Transmitter

ZM-940PA/ZM-941PA

If you have any comments or suggestions on this manual, please contact us at:
www.nihonkohden.com

0614-009881B

Contents

GENERAL HANDLING PRECAUTIONS

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

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

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

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

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

4. **During Operation**
   (1) Both the instrument and the patient must receive continual, careful attention.
   (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient's safety.
   (3) Avoid direct contact between the instrument housing and the patient.

5. **To Shutdown After Use**
   (1) Turn power off with all controls returned to their original positions.
   (2) Remove the cords gently; do not use force to remove them.
   (3) Clean the instrument together with all accessories for their next use.

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

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

8. **Maintenance and Inspection**
   (1) The instrument and parts must undergo regular maintenance inspection at least every 6 months.
   (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.
   (3) Technical information such as parts list, descriptions, calibration instructions or other information is available for qualified user technical personnel upon request from your Nihon Kohden representative.

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

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

WARRANTY POLICY

Nihon Kohden Corporation (NKC) shall warrant its products against all defects in materials and workmanship for one year from the date of delivery. However, consumable materials such as recording paper, ink, stylus and battery are excluded from the warranty.

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

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

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

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

In the USA and Canada other warranty policies may apply.

CAUTION

United States law restricts this device to sale by or on the order of a physician.

Equipment Authorization Requirement

Operation of this equipment requires the prior coordination with a frequency coordinator designated by FCC for the Wireless Medical Telemetry Service.

EMC RELATED CAUTION

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

The following describes some common interference sources and remedial actions:

1. Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:
   Install the equipment and/or system at another location. Keep the emitter source such as cellular phone away from the equipment and/or system, or turn off the cellular phone.

2. Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

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

4. Electromagnetic interference with any radio wave receiver such as radio or television:
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

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

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

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

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

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

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

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Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to the possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

Explanations of the Symbols in this Manual and Instrument

The following symbols found in this manual/instrument bear the respective descriptions as given.

On Panel

Symbol	Description	Symbol	Description
	Defibrillation proof type BF applied part		Serial number
	Defibrillation proof type CF applied part		Year of manufacture
	Attention, consult operator's manual		CSA mark
	Direction for attaching battery cover		RF transmitter Non-ionizing radiation
	Direct current		

Inside Battery Case

Symbol	Description	Symbol	Description
	Battery position		Attention, consult operator's manual

On LCD

Symbol	Description	Symbol	Description
	Full battery		Replace battery NIBP cannot be measured
	Replace battery		Check electrode

Introduction

The ZM-940PA/ZM-941PA transmitter transmits ECG, respiration, SpO_2, NIBP and pulse waveform from a patient to a Nihon Kohden monitor for continuous monitoring. The transmitter can change channels when connected to the QI-901PK channel writer. The front LCD displays SpO_2%, NIBP, pulse rate, pulse waveform amplitude, electrode condition mark, battery condition and NIBP measuring mode and interval.

The difference between the ZM-940PA and ZM-941PA is the transmission frequency range.
ZM-940PA: 608.0250 MHz (channel number 9002) to 613.9750 MHz (channel number 9478)
ZM-941PA: 1395.0250 MHz (channel number E002) to 1399.9750 MHz (channel number E398)
1427.0250 MHz (channel number E502) to 1431.9750 MHz (channel number E898)

Read the operator's manual for the receiving monitor together with this manual before operation.

WARNING

Do not use the same transmitter on more than one patient at the same time. Do not connect different sensors on different patients to the same transmitter.

CAUTION

- Do not use the same channel for different patients. If the same channel is used for two patients, the two patients' data will be lost due to mutual modulation interference, or another patient's data may appear on the receiving monitor screen.
- Do not use transmitters of adjacent channels in a hospital. If a transmitter of an adjacent channel is used, radio waves from one transmitter affect the receiver of the adjacent channel's transmitter and there may be interference.

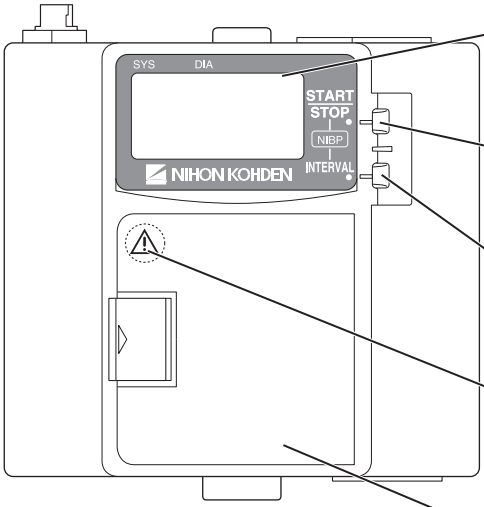
NOTE

- To prevent interference between channels, assign a channel administrator in the hospital and only he or she should manage channel assignment.
- Use Nihon Kohden parts and accessories to assure maximum performance from your instrument.
- For stable signal reception, it is recommended to use a diversity antenna system on the receiving monitor. Otherwise, spike noise from transient fading of electric field strength (for example, people moving) may interfere with the transmitter signal and may be mistaken as an arrhythmia on the receiving monitor.

- NIBP cannot be measured on a neonate. (ECG, respiration and SpO_2 can be monitored on a neonate.)
- Do not diagnose a patient based on only part of the monitoring data on the transmitter or only on the data acquired by the transmitter. Overall judgement must be performed by a physician who understands the features, limitations and characteristics of the transmitter by reading this operator's manual thoroughly and by reading the biomedical signals acquired by other instruments.
- For details on the receiving monitor and upgrade information, contact your Nihon Kohden representative.

Panel Description

Front Panel



LCD:
Displays measuring data, settings and other information.

NIBP START/STOP key:
Starts/stops NIBP measurement in selected mode.

NIBP INTERVAL key:
Selects NIBP measurement mode.

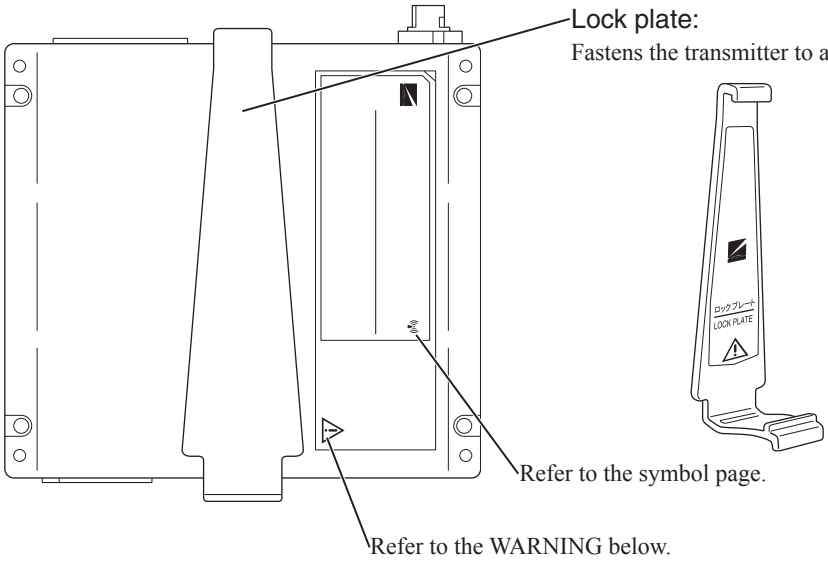
Refer to the WARNING below.
(This symbol is attached to the rear of the battery case cover.)

Battery case:
Contains three 1.5 V AA (R6) batteries.

WARNING

Close the battery case cover during operation. If the transmitter is used with the battery case cover open, anyone who touches the opened battery case may receive an electrical shock when defibrillation is performed. Touching the opened battery case may cause electrostatic discharge and intermittently interfere with the waveform or data.

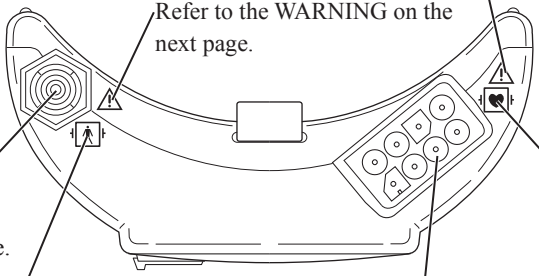
Rear Panel



WARNING

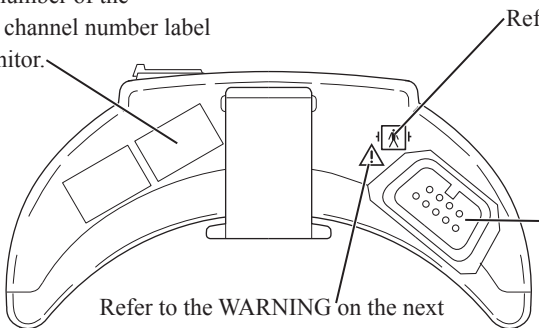
This transmitter is not waterproof. If detergent or liquid spills into the transmitter, stop using it and contact your Nihon Kohden representative. If a wet transmitter is used, the patient or operator may receive an electrical shock or injury.

Top Panel



Bottom Panel

Channel number label:
Indicates the channel number of the transmitter. Attach the channel number label to the panel of the monitor.



WARNING

Before defibrillation, all persons must keep clear of the bed and must not touch the patient or any equipment or cord connected to the patient. Failure to follow this warning may cause electrical shock or injury.

WARNING

When performing defibrillation, discharge as far as possible from electrodes, patches and any gel, cream or medicine on the chest of the patient. If there is a possibility that the defibrillator paddle could touch these materials, remove them from the patient. If the defibrillator paddle directly contacts these materials, the discharged energy may cause skin burn to the patient.

WARNING

When the transmitter is used with an electrosurgical unit (ESU), firmly attach the entire area of the ESU return plate. Otherwise, the current from the ESU flows into the electrodes of the transmitter, causing electrical burn where the electrodes are attached. For details, refer to the ESU manual.

CAUTION

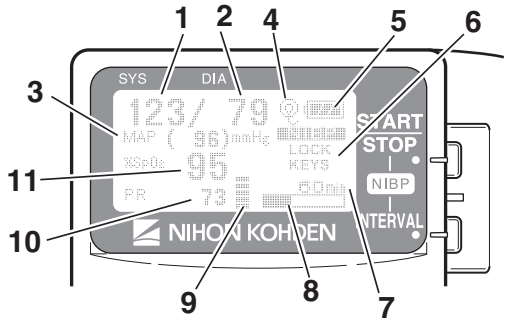
Do not shake or swing the transmitter while holding the leads or cables connected to the transmitter. The transmitter may come off and injure someone or damage surrounding instruments.

WARNING

The following actions must be taken to properly receive the transmitter signal of the correct patient on the receiving instrument. Otherwise, there may be signal loss or signals may mix causing a serious accident, such as monitoring a different patient.

- Assign a channel administrator in the hospital and only he or she should manage channel assignment.
- The channel administrator must manage the channels in the facility so that there is no signal interference.
- When the transmitter channel is changed, the channel administrator must check that the channel on the receiving monitor is also changed and the signal is properly received.
- The channel administrator must replace the channel number label on the transmitter with the new one after changing the channel.

LCD

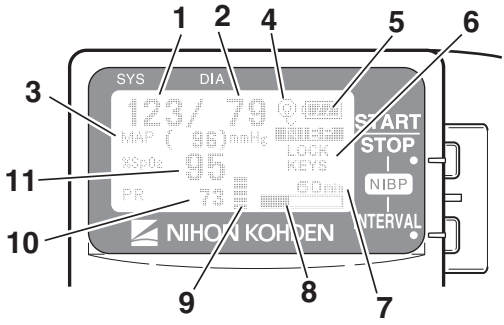


No.	Name	Description
1	NIBP SYS	Displays NIBP systolic value.
2	NIBP DIA	Displays NIBP diastolic value.
3	NIBP MAP	Displays NIBP mean value. "CUFF" is displayed with the cuff inflation pressure during measurement.
4	Check electrode mark	Appears when an electrode or electrode lead becomes detached during ECG measurement.
5	Battery replacement mark	Appears when the batteries are weak. For details, refer to the "Battery Condition Indication" section.
6	Message display area	Displays messages. When ECG is monitored with 6 electrodes and an electrode or electrode lead is detached, "Check electrode" is indicated as below, depending on the PARAMETER SETUP setting. Refer to the "Changing Parameter Setup Settings" and "ECG and Respiration Monitoring" sections.

LEADS OFF DISPLAY set to CHAR
ECG ELECTRODE set to AHA

LEADS OFF DISPLAY set to CHAR
ECG ELECTRODE set to IEC

LEADS OFF DISPLAY set to IMAGE



No.	Name	Description
7	NIBP measurement mode	Displays NIBP measurement mode. When set to auto mode, the measurement interval is displayed.
8	NIBP interval bar graph	In auto NIBP measurement, the remaining time from the last measurement to the next measurement is displayed as a bar graph.
9	Pulse level bar graph	Displays pulse level in 7 steps.
10	%SpO_2	Displays SpO_2 data.
11	PR	Displays pulse rate when NIBP or SpO_2 is measured. When the SpO_2 probe is attached to the patient, the real time pulse rate is displayed. When the SpO_2 probe is not attached to the patient, the pulse rate at the end of NIBP measurement is displayed.

Notes on Parameter Settings

When monitoring NIBP and SpO_2, the following setting must be set as indicated in the table to properly transmit the monitoring data to the receiving monitor. Otherwise, SpO_2 cannot be monitored properly during NIBP measurement.

Some receiving monitors require the software to be upgraded. For details, contact your Nihon Kohden representative.

SpO_2 probe attachment site	INHIBIT SpO_2 DURING NIBP setting
Probe attached to the same limb as the cuff	ON
Probe attached to the limb without cuff*	OFF

* When the SpO_2 probe is attached to the same limb as the NIBP cuff and the cuff is inflated, the SpO_2 value becomes unstable and SpO_2 or PR alarm may occur.

Important Safety Information

General

WARNING

Never use the transmitter in the presence of any flammable anesthetic gas or high concentration oxygen atmosphere. Failure to follow this warning may cause explosion or fire.

WARNING

Never use the transmitter in a hyperbaric oxygen chamber. Failure to follow this warning may cause explosion or fire.

WARNING

When performing MRI test, remove all electrodes from the patient which are connected to this transmitter. Failure to follow this warning may cause skin burn on the patient. For details, refer to the MRI manual.

WARNING

When performing defibrillation, discharge as far as possible from electrodes, patches and any gel, cream or medicine on the chest of the patient. If there is a possibility that the defibrillator paddle could touch these materials, remove them from the patient. If the defibrillator paddle directly contacts these materials, the discharged energy may cause skin burn to the patient.

WARNING

Before defibrillation, all persons must keep clear of the bed and must not touch the patient or any equipment or cord connected to the patient. Failure to follow this warning may cause electrical shock or injury.

WARNING

When the transmitter is used with an electrosurgical unit (ESU), firmly attach the entire area of the ESU return plate. Otherwise, the current from the ESU flows into the electrodes of the transmitter, causing electrical burn where the electrodes are attached. For details, refer to the ESU manual.

WARNING

Close the battery case cover during operation. If the transmitter is used with the battery case cover open, anyone who touches the opened battery case may receive an electrical shock when defibrillation is performed. Touching the opened battery case may cause electrostatic discharge and intermittently interfere with the waveform or data.

WARNING

This transmitter is not waterproof. If detergent or liquid spills into the transmitter, stop using it and contact your Nihon Kohden representative. If a wet transmitter is used, the patient or operator may receive an electrical shock or injury.

WARNING

Do not use the same transmitter on more than one patient at the same time. Do not connect different sensors on different patients to the same transmitter.

CAUTION

Only use Nihon Kohden specified electrodes, electrode leads, SpO_2 probes, and NIBP cuffs. Otherwise, the maximum performance from the transmitter cannot be guaranteed.

CAUTION

Do not reuse disposable parts and accessories.

CAUTION

Do not shake or swing the transmitter while holding the leads or cables connected to the transmitter. The transmitter may come off and injure someone or damage surrounding instruments.

CAUTION

- Do not use the same channel for different patients. If the same channel is used for two patients, the two patients' data will be lost due to mutual modulation interference, or another patient's data may appear on the receiving monitor screen.
- Do not use transmitters of adjacent channels in a hospital. If a transmitter of an adjacent channel is used, radio waves from one transmitter affect the receiver of the adjacent channel's transmitter and there may be interference.

CAUTION

Turn off the power of mobile phones, small wireless devices and other devices which produce strong electromagnetic interference around a patient (except for devices allowed by the hospital administrator). Radio waves from devices such as mobile phones or small wireless devices may be mistaken as pulse waves and the displayed data may be incorrect.

Output Signal

WARNING

Do not use the output signal from the receiving monitor as the synchronization signal for other equipment such as IABP, MRI, echocardiography or defibrillator. There may be time delay between the monitor and the other equipment caused by waveform transmission delay and spike noise may interfere on the output signal and be mistaken as a trigger.

Battery

WARNING

- Keep the batteries away from fire. They may explode.
- Keep the batteries away from patients.
- Never short-circuit the + and – terminals on the battery. It may cause overheating and fire.
- Do not damage, disassemble, drop or give impact to the battery.

WARNING

If the battery is damaged and the substance inside the battery contacts the eyes or skin, wash immediately and thoroughly with water and see a physician. Never rub your eyes, because you may lose your eyesight.

CAUTION

Battery replacement must be performed by the operator. When replacing batteries of the transmitter currently used for a patient, disconnect electrode leads from the transmitter before replacing batteries or do not touch the patient during replacement.

CAUTION

The battery charger must be used outside the patient environment.

CAUTION

Refer to the battery and battery charger manuals for details on handling the batteries.

Transmitter Channel Management

WARNING

The following actions must be taken to properly receive the transmitter signal of the correct patient on the receiving instrument. Otherwise, there may be signal loss or signals may mix causing a serious accident, such as monitoring a different patient.

- Assign a channel administrator in the hospital and only he or she should manage channel assignment.
- The channel administrator must manage the channels in the facility so that there is no signal interference.
- When the transmitter channel is changed, the channel administrator must check that the channel on the receiving monitor is also changed and the signal is properly received.
- The channel administrator must replace the channel number label on the transmitter with the new one after changing the channel.

For Patients Using Implantable Pacemaker

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by transmitter which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and the transmitter may give incorrect data to the monitor. If this occurs, disconnect the electrode leads from the patient or change the setting on the pacemaker by referring to the pacemaker's manual. For more details, contact your pacemaker representative or Nihon Kohden representative.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

NIBP Monitoring

WARNING

Be careful when measuring NIBP on a patient with known bleeding disorders or coagulation. After NIBP measurement, there may be dot hemorrhage, or circulatory disorder by thrombus where the cuff is attached.

WARNING

When performing NIBP measurements in STAT mode or 5 minute intervals, periodically remove the cuff from the patient for ventilation. The skin temperature may increase at the cuff attachment site by 2 or 3°C (4 or 5°F). When measuring a patient with a fever or peripheral circulation insufficiency, it may cause a burn.

WARNING

NIBP measurement may be incorrect in the following cases.

- When using an electrosurgical unit
- When there is body movement
- When the pulse wave is small (insufficient peripheral circulation)
- Too many arrhythmias
- When there is vibration
- When there is a rapid blood pressure change
- During CPR

CAUTION

Do not wrap the cuff on an arm or thigh which is used for injection. NIBP measurement on an arm or thigh which is used for injection may cause reflux of blood and stop injection.

CAUTION

Do not wrap the cuff too tight. It may cause poor blood circulation and congestion. If the cuff is wrapped too loosely, the NIBP value may increase.

CAUTION

Do not attach the cuff to the site where there is injury or inflammation. If the skin gets irritated or redness appears on the skin from the cuff, change the attachment site or stop using the cuff. Take extreme care on the patients with delicate skin.

CAUTION

When using an extension hose, check that the extension hose is not bent or squeezed. Otherwise, the cuff might not inflate or deflate. If the cuff cannot deflate, it may cause congestion on the patient at the cuff attachment site.

CAUTION

When performing NIBP measurement repeatedly, have a rest between measurements to recover adequate circulation.

ECG Monitoring

CAUTION

Only use Nihon Kohden specified electrodes and electrode leads. When other type of electrodes or electrode leads are used, the “CHECK ELECTRODES” message may be displayed and monitoring may stop.

CAUTION

When the “ELECTRODE OFF” or “CHECK ELECTRODE” message is displayed on the receiving monitor, ECG is not monitored properly and the ECG alarm does not function. Check the electrode, electrode leads, and if necessary, replace with new ones.

SpO_2 Monitoring

WARNING

SpO_2 measurement may be incorrect in the following cases.

- When the patient's carboxyhemoglobin or methemoglobin increases abnormally.
- When dye is injected in the blood.
- When using an electrosurgical unit.
- During CPR.
- When measuring at a site with venous pulse.
- When there is body movement.
- When the pulse wave is small (insufficient peripheral circulation).

WARNING

- When using the TL-201T finger probe, do not fasten the probe and cable to the finger by wrapping with tape. This may cause burn, congestion or pressure necrosis from poor blood circulation.
- When using probes other than the TL-201T finger probe, to avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.

WARNING

When not monitoring SpO_2, disconnect the SpO_2 cable from the transmitter. Otherwise, noise from the probe sensor may interfere and incorrect data is displayed on the screen.

WARNING

Check the circulation condition by observing the skin color at the measurement site and pulse waveform. Change the measurement site every 8 hours for disposable probes and every 4 hours for reusable probes (every 8 hours for TL-630T/TL-631T series probe). The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.

- Patient with a fever
- Patient with peripheral circulation insufficiency
- Neonate or low birth weight infant with delicate skin
- Patient who is receiving photodynamic therapy*

* Photodynamic therapy is a treatment to remove the affected tissue by using a photosensitizing agent and exposing the tissue to light. This treatment has a side effect of photosensitivity and the light from the finger probe sensor may cause a burn. This probe uses two light wavelengths in the range from 650 to 950 nm. The maximum light intensity is less than 5.5 mW/sr.

CAUTION

NIBP and SpO_2 can be measured on the same limb, but the SpO_2 monitoring might not be accurate during NIBP measurement. Be careful when reading the SpO_2 values.*

* Monitoring SpO_2 during NIBP Measurement
When the SpO_2 probe is attached to the same limb as the NIBP cuff, the blood flow decreases during NIBP measurement and pulse wave cannot be detected and SpO_2 cannot be monitored properly. When "INHIBIT SpO_2 DURING NIBP" on the PARAMETER SETUP screen is set to ON (factory default setting), SpO_2 monitoring is paused during NIBP measurement to avoid SpO_2 alarm occurrence. However, when monitoring SpO_2 on the same limb as the NIBP, be careful when reading SpO_2 values.

CAUTION

Do not use a damaged or disassembled probe. It causes incorrect measurement and may injure the patient.

CAUTION

If the attachment site is dirty with blood or bodily fluids, clean the attachment site before attaching the probe. If there is nail polish on the attachment site, remove the polish. Otherwise, the amount of transmitted light decreases, and measured value may be incorrect or measurement cannot be performed.

CAUTION

While a patient is on medication which causes vasodilation, the pulse waveform may change and in rare cases the SpO_2 value might not be displayed.

CAUTION

Normal external light does not affect monitoring but strong light such as a surgical light or sunlight may affect monitoring. If affected, cover the measuring site with a blanket.

CAUTION

Do not use a probe which is deteriorated by aging. Accurate measurement cannot be performed.

CAUTION

The disposable probe is not sterilized. Use the disposable probe only for a single patient. Never reuse the disposable probe for another patient because it causes cross infection.

CAUTION

If the skin gets irritated or redness appears on the skin from the probe, change the attachment site or stop using the probe. Take extreme care for the patients with delicate skin.

CAUTION

Do not pull or bend the probe cable, and do not put caster feet on the probe cable. Do not immerse the probe cable in chemical solutions or water. Failure to follow these instructions may cause cable discontinuity, short circuit, skin burn on the patient and incorrect measurement data. Replace any broken probe with a new one.

CAUTION

When the probe is attached on an appropriate site with sufficient circulation and the error message confirming the probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.

CAUTION

When a message indicates a faulty probe, stop monitoring and replace the probe with a new one.

CAUTION

When removing a probe that is taped to the skin, do not pull the probe cable because this can damage the cable.

CAUTION

Neonatal skin is delicate. Remove the probe and tape carefully and slowly.

CAUTION

When removing the probe from the attachment tape, do not pull the sensor cable because this can damage the cable.

CAUTION

Do not immerse the disposable probe in detergents or water. If the probe adhesive surface gets wet, adhesiveness becomes weak and the probe cannot be attached to the skin.

CAUTION

Refer to the probe instruction manual for details.

Maintenance

CAUTION

Before cleaning or disinfection, remove the batteries from the transmitter. Failure to follow this instruction may result in electrical shock or transmitter malfunction.

CAUTION

This transmitter is not waterproof. If detergent or liquid spills into the transmitter, stop cleaning or disinfecting it and contact your Nihon Kohden representative. The transmitter needs to be checked for safety and function before use.

CAUTION

The transmitter cannot be sterilized. Sterilizing the transmitter may damage it.

CAUTION

Never disassemble or repair the transmitter. Disassembly and repair must be performed by qualified service personnel.

Installing (Replacing) Batteries

WARNING and CAUTION for Battery Handling

WARNING

- Keep the batteries away from fire. They may explode.
- Keep the batteries away from patients.
- Never short-circuit the + and – terminals on the battery. It may cause overheating and fire.
- Do not damage, disassemble, drop or give impact to the battery.

WARNING

If the battery is damaged and the substance inside the battery contacts the eyes or skin, wash immediately and thoroughly with water and see a physician. Never rub your eyes, because you may lose your eyesight.

CAUTION

Refer to the battery and battery charger manuals for details on handling the batteries.

CAUTION

The battery charger must be used outside the patient environment.

CAUTION

Do not handle the batteries with wet hands.

CAUTION

When the transmitter is not in use, remove batteries. When batteries are installed, battery power is consumed even if measurement is not performed. Especially, when NiMH batteries remain in the transmitter when the transmitter is not in use, the battery may become unusable from overdischarge and leak liquid which will damage the transmitter.

Battery Lifetime

Use three AA (R6) type alkaline dry cell batteries. NiMH rechargeable batteries can also be used.

ZM-940PA

Type	Lifetime (Measuring parameters)		
	ECG, SpO_2, NIBP	ECG, SpO_2	ECG only
NiMH secondary	2 days	2.5 days	3 days
Alkaline primary	1 day	2.5 days	3 days

ZM-941PA

Type	Lifetime (Measuring parameters)		
	ECG, SpO_2, NIBP	ECG, SpO_2	ECG only
NiMH secondary	1.5 days	2 days	2.5 days
Alkaline primary	1 day	2 days	2.5 days

The above data is when the following batteries and battery charger which are recommended by Nihon Kohden are used. The measurement is performed at room temperature, NIBP is measured in auto mode at 60 minute intervals and SpO_2 is measured on an index finger of a male patient with weight 60 kg. Operation time depends on the thickness of the SpO_2 probe attachment site.

NiMH secondary: SANYO HR-3UF (W)
Battery charger: SANYO NC-M55
Alkaline primary: Nihon Kohden Medipower (equivalent to Panasonic LR6 (G))

NOTE

- When the "Low battery" message is displayed on the receiving monitor, NIBP might not have been measured according to the NIBP interval setting.
  Therefore, the NIBP data displayed on the receiving monitor might not be updated. In this case, check the measurement time of the NIBP data displayed on the receiving monitor.
- When using rechargeable NiMH batteries, shallow charging/discharging shortens battery capacity. For details, refer to the battery operator's manual.

Installing (Replacing) Batteries

CAUTION

Battery replacement must be performed by the operator. When replacing batteries of the transmitter currently used for a patient, disconnect electrode leads from the transmitter before replacing batteries or do not touch the patient during replacement.

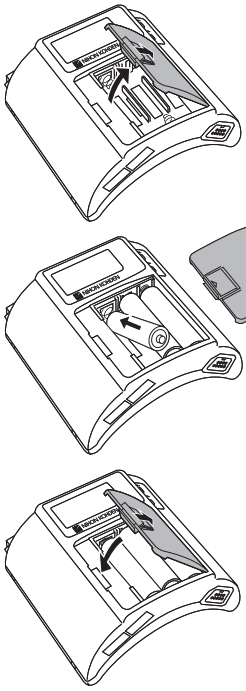
If electrode leads are attached to the patient and a person replacing batteries touches the patient during battery replacement, patient leakage current over the allowed amount may flow.

CAUTION

- Replace all batteries at the same time.
- Do not use different types of batteries together.

NOTE

Insert the batteries with the correct polarity (+ and –).



Procedure

1. Remove the battery case cover.
2. Insert three new or fully charged batteries into the battery case observing the correct polarity.
3. Close the cover.

NOTE

Remove the batteries before disposing of the transmitter.

Situations Requiring Battery Replacement

Replace the batteries when any of the following occurs.

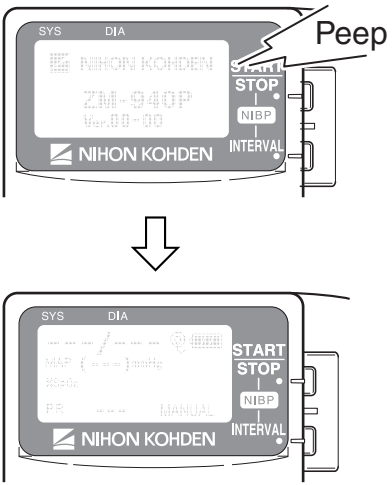
- The transmitter LCD displays the " " or " "mark.
- The transmitter generates a constant alarm (continuous "peep" sound).
- The transmitter LCD does not display anything when the power is turned on.
- The monitor displays the battery replacement message on the screen.

Battery Condition Indication

The battery condition is indicated as follows.

Indication	Condition	Receiving Monitor
	Fully charged battery	Batteries are full. There is no indication on the monitor.
	Batteries are low. Replace batteries.	Message requiring battery replacement is displayed.
	Batteries are low. NIBP cannot be measured. Replace batteries.	
No indication	Dead batteries	No signal can be transmitted to the monitor. There is no indication on the monitor.

Turning the Transmitter On/Off



Turning On the Power

When the batteries are installed correctly, the power is turned on. A one second “peep” sounds and the startup screen appears. (There is no “peep” sound when there is no battery power.)

NOTE

Replace the batteries when the LCD displays the “ ” or “ ”mark.

Turning Off the Power

To turn off the power, remove batteries.

Check Items Before Use

Before turning on the transmitter power, check the following to confirm that the transmitter can be used in normal and safe condition.

Appearance

- There are no damaged or dirty parts on the outside of the transmitter (LCD, keys, sockets, battery case cover, battery case, lock plate, etc.).

- The transmitter is completely dry.
- The electrode lead, SpO_2 probe and NIBP cuff are not broken.
- There are no damaged or dirty parts on the disposable SpO_2 probe, disposable electrodes or disposable NIBP cuff.

Batteries

- The battery polarity is correct.
- The battery case spring is firmly fixed and the battery is not loose.
- The battery case cover is firmly closed.

Channel Setting

- The transmitter channel corresponds to those of the receiving monitor.
- There is no transmitter in the surrounding area with the same channel.

Check Items After Power On

After turning on the power, check the following.

Power On

- The transmitter generates about a one second “peep” sound and the startup screen appears.
- The transmitter does not generate a continuous “peep” sound.
- The transmitter does not give excessive heat.
- The transmitter LCD displays a “  ” mark.
- The transmitter does not interfere with the operation of other medical instruments in use.

Basic Operation

- The “signal loss” message is not displayed on the receiving monitor when the transmitter is inside the receiving range of the monitor.
- The battery replacement message is not displayed on the monitor.
- The keys on the transmitter function properly.
- The LCD brightness is appropriate. To adjust brightness, refer to the “Changing System Setup Settings” section.

Check Items After Use

To use the transmitter in safe and optimum condition for next time, check the following.

Before Turning Power Off

- Temporarily changed settings are changed back to the previous settings.
- There was no malfunction on the transmitter.

Storage

- ECG electrode leads, SpO_2 probe and NIBP cuff are cleaned and disinfected.
- When the transmitter gets wet, liquid is wiped off and the transmitter is thoroughly dried.
- There are enough consumables, such as disposable electrodes.
- The transmitter power is turned off by removing batteries from the transmitter.
- Dead batteries are disposed of properly.

Changing the Transmitter Channel

The channel of the transmitter can be changed. The optional QI-901PK Channel Writer is required.

WARNING

The following actions must be taken to properly receive the transmitter signal of the correct patient on the receiving instrument. Otherwise, there may be signal loss or signals may mix causing a serious accident, such as monitoring a different patient.

- Assign a channel administrator in the hospital and only he or she should manage channel assignment.
- The channel administrator must manage the channels in the facility so that there is no signal interference.
- When the transmitter channel is changed, the channel administrator must check that the channel on the receiving monitor is also changed and the signal is properly received.
- The channel administrator must replace the channel number label on the transmitter with the new one after changing the channel.

NOTE

The software version of the QI-901PK channel writer must be 02-01 or later to change the channel on the ZM-940PA/941PA transmitter.

To check the transmitter channel, refer to “CHANNEL” in the “Changing System Setup Settings” section.

Changing Parameter Setup Settings

The initial settings on the PARAMETER SETUP screen must be changed before monitoring. Changing these settings during monitoring interrupts monitoring.

Parameter Setup Setting List

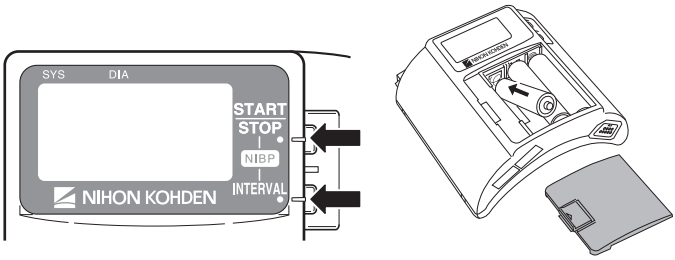
The factory default settings are underlined.

Setting Item	Description	Settings
SELECTABLE INTERVALS	Select the NIBP measurement modes for the mode selection.	STAT, 5, 10, 15, 30, 60, 120, 240
INITIAL INTERVAL	Select the initial NIBP measurement mode at power on.	MAN., 5 min, 10 min, 15 min, 30 min, 60 min, 120 min, 240 min
INITIAL CUFF PRESS	Select the NIBP cuff inflation pressure.	120 mmHg, 150 mmHg, 180 mmHg, 210 mmHg, 240 mmHg
NIBP MODE AFTER STAT	Select the NIBP measurement mode after completing STAT measurement.	MAN., 5 min, 10 min, 15 min, 30 min
START/FINISH SOUND	Turn ON or OFF the sound for NIBP measurement start/finish.	ON, OFF/ON, OFF
OLD NIBP DATA AFTER	Select whether to hide or dim the NIBP data after measurement and how long to wait after measurement to dim or hide it.	DATA: HIDE, DIM AFTER: 5 min, 10 min, 30 min
INHIBIT SpO_2 DURING NIBP	Turn SpO_2 monitoring on or off during NIBP measurement.	ON, OFF
2ND PARAMETER	Set SpO_2 and PR display order.	SpO_2, PR
LEADS OFF DISPLAY	Select the mode for displaying electrode off. This setting is only available when ECG is monitored with 6 electrodes.	CHAR, IMAGE
ECG ELECTRODE	Select the electrode lead type. This setting is only available when CHAR is selected for LEADS OFF DISPLAY.	IEC, AHA

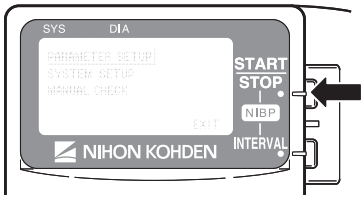
Displaying the PARAMETER SETUP Screen

1. Remove one battery.

2. While pressing the NIBP START/STOP and NIBP INTERVAL keys, install the battery.
   The SETUP screen appears.

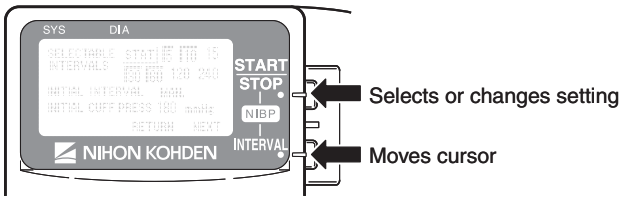


3. Press the NIBP START/STOP key to enter the PARAMETER SETUP screen.



   When the cursor is moved to “EXIT” by pressing the NIBP INTERVAL key and the NIBP START/STOP key is pressed, the startup screen appears, then the monitoring screen appears.

4. To select or change a setting, press the NIBP START/STOP key.
   To move the cursor, press the NIBP INTERVAL key.

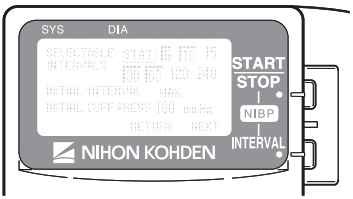


   When the cursor is moved to “RETURN” by pressing the NIBP INTERVAL key and the NIBP START/STOP key is pressed, the SETUP screen appears.

Changing Settings

SELECTABLE INTERVALS

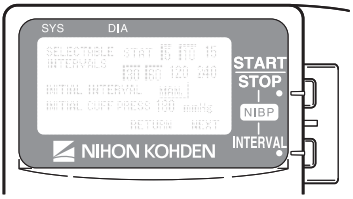
During monitoring, when the NIBP INTERVAL key is pressed, the measurement mode changes according to the modes selected in this item. MANUAL mode is already selected for the mode selection.



1. Press the NIBP INTERVAL key to move the cursor to the desired mode.
2. Press the NIBP START/STOP key to select or unselect the mode. Selectable modes are: STAT, 5, 10, 15, 30, 60, 120 and 240 min.

INITIAL INTERVAL

Select the initial NIBP measurement mode at power on.

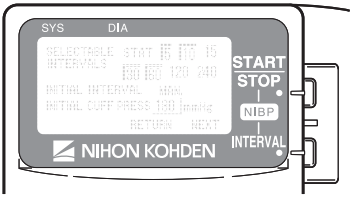


1 Press the NIBP INTERVAL key to move the cursor to “INITIAL INTERVAL”.

2. Press the NIBP START/STOP key to select the mode. Selectable modes are the modes selected for “SELECTABLE INTERVALS” and “MAN.” (MANUAL).

INITIAL CUFF PRESS

Select the NIBP cuff inflation pressure.

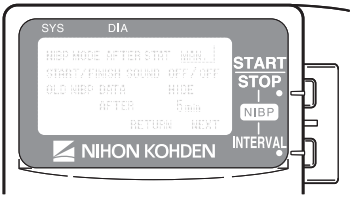


1 Press the NIBP INTERVAL key to move the cursor to “INITIAL CUFF PRESS”.

2. Press the NIBP START/STOP key to select the inflation pressure from 120, 150, 180, 210 and 240 mmHg.

NIBP MODE AFTER STAT

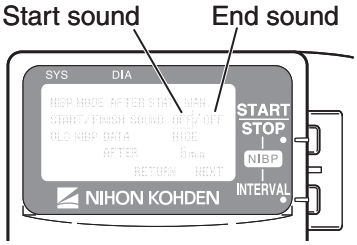
Select the NIBP measurement mode after completing the STAT measurement.



1. Press the NIBP INTERVAL key to move the cursor to “NIBP MODE AFTER STAT”.
2. Press the NIBP START/STOP key to select the mode. The selected mode is automatically selected for “SELECTABLE INTERVALS” as well.

START/FINISH SOUND

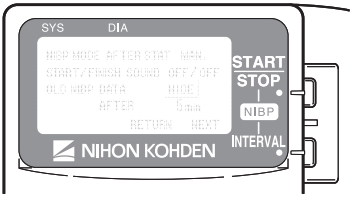
Turn on or off the sound for NIBP measurement start and finish.



1. Press the NIBP INTERVAL key to move the cursor to “START/FINISH SOUND”.
2. Press the NIBP START/STOP key to turn ON or OFF

OLD NIBP DATA/AFTER

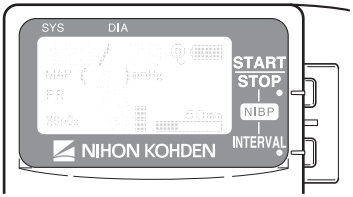
Select whether to dim or hide the NIBP data after measurement and how long to wait after NIBP measurement to dim or hide it.



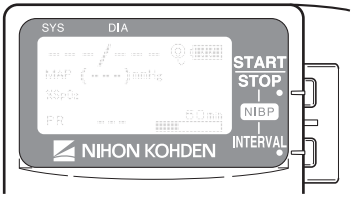
1. Press the NIBP INTERVAL key to move the cursor to “OLD NIBP DATA/AFTER”.
2. Press the NIBP START/STOP key to select the setting.

DATA: DIM NIBP data is dimmed after the “AFTER” interval.
HIDE NIBP data is hidden after the “AFTER” interval. “– – –” is displayed on the screen.
AFTER: Select the interval after NIBP measurement to dim or hide.

Dimmed



Hidden



INHIBIT SpO_2 DURING NIBP

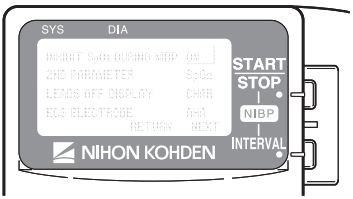
Set whether or not to monitor SpO_2 during NIBP measurement.

When the SpO_2 probe is attached to the same limb as the NIBP cuff and this setting is set to OFF, the pulse may become unstable and SpO_2 or PR alarm may occur. It is recommended to set this setting to ON so that SpO_2 is not measured during NIBP measurement.

When the SpO_2 probe is attached to the other limb from the NIBP cuff, this setting can be set to OFF.

NOTE

When this "INHIBIT SpO_2 DURING NIBP" is set to OFF, refer to the "Monitoring SpO_2 during NIBP Measurement" section.

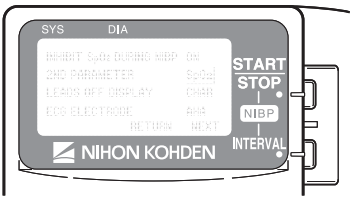


1. Press the NIBP INTERVAL key to move the cursor to "INHIBIT SpO_2 DURING NIBP".
2. Press the NIBP START/STOP key to select "ON" or "OFF".

ON: Stops SpO_2 monitoring during NIBP measurement.
OFF: SpO_2 is monitored during NIBP measurement.

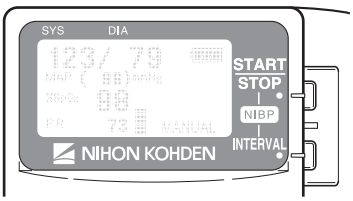
2ND PARAMETER

Set the display order of SpO_2 and PR.
When set to SpO_2 When set to PR

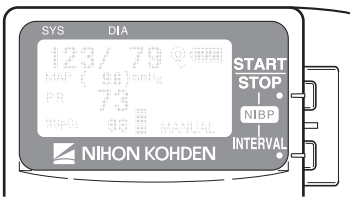


1. Press the NIBP INTERVAL key to move the cursor to "2ND PARAMETER".
2. Press the NIBP START/STOP key to select "SpO_2" or "PR".

When set to SpO_2

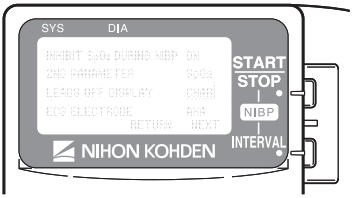


When set to PR



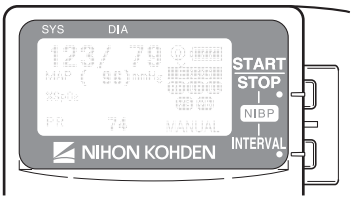
LEADS OFF DISPLAY

Select the mode for displaying electrode off. This setting is only available when ECG is monitored with 6 electrodes.

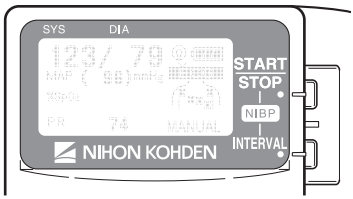


1. Press the NIBP INTERVAL key to move the cursor to “LEADS OFF DISPLAY”.
2. Press the NIBP START/STOP key to select “CHAR” or “IMAGE”.

When set to CHAR

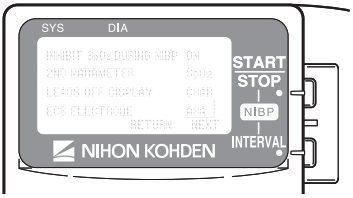


When set to IMAGE



ECG ELECTRODE

Select the electrode lead type. This setting is only available when “CHAR” is selected for LEADS OFF DISPLAY.



1. Press the NIBP INTERVAL key to move the cursor to “ECG ELECTRODE”.
2. Press the NIBP START/STOP key to select “IEC” or “AHA”.

   AHA: RA, LA, LL, Va, Vb
   IEC: R, L, F, Ca, Cb

Changing System Setup Settings

NOTE

Changing System Setup settings must be done only by a qualified personnel.

System Setup Setting List

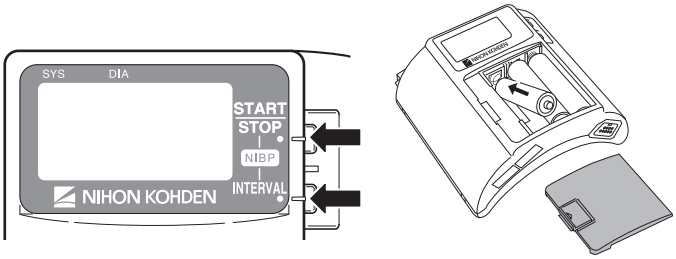
The factory default settings are underlined.

Setting Item	Description	Settings
CHANNEL	Displays the transmitter channel.	—
PRESSURE UNIT	Select the units for NIBP.	mmHg, kPa
LANGUAGE	Select the language for screen display.	JPN, ENG
BRIGHTNESS	Select the LCD brightness.	1, 2, 3, 4
SYSTEM INITIALIZE	Initializes all settings to the factory default settings.	—

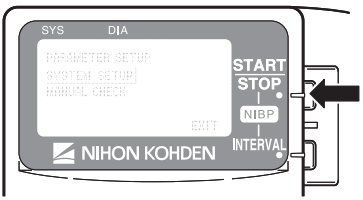
Displaying the SYSTEM SETUP Screen

1. Remove one battery.

2 While pressing the NIBP START/STOP and NIBP INTERVAL keys, install the battery. The SETUP screen appears.



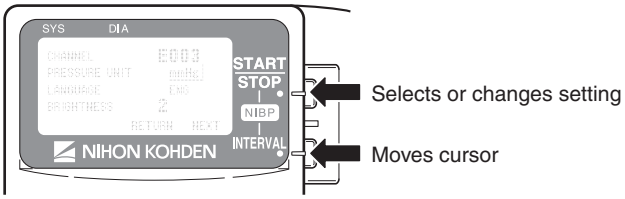
3. Press the NIBP INTERVAL key to move the cursor to “SYSTEM SETUP”.



4. Press the NIBP START/STOP key to enter the SYSTEM SETUP screen.

   When the cursor is moved to “EXIT” by pressing the NIBP INTERVAL key and the NIBP START/STOP key is pressed, the startup screen appears, then the monitoring screen appears.

5. To select or change a setting, press the NIBP START/STOP key.
   To move the cursor, press the NIBP INTERVAL key.



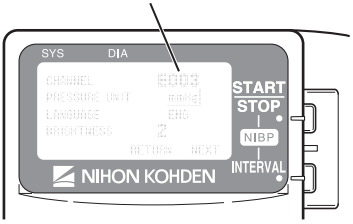
When the cursor is moved to “RETURN” by pressing the NIBP INTERVAL key and the NIBP START/STOP key is pressed, the SETUP screen appears.

Changing Settings

CHANNEL

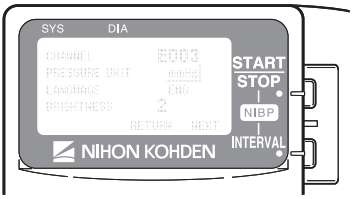
The channel of this transmitter is displayed.

Channel of this transmitter



PRESSURE UNIT

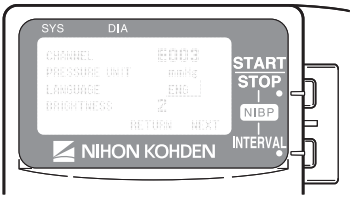
Select the unit for NIBP.



1. Press the NIBP INTERVAL key to move the cursor to “PRESSURE UNIT”.
2. Press the NIBP START/STOP key to select “mmHg” or “kPa”.

LANGUAGE

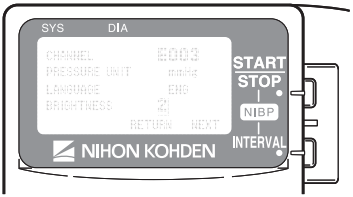
Select the language for screen display.



1. Press the NIBP INTERVAL key to move the cursor to “LANGUAGE”.
2. Press the NIBP START/STOP key to select the language.

BRIGHTNESS

Select the LCD brightness.



1. Press the NIBP INTERVAL key to move the cursor to “BRIGHTNESS”.
2. Press the NIBP START/STOP key to select the LCD brightness from 1 to 4.

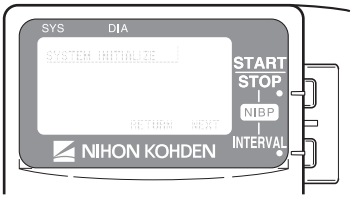
   1 2 3 4

Light ..... Dark

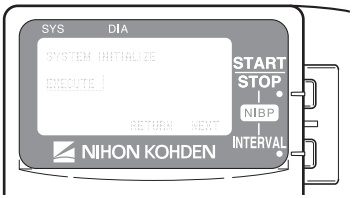
SYSTEM INITIALIZE

Do the following procedure to initialize the settings to the factory default settings.

1. Press the NIBP INTERVAL key to move the cursor to “SYSTEM INITIALIZE”.



2. Press the NIBP START/STOP key. The “EXECUTE” message appears.



3. Press the NIBP START/STOP key to initialize the settings to the factory default settings.

Attaching NIBP Cuff, Electrodes and SpO_2 Probe to the Patient

The transmitter can be attached to an arm of the patient or placed on the bedside. The required length of the electrode leads and SpO_2 probe cable depends on how the transmitter is to be attached to the patient.

NOTE

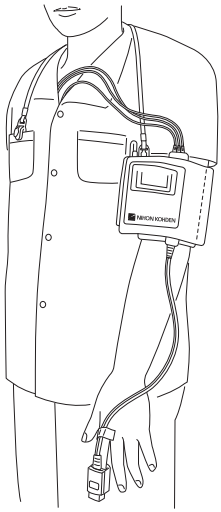
Monitoring SpO_2 during NIBP Measurement

When the SpO_2 probe is attached to the same limb as the NIBP cuff, the blood flow decreases during NIBP measurement and pulse wave cannot be detected and SpO_2 cannot be monitored properly. When "INHIBIT SpO_2 DURING NIBP" on the PARAMETER SETUP screen is set to ON (factory default setting), SpO_2 monitoring is paused during NIBP measurement to avoid SpO_2 alarm occurrence. However, when monitoring SpO_2 on the same limb as NIBP, be careful when reading SpO_2 values.

When monitoring SpO_2 is important, attach the probe to the limb to which the NIBP cuff or catheter is not attached.

Attachment Examples

When transmitter is attached on an arm



When transmitter is placed on a bedside

NOTE

When placing the transmitter on a bedside, place it on a stable and flat place. If the transmitter falls off, it may be damaged.

Attaching the NIBP Cuff

Selecting the NIBP Cuff

Select the NIBP cuff appropriate for the patient.

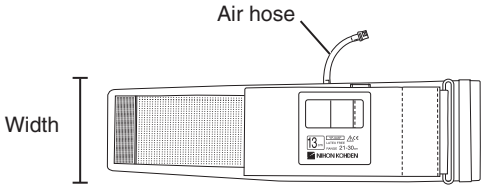
NOTE

NIBP cannot be measured on neonates using this transmitter.

Reusable Cuffs

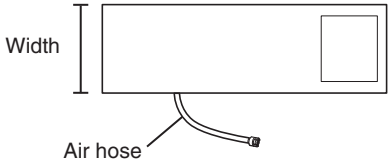
When attaching the transmitter to the patient arm, a special NIBP cuff is required. An optional YN-990P extension hose (1.5 m) is available to extend the length between the NIBP socket on the transmitter and NIBP cuff (e.g. when not attaching the transmitter to the patient arm and placing the transmitter on a bedside).

Reusable cuff		Model	Width (cm)	Air hose length (cm)
For adult	Standard	YP-943P	13	15
	Large	YP-944P	15	15



When not attaching the transmitter to the patient arm, the following cuffs can be used. To use these cuffs, an optional YN-990P extension hose (1.5 m) is required.

Reusable cuff		Model	Width (cm)	Air hose length (cm)
For infant		YP-960T	5	15
For child	Small	YP-961T	7	
	Standard	YP-962T	10	
For adult	Standard	YP-963T	13	
	Large	YP-964T	15	



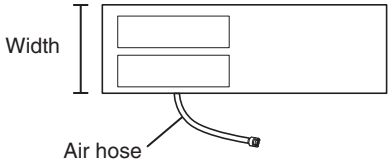
Disposable Cuffs

CAUTION

Disposable cuffs are not sterilized. If necessary, sterilize the cuff using glutaraldehyde solution.

When not attaching the transmitter to the patient arm, the following disposable cuffs can be used. To use these cuffs, an optional YN-990P extension hose (1.5 m) is required.

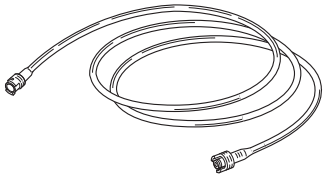
Reusable cuff		Model	Width (cm)	Air hose length (cm)
For infant		YP-810P	6	17
For child		YP-811P	8	17
For adult	Small	YP-812P	10	17
	Standard	YP-813P	14	20
	Medium large	YP-814P	15	20
	Large	YP-815P	17	20
	Extra large	YP-816P	18	20



Extension Hose

CAUTION

When using an extension hose, check that the extension hose is not bent or squeezed. Otherwise, the cuff might not inflate or deflate. If the cuff cannot deflate, it may cause congestion on the patient at the cuff attachment site.



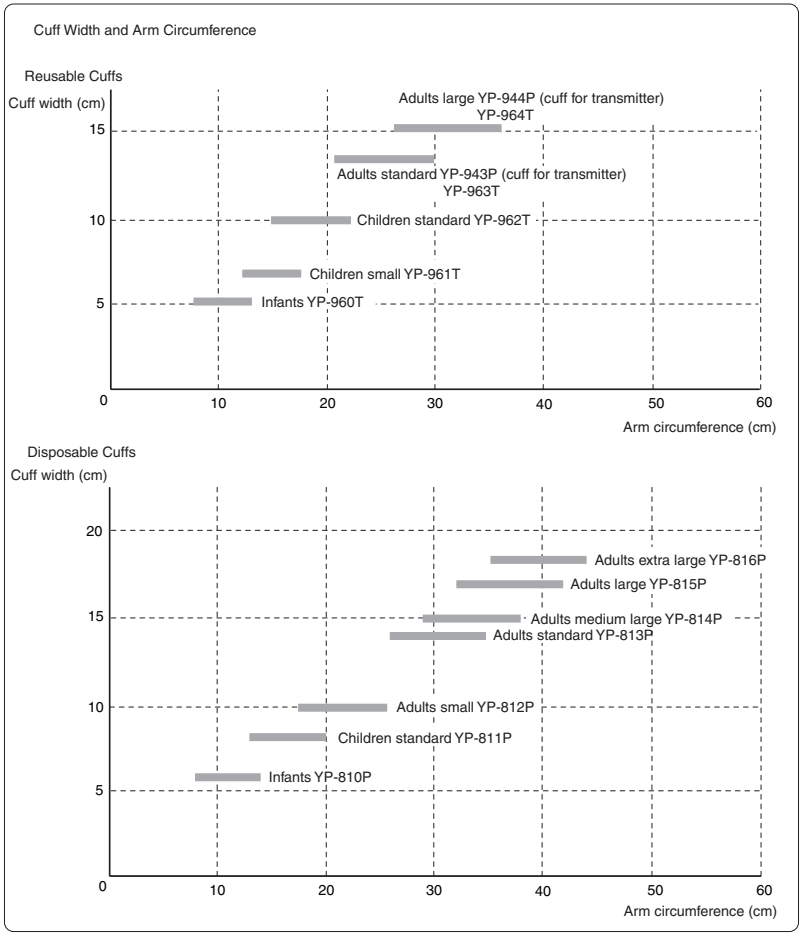
YN-990P extension hose, 150 cm

Reference for selecting a cuff

The AHA (American Heart Association) recommends that the cuff width be 40% of the circumference of the upper arm. Refer to the following graph and select the cuff which suits the patient's arm.

NOTE

- If a range of arm circumference appropriate for the cuff is prescribed, use a cuff within that range.
- To obtain accurate measured values, select a wide cuff which can be attached to the upper arm. Measuring with a very narrow cuff may result in measured values higher than the actual values.
- The YP-943P NIBP cuff is for standard size adult. Do not use this cuff when it does not fit the patient.

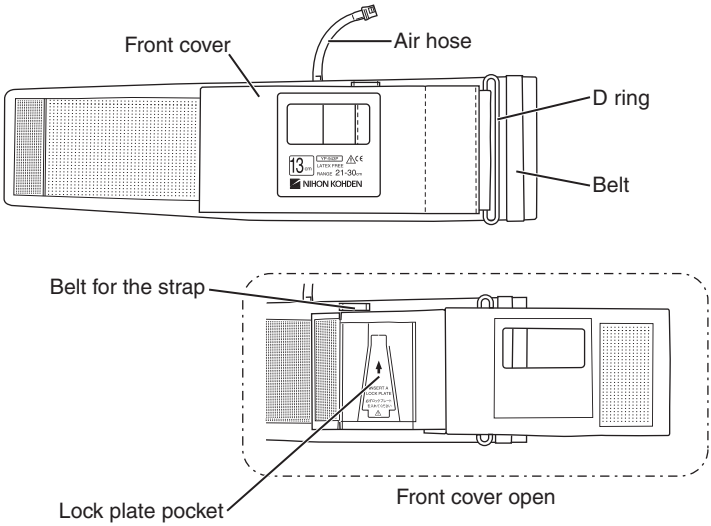


Connecting the NIBP Cuff to the Transmitter

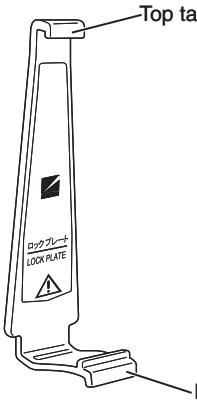
When Using YP-943P/944P NIBP Cuff

To attach the YP-943P/944P NIBP cuff to the transmitter, the lock plate is required.

YP-943P/944P NIBP cuff



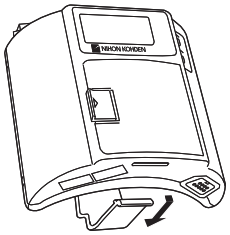
Lock plate



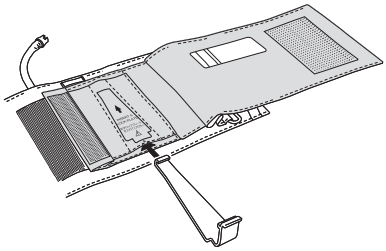
For attaching the NIBP cuff to the transmitter

NOTE

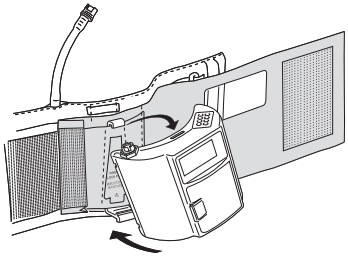
Do not roll up or put weight on the cuff when the lock plate is attached to it. The lock plate may break if the cuff is rolled up or weight is put on it when the lock plate attached.



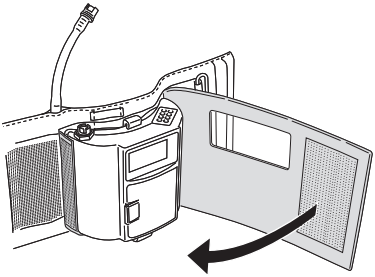
1. Remove the lock plate from the transmitter.



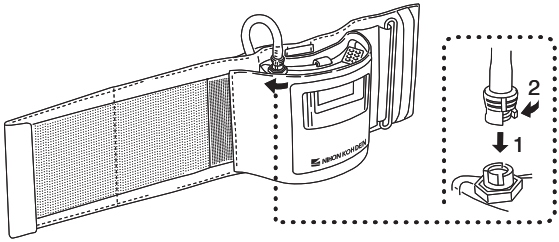
2. Insert the lock plate into the lock plate pocket on the NIBP cuff.



3. Attach the transmitter to the lock plate by inserting the tabs on the lock plate into the slots on the transmitter.



4. Cover the transmitter with the front cover of the NIBP cuff.



5. Connect the air hose to the NIBP socket on the transmitter. Turn the cuff connector joint until it clicks.