

EDAN

SE-1010

PC ECG

Version 21

CE₀₁₂₃

About this Manual

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Statement

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Upon request, EDAN may provide, with compensation, necessary circuit diagrams, and other information to help qualified technician to maintain and repair some parts, which EDAN may define as user serviceable.

Terms Used in this Manual

This guide is designed to give key concepts on safety precautions.

WARNING

A **WARNING** label advises against certain actions or situations that could result in personal injury or death.

CAUTION

A **CAUTION** label advises against actions or situations that could damage equipment, produce inaccurate data, or invalidate a procedure.

NOTE

A **NOTE** provides useful information regarding a function or a procedure.

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Chapter 1 Safety Guidance

This chapter provides important safety information related to the use of SE-1010 PC ECG.

1.1 Intended Use

SE-1010 PC ECG is a PC-based diagnostic tool intended to acquire, process and store ECG signals from adult and pediatric patients undergoing stress exercise test or resting test. SE-1010 PC ECG is intended to be used only in hospitals and healthcare facilities by doctors and trained healthcare professionals. The cardiogram recorded by SE-1010 PC ECG can help users to analyze and diagnose heart disease. However the ECG with measurements and interpretive statements is offered to clinicians on an advisory basis only.

WARNING

- ◆ This system is not designed for intracardiac use or direct cardiac application.
 - ◆ This system is not intended for home use.
 - ◆ This system is not intended for treatment or monitoring.
 - ◆ This system is intended for use on adult and pediatric patients only.
 - ◆ The results given by the system should be examined based on the overall clinical condition of the patient, and they can not substitute for regular checking.
-

1.2 Warnings and Cautions

To use the system safely and effectively, firstly be familiar with the operation method of Windows and read the user manual in detail to be familiar with the proper operation method for the purpose of avoiding the possibility of system failure. The following warnings and cautions must be paid more attention to during the operation of the system.

1.2.1 General Warnings

WARNING

1. The system is intended to be used by qualified physicians or personnel professionally trained. They should be familiar with the contents of this user manual before operation.
 2. Only qualified service engineers can install this equipment, and only service engineers authorized by the manufacturer can open the shell.
-

WARNING

3. **EXPLOSION HAZARD** - Do not use the system in the presence of flammable anesthetic mixtures with oxygen or other flammable agents.
 4. **SHOCK HAZARD** - The power receptacle must be a hospital grade grounded outlet. Never try to adapt the three-prong plug to fit a two-slot outlet.
 5. Only the patient cable and other accessories supplied by the manufacturer can be used. Or else, the performance and electric shock protection can not be guaranteed. The system has been safety tested with the recommended accessories, peripherals, and leads, and no hazard is found when the system is operated with cardiac pacemakers or other stimulators.
 6. Make sure that all electrodes are connected to the patient correctly before operation.
 7. Ensure that the conductive parts of electrodes and associated connectors, including neutral electrodes, do not come in contact with earth or any other conducting objects.
 8. If reusable electrodes with electrode gel are used during defibrillation, the system recovery will take more than 10 seconds. The manufacturer recommends the use of disposable electrodes at all times.
 9. Electrodes of dissimilar metals should not be used; otherwise it may cause a high polarization voltage.
 10. The disposable electrodes can only be used for one time.
 11. Do not touch the patient, bed, table or the equipment while using the ECG together with a defibrillator.
 12. Do not touch accessible parts of non-medical electrical equipment and the patient simultaneously.
 13. The use of equipment that applies high frequency voltages to the patient (including electrosurgical equipment and some respiration transducers) is not supported and may produce undesired results. Disconnect the patient data cable from the electrocardiograph, or detach the leads from the patient prior to performing any procedure that uses high frequency surgical equipment.
 14. Fix attention on the examination to avoid missing important ECG waves.
 15. **SHOCK HAZARD** - Don't connect non-medical electrical equipment, which has been supplied as a part of the system, directly to the wall outlet when the non-medical equipment is intended to be supplied by a multiple portable socket-outlet with an isolation transformer.
-
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WARNING

16. **SHOCK HAZARD** - Don't connect electrical equipment, which has not been supplied as a part of the system, to the multiple portable socket-outlet supplying the system.
 17. Do not connect any equipment or accessories that are not approved by the manufacturer or that are not IEC/EN 60601-1-1 approved to the system. The operation or use of non-approved equipment or accessories with the system is not tested or supported, and system operation and safety are not guaranteed.
 18. Any non-medical equipment (such as the external printer) is not allowed to be used within the patient vicinity (1.5m/6ft.).
 19. Do not exceed the maximum permitted load when using the multiple portable socket-outlet(s) to supply the system.
 20. Multiple portable socket-outlets shall not be placed on the floor.
 21. Do not use the additional multiple portable socket-outlet or extension cord in the medical electrical system, unless it's specified as part of the system by manufacturer. And the multiple portable socket-outlets provided with the system shall only be used for supplying power to equipment which is intended to form part of the system.
 22. Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC/EN standards (e.g. IEC/EN 60950 for data processing equipment and IEC/EN 60601-1 for medical equipment). Furthermore all configurations shall comply with the valid version of the standard IEC/EN 60601-1-1. Therefore anybody, who connects additional equipment to the signal input or output connector to configure a medical system, must make sure that it complies with the requirements of the valid version of the system standard IEC/EN 60601-1-1. If in doubt, consult our technical service department or your local distributor.
 23. Connecting any accessory (such as external printer) or other device (such as the computer) to this electrocardiograph makes a medical system. In that case, additional safety measures should be taken during installation of the system, and the system shall provide:
 - a) Within the patient environment, a level of safety comparable to that provided by medical electrical equipment complying with IEC/EN 60601-1, and
 - b) Outside the patient environment, the level of safety appropriate for non-medical electrical equipment complying with other IEC or ISO safety standards.
 24. All the accessories connected to system must be installed outside the patient vicinity, if they do not meet the requirement of IEC/EN 60601-1.
-
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WARNING

25. You should purchase computer, printer, treadmill, ergometer, BP monitor and bar code reader from the manufacturer. Otherwise, the manufacturer will not be held responsible for the maintenance of the PC hardware, operating system and other accessories.
26. If multiple instruments are connected to a patient, the sum of the leakage currents may exceed the limits given in the IEC/EN 60601-1 and may pose a safety hazard. Consult your service personnel.
27. Connecting to other devices may decrease the antistatic gradation of the system during operation.
-
-

1.2.2 Battery Care Warnings

WARNING

1. Improper operation may cause the internal battery to be hot, ignited or exploded, and it may lead to the decrease of the battery capacity. It is necessary to read the user manual carefully and pay more attention to warning messages.
 2. Batteries of the same model and specification as manufacture configuration should be used.
 3. **DANGER OF EXPLOSION** -- Do not reverse the anode and the cathode when installing the battery.
 4. Do not heat or splash the battery or throw it into fire or water.
 5. Do not destroy the battery; do not pierce battery with a sharp object such as a needle; do not hit with a hammer, step on or throw or drop to cause strong shock; do not disassemble or modify the battery.
 6. When leakage or foul smell is found, stop using the battery immediately. If your skin or cloth comes into contact with the leakage liquid, cleanse it with clean water at once. If the leakage liquid splashes into your eyes, do not wipe them. Irrigate them with clean water first and go to see a doctor immediately.
 7. Properly dispose of or recycle the depleted battery according to local regulations.
 8. Remove the battery from the transmitter if the system won't be used for a long time.
-
-

1.2.3 General Cautions

CAUTION

1. Avoid liquid splash and excessive temperature. The temperature must be kept between 5 °C and 40 °C during operation, and it should be kept between -20 °C and 55 °C during transportation and storage.
 2. Do not use the equipment in a dusty environment with bad ventilation or in the presence of corrosive.
 3. Make sure that there is no intense electromagnetic interference source around the equipment, such as radio transmitters or mobile phones etc. Attention: large medical electrical equipment such as electrosurgical equipment, radiological equipment and magnetic resonance imaging equipment etc. is likely to bring electromagnetic interference.
 4. Ruptured fuse must only be replaced with that of the same type and rating as the original.
 5. The device and accessories are to be disposed of according to local regulations after their useful lives. Alternatively, they can be returned to the dealer or the manufacturer for recycling or proper disposal. Batteries are hazardous waste. Do NOT dispose of them together with house-hold garbage. At the end of their lives hand the batteries over to the applicable collection points for the recycling of waste batteries. For more detailed information about recycling of this product or battery, please contact your local Civic Office, or the shop where you purchased the product.
 6. Federal (U.S.) law restricts this device to sale by or on the order of a physician.
-
-

1.2.4 Operation for Wireless System

WARNING

1. Make sure that there is no intense electromagnetic interference source around the wireless system.
 2. Do not open the battery cover of the transmitter during operation.
-
-

1.2.5 Preparation and Operation Warnings (for Exercise ECG)

WARNING

1. Test the safety stop (mushroom type) and safety stop (cord type) of the treadmill before using the system.
 2. During the exercise test, ensure that there are at least 2 experienced physicians present. One of them observes the patient and deals with the emergency.
 3. Make sure that there is necessary valid first-aid equipment such as defibrillators, blood-pressure meters etc, and necessary valid medication in the exercise test room.
 4. Turn off the system power and disconnect the power cord from the wall outlet after using the system.
 5. Make sure that the power is turned off and the power cord is disconnected from the AC socket before defibrillation.
 6. Keep the four feet of the machine on the ground and make sure that it's stably working.
 7. The treadmill must be powered by the specific power outlet.
 8. Examine the treadmill/ergometer carefully before using it.
 9. The patient undergoing the exercise test should wear suitable clothes and shoes.
 10. Keep hands, hair, jewelry, and loose clothing away from moving parts.
 11. Don't let the patient stand on the running belt when starting the treadmill. The patient should stand on the foot rails and hold the handrails during start-up. Wait until the running belt is moving before placing feet on the belt.
 12. To avoid the static electricity, the patient should not wear loose clothing or clothing (such as nylon) that easily produces static electricity.
 13. Stop exercising immediately when the patient feels uncomfortable or something abnormal in the operation.
 14. Press down the safety stop (mushroom type) or pull out the safety stop (cord type) to stop the treadmill immediately when an emergency happens.
-
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1.2.6 Contraindications (for Exercise ECG)











Absolute Contraindications:





1. Acute MI (within 2 days)
2. High-risk unstable angina
3. Hemodynamic compromise caused by uncontrolled cardiac arrhythmia
4. Symptomatic severe aortic stenosis
5. Heart failure with clinic episode uncontrolled
6. Acute pulmonary embolus or pulmonary infarction
7. Acute myocarditis or pericarditis
8. The patient opposes the test.

Relative Contraindications:

1. Left main coronary stenosis
2. Moderate stenotic valvular heart disease
3. Serum Electrolyte abnormalities
4. Severe hypertension (systolic blood pressure >200 mmHg or diastolic blood pressure >110 mmHg)
5. Tachyarrhythmias or bradyarrhythmias
6. Hypertrophic cardiomyopathy
7. Patients can not cooperate because of mental impairment or physical disability
8. High-degree AV block

1.3 List of Symbols

	Equipment or part of CF type with defibrillator proof
	Caution
	Consult Instructions for Use
	Recycle
P/N	Part Number
	Serial Number
	Date of Manufacture
	Manufacturer
	Authorized Representative in the European Community
	The symbol indicates that the device complies with the European Council Directive 93/42/EEC concerning medical devices.
	It indicates that the device should be sent to the special agencies according to local regulations for separate collection after its useful life.
Rx only (U.S.)	Federal (US) law restricts this device to sale by or on the order of a physician

	Class II
	Transmission Status Indicator of Bluetooth
	Burglar Lock
	Power Supply Indicator of DX12 Receiver
<p>FCC ID:SMQDX12TEDAN (for DX12 Transmitter)</p> <p>FCC ID:SMQDX12REDAN (for DX12 Receiver)</p>	<p>This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:</p> <p>(1) this device may not cause harmful interference, and</p> <p>(2) this device must accept any interference received, including interference that may cause undesired operation.</p>

Chapter 2 Introduction

SE-1010 PC ECG has similar functions with an ordinary electrocardiograph. ECG data can be sampled, analyzed and stored in a PC, and it can be saved in PDF, Word, BMP or JPG format. ECG waves can be frozen and reviewed. Auto measurement and diagnosis are available, and the diagnosis template can be edited. SE-1010 PC ECG can also be invoked by Smart ECG Net version 1.3 or above.

When a patient with coronary heart disease runs, the added heart load will cause myocardium hypotension, and then the ECG will change abnormally. Therefore, with the function of exercise ECG, SE-1010 PC ECG can also be used to diagnose concealed coronary heart disease and atypical angina pectoris, prescribe the workload for patients with myocardial infarction before they leave hospital, and assess the effect of the treatment. With SE-1010 PC ECG, doctors' workload can be reduced greatly.

NOTE:

1. The exercise ECG function is optional. It is available only if you purchased this function.
2. The pictures and windows in this manual are for reference only.

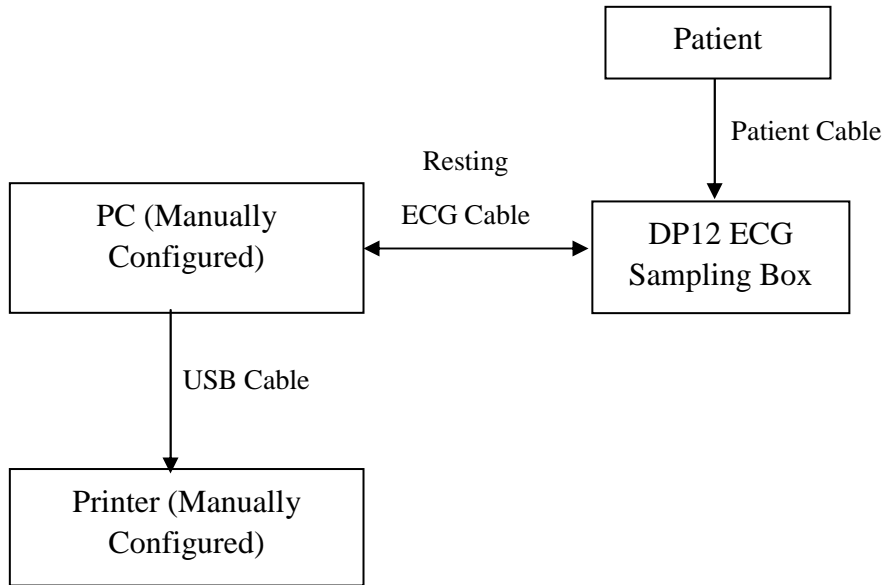
2.1 SE-1010 PC ECG System

SE-1010 PC ECG system includes the following equipment:

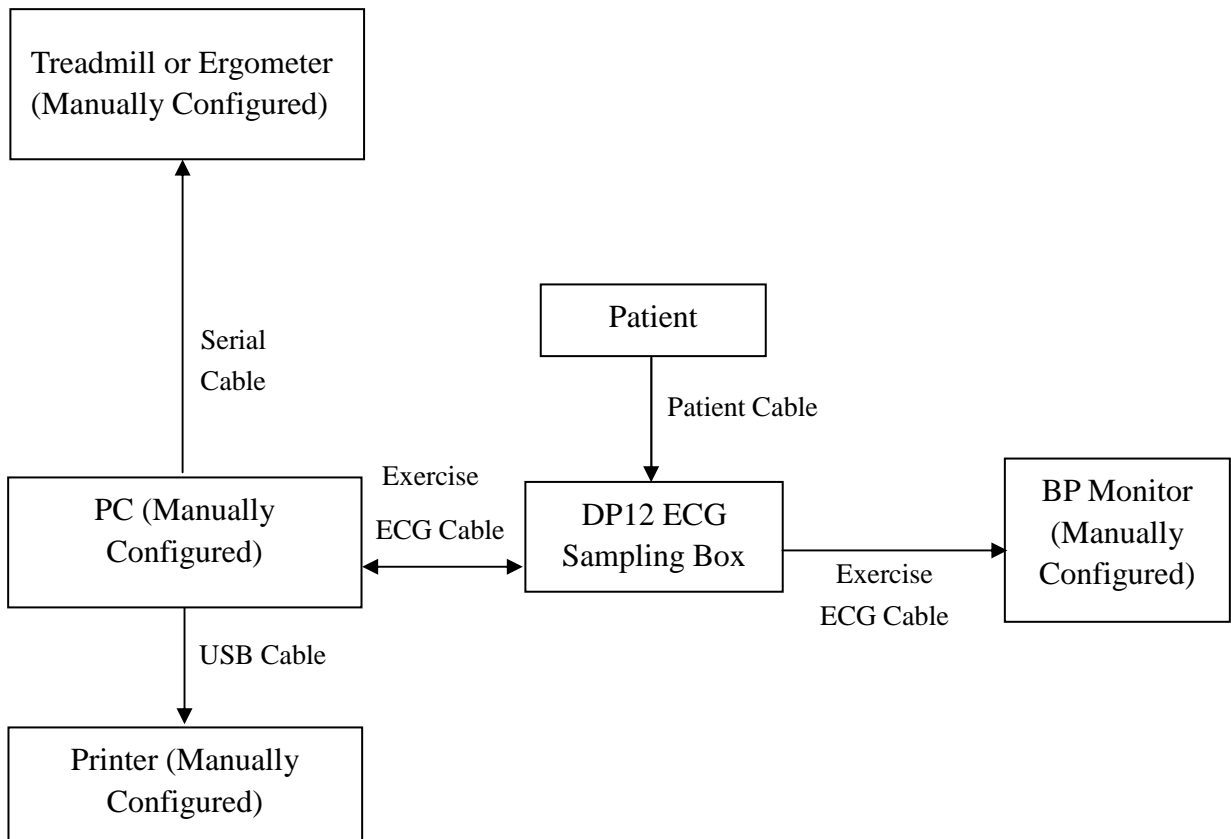
1. PC ECG software
2. ECG Sampling Box (wired or wireless system)
3. Patient Cable
4. Electrodes
5. Sentinel
6. USB Cable

Wired System of SE-1010 PC ECG System

1. Resting ECG of Wired System



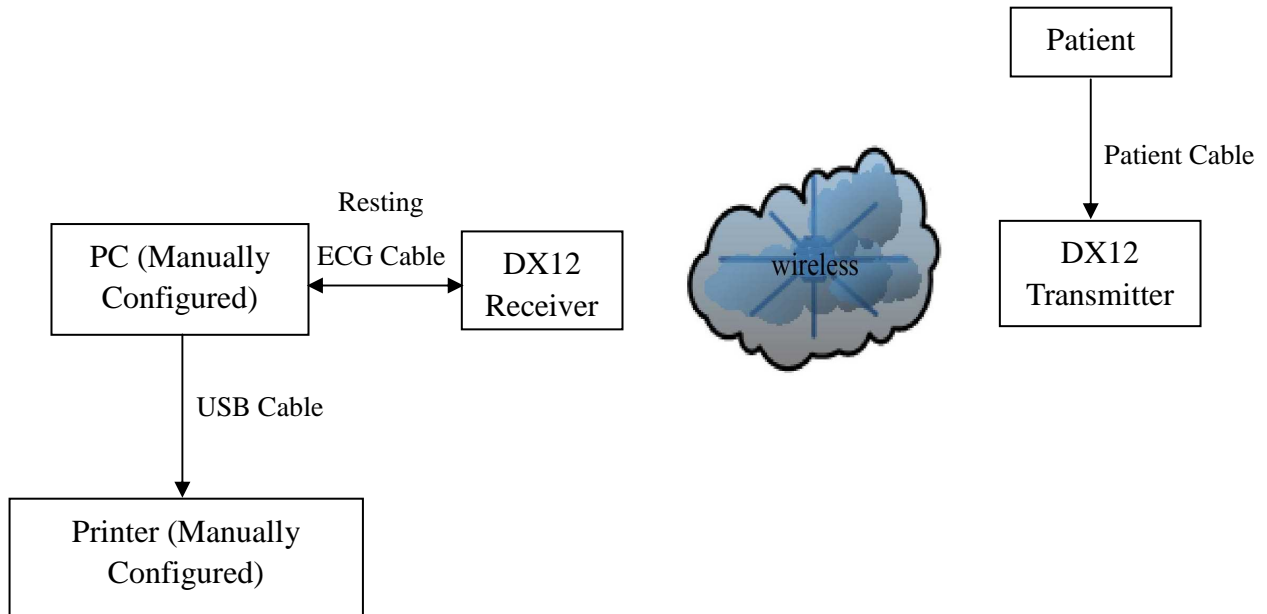
2. Exercise ECG of Wired System



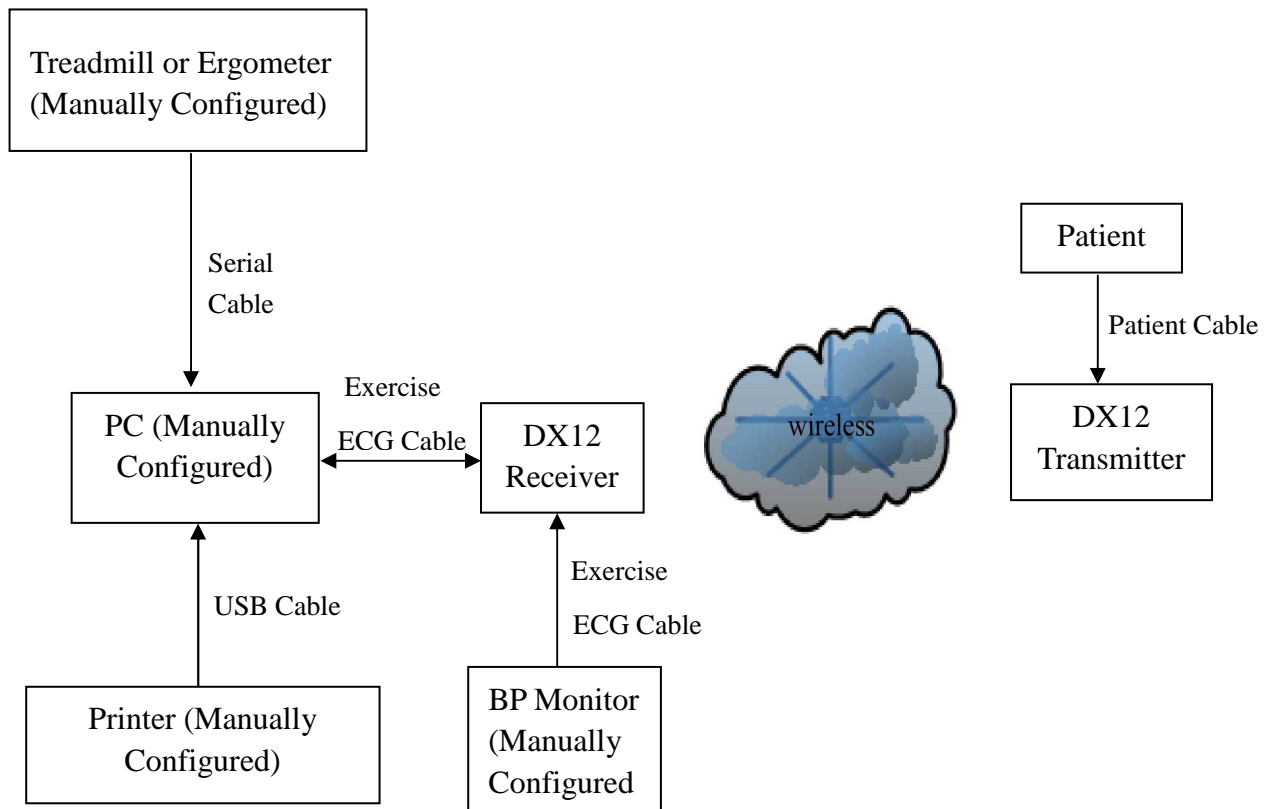
Wireless System of SE-1010 PC ECG System

The DX12 device which consists of transmitter and receiver has passed FCC certification. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1. Resting ECG of Wireless System



2. Exercises ECG of Wireless System



3. FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct

The interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference,
2. And this device must accept any interference received, including interference that may cause undesired operation.

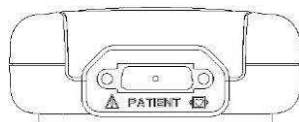
NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. such modifications could void the user's authority to operate this equipment.

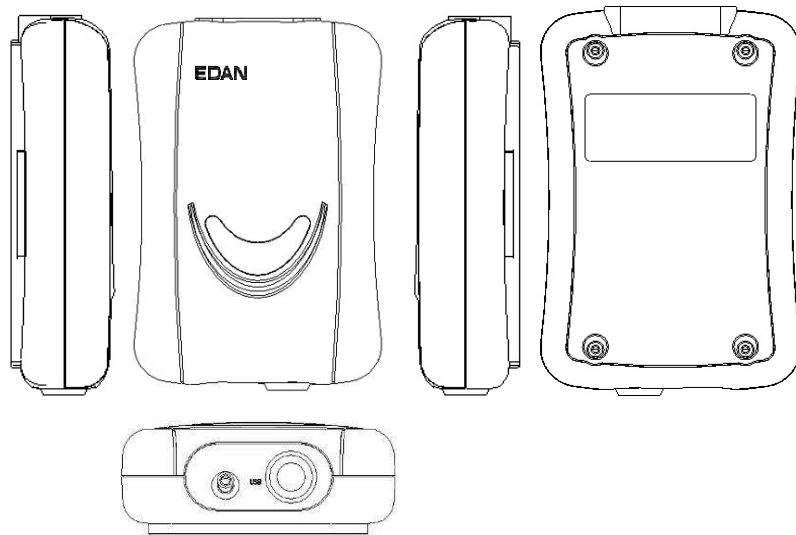
WARNING

The system should be installed by a qualified service engineer. Do not power on the system until all cables are properly connected and verified.

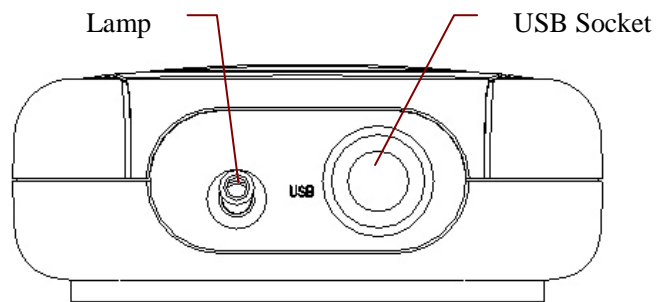
2.2 DP12 ECG Sampling Box of Wired System

DP12 ECG Sampling Box Appearance



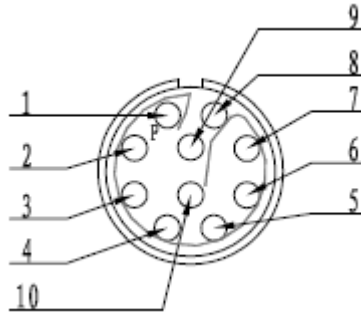


Front Panel



Name	Explanation
Lamp	When the ECG sampling box is powered by the PC, the lamp will be lit.
USB Socket	Connecting to the USB socket of the PC with a USB cable

USB Socket



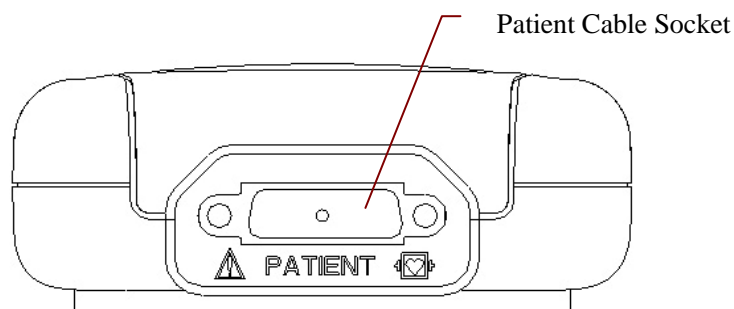
Definitions of corresponding pins:

Pin	Signal	Pin	Signal
1	GND	6	GND
2	VCC	7	GND
3	QRS	8	GND
4	GND	9	D-
5	GND	10	D+

WARNING

1. When the computer connected to the USB cable is powered on, do not connect the USB cable to the DP12 ECG sampling box; when the system is powered on, do not disconnect the USB cable from the ECG sampling box.
2. It is not necessary or recommended to regularly disconnect the USB cable from the DP12 ECG sampling box. Disconnect the USB cable from the PC if necessary.

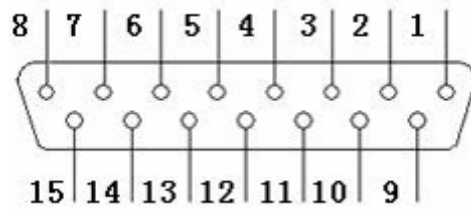
Back Panel



: Applied part of type CF with defibrillator proof

: Caution

Patient Cable Socket

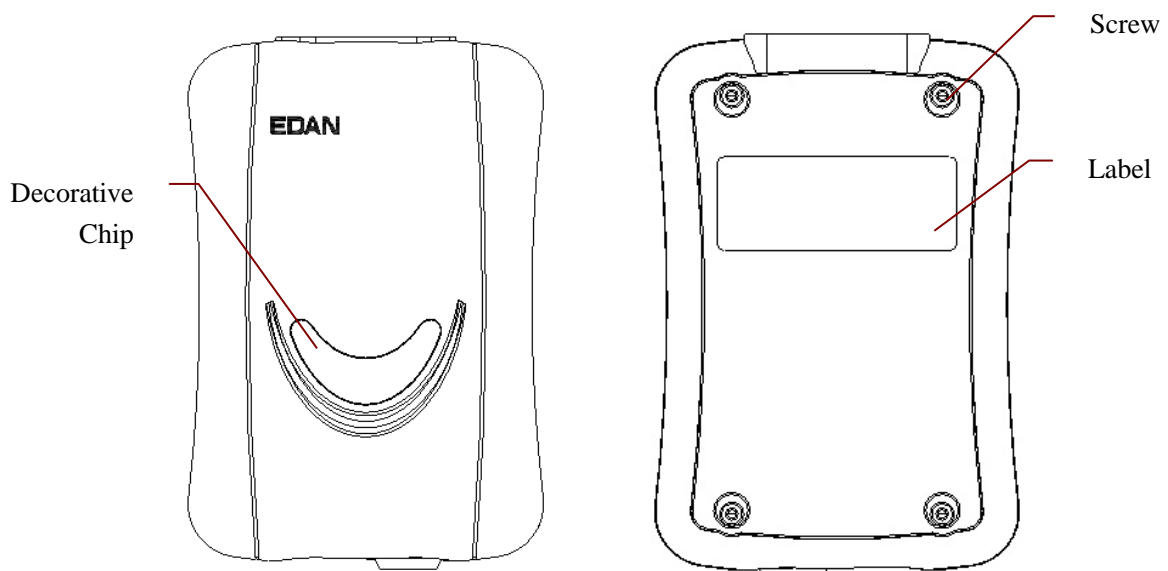


Definitions of corresponding pins:

Pin	Signal	Pin	Signal	Pin	Signal
1	C2 / V2	6	SH	11	F / LL
2	C3 / V3	7	NC	12	C1 / V1 or NC
3	C4 / V4	8	NC	13	C1 / V1
4	C5 / V5	9	R / RA	14	RF (N) / RL or NC
5	C6 / V6	10	L / LA	15	RF (N) / RL

NOTE: The left side of “/” is European standard, and the right side is American standard.

Top Panel and Bottom Panel

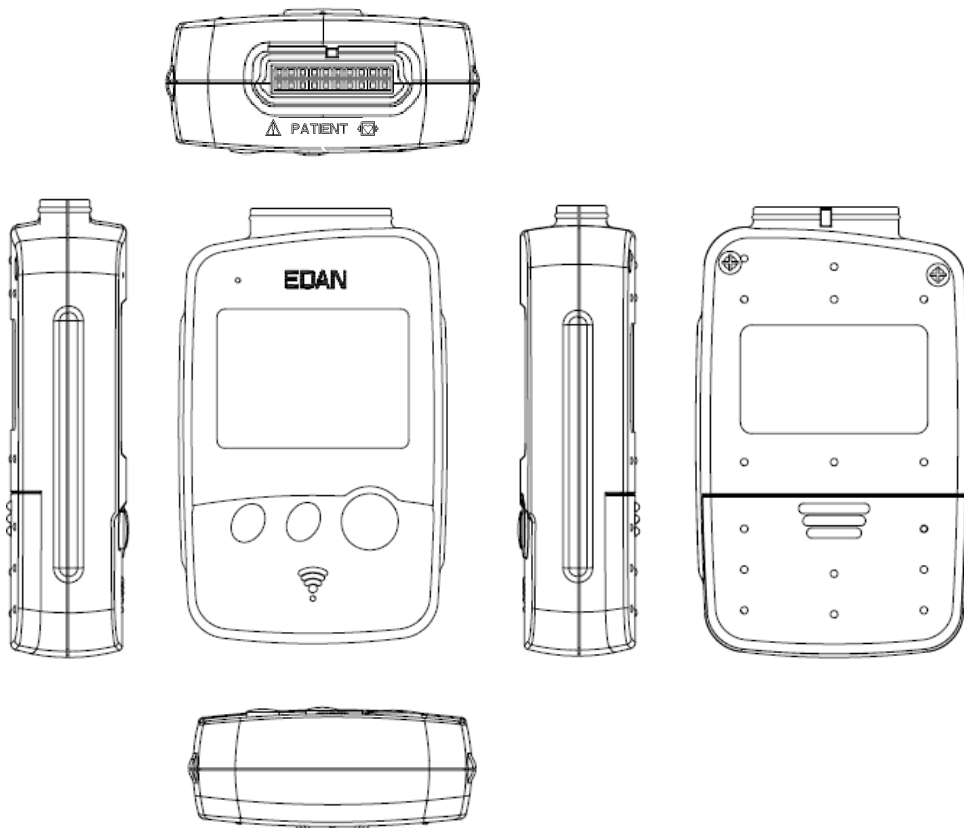


WARNING

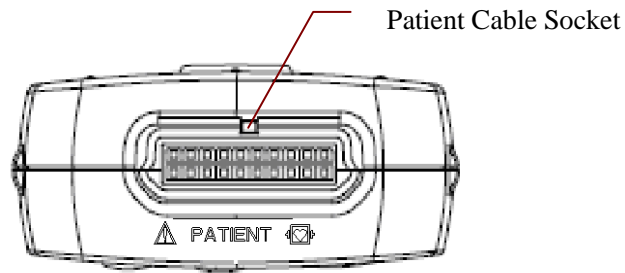
1. Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC/EN standards (e.g. IEC/EN 60950 for data processing equipment and IEC/EN 60601-1 for medical equipment). Furthermore all configuration shall comply with the valid version of the standard IEC/EN 60601-1-1. Therefore anybody, who connects additional equipment to the signal input or output connector to configure a medical system, must make sure that it complies with the requirements of the valid version of the system standard IEC/EN 60601-1-1. If in doubt, consult our technical service department or your local distributor.
 2. If multiple instruments are connected to a patient, the sum of the leakage currents may exceed the limits given in the IEC/EN 60601-1 and may pose a safety hazard. Consult your service personnel.
-
-

2.3 DX12 ECG Sampling Boxes of Wireless System

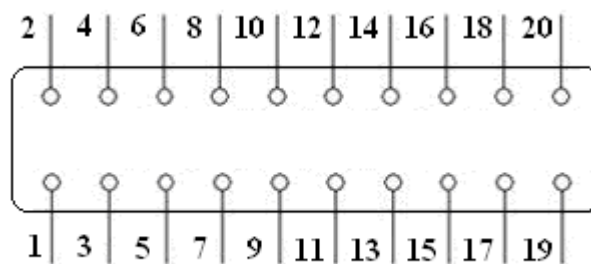
DX12 Transmitter Appearance




Front Panel



Patient Cable Socket



: Applied part of type CF with defibrillator proof

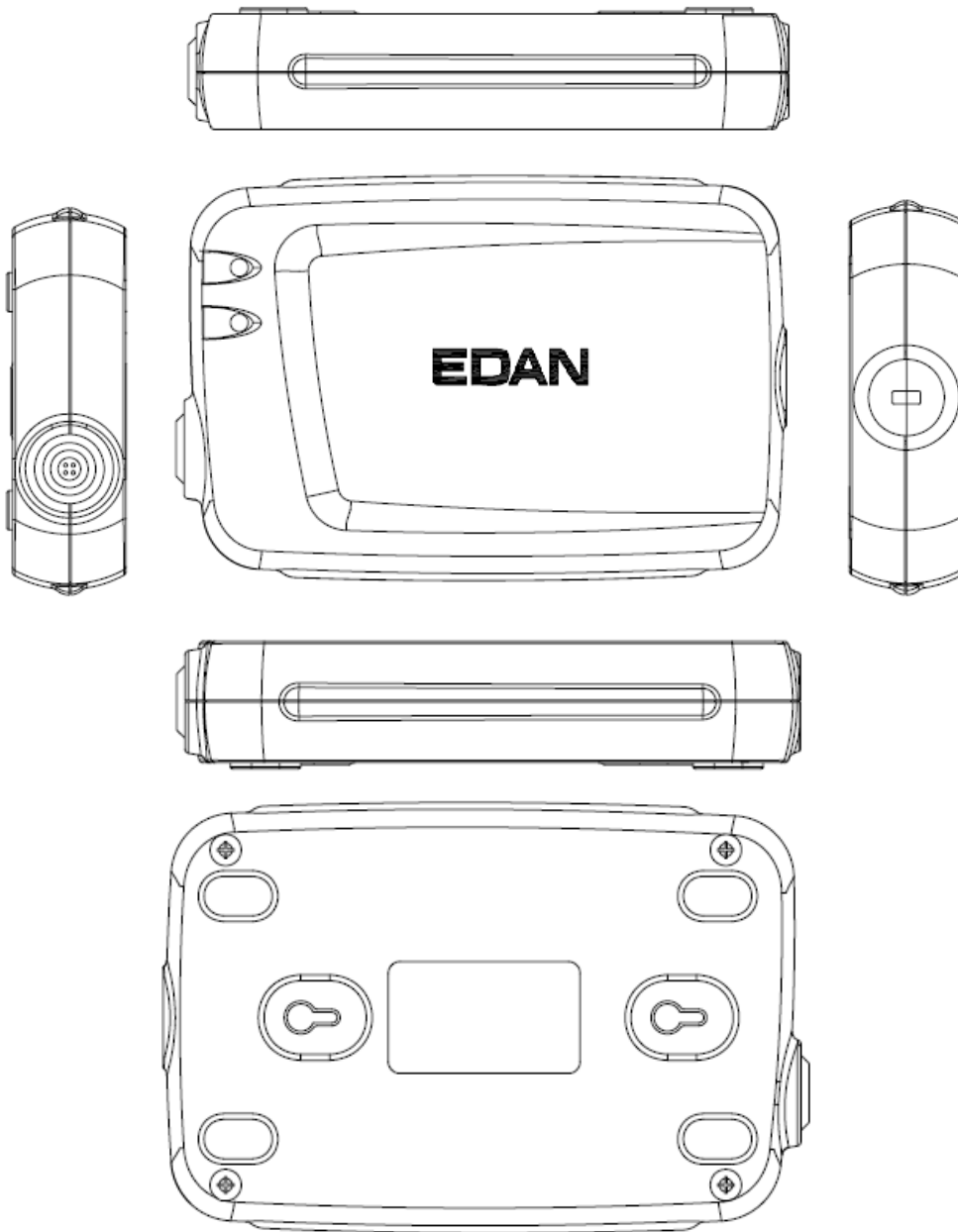
: Caution

Definitions of corresponding pins:

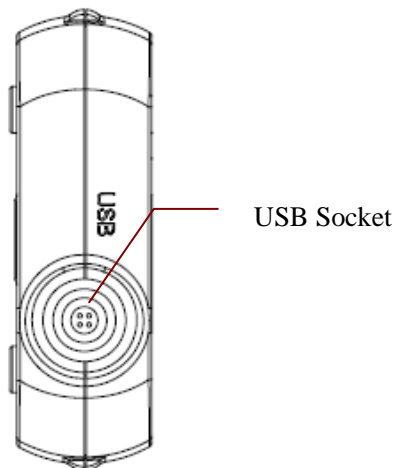
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	NC	6	C5/V5	11	NC	16	L/LA
2	F/LL	7	NC	12	C2/V2	17	NC
3	NC	8	C4/V4	13	NC	18	R/RA
4	C6/V6	9	NC	14	C1/V1	19	NC
5	NC	10	C3/V3	15	NC	20	N/RL

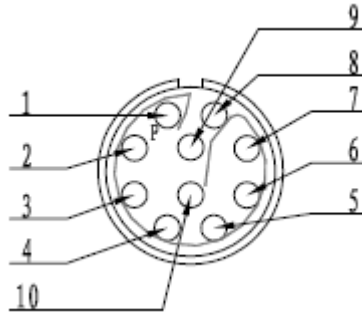
NOTE: The left side of “/” is European standard, and the right side is American standard.

DX12 Receiver Appearance



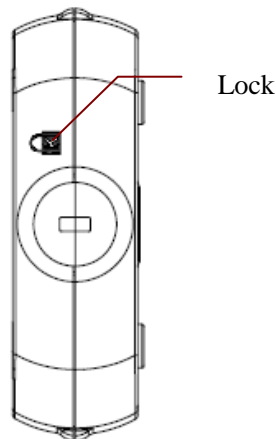
USB Socket





Definitions of corresponding pins:

Pin	Signal	Pin	Signal
1	GND	5	GND
2	VCC	6	GND
3	QRS	7	GND
4	GND	8	D-
5	GND	10	D+



2.4 Features

1. Powerful functions, friendly windows and easy operation
2. 3/6/12-channel ECG waves are displayed and printed simultaneously
3. ECG waves can be frozen and reviewed
4. Supporting auto measurement and diagnosis
5. Measurement point adjustment and re-analysis, manual measurement with an electronic ruler of high precision
6. Perfect data management and processing functions

7. Reports can be printed in PDF, Word, JPG or BMP format
8. Supporting multi-language
9. Updated to be a network electrocardiograph, transmitting ECG data over LAN or WAN or INTERNET
10. Automatic baseline adjustment for optimal printing
11. High performance filters guarantee stable ECG waveforms
12. Real-time analysis, real-time displaying and printing 12-lead simultaneous ECG waveforms
13. Nine analysis functions including Normal ECG, Frequency ECG, High Frequency ECG, QT Dispersion, Vector ECG, Time Vector ECG, HRT analysis, HRV analysis and Signal Averaged ECG (Only for resting ECG)

The following features are only for the exercise test function of SE-1010 PC ECG

1. Automatically controlling and adjusting the speed and the elevation of the treadmill
2. Supporting many kinds of treadmills and ergometers
3. Providing classical exercise protocols; new exercise protocols can be added to the system
4. ST segment analysis and measurement of 12-lead waveforms while sampling ECG; ST position is adjustable while sampling ECG
5. Providing summaries, ST analysis, wave reviews and trends
6. Providing specific statistic data of each lead in each stage
7. Providing average waves of each lead in each stage for you to observe the changes of ST segments among different stages

Chapter 3 Assembling SE-1010 PC ECG System

3.1 Assembling Wired System



Patient Cable for Resting ECG



Patient Cable for Exercise ECG



DP12 ECG Sampling Box



Exercise ECG Cable



Resting ECG Cable



Assembly Drawing

For Resting ECG of wired system,

- ◆ Insert plug 1 of the patient cable into socket 3 of DP12 ECG sampling box.
- ◆ Insert plug 8 of the cable into socket 4 of DP12 ECG sampling box.
- ◆ Insert plug 9 of the cable into the USB socket of the PC.
- ◆ Connect a printer to the PC.
- ◆ Insert the Sentinel into the USB socket of the PC.
- ◆ Make sure that the above parts are properly connected, and then connect the PC, and the printer to the power supply.

For Exercise ECG of wired system,

1. Insert plug 2 of the patient cable into socket 3 of DP12 ECG sampling box.
2. Insert plug 7 of the cable into socket 4 of DP12 ECG sampling box.
3. Insert plug 5 of the cable into the USB socket of the PC.
4. Connect plug 6 of the cable to the BP monitor.
5. Connect a treadmill or an ergometer to the PC.
6. Connect a printer to the PC.
7. Insert the Sentinel into the USB socket of the PC.
8. Make sure that the above parts are properly connected, and then connect the PC, treadmill/ergometer and printer to the power supply.

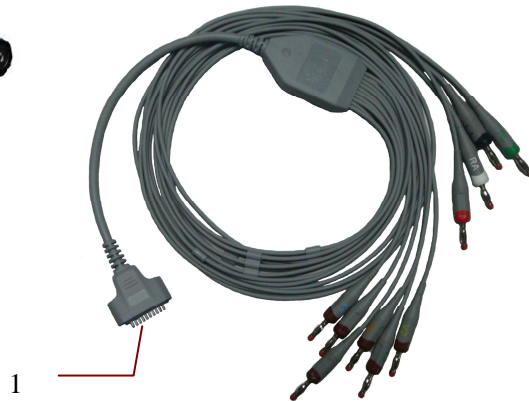
WARNING

1. Use a special grounded socket to get accurate voltage and current.
 2. When using a laptop with a two-prong plug, please connect a grounded printer to avoid power interference.
 3. Only stress BP monitors can be used.
-

3.2 Assembling Wireless System



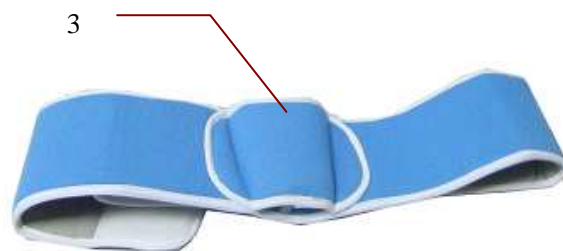
Patient Cable



Patient Cable



DX12 Transmitter



DX12 Belt



Resting ECG Cable



For Resting ECG of wireless system,

1. Insert plug 1 of the patient cable into socket 2 of DX12 transmitter.
2. Insert plug 4 of the cable into socket 6 of DX12 receiver.
3. Insert plug 5 of the cable into the USB socket of the PC.
4. Connect a printer to the PC.
5. Insert the Sentinel into the USB socket of the PC.
6. Make sure that the above parts are properly connected, and then connect the PC, and the printer to the power supply.

For Exercise ECG of wireless system,

1. Insert plug 1 of the patient cable into socket 2 of DX12 transmitter.
2. Insert DX12 transmitter into pocket 3 of DX12 belt, and then wear the belt around the waist.
3. Insert plug 8 of the cable into socket 6 of the DX12 receiver.

4. Insert plug 9 of the cable into the USB socket of the PC.
5. Connect plug 10 of the cable to the BP monitor.
6. Connect a treadmill or an ergometer to the PC.
7. Connect a printer to the PC.
8. Insert the Sentinel into the USB socket of the PC.
9. Make sure that the above parts are properly connected, and then connect the PC, treadmill/ergometer and printer to the power supply.

WARNING

1. Use a special grounded socket to get accurate voltage and current.
 2. When using a laptop with a two-prong plug, please connect a grounded printer to avoid power interference.
 3. Only stress BP monitors can be used.
-
-

Chapter 4 Installing SE-1010 PC ECG Software

4.1 System Running Environment

4.1.1 Requirements on the Hardware of the PC

CPU:	Pentium P4, Celeron D 310 or above
System Memory (RAM):	512MB or above
Main Board	Recommend the main board of Intel chipset
Hard Disk:	40G or above
Printer:	ink jet printer of more than 600dpi or laser printer Recommend HP2035, HP2010、CANON iP1980
Display:	17" TFT (Resolution: 1024×768, 1280*1024, 1366*768) or 19" TFT (1440×900 resolution), 16 bit actual color, regular icon and font setup
Others:	CD-ROM (24 × or above)

4.1.2 Requirements on the Software of the PC

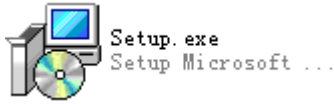
1. Windows XP PROFESSIONAL SP2/SP3, Windows Vista (32/64 bit) or Windows 7 (32/64 bit)
2. MSDE2000 (Microsoft SQL Server 2000 Desktop Engine) or Microsoft SQL Server 2005 Express

CAUTION

1. Ensure that there is no other database software in the PC in which our software will be installed.
 2. Ensure that there is a graphic driver installed in the PC. Otherwise, the displayed ECG waves may be abnormal.
-
-

4.2 About Installation Window

Insert the installation CD into CD-ROM, and double-click on **Setup.exe**



to open the following installation window.



Figure 4-1 Installation Window

Click on the **Install** button to install PC ECG. Click on the **Next** button continually during installation.

After installing PC ECG, click on the **Install** button in the installation window. Then the **Environment Detection** window pops up. Check the installing status of all the components. If the **Environment Detection** window shows that a certain component needs to be installed, please install it manually.

NOTE: During the installation of SQL Server 2005 Express in Windows 7/Vista, only if **Add user to the SQL Server Administrator role** is selected, can the database be available.

Click on the **Help** button to see the installation guide.

For details on installing PC ECG software, please refer to *SE-1010 PC ECG Installation Guide*.

Chapter 5 Preparations Before Operation

5.1 Preparing the Patient

5.1.1 Instructing the Patient

Before attaching the electrodes, greet the patient and explain the procedure. Explaining the procedure decreases the patient's anxiety. Reassure the patient that the procedure is painless. Privacy is important for relaxation. When possible, prepare the patient in a quiet room or area where others can't see the patient. Make sure that the patient is comfortable. The more relaxed the patient is, the less the ECG will be affected by noise.

5.1.2 Preparing the Skin

Thorough skin preparation is very important. The skin is a poor conductor of electricity and frequently creates artifacts that distort the ECG signals. By performing methodical skin preparation, you can greatly reduce the possibility of noise caused by muscle tremor and baseline drift, ensuring high-quality ECG waves. There is natural resistance on the skin surface due to dry, dead epidermal cells, oils and dirt.

To prepare the skin

1. Shave hair from electrode sites, if necessary. Excessive hair prevents a good connection.
2. Wash the area thoroughly with soap and water.
3. Dry the skin to increase capillary blood flow and to remove the dead, dry skin cells and oils.
4. Use the disposable frosting film in the standard accessory list to get good ECG waveform.

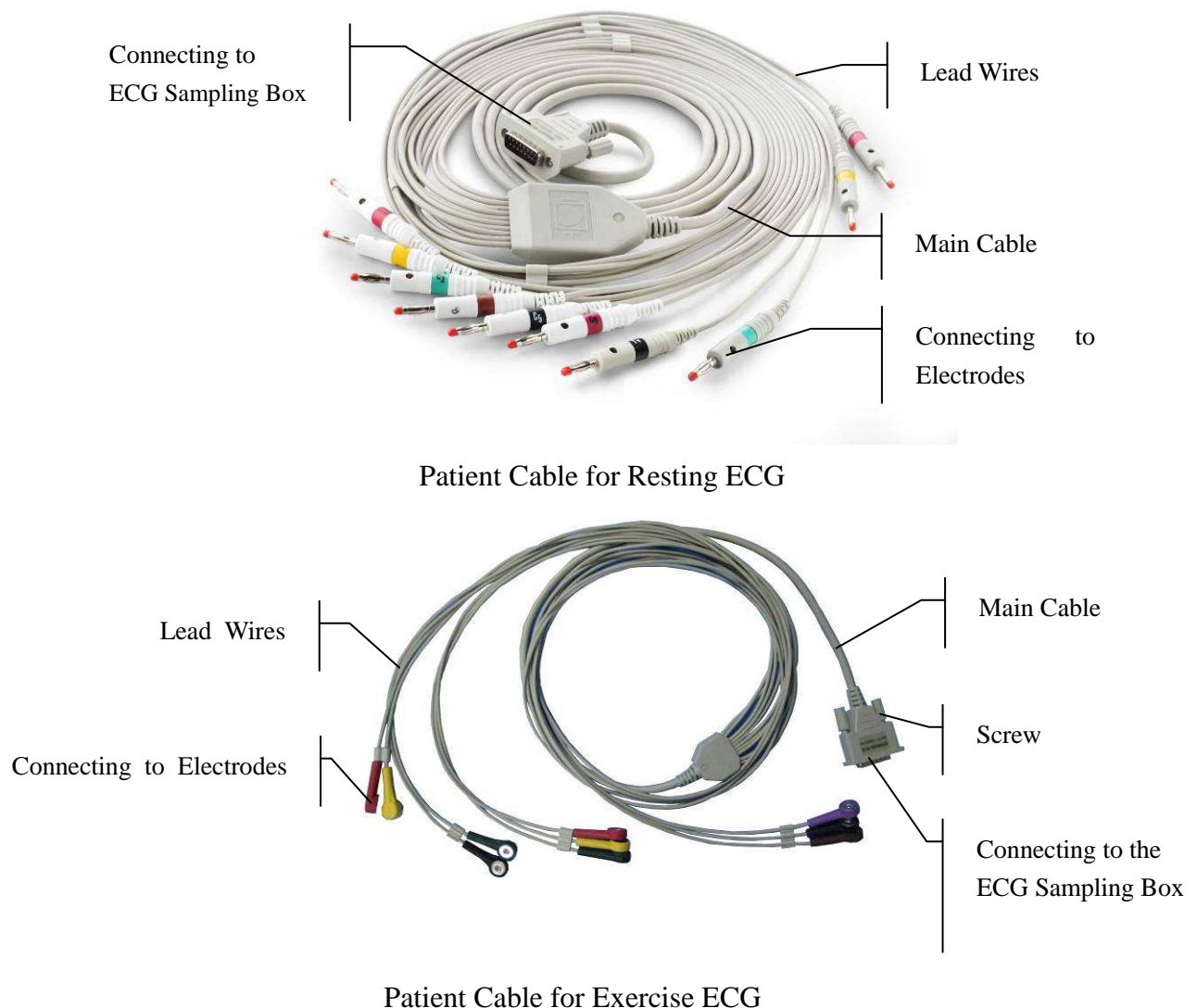
NOTE: Rub the skin with a gauze pad to increase capillary blood flow if you don't operate the steps above.

5.2 Connecting the Electrodes of Wired System

WARNING

The performance and electric shock protection can be guaranteed only if the original patient cable and electrodes of the manufacturer are used.

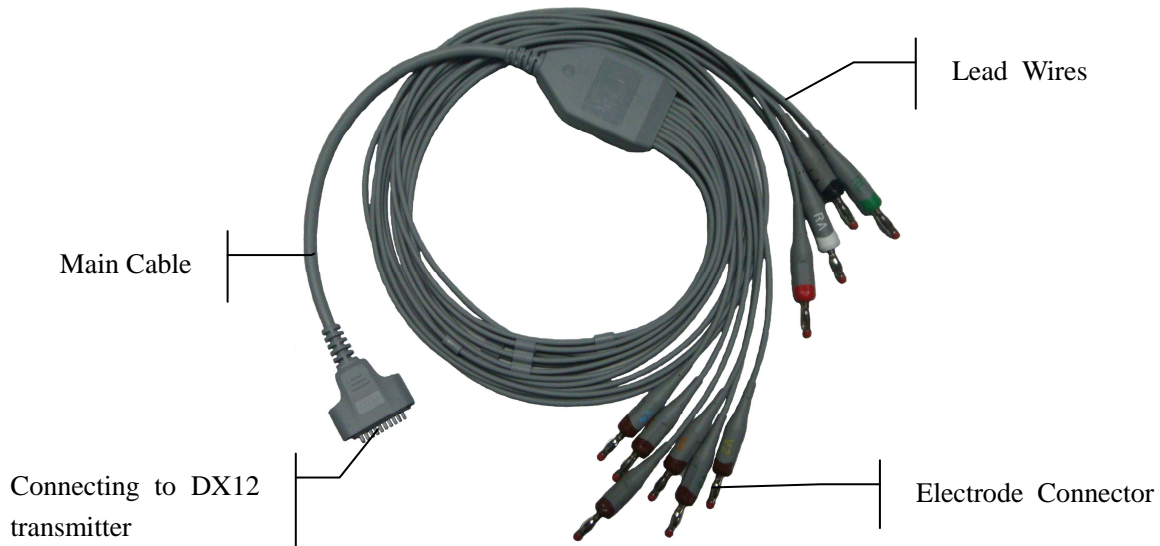
The patient cable includes main cable and lead wires which can be connected to electrodes according to the colors and identifiers.



1. Connect the patient cable to DP12 ECG sampling box of wired system. For details, please refer to Section 3.1, “Assembling Wired System”.
2. Align all lead wires of the patient cable to avoid twisting, and connect the lead wires to the corresponding electrodes according to the colors and identifiers. Firmly attach them.

5.3 Connecting the Electrodes of Wireless System

The patient cable includes main cable and lead wires which can be connected to electrodes according to the colors and identifiers.



Patient Cable for Resting ECG



Patient Cable for Exercise ECG

1. Connect the patient cable to DX12 transmitter of wireless system. For details, see Section 3.2, "Assembling Wireless System".
2. Align all lead wires of the patient cable to avoid twisting, and connect the lead wires to the corresponding electrodes according to the colors and identifiers. Firmly attach them.

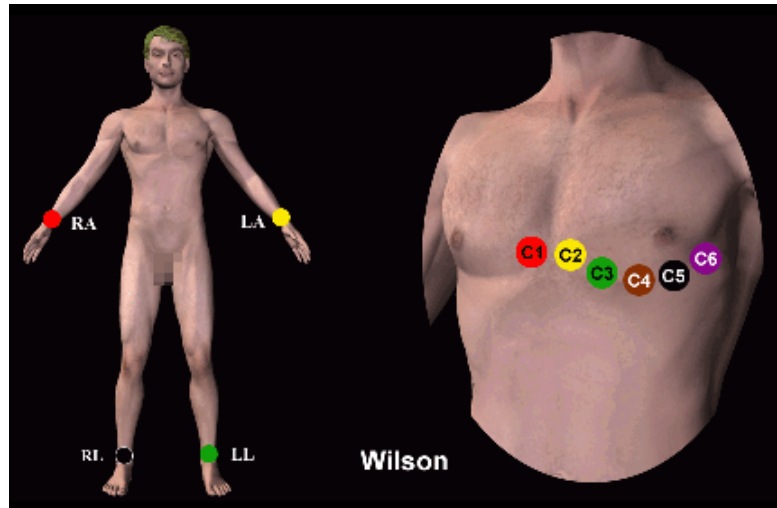
5.4 Attaching Electrodes (for Resting ECG)

The identifiers and color codes of electrodes used comply with IEC/EN requirements. In order to avoid incorrect connections, the electrode identifiers and color codes are specified in Table 5-1. Moreover the equivalent codes according to American requirements are given in Table 5-1 too.

Table 5-1 Electrodes and Their Identifiers and Color Codes

WILSON	FRANK	European		American	
		Identifier	Color Code	Identifier	Color Code
Right arm	Right arm	R	Red	RA	White
Left arm	Left arm	L	Yellow	LA	Black
Right leg	Right leg	N or RF	Black	RL	Green
Left leg	Left leg	F	Green	LL	Red
Chest 1	I	C1	White/Red	V1	Brown/Red
Chest 2	E	C2	White/Yellow	V2	Brown/Yellow
Chest 3	C	C3	White/Green	V3	Brown/Green
Chest 4	A	C4	White/Brown	V4	Brown/Blue
Chest 5	M	C5	White/Black	V5	Brown/Orange
Chest 6	H	C6	White/Violet	V6	Brown/Violet

5.4.1 Wilson Lead System



C1: Fourth intercostal space at the right border of the sternum

C2: Fourth intercostal space at the left border of the sternum

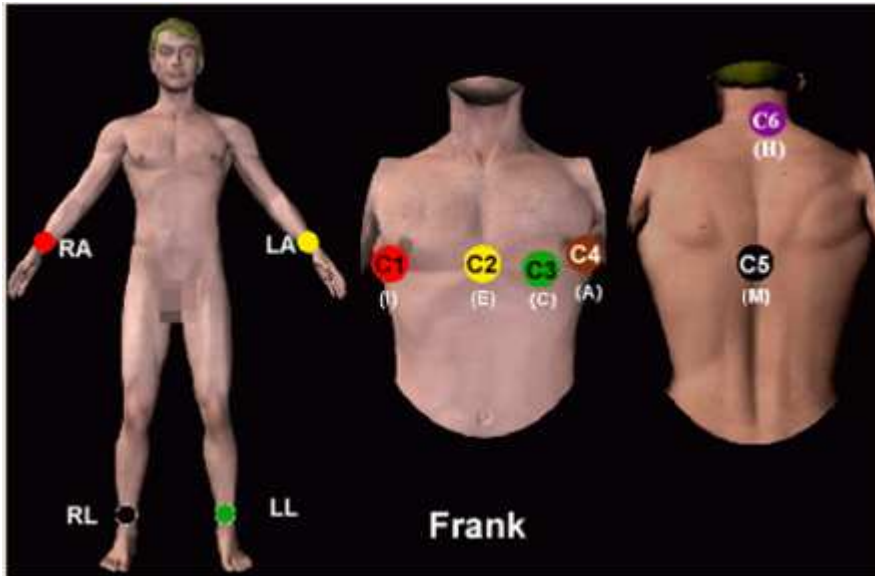
C3: Fifth rib between C2 and C4

C4: Fifth intercostal space on the left midclavicular line

C5: Left anterior axillary line at the horizontal level of C4

C6: Left midaxillary line at the horizontal level of C4

5.4.2 Frank Lead System



FRANK lead system is usually adopted when PC ECG is used to produce VCG. The conventional letter designations for the electrodes and their respective positions are:

E/C2: at the front midline

M/C5: at the back midline

I/C1: at the right mid-axillary line

A/C4: at the left mid-axillary line

C/C3: at 45° angle between the front midline and the left mid-axillary line

F: on the left leg

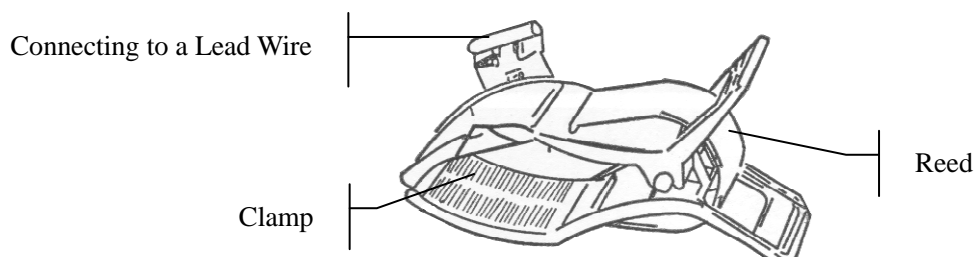
N: on the right leg

H: on the back of the neck

The first five electrodes (E, M, I, A and C) are all located at the same transverse level -- approximately at the interspace between the fourth rib and the fifth rib.

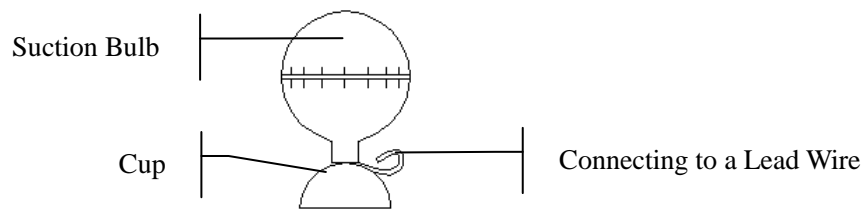
5.4.3 Attaching Electrodes to the Patient

For Limb Electrodes:



1. Clean the electrode area which is in a short distance above the ankle or the wrist with alcohol.
2. Daub the electrode area on the limb with gel evenly.
3. Place a small amount of gel on the metal part of the limb electrode clamp.
4. Connect the electrode to the limb, and make sure that the metal part is placed on the electrode area above the ankle or the wrist.
5. Attach all limb electrodes in the same way.

For Chest Electrodes:



- ◆ Clean the electrode area on the chest surface with alcohol.
- ◆ Daub the round area of 25mm in diameter on each electrode area with gel evenly.
- ◆ Place a small amount of gel on the brim of the chest electrode's metal cup.
- ◆ Place the electrode on the chest electrode area and squeeze the suction bulb. Unclench it and the electrode is adsorbed on the chest.
- ◆ Attach all chest electrodes in the same way.

Chest Electrode (Only for C5 in Frank Lead System):

Snap/Banana Socket Adapter:



Disposable Electrode:



Disposable Electrode Connection:

- ◆ Connect the snap/banana socket adapter to the lead wire.
- ◆ Connect the snap/banana socket adapter to the disposable electrode.
- ◆ Clean the electrode area at the back midline with 75% alcohol.

- ◆ Attach the disposable electrode to the electrode area at the back midline.

The quality of ECG waveform will be affected by the contact resistance between the patient and the electrode. In order to get a high-quality ECG, the skin-electrode resistance must be minimized while connecting electrodes.

WARNING

1. Make sure that all electrodes are connected to the patient correctly before operation.
2. Make sure that the conductive parts of electrodes and associated connectors, including neutral electrodes, do not come in contact with earth or any other conducting objects.
3. The disposable electrodes can only be used for one time.

5.5 Attaching Electrodes to the Patient (for Exercise ECG)

The identifiers and color codes of electrodes used comply with IEC/EN requirements. In order to avoid incorrect connections, the electrode identifiers and color codes are specified in Table 5-2. Moreover the equivalent codes according to American requirements are given in Table 5-2 too.

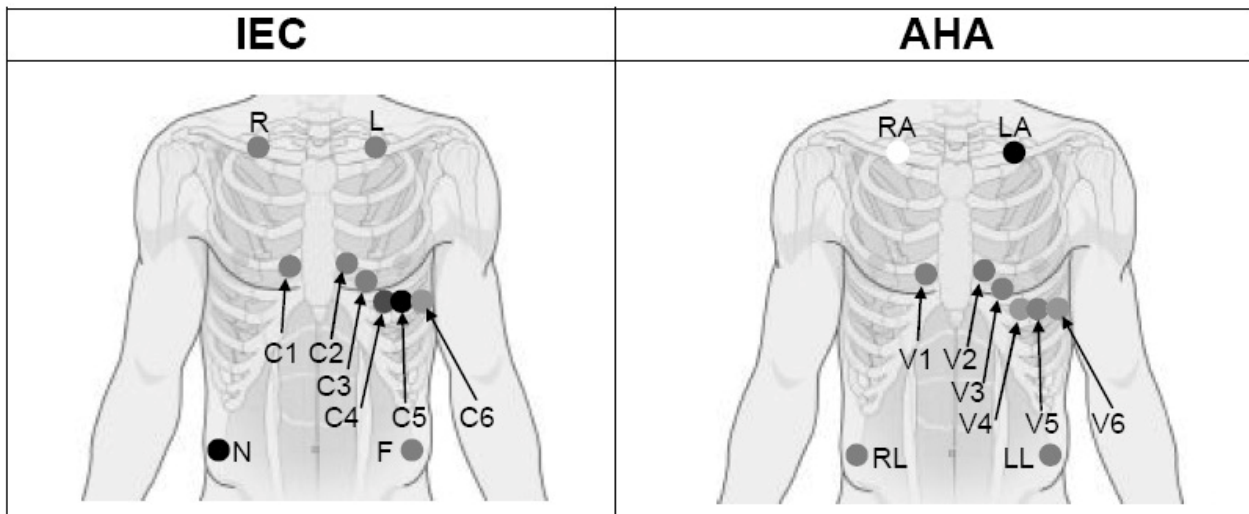


Table 5-2 Electrodes and their identifiers and color codes

European		American	
Electrodes	Color code	Electrodes	Color code
R	Red	RA	White
L	Yellow	LA	Black
N or RF	Black	RL	Green
F	Green	LL	Red

C1	White/Red	V1	Brown/Red
C2	White/Yellow	V2	Brown/Yellow
C3	White/Green	V3	Brown/Green
C4	White/Brown	V4	Brown/Blue
C5	White/Black	V5	Brown/Orange
C6	White/Violet	V6	Brown/Violet

The Precordial Electrodes' Positions on Body Surface:

C1: Fourth intercostal space at the right border of the sternum

C2: Fourth intercostal space at the left border of the sternum

C3: Fifth rib between C2 and C4

C4: Fifth intercostal space on the left midclavicular line

C5: Left anterior axillary line at the horizontal level of C4

C6: Left midaxillary line at the horizontal level of C4

The Extremity Electrodes' Positions on Body Surface:

R/L: below the right/left clavicle

N/F: below the right/left rib

The quality of ECG waveform will be affected by the contact resistance between the patient and the electrode. In order to get a high-quality ECG, the skin-electrode resistance must be minimized while connecting electrodes.

Electrodes Connection:

1. Align all lead wires of the patient cable to avoid twisting, and connect the disposable electrodes to the lead wires.
2. Clean the electrode areas on the body surface with 75% alcohol.
3. Attach the disposable electrodes to the electrode sites.

NOTE: The quality and the placement of the electrode will directly influence the quality of exercise ECG. The wrong placement and use of electrodes will cause incorrect analysis results.

WARNING

1. Make sure that all electrodes are connected to the patient correctly before operation.
2. Make sure that the conductive parts of electrodes and associated connectors, including neutral electrodes, do not come in contact with earth or any other conducting objects.
3. The disposable electrodes can only be used for one time.

5.6 Inspection Before Test

In order to avoid safety hazards and get good ECG records, the following inspection procedure is recommended before operation.

1. **Environment:**

1. Make sure that there is no electromagnetic interference source around the equipment, especially large medical electrical equipment such as electrosurgical equipment, radiological equipment, magnetic resonance imaging equipment etc. Switch off these devices when necessary.
2. Keep the examination room warm to avoid muscle action voltages in ECG signals caused by cold.

2. **Power Supply:**

1. Check whether the power cord is connected well. The grounded outlet should be used.

3. **Patient Cable:**

2. Check whether the patient cable is connected to the ECG sampling box firmly, and keep it far away from the power cord.

4. **Electrodes:**

3. Check whether all electrodes are connected to lead wires of the patient cable correctly.
4. Ensure that the electrodes do not contact.


5. **Patient:**

5. The patient should not come into contact with conducting objects such as earth, metal parts etc.
6. Ensure the patient is warm and relaxed, and breathes calmly.

WARNING

1. The system is intended to be used by qualified physicians or personnel professionally trained. They should be familiar with the contents of this user manual before operation.
 2. Before connecting the device to the power line, make sure that the voltage and frequency ratings of your power line match those indicated on the device label. For details, see Appendix 1, "Technical Specifications".
 3. Before use, the system, patient cable, electrodes etc. should be checked. Replacement should be taken if there is any evident defectiveness or aging symptom which may impair the safety or the performance.
-

5.7 Setting DX12 Transmitter (for Wireless System)

Switch on DX12 receiver and install batteries on DX12 transmitter. Press  to start up DX12 transmitter, and then the company information and the main screen will be displayed.

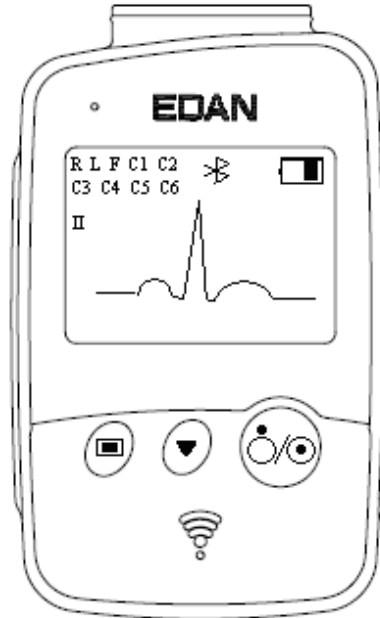
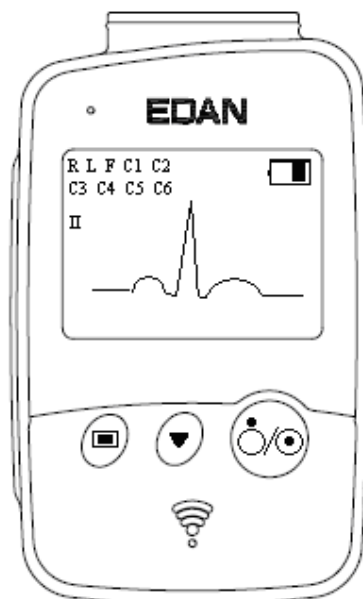


Figure 5-1 Main Screen

When the main screen is displayed, press  to switch the leads.

If the Bluetooth connection icon  is not displayed on the main screen, you have to match the device manually. Operation instructions are as follows:






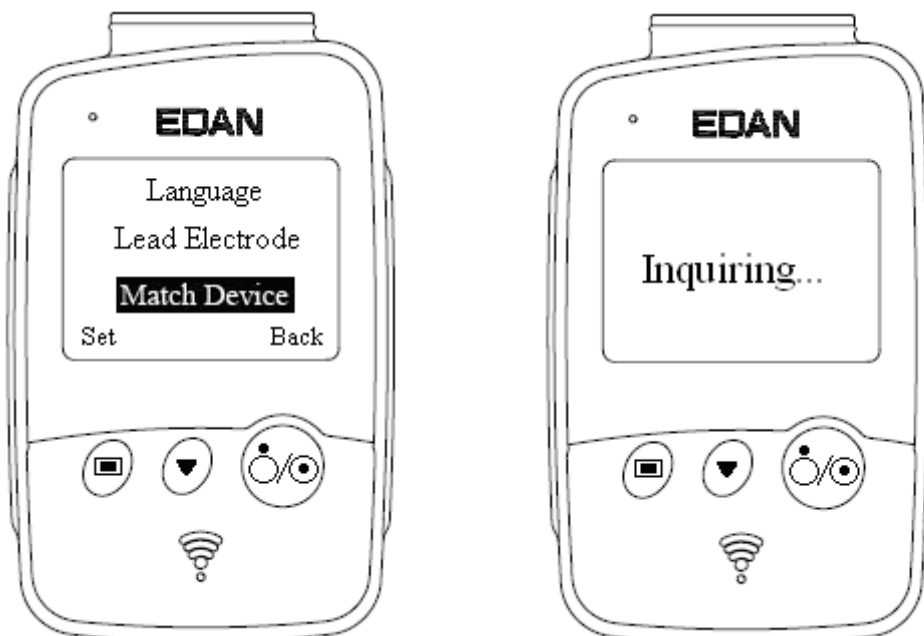
- 1) Press  to enter the menu screen.





Figure 5-2 Menu Screen

- 2) Press  to display **Match Device** item in black, and then press  to open the screen with a prompt “Inquiring...”.




3) When the receiver is found, the address of DX12 receiver will be displayed on the screen

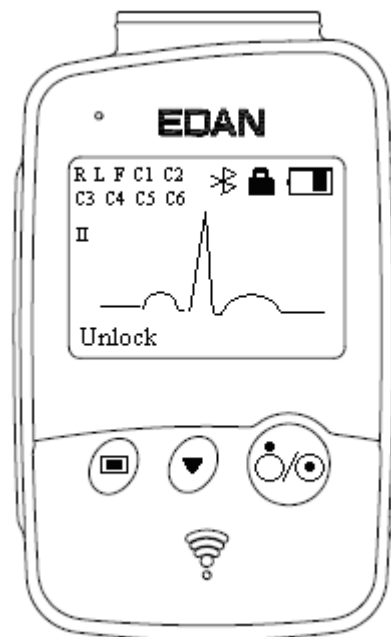
in 10 seconds. Press  to start up the Bluetooth connection. The Bluetooth connection  will be displayed on the main screen of DX12 transmitter and the Bluetooth status indicator illuminates in kelly when DX12 transmitter and DX12 receiver are matched successfully. The Bluetooth status indicator blinks when a data transmission builds between DX12 transmitter and DX12 receiver. The system will return to the previous menu if no DX12 receiver is found.



NOTE: Select the receiver address displayed in the PC ECG software when receiving more than one addresses. For details, please refer to Section 9.3 “Device Setup”.



5.7.1 Keyboard Locking/Unlocking

If no operation is taken, the keyboard will be locked automatically in 8 seconds. If the previous screen is the menu screen, it will return to the main screen after the keyboard is locked automatically.

When the keyboard is locked, a prompt **unlock** will be displayed on the left bottom of the main screen and an icon  will be displayed on the top right.



When the keyboard is locked, press , and then press  in 1.2 seconds to unlock the keyboard.

When the keyboard is unlocked, press , and then press  in 1.2 seconds to lock the keyboard manually.

5.7.2 Menu Settings






Press  on the main screen to enter the menu screen (Figure 5-2). Press  on the menu screen to display an item in black, and then press  to enter the setting screen of this item.

Table 5-3 Menu

Menu	Option	Description
Back Light	On	Select On to turn on the backlight of LCD screen.
	Off	Select Off to turn off the backlight of LCD screen.
Auto Sleep	On	Select On to display Sleeping on the screen and make DX12 transmitter be in low power consumption mode after lead off for 5 minutes.
	Off	Select Off to turn off auto sleep function.
Language	English	You can select English or Chinese .
	Chinese	
Lead Electrode	IEC	You can select IEC or AHA .
	AHA	
Match Device	Inquiring..... Address of DX12 receiver No device found. Try again later.	Inquiring..... will be displayed (for 10 seconds) to search DX12 receiver. The address of DX12 receiver will be displayed (for 8 seconds) if a matching DX12 receiver is found. No device found. Try again later will be displayed (for 1 second) if no matching DX12 receiver is found.
Device Information	Software version: 1.0 ID: 0016a400035D EDAN 2010.04.20	You can see the related information, such as software version, ID, address of DX12 receiver, manufacture and release time about the device. NOTE: The device information is for reference only.

Chapter 6 Operation Instructions for Resting ECG

Double-click on the shortcut icon  on the desktop to display the main screen.  is the desktop icon for SE-1010 PC ECG.

NOTE: Do not use other software when using PC ECG software.



Figure 6-1 Toolbar of Main Screen

The toolbar contains six buttons. From left to right, they are **New Patient**, **STAT ECG**, **Data Manager**, **System Setting**, **Lead Placement** and **Exit**.

Below the toolbar, the software name, version number and copyright information can be seen.

Click on **Help (H)** to see the help information.

Click on the **Exit** button on the main screen to exit the system.

If you use PC ECG software for the first time, the following window will be displayed.

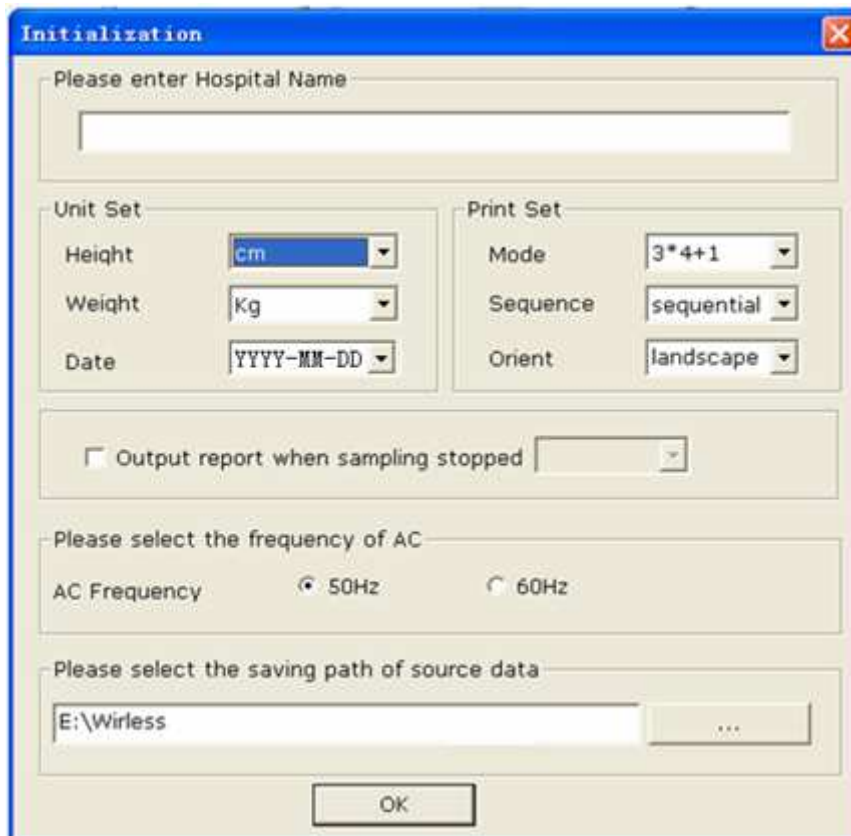


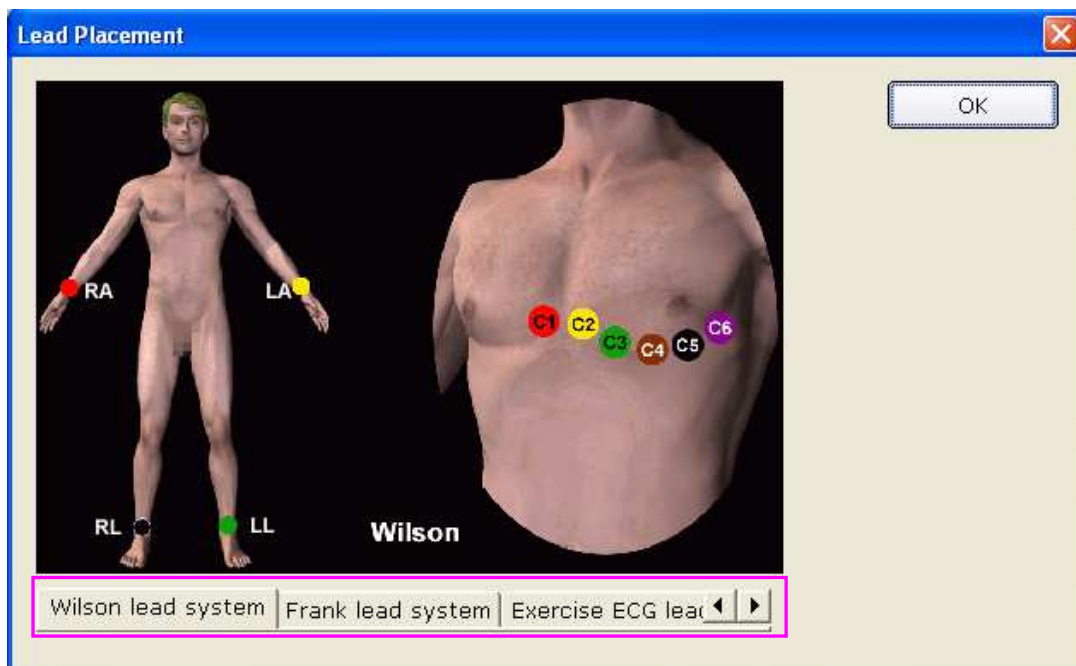
Figure 6-2 Initial Window

You can set the unit, print, frequency of AC and the saving path of source data based on your needs. Click on the **OK** button after setup, the system will enter the main screen automatically.

NOTE: You should install the software to the saving path of source data after the uninstallation and reinstallation; otherwise, the software needs a new configuration.

6.1 Viewing Lead Placement Information

1. Click on the **Lead Placement** button on the main screen to display the **Lead Placement** window.



2. Click on **Wilson lead system**, **Frank lead system** or **Exercise ECG lead system** to view the lead placement information in the corresponding system.

6.2 Selecting a Patient Record to Start a New Test

Click on the **Data Manager** button on the main screen (Figure 6-1) to open the **Data Manager** screen (Figure 6-3).

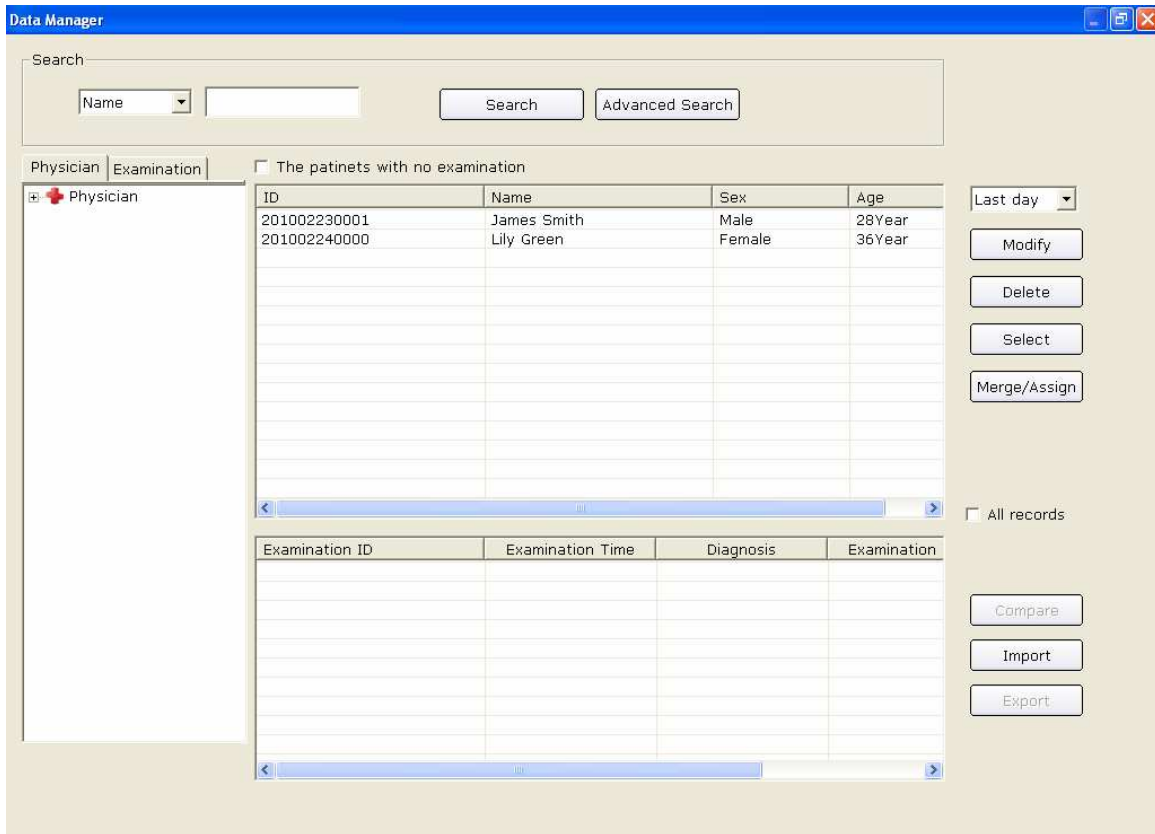
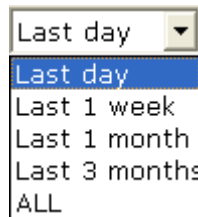
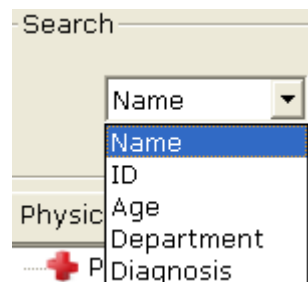


Figure 6-3 Data Manager Screen



1. Select a search item in the pull-down list **ALL** on the **Data Manager** screen. Then all the patient records which meet the search condition are listed in the patient information list.



2. Or, select a search item in the pull-down list **Physic**, enter the corresponding information in the right textbox, and then click on the **Search** button. All the patient records which meet the conditions will be displayed in the patient information list.

3. Or, click on **Advanced Search** to display the **Search Condition** window. Enter the search conditions, and click on the **Search** button, and all the patient records which meet the conditions will be displayed in the patient information list.


4. Click on the patient record in the patient information list and click on the **Select** button to open the **Patient Information** window. Or, double-click on the patient record in the patient information list to open the **Patient Information** window.

Figure 6-4 Patient Information Window

6.3 Entering New Patient Information

6.3.1 Entering New Patient Information Manually



If the patient is a new one, you can click on the **New Patient** button  on the main screen (Figure 6-1) to display the **Patient Information** window.

Then you need to input the patient's related information.

1. Enter basic information, such as patient ID, name, sex and age.

User-defined 1 and User-defined 2: You can input other related information such as patients' medical records.

User-defined 1 and User-defined 2 can be set in the **Basic Information** window (Figure 9-1). Before setting them, the two items in the **Patient Information** window are unavailable. For details, please refer to Section 9.1.1, "Setting Basic Information".

NOTE: In the **Patient information** window, patient ID is a must. You can use the number generated by the system or input a number manually. Patient ID can be a random character string excluding '/', '\', ':', '*', '?', '<', '>' and '|'.

2. Enter additional information, such as BP, height, weight, medication and race.

NOTE: You can select the additional information items in the **Print Setting** window, and these additional information items will be displayed in the **Patient Information** window after setting printer.

For details, please refer to Section 9.4.1, "Choosing Patient Information to be Printed".

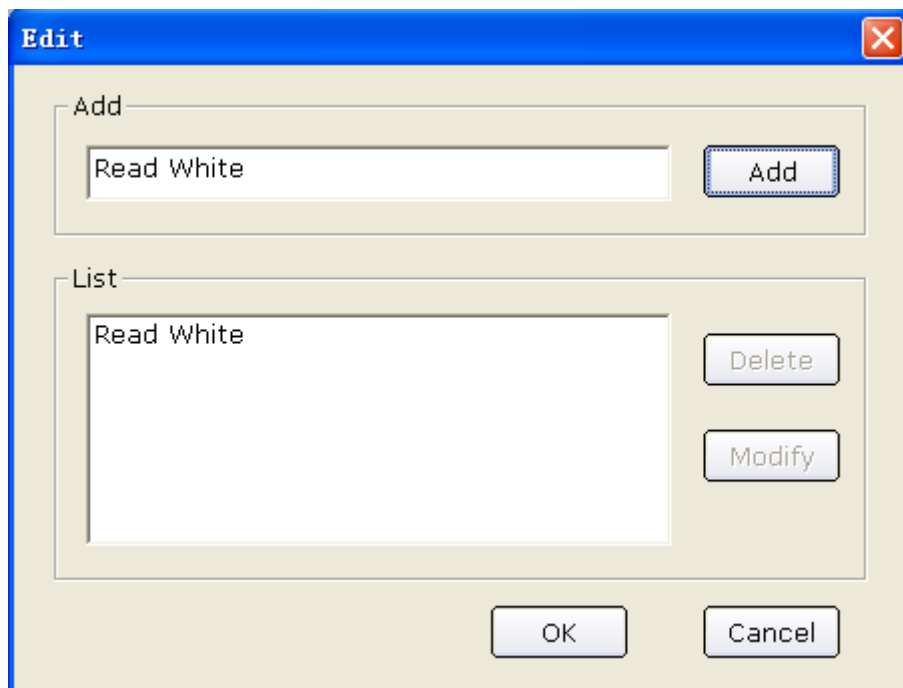
3. Enter information of doctor and department

1) Enter information of physician, technician or Req. physician



Click on the pull-down list **Edit...**, and then click on the **Edit** button to display the **Edit** window.

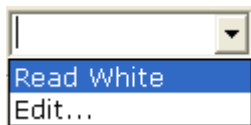
Enter the doctor name in the textbox, and then click on the **Add** button. The doctor name will be displayed in **List**. Meanwhile, you can also directly enter the doctor name in textbox of **Physician** item, and then click on the **OK** button in the **Patient Information** window.



Click on one name in **List**, and then you can delete or modify the name:

- a) Click on the **Delete** button, and then click the **OK** button to delete the name from the list.
- b) Click on the **Modify** button, enter a new name in textbox to modify the name, and then click on the **OK** button.

Click on the **OK** button to confirm and exit the **Edit** window, and then click on the



pull-down list, you can select the doctor name you enter.

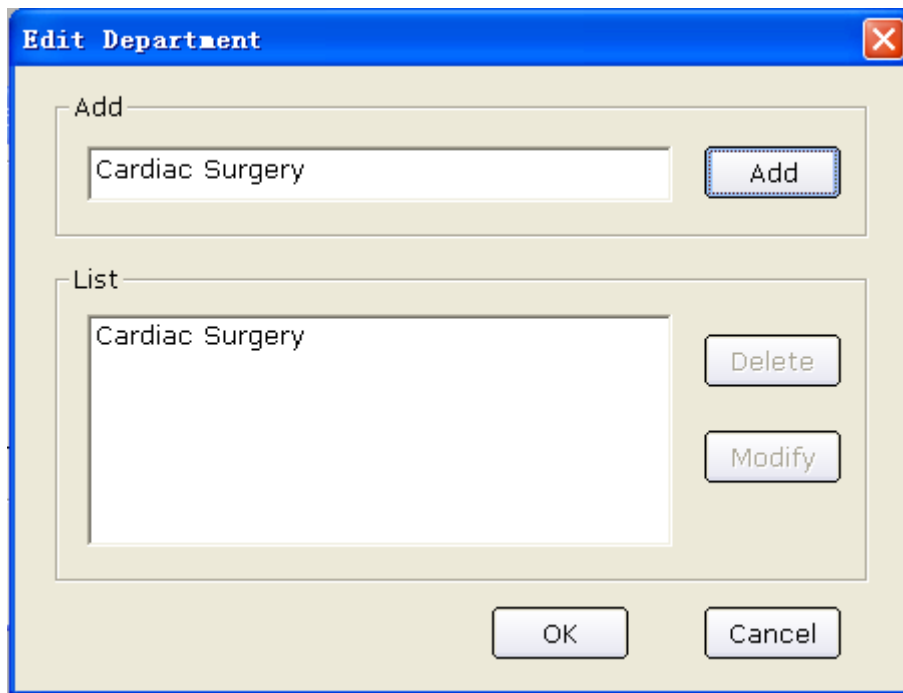
NOTE: Take the same steps above for entering information of technician or Req.physician.

2) Enter information of department



Click on the pull-down list **Edit...**, and then click on the **Edit** button to display the **Edit Department** window.

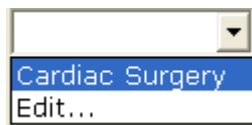
Enter the department name in the textbox, and then click on the **Add** button. The doctor name will be displayed in **List**. Meanwhile, you can also enter the department name in the textbox of **Dept.** item, and then click on the **OK** button in the **Patient Information** window.



Click on one department name in **List**, and then you can delete or modify the name:

- ◆ Click on the **Delete** button, and then click the **OK** button to delete the department name from the list.
- ◆ Click on the **Modify** button, enter a new name in the textbox to modify the department name, and then click on the **OK** button.

Click on the **OK** button to confirm and exit the **Edit** window, and then click on the



pull-down list **Edit...**, you can select the doctor name you enter.

NOTE: You can select **Physician**, **Technician** or **Req.physician** in the **Print Setting** window. Before setting them, these items in the **Patient Information** window are unavailable. For details, please refer to Section 9.4.1, “Choosing Patient Information to be Printed”.

4. Confirm pacemaker information

If you select **Pacemaker** in the **Print Setting** window, **Pacemaker** appears in the **Patient Information** window. Select **Pacemaker** to detect very small pacemaker pulses. However, when pacemaker pulse enhancer is on, the system is very sensitive, and should not be close to equipment emitting high frequency radiation. High frequency radiation can interfere with pacemaker pulse detection and normal ECG acquisition.

NOTE: Pacemaker is recommended to be deselected unless it is known that the majority of the electrocardiograph usage will be on patients with pacemakers.

5. Select risk indicators and symptoms (for Exercise ECG), such as cigarette, diabetes, congenital heart disease, hypertension, hyperlipemia and family medical history.

NOTE: You can select risk indicators and symptoms only in Exercise ECG mode.

6.3.2 Entering Patient Information by Using a Bar Code Reader

Operation procedures are as follows:

1. Configure the bar code

For more detailed information about configuring the bar code, please refer to Section 9.3.5.2, "Setting Barcode".

NOTE: If the two-dimensional bar code reader is used, you should install Symbol COM Port Emulation Drive manually. For details, please refer to *SE-1010 PC ECG Installation Guide*.

2. Connect the bar code reader to the PC.

3. Log into the PC ECG software.

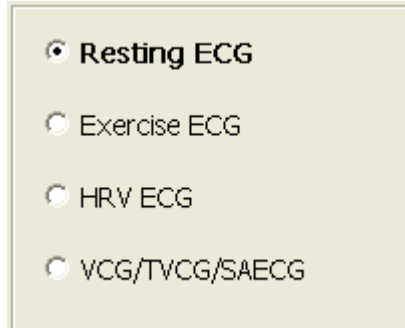
4. When the main screen or the **Patient Information** window is displayed, scan the patient's bar code with the bar code reader, and then the patient information will appear in the corresponding boxes of the **Patient Information** window.

NOTE:

1. Only bar code readers recommended by the manufacturer can be used.
2. Only the basic information of the patient can be scanned by the bar code reader.

6.4 Selecting Sampling Type

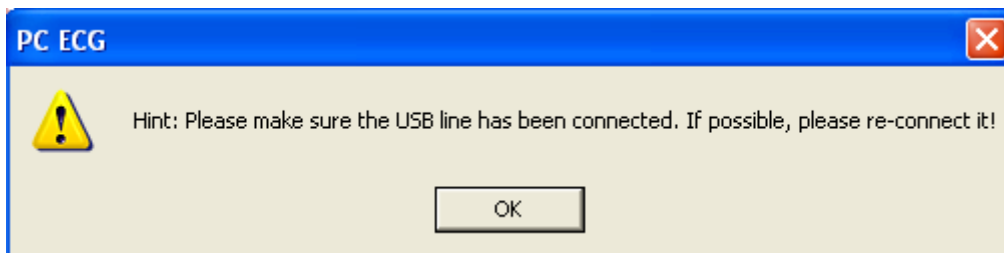
You can select a sampling type in the **Patient information** window.



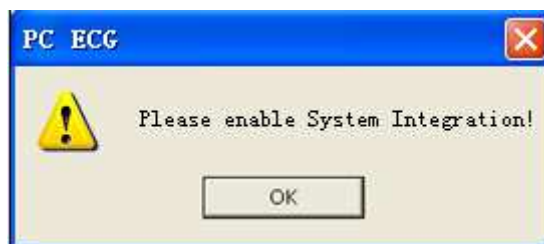
6.5 Sampling Resting ECG

After inputting the patient information, click on the **OK** button in the **Patient information** window to open the ECG sampling screen.

Before sampling, if you do not connect the PC to the ECG sampling box, the following hint will pop up.



If the system is invoked by Smart ECG Net, but the system integration is not activated, the following hint will pop up.



The system begins to pre-sample ECG.

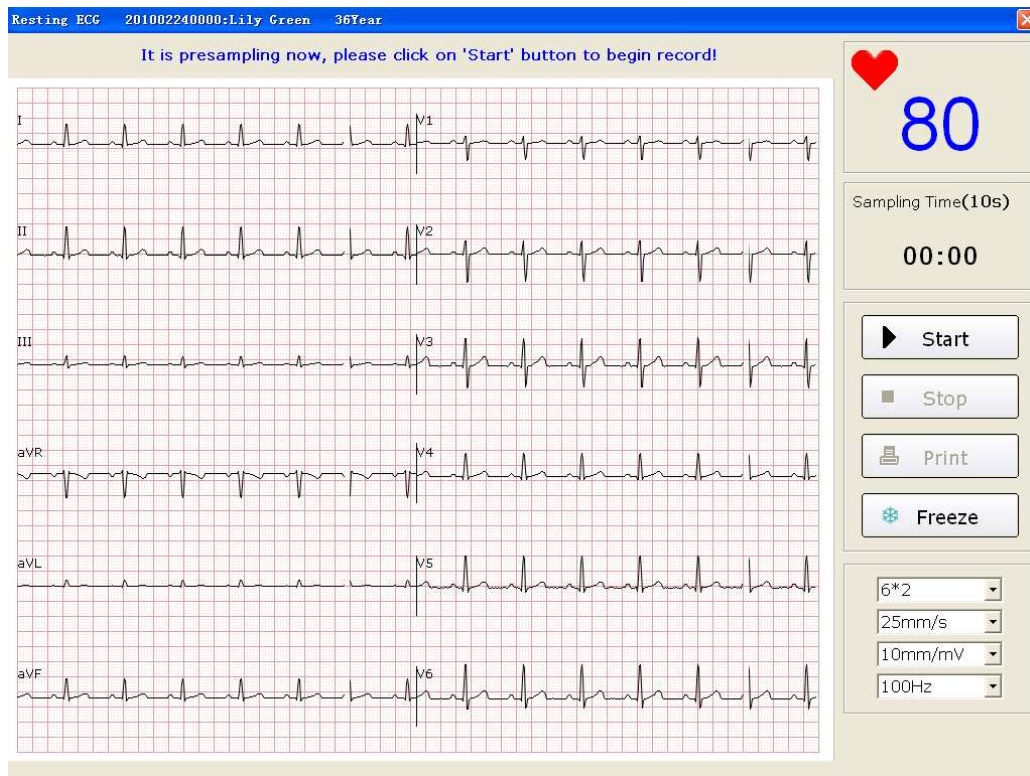
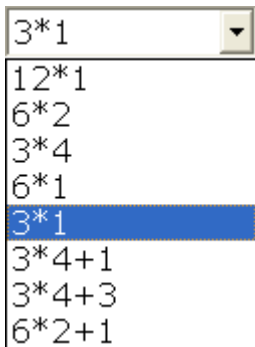


Figure 6-5 Pre-Sampling Screen

6.5.1 Specifying Display Mode



There are eight display modes including **12*1**, **6*2**, **3*4**, **6*1**, **3*1**, **3*4+1**, **3*4+3** and **6*2+1**.

When the display mode is set to **12*1**, 12-channel ECG waves are displayed on one screen simultaneously.

When the display mode is set to **6*2**, 12-channel ECG waves are displayed in 2 groups of 6 on one screen.

When the display mode is set to **3*4**, 12-channel ECG waves are displayed in 4 groups of 3 on one screen.

When the display mode is set to **6*1**, 6-channel ECG waves are displayed on one screen.

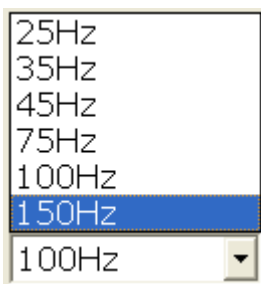
When the display mode is set to **3*1**, 3-channel ECG waves are displayed on one screen simultaneously.

When the display mode is set to **3*4+1**, 12-channel ECG waves are displayed in 4 groups of 3 and one rhythm lead on one screen.

When the display mode is set to **3*4+3**, 12-channel ECG waves are displayed in 4 groups of 3 and three rhythm leads on one screen.

When the display mode is set to **6*2+1**, 12-channel ECG waves are displayed in 2 groups of 6 and one rhythm lead on one screen.

6.5.2 Specifying Lowpass Filter



Lowpass Filter restricts the bandwidth of input signals. The cutoff frequency can be set to **25Hz**, **35Hz**, **45Hz**, **75Hz**, **100Hz**, or **150Hz**. The input signals whose frequency is higher than the set cutoff frequency will be attenuated.

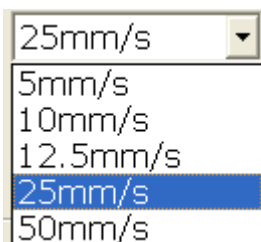
6.5.3 Specifying Gain



You can set the indicated length of 1mV ECG on the paper.

You can set the gain to **2.5mm/mV**, **5mm/mV**, **10mm/mV** or **20mm/mV**.

6.5.4 Specifying Speed



You can set the paper speed to **5mm/s**, **10mm/s**, **12.5mm/s**, **25mm/s** or **50mm/s**.

6.5.5 Recording ECG Data

When the pre-sample ECG waves are steady, you can click on the **Start** button to save the sampled ECG data to the designated directory. For details, please refer Section 9.1.4, “Specifying the Storage Path of the ECG Data”.

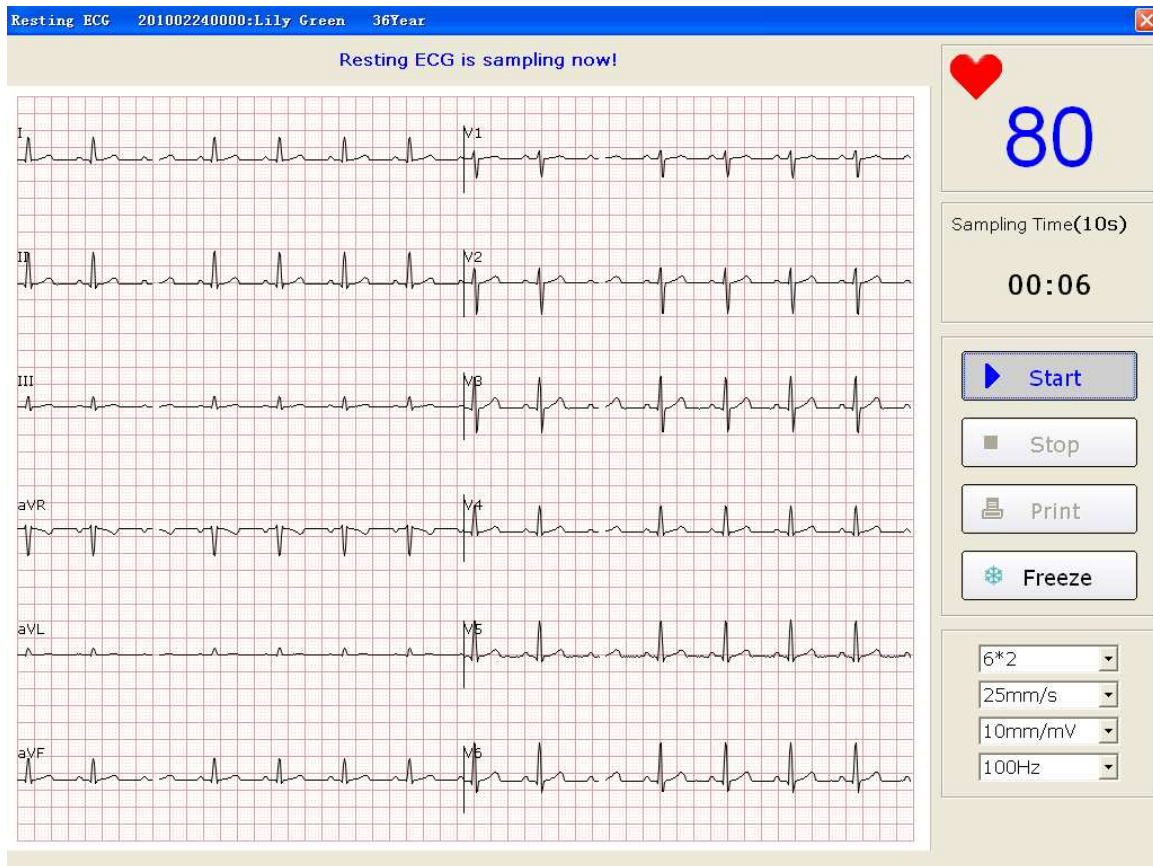


Figure 6-6 ECG Sampling Screen

NOTE: After you click on the **Start** button, the system will save the sampled ECG data. If you don't click on the **Start** button, the system won't save the sampled ECG data.

6.5.6 Freezing and Previewing ECG

Click on the **Freeze** button on the ECG sampling screen (Figure 6-6), the system will display the **Wave review** window. The system can review a 3-minute (at least) waveform (counted from before clicking on the **Freeze** button for 3 minutes). You can review the waveform by dragging the scrollbar and you can print the current waveform by clicking on the **Print** button.

NOTE: Printing ECG reports in the **Wave review** window are only available for Resting ECG and Exercise ECG.

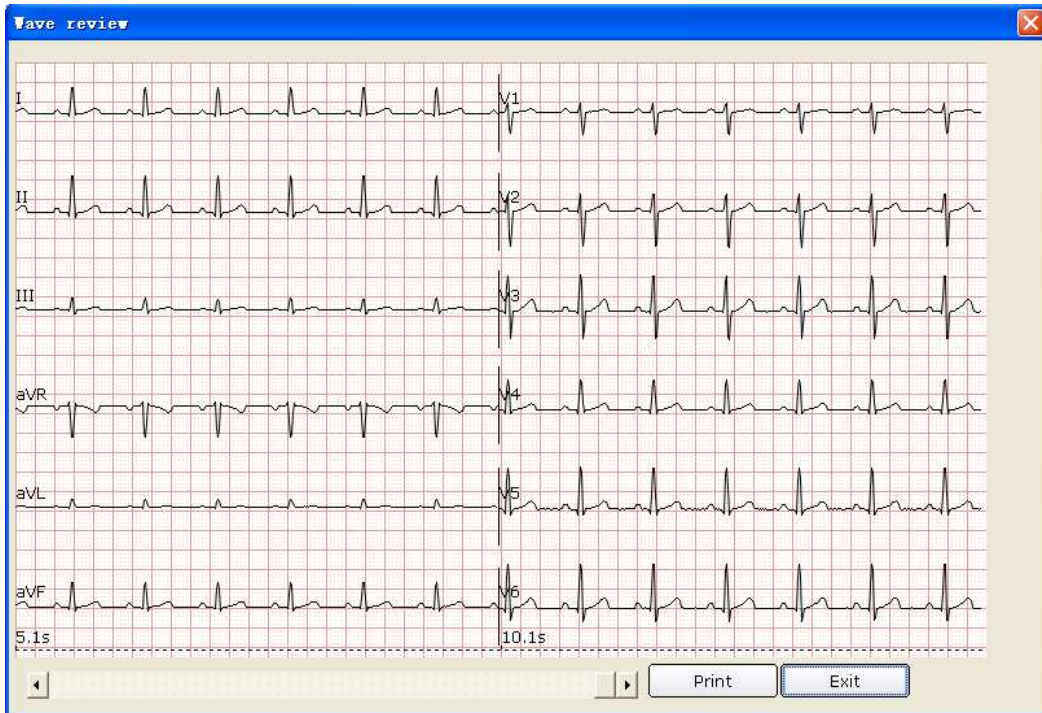


Figure 6-7 Wave Review Window

Click on **Exit** to return to the ECG sampling screen.

NOTE: The display modes in the **Wave review** window are the modes you select on the ECG sampling screen. 3*1 and 6*1 display modes are displayed in 3*4 and 6*2 modes.

6.5.7 Stopping Sampling Data

After clicking on the **Start** button, there are two ways to stop sampling data.

1. The system will stop sampling ECG data and display the ECG analysis screen automatically after the ECG sampling time is over. For details, please refer to Section 9.2.2, "Setting Sampling Time".
2. Before the ECG sampling time is over, you can click on the **Stop** button to stop sampling data and the ECG analysis screen will pop up automatically.

6.5.8 Printing ECG Waves

Click on the **Print** button on the ECG sampling screen to print the ECG waves on the ECG sampling screen.

NOTE:

1. You can set the printer type on the **Printer and Faxes** screen. For details, please refer to Section 6.6.10, "Printing ECG Reports".
2. The report can be printed in **white- black** or **color**. The report color is defined by setting the printer type and can be observed on the preview screen. For details, please refer to Section 9.4.4, "Print Setup".

6.6 Analyzing ECG Data

You can open the ECG analysis screen in one of the following three ways:

1. Click on the **Start** button, and then the system will stop sampling ECG and display the ECG analysis screen automatically after the ECG sampling time is over.
2. Or, click on the **Stop** button to stop sampling after clicking on the **Start** button, and the system will display the ECG analysis screen automatically.
3. Or, double-click on an examination record in the examination record list on the **Data Manager** screen (Figure 6-3) to open the ECG analysis screen.

When **Resting ECG** is selected as the sampling type, the ECG analysis screens include Normal ECG, QT Dispersion (QTD), Frequency ECG (FCG) and High Frequency ECG (HF ECG).

When **HRV ECG** is selected as the sampling type, the ECG analysis screens include Heart Rate Variability (HRV) and Heart Rate Turbulence (HRT).

When **VCG/TVCG/SAECG** is selected as the sampling type, the ECG analysis screens include Vector ECG (VCG), Time Vector ECG (TVCG) and Signal Averaged ECG (SAECG).

6.6.1 Analyzing Normal ECG

Click on the **Normal Analysis** button to open the normal ECG analysis screen. There are four tabs: **Waveform**, **Average Template**, **Detail information** and **Rhythm Wave**.

6.6.1.1 Viewing the Waveform

Click on the **Waveform** tab on the normal ECG analysis screen to open the **Waveform** window (Figure 6-8).

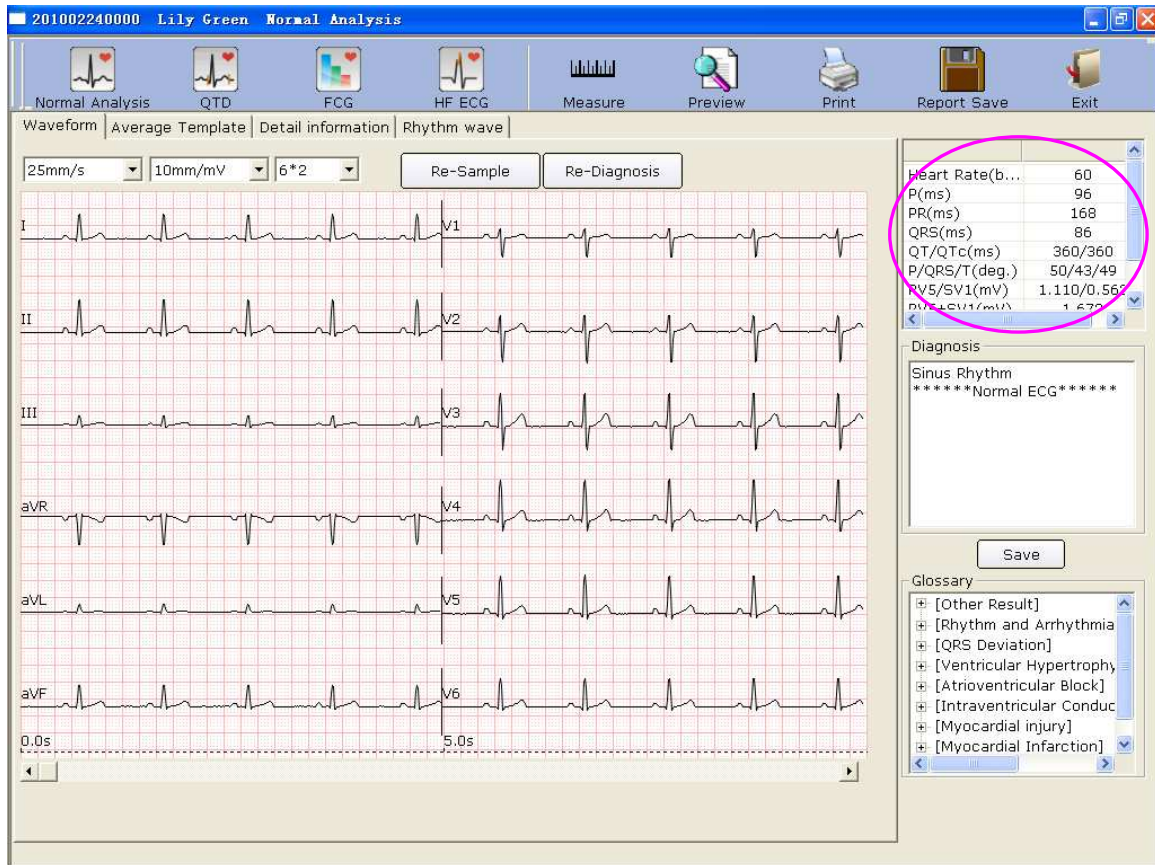


Figure 6-8 Normal ECG - Waveform Window

You can choose a speed, a gain and a display mode for the displayed waves.

Click on the **Measure** button in the **Waveform** window (Figure 6-8). Click on one point on the wave, and then drag the mouse to another point. The distance, amplitude difference and heart rate between the two points will be displayed.

NOTE:

1. You can measure the distance between any two points more than once after running the ruler. The last measure track and data will be displayed after the measurement.
2. Only ECG waves can be measured.

Click on **Re-Sample**, and then the system can re-sample ECG data.

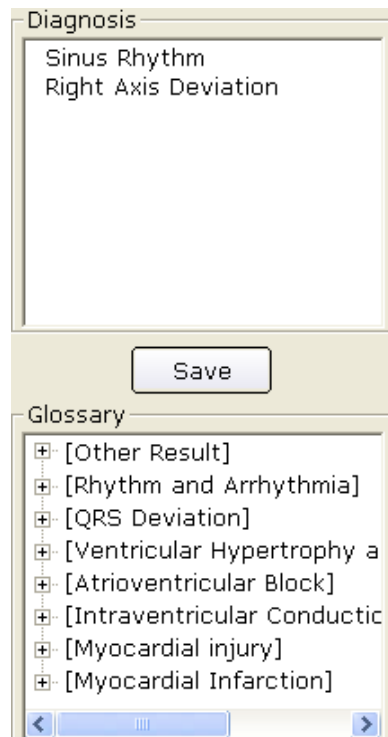
Click on **Re-Diagnosis**, and then the system can re-diagnose the 10s ECG data on the screen automatically.

The common parameters are displayed in the circle in Figure 6-8. These parameters are as follows.

Designation	Description
Heart Rate	Heart Rate
P Duration	P-wave duration of the current lead
PR Dur.	P-R interval of the current lead
QRS Dur.	QRS complex duration of the current lead
QT/QTc	Q-T interval of the current lead/Normalized QT interval
P/QRS/T	Dominant direction of the average integrated ECG vectors
RV5/SV1	The amplitude of R wave of V5 lead/the amplitude of S wave of V1 lead
RV5+SV1	The amplitude of R wave of V5 lead plus the amplitude of S wave of V1 lead
RV6/SV2	The amplitude of R wave of V6 lead/the amplitude of S wave of V2 lead

Double-click on a parameter, and then you can modify it. Then click on the **Save** button to save the modifications.

To Edit Diagnosis Result in the Waveform Window



1. Enter your own opinions in the **Diagnosis** textbox, and then click on the **Save** button.
2. Or, double-click on the necessary results required to be added in the **Glossary** textbox, the selected results will be displayed in the **Diagnosis** textbox, and then click on the **Save** button.

If the Integration function is activated, the data can be uploaded to Smart ECG Net system after you click on the **Save** button.

6.6.1.2 About the Average Template Window

Click on the **Average Template** tab on the normal ECG analysis screen to open the **Average Template** window (Figure 6-9). You can analyze average templates in this window.

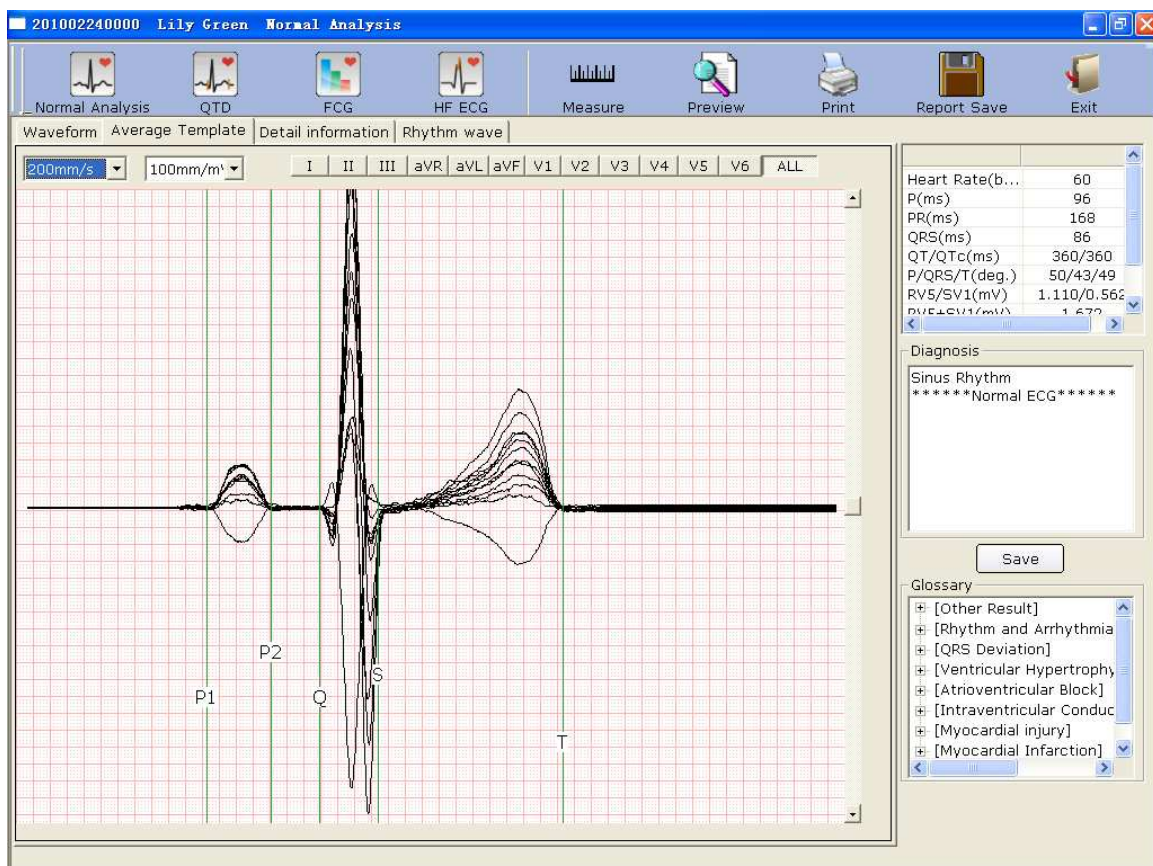

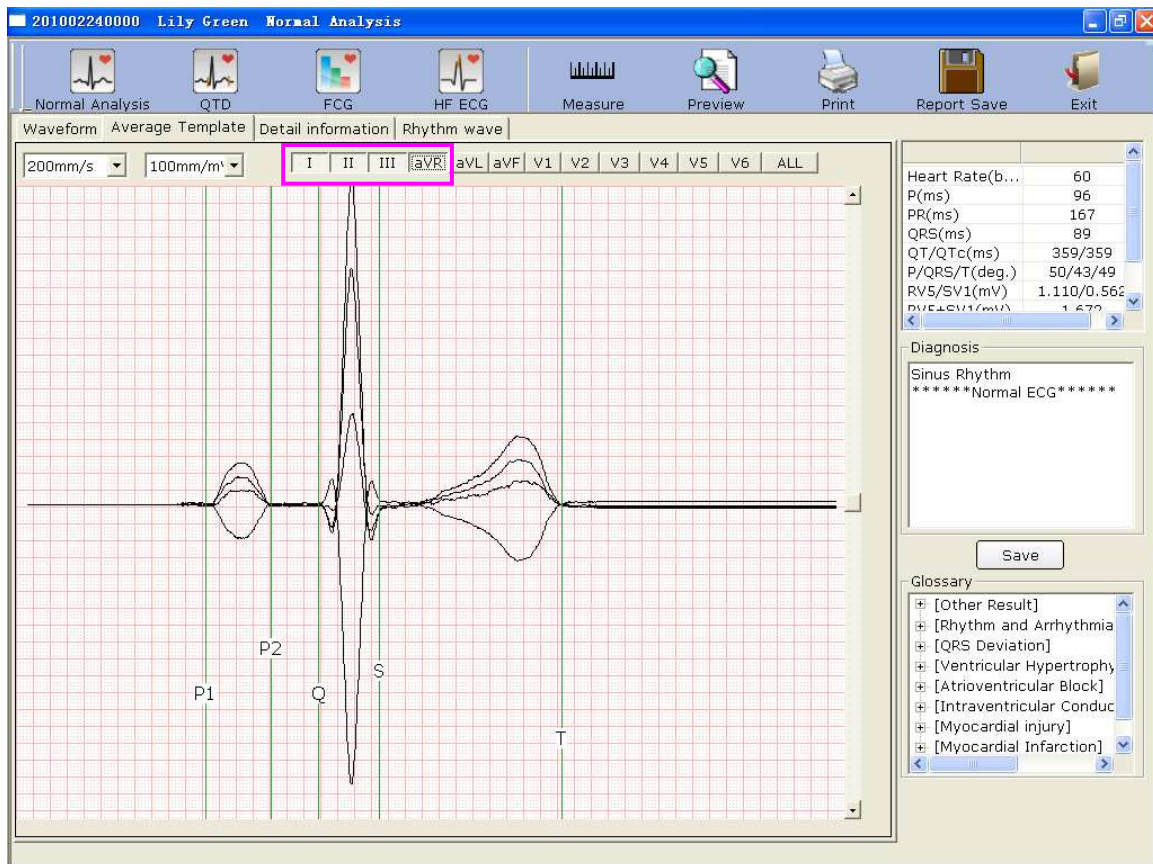


Figure 6-9 Normal ECG - Average Template Window

To Edit Waveform on the Analysis Screen

You can press a lead button in  to display magnified average templates of this lead. When you press more than one lead button, magnified average templates of these leads will be overlapped with the same central axis.



When you press **ALL**, magnified average templates of all leads will be overlapped with the same central axis.

You can set the speed and the gain of average templates.

You can drag marker lines of P1, P2, Q, S and T on average templates.

P1 is the start point of P wave, P2 is the end point of P wave, Q marks the position of Q point, S marks the position of S point, and T is the end point of T wave. You can move these lines by dragging on the mouse and the mouse will turn to a hand pointer when it is put on these marks. You can also use the arrows key on the keyboard to move these marks, and the corresponding parameter values will change.

To Edit Diagnosis Result in the Average Template Window

For details, please refer to Section 6.6.1.1, “Viewing the Waveform”.

6.6.1.3 About the Detail Information Window

Click on the **Detail information** tab on the normal ECG analysis screen to open the **Detail information** window. This window displays lead parameter values as Figure 6-10 shows.

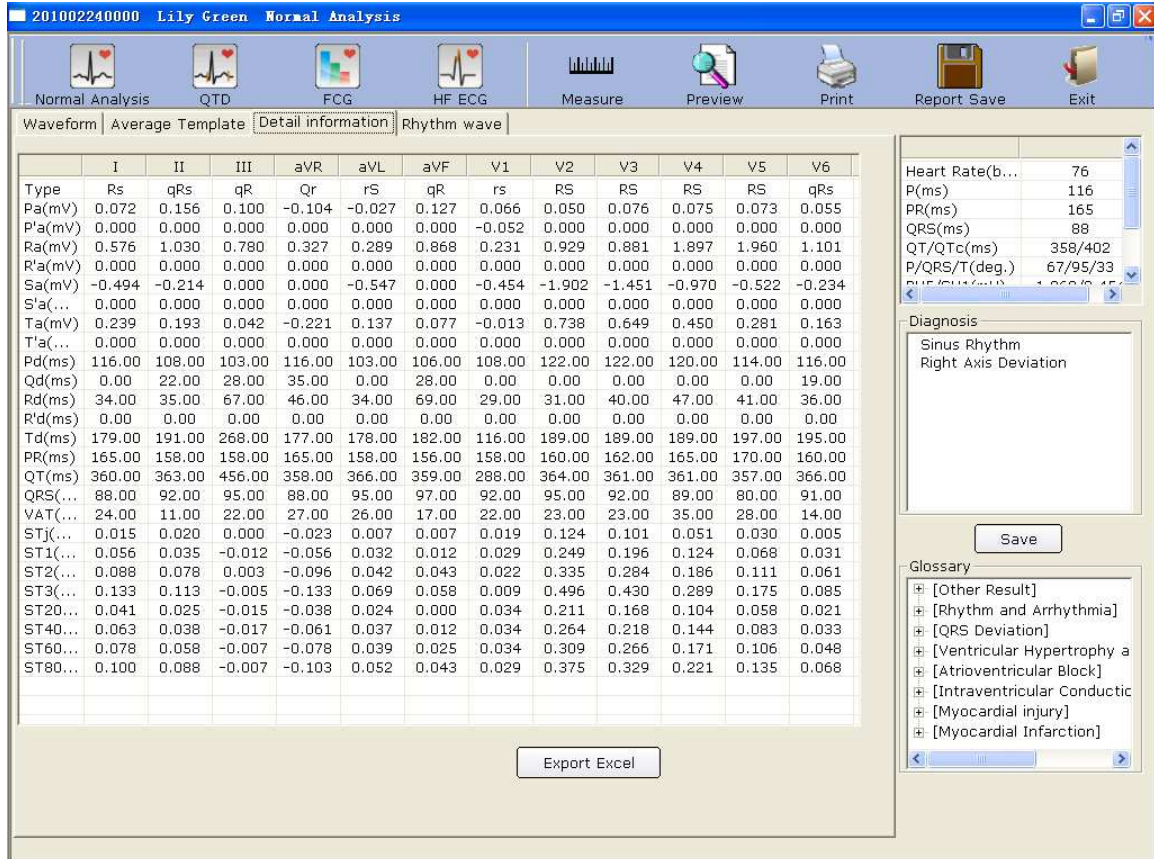


Figure 6-10 Normal ECG - Detail Information Window

Click on the **Export Excel** button to export an Excel file.

To Edit Diagnosis Result in the Detail Information Window

For details, please refer to Section 6.6.1.1, “Viewing the Waveform”.

6.6.1.4 About the Rhythm Wave Window

Click on the **Rhythm Wave** tab on the normal ECG analysis screen to open the **Rhythm wave** window. This window displays rhythm wave as Figure 6-11 shows.

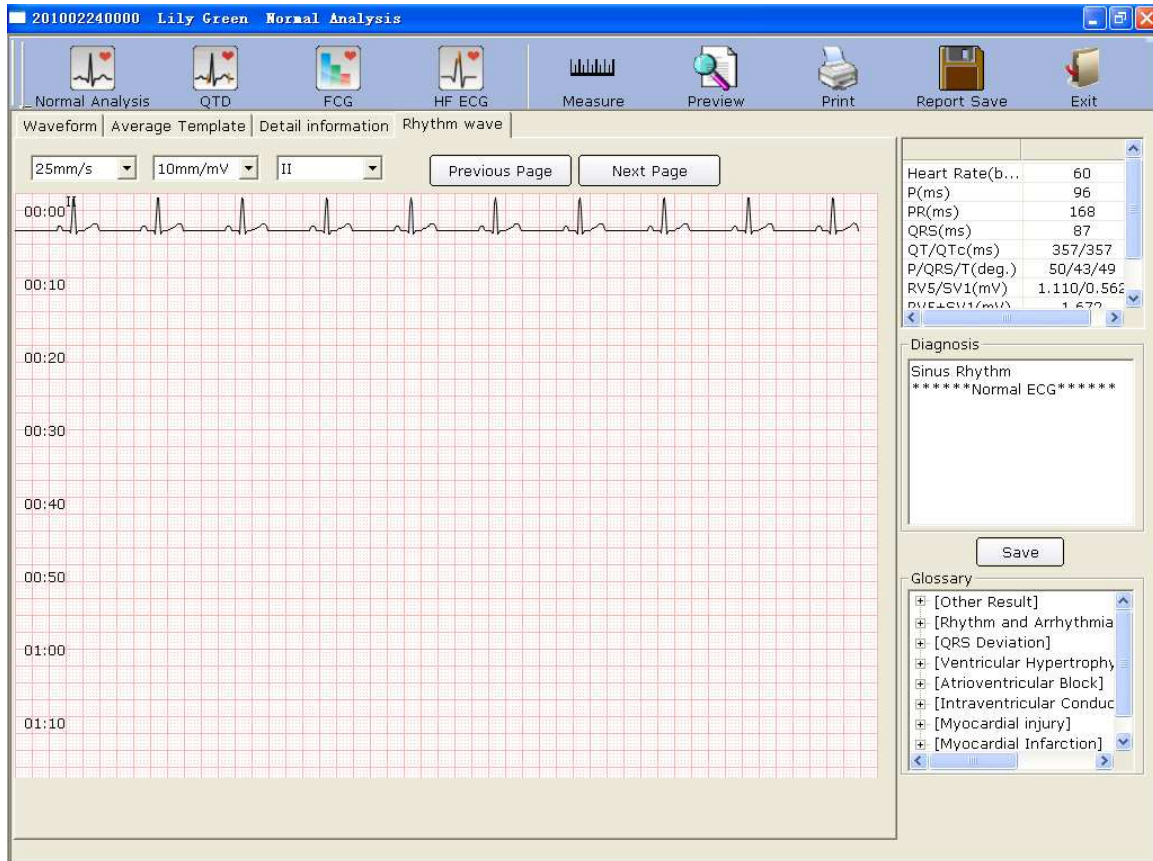


Figure 6-11 Normal ECG - Rhythm Wave Window

You can set the gain, the speed and the lead of the displayed ECG waves.

You can click on **Previous Page** or **Next Page** to display the waves of the previous or next page.

Click on one point on the wave, and then drag the mouse to another point. Then click on **Print** to print the selected wave field.

6.6.1.5 Previewing Normal ECG

Click on the **Preview** button to display the normal ECG preview screen.



is the toolbar on the normal ECG preview screen.

1. Click on **Previous Page/Next Page** to switch to the previous/next preview page.
2. Click on **Zoom In/ Zoom Out** to magnify/minify the preview page.
3. Click on **Print** to print the report.

4. Click on **Close** to close the normal ECG preview screen and return to the previous screen.

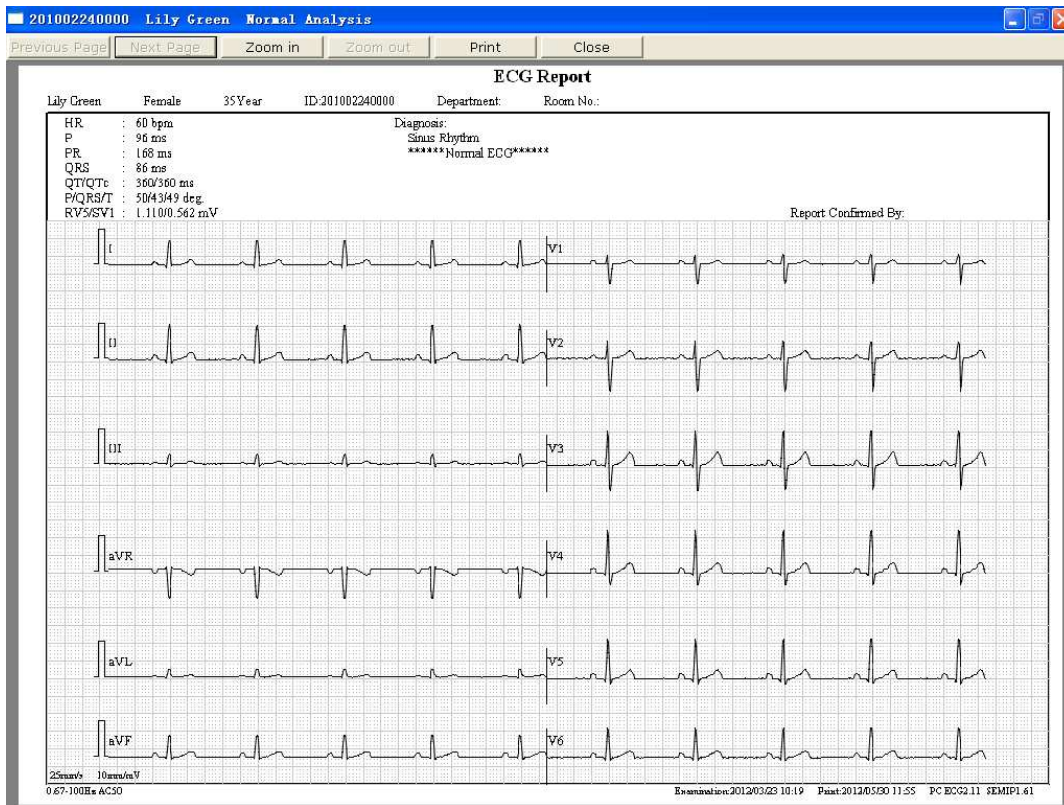
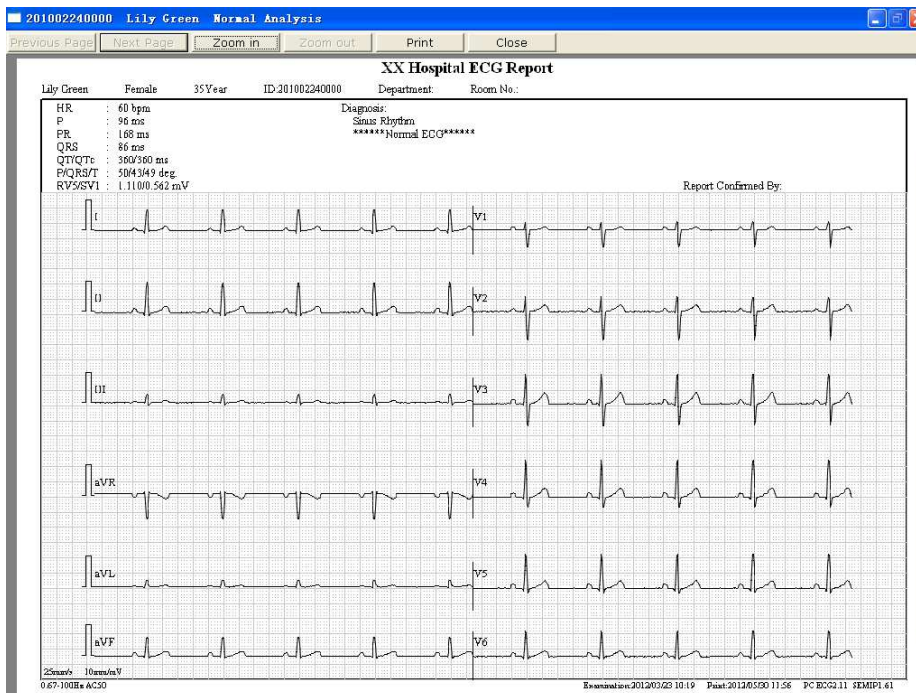


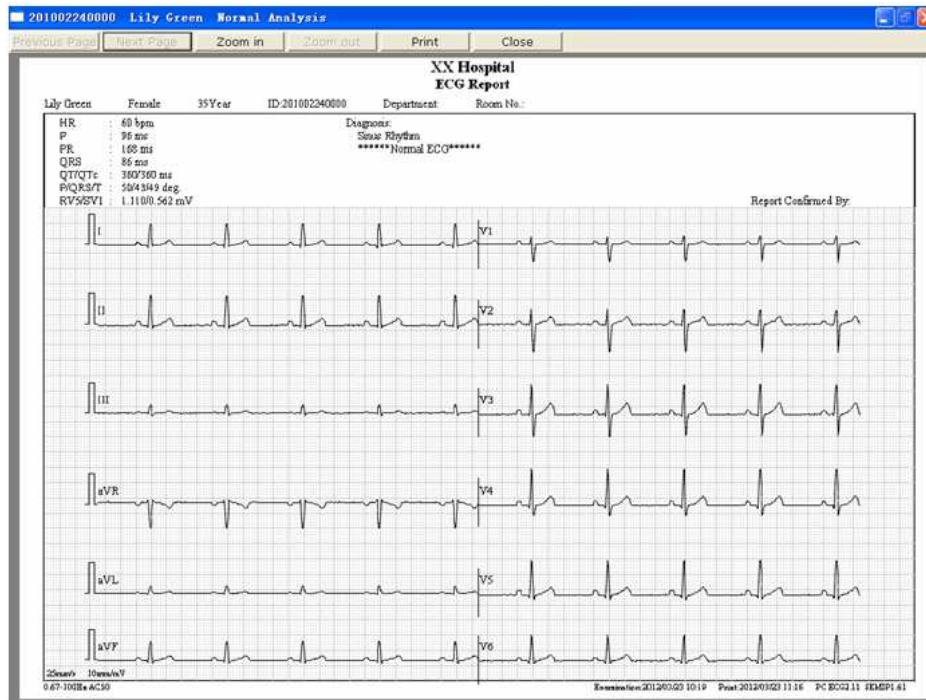
Figure 6-12 ECG Wave

NOTE: The report title is in one line by default, you can also change the line to two lines. Find the text named **PCECG.ini** in the installation path, modify **LineofTitle=0** to **LineofTitle=1**, and then save the text to change the line to two lines.

Effect pictures of report title are as shown below:



Report Title in One Line



Report Title in Two Lines

6.6.2 Analyzing QT Dispersion

Click on the **QTD** button to open the QT Dispersion screen.

QT Dispersion: The difference between the largest QT interval and the shortest QT interval based on the synchronous 12-lead surface ECG. The QT interval is a measurement of the time difference between the start of the Q wave and the end of the T wave.

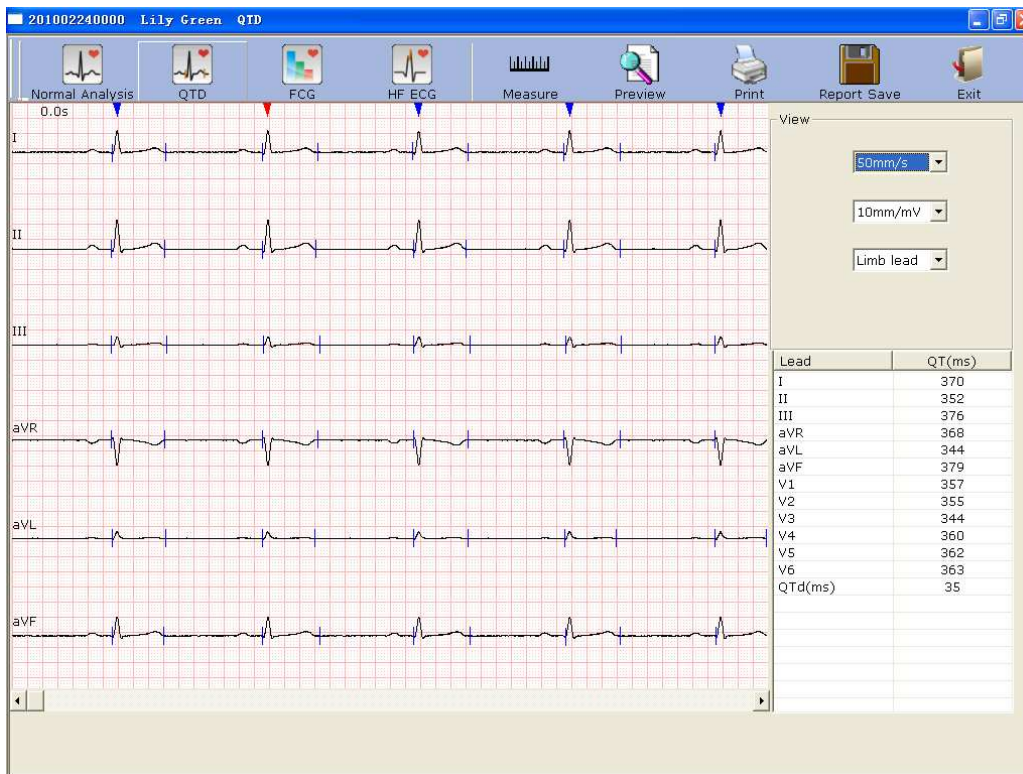


Figure 6-13 QT Dispersion screen

6.6.2.1 Editing Waveform on the QT Dispersion Screen

There are red and blue triangle icons on top of the displayed ECG waves. You can click on the triangle icon to change the color.



represents the current chosen R wave



represents the position of R wave



You can set the speed and the gain of the displayed ECG waves. The lead number and the lead type of the displayed ECG waves can also be chosen.

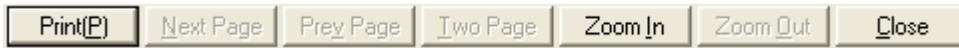
6.6.2.2 About QT Value

Lead	QT(ms)
I	358
II	360
III	350
aVR	358
aVL	358
aVF	360
V1	377
V2	366
V3	363
V4	355
V5	354
V6	353
QTd(ms)	27

QT values of 12 leads and QT dispersion (QTd) are displayed as the left figure shows.

6.6.2.3 Previewing QT Dispersion

Click on the **Preview** button on the QT Dispersion screen to open the QT Dispersion preview screen.



is the toolbar on the

QT Dispersion preview screen.

1. Click on **Print(P)** to print the report.
2. Click on **Next Page/Prey Page** to switch to the previous/next preview page.
3. Click on **Two Page** to preview two pages on one screen simultaneously.
4. Click on **Zoom In/ Zoom Out** to magnify/minify the preview page.
5. Click on **Close** to close the preview screen and return to the previous screen.

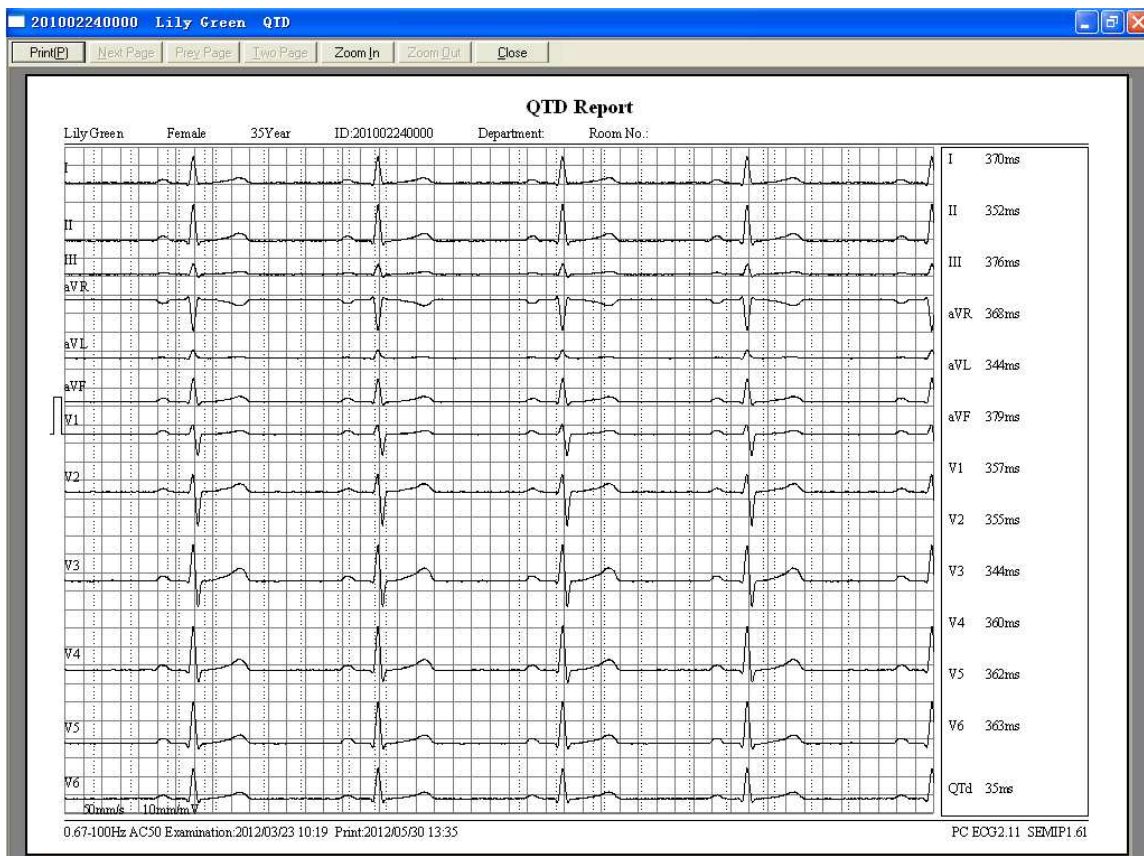


Figure 6-14 QT Dispersion Preview Screen

6.6.3 Analyzing Frequency ECG

Click on the **FCG** button to open the Frequency ECG screen.

Frequency ECG displays characteristic waves of ECG signal spectrum.

There are two tabs on the Frequency ECG screen: **Two leads compare** and **12-lead power spectrum**.

6.6.3.1 About Two-lead Comparison Window

The two-lead comparison window displays the power spectrum, phase shift, amplitude shift, coherence, impulse response and correlation functions of ECG waves, as Figure 6-15 shows.

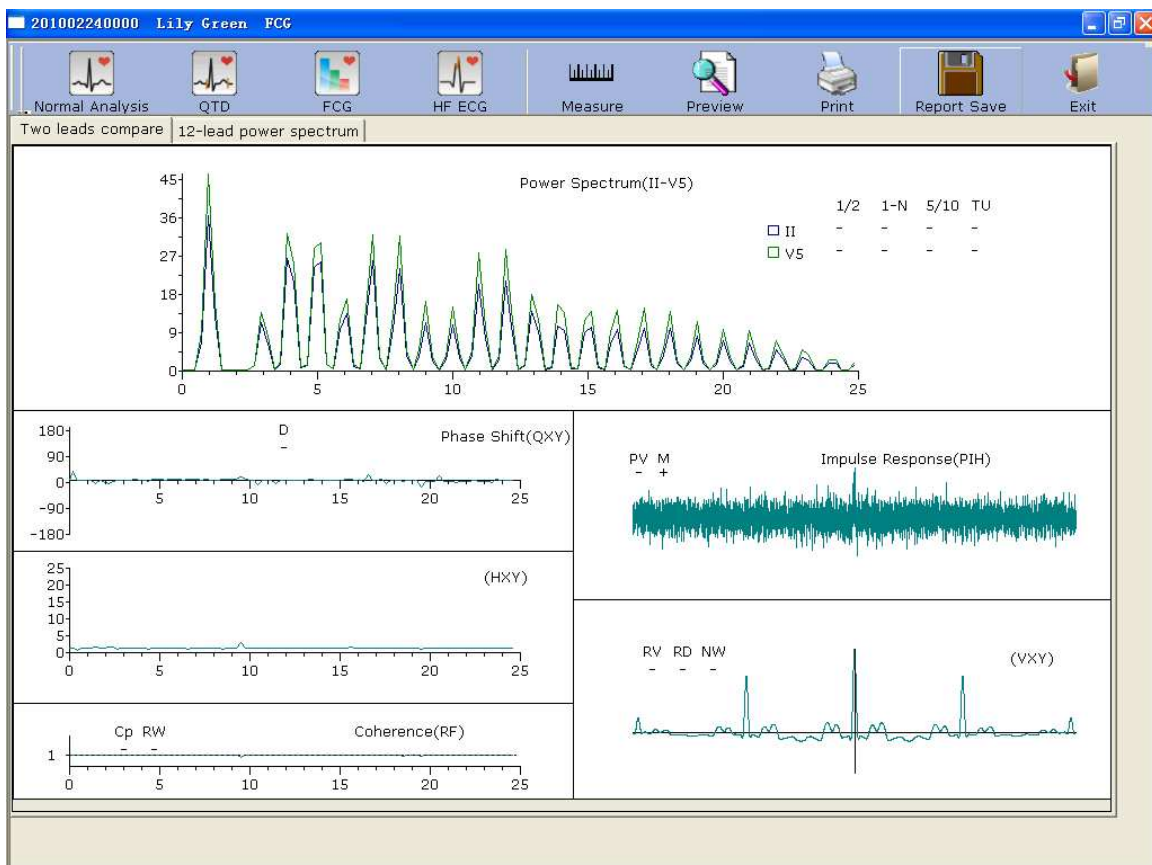


Figure 6-15 Frequency ECG - Two-lead Comparison Window

Every parameter of Frequency ECG is shown in the following table.

	Designation	Definition
Power Spectrum	1/2	If the first peak value is lower than 90% of the second peak value, it is positive ('+'). Otherwise it is minus ('-').
	1-N	The first peak is too low or disappears. (The frequency value of the first peak's position * 60 = heart rate. For example, if the frequency value of the first peak's position is 1.2, the heart rate is 72.)
	5/10	If the peak value of any peak behind the fifth peak is higher than the first peak value, it is positive. Otherwise it is minus.
	TU	If the distances between peak values are not equal, it is positive. Otherwise it is minus.
Phase Shift	D	If the phase shift in the range of 6~18Hz exceeds 90 degrees, it is positive. Otherwise it is minus.
Coherence	Cp	If the coherence value of the fundamental (the position of the first peak in power spectrum) is less than 0.8, it is positive. Otherwise it is minus.
	RW	If there are four twists and turns with peak-to-valley interval >0.5r or five twists and turns with peak-to-valley interval >0.1 in the range of 10~20Hz, it is positive. Otherwise it is minus.
Impulse Response	PV	If the main peak in the middle upends, the downward peak value is higher than the upward peak value, it is positive. Otherwise it is minus.
	M	If there is a peak around the main peak higher than 60% of the main peak, it is positive. Otherwise it is minus.
Correlation Function (VXY)	RV	If the main peak in the middle upends, it is positive. Otherwise it is minus.
	RD	If the main peak in the middle deviates from the origin and the baseline, it is positive. Otherwise it is minus.
	NW	The main peak is like the letter 'N'.

6.6.3.2 About 12-lead Power Spectrum Window

The **12-lead power spectrum** window displays the power spectrum of 12-lead ECG waves.

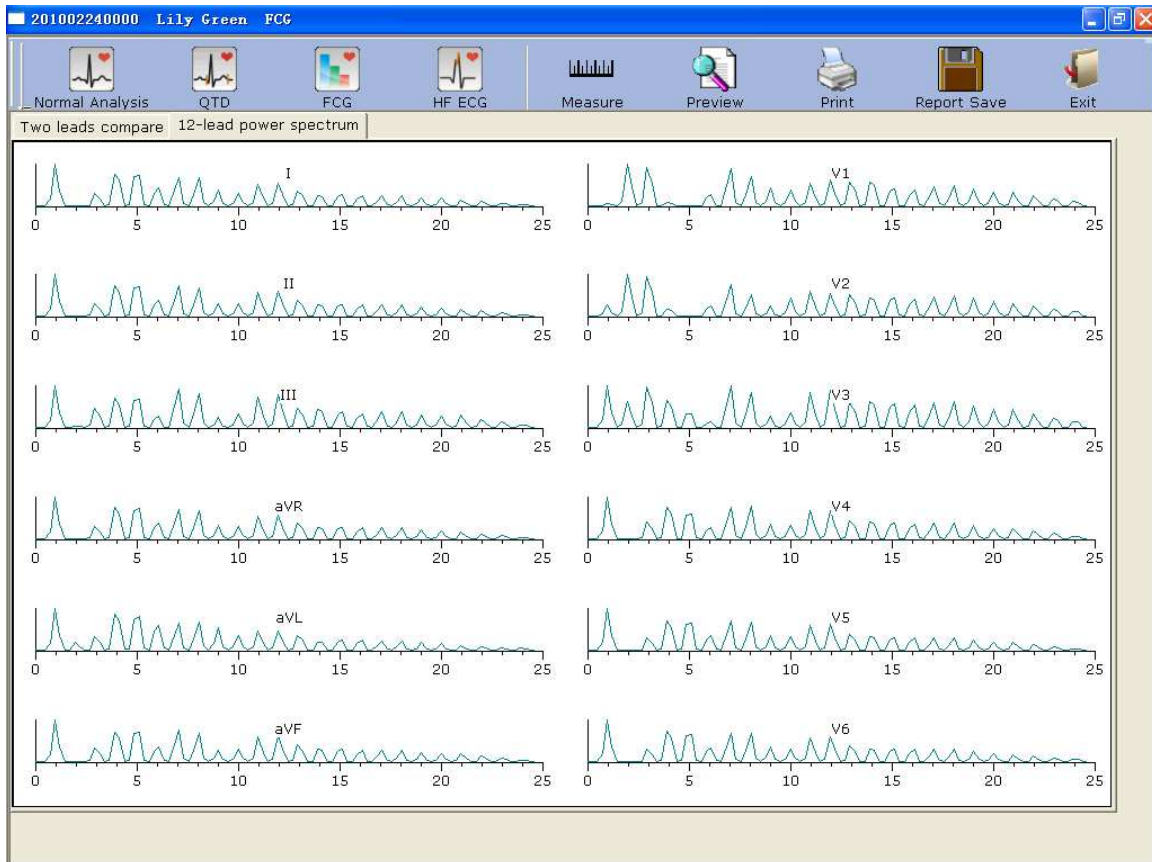
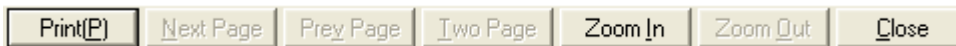


Figure 6-16 Frequency ECG - 12-lead Power Spectrum Window

6.6.3.3 Previewing Frequency ECG

Click on the **Preview** button to open the Frequency ECG preview screen.



is the toolbar on the

Frequency ECG preview screen.

1. Click on **Print(P)** to print the report.
2. Click on **Next Page/Prey Page** to switch to the previous/next preview page.
3. Click on **Two Page** to preview two pages on one screen simultaneously.
4. Click on **Zoom In/ Zoom Out** to magnify/minify the preview page.
5. Click on **Close** to close the preview screen and return to the previous screen.

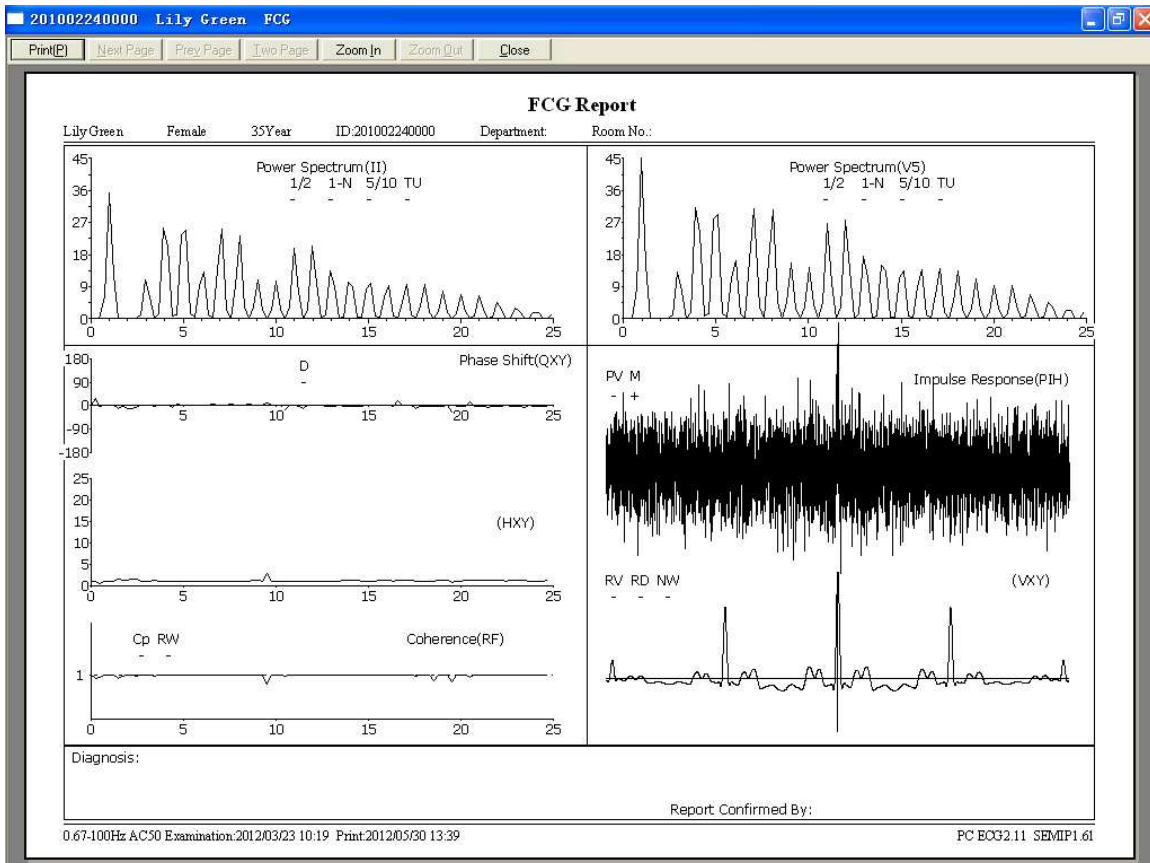


Figure 6-17 Two-lead Comparison Report



Figure 6-18 12-lead Power Spectrum Report

6.6.4 Analyzing High Frequency ECG

In a conventional electrocardiogram, only these ECG signals, of which the amplitude is in the millivolt range and the frequency is less than 100 Hz, are visible. Those ECG signals, of which the amplitude is in the microvolt range and the frequency is between 150Hz and 250Hz, are invisible. If these invisible high frequency components are abnormal, it is the indication of myocardial ischemia or myocardial infarction.

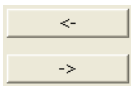
HF ECG is to detect high frequency components of QRS such as notches, slurs and beatings.

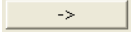
Click on the **HF ECG** button to open the HF ECG analysis screen.



Figure 6-19 HF ECG Analysis Screen

The ECG wave between the two green lines is the present one.



Click on  to select another QRS wave. Select the present lead in the pull-down list



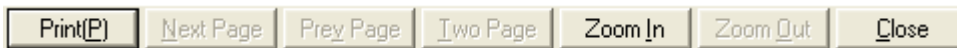
You can choose the lead group, the gain and the speed of the waves displayed in the bottom part of the HF ECG analysis screen.

	I	II	III	aVR	aVL	aVF	V1	V2	V3	V4	V5	V6	Tot.
N	0	0	0	0	3	0	0	0	0	0	0	0	3
S	0	0	0	0	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0	0	0

is the statistic data

of beatings, notches and slurs. You can change a value by double-clicking on the value.

Click on the **Preview** button to open the HF ECG preview screen.



is the toolbar on the

HF ECG preview screen.

1. Click on **Print(P)** to print the report.
2. Click on **Next Page/Prey Page** to switch to the previous/next preview page.
3. Click on **Two Page** to preview two pages on one screen simultaneously.
4. Click on **Zoom In/ Zoom Out** to magnify/minify the preview page.
5. Click on **Close** to close the preview screen and return to the previous screen.

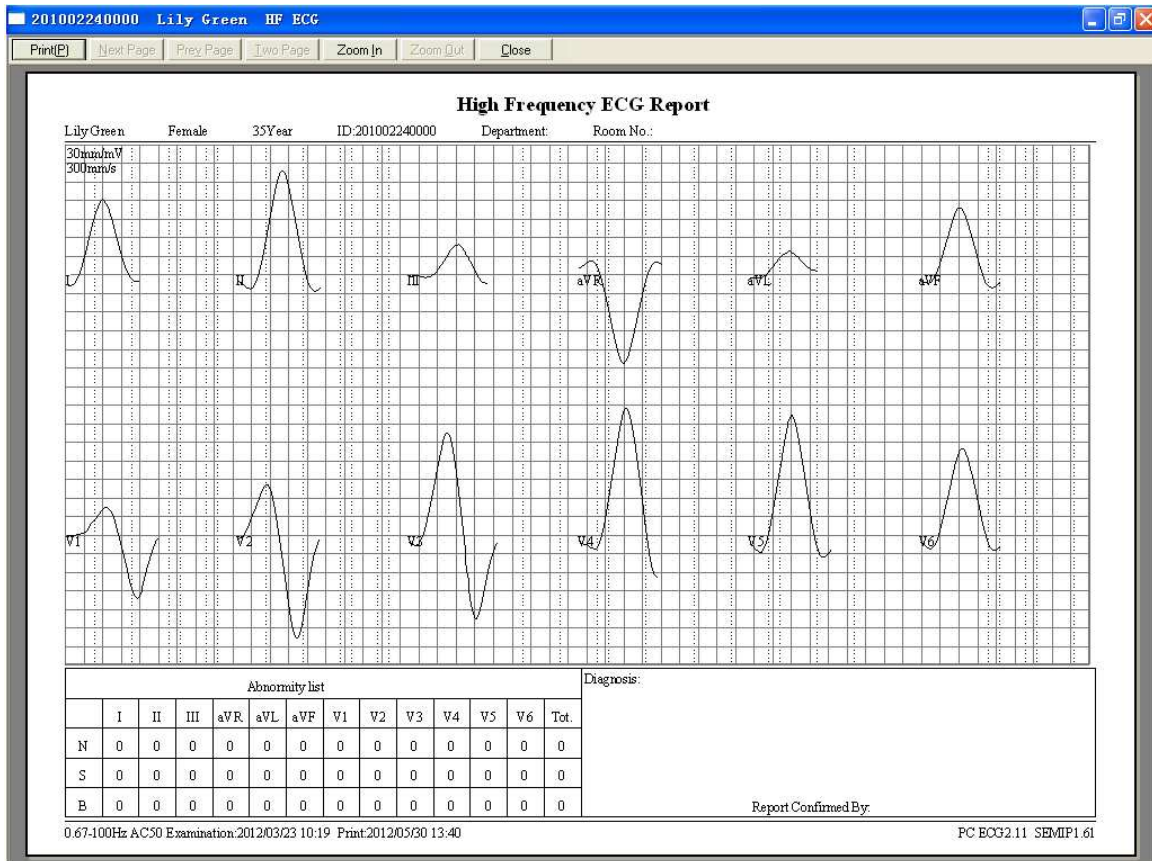


Figure 6-20 HF ECG Report

6.6.5 Analyzing HRV

Click on **HRV** to display the HRV ECG analysis screen. The HRV ECG analysis screen includes two tabs: **Auto diagnosis result** and **Waveform**.

NOTE:

1. The HRV sampling time can be set in the **Sample Setting** window.
2. The HRV analysis lead can be selected in the **Sample Setting** window.

6.6.5.1 Editing the HRV Data on the Analysis Screen

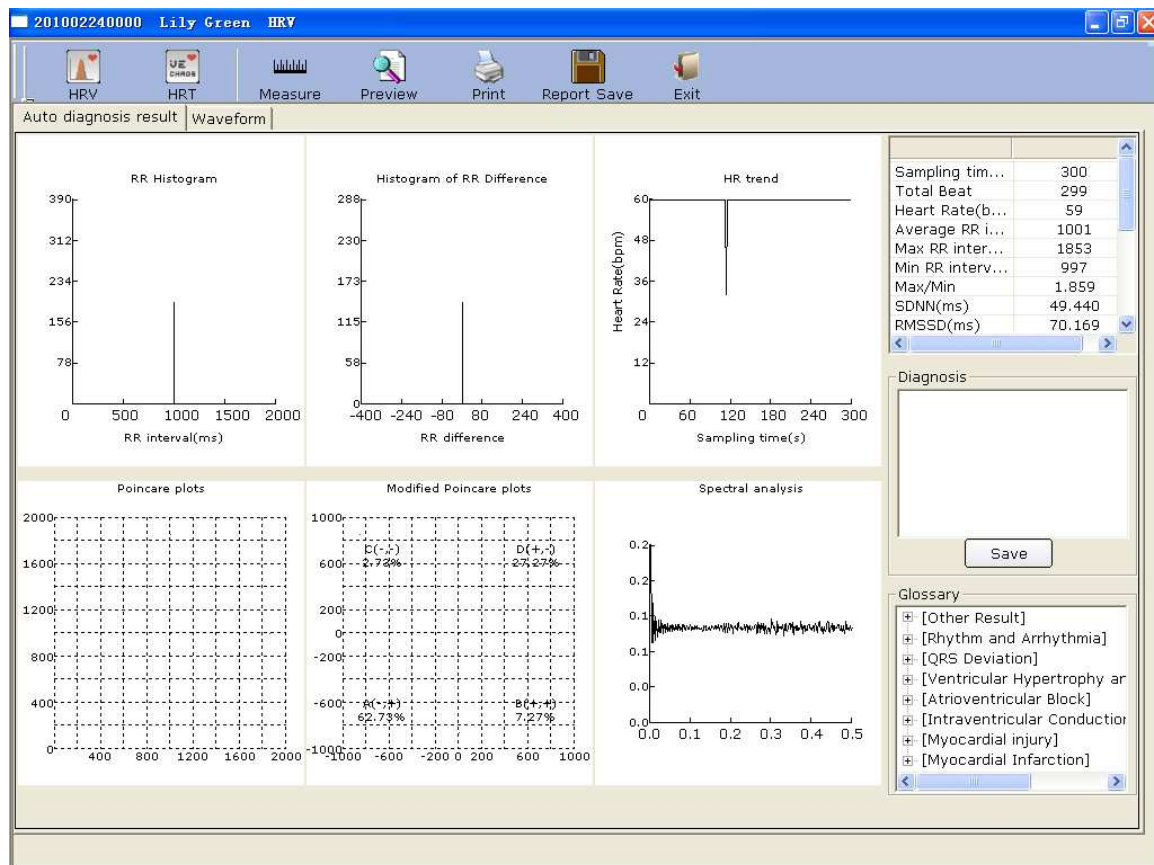


Figure 6-21 Analysis Screen of HRV

Designation	Definition
Sampling time	Set sampling time
Total Beat	Total beat number during the measuring course
Heart Rate	Heart rate
Average RR interval	Average RR interval
Max RR interval	Maximum RR interval
Min RR interval	Minimum RR interval
Max/Min	Ratio of Maximum RR interval to Minimum RR interval
SDNN	Standard Deviation of Normal to Normal Intervals
RMSSD	Root Mean Square Successive Difference
NN50 (the total beat number)	The number of duration difference that is more than 50ms between the adjacent NN durations.
PNN50 (unit: per centum)	NN50 divide the total NN number

LF	Low Frequency
HF	High Frequency
LF/HF	Ratio of low frequency to high frequency
LF (norm)	Standard LF power
HF (norm)	Standard HF power

H- Doctor Diagnosis Field

1. Enter your own opinions in the **Auto diagnosis** textbox, and then click on the **Save** button.
2. Or, double-click on the necessary results required to be added in the **Glossary** textbox, the selected results will be displayed in the **Auto Diagnosis** textbox, and then click on the **Save** button.

6.6.5.2 Editing the HRV Waveform in the Waveform Window

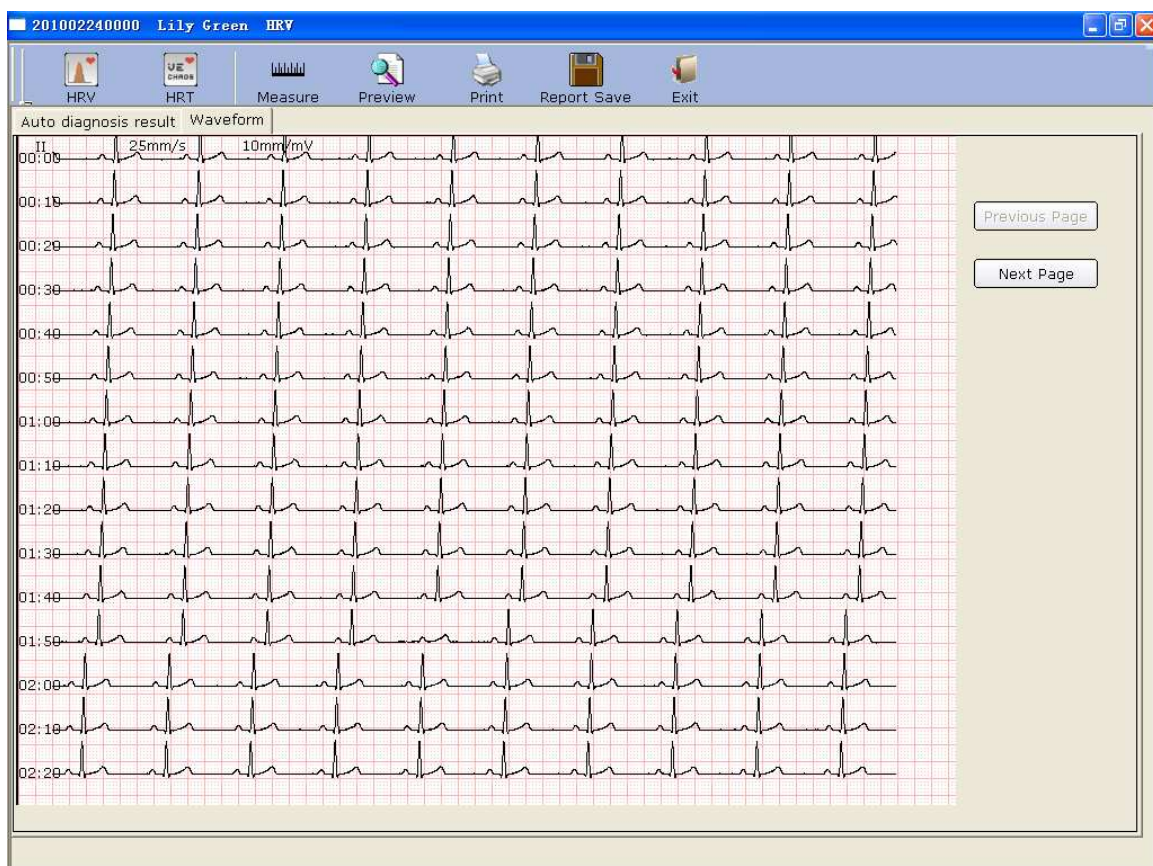


Figure 6-22 Waveform Window of HRV

HRV waveform is displayed in the **Waveform** window (Figure 6-22).

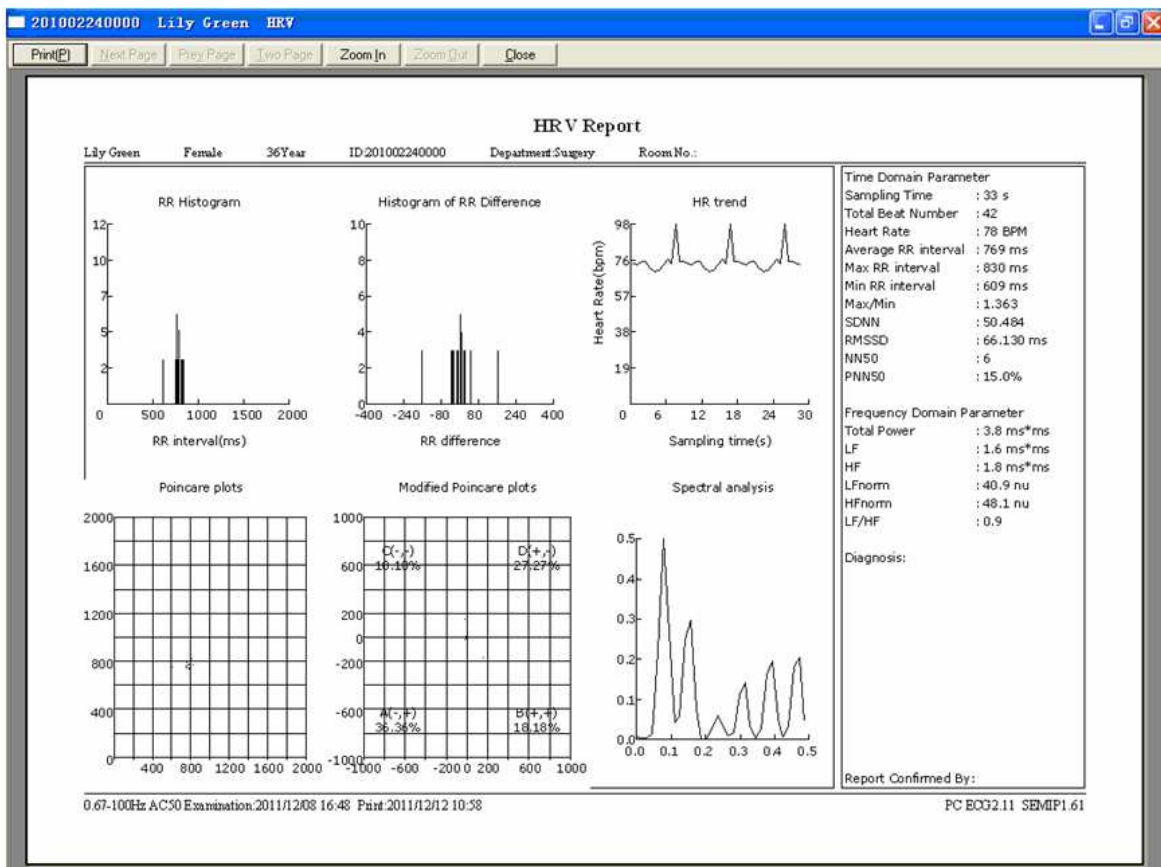
1. You can drag the mouse in the window to choose the wave field to be printed. Then click on the **Print** button to print the selected wave field.
2. Click on **Previous Page** or **Next Page** to display the waves of the previous or next page.

6.6.5.3 Previewing HRV

Click on the **Preview** button to open the HRV preview screen.

 is the toolbar on the HRV preview screen.

- ◆ Click on **Print(P)** to print the report.
- ◆ Click on **Next Page/Prev Page** to switch to the previous/next preview page.
- ◆ Click on **Two Page** to preview two pages on one screen simultaneously.
- ◆ Click on **Zoom In/ Zoom Out** to magnify/minify the preview page.
- ◆ Click on **Close** to close the preview screen and return to the previous screen.



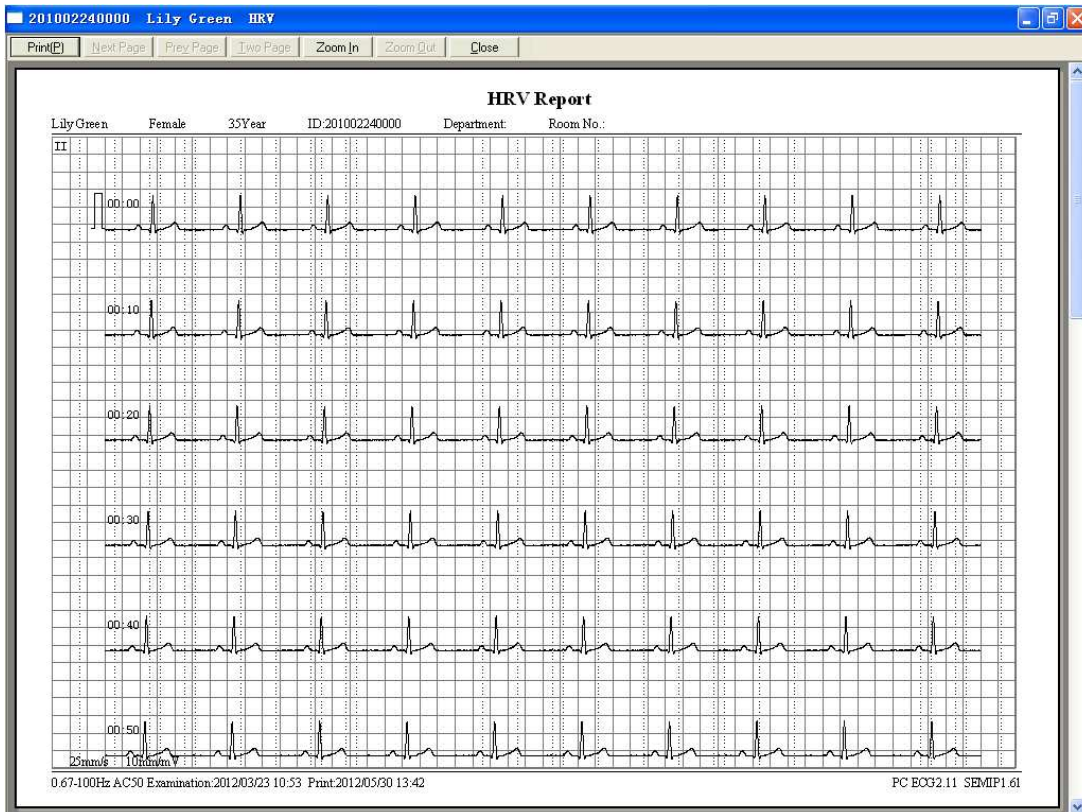
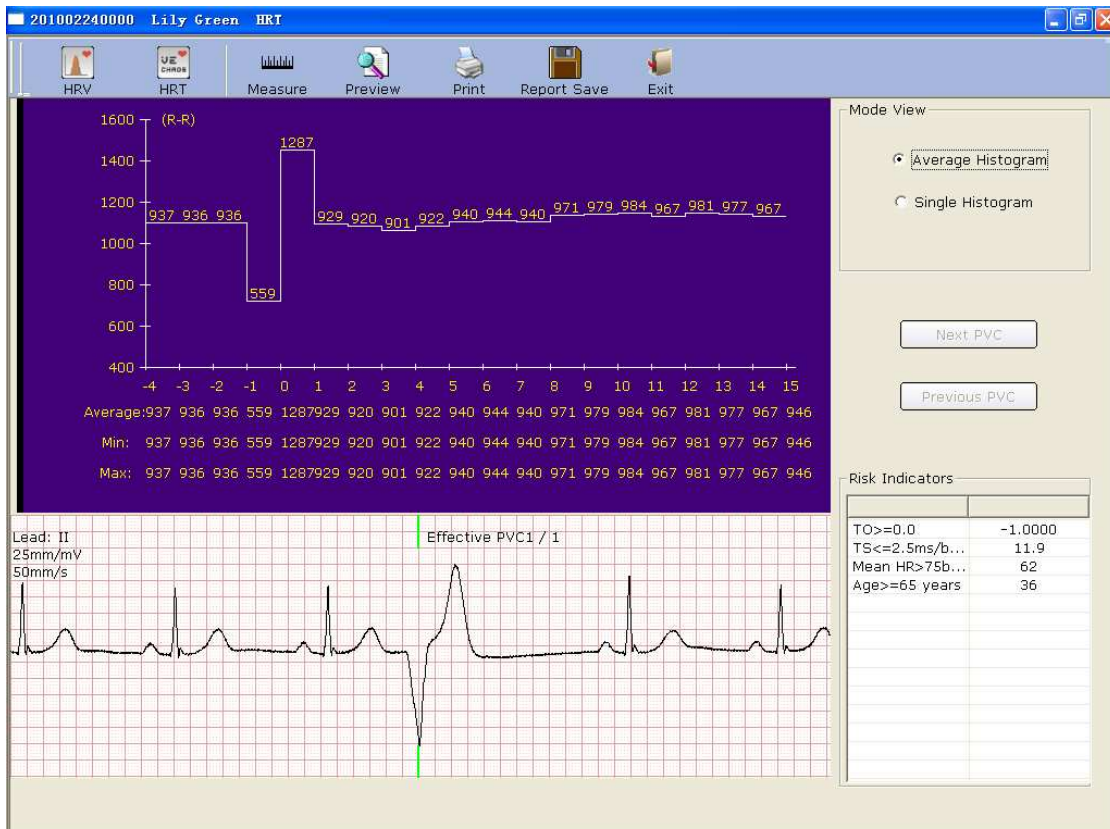


Figure 6-23 HRV Preview Screen

6.6.6 Analyzing HRT

Click on **HRT** to display the HRT ECG analysis screen.



You can select **Average Histogram** or **Single Histogram** in **Mode View** field.

Click on **Next PVC** or **Previous PVC** to see the Next or Previous PVC wave and the relevant histogram.

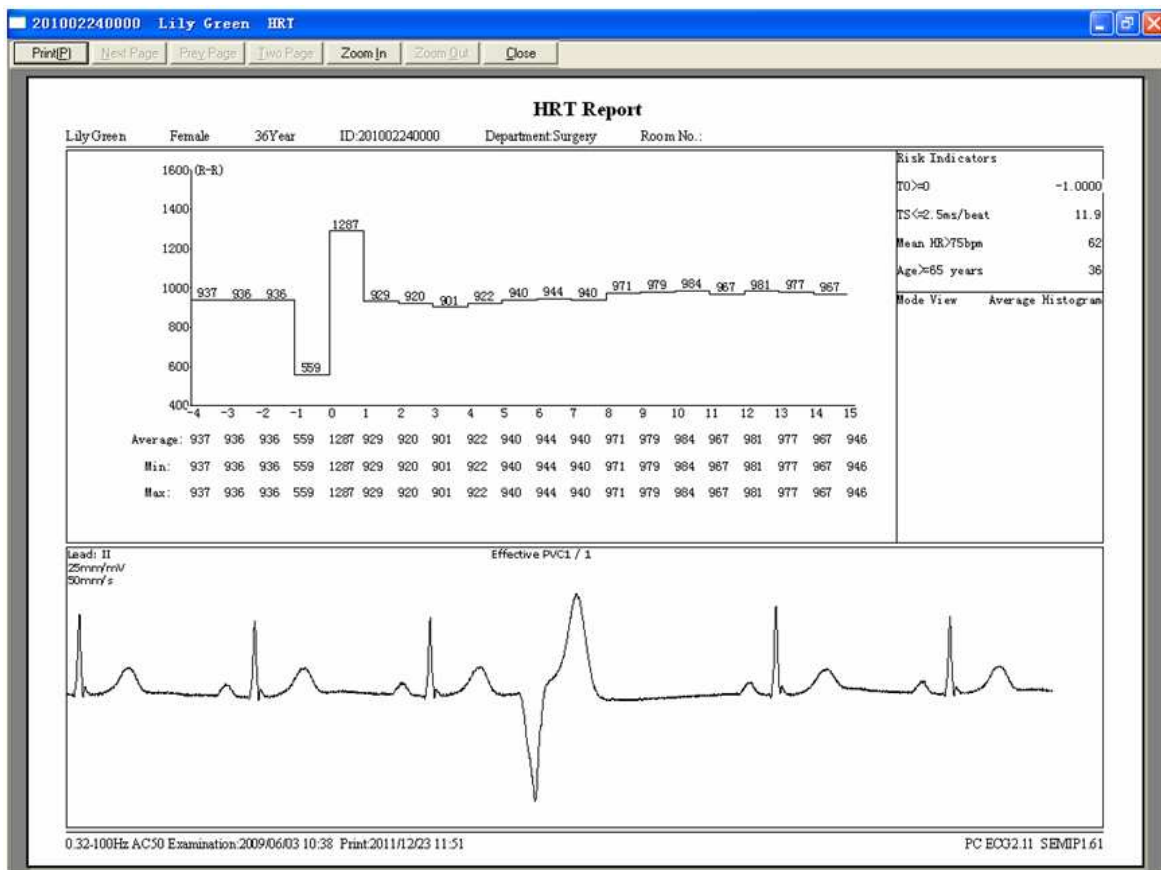
Click on the **Preview** button to open the HRT preview screen.



is the toolbar on the

HRT preview screen.

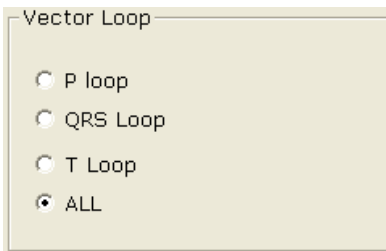
1. Click on **Print(P)** to print the report.
2. Click on **Next Page/Prey Page** to switch to the previous/next preview page.
3. Click on **Two Page** to preview two pages on one screen simultaneously.
4. Click on **Zoom In/ Zoom Out** to magnify/minify the preview page.
5. Click on **Close** to close the preview screen and return to the previous screen.



6.6.7 Analyzing Vector ECG

Click on the **VCG** button on the ECG analysis screen to display the VCG analysis screen. Vector ECG displays 3D image of ECG activity.

You can choose the plane **Frontal(F)** | **Horizontal(H)** | **Sagittal(S)** | **ALL** and the vector loop



on the VCG analysis screen. Plane choices include **Frontal (F)**, **Horizontal (H)**, **Sagittal(S)** and **ALL**. Loop choices include **P loop**, **QRS loop**, **T loop** and **ALL**.

6.6.7.1 Displaying Vector ECG with All Plane and All Loop

Set the plane to **ALL** and the loop to **ALL**.

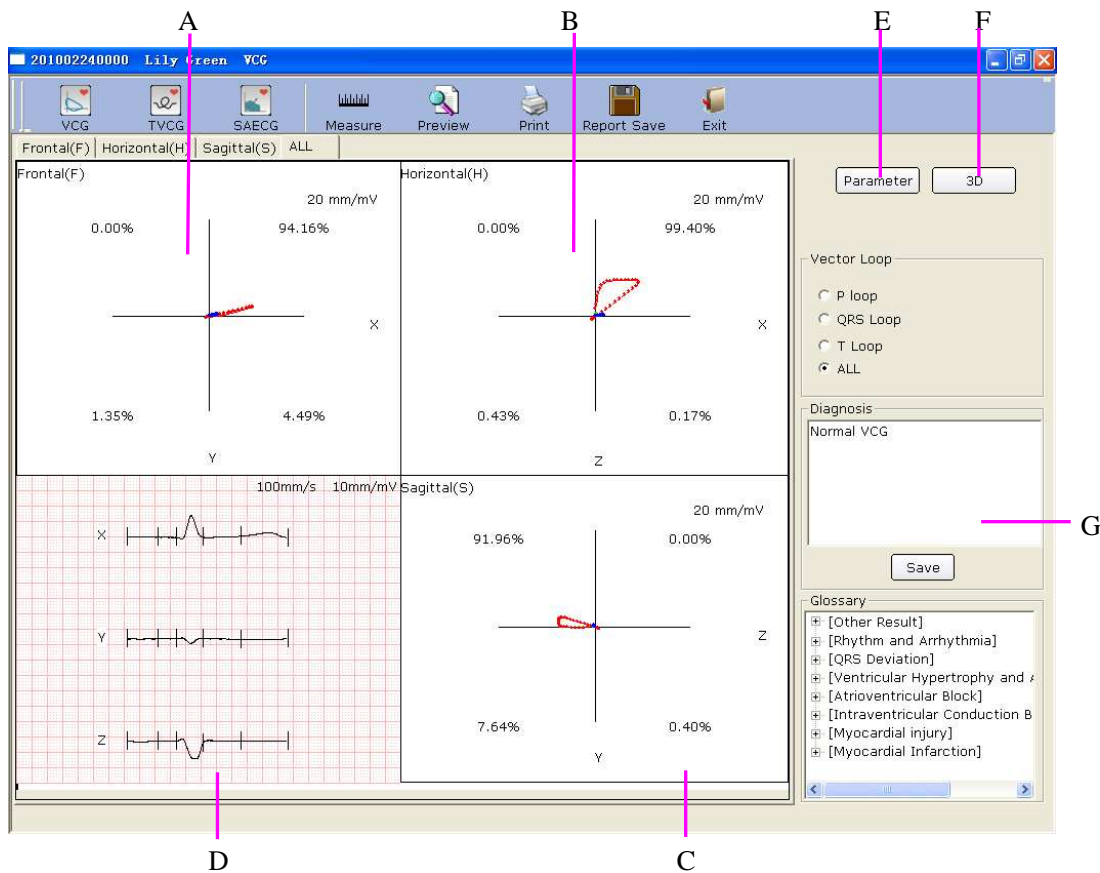


Figure 6-24 Vector ECG - Plane of ALL and Loop of ALL

Figure 6-24 displays Vector ECG with the plane of **ALL** and the loop of **ALL**.

A- Vector ECG of Frontal (F)

B- Vector ECG of Horizontal (H)

C- Vector ECG of Sagittal (S)

D- Average templates of X, Y and Z leads. Double-click on this figure to display the magnified average template. You can drag these lines marked P1, P2, Q, S, T1 and T2 on the wave. With the change of the line position, the corresponding parameter values change.

E- Click on the **Parameter** button to display the following Vector ECG parameter list.

Amp.:mV Ang.:deg		Frontal(F)		Horizontal(H)		Sagittal(S)	
		Ang.	Amp.	Ang.	Amp.	Ang.	Amp.
P	MaxV.30ms	12	0.13	-53	0.20	180	0.16
	Direction	CCW		CCW		CW	
QRS	MaxV.33ms	-3	1.60	-56	2.80	181	2.34
	0.01s	0	0.11	60	0.22	0	0.19
	0.02s	-6	0.61	-13	0.62	204	0.16
	0.03s	-5	1.49	-51	2.38	184	1.87
	0.04s	0	0.96	-64	2.21	179	2.00
	StartV.16ms	0	0.30	37	0.37	0	0.22
	EndV.25ms	172	0.21	240	0.42	176	0.36
	Direction	CW		CCW		CCW	
T	MaxV.74ms	-5	0.42	10	0.42	-34	0.09
	STV.	3	0.05	-41	0.06	177	0.04
	Length/Width	7.27		6.50		3.29	
	T-R angle	-2		66		-215	
	Direction	CCW		CCW		CCW	
	HR	P Dur.	QRS Dur.		T Dur.		
76 BPM	81 ms	92 ms		187 ms			

Designation	Definition
Max Vector	The position of the maximal amplitude of QRS/P/T loop (mV)
Amplitude	The amplitude of the Max vector of QRS/P/T loop (mV)
Angle	The angle of the Max vector of QRS/P/T loop (degree)
Direction	Rotation direction of QRS/P/T loop
CW	Clockwise
CCW	Counter-clockwise