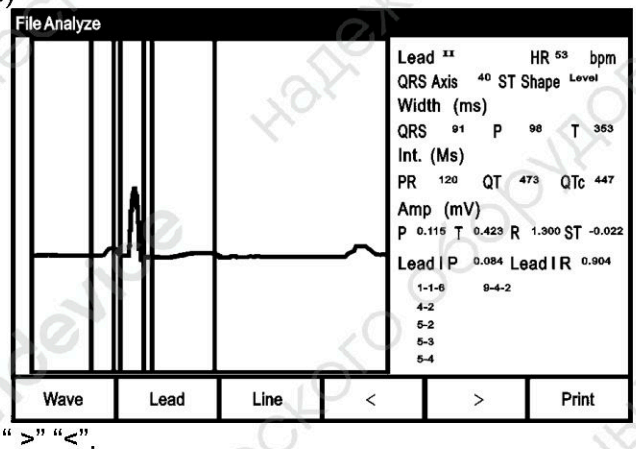
Edit：

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

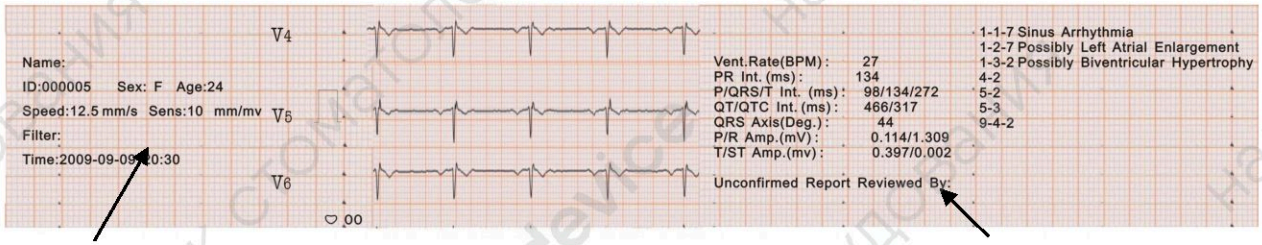
Open: enter into the page of scanning the file



Analysis: (enter next page)



curve: Adjust the curve by " >" "<".
Leads: switch different leads
Analysis curve: Adjust the curve by " >" "<".
Print: the display of with analysis and without analysis result is showed as below:

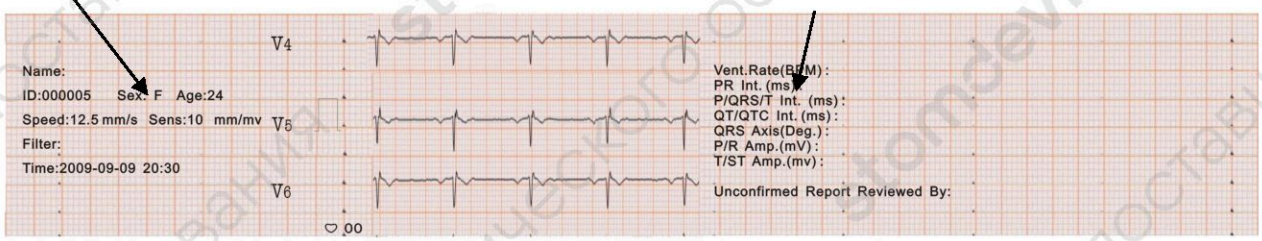


Patient's information

With analysis display

automatic analysis

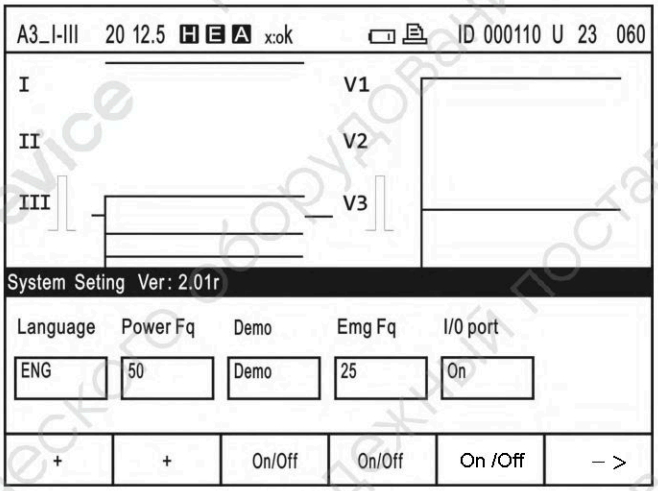
analysis by doctor

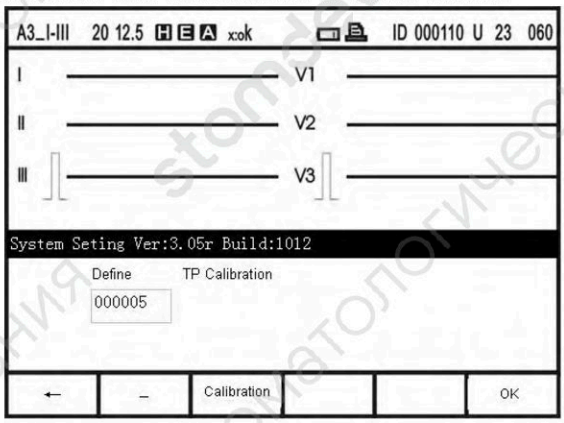


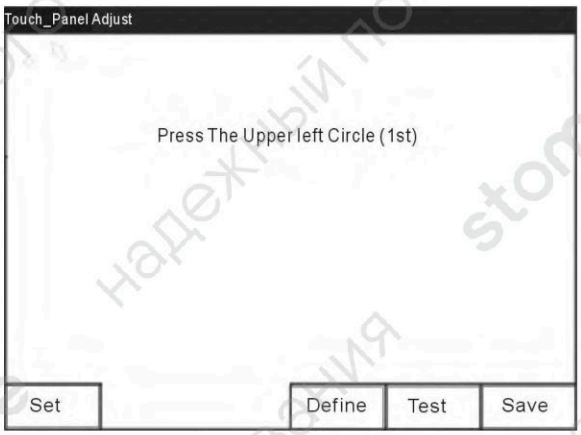
Without analysis result display

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

7） System settings

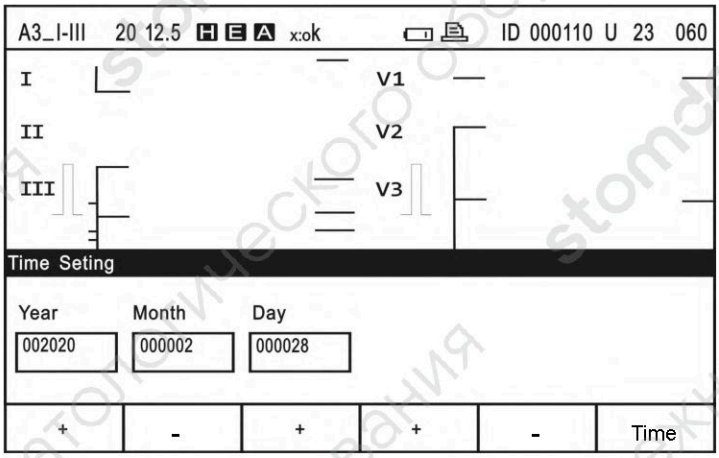






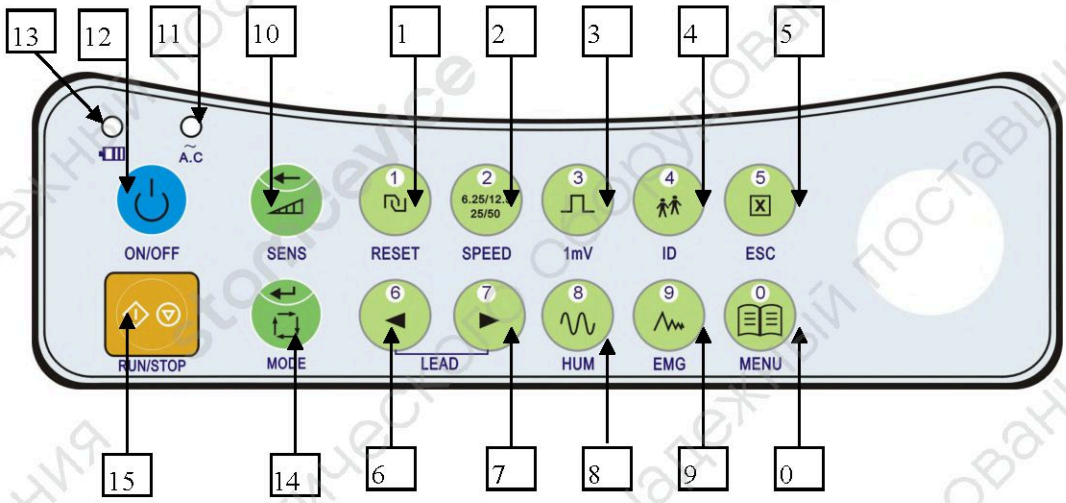
set:complete emendation
define:renew to default value of emendation
test: test effects of emendation
save:save value of emendation

8） Time settings



https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

3.3 Content on color keyboard as follows



1）MENU set key

Used to enter status setup menu to set the unit status, it can work when recorder stops, unworkable when stars recorder.

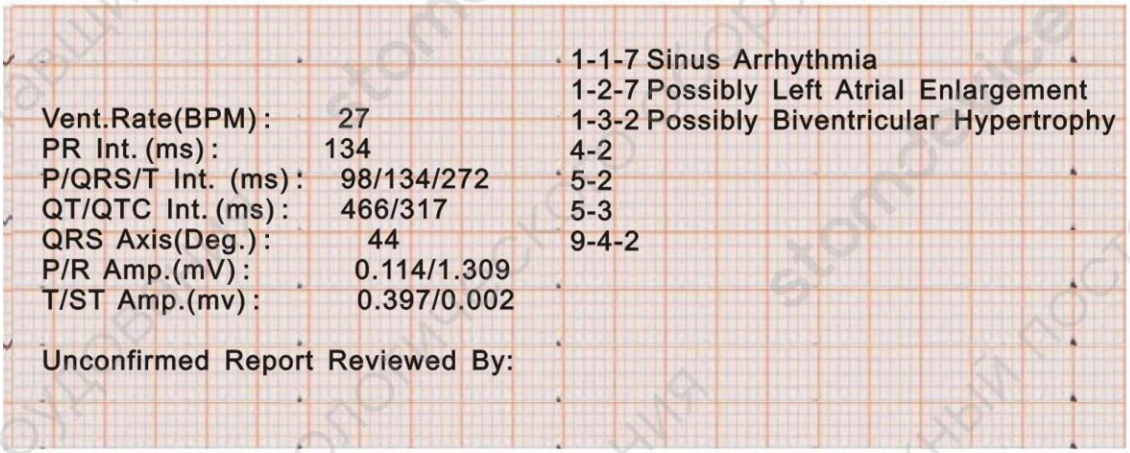
First time to open this machine, the LCD displays the factory's preset status. All the status set before switching off the device, it will not disappear after switching off.Once every operation, the device wll automatically resume the original status of last time set, so no need to reset. All the options can be changed according to MENU coordinated with other four keys. Setting method is as follows:

Press MENU under the status of without using recorder, LCD displays status setting table. Select "►" to move to the item that needs to set through "▲"and"▼"on the control panel., it is used to change the setting items for the "►"and"◄" on control panel. It can decrease the numerical value when pressing "►" in regard to numerical value settings, vice versa. If you need to resume the original state preset by factory, choose "reset to default configuration"

Analytic result output option： The device can be automatically analyzed through MEN setting but nonsupport manual mode.

Printed graphic sample of automatically analytic result is as follows:

Detailed ECG category please see appendix C



https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

1） RESET

Press this key to seal off leads, and the corresponding waveform will become a line. In the actual operation of ECG, Sometimes, press this key can quickly reset to zero because of the unsteady

> ⚠ **Notice：When polarizing voltage is too high, it may indicate the load is too much, this time should check the leads and patient's skin, and do keratinization treatment to the skin if necessary.**

baseline caused by excursion. After sealing off the baseline, press again this key to terminate sealing off. The LCD displays "OVER" if the device appears overload, it will quickly terminate the sealing off function of the baseline.

2）SELECT Key of printing speed

Use to change recording speed of ECG waveform.

3）1mV mark：

Use to print 1mV mark waveform under the recording state in order to learn the present sensitivity. Each press can print one marking waveform.

4）Patient No

5）Menu exit

6）Lead backward switch/Status setup key（◄）：

- Change menu setup value under setup status;
- Transform leads backwards under recording status;
- A3（ Standard three trace auto mode）

  Ⅰ-Ⅱ-Ⅲ→aVR-aVL-aVF→V1-V2-V3→V4-V5-V6→ Ⅰ-Ⅱ-Ⅲ→……

7） Leads forward switch/ status set（►）：

- Change menu set value under setup status;
- Transform leads forward under recording status, the leads transforming sequence is contrast to the backward transforming key under all recording mode.

Notice:

While pressing the button, the buzzer sounds "bee---",that means input is accepted, and then the display will be changed normally, otherwise the buzzer sounds "bee--""bee--"twice, it means input isn't accepted, normally it caused by pressing wrong button.

⚠	**Don't use rigid object (e.g. penpoint) for pressing operation, otherwise the surface of panel might be damaged permanently!**

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

8) HUM
9) EMG(FILTER)
10) Sensitivity（SEN）

Setup it when the record stops. This is a recycling key among 2.5, 5, 10, 20, which 2.5 stands for 2.5mm/mV, 5 stands for 5mm/mV, 10 stands for 10mm/mV，20 stands for 20mm/mV. The *5/*10/*20's appearance means that the device chooses a right sensitivity automatically according to the range of the input signal.

11) A/C indicator

12) ON/OFF

Being used for power switch on and charging in standby condition. When the unit is electrifying and the power-switch on the rear is on, this button can realize to convert the conditions between switch on and standby.

13) Charge indicator

This light is orange while charging, and change to green in full power.

14) Recording mode

Transform from two kinds of recording mode: automatic and manual. The button is not affected during recording.

(a) M3: manual three leads

(b) A3: standard three leads

15) Start/stop button: In all kinds of recording mode, it is used to start or stop to record ECG track.

4. Operation preparation

4.1Connect to power

Connect to AC power

⚠Notice

- **When ECG-213 is used in combination with other equipment, you are required to connect the grounding cable together with that of the other so as to protect the patient from possible shock.**
- **The grounding cable must be connected between grounding post of the device and the earth. It is not permitted to connect the grounding cable between a pipe and the grounding post. Otherwise, the first safety measurement of device is invalid, which may cause danger of electric shock by patient**
- **When there is problem on grounding cable or unstable AC power, please use built-in battery to supply power, in order to decrease danger and interference.**
- **Please preheat 5 minutes before testing**

Insert one end of the 3-cord power cable into the device and the other end into the power socket in wall. Then bridge the grounding cable between the grounding terminal of the device and ground.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

4.2 Paper loading

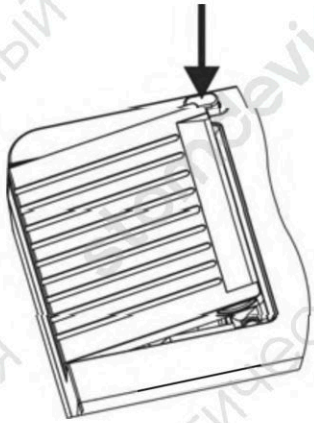


Fig. 1

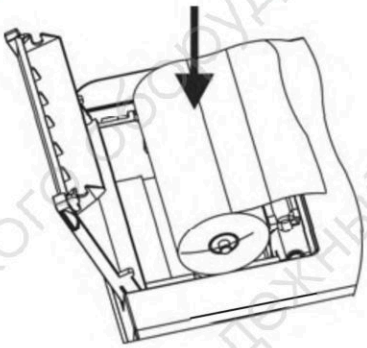


Fig. 2

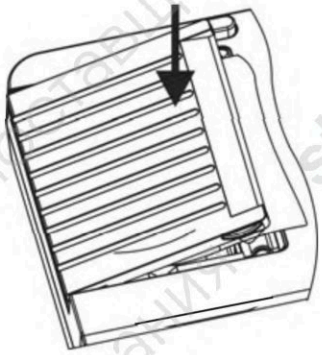


Fig.3

Step 1: According to fig.1, Push the tray along the arrow pointed direction to pop up the paper cabinet cover. And take out paper axis (see fig.1)

Step 2: Insert the paper axis into the roll paper and pull out about 10cm of the paper and put it into the cabinet along the arrow poited direction. (See fig.2)

Step 3: Cover the paper cabinet. (See fig.3)

- The recording paper applied to the device is 80mm three channel roll thermal paper.
- Cover the paper cabinet, and leave the beginning of paper.
- Make the square side downward。

⚠Notice

If LCD screen shows like this：

```
No Paper ! !
Please check Paper!!
```

Means there's no paper or the paper is not set properly, and the device can't record. The device will go back to the working condition automatically after insert the paper according to the above method.

4.3 Connection of patient cable

Connection of patient cable is involved whether record ECG is accurate or not. Please ensure to connect the patient cable well. New and old electrodes or reusable and disposable electrodes can't be used synchronously. Different type of electrodes can't be used together, which will have great influence on ECG record. Electrodes or cable plug can't touch other surface or conductor, such as metal bed. Renovate all the electrodes together.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

(1). Placement of limb electrodes

Clean all the limb electrodes, patient limbs and where the electrodes are to be attached with alcohol and then apply some ECG cream to the positions to ensure good contact. Firmly attach the electrodes to the positions as right illustration.

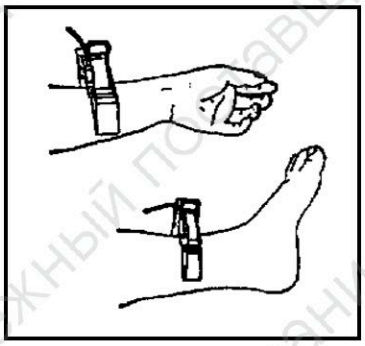
R(RA) for right arm

L(LA) for left arm

RF(RL) for right leg

F(LL) for left leg

It shows as the right picture:



(2). Placement of chest electrodes

Clean all the chest electrodes and the chest skin with alcohol and apply some ECG cream to the edge of chest electrodes and the positions where the electrodes are to be attached, it is range about φ25mm.

Press the sucking ball of electrodes, and attach the electrodes to V1~V6 positions.

The positions of V1~V6 are as follows:

V1: Fourth inter-costal space at right border of sternum.

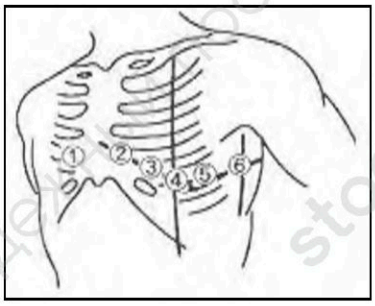
V2: Fourth inter-costal space at left border of sternum.

V3: Midway between V2 and V4.

V4: Fifth inter-costal space at left mid-clavicles line.

V5: Left anterior axillary line at the horizontal lever of V4.

V6: Left mid-axillary line at the horizontal lever of V4.



⚠Attention

Tangling of electrodes or overlap from one place to another of ECG cream is not allowed to avoid short circuit. If there is no ECG scream, inspecting ECG can be used 75% alcohol to clean each electrodes, and connect the electrodes to related position immediately to ensure that the attached skin is wet. Don't use normal saline instead of ECG scream to avoid rusting electrodes.

⚠Attention

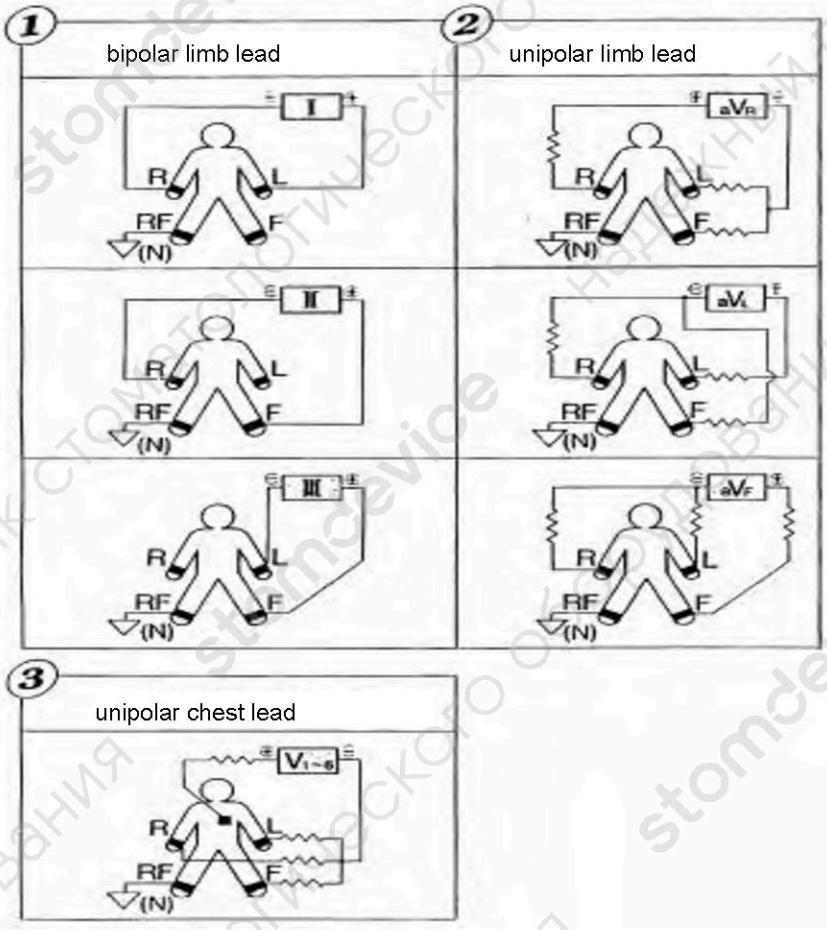
Patient cable plug should be screwed down to insert to the

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

(3). Electrode connection definitions and color code

Electrode Location	Electrode Code	Line Color	Electrode Color	Socket Number
Right arm	R	Black	Red	9
Left arm	L	Black	Yellow	10
Right leg	RF	Black	Black	14
Left leg	F	Black	Green	11
Chest	V1(C1)	White	Red	12
	V2(C2)	White	Yellow	1
	V3(C3)	White	Green	2
	V4(C4)	White	Brown	3
	V5(C5)	White	Black	4
	V6(C6)	White	Purple	5

(4) ECG lead and structure



https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

5. Daily maintenance

5.1 Battery charging, capacity indicator and replacement

ECG-213 device is built in rechargeable battery to realize AC/DC operation. The illustration on charging, indicating capacity and replacement are as follows:

- Charging battery

  ECG-213 device is designed with a charger and protector for the rechargeable battery. While supported by AC power, the unit is able to charge the battery provided that the power switch turns to ON the rear panel. It is required to charge & discharge the battery at least every 3 months, and device is in spare condition. Charging indicator will blink while charging, and keep in light when charging is completed.

- Capacity indicator

  Whenever the machine is powered by DC battery, there will be a prompt, in the middle of first line on the LCD screen, to indicate battery capacity as follows.


Sufficient battery capacity


Insufficient battery capacity, charging is required.


Battery capacity is running out, immediate charging is demanded.

- Battery replacement

  Battery replacement shall be carried out by a service engineer as follows.

  a. Power switches off and disconnects power cable.

  b. According to the bottom figure of device, open the cover of battery cabinet.

  c. Pull out the plug of battery and remove the damaged battery.

  d. Replace the battery with a new one and plug in the battery socket to connect well.

  e. Reassemble the instrument.

Notice:

- Don't connect directly anode and cathode of the battery with lead otherwise may cause fire hazard.
- Don't put battery near to open fire, otherwise may cause explosion hazard.
- Don't disassemble battery without allowance.
- Please take and put battery gently, don't fall it to the ground or strike on other items.

5.2 Recording paper

For the sake of recording quality of ECG trace, please use the recommended or provided thermal paper. If purchase other thermal paper, maybe shorten the life time of thermal lattice printing head, cause recording trace to blur, or bad paper running.

Please do notice!

a. Avoid use of grayish and blackish paper or with wax; otherwise may cause printer head damaged.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

b. High temperature, high humidity and direct sunshine will cause paper color to change. Please keep the paper in a dry and cool place;

c. Do not expose the paper in fluorescent light for a long time, otherwise will have influence on recording quality.

d. Do not store the paper with PVC to avoid color change;

e. Do not pile up the recorded paper for a long time to avoid waveform transfer.

f. Please pay highly attention to the specification of recording paper. The thermal lattice printing head or the silicon-rubber axis will damage by the wrong paper.

5.3 Maintenance Following Operation

After using ECG device, please notice:

a. Turn key "ON/OFF" to power off the control panel before turning off the power switch.

b. While pulling out the leads and power cable, please grasp the plug to pull out, don't grasp the cable.

c. Clean the machine as well as accessories and cover the instrument with a shade.

d. Place the device in a dry and shading environment. Vibration in the process of transportation should be avoided.

e. Don't immerse the device into cleaner while cleaning the device, please cut off power supply while cleaning the shell of device. Please use neutral solvent to clean which doesn't contain alcohol or bactericide.

5.4 Patient cable maintenance

- Check the patient cable continuity with a multi-meter. The resistance should be less than 10 ohms.

  Following table is the continuity of the patient cable.

Electrode	R	L	F	RF	C1	C2	C3	C4	C5	C6
Patient Lead	9	10	11	14	12	1	2	3	4	5

  Please periodic inspecting patient cable to keep it well, any piece of the cable is damaged will occur corresponding or all lead to appear false wave. Patient cable can be cleaned with water or soap, or disinfected by 75% alcohol. (Don't immerse patient cable into the liquid).

- Curve or tie patient cable will shorten its life time, please make it in line and then connect with electrodes.
- All the electrodes should be kept well, after being used for a long time, the surface of electrodes will be oxidized to effect on recording the trace, and please renew electrodes.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

5.5 Silicon rubber axis maintenance

Silicon rubber axis should be kept smooth and clean, otherwise will have an influence on the effect of ECG record. Please use clean and soft cotton with few alcohols to clean the smear on the silicon rubber axis along portrait, and rotate to the direction of conveying the recording paper until make it clean.

5.6 Thermal Printer Maintenance

Residue and dirt on the thermal printer could affect the clarity of printing out ECG trace.

To clean the thermal printer, you are required to open the paper magazine and clean the printer with cotton dipped with alcohol. It is not permitted to operate on the printer with a sharp object. Otherwise, permanent damage could be resulted. After the alcohol is volatilized completely, close the cabinet. Thermal printer maintenance should be done at least once a month.

5.7 Fuse Replacement

Switch on AC power, turn on the power switch on the right device, the power indicator doesn't light up and press the ON/OFF button on the control panel but cann't realize boot-strap or the signal of battery is showed like"🔋"after boot-strap . This may be caused by a burnt fuse.

- Disconnect the power cable.,switch off the power .
- Discover the fuse holder with a screw-driver.
- Take out the damaged or burned fuse.
- Install a new fuse before recovering the fuse holder as shown in the following figure.

Notification

If a newly replaced fuse is burnt again, please power off the device and contact our service department or appointed maintenance center.

⚠Attention

Don't use undefined fuse.

Specification of fuse: AC220V±10% 2*Φ5×20mm,T2A/250V AC time lag
AC110V±10% 2*Φ5×20mm,T4A/125V AC time lag

⚠Danger

Please ensure to pull out power cable and then replace fuse.

6. Troubleshooting and solution

6.1 Some lead without waveform

- When the cables are connected well with the patient, the device usually needs several seconds to

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

get ready.Press RESET and start recording after 2~3 seconds to solve the problem.

- Patient cabel is at fault.checking the patient cable according to 5.4,if patient cable breaks down,please connect with our after-sale department or appointed maitenance center.
- Excluded the above cause,the device still exist problem,normally it is resulted from the problem of signal channel, please connect with our after-sale department or appointed maitenance center.

6.2 Vertical broken track of printed waveform

Whenever a printer fault occurs, which manifests itself as not continuous trace on the recording paper; you are required to clean the thermal printer with soft cotton with alcohol. If this action does not work, certain thermal emitting component is probable damaged, and you are required to contact the manufacturer or the local agent for help.

6.3 Control Panel Failure

Control panel failure is probably caused by bad continuity between the panel and the Keyboard Control Module due to transportation or vibration. If a reconnection of the control panel to the Keyboard Control Module does not work, you are required to contact a service engineer.

6.4 AC Interference

In the process of recording ECG trace,there are some interference and apparent wobble of baseline as follows:



Please check the following:

1. Make sure that the unit is properly grounded according to instructions.
2. Check for good electrode attachment and patient cable connection.
3. Check the cleaning of electrode and patient body surface.
4. Make sure that the exam bed is properly grounded.
5. The patient shall not be in touch with the metal parts of the exam bed.
6. The patient shall not be in touch with anybody else.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

7. There shall be no large power electric equipment working nearby.

8. The patient shall put off such things as ring and the like.

Please use AC filter if still exists above-mentioned interference.

6.5 EMG interference

EMG interference may cause irregular wobble of waveform.



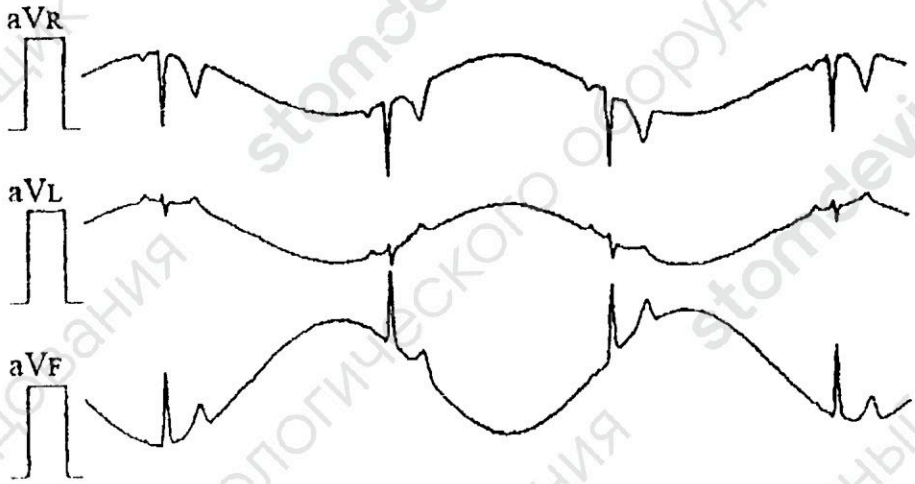
Please check the following:

- Make sure that the exam room is comfortable for examination.
- Soothe the patient from irritation or excitement.
- Make sure the exam bed shall be in suitable size.
- Never have talks with the patient during ECG trace is recorded.

Please apply EMG filter if still exists above-mentioned interference. The waveform will be weakened a little more, which will decline obviously on R wave.

6.6 Baseline drift

There is irregular movement on the baseline of wave, shown as below:



https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

Check the following:

- Verify the electrode attachment and lead wire performance.
- Check the connection between patient cable and electrodes.
- Check the cleaning of electrode and patient body surface.
- Is there enough ECG cream on skin and electrodes?
- Keep the patient from motion or hyperventilation.
- Old electrodes and new ones mixed up

If still exists, Please contact with our service department or appointed maitenance center.

7. Specifications

Main technical specification

Items	specification
Lead	standard 12 leads
lead acquisition	synchronously 12 leads
Input circuit	Floating; Protection circuit against Defibrillator effect
Data acquisition	16 bit/1000Hz
Input Impedance	≥50MΩ
Input circuit current	≤0.1μA
Record mode	Manual mode; AUTO mode
Filter	AC, EMG，Drift Fliter
CMRR	>80dB,>100dB(with AC filter)
Patient current leakage	＜10μA
Voltage tolerance	≥±500mV (sensitive transformation ≤±5%)
Sensitivity valve	≤20μV
Sensitivity	AUTO，2.5，5，10，20mm/mV
Calibrating voltage	1mV±2%
Time constant	≥3.2s
Frequency response	1 ~150Hz(-3db)
Noise level	＜15μV_{p-p}
Inter-Channel Interference	≤0.5mm
Paper speed	6.25、12.5、25、50mm/s(±3%)
Recording mode	Thermal Array printing
Paper specification	80mmx30m paper roll
LCD display	640×480 TFT 5.7” graphic LCD

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

Safety classification	IEC60601-1 class I, type CF
Power supply	AC ： 110~230V (±10 %)，50/60Hz±1Hz；40VA
	DC ： 12V rechargeable NI-MH battery
Fuse	AC220V±10% 2*Φ5×20mm,T2A/250V AC time lag
	AC110V±10% 2*Φ5×20mm,T4A/250V AC time lag

Dimension & Weight

Dimension (L*W*H) 310mm×235mm×66mm

Net weight 3.8kg

Environment requirement

Storage

Temperature -10℃～+40℃

Humidity 30％～80％

Pressure 700hPa~1060hPa

Operation

Temperature +5℃~+40℃

Humidity 25％～95％

Pressure 860hPa~1060hPa

EXT & CRO (if required)

EXT

Input impendence > 100kΩ

Sensitivity 10mm/V (±5%)

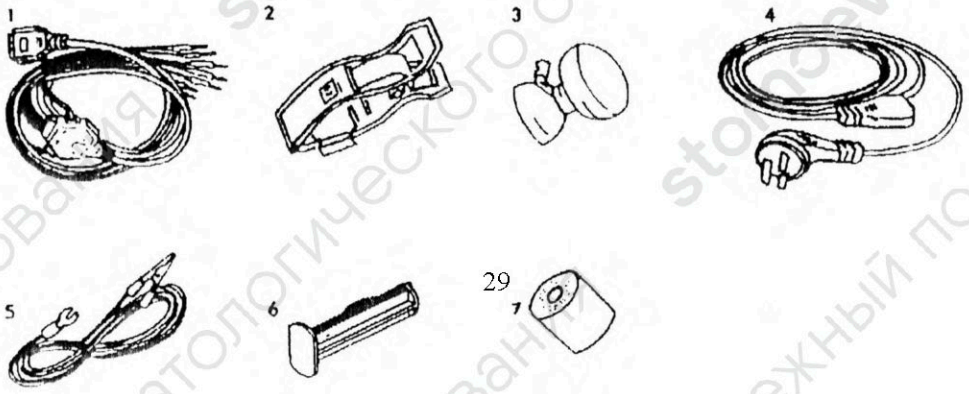
CRO

Output impendence ≤100Ω

Sensitivity 1V/mV (±5%)

8. Accessory List

In order to obtain a good ECG trace, you are required to use the accompanying accessories of this unit. Following is the demonstration of the standard accessories for the unit.



https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

Item	Description	Quantity
1	Patient Cable	1
2	Limb Electrode	4pcs/set
3	Chest Electrode	6pcs/set
4	Three plugged power cable	1
5	Grounding Cable	1
6	Paper Shaft	1
7	Thermal Recording Paper	1

Responsibility of Manufacturer

Shenzhen Bestman Instrument Co.,Ltd. only takes the responsibility on reliability and security of the device under the below conditions:

1. The device is assembled and maintained by the service engineer which is appointed by Shenzhen Bestman Instrument Co.,Ltd.

2. The device is strictly operated according to user manual.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

Appendix A

The Minnesota Code Classification System for Electrocardiographic Findings Q and QS Patterns (Do not code in the presence of WPW code 6-4-1.) To qualify as a Q- or QS-wave, the deflection should be at least 0.1 mV (1 mm in amplitude).

Anterolateral site (leads I, aVL, V6)

1-1-1 Q/R amplitude ratio ≥ 1/3, plus Q duration ≥ 0.03 sec in lead I or V6.
1-1-2 Q duration ≥ 0.04 sec in lead I or V6.
1-1-3 Q duration ≥ 0.04 sec, plus R amplitude ≥ 3 mm in lead aVL.
1-2-1 Q/R amplitude ratio ≥ 1/3, plus Q duration ≥ 0.02 sec and < 0.03 sec in lead I or V6.
1-2-2 Q duration ≥ 0.03 sec and < 0.04 sec in lead I or V6.
1-2-3 QS pattern in lead I. Do not code in the presence of 7-1-1.
1-2-8 Initial R amplitude decreasing to 2 mm or less in every beat (and absence of codes 3-2, 7-1-1, 7-2-1, or 7-3 between V5 and V6. (All beats in lead V5 must have an initial R > 2 mm.)
1-3-1 Q/R amplitude ratio ≥ 1/5 and < 1/3, plus Q duration ≥ 0.02 sec and < 0.03 secin lead I or V6.
1-3-3 Q duration ≥ 0.03 sec and < 0.04 sec, plus R amplitude ≥ 3 mm in lead aVL.

Posterior (inferior) site (leads II, III, aVF)

1-1-1 Q/R amplitude ratio ≥ 1/3, plus Q duration ≥ 0.03 sec in lead II.
1-1-2 Q duration ≥ 0.04 sec in lead II.
1-1-4 Q duration ≥ 0.05 sec in lead III, plus a Q-wave amplitude ≥ 1.0 mm in the majority of beats in lead aVF.
1-1-5 Q duration ≥ 0.05 sec in lead aVF.
1-2-1 Q/R amplitude ratio ≥ 1/3, plus Q duration ≥ 0.02 sec and < 0.03 sec in lead II.
1-2-2 Q duration ≥ 0.03 sec and < 0.04 sec in lead II.
1-2-3 QS pattern in lead II. Do not code in the presence of 7-1-1.
1-2-4 Q duration ≥ 0.04 sec and < 0.05 sec in lead III, plus a Q-wave ≥ 1.0 mm amplitude in the majority of beats in aVF.
1-2-5 Q duration ≥ 0.04 sec and < 0.05 sec in lead aVF.
1-2-6 Q amplitude ≥ 5.0 mm in leads III or aVF.
1-3-1 Q/R amplitude ratio ≥ 1/5 and < 1/3, plus Q duration ≥ 0.02 sec and < 0.03 sec in lead II.
1-3-4 Q duration ≥ 0.03 sec and < 0.04 sec in lead III, plus a Q-wave ≥ 1.0 mm amplitude in the majority of beats in lead aVF.
1-3-5 Q duration ≥ 0.03 sec and < 0.04 sec in lead aVF.
1-3-6 QS pattern in each of leads III and aVF. (Do not code in the presence of 7-1-1.)

Anterior site (leads V1, V2, V3, V4, V5) 1 2 3 4 5

1-1-1 Q/R amplitude ratio ≥ 1/3 plus Q duration ≥ 0.03 sec in any of leads V2, V3, V4, V5.
1-1-2 Q duration ≥ 0.04 sec in any of leads V1, V2, V3, V4, V5.
1-1-6 QS pattern when initial R-wave is present in adjacent lead to the right on the chest, in any of leads V2, V3,V4,V5, V6.
1-1-7 QS pattern in all of leads V1-V4 or V1-V5.
1-2-1 Q/R amplitude ratio ≥ 1/3, plus Q duration ≥ 0.02 sec and < 0.03 sec, in any of leads V2, V3, V4, V5.
1-2-2 Q duration ≥ 0.03 sec and < 0.04 sec in any of leads V2, V3, V4, V5.
1-2-7 QS pattern in all of leads V1, V2, and V3. (Do not code in the presence of 7-1-1).
1-2-8 Initial R amplitude decreasing to 2.0 mm or less in every beat (and absence of codes 3-2, 7-1-1,

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

7-2-1, or 7-3)between any of leads V2 and V3, V3 and V4, or V4 and V5. (All beats in the lead immediately to the right on the chest must have an initial R > 2 mm.)

1-3-1 Q/R amplitude ratio ≥ 1/5 and < 1/3 plus Q duration ≥ 0.02 and < 0.03 sec in any of leads V2, V3, V4, V5.

1-3-2 QS pattern in lead V1 and V2. (Do not code in the presence of 3-1 or 7-1-1.)

QRS Axis Deviation(Do not code in presence of low-voltage QRS, code 9-1, WPW 6-4-1, ventricular conduction defects, or 7-1-1, 7-2-1, and7-4.)

2-1 Left.QRS axis from -300 through -900 in leads I, II, III. (The algebraic sum of major positive and major negative QRS waves must be zero or positive in I, negative in III, and zero or negative in II.)

2-2 Right. QRS axis from +1200 through -1500 in leads I, II, III. (The algebraic sum of major positive and major negative QRS waves must be negative in I, and zero or positive in III, and in I must be one-half or more of that in III.)

2-3 Right (optional code when 2-2 is not present). QRS axis from +900 through +1190 in leads I, II, III. (The algebraic sum of major positive and major negative QRS waves must be zero or negative in I and positive in II and III.)

2-4 Extreme axis deviation (usually S1, S2, S3 pattern). QRS axis from -900 through -1490 in leads I, II, and III(The algebraic sum of major positive and major negative QRS waves must be negative in each of leads I, II, andIII.)

2-5 Indeterminate axis QRS axis approximately 900 from the frontal plane. (The algebraic sum of major positive and major negative QRS waves is zero in each of leads I, II and III, or the information from these three leads is incongruous.)

High Amplitude R Waves

3-1 Left: R amplitude > 26 mm in either V5 or V6, or R amplitude > 20.0 mm in any of leads I, II, III, aVF, or Ramplitude > 12.0 mm in lead aVL. (All criteria measured only on second to last complete normal beat.)

3-2 Right: R amplitude ≥ 5.0 mm and R amplitude ≥ S amplitude in the majority of beats in lead V1, when Samplitude is > R amplitude somewhere to the left on the chest of V1 (codes 7-3 and 3-2, if criteria for both arepresent).

3-3 Left (optional code when 3-1 is not present): R amplitude > 15.0 mm but ≤ 20.0 mm in lead I, or R amplitude in V5 or V6, plus S amplitude in V1 > 35.0 mm. (Measured only on second to last complete normal beat.)

3-4 Criteria for 3-1 and 3-2 both present.ST Junction (J) and Segment Depression

ST Junction (J) and Segment Depression

(Do not code in the presence of codes 6-4-1, 7-1-1, 7-2-1 or 7-4. When 4-1, 4-2, or 4-3 is coded, then a 5-code must also be assigned except in lead V1.)

Anterolateral site (leads I, aVL, V6)

4-1-1 STJ depression ≥ 2.0 mm and ST segment horizontal or downward sloping in any of leads I, aVL, or V6.

4-1-2 STJ depression ≥ 1.0 mm but < 2.0 mm, and ST segment horizontal or downward sloping in any of leads I,aVL, or V6.

4-2 STJ depression ≥ 0.5 mm and < 1.0 mm and ST segment horizontal or downward sloping in any of leads I,aVL, or V6.

4-3 No STJ depression as much as 0.5 mm but ST segment downward sloping and segment or

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

T-wave nadir ≥ 0.5mm below P-R baseline, in any of leads I, aVL, or V6.

4-4 STJ depression ≥ 1.0 mm and ST segment upward sloping or U-shaped, in any of leads I, aVL, or V6.

Posterior (inferior) site (leads II, III, aVF)

4-1-1 STJ depression ≥ 2.0 mm and ST segment horizontal or downward sloping in lead II or aVF.

4-1-2 STJ depression ≥ 1.0 mm but < 2.0 mm and ST segment horizontal or downward sloping in lead II or aVF.

4-2 STJ depression ≥ 0.5 mm and < 1.0 mm and ST segment horizontal or downward sloping in lead II or aVF.

4-3 No STJ depression as much as 0.5 mm, but ST segment downward sloping and segment or T-wave nadir ≥0.5 mm below P-R baseline in lead II.

4-4 STJ depression ≥ 1.0 mm and ST segment upward sloping, or U-shaped, in lead II.

ST Junction (J) and Segment Depression (continued)

Anterior site (leads V1, V2, V3, V4, V5)

4-1-1 STJ depression ≥ 2.0 and ST segment horizontal or downward sloping in any of leads V1, V2, V3, V4, V5.

4-1-2 STJ depression ≥ 1.0 mm but < 2.0 mm and ST segment horizontal or downward sloping in any of leads V1,V2, V3, V4, V5

4-2 STJ depression ≥ 0.5 mm and < 1.0 mm and ST segment horizontal or downward sloping in any of leads V1,V2, V3, V4, V5.

4-3 No STJ depression as much as 0.5 mm, but ST segment downward sloping and segment orT-wave nadir ≥ 0.5 mm below P-R baseline in any of leads V2, V3, V4, V5.

4-4 STJ depression ≥ 1.0 mm and ST segment upward sloping or U-shaped in any of leads V1, V2, V3, V4, V5.T-Wave Items(Do not code in the presence of code 6-4-1, 7-1-1, 7-2-1 or 7-4.)

Anterolateral site (leads I, aVL, V6)

T-Wave Items

(Do not code in the presence of code 6-4-1, 7-1-1, 7-2-1 or 7-4.)

Anterolateral site (leads I, aVL, V)6

5-1 T amplitude negative 5.0 mm or more in either of leads I, V6, or in lead aVL when R amplitude is ≥ 5.0 mm.

5-2 T amplitude negative or diphasic (positive-negative or negative-positive type) with negative phase at least 1.0mm but not as deep as 5.0 mm in lead I or V6, or in lead aVL when R amplitude is ≥ 5.0 mm.

5-3 T amplitude zero (flat), or negative, or diphasic (negative-positive type only) with less than 1.0 mm negative phase in lead I or V6, or in lead aVL when R amplitude is ≥ 5.0 mm.

5-4 T amplitude positive and T/R amplitude ratio < 1/20 in any of leads I, aVL, V6; R wave amplitude must be ≥10.0 mm.

Posterior (inferior) site (leads II, III, aVF)

5-1 T amplitude negative 5.0 mm or more in lead II, or in lead aVF when QRS is mainly upright.

5-2 T amplitude negative or diphasic with negative phase (negative-positive or positive-negative type) at least 1.0mm but not as deep as 5.0 mm in lead II, or in lead aVF when QRS is mainly upright.

5-3 T amplitude zero (flat), or negative, or diphasic (negative-positive type only) with less than 1.0 mm negative phase in lead II; not coded in lead aVF.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

5-4 T amplitude positive and T/R amplitude ratio < 1/20 in lead II; R wave amplitude must be ≥ 10.0 mm.

Anterior site (leads V , V , V , V) 2 3 4 5

5-1 T amplitude negative 5.0 mm or more in any of leads V2, V3, V4, V5.

5-2 T amplitude negative (flat), or diphasic (negative-positive or positive-negative type) with negative phase at least 1.0 mm but not as deep as 5.0 mm, in any of leads V2, V3, V4, V5.

5-3 T amplitude zero (flat), or negative, or diphasic (negative-positive type only) with less than 1.0 mm negative phase, in any of leads V3, V4, V5.

5-4 T amplitude positive and T/R amplitude ratio < 1/20 in any of leads V3, V4, V5; R wave amplitude must be ≥10.0 mm.A-V Conduction Defect

A-V Conduction Defect

6-1 Complete (third degree) A-V block (permanent or intermittent) in any lead. Atrial and ventricular complexes independent, and atrial rate faster than ventricular rate, with ventricular rate < 60.

6-2-1 Mobitz Type II (occurrence of P-wave on time with dropped QRS and T).

6-2-2 Partial (second degree) A-V block in any lead (2:1 or 3:1 block).

6-2-3 Wenckebach's Phenomenon (P-R interval increasing from beat to beat until QRS and T dropped).

6-3 P-R (P-Q) interval ≥ 0.22 sec in the majority of beats in any of leads I, II, III, aVL, aVF.

6-4-1 Wolff-Parkinson-White Pattern (WPW), persistent. Sinus P-wave. P-R interval < 0.12 sec, plus QRS duration ≥0.12 sec, plus R peak duration ≥ 0.06 sec, coexisting in the same beat and present in the majority of beats in any of leads I, II, aVL, V4, V5, V6. (6-4-1 suppresses 1-2-3, 1-2-7, 1-2-8, 1-3-2, 1-3-6, all 3, 4, 5, 9-2, 9-4, 9-5codes.)

6-4-2 WPW Pattern, intermittent. WPW pattern in ≤ 50% of beats in appropriate leads.

6-5 Short P-R interval. P-R interval < 0.12 sec in all beats of any two of leads I, II, III,aVL, aVF.

6-6 Intermittent aberrant atrioventricular conduction. P-R > 0.12 sec (except in presence of 6-5 or heart rate greater than 100); wide QRS complex > 0.12 sec; normal P-wave when most beats are sinus rhythm. (Do not code in the presence of 6-4-2.)

6-7 Artificial pacemaker.

Ventricular Conduction Defect

7-1-1 Complete left bundle branch block (LBBB). (Do not code in presence of 6-1, 6-4-1, 6-8, 8-2-1 or 8-2-2.) QRS duration ≥ 0.12 sec in a majority of beats in any of leads I, II, III, aVL, aVF, plus R peak duration ≥ 0.06 sec in amajority of beats (of the same QRS pattern) in any of leads I, II, aVL, V5, V6. (7-1-1 suppresses 1-2-3, 1-2-7, 1-2-8, 1-3-2, 1-3-6, all 2, 3, 4, 5, 9-2, 9-4, 9-5 codes. If any other codable Q-wave coexists with the LBBB pattern,code the Q and diminish the 7-1-1 code to a 7-4 code.)

7-1-2 Intermittent left bundle branch block. Same as 7-1-1 but with presence of normally conducted QRS complexes of different shape than the LBBB pattern.

7-2-1 Complete right bundle branch block (RBBB). (Do not code in the presence of 6-1, 6-4-1, 6-8, 8-2-1 or 8-2-2.)QRS duration ≥ 0.12 sec in a majority of beats in any of leads I, II, III, aVL, aVF, plus: R' > R in V1 or V2;or QRS mainly upright, with R peak duration ≥ 0.06 sec in V1 or V2; or S duration >R duration in all beats in lead I or II. (7-1 suppresses 1-2-3, 1-2-7, 1-2-8, 1-3-2, 1-3-6, all 2, 3, 4, 5, 9-2, 9-4, 9-5 codes.

7-2-2 Intermittent right bundle branch block. Same as 7-2-1 but with presence of normally conducted QRS complexes of different shape than the RBBB pattern.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

7-3 Incomplete right bundle branch block. QRS duration < 0.12 sec in each of leads I, II, III, aVL, aVF, and R' > R in either of leads V1, V2 .(Code as 3-2 in addition if those criteria are met. 7-3 suppresses code 1-2-8.)

7-4 Intraventricular block. QRS duration ≥ 0.12 sec in a majority of beats in any of leads I, II, III, aVL, aVF. (7-4 suppresses all 2, 3, 4, 5, 9-2, 9-4, 9-5 codes.)

7-5 R-R' pattern in either of leads V1, V2 with R' amplitude ≥ R.

7-6 Incomplete left bundle branch block. (Do not code in the presence of any codable Q- or QS-wave.) QRS duration≥ 0.10 sec and < 0.12 in the majority of beats of each of leads I, aVL, and V5 or V6.5 6

7-7 Left anterior hemiblock (LAH). QRS duration < 0.12 sec in the majority of beats in leads I, II, III, aVL, aVF, plus Q-wave amplitude ≥ 0.25 mm and < 0.03 sec duration in lead I, plus left axis deviation of -450 or more negative.(In presence of 7-2, code 7-8 if axis is < -450 and the Q-wave in lead I meets the above criteria.)

7-8 Combination of 7-7 and 7-2.

Arrhythmias

8-1-1 Presence of frequent atrial or junctional premature beats (10% or more of recorded complexes).

8-1-2 Presence of frequent ventricular premature beats (10% or more of record complexes).

8-1-3 Presence of both atrial and/or junctional premature beats and ventricular premature beats (so that individual frequencies are < 10% but combined premature beats are ≥ 10% of complexes).

8-1-4 Wandering atrial pacemaker.

8-1-5 Presence of 8-1-2 and 8-1-4.

8-2-1 Ventricular fibrillation or ventricular asystole.

8-2-2 Persistent ventricular (idioventricular) rhythm.

8-2-3 Intermittent ventricular tachycardia. Three or more consecutive ventricular premature beats occurring at a rate≥100. This includes more persistent ventricular tachycardia.

8-2-4 Ventricular parasystole (should not be coded in presence of 8-3-1).

8-3-1 Atrial fibrillation (persistent).

8-3-2 Atrial flutter (persistent).

8-3-3 Intermittent atrial fibrillation (code if 3 or more clear-cut, consecutive sinus beats are present in any lead).

8-3-4 Intermittent atrial flutter (code of 3 or more clear-cut, consecutive sinus beats are present in any lead).

8-4-1 Supraventricular rhythm persistent. QRS duration < 0.12 sec; and absent P-waves or presence of abnormal P-waves (inverted or flat in aVF); and regular rhythm.

8-4-2 Supraventricular tachycardia intermittent. Three consecutive atrial or junctional premature beats occurring at arate ≥ 100.

8-5-1 Sinoatrial arrest. Unexpected absence of P, QRS and T, plus a R-R interval at a fixed multiple of he normal interval, + 10%.

8-5-2 Sinoatrial block. Unexpected absence of P, QRS and T, preceded by progressive shortening of P-P intervals. (R-R interval at a fixed multiple of the normal interval, + 10%.

8-6-1 A-V dissociation with ventricular pacemaker (without capture). Requires: P-P and R-R occur at variable rates with ventricular rate as fast as or faster than the atrial rate, plus variable P-R intervals, plus no capture beats.

8-6-2 A-V dissociation with ventricular pacemaker (with capture).

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

8-6-3 A-V dissociation with atrial pacemaker (without capture).
8-6-4 A-V dissociation with atrial pacemaker (with capture).
8-7 Sinus tachycardia (over 100/min).
8-8 Sinus bradycardia (under 50/min).
8-9 Other arrhythmias. Heart rate may be recorded as a continuous variable.

ST Segment Elevation

Anterolateral site (leads I, aVL, V6)

9-2 ST segment elevation ≥ 1.0 mm in any of leads I, aVL, V6.

Posterior (inferior) site (leads II, III, aVF)

9-2 ST segment elevation ≥ 1.0 mm in any of leads II, III, aVF.

Anterior site (leads V 1, V2 , V3 , V4 , V5)

9-2 ST segment elevation ≥ 1.0 mm in lead V5 or ST segment elevation ≥ 2.0 mm in any of leads V1, V2, V3, V4.

Miscellaneous Items

9-1 Low QRS amplitude. QRS peak-to-peak amplitude < 5 mm in all beats in each of leads I, II, III, or < 10 mm in all beats in each of leads V1, V2, V3, V4, V5, V6. (Check calibration before coding.)
9-3 P-wave amplitude ≥ 2.5 mm in any of leads II, III, aVF, in a majority of beats.
9-4-1 QRS transition zone at V3 or to the right of V3 on the chest. (Do not code in the presence of 6-4-1, 7-1-1, 7-2-1 or 7-4.)
9-4-2 QRS transition zone at V4 or to the left of V4 on the chest. (Do not code in the presence of 6-4-1, 7-1-1, 7-2-1 or 7-4.)
9-5 T-wave amplitude > 12 mm in any of leads I, II, III, aVL, aVF, V1, V2, V3, V4, V5, V6. (Do not code in the presence of 6-4-1, 7-1-1, 7-2-1 or 7-4.)
9-8-1 Technical problems which interfere with coding.
9-8-2 Technical problems which do not interfere with coding.

Incompatible Codes

The codes in the left column suppress codes in the right column.

Code	Suppress this code(s)
All Q-, QS-codes	7-6
Q > 0.03 in lead I	7-7
3-1	1-3-2
3-2	1-2-8, 7-3
6-1	All other codes except 8-2
6-4-1	All other codes
6-8	All other codes
7-1-1	1-2-3, 1-2-7, 1-2-8, 1-3-2, 1-3-6, all 2-, 3-, 4-, and 5- codes, 7-7, 9-2, 9-4, 9-5
7-2-1	1-2-8, all 2-, 3-, 4-, and 5-codes, 9-2, 9-4, 9-5
7-3	1-2-8
7-4	All 2-, 3-, 4-, and 5-codes, 9-2, 9-4, 9-5
8-1-2	8-2-4
8-1-4	8-1-1, 9-3
8-2-1	All other codes
8-2-2	All other codes
8-2-3	8-1-2

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

8-3-1	8-1-1, 8-1-2
8-3-2	6-2-2, 8-1-1, 8-1-2
8-3-3	8-1-1, 8-1-2
8-3-4	6-2-2
8-4-1	6-5
8-4-1 + heart rate≧140	All other codes except 7-4 or 6-2
Heart rate > 100	6-5
8-4-2	8-1-1
9-1	All 2-codes

Categories of Minnesota ECG Abnormalities

Diagnostic ECG:

(any ECG may be used for this classification)

D1. An ECG record with any Diagnostic Q-code (Minn. code 1-1-1 through 1-2-5 plus 1-2-7).

D2. An ECG record with ST-segment elevation code 9-2 PLUS (T-wave inversion code 5-1 or 5-2 in the absence of 7-2-1 or 7-4).

Equivocal ECG:

(any ECG may be used for this classification)

E1. An ECG record with an Equivocal Q-code [(Minn. code 1-2-8 in the absence of a 7-1-1 or 7-3 or (any 1-3-code)].

E2. An ECG record with ST-segment depression (code 4-1-x or 4-2 or 4-3 in the absence of 7-2-1 or 7-4), or 1-3-x.

E3. An ECG record with T-wave inversion (code 5-1 or 5-2 or 5-3 in the absence of 7-2-1 or 7-4).

E4. An ECG record with ST-segment elevation code 9-2.

Other ECG:

01. Reference ECG coded 7-1-1.

02. Any ECG coded 7-1-1.

03. Normal ECG(s), defined as 1 in “clear” field of all ECGs.

04. Other findings including 1-2-6.

Uncodable ECG:

U1. Technical errors coded 9-8-1 by Minnesota Code.

Absent ECG:

A1. No ECG available for coding.

Prineas R, Crow R, Blackburn H. The Minnesota Code Manual of Electrocardiographic Findings. John Wright-PSG, Inc. Littleton, MA, June 1982.

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

Appendix B

Diagnosis Code Table

Code	Item
SR	Sinus Rhythm
SR-1	Sinus Arrhythmia
SR-2	Sinus Tachycardia
SR-3	Sinus Bradycardia
SR-0	Sinus Rhythm
ER	Ectopic rhythm(refer to M-code-8)
AE	Atrial Enlargement
LAE-1	Left Atrial Enlargement
LAE-2	Possibly Left Atrial Enlargement
RAE-1	Right Atrial Enlargement
RAE-2	Possibly Right Atrial Enlargement
BAE-1	Biatrial Enlargement
BAE-2	Possibly Biatrial Enlargement
PA	P-wave Axis Abnormality
PA-1	Probably Leads Reversed
PA-2	Probably Dextrocardia
AD	Axis Deviation
LAD-1	Mild Left Axis Deviation
LAD-2	Marked Left Axis Deviation
RAD-1	Mild Right Axis Deviation
RAD-2	Right Axis Deviation
RAD-3	Marked Right Axis Deviation
AD?	Indeterminate Axis
S1S2S3	S1-S2-S3 Pattern
LOWV	Low Voltage
LOWV-1	Low Voltage(Limb Leads)
LOWV-2	Low Voltage(Chest Leads)
LOWV-3	Low Voltage(All Leads)
VH	Ventricular Hypertrophy

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

RVH -1	Right Ventricular Hypertrophy
RVH-2	Possibly Right Ventricular Hypertrophy
LVH-1	Left Ventricular High Voltage
LVH-2	Left Ventricular Hypertrophy
LVH-3	Possibly Left Ventricular Hypertrophy
BVH-1	Biventricular Hypertrophy
BVH-2	Possibly Biventricular Hypertrophy
W	Pre-exciting Syndrome
S-PR	Shortened PR Internal
W-1	W-P-W Syndrome(Type A)
W-2	W-P-W Syndrome(Type B)
W-3	W-P-W Syndrome
AVB	A-V Block
AVB-1	A-V Block(Type I)
AVB-2-1	A-V Block(Type II)(Mobitz)
AVB-2-2	A-V Block(Type II)(Wenckbach)
AVB-3	A-V Block(Type III)
LBBB	Left Bundle Branch Block
LBBB-1	Complete Left Bundle Branch Block
LBBB-2	Incomplete Left Bundle Branch Block
RBBB	Right Bundle Branch Block
RBBB-1	Complete Right Bundle Branch Block
RBBB-2	Incomplete Right Bundle Branch Block
AFB	Left Anterior Fascicular Block
PFB	Left Posterior Fascicular Block
RSR'	RSR'(QR) Pattern InV1/V2, Right Ventricular Conduction Delay
MI	Myocardial Infarction
AMI-1	Can't Exclude Anterior Myocardial Infarction
AMI-2	Anterior Myocardial Infarction
AMI-3	Possibly Anterior Myocardial Infarction
SMI-1	Can't Exclude Septal Myocardial Infarction
SMI-2	Septal Myocardial Infarction
SMI-3	Possibly Septal Myocardial Infarction
ASMI-1	Can't Exclude Anteroseptal Myocardial Infarction
ASMI-2	Anteroseptal Myocardial Infarction
ASMI-3	Possibly Anteroseptal Myocardial Infarction
ALMI-1	Can't Exclude Anterior-Lateral Myocardial Infarction

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

ALMI-2	Anterior-Lateral Myocardial Infarction
ALMI-3	Possibly Anterior-Lateral Myocardial Infarction
LMI-1	Can't Exclude Lateral Myocardial Infarction
LMI-2	Lateral Myocardial Infarction
LMI-3	Possibly Lateral Myocardial Infarction
EAMI-1	Can't Exclude Extensive Anterior Myocardial Infarction
EAMI-2	Extensive Anterior Myocardial Infarction
EAMI-3	Possibly Extensive Anterior Myocardial Infarction
IMI-1	Can't Exclude Inferior Myocardial Infarction
IMI-2	Inferior Myocardial Infarction
IMI-3	Possibly Inferior Myocardial Infarction
PMI-1	Can't Exclude Posterior Myocardial Infarction
PMI-2	Posterior Myocardial Infarction
PMI-3	Possibly Posterior Myocardial Infarction
-	MI Age
-A	Acute
-B	Subacute
-C	Obsolete
-?	Undetermined
STE	ST Elevation
STE-1	ST Elevation (Consider Early Repolarization, Injury or Acute Pericarditis)
STE-2	ST Elevation (Consider Early Repolarization)
STE-3	Early Repolarization
STE-4	ST Elevation (Consider Acute Pericarditis)
STE-5	Acute Pericarditis
STE-?	ST Elevation(Nonspecific)
STD	ST Depression
STD-1	ST Depression(Possibly Subendocardial Injury, Anterior)
STD-2	ST Depression(Possibly Subendocardial Injury, Septal)
STD-3	ST Depression(Possibly Subendocardial Injury, Anterior-Septal)
STD-4	ST Depression(Possibly Subendocardial Injury, Lateral)
STD-5	ST Depression(Possibly Subendocardial Injury, Anterior-Lateral)
STD-6	ST Depression(Possibly Subendocardial Injury, Inferior)
STD-?	ST Depression (Nonspecific)
T	Myocardial Ischemia
T-1	T-wave Abnormality, Possibly Myocardial Ischemia(Anterior)

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

stomdevice

T-2	T-wave Abnormality, Possibly Myocardial Ischemia(Lateral)
T-3	T-wave Abnormality, Possibly Myocardial Ischemia(Anterior-Lateral)
T-4	T-wave Abnormality, Possibly Myocardial Ischemia(Inferior)
T-5	High T-wave, Possibly Hyperkalemia
T-?	T-wave Abnormality(Nonspecific)
ST-T	ST-T Abnormality
ST-T-1	Abnormal QRS-T Angle
ST-T-2	ST-T Abnormality, Probably Digitalis Effect
ST-T-3	Digitalis Effect
ST-T-?	ST-T Abnormality(Nonspecific)
QT	QT Interval Abnormality
QT-1	Shortened QT
QT-2	Prolonged QT

Information of manufacturer:
Company: SHENZHEN BESTMAN INSTRUMENT CO., LTD.

Address: 4/F, Block 210,2nd Industrial Area of Nanyou, Xiangnan Rd., DistNanshan Dist., Shenzhen, P.R.China

Postcode: 518054

Tel: +86- 755-26713783/26713784/26440107

Fax: +86-755-26495167/26713783/26713784

Website: www.szbestman.com

Email: szbestman@szbestman.com

EC- representative

Company Name : Lotus Medical Equipment Limited

Company Address: 26B Cameron Court, Cork Street, Dublin 8, Ireland

Tel：+00353-1-6571034

Release Date:2016-02-02

https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ