Service Manual

cardiofax C

Electrocardiograph

ECG-3150

0634-901099C

NIHON KOHDEN

About This Manual

In order to use this product safely and fully understand all its functions, read this manual before using the product. Keep this manual near the instrument or in the reach of the operator and refer to it whenever the operation is unclear.

Accompanying Documentation

The product comes with the following manuals. Refer to the manual depending on your needs.

Operator's Manual

Describes the operation and settings of the product. Read this manual before use.

Service Manual (this manual)

For qualified service personnel. Describes information on servicing the product. Only qualified service personnel can service the electrocardiograph.

This product stores personal patient information. Manage the information appropriately.

Patient names on the screen shots and recording examples in this manual are fictional and any resemblance to any person living or dead is purely coincidental.

The contents of this manual are subject to change without notice. If you have any comments or suggestions on this manual, please contact us at: https://www.nihonkohden.com/

Contents

GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel.
Use only Shanghai Kohden approved products with this device. Use of non-approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens, extension cables, electrode leads, input boxes and AC power.
The intended use is just only for diagnosis, not for monitoring of vital physiological parameters.

Please read these precautions thoroughly before attempting to operate the device.

1. **To safely and effectively use the device, its operation must be fully understood.**

2. **When installing or storing the device, take the following precautions:**
   (1) Avoid moisture or contact with water, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and dust, saline or sulphuric air.
   (2) Place the device on an even, level floor. Avoid vibration and mechanical shock, even during transport.
   (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
   (4) The power line source to be applied to the device must correspond in frequency and voltage to product specifications, and have sufficient current capacity.
   (5) Choose a room where a proper grounding facility is available.

3. **Before Operation**
   (1) Check that the device is in perfect operating order.
   (2) Check that the device is grounded properly.
   (3) Check that all cords are connected properly.
   (4) Pay extra attention when the device is combined with other devices to avoid misdiagnosis or other problems.
   (5) All circuitry used for direct patient connection must be doubly checked.
   (6) Check that battery pack level is acceptable and battery pack condition is good when using battery pack-operated models.

4. **During Operation**
   (1) Both the device and the patient must receive continual, careful attention.
   (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient's safety.
   (3) Avoid direct contact between the device housing and the patient.
   (4) The operator must not touch patients and the input/output interface of the equipment simultaneously, this may cause electric shock.

5. **To Shutdown After Use**
   (1) Turn the power off with all controls returned to their original positions.
   (2) Remove the cords gently; do not use force to remove them.
   (3) The mains plug or appliance coupler is intended to be used as an isolation device from the supply mains. Always make sure that the mains plug or appliance coupler is easy to operate.
   (4) Clean the device together with all accessories for their next use.

6. **The device must receive expert, professional attention for maintenance and repairs. When the device is not working properly, it should be clearly marked to avoid operation while it is out of order.**

7. **The device must not be altered or modified in any way.**

8. **Maintenance and Inspection**

   (1) The device and parts must undergo regular maintenance inspection at least every 6 months.

   (2) If stored for extended periods without being used, make sure prior to operation that the device is in perfect operating condition.

   (3) Technical information such as circuit diagrams, component part lists, descriptions, calibration instructions or other information is available for SERVICE PERSONNEL upon request from your Nihon Kohden representative.

9. **When the device is used with an electrosurgical device, pay careful attention to the application and location of electrodes and transducers to avoid possible burn to the patient.**

10. **When the device is used with a defibrillator, make sure that the device is protected against defibrillator discharge. If not, remove patient cables and transducers from the device to avoid possible damage.**

11. **Contraindications: None.**

12. **The electrodes cannot be applied directly on the heart.**

WARRANTY POLICY

Shanghai Kohden Medical Electronic Instrument Corp. (SKC) shall warrant its products against all defects in materials and workmanship for one year from the date of delivery. However, consumable materials such as recording paper, ink, stylus and battery pack are excluded from the warranty.

SKC or its authorized agents will repair or replace any products which prove to be defective during the warranty period, provided these products are used as prescribed by the operating instructions given in the operator's and service manuals.

No other party is authorized to make any warranty or assume liability for SKC's products. SKC will not recognize any other warranty, either implied or in writing. In addition, service, technical modification or any other product change performed by someone other than SKC or its authorized agents without prior consent of SKC may be cause for voiding this warranty.

Defective products or parts must be returned to SKC or its authorized agents, along with an explanation of the failure. Shipping costs must be pre-paid.

This warranty does not apply to products that have been modified, disassembled, reinstalled or repaired without Shanghai Kohden approval or which have been subjected to neglect or accident, damage due to accident, fire, lightning, vandalism, water or other casualty, improper installation or application, or on which the original identification marks have been removed.

EMC RELATED CAUTION

This equipment and/or system complies with IEC 60601-1-2 International Standard for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in IEC 60601-1-2, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:

   Install the equipment and/or system at another location. Keep the emitter source such as cellular phone away from the equipment and/or system, or turn off the cellular phone.

2. Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:

   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. Effect of direct or indirect electrostatic discharge:

   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.

4. Electromagnetic interference with any radio wave receiver such as radio or television:

   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

5. Interference of lightning:

   When lightning occurs near the location where the equipment and/or system is installed, it may induce an excessive voltage in the equipment and/or system. In such a case, disconnect the AC power cord from the equipment and/or system and operate the equipment and/or system by battery power, or use an uninterruptible power supply.

6. Use with other equipment:

   When the equipment and/or system is adjacent to or stacked with other equipment, the equipment and/or system may affect the other equipment. Before use, check that the equipment and/or system operates normally with the other equipment.

7. Use of unspecified accessory, transducer and/or cable:

   When an unspecified accessory, transducer and/or cable is connected to this equipment and/or system, it may cause increased electromagnetic emission or decreased electromagnetic immunity. The specified configuration of this equipment and/or system complies with the electromagnetic requirements with the specified configuration. Only use this equipment and/or system with the specified configuration.

Caution - continued

8. Use of unspecified configuration:

   When the equipment and/or system is used with the unspecified system configuration different than the configuration of EMC testing, it may cause increased electromagnetic emission or decreased electromagnetic immunity. Only use this equipment and/or system with the specified configuration.

9. Measurement with excessive sensitivity:

   The equipment and/or system is designed to measure bioelectrical signals with a specified sensitivity. If the equipment and/or system is used with excessive sensitivity, artifact may appear by electromagnetic interference and this may cause mis-diagnosis. When unexpected artifact appears, inspect the surrounding electromagnetic conditions and remove this artifact source.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden representative for additional suggestions.

For EMC compliance, refer to "Specification - Electromagnetic Compatibility" in the Reference section.

NOTE about Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC
For the member states of the European Union only:
The purpose of WEEE directive 2002/96/EC is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste.
Contact your Nihon Kohden representative for disposal.

Conventions Used in this Manual and Device

Warnings, Cautions and Notes

⚠ **WARNING:**	A warning alerts the user to possible injury or death associated with the use or misuse of the instrument.
⚠ **CAUTION:**	A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.
NOTE:	A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

Text Conventions in this Manual

- Name of keys on the screen are enclosed in square brackets: [OK]
- Messages that are displayed on the screen are enclosed in quotation marks: "Continue?"
- Names of items that are displayed on the screen are enclosed in angle brackets: <Communication settings>
- Name of keys on the operation panel are enclosed in bold form: **POWER** key

1 General

Introduction

This service manual provides useful information for qualified service personnel to understand, troubleshoot, service, maintain and repair the ECG-3150 electrocardiograph (hereinafter referred to as "the instrument" or "ECG-3150"). All replaceable parts or units of the instrument and its optional units are clearly listed with exploded illustration to help you locate the parts quickly.

The information in the operator's manual is primarily for the user. However, it is important for service personnel to thoroughly read the operator's manual and service manual before starting to troubleshoot, service, maintain or repair the instrument. This is because service personnel need to understand the operation of the instrument in order to effectively use the information in the service manual.

General Information on Servicing

Note the following information when servicing the instrument.

⚠ CAUTION

Safety

- There is the possibility that the outside surface of the instrument, such as the operation keys, could be contaminated by contagious germs, so disinfect and clean the instrument before servicing it. When servicing the instrument, wear rubber gloves to protect yourself from infection.
- There is the possibility that when the lithium battery is broken, a solvent inside the lithium battery could flow out or a toxic substance inside it could come out. If the solvent or toxic substance touches your skin or gets into your eyes or mouth, immediately wash it with a lot of water and see a physician.

Liquid ingress

The instrument is not waterproof, so do not install the instrument where water or liquid can get into or fall on the instrument. If liquid accidentally gets into the instrument or the instrument accidentally drops into liquid, disassemble the instrument, clean it with clean water and dry it completely. After reassembling, verify that there is nothing wrong with the patient safety checks and function/ performance checks. If there is something wrong with the instrument, contact your Nihon Kohden representative for repair.

Environmental safeguards

Depending on the local laws in your community, it may be illegal to dispose of the lithium battery in the regular waste collection. Check with your local officials for proper disposal procedures.

Disinfection and cleaning

To disinfect the outside surface of the instrument, wipe it with a non-abrasive cloth moistened with any of the disinfectants listed below. Do not use any other disinfectants or ultraviolet rays to disinfect the instrument and using a dry soft cloth or a cloth which is moistened with neutral soap and wrung out.

- Ethanol	76.9 % to 81.4 % (by vol. in 15 oC)
- Chlorhexidine gluconate solution:	0.5 %
- Benzalkonium chloride	0.2 %
- Benzethonium chloride solution:	0.2 %
- Glutaraldehyde solution:	2.0 %
- Alkyldiaminoethylglycine hydrochloride:	0.5 %
- Phtharal	0.55 %
- Phenol	1.56 %
- Isopropyl alcohol	70 % (by vol.)

Caution - continued

Transport

- Use the specified shipment container and packing material to transport the instrument. If necessary, double pack the instrument. Also, put the instrument into the shipment container after packing so that the buffer material does not get inside the instrument.
- When transporting a board or unit of the instrument, be sure to use a conductive bag on. Never use an aluminum bag to transport a board or unit which a lithium battery is mounted. Also, never use a styrene foam or plastic bag which generates static electricity to wrap the board or unit of the instrument.

Handling the instrument

- Because the outside surface of the instrument is made of resin, the outside surface of the instrument is easily damaged. So when handling the instrument, remove clutter from around the instrument and be careful to not damage the instrument or get it dirty.
- Because most of the boards in the instrument are multilayer boards with surface mount electrical devices (SMD), when removing and soldering the electrical devices, a special tool is required. To avoid damaging other electrical components, do not remove and solder SMD components yourself.

Measuring and test equipment

Maintain the accuracy of the measuring and test equipment by checking and calibrating it according to the check and calibration procedures.

Maintenance

Turn off the power of the instrument before doing maintenance, cleaning or disinfecting. Otherwise you may get an electrical shock or the instrument may malfunction.

Preventing infection

Follow the local laws or regulations to prevent infection.

Service Policy and Service Parts

Service Policy

Our technical service policy for the instrument is to replace the whole instrument. Do not perform electrical device or component level repair of the multilayer board or unit. We do not support component level repair outside the factory for the following reasons:

- Most of the boards are multilayer boards with surface mount electrical devices, so the mounting density of the board is too high.
- A special tool or high degree of repair skill is required to repair the multilayer boards with surface mount electrical devices.

Only disassemble the instrument or replace a board or unit in an environment where the instrument is protected against static electricity.

As background knowledge for repair, pay special attention to the following:

- You can reduce the repair time by considering the problem before starting repair.
- You can clarify the source of most of the troubles using the information from the error massage and troubleshooting in the “Troubleshooting” section of this manual.

Service Parts

NOTE: When ordering parts or accessories from your Nihon Kohden representative, please quote the code number and part name which is listed in this service manual, and the name or model of the unit in which the required part is located. This will help us to promptly attend to your needs. Always use parts and accessories recommended or supplied by Shanghai Kohden Medical Electronic Instrument Corp. to assure maximum performance from your instrument.

Specifications

ECG Input

Input impedance:	≥ 50 MΩ (at 0.67 Hz)
Electrode offset tolerance:	±550 mV
Defibrillation-proof:	Isolated and defibrillator protected only when the following specified patient cable is connected.
	Patient cable: BJ-961D, BJ-962D, BJ-901D, BJ-902D, BJ-903D, BA-901D
	Recovery time: < 5 s
	NOTE: Complies with IEC 60601-2-25:2011.
Common mode rejection ratio:	≥ 105 dB (at 10 V)
Input circuit current:	≤ 0.05 μA
Standard sensitivity:	10 mm/mV, not more than ±2 %
Internal noise:	≤ 20 μVp-v
Interference between channels:	≤ -40 dB
Frequency response:	With 10 Hz as benchmark, 0.05 Hz to 150 Hz (+0.4 dB /-3.0 dB)
	150 Hz (≥ 71 %, high-cut filter: 150 Hz)
Sample rate:	8000 samples/s

Waveform Data Processor

Sampling and amplitude quantisation during data acquisition:	500 samples/s, 1.25 μv/LSB
Response to minimum signal:	20 μVp-v
EMG suppression:	25 Hz filter is on: Not less than 70 % for 20 Hz, and not more than 70 % for 30 Hz;
	35 Hz filter is on: Not less than 70 % for 30 Hz, and not more than 70 % for 40 Hz;
High-cut filter:	When the filter is set to 75 Hz, 100 Hz, 150 Hz, the attenuation for 75 Hz, 100 Hz, 150 Hz is not more than 3 dB.
AC line filter:	50 Hz ± 0.05 % ≥ 20 dB
	60 Hz ± 0.05 % ≥ 20 dB
Baseline drift suppression:	Weak: -20 dB (0.1 Hz); Strong: -34 dB (0.1 Hz)
Time constant:	≥ 3.2 s
Sensitivity:	5 mm/mV, not more than ±5 %.
	10 mm/mV, not more than ±2 %
	20 mm/mV, not more than ±5 %

Recorder

Recording speed accuracy:	±5 %
Printing density:	200 dpi (8 dots/mm); 320 dot/mm^2 (25 mm/s)
Scanning line density:	1 ms
Number of recording channels:	1, 1+rhythm, 3
Paper speed:	25 mm/s, 50 mm/s

Recording paper:	63 mm width, 30 m roll paper
Mechanical noise:	≤ 48 dB at paper speed 25 mm/s
Printed data:	ECG waveform, heart rate, lead name, version, date and time, program type, paper speed, sensitivity, filter, patient information (ID number, sex, age), event mark, electrode detachment, noise.

Wireless Communication

Wireless Communication Standard	IEEE 802.11a/b/g/n/ac
Channel/Frequency Band	IEEE 802.11b/g/n 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 (2412 MHz to 2472 MHz)
	IEEE 802.11a/n/ac 36, 40, 44, 48 (5180 MHz to 5240 MHz)
	52, 56, 60, 64 (5260 MHz to 5320 MHz)
	100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140 (5500 MHz to 5720 MHz)
	149, 153, 157, 161, 165 (5745 MHz to 5825 MHz)
	IEEE 802.11n: The channel bandwidth of 40 MHz is also available.
	IEEE 802.11ac: The channel bandwidths of 40 MHz and 80 MHz are also available.
	NOTE: • Channels above are of limited use in each country for compliance with each country's regulations. • Indoor use only in the frequency band 5150 MHz to 5350 MHz.
Maximum Output Power	100mW or less (20dBm or less)
Authentication	Open System
	Shared Key
	WPA/WPA2-PSK
Encryption	WEP(64bit/128bit)
	TKIP
	AES(CCMP)

Power Requirements

Line voltage:	100 V AC to 240 V AC ± 10 %
Line frequency:	50 Hz, 60 Hz
Power input:	≤ 45 VA
Battery pack:	8.4V, 1600 mAh
Battery pack operation time:	More than 180 minutes (auto recording once each 3 minutes with a new battery, at 25 °C)
	About 60 minutes (continuous recording with a new battery, at 25 °C)
	NOTE: Recording condition: 3-channel recording, input 1 mV 10 Hz sine wave; paper speed 25 mm/s

Color LCD (with Backlight)

Display size:	W × H: 108 mm × 64.8 mm, 5 inch
Display type:	TFT, 800 dots × 480 dots
Display data:	Waveform, patient information, recording settings, operation mode, heart rate, QRS sync mark, error message, electrode detachment, noise.

Connector and Port

USB A type × 2

LAN port × 1

Dimensions and Weight

Dimensions:	(W × H × D): (260 mm × 75 mm × 172 mm) ± 10%
Weight:	1.1 kg ± 10% (without battery pack, recording paper and AC power adapter)

Environment

Operating environment

Temperature:	5 °C to 40 °C (41 °F to 104 °F)
Relative Humidity:	ECG-3150: 25 % to 95 % (noncondensing)
	Battery Pack: 40 % to 85 % (noncondensing)

Transport storage environment

Temperature:	ECG-3150: -20 °C to +65 °C (-4 °F to +149 °F)
	Recording Paper: 0 °C to +45 °C (32 °F to +113 °F)
	Battery Pack: The storage environment affects the performance and lifetime of the battery pack. Please store the battery pack under proper environmental conditions depending on the storage period. -20 °C to +65 °C (Less than 1 week) -20 °C to +55 °C (Less than 1 month) -20 °C to +45 °C (Less than 6 months) -20 °C to +35 °C (Less than 1 year)
Relative Humidity:	ECG-3150: 10 % to 95 % (noncondensing)
	Recording Paper: 40 % to 80 % (noncondensing)
	Battery Pack (within 2 months): 10 % to 95 % (noncondensing)
	Battery Pack (over 2 months and within 1 year): 45 % to 85 % (noncondensing)
Atmospheric pressure:	700 hPa to 1060 hPa altitude: < 3000 m
Overvoltage category:	II
Pollution degree:	2

Electromagnetic Compatibility

IEC 60601-1-2: 2014 Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance Collateral standard: Electromagnetic compatibility Requirements and tests.

Safety Specification Classification

IEC 60601-1:2012 Medical electrical equipment - Part 1: General requirements for basic safety and essential performance

IEC 60601-2-25:2011 Medical electrical equipment - Part 2-25: Particular requirements for the basic safety and essential performance of electrocardiographs

Type of protection against electrical shock:	Class I EQUIPMENT (AC powered) INTERNAL POWER EQUIPMENT (battery pack power)
Degree of protection against electrical shock:	Defibrillation-proof type CF applied parts when patient cable BJ-961D, BJ-962D or BJ-901D, BJ-902D,BJ-903D, BA-901D is used.
Degree of protection against harmful ingress of water:	IPX0 (non-protected)
Degree of safety of application in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE:	Equipment not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE.
Operation Mode	Continuous operation

Lifetime

6 years

(Self certified based on our data; only when the specified yearly inspection is performed.)

Electromagnetic Emissions

The ECG-3150 essential performance in EMC standard satisfies the following criteria.

This Model ECG-3150 is intended for use in the electromagnetic environment specified below.

The customer or the user of the ECG-3150 should assure that it is used in such an environment.

Emissions test	Compliance	Electromagnetic environment - guidance
Conducted and radiated RF EMISSIONS CISPR 11	Group 1	The ECG-3150 uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The ECG-3150 is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic distortion IEC 61000-3-2	Class A	
Voltage fluctuations and flicker IEC 61000-3-3	Complies	

NOTE: The EMISSIONS characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

Electromagnetic Immunity

The ECG-3150 essential performances in EMC standard satisfies the following criteria.

This Model ECG-3150 is intended for use in the electromagnetic environment specified below.

The customer or the user of the ECG-3150 should assure that it is used in such an environment.

Phenomenon Basic EMC standard	IMMUNITY TEST LEVELS	Compliance levels	Electromagnetic environment - guidance
ELECTROSTATIC DISCHARGE IEC 61000-4-2	±8 kV contact ±2 kV, ±4 kV, ±8 kV, ±15 kV air	±8 kV contact ±2 kV, ±4 kV, ±8 kV, ±15 kV air	Floors should be wood, concrete or ceramic tiles. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/ burst IEC 61000-4-4	±2 kV, 100 kHz for power supply lines	±2 kV, 100 kHz for power supply lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV Line-to-line ±2 kV Line-to-ground	±1 kV Line-to-line ±2 kV Line-to-ground	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips IEC 61000-4-11	0 % U_T; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° 0 % U_T; 1 cycle and 70 % U_T; 25/30 cycles Single-phase: at 0°	0 % U_T; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° 0 % U_T; 1 cycle and 70 % U_T; 25/30 cycles Single-phase: at 0°	Mains power quality should be that of a typical commercial or hospital environment. If the user of the ECG-3150 requires continued operation during power mains interruptions, it is recommended that the ECG-3150 be powered from an uninterruptible power supply or a battery.
Voltage interruptions IEC 61000-4-11	0 % U_T; 250/300 cycle	0% U_T; 250/300 cycles	
Power frequency (50/60 Hz) Magnetic field IEC 61000-4-8	30 A/m	30 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the AC mains voltage prior to application of the test level.			
Conducted disturbances induced by RF fields IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz 6 Vrms in ISM bands between 150 kHz and 80 MHz*[a]	3 Vrms 6 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the ECG-3150 including cables than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.2\sqrt{P}$ $d = 0.6\sqrt{P}$

Phenomenon Basic EMC standard	IMMUNITY TEST LEVELS	Compliance levels	Electromagnetic environment - guidance
Radiated RF EM fields IEC 61000-4-3	3 V/m 80 MHz to 2.7 GHz	3 V/m	d = $1.2\sqrt{P}$ 80 MHz to 800 MHz d = $2.3\sqrt{P}$ 800 MHz to 2.7 GHz where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey*[b], should be less than the compliance level in each frequency range*[c]. Interference may occur in the vicinity of equipment marked with the following symbol: 

NOTE • At 80 MHz and 800 MHz, the higher frequency range applies.

• These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

*[a] The ISM (industrial, scientific and medical) bands between 0.15 MHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz. The amateur radio bands between 0.15 MHz and 80 MHz are 1.8 MHz to 2.0 MHz, 3.5 MHz to 4.0 MHz, 5.3 MHz to 5.4 MHz, 7 MHz to 7.3 MHz, 10.1 MHz to 10.15 MHz, 14 MHz to 14.2 MHz, 18.07 MHz to 18.17 MHz, 21.0 MHz to 21.4 MHz, 24.89 MHz to 24.99 MHz, 28.0 MHz to 29.7 MHz and 50.0 MHz to 54.0 MHz.

*[b] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy.

To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the ECG-3150 is used exceeds the applicable RF compliance level above, the ECG-3150 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the ECG-3150.

*[c] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m

Recommended Separation Distances between Portable and Mobile RF Communications Equipment

The ECG-3150 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the ECG-3150 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the ECG-3150 as recommended below, according to the maximum output power of the transmitter.

Rated maximum output power of transmitter (W)	Separation distance according to frequency of transmitter (m)		
	150 kHz to 80 MHz d = $1.2\sqrt{P}$	80 MHz to 800 MHz d = $1.2\sqrt{P}$	800 MHz to 2.7 GHz d = $2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE • At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

• These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Test specifications for ENCLOSURE PORT IMMUNITY to RF wireless communication equipment

⚠ WARNING

Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the ECG-3150, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.

Test frequency (MHz)	Band (MHz)	Service	Modulation	Maximum power (W)	Distance (m)	IMMUNITY TEST LEVEL (V/m)
385	380 ~ 390	TETRA 400	Pulse modulation 18 Hz	1.8	0.3	27
450	430 ~ 470	GMRS 460, FRS 460	FM ±5 kHz deviation 1 kHz sine	2	0.3	28
710	704 ~ 787	LTE Band 13, 17	Pulse modulation 217 Hz	0.2	0.3	9
745						
780						
810	800 ~ 960	GSM 800/900, TETRA 800, iDEN 820, CDMA 850, LTE Band 5	Pulse modulation 18 Hz	2	0.3	28
870						
930						
1435.4	1427.9 ~ 1510.9	LTE Band 11, 21; UMTS	Pulse modulation 217 Hz	2	0.3	28
1452.9						
1720	1700 ~ 1990	GSM 1800, CDMA 1900, GSM 1900, DECT, LTE Band 1, 3, 4, 25; UMTS	Pulse modulation 217 Hz	2	0.3	28
1845						
1970						
2450	2400 ~ 2570	Bluetooth, WLAN, 802.11 b/g/n, RFID 2450, LTE Band 7	Pulse modulation 217 Hz	2	0.3	28
5240	5100 ~ 5800	WLAN 802.11 a/n	Pulse modulation 217 Hz	0.2	0.3	9
5500						
5785						

System Composition for EMC Test

The ECG-3150 is tested to comply with IEC 60601-1-2: 2014, with the following composition. If any part which is not specified by Shanghai Kohden is used, the EMC specifications may not comply.

Unit	Cable length
ECG-3150 electrocardiograph	—
Battery pack, SB-301DC	—
Patient cable, BJ-961D	3.4 m
Magnetic card reader, CRF-200U-5101-00	—
Bar code reader, LS2208	—
LAN cable	2 m
Ground lead	4 m

Member States in Which this Instrument is Intended for Use

As of April 2016, Shanghai Kohden Corporation has notified the intended use of this instrument to the authority of the following member states based on Radio Equipment Directive (2014/53/EU).

• Austria	• Belgium	• Bulgaria	• Croatia	• Cyprus	• Czech Republic
• Denmark	• Estonia	• Finland	• France	• Germany	• Greece
• Hungary	• Iceland	• Ireland	• Italy	• Latvia	• Liechtenstein
• Lithuania	• Luxembourg	• Malta	• Netherlands	• Norway	• Poland
• Portugal	• Romania	• Slovakia	• Slovenia	• Spain	• Sweden
• Switzerland	• U.K.				

This instrument complies with International Standard IEC 60601-1-2: 2014 which requires CISPR11, Group 1, Class A. Class A EQUIPMENT is instrument suitable for use in all establishments, excluding domestic establishments or in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

NOTE: Indoor use only within the band 5150 MHz to 5350 MHz.

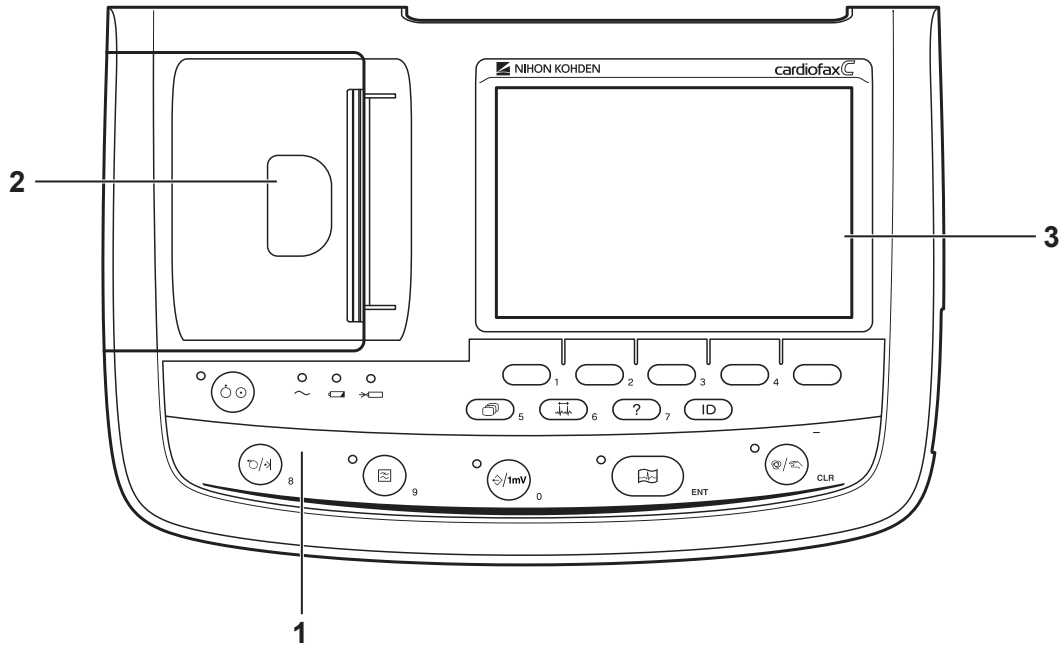
cs Česky [Czech]	Tímto Shanghai Kohden prohlašuje, že ECG-3150 je v souladu se směrnicí 2014/53/EU. Úplné znění EU prohlášení o shodě je k dispozici na této internetové adrese: https://www.nihonkohden.com/
da Dansk [Danish]	Hermed erklærer Shanghai Kohden, at ECG-3150 er i overensstemmelse med direktiv 2014/53/EU. EU-overensstemmelseserklæringens fulde tekst kan findes på følgende internetadresse: https://www.nihonkohden.com/
de Deutsch [German]	Hiermit erklärt Shanghai Kohden, dass der ECG-3150 der Richtlinie 2014/53/EU entspricht. Der vollständige Text der EU-Konformitätserklärung ist unter der folgenden Internetadresse verfügbar: https://www.nihonkohden.com/
et Eesti [Estonian]	Käesolevaga deklareerib Shanghai Kohden, et ECG-3150 vastab direktiivi 2014/53/EL nõuetele. ELi vastavusdeklaratsiooni täielik tekst on kättesaadav järgmisel internetiaadressil: https://www.nihonkohden.com/
en English	Hereby, Shanghai Kohden declares that the ECG-3150 is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: https://www.nihonkohden.com/
es Español [Spanish]	Por la presente, Shanghai Kohden declara que el ECG-3150 es conforme con la Directiva 2014/53/UE. El texto completo de la declaración UE de conformidad está disponible en la dirección Internet siguiente: https://www.nihonkohden.com/
el Ελληνική [Greek]	Με την παρούσα ο/η Shanghai Kohden, δηλώνει ότι ο ECG-3150 πληροί την οδηγία 2014/53/ΕΕ. Το πλήρες κείμενο της δήλωσης συμμόρφωσης ΕΕ διατίθεται στην ακόλουθη ιστοσελίδα στο διαδίκτυο: https://www.nihonkohden.com/
fr Français [French]	Le soussigné, Shanghai Kohden, déclare que le ECG-3150 est conforme à la directive 2014/53/UE. Le texte complet de la déclaration UE de conformité est disponible à l'adresse internet suivante: https://www.nihonkohden.com/
it Italiano [Italian]	Il fabbricante, Shanghai Kohden, dichiara che il ECG-3150 è conforme alla direttiva 2014/53/UE. Il testo completo della dichiarazione di conformità UE è disponibile al seguente indirizzo Internet: https://www.nihonkohden.com/
lv Latviski [Latvian]	Ar šo Shanghai Kohden deklarē, ka ECG-3150 atbilst Direktīvai 2014/53/ES. Pilns ES atbilstības deklarācijas teksts ir pieejams šādā interneta vietnē: https://www.nihonkohden.com/
lt Lietuvių [Lithuanian]	Aš, Shanghai Kohden, patvirtinu, kad ECG-3150 atitinka Direktyvą 2014/53/ES. Visas ES atitikties deklaracijos tekstas prieinamas šiuo interneto adresu: https://www.nihonkohden.com/
nl Nederlands [Dutch]	Hierbij verklaar ik, Shanghai Kohden, dat het ECG-3150 conform is met Richtlijn 2014/53/EU. De volledige tekst van de EU-conformiteitsverklaring kan worden geraadpleegd op het volgende internetadres: https://www.nihonkohden.com/
mt Malti [Maltese]	B'dan, Shanghai Kohden, niddikjara li dan it-tip ta' tagħmir tar-radju ECG-3150 huwa konformi mad-Direttiva 2014/53/UE. It-test kollu tad-dikjarazzjoni ta' konformità tal-UE huwa disponibbli f'dan l-indirizz tal-Internet li ġej: https://www.nihonkohden.com/
hu Magyar [Hungarian]	Shanghai Kohden igazolja, hogy a ECG-3150 megfelel a 2014/53/EU irányelvnek. Az EU-megfelelőségi nyilatkozat teljes szövege elérhető a következő internetes címen: https://www.nihonkohden.com/
pl Polski [Polish]	Shanghai Kohden niniejszym oświadcza, że typ urządzenia radiowego ECG-3150 jest zgodny z dyrektywą 2014/53/UE. Pełny tekst deklaracji zgodności UE jest dostępny pod następującym adresem internetowym: https://www.nihonkohden.com/

pt Português [Portuguese]	O(a) abaixo assinado(a) Shanghai Kohden declara que o presente ECG-3150 está em conformidade com a Diretiva 2014/53/UE. O texto integral da declaração de conformidade está disponível no seguinte endereço de Internet: https://www.nihonkohden.com/
sl Slovensko [Slovenian]	Shanghai Kohden potrjuje, da je ECG-3150 skladen z Direktivo 2014/53/EU. Celotno besedilo izjave EU o skladnosti je na voljo na naslednjem spletnem naslovu: https://www.nihonkohden.com/
sk Slovenský [Slovak]	Shanghai Kohden týmto vyhlasuje, že ECG-3150 je v súlade so smernicou 2014/53/EÚ. Úplné EÚ vyhlásenie o zhode je k dispozícii na tejto internetovej adrese: https://www.nihonkohden.com/
fi Suomi [Finnish]	Shanghai Kohden vakuuttaa, että ECG-3150 on direktiivin 2014/53/EU mukainen. EU-vaatimustenmukaisuusvakuutuksen täysimittainen teksti on saatavilla seuraavassa internetosoitteessa: https://www.nihonkohden.com/
sv Svenska [Swedish]	Härmed försäkrar Shanghai Kohden att denna typ av radioutrustning ECG-3150 överensstämmer med direktiv 2014/53/EU. Den fullständiga texten till EU-försäkran om överensstämmelse finns på följande webbadress: https://www.nihonkohden.com/
is Íslenska [Icelandic]	Hér með lýsir Shanghai Kohden því yfir að ECG-3150 er í samræmi við tilskipun 2014/53/EU. Heildartexti EB-samræmisyfirlýsingarinnar er fáanlegur á eftirfarandi veffangi: https://www.nihonkohden.com/
no Norsk [Norwegian]	Shanghai Kohden erklærer herved at ECG-3150 er i samsvar med direktiv 2014/53/EU. Hele samsvarserklæringsteksten er tilgjengelig på følgende Internett-adresse: https://www.nihonkohden.com/
bg български език [Bulgarian]	С настоящото Shanghai Kohden декларира, че този ECG-3150 е в съответствие с Директива 2014/53/ЕС. Цялостният текст на ЕС декларацията за съответствие може да се намери на следния интернет адрес: https://www.nihonkohden.com/
ro Română [Romanian]	Prin prezenta, Shanghai Kohden declară că ECG-3150 este în conformitate cu Directiva 2014/53/UE. Textul integral al declarației UE de conformitate este disponibil la următoarea adresă internet: https://www.nihonkohden.com/
hr Hrvatski [Croatian]	Shanghai Kohden ovime izjavljuje da je ECG-3150 u skladu s Direktivom 2014/53/EU. Cjeloviti tekst EU izjave o sukladnosti dostupan je na sljedećoj internetskoj adresi: https://www.nihonkohden.com/

Panel and Parts Description

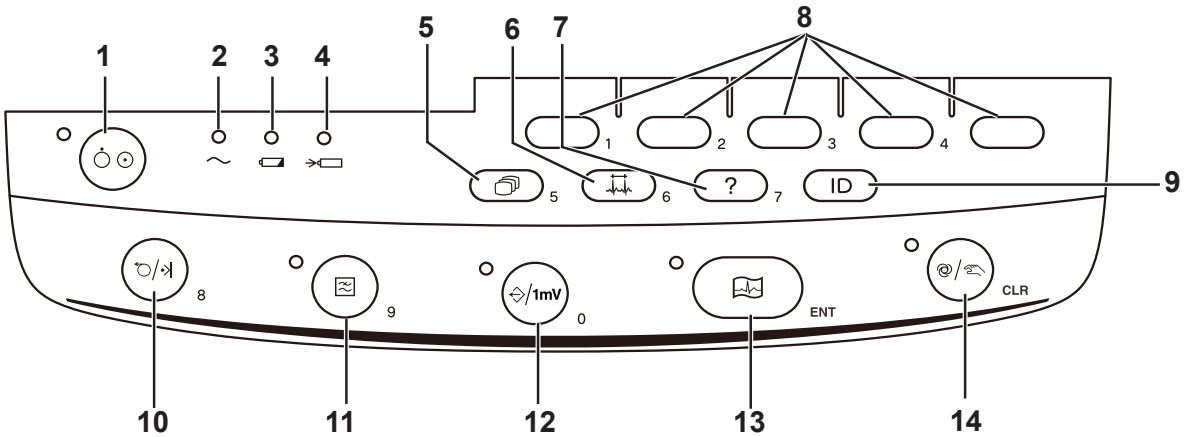
Electrocardiograph Main Unit

Top View



	Name	Function
1	Operation panel	Refer to the “Operation Panel” section.
2	Paper magazine	Contains the recording paper.
3	LCD screen	Displays ECG waveforms, patient information, marks and messages.

Operation Panel

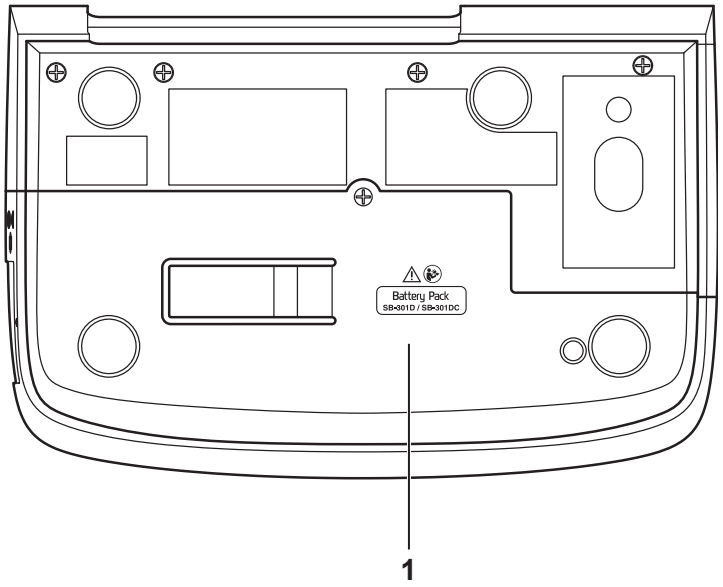


	Name	Function
1	**POWER** key/lamp	Turns the electrocardiograph on/off. NOTE: **Press the POWER key for 10 seconds to turn the power off when the electrocardiograph system crashes.**
2	AC power lamp ~	When AC power is supplied, the lamp is lighting.
3	Battery operation lamp	During battery operation, indicates the remaining battery power with the color and lighting state. Blinking in orange indicates that the battery pack is almost discharged. Blinking in green indicates that the battery pack is failed, do not use the electrocardiograph and contact your Nihon Kohden representative. When AC power is supplied, the lamp is off.
4	Battery charge lamp	Indicates the battery pack charge status. Lights when the battery pack is charging.
5	**FUNCTION** key (“5” number key)	Calls up the FUNCTION screen. On some screens, this key enters the number “5”.
6	**RHYTHM** key/lamp (“6” number key)	Performs rhythm recording in resting ECG examination. The lamp is lit while waveforms are acquired. On some screens, this key enters the number “6”.
7	**HELP** key (“7” number key)	Display the <Operation guide> screen. If there is an error, the “?” mark is displayed in the lower right corner of the screen. Press the HELP key on the operation panel to display the operation guide.
8	**F1, F2, F3, F4, F5 function keys** (“1”, “2”, “3”, “4”, number keys)	Correspond to the four items at the bottom of the screen. On some screens, these keys enter the number “1”, “2”, “3”, and “4”.
9	ID key	Use to enter patient information.
10	**FEED/MARK** key (“8” number key)	Paper feeding: Feeds the paper while the key is pressed. Event mark: In manual recording mode, adds an event mark to the ECG waveform. On some screens, this key enters the number “8”.
11	**FILTER** key/lamp (“9” number key)	Turns the EMG filter on/off. The lamp lights when the EMG filter is turned on. On some screens, this key enters the number “9”.
12	**COPY/CAL** key lamp (“0” number key)	Automatic recording mode and rhythm recording mode: Prints copies of the recording results. The lamp lights when copy is available and during printing. Manual recording mode: Records the calibration waveforms. This key does not function for external input signals. On some screens, this key enters the number “0”.
13	**START/STOP** key/lamp	Starts or stops recording. The lamp lights during recording.

	Name	Function
14	**AUTO/MANUAL** key/lamp	Selects automatic or manual recording. Lamp on: automatic recording Lamp off: manual recording

The FUNCTION, RHYTHM, HELP, F1, F2, F3, F4,FEED/MARK, FILTER and COPY/CAL keys are used to enter numbers in the System Setup screen and patient information. Refer to “Changing the System Setup Settings” in Section 3 and “Entering the Patient Information” in Section 4.

Bottom View

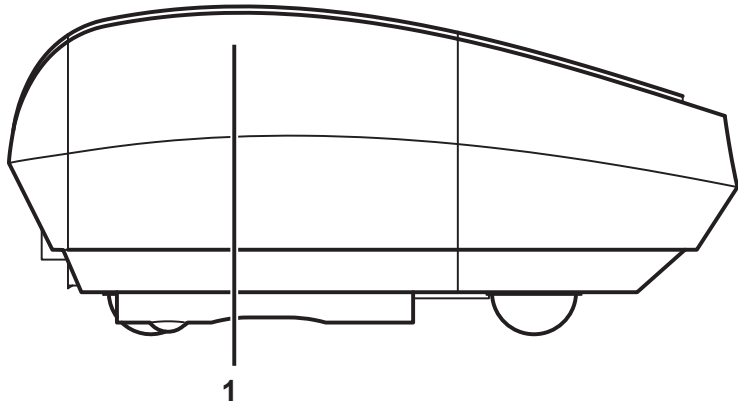


	Name	Function
1	Battery compartment	Contains the battery pack.

⚠ CAUTION

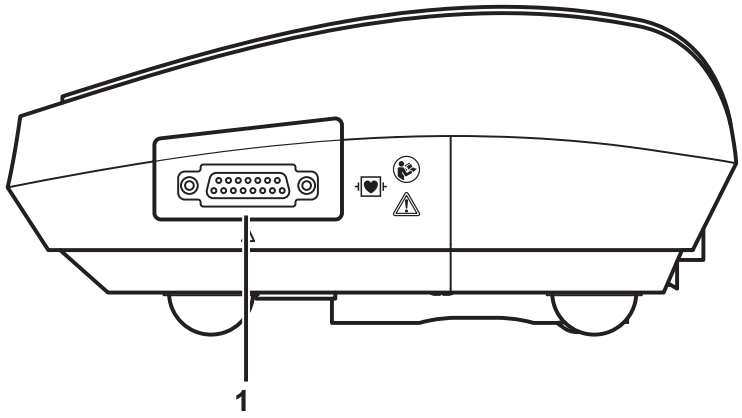
Always install the battery pack even when the electrocardiograph operates on AC power. Otherwise sudden power off occurs when an electrode is detached during recording.

Left View



	Name	Function
1	Paper magazine	Contains the recording paper.

Right View



⚠ WARNING

Connect only the specified instrument to the electrocardiograph and follow the specified procedure. Failure to follow this warning may result in electrical shock or injury to the patient and operator, and cause fire or instrument malfunction.

⚠ WARNING

Install non-medical instruments which are connected to the electrocardiograph outside the patient environment (IEC 60601-1). If they are installed inside the patient environment, the patient or operator may receive electrical shock or injury. For installation, contact your Nihon Kohden representative.

⚠ WARNING

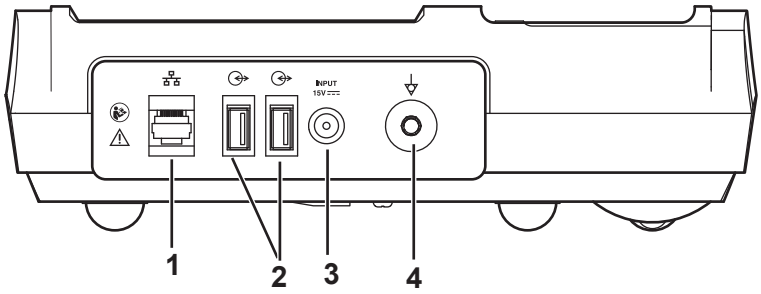
Follow IEC 60601-1 for connecting the electrocardiograph to other instruments.

⚠ WARNING

The operator should not touch patient and the input/output interface of the instrument simultaneously. This may cause electric shock

	Name	Function
1	Patient cable connector	Connects the patient cable.

Rear View



⚠ WARNING

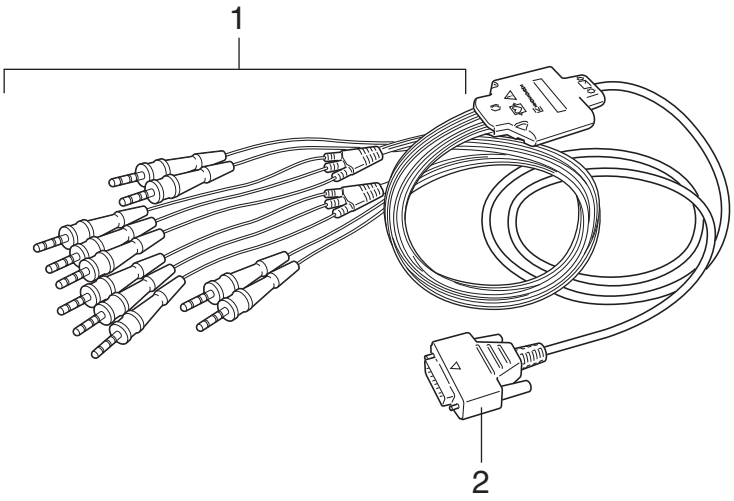
Connect only the specified instrument to the electrocardiograph and follow the specified procedure. Failure to follow this warning may result in electrical shock or injury to the patient and operator, and cause fire or instrument malfunction.

⚠ WARNING

Install non-medical instruments which are connected to the electrocardiograph outside the patient environment (IEC 60601-1). If they are installed inside the patient environment, the patient or operator may receive electrical shock or injury. For installation, contact your Nihon Kohden representative.

	Name	Function
1	LAN port	Connects a network cable.
2	USB connector	Connects a USB bar code reader, a magnetic card reader or a USB flash disk.
3	AC adapter socket	To supply DC power for electrocardiograph, connects the AC adapter.
4	Equipotential grounding termial	Connect to an external equipotential grounding system by an equipotential grounding conductor.

Patient Cable



	Name	Function
1	Lead Wires	Connects to chest or limb electrodes.
2	Connector	Connects the patient cable to the electrocardiograph.

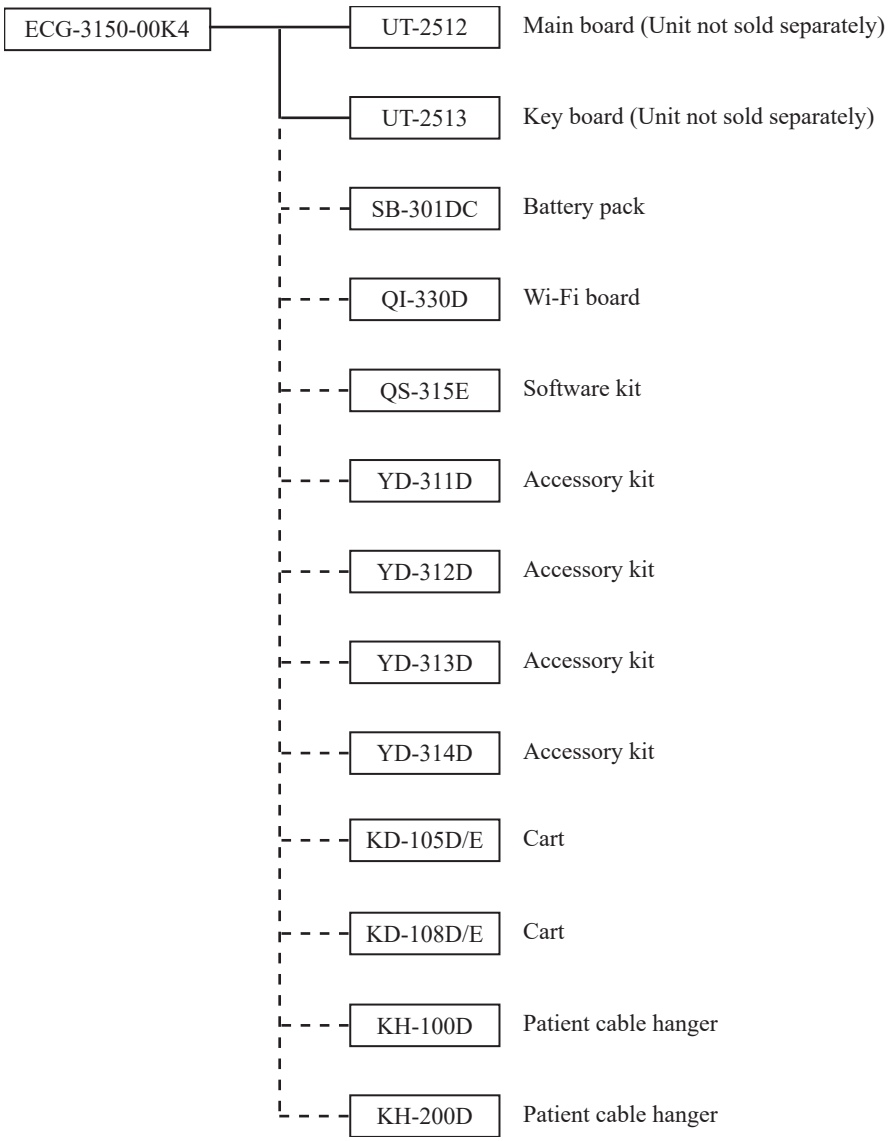
NOTE: The applied part includes the electrodes and those parts of the patient cable and lead wires to physically contact the PATIENT in NORMAL USE.

Defibrillation-proof function

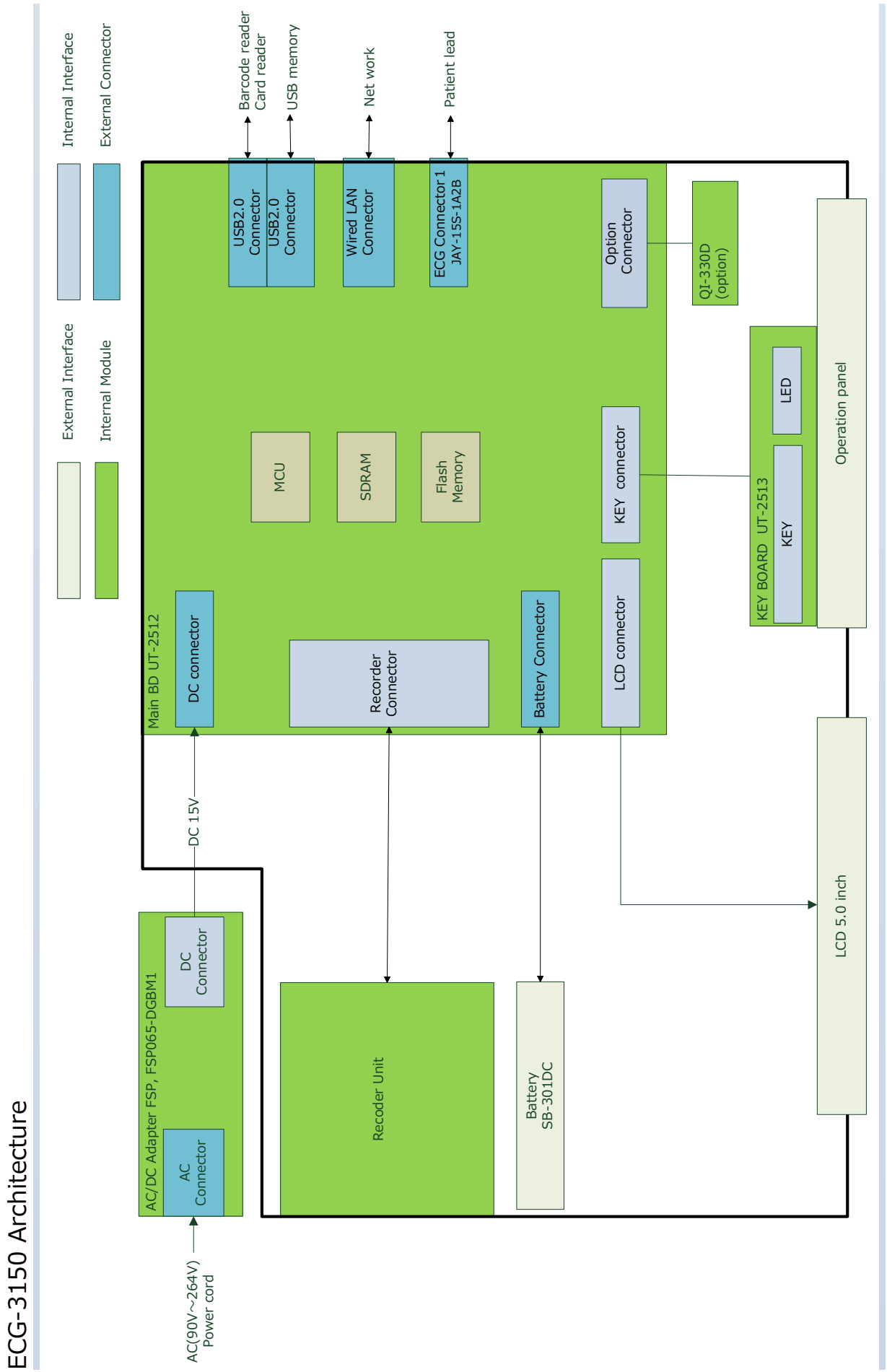
Patient cable: BA-901D / BJ-901D / BJ-902D / BJ-903D / BJ-961D / BJ-962D are in compliance with IEC 60601-2-25 standard. Waveforms and electrode recovery time are within 5 seconds.

Composition

ECG-3150-00K4



Circuit Diagram



Outline of Operation

Main Board

The main board consists of the following components.

CPU: I.MX6UL

RAM: 128 MB

Input unit:

- R/L/F/RF/C1 to C6 (10 channel analog signal) is input.
- Converts inputs to digital signal of 8000 samples/second by A/D converter.

ECG data processing unit:

- Processes input signal at 500 samples/second (1.25 μV/LSB).
- Processes hum filter, EMG filter and drift filter.
- Motor control unit
- Thermal head control unit
- USB, WiFi, LAN control unit
- LCD control unit

Key Board

The key board controls LED blinking in the LED controller and sends information of the keys to the main board.

Power

When the **POWER** key is pressed, the software controls power off to prevent turning power off during data writing.

If a problem occurs in the system, all the LEDs light and the keys do not work. Press and hold the **POWER** key for 10 seconds to turn the power off.

NOTE
- Normally do not press and hold the **POWER** key for 10 seconds.
- Pressing and holding the **POWER** key for 10 seconds turns the power off even while data is being written. If power is cut off while data is being written, the file may be damaged and the electrocardiograph might not operate.

2 Troubleshooting

How to Troubleshoot

This section explains how to locate, identify and solve a problem in the instrument. The troubleshooting tables in this section are divided into general problems and error messages.

How to Troubleshoot

1. Determine which troubleshooting table to use.
2. In the “Problem” column, find the trouble item that matches the problem or error message.
3. Do the first action recommended in the “Action” column.
4. If the problem is not solved, do the next action recommended in the “Action” column. (If this does not solve the problem, do the next recommended sections.)
5. If none of the actions solve the problem, contact your Nihon Kohden distributor or representative.

Check Points for the Instability of Waveforms

When there come the instable waveforms, the reasons may be the problems of electrocardiograph itself, including the input device, or the conditions of electrodes and the examining room. To distinguish the reasons is of great importance.

The check points are as follows.

- What are the specific conditions? What are the period and size of the waveforms?
- When did the instability of waveforms take place?
- When did this product make a delivery?
- What's the serial number of this product?
- What was the product you ever use before this product was introduced?
- Which types are the electrodes, the electrode cream and the patient cable used?
- Is the contiditon related to the induction or the channel?
- How often did this electrocardiograph use in one day?
- How often did this condition take place?
- What's the temperature and humidity of the place that the product was used in?
- Does the condition occur more easily in the morning or after a long placement?
- Does the frequency of occurrence differ as the time period changes?
- Is the product used always in one place?
- Are there any commons among the conditions, such as ages and the disease durations of the patients?
- Were there some new imported things when the conditions began to occur?
- Are there some parts newly replaced?
- Are there some curtains used around the carpet or the bed?
- How are the AC power cord and the earth conductor disassembled?
- What's it going to do when the condition occur?
- How often does the disposable electrodes and the pads change when they are used?
- What is the condition that the filter always used in?
- How are the electrodes cleaned?
- Does the error message or abnormal information often occur without the electrodes?
- What's the version number of the software?

Operation

Problem	Possible Cause/Criteria	Action
The POWER LED lights but there is no display or backlight on the LCD screen.	Faulty connections of connectors.	Replace the electrocardiograph.
	Faulty LCD unit.	
The instrument does not operate during AC power operation.	Damaged power cord.	Replace the power cord.
	Damaged AC adapter.	Replace the AC adapter.
	Faulty connections of connectors.	Check the connections of AC adapter.
	Faulty eletrocardiograph.	Replace the electrocardiograph.
The instrument does not operate on battery power.	The battery is not charged.	Charge the battery.
	Damaged battery.	Replace the battery.
	Damaged battery huse.	Replace the battery.
	Other problems.	Replace the electrocardiograph.
The instrument does not operate when the **START**/**STOP** key is pressed.	Jammed paper magazine.	Clean the paper magazine.
	Faulty electrocardiograph.	Replace the electrocardiograph.
The power does not turn off.	The electrocardiograph is affected by static electricity.	Press the **POWER** key for 10 seconds to turn the power off.
Only certain electrode lead waveforms are displayed on the screen or noise appears on the waveform.	Faulty connections of the electrodes or cables.	Clean the electrodes or cables. And check the connections of connector.
	Faulty cables.	Replace the cables.
	Faulty electrocardiograph.	Replace the electrocardiograph.
Vertical and horizontal strips appear on the LCD screen at constant intervals.	Faulty connection of LCD connector.	Check the connection of LCD connector.
	Faulty electrocardiograph.	Replace the electrocardiograph.
No sound	Faulty electrocardiograph.	Replace the electrocardiograph.

Recording

Problem	Possible Cause/Criteria	Action
Sometimes the recorder does not print and blank recording paper is fed from the recorder.	The input protection circuit which protects the thermal head from strong noise, such as hum, is rejecting noisy waveforms.	Check the electrode attachment to the patient, and if necessary, re-position the electrodes so that a good ECG waveform is displayed.
The recording paper tracks zigzag or to one side.	Dirty thermal head.	Clean the thermal head.
	The recording paper is not properly set in the instrument.	Make sure that recording paper is aligned with the lower recording paper guide.
	Faulty electrocardiograph.	Replace the electrocardiograph.

3 Maintenance

Periodic Replacement Schedule

To maintain the performance of the electrocardiograph, the following parts must be periodically replaced by qualified service personnel.

Battery pack **1 year**

The battery pack deteriorates with the use or time. Replace the battery with a new one if the operation time is less than 30 minutes after 3 hours charging.

NOTE: Charge the battery pack every six months when placed it for more than half a year.

Platen Roller **50 km recording**

When the platen roller wears out , the recording speed will be slow and may be unstable due to skid.

For inspection and replacement of the above parts, consult Nihon Kohden or its agents.

Cleaning the Parts

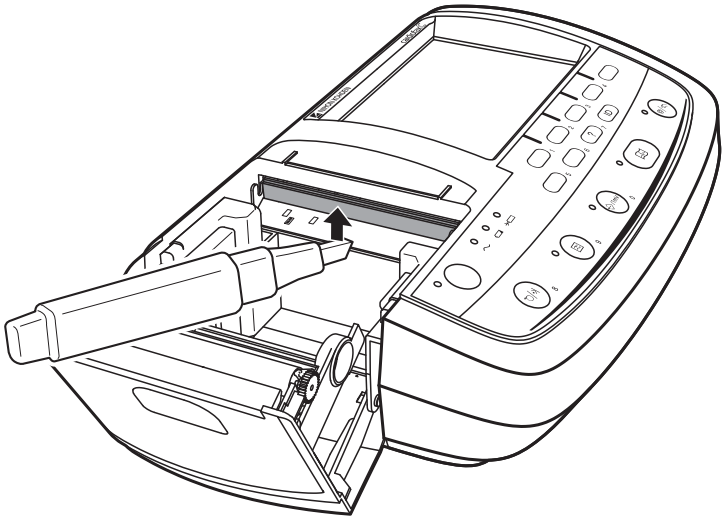
Cleaning the Thermal Head

⚠ CAUTION

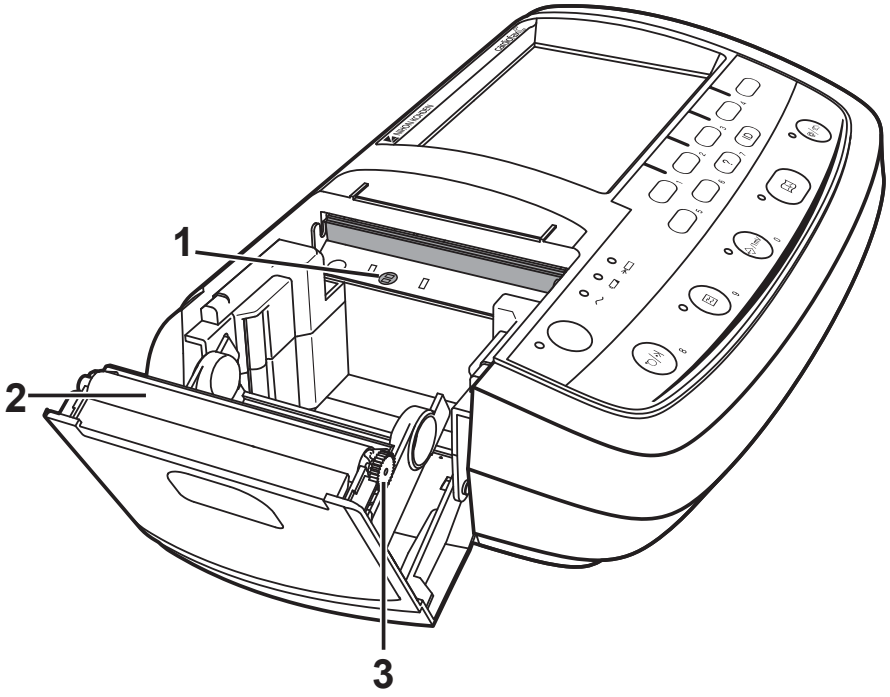
- Do not clean the thermal head right after recording because the head is still hot.
- Only clean the head with the provided thermal head cleaner pen. Otherwise the thermal head may be damaged.

To protect the thermal head from abrasion or damage and assure optimum performance and long service life, clean the surface of the head with the provided thermal head cleaning pen after every 10 sets of recording paper.

1. Turn off the electrocardiograph before cleaning the thermal head.
2. Push the paper magazine release button and open the paper magazine.
3. Clean the gray colored part of the thermal head with the thermal head cleaner pen.



Cleaning the Sensor, Paper Roller and Wheel Gear



1 Cleaning the Sensor

If the sensor is dirty, clean the sensor surfaces with a cotton swab moistened with alcohol.

2 Cleaning the Paper Roller

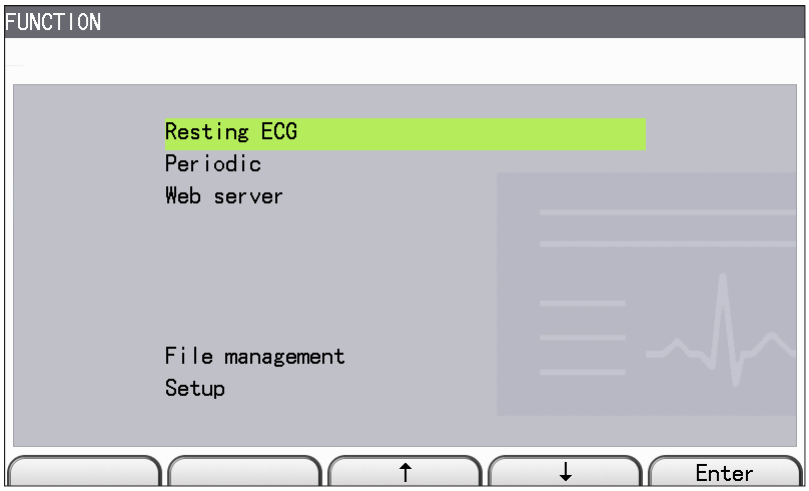
If the paper roller is dirty, clean the paper roller surface with gauze moistened with alcohol.

3 Cleaning the Wheel Gear

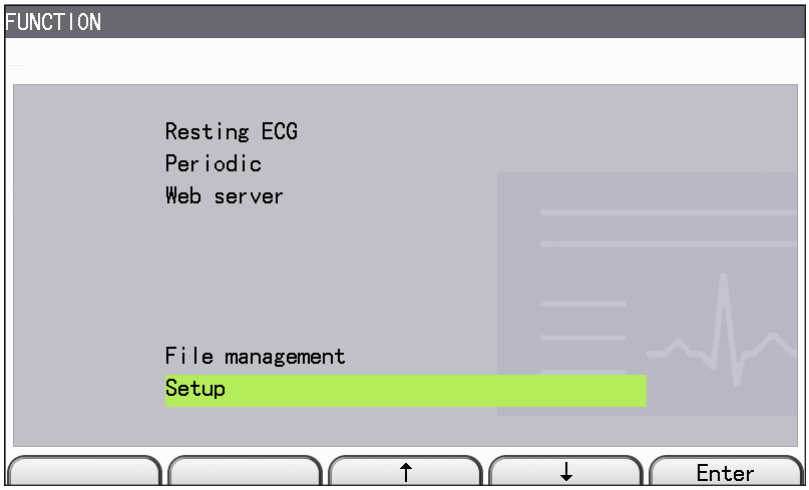
If the wheel gear is dirty, clean the wheel gear surface with a cotton swab moistened with alcohol.

Setting the Date and Time

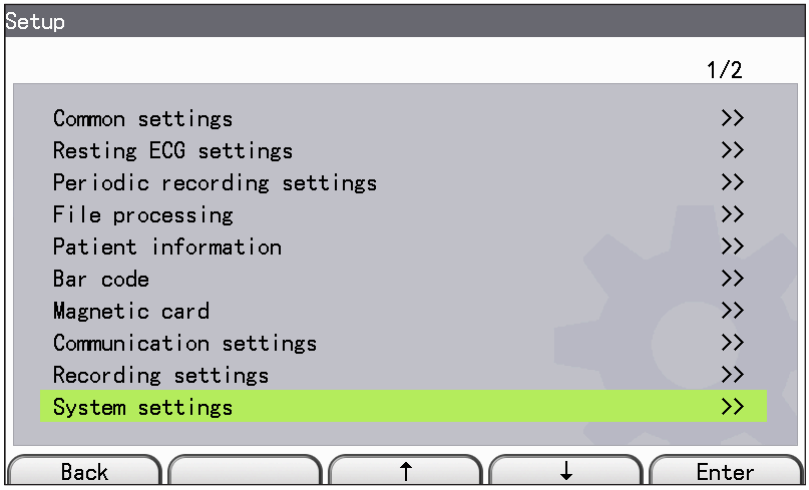
1 Press the **FUNCTION** key to display the <Main Menu> screen.



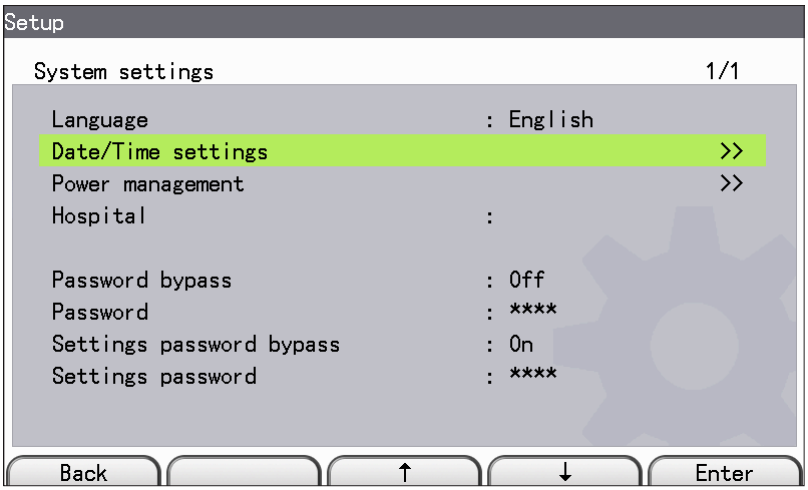
2 Press the [↑] or [↓] function key to select <Setup> and then press the [Enter] function key.



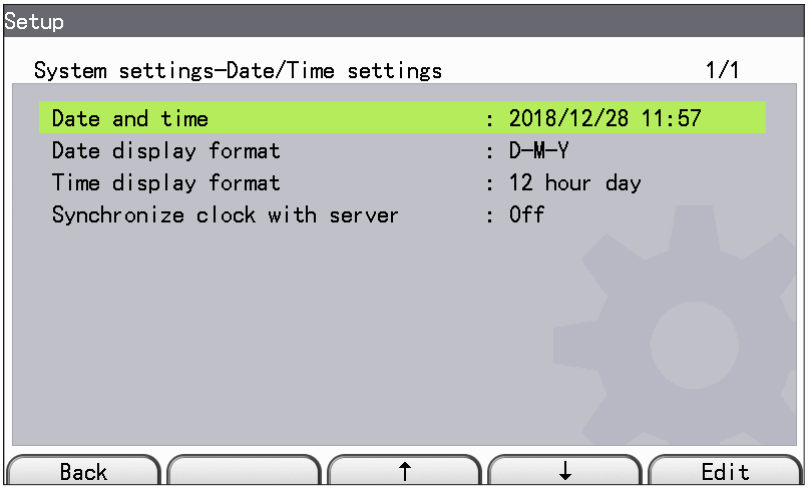
3 Press the [↑] or [↓] function key to select “System settings” on the <Setup> screen and then press the [Enter] function key.



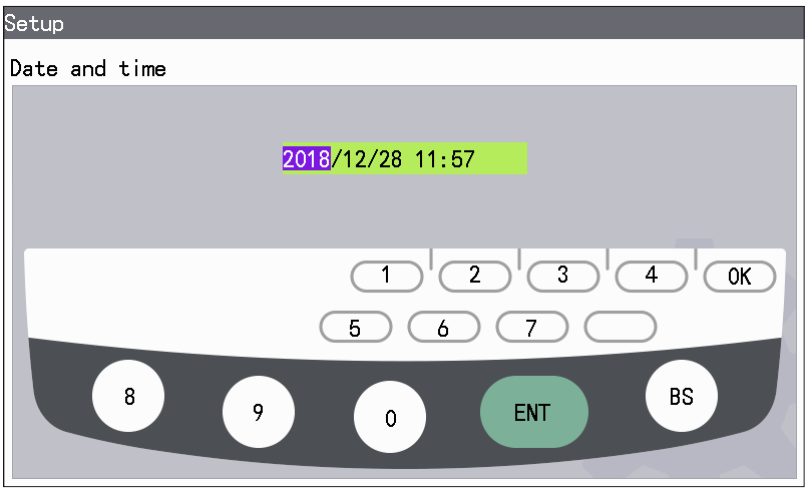
4 Press the [↑] or [↓] function key to select <Date/Time settings>. Press the [Enter] function key.



5 Press the [Edit] funtion key to enter the current date and time according to the format displayed.



6 Press the digit funtion keys to enter the current date and time. After entering them, press the [ENT] function key to go back to the Setup screen.

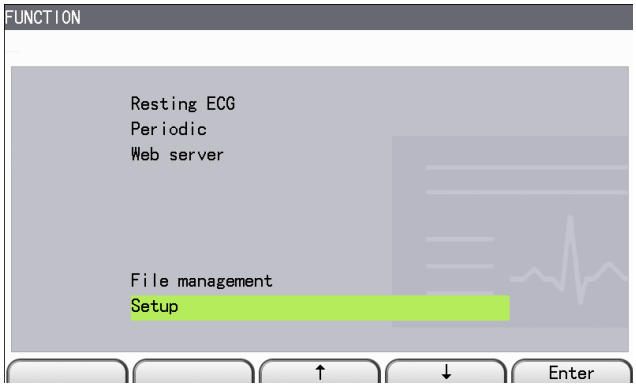


Saving the Error Messages

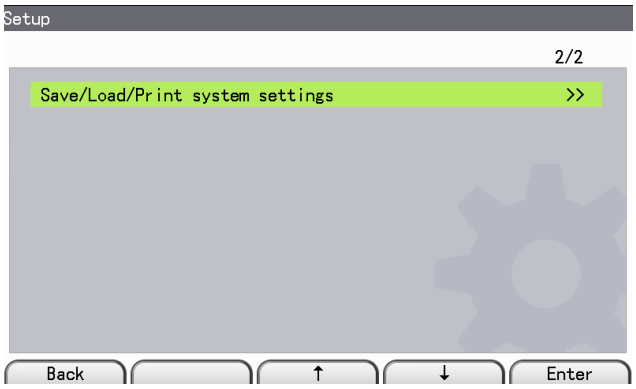
When there comes an error, the error messages can be saved into the USB flash disk. The save methods of error messages are as follows.

1 Press the **FUNCTION** key on the panel to display the <Main Menu> screen.

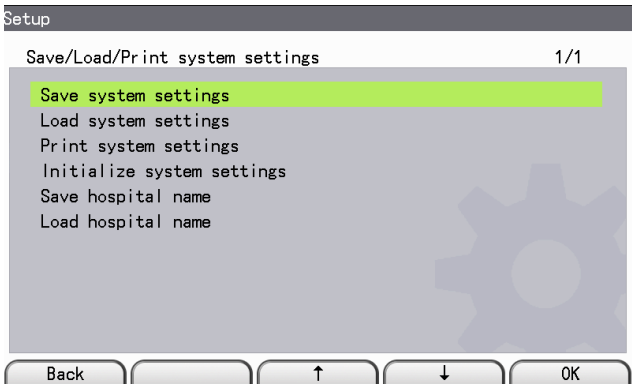
2 Select <Setup> and then press the [Enter] function key.



3 Press the [↑] or [↓] function key to turn to the second page and select “Save/Load/Print system settings” on the <Setup> screen, then press the [Enter] function key.



4 Select “Save system settings” and then press the [OK] key to save both the system settings and error messages.



Then the system settings and the error messages will be saved to the USB flash disk at the same time.

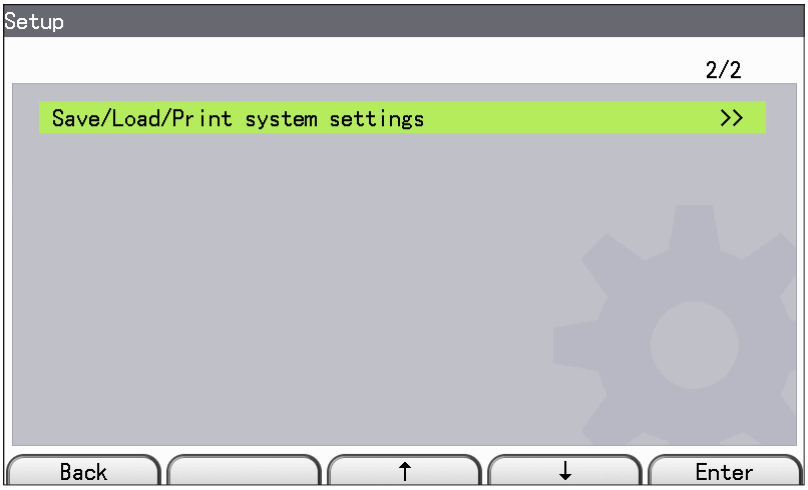
Saving the System Settings

You can save all system settings to a USB flash disk. Insert the USB flash disk into the USB connector of the electrocardiograph before saving the system settings.

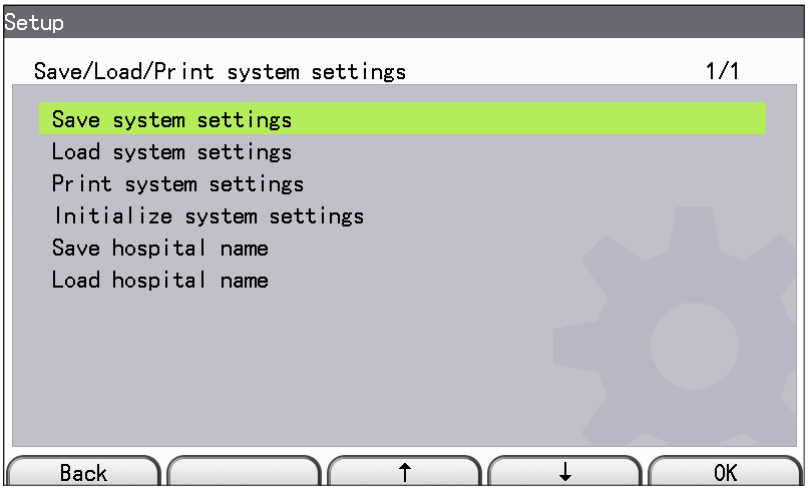
1 Press the **FUNCTION** key to display the <Main Menu> screen.

2 Press **8** to select <Setup>. Then the <Setup> screen is displayed.

3 Press the [↑] or [↓] function key to turn to the second page and select <Save/Load/Print system settings> on the <Setup> screen. Press the [Enter] function key.



4 Select <Save system settings>, and press the [OK] function key. The “Save completed” message will be displayed, which indicates the completion of saving.



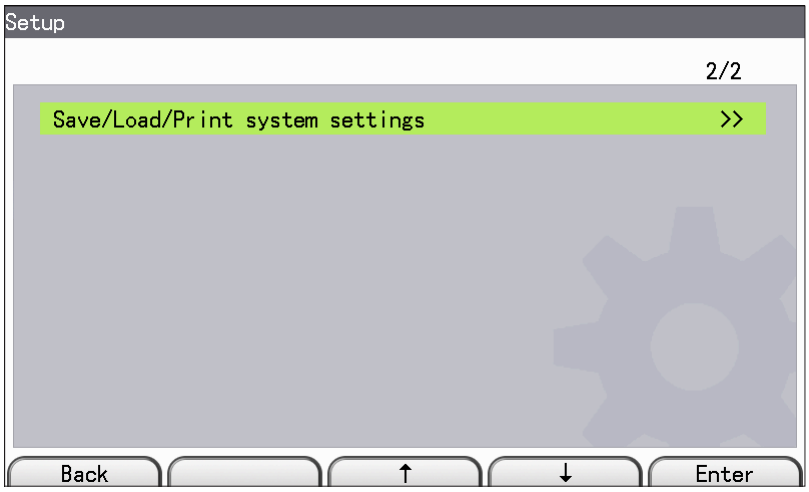
Loading the System Settings

You can load previously saved system settings from the USB flash disk.

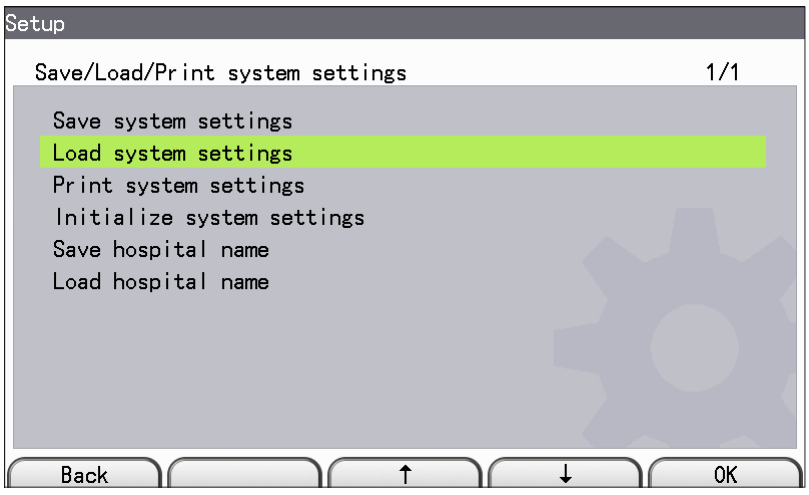
Insert the USB flash disk in the USB connector on the rear panel of the electrocardiograph before loading the system settings.

NOTE: The terminal number and IP address are not loaded.

1. Press the **FUNCTION** key to display the <Main Menu> screen.
2. Press **8** to select "Setup". The <Setup> screen is displayed.
3. Press the [↑] or [↓] function key to select the <Save/Load/Print system settings> on the <Setup> screen and press the [Enter] function key.



4. Select <Load system settings>, and press the [OK] function key. The "Load completed" message will be displayed,, which indicates the completion of loading.



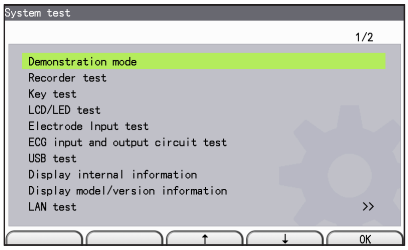
System Test

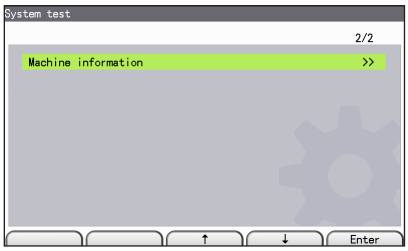
You can check the system with the system test functions.

Displaying the System Test Screen

There are two modes for the <System test> screen: user mode and service mode.

User Mode

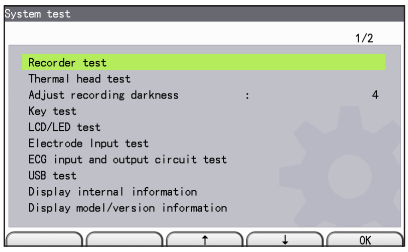


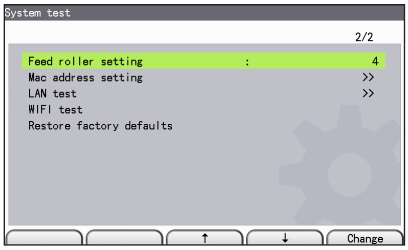


The user mode checks the condition of the electrocardiograph. To display the user mode <System test> screen, press the **POWER** key while pressing the **FEED/ MARK** key. You can check the items below.

- Demonstration mode
- Recorder test
- Key test
- LCD/LED test
- Electrode Input test
- ECG input and output circuit test
- USB test
- Display internal information
- Display model/version information
- LAN Test
- Machine information

Service Mode





The service mode is used for repairing the electrocardiograph and changing the parts. To display the service mode <System test> screen, press the **POWER** key while pressing the **FEED/MARK** key and **AUTO/MANUAL** key. The following items are available.

- Recorder test
- Thermal head test
- Adjust recording darkness
- Key test
- LCD/LED test
- Electrode Input test
- ECG input and output circuit test
- USB test
- Display internal information
- Display model/version information
- Feed roller setting
- Mac address setting
- LAN test
- WIFI test

- Restore factory defaults

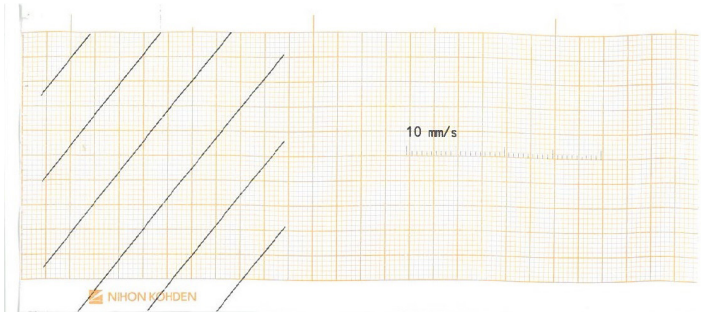
Demonstration Mode

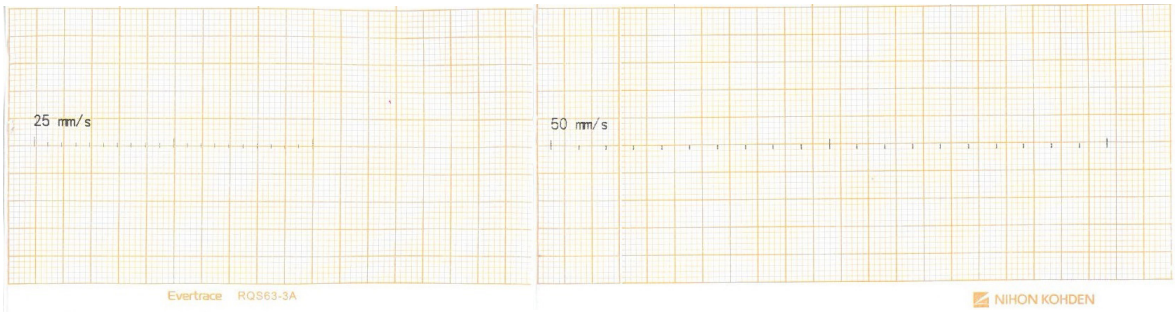
This item displays the demonstration waveform. Select <Demonstration mode> and press the [OK] function key.

Recorder Test

This item checks the recorder function. Select <Recorder test> and press the [OK] function key. This test prints the following figures:

- Diagonal line
- Thermal head check pattern
- Paper speed scale
- Paper mark detection mark





Item	Check	Possible causes and countermeasures
Diagonal line	Check that there are no missing points in the diagonal lines that are recorded.	If there is a problem with the thermal head, the points that are missing will always appear in the same place(s). If some foreign matter is on the thermal head, use the cleaner pen to remove it. If cleaning the head does not improve recording, the thermal head is faulty, so replace the electrocardiograph.
Thermal head check pattern	Check that the printing of the grid is uniform.	If the unit fails to print or the printing is abnormal, the main board may be faulty.
Paper speed scale	Check whether the unit is maintaining a precise feed speed.	• Check that the thermal head is installed properly. • Check for missing gears, warping and or improper installation. • Check whether the driving part gets loose or damaged. • Check for looseness or damage to the drive parts. • Replace the electrocradiograph.

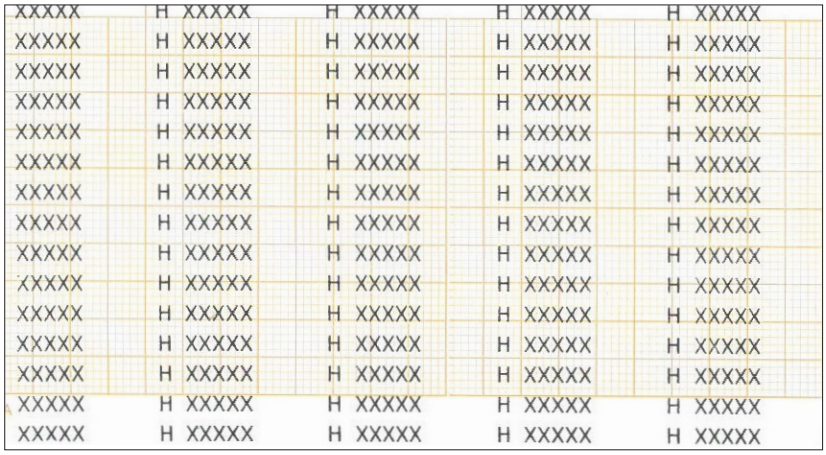
Thermal Head Test

This item checks the thermal head contact.

1 Select the “Thermal head test” on the <System test> screen and press the [OK] function key.

The recorder prints a continuous series of H’s and X’s.

2 To stop the test, press the [Back] function key.



Check	Possible causes and countermeasures
Check that the recorded letters are uniform and clear. In particular, look for any unevenness or smudging in the vertical parts of the letter H. When recording for 1 m or more, check for any meandering or slanting.	Adjust the print level. Problem with connector contacts. Replace the electrocradiograph. Problem with the installation of parts of the recorder.

Adjust Recording Darkness

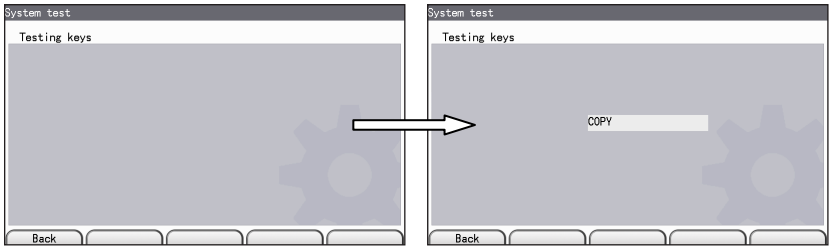
Refer to *Adjusting Recording Darkness* later in this section.

Key Test

This item checks the functions of the keys.

1 Select <Key test> and press the [OK] function key to start the test.

Press any key other than the **POWER** key for test. The name of the pressed key is shown on the screen.



2 Press the [Back] function key to exit from test.

Check	Possible causes and countermeasures
Check and make sure that the name of the pressed key is displayed correctly on the screen.	Replace the electrocradiograph.

LCD/LED Test

This item checks the LCDs and LEDs.

Select "LCD/LED test" and press the [OK] function key or the **START/STOP** key to start the test. In the LED test, the LEDs light up one by one until all are lit up and then they go out; then it proceeds to the LCD test. In the LCD test, the screen lights up in the order red – green – blue.

During the LED test, the battery charge lamp only lights if the battery is charged. The POWER lamp is lit continuously while the power is on. The AC power lamp is lit when power is taken from AC power. The AC power lamp is directly controlled by hardware, so this test cannot check it.

LED Test

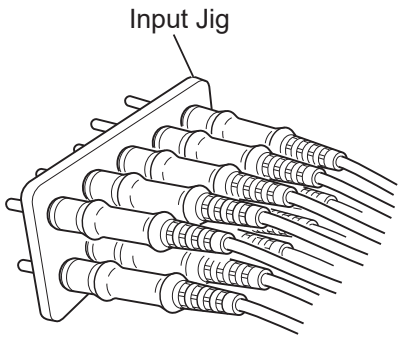
Check	Possible causes and countermeasures
The LEDs light up one by one in order.	• Check the connections of the connector. • Replace the electrocradiograph.

LCD Test

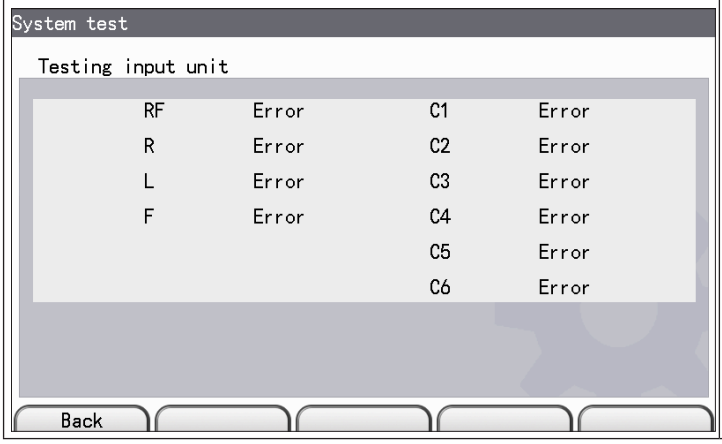
Check	Possible causes and countermeasures
During the LCD test, check that nothing is abnormal with the LCD.	• Check the connections of the connector. • Replace the electrocradiograph.

Electrode Input Test

This item checks the ECG input circuit by using the electrode leads and the input check jig.



1. Connect the electrode lead to the electrocardiograph.
2. Insert the tip of the electrode lead in the input check jig. If it is a clip type induction lead, pinch the edge of the input check jig.
3. Select “Electrode Input test” and press the [OK] function key to start the test.

Check	Possible causes and countermeasures
Check that when you remove an electrode, the display for the removed electrode automatically changes to “Error”. Be sure to remove the electrodes one by one. 	Replace the electrodes.

ECG Input and Output Circuit Test

This item checks the sensitivity, accuracy and operation of the ECG input circuit (amp) by using the electrode leads and the input check jig.

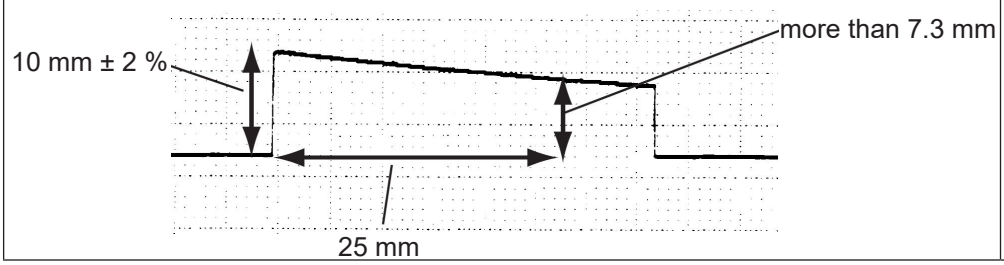
1 Connect the electrode leads to the electrocardiograph.

2 Insert the tips of all the electrode leads into the input check jig. If they are clip type electrode leads, pinch the edge of the testing tool.

3 Select “ECG input and output circuit test” and press the [OK] function key to start the test.

The electrocardiograph sends a standard signal from the beginning of the ECG input circuit and prints the waveform.

When all the waveforms are printed, the test is finished and the <System test> screen is displayed. To cancel the test, press the [Back] function key.

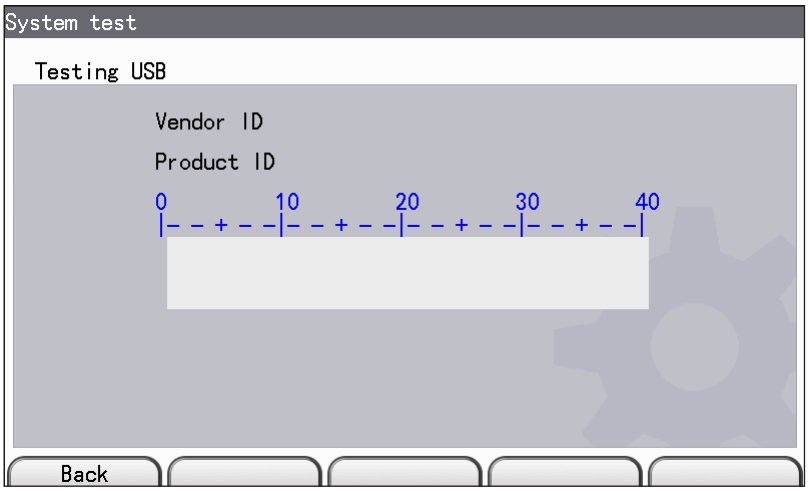
Check	Possible causes and countermeasures
Amplitude when CAL waveform is raised: 10 mm ± 2 % Amplitude of point which is 25 mm from the rising point of the CAL waveform: more than 7.3 mm  	Replace the electrocradiograph.

USB Test

This item checks the USB function.

1 Connect the USB device to one of the USB connectors of the electrocardiograph.

2 Select <USB test> on the <System test> screen and press the [OK] function key. The 4 digits of Vender ID and Product ID are displayed.



3 Press the [Back] function key to return to the <System test> screen.

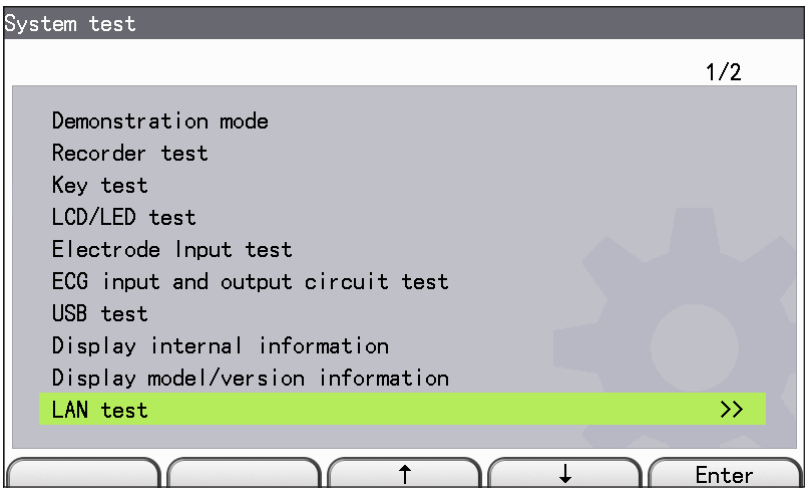
To cancel the test, press the [Back] function key. The <System test> screen is displayed.

When you connect an unspecified USB device, the 4 digits of Vender ID and Product ID are not displayed. Use a specified USB device and test again.

LAN Test

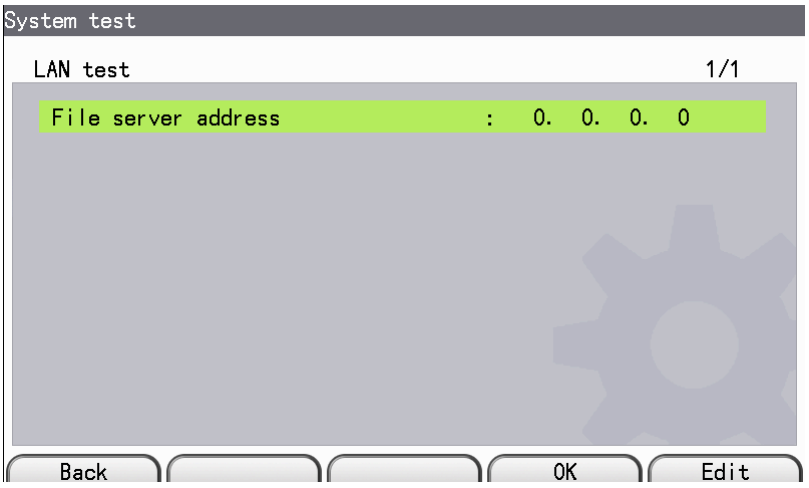
1 Use wire to connect electrocardiograph to server.

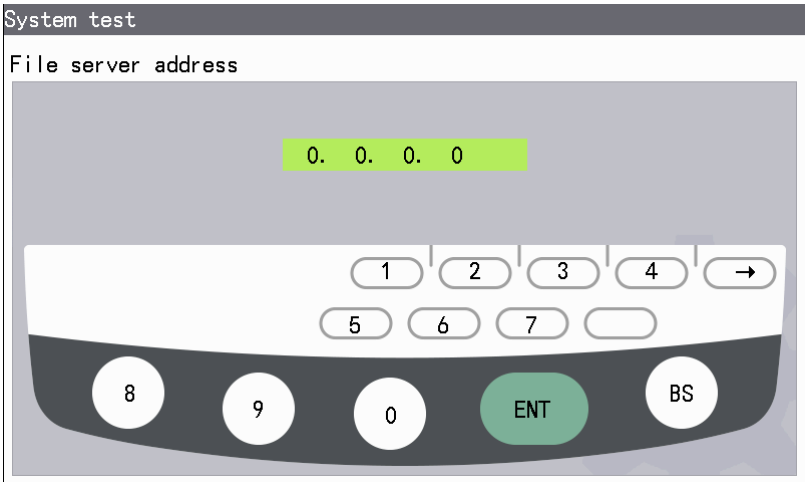
2 Select <LAN Test> on the <System test> screen and press the [Enter] function key.



3 Press the [Edit] function key. Enter the file server address and press the [OK] function key.

The test result will be displayed.





4 Press the [Back] function key to go back to the <System test> screen.

Display Internal Information

Refer to *Displaying the Internal Information* later in this section.

Display Model/Version Information

Refer to *Displaying the Model / Version Information* later in this section.

Feed Roller Setting

Refer to *Setting the Diameter of the Platen Roller* later in this section.

Mac Address Setting

Refer to *Setting the Mac Address* later in this section.

Adjusting Recording Darkness

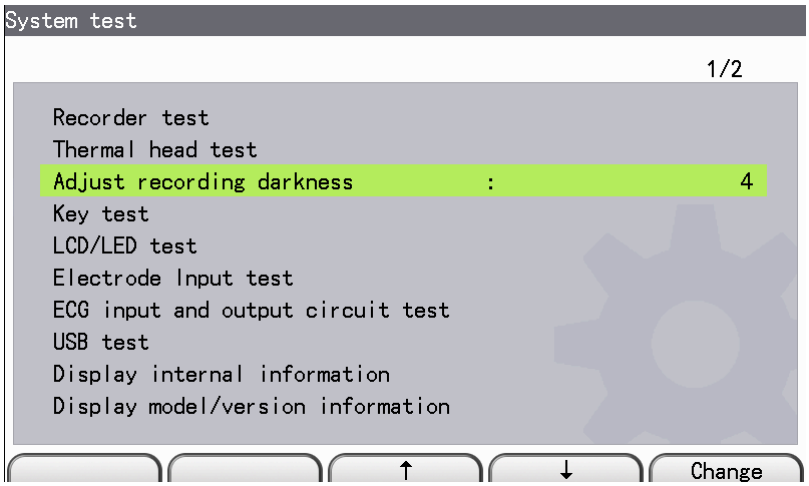
The impedance value of the heat elements of thermal heads is a fixed value that is different for each thermal head. Even if the same amount of energy is applied, the difference in impedance results in a differing print quality. The setting is adjusted in a system test by matching the width of the print pulse applied to the thermal head with the impedance and making the print darkness of each head nearly the same.

NOTE: Always perform this adjustment using AC power.

Procedure for Adjusting the Recording Darkness

1 Display the service mode <System test> screen. Refer to *System Test* in this section.

2 Select <Adjust Recording Darkness> on the <System test> screen.



3 Check the impedance value printed on the label that is attached to the thermal head and press the [Change] function key until the applicable number from 1 to 8 is displayed. This sets the adjusted value of the print level for the thermal head.

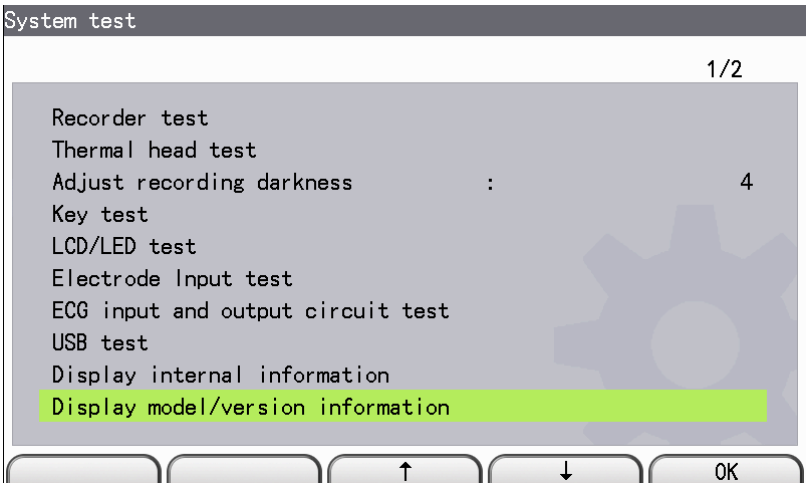
4 Turn off the power to finish the adjustment.

If the print darkness still fails to become uniform, replace the AC adaptor or the electrocardiograph.

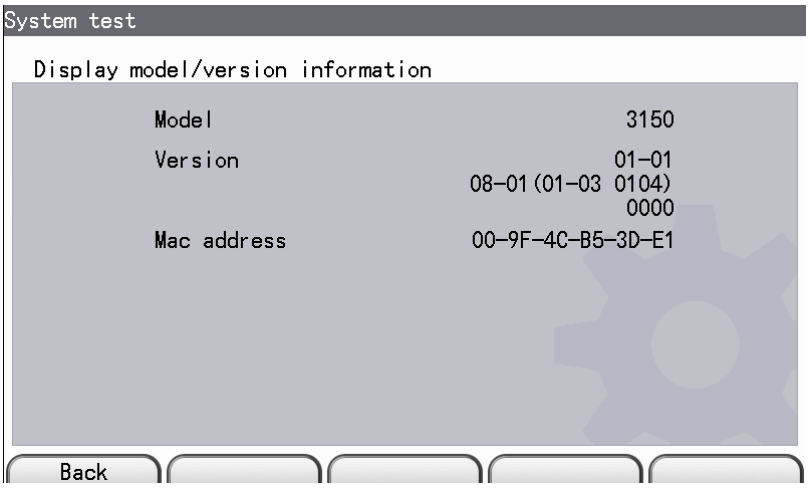
Displaying the Model and Software Version information

1 Display the service mode <System test> screen. Refer to *System Test* in this section.

2 Select “Display model/version information” and press the [OK] fucntion key.



3 The model name and the software version of this electrocardiograph are displayed on the screen.

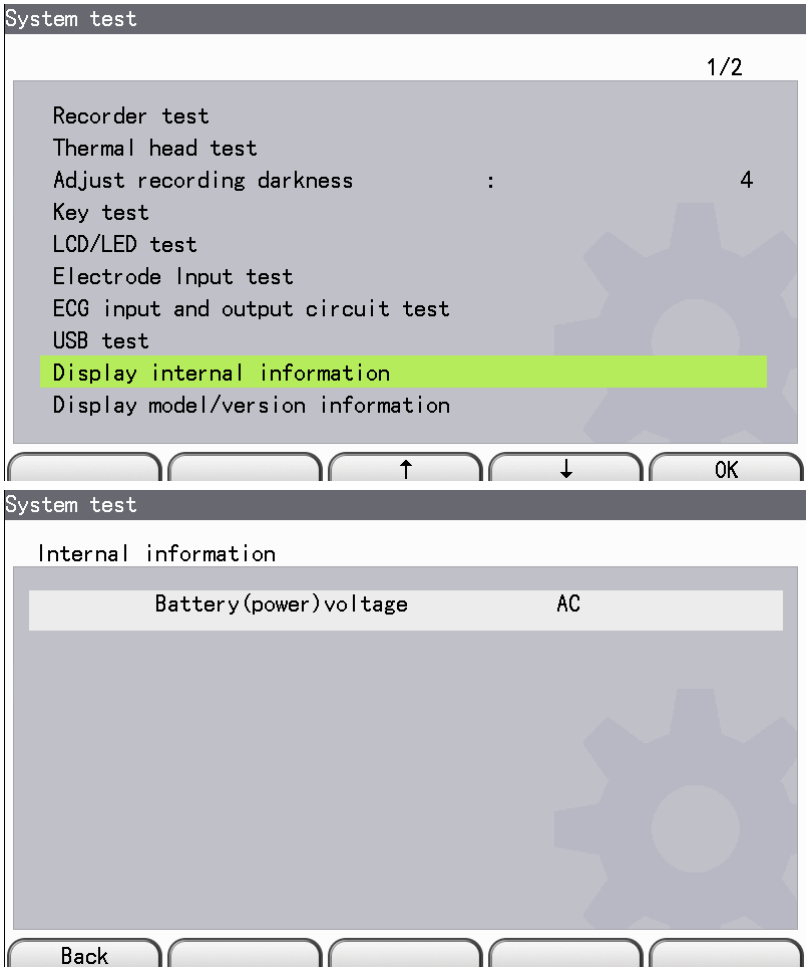


4 Press the [Back] function key to return to the <System test> screen.

Displaying the Internal Voltage

1 Display the service mode <System test> screen. Refer to *System Test* in this section.

2 Select “Display internal information” and press the [OK] function key. The internal information is displayed.



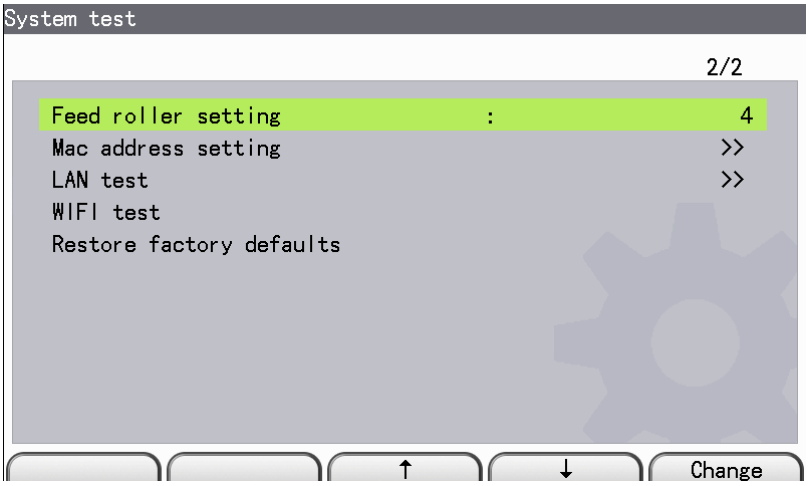
3 Press the [Back] function key. The <System test> screen is displayed.

Setting the Diameter of the Platen Roller

When changing the platen roller, set the diameter of the platen roller on the <System test> screen.

1 Display the service mode <System test> screen. Refer to *System Test* in this section.

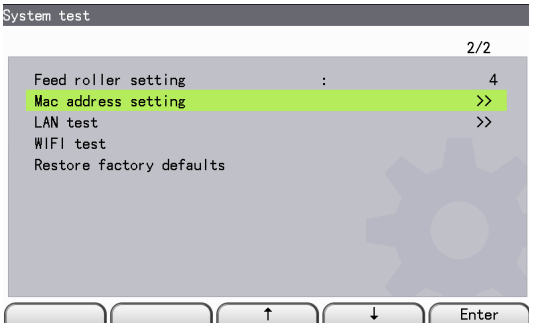
2 Select <Feed roller setting> on the <System test> screen.



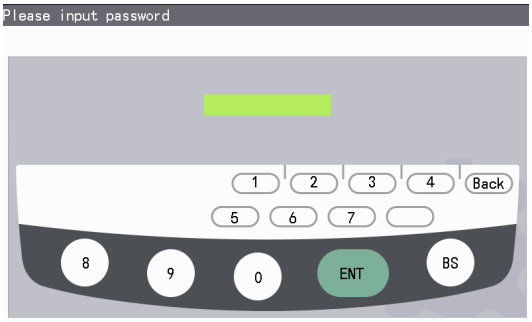
3 Press the [Change] function key. The diameter of the platen roller is set up.

Setting the Mac Address

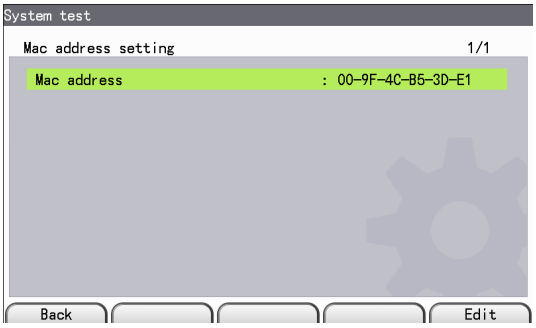
1 Select “Mac address setting” on the second page of <System test> screen and press the [Enter] function key.

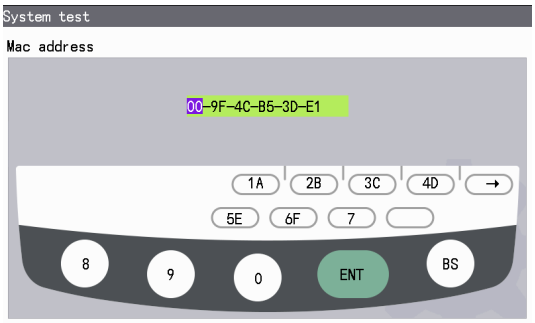


2 Input the password “0506” and press the [OK] function key.



3 Then the Mac address will be showed on the screen. Press the [Edit] funtion key to change the mac address one by one.





4 Press the [Back] function key to go back to the <System test> screen.

Maintenance Check Sheet

The maintenance check sheet is provided at the end of this subsection.

Make a copy of this check sheet before using it. The check sheet contains the check items grouped as follows:

- Overview
- Operation
- LCD
- Recorder Unit
- Safety

Refer to the following lists to check the items.

Overview

Item	Check Procedure	Action
Dirt	Check if the outside of the electrocardiograph and input box is dirty.	If the outside of the electrocardiograph or input box is dirty, clean it with a cotton moistened with warm water, then dry it.
Loose screws	Check if there are any loose screws.	If any screw is loose, tighten it.
Damaged or bent parts	Check if there are any physically damaged or bent parts. This includes the pins on the connector or socket, key switch on the operation panel and power switch.	If any part is damaged or bent, replace the electrocradiograph.
Cable connection	Check if the input box is connected to the electrocardiograph firmly.	If the input box is not connected to the electrocardiograph, connect them firmly.
Battery pack	Check if the battery pack is used over one year.	If it is used over one year, replace it.

Operation

Item	Check Procedure	Action
Electrode detachment detection	Check if an error message appears on the screen when an electrode is detached.	If the error message does not appear, check the input box with the <System test> screen – “Electrode Input test”.
Manual recording	Check if the manual recording is available.	If the manual recording is not available, replace the electrocardiograph.
Automatic recording	Check if the automatic recording is available.	If the automatic recording is not available, replace the electrocardiograph.
LED	Check that all LEDs on the operation panel light when the <System test> screen – “LCD/LED test” is performed.	If any LED does not light, replace the electrocardiograph.
Key on the operation panel	Check the key response with the <System test> screen – “Key test”.	If there is a key which does not respond, replace the electrocardiograph.
USB flash disk	Check if a USB flash disk has no problem with the <System test> screen – “USB test”.	If the information is not displayed, replace the USB flash disk.

LCD

Item	Check Procedure	Action
Display quality	Check the display quality with the <System test> screen – “LCD/LED test”.	If the display quality is low, replace the electrocardiograph.
Color pattern	Check if the color pattern is correct with the <System test> screen – “LCD/LED test”.	If the color pattern is not correct, replace the electrocardiograph.
Backlight	Check backlight function with the <System test> screen – “LCD/LED test”.	If the backlight function is not correct, replace the electrocardiograph.

Recorder Unit

Item	Check Procedure	Action
Dirt	Check if the thermal head is dirty.	If the thermal head is dirty, clean it with a thermal head cleaner pen.
	Check if the paper empty sensor is dirty.	If the paper empty sensor is dirty, clean it with a cotton swab moistened with alcohol.
Magazine	Check if the magazine opens by pushing up the magazine release lever.	If the magazine does not open, check the magazine release lever attachment and correct it.
Paper skew	Check that there is no paper skew (after 100 cm recoding, paper skews less than 0.5 mm per 50 cm).	If paper skews, do the following. • Set the recording paper so that it aligns with recording paper guide correctly. • Clean the thermal head. • Clean the feeding roller. • Readjust the thermal head position.
Paper speed	Check if the paper speed is correct with the <System test> screen – “Recorder test”.	If the paper speed is not correct, do the following. • Clean the paper feeding roller. • Replace the electrocardiograph.
Paper empty detection	Check that the “Check paper or recorder” message appears when there is no recording paper.	If the message does not appear, do the following. • Clean the paper empty sensor. • Replace the electrocardiograph.
Paper mark detection	Check if the paper feeding is correct and stops at the paper mark or do the <System test> screen – “Recorder test”.	If the paper does not stop at the paper mark, clean the mark sensor.
Print intensity	Check if there is any unevenly or incompletely printed part with the <System test> screen – “Recorder test”.	If there is any unevenly or incompletely printed part, do the following. • Clean the thermal head with a thermal head cleaner pen. • Replace the electrocardiograph.
Baseline width	Check if the baseline width is 1 mm or less with the <System test> screen – “Recorder test”.	If the baseline width is more than 1 mm, replace the electrocardiograph.
Missing dots	Check if there are any missing dots with the <System test> screen – “Recorder test”.	If there are any missing dots, do the following. • Clean the thermal head with a thermal head cleaner pen. • Replace the electrocardiograph.

Safety

Item	Check Procedure	Action
Power cord	Check that a 3-prong power cord which has three terminals (hot, neutral and ground) is used.	If the 3-prong power cord is not used, replace it.
Power cord, connection cable and AC adapter	Check if the power cord, connection cable or AC adapter is damaged.	If the power cord connection cable or AC adapter is damaged, replace it.
Equipotential grounding	Check if the cardiograph is grounded to a dedicated equipotential ground terminal in the facility when operating on AC power.	If the cardiograph is not grounded, use the provided ground cable to ground the system to a dedicated equipotential ground terminal.
Protective earth resistance	Check that the protective earth resistance is within 0.1 Ω of the prescribed range.	If the protective earth resistance is out of range, find the cause and reduce it to within range.
Earth leakage current	Check that the earth leakage current is within 500 μA of the prescribed range.	If the earth leakage current is out of range, find the cause and reduce it to within range.
Enclosure leakage current	Check that the enclosure leakage current is within 100 μA of the prescribed range.	If the enclosure leakage current is out of range, find the cause and reduce it to within range.
Patient leakage current	Check that the patient leakage current is within 10 μA of the prescribed range.	If the patient leakage current is out of range, find the cause and reduce it to within range.
Withstand voltage	Check that the electrocardiograph can withstand the following prescribed withstand voltage. - (A-a1): 1,500 V AC for one minute - (B-d): 1,500 V AC for one minute	If the electrocardiograph cannot withstand the prescribed voltage, find the cause and fix it.

Maintenance Check Sheet

Date: _____

Customer: _____

Customer Address: _____

Service Personnel: _____ Service Company: _____

Instrument Name: _____ Instrument Model: _____

Instrument Serial Number: _____ Hardware Version: _____

Software Version: _____

Overview	Instrument is not dirty, damaged or rusty.	Yes ☐	No ☐
	No peeling or tear on the operation panel.	Yes ☐	No ☐
	Power key is not broken.	Yes ☐	No ☐
Input circuit	Patient cable is not dirty and damaged.	Yes ☐	No ☐
	The patient cable is not broken.	Yes ☐	No ☐
	The sensitivities and time constant are correct.	Yes ☐	No ☐
	AC filter and high-cut filter operate correctly.	Yes ☐	No ☐
Screen	Contrast and backlight brightness are correct.	Yes ☐	No ☐
	Battery charge lamp operates correctly.	Yes ☐	No ☐
	Waveform display and screen display are correct.	Yes ☐	No ☐
Power	AC power cord and DC power cord of the AC adapter.		
	are not frayed or damaged.	Yes ☐	No ☐
	Battery is full charged.	Yes ☐	No ☐
Operation	Automatic ECG measurement function is correct.	Yes ☐	No ☐
	Electrode detachment detection function is correct.	Yes ☐	No ☐
	Instrument passes all check items in the <System test> screen.	Yes ☐	No ☐
	QRS synchronization sound and system information sound are correct.	Yes ☐	No ☐
	System settings are correct and are saved correctly.	Yes ☐	No ☐
	Date and time setting are correct.	Yes ☐	No ☐
Safety	No current leakage.		
	(Less than 500 μA between metal part and ground)	Yes ☐	No ☐
	Fuse rating is correct. (AC adapter)	Yes ☐	No ☐
USB and accessories			
	USB flash disk operates correctly.	Yes ☐	No ☐
	Enough accessories.	Yes ☐	No ☐

4 Disassembly and Assembly

Before You Begin

The procedures in this section explain how to remove, replace and install major components in the electrocardiograph.

Warnings, Cautions and Notes

⚠ WARNING

- Removal and replacement of any components in the electrocardiograph should only be done by qualified service personnel.
- To avoid the possibility of injury to yourself or damage to the electrocardiograph, do not install or remove any component while the power is on. When disassembling, make sure that the power is off (The power lamp and standby lamp do not light), the AC power cord is disconnected and the battery pack is removed. There are several high voltage units inside the electrocardiograph: Key board, LCD backlight (LCD display) and main board.

⚠ CAUTION

- To avoid accidental discharge of static electricity which could damage the components of the electrocardiograph, use a grounded wrist strap when installing or removing any component.
- Use only parts recommended by Shanghai Kohden to assure maximum performance from your electrocardiograph.

Required Tools

- Anti-static bench mat
- Wrist ground strap
- Phillips screwdriver (insulated type, for M3 and M4 screws)
- Hexagon socket driver (for 3 mm spacer bolt and nut)
- Torque wrench (for 4 mm hexagon socket head bolt)
- Allen wrench
- Tweezers

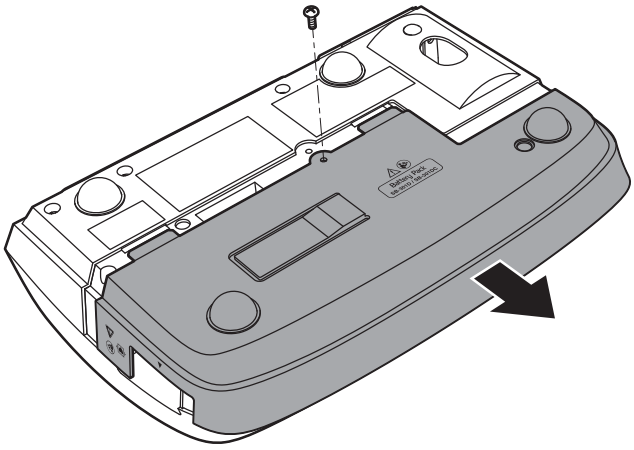
Replacing the Battery Pack

⚠ WARNING

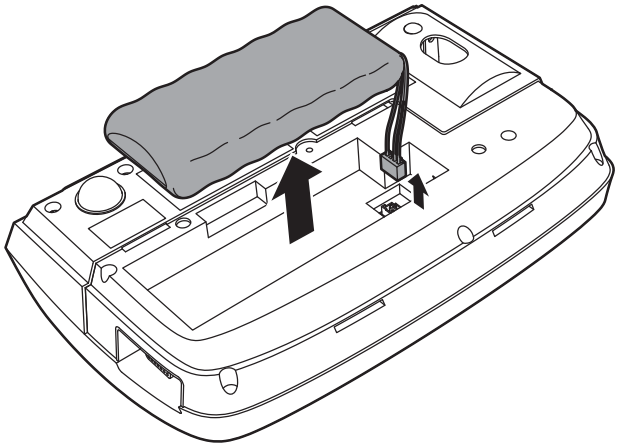
Do not touch the patient while touching any metal part of non-medical electrical equipment or an exposed part when a connector or cover is removed. Failure to follow this warning may cause electrical shock or injury to the patient.

Follow the procedure below to remove the battery pack into the electrocardiograph after use.

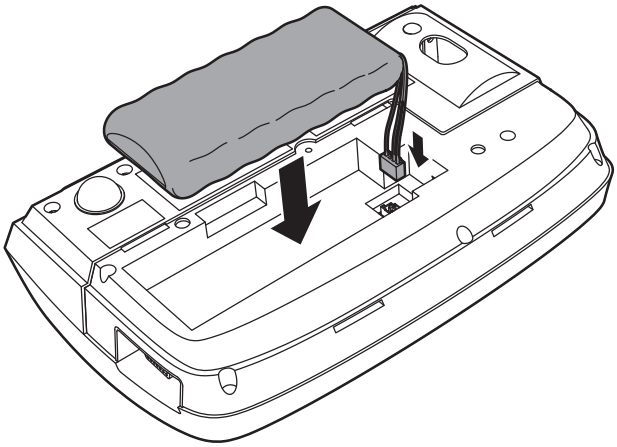
1. Turn the power off. Make sure the power cord is removed from the electrocardiograph.
2. Remove the screw from the battery pack cover and pull off the battery pack cover.



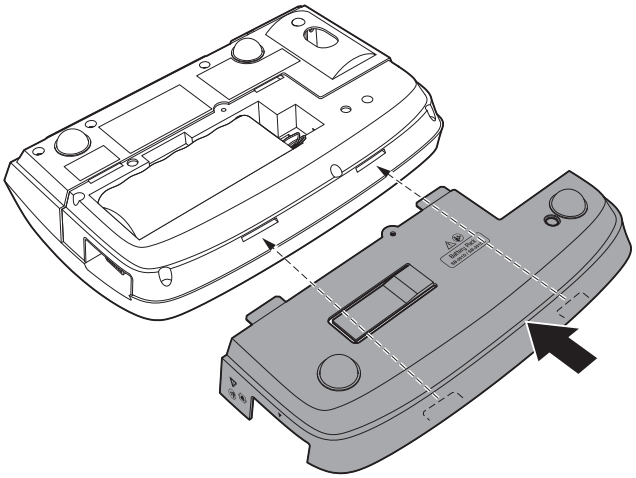
3. Press the lock under the battery pack cable, then remove three battery pack cables with the color of red, blue, and black from the battery pack connector. Remove the battery pack from the battery pack compartment.



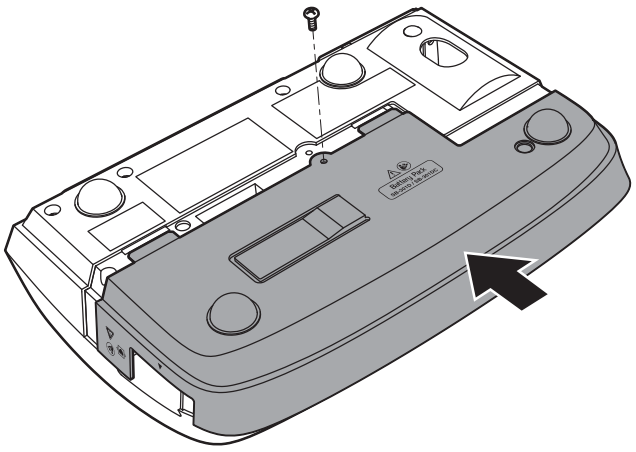
4 Then take out a new battery pack, connect three battery pack cables with the color of red, blue, and black to the battery pack connector. Put the new battery pack into the battery pack compartment.



5 Reattach the battery pack cover.



6 Secure the battery pack cover with the screw.



Assembly the Wi-Fi Module

The Wi-Fi module is an optional accessory which enables network connection through wireless LAN.

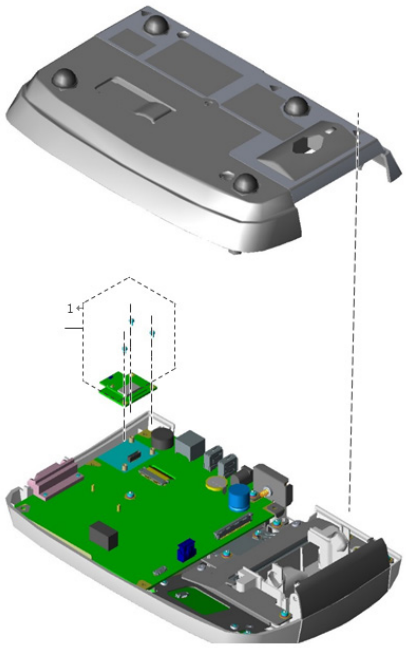
Composition

Description	Q'ty
Wireless LAN Module TEMP	1
Screw 2.6×4	3

Cautions

- The assembly of wireless LAN module should be conducted by service personnel only. Any incorrect operations during assembly would lead to malfunction of the equipment and might cause electrical shock to the operator.
- In order to confirm that the wireless LAN module is installed properly and works appropriately, please carry out the confirmation actions.
- Please follow the instructions of system administrators and specialists to configure the network settings and connect to the network. Incorrect settings and failure of connecting to the network might lead to the cessation of network system and the breakdown of the equipment.

Exploded diagram

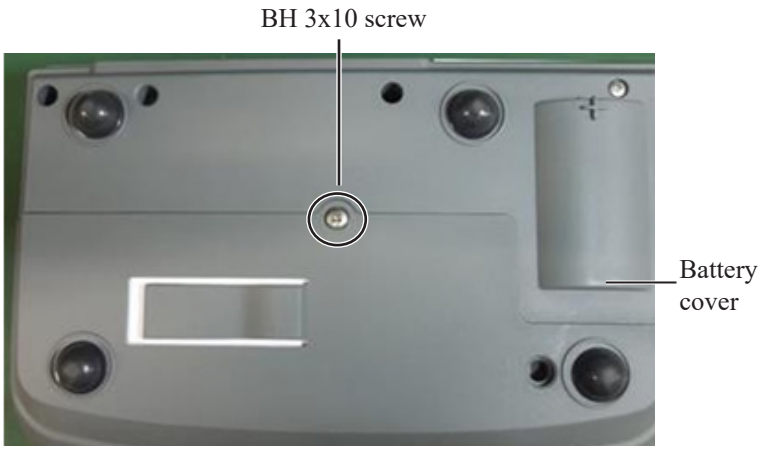


No.	Code No.	Description
1	QI-330D	Wireless LAN module

Assembly instructions

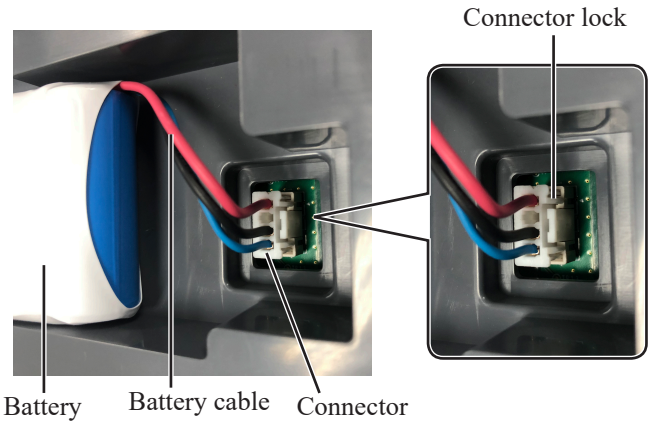
NOTE: Before you start to assemble the wireless LAN module, please stabilize the equipment with cushion or other counterparts.

1 Flip the equipment to its back. Next, remove 1 BH 3x10 screw. Then, take off the battery cover by sliding it in the direction as illustrated.



2 Disconnect the battery cable and then take the battery out.

NOTE: Press the connector lock in the direction as illustrated while removing the connector.



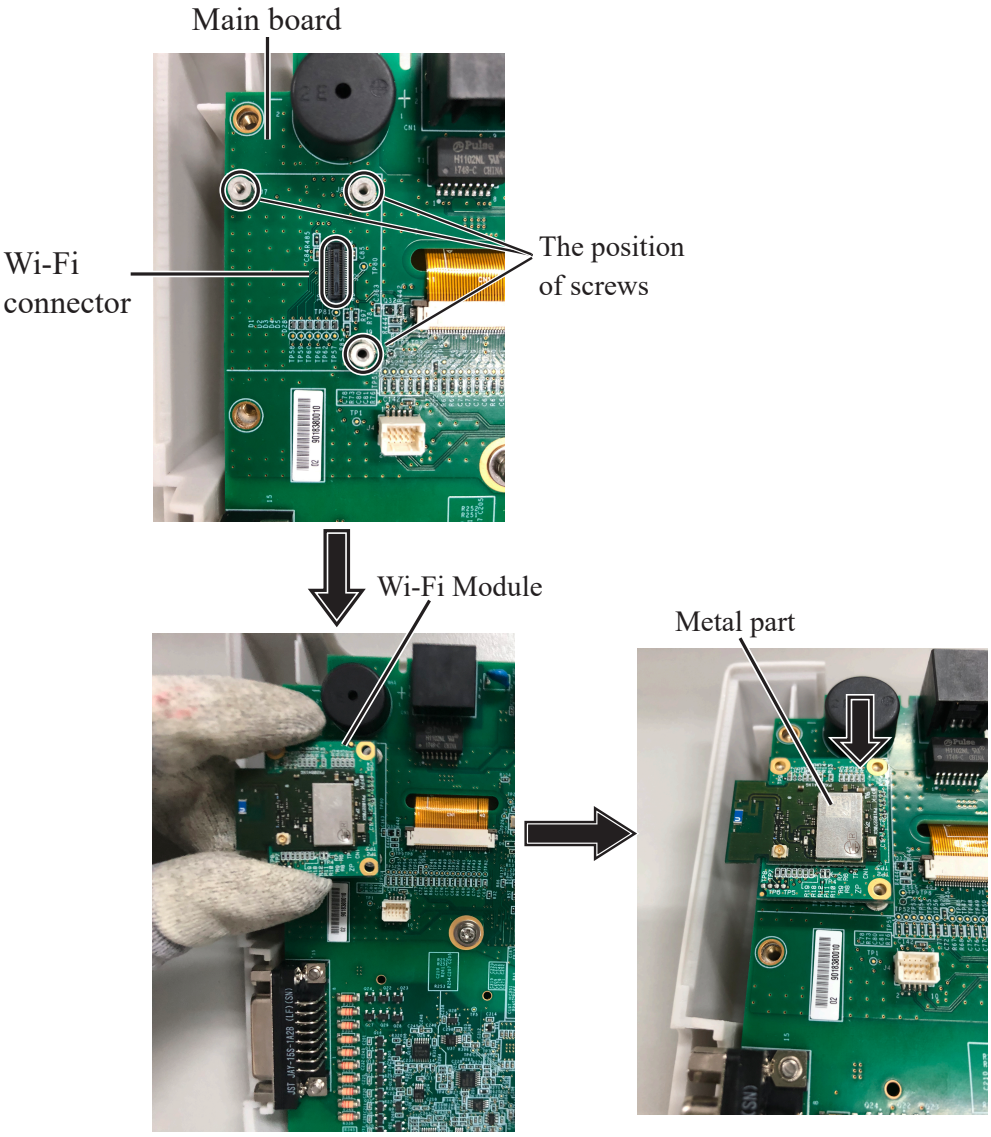
3 Remove the equipotential terminal at the back of the equipment.

NOTE: Please take care of the spring washer and do not lose it.

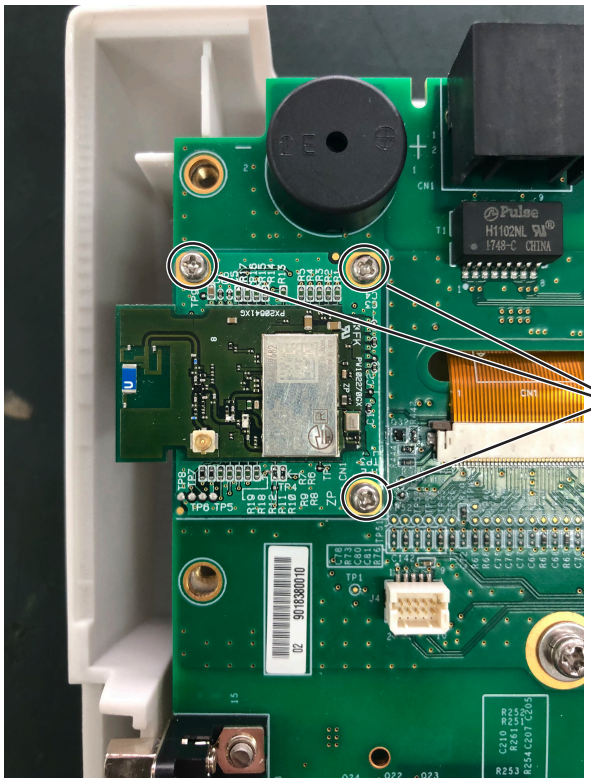
4 Remove eight BH 3x10 screws as illustrated. Then, take off the bottom case.

5 Align the screw holes of the Wi-Fi module with those of the main board and then connect the Wi-Fi module to the Wi-Fi connector of the main board.

NOTE: When connecting the Wi-Fi module, please press the surface of metal part as illustrated to ensure that there will be no clearance between the Wi-Fi module and the main board.



6 Lock the Wi-Fi module with 3 BH 2.6x4 screws.



7 Assemble the bottom case, battery, battery cover and equipotential terminal back to the original positions.

Confirmation actions

1 Press the **FEED/MARK** key, **AUTO/MANUAL** key and **POWER** key at the same time. Then, the system test screen will appear.

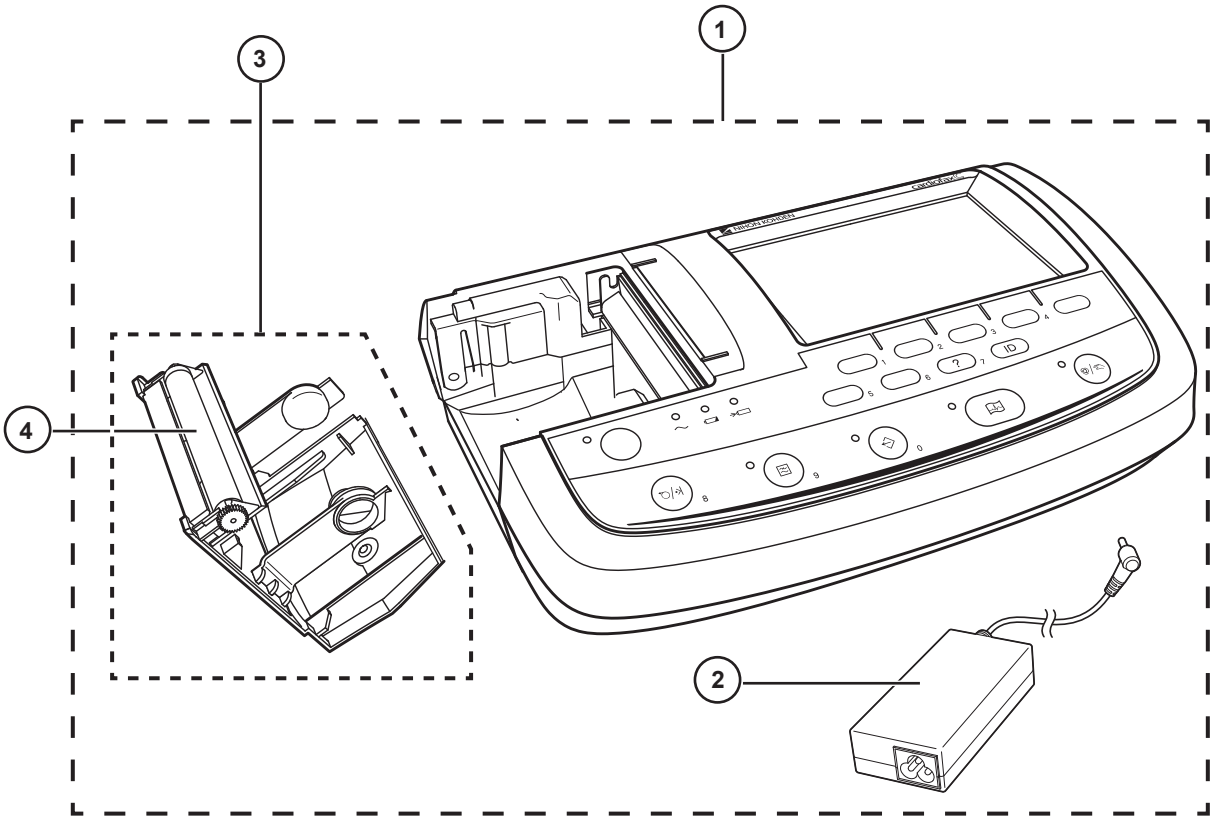
2 Press the [↑] or [↓] function key to select <Wi-Fi test>. Then, press the [OK] function key. The Wi-Fi test starts automatically.

3 Please check whether “OK” appears on the screen. If “NG” appears, please check the connection status of the connector. If necessary, please reassemble.

NOTE: If such situation could not be fixed even after reassembling for a couple of times, malfunction of the Wi-Fi module might be the possible cause.

5 Replaceable Parts List

Replaceable Parts List

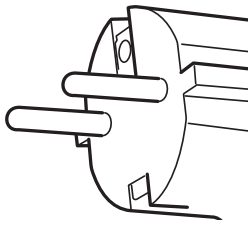


No.	Code No.	Q'ty	Description
1	(SK-) ECG-3150-00K4	1	ECG-3150-00K4 MAIN UNIT * Include MAIN UNIT, AC adapter, OM, SM CD etc.
2	(SK-) 6104-900343*	1	FSP AC ADAPTER
3	(SK-) 6142-902723*	1	MAGAZINE UNIT ECG-3150 (* Without PLATEN ROLLER)
4	9000-067443*	1	FTP-6385MP0048-R (Platen Roller)

Option List

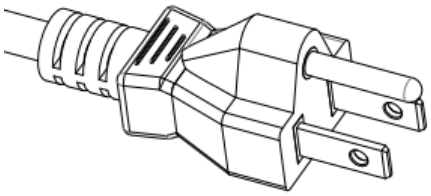
Description	Q'ty	Model	Code No.
Battery pack	1	SB-301DC	(SK-)SB-301DC
Cart	1	KD-105D / 105E, KD-108D / 108E	—
Patient cable hanger	1	KH-100D / KH-200D	—
Patient cable			
Power cord (EU)①	1	365+705	(SK-)6104-900344*
Power cord (UL)②	1	LAP-31+705	(SK-)6104-900345*
AHA 3 mm diameter tip	1	BA-901D	K019
IEC 3 mm diameter tip, thin cable	1	BJ-901D	K079
IEC/DIN 4 mm diameter tip	1	BJ-902D	K081
IEC/DIN clip	1	BJ-903D	K082
IEC 3 mm diameter tip, thick cable	1	BJ-961D	(SK-)9000-062128*
IEC 4 mm diameter tip, thick cable	1	BJ-962D	(SK-)9000-062130*
Ground lead	1	OEM-V1125A	(SK-)6104-900045*
Chest electrode, 3 mm diameter tip, for adult, 3 pcs/set	2	—	H041A
Chest electrode, 4 mm diameter tip, for adult, 3 pcs/set	2	—	H043A
Clip-on limb electrode, 3 mm diameter tip, 4 pcs/set, Fast clip	1	—	H068A
Clip-on limb electrode, 4 mm diameter tip, 4 pcs/set, Fast clip	1	—	H068B

①



Plug of power cord (EU)

②



Plug of power cord (UL)

NIHON KOHDEN

制造商 上海光电医用电子仪器有限公司
上海市奉贤区环城北路 567 号（上海市工业综合开发区内）〒201401
021-57436998 Fax 021-57436936
https://www.nihonkohden.com.cn/

SHANGHAI KOHDEN MEDICAL ELECTRONIC INSTRUMENT CORP.
No. 567 Huancheng Bei Road, Shanghai Comprehensive Industrial
Development Zone, Fengxian District, Shanghai 201401, China
Phone +86 21-5743-6998
https://www.nihonkohden.com/

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