

# Service Manual

Life Scope *TR*

## Bedside Monitor

BSM-6301/BSM-6501/BSM-6701

BSM-6000 series  
BSM-6301A  
BSM-6301K  
BSM-6501A  
BSM-6501K  
BSM-6701A  
BSM-6701K

In order to use this product safely and fully understand all its functions, read this manual before using the product.

Keep this manual near the instrument or in the reach of the operator and refer to it whenever the operation is unclear.

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

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

The contents of this manual are subject to change without notice.

If you have any comments or suggestions on this manual, please contact us at: [www.nihonkohden.com](http://www.nihonkohden.com)

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## 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 combined 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 battery-operated 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 specified parts must undergo regular maintenance inspection at the interval which is specified after the GENERAL HANDLING PRECAUTIONS section.
- (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 product to sale by or on the order of a physician.

### **EMC RELATED CAUTION**

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



The following describes some common interference sources and remedial actions:

1. Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:  
Install the equipment and/or system at another location. Keep the emitter source such as cellular phone away from the equipment and/or system, or turn off the cellular phone.
2. Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:  
Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.
3. Effect of direct or indirect electrostatic discharge:  
Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.
4. Electromagnetic interference with any radio wave receiver such as radio or television:  
If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.
5. Interference of lightning:  
When lightning occurs near the location where the equipment and/or system is installed, it may induce an excessive voltage in the equipment and/or system. In such a case, disconnect the AC power cord from the equipment and/or system and operate the equipment and/or system by battery power, or use an uninterruptible power supply.
6. Use with other equipment:  
When the equipment and/or system is adjacent to or stacked with other equipment, the equipment and/or system may affect the other equipment. Before use, check that the equipment and/or system operates normally with the other equipment.
7. Use of unspecified accessory, transducer and/or cable:  
When an unspecified accessory, transducer and/or cable is connected to this equipment and/or system, it may cause increased electromagnetic emission or decreased electromagnetic immunity. The specified configuration of this equipment and/or system complies with the electromagnetic requirements with the specified configuration. Only use this equipment and/or system with the specified configuration.
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.

Caution - continued

10. Use with radiation therapy equipment:

When the equipment and/or system is used in a radiotherapy room, it may cause failure or malfunction due to electromagnetic radiation or corpuscular radiation. When you bring the equipment and/or system into a radiotherapy room, constantly observe the operation. Prepare countermeasures in case of failure or malfunction.

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

BSM-6301 and BSM-6501 (JA-690PA or JA-694PA data acquisition unit, QE-910P BIS processor, AE-918P neuro unit, JP-911P IBP interface isolation cable, QI-320PA or QI-420PA wireless LAN station and QI-670P interface are not connected) comply with International Standard IEC 60601-1-2: 2001 and Amendment 1: 2004 which requires CISPR11, Group 1, Class B. Class B EQUIPMENT is equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

BSM-6301, BSM-6501 (JA-690PA or JA-694PA data acquisition unit, QE-910P BIS processor, AE-918P neuro unit, JP-911P IBP interface isolation cable, QI-320PA or QI-420PA wireless LAN station or QI-670P interface is connected) and BSM-6701 comply with International Standard IEC 60601-1-2: 2001 and Amendment 1: 2004 which requires CISPR11, Group 1, Class A. Class A EQUIPMENT is equipment suitable for use in industrial or light industrial establishments and commercial environment.

BSM-6301 and BSM-6501 (when ZS-900P is connected) are CLASS A equipment if the equipment complies with IEC 60601-1-2: 2001 36 201.1.5 in the countries which do not have national wireless rule.

### WARNING

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. If this occurs, disconnect the monitor or diagnostic equipment 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.

**The CE mark is a protected conformity mark of the European Community. Products with the CE mark comply with the requirements of the Medical Device Directive 93/42/EEC.**

NOTE about Waste Electrical and Electronic Equipment (WEEE) directive 2002/96/EC

For the member states of the European Union only:

The purpose of WEEE directive 2002/96/EC is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste.

Contact your Nihon Kohden representative for disposal.

# Conventions Used in this Manual and 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 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, prerequisites, alternative methods or supplemental information.

## Text Conventions

- Names of hard keys on the main unit are enclosed in square brackets: [Menu]
- Messages that are displayed on the screen are enclosed in quotation marks: "CHECK ELECTRODES"
- Names of items that are displayed on the screen are enclosed in angle brackets: <SENSITIVITY>

## Related Documentation

The BSM-6301A/K, BSM-6501A/K and BSM-6701A/K bedside monitors come with the following manuals in addition to the operator's manual.

### Administrator's Guide

Describes how to install the bedside monitor. It also explains about the password protected settings on the SYSTEM SETUP window and SYSTEM CONFIGURATION screen which only an administrator can change.

### User's Guide, Part I

Gives supplemental information on the operation of the bedside monitor.

### User's Guide, Part II

Describes the features and settings of the monitoring parameters.

### Service Manual

Describes information on servicing the bedside monitor. Only qualified service personnel can service the bedside monitor.

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## Introduction

This service manual provides useful information to qualified personnel to understand, troubleshoot, service, maintain and repair the BSM-6000A/K series bedside monitor.

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

For simplicity, the model number suffix A/G/K is omitted in this manual. There is no difference in operation among models with different suffixes unless otherwise specified.

When using the BSM-1700 series bedside monitor as an input unit, refer to the service manual of the BSM-1700 series bedside monitor.

### Precautions on Improper Use

This monitor's performance and safety are assured only by proper use as described in the service manual and the operator's manual. Nihon Kohden cannot be held responsible for problems caused by use other than indicated in the manuals.

## General Information on Servicing

Note the following information when servicing the monitor.

### CAUTION

#### Safety

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

#### Liquid ingress

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

#### Environmental safeguards

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

#### Disinfection and cleaning

To disinfect the outside surface of the instrument, wipe it with a nonabrasive cloth moistened with any of the disinfectants listed below. Do not use any other disinfectants or ultraviolet rays to disinfect the instrument.

- Chlorhexidine gluconate solution: 0.5%
- Benzethonium chloride solution: 0.2%
- Glutaraldehyde solution: 2.0%
- Benzalkonium chloride: 0.2%
- Alkyldiaminoethylglycine hydrochloride: 0.5%

#### Transport

- Use the specified shipment container and packing material to transport the instrument. If necessary, double pack the instrument.

Also, put the instrument into the shipment container after packing so that the buffer material does not get inside the instrument.

- When transporting a board or unit of the instrument, be sure to use a conductive bag. Never use an aluminum bag when transporting the power board, power unit or board on which a lithium battery is mounted. Also, never wrap the board or unit of the instrument with styrene foam or a plastic bag which generates static electricity.

#### Handling the instrument

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

#### Measuring and test equipment

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



## Precautions on Handling Information

Personal medical information may be handled in the monitor. Observe the following points in repair or replacement.

- When the monitor is to be taken out from a facility, explain about that to the facility and obtain approval from the facility.
- Before the monitor is to be transferred from a facility or outside of the company, be sure to erase data by the system initialization (general).
- Before disposing of the MAIN DIGITAL board, take measures to completely disable data reading.

## Precautions on Repair

- When packaging and transporting a monitor, use the designated package box and packaging materials. Perform double packaging as necessary. Be also sure to wrap the monitor before packaging in order to prevent intrusion of the cushioning material.
- When transporting boards, be sure to put it in a conductive bag. When transporting boards with batteries or other power supply components, never use aluminum foil. (For packaging, never use polystyrene foam, plastic bags or any other electrostatically sensitive materials.)
- The boards in this monitor use surface-mount components. Therefore, for removing components or soldering, special tools must be used. Be careful in the operation. Careless operation can cause damage to the printed circuit board itself or component failure. Check and calibrate jigs and measuring instruments used for repair and inspection according to the instruction in order to maintain a high accuracy.
- This monitor can be connected to the network of the facility where this monitor is installed, as well as to a special network. When performing a network connection work, observe the following notes.
  - First obtain the approval from the network administrator of the facility. Then follow their instruction throughout the work and setting operations.
  - Check that the connection is made by way of the LAN Isolation (HIT-100, code number: 676457).

## Service Policy and Patient Safety Checks

### Service Policy

Our technical service policy for the monitor is to replace the faulty unit, board or part or damaged mechanical part with a new one. Do not perform electrical device or component level repair of the multilayer board or unit. We do not support component level repair outside the factory for the following reasons:

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

Disassemble the monitor or replace a board or unit in an environment where the monitor is protected against static electricity.

As background knowledge for repair, note the following:

- You can reduce the repair time by considering the problem before starting repair.
- You can clarify the source of most of the troubles using the information from the diagnostic check function of the monitor.

### Patient Safety Checks

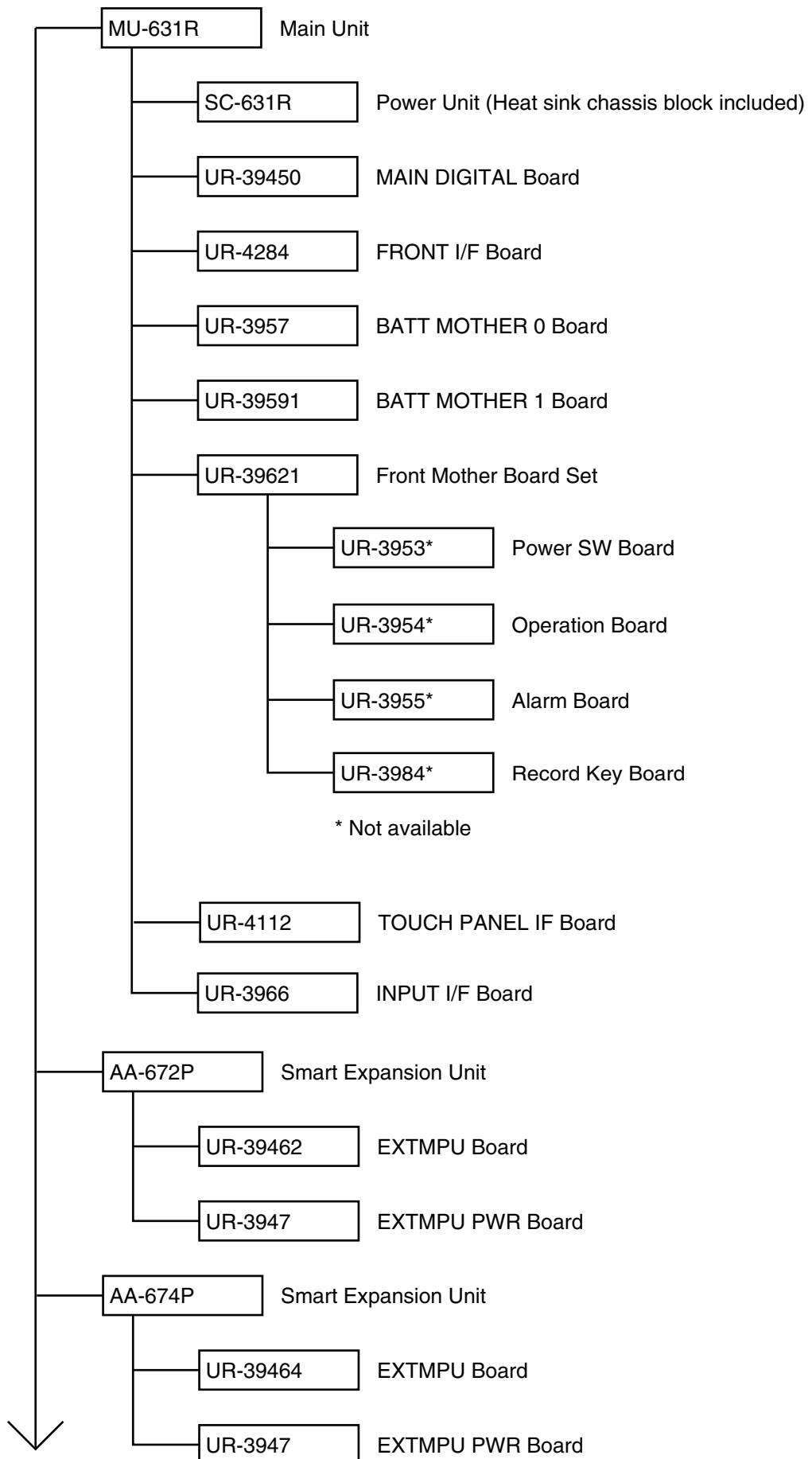
Periodic maintenance procedures and diagnostic check procedures are provided in this manual to ensure that the monitor is operating in accordance with its design and production specifications. To verify that the monitor is working in a safe manner with regard to patient safety, patient safety checks should be performed on the monitor before it is first installed, periodically after installation, and after any repair is made on the monitor.

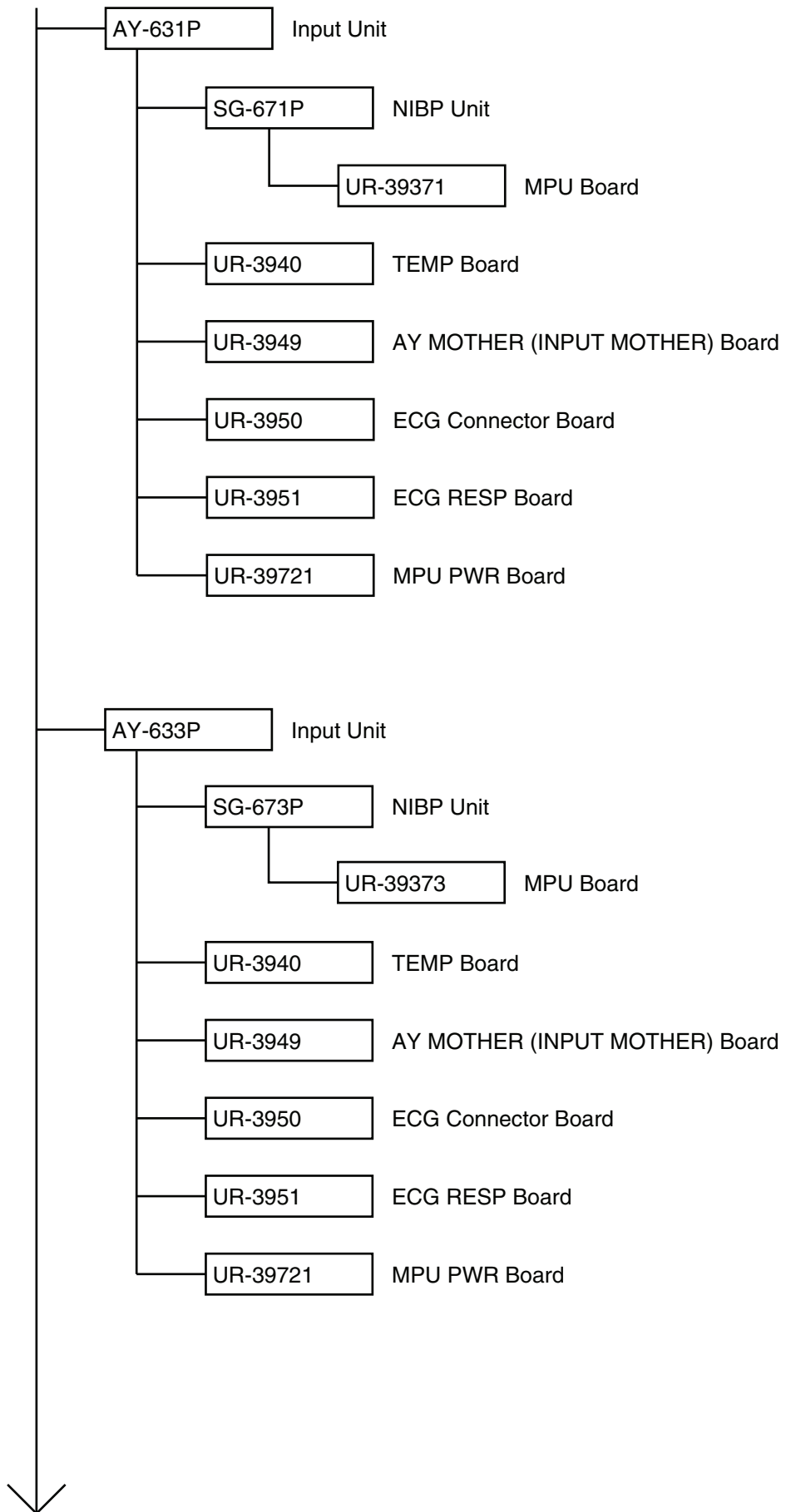
For patient safety checks, perform the following checks as described in the International Electrotechnical Commission's standard, IEC 60601-1: 1988.

- Protective earth resistance check
- Earth leakage current check
- Enclosure leakage current check
- Patient leakage current check
- Withstanding voltage check

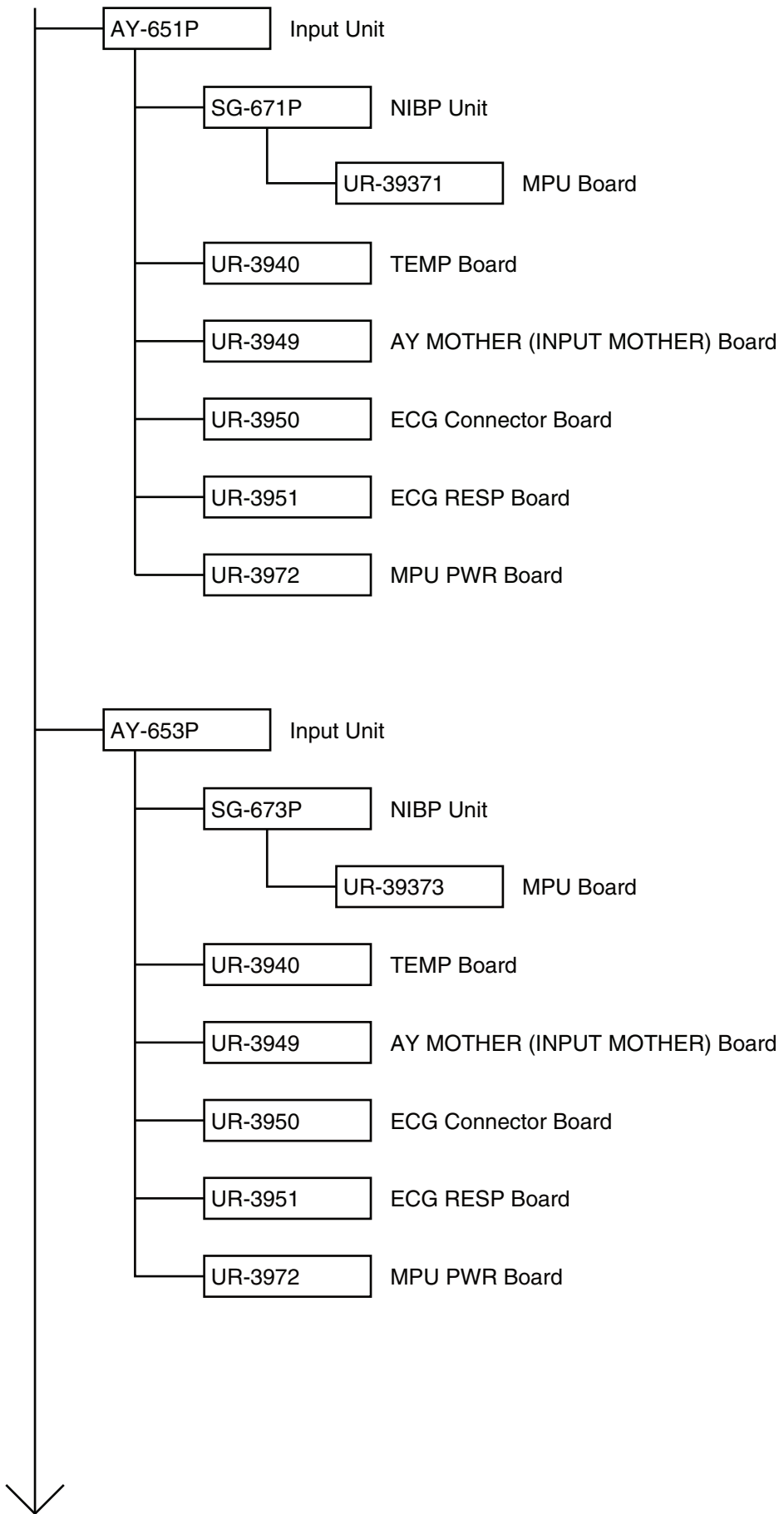
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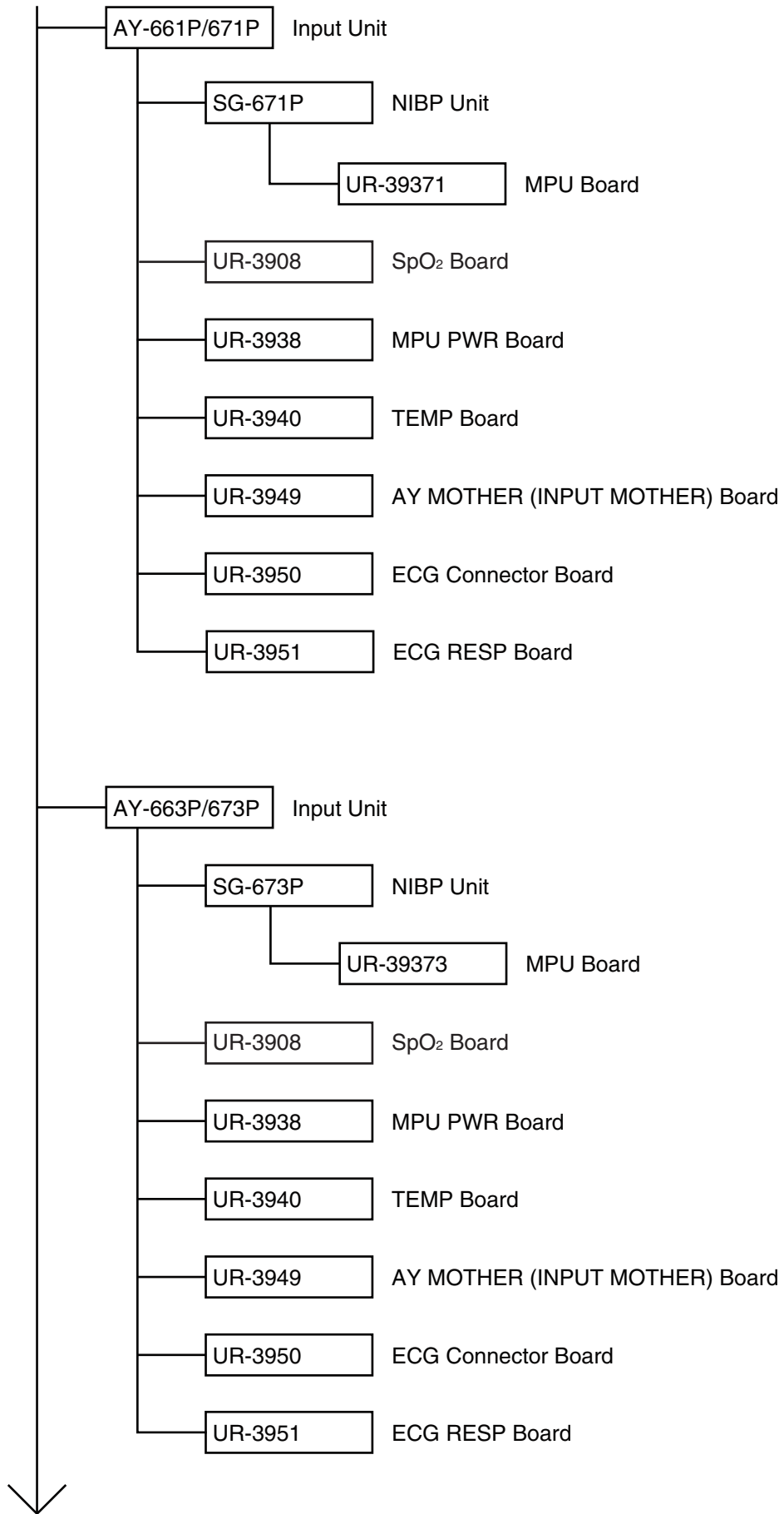
## BSM-6301



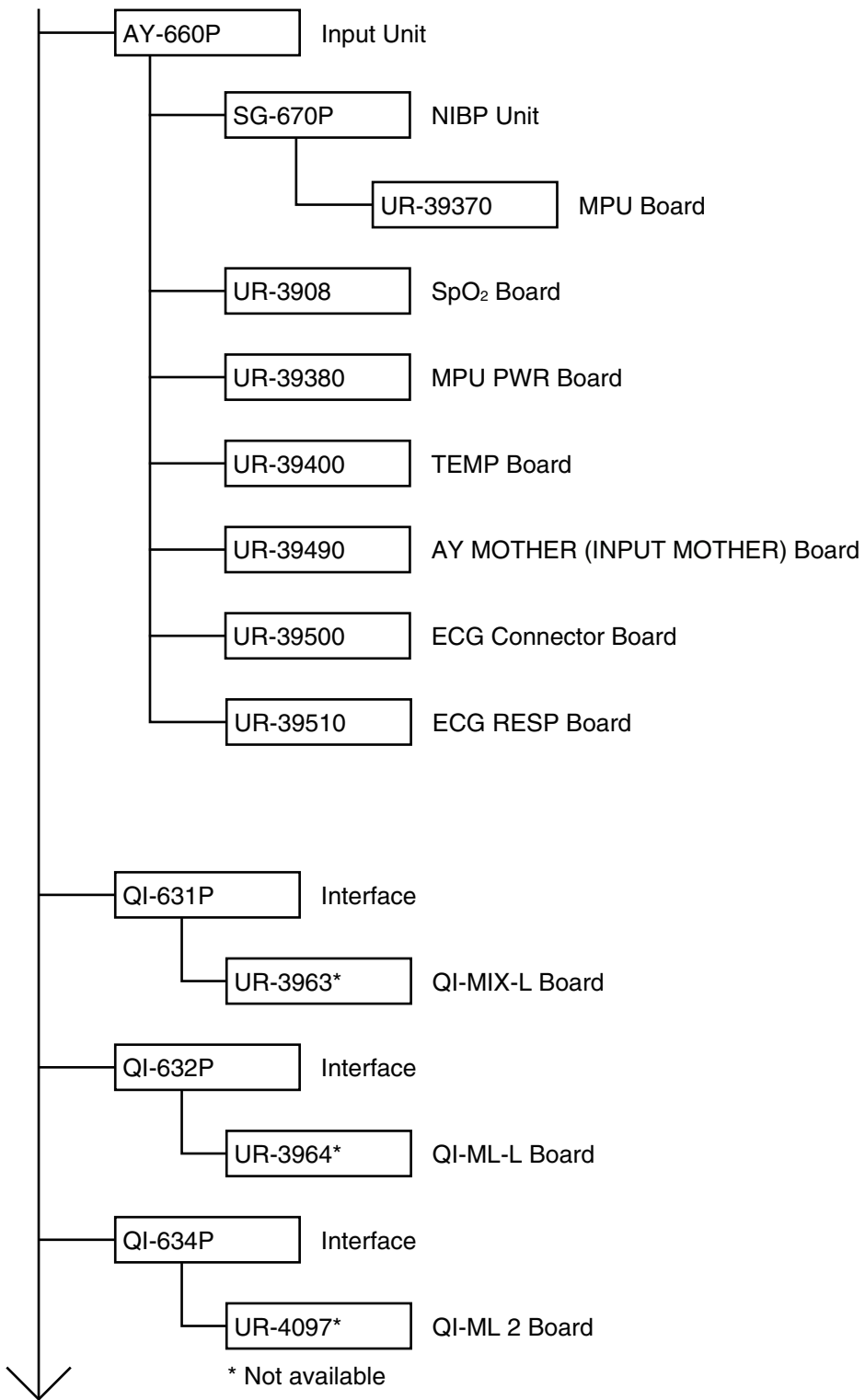


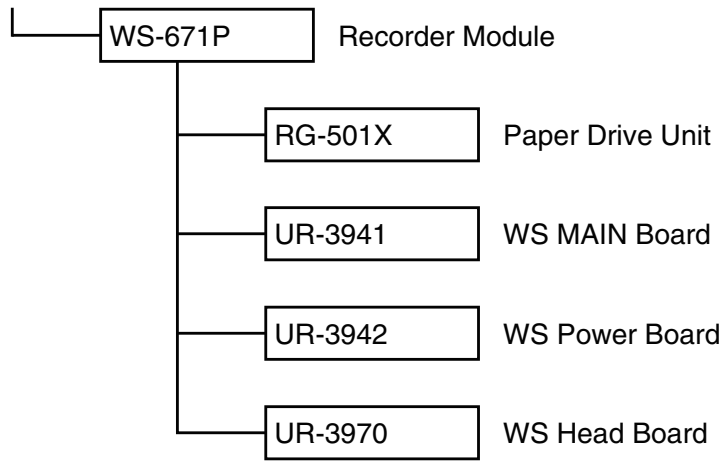
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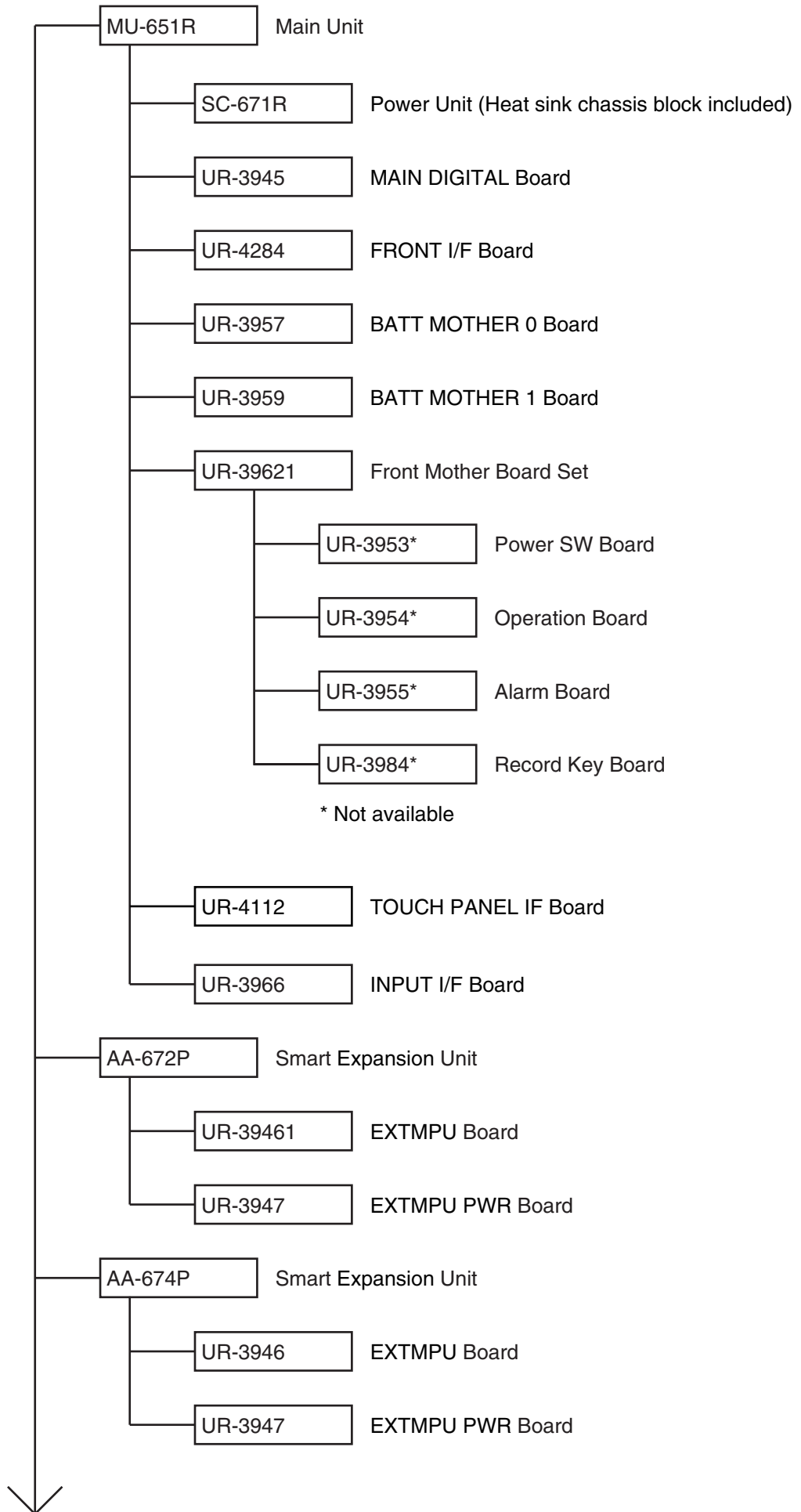
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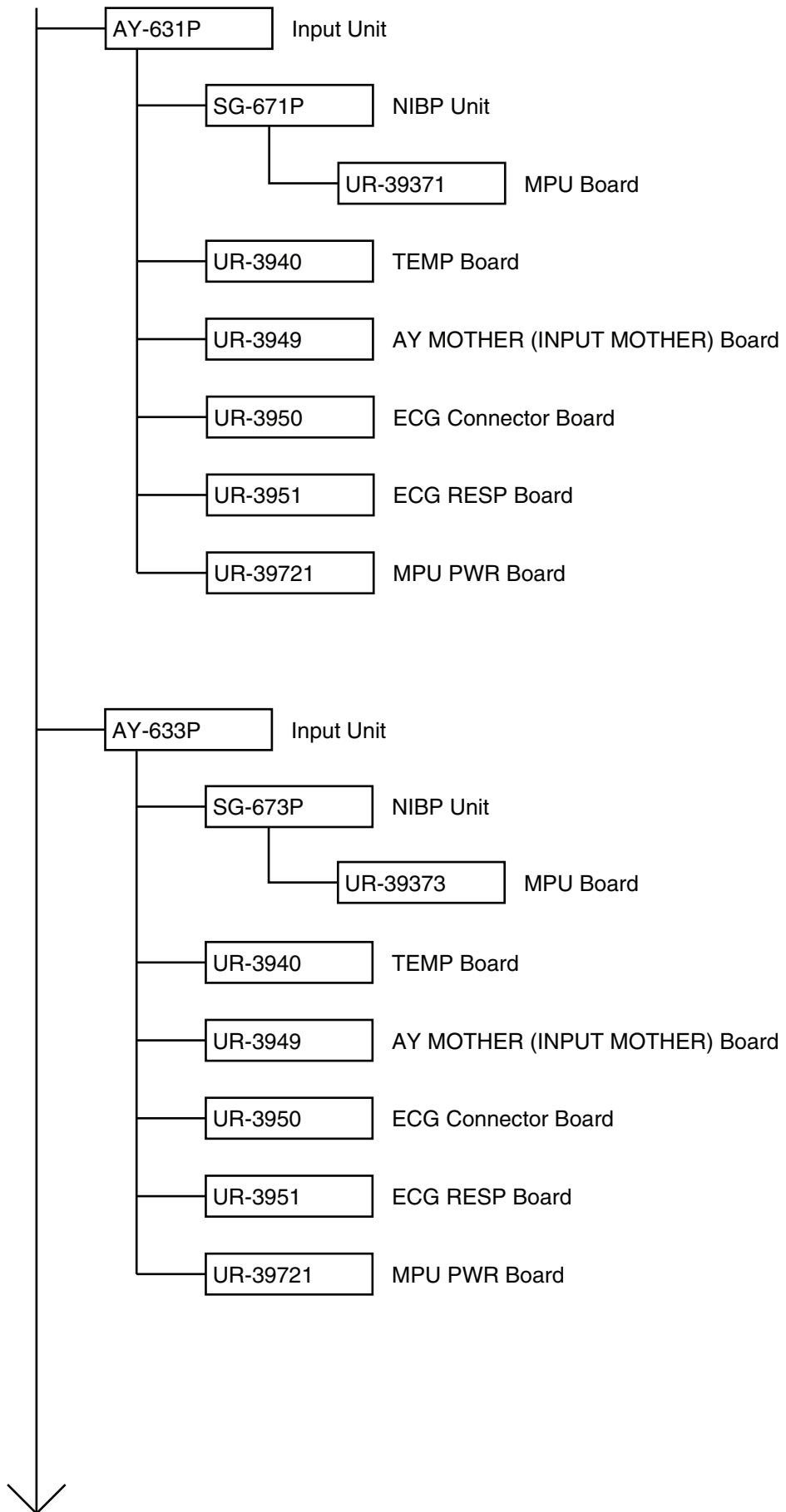




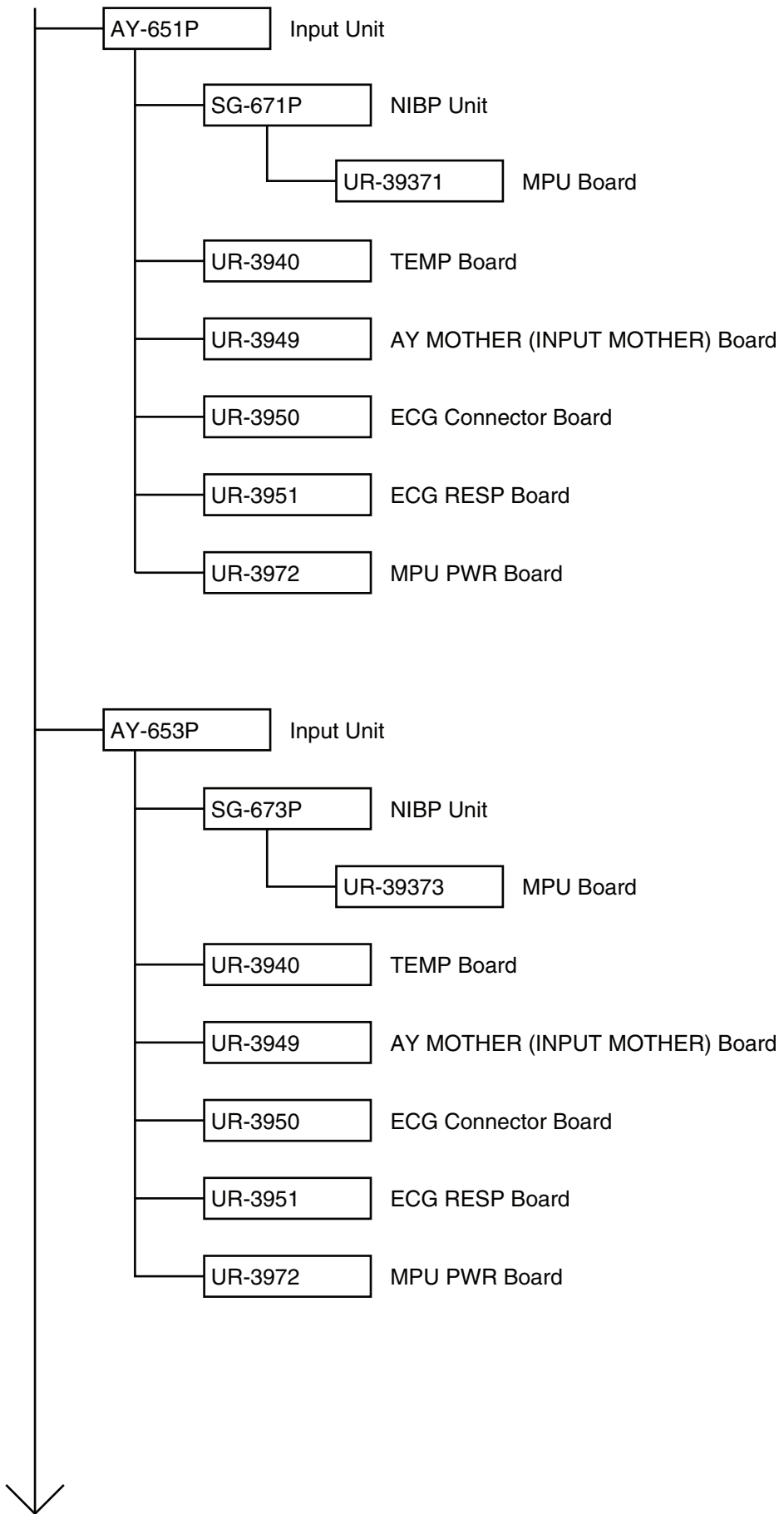


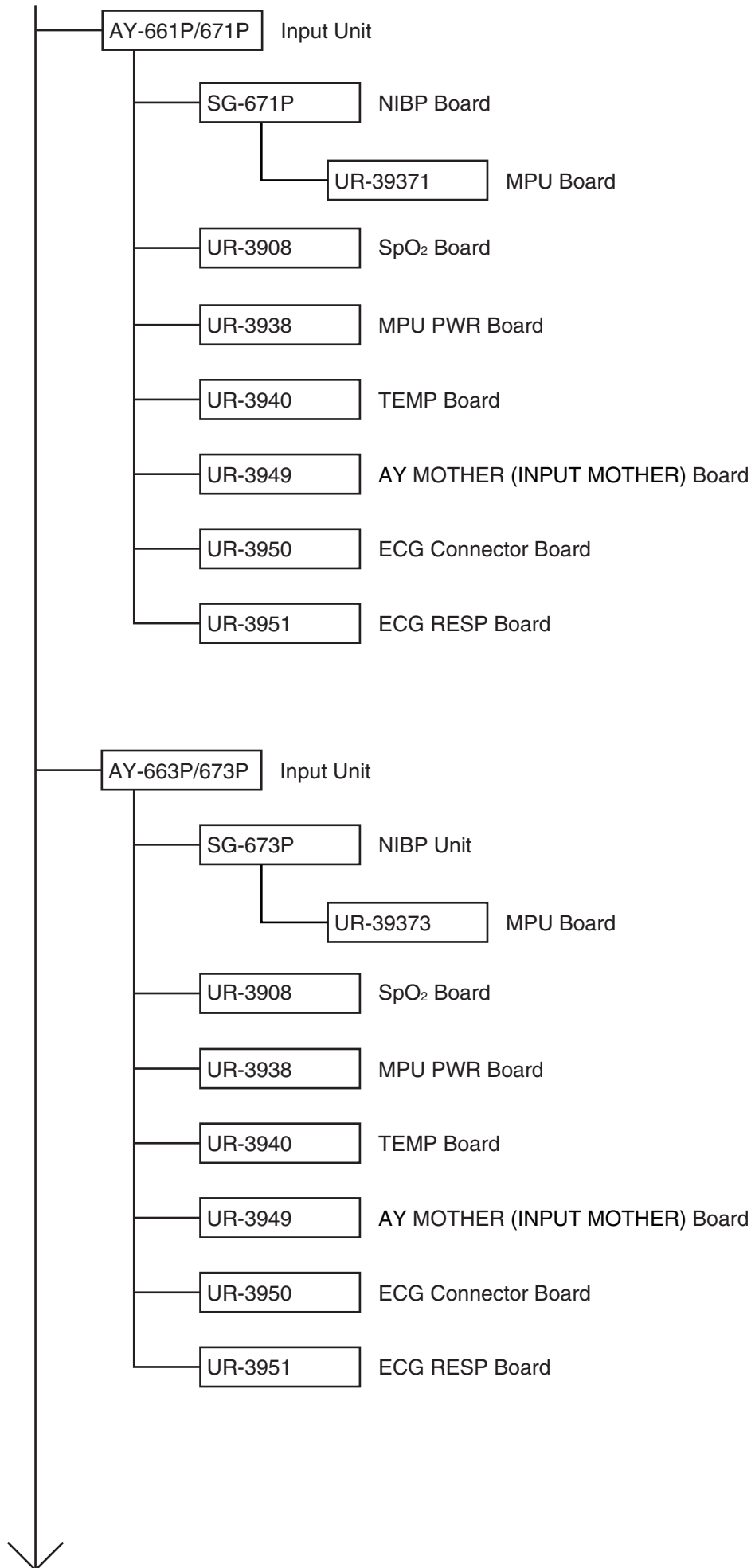
**BSM-6501**



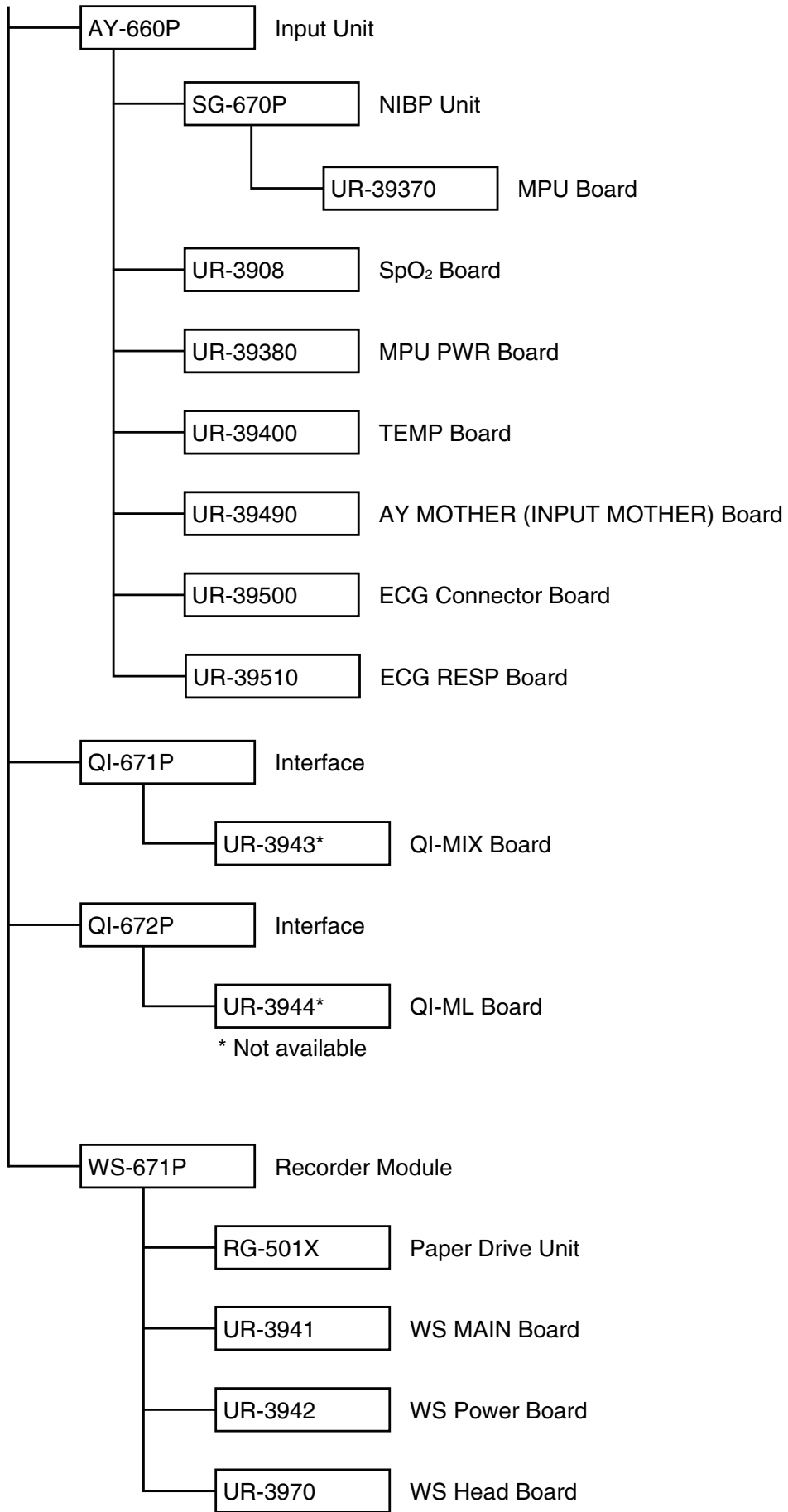


1. GENERAL

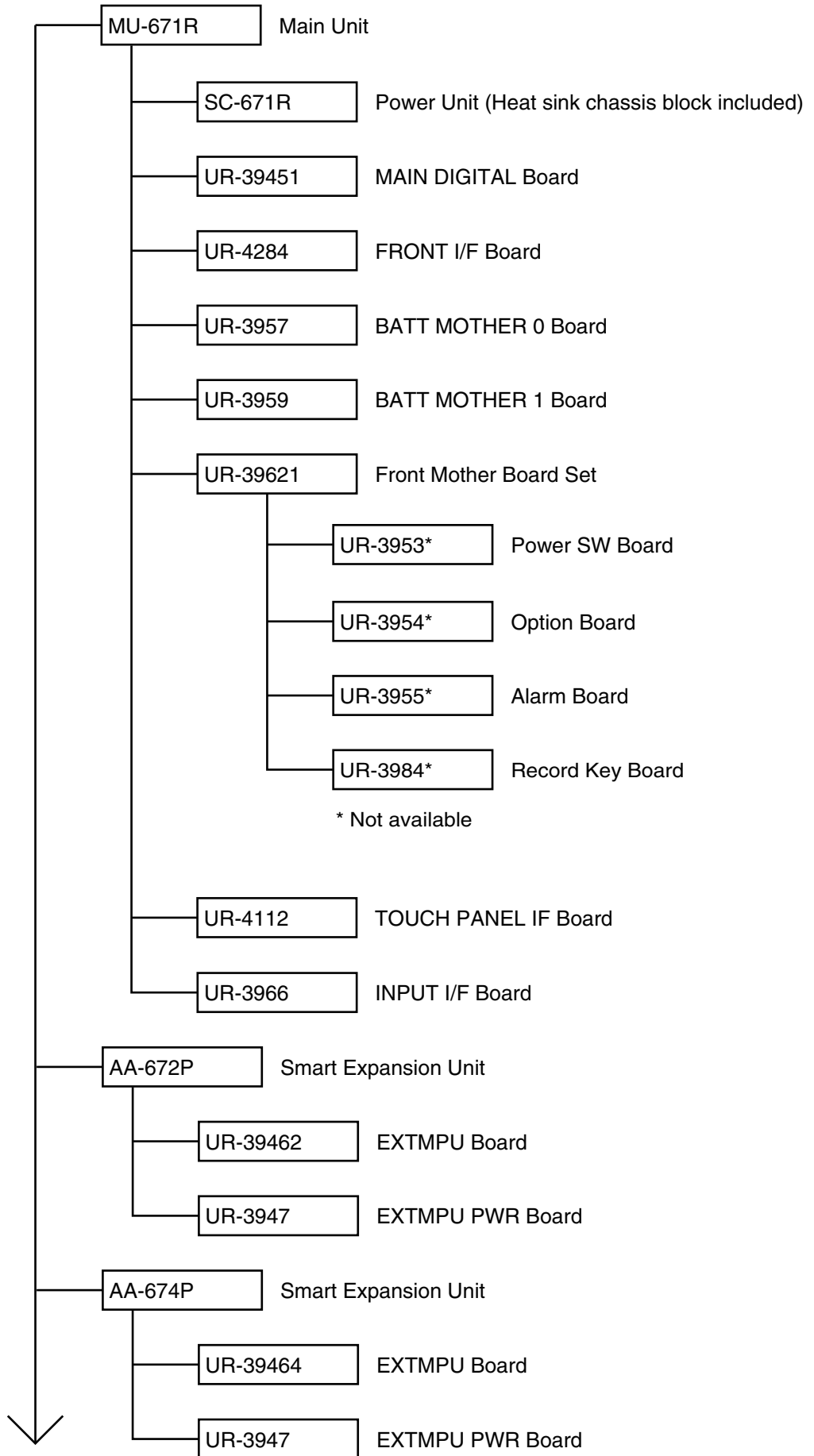




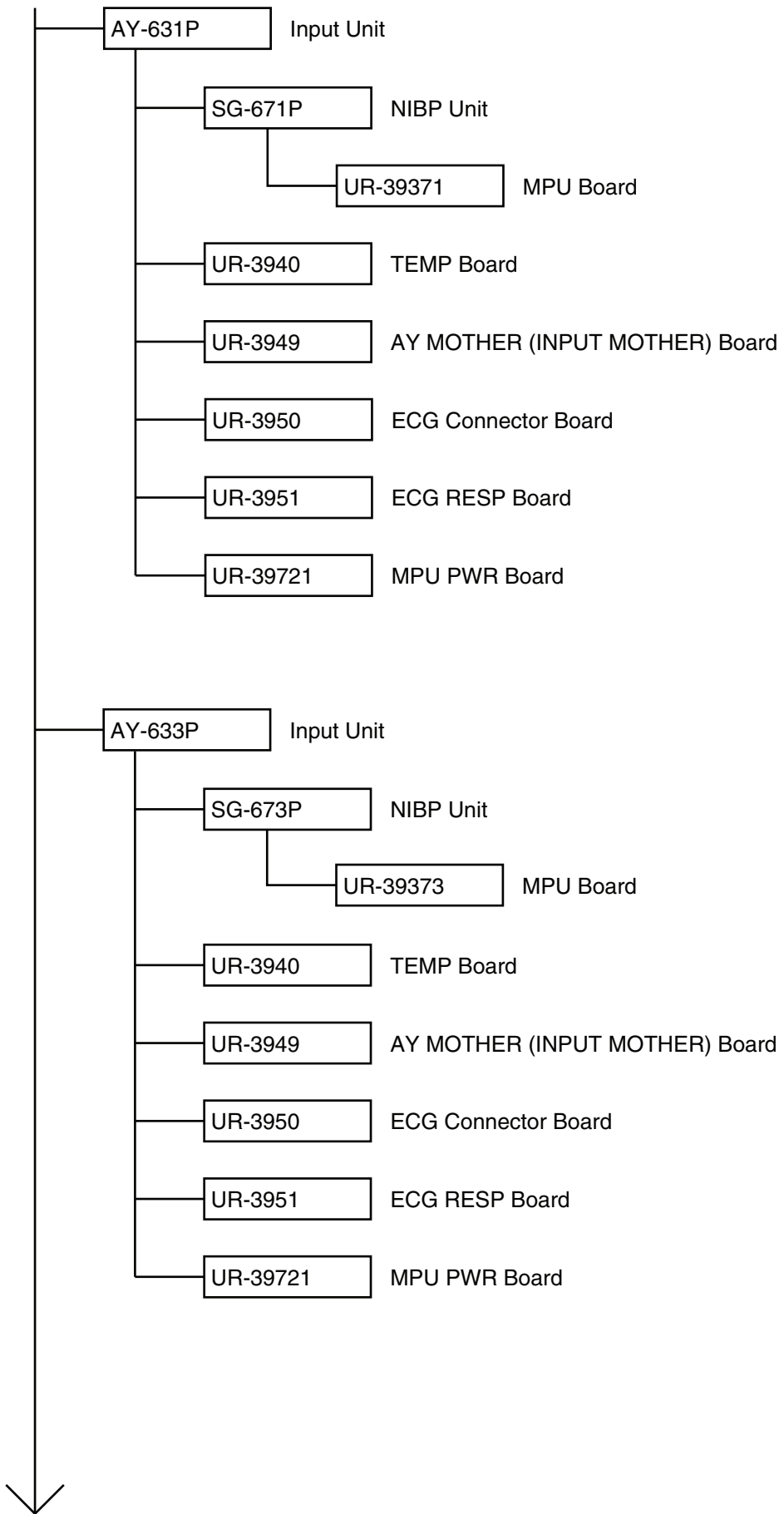
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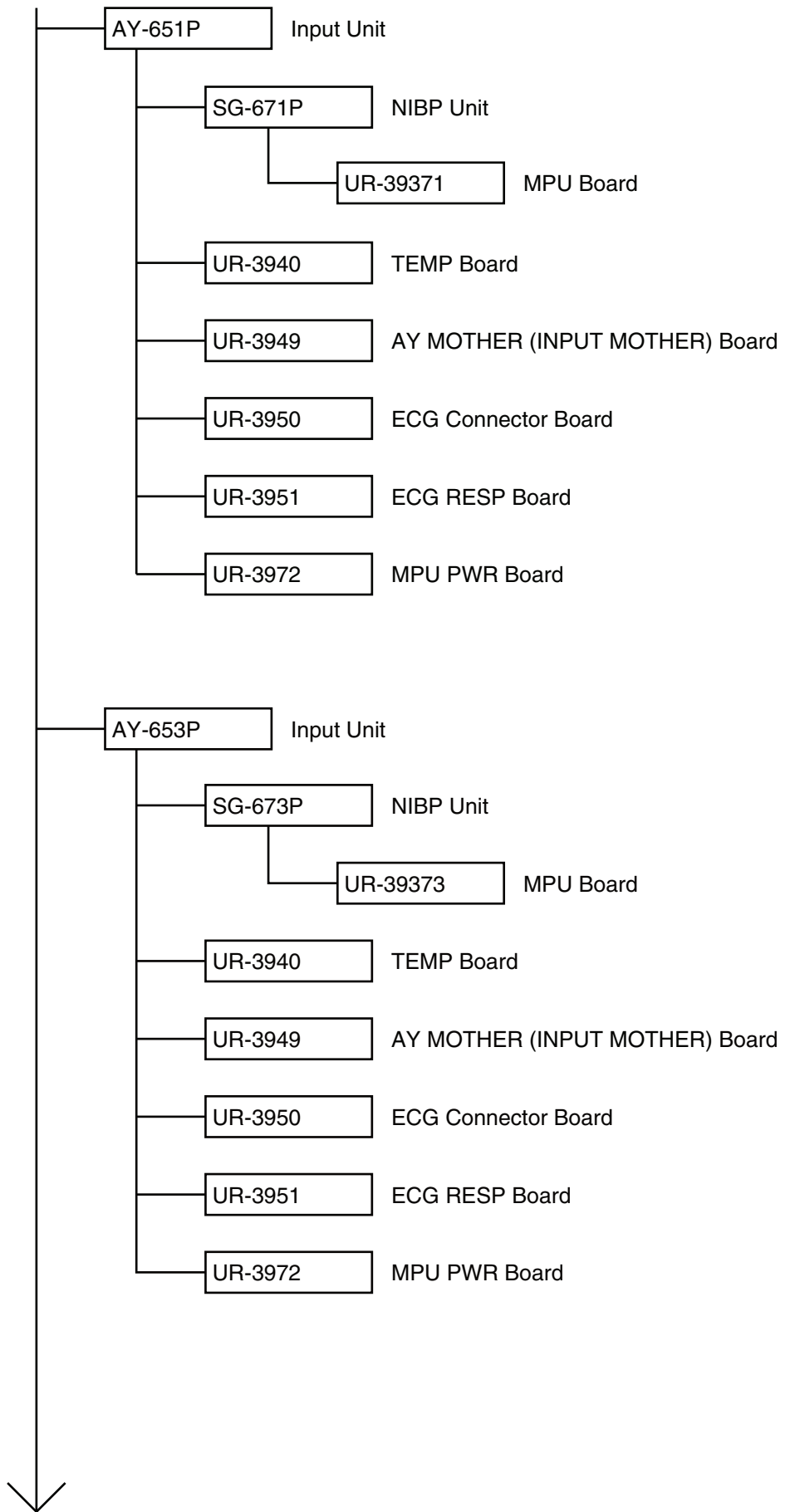


BSM-6701



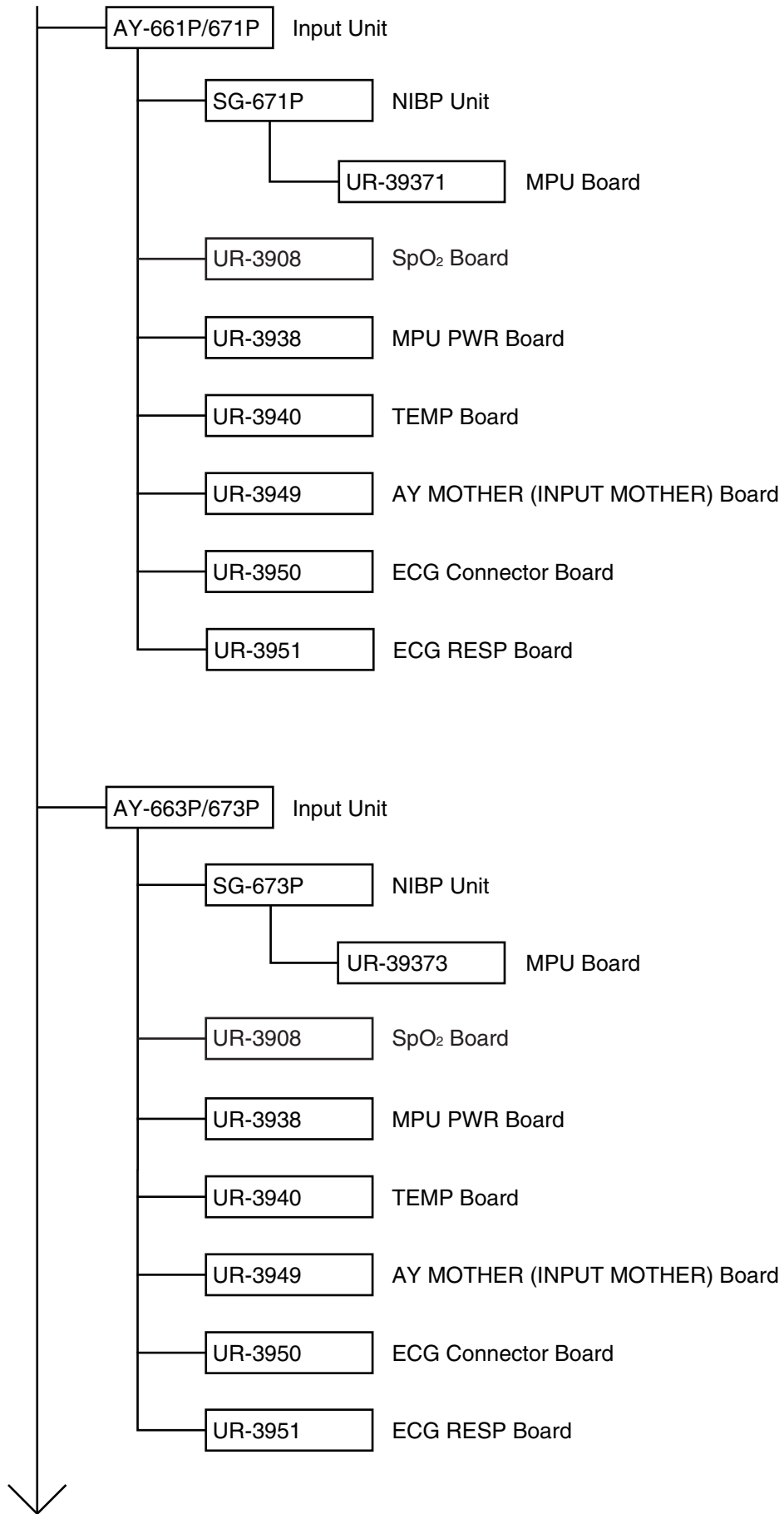
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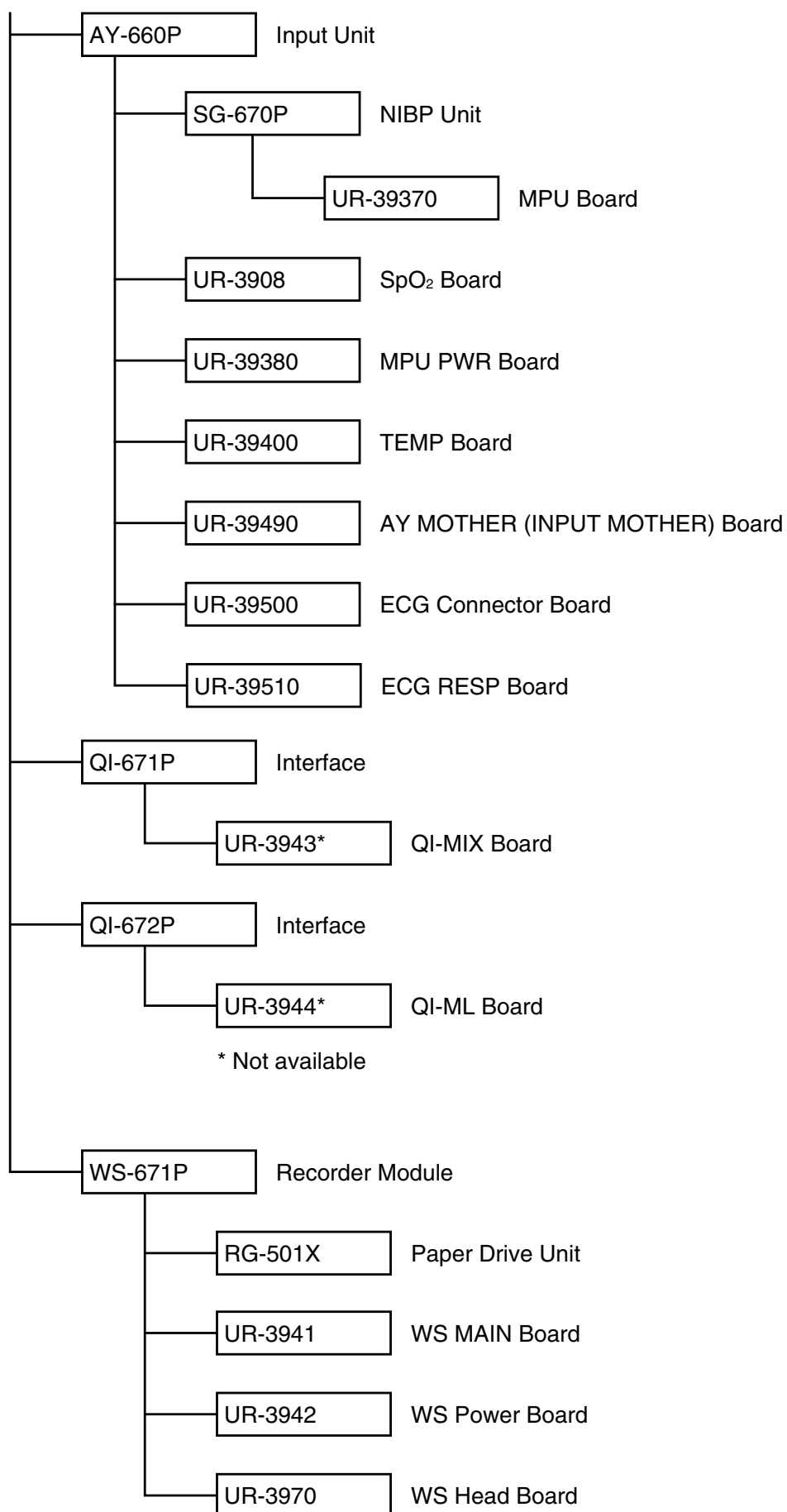






1. GENERAL





## 1. GENERAL

### Software Composition

The software composition is described below.

#### MU-631P/651P/671P

Board Model	Board Name	Software (displayed on screen)	Remark
UR-3945 (UR-39450) (UR-39451)	MAIN DIGITAL board	IPL	Boot program
		CPU	Main program
		LANG	Language
		ARR*	Arrhythmia analysis
		NIBP*	NIBP measurement
		ECAPS*	12 lead analysis

\* For this software, the version number is not displayed on the DIAGNOSTIC CHECK screen. It can be checked on the INFO page of the INFO window in the SYSTEM SETUP window.

#### WS-671P

Board Model	Board Name	Software (displayed on screen)	Remark
UR-3941	WS MAIN board	RPU*	Recorder

\* This software is displayed as “WS” on the DIAGNOSTIC CHECK screen.

#### AY-631P/633P/651P/653P/660P/661P/663P/671P/673P

Board Model	Board Name	Software (displayed on screen)	Remark
UR-3951	ECG RESP board	EPU	ECG control program
UR-39370/39371/39373	MPU board	DPU0	MPU control program
UR-3908* <sup>1</sup>	SpO <sub>2</sub> board	SpO <sub>2</sub> * <sup>2</sup>	SpO <sub>2</sub> control program

\*<sup>1</sup> This board is mounted on AY-660P/661P/663P/671P/673P only.

\*<sup>2</sup> For this software, the version number is not displayed on the DIAGNOSTIC CHECK screen. It can be checked on the INFO page of the INFO window in the SYSTEM SETUP window.

#### AA-672P/674P

Board Model	Board Name	Software (displayed on screen)	Remark
UR-39462/39464	EXTMPU board	DPU1	MPU control program

## Specifications

### Measuring Parameters

ECG, respiration in impedance and thermistor method, SpO<sub>2</sub>, NIBP, IBP, temperature, cardiac output, O<sub>2</sub>, CO<sub>2</sub> in mainstream method and sidestream method, flow/Paw, BIS, anesthetic gas (CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>O, agent), TOF, ventilation, CCO, EEG, tcPO<sub>2</sub>, tcPCO<sub>2</sub>, rSO<sub>2</sub>

### Influence on Measuring Accuracy by Electrosurgery/Defibrillation/Electrostatic Discharge

The bedside monitor returns to the previous operating mode within 10 seconds without loss of any stored data. When performing defibrillation, the filter setting on the bedside monitor must be set to MONITOR on the ECG window to return to the previous operating mode within 10 seconds without loss of any stored data. Measurement accuracy may be temporarily decreased while performing electro-surgery or defibrillation. This does not affect patient or equipment safety.

### Display

Display size:

BSM-6301:	10.4 inch, color TFT type LCD
BSM-6501:	12.1 inch, color TFT type LCD
BSM-6701:	15 inch, color TFT type LCD

Resolution:

BSM-6301/6501:	800 × 600 dots
BSM-6701:	1024 × 768 dots

Viewing area:

BSM-6301:	212.2 mm × 159.4 mm
BSM-6501:	246.0 mm × 184.5 mm
BSM-6701:	304.1 mm × 228.1 mm

Waveform display:

ECG (maximum 12 traces), respiration, IBP (maximum 7 traces), SpO<sub>2</sub> pulse wave, CO<sub>2</sub> and CO thermodilution curve, EEG, N<sub>2</sub>O concentration, O<sub>2</sub> concentration, anesthetic agent concentration (Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane), flow, Paw, volume

Waveform display mode:

Non-fade moving or non-fade fixed

Maximum number of waveform trace:

15 traces

Sweep speed:

6.25, 12.5, 25 or 50 mm/s

Respiration sweep speed:

1.56, 6.25, 12.5 or 25 mm/s

Aspect ratio (ECG display sensitivity ratio to sweep speed):

Standard:	0.4 s/mV
Setting range:	0.05 to 6.4 s/mV

Sweep time (at 25 mm/s sweep speed):

BSM-6301:	6.0 s
BSM-6501:	6.5 s
BSM-6701:	9.5 s

Display delay time:

DIAG and MONITOR mode:	≤ 250 ms
MAXIMUM mode:	≤ 1 s

Waveform display color:

12 colors

Numeric data display:

Heart rate, VPC rate, ST level, respiration rate, NIBP (systolic, diastolic, MAP), PWTT, delta PWTT, IBP (systolic, diastolic, mean), SpO<sub>2</sub>, pulse rate, temperature, cardiac output, cardiac index, injectate temperature, blood temperature, O<sub>2</sub> concentration, ETCO<sub>2</sub>, FiCO<sub>2</sub>, BIS, inspired/expired N<sub>2</sub>O

## 1. GENERAL

	concentration, inspired/expired O <sub>2</sub> concentration, inspired/expired anesthetic agent concentration (Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane), minimum alveolar concentration, peak airway pressure, positive end expiratory pressure, mean airway pressure, minute volume, expiratory/inspiratory tidal volume, compliance, airway resistance, expiratory/inspiratory airway resistance, inspiration expiration ratio, inspired setO <sub>2</sub> , CCO, SVRI, S $\bar{v}$ O <sub>2</sub> , Tb, EF, Sc $\bar{v}$ O <sub>2</sub> , CCI, EDV, SVR, EDVI, PCCO, PCCI, SEF, MDF, PPF, TP, Abs $\delta$ , Abs $\theta$ , Abs $\alpha$ , Abs $\beta$ , Abs $\gamma$ , % $\delta$ , % $\theta$ , % $\alpha$ , % $\beta$ , % $\gamma$ , tcPO <sub>2</sub> , tcPCO <sub>2</sub> , PPV, SPV, rSO <sub>2</sub>
Synchronization mark:	Heart rate sync mark, pulse rate sync mark, respiratory sync mark
Numeric display color:	12 colors
Recovery time after defibrillation:	≤ 10 s (at MONITOR mode)

### Alarm

#### Alarm levels:

Crisis:	Patient is in critical condition and the patient's life may be at risk. Immediate action must be taken.
Warning:	Patient is in critical condition. Prompt action should be taken.
Advisory:	Setting or condition is not appropriate for accurate monitoring.

#### Alarm items:

Vital sign alarms:	HR, PR, ST, RR, APNEA, TEMP, delta TEMP, SpO <sub>2</sub> , SpO <sub>2</sub> -2, delta SpO <sub>2</sub> , NIBP, IBP, ETCO <sub>2</sub> , CO <sub>2</sub> (I), O <sub>2</sub> (I), O <sub>2</sub> (E), Tb, MV, Ppeak, PEEP, N <sub>2</sub> O (I), N <sub>2</sub> O (E), Agent (I), Agent (E), SEF, BIS
Arrhythmia alarms:	ASYSTOLE, VF, VT, V BRADY, EXT TACHY, EXT BRADY, SV TACHY, VPC RUN, TACHYCARDIA, BRADYCARDIA, COUPLET, EARLY VPC, MULTIFORM, V RHYTHM, PAUSE, BIGEMINY, TRIGEMINY, VPC, AF*, IRREGULAR RR, PACER NON-CAPTURE, PROLONGED RR, NO PACER PULSE * Not available for BSM-6000K series.

#### Interbed alarms

Technical alarms:	Alarms concerning instrument and measuring environment such as, connector disconnection alarm, noise alarm, electrode off alarm, waveform detecting alarm, probe off alarm, cuff/hose check alarm, sensor check alarm, low battery alarm, etc.
-------------------	--

Alarm indication*:	<u>Alarm sound</u> , blinking/lighting alarm indicator, <u>highlighted numeric data/message</u> . <u>Displays the alarmed item at the upper part of the screen.</u> *
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\* Essential performance in EMC standard

#### Alarm indicator:

Crisis:	Red blinking: approx. 1.6 Hz (approx. 640 ms), duty 50%
Warning:	Yellow blinking: approx. 0.8 Hz (approx. 1280 ms), duty 50%
Advisory:	Yellow or cyan lighting

#### Alarm sound:

Crisis:	NK1 (Continuous pip sound), NK2 (Continuous ping sound) or IEC standard
Warning:	NK1 (Continuous bing bong sound), NK2 (Continuous ding ding sound) or IEC standard
Advisory:	NK1 and NK2 (Single beep every 20 or 120 seconds) or IEC standard

Alarm silence:	Provided for 1, 2 or 3 min. When another alarm occurs during alarm silence, alarm is indicated
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Alarm suspend:	Provided for 1, 2, 3 min or OFF
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All alarms off:	Provided
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Alarm volume:	
Volume range:	45 to 85 dB (A) (Requirement of IEC 60601-2-49: 2001) (at 1 m in front of monitor)
Volume priority:	Crisis $\geq$ Warning $\geq$ Advisory

### Alarm Delay Time

Includes time to output alarm from the network socket on the monitor when connected to the network.

Includes time to output alarm from the transmitter when the ZS-900P transmitter is connected.

Heart rate:	HR change from 80 to 120 bpm $\leq$ 10 seconds (upper limit: 100 bpm) HR change from 80 to 40 bpm $\leq$ 10 seconds (lower limit: 60 bpm)
Time to alarm for tachycardia:	Ventricular tachycardia (amplitude 1 mV p-v, heart rate 206 bpm): at $\times 1$ gain (Test waveform name: aami4a*): 4 to 10 seconds at $\times 0.5$ gain (Test waveform name: aami4a_h*): 4 to 10 seconds at $\times 2$ gain (Test waveform name: aami4a_d*): 4 to 10 seconds Ventricular tachycardia (amplitude 2 mV p-v, heart rate 195 bpm): at $\times 1$ gain (Test waveform name: aami4b*): 4 to 10 seconds at $\times 0.5$ gain (Test waveform name: aami4b_h*): 4 to 10 seconds at $\times 2$ gain (Test waveform name: aami4b_d*): 4 to 10 seconds * The test waveforms can be downloaded at <a href="http://www.physionet.org">http://www.physionet.org</a>
Pulse rate:	PR change from 80 to 120 bpm $\leq$ 35 seconds (upper limit: 100 bpm) PR change from 80 to 40 bpm $\leq$ 35 seconds (lower limit: 60 bpm)
ST:	Approx. 1 second after measurement value reaches alarm threshold (averaged 15-second data)
Respiration rate:	Approx. 5 seconds after measurement value reaches alarm threshold (depends on the setting)
NIBP:	Approx. 1 seconds after measurement value becomes stable
IBP:	IBP change from 100 to 60 mmHg $\leq$ 15 seconds (at pulse rate 80 bpm, SYS lower limit: 80 mmHg)
SpO <sub>2</sub> :	Approx. 0 to 10 seconds after measurement value reaches alarm threshold (depends on the setting)
Blood temperature:	Approx. 1 second after measurement value reaches alarm threshold For catheter response time, refer to the manual for the catheter.
O <sub>2</sub> (when JO-900P FiO <sub>2</sub> connection cord is used):	Approx. 1 second after measurement value reaches alarm threshold Sensor response time (90%): Maximum 15 seconds
CO <sub>2</sub> (Mainstream method):	
CO <sub>2</sub> (I):	Approx. 20 seconds (when TG-950P, TG-970P or TG-980P CO <sub>2</sub> sensor kit is used)
Upper CO <sub>2</sub> (E):	Approx. 5 seconds
Lower CO <sub>2</sub> (E):	Approx. 5 seconds (when the <ETCO <sub>2</sub> MAX HOLD>* is OFF) Maximum 15 seconds (when the <ETCO <sub>2</sub> MAX HOLD>* is 10 s) Maximum 25 seconds (when the <ETCO <sub>2</sub> MAX HOLD>* is 20 s) * When the TG-950P (depends on the TG-950P software version), TG-970P or TG-980P CO <sub>2</sub> sensor kit is used. The alarm delay time is approx. 5 seconds for the version which does not have the <ETCO <sub>2</sub> MAX HOLD>.
CO <sub>2</sub> (Sidestream method):	
CO <sub>2</sub> (I):	Approx. 20 seconds
CO <sub>2</sub> (E):	Approx. 5 seconds
Gas	
CO <sub>2</sub> (I):	Approx. 20 seconds

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CO <sub>2</sub> (E):	Approx. 5 seconds
N <sub>2</sub> O, O <sub>2</sub> , anesthetic agent:	Approx. 5 seconds
Ppeak, PEEP (FLOW):	Approx. 5 seconds after measurement value reaches alarm threshold (when the next respiration is detected)
MV (FLOW):	Approx. 5 seconds after measurement value reaches alarm threshold (Integrated data from 8 respiration intervals and TV (tidal volume))
Temperature, BIS, SEF, TP (EEG), CCO, CCI:	Approx. 1 second after measurement value reaches alarm threshold
Alarm signal delay in central monitor network:	≤ 4 s

## ECG

Complies with IEC 60601-2-27: 2005, ANSI/AAMI EC13: 2002, ANSI/AAMI EC57: 1998.

Leads:

3-electrode cable:	I, II, III
6-electrode cable:	I, II, III, aVR, aVL, aVF, 2 from V1 to V6
10-electrode cable:	I, II, III, aVR, aVL, aVF, V1 to V6
Defibrillation-proof:	ECG input protected against 400 Ws/DC 5 kV IEC 60601-2-27 17.101 compatible
Electrode offset potential tolerance:	≥ ±500 mV
Input dynamic range:	≥ ±5 mV
Internal noise:	≤ 30 μVp-p (Referred to input)
Noise suppression:	
RL driving gain:	maximum 40 dB
Maximum voltage:	1.23 Vrms
Common mode rejection ratio:	≥ 95 dB
Input bias current:	≤ 100 nA
Frequency response:	
DIAG mode:	0.05 to 150 Hz (-3 dB)
MONITOR mode:	0.3 to 40 Hz (-3 dB)
MAXIMUM mode:	1 to 18 Hz (-3 dB)
AC hum filter:	≤ -40 dB (at 50 or 60 Hz)
Input impedance:	≥ 5 MΩ (at 10 Hz) ≥ 2.5 MΩ (at 0.67 to 40 Hz)
ESU protection:	Provided, recovers within 10 seconds after ESU and acquired data is not lost. IEC 60601-2-27: 2005 compatible
Leads-off sensing:	Each leads has own sensing
Active electrode:	< 100 nA
Reference electrode:	< 900 nA
12 lead ECG interpretation:	ECAPS 12C (BSM) Available when monitoring 12 leads
Interpretation items:	Normal sinus rhythm, TACHYCARDIA, BRADYCARDIA, VPC RUN, COUPLET, EARLY VPC
Display and output:	Screen, recorder module, network printer, printer connected to the central monitor
File storage:	6 files
Waveform display:	
Display sensitivity:	10 mm/mV ±5% (at ×1 sensitivity)
Number of channels:	3 (maximum, with 6 or 10 electrodes on home screen) 12 (maximum, with 10 electrodes at 12 LEAD window)

Sensitivity control:	×1/4, ×1/2, ×1, ×2, ×4, or AUTO
Pacing mark display:	Available
Recording sensitivity:	10 mm/mV ±5% (same as the display sensitivity)
Heart rate count:	
Calculation method:	Moving average/Instantaneous beat to beat
QRS detection (at × 1 sensitivity):	Adult:                   Width: 70 to 120 ms Amplitude: ≥ 0.5 mV, rate: 30 to 200 beats/min Child and neonate: Width: 40 to 120 ms Amplitude: ≥ 0.5 mV, rate: 30 to 250 beats/min
Counting range:	0, 15 to 300 beats/min (±2 beats/min)
Counting accuracy*:	±2 beats/min (0, 15 to 300 beats/min) * Essential performance in EMC standard
Heart rate display update cycle:	Every 3 s or when alarm is generated
Heart rate sync mark delay time:	within 100 to 200 ms (when QRS is detected)
Tall T-wave rejection capability:	Complies with the heights of T-waves from 0 mV to 1.2 mV specified in ANSI/AAMI EC13 Sect. 4.1.2.1(c)
Heart rate averaging:	Calculated by using the most recent 4 or 12 beats.
Heart rate meter accuracy and response to irregular rhythm:	Ventricular bigeminy (Test waveform name: aami3a*): 80 bpm Slow alternating ventricular bigeminy (Test waveform name: aami3b*): 60 bpm Rapid alternating ventricular bigeminy (Test waveform name: aami3c*): 120 bpm Bidirectional systoles (Test waveform name: aami3d*): 90 bpm * The test waveforms can be download at <a href="http://www.physionet.org">http://www.physionet.org</a>
Response time of heart rate meter to change in heart rate:	HR change from 80 to 120 bpm: 9 to 12 seconds HR change from 80 to 40 bpm: 9 to 13 seconds
Time to alarm for tachycardia:	Ventricular tachycardia (amplitude 1 mV p-v, heart rate 206 bpm): at ×1 gain (Test waveform name: aami4a*): 4 to 10 seconds at ×0.5 gain (Test waveform name: aami4a_h*): 4 to 10 seconds at ×2 gain (Test waveform name: aami4a_d*): 4 to 10 seconds Ventricular tachycardia (amplitude 2 mV p-v, heart rate 195 bpm): at ×1 gain (Test waveform name: aami4b*): 4 to 10 seconds at ×0.5 gain (Test waveform name: aami4b_h*): 4 to 10 seconds at ×2 gain (Test waveform name: aami4b_d*): 4 to 10 seconds * The test waveforms can be download at <a href="http://www.physionet.org">http://www.physionet.org</a>
Pacemaker pulse detector rejection of fast ECG signals:	Slew rate at which the pacemaker pulse detector responds: 6 to 8 V/s Tested as specified in ANSI/AAMI EC13 Sect. 4.1.4.3
Pacemaker pulse rejection capability, without overshoot:	Complies with the amplitudes of pacemaker pulses ±2 to ±700 mV and widths 0.1 to 2 ms specified in ANSI/AAMI EC13 Sect. 4.1.4.1
Pacemaker pulse rejection capability, with overshoot:	Overshoot amplitudes and time constants of ±0.12 mV/100 ms to ±2 mV/4 ms (As defined by method B of ANSI/AAMI EC13 Sect. 4.1.4.2, this corresponds to the pacemaker pulses amplitudes and widths of ±4 mV/2 ms to amplitudes ±80 mV/0.1 ms.)
Heart rate alarm:	Upper limit range: 16 to 300 beats/min, OFF in 1 beat/min steps Lower limit range: OFF, 15 to 299 beats/min in 1 beat/min steps Alarm items: TACHYCARDIA, BRADYCARDIA



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### Arrhythmia analysis:

Analysis method:	Multi-template matching method
Number of channels:	2
VPC counting rate:	0 to 99 VPCs/min
Arrhythmia message:	ASYSTOLE, VF, VT, V BRADY, EXT TACHY, EXT BRADY, SV TACHY, VPC RUN, TACHYCARDIA, BRADYCARDIA, COUPLET, EARLY VPC, MULTIFORM, V RHYTHM, PAUSE, BIGEMINY, TRIGEMINY, VPC, AF*, IRREGULAR RR, PACER NON-CAPTURE, PROLONGED RR, NO PACER PULSE * Not available for BSM-6000K series.
Other messages:	NOISE, CHECK ELECTRODES, LEARNING
Arrhythmia alarm:	Upper limit range: OFF, 1 to 99 VPC/min
Number of arrhythmia recall files:	8,192 (24 hours)
Storage time per file:	8 s

### ST level measurement:

Number of measurement channels:	3-electrode: 1 ch 6-electrode: 8 ch 10-electrode: 12 ch
ST level measuring range:	$\pm 2.5$ mV
Measurement point:	Manual
ST level alarm:	Upper limit range: $-1.99$ to $2.00$ mV in $0.01$ mV steps, OFF Lower limit range: OFF, $-2.00$ to $1.99$ mV in $0.01$ mV steps
Number of ST recall files:	1,440 files

### Respiration (Transthoracic impedance pneumography)

Measuring method:	Transthoracic impedance pneumography
Number of channels:	Selectable from R-F and R-L
Measuring impedance available range:	$220 \Omega$ to $4 \text{ k}\Omega$
Excitor current:	$45 \pm 10 \mu\text{Arms}$ at $40 \text{ kHz}$ (sine wave)
Internal noise:	$\leq 0.2 \Omega$ (Referred to input)
Respiration rate counting range:	0 to 150 counts/min
Respiration rate counting accuracy*:	$\pm 2$ counts/min (0 to 150 counts/min) * Essential performance in EMC standard
Frequency response (high frequency cut-off):	$3 \text{ Hz} \pm 1 \text{ Hz}$ ( $-3 \text{ dB}$ )
Defibrillation proof:	Respiration input protected against $400 \text{ Ws/DC}$ $5 \text{ kV}$
Impedance respiration:	Measurement On/Off available
Heart beat rejection:	Available
Waveform display:	
Display sensitivity:	$10 \text{ mm/1 } \Omega \pm 25\%$ (at $\times 1$ sensitivity)
Sensitivity control:	$\times 1/4$ , $\times 1/2$ , $\times 1$ , $\times 2$ , $\times 4$
Respiration rate display update cycle:	Every 3 s or when alarm is generated
Alarm:	Upper limit range: 2 to 150 counts/min in 2 counts/min steps, OFF Lower limit range: OFF, 0 to 148 counts/min in 2 counts/min steps Apnea alarm: OFF, 5 to 40 s in 5 s steps Displayed message: APNEA

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

Complies with ISO 9919: 2005.

## Display:

Display update cycle:	Every 3 s or when alarm is generated
Sync tone modulation:	Changes tone depending on SpO <sub>2</sub> value
Sweep speed:	6.25, 12.5, 25, 50 mm/s
Waveform sensitivity:	×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or AUTO

SpO<sub>2</sub>:

Measuring method:	Two wavelength light absorption method	
Wavelength range:	AY-631P/AY-633P: 660/905 nm (LNOP tip clip and LNCS tip clip) 663/880 nm (Other clips) AY-651P/AY-653P: 660/900 nm	
Emitted light energy:	AY-631P/AY-633P: 0.13 mW minimum, 0.79 mW maximum AY-651P/AY-653P: < 15 mW	
Data delay time:	≤ 10 s	
Averaging time:	AY-651P/AY-653P: 6 to 7 s (approximately 3 seconds in FAST mode) If the dynamic averaging time exceeds 20 seconds for SpO <sub>2</sub> , the SpO <sub>2</sub> and pulse rate will continue to be updated every second.	
Display range:	AY-631P/AY-633P/AY-651P/AY-653P:	1 to 100%SpO <sub>2</sub>
	AY-660P/AY-661P/AY-663P/AY-671P/AY-673P:	0 to 100%SpO <sub>2</sub>
Declared range:	AY-631P/AY-633P/AY-651P/AY-653P:	Depends on probe. Refer to the probe manual.
	AY-660P/AY-661P/AY-663P/AY-671P/AY-673P:	70 to 100%SpO <sub>2</sub>
Measuring accuracy*:	AY-631P/AY-633P/AY-651P/AY-653P:	Depends on probe. Refer to the probe manual.
	AY-660P/AY-661P/AY-663P/AY-671P/AY-673P:	70%SpO <sub>2</sub> ≤ %SpO <sub>2</sub> ≤ 80%SpO <sub>2</sub> ±3%SpO <sub>2</sub> 80%SpO <sub>2</sub> ≤ %SpO <sub>2</sub> ≤ 100%SpO <sub>2</sub> ±2%SpO <sub>2</sub> Accuracy at surrounding temperature: 18 to 40°C (64.4 to 104°F)

\* Essential performance in EMC standard

**NOTE for SpO<sub>2</sub> Accuracy of AY-660P/AY-661P/AY-663P/AY-671P/AY-673P**

- The SpO<sub>2</sub> accuracy was tested on OLV-3100 pulse oximeter using the TL-201T, TL-260T, TL-271T and TL-631T SpO<sub>2</sub> probes. The testing was performed during induced hypoxia on healthy volunteers (Ethnicity: 10 Caucasians, 2 Africans, 1 Asian and 3 Indians), (Skin: 8 Light, 4 Medium, 4 Dark), (Age: 21 to 34), (5 women and 11 men) under the condition of no motion. Arterial blood was sampled and measured by a CO-oximeter. The difference between SpO<sub>2</sub> measured by the SpO<sub>2</sub> probe and functional SaO<sub>2</sub> measured by a CO-oximeter was calculated using the root-mean-square (rms) according to ISO 9919: 2005. This measurement accuracy figure represents 2/3 of all test measurements.
- A pulse oximeter tester that generates simulated signals can be used to check the difference from the design specification, but it cannot be used as a replacement for human signals for testing accuracy.

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### **NOTE for SpO<sub>2</sub> Accuracy of AY-631P/AY-633P/AY-651P/AY-653P**

The SpO<sub>2</sub> accuracy has been validated in human studies against arterial blood sample reference measured with a CO-oximeter. Pulse oximeter measurement are statistically distributed, only about two-thirds of the measurements can be expected to fall within the specified accuracy compared to CO-oximeter measurements.

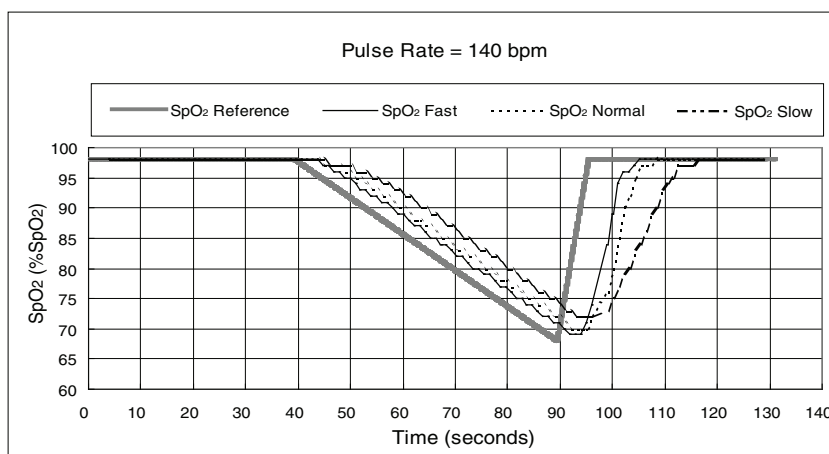
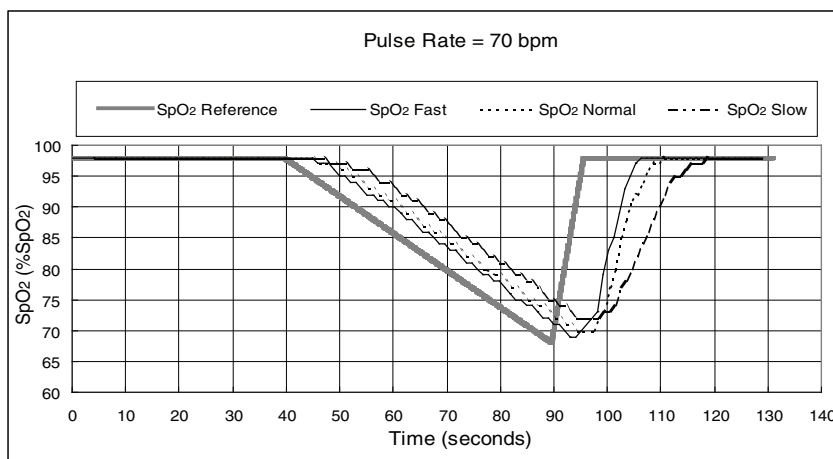
### **NOTE for AY-631P/AY-633P**

The plethysmographic waveform is scaled to a fixed size for signal strengths above 10% or 0.5%.

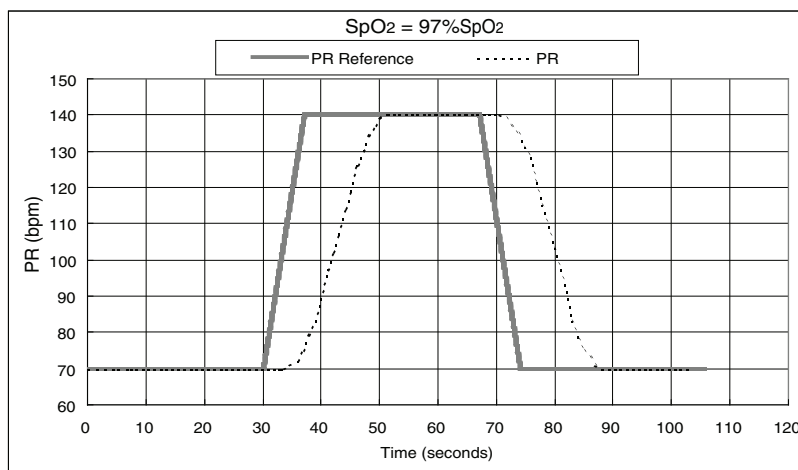
### **NOTE for AY-651P/AY-653P**

Nellcor OEM modules communicate a non-normalized depiction of the plethysmographic waveform.

SpO <sub>2</sub> alarm:	Upper limit range: 51 to 100%SpO <sub>2</sub> in 1%SpO <sub>2</sub> steps, OFF Lower limit range: OFF, 50 to 99%SpO <sub>2</sub> in 1%SpO <sub>2</sub> steps
Pulse rate:	
Display range:	AY-631P/AY-633P: 25 to 240 beats/min AY-651P/AY-653P: 20 to 300 beats/min AY-660P/AY-661P/AY-663P/AY-671P/AY-673P: 30 to 300 beats/min
Declared range:	AY-631P/AY-633P: 25 to 240 beats/min AY-651P/AY-653P: 20 to 300 beats/min AY-660P/AY-661P/AY-663P/AY-671P/AY-673P: 30 to 300 beats/min
Counting accuracy (rms)*:	AY-631P/AY-633P: ±3 beats/min: No motion ±5 beats/min: Motion AY-651P/AY-653P: ±3 beats/min AY-660P/AY-661P/AY-663P/AY-671P/AY-673P: ±3% ±1 beat/min * Essential performance in EMC standard
Pulse rate alarm:	Upper limit range: When SYNC SOURCE is set to ECG: 16 to 300 beats/min in 1 beat/min steps, OFF When SYNC SOURCE is set to PRESS or SpO <sub>2</sub> : 31 to 300 beats/min in 1 beat/min steps, OFF Lower limit range: When SYNC SOURCE is set to ECG: OFF, 15 to 299 beats/min in 1 beat/min steps When SYNC SOURCE is set to PRESS or SpO <sub>2</sub> : OFF, 30 to 299 beats/min in 1 beat/min steps
Response time (AY-660P/AY-661P/AY-663P only):	Selectable from "SLOW", "NORMAL" and "FAST". The following graphs show the response time example when SpO <sub>2</sub> changes 0.6%SpO <sub>2</sub> /s.



The following graph shows the response time example when pulse rate changes 10 bpm/s.



**Non Invasive Blood Pressure, NIBP**

Complies with IEC 60601-2-30: 1999.

- Measuring method: Oscillometric
- Measuring range: 0 to 300 mmHg
- Cuff pressure display range: 0 to 300 mmHg
- Accuracy: ±3 mmHg (0 mmHg ≤ NIBP < 200 mmHg)  
±4 mmHg (200 mmHg ≤ NIBP ≤ 300 mmHg)

Cuff inflation time:  
Adult/Child: ≤ 7 s (700 cc)

## 1. GENERAL

Neonate:	$\leq 5$ s (72 cc)
Measurement mode:	Adult, child or neonate is recognized by connected air hose
Maximum measurement time:	
Adult/Child:	$\leq 160$ s
Neonate:	$\leq 80$ s
Operation mode:	Manual, STAT ( $\leq 15$ min), Periodic, PWTT and SIM (depends on the SITE setting)
Auto remeasurement:	1 time
Air leakage:	$\leq 3$ mmHg/min
Measurement accuracy with a simulator*:	$\pm 10$ mmHg
	* Essential performance in EMC standard
Initial pressurization value:	
Adult:	180 mmHg
Child:	140 mmHg
Neonate:	100 mmHg
Maximum pressurization value:	
Adult/Child:	300 mmHg
Neonate:	150 mmHg
Display items:	Systolic (SYS), diastolic (DIA), mean (MAP), cuff pressure during NIBP measurement, delta PWTT
NIBP data display update cycle:	Updated every measurement
Measurement completion sound:	Generated at measurement completion (depends on the setting)
Alarm	
Upper limit range:	15 to 260 mmHg in 5 mmHg steps, OFF
Lower limit range:	OFF, 10 to 255 mmHg in 5 mmHg steps
Safety	
Maximum pressurization value cuff inflation limiter:	Adult/Child: 300 to 330 mmHg Neonate: 150 to 165 mmHg
Cuff inflation time limiter:	Adult/Child: 161 to 165 s Neonate: 81 to 84 s
Interval time limiter:	25 to 29 s
Power discontinuity:	Deflate immediately after power down

### Multi Socket

Input impedance:	$\geq 900$ k $\Omega$
Excitor output impedance:	$\leq 2$ $\Omega$
Excitor overcurrent protection:	100 mA
+5 V maximum power output from the socket:	500 mA

### Invasive Blood Pressure, IBP

Complies with IEC 60601-2-34: 2000 except for clauses 44.6, 45.101 a) and 45.101 b).

Complied transducer:	For warm-up time (for balancing the whole system), refer to the manuals of each transducer. P23XL-1 and P10EZ-1 Argon Medical Devices disposable transducers Argon Medical Devices disposable transducers DX series 5 $\mu$ V/V/mmHg, bridge resistor: 200 $\Omega$ to 20 k $\Omega$ , defibrillation-proof or the equivalents
Volume displacement:	0.04 mm <sup>3</sup> /100 mmHg
Auto zero balancing range:	$\pm 200$ mmHg

Auto zero balancing accuracy:	±1 mmHg
Measuring range:	-50 to 300 mmHg
Measuring accuracy:	±1 mmHg ±1 digit (-50 mmHg ≤ IBP < 100 mmHg) ±1% ±1 digit (100 mmHg ≤ IBP ≤ 300 mmHg)
Total measuring accuracy*:	±4% or ±4 mmHg (whichever is greater)**
	* Essential performance in EMC standard
	** When used with ANSI/AAMI BP-22-1994 complied equipments
Internal noise:	within ±1 mmHg
Temperature zero drift:	±0.1 mmHg/1°C
Frequency response:	DC to 12 Hz or 20 Hz (selectable)
Display items:	Systolic (SYS), diastolic (DIA), mean (MEAN)
Display update cycle:	Every 3 s or when alarm is generated
BP sync sound:	Systolic value 20 to 120 mmHg, changes in 20 steps every 5 mmHg
Alarm:	
Upper limit range:	2 to 300 mmHg in 2 mmHg steps, OFF
Lower limit range:	OFF, 0 to 298 mmHg steps in 2 mmHg steps
Alarm inactivation:	Alarm is inactivated in certain period when zero balancing is performed.
Pulse rate	
Counting range:	0, 30 to 300 beats/min
Display range:	0 to 300 beats/min
Counting accuracy (rms):	±2 beats/min (30 beats/min ≤ PR ≤ 300 beats/min)
Alarm:	Upper limit range: When SYNC SOURCE is set to ECG: 16 to 300 beats/min in 1 beat/min steps, OFF When SYNC SOURCE is set to PRESS or SpO <sub>2</sub> : 31 to 300 beats/min in 1 beat/min steps, OFF Lower limit range: When SYNC SOURCE is set to ECG: OFF, 15 to 299 beats/min in 1 beat/min steps When SYNC SOURCE is set to PRESS or SpO <sub>2</sub> : OFF, 30 to 299 beats/min in 1 beat/min steps

## Temperature

Complies with EN 12470-4: 2000 only for clauses 6.2, 6.3 a), 6.5, 6.6, 6.7, 6.8, 6.9, 6.10 and 8.

Thermistor probe:	400 series (YSI)
Number of channels:	Up to 4 (2 channels fixed TEMP sockets and 1 MULTI socket)
Measuring range:	0 to 45°C, 32 to 113°F
Measuring accuracy*:	±0.1°C (25°C ≤ TEMP ≤ 45°C) ±0.2°C (0°C ≤ TEMP < 25°C)
	* Essential performance in EMC standard
Internal noise:	≤ 0.014°C (at 37°C)
Temperature drift:	within ±0.005°C /°C
Display range:	0 to 45°C (32 to 113°F)
Display update cycle:	Every 3 s or when alarm is generated
Time response delay from probe to monitor display:	≤ 6 seconds (sensor time constant is not included)
Alarm	
Upper limit range:	0.1 to 45.0°C (33 to 113°F) in 0.1°C (1°F) steps, OFF
Lower limit range:	OFF, 0.0 to 44.9°C (32 to 112°F) in 0.1°C (1°F) steps

## 1. GENERAL

### Carbon Dioxide, CO<sub>2</sub> (Mainstream method)

For the TG-900P/TG-920P/TG-950P\*/TG-970P/TG-980P CO<sub>2</sub> sensor kit specifications, refer to the kit manual.

\* TG-950P is not available for BSM-6000A series.

#### Calculation method

TG-900P/TG-920P: semi-quantitative

TG-950P/TG-970P/TG-980P: quantitative

#### CO<sub>2</sub> measuring range

TG-900P/TG-920P/TG-950P: 0 to 100 mmHg

TG-970P/TG-980P: 0 to 150 mmHg

#### CO<sub>2</sub> measuring accuracy\*\*

TG-900P/TG-920P:  $\pm 0.4$  kPa ( $0 \leq \text{CO}_2 \leq 1.33$  kPa) ( $\pm 3$  mmHg ( $0 \leq \text{CO}_2 \leq 10$  mmHg))  
 $\pm 0.53$  kPa ( $1.33 < \text{CO}_2 \leq 5.33$  kPa) ( $\pm 4$  mmHg ( $10 < \text{CO}_2 \leq 40$  mmHg))  
 $\pm 10\%$  reading ( $5.33 < \text{CO}_2 \leq 13.3$  kPa ( $40 < \text{CO}_2 \leq 100$  mmHg))  
(At 1 atmospheric pressure, air inspiration, no condensation)

TG-950P/TG-970P/TG-980P:  $\pm 0.27$  kPa ( $0 \leq \text{CO}_2 \leq 5.33$  kPa) ( $\pm 2$  mmHg ( $0 \leq \text{CO}_2 \leq 40$  mmHg))  
 $\pm 5\%$  reading ( $5.33 < \text{CO}_2 \leq 9.33$  kPa ( $40 < \text{CO}_2 \leq 70$  mmHg))  
 $\pm 7\%$  reading ( $9.33 < \text{CO}_2 \leq 13.3$  kPa ( $70 < \text{CO}_2 \leq 100$  mmHg))  
(When no condensation)

\*\* Essential performance in EMC standard

#### Warm-up time:

TG-900P/TG-920P: 5 s

TG-950P: 15 s

TG-970P/TG-980P: 10 s

#### Response time

TG-900P: 160 ms (typical) for steps from 10 to 90%

TG-920P/TG-950P/TG-970P: 120 ms (typical) for steps from 10 to 90%

TG-980P: < 60 ms (typical) for steps from 10 to 90%

#### Respiration rate counting range

TG-900P/TG-920P: 3 to 150 counts/min

TG-950P/TG-970P/TG-980P: 0 to 150 counts/min

#### Respiration rate counting accuracy

TG-900P/TG-920P:  $\pm 10\%$  (3 to 150 counts/min)

TG-950P/TG-970P/TG-980P:  $\pm 1$  count/min

CO<sub>2</sub> value display update cycle: Every 3 s or when alarm is generated

#### CO<sub>2</sub> alarm:

Upper limit:

CO<sub>2</sub> (I): 1 to 5 mmHg in 1 mmHg steps, OFF  
0.1 to 0.7 kPa in 0.1 kPa steps, OFF

ETCO<sub>2</sub>: 2 to 99 mmHg in 1 mmHg steps, OFF  
1.0 to 13.5 kPa in 0.1 kPa steps, OFF

Lower limit:

ETCO<sub>2</sub>: OFF, 1 to 98 mmHg in 1 mmHg steps  
OFF, 0.5 to 13.0 kPa in 0.1 kPa steps

#### Respiration rate alarm:

Upper limit range: 2 to 150 counts/min in 2 counts/min steps, OFF

Lower limit range: OFF, 0 to 148 counts/min in 2 counts/min steps

Apnea time: OFF, 5 to 40 s in 5 s steps

Displayed message: APNEA

Total system response time:  $\leq 1.0$  second

### Inspired Oxygen Fractional Concentration, O<sub>2</sub>

Measuring parameters: Inspired oxygen fraction concentration

Number of channels:	1
Calibration condition:	21 or 100% O <sub>2</sub>
Measuring range:	10 to 100% O <sub>2</sub>
Accuracy*:	±3% full scale (includes sensor, when calibrated with air) * Essential performance in EMC standard
Internal noise:	≤ 0.12% O <sub>2</sub> RMS ±0.72% O <sub>2</sub>
Temperature drift:	±0.12% O <sub>2</sub> /°C
O <sub>2</sub> display update cycle:	Every 3 s or when alarm is generated
Alarm	
Upper limit range:	19 to 100% in 1% steps, OFF
Lower limit range:	18 to 99% in 1% steps

### Cardiac Output, CO

Measuring method:	Thermodilution method
Measuring parameters:	Cardiac output (CO), injectate temperature (Ti), blood temperature (Tb), delta Tb
Number of channel:	1
Measuring range:	
Injectate temperature (Ti):	0°C to 27°C (32 to 81°F)
Blood temperature (Tb):	15°C to 45°C (59 to 113°F)
Thermodilution curve (delta Tb):	0°C to 2.5°C (32 to 37°F)
Cardiac output (CO):	0.5 to 20 L/min
Measuring accuracy:	
Ti:	±0.2°C (0°C to 27°C)
Tb:	±0.1°C (25°C ≤ TEMP ≤ 45°C) ±0.2°C (15°C ≤ TEMP < 25°C)
CO:	±5%
Internal noise:	
Ti:	≤ 0.025°C RMS
Tb:	≤ 0.016°C RMS (correspond to 37°C)
Delta Tb:	≤ 0.005°C RMS
Temperature drift:	
Ti:	±0.005°C /°C
Tb:	±0.005°C /°C
Frequency response (delta Tb):	DC to 12 Hz (−3 dB)
Injectate volume range:	3, 5, 10 mL
Display update cycle:	Updated every measurement
Tb alarm	
Upper limit range:	15.1 to 45.0°C (60 to 113°F) in 0.1°C (1°F) steps, OFF
Lower limit range:	OFF, 15.0 to 44.9°C (59 to 112°F) in 0.1°C (1°F) steps

### Respiration (Thermistor method)

Complied sensor:	TR-900P respiration pickup for nose and TR-910P respiration pickup for airway
Measuring items:	Thermistor respiration curve, respiration rate
Number of channel:	1
APNEA detection:	Available
Respiration rate counting range:	0 to 150 counts/min
Respiration rate counting accuracy*:	±2 counts/min * Essential performance in EMC standard
Measurable temperature range:	10 to 40°C
Internal noise:	≤ 2.5 Ω (Referred to input)



## 1. GENERAL

Frequency response:	0.1 to 3 Hz (-3 dB)
Waveform display:	
Display sensitivity:	10 mm/100 $\Omega$ $\pm$ 20% (at $\times$ 1 sensitivity)
Sensitivity control:	$\times$ 1/4, $\times$ 1/2, $\times$ 1, $\times$ 2, $\times$ 4
Respiration rate display update cycle:	Every 3 s or when alarm is generated
Alarm:	
Upper limit range:	2 to 150 counts/min in 2 counts/min steps, OFF
Lower limit range:	OFF, 0 to 148 counts/min in 2 counts/min steps
Apnea alarm:	OFF, 5 to 40 s in 5 s steps
	Displayed message: APNEA

### Bispectral Index, BIS

For the BISx/BIS processor specifications, refer to the BISx/BIS processor manual.

BIS can be monitored with Aspect's BIS monitor.

BIS alarm:

Upper limit range:	2 to 100 in 1 steps, OFF
Lower limit range:	OFF, 0 to 99% in 1 steps

### ECG/BP Output

Outputs 100 mmHg/V IBP waveform and the first trace of 1 mV/V ECG waveform. When more than one IBP waveforms are acquired, the IBP waveform of the top MULTI socket is output (when "FIXED POSITION" is set for IBP Analog Output) or the IBP waveform is output following the highest priority label (when "HIGHEST PRIORITY LABEL" is set for IBP Analog Output).

Complied medical electrical equipments

Connecting medical electrical equipment must comply to the following standards:

IEC 60601-1: 1988  
IEC 60601-1 Amendment 1: 1991  
IEC 60601-1 Amendment 2: 1995  
CSA C22.2 No.601.1

Medical electrical equipment must be connected by specified method in following standards:

IEC 60601-1-1: 2000  
CSA C22.2 No.60601-1-1-02

Output impedance:

ECG:	$\leq$ 100 $\Omega$
BP:	$\leq$ 100 $\Omega$

Output-waveform:

ECG:	$\pm$ 5.0 V (at 1 mV/V $\pm$ 5% sensitivity)
BP:	-0.5 to +3.0 V (at 100 mmHg/V $\pm$ 1% sensitivity)
HT:	5.0 to 15.0 V (Open collector output: 0.5 to 50 mA)

Frequency response:

ECG:	$\geq$ 0.5 to 100 Hz ( $\geq$ -3 dB) (No reproducibility of pace maker pulse)
BP:	$\geq$ DC to 20 Hz $\pm$ 3 Hz (-3 dB)

HT pulse width: 15 ms

Gain:

ECG:	1000
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Offset:

ECG:	$\leq$ $\pm$ 50 mV
BP:	$\leq$ $\pm$ 10 mV

Sensitivity accuracy:	
ECG:	±5%
BP:	±1%
Delay:	
ECG, HT:	20 ms max
BP:	40 ms max
ART (CCO):	60 ms max

#### RGB Socket (when QI-631P or QI-671P is connected)

Output signal:	Analog RGB signal, 0.7 Vp-p
Resolution:	
BSM-6301/BSM-6501:	800 × 600 dots
BSM-6701:	1024 × 768 dots

#### RS-232C Socket (when QI-631P or QI-671P is connected)

Serial communication:	RS-232C complies
Baud rate:	9600, 19200, 38400 bps

#### Alarm Socket (when QI-632P or QI-671P is connected)

Nurse call output:	Open collector output (Low active)
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#### When WS-671P Recorder Module is Connected

Recording method:	Thermal array recording
Number of channels:	3 traces (maximum)
Recording width:	≥ 46 mm
Paper speed:	12.5, 25, 50 mm/s
Recording mode:	Manual, periodic, alarm
Recording density:	
Amplitude direction:	8 dots/mm
Feeding direction:	40 dots/mm (≤ 25 mm/s) 20 dots/mm (50 mm/s)
Recording paper:	FQW-50-2-100

#### When ZS-900P Transmitter is Connected

ZS-900P transmitter is not available for BSM-6000A series.

Frequency capacity deviation:	≤ ±3 ppm (15 to 35°C)
Transmission power:	1.0 mW +5%, -40% (15 to 35°C)
Spurious emission strength:	≤ 2.5 μW (5 MHz to 1.5 GHz)
Occupied bandwidth:	5.0 to 8.5 kHz
Adjacent channel leaking power:	≥ 40 dBR
Transmission frequency range:	420.0500 to 449.6625 MHz
Modulation method:	Frequency shift keying

#### Gas

Gas can be monitored with the AG-920R, GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit. For the AG-920R, GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit specifications, refer to the manual.

Measurement method:	Sidestream gas sampling
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## 1. GENERAL

Measured parameters:	Inspired/expired CO <sub>2</sub> partial pressure, inspired/expired N <sub>2</sub> O concentration, inspired expired O <sub>2</sub> concentration, inspired/expired anesthetic agent concentration (Halothane, Isoflurane, Enflurane, Sevoflurane, Desflurane), respiration rate, minimum alveolar concentration	
Warm-up time:		
AG-920R, GF-110PA/120PA:	within 45 seconds to first measurement within 10 minutes to measurement with guaranteed accuracy	
GF-210R/220R:	about 1 minute to CO <sub>2</sub> measurement about 6 minutes to measurement with guaranteed accuracy	
Sampling rate:	70 to 100 mL/min ±10 mL/min 100 to 200 mL/min ±10%rel	
Total system response time:		
AG-920R, GF-110PA/120PA:	≤ 5.0 seconds (when sampling volume is 200 mL/min, using adult sampling tube and adult water trap)	
GF-210R/220R:	≤ 5.0 seconds (when YG-610P sampling line is connected)	
CO <sub>2</sub> measurement:		
Measurement method:	Non-dispersive infrared ray absorption	
Measuring range:	AG-920R, GF-110PA/120PA:	0 to 76 mmHg, 0 to 10.13 kPa
	GF-210R/220R:	0 to 10 vol%
Measuring accuracy:	AG-920R, GF-110PA/120PA:	±2 mmHg (0 ≤ CO <sub>2</sub> < 40 mmHg), ±0.27 kPa (0 ≤ CO <sub>2</sub> < 5.33 kPa) ±3 mmHg (40 ≤ CO <sub>2</sub> < 55 mmHg), ±0.40 kPa (5.33 ≤ CO <sub>2</sub> < 7.33 kPa) ±4 mmHg (55 ≤ CO <sub>2</sub> ≤ 76 mmHg), ±0.53 kPa (7.33 ≤ CO <sub>2</sub> ≤ 10.13 kPa)
<b>NOTE for AG-920R and GF-110PA/120PA</b>		
CO <sub>2</sub> measurement accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:3, 1:2, 1:1 and 2:1.		
	GF-210R/220R:	± (0.43 vol% + 8%rel)
<b>NOTE for GF-210R and GF-220R</b>		
CO <sub>2</sub> measurement accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:2.		
Response time (10 to 90%):	AG-920R, GF-110PA/120PA:	≤ 250 ms (under the condition of sampling flow is 200 mL/min and sampling line for adult and water trap for adult is connected)
Alarm:	Upper limit:	CO <sub>2</sub> (I): 1 to 5 mmHg in 1 mmHg steps, OFF 0.1 to 0.7 kPa in 0.1 kPa steps, OFF ETCO <sub>2</sub> : 2 to 99 mmHg in 1 mmHg steps, OFF 1.0 to 13.5 kPa in 0.5 kPa steps, Off
	Lower limit:	ETCO <sub>2</sub> : OFF, 1 to 98 mmHg in 1 mmHg steps OFF, 0.5 to 13.0 kPa in 0.5 kPa steps
N <sub>2</sub> O measurement:		
Measurement method:	Non-dispersive infrared ray absorption	
Measuring range:	AG-920R, GF-110PA/120PA:	0 to 100%
	GF-210R/220R:	0 to 100 vol%

Measuring accuracy: AG-920R, GF-110PA/120PA:  $\pm 3\%$

**NOTE for AG-920R and GF-110PA/120PA**

N<sub>2</sub>O measurement accuracy is maintained up to a respiratory rate of 30 bpm with I:E ratio of 1:3, up to a respiratory rate of 40 bpm with I:E ratio of 1:2 and up to a respiratory rate of 60 bpm with I:E ratio of 1:1 and 2:1.

GF-210R/220R:  $\pm(2\text{vol}\% + 8\%\text{rel})$

**NOTE**

N<sub>2</sub>O measurement accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:2.

Response time (10 to 90%): AG-920R, GF-110PA/120PA:  $\leq 250$  ms (under the condition of sampling flow is 200 mL/min and sampling line for adult and water trap for adult is connected)

Alarm (N<sub>2</sub>O(I), N<sub>2</sub>O(E)): Upper limit: 1 to 100% in 1% steps, OFF  
Lower limit: OFF, 0 to 99% in 1% steps

O<sub>2</sub> measurement:

Measurement method: Paramagnetic

Measuring range: 0 to 100%

Measuring accuracy: AG-920R, GF-110PA/120PA:  $\pm 2\%$  ( $0 \leq \text{O}_2 < 55\%$ )  
 $\pm 3\%$  ( $55 \leq \text{O}_2 \leq 100\%$ )  
GF-210R/220R:  $\pm(2.5 \text{ vol}\% + 2.5\%\text{rel})$

**NOTE for GF-210R/220R**

O<sub>2</sub> measurement accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:2.

Response time (10 to 90%): AG-920R, GF-110PA/120PA:  $\leq 500$  ms (under the condition of sampling flow is 200 mL/min and sampling line for adult and water trap for adult is connected)

Alarm: Upper limit: O<sub>2</sub>(I): 19 to 100% in 1% steps, OFF  
O<sub>2</sub>(E): 11 to 100% in 1% steps, OFF  
Lower limit: O<sub>2</sub>(I): 18 to 99% in 1% steps  
O<sub>2</sub>(E): OFF, 10 to 99% in 1% steps

Anesthetic agent measurement:

Measurement method: Non-dispersive infrared ray absorption

Measured items: HAL (Halothane), ISO (Isoflurane), ENF (Enflurane), SEV (Sevoflurane), DES (Desflurane)

Measuring range: AG-920R, GF-110PA/120PA: HAL, ISO, ENF 0 to 5%  
SEV 0 to 8%  
DES 0 to 18%  
GF-210R/220R: HAL, ISO 0 to 8.5 vol%  
ENF, SEV 0 to 10 vol%  
DES 0 to 20% vol%

Measuring accuracy: AG-920R, GF-110PA/120PA:  $\pm 0.2\%$  ( $0 \leq \text{GAS} \leq 5\%$ )  
 $\pm 0.4\%$  ( $5 < \text{GAS} \leq 10\%$ )  
 $\pm 0.6\%$  ( $10 < \text{GAS} \leq 15\%$ )  
 $\pm 1.0\%$  ( $15 < \text{GAS} \leq 18\%$ )

## 1. GENERAL

### NOTE for AG-920R, GF-110PA and GF-120PA

Anesthetic agent accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:3, 1:2, 1:1 and 2:1.

GF-210R/220R:  $\pm (0.2 \text{ vol\%} + 15\% \text{rel})$

### NOTE for GF-210R/220R

Anesthetic agent accuracy is maintained up to a respiratory rate of 60 bpm with I:E ratio of 1:2.

Response time (10 to 90%) :	AG-920R, GF-110PA/120PA:	$\leq 300 \text{ ms (HAL, ISO, SEV, DES)}$ $\leq 500 \text{ ms (ENF)}$ (under the condition of sampling flow is 200 mL/min and sampling line for adult and water trap for adult is connected)
Alarm:	Upper limit: Agent(I), Agent(E) (HAL, ISO, SEV, ENF): 0.1 to 7.0% in 0.1% steps, OFF DES(I), DES(E): 0.1 to 20.0% in 0.1% steps, OFF Lower limit: Agent(I), Agent(E) (HAL, ISO, SEV, ENF): OFF, 0.0 to 6.9% in 0.1% steps, OFF DES(I), DES(E): OFF, 0.0 to 19.9% in 0.1% steps	
MAC:		
Uncorrected MAC:	When AG-920R multigas unit is connected Uncorrected MAC = $\%Et(AA1)/x(AA1) + \%Et(AA2)/x(AA2) + \%Et(N_2O)/x(N_2O)$ $\%Et(AA1)$ : End tidal concentration of primary anesthetic agent $\%Et(AA2)$ : End tidal concentration of secondary anesthetic agent $\%Et(N_2O)$ : End tidal concentration of N <sub>2</sub> O $x(AA1)$ : Uses the following values with the MAC of primary anesthetic agent HAL = 0.77%, ENF = 1.7%, ISO = 1.15%, SEV = 2.1%, DES = 6.0%* $x(AA2)$ : Uses the following values with the MAC of secondary anesthetic agent HAL = 0.77%, ENF = 1.7%, ISO = 1.15%, SEV = 2.1%, DES = 6.0%* $x(N_2O)$ : Uses 105% with the MAC of N <sub>2</sub> O	
		<b>* NOTE</b> DES value is 7.3% if the BSM-6000 series bedside monitor has software version 04-14 or earlier. When using two or more AG-920R multigas units in a facility, use bedside monitors with the same software version.  For the GF-110PA or GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit, refer to the manual.
Ambient pressure corrected MAC:	For GF-110PA or GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit, refer to the manual.	
Enhanced MAC correction:	For GF-110PA or GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit, refer to the manual.	
Respiration rate:		
Measuring range:	0, 4 to 60 counts/min	
Measuring accuracy:	$\pm 1 \text{ count/min}$	
Alarm:	Upper limit: 2 to 150 counts/min in 2 counts/min steps, OFF Lower limit: OFF, 0 to 148 counts/min in 2 counts/min steps	

Apnea alarm: OFF, 5 to 40 s in 5 s steps  
 Displayed message: APNEA

### Carbon Dioxide, CO<sub>2</sub> (Sidestream method)

CO<sub>2</sub> in sidestream method can be monitored with the AG-400R CO<sub>2</sub> unit.

For the AG-400R CO<sub>2</sub> unit specifications, refer to the AG-400R CO<sub>2</sub> unit manual.

Sampling flow: 50 mL/min +15/-7.5 mL/min  
 Warm up time: 30 s average (from power on to the measurable state)  
 Measuring range: 0 to 99 mmHg  
 Total measuring accuracy: Whichever greater in following measuring accuracy  
 Measuring accuracy: 0 to 38 mmHg ±2 mmHg  
 39 to 99 mmHg ± [5 + 0.08 × (χ - 39)] % of reading  
 χ: CO<sub>2</sub> partial pressure of a standard gas with a known CO<sub>2</sub> partial pressure (mmHg)

ETCO<sub>2</sub> and CO<sub>2</sub>(I) alarm:

Upper limit: CO<sub>2</sub>(I) : 1 to 5 mmHg in 1 mmHg steps, OFF  
 0.1 to 0.7 kPa in 0.1 kPa steps, OFF

ETCO<sub>2</sub>: 2 to 99 mmHg in 1 mmHg steps, OFF  
 1.0 to 13.5 kPa in 0.5 kPa steps, OFF

Lower limit: ETCO<sub>2</sub>: OFF, 1 to 98 mmHg in 1 mmHg steps  
 OFF, 0.5 to 13.0 kPa in 0.5 kPa steps

Respiration rate measuring range: 0 to 150 counts/min

Respiration rate measuring accuracy: 101 to 150 counts/min: ±5%  
 71 to 100 counts/min: ±3%  
 41 to 70 counts/min: ±2 counts/min  
 0 to 40 counts/min: ±1 count/min

Respiration rate alarm:

Upper limit range: 2 to 150 counts/min in 2 counts/min steps, OFF

Lower limit range: OFF, 0 to 148 counts/min in 2 counts/min steps

Apnea alarm: OFF, 5 to 40 s in 5 s steps  
 Displayed message: APNEA

Total system response time: ≤ 4 seconds

### FLOW/Paw

Flow/Paw can be monitored with the GF-120PA or GF-220R multigas/flow unit. For the GF-120PA or GF-220R multigas/flow unit specifications, refer to the GF-120PA or GF-220R multigas/flow unit manual.

FLOW measurement:

Measurement method: Differential pressure method (fixed orifice)

Measuring range: -3 to +3 L/s

Measuring accuracy: ±3% rel or ±0.005 L/s whichever is greater  
 Applicable when 10 minutes or more has elapsed

Paw measurement:

Ppeak, Pmean, PEEP: Measuring range: -20 to +100 cmH<sub>2</sub>O, hPa

Measuring accuracy: ±1 cmH<sub>2</sub>O, hPa

Applicable when 10 minutes or more has elapsed

Ppeak alarm: Upper limit range: 1 to 100 cmH<sub>2</sub>O, hPa in 1 cmH<sub>2</sub>O, hPa steps, OFF

Lower limit range: OFF, 0 to 99 cmH<sub>2</sub>O, hPa in 1 cmH<sub>2</sub>O, hPa steps

## 1. GENERAL

PEEP alarm:	Upper limit range: 1 to 50 cmH <sub>2</sub> O, hPa in 1 cmH <sub>2</sub> O, hPa steps, OFF Lower limit range: OFF, 0 to 49 cmH <sub>2</sub> O, hPa in 1 cmH <sub>2</sub> O, hPa steps
Volume measurement:	
Measuring range:	0 to 3000 mL
Measuring accuracy:	±5% rel or ±10 mL whichever is greater Applicable when 10 minutes or more has elapsed
TVe, TVi measurement:	
Measuring range:	0 to 3000 mL
Display range:	0 to 9999 mL
Measuring accuracy:	±5% rel or ±10 mL whichever is greater Applicable when 10 minutes or more has elapsed Not applicable when TVi and TVe is less than 100 mL
MV measurement:	
Display range:	0 to 99.9 L/min
Alarm:	Upper limit range: 0.1 to 30.0 L/min in 0.1 L/min steps, OFF Lower limit range: OFF, 0.0 to 29.9 L/min in 0.1 L/min steps
C measurement:	
Display range:	0.0 to 999.9 mL/cmH <sub>2</sub> O
R, Ri, Re measurement:	
Display range:	0.0 to 999.9 cmH <sub>2</sub> O/L/s
Respiration rate measurement:	
Counting range:	0, 4 to 60 counts/min
Counting accuracy:	±1 counts/min
Alarm:	Upper limit range: 2 to 150 counts/min in 2 counts/min steps, OFF Lower limit range: OFF, 0 to 148 counts/min in 2 counts/min steps
Apnea time:	OFF, 5 to 40 s in 5 s steps Displayed message: APNEA

## EEG

EEG can be monitored with the AE-918P neuro unit. For the AE-918P neuro unit specifications, refer to the AE-918P neuro unit manual.

Number of channels:	8
Measuring range:	
SEF, MDF, PPF:	0.0 to 62.5 Hz
TP:	0.01 to 9.99 nW
ABS $\delta$ , ABS $\theta$ , ABS $\alpha$ , ABS $\beta$ , ABS $\gamma$ :	1 to 9999 pW
% $\delta$ , % $\theta$ , % $\alpha$ , % $\beta$ , % $\gamma$ :	0 to 100%
CSA:	0 to 60 Hz
DSA:	0 to 60 Hz
aEEG trace:	0.0 to 100.0 $\mu$ V
aEEG value:	0.0 to 3276.7 $\mu$ V
Data display update cycle:	Every 3 s or when alarm is generated
Electrode impedance check:	> 10 k $\Omega$ within ±20%
Sensitivity:	10 $\mu$ V/1 mm within ±5%
Non distorted maximum input:	> ±2 mV
Polarization voltage:	> ±700 mV
Input impedance:	> 15 M $\Omega$ at 10 Hz
CMRR:	> 110 dB (in isolation mode)

Frequency characteristics:	
High range:	70 Hz at 70% amplitude (−3 dB) within ±20%
Low range:	2 s ±20% or 0.08 Hz at 70% amplitude (−3 dB) within ±20%
AC filter:	attenuation ratio > 26 dB
Noise:	within 3 μVp-p
SEF alarm:	
Upper limit range:	1.0 to 60.0 Hz in 0.5 Hz steps, OFF
Lower limit range:	OFF, 0.5 to 59.5 Hz in 0.5 Hz steps
TP alarm:	
Upper limit range:	0.02 to 9.99 nW in 0.01 nW steps, OFF
Lower limit range:	OFF, 0.01 to 9.98 nW in 0.01 nW steps

## CCO

For the APCO/IBP processor specifications, refer to the APCO/IBP processor manual.

CCO alarm:	
Upper limit range:	1.1 to 20.0 L/min in 0.1 L/min steps, OFF
Lower limit range:	OFF, 1.0 to 19.9 L/min in 0.1 L/min steps
CCI alarm:	
Upper limit range:	1.1 to 20.0 L/min/m <sup>2</sup> in 0.1 L/min/m <sup>2</sup> steps, OFF
Lower limit range:	OFF, 1.0 to 19.9 L/min/m <sup>2</sup> in 0.1 L/min/m <sup>2</sup> steps

## Battery (SB-671P Battery Pack)

Type of battery:	Nickel-metal hydride
Number of batteries:	2
Battery lifetime:	1 year or 200 cycles of full discharging/charging
Battery operation time:	
BSM-6301/6501:	90 minutes
BSM-6701:	60 minutes
	(new battery, fully charged and no options are used in normal temperature)
DC voltage:	9.6 V
Charging current:	360 mA ±50 mA (normal use)
Charging time:	
During monitoring:	10 hours
During non-monitoring:	6 hours (two battery at the same time)
Battery status indication:	Battery lamps on the front panel, screen message and alarm sound, alarm indicator
Operating environment:	
Charging temperature:	10 to 55°C (50 to 131°F)
Discharging temperature:	5 to 50°C (41 to 122°F)
Humidity:	30 to 85% RH (noncondensing)
Atmospheric pressure:	700 to 1060 hPa
Transport and storage environment:	When the battery pack is stored more than 6 months, charge and discharge or charge the battery once every 6 months.
Temperature:	−20 to +60°C (−4 to +140°F) (within 30 days) −20 to +45°C (−4 to +113°F) (within 90 days) −20 to +35°C (−4 to +95°F) (more than 90 days)
Humidity:	20 to 85% RH (noncondensing)
Atmospheric pressure:	700 to 1060 hPa



## 1. GENERAL

### Power Requirement

Line voltage:

AC: AC 100 to 240 V  $\pm$ 10%  
DC (SB-671P): 8.5 to 12.6 V

Line frequency: 50 or 60 Hz

Power consumption:

BSM-6301: AC 140 VA  
BSM-6501: AC 90 VA  
BSM-6701: AC 100 VA

### Clock Accuracy

At operating temperature 25°C: approx.  $\pm$ 2 min 40 s/month maximum

At storage temperature  $-20$  to  $+60$ °C: approx.  $\pm$ 6 min/month maximum

### Environment

Operating environment:

Temperature: 10 to 40°C (50 to 104°F)  
SpO<sub>2</sub> accuracy is guaranteed at surrounding temperature of 18 to 40°C (60 to 104°F)

Humidity: 30 to 85% RH (10 to 40°C, noncondensing)

Atmospheric pressure: 700 to 1060 hPa

Transport and storage environment:

Temperature:  $-20$  to  $+65$ °C ( $-4$  to  $+149$ °F)  
 $-15$  to  $+55$ °C (Recording paper)

Humidity: 10 to 95% RH

Atmospheric pressure: 700 to 1060 hPa

### Mechanical Strength

Mechanical strength: Indoor mobile type

### Electromagnetic Compatibility

IEC 60601-1-2: 2001  
IEC 60601-1-2 Amendment 1: 2004

### Safety Standard

Safety standard: CAN/CSA C22.2 No. 601-1 M90 (BSM-6501A, BSM-6701A)  
CAN/CSA C22.2 No. 601-1S1-94 (BSM-6501A, BSM-6701A)  
CAN/CSA C22.2 No. 601-1B-98 (BSM-6501A, BSM-6701A)  
CAN/CSA C22.2 No. 60601-1-1-02 (BSM-6501A, BSM-6701A)  
CAN/CSA C22.2 No. 601.2.27-98 (BSM-6501A, BSM-6701A)  
CAN/CSA C22.2 No. 60601-2-30-02 (BSM-6501A, BSM-6701A)  
CAN/CSA C22.2 No. 60601-2-34-02 (BSM-6501A, BSM-6701A)  
CAN/CSA C22.2 No. 60601-2-49-04 (BSM-6501A, BSM-6701A)  
EN 12470-4: 2000\*<sup>1</sup>  
IEC 60601-1: 1988  
IEC 60601-1 Amendment 1: 1991  
IEC 60601-1 Amendment 2: 1995  
IEC 60601-1-1: 2000  
IEC 60601-1-2: 2001  
IEC 60601-1-2 Amendment 1: 2004

IEC 60601-1-6: 2010

IEC 60601-1-8: 2006\*2\*3

IEC 60601-2-27: 2005 - Particular requirements for the safety, including essential performance, of electrocardiographic monitoring equipment

IEC 60601-2-30: 1999 - Particular requirements for the safety of automatic cycling in in-direct blood pressure monitoring equipment

IEC 60601-2-34: 2000 - Particular requirements for the safety of direct blood pressure monitoring equipment\*4

IEC 60601-2-49: 2001 - Particular requirements for the safety of multifunction patient monitoring equipment

ISO 21647: 2004

ISO 9919: 2005

\*1 This monitor complies with EN 12470-4: 2000 only for clauses 6.2, 6.3 a), 6.5, 6.6, 6.7, 6.8, 6.9, 6.10 and 8.

\*2 Only the "IEC standard" alarm sound complies with clause 6.3.3.2.

\*3 This monitor complies with IEC 60601-1-8: 2006 except for interbed alarm.

\*4 This monitor complies with IEC 60601-2-34: 2000 except for clauses 44.6, 45.101 a) and 45.101 b).

Type of protection against electrical shock: CLASS I EQUIPMENT (AC Powered)

Internally Powered EQUIPMENT (BATTERY Powered)

Degree of protection against electrical shock

Defibrillator-proof type CF applied part:

AY-631P, AY-633P, AY-651P, AY-653P, AY-661P, AY-663P, AY-671P and AY-673P:

ECG, Respiration (impedance and thermistor method), IBP, Temperature, SpO<sub>2</sub>, SpO<sub>2-2</sub>, CO<sub>2</sub>, O<sub>2</sub>, NIBP, BIS, CCO (APCO)

AY-660P: ECG, Respiration (impedance method), IBP, Temperature, SpO<sub>2</sub>, CO<sub>2</sub>, NIBP

AA-672P, AA-674P, JA-694P:

Respiration (thermistor method), IBP, Temperature, SpO<sub>2-2</sub>, CO<sub>2</sub>, O<sub>2</sub>, BIS, CCO (APCO)

BSM-1700 series: ECG, Respiration (impedance method), IBP, Temperature, SpO<sub>2</sub>, SpO<sub>2-2</sub>, CO<sub>2</sub>, NIBP, BIS

CF applied part:

AY-631P, AY-633P, AY-651P, AY-653P, AY-661P, AY-663P, AY-671P, AY-673P, AA-672P, AA-674P, JA-694P and BSM-1700 series: CO

Degree of protection against harmful ingress of water:

IPX0 (non-protected)

Degree of safety of application in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE:

Equipment not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE

Mode of operation:

CONTINUOUS OPERATION

## 1. GENERAL

### Dimensions and Weight (approximate)

MU-631R main unit	Dimensions: 316 W × 325 H × 188 D mm (excluding protruding parts) Weight: 5.3 kg
MU-651R main unit	Dimensions: 342 W × 353 H × 183 D mm (excluding protruding parts) Weight: 7.0 kg
MU-671R main unit	Dimensions: 415 W × 392 H × 191 D mm (excluding protruding parts) Weight: 9.0 kg
AY-631P/AY-633P/AY-651P/AY-653P/AY-660P/AY-661P/AY-663P/AY-671P/AY-673P input unit	Dimensions: 83 W × 176 H × 145 D mm (excluding protruding parts) Weight: 1.3 kg
AA-672P/AA-674P smart expansion unit	Dimensions: 38 W × 165 H × 145 D mm (excluding protruding parts) Weight: 0.5 kg
WS-671P recorder module	Dimensions: 77 W × 73 H × 120 D mm (excluding protruding parts) Weight: 0.35 kg
QI-631P interface	Dimensions: 28.5 W × 94 H × 106 D mm (excluding protruding parts) Weight: 0.1 kg
QI-632P/QI-634P interface	Dimensions: 27 W × 94 H × 106 D mm (excluding protruding parts) Weight: 0.1 kg
QI-671P interface	Dimensions: 29 W × 173 H × 112 D mm (excluding protruding parts) Weight: 0.16 kg
QI-672P interface	Dimensions: 26 W × 173 H × 107 D mm (excluding protruding parts) Weight: 0.15 kg
RY-910PA remote controller	Dimensions: 45 W × 35 H × 135 D mm Weight: 0.08 kg
Interface QF series:	Dimensions: 65 W × 23 H × 44 D mm (excluding cables) Weight: 0.13 kg
Communication cable IF series:	Dimensions: 65 W × 23 H × 44 D mm (excluding cables) Weight: 0.13 kg
JA-690PA/JA-694PA data acquisition unit:	Dimensions: 145 mm W × 205 mm H × 190 mm D Weight: 1.8 kg (JA-690PA), 2.0 kg (JA-694PA)

## Electromagnetic Emissions

The BSM-6000's essential performances in EMC standard satisfy the following criteria.

This Model BSM-6000 is intended for use in the electromagnetic environment specified below.

The customer or the user of the BSM-6000 should assure that it is used in such an environment.

**BSM-6301 and BSM-6501 (JA-690PA or JA-694PA data acquisition unit, QE-910P BIS processor, AE-918P neuro unit, JP-911P IBP interface isolation cable, QI-320PA or QI-420PA wireless LAN station and QI-670P interface are not connected)**

Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The BSM-6301 and BSM-6501 (JA-690PA/JA-694PA, QE-910P, AE-918P, JP-911P, QI-320PA/QI-420PA and QI-670P are not connected) use RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B* <sup>1</sup>	The BSM-6301 and BSM-6501 (JA-690PA/JA-694PA, QE-910P, AE-918P, JP-911P, QI-320PA/QI-420PA and QI-670P are not connected) are suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A* <sup>2</sup>	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

\*<sup>1</sup> BSM-6301 and BSM-6501 (when ZS-900P is connected) are CLASS A equipment if the equipments comply with IEC 60601-1-2: 2001 36.201.1 5 in the countries which do not have national wireless rule.

\*<sup>2</sup> BSM-6301 is not applicable.

**BSM-6301, BSM-6501 (JA-690PA or JA-694PA data acquisition unit, QE-910P BIS processor, AE-918P neuro unit, JP-911P IBP interface isolation cable, QI-320PA or QI-420PA wireless LAN station or QI-670P interface is connected) and BSM-6701**

Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The BSM-6301, BSM-6501 (JA-690PA/JA-694PA, QE-910P, AE-918P, JP-911P, QI-320PA/QI-420PA or QI-670P is connected) and BSM-6701 use RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The BSM-6301, BSM-6501 (JA-690PA/JA-694PA, QE-910P, AE-918P, JP-911P, QI-320PA/QI-420PA or QI-670P is connected) and BSM-6701 are suitable for use in all establishments, excluding domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A*	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

\* BSM-6301 is not applicable.

## 1. GENERAL


### Electromagnetic Immunity

The BSM-6000's essential performances in EMC standard satisfy the following criteria.

This Model BSM-6000 is intended for use in the electromagnetic environment specified below.

The customer or the user of the BSM-6000 should assure that it is used in such an environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tiles. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
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 cycles  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 5 s	<5% $U_T$ (>95% dip in $U_T$ ) for 0.5 cycles  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 5 s	Mains power quality should be that of a typical commercial or hospital environment.  If the user of the BSM-6000 requires continued operation during power mains interruptions, it is recommended that the BSM-6000 be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: $U_T$ is the AC mains voltage prior to application of the test level.			

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	<p>Portable and mobile RF communications equipment should be used no closer to any part of the BSM-6000 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> $d = 1.2\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m 80 MHz to 2.5 GHz	$d = 1.2\sqrt{P} \quad 80 \text{ MHz to } 800 \text{ MHz}$ $d = 2.3\sqrt{P} \quad 800 \text{ MHz to } 2.5 \text{ GHz}$ <p>where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey*<sup>1</sup>, should be less than the compliance level in each frequency range*<sup>2</sup>.</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 
NOTE 1: At 80 MHz and 800 MHz, 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.			
* <sup>1</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 BSM-6000 is used exceeds the applicable RF compliance level above, the BSM-6000 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the BSM-6000.			
* <sup>2</sup> Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

1. GENERAL

**Recommended Separation Distances between Portable and Mobile RF Communications Equipment**

The BSM-6000 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the BSM-6000 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the BSM-6000 as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter (W)	Separation distance according to frequency of transmitter (m)		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

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

NOTE 1: At 80 MHz and 800 MHz, 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.

### System Composition for EMC Test

The BSM-6000 bedside monitor is tested to comply with IEC 60601-1-2: 2001 and Amendment 1: 2004 with the following composition. If any part which is not specified by Nihon Kohden is used, the EMC specifications might not comply.

Units	Cable length	Units	Cable length
MU-631R/MU-651R/MU-671R main unit	—	NE-114A EEG disk electrode	0.8 m
AY-633P/AY-660P/AY-673P input unit	—	YJ-910P ECG/BP output cable	5.0 m
QM-600P memory unit	—	JP-600P APCO/IBP processor	2.72 m
AA-674P smart expansion unit	—	MHD8S FloTrac sensor	0.39 m
QI-631P/QI-632P/QI-634P/QI-671P/ QI-672P interface	—	QF-901P interface (including a cable for Drager ventilator)	—
QI-670P interface	—	QF-902P interface (including a cable for A-2000 BIS monitor)	—
BJ-900P ECG patient cable	3.8 m	QF-903P interface (including a cable for Vigilance CCO monitor)	—
JL-900P SpO <sub>2</sub> connection cord	2.5 m	QF-904P interface (including a cable for AG-920R multigas unit)	—
JL-500P1 SpO <sub>2</sub> adapter	2.5 m	QF-905P interface (including a cable for AG-400R CO <sub>2</sub> unit)	—
TL-201T finger probe	1.6 m	YS-080P3 RGB cable	10 m
JL-650P SpO <sub>2</sub> connection cord	3.0 m	YS-089P2 serial connection cable	10 m
JL-630P SpO <sub>2</sub> connection cord	3.0 m	Basic optical mouse	—
LNOP-DCI Masimo adult reusable sensor	—	SB-671P battery pack	—
YN-921P air hose for neonate	3.5 m	ZS-900P transmitter	—
YP-821P disposable cuff for neonate	0.2 m	YS-089P7 network connection cable	0.7 m
YN-901P air hose for adult/child	3.5 m	HIT-100 hyper isolation transformer	—
YP-963T cuff for adult	0.15 m	RY-910PA remote controller	—
JP-900P IBP connection cord	3.5 m	Power cord W	2.5 m
JP-911P IBP connection cord	0.8 m	Power cord H	2.5 m
DX-300 monitoring kit	—	Power cord N	2.4 m
JT-950P CO connection cord	2.0 m	Power cord UL	2.5 m
TC-704MU Argon Medical Devices catheter soft type	1.1 m	Power cord GB	2.5 m
SP-5030 bath probe	1.5 m	Grounding lead	—
JT-900P temperature connection cord	0.3 m	QI-320PA wireless LAN station	—
401J thermistor probe for adult	3.5 m	YS-095P3 wireless LAN mounting set	0.19 m/0.22 m
402J thermistor probe for child	3.5 m	QI-420PA wireless LAN station	0.2 m/0.22 m
TG-900P CO <sub>2</sub> sensor kit	3.0 m	QI-600P interface unit	—
TG-920P CO <sub>2</sub> sensor kit	3.5 m	JA-690PA/JA-694PA data acquisition unit	—
TG-950P CO <sub>2</sub> sensor kit	4.0 m	YS-096P2/YS-096P3 unit connection cable	2.5 m/5.0 m
TG-970P CO <sub>2</sub> sensor kit	3.5 m	YS-096P5 multi-link cable	0.27 m
JO-900P FiO <sub>2</sub> connection cord	3.0 m		
074705 oxygen sensor	0.6 m		
TR-900P respiration pickup for nose	3.0 m		
YJ-671P BISx connection cord	0.3 m		
QE-910P BIS processor	—		
AE-918P neuro unit	0.4 m		
JE-906P EEG connection cord	3.0 m		

#### NOTE

When the following units are used, IEC 60601-1-2: 1993 complies.

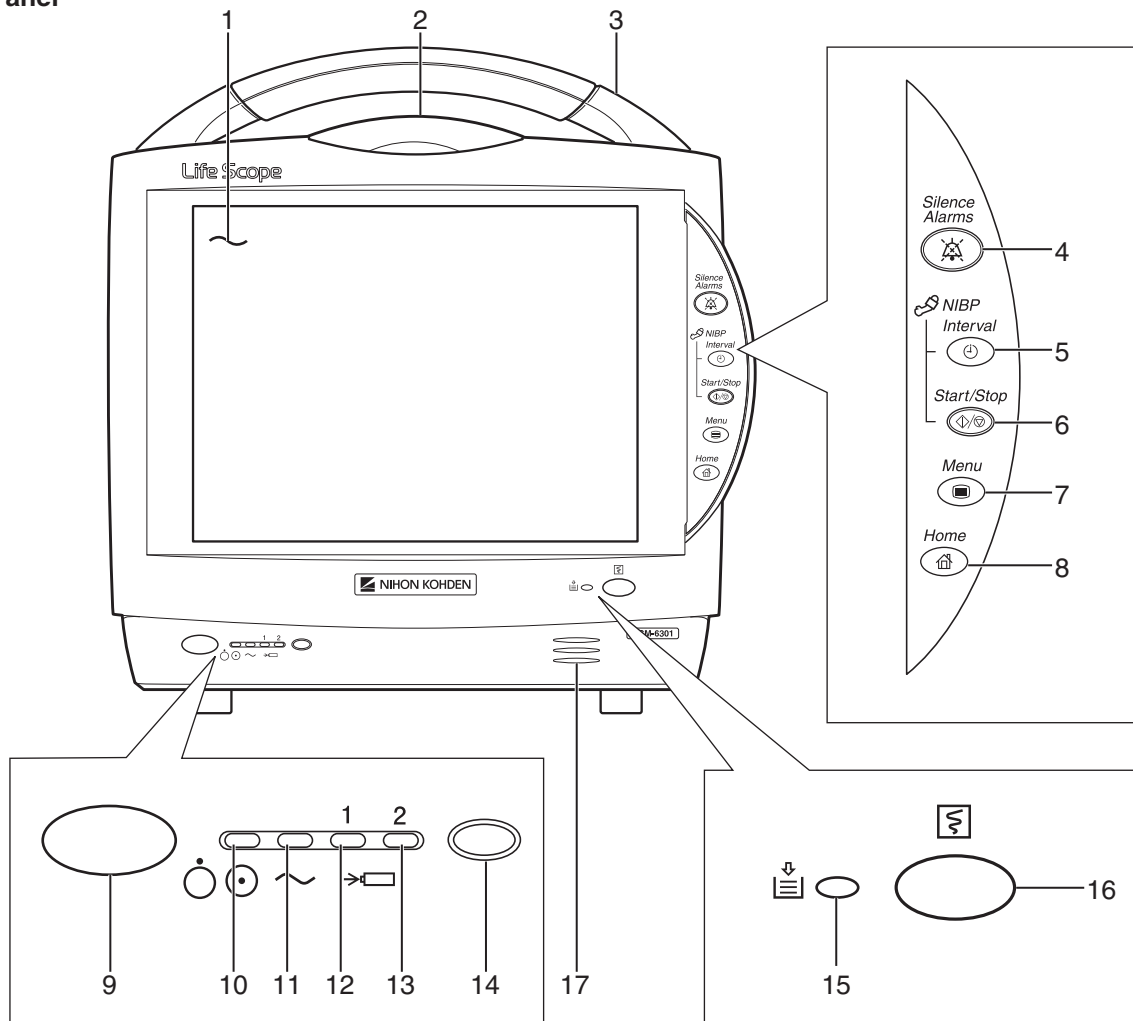
- Multigas unit AG-920R
- CO<sub>2</sub> unit AG-400R



## Panel Description

### MU-631R Main Unit

#### Front Panel



#### 1 Touch screen

Displays monitoring data. Touching a key or data on the screen changes the displayed screen and settings.

#### 2 Alarm indicator

Red or yellow lamp blinks, or yellow or cyan lamps lights according to the alarm settings. Green lamp blinks in synchronization with the patient's QRS or pulse.

#### 3 Handle

For carrying the monitor.

#### 4 Silence Alarms key

Silences the alarm sound.

#### 5 NIBP Interval key

Selects NIBP measurement mode. Pressing this key changes the mode.

#### 6 NIBP Start/Stop key

Starts NIBP measurement in selected mode. Pressing the key during measurement stops measurement.

#### 7 Menu key

Displays the MENU window.

#### 8 Home key

Closes all opened windows and displays the home screen.

#### 9 Power switch

Press to turn the monitor power on. When turning the monitor power off, press and hold for more than three seconds.

#### 10 Power lamp

Lights when the monitor power is turned on.

#### 11 AC power lamp

Lights when the power cord is connected between the AC SOURCE socket and AC outlet.

#### 12 Battery lamp 1

Indicates a battery status of the battery in the battery slot 1.

#### 13 Battery lamp 2

Indicates a battery status of the battery in the battery slot 2.

#### 14 Remote control sensor

Receives an infrared signal from the remote control.

#### 15 ERROR lamp (option)

Blinks when out of paper. Lights when the recorder door is open.

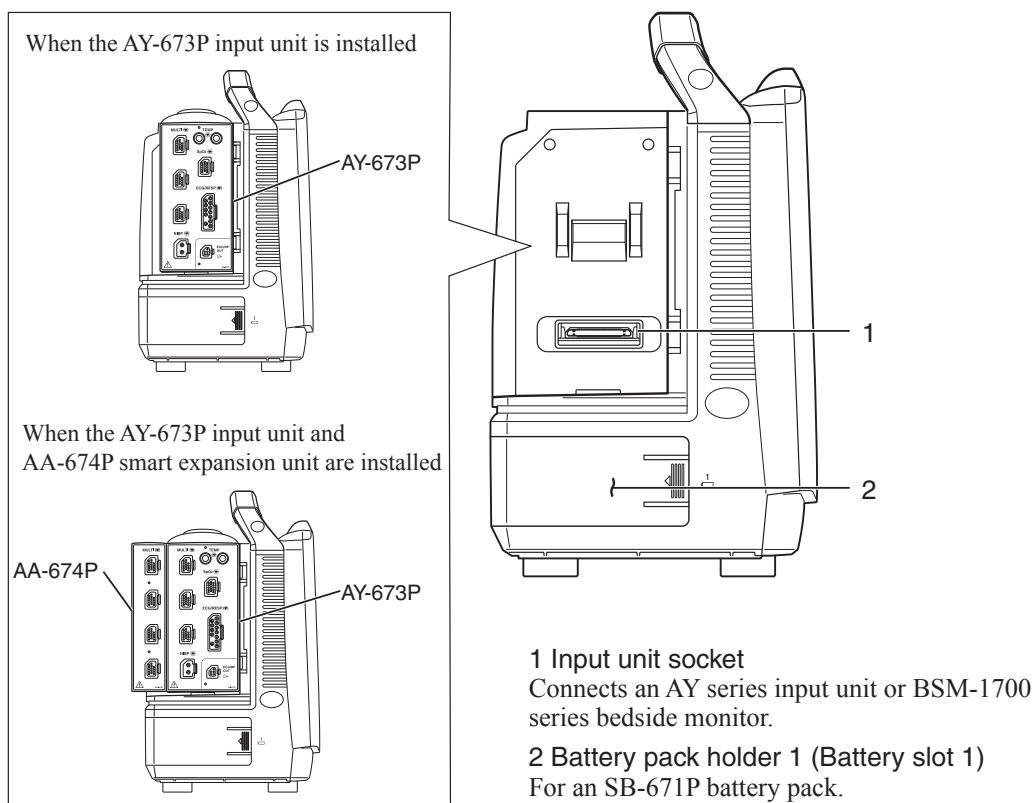
#### 16 RECORD/STOP key (option)

Press to start or stop recording.

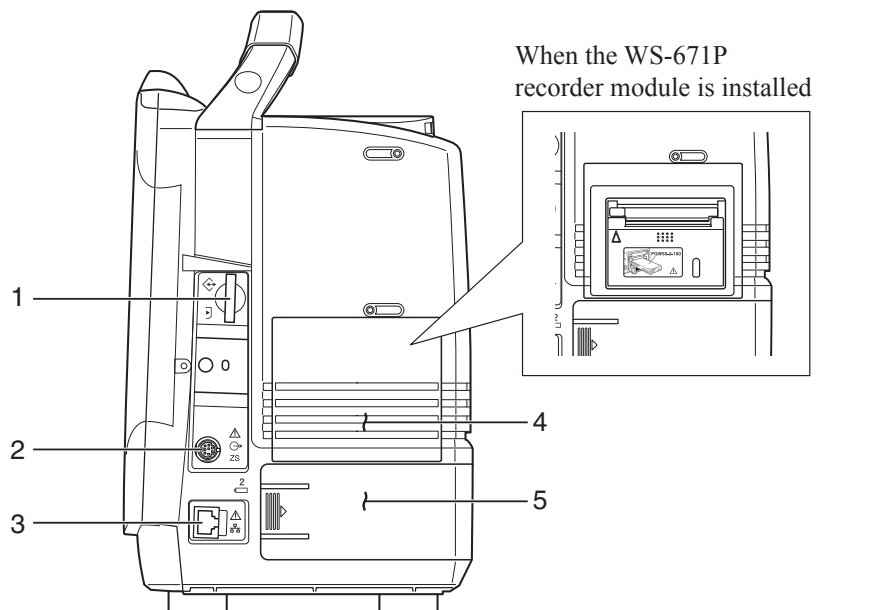
#### 17 Speaker

For alarms and sync sound.

## Left Side Panel



## Right Side Panel

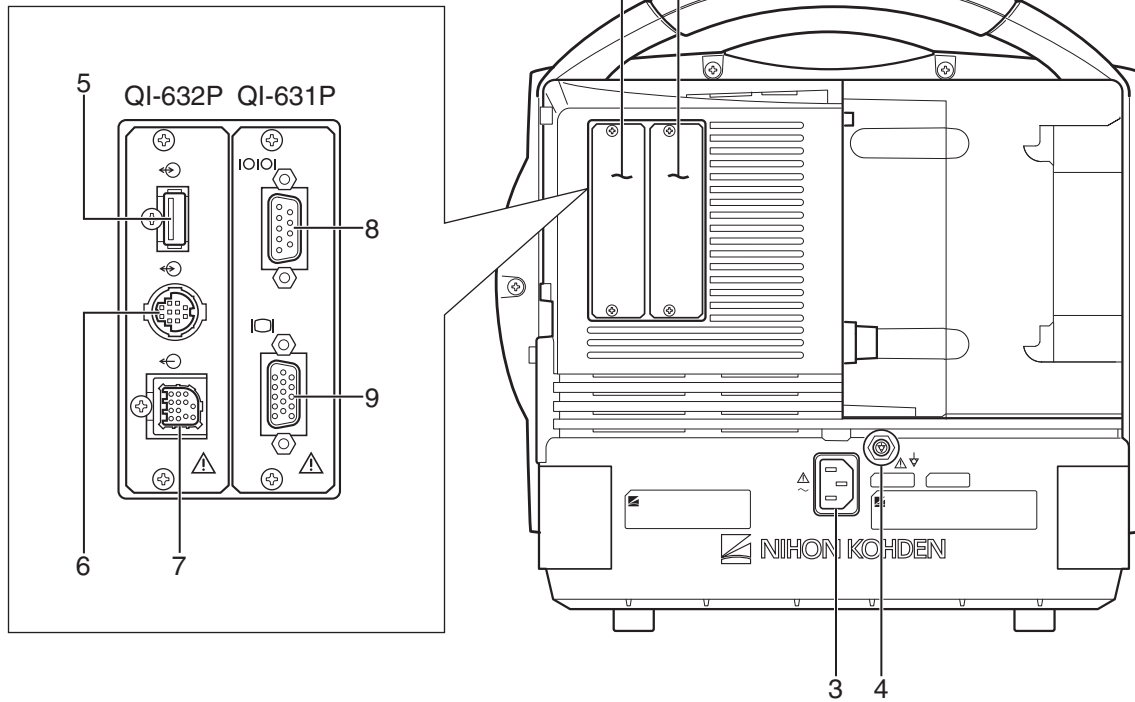


# 1. GENERAL

## Rear Panel

Example shows the QI-631P and QI-632P interfaces installed.

When the optional interface is connected



**1 QI-632P/QI-634P interface socket**  
Connects the QI-632P or QI-634P interface.

**2 QI-631P interface socket**  
Connects the QI-631P interface.

**3 AC SOURCE power cord socket**  
For the AC power cord.

**4 Equipotential grounding terminal**  
For an equipotential grounding lead.

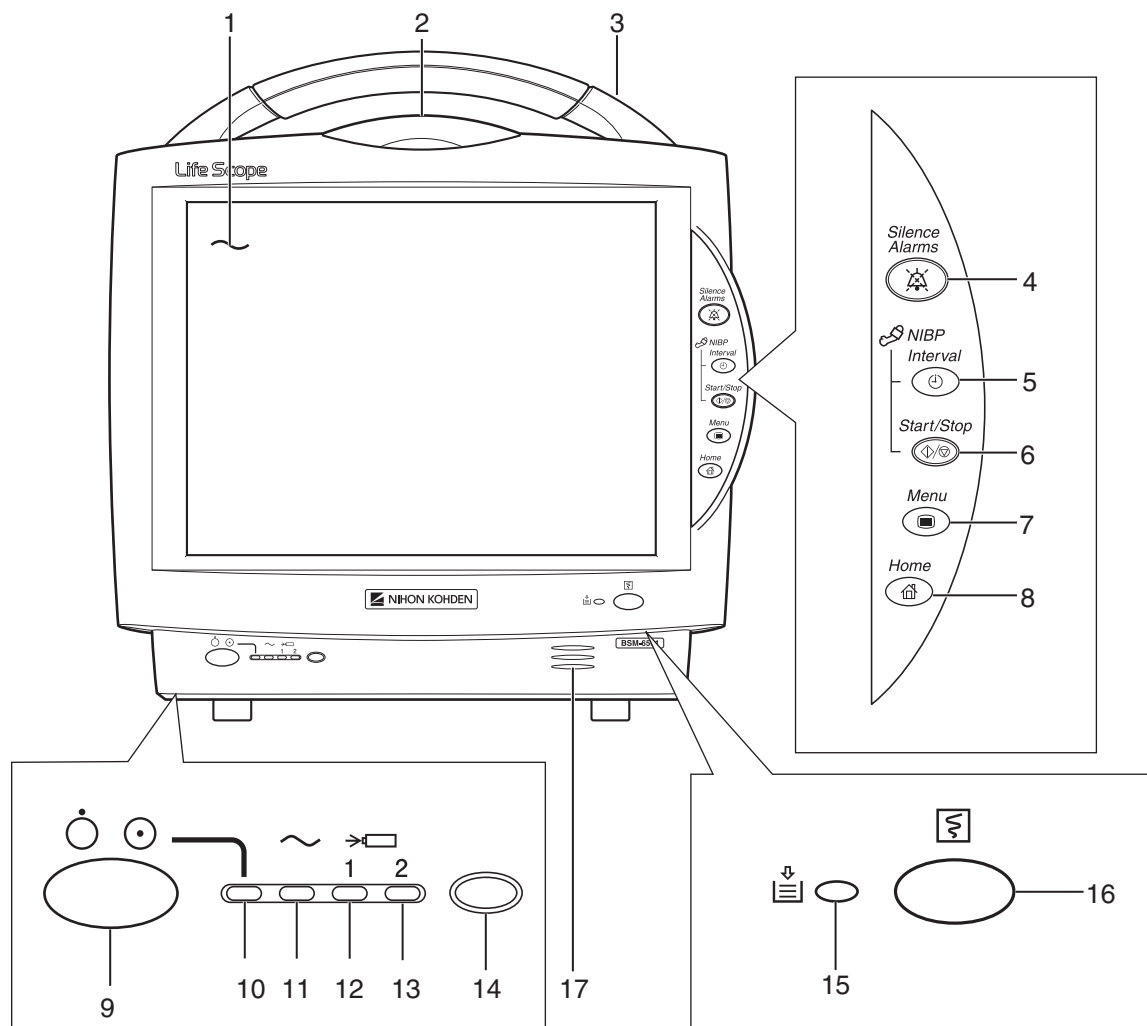
**5 USB socket (QI-632P/QI-634P)**  
Connects a mouse or bar code reader.

**6 Multi-link socket (QI-632P/QI-634P)**  
Connects a QF series interface, IF series communication cable or multi-link cable of an external unit.

**7 Alarm socket (QI-632P)**  
Connects a YJ-672P nurse call cable.

**8 RS-232C socket (QI-631P)**  
Connects a YJ-672P nurse call cable.

**9 RGB socket (QI-631P)**  
Outputs the RGB video signal. Connects to the slave display.

**MU-651R/MU-671R Main Unit****Front Panel****1 Touch screen**

Displays monitoring data. Touching a key or data on the screen changes the displayed screen and settings.

**2 Alarm indicator**

Red or yellow lamp blinks, or yellow or cyan lamps lights according to the alarm settings. Green lamp blinks in synchronization with the patient's QRS or pulse.

**3 Handle**

For carrying the monitor.

**4 Silence Alarms key**

Silences the alarm sound.

**5 NIBP Interval key**

Selects NIBP measurement mode. Pressing this key changes the mode.

**6 NIBP Start/Stop key**

Starts NIBP measurement in selected mode. Pressing the key during measurement stops measurement.

**7 Menu key**

Displays the MENU window.

**8 Home key**

Closes all opened windows and displays the home screen.

**9 Power switch**

Press to turn the monitor power on. When turning the monitor power off, press and hold for more than three seconds.

**10 Power lamp**

Lights when the monitor power is turned on.

**11 AC power lamp**

Lights when the power cord is connected between the AC SOURCE socket and AC outlet.

**12 Battery lamp 1**

Indicates a battery status of the battery in the battery slot 1.

**13 Battery lamp 2**

Indicates a battery status of the battery in the battery slot 2.

**14 Remote control sensor**

Receives an infrared signal from the remote control.

**15 ERROR lamp (option)**

Blinks when out of paper. Lights when the recorder door is open.

**16 RECORD/STOP key (option)**

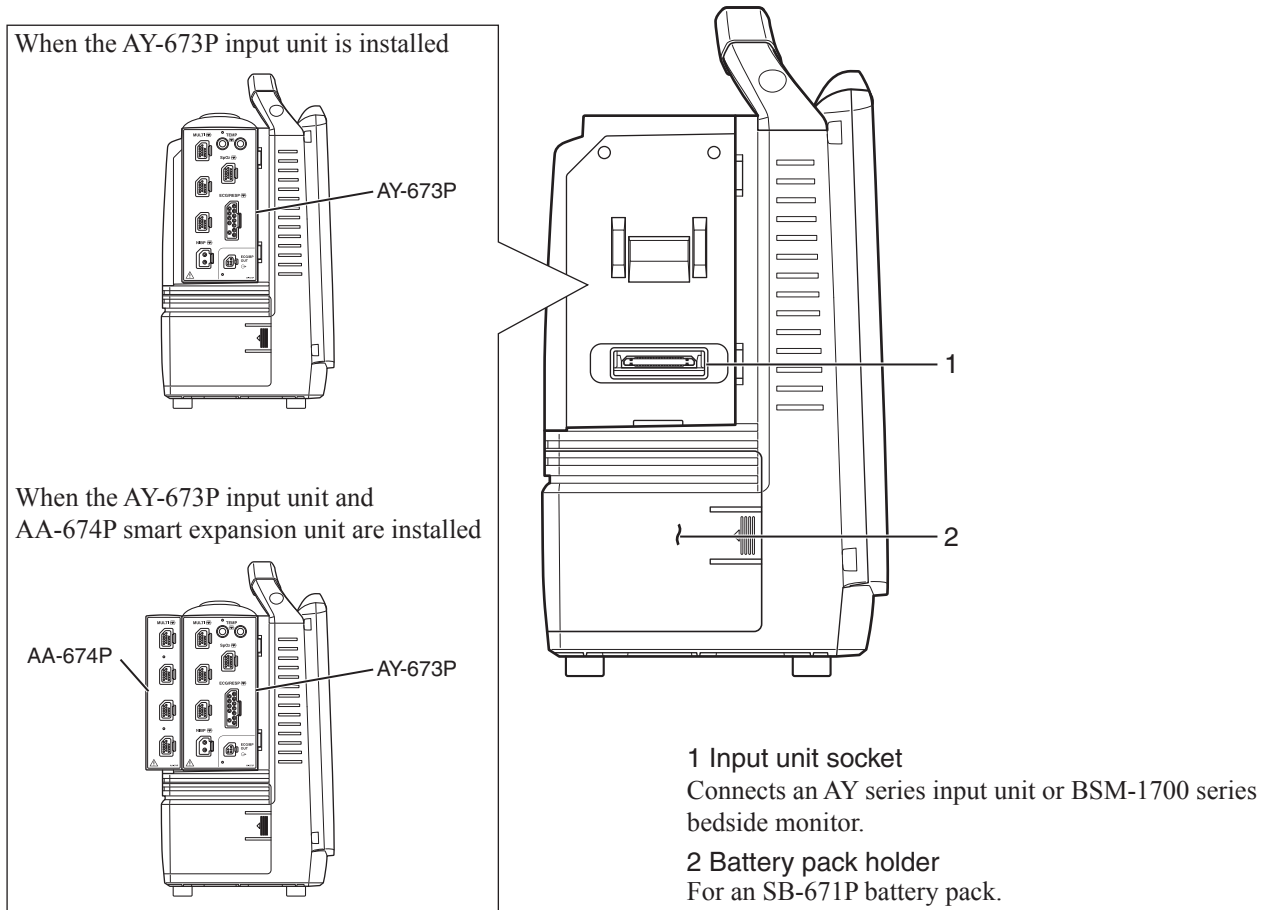
Press to start or stop recording.

**17 Speaker**

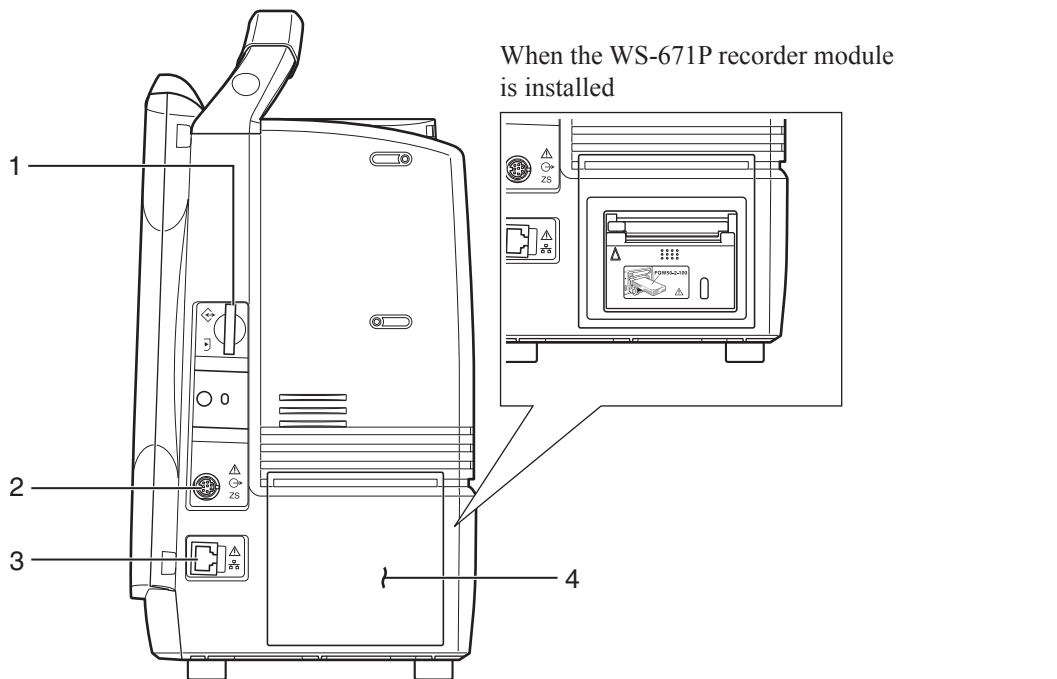
For alarms and sync sound.

# 1. GENERAL

## Left Side Panel



## Right Side Panel



1 SD card slot  
For an SD card or program card.

2 ZS socket  
For the ZS-900P\* transmitter.

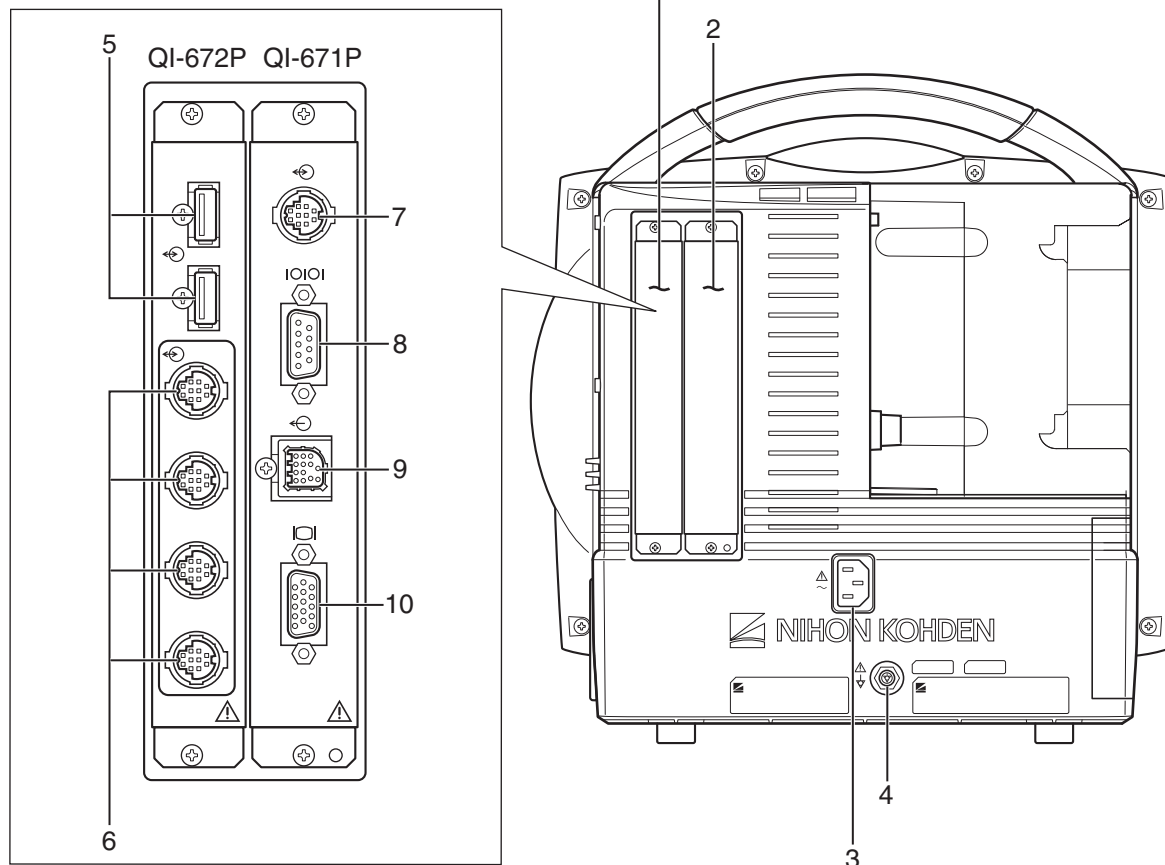
\*ZS-900P transmitter is not available for BSM-6000A series.

3 Network socket  
Connects to monitor network system via the network separation unit.

4 Recorder module holder  
For the WS-671P recorder module.

## Rear Panel

When the optional interface is connected



**1 QI-672P interface socket**

Connects the QI-672P interface.

**2 QI-671P interface socket**

Connects the QI-671P interface.

**3 AC SOURCE power cord socket**

For the AC power cord.

**4 Equipotential grounding terminal**

For an equipotential grounding lead.

**5 USB sockets**

Connects a mouse or bar code reader.

**6 Multi-link sockets**

Connects a QF series interface or IF series communication cable.

**7 Multi-link sockets**

Connects a QF series interface or IF series communication cable.

**8 RS-232C socket**

Not available.

**9 Alarm socket**

Connects a YJ-672P nurse call cable.

**10 RGB socket**

Outputs the RGB video signal. Connects to the dual display or slave display.

## BSM-1700 series Bedside Monitor

When using the BSM-1700 series bedside monitor as an input unit, refer to the BSM-1700 series bedside monitor service manual for its panel description.

1. GENERAL

**AY-631P/633P/651P/653P/660P/661P/663P/671P/673P Input Unit**

AY-660P: One TEMP socket, one MULTI socket, no ECG/BP OUT socket

AY-631P/AY-651P/AY-661P/AY-671P: One MULTI socket

AY-633P/AY-653P/AY-663P/AY-673P: Three MULTI sockets

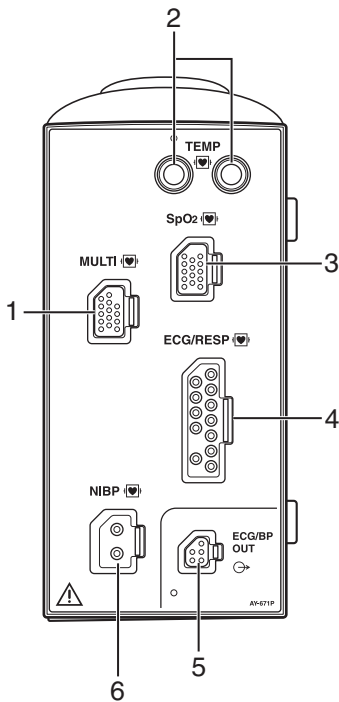
**Front Panel**

**NOTE**

- AY-660P/AY-661P/AY-663P input units are not available for BSM-6000A series.
- With the MULTI socket on the AY-660P input unit, either IBP or CO<sub>2</sub> can be monitored.

**One MULTI socket**

Example is AY-671P input unit.



**1 MULTI socket**

Connects to the connection cord of the parameter to be monitored (IBP, temperature, CO, CO<sub>2</sub>, SpO<sub>2</sub>-2 (AY-661P/AY-663P/AY-671P/AY-673P only), O<sub>2</sub>, respiration by thermistor method or BIS). The type of parameter is automatically recognized.

**2 TEMP socket**

Connects to the temperature probe cord.

**3 SpO<sub>2</sub> socket**

Connects to the SpO<sub>2</sub> connection cord.

**4 ECG/RESP socket**

Connects to the ECG connection cord.

**5 ECG/BP OUT socket**

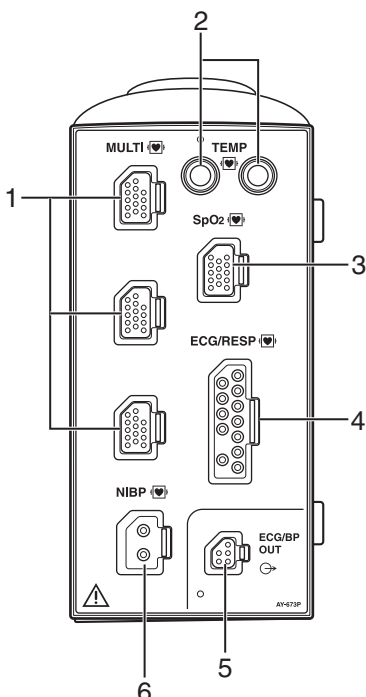
Outputs 100 mmHg/V IBP waveform of the IBP connected to the MULTI socket, 1 mV/V ECG waveform and heart rate trigger by using the YJ-910P or YJ-920P ECG/BP output cable. These analog signals can be used as the synchronization signal for other equipment, such as IABP.

**6 NIBP socket**

Connects to the air hose.

**Three MULTI sockets**

Example is AY-673P input unit.



**WARNING**

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

**Using MULTI Sockets for CO Monitoring**

**WARNING**

When performing defibrillation during cardiac output monitoring, never touch the CO connection cord. The discharged energy may cause electrical shock or injury.

**NOTE**

CO monitoring using the MULTI socket does not comply with the defibrillator proof type CF.

## Using the Output Signal from the ECG/BP OUT Socket

**CAUTION**

When using the output signal from the monitor as the synchronization signal for other equipment such as an IABP (intra-aortic balloon pump) or defibrillator:

- Set the timing of the IABP by checking the waveform on the IABP screen.
- Check the condition of the bedside monitor at all times. The output signal may become unstable.
- Check that the delay time of the output signal is within the range of the connected equipment.

**CAUTION**

Only a Nihon Kohden defibrillator can use the output signal from the monitor as a synchronization signal. Check that the delay time of the output signal (heart rate trigger 20 ms maximum) is within the range of the connected defibrillator.

**NOTE**

- When using an IBP waveform as a synchronization signal for other equipment, connect the IBP line to the MULTI socket. The IBP waveform that is used for the synchronization signal depends on the "IBP ANALOG OUT" setting in the SYSTEM SETUP window.
  - When "IBP ANALOG OUT" is set to "FIXED POSITION":  
The IBP line connected to the top MULTI socket is used.
  - When "IBP ANALOG OUT" is set to "HIGHEST PRIORITY LABEL":  
When more than one IBP waveform is acquired, the IBP waveform of the highest priority label is used.

IBP label priority:  
ART > ART2 > RAD > DORS > AO > FEM > UA > LVP > P1 > P2 > P3 > P4 > P5 > P6 > P7
- The output signal from the ECG/BP OUT socket may become unstable in the following conditions.
  - Electrode is dry or detached.
  - Electrode lead is damaged or disconnected from the electrode.
  - Electrode lead is pulled.
  - AC interference or EMG noise superimposed.
  - Air bubbles or blood clog in the circuit for monitoring IBP.
  - Cord or cable is disconnected or damaged.
- All instruments which are to be connected to the ECG/BP OUTPUT socket must use a YJ-910P or YJ-920P ECG/BP output cable and comply with the IEC 60601-1 safety standard for medical equipment.
- When using an IABP, set <CALCULATION METHOD> on the OTHER page of the PRESS window to "PEAK" to improve measurement accuracy.

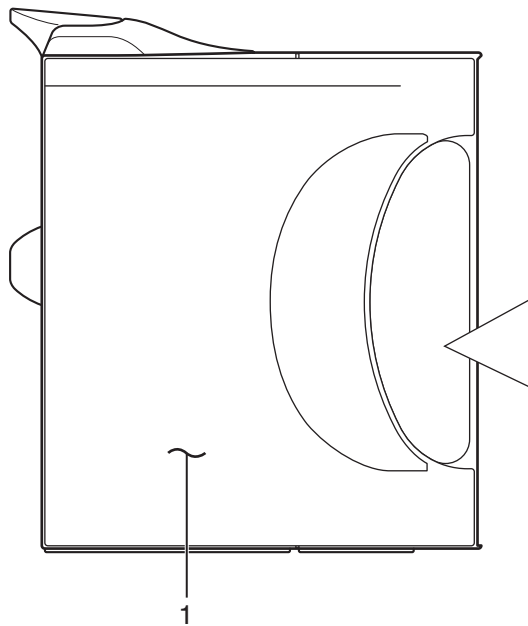
## Output Signal Delay Time

Output Signal	Delay Time
ECG	maximum 20 ms
IBP	maximum 40 ms
Heart rate trigger	maximum 20 ms

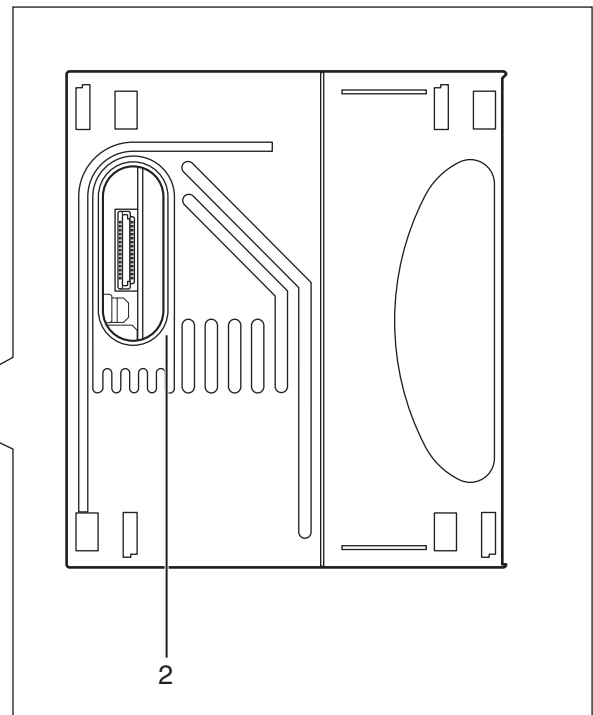


1. GENERAL

**Left Side Panel**



When the side panel is removed



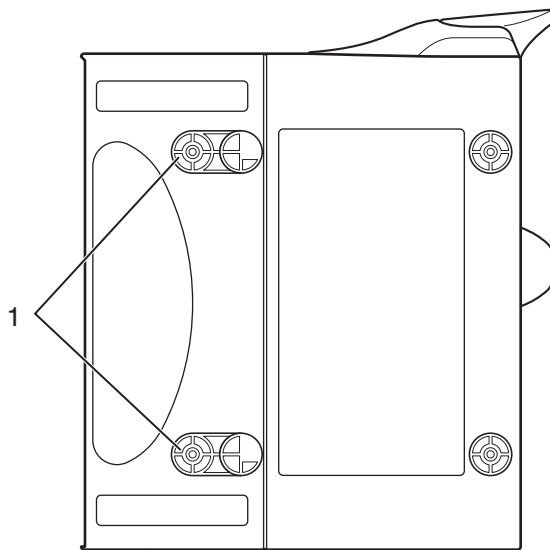
**1 Side panel**

Remove to attach an AA-672P/AA-674P smart expansion unit.

**2 Smart expansion unit socket**

Connects an AA-672P/AA-674P smart expansion unit.

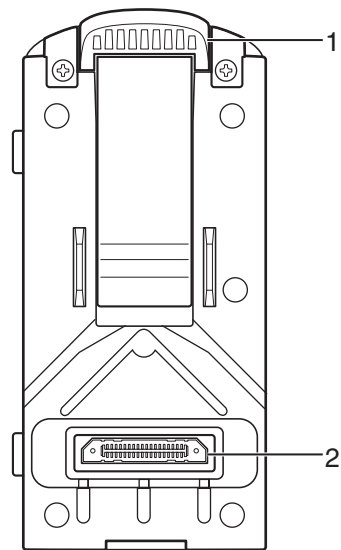
**Right Side Panel**



**1 Tabs**

Match the tabs on the input unit to the slots on the bedside monitor.

**Rear Panel**



**1 Lock release lever**

Lift up the lever to remove the input unit from the bedside monitor.

**2 Input unit socket**

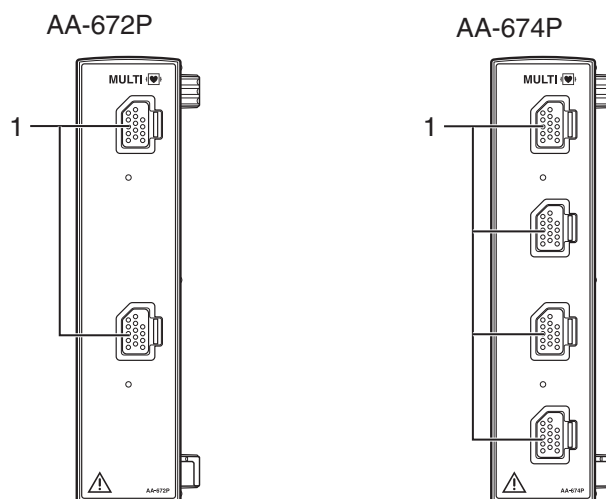
For connecting a bedside monitor.

## AA-672P/AA-674P Smart Expansion Unit

### NOTE

AA-672P/674P smart expansion unit cannot be used with AY-660P input unit.

### Front Panel



#### 1 MULTI socket

Connect to the connection cord of the parameter to be monitored (Respiration by thermistor method, CO<sub>2</sub>, SpO<sub>2</sub>-2 (only when AY-661P/AY-663P/AY-671P/AY-673P input unit is used), IBP, temperature, CO, O<sub>2</sub> or BIS). The type of parameter is automatically recognized.

### Using MULTI Sockets for CO Monitoring

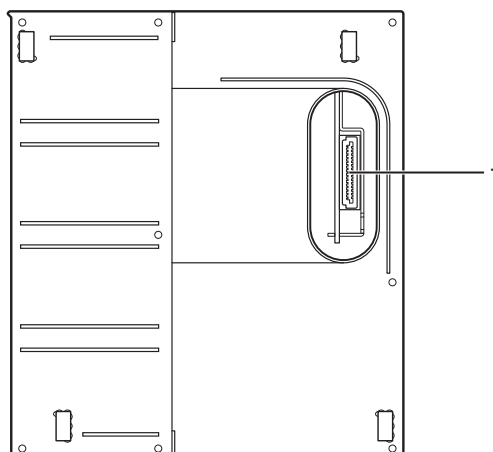
#### WARNING

When performing defibrillation during cardiac output monitoring, never touch the CO connection cord. The discharged energy may cause electrical shock or injury.

#### NOTE

CO monitoring using the MULTI socket does not comply with the defibrillator proof type CF.

### Right Side Panel

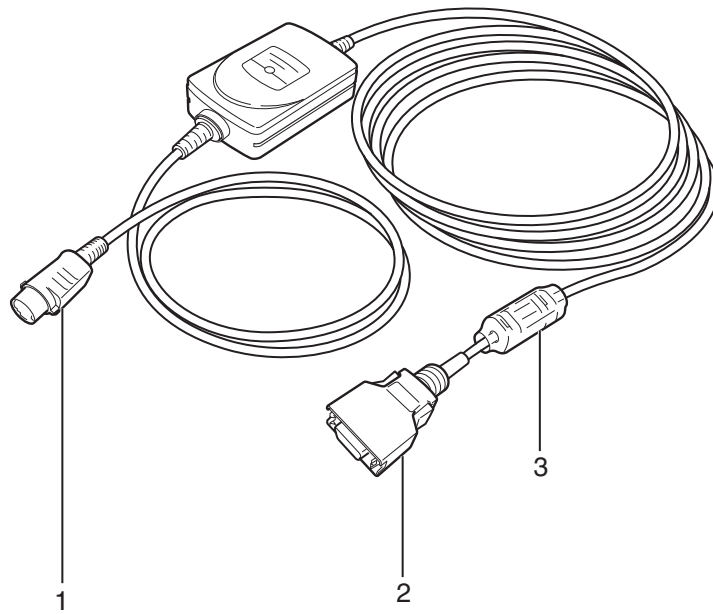


#### 1 Connector

Connects an AY-631P/AY-633P/AY-651P/AY-653P/AY-661P/AY-663P/AY-671P/AY-673P input unit.

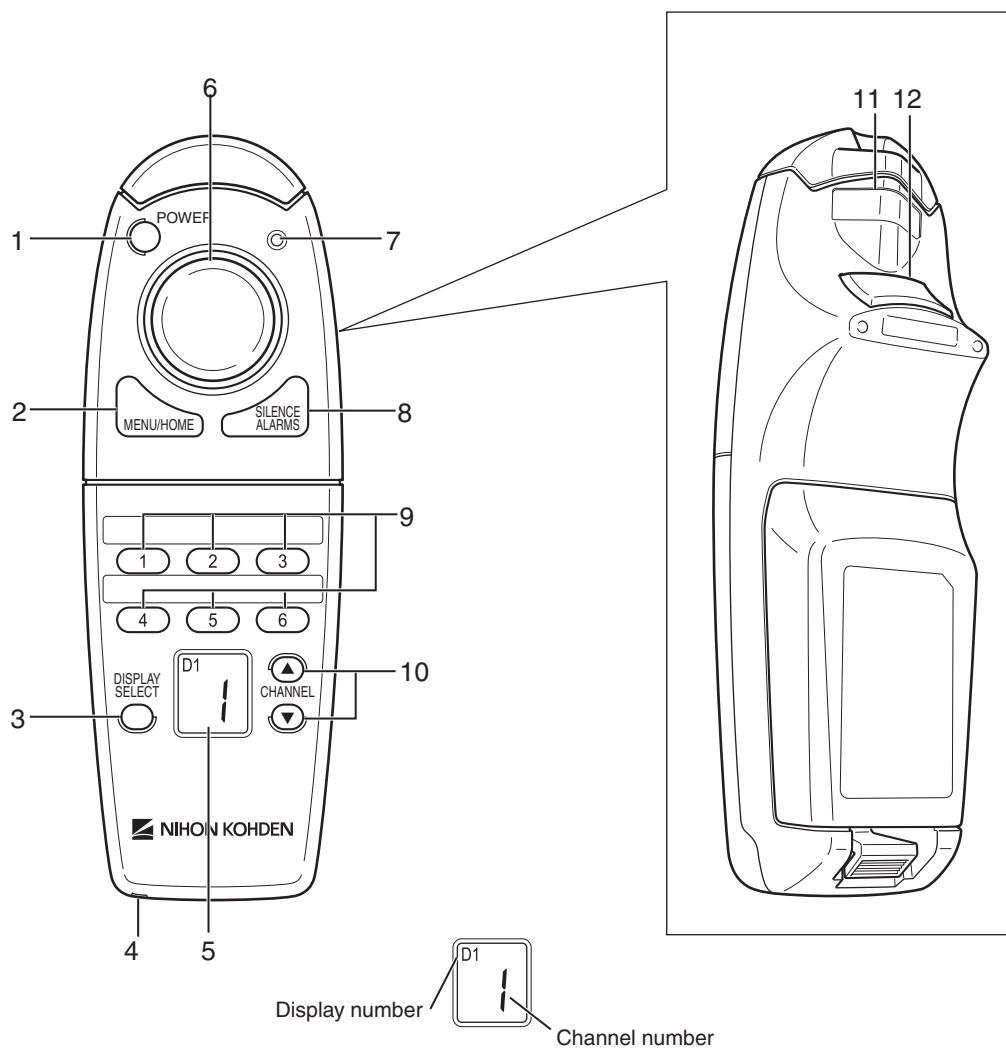
1. GENERAL

**QF series Interface and IF series Communication Cable**



- 1 Multi-link connector  
Connect to the multi-link socket on the bedside monitor.
- 2 External device connector  
Connect to an external device.
- 3 Ferrite core

## RY-910PA Remote Controller



### 1 POWER button

When the power cord is connected between the bedside monitor and AC outlet, turns the monitor power on or off.

### 2 MENU/HOME key

Opens the MENU window. Closes the window and displays the home screen when a window is opened.

### 3 DISPLAY SELECT key

Not available.

### 4 Strap hole

Use a strap to prevent dropping the remote control.

### 5 Display

Displays the channel number and the display number.

### 6 Selection knob

Move this knob up/down/left/right to move the cursor or mouse pointer on the screen.

### 7 LED

Lights when the pointer on the screen is moved by the selection knob. Blinks when a key on the remote control is pressed.

### 8 SILENCE ALARMS key

Silences the alarm sound.

### 9 Customized keys

Windows and functions can be assigned to each key for shortcut key operations.

### 10 CHANNEL keys

Select the monitor when a channel is assigned to the monitor.

### 11 Transmitter

Signal is transmitted from here. Point the transmitter to the remote control sensor on the bedside monitor when operating the monitor with the remote control.

### 12 ENTER key

Registers the setting selected on the screen.

## Storage and Transport

Follow these procedures when storing or transporting the monitor.

### Storage

Before storing the monitor for a long time, perform the following steps:

1. Disconnect the power cord from the monitor.
2. Cover the monitor with a dust cover.
3. If possible, store the monitor in its original shipping container.
4. Make sure the storage place meets the following storage conditions for the duration of the storage.  
Storage temperature:  $-20$  to  $+65^{\circ}\text{C}$  ( $-4$  to  $+149^{\circ}\text{F}$ )  
Storage humidity: 10 to 95% RH

### Transport

To transport the monitor, perform the following steps:

1. Disconnect the power cord from the monitor.
2. Cover the monitor with a dust cover.
3. If possible, transport the monitor in its original shipping container. Following transport conditions are required.  
Transport temperature:  $-20$  to  $+65^{\circ}\text{C}$  ( $-4$  to  $+149^{\circ}\text{F}$ )  
Transport humidity: 10 to 95% RH

## Hard Keys and Soft Keys

### Hard Keys

The monitor has six hard keys: Silence Alarms, NIBP Interval, NIBP Start/Stop, Menu, Home and Record. These keys always have the same functions, regardless of the screen display.

### Soft Keys

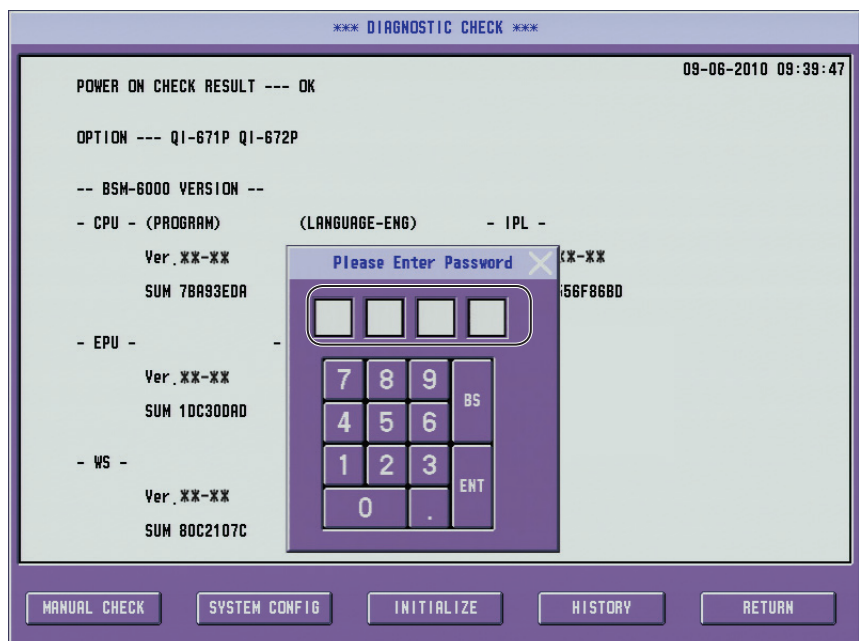
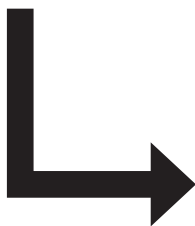
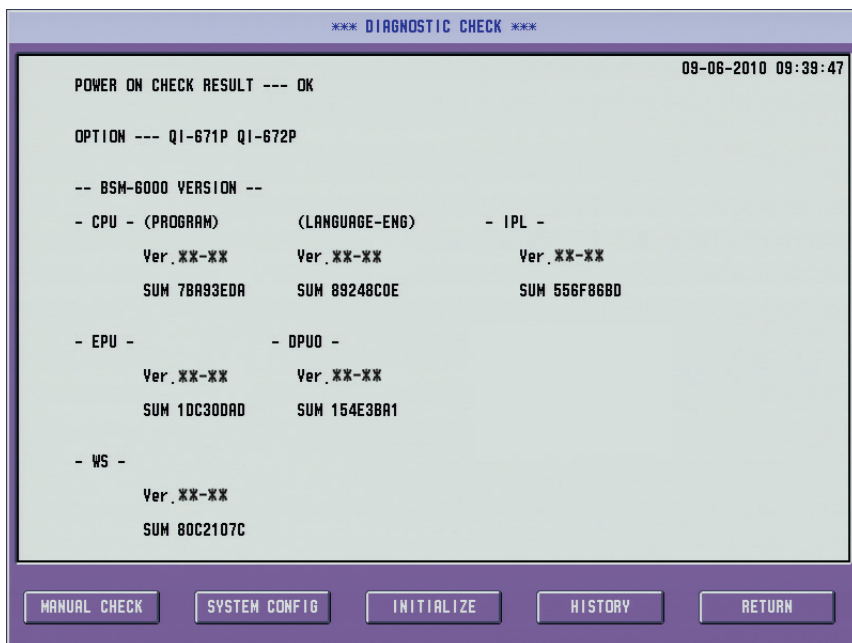
When the Menu key is pressed or the screen is touched, the screen displays several keys which have different functions depending on the screen display. For example, when the HR numeric display is touched, the ECG setting screen appears and several tabs such as ST ALARMS, ARRHYTH, OTHER, etc are displayed.

# Maintenance and Software

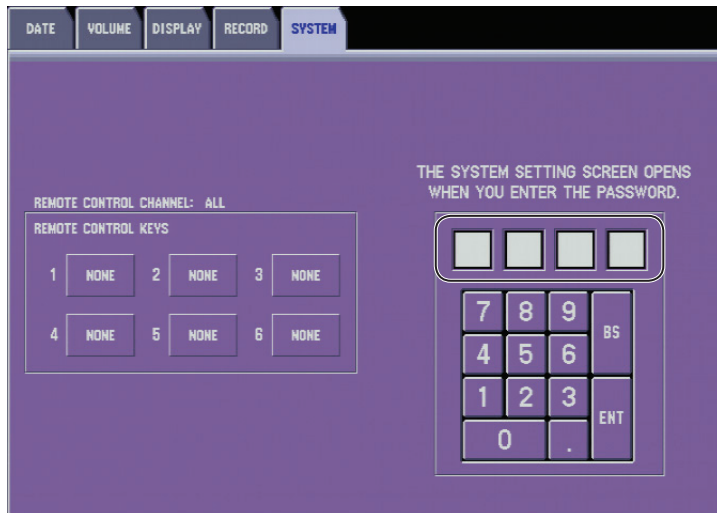
## Password

A password is necessary to enter the MANUAL CHECK screen, SYSTEM CONFIGURATION screen, HISTORY screen and SYSTEM SETUP window. (The password is set to “1234” by factory default.) To enter the relevant screen without using the password (“1234” by factory default), enter the current time as the password (for example, if the current time is 10:46, enter “1046”).

The MANUAL CHECK screen, SYSTEM CONFIGURATION screen and HISTORY screen can be accessed from the DIAGNOSTIC CHECK screen. The DIAGNOSTIC CHECK screen can be opened by pressing the [Power] switch while holding the [Silence Alarms] key.



The SYSTEM SETUP window can be accessed from the MENU window.

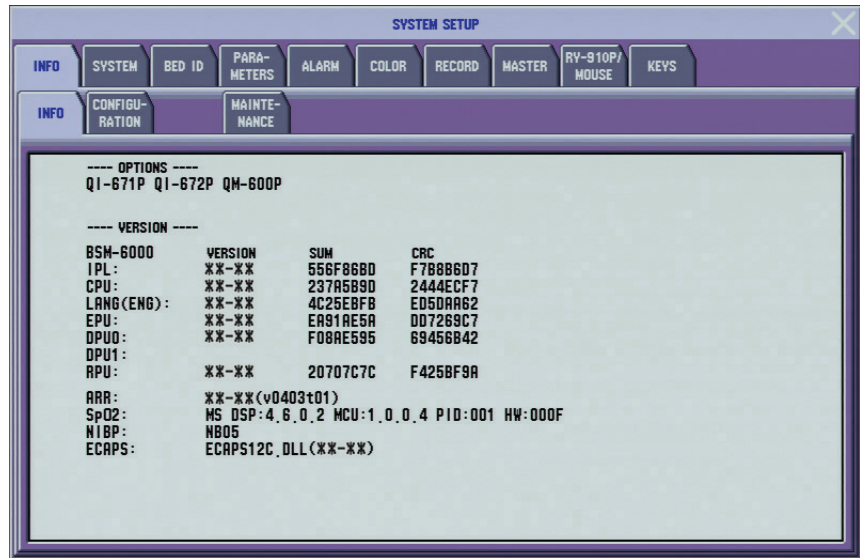




## Checking Software Version

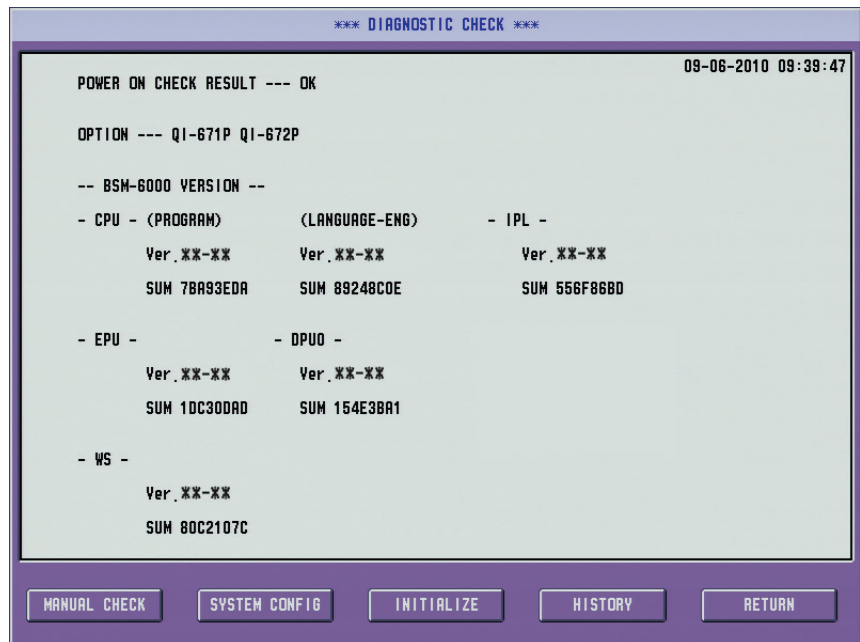
### Checking on the SYSTEM SETUP Window

Select SYSTEM in the MENU window and enter the password. The following information window is displayed. In this information window, versions of each software described in the “Software Composition” section can be checked.



### Checking on the DIAGNOSTIC CHECK Screen

Turn on the power while holding the [Silence Alarms] key.

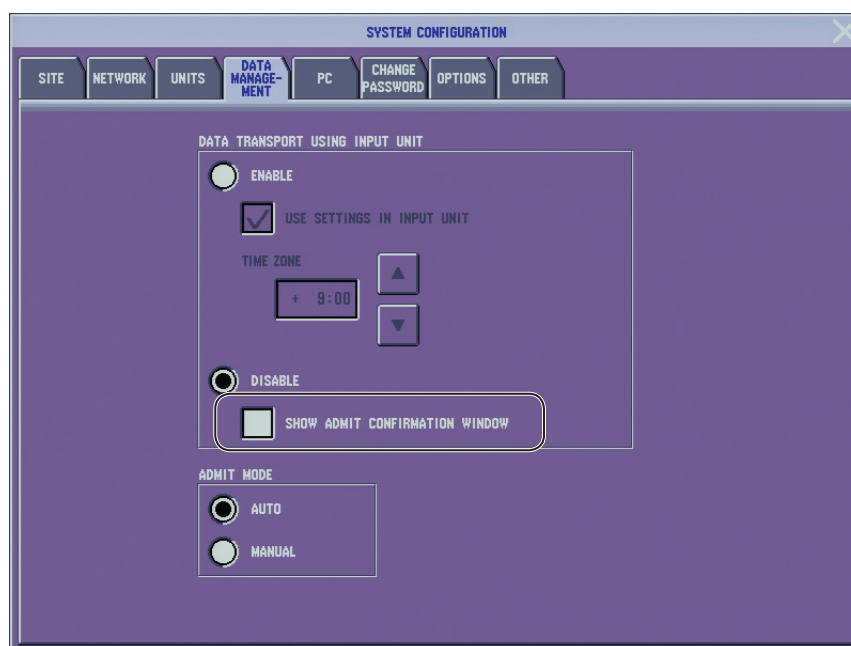


## SHOW ADMIT CONFIRMATION WINDOW Setting

In BSM-6000 series, a patient's admit data and measurement data is erased when <SHOW ADMIT CONFIRMATION WINDOW> in the SYSTEM CONFIGURATION screen is set to OFF and 30 minutes passes after the power is turned off. In a maintenance operation, if settings and a patient's data are to be retained after the power is turned off, set <SHOW ADMIT CONFIRMATION WINDOW> to ON in advance.

### Displaying the DATA MANAGEMENT Page of the SYSTEM CONFIGURATION Window

When <DATA TRANSPORT USING INPUT UNIT> is set to DISABLE, check <SHOW ADMIT CONFIRMATION WINDOW>. When it is set to ENABLE, <SHOW ADMIT CONFIRMATION WINDOW> function is fixed to Off.



### SHOW ADMIT CONFIRMATION WINDOW

This sets whether or not a patient's admit data and measurement data is to be automatically erased when 30 minutes passes after the power is turned off.

#### Setting:

- Off (unchecked): A patient's admit data and measurement data are erased and settings are initialized when 30 minutes passes after the power is turned off, and a new monitoring of another patient is started. When the power is turned on within 30 minutes after turning off the power, the recent patient's measurement data is successively displayed.
- On (checked): When the power is turned on, regardless of the time elapsed since the last power-off, a confirmation message appears. When you touch YES, a patient's admit data and measurement data are erased and settings are initialized. Then a new monitoring of another patient is started. When you touch NO, the recent patient's measurement data is successively displayed.

## Backup of Data and Settings

Back up the system settings and environmental settings before performing a periodic inspection or a repair operation in order to restore the settings after the operation.

### Locations Where Data and Settings are Stored

Location	Storing Data
Internal SD card	Review Data (Trends, Tabular trend, NIBP tabular trend, Alarm history, Full disclosure waveforms, Arrhythmia recall)
FRAM on MAIN DIGITAL board	Settings other than review data (Network settings, Interbed settings, Passwords, Error history, Alarm settings, Patient information, etc.)

### Notes on Saving and Initialization of Data and Settings

Be aware that when performing maintenance operation, some data and settings are to be initialized. Save (back up) data before performing maintenance operation and load (restore) it after maintenance operation as necessary.

Notes in each maintenance type are explained below.

- In system initialization
- In replacement of units or parts
- In replacement with alternate monitor (when making same settings for multiple monitors)
- In upgrade or downgrade
- In maintenance operation of monitor for which the transport function is activated

#### Notes in system initialization

There are three ways of system initialization: Initialization by general password, Initialization by administrator password and Initialization to reset to factory default. The range to be initialized differs depending on the initialization method. Among the data listed in the above “Locations Where Data and Settings are Stored”, data types that are initialized when the system is initialized are shown in the following table. Also, among those data, data types that can be saved into an internal or external SD card are shown.

Before performing a system initialization, understand the following tables and back up data by following the procedures in “Saving/Loading Settings” as necessary.

Refer to “System Initialization” for details.

### NOTE

When initializing a monitor in which the transport function is activated, note the following to retain data in a memory unit of the input unit: Remove the input unit once from the main unit before performing a system initialization. After the system initialization is completed, activate the transport function in the system details screen, and then reconnect the input unit to the main unit.

Methods of System Initialization	Review Data	Settings (alarm setting, etc.)	Patient Information	Network Settings	Interbed Settings	Passwords	Error History
General password	Initialized	Initialized	Initialized	Not initialized	Initialized	Not initialized	Not initialized
Administrator password	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized	Not initialized
Factory initialization	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized

Media	Review Data	Settings (alarm setting, etc.)	Patient Information	Network Settings	Interbed Settings	Passwords	Error History
Internal SD card	Impossible	Possible	Impossible	Impossible	Possible	Possible	Impossible
Optional SD card	Impossible	Possible	Impossible	Impossible	Impossible	Possible	Impossible

#### Notes in replacement of units or parts

Be aware that when performing maintenance operation, some settings or review data are lost depending on the unit or part to be replaced. Items which are lost in replacement of respective units or parts are shown below.

	Review Data	Settings (alarm setting, etc.)	Patient Information	Network Settings	Interbed Settings	Passwords	Error History	Date and Time
In MAIN DIGITAL board replacement	Lost	Lost	Lost	Lost	Lost	Lost	Lost	Lost
In internal SD card replacement	Lost	Retained	Retained	Retained	Retained	Retained	Retained	Retained
In lithium battery replacement	Lost	Retained	Retained	Retained	Retained	Retained	Retained	Lost

#### NOTE

- When the MAIN DIGITAL board is replaced, all data are erased. If the MAIN DIGITAL board data can be output before replacing the board, be sure to output the settings in the MAIN DIGITAL board to the internal SD card. The settings can be restored after replacement by connecting the same memory card to the new MAIN DIGITAL board and loading the saved data (for details on loading data, refer to “Saving/Loading Settings” in this section).
- On the MAIN DIGITAL board, a dip switch is mounted for identifying the hardware revision. When replacing the MAIN DIGITAL board, be sure to check the dip switch setting (for details, refer to “Dip Switch (SW201) Settings” in Section 5).
- After replacing the internal SD card, be sure to perform the discharge operation to delete the review data. Refer to the operator’s manual for details.

## 1. GENERAL

- When replacing a monitor in which the transport function is activated with an alternate monitor, note the following to retain data in the input unit: Be sure to activate the transport function of the alternate monitor in the SYSTEM SETUP window before connecting the input unit to the alternate monitor.

### Notes on replacement with alternate monitor

#### **Procedures of replacement with alternate monitor**

1. Save the monitor's user settings into an optional SD card. Refer to the "Saving/Loading Settings" on the next page for details.
2. For the following items, which are not to be saved into an optional SD card, write them down.
  - Patient information
  - Network settings
  - Interbed settings
  - Date and time
3. Previous user's settings may be left in the alternate monitor. Therefore execute the administrator initialization on the alternate monitor.
4. Load the settings saved in the optional SD card into the alternate monitor.
5. Manually set the items that have been written down in step 2 on the alternate monitor.

#### **Notes on replacement with alternate monitor**

- Only an optional SD card can be used for moving set data.
- Set data and review data cannot be moved by re-installing the user's memory card into the alternate monitor.
- Moving set data by using an optional SD card is possible only between the same models and same versions. Do not move set data between different models or different versions.
- The user monitor and the alternate monitor must be the same in their version numbers.

### Notes in upgrade or downgrade

Settings and data are initialized when the system is initialized. Therefore, be sure to save the settings and data into the internal SD card before executing an upgrade. After executing an upgrade or downgrade, perform a system initialization. After that, load the settings from the internal SD card.

#### **NOTE**

- In a downgrade operation, do not perform reading/loading of settings.
- For newly added items by an upgrade, their factory values are set.
- For deleted items by an upgrade, their values are ignored.
- In the future, compatibility among MU-631R/651R/671R main unit, AY-600P series input unit and AA-672P/674P smart expansion unit may be ensured. Therefore, check the maintenance information in advance especially when executing an upgrade or downgrade for only one of them.

In maintenance operation of monitor for which the transport function is activated

To retain the patient's data and set data in the input unit until after a maintenance operation of a monitor in which the transport function is activated, note the following:

If connecting the input unit to a monitor in which the transport function is inactivated and starting monitoring, or if the monitor is started while the input unit is connected, data in a memory unit of the input unit is initialized. The transport function is deactivated by default. Therefore when the system is initialized, remove the input unit once, and execute the system initialization, and activate the transport function, and then connect the input unit. When replacing the monitor with an alternate monitor, be sure to activate the transport function of the alternate monitor before connecting the input unit.

### Saving/Loading Settings

Settings can be saved to the internal memory card or an optional SD card. However, review data cannot be saved. For settings and data that can be saved, refer to "Notes on Saving and Initialization of Data and Settings".

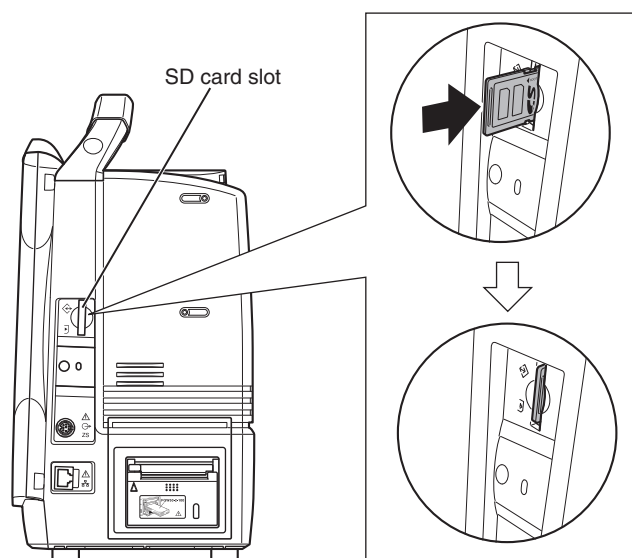
Note that moving the settings and data by using an optional SD card is possible only between the monitors with the same models and same versions. Do not move the settings and data to a monitor with a different model or different version.

#### SD card usable for optional SD card slot

SD card 1 GB: Code number 9000-057839

#### NOTE

We cannot guarantee proper operation for other SD cards.

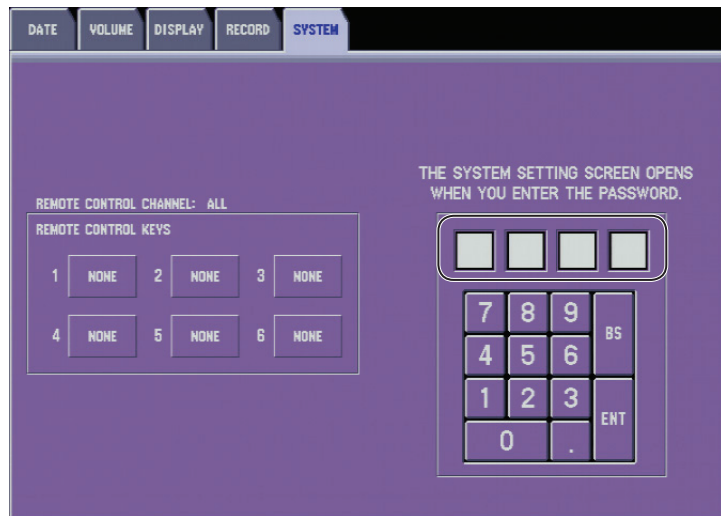


1. GENERAL

1. Touch the MENU key and select SYSTEM.



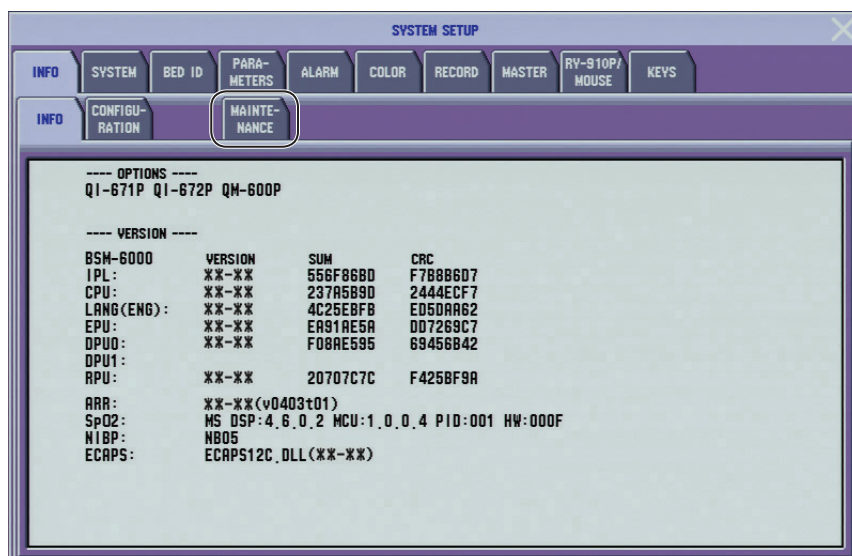
2. Enter the password.





3. Touch the INFO tab → MAINTENANCE tab.

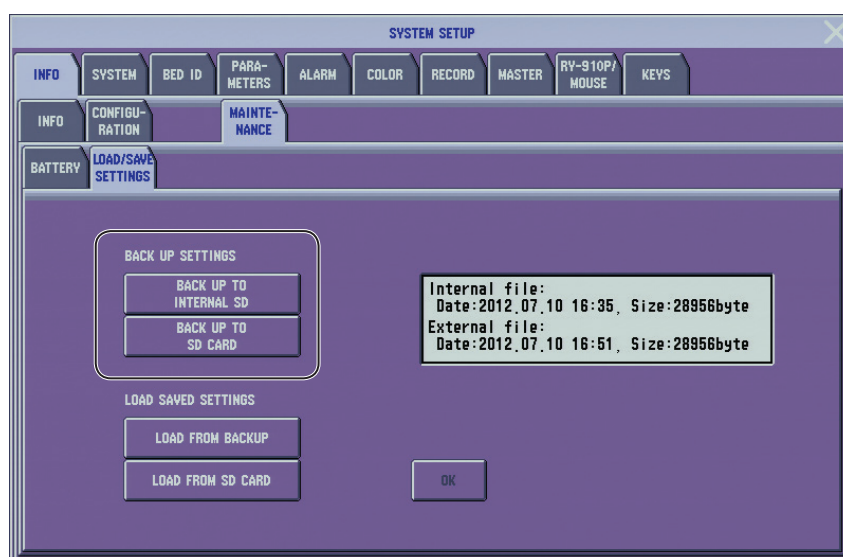
1



4. Select BACK UP TO INTERNAL SD or BACK UP TO SD CARD in <BACK UP SETTINGS>.

When BACK UP TO INTERNAL SD is selected, settings are saved to the internal SD card.

When BACK UP TO SD CARD is selected, settings are saved to an optional SD card inserted into the slot.



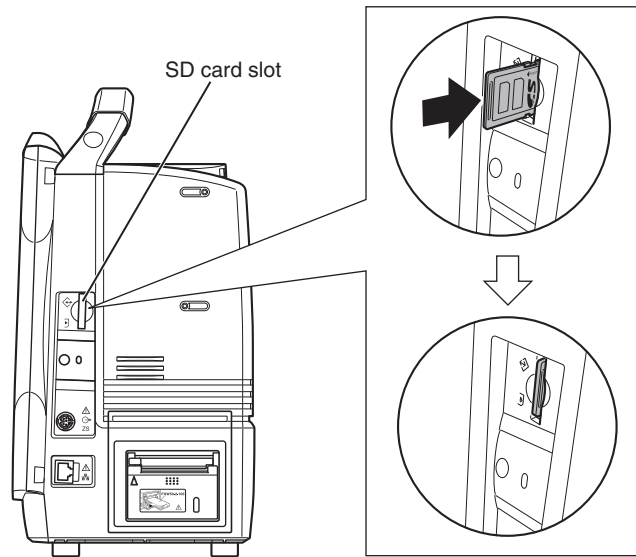
### CAUTION

Do not turn off the power or remove the SD card while data is being saved.



### Loading procedures

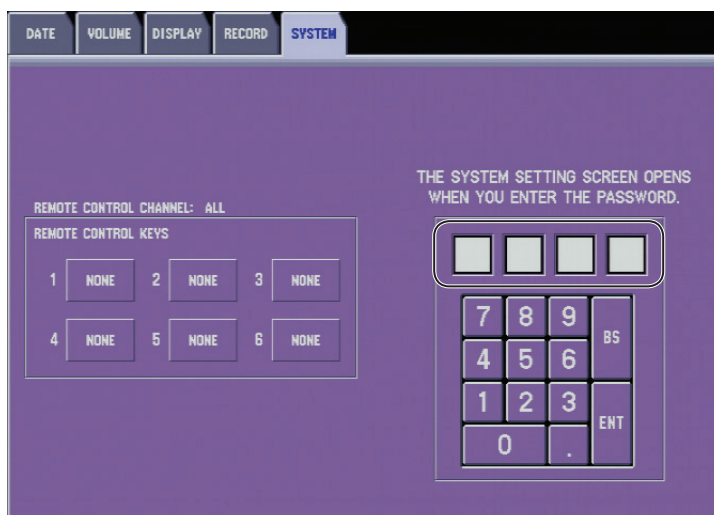
1. Insert the SD card in which the settings are saved into the SD card slot.



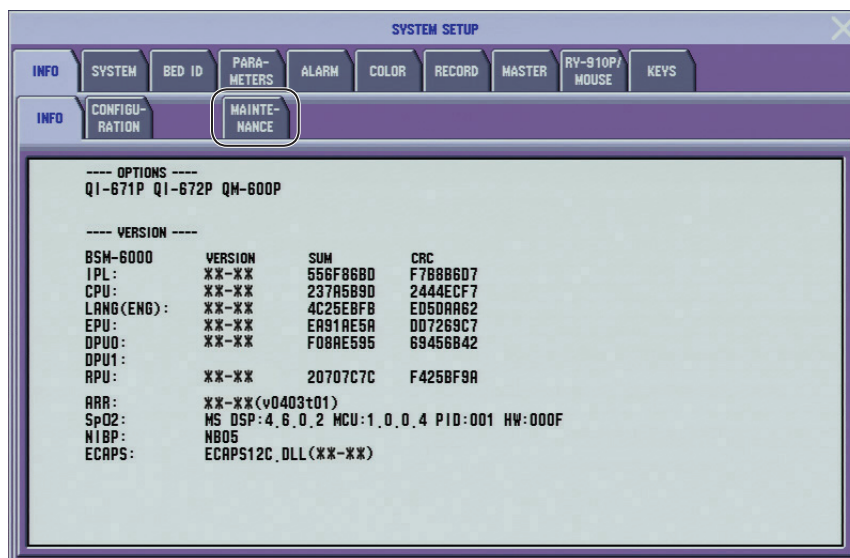
2. Touch the MENU key and select SYSTEM.



3. Enter the password.



4. Select MAINTENANCE.

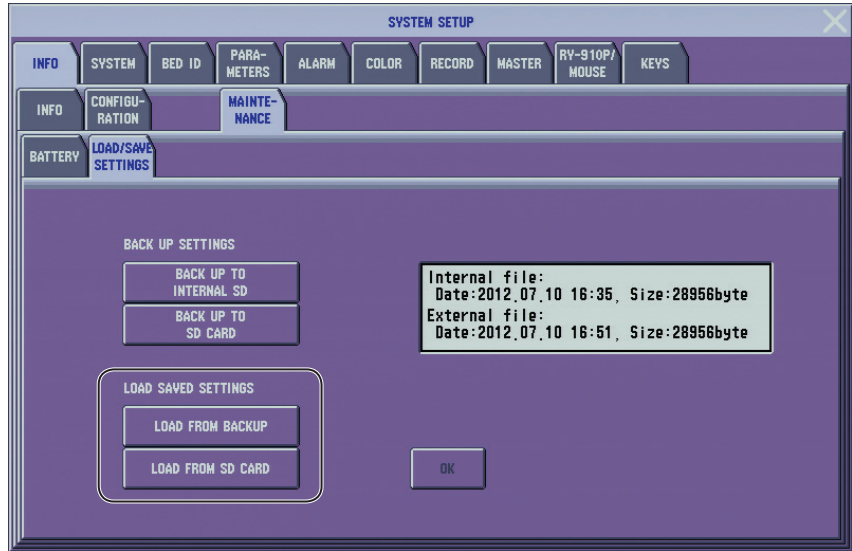


1. GENERAL

- 5. Select LOAD FROM BACKUP or LOAD FROM SD CARD in <LOAD SAVED SETTINGS>.

When LOAD FROM BACKUP is selected, settings are loaded from the internal SD card.

When LOAD FROM SD CARD is selected, settings are loaded from an optional SD card inserted into the slot.



**CAUTION**

Do not turn off the power or remove the SD card while data is being loaded.

## System Initialization

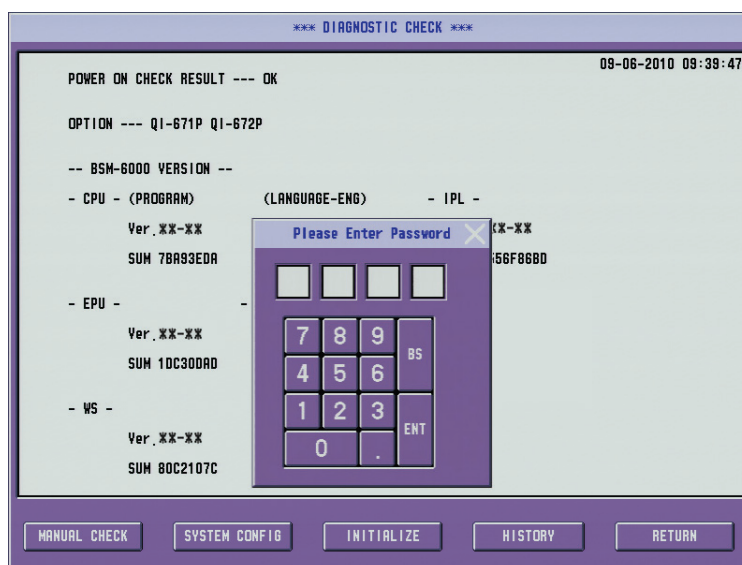
There are three modes of system initialization for the monitor.

- General
- Administrator
- Factory

1. Start the monitor by pressing the [Power] switch while holding the [Silence Alarms] key.
2. When the DIAGNOSTIC CHECK screen appears, touch INITIALIZE.



3. When a window to enter a password as shown below appears, enter a four-digit password.



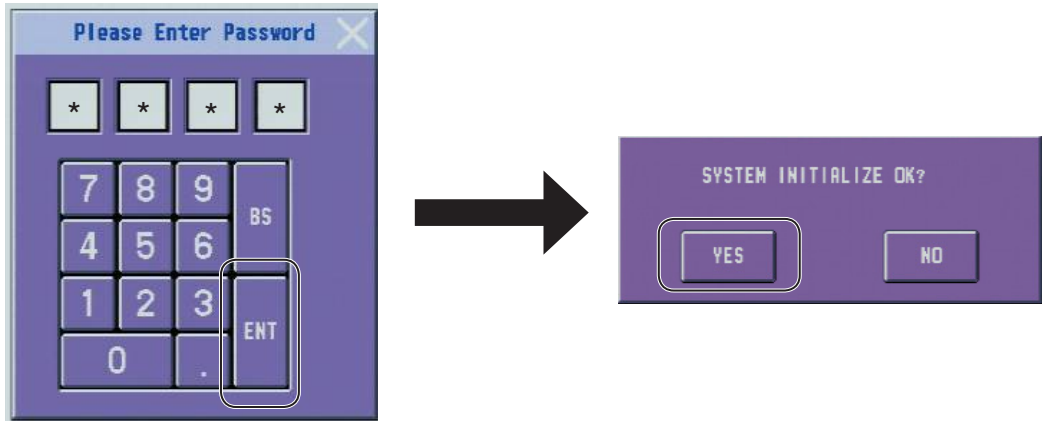
The system initialization mode is determined by the password entered here.

- For the general mode  
Enter the password (“1234” by default).
- For the administrator or factory mode  
Enter the current time as the password (for example, if the current time is 10:46, enter “1046”).

1. GENERAL

4. Touch ENT.

The “SYSTEM INITIALIZE OK?” message is displayed to confirm execution of the system initialization. Touch YES.



To engage the factory mode, enter the current time as the password and touch YES while holding the [Silence Alarms] key.

Data Types to be Initialized

The data types to be initialized differ depending on the initialization mode. Check details in the table below.

System Initialization Modes	Settings	Review Data	Patient Information	Network Settings	Interbed Settings	Passwords	Error History
General	Initialized	Initialized	Initialized	Retained	Initialized	Retained	Retained
Administrator	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized	Retained
Factory	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized	Initialized

**NOTE**

When the factory mode is executed, the error history is initialized. When the error history is not to be initialized, execute administrator mode.

## Upgrading the System Software and Changing the Language on the Screen

### CAUTION

Upgrading the system software and changing the language on screen erases all system and monitoring settings. Write down these settings so they can be re-entered after the software upgrade.

The monitor uses a program card for upgrading its system software and changing the screen language. When the monitor detects that a program card is inserted into its SD card slot during the booting stage after it is turned on, it checks the program card for a system program or language. If the program card contains a newer version of the system program or language, the monitor automatically replaces its current system program or language information with the new one. If the program card contains a system program whose version number is the same or older than the one in the monitor, you have the option to replace or keep the current system program. If the program card does not contain a system program, the monitor continues the boot-up process.

In the system software upgrading or language changing process, the monitor first deletes the old system software or language stored in its system ROM. Then it checks whether the data in the system ROM is completely deleted. When the data is completely deleted, it copies the new version of the system program or language information from the program card to the system ROM and then checks the copy process. After the data is successfully copied, it performs the self-check programs to check the monitor.

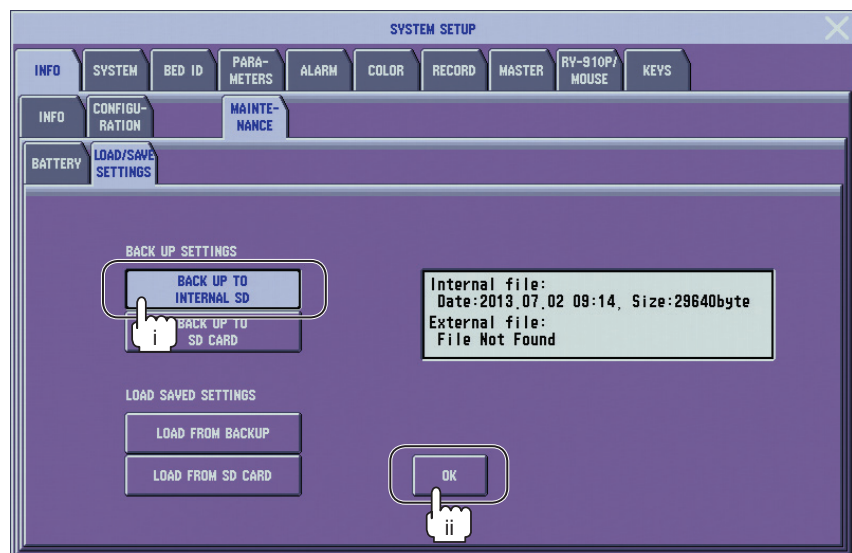
### Procedure

1. Write down the system setup settings and monitoring settings of the monitor.
2. Insert the program card into the SD card slot on the right side panel of the monitor.
3. Turn on the monitor. The monitor performs the upgrading process and self-check programs. The DIAGNOSTIC CHECK screen appears.
4. Confirm that the new system software version number appears.

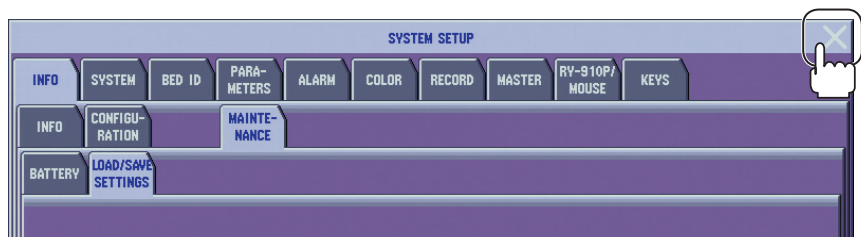
## Backing Up Settings (System Setup)

The current system setup data can be backed up to the SD card built in the monitor main unit before execution of an upgrade.

1. Display the SYSTEM SETUP window.  
For procedures of displaying the SYSTEM SETUP window, refer to the “Saving/Loading Settings” section.
2. Display the LOAD/SAVE SETTINGS.  
Touch the INFO → MAINTENANCE → LOAD/SAVE SETTINGS tab.
3. Back up the current settings.
  - i) Touch BACK UP TO INTERNAL SD in <BACK UP SETTINGS>.
  - ii) Touch OK to back up the settings.



4. Close the SYSTEM SETUP window by touching .



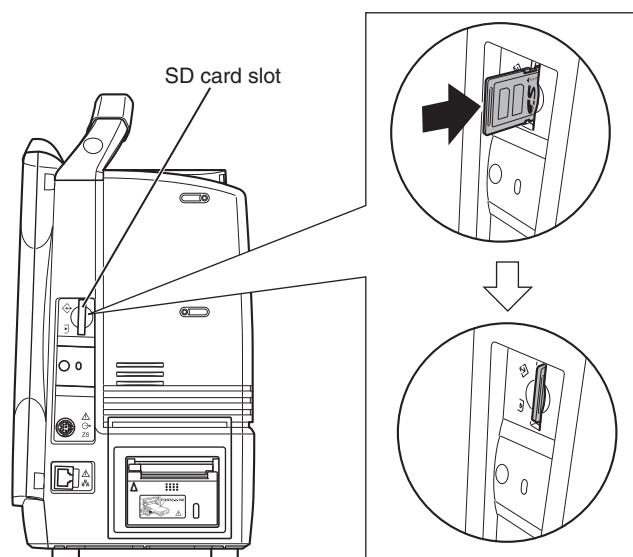
## Upgrade Procedures

1

### NOTE

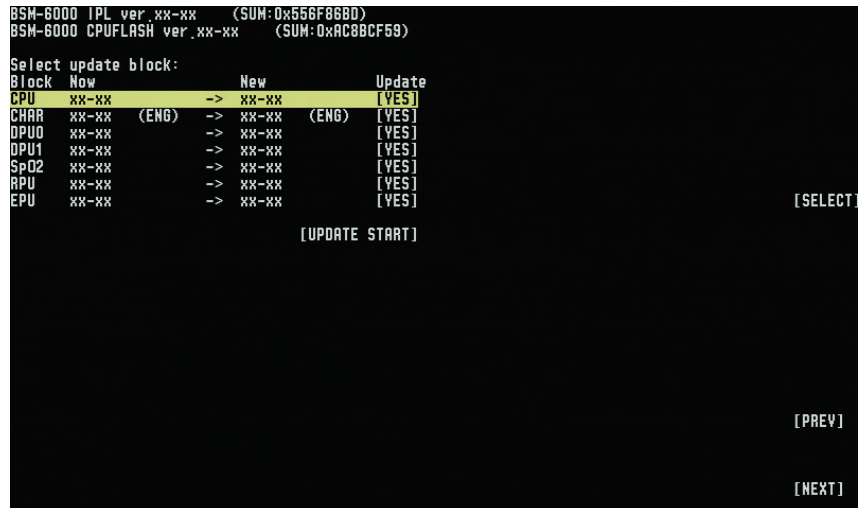
- Upgrade cannot be performed on battery power. Perform the upgrade on AC power.
- Upgrading deletes the review data.

1. Turn off the power to the monitor if it is in the power-on status.
2. Connect an input unit to the monitor to simultaneously upgrade the input unit.
3. Insert the program card into the SD card slot on the right panel of the monitor as shown below.

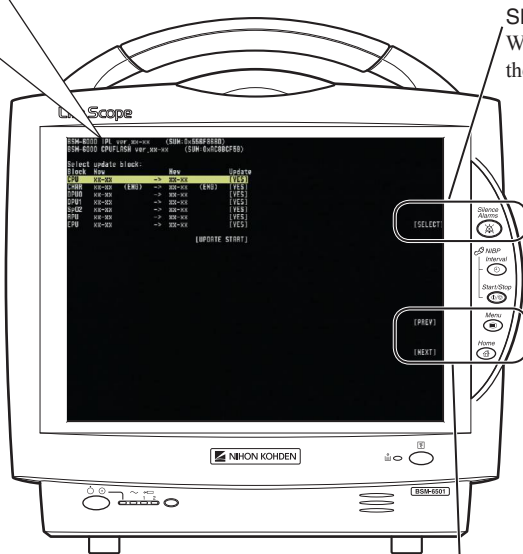
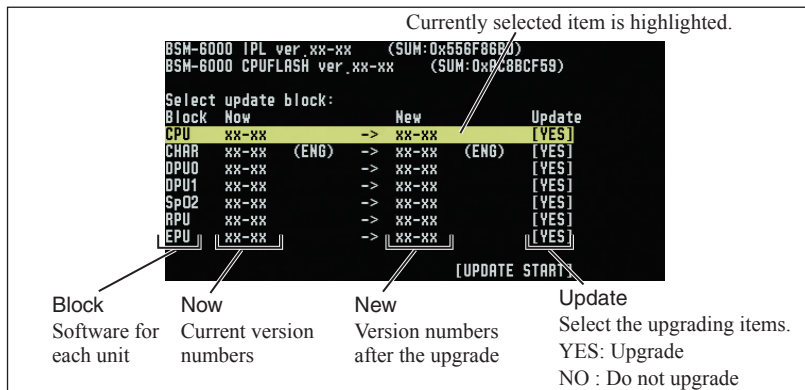




- Turn on the power by pressing the [Power] switch on the front panel of the monitor. The screen for upgrade is displayed.



- Select whether the upgrade is to be performed or not for each unit software. Usually set YES for all. However, if the current version and the version after upgrade is the same, there is no need to set YES.
  - Press PREV ([Menu] key) or NEXT ([Home] key) and select software.
  - Press SELECT ([Silence Alarms] key) to switch whether the upgrade is to be performed or not (YES/NO) for the currently selected software.



SELECT ([Silence Alarms] key)  
 When UPDATE START is selected, the upgrade procedure starts.

PREV ([Menu] key), NEXT ([Home] key)  
 Press each key to select the item.  
 (software for each unit and UPDATE START)

## 6. Execute upgrade.

**NOTE**

Do not turn off the power or remove the program card from the monitor main unit during the upgrade.

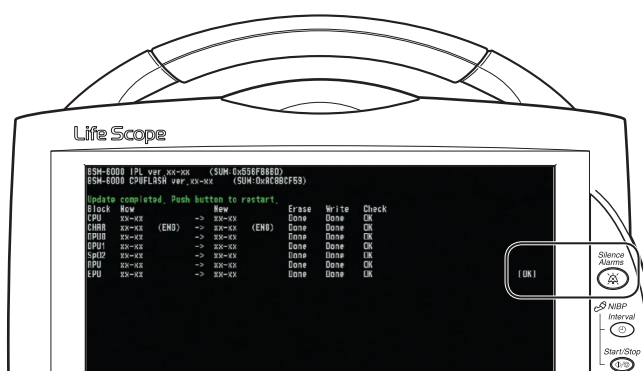
- i) Press PREV ([Menu] key) or NEXT ([Home] key) and select UPDATE START.
- ii) Press SELECT ([Silence Alarms] key) to start the upgrade procedure. While the upgrade is being processed, a “Now updating. Never turn off power.” message is displayed.

```
BSM-6000 IPL ver.xx-xx (SUM:0x556F868D)
BSM-6000 CPUFLASH ver.xx-xx (SUM:0x4C8BCF59)
Now updating. Never turn off power.
Block Now New Erase Write Check
CPU xx-xx -> xx-xx 21%
CHAR xx-xx (ENG) -> xx-xx (ENG)
DPU0 xx-xx -> xx-xx
DPU1 xx-xx -> xx-xx
SP02 xx-xx -> xx-xx
RPU xx-xx -> xx-xx
EPU xx-xx -> xx-xx
```

- iii) During the upgrade an “Update completed. Push button to restart.” message is displayed.

```
BSM-6000 IPL ver.xx-xx (SUM:0x556F868D)
BSM-6000 CPUFLASH ver.xx-xx (SUM:0x4C8BCF59)
Update completed. Push button to restart.
Block Now New Erase Write Check
CPU xx-xx -> xx-xx Done Done OK
CHAR xx-xx (ENG) -> xx-xx (ENG) Done Done OK
DPU0 xx-xx -> xx-xx Done Done OK
DPU1 xx-xx -> xx-xx Done Done OK
SP02 xx-xx -> xx-xx Done Done OK
RPU xx-xx -> xx-xx Done Done OK
EPU xx-xx -> xx-xx Done Done OK [OK]
```

- iv) Press OK ([Silence Alarms] key). The monitor main unit restarts and the DIAGNOSTIC CHECK screen is displayed.

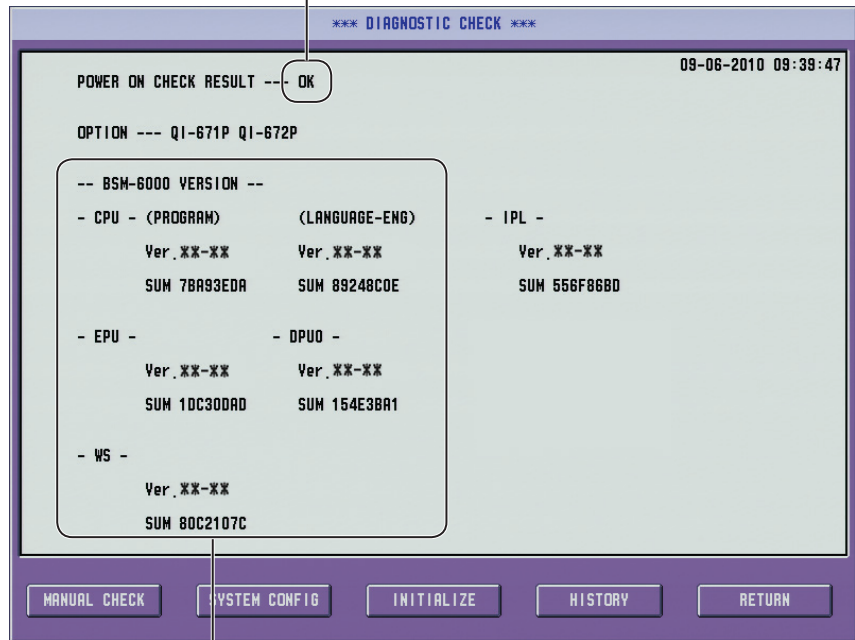
**NOTE**

If a “\*\*\* block update error” error message is displayed after the upgrade process is completed, display the DIAGNOSTIC CHECK screen and turn off the power of the monitor, and then do steps 4 through 6 again.

7. Check the versions.

In the DIAGNOSTIC CHECK screen, check that <POWER ON CHECK RESULT> is OK and the software versions other than <- IPL -> have been changed to the new versions.

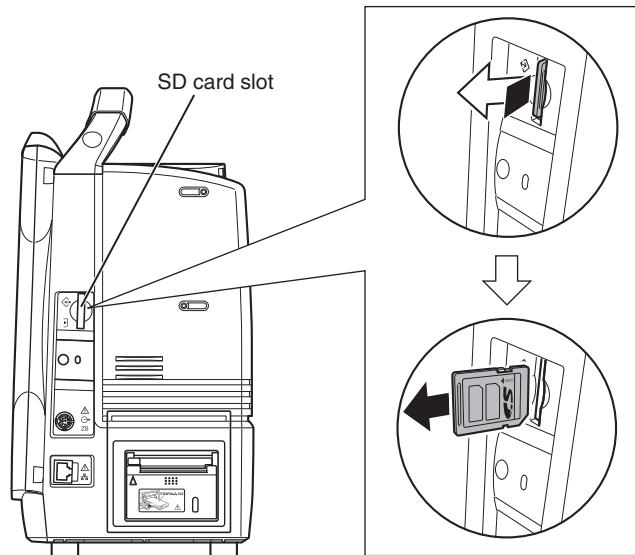
Check that OK is shown.



Check that the software versions other than <- IPL -> have been changed to the new versions.

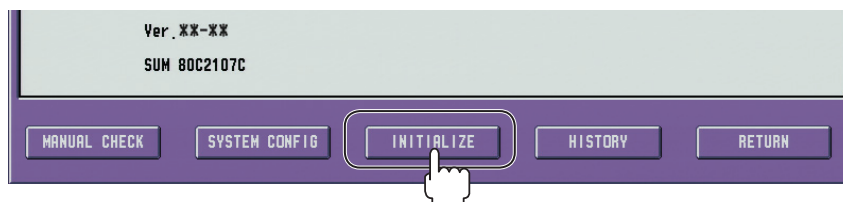
8. Remove the program card from the monitor.

Push the program card to remove it from the SD card slot of the monitor.



## 9. Initialize settings.

- i) Touch INITIALIZE in the DIAGNOSTIC CHECK screen to initialize the settings of the monitor. Execute the general mode by referring to “System Initialization”.



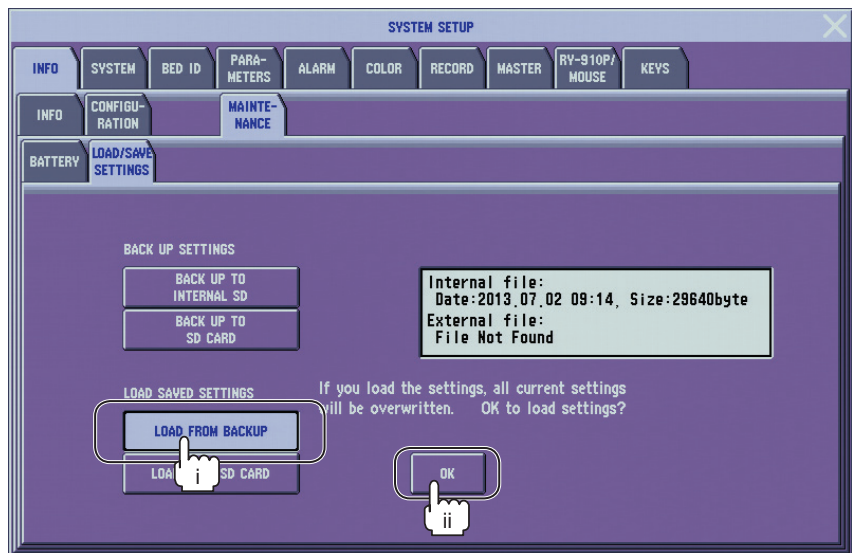
- ii) When the initialization is completed, touch RETURN in the DIAGNOSTIC CHECK screen to display the home screen.



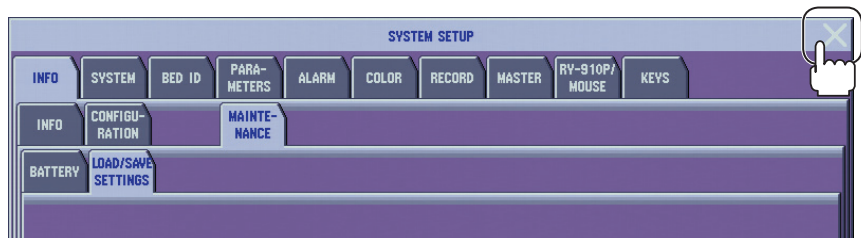
# Loading Settings (System Setup)

When the upgrade process is completed, load the system setup data that has been backed up to the SD card built in the monitor.

1. Display the SYSTEM SETUP window.  
For procedures of displaying the SYSTEM SETUP window, refer to “Saving/Loading Settings”.
2. Display the LOAD/SAVE SETTINGS.  
Touch the INFO → MAINTENANCE → LOAD/SAVE SETTINGS tab.
3. Load the backup settings.
  - i) Touch LOAD FROM BACKUP in <LOAD SAVED SETTINGS>.
  - ii) Touch OK to execute loading the settings.



4. Close the SYSTEM SETUP window by touching .



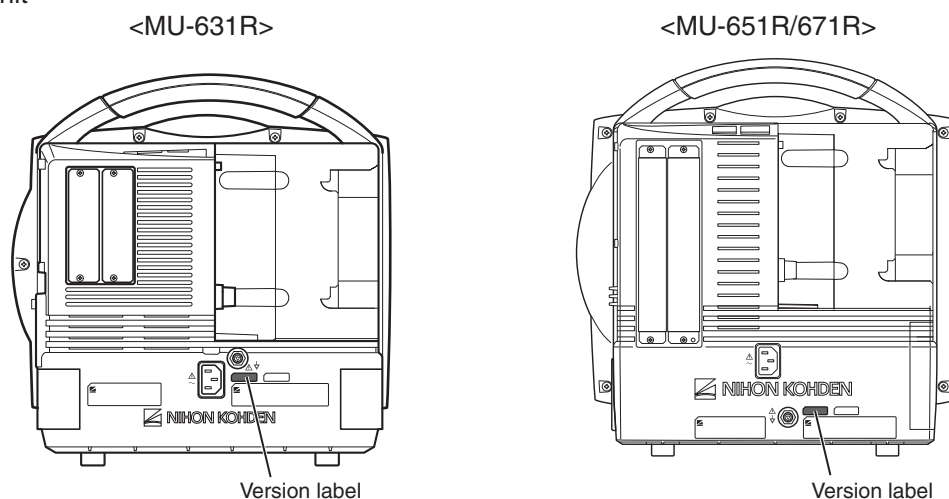
5. Turn off the power to the monitor and then turn it on to restart the monitor.

## Replacing Version Labels

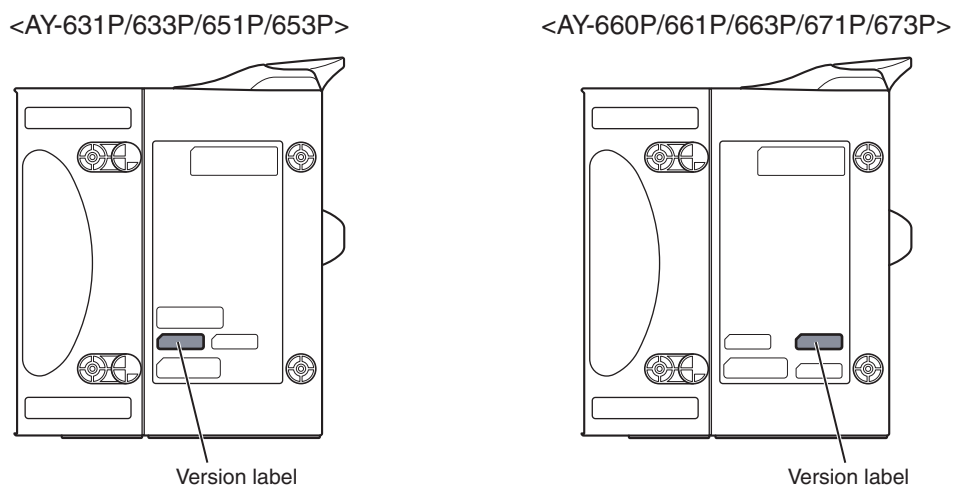
When the upgrade and load of the settings (system setup) are completed, peel off the old version label and attach the newly supplied version label (or attach the new version label over the old version label). After the label replacement is completed, send the following to your Nihon Kohden representative.

- Unused version label(s)
- List of the upgraded items

### Monitor main unit



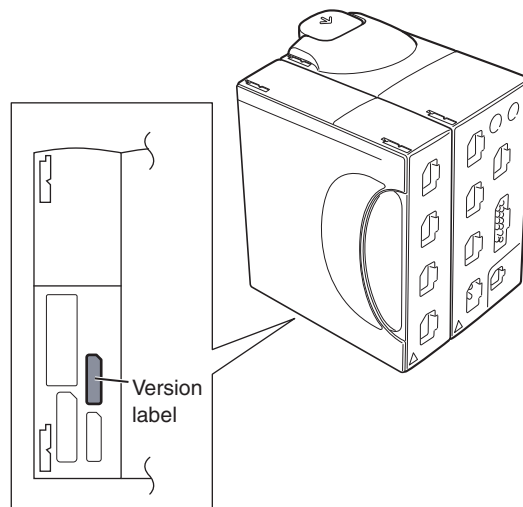
### Input unit



## 1. GENERAL

### Smart Expansion Unit

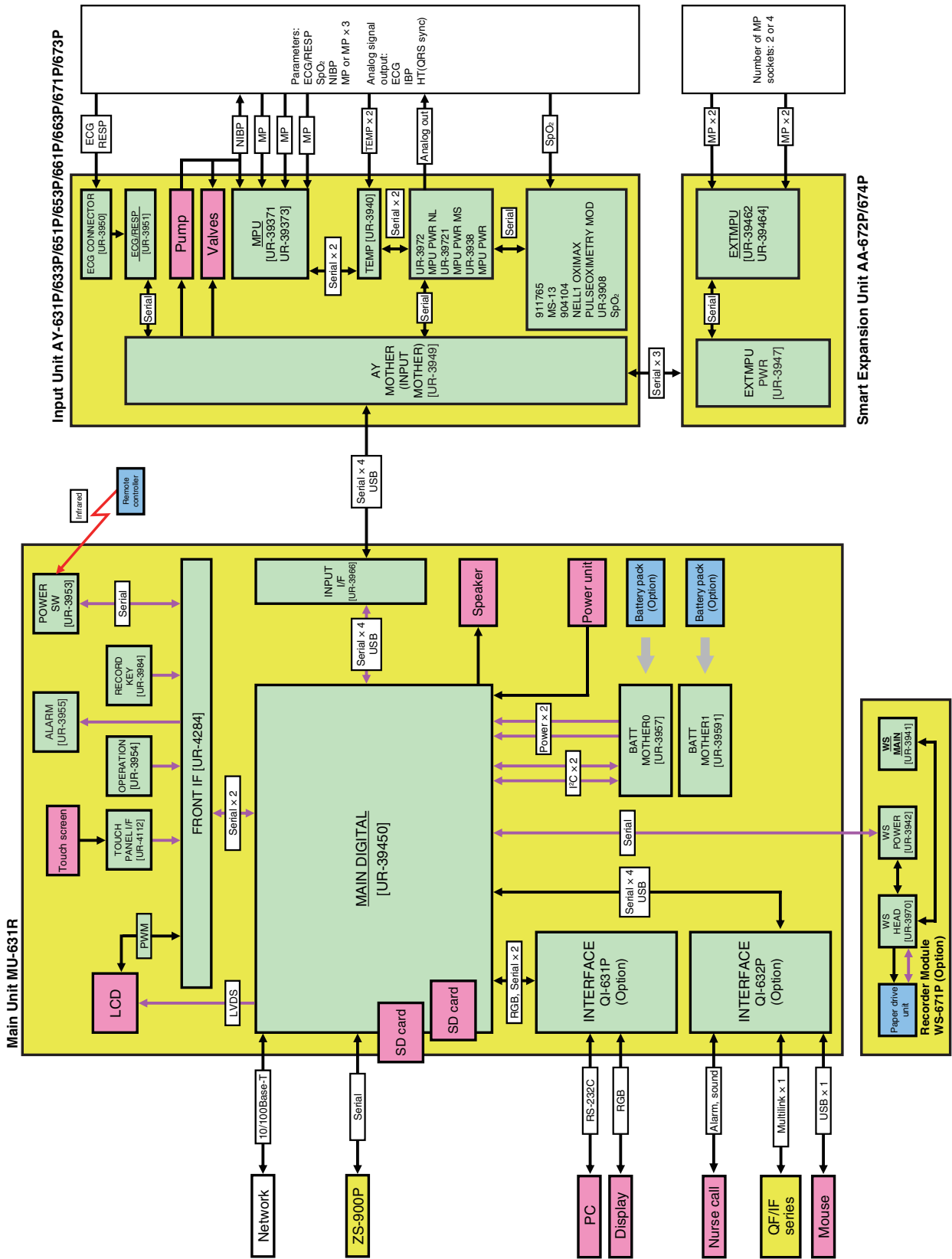
<AA-672P/674P>



One software kit can be installed into total 80 units of main unit, input unit, smart expansion unit and recorder unit. However, only one copy of the accompanying document is supplied due to delivery reasons.

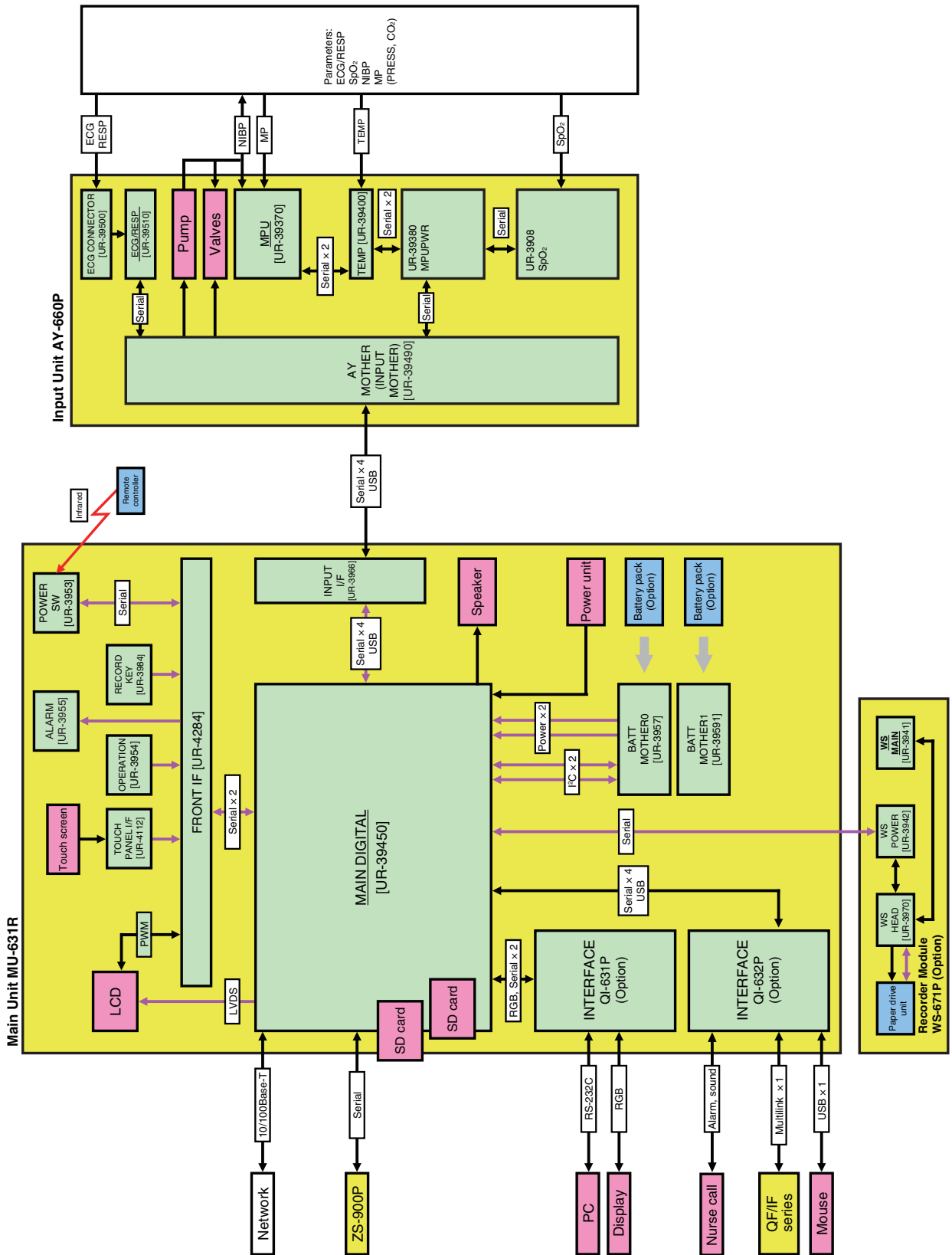
# Board/Unit Connection Diagram

## BSM-6301

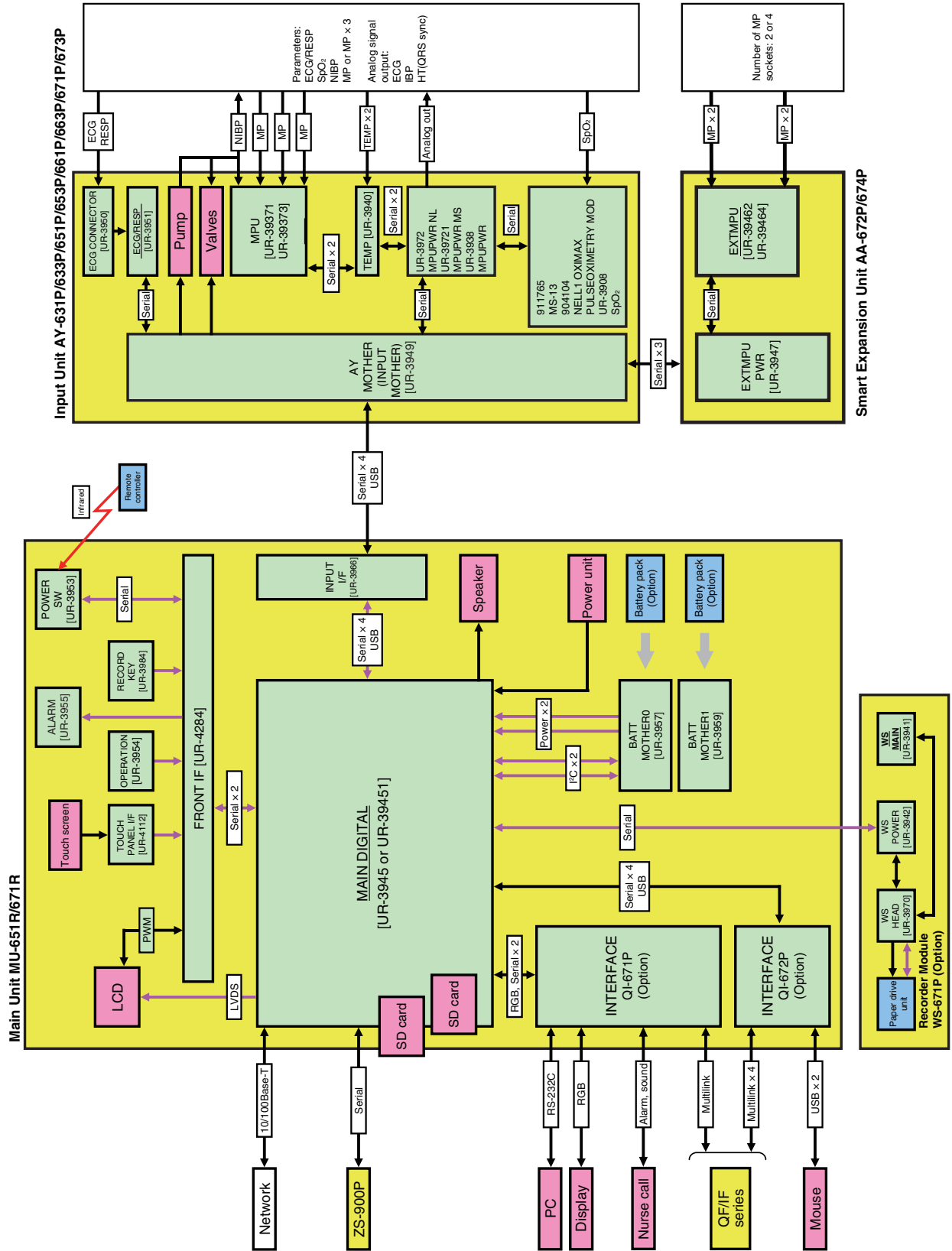




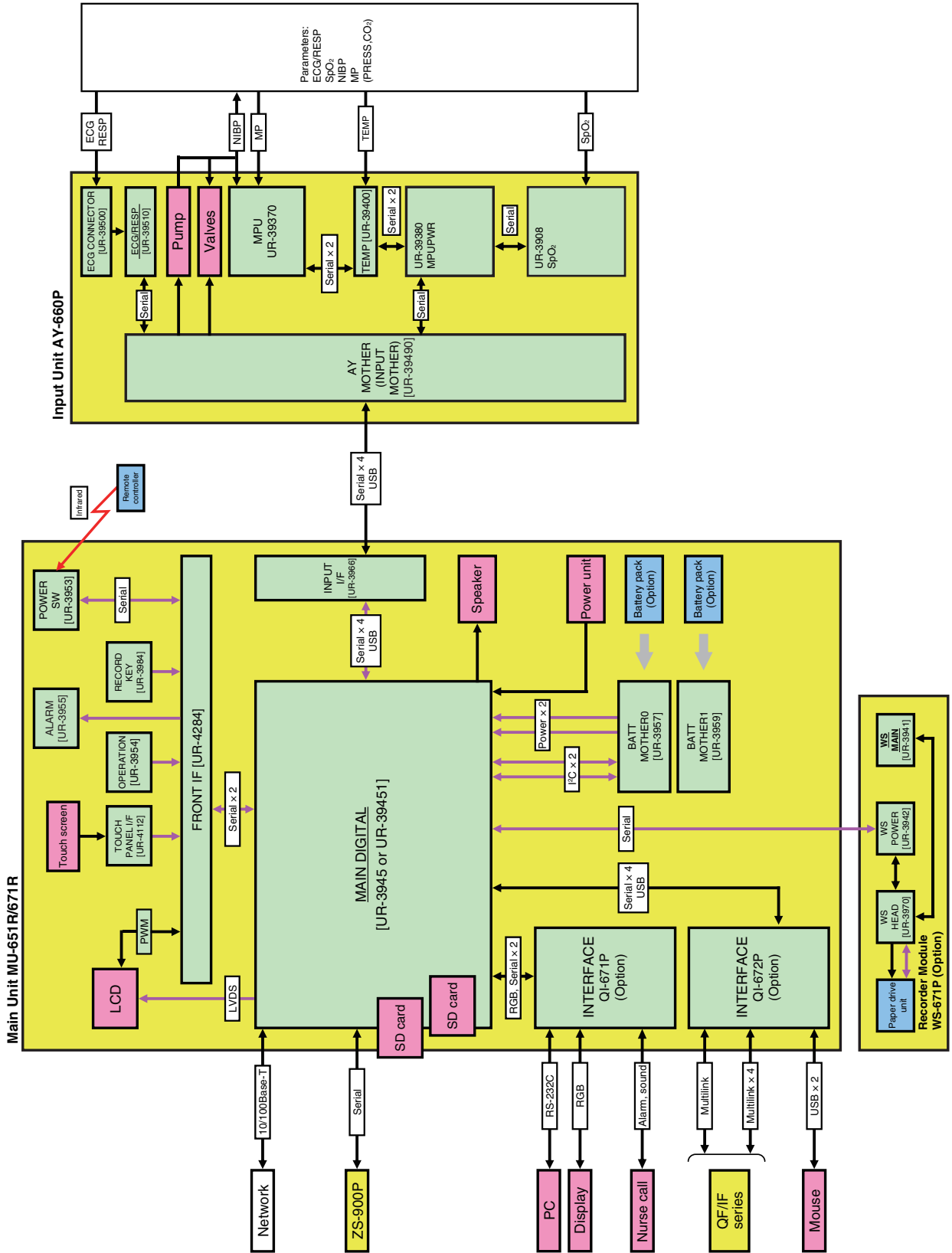
1. GENERAL



BSM-6501/BSM-6701



1. GENERAL



## Replaceable Parts/Boards/Units

Refer to Section 7 “Replaceable Parts List” for details.

### MU-631R

Model/Code No.	Description	Remark
UR-39450	MAIN DIGITAL board	—
UR-39621	Front Mother board set	This is a composite board composed of the following boards. UR-3953: Power SW board UR-3954: Operation board UR-3955: Alarm board UR-3984: Record key board
UR-4112	Touch panel I/F board	—
UR-4284	FRONT I/F board	—
UR-3966	INPUT I/F board	—
UR-3957	BATT MOTHER 0 board	—
UR-39591	BATT MOTHER1 board	—
9000-057861	Touch screen	—
9000-023485	10.4-inch TFT LCD display	—
SC-631R	Power unit with heat sink chassis block	—
916858	Power unit	—
718395	AC inlet	—
718439	Speaker	—
481809	Lithium battery	—
9000-057839	SD card 1 GB	—

1. GENERAL

**MU-651R**

Model/Code No.	Description	Remark
UR-3945	MAIN DIGITAL board	—
UR-39621	Front Mother board set	This is a composite board composed of the following boards. UR-3953: Power SW board UR-3954: Operation board UR-3955: Alarm board UR-3984: Record key board
UR-4112	Touch panel I/F board	—
UR-4284	FRONT I/F board	—
UR-3966	INPUT I/F board	—
UR-3957	BATT MOTHER 0 board	—
UR-3959	BATT MOTHER1 board	—
9000-057862	Touch screen	—
930655	12.1-inch TFT LCD display	—
SC-671R	Power unit with heat sink chassis block	—
916867B	Power unit	—
718395	AC inlet	—
718439	Speaker	—
481809	Lithium battery	—
9000-057839	SD card 1 GB	—

**MU-671R**

Model/Code No.	Description	Remark
UR-3945	MAIN DIGITAL board	—
UR-39621	Front Mother board set	This is a composite board composed of the following boards. UR-3953: Power SW board UR-3954: Operation board UR-3955: Alarm board UR-3984: Record key board
UR-4112	Touch panel I/F board	—
UR-4284	FRONT I/F board	—
UR-3966	INPUT I/F board	—
UR-3957	BATT MOTHER 0 board	—
UR-3959	BATT MOTHER1 board	—
9000-057863*	Touch screen	—
9000-056672	15-inch TFT LCD display	—
SC-671R	Power unit with heat sink chassis block	—
916867B	Power unit	—
718395	AC inlet	—
718439	Speaker	—
481809	Lithium battery	—
9000-057839	SD card 1 GB	—

**WS-671P**

Model/Code No.	Description	Remark
UR-3941	WS-MAIN board	—
UR-3942	WS-power board	—
UR-3970	WS-head board	—
RG-501X	Paper drive unit	—
YS-086P9	Magazine door assy	—
662311	Thermal head	—
6114-908494	Head pressure plate	—

**QI-671P**

Model	Description	Remark
QI-671P	Interface	Board inside QI-671P is not available.

**QI-672P**

Model	Description	Remark
QI-672P	Interface	Board inside QI-672P is not available.

**QI-631P**

Model	Description	Remark
QI-631P	Interface	Board inside QI-631P is not available.

**QI-632P**

Model	Description	Remark
QI-632P	Interface	Board inside QI-632P is not available.

**QI-634P**

Model	Description	Remark
QI-634P	Interface	Board inside QI-634P is not available.

**QI-670P**

Model	Description	Remark
UR-4294	BT module	—

1. GENERAL

**AY-631P**

Model/Code No.	Description	Remark
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-39721	MPUPWR board	—
UR-3940	TEMP board	—
SG-671P	NIBP unit	—
UR-39371	MPU board	Included in SG-671P
923119	Solenoid valve	Included in SG-671P
532149	NIBP pump	Included in SG-671P
9000-058392	SpO <sub>2</sub> unit by MASIMO Corporation	—

**AY-633P**

Model/Code No.	Description	Remark
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-39721	MPUPWR board	—
UR-3940	TEMP board	—
SG-673P	NIBP unit	—
UR-39373	MPU board	Included in SG-673P
923119	Solenoid valve	Included in SG-673P
532149	NIBP pump	Included in SG-673P
9000-058392	SpO <sub>2</sub> unit by MASIMO Corporation	—

**AY-651P**

Model/Code No.	Description	Remark
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3972	MPUPWR board	—
UR-3940	TEMP board	—
SG-671P	NIBP unit	—
UR-39371	MPU board	Included in SG-671P
923119	Solenoid valve	Included in SG-671P
532149	NIBP pump	Included in SG-671P
9000-046424	SpO <sub>2</sub> unit by NELLCOR	—

**AY-653P**

Model/Code No.	Description	Remark
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3972	MPUPWR board	—
UR-3940	TEMP board	—
SG-673P	NIBP unit	—
UR-39373	MPU board	Included in SG-673P
923119	Solenoid valve	Included in SG-673P
532149	NIBP pump	Included in SG-673P
9000-046424	SpO <sub>2</sub> unit by NELLCOR	—

**AY-660P**

Model/Code No.	Description	Remark
UR-39490	AY MOTHER (INPUT MOTHER) board	—
UR-39500	ECG connector board	—
UR-39510	ECG RESP board	—
UR-39380	MPUPWR board	—
UR-39400	TEMP board	—
SG-670P	NIBP unit	—
UR-39370	MPU board	Included in SG-670P
923119	Solenoid valve	Included in SG-670P
532149	NIBP pump	Included in SG-670P
UR-3908	SpO <sub>2</sub> board	—

**AY-661P**

Model/Code No.	Description	Remark
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3938	MPUPWR board	—
UR-3940	TEMP board	—
SG-671P	NIBP unit	—
UR-39371	MPU board	Included in SG-671P
923119	Solenoid valve	Included in SG-671P
532149	NIBP pump	Included in SG-671P
UR-3908	SpO <sub>2</sub> board	—



1. GENERAL

**AY-663P**

Model/Code No.	Description	Remark
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3938	MPUPWR board	—
UR-3940	TEMP board	—
SG-673P	NIBP unit	—
UR-39373	MPU board	Included in SG-673P
923119	Solenoid valve	Included in SG-673P
532149	NIBP pump	Included in SG-673P
UR-3908	SpO <sub>2</sub> board	—

**AY-671P**

Model/Code No.	Description	Remark
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3938	MPUPWR board	—
UR-3940	TEMP board	—
SG-671P	NIBP unit	—
UR-39371	MPU board	Included in SG-671P
923119	Solenoid valve	Included in SG-671P
532149	NIBP pump	Included in SG-671P
UR-3908	SpO <sub>2</sub> board	—

**AY-673P**

Model/Code No.	Description	Remark
UR-3949	AY MOTHER (INPUT MOTHER) board	—
UR-3950	ECG connector board	—
UR-3951	ECG RESP board	—
UR-3938	MPUPWR board	—
UR-3940	TEMP board	—
SG-673P	NIBP unit	—
UR-39373	MPU board	Included in SG-673P
923119	Solenoid valve	Included in SG-673P
532149	NIBP pump	Included in SG-673P
UR-3908	SpO <sub>2</sub> board	—

**AA-672P**

Model	Description	Remark
UR-39462	EXTMPU board	—
UR-3947	EXTMPU PWR board	—

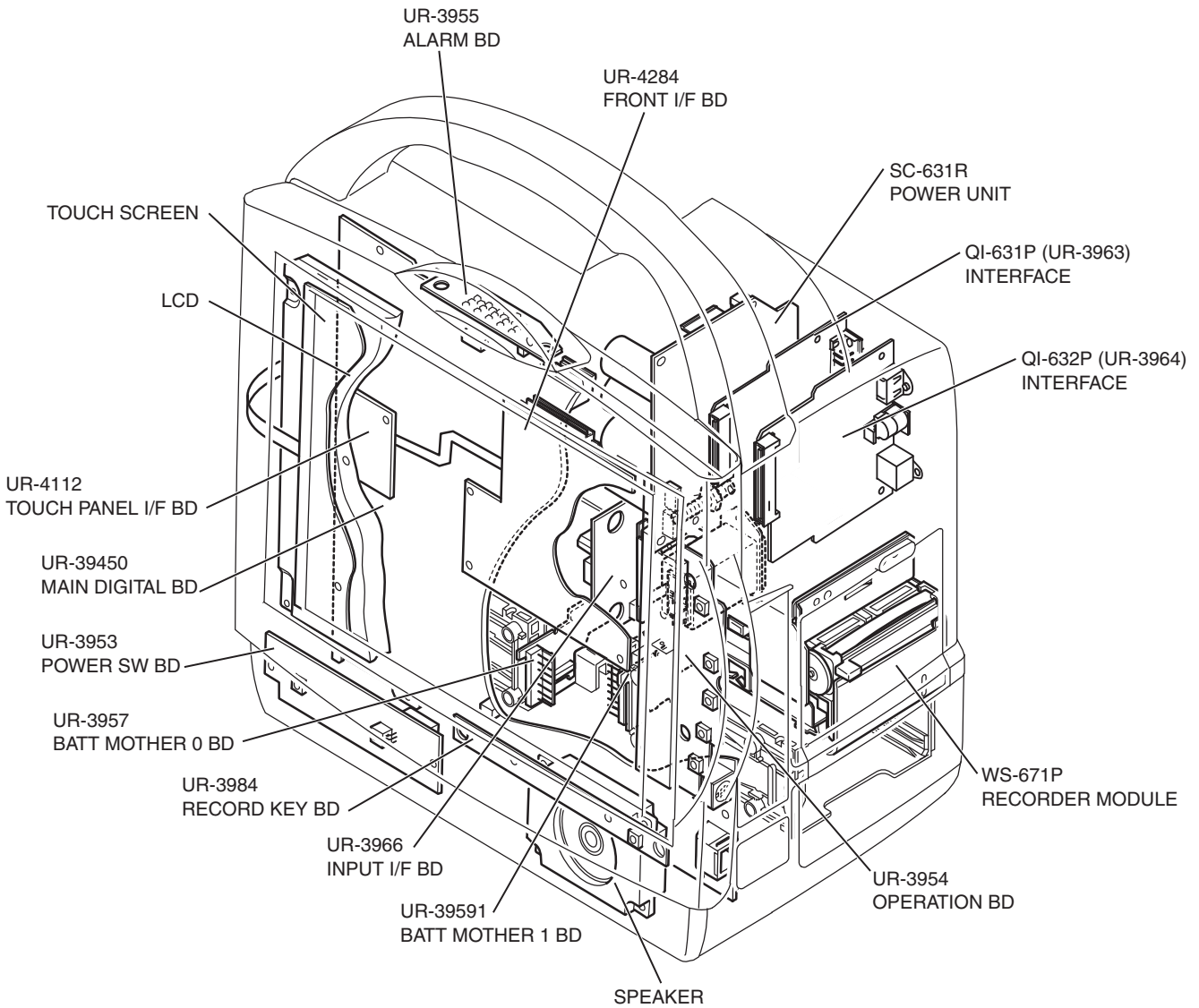
**AA-674P**

1

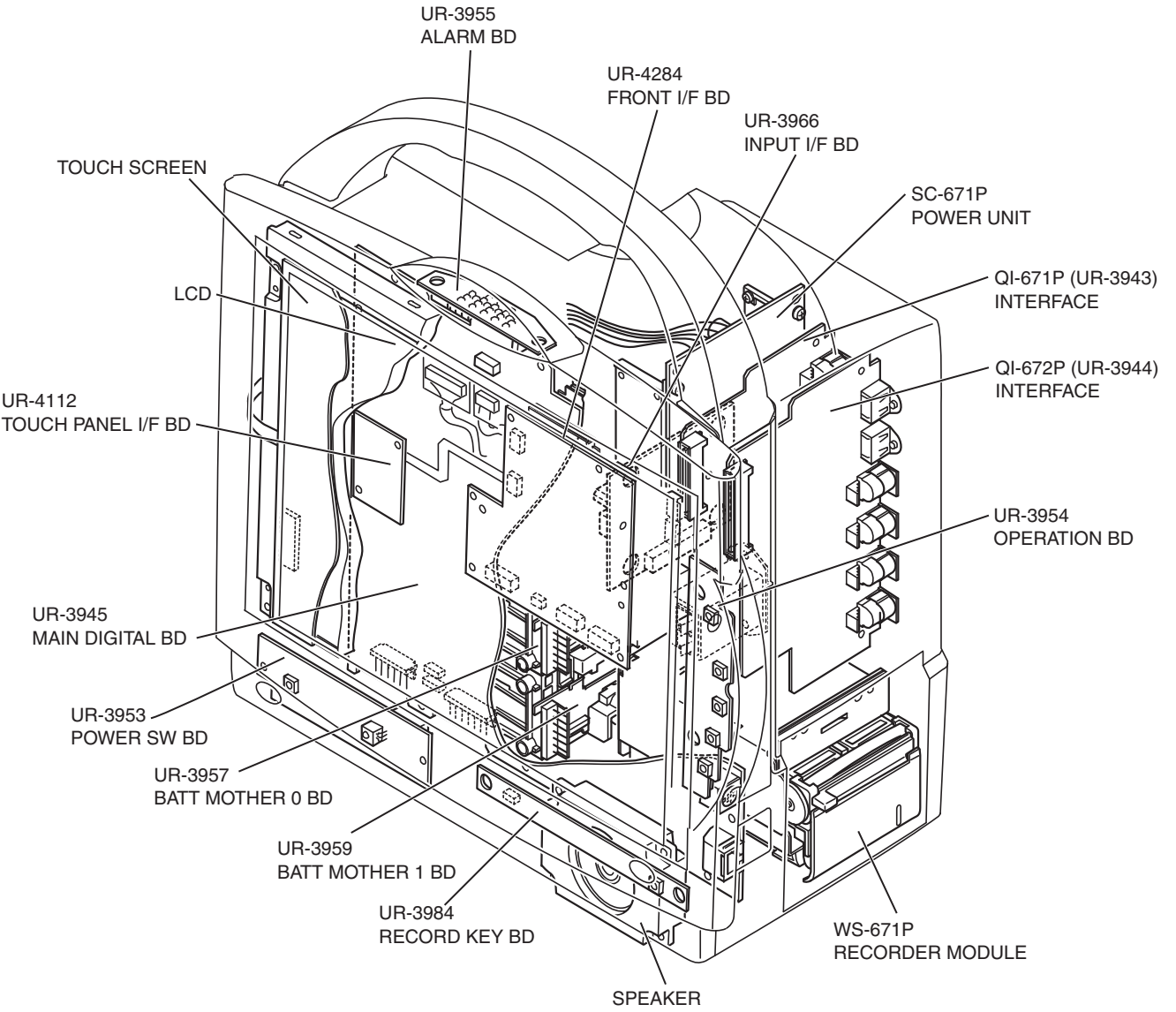
<b>Model</b>	<b>Description</b>	<b>Remark</b>
UR-39464	EXTMPU board	—
UR-3947	EXTMPU PWR board	—

# Board/Unit Layout

## MU-631R

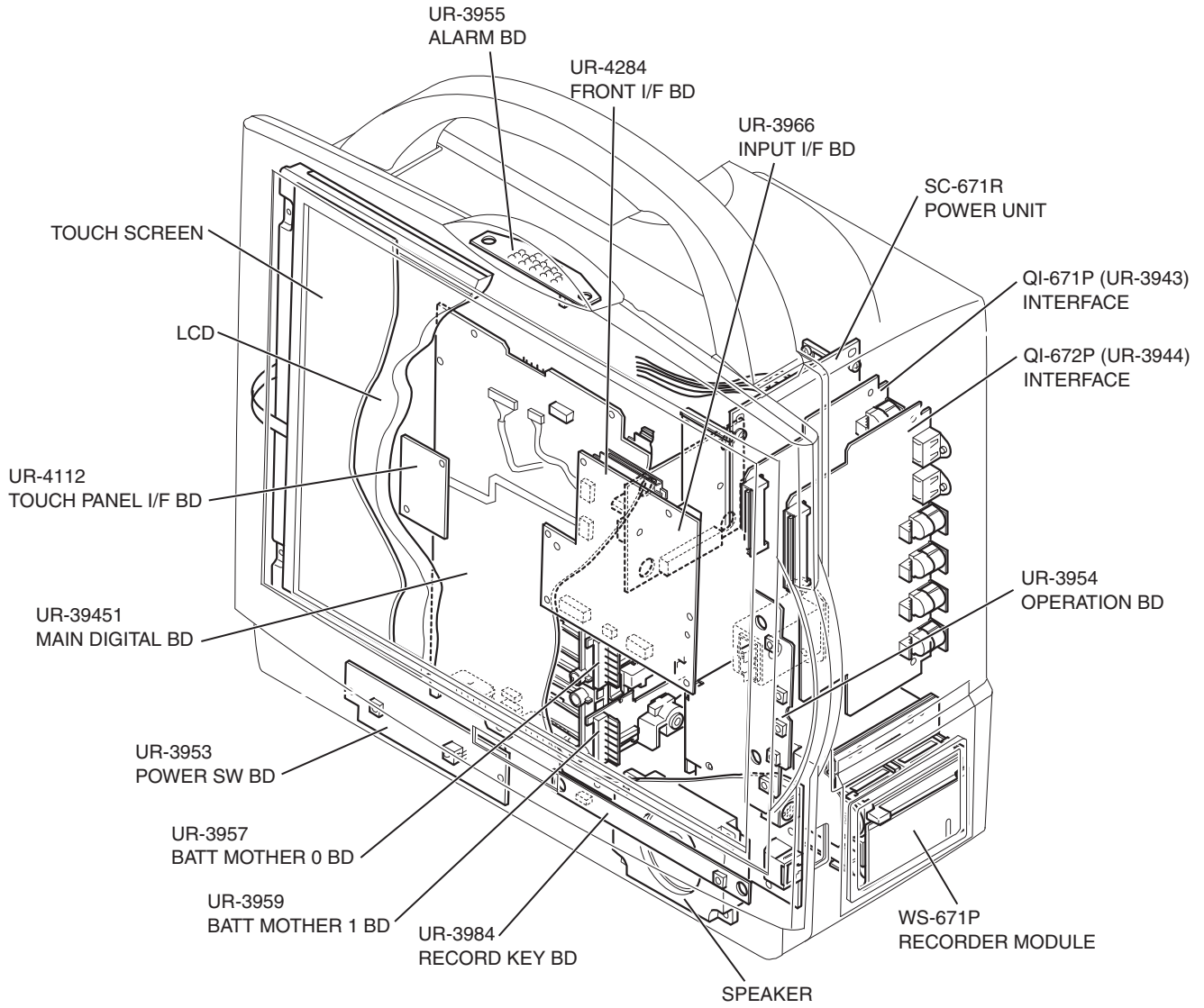


MU-651R

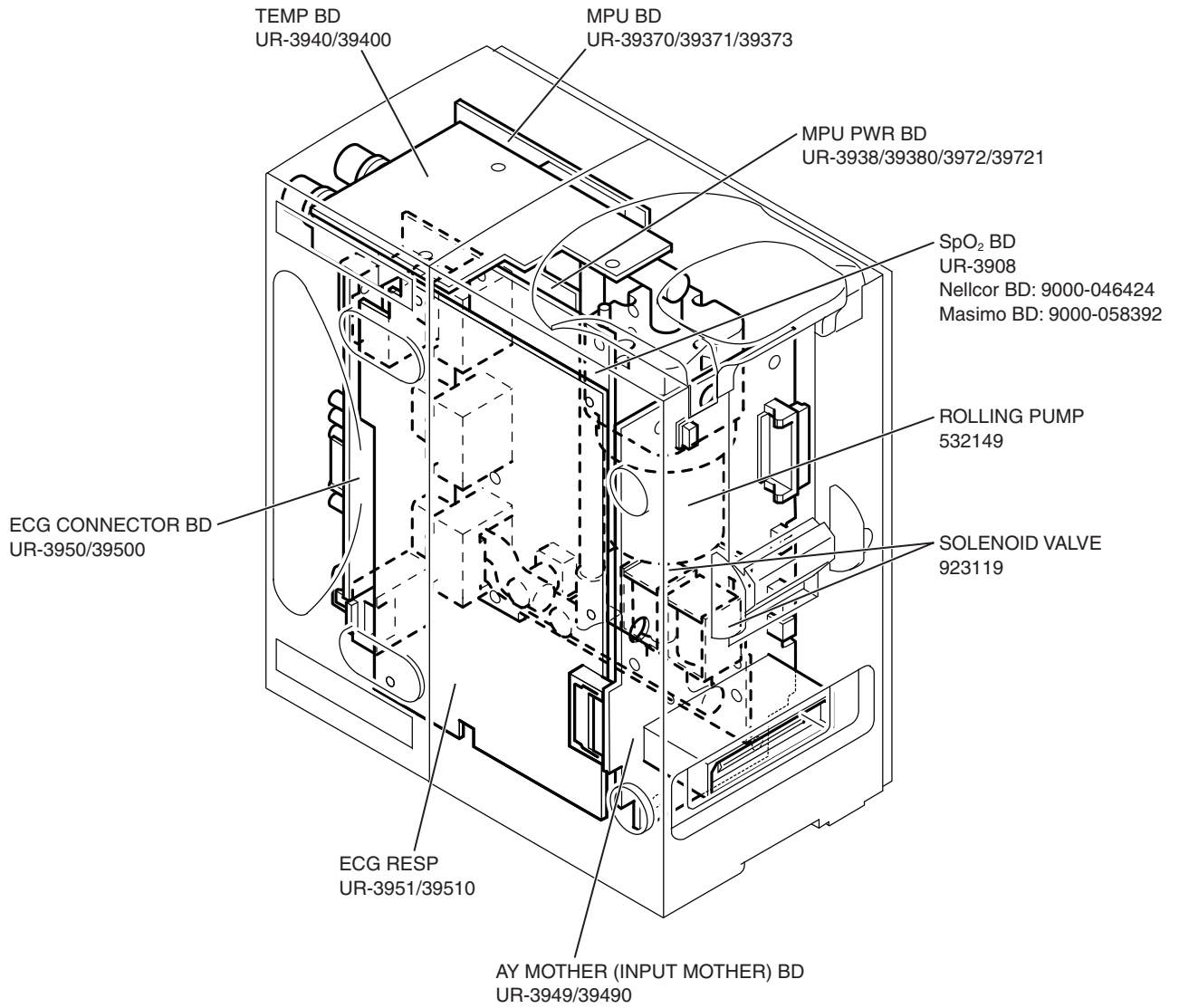


1. GENERAL

**MU-671R**



AY-631P/633P/651P/653P/660P/661P/663P/671P/673P



# Section 2 Troubleshooting

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### General

Use the screen messages and troubleshooting tables to locate, identify, and solve a problem in the monitor.

You can also view the error code and history on the HISTORY screen of the DIAGNOSTIC CHECK screen. The error code list is listed at the end of this section.

#### **NOTE**

When contacting your Nihon Kohden representative for technical support, please provide detailed information on the problem. This will allow your Nihon Kohden representative to provide you with the best support.

#### **How to Troubleshoot**

1. Refer to the screen messages table.
2. Determine which troubleshooting table to use.
3. In the “Problem” column, find the trouble item that matches the problem.
4. Do the action recommended in the “Action” column.
5. If the problem is not solved, do the action for the next possible cause or criteria.
6. If you cannot solve the problem using this troubleshooting information, contact your Nihon Kohden representative.



## Screen Messages

The messages are listed in alphabetical order. Each message is followed by the corresponding cause and countermeasure.

An item with an asterisk (\*) in the left column is an alarm.

An item with a dagger (†) in the left column is an alarm which is displayed when <AVAILABLE ALARM TYPES> on the ALARM – DISPLAY/SOUND page of the SYSTEM SETUP window is set to ALL. Refer to Section 3 of the Administrator's Guide.

Screen Message	Parameter	Possible Cause/Criteria	Action
* --- ALARM	All parameters	Alarm concerning the --- (parameter name) occurred.	Take appropriate action depending on the alarm level. (Displaying the home screen may display the alarm in detail.)
- Bed name INTERBED ALARM	All parameters	Alarm occurred on an interbed bed of the bed name.	Check the data of the alarmed bed on the INTERBED window and remove the cause.
- ACQUIRING PWTT DATA	NIBP	Started acquiring data for PWTT measurement.	Monitor ECG and SpO <sub>2</sub> and wait until the PWTT mark is displayed on the screen (about one minute).
- ALARM SILENCED	All parameters	The [Silence Alarms] key was pressed to silence the alarm.	<ul style="list-style-type: none"> <li>When the alarm cause is resolved, the alarm is cleared.</li> <li>When the [Silence Alarms] key is pressed during alarm silence, all alarms are resumed.</li> </ul>
- ALARMS SUSPENDED	All parameters	The [Silence Alarms] key was pressed before alarm occurrence.	To cancel alarm suspension, press the [Silence Alarms] key again.
- ALARMS SUSPENDED – min	All parameters	The SUSPEND MONITORING key was touched. The SUSPEND ALARMS key was touched.	All alarms resume when the SUSPEND MONITORING or SUSPEND ALARMS key is touched again during alarm suspension.
- ALL ALARMS OFF	All parameters	The BYPASS key or ALL ALARMS OFF key is touched to suspend alarm function.	To resume alarm function, touch the BYPASS or ALL ALARMS OFF key.
- ARRHYTHMIA ANALYSIS OFF	ECG	<ARRHYTHMIA ANALYSIS> on the SYSTEM SETUP window is set to OFF.	If arrhythmia analysis is necessary, set <ARRHYTHMIA ANALYSIS> on the SYSTEM SETUP window to ON.
* BATTERY ERROR	System	Battery problems.	Contact your Nihon Kohden representative.
* BATTERY WEAK	System	Remaining battery is less than 25%.	Switch to AC power and charge the battery pack.
* BIS CHECK EXTERNAL DEVICE	BIS (BIS monitor)	The BIS monitor is disconnected from the bedside monitor.	Check the interface connection between the BIS monitor and bedside monitor.

## 2. TROUBLESHOOTING

Screen Message	Parameter	Possible Cause/Criteria	Action
* BIS CHECK SENSOR	BIS (BIS processor/ BISx)	The BIS sensor is detached from the patient.	Attach the BIS sensor to the patient properly.
		The BIS sensor is disconnected from the PIC Plus patient interface cable.	Connect the BIS sensor to the PIC Plus patient interface cable properly.
		The PIC Plus patient interface cable is disconnected from the BIS processor.	Connect the PIC Plus patient interface cable to the BIS processor properly.
		The impedance between the BIS sensor and skin is too high.	Check the BIS sensor attachment and remove the cause. If necessary, replace it with a new one. Use only the specified BIS sensor.
* BIS CONNECTOR OFF	BIS (BIS processor/ BISx)	The BIS processor is disconnected from the connection cord or the connection cord is disconnected from the monitor.	Check that the BIS processor is firmly connected to the connection cord and connection cord is firmly connected to the monitor.
- BIS HIGH IMPEDANCE	BIS (BIS processor/ BISx)	The impedance between the BIS sensor and skin is too high.	Check the BIS sensor attachment and if necessary, replace it with a new one.
- BIS CHECKING IMPEDANCE	BIS (BIS processor/ BISx)	The impedance of the BIS sensor is being checked.	Wait until the impedance check is complete.
* BIS MODULE FAILURE	BIS (BIS processor/ BISx)	Faulty BIS processor.	Contact your Nihon Kohden representative.
- BIS NOISE	BIS (BIS processor/ BISx)	Noise interference.	Check the BIS sensor attachment. If necessary, replace the sensor with a new one.
* BIS SENSOR ERROR	BIS (BIS processor/ BISx)	The BIS sensor failure.	Display the BIS window and touch the RESET key after replacing the BIS sensor with a new one.
* BIS SENSOR EXPIRED	BIS (BIS processor/ BISx)	BIS sensor is past its expiration date.	Replace the BIS sensor with a new one.
- CANNOT ANALYZE‡	ECG	Noise interference for more than 30 seconds and heart rate cannot be counted and arrhythmia cannot be analyzed.	Remove noise.
* CCO ALARM	CCO CCO/SvO <sub>2</sub>	Alarm occurring on the CCO monitor.	Check the CCO monitor and remove the cause of the alarm.
* CCO CHECK EXTERNAL DEVICE	CCO	The CCO monitor is disconnected from the bedside monitor.	Check the interface connection between the CCO monitor and the bedside monitor.
- CCO CHECK PATIENT INFORMATION	CCO (APCO/IBP processor)	The patient's gender, age and/or BSA are not entered.	Enter the patient's gender, age and/or BSA.
		The patient's gender, age and/or BSA are out of range.	Check the patient's gender, age and/or BSA. Enter the patient information correctly.

‡ When <ARRHYTHMIA ANALYSIS> on the ECG window is set to ON, a "CANNOT ANALYZE" message appears instead of "ECG NOISE". If the "CANNOT ANALYZE" message is displayed for more than 30 seconds, the message changes to an alarm.

Screen Message	Parameter	Possible Cause/Criteria	Action
* CCO CHECK SENSOR	CCO (APCO/IBP processor)	The FloTrac sensor is disconnected from the APCO/IBP processor.	Connect the FloTrac sensor to the APCO/IBP processor.
		The specified FloTrac sensor is not used.	Use the specified FloTrac sensor.
		The cable or sensor is damaged.	Replace the cable or sensor with a new one.
		APCO/IBP processor internal system failure.	Contact your Nihon Kohden representative.
* CCO CHECK WAVEFORM	CCO (APCO/IBP processor)	The arterial waveform is not accurate enough for measuring CO.	Check the arterial blood pressure waveform and whether there is a critical low blood pressure or high blood pressure, noise, body movement or overdamping. Check that the FloTrac sensor pressure bag is inflated enough. Check the IBP line and the connection. Check the cable connection.
		The arterial waveform is not accurate enough for a long period.	
		The IBP line is not appropriate.	
		The arterial systolic pressure is too high or arterial diastolic pressure is too low.	
* CCO CONNECTOR OFF	CCO (APCO/IBP processor)	The APCO/IBP processor is disconnected from the monitor.	Connect the APCO/IBP processor properly. When APCO monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
		The APCO/IBP processor is damaged.	Replace the APCO/IBP processor with a new one.
* CCO MODULE FAILURE	CCO (APCO/IBP processor)	Faulty APCO/IBP processor.	Contact your Nihon Kohden representative.
- CCO UNSTABLE	CCO (APCO/IBP processor)	The arterial waveform is not accurate enough for measuring CCO.	Check the arterial blood pressure waveform and whether there is a critical low blood pressure or high blood pressure, noise, body movement or overdamping. Check that the FloTrac sensor pressure bag is inflated enough. Check the IBP line and the connection. Check the cable connection.
		The IBP line is not appropriate.	
		The arterial systolic pressure is too high or arterial diastolic pressure is too low.	
		The patient's pulse is getting low.	
- CCO ZERO IMBALANCE	CCO (APCO/IBP processor)	Zero balance is not adjusted.	Adjust zero balance.
- CCO ZERO UNSTABLE	CCO (APCO/IBP processor)	The circuit is not exposed to air during zero balance adjustment.	Expose the circuit to air and perform zero balance adjustment again.
		The pressure of zero balance is unstable.	Reconnect the circuit and perform zero balance adjustment again.
- CCO ZEROING COMPLETE	CCO (APCO/IBP processor)	Zero balance adjustment is complete.	—
* CCO SVV: HIGHLY VARIABLE PULSE RATE	SVV (APCO/IBP processor)	The pulse rate changes greatly from the arrhythmia, etc. The SVV value might not be reliable.	—
* CHECK CO <sub>2</sub> CELL	CO <sub>2</sub> (TG-950P/970P/980P)	The respiration circuit has fluid or fluid prevents measurement.	Remove fluid from the respiration circuit and fix the airway adapter to the respiration circuit in the correct direction.
		The respiration circuit has fluid and CO <sub>2</sub> cannot be measured.	
* CHECK INPUT UNIT BATTERY	System	The battery pack is not inserted correctly in the BSM-1700 series bedside monitor.	Insert the battery pack into the BSM-1700 series bedside monitor correctly.
* CLOCK IC FAILURE	System	The clock circuit is damaged.	Contact your Nihon Kohden representative.

## 2. TROUBLESHOOTING

Screen Message	Parameter	Possible Cause/Criteria	Action
– CLOSE PAPER MAGAZINE	Recording	The recorder door is open.	Push the recorder door closed until it clicks.
– CO BASELINE DRIFT	CO	Physiological change.	Increase the injectate volume or cool the injectate.
		Using a respirator.	Adjust the respiration phases.
		Injection interval is short.	Increase the injection interval.
		Noise interference from external devices.	Place external devices as far as possible from the catheter.
* CO CHECK SENSOR	CO	The catheter is not connected to the CO connection cord.	Connect the catheter to the CO connection cord properly.
		The catheter is faulty.	Replace the catheter with a new one.
		The CO connection cord is damaged.	Replace the CO connection cord with a new one.
– CO CHECK Ti TEMP♦	CO	The injectate temperature is not measured.	Measure the injectate temperature to monitor CO.
* CO CONNECTOR OFF	CO	The CO connection cord is disconnected from the monitor.	Connect the connection cord properly. When CO monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
		The CO connection cord is damaged.	Replace the CO connection cord with a new one.
– CO DETECTING BASELINE	CO	Searching for the baseline of the blood temperature.	Wait for the baseline of the blood temperature to be detected.
– CO INJECT	CO	Injectate is not injected or the monitor does not acknowledge that injectate is injected.	Inject the injectate. The monitor has not acknowledged the injection if the “MEASURING CO” message is not displayed on the CO window even when the injectate is injected. Inject the injectate again.
– CO INJECTION TIME OUT	CO	Injectate is not detected within 4 minutes after the “INJECT” message was displayed (or 30 seconds after the MANUAL key is pressed).	Touch the MANUAL key and inject the injectate within 30 seconds.
– CO MEASURING CO	CO	Measuring the CO.	Wait for the calculation to be completed.
* COMMUNICATION LOSS	System	The network cable is disconnected.	Connect the network cable properly.
		The cable or connector is faulty.	Replace the cable or connector.
		The hub or router is faulty.	Replace the hub or router.
– CONNECT INPUT UNIT	System	The input unit‡ is not connected to the main unit or data acquisition unit and the monitor is not ready for monitoring when the transport function is enabled.	Connect the input unit‡ to the main unit or data acquisition unit and authenticate the patient on the SELECT PATIENT DATA window.

♦ On BSM-6000K series bedside monitor, when <<“CHECK Ti TEMP” MESSAGE> on the OTHER PARAM window of the SYSTEM SETUP window is turned off, this message does not appear. Refer to “OTHER PARAM Page” in Section 3 of the Administrator’s Guide.

‡ The “input unit” means the AY-600P series input unit and the BSM-1700 series bedside monitor.

Screen Message	Parameter	Possible Cause/Criteria	Action
– CO OUT OF RANGE	CO	Calculated a value outside the measuring range.	If the catheter retaining condition is not appropriate, the temperature change becomes small and the CO value may be outside the measuring range. Check the catheter retaining condition and the coefficient value setting.
		The coefficient value of the injectate temperature is not specified by the catheter manufacturer.	Make sure the injectate temperature is within the range specified by the manufacturer. For example, when using an Argon Medical Devices catheter, the coefficient values for the injectate temperature between 5 and 18°C are not specified so do not use an injectate temperature between 5 and 18°C.
– CO T <sub>b</sub> TEMP ERROR	CO	The blood temperature is below 15°C or above 45°C.	—
		The catheter is faulty.	Replace the catheter with a new one.
– CO THERMODILUTION CURVE ERROR	CO	Returned to the baseline of the thermodilution curve too late.	Use the appropriate injection method.
		Possible endocardial shunt.	Check the accuracy of the measured value.
– CO T <sub>i</sub> TEMP ERROR	CO	The injectate is not cooled or the room temperature is above 27°C.	Cool the injectate or decrease the room temperature.
		The bath probe or inline sensor is faulty.	Replace the probe or sensor with a new one.
* CO <sub>2</sub> APNEA	CO <sub>2</sub>	Apnea exceeded the apnea alarm limit.	—
– CO <sub>2</sub> CAL??	CO <sub>2</sub> (Mainstream with TG-950P/970P/980P)	Zero calibration is not performed.	Perform zero calibration.
– CO <sub>2</sub> CALIBRATING	CO <sub>2</sub> (Mainstream with TG-900P/920P)	Zero calibration is being performed.	—
	CO <sub>2</sub> (Sidestream)	Calibration is being performed.	—
– CO <sub>2</sub> CAL COMPLETE	CO <sub>2</sub> (Sidestream)	Calibration is complete.	—
– CO <sub>2</sub> CAL ERROR	CO <sub>2</sub> (Sidestream)	Calibration failed.	Calibrate again. If the problem still occurs, contact your Nihon Kohden representative.
* † CO <sub>2</sub> CELL OFF	CO <sub>2</sub> (TG-970P/980P)	The airway adapter is disconnected.	Connect the airway adapter to the CO <sub>2</sub> sensor.
* CO <sub>2</sub> CHANGE ABSORBENT	CO <sub>2</sub> (Sidestream)	The CO <sub>2</sub> absorbent needs to be replaced.	Contact your Nihon Kohden representative.
* CO <sub>2</sub> CHANGE ADAPTER	CO <sub>2</sub> (Mainstream)	The CO <sub>2</sub> adapter is damaged.	Refer to the CO <sub>2</sub> sensor kit manual. If necessary, replace the adapter with a new one.
* CO <sub>2</sub> CHECK EXTERNAL DEVICE	CO <sub>2</sub> (Microcap <sup>®</sup> /MicroPod <sup>™</sup> )	The interface is disconnected from the bedside monitor or external instrument.	Check all cable connections between the external instrument and bedside monitor.
	CO <sub>2</sub> (Sidestream)	The AG-400R CO <sub>2</sub> unit is disconnected from the bedside monitor.	Check the interface connection between the AG-400R CO <sub>2</sub> unit and bedside monitor.

## 2. TROUBLESHOOTING

Screen Message	Parameter	Possible Cause/Criteria	Action
* CO <sub>2</sub> CHECK SENSOR	CO <sub>2</sub> (Mainstream)	Insufficient sensor light.	Refer to the CO <sub>2</sub> sensor kit manual. If necessary, replace the kit with a new one.
* CO <sub>2</sub> CONNECTOR OFF	CO <sub>2</sub> (Mainstream)	The CO <sub>2</sub> sensor kit is disconnected from the monitor.	Connect the CO <sub>2</sub> sensor kit properly. When CO <sub>2</sub> monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
		The CO <sub>2</sub> sensor kit is damaged.	Replace the CO <sub>2</sub> sensor kit with a new one.
* CO <sub>2</sub> DEVICE ERROR	CO <sub>2</sub> (Microcap <sup>®</sup> / MicroPod <sup>™</sup> )	The external instrument or interface failure. Communication error between the external instrument and bedside monitor.	Contact your Nihon Kohden representative.
	CO <sub>2</sub> (Sidestream)	CO <sub>2</sub> unit failure.	Contact your Nihon Kohden representative.
* CO <sub>2</sub> LINE BLOCK	CO <sub>2</sub> (Sidestream/ Microcap <sup>®</sup> / MicroPod <sup>™</sup> )	The airway adapter, filterline or exhaust gas tube is clogged and CO <sub>2</sub> cannot be measured.	Check that there is no clog in the airway adapter, filterline or exhaust gas tube. If necessary, replace with a new one.
			Make sure that the filterline is placed above the airway adapter.
* CO <sub>2</sub> NO FILTERLINE	CO <sub>2</sub> (Sidestream)	The filterline is not connected to the CO <sub>2</sub> unit or unspecified tube is connected.	Firmly connect the specified filterline to the CO <sub>2</sub> unit.
	CO <sub>2</sub> (Microcap <sup>®</sup> / MicroPod <sup>™</sup> )	The filterline is not connected to the external instrument or unspecified tube is connected.	Firmly connect the specified filterline to the external instrument.
– CO <sub>2</sub> PLEASE WAIT	CO <sub>2</sub> (Sidestream)	Measurement of the sensitivity calibration is complete and calculation is started.	Stop the gas supply and wait for the calculation to complete.
– CO <sub>2</sub> PURGING	CO <sub>2</sub> (Sidestream/ Microcap <sup>®</sup> / MicroPod <sup>™</sup> )	Purging to remove clogging of the sampling path.	When the clogging is removed, measurement is possible. If the clogging is not removed, the “CO <sub>2</sub> LINE BLOCK” message appears. Refer to the “CO <sub>2</sub> LINE BLOCK” message.
* CO <sub>2</sub> SENSOR ERROR	CO <sub>2</sub> (Mainstream)	CO <sub>2</sub> sensor is damaged.	Replace the CO <sub>2</sub> sensor with a new one.
– CO <sub>2</sub> WARMING UP	CO <sub>2</sub> (Sidestream)	The CO <sub>2</sub> unit is warming up. Measurement is not possible.	Wait for the message to disappear.
	CO <sub>2</sub> (Microcap <sup>®</sup> / MicroPod <sup>™</sup> )	The external instrument is warming up. Measurement is not possible.	
– CO <sub>2</sub> ZERO CALIBRATING	CO <sub>2</sub> (Microcap <sup>®</sup> / MicroPod <sup>™</sup> )	Auto zero balance adjustment is being performed.	Wait until zero balance adjustment is complete.
	CO <sub>2</sub> (Sidestream)	Zero calibration is being performed.	Wait for the zero calibration to complete.



Screen Message	Parameter	Possible Cause/Criteria	Action
– DATA SEND ERROR	System	The network cable is not properly connected to the bedside monitor, hub and central monitor.	Connect the network cable to the bedside monitor, hub and central monitor properly and insert and remove the input unit‡ from the bedside monitor.
		The network cable is damaged.	Replace the network cable with a new one and insert and remove the input unit‡ from the bedside monitor.
		The bedside monitor is not registered as a monitored bed on the central monitor.	Register the bedside monitor on the central monitor as a monitored bed and insert and remove the input unit‡ from the bedside monitor.
– ECG AUTO LEAD CHANGE	ECG	<AUTO LEAD CHANGE> on the ECG window is set to ON, an electrode of the lead for the first trace was detached for more than 5 seconds and therefore the lead was changed to a stable lead.	Check the electrode attachment.
* ECG CHECK ELECTRODES	ECG	The electrode lead is detached from the electrode.	Connect the electrode lead to the electrode firmly.
		The electrode cannot be attached firmly to the skin.	Replace the electrode with a new one.
		The electrode lead is disconnected from the ECG connection cord.	Connect the electrode lead to the ECG connection cord.
		The contact between the lead and electrode is poor.	Clean the electrode lead clip or replace the electrode lead with a new one.
		<NUMBER OF ELECTRODES> setting on the ECG window is not correct.	Set the correct settings for <NUMBER OF ELECTRODES>.
		The electrode lead is damaged.	Replace the electrode lead with a new one.
		Differential offset voltage at electrodes.	Replace the electrode with a new one.
* ECG CHECK ELECTRODE --	ECG	Problems at the specified electrode.	Remove the cause by referring to the “ECG CHECK ELECTRODES” message.
– ECG LEARNING	ECG	Started learning QRS for arrhythmia analysis.	Wait for learning to finish.
– ECG LOW mV	ECG	The QRS amplitude is too small.	Move the electrodes to where the QRS amplitude is large enough and relearn the ECG.
* ECG MODULE ERROR	ECG	Module malfunction.	Contact your Nihon Kohden representative.

‡ The “input unit” means the AY-600P series input unit and the BSM-1700 series bedside monitor.

## 2. TROUBLESHOOTING

Screen Message	Parameter	Possible Cause/Criteria	Action
– ECG NOISE‡	ECG	The baseline is not stable due to respiration or body movement.	Change the electrode position.
		EMG noise is superimposed.	Change the electrode position to where there is less muscle.
		The electrode is pulled by the lead.	Put some slack into the electrode lead.
		The electrode is dry.	Replace the electrode with a new one.
		The contact between the lead and electrode is poor.	Clean the electrode lead clip or replace the electrode lead with a new one.
		High electrode impedance.	Rub the skin with “skinPure” skin preparation gel.
		An electric blanket is used.	Use another warming method.
		Equipment which emits strong electromagnetic interference is nearby. e.g. ESU, cellular phone.	Keep the interference source away from the monitor or turn off the emitter source power.
		Equipotential grounding is not acquired.	Connect the equipotential ground terminal on the monitor to the equipotential ground terminal on the wall with the grounding lead.
– ECG PACING (This message appears only when pacing spike detection on the ECG window is set to ON.)	ECG	Paced QRS is detected.	When the patient does not have an implanted cardiac pacemaker, set the pacing spike detection to OFF on the ECG window.
		An electric blanket is used.	Use another warming method.
		ECG of a neonate is monitored.	Set the pacing spike detection to OFF on the ECG window.
– EEG CALIBRATING	EEG	The CAL key on the EEG window is touched to display the calibration waveforms.	—
* EEG CHECK ELECTRODES	EEG	The electrode is dry or not attached to the patient.	Attach the electrodes to the patient properly. When using disposable electrodes, replace them with new one.
		The electrode lead is disconnected from the EEG connection cord.	Connect the electrode lead to the EEG connection cord.
		Contact between the electrode lead clip and electrode is poor (when using disposable electrodes).	Replace the EEG electrode lead with a new one.
		The electrode lead is damaged.	Replace the electrode lead with a new one.
		Differential offset voltage at electrodes.	Attach the electrodes to the patient properly. When using disposable electrodes, replace them with new one.
		The electrode impedance is too high.	Clean the attachment site and attach the electrodes again.
		The EEG connection cord is disconnected then connected.	When the EEG connection cord is disconnected and then connected again, this message may appear. Press the [Silence Alarms] key to clear the message.
* EEG CHECK EXTERNAL DEVICE	EEG	The neuro unit is disconnected from the bedside monitor.	Check the cable connection between the units.
– EEG CHECKING IMPEDANCE	EEG	Checking electrode impedance.	—

‡ When <ARRHYTHMIA ANALYSIS> on the ECG window is set to ON, a “CANNOT ANALYZE” message appears instead of “ECG NOISE”. If the “CANNOT ANALYZE” message is displayed for more than 30 seconds, the message changes to an alarm.



Screen Message	Parameter	Possible Cause/Criteria	Action
* EEG CONNECTOR OFF	EEG	The EEG connection cord is disconnected from the neuro unit.	Connect the EEG connection cord to the neuro unit. When EEG monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
		The EEG connection cord is damaged.	Replace the EEG connection cord with a new one.
- EEG HIGH IMPEDANCE	EEG	The electrode impedance is too high.	Clean the attachment site and attach the electrodes again.
- EEG RESETTING BASELINE	EEG	The RESET key on the EEG window is touched to return all EEG waveforms to the baseline position.	—
* FLOW APNEA	FLOW/Paw	Apnea exceeded the apnea alarm limit.	—
- FLOW CAL COMPLETE	FLOW/Paw	Zero calibration is complete.	—
- FLOW CAL ERROR	FLOW/Paw	There was vibration during calibration and zeroing failed.	If the message appears several times, contact your Nihon Kohden representative.
		Nearby device was generating a strong noise during calibration and zeroing failed.	
* FLOW CHECK EXTERNAL DEVICE	FLOW/Paw	Measure switch on the unit is turned off.	Turn on the measure switch on the unit.
		The connection cable is disconnected from the monitor.	Check the connection between the unit and the monitor.
		An error occurs in the communication between the unit and monitor.	Remove the connection cable from the monitor and connect it again. If the problem still occurs, contact your Nihon Kohden representative.
	FLOW/Paw	The power cord of the multigas/flow unit is disconnected.	Check that the power cord of the multigas/flow unit is securely connected.
FLOW/Paw	<FLOW/Paw MEASUREMENT> on the FLOW/Paw window is OFF.	Set the <FLOW/Paw MEASUREMENT> on the FLOW/Paw window to ON.	
* FLOW CONNECTOR OFF	FLOW/Paw	Faulty flow tube.	Replace the flow tube with a new one.
		The flow tube is disconnected from the unit.	Connect the flow tube to the unit securely.
* FLOW DEVICE ERROR	FLOW/Paw	Faulty unit.	Contact your Nihon Kohden representative.
- FLOW OUT OF RANGE	FLOW/Paw	The measured value is outside the measurable range.	Replace the flow tube and/or flow adapter with a new one. If the problem still occurs, contact your Nihon Kohden representative.
- FLOW ZERO CALIBRATING	FLOW/Paw	Zero calibration is being performed.	Wait for calibration to complete.
- FREEZE	All parameters	The waveforms are frozen.	To unfreeze the waveforms: <ul style="list-style-type: none"> <li>• Press any key on the screen</li> <li>• Press any key on the monitor</li> <li>• The waveforms are unfrozen 3 minutes after freezing</li> </ul>
* GAS APNEA	GAS	Apnea exceeded the apnea alarm limit.	—
- GAS CALIBRATING	GAS	Air or gas calibration is being performed.	Wait for the calibration to complete.

## 2. TROUBLESHOOTING

Screen Message	Parameter	Possible Cause/Criteria	Action
- GAS CAL COMPLETE	GAS (GF-110PA/ 120PA/210R/ 220R)	Air or gas calibration is complete.	—
- GAS CAL ERROR	GAS	The sampling line or exhaust gas tube is clogged.	Check that the sampling line and exhaust gas tube are not bent or clogged. Replace with a new one if necessary and perform the manual or air calibration. If the problem still occurs, contact your Nihon Kohden representative.
		Contaminated air due to leaking prevented air calibration.	Check that sampling line and respiration circuit are not leaking. After confirming that there are no leaking, ventilate the air around the unit and perform the manual air calibration. If the problem still occurs, contact your Nihon Kohden representative.
	GAS (AG-920R GF-110PA/ 120PA)	The pressure in the gas cylinder is less than 0.1 MPa.	If the pressure in the gas cylinder is less than 0.1 MPa, replace with a new calibration gas and calibrate again.
		Correct gas is not used for calibration.	Check that correct gas is used for calibration.
* GAS CHECK EXTERNAL DEVICE	GAS	Measure switch on the unit is turned off.	Turn on the measure switch on the unit.
		The connection cable is disconnected from the monitor.	Check the connection between the unit and the monitor.
		An error occurs in the communication between the unit and monitor.	Remove the connection cable from the monitor and connect it again. If the problem still occurs, contact your Nihon Kohden representative. When using an AG-920R multigas unit, refer to the QF-904P interface manual.
	GAS (AG-920R GF-210R/ 220R)	The power cord is disconnected.	Check the power cord is securely connected.
	GAS (GF-110PA/ 120PA/210R/ 220R)	<GAS MEASUREMENT> on the GAS window is OFF.	Set the <GAS MEASUREMENT> on the GAS window to ON.
* GAS CHECK SAMPLE LINE	GAS (AG-920R)	The sampling gas inlet on the water trap or sampling gas outlet on the rear panel of the unit is pressurized.	Check that the sampling gas inlet or sampling gas outlet of the unit is not pressurized.
* GAS CHECK WATERTRAP	GAS	The water trap is not attached properly. The sampling line is not connected properly.	Make sure that the water trap is securely attached to the unit. Connect the sampling line properly.
	GAS (GF-210R/ 220R)	An unspecified sampling line is used.	Use a specified sampling line.

Screen Message	Parameter	Possible Cause/Criteria	Action
* GAS CHECK WATERTRAP AND SAMPLE LINE	GAS	The water trap is clogged.	Empty the water from the water trap. If the problem still occurs, replace the water trap with a new one.
		The sampling line is clogged.	Check that sampling line is not bent or clogged. Replace with a new one if necessary.
		The exhaust gas tube is clogged.	Check that exhaust gas tube is not bent or clogged. Replace with a new one if necessary.
* GAS DEVICE ERROR	GAS	Faulty unit.	Contact your Nihon Kohden representative.
* GAS LINE BLOCK	GAS	The water trap is clogged.	Empty the water from the water trap. If the problem still occurs, replace the water trap with a new one.
		The sampling line is clogged.	Check that sampling line is not bent or clogged. Replace with a new one if necessary.
		The exhaust gas tube is clogged.	Check that exhaust gas tube is not bent or clogged. Replace with a new one if necessary.
* GAS MIXED GAS	GAS	Two anesthetic agents are detected at the same time when the vaporizer is changed.	When either agent concentration becomes below 0.2% or alarm silences.
		Wrong agent is delivered to the vaporizer.	Contact the anesthetic machine manufacturer.
		Two anesthetic agents are detected when two vaporizers operated at the same time.	
- GAS OUT OF RANGE	GAS	The measured value is outside the measurable range.	<ul style="list-style-type: none"> <li>• Check the condition of the patient and anesthetic machine.</li> <li>• Check the connection of the sampling line and respiration circuit.</li> <li>• Remove the connection cable from the monitor and connect it again.</li> </ul> If the problem still occurs, contact your Nihon Kohden representative.
		The measurement sensitivity has shifted.	Perform gas calibration with the correct gas.
* GAS OVERHEAT	GAS (GF-210R/220R)	Faulty fan.	Contact your Nihon Kohden representative.
- GAS PURGING	GAS (AG-920R)	Purging to remove clogging from the sampling line.	Wait for purging to complete.
- GAS UNSPECIFIED ACCURACY	GAS (AG-920R)	The measured value is outside the accuracy range.	<ul style="list-style-type: none"> <li>• Check the condition of the patient and anesthetic machine.</li> <li>• Check the connection of the sampling line and respiration circuit.</li> <li>• Remove the connection cable from the monitor and connect it again.</li> </ul> If the problem still occurs, contact your Nihon Kohden representative.
		The measurement sensitivity has shifted.	Perform gas calibration with the correct gas.
- GAS WARMING UP	GAS	The unit is still warming up.	Wait for warming up to complete.

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Screen Message	Parameter	Possible Cause/Criteria	Action
* HIS SYNC ERROR	System	The settings for HL7 are not correct.	Set the HL7 settings correctly on the HL7 page in the NETWORK window of the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator's Guide.
		The entered patient ID is not correct.	Enter the correct patient ID.
* INPUT UNIT DISCONNECT	System	The input unit‡ is disconnected from the main unit or data acquisition unit when the transport function is enabled.	Connect the input unit‡ and authenticate the patient on the SELECT PATIENT DATA window to select the monitoring patient.
* INPUT UNIT FAILURE	System	Communication error between the input unit‡ and main unit.	Insert and remove the input unit‡ from the bedside monitor. If the problem is not solved, contact your Nihon Kohden representative
		The QM-600P memory unit installed inside the input unit‡ is damaged.	
		The data is sent to a bedside monitor or central monitor which has a different time zone setting and data in the input unit‡ is deleted.	Insert and remove the input unit‡ from the bedside monitor or JA-690PA/694PA data acquisition unit and press the [Silence Alarms] key. Make sure to change the zone setting to the same setting as the other bedside monitors or central monitors.
– INSERT REC PAPER	Recording	No recording paper.	Load the recording paper.
		The recording paper is not loaded correctly.	Correctly load the recording paper.
– INVALID CARD	System	Invalid SD card is inserted.	Only use the Nihon Kohden specified SD card.
– Lost communication with instruments (such as a central monitor) in the network.	System	<AVAILABLE ALARM TYPES> is set to ALL or <ARRHYTHMIA TYPE> is set to EXTENDED on this monitor and the monitor is connected to the network. One or more instruments in the network have software version which does not support extended arrhythmia and communication is lost.	<ul style="list-style-type: none"> <li>Set the &lt;AVAILABLE ALARM TYPES&gt; setting to MAIN to restore communication.</li> <li>Set the &lt;ARRHYTHMIA TYPE&gt; setting to STANDARD.</li> <li>Upgrade all instruments in the network to the recommended software version.</li> </ul>
– MONITOR OFF (interbed window)	System	The instrument which is registered to interbed is turned off.	Check the patient condition and secure the patient safety. Then check that the system has no trouble.
		The instrument which is registered to interbed is disconnected from the network.	
* MPU MODULE ERROR	All parameters	MPU circuit malfunction.	Contact your Nihon Kohden representative.
	TEMP	The monitor simulates the temperature signal of 27°C and 37°C inside the monitor. Monitoring this simulated signal periodically (every 128 ms), the monitor self-diagnoses the temperature signal processor part of the monitor. When the monitor could not cover the 0 to 45°C measurement range, a “MPU MODULE ERROR” message is displayed.	

‡ The “input unit” means the AY-600P series input unit and the BSM-1700 series bedside monitor.

Screen Message	Parameter	Possible Cause/Criteria	Action
* MULTILINK CONFIG ERROR	All parameters	Communication failure between QF series interface or IF series communication cable and monitor.	Contact your Nihon Kohden representative.
* MULTILINK POWER ERROR	All parameters	Multi-link power supply failure.	Contact your Nihon Kohden representative.
* NIBP AIR LEAK	NIBP	The cuff pressure does not change after inflation even after a certain period of time.	Connect the cuff to the air hose properly. Connect the air hose to the socket properly.
		The cuff or air hose is damaged.	Replace the cuff or air hose with a new one.
* NIBP CANNOT DETECT PULSE	NIBP	The patient's pulse wave is small.	Measure by palpation or the invasive blood pressure method.
		The cuff is not wrapped on the patient correctly.	Wrap the cuff around the arm of the patient properly.
* NIBP CHECK INTERVAL SETTING	NIBP	NIBP is measured at 1 minute intervals for more than 30 minutes.	Check the patient condition and determine whether to continue measuring NIBP at 1 minute intervals.
* NIBP CONNECTOR OFF	NIBP	The air hose is disconnected from the monitor.	Connect the air hose properly. When NIBP monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
		The air hose is damaged.	Replace the air hose with a new one.
* NIBP CUFF OCCLUSION	NIBP	The cuff pressure does not decrease after measurement has completed.	Check that the air hose is not bent or squeezed.
* NIBP HIGH CUFF PRESS	NIBP	Enormous pressure was applied to the pressure of the cuff.	When measuring an adult, ask the patient not to move too much.
- NIBP INFLATION PRESS LOW	NIBP	Insufficient cuff inflation pressure.	Wait until the cuff pressure rises.
* NIBP MEAS TIMEOUT	NIBP	The measuring time exceeded the specified time due to arrhythmia or noise.	If the cause is arrhythmia, measure by invasive blood pressure measurement. Remove the cause if due to noise.
- INFLATION TIME PASSED	NIBP	Venous puncture cuff inflation time is exceeded.	Restart venous puncture.
- NIBP MEASURING NIBP	NIBP	Start venous puncture during NIBP.	Finish the NIBP measurement and restart venous puncture.
* NIBP MODULE ERROR	NIBP	Module malfunction.	Contact your Nihon Kohden representative.
- NIBP PLEASE WAIT	NIBP	Measurement started before the cuff inflation pressure was deflated enough.	Check the cuff pressure before starting measurements. When measuring using the adult cuff: below 15 mmHg When measuring using the cuff for neonates: below 3 mmHg

## 2. TROUBLESHOOTING

Screen Message	Parameter	Possible Cause/Criteria	Action
– NIBP REMEASURING (Remeasurement is automatically performed. If the message still appears, after remeasurement, do the counter actions.)	NIBP	The cuff is not attached to the patient.	Attach the cuff to the patient.
		Patient moved during measurement.	Wait for the patient to stop moving, then measure again.
		Patient's pulse is too small.	Measure by palpation or the invasive blood pressure method.
		The cuff is not attached properly.	Attach the cuff properly.
		The cuff size is not appropriate.	Check that the cuff of the correct size is used.
		Patient's pulse and heart rate is unstable.	Wait for the patient to relax and stop moving.
* NIBP SAFETY CIRCUIT RUNNING (When this message is displayed, measurement cannot be performed for 40 seconds.)	NIBP	The hose is bent.	Check that the hose is not bent.
		The inflation time is too long.	Stop measurement.
		In auto mode measurement, the cuff inflation started before the cuff deflation is complete.	Stop measurement.
* NIBP SYSTOLIC OVER	NIBP	The maximum blood pressure exceeded 280 mmHg when using the adult cuff, or 150 mmHg when using the neonate cuff.	Measure by palpation or the invasive blood pressure method.
– NIBP WEAK PULSE	NIBP	The patient's pulse wave is too small.	Measure by palpation or the invasive blood pressure method.
		The cuff is wrapped too loosely.	Wrap the cuff around the arm properly.
		The cuff size is inappropriate.	Use the appropriate cuff.
– NIBP ZEROING	NIBP	NIBP zero balance adjustment is being performed.	Do not touch the cuff during zeroing and wait for the message to disappear.
– O <sub>2</sub> CAL??	O <sub>2</sub>	The oxygen sensor is not calibrated.	Calibrate the oxygen sensor.
		The oxygen sensor has reached the end of its life.	Replace the oxygen sensor with a new one.
		The oxygen sensor is not connected properly.	Check the connection of the oxygen sensor, wait for more than 1 minute and then calibrate again. If the problem still occurs, replace the oxygen sensor with a new one.
		Calibration is performed when the oxygen sensor is not stable.	Check the connection of the oxygen sensor, wait for more than 1 minute and then calibrate again. If the problem still occurs, replace the oxygen sensor with a new one.
		The calibration mode is not appropriate.	Select the correct calibration mode.
– O <sub>2</sub> CALIBRATING	O <sub>2</sub>	Calibrating the oxygen sensor.	Wait for the calibration to be connected.
* O <sub>2</sub> CONNECTOR OFF	O <sub>2</sub>	The FiO <sub>2</sub> connection cord is disconnected from the monitor.	Connect the FiO <sub>2</sub> connection cord properly. When O <sub>2</sub> monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
		The FiO <sub>2</sub> connection cord is damaged.	Replace the FiO <sub>2</sub> connection cord with a new one.
* O <sub>2</sub> CHECK SENSOR	O <sub>2</sub>	The oxygen sensor is disconnected from the FiO <sub>2</sub> connection cord.	Connect the oxygen sensor to the FiO <sub>2</sub> connection cord properly.
		The FiO <sub>2</sub> connection cord is damaged.	Replace the FiO <sub>2</sub> connection cord with a new one.
		The oxygen sensor is damaged.	Replace the oxygen sensor with a new one.



Screen Message	Parameter	Possible Cause/Criteria	Action
— † OUT OF RANGE‡	CO <sub>2</sub> (TG-950P/ 970P/980P)	CO <sub>2</sub> measurement value exceeds the measurement range.	—
* PARAMETER NOT AVAILABLE	All parameters	Connected cord or cable of the parameter is not available on the monitor.	—
* PCCO CHECK EXTERNAL DEVICE	PiCCO	The PiCCO monitor is disconnected from the bedside monitor.	Check the interface connection between the PiCCO monitor and the bedside monitor.
* PRESS CHECK SENSOR	IBP	The blood pressure transducer is disconnected from the IBP connection cord.	Connect the blood pressure transducer to the IBP connection cord properly.
		Malfunction of the blood pressure transducer.	Replace the blood pressure transducer with a new one.
		The IBP connection cord is damaged.	Replace the IBP connection cord with a new one.
* PRESS CONNECTOR OFF	IBP	The IBP connection cord is disconnected from the monitor.	Connect the IBP connection cord properly. When IBP monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
		The IBP connection cord is damaged.	Replace the IBP connection cord with a new one.
— PRESS OUT OF RANGE	IBP	The measured value is outside the measuring range.	Check the measuring environment.
		Malfunction of the blood pressure transducer.	Replace the blood pressure transducer with a new one.
* PRESS THIS LABEL IS ALREADY REGISTERED	IBP	More than one IBP connection cord with the same label are used.	Set another label.
— PRESS ZERO CALIBRATING	IBP	Zero balance adjustment is performed.	Wait for the zero balance adjustment to complete.
— PRESS ZERO IMBALANCE	IBP	Zero balance is not adjusted.	Adjust the zero balance.
— PRESS ZERO OUT OF RANGE	IBP	Malfunction of the blood pressure transducer.	Replace the blood pressure transducer with a new one.
		Monitor malfunction.	Contact your Nihon Kohden representative.
— PRESS ZERO UNSTABLE	IBP	The circuit is not exposed to air during zero balance adjustment.	Expose the circuit to air and perform zero balance adjustment again.
		The pressure of zero balance is unstable.	Re-connect the circuit and perform zero balance adjustment again.
— PRESS ZEROING COMPLETE	IBP	Zero balance adjustment is complete.	IBP monitoring is available.
* PRINT ERROR	Print	Too many print commands are sent to the network printer.	Wait a while and print again.
		Printer settings are not correct.	Correctly set the printer setting on the PRINTER window on the SYSTEM CONFIGURATION screen.
		The recording paper is not loaded correctly.	Correctly load the recording paper.
— PRINTING	System	Data is sent to the network printer.	—
— PWTT CAL??	NIBP	Uncalibrated.	Measure NIBP (calibrate) again.
— RECEIVING TEC DATA	System	Receiving data from the defibrillator.	—

‡ When the TG-950P CO<sub>2</sub> sensor kit is used, the “OUT OF RANGE” message might not be displayed depending on the software version of the CO<sub>2</sub> sensor kit.

## 2. TROUBLESHOOTING

Screen Message	Parameter	Possible Cause/Criteria	Action
* RESP CHECK SENSOR	RESP (Thermistor)	The respiration pickup is damaged.	Replace the respiration pickup with a new one.
* RESP CONNECTOR OFF	RESP (Thermistor)	The respiration pickup is disconnected from the monitor.	Connect the respiration pickup properly. When respiration monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
		The respiration pickup is damaged.	Replace the respiration pickup with a new one.
- RESP OFF	RESP (Impedance)	<IMPEDANCE MEASUREMENT> on the RESP/CO <sub>2</sub> window is set to OFF.	When monitoring respiration by impedance method is necessary, set <IMPEDANCE MEASUREMENT> to ON.
* rSO <sub>2</sub> CHECK EXTERNAL DEVICE	rSO <sub>2</sub>	The cerebral/somatic oximeter is disconnected from the bedside monitor.	Check the communication cable connection between the cerebral/somatic oximeter and bedside monitor.
		Communication error between the bedside monitor and cerebral/somatic oximeter.	Check the communication settings and the communication cable connection. Refer to the communication cable manual.
- SENDING DATA	System	The input unit <sup>‡</sup> is removed from a bedside monitor and connected to another bedside monitor in a central monitor network. The data of the source bedside monitor is sent to the central monitor.	—
- SIMULATED DATA	All parameters	The displayed data is simulated data.	To monitor a patient, set <SIMULATION MODE> to OFF on the SYSTEM CONFIGURATION screen. (Administrator setting)
* SpO <sub>2</sub> -2 ALARM	SpO <sub>2</sub> -2 (Nellcor/Masimo)	Alarm occurring on the pulse oximeter.	Look at the pulse oximeter and remove the cause of the alarm.
* SpO <sub>2</sub> CANNOT DETECT PULSE	SpO <sub>2</sub> (NK)	Poor blood circulation for measuring the SpO <sub>2</sub> value.	Check the patient condition, probe attachment or change the attachment site.
		The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.
		The probe is not attached to the patient properly.	Attach the probe to the patient properly.
		One of the following message is displayed for 30 seconds. <ul style="list-style-type: none"> <li>• SpO<sub>2</sub> LIGHT INTERFERENCE</li> <li>• SpO<sub>2</sub> CHECK PROBE SITE</li> <li>• SpO<sub>2</sub> DETECTING PULSE</li> </ul>	Refer to the each screen message section and remove the cause of the alarm or message.
	SpO <sub>2</sub> (Nellcor)	The pulse waveform cannot be detected.	Attach the probe to the patient properly.

<sup>‡</sup> The “input unit” means the AY-600P series input unit and the BSM-1700 series bedside monitor.



Screen Message	Parameter	Possible Cause/Criteria	Action	
* SpO <sub>2</sub> -2 CANNOT DETECT PULSE	SpO <sub>2</sub> (NK)	Poor blood circulation for measuring the SpO <sub>2</sub> value.	Check the patient condition, probe attachment or change the attachment site.	
		The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.	
		The probe is not attached to the patient properly.	Attach the probe to the patient properly.	
		One of the following message is displayed for 30 seconds. <ul style="list-style-type: none"> <li>SpO<sub>2</sub>-2 LIGHT INTERFERENCE</li> <li>SpO<sub>2</sub>-2 CHECK PROBE SITE</li> <li>SpO<sub>2</sub>-2 DETECTING PULSE</li> </ul>	Refer to the each screen message section and remove the cause of the alarm or message.	
* SpO <sub>2</sub> CHANGE PROBE	SpO <sub>2</sub> (NK)	Probe is deteriorated.	Replace the probe with a new one.	
		Probe is damaged or short-circuited.	Replace the probe with a new one.	
		SpO <sub>2</sub> connection cord is damaged.	Replace the SpO <sub>2</sub> connection cord with a new one.	
	SpO <sub>2</sub> (Masimo)	The monitor cannot identify the connected probe or the probe is broken.	Replace the probe. Refer to the probe manual.	
* SpO <sub>2</sub> -2 CHANGE PROBE	SpO <sub>2</sub> (NK)	Probe is deteriorated.	Replace the probe with a new one.	
		Probe is damaged or short-circuited.	Replace the probe with a new one.	
		SpO <sub>2</sub> adapter is damaged.	Replace the SpO <sub>2</sub> adapter with a new one.	
* SpO <sub>2</sub> -2 CHECK EXTERNAL DEVICE	SpO <sub>2</sub> -2 (Nellcor/Masimo)	The pulse oximeter is disconnected from the bedside monitor.	Check the communication cable connection between the pulse oximeter and bedside monitor.	
		Communication error between the bedside monitor and pulse oximeter.	Check the communication settings and the communication cable connection. Refer to the communication cable manual.	
* SpO <sub>2</sub> CHECK PROBE	SpO <sub>2</sub> (NK)	The probe is not attached to the patient properly.	Attach the probe to the patient properly.	
		When the pulse waveform on the screen is flat	The probe cable is disconnected from the SpO <sub>2</sub> connection cord or not connected properly. Connect the probe cable to the SpO <sub>2</sub> connection cord. If SpO <sub>2</sub> monitoring is not necessary, press the [Silence Alarms] key.	
			The probe is damaged or short-circuited.	Replace the probe with a new one. If the message still appears, replace the SpO <sub>2</sub> connection cord with a new one.
		When the pulse waveform is displayed on the screen	The probe is not attached at the appropriate site.	Attach the probe to the appropriate site.
			The probe is deteriorated.	Replace the probe with a new one.
	SpO <sub>2</sub> (Nellcor/Masimo)	The probe is not attached to the patient properly.	Attach the probe to the patient properly.	

## 2. TROUBLESHOOTING

Screen Message	Parameter	Possible Cause/Criteria	Action
* SpO <sub>2</sub> -2 CHECK PROBE	SpO <sub>2</sub> (NK)	The probe cable is disconnected from the SpO <sub>2</sub> adapter.	Connect the probe cable to the SpO <sub>2</sub> adapter. If SpO <sub>2</sub> monitoring is not necessary, press the [Silence Alarms] key.
		The probe is not attached to the patient properly.	Attach the probe to the patient properly.
		The probe is broken or short-circuited.	Replace the probe with a new one. If the message still appears, replace the SpO <sub>2</sub> adapter with a new one.
* SpO <sub>2</sub> CHECK PROBE SITE	SpO <sub>2</sub> (NK)	The probe is not attached at the appropriate site.	Attach the probe to a site 6 to 14 mm thick.
		Probe is deteriorated.	Replace the probe with a new one.
* SpO <sub>2</sub> -2 CHECK PROBE SITE	SpO <sub>2</sub> (NK)	The probe is not attached at the appropriate site.	Attach the probe to a site 6 to 14 mm thick.
		Probe is deteriorated.	Replace the probe with a new one.
* SpO <sub>2</sub> CONNECTOR OFF	SpO <sub>2</sub> (NK/Nellcor/Masimo)	The SpO <sub>2</sub> connection cord is disconnected from the SpO <sub>2</sub> socket.	Connect the SpO <sub>2</sub> connection cord properly. When SpO <sub>2</sub> monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
	SpO <sub>2</sub> (Nellcor/Masimo)	The probe cable is disconnected from the SpO <sub>2</sub> connection cord.	Connect the probe cable to the SpO <sub>2</sub> connection cord. If SpO <sub>2</sub> monitoring is not necessary, press the [Silence Alarms] key.
	SpO <sub>2</sub> (Masimo)	The probe is not connected to the patient cable correctly.	Connect the probe to the patient cable with the logo labels facing the same direction.
		The monitor cannot identify the connected probe.	Replace the probe. Refer to the probe manual.
* SpO <sub>2</sub> -2 CONNECTOR OFF	SpO <sub>2</sub> (NK)	The probe cable is disconnected from the SpO <sub>2</sub> adapter.	Connect the probe cable to the SpO <sub>2</sub> adapter. If SpO <sub>2</sub> monitoring is not necessary, press the [Silence Alarms] key.
		The SpO <sub>2</sub> adapter is disconnected from the SpO <sub>2</sub> socket.	Connect the SpO <sub>2</sub> adapter properly. When SpO <sub>2</sub> monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
- SpO <sub>2</sub> DETECTING PULSE	SpO <sub>2</sub> (NK/Nellcor/Masimo)	Searching for the correct pulse wave.	Wait until the pulse wave is detected.
		The probe is not attached to the patient properly.	Attach the probe to the patient properly.
	SpO <sub>2</sub> (NK)	The SpO <sub>2</sub> value cannot be obtained because the waveform is unstable.	Check the probe attachment.
		Poor blood circulation for measuring SpO <sub>2</sub> .	Check the patient condition, probe attachment or change the attachment site.
		The probe is secured too tightly and is obstructing the blood circulation.	Reattach the probe.
		The probe is disconnected from the SpO <sub>2</sub> connection cord.	Connect the probe to the SpO <sub>2</sub> connection cord.
		The finger probe is not attached to the patient properly.	Attach the finger probe firmly to the patient.
	SpO <sub>2</sub> (Nellcor/Masimo)	The probe attachment site is not appropriate.	Attach the probe to an appropriate place.

Screen Message	Parameter	Possible Cause/Criteria	Action
– SpO <sub>2</sub> -2 DETECTING PULSE	SpO <sub>2</sub> (NK)	Searching for the correct pulse wave.	Wait until the pulse wave is detected.
		The probe is not attached to the patient properly.	Attach the probe to the patient properly.
		The SpO <sub>2</sub> value cannot be obtained because the waveform is unstable.	Check the probe attachment.
		Poor blood circulation for measuring SpO <sub>2</sub> .	Check the patient condition, probe attachment or change the attachment site.
		The probe is secured too tightly and is obstructing the blood circulation.	Reattach the probe.
		The probe is disconnected from the SpO <sub>2</sub> adapter.	Connect the probe to the SpO <sub>2</sub> adapter.
		The finger probe is not attached to the patient properly.	Attach the finger probe firmly to the patient.
* SpO <sub>2</sub> -2 ERROR	SpO <sub>2</sub> -2 (Nellcor/Masimo)	There is an error on the pulse oximeter.	Look at the pulse oximeter screen and remove the cause of the error.
* SpO <sub>2</sub> LIGHT INTERFERENCE	SpO <sub>2</sub> (Masimo)	Too much light on the probe.	Remove light or cover the probe site with blanket.
		Interference from surroundings.	Remove the interference.
		The probe attachment site is not appropriate.	Attach the probe to an appropriate site.
– SpO <sub>2</sub> LOW QUALITY SIGNAL	SpO <sub>2</sub> (NK/Nellcor/Masimo)	Considerable body movement. The probe is not attached to the patient properly.	When the message is displayed frequently, check the patient condition and, if necessary, change the attachment site.
	SpO <sub>2</sub> (Nellcor)	Low signal IQ.	When the message is displayed frequently, check the patient condition and, if necessary, change the attachment site.
– SpO <sub>2</sub> -2 LOW QUALITY SIGNAL	SpO <sub>2</sub> (NK)	Considerable body movement. The probe is not attached to the patient properly.	When the message is displayed frequently, check the patient condition and, if necessary, change the attachment site.
* SpO <sub>2</sub> MODULE ERROR	SpO <sub>2</sub> (NK/Nellcor/Masimo)	SpO <sub>2</sub> hardware malfunction.	Turn off the monitor power, wait for a few minutes and turn on the power again. If the message still appears, contact your Nihon Kohden representative.
* SpO <sub>2</sub> -2 MODULE ERROR	SpO <sub>2</sub> (NK)	SpO <sub>2</sub> hardware malfunction.	Turn off the monitor power, wait for a few minutes and turn on the power again. If the message still appears, contact your Nihon Kohden representative.
* SpO <sub>2</sub> NO PROBE	SpO <sub>2</sub> (NK)	The probe is not connected to the SpO <sub>2</sub> connection cord.	Connect the probe to the SpO <sub>2</sub> connection cord properly.
* SpO <sub>2</sub> -2 NO PROBE	SpO <sub>2</sub> (NK)	The probe is not connected to the SpO <sub>2</sub> connection cord.	Connect the probe to the SpO <sub>2</sub> connection cord properly.
– SpO <sub>2</sub> WEAK PULSE	SpO <sub>2</sub> (NK/Masimo)	Poor peripheral circulation.	Check the patient condition and change the attachment site.
		The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.
	SpO <sub>2</sub> (Masimo)	Low perfusion.	Check the patient condition and change the attachment site.
– SpO <sub>2</sub> -2 WEAK PULSE	SpO <sub>2</sub> (NK)	Poor peripheral circulation.	Check the patient condition and change the attachment site.
		The probe is attached too tightly and is obstructing the blood circulation.	Reattach the probe.

## 2. TROUBLESHOOTING

Screen Message		Parameter	Possible Cause/Criteria	Action
*	tcPO <sub>2</sub> /PCO <sub>2</sub> ALARM	tcPO <sub>2</sub> /PCO <sub>2</sub>	Alarm occurring on the transcutaneous monitor.	Look at the transcutaneous monitor and remove the cause of the alarm.
*	tcPO <sub>2</sub> /PCO <sub>2</sub> CHECK EXTERNAL DEVICE	tcPO <sub>2</sub> /PCO <sub>2</sub>	The transcutaneous monitor is disconnected from the bedside monitor.	Check the communication cable connection between the transcutaneous monitor and bedside monitor.
			Communication error between the bedside monitor and transcutaneous monitor.	Check the communication settings and the communication cable connection. Refer to the communication cable manual.
*	TEC DATA RECEIVE ERROR	System	Sending data is canceled on the defibrillator.	—
			Communication distance is too far.	Move the defibrillator closer and send data to the bedside monitor again.
			Radio waves interference	Keep the monitor away from electronic devices which emit strong radio waves.
*	TEC INTERFACE ALREADY CONNECTED	System	Two QI-670P interfaces are connected.	Remove the most recently connected QI-670P interface from the monitor.
*	TEC INTERFACE DISCONNECTED	System	USB cable of the QI-670P interface is disconnected from the monitor.	Connect the USB cable of the QI-670P interface to the monitor.
*	TEC INTERFACE ERROR	System	Communication error between the QI-670P interface and monitor.	Reconnect the QI-670P interface to the monitor. If the problem still occurs, contact your Nihon Kohden representative.
			QI-670P interface error	
*	TEMP CHECK SENSOR	TEMP	The probe is disconnected from the TEMP socket or temperature connection cord is disconnected from the MULTI socket.	Connect the probe to the TEMP socket or the temperature connection cord to the MULTI socket properly.
			The probe or temperature connection cord is damaged.	Replace the probe or temperature connection cord with a new one.
			The measured value is outside the measuring range.	Check the probe attachment site.
*	TEMP CONNECTOR OFF	TEMP	The temperature connection cord is disconnected from the monitor.	Connect the temperature connection cord properly. When temperature monitoring is not necessary, press the [Silence Alarms] key to silence the alarm.
			The temperature connection cord is damaged.	Replace the temperature connection cord with a new one.
*	TEMP THIS LABEL IS ALREADY REGISTERED	TEMP	More than one temperature probe with the same label are used.	Set another label.
*	--- THIS PARAMETER IS ALREADY REGISTERED	All parameters	More than the specified number of channels are used for a parameter.	Only use the specified number of channels.
*	TOF CHECK EXTERNAL DEVICE	TOF	The TOF-watch® SX is disconnected from the monitor.	Check the interface connection between the TOF-watch® SX and monitor.
*	TOF ALARM	TOF	There is an error on the TOF-watch® SX.	Check the TOF-watch® SX screen and remove the cause of the error.
*	TRANSMITTER CONNECTOR OFF	System	The connection cord of the transmitter is disconnected from the monitor.	Connect the connection cord properly.

	Screen Message	Parameter	Possible Cause/Criteria	Action
– †	UNSPECIFIED ACCURACY‡	CO <sub>2</sub> (TG-950P/ 970P/980P)	Temperature or pressure exceeds the operating environment.	—
–	UPDATING DATA	All parameters	Changing the parameter on the trend screen.	Wait until the message disappears.
*	VENT ALARM	VENT	Alarm occurring on the ventilator.	Check the ventilator and remove the cause of the alarm.
*	VENT CHECK EXTERNAL DEVICE	VENT	The ventilator is disconnected from the monitor.	Check the interface or communication cable connection between the ventilator and the monitor.

‡ When the TG-950P CO<sub>2</sub> sensor kit is used, the “UNSPECIFIED ACCURACY” message might not be displayed depending on the software version of the CO<sub>2</sub> sensor kit.

## Troubleshooting

For troubleshooting during operation, refer to the operator's manual.

In this "Troubleshooting" section, the "input unit" means the AY-600P series input unit and the BSM-1700 series bedside monitor.

### Power-related Problems

Problem	Possible Cause/Criteria	Action
The instrument does not turn on in AC power operation and the AC power lamp lights.	MAIN DIGITAL board, FRONT IF board or Power SW board failure.	Replace the MAIN DIGITAL board, FRONT IF board or Front Mother board set with a new one. When replacing the MAIN DIGITAL board, calibrate the touch panel. Refer to "Calibrating the Touch Panel" in Section 3.
The instrument does not turn on in AC power operation and the AC power lamp does not light.	AC line voltage or power cord failure.	<ul style="list-style-type: none"> <li>• Check the AC line voltage.</li> <li>• Replace the power cord.</li> </ul>
	Poor contact at either connector of the cable between the AC inlet and power supply unit or failure in the cable.	Check the cable between AC inlet and power supply unit or replace the cable.
	Power supply unit failure.	Replace the power supply unit.
	Poor contact at either connector of the cable between the power supply unit and MAIN DIGITAL board or failure in the cable.	Check the cable between the power supply unit and MAIN DIGITAL board or replace the cable.
	Poor contact at either connector of the cable between the MAIN DIGITAL board and FRONT IF board or failure in the cable.	Check the cable between the MAIN DIGITAL board and FRONT IF board or replace the cable.
	Poor contact at either connector of the cable between the FRONT IF board and Power SW board or failure in the cable.	Check the cable between the FRONT IF board and Power SW board or replace the cable.
	MAIN DIGITAL board, FRONT IF board or Power SW board failure.	Replace the MAIN DIGITAL board, FRONT IF board or Front Mother board set with a new one.
The instrument does not turn on in battery operation.	Rechargeable battery is weak.	Charge the battery.
	Battery failure or battery life expired.	Replace the battery with a new one.
	Poor contact at either connector of the two cables between the BATT MOTHER 0 and MAIN DIGITAL boards or failure in the two cables.	Check each connector or replace the cable.
	Poor contact at either connector of the two cables between the BATT MOTHER 1 and MAIN DIGITAL boards or failure in the two cables.	Check each connector or replace the cable.
	MAIN DIGITAL, BATT MOTHER 0 or BATT MOTHER 1 board failure.	Replace the MAIN DIGITAL, BATT MOTHER 0 or BATT MOTHER 1 board with a new one.

Problem	Possible Cause/Criteria	Action
Battery operation time is shorter than expected.	Battery life expired.	Replace the battery with a new one.
	Memory effect in battery.	Fully charge the battery for 2 or 3 times after fully discharging the battery. If the problem is still there, replace the battery with a new one.
	Charging circuit failure.	Replace the MAIN DIGITAL board with a new one.

## Display Problems

Problem	Possible Cause/Criteria	Action
Nothing is displayed and AC power lamp does not light.	Power cord is loose.	Check that the power cord is firmly connected.
	Power supply unit failure.	Replace the power supply unit.
Nothing is displayed, AC power lamp lights and power lamp does not light.	Failure in the cable between the MAIN DIGITAL and FRONT IF boards.	Replace the cable.
	Failure in the cable between the FRONT IF and Power SW boards.	Replace the cable.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Nothing is displayed and AC power lamp and power lamp both light.	Failure in the cable between the MAIN DIGITAL and FRONT IF boards.	Replace the cable.
	LVDS cable failure.	Replace the LVDS cable.
	LCD unit failure.	Replace the LCD unit.
	Inverter board failure.	Replace the Inverter board.
	Failure in the cable between the Inverter board and MAIN DIGITAL board.	Replace the cable.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Abnormal screen is displayed.	Failure in the cable between the MAIN DIGITAL and FRONT IF boards.	Replace the cable.
	LVDS cable failure.	Replace the LVDS cable.
	LCD unit failure.	Replace the LCD unit.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.

## Alarm Indicator Problem

Problem	Possible Cause/Criteria	Action
LEDs do not light.	Some LEDs light by using "ALARM" function on the MANUAL CHECK screen.	Replace the MAIN DIGITAL board.
	Some LEDs do not light by using "ALARM" function on the MANUAL CHECK screen.	Alarm board or MAIN DIGITAL board failure.



**Sound Problems**

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>
No sound or small volume even if you increase the sound volume in the VOLUME window selected on the MENU window.	Speaker failure.	Replace the speaker.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Sound is distorted even if you try various sounds by using "SOUND" function on the MANUAL CHECK screen.	Speaker failure.	Replace the speaker.
	Object in front of the speaker.	Remove the object.

**Key Operation Problems**

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>	
CHECK key does not work.	Key top cover is broken.	Replace the key top cover.	
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.	
Active area for a key does not match the key display on the screen.	The mark appears under your finger when you press a position on the screen by using "TOUCH KEY" function on the MANUAL CHECK screen. When you release the finger from the screen, the mark returns to a particular position. In other words, the particular position is always pressed.	Foreign object between the touch screen and front panel.	Remove the foreign object.
		The edge protection rubber is not properly attached to the touch screen.	Remove the rubber from the touch screen and reattach it to the touch screen properly.
		Touch screen failure.	Replace the touch screen.
	The mark appears under your finger when you press a position on the screen by using "TOUCH KEY" function on the MANUAL CHECK screen. When you release the finger from the screen, the mark stays around the position but it is always out of the acceptable range.	The touch screen was not calibrated after replacement.	Calibrate the touch screen.
		Touch screen failure.	Replace the touch screen.
		MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.



## Recording Problems

Problem	Possible Cause/Criteria	Action
Nothing is recorded on the paper but the model number "WS-671P" is displayed on the INFO page of the SYSTEM SETUP window.	Recording paper in the wrong position in the magazine.	Load the paper into the magazine properly.
	The heat-sensitive side of the paper is not facing the thermal array head.	Load the paper into the magazine properly.
	If the recorder door is firmly closed but the "CLOSE PAPER MAGAZINE" message and icon are still displayed: Mechanical failure in recorder module.	Replace the RG-501X paper drive unit.
	If paper is properly set into the magazine and the recorder door is firmly closed but the "INSERT REC PAPER" message is still displayed: • Dirty paper sensor or failure in the sensor or related circuit of the recorder.	<ul style="list-style-type: none"> <li>• Clean the paper sensor with a cotton swab. Refer to operator's manual.</li> <li>• Replace the RG-501X paper drive unit or WS-671P recorder module.</li> </ul>
	If waveforms and numeric data can be recorded on the paper when you pull out the paper after touching the Record key on the screen: • RG-501X paper drive unit or WS-671P recorder module failure.	Replace the RG-501X paper drive unit or WS-671P recorder module.
Nothing recorded on the paper and the model number "WS-671P" is not displayed on the INFO page of the SYSTEM SETUP window.	Recorder module failure.	Replace the WS-671P recorder module.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Page-dependent recording such as trend graph and vital sign list does not start at the top of the page.	Recording paper in the wrong position in the magazine.	Load the paper into the magazine properly so that each black square mark on the paper is detected.
	Dirty mark sensor.	Clean the mark sensor with a cotton swab. Refer to operator's manual.
	Failure in the mark sensor or related circuit of the recorder.	Replace the RG-501X paper drive unit or WS-671P recorder module.
Garbled numeric data on the paper.	Failure in the Recorder board of the recorder module.	Replace the WS-671P recorder module.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Waveforms and numeric data are distorted because the paper speed is unstable.	Platen roller or gears are dusty or damaged.	Clean the platen roller and gears. If the problem is still there, replace the YS-086P9 Magazine door assy.
	Unstable motor rotation.	Replace the RG-501X paper drive unit or MAIN DIGITAL board.
Waveforms and grid have faint parts.	Dirt on the thermal array head.	Clean the thermal array head.
	Thermal array head is improperly attached.	Remove the thermal array head and reattach it properly.
	Recorder door is not firmly closed.	Close the recorder door firmly.
	Thermal array head failure.	Replace the thermal array head.
	Recorder module failure.	Replace the WS-671P recorder module.

**Network Communication Problem**

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>
Cannot communicate with the network.	If BSM-6000 is connected to a PC with a cross network cable and ping response is not returned to the PC: • MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
	If BSM-6000 is connected to a PC with a cross network cable and ping response is returned to the PC: • Hub and cables have problems.	Check the hub and cables in the network.

**SD Card Problem**

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>
SD card error is displayed.	SD card is not inserted properly.	Remove then re-insert the SD card into the slot.
	SD card failure.	Replace the SD card.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.

**Communication Problems with Optional Units or External Equipment**

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>
Cannot recognize an AY-600P series input unit.	AY-600P series input unit failure.	Replace the input unit.
	Failure in the cable between the INPUT IF and MAIN DIGITAL boards.	Replace the cable.
	INPUT IF board failure.	Replace the INPUT IF board.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board.
Cannot communicate with an optional unit through a multilink port on the optional interface and "MULTILINK CONFIG ERROR" message is displayed.	Optional unit failure.	Replace the unit with a new one.
	Optional interface failure.	Replace the interface with a new one.
	MAIN DIGITAL board failure.	Replace the MAIN DIGITAL board with a new one.
Cannot communicate with an optional unit through a multilink port on the optional interface and "MULTILINK POWER ERROR" message is displayed.	Optional unit failure.	Replace the unit with a new one.
	Interface failure.	Replace the interface with a new one.

Problem	Possible Cause/Criteria	Action
Cannot communicate with an optional unit or external equipment through a multilink port on the optional interface and no error message is displayed.	If QI-631P, QI-632P, QI-634P, QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: <ul style="list-style-type: none"> <li>• Interface or MAIN DIGITAL board failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace the interface with a new one.</li> <li>• Replace the MAIN DIGITAL board.</li> </ul>
	If a port does not display the model number of the optional unit connected to the port on the MULTILINK CHECK screen in the MANUAL CHECK mode: <ul style="list-style-type: none"> <li>• Failure in the optional unit connected to this port or in the interface.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace the optional unit with a new one.</li> <li>• Replace the interface with a new one.</li> </ul>
	If no ports display the model numbers of the optional units connected to the ports on the MULTILINK CHECK screen in the MANUAL CHECK mode: <ul style="list-style-type: none"> <li>• Interface or MAIN DIGITAL board failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace the interface with a new one.</li> <li>• Replace the MAIN DIGITAL board with a new one.</li> </ul>
	If all ports display the model numbers of the optional units or external equipment connected to the ports on the MULTILINK CHECK screen in the MANUAL CHECK mode: <ul style="list-style-type: none"> <li>• MAIN DIGITAL board failure.</li> </ul>	Replace the MAIN DIGITAL board with a new one.
Cannot communicate with an external equipment through an RS-232C port on the optional interface.	If QI-631P, QI-632P, QI-634P, QI-671P or QI-672P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: <ul style="list-style-type: none"> <li>• Wrong baud rate setting or connection cable failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Set the baud rate properly.</li> <li>• Replace the connection cable if there is a poor contact or break in the cable or the cable is not cross type.</li> </ul>
	If QI-631P, QI-632P, QI-634P, QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: <ul style="list-style-type: none"> <li>• Interface or MAIN DIGITAL board failure.</li> </ul>	Replace the interface or MAIN DIGITAL board.

## 2. TROUBLESHOOTING

Problem	Possible Cause/Criteria	Action
USB mouse does not work.	If QI-631P, QI-632P, QI-634P, QI-671P or QI-672P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window and the LED of an optical mouse lights: <ul style="list-style-type: none"> <li>• MAIN DIGITAL board failure.</li> </ul>	Replace the MAIN DIGITAL board with a new one.
	If QI-631P, QI-632P, QI-634P, QI-671P or QI-672P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window and the LED of an optical mouse does not light: <ul style="list-style-type: none"> <li>• Mouse, interface or MAIN DIGITAL board failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace the mouse with a new one.</li> <li>• Replace the interface with a new one.</li> <li>• Replace the MAIN DIGITAL board with a new one.</li> </ul>
	If QI-631P, QI-632P, QI-634P, QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: <ul style="list-style-type: none"> <li>• Interface or MAIN DIGITAL board failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace the interface with a new one.</li> <li>• Replace the MAIN DIGITAL board with a new one.</li> </ul>
Vital sign waveforms cannot be transmitted to a receiver with a ZS-900P transmitter.	If the transmitter LED does not turn on: <ul style="list-style-type: none"> <li>• Poor contact between instrument and transmitter or failure in the transmitter or MAIN DIGITAL board.</li> </ul> If the LED lights in red: <ul style="list-style-type: none"> <li>• Transmitter or MAIN DIGITAL board failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Firmly connect the transmitter cable to the instrument.</li> <li>• Replace the transmitter with a new one.</li> <li>• Replace the MAIN DIGITAL board.</li> </ul>
Nothing is displayed on an external display.	If QI-631P, QI-632P, QI-634P, QI-671P or QI-672P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: <ul style="list-style-type: none"> <li>• Poor contact or break in the display cable or failure in the display, interface or MAIN DIGITAL board.</li> </ul>	<ul style="list-style-type: none"> <li>• Firmly connect the display cable between the instrument and display or replace the display cable with a new one.</li> <li>• Replace the display, interface or MAIN DIGITAL board with a new one.</li> </ul>
	If QI-631P, QI-632P, QI-634P, QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: <ul style="list-style-type: none"> <li>• Interface or MAIN DIGITAL board failure.</li> </ul>	Replace the interface or MAIN DIGITAL board with a new one.

Problem	Possible Cause/Criteria	Action
Alarm information of a bedside monitor is not output from the nurse call system.	If QI-632P or QI-671P interface is displayed in OPTIONS on the INFO page in the SYSTEM SETUP window and alarm signals are not output on the INDICATOR CHECK in MANUAL CHECK mode: <ul style="list-style-type: none"> <li>• Short circuit in the YJ-672P nurse call cable or failure in the interface or MAIN DIGITAL board.</li> </ul>	Replace the nurse call cable, interface or MAIN DIGITAL board with a new one.
	If QI-631P, QI-632P, QI-634P, QI-671P or QI-672P interface is not displayed in OPTIONS on the INFO page in the SYSTEM SETUP window: <ul style="list-style-type: none"> <li>• Interface or MAIN DIGITAL board failure.</li> </ul>	Replace the interface or MAIN DIGITAL board with a new one.

### Problems in ECG Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure ECG and “ECG MODULE ERROR” is displayed.	If ECG can be measured after disconnecting the ECG connection cord and removing then reattaching the input unit to the main unit: <ul style="list-style-type: none"> <li>• Noise such as static electricity causes the problem.</li> </ul>	Remove the cause of the noise.
	If ECG cannot be measured after disconnecting the ECG connection cord and removing then reattaching the input unit to the main unit: <ul style="list-style-type: none"> <li>• Input unit failure.</li> </ul>	Replace the input unit with a new one.
ECG waveform does not appear on the screen.	If “ECG CHECK ELECTRODES” is displayed: <ul style="list-style-type: none"> <li>• Failure in the path from patient to ECG input socket. <ul style="list-style-type: none"> <li>– The electrode peels or the gel of the electrode is dry.</li> <li>– High contact impedance between the electrode and the skin.</li> <li>– Instrument is not properly grounded.</li> <li>– ECG connection cord is not firmly connected.</li> </ul> </li> <li>– ECG connection cord failure.</li> <li>• Number of electrodes is set incorrectly on the instrument.</li> </ul>	<ul style="list-style-type: none"> <li>– Replace the electrodes.</li> <li>– Perform the skin preparation before attaching the electrode.</li> <li>– Ground the instrument properly.</li> <li>– Firmly connect the ECG connection cord between the input socket and electrode lead wires.</li> <li>– Replace the ECG connection cord.</li> <li>• Properly set the number of electrodes actually used.</li> </ul>
	If none of the above problems are found and “ECG CHECK ELECTRODES” is still displayed after you short-circuit all the electrode lead wires: <ul style="list-style-type: none"> <li>• Input unit failure.</li> </ul>	Replace the input unit with a new one.

## 2. TROUBLESHOOTING

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>
Heart rate not counted correctly and “ECG NOISE” is displayed.	Failure in the path from patient to ECG input socket. <ul style="list-style-type: none"> <li>• The electrode peels or the gel of the electrode is dry.</li> <li>• A baseline drift or EMG is on the ECG due to body movement.</li> <li>• High contact impedance between the electrode and skin.</li> <li>• The instrument is not properly grounded.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace the electrodes.</li> <li>• Attach new electrodes to different positions so that the affection of body movement is reduced.</li> <li>• Perform the skin preparation before attaching the electrode.</li> <li>• Ground the instrument properly.</li> </ul>
	If none of the above problems are found and “ECG NOISE” is still displayed after you short-circuit all the electrode lead wires: <ul style="list-style-type: none"> <li>• Input unit failure.</li> </ul>	Replace the input unit.
Heart rate not counted correctly and heart rate is not accurate.	Patient has a pacemaker but pacing detection is set to OFF.	Set the pacing detection to ON.
	Patient’s condition has changed, and current ECG template is different from the previous ECG reference template.	Perform “Learning ECG.”
	High frequency noise on the ECG waveform when an electrosurgical unit (ESU) is used.	Reduce the high frequency noise by changing the positions of electrodes and return plate. Refer to “Use with an Electrosurgical Unit” in “ECG Monitoring” of the User’s Guide Part II.
	If frequent pacing marks appear on the ECG: <ul style="list-style-type: none"> <li>• Instrument not properly grounded.</li> <li>• Electric blanket not shielded.</li> <li>• If none of the above problems are found and the baseline is unstable after you short-circuit all the electrode lead wires:               <ul style="list-style-type: none"> <li>– Input unit failure.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Ground the instrument properly.</li> <li>• Use a shield cover.</li> <li>• Replace the input unit.</li> </ul>

### Problems in Respiration (Impedance Method) Measurement

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>
Impedance method respiration waveform does not appear and “RESP OFF” message is displayed on the screen.	Impedance method respiration measurement is set to OFF.	Set the <IMPEDANCE MEASUREMENT> in the RESP window to ON.

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>
Impedance method respiration waveform does not appear and “- - -” is displayed instead of the respiration rate (RR).	The electrode peels or the gel of the electrode is dry.	Replace the electrodes.
	Electrodes are not made by Nihon Kohden.	Use Nihon Kohden electrodes.
	High contact impedance between the electrode and skin.	Perform the skin preparation before attaching the electrodes to the patient.
	ECG connection cord is not properly connected.	Properly connect the ECG connection cord.
	Break in ECG connection cord.	Replace the ECG connection cord.
	If none of the above problems are found and the baseline is still unstable after you short-circuit all the electrode lead wires: <ul style="list-style-type: none"> <li>• Input unit failure.</li> </ul>	Replace the input unit.
Respiration rate on screen is different from manually counted respiration rate.	The electrode peels or the gel of the electrode is dry.	Replace the electrodes.
	Electrodes are not made by Nihon Kohden.	Use Nihon Kohden electrodes.
	High contact impedance between the electrode and skin.	Perform the skin preparation before attaching the electrodes to the patient.
	ECG connection cord is not properly connected.	Properly connect the cord.
	Break in ECG connection cord.	Replace the cord.
	Baseline drift due to body movement, or waveform synchronized with heartbeat is mixed in the respiration waveform.	<ul style="list-style-type: none"> <li>• Select a lead from the ECG leads so that the affection is less than the others.</li> <li>• Change the positions of the two electrodes for respiration pickup so that the affection is less than the other positions.</li> <li>• Set the &lt;NOISE REDUCTION ON IMPEDANCE RESP&gt; in the SYSTEM SETUP window to ON.</li> </ul>
	High frequency noise on the respiration waveform when an electrosurgical unit (ESU) is used.	Reduce the high frequency noise by changing the positions of electrodes and return plate. Refer to “Use with an Electrosurgical Unit” in “ECG Monitoring” of the User’s Guide Part II.
If none of the above problems are found and the baseline is still unstable after you short-circuit all the electrode lead wires: <ul style="list-style-type: none"> <li>• Input unit failure.</li> </ul>	Replace the input unit.	

**Problem in Invasive Blood Pressure (IBP) Measurement**

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>
Cannot measure IBP and “MPU MODULE ERROR” is displayed.	If IBP can be measured after disconnecting the IBP connection cord and removing then reattaching the input unit to the main unit: <ul style="list-style-type: none"> <li>Noise such as static electricity causes the problem.</li> </ul>	Remove the cause of the noise.
	If IBP cannot be measured after disconnecting the IBP connection cord and removing then reattaching the input unit to the main unit: <ul style="list-style-type: none"> <li>Input unit* failure</li> <li>* When a smart expansion unit is attached to the input unit, remove the smart expansion unit and check whether the message appears with the input unit.</li> </ul>	Replace the input unit or smart expansion unit with a new one.
Cannot measure IBP, “---” is displayed and “PRESS CHECK SENSOR” message is displayed.	IBP connection cord or blood pressure transducer failure.	Replace the IBP connection cord or blood pressure transducer with a new one.
Cannot measure IBP, there is no error message, and blood pressure value is not displayed.	If IBP can be measured after connecting the IBP connection cord and blood pressure transducer to one of the other MP sockets: <ul style="list-style-type: none"> <li>MPU board or EXTMPU board failure</li> </ul>	Replace the MPU board or EXTMPU board with a new one.
	If IBP cannot be measured after connecting the IBP connection cord and blood pressure transducer to one of the other MP sockets: <ul style="list-style-type: none"> <li>IBP connection cord or blood pressure transducer failure.</li> </ul>	Replace the IBP connection cord or blood pressure transducer with a new one.
Zeroing (zero adjustment) is incomplete.	If “MPU MODULE ERROR” is displayed: <ul style="list-style-type: none"> <li>Refer to “Cannot be measured and MPU MODULE ERROR is displayed”.</li> </ul>	<ul style="list-style-type: none"> <li>Remove the cause of the noise.</li> <li>Replace the input unit or smart expansion unit with a new one.</li> </ul>
	If “PRESS CHECK SENSOR” is displayed: <ul style="list-style-type: none"> <li>Failure in IBP connection cord or blood pressure transducer.</li> </ul>	Replace the IBP connection cord or blood pressure transducer with a new one.
	If “PRESS ZERO OUT OF RANGE” is displayed after zeroing: <ul style="list-style-type: none"> <li>Pressure less than -200 mmHg or more than +200 mmHg is applied to the transducer.</li> <li>Transducer failure.</li> </ul>	<ul style="list-style-type: none"> <li>Open the cock at the transducer and check that the transducer faces open air.</li> <li>Replace the transducer with a new one.</li> </ul>
	If “PRESS ZERO UNSTABLE” is displayed after zeroing: <ul style="list-style-type: none"> <li>Some pressure remains.</li> <li>External pressure or vibration is applied to the blood circuit.</li> </ul>	<ul style="list-style-type: none"> <li>Open the cock at the transducer and check that the transducer faces open air.</li> <li>Remove the cause.</li> </ul>



Problem	Possible Cause/Criteria	Action
Zeroing (zero adjustment) is incomplete.	If none of the above mentioned actions solve the problem but connecting the IBP connection cord and transducer to another MP socket solves the problem: <ul style="list-style-type: none"> <li>• MPU board or EXTMPU board failure.</li> </ul>	Replace the MPU board or EXTMPU board with a new one.
Noise on blood pressure waveform.	If an IBP connector of an AX-400G is connected to the MP socket, constant pressure is applied, and noise on the waveform trace is much more than 2 mmHg: <ul style="list-style-type: none"> <li>• Input unit or smart expansion unit failure.</li> </ul>	Replace the MPU board or EXTMPU board with a new one.
	If an IBP connector of an AX-400G is connected to the MP socket, constant pressure is applied, and noise on the waveform trace is around 1 to 2 mmHg: <ul style="list-style-type: none"> <li>• Mechanical vibration.</li> </ul>	Remove the cause of the noise.

### Problem in Temperature (TEMP) Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure TEMP.	If another working temperature probe is connected to the input jack and the temperature value appears: <ul style="list-style-type: none"> <li>• Probe failure.</li> </ul>	Replace the temperature probe.
	If another working temperature probe is connected to the input jack and the temperature value does not appear: <ul style="list-style-type: none"> <li>• Connector board or Analog board failure.</li> </ul>	Replace the Connector board or Analog board.

**Problems in Respiration (Thermister Method) Measurement**

<b>Problem</b>	<b>Possible Cause/Criteria</b>	<b>Action</b>
Cannot measure TEMP and “MPU MODULE ERROR” is displayed.	If respiration can be measured after disconnecting the MP connector of the respiration pickup and removing and reattaching the input unit to the main unit: • Noise such as static electricity causes the problem.	Remove the cause of the noise.
	If respiration cannot be measured after disconnecting the MP connector of the respiration pickup and removing and reattaching the input unit to the main unit: • Input unit* failure * When a smart expansion unit is attached to the input unit, remove the smart expansion unit and check whether the message appears with the input unit.	Replace the input unit or smart expansion unit with a new one.
Cannot measure TEMP, “---” is displayed and “RESP CHECK SENSOR” message is displayed.	Respiration pickup failure.	Replace the pickup with a new one.
Cannot measure TEMP, no error message is displayed and no respiration rate is displayed.	If respiration can be measured after connecting the respiration pickup to one of the other MP sockets: • MPU board or EXTMPU board failure.	Replace the pickup with a new one.
	If respiration cannot be measured after connecting the respiration pickup to one of the other MP sockets: • Pickup failure.	Replace the pickup with a new one.

## Problem in Oxygen Gas (O<sub>2</sub>) Concentration Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure FiO <sub>2</sub> and “MPU MODULE ERROR” is displayed.	If FiO <sub>2</sub> can be measured after disconnecting the FiO <sub>2</sub> connection cord and removing then reattaching the input unit to the main unit: <ul style="list-style-type: none"> <li>Noise such as static electricity causes the problem.</li> </ul>	Remove the cause of the noise.
	If FiO <sub>2</sub> cannot be measured after disconnecting the FiO <sub>2</sub> connection cord and removing then reattaching the input unit to the main unit: <ul style="list-style-type: none"> <li>FiO<sub>2</sub>, input unit* failure</li> </ul> * When a smart expansion unit is attached to the input unit, remove the smart expansion unit and check whether the message appears with the input unit.	Replace the input unit or smart expansion unit with a new one.
Cannot measure FiO <sub>2</sub> , “---” is displayed and “O <sub>2</sub> CHECK SENSOR” message is displayed.	FiO <sub>2</sub> connection cord or O <sub>2</sub> sensor failure.	Replace the FiO <sub>2</sub> connection cord or O <sub>2</sub> sensor with a new one.
Cannot measure FiO <sub>2</sub> , no error message is displayed and no FiO <sub>2</sub> value is displayed.	If FiO <sub>2</sub> can be measured after connecting the FiO <sub>2</sub> connection cord and O <sub>2</sub> sensor to one of the other MP sockets: <ul style="list-style-type: none"> <li>MPU board or EXTMPU board failure.</li> </ul>	Replace the MPU board or EXTMPU board with a new one.
	If FiO <sub>2</sub> cannot be measured after connecting the FiO <sub>2</sub> connection cord and O <sub>2</sub> sensor to one of the other MP sockets: <ul style="list-style-type: none"> <li>FiO<sub>2</sub> connection cord or O<sub>2</sub> sensor failure.</li> </ul>	Replace the FiO <sub>2</sub> connection cord or O <sub>2</sub> sensor with a new one.
FiO <sub>2</sub> value is randomly unstable.	If the O <sub>2</sub> sensor is exposed to air and the FiO <sub>2</sub> value becomes stable: <ul style="list-style-type: none"> <li>Ventilator circuit failure.</li> </ul>	Remove the cause from the ventilator circuit.
	If the O <sub>2</sub> sensor is exposed to air and the FiO <sub>2</sub> value is still unstable: <ul style="list-style-type: none"> <li>O<sub>2</sub> sensor failure.</li> </ul>	Replace the O <sub>2</sub> sensor with a new one.
Cannot calibrate and “O <sub>2</sub> CAL??” is displayed.	If there is no problem with O <sub>2</sub> calibration gas and calibration cannot be done: <ul style="list-style-type: none"> <li>The O<sub>2</sub> sensor has reached the end of its life.</li> <li>MPU board or EXTMPU board failure.</li> </ul>	<ul style="list-style-type: none"> <li>Replace the O<sub>2</sub> sensor with a new one.</li> <li>Replace the MPU board or EXTMPU board with a new one.</li> </ul>

### Problem in Cardiac Output (CO) Measurement

Problem	Possible Cause/Criteria	Action
CO, Tb and Ti temperatures cannot be measured and “MPU MODULE ERROR” is displayed.	If CO can be measured after disconnecting the CO connection cord and removing then reattaching the input unit to the main unit: <ul style="list-style-type: none"> <li>Noise such as static electricity causes the problem.</li> </ul>	Remove the cause of the noise.
	If CO can be measured after disconnecting the CO connection cord and removing then reattaching the input unit to the main unit: <ul style="list-style-type: none"> <li>Input unit* failure.</li> </ul> <p>* When a smart expansion unit is attached to the input unit, remove the smart expansion unit and check whether the message appears with the input unit.</p>	Replace the input unit or smart expansion unit with a new one.
Tb and Ti cannot be measured, “--” is displayed and “CO CHECK SENSOR” message is displayed.	CO connection cord or balloon catheter failure.	Replace the CO connection cord or balloon catheter with a new one.
CO, Tb and Ti cannot be measured and no error message is displayed.	If CO can be measured after connecting the CO connection cord and balloon catheter to one of the other MP sockets: <ul style="list-style-type: none"> <li>MPU board or EXTMPU board failure.</li> </ul>	Replace the MPU board or EXTMPU board with a new one.
	If CO cannot be measured after connecting the CO connection cord and balloon catheter to one of the other MP sockets: <ul style="list-style-type: none"> <li>CO connection cord or balloon catheter failure.</li> </ul>	Replace the CO connection cord or balloon catheter with a new one.
Only Ti cannot be measured, “---” is displayed at Ti and “CO Ti TEMP ERROR” is displayed.	CO connection cord or balloon catheter failure.	Replace the CO connection cord or balloon catheter with a new one.
	Injection liquid temperature outside measurable range.	Let the injection liquid temperature within the measurable range (0 to 27°C).
Only Tb cannot be measured, “---” is displayed at Tb and “CO Tb TEMP ERROR” is displayed.	CO connection cord or balloon catheter failure.	Replace the CO connection cord or balloon catheter with a new one.
	Blood temperature outside measurable range.	Check that the blood temperature is in the measurable range (15 to 45°C).
CO cannot be measured and “CO BASELINE DRIFT” is displayed.	If the CO connector of an AX-400G is connected to the MP socket and the problem remains: <ul style="list-style-type: none"> <li>MPU board or EXTMPU board failure.</li> </ul>	Replace the MPU board or EXTMPU board with a new one.
	If an AX-400G is connected and the problem disappears: <ul style="list-style-type: none"> <li>Physiological fluctuation or external noise interferes with the baseline.</li> </ul>	Remove the cause of physiological fluctuation or cause of the noise.

## Problems in Non-invasive Blood Pressure (NIBP) Measurement

Problem	Possible Cause/Criteria	Action
The display area for NIBP values does not appear after an air hose is connected.	Poor contact between air hose and red input socket.	Disconnect the air hose from the socket and reconnect the air hose to the socket tightly.
	Failure in the air hose.	Replace the air hose.
	If none of the above problems are found and the NIBP display area does not appear: <ul style="list-style-type: none"> <li>• Input unit failure.</li> </ul>	Replace the MPU board.
The NIBP display area appears and the cuff does not inflate.	When “NIBP SAFETY CIRCUIT RUNNING” message is displayed, the cuff inflation disables for 30 seconds.	Before starting the measurement after 30 seconds, check that there is no blockage in the cuff and air hose and no excessive pressure to the patient.
	If you touch the [NIBP Start/Stop] key and there is no pump sound: <ul style="list-style-type: none"> <li>• Pump or pump drive circuit failure.</li> </ul>	Replace the pump, AY MOTHER (INPUT MOTHER) board or MPU board with a new one.
The NIBP display area appears and the cuff inflates.	If you touch the [NIBP Start/Stop] key, there is a pump sound, and pressure does not reach the target pressure: <ul style="list-style-type: none"> <li>• Air leak in the cuff or air hose.</li> <li>• Pneumatic circuit, valve or valve drive circuit failure.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace the cuff or air hose.</li> <li>• Check each component of the pneumatic circuit and replace it if necessary.</li> <li>• Replace the valve or MPU board.</li> </ul>
	If remeasurement starts after step deflation and finally “MEAS TIMEOUT” appears: <ul style="list-style-type: none"> <li>• The cuff is not properly attached to the patient.</li> <li>• Vibration or external pressure on the cuff or air hose.</li> <li>• Failure in the oscillation signal amplification circuit of the MPU board.</li> </ul>	<ul style="list-style-type: none"> <li>• Attach the cuff to the patient properly.</li> <li>• Find any cause which can give vibration or pressure to the cuff or air hose, and remove the cause.</li> <li>• Replace the MPU board.</li> </ul>

## 2. TROUBLESHOOTING

### Problems in SpO<sub>2</sub> Measurement

Problem	Possible Cause/Criteria	Action
Cannot measure SpO <sub>2</sub> and “SpO <sub>2</sub> MODULE ERROR” is displayed on the screen.	SpO <sub>2</sub> board, MPUPWR board or TEMP board failure.	Replace the SpO <sub>2</sub> board, MPUPWR board or TEMP board with a new one.
Cannot measure SpO <sub>2</sub> and “SpO <sub>2</sub> CONNECTOR OFF” or “SpO <sub>2</sub> CHECK PROBE” is displayed on the screen.	SpO <sub>2</sub> connection cord or SpO <sub>2</sub> probe failure.	Replace the SpO <sub>2</sub> connection cord or probe.
	If the problem remains after replacing the SpO <sub>2</sub> connection cord or probe: • SpO <sub>2</sub> board or MPUPWR board failure.	Replace the SpO <sub>2</sub> board or MPUPWR board with a new one.
Cannot measure SpO <sub>2</sub> and “SpO <sub>2</sub> WEAK PULSE” or “SpO <sub>2</sub> CANNOT DETECT PULSE” is displayed.	SpO <sub>2</sub> connection cord or SpO <sub>2</sub> probe failure.	Replace the SpO <sub>2</sub> connection cord or probe.
	If the message remains after replacing the SpO <sub>2</sub> connection cord and probe, connect an AX-400G vital sign simulator to the SpO <sub>2</sub> socket instead. If the messages disappear after connecting an AX-400G vital sign simulator to the SpO <sub>2</sub> socket: • The instrument and accessories have no problem.	Refer to “Screen Messages”.
	If there is still a message after connecting an AX-400G vital sign simulator to the SpO <sub>2</sub> socket: • SpO <sub>2</sub> board or MPUPWR board failure.	Replace the SpO <sub>2</sub> board or MPUPWR board with a new one.

## Error Code and History

The error history records the results of the self tests which are automatically executed when the power is turned on, and the errors which are detected while the monitor is in operation. The monitor saves the history of failures that occurred in the past, and retains it until the factory system initialization is executed.

Use the HISTORY screen of the DIAGNOSTIC CHECK screen to display the error history. Refer to the Section 3 “Displaying the DIAGNOSTIC CHECK screen” to display the DIAGNOSTIC CHECK screen.

Error codes displayed in the error history are listed below.

### Error Code List

Large Classification	Details	Error Description
DIAG ERROR	FRAM Check: Manage Table Error.	Set value check error (an error was detected in the management area).
	FRAM Check: Setting Table Size Error.	Set value check error (an error was detected in the memory size check).
	FRAM Check: Setting Area1&2 Sum Error.	Set value check error (an error was detected in the SUM check).
	SETLIB: Keycode Err	There was a same key code when copying a set value.
	DIAG NG [error code] error messages	An error was detected in the self-check in the start-up. DIAG NG error messages 1) ROM: FlashRom program area check sum error 2) CHR: FlashRom character area check sum error 3) INFO: FlashRom information block check sum error 4) RAM: SDRAM data area 5) FRAM: FRAM data area check error 6) TCH: An error was detected in the touch panel. 7) RTC: An error was detected in the date and real time clock IC. 8) SD: An error was detected in the memory card, or the power was turned on before a memory card is inserted. 9) DAT: An error was detected in the data check of the setting value management. 10) MAC: The MAC address was not correct.
SYSTEM DOWN	**** ZERO DIVIDE ****	Error of division by zero (divided by zero).
	**** UNDEFINED INSTRUCTION ****	An undefined instruction was given.
	**** PREFETCH ABORT ****	An unauthorized instruction was fetched.
	**** DATA ABORT/WP ERROR ****	An unauthorized address was accessed.

## 2. TROUBLESHOOTING

Large Classification	Details	Error Description
SYSTEM DOWN	**** SYSTEM ERROR ****	A system error occurred (SYSTEM ERROR in the large classification occurred).
	**** WATCHDOG ERROR ****	An interruption by the watchdog timer occurred.
	**** UNKNOWN ERROR ****	A system shutdown occurred due to causes other than the above.
SYSTEM ERROR	pc_sd_io:Illegal buffer address.	Input-output buffer was in an odd address.
	pc_sd_io:Illegal drive number.	Drive number check error (a nonexistent drive number was designated).
	pc_sd_io:Illegal task priority.	An access of a task with a priority higher than the SD card transfer task occurred.
	MMEExEntryEventBufferFail.	An event buffer registration failed.
	MMEExEventBufferFull.	Overflow occurred in EventBuffer.
	InitialaizeNet:error at call to NU_Init_Net	Initialization of the nucleus net failed.
	File system initialaize error!	Initialization of the file system failed.
	ILLEGAL MAIN EXEC!	An illegal restart happened.
	Reached_raise().	A C language library runtime error occurred.
	Reached_sys_exit().	The main() function was exited, or a C language library runtime error occurred.
	OS resouces can not create!	Judged as a system error if all the resources cannot be properly created.
	HISR[%s] stack broken!	Overflow occurred in the HISR stack buffer.
	TASK[%s] stack broken!	Overflow occurred in the task stack buffer.
	FATAL OS ERROR!	A fatal error was detected in OS.
	ILLEGAL RESET!	An illegal reset interruption occurred while in operation.
	ILLEGAL INTERRUPT!	An illegal software interruption occurred.
	UNKNOWN FIQ!	An unknown high-speed interruption occurred.
	Wave buffer initialize error!	Wave buffer initialization failed.
	Root memory check error!	Fixed data or initialization data was broken.
	InitializeCheckResource() failure!	Resource check initialization failed.
	System stack broken!	An error was detected in the stack check.
	CheckResource() failure!	An error was detected in the resource check.
	Resouce[%s] overflow!	The resource usage ratio exceeded 95%.
	APSB_tBuffer over run!	The AP shared buffer exceeded its capacity.
	Buffer[%s] broken!	Fixed data or initialization data was broken.
	SYSCHK: VSync(LISR) NOP!	The VSYNC interruption was not activated.
	SYSCHK: Monitor Task NOP!	The monitor task was not activated.
	SYSCHK: WaveDrawTask NOP!	The wave drawing task was not activated.
	“SYSCHK: TimerTask NOP!	The timer manager was not activated.
	“SYSCHK: AlarmManager NOP!	The alarm manager was not activated.
	SYSCHK: NumericDrawTask NOP!	The numeric character drawing task was not activated.
	SYSCHK: RootTask NOP!	The root task was not activated.
	SYSCHK: Scheduler(HISR) NOP!	HISR did not operate during the VSYNC interruption.
TIMER: RTC STOP?	Date and time indication was not updated for three seconds or over.	
TIMER: GetPresentTime() fail.	Acquisition of the current date and time from the date and real time clock IC failed.	
Exception repeated many times!	Exception handlings occurred repeatedly.	
Interrupt Error!	An interruption did not occur.	



# Section 3 Diagnostic Check and Safety Check

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3. DIAGNOSTIC CHECK AND SAFETY CHECK

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## Appearance Check

### Checking the Appearance for Damage and Dirt

Check the following items.

- All parts of the monitor are free of dirt.
- The exterior of the monitor is free of breakage, including cracks.
- The labels are not come off or torn off.
- The connectors and switches are not cracked or loose.
- No parts are soiled with blood or chemicals.

### Checking the Power Cord

Use only the power cord specified by Nihon Kohden. Visually check that it is free of dirt, breakage or torn coating. Additionally, use a circuit tester to check that the power cord's grounding conductor is not broken.

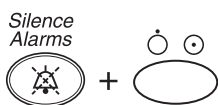
## Displaying the DIAGNOSTIC CHECK Screen

Use this screen to display the error history or perform manual check or system setup and initialization.

3

### CAUTION

This procedure interrupts all monitoring. Only change these settings before or after monitoring.



1. Turn the monitor power off.
2. Press the [Power] switch while pressing the [Silence Alarms] key on the front panel until the DIAGNOSTIC CHECK screen is displayed.



3. To exit the DIAGNOSTIC CHECK screen and return to the home screen, touch the RETURN key.

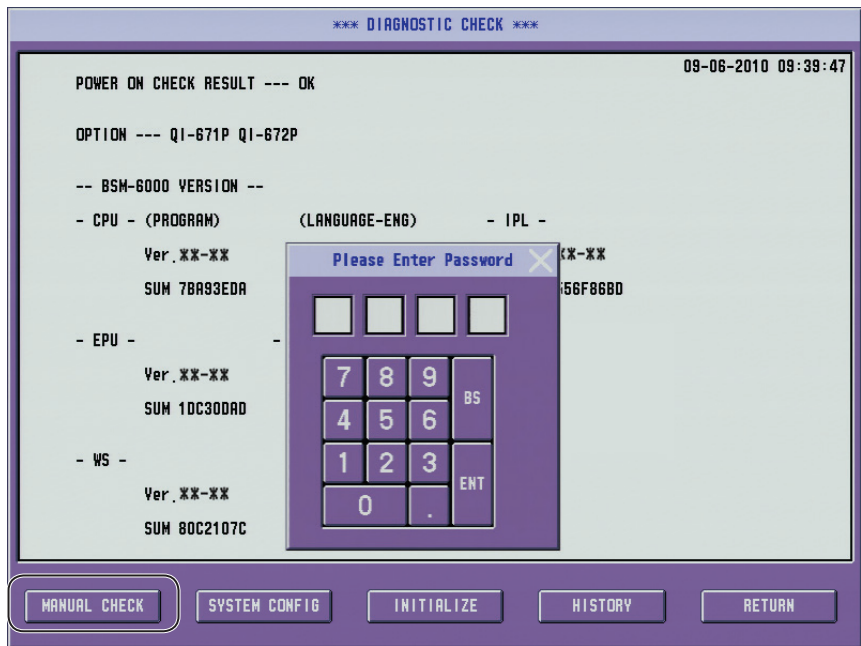
3. DIAGNOSTIC CHECK AND SAFETY CHECK

Displaying the MANUAL CHECK Screen

NOTE

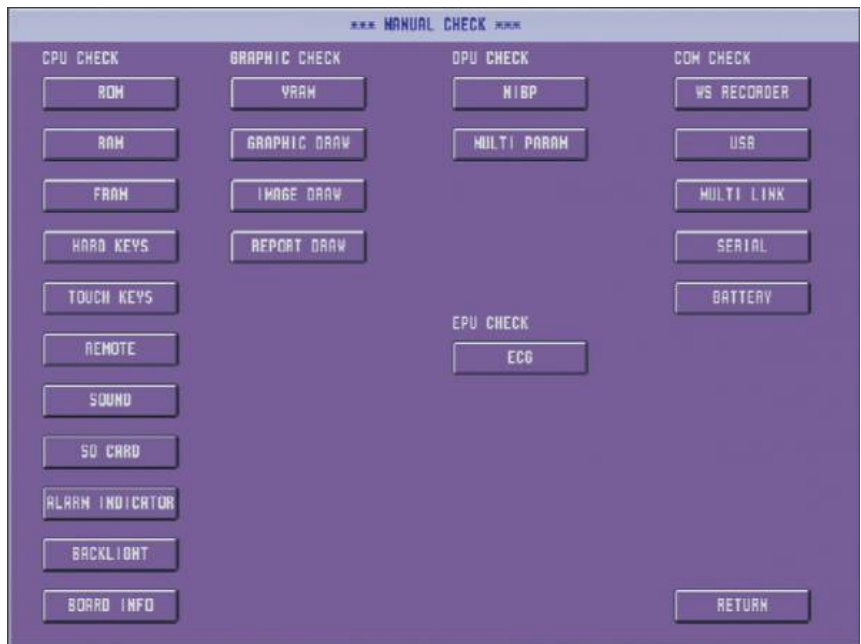
When a BSM-1700 series bedside monitor is mounted on a BSM-6000 series bedside monitor, remove the BSM-1700 series bedside monitor from the BSM-6000 series bedside monitor before performing manual checks. Otherwise the manual checks may not be performed correctly.

- 1. Touch the MANUAL CHECK key. The window to enter the password appears.



- 2. Enter the password with the number keys and touch the ENT key. The MANUAL CHECK screen appears.

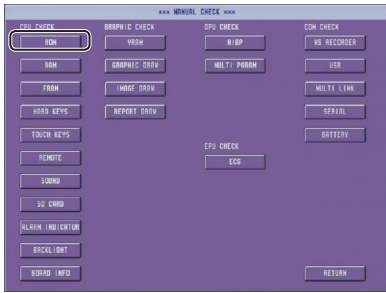
The default password is "1234".



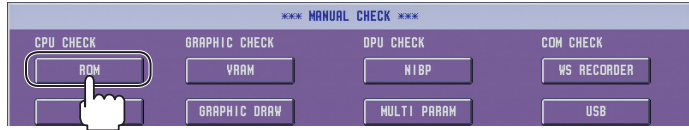
- 3. To exit the MANUAL CHECK screen and return to the DIAGNOSTIC CHECK screen, touch the RETURN key.

## Checking the ROM

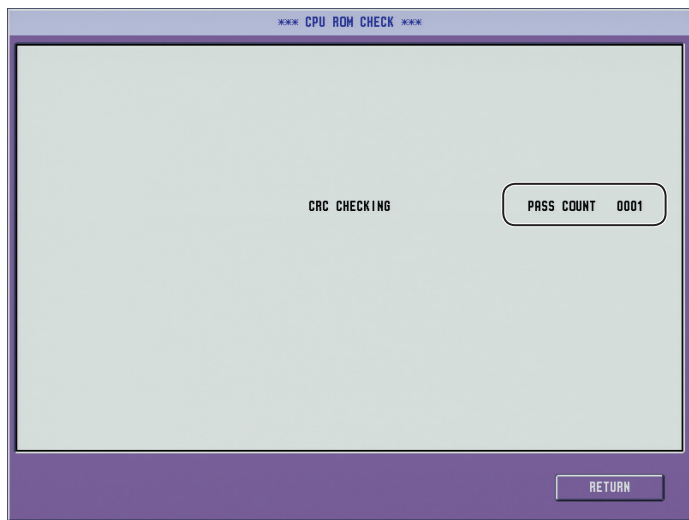
Check the ROM within the monitor to see if the main board is not defective.



1. On the MANUAL CHECK screen, touch the ROM key to display the CPU ROM CHECK screen.



2. The ROM is checked automatically. On the CPU ROM CHECK screen, check that the PASS COUNT value increments from 00000 in steps of 1. This takes about 10 to 15 seconds. Make sure that no error indication appears.



When there is no error indication and the count is increased from 00000 to 00001, it is the end of the check.

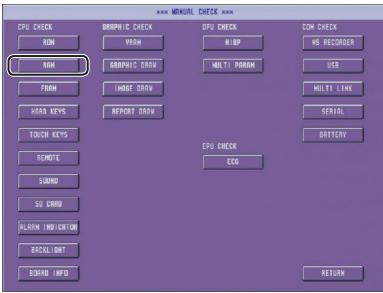
3. Touch the RETURN key to return to the MANUAL CHECK screen.



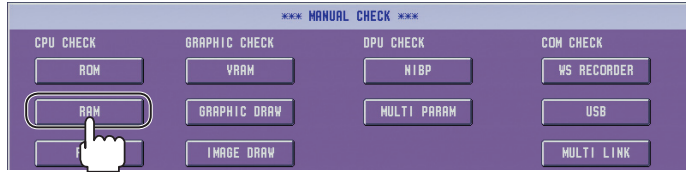
### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the RAM

Check the RAM within the monitor to see if the main board is not defective.



1. On the MANUAL CHECK screen, touch the RAM key to display the CPU RAM CHECK screen.



2. The RAM is checked automatically. On the CPU RAM CHECK screen, check that the PASS COUNT value increments from 00000 in steps of 1. This takes about 30 seconds. Make sure that no error indication appears.



When there is no error indication and the count is increased from 00000 to 00001, it is the end of the check.

3. Touch the RETURN key to return to the MANUAL CHECK screen.



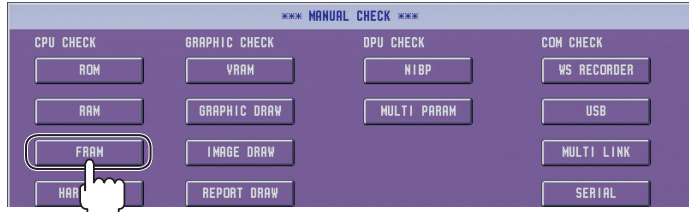


## Checking the FRAM

Check the FRAM within the monitor to see if the main board is not defective.



1. On the MANUAL CHECK screen, touch the FRAM key to display the FRAM CHECK screen.



2. The FRAM is checked automatically. On the FRAM CHECK screen, check that the PASS COUNT value increments from 0000 in steps of 1. Make sure that no error indication appears.



When there is no error indication and the count is increased from 0000 to 0001, it is the end of the check.

3. Touch the RETURN key to return to the MANUAL CHECK screen.

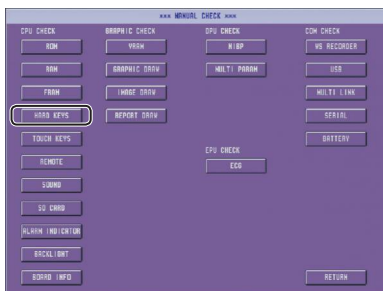


### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

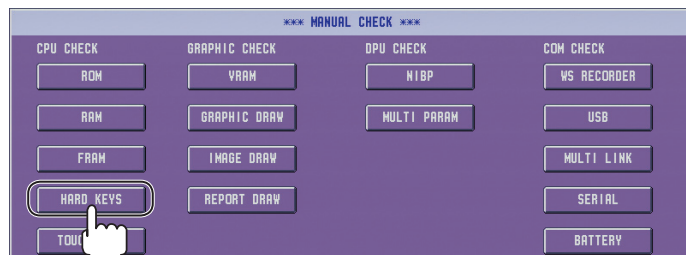
#### Checking Key Operation

Check if the following keys on the front of the main unit are free of internal failure, such as poor contact.

- [Silence Alarms] key
- [NIBP Start/Stop] key
- [Menu] key
- [Home] key
- [Record/Stop] key (option)

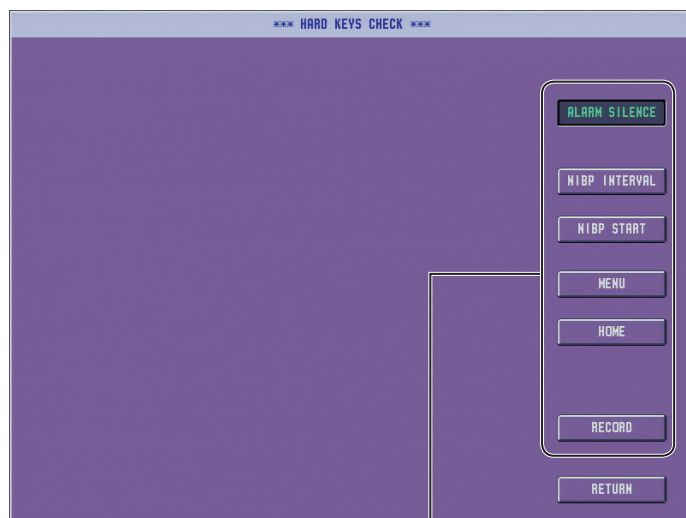


1. On the MANUAL CHECK screen, touch the HARD KEYS key to display the HARD KEYS CHECK screen.



2. Press each key and check that the image corresponding to the pressed key is highlighted.

<Example: When the Silence Alarms key is pressed>



Check that the image corresponding to the pressed key is highlighted.

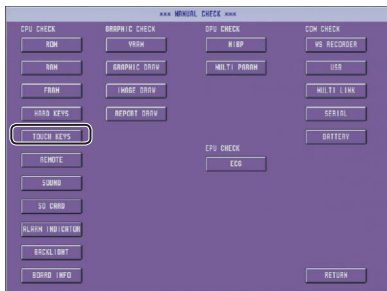
- ALARM SILENCE: [Silence Alarms] key
- NIBP INTERVAL: [NIBP interval] key
- NIBP START: [NIBP Start/Stop] key
- MENU: [Menu] key
- HOME: [Home] key
- RECORD: [Record/Stop] key (option)

3. Touch the RETURN key to return to the MANUAL CHECK screen.

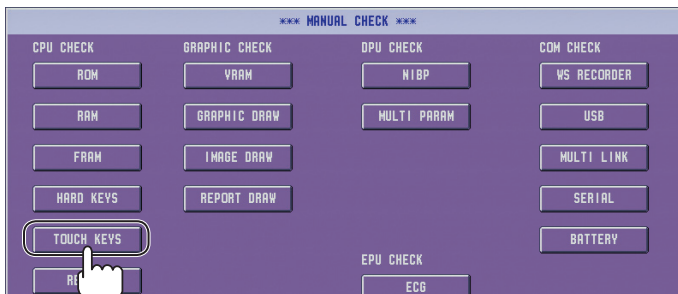


### Checking the Operation of Touch Keys

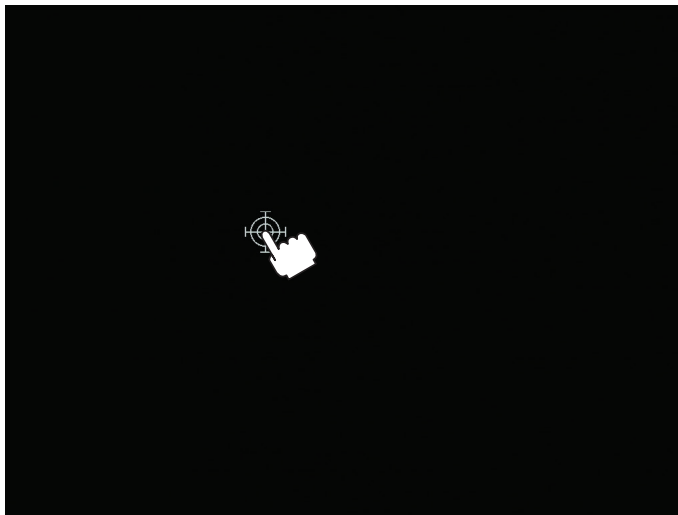
Check that the touch key position is correct.



1. On the MANUAL CHECK screen, touch the TOUCH KEYS key to display the confirmation screen for touch keys.



2. Touch somewhere on the screen and check that the confirmation mark moves to the touched position.



If the touched position does not match the confirmation mark, perform the procedure explained in “Calibrating the Touch Panel” on the next page.



3. Press the [Home] key to return to the MANUAL CHECK screen.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Calibrating the Touch Panel

You can calibrate the touch panel, as required. If the actual working position is different from the touched position, correct the working position.

1. On the MANUAL CHECK screen, touch the RETURN key to return to the DIAGNOSTIC CHECK screen.



2. With the DIAGNOSTIC CHECK screen displayed, press the [Menu] key to display the calibration screen for the touch panel.
3. Calibrate the touch panel.

#### NOTE

If you stop calibration halfway (by pressing the [Home] key or turning off power), the result is that the detection position in the touch panel shows a shift. If this occurs, perform the calibration again.

- i) Touch the “@” calibration key, which appears at the top left of the screen, keep it pressed for at least 2 seconds and release your finger when the “Please release from touch panel.” message appears.

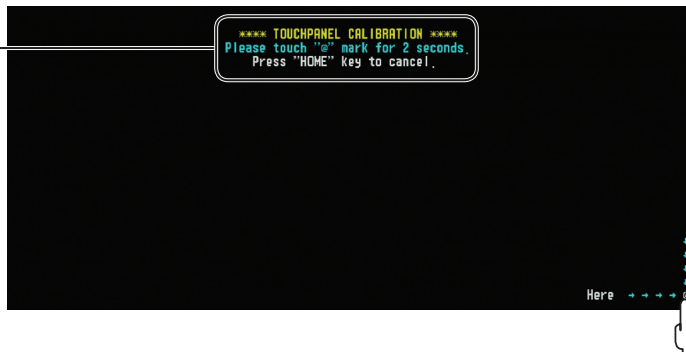


Release your finger when the following message appears.

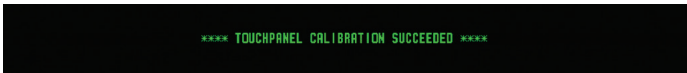


- ii) Touch the “@” calibration key, which appears at the bottom right of the screen, keep it pressed for at least 2 seconds and release your finger when the “Please release from touch panel.” message appears.

Release your finger when the following message appears.



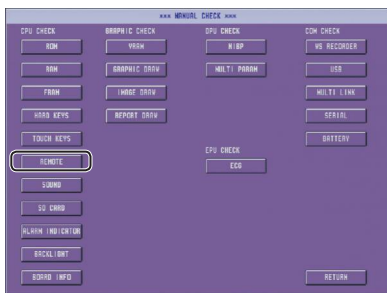
- iii) Check that the “TOUCHPANEL CALIBRATION SUCCEEDED” message appears to show that calibration is completed.



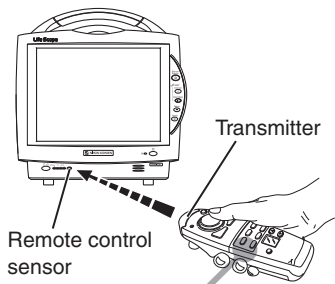
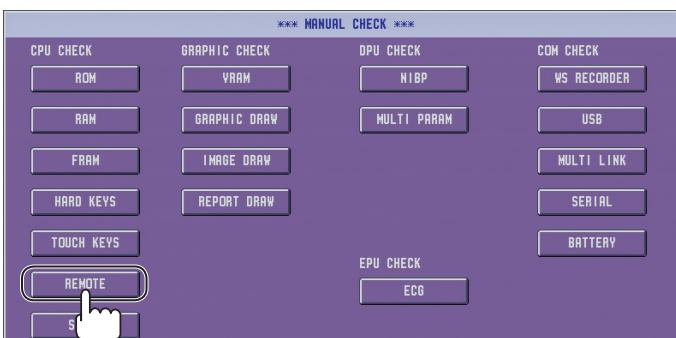
- 4. Press the [Home] key to return to the DIAGNOSTIC CHECK screen.

### Checking the RY-910PA Remote Controller (Option)

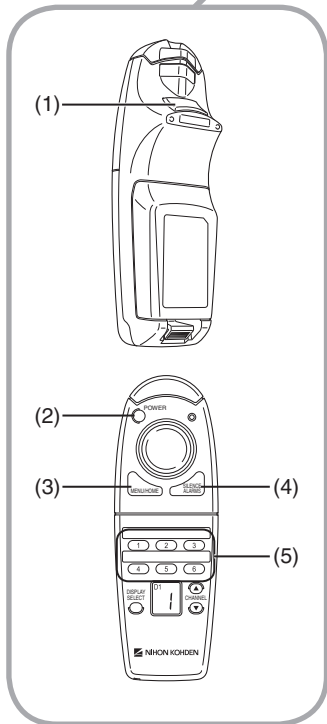
As an optional item, the RY-910PA remote controller is available. Check that all keys on the remote controller are not defective.



- 1. On the MANUAL CHECK screen, touch the REMOTE key to display the REMOTE CHECK screen.



- 2. Check that all keys on the remote controller are not defective.
  - i) Face the transmitter of the remote controller to the remote control sensor on the front of the monitor and press individual operation keys.
  - ii) On the REMOTE CHECK screen, check that you see the code number corresponding to the pressed operation key.



Operation Key on the Remote Controller		Corresponding Code Number	
(1)	ENTER key		82 XX XX 00 XX
(2)	POWER button		80 XX XX 02 XX
(3)	MENU/HOME key		80 XX XX 03 XX
(4)	SILENCE ALARMS key		80 XX XX 04 XX
(5)	Customize key	1	80 XX XX 63 XX
		2	80 XX XX 65 XX
		3	80 XX XX 67 XX
		4	80 XX XX 69 XX
		5	80 XX XX 6B XX
		6	80 XX XX 6D XX

- 3. Touch the RETURN key to return to the MANUAL CHECK screen.

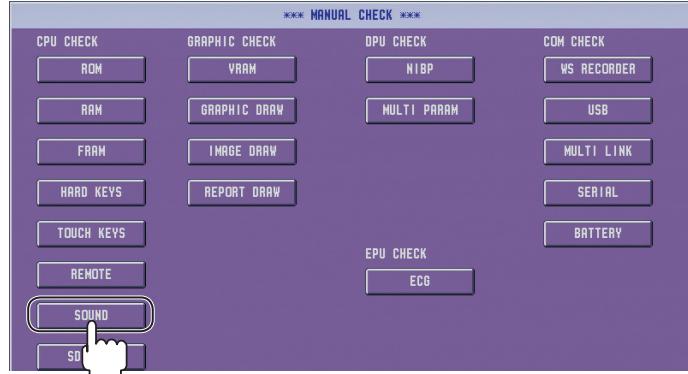
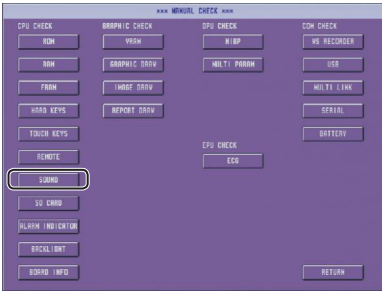


### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

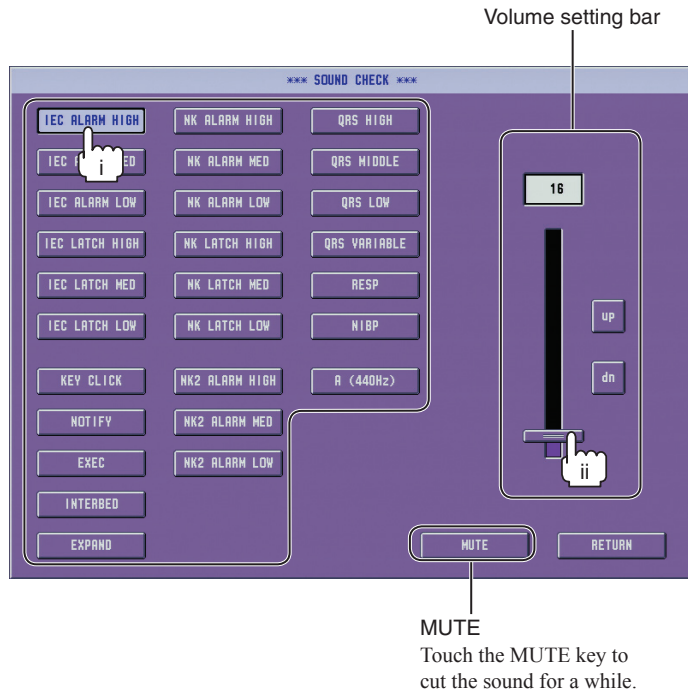
#### Checking the Sound Output

Generate the alarm sound, synchronous sound and key sound to check the status of the sound source and the amplifier. Additionally, check the sound volume.

1. On the MANUAL CHECK screen, touch the SOUND key to display the SOUND CHECK screen.



2. Check the sound output.
  - i) Select the type of a sound to be checked.
  - ii) Check that the selected sound is changed in volume when you slide the volume setting bar vertically or touch the up and dn keys.



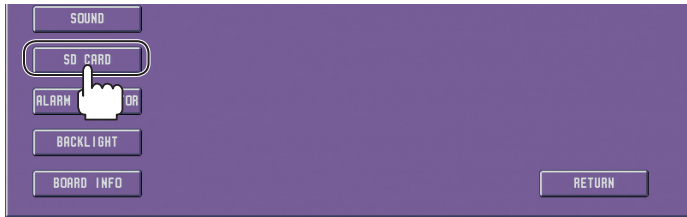
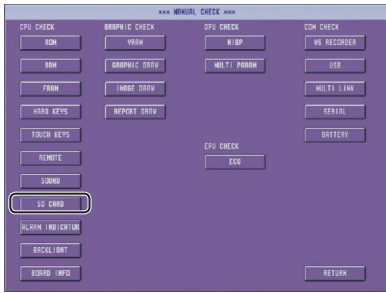
3. Touch the RETURN key to return to the MANUAL CHECK screen.



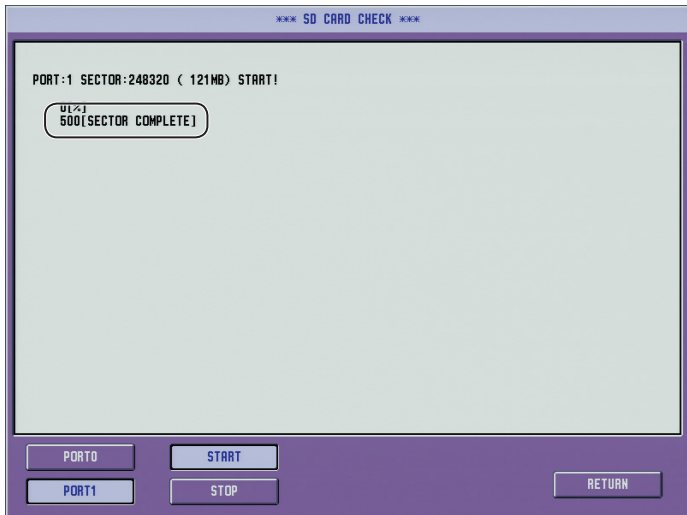
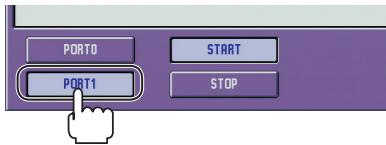
### Checking the Memory Card

Check that the internal memory card works normally.

1. On the MANUAL CHECK screen, touch the SD CARD key to display the SD CARD CHECK screen.



2. Touch the PORT1 key to start checking the internal memory card. Observe the screen for approximately one minute to check that the SECTOR COMPLETE value increments from 0 in steps of 1 and that there is no error indication.



The check is completed if there is no error indication and the SECTOR COMPLETE value increments from 0 in steps of 100.

3. Touch the RETURN key to return to the MANUAL CHECK screen.

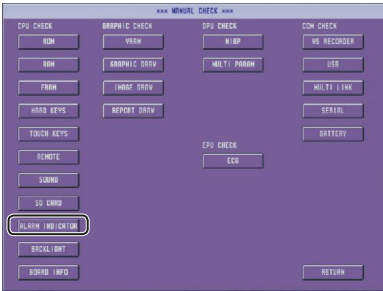




### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the Alarm Indicator

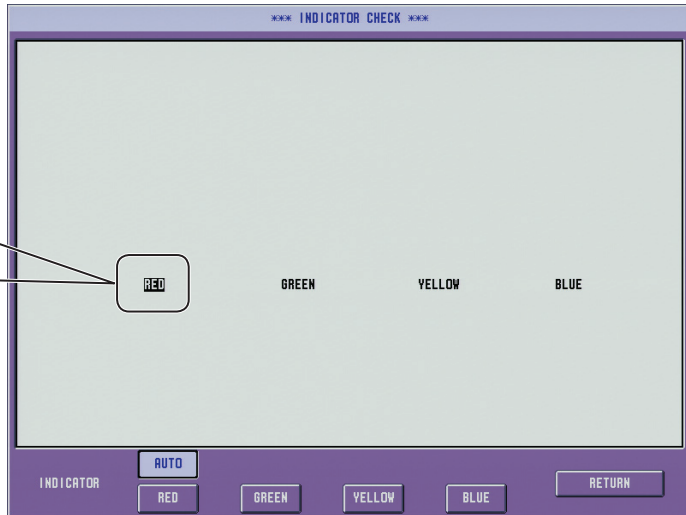
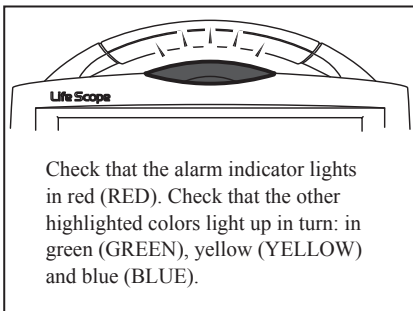
Check that there is nothing wrong with the optical transmitter of the alarm indicator.



1. On the MANUAL CHECK screen, touch the ALARM INDICATOR key to display the INDICATOR CHECK screen.



2. The RED, GREEN, YELLOW and BLUE indicators shown on the screen are highlighted in order. You can also check the alarm indicator by touching RED, GREEN, YELLOW and BLUE key at the bottom of the screen. Check that the highlighted color illuminates the indicator.



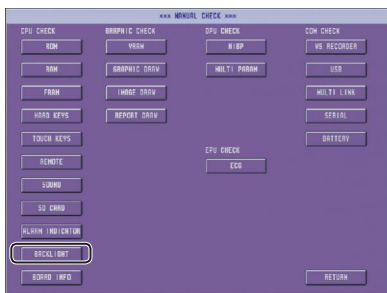
3. Touch the RETURN key to return to the MANUAL CHECK screen.





### Checking the Backlighting

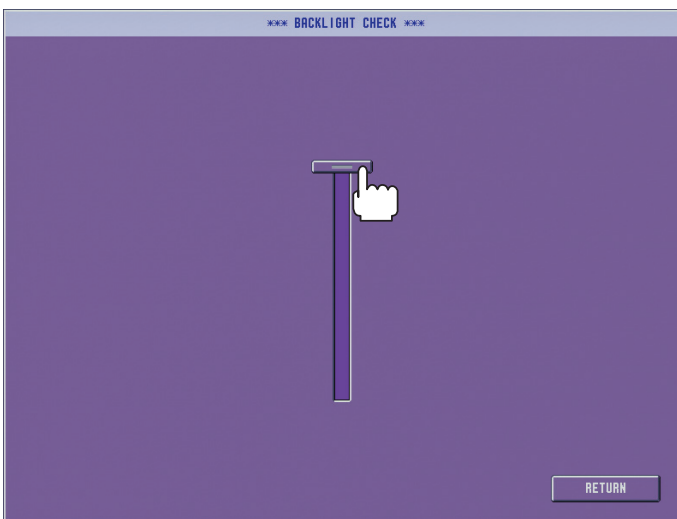
Check the display's brightness adjustment function.



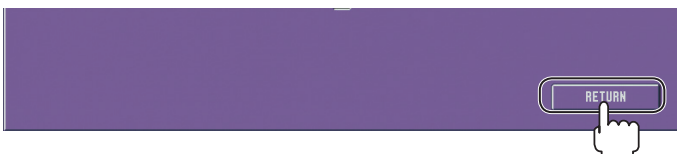
1. On the MANUAL CHECK screen, touch the BACKLIGHT key to display the BACKLIGHT CHECK screen.



2. Check that the screen brightness changes by sliding the brightness adjustment bar vertically.



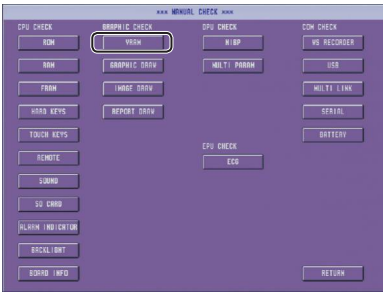
3. Touch the RETURN key to return to the MANUAL CHECK screen.



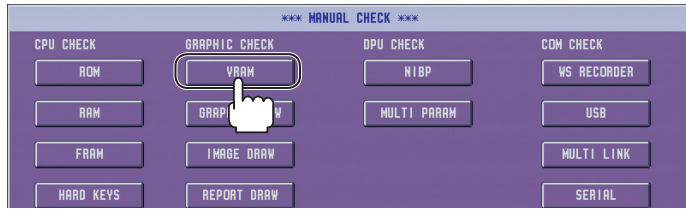
### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the VRAM

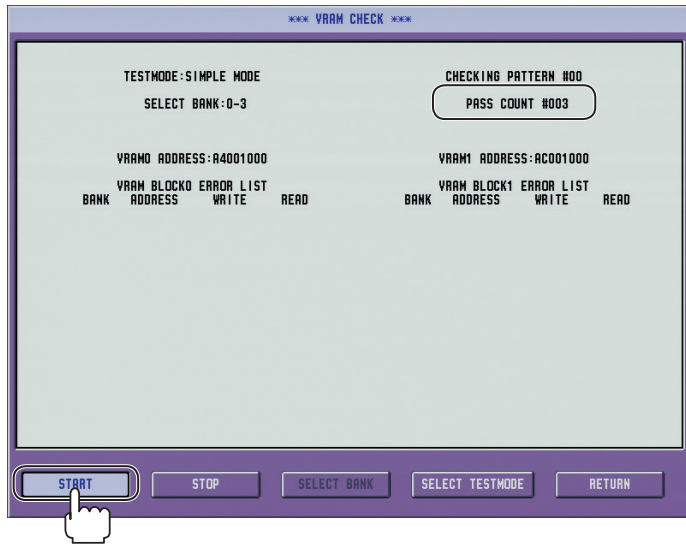
Check the VRAM within the monitor to see if the main board is not defective.



1. On the MANUAL CHECK screen, touch the VRAM key to display the VRAM CHECK screen.



2. Touch the START key to check the VRAM (SIMPLE MODE). Observe the screen for approximately one minute to check that the PASS COUNT value increments from #000 in steps of 1 and that there is no error indication.



The check is completed if there is no error indication and the PASS COUNT value increments from #000 in steps of 1.

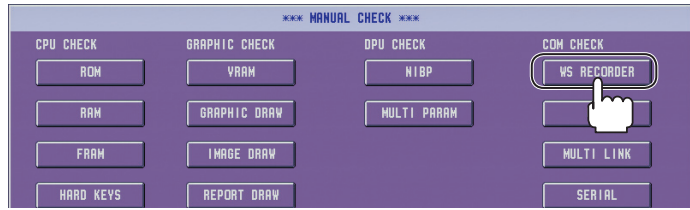
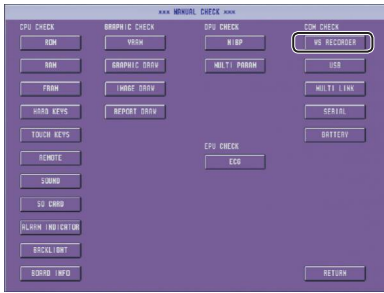
3. Touch the RETURN key to return to the MANUAL CHECK screen.



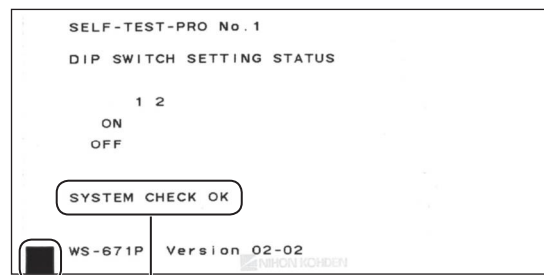
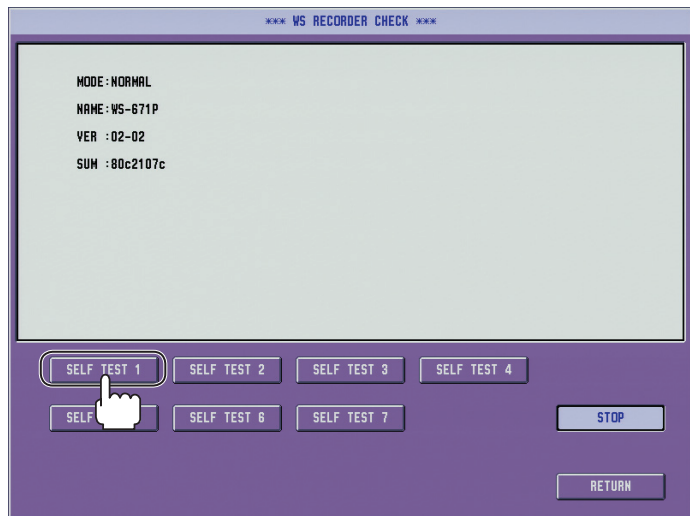
### Checking the WS-671P Recorder Module (Option)

Check that the optional WS-671P recorder module is free from poor operation.

1. On the MANUAL CHECK screen, touch the WS RECORDER key to display the RECORDER CHECK screen.



2. Touch the SELF TEST 1 key to perform test recording and check that “SYSTEM CHECK OK” is recorded on the recording paper.



Check that “SYSTEM CHECK OK” is recorded.

Mark

Check that recording paper is fed to the marked position before recording is started.

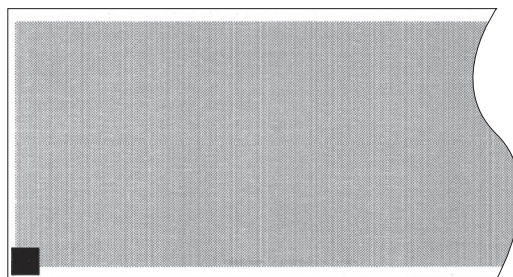
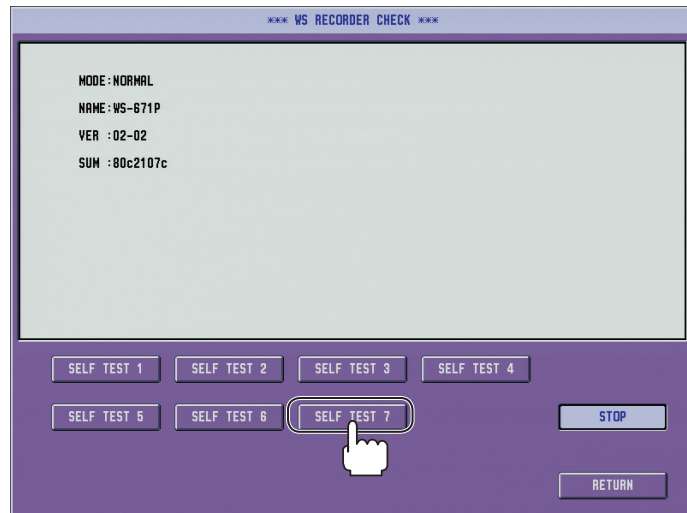
If you are running out of recording paper or if the magazine is left open, the following messages appear.

- Running out of recording paper: PAPER EMPTY
- The magazine is left open: MAGAZINE OPEN

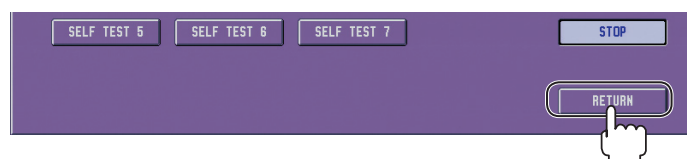
### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

3. Touch the SELF TEST 7 key to perform test recording, and touch the STOP key when at least one page has been recorded. Check that recording paper shows no blurred printing, missing dots or non-uniform density.

If there are blurred printing, missing dots or non-uniform density, clean the thermal head of recorder module.



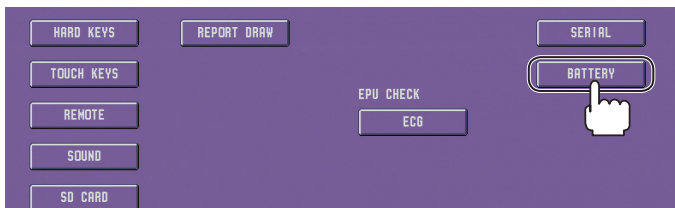
4. Touch the RETURN key to return to the MANUAL CHECK screen.



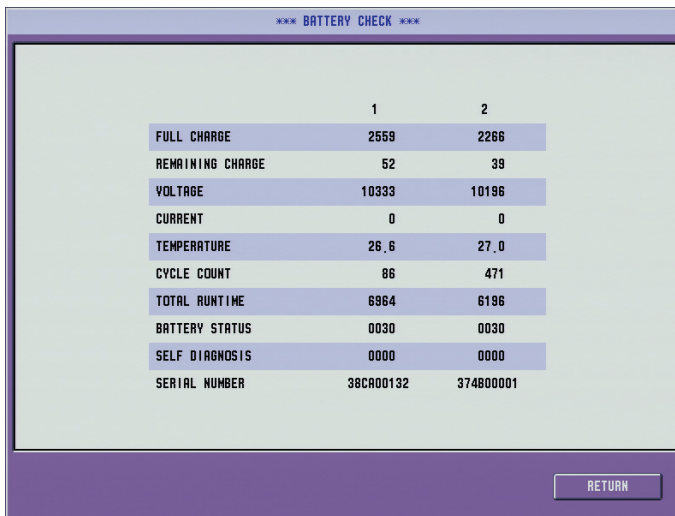
### Checking the Battery (Option)

Check the optional SB-671P battery pack.

1. On the MANUAL CHECK screen, touch the BATTERY key to display the BATTERY CHECK screen.

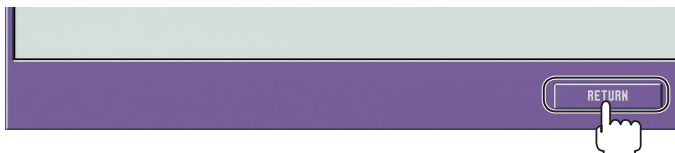


2. Check the battery information on the screen.



- FULL CHARGE: Charged battery capacity (mAh)
- REMAINING CHARGE: Percentage of the remaining battery capacity (%)
- VOLTAGE: Measured battery voltage (mV)
- CURRENT: Measured battery current (mA)
- TEMPERATURE: Measured battery temperature (°C)
- CYCLE COUNT: Number of discharges
- TOTAL RUNTIME: Accumulated runtime (h)
- BATTERY STATUS: Hexadecimal code of the battery status
- SELF DIAGNOSIS: Hexadecimal code of check result of the battery
- SERIAL NUMBER: Product serial number of the battery

3. Touch the RETURN key to return to the MANUAL CHECK screen.



### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

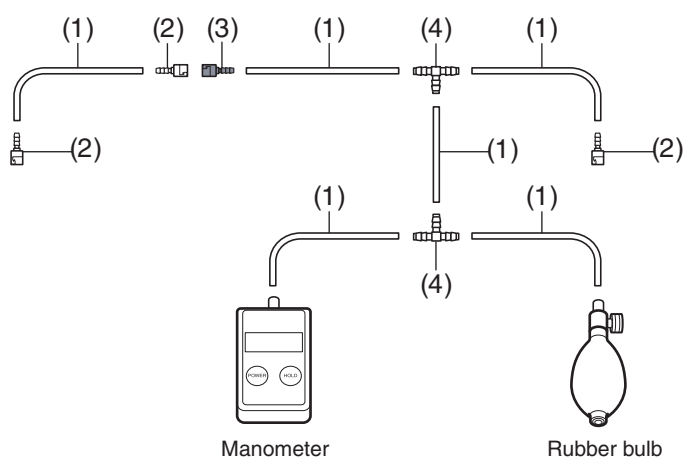
#### Checking the NIBP

Check the NIBP for measurement accuracy and other factors. This manual explains a method of verification with a manometer.

#### Preparation (Equipment Connection)

Before checking the NIBP, connect the following parts (1) to (4) to a manometer as shown below. In the following procedure, the term “manometer” refers to what is connected with the (1) to (4) parts.

	Description	Code No.	Qty
(1)	Silicon tube 4 (diameter) L150	6114-110213	6
(2)	SMM-02 air joint (male)	531524	3
(3)	SMF-02 air joint (female)	538624	1
(4)	T-type coupling F-3145-85	551396	2



The following parts are used or changed depending on the check items. Prepare the parts before starting the check. The connection diagram and the direction for use are explained under each section.

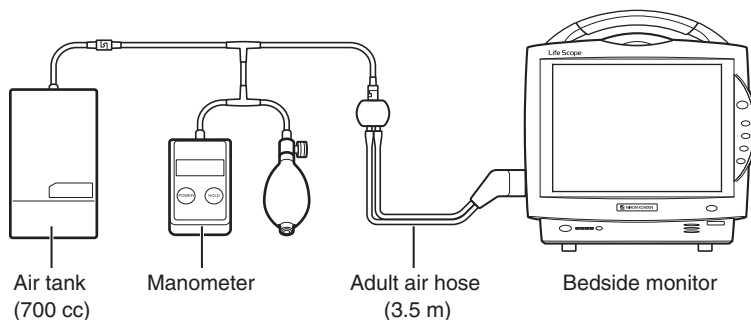
Name/Model	Supply Code/ Code No.	Qty
YN-901P adult/child air hose (3.5 m)	S902	1
YN-921P neonate air hose (3.5 m)	S905	1
Clamp*	—	1
Luer fitting (male) for neonate air hose	930272	1
Air tank 70 cc (dummy cuff)	626262	1
Air tank 250 cc (dummy cuff)	626289	1
Air tank 700 cc (dummy cuff)	626306	1

\* Purchase locally

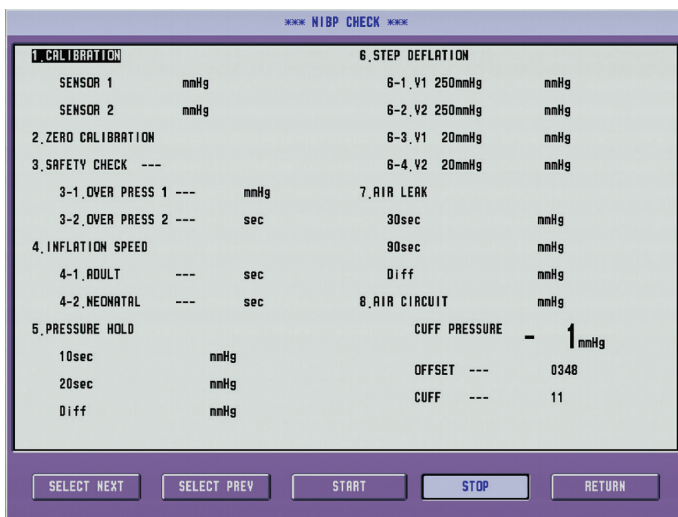
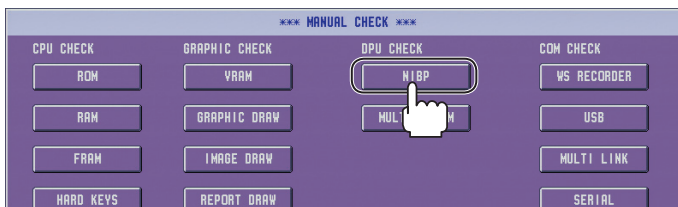
**Checking the Pressure Measurement Accuracy (1. CALIBRATION)**

A manometer is used to check the pressure measurement accuracy.

1. Connect the bedside monitor, adult air hose (3.5 m), a manometer, and a 700 cc air tank as shown below.



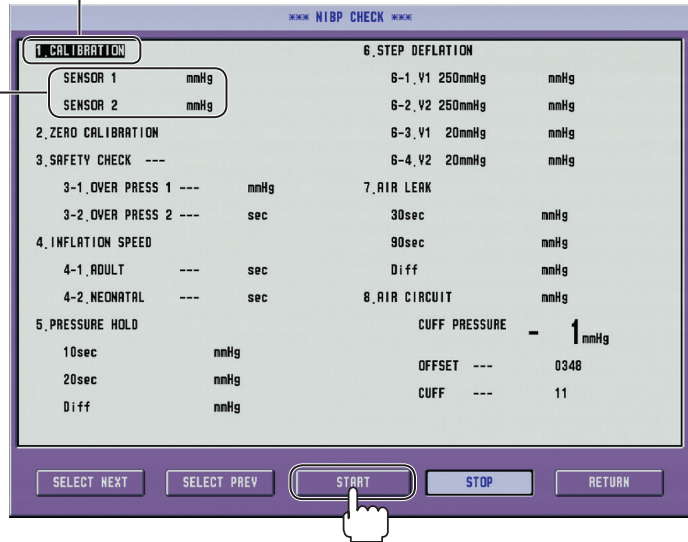
2. Turn on the manometer.
3. On the MANUAL CHECK screen, touch the NIBP key to display the NIBP CHECK screen.



3. DIAGNOSTIC CHECK AND SAFETY CHECK

4. Zero calibration is required before you start the check.
  - i) Touch the SELECT NEXT key to perform the procedure explained in the next “Zero Calibration (2. ZERO CALIBRATION)” section.
  - ii) When zero calibration is completed, touch the SELECT PREV key.
  
5. Run the check.
  - i) On the NIBP CHECK screen, check that <1. CALIBRATION> is highlighted and touch the START key.  
During the check, <1. CALIBRATION> blinks.  
Touching the STOP key stops the check.
  - ii) Using a rubber bulb, apply pressure until the value shown on the manometer reaches a value between 0 and 300 mmHg. Check that the value shown on the manometer and the values shown in the screen’s SENSOR 1 and SENSOR 2 meet the requirement of the tables below.  
Check that <1. CALIBRATION> is highlighted.

Check the values shown in <SENSOR 1> and <SENSOR 2>.



<SENSOR 1>

Indication of the Manometer (Pressurized Value)	Indication of <SENSOR 1>
0 to 199 mmHg	Value of the manometer $\pm 3$ mmHg (If the reading is 0 mmHg, then it is always at 0 mmHg.)
200 to 300 mmHg	Value of the manometer $\pm 4$ mmHg

<SENSOR 2>

Indication of the Manometer (Pressurized Value)	Indication of <SENSOR 2>
0 to 15 mmHg	Value of the manometer $-2$ to $+3$ mmHg (If the reading is 0 mmHg, then it is always at 0 mmHg.)
16 to 200 mmHg	Value of the manometer $\pm 8$ mmHg
201 to 300 mmHg	Value of the manometer $\pm 12$ mmHg



6. When the check is completed, touch the SELECT NEXT key to perform the procedure explained in the next “Zero Calibration (2. ZERO CALIBRATION)” section.



### Zero Calibration (2. ZERO CALIBRATION)

1. On the NIBP CHECK screen, check that <2. ZERO CALIBRATION> is highlighted.

2. Run the zero calibration.

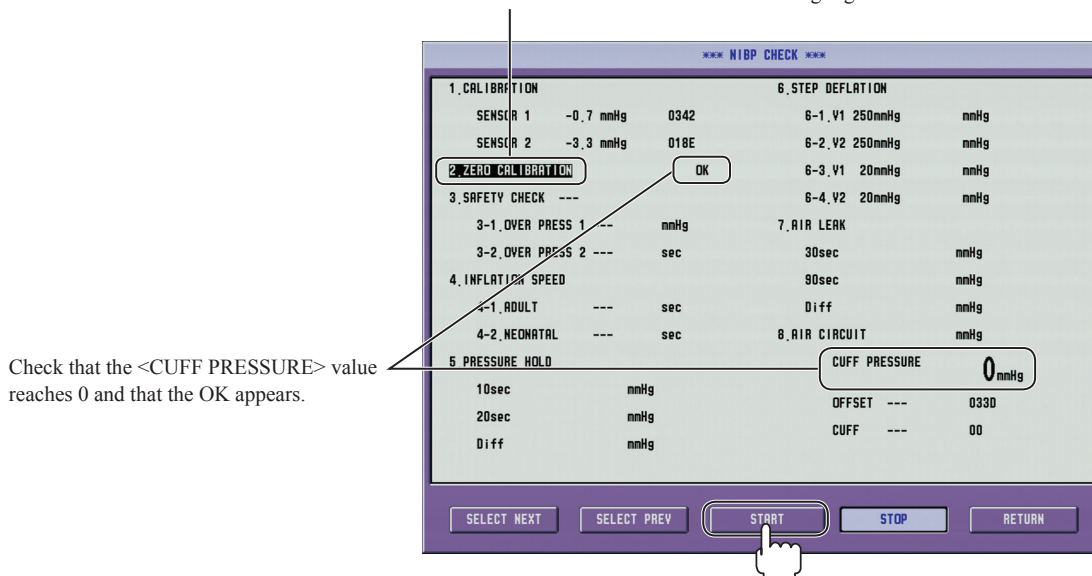
- i) Check that the air tank is completely exhausted and touch the START key.

During zero calibration, <2. ZERO CALIBRATION> blinks.

Touching the STOP key stops the check.

- ii) Check that the <CUFF PRESSURE> value reaches 0 and that the OK appears.

Check that <2. ZERO CALIBRATION> is highlighted.



3. Touch the SELECT NEXT key to perform the procedure explained in the next “Checking the Safety Circuit (3. SAFETY CHECK)” section.

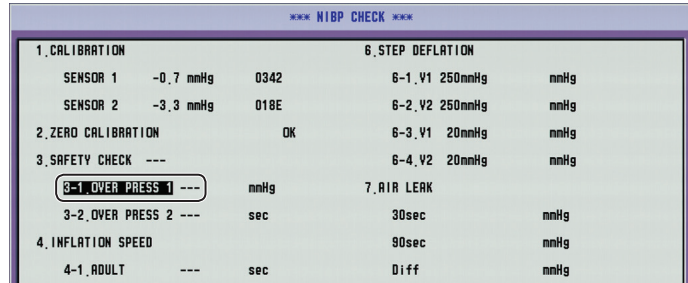


### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the Safety Circuit (3. SAFETY CHECK)

Using a manometer, check the operation of each safety circuit in adult/child mode and in neonatal mode.

1. On the NIBP CHECK screen, check that <3-1. OVER PRESS 1> is highlighted.

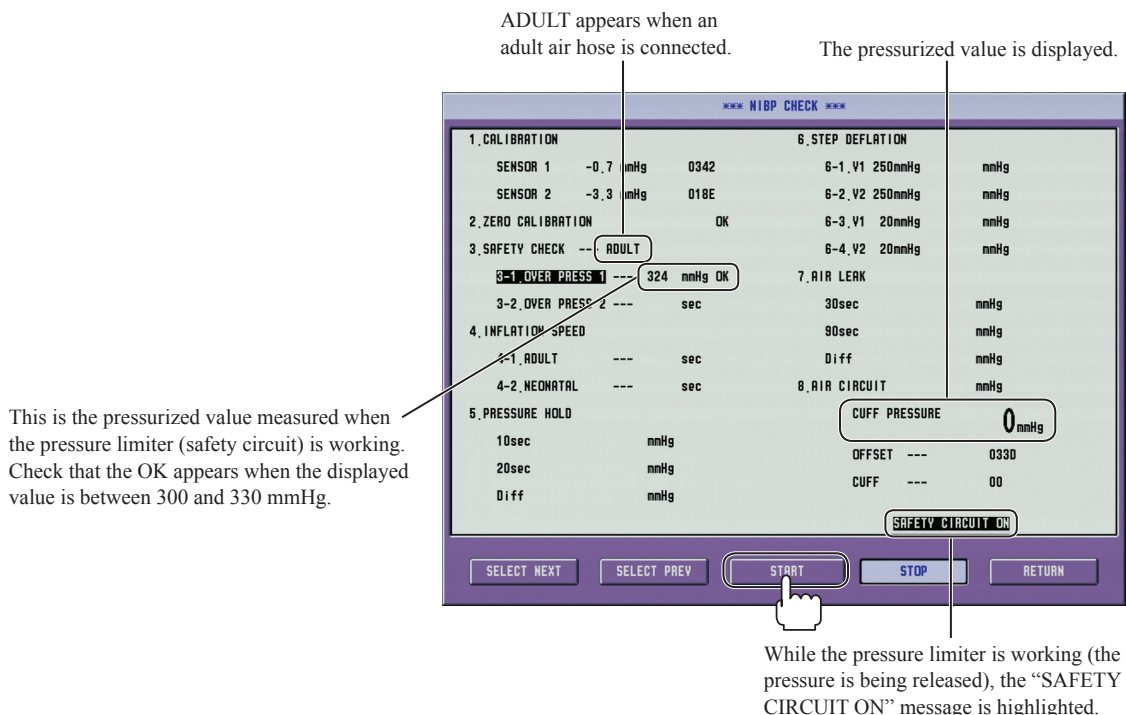


2. Run the check in adult/child mode.

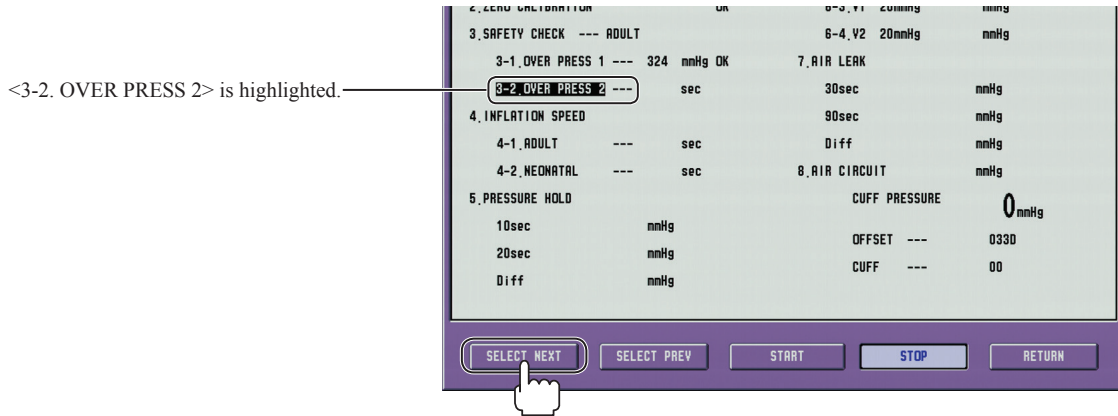
#### Checking in Adult/Child Mode

- i) Touch the START key to start the check procedure in <3-1. OVER PRESS 1>. ADULT is displayed in <3. SAFETY CHECK>. During the check, <3-1. OVER PRESS 1> blinks. Touching the STOP key stops the check.
- ii) Apply pressure quickly from the rubber bulb until the <CUFF PRESSURE> value reaches 300 mmHg.
- iii) Once the <CUFF PRESSURE> value reaches 300 mmHg, apply pressure slowly from the rubber bulb.
- iv) During pressurization, the pressure limiter (safety circuit) works to release the pressure. Check that the OK appears when the value shown in <3-1. OVER PRESS 1> is between 300 and 330 mmHg.

While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted at the bottom right of the screen.



v) Touch the SELECT NEXT key to highlight <3-2. OVER PRESS 2>.



vi) Touch the START key to start the check procedure in <3-2. OVER PRESS 2>.

During the check, <3-2. OVER PRESS 2> blinks.

Touching the STOP key stops the check.

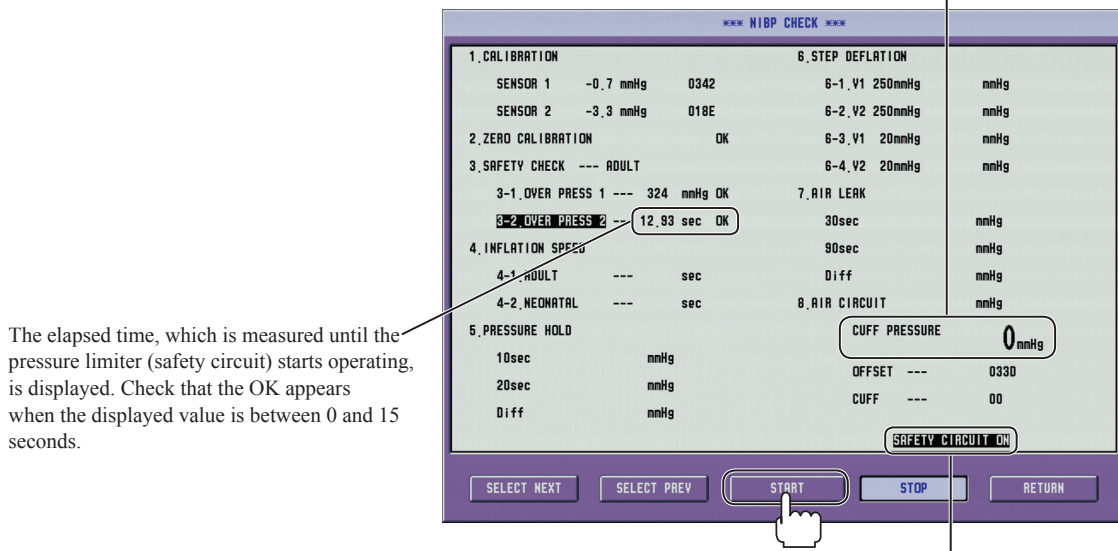
vii) Apply pressure quickly from the rubber bulb until the <CUFF PRESSURE> value reaches 300 mmHg.

viii) Once the <CUFF PRESSURE> value reaches 300 mmHg, apply pressure slowly from the rubber bulb and keep the value for a while in the range from 300 to 310 mmHg.

ix) While the value is thus maintained, the pressure limiter (safety circuit) works to release the pressure. Check that the OK appears when the value shown in <3-2. OVER PRESS 2> is between 0 and 15 seconds.

While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted at the bottom right of the screen.

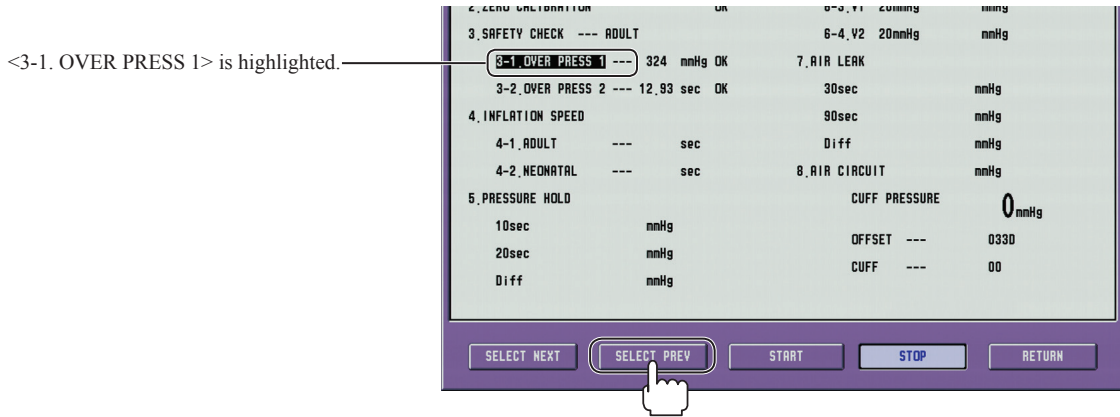
The pressurized value is displayed.



While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

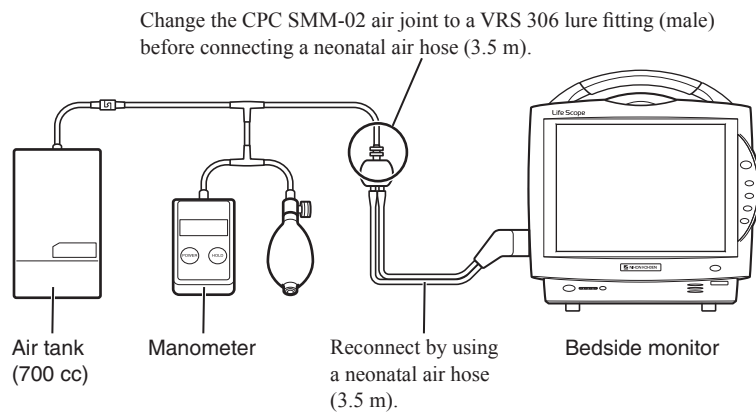
3. When the check in adult/child mode is completed, touch the SELECT PREV key to highlight <3-1. OVER PRESS 1>.



4. Run the check in neonatal mode.

#### Checking in Neonatal Mode

- i) Using a neonatal air hose (3.5 m), reconnect between the bedside monitor and the manometer. Before connecting a neonatal air hose (3.5 m), change the CPC SMM-02 air joint to a VRS 306 luer fitting (male).



- ii) Touch the START key to start the check procedure in <3-1. OVER PRESS 1>. Check that NEO is displayed in <3. SAFETY CHECK>. During the check, <3-1. OVER PRESS 1> blinks. Touching the STOP key stops the check.
- iii) Apply pressure quickly from the rubber bulb until the <CUFF PRESSURE> value reaches 150 mmHg.
- iv) Once the <CUFF PRESSURE> value reaches 150 mmHg, apply pressure slowly from the rubber bulb.

- v) During pressurization, the pressure limiter (safety circuit) works to release the pressure. Check that the OK appears when the value of <3-1. OVER PRESS 1> is between 150 and 165 mmHg.

While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted at the bottom right of the screen.

NEO appears if a neonatal air hose is connected.

The pressurized value is displayed.

This is the pressurized value measured when the pressure limiter (safety circuit) is working. Check that the OK appears when the displayed value is between 150 and 165 mmHg.

While the pressure limiter is working (the pressure is being released), the “SAFETY CIRCUIT ON” message is highlighted.

1. CALIBRATION		6. STEP DEFLATION	
SENSOR 1	-0.7 mmHg 0342	6-1. V1	250mmHg mmHg
SENSOR 2	-3.3 mmHg 018E	6-2. V2	250mmHg mmHg
2. ZERO CALIBRATION OK		6-3. V1	20mmHg mmHg
3. SAFETY CHECK --- NEO		6-4. V2	20mmHg mmHg
3-1. OVER PRESS 1 --- 155 mmHg OK		7. AIR LEAK	
3-2. OVER PRESS 2 --- 12.93 sec OK			30sec mmHg
4. INFLATION SPEED			90sec mmHg
4-1. ADULT	--- sec		Diff mmHg
4-2. NEONATAL	--- sec	8. AIR CIRCUIT	
5. PRESSURE HOLD			mmHg
10sec	mmHg	CUFF PRESSURE 0 mmHg	
20sec	mmHg	OFFSET --- 0330	
Diff	mmHg	CUFF --- 00	

- 5. When the check in neonatal mode is completed, touch the SELECT NEXT key to perform the procedure explained in the next “Checking the Pressurization Speed (4. INFLATION SPEED)” section.



**Checking the Pressurization Speed (4. INFLATION SPEED)**

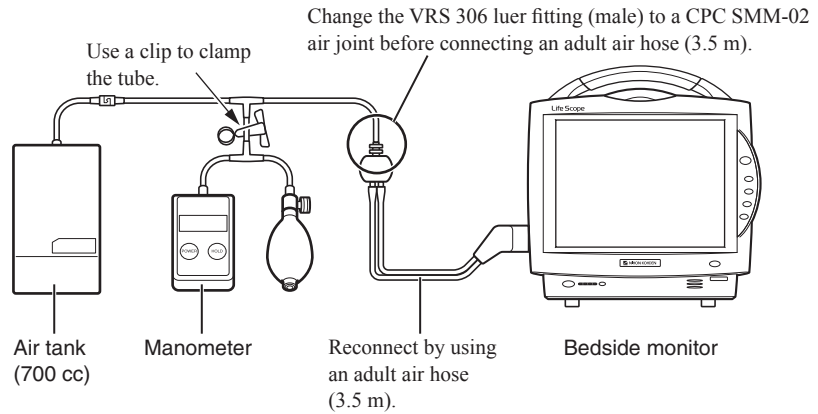
Check the pressurization speed in adult/child mode and in neonatal mode.

1. After the check in neonatal mode is run in the previous “Checking the Safety Circuit (3. SAFETY CHECK)” section, use an adult air hose (3.5 m) to reconnect between the bedside monitor and the manometer. Before connecting an adult air hose (3.5 m), change the VRS 306 luer fitting (male) to a CPC SMM-02 air joint.
2. Clamp the silicon tube which connects the manometer and the rubber bulb with a clip.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### NOTE

Connecting a rubber bulb lets a small amount of air leak out during pressurization. As shown, therefore, use a clip to firmly clamp the silicon tube connecting the manometer and the rubber bulb. Alternatively, you can remove the manometer and connect the air tank directly to the adult air hose (3.5 m).



#### 3. Run the check in adult/child mode.

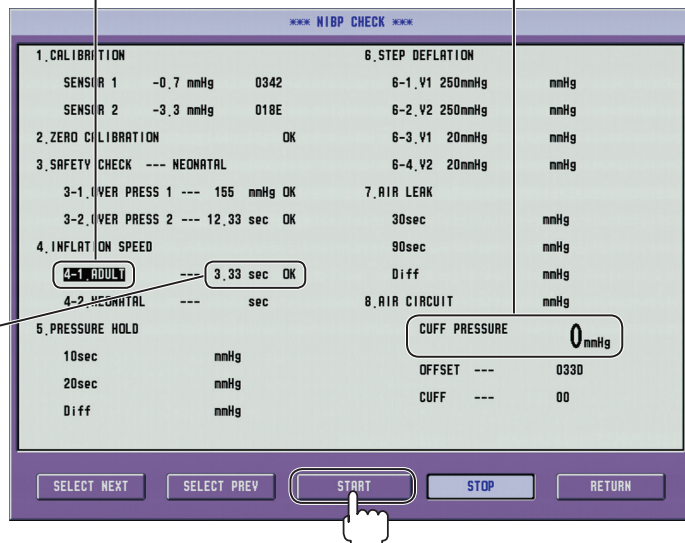
##### Checking in Adult/Child Mode

- i) On the NIBP CHECK screen, check that <4-1. ADULT> is highlighted.
- ii) Touch the START key to start the check procedure in <4-1. ADULT>. During the check, <4-1. ADULT> blinks. Touching the STOP key stops the check.
- iii) Automatic pressurization is started. Pressurization continues until the <CUFF PRESSURE> value reaches 200 mmHg, and it is followed by air evacuation. Check the OK appears when the value displayed in <4-1. ADULT> is between 0 and 7 seconds.

Check that <4-1. ADULT> is highlighted.

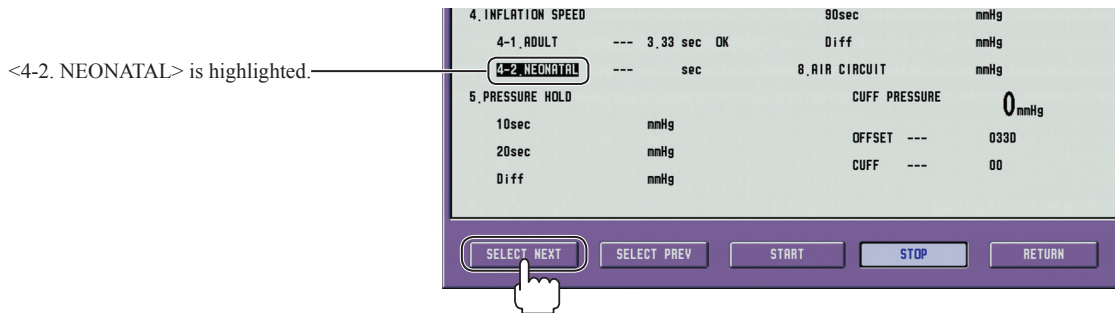
The pressurized value is displayed.

The pressurization time, which is measured until the <CUFF PRESSURE> value reaches 200 mmHg, is displayed. Check that the OK appears when the displayed value is between 0 and 7 seconds.





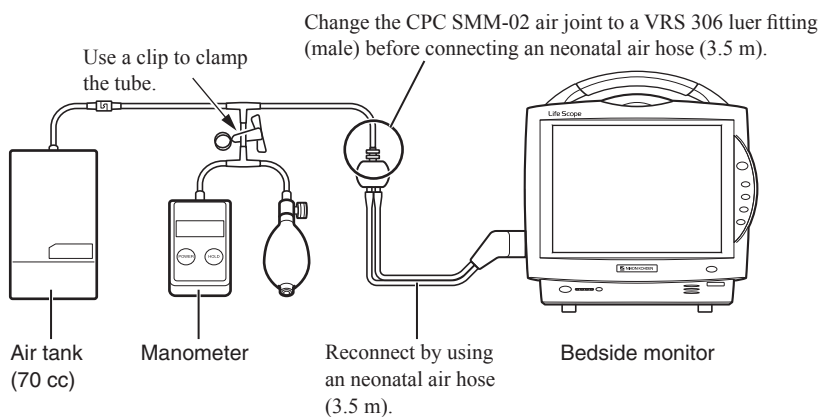
4. When the check in adult/child mode is completed, touch the SELECT NEXT key to highlight <4-2. NEONATAL>.



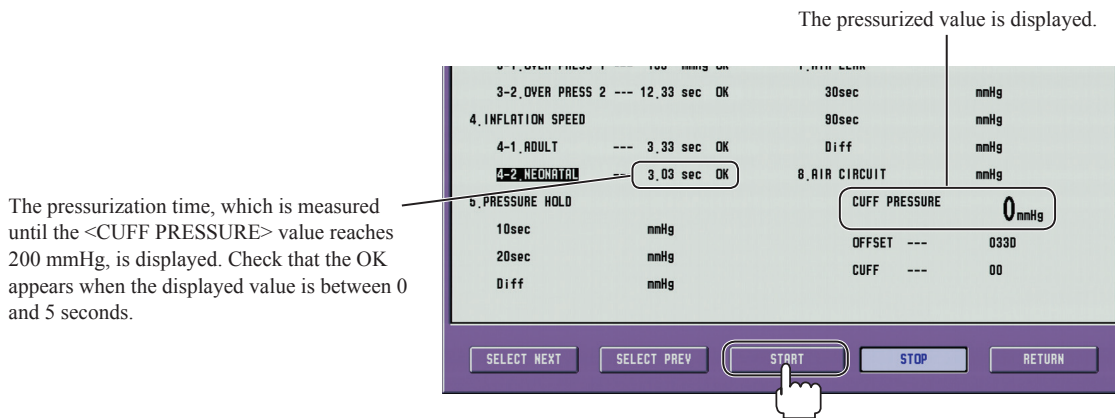
5. Run the check in neonatal mode.

**Checking in Neonatal Mode**

- i) Replace the air tank with a 70 cc tank.

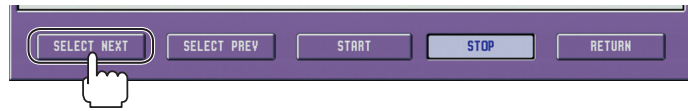


- ii) Touch the START key to start the check procedure in <4-2. NEONATAL>.
- During the check, <4-2. NEONATAL> blinks.
- Touching the STOP key stops the check.
- iii) Automatic pressurization is started. Pressurization continues until the <CUFF PRESSURE> value reaches 200 mmHg, and it is followed by air evacuation. Check that the OK appears when the value displayed in <4-2. NEONATAL> is between 0 and 5 seconds.



### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

- When the check in neonatal mode is completed, touch the SELECT NEXT key to perform the procedure explained in the next “Checking the Held Pressure (5. PRESSURE HOLD)” section.



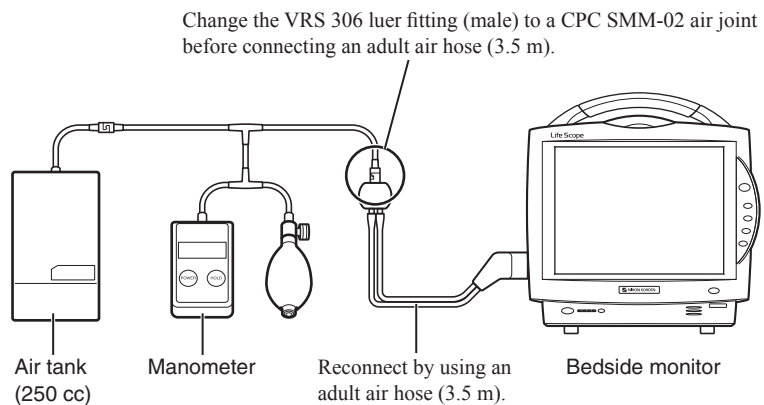
#### Checking the Held Pressure (5. PRESSURE HOLD)

Check the held pressure.

- After you have performed the check in neonatal mode according to the previous “Checking the Pressurization Speed (4. INFLATION SPEED)” section, use an adult air hose (3.5 m) to reconnect between the bedside monitor and the manometer and remove the clip from the silicon tube connecting the manometer and the rubber bulb. Additionally, replace the air tank with a 250 cc tank. Before connecting an adult air hose (3.5 m), change the VRS 306 luer fitting (male) to a CPC SMM-02 air joint.

#### NOTE

Using an adult air hose (1.5 m) and a neonatal air hose prevents you from making accurate inspection in the following items.



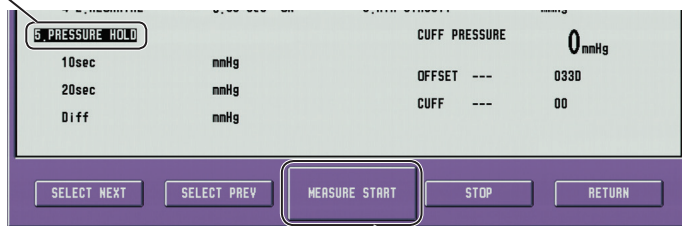
- Run the check.
  - On the NIBP CHECK screen, check that <5. PRESSURE HOLD> is highlighted and touch the START key. The <5. PRESSURE HOLD> starts blinking and the START key is replaced with the MEASURE START key.  
During the check, <5. PRESSURE HOLD> blinks.  
Touching the STOP key stops the check.

Check that <5. PRESSURE HOLD> is highlighted.





Starts blinking.

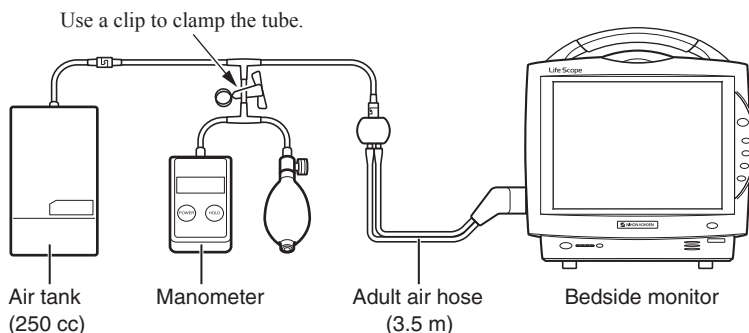


Changed to MEASURE START.

- ii) Apply pressure from the rubber bulb until the <CUFF PRESSURE> value reaches 250 mmHg.
- iii) When the <CUFF PRESSURE> value reaches 250 mmHg, use a clip to clamp the silicon tube connecting the manometer and the rubber bulb, thus stopping the pressurization.

**NOTE**

Connecting a rubber bulb lets a small amount of air leak out during pressurization. As shown, therefore, use a clip to firmly clamp the silicon tube connecting the manometer and the rubber bulb.



- iv) Touch the MEASURE START key to start the test.
- v) The “CUFF PRESSURE” values of 10 and 20 seconds later (10 sec and 20 sec) and the difference (Diff) between them are automatically measured. Check that the Diff value does not exceed 5 mmHg and the OK appears.

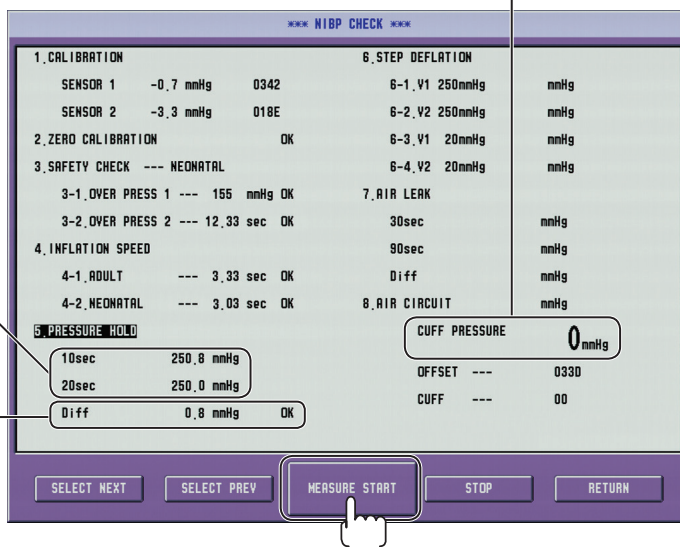
The pressurized value is displayed.

10sec, 20sec

These are the pressurized values measured in 10 and 20 seconds after the MEASURE START key is touched.

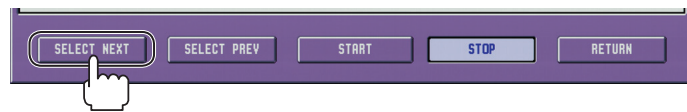
Diff

This displays the difference between the 10sec and 20sec items. Check that the OK appears and the measured value does not exceed 5 mmHg.



### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

- When the check is completed, touch the SELECT NEXT key to perform the procedure explained in the next “Checking the Operation of the Solenoid Valve (6. STEP DEFLATION)” section.



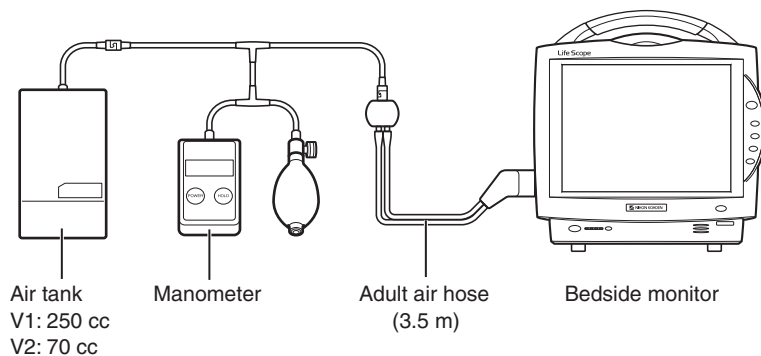
#### Checking the Operation of the Solenoid Valve (6. STEP DEFLATION)

Check the operation of the quick exhaust valve (V1) and the slow exhaust valve (V2).

- Reconfirm that the following components are connected as shown: the bedside monitor, an adult air hose (3.5 m), a manometer, and an air tank.

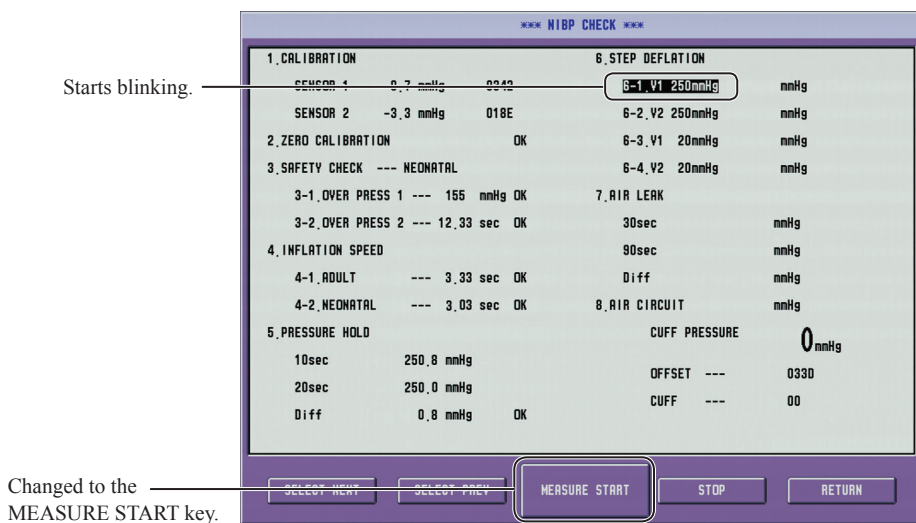
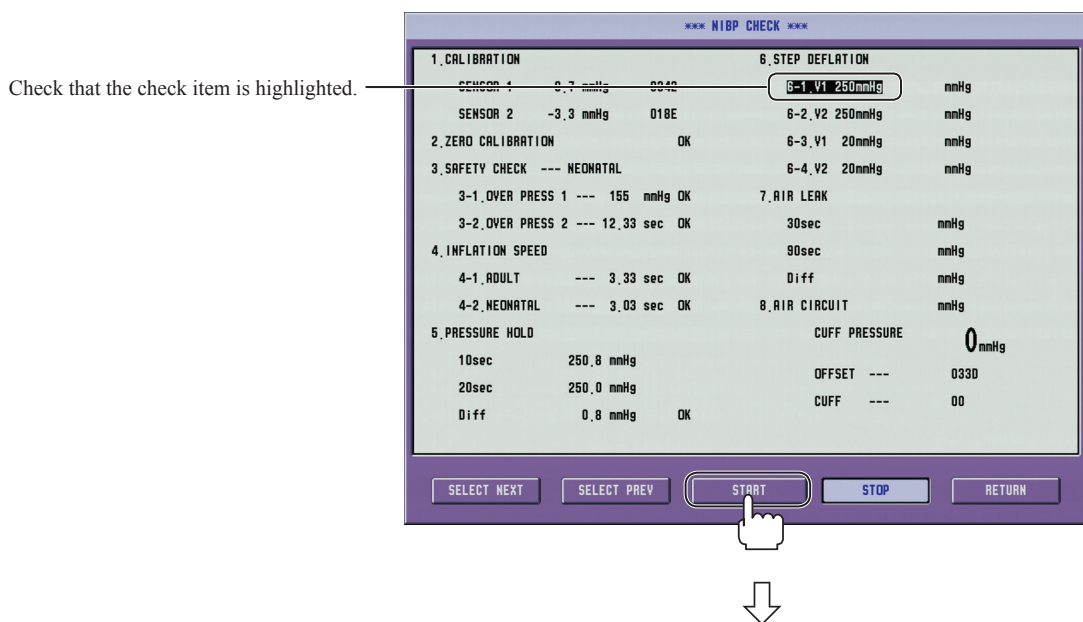
#### NOTE

- Using an adult air hose (1.5 m) and a neonatal air hose prevents you from making accurate inspection.
- Change the capacity of an air tank, depending on the check items.



- Repeat steps i) to v) to check all of the following items: <6-1. V1 250 mmHg>, <6-2. V2 250 mmHg>, <6-3. V1 20 mmHg>, and <6-4. V2 20 mmHg>.

- i) On the NIBP CHECK screen, check that the check items are highlighted and touch the START key. The check item starts blinking and the START key is replaced with the MEASURE START key. During the check, each of the check items blinks. Touching the STOP key stops the check.



- ii) Apply pressure from the rubber bulb until the <CUFF PRESSURE> value reaches the value shown below. (For details about the pressurized value, refer to the table below.)

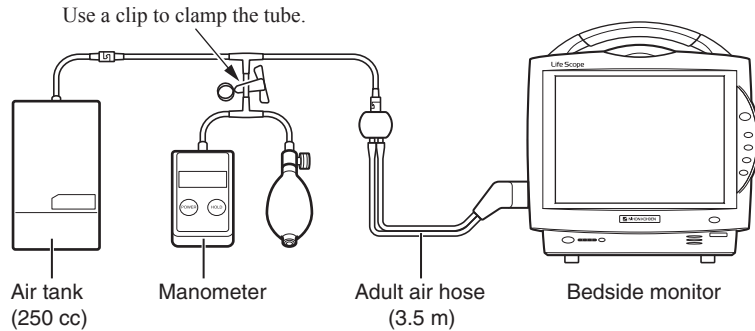
Item	Air Tank Capacity	<CUFF PRESSURE> Value
6-1.V1 250 mmHg	250 cc	250 mmHg
6-2.V2 250 mmHg	70 cc	
6-3.V1 20 mmHg	250 cc	20 mmHg
6-4.V2 20 mmHg	70 cc	

- iii) When the <CUFF PRESSURE> value reaches 250 mmHg, use a clip to clamp the silicon tube connecting the manometer and the rubber bulb, thus stopping the pressurization.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### NOTE

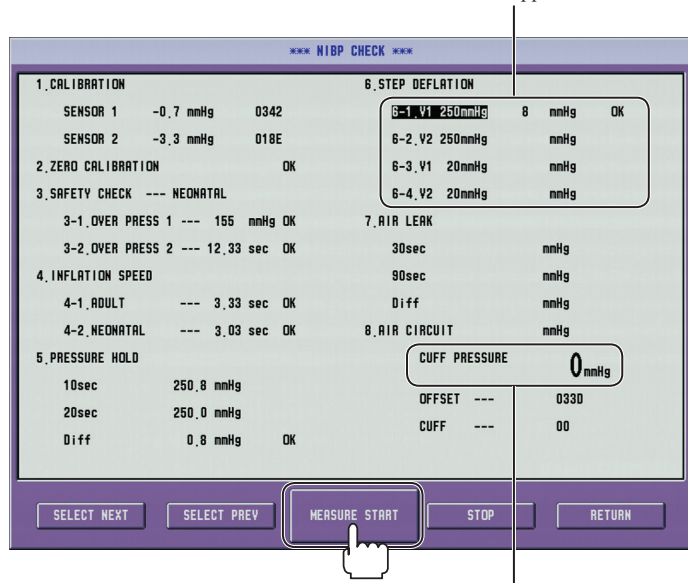
Connecting a rubber bulb lets a small amount of air leak out during pressurization. As shown, therefore, use a clip to firmly clamp the silicon tube connecting the manometer and the rubber bulb.



- iv) Touch the MEASURE START key to start the test.
- v) Check that the OK appears when the measured value shown in each item meets the requirement of the table below.

Item	Air Tank Capacity	Measured Value
6-1.V1 250 mmHg	250 cc	7 to 23 mmHg
6-2.V2 250 mmHg	70 cc	5 to 15 mmHg
6-3.V1 20 mmHg	250 cc	2 to 8 mmHg
6-4.V2 20 mmHg	70 cc	

Check the measured value of each item and the OK appear.



The pressurized value is displayed.

- vi) Touch the SELECT NEXT key to highlight the next check item.



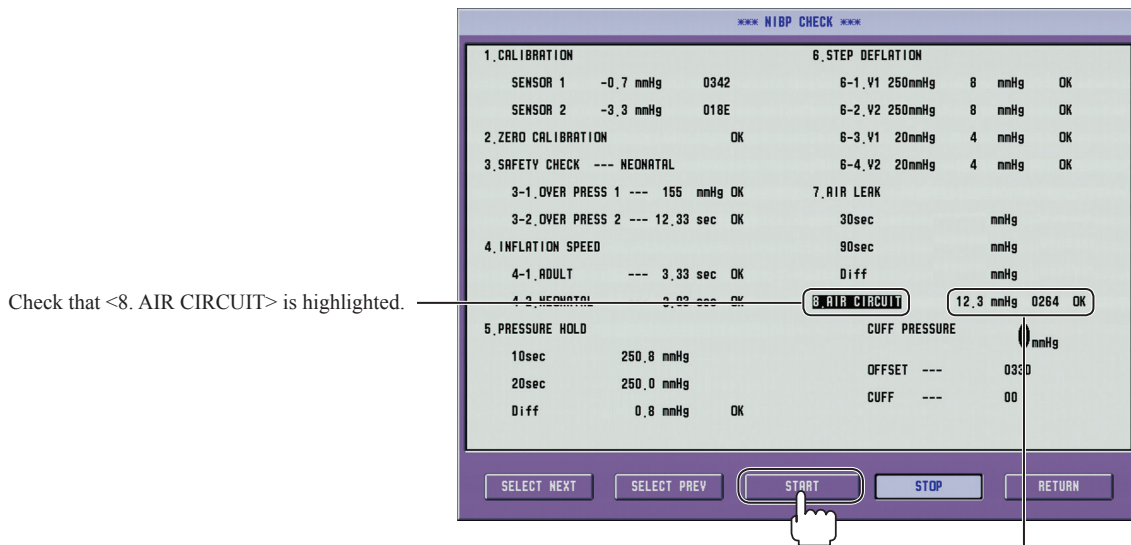
3. Once the check ranging from <6-1. V1 250 mmHg> to <6-4. V2 20 mmHg> is completed, touch the SELECT NEXT key twice to perform the procedure shown in the next “Checking the Operation of the Circuit (8. AIR CIRCUIT)” section.



**Checking the Operation of the Air Circuit (8. AIR CIRCUIT)**

Check the operation of the air circuit.

1. Remove the air hose from the NIBP socket.
2. Run the check.
  - i) On the NIBP CHECK screen, check that <8. AIR CIRCUIT> is highlighted and touch the START key. Automatic check is started. During the check, <8. AIR CIRCUIT> blinks. Touching the STOP key stops the check.
  - ii) When the check is completed, check that the measured value and the OK appear in <8. AIR CIRCUIT>.



3. Touch the RETURN key to return to the MANUAL CHECK screen.



## Checking on the Home Screen

Perform the procedures from “Checking the Date and Time” to “Checking Battery Operation” on the home screen. Checking on the home screen requires you to change the system setup, alarm, and other settings. Before changing the system setup, alarm, and other settings, write down the current settings because they must be reset after maintenance is completed.

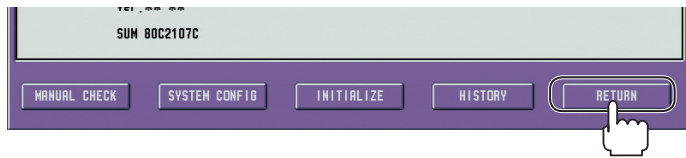
### Displaying the Home Screen

Perform the procedures from “Checking the Date and Time” to “Checking Battery Operation” on the home screen referring to the following sections. Refer to this section to display the home screen after checking on the MANUAL CHECK screen, and go to the particular section for the specific check procedure.

1. On the MANUAL CHECK screen, touch the RETURN key to return to the DIAGNOSTIC CHECK screen.



2. On the DIAGNOSTIC CHECK screen, touch the RETURN key to display the home screen.



### Checking the Date and Time

Check that the date and time settings of the monitor main unit are correct.



1. Press the [Menu] key to display the MENU window. Alternatively, you can use the remote controller. You can also touch the MENU function key to display the MENU window if the function key is registered.
2. Touch the DATE key on the MENU window to display the DATE window. Alternatively, you can touch the clock displayed at the top right of the home screen to display the DATE window.

3. Check that the date and time displayed on the DATE window are correct. If the displayed date and time are not correct, reset them.
4. Press the [Home] key to return to the home screen. Alternatively, you can use the remote controller. Additionally, you can also use the following operations to return to the home screen.
  - Touching the waveform display area
  - Touching the HOME function key  
(Only when the function key is registered.)



## Checking the Electrocardiogram (ECG)

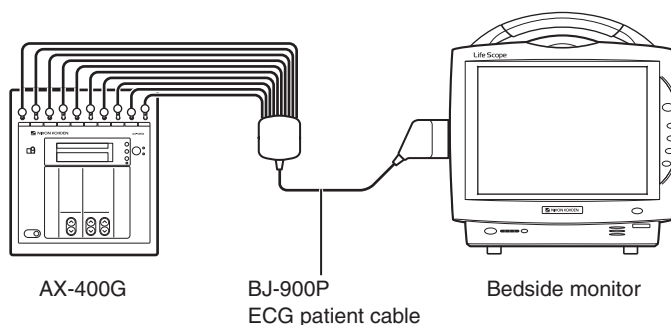
Connect the AX-400G vital sign simulator to the bedside monitor, and check the accuracy of the heart rate as well as the amplitude of ECGs in each lead. Additionally, check if the alarm works normally.

After the check, return the current settings to your own settings.

### Preparation

#### Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the BJ-900P ECG patient cable.



#### Setting

Set the following items on the bedside monitor.

- ECG window

ECG Window		Setting Item
MAIN setting	SENSITIVITY	×1
	LEAD	II
OTHER setting	FILTERS	DIAG
	NUMBER OF ELECTRODES	STANDARD
	SYNC SOURCE	ECG

- Record window in SETUP window

RECORD Window			Setting Item
REC PARAMS setting	TRACES	TRACE 1	ECG
		TRACE 2	NONE
		TRACE 3	



### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

- Record window in SYSTEM SETUP window

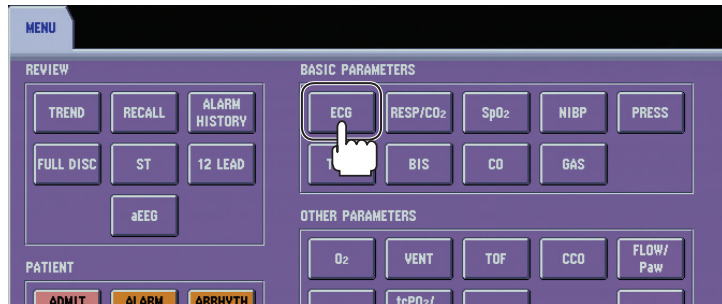
Record Window		Setting Item
Recorder	Manual recording	Real time recording

#### <Setting the Parameter Window>

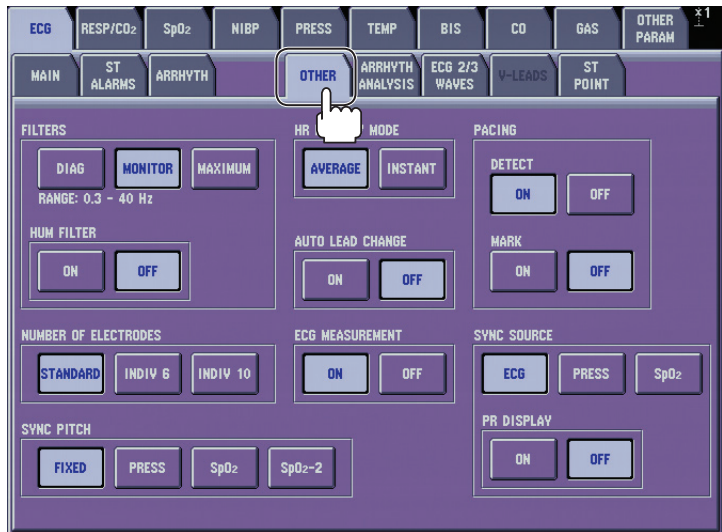
Example: When setting on the OTHER page of the ECG window



- Press the [Menu] key to display the MENU window. Alternatively, you can use the remote controller. You can also touch the MENU function key to display the MENU window only when the function key is registered.
- Touch the ECG key to display the ECG window.



- Touch the OTHER tab to set individual items.



- Press the [Home] key to return to the home screen. Alternatively, you can use the remote controller. Additionally, you can also use the following operations to return to the home screen.
  - Touching the waveform display area
  - Touching the HOME function key (Only when the function key is registered.)

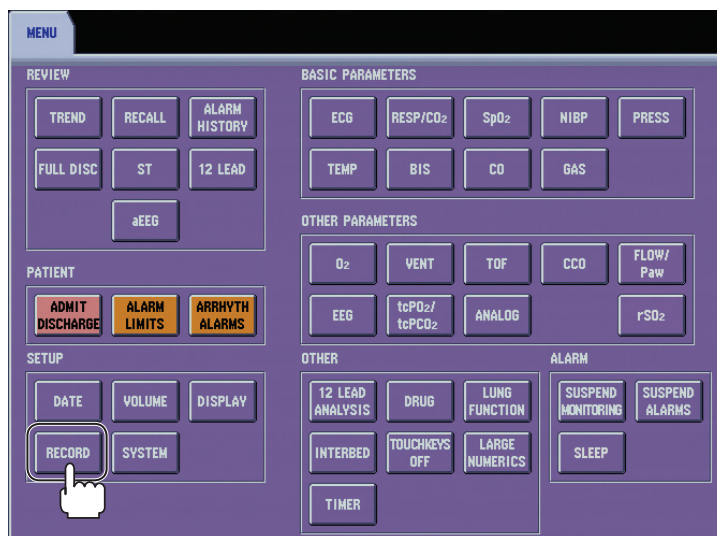


## &lt;Setting the Setup Window&gt;

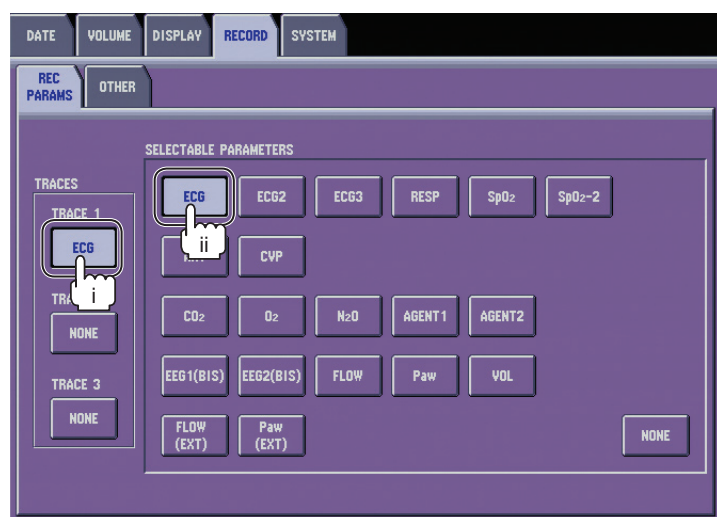
Example: When setting ECG for TRACE 1 on the REC PARAMS page of the RECORD window



1. Press the [Menu] key to display the MENU window. Alternatively, you can use the remote controller. You can also touch the MENU function key to display the MENU window if the function key is registered.
2. Touch the RECORD key to display the RECORD window.



3. Set the ECG trace.
  - i) Touch the ECG key in <TRACES> box.
  - ii) Touch the ECG key in <SELECTABLE PARAMETERS> box.



4. Press the [Home] key to return to the home screen. Alternatively, you can use the remote controller. Additionally, you can also use the following operations to return to the home screen.
  - Touching the waveform display area
  - Touching the HOME function key  
(Only when the function key is registered.)

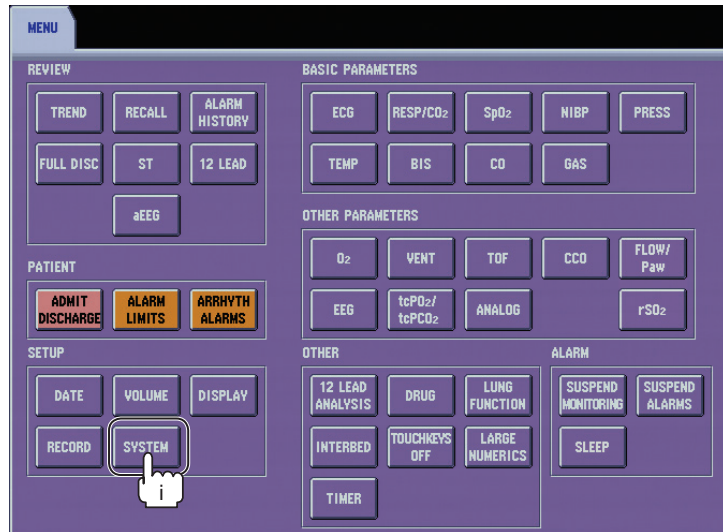
### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### <Setting the SYSTEM SETUP window>

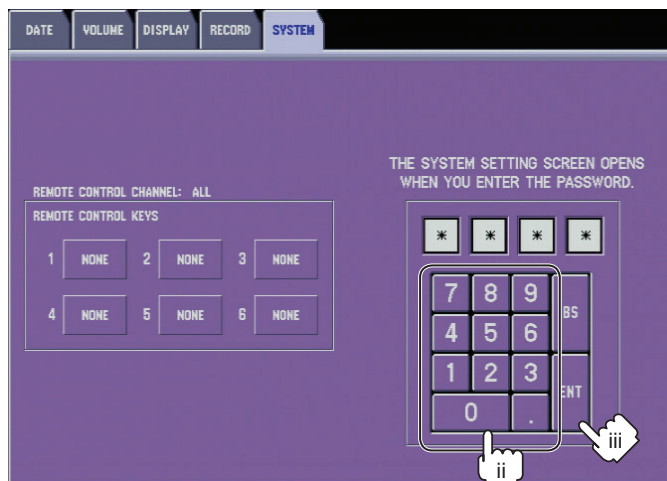
Example: When setting REAL TIME for <MANUAL RECORD> on the RECORDER window

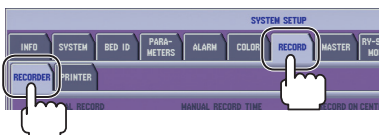


1. Press the [Menu] key to display the MENU window. Alternatively, you can use the remote controller. You can also touch the MENU function key to display the MENU window if the function key is registered.
2. Perform the following steps i) to iii) to display the SYSTEM SETUP window.
  - i) Touch the SYSTEM key.



- ii) Using the numeric keypad in the password entry area, enter a four-digit password (consisting of numeric data). The password is set at the initial value of 1234. You can change your password on the CHANGE PASSWORD window in the SYSTEM CONFIGURATION screen.
- iii) Touch the ENT key. When the correct password is entered, the SYSTEM SETUP window appears.






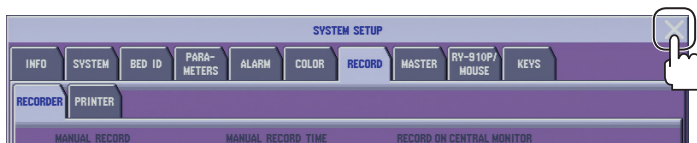
3. Display the RECORDER page of the RECORD window.  
Touch the RECORD → RECORDER tab.



4. Select REAL TIME for <MANUAL RECORD>.



5. Press the [Home] key or touch  on the SYSTEM SETUP window to return to the home screen. Alternatively, you can use the remote controller.



Additionally, you can also use the following operations to return to the home screen.

- Touching the area for displaying the waveform or short trend
- Touching the HOME function key  
(Only when the function key is registered.)

### Checking the Accuracy of the Heart Rate and the Generation of Synchronous Sound

Set the heart rate in ECGs produced from the AX-400G vital sign simulator in the following way and check that the heart rate displayed on the bedside monitor is within the accuracy shown in the table below. Additionally, check that there is a sound synchronous with the QRS.

Setting on the AX-400G	Display on the Bedside Monitor
<b>BRADY 30</b>	28 to 32 beat/min
<b>NORMAL 80</b>	78 to 82 beat/min
<b>TACHY 160</b>	158 to 162 beat/min

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the Detection of the Heart Rate and Electrode-Off Alarms

Check that the alarms for the upper and lower limits of the heart rate and for the electrode-off event are normally generated.

1. Set the ECG window for basic parameter on the bedside monitor.

ECG Window		Setting Item
MAIN setting	HR/PR ALARM	Lower limit: 90
	LEAD	II

2. Set the heart rate in ECGs produced from the AX-400G vital sign simulator to “NORMAL 80” and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Display of the heart rate	Numerical data is highlighted.
Message display	Turning ON/OFF arrhythmia analysis displays the following messages. <ul style="list-style-type: none"> <li>• Arrhythmia analysis “ON”: BRADYCARDIA</li> <li>• Arrhythmia analysis “OFF”: HR alarm</li> </ul>
Alarm sound	The alarm sound varies depending on your setting.
Alarm indicator	The alarm indicator lights or blinks depending on your setting.

The Arrhythmia analysis ON/OFF is selected on the ARRHYTHMIA ANALYSIS page of the ECG window.

3. Check that the bedside monitor works in the following way when you remove any of the lead wires connected to the AX-400G vital sign simulator.

Alarm	Operation of the Bedside Monitor
Message display	The “ECG CHECK ELECTRODE __” message appears. * When the RF is removed, the electrode name is not displayed.
Alarm sound	The alarm sound varies depending on your setting.
Alarm indicator	The alarm indicator lights or blinks depending on your setting.

The alarm priority, alarm sound and alarm display color are selected on the SYSTEM SETUP window.

#### Checking the Respiration

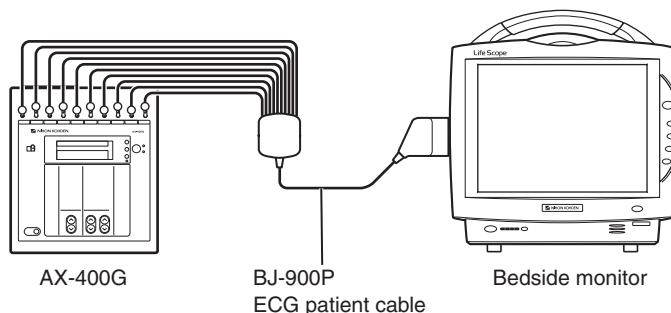
Connect the AX-400G vital sign simulator to the bedside monitor and check the accuracy of the respiration rate. Additionally, check that the alarm is normally generated.

After the check, return the current settings to your own settings.

## Preparation

### Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the BJ-900P ECG patient cable.



### Checking the Accuracy of the Respiration Rate

Check the accuracy of the respiration rate.

1. Set the RESP/CO<sub>2</sub> window for basic parameter as follows.

RESP/CO <sub>2</sub> Window		Setting Item
MAIN setting	IMPEDANCE RESP LEAD	R-F
	SENSITIVITY	×1

2. Set the heart rate in ECGs produced from the AX-400G vital sign simulator at “NORMAL 80” and check that the respiration rate displayed on the bedside monitor is within the range from 18 to 22 count/min. The respiration rate generated from the AX-400G vital sign simulator is 20 count/min.

### Checking the Detection of Alarms for the Respiration Rate

Check that alarms for the upper and lower limits of the respiration rate are normally generated.

1. Set the RESP/CO<sub>2</sub> window for basic parameter as follows.

RESP/CO <sub>2</sub> Window		Setting Item
MAIN setting	RR ALARM	Lower limit: 30

2. Set the heart rate in ECGs produced from the AX-400G vital sign simulator to “NORMAL 80” and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Display of the respiration rate	Numerical data is highlighted.
Message display	The “RESP (IMP) Alarm” message appears.
Alarm sound	The alarm sound varies depending on your setting.
Alarm indicator	The alarm indicator lights or blinks depending on your setting.

The alarm priority, alarm sound and alarm display color are selected on the SYSTEM SETUP window.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the SpO<sub>2</sub> Value

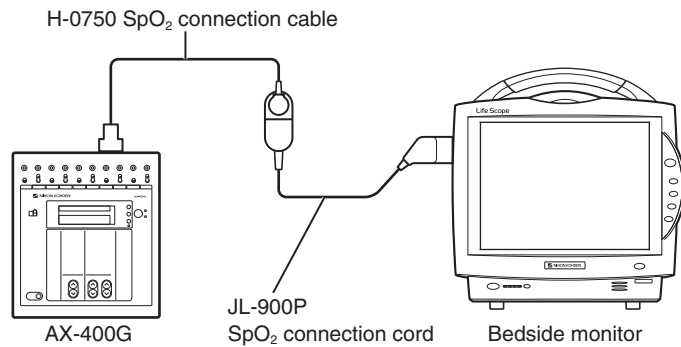
Connect the AX-400G vital sign simulator to the bedside monitor to check the SpO<sub>2</sub> value and the accuracy of the pulse rate. Additionally, check that the alarm is normally generated.

After the check, return the current settings to your own settings.

#### Preparation

##### Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the JL-900P SpO<sub>2</sub> connection cord and H-0750 SpO<sub>2</sub> connection cable.



#### Checking the Accuracy of the SpO<sub>2</sub> Value and the Pulse Rate

Check the accuracy of the SpO<sub>2</sub> value and the pulse rate.

1. Set the SpO<sub>2</sub> window for basic parameters as follows.

SpO <sub>2</sub> Window		Setting Item
<b>OTHER setting</b>	<b>SYNC SOURCE</b>	SpO <sub>2</sub>

2. Set the SpO<sub>2</sub> value produced from the AX-400G vital sign simulator in the following way and check that the SpO<sub>2</sub> value and the pulse rate (SpO<sub>2</sub>-PR) displayed on the bedside monitor are within the accuracy shown in the table below. Additionally, check that there is a sound synchronous with the pulse wave.

Setting on the AX-400G		Display on the Bedside Monitor
<b>SpO<sub>2</sub></b>	<b>97% SpO<sub>2</sub></b>	95 to 99% SpO <sub>2</sub>
	<b>80% SpO<sub>2</sub></b>	78 to 82% SpO <sub>2</sub>
	<b>70% SpO<sub>2</sub></b>	66 to 74% SpO <sub>2</sub>
<b>ECG</b>	<b>NORMAL 80</b>	76 to 84 bpm

By setting the ECG to NORMAL 80 on the vital sign simulator, the pulse rate (SpO<sub>2</sub>-PR) can be checked on the bedside monitor.

### Checking the Detection of Alarm for the SpO<sub>2</sub> Value and a Connector-Off Alarm

Check that alarms for the upper and lower limits of the SpO<sub>2</sub> value and a connector-off alarm are normally generated.

1. Set the SpO<sub>2</sub> window on the bedside monitor as follows.

SpO <sub>2</sub> Window		Setting Item
MAIN setting	SpO <sub>2</sub> alarm	Lower limit: 90

2. Set the SpO<sub>2</sub> value produced from the AX-400G vital sign simulator to “80” and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Displaying the SpO <sub>2</sub> value	Numerical data is highlighted.
Message display	SpO <sub>2</sub> alarm
Alarm sound	The alarm sound varies depending on your setting.
Alarm indicator	The alarm indicator lights or blinks depending on your setting.

3. Check that the bedside monitor works in the following way when you remove the SpO<sub>2</sub> connection cable and the SpO<sub>2</sub> connection cord.

Alarm	Operation of the Bedside Monitor
Message display	The “SpO <sub>2</sub> CONNECTOR OFF” message appears.
Alarm sound	The caution alarm sounds.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

The alarm priority, alarm sound and alarm display color are selected on the SYSTEM SETUP window.

## Checking the IBP

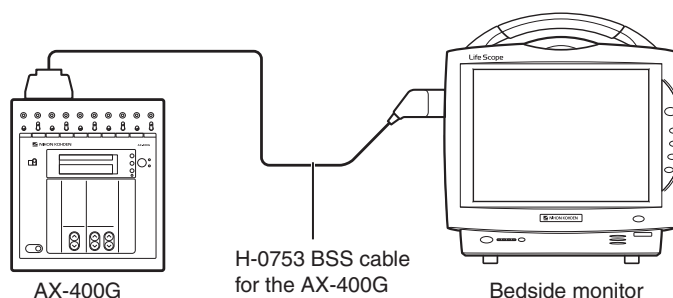
Connect the AX-400G vital sign simulator to the bedside monitor to check zero calibration and the accuracy of the blood pressure value. Check with all MULTI sockets.

After the check, return the current settings to your own settings.

### Preparation

#### Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the H-0753 BSS cable for the AX-400G.





### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the Accuracy of Zero Calibration

Check the accuracy of zero calibration.

1. Set the AX-400G vital sign simulator to “0 mmHg”.
2. Touch PRESS → MAIN → ART tab. Touch the ZERO ALL key to perform zero calibration. Check that the blood pressure displayed after calibration is within the range of  $-2$  to  $2$  mmHg. Alternatively, you can touch the ZERO ALL function key to perform all-zero calibration if the function key is registered.



#### Checking the Accuracy of the Blood Pressure Value

Check the accuracy of the blood pressure value. After performing the zero calibration, set ECG to any setting other than CAL or NORMAL 80, and set the blood pressure to the value in the table below. Check that the blood pressure value displayed on the bedside monitor is in the following range.

Setting on the AX-400G	Display on the Bedside Monitor
10 mmHg	8 to 12 mmHg
100 mmHg	96 to 104 mmHg
250 mmHg	242 to 258 mmHg

#### Checking the Detection of an Connector-Off Alarm

Check that the connector-off alarm is normally generated. While the blood pressure signal is being entered from the AX-400G vital sign simulator, remove the connector for the blood pressure cable from the bedside monitor and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Message display	The “PRESS CONNECTOR OFF” message appears.
Alarm sound	The caution alarm’s sound is sounded.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.



## Checking the Temperature

Connect the AX-400G vital sign simulator to the bedside monitor and check the accuracy of the temperature with the MULTI and TEMP sockets. After the check, return the setting to your setting used at your facility.

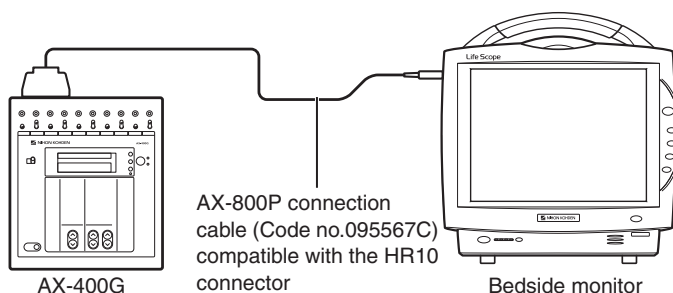
### Preparation

#### Connection and Required Cable

Connect the AX-400G vital sign simulator to the bedside monitor.

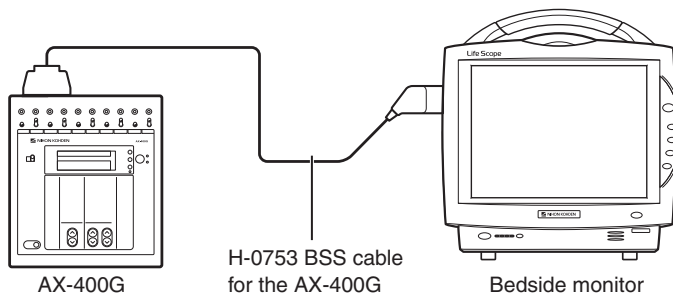
#### To the TEMP socket

Use the AX-800P connection cable which is compatible with the HR10 connector.



#### To the MULTI socket

Use the H-0753 BSS cable for the AX-400G.



### Check the Accuracy of Temperature

Set the temperature output from the AX-400G vital sign simulator and make sure that the temperature shown on the instrument is within the accuracy range shown in the table below.

Setting on the AX-400G	Indication on the Bedside Monitor
25°C	24.8 to 25.2°C
37°C	36.8 to 37.2°C
44°C	43.8 to 44.2°C

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the Connector-Off Detection

Make sure that the connector-off is detected. While the temperature signal from the AX-400G vital sign simulator is being input, disconnect the temperature connection cord from the MULTI socket. Make sure that monitor operates as follows.

Alarm	Operation of the Bedside Monitor
Message display	The “TEMP CONNECTOR OFF” message appears.
Alarm sound	The caution alarm’s sound is sounded.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

#### Checking the Sensor-Off Detection

Make sure that the sensor-off is detected. While the temperature signal from the AX-400G vital sign simulator is being input, remove the temperature cable plug from the TEMP socket. Make sure that monitor operates as follows.

Alarm	Operation of the Bedside Monitor
Message display	The “TEMP CHECK SENSOR” message appears.
Alarm sound	The caution alarm’s sound is sounded.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

### Checking the CO<sub>2</sub> Value

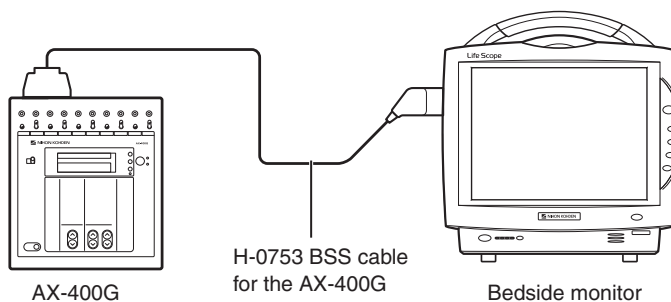
Connect the AX-400G vital sign simulator to the bedside monitor and check the CO<sub>2</sub> value and alarm with all MULTI sockets. Additionally, check the accuracy of the CO<sub>2</sub> sensor kit, as required.

After the check, return the current settings to your own settings.

#### Preparation

##### Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the H-0753 BSS cable for the AX-400G.



**Checking the Accuracy of the Respiration Rate and the CO<sub>2</sub> Value**

Check that the respiration rate displayed on the bedside monitor is between 18 and 22 count/min and that the CO<sub>2</sub> value is between 40 and 46 mmHg.

**Checking the Detection of an Connector-Off Alarm**

Check that the connector-off alarm is normally generated. While the CO<sub>2</sub> signal is being entered from the AX-400G vital sign simulator, remove the connector for the CO<sub>2</sub> sensor kit from the bedside monitor and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Message display	The "CO <sub>2</sub> CONNECTOR OFF" message appears.
Alarm sound	The caution alarm's sound is sounded.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

**Checking the Measurement Accuracy of the CO<sub>2</sub> Sensor Kit**

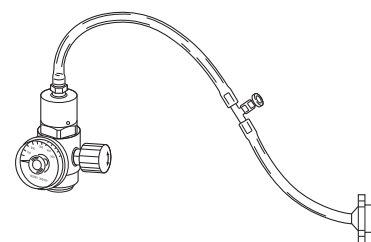
If the CO<sub>2</sub> measurement involves significant error, use the gas for sensitivity calibration to check the accuracy. To obtain stable measurement accuracy, perform the accuracy check regularly every six months.

**Preparation**

Only use the gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden to check the accuracy. Also, prepare a CO<sub>2</sub> sensor kit and airway adapter.

<Gas cylinder for sensitivity calibration>  
CO<sub>2</sub> 5% sensitivity gas A-4

<Flow regulator>  
PR-150

**CAUTION**

Follow the CAUTION label on the CO<sub>2</sub> gas cylinder.

**NOTE**

- The gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden must be purchased locally. Use CO<sub>2</sub> cylinders with the following specifications.

Manufacturer: Nellcor Puritan Bennett, Scott Medical Products division of Air Liquide Healthcare, or other

Outlet fitting: CGA 600

Gas component: 5% CO<sub>2</sub>, 21% O<sub>2</sub> and N<sub>2</sub> mix

Expiration: 3 years after the gas is packed in the cylinder

Accuracy: ±0.03% absolute

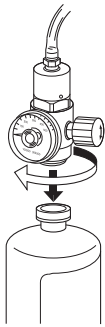
### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

If the above CO<sub>2</sub> cylinders are not available in your country, find highly compressed disposable gas cylinders with the same specifications from other manufacturers.

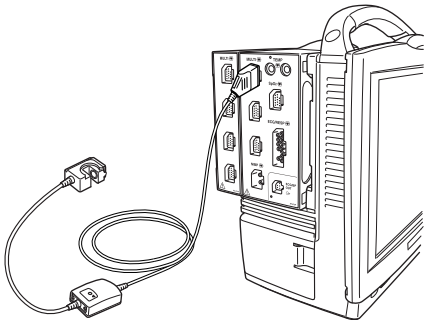
- The gas cylinder for sensitivity calibration has its expiration date. Using the gas cylinder whose expiration date has been reached would not guarantee the accuracy of calibration. Take a look at the expiration date (EXP. DATE) which is shown on the gas cylinder.
- Only use the PR-150 in which the pressure meter has a full scale of 700 psi. Using a non-specified flow regulator might damage the pressure meter.
- When disposing of calibration gas after use, please ask the business from which you purchased the gas for instruction.

#### Checking the Accuracy of the TG-900P

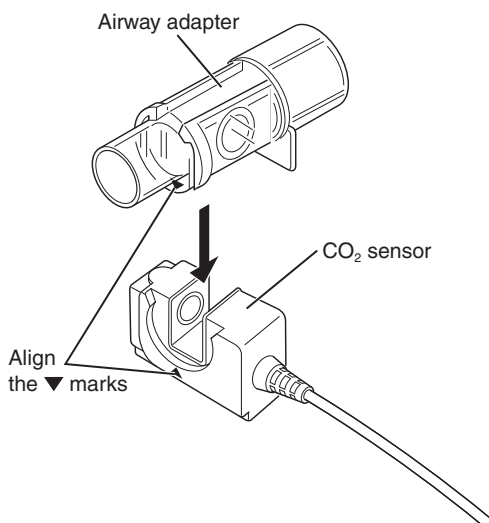
1. Rotate the flow regulator to attach it firmly to the top of the gas cylinder for sensitivity calibration.

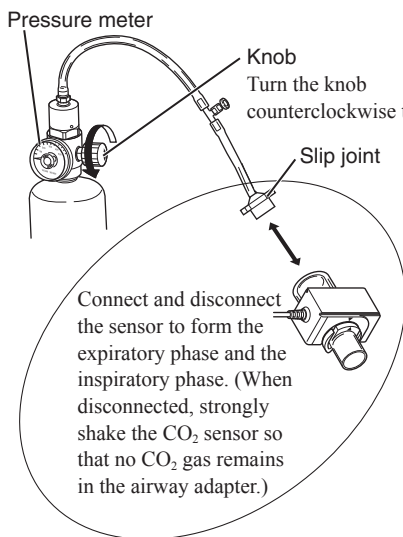


2. Connect the CO<sub>2</sub> sensor kit to the MULTI socket.



3. Connect the airway adapter to the CO<sub>2</sub> sensor.





4. Let the CO<sub>2</sub> gas flow.  
Turn the knob of the flow regulator counterclockwise by about a half turn to let the CO<sub>2</sub> gas flow. Turn the knob slowly.
5. Form the expiratory and inspiratory phases and display the value of the CO<sub>2</sub> partial pressure (preparation).
  - i) Connect the slip joint and the air adapter (expiratory phase).
  - ii) Disconnect the air adapter from the slip joint section (inspiratory phase).
  - iii) Repeat steps i) and ii) three times to display the value of the CO<sub>2</sub> partial pressure.
6. Check the accuracy.
  - i) Connect the slip joint and the air adapter (expiratory phase).  
Check that the value of the CO<sub>2</sub> partial pressure displayed on the screen is between 34 and 42 mmHg. (See the “Supplementary” information on the next page.)
  - ii) Disconnect the air adapter from the slip joint section (inspiratory phase).  
Check that 0 mmHg is read in the CO<sub>2</sub> display area on the monitor.
  - iii) Repeat steps i) and ii) to check the accuracy.

**NOTE**

Measuring the CO<sub>2</sub> value in the TG-900P is based on the inspiratory compensation method; therefore, the CO<sub>2</sub> condensation in inspiratory mode should be calibrated to 0 mmHg. After the CO<sub>2</sub> gas equivalent to expiratory air is made to flow and the airway adapter is removed from the slip joint, strongly shake the CO<sub>2</sub> sensor so that no CO<sub>2</sub> gas remains (that is, the CO<sub>2</sub> gas in the airway adapter shows a reading of 0 mmHg), with the result that the existing CO<sub>2</sub> gas is completely replaced.

7. After checking the measurement accuracy, firmly turn the knob of the flow regulator clockwise to stop the CO<sub>2</sub> gas.

**NOTE**

Once the pressure meter of the flow regulator shows a reading of 0, the gas cylinder for sensitivity calibration should be replaced with a new one.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Supplementary

- The TG-900P is calibrated at a temperature of 37°C in exhaled gas; therefore, the indication will show a change of approximately  $-0.4\%/^{\circ}\text{C}$  at any other temperature. Generally, the gas to be calibrated is low in temperature and it might indicate a pressure of 40 mmHg.
- With the TG-900P, the unit of 1 atm is used for calibration. The indication will change at a rate of 1 mmHg/30 hPa in an environment of other than 1 atm.

#### Example 1: Checking the accuracy at high air pressure

Condensation of CO<sub>2</sub> calibration gas: 38 mmHg (5%); atmospheric pressure: an increase of 60 hPa

The measurement is higher by the amount of  $1 \text{ mmHg} \times (60\text{hPa}/30\text{hPa}) = 2 \text{ mmHg}$ .

Therefore, 40 mmHg is indicated.

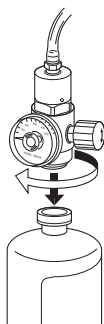
#### Example 2: Checking the accuracy at a high altitude

Condensation of CO<sub>2</sub> calibration gas: 38 mmHg (5%); altitude: 1,000 m  
Change in atmospheric pressure =  $1013 \text{ hPa} \times 0.1$  (altitude-based rate of change in atmospheric pressure) = 101.3 hPa

$101.3 \text{ hPa} / 30 \text{ hPa} = 3.4 \text{ mmHg}$

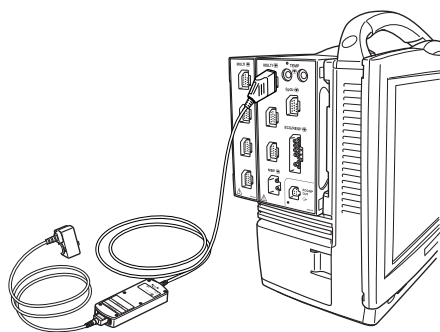
$38 \text{ mmHg} - 3.4 \text{ mmHg} = 34.6 \text{ mmHg}$

Therefore, 34.6 mmHg is indicated.

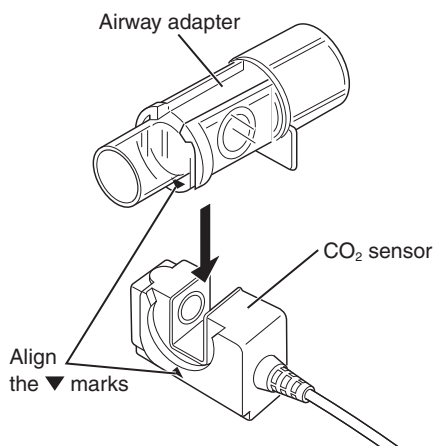


#### Checking the Accuracy of the TG-950P/970P/980P

1. Rotate the flow regulator to attach it firmly to the top of the gas cylinder for sensitivity calibration.

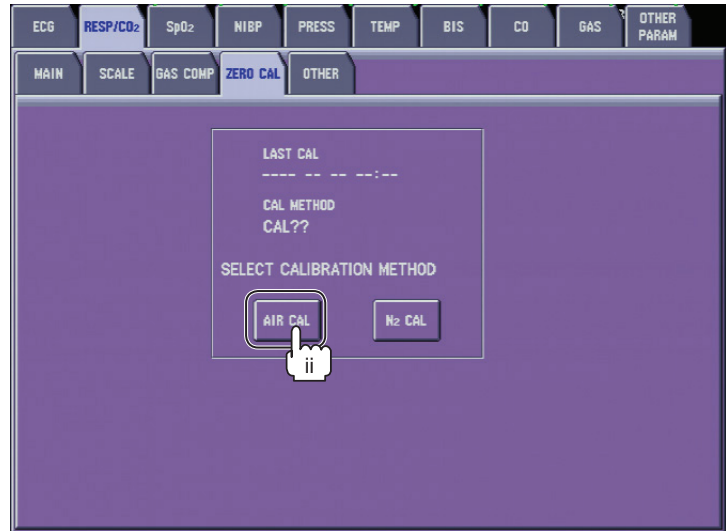


2. Connect the CO<sub>2</sub> sensor kit to the MULTI socket.

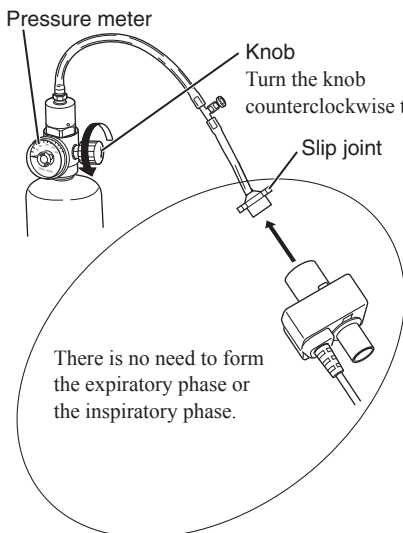


3. Connect the airway adapter to the CO<sub>2</sub> sensor.

4. Follow steps i) to iv) to perform zero calibration of the CO<sub>2</sub> sensor (Air calibration).
  - i) Expose the airway adapter placed in the CO<sub>2</sub> sensor kit to room air.
  - ii) Touch the RESP/CO<sub>2</sub> → ZERO CAL tab. Touch the AIR CAL key for the calibration method.



- iii) When the “EXPOSE SENSOR TO AIR” message appears, touch YES to perform air calibration. While the calibration is being performed, the “CALIBRATING” message appears.
- iv) When the calibration is completed, the “CALIBRATION COMPLETE” message appears and the message is followed by the date of calibration and the method of calibration.



5. Turn the knob of the flow regulator counterclockwise by about a half turn to let the CO<sub>2</sub> gas flow. Turn the knob slowly.
6. Connect the split joint and the airway adapter. Check that the value of the CO<sub>2</sub> partial pressure displayed on the screen is between 36 and 40 mmHg.
7. After checking the measurement accuracy, firmly turn the knob of the flow regulator clockwise to stop the gas.

#### NOTE

Once the pressure meter of the flow regulator shows a reading of 0, the gas cylinder for sensitivity calibration should be replaced with a new one.

#### Supplementary

- The TG-950P/970P/980P is calibrated at a temperature of 37°C in exhaled gas; therefore, the indication will show a change of approximately -0.4%/°C at any other temperature. Generally, the gas to be calibrated is low in temperature and it might indicate a pressure of 40 mmHg.
- When the TG-950P/970P/980P is used, atmospheric compensation is already performed. There is no need to read the indication again.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the O<sub>2</sub> Value

Connect the oxygen sensor to the bedside monitor and calibrate the oxygen sensor with air while leaving the oxygen sensor in the atmosphere. Check that the O<sub>2</sub> value which is displayed on the window is 21%.

#### CAUTION

The oxygen sensor must be stored with the detector facing down. If the oxygen sensor is not stored with the detector facing down, the oxygen sensor must be left with the detector facing down for a few minutes before calibration. If the calibration is performed right after the oxygen sensor has been stored with the detector not facing down, calibration cannot be performed properly.

#### Checking the Cardiac Output

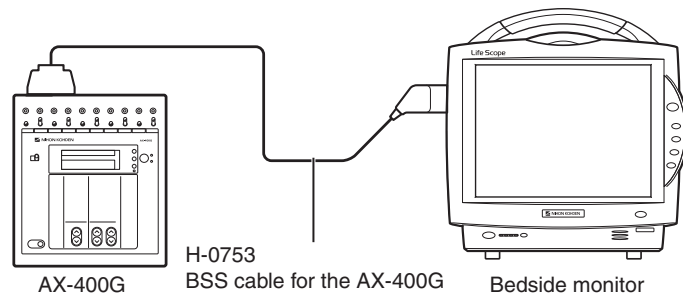
Connect the AX-400G vital sign simulator to the bedside monitor and check that blood temperature (Tb), injectate temperature (Ti) and cardiac output (CO) are normally displayed. Additionally, check if the alarm works normally with all MULTI sockets.

After the check, return the current settings to your own settings.

#### Preparation

##### Connection

Connect the AX-400G vital sign simulator to the bedside monitor with the H-0753 BSS cable for the AX-400G.



#### Checking the Accuracy of the Blood Temperature (Tb) and Injectate Temperature (Ti)

When the AX-400G vital sign simulator is set to Tb = 37°C and Ti = 0°C, check that the Tb value displayed on the bedside monitor is between 36.8 and 37.2°C and that the Ti value is between -0.2 and +0.2 °C.

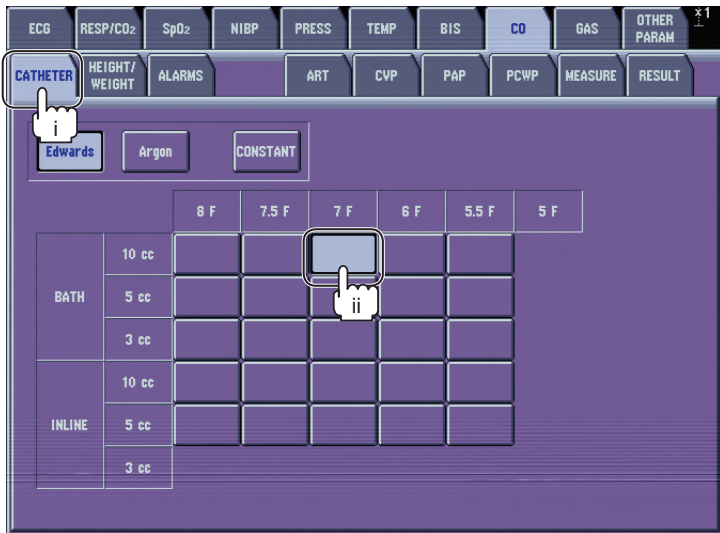


**Checking the Accuracy of the Cardiac Output (CO)**

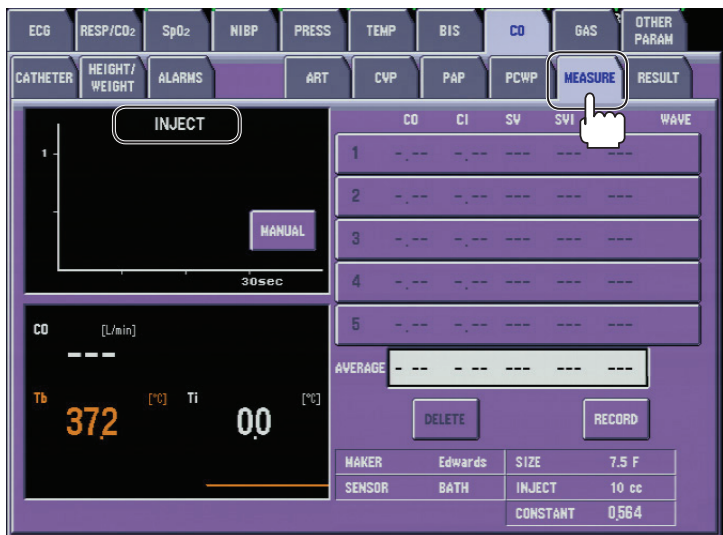
1. Set the cardiac output window on the bedside monitor.

CO Window		Setting Item
CATHETER setting	Method of measuring the injectate temperature	Bath probe
	Size of the catheter	7 F
	Injectate amount	10 cc

- i) Touch CO → CATHETER tab to display the CATHETER page.
- ii) On the CATHETER page, touch the field in which the bath probe’s 10 cc and 7 F intersect.

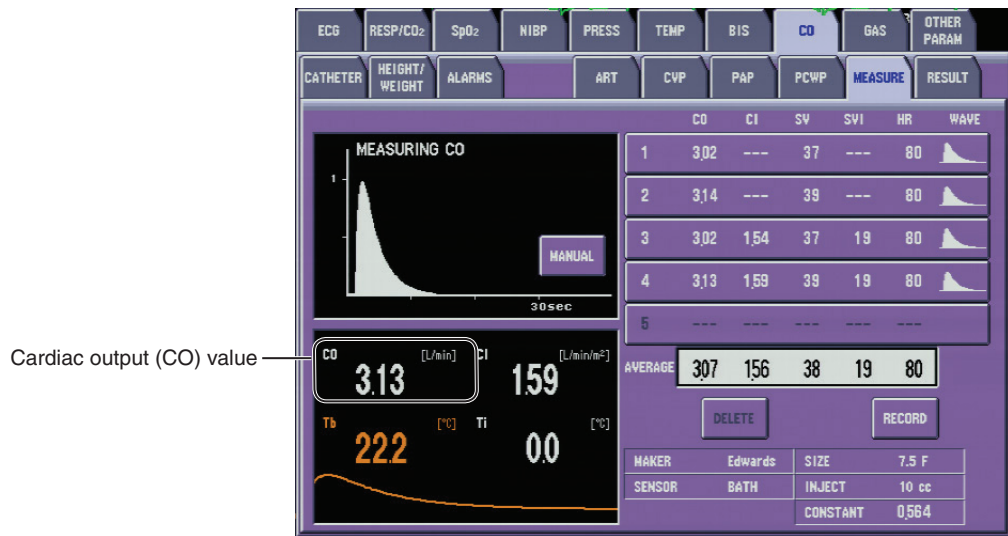


2. Touch the MEASURE tab to switch to the measurement window. When the “INJECT” message appears on the window, press the CO START key of the AX-400G vital sign simulator.



### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

3. Check that a thermodilution curve is drawn and that the value of the cardiac output (CO) is between 4.50 and 5.50.



#### Checking the Detection of a Connector-Off Alarm

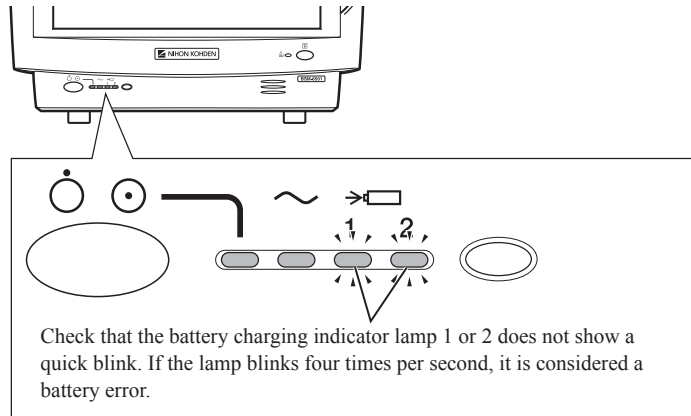
Check that the connector-off alarm is normally generated. Remove the connector of the CO cable from the bedside monitor and check that the bedside monitor works in the following way.

Alarm	Operation of the Bedside Monitor
Message display	The “CO CONNECTOR OFF” message appears.
Alarm sound	The caution alarm sounds.
Alarm indicator	The alarm indicator lights in the color specified for the caution alarm.

## Checking Battery Operation

When the optional SB-671P battery pack is already set, check that the bedside monitor is correct in battery operation.

1. Remove the power cord and check that the bedside monitor continues operating.
2. Connect the power cord and check that the battery charging indicator lamp 1 or 2 does not show a quick blink. If the lamp blinks four times per second, it is considered a battery error.



# QI-670P Interface

## Checking the Appearance for Damage and Dirt

Check the following items.

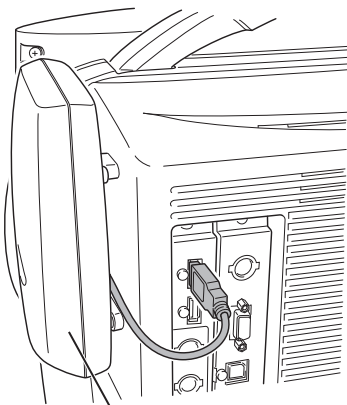
- All parts of the monitor are free of dirt.
- The exterior of the monitor is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The labels are not come off or be torn off.
- The connectors can be connected and disconnected normally.
- The connectors and connection cables are not cracked or loose.

## Checking the Connection

Check the QI-670P interface connection.

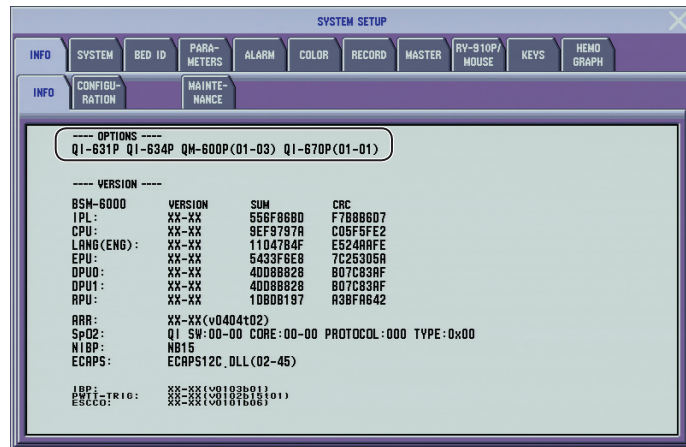
### NOTE

The QI-670P interface can only be mounted if a QI-632P, QI-634P or QI-672P interface is installed.



QI-670P interface

1. Connect the QI-670P interface to the bedside monitor. Refer to the QI-670P interface operator’s manual.
2. Turn on the bedside monitor.
3. Enter the monitor to the patient admit state to start monitoring. The monitor needs to be in the monitoring state to recognize the QI-670P interface.
4. Display the SYSTEM SETUP window and check that the QI-670P interface version is displayed in OPTIONS. To display the SYSTEM SETUP window, refer to the BSM-6000 series bedside monitor administrator’s guide.



5. Check that a “TEC INTERFACE ERROR” does not appear on the home screen.

## ZS-900P Transmitter

3

### Availability of Service Parts

The period during which Nihon Kohden is responsible for the maintenance and repair of the ZS-900P transmitter is eight years after delivery. Note that repair parts for the transmitter (the parts required to maintain the product's functionality) are available for at least eight years after discontinuation of the transmitter. The period during which these parts are available is also the period during which repair is available.

The parts availability period might be less depending on when you purchased the product. Even after the parts availability period is over, some parts might be repairable.

### Checking the Appearance for Damage and Dirt

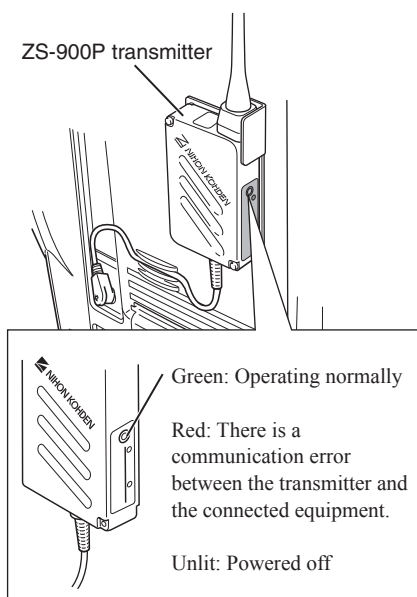
Check the following items.

- All parts of the monitor are free of dirt.
- The exterior of the monitor is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The labels are not come off or be torn off.
- The connectors can be connected and disconnected normally.
- The connectors and connection cables are not cracked or loose.

### Checking the State of Operation

Check the transmitter for its state of operation.

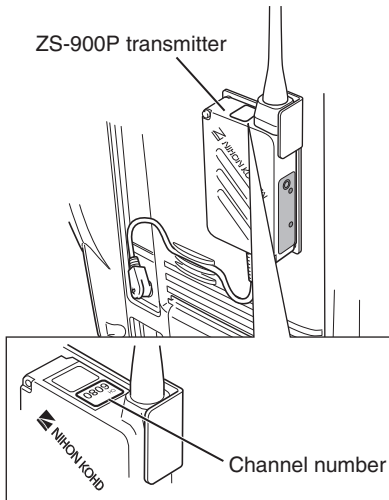
1. Check that the transmitter is already connected to the bedside monitor.
2. Turn on the bedside monitor and check that the LED on the transmitter lights green.



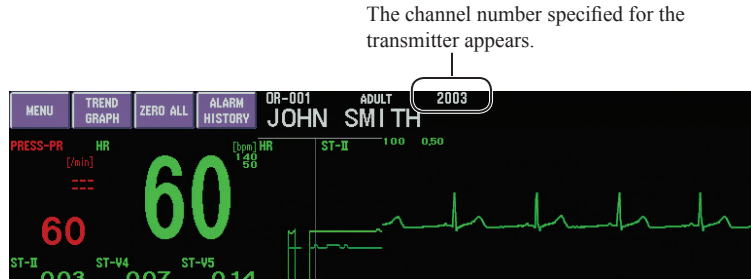
### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Checking the State of Transmission

Check that information from the transmitter is normally transmitted to the receiving monitor.

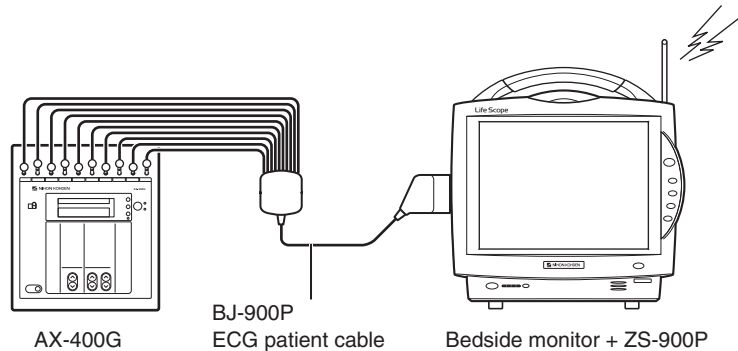


1. Check that the channel number attached to the transmitter is the same as the channel number displayed on the bedside monitor's home screen.

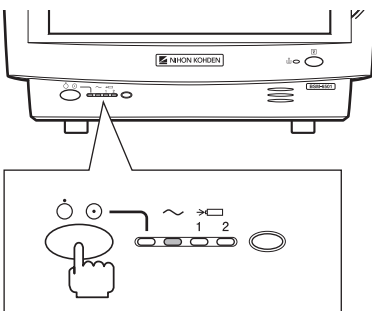


2. Place the receiving monitor by a visible distance of 2 to 3 m apart from the bedside monitor.
3. Turn on the receiving monitor and set the receiving channel to the transmitter's channel.
4. Connect the AX-400G vital sign simulator to the bedside monitor and turn on each of the power supplies.

<Example: When the BJ-900P ECG patient cable is used>



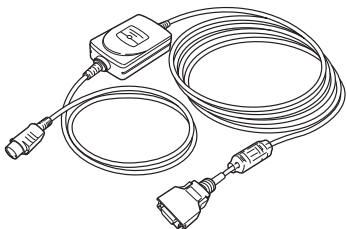
5. On the receiving monitor, check that the ECG and heart rate are normally received.
6. Press the [Power] switch on the front of the bedside monitor to turn off the bedside monitor.
7. Check that the ECG displayed on the receiving monitor shows triangle waveform.



# QF series Interface/IF series Communication Cable

Check the QF series interface or IF series communication cable.

## Checking the Appearance for Damage and Dirt



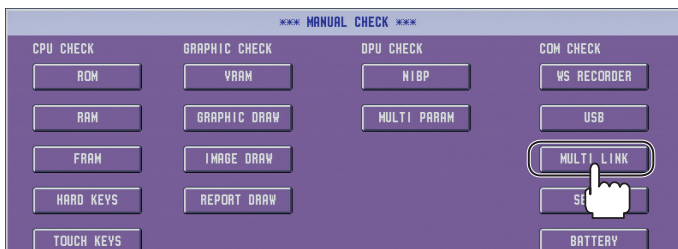
Check the following items.

- The exterior of the QF series interface or IF series communication cable is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The labels are not come off or torn off.
- The connectors can be connected and disconnected normally.

## Checking the Connection

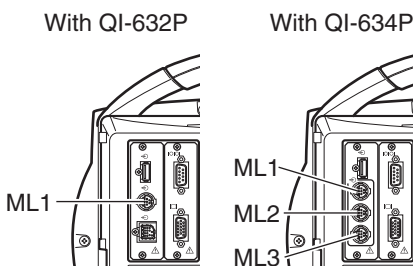
Check the state of connection between the QF series interface or IF series communication cable and the bedside monitor.

1. On the MANUAL CHECK screen, touch the MULTI LINK key to display the MULTI LINK CHECK screen.

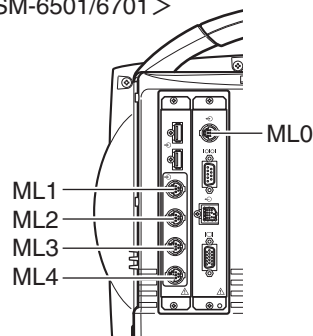


2. Check the state of communication.
  - i) Connect the QF series interface or IF series communication cable to be checked to the multi-link sockets (BSM-6301: ML1 or ML1 to ML3; BSM-6501 and BSM-6701: ML0 to ML4) at the rear of the bedside monitor.

<BSM-6301>



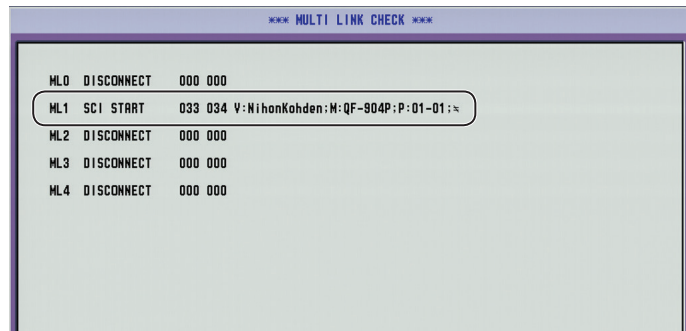
<BSM-6501/6701>



- ii) Check that the information about the connected QF series interface or IF series communication cable appears on the MULTI LINK CHECK screen.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

<Example: When the QF-904P is connected to ML1 of the BSM-6501>



3. Touch the RETURN key to return to the MANUAL CHECK screen.



4. On the MANUAL CHECK screen, touch the RETURN key to return to the DIAGNOSTIC CHECK screen.



5. On the DIAGNOSTIC CHECK screen, touch the RETURN key to return to the home screen.

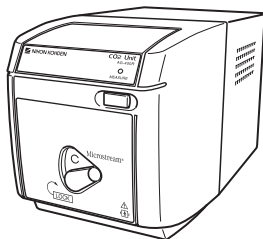




## AG-400R CO<sub>2</sub> Unit

3

### Checking the Appearance for Damage and Dirt



Check the following items.

- The exterior of the CO<sub>2</sub> unit is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The connectors can be connected and disconnected normally.
- It is possible to connect and lock the QF-905P interface.

### Checking the Accuracy of the O<sub>2</sub> Value

#### Timing of Accuracy Check and Sensitivity Calibration

#### CAUTION

When the monitoring value is not appropriate, perform gas calibration. Perform gas calibration every six months for stable measuring accuracy.

#### NOTE

Turn on the MEASURE switch of the CO<sub>2</sub> unit and connect the filter line and wait at least 20 minutes to perform accuracy check and sensitivity calibration.

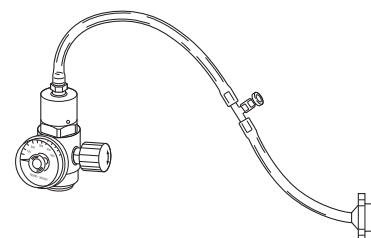
#### Preparation

Only use the specified gas cylinder for sensitivity calibration and flow regulator to check the accuracy. Also, prepare a filter line and airway adapter.

<Gas cylinder for sensitivity calibration>  
CO<sub>2</sub> 5% sensitivity gas A-4

<Flow regulator>  
PR-150

Cabling required  
• Filter line  
• Airway adapter



#### CAUTION

Follow the CAUTION label on the CO<sub>2</sub> gas cylinder.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### NOTE

- The gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden must be purchased locally. Use CO<sub>2</sub> cylinders with the following specifications.

Manufacturer: Nellcor Puritan Bennett, Scott Medical Products  
division of Air Liquide Healthcare, or other

Outlet fitting: CGA 600

Gas component: 5% CO<sub>2</sub>, 21% O<sub>2</sub> and N<sub>2</sub> mix

Expiration: 3 years after the gas is packed in the cylinder

Accuracy: ±0.03% absolute

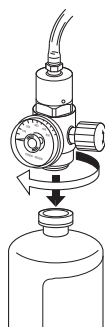
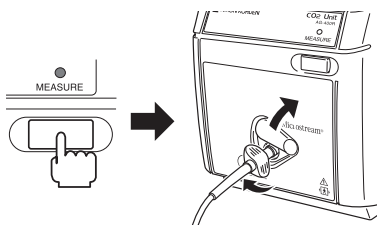
If the above CO<sub>2</sub> cylinders are not available in your country, find highly compressed disposable gas cylinders with the same specifications from other manufacturers.

- The gas cylinder for sensitivity calibration has its expiration date. Using a gas cylinder whose expiration date has been reached would not guarantee the accuracy of calibration. Take a look at the expiration date (EXP. DATE), which is shown on the gas cylinder.
- Only use the flow regulator in which the pressure meter has a full scale of 700 psi. Using a non-specified flow regulator might damage the pressure meter.
- When disposing of calibration gas after use, please ask the business from which you purchased the gas for instruction.

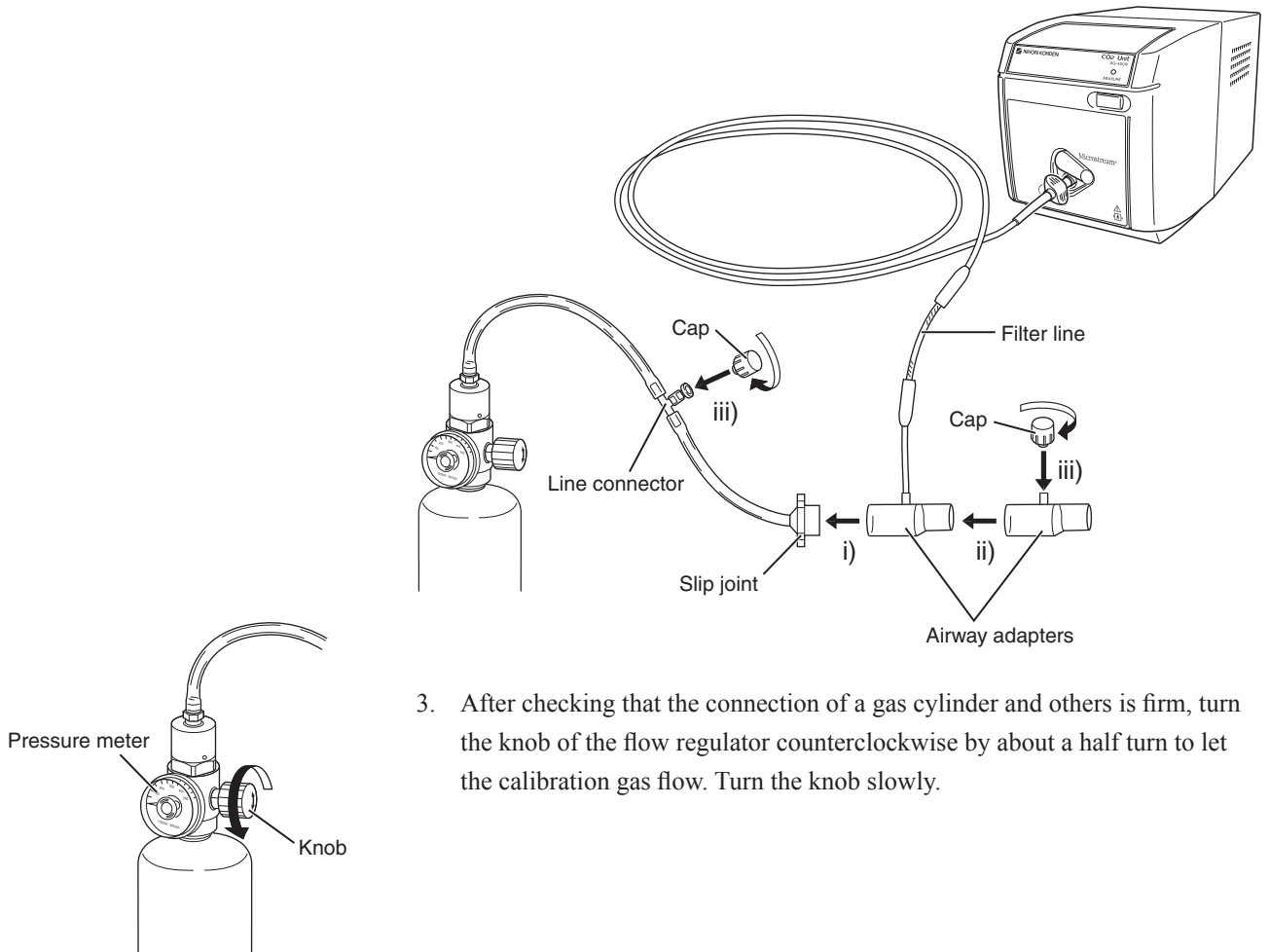
#### Performing Accuracy Check and Sensitivity Calibration

#### NOTE

Turn on the MEASURE switch of the CO<sub>2</sub> unit and connect the filter line and wait at least 20 minutes to perform accuracy check and sensitivity calibration.



1. Rotate the flow regulator to attach it firmly to the top of the gas cylinder for sensitivity calibration.
2. Connect the filter line.
  - i) Connect the split joint and the airway adapter.
  - ii) Connect another airway adapter to the filter line's airway adapter.
  - iii) Cap the regulator's luer connector and the airway adapter.



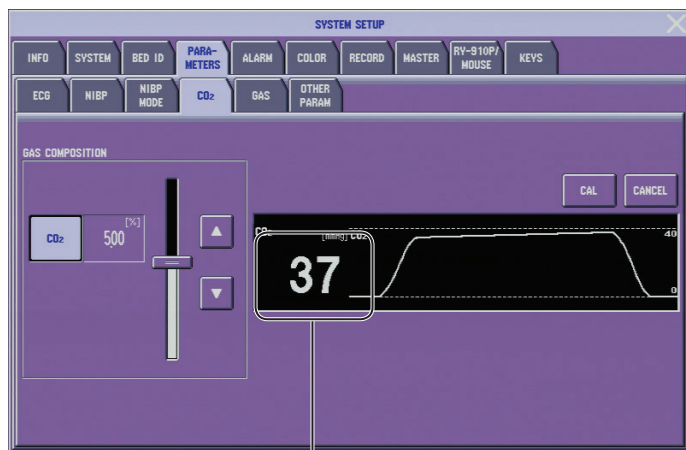
3. After checking that the connection of a gas cylinder and others is firm, turn the knob of the flow regulator counterclockwise by about a half turn to let the calibration gas flow. Turn the knob slowly.

4. Display the CO<sub>2</sub> page of the PARAMETER window.  
 Press [Menu] key → SYSTEM key → enter the password → PARAMETERS tab → CO<sub>2</sub> tab.



5. Check that the value of the instantaneous CO<sub>2</sub> partial pressure displayed on the CO<sub>2</sub> page meets the following accuracy range.

Gas for Sensitivity Calibration		Displayed Instantaneous CO <sub>2</sub> Partial Pressure (Error)
CO <sub>2</sub>	5%	Atmospheric pressure × 0.05 mmHg (±2 mmHg)



Instantaneous CO<sub>2</sub> partial pressure

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

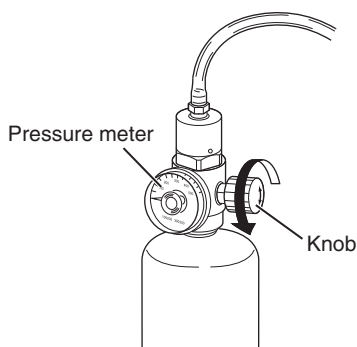
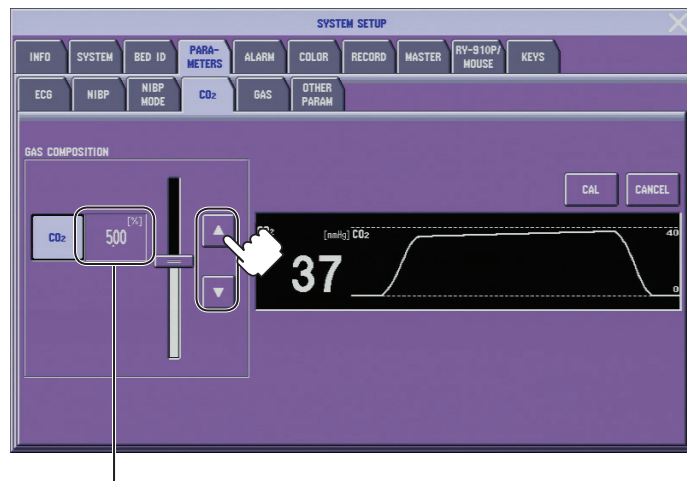
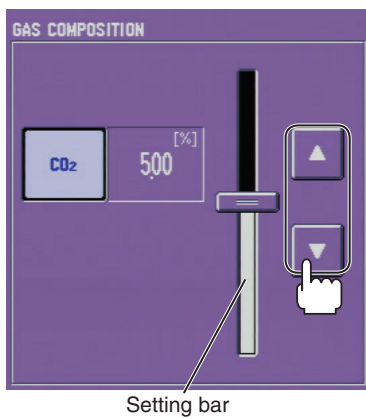
6. After accuracy check is completed, firmly turn the knob of the flow regulator clockwise to stop the gas.

#### NOTE

Once the pressure meter of the flow regulator shows a reading of 0, the gas cylinder for sensitivity calibration should be replaced with a new one.

If the above measurement accuracy is not met, follow steps 7 to 11 to perform sensitivity calibration.

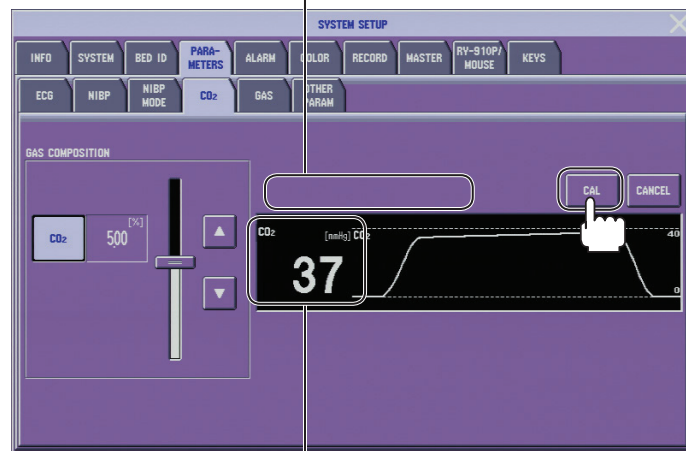
7. On the CO<sub>2</sub> page, check to see if the value of the CO<sub>2</sub> condensation displayed in the GAS COMPOSITION matches the CO<sub>2</sub> condensation of the calibration gas to be used. If it does not match, set the value by sliding the setting bar vertically or touching ▲ and ▼.



8. After checking that the connection of a gas cylinder and others is firm, turn the knob of the flow regulator counterclockwise by about a half turn to let the CO<sub>2</sub> gas flow. Turn the knob slowly.

9. Check that the measurement is stable and touch the CAL key. While calibration is in progress, the “CO<sub>2</sub> ZERO CALIBRATING” message appears. You can stop the calibration by touching the CANCEL key.

This area displays one of the following messages “CALIBRATING”  
“PLEASE WAIT” and “CALIBRATION COMPLETED”.

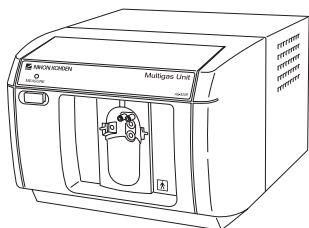


Check that the measurement is stable.

10. If the “CO<sub>2</sub> PLEASE WAIT” message appears, turn the flow regulator’s knob fully clockwise to stop the gas.
11. When the sensitivity calibration is completed, the “CO<sub>2</sub> CAL COMPLETE” message appears. The message is displayed for several seconds and disappears automatically.

## AG-920R Multigas Unit

### Checking the Appearance for Damage and Dirt



Check the following items.

- The exterior of the multi-gas unit is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The connectors can be connected and disconnected normally.
- It is possible to connect and lock the QF-904P interface.

### Checking the Accuracy of Anesthesia Gas

#### Timing of Accuracy Check and Sensitivity Calibration

#### CAUTION

When the monitoring value is not appropriate, perform gas calibration. Perform gas calibration once a year for stable measuring accuracy.

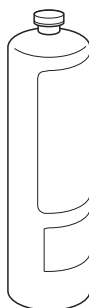
#### Cabling required

- Adult water trap
- Adult sampling line

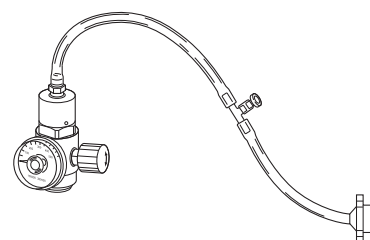
#### Preparation

Only use the gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden to check the accuracy and to perform sensitivity calibration. Perform the sensitivity calibration of CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>O and AGENT values simultaneously.

<Gas cylinder for sensitivity calibration>  
for the multi-gas unit A-5



<Flow regulator>  
PR-150P 250 mL/min



A single gas cylinder lets gas flow for approximately 10 minutes (requiring one minute for a single cycle of calibration allows you to perform about 10 cycles of calibration).

#### CAUTION

Follow the CAUTION label on the CO<sub>2</sub> gas cylinder.

#### NOTE

- The gas cylinder for sensitivity calibration and flow regulator specified by Nihon Kohden must be purchased locally. Use CO<sub>2</sub> cylinders with the following specifications.

Manufacturer: Nellcor Puritan Bennett, Scott Medical Products  
division of Air Liquide Healthcare, or other

Outlet fitting: CGA 600

Gas component: 3% isoflurane, 5% CO<sub>2</sub>, 40% N<sub>2</sub>O and 52% BaO<sub>2</sub>

Expiration: 3 years after the gas is packed in the cylinder

Accuracy: ±0.03% absolute

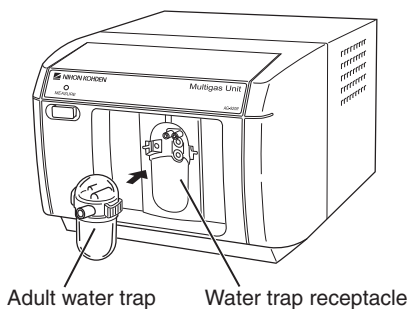
If the above CO<sub>2</sub> cylinders are not available in your country, find highly compressed disposable gas cylinders with the same specifications from other manufacturers.

- The gas cylinder for sensitivity calibration has its expiration date. Using a gas cylinder whose expiration date has been reached would not guarantee the accuracy of calibration. Take a look at the expiration date (EXP. DATE), which is shown on the gas cylinder.
- Only use the PR-150P flow regulator in which the pressure meter has a full scale of 0.6 Mpa. Using a non-specified flow regulator might damage the pressure meter.
- When disposing of calibration gas after use, please ask the business from which you purchased the gas for instruction.

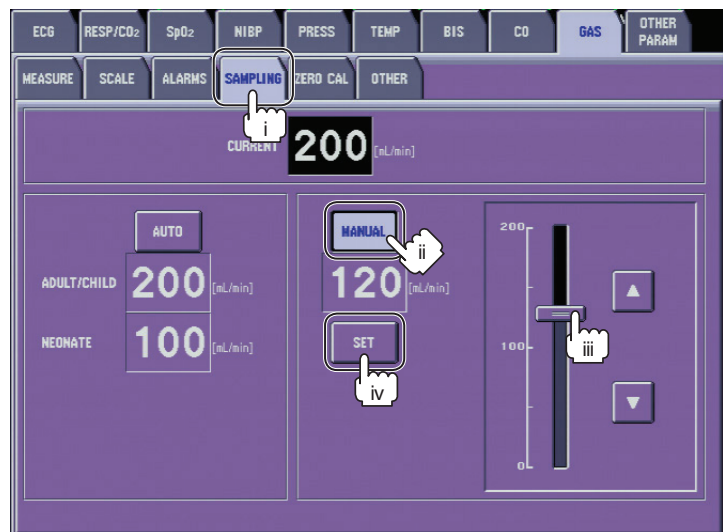
### Method of Accuracy Check

#### NOTE

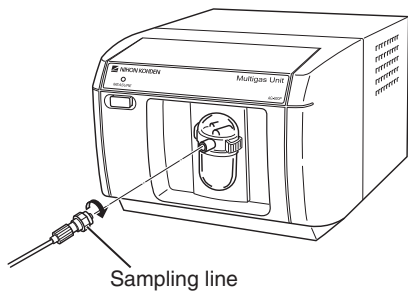
After the power supply is turned on, wait for at least 1 hour to perform accuracy check and sensitivity calibration.



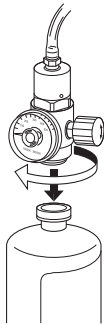
1. Attach the adult water trap to the water trap receptacle of the multi-gas unit.
2. On the SAMPLING page of the bedside monitor, set the sampling flow to 120 mL/min in MANUAL.
  - i) Touch the SAMPLING tab to display the SAMPLING page.
  - ii) Touch the MANUAL key.
  - iii) Slide the setting bar vertically and set the flow rate to "120". You can fine-adjust the setting by touching ▲ or ▼.
  - iv) Touch the SET key to determine the value.



### 3. DIAGNOSTIC CHECK AND SAFETY CHECK



3. Attach the adult sampling line to the adult water trap attached to the multi-gas unit.

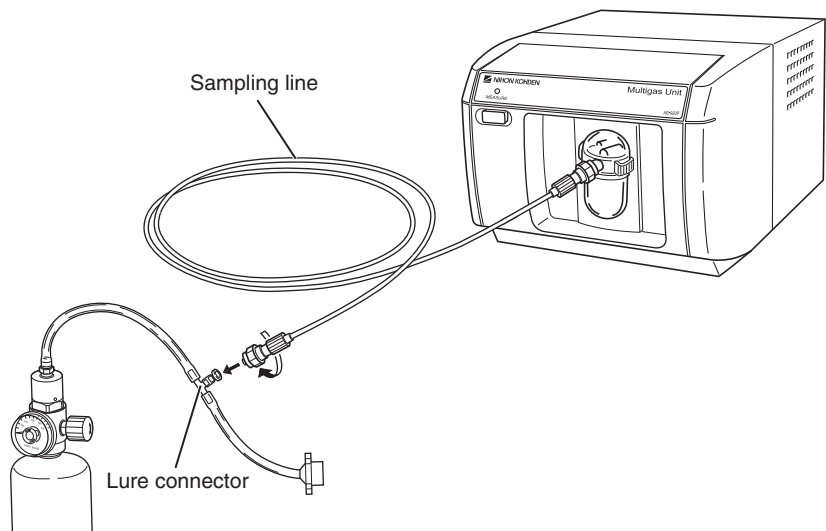


4. Rotate the flow regulator to attach it firmly to the top of the gas cylinder for sensitivity calibration.

5. Turn the sampling line (male) clockwise to connect it to the luer connector of the flow regulator.

#### NOTE

- Be sure that the unit is not exposed to direct pressure.
- Do not block the exit to the flow regulator.
- The gas leading to the unit must always be under atmospheric pressure.

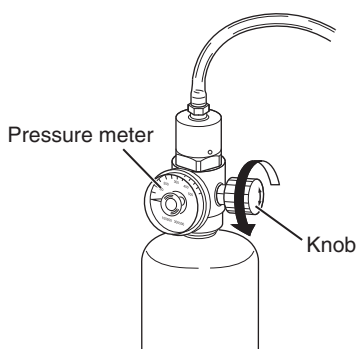
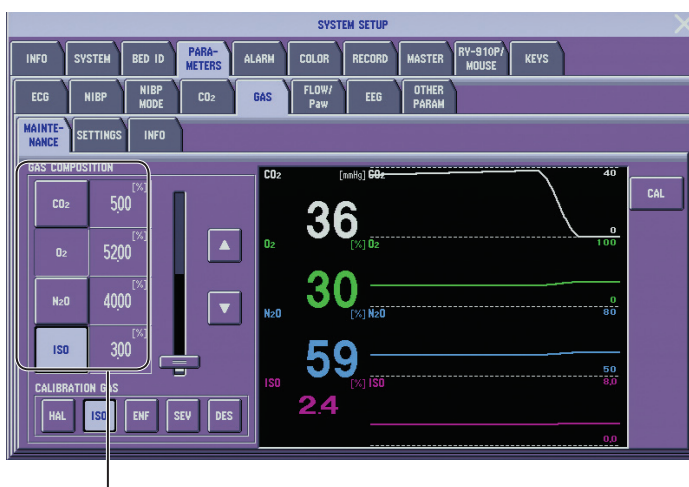
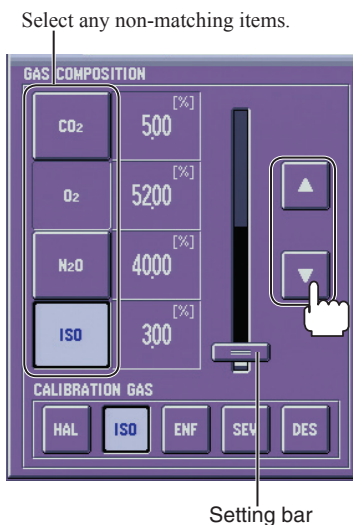


6. Display the GAS page in the SYSTEM SETUP screen.  
Press the [Menu] key and touch the SYSTEM key → PARAMETERS tab → GAS tab.





7. Check if the value of condensation displayed in <GAS COMPOSITION> of the GAS page matches the condensation of each gas described on the gas cylinder for sensitivity calibration to be used. If not, set the value by selecting any non-matching item and sliding the setting bar vertically or touching ▲ and ▼.



8. Turn the knob of the flow regulator counterclockwise by about a half turn to let the calibration gas flow. Turn the knob slowly.

**NOTE**

Before letting the calibration gas flow, check that the reading of the flow regulator's pressure meter is at least 0.1 Mpa. If the reading of 0.1 Mpa is not reached, replace the gas cylinder for sensitivity calibration with a new one. This is because correct sensitivity calibration fails if the remaining pressure of the gas cylinder is too low.

9. In approximately 30 seconds after flowing the calibration gas, check that the measurement is stable and that the measured value of each gas meets the requirement of the table below.

Gas for sensitivity calibration		Display on the bedside monitor (Error)
CO <sub>2</sub>	5 %	Atmospheric pressure × 0.05 mmHg (±2 mmHg)
O <sub>2</sub>	52 %	50 to 54 % (52 ± 2%)
N <sub>2</sub> O	40 %	37 to 43 % (40 ± 3%)
ISO	3 %	2.8 to 3.2 % (3.0 ± 0.2 %)

If the above measurement accuracy is not met, follow steps 10 to 13 to perform sensitivity calibration.

### 3. DIAGNOSTIC CHECK AND SAFETY CHECK

#### Method of Sensitivity Calibration

1. In approximately 30 seconds after the calibration gas is caused to flow, check that the measurement is stable and touch the CAL key. While calibration is in progress, the “CALIBRATING” message appears.

This area displays the “CALIBRATING” message.



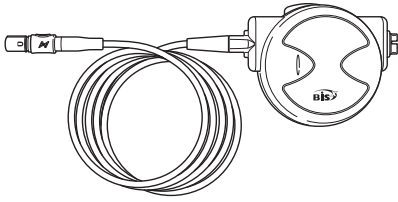
Touching is not possible if the gas described on the gas cylinder is not different from the gas name displayed on the screen or if the measurement is not stable.

2. When the calibration is completed, the “CALIBRATING” message disappears.
3. Turn the flow regulator’s knob fully clockwise to stop the gas.
4. By referring to step 2, turn the sampling flow of the bedside monitor to the state before calibration.

## QE-910P BIS Processor

3

### Checking the Appearance for Damage and Dirt

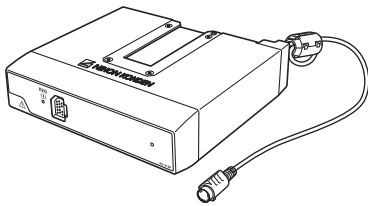


Check the following items.

- The exterior of the BIS processor is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The connectors can be connected and disconnected normally.
- It is possible to connect and lock the connection cable.

## AE-918P Neuro Unit

### Checking the Appearance for Damage and Dirt



Check the following items.

- The exterior of the neuro unit is free of breakage, including cracks.
- No parts are soiled with blood or chemicals.
- The connector can be connected and disconnected normally.

### Checking the Accuracy of the Neuro Unit

A particular device is necessary for checking the accuracy of EEG measurement data. Contact your Nihon Kohden representative.

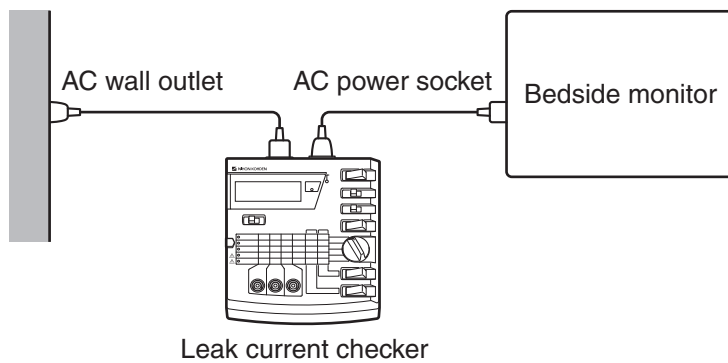
# Safety Check

Safety check is performed while the components are connected. You need to measure four different currents (earth leakage current, enclosure leakage current, patient leakage current and patient auxiliary current) in both the normal condition and a single-fault condition to make sure that the allowable value is not exceeded. You also need to record the measured values.

**NOTE**

Performing safety inspection requires a special instrument for measuring leak currents.

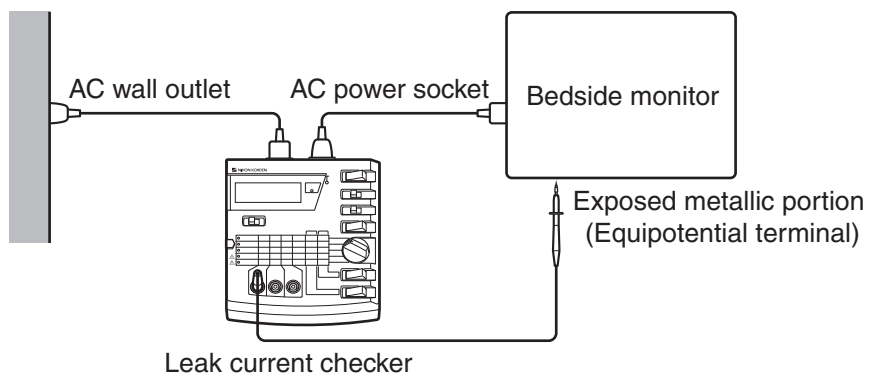
<Example of measuring earth leakage current>



- Make sure that the measured value is within the range below.

Normal condition	500 $\mu$ A or less
Single-fault condition	1 mA or less

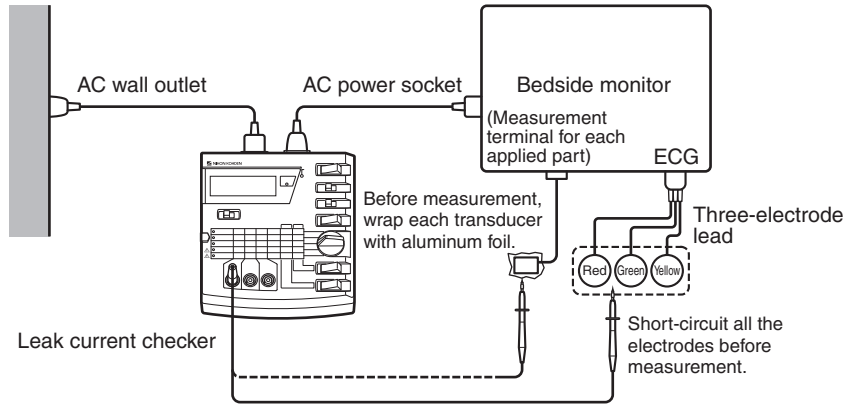
<Example of measuring enclosure leakage current>



- Make sure that the measured value is within the range below.

Normal condition	100 $\mu$ A or less
Single-fault condition	500 $\mu$ A or less

<Example of measuring patient leakage current I>



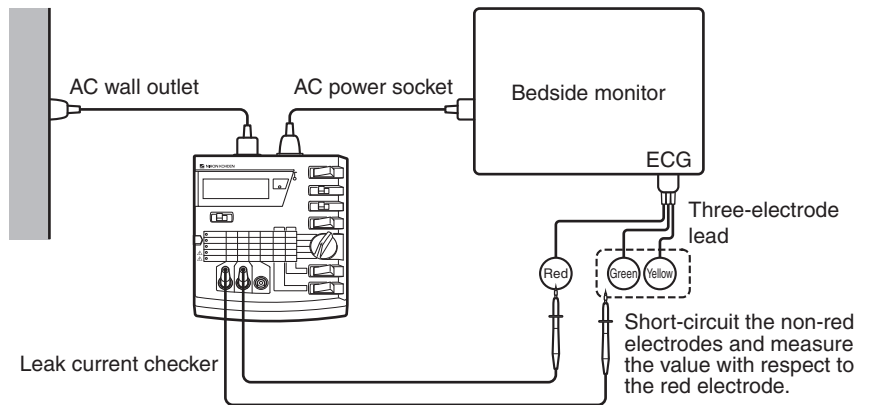
Measure the patient leakage current flowing in the measurement system for each parameter other than NIBP and CO<sub>2</sub>. For the ECG, short-circuit all the electrode leads before measurement. For the other parameters, wrap the transducer with aluminum foil before measurement.

- Make sure that the measured value is within the range below.

Normal condition	10 $\mu$ A or less
Single-fault condition	50 $\mu$ A or less

\* If you are using the leak current checker as a leak current measuring instrument, first measure the current in the DC+AC mode to make sure that the above DC range is satisfied. If the allowable value is exceeded, you need to measure the current in the DC mode again; the result is considered successful if the above DC range is satisfied.

<Example of measuring patient auxiliary current>



For the ECG, measure the patient auxiliary current (AC). Short-circuit the non-red electrode leads for the ECG and measure the value with respect to the red one.

- Make sure that the measured value is within the range below.

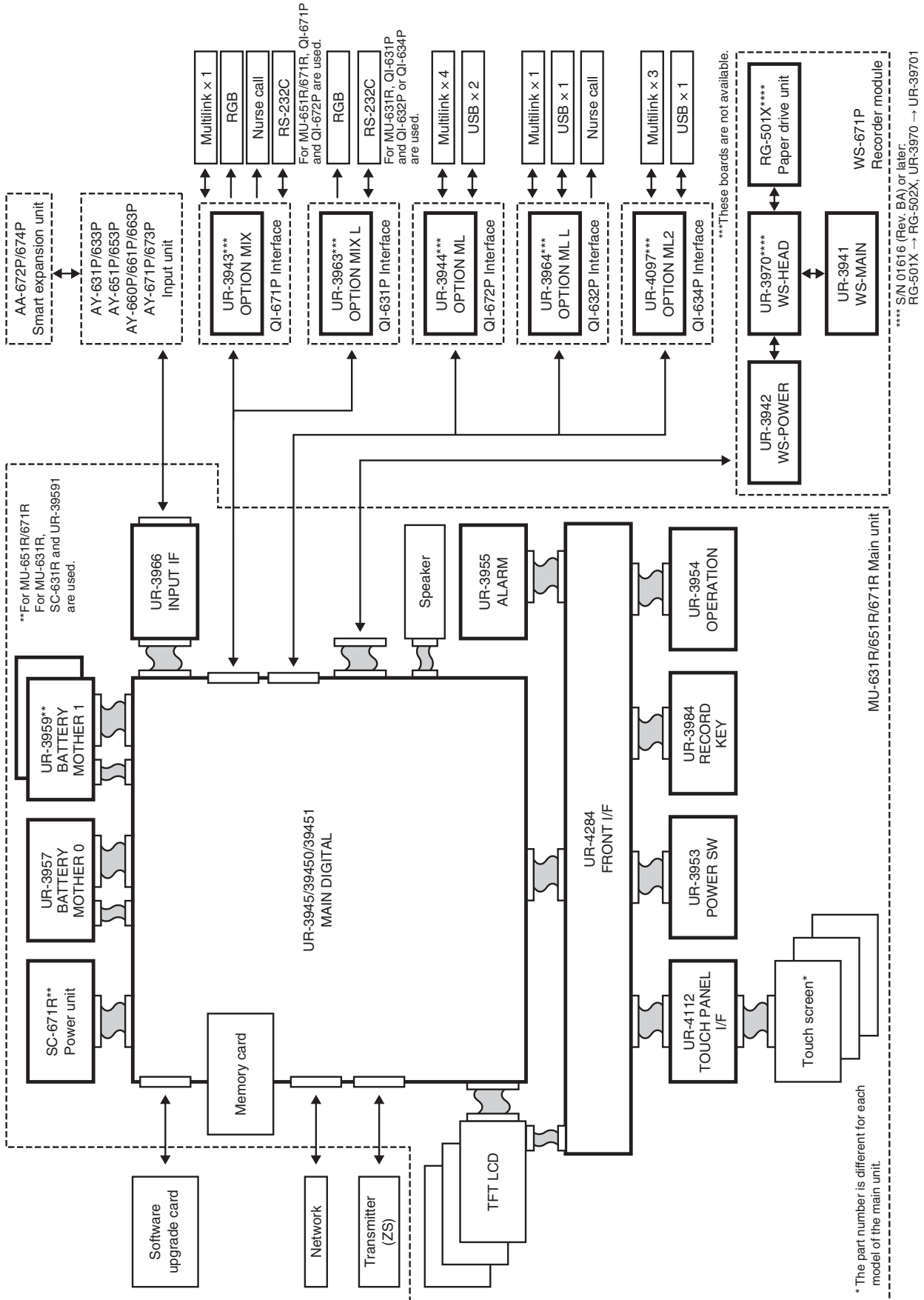
Normal condition	10 $\mu$ A or less
Single-fault condition	50 $\mu$ A or less

# Section 4 Board/Unit Description

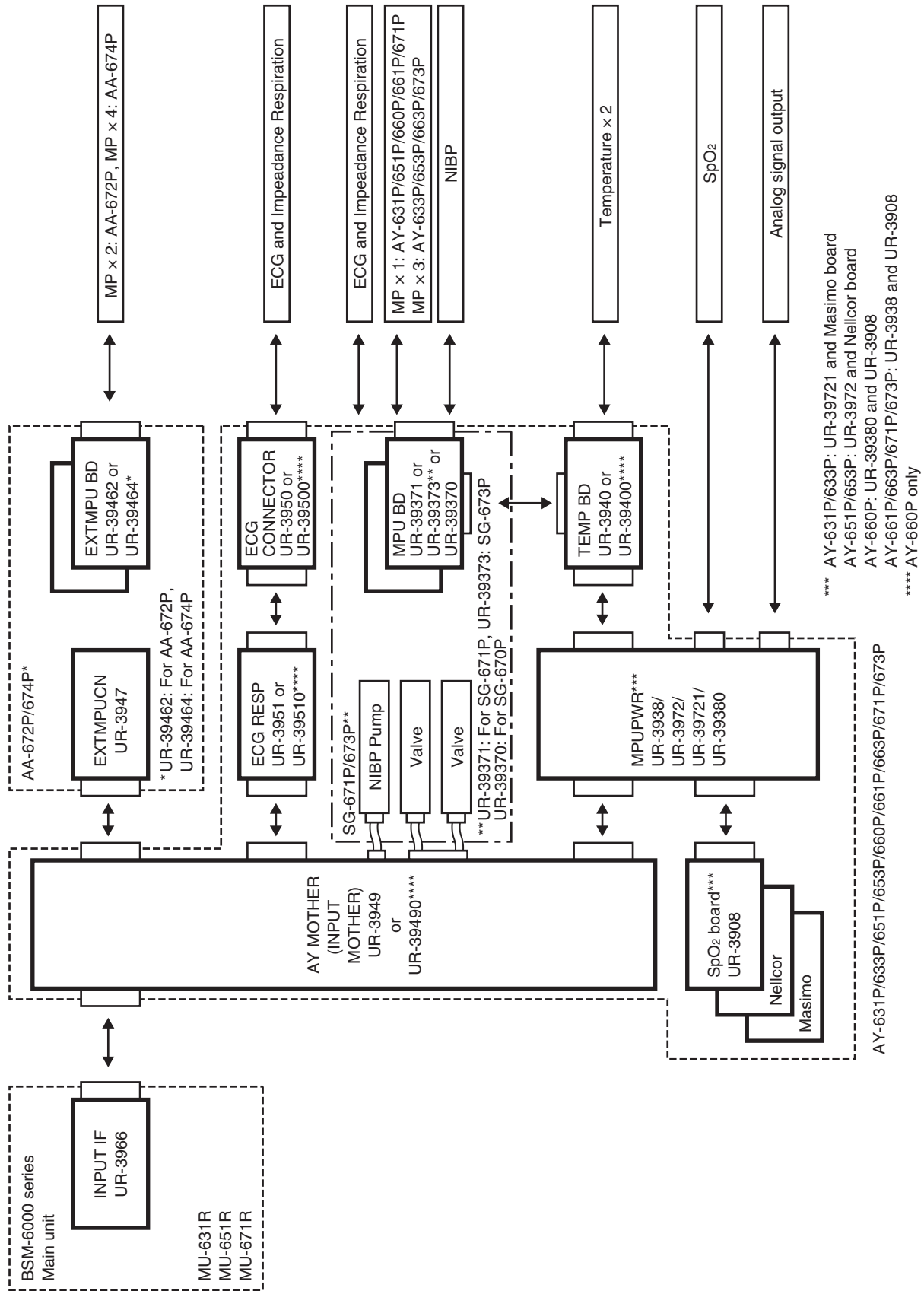
Overall Connection Diagram.....	4.2
MU-631R/MU-651R/MU-671R .....	4.2
AY-600P series/AA-672P/AA-674P .....	4.3
Overall Block Diagram .....	4.4
MU-631R/MU-651R/MU-671R .....	4.4
AY-600P series/AA-672P/AA-674P .....	4.5
Internal Cable Connections .....	4.6
MU-631R Wiring Diagram .....	4.6
MU-631R Cable List .....	4.7
MU-651R Wiring Diagram .....	4.8
MU-651R Cable List .....	4.9
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MU-631R/MU-651R/MU-671R Main Unit .....	4.12
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UR-3966 INPUT I/F Board .....	4.20
UR-3951/39510 ECG RESP Board .....	4.21
UR-3950/39500 ECG Connector Board .....	4.23
UR-39370/39371/39373 Multi Parameter Unit Board (MPU Board) .....	4.24
UR-3940/39400 TEMP Board .....	4.29
UR-3938/39380/3972/39721 Multi Parameter Unit Power Board .....	4.30
UR-3949/39490 AY MOTHER (INPUT MOTHER) Board .....	4.33
UR-3908 SpO <sub>2</sub> Board .....	4.35
UR-39462/39464 External Multi Parameter Unit Board (EXTMPU Board) .....	4.37
UR-3947 External Multi Parameter Unit Connection Board .....	4.41
QI-631P Interface (MIX) .....	4.41
QI-632P Interface (ML) .....	4.42
QI-634P Interface .....	4.43
QI-671P Interface .....	4.44
QI-672P Interface .....	4.45
WS-671P Recorder Module.....	4.46
UR-3942 WS Power Board .....	4.46
UR-3941 WS Main Board .....	4.47
UR-3970/39701/4318 WS Head Board .....	4.48
RG-501X/502X/502X-01 Paper Drive Unit .....	4.49

# Overall Connection Diagram

## MU-631R/MU-651R/MU-671R



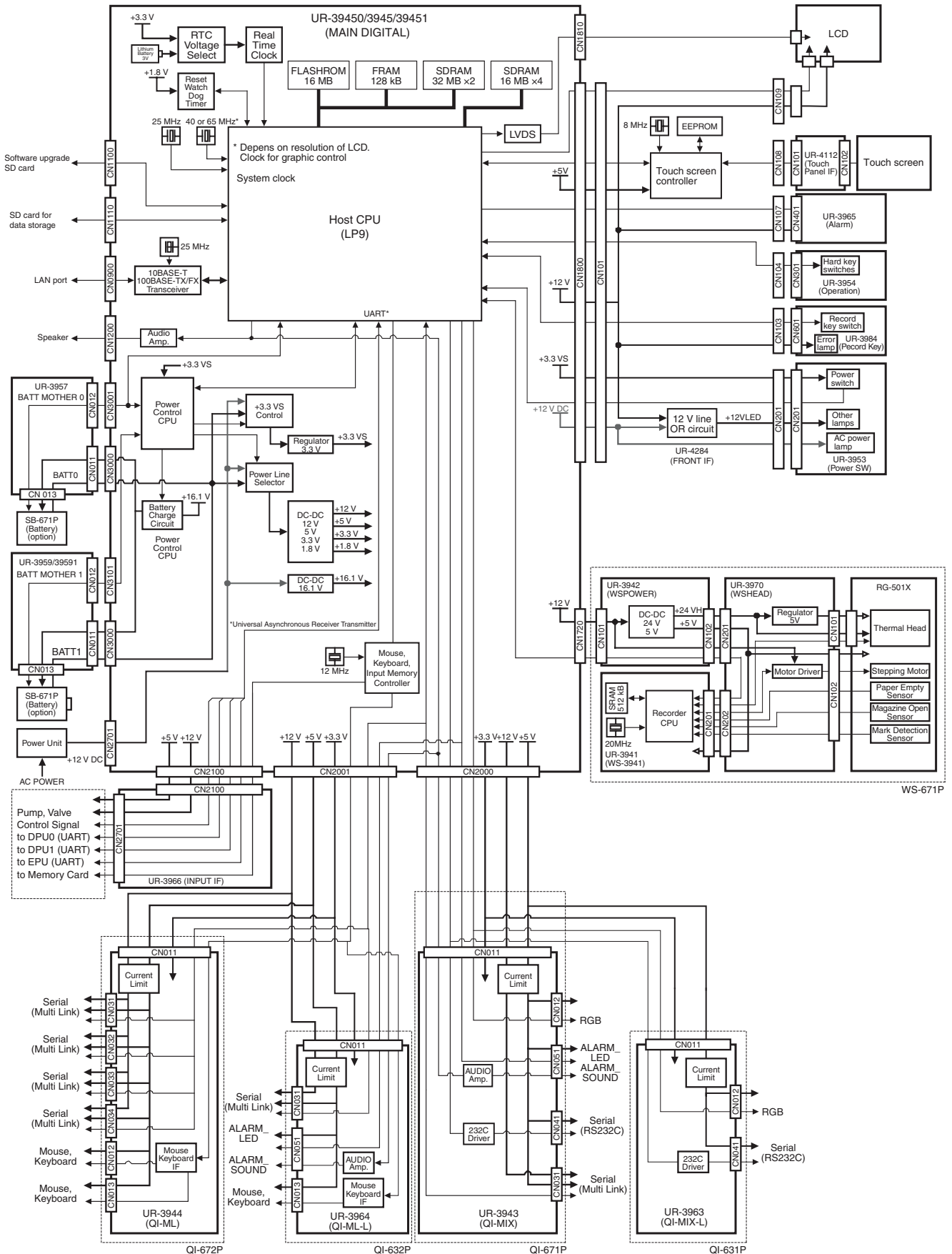
AY-600P series/AA-672P/AA-674P



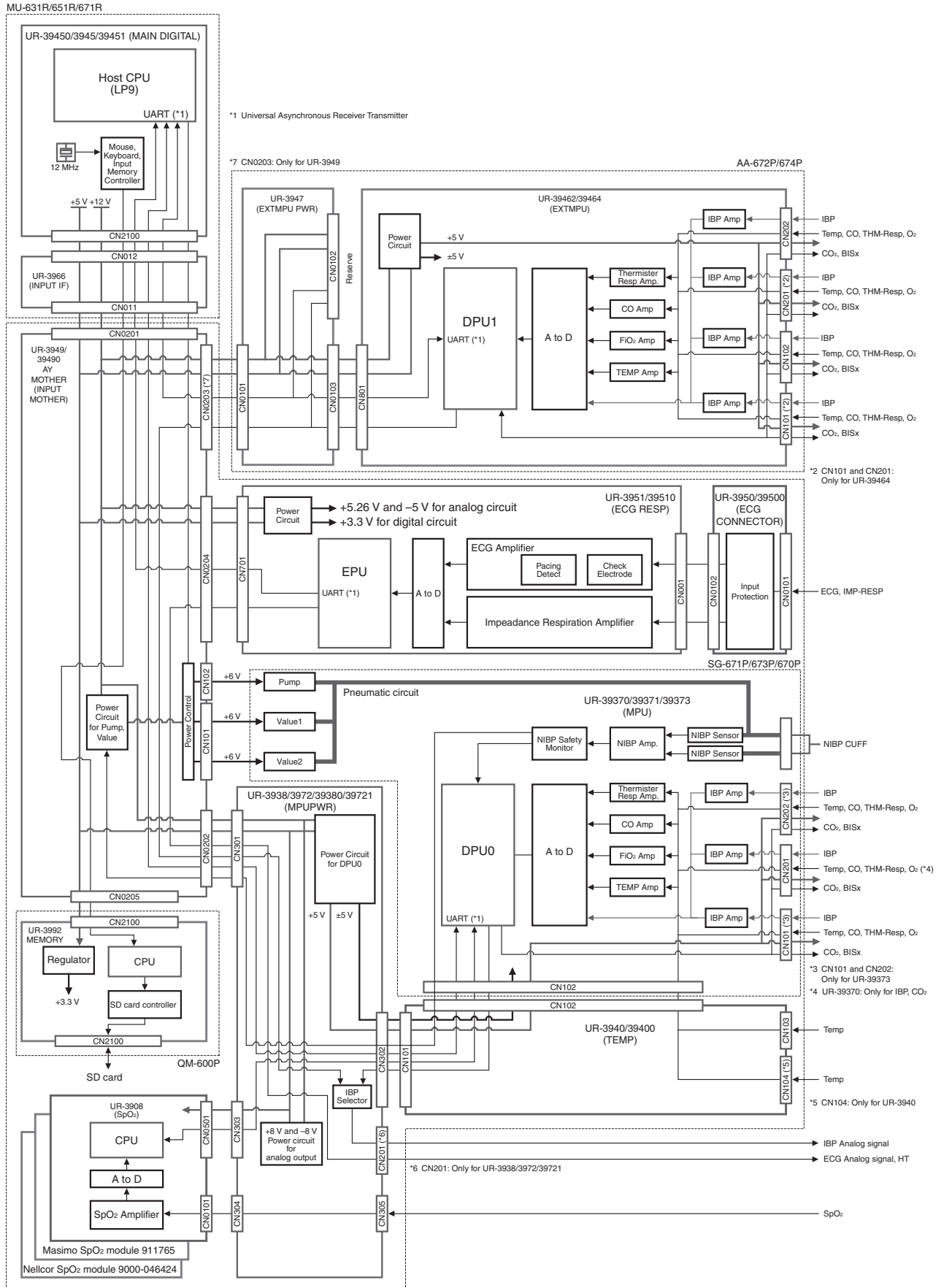


# Overall Block Diagram

## MU-631R/MU-651R/MU-671R



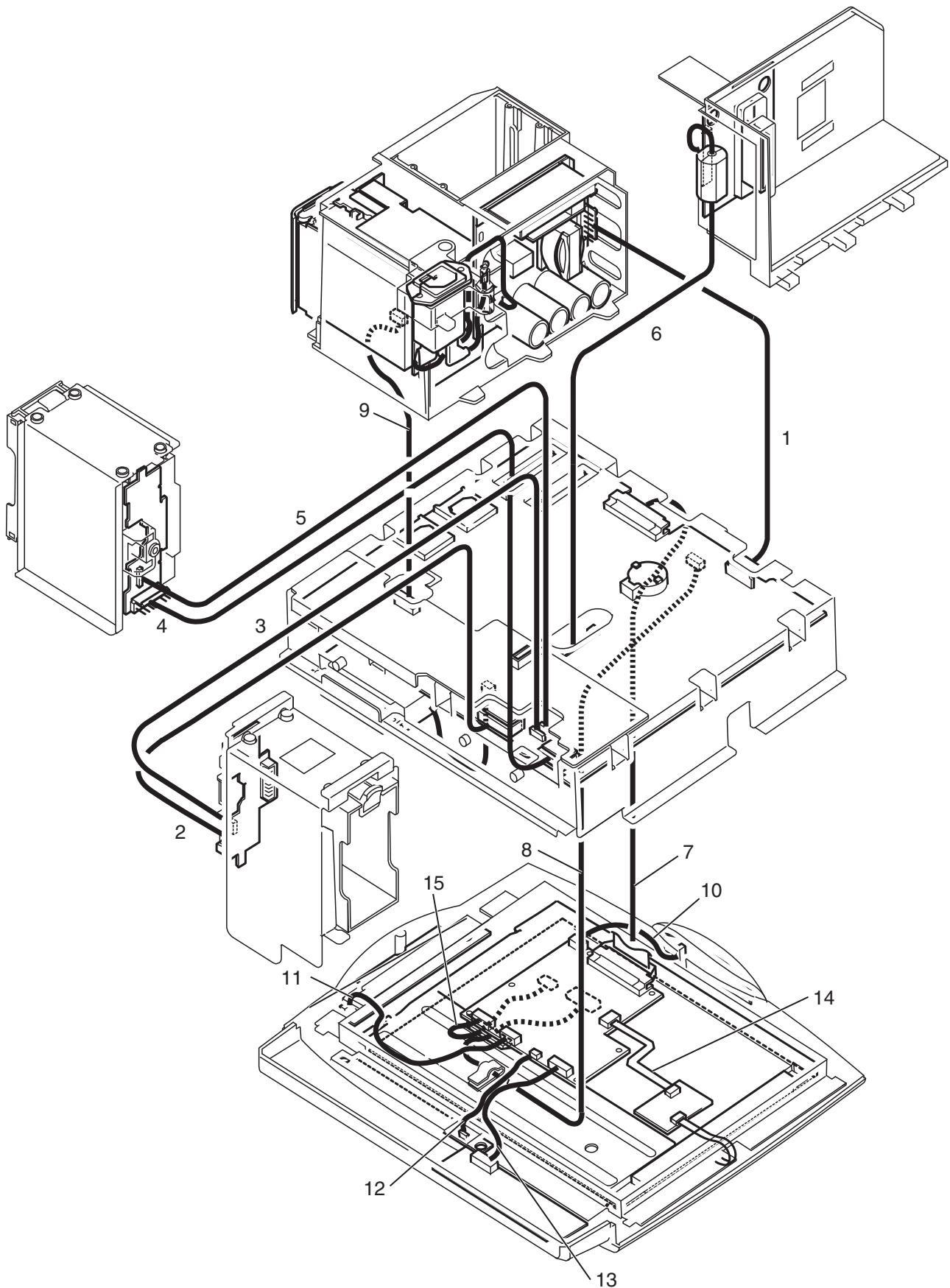
AY-600P series/AA-672P/AA-674P



AY-631P/633P/651P/653P/660P/661P/663P/671P/673P

## Internal Cable Connections

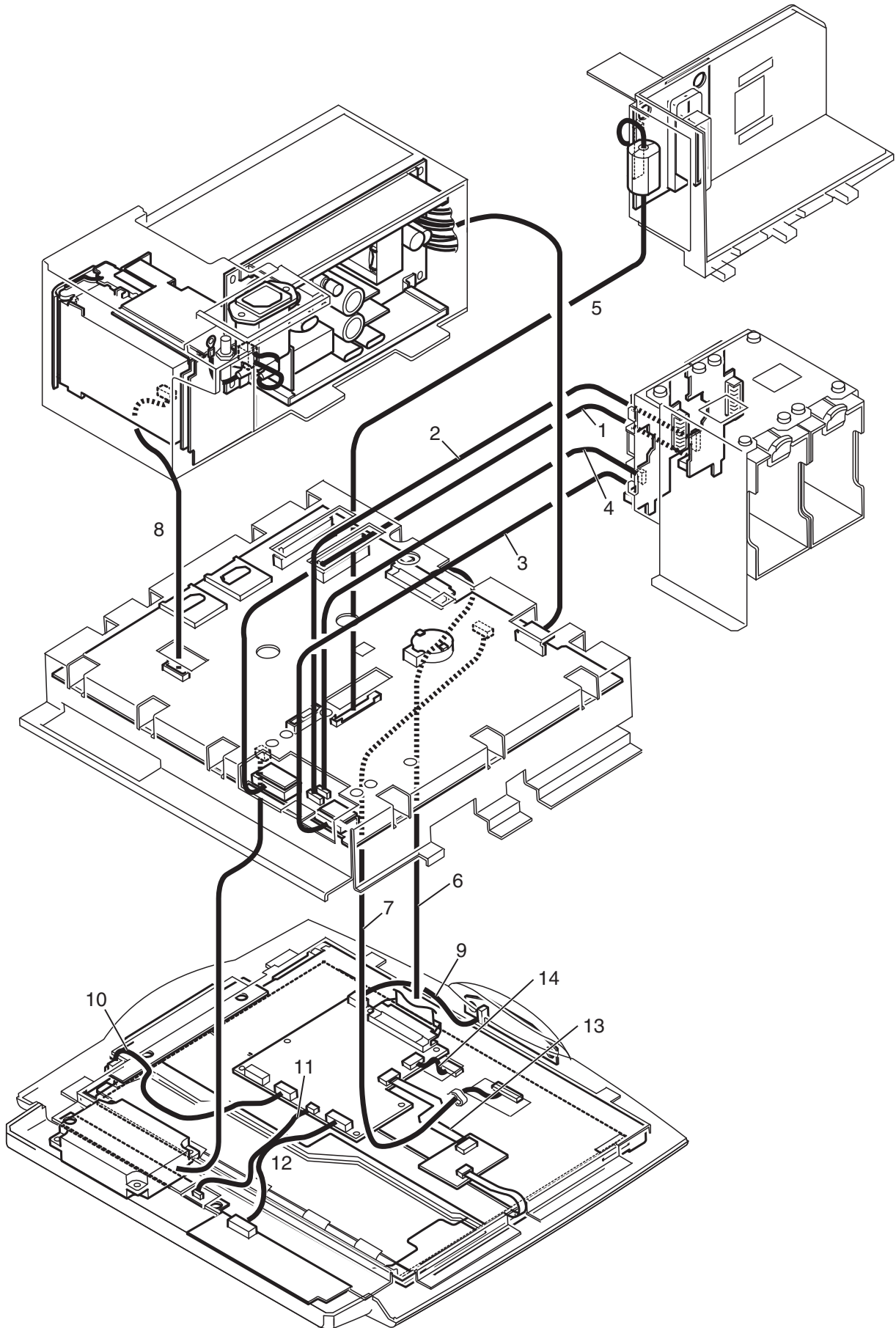
### MU-631R Wiring Diagram



## MU-631R Cable List

Connecting Cables			Board 1		Board 2	
No.	Code No.	Description	Board Model	Connector	Board Model	Connector
1	903034	VHR-6N (W150)	UR-39450	CN2701	NIH-Z067-1	TB2
2	716156	VHR-7N (W160)	UR-39450	CN3000	UR-3957	CN011
3	716058	DF13-8S-1.25C (W160)	UR-39450	CN3001	UR-3957	CN012
4	716147	VHR-6N (W160)	UR-39450	CN3100	UR-39591	CN014
5	716049	DF13-6S-1.25C (W160)	UR-39450	CN3101	UR-39591	CN015
6	721364	LY10-DC36 twisted at both wire ends (W170)	UR-39450	CN2100	UR-3966	CN012
7	721355	8825E-050-175F-005-GH	UR-39450	CN1800	UR-4284	CN101
8	921496	SHDR20VSB_DF19G20S1CLVDS (W415)	UR-39450	CN1810	T104S4D1	CN101
9	920033	DF11-12DS-2C (W180)	UR-39450	CN1720	WS-671P	—
10	721382	PHR-5 (W130)	UR-4284	CN107	UR-3955	CN401
11	716085	PHDR-12VS/DF13-10DS-1.25 (W205)	UR-4284	CN104	UR-3954	CN301
12	716031	DF13-4S-1.25C (W120)	UR-4284	CN103	UR-3984	CN601
13	718698	PHDR-16VS (W180)	UR-4284	CN102	UR-3953	CN201
14	9000-057859	20624AFBNCD-P0.5-K1-10-82Z	UR-4284	CN108	UR-4112	CN101
15	721391	PHR-7/51021-0700 (W115)	UR-4284	CN106	T104S4D1	CN301

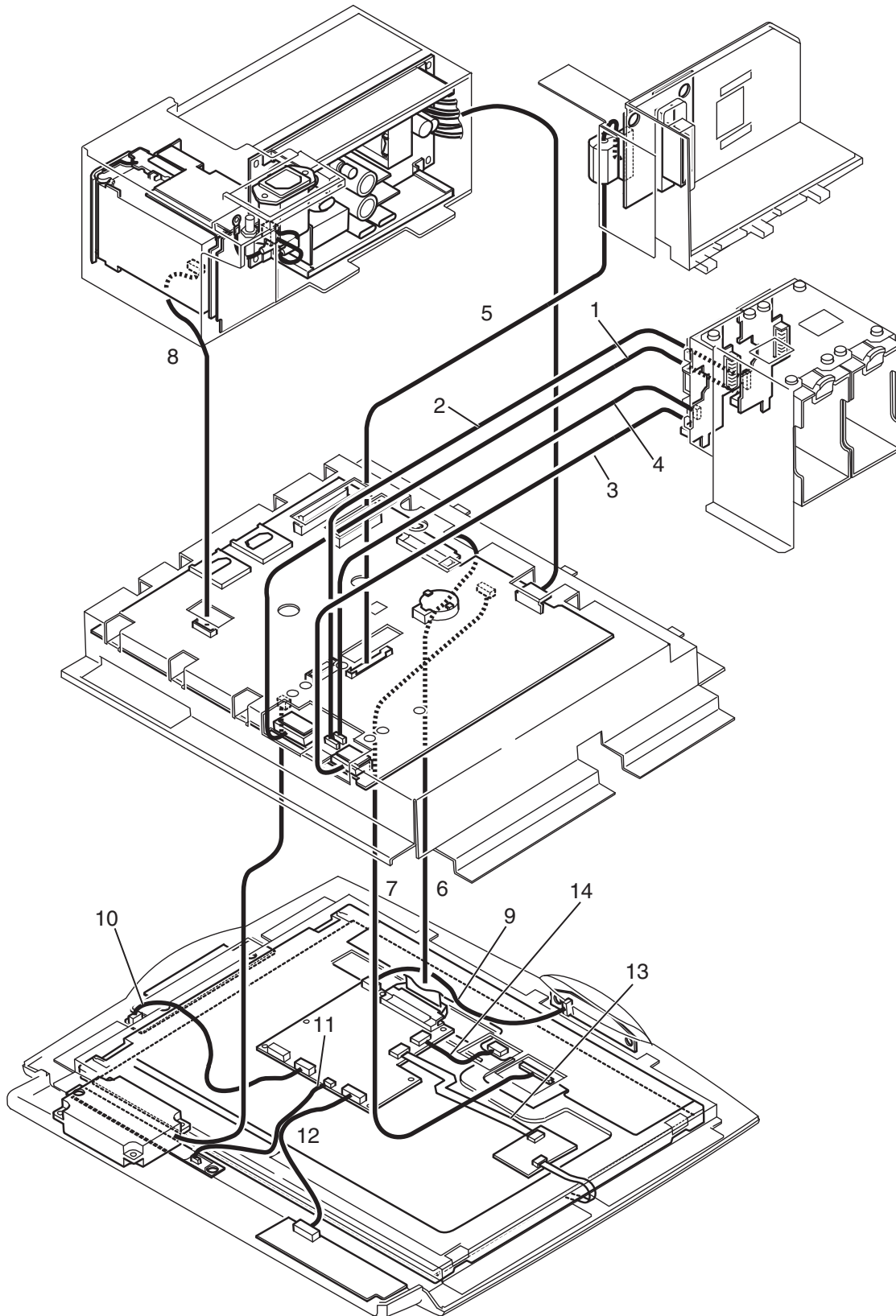
### MU-651R Wiring Diagram



**MU-651R Cable List**

Connecting Cables			Board 1		Board 2	
No.	Code No.	Description	Board Model	Connector	Board Model	Connector
1	716156	VHR-7N (W160)	UR-3945	CN3000	UR-3957	CN011
2	716058	DF13-8S-1.25C (W160)	UR-3945	CN3001	UR-3957	CN012
3	716147	VHR-6N (W160)	UR-3945	CN3100	UR-3959	CN011
4	716049	DF13-6S-1.25C (W160)	UR-3945	CN3101	UR-3959	CN012
5	721364	LY10-DC36 twisted at both wire ends (W170)	UR-3945	CN2100	UR-3966	CN012
6	721355	8825E-050-175F-005-GH	UR-3945	CN1800	UR-4284	CN101
7	722096	SHDR-20V_DF14-20S (W430)_LVDS	UR-3945	CN1810	G121SN01 V4(Z)	CN1
8	920033	DF11-12DS-2C (W180)	UR-3945	CN1720	WS-671P	—
9	721382	PHR-5 (W130)	UR-4284	CN107	UR-3955	CN401
10	716085	PHDR-12VS/DF13-10DS-1.25 (W205)	UR-4284	CN104	UR-3954	CN301
11	716031	DF13-4S-1.25C (W120)	UR-4284	CN103	UR-3984	CN601
12	718698	PHDR-16VS (W180)	UR-4284	CN102	UR-3953	CN201
13	9000-057859	20624AFBNCD-P0.5-K1-10-82Z	UR-4284	CN108	UR-4112	CN101
14	9000-057856	51146-0500 (W50)	UR-4284	CN109	G121SN01 V4(Z)	CN2

### MU-671R Wiring Diagram



**MU-671R Cable List**

Connecting Cables			Board 1		Board 2	
No.	Code No.	Description	Board Model	Connector	Board Model	Connector
1	716156	VHR-7N (W160)	UR-39451	CN3000	UR-3957	CN011
2	716058	DF13-8S-1.25C (W160)	UR-39451	CN3001	UR-3957	CN012
3	716147	VHR-6N (W160)	UR-39451	CN3100	UR-3959	CN011
4	716049	DF13-6S-1.25C (W160)	UR-39451	CN3101	UR-3959	CN012
5	721364	LY10-DC36 twisted at both wire ends (W170)	UR-39451	CN2100	UR-3966	CN012
6	721355	8825E-050-175F-005-GH	UR-39451	CN1800	UR-4284	CN101
7	722096	SHDR-20V_DF14-20S (W430)_LVDS	UR-39451	CN1810	LQ150X1LW12	CN1
8	920033	DF11-12DS-2C (W180)	UR-39451	CN1720	WS-671P	—
9	721382	PHR-5 (W130)	UR-4284	CN107	UR-3955	CN401
10	716085	PHDR-12VS/DF13-10DS-1.25 (W205)	UR-4284	CN104	UR-3954	CN301
11	716031	DF13-4S-1.25C (W120)	UR-4284	CN103	UR-3984	CN601
12	718698	PHDR-16VS (W180)	UR-4284	CN102	UR-3953	CN201
13	9000-057858	20624AFBNCD-P0.5-K1-10-147Z	UR-4284	CN108	UR-4112	CN101
14	9000-057857	51146-0500/SHLP-06V-S-B (W70)	UR-4284	CN109	LQ150X1LW12	CN2

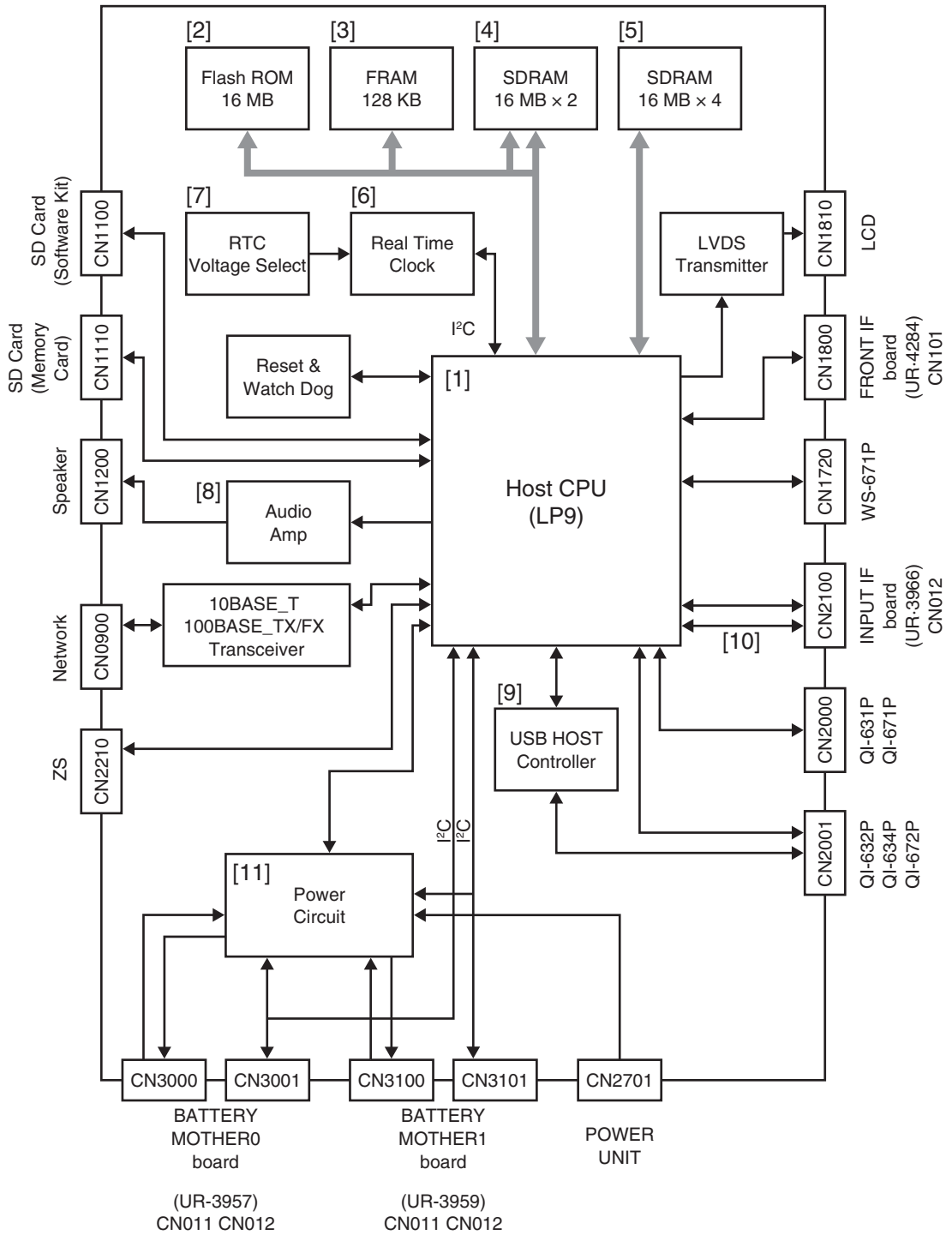


# MU-631R/MU-651R/MU-671R Main Unit

## UR-3945/UR-39450/UR-39451 MAIN DIGITAL Board

### Outline of Function

MAIN DIGITAL board (UR-3945/UR-39450/UR-39451) is used in a monitor main unit (MU-631R/MU-651R/MU-671R) to perform digital processing and supply power to the overall monitor.



**Explanation of Each Circuit Block Operations****[1] Host CPU (LP9)**

## • System Control

Immediately after the power is turned on, Host CPU (LP9) checks for the existence of a software kit by using the boot program (IPL) in the flash ROM.

If a software kit compatible with the device type is detected, the state of rewriting the program in flash ROM is engaged. If a software kit compatible with the device type is not detected, the main program in the flash ROM is to be executed.

## • Display Control

Processes display data, and conducts the LVDS output for LCD and the analog RGB output to external displays.

Analog RGB output specifications

## - MU-671R

Resolution: XGA (1024 × 768)

HSYNC: 48.4 kHz (20.7 μs)

VSYNC: 60 Hz (16.67 ms)

## - MU-651R/MU-631R

Resolution: SVGA (800 × 600)

HSYNC: 37.87 kHz (26.4 μs)

VSYNC: 60.3 Hz (16.6 ms)

## • Sound Control

Can generate the alarm sound, heart rate synchronous sound, and key sound concurrently. Also controls sound volume. Conducts PWM output.

## • Serial Communication (touch panel)

Performs serial communication with touch screen controller incorporated in the FRONT IF board (UR-4284).

## • Serial Communication (remote control)

Performs serial communication with the receiver IC incorporated in the FRONT IF board (UR-4284).

## • Serial Communication (recorder module)

Performs serial communication with WS-671P.

## • Serial Communication (multi link)

Performs serial communication with the multi link device connected via the optional board (QI-632P/634P/671P/672P).

## • Serial Communication (transmitter)

Performs serial communication with the transmitter connected to CN2210.

## • Serial communication (input unit)

Performs serial communication with AY-600P series EPU (UR-3951), DPU0 (UR-39370/39371/39373), and AA-672P/674P DPU1 (UR-39462/39464).

## • Serial Communication (serial connector)

Communication settings can be made under the following conditions.

Communication method: Asynchronous

Baud rate: 9600 bps/19200 bps/38400 bps

Data length: 7 bits/8 bits

Parity check: None/even number/odd number

Stop bit: 1 bit/2 bits

## 4. BOARD/UNIT DESCRIPTION

- **Key**  
Detects an action of pressing the [Silence Alarms] key, [NIBP Interval] key, [NIBP Start/Stop] key, [Menu] key, [Home] key, or [Record/Stop] key.
- **Brightness Adjustment**  
Conducts PWM output corresponding to a set LCD brightness. The PWM output is converted into analog and the brightness is adjusted by the inverter.
- **Network**  
Performs network communication. A unique MAC address is assigned to each MAIN board and it is stored in flash ROM.
- **I<sup>2</sup>C Communication (Real Time Clock)**  
Acquires current date and time from Real Time Clock.
- **I<sup>2</sup>C Communication (battery)**  
Acquires battery status (voltage, remaining battery level, etc.).
- **Serial-to-Parallel Conversion**  
Receives serial signals containing detection of the serial connector's overcurrent and CTS/DSR information, etc., and performs parallel conversion.
- **Parallel-to-Serial Conversion**  
Converts alarm information, serial connector's RTS/DTR information, and multi link control signals, etc. to serial, and outputs them.
- **SD Card**  
Performs communication with the memory card, an SD card, and the software kit.

### [2] Flash ROM (16 MB)

The flash ROM stores the boot program, the main program, and the MAC address for the device.

### [3] FRAM (128 KB)

The FRAM stores system setup data and alarm setting values, etc. These data are kept even after the power is turned off.

### [4] SDRAM (16 MB × 2)

Records data related to Host CPU processes.

### [5] SDRAM (16 MB × 4)

Records data for screen display.

### [6] Real Time Clock

Keeps time. Kept activated even while the power is turned off by the lithium battery power.

### [7] RTC Voltage Select

Changes power source to be supplied to real time clock.

While the power is turned ON, the power is supplied from the power circuit.  
While the power is turned OFF, the power is supplied from the lithium battery.

## [8] Audio Amp.

Converts PWM signals output from Host CPU into analog signals, and drives the speaker.

## [9] USB HOST Controller

Performs USB communication with the QI-ML board (UR-3944) under the control of Host CPU.

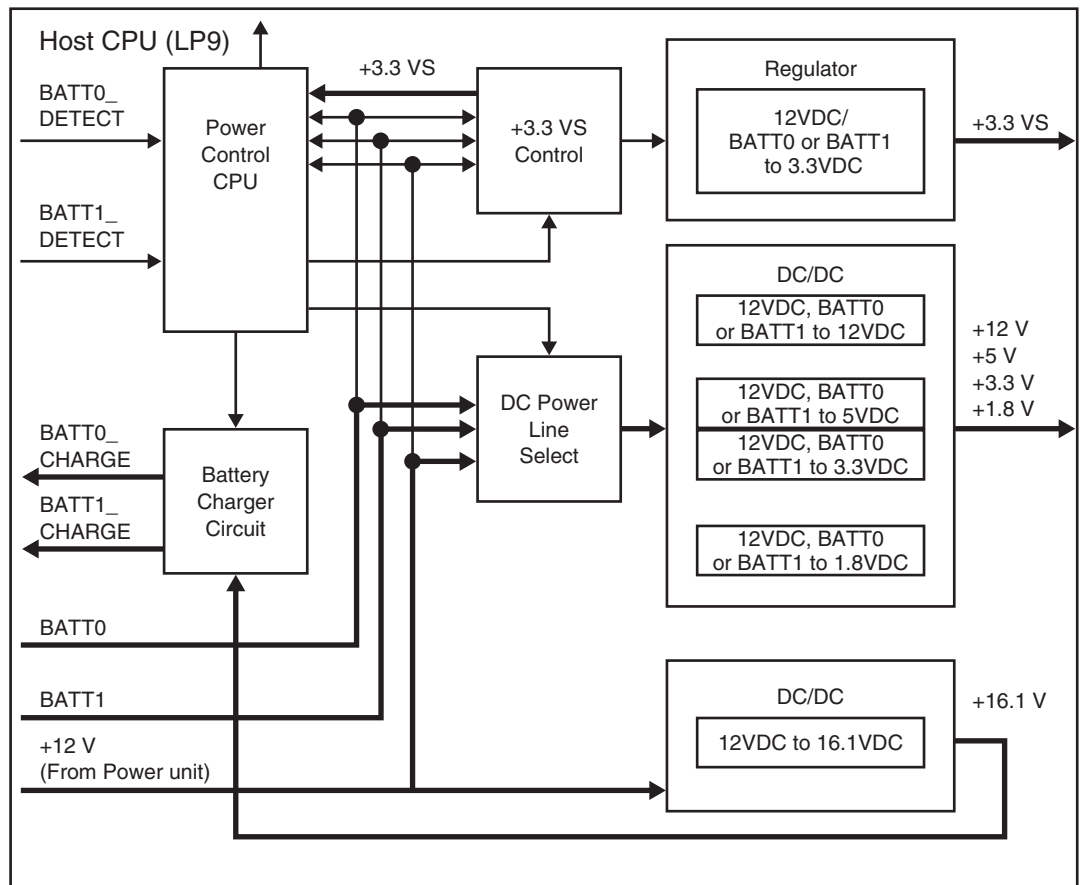
(For MU-631R, performs USB communication with the QI-ML-L board (UR-3964) and OPTION ML 2 board (UR-4097).)

When the memory board (QM-600P) is mounted on the input unit, it also performs USB communication with the memory board.

## [10] NIBP Control

The NIBP pump and solenoid valve are controlled from the Host CPU (LP9) port.

## [11] Power Circuit



- Power Control CPU

Performs communication with Host CPU, detects ON/OFF of the power switch, controls the +3.3 VS Control circuit, controls the power line select circuit, and controls the battery charge circuit.

Controls the power on/off status as follows: If the AC power supply is stopped (in a condition of no battery) due to interruption of electric service or others, and afterwards the power supply is recovered, the monitor power is automatically turned on.

## 4. BOARD/UNIT DESCRIPTION

- +3.3 VS Control

When the AC power is connected, generates +3.3 VS from +12 V regardless of the monitor power ON/OFF status.

When the AC power is not connected, generates +3.3 VS from BATT0 or BATT1 immediately after the device is powered ON.

- Power Line Select

When the AC power is connected, +12 V is used regardless of whether the battery is loaded or not. When two batteries are loaded, Host CPU communicates with the batteries and uses the one with less remaining capacity first.

- Battery Charge Circuit

When the AC power is connected and the battery is loaded, supplies charging current to the battery. When the power is turned OFF, two batteries are simultaneously charged. When the power is turned ON, only one battery is charged at one time (batteries are charged one by one in order).

- Regulator

Outputs +3.3 VS when the power is turned ON. It outputs even while the power is turned off, as long as the AC power is connected.

- DC/DC

+16.1 V Output regardless of the power ON/OFF status, as long as the AC power is connected.

+12 V Output when the power is turned ON.  
Used in the overall device.

+5 V Output when the power is turned ON.  
Used in the overall device.

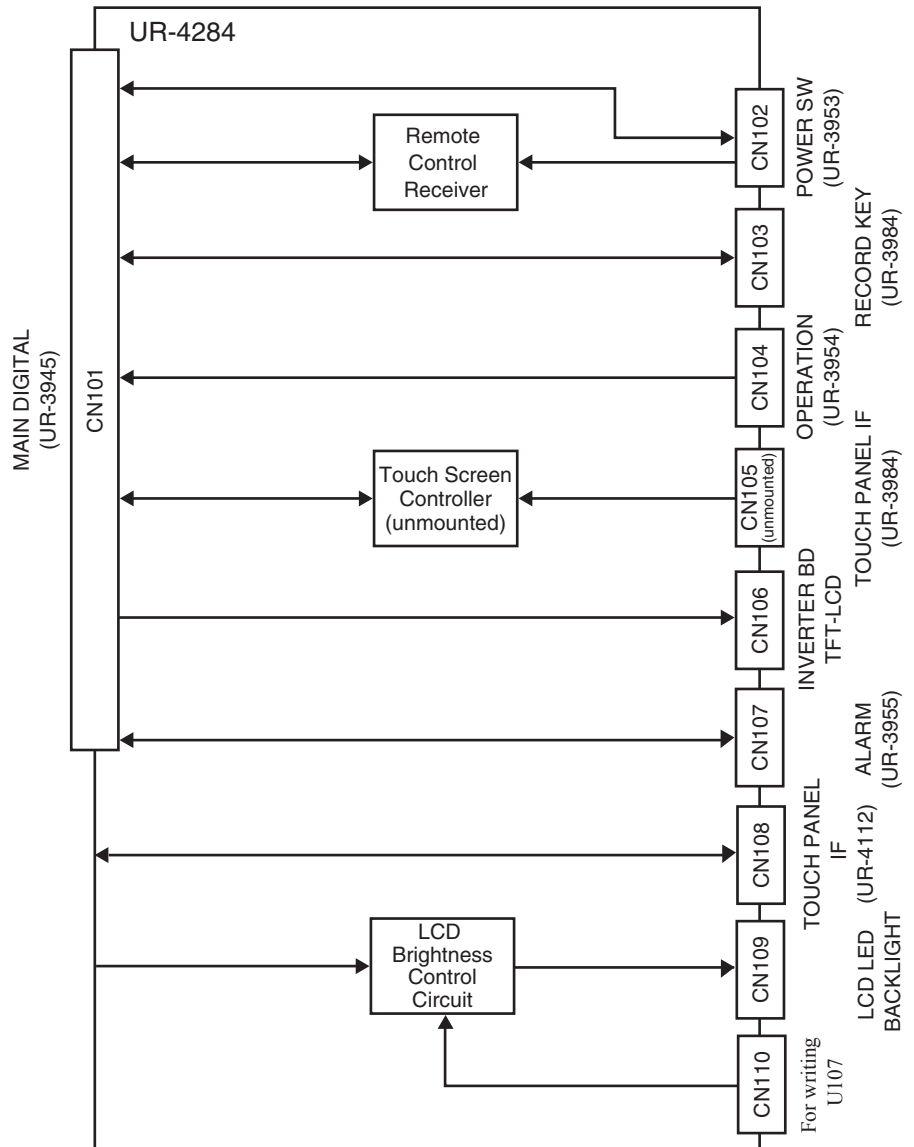
+3.3 V Output when the power is turned ON.  
Used in the overall device.

+1.8 V Output when the power is turned ON.  
Used as the power to host CPU (LP9).

## UR-4284 FRONT I/F Board

### Overview of Function

This board is installed in an MU-631R, MU-651R or MU-671R main unit. This board has a remote control receiver and a touch screen controller. It performs relay functions between each board of the front panel and the MAIN DIGITAL board (UR-3945).



### Operations of Each Circuit Block

- Remote Control Receiver

This remote control optical receiver receives signals from the POWER SW (UR-3953) PD201 by a receiver IC (1-chip CPU), and transmits the received data serially to the MAIN DIGITAL board.

- Touch Screen Controller

Receives touch screen signals by a controller IC and transmits the coordinate data serially to the MAIN DIGITAL board.

#### 4. BOARD/UNIT DESCRIPTION

- LCD Brightness Control Circuit

Converts the LCD brightness control analog signal from the MAIN board to a PWM signal by microcontroller and sends the signal to the LCD LED BACKLIGHT.

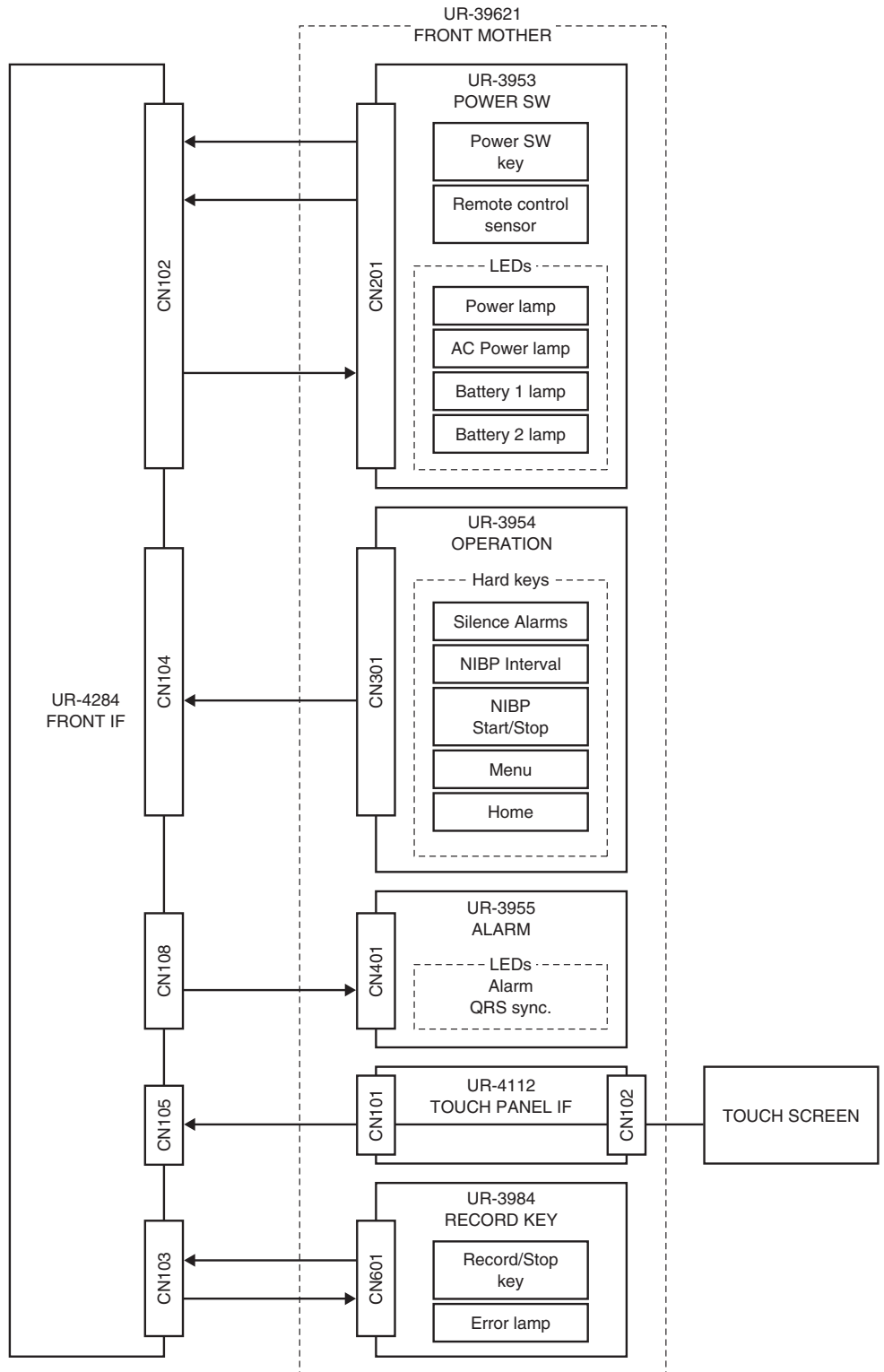
### UR-39621 Front Mother Board Set and UR-4112 Touch Panel IF Board

**Outline of Function**

The UR-39621 front mother board set and UR-4112 touch panel IF board are installed in the BSM-6000 series main unit.

The UR-39621 front mother board is a composite board composed of the following four boards.

- UR-3953 Power SW board
- UR-3954 Operation board
- UR-3955 Alarm board
- UR-3984 Record key board





#### 4. BOARD/UNIT DESCRIPTION

##### Explanation of Each Circuit Block Operations

Power SW board (UR-3953)

Equipped with 1 key switch, 4 LEDs, and a remote control optical receiver module, and conducts power ON/OFF, reception of remote control signals, and indication of the power status.

Operation board (UR-3954)

Equipped with 5 key switches, and detects pressing of the switches.

Alarm board (UR-3955)

Equipped with 9 red LEDs, 9 yellow LEDs, 4 cyan LEDs, and 4 green LEDs, which light/blink according to the alarm information and the heart rate synchronous signals.

TOUCH PANEL I/F board (UR-4112)

Interface board between the FRONT IF board (UR-4284) and the touch screen.

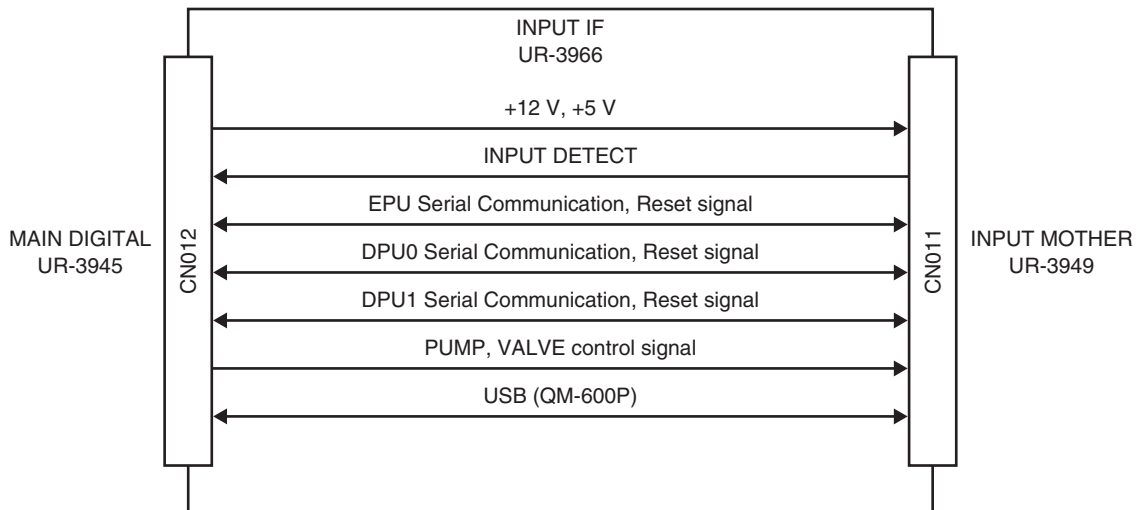
Record key board (UR-3984)

Equipped with 1 key switch and 1 LED, and conducts recording start/stop, and indicates the detection of paper empty and magazine open/closed status.

#### UR-3966 INPUT I/F Board

##### Outline of Function

This is an interface board between the bedside monitor BSM-6000 series MAIN DIGITAL board and the input unit AY-600P series, and used in a state installed in the monitor main unit.



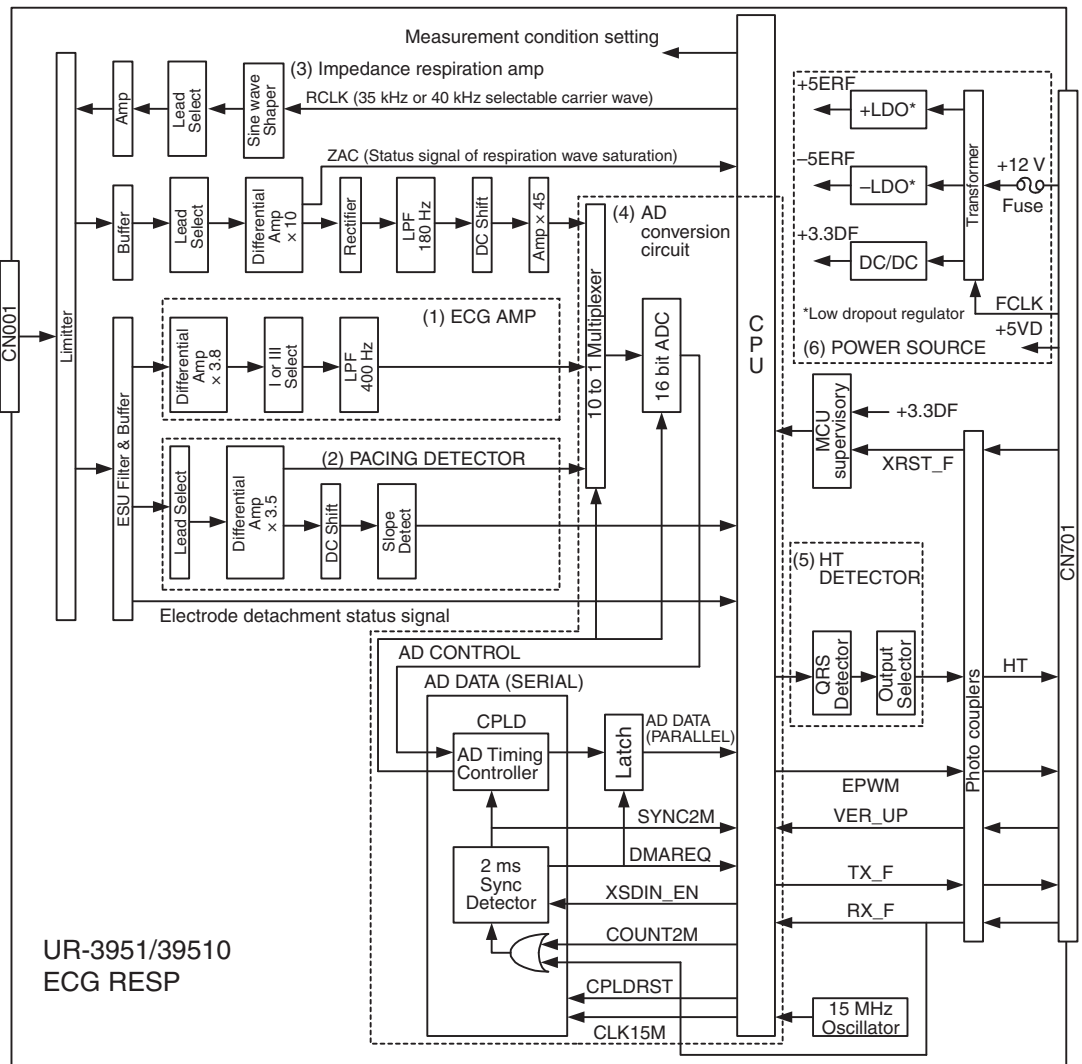
## UR-3951/39510 ECG RESP Board

### Outline of Function

This board is installed in the input unit, and conducts the primary process of the electrocardiogram and the impedance respiration waveform.

Performs asynchronous serial communication with the monitor main unit, and transmits the waveform data status and receives measurement settings and others. CN001 is connected to UR-3950/39500 (ECG connector board), and functions as the input block for biological signals.

CN701 is connected to UR-3949/39490 (AY MOTHER (INPUT MOTHER) board), and functions as the input/output block for communication with the monitor main unit.



### Explanation of Each Circuit Block Operations

#### (1) ECG AMP

Performs the analog process of ECG waveforms.

- Differential Amp  $\times 3.8$   
I, II, III, V1, V2, V3, V4, V5, V6 lead 3.8 times differential amplifier (9 channels in total)
- I or III Select  
Selects either I lead or III lead.

## 4. BOARD/UNIT DESCRIPTION

- LPF 400 Hz  
400 Hz –3 dB low-pass filter

### (2) PACING DETECTOR

Detects the waveforms defined in ANSI/AAMI EC13 4.1.4.

- Lead Select  
UR-3951: Selects any one of the standard 12 leads.  
UR-39510: Selects any one of the 8 leads.
- Differential Amp  $\times 3.5$   
3.5 times differential amplifier (DC gain is 1 time)
- DC Shift  
Cancels polarizing potential.
- Slope Detect  
Detects waveforms which passed through the differentiating circuit as pacing.

### (3) Impedance respiration amp

Performs generation of respiration carrier and analog processing of impedance respiration.

- Sine Shaper  
Forms sine waves from the CPU carrier clock.
- Lead Select  
Selects either R-F lead or R-L lead.
- Differential Amp  $\times 10$   
Differentially amplifies 30 to 40 kHz signals by 10 times.
- Rectifier  
Modulated wave rectifier
- LPF 180 Hz  
Demodulator (180 Hz –3 dB low-pass filter)
- DC Shift  
Cancels DC potential after demodulation.
- Amp  $\times 45$   
Amplifies respiratory variation by 45 times.

### (4) AD conversion circuit

Performs AD conversion in synchronization with signals received from the monitor main unit.

The converted data is output to CPU in the order of upper 8 bits, and then lower 8 bits.

- 10 to 1 Multiplexer  
Converts the analog waveforms of ECG 8 ch, RESP 1 ch, and PACING 1 ch (10 channels in total) into 1ch time-division data.
- 16 bit ADC  
Sampling rate: 8 ksps per channel  
Input range/resolution  
ECG:  $\pm 655 \text{ mV}/20 \text{ uV}$   
RESP:  $163.84 \Omega / 2.5 \text{ m} \Omega$   
PACING:  $\pm 714 \text{ mV}/22 \text{ uV}$
- AD Timing Controller  
Generates 10 to 1 Multiplexer conversion signals and AD control signals.

- 2 ms Sync Detector  
Generates 2 ms synchronous signals received from the monitor main unit.
- Latch  
8-bit D flip-flop  
Parallel output AD data in the order of upper 8 bits, and then lower 8 bits.

## (5) HT DETECTOR

Generates pulses synchronous with R wave, from the ECG waveforms primarily processed by CPU.

- QRS Detector  
Detects waveforms, which passes through the 10 to 20 Hz band-pass filter, as QRS.
- Output Selector  
Selects width and polarity of detected pulse.

## (6) POWER SOURCE

Generates power supply by use, from the power supplied from the monitor main unit.

- Transformer  
Power transformer used for insulation of patient circuit  
Winding ratio of primary:secondary = 11:6
- +LDO  
Positive power supply for analog  
 $+5.26\text{ V} \pm 3.4\%$
- -LDO  
Negative power supply for analog  
 $-5\text{ V} \pm 5\%$
- DC/DC  
Power supply for digital  
 $+3.3\text{ V} \pm 5\%$

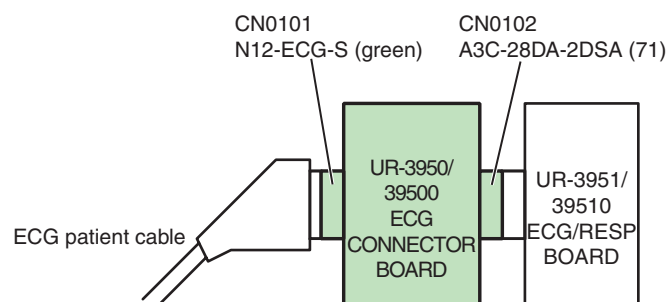
## UR-3950/39500 ECG Connector Board

### Outline of Function

This board is installed in the input unit, and functions as the interface between the ECG lead wires and UR-3951/39510 (ECG/RESP).

Protective resistance against DEF is installed, and the separation between lead signals is secured by the slits and its structure.

This resistance forms the capacitor and the filter of UR-3951/39510.



### UR-39370/39371/39373 Multi Parameter Unit Board (MPU Board)

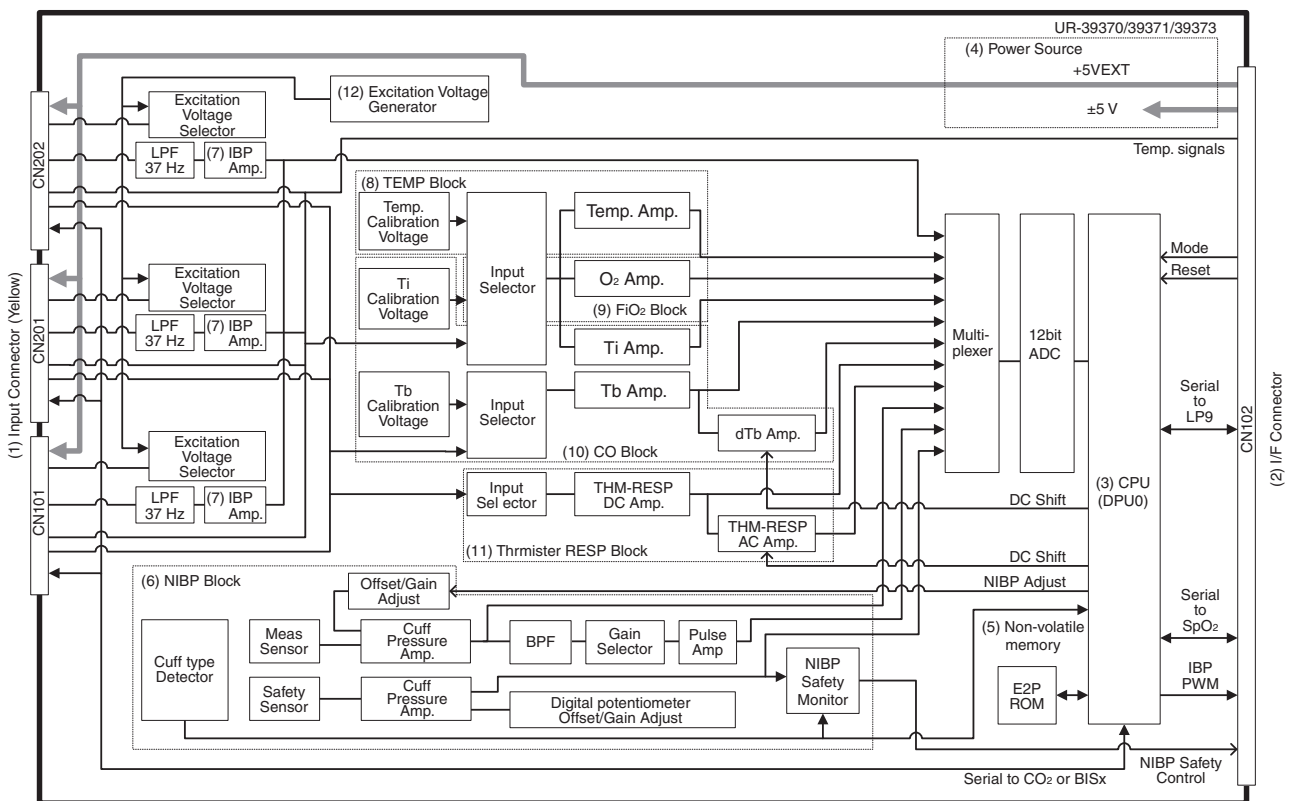
#### Outline of Function

This board is installed in the input unit, and conducts the primary process of the input signals of NIBP, IBP, temperature, thermistor respiration, cardiac output, and oxygen concentration in inspiration.

This board also performs asynchronous serial communication with SpO<sub>2</sub>, CO<sub>2</sub>, and BISx, and acquires waveforms, numeric data, and sensor status. This board performs asynchronous serial communication with the monitor main unit, and transmits these parameters of waveforms/numeric data/status, and receives measurement settings and others.

This board has an NIBP pressure sensor, and performs measurement of cuff pressures and pulse waves. CN101/CN201/CN202 function as the input block of IBP, temperature, thermistor respiration, cardiac output, and oxygen concentration in inspiration, and have a CO<sub>2</sub>/BISx asynchronous serial communication line.

For UR-39370/39371, only CN201 (among the three connectors) is installed. CN102 is connected to UR-3940/39400 (TEMP board). This connector functions as the input/output block for communication with the monitor main unit, as well as functions as the input block for the temperature input signal 2 ch from the temperature connector mounted on UR-3940/39400, and functions as the input/output block for asynchronous serial communication with the SpO<sub>2</sub> module incorporated in AY. The power to this board is supplied via this connector.



**Explanation of Each Circuit Block Operations****(1) Input Connector (CN101, CN201, CN202)**

All connectors have the same function as the input/output block for the following signals.

- Exciter voltage output for sensor
- IBP transducer differential signal input
- Analog signal input 2 channels (for temperature, CO, thermistor respiration, and FiO<sub>2</sub> sensor)
- Asynchronous serial communication 1 channel (for CO<sub>2</sub>, BISx, and other external modules)
- I<sup>2</sup>C bus 1 channel (for identification of sensor type)
- +5 V output (power to sensor)

**(2) I/F Connector**

Connector to be connected to TEMP board (UR-3940/39400), and functions as the input/output block for the following signals.

- Asynchronous serial communication with the main CPU (DPU0) on this board and LP9
- Asynchronous serial communication with the SpO<sub>2</sub> module built in the AY series input unit
- Input of internal circuit  $\pm 5$  V power supply and input of sensor/external module +5 VEXT
- Temperature input 2 channels (for input of UR-3940 temperature dedicated connector)
- NIBP safety circuit output (pump/solenoid valve power supply control)
- Input of reset signal of the main CPU on this board
- Output of PWM signal for IBP analog output signal

**(3) CPU (DPU0)**

Main CPU of this board (hereinafter referred to as DPU0). Major features are listed below.

- AD converter control
- Input channel control
- Exciter output voltage control
- Sensor identification
- Asynchronous serial communication with CO<sub>2</sub>, BISx and other external module and the SpO<sub>2</sub> module built in the AY series input unit
- Asynchronous serial communication with LP9
- Detection of disconnection of each transducer and sensor
- NIBP amplifier (for measurement) gain/offset control
- Function of DC component removal for dTb and thermistor respiration
- IBP decimation (12 bit  $\rightarrow$  14 bit)
- IBP PWM signal output (for analog output)
- Monitoring of external output power supply (+5 VEXT)
- Monitoring of calibration voltage

## 4. BOARD/UNIT DESCRIPTION

### (4) Power Source

The following powers are supplied to this board.

- +5 V: Power for internal analog/digital circuits
- -5 V: Power for internal analog circuits
- +5 VEXT: Power for the sensor connection cable E2PROM and external modules

### (5) Non-volatile Memory

In this memory the following information is written and stored in the production process.

DPU0 reads this information at the time of startup.

- NIBP gain/offset control information
- IBP gain/offset control information (by channel)
- Hardware identification information

### (6) NIBP Block

NIBP circuit is divided into the NIBP measurement circuit and the safety circuit. The safety circuit works separately from other circuits to monitor excessive pressure and long-time pressure application.

#### **NIBP measurement circuit**

##### • MEAS Sensor

Pressure sensor for measurement of counter pulsatile oscillations

##### • Cuff Pressure Amp

Amplifies output of the pressure sensor. The output of this amplifier is treated as the pressure within the cuff.

Gain: 31 times (approximately)

Dynamic range: 300 mmHg or over

Sensitivity: 0.125 mmHg/LSB

##### • Offset/Gain Adjust

DPU0 controls the offset and the gain. Adjustment is performed in the production process, and the adjusted values are written and stored in E2PROM on this board. DPU0 uses the adjusted values read at the time of startup, and controls the gain and offset. Thus, the pressure within the cuff is set to work in the dynamic range and sensitivity as shown above.

##### • BPF, Gain selector, Amplification circuit for counter pulsatile oscillation signal

amplifies the small electric signal of the counter pulsatile oscillation obtained with the pressure sensor by passing it through the Band Pass Filter. The output is treated as the pulse wave.

Center frequency: 2 Hz (approximately)

Gain (after cuff pressure amplification): 11 times, 61 times, 41.5 times, 302 times

**Safety circuit**

- Safety Sensor  
Pressure sensor for safety monitoring
- Cuff Pressure Amp  
Amplifies output of the pressure sensor for safety monitoring. The output of this amplifier is AD-converted by the AD converter on this board and the AD converter built in the safety monitoring CPU (NIBP Safety Monitor).  
Gain: 33.4 times (approximately)  
Dynamic range: 330 mmHg or over  
Sensitivity: 0.117 mmHg/LSB (12 bit: DPU0), 0.489 mmHg/LSB (10 bit: NIBP Safety Monitor)
- NIBP Safety Monitor  
Monitors output of the safety monitoring sensor by the built-in AD. Stops applying voltage to the pump and the solenoid valve according to the conditions below, and discharge the air inside of the cuff.
  - When an excessive pressure is applied,  
Cuff for adults and children: 300 mmHg or over  
Cuff for neonates: 150 mmHg or over
  - Measurement time  
Cuff for adults and children: Within 180 seconds  
Cuff for neonates: Within 90 seconds
  - Time interval in interval measurement:  
Less than 30 seconds interval of time between measurement

## (7) IBP Amp.

Each input connector is equipped with an instrumentation amplifier.

- Gain: 156 times (approximately)
- Dynamic range:  $\pm 500$  mmHg or over
- Sensitivity: 0.25 mmHg/LSB (ADC output), 0.0125 mmHg/LSB (DPU0 output)
- Cutoff frequency: 37 Hz (approximately)

## (8) TEMP Block

Periodically switches and amplifies the input of all connectors including the temperature dedicated connector on UR-3940/39400. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.

- Gain: 13.1 times (approximately)

(9) O<sub>2</sub> Block

Periodically switches and amplifies the input of all connectors. Also periodically inputs the calibration signals and corrects the offset voltage of the amplifier.

- Gain: 19.6 times (approximately)
- Sensitivity: 0.073%O<sub>2</sub>/LSB



## 4. BOARD/UNIT DESCRIPTION

### (10) CO block

CO block consists of the injectate temperature (Ti) amplifier, blood temperature (Tb) amplifier, and  $\Delta$  Tb amplifier.

- Ti Amp.

Periodically switches and amplifies the input of all connectors. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.

Gain: 4 times (approximately)

- Tb Amp.

Amplifies the signals input from the connector to the IBP connection cable. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier. Gain: 82.4 times (approximately)

- dTb Amp.

Amplifies output of Tb Amp. DC components are removed by the DPU0 timer output.

Gain: 10 times

Frequency response: DC to 12 Hz (-3 dB)

### (11) Thermistor RESP Block

Thermistor respiration amplifier has a double-stage structure consisting of a DC amplifier and an AC amplifier. In the AC amplifier, DC components are removed by the DPU0 DA output.

Gain: DC amplifier: 41.4 times (approximately)

AC amplifier: 24 times (approximately)

### (12) Excitation Voltage Generator

Generates excitation voltage as shown below for the transducer and thermistor sensor. Excitation voltage is switched depending on the connected sensor and output.

- IBP: 4.096 V

- Temperature: 0.5 V

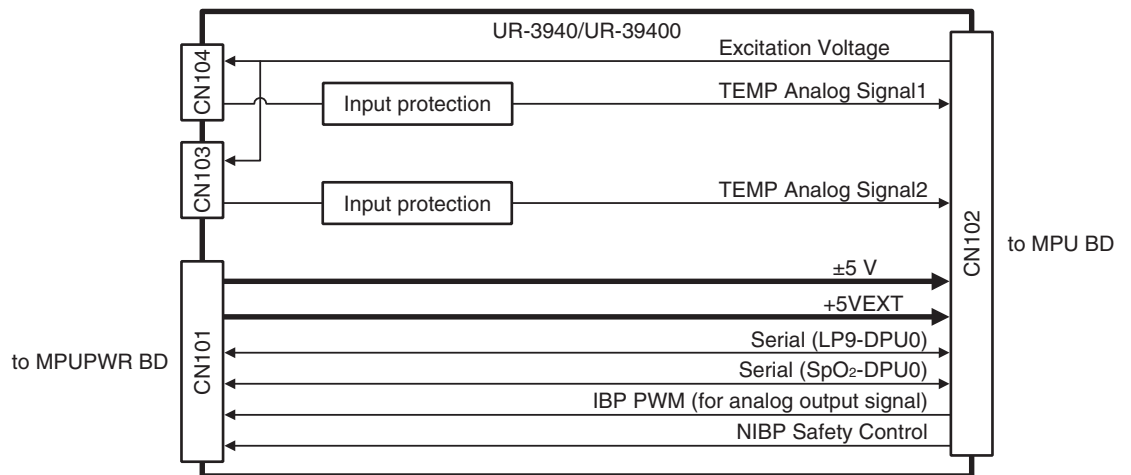
- CO, Thermistor respiration: 2.5 V

## UR-3940/39400 TEMP Board

### Outline of Function

This board is installed in the input unit (AY-600P series), and is connected to the MPU board (UR-39370/39371/39373) and MPU PWR board (UR-3938/39380/3972/39721). This board functions as the physical interface for MPU board power supply and analog output IBP PWM signals, as well as the physical interface of asynchronous serial communication between MPU board and LP9 and asynchronous serial communication between MPU board and SpO<sub>2</sub> unit.

This board also has two input connectors for dedicated use for temperature input, and the temperature signals input from these connectors are transmitted to the MPU board.



### UR-3938/39380/3972/39721 Multi Parameter Unit Power Board

#### Outline of Function

This board is installed in the input unit (AY-600P series), and is connected to the TEMP board (UR-3940/39400) and AY MOTHER (INPUT MOTHER) board (UR-3949/39490). This board also has a connector to the SpO<sub>2</sub> module and the SpO<sub>2</sub> input connector. In addition, it is equipped with an analog output connector.

This board has the following functions:

- Generation of the DPU0 floating power supply
- Transmission of signals between this floating power supply and the ground
- SpO<sub>2</sub> module interface
- Generation of the floating power supply for analog output
- Transmission of signals between this floating power supply and the ground
- Demodulation of PWM signals for analog output

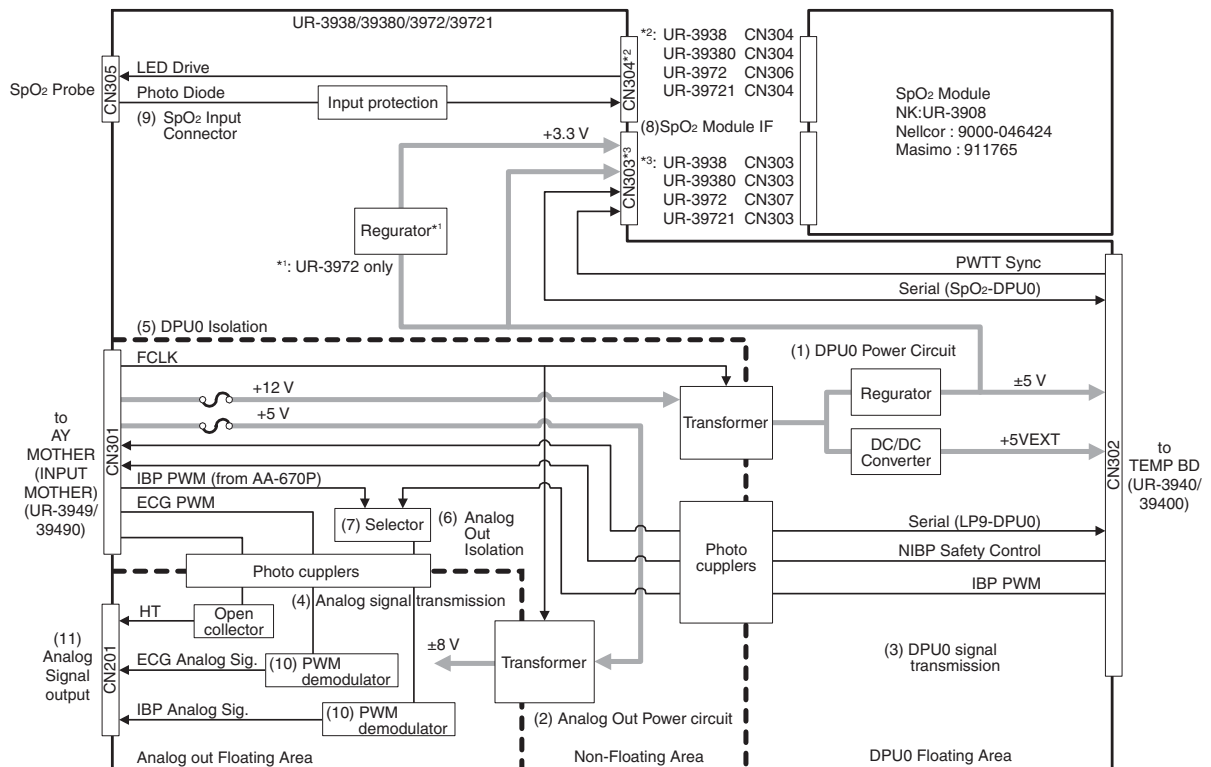
The patient circuit is isolated by this board. The analog output block is also floated and electrically isolated from the other devices.

The model name of this board differs depending on the type of the SpO<sub>2</sub> module to be connected, as shown below.

NK SpO<sub>2</sub>: UR-3938/39380

Nellcor: UR-3972

Masimo: UR-39721



**Explanation of Each Circuit Block Operations****(1) DPU0 Power Circuit**

Generates the DPU0 floating power supply from +12 V supplied from AY MOTHER (INPUT MOTHER) board (UR-3949/39490) by switching the transformer with FCLK.

- ±5 V

Usage: DPU0 floating internal circuit

Accuracy: ±5%

- +5 VEXT

Usage: Sensor connection cable E2PROM and external modules (CO<sub>2</sub>, BISx, and others)

Accuracy: ±5%

- +3.3 V (UR-3972 only)

Usage: Power supply for the Nellcor SpO<sub>2</sub> module

**(2) Analog Out Power Circuit**

Generates the DPU0 floating power supply from +12 V supplied from INPUT MOTHER board (UR-3949/39490) by switching the transformer with FCLK.

- ±8 V

Usage: Analog output floating circuit power supply

Accuracy: +8 V or over, -8 V or under

**(3) DPU0 Signal Transmission**

Transmits the following signals to the grounding circuit by the photo coupler.

- Asynchronous serial communication between LP9 and DPU0
- IBP PWM signals for analog output
- NIBP safety monitoring circuit output signals
- DPU0 reset/mode signals

**(4) Analog Signal Transmission**

Transmits the following signals to the analog output floating block by the photo coupler.

- IBP PWM signals
- ECG PWM signals
- HT pulse signals

**(5) DPU0 Isolation**

Electrically separates the DPU0 patient circuit from the grounding circuit by the transformer and the photo coupler.

Withstand voltage: 1500 Vrms

**(6) Analog Out Isolation**

Electrically separates the analog output block from the grounding circuit by the transformer and the photo coupler.

Withstand voltage: 1500 Vrms

## 4. BOARD/UNIT DESCRIPTION

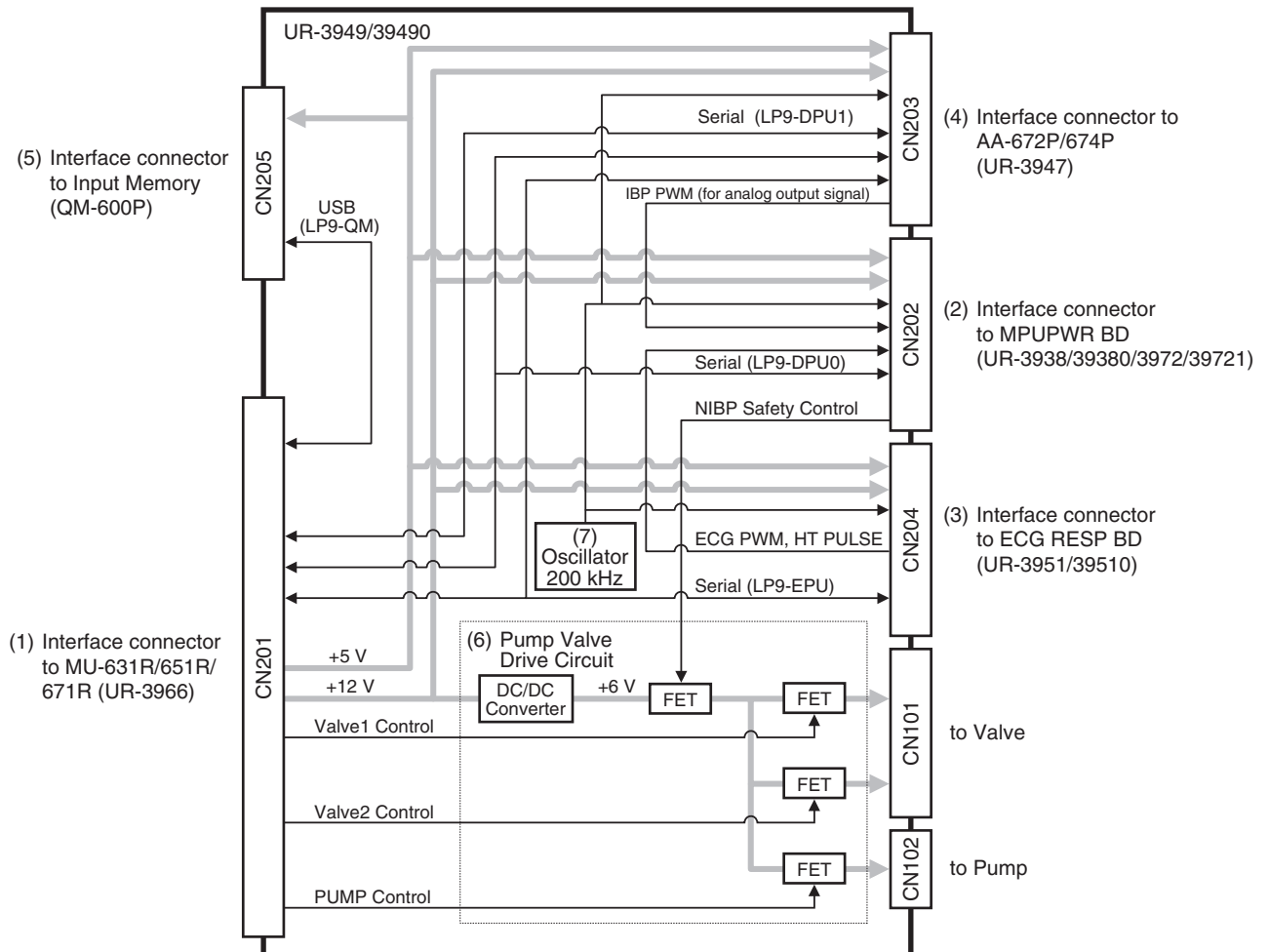
- (7) IBP PWM Selector  
As the analog output IBP PWM signals, either the AY DPU0 output or the AA DPU1 output is selected and output.
- (8) SpO<sub>2</sub> Module IF  
Transmits the input signal from the SpO<sub>2</sub> input connector (CN305) mounted on this board to the SpO<sub>2</sub> module. SpO<sub>2</sub> module transmits the digital signals including waveform information, numeric information, and status information from CN302 to TEMP board. It also supplies +5 V power supply generated by this board to the SpO<sub>2</sub> module. However for the Nellcor SpO<sub>2</sub> module, separately generates +3.3 V and supply it along with +5 V. In addition, transmits the PWTT synchronous signals output from DPU0 to the NK SpO<sub>2</sub> module.
- (9) SpO<sub>2</sub> Input Connector (CN305)  
Outputs the LED-driving signals for the SpO<sub>2</sub> probe, and inputs the photodiode signals from the SpO<sub>2</sub> probe.
- (10) PWM Demodulator  
Demodulates IBP PWM signals and ECG PWM signals for analog signals.
- (11) Analog Signal Output (CN201)  
Outputs the following signals.
- ECG analog signal
    - Sensitivity: 1 V/1 mV ± 5%
    - Offset: Within ± 50 mV
    - Frequency response (lower range): 0.5 Hz (–3 dB)
    - Frequency response (higher range): 100 Hz (–3 dB)
  - HT pulse
    - Open collector output
  - IBP analog output
    - Sensitivity: 1 V/100 mHg ± 1%
    - Offset: Within ± 10 mV
    - Frequency response: DC to 20 Hz (–3 dB)

## UR-3949/39490 AY MOTHER (INPUT MOTHER) Board

### Outline of Function

This board is installed in the input unit (AY-600P series). This board is equipped with an interface connector with the MU-631R/MU-651R/MU-671R and AY-600P series, and works as the interface for the asynchronous serial communication between MU-631R/MU-651R/MU-671R and EPU/DPU0. This board is also equipped with an interface connector with AA-600P, and works as the interface for the asynchronous serial communication between MU-631R/MU-651R/MU-671R and DPU1. In addition, by the connector to Input Memory (QM-600P), this board works as the interface for the USB communication between MU-631R/MU-651R/MU-671R and QM-600P.

Besides, this board has the connectors for the NIBP pump and valve, as well as the power supply circuit and the driving circuit for them, to switch ON/OFF status of the power to the pump and the solenoid valve.



### Explanation of Each Circuit Block Operations

(1) Interface Connector to MU-631R/MU-651R/MU-671R

Interface connector to MU-631R/MU-651R/MU-671R, and functions as the input/output block for the following signals.

- AY-600P series, AA-672P/674P, and QM-600P power supply (+12 V, +5 V)
- Asynchronous serial communication between LP9 and EPU0
- Asynchronous serial communication between LP9 and DPU0
- Asynchronous serial communication between LP9 and DPU1
- USB communication between LP9 and QM-600P
- NIBP pump and solenoid valve control signals

(2) Interface Connector to MPUPWR board

Interface connector to MPUPWR board, and functions as the input/output block for the following signals.

- Asynchronous serial communication between LP9 and DPU0
- Power output (+12 V, +5 V) for the DPU0 floating block and the analog out floating circuit
- PWM (AA-672P/674P output signals) output for IBP analog output
- PWM output for ECG analog output and HT pulse output
- NIBP safety control signal input
- Clock output for transformer switching

(3) Interface Connector to ECG RESP board

Interface connector to ECG RESP board, and functions as the input/output block for the following signals.

- Asynchronous serial communication between LP9 and EPU
- Power output (+12 V, +5 V) for the EPU floating block
- PWM signal input for ECG analog output and HT pulse input
- Clock output for transformer switching

(4) Interface Connector to AA-672P/674P

Interface connector to AA-672P/674P, and functions as the input/output block for the following signals.

- Asynchronous serial communication between LP9 and DPU1
- Power output (+12 V, +5 V) for the DPU1 floating block
- IBP PWM signal input for analog output
- Clock output for transformer switching

This connector also functions as the input/output block for asynchronous serial communication between LP9 and EPU0, and between LP9 and DPU0, for extensive use in the future.

(5) Interface Connector to Input Memory

Interface connector to QM-600P, and functions as the input/output block for the following signals.

- USB communication between LP9 and QM-600P
- Power output (+5 V) for QM-600P

(6) Pump Valve Drive Circuit

Driving circuit for the pump and the solenoid valve. It has the following functions.

- Generation of +6 V power for the pump and the solenoid valve
- FET for ON/OFF of the pump and the solenoid valve
- FET for safety control

(7) Oscillator

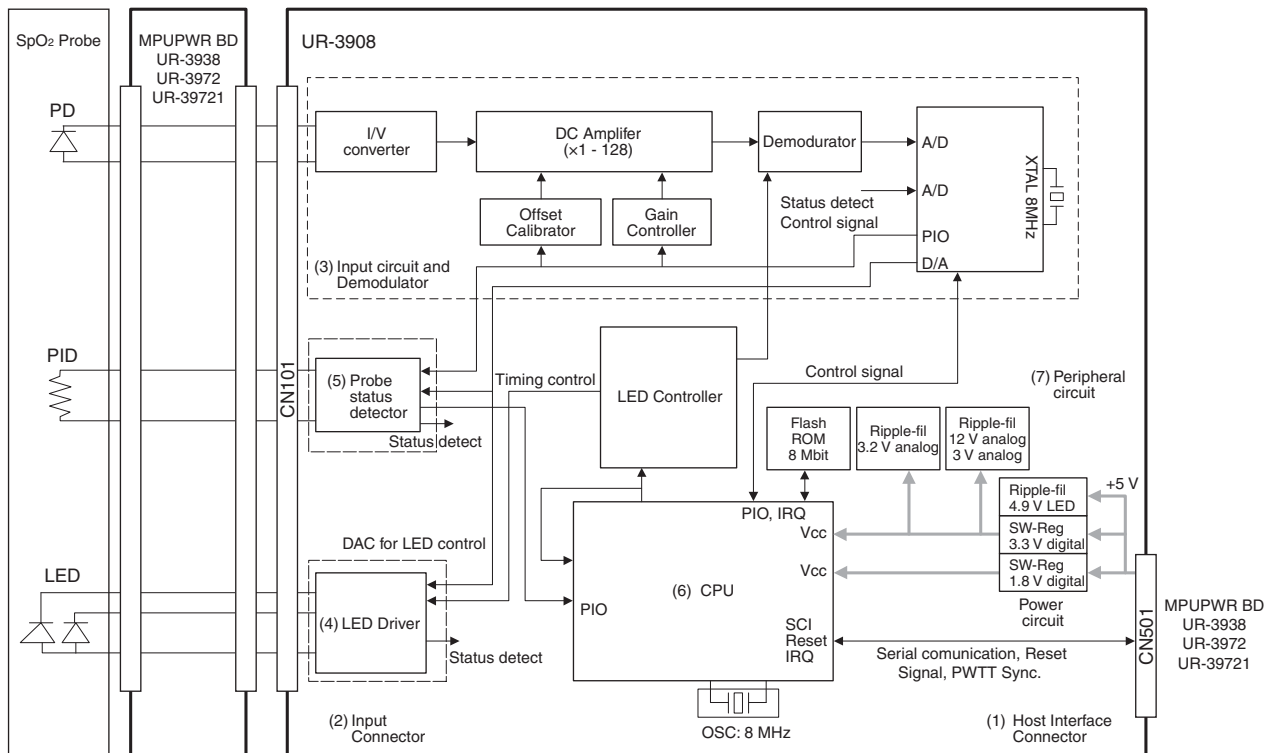
Generates the clock signals for each floating power supply transformer switching.

Oscillating frequency: 200 kHz (approximately)

**UR-3908 SpO<sub>2</sub> Board**

**Outline of Function**

This board controls the SpO<sub>2</sub> probe LED status, and performs the photodiode current/voltage conversion, analog signal processing, and A/D conversion in order, to measure SpO<sub>2</sub>, pulse rate, etc. and transmit their data in serial signals to the host system.



**Explanation of Each Circuit Block Operations**

(1) Host Interface Connector

CN0501 connector passes serial communication signals of DPU0 and receives power from MPUPWR BD.

(2) Input Connector

CN0101 is a connector for the sensor. This connector passes signals of the connection cord and sensor.



## 4. BOARD/UNIT DESCRIPTION

### (3) Input Circuit and Demodulator

- I/V conversion circuit: Converts the PD output signals to voltage.
- DC amplifier: Amplifies the differential components of input signals in eight steps by an external control.
- Demodulation circuit: Demodulates the red light and infrared light components received as time-series pulses.
- A/D: A/D-converts the demodulated red light and infrared light pulse signals.

### (4) LED Driver

- Sets the amount of light by the LED-driving external control, and blinks the probe LED in synchronized timing.  
Resolution: 0.3 mA/LSB (80 mA/255 LSB)
- Detects short circuit on R or IR\_LED by having A/D conversion on IR\_LED luminescence signals.

### (5) Probe Status Detector

- Probe ID detector  
Detects the probe ID by the ID identification resistance built in the probe.
- Shield disconnection detector  
Detects a shield disconnection via the input parallel I/O built in CPU.
- Detector of connection cord insertion/removal status  
Identifies whether the connection cord is inserted or removed via the input parallel I/O built in CPU.

### (6) CPU

Calculate SpO<sub>2</sub> and PR values.

AT91R40008 (ARM7 Core CPU by ATMEL corporation) is used as the CPU that conducts the following jobs necessary for SpO<sub>2</sub> measurement: timing occurrence, LED driving current amount, demodulation timing, measurement status detection, and communication with the host device.

Operating frequency: 64 MHz

SCI 2 ch, SRAM 256 KB incorporated

### (7) Peripheral Circuit

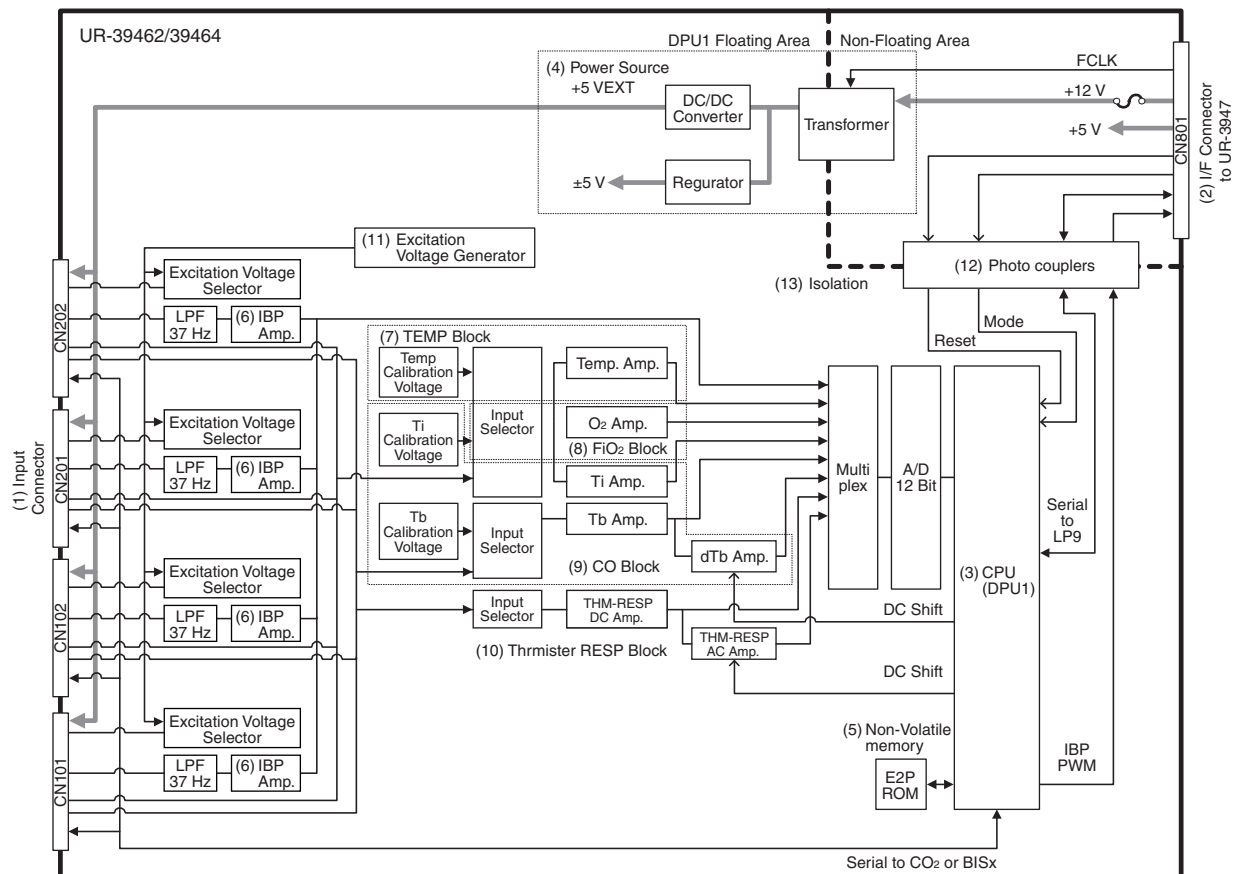
- Power supply circuit  
Generates analog  $\pm 3$  V/+12 V, digital +3.3 V/+1.8 V from the +5 V power supplied by the host device, by the DC/DC converter and regulator.
- Interface with the host device  
Transmits electronic information via serial communication between the SpO<sub>2</sub> board and host device, also transmits PWTT synchronization reference clock, CPU reset signals, and CPU-built-in flash ROM writing control signals.
- External FLASH  
Accesses the external FLASH (8 Mbit) by the address bus, data bus, and control bus.

## UR-39462/39464 External Multi Parameter Unit Board (EXTMPU Board)

### Outline of Function

This board is installed in the smart expansion unit, and conducts the primary process of the input signals of IBP, temperature, thermistor respiration, cardiac output, and oxygen concentration in inspiration. This board also performs asynchronous serial communication with CO<sub>2</sub> and BISx, and acquires waveforms, numeric data, and sensor status. This board performs asynchronous serial communication with the monitor main unit, and transmits these parameters of waveforms/numeric data/status, and receives measurement settings and other data.

CN101/CN102/CN201/CN202 function as the input block of IBP, temperature, thermistor respiration, cardiac output, and oxygen concentration in inspiration, and are equipped with the CO<sub>2</sub>/BISx asynchronous serial communication line. For UR-39462, only CN102 and CN202 (among the four connectors) are installed. CN801 is connected to UR-3947 (EXTMPU PWR board). This connector functions as the input/output block for communication with the monitor main unit. The power to this board is supplied via this connector.



### Explanation of Each Circuit Block Operations

#### (1) Input Connector (CN101, CN102, CN201, CN202)

All connectors have the same function as the input/output block for the following signals.

- Exciter voltage output for sensor
- IBP transducer differential signal input
- Analog signal input 2 channels (for temperature, CO, thermistor respiration, and FiO<sub>2</sub> sensor)
- Asynchronous serial communication 1 channel (for CO<sub>2</sub>, BISx, and other external modules)
- I<sup>2</sup>C bus 1 channel (for identification of sensor type)
- +5 V output (power to sensor)

#### (2) IF Connector

Connector to be connected to EXTMPU PWR board (UR-3947), and functions as the input/output block for the following signals.

- Asynchronous serial communication with the main CPU (DPU1) on this board and LP9
- +12 V power supply, +5 V power supply
- Input of reset signal of the main CPU on this board
- Output of PWM signal for IBP analog output signal

#### (3) CPU (DPU1)

Main CPU of this board (hereinafter referred to as DPU1\*). Major features are listed below.

\* DPU1 is operated by the software same as DPU0.

- AD converter control
- Input channel control
- Exciter output voltage control
- Sensor identification
- Asynchronous serial communication with the CO<sub>2</sub>, BISx, and other external modules
- Asynchronous serial communication with LP9
- Detection of disconnection of each transducer and sensor
- Function of DC component removal for dTb and thermistor respiration
- IBP decimation (12 bit → 14 bit)
- IBP PWM signal output (for analog output)
- Monitoring of external output power supply (+5 VEXT)
- Monitoring of calibration voltage

#### (4) Power Source

+12 V and +5 V are supplied to this board, and the following powers are generated by the DC/DC converter and regulator.

- +5 V: Power for DPU1 floating block analog and digital circuits
- -5 V: Power for DPU1 floating block analog circuits
- +5 VEXT: Power for the sensor connection cable E2PROM and external modules

## (5) Non-volatile Memory

In this memory the following information is written and stored in the production process.

DPU1 reads this information at the time of startup.

- IBP gain/offset control information (by channel)
- Hardware identification information

## (6) IBP Amp.

Each input connector is equipped with an instrumentation amplifier.

Gain: 156 times (approximately)

Dynamic range:  $\pm 500$  mmHg or over

Sensitivity: 0.25 mmHg/LSB (ADC output), 0.0125 mmHg/LSB (DPU1 output)

Cutoff frequency: 37 Hz (approximately)

## (7) TEMP Block

Periodically switches and amplifies the input of all connectors.

Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.

Gain: 13.1 times (approximately)

(8) FiO<sub>2</sub> Block

Periodically switches and amplifies the input of all connectors. Also periodically inputs the calibration signals and corrects the offset voltage of the amplifier.

Gain: 19.6 times (approximately)

Sensitivity: 0.073%O<sub>2</sub>/LSB

## (9) CO block

CO block consists of the injectate temperature (Ti) amplifier, blood temperature (Tb) amplifier, and  $\Delta$  Tb amplifier.

## • Ti Amp.

Periodically switches and amplifies the input of all connectors. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.

Gain: 4 times (approximately)

## • Tb Amp.

Amplifies the signals input from the connector to the CO sensor connection cable. Also periodically inputs the voltage for calibration and corrects the offset and gain of the amplifier.

Gain: 82.4 times (approximately)

## • dTb Amp.

Amplifies output of Tb Amp. DC components are removed by the DPU1 timer output.

Gain: 10 times

Frequency response: DC to 12 Hz (−3 dB)

#### 4. BOARD/UNIT DESCRIPTION

(10) Thermistor RESP Block

Thermistor respiration amplifier has a double-stage structure consisting of a DC amplifier and an AC amplifier.

In the AC amplifier, DC components are removed by the DPU1 DA output.

Gain: DC amplifier: 41.4 times (approximately)

AC amplifier: 24 times (approximately)

(11) Excitation Voltage Generator

Generates excitation voltage as shown below for the transducer and thermistor sensor. Excitation voltage is switched depending on the connected sensor and output.

- IBP: 4.096 V
- Temperature: 0.5 V
- CO, thermistor respiration: 2.5 V

(12) Photo Couplers

Transmits the following signals to the grounding circuit by the photo couplers.

- Asynchronous serial communication between LP9 and DPU1
- IBP PWM signals for analog output
- DPU1 reset/mode signals

(13) Isolation

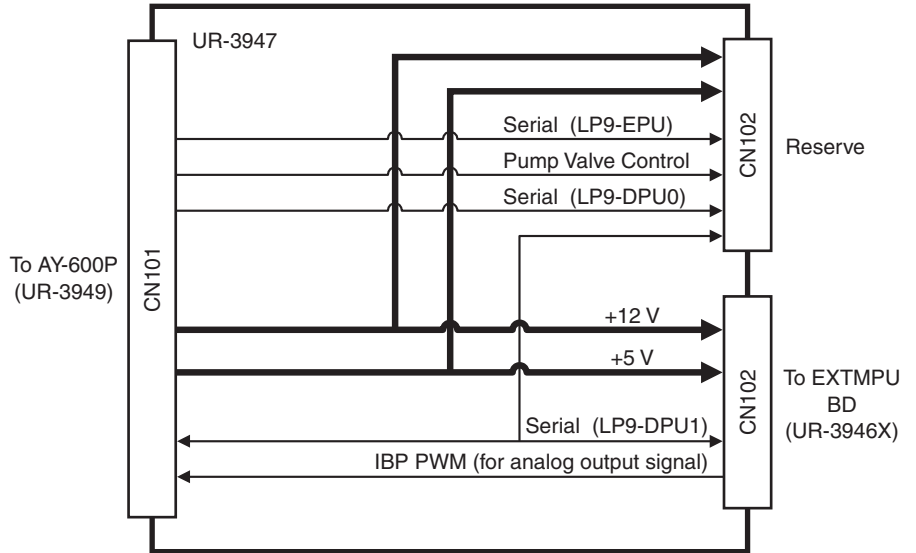
Electrically isolates the DPU1 isolation circuit from the grounding circuit by the transformer and the photo coupler.

Withstand voltage: 1500 Vrms

### UR-3947 External Multi Parameter Unit Connection Board

**Outline of Function**

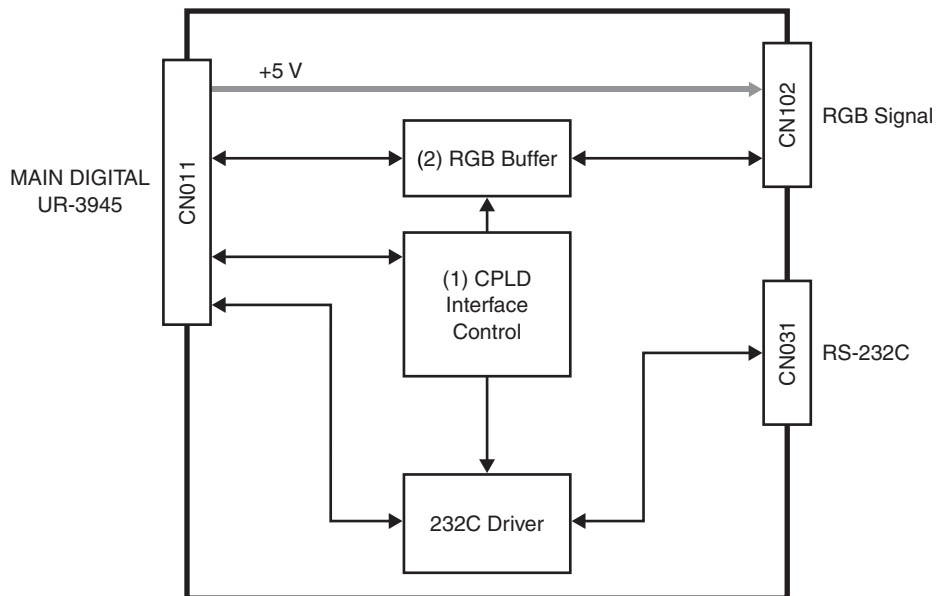
This board is installed in the smart expansion unit (AA-670P series), and is connected to EXTMPU board (UR-39462/39464). This board functions as the physical interface for EXTMPU board power supply, as well as the physical interface of asynchronous serial communication between DPU1 and LP9.



### QI-631P Interface (MIX)

**Outline of Function**

The interface (QI-631P) is an external interface board connected to the monitor main unit (MU-631R), and is equipped with the RGB output and RS-232C.



**Explanation of Each Circuit Block Operation**

(1) Communication Control (CPLD)

Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-39450) to parallel data.

Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

(2) RGB Buffer Circuit

Buffers the analog RGB signals from the monitor main unit MAIN DIGITAL board, and output them externally.

Also controls the +5 V power supply by the power supply control signals from the communication controller.

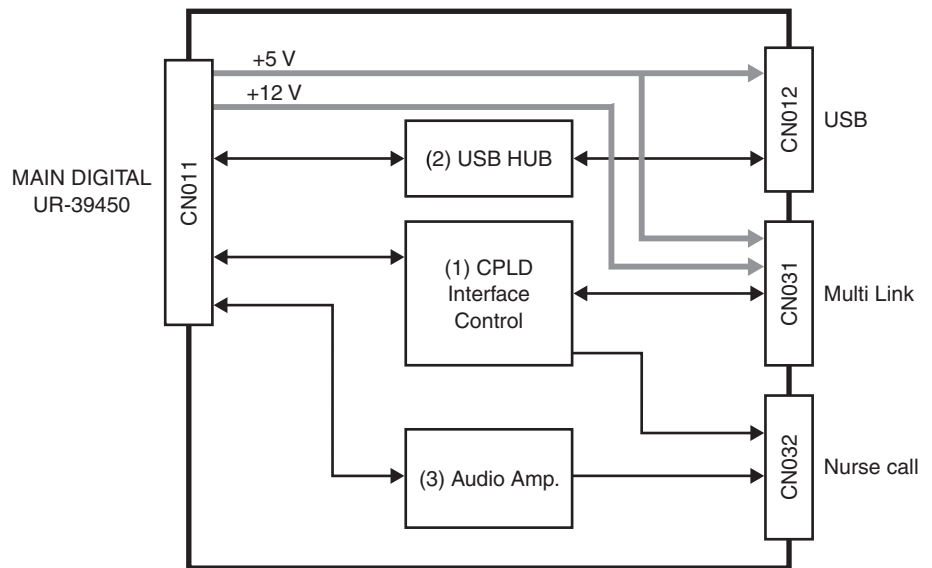
(3) Output Voltage

RGB +5 V  $\pm$  5% (load current 200 mA)

**QI-632P Interface (ML)**

**Outline of Function**

The interface (QI-632P) is an external interface board connected to the monitor main unit (MU-631R), and is equipped with USB, multi link and nurse call.



**Explanation of Each Circuit Block Operation**

(1) Communication Control (CPLD)

Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-39450) to parallel data.

Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

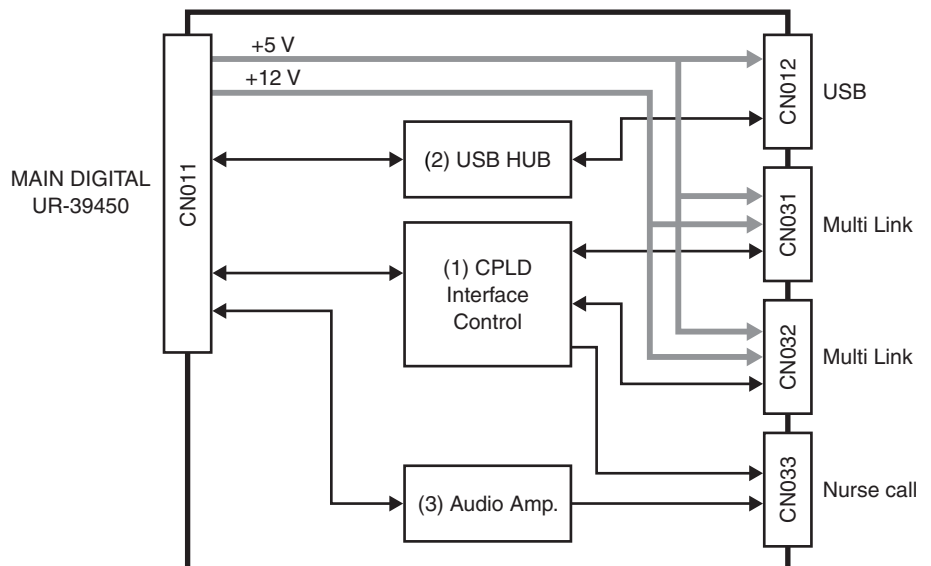
In addition, this is equipped with the multi link communication IDROM access function, and converts the communication line baud rate as necessary.

- (2) USB Hub Controller  
Relays the USB signals from the monitor main unit MAIN DIGITAL board.
- (3) Sound Circuit  
Converts the PWM signals from the monitor main unit MAIN DIGITAL board to the sound output signals.
- (4) Output Voltage  
Multi link communication +12 V  $\pm$  5% (load current 500 mA)  
Multi link communication +5 V  $\pm$  5% (load current 200 mA)  
USB +5 V  $\pm$  5% (load current 500 mA)

## QI-634P Interface

### Outline of Function

The interface (QI-634P) is an external interface board connected to the monitor main unit (MU-631R), and is equipped with USB, multi link and nurse call.



### Explanation of Each Circuit Block Operations

#### (1) Communication Control (CPLD)

Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-39450) to parallel data.

Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

In addition, this board has the multi link communication IDROM access function, and converts the communication line baud rate as necessary.

#### (2) USB Hub Controller

Relays the USB signals from the monitor main unit MAIN DIGITAL board.

#### (3) Sound Circuit

Converts the PWM signals from the monitor main unit MAIN DIGITAL board to the sound output signals.



(4) Output Voltage

Multi link communication +12 V ± 5% (load current 500 mA)

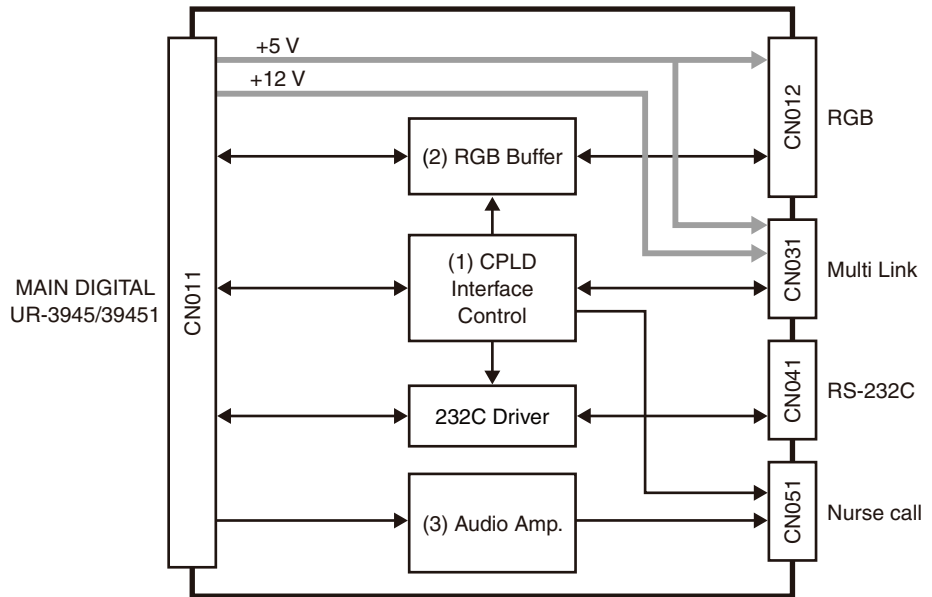
Multi link communication +5 V ± 5% (load current 200 mA)

USB +5 V ± 5% (load current 500 mA)

**QI-671P Interface**

**Outline of Function**

The interface (QI-671P) is an external interface board connected to the monitor main unit (MU-651R/MU-671R), and is equipped with the RGB output, alarm polling, nurse call, sound output, RS-232C, and multi link.



**Explanation of Each Circuit Block Operations**

(1) Communication Control (CPLD)

Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-3945/UR-39451) to parallel data. Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

This board also has the multi link communication IDROM access function, and converts the communication line baud rate as necessary.

(2) RGB Buffer Circuit

Buffers the analog RGB signals from the monitor main unit MAIN DIGITAL board, and output them externally. Also controls the +5 V power supply by the power supply control signals from the communication controller.

## (3) Sound Circuit

Converts the PWM signals from the monitor main unit MAIN DIGITAL board to the sound output signals.

## (4) Output Voltage

Multi link communication +12 V  $\pm$  5% (load current 500 mA)

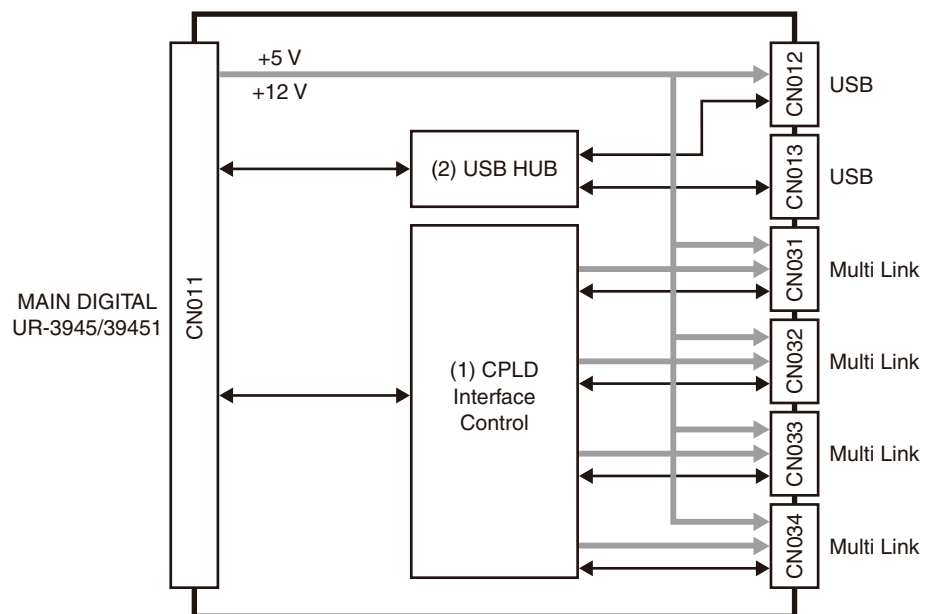
Multi link communication +5 V  $\pm$  5% (load current 200 mA)

RGB +5 V  $\pm$  5% (load current 200 mA)

## QI-672P Interface

### Outline of Function

The interface (QI-672P) is an external interface board connected to the monitor main unit (MU-651R/MU-671R), and is equipped with USB and multi link.



### Explanation of Each Circuit Block Operation

## (1) Communication Control (CPLD)

Converts EXT-IO (serial data) from the monitor main unit MAIN DIGITAL board (UR-3945/UR-39451) to parallel data. Also converts parallel data to EXT-IO (serial data) and transmits the data to the MAIN DIGITAL board.

This board also has the multi link communication IDROM access function, and converts the communication line baud rate as necessary.

## (2) USB Hub Controller

Divides the USB signals from the monitor main unit MAIN DIGITAL board for two ports, by the hub controller.

## (3) Output Voltage

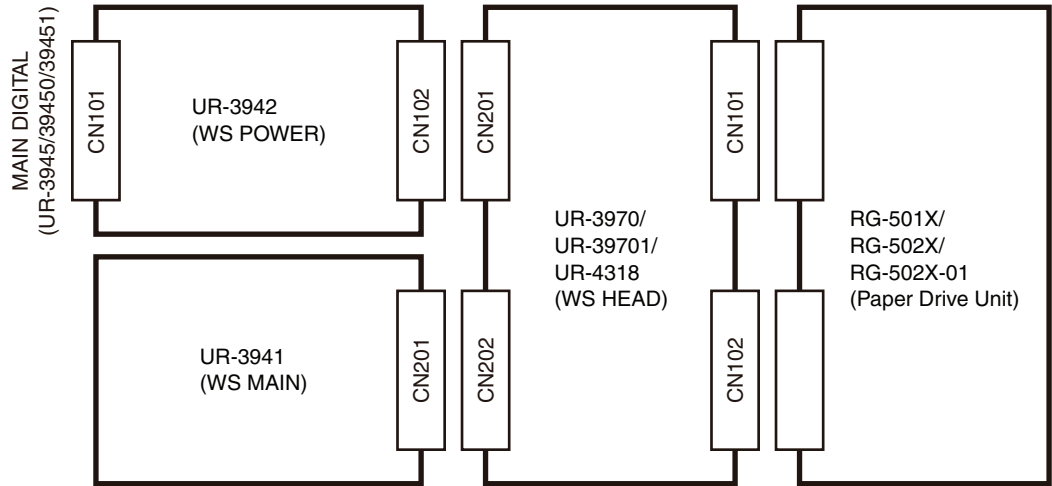
Multi link communication +12 V  $\pm$  5% (load current 500 mA)

Multi link communication +5 V  $\pm$  5% (load current 200 mA)

USB +5 V  $\pm$  5% (load current 500 mA)

# WS-671P Recorder Module

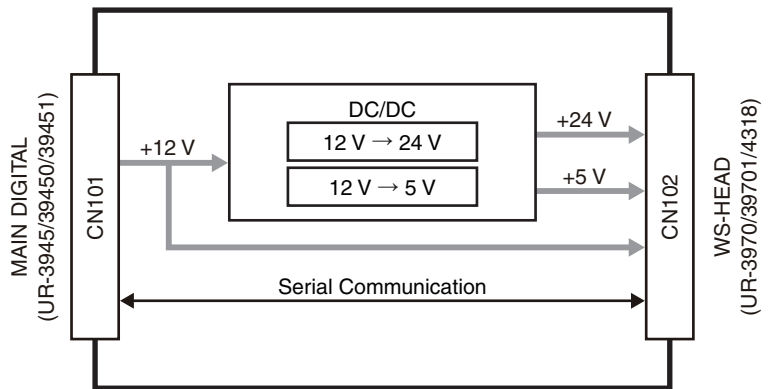
WS-671P Overall Block Diagram



**Outline**

Controls the recording processes.

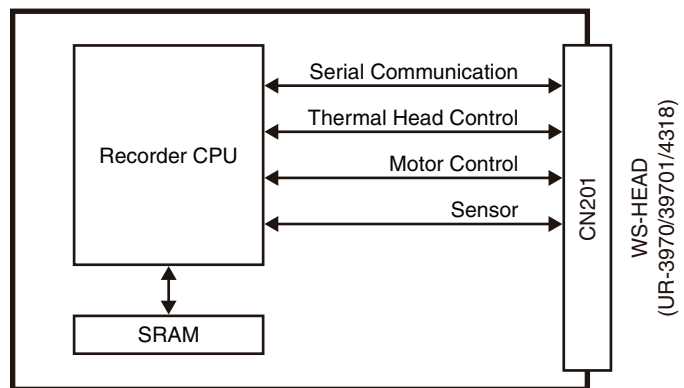
## UR-3942 WS Power Board



**Function**

- DC/DC
  - +24 V: Used as the power to the thermal head.
  - +5 V: Used in the overall recorder module.
- Serial Communication
  - Passes signals transmitted between the MAIN DIGITAL board and the WS MAIN board.

## UR-3941 WS Main Board

**Function**

- Recorder CPU

The program for the recorder is stored in CPU-internal ROM, and upgrade can be performed on the device itself.

This CPU performs communication with the device (serial communication), as well as control the thermal head control, motor control, and sensor detection (paper empty, magazine open, mark detection).

- Serial Communication

Performs serial communication with Host CPU in the MAIN DIGITAL board (UR-3945/UR-39450/UR-39451).

- Thermal Head Control

Detects the head's temperature from a thermistor in the thermal head, and controls the print density.

- Motor Control

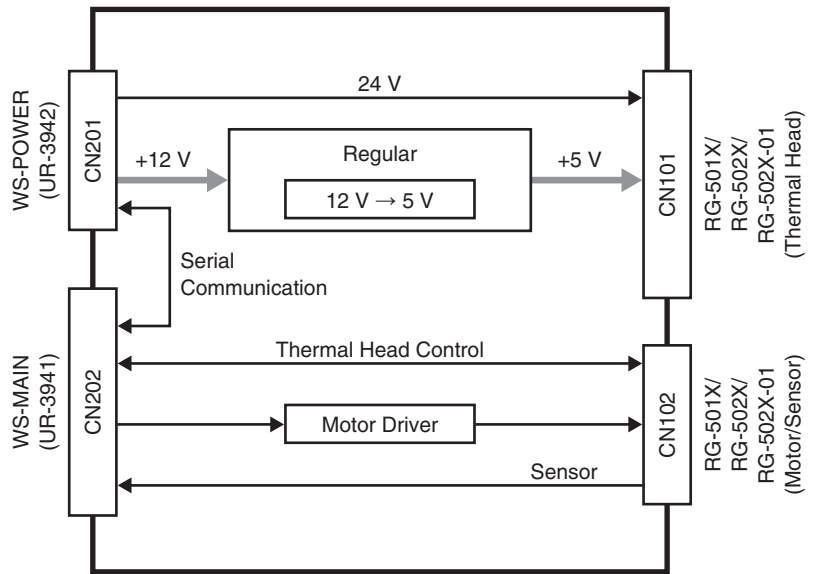
Transmits signals to set the recording speed to 25 mm/s  $\pm$  5% or 50 mm/s  $\pm$  5% to the motor driver.

- Sensor

Detects signals of Paper Empty, Magazine Open and Mark Detection from the sensors in the paper drive unit, and conveys them to the monitor.

**UR-3970/39701/4318 WS Head Board**

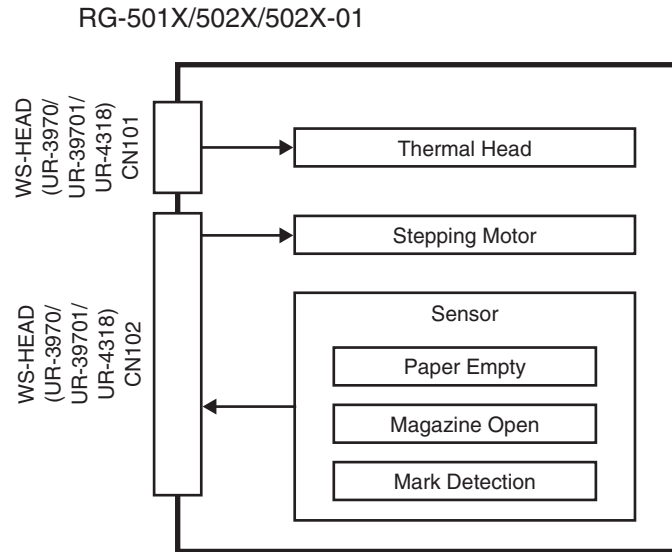
WS HEAD (UR-3970/39701/4318)



**Function**

- Regulator  
5 V: Used for controlling the thermal head.
- Motor Driver  
Converts motor control signals transmitted from the WS MAIN board into RG-501X stepping motor signals.
- Serial Communication  
Passes signals transmitted between the MAIN DIGITAL board and the WS MAIN board.
- Thermal Head Control  
Passes thermal head control signals.
- Sensor  
Passes signals of Paper Empty, Magazine Open and Mark Detection.

## RG-501X/502X/502X-01 Paper Drive Unit



4

### Function

- Thermal Head  
Records on the thermal paper and measure the temperature of the thermal head by thermistor.  
  
Maximum recording width: more than 46 mm
- Stepping Motor  
Feeds the recording paper.
- Sensor  
Detects the out of paper by the photo sensor.
- Magazine Open  
Detect the opening of the magazine by the lever switch.
- Mark Detection  
Detects the recording paper mark by the photo sensor.

# Section 5 Disassembly and Assembly

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**CAUTION**

- Before performing replacement, be sure to turn off the power switch.
- Disconnect the power cord and the connection cables.
- When replacing the boards, be sure to confirm the dip switch settings.

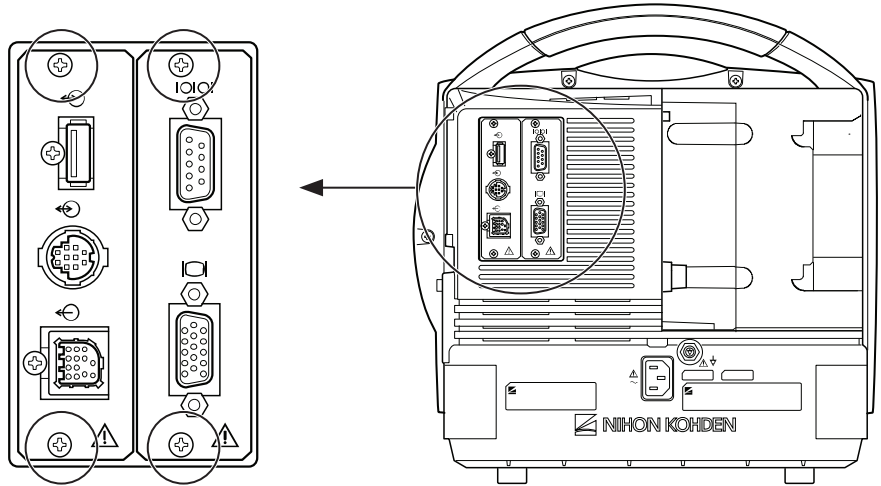
**Disassembling the Main Unit (MU-631R)**

Tools required: A Phillips-head screwdriver (for M3 and M4), a flathead screwdriver, hexagon wrenches (5) and tweezers

**Removing the Rear Enclosure****Removing the Optional Interface (QI-631P/632P/634P)**

Remove the optional QI-631P and QI-632P or QI-634P interfaces if installed. Example shows the QI-631P and QI-632P interfaces are installed.

1. Remove the four BH3 × 6 screws.



## 5. DISASSEMBLY AND ASSEMBLY

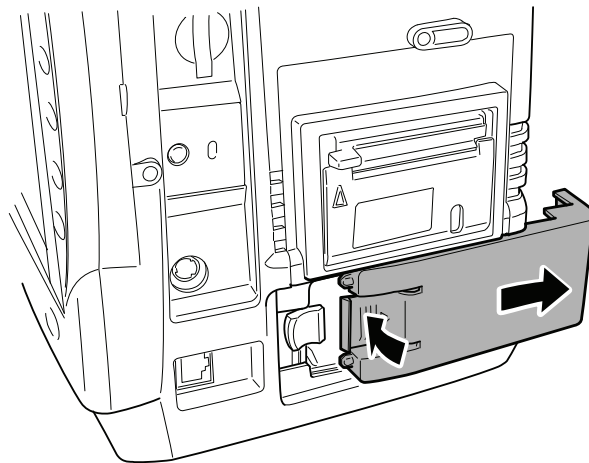
2. Insert the flathead screwdriver between the two interfaces as shown below and pull them out.



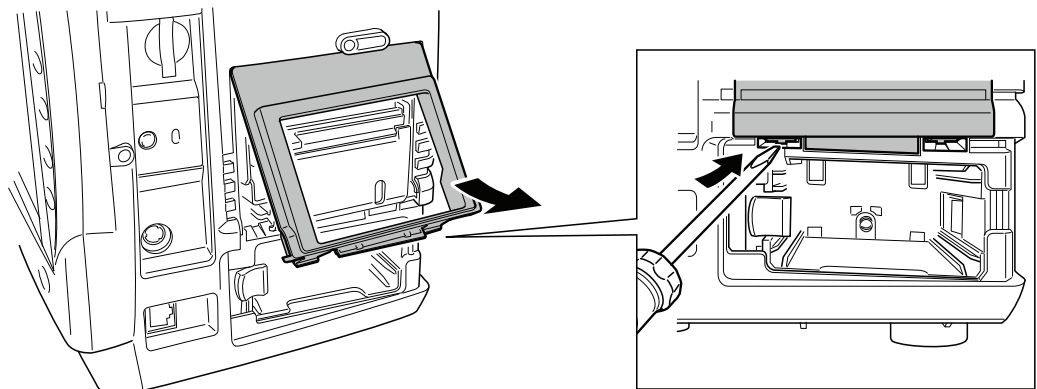
### Removing the Recorder Module (WS-671P)

Remove the WS-671P recorder module if installed.

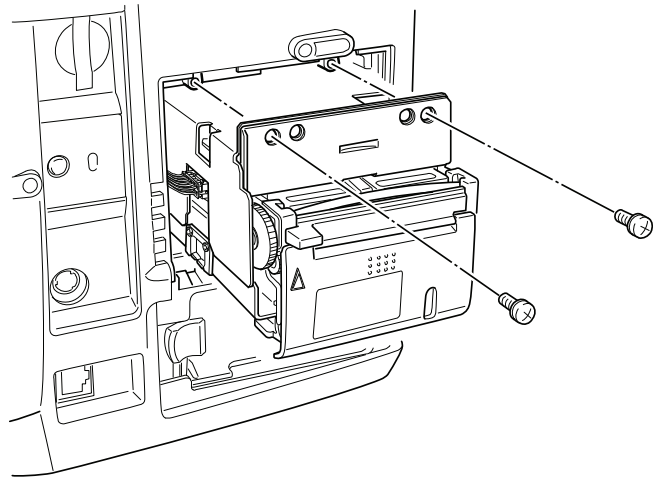
1. Remove the cover from the battery slot 2.



2. Insert the flathead screwdriver as shown below and remove the front cover of the recorder module.

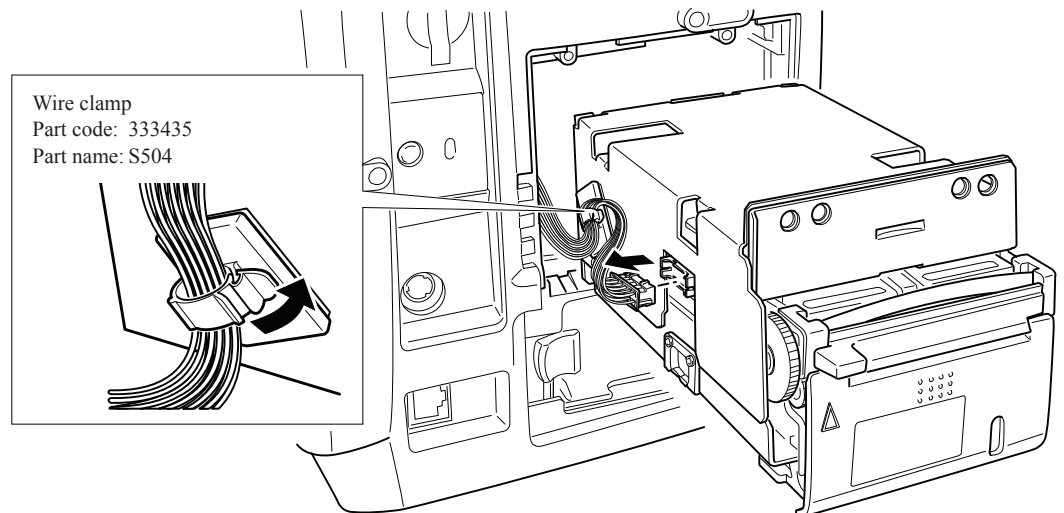


3. Remove the two PS3 × 6 screws fixing the recorder module to the body of bedside monitor.



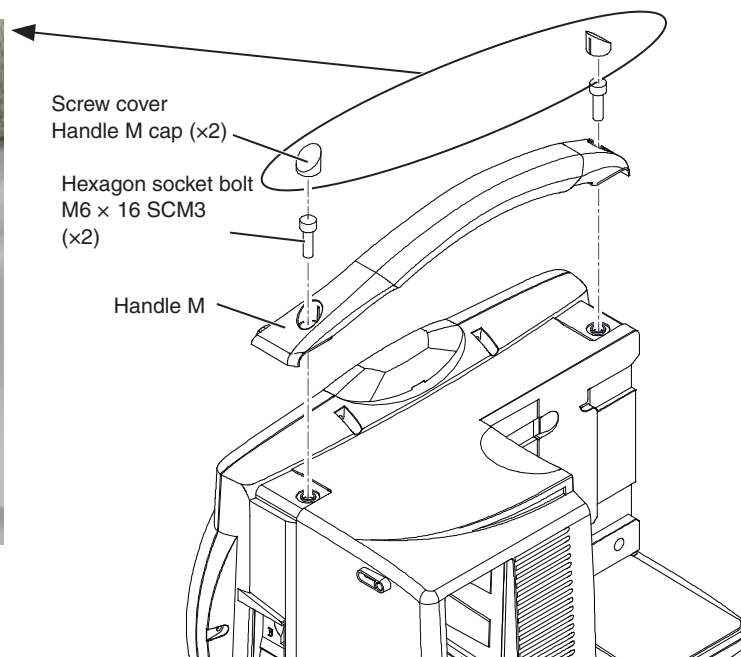
5

4. Pull out the recorder module. Remove the internal cable from the wire clamp and from the connector connected to the recorder module.



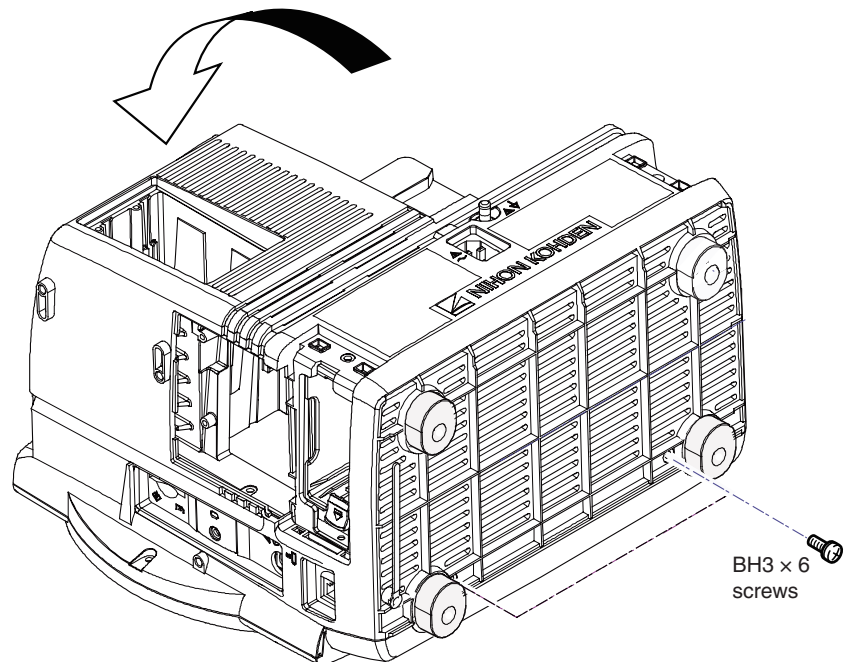
### Removing the Handle

1. Use the flathead screwdriver to remove the two screw covers (handle M caps) from the right and left ends of the handle.
2. Use the hexagon wrench to remove the two hexagon socket bolts (M6 × 16 SCM3). Then remove the handle M.



### Removing the Rear Enclosure

1. Remove the cover from the battery slot 1 on the left side.
2. Lay the monitor face down and remove the two BH3 × 6 screws from the bottom of the bedside monitor.

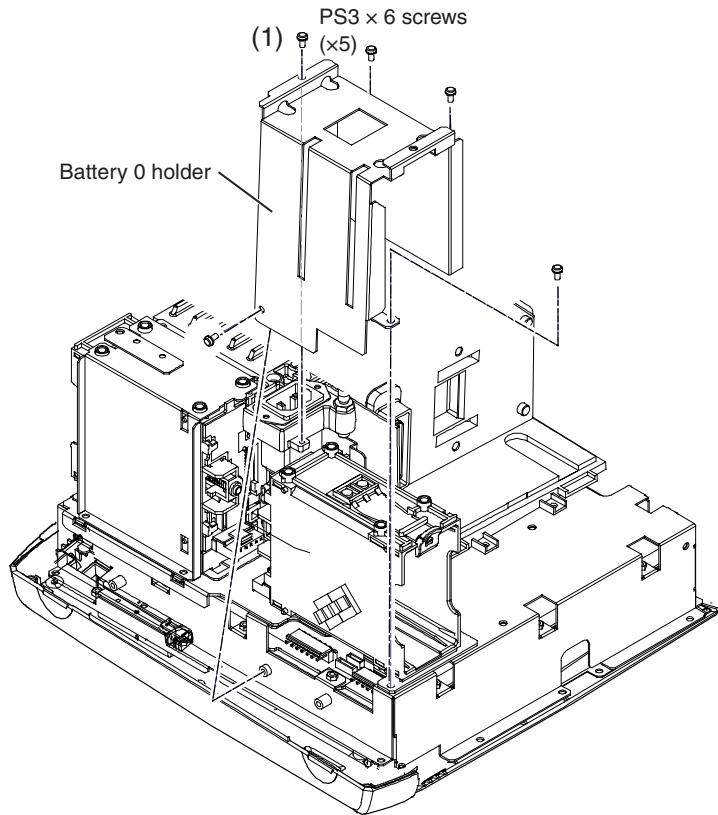


3. Remove the seven BH3 × 6 screws from the rear enclosure. Insert the flathead screwdriver between the alarm indicator and the rear enclosure and remove the rear enclosure.

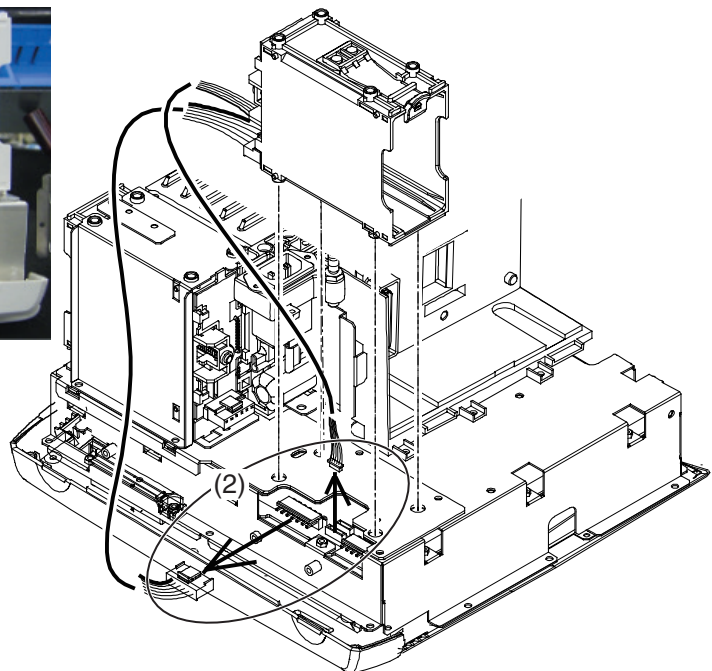
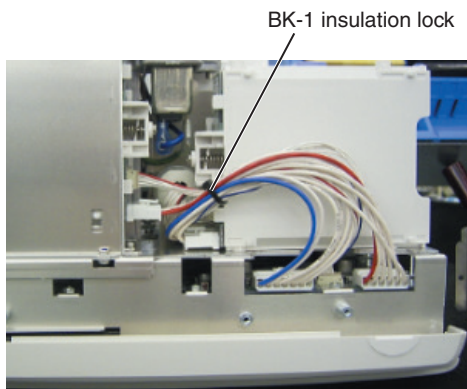


### Removing the SC-631R Power Unit from the Heat Sink Block

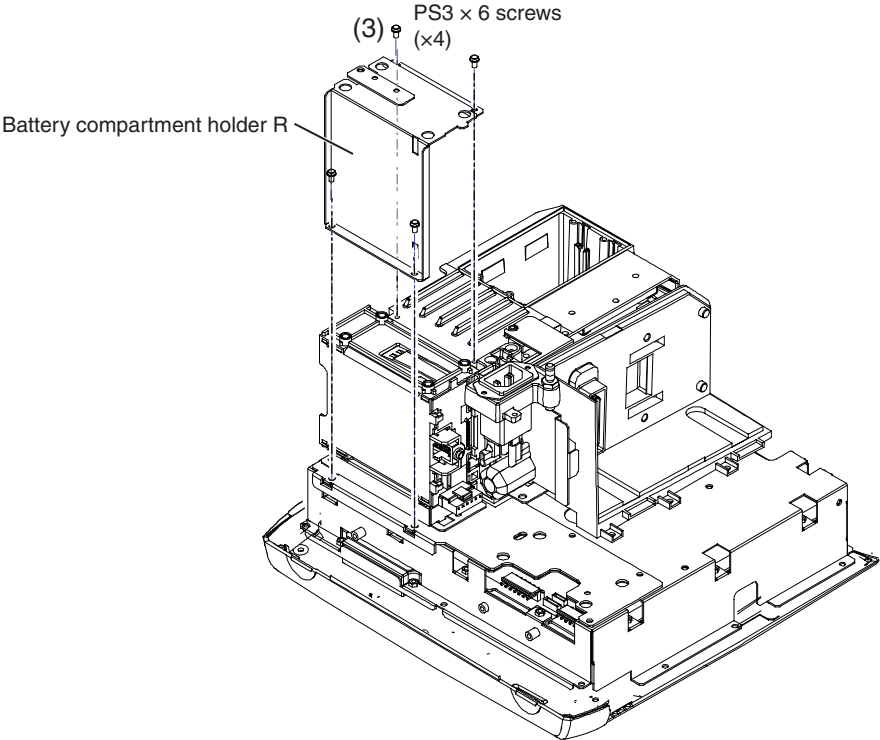
1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.
2. Remove the five PS3 × 6 screws of (1) and battery 0 holder.



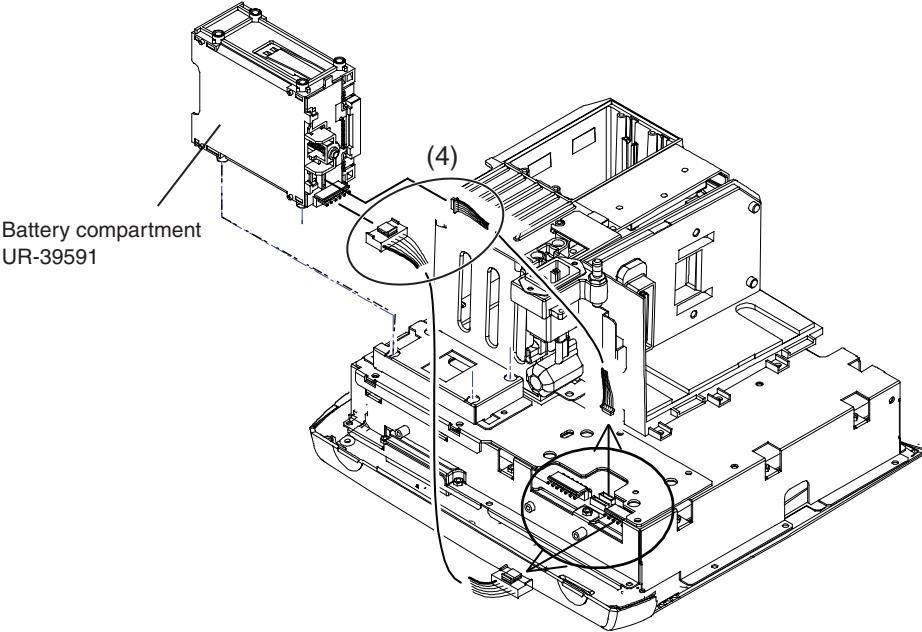
3. Take out the BK-1 insulation lock that bundles cables and remove the two cables of (2). Then remove the battery compartment from the left side of the rear enclosure.



4. Remove the four PS3 × 6 screws of (3) and battery compartment holder R.



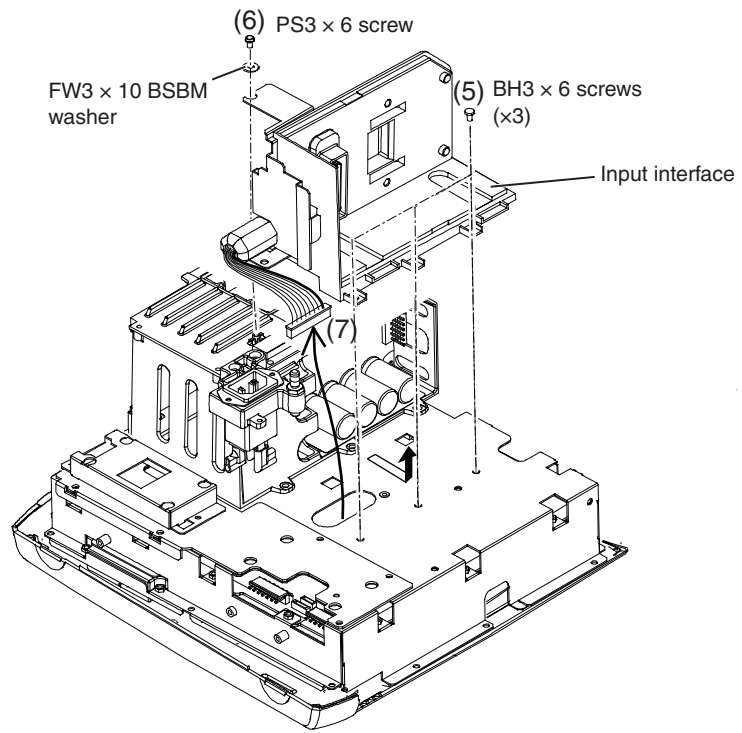
5. Remove the two cables of (4) and remove the battery compartment.



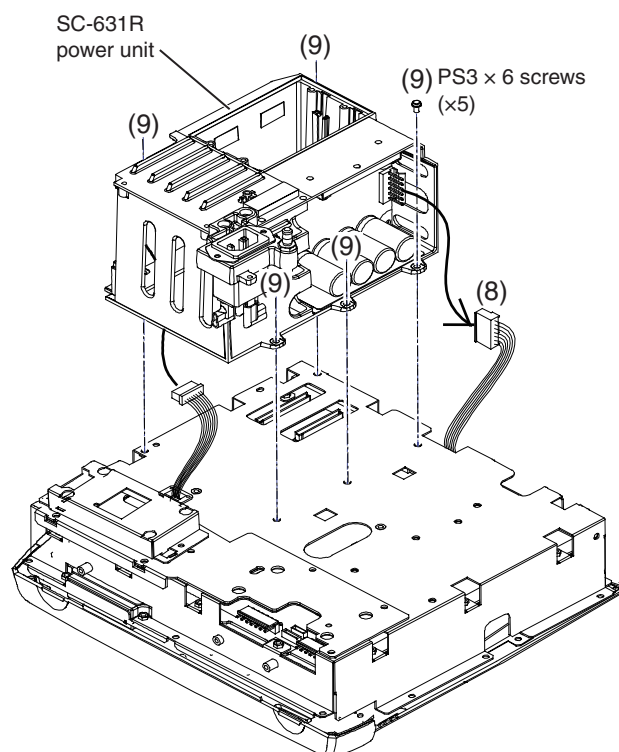


## 5. DISASSEMBLY AND ASSEMBLY

- Remove the three BH3 × 6 screws of (5) and remove the PS3 × 6 screw and the FW3 × 10 BSBM washer of (6). Slide the input interface to the direction indicated with the arrow and lift it upward.
- Disconnect the cable connector of (7) from the MAIN DIGITAL board and remove the input interface.



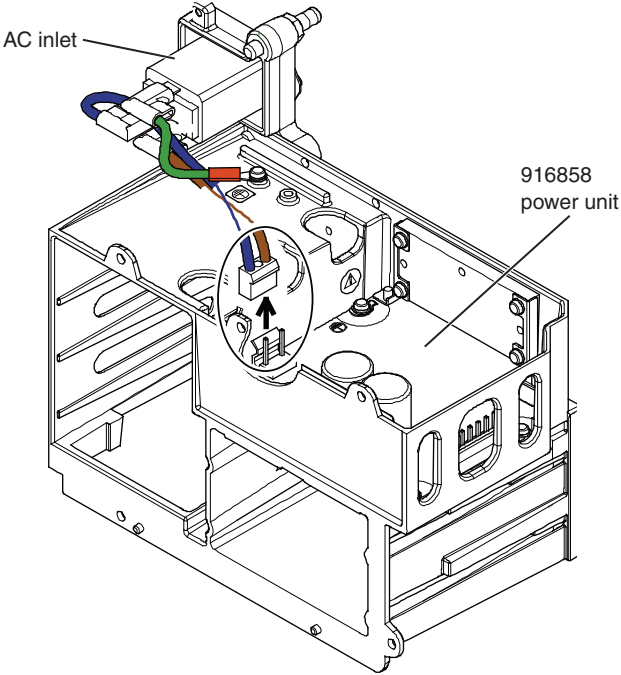
- Remove the cable of (8) from the power unit.
- Remove the five PS3 × 6 screws of (9) and remove the SC-631R power unit.



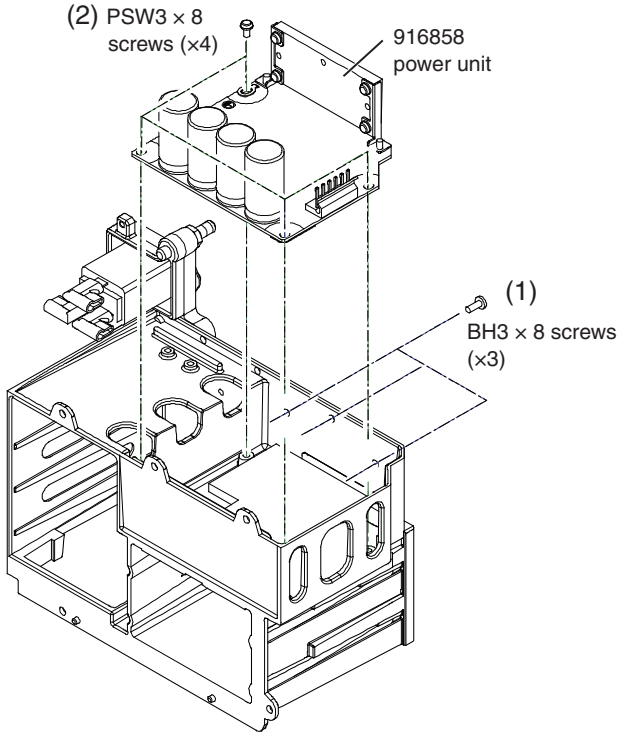


### Removing the 916858 Power Unit

- 1. Remove the power unit. For details, refer to “Removing the SC-631R Power Unit from the Heat Sink Block”.
- 2. Disconnect the cable which connects the AC inlet and the 916858 power unit from the SC-631R power unit.

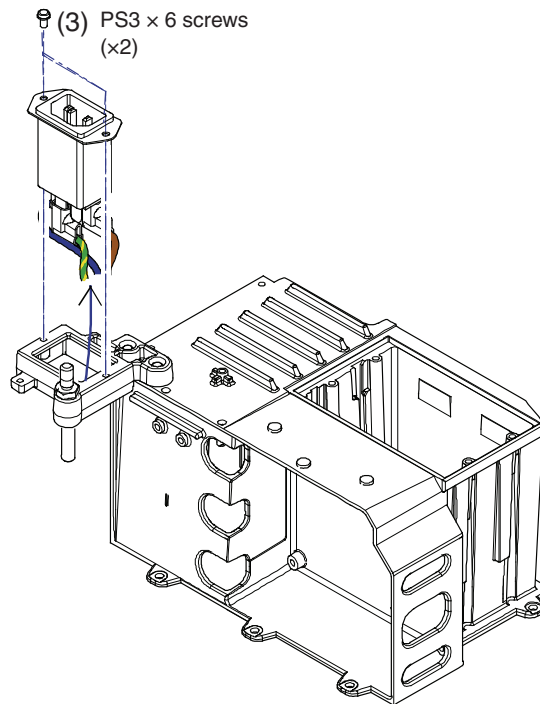


- 3. Remove the three BH3 × 8 screws of (1) and the four PSW3 × 8 screws of (2). Then remove the 916858 power unit.



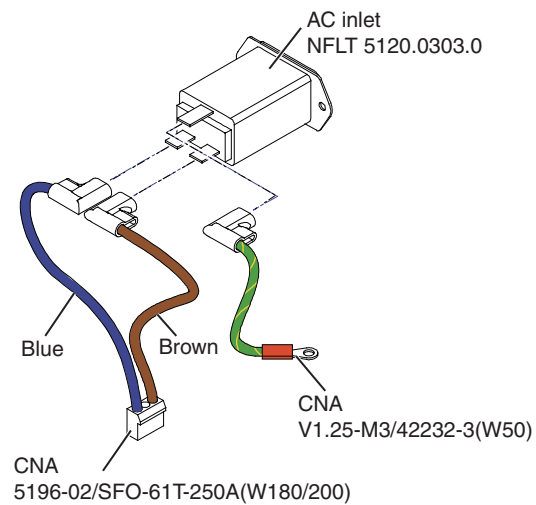
## 5. DISASSEMBLY AND ASSEMBLY

4. Remove the two PS3 × 6 screws of (3) and AC inlet.



### NOTE

Pay attention to cable colors when connecting the AC inlet.

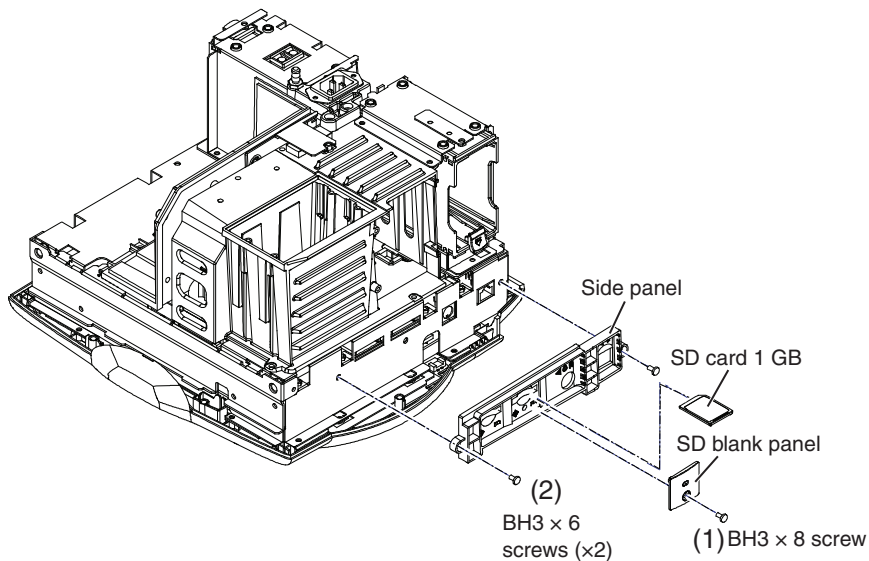


### Replacing the MAIN DIGITAL Board (UR-39450)

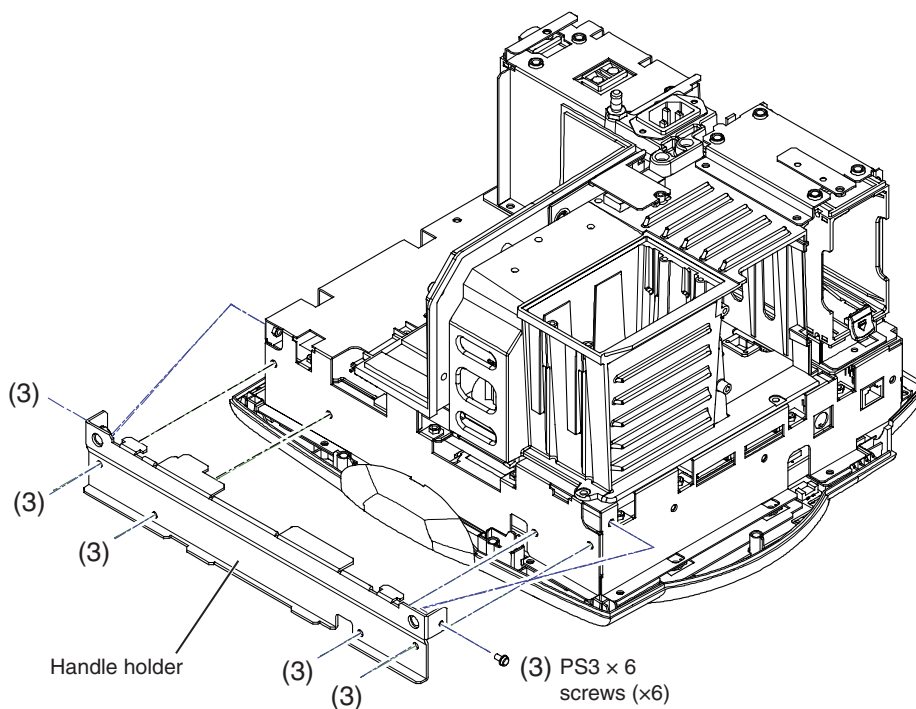
**NOTE**

After replacing the MAIN DIGITAL board, calibrate the touch panel. Refer to the “Calibrating the Touch Panel” in Section 3.

1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.
2. Remove the BH3 × 8 screw of (1) and the two BH3 × 6 screws of (2). Then remove the SD blank panel and side panel and pull out the SD card.

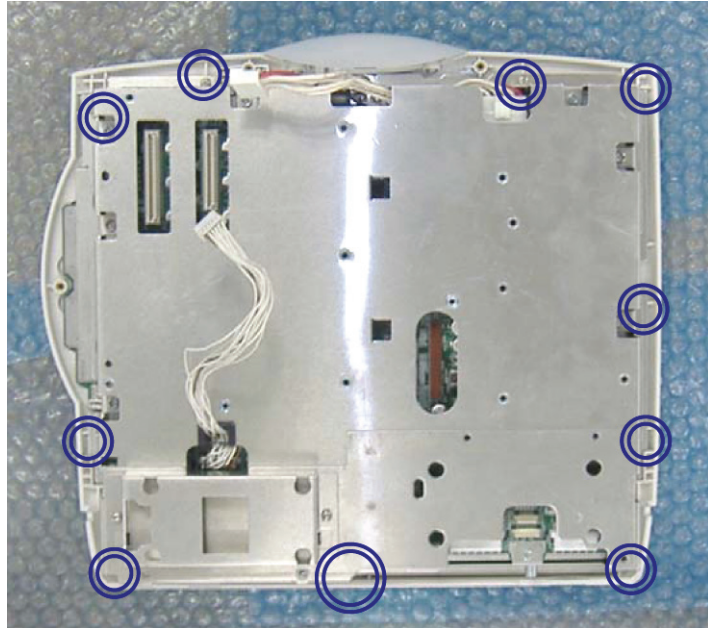


3. Remove the six PS3 × 6 screws of (3), one from each side and four from the top. Then remove the handle holder.

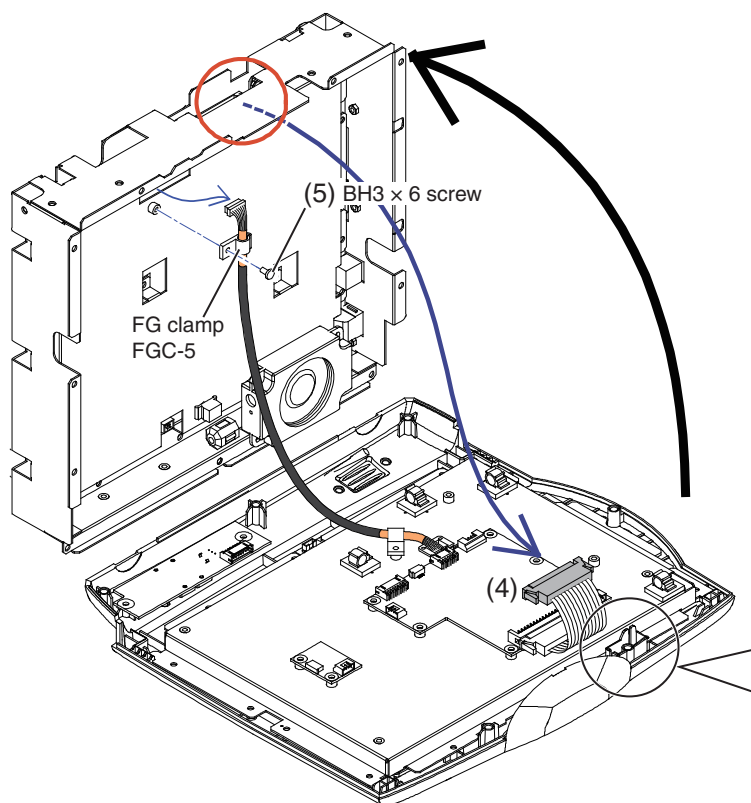


## 5. DISASSEMBLY AND ASSEMBLY

- 4 Remove the SC-631R power unit. For details, refer to “Removing the SC-631R Power Unit.”
- 5 Remove the ten PS3 × 6 screws.



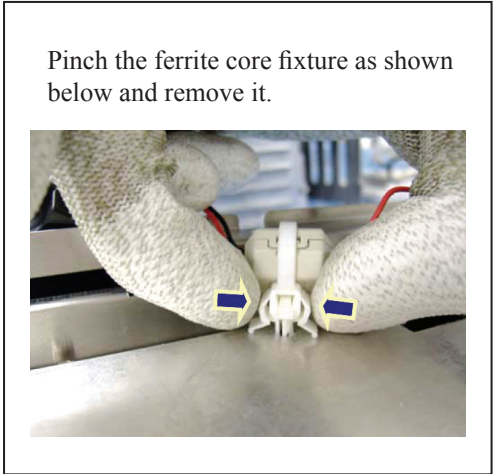
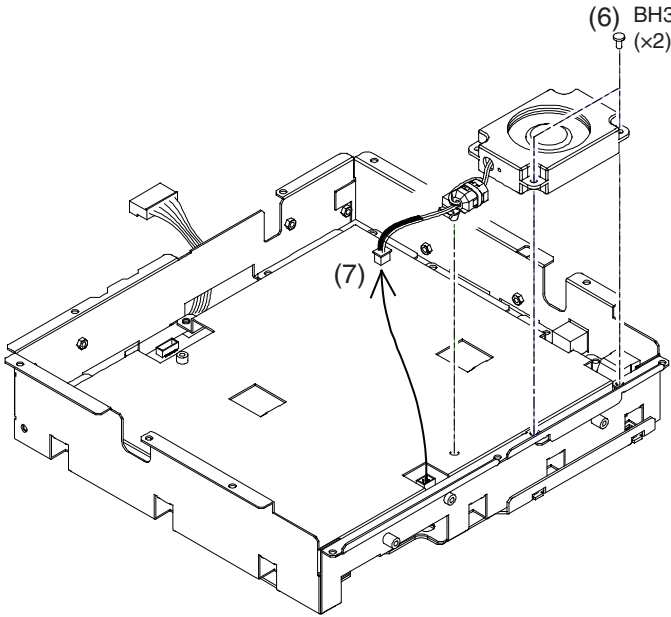
- 6 Disconnect the flat cable of (4) and remove the BH3 × 6 screw of (5) that fixes the FG clamp (FGC-5). Then remove the cable connector between the MAIN DIGITAL board and the FRONT IF board from the MAIN DIGITAL board.



When reassembling the unit, take care not to trap the alarm indicator cable.

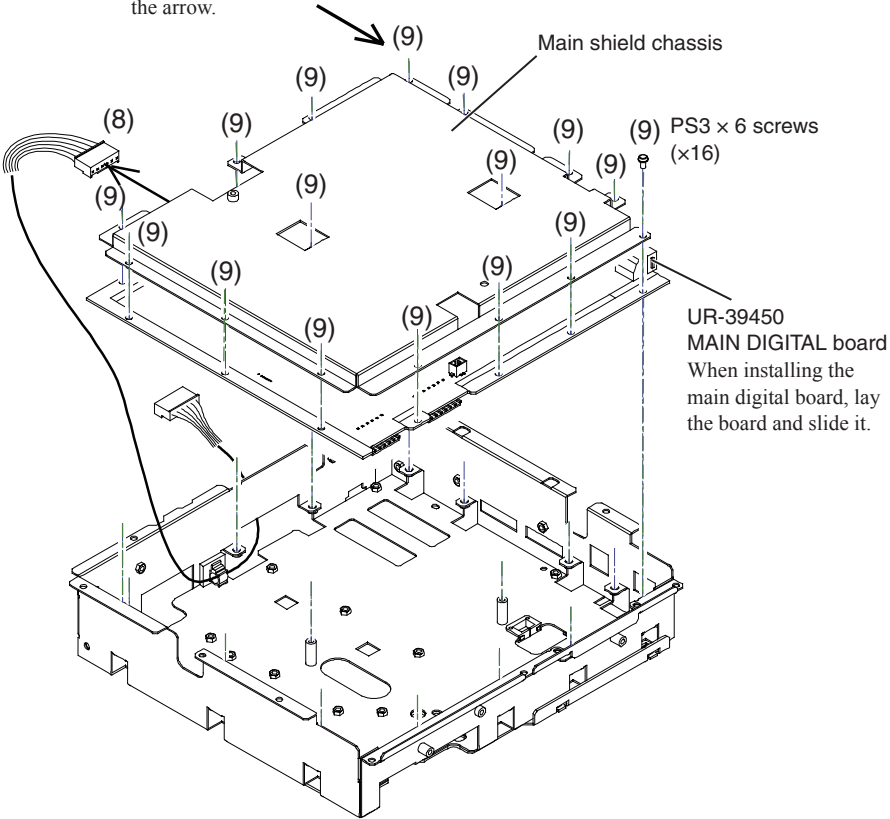


- 7. Remove the two BH3 × 6 screws of (6) and remove the fixture of ferrite core from the chassis. Then remove the connector of (7) and the speaker.

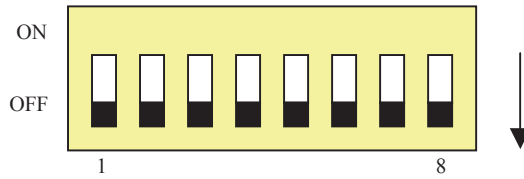


- 8. Remove the connector of (8) and the sixteen PS3 × 6 screws of (9). Lift and remove the main shield chassis and remove the MAIN DIGITAL board.

When reassembling the unit, fix the screws from the side indicated with the arrow.



**Dip Switch (S17100) Settings of MAIN DIGITAL Board (UR-39450)**

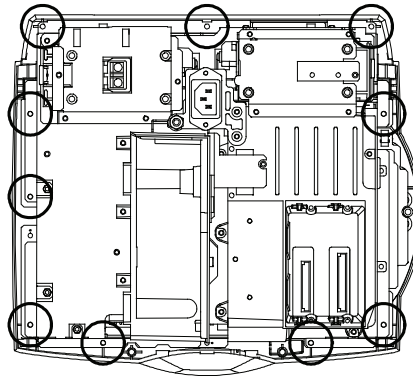


Bits 1 to 8 of the S17100 dip switch on the board must be set to OFF.

**Removing the FRONT IF Board (UR-4284)**

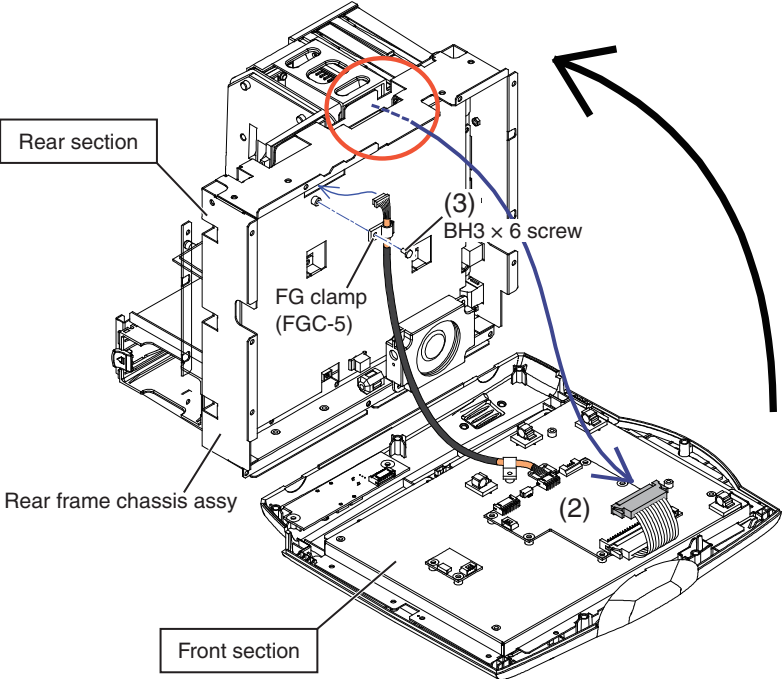
1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.
2. Remove the BH3 × 8 screw and the two BH3 × 6 screws. Then remove the SD blank panel and side panel and pull out the SD card. For details, refer to step 2 of “Replacing the MAIN DIGITAL Board (UR-39450)”.
3. Remove the six PS3 × 6 screws, one from each side and four from the top. Then remove the handle holder. For details, refer to step 3 of “Replacing the MAIN DIGITAL Board (UR-39450)”.
4. Remove the ten PS3 × 6 screws of (1).

(1) PS3 × 6 screws (×10)

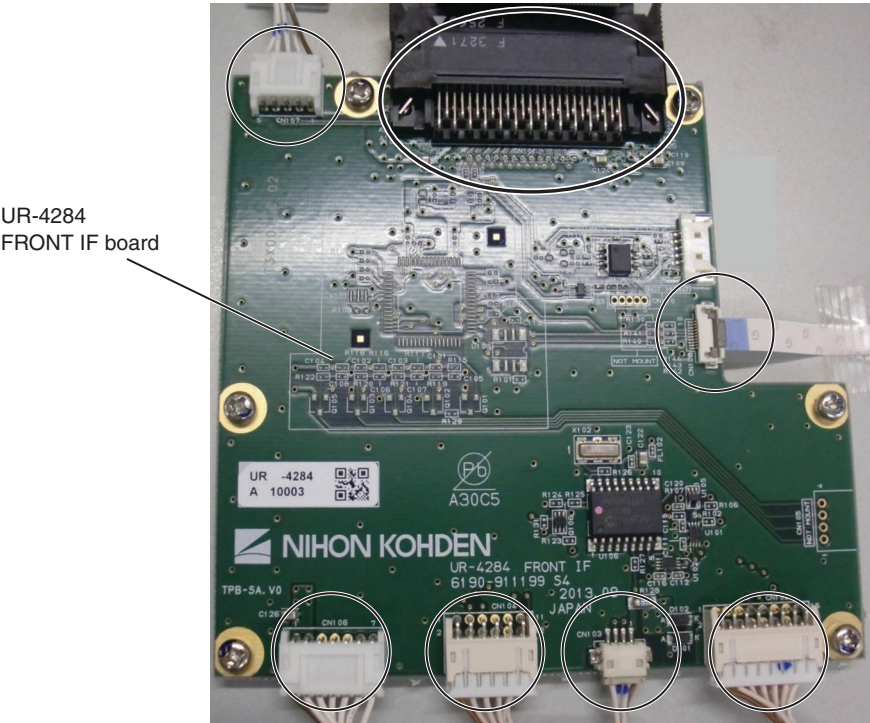




- 5. Disconnect the cable of (2) from the main digital board. Remove the BH3 × 6 screw of (3) that fixes the FG clamp (FGC-5) and remove the cable connected to the MAIN DIGITAL board. Lift the rear frame chassis assy and separate the front and rear sections.

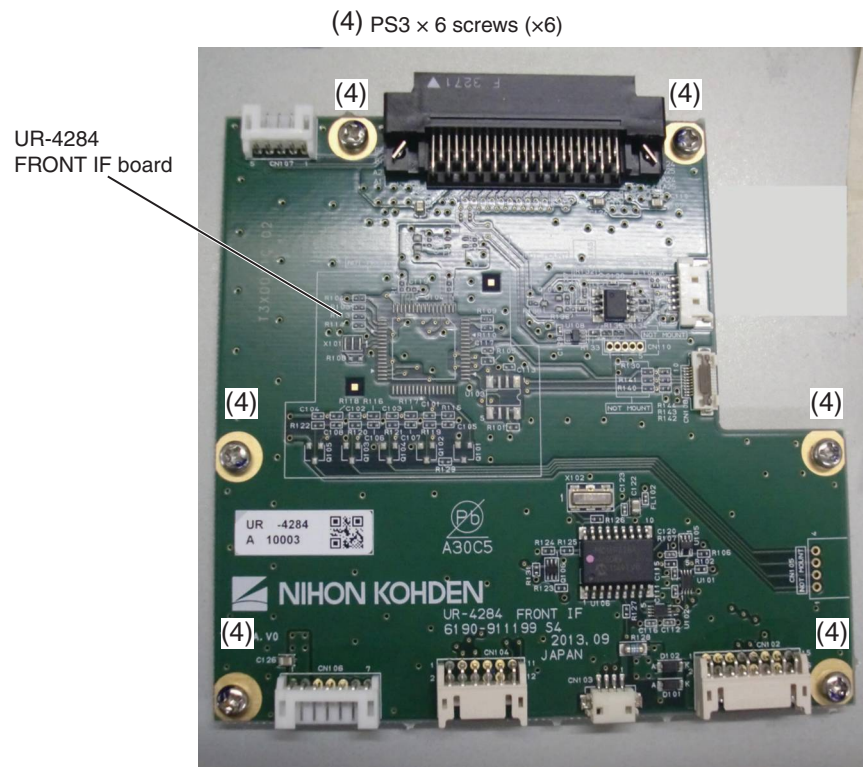


- 6. Remove all the seven cables connected to the FRONT IF board (UR-4284).



## 5. DISASSEMBLY AND ASSEMBLY

7. Remove the six PS3 × 6 screws of (4) and remove the FRONT IF board (UR-4284) from the main chassis front.

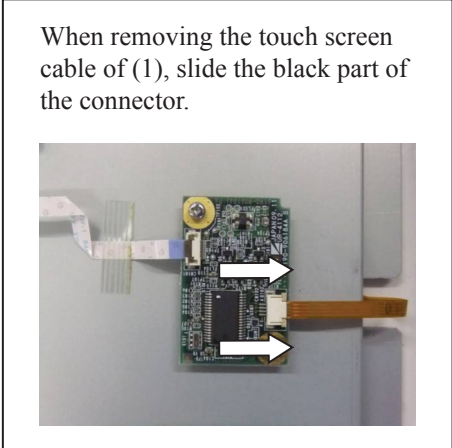
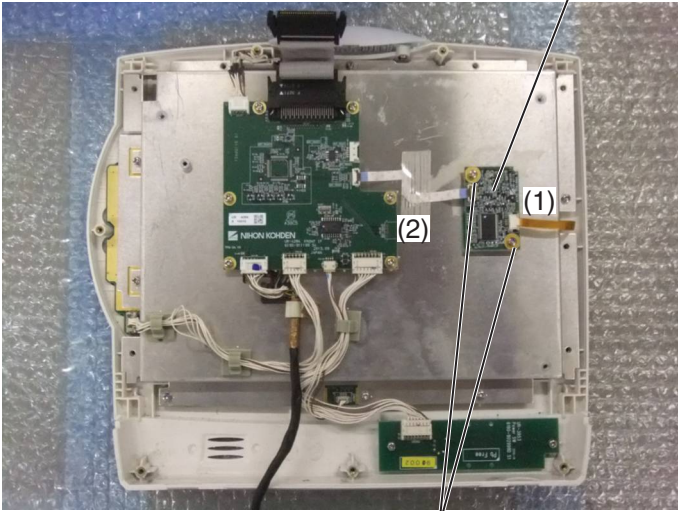




### Removing the TOUCH PANEL IF Board (UR-4112)

1. Remove the rear frame chassis assy. For details, refer to steps 1 to 5 of “Removing the FRONT IF Board (UR-4284)”.
2. Remove the touch screen cables of (1) and (2) and the two PS3 × 6 screws of (3). Then remove the TOUCH PANEL IF board from the main chassis front.

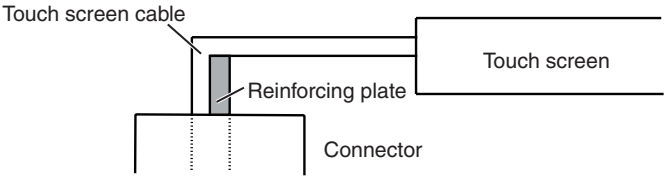
UR-4112  
TOUCH PANEL IF board



(3) PS3 × 6 screws  
(x2)

**NOTE**

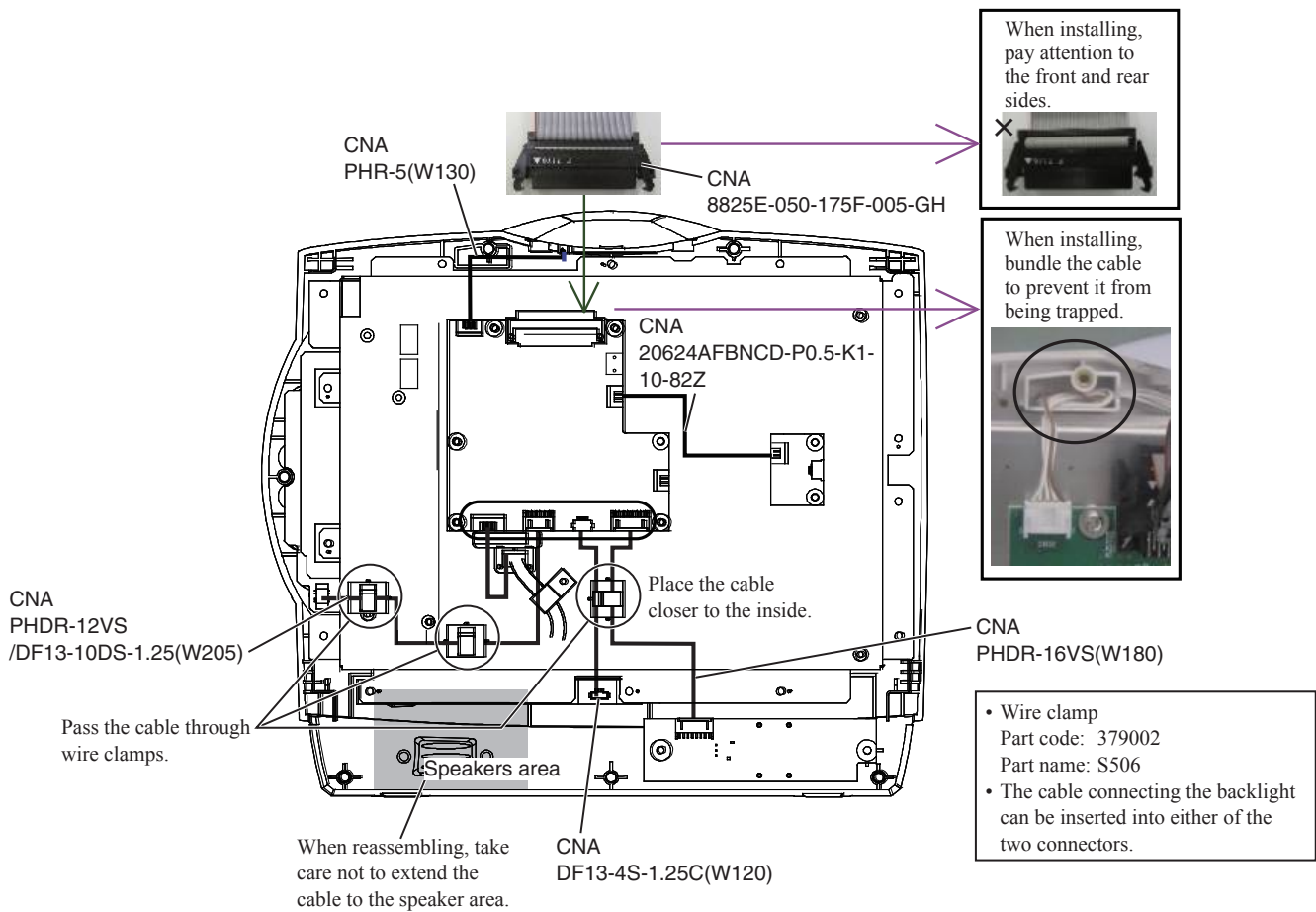
Do not fold or bend the touch screen cable. The cable may break. On the connector insertion part, the reinforcing plate is attached. Take care to avoid excessive force while inserting the connector. Unnecessary removal and insertion of the connector may damage the touch screen.



## 5. DISASSEMBLY AND ASSEMBLY

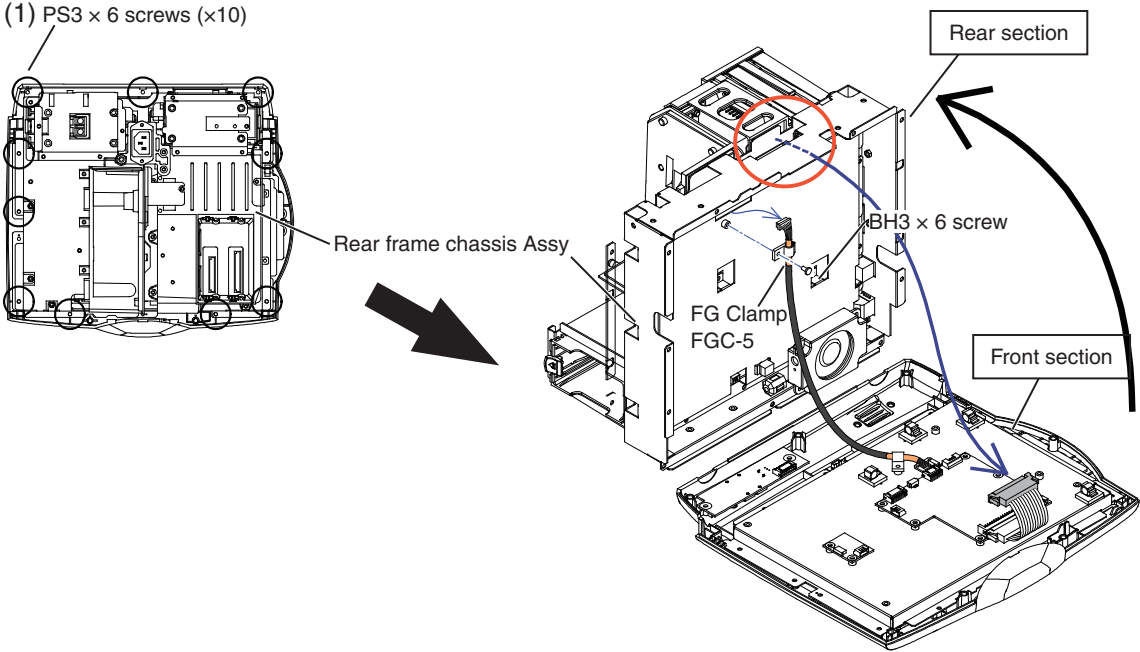
### NOTE

Take care of the following when installing the boards and cables.

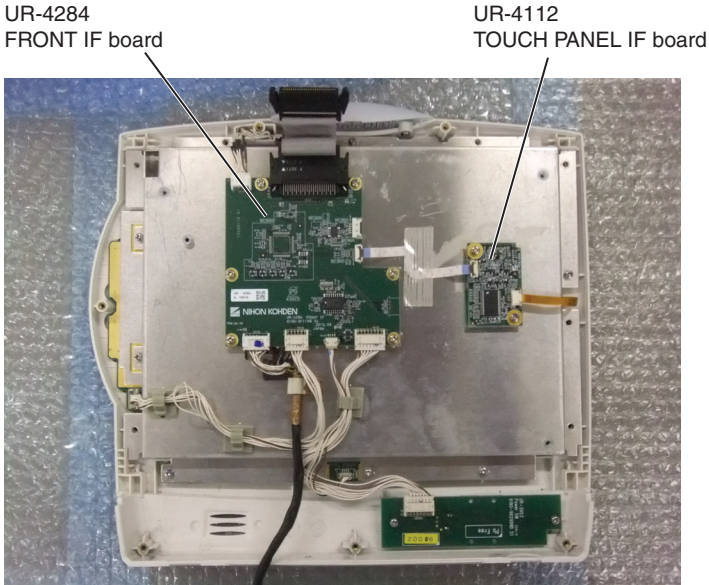


### Removing the LCD Unit

- 1. Remove the rear enclosure and ten PS3 × 6 screws of (1). Then lift the rear frame chassis assy and separate the front and rear sections. For details, refer to steps 1 to 5 of “Removing the FRONT IF Board (UR-4284)”.

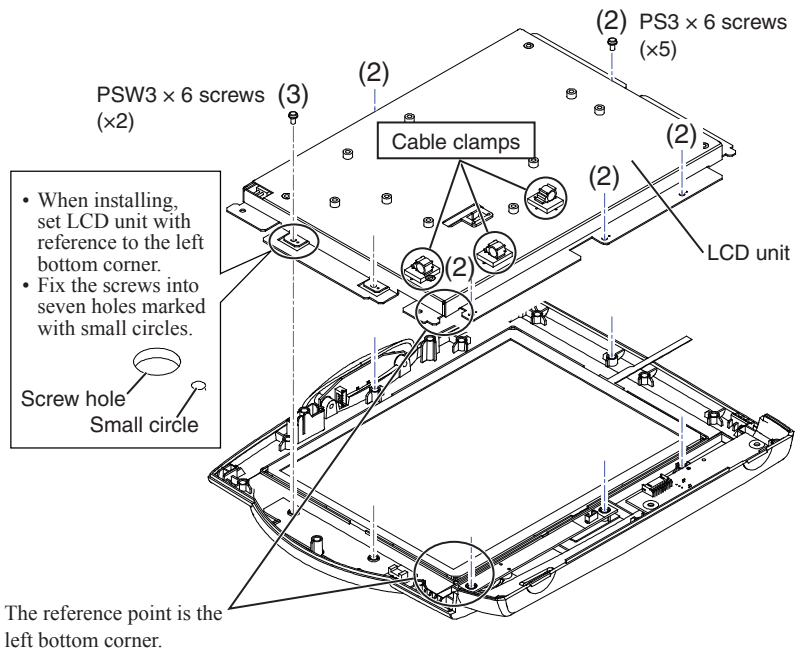


- 2. Remove the FRONT IF board. For details, refer to steps 6 and 7 of “Removing the FRONT IF Board (UR-4284)”.
- 3. Remove the touch panel IF. For details, refer to “Removing the TOUCH PANEL IF Board (UR-4112)”.

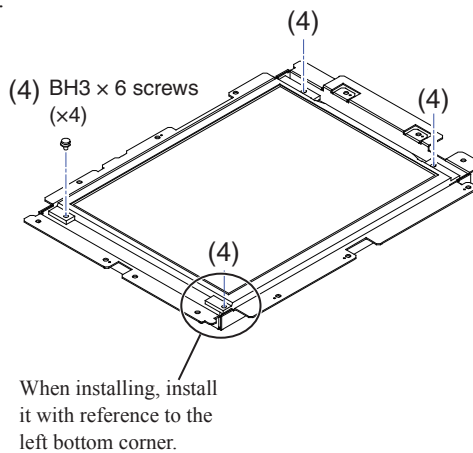


5. DISASSEMBLY AND ASSEMBLY

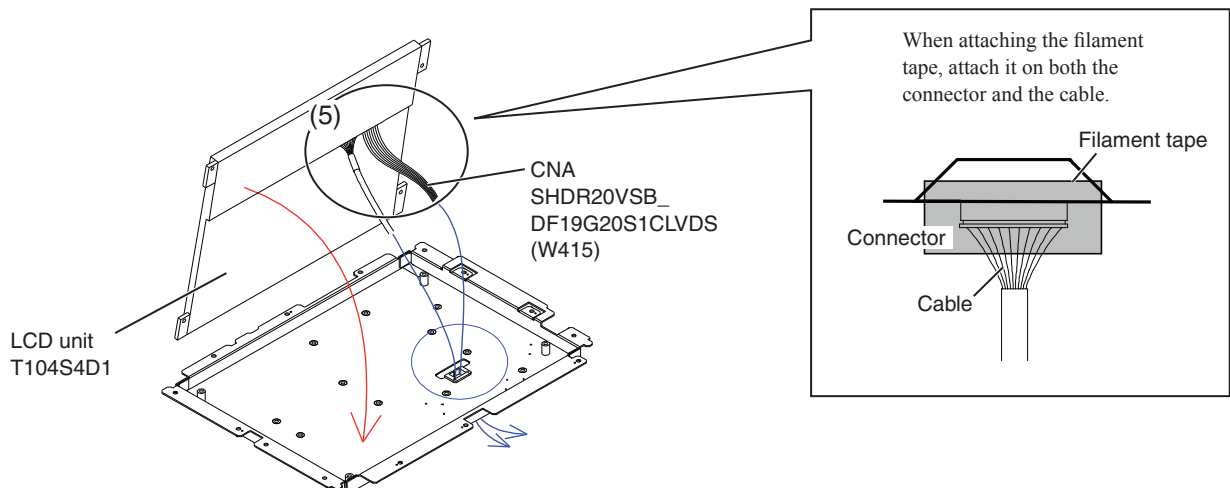
- Remove the cable from all cable clamps. Remove the five PS3 × 6 screws of (2) and the two PSW3 × 6 screws of (3). Then remove the main chassis front.



- Turn the main chassis front upside down and remove the four BH3 × 6 screws of (4).

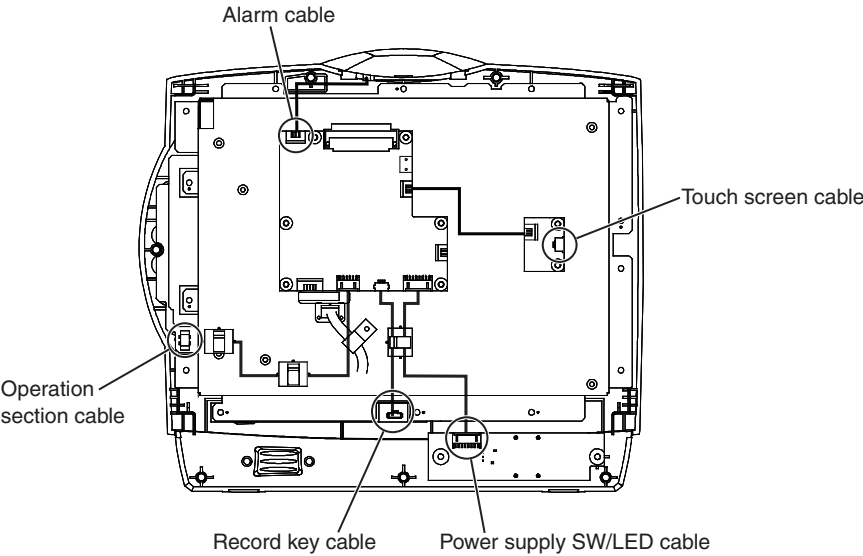


- Remove the filament tape (Sumitomo 3M, No. 897, 18 × 40 mm) or locally available insulating tape which has a fire resistance exceeding that specified in UL 94V-0. Disconnect the CNA cable of (5) and remove the LCD unit.

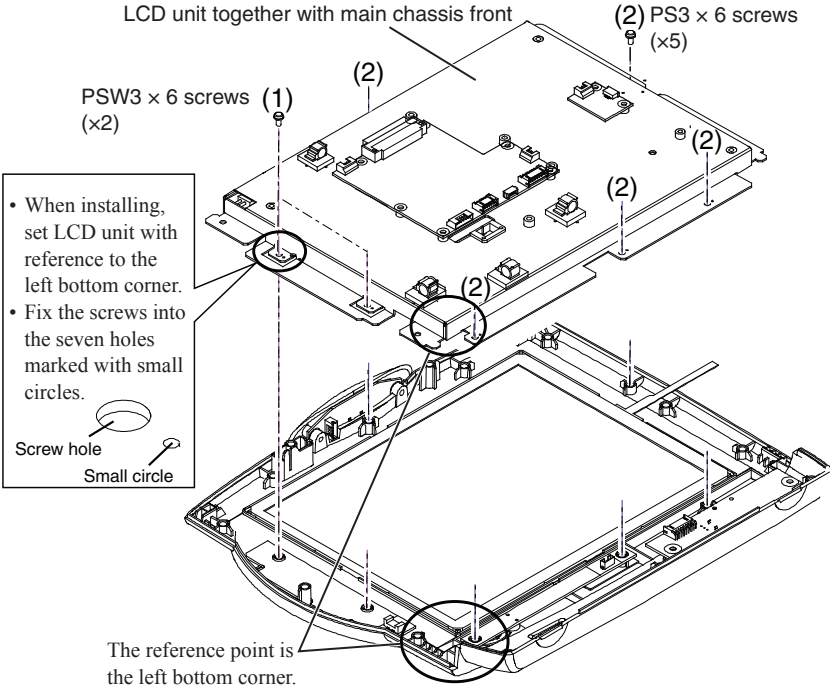


### Replacing the Touch Screen

1. Remove the rear enclosure and separate the front and rear sections. For details, refer to step 1 of “Removing the LCD Unit”.
2. Remove the touch screen cable, backlight cable, alarm cable, operation section cable, record key cable and power supply SW/LCD cable.

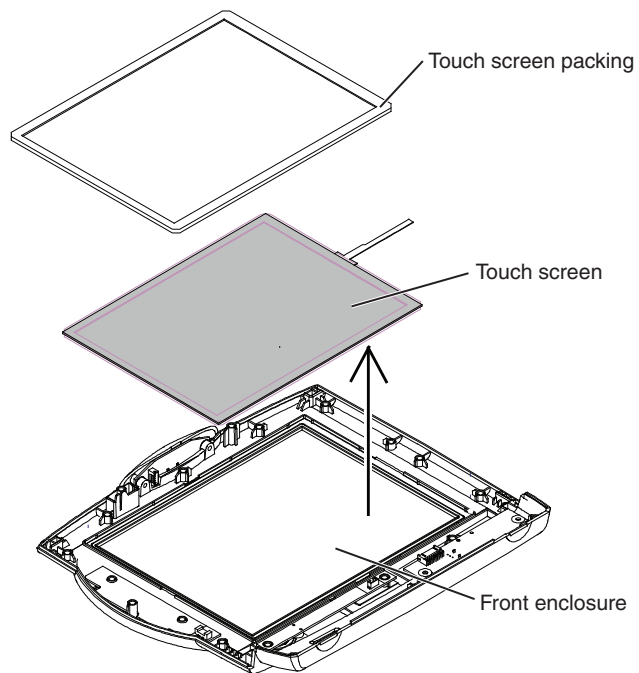


3. Remove the two PSW3 × 6 screws of (1) and five PS3 × 6 screws of (2). Then remove LCD unit together with the main chassis front.

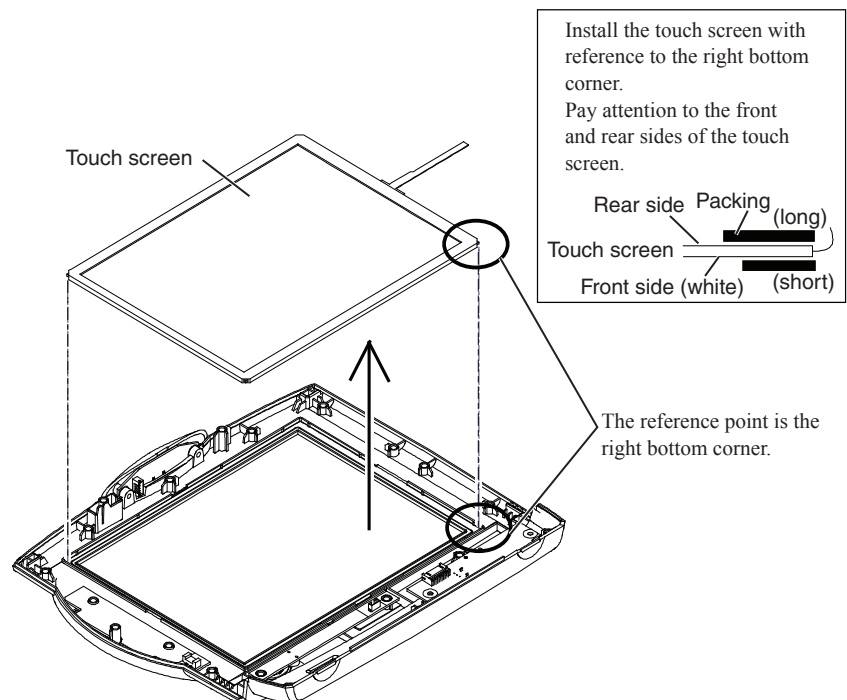


## 5. DISASSEMBLY AND ASSEMBLY

4. Remove the touch screen from the front enclosure and the touch screen packing from the touch screen.



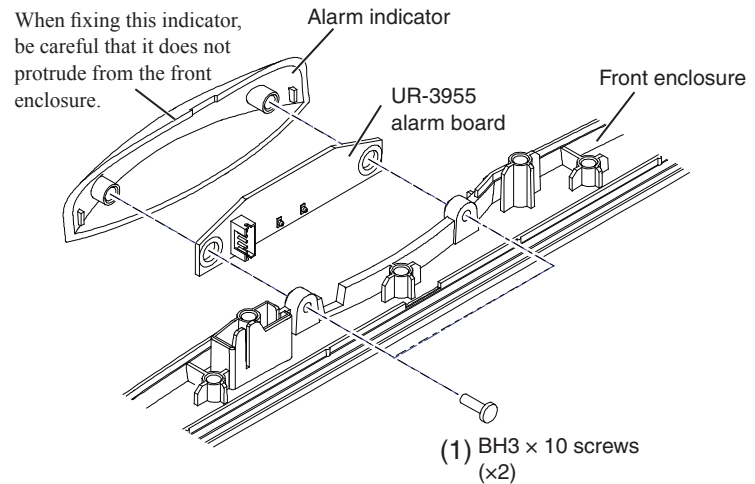
5. When installing, place the touch screen with its rear side up, pass the cable of the touch screen through the packing, and attach the packing to the touch screen. Set the touch screen into the front enclosure with its rear side up and with reference to the right bottom corner.





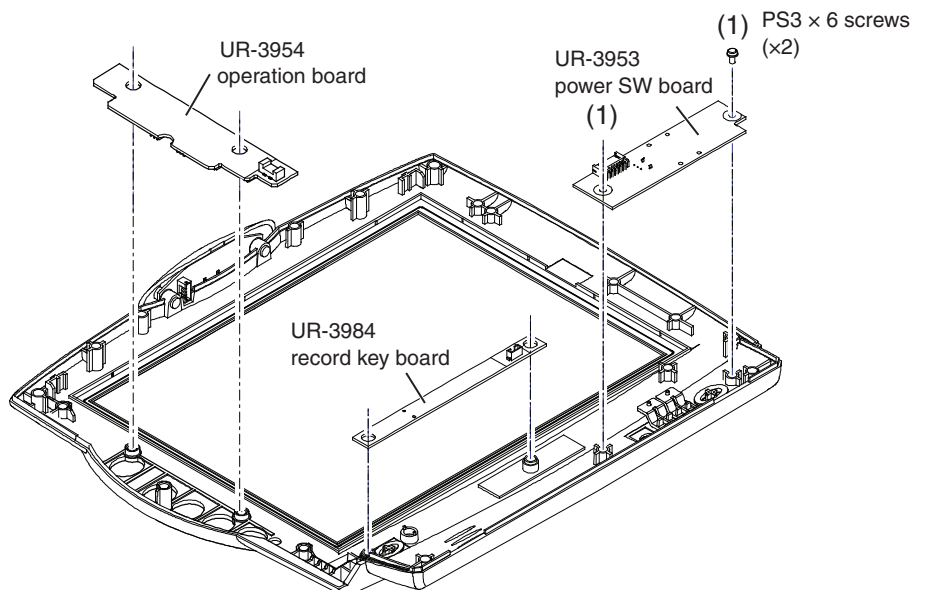
## Removing the ALARM Board (UR-3955)

1. Remove the rear enclosure and separate the front and rear sections. Then remove LCD unit together with the main chassis. For details, refer to steps 1 to 3 of “Replacing the Touch Screen”.
2. Remove the two BH3 × 10 screws of (1). Then remove the alarm indicator and alarm board (UR-3955) from the front enclosure.



## Removing the Operation Board, Record Key Board and Power SW Board (UR-3954/3984/3953)

1. Remove the rear enclosure and separate it from the front section. Then remove the LCD unit together with the main chassis. For details, refer to steps 1 to 3 of “Replacing the Touch Screen”.
2. Remove the two PS3 × 6 screws of (1) and power SW board (UR-3953). Remove the record key board (UR-3984) and operation board (UR-3954) which are mounted on protrusions of the front enclosure.



## Disassembling the Main Unit (MU-651R/671R)

### CAUTION

- Before performing replacement, be sure to turn off the power switch.
- Disconnect the power cord and the connection cables.
- When replacing the boards, be sure to confirm the dip switch settings.

Tools required: A Phillips-head screwdriver\* (for M3 and M4), a flathead screwdriver, hexagon wrenches (5), and tweezers

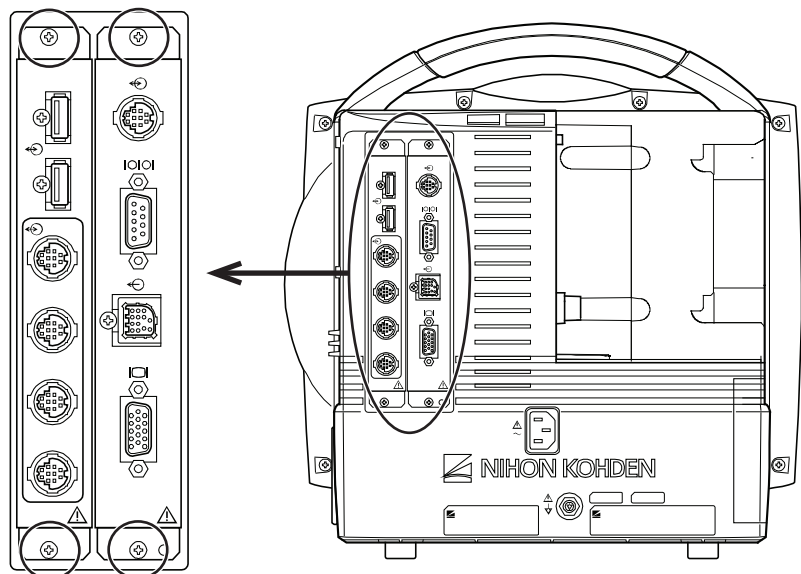
\* The shaft of the Phillips-head screwdriver must be at least 10 cm long to remove the power supply unit.

### Removing the Rear Enclosure

#### Removing the Optional Interfaces (QI-671P/672P)

Remove the optional QI-671P and QI-672P interfaces if installed.

1. Remove the four BH3 × 6 screws.



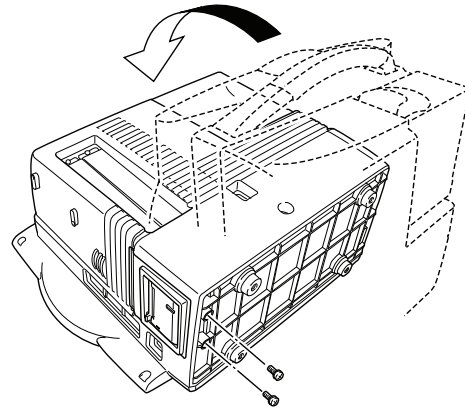
2. Insert the flathead screwdriver between the two optional boards and pull them out.



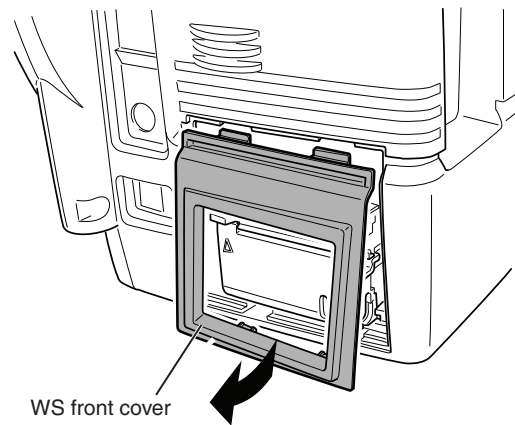
**Removing the Recorder Module (WS-671P)**

Remove the WS-671P recorder module if installed.

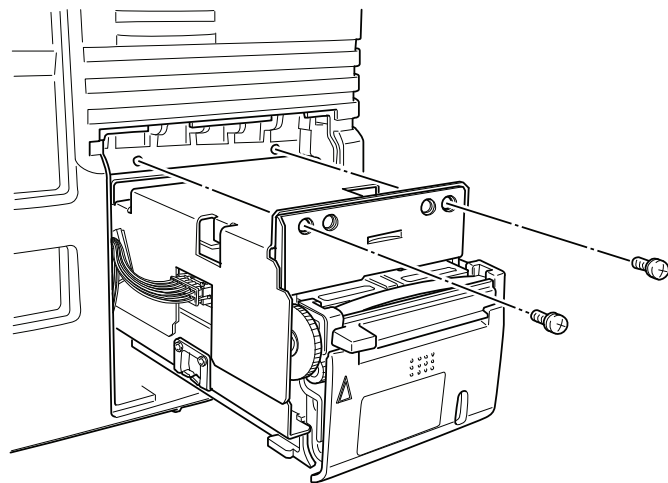
1. Lay the monitor face down and remove the two BH3 × 6 screws from the bottom of the bedside monitor.



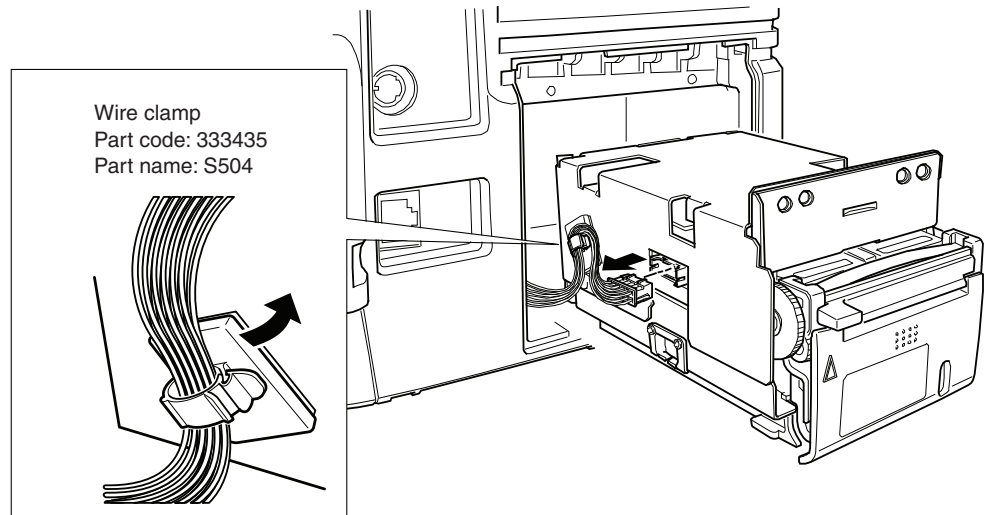
2. Remove the WS front cover.



3. Remove the two PS3 × 6 screws fixing the recorder module to the bedside monitor.



4. Pull out the the recorder module. Remove the internal cable from the wire clamp and from the connector connected to the recorder module.



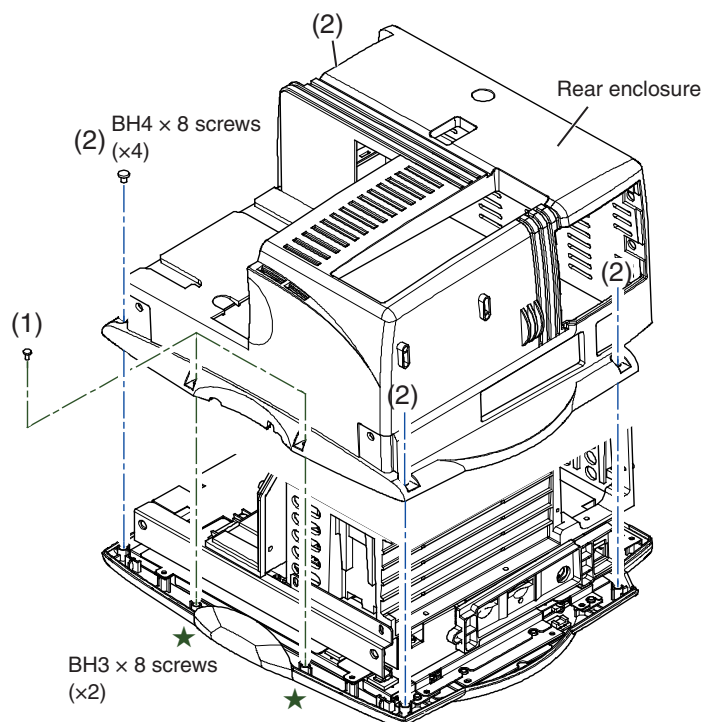
### Removing the Handle

Use the flathead screwdriver to remove the two screw covers from the right and left ends of the handle. Use the hexagon wrench to remove the two M6 × 16 hexagon screws. Then remove the handle. For details, see “Removing the Handle.”

### Removing the Rear Enclosure

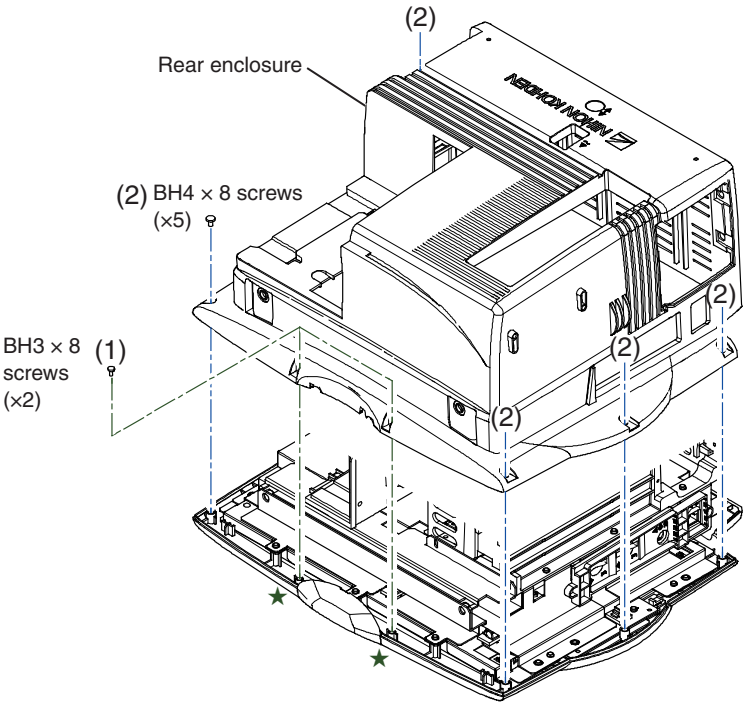
#### MU-651R

1. Lay the monitor face down.
2. Remove the two BH3 × 8 screws of (1) and the four BH4 × 8 screws of (2) from the rear side of the unit.



**MU-671R**

- 1. Lay the monitor face down.
- 2. Remove the two BH3 × 8 screws of (1) and five BH4 × 8 screws of (2) from the rear side of the monitor.



- 3. On MU-651R or MU-671R, insert the flathead screwdriver between the alarm indicator and the rear enclosure, and remove the rear enclosure.



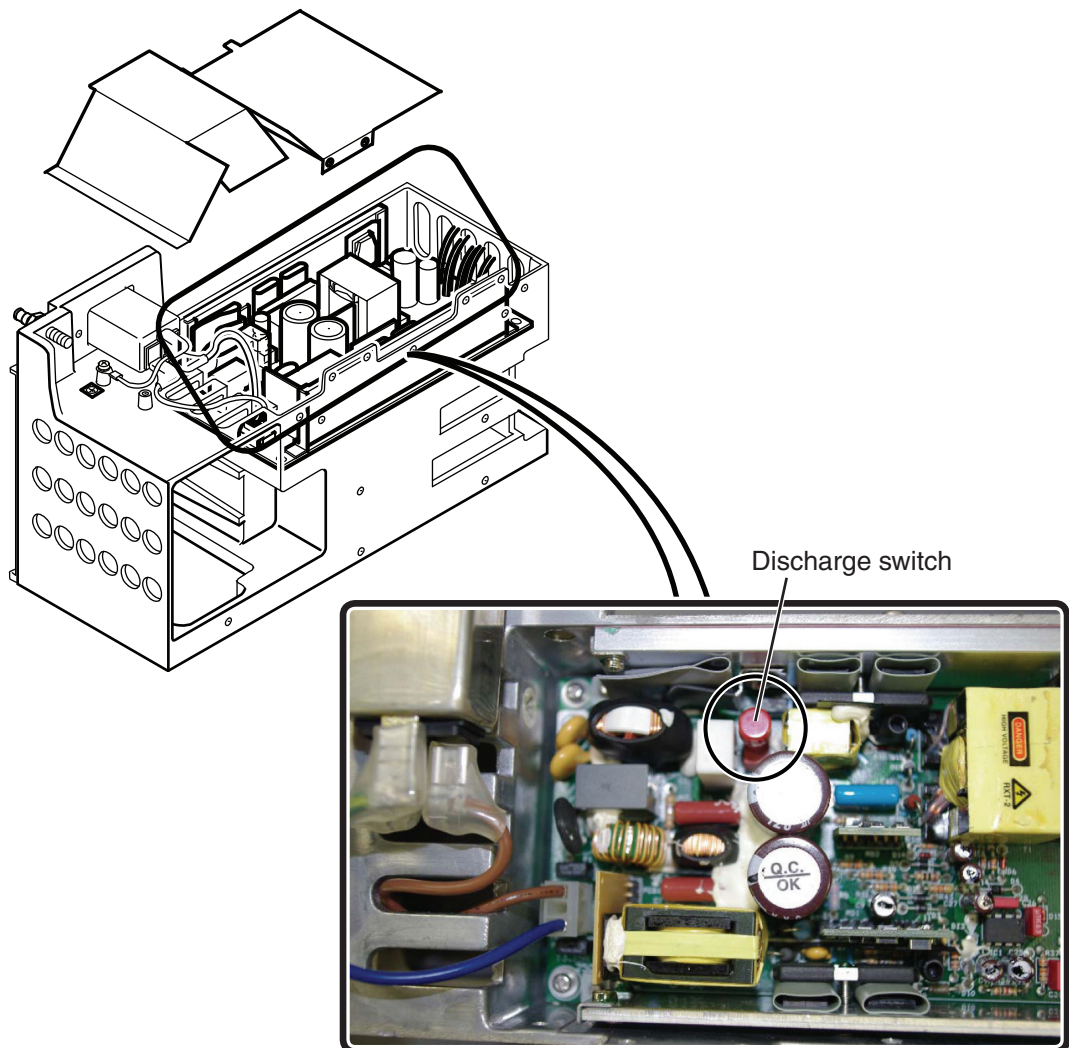
## Removing the SC-671R Power Unit from the Heat Sink Block

### CAUTION

Before starting the maintenance work, pull out the power cord from the unit and press the red discharge switch in the figure below. Be careful not to touch the conductive areas around the switch with your finger.

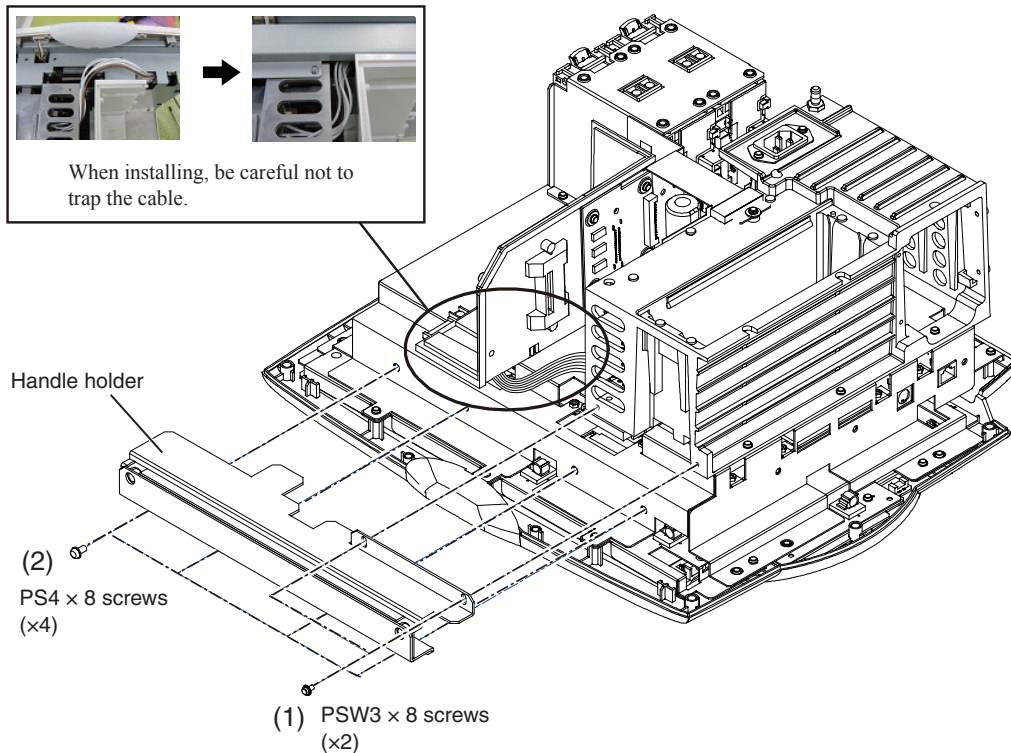
### CAUTION

Never press the red discharge switch before pulling out the power cord.

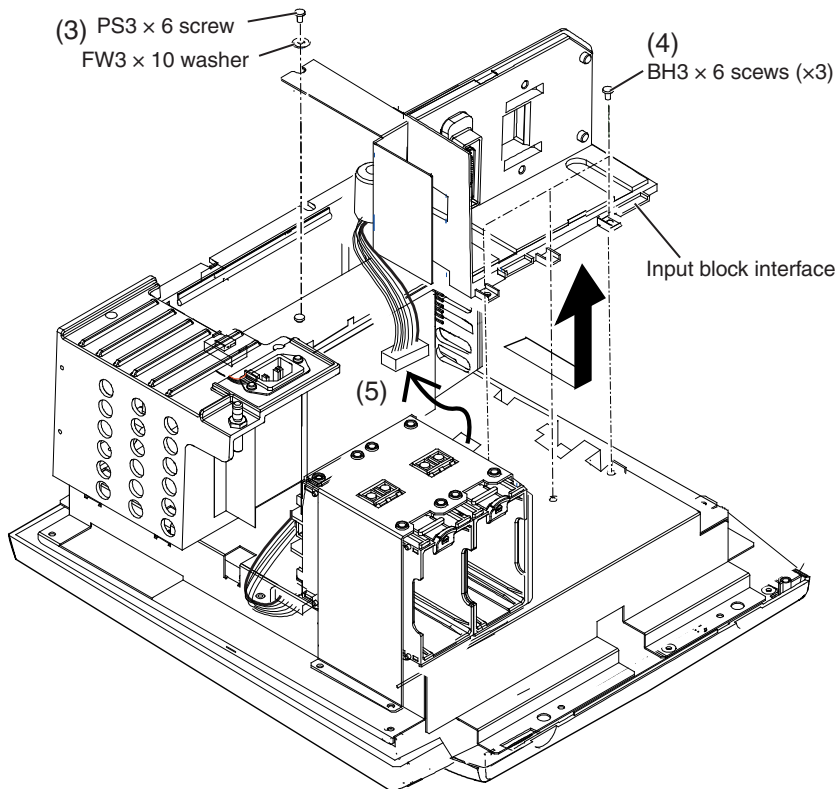


1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.

- Remove the two PSW3 × 8 screws of (1) and the four PS4 × 8 screws of (2). Then remove the handle holder.

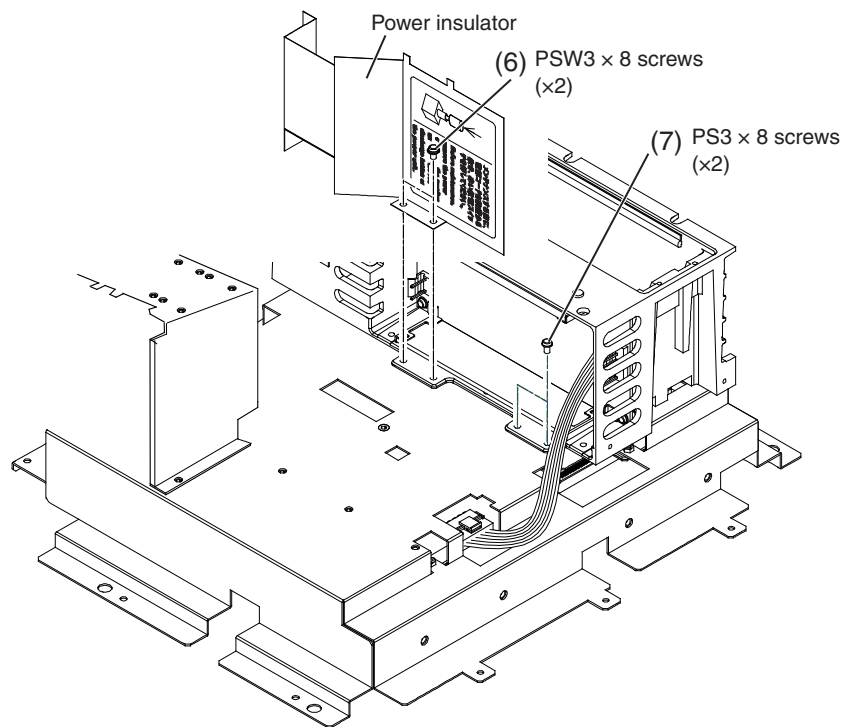


- Remove the PS3 × 6 screw and the FW3 × 10 BSBM washer of (3) and the three BH3 × 6 screws of (4). Slide the input block interface in the direction indicated with the arrow and lift it upward.
- Remove the cable connector of (5) from the MAIN DIGITAL board and remove the input block interface.

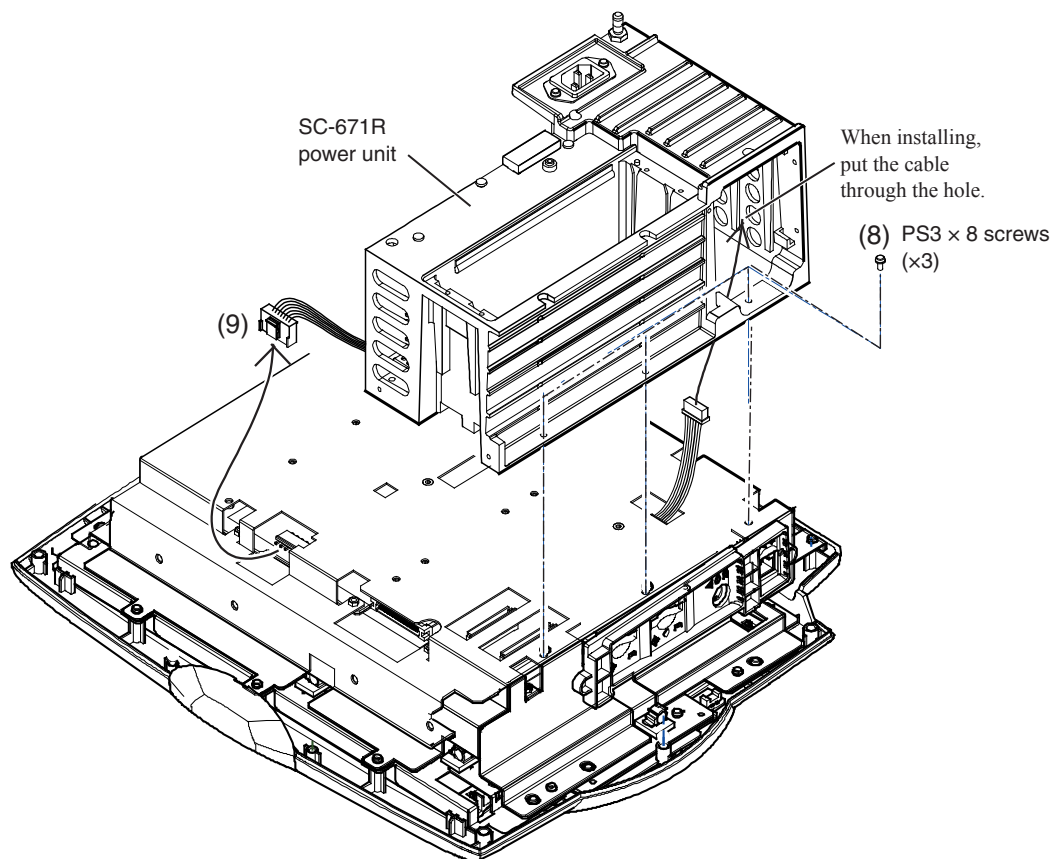


## 5. DISASSEMBLY AND ASSEMBLY

5. Remove the two PSW3 × 8 screws of (6) and the power insulator covering the power unit. Then remove the two PS3 × 8 screws of (7).



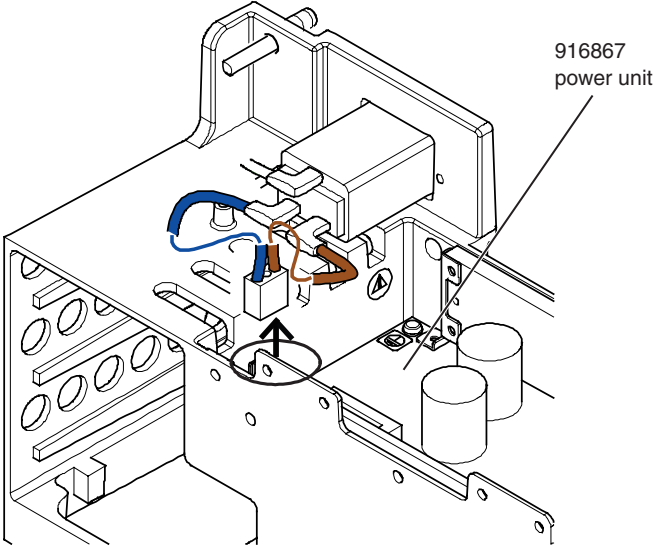
6. Remove the three PS3 × 8 screws of (8). Disconnect the power supply cable of (9) from the MAIN DIGITAL board and remove the power unit (SC-671R).



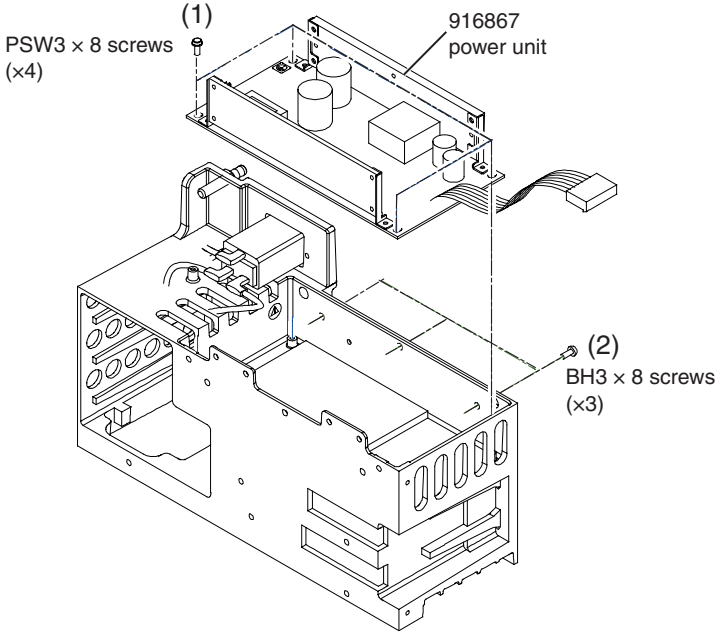


### Removing the 916867 Power Unit

- 1. Remove the power unit. For details, refer to “Removing the SC-671R Power Unit from the Heat Sink Block”.
- 2. Disconnect the cable connecting the AC inlet and the 916867 power unit from the SC-671R power unit.

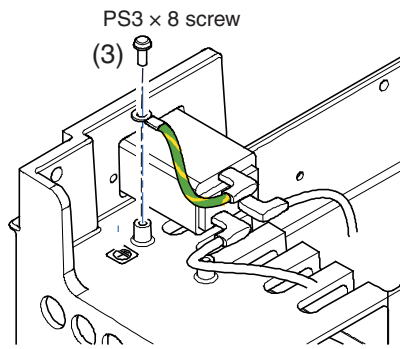


- 3. Remove the four PSW3 × 8 screws of (1) and three BH3 × 8 screws of (2). Then lift and remove the power unit (916867).

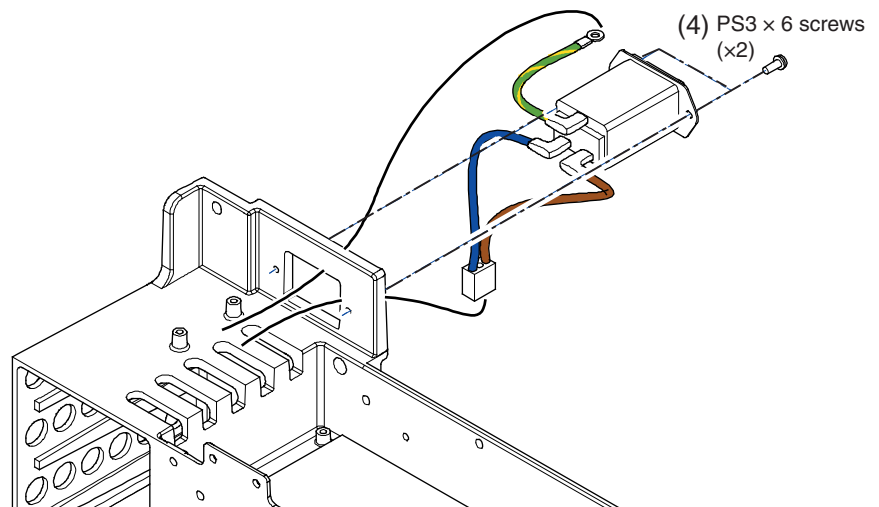


## 5. DISASSEMBLY AND ASSEMBLY

4. Remove the PS3 × 8 screw of (3) and remove the protective ground conductor.

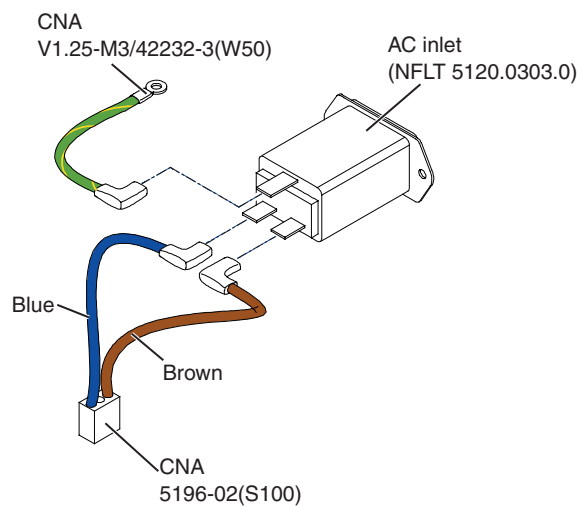


5. Remove the two PS3 × 6 screws of (4) and the AC inlet.



### NOTE

Pay attention to the cable colors while installing the AC inlet.



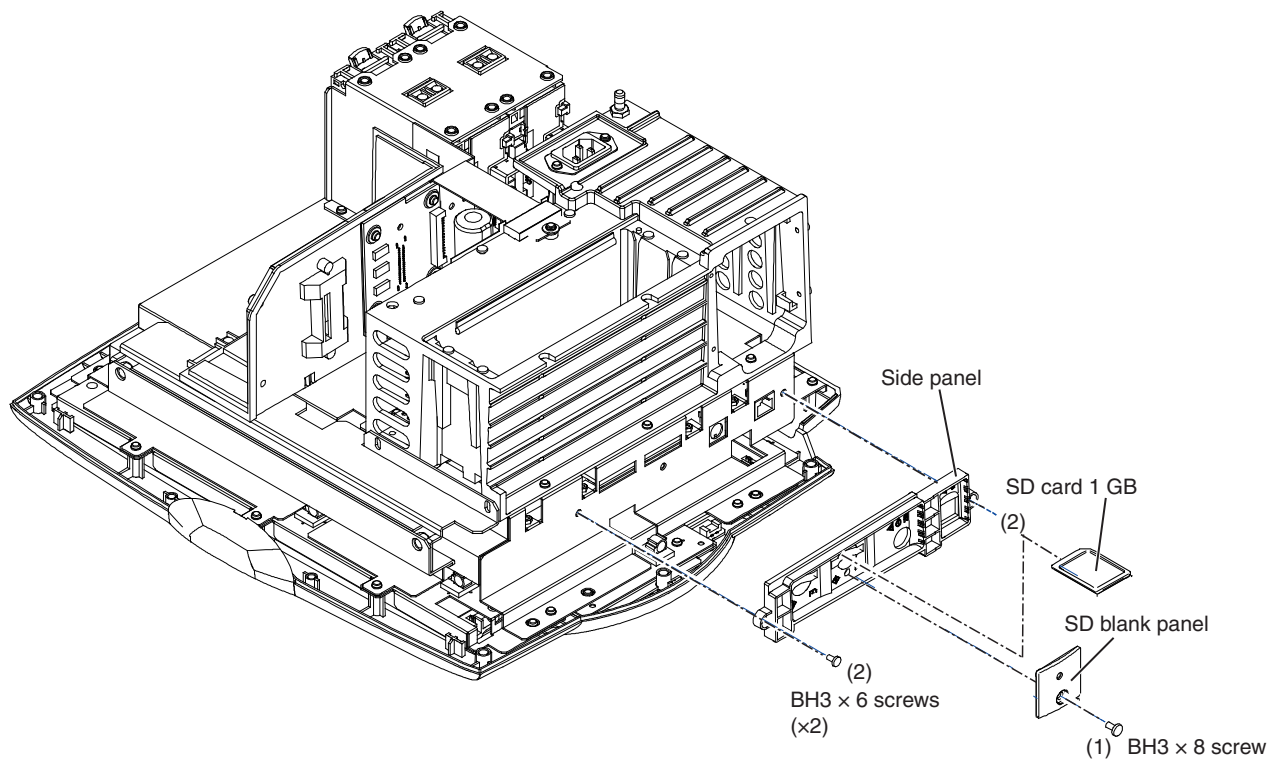


## Replacing the MAIN DIGITAL Board (UR-3945/39451)

### NOTE

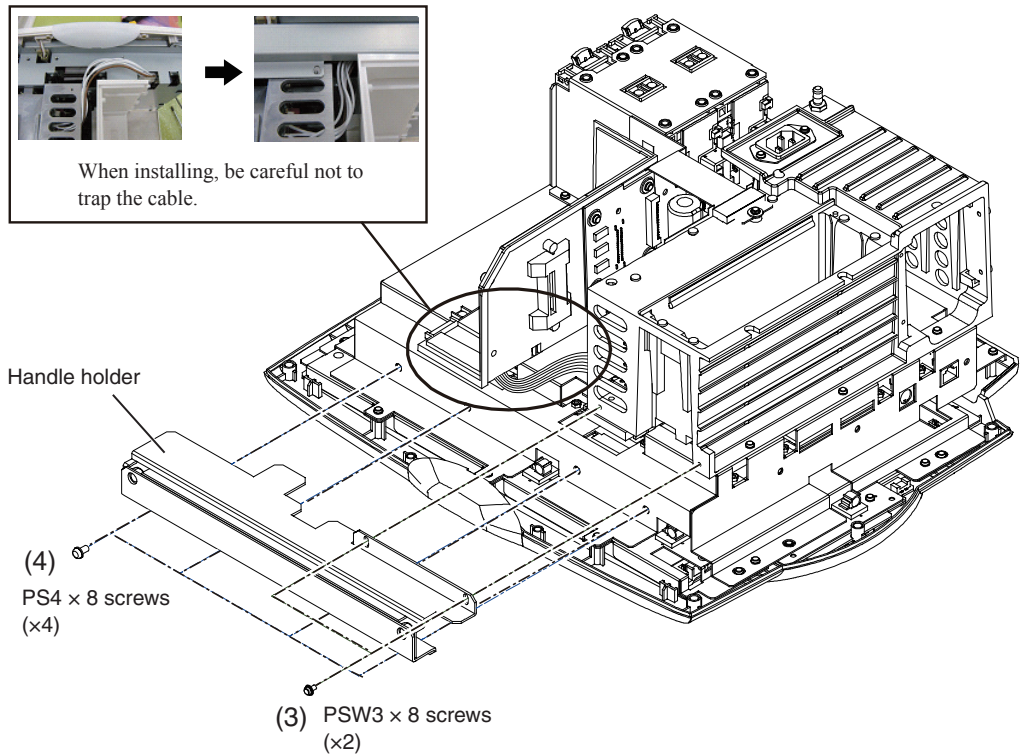
After replacing the MAIN DIGITAL board, calibrate the touch panel. Refer to the “Calibrating the Touch Panel” in Section 3.

1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.
2. Remove the BH3 × 8 screw of (1) and two BH3 × 6 screws of (2). Then remove the SD blank panel and side panel and pull out the SD card.

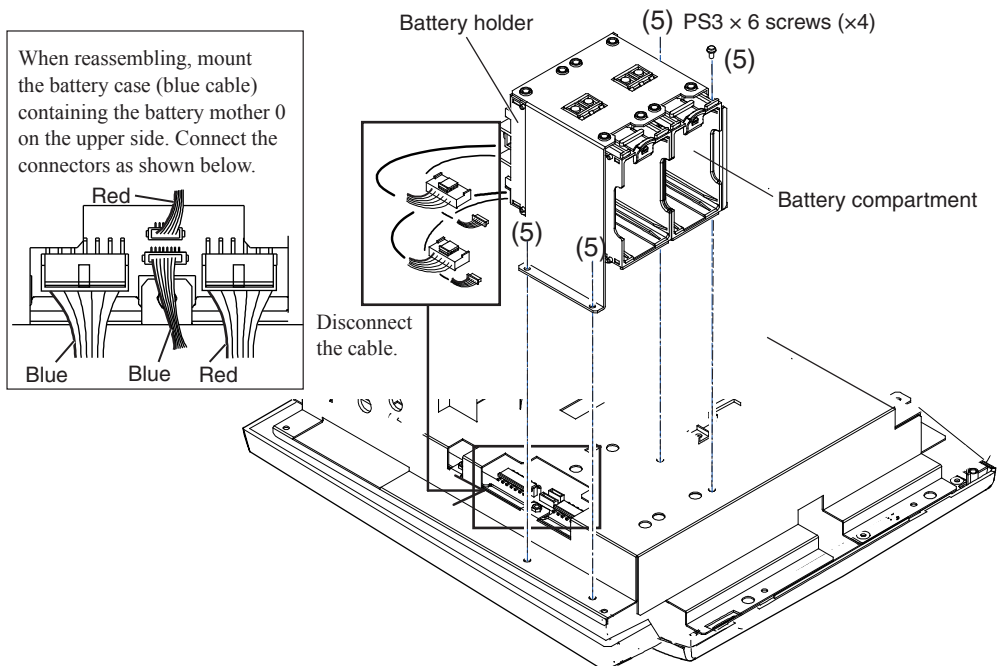


5. DISASSEMBLY AND ASSEMBLY

3. Remove the two PSW3 × 8 screws of (3) and the four PS4 × 8 screws of (4). Then remove the handle holder.

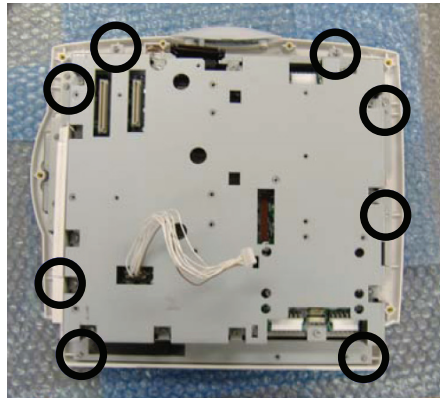


4. Remove the SC-671R power unit. For details, refer to “Removing the SC-671R Power Unit”.
5. Remove the four PS3 × 6 screws of (5) and remove the battery holder together with the battery compartment.

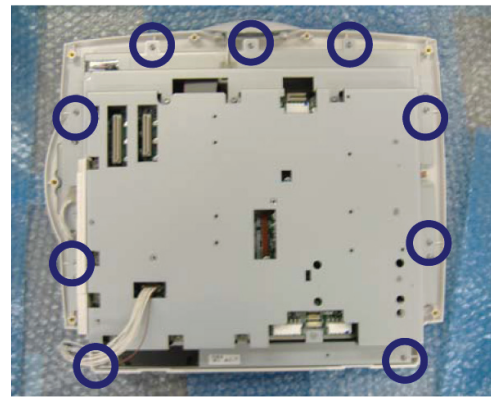


- Remove the eight PS3 × 6 screws for MU-651R, or the nine screws for MU-671R.

MU-651R

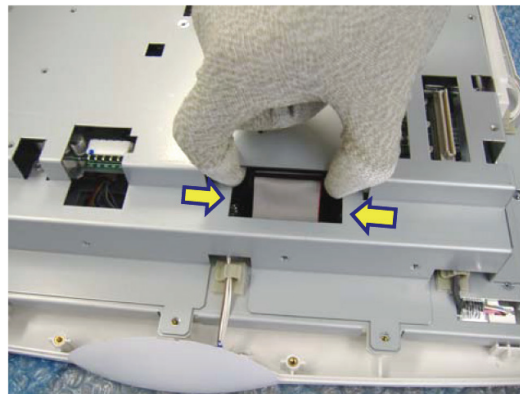


MU-671R



5

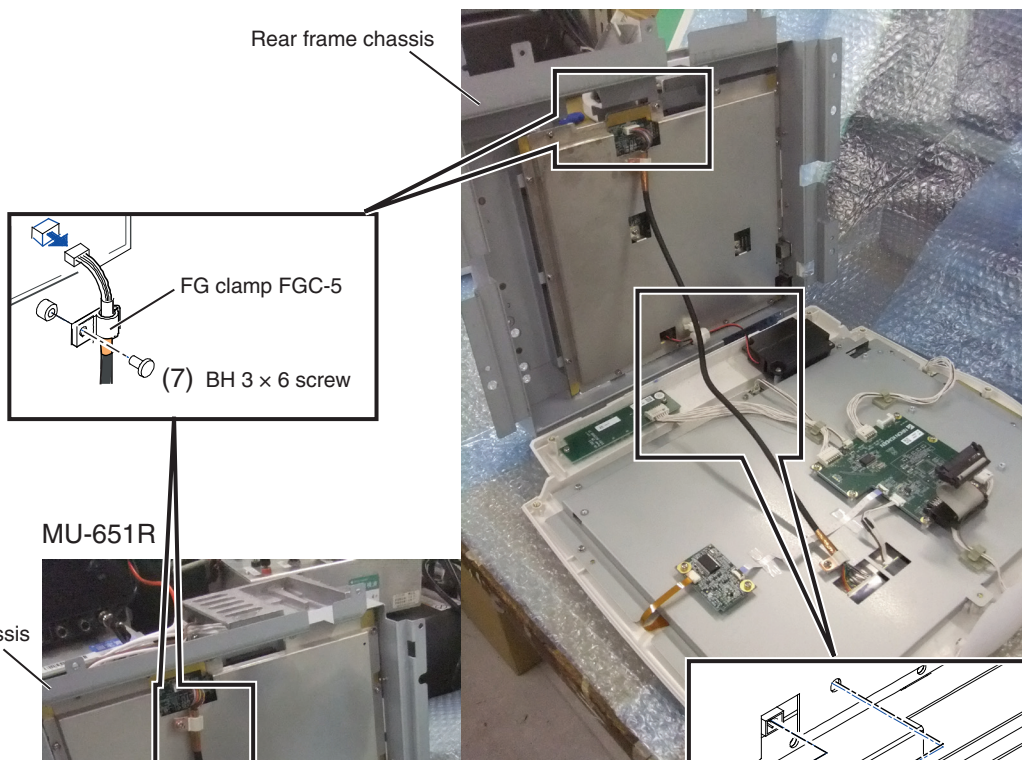
- Pinch the cable connector in the direction of the arrows shown below to release the lock. Remove the flat cable from the MAIN DIGITAL board connector.



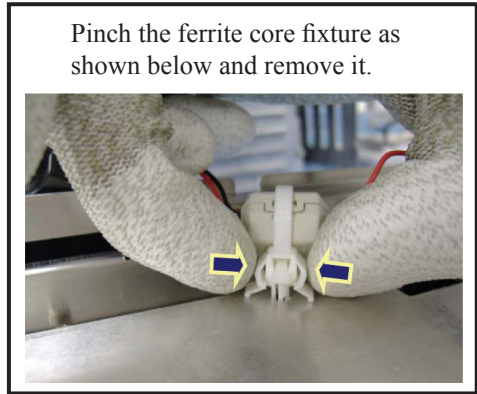
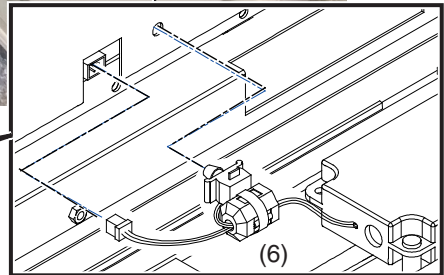
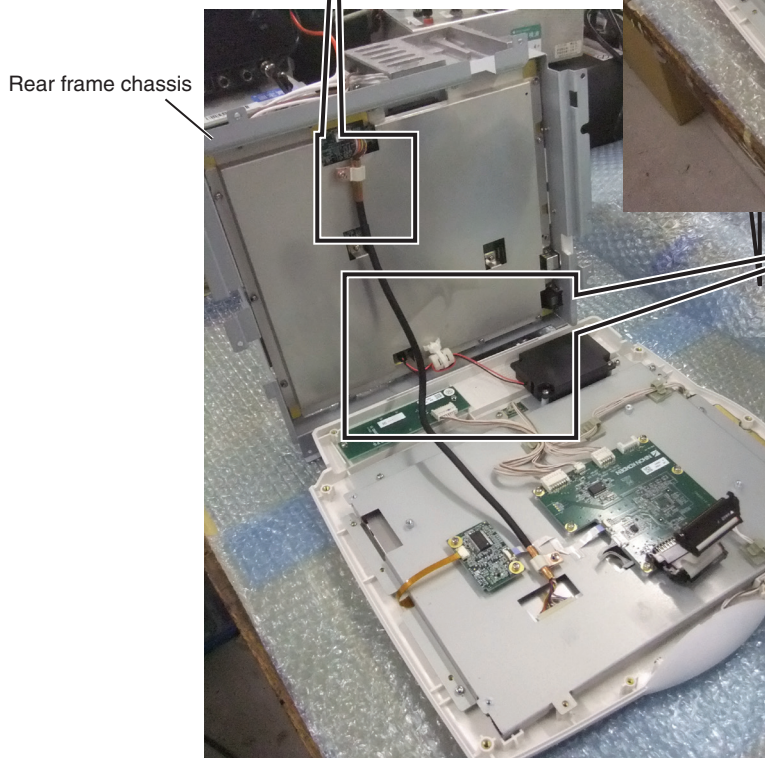
- Lift the rear frame chassis with attention paid to the internal wiring connecting the MAIN DIGITAL board and LCD.
- Pinch and remove the ferrite core fixture of (6) and disconnect the cable connecting the speaker from the MAIN DIGITAL board.
- Remove the BH3 × 6 screw of (7) that fixes the FG clamp. Then remove the cable connector connecting the LCD unit from the MAIN DIGITAL board.

5. DISASSEMBLY AND ASSEMBLY

MU-671R

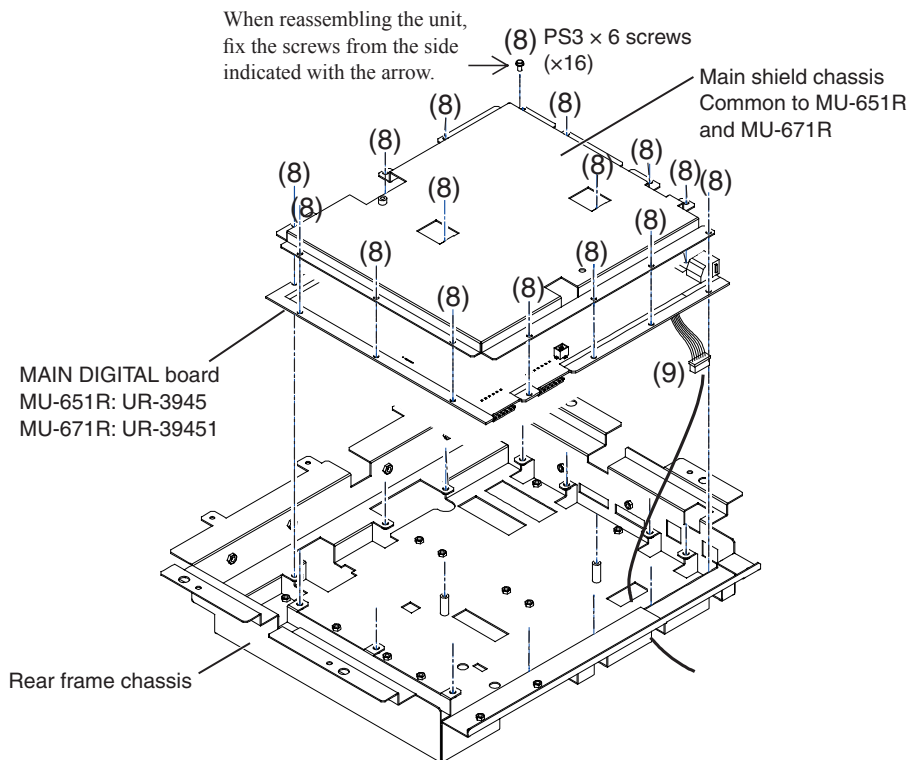


MU-651R

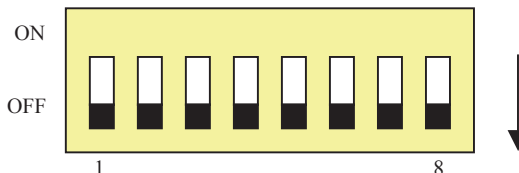




11. Remove the sixteen PS3 × 6 screws of (8) and lift and remove the main shield chassis. Remove the connector of (9) and remove the MAIN DIGITAL board from the rear frame chassis.



**Dip Switch (S17100) Settings of MAIN DIGITAL Board (UR-3945/39451)**



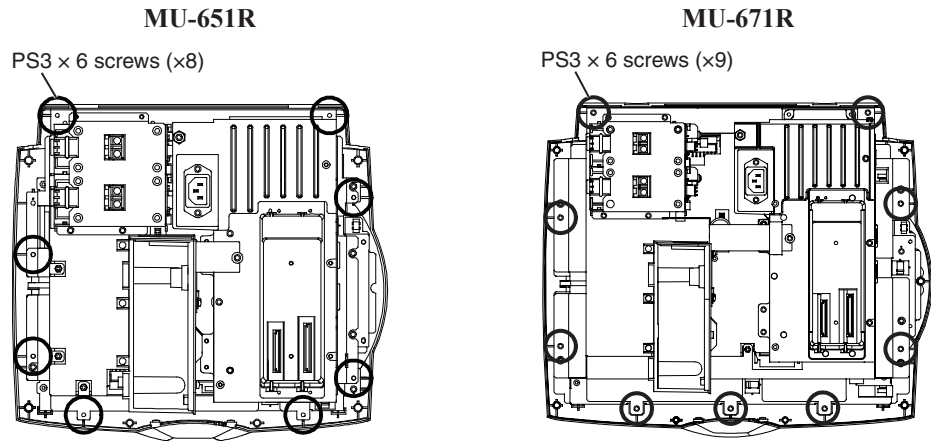
Bits 1 to 8 of the S17100 DIP switch on the board must be set to OFF.

**Removing the FRONT IF Board (UR-4284)**

1. Remove the rear enclosure. For details, refer to “Removing the Rear Enclosure”.
2. Remove the BH3 × 8 screw and the two BH3 × 6 screws. Then remove the SD blank panel and side panel and pull out the SD card. For details, refer to step 2 of “Replacing the MAIN DIGITAL Board (UR-3945/39451)”.
3. Remove the two PSW3 × 8 screws and four PS4 × 8 screws. Then remove the handle holder. For details, refer to step 3 of “Replacing the MAIN DIGITAL Board (UR-3945/39451)”.

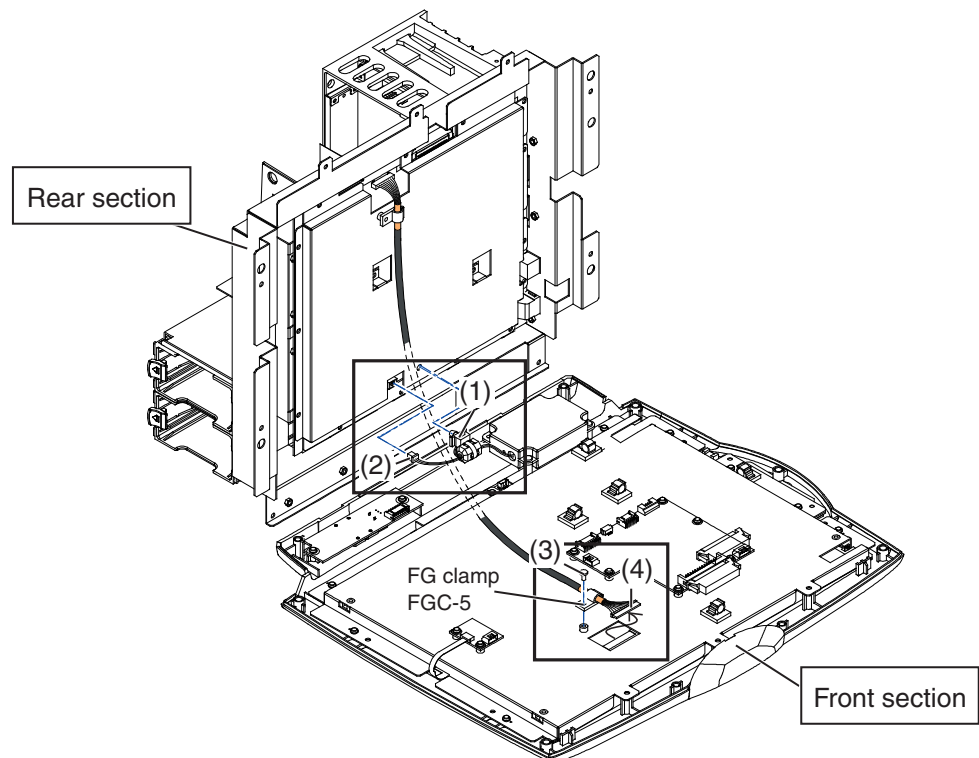
## 5. DISASSEMBLY AND ASSEMBLY

4. Remove the eight screws for MU-651R or nine PS3 × 6 screws for MU-671R. Positions of screws are indicated in the figures below.

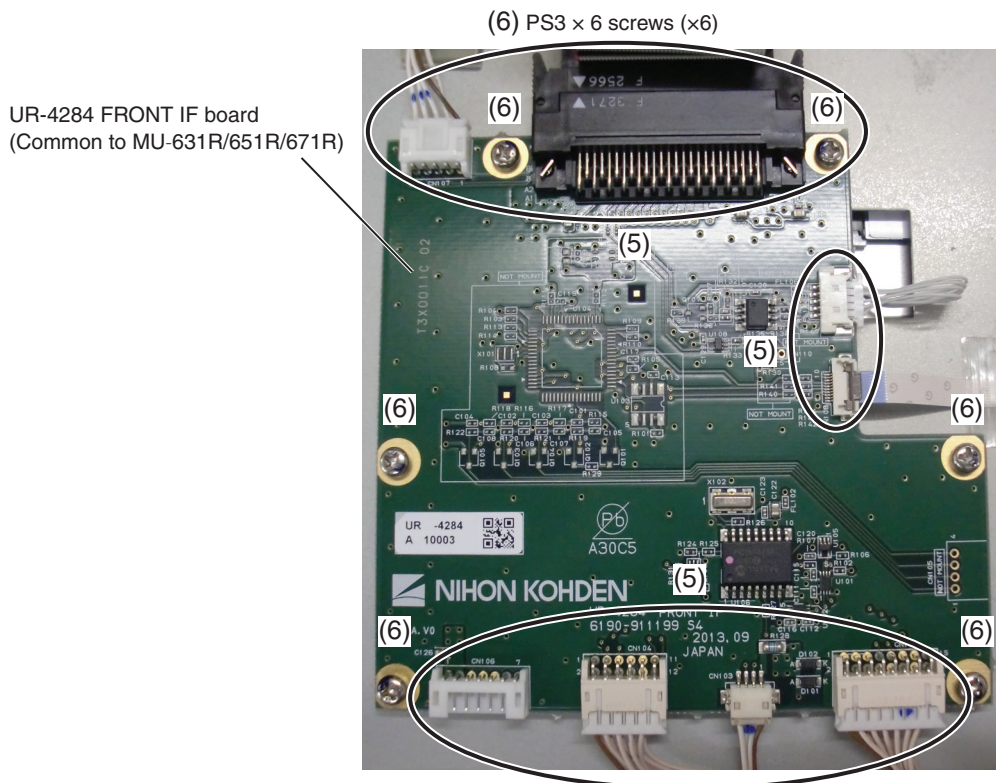


5. Remove the flat cable from the main board connector. For details, refer to step 7 of “Replacing the MAIN DIGITAL Board (UR-3945/39451)”.
6. Lift the rear frame chassis with attention paid to the internal wiring connecting the MAIN DIGITAL board and LCD.
7. Pinch and remove the ferrite core fixture of (1) and disconnect the cable of (2) connecting the speaker from the MAIN DIGITAL board. Remove the BH3 × 6 screw of (3) that fixes the FG clamp and remove the cable connector of (4) connecting the MAIN DIGITAL board from the LCD unit to separate the front and rear sections.

Example: MU-671R

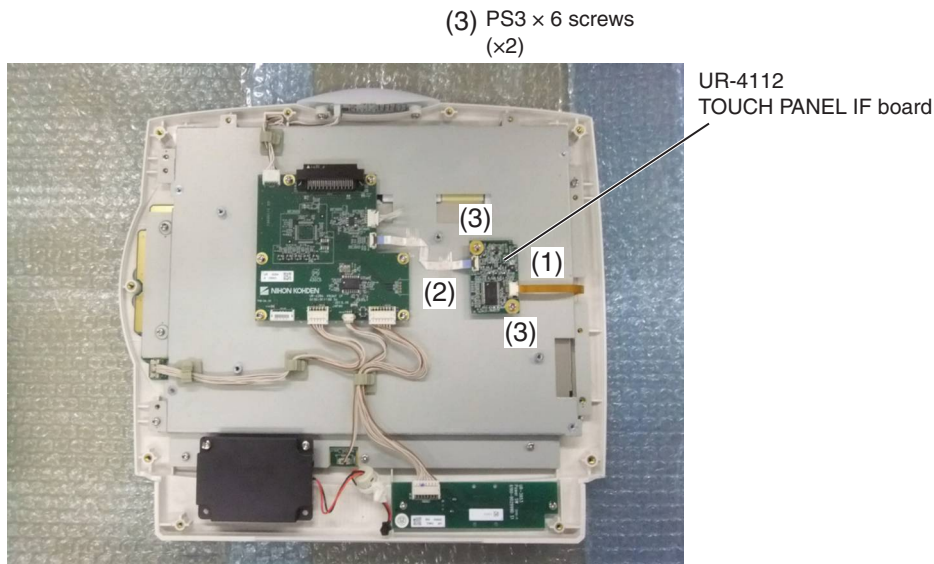


8. Disconnect all the seven cables of (5) from the FRONT IF board (UR-4284).
9. Remove the six PS3 × 6 screws of (6) and remove the FRONT IF board (UR-4284) from the main chassis M front A or main chassis MH front.



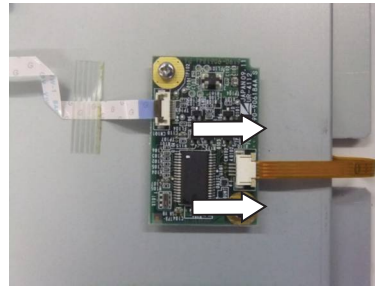
### Removing the TOUCH PANEL IF Board (UR-4112)

1. Remove the rear frame chassis and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-4284)”.
2. Remove the touch screen cable of (1) and (2) and two PS3 × 6 screws of (3). Then remove the TOUCH PANEL IF board from the main chassis.

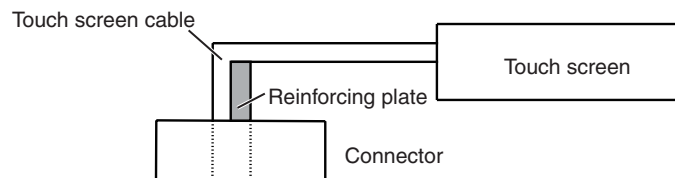


**NOTE**

- When removing the touch screen cable of (1), slide the black part of the connector.

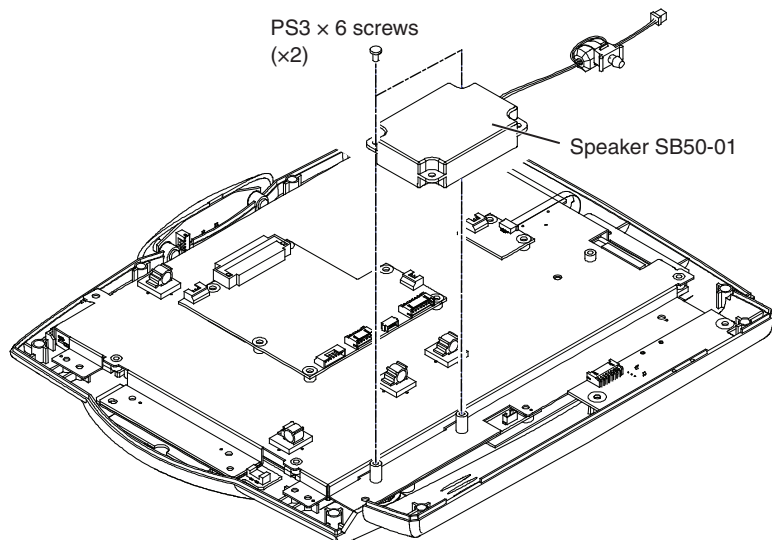


- Do not fold or bend the touch screen cable. The cable may break. On the connector insertion part, the reinforcing plate is attached. Take care to avoid excessive force while inserting the connector. Unnecessary removal and insertion of the connector may damage the touch screen.



## Removing the Speaker

1. Remove the rear frame chassis and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-4284)”.
2. Remove the two BH3 × 6 screws and speaker (SB50-01).

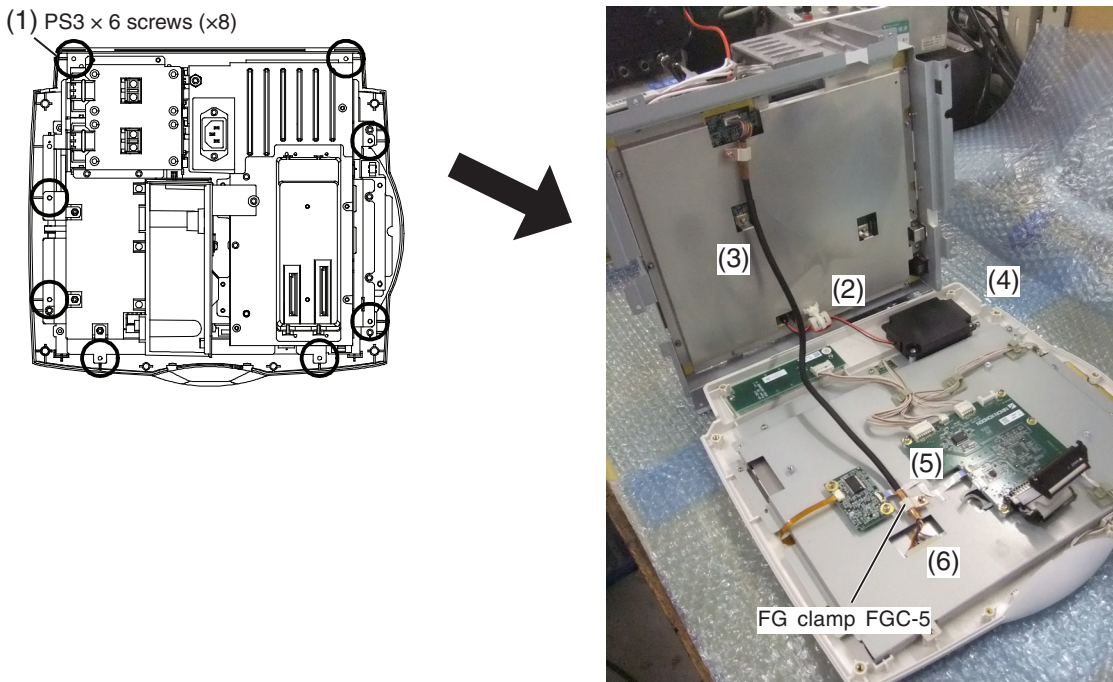




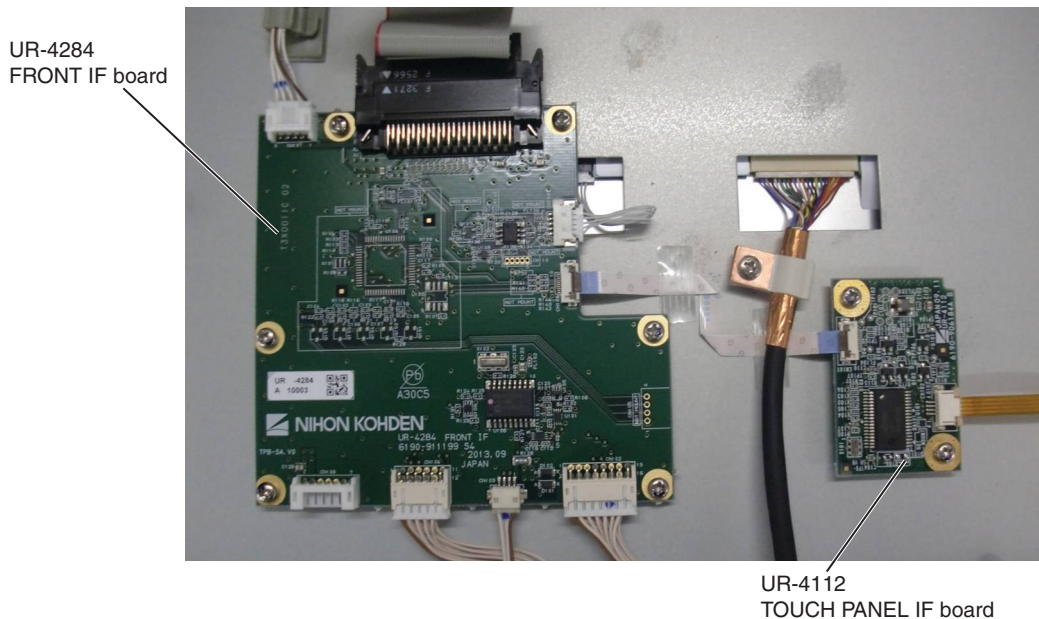
### Removing the LCD Unit

#### MU-651R

1. Remove the rear enclosure and eight PS3 × 6 screws of (1). Lift the rear frame chassis assy and remove the ferrite core fixture of (2) and the cable of (3) from the MAIN DIGITAL board (UR-3945). Then remove the PS3 × 6 screw of (4) and speaker. Remove the BH3 × 6 screw of (5) that fixes the FG clamp (FGC-5). Then remove the cable connector of (6) from the LCD unit and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-4284)”.



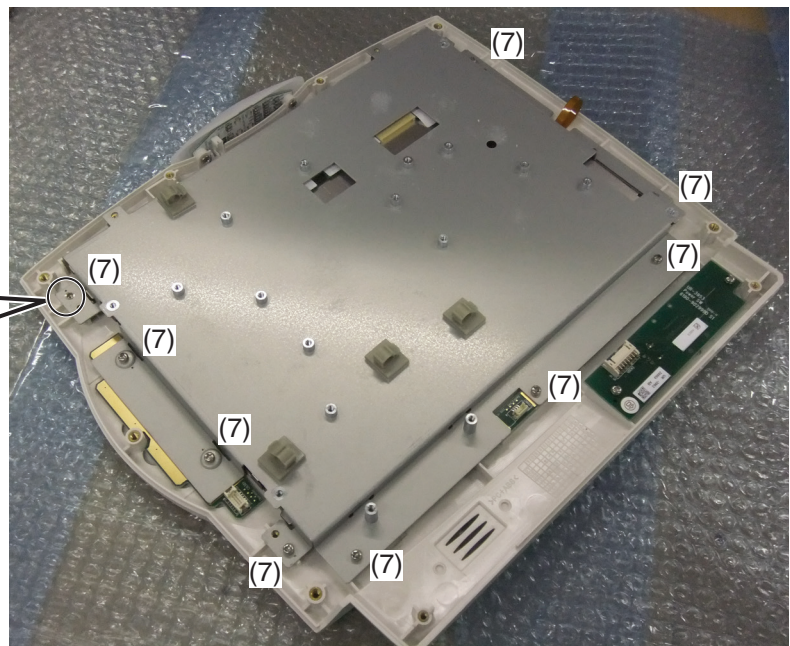
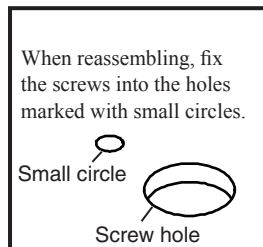
2. Remove the FRONT IF board. For details, refer to steps 8 and 9 of “Removing the FRONT IF Board (UR-4284)”.
3. Remove the TOUCH PANEL IF board. For details, refer to “Removing the TOUCH PANEL IF Board (UR-4112)”.



## 5. DISASSEMBLY AND ASSEMBLY

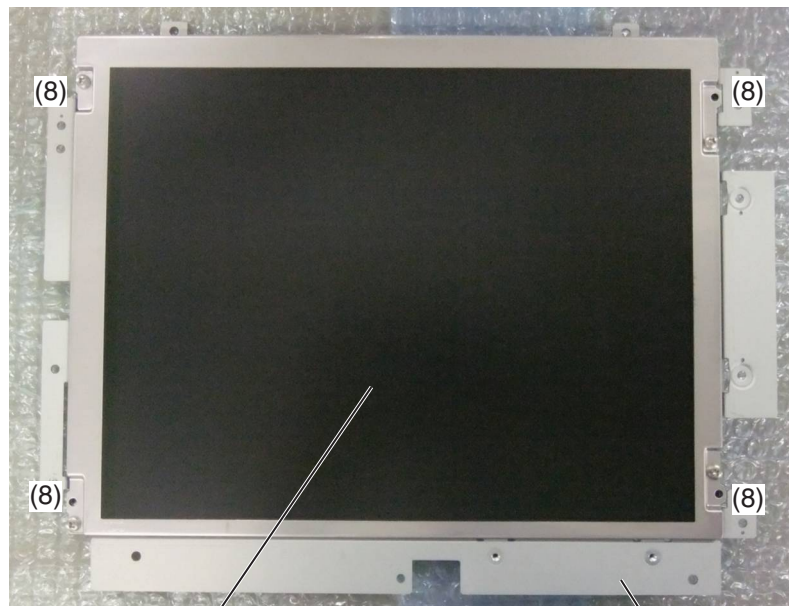
4. Remove the nine PS3 × 6 screws of (7).

(7) PS3 × 6 screws (×9)



5. Remove the four BH3 × 6 screws of (8) and then lift and remove the LCD unit.

(8) BH3 × 6 screws (×4)



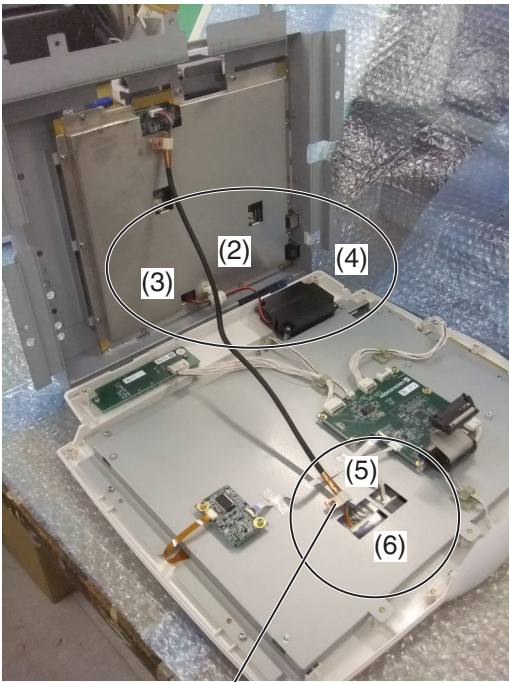
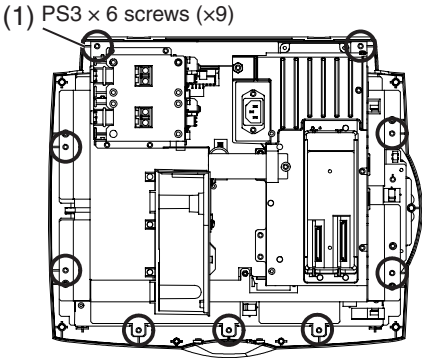
LCD unit  
G121SN01 V4 (Z)

Main chassis M front A



MU-671R

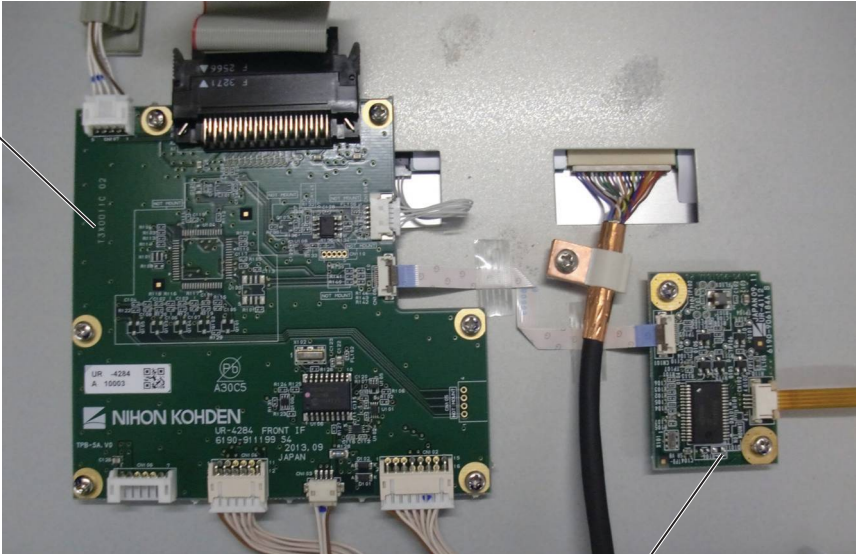
1. Remove the rear enclosure and nine PS3 × 6 screws of (1). Lift the rear frame chassis and remove the ferrite core fixture of (2) and cable of (3) from the MAIN DIGITAL board (UR-39451). Then remove the PS3 × 6 screw of (4) and speaker. Remove the BH3 × 6 screw of (5) that fixes the FG clamp. Then remove the cable connector of (6) from the LCD unit and separate the front and rear sections. For details, refer to steps 1 to 7 of “Removing the FRONT IF Board (UR-4284)”.



FG Clamp FGC-5

2. Remove the front IF board. For details, refer to steps 8 and 9 of “Removing the FRONT IF Board (UR-4284)”.
3. Remove the TOUCH PANEL IF board. For details, refer to “Removing the TOUCH PANEL IF Board (UR-4112)”.

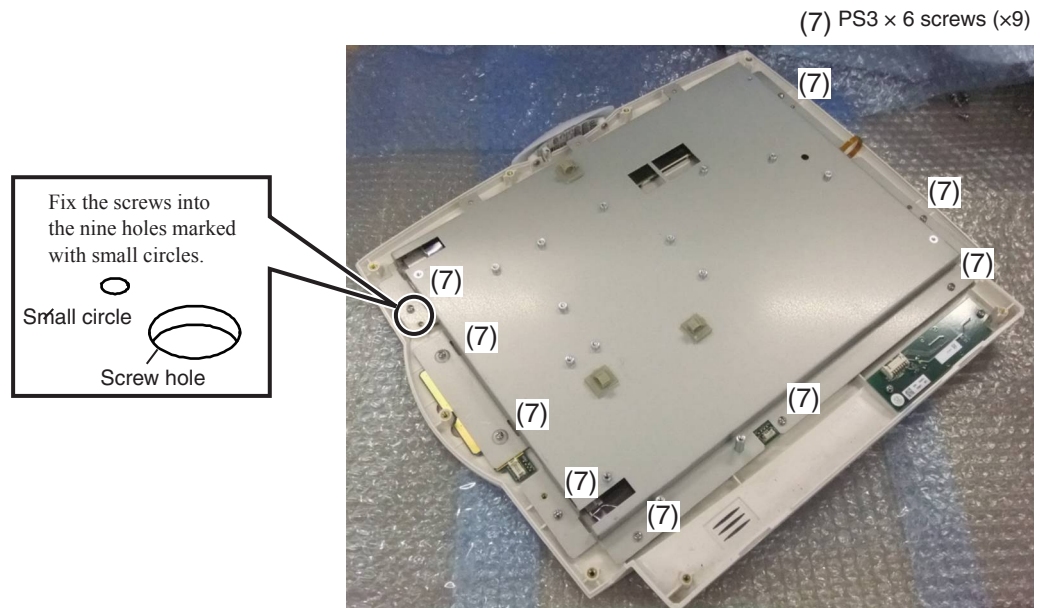
UR-4284 FRONT IF board



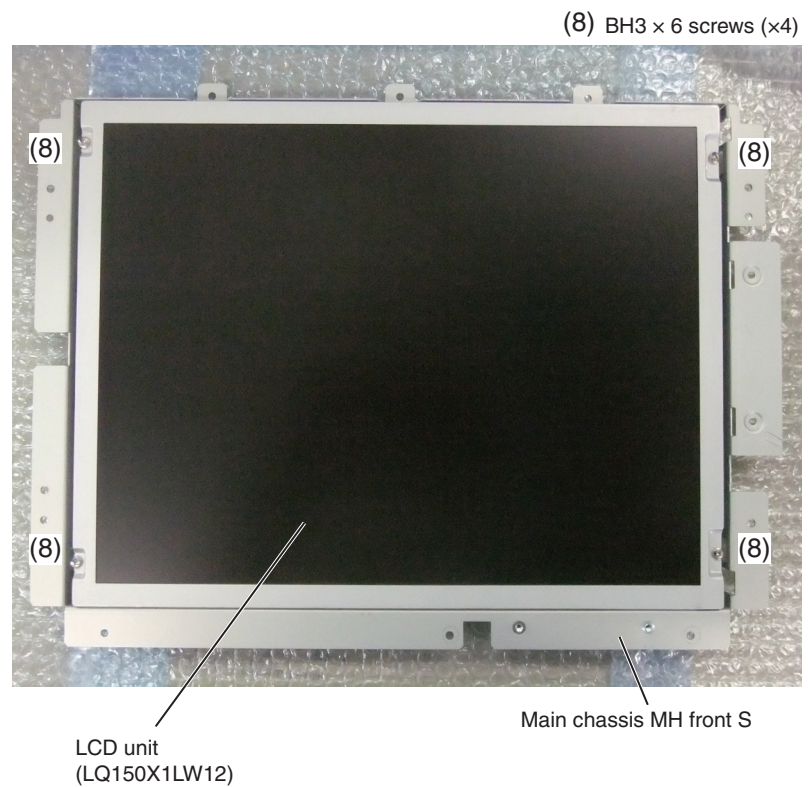
UR-4112 TOUCH PANEL IF board

## 5. DISASSEMBLY AND ASSEMBLY

- Remove the nine PS3 × 6 screws of (7) and then lift and remove the LCD unit together with the main chassis front.



- Turn the main chassis front upside down and remove the four BH3 × 6 screws of (8). Lift and remove the LCD unit.

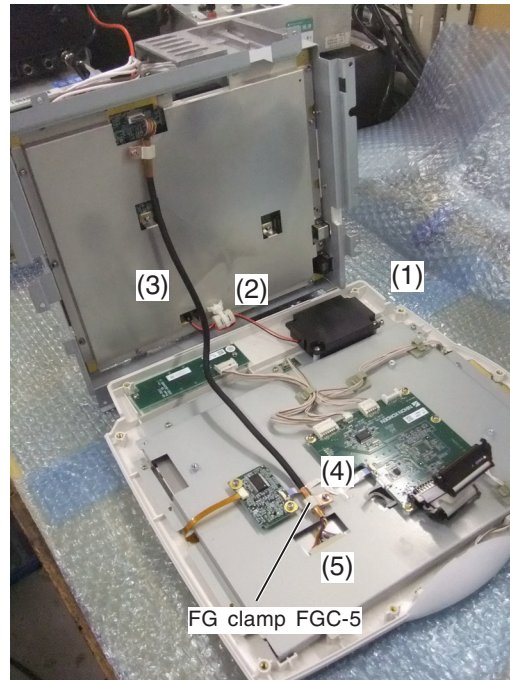




## Replacing the Touch Screen

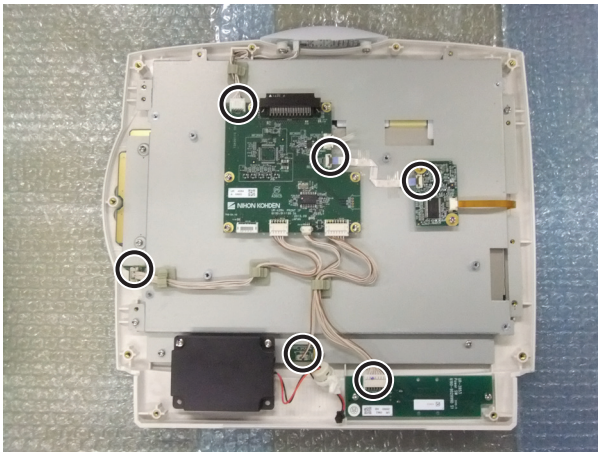
1. Remove the rear frame chassis and separate the front and rear sections. For details, refer to steps 1 to 6 of “Removing the FRONT IF Board (UR-4284)”.
2. Remove the two BH3 × 6 screws of (1). Remove the ferrite core fixture of (2) and connector (3), and then remove the speaker.
3. Remove the BH3 × 6 screw of (4) that fixes the FG clamp. Then remove the cable connector of (5) from the LCD unit.

5

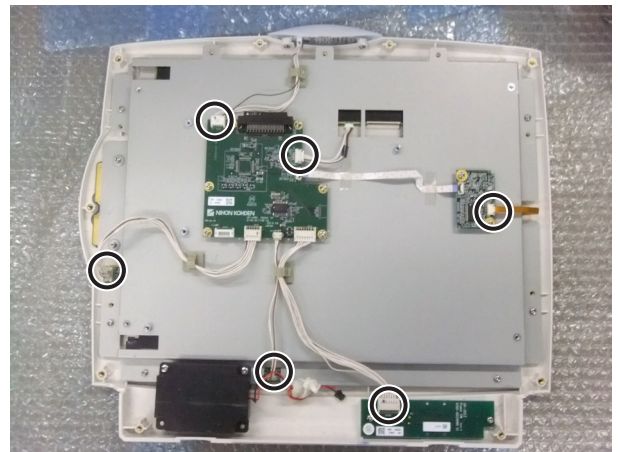


4. Remove the six cables shown below.

**MU-651R**

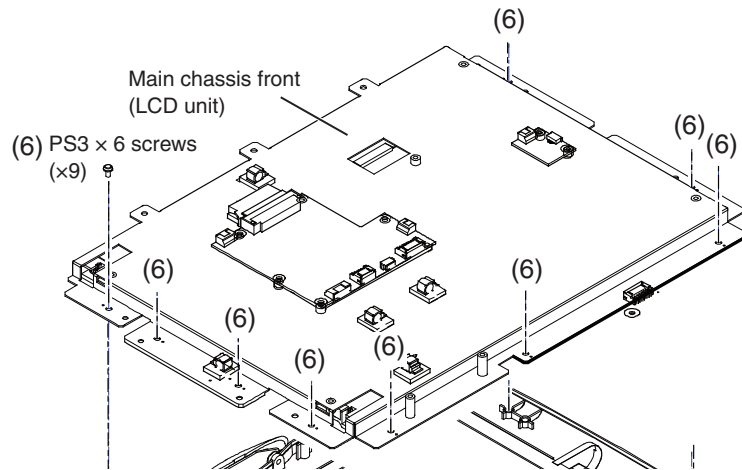


**MU-671R**

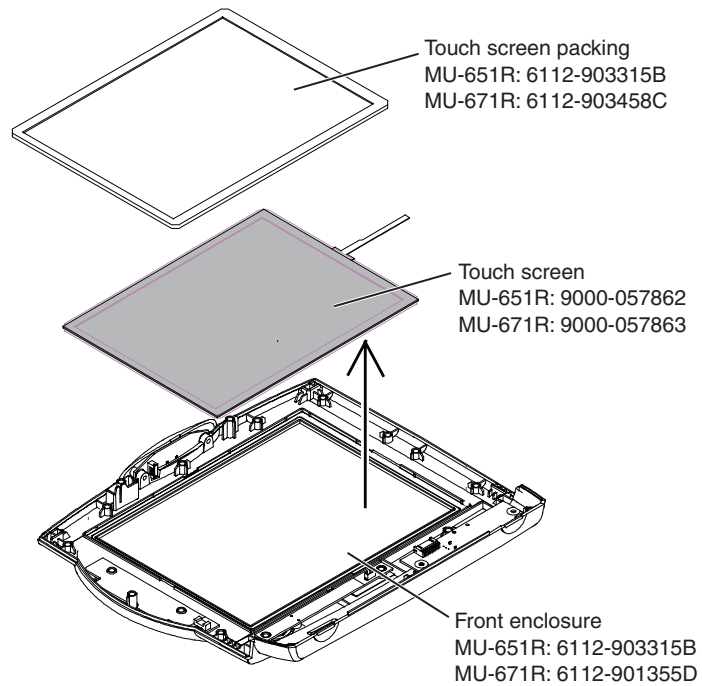


## 5. DISASSEMBLY AND ASSEMBLY

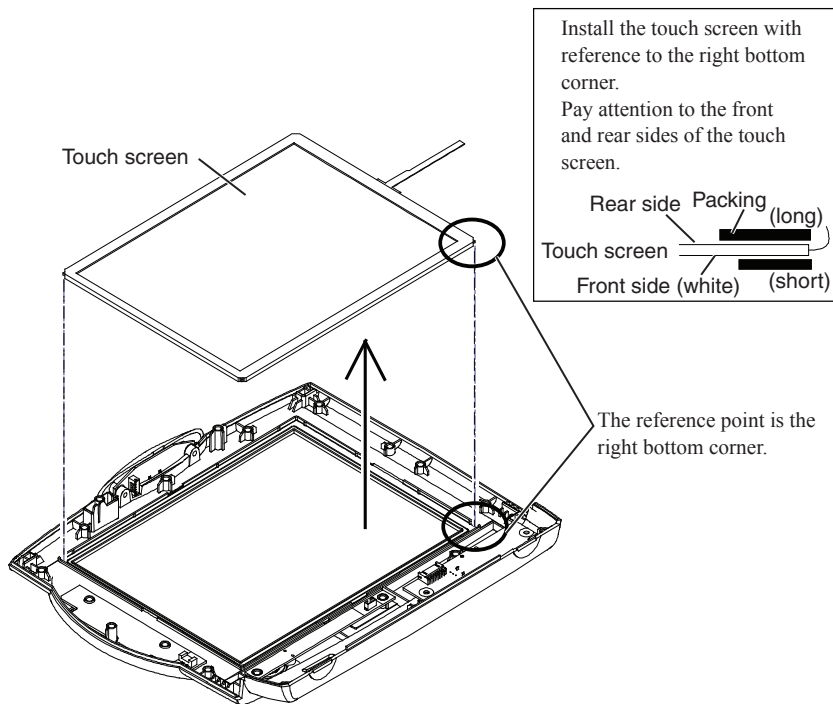
5. Remove the nine PS3 × 6 screws of (6) and remove the main chassis front.



6. Remove the touch screen from the front enclosure and the touch screen packing from the touch screen.



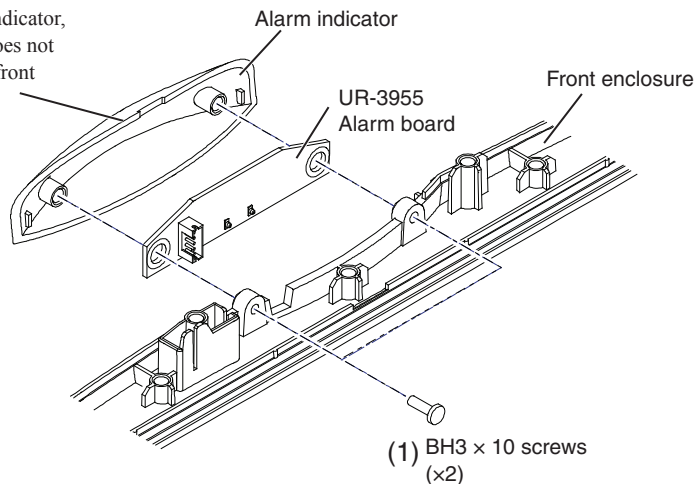
- When installing, place the touch panel with its rear side up, pass the cable of the touch screen through the packing, and attach the packing to the touch screen. Set the touch screen into the front enclosure with its front side up and with reference to the right bottom corner.



### Removing the ALARM Board (UR-3955)

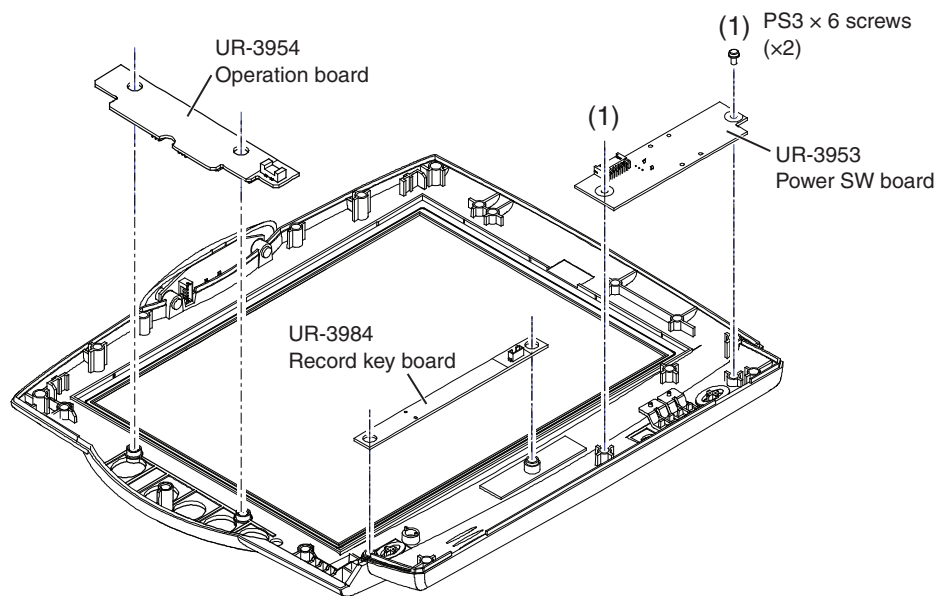
- Remove the rear enclosure and separate the front and rear sections. Then remove the LCD together with the main chassis. For details, refer to steps 1 to 4 of “Replacing the Touch Screen”.
- Remove the alarm indicator from the front enclosure. Remove the two BH3 × 10 screws of (1) and remove the alarm board (UR-3955).

When fixing this indicator, be careful that it does not protrude from the front enclosure.



### Removing the Operation Board, Record Key Board and Power SW Board (UR-3954/3984/3953)

1. Remove the rear enclosure and separate the front and rear sections. Then remove the LCD together with the main chassis. For details, refer to steps 1 to 4 of “Replacing the Touch Screen”.
2. Remove the five PS3 × 6 screws and two PSW × 6 screws. Then remove the LCD together with the main chassis from the front enclosure. For details, refer to “Removing the Touch Screen”.
3. Remove the two PS3 × 6 screws of (1) and power SW board (UR-3953). Remove the record key board (UR-3984) and operation board (UR-3954) which are mounted on protrusions of the front enclosure.





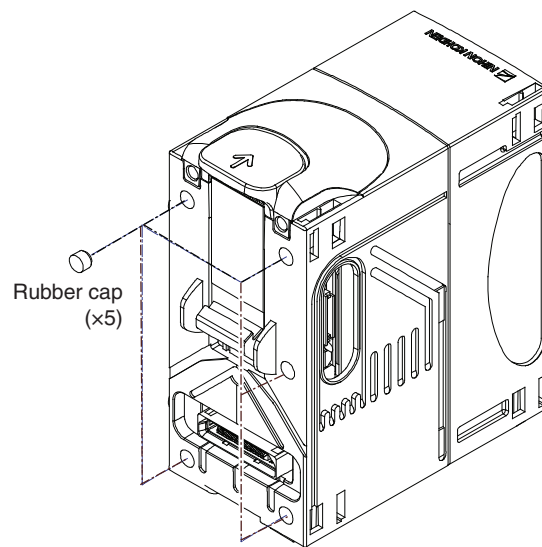
## Disassembling the Input Unit (AY-631P/633P/651P/653P/660P/661P/663P/671P/673P)

Tools required: A Phillips-head screwdriver (for M3 and M4), a Phillips-head screwdriver (M2), a flathead screwdriver, a flathead screwdriver (1.4 mm), a box screwdriver (AY-660P/661P/663P/671P/673P: 5.5 mm, AY-631P/633P/651P/653P: 5 mm) and tweezers

5

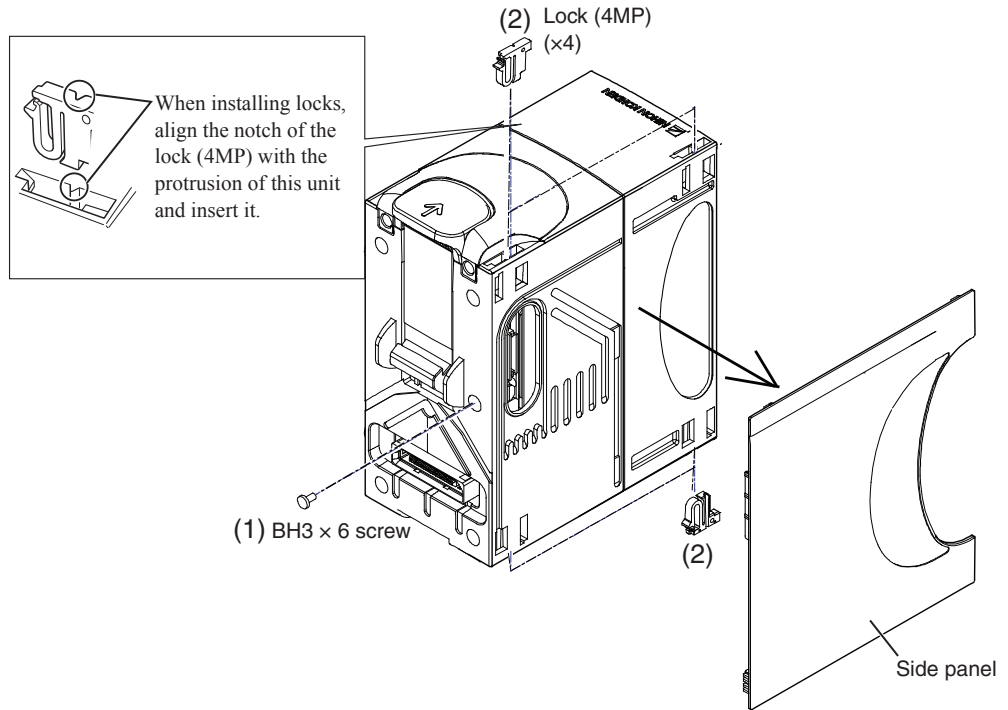
### Removing the Front Enclosure

1. Remove the five rubber caps from the rear side of the input unit.

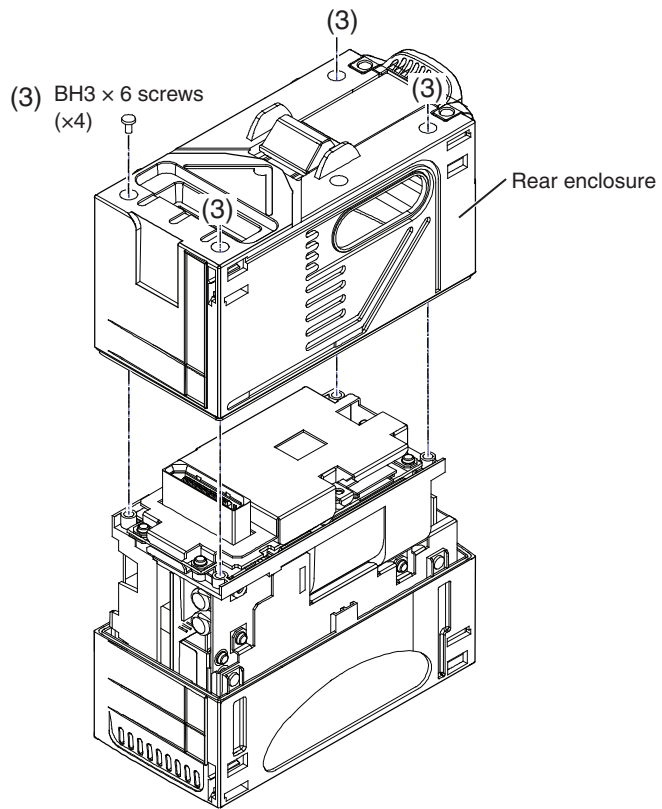


5. DISASSEMBLY AND ASSEMBLY

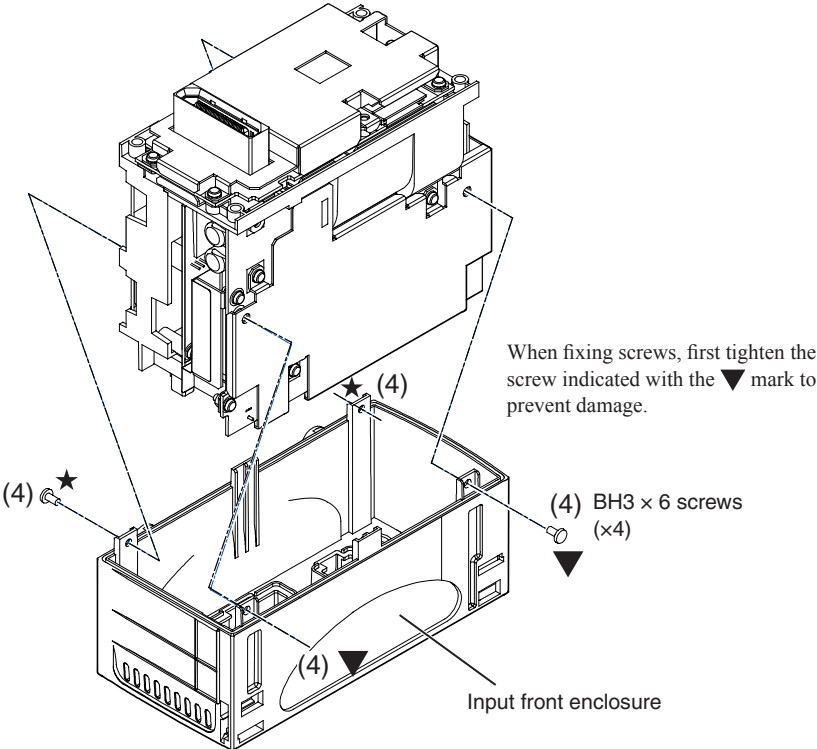
2. Remove the BH3 × 6 screw of (1). Use the flathead screwdriver (1.4 mm) to remove the two locks of (2) from both the top and bottom of the input unit. Then remove the side panel.



3. Remove the four BH3 × 6 screws of (3) and rear enclosure.

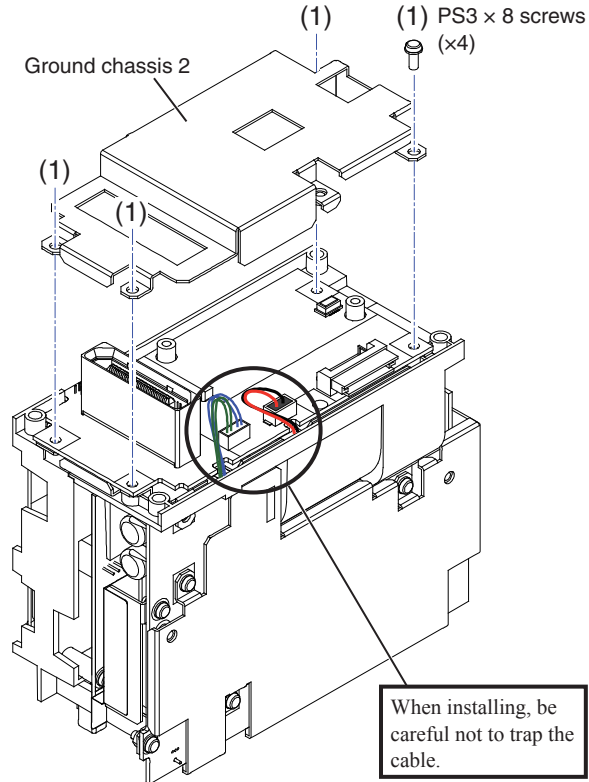


- 4. Remove the four BH3 × 6 screws of (4) and front enclosure. Remove the screws indicated with stars first.

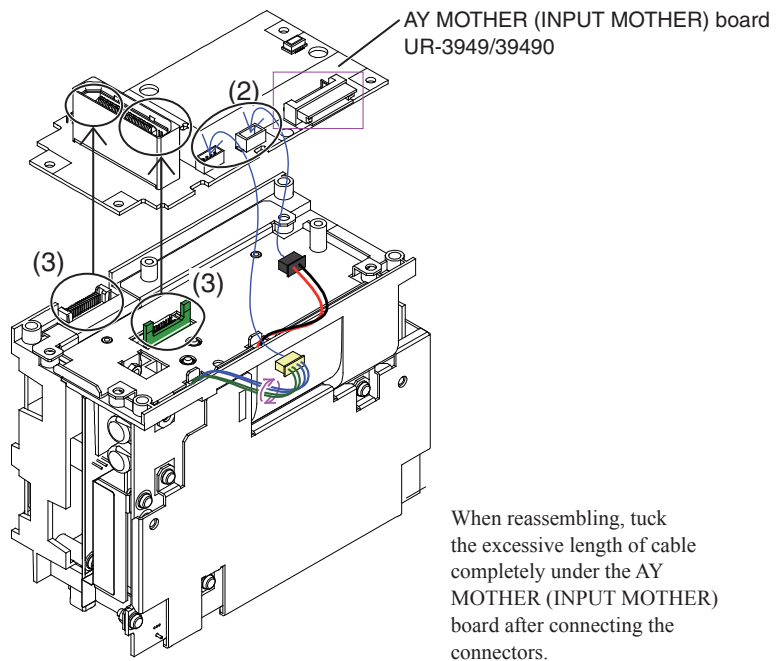


### Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)

1. Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.
2. Remove the four PS3 × 8 screws of (1) and ground chassis 2 from the rear side.

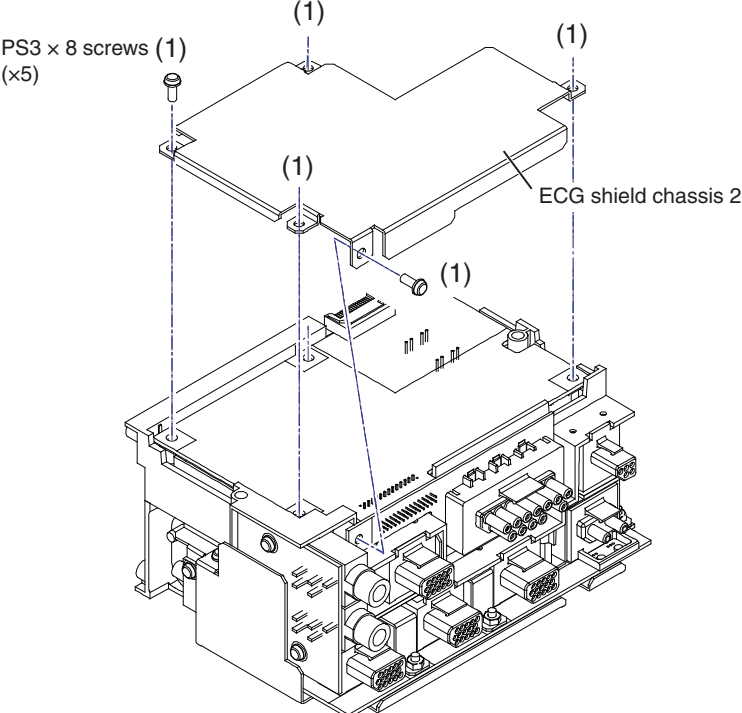


3. Remove the connectors of (2) connecting the cables to the pump and the solenoid valve. Lift the AY MOTHER (INPUT MOTHER) board, remove the two connectors of (3) connected on the rear side of the board, and remove the AY MOTHER (INPUT MOTHER) board.



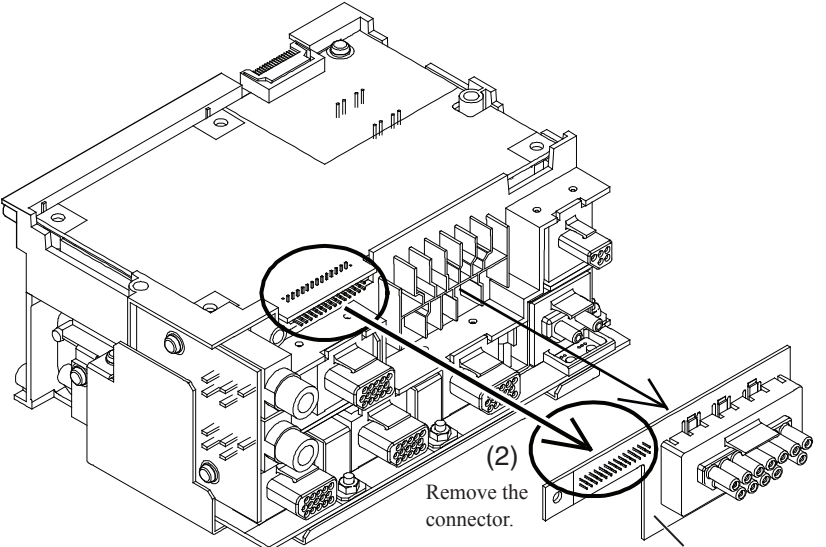
### Removing the ECG RESP Board (UR-3951/39510)

1. Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.
2. Remove the AY MOTHER (INPUT MOTHER) board (UR-3949/39490). For details, refer to “Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)”.
3. Remove the five PS3 × 8 screws of (1) and ECG shield chassis 2.



The above figure shows AY-663P.

4. Remove the ECG connector (UR-3950/39500) that is directly connected to the connector of (2).

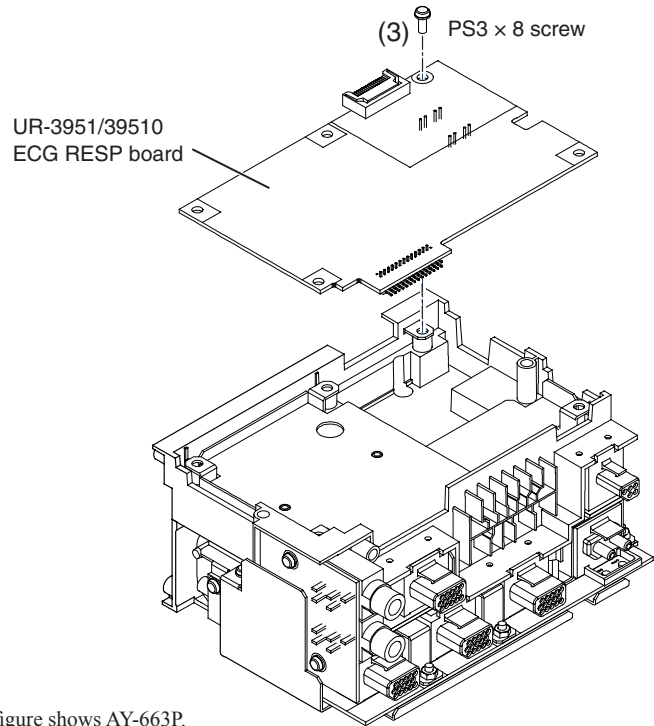


The above figure shows AY-673P.

UR-3950/39500 ECG connector

## 5. DISASSEMBLY AND ASSEMBLY

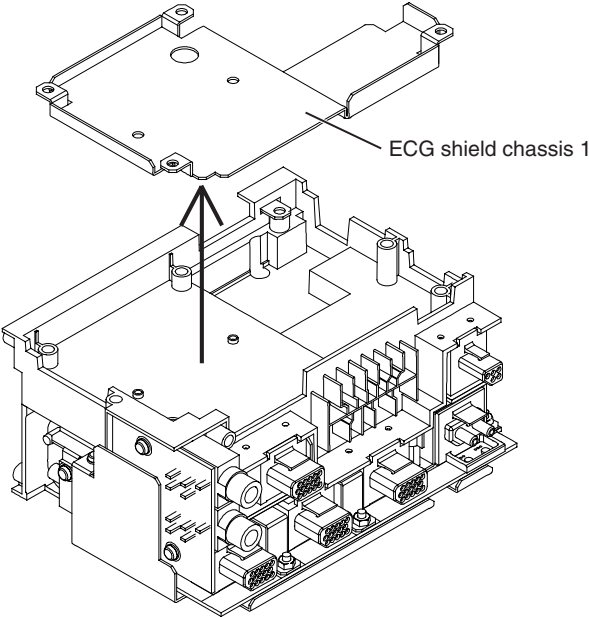
5. Remove the PS3 × 8 screw of (3) and ECG RESP board.



### Removing the NIBP Unit (SG-670P/671P/673P)

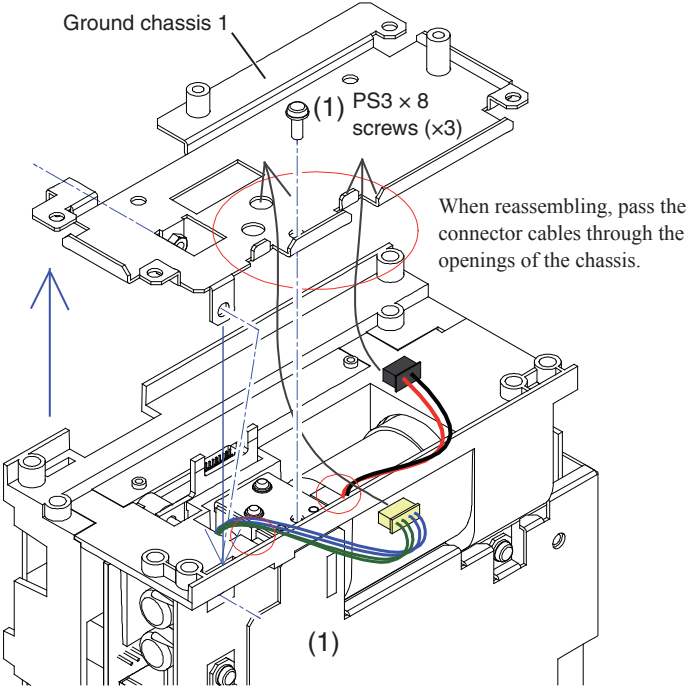
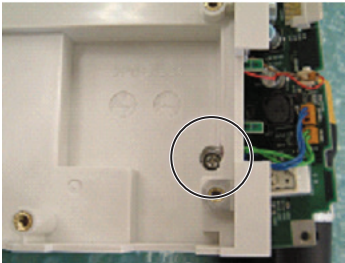
1. Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.
2. Remove the AY MOTHER (INPUT MOTHER) board (UR-3949/39490). For details, refer to “Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)”.
3. Remove the ECG RESP board. For details, refer to “Removing the ECG RESP Board (UR-3951/39510)”.

4. Lift and remove the ECG shield chassis 1.



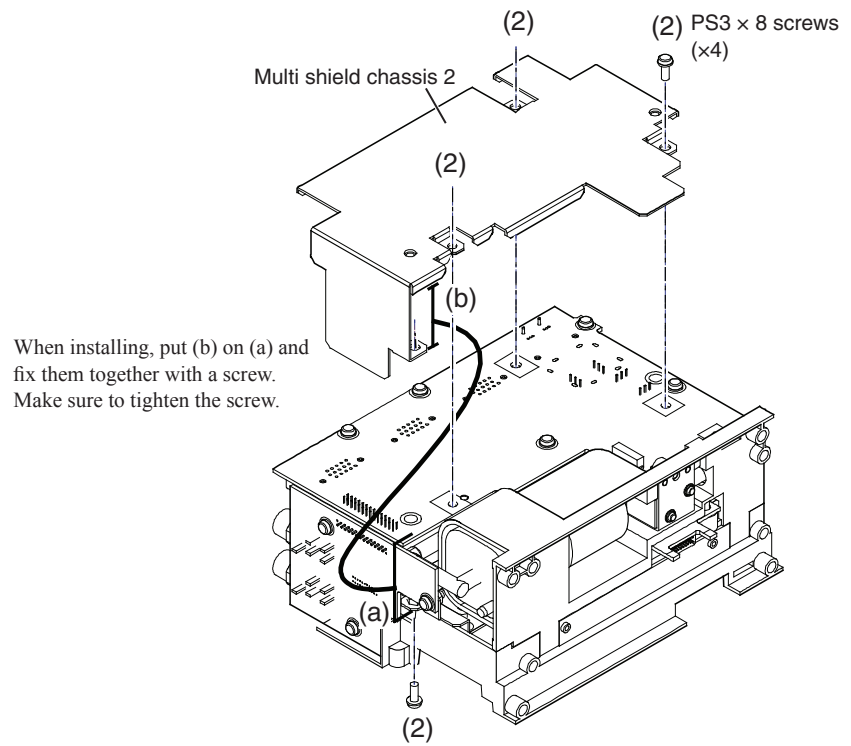
The above figure shows AY-663P.

5. Remove three PS3 × 8 screws of (1). Then lift and remove the ground chassis 1.



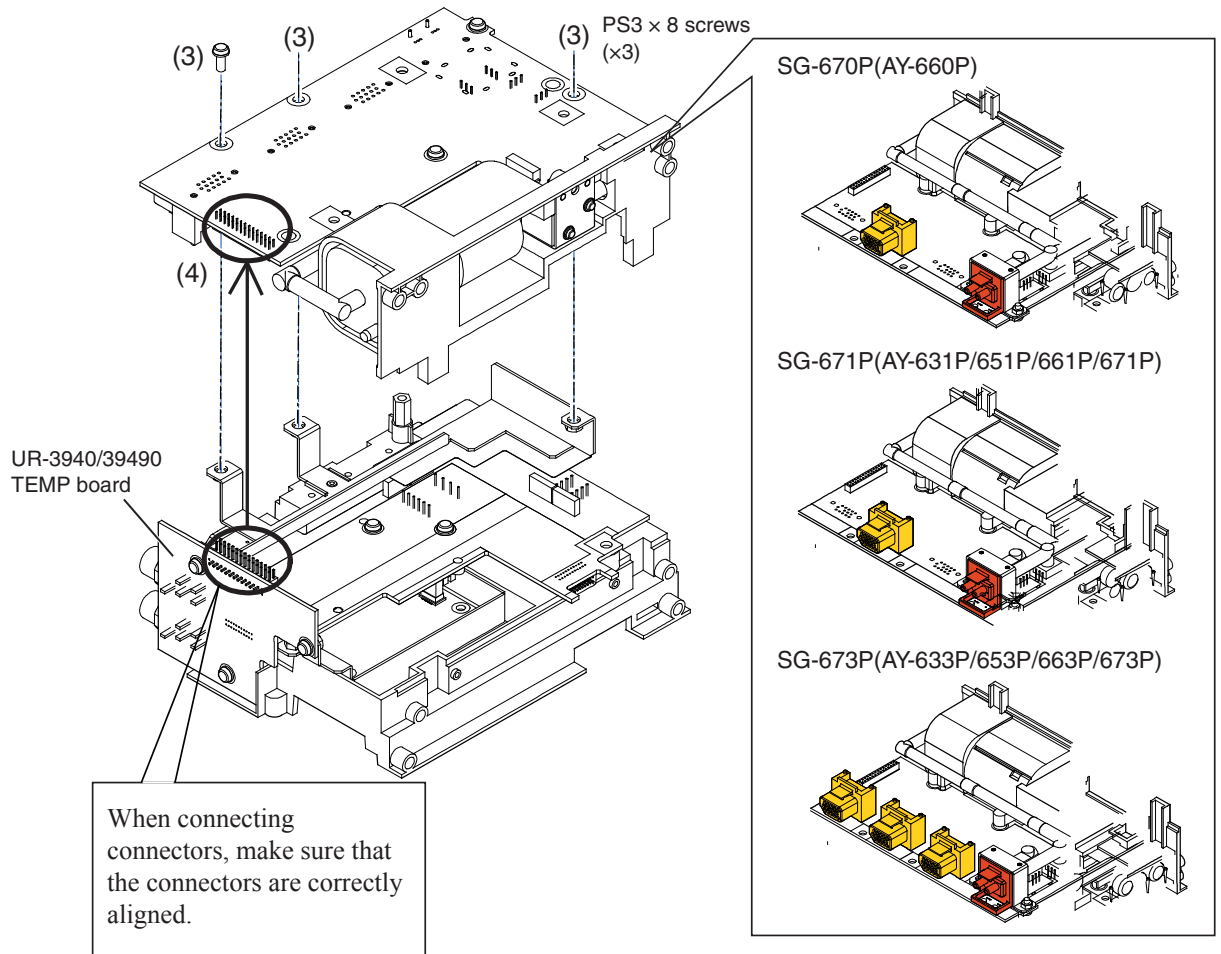
## 5. DISASSEMBLY AND ASSEMBLY

- Remove the four PS3 × 8 screws of (2). Then lift and remove the multi shield chassis 2.





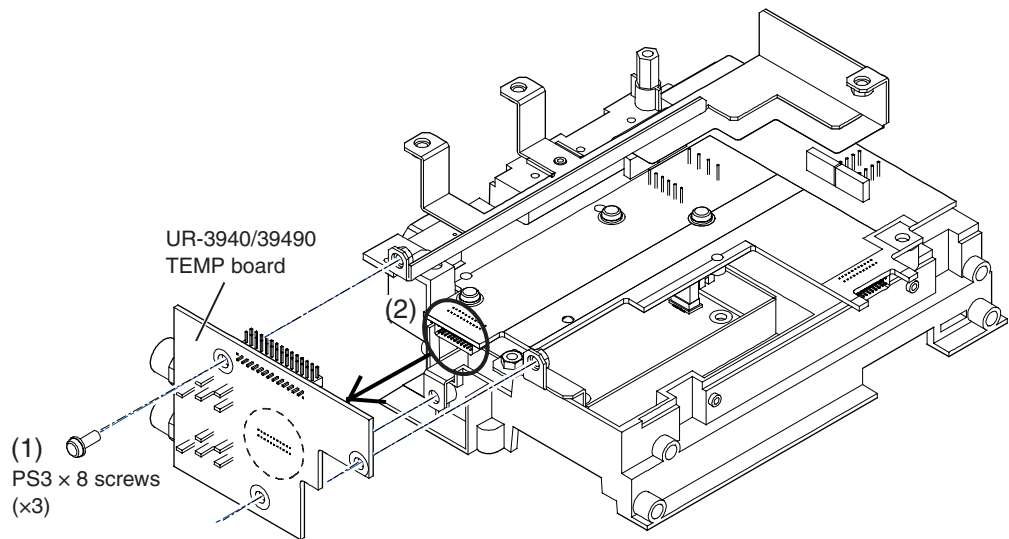
- Remove the three PS3 × 8 screws of (3). Remove the connector of (4) that is connected to the connector of TEMP board (UR-3940/39490) and remove the NIBP unit (SG-670P/671P/673P).



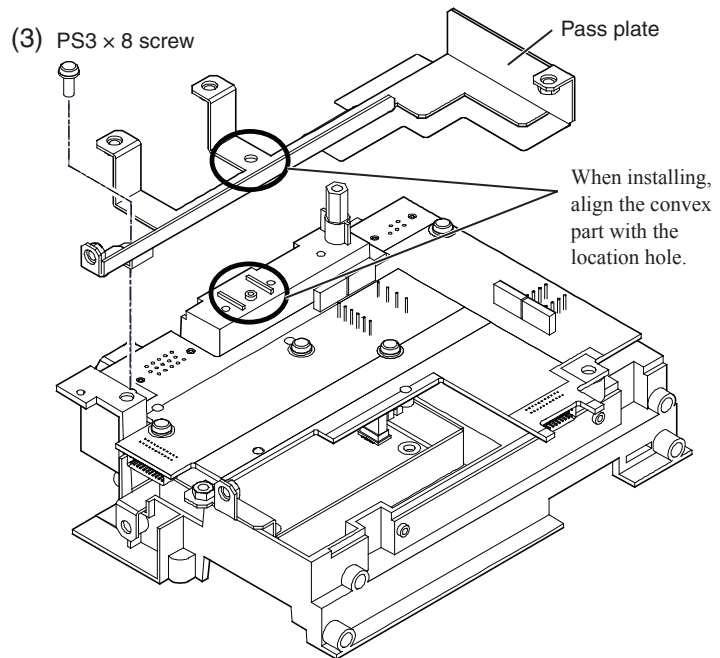
## Removing the SpO<sub>2</sub> Board

- Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.
- Remove the AY MOTHER (INPUT MOTHER) board (UR-3949/39490). For details, refer to “Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)”.
- Remove the ECG RESP board. For details, refer to “Removing the ECG RESP Board (UR-3951/39510)”.
- Remove the SG-670P/671P/673P. For details, refer to “Removing the NIBP Unit (SG-670P/671P/673P)”.
- Remove the three PS3 × 8 screws of (1) and connector of (2). Then remove the TEMP board (UR-3940/39400) from MPU PWR board.

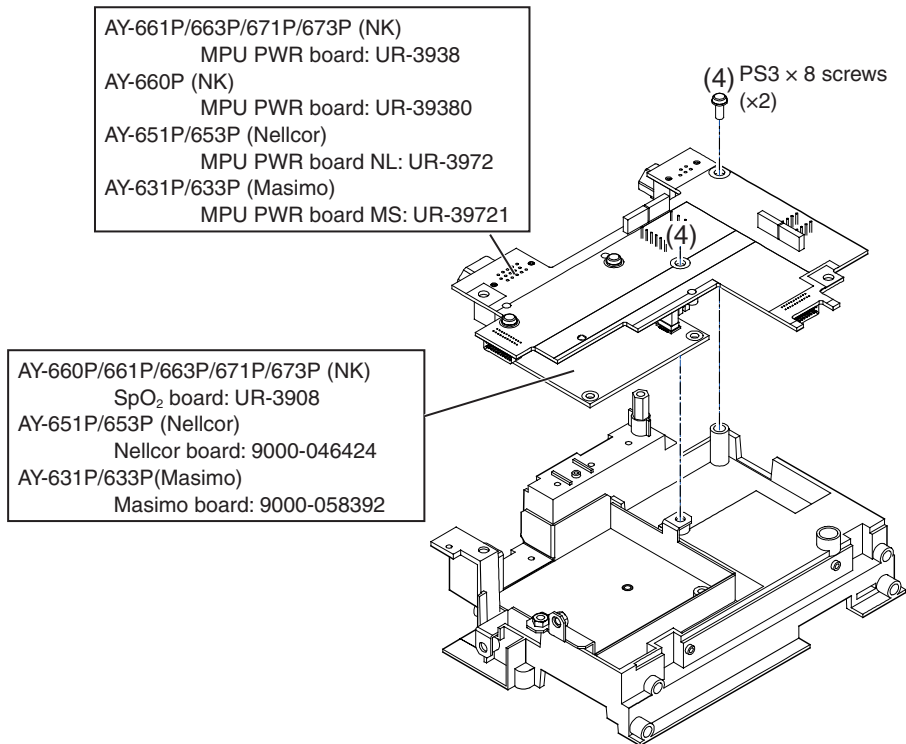
## 5. DISASSEMBLY AND ASSEMBLY



6. Remove the PS3 × 8 screw of (3) and pass plate (steel plate).

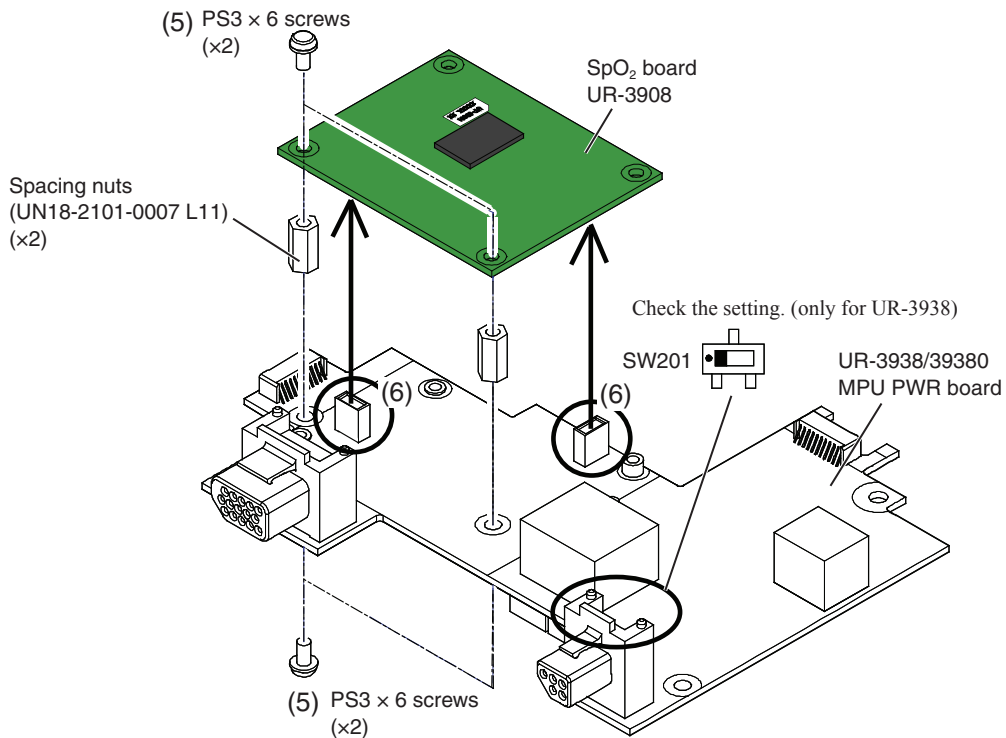


- Remove the two PS3 × 8 screws of (4) and MPU PWR board (UR-3938/3972/39380/39721).

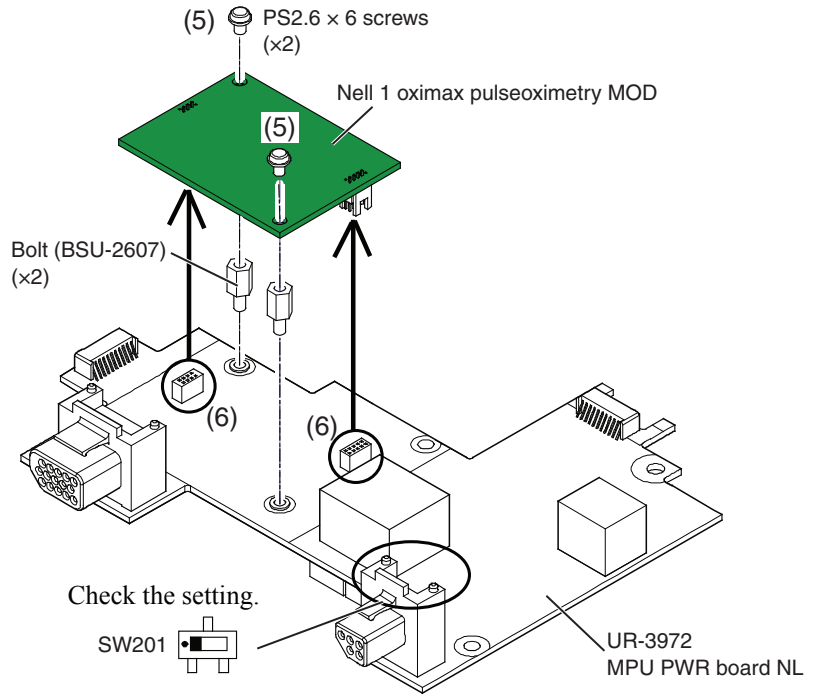


- Remove the two screws of (5). The screw sizes are different between NK and other makers. Remove the two connectors of (6) that are directly connected to the MPU PWR board. The connector location varies depending on the SpO<sub>2</sub> type. Then remove the SpO<sub>2</sub> board from the MPU PWR board.

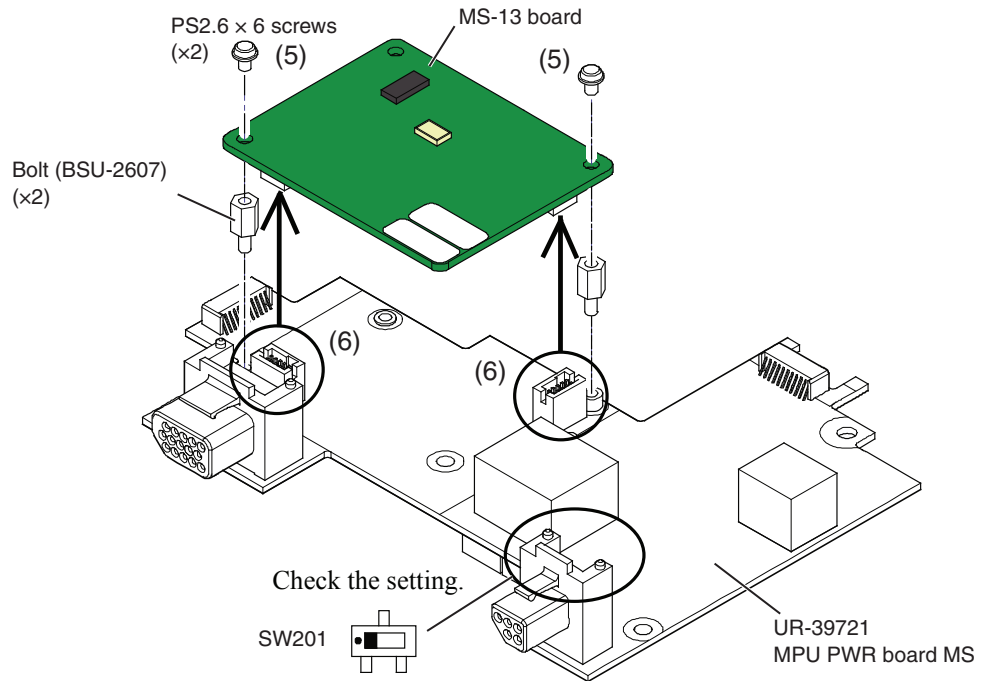
**AY-660P/661P/663P/AY-671P/673P (NK SpO<sub>2</sub>) [two PS3 × 6 screws]**



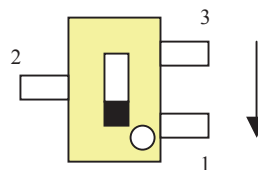
**AY-651P/653P (Nellcor SpO<sub>2</sub>) [two PS2.6 × 6 screws]**



**AY-631P/633P (Masimo SpO<sub>2</sub>) [two PS2.6 × 6 screws]**



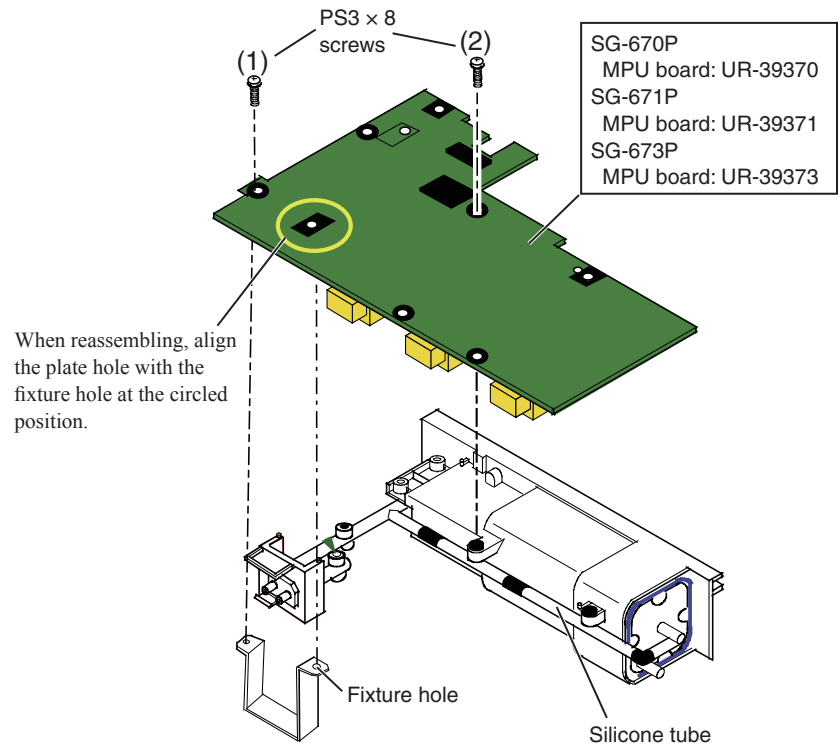
**Dip Switch (SW201) Settings**



When the MPU PWR board is replaced with a new one, check that the terminal 1 of SW201 switch on the new board is selected.

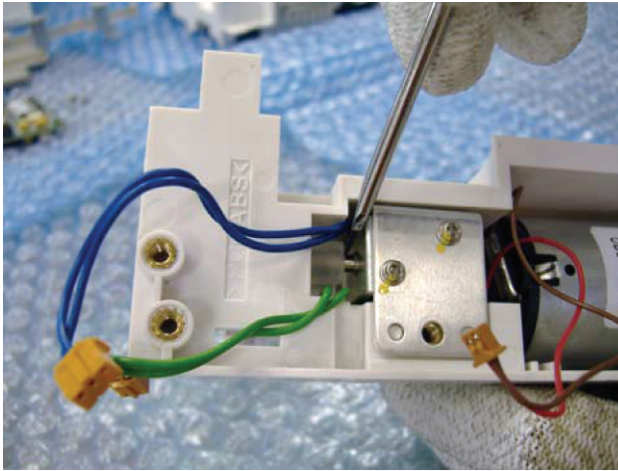
## Disassembling the NIBP Unit (SG-670P/671P/673P)

1. Remove the front enclosure. For details, refer to “Removing the Front Enclosure”.
2. Remove the AY MOTHER (INPUT MOTHER) board (UR-3949/39490). For details, refer to “Removing the AY MOTHER (INPUT MOTHER) Board (UR-3949/39490)”.
3. Remove the ECG RESP board. For details, refer to “Removing the ECG RESP Board (UR-3951/39510)”.
4. Remove the SG-670P/671P/673P. For details, refer to “Removing the NIBP Unit (SG-670P/671P/673P)”.
5. Remove the PS3 × 8 screw of (1) and remove the plate holding down the NIBP connector. Remove the PS3 × 8 screw of (2) and silicone tube from the MPU board (UR-39370/39371/39373).



## 5. DISASSEMBLY AND ASSEMBLY

6. Remove the silicone tube from the solenoid valve.



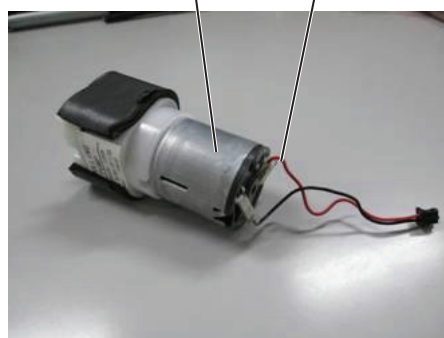
7. Remove the silicone tube from the pump and push the pump out.



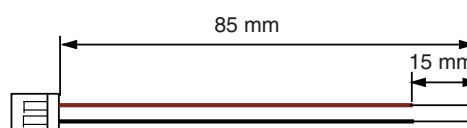
### Notes on Rolling Pump Replacement

#### Processing and Installing the Rolling Pump

Rolling pump (532149)      Cable (9000-041786)



1. Cut the cable to the length of 85 mm and strip the cable insulation about 15 mm from the end.



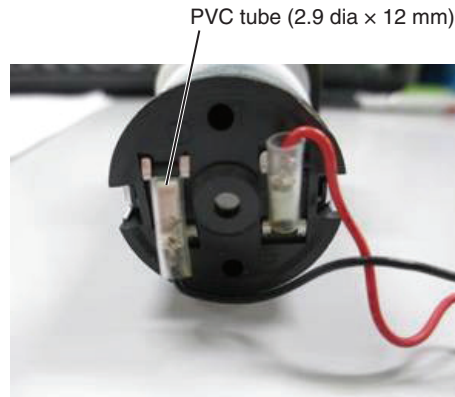
2. Connect the red cable to the plus (+) side of the rolling pump.



3. Connect the black cable to the minus (-) side of the rolling pump.
4. Insert the each of the cables into each PVC tube (2.9 dia × 12 mm). Solder the cable to the fixture slits of the rolling pump and cover the connected position with the PVC tube.

**NOTE**

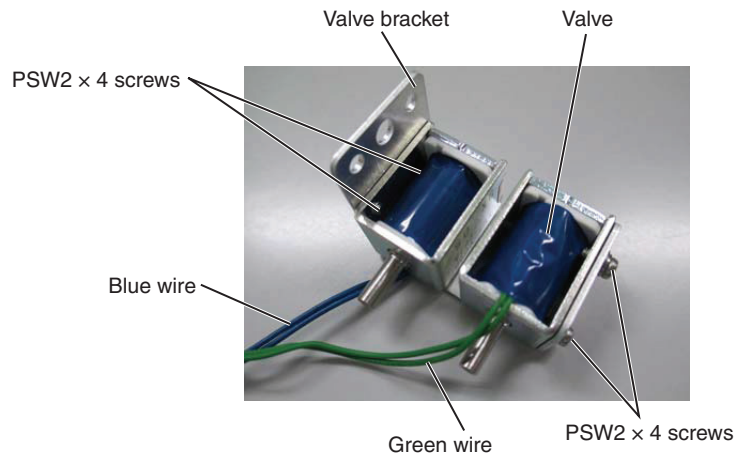
The PVC tube should be inserted to the end of the pump fixture.



**Note on Installing the Valve on the Valve Bracket**

**Installing the Valve into the Valve Bracket**

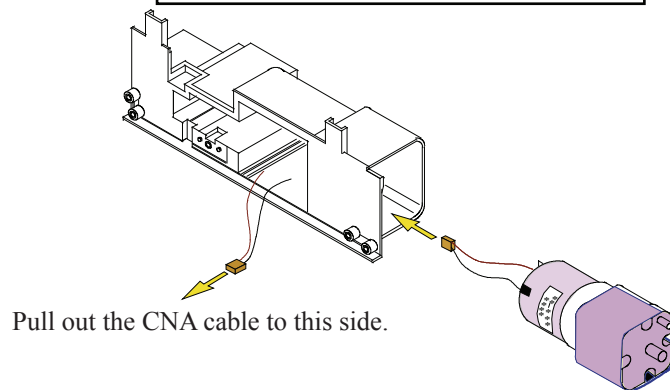
Fix the valve on the valve bracket with the four PSW2 × 4 screws.



### Notes on Installing the Rolling Pump and NIBP FRAME

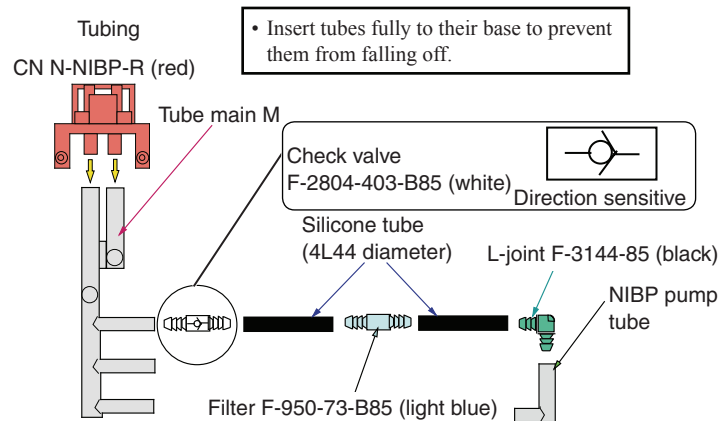
#### Installing the Rolling Pump/NIBP FRAME M

- Pay attention to the orientation of the rolling pump.
- Hold the vibration damper sponge with fingers to prevent it from peeling off while inserting the rolling pump into NIBP FRAME M.
- After installation, pull out the CNA cable from NIBP FRAME M.



### Note on Installing Tubes

#### Connecting Tubing to the Board





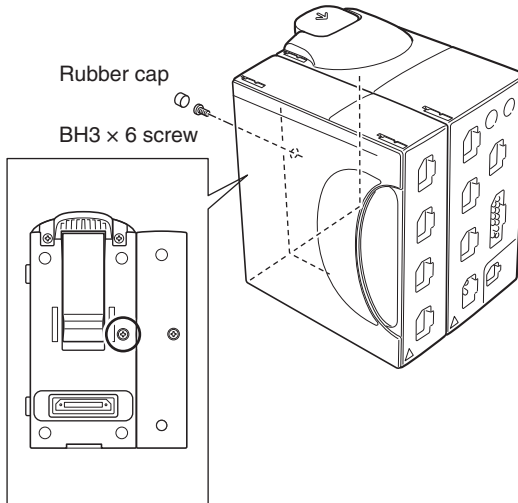
# Disassembling the Smart Expansion Unit (AA-672P/674P)

Tools required: A Phillips-head screwdriver (for M3 and M4), a flathead screwdriver, a flathead screwdriver (1.4 mm) and tweezers

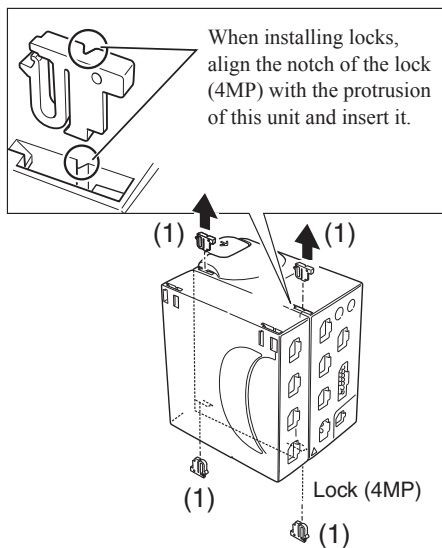
## Removing the Smart Expansion Unit from the Input Unit

5

1. Use the flathead screwdriver (1.4 mm) to remove the rubber cap and BH3 × 6 screw from the rear panel of the input unit.

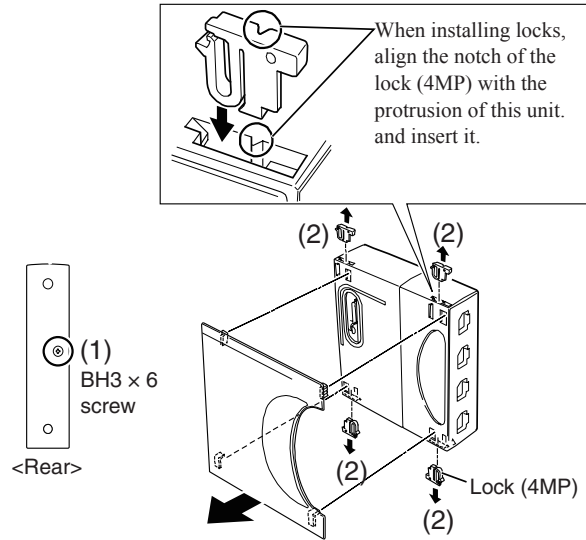


2. Use the flathead screwdriver (1.4 mm) to hold down the stoppers of the four locks of (1) and remove the locks (two from the top and another two from the bottom). Then separate the input unit and the smart expansion unit.

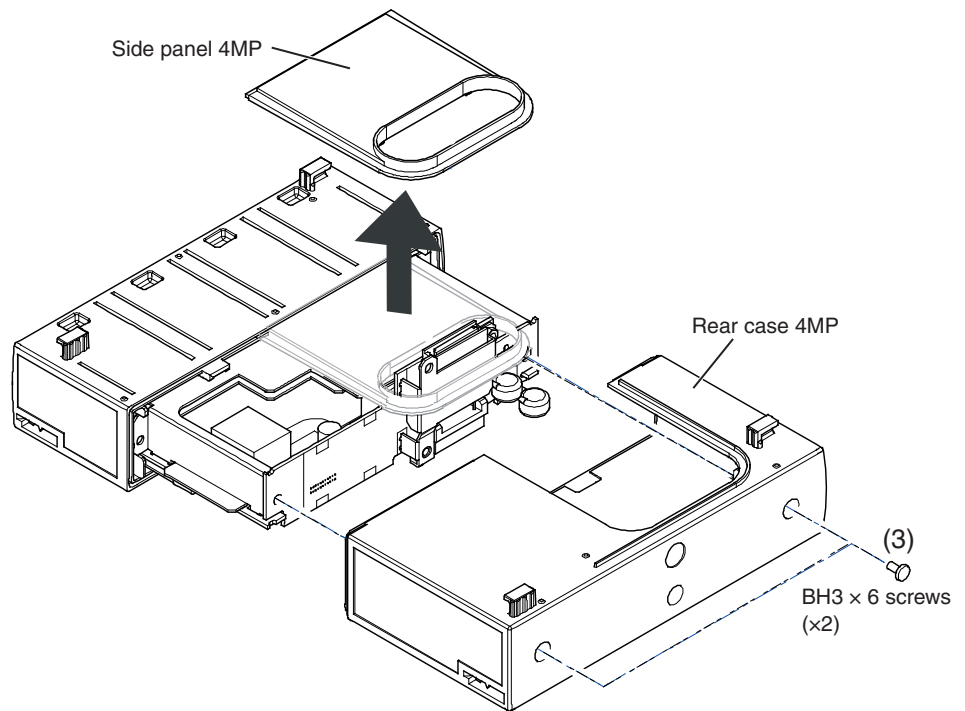


### Disassembling the Smart Expansion Unit

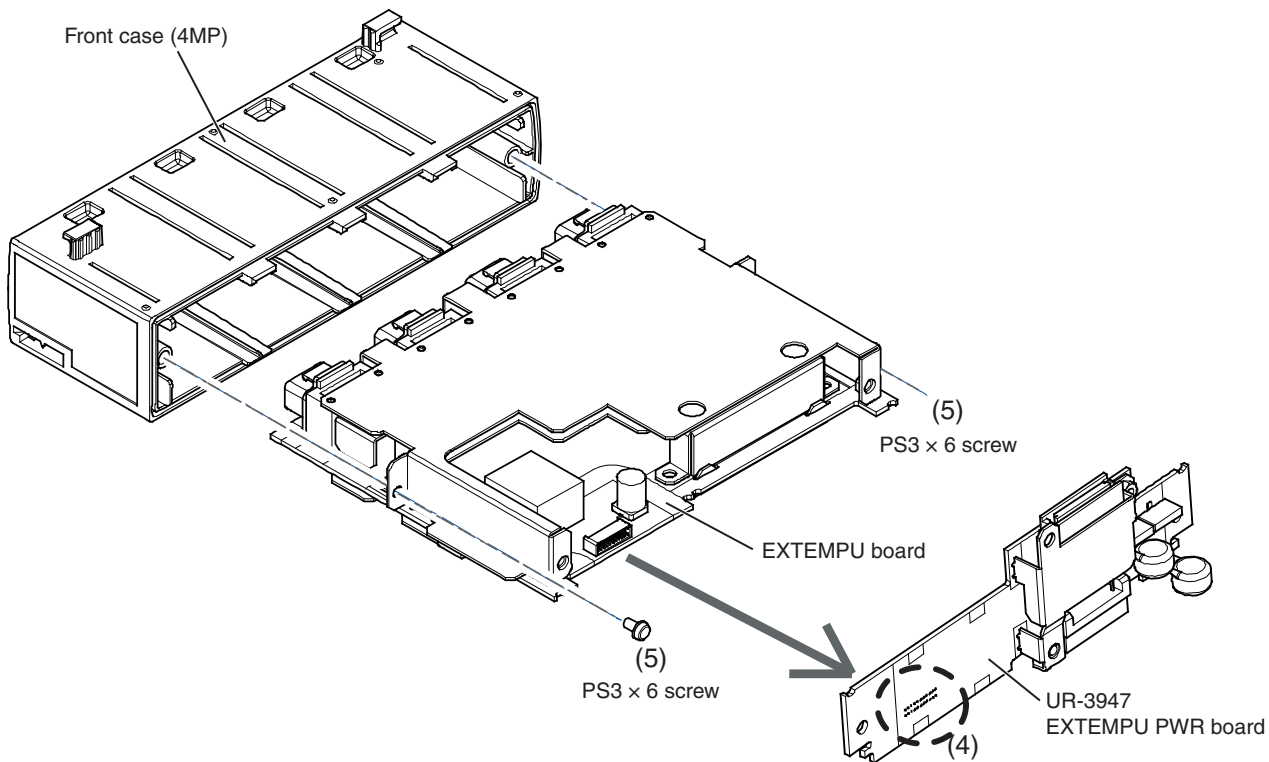
1. Remove the BH3 × 6 screw of (1) from the rear side of the unit. Use the flathead screwdriver (1.4 mm) to hold down the stoppers of the four locks of (2) and remove the locks (two from the top and another two from the bottom). Then remove the side panel.



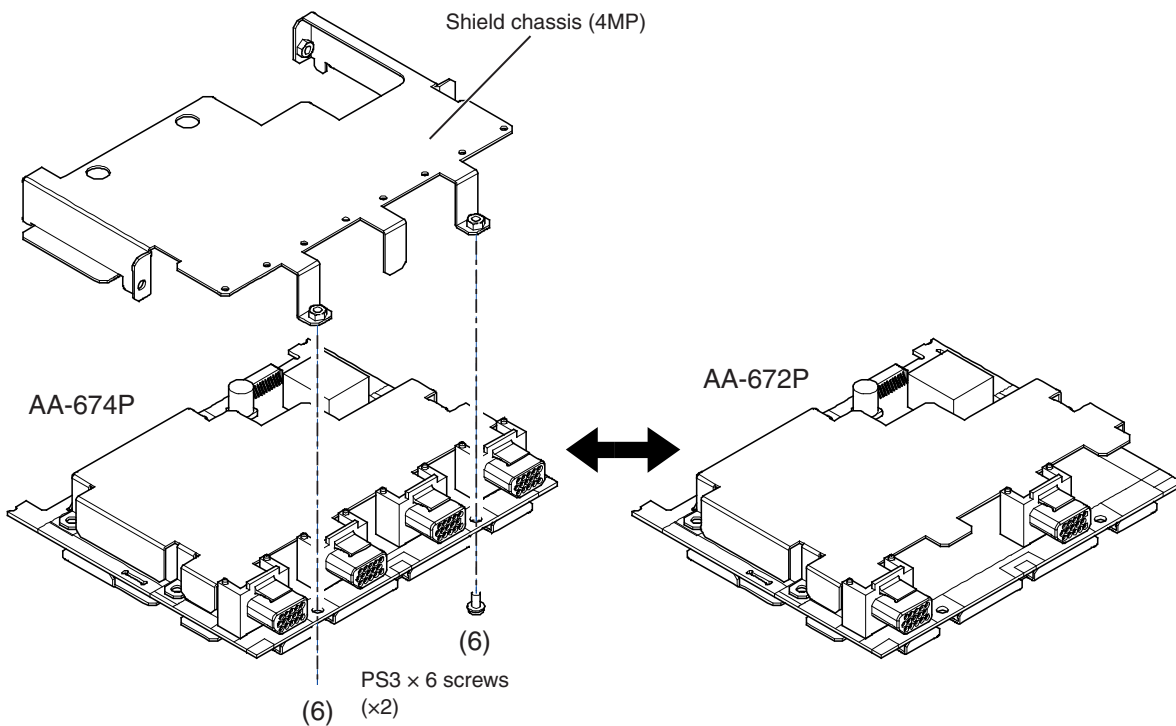
2. Use the Phillips-head screwdriver to remove the two BH3 × 6 screws of (3). Remove the rear case and the side panel 4MP.



3. Remove the connector of (4) that is directly connected to the EXTEMPU PWR board. Then remove the EXTEMPU PWR board (UR-3947). Remove the two PS3 × 6 screws of (5) and the front case.

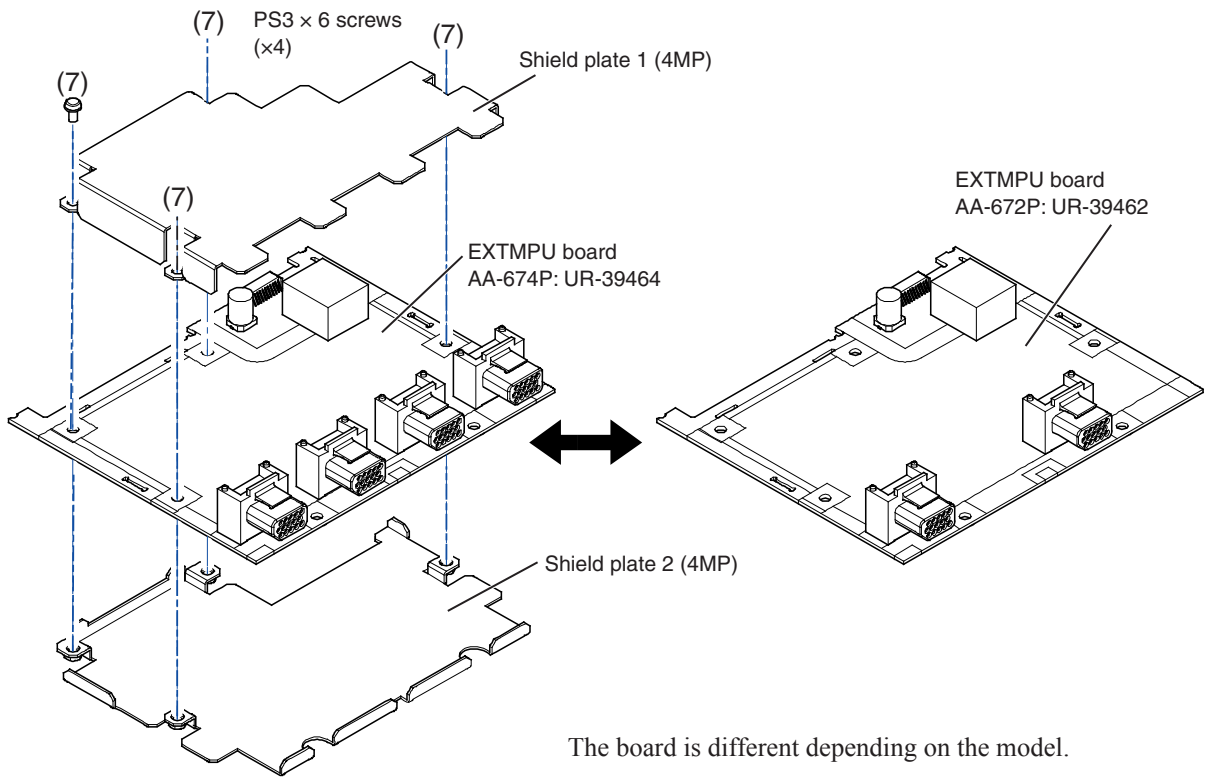


4. Remove the two PS3 × 6 screws of (6) and shield chassis.

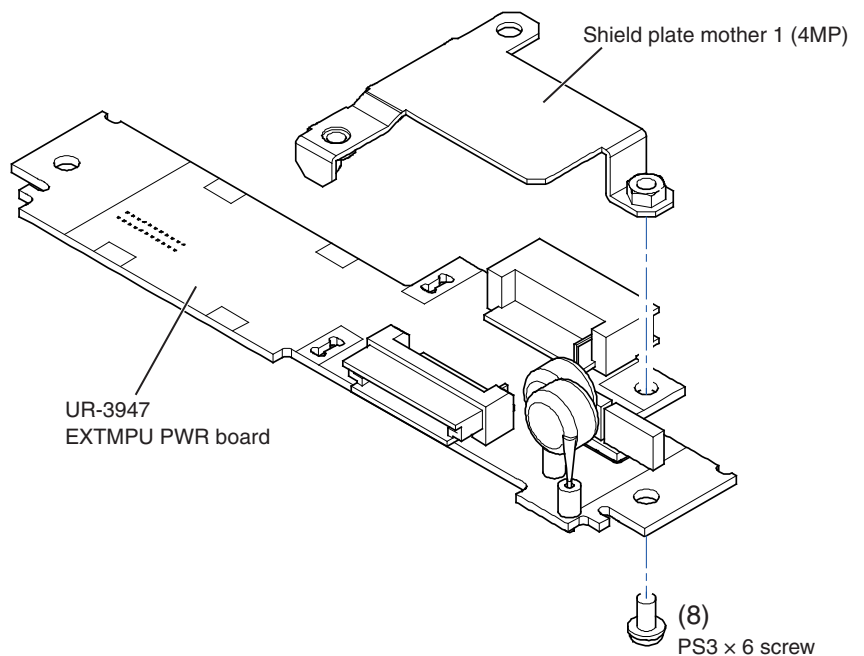


5. DISASSEMBLY AND ASSEMBLY

5. Use the Phillips-head screwdriver to remove the four PS3 × 6 screws of (7). Then remove the shield plate 1 and shield plate 2.



6. Remove the PS3 × 6 screw of (8) and remove the shield plate mother 1. Then remove the EXTMPU PWR board (UR-3947).



# Disassembling the Recorder Module (WS-671P)

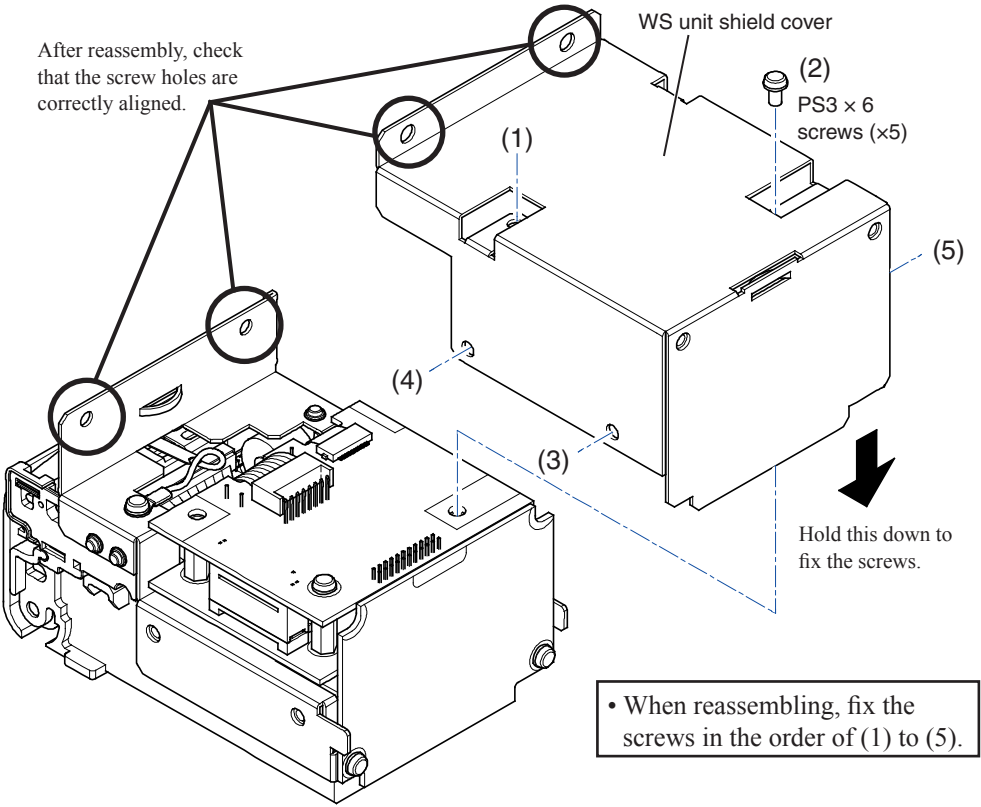
Tools required: A Phillips-head screwdriver (for M3 and M4), a flathead screwdriver, a flathead screwdriver (1.4 mm), a box screwdriver (5.5 mm), and tweezers

## Removing the Recorder Module from the Main Unit

When removing the WS-671P recorder module from the MU-631R main unit, refer to the procedure described in "Removing the Recorder Module (WS-671P)" of the "Disassembling the Main Unit (MU-631R)" section. When removing the WS-671P recorder module from the MU-651R or MU-671R main unit, refer to the procedure described in "Removing the Recorder Module (WS-671P)" of the "Disassembling the Main Unit (MU-651R/671R)" section.

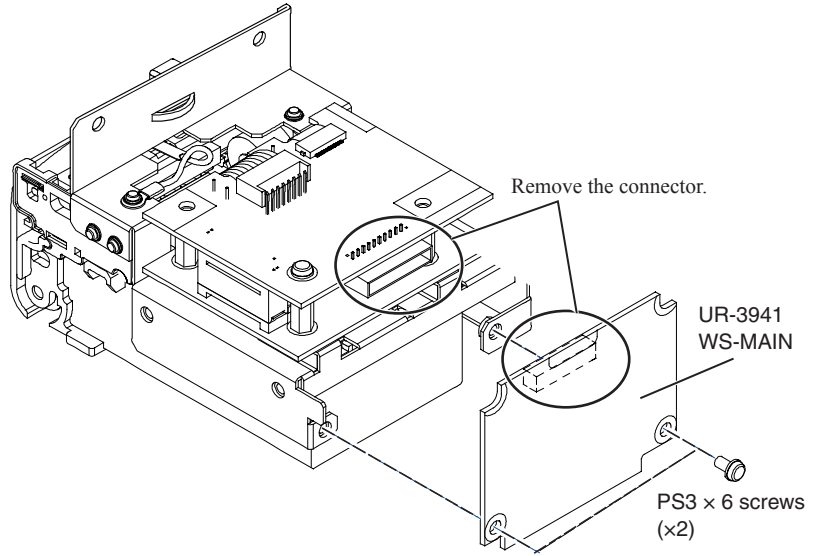
## Disassembling the Recorder Module

- 1. Remove the five PS3 × 6 screws of (1) to (5) and WS unit shield cover.

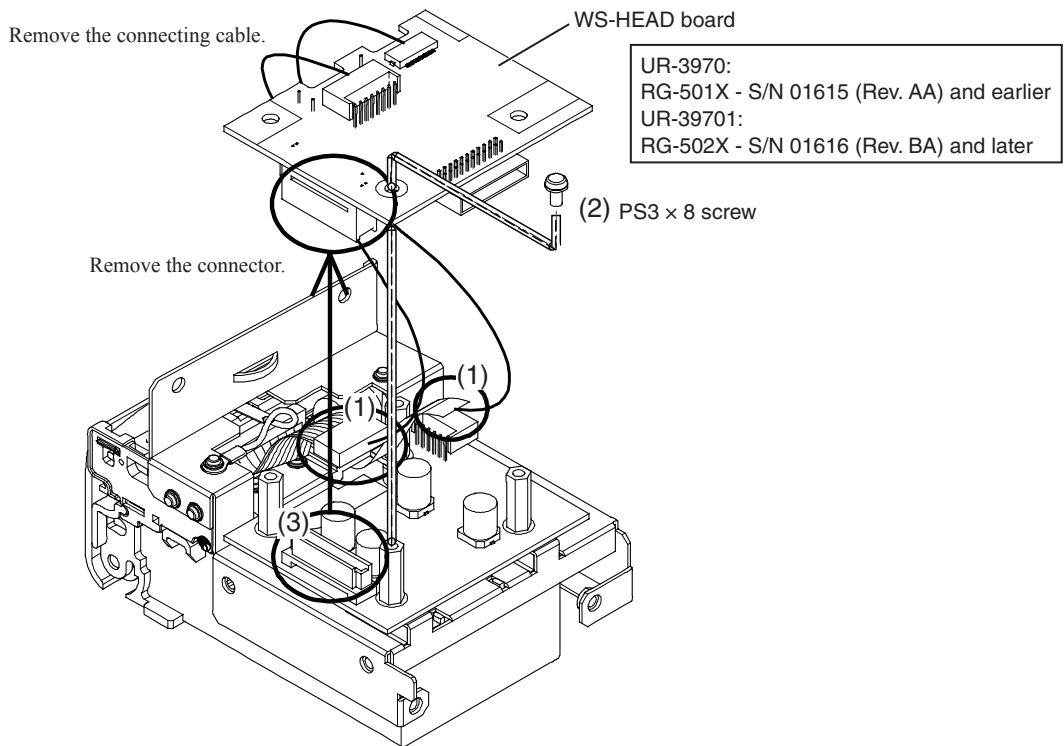


5. DISASSEMBLY AND ASSEMBLY

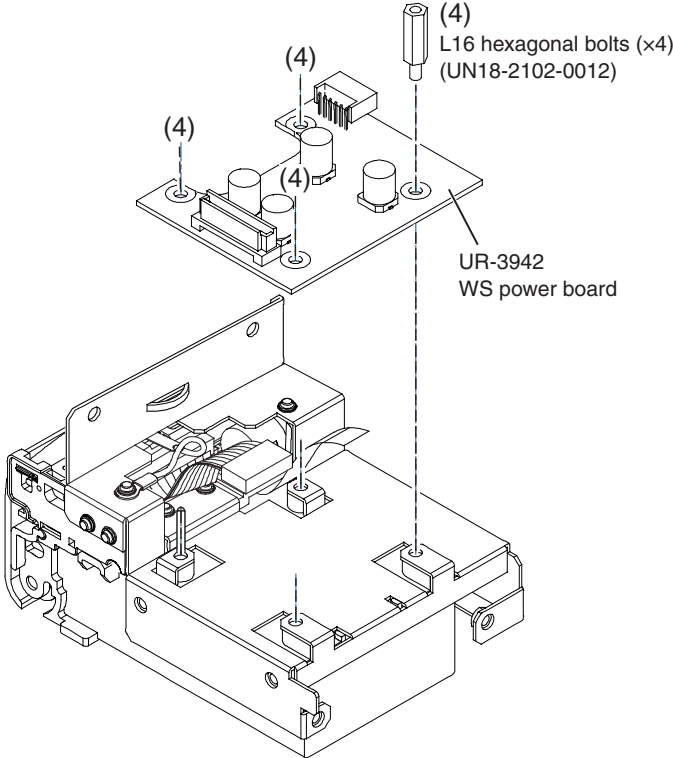
- Remove the two PS3 × 6 screws and WS-MAIN (UR-3941).



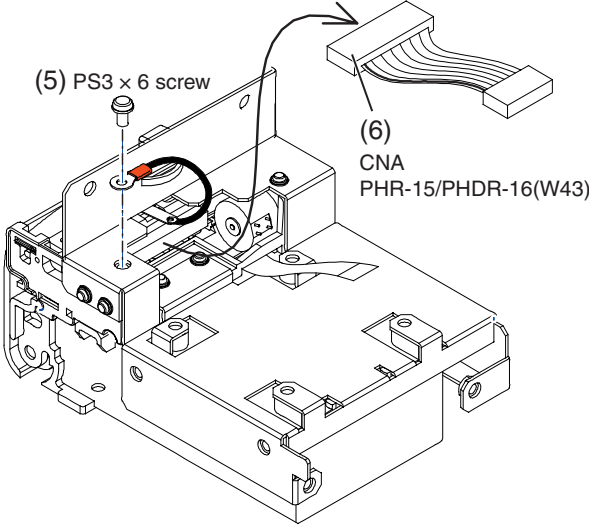
- Remove the two thermal head connectors of (1) and the PS3 × 8 screw of (2). Then remove the connector of (3) that connects the WS power board and WS-HEAD board, and remove the WS-HEAD board (UR-3970/39701).



- 4. Remove the four L16 hexagonal bolts of (4) and WS power board (UR-3942).

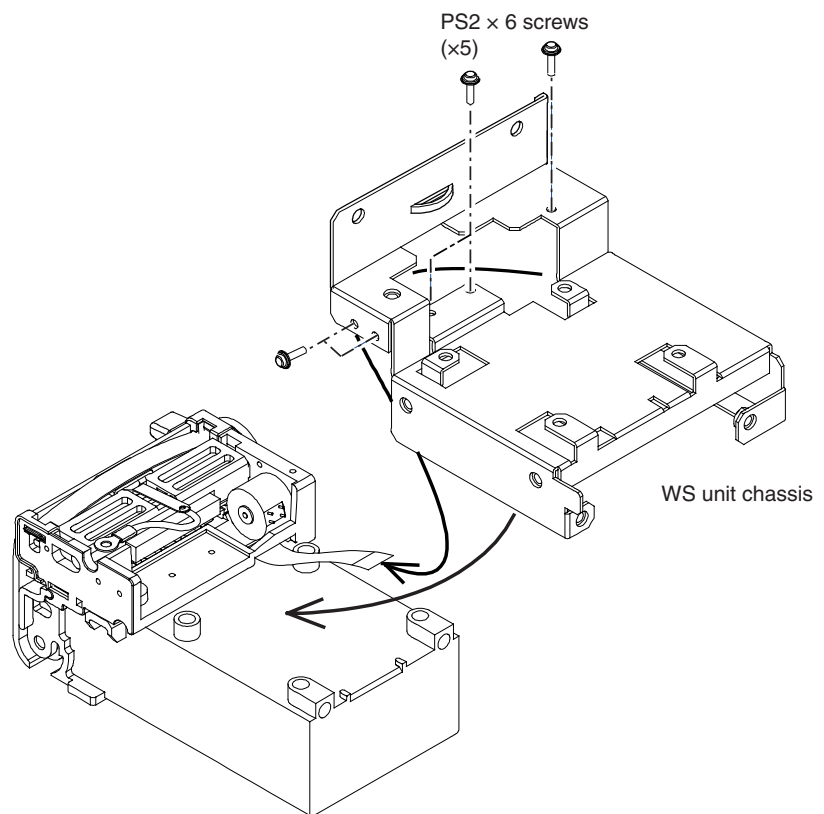


- 5. Remove the PS3 × 6 screw of (5) and CNA cable of (6).



## 5. DISASSEMBLY AND ASSEMBLY

6. Remove the five PS2 × 6 screws and WS unit chassis. Then remove the paper drive unit (RG-501X/502X/502X-01).

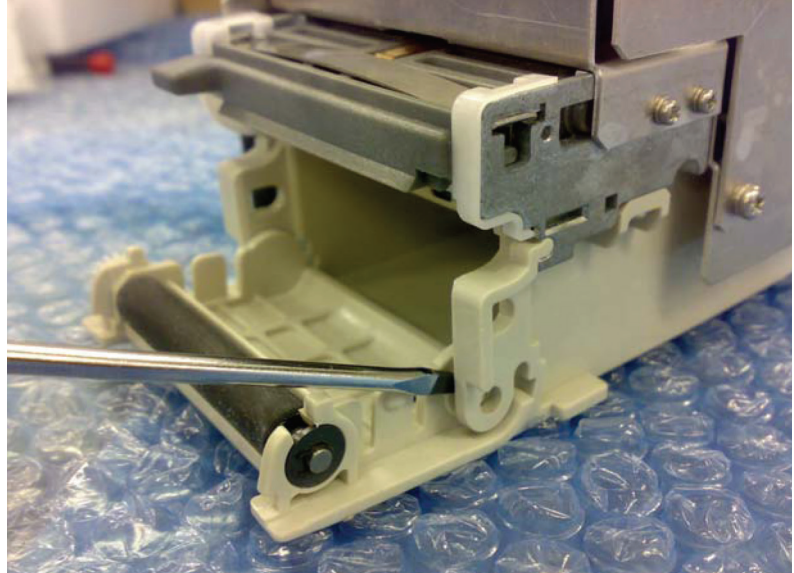


Paper drive unit  
RG-501X: S/N 01615 (Rev. AA) and earlier  
RG-502X: S/N 01616 (Rev. BA) and later



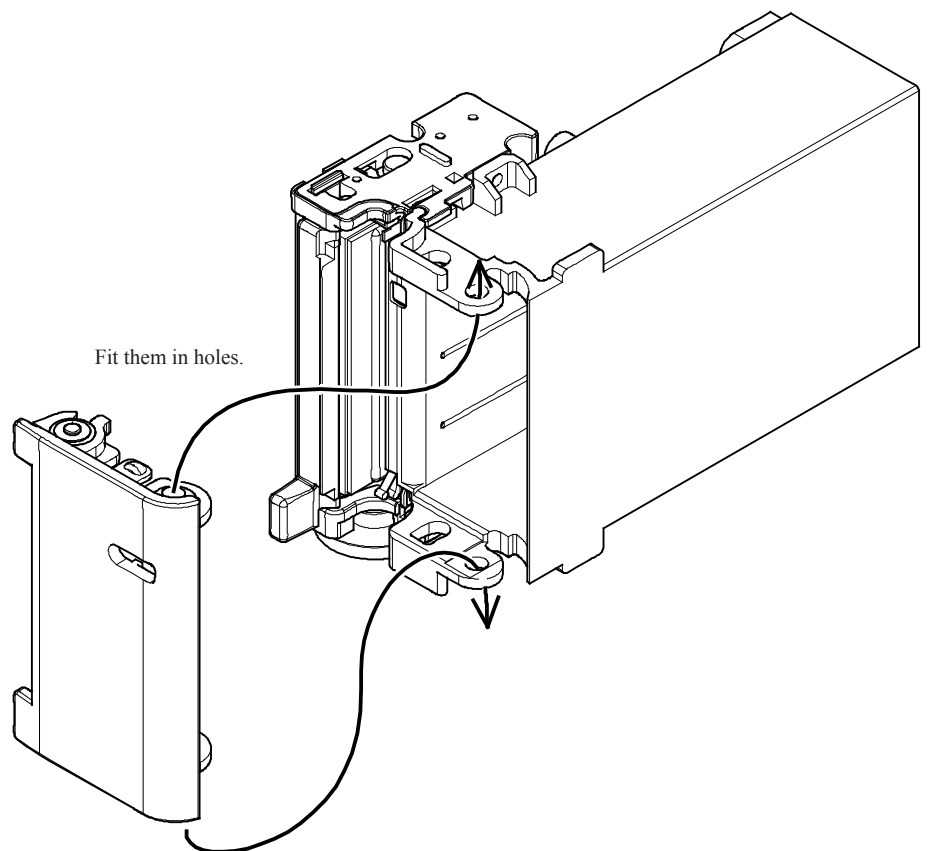
### Disassembling the Paper Drive Unit (RG-501X/502X/502X-01)

1. Remove the paper drive unit (RG-501X/502X/502X-01). For details, refer to “Disassembling the Recorder Module (WS-671P)”.
2. Insert the flathead screwdriver into the position shown below and remove Magazine door assy (YS-086P9).



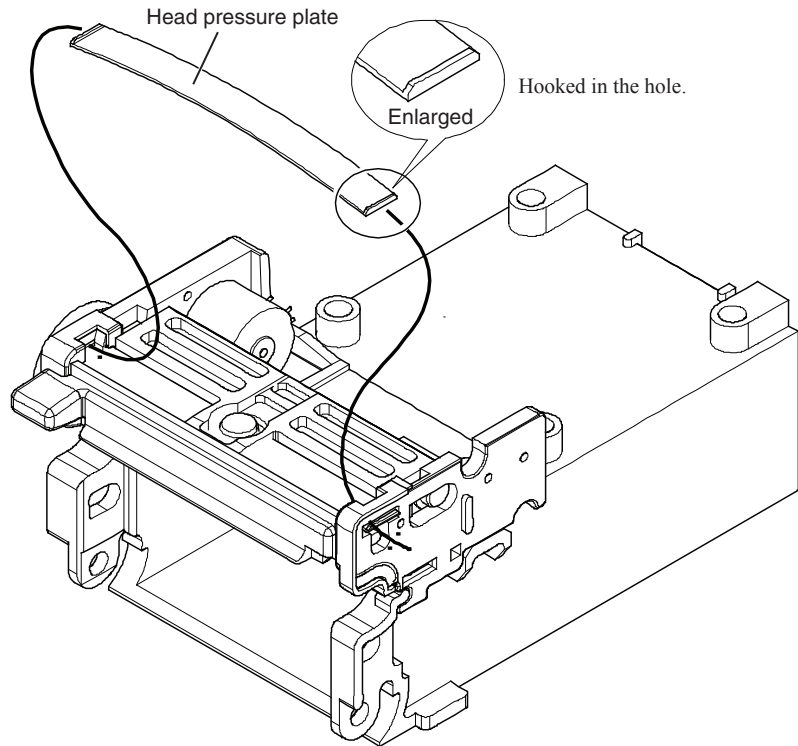
5

When installing, put the Magazine door assy as shown below.

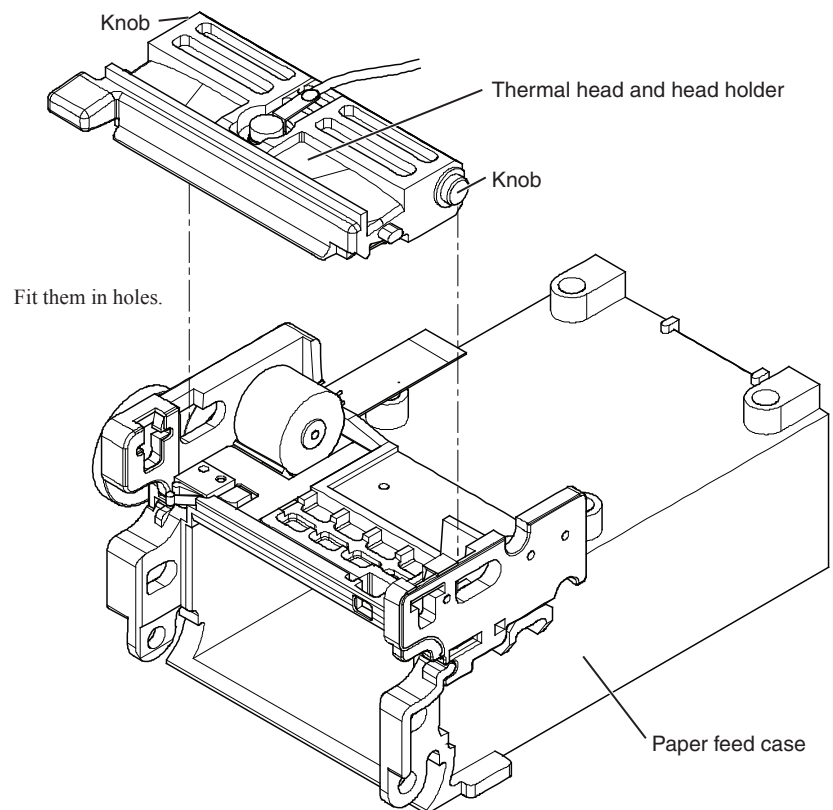


## 5. DISASSEMBLY AND ASSEMBLY

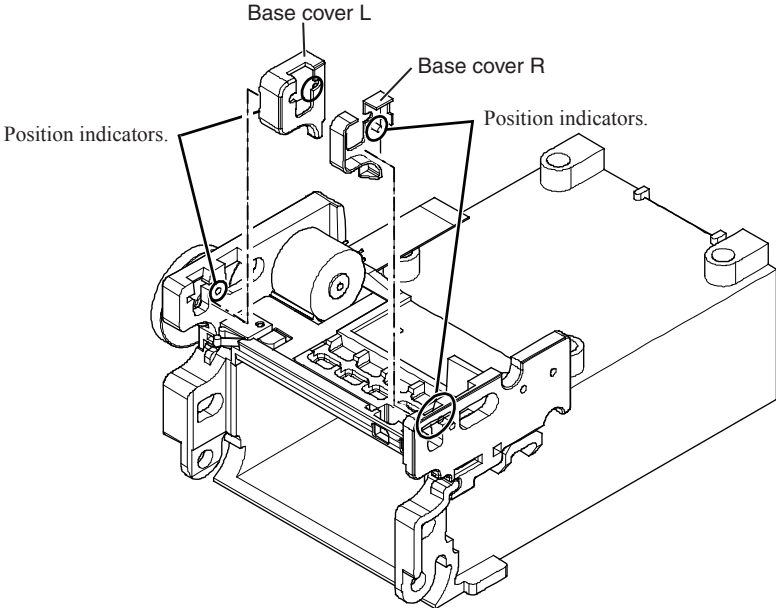
- Slide the head pressure plate while holding down its center and remove it.



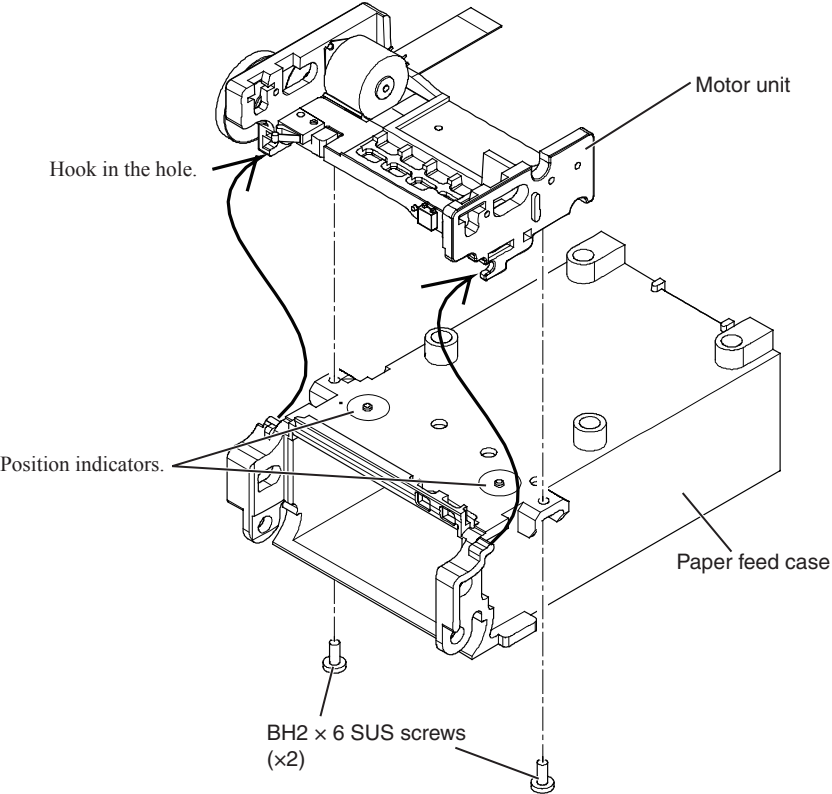
- Remove the right and left knobs of the base cover installed in the paper feed case and remove the thermal head and head holder.



5. Remove the right and left base covers.

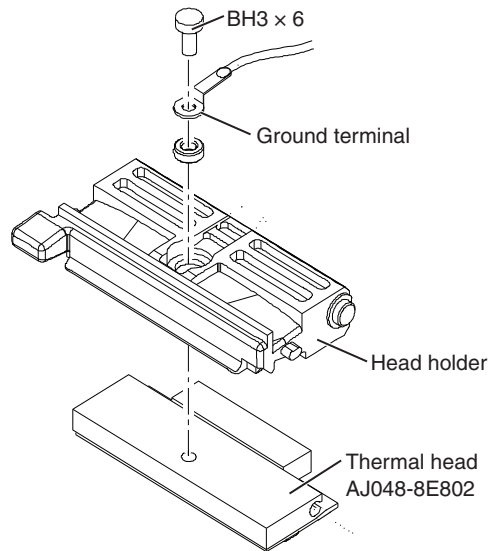


6. Remove the two BH2 × 6 screws from the paper feed case, then remove the motor unit.



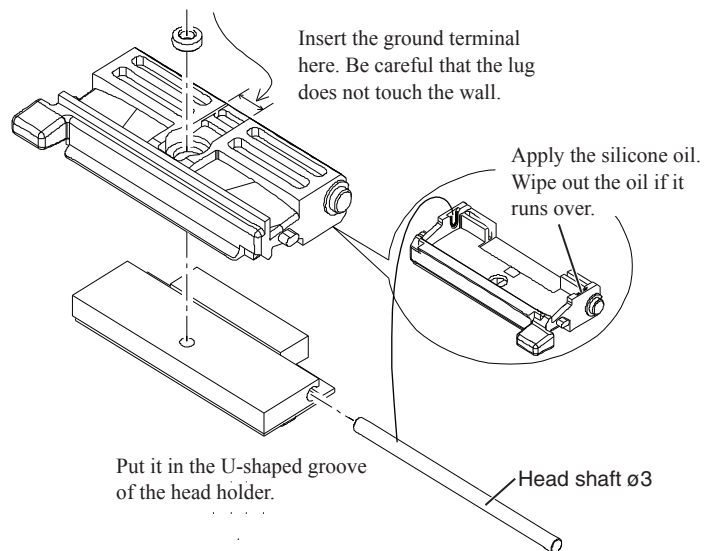
## Replacing the Thermal Head

1. Remove the head pressure plate from RG-501X. Remove the right and left knobs of the base cover installed in the paper feed case and then the thermal head and head holder. For details, refer to “Disassembling the Paper Driver Unit (RG-501X/502X/502X-01)”.
2. Remove the BH3 × 6 screw from the head holder and remove the thermal head.



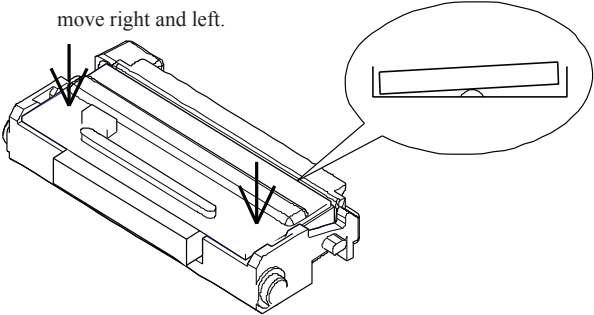
### Notes on Installing the Thermal Head

1. Pay attention to the installation position of ground terminal. Apply silicone oil to the part in which the head shaft is to be installed.



- 2. Check that the installed thermal head can move right and left.

Check that the thermal head can move right and left.



# *Section 6 Maintenance*

Periodic Replacement Parts .....	6.2
Compatibility between Paper Drive Unit and WS Head Board .....	6.2
Periodic Inspection .....	6.3

## Periodic Replacement Parts

Model/Code No.	Description	Remark	Lifetime
RG-501X/ RG-502X/ RG-502X-01	Paper drive unit	Stepping motor included.	Usable for approximately 9000 stacks of the recording paper.
662311	Thermal head	—	Usable for approximately 370 stacks of the recording paper.
YS-086P9	Magazine door assy	Platen roller included.	Usable for approximately 6 years.

## Compatibility between Paper Drive Unit and WS Head Board

Note the compatibility of units in WS-671P recorder module.

	UR-3970	UR-39701/4318
RG-501X paper drive unit	✓	
RG-502X/502X-01 paper drive unit		✓

If either one is replaced with a different type due to stock availability, the other one also needs to be replaced with the compatible one.

## Periodic Inspection

If the periodic inspection is not performed, degradation or loss of function may go unnoticed and lead to misdiagnosis.

Service personnel should perform the periodic inspection at least once every year. Make sure that the bedside monitor operates properly and replace the consumables.

If you found abnormalities as a result of inspection and the bedside monitor is suspected to be faulty, attach an “Unusable” or “Repair request” label to the bedside monitor and contact your Nihon Kohden representative.

An inspection record sheet is provided at the end of this section. Make a copy of this inspection record sheet before using it. The check items are grouped as follows.

- Appearance
- Power cord
- Power on
- ROM
- RAM
- FRAM
- VRAM
- Hard key
- Touch key
- RY-910PA remote controller
- Sound
- SD card
- Alarm indicator
- Screen brightness (backlight)
- WS-671P recorder module
- Date and time
- Battery
- Vital sign parameters  
(ECG, RESP, SpO<sub>2</sub>, IBP, NIBP, TEMP, CO<sub>2</sub>, O<sub>2</sub>, CO)
- Safety
- ZS-900P transmitter
- QF series interface/IF series communication cable
- AG-400R CO<sub>2</sub> unit
- AG-920R multigas unit
- QE-910P BIS processor
- AE-918P neuro unit

Refer to Section 3 “Diagnostic Check and Safety Check” about procedures for each check item.





Standard Configuration	16	NIBP	Check the accuracy of two pressure sensors for NIBP measurement. Select the NIBP from the DPU CHECK items on the MANUAL CHECK screen and select "1. CALIBRATION" on the NIBP CHECK screen.		
			Check the zeroing for NIBP measurement. Select the NIBP on the MANUAL CHECK screen and select "2. ZERO CALIBRATION" on the NIBP CHECK screen.		
			Check the NIBP safety circuit. Select the NIBP on the MANUAL CHECK screen and select "3. SAFETY CHECK" on the NIBP CHECK screen.		
			Check the inflation speed. Select the NIBP on the MANUAL CHECK screen and select "4. INFLATION SPEED" on the NIBP CHECK screen.		
			Check the pressure holding time. Select the NIBP on the MANUAL CHECK screen and select "5. PRESSURE HOLD" on the NIBP CHECK screen.		
			Check the two valves. Select the NIBP on the MANUAL CHECK screen and select "6. STEP DEFLATION" on the NIBP CHECK screen.		
			Check the NIBP circuit. Select the NIBP on the MANUAL CHECK screen and select "8. AIR CIRCUIT" on the NIBP CHECK screen.		
	17	Date/time	Check that the current date and time are properly set on the monitoring screen.		
	18	ECG	Check the heart rate accuracy with an AX-400G vital sign simulator.		
			Check the heart rate alarm, alarm message, alarm sound and alarm indication with BJ-900P ECG patient cable and AX-400G vital sign simulator.		
	19	RESP	Check the respiration rate accuracy with an AX-400G vital sign simulator.		
			Check the respiration rate alarm, alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator.		
	20	SpO <sub>2</sub>	Check the accuracy of SpO <sub>2</sub> and pulse rate with an AX-400G vital sign simulator.		
			Check the SpO <sub>2</sub> alarm, alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator.		
	21	IBP	Check that the zeroing for IBP measurement is within the specified range with an AX-400G vital sign simulator.		
			Check the blood pressure accuracy with an AX-400G vital sign simulator.		
			Check the blood pressure alarm, alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator.		
			Check the alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator when disconnecting the IBP connection cord from the instrument.		
	22	TEMP	Check the temperature accuracy with an AX-400G vital sign simulator.		
			Check the alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator when disconnecting the TEMP connection cord from the instrument.		
	23	CO <sub>2</sub>	Check that the CO <sub>2</sub> wave, data and respiration rate are properly displayed with an AX-400G vital sign simulator.		
			Check the alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator when disconnecting the CO <sub>2</sub> connection cord from the instrument.		
			Check the accuracy of CO <sub>2</sub> sensor with CO <sub>2</sub> calibration gas.		
	24	O <sub>2</sub>	Check that O <sub>2</sub> value on the window is 21%.		
	25	CO	Check the accuracy of two temperatures (Tb and Ti) with an AX-400G vital sign simulator.		
			Check the CO accuracy with an AX-400G vital sign simulator.		
Check the alarm message, alarm sound and alarm indication with an AX-400G vital sign simulator when disconnecting the CO connection cord from the instrument.					
26	Battery	When an optional SB-671P battery pack is used, check the battery pack.			
Safety	27	Check that the earth leakage current is less than prescribed limits.	[     ] $\mu$ A under normal condition [     ] $\mu$ A under single-fault condition		
	28	Check that the enclosure leakage current is less than prescribed limits.	[     ] $\mu$ A under normal condition [     ] $\mu$ A under single-fault condition		
	29	Check that the patient leakage current is less than prescribed limits.	[     ] $\mu$ A under normal condition [     ] $\mu$ A under single-fault condition		
	30	Check that the patient auxiliary current is less than the prescribed limits.	[     ] $\mu$ A under normal condition [     ] $\mu$ A under single-fault condition		

## 6. MAINTENANCE

ZS-900P transmitter	Instrument serial No.	Version number	Maintenance No.	
	Item		Result	Action
	Check that there is no dirt, rust, scratch or crack on the transmitter.			
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the transmitter.			
	Check that the transmitter has no loose screw.			
	Check that the transmitter has no connector and switch loosely attached.			
	Check that the labels on the transmitter are not peeled or damaged.			
	Check that the LED on the transmitter lights green when it is connected to the instrument.			
Check that the vital sign data and waveforms from the instrument connected to the transmitter are properly received at a receiver and displayed on the receiver screen.				
QF series interface/IF series communication cable	Instrument serial number	Version number	Maintenance No.	
	Item		Result	Action
	Check that there is no dirt, rust, scratch or crack on the interface.			
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the interface.			
	Check that the interface has no loose screw.			
	Check that the interface has no connector and switch loosely attached.			
	Check that the labels on the interface are not peeled or damaged.			
	Check that the communication between the interface and instrument is done on the MULTILINK CHECK screen in the MANUAL CHECK mode.			
AG-400R CO <sub>2</sub> unit	Instrument serial number	Version number	Maintenance No.	
	Item		Result	Action
	Check that there is no dirt, rust, scratch or crack on the interface.			
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the CO <sub>2</sub> unit.			
	Check that the interface has no loose screw.			
	Check that the interface has no connector and switch loosely attached.			
	Check that the labels on the interface are not peeled or damaged.			
	Check that the CO <sub>2</sub> data is acceptable with a CO <sub>2</sub> calibration gas cylinder.			

AG-920R multigas unit	Instrument serial number	Version number	Maintenance No.	
	Item		Result	Action
	Check that there is no dirt, rust, scratch or crack on the multigas unit.			
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the multigas unit.			
	Check that the multigas unit has no loose screw.			
	Check that the multigas unit has no connector and switch loosely attached.			
Check that the labels on the multigas unit are not peeled or damaged.				
Check that each gas concentration data is acceptable with a multigas calibration gas cylinder.				
QE-910P BIS processor	Instrument serial number	Version number	Maintenance No.	
	Item		Result	Action
	Check that there is no dirt, rust, scratch or crack on the BIS processor.			
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the BIS processor.			
	Check that the BIS processor has no loose screw.			
	Check that the BIS processor has no connector and switch loosely attached.			
	Check that the labels on the BIS processor are not peeled or damaged.			
Check that there is no error on the screen when the BIS processor is connected to the instrument.				
AE-918P neuro unit	Instrument serial number	Version number	Maintenance No.	
	Item		Result	Action
	Check that there is no dirt, rust, scratch or crack on the neuro unit.			
	Check that there is no stain which shows that liquid such as blood or liquid medicine got inside the neuro unit.			
	Check that there is no error on the screen when the neuro unit is connected to the instrument.			
Check that EEG data is acceptable.				

# Section 7 Replaceable Parts List

BSM-6301 Bedside Monitor (MU-631R Main Unit).....	7.2
BSM-6501 Bedside Monitor (MU-651R Main Unit).....	7.5
BSM-6701 Bedside Monitor (MU-671R Main Unit).....	7.8
AY-631P/633P Input Unit .....	7.11
AY-651P/653P Input Unit .....	7.13
AY-660P/661P/663P/671P/673P Input Unit .....	7.15
AA-672P/674P Smart Expansion Unit.....	7.18
WS-671P Recorder Module.....	7.19
RG-501X/502X-01 Paper Drive Unit.....	7.20
Optional Interface Board.....	7.21
QI-631P Interface .....	7.21
QI-632P Interface .....	7.21
QI-634P Interface .....	7.22
QI-670P Interface .....	7.22
QI-671P Interface .....	7.24
QI-672P Interface .....	7.24

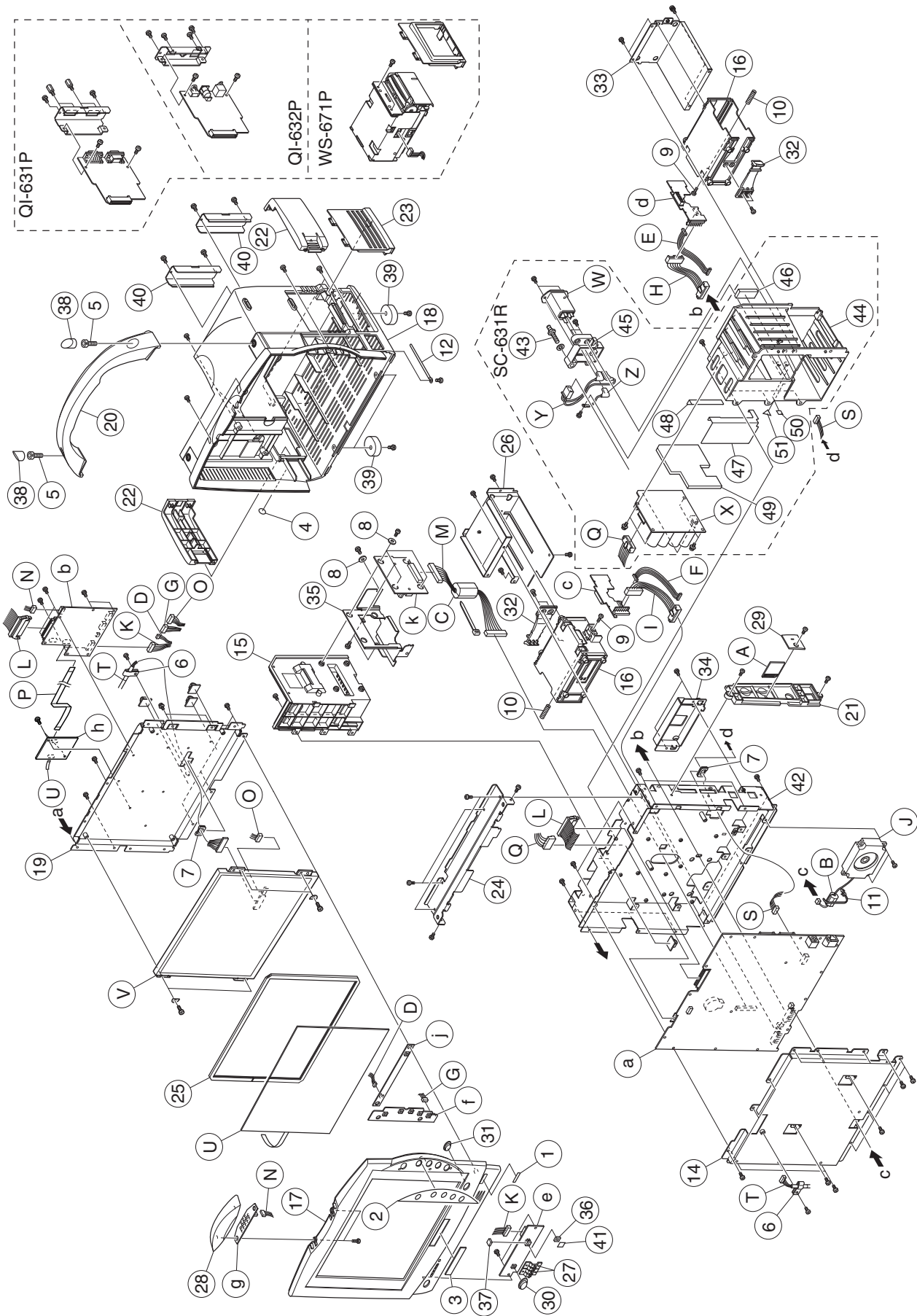
When ordering parts or accessories from your nearest Nihon Kohden representative, please quote the NK code number and part name which are listed in this service manual, and the name or model of the unit in which the required part is located. This will help us to promptly attend to your needs. Always use Nihon Kohden parts and accessories to assure maximum performance from your instrument.

## BSM-6301 Bedside Monitor (MU-631R Main Unit)

No.	Code No./Model	Description	Qty
1	6124-903417	MU-631RA model label	1
	6124-903426	MU-631RK model label	1
2	6123-902153A	Operation panel	1
3	6124-902534	Company logo label	1
4	910338	1-inch "BIS ready" logo label	1
5	289875	Hexagon socket head cap screw	2
6	361075	FG clamp	2
7	458612	Edge holder	2
8	579375	Washer	5
9	611964A	Pan head screw	2
10	719955	Ultra spring	2
11	919935	Reuse snapping tie	1
12	922299	Cord clip	1
14	6111-901248B	Main shield chassis	1
15	6111-901257C	Connector plate	1
16	6111-901293E	Battery compartment	2
17	6111-902229B	Front enclosure	1
18	6111-902309C	Rear enclosure	1
19	6111-905431	Main chassis front	1
20	6112-902735C	Handle	1
21	6112-903333C	Side panel	1
22	6112-904377B	Battery cover	2
23	6112-904395B	WS blank panel	1
24	6112-904403A	Handle holder	1
25	6112-904475D	Touch screen packing	1
26	6112-905251A	Battery compartment holder L	1
27	6113-049754B	LED filter	2
28	6113-905187B	Alarm indicator	1
29	6113-906489A	SD blank panel	1
30	6113-906498A	Power key top	1
31	6113-906506B	WS key top	1
32	6113-906658B	Battery lever	2
33	6112-905242A	Battery compartment holder R	1
34	6113-910047A	Spacer plate	1
35	6113-910074	IF ground plate	1
36	6114-137915	Square cover 1	1
37	6114-137924	Square cover 2	1
38	6114-906504C	Handle cap	2
39	6114-908413A	Rubber foot	4
40	6114-912043	Blank panel for option	2
41	6124-901713	IR filter	1
42	6142-900841A	Chassis assy	1
43	551734	Ground terminal	1
44	6111-902211B	Chassis block	1
45	6113-908273B	AC inlet frame	1
46	6114-908725	Gasket	1
47	6114-911944A	Isolation sheet 1	1

No.	Code No./Model	Description	Qty
48	6114-911953	Isolation sheet 2	1
49	6114-934664	Cooling pad	1
50	6124-035614	Protective earth label	1
51	6124-902712	Attention label	1
A	9000-057839	SD card 1 GB	1
B	9000-049252	Ferrite core	1
C	711384A	Sleeve ferrite clamp	1
D	716031	Cable	1
E	716049	Cable	1
F	716058	Cable	1
G	716085	Cable	1
H	716147	Cable	1
I	716156	Cable	1
J	718439	Speaker	1
K	718698	Cable	1
L	721355A	Cable	1
M	721364A	Cable	1
N	721382	Cable	1
O	721391	Cable	1
P	9000-057859	Cable	1
Q	903034	Cable	1
S	920033	Cable	1
T	921496	Cable	1
U	9000-057861	Touch screen	1
V	9000-023485	10.4 inch LCD unit	1
a	UR-39450	Main digital board	1
b	UR-4284	Front I/F board	1
c	UR-3957	Batt mother 0 board	1
d	UR-39591	Batt mother 1 board	1
—	UR-39621	Front Mother board set	1
e	—	Power SW board	1
f	—	Operation board	1
g	—	Alarm board	1
h	UR-4112	Touch panel I/F board	1
j	—	Record key board	1
k	UR-3966	Input I/F board	1
W	718395	AC inlet socket	1
X	916858A	Power unit	1
Y	924181	Primary circuit wires	1
Z	613169B	Ground wire	1

7. REPLACEABLE PARTS LIST



BSM-6301



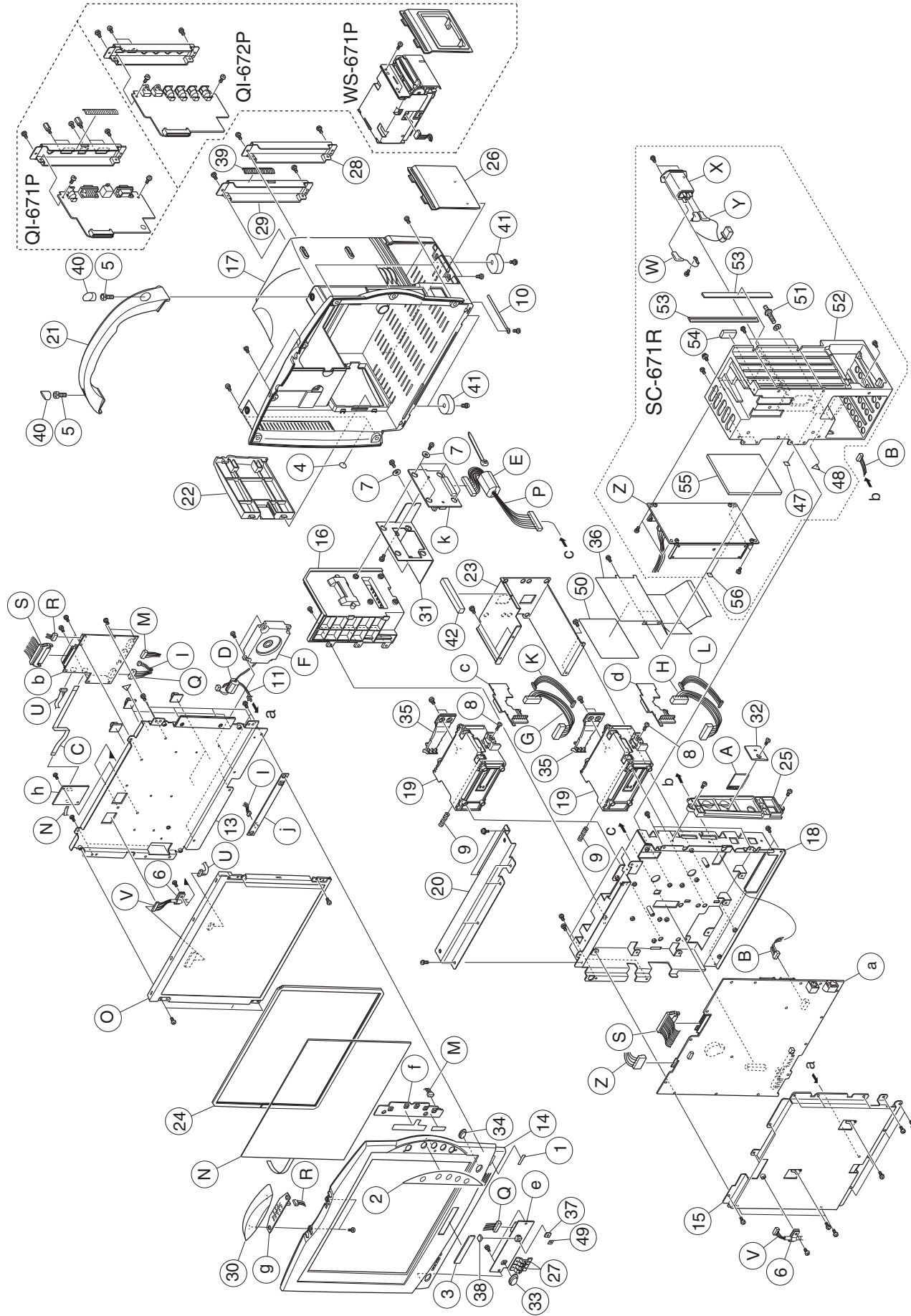
## BSM-6501 Bedside Monitor (MU-651R Main Unit)

No.	Code No./Model	Description	Qty
1	6124-902204	MU-651RA model label	1
	6124-902213	MU-651RK model label	1
2	6123-902153A	Operation panel	1
3	6124-902543	Company logo label	1
4	910338	1-inch "BIS ready" logo label	1
5	289848	Hexagon socket head cap screw	2
6	361075	FG clamp	2
7	579375	Washer	5
8	611964A	Pan head screw	2
9	719955	Ultra spring	2
10	722202	Cord clip	1
11	919935	Reuse snapping tie	1
13	6111-905432	Main chassis front	1
14	6111-901212D	Front enclosure	1
15	6111-901248B	Main shield chassis	1
16	6111-901257C	Connector plate	1
17	6111-901275C	Rear enclosure	1
18	6111-901284C	Rear frame chassis	1
19	6111-901293E	Battery compartment	2
20	6112-902691B	Handle holder	1
21	6112-902735C	Handle	1
22	6112-902762C	Battery cover	1
23	6112-902771B	Battery compartment holder	1
24	6112-903315C	Touch screen packing	1
25	6112-903333C	Side panel	1
26	6112-903342B	WS blank panel	1
27	6113-049754B	LED filter	2
28	6113-905151C	Blank panel for QI-ML	1
29	6113-905169C	Blank panel for QI-MIX	1
30	6113-905187B	Alarm indicator	1
31	6113-905196C	IF ground plate	1
32	6113-906489A	SD blank panel	1
33	6113-906498A	Power key top	1
34	6113-906506B	WS key top	1
35	6113-906658B	Battery lever	2
36	6113-907568A	Power insulator	1
37	6114-137915	Square cover 1	1
38	6114-137924	Square cover 2	1
39	6114-139397	EMI gasket	1
40	6114-906504C	Handle cap	2
41	6114-908413A	Rubber foot	4
42	6114-908734	Gasket	1
49	6124-901713	IR filter	1
50	6124-902793	Discharge switch description label	1
51	551734	Ground terminal	1
52	6111-901266D	Unit chassis	1
53	6114-908716	Sealer L130	2



## 7. REPLACEABLE PARTS LIST

No.	Code No./Model	Description	Qty
54	6114-908725	Gasket	1
55	6114-934806	Cooling pad	1
56	6124-035614	Protective earth label	2
57	6124-902712	Attention label	1
A	9000-057839	SD card 1 GB	1
B	920033	Cable	1
C	9000-057859	Cable	1
D	9000-049252	Ferrite core	1
E	711384A	Sleeve ferrite clamp	1
F	718439	Speaker	1
G	716156	Cable	1
H	716147	Cable	1
I	716085	Cable	1
K	716058	Cable	1
L	716049	Cable	1
M	716031	Cable	1
N	9000-057862	Touch screen	1
O	930655	12.1 inch LCD unit	1
P	721364A	Cable	1
Q	718698	Cable	1
R	721382	Cable	1
S	721355A	Cable	1
U	9000-057856	Cable	1
V	722096	Cable	1
W	613169B	Ground wire	1
X	718395	AC inlet socket	1
Y	916911C	Primary circuit wires	1
Z	916867B	Power unit	1
a	UR-3945	Main digital board	1
b	UR-4284	Front I/F board	1
c	UR-3957	Batt mother 0 board	1
d	UR-3959	Batt mother 1 board	1
—	UR-39621	Front Mother board set	1
e	—	Power SW board	1
f	—	Operation board	1
g	—	Alarm board	1
h	UR-4112	Touch panel I/F board	1
j	—	Record key board	1
k	UR-3966	Input I/F board	1

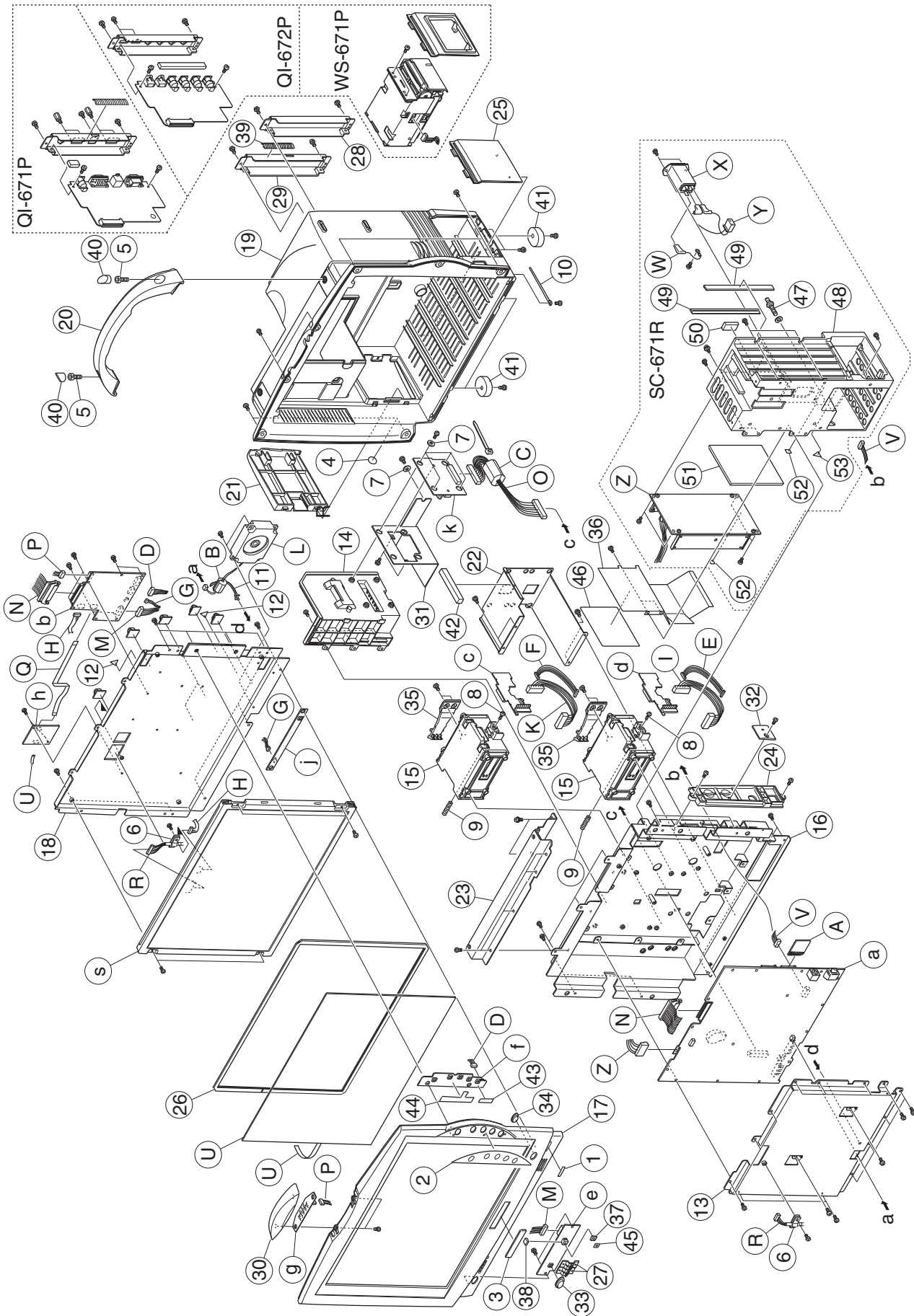


## BSM-6701 Bedside Monitor (MU-671R Main Unit)

No.	Code No./Model	Description	Qty
1	6124-902231	MU-671RA model label	1
	6124-902249	MU-671RK model label	1
2	6123-902153A	Operation panel	1
3	6124-902543	Company logo label	1
4	910338	1-inch "BIS ready" logo label	1
5	289848	Hexagon socket head cap screw	2
6	361075	FG clamp	2
7	579375	Washer	5
8	611964A	Pan head screw	2
9	719955	Ultra spring	2
10	722202	Cord clip	1
11	919935	Reuse snapping tie	1
13	6111-901248B	Main shield chassis	1
14	6111-901257C	Connector plate	1
15	6111-901293E	Battery compartment	2
16	6111-901346C	Rear frame chassis	1
17	6111-901355D	Front enclosure	1
18	6111-905433	Main chassis front	1
19	6111-901373C	Rear enclosure	1
20	6112-902735C	Handle	1
21	6112-902762C	Battery cover	1
22	6112-902771B	Battery compartment holder	1
23	6112-902824B	Handle holder	1
24	6112-903333C	Side panel	1
25	6112-903342B	WS blank panel	1
26	6112-903458D	Touch screen packing	1
27	6113-049754B	LED filter	2
28	6113-905151C	Blank panel for QI-ML	1
29	6113-905169C	Blank panel for QI-MIX	1
30	6113-905187B	Alarm indicator	1
31	6113-905392A	IF ground plate	1
32	6113-906489A	SD blank panel	1
33	6113-906498A	Power key top	1
34	6113-906506B	WS key top	1
35	6113-906658B	Battery lever	2
36	6113-907568A	Power insulator	1
37	6114-137915	Square cover 1	1
38	6114-137924	Square cover 2	1
39	6114-139397	EMI gasket	1
40	6114-906504C	Handle cap	2
41	6114-908413A	Rubber foot	4
42	6114-908734	Gasket	1
45	6124-901713	IR filter	1
46	6124-902793	Discharge switch description label	1
47	551734	Ground terminal	1
48	6111-901266D	Unit chassis	1
49	6114-908716	Sealer L130	2

No.	Code No./Model	Description	Qty
50	6114-908725	Gasket	1
51	6114-934806	Cooling pad	1
52	6124-035614	Protective earth label	2
53	6124-902712	Attention label	1
A	9000-057839	SD card 1 GB	1
B	9000-049252	Ferrite core	1
C	711384A	Sleeve ferrite clamp	1
D	716031	Cable	1
E	716049	Cable	1
F	716058	Cable	1
G	716085	Cable	1
H	9000-057857	Cable	1
I	716147	Cable	1
K	716156	Cable	1
L	718439	Speaker	1
M	718698	Cable	1
N	721355A	Cable	1
O	721364A	Cable	1
P	721382	Cable	1
Q	9000-057858	Cable	1
R	722096	Cable	1
U	9000-057863	Touch screen	1
V	920033	Cable	1
W	613169B	Ground wire	1
X	718395	AC inlet socket	1
Y	916911C	Primary circuit wires	1
Z	916867B	Power unit	1
a	UR-39451	Main digital board	1
b	UR-4284	Front I/F board	1
c	UR-3957	Batt mother 0 board	1
d	UR-3959	Batt mother 1 board	1
—	UR-39621	Front Mother board set	1
e	—	Power SW board	1
f	—	Operation board	1
g	—	Alarm board	1
h	UR-4112	Touch panel I/F board	1
j	—	Record key board	1
k	UR-3966	Input I/F board	1
s	9000-056672	15 inch LCD display	1

7. REPLACEABLE PARTS LIST



BSM-6701

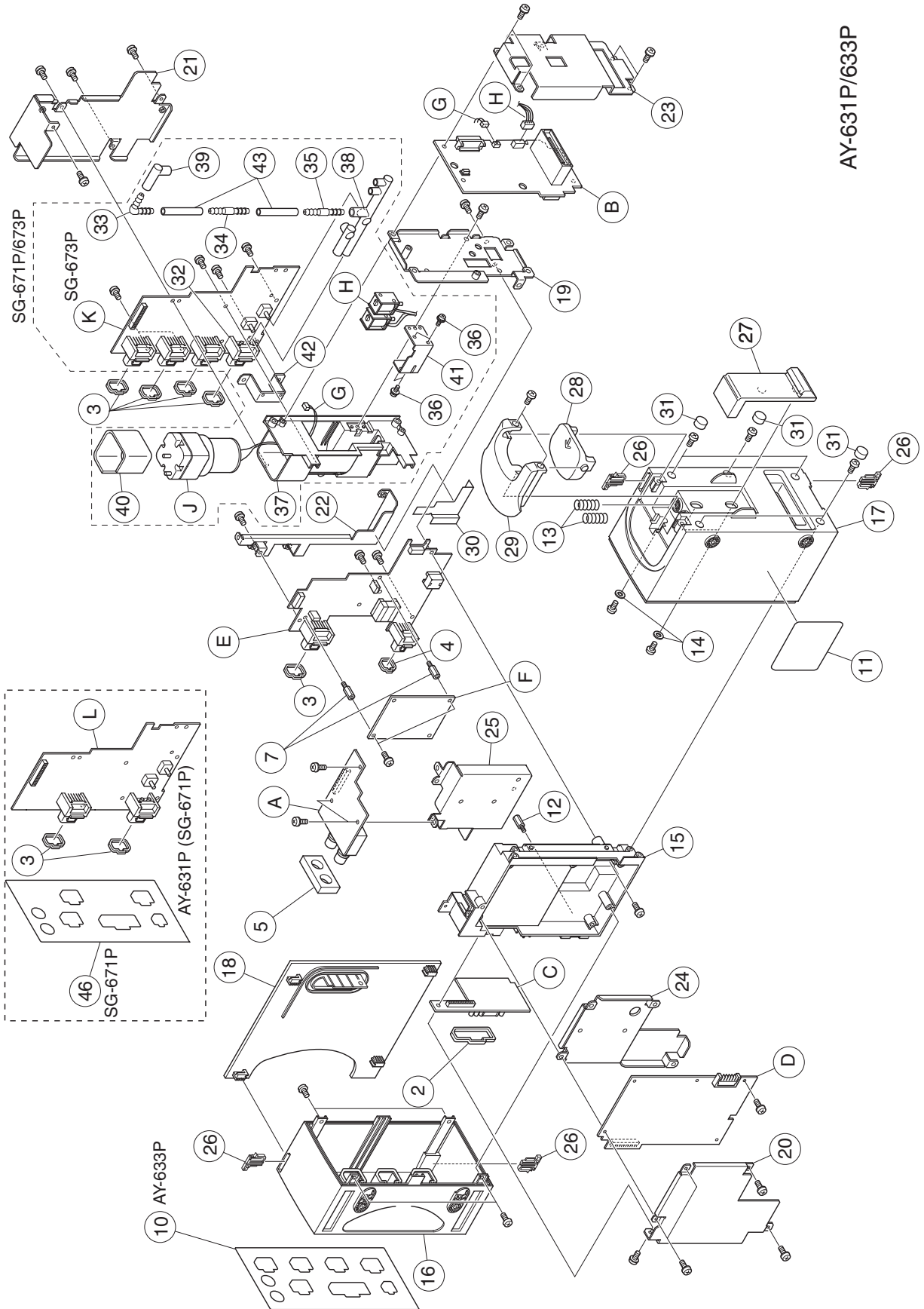
## AY-631P/633P Input Unit

No.	Code No./Model	Description	Qty
2	6114-137185	12P connector packing	1
3	6114-137194	15P connector packing	5
4	6114-137202	5P connector packing	1
5	6114-906487	TEMP socket packing	1
7	719732	Spacer bolt	2
10	6123-902189B	AY-633P panel (MASIMO 3MP)	1
11	6124-902285A	MASIMO patent label MS-13	1
12	127925A	Spacer bolt	1
13	374765A	Spring	2
14	579375	Washer	2
15	6111-901203D	Unit frame	1
16	6111-901221C	Input front enclosure	1
17	6111-901239C	Input rear enclosure	1
18	6111-901631B	Side panel	1
19	6112-902655A	Ground chassis 1	1
20	6112-902664A	ECG shield chassis 2	1
21	6112-902673A	Multi shield chassis 2	1
22	6112-902682B	Pass plate	1
23	6113-905089B	Ground chassis 2	1
24	6113-905098A	ECG shield chassis 1	1
25	6113-905106A	Multi shield chassis 1	1
26	6113-905258B	Lock (4MP)	4
27	6113-906417C	Lock plate	1
28	6113-906426C	Lock release lever	1
29	6113-906435B	Lock plate cover	1
30	6114-908066	Multi insulator	1
31	6114-908681C	Rubber cap	5
32	515542C	NIBP socket	1
33	531337	L-joint	1
34	531346	Filter	1
35	531355	Check valve	1
36	613089	Pan head screw	4
37	6112-902717C	NIBP frame	1
38	6113-905115C	Tube main	1
39	6114-134954B	NIBP pump tube	1
40	6114-135418	Vibration damping sponge	1
41	6114-906424A	Valve bracket	1
42	6114-906469A	NIBP receptacle bracket	1
43	6114-906478A	Silicon tube	2
46	6123-902171B	AY-631P panel (MASIMO 1MP)	1
A	UR-3940	TEMP board	1
B	UR-3949	AY Mother (Input mother) board	1
C	UR-3950	ECG connector board	1
D	UR-3951	ECG RESP board	1
E	UR-39721	MPU PWR board	1
F	9000-058392	MS-2013 SB board	1
G	9000-041786	Cable	1



7. REPLACEABLE PARTS LIST

No.	Code No./Model	Description	Qty
H	923119	Valve	1
J	532149B	Rolling pump	1
K	UR-39373	MPU board for AY-633P	1
L	UR-39371	MPU board for AY-631P	1



AY-631P/633P

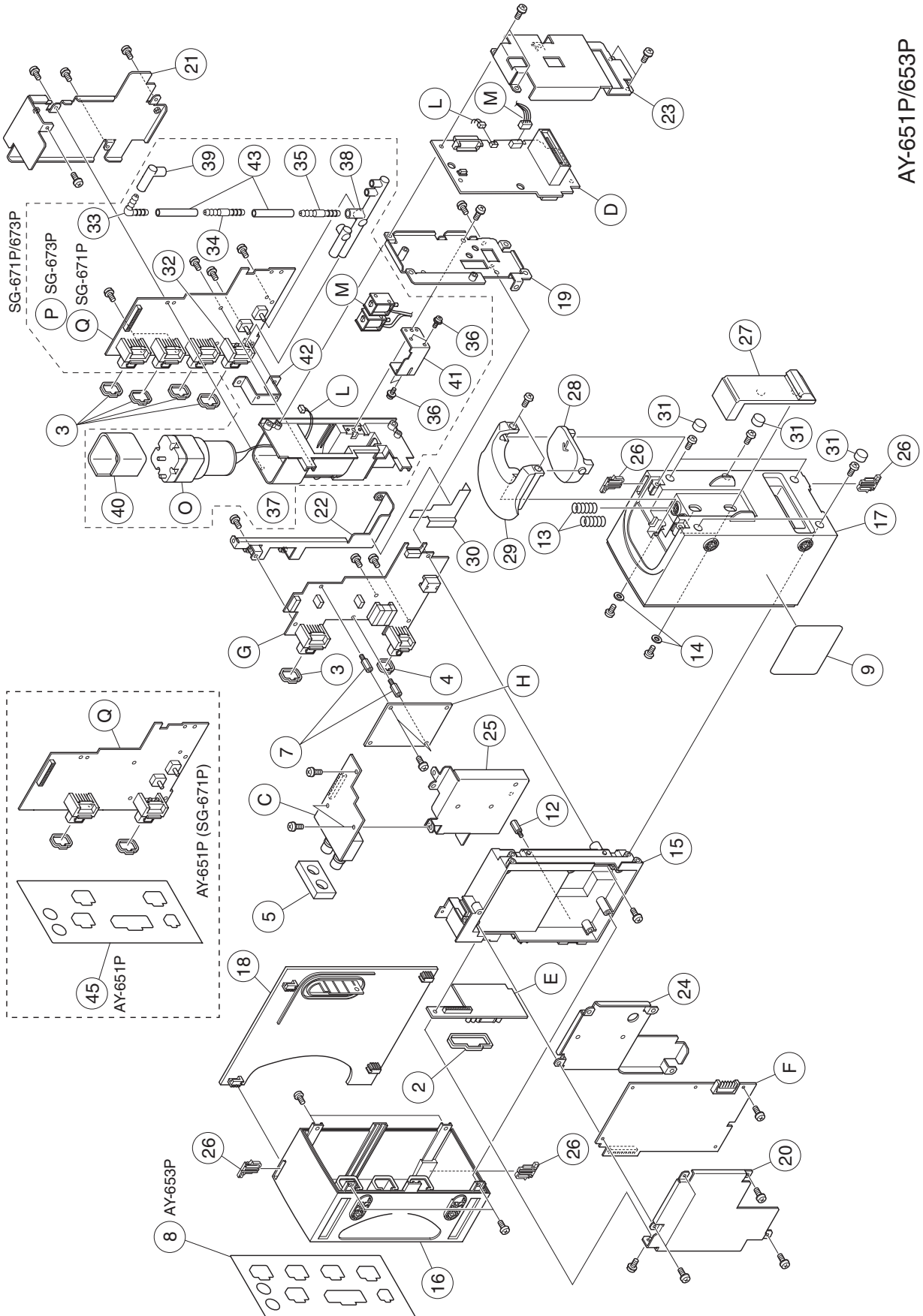
## AY-651P/653P Input Unit

No.	Code No./Model	Description	Qty
2	6114-137185	12P connector packing	1
3	6114-137194	15P connector packing	5
4	6114-137202	5P connector packing	1
5	6114-906487	TEMP socket packing	1
7	719732	Spacer bolt	2
8	6123-902206B	AY-653P panel (NELLCOR 3MP)	1
9	6124-042232A	NELLCOR patent label NELL3	1
12	127925A	Spacer bolt	1
13	374765A	Spring	2
14	579375	Washer	2
15	6111-901203D	Unit frame	1
16	6111-901221C	Input front enclosure	1
17	6111-901239C	Input rear enclosure	1
18	6111-901631B	Side panel	1
19	6112-902655A	Ground chassis 1	1
20	6112-902664A	ECG shield chassis 2	1
21	6112-902673A	Multi shield chassis 2	1
22	6112-902682B	Pass plate	1
23	6113-905089B	Ground chassis 2	1
24	6113-905098A	ECG shield chassis 1	1
25	6113-905106A	Multi shield chassis 1	1
26	6113-905258B	Lock (4MP)	4
27	6113-906417C	Lock plate	1
28	6113-906426C	Lock release lever	1
29	6113-906435B	Lock plate cover	1
30	6114-908066	Multi insulator	1
31	6114-908681C	Rubber cap	5
32	515542C	NIBP socket	1
33	531337	L-joint	1
34	531346	Filter	1
35	531355	Check valve	1
36	613089	Pan head screw	4
37	6112-902717C	NIBP frame	1
38	6113-905115C	Tube main	1
39	6114-134954B	NIBP pump tube	1
40	6114-135418	Vibration damping sponge	1
41	6114-906424A	Valve bracket	1
42	6114-906469A	NIBP receptacle bracket	1
43	6114-906478A	Silicon tube	2
45	6123-902198B	AY-651P panel (NELLCOR 1MP)	1
C	UR-3940	TEMP board	1
D	UR-3949	AY Mother (Input mother) board	1
E	UR-3950	ECG connector board	1
F	UR-3951	ECG RESP board	1
G	UR-3972	MPUPWR board	1
H	9000-046424	NELL1SR pulse oximetry module	1
L	9000-041786	Cable	1



7. REPLACEABLE PARTS LIST

No.	Code No./Model	Description	Qty
M	923119	Valve	1
O	532149B	Rolling pump	1
P	UR-39373	MPU board for AY-653P	1
Q	UR-39371	MPU board for AY-651P	1



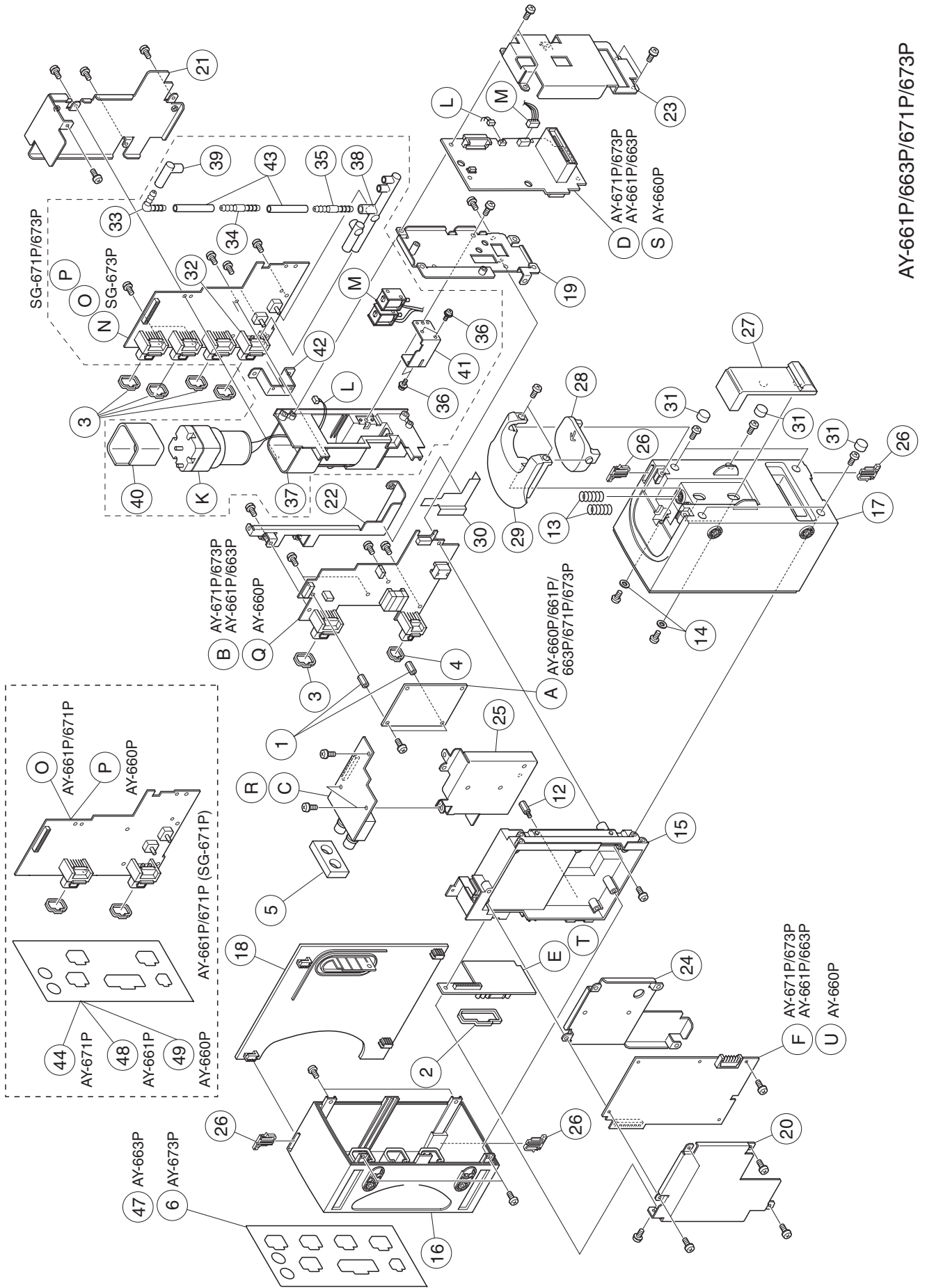
AY-651P/653P

## AY-660P/661P/663P/671P/673P Input Unit

No.	Code No./Model	Description	Qty
1	128078	Spacer nut	2
2	6114-137185	12P connector packing	1
3	6114-137194	15P connector packing	5
4	6114-137202	5P connector packing	1
5	6114-906487	TEMP socket packing	1
6	6123-902224A	AY-673P panel	1
12	127925A	Spacer bolt	1
13	374765A	Spring	2
14	579375	Washer	2
15	6111-901203D	Unit frame	1
16	6111-901221C	Input front enclosure	1
17	6111-901239C	Input rear enclosure	1
18	6111-901631B	Side panel	1
19	6112-902655A	Ground chassis 1	1
20	6112-902664A	ECG shield chassis 2	1
21	6112-902673A	Multi shield chassis 2	1
22	6112-902682B	Pass plate	1
23	6113-905089B	Ground chassis 2	1
24	6113-905098A	ECG shield chassis 1	1
25	6113-905106A	Multi shield chassis 1	1
26	6113-905258B	Lock (4MP)	4
27	6113-906417C	Lock plate	1
28	6113-906426C	Lock release lever	1
29	6113-906435B	Lock plate cover	1
30	6114-908066	Multi insulator	1
31	6114-908681C	Rubber cap	5
32	515542C	NIBP socket	1
33	531337	L-joint	1
34	531346	Filter	1
35	531355	Check valve	1
36	613089	Pan head screw	4
37	6112-902717C	NIBP frame	1
38	6113-905115C	Tube main	1
39	6114-134954B	NIBP pump tube	1
40	6114-135418	Vibration sponge	1
41	6114-906424A	Valve bracket	1
42	6114-906469A	NIBP receptacle bracket	1
43	6114-906478A	Silicon tube	2
44	6123-902215A	AY-671P panel (NK 1MP)	1
47	6123-902581	AY-663P panel (NK 3MP)	1
48	6123-902572	AY-661P panel (NK 1MP)	1
49	6123-903161B	AY-660P panel (NK 1MP)	1
A	UR-3908	SpO <sub>2</sub> board for AY-660P/661P/663P/671P/673P	1
B	UR-3938	MPUPWR board	1
C	UR-3940	TEMP board	1
D	UR-3949	AY Mother (Input mother) board	1
E	UR-3950	ECG connector board	1
F	UR-3951	ECG RESP board	1

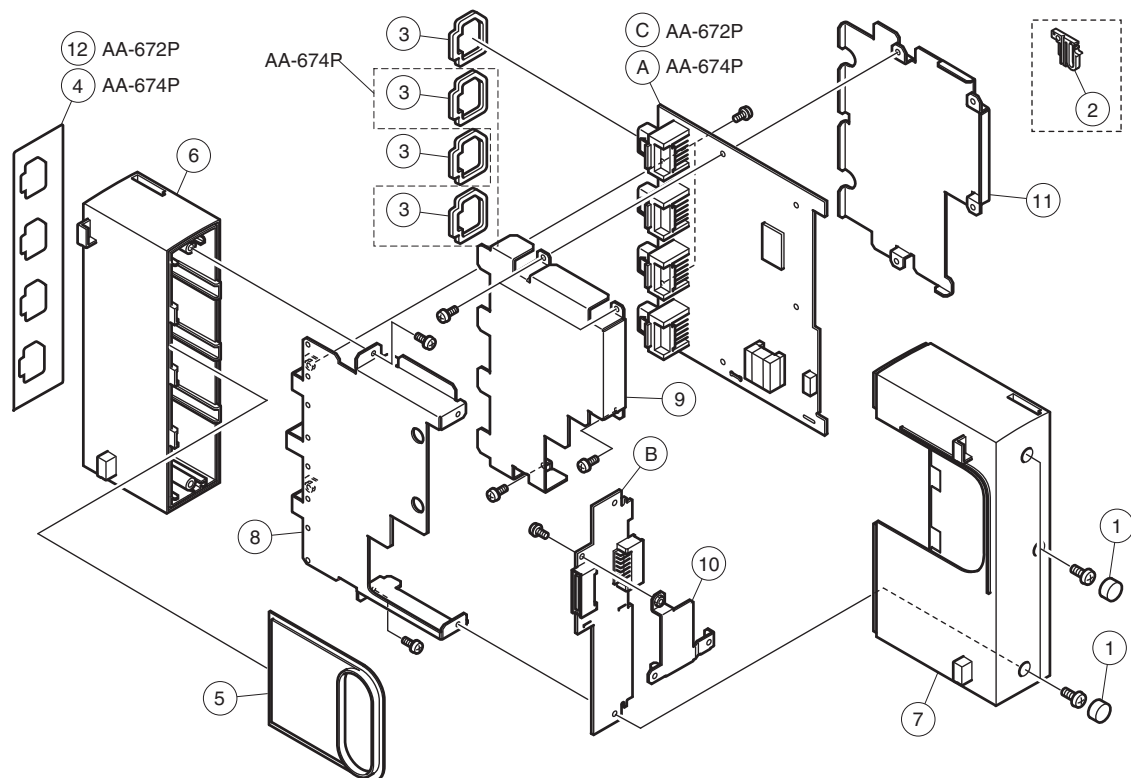
## 7. REPLACEABLE PARTS LIST

<b>No.</b>	<b>Code No./Model</b>	<b>Description</b>	<b>Qty</b>
K	532149B	Rolling pump	1
L	9000-041786	Cable	1
M	923119	Valve	1
N	UR-39373	MPU board for AY-663P/673P	1
O	UR-39371	MPU board for AY-661P/671P	1
P	UR-39370	MPU board for AY-660P	1
Q	UR-39380	MPU PWR board for AY-660P	1
R	UR-39400	TEMP board for AY-660P	1
S	UR-39490	AY Mother (Input mother) board for AY-660P	1
T	UR-39500	ECG connector board for AY-660P	1
U	UR-39510	ECG RESP board for AY-660P	1



## AA-672P/674P Smart Expansion Unit

No.	Code No./Model	Description	Qty
1	6114-908681C	Rubber cap	3
2	6113-905258B	Lock (4MP)	4
3	6114-137194	15P connector packing	4
4	6123-902144	AA-674P panel	1
5	6113-904883C	Side panel (R) 4MP	1
6	6111-901168C	Front case (4MP)	1
7	6111-901177C	Rear case (4MP)	1
8	6112-902486A	Shield chassis (4MP)	1
9	6113-904918C	Shield plate 1 (4MP)	1
10	6113-904927A	Shield plate mother 1 (4MP)	1
11	6112-902503B	Shield plate 2 (4MP)	1
12	6123-902135	AA-672P panel	1
A	UR-39464	EXTMPU board for AA-674P	1
B	UR-3947	EXTMPU PWR board	1
C	UR-39462	EXTMPU board for AA-672P	1

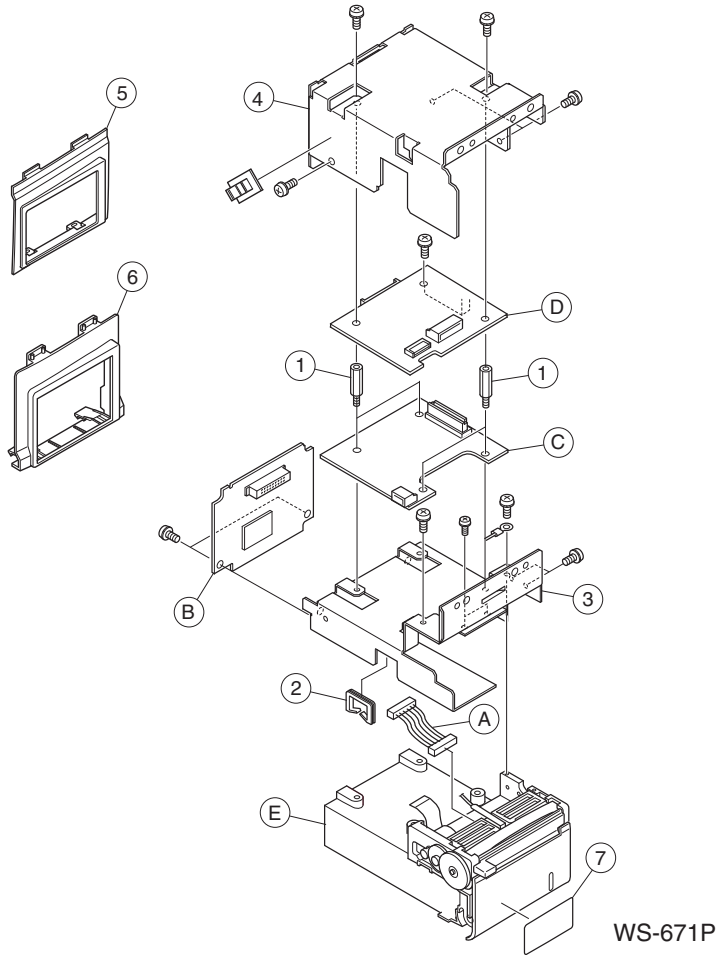


AA-672P/674P

# WS-671P Recorder Module

No.	Code No./Model	Description	Qty
1	127961A	Spacer bolt	4
2	458612	Edge holder	1
3	6112-902726C	WS unit chassis	1
4	6112-903235B	WS unit shield cover	1
5	6112-903396B	WS front cover M	1
6	6112-904573B	WS front cover L	1
7	6124-902356	Recording paper type name sticker FQW 2	1
A	716138	Wire harness	1
B	UR-3941	WS-main board	1
C	UR-3942	WS-power board	1
D	UR-3970/4318	WS-head board	1
E	RG-501X/502X-01	Paper drive unit	1

7



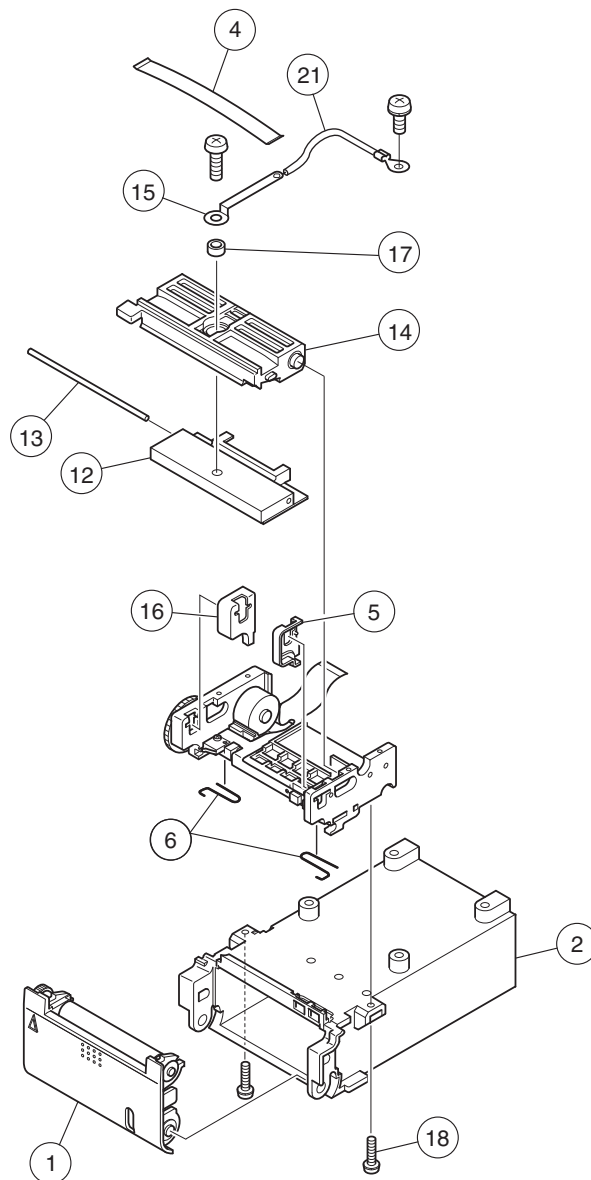
## 7. REPLACEABLE PARTS LIST

### RG-501X/502X-01 Paper Drive Unit

No.	Code No./Model	Description	Qty
1	YS-086P9	Magazine door assy	1
2	6113-050235D	Paper feed case	1
4	6114-908494	Head pressure plate	1
5	6114-136551A	Base cover R	1
6	6114-135463B	Magazine spring	2
12	662311A	Thermal head	1
13	6114-135445A	Head shaft	1
14	6113-050226B	Head holder	1
15	6114-073378A	Ground terminal	1
16	6114-136542A	Base cover	1
17	6114-135454A	M3 spacer	1
18	366792	BH2 × 6 SUS screw	2
21	662668A	Wire lead	1

#### NOTE

Parts other than listed above cannot be replaced. Replacement of the whole RG-501X/502X-01 is necessary.

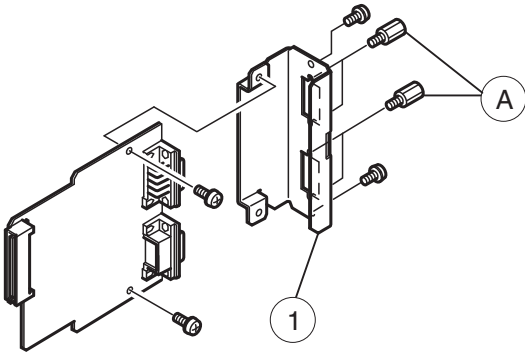


RG-501X

# Optional Interface Board

## QI-631P Interface

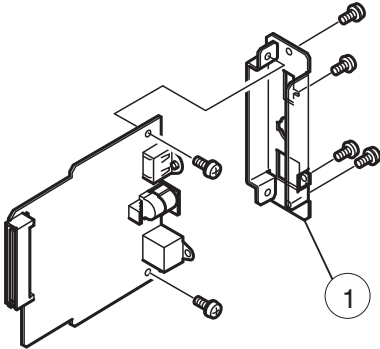
No.	Code No.	Description	Qty
1	6123-902411A	Panel chassis MIX	1
A	919436	Set screw	4



QI-631P

## QI-632P Interface

No.	Code No.	Description	Qty
1	6123-902429A	Panel chassis ML	1



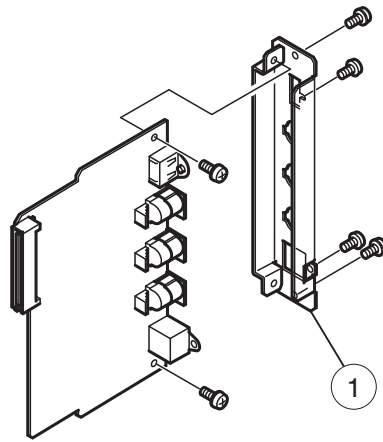
QI-632P



## 7. REPLACEABLE PARTS LIST

### QI-634P Interface

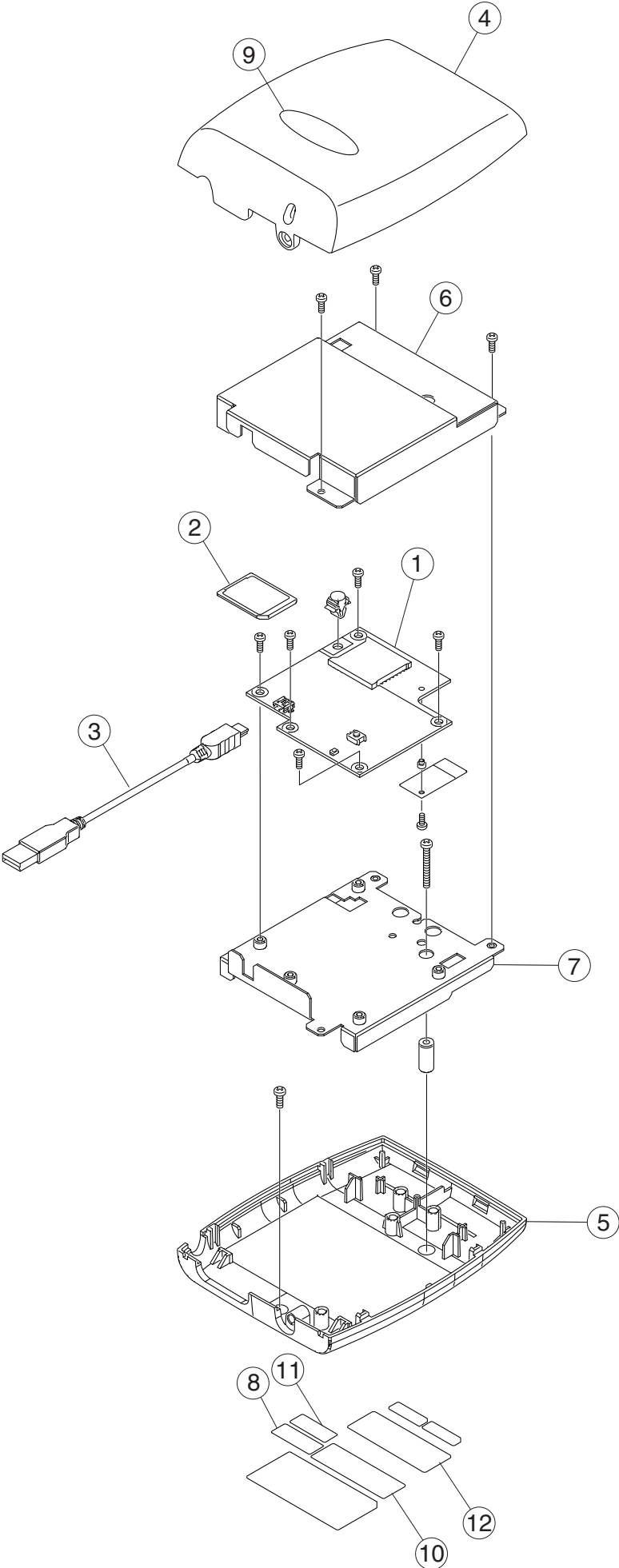
No.	Code No.	Description	Qty
1	6123-903099	Panel chassis ML	1



QI-634P

### QI-670P Interface

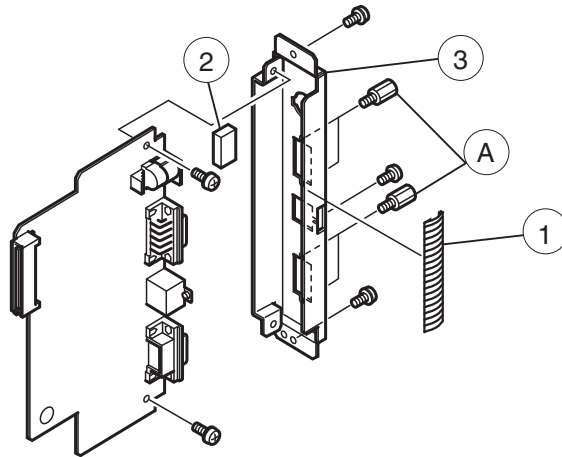
No.	Code No.	Description	Qty
1	UR-4294	BT module	1
2	9000-057839	AF1GSDI-KDE001 1GB SD card	1
3	9000-057968	USB A to mini B (W300)	1
4	6111-902345	Top enclosure	1
5	6111-902354	Bottom enclosure	1
6	6112-911100	Cover chassis	1
7	6112-911099	Bracket chassis	1
8	6124-903471	Bluetooth label (2100)	1
9	6124-912104	QI-670P panel	1
10	6124-041901A	WEEE label	1
11	6124-012333	R&TTE lable 6 Class 2	1
12	6184-940815	QI-670P FCC ID label	1



## 7. REPLACEABLE PARTS LIST

### QI-671P Interface

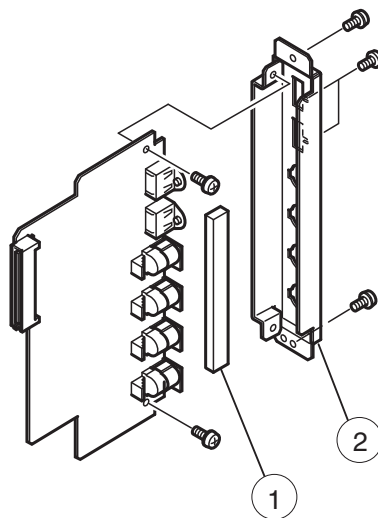
No.	Code No.	Description	Qty
1	6114-139397	EMI gasket	1
2	6114-909038	Sealer	1
3	6123-902322B	Panel chassis MIX	1
A	919436	Set screw	4



QI-671P

### QI-672P Interface

No.	Code No.	Description	Qty
1	6114-909047	Sealer	1
2	6123-902331A	Panel chassis ML	1



QI-672P



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Contact information is accurate as of July 2016. Visit [www.nihonkohden.com](http://www.nihonkohden.com) for the latest information.

The model and serial number of your instrument are identified on the rear or bottom of the unit.  
 Write the model and serial number in the spaces provided below. Whenever you call your representative concerning  
 this instrument, mention these two pieces of information for quick and accurate service.

Model \_\_\_\_\_

Serial Number \_\_\_\_\_

Your Representative
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