Chapter 3

Vital Application

This chapter describes the procedure for vital application, etc.

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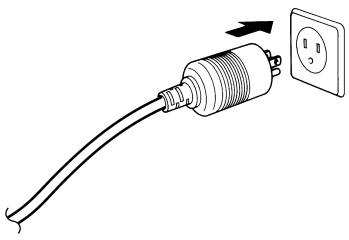
— To Acquire ECG Waveform —

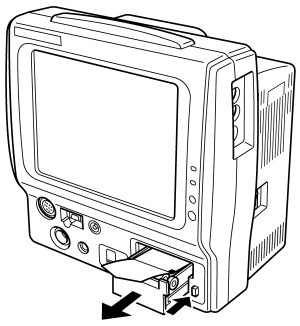
Before turning ON the power

1. Check the grounding.



Properly ground using the 3-way AC plug.
The grounding is required to prevent AC noise.

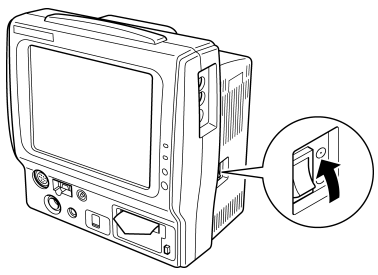
2. Check the recording paper.



The magazine will be released by pressing the magazine release button.

Open the recorder magazine, and check that there is enough amount of paper installed.

3. Turn ON the power.

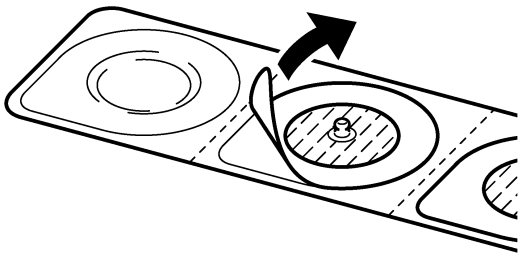


Turn ON the power and check for appropriate display.

Before Attaching the Electrodes

1. **Clean the electrode sites with an alcohol swab or other skin preparation. If necessary, shave the electrode sites to remove excessive hair.**

2. **Peel off the backing of disposable electrode.**



Pay attention not to touch the electrode jelly.

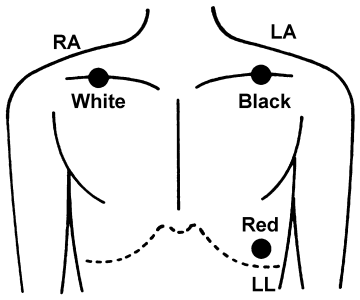
Electrode Placement

There are 3-electrode, 4-electrode, 5-electrode application depending on the cable type. Using the 4-electrode or 5-electrode application allows simultaneous monitoring of 2 ECG waveforms, and high accuracy of arrhythmia analysis can be attained.
Also, the displayed lead type can be changed.

For 3-electrode lead (1 waveform monitoring)

Lead Type I / II / III

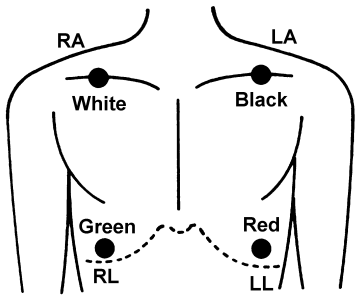
Symbol	*Color*	*Electrode Site*
RA	White	On the right infraclavicular fossa
LA	Black	On the left infraclavicular fossa
LL	Red	On the left midclavicular line, near the supracrestal line.



For 4-electrode lead (Simultaneous 2 waveforms monitoring)

Lead Type I / II / III / aVR / aVL / aVF

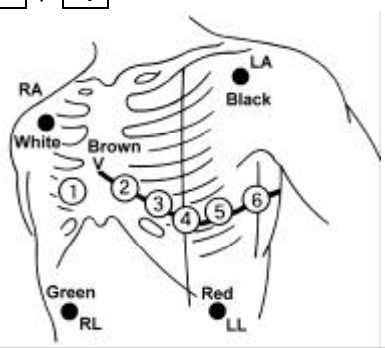
Symbol	*Color*	*Electrode Site*
RA	White	On the right infraclavicular fossa
LA	Black	On the left infraclavicular fossa
LL	Red	On the left midclavicular line, near the supracrestal line.
RL	Green	On the right midclavicular line at the same height as F.



For 5-electrode lead (Simultaneous 2 waveforms monitoring)

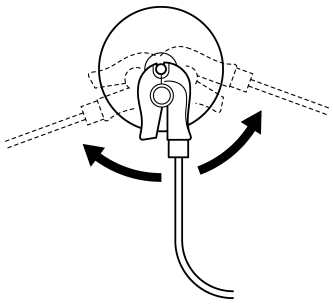
Lead Type I / II / III / aVR / aVL / aVF / V

Symbol	*Color*	*Electrode Site*
RA	White	On the right infraclavicular fossa
LA	Black	On the left infraclavicular fossa
LL	Red	On the left midclavicular line, near the supracrestal line.
RL	Green	On the right midclavicular line at the same height as F.
V	Brown	Chest Lead (V1～V6)



Connection to the Patient Monitor

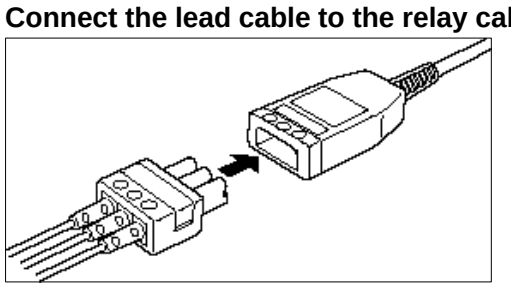
1. Connect the lead cable to the electrode.



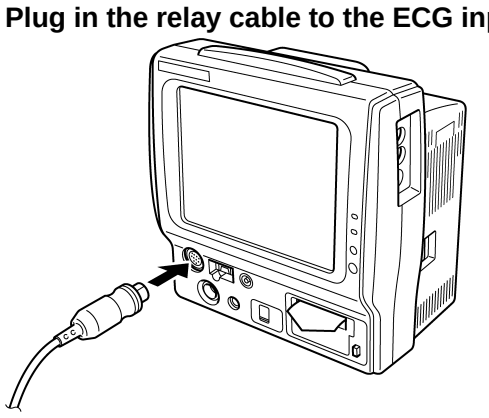
Clip on the lead cable end to the electrode convex part.

⚠CAUTION	✍ The indication for continuous use of the electrode is about one day. ✍ Replace the electrode if the skin contact gets loosen due to perspiring, etc. ✍ When an electrode is attached at the same location for a long time, some patients may develop a skin irritation. Check the patient's skin condition periodically and change the electrode site as required.

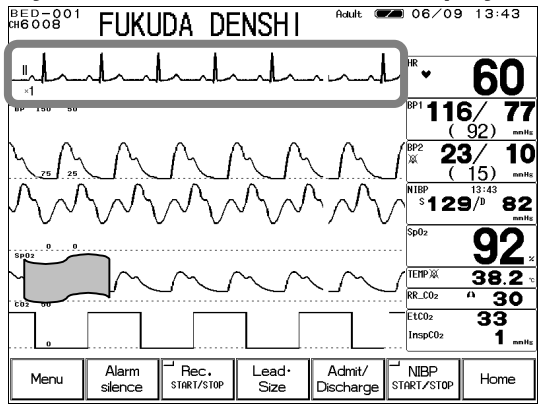
2. Connect the lead cable to the relay cable.



3. Plug in the relay cable to the ECG input connector (green) of the patient monitor.



4. Verify that the ECG waveform is displayed on the monitor.

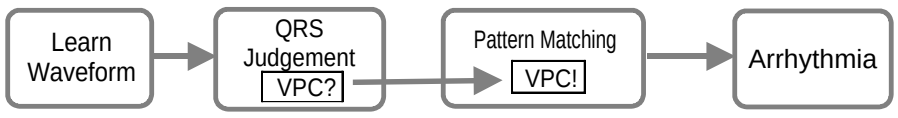


Adjust the waveform size and position. The monitoring lead can be also changed.

Reference Refer to " 6. Parameter Setup ECG" for size / lead setup.

About the Arrhythmia Analysis

Arrhythmia Analysis Flow



The arrhythmia detection algorithm learns the normal waveform of the patient and compares the waveform (QRS pattern) and RR interval for each heartbeat to determine the VPC. It compares the parameters such as QRS amplitude, QRS width, QRS polarity, RR interval, and selects abnormal QRS. Then the QRS with suspected VPC is pattern matched to distinguish the noise and VPC. This will finally determine the VPC and generate the arrhythmia alarm.

●QRS Classification

Each heartbeat will be classified to the following patterns according to the QRS judgement.

N (Normal)	Normal QRS beat
V (VPC)	Ventricular Extrasystole
S (SVPC)	Supraventricular Extrasystole
P (Pacing Beat)	Pacing beat
F (Fusion Beat)	Fusion beat of pacing and spontaneous beat
? (Undetermined Beat)	Learning arrhythmia, or beat not matching the pattern

●Arrhythmia Type

With the above QRS judgement, the following 12 types of arrhythmia alarm can be generated.

Type	***Meaning***	***Detection Criteria***
ASYSTOLE	Cardiac Arrest	Cardiac arrest is detected for more than preprogrammed time.
VF	Ventricular Fibrillation	A random, rapid electrical activity of the heart is detected.
VT	Ventricular Tachycardia	9 or more continuous ventricular beats are detected. (HR: 140bpm / 120bpm or over)
SLOW_VT		9 or more continuous ventricular beats are detected. (HR: under 140bpm / 120bpm)
TACHY	Tachycardia	HR is over the upper alarm limit.
BRADY	Bradycardia	HR is below the lower alarm limit.
RUN	Consecutive VPC	Continuous VPC exceeding the preprogrammed value is detected.
COUPLET	Couplet Ventricular Extrasystole	2 continuous beats of VPC is detected.
PAUSE		Cardiac arrest of 1.5 seconds and over is detected.
BIGEMINY	Ventricular Bigeminy	QRS pattern of V-N-V-N-V-N is detected.
TRIGEMINY	Ventricular Trigeminy	QRS pattern of V-N-N-V-N-N is detected.
FREQUENT	Frequent VPC	VPC exceeding the preprogrammed value is detected within 1 minute.

Filter Selection

●Filter Mode Setup

The waveform frequency characteristic can be selected from Monitor Mode, ESIS Mode, or ST Display Mode according to the monitoring purpose.

1. Monitor Mode Frequency Characteristic Adult / Pediatric：0.5～40Hz Neonate：1.6～40Hz

This is the standard mode for ECG monitoring. The upper frequency is set to 40Hz to reduce artifact caused by EMG, etc.

2. ESIS Mode Frequency Characteristic Adult / Pediatric：1.6～15Hz Neonate：1.6～15Hz

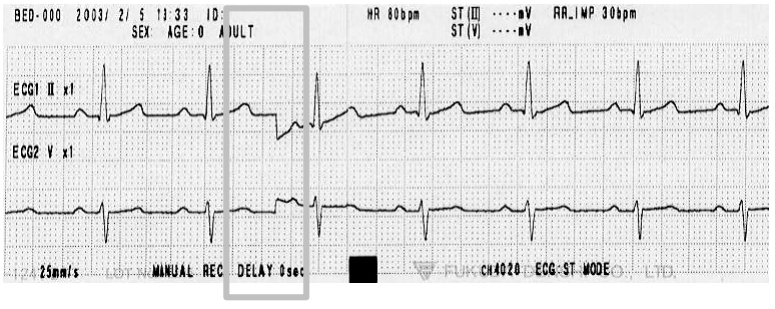
By selecting this mode when using electrosurgical instrument, electrical noise can be largely reduced. Do not select this mode unless using electrosurgical instrument.

3. ST Display Mode Frequency Characteristic Adult / Pediatric：0.05～40Hz

Select this mode if ST measurement is the main purpose of ECG monitoring.

NOTE	If “Neonate” is selected as patient type, ST display mode can not be selected

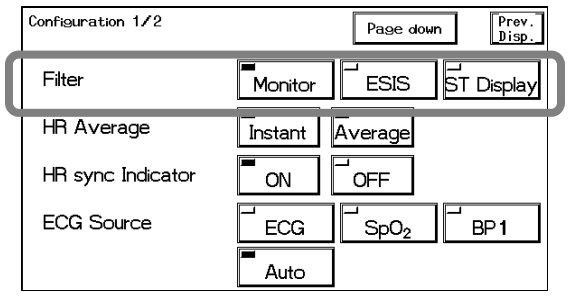
NOTE	When the filter setup is changed, a notch will appear on the ECG waveform due to the change in frequency characteristic.



Reference Refer to ” 6. Parameter Setup ECG” for details of filter mode.

●Procedure for Filter Mode Selection

1. **Press the ECG parameter key and display the ECG setup menu.**
2. **Press the [Config.] key.**



3. **Select the filter mode from 3 selections.**

●AC Filter

If the ECG waveform is interfered with AC noise, the AC filter cuts off the frequency component (50Hz or 60Hz).
The AC filter is always set to ON.

Reference Refer to “8. System Configuration Hospital Setup AC Filter” for AC filter setup (50Hz or 60Hz).

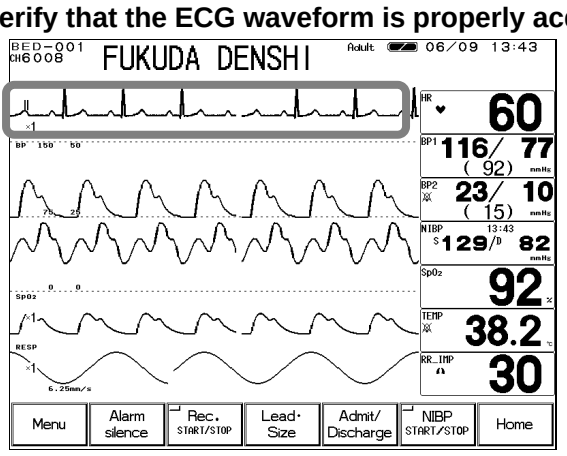
Lead Cable Types

There are various combinations of lead cable connecting type and electrode material.
Contact our service representative for details and select the appropriate electrode.

【for 3-electrode】	ECG Relay Cable (defibrillation-proof)	CI-700D-3
	ECG Relay Cable (electrosurgery-proof)	CI-700E-3
	ECG Lead Cable	3380.0648.13
【for 4-electrode】	ECG Relay Cable (defibrillation-proof)	CI-700D-4
	ECG Relay Cable (electrosurgery-proof)	CI-700E-4
【for 5-electrode】	ECG Relay Cable (defibrillation-proof)	CI-700D-5
	ECG Relay Cable (electrosurgery-proof)	CI-700E-5
	ECG Lead Cable	3380.0661.13

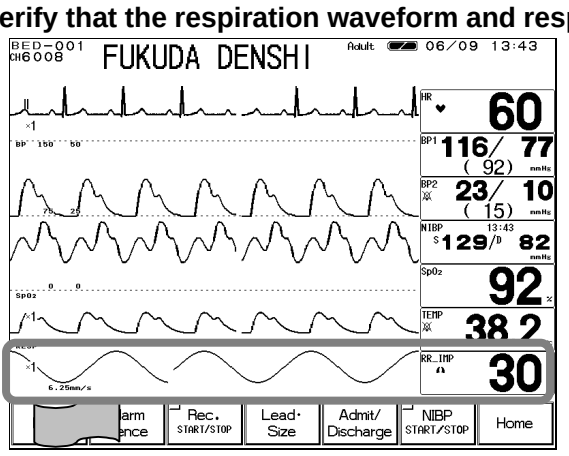
— Respiration (Impedance Measurement) —

1. Verify that the ECG waveform is properly acquired.



The respiration waveform is detected from lead II of ECG mentioned in the previous section. Therefore if stable ECG is acquired, the respiration waveform can be acquired at the same time.

2. Verify that the respiration waveform and respiration rate is displayed on the home display.



Adjust the waveform size, baseline position and sweep speed.

Reference

Refer to “6. Parameter Setup Respiration” for scale / baseline setup.
Refer to ”8. System Configuration Sweep Speed” for sweep speed setup.

— To Measure the SpO_2 —

1. Prepare an appropriate probe or sensor for the patient.

Sensor Types

Probe Type (Reusable type, for adult finger)

DS-100A
For adult with weight of 40kg and over.
This is for temporary use. When continuously using for long period of time, use the following single-use type.

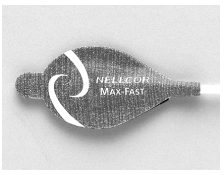
Single Use Type

OXISENSORIII N-25 (for neonate toe)
For neonate with weight of 3kg and over.

OXISENSORIII I-20 (for pediatric toe)
For pediatric with weight of 3kg～20kg

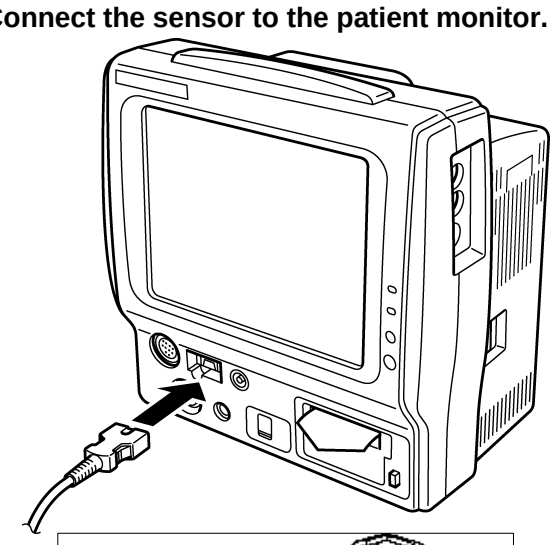
OXISENSORIII D-20 (for pediatric finger)
For pediatric or adult with weight of 10kg～50kg

OXISENSORIII D-25 (for adult finger)
For adult with weight of 30kg and over.

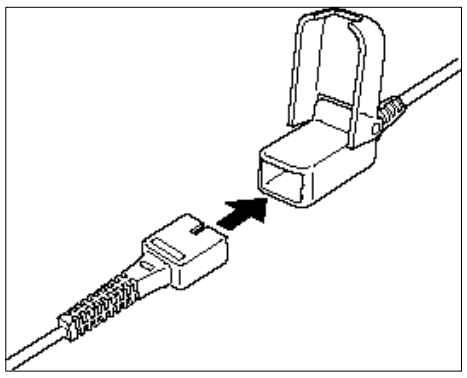


MAX Fast (for adult forehead)
For adult with weight of 40kg and over.
With the use of new technology of NELLCOR®, OXIMAX, stable monitoring during body motion / low perfusion is possible.

2. Connect the sensor to the patient monitor.



(1) Connect the SpO_2 relay cable (DOC-10) to the SpO_2 connector on the patient monitor.

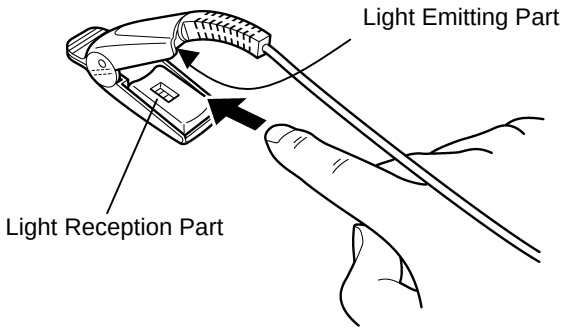


(2) Insert the sensor into the SpO_2 relay cable connector, and lock with the transparent part.

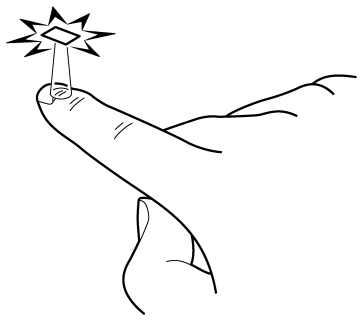
3. Attach the sensor to the patient.

⚠CAUTION	If the nail is rough, dirty, or manicured, accurate measurement will not be possible. Change the finger or clean the nail before attaching the probe and sensor.

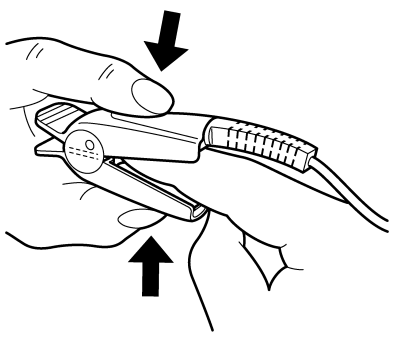
【Probe Type Sensor】



(1) Attach the probe as shown on left.
The probe cable should be on the nail side.



(2) Adjust the sensor so that the light-emitting part (on cable side) touches the root of the nail, and close the probe.

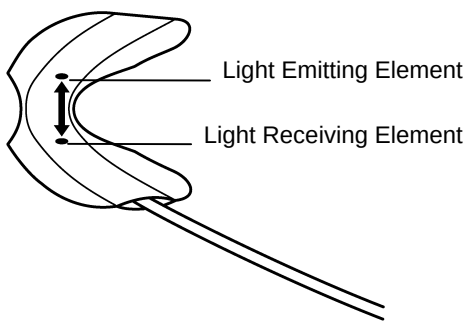


(3) Press the probe lightly so that the finger and the rubber cover are appressed.
This is to stabilize the probe, and to avoid ambient light.

【Single-use Type】

(1) Clean the attachment site with alcohol, etc.

(2) Align the light emitting element and light receiving element of the sensor with the measuring site in between when attaching the sensor to patient.

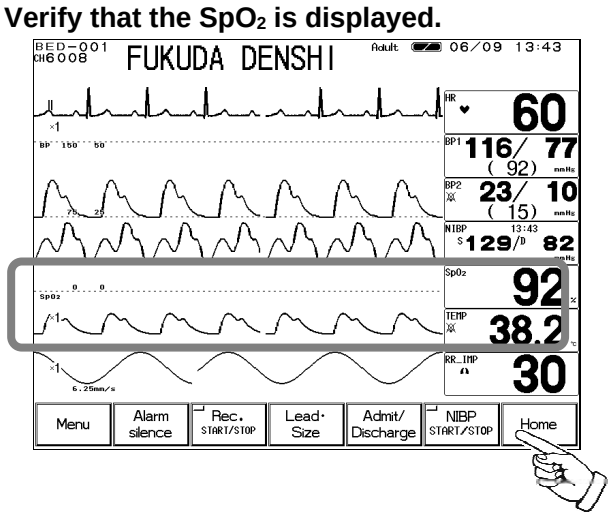


(3) Fixate the cable with surgical tape so that the sensor does not come off when a cable is pulled.

Attachment to the toe

Attachment to the finger

4. Verify that the SpO_2 is displayed.



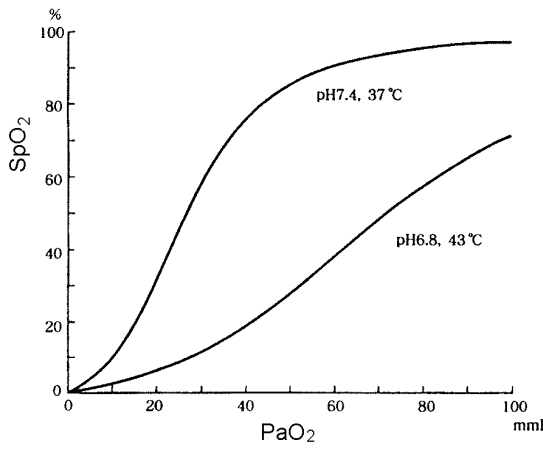
Press the HOME key on the lower part of the display.
Verify that the SpO_2 measurement and SpO_2 waveform are displayed on the home display.

●Functional and Fractional Saturation

The DS-7100 measures functional SpO_2 and may therefore produce measurements that differ from devices measuring fractional SpO_2. "Functional" SpO_2 is the amount of oxygenated hemoglobin expressed as a percentage of the total amount of hemoglobin capable of transporting oxygen. By utilizing the light of two different wavelengths, the DS-7100 can analyze for both oxygenated and deoxygenated hemoglobin, and consequently, can determine the functional SpO_2. The DS-7100 does not detect the presence of abnormal hemoglobin, such as carboxyhemoglobin or methemoglobin.

●Measured Versus Calculated Saturation

When SpO_2 is calculated from a blood gas measurement of the partial pressure of arterial oxygen (PaO_2), the calculated value may differ from the DS-7100 SpO_2 measurement. This is because the calculated SpO_2 may not have been corrected for the effects of variables that shift the relationship between PaO_2 and SpO_2 : temperature, pH, the partial pressure of carbon dioxide($PaCO_2$), and the concentrations of 2, 3-DPG and fetal hemoglobin.



⚠WARNING	✍ When measuring the SpO_2 of patient with high fever or peripheral circulatory insufficiency, check the sensor attachment periodically and change the attachment site. The temperature of attachment site will rise 2～3?C due to the sensor heat which may result in burn injury. ✍ For the following case, accurate measurement may not be possible. ✍ Patient with excessive abnormal hemoglobin (HbCO, MetHb) ✍ Patient with the pigment injected to the blood ✍ Patient receiving CPR treatment ✍ When a sensor is applied to a limb with NIBP cuff, arterial catheter, or intracatheter ✍ When measuring at site with venous pulse ✍ Patient with body motion ✍ Patient with small pulse

⚠CAUTION	✍ If irritation such as skin reddening or skin fit appears with the sensor use, change the attachment site or stop using the sensor. ✍ When fixating the sensor with a tape, do not wind the tape too strong. At the same time, check the blood flow constantly so that congestion is not generated at the peripheral. ✍ Even a short duration of attachment may inhibit the blood flow and generate compression necrosis and burn injury. ✍ Change the sensor attachment site constantly (every 4 hours). As the temperature of sensor attachment site normally rises 2～3?C, compression necrosis and burn injury may generate. ✍ As the skin of neonate / low birth weight infant is immature, change the sensor attachment site more frequently depending on the condition. ✍ Direct sunlight to the sensor area can cause a measurement error. Place a black or dark cloth over the sensor. ✍ When not performing the measurement, unplug the relay cable and sensor from the SpO_2 connector. Otherwise, the measurement data may be erroneously displayed by the ambient light.