⚠ CAUTION

◆ *If the device is damaged or does not work, it cannot be used to acquire and record the patient ECG. Please contact the service personnel or the manufacturer immediately.*

3.6 ECG Machine Setting

There are some settings need to be done for the first time use, such as time, report storage ways etc. During ECG waveform acquisition and measurement, you need to set such parameters as recording modes, sampling time, gain, paper speed, filter etc. For more details, please refer to *Section 2.3* and *Chapter 4*.

3.7 Power off

Please follow the steps below to power off the ECG machine:

1) Verify that the patient ECG acquisition and recording can be ended.

2) Disconnecting al the ECG electrodes with the patient.

3) Press the power switch, a dialog appears with three options, then select "Power Off".

⚠ CAUTION

◆ *If you cannot shut down the machine normally, or special circumstances arise, please long press the power switch for 10 seconds to force a shutdown. Forced shutdown may incur ECG data loss, thus usually not recommended except in special circumstances.*

Chapter 4 System Applications

4.1 Entering Main Menu

In the waveform acquisition interface, click the 〝Application〞 button on the touch screen or **F7** key on panel to enter into the system application interface. The system application interface layout is described in Section 2.3.8. The touch screen allows you to directly click on the item you want to view.

Key operation mode:

● Tab key to make the focus switch to the next control, Shift+Tab to make the focus switch to the next control;

● In the control options, you can press the 〝↑〞 and 〝↓〞 direction keys to switch vertically. The 〝←〞 〝→〞 direction keys switch horizontally, and the space bar confirms the selection;

● You can touch the screen to select; or connect an external USB mouse and left click to select.

The settings made in the system settings interface will be saved as default user settings and will remain active the next time you turn the phone on.

The general setting interface has a locking function. Pressing the key combination 〝CTRL+ALT+L〞 will pop up the lock dialog box, which can lock the machine settings, report settings, recorder settings, filter settings and heartbeat warning settings. After locking, the option button is grayed out; if you need to change the option settings, press the key combination "CTRL+ALT+L" again to unlock the option.

4.2 Application Interface
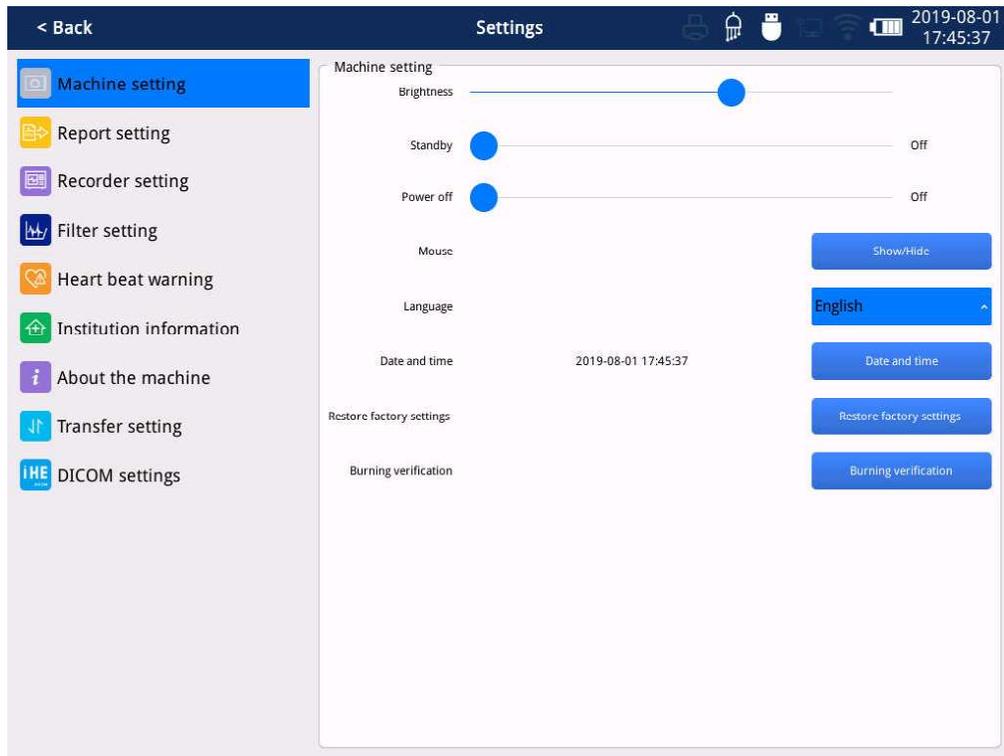
4.2.1 General–Machine Setting

Fig. 4.1 Machine Setting Interface

Machine Setting			
Menu Item	Option	Defaults	Illustration
Brightness	/	/	Adjust the backlight intensity of the display.

Standby	Off, 5 min, 10 min, 15 min, 20 min, 25 min, 30 min	Off	Set the time when the ECG machine automatically enters standby mode. If there is no user operation within the set standby time, the ECG machine enters the standby state. When entering standby mode, the screen is turned off. The standby time you set cannot be longer than the automatic shutdown time.
Shut down	Off, 5 min, 10 min, 15 min, 20 min, 25 min, 30 min	Off	Set the auto power off time. If the user does not perform any operation during the set auto power off time, the ECG will automatically shut down.
Mouse	Show/Hide	Hide	When "Display" is turned on, the screen displays the current position of the mouse.
Language	Simplified Chinese, English,etc.	Chinese	Select the interface language.
Date and time	/	/	Set the date and time of the machine.
Factory settings	Restore factory settings	/	To restore factory settings
Burn verification	Burn verification (MD5 file) / system upgrade	/	Burn verification is used to verify that the current version is successfully burned.

⚠ **CAUTION**

◆ *The factory settings will be restored and the machine will restart automatically.*
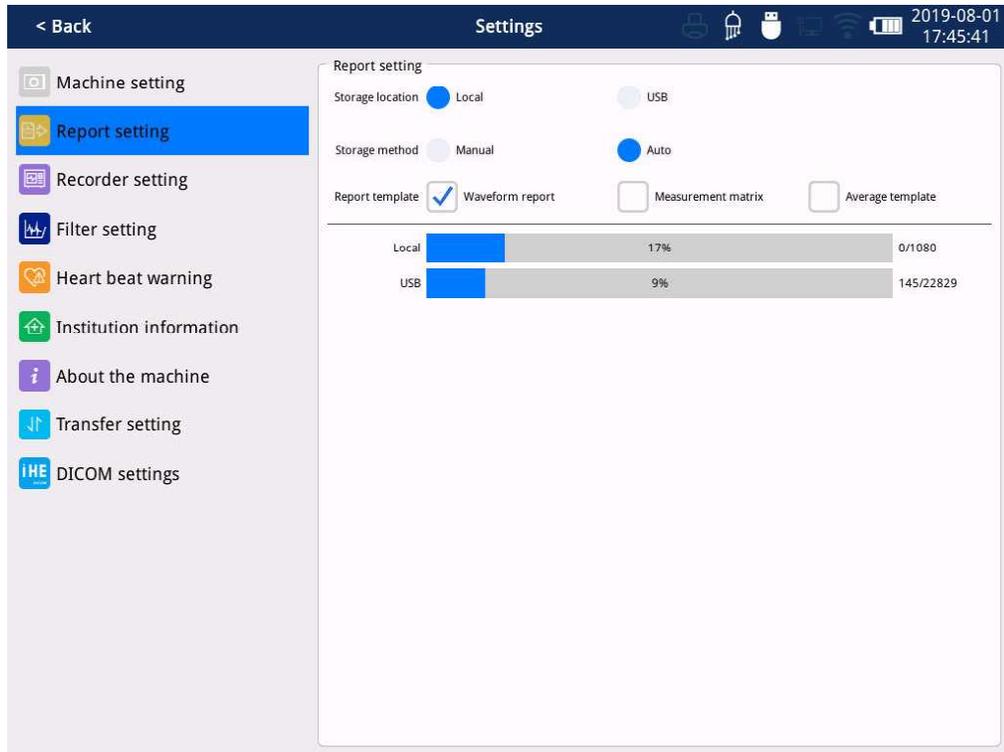
4.2.2 General-Report Setting

Fig. 4.2 General-Report setting

Report setting			
Menu Item	**Option**	**Defaults**	**Illustration**
Storage location	Local/ SD / USB	Local	See section 6.4.1 for details.
Storage method	Auto/Manual	Auto	See section 6.4.2 for details.
Report template	Waveform report / Measurement matrix / Average template	Waveform report	Check the waveform and display the ECG waveform on the printed report. Check the measurement matrix and display the ECG measurement matrix on the printed report (when printing, multiple periodic waveform of each lead will be combined into a single cycle waveform.) Check the average template and display the ECG average template on the printed report (when

			printing, the horizontal display shows 12 leads; the vertical display shows the parameters of each lead, such as P, QRST wave start and end points, P, QRS, T wave group period, etc.) Built-in print report in real-time sampling mode, only supports waveform report; other sampling mode built-in printing or ECG preview interface printing regular ECG report can support all report templates, you can select multiple or single. The report template for regular ECG external printing supports single or multiple selection by printer model. (See 4.2.3 General Settings - Recorder Settings)
Local/USB/SD Card	/	/	Display storage capacity

4.2.3 General-Recorder Setting
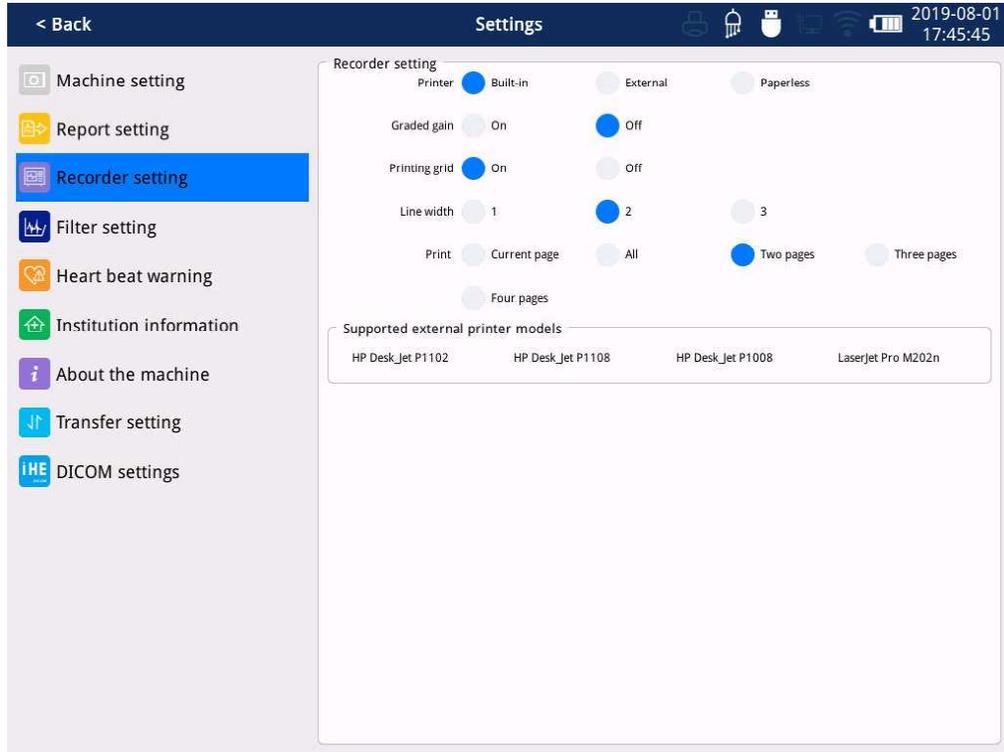
Fig. 4.3 General-Recorder setting

Recorder Setting			
Menu Item	Options	Default Value	Illustration
Printer	Built-in/exter nal/ paperless	Built-in	In paperless mode, click ECG key, the system will acquire and save ECG waveforms. No matter there is recording paper in the printer or not, it will not print the waveforms.
Graded gain	Off/On	Off	When set to On, the gain amplitude of the first six leads is twice the gain of the last lead. For example, when the gain amplitude is set to 20 mm/mv, the first six-lead gain amplitude is 20 mm/mv, and the last lead amplitude is 10 mm/mv.

Recorder Setting			
Menu Item	**Options**	**Default Value**	**Illustration**
			If the waveform acquisition interface selects automatic gain, the gain amplitude of each lead is automatically assigned.
Printing Grid	Off/On	On	Set the grid when export PDF reports. When it is set "On", the waveform zone and footer zone will display grid background; When set "Off", no grid will appear on the report. Printing grid is only available for an External printer.
Line width	1/2/3	2	The width of the waveform line displayed on the thermal paper.
Printing	Current page / all / two pages / three pages / four pages	Two pages	Preview the contents of the print when the it is in built-in printer.

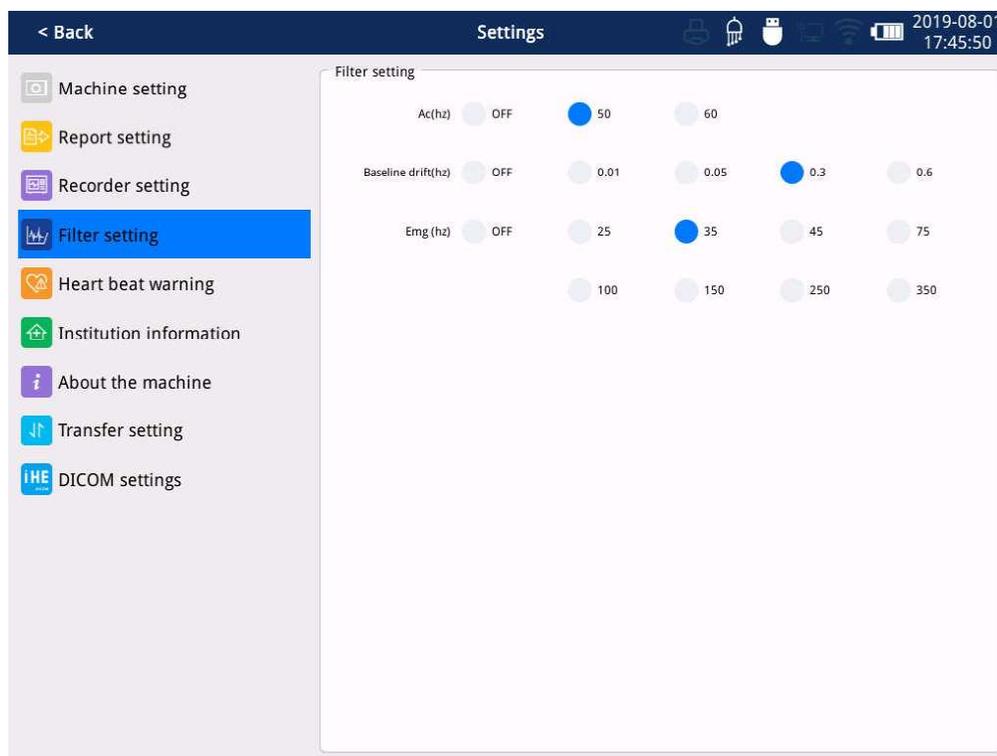| Recorder Setting			
Menu Item	Options	Default Value	Illustration
Supported external printer models	/	/	Supported printer models: HP Dest_Jet P1102 (only report template radio is supported) HP Dest_Jet P1108 (only report template radio is supported) HP Dest_Jet P1008 (only report template radio is supported) LaserJet Pro M202n (supports report template multiple selection and single selection) If the report template is multi-selected, the connection only supports external printers that report single-selection, and the waveform report is printed by default.

4.2.4 General-Filter Setting

Fig. 4.4 General-filter setting

Filter setting			
Menu Item	Options	Default Value	Illustration
AC Filter（Hz）	OFF、50、60	50	Select whether to turn on the AC filter to filter out AC power interference. AC Filter should always be turned on, unless it is necessary to turn it off.
Baseline drift（Hz）	OFF、0.01、0.05、0.3、0.6	0.6	Select the baseline drift filter (BDR) frequency. Baseline drift filter rejects most of the baseline drift interference and makes the ST segment undistorted. Baseline drift filtering is not performed when set to [Off]. (This filter is high-pass filtering)

EMG（Hz）	OFF、25、35、45、75、100、150、250、350	35	Set the frequency of EMG. Turning on the EMG filter can filter out EMG interference, but it may reduce the bandwidth and cause the ECG waveform shape to change. The EMG filter is low-pass filtering. signals with a frequency higher than the set value will be filtered out. When set to 35 Hz, the system only displays signals below 35 Hz and below 35 Hz, and signals beyond 35 Hz will be filtered out.

⚠ **CAUTION**

◆ *The settings of the baseline drift filter and the EMG filter affect the frequency response range of the electrocardiograph. If the baseline drift filter setting value is too high and the EMG filter setting value is too low, it will affect the accuracy of the ECG machine for waveform restoration. For example, when the baseline drift filter frequency is set to 0.6 Hz and the EMG filter frequency is set to 25 Hz, the system frequency response range is 0.6 Hz to 25 Hz.*
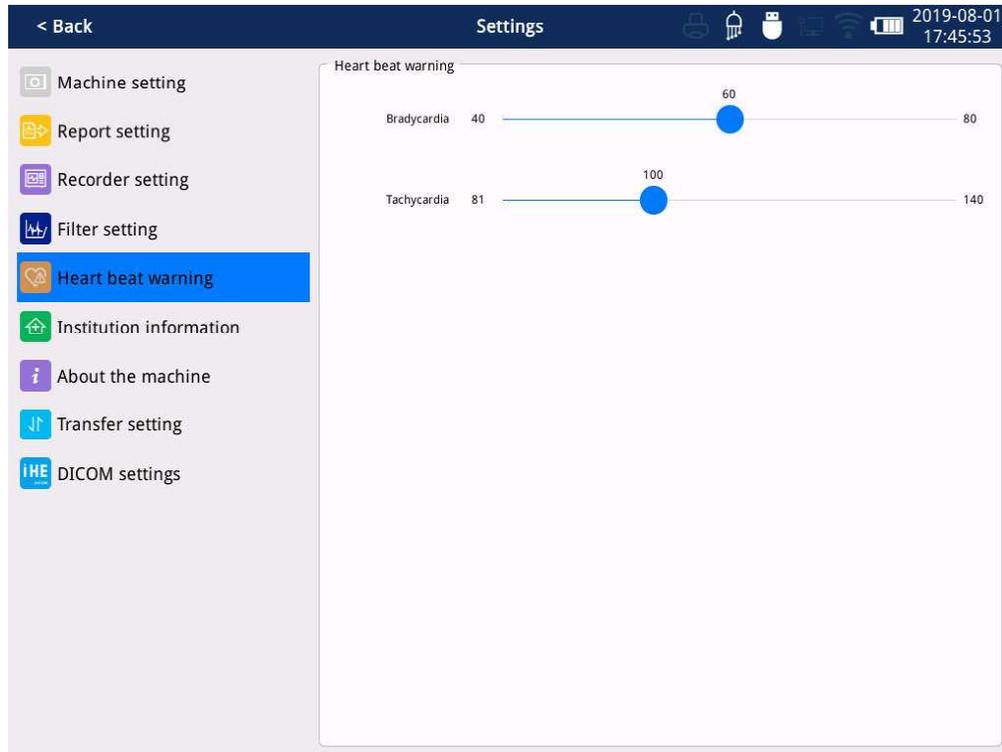
4.2.5 General-Heartbeat Warning

Fig. 4.5 Heartbeat Warning Interface

Heartbeat Warning			
Menu Item	Options	Default Value	Illustration
Bradycardia	40-80	60	Set the bradycardia threshold.
Tachycardia	81-140	100	Set the tachycardia threshold.

4.2.6 General-Institution Information

Fig. 4.6 Institution Information Interface

4.2.7 General-About the Machine
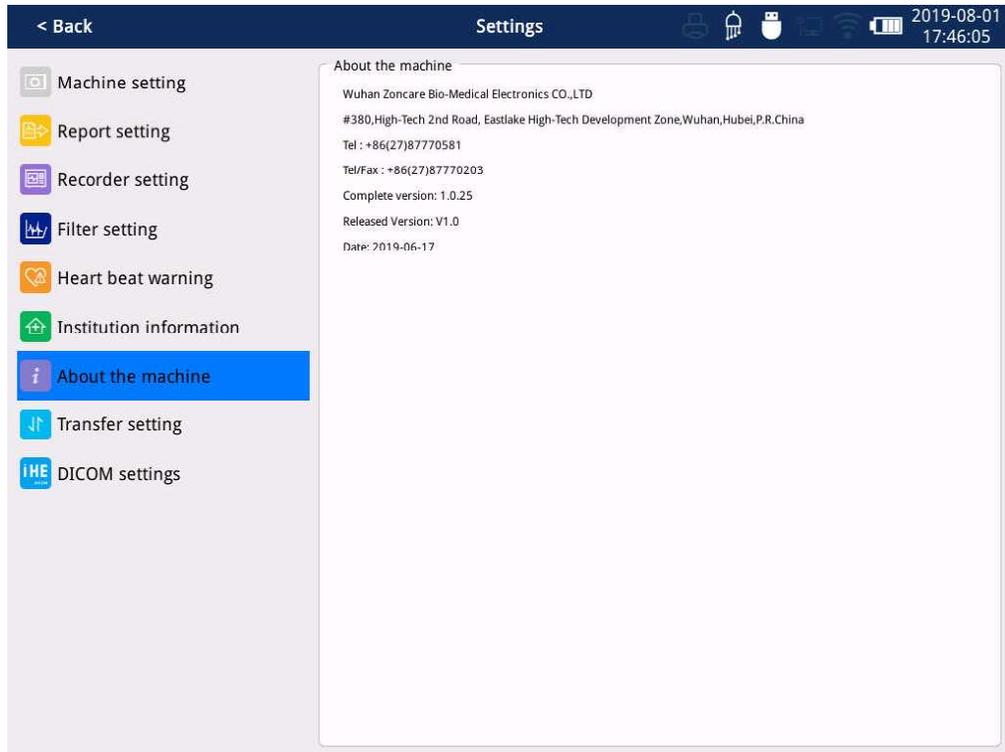
Fig. 4.7 About the Machine Interface

4.2.8 General-Transfer Setting

Enter the transfer setting interface. Enter the unlock password according to the prompt.
The password defaults to 4000400499.
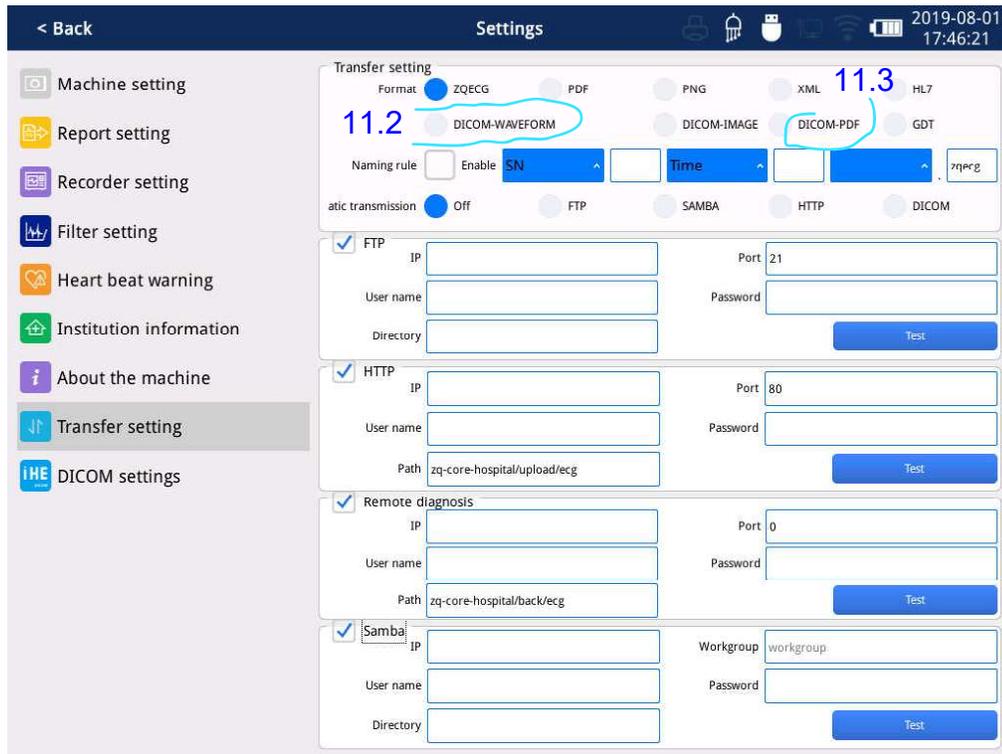
Fig. 4.8 Transfer Setting Setting Interface

Transfer Setting			
Menu Item	Options	Default Value	Illustration
Report transmission format	ZQECG、PDF、PNG、XML、HL7、DICOM-WAVEFORM、DICOM-IMAGE、DICOM-PDF GDT	ZQECG	The transmission format of the ECG file.
Naming rule	SN/PID/StudyID/ Time + XXX + SN/PID/StudyID /Time + XXX + SN/PID/StudyID	SN+ Time. ZQECG	The naming rules can be a combination of SN, PID, StudyID, Time, or can be named separately. The file name suffix is automatically generated based

	/Time .		on the selected report transfer format.
Auto transfer	OFF/FTP/SAMBA /HTTP/DICOM	OFF	When it is OFF, you can manually select the ECG report transmission on the [Report Management] interface. When it is on, the report can be transmitted in real time in the FTP/SAMBA/HTTP/DICOM transmission mode when the ECG report is printed and frozen. (You should ensure that the network is properly connected and the FTP/SAMBA/HTTP/DICOM transmission mode is successfully enabled) Note: The corresponding button will only be highlighted if the FTP/SAMBA/HTTP/DICOM transfer mode is enabled, otherwise it will be grayed out.
FTP setting	IP address, port number, username, password, directory	/	1) The FTP username and password that you set must be the username and password that can be logged into the FTP server. 2) The FTP path that you set must be a subdirectory that already exists in the root directory of the FTP server. Note: For more information about the FTP server, please consult your network administrator. 3) After setting, you can click the " Test " button to check if

			it can be connected.
			4) After the test is passed, check the " ☐ " button to enable it. (Note: It can only be used in the transmission of the [Report Management] interface after it is enabled.)
HTTP setting	IP address, port number, username, password, directory	/	1) The HTTP username and password that you set must be the username and password that can be logged into the FTP server. 2) The HTTP path that you set must be a subdirectory that already exists in the root directory of the HTTP server. Note: For more information about the HTTP server, please consult your network administrator. 3) After setting, you can click the " [Test] " button to check if it can be connected. 4) After the test is passed, check the " ☐ " button to enable it. (Note: It can only be used in the transmission of the [Report Management] interface after it is enabled.)
Remote diagnosis settings	IP address, port number, username, password, directory	/	1) The remote diagnosis username and password that you set must be the username and password that can be logged into the FTP server.

			2) The remote diagnosis path that you set must be a subdirectory that already exists in the root directory of the remote diagnosis server. Note: For more information about the remote diagnosis server, please consult your network administrator. 3) After setting, you can click the "[Test]" button to check if it can be connected. 4) After the test is passed, check the "[ ]" button to enable it. (Note: It can only be used in the transmission of the [Naming Rule] interface after it is enabled.)
SAMBA setting	IP address, port number, username, password, directory	/	1) The SAMBA username and password that you set must be the username and password that can be logged into the FTP server. 2) The SAMBA path that you set must be a subdirectory that already exists in the root directory of the SAMBA server. Note: For more information about the SAMBA server, please consult your network administrator. 3) After setting, you can click the "[Test]" button to check if it can be connected. 4) After the test is passed, check

		64	the "⬜" button to enable it. (Note: It can only be used in the transmission of the [Report Management] interface after it is enabled.)

4.2.9 General-DICOM Setting

Enter the transfer setting interface. Enter the unlock password according to the prompt. **11.5 Duomenys perduodami tiesiai iš ECG**
The password defaults to 4000400499. aparato
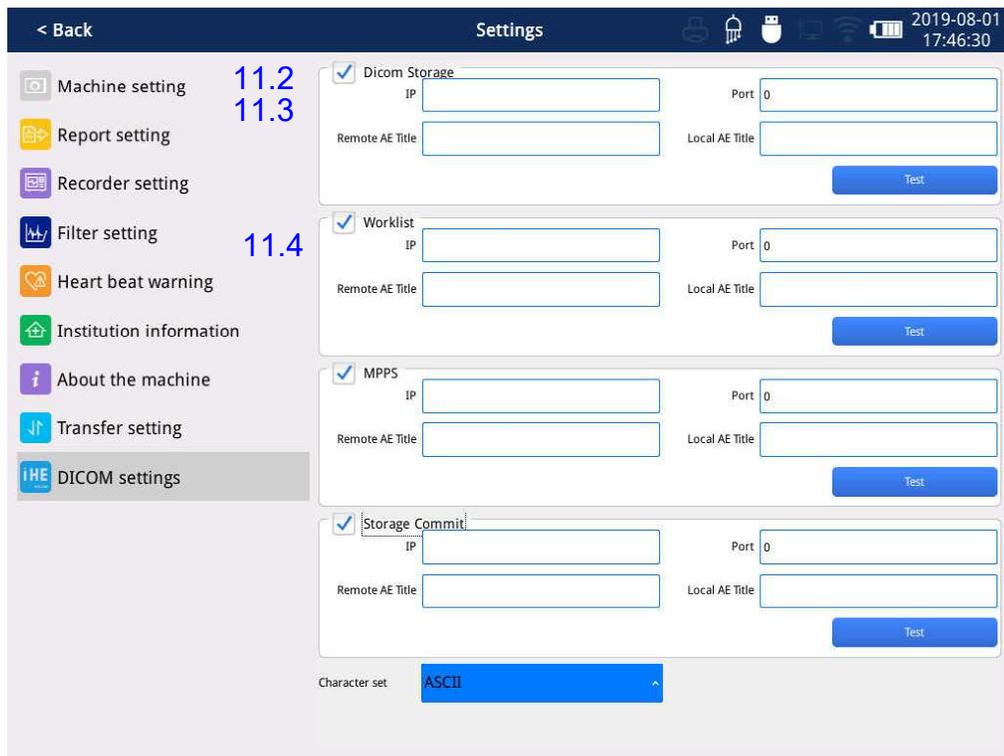
Fig. 4.9 DICOM Setting Interface

DICOM SETTING			
Menu Item	**Options**	**Default Value**	**Illustration**
Dicom Storage	IP address, remote port number, remote AE	/	The ECG file is uploaded to this server in the "dicom" transfer

（upload configuratio n）	directory, local AE directory		format. 1) After setting, you can click the "[Test]" button to check if it can be connected. 2) After the test is passed, check the "☐" button to enable it. (Note: It can only be used in the transmission of the [Report Management] interface after it is enabled.)
Worklist （Server settings）	IP address, remote port number, remote AE directory, local AE directory	/	The ECG machine imports patient information data from this server. 1) After setting, you can click the "[Test]" button to check if it can be connected. 2) After the test is passed, check the "☐" button to enable it.
MPPS （Server settings）	IP address, remote port number, remote AE directory, local AE directory	/	The ECG machine will send three states of acquisition, start to collect, complete the acquisition, and cancel the acquisition, to this server. 1) After setting, you can click the "[Test]" button to check if it can be connected. 2) After the test is passed, check the "☐" button to enable it.
Storage Commit （Storage server	IP address, remote port number, remote AE directory, local AE directory	/	A server that confirms whether the ECG file has been uploaded. 1) After setting, you can click the "[Test]" button to check if it can be connected.

configuratio n)			2) After the test is passed, check the "☐" button to enable it.
Character set	ASCII/GB1 8030/ISO-8859-1~ ISO-8859-9/ UTF-8	ASCII	Select the appropriate character set to avoid garbled characters in the transmitted ECG file.

4.2.10 E-Mail setting

1. Click the " [Email] " button to open the mail dialog. Note: For more information on configuring your network and interfaces, please consult your network administrator. Use wired Ethernet or WIFI transmission:

1) Manually add the sender, recipient's account number, server address and port number.

2) Select and confirm the appropriate sender, recipient.

3) Click the " [Attachment] " button to check the files you want to upload. The system will automatically fill in the email subject.
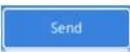
4) Click the " [Send] " button to send the mail.

2. The recipient can browse the png format ECG file through the mailbox.

Fig 4.10 Email Interface

4.2.11 LAN setting

Click the "![LAN]" button to open the Wired Settings dialog box to make the appropriate network settings. (Note: For details on configuring the network, please 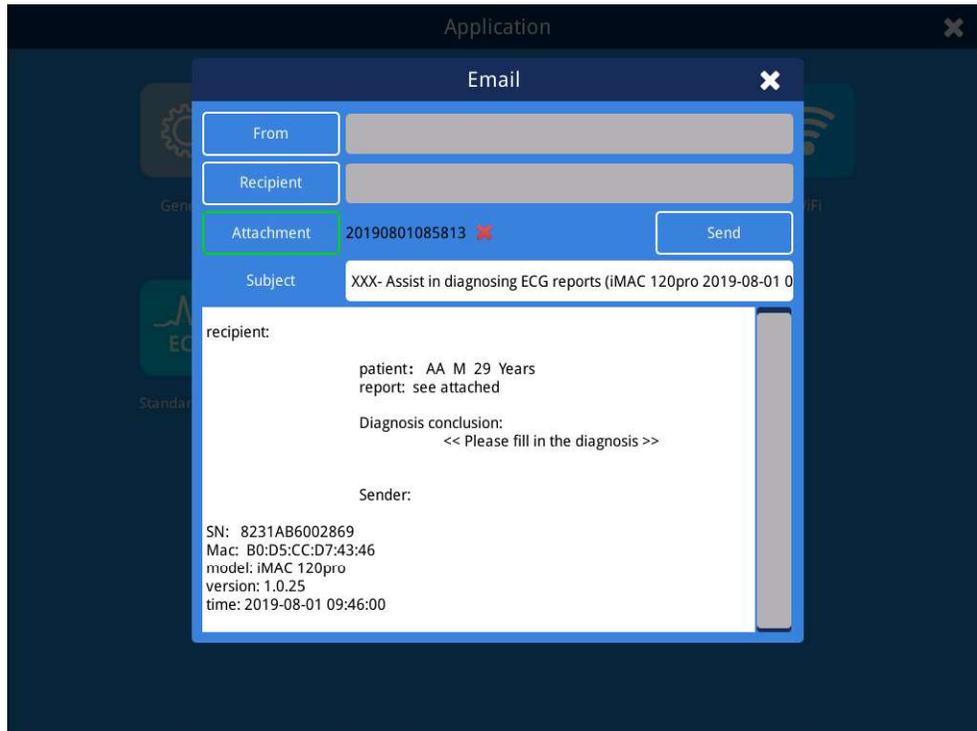consult your network administrator.) After setting, click the "![Save]" button to save and take effect. You can automatically obtain the local IP address or manually enter the local IP address.
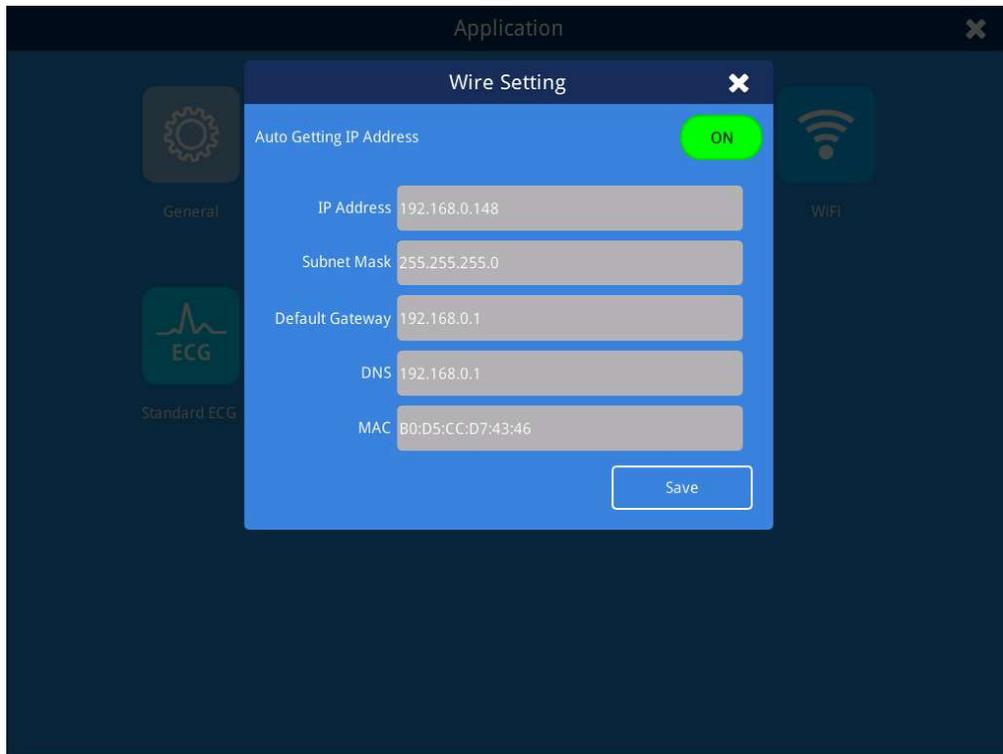
Fig. 4.11 LAN Interface

4.2.12 WIFI setting

Click the " " button to open the Wireless Settings dialog box, you can choose to turn WiFi on or off. Click the " " button to manually connect hidden WiFi and support WEP encryption type hotspots.
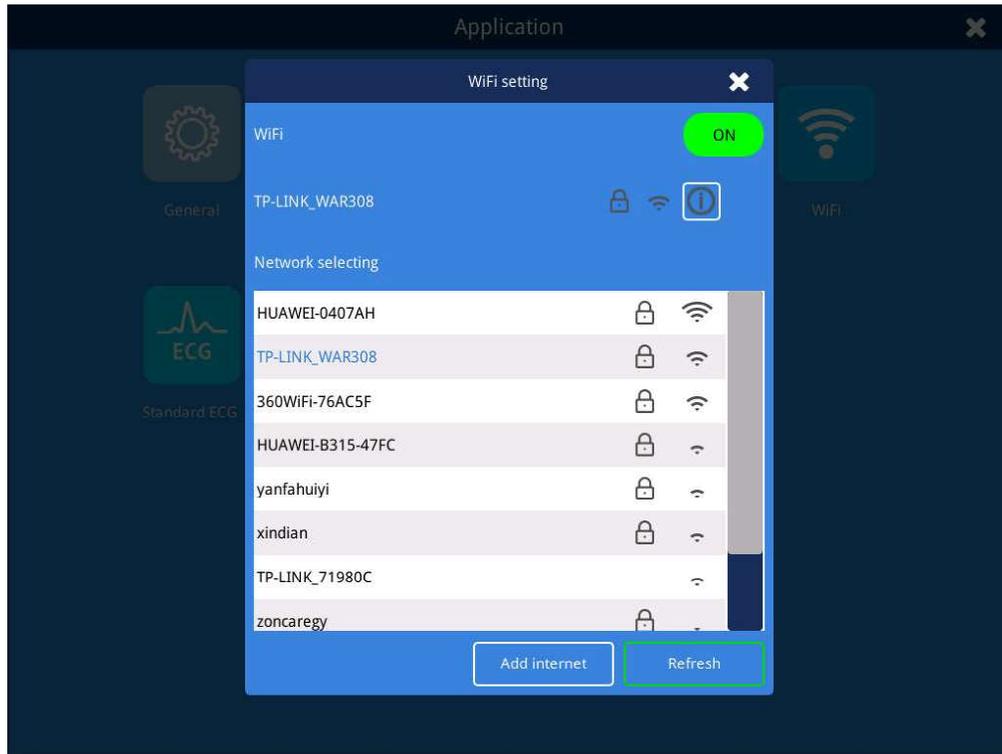
Fig. 4.12 WIFI Interface

4.2.13 Standard ECG setting

Click the " " button to enter the waveform acquisition interface.

4.2.13.1 Auto mode

The automatic mode refers to the automatic acquisition and printing of waveforms by the electrocardiograph. It is a common mode of the electrocardiograph and is used for routine electrocardiogram examination. The user simply presses the " " button to automatically capture and print the waveform. (Does not include pre-sampling mode).

Specific operation method:

1. In the waveform acquisition interface, set the layout, gain, and paper speed according to actual needs;

2. Click the " " button in the upper left corner of the waveform acquisition interface to enter the [Standard ECG] setting interface, select the auto-simultaneous or auto-sequential recording mode, set the sampling mode, acquisition duration, and printing duration;

3. Enter the [12-lead] interface and select the lead system and the single or three-rhythm lead label;

4. According to your own needs, set other parameters, and exit the [Standard ECG] interface after the setting is completed.

5. Click the " " button on the panel to print the automatic mode ECG report.

⚠️*CAUTION*

- ◆ *When the ECG signal is just connected or the device receives the overload noise, the waveform will be disordered, the baseline drift is serious, and the signal waveform amplitude may exceed the maximum display width. At this time, wait for the device connection and the patient as well as the waveform to stabilize. Then start measuring and recording.*

- ◆ *When the ECG is overloaded or any part of the amplifier is saturated, the ECG machine is in an abnormal working state. At this time, the interface only displays the baseline. In order to obtain accurate measurement results, wait for the device connection and the patient as well as the waveform to stabilize. Then start measuring and recording.*

- ◆ *If the waveform becomes cluttered or unstable during the patient's ECG signal acquisition, see Chapter 8.*

4.2.13.2 Manual mode

Manual mode means that the user can manually control the duration of the ECG machine to collect and print the ECG. It is generally used by the user to collect and print ECG waveforms of any length according to clinical needs.

Specific operation method:

1. Click the " " button in the upper left corner of the waveform acquisition interface to enter the [Standard ECG] setting interface, select the real-time sampling mode and manual recording mode;

2. Enter the [12-lead] interface and select the lead system and the single the single or three-rhythm lead label;

3. In the waveform acquisition interface, set the layout, gain, and paper speed according to actual needs;

4. According to your needs, set other parameters, and exit the [Standard ECG] setting interface after the setting is completed.

5. Click the " " button on the panel to print the manual mode ECG report.

6. The built-in /paperless can be switched through the floating button in the lower left corner of the interface. Note: External printer is not supported in manual mode.
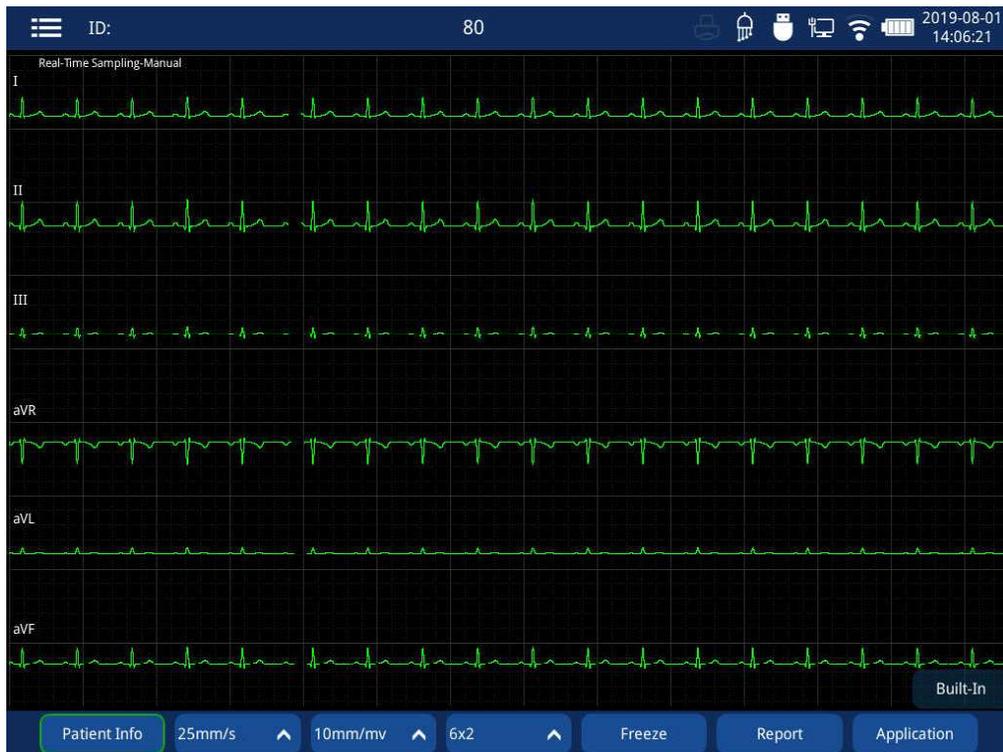
Fig. 4.13 Manual mode waveform acquisition Interface

4.2.13.3 Rhythm mode

The rhythm mode is for user to collect and print a single lead for a long time to observe and capture sporadic or frequent arrhythmia.

Specific operation method:

1. Click the " " button in the upper left corner of the waveform acquisition interface to enter the [Standard ECG] setting interface, and select the real-time sampling mode, rhythm recording mode and rhythm analysis time;

2. In the waveform acquisition interface directly touche the screen to select the rhythm lead label.

3. After setting, click the " " button on the screen, the sampling time countdown will appear. A complete rhythm waveform will be recorded after the countdown ends. During the recording process, press the " " button to stop recording if necessary.

4. Click the " " button on the panel, and the sampling time countdown will appear. A complete rhythm waveform will be printed after the countdown ends. During the recording process, press the " " button to stop recording or stop printing the rhythm analysis report if necessary.

Fig. 4.14 Rhythm Analysis waveform acquisition Interface
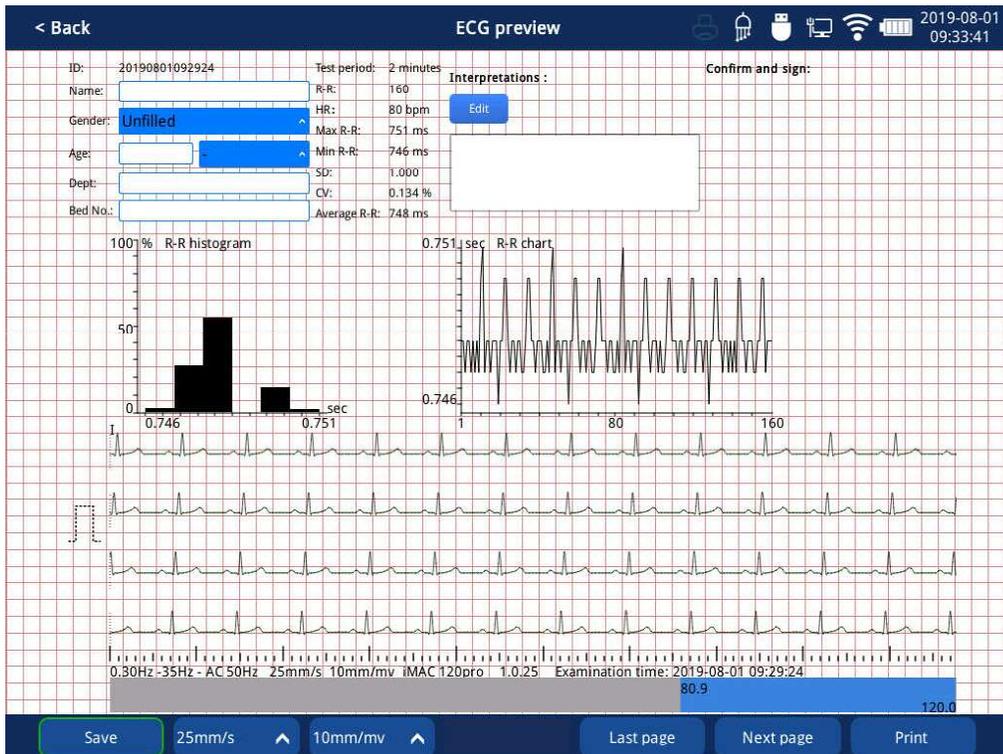
Fig. 4.15 2 minute rhythm analysis report Interface

4.3 Machine Setting

4.3.1 First time setup

When using the ECG for the first time or use it after repair or update, be sure to check and improve the following settings:
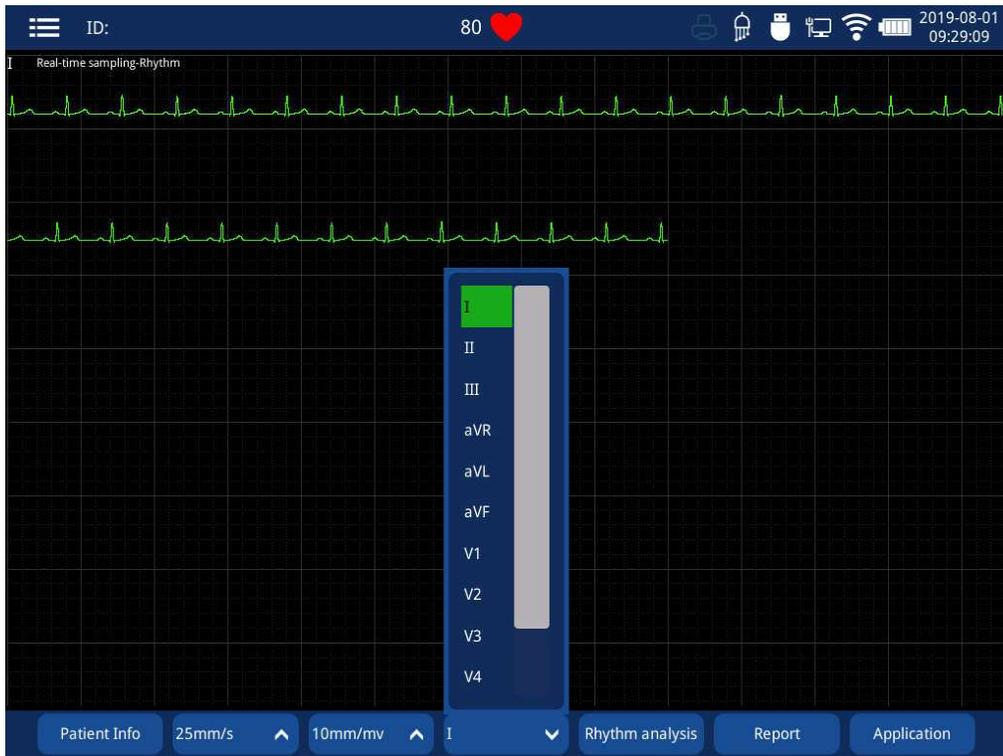
Fill in the relevant device information in [Institution Information] for the convenience of centralized management and maintenance.

Set the date and time in [Machine Settings] to ensure accurate date and time for the convenience of patient number generation and report management.

Set the backlight brightness in [Machine Setting].

Set the standby time in [Machine Setting]

Set the language type in [Machine Setting].

Set the report save location and save mode in [Report Setting].

⚠ *CAUTION*

- ◆ *When the equipment is repaired or upgraded, the equipment settings will usually be restored to the factory values and need to be reset at that time.*

4.3.2 Setup before Use

When using the ECG for the first time or use it after repair or update, be sure to check and improve the following settings:

In the [12-lead] interface , select the lead system and the single or three rhythm lead label;

In the [General-Filter Setting] setting interface, set the filter frequency;

In the waveform acquisition interface, set the layout, gain, and paper speed according to actual needs;

In the [Standard ECG] setting interface, select sampling mode, printing time, freezing time and other parameters according to actual needs.

⚠ *CAUTION*

- ◆ *In the measurement, the paper speed, gain, layout, etc. can be quickly set by the real-time shortcu key. For details, see section 2.3.*

Chapter 5 Connecting ECG Cable

◆ *During defibrillation, don't touch the patient, electrodes, patient cable and lead terminals. Otherwise it may result in serious injury or death.*

◆ *For a pacemaker patient, ECG machine may interpret and record the pacemaker pulse as the QRS complex wave. Please carefully inspect the ECG waveform recorded by ECG machine.*

◆ *For a pacemaker patient, pacemaker detection should be activated when set the machine. Please refer to Section 2.3.2.2 for details.*

◆ *Please verify that all electrodes are connected to the correct sites on patient body. Avoid electrodes (including neutral electrodes) and the patient contacting the ground or any other electric conductors.*

◆ *As with all medical equipment, carefully route patient cabling to reduce the possibility of patient entanglement or strangulation.*

◆ *Suction ball of chest electrodes contains natural rubber, which may cause allergy. Please pay close attention to the skin placed with electrodes, if allergy occurs, please change other types of electrodes.*

◆ *Automatic measurement and diagnosis are for the doctors' reference only, and cannot be directly used as the basis for clinical treatment.*

5.1 Environmental Requirements

● It is required to keep warm indoors in winter, and the room temperature is no lower than 18 ℃ so as to avoid EMG interference caused by coldness. In summer, open the air conditioner to control room temperature and to prevent insecure placement of electrodes cause by the patient's sweating.

● AC power outlet must be connected with dedicated and reliable ground wire. .

● When place the ECG machine, try to keep its power cord away from the patient's bed and patient cable. Do not place other appliances or power cord near the bed.

- The patient's bed should be of suitable size to ensure that the patient can naturally lie down, with hands and feet stretching naturally.

5.2 Preparation

To acquire accurate ECG signals, the patient should be explained about the following information.

- Before ECG examination, the patient should not do strenuous exercise, drink alcohol, smoke, have full meal, have tea, have uncooked and cold food.

- Inform the patient of preparation for ECG examination, and make a good explanation to him or her so as to eliminate his or her mental nervousness.

- Before examination, the patient should have a good rest and stay calm.

- During examination, the patient should lie down naturally, relax, and breathe calmly and evenly.

- During examination, the patient should not move or turn over casually, with hands and feet no touching metal objects, such as metals at the bed edges.

- Open the ECG machine to warm it up, and then set its parameters. For startup and system setup, please refer to *Chapter 3* and *Chapter 4*. Power off the ECG machine when connecting the patient cable and electrodes.

5.3 Electrode Selection and Usage

5.3.1 Examinee's Skin Preparation

When environmental factors are correct and the examinee is ready for the exam, place electrodes on examinee body. To obtain accurate ECG signals, properly prepare the examinee's skin to be placed with electrodes.

Remove body hair on intended sites.

Wipe the intended sites with alcohol to degrease and remove dead skin cells.

Dry each site with a dry cotton ball.

5.3.2 Electrode Selection

The ECG machine is equipped with reusable chest bulbs and limb clamps. For your convenience, you can also purchase disposable electrode slices from the manufacturer. Use chest bulbs or disposable electrode slices to connect the chest leads (C1 ~ C6), while use limb clamps or disposable electrode slices to connect the limb leads (R, F, L, RF).

5.3.2.1 Chest Bulb

The chest bulb is composed of suction bulb and metal electrode. There is a connection hole on metal electrode, which is used to connect the lead wire of Φ4.0 mm connector.
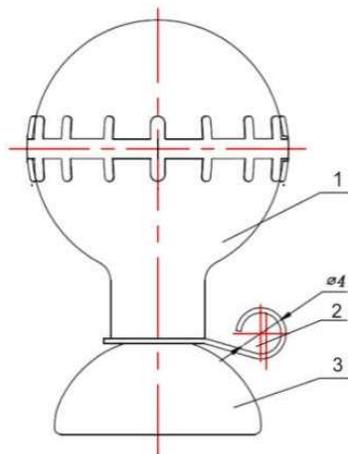
Figure 5.1 Chest Bulb

1. Suction bulb;

2. Connection hole (Φ4.0mm);

3. Metal electrode;

Placing Chest Electrodes

● Check the chest electrodes, and verify that they are clean;

● Respectively connect 6 chest electrodes with its corresponding lead wire. Straighten out the lead wires, and avoid twisting and twining;

● Unsnap the patient's chest button to expose electrode sites;

● Prepare the skin;

● Apply a thin layer of conductive cream on the surface of electrode sites.

● Evenly apply a thin layer of conductive cream on the edges of chest bulbs,;

- Well place the electrodes: squeeze the chest suction bulb to make the lower edge of the metal electrode tightly connected with the skin. Loosen the bulb to make the electrode adsorbed on the patient's skin;
- Ensure that the ECG machine and its cable, electrodes and lead wires are firmly connected.

5.3.2.2 Limb Clamp

The limb clamp is composed of the clamp and metal electrode. There is a connection hole on the metal electrode, which is used to connect the lead wire of Φ4.0 mm connector.
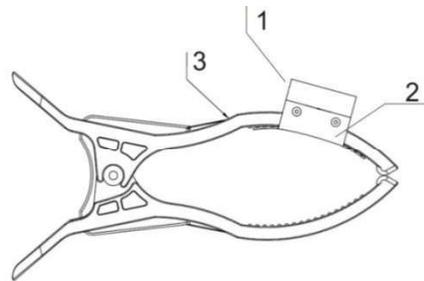
Fig 5.2 Limb Clamp

1. Connection hole (Φ4.0mm);

2. Metal electrode;

3. Clamp

Placing Limb Clamps

Limb electrodes should be placed above the forearm wrist joint and the calf ankle joint medial to make them closely contact with skin, bypassing the bones.

- Check the electrodes to verify that they are clean,
- The four limb electrodes are respectively connected with the corresponding lead wire. Straighten out the lead wires, and avoid twisting,
- Roll up sleeves and trousers to expose electrode sites.
- Prepare the skin,
- Apply a thin layer of conductive cream on the surface of electrode sites;
- Apply a thin layer of conductive cream on metal electrodes,
- Well place the electrodes: clamp the prepared sites by limb clamps;

- Ensure the ECG machine and its patient cable, the electrodes and the lead wires are firmly connected.

5.3.2.3 Disposable Electrode Slice

Disposable electrode slices are not accompanied with this ECG machine. Please contact the manufacturer or authorized representatives if needed.

Steps of placing disposable electrode slices:

- Roll up the patient's sleeves and trousers, and loosen his or her chest button to expose electrode sites,

- Prepare the skin,

- Attach the electrodes in correct position. Limb electrodes should be placed above the forearm wrist joint and the calf ankle joint medial to make them closely contact the skin, bypassing the bones.

- Straighten out the lead wires, and avoid twisting and twining. Connect the lead wires with electrode slices;

- Ensure the ECG machine and its patient cable, the electrodes and lead wires are firmly connected.

- *Please don't mix up electrodes of different types and brands. Otherwise it may cause large baseline drift or longer baseline recovery after defibrillation.*

- *Disposable electrodes can be used only once, repeated use may result in performance degradation or cross infection.*

- *Reusable electrodes must be cleaned and disinfected before use.*

- *Suction bulb of chest electrode contains natural rubber, which may cause allergy. Please pay close attention to the electrode sites, if allergy occurs, please change another type of electrodes.*

- *If reusable electrodes are damaged after long-term use, please contact our after-sale service in time for purchase and replacement. We receive order of*

---

electrodes only by set. Old and new electrodes cannot be mixed up.

⚠ **CAUTION**

◆ *In order to achieve satisfactory ECG recording results, metal electrodes must be closely contacted with the skin evenly.*

◆ *Metal electrodes must be clean. And the prepared sites contacting metal electrodes must be clean, free of grease and perspiration.*

◆ *When placing chest electrodes, don't let metal electrodes contact with each other, or the conductive cream zone of adjacent electrodes overlap.*

◆ *When placing the four limb electrodes, don't injury the patient' hands and feet. After placement, check whether the electrodes are too loose or too tight.*

◆ *Frequent plugging and unplugging may cause the metal plates of limb electrodes moving or loosening, which need adjustment during use.*

◆ *Reusable electrodes should be immediately cleaned after each use.*

5.4 Electrode Placement

5.4.1 ECG Patient Cable

Contrast Table of Electrodes and Lead Wires:

Placement	Symbol	Color Code
Right Arm	R	Red
Left Arm	L	Yellow
Left Foot	F	Green
Right Foot	RF	Black
Chest	C1	Red
Chest	C2	Yellow
Chest	C3	Green
Chest	C4	Brown
Chest	C5	Black
Chest	C6	Purple

5.4.2 Limb Lead Placement

R ——Right Arm

L ——Left Arm

RF——Right Foot

F ——Left Foot

Fig 5.3 Chest & Limb Lead Electrode Placement
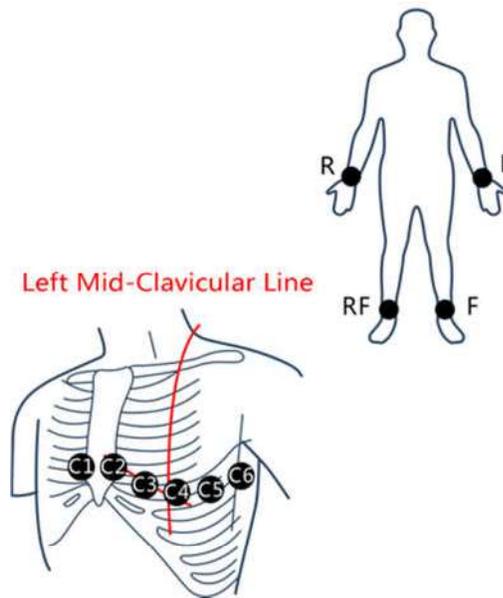
5.4.3 Chest Lead Placement

C1: Fourth intercostal space at the right sternal border.

C2: Fourth intercostal space at the left sternal border

C3: Midway between location C2 and C4.

C4: Left mid-clavicular line in the fifth intercostal space.

C5: Left anterior axillary line on the same horizontal level as C4.

C6: Left mid-axillary line on the same horizontal level as C4.

5.4.4 Pediatric Electrode Placement

When acquiring pediatric ECG, C3 lead should be placed in C4R position rather than the site where standard C3 lead is placed, as shown in right figure.
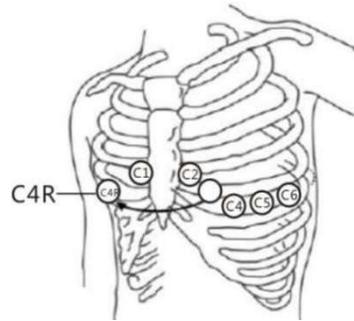
Fig 5.4 Pediatric Chest Lead Electrode Placement

5.5 Electrode Connection

Plug chest lead wires and limb lead wires respectively into connection holes of the chest electrode bulbs and limb electrode clamps. Adjust the contact sites to guarantee compact connection. Pay attention to the electrode placement.

5.6 Lead-off Handling

When the electrode is loose, or the electrode is not properly connected to the lead wire, or the ECG cable is loose from the machine side, the lead name on the ECG display will be red. The " " icon is illuminated (white) after all leads are connected.

5.7 Entering Patient Information

Some of the patient's information directly affects ECG measurements. Patient information must be checked before starting ECG acquisition. The user can enter into Patient Information page with **F1** key on panel or hotkey at bottom right of numeric keyboard. Enter patient information by keyboard; select the desired blank by direction key. For details, please refer to *Chapter 2*. After filling out the information, please confirm and exit.

Chapter 6 ECG Acquisition and Recording

6.1 Acquisition Preparation

To secure the patient and to record stable accurate electrocardiogram (ECG), please carefully check the following items before you power on the machine for measurement.

1）Check whether the exam room is appropriate;

◆ Whether there are apparatuses such as X-ray machine, ultrasound system and so forth in the patient room, as they may interfere with each other;

◆ Whether the ground is well connected;

◆ Whether room temperature and humidity are suitable; temperature would better be in the range of 20 ~ 25℃, ambient humidity would better be in the range of 30% ~ 60%.

2） Whether the power is well connected.

● Whether the power plug is loose;

● Whether the power cord is intertwined;

● Whether the power is sufficient if supplied by battery.

3）Whether the lead wires are well connected.

● Whether the plug is loose;

● Whether the patient cable stays too close to the power cord;

● Whether the lead wires and electrodes are well connected;

● Whether electrodes are installed loosely, or adjacent electrodes have contact with each other.

4）How is the patient?

● Whether the patient is too nervous; whether he or she moves or talks

● Whether the patient's hands or feet contact metal objects such as bed edges.

5）Whether instruments are in good condition.

● Whether the ECG machine is damaged;

● Whether ECG machine is inspected and maintained regularly:

● Whether recording paper is sufficient.

6.2 Acquisition and Recording

6.2.1 Recording Setup

After the checks are all right, power on the ECG machine, it enters into Waveform Acquisition interface, and then you can observe the waveforms after they become stable. Set the sampling mode, layout, gain, and paper speed on actual needs, and then press ⬭ key to print ECG waveforms. On Waveform Acquisition interface, you can set the ECG machine with **F1~F7** key or by clicks on touchscreen. Press the key ⬭ to switch between auto mode and manual mode. In manual mode, you can change leads with " ◀ ▶ " key. If you select a layout with rhythm lead, set it in **12-Lead**. For details, please refer to *Chapter 2*.
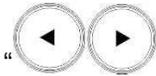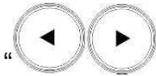
⚠ ***CAUTION***

- ◆ *When ECG signal is just connected or the machine receives overload noise, waveforms will be chaotic, baseline drift will be severe, and waveform amplitude may exceed the maximum width. At this moment, please wait until the machine is connected, the patient calms down, and waveforms displayed on the interface become stable, then start measuring and recording.*

- ◆ *When the ECG machine is overloaded or any part of the amplifier is saturated, or ECG machine works abnormally, at this moment, only baseline is displayed on the interface. In order to achieve accurate results, please wait until the machine is connected, the patient calms down, and waveforms displayed on the interface become stable, then start measuring and recording.*

- ◆ *During the process of ECG signal acquisition, if waveforms become cluttered or unstable, please refer to Chapter 8.*

6.2.2 Recording Report

The following are the reports printed in real-time auto-simultaneous mode:

Fig. 6.1 ECG Recording Report(a)

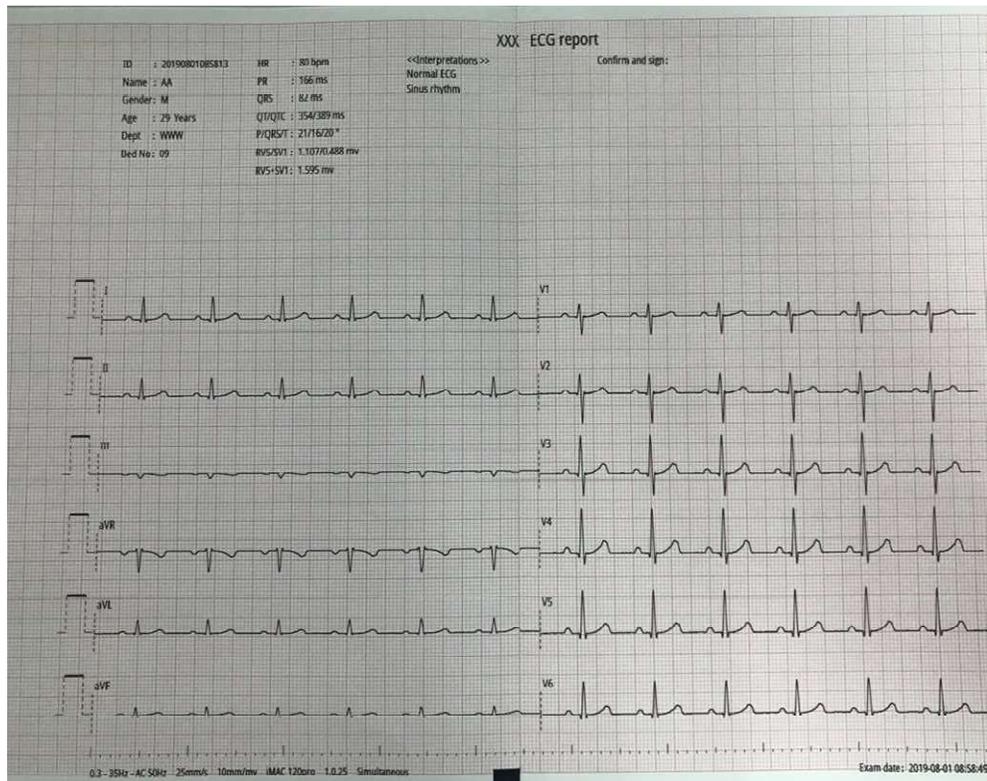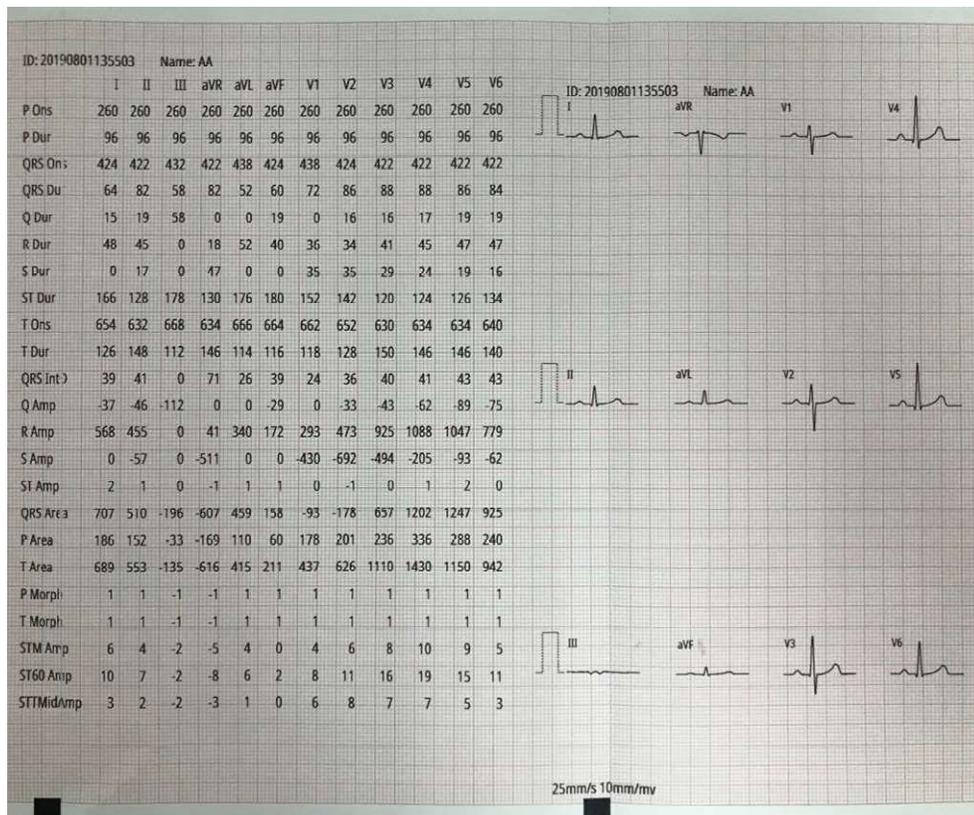|	I	II	III	aVR	aVL	aVF	V1	V2	V3	V4	V5	V6
P Ons	260	260	260	260	260	260	260	260	260	260	260	260
P Dur	96	96	96	96	96	96	96	96	96	96	96	96
QRS Ons	424	422	432	422	438	424	438	424	422	422	422	422
QRS Du	64	82	58	82	52	60	72	86	88	88	86	84
Q Dur	15	19	58	0	0	19	0	16	16	17	19	19
R Dur	48	45	0	18	52	40	36	34	41	45	47	47
S Dur	0	17	0	47	0	0	35	35	29	24	19	16
ST Dur	166	128	178	130	176	180	152	142	120	124	126	134
T Ons	654	632	668	634	666	664	662	652	630	634	634	640
T Dur	126	148	112	146	114	116	118	128	150	146	146	140
QRS Int	39	41	0	71	26	39	24	36	40	41	43	43
Q Amp	-37	-46	-112	0	0	-29	0	-33	-43	-62	-89	-75
R Amp	568	455	0	41	340	172	293	473	925	1088	1047	779
S Amp	0	-57	0	-511	0	0	-430	-692	-494	-205	-93	-62
ST Amp	2	1	0	-1	1	1	0	-1	0	1	2	0
QRS Area	707	510	-196	-607	459	158	-93	-178	657	1202	1247	925
P Area	186	152	-33	-169	110	60	178	201	236	336	288	240
T Area	689	553	-135	-616	415	211	437	626	1110	1430	1150	942
P Morph	1	1	-1	-1	1	1	1	1	1	1	1	1
T Morph	1	1	-1	-1	1	1	1	1	1	1	1	1
STM Amp	6	4	-2	-5	4	0	4	6	8	10	9	5
ST60 Amp	10	7	-2	-8	6	2	8	11	16	19	15	11
STTMidAmp	3	2	-2	-3	1	0	6	8	7	7	5	3

Fig. 6.1 ECG Recording Report(b)

The ECG report above consists of two parts (a) and (b) with a print layout of 6×2.

This ECG report contains the following information: The ECG waveform 6×2 layout, patient information, date of inspection, and measurement information.

Measurement information:

HR: heart rate

P duration: average value of the P-wave duration of the average heart beat of each lead

PR interval: average value of the PR interval of the average heart beat of each lead

QRS duration: average value of the QRS duration of the average heart beat of each lead

QT/QTc interval: average/normalized value of the QT interval of the average heart beat per lead of each lead

P/QRS/T electric axis: the dominant direction of the average integrated ECG vector on the frontal plane.

RV5/SV1 amplitude: the maximum amplitude of the R and R' waves in the average heart beat on the lead V5 / The maximum value of the absolute amplitude of the S and S' waves in the average heart beat on the lead V1

RV5+SV1 amplitude: RV5 and SV1 sum

Minnesota code (optional) ECG code

Average template (optional) : multiple periodic waveform for each lead will be combined into an average of a single periodic waveform

Measurement matrix (optional) : the horizontal display shows 12 leads; the vertical display shows the parameters of each lead, such as PQRST wave start and end points, P, QRS, T wave group interval, etc.

The dotted line on the ECG waveform is the position marker, which marks the start and end points of the P wave, the start and end points of the QRS wave, and the T wave end point.

Diagnostic results: the diagnostic results show the results of the automated diagnosis.

Top information; name of medical institution

Bottom information: 0.6~35Hz (0.6Hz baseline drift filter, 35Hz low pass filter)

AC50 (50Hz AC filter)

25mm/s (paper feed speed)

10mm/mV (gain)

iMAC 120pro (machine model)

1.0.25 (software version)

Simultaneous (recording order)

Inspection date

Confirm report and sign

⚠ **WARNING**

◆ *This machine's auto-measurement precision conforms to the measurement standard of ECG machine (please refer to Appendixes). Diagnostic structure is made of related parameters in each wave segment. The interpretations are for doctors' reference only, which cannot be used as the basis of clinical treatment.*

6.2.3 ECG Waveform Description

Standard ECG waveform is shown as follows:
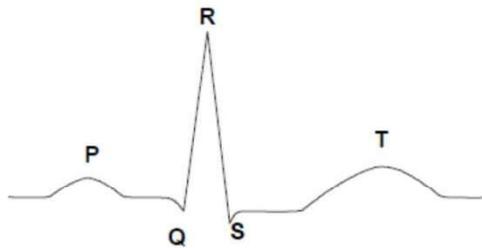
Fig 6.2 Standard ECG Waveform

Meaning and description of each segment of ECG waveform:

◆ P wave is of blunt round shape, and its amplitude is lower than T wave's.

◆ PR interval: time from the start point of P wave to the start point of QRS wave group. It represents the depolarization time from atrial to ventricle. The older the patient is or the slower the heart rate is, the longer PR interval will be. Abnormally-prolonged PR interval indicates atrioventricular conduction disturbance.

◆ QRS waveform group: it indicates the changes of potential and time during ventricular

muscle depolarization. R wave is high and narrow without notch, and its segments are completely above or below the base point.

◆ S-T segment: a horizontal line from the end point of QRS wave group (J point) to the start point of T wave is called S-T segment. Down deviation of any normal lead's S-T segment should not exceed 0.05mV. When S-T segment's down deviation exceeds the standard range, it is common in myocardial ischemia or strain. Normally, if S-T segment deviates upwards, limb lead and precordia leads of V4-6 should not exceed 0.1mV and precordia leads of V1-3 should not exceed 0.3mV. When S-T segment's up deviation exceeds the standard range, it is common in acute myocardial infarction or pericarditis.

◆ T wave is of blunt round shape. Its amplitude is lower than 1/3 of R wave's. But it takes longer time. The direction of T wave is usually the same as that of the main wave of QRS wave group. Ⅰ,Ⅱ, V4-6 leads are upright while aVR is upside down. Other leads can be upright, bidirectional or upside down. If V1 is upright, V3 could not be upside down. In the leads of QRS wave group whose main wave is up, when T wave is low and smooth or upside down, it is common in myocardial ischemia or hypokalemia.

⚠ CAUTION

◆ *Here is a simple description of ECG waveforms. For details, please see relevant references.*

6.3 Freeze

Before ECG signal acquisition, please set the freeze time on Standard ECG interface. For details, please refer to *Section 2.3.2.1*. On Freeze interface, use the real-time hotkeys to observe ECG waveforms as needed.
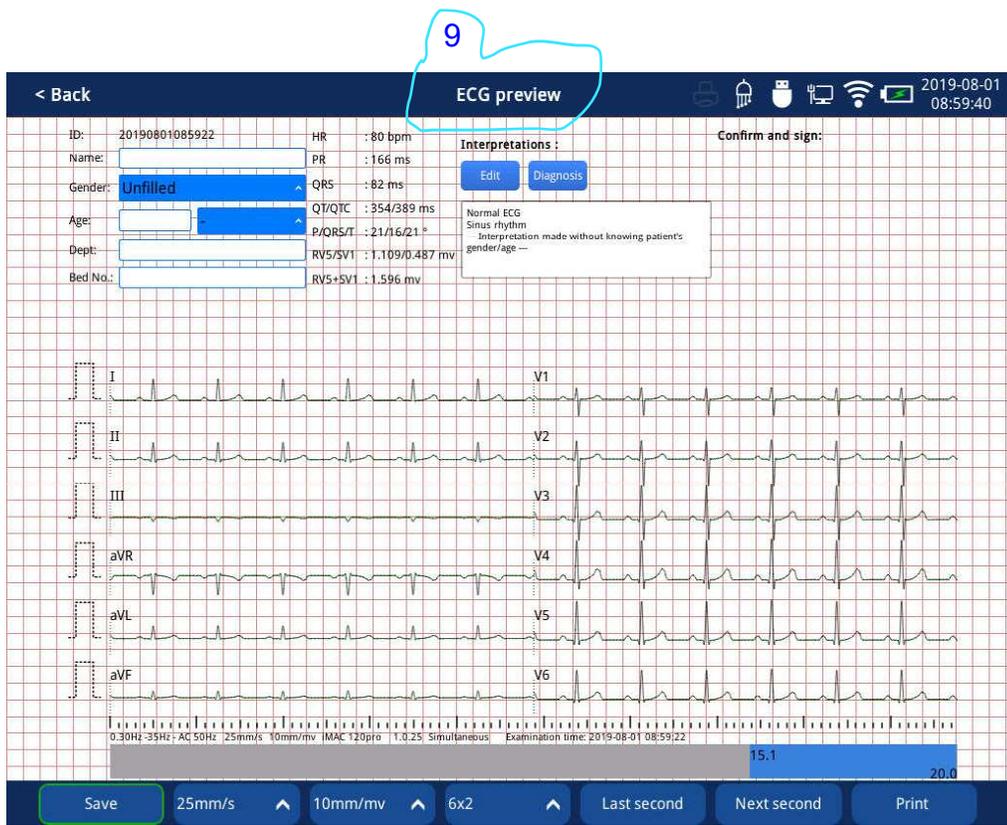
< Back   ECG preview   2019-08-01 08:59:40

ID: 20190801085922   HR   : 80 bpm   Confirm and sign:
Name: PR   : 166 ms
Gender: Unfilled   QRS   : 82 ms   Interpretations :
                                  QT/QTC   : 354/389 ms   Edit   Diagnosis
Age: P/QRS/T : 21/16/21 °
Dept: RV5/SV1 : 1.109/0.487 mv   Normal ECG
Bed No.:   RV5+SV1 : 1.596 mv   Sinus rhythm
                                                              Interpretation made without knowing patient's
                                                              gender/age —

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

0.30Hz -35Hz - AC 50Hz 25mm/s 10mm/mv MAC 120pro 1.0.25 Simultaneous   Examination time: 2019-08-01 08:59:22

15.1
20.0

Save   25mm/s ∧   10mm/mv ∧   6x2 ∧   Last second   Next second   Print

Fig 6.3 Freeze Interface

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6.4 Report Storage

6.4.1 Report Storage Location

Configure the report storage location in Application→ Convention→ General with options such as Local/SD card/U disk.

Local:　　　　　When sampling time is 10s, and layout is 6×2, you can store no less than 1500 reports.

　　　　　　　　When sampling time is 2.5s, and layout is 6×2, you can store no less than 2000 reports.

U disk (SD card): you can select U disk (SD card) only when it is inserted. Reports are stored in .ECG format and can be viewed from this ECG Machine or dedicated software workstation.

⚠ **CAUTION**

◆ *Local storage has limited capacity, thus U disk (SD card) is recommended to store the reports.*

6.4.2 Report Storage Mode

In the [Report Management] interface, you can set the report save mode to automatic / manual.

Auto Storage

In auto recording mode, after each measurement, the system will automatically store the current report to designated location.

When freezing the ECG waveforms, the system will automatically generate the report and store it in designated location.

⚠ **CAUTION**

◆ *In auto recording mode, the system will store the report only when the measurement is finished. If it stops recording abnormally, the report will not be saved.*

◆ *In manual recording mode, reports are automatically saved every 10s.*

◆ *When a lead is off the patient, freezing loses its effect, still it can print, but the system cannot store the recording results automatically.*

Manual Storage

When the save mode is set to manual, when the recording ends, the system will pop up the "Save the ECG file?" dialog box .

After freezing the ECG waveform, click the Back button on the Freeze interface. The system will pop up the "Save the ECG file?" dialog box .

Chapter 7 Report Management

7.1 Report Storage

The report is default to be saved locally, but the local storage capacity is limited. It is recommended to use USB storage. The USB has large storage capacity, which is convenient for category management and storage.

To avoid damage or loss of external storage devices, you can back up the reports in the storage device to a dedicated computer server.

7.2 Report Management

In the waveform acquisition interface directly click the " Report " button at the bottom of the screen or click **F6** key enter into the **[Report Management]** interface. For the layout of the interface, see section 2.3.7.

The general setting interface has a locking function. Pressing the key combination "CTRL+ALT+L" will pop up a lock dialog box, which can lock the functions of report printing, report transmission, report deletion and so on. After locking, the option button is grayed out; if you need to change the option settings, press the key combination "CTRL+ALT+L" again to unlock the option.

7.2.1 Selecting Reports

Ways of selecting reports:

- Select a storage device to view reports;
- Touch select the desired report or control it by an external USB mouse;
- Select all reports on the current page;
- Check the Select All button to select all reports.

7.2.2 Searching Reports

Enter relevant information (such as ID number, name) in the " [Query ID/Name] " query dialog box to query related reports. After the query, the list area only displays the reports that meet the requirements, which is convenient for finding and operating. Figure 7.1.
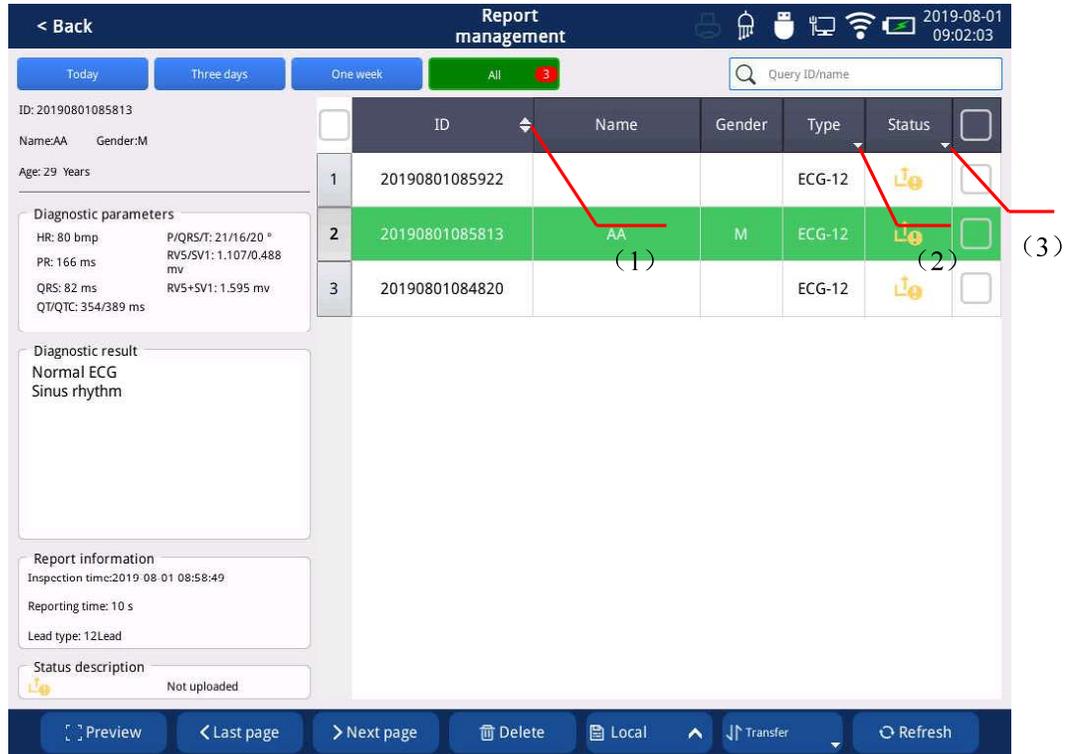

Fig 7.1 Searching Reports

After the query is completed, the query information is deleted, and the content of the report list before the query can be restored.

You can also filter the report in the following ways:

(1) Click the up arrow next to the "ID" button, all reports will be sorted in ascending order by ID number; click the down arrow, all reports will be sorted by ID number in descending order; click the "ID" button, all reports will be sorted in descending order of report modification time.

(2) Click the "Type" button to filter the report by report type. They are: all, standard 12 leads, rhythm, etc.

(3) Click the "Status" button to filter the report by report upload status. They are: all, not uploaded, uploaded, failed to upload, diagnosed, etc.

7.2.3 Editing Reports

After selecting the report, click the " [ ] Preview " button to enter the ECG report preview interface, you can edit the patient information in the report, edit or re-analyze the diagnostic parameters and diagnosis results in the report. Click the " Edit " button, the "Case dictionary" page will pop up, and the diagnosis result can be quickly edited; the medical record can also be customized and added to the "Case dictionary". Click the " Diagnosis " button, the "Previous diagnosis" and "Current diagnosis" comparison pages will pop up. Click the " Reanalysis " button to give the diagnosis parameters and diagnosis results of the ECG waveform displayed on the current ECG preview interface. After editing, click the " Save " button to save and return to the report management interface.
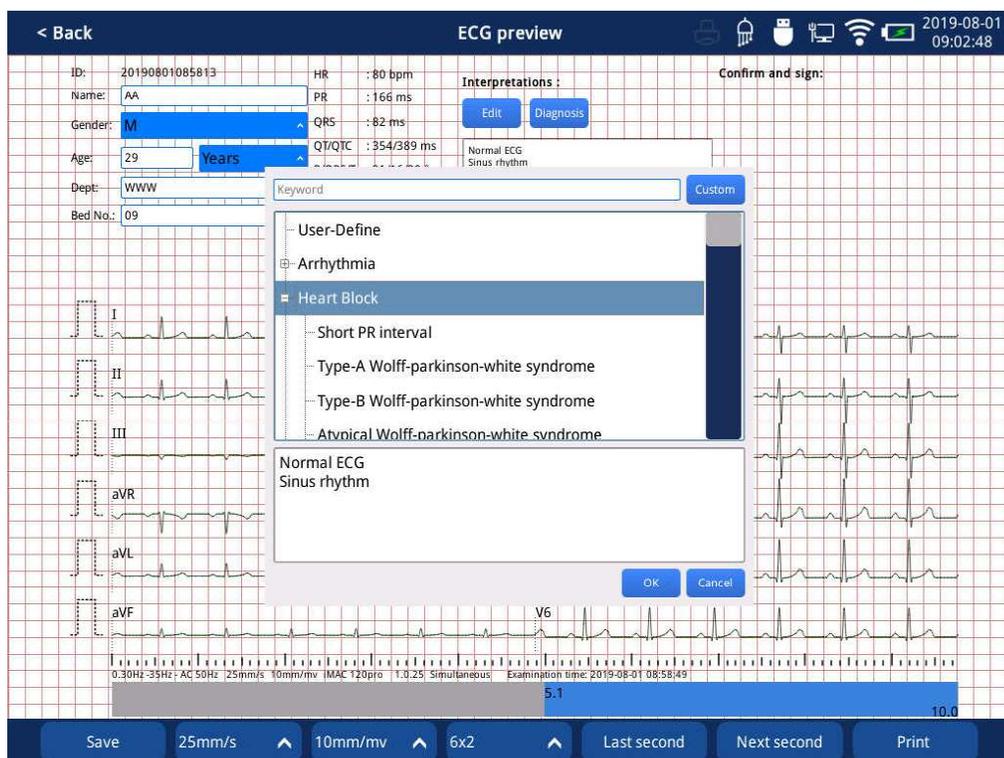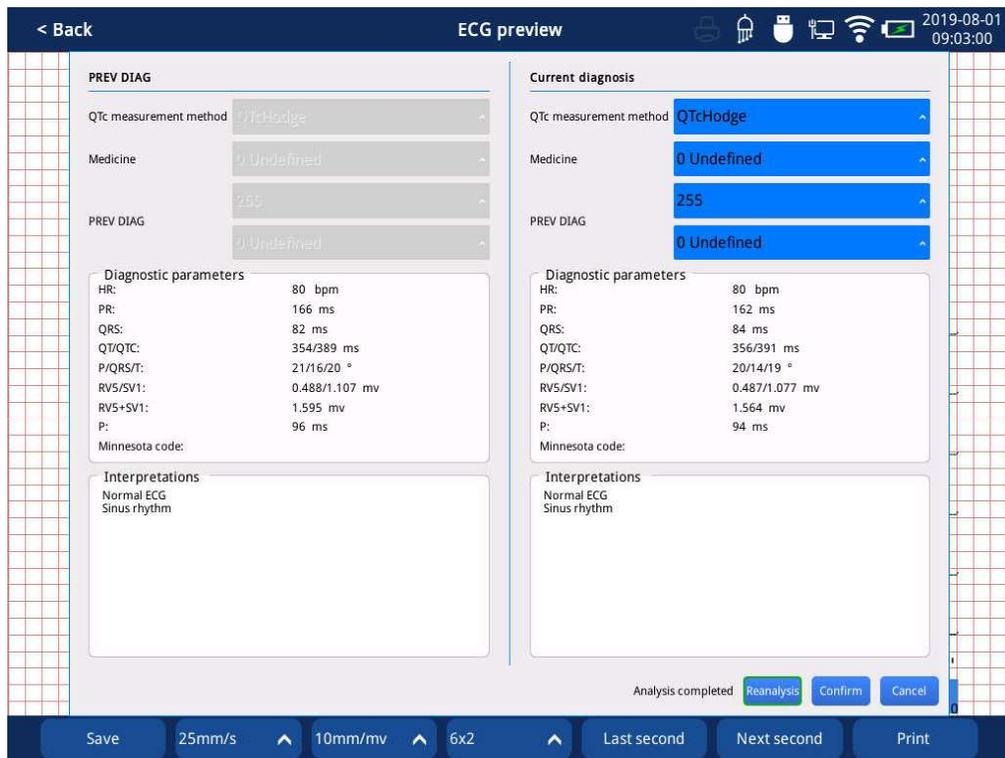

Fig 7.2 Editing Reports

Fig. 7.3 Reanalysis report

7.2.4 Printing Reports

When preview a report, you can print it with [ECG] key.

⚠ **CAUTION**

◆ *When preview and edit the report, you can select only one report.*

7.2.5 Deleting Reports

Select a report and press the key [🗑 Delete] to delete it.

(1) Check to select all the reports in **[Report Management]**

(2) Check to select all the reports in the current page.