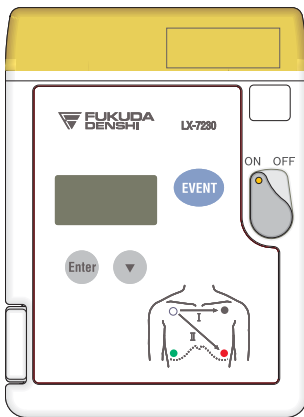


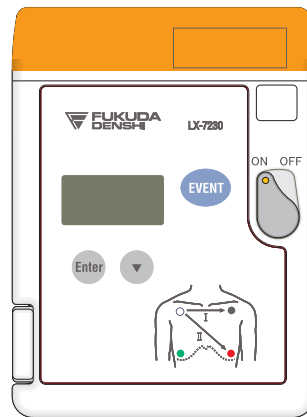
**ECG, Respiration and SpO<sub>2</sub>  
Transmitter**

**LX-7230**

**Operation Manual**



**LX-7230N**



**LX-7230KM**

- Before using this device, read this operation manual thoroughly.
- Keep this manual near the device for future reference.

** CAUTION**

Federal Law restricts this device to sale by or on the order of a physician.

** CAUTION**

Users are advised to periodically contact the FCC or specified frequency coordinator and determine if other or your transmitter frequencies that may cause interference.

** CAUTION**

The manufacturers, installers and users of Wireless Medical Telemetry System equipment are cautioned that the operation of this equipment could result in harmful interference to other nearby medical devices.

**CAUTION:**

- This device for sale by or on the order of a physician.
- The company and product names used in this manual are trademarks or registered trademarks.
- If this manual has pages missing or out of order, contact Fukuda Denshi for replacement.
- Only physician or persons instructed by physicians are allowed to use the equipment.
- The information contained in this document is subject to change without notice due to improvement in the equipment.

Copyright © 2010 by Fukuda Denshi Co., Ltd.

No part of this document may be copied or transmitted in any form without the prior written permission of Fukuda Denshi Co., Ltd.


Printed in Japan


Thank you for purchasing this product from Fukuda Denshi.  
Before use, read this operation manual thoroughly for correct handling and operation.


## Safety Precautions

---

- Read the “Safety Precautions” thoroughly before use to ensure correct and safe use of the product.
- Make sure to follow the precautions indicated below, as these are important messages related to safety.

 <b>DANGER</b>	Failure to follow this message may cause immediate threat of death or serious injury.
---	---

 <b>WARNING</b>	Failure to follow this message may result in death or serious injury.
--	---

 <b>CAUTION</b>	Failure to follow this message may cause injury or failure to the equipment.
--	--

<b>NOTE</b>	A note is not related to product safety, but provides information about the correct use and operating procedures to prevent incorrect operation and malfunction of the equipment.
-------------	---

### Precaution from Fukuda Denshi

Fukuda Denshi is liable for the safety, reliability, and performance of its device only if;




- Maintenance, modifications, and repairs are carried out by authorized personnel.
- Components are used in accordance with Fukuda Denshi operating instructions.

If the equipment is used incorrectly and become unusable, Fukuda Denshi is not liable for the malfunction. Use the equipment only for the purpose specified in this manual.


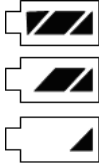

## Equipment Symbols

Refer to the following symbols indicated on the LX-7230 for their meanings.

Symbols indicated on the main unit

<i>Symbol</i>	<i>Description</i>
	Caution; read the operation manual. Indicates the need to refer to the operation manual before operation.
	Type CF Applied Part with Defibrillation-Proof Indicates that the degree of protection against electric shock is Type CF Applied Part with defibrillation-proof.
	Indicates the battery type and direction.

Symbols indicated on the LCD screen

<i>Symbol</i>	<i>Description</i>
	Heart Rate Synchronization Mark: This mark flashes synchronizing with the heartbeat.
	Battery Mark: Indicates the remaining battery level.
	Intermittent SpO <sub>2</sub> Mode: Indicates that the SpO <sub>2</sub> Intermittent measurement is activated. Displayed only on the LX-7230KM.

## Precautions for Safe Operation of Medical Electrical Equipment

Cautions described here are regarding the general instructions for safety use to the patient and the operator. As for cautions about the LX-7230, please refer to the following pages.

### CAUTION

- 1. Users should have a thorough knowledge of the operation before using this equipment.**
- 2. Pay attention to the following when installing or storing the equipment.**
  - . Do not install or store in an area where the equipment will be subject to splashing water.
  - . Do not install or store in an area where the environmental conditions, such as atmospheric pressure, temperature, humidity, ventilation, sunlight, dust, sodium, sulfur, will adversely affect the system.
  - . Place the equipment on a stable surface where there is no inclination, vibration, or shock (including during transportation).
  - . Do not install or store in an area where chemicals are stored or gases are generated.
- 3. Before operating the equipment, verify the following items.**
  - . Check the cable connection and polarity to ensure proper operation of the equipment.
  - . Ensure that all cables are firmly and safely connected. Especially, recheck the attachment and connection condition of electrode and the probe (sensor).
  - . Pay special attention when the equipment is used in conjunction with other equipment as it may cause erroneous judgment and danger.
  - . Check the remaining battery level.
  - . When replacing the battery, make sure that the battery polarity is correct. Do not charge the battery.
- 4. During operation of the equipment, verify the following items.**
  - . Do not operate the equipment beyond the time period required for diagnosis and medical care.
  - . Do not pick up and/or swing the equipment pulling/grabbing the probe (sensor) or cable part. It may damage the equipment and lead to measurement error.
  - . Always observe the equipment and patient to ensure safe operation of the equipment.
  - . If any abnormality is found on the equipment or patient, take appropriate measures such as ceasing operation of the equipment and/or detaching the probe (sensor) and/or electrode, in the safest way for the patient.
  - . Do not allow the patient to come in contact with other equipments.

## CAUTION

5. **After using the equipment, verify the following items.**
  - Make sure to turn off the power of the equipment.
  - When unplugging the cables, do not apply excessive force on the cable and pull from its connector.
  - Clean the accessories and cables, and keep them together in one place.
  - Keep the equipment clean to ensure proper operation for the next use.
  - Make sure to remove the batteries if the equipment is not used for a long time. The leakage from the batteries may damage the device or an explosion from the batteries may occur.
6. **If the equipment is damaged and in need of repair, ensure patient safety by immediately turning the equipment off and remove the electrodes and/or probe from the patient. User should not attempt service. Label the unit “OUT OF ORDER” and contact Fukuda Denshi representative.**
7. **Do not remodel the equipment.**
8. **Maintenance Check**
  - Make sure to periodically check the equipment, and accessories.
  - Before reusing the equipment that has been left unused for a while, make sure that the equipment works normally and safely.
9. **When using electrosurgical knives or defibrillator with this equipment, take care of the following.**
  - To prevent burn injury to the patient, verify proper attachment of patient ground plate, ECG electrode type for the electrosurgical knives, and the quantity of gel, output energy for the defibrillator. Also, verify that a proper ground is selected.
  - Some types of equipment other than the above may cause accidental hazards to the patient and operator due to the conditions of the equipment. Read the operation manual attached to each device and understand the precautionary instructions prior to use.

## Non-Explosion Proof

### DANGER

- Never operate the equipment in the presence of flammable anesthetics, high concentration of oxygen. It may cause an explosion or fire.
- Never operate the equipment inside a hyperbaric chamber. It may cause an explosion or fire.
- Never operate the equipment where flammable gas or fluid such as anesthetic, oxygen, and hydrogen are used. It may cause an explosion or fire.

## Precautions about Magnetic Resonance Imaging (MRI)

### WARNING

- Do not operate this equipment in magnetic resonance imaging (MRI) environments.
- When conducting MRI test, remove the electrodes and sensors connected to the patient (test subject).  
The local heating caused by the induced electromotive force may cause burn injury to the patient (subject). For details, refer to the operation manual for the MRI testing device.

## Electrosurgery Safety

### WARNING

- When using electrosurgical instrument, make sure the contact between the patient and the ground plate is secure. If the connection is incomplete, the patient may suffer a burn at the electrode site.
- When using an electrosurgical instrument, it may misidentify noise from the electrosurgical instrument as a heartbeat or arrhythmia.

## Defibrillation Safety

### WARNING

- Use only the lead cable specified by Fukuda Denshi when defibrillating. If used by unspecified lead cable, the device may be damaged, resulting in a safety hazard.
- When using the defibrillator, keep away from the electrodes or medicament applied to the patient chest. If this is not possible, remove the electrodes or medicament before using it.  
If the defibrillator paddles are directly in contact with the electrodes or medicament, an electrical shock may result from the discharged energy.
- When using the defibrillator, do not touch the patient and the metal part of the device or cables. Electric shock may result from the discharged energy.

## Precautions about the Pacemaker

### WARNING

- Minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing the pacemakers to pace at their maximum programmed rate. The cardiac monitoring and diagnostic equipment may possibly send wrong information.  
If such event occurs, please disconnect the cardiac monitoring and diagnostic equipment, or follow the procedures described in the operation manual of the pacemaker.  
(For more details, contact FUKUDA DENSHI personnel, your institution's professionals, or your pacemaker distributors.)
- ➡ Reference  
"Minute Ventilation Rate-Adaptive Pacemakers"  
FDA alerts health professionals that minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing pacemakers to pace at their maximum programmed rate.  
[October 14, 1998 (Letter: [www.fda.gov/cdrh/safety.html](http://www.fda.gov/cdrh/safety.html)) – FDA]
- ECG meter may continue to count the pacemaker rate during occurrences of cardiac arrest or arrhythmias. Do not rely entirely upon the ECG meter alarms. Keep pacemaker patients under close surveillance. Check this manual for disclosure of the pacemaker pulse rejection capability of this instrument.

## Precautions about the LX-7230

### WARNING

- Do not connect cables not authorized by Fukuda Denshi to any I/O connector. If done so by mistake, the LX-7230 cannot deliver its maximum performance and may be damaged, resulting in a safety hazard.
- Do not use this device with multiple patients simultaneously.

### CAUTION

Do not pick up and/or swing the LX-7230 pulling/grabbing the probe (sensor) or cord part. The cable could break or get disconnected from the LX-7230. And it may hit people or damage other equipment around.



## Precautions about Waterproof

### CAUTION

- Replace the “Battery Compartment Lid” of the LX-7230 regularly to keep the main unit performance of waterproof. If not regularly replaced, the quality of the lid will deteriorate and cannot keep the waterproof performance. For details about the regular replacement, contact your local Fukuda Denshi service representative.
- The lid may be damaged from high impact. If the LX-7230 is dropped or is subjected to a high impact, make sure that the lid is not damaged.
- However, the SpO<sub>2</sub> probes (sensors/relay cables) are not waterproof. Do not take a bath with them, and ensure to be away from liquid.
- Do not use the LX-7230 wet. Always wipe the LX-7230 with a soft cloth and dry it thoroughly before use.

## Precautions about ECG

### CAUTION

- When removing electrodes from the patient, remove them carefully and slowly. Do not apply excessive force to remove them. Otherwise, it may damage the skin.
- There are some cases when the pacemaker pulse cannot be detected depending on the pacemaker type, pulse voltage, pulse width, electrode lead type (unipolar, bipolar), electrode placement, or lead method which causes the pacemaker pulse amplitude to decrease and disables pacemaker pulse detection.
- If signals similar to a pacemaker pulse are present, such as electric blanket noise or excessive AC frequency noise, these may be erroneously detected and displayed as a pacemaker pulse. In this case, check the condition of the electrodes and ECG lead cable to resolve the cause or turn off the pacemaker detection setting on the receiving monitor.

## Precautions about SpO<sub>2</sub>

### WARNING

- During SpO<sub>2</sub> monitoring, always use the probe (sensor)/relay cable specified by Fukuda Denshi. If any other probe (sensor)/relay cable is used, a high temperature rise of the probe (sensor) may place the patient in danger of burns in the worst case.
- When the SpO<sub>2</sub> probe (sensor) is in a connector-off condition, the SpO<sub>2</sub> alarm will not be generated on the receiving monitor. Make sure that the SpO<sub>2</sub> probe (sensor)/ relay cable is securely connected. If the SpO<sub>2</sub> waveform/numeric data is not displayed, check the patient's condition and pay attention not to miss the connector-off condition.
- When measuring the SpO<sub>2</sub> of a patient with high fever or peripheral circulatory insufficiency, check the probe (sensor) attachment periodically and change the attachment site. The temperature of the attachment site will rise 2 to 3°C due to the sensor heat which may result in compression necrosis and burn injury.
- Even a short duration of attachment may inhibit the blood flow and generate compression necrosis and burn injury.
- When securing the probe (sensor) with tape, do not apply the tape too tight. At the same time, check the blood flow constantly so that congestion is not generated at the peripheral. When removing the tape, remove it slowly with care not to damage the patient's skin.

### CAUTION

For the following case, accurate measurement may not be possible.

- Patient with excessive abnormal hemoglobin (COHb, MetHb)
- Patient with the pigment injected to the blood
- Patient receiving CPR treatment
- Placement of SpO<sub>2</sub> probe (sensor) on limb with a blood-pressure cuff, arterial catheter, or intravascular line
- When measuring at placement position with venous pulse
- Patient with body motion
- Patient with small pulse
- Excessive body motion (patient's motion)
- Excessive light (direct sunlight, fluorescent, light therapy equipment, surgical light, infrared heat ramp, etc.)
- External colorant such as nail polish
- Abnormally low or high hemoglobin concentration
- Electrosurgery
- Influence of electromagnetic waves from other electronics devices
- High-intensity radio waves from cell phone

## Precautions about Output Signal

### WARNING

Do not use the output signal of the monitor that receives radio wave signal from the LX-7230 as the trigger signal for IABP, MRI echocardiographic, or defibrillator for the following reasons.

- It may lead to a delay of operating timing due to the delay time of waveform transmission.
- A trigger signal unrelated to the heart rate may be generated due to the interfusion of spike noise at weak electric field.

## Precautions about Accessories and Optional Accessories

### WARNING

Use only the accessories, such as ECG Lead cable and SpO<sub>2</sub> probe (sensor)/ relay cable, specified by Fukuda Denshi for the LX-7230. Otherwise, the LX-7230 cannot deliver its maximum performance and may be damaged, resulting in a safety hazard.

### CAUTION

- Do not reuse disposable products.
- Store the disposable products properly as mentioned in their user manuals.

## Precautions about Battery

### WARNING

- Use new "AA" size ("LR06" size) alkaline cell.
- Install the battery with the correct polarity.
- Do not charge the battery. Any attempt to charge the battery may cause it to leak or break.
- Do not short the (+) and (-) terminals. It may result in exothermic heat and fire.
- Do not throw the battery into fire. It may explode.

## Precautions about Disposing of Equipment, Accessories, or Components

### CAUTION

- When disposing of the equipment, accessories, or components, use an industrial waste distributor. Do not dispose of as ordinary waste.
- Used disposal items (ECG electrodes, etc.) shall be discarded as medical waste.

## Precautions about Disposing of Battery

### CAUTION

Obey the local municipal rule to dispose the used dry cell battery.

## Precautions for Use of Medical Telemeter

### WARNING

- The LX-7230 transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.
- The LX-7230 complies with FCC radiation exposure limits set forth for a controlled environment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. The LX-7230 has very low levels of RF energy that are deemed to comply without testing of specific absorption ratio (SAR).
- Operation of LX-7230 requires the prior coordination with a frequency coordinator designated by the FCC for the Wireless Medical Telemetry Service.
- This radio frequency device is susceptible to interference from outside sources. Interference may prevent the monitoring of patients connected to this device. If a problem exists, contact your local service representative.
- The LX-7230 transmits vital signs to the receiving monitor using radio wave signal. Under unstable radio wave signals, the receiving monitor will not generate any alarms. This situation may miss sudden change in the patient's condition and may cause a serious accident. Under unstable radio wave signals, check the patient status consistently under this situation. To get stable radio wave signals, make sure to have a proper telemetry installation.

### CAUTION

- For installation, make sure the following.
  - The medical institution (hereinafter referred to as the "Institution") must decide the telemetry installation plan for the medical department in order to prevent interference and interference between transmitters (telemetry

based on destination country's radio law). When telemetry has already been installed and been used, radio format, frequency, and antenna power are required to be examined to prevent interference.

- . When using telemetry, which requires zone location, the Institution is to set up the zones as an operation unit for each transmitter to prevent electronic interference between telemetry throughout the Institution.
- . When using telemetry, which requires zone location, display and identify each prepared zone in the equipment. When laying receiver antenna for each transmitter, the Institution has to examine the installation so that electronic interference does not occur.
- . Based on the above examination result, the Institution should install each receiver antenna as required.
- For management, make sure to follow the precautions below.
  - . The Institution should appoint a person (hereinafter referred to as the "Overall Manager") to manage the wireless channels for the whole Institution.
  - . And when using telemetry, which requires zone location, the Institution should nominate a person (hereinafter referred to as the "Zone Manager") to manage the wireless channels in each zone. However, when using such telemetry in a local Institution, one person can perform both functions.
  - . The Overall Manager and Zone Manager must be selected from people who understand the characteristics and functionality of telemetry systems, and are skilled in operating telemetry.
  - . When installing telemetry, the Overall Manager and the Zone Manager have to understand the precautions for use of telemetry in advance.
  - . The Overall Manager is responsible for maintenance of wireless channel and storage and maintenance of telemeter in the overall medical facilities to give proper instructions to the Zone Manager when using telemetry needing zone alignment, and to the telemetry user when using telemetry not-needing zone alignment.
  - . The Overall Manager should create a management log (hereinafter referred to as the "log"), which contains a list of the management status of the wireless channels for the whole Institution. When changing a wireless channel, register it in the log and give proper instructions to the Zone Manager or to the user.
  - . The Zone Manager assumes responsibility for managing the wireless channels, storing, and managing telemetry.
  - . The Zone Manager assigns the transmitter to the user, and provides enough education for use inside the zone.
  - . The telemetry user verifies operation of the transmitter/receiver before use.
  - . The telemetry user, if using the telemetry in a zone location, follows the instructions of the Zone Manager for the zone and gives instructions to the patient if required.
  - . When interference or breakdown occurs in telemetry communication, the user is required to inform the Zone Manager and the Overall Manager of the problems. The Zone Manager and Overall Manager are to deal with the problem properly and/or contact their nearest Fukuda Denshi representative for service.

# Electromagnetic Compatibility

---

The performance of this device under electromagnetic environment complies with IEC 60601-1-2 (2007).

## Precautions for Safe Operation under Electromagnetic Influence

### CAUTION

If any sorts of electromagnetic wave, magnetic field, or static electricity exist around the device, noise interference or malfunction of the device may occur. If any unintended malfunction or noise occurs during monitoring, check the magnetic influence and take appropriate countermeasures.

The following are examples of the common cause and countermeasures.

#### ● Cellular Phone

The radio wave may cause malfunction to the device.

Cellular phones and radio sets should be turned off in the room (building) where medical device is located.

#### ● Static Electricity

In a dry environment (room), static electricity is likely to occur. Take the following countermeasures.

- Both operator and patient should remove any static electricity before entering the room.
- Humidify the room.

## EMC Guidance

This equipment complies with IEC 60601-1-2 (2007). However, if portable transmitter or wireless LAN equipment is used extremely nearby, the electromagnetic influence may largely exceed the compliance level and may cause unexpected phenomenon such as noise interference on the waveform, etc.

Therefore, this equipment should be used in a location specified by each medical institution. If any unexpected noise interference on the waveform or failure to the peripheral device occurs, stop using the equipment and follow the instruction of the technician.

The following is the information relating to EMC (Electromagnetic Compatibility).

(When using this equipment, verify that it is used within the environment specified below.)

### ● Compliance to the Electromagnetic Emissions

The LX-7230 is intended for use in the electromagnetic environment specified below. The customer or the user of the LX-7230 should assure that it is used in such an environment.

<i><b>Emission Test</b></i>	<i><b>Compliance</b></i>	<i><b>Electromagnetic Environment – Guidance</b></i>
RF Emission CISPR 11	Group 1	The LX-7230 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 Emission CISPR 11	Class A	This LX-7230 is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emission IEC 61000-3-2	N/A	
Voltage Limit / Flicker Emission IEC 61000-3-3	N/A	

## ● Compliance to the Electromagnetic Immunity (1)


The LX-7230 is intended for use in the electromagnetic environment specified below. The customer or the user of the LX-7230 should assure that it is used in such an environment.

<b>Immunity Test</b>	<b>IEC 60601-1-2 Test Level</b>	<b>Compliance Level</b>	<b>Electromagnetic Environment Guidance</b>
Electrostatic Discharge (ESD) IEC 61000-4-2	±6kV contact ±8kV air	±6kV contact ±8kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2kV: Power supply lines ±1kV: Input/output lines	N/A	
Surge IEC 61000-4-5	±1kV: differential mode ±2kV: common mode	N/A	
Voltage dips, short interruptions and voltage variations on power supply input lines. IEC 61000-4-11	<5% $U_T$ (>95% dip in $U_T$ ) for 0.5 cycle  40% $U_T$ (60% dip in $U_T$ ) for 5 cycles  70% $U_T$ (30% dip in $U_T$ ) for 25 cycles  <5% $U_T$ (>95% dip in $U_T$ ) for 5sec.	N/A	
Power Frequency (50/60Hz) Magnetic Field IEC 61000-4-8	3A/m	3A/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.			



## ● Compliance to the Electromagnetic Immunity (2)

The LX-7230 is intended for use in the electromagnetic environment specified below. The customer or the user of the LX-7230 should assure that it is used in such an environment.

<b>Immunity Test</b>	<b>IEC60601-1-2 Test Level</b>	<b>Compliance Level</b>	<b>Electromagnetic Environment Guidance</b>
Conducted RF IEC 61000-4-6  Radiated RF IEC 61000-4-3	3Vrms 150kHz to 80MHz  3V/m 80MHz to 2.5GHz	3Vrms  3V/m	<p>Portable and mobile RF communications equipment should be used no closer to any part of the LX-7230, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p><b>Recommended Separation Distance</b></p> $d = 1.2 \sqrt{P}$ <p><math>d = 1.2 \sqrt{P}</math> 80MHz to 800MHz  <math>d = 2.3 \sqrt{P}</math> 800MHz to 2.5GHz</p> <p>Where <math>P</math> is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and <math>d</math> is the recommended separation distance in meters (m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey<sup>a)</sup>, should be less than the compliance level in each frequency range<sup>b)</sup>.</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:  </p>
<p>Note 1: At 80MHz and 800MHz, the higher frequency range applies.</p> <p>Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.</p>			
<p><sup>a)</sup> 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 LX-7230 is used exceeds the applicable RF compliance level above, the LX-7230 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the LX-7230.</p> <p><sup>b)</sup> Over the frequency range 150kHz to 80MHz, field strength should be less than 3V/m.</p>			

● **Recommended Separation Distances between Portable and Mobile RF Communications Equipment and the LX-7230**

The LX-7230 is intended for use in an environment in which radiated RF disturbances are controlled. The customer or the user of the LX-7230 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the LX-7230 as recommended below, according to the maximum output power of the communications equipment.

<b>Rated Maximum Output Power of Transmitter (W)</b>	<b>Separation Distance according to Frequency of Transmitter (m)</b>		
	150kHz to 80MHz $d = 1.2 \sqrt{P}$	80MHz to 800MHz $d = 1.2 \sqrt{P}$	800MHz to 2.5GHz $d = 2.3 \sqrt{P}$
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 determined 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 1 : At 80MHz and 800MHz, the separation distance for the higher frequency range applies.

Note 2 : These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

# CONTENTS

<b>Safety Precautions</b> .....	i
Precaution from Fukuda Denshi.....	i
Equipment Symbols .....	ii
Precautions for Safe Operation of Medical Electrical Equipment .....	iii
Non-Explosion Proof .....	iv
Precautions about Magnetic Resonance Imaging (MRI).....	v
Electrosurgery Safety.....	v
Defibrillation Safety .....	v
Precautions about the Pacemaker .....	vi
Precautions about the LX-7230.....	vi
Precautions about Waterproof .....	vii
Precautions about ECG .....	vii
Precautions about SpO <sub>2</sub> .....	viii
Precautions about Output Signal .....	ix
Precautions about Accessories and Optional Accessories .....	ix
Precautions about Battery.....	ix
Precautions about Disposing of Equipment, Accessories, or Components .....	x
Precautions about Disposing of Battery .....	x
Precautions for Use of Medical Telemeter .....	x
<b>Electromagnetic Compatibility</b> .....	xii
Precautions for Safe Operation under Electromagnetic Influence .....	xii
EMC Guidance.....	xiii
1. General Description .....	1
2. Names of Parts and Their Functions.....	3
3. Preparation .....	5
1) Installing the Batteries .....	5
2) Operating Power Switch .....	7
4. ECG Monitoring .....	9
■ Connecting the ECG Lead Cable and Electrodes.....	9
■ Attaching the Electrodes.....	12
■ Connecting the ECG Lead Cable to the LX-7230 .....	13
5. Respiration Monitoring .....	15
6. SpO <sub>2</sub> Monitoring.....	17
SpO <sub>2</sub> Monitoring (LX-7230N) .....	18
SpO <sub>2</sub> Monitoring (LX-7230KM) .....	35
7. Measurement .....	45
■ Starting Screen .....	45
■ Waveform Display Screen .....	45
■ Battery Level Check .....	46
■ Waveform Display .....	47

8. Operation .....	57
■ Changing Setup .....	57
■ Restarting the LCD display .....	62
■ Pressing the EVENT button .....	62
9. Other Setting Items .....	63
■ Changing the Time Constant .....	63
■ Changing the Detection Sensitivity of the Pacemaker Pulse ...	64
■ Changing the Respiration Detection Signal ON/OFF .....	65
■ Changing the LCD Contrast .....	65
10. Changing the Transmitter Channel and Group ID .....	67
■ Changing the Transmitter Channel .....	67
■ Changing the Group ID .....	67
11. Troubleshooting .....	69
■ List of Displayed messages .....	69
■ Troubleshooting .....	72
■ In Case of Dropping the LX-7230 into Water .....	74
12. Cleaning and Disinfection .....	75
■ Cleaning .....	75
■ Disinfection .....	75
13. Maintenance and Inspection .....	77
14. Standard and Optional Accessories .....	79
■ Standard Accessories .....	79
■ Optional Accessories .....	80
15. Specification .....	83
■ Specification .....	83
■ Displays .....	87
■ Details of the “ELECTRODE?” Message .....	89
■ List of Setup Items .....	90

# 1. General Description

---

The LX-7230 is a radio telemetry transmitter designed to measure the ECG, respiration waveform, SpO<sub>2</sub> (arterial oxygen saturation), pulse waveform with two “AA” size (“LR06” size) alkaline batteries.

Information such as ECG measurements, respiration waveform, SpO<sub>2</sub> measurements, pulse waveform, battery level, and the conditions of the ECG electrodes and SpO<sub>2</sub> probe (sensor) are displayed on the LCD of the front panel.

ECG lead selection is available using the two buttons (Enter and ▽) on the front panel. (In case of using a 3-electrode lead cable or a 5-electrode chest lead cable)

The LX-7230 can also function as a transmitter to measure only the ECG/Respiration without SpO<sub>2</sub> or to measure only the SpO<sub>2</sub> without ECG/Respiration.

Before using the LX-7230, read also the operation manual of the patient monitor at the receiving side thoroughly.

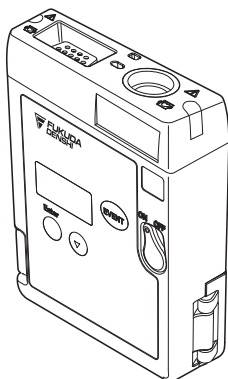
There are two types of transmitters depending on the SpO<sub>2</sub> Module, which is built-in as below.

LX-7230N : Built-in Nellcor<sup>®</sup> SpO<sub>2</sub> Module

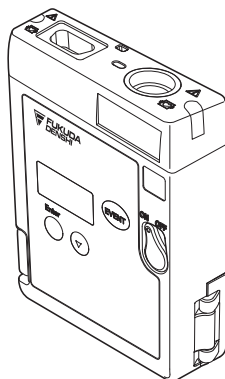
LX-7230KM : Built-in Konica Minolta<sup>®</sup> SpO<sub>2</sub> Module

## External Appearance

LX-7230N



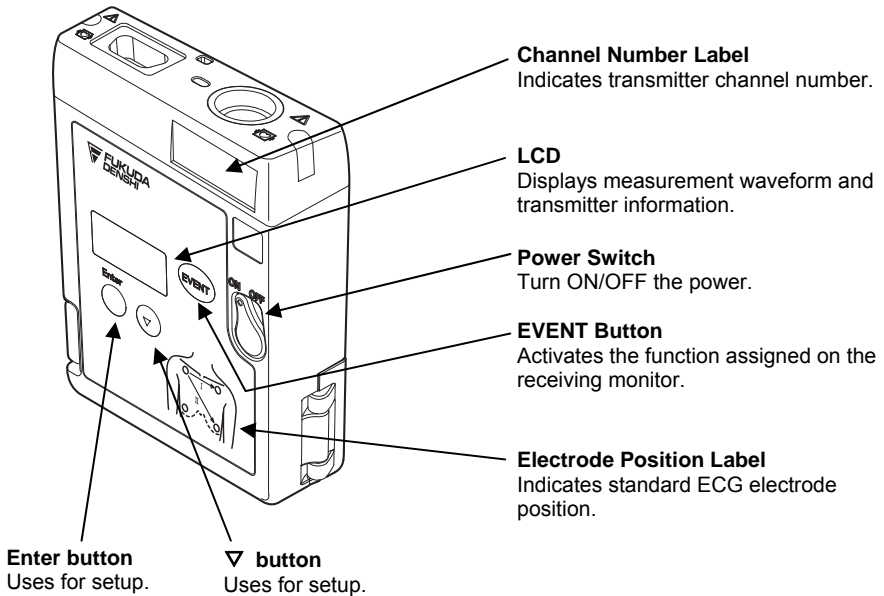
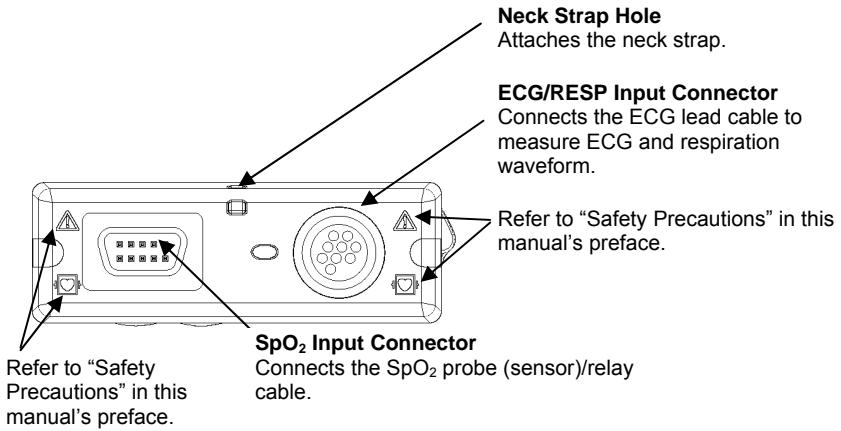
LX-7230KM



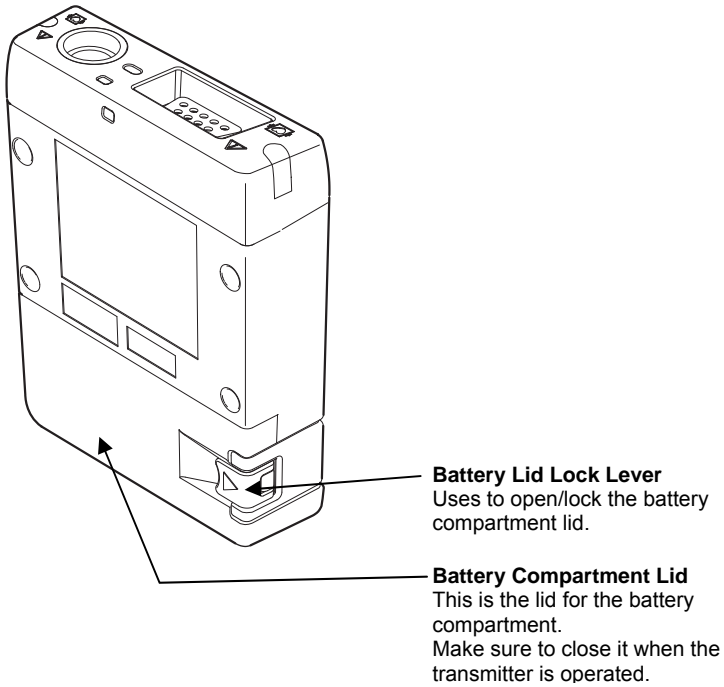
## 1. General Description

Blank Page

## 2. Names of Parts and Their Functions



## 2. Names of Parts and Their Functions





## 3. Preparation

---

### 1) Installing the Batteries

The LX-7230 functions with two "AA" size ("LR06" size) alkaline batteries. With new batteries, the LX-7230 is capable of the following operation.

LX-7230N: approximately 2.5 days

LX-7230KM: approximately 5 days

(However, continuous operating time may be shorter than the above mentioned time depending on the application of the SpO<sub>2</sub> probe (sensor).)

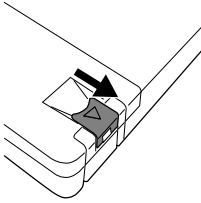
#### WARNING

- Unplug the ECG lead cable when the battery compartment lid is opened. Otherwise, patient leakage current beyond the allowable value may occur.
- Use new "AA" size ("LR06" size) alkaline batteries.
- Do not short out the (+) and (-) terminals. It may result in exothermic heat and fire, the leakage from the batteries may damage the device, or an explosion from the batteries may occur.
- Install the batteries with the correct polarity.
- Do not use a disassembled or a damaged battery due to drop or shock. The leakage from the batteries may damage the device, or an explosion from the batteries may occur.
- Do not use different types of batteries at the same time. The leakage from the batteries may damage the device, or an explosion from the batteries may occur.
- Remove the exhausted batteries immediately. The leakage from the batteries may damage the device, or an explosion from the batteries may occur.
- If the transmitter is not in use for a long period of time, remove the batteries and store the device in an appropriate place. If the batteries are left in the transmitter for a long period of time, the leakage from the batteries may damage the device or an explosion from the batteries may occur.
- Make sure to replace the two batteries simultaneously. If a new and used battery are mixed, a leakage from the batteries may damage the device or an explosion from the batteries may occur.

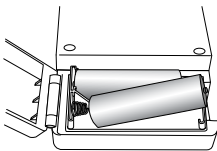
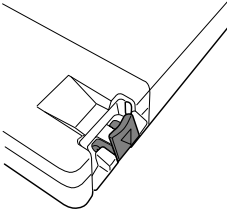
#### CAUTION

- Use only alkaline batteries. Other batteries will shorten the continuous operating time.
- Once the power switch is on the OFF position, then open the battery compartment lid.
- Do not replace the batteries with wet hands.
- In case of storing the used or unused batteries, make sure that the terminals are not touching other batteries or metal parts.

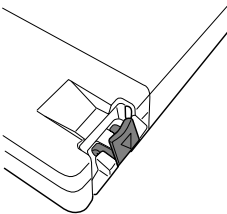
### 3. Preparation



Lift the lock lever to open the battery compartment lid as shown in the left picture.



Install new batteries according to the polarity indication inside the battery compartment. Make sure to first Insert the battery into the battery compartment from the minus (-) terminal as shown in the left picture.



Hook the lock lever on the projection from the body and press it down until it is horizontal (flat position).

#### CAUTION

- Make sure that any foreign particles, such as hairs, are not held on the battery compartment lid and dust is not adhered to the edge of the lid to prevent water entering into the battery compartment area.
- Make sure to only turn ON the LX-7230 after closing the battery compartment lid.

## 2) Operating Power Switch

Turning the power switch to “ON”



Rotate the power switch to the left until it clicks.

LCD screen turns ON and measurement starts.  
Regarding the LCD screen, refer to page 45 (7. Measurement).  
The screen automatically turns itself OFF after a minute.

After the power is turned ON, make sure to check the remaining battery level on the LCD screen.

Refer to the following symbol about the remaining battery level.

Battery Symbol	Remaining Battery Level
	Full
	Getting low but still available
	Nearly empty; Replace the battery

The battery level estimation is in case of using alkaline batteries.

Turning the power switch to “OFF”



Rotate the power switch to the right until it clicks.

### 3. Preparation

Blank Page

## 4. ECG Monitoring

---

When the transmitter is used without the SpO<sub>2</sub> probe (sensor), it will measure only ECG and respiration.

### CAUTION

When using the transmitter with only the ECG lead cable, SpO<sub>2</sub> measurements on the receiving monitor shall be turned off to prevent an erroneous alarm.

### ■ Connecting the ECG Lead Cable and Electrodes

The optional ECG lead cables for LX-7230 are as follows.

#### ECG Lead Cables

AHA color code:

Item No.	Applicable Lead	Remark
<b>CMT-01HTH-0.8DA</b>	Limb Lead (1CH)	3-electrode Hook Type (White, Black, Red)
<b>CMT-02HTH-0.8DA</b>	Limb Lead (2CH)	4-electrode Hook Type (White, Black, Red, Green)
<b>CMT-03HTH-0.8DA</b>	Limb Lead (1CH) +Chest (1CH)	5-electrode Hook Type (White, Black, Red, Green, Brown)
<b>CMT-01FTH-0.8DA</b>	Limb Lead (1CH)	3-electrode Clip Type (White, Black, Red)
<b>CMT-02FTH-0.8DA</b>	Limb Lead (2CH)	4-electrode Clip Type (White, Black, Red, Green)
<b>CMT-03FTH-0.8DA</b>	Limb Lead (1CH) +Chest (1CH)	5-electrode Clip Type (White, Black, Red, Green, Brown)

### WARNING

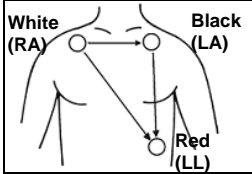
Use only the specified lead cable from Fukuda Denshi. Otherwise, proper monitoring may not be performed, and also it may fail defibrillation or cause a malfunction of the device when the device is used with a defibrillator.

#### 4. ECG Monitoring

The relations between the attached electrode positions and lead method are as follows. Attach the electrodes to monitor proper waveform.

##### For 3-electrode lead cable

For AHA color code electrode position (No. CMT-01HTH-0.8DA, CMT-01FTH-0.8DA)



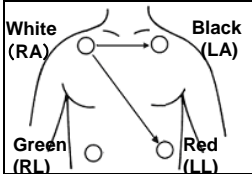
Standard Limb leads

Standard Limb leads can be selected from lead I, lead II, or lead III under the setting of the device.

Refer to “8. Operation ■ Changing Setup ● ECG Display Screen (1) <<Switching Lead>>” in page 57.

##### For 4-electrode lead cable

For AHA color code electrode position (No. CMT-02HTH-0.8DA, CMT-02FTH-0.8DA)

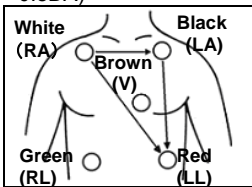


Standard Limb leads

Two leads measurements, lead I and II are fixed. Lead III, aVR, aVL, and aVF can be also displayed from the setting on the receiving monitor. For details, refer to the operation manual of the receiving monitor.

**For 5-electrode (Chest) lead cable**

For AHA color code electrode position (No. CMT-03HTH-0.8DA, CMT-03FTH-0.8DA)



Standard Limb lead  
and Chest lead

One limb lead and one chest lead (Brown) measurements are available. Standard Limb leads can be selected from lead I, lead II, or lead III under the setting of the device.

The chest lead waveform is measured from the chest lead (Brown) positioned on the chest.

Refer to "8. Operation ■ Changing Setup ● ECG Display Screen (1) <<Switching Lead>>" in page 57.

## ■ Attaching the Electrodes

### ⚠ CAUTION

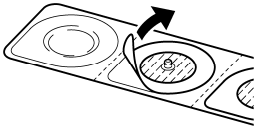
Always use the same type of electrodes. If different types of electrodes are used at the same time, the difference between the polarization potential from each electrode may interfere with monitoring.

### ⚠ CAUTION

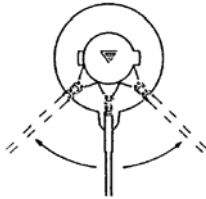
Do not reuse the disposable electrodes. It is intended for single patient use only.



Clean the electrode sites with alcohol wipes or other skin preparation. If necessary, shave the electrode sites to remove excessive hair.



Peel off the disposable electrode.  
Pay attention not to touch the electrode gel.

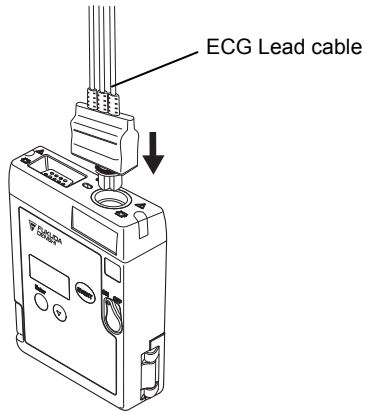


Attach the lead cable end to the electrode (convex part).  
Turn right and left to verify that it is securely attached.



### ■ Connecting the ECG Lead Cable to the LX-7230

Insert the ECG lead cable firmly into the ECG/RESP input connector matching the transmitter's connector guide and the direction of the notched part on the connector.



 CAUTION

- There are some cases when pacemaker pulse cannot be detected depending on the pacemaker type, pulse voltage, pulse width, electrode lead type (unipolar, bipolar), electrode placement, or lead method which causes the pacemaker pulse amplitude to decrease and disables pacemaker pulse detection.
- If signals similar to a pacemaker pulse are present, such as electric blanket noise or excessive AC frequency noise, these may be erroneously detected and displayed as a pacemaker pulse. In this case, check the condition of the electrodes and ECG lead cable to resolve the cause or turn off the pacemaker detection setting on the receiving monitor.
- Time constant of this device is shorter than Fukuda Denshi monitors (direct ECG connection). Therefore, there is a difference in the ST measurement value between them. Pay attention to the difference when monitoring a patient from a transmitter or a monitor.
- When an electrode is attached on the same location for a long time, some patients may develop skin irritation. Check the patient's skin condition periodically and change the electrode position as required.
- The indication for continuous use of an electrode is about one day.
- Replace the electrode if the skin contact gets loosen due to perspiring, etc.
- Make sure to use new disposable electrodes. Otherwise, the waveform quality may become poor and it may fail to perform correct monitoring.
- When "Check Electrode" message is displayed on the screen of the receiving monitor or the LCD of this device, check the condition of the electrodes and ECG lead cable to resolve the cause.
- When removing electrodes from the patient, remove them carefully and slowly. Do not apply excessive force to remove them. Otherwise, it may damage the skin.
- It may not perform a correct measurement due to the attached position of the electrodes. Attach the electrodes on the patient referring to page 10 and 11 and make sure that the correct waveform is measured on the LCD.

## 5. Respiration Monitoring

---

Follow the preparation of “4.ECG Monitoring” to allow the respiration monitoring.

This respiration monitoring is performed with impedance method. The ECG electrodes are also used for detecting the respiration. Each lead cable specifies the electrodes to detect the respiration. For 3-electrode and 5-electrode (chest) lead cable, the electrodes to detect the respiration are fixed as follows. Even if lead method is switched, they are no changes.

Lead Cable	Color of Electrode
3-electrode	White (RA) and Red (LL)
4-electrode	White (RA) and Red (LL)
5-electrode (Chest)	White (RA) and Red (LL)

### WARNING

Minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing the pacemakers to pace at their maximum programmed rate. The cardiac monitoring and diagnostic equipment may possibly send wrong information.

If such event occurs, please disconnect the cardiac monitoring and diagnostic equipment, or follow the procedures described in the operation manual of the pacemaker.

(For more details, contact FUKUDA DENSHI personnel, your institution's professionals, or your pacemaker distributors.)

 Reference

“Minute Ventilation Rate-Adaptive Pacemakers”

FDA alerts health professionals that minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing pacemakers to pace at their maximum programmed rate.

[October 14, 1998 (Letter: [www.fda.gov/cdrh/safety.html](http://www.fda.gov/cdrh/safety.html)) - FDA]

### CAUTION

- Even if the electrodes are attached on the proper positions for ECG monitoring, it may not be always the proper ones for respiration monitoring as well.
- When a defibrillator is used during respiration monitoring, a large offset voltage will be placed on the ECG electrodes, which may cause interruption of monitoring for a few seconds.

Blank Page

## 6. SpO<sub>2</sub> Monitoring

---

When the transmitter is used without the ECG lead cable, it will measure only SpO<sub>2</sub>.

### WARNING

When the SpO<sub>2</sub> probe (sensor) is in a connector-off condition, the SpO<sub>2</sub> alarm will not be generated on the receiving monitor. Make sure that the SpO<sub>2</sub> probe (sensor)/ relay cable is securely connected. If the SpO<sub>2</sub> waveform/numeric data is not displayed, check the patient's condition and pay attention not to miss the connector-off condition.

### CAUTION

When using the transmitter with only the SpO<sub>2</sub> sensor cable, ECG and respiration measurements on the receiving monitor shall be turned off to prevent an erroneous alarm.

There are varieties of SpO<sub>2</sub> sensors depending on the purpose and intended use for LX-7230N and LX-7230KM. Select a proper one and attach it to the patient.

### CAUTION

SpO<sub>2</sub> sensor for LX-7230N and SpO<sub>2</sub> sensor for LX-7230KM are not compatible. SpO<sub>2</sub> sensors for LX-7230KM cannot be used on the LX-7230N transmitter; vice-versa. Make sure to use the correct sensor for operation.

## SpO<sub>2</sub> Monitoring (LX-7230N)

LX-7230N, which has a built-in Nellcor<sup>®</sup> SpO<sub>2</sub> module, is described in this section.

Regarding the LX-7230KM, which has a built-in Konica Minolta<sup>®</sup> SpO<sub>2</sub> module, refer to page 35.

### < SpO<sub>2</sub> Sensors for LX-7230N >

The optional SpO<sub>2</sub> sensors available for LX-7230N are as follows.

The following table shows applicable patient and proper site for each SpO<sub>2</sub> sensor. Select the proper one depending on the purpose and intended use.

Sensor Types	Applicable Patient	Applied Site
OxiMax <sup>®</sup> MAX-I	Infant (weight of 3 to 20Kg)	Toe
OxiMax <sup>®</sup> MAX-P	Pediatric (weight of 10 to 50Kg)	Finger
OxiMax <sup>®</sup> MAX-A/AL	Adult (weight of 30Kg and over)	Finger
Durasensor <sup>®</sup> DS-100A	Adult (weight of 40Kg and over)	Finger
OxiMax <sup>®</sup> MAX-R	Adult (weight of 50Kg and over)	Nose
OxiMax <sup>®</sup> MAX-FAST	Adult/Pediatric (weight of 10Kg and over)	Forehead
OxiMax <sup>®</sup> MAX-N	Adult (weight of 40Kg and over)	Finger
	Neonate (weight of less 3Kg)	Foot

### WARNING

- For SpO<sub>2</sub> monitoring, always use the sensor specified by Fukuda Denshi. If any other sensor is used, high temperature rise of the sensor may place the patient in danger of burns in the worst case.
- As with all medical equipment, carefully route cables to reduce the possibility of patient entanglement and strangulation.

 **CAUTION**

- SpO<sub>2</sub> sensors for LX-7230N cannot be used on the LX-7230KM.
- SpO<sub>2</sub> sensors are not waterproof. Keep away from liquids.
- Do not pick up the device pulling the sensor or cable part. It may get disconnected from the device and the device may be dropped.
- A message is displayed when the SpO<sub>2</sub> sensor is disconnected from the device.
- A message is displayed when the device detects that the SpO<sub>2</sub> sensor is disconnected from the patient. Properly attach the SpO<sub>2</sub> sensor to the patient.
- Do not reuse the single-use SpO<sub>2</sub> sensor. It may cause incorrect measurements.
- Read through the instruction of the SpO<sub>2</sub> sensor as well.

 **CAUTION**

The accuracy of SpO<sub>2</sub> measurement may be influenced by abnormal hemoglobin, such as carbon monoxide hemoglobin (COHb) and methemoglobin (MetHb). It may be also affected by cardiogreen or intravascular dyes.

In addition, the following case may affect the accuracy of SpO<sub>2</sub> and pulse rate measurement.

- Outside light (direct sunlight, fluorescent, light therapy equipment, surgical light, infrared heat ramp, etc.)
- Hypoperfusion
- Excessive body motion (patient's motion)
- Pigment injected to the blood for testing
- In case of measurement during receiving CPR treatment
- Placement of SpO<sub>2</sub> sensor on limb with a blood-pressure cuff, arterial catheter
- External colorant such as nail polish
- Abnormally low or high hemoglobin concentration
- Venous pulse
- Electrosurgery
- Influence of electromagnetic waves from other electronics
- High-intensity radio waves from cell phone

## ■ Applying the OxiMax<sup>®</sup> MAX-I sensor

This Nellcor<sup>®</sup> adhesive sensor, model MAX-I, is indicated for continuous noninvasive arterial oxygen saturation and pulse rate monitoring and can be reused on the same patient as long as the adhesive tape attaches without slippage.

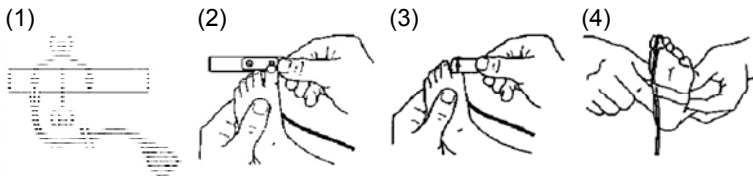
1. Remove the plastic backing from the MAX-I and locate the two transparent windows on the adhesive side. Windows cover optical components. Note the corresponding alignment marks (a) on the non-adhesive side and the dashed line (b) midway between the marks (Figure (1)).

The big toe is the preferred MAX-I location. Alternatively, apply the sensor to another digit of similar size, for example, the thumb.

### NOTE

When selecting the sensor site, priority should be given to an extremity free of an arterial catheter, blood pressure cuff, or intravascular infusion line.

2. Orient the MAX-I so that the window next to the cable is aligned on the bottom of the big toe as shown. The cable should extend towards the heel (Figure (2)).
3. Wrap the MAX-I firmly, but not too tightly around the toe. Windows must oppose each other for correct measurement (Figure (3)).
4. Wrap any excess tape loosely around the toe. Use additional tape provided to secure the cable across the bottom of the foot, loosely enough to maintain good circulation (Figure (4)).
5. Connect the MAX-I into the LX-7230N. Verify proper operation as described in the operation manual.



### NOTE

If the sensor does not track the pulse reliably, it may be incorrectly positioned – or the sensor site may be too thick, thin, or deeply pigmented, or otherwise deeply colored (for example, as a result of externally applied coloring such as nail polish, dye, or pigmented cream) to permit appropriate light transmission. If any of these situations occurs, reposition the sensor or choose an alternate Nellcor sensor to use on a different site.



## Reapplication

1. The MAX-I can be reused on the same patient as long as the adhesive tape attaches without slippage.
2. Enclosed adhesive “dots” are provided for reapplication. Place a transparent dot over each window as shown, and then remove the protective paper that covers each dot (Figure (5)). The sensor is now ready to be reapplied to the same patient. For the reapplication, do not remove the previous adhesive dot, but place the enclosed adhesive dot over it.

(5)



### **⚠ CAUTION**

- **Precautions for Use of adhesive sensor, MAX-I**
  - Do not reuse the sensor on other patients. This is a sterilized product and it is intended for single patient use only.
  - Circulation distal on the sensor site should be checked routinely. The site must be inspected every 8 hours to ensure adhesion, skin integrity, and correct optical alignment. If skin integrity changes, move the sensor to another site
  - Do not use the sensor on patients who exhibit allergic reactions to the adhesive tape.
  - Failure to apply the sensor properly may cause incorrect measurements.
  - While the sensor is designed to reduce the effects of ambient light, excessive light may cause inaccurate measurements. In such cases, cover the sensor with an opaque material.
  - If the sensor is wrapped too tightly or supplemental tape is applied, venous pulsations may lead to inaccurate saturation measurements.
  - Excessive motion may compromise performance. In such cases, try to keep the patient still, or change the sensor site to one with less motion.
  - Intravascular dyes or externally applied coloring such as nail polish, dye, or pigmented cream may lead to inaccurate measurements.
  - Do not pull the sensor cable to remove the sensor from the device.
  - In the event of damage to the sterile packaging, do NOT use. Make sure to check whether the packaging and product is cracked or damaged before use. If there is any damage.
  - Do not immerse in water or cleaning solutions. Do not resterilize.

For additional warnings, cautions or contraindications when using sensors with Nellcor-compatible device, refer to each SpO<sub>2</sub> sensor instruction manual.

## ■ Applying the OxiMax<sup>®</sup> MAX-P/ MAX-A/ MAX-AL sensor

This Nellcor<sup>®</sup> adhesive sensor, model MAX-P/ MAX-A/ MAX-AL, is indicated for continuous noninvasive arterial oxygen saturation and pulse rate monitoring and can be reused on the same patient as long as the adhesive tape attaches without slippage.

1. Remove the plastic backing from the MAX-P/MAX-A/MAX-AL and locate the transparent windows (a) on the adhesive side. Windows cover optical components (Figure (1)).

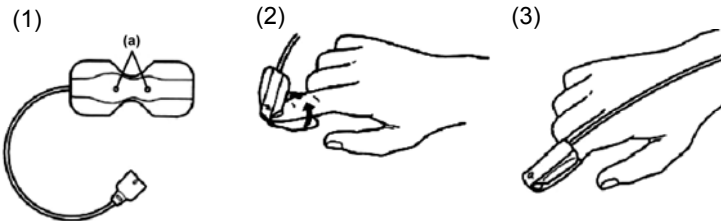
The index finger is the preferred MAX-P/MAX-A/MAX-AL location.

Alternatively, apply the sensor to the small thumb, smaller finger, or big toe.

### NOTE

When selecting the sensor site, priority should be given to an extremity free of an arterial catheter, blood pressure cuff, or intravascular infusion line.

2. Orient the MAX-P/MAX-A/MAX-AL so that the dashed line in the middle of the sensor is centered on the tip of the finger/toe (Figure (2)). Wrap the adhesive flaps around the digit. Note that the cable must be positioned on the top of the hand or foot.
3. Fold the cable end over the top of the finger/toe so that the windows are directly opposite to each other. Wrap the adhesive securely around both sides of the digit (Figure (3)).
4. Connect the MAX-P/MAX-A/MAX-AL into the LX-7230N. Verify proper operation as described in the operation manual.



### NOTE

If the sensor does not track the pulse reliably, it may be incorrectly positioned – or the sensor site may be too thick, thin, or deeply pigmented, or otherwise deeply colored (for example, as a result of externally applied coloring such as nail polish, dye, or pigmented cream) to permit appropriate light transmission. If any of these situations occurs, reposition the sensor or choose an alternate Nellcor sensor to use on a different site.

 **CAUTION**

- **Precautions for Use of adhesive sensors, MAX-P/MAX-A/MAX-AL**
  - Do not reuse the sensor on other patients. This is a sterilized product and it is intended for single patient use only.
  - Circulation distal on the sensor site should be checked routinely. The site must be inspected every 8 hours to ensure adhesion, skin integrity, and correct optical alignment. If skin integrity changes, move the sensor to another site
  - Do not use the sensor on patients who exhibit allergic reactions to the adhesive tape.
  - Failure to apply the sensor properly may cause incorrect measurements.
  - While the sensor is designed to reduce the effects of ambient light, excessive light may cause inaccurate measurements. In such cases, cover the sensor with an opaque material.
  - If the sensor is wrapped too tightly or supplemental tape is applied, venous pulsations may lead to inaccurate saturation measurements.
  - Excessive motion may compromise performance. In such cases, try to keep the patient still, or change the sensor site to one with less motion.
  - Intravascular dyes or externally applied coloring such as nail polish, dye, or pigmented cream may lead to inaccurate measurements.
  - Do not pull the sensor cable to remove the sensor from the device.
  - In the event of damage to the sterile packaging, do NOT use. Make sure to check whether the packaging and product is cracked or damaged before use. If there is any damage.
  - Do not immerse in water or cleaning solutions. Do not resterilize.

For additional warnings, cautions or contraindications when using sensors with Nellcor-compatible device, refer to each SpO<sub>2</sub> sensor instruction manual.

## ■ Applying DURASENSOR<sup>®</sup> DS-100A

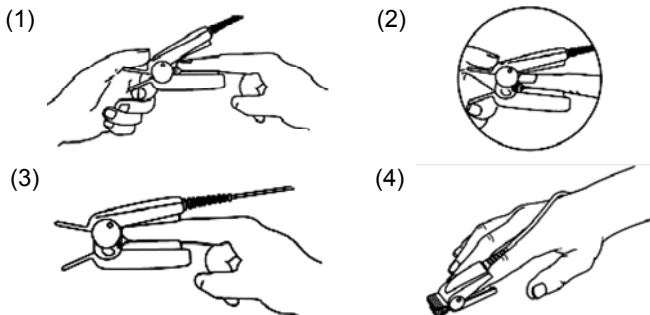
This Nellcor<sup>®</sup> reusable sensor, model DS-100A, is indicated for continuous noninvasive arterial oxygen saturation and pulse rate monitoring for patients weighing greater than 40 kg. The DS-100A is contraindicated for use on active patients or for prolonged use.

1. Place the index finger over the sensor window of the DS-100A with the finger tip against the stop (Figure (1)).
2. If the fingernail is long, the nail tip will extend over the finger stop (Figure (2)).
3. Spread open the rear tabs of the sensor to provide even force over the length of the pads (Figure (3)). If the index finger cannot be positioned correctly, or is not available, a smaller finger can be used, or use other OxiMax<sup>®</sup> sensor. Do not use the DS-100A on a thumb or toe or across a child's hand or foot.

### NOTE

When selecting the sensor site, priority should be given to an extremity free of an arterial catheter, blood pressure cuff, or intravascular infusion line.

4. The sensor should be oriented in such a way that the cable is positioned along the top of the hand (Figure (4)).
5. Connect the DS-100A into the LX-7230N. Verify proper operation as described in the operation manual.



### NOTE

If the sensor does not track the pulse reliably, it may be incorrectly positioned – or the sensor site may be too thick, thin, or deeply pigmented, or otherwise deeply colored (for example, as a result of externally applied coloring such as nail polish, dye, or pigmented cream) to permit appropriate light transmission. If any of these situations occurs, reposition the sensor or choose an alternate Nellcor sensor to use on a different site.

 **CAUTION****● Precautions for Use of reusable sensors, DS-100A**

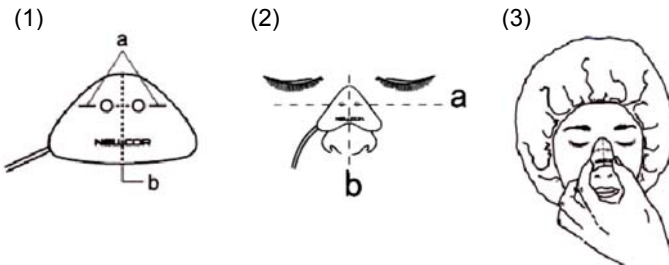
- Do not apply the sensor on the thumb or toe. It may cause incorrect measurements.
- Do not use the sensor for long-term monitoring.
- Circulation distal on the sensor site should be checked routinely. Reusable sensors must be moved to a new site at least every 4 hours. Because individual skin condition affects the ability of the skin to tolerate sensor placement, it may be necessary to change the sensor site more frequently with some patients. If skin integrity changes, move the sensor to another site. If long-term monitoring is required, use an OxiMax<sup>®</sup> sensor (MAX-A, MAX-AL, or MAX-N).
- Failure to apply the sensor properly may cause incorrect measurements.
- While the sensor is designed to reduce the effects of ambient light, excessive light may cause inaccurate measurements. In such cases, cover the sensor with an opaque material.
- Do not apply tape to secure the sensor in place or to tape it shut; venous pulsations may lead to inaccurate saturation measurements.
- Excessive motion may compromise performance. In such cases, try to keep the patient still, or change the sensor site to one with less motion.
- Intravascular dyes or externally applied coloring such as nail polish, dye, or pigmented cream may lead to inaccurate measurements.
- Do not pull the sensor cable to remove the sensor from the device.
- In the event of damage to the sterile packaging, do NOT use. Make sure to check whether the packaging and product is cracked or damaged before use. If there is any damage.
- Do not immerse in water or cleaning solutions. Do not resterilize.

For additional warnings, cautions or contraindications when using sensors with Nellcor-compatible device, refer to each SpO<sub>2</sub> sensor instruction manual.

## ■ Applying the OxiMax<sup>®</sup> MAX-R sensor

This Nellcor<sup>®</sup> adhesive sensor, model MAX-R, is indicated for continuous noninvasive arterial oxygen saturation and pulse rate monitoring. The MAX-R is designed for use only on the nose. Use this sensor when finger pulsatile flow is inadequate, or monitoring a finger/toe is not possible.

1. Clean the bridge of the patient's nose with the contents of the enclosed acetone/alcohol ampule to remove skin oils. Do not allow the acetone/alcohol solution to get in the patient's eyes.
2. Remove the plastic backing from the MAX-R and locate the transparent windows on the adhesive side. Windows cover optical components. Note the corresponding alignment marks on the non-adhesive side (a) and the dashed center line (b) midway between the marks (Figure (1)).
3. Orient the MAX-R so that the dashed line is centered on the nose (a) and the alignment marks are at the bone-cartilage junction (b). The cable should extend toward the patient's right side (Figure (2)).
4. Press the MAX-R firmly onto the nose and hold in place for 10 seconds to ensure adhesion (Figure (3)). The MAX-R must be secured firmly for proper operation.
5. As with all medical equipment, carefully route cables to reduce the possibility of patient entanglement or strangulation.
6. Connect the MAX-R into the LX-7230N. Verify proper operation as described in the operation manual.



### NOTE

If the sensor does not track the pulse reliably, it may be incorrectly positioned – or the sensor site may be too thick, thin, or deeply pigmented to permit appropriate light transmission. If any of these situations occurs, try another MAX-R or choose an alternate Nellcor Puritan Bennett sensor.

 **CAUTION**

- **Precautions for Use of adhesive sensor, MAX-R**
  - Do not reuse the sensor on other patients. This is a sterilized product and it is intended for single patient use only.
  - Circulation distal on the sensor site should be checked routinely. The site must be inspected every 8 hours to ensure adhesion, skin integrity, and correct sensor site. If skin integrity changes, move the sensor to another site
  - Do not use the sensor on patients who exhibit allergic reactions to the adhesive tape.
  - Do not get the acetone/alcohol cleaning solution in the patient's eyes.
  - Failure to apply the sensor properly may cause incorrect measurements.
  - While the sensor is designed to reduce the effects of ambient light, excessive light may cause inaccurate measurements. In such cases, cover the sensor with an opaque material.
  - Intravascular dyes or externally applied coloring such as dye or pigmented cream may lead to inaccurate measurements.
  - Take care when removing the MAX-R so that the adhesive does not damage delicate facial tissue.
  - The MAX-R is not recommended for patients wearing oxygen or anesthesia masks.
  - Excessive motion may compromise performance.
  - Do not pull the sensor cable to remove the sensor from the device.
  - In the event of damage to the sterile packaging, do NOT use. Make sure to check whether the packaging and product is cracked or damaged before use. If there is any damage.
  - Do not immerse in water or cleaning solutions. Do not resterilize.

**For additional warnings, cautions or contraindications when using sensors with Nellcor-compatible device, refer to each SpO<sub>2</sub> sensor instruction manual.**

## ■ Applying the OxiMax<sup>®</sup> MAX-N sensor

This Nellcor<sup>®</sup> adhesive sensor, model MAX-N, is indicated for continuous noninvasive arterial oxygen saturation and pulse rate monitoring and can be reused on the same patient as long as the adhesive tape attaches without slippage.

1. Remove the plastic backing from the MAX-N and locate the two transparent windows on the adhesive side. Windows cover optical components. Note the corresponding alignment marks (a) on the non-adhesive side and the dashed line (b) midway between the marks (Figure (1)).
2. Orient the MAX-N so that the dashed line is on the lateral edge of the site (a):

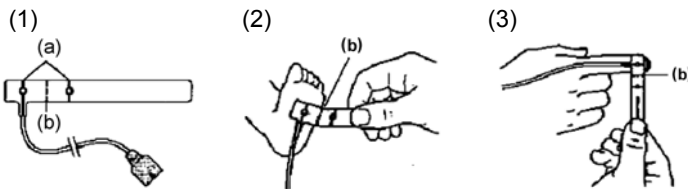
**Neonates:** The preferred site is the foot. Alternatively, use the hand. The window next to the cable goes on the sole of the foot as shown (Figure (2)).

**Adults:** The preferred site is the index finger. Alternatively, other fingers may be used. The window next to the cable goes on the nail side, distal to the first joint. Do not place on a joint. Note that the cable must be positioned on the top of the hand (Figure (3)).

### NOTE

When selecting a sensor site, priority should be given to an extremity free of an arterial catheter, blood pressure cuff, or intravascular infusion line.

3. Wrap the MAX-N firmly, but not too tightly around the foot or finger. Windows must oppose each other.
4. Connect the MAX-N into the LX-7230N. Verify proper operation as described in the operation manual.





**NOTE**

If the sensor does not track the pulse reliably, it may be incorrectly positioned - or the sensor site may be excessively wrinkled, or too deeply pigmented or otherwise deeply colored (for example, as a result of externally applied coloring such as dye or pigmented cream) to permit appropriate light transmission. If any of these situations occurs, reposition the sensor in a different location or choose an alternate Nellcor sensor to use on a different site.

**Reapplication**

1. The MAX-A can be reused on the same patient as long as the adhesive tape attaches without slippage.
2. Enclosed adhesive “dots” are provided for reapplication. Place the transparent dot over each window as shown, and then remove the protective paper that covers each dot (Figure (4)). The sensor is now ready to be reapplied to the same patient. For the reapplication, do not remove the previous adhesive dot, but place the enclosed adhesive dot over it.

(4)



 **CAUTION**

● **Precautions for Use of adhesive sensor, MAX-N**

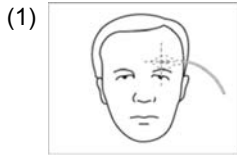
- Do not reuse the sensor on other patients. This is a sterilized product and it is intended for single patient use only.
- Circulation distal on the sensor site should be checked routinely. The site must be inspected every 8 hours to ensure adhesion, skin integrity, and correct optical alignment. If skin integrity changes, move the sensor to another site.
- Do not use the sensor on patients who exhibit allergic reactions to the adhesive tape.
- Failure to apply the sensor properly may cause incorrect measurements.
- While the sensor is designed to reduce the effects of ambient light, excessive light may cause inaccurate measurements. In such cases, cover the sensor with an opaque material.
- If the sensor is wrapped too tightly or supplemental tape is applied, venous pulsations may lead to inaccurate saturation measurements.
- Excessive motion may compromise performance. In such cases, try to keep the patient still, or change the sensor site to one with less motion.
- Intravascular dyes or externally applied coloring such as nail polish, dye, or pigmented cream may lead to inaccurate measurements.
- Do not pull the sensor cable to remove the sensor from the device.
- In the event of damage to the sterile packaging, do NOT use. Make sure to check whether the packaging and product is cracked or damaged before use. If there is any damage.
- Do not immerse in water or cleaning solutions. Do not resterilize.

For additional warnings, cautions or contraindications when using sensors with Nellcor-compatible device, refer to each SpO<sub>2</sub> sensor instruction manual.

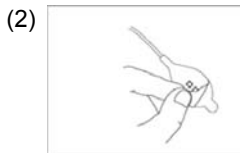
## ■ Applying the OXIMAX<sup>®</sup> MAX-FAST sensor

This is an adhesive sensor, model MAX-FAST, for continuous noninvasive arterial oxygen saturation and pulse rate monitoring and can be reused on the same patient as long as the adhesive tape attaches without slippage.

1. Clean the sensor site with an alcohol wipe to remove skin oils. See illustration for the recommended site. (Figure (1))



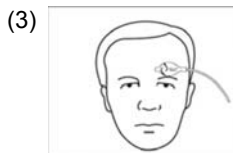
2. Remove the white paper backing to expose the first of three adhesive pads (Figure (2)). The OXIMAX<sup>®</sup> MAX-FAST sensor is now ready to be applied on the patient.



### NOTE

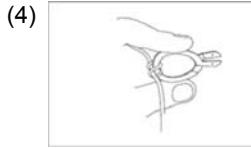
There are three adhesive pads attached to the sensor, each with a pull-tab for removal. When repositioning the sensor on the same patient, first expose the new adhesive pad by grasping the tab and peeling off the old adhesive pad. The sensor is now ready to be reapplied to the patient.

3. Place the sensor onto a flat, hairless portion of the patient's forehead just above the left or right eyebrow. If the patient is lying on their side, place the sensor above the eye on the side of the patient's head not in contact with the bed. Press the MAX-FAST sensor firmly in place for 10 seconds, ensuring that the entire surface area of the adhesive pad makes contact with the skin (Figure (3)).



## 6. SpO<sub>2</sub> Monitoring (LX-7230N)

4. If desired, the sensor cable can be secured to the patient's clothing or other material by using the clip located on the cable. To open, pinch the sides of the clip; release to close (Figure (4)).



5. Connect the OXIMAX<sup>®</sup> MAX-FAST oximetry sensor into the LX-7230N. Verify proper operation as described in the operation manual.

### NOTE

If the sensor does not track the pulse reliably, it may be incorrectly positioned - or the sensor site may be excessively wrinkled, or too deeply pigmented or otherwise deeply colored (for example, as a result of externally applied coloring such as dye or pigmented cream) to permit appropriate light transmission. If any of these situations occurs, reposition the sensor in a different location or choose an alternate Nellcor sensor to use on a different site.

### ⚠ WARNING

- Precautions for Use of headband
  - Do not use headband on children age 24 months and younger.
  - Do not use headband on children with open fontanelles.

For details, refer to the instruction manual of OXIMAX<sup>®</sup> MAX-FAST oximetry sensor.

### ⚠ CAUTION

- Precautions for Use of headband
  - Applying the headband too loose or too tight can cause inaccurate readings. Make sure the headband applies equal pressure to the entire sensor. The sensor must be completely covered by the headband.

For details, refer to the instruction manual of OXIMAX<sup>®</sup> MAX-FAST oximetry sensor.

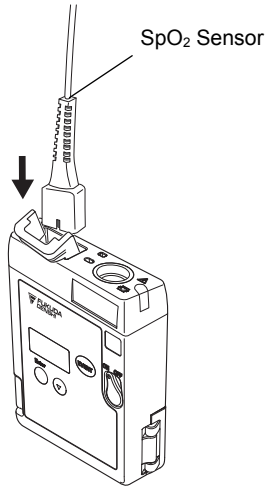
 **CAUTION****● Precautions for Use of adhesive sensors, MAX-FAST**

- Do not reuse the sensor on other patients. This is a sterilized product and it is intended for single patient use only.
- Circulation distal on the sensor site should be checked routinely. The site must be inspected every 12 hours to ensure adhesion, skin integrity, and correct position. Because individual skin condition affects the ability of the skin to tolerate sensor placement, it may be necessary to change the sensor site more frequently with some patients.
- Do not use the OXIMAX<sup>®</sup> MAX-FAST sensor on patients who exhibit allergic reactions to the adhesive pad; for patients who perspire profusely; or under conditions where the patient is in the Trendelenburg position (head lower than the heart).
- Failure to apply the sensor properly may cause incorrect measurements.
- While the sensor is designed to reduce the effects of ambient light, excessive light may cause inaccurate measurements. In such cases, cover the sensor with an opaque material.
- Do not use tape with the sensor. Use of additional tape or other types of adhesives may cause skin damage.
- Applying the headband too tightly can lead to inaccurate saturation measurements, or possibly to temporary pressure marks from sensor.
- Excessive motion may compromise performance. In such cases, try to keep the patient still, or change the sensor site to one with less motion.
- For patients in a prone position, venous pooling and/or pulsation may cause inaccurate SpO<sub>2</sub> readings. Use of the headband is advised.
- Do not pull the sensor cable to remove the sensor from the device.
- In the event of damage to the sterile packaging, do NOT use. Make sure to check whether the packaging and product is cracked or damaged before use. If there is any damage.
- Do not immerse in water or cleaning solutions. Do not resterilize.

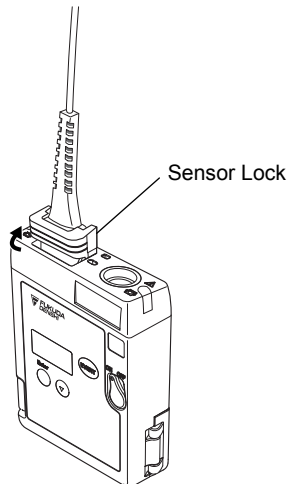
For additional warnings, cautions or contraindications when using sensors with Nellcor-compatible device, refer to each SpO<sub>2</sub> sensor and headband instruction manual.

■ Connecting the Nellcor<sup>®</sup> SpO<sub>2</sub> Sensor to the LX-7230N

- 1 Insert the SpO<sub>2</sub> sensor into the SpO<sub>2</sub> input connector on the LX-7230N.



- 2 Attach the sensor lock as shown in the following illustration to prevent the SpO<sub>2</sub> sensor to be disconnected.



**SpO<sub>2</sub> Monitoring (LX-7230KM)**

LX-7230KM, which has a built-in Konica Minolta® SpO<sub>2</sub> module, is described in this section.

Regarding the LX-7230N, which has a built-in Nellcor® SpO<sub>2</sub> module, refer to page 18.

**< SpO<sub>2</sub> probes for LX-7230KM >**

The optional SpO<sub>2</sub> probes available for LX-7230KM are as follows.

The following table shows applicable patient and proper site for each SpO<sub>2</sub> probe. Select the proper one depending on the purpose and intended use.

Sensor Types	Applicable Patient	Applied Site
Finger Clip SR-5C	Adult and Pediatric (weight of 30Kg and over)	Finger
Spot Check SP-5C	Adult and Pediatric (weight of 30Kg and over)	Finger
Universal Probe UD-5C	Adult and Pediatric (weight of 40Kg and over)	Finger
Personal Probe SD-5C(25), SD-5C(20)	Adult and Pediatric (weight of 15Kg and over)	Finger
	Pediatric and Infant (weight of 5 to 15Kg)	Big toe or the root of the big toe

**⚠ WARNING**

- For SpO<sub>2</sub> monitoring, always use the probe/relay cable specified by Fukuda Denshi. If any other probe/relay cable is used, high temperature rise of the sensor may place the patient in danger of burns in the worst case.
- As with all medical equipment, carefully route cables to reduce the possibility of patient entanglement and strangulation.

 CAUTION

- SpO<sub>2</sub> probes for LX-7230KM cannot be used on the LX-7230N.
- SpO<sub>2</sub> probes and relay cable are not waterproof. Keep away from liquids.
- Do not apply excessive force on the sensor or relay cable. Otherwise, damage to it may result.
- Do not pick up the device pulling the probe/relay cable part. It may get disconnected from the device and the device may be dropped.
- A message is displayed when the SpO<sub>2</sub> sensor is disconnected from the device.
- A message is displayed when the device detects that the SpO<sub>2</sub> probe is disconnected from the patient. Properly attach the SpO<sub>2</sub> probe to the patient.
- Read through the instruction of the SpO<sub>2</sub> probe as well.



## ⚠ CAUTION

The accuracy of the SpO<sub>2</sub> measurement may be influenced by abnormal hemoglobin, such as carbon monoxide hemoglobin (COHb) and methemoglobin (MetHb). It may be also affected by cardiogreen or intravascular dyes.

SpO <sub>2</sub>	HbCO			METHEMOGLOBIN		
	1%	5%	10%	1%	5%	10%
50%	-0.1%	-0.7%	-1.5%	0.2%	1.3%	3.2%
70%	-0.1%	-0.7%	-1.5%	-0.6%	-2.3%	-3.2%
90%	-0.2%	-0.8%	-1.6%	-1.5%	-6.0%	-9.6%
100%	-0.2%	-0.8%	-1.7%	-1.8%	-7.5%	-12.2%
Note	The value will be displayed lower than the actual value.			The value may be displayed higher than the actual value when the SpO <sub>2</sub> value is around 50%.		

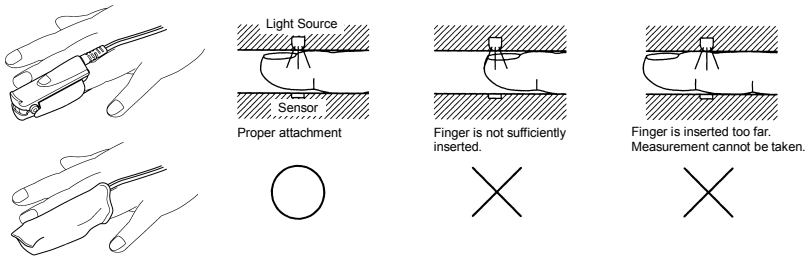
The following case may affect the accuracy of SpO<sub>2</sub> and pulse rate measurement.

- Outside light (direct sunlight, fluorescent, light therapy equipment, surgical light, infrared heat ramp, etc.)
- Hypoperfusion
- Excessive body motion (patient's motion)
- Pigment injected to the blood for testing
- In case of measurement during receiving CPR treatment
- Placement of SpO<sub>2</sub> sensor on limb with a blood-pressure cuff, arterial catheter
- External colorant such as nail polish
- Abnormally low or high hemoglobin concentration
- Venous pulse
- Electrosurgery
- Influence of electromagnetic waves from other electronics
- High-intensity radio waves from cell phone

## ■ Applying Finger Clip Probe (SR-5C)

The SR-5C is suitable for middle/long-term measurement, and should be clipped to the fingertip of an adult/ pediatric who is 30kg or above.

It should be positioned so that the LED (light source) is at the base of the fingernail, as shown in the figure below. Use the finger mesh cover (FC-M) to secure the probe. Also, use the finger mesh cover to get better measurement if it is exposed to high-intensity light.



### ⚠ WARNING

- Precautions for Use of Finger Clip Probe (SR-5C)
  - If continuously measuring over a long period of time, change the measuring finger every 8 hours (recommended wearing hours) to prevent low-temperature burn. Especially for continuous use on patient with peripheral circulatory disturbance, change the measuring finger more frequently.
  - Do not use tape to fix the probe. It may cause edema or congestion.

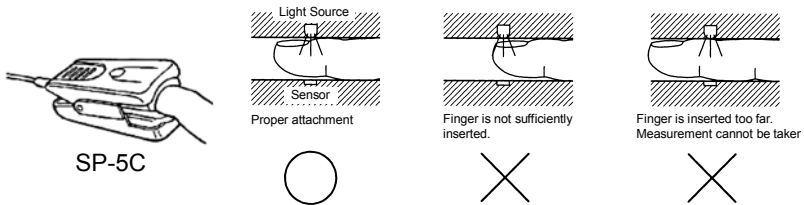
### ⚠ CAUTION

- Precautions for Use of Finger Clip Probe (SR-5C)
  - The probe should be positioned so that the light source is at the base of the fingernail. Take care not to insert the finger too deep to prevent injury.
  - When removing the probe, do not pull on the cord.
  - Cover the probe with the finger mesh cover (FC-M) if it is exposed to high-intensity light such as direct light and surgical light to prevent measurement error.
  - The SR-5C is designed for use on finger of an adult/ pediatric who is 30kg and above. Do not use on other parts.
  - Before attaching the probe to a patient, clean the probe using a cloth moistened with sterilizing alcohol.
  - Remove nail polish before taking measurements to enable stable measurements.
  - It may not be possible to take measurements in case of an excessively high hematocrit value. In such case, reattach the probe to a thinner finger.
  - Take note that it may not be possible to take measurements in place with vibrations or while walking.
  - After attaching the probe, make sure that there is no failure message and the pulse wave level on the LCD is upper than 2. If not upper than level 2, it may measure incorrectly. In such case, warm the finger to improve blood circulation.

## ■ Applying Spot Check Probe (SP-5C)

The SP-5C is suitable for short-term measurement, and should be clipped to a fingertip of an adult/ pediatric who is 30kg and above.

It should be positioned so that the LED (light source) is at the base of the fingernail.



### ⚠ WARNING

- Precautions for Use of Spot Check Probe (SP-5C)
  - The SP-5C is designed for short-term measurement. If measurements are taken continuously over a long period of time, change the measuring finger every 2 hours (recommended wearing hours) to prevent low-temperature burn. Especially for continuous use on patient with peripheral circulatory disturbance, change the measuring finger more frequently.
  - Do not use tape to fix the probe. It may cause edema or congestion.

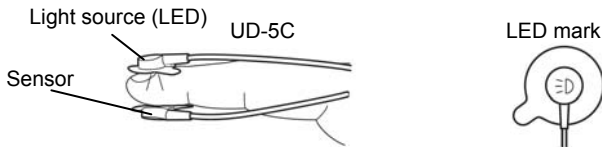
### ⚠ CAUTION

- Precautions for Use of Spot Check Probe (SP-5C)
  - The probe should be positioned so that the light source (LED) is at the base of the fingernail. Take care not to insert a finger too deep to prevent injury.
  - When removing the probe, do not pull on the cord.
  - Cover the probe with a black cover if it is exposed to high-intensity light such as direct light and surgical light to prevent measurement error.
  - The SP-5C is designed for use on finger of an adult/ pediatric who is 30kg and above. Do not use on other parts.
  - Before attaching the probe to a patient, clean the probe using a cloth moistened with sterilizing alcohol.
  - Remove nail polish before taking measurements to enable stable measurements.
  - It may not be possible to take measurements in case of an excessively high hematocrit value. In such case, reattach the probe to a thinner finger.
  - Take note that it may not be possible to take measurements in place with vibrations or while walking.
  - After attaching the probe, make sure that there is no failure message and the pulse wave level on the LCD is upper than 2. If not upper than level 2, it may measure incorrectly. In such case, warm the finger to improve blood circulation.

## ■ Applying Universal Probe (UD-5C)

The UD-5C is suitable for long-term measurement, and can be attached to a fingertip of an adult/ pediatric who is 40kg and above.

1. Fix the probe with tape. Before attaching the probe to a patient, clean the probe using a cloth moistened with sterilizing alcohol.
2. Make sure that the two pads are aligned.
3. Attach the pad with the LED to the base of the fingernail and the sensor pad to the opposite side of the finger.



### ⚠ WARNING

#### ● Precautions for Use of Universal Probe (UD-5C)

- Although UD-5C is suitable for long-term measurement, change the measuring site every 8 hours (recommended wearing hours) to prevent rash or a low-temperature burn. Be especially careful for continuous use on a patient with peripheral circulatory disturbance by changing the measuring site frequently.
- If the use of adhesive tape causes skin irritation, it should be discontinued.
- When securing the probe with bandage tape, do not tighten it too hard as this may cause edema or congestion.
- When removing the tape, be careful not to damage the skin.

### ⚠ CAUTION

#### ● Precautions for Use of Universal Probe (UD-5C)

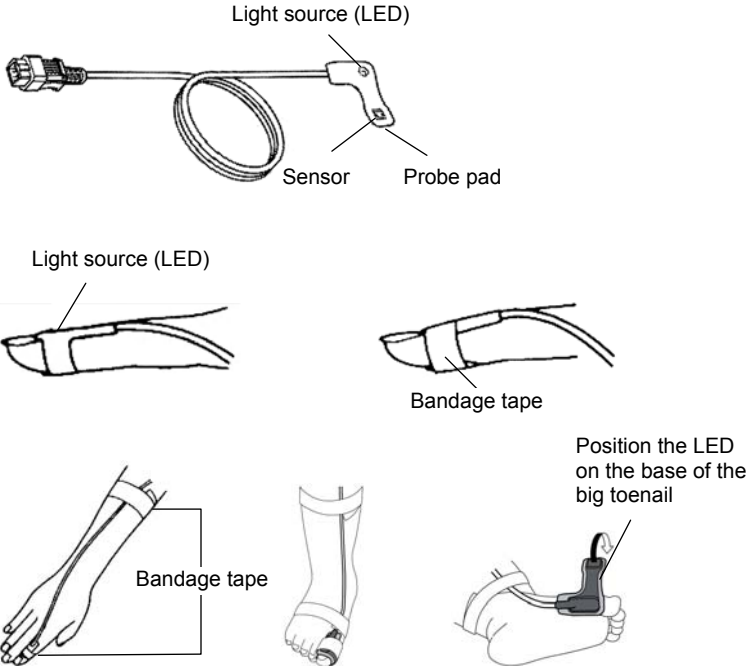
- When removing the probe, do not pull on the cord, and remove the tape. Do not apply excessive force to remove the tape. It may break the probe.
- Cover the probe with a black cover if it is exposed to high-intensity light such as direct light and surgical light to prevent measurement error.
- Remove nail polish before taking measurements to enable stable measurements.
- It may not be possible to take measurements in case of an excessively high hematocrit value. In such case, reattach the probe to a thinner finger.
- After attaching the probe, make sure that there is no failure message and the pulse wave level on the LCD is upper than 2. If not upper than level 2, it may measure incorrectly. In such case, warm the finger to improve blood circulation.

## ■ Applying Personal Probe (SD-5C(20) and SD-5C(25))

The SD-5C (20) and SD-5C (25) are disposable probes to prevent infection. The probe should be used for only one patient, and should be replaced after using it for approximately one week.

These probes can be attached to a finger of an adult/pediatric (15kg and above), or to the big toe or the root of the big toe of a pediatric/ infant (5 to 15kg) by using bandage tape.

1. Before attaching the probe, clean the probe using a cloth moistened with sterilizing alcohol.
2. When used on finger, position the LED (light source) on the base of the fingernail, and secure the sensor using bandage tape.
3. When used on the big toe, position the LED (light source) on the base of the big toenail, and secure the sensor using bandage tape.



 **WARNING**

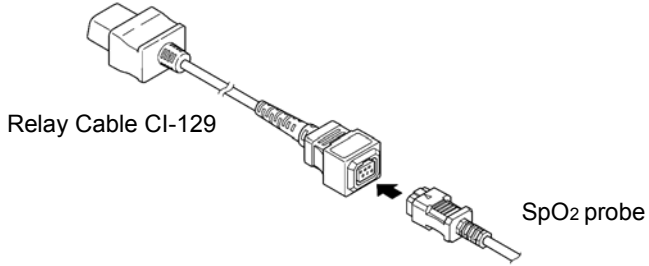
- **Precautions for Use of Personal Probe (SD-5C(20) and SD-5C(25))**
  - If measurements are taken over a long period of time, change the measuring site every 8 hours (recommended wearing hours) to prevent rash or low-temperature burn. Be especially careful for continuous use on a patient with peripheral circulatory disturbance by changing the measuring site frequently.
  - If the use of adhesive tape causes skin irritation, it should be discontinued.
  - When securing the probe with bandage tape, do not tighten it too hard as this may cause edema or congestion.
  - When removing the tape, be careful not to damage the skin.

 **CAUTION**

- **Precautions for Use of Personal Probe (SD-5C(20) and SD-5C(25))**
  - When removing the probe, do not pull on the cord, and remove the tape. Do not apply excessive force to remove the tape. It may break the probe.
  - Do not apply excessive force on the LED and sensor; otherwise damage to the probe may result.
  - Cover the probe with a black cover if it is exposed to high-intensity light such as direct light and surgical light to prevent measurement error.
  - Remove nail polish before taking measurements to enable stable measurements.
  - It may not be possible to take measurements in case of an excessively high hematocrit value. In such case, reattach the probe to a thinner finger.
  - After attaching the probe, make sure that there is no failure message and the pulse wave level on the LCD is upper than 2. If not upper than level 2, it may measure incorrectly. In such case, warm the finger to improve blood circulation.

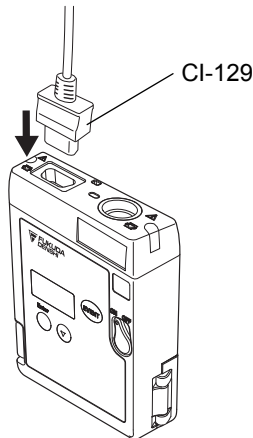
■ Connect the SpO<sub>2</sub> sensor to the Relay Cable (CI-129)

Connect the SpO<sub>2</sub> probe connector to the SpO<sub>2</sub> relay cable (CI-129), as shown in the figure below.



■ Connecting the Relay Cable (CI-129) to the LX-7230KM

Connect the relay cable (CI-129) to the SpO<sub>2</sub> input connector on the LX-7230KM.



Blank Page



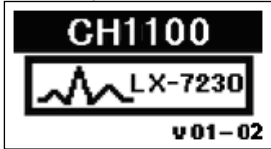
## 7. Measurement

---

Turn ON the power and the measurement starts.

### ■ Starting Screen

When the power is turned ON, the channel number configured on the LX-7230 is displayed at the top of the LCD.



Make sure whether the channel number on the LCD matches the channel number indicated on the label of the LX-7230 and the channel number configured on the receiving monitor.

This screen automatically moves onto the next waveform display screen.

### ■ Waveform Display Screen

ECG waveform (1CH when using 3-electrode lead cable, 2CH when using other lead cable), heart rate, pacemaker marker, respirogram, respiration rate, pulse wave, SpO<sub>2</sub> measurement value, remaining battery level, and various messages are displayed.




#### ⚠ CAUTION

- The LX-7230 does not have a diagnostic function. Check the diagnostic function on the receiving monitor.
- The LX-7230 does not have an alarm function. Check the alarm function on the receiving monitor.
- The ECG waveform size and sweep speed settings displayed on the LCD of the LX-7230 do not interface with the ones displayed on the screen of the receiving monitor.
- The heart rate and respiration rate displayed on the LCD of the LX-7230 may be different from the ones displayed on the receiving monitor. Because the algorithm of the ECG and respiration rate is different.

### ■ Battery Level Check

Check the battery level on the waveform display screen.




Battery Symbol	Remaining Battery Level
	Full
	Getting low but still available
	Nearly empty Replace the battery. A message that prompts the battery check appears on the screen of the receiving monitor.

## ■ Waveform Display

### ● ECG Display Screen (1)

ECG1 waveform, heart rate, pacemaker marker, remaining battery level, and electrode check message are displayed.

The LCD display will automatically turn itself OFF after 60 seconds if no operation is done. To restart the LCD display, refer to page 62.

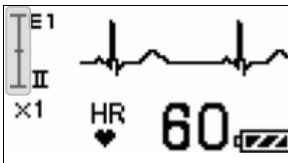
When the LCD display is active, press the  button to move onto the next waveform display screen.

#### 【Descriptions of the Screen】

The descriptions of contents displayed on the LCD are as follows.

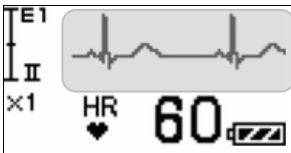


Indicates ECG 1.

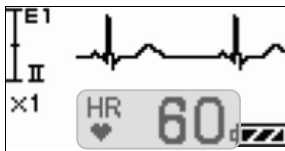


Indicates the scale of the displayed ECG.

One scale corresponds to 1mV. In the left illustration, it can display ECG waveform between -1mV and +1mV.



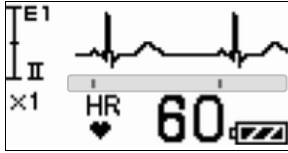
Displays the ECG waveform.



Displays the heart rate.

♥ is displayed in synchronization with the heart rate.

7. Measurement



Displays the detection marker when the pacemaker pulse is detected.



Indicates the measuring lead.



Indicates the ECG waveform size displayed on the LCD.

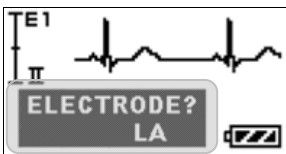
**⚠ CAUTION**

- The ECG waveform size setting displayed on the LCD does not interact with the one displayed on the screen of the receiving monitor, because the LX-7230 cannot transmit the setting information of the waveform size to the receiving monitor. If the ECG waveform size displayed on the screen of the receiving monitor is changed, follow the instruction in the operation manual of the receiving monitor.
- In case of the outside of the heart rate range (12 to 300bpm), 0bpm will be displayed if 11bpm and below is measured and 300bpm will be displayed if 300bpm and above is measured.



Indicates the remaining battery level.

For details of the battery level, refer to page 46.



Displays the electrode check "ELECTRODE?" message appears when the ECG electrode is detached.


## ● ECG Display Screen (2)

ECG2 waveform, heart rate, pacemaker marker, remaining battery level, and electrode check message are displayed.

### NOTE

If a 3-electrode lead cable is used, this screen will not appear.

The LCD display will automatically turn itself OFF after 60 seconds if no operation is done. To restart the LCD display, refer to page 62.

When the LCD display is active, press the  button to move onto the next waveform display screen.

### 【Descriptions of the Screen】

The descriptions of contents displayed on the LCD are as follows.



Indicates ECG 2.

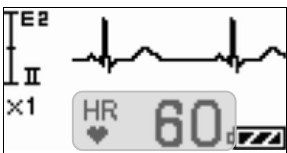


Indicates the scale of the displayed ECG.

One scale corresponds to 1mV.  
In the left illustration, it can display ECG waveform between -1mV and +1mV.



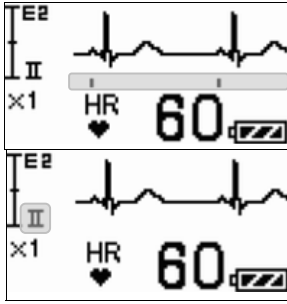
Displays the ECG waveform.



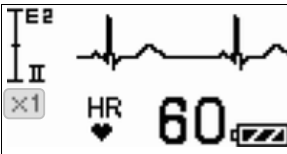
Displays the heart rate.

♥ is displayed in synchronization with the heart rate.

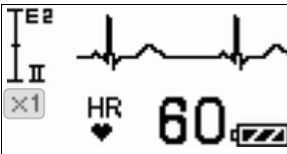
7. Measurement



Displays the detection marker when the pacemaker pulse is detected.



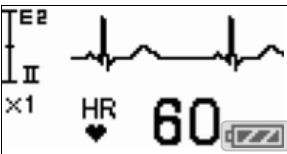
Indicates the measuring lead.



Indicates the ECG waveform size displayed on the LCD.

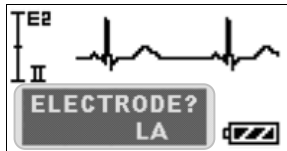
**⚠ CAUTION**

- The ECG waveform size setting displayed on the LCD of the LX-7230 does not interact with the one displayed on the screen of the receiving monitor, because the LX-7230 cannot transmit the setting information of the waveform size to the receiving monitor. If the ECG waveform size displayed on the screen of the receiving monitor is changed, follow the instruction in the operation manual of the receiving monitor.
- In case of the outside of the heart rate range (12 to 300bpm), 0bpm will be displayed if 11bpm and below is measured and 300bpm will be displayed if 300bpm and above is measured.



Indicates the remaining battery level.

For details of the battery level, refer to page 46.




Displays the electrode check "ELECTRODE?" message appears when the ECG electrode is detached.

## ● Respiration Display Screen

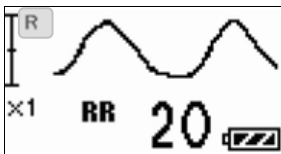
Respiration waveform, respiration rate, remaining battery level, and electrode check message are displayed.

The LCD display will automatically turn itself OFF after 60 seconds if no operation is done. To restart the LCD display, refer to page 62.

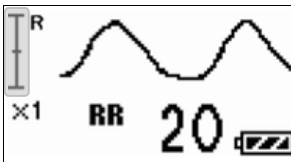
When the LCD display is active, press the  button to move onto the next waveform display screen.

### 【Descriptions of the Screen】

The descriptions of contents displayed on the LCD are as follows.

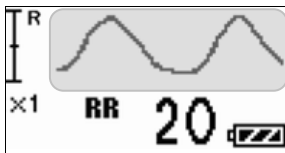


Indicates the respiration waveform display screen.



Indicates the scale of the displayed respiration waveform.

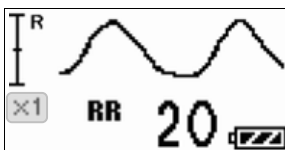
One scale corresponds to  $1\Omega$ . In the left illustration, it can display the change of respiration waveform between  $-1\Omega$  and  $+1\Omega$ .



Displays the respiration waveform.



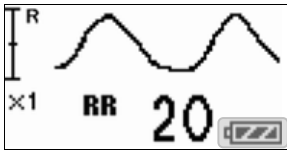
Displays the respiration rate.



Indicates the respiration waveform size displayed on the LCD.

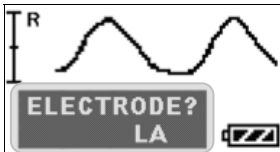
**⚠ CAUTION**

- The respiration waveform size setting displayed on the LCD does not interact with the one displayed on the screen of the receiving monitor, because the LX-7230 cannot transmit the setting information of the waveform size to the receiving monitor. If the respiration waveform size displayed on the screen of the receiving monitor is changed, follow the instruction in the operation manual of the receiving monitor.
- In case of the outside of the respiration rate range (9 to 150Bpm), 0Bpm will be displayed if 8Bpm and below is measured and 150Bpm will be displayed if 150Bpm and above is measured.



Indicates the remaining battery level.

For details of the battery level, refer to page 46.



Displays the electrode check "ELECTRODE?" message appears when the ECG electrode is detached.




## ● SpO<sub>2</sub> Display Screen

SpO<sub>2</sub> display screen depends on the transmitter LX-7230N or LX-7230KM.

For the LX-7230N

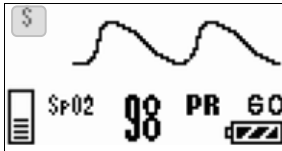
Pulse wave, pulse rate, SpO<sub>2</sub> measurement value, remaining battery level, and probe condition are displayed.

The LCD display will automatically turn itself OFF after 60 seconds if no operation is done. To restart the LCD display, refer to page 62.

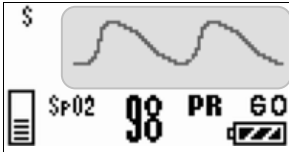
When the LCD display is active, press the  button to move onto the next waveform display screen.

### 【Descriptions of the Screen】

The descriptions of contents displayed on the LCD are as follows.



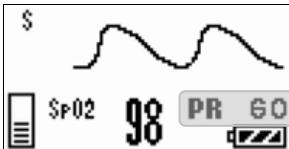
Indicates the SpO<sub>2</sub> display screen.



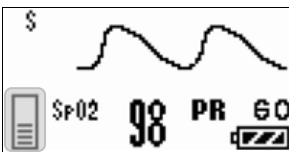
Displays the pulse wave.  
The waveform size displayed on the LCD is adjusted automatically.



Displays the SpO<sub>2</sub> measurement value.

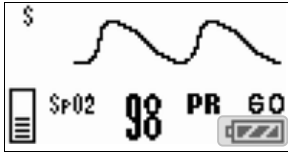


Displays the pulse rate.



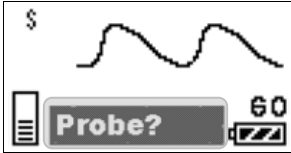
Displays the level meter of the pulse wave.  
Indicates the amplitude level of the pulse wave in 8 steps.

7. Measurement



Indicates the remaining battery level.

For details of the battery level, refer to page 46.




Displays messages such as probe off.

For details of messages, refer to page 87.

For the LX-7230KM

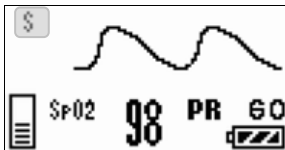
Pulse wave, pulse rate, SpO<sub>2</sub> measurement value, remaining battery level, and probe condition are displayed.

The LCD display will automatically turn itself OFF after 60 seconds if no operation is done. To restart the LCD display, refer to page 62.

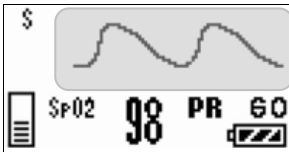
When the LCD display is active, press the  button to move onto the next waveform display screen.

**【Descriptions of the Screen】**

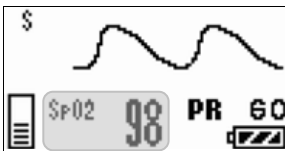
The descriptions of contents displayed on the LCD are as follows.



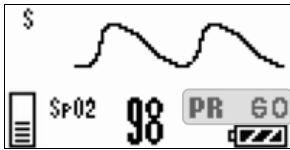
Indicates the SpO<sub>2</sub> display screen.



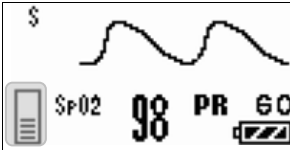
Displays the pulse wave.  
The waveform size displayed on LCD is adjusted automatically.



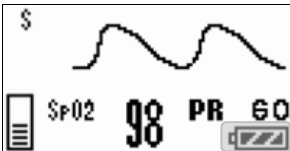
Displays the SpO<sub>2</sub> measurement value.



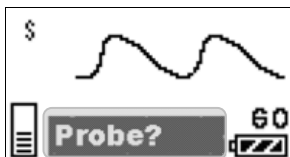
Displays the pulse rate.



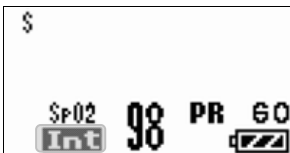
Displays the level meter of the pulse wave.  
Indicate the amplitude level of the pulse wave in 8 steps.



Indicates the remaining battery level.  
For details of the battery level, refer to page 46.



Displays messages such as probe off.  
For details of messages, refer to page 87.



Indicates "Int" for the SpO<sub>2</sub> intermittent measurement mode.  
For the SpO<sub>2</sub> continuous measurement mode, nothing is indicated.

### ⚠ CAUTION

- In the SpO<sub>2</sub> intermittent mode, the SpO<sub>2</sub> is measured at 25 seconds interval. Even when the SpO<sub>2</sub> value suddenly changes during this interval, the LX-7230 and receiving monitor will only show the last SpO<sub>2</sub> measurement value. For a patient with the possibility of sudden change, select SpO<sub>2</sub> continuous mode.
- Pulse wave and pulse wave level meter are not displayed on the LCD during the SpO<sub>2</sub> intermittent measurement mode. On the screen of the receiving monitor, pulse wave is not displayed as well.
- Make sure that SpO<sub>2</sub> is measured correctly, and the SpO<sub>2</sub> value and pulse rate are updated at 25 seconds interval on the LCD or on the screen of the receiving monitor.

Blank Page

## 8. Operation

### ■ Changing Setup

#### ● ECG Display Screen (1)

In the ECG display screen (1), the ECG waveform size and lead displayed on the LCD of the LX-7230 can be changed.

#### 【Setting Method】

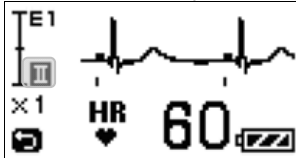
How to enter the setup mode:

Press and hold the **Enter** button for 2 seconds in the ECG display screen (1).

#### <<Switching Lead>>

Lead of ECG 1 can be switched when 3-electrode lead cable or 5-electrode (Chest) lead cable is used.

Select an appropriate lead by checking the ECG waveform on the LCD.



The lead indication of ECG 1 is highlighted.

Pressing the **Enter** button will sequentially change the lead of ECG 1.

Lead I → II → III → I

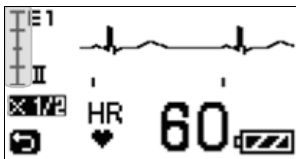
#### <<Changing ECG1 Waveform Size on LCD>>



Press the **▽** button to highlight the size indication of ECG 1.

Pressing the **Enter** button will sequentially change the size of ECG 1.

Size ×1 → ×1/2 → ×1

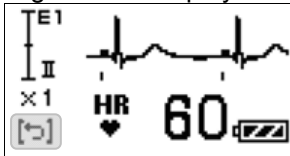


When changing the size of the ECG waveform on the LCD, the ECG scale will also change. In the left illustration, it can display the ECG waveform between -2mV and +2mV.

**⚠ CAUTION**

The ECG waveform size setting displayed on the LCD of the LX-7230 does not interact with the one displayed on the screen of the receiving monitor, because the LX-7230 cannot transmit the setting information of the waveform size to the receiving monitor. If the ECG waveform size displayed on the screen of the receiving monitor is changed, follow the instruction in the operation manual of the receiving monitor.

<< Returning to ECG Display Screen (1) >>



Press the  button to highlight the  button.

Press the  button to return to the ECG display screen (1).

**⚠ CAUTION**

Do not operate the LX-7230 with the setup screen open to prevent the settings to be changed due to an unintended operation. Make sure to press the  button to terminate the setup screen. The LCD display will automatically turn itself OFF after 60 seconds if the  button is not pressed.

## ● ECG Display Screen (2)

In the ECG display screen (2), the ECG waveform size displayed on the LCD of the LX-7230 can be changed.

### 【Setting Method】

How to enter the setup mode:

Press and hold the **Enter** button for 2 seconds in the ECG display screen (2).

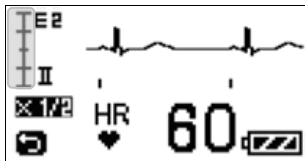
### << Changing ECG2 Waveform Size on LCD >>



The size indication of ECG 2 is highlighted.

Pressing the **Enter** button will sequentially change the size of ECG 2.

Size  $\times 1 \rightarrow \times 1/2 \rightarrow \times 1$



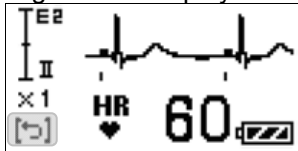
When changing the size of the ECG waveform on the LCD, the ECG scale will also change.

In the left illustration, it can display ECG waveform between -2mV and +2mV.

## ⚠ CAUTION

The ECG waveform size setting displayed on the LCD of the LX-7230 does not interact with the one displayed on the screen of the receiving monitor, because the LX-7230 cannot transmit the setting information of the waveform size to the receiving monitor. If the ECG waveform size displayed on the screen of the receiving monitor is changed, follow the instruction in the operation manual of the receiving monitor.

### << Returning to ECG display screen (2) >>



Press the **Return** button to highlight the **Return** button.

Press the **Enter** button to return to the ECG display screen (2).

## ● Respiration Display Screen

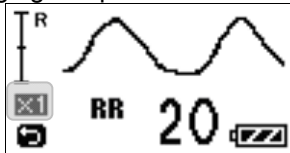
In the respiration display screen, the respiration waveform size displayed on the LCD of the LX-7230 can be changed.

### 【Setting Method】

How to enter the setup mode:

Press and hold the **Enter** button for 2 seconds in the respiration display screen.

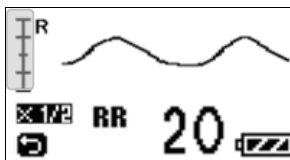
### << Changing Respiration Waveform Size on LCD >>>



The size indication of the respiration is highlighted.

Pressing the **Enter** button will sequentially change the size of respiration.

Size  $\times 1 \rightarrow \times 1/2 \rightarrow \times 1$



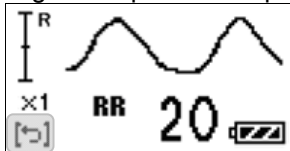
When changing the size of the respiration waveform on the LCD, the respiration scale will also change.

In the left illustration, it can display the respiration waveform until 4Q of change.

## ⚠ CAUTION

The respiration waveform size setting displayed on the LCD of the LX-7230 does not interact with the one displayed on the screen of the receiving monitor, because the LX-7230 cannot transmit the setting information of the waveform size to the receiving monitor. If the respiration waveform size displayed on the screen of the receiving monitor is changed, follow the instruction in the operation manual of the receiving monitor.

### << Returning to Respiration Display Screen >>



Press the **Return** button to highlight the **Return** button.

Press the **Enter** button to return to the respiration display screen.



## ● SpO<sub>2</sub> Display Screen

SpO<sub>2</sub> display screen depends on the transmitter LX-7230N or LX-7230KM.

LX-7230N: LX-7230N has no setup item in the SpO<sub>2</sub> display screen.

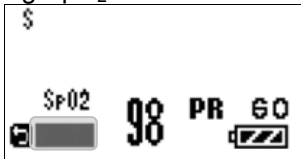
LX-7230KM: LX-7230KM has a setup item to select the SpO<sub>2</sub> measurement mode (continuous or intermittent) in the SpO<sub>2</sub> display screen.

### 【Setting Method】

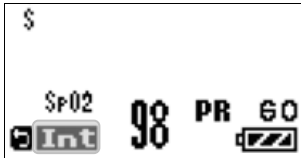
How to enter the setup mode:

Press and hold the **Enter** button for 2 seconds in the SpO<sub>2</sub> display screen.

### <<Changing SpO<sub>2</sub> Measurement Mode>>

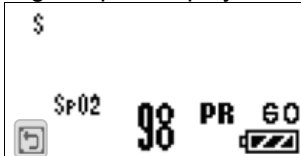


Indicates the current measurement mode. (In the SpO<sub>2</sub> continuous measurement mode, nothing is indicated. In the SpO<sub>2</sub> intermittent measurement mode, “Int” is indicated.)



Pressing the **Enter** button will sequentially change modes.  
Mode Continuous → intermittent  
→ Continuous

### << Returning to SpO<sub>2</sub> display screen>>



Press the **Return** button to highlight the **Return** button.  
Press the **Enter** button to return to the SpO<sub>2</sub> display screen.

## ⚠ CAUTION

- In the SpO<sub>2</sub> intermittent mode, the SpO<sub>2</sub> is measured at 25 seconds interval. Even when the SpO<sub>2</sub> value suddenly changes during this interval, the LX-7230 and receiving monitor will only show the last SpO<sub>2</sub> measurement value. For a patient with the possibility of sudden change, select SpO<sub>2</sub> continuous mode.
- Pulse wave and pulse wave level meter are not displayed on the LCD during the SpO<sub>2</sub> intermittent measurement mode. On the screen of the receiving monitor, pulse wave is not displayed as well.
- Make sure that SpO<sub>2</sub> is measured correctly, and the SpO<sub>2</sub> value and pulse rate are updated at 25 seconds interval on the LCD or on the screen of the receiving monitor.

**⚠ CAUTION**

Do not operate the LX-7230 with the setup screen open to prevent the settings to be changed due to an unintended operation. Make sure to press the **Return** button to terminate the setup screen. The LCD display will automatically turn itself OFF after 60 seconds if the **Return** button is not pressed.

■ **Restarting the LCD display**

The LCD display will automatically turn itself OFF after 60 seconds if no operation is done.

Press the **Enter** button or press and hold the **▽** button to restart the LCD display.

The starting screen with telemetry channel number appears, and then the waveform display screen appears.

■ **Pressing the EVENT button**

Press and hold the **EVENT** button for 2 seconds to activate the function assigned on the receiving monitor. The following message appears on the LCD while the “EVENT” is transmitted.



After the transmission is completed, the starting screen with the telemetry channel number appears, and then the waveform display screen appears. “EVENT” operation is available as a remote recording.

For details of the receiving monitor operation and settings related to the “EVENT” function, refer to the operation manual of the receiving monitor.

## 9. Other Setting Items

The following settings are available for the LX-7230 depending on the use and condition of the patient. For details of the settings, contact our service representative.

Items	Selection	Default	Backup
Time Constant	0.4 sec., 0.1 sec.	0.4 sec.	Yes
Detection Sensitivity of Pacemaker Pulse	Low, Mid, High	Mid	Yes
Respiration Detection Signal	ON, OFF	ON	Yes
LCD Contrast	8 steps	8	Yes
Transmitter Channel	One from the following channels.  0801 to 0879 0900 to 0979 1000 to 1079 1100 to 1179 1200 to 1279 1300 to 1379	1100	Yes
Group ID	One from 00 to 63	00	Yes

### ■ Changing the Time Constant

The default setting of the time constant is “0.4 seconds”.

If a stable monitoring is difficult with excessive change in the baseline due to excessive body motion of the patient or an interference noise, such as AC frequency, by changing the time constant to “0.1 second” the monitoring may become relatively stable.

For details of the setting change, contact your local Fukuda Denshi service representative.

#### CAUTION

- When changing the time constant to “0.1 seconds”, the lower frequency characteristic becomes 1.6Hz  $\pm$ 25%. This setup does not meet IEC 60601-2-27 standard. It may lead to a change in the ECG waveform and ST measurement value may be especially affected. Fukuda Denshi recommends “0.4 seconds” setting in normal use.
- The LCD screen in normal use does not indicate the selection of time constant. Make sure to take measures, such as marking on the LX-7230, to distinguish whether the selection of time constant is changed.

## ■ Changing the Detection Sensitivity of the Pacemaker Pulse

The default setting of pacemaker pulse detection sensitivity is “Mid”. The “Mid” setting can detect and reject the following pacemaker pulse specified in ANSI/AAMI EC13 standard.

### **Detection/ Rejection of Pacemaker Pulse:**

- a) Pacemaker Pulse without Over/Undershoot:  
Capable to reject pulses of pulse width 0.1 to 2ms,  
amplitude  $\pm 2$  to  $\pm 700$ mV
- b) Pacemaker Pulse with Over/Undershoot:  
Rejection is not possible.

Fukuda Denshi recommends the “Mid” setting in normal use.

There may be some cases when the pacemaker pulse cannot be detected depending on the pacemaker type, pulse voltage, pulse width, electrode lead type (unipolar, bipolar). In this case, change the lead or the position of the electrodes to be able to detect the pacemaker pulse.

Nonetheless, if the detection is still undetectable, change the setting to “High” in order to increase the detection sensitivity. So that smaller pacemaker pulse can be detected. However, the “High” setting may lead to erroneous detection due to interference noise, such as AC frequency.

If erroneous detections occur due to interference noise, such as AC frequency, turn OFF the setting of the pacemaker pulse detection in the receiving monitor. If erroneous detections occur due to interference noise, such as AC frequency, while monitoring a patient with a pacemaker, and the setting of the pacemaker pulse detection cannot be turned OFF, replace the electrodes or change the lead to remove the interference noise, such as AC frequency.

Nonetheless, if erroneous detections still occur, change the setting to “Low” in order to decrease the detection sensitivity. It makes the LX-7230 less likely to be interfered by the noise, such as AC frequency.

The “Low” setting decreases the detection sensitivity. Therefore, it cannot detect the pacemaker pulse specified in ANSI/AAMI EC13 standard.

For details of the setting change, contact your local Fukuda Denshi service representative.

### CAUTION

The LCD screen in normal use does not indicate the setting status of the pacemaker pulse detection. Make sure to take measures, such as marking on the LX-7230, to distinguish whether the setting of the pacemaker pulse detection is changed.

## ■ Changing the Respiration Detection Signal ON/OFF

The default setting of the respiration detection signal is “ON”.

The respiration waveform can be detected when the setting of the respiration detection signal is turned “ON”.

### WARNING

If the LX-7230 is used with minute ventilation rate-adaptive implantable pacemaker, the respiration detection signal may cause the pacemaker to pace at its maximum programmed rate. If such event occurs, change the setting to “OFF” to prevent an occurrence of erroneous pacing rate.

For details of the setting change, contact your local Fukuda Denshi service representative.

### CAUTION

- The respiration waveform cannot be measured if the setting of the respiration detection signal is turned “OFF”.
- Make sure to turn OFF the respiration measurement function on the receiving monitor to prevent an erroneous detection of the respiration alarm (on the receiving monitor side).
- The LCD screen in normal use does not indicate the setting status of the respiration detection signal ON/OFF. Make sure to take measures, such as marking on the LX-7230, to distinguish whether the setting of the respiration detection signal ON/OFF is changed.

## ■ Changing the LCD Contrast

The LCD display contrast of the LX-7230 can be changed in 8 steps.

For details of the setting change, contact your local Fukuda Denshi service representative.

Blank Page

## 10. Changing the Transmitter Channel and Group ID

---

### ■ Changing the Transmitter Channel

The LX-7230 is a transmitter of PLL synthesizer type, and its transmitter channel can be programmed. It can be set up with an arbitrary channel among the channels assigned by the Telemetry Laws (according to each country).

For details of the setting change, contact your local Fukuda Denshi service representative.

#### WARNING

- If the transmitter channel is changed, follow the instruction by the person in charge of the radio telemetry channel in your facility. Mismanagement may result in a serious accident, such as interference and mixing up patients.
- Replace promptly the new channel label if the transmitter channel has been changed.

### ■ Changing the Group ID

The LX-7230 transmits its group ID, which it belongs to, to prevent interference with neighboring hospital's transmitter.

The receiving monitor checks whether the incoming group ID is the same as the programmed one that the receiving monitor has. There are 64 group codes available. The default setting is "00".

The transmitter group ID can be changed if there is interference with a neighboring hospital's transmitter,

For details of the setting change, contact your local Fukuda Denshi service representative.

#### CAUTION

Possible causes of interference other than radio telemetry from neighboring hospital's transmitter, are the proximity of cell phone, amateur radio station, radio taxi, and illegal citizens band, which may be a cause of interference. In such a case, the situation should be carefully observed to find the cause of interference.

## 10. Changing the Transmitter Channel and Group ID





Blank Page



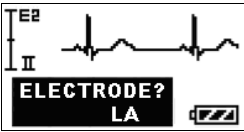
# 11. Troubleshooting

## ■ List of Displayed messages

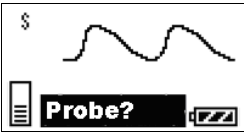
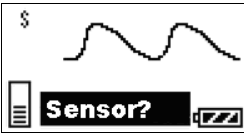
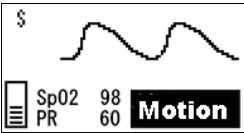
### Transmitter (main unit)

Message	Cause	Solution
	Faulty SpO <sub>2</sub> module.	Contact your local Fukuda Denshi service representative.
	Failed to transmit waveform and value.	
	Faulty EEPROM.	
	Failed to initialize CPU.	

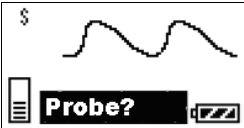
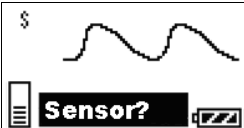


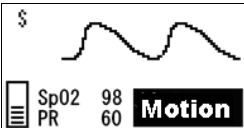
### ECG

Message	Cause	Solution
 <p>Character string displayed, such as LA, depends on the detached electrode position.</p>	Electrode is off.	Check the electrode condition.

SpO<sub>2</sub> (LX-7230N)

Message	Cause	Solution
	Probe is off.	Check the attached condition of the probe.
	Faulty Probe.	Replace the probe with new one.
	SpO <sub>2</sub> is not measured correctly.	Check the attached condition of the probe.
		Cover the probe with an opaque material to cut off the outside light.
	Due to excessive body motion, SpO <sub>2</sub> is not measured correctly	Keep the patient still.

SpO<sub>2</sub> (LX-7230KM)

Message	Cause	Solution
	Probe is off.	Check the attached condition of the probe.
	Faulty Probe.	Replace the probe with new one.
	Unspecified probe is connected.	Replace the probe with a specified one.
	SpO <sub>2</sub> is not measured correctly.	Check the attached condition of the probe.
		Cover the probe with an opaque material to cut off the outside light.
	When the pulse rate is less than 30bpm (under the measuring range).	
	When the pulse rate is more than 230bpm (over the measuring range).	
	Due to excessive body motion, SpO <sub>2</sub> is not measured correctly	Keep the patient still.

## ■ Troubleshooting

Make sure of the followings. However, if there is no improvement in the phenomenon, contact your local Fukuda Denshi service representative.

### Transmitter (main unit)

Phenomenon	Cause	Solution
Nothing is displayed on the LCD when the power switch is turned ON.	No battery or wrong polarity	Install the battery correctly.
	Battery level is empty.	Replace the battery with a new one.
Nothing is displayed on the receiving monitor screen.	The channel number between the transmitter and the receiving monitor do not match up.	Set the same channel number for the transmitter and the receiving monitor.
Transmission problem.	Same channel number is already used.	Make sure to not duplicate channel numbers. Follow the instruction by the person in charge of radio telemetry channel in your facility and use the LX-7230 with the correct channel setting.
	Channel interference	Follow the instruction by the person in charge of radio telemetry channel in your facility and use the LX-7230 with the correct channel setting.
	Transmitter failure	Contact your local Fukuda Denshi service representative.

## ECG

Phenomenon	Cause	Solution
“ELECTRODE?” message is displayed.	Lead cable is off.	Check the connection between the lead cable and the LX-7230.
		Check the connection between the lead cable and the electrode.
	Faulty Lead cable.	Replace the ECG cable with a new one.
	Electrode is peeling off.	Replace the electrode with a new one.
	Polarization potential of the electrode is too high.	Replace the electrode with a new one.
ECG waveform contains noise	Electrode gel is dry.	Replace the electrode with a new one.
	Electrode is peeling off.	
	Electric blanket is used.	Cover the electric blanket with a shield cover.
	AC filter setting of the receiving monitor is OFF.	Set the AC filter up as ON.
Respiration waveform cannot be measured.	Electrode gel is dry.	Replace the electrode with a new one.
	Electrode is peeling off.	
	The positions of the electrodes are improper.	Attach the electrodes where the respiration waveform can be measured appropriately.

## SpO<sub>2</sub>

Phenomenon	Cause	Solution
SpO <sub>2</sub> value is unstable.	The probe size is improper.	Use a probe, which fit properly.
	The probe is peeling off or is affected by the outside light due to the poor condition	Attach the probe properly following the instruction.
	Transmitting and measuring LEDs sensor are dirty.	Clean both LED sensors from dirt.

### ■ In Case of Dropping the LX-7230 into Water

In case of dropping the LX-7230 into water containing disinfectant, pick up the LX-7230 quickly from it. Rinse it well with running water, and dry it thoroughly with a soft cloth.

#### CAUTION

- Do not use a drier. The LX-7230 shape may change or be broken.
- When the LX-7230 is rinsed with running water, make sure to close the battery compartment lid.

## 12. Cleaning and Disinfection

---

The Cleaning and disinfection of the LX-7230, ECG lead cable, and SpO<sub>2</sub> probe (sensor) shall be performed as follows.

### CAUTION

Do not sterilize the LX-7230, ECG lead cable, and SpO<sub>2</sub> probe (sensor) in any manners, such as radioactive rays, steam, or ethylene oxide.

### ■ Cleaning

Clean the LX-7230 using a squeezed gauze or an absorbent cotton cloth dampened with alcohol or a neutral cleanser.

### CAUTION

- Clean the equipment frequently so stains can be removed easily.
- To prevent injury, it is recommended to wear gloves when cleaning the equipment.
- Do not allow any chemical solution to enter the inside of LX-7230 or connectors.
- The LX-7230 cannot be sterilized.
- Do not use organic solvents, thinner, toluene and benzene to avoid damaging the resin case.
- Do not polish the housing with abrasive or chemical cleaner.
- Use only neutral detergent to clean the housing. Do not use chemical cloth, scrub brush, abrasive, polishing powder, hot water, volatile solvent and chemicals (cleanser, thinner, benzine, benzol, and synthetic detergent for house and furniture), or sharp-edged tools. The surface resin coating may be damaged, resulting in discoloration, scratches, and other problems.

### ■ Disinfection

If there is a possibility of being infected, clean the LX-7230 using a squeezed gauze or an absorbent cotton cloth dampened with alcohol or invert soap.

### CAUTION

- Do not immerse the connector parts of the LX-7230 in any chemical solution to prevent connection failure.
- When disinfecting the entire room using a spray solution, pay close attention not to have liquids get into the LX-7230 or connectors.

Blank Page



## 13. Maintenance and Inspection

---

This section explains the daily checks and periodic checks of the LX-7230. To ensure safety, reliability, and high performance, a “Daily Check” and “Periodic Check” must be performed. We are not liable for any accident arising from lack of maintenance.

### CAUTION

- Do not open the housing or attempt service. The service should be done by Fukuda Denshi or Fukuda Denshi’s representative.
- Do not allow excessive moisture or cleaning agents into the connectors or inside the equipment.

### ■ Daily Check

Perform daily checks using the “Daily Check List” on the next page.

### ■ Periodic Check

Periodic check of medical electronic equipment is mandatory to prevent failures and accidents and to ensure safety and reliability.

Periodic maintenance may be performed by the medical institution or by a third party by concluding a “Maintenance Contract”.

For more details, contact your local Fukuda Denshi service representative.

### ■ Periodic Replacement Parts

The “**Battery Compartment Lid (Waterproof)**” is the only periodic replacement part.

To ensure the reliability of waterproof (IPX8) performance of the LX-7230, replace it once a year.

You may be able to keep using the LX-7230 without periodic replacement of the lid. However, as it gets older, the reliability of water resistance (IPX8) performance will not be ensured.

When replacing the lid, contact your local Fukuda Denshi service representative.

### CAUTION

The periodic replacement parts must be replaced at specified period.

13. Maintenance and Inspection

## Daily Check List

No. \_\_\_\_\_

Inspected Date \_\_\_\_\_ Inspected by \_\_\_\_\_ Location \_\_\_\_\_

Device Type LX-7230N/KM S/No. \_\_\_\_\_ Date of Purchase \_\_\_\_\_

<i>Items</i>	<i>Details</i>	<i>Criteria</i>	<i>Judgment</i>
Appearance	Visually check for any damage, cracks, chip, peeled label, and loosen screw on the housing.	No abnormality should be found.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
Battery Compartment	Visually check for the ring condition of the battery compartment lid.	No damage, kink, floating, and adhesion of dust should be found.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
	Visually check for the contact springs, inside the LX-7230, to the battery and the lock lever of the battery compartment lid.	No deformation, cracks, and rust should be found.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
Power Supply	Turn the power ON/OFF to verify proper switch operation.	With batteries installed, the LCD should turn ON.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
ECG Connectors	Visually check the connectors of the cable and the LX-7230.	No damage, chip, and adhesion of dust should be found.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
ECG Lead cable	Visually check each lead for damages.	No crack and damage should be found.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
SpO <sub>2</sub> Relay Cable (LX-7230KM only)	Visually check the cable, and connector for damages.	No crack, chip and damage should be found.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
SpO <sub>2</sub> Sensor (Probe)	Visually check the cable, optical receiver, LED, and connector for damages.	No crack, chip, damage, and adhesion of dust should be found.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
Wireless Channel	Verify whether the transmitting channel and group ID are the same with the receiving monitor.	Must match the wireless channel check list.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
Transmission Function	Turn the power ON and make sure the information is displayed on the receiving monitor.	Waveforms and values should be received without any problem.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
Display Function	Turn the power ON and verify each display condition, such as SpO <sub>2</sub> value and bargraph.	All data should be properly displayed.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG
Periodic Check	Check the date of the previous periodic check.	Should be within one year.	<input type="checkbox"/> OK/ <input type="checkbox"/> NG

Comment

-----

-----

-----

## 14. Standard and Optional Accessories

This section lists the accessories for the LX-7230.

### ⚠ WARNING

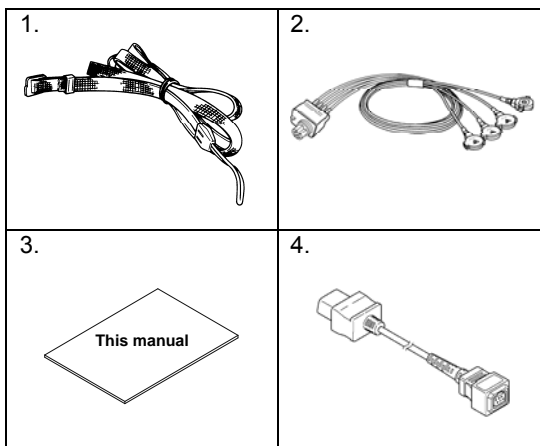
Use only the accessories, such as ECG Lead cable and SpO<sub>2</sub> probe (sensor)/ relay cable, specified by Fukuda Denshi for the LX-7230. Otherwise, the LX-7230 cannot deliver its maximum performance and may be damaged, resulting in a safety hazard.

### ⚠ CAUTION

For quality improvement, specifications are subject to change without prior notice.

### ■ Standard Accessories

No.	Item	Model Type	Q'ty	Note
1	Neck Strap	OA-311	1	
2	4-electrode ECG lead cable	<b>CMT-02HTH-0.8DA</b>	1	AHA color code, Hook Type, Limb Lead (2CH)
3	Operation Manual		1	
4	SpO <sub>2</sub> Relay Cable	CI-129	1	LX-7230KM only



## ■ Optional Accessories

The following accessories are available as optional for the LX-7230. Purchase them as required.

### ● ECG, Impedance Respiration Measurement (For LX-7230N and LX-7230KM)

AHA color code:

<i>Item</i>	<i>Model Type</i>	<i>Note</i>
ECG Hook Type Lead Cable	<b>CMT-01HTH-0.8DA</b>	3-electrode (White, Black, Red), Limb Lead (1CH)
ECG Hook Type Lead Cable	<b>CMT-02HTH-0.8DA</b>	4-electrode (White, Black, Red, Green), Limb Lead (2CH)
ECG Hook Type Lead Cable	<b>CMT-03HTH-0.8DA</b>	5-electrode (White, Black, Red, Green, Brown), Limb Lead (1CH)+Chest (1CH)
ECG Clip Type Lead Cable	<b>CMT-01FTH-0.8DA</b>	3-electrode (White, Black, Red), Limb Lead (1CH)
ECG Clip Type Lead Cable	<b>CMT-02FTH-0.8DA</b>	4-electrode (White, Black, Red, Green), Limb Lead (2CH)
ECG Clip Type Lead Cable	<b>CMT-03FTH-0.8DA</b>	5-electrode (White, Black, Red, Green, Brown), Limb Lead (1CH)+Chest (1CH)

● SpO<sub>2</sub> Measurement (For LX-7230N)

<i>Item</i>	<i>Model Type</i>	<i>Note</i>
Durasensor®	DS-100A	Reusable Adult (weight of 40Kg and over) Finger
OxiMax®	MAX-P	Single-Use Pediatric (weight of 10 to 50Kg) Finger
OxiMax®	MAX-A/AL	Single-Use Adult (weight of 30Kg and over) Finger
OxiMax®	MAX-I	Single-Use Infant (weight of 3 to 20Kg) Toe
OxiMax®	MAX-R	Single-Use Adult (weight of 50Kg and over) Nose
OxiMax®	MAX-N	Single-Use Adult (weight of 40Kg and over) Finger
		Neonate (weight of less 3Kg) Foot
OxiMax®	MAX-FAST	Single-Use Adult /Pediatric (weight of 10Kg and over) Forehead

 **CAUTION**

SpO<sub>2</sub> sensors for the LX-7230N cannot be used with the LX-7230KM.

● SpO<sub>2</sub> Measurement (For LX-7230KM)

<i>Item</i>	<i>Model Type</i>	<i>Note</i>
Finger Clip	SR-5C	Reusable Adult and Pediatric (weight of 30Kg and over) Finger
Spot Check	SP-5C	Reusable Adult and Pediatric (weight of 30Kg and over) Finger
Universal Probe	UD-5C	Semi-Disposable Adult and Pediatric (weight of 40Kg and over) Finger
Personal Probe	SD-5C(25)	Semi-Disposable Adult and Pediatric (weight of 15Kg and over) Finger
	SD-5C(20)	Semi-Disposable Pediatric and Infant (weight of 5 to 15Kg) Big toe or the root of the big toe

 CAUTION

SpO<sub>2</sub> sensors for the LX-7230KM cannot be used with the LX-7230N.

# 15. Specification

---

## ■ Specification

### CAUTION

For quality improvement, specifications are subject to change without prior notice.

### Standard Specification

Size:	72.0(W) x 98.0(H) x 24.8(D)mm (not including the protrusion)
Weight:	Approximately 190 grams (with batteries)
Transmitting	ECG 1CH or 2CH (selectable from the ECG lead cable), Respiration waveform, pulse waveform (with SpO <sub>2</sub> value)
Waveform:	
ECG Lead cable Type:	3-electrode, 4-electrode, or 5-electrode (Limb+Chest) lead cable Automatically detect the type after inserting the lead cable
Transmitting Status	Electrode Off, Low Battery, Event Switch, Pacemaker Detection, Channel ID, 64group Codes, SpO <sub>2</sub> Sensor Off
Data:	
LCD:	Built-in
Waterproof:	IPX8
Power Supply:	DC: Two 1.5 V "AA" size ("LR06" size) alkaline batteries
Continuous Operating	LX-7230N Approximately 2.5 days
Time:	LX-7230KM Approximately 5 days
※Continuous operating time is assumed when using new "AA" size ("LR06" size) Alkaline batteries specified by Fukuda Denshi.	

### ECG

Numbers of Lead	3-electrode, 4-electrode, or 5-electrode
Electrode:	(Limb+Chest)
Numbers of Input	1CH(3-electrode) or 2CH
Channel:	
Accuracy of Sensitivity	10mm /1mV ±1mm (Display sensitivity on the receiving monitor)
ECG Input Impedance:	5MΩ and above
Maximum Input Voltage:	±5mV and above
Common Mode Rejection	Less than 10mVp-p (95dB and above)
Ratio:	
Accuracy of Heart Rate	±10% or ±5bpm, whichever is greater
Measurement:	
Display Coverage of	0, 12 to 300bpm (1bpm step)
Heart Rate:	
Frequency	0.5 to 40Hz (within -3dB)
Characteristic:	

15. Specification

Time Constant                    0.4 sec  $\pm$ 25%  
 Switching and available to set 0.1 sec  $\pm$ 25%  
 Pacemaker Pulse                Comply with ANSI/AAMI EC13 Pacemaker pulse  
 Detection/ Rejection:        rejection capability  
 Protection to                    Meet the requirement of IEC60601-2-27  
 Defibrillation:

**Respiration (Impedance Method)**

Accuracy of Sensitivity:        10mm/1 $\Omega$   $\pm$ 2mm  
 (When standard Impedance is 480 $\Omega$ .)  
 Display Coverage of Respiration Rate: 0, 9 to 150Bpm  
 Display Error of Respiration Rate: 3Bpm  
 Measured Current of Respiration: Below 100 $\mu$ A (at 42kHz)

**SpO<sub>2</sub>**

LX-7230N

SpO<sub>2</sub> Measurement Range:    1 to 100%  
 Resolution:                        1%  
 Measurement Accuracy:        Accuracy of measurement with SpO<sub>2</sub>  
 Probe is as follows.

SpO <sub>2</sub> Probe	Measurement Accuracy ( $\pm$ 1SD)
OxiMax <sup>®</sup> MAX-I	$\pm$ 2%
OxiMax <sup>®</sup> MAX-P	$\pm$ 2%
OxiMax <sup>®</sup> MAX-A/AL	$\pm$ 2%
Durasensor <sup>®</sup> DS-100A	$\pm$ 3%
OxiMax <sup>®</sup> MAX-R	$\pm$ 3.5%
OxiMax <sup>®</sup> MAX-FAST	$\pm$ 2%
OxiMax <sup>®</sup> MAX-N	$\pm$ 2%

(When SpO<sub>2</sub> is 70 to 100%. Less than 70% is not specified.)

Wavelength:                    Approx. 660nm (Red light)  
 Approx. 890nm (Infrared light)



## LX-7230KM

SpO<sub>2</sub> Measurement Range: 0 to 100%  
 Resolution: 1%  
 Measurement Accuracy: Accuracy of measurement with SpO<sub>2</sub> probe is as follows.

Measurement Spot	Measurement Accuracy (±1SD)
Finger	±2%
Big toe or the root of the big toe	±3%

(When SpO<sub>2</sub> is 70 to 100%. Less than 70% is not specified.)

Wavelength: 658 to 665nm (Red light), 860 to 925nm (infrared light)  
 Power Loss on Probe: 2.0mW  
 Measurement Reply Time: 12 sec (moving average time)  
 Measurement Value Update Rate: Continuous mode 1 second  
 Intermittent mode 25 seconds

## NOTE

The SpO<sub>2</sub> measurement accuracy is determined based on the values of the root-mean-square (rms) difference between SpO<sub>2</sub> readings of the pulse oximeter equipment and values of SaO<sub>2</sub> determined with a CO-oximeter, by healthy adult volunteers. The pulse oximeter equipment measurements are statistically distributed; ±2% measurement accuracy means that only about two-thirds of pulse oximeter equipment measurements can be expected to fall within ±2% of the value measured by a CO-oximeter.

## Pulse Wave

## LX-7230N

Pulse Rate Measurement Range: 20 to 250bpm  
 Measurement Accuracy: ±3bpm

## LX-7230KM

Pulse Rate Measurement Range: 30 to 230bpm  
 Measurement Accuracy: ±2bpm (30 to 100bpm)  
 ±2% (100 to 230bpm)  
 Measurement Response Time: 6 sec. (Moving Average Time)

## 15. Specification

### Transmission Method

Modulation Mode:	Digital, Frequency shift keying
Frequency:	608 to 614MHz
Oscillation Method:	PLL Synthesizer method by crystal control
Channel Spacing:	12.5kHz
Occupied Frequency	8.5kHz
Bandwidth:	
RF output power:	1mW $\pm$ 2dB
Transmitting Antenna:	ECG lead cable and/or SpO <sub>2</sub> Probe

### Safety

General Standard:	IEC 60601-1:1988 +A1: 1991 +A2: 1995 (Medical electrical equipment – Part 1: General requirements for safety)
EMC Standard:	IEC 60601-1-2: 2007 (Medical electrical equipment – Part 1: General requirements for safety – 2. Collateral standard: Electromagnetic compatibility – Requirements and tests)
The class of protection against electric shock	Internally Powered Equipment
The type of protection against electric shock	Type CF Applied part

### Operating Environment

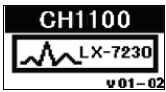


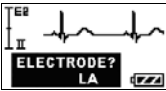
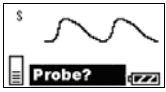
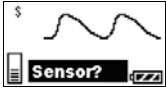
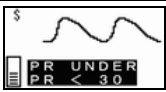

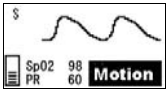
Temperature:	10 to 40°C
Humidity:	30 to 85% RH (No condensation)
Vibration/Shock:	Comply with IEC60068-2-64:1987, IEC60068-2-32:1975, IEC60068-2-6:1995

### Transport / Storage Environment





Temperature:	-10 to 60°C
Humidity:	10 to 95% RH (No condensation)

## ■ Displays

The following displays are shown on the LCD of the LX-7230.

	Display	Description
Starting Screen		Displays after turning on the power. Automatically moves onto the channel display screen.
Channel Display Screen		Displays the transmitter channel after turning on the power and also when refreshing the screen. Automatically move onto the waveform display screen.
EVENT		Displays when the <b>EVENT</b> button is pressed. Automatically move onto the channel display screen.
ELECTRODE?		Displays when the ECG electrode is disconnected or the ECG/respiration waveform cannot be measured normally. For details about electrode check message, refer to page 89.
<b>SpO<sub>2</sub> measurement Status</b>		
Probe?		Displays when the SpO <sub>2</sub> probe is disconnected from the device.
Sensor?		Displays when the SpO <sub>2</sub> probe is off from the measuring position or SpO <sub>2</sub> cannot be measured normally due to outside light, etc..
PR UNDER PR<30		Displays when the pulse rate is less than 30bpm, the SpO <sub>2</sub> value and pulse rate cannot be measured. This display is only available for LX-7230KM.
PR OVER PR>230		Displays when the pulse rate is more than 230bpm, the SpO <sub>2</sub> value and pulse wave rate cannot be measured. This display is only available for LX-7230KM.
Motion		Displays when the measurement cannot be executed due to an artifact such as body motion.

15. Specification

	Display	Description
Error Message		
SpO <sub>2</sub> Error		Displays when the SpO <sub>2</sub> measurement module is faulty
Telemeter Error		Displays when the transmitter is faulty
EEPROM Error		Displays when the EEPROM is faulty
CPU Error		Displays when the CPU is faulty

## ■ Details of the “ELECTRODE?” Message

The following “ELECTRODE?” messages are displayed on the LCD depending on the selected lead cable and lead.

For AHA color code

Check Position	3-electrode lead cable Lead I display	3-electrode lead cable Lead II display	3-electrode lead cable Lead III display
LL	<b>ELECTRODE?</b> LL	<b>ELECTRODE?</b> LL	<b>ELECTRODE?</b> LL
RA	<b>ELECTRODE?</b> RA	<b>ELECTRODE?</b> RA	<b>ELECTRODE?</b>
LA	<b>ELECTRODE?</b> LA	<b>ELECTRODE?</b>	<b>ELECTRODE?</b> LA
Several Position Simultaneously	<b>ELECTRODE?</b>	<b>ELECTRODE?</b>	<b>ELECTRODE?</b>

Check Position	4-electrode lead cable	For 5-electrode (Chest) lead cable
LL	<b>ELECTRODE?</b> LL	<b>ELECTRODE?</b> LL
RA	<b>ELECTRODE?</b> RA	<b>ELECTRODE?</b> RA
LA	<b>ELECTRODE?</b> LA	<b>ELECTRODE?</b> LA
RL	<b>ELECTRODE?</b>	<b>ELECTRODE?</b>
V		<b>ELECTRODE?</b> V
Several Position Simultaneously	<b>ELECTRODE?</b>	<b>ELECTRODE?</b>

## ■ List of Setup Items

This section lists the available selection, default setting, and backup status for each setup item, which is available for the LX-7230.

Items	Selection	Default	Backup
ECG Lead	I, II, III	II	Yes
Display Size of ECG (1)	×1, ×1/2	×1	Yes
Display Size of ECG (2)	×1, ×1/2	×1	Yes
Display Size of Respiration Waveform	×1, ×1/2	×1	Yes
SpO <sub>2</sub> Measurement mode (LX-7230KM only)	Continuous, Intermittent	Continuous	Yes

- For details of the following settings, contact our service representative.

Items	Selection	Default	Backup
Time Constant	0.4 sec., 0.1 sec.	0.4 sec.	Yes
Detection Sensitivity of Pacemaker Pulse	Low, Mid, High	Mid	Yes
Respiration Detection Signal	ON, OFF	ON	Yes
LCD Contrast	8 steps	8	Yes
Transmitter Channel	One from the following channels.  0801 to 0879 0900 to 0979 1000 to 1079 1100 to 1179 1200 to 1279 1300 to 1379	1100	Yes
Group ID	One from 00 to 63	00	Yes





39-4, Hongo 3-chome, Bunkyo-ku, Tokyo, Japan  
Phone:+81-3-3815-2121 Fax:+81-3-3814-1222