MK—1212A

Operation and Service Manual

V1.0 2019-8-31

No.	Revision date	Release date	Ver. No.	Revision history	Approver
1.	2019.8.31	2019.8.31	1.0	N/A	PanXinhua

Preface

The unit is designed for operation by medical professional.

You are required to read through this Manual before operating the unit.

This Manual is for devices with software versions 1.0 and above.

Manufacturer reserves the rights for unannounced modifications concerning further device development.

Copying this MODE in whole or in part is only allowed with our written consent.

Warranty

We manufacturer do give an 18 months warranty for all of our products concerning quality defect of the adopted components and technology except the accompanying accessories & consumable. This warranty does not apply to the products modified, disassembled, innovated, and repaired without our authorization or instructions as well as the products damaged due to accident, fire, thunder & lightning, flood; intentional destruction, improper installation & operation.

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Chapter 1 Safety Information and Introduction

1.1 Warnings



Warnings are identified by the WARNING symbol shown above.
Warnings alert the user to potential serious outcomes (death, injury, or adverse events) to the patient or user.



WARNING: Explosion hazard. Do not use the MK-1212A in the presence of flammable anesthetics or gases.



WARNING: The unit is designed for operation by medical professional.
ECG machine is to work in an environment free from interference caused by high voltage cable, X-ray machine, Ultrasound scanner, and Electrotherapeutic equipments.



WARNING: Keep the unit away from water. Do not install or store the instrument in the place where chemicals are stored. Keep the unit away from excessive humidity, temperature, dust, salt, and sulphate.



WARNING: MK-1212A is not designed for operation in sterilized room or outdoor application.



WARNING: MK-1212A shall be placed on a stable platform and be protected from tilting, excessive vibration, and/or shocking in the process of transportation.



WARNING: AC power conditions shall comply with requirements as mentioned in the specifications. Proper grounding is required.



WARNING: If proper grounding cannot be guaranteed, you shall operate the device with the built in rechargeable battery only.



WARNING: While being used together with other equipments, attention shall be paid to good connections so as to avoid incorrect diagnosis. If necessary, you shall consult a professional for advice.



WARNING: All circuitry directly connected to the patient shall be checked in particular. The operator shall not leave the exam room. They shall keep observation on the patient and, if necessary, turn off the power or disconnect the electrodes to assure patient safety. Operation and maintenance of this unit shall be in the charge of experienced professional.
Whenever there is any problem to machine, you shall make clear mark to avoid operation with problem of the machine.



WARNING: Used together with a defibrillator, the unit MK-1212A should not be in touch with the patient or the exam table.
It is not necessary to ground the patient and all electrodes whatever connected to the patient or not. The accompanying standard electrode shall not be used together with other electric stimulator or be used under instructions from professionals at present. Since excessive leakage current in total will harm the patient, only IEC 601-1-1 class I

equipment is allowed to be connected to the unit MK-1212A, better consult a technician for such connection to guarantee patient safety. In order to prevent burning, special attentions shall be paid to guarantee the high frequency electric knife away from the electrodes & minimized resistance between the high frequency electric and the patient body.
If necessary, plate electrodes shall be used to limit the density of high frequency electric current within acceptable range.

WARNING: Chemicals from a broken LCD display panel are toxic when ingested. Must be careful when handling a ECG machine with a broken display panel.

WARNING: It is not allowed to do any modification and innovation on the unit without the manufacturer authorization. The device's defibrillator protection is only guaranteed with the manufacturer recommended defibrillator protected cable[Cable type: FD08X4 (monochromatic EU standard)].

WARNING: It is advised to use the device with paper suggested by the manufacturer, as this is the only way the printer head lifetime can be guaranteed.

WARNING: The MK-1212A is intended only as an adjunct in patient assessment. It must be used in conjunction with clinical signs and symptoms.

WARNING: In case of any accident, the operator should immediately turn off the power switch or pull out the power plug to disconnect from the mains.

WARNING: This device is suitable for direct cardiac applications.

WARNING: Care must be taken when the patient is connected to more than one equipment working at the same time. Only class I CF type equipment conforming to EN 60601-1 standard can be connected with this machine. Because the sum of leakage current of multiple instruments may cause electric shock to patients, the monitoring of leakage current shall be carried out by the access equipment side and relevant responsibilities shall be borne. Special attention should be paid to whether the connection is correct to avoid diagnostic errors or other problems. It is suggested that it is better not to use it with other electrical stimulation instruments at the same time. If it is necessary to use them at the same time, professional and technical personnel should be present for guidance.

WARNING: When used with other medical equipment, use the potential equalization wire (grounding wire) provided by the unit to connect the equipotential terminal of ECG machine with the same equipotential terminal (or grounding terminal) of other machines, so as to prevent the examinee from electric shock. If there is leakage current in other equipment, it can be connected to the ground for protection

WARNING: Equipment can only be connected to other equipment or parts of the system if it is determined that there is no danger to the patient, operator or environment. If there is any doubt about the safety of the connected device, the user should contact the relevant manufacturer or other experts to see if the planned device connection poses a risk to the patient, operator or the environment. In all cases, EN60601-1-1 standards must be met.

1.2 Cautions

Cautions are identified by the CAUTION symbol shown above.

Cautions alert the user to exercise care necessary for the safe and effective use of the MK-1212A.

CAUTION: Electrocardiograph does not belong to treatment equipment and has no contraindications.

CAUTION: INST/UPALL THE INSTRUMENT IN A QUIET ENVIRONMENT TO ACHIEVE PRECISE ECG TRACE.

CAUTION: The unit and accompanying shall be periodically checked and maintained at least every half year.

CAUTION: When connecting the MK-1212A to any instrument, verify proper operation before clinical use. Both the MK-1212A and the instrument connected to it must be connected to a grounded outlet. Accessory equipment connected to the MK-1212A's data interface must be certified according to IEC Standard 950 for data-processing equipment or EN Standard 60601-1 for electro medical equipment. All combinations of equipment must be in compliance with EN Standard 60601-1-1 systems requirements. Anyone who connects additional equipment to the signal input port or signal output port (MK-1212A data port connector) configures a medical system and is therefore responsible for ensuring that the system complies with the requirements of system standard EN Standard 60601-1-1 and the electromagnetic compatibility system standard EN Standard 60601-1-2. The MK-1212A accuracy may degrade if it is connected to secondary I/O devices when the instrument is not connected to earth reference.

CAUTION: Federal law (U.S.A.) restricts this device to sale by or on the order of a physician.

CAUTION: Dispose of battery in accordance with local requirements and regulations.

CAUTION: At the end of the service life of the product, the product and its accessories must be disposed of in accordance with the laws and regulations of local environmental protection requirements.

1.3 Introduction

1.3.1 Precautions

You are required to read through the operating instructions before use MK-1212A so as to ensure proper operation of the unit.

1.3.2 Introduction

General

MK-1212A is a twelve channel digital ECG Instrument featuring simultaneous 12-lead signal acquisition. Its features include high-resolution thermal array printing system, high performance single-chip computer and large memory capacity. The advanced features make it ideal for the ECG examination in clinic and hospitals.

Intended Use

The product is to collect, display and record patients' ECG signals for clinical diagnosis.

Contraindications

No contraindication.

Side effects

No side effects.

Features

- **MK-1212A is designed with a high-resolution thermal printer featuring 8dot/mm vertical resolution and 40dot/mm horizontal resolution(at 25mm/s) speed and filter as well as related marks.**
- **Simultaneously 12 lead signal acquisitions.**
- **Digital filter to prevent baseline drift and automatic positioning of the baseline provide accurate ECG trace.**
- **Able to detect and alarm on electrode disconnection.**
- **LED indicator and LCD display show operation status of the unit.**
- **Isolated input circuit guarantees safety standard in compliance to Class I type CF.**
- **AC/Rechargeable battery supports continuous operation when AC power supply is not available. For the battery operation, MK-1212A is equipped with a battery charger and a system for battery capacity management and protection.**
- **Compact size.**

1.3.3 Function

- **Simultaneous printing 12 lead ECG traces of the same heat beat cycle enables prompt detection and location of ectopic premature, classification and diagnosis of arrhythmia, classification and location of WPW syndrome, diagnosis of tachycardia with broad QRS complex, as well as diagnosis of intraventricular conduction block with little tolerance.**
- **Simultaneous observation of ECG trace of the same heart beat cycle enables examination of detailed ECG and improvement of accuracy and precision in measurement of ECG parameters without the randomness, variant and irregularity in single lead acquisition.**
- **Standard measurements of ECG parameters include P wave duration, QRS duration and T wave duration, P-R interval and Q-T interval.**
- **Simultaneous display of ECG trace of the same heart beat cycle enables accurate judgment of ECG variant by directly comparing the 12 lead ECG trace and location of ECG trace with lower amplitude, particularly P wave, U wave and etc.**
- **Capable to set up ECG trace database compliant to international ECG standard for printing out accurate ECG waveform, annotation, statistic diagram and lead marks.**

1.3.4 Product Standard Requirements

- **MK-1212A is manufactured in compliance with Standard EN 60601-1:2006/A1:2012, EN 60601-1-2:2015, EN 60601-2-25:2015 at the safety level of class I type CF.**
- **Power supply conditions for the room where MK-1212A is to work shall be suitable for standard three-plug socket with the grounding plug properly grounded. Otherwise, you are required to ground the unit using the grounding wire accompanying the unit.**

Note: Grounding shall be carried out b y an experienced professional.

1.3.5 Symbols and meanings

Symbols	Meanings
	**Refer to instruction manual**
	**Defibrillation-proof Type CF applied part (ECG electrodes)**
	**Caution: Protection of this device against the effects of the discharge of a cardiac defibrillator is dependent upon the use of the manufacturer recommended cable.**
	**The following definition of the WEEE label applies to EU member states only. This symbol indicates that this product should not be treated as household waste. By ensuring that this product is disposed of correctly, you will help prevent bringing potential negative.**
	**Potential equalization terminal.**
	**The name and contact information of the manufacturer.**
	**The date of manufacture**
	**Serial Number**
	**CE Mark**
	**Pressure limit**
	**Humidity limit**
	**Temperature limit**
	**Fragile! Handle with care!**

Symbols	Meanings
	**Up**
	**Keep dry**

Chapter 2 Using MK-1212A

2.1 Identification of Front Panel Buttons and Symbols



Figure 1 Top View

2.1.1 Top View

1. Paper Tray: Contains recording paper.
2. Status Indicator:

(1) “AC” & “DC”: Indicate power sources.
(2) “CHARGE”: Blinking indicate Pre-charge or Trickle charge, light indicate Fast charging, switch off indicate charge complete.
(3) “ERROR”/”READY”: The “ERROR” blinking when electrode disconnected, paper run out and/or low battery; The “ERROR” light out, when electrode is connected. The “READY” light up when the patient signal stabled and ready to print; The “READY” light out, “START/STOP” is not response. The any lead off.
3. The handle .

2.1.2 Identification of Front Panel Buttons



Key“ON/STBY”: Provided the unit is powered on, key“ON/STBY” could be used to change its condition between “ON” and “STBY”.



Key“1mV/SET”: For setting the unit’s operation condition at the setting menu while the machine is not recording.
Key“1mV”:For printing out 1mV calibration waveform in the process of recording while the machine is recording.



Key “PREV” and “NEXT”: For change of menu item while setting the menu and change of lead sequence between chest and limb when the unit is not menu setting.



Key“MODE”: For switch over the machine’s operation MODE among automatic, MODE, and long time .



Keys “FREEZE”: For waveform freeze.



Key “INST” : For changing the ECG waveform into straight line.



Key“START/STOP”: For start/stop recording.

2.1.3 LCD

The 10.1” TFT 1024 X 600 **liquid crystal display (LCD) at the top of the Keyboard Control Module is designed to display operation mode/status and setting menu. When the machine is powered on for the first time, it is to display information about the model name MK-1212A and the software version followed by the default values pre-set at the manufacturing factory. Then display main menu:**

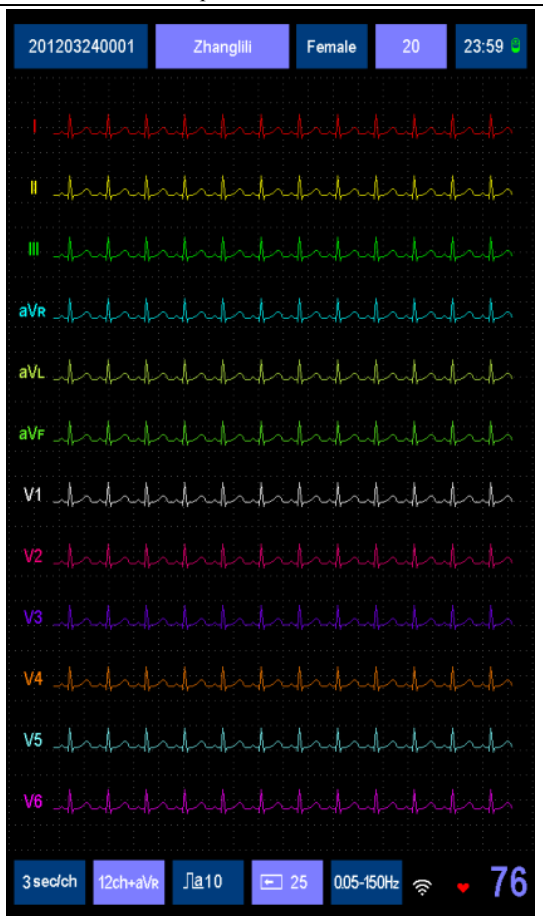


Figure2 Main Menu

Middle display zone: ECG waveform.

Top display zone:

Start from the left:

1 **Patient number: display the patient number automatically**

2 **Name: display the name of the patient**

3 **Gender: display male or female or - - -**

4 **Age: display the age of the patient**

5 **Clock and battery**

Battery capacity indicator: Whenever the machine is powered by DC battery, there will be a prompt at the LCD to indicate battery capacity as follows:

Sufficient battery capacity

Sufficient battery capacity

Insufficient battery capacity, charging is required.

Battery capacity is running out, immediate charging is demanded.

Bottom display zone:

Start from the left:

1 **Lead change mode**

Automatic change lead and printing. Length of lead can be set from 3sec to 20sec.

Pre-acquisition: Pre-acquisition lead several seconds and then printing. Acquisition lead can be set from 3sec to 20sec.

Long term:

1ch1min: Acquisition a lead 1min and then printing at 12.5mm/s, 5 trace.

Rhythm: Acquisition a lead 5minutes and then printing at 12.5mm/s, 5 trace.

2 **Lead**

12 lead: I-II-III、aVRLF、V123、V456

9 lead: I-II-III、aVRLF、V135

Rhythm Lead: I～V6 selectable

3 **Sensitivity**

The sensitivity of ECG machine decreases due to the aging of electronic devices after

long-term use, which should be tested twice within 3 months about the sensitivity. Pressing the Setting button will produce a test signal when printing, the measuring range is 10 mm when the sensitivity is 10 mm, and the error ±5% which meets the design requirements.

Can be set to 1.25、2.5、5、10、20 mm/mV at MODE printing MODE, and 40mm/mV can be selected when Record Format set at 6ch or 3+3ch.

Can be set automatically at automatic printing MODE, display  **icon, when the ECG signal within range, sensitivity will be 10mm/mV, if the ECG signal too strong, sensitivity will be reduced by half;**

4 **Speed**

Can be set to 5、6.25、10、12.5、25、50mm/s;

Paper empty indicator.  .

5 **Filter**

ECG signal is a weak signal with low frequency, most interference and useful frequency bands of ECG signal overlap each other, therefore, the filtering method can affect ECG signal while dealing with noise. Butterworth low-pass filter is used to filter higher frequency interference signals such as EMG in ECG signals, and simple integer coefficient band-stop filter is used to filter drift and AC interference signals in ECG signals. It has been proved that the effect of filter on ECG signal is acceptable.

0.05-150Hz	**no filter**
0.5~150Hz	**filter HUM and baseline wander**
0.5~25Hz	**filter HUM and Serious Muscle (25Hz EMG)**
0.5~35Hz	**filter HUM and light Muscle (35Hz EMG)**
0.5~45Hz	**filter HUM and light Muscle (45Hz EMG)**
0.5~75Hz	**filter HUM and light Muscle (75Hz EMG)**
0.5~100Hz	**filter HUM and light Muscle (100Hz EMG)**
0.05-25Hz	**filter Serious Muscle (25Hz EMG)**
0.05-35Hz	**filter light Muscle (35Hz EMG)**
0.05-45Hz	**filter light Muscle (45Hz EMG)**
0.05-75Hz	**filter light Muscle (75Hz EMG)**
0.05-100Hz	**filter light Muscle (100Hz EMG)**

6 **Heart rate: Display HR when HR from 30 to 300 per minute, display ⌄ when HR lower than 30 per minute, display ⌃ when HR high than 300 per minute. display — — — when the ECG signal overload.**

Indication or identification of signal overload is as follows:

1) Heart rate display — — — when the ECG signal overload.

2) "Signal overload" will appear on the screen.

The above mentioned apply to the setting menu and can be changed in compliance with key strike and operation. See relevant illustration and description for details.



CAUTION: Do not use any sharp object for key operation. Permanent damage could occur.

2.1.4 Lateral View

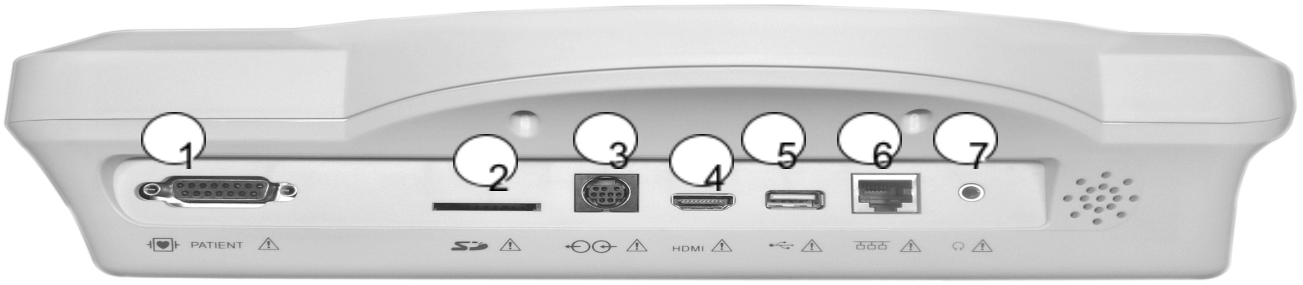


Figure 3

1. **Patient Cable Connector: For connection with the patient cable.**
2. **SD card interface: Insert into SD card to achieve mass storage of ECG cases(no longer provide this function).**
3. **EXT/CRO Jack: For recording of external signal or outputting the selected rhythm ECG trace to an oscilloscope and the like device(This function is not provided).**
4. **High-definition multimedia interface(this function is not available).**
5. **RS232 Interface: For communication with computer(this function is not available).**
6. **Internet Interface: For communicate with computer by internet and transfer the information (this function is not available).**
7. **Audio output interface, can output ECG machine tone, cardiac sounds and so on(this function is not available).**

2.1.5 Back View



Figure 4

1. **AC Switch: For switch on/off AC power supply of the unit.**
2. **AC Socket: For connection with AC power supply.**
3. **Equipotent Terminal (Ground): For connection to the earth by ways of grounding cable while the unit is operated together with other equipments.**

2.1.6 Bottom View



Figure 5

1: Fuse holder
2: Rechargeable battery
3: support frame

2.2 Setting up ECG

2.2.1 Environmental Conditions

	Temperature	Humidity	Atmospheric Pressure
Operation	5℃～40℃	25%～95% (without condensation)	800hpa～1060hpa
Transportation	－20℃～＋55℃	25%～93%	700hpa～1060hpa
Storage	－20℃～＋55℃	25%～93%	700hpa～1060hpa

WARNING: To ensure patient safety, do not place the ECG in any position that might cause it to fall on the patient and difficult to operate the disconnection device.

WARNING: To ensure patient safety, do not place the ECG in any position that might cause it to fall on the patient.

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

WARNING: Do not use any sharp object for key operation. Permanent damage could occur.

WARNING: ECG shall work with tree-plugged AC power cable to avoid possible hazard of electric shock to the patient and the operator. Whenever the three-plugged AC power cable is unable to work, you shall operate the unit by the built in battery.

WARNING: If proper grounding cannot be guaranteed, you shall operate the instrument with the built in rechargeable battery.

2.2.2 List of Components

Item	Quantity	Description
1	1	12 channels electrocardiograph(ECG)
2	1	Patient cable
3	4pcs/set	Limb electrode
4	6pcs/set	Chest Suction Electrode
5	1	Grounding Cable
6	1	Power Cord (applicable to country of sale)
7	1	Operator's Manual
8	1	216mm×20M thermal roll paper (paper core diameter ≥ 12mm)

2.2.3 Connecting the MK-1212A to Ground and AC Power

While connecting the ECG machine, you shall make sure that the conditions for local power supply complies with the requirements as mentioned in the nameplate of the unit.

WARNING: When ECG is used in combination with other equipments, you are required to connect the grounding cable together with that of the others so as to protect the patient from possible shock.

WARNING: The grounding cable must be connected between ECG's grounding post and the ground. It is not permitted to connect the grounding cable between a pipe and the grounding post.

WARNING: Please make sure the power voltage in MK-1212A is same with the local voltage used.

CAUTION: Use only the hospital-grade power cord provided by manufacturer.

Make sure the AC switch is turn off .

1, Connect one end of the ground to the ground terminal and the other end to a properly grounded wall terminal.

2, Plug the female connector end of the power cord into the ECG POWER CONNECTOR (1) on the rear of the unit.
3, Plug the male connector of the power cord into a properly grounded AC outlet.
4, Switch on the AC switch, verify that the unit's AC POWER INDICATOR is lit.
Note: If the AC POWER INDICATOR is not lit, check:
- **the power cord**
- **the user-accessible fuses**
- **the AC power outlet**

WARNING: Avoid using water or other channels used as grounding cable. It may not provide a proper ground.

CAUTION:Metal dollies,window frames and TV antenna terminals do not work as grounds. When a metal-framed bed is used,connect it to the ground terminal as well.

2.2.4 Operating the ECG on Battery Power

WARNING: Dispose of battery in accordance with local requirements and regulations.

MK-1212A has an internal Lithium battery-pack that can be used to power the unit during transport or when AC power is not available. A new, fully charged battery-pack will provide at least 50 recording under the following conditions:
- **AUTO mode**
- **Length of the recording: 3sec**

The MK-1212A cannot operate with a fully discharged battery. Before attempting to turn on ECG whose battery charge has been completely depleted, first plug the unit into an AC outlet and switch on the AC switch to allow the battery to charge for a few minutes. The unit may then be powered on.

To charge a low or dead battery, connect the unit to AC power and switch on the AC switch. It takes 9 to 10 hours to charge the exhausted battery to 90%.

Charge indicator:
"CHARGE": blinking indicate fast charging,
light indicate charge complete

Whenever the machine is powered by DC battery, there will be an icon at the LCD to indicate battery capacity as follows.


Sufficient battery capacity


Sufficient battery capacity


Insufficient battery capacity, charging is required.


Battery capacity is running out, immediate charging is demanded.

When all of the following conditions are present for 5 minutes, the MK-1212A will automatically shut down:
- **Unit is running on battery power**
- **No buttons have been pressed**

Note: Whenever the unit is connected to AC power and AC power switch is ON, the battery is being charged. Therefore, it is recommended that the unit remain connected to AC power when not in use. This will ensure a fully charged battery whenever it is needed.

Note: As the battery is used and recharged over a period of time, the amount of time between the onset of the low battery alarm and the instrument shut-off may become shorter.
Note: It is recommended that qualified service personnel replace the internal battery every 24 months.

WARNING: If the ECG machine is to be stored for a period of 30 days or longer, notify service personnel to remove the battery from the machine prior to storage. Recharge the battery when the battery has not been charged for 2 or more months.

Note: when the battery is first used, it must be pre charged for more than 10 hours. Batteries should be charged and discharged at least once every 3 months.

Note: In order to prolong battery life and ensure printing clarity, it is recommended to use AC power supply.

WARNING: Dispose of battery in accordance with local requirements and regulations.

Battery Replacement

Battery replacement shall be carried out by service engineer or done by operator in the charge of an engineer according to the following description.

- **Open the battery compartment at the bottom of the unit as shown in the below figure.**
- **Disconnect the existing battery and take it out.**
- **Place a new battery and connect the battery plug. Cover the battery compartment.**

Notes:

- **Do not directly contact the positive pole and negative pole of the battery. Otherwise, there will occur the hazard of fire.**
- **Do not place the battery near a fire. Otherwise, there will occur the hazard of explosion.**
- **Do not disassembly the battery without professional instructions.**

2.2.5 Install Recording Paper

To attain a satisfactory print out, the operator shall use the most suitable thermal recording paper for ECG. Otherwise, there may be damage to thermal printer and a problem including blurring trace and bad paper running.

a. **Do not use black or gray recording paper, and that with facial wax coating, otherwise, there will occur problem to the printer.**
b. **The thermal recording paper should be stored in a dry and shaded environment to avoid fading due to direct exposure to high temperature, humidity and sunlight.**
c. **Do not expose the recording paper to fluorescent lamp for a long time.**
d. **Do not tag the recording paper using a glue contain an organic solvent or PV sheets.**
e. **Do not store the recording paper together with polyvinyl chloride, or the paper will fade. Keeping the recording overlap to each other for a long time can lead to overlap of recorded ECG trace.**

ECG is designed to use roll recording paper 210mm or 216mm(width)×20M(length). Generally, the unit is included with roll recording paper as accessory.

Install Recording Paper as follow:
Pull the button as shown in the following to open the paper magazine.
Insert paper shaft into a roll of recording paper and pull out about 10 cm before put back them to paper tray as shown below.
Close the paper tray

When the paper is run out, the unit will automatically stop the paper motor and display prompt "Paper" and "ERROR" blinking. Within the range of the last 2 meter of the paper roll, there will appear a red line at the margin of the paper alerting preparation for installing another paper roll.

2.3 Using the ECG

2.3.1 Introduction

MK-1212A is a twelve channel digital ECG instrument featuring simultaneous 12-lead signal acquisition. Its features include high-resolution thermal array printing system, high performance single-chip computer and large memory capacity. The advanced features make it ideal for the ECG examination in clinic and hospitals.

2.3.2 Lead

MK-1212A can use Standard 12 leads or Cabrera leads:
·Standard 12 leads：I-II-III aVR-L-F V1-2-3 V4-5-6
·Cabrera 12 leads：aVL I -aVR II- aVF-III V1-2-3 V4-5-6

2.3.3 Rhythm Lead

Any lead of 12 lead can be selected as rhythm lead.

CAUTION: Only the selected rhythm lead signal can be output to CRO jack.

2.3.4 Long term

MK-1212A provide long term recorder MODE: pre-sample 1 minute selected lead signal and printout with 12.5mm/S, 5 trace.

2.3.5 Copy

MK-1212A provide flexible copy function, not only copy the last recorder totally but also copy a "new" recorder with another printing format or lead group etc.

Function	Item	Factory default settings
Lead change	MODE Auto Long term	Auto
Auto MODE	Auto	Auto ※
Length of auto recording	3～20sec	3sec
Lead group	Standard Cabrera	Standard
Print format	3+3 trace 6 trace 6+1 trace 9 trace 9+1 trace 12 trace	12 trace

	12+1 trace	
Rhythm lead	I～V6, off	
Sensitivity	1.25mm/ mV (Manual) 2.5mm/ mV (Manual) 5mm/mV （Manual） 10mm/mV （Manual） 10mm/mV 20mm/mV （Manual） 40mm/mV （Manual）Record Format 6ch or 3+3ch Auto （Auto）	
Speed	5mm/s 6.25 mm/s 10mm/s 12.5mm/s 25mm/s 25mm/s 50mm/s	
Filter	0.05～150Hz 0.5～150Hz - AC 0.05～100Hz 0.05～75Hz 0.05～45Hz 0.05～35Hz 0.05～25Hz 0.5～100Hz 0.5～75Hz 0.5～45Hz 0.5～35Hz 0.5～25Hz 0.5～25Hz	
Buzzer	on on off	
Date	2011 ～2099 Year	Current date
Language	English or Chinese	English

2.3.6 Check before Power on

In order to ensure safe examination and stable printing out of electrocardiogram, you are required to make the below-mentioned checks before operating of the Instrument.

Checks on Grounding Connection

- **Good performance (such as continuity, etc) of the grounding cable.**
- **Correct connection of the grounding cable with the Instrument.**
- **Correct position of the grounding post.**
- **Correct connection of ECG's grounding cable with the earth.**

Checks on Operation Environment

- **Operation environment of the machine should be free of X-ray equipment, short wave devices, and the like, which may impose interference on the ECG unit.**
- **In situation of interference, you are required to move the Instrument to another environment after turning off its power.**
- **Temperature & humidity of the operation environment should be within the requirements.**

Checks on Power Cable

- **Possible loosening of the power cable plug.**
- **Possible entangling of the power cable with other cables.**

Checks on Patient Cable

- **Possible loosening of the patient cable connector.**
- **The patient cable itself should be placed away from other AC power cables.**
- **Correct connection of the patient cable plugs with the related electrodes.**

Checks on Electrode Attachment

- **Electrodes should be attached to the desired positions only after the latter are cleaned with gel cream.**
- **Electrodes should be kept clean with alcohol and the like whenever necessary.**
- **Proper attachment of the electrodes to the desired positions.**
- **Use of new electrodes together with the old ones is not permitted.**
- **Electrodes should not be overlapped with each other.**

Checks on Patient Situation

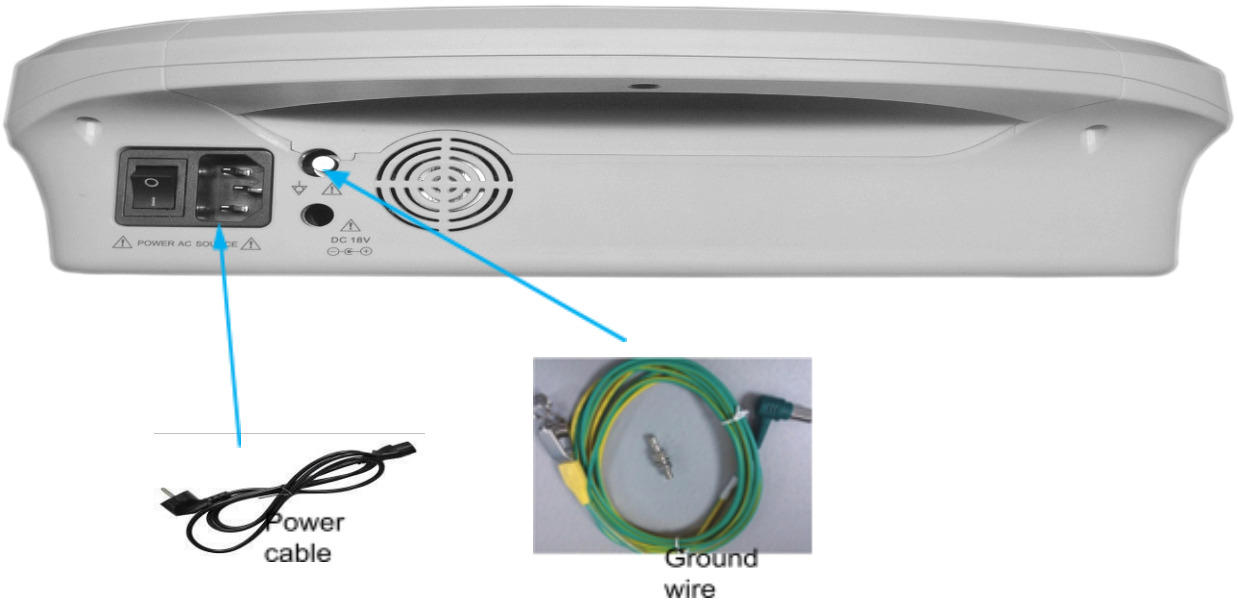
- **The patient should be explained about the ECG procedures.**
- **The patient should not speak or be move in the process of examination.**
- **The patient should be kept comfortable.**
- **The patient should be kept away from metal parts of the examination table, or AC interference is inevitable.**
- **Examination environment should be kept pleasant.**

Checks on Recording Paper

Considering patient safety and stable ECG trace, operator shall complete all the aforementioned checks and sufficient recording paper before powering on the Instrument.

DANGER: Possible explosion hazard if used in the presence of flammable anesthetics.

2.3.7 Connection of ground wire



Before connecting the mains, the grounding wire should be connected first. One end of the attached grounding wire is connected to the equipotential terminal of the equipment, and the other end is connected to the equipotential connection terminal of the building.

2.3.8 Power On/down

- **Connect the power cable before turning the AC switch to " | ".**

- **Keep pressing key "ON/STBY" until the unit displays operation conditions that enable start of operation.**
- **Keep pressing key "ON/STBY" until the operation conditions disappear from the LCD.**
- **Turn the AC switch to "○" before disconnecting the power cable.**

2.3.9 Patient cable Connection

Proper electrode connection is a very important fact concerning recording of accurate ECG trace. It is generally required to guarantee good contact while connecting the electrodes. New or used re-useable electrodes shall not be used together with disposable ones. Use of different electrodes in one exam any result in bad ECG trace. Electrodes or patient cable lead shall not be in contact with any other metal part or conductor. Change all electrodes when any one is supposed to be changed.

Following table is the description of electrode connection definition and color code.

Electrode Location	Electrode Code	Lead Color	Electrode Color
Right arm	RA	White	Red
Left arm	LA	White	Yellow
Left leg	LL	White	Green
Right leg	RL	White	Black
Chest	V1/C1	Red	Red
Chest	V2/C2	Yellow	Yellow
Chest	V3/C3	Green	Green
Chest	V4/C4	Brown	Brown
Chest	V5/C5	Black	Black
Chest	V6/C6	Purple	Purple

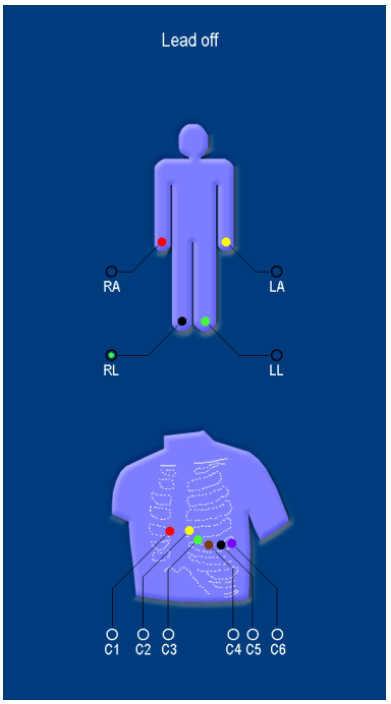
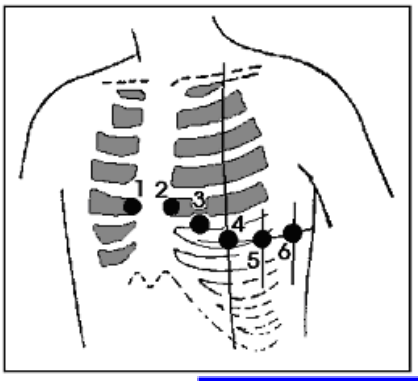


Figure 6

2.3.10 Chest Electrode Connection

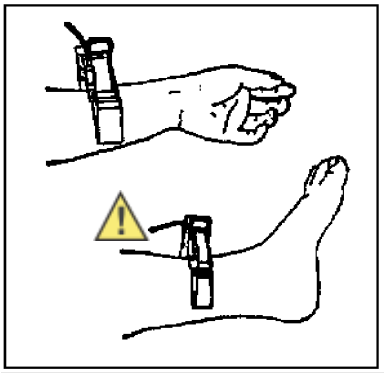
Attach the chest electrodes to the locations as following after clean them with alcohol and applying of MK-1212A cream in the similar way as mentioned in part 5.4.1. Keep in mind that the electrodes' coming into contact with each other or cream's overlap with each other is not permitted. Following is the description of chest electrode connection.



C_1: Fourth inter-costal space at right border of sternum.
C_2: Fourth inter-costal space at left border of sternum.
C_3: Midway between C_2 and C_4.
C_4: Fifth inter-costal space at left mid-clavicular line.
C_5: Left anterior axillary's line at the horizontal lever of C_4.
C_6: Left mid-axillary's line at the horizontal lever of C_4.

Keep in mind that the electrodes' coming into contact with each other or cream's overlap with each other is not permitted. Following is the description of chest electrode connection.

2.3.11 Limb Electrode Connection



a. **Clean all the limb electrodes and the positions of the patient extremity, to which limb electrodes are to be attached, with alcohol before applying MK-1212A cream to them.**

b. Firmly attach the electrodes to the aforementioned positions.

Figure 8

MK-1212A will indicate the unconnected electrode by light on the electrode LED and "ERROR" LED blinking. When all electrodes well-connected the electrode LED switch off and "READY"LED light after 3~5 seconds if there are no other errors occured.

CAUTION: When the electrode "N" light, it means the right leg electrode unconnected or all electrodes unconnected.

CAUTION: ECG do nothing when press key "START/STOP" while the "READY" LED switch off.

CAUTION: All electrodes must be attached under Auto MODE printing, and only

the needed electrodes must be attached under MODE or Long-term MODE printing.

CAUTION: Be sure that the conductive parts of electrodes and associated connectors, including neutral electrode, should not contact with earth or any other conducting objects.

2.3.12 Save ECG

Save ECG records into machine.

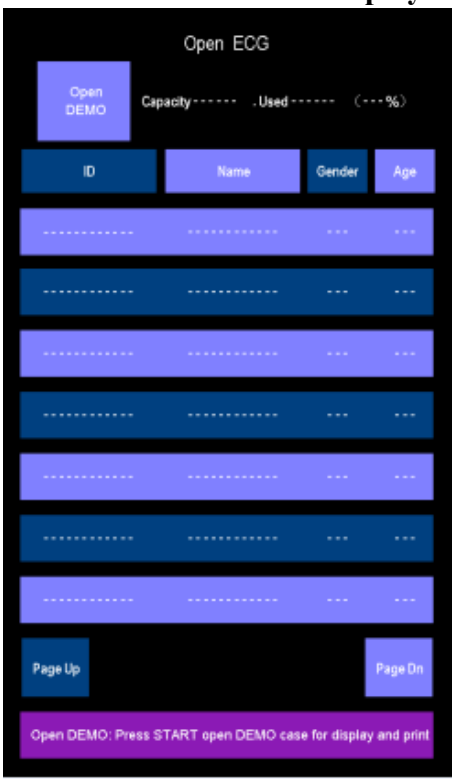


2.3.13 Open ECG



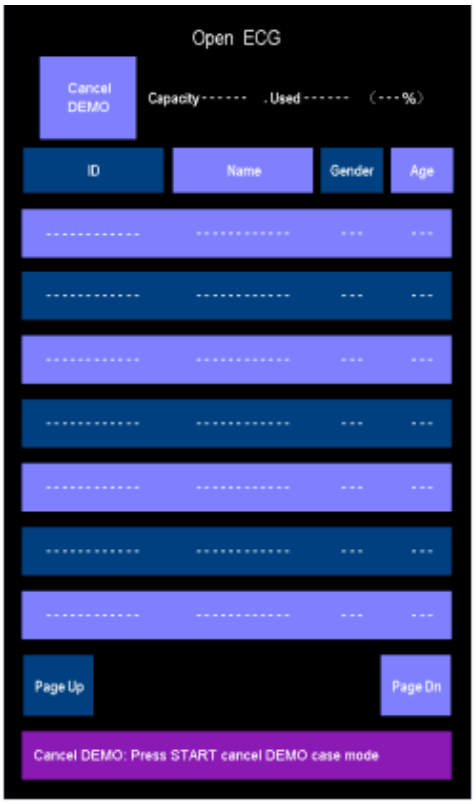
2.3.13.1 Open DEMO

Press Start/Stop to open DEMO case mode for display and print.



2.3.13.2 Cancel DEMO

Press Start/Stop to cancel DEMO case mode.



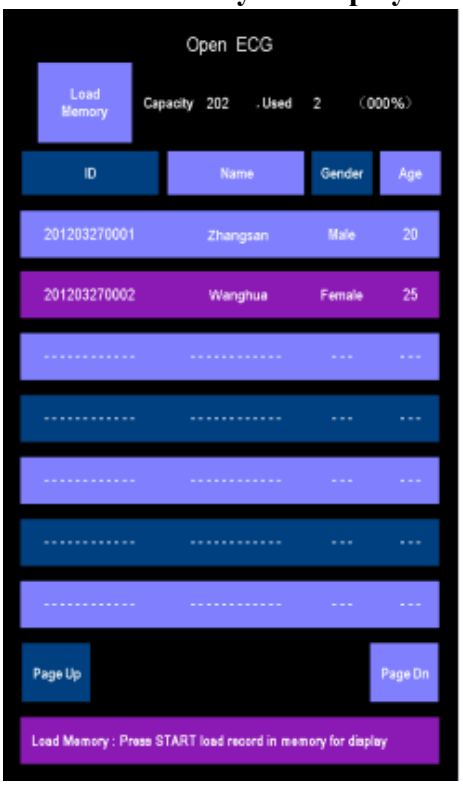
2.3.13.3 Print again

Press Start/Stop to print again the last ECG.



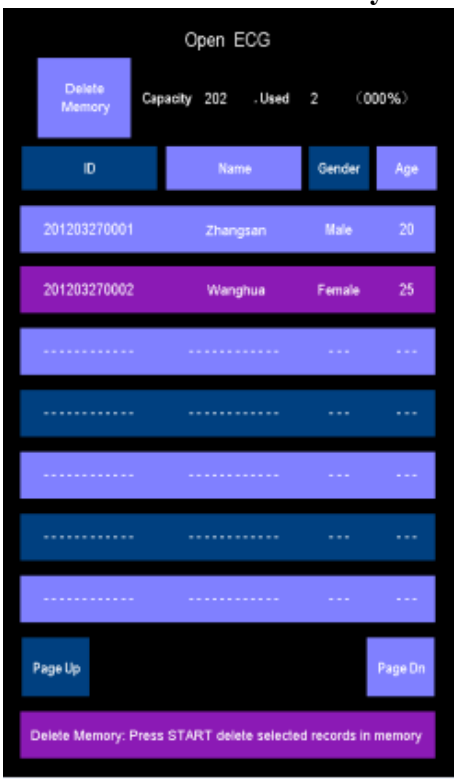
2.3.13.4 Load Memory

Press Start/Stop to load record in memory for display.



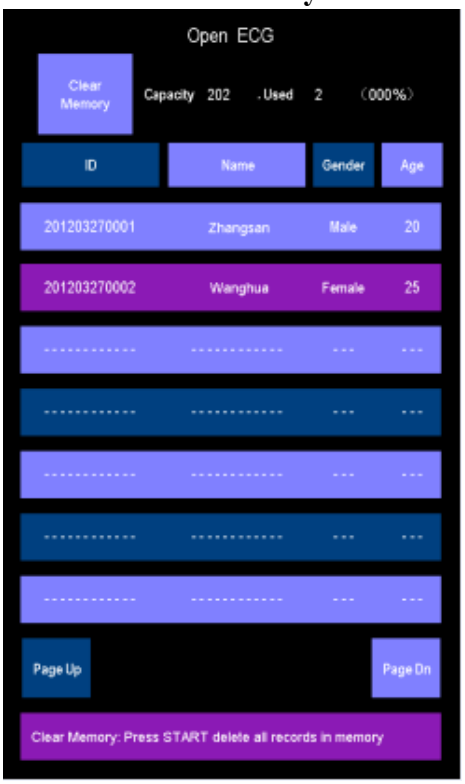
2.3.13.5 Delete Memory

Press Start/Stop to delete selected record in memory.



2.3.13.6 Clear Memory

Press Start/Stop to delete all records in memory.



2.3.14 50Hz HUM Filter



•Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF"until the unit displays initial operation conditions.

•Press key "SETUP" till reverse display "50Hz HUM Filter" .

•Press key "PREV" or "NEXT " to select On or Off.

•Press key "START/STOP" to exit from setup.



2.3.15 Filter



· Power on the machine by turning the AC switch to " | " and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

·Press key "SETUP" till reverse display "Filter" .

·Press key "PREV" ,the filter will increase from 150Hz to 25Hz.

·Press key "NEXT " : the filter will decrease from 25Hz to 150Hz.

·Press key "START/STOP" to exit from setup.



2.3.16 ECG report off



2.3.17 Print ahead (Option)

Not work now, need to be developed.



2.3.18 Sensitivity



· Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

·Press key "SETUP" and reverse display the"10mm/mV"

·Press key "PREV" or "NEXT" to select needed sensitivity from 1.25mm/mV to 40mm/mV(Record Format set at 6ch or 3+3ch)

·Press key "START/STOP" to exit from setup.



2.3.19 Recorder Speed



·Power on the machine by turning the AC switch to "|" and continuous pressing "ON/OFF" until the unit displays initial operation conditions.

·Press key "SETUP" till display "Paper Speed 25mm/s"（from 5 to 50）.

·Press key "PREV" or "NEXT " to select needed paper speed.

·Press key "START/STOP" to exit from setup.



2.3.20 Lead Mode



·Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

·Press key "SETUP" and reverse display "Standard"or"Cabrera".

·Press key "PREV" or "NEXT " to select needed lead Mode.

·Press key "START/STOP" to exit from setup.

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

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



2.3.21 Lead Quantity



·Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

·Press key "SETUP" and reverse display "9ch","12ch".

·Press key "PREV" or "NEXT " to select "9ch" ,"12ch".

·Press key "START/STOP" to exit from setup.

9 Ch : I II III aVR aVL aVF V1 V3 V5

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



2.3.22 Sequence/Simultaneous



•Power on the machine by turning the AC switch to "| " and continuous pressing key "ON/OFF "until the unit displays initial operation conditions.

•Press key "SETUP" till reverse display "Sequence" or "Simultaneous".

•Press key "PREV" or "NEXT " to select "Sequence" or "Simultaneous" .

•Press key "START/STOP" to exit from setup.



2.3.23 Recording Mode



·Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.



·Press key "SETUP" till reverse display "Format 3+3ch" or "Format 6ch" or "Format9ch" or "Format 12ch".



·Press key "PREV" or "NEXT" to select needed recording mode

·Press key "START/STOP" to exit from setup.



When lead quantity set at 9ch, the "Format 3+3ch" or "Format 6ch" or "Format 9ch" can be selected. If the lead quantity set at 12ch, the "Format 3+3ch" or "Format 6ch" or "Format 12ch" can be selected.



2.3.24 Select Rhythm Lead



· Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.



·Press key "SETUP" till reverse display "Rhythm Lead Off"(or Rhythm I～V6).



·Press key "PREV" or "NEXT " to select any lead as rhythm lead or select no rhythm lead.

·Press key "START/STOP" to exit from setup.





2.3.25 Length of Lead under auto mode



·Power on the machine by turning the AC switch to "| " and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

·Press key "SETUP" and reverse display "Length of recording n second"(n=3～20)

·Press key "PREV" or "NEXT " to select needed length。

·Press key "START/STOP" to exit from setup.



2.3.26 Key-press Sound



·Power on the machine by turning the AC switch to " | " and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

· Press key "SETUP" till reverse display "Volume" logo.

·Press key "PREV" or "NEXT" to switch the speaker off ⊘ or 1-12 level.

·Press key "START/STOP" to exit from setup.



2.3.27 HR Sound (Option)

Not work now, need to be developed.



2.3.28 Low-speed Printing



·Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

· Press key "SETUP" till reverse display "Low-speed Pringting" logo.

·Press key "PREV" or "NEXT" to switch Low-speed printing on or off.

·Press key "START/STOP" to exit from setup.



2.3.29 Heating adjustment



·**Power on the machine by turning the AC switch to "| " and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.**

·**Press key "SETUP" till reverse display "Heating adjustment" logo .**

·**Press key "PREV" or "NEXT " to select needed print heating.**

·**Press key "START/STOP" to exit from setup.**



2.3.30 Adjust LCD brightness



·Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

·Press key "SETUP" till reverse display "LCD brightness" .

·Press key "PREV" or "NEXT " to select needed brightness.

·Press key "START/STOP" to exit from setup.



2.3.31 Load Default



· Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

·Press key "SETUP" till reverse display "Load Default" .

·Press key "PREV" or "NEXT" enter into Load Default or not.

·Press key "START/STOP" to confirm Load Default, Press key "SETUP" to exit.



2.3.32 Adjust Calendar

2.3.32.1 Adjust Month



·Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

·Press key "SETUP" till reverse display "year".

·Press key "PREV" or "NEXT" to select year from 2011 to 2099.

·Press key "START/STOP" to confirm the setup for year.



2.3.32.2 Adjust Month



· Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

· Press key "SETUP" till reverse display "month".

·Press key "PREV" or "NEXT" to select current month from JAN to DEC.

Press key "START/STOP" to confirm the setup for month.



2.3.32.3 Adjust Date



· Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

· Press key "SETUP" till reverse display "date".

·Press key "PREV" or "NEXT" to select current date from 1 to 31.

·Press key "START/STOP" to confirm the setup for date.



2.3.32.4 Adjust Hour and Minute



· Power on the machine by turning the AC switch to "|" and continuous pressing key "ON/OFF" until the unit displays initial operation conditions.

· Press key "SETUP" till reverse display "hour" and "minute".

· Press key "PREV" to select current hour.

· Press key "NEXT" or to select current minute.

· Press key "START/STOP" to confirm the setup for hour and minute.



2.3.33 Characteristic waveform

Can select Characteristic waveform print or not.



2.3.34 Version



2.3.35 Language



2.3.36 Screen calibration (Option)

This function is not available now.



Chapter 3 Maintenance

3.1 Maintenance

WARNING: The cover should be removed only by qualified service personnel. There are no user-serviceable parts inside.

WARNING: The MK-1212A may be surface-cleaned by using a soft cloth dampened with either a commercial, nonabrasive cleaner or a solution of 75% alcohol in water, and lightly wiping the surfaces of the unit.

CAUTION: Do not spray, pour, or spill any liquid on the MK-1212A, its accessories, connectors, switches, or openings in the chassis.

3.1.1 Battery Charge

MK-1212A is designed with a charger and protector for the built-in rechargeable Li-battery. Powered by AC, it is able to charge the battery provided that the AC switch on the back of the unit is turned to "| ". It is required to charge & discharge the battery at least every 3 months. When charging, you are required to keep the machine in standby condition or recording stopped. Indicator on the top the unit will blink while pre-charging or light while charging, and switch off when charging is almost completed that it requires additional 2～3 hours to complete the charging.

3.1.2 Battery Replacement

Battery replacement shall be carried out by service engineer or done by operator in the charge of an engineer according to the following description.

- **Open the battery compartment at the bottom of the unit as shown in the below figure.**
- **Disconnect the existing battery and take it out.**
- **Place a new battery and connect the battery plug.**
- **Cover the battery compartment.**

It is recommended that qualified service personnel replace the internal battery every 24 months. Replaced batteries should be disposed of in accordance with local ordinances.

Do not directly contact the positive pole and negative pole the battery. Otherwise, there will occur the hazard of fire.

Do not place the battery near a fire. Otherwise, there will occur the hazard of explosion.

Do not disassembly the battery without professional instructions.

CAUTION: If the MK-1212A is to be stored for a period of 3 months or longer, notify service personnel to remove the battery from the machine prior to storage. Recharge the battery when the battery has not been charged for 2 or more months.

3.1.3 Recording Paper Maintenance

To attain a satisfactory print out, the operator shall use the most suitable thermal recording paper for MK-1212A. Otherwise, there will be a harm to thermal printer and a problem including blurring trace and bad paper running, The suitable paper for MK-1212A excludes black or gray one, and that with facial wax coating, otherwise. There will occur problem to the printer.

Exposed to high temperature, damp and direct sunlight, the recording paper will become deteriorate. It is therefore required to store the thermal recording paper in a dry and shaded environment.

Exposed to fluorescent light, the recording paper will become deteriorate. Stored with polyvinyl chloride (PCC), the recording paper will become deteriorate.

Paper size shall be especially noted.

If the thermal recording paper is stored for long time with overlapping of the pages with each other, they will also press each other with irregular impression.

3.1.4 Thermal Printer Maintenance

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

To clean the thermal printer, you are required to open the paper tray and clean the printer with soft cotton dipped with alcohol (≥75%). It is not permitted to operate on the printer with a sharp object. Otherwise, permanent damage could be resulted. Thermal printer maintenance should be done at least once a month.

Use soft brush only to clean the silicone roller. Alcohol, other organic agents or detergents should never be used. Otherwise, the silicone roller will be damaged and the printing effect will be affected.

3.1.5 Patient Cable and Electrodes Maintenance

Check the patient cable continuity with a multi-meter. The resistance should be less than 25K ohms. Following table is the continuity of the patient cable.

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

Generally, it is not required to bend or entangle the patient cable. You'd better put the patient cable in good order before connecting the electrodes.

Electrodes shall be properly stored. Due to long time use, they may become corroded, staled, and oxidized at the surface. If these conditions exist, you are required to change all of the electrodes, whatever one or all faces the conditions.

CAUTION:
Electric shock injury to patients
1) When the electrode is connected with the patient, do not wipe the machine with a wet cloth;
2) For patient safety, use only the original patient cable. Check for mechanical damage before connecting cables to equipment. Do not use damaged cables.
3) When the machine is powered by battery to mains, the cable cannot be connected with the patient to prevent electric shock injury caused by machine leakage.

3.1.6 Fuse Replacement

Fuse replacement should be done as shown in right.

- **Disconnect the power cable.**
- **Discover the fuse holder with a screw-driver and take out the damaged or burned fuse.**
- **Install a new fuse【T3.15AH250V(TIMELAG), Φ5x20mm】before recovering the fuse holder.**

Note: If a newly replace fuse with same specification is burned, the unit may be in operating problem. You'd better contact our service technicians.

3.1.7 Accuracy of input signal reconstruction

ECG machine gain setting is10mm/mV：

A：Input 10Hz,Sine wave waveform of amplitude 10mm is obtained，change frequency 0.67Hz～40Hz，the amplitude of the recorded waveform±10%。

B：Input 10Hz ,Sine wave waveform of amplitude 5mm is obtained，change frequency40Hz～100Hz，the amplitude of the recorded waveform±10%～±30%。

D: Input a 1.5mV triangular wave signal with a base width of 200mS and a repetition rate of >1S，

Adjust the base width in turn200mS/150mS/100mS/50mS/40mS/30mS/20mS，all recorded wave peak amplitude>90% of 200mmSbase width。(Figure 9）

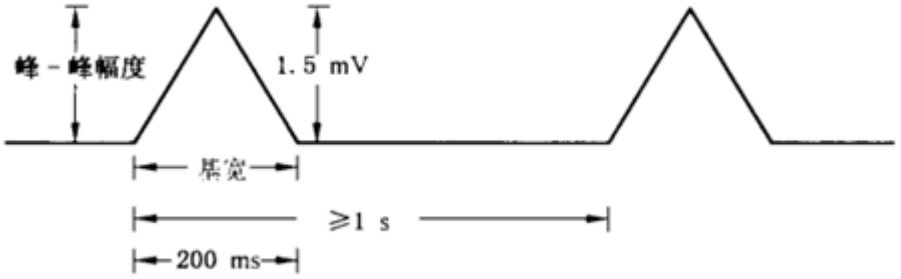


Figure 9

E：An input pulse of 3mV amplitude and 100mS duration is applied to verify that the equivalent input of the baseline ratio of the output baseline to the baseline of the pulse is not more than 0.1mV。It is also verified that the response slope is not more than 0.30mV/s after the end of the pulse.（Figure 10）

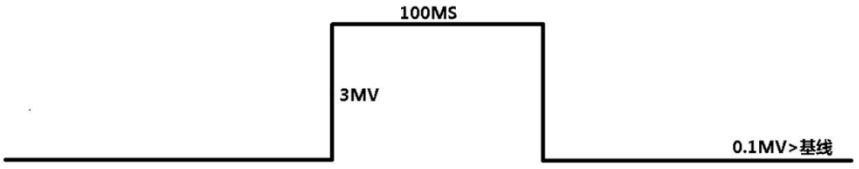


Figure 10

3.1.8 Polarization

Accessories such as ECG cables, chest suction electrode, limb electrode and other accessories shall be designated or recommended by the manufacturer。In the standard test, when the polarization voltage ±300mV is applied or the defibrillator is used, the automatic recovery time should be within 5 seconds. If the recovery time is too long, press the button [redacted] store manually.

3.2 Theory of Operation

3.2.1 Schematics

Only qualified field service engineer will be provided schematics and spare parts list for MK-1212A.

3.2.2 Theory of Operation

MK-1212A acquires a microvolt level signal from human body surface via patient cable and electrodes. It amplifies the signal by the Amplification Module before Analog to Digital (A/D) converting. Following A/D conversion, the signal is processed by the CPU of the Keyboard Control Module. The CPU outputs the signal to the thermal printer that features integration of 1728 thermal emitting components at a density of 8 dot/mm. Precision control program from the Keyboard Control Module is used to drive the stepping motor so as to make recording paper run at a constant speed. By controlling temperature of the above mentioned thermal emitting components, relevant ECG trace and character could be printed out on the thermal recording paper. In addition, the Keyboard Control Module also processes the keyboard signal, and controls the trace display, the real time clock, and etc. The Power Supply Module provides other modules of MK-1212A with power sources, of which AC

power is of priority to the rechargeable battery. When the Instrument is powered by AC power, battery is charged if there is no operation of the unit.

3.2.3 Block Diagram

Figure 11 Block Diagram (not provide)

3.3 Trouble shooting

WARNING: The cover should be removed only by qualified service personnel. There are no user-serviceable parts inside.

3.3.1 AC Interference

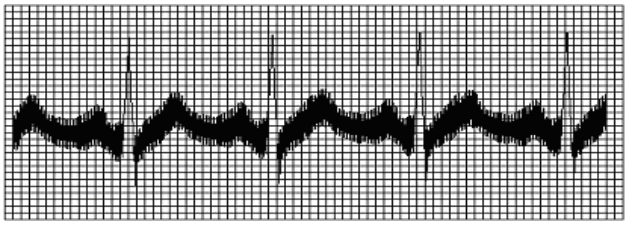


Figure 12 ECG interference with AC

- **Make sure that the unit is properly grounded according to instructions.**
- **Check for good electrode connection and patient cable connection.**
- **Check the cleaning of electrode and patient body surface.**
- **Make sure that the exam bed is properly grounded.**
- **The patient shall not be in touch with the metal parts of the exam bed.**
- **The patient shall not be in touch with anybody else.**
- **There shall be no large power electric equipment working nearby.**
- **The patient shall take off such things as ring and the like.**

Please use filter if above-mentioned interference persists.

3.3.2 EMC Interference



Figure 13 EMC Interference

- **Make sure that the exam room is comfortable for examination.**
- **Calm the patient from disturbance or excitement.**
- **Make sure the exam bed shall be in suitable size.**
- **Never talk with the patient during ECG exams.**

Please use filter if above-mentioned interference persists.

3.3.3 Baseline Drift

Figure 14 Baseline Drift



- **Verify the electrode connection and lead wire performance.**
- **Check the connection between patient cable and electrodes.**
- **Check the cleaning of electrode and patient skin.**
- **Keep the patient from moving or hyperventilation.**

Please use filter if above-mentioned interference persists.

3.4 Warranty

We manufacturer do give an 18 months warranty for all of our products concerning quality defect of the adopted components and technology except the accompanying accessories & consumable. This warranty does not apply to the products modified, disassembled, innovated, and repaired without our authorization or instructions as well as the products damaged due to accident, fire, thunder & lightning, flood; intentional destruction, improper installation & operation.

3.5 Specifications

3.5.1 Specifications

Lead:	**Standard or Cabrera 12 leads, Simultaneously 12 leads acquisition**
Sampling Rate & Quantization	**1000samples/second/channel 3.125μV/LSB**
Recovery time of defibrillator after discharge	**＜10s**
Frequency Response:	**0.05～150Hz（-3.0dB - +0.4dB）under 10Hz**
Time Constant:	**≥3.2s**
CMRR:	**＞100dB with filter, ＞89dB without filter**
Input Circuit Current:	**≤ 0.1μA**
Noise Level:	**≤15μVp-p**
Polarization Voltage:	**±500mV**
Minimum Detection Signal:	**20μV**
Calibration Voltage:	**1mV ± 2%**

Filter:	**AC filter: 50Hz/60Hz, -20dB** **EMG filter:25Hz/35Hz/45Hz/75Hz/100Hz, -3.0dB** **Drift filter: 0.5Hz, -3.0dB**
Sensitivity:	**1.25, 2.5, 5, 10, 20mm/mV± 2%(40mm/mV can be selected when Record Format set at 6ch or 3+3ch)**
Paper Speed:	**5, 6.25, 10, 12.5, 25, 50mm/s ± 3%**
Recording Mode:	**Thermal paper printing**
Printing Resolution:	**⩾8 dot/mm(Vertical)** **⩾40 dot/mm(Horizontal, 25mm/s)** **⩾20 dot/mm(Horizontal, 50mm/s)**
Paper Size:	**216mm×20M, thermal roll paper** **(paper core diameter ≥ 12mm)**
Dimension:	**330mm×332mm×87mm**
Weight:	**4.1Kg**

3.5.2 Safety Index

Input Circuit:	**Floating, Defibrillation protection** **[use defibrillation ECG cables: FD08X4 (monochromatic EU standard)]**
Patient Current Leakage:	**＜10μA**
Input Impedance:	**DC signals⩾50MΩ, AC signals⩾2.5MΩ**
Safety:	**Protection against electric shock: Class I or internally powered; Type CF applied part with Defibrillation protection; IPX0; Continuous operation**
Power supply:	**AC 110V～230V, 50Hz/60Hz, 160VA**
Built-in Rechargeable Li-ion battery:	**14.8V 4400mAh**

3.5.3 Environmental Conditions

Transportation **Temperature:-20℃～+55℃**
Relative Humidity:25%～93%
Atmospheric Pressure:700hP$_a$～1060hP$_a$
Storage **Temperature:-20℃～+55℃**
Relative Humidity:25%～93%
Atmospheric Pressure:700hP$_a$～1060hP$_a$
Operation **Temperature:+5℃～+40℃**
Relative Humidity: 25%～95%(without condensation)
Atmospheric Pressure:800hP$_a$～1060hP$_a$