
Holter Software

SCM-510W

Ver. 03

•

Operation Manual

•

C E 0086

- Before using this software, read this operation manual thoroughly.





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

CE 0086

This software is conformed with the provisions of Medical Device Directive 93/42/EEC in connecting with the Fukuda Denshi equipment labeled “CE 0086”.

THE PERSONS RESPONSIBLE FOR PLACING DEVICES ON THE EC MARKET UNDER MDD 93/42/EEC

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CAUTION:

- Only physician or persons instructed by physicians are allowed to use this software.

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Printed in Japan

Preface

Thank you for purchasing this product. Before using this product, read this “Operation Manual” thoroughly and make sure to use the product correctly. It is also recommended for users who are well acquainted with our product to read this operation manual, as some procedures are unique to this software.

This operation manual explains the procedure on how to use the SCM-510W.
It is composed of the following chapters.

Preface

About This Operation Manual

Chapter 1 Before Usage

Chapter 2 Initial Window

Chapter 3 Settings

Chapter 4 Pre-registration

Chapter 5 Reading Card

Chapter 6 Patient Data

Chapter 7 Removable Disk

Chapter 8 Default Settings

Appendix

Registered Trademark

- Windows, Windows XP are registered trademarks of Microsoft Corporation in the US and other countries.
- Pentium is a registered trademark of Intel Corporation, USA.

This Operation Manual is for the SCM-510W Version 03.

About the SCM-510W Holter Software

Intended Use

The SCM-510W has to be installed into a personal computer to activate its function. This software reads, analyzes, edits, and prints data that is recorded on the IC card using the Fukuda Denshi Holter recorder.

Special Notice for Use

Note 1	The trial period of the "SCM-510W Holter Software" is 7 days. Please provide the KEY CODE to Fukuda Denshi's service representative to obtain a password. The KEY CODE is shown on the password authentication window which is displayed when you first start the "SCM-510W Holter Software."
Note 2	The user must log on to Windows XP as an Administrator to operate the "SCM-510W Holter Software."
Note 3	Please read the following AGREEMENT carefully. By using all or any portion of this "SCM-510W Holter Software," the user hereby shall be deemed to accept all the terms and conditions of the AGREEMENT.

Note for Use in Windows Vista

Please note that some operations in Note 1, 2 and 3 are limited due to the system security when operating SCM-510W on Windows Vista. However, there are no limitations in reading, editing and printing the Holter data.

Note 1	The user must log on to Windows Vista as administrator to operate the "SCM-510W Holter Software".
Note 2	When the SCM-510W is operated by several users, it is necessary to confirm the password for each user. A KEY CODE and a password must be provided to each user. Please contact your Fukuda Denshi's sales representative.
Note 3	When the SCM-510W is operated by several users; the System, Analysis, Report and Table settings cannot be shared between them. Each user will have to setup their own settings individually.

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Precautions

Cautions about Diagnosis

The result of analysis performed by the SCM-510W does not necessarily point to the type and degree of the heart disease. The analysis by the SCM-510W outputs the result of arrhythmia judgment made by the computer according to the ECG recorded for an extended period of time. That is, normal heartbeats may be judged as arrhythmia, or irregular heartbeats may be judged as normal heartbeats. Therefore, the final judgment should always be made by a physician whatever the analysis result indicated by SCM-510W may be.

Work Environment

When working with a computer, adjust the desk and chair to your height so that you can operate the computer in a natural and comfortable position. Sitting at the desk for long hours could result in muscular pain and stiffness. To keep such muscular strain minimum, it is a prime necessity to create a working environment where you can work without physical strain.

Take a rest at regular intervals to give your muscles and eyes a rest. Looking at an object such as a computer screen for a long period of time in a close distance can cause muscle and eye fatigue. When you begin to feel tired, sit in a different position, stand up, stretch yourself, and/or take a short break at regular intervals.

Safety Notifications

The following safety messages are used throughout this manual. These notices have different meanings as described below. Read this section carefully and become familiar with their meanings.

⚠ DANGER	Failure to follow this message may cause immediate threat of death or serious injury, or complete failure of the equipment.
⚠ WARNING	Failure to follow this message may result in death or serious injury, or complete failure of the equipment.
⚠ CAUTION	Failure to follow this message may cause injury or failure to the equipment.

 Memo	A memo is not related to product safety, but provides information about the correct usage and operating procedures to prevent incorrect operation and malfunction of the equipment.
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Warning Symbols

Dangers and damages caused by using the product without following the safety precautions are classified into the following three levels.

	This symbol indicates an action that must not be performed. A detailed description is written nearby.
	This symbol indicates a danger, warning, or caution that must be followed to ensure safety. A detailed description is written nearby.
	This symbol indicates an action that must not be performed. A detailed description is written nearby.

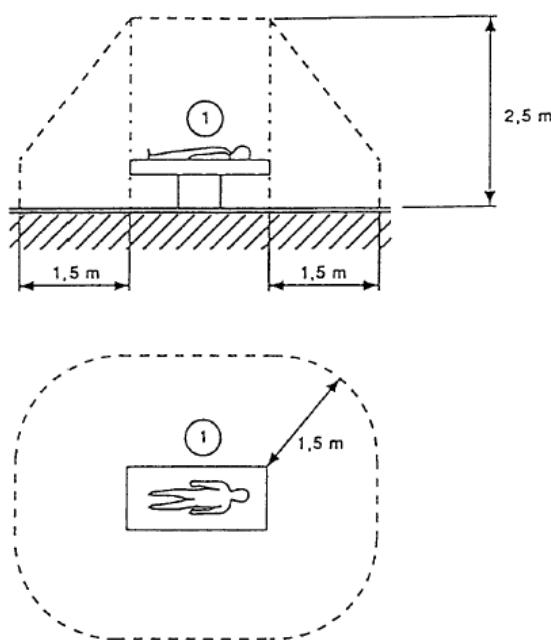
Safety

Design Specifications

The SCM-510W runs on Windows XP environment. Use commercially available hardware units to establish the operating environment. However, since the commercially available hardware units are not medical equipments, they must be used outside the patient environment. Use the hardware units conforming to IEC60950 “Safety of information technology equipment, including electrical business equipment” for the purpose of securing the safety of operators. For details of the hardware requirements, see Section 1.1 “Preparation.”

The following is quoted from IEC60601-1-1:

PATIENT ENVIRONMENT: Volume in which intentional or unintentional contact between PATIENT and parts of the SYSTEM or some other persons touching parts of the SYSTEM could occur.



Example of PATIENT ENVIRONMENT

Caution about Transportation

When transporting the SCM-510W, use Fukuda-specified packing material.

Caution about Disposal of Equipment and Accessories

The equipment and accessories should be professionally disposed in accordance with local regulations.

Precautions Used Throughout This Manual

⚠DANGER



- Do not use in presence of flammable or combustible gas or liquid such as anesthetic, oxygen, and hydrogen. There is a risk of explosion or fire.

⚠CAUTION



- Do not connect the system's power plug to the wall outlet to which another electric product, such as air-conditioner, copy machine, or shredder, is connected. Electrical noise could cause the analyzer or recorder to fail to work properly.
- To prevent dew condensation from occurring in the analyzer, do not move the system from a place where the humidity and temperature are low to a place where the humidity and temperature are high, or do not change the room temperature quickly.
- Do not install the system near fire or flammable or combustible materials.
- Install the system in a well-ventilated place.
- Do not expose the system to direct sunlight. Exposure to direct sunlight could cause the temperature in the analyzer to rise excessively, damaging the internal parts.
- Install the system on a level floor.
- Do not install the system in a dusty place or a place where corrosive gases exist.
- Do not install the system in a place exposed to frequent vibrations.
- Install the system so that it is separated about 10 cm or more from the wall and other objects.
- Do not insert any object in the CD-ROM drive other than a CD-ROM. This could cause damage to the CD-ROM drive or system.
- Do not insert any object in the floppy disk drive other than a floppy disk. This could cause damage to the floppy disk drive or system.
- If the system is turned off without performing the shut-down sequence, it could cause damage to the software or hardware. Be sure to perform the termination shutdown sequence before turning the power off.

⚠ CAUTION



- If the IC card is used on a system not specified by FUKUDA, it may damage the data stored in the IC card or the IC card itself.
- If the IC card is inserted upside down or inserted in a wrong slot, not only the IC card but also the system could be damaged.
- If the IC card is removed while reading or writing data, it may damage the data stored in the IC card or the IC card itself.
- Keep the IC card connector clean of dust. Do not touch it with your hand or a metal piece.
- When the IC card is not used; store it in a place where it will not be exposed to high temperature, moisture, dust or chemicals. Avoid strong shock to the IC card while it is stored.
- Take care not to expose the IC card to volatile chemicals such as thinner, benzene, and alcohol.
- Do not leave or store the IC card in a place where it will be exposed to direct sunlight, abrupt temperature change, high temperature, or moisture.
- Do not apply a strong shock (dropping) or vibration to the IC card.
- Do not store the IC card in a dirty or dusty place.
- Do not open the removable disk shutter or touch the disk surface.

About This Operation Manual

This operation manual basically explains the operating procedures of this software program. The title of each chapter indicates the main operation of the software and is divided into sections. Each section describes the procedures for each operation with its respective screen.

The mark indicates the following.



Provides information about the correct usage and operating procedures.

1.3 Starting / Ending the SCM-510W

To Start the SCM-510W

To start the SCM-510W program from the start menu, follow the procedure below.

Memo Only one SCM-510W program can run on one computer. If the SCM-510W program is already started on a computer, another SCM-510W cannot start up.

- 1) Click [Start] on the task bar to display the Start menu.



- 2) On the Start menu, select "All Programs", and click "SCM-510W". The SCM-510W program will start, and the initial window will be displayed.

Memo Only one SCM-510W program can run on one computer. If the SCM-510W program is already started on a computer, another SCM-510W cannot start up.



- 3) When starting the SCM-510W for the first time, "Password Authentication" and "Language Setting" will be required. For procedures, refer to the following sections.

Contents

Preface	i
About the SCM-510W Holter Software	ii
Fukuda Denshi Software License Agreement	iii
Precautions	v
Safety	vii
About This Operation Manual	x

Chapter 1 Before Usage

1.1 Preparation	1-2
SCM-510W Package Item	1-2
Setup Flow	1-3
Hardware Requirements	1-4
1.2 Installing and Uninstalling the SCM-510W	1-5
Installing the SCM-510W	1-5
Uninstalling the SCM-510W	1-10
1.3 Starting / Ending the SCM-510W	1-12
To Start the SCM-510W	1-12
Password Authentication	1-14
Language Setting	1-16
To End the SCM-510W	1-17

Chapter 2 Initial Window

2.1 Initial Window	2-2
2.2 Settings	2-3
2.3 Pre-registration	2-4
2.4 Card Reading	2-5
2.5 Patient Data	2-6
2.6 Removable Disk	2-8

Chapter 3 Settings

3.1 Settings	3-2
3.2 Analysis and Measurement Settings	3-3
3.3 Report Settings	3-8
3.4 System Settings	3-11
3.5 Table Settings	3-14

Chapter 4 Pre-registration

4.1 Pre-registration	4-2
4.2 Patient Information	4-3

Chapter 5 Card Reading

5.1 Card Reading	5-2
5.2 Confirmation of Patient Information	5-3
5.3 Input Patient Information	5-4
5.4 Analysis Settings	5-7
5.5 Analysis Program Selection	5-8
5.6 Printing Program Selection	5-9
5.7 Analysis Mode Selection	5-10
5.8 Review Waveform	5-11

Chapter 6 Patient Data

6.1	Patient Data	6-2
6.2	Working on the Patient Data	6-4
	Analyze	6-4
	Save	6-5
	Transfer	6-6
	Protection / Cancellation of Protection	6-21
	Re-order	6-22
	Delete	6-23
	Select All / Cancel All	6-24
6.3	Data Processing	6-25
6.4	Morphology	6-25
	Morphology Classification	6-26
	Morphology Groups	6-27
	Morphology Series	6-31
6.5	Search	6-39
	Search Method Types	6-39
	Main Search Window	6-40
	Event Search	6-41
	Trend Search	6-46
	RR Search	6-49
	Registered Waveform Search	6-52
	Waveform Display	6-53
	Edit Procedure Types	6-60
6.6	Measurement	6-69
	Type of Measurements	6-69
	Main Measurement Window	6-70
	HRV Measurement	6-70
	Lorenz Plot	6-97
	SAS Measurement	6-109
	Pacemaker Measurement	6-125
	QT Measurement	6-136
6.7	Analysis Summary	6-154
	Types of Analysis Summary	6-154
	Summary	6-154
	Arrhythmia List	6-156
6.8	Print	6-157
	Types of Printing	6-157
	Main Print Window	6-157
	Print Report	6-158
	Print Selected Time	6-161

Chapter 7 Removable Disk

7.1	Removable Disk	7-2
7.2	Media Number Registration	7-4
	Procedure to Register the Media Number	7-5
7.3	Searching Data	7-6
	“Search” Window	7-6
	After Searching the Data	7-7
7.4	Loading Data	7-8
	Working on the Removable Disk Data	7-8
7.5	Other Operations on the Removable Disk Data	7-9
	Redisplay	7-9
	Delete	7-10
	Select All / Cancel All	7-11

Chapter 8 Default Settings

8.1	Analysis and Measurement Settings	8-2
	Analysis Settings	8-2
	Arrhythmia Threshold	8-2
	ST Measurement Threshold	8-2
	Pacemaker Analysis Threshold	8-2
	SAS Threshold	8-2
8.2	Report Settings	8-3
8.3	System Settings	8-4
8.4	Table Settings	8-5

Appendix

1.	Event	Appendix-2
	Ventricular Arrhythmia Event	Appendix-2
	Supraventricular Arrhythmia Event	Appendix-3
	Other Arrhythmia Event	Appendix-4
	Patient Event	Appendix-4
	Priority of the Event	Appendix-4
2.	Abbreviations	Appendix-5

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Chapter 1

Before Usage

1. 1 Preparation	1–2
SCM-510W Package Item	1–2
Setup Flow	1–3
Hardware Requirements	1–4
1. 2 Installing and Uninstalling the SCM-510W.....	1–5
Installing the SCM-510W	1–5
Uninstalling the SCM-510W	1–10
1. 3 Starting / Ending the SCM-510W.....	1–12
To Start the SCM-510W	1–12
Password Authentication.....	1–14
Language Setting.....	1–16
To End the SCM-510W	1–17

1. 1 Preparation

SCM-510W Package Item

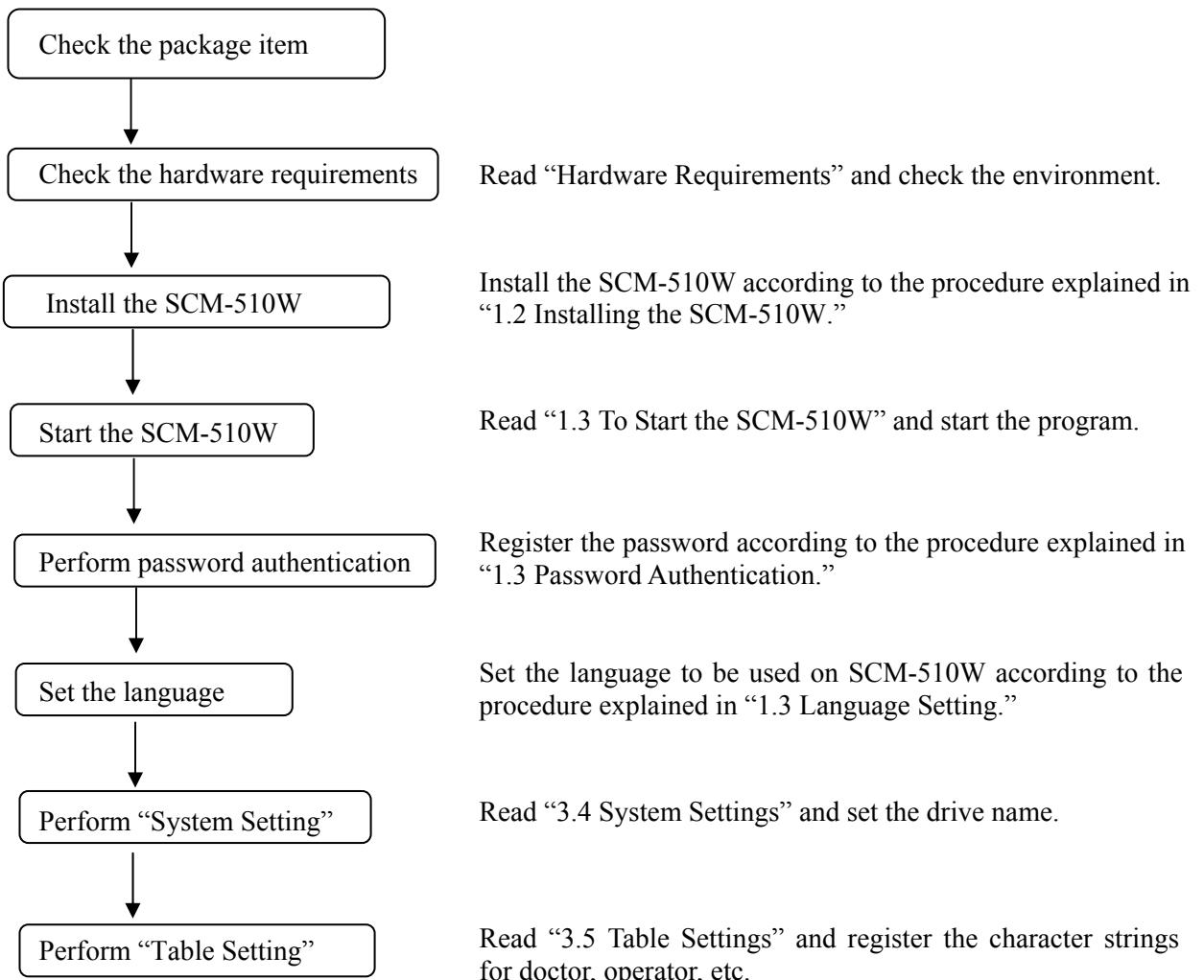
Before using the software, check that the following items are included in the package.

- SCM-510W Program CD : Quantity 1
- User's Guide : Quantity 1

If there is any shortage, contact your nearest Fukuda Denshi's service representative.

Setup Flow

The setup flow for using the SCM-510W is as follows.



Hardware Requirements

The SCM-510W Holter Software is used to analyze the long term ECG and to edit and print the analyzed result.

Depending on the hardware used, the process speed will largely differ.

As this software analyzes large amount of ECG data, the processing speed may slow down if other software is operated at the same time.

To maximize the processing speed, do not perform Internet connection or operate other software when using this software.

The data that can be read and analyzed on this software are the ECG data recorded on the Fukuda Denshi digital recorder.

The analyzed result will be stored on the hard disk of the PC that is being used.

The hard disk is capable to store a large amount of data. But on the other hand, if a hard disk failure occurs, the restoration of the data is almost impossible.

To avoid such case, this software is provided with a function to back up the ECG data by connecting a removable disk device to the PC that is being used.

Also, by using the PC that has a mirroring function, data loss can be minimized.



Memo The mirroring function is one of the disk duplexing methods that perform writing of the same data to two hard disks simultaneously.

The hardware requirements for the SCM-510W are as follows.

[Personal Computer]

- | | |
|----------------------------|---|
| • Operating System | : Windows XP Professional , Windows Vista Home Premium
(English/German/French/Italian/Spanish) |
| • CPU | : Pentium 4 1.8GHz or above |
| • Hard Disk Space | : Program Area 100MB or above, NTFS File System
Data Area 20GB or above, NTFS File System |
| • Memory Capacity | : 512MB or above (Windows XP)
1GB or above (Windows Vista) |
| • Display Resolution | : XGA(1024×768) or SXGA (1280×1024)
16-bit color or above |
| • DPI Setting (Windows XP) | : Normal Size (96DPI) |
| • Card Reader | : Multi Media card should be readable |
| • CD-ROM Drive | : CD-R media should be readable |
| • Removable disk device | : DVD-RAM Drive |

[Printer]

- | | |
|-------------------|------------------------------------|
| • Type | : Laser Printer |
| • Printer Driver | : Driver specified for the printer |
| • Print Density | : 600dpi or above |
| • Paper Size | : A4/Letter |
| • Print Direction | : Portrait/Landscape |

1. 2 Installing and Uninstalling the SCM-510W

Installing the SCM-510W

 **Memo** To install the SCM-510W, the user must log in as administrator.

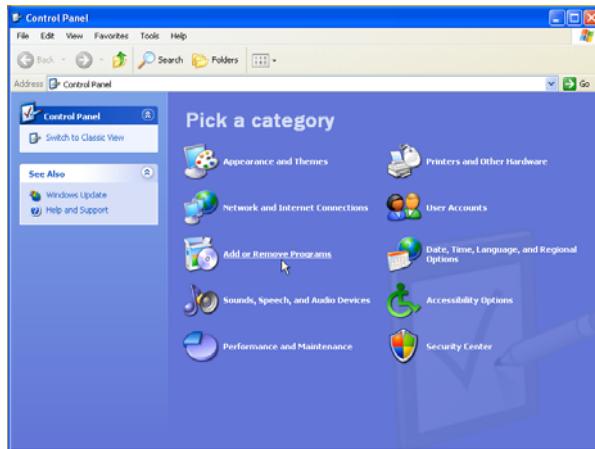
- 1) Click **start** on the task bar to display the Start menu.



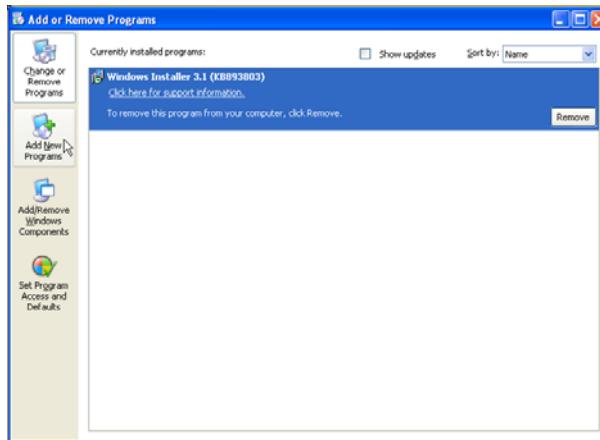
- 2) Click “Control Panel” on the start menu to open the control panel.



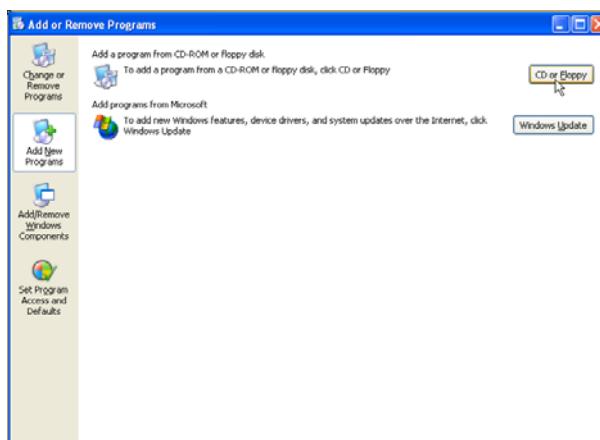
3) Click on the “Add or Remove Programs” icon to open the “Add or Remove Programs” window.



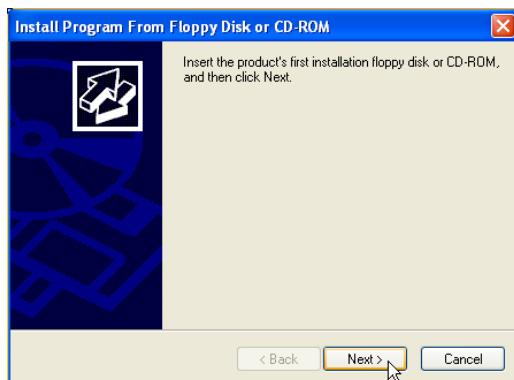
4) Click on the “Add New Programs” icon displayed on the left.



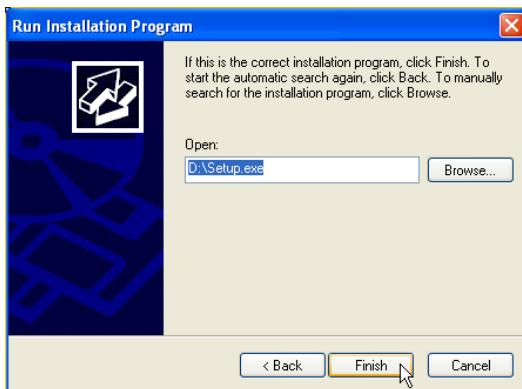
5) Click **CD or Floppy** displayed on the right.



- 6) Insert the SCM-510W CD-ROM in the CD-ROM drive and click **[Next >]**. The Run Installation Program window will open.



- 7) “D:\SETUP.EXE” will be displayed inside the text box on the Run Installation Program window. Click **[Finish]**. The InstallShield Wizard will start.
If nothing is displayed inside the text box, enter “D:\SETUP.EXE” using the keyboard.



Memo

When the CD-ROM drive is D drive, “D:\SETUP.EXE” will be displayed.
When another drive is set, the name of the CD-ROM drive will be displayed.

- 8) To continue with the install process, click **[Next >]**.



- 9) The License Agreement window will appear. Read the agreement carefully.
If you agree, click **[Yes]**. If you do not agree, click **[No]** and cancel the installation.



- 10) Specify the destination folder to install the SCM-510W.
To change the default setting, click **[Browse...]** and specify the directory.
Then, click **[Next >]**.



- 11) Specify the program folder, then, click **[Next >]**. File-copying will start.



- 12) When the file-copying is completed, “InstallShield Wizard Complete” window will be displayed.
Click **Finish**.



- 13) The SCM-510W will be automatically added to the Program menu and its icon on the Desktop.

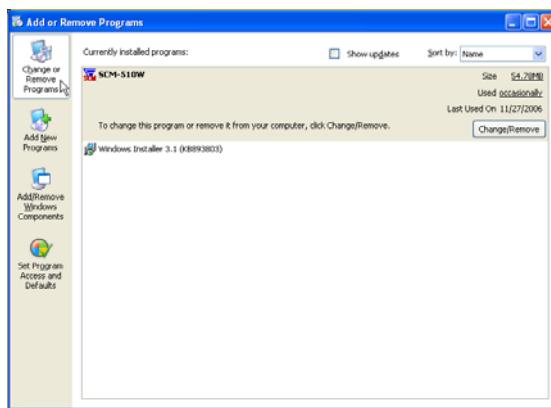


Uninstalling the SCM-510W

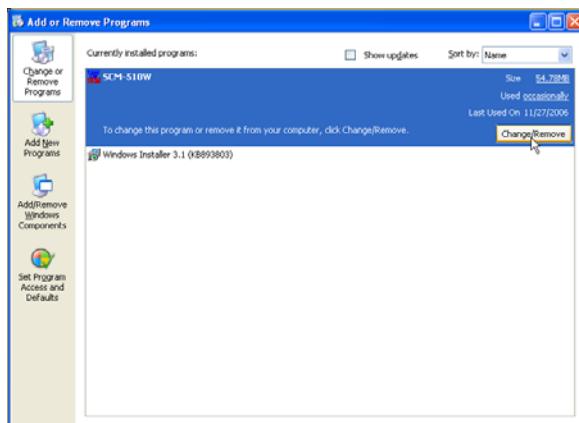
To uninstall the SCM-510W, begin by double-clicking the Add/Remove Programs icon on the control panel. When performing this procedure, ensure that the SCM-510W program is not running. Otherwise, the SCM-510W cannot be completely uninstalled.

 **Memo** To uninstall the SCM-510W, the user must log in as administrator.

- 1) Open the “Add or Remove Programs” window on the control panel in the same manner as for installation.
- 2) Click on the “Change or Remove Programs” icon displayed on the left. The list of installed program will be displayed.

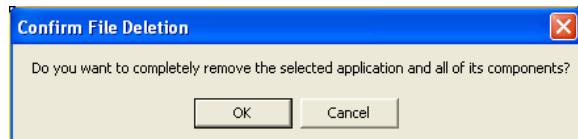


- 3) Select “SCM-510W” from the list of installed program, and click **Change / Remove**.



- 4) Click **OK** to start the uninstall process. Follow the messages to proceed with the uninstall process. To cancel the uninstall process, click **Cancel**.

The uninstall process will only delete the SCM-510W program, and will not delete the waveform data and measurement results. To delete all data, start the Explorer and delete all files in the SCM-510W install folder.



1. 3 Starting / Ending the SCM-510W

To Start the SCM-510W

To start the SCM-510W program from the start menu, follow the procedure below.

 **Memo** Only one SCM-510W program can run on one computer. If the SCM-510W program is already started on a computer, another SCM-510W cannot start up.

- 1) Click **[start]** on the task bar to display the Start menu.



- 2) On the Start menu, select "All Programs" and click "SCM-510W." The SCM-510W program will be started, and the initial window will be displayed.

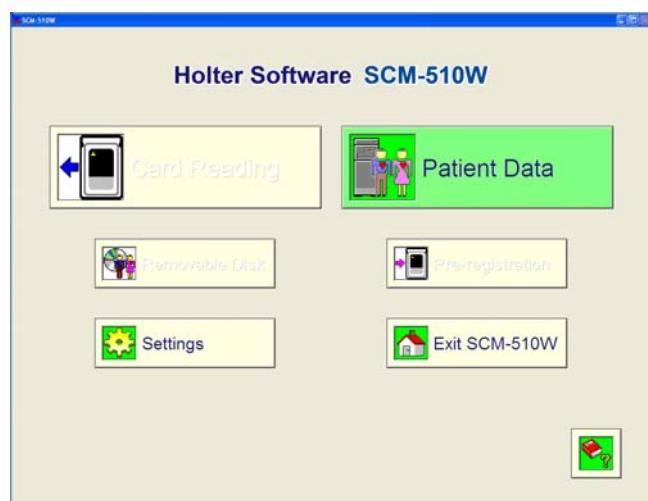
 **Memo** Only one SCM-510W program can run on one computer. If the SCM-510W program is already started on a computer, another SCM-510W cannot start up.



- 3) When starting the SCM-510W for the first time, "Password Authentication" and "Language Setting" is required. For procedures, refer to the following sections.



Startup Window



Initial Window

Password Authentication

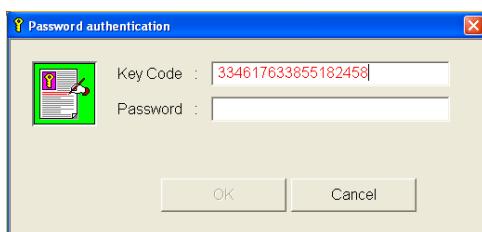
When you first start up the SCM-510W, you need to register a password. Please provide the “Key Code” displayed on the “Password Authentication” window to your nearest Fukuda Denshi’s representative to obtain a password.

A trial period of 7 days is provided for the SCM-510W. Until you obtain the password, you can start the SCM-510W by clicking **Cancel** on the “Password Authentication” window. There will be no restriction to the function even if you do not perform the password authentication.

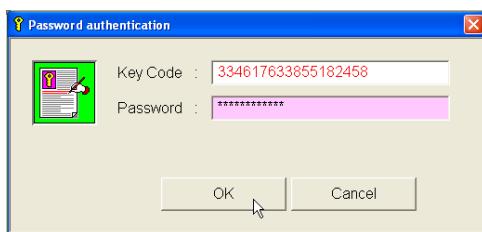
Memo If the trial period of 7 days expires without performing the password authentication, the SCM-510W can no longer be started. Make sure to perform the password authentication within 7 days.

Memo The “Key Code” and the corresponding password are effective for only one PC. If you install the software to another PC or if you re-install the operating system due to PC failure, you need to perform the password authentication again. In such case, please obtain the password again from your nearest Fukuda Denshi’s representative.

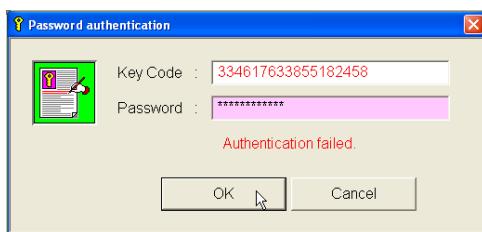
- 1) When you first start up the SCM-510W, the password authentication window will be displayed.



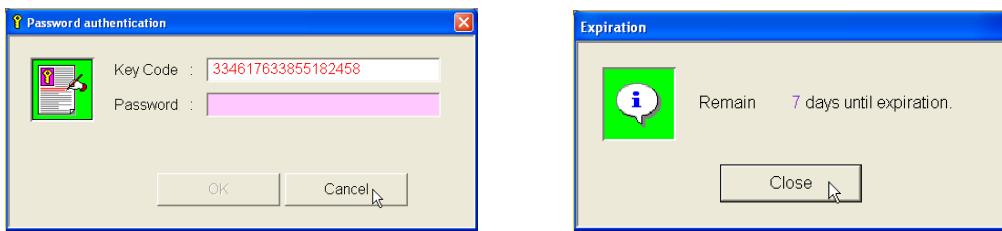
- 2) Enter the password, and click **OK**.



- 3) If the password is not correct, an error message will be displayed. Check the password and enter the correct password.



- 4) If you click [Cancel] without entering the password, the SCM-510W will start in trial mode. In this case, the remaining days for the trial period will be displayed. Until you register the password, the password authentication window will be displayed each time you start the SCM-510W.



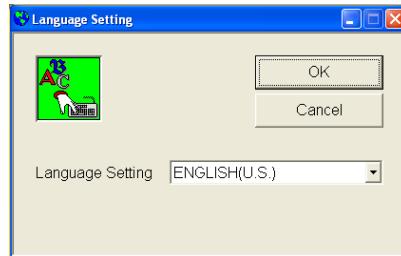
- 5) If the trial period expires before registering the password, an error message will be displayed and the SCM-510W will not be able to start up.



Language Setting

When you first start up the SCM-510W, you need to select the language to be used on the SCM-510W.

- 1) On the language setting window, click the language combo box, and select the language from the drop-down list.



- 2) Select the language to be displayed/printed, and click **OK**.



- 3) If you click **Cancel** without selecting a language, "ENGLISH (U.S.)" will be set as default.

The date format for displaying/printing will be automatically set as follows according to the selected language.

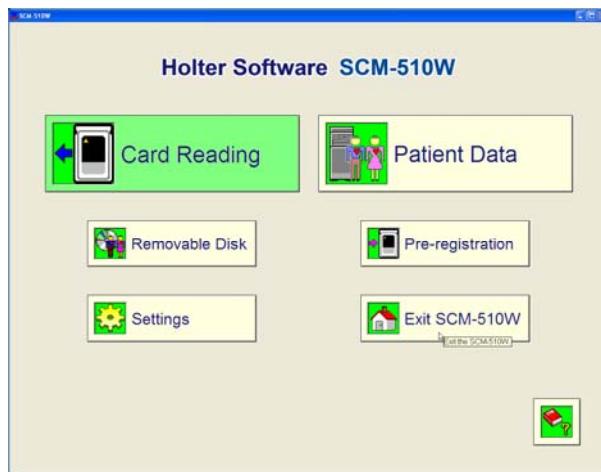
Language	Date Format	Example
ENGLISH	MM/dd/yyyy	04/30/2006
FRENCH	dd/MM/yyyy	30/04/2006
SPANISH	dd/MM/yyyy	30/04/2006
GERMAN	dd/MM/yyyy	30/04/2006
ITALIAN	dd/MM/yyyy	30/04/2006

To End the SCM-510W

The exit process of the SCM-510W can be performed on the “Initial” window.

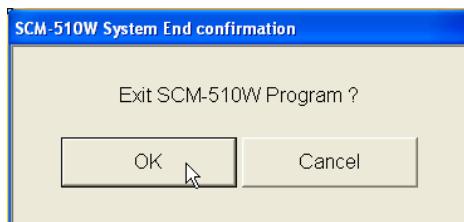
- 1) Click **Exit SCM-510W** on the SCM-510W “Initial” window.

A confirmation message to end the SCM-510W program will be displayed.



- 2) To end the program, click **OK**, and to not end the program, click **Cancel**.

OK button : Exits the SCM-510W program.
Cancel button : Returns to “Initial” window.



Blank Page

Chapter 2

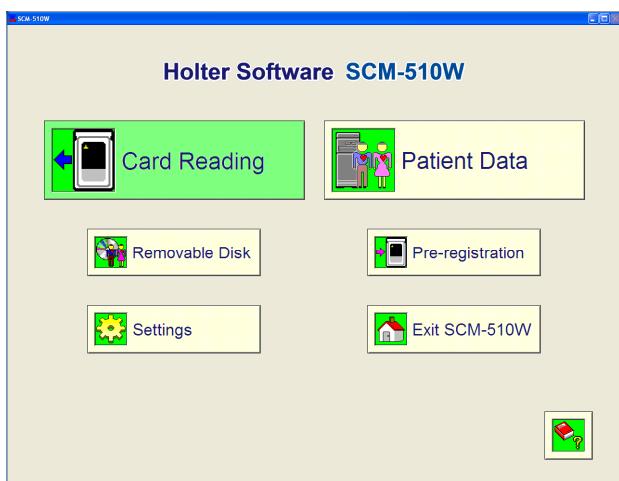
Initial Window

2. 1	Initial Window	2-2
2. 2	Settings	2-3
2. 3	Pre-registration	2-4
2. 4	Card reading	2-5
2. 5	Patient Data	2-6
2. 6	Removable Disk	2-8

2. 1 Initial Window

When the SCM-510W starts, hard disk space, presence of removable disk, graphic display, etc. are checked. When these startup conditions are fulfilled, the “Initial” window will be displayed.

On the “Initial” window, there are seven control buttons, which are **Card Reading**, **Patient Data**, **Removable Disk**, **Pre-registration**, **Settings**, **Exit SCM-510W**, and the “Manual Reference” Icon.



Refer to the following for details of each function.

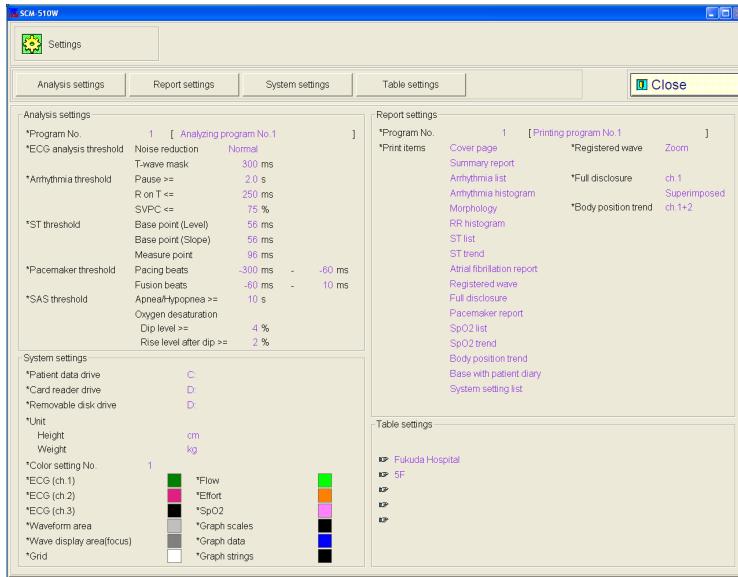
- | | |
|-------------------------|--|
| Card Reading | : Reads data on the card and stores data to the hard disk. |
| Patient Data | : Performs data processing stored on the hard disk. |
| Removable Disk | : Performs data processing stored on the removable disk. |
| Pre-registration | : Writes data to the card. |
| Settings | : Performs setup of each function. |
| Exit SCM-510W | : Ends the SCM-510W program. |
| Manual Reference | : Refers to the Operation Manual (PDF). |

Memo To refer to the operation manual (PDF), Acrobat Reader or other software to display PDF file needs to be installed on you PC.

In this chapter, outline of these functions will be explained.

2.2 Settings

On the “Settings” menu, “Analysis settings,” “Report settings,” “Table settings,” and “System settings” can be performed.



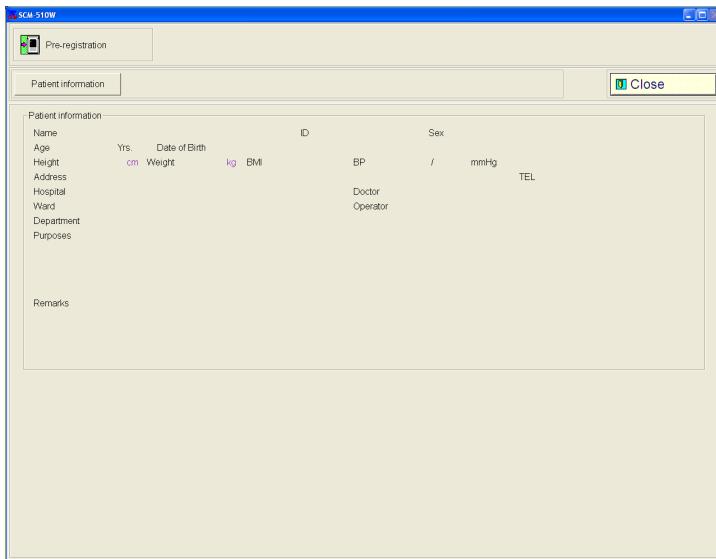
Refer to the following for details of each function.

Analysis settings
Report settings
System settings
Table settings
Close

- : Sets the threshold level of analysis / measurement.
- : Sets the condition for report output.
- : Sets the operation environment.
- : Sets the condition for master table.
- : Closes the “Settings” window.

2. 3 Pre-registration

Using this function allows to write patient information to the card.

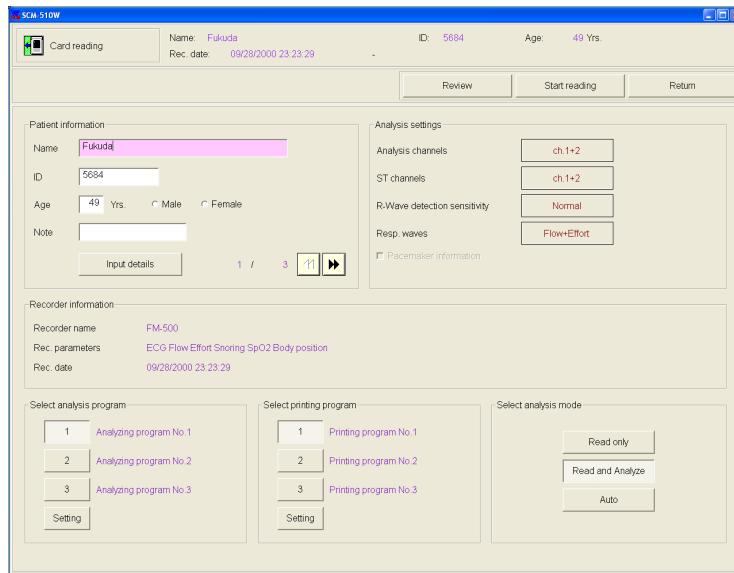


Refer to the following for details of the function.

Patient information : Writes patient information to the card.

2. 4 Card Reading

On the “Card reading” menu, a preliminary reading is performed to allow the setting of reading/analyzing conditions.



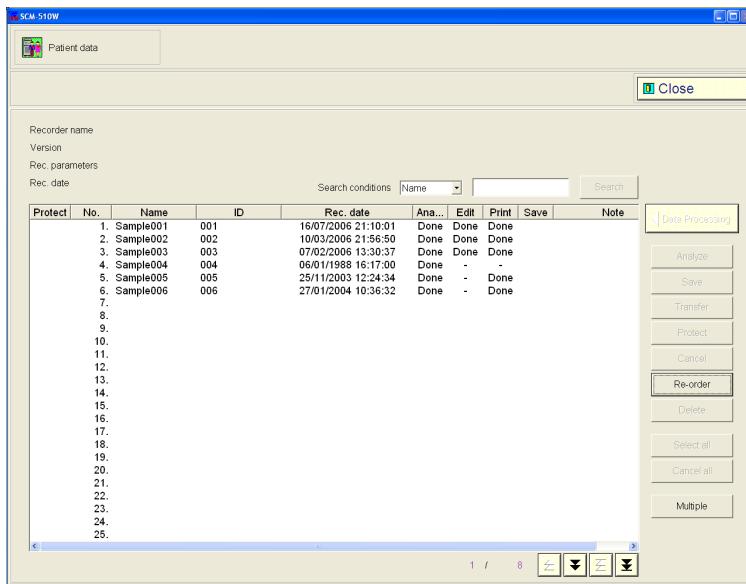
On the “Card reading” window, the following setups can be performed.

- | | |
|-------------------------|---|
| Patient information | : Enter patient information. |
| Analysis settings | : Set the analysis condition. |
| Select analysis program | : Select the analysis program number (preset). |
| Select printing program | : Select the printing program number (preset). |
| Select analysis mode | : Select the analysis method of “Read only,” “Read and Analyze,” or “Auto.” |
| Review | : Allows to verify the waveform. |
| Start reading | : Starts the read/analyze process. |
| Return | : Returns to the initial window. |

2. 5 Patient Data

The “Patient data” window displays the patient list stored in the hard disk, and allows to perform various operations on the patient data.

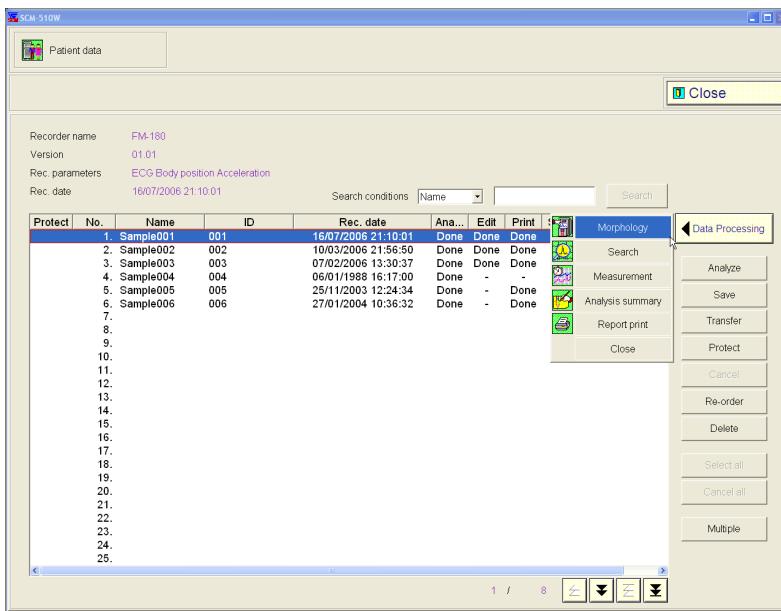
There are 12 buttons on the “Patient data” window, which are **Data Processing**, **Analyze**, **Save**, **Transfer**, **Protect**, **Cancel**, **Re-order**, **Delete**, **Select all**, **Cancel all**, **Multiple**, and **Close**.



Refer to the following for details of each function.

- | | |
|------------------------|--|
| Data Processing | : Process the data selected on the patient list. |
| Analyze | : Analyzes the data selected on the patient list. |
| Save | : Saves the data selected on the patient list to the removable disk. |
| Transfer | : Transfers the data selected on the patient list. |
| Protect | : Protects the data selected on the patient list. |
| Cancel | : Cancels the protection of the data selected on the patient list. |
| Re-order | : Re-orders the data selected on the patient list. |
| Delete | : Deletes the data selected on the patient list. |
| Select all | : Selects all the data on the patient list. |
| Cancel all | : Cancels the selections on the patient list. |
| Multiple | : Allows multiple selections on the patient list. |
| Close | : Closes the “Patient data” window. |

In addition, there are 5 functions for the “Data Processing,” which are “Morphology,” “Search,” “Measurement,” “Analysis Summary,” and “Report print.”



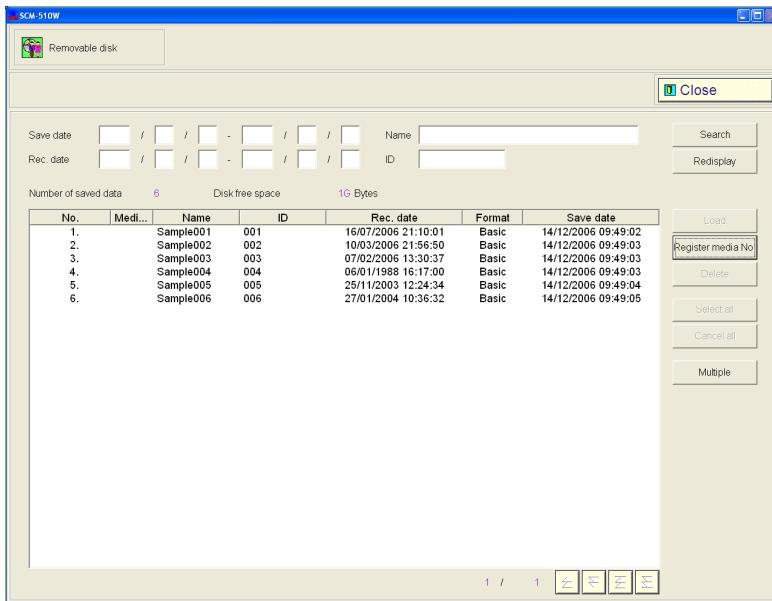
Refer to the following for details of each function.

- | | |
|------------------|---|
| Morphology | : Performs morphology classification of the patient data. |
| Search | : Searches patient data. |
| Measurement | : Performs measurement for the selected patient data. |
| Analysis Summary | : Displays/Edits analysis summary of the selected patient data. |
| Report Print | : Prints the patient data report. |

2. 6 Removable Disk

On the “Removable disk” menu, various operation on the data stored on the removable disk can be performed.

There are nine control buttons, which are **Search**, **Redisplay**, **Load**, **Register media No.**, **Delete**, **Select all**, **Cancel all**, **Multiple**, **Close**.



Refer to the following for details of each function.

- Search** : Searches patient data from the removable disk.
- Redisplay** : Redisplays the data on the removable disk.
- Load** : Loads patient data on the hard disk from the removable disk.
- Register media No.** : Registers the removable disk media number to the database.
- Delete** : Deletes patient data on the removable disk.
- Select all** : Selects all patient data on the removable disk.
- Cancel all** : Cancels multiple selections of patient data on the removable disk.
- Multiple** : Allows multiple selections of patient data on the removable disk.
- Close** : Closes the “Removable disk” window.

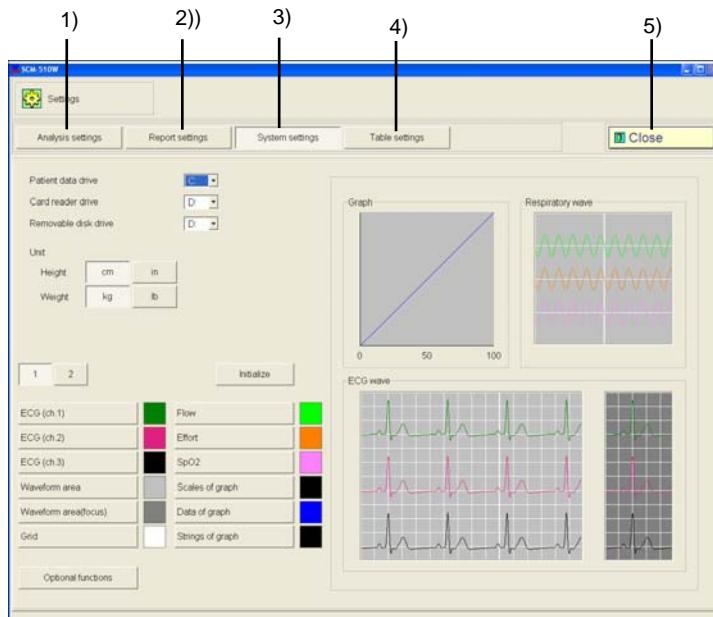
Chapter 3

Settings

3. 1 Settings	3-2
3. 2 Analysis Settings	3-3
■ ECG Analysis threshold	3-4
■ Arrhythmia Threshold.....	3-4
■ ST Threshold.....	3-5
■ Pacemaker Threshold	3-6
■ SAS Threshold.....	3-7
3. 3 Report Settings	3-8
■ Printing Order.....	3-9
■ Other Settings	3-10
3. 4 System Settings	3-11
■ Activate optional functions	3-12
3. 5 Table Settings	3-14

3. 1 Settings

On the “Settings” menu, “Analysis settings,” “Report settings,” “System settings,” and “Table settings” can be performed.



- Clicking the **Settings** button on the “Initial” window will display the “Settings” window. On the “Settings” window, the current settings will be displayed. The function of each setting button is described as follows.

1) **Analysis settings**

Sets the threshold levels for analysis / measurement.

2) **Report settings**

Sets the condition for printing reports.

3) **System settings**

Sets the system.

4) **Table settings**

Sets the master table.

5) **Close**

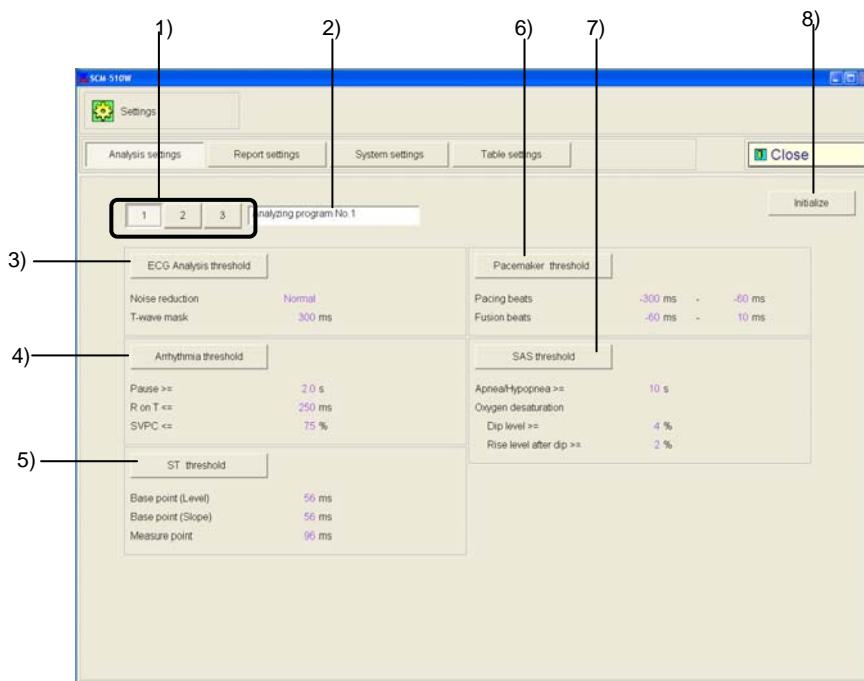
Closes the “Settings” window.

3. 2 Analysis Settings

The threshold level settings for the data analysis are performed.

Clicking the **Analysis settings** button on the “Settings” window will display the “Analysis settings” window.

Three types of settings can be programmed.



1) Program Number Selection

Select the program number from 1, 2, or 3.

2) Program Title

Enter the title for each program.

3) ECG Analysis threshold

Sets “Noise reduction” and “T-wave mask.”

4) Arrhythmia threshold

Sets the thresholds for “Pause,” “R on T,” and “SVPC (Supraventricular Premature Contraction).”

5) ST threshold

Sets “Base point (Level),” “Base point (Slope),” and “Measure point.”

6) Pacemaker threshold

Sets the thresholds for “Pacing beats” and “Fusion beats.”

7) SAS threshold

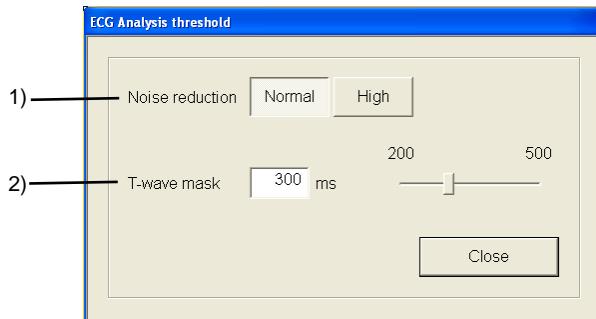
Sets the thresholds for “Apnea/Hypopnea” and “Oxygen desaturation.”

8) Initialize

Initializes the settings.

■ ECG Analysis threshold

- Clicking the **ECG Analysis threshold** button on the “Analysis settings” window will open the “ECG Analysis threshold” window.
- On the “ECG Analysis threshold” window, the following settings can be performed.



1) Noise Reduction

Select from **Normal** and **High**.

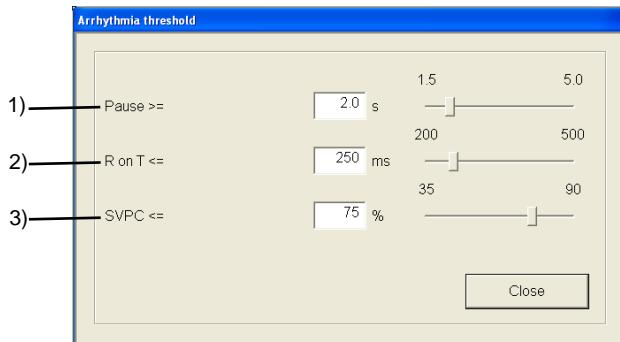
2) T-wave Mask

Move the slider to the right or left to set the value. The adjustable range is 200 ~ 500ms.

- Click the **Close** button to close the window.

■ Arrhythmia Threshold

- Clicking the **Arrhythmia threshold** button on the “Analysis settings” window will open the “Arrhythmia threshold” window.
- On the “Arrhythmia threshold” window, the following settings can be performed.



1) Pause

Move the slider to the right or left to set the threshold level. The adjustable range is 1.5 ~ 5.0s.

2) R on T

Move the slider to the right or left to set the threshold level. The adjustable range is 200ms ~ 500ms.

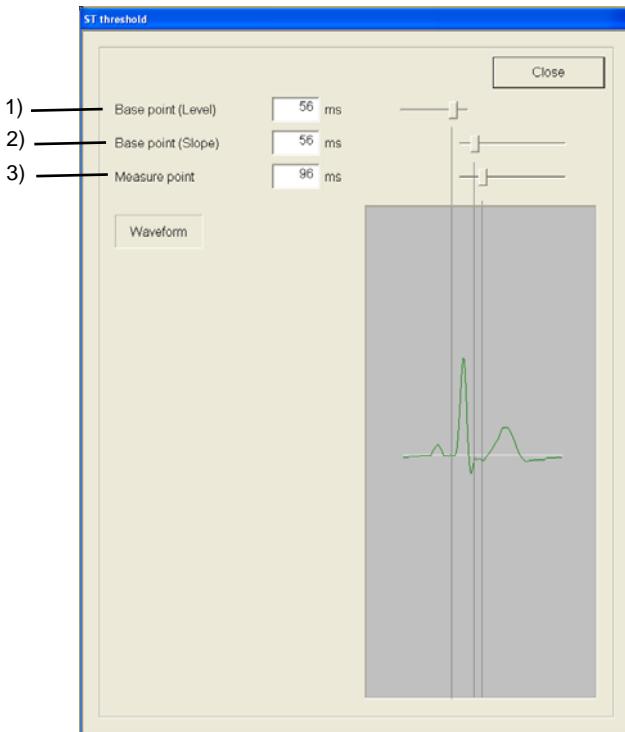
3) SVPC (Supraventricular Premature Contraction)

Move the slider to the right or left to set the threshold level. The adjustable range is 35 ~ 90%.

- Click the **Close** button to close the window.

■ ST Threshold

- Clicking the **[ST threshold]** button on the “Analysis settings” window will open the “ST threshold” window.
- On the “ST threshold” window, the following settings can be performed.



1) Base Point (Level)

Move the slider to the right or left to set the value.
The adjustable range is 296 ~ 0ms before the R wave.

2) Base Point (Slope)

Move the slider to the right or left to set the value.
The adjustable range is 0 ~ 496ms after the R wave.

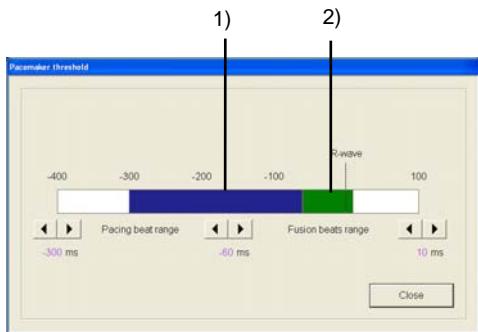
3) Measure Point

Move the slider to the right or left to set the value.
The adjustable range is 0 ~ 496ms after the R wave.

- Click the **[Close]** button to close the window.

■ Pacemaker Analysis Threshold

- Clicking the **Pacemaker threshold** button on the “Analysis settings” window will open the “Pacemaker threshold” window.
- On the “Pacemaker threshold” window, the following settings can be performed.



1) Pacing Beat Range

Adjust the threshold level using the **[◀]**, **[▶]** keys. The adjustable range is -400ms from the R-wave.

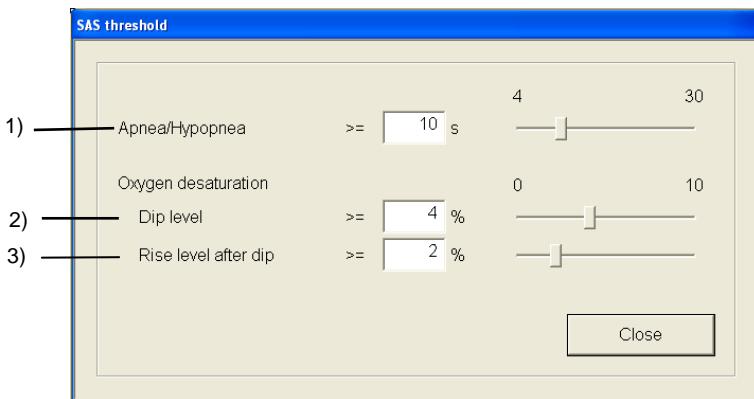
2) Fusion Beat Range

Adjust the threshold level using the **[◀]**, **[▶]** keys. The adjustable range is +100ms from the R-wave.

- Click the **Close** button to close the window.

■ SAS Threshold

- Clicking the **SAS threshold** button on the “Analysis settings” window will open the “SAS threshold” window.
- On the “SAS threshold” window, the following settings can be performed.



1) Apnea / Hypopnea

Move the slider to the right or left to set the value. The adjustable range is 4 ~ 30s.

2) Oxygen desaturation: Dip level

Move the slider to the right or left to set the value. The adjustable range is 0 ~ 10%.

3) Oxygen desaturation: Rise level after dip

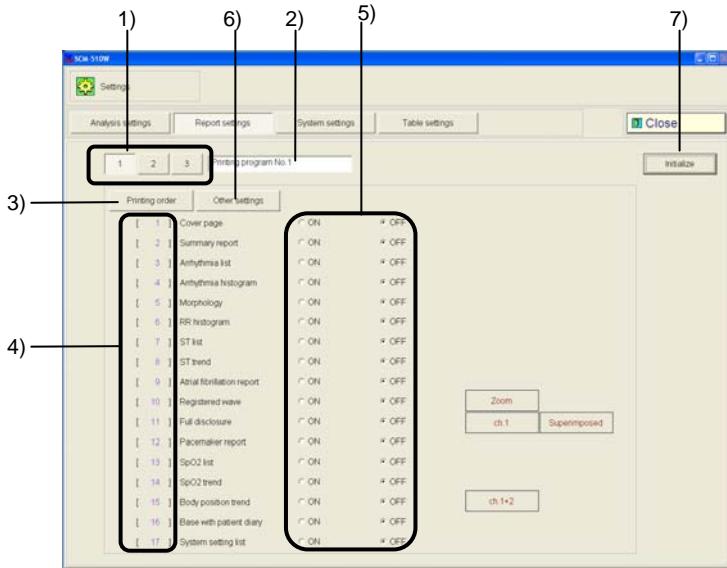
Move the slider to the right or left to set the value. The adjustable range is 0 ~ 10%.

- Click the **Close** button to close the window.

3. 3 Report Settings

The settings for printing report condition can be performed.

Clicking the **Report settings** button on the “Settings” window will open the “Report settings” window. Three types of settings (Programs 1 ~ 3) are available for report printing.



1) Program Number Selection

Select the program number from 1, 2, or 3.

2) Program Title

Enter the title for each program.

3) Printing order

Opens the window, which allows to set the printing order.

4) Order of Printing

Displays the order of printing.

5) Print Setting

For each item, select whether to print or not.

The items that can be printed are as follows.

Cover Page	AF Report
Summary Report	Registered Wave
Arrhythmia List	Full disclosure
Arrhythmia Histogram	Pacemaker
Morphology	SpO ₂ List
RR Histogram	SpO ₂ Trend
ST List	Base with patient diary
ST Trend	

6) Other settings

Sets other items such as paper size and paper orientation.

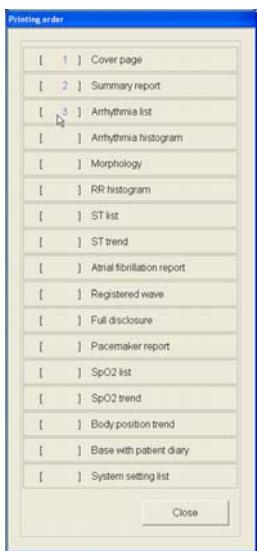
7) Initialize

Initializes the settings.

■ Printing Order

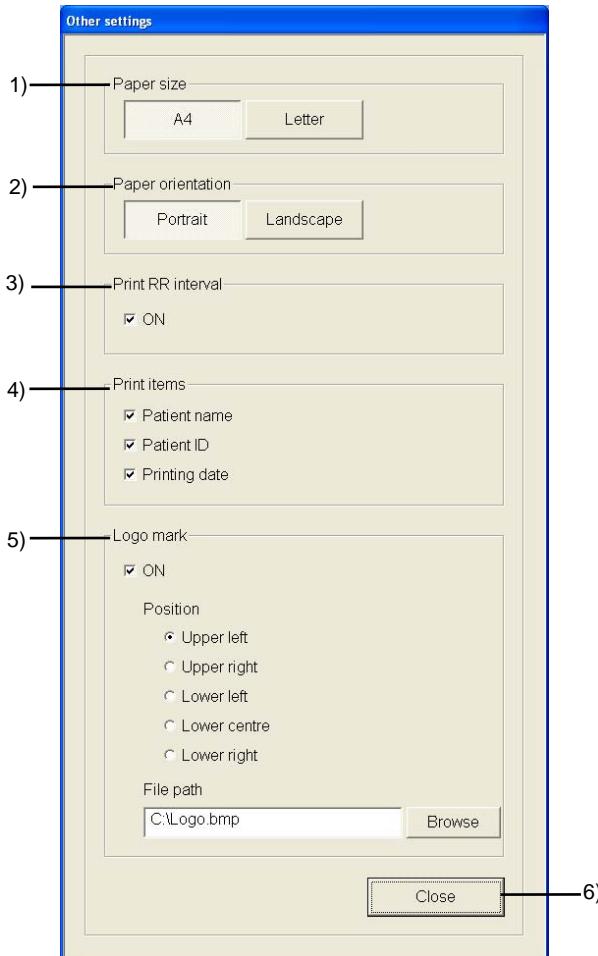
Clicking the **Printing order** button will open the “Printing order” window.

The order of printing can be set by clicking the items. The items will be numbered sequentially in the clicked order. When all the items are numbered, click the **Close** button to finalize the settings.



■ Other Settings

Clicking the **Other settings** button will open the “Other settings” window.



1) Paper Size

Select the paper size from A4 or Letter.

2) Paper Orientation

Select the paper orientation from Portrait or Landscape.

3) Print RR Interval

Put a check mark inside ON if you wish to print RR interval on the zoom waveform report.

4) Print Items

Select the print items from patient name, patient ID, and printing date. Regardless of this setting, patient name and ID will always be printed on the cover page.

5) Logo mark

Select whether to print the Logo “ON/OFF” and its position on the report. The Logo’s location can be found using the browse button.

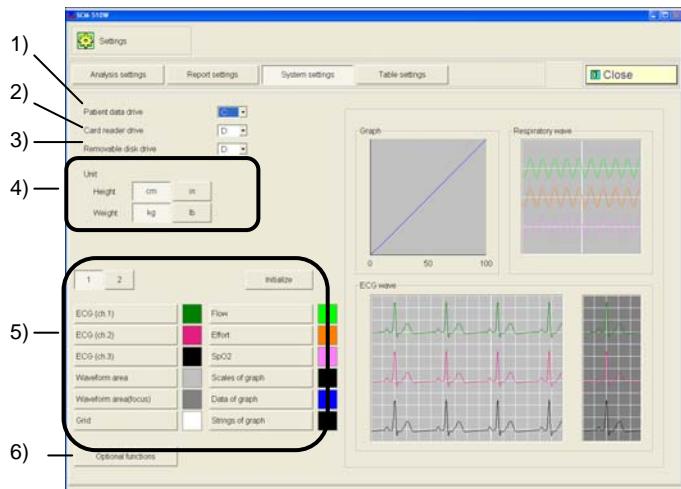
6) **Close** Button

Closes the “Other settings” window.

3. 4 System Settings

Clicking the **System settings** button on the “Settings” window will open the “System settings” window.

On the “System settings” window, the following settings can be performed.



1) Patient Data Drive

Select the drive where patient data is stored from the drop-down box.

2) Card Reader Drive

Select the card reader drive from the drop-down box.

3) Removable Disk Drive

Select a removal disk drive from the drop-down box.

4) Unit

Select the measurement units for patient's height and weight from cm/inch and kg/lb, respectively.

5) Color Selection

Select the colors of the waveforms, background, letters, etc.

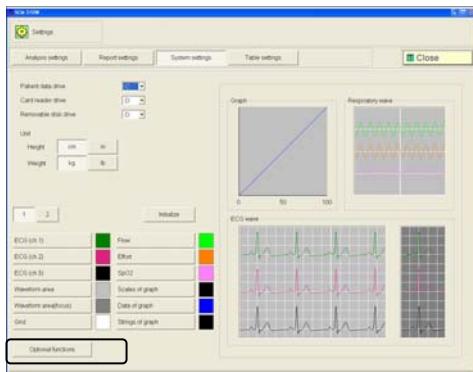
6) Optional functions

Activate optional functions of SCM-510W.

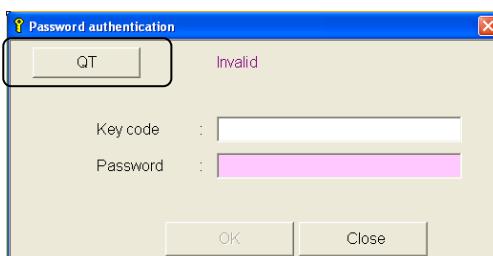
■ Activate optional functions

Here in this section we will explain how to activate the optional functions. And to do this, you will need to acquire a special password.

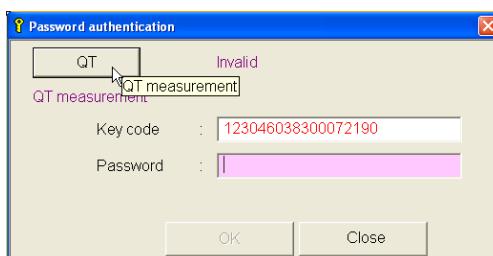
 **Memo** The password authentication of the SCM-510W is possible only for the user with administrator authority.



- 1) Click on the **Optional functions** button, under the “System settings” screen. The “Password authentication” window for the optional functions will be displayed.



- 2) The button of the function (QT for example) is displayed in the “Password authentication” window, and beside it “Invalid” is displayed.
Then click on the function button.

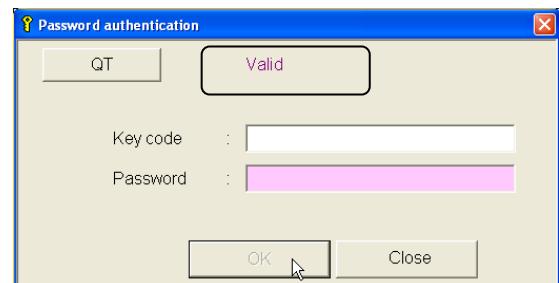


- 3) A Key code will be displayed to activate the function. Please provide the “Key Code” displayed on the “Password Authentication” window to your nearest Fukuda Denshi’s representative to obtain a password.

 **Memo** The “Key Code” and the corresponding password are effective for only one PC. If you install the software to another PC or if you re-install the operating system due to PC failure, you will need to perform the password authentication again. In such case, please obtain the password again from your nearest Fukuda Denshi’s representative.



< Password failed >



< Password succeeded >

- 4) Enter the password and then click on the [OK] button. When the password is correct, the message “Valid” beside the function will then be displayed. Please click on the [Close] button to close the window.

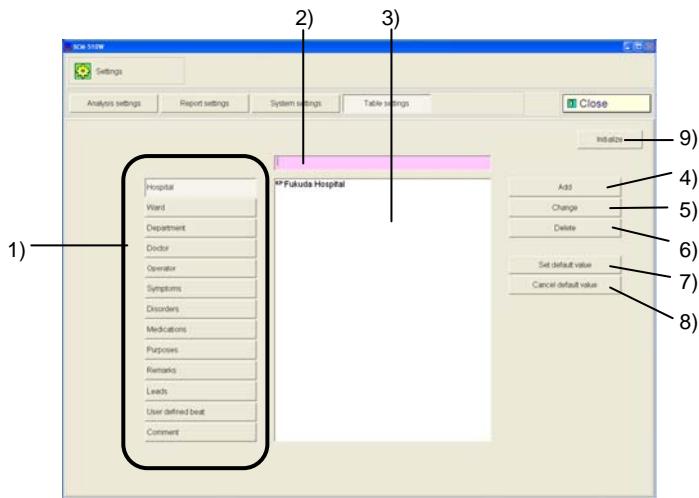
If the password failed, the message “Authentication failed” will be displayed. Check if you entered the password correctly, then re-enter the password.

Memo Once the function has been activated (message “Valid”), even if you click on the function button, the key code will not be displayed and you will not be able to enter the password.

3. 5 Table Settings

Clicking the **Table settings** button on the “Settings” window will open the “Table settings” window.

On the “Table settings” window, frequently used character string can be registered.



1) Registering Item Selection Button

Select the item to register.

2) Input Area

Area to enter or revise character strings for registering.

3) Registered List

Displays the registered character strings for the selected item.

4) Add

Adds the entered character string to the registered list.

5) Change

Replaces the selected character string on the list with the new entered character string.

6) Delete

Deletes the selected character string from the list.

7) Set default value

Sets the selected character string on the list as default.

8) Cancel default value

Cancels the default setting of the selected character string on the list.

9) Initialize

Initializes the setting.

The character strings for the following items can be set.

1) Hospital

Maximum of 50 data, 32 characters each can be entered using the keyboard.

2) Ward

Maximum of 50 data, 24 characters each can be entered using the keyboard.

3) Department

Maximum of 50 data, 24 characters each can be entered using the keyboard.

4) Doctor

Maximum of 50 data, 24 characters each can be entered using the keyboard.

5) Operator

Maximum of 50 data, 24 characters each can be entered using the keyboard.

6) Symptoms

Maximum of 50 data, 32 characters each can be entered using the keyboard.

7) Disorders

Maximum of 50 data, 32 characters each can be entered using the keyboard.

8) Medications

Maximum of 50 data, 32 characters each can be entered using the keyboard.

9) Purposes

Maximum of 50 data, 64 characters each can be entered using the keyboard.

10) Remarks

Maximum of 50 data, 64 characters each can be entered using the keyboard.

11) Leads

Maximum of 50 data, 4 characters each can be entered using the keyboard.

12) User Defined Beat

One data of maximum 8 characters can be entered using the keyboard.

13) Comment

Maximum of 50 data, 32 characters each can be entered using the keyboard.

- To register a character string on the table, first click the registering item. Then, enter the character string and click **Add**. The entered character string will be added to the registered list.
- To change the already registered character string, select the character string in the list, enter the new character string, and click **Change**.
- To delete the character string, select the character string in the list, and click **Delete**.
- The **Set default value** button will register the selected character string as default to automatically display it on the detailed entered window for reading process, etc. The items which can register a default character string are “Hospital,” “Ward,” “Department,” “Doctor,” and “Operator.”

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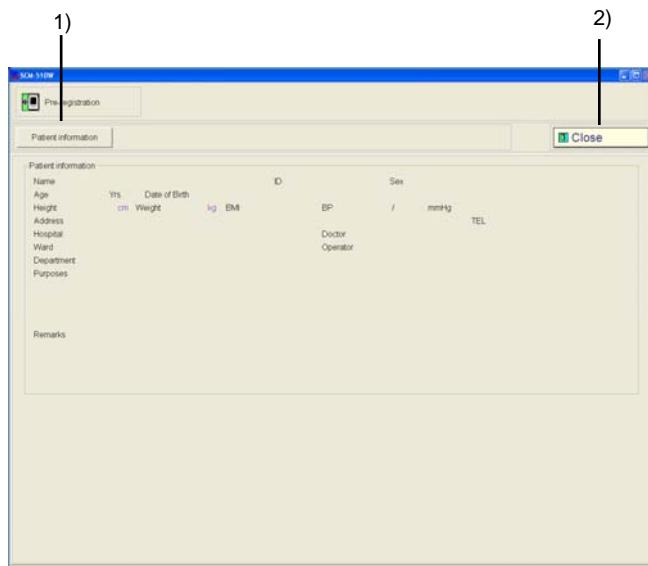
Chapter 4

Pre-registration

4. 1 Pre-registration	4-2
4. 2 Patient Information	4-3

4. 1 Pre-registration

The pre-registration function allows to write patient information to the card.



- Clicking the **Pre-registration** button on the “Initial” window will open the “Pre-registration” window.
On this window, the patient information recorded on the card will be displayed.

The following control buttons on this window are:

1) **Patient information**

Writes the patient information to the card.

2) **Close**

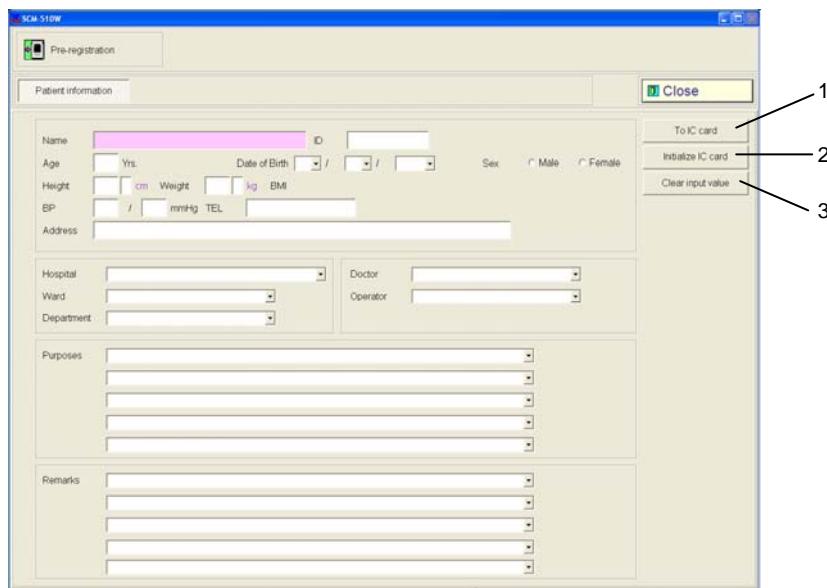
Closes the “Pre-registration” window.

4. 2 Patient Information

From the “Patient information” window, patient information can be written to the card before recording.

Clicking the **Patient information** button on the “Pre-registration” window will open the “Patient information” window.

On the “Patient information” window, there are three control buttons, which are **To IC card**, **Initialize IC card**, and **Clear input value**.



Refer to the following for details of each function.

1) **To IC card**

Writes the patient information entered on this window to the card.

2) **Initialize IC Card**

Deletes all data on the card, and initializes the card.

Memo This process will not format the card.

3) **Clear input value**

Deletes the entered information, or displays the default value(s) set in the Table setting.

- The following patient information can be written to the card from this window.

Name	: Click inside the name box and enter a maximum of 32 characters using the keyboard.
ID	: Click inside the ID box and enter a maximum of 12 characters using the keyboard.
Age	: Click inside the age box and enter a maximum of 3 characters using the keyboard.
Sex	: Select from “male” or “female.”
Date of Birth	: Click inside the boxes and enter the year (max. 4 characters); month, day (max. 2 characters) using the keyboard.
Height	: Click inside the box and enter a maximum of 3 digits with one digit after the decimal point using the keyboard.

Weight	: Click inside the box and enter a maximum of 3 digits with one digit after the decimal point using the keyboard.
BP (Blood Pressure)	: Click inside the box and enter a maximum of 3 characters using the keyboard.
TEL	: Click inside the box and enter a maximum of 16 characters using the keyboard.
Address	: Click inside the box and enter a maximum of 64 characters using the keyboard.
Hospital (*1)(*2)	: Click inside the box and enter a maximum of 32 characters using the keyboard.
Ward (*1)(*2)	: Click inside the box and enter a maximum of 24 characters using the keyboard.
Department (*1)(*2)	: Click inside the box and enter a maximum of 24 characters using the keyboard.
Doctor (*1)(*2)	: Click inside the box and enter a maximum of 24 characters using the keyboard.
Operator (*1)(*2)	: Click inside the box and enter a maximum of 24 characters using the keyboard.
Purposes (*1)	: Click inside the box and enter a maximum of 5 items, 64 characters each, using the keyboard.
Remarks (*1)	: Click inside the box and enter a maximum of 5 items, 64 characters each, using the keyboard.

(*1) : Selection from the master table is possible.

(*2) : The default setting of the master table will be automatically displayed.

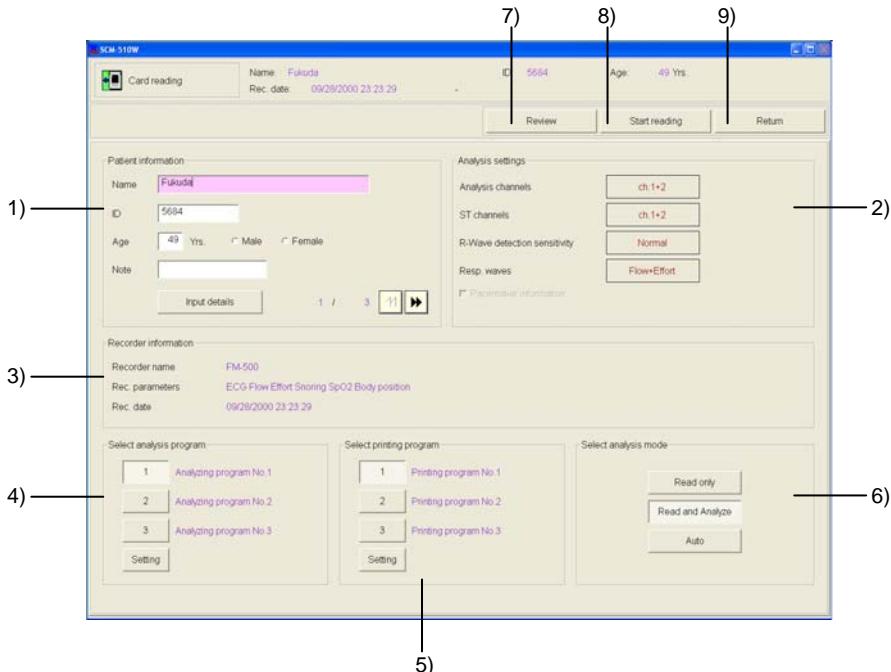
Chapter 5

Card Reading

5. 1 Card Reading.....	5-2
5. 2 Confirmation of Patient Information.....	5-3
5. 3 Input Patient Information.....	5-4
5. 4 Analysis Settings	5-7
5. 5 Analysis Program Selection.....	5-8
5. 6 Printing Program Selection.....	5-9
5. 7 Analysis Mode Selection	5-10
5. 8 Review Waveform	5-11

5. 1 Card Reading

Preliminary reading is performed, allowing the settings of reading/analyzing conditions.



Memo If respiration data is not recorded on the card, “Respiratory measurement wave” will not be displayed in the “Analysis settings” area.

1) Patient Information Area

Enter the name, ID, age, sex, and note.

2) Analysis Settings Area

Set the “Analysis channels”, “ST channels”, “R-wave detection sensitivity” and “Resp. waves”.

3) Recorder Information

Display the recorder information.

4) Select Analysis Program Area

Select the analysis program.

5) Select Printing Program Area

Select the printing program.

6) Select Analysis Mode Area

Select the analysis mode.

7) Review

Allows verification of the waveform during the preliminary reading process.

8) Start reading

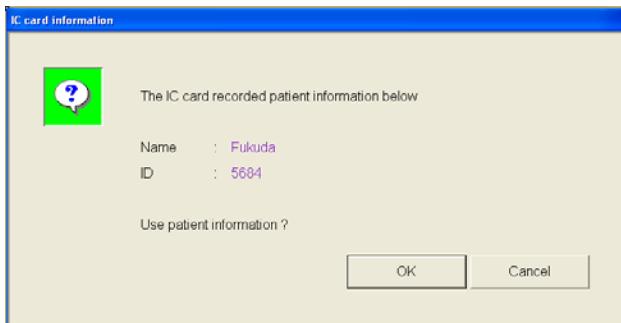
Starts the reading process with the selected analysis mode.

9) Return

Cancels the reading process and returns to the “Initial” window.

5. 2 Confirmation of Patient Information

If patient information is recorded on the card, a confirmation window will be displayed before starting the preliminary reading process.



If using the same patient information on the card, click [OK].

If not using the same patient information on the card, click [Cancel].

Memo If 30 seconds have passed without clicking either button, the preliminary reading process will start without using the patient information.

5. 3 Input Patient Information

On the patient information area, name, ID, age, sex, and note can be entered.

The diagram illustrates the 'Patient information' input area. It consists of several fields and a button:

- 1) Name:** A text input field containing "Fukuda".
- 2) ID:** A text input field containing "5684".
- 3) Age:** A text input field containing "49" followed by "Yrs.", with two radio buttons for "Male" and "Female".
- 5) Note:** An empty text input field.
- 4)** A vertical line pointing to the "Input details" button.
- 6)** A vertical line pointing to the bottom right corner of the input area.

1) Name

Click inside the name box, and enter the name using the keyboard. Maximum of 32 characters can be entered.

2) ID

Click inside the ID box, and enter the ID using the keyboard. Maximum of 12 characters can be entered.

3) Age

Click inside the Age box, and enter the age using the keyboard. Maximum of 3 characters can be entered.

4) Sex

Select "male" or "female".

5) Note

Click inside the input box, and enter a comment using the keyboard. Maximum of 16 characters can be entered.

6) **Input details** Button

Allows to enter more detailed information.

To enter more detailed information, click on the **Input details** button. The “Input details” window will open.

The screenshot shows the 'Patient Information' dialog box. It includes fields for Name (1), Age (3), Height (6), BP (8), ID (5), Date of Birth (7), Sex (4), Address (10), Symptoms (13), Hospital (14), Ward (15), Department (16), Medications (19), Disorders (20), Purposes (21), and Remarks (22). A 'Leads' section (12) contains dropdown menus for ch.1, ch.2, and ch.3. Buttons for 'Close' and 'Input details' are also present.

1)Name

Click inside the name box, and enter the name using the keyboard. Maximum of 32 characters can be entered.

2)ID

Click inside the Id box, and enter the ID using the keyboard. Maximum of 12 characters can be entered.

3)Age

Click inside the age box, and enter the age using the keyboard. Maximum of 3 characters can be entered.

4)Sex

Select from male or female.

5)Date of Birth

Click inside the box, and enter the date of birth using the keyboard. Maximum of 4 characters for the year and 2 characters for the month and day can be entered.

6)Height

Click inside the height box, and enter the height using the keyboard. Maximum of 3 digits with 1 digit after the decimal point can be entered.

7)Weight

Click inside the weight box, and enter the weight using the keyboard. Maximum of 3 digits with 1 digit after the decimal point can be entered.

8)BP (Blood Pressure)

Click inside the BP box, and enter the blood pressure using the keyboard. Maximum of 3 characters can be entered.

9)TEL (Telephone Number)

Click inside the TEL box, and enter the number using the keyboard. Maximum of 16 characters can be entered.

10)Address

Click inside the box, and enter the address using the keyboard. Maximum of 64 characters can be entered.

11)Note

Click inside the box, and enter the note using the keyboard. Maximum of 16 characters can be entered.

12)Leads (*1)

Click inside the box, and enter the lead using the keyboard. Maximum of 4 characters can be entered.

13)Symptoms (*1)

Click inside the box, and enter the symptom using the keyboard. Maximum of 4 items, 32 characters each, can be entered.

14)Hospital (*1)(*2)

Click inside the box, and enter the hospital name using the keyboard. Maximum of 32 characters can be entered.

15)Ward (*1)(*2)

Click inside the box, and enter the ward name using the keyboard. Maximum of 24 characters can be entered.

16)Department (*1)(*2)

Click inside the box, and enter the department name using the keyboard. Maximum of 24 characters can be entered.

17)Doctor (*1)(*2)

Click inside the box, and enter the physician's name using the keyboard. Maximum of 24 characters can be entered.

18)Operator (*1)(*2)

Click inside the box, and enter the operator name using the keyboard. Maximum of 24 characters can be entered.

19)Medications (*1)

Click inside the box, and enter the medication using the keyboard. Maximum of 3 items, 32 characters each, can be entered.

20)Disorders (*1)

Click inside the box, and enter the disorder using the keyboard. Maximum of 3 items, 32 characters each, can be entered.

21)Purposes (*1)

When List is selected, click inside the box, and enter the purpose using the keyboard. Maximum of 5 items, 64 characters each, can be entered. Or select from the drop-down list.

When Text is selected, click on the box and enter the purpose using the keyboard. Maximum of 8 lines with 64 characters per line.

22)Remarks

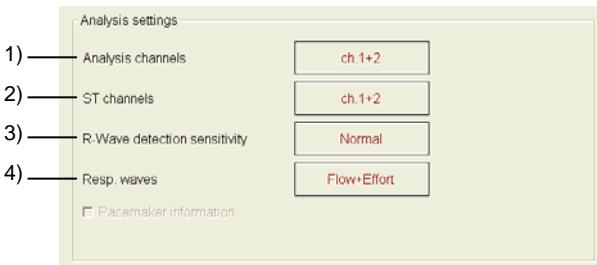
Click inside the box and enter remark(s) using the keyboard. Maximum of 8 lines with 64 characters per line.

(*1) : Selection from the master table is possible.

(*2) : The default setting of the master table will be automatically displayed.

5. 4 Analysis Settings

On the “Analysis settings” area, analysis channels, ST channels, R-wave detection sensitivity, and respiration waves can be set.



1) Analysis Channels

Select from [ch.1], [ch.2], [ch.3], [ch.1+2], [ch.1+3], and [ch.2+3].

2) ST Channels

Select from [ch.1], [ch.2], [ch.3], [ch.1+2], [ch.1+3], [ch.2+3], and [ch.1+2+3].

3) R-Wave Detection Sensitivity

Select the R-wave detection sensitivity from [Normal] and [High].

4) Respiratory Waves

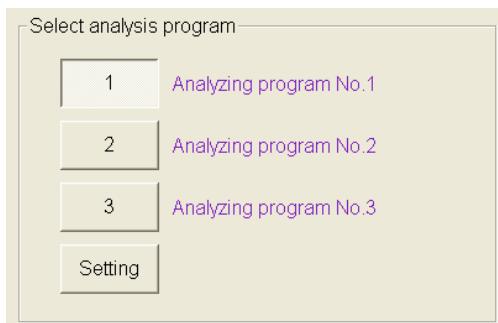
Select from [Flow], [Effort], and [Flow + Effort].

Memo If respiration data is not recorded on the card, “Respiratory waves” will not be displayed in the “Analysis settings” area.

If pacemaker information is recorded, the “Pacemaker information” check box will be validated and allows verification during the preliminary reading process.

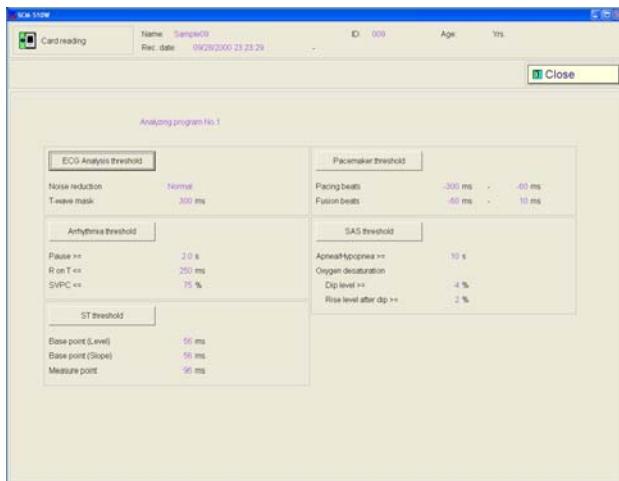
5. 5 Analysis Program Selection

The analysis program number can be selected.



- The program number previously used will be selected. To change the selection, click the program number.
- Click **Setting** to set the analysis condition other than Programs 1 to 3.

Memo For procedure on how to change the analysis settings, refer to "Chapter 3 Settings."



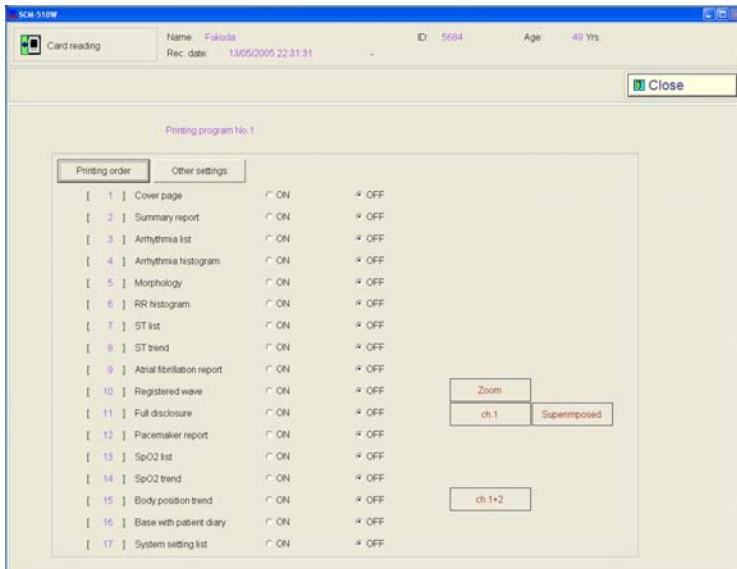
5. 6 Printing Program Selection

The program number for report printing can be selected.



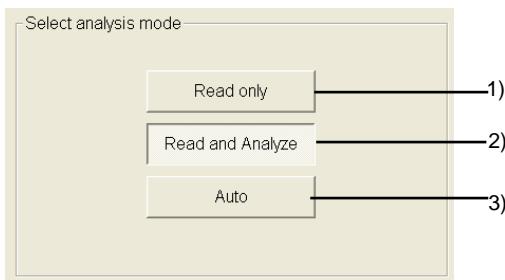
- The program number previously used will be selected. To change the selection, click the program number.
- Click **Setting** to set the printing condition other than Programs 1 to 3.

Memo For procedure on how to change the printing settings, refer to “Chapter 3 Settings.”



5. 7 Analysis Mode Selection

The analysis method can be selected.



- Select from **Read only**, **Read and Analyze**, and **Auto**.

1) Read only

Reads the card data and stores it to the hard disk.

2) Read and Analyze

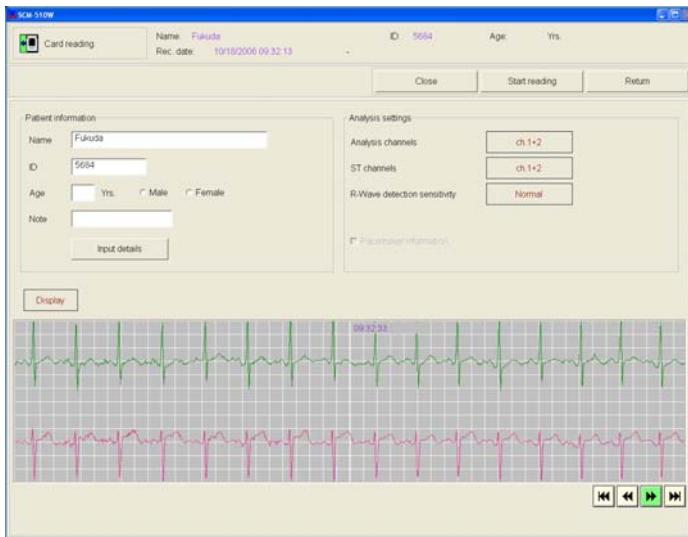
Reads and analyzes the card data, and stores it to the hard disk.

3) Auto

Reads and analyzes the card data, stores it to the hard disk, and prints it.

5. 8 Review Waveform

The waveform during the preliminary analysis process can be verified.



- Click the [Review] button on the “Patient information” window.
- Enlarged waveform of 10 seconds duration will be displayed at the lower part of the window for verification.
- All waveforms can be verified over 24 hours.

Blank Page

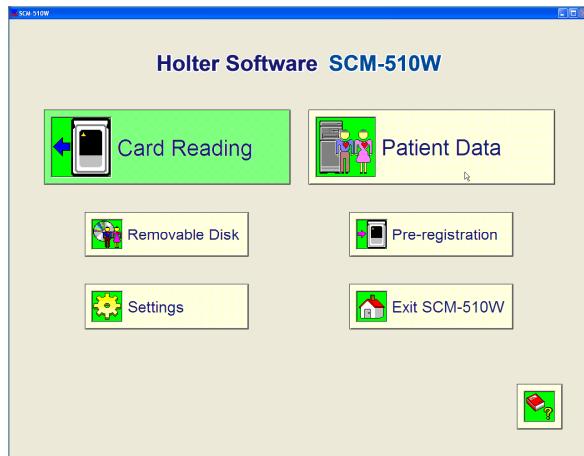
Chapter 6

Patient Data

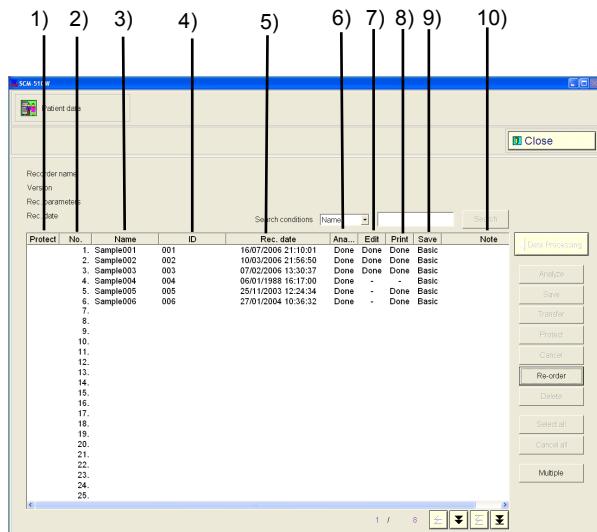
6. 1 Patient Data	6-2
6. 2 Working on the Patient Data	6-4
Analyze.....	6-4
Save	6-5
Transfer	6-6
Protection / Cancellation of Protection	6-21
Re-order	6-22
Delete	6-23
Select All / Cancel All.....	6-24
6. 3 Data Processing	6-25
6. 4 Morphology	6-26
Morphology Classification	6-26
Morphology Groups	6-27
Morphology Series	6-31
6. 5 Search	6-39
Search Method Types	6-39
Main Search Window	6-40
Event Search.....	6-41
Trend Search.....	6-46
RR Search.....	6-49
Registered Waveform Search	6-52
Waveform Display	6-56
Edit Procedure Types	6-60
6. 6 Measurement	6-69
Type of Measurements	6-69
Main Measurement Window	6-70
HRV Measurement	6-70
Lorenz Plot	6-97
SAS Measurement	6-109
Pacemaker Measurement	6-125
QT measurement	6-136
6. 7 Analysis Summary	6-154
Types of Analysis Summary	6-154
Summary	6-154
Arrhythmia List	6-156
6. 8 Print	6-157
Types of Printing.....	6-157
Main Print Window	6-157
Print Report	6-158
Print Selected Time	6-161

6. 1 Patient Data

On the “Patient data” window, stored patient data will be displayed in list format, allowing various operations to be performed on the selected data.



Click the **Patient Data** button on the “Initial” window, to open the “Patient data” window.



The following information will be displayed.

1) Protect

Displays whether the data is protected or not. If protected, “○” will be displayed.

2) No.

Displays the stored number of the patient data. The number will be assigned from No.1 to 200.

3) Name

Displays the patient name.

4) ID

Displays the patient ID.

5) Rec. date

Displays the date/time the recording started.

6) Analyze

Displays whether the data is analyzed or not. If analyzed, “Done” will be displayed. If not, “–” will be displayed. If the data of simplified format is loaded from the removable disk, “–” will be displayed to indicate that analyzing is not possible.

7) Edit

Displays whether the data is edited or not. If edited, “Done” will be displayed. If not, “–” will be displayed.

8) Print

Displays whether the data is printed or not. If printed, “Done” will be displayed. If not, “–” will be displayed.

9) Save

Displays whether the data is stored or not. If stored, the stored format will be displayed abbreviated as follows.

All data : “All”

Basic : “Basic”

IC card : “IC”

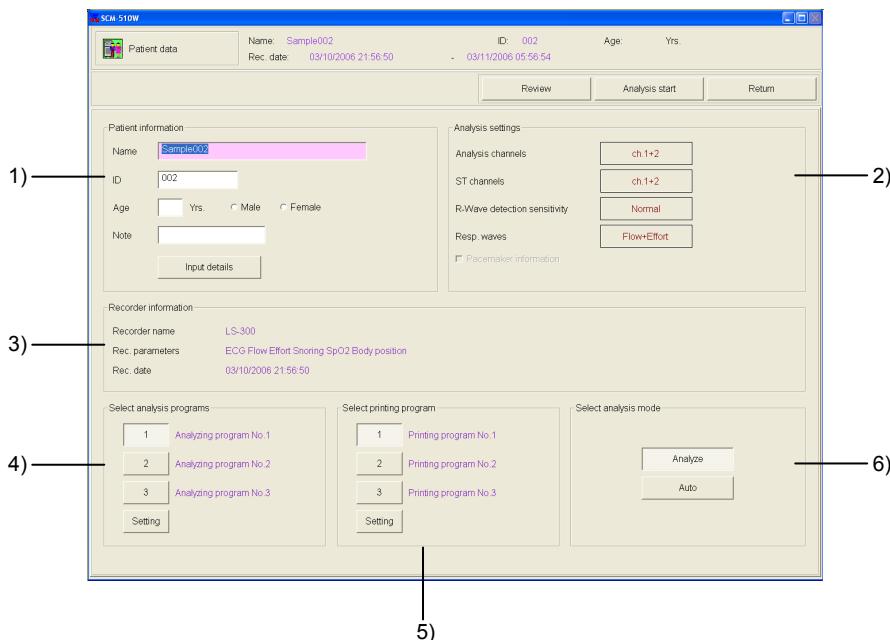
10) Note

Displays the comment, which was input during the reading process.

6. 2 Working on the Patient Data

Analyze

The patient information window will be displayed by selecting a patient data from the patient data list and clicking the **Analyze** button.



Memo If the respiration data is not recorded on the card, the “Respiratory waves” will not be displayed.

■Patient Information

On the patient information window, the following settings can be performed.

1) Patient Information

Enter the patient information.

2) Analysis Settings

Select the analysis channel, ST measurement channel, R-wave detection sensitivity, and respiratory measurement waves.

3) Recorder Information

Displays the recorder information.

4) Select Analysis Program

Select the analysis program number (preset).

5) Select Printing Program

Select the printing program number (preset).

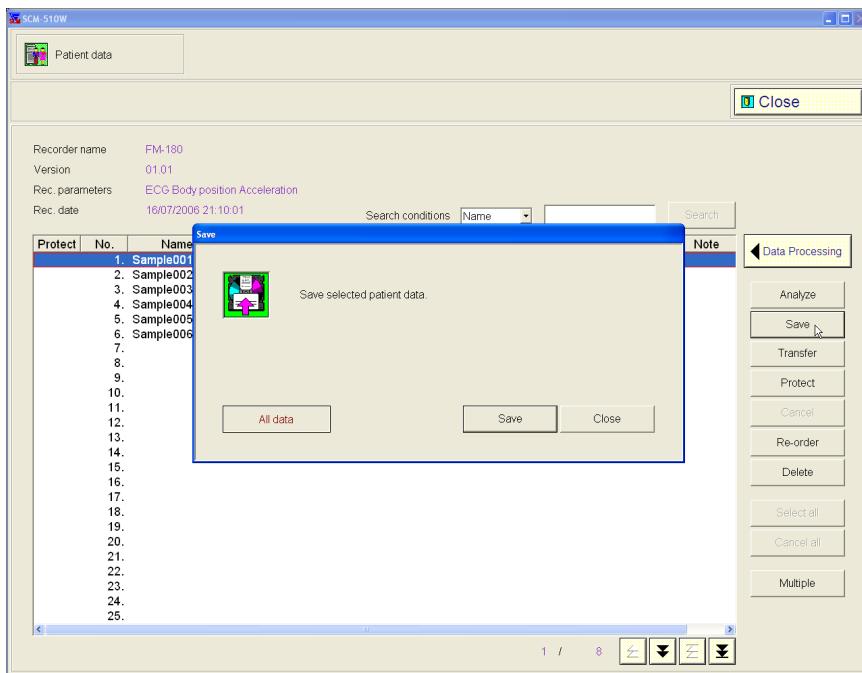
6) Select Analysis Mode

Select from **Analyze** and **Auto**.

When the above setup is completed, click on the **Analysis start** button to start the analysis.

To cancel the analysis, click on the **Return** button. The window will return to the patient data list.

Save



To store the data, select the patient data from the patient data list, and click the **Save** button. The “Save” window will be displayed.

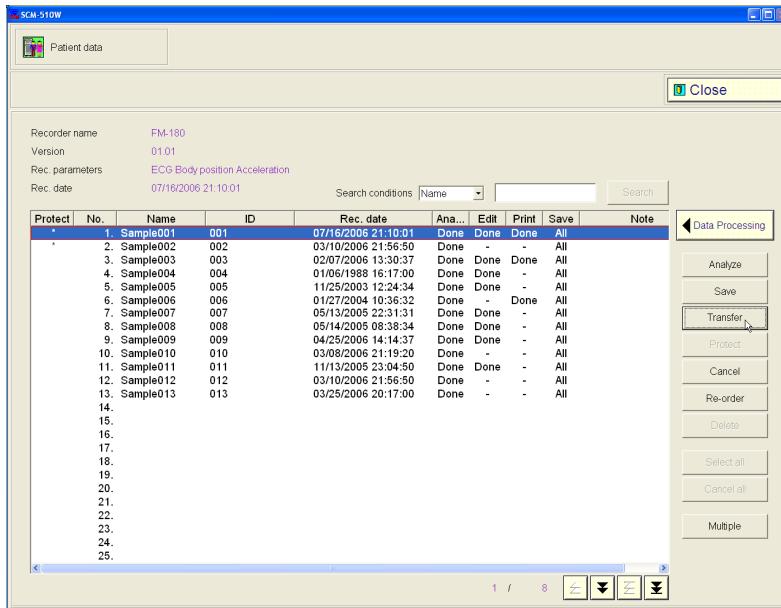
On the “Save” window, three types of storing format (All data, Basic, and IC card) are available to select from.

Select the format, and click on the **Save** button. The message, “Save selected patient data.” will be displayed, and the storing process will start. The progress bar will be displayed to indicate the remaining time.

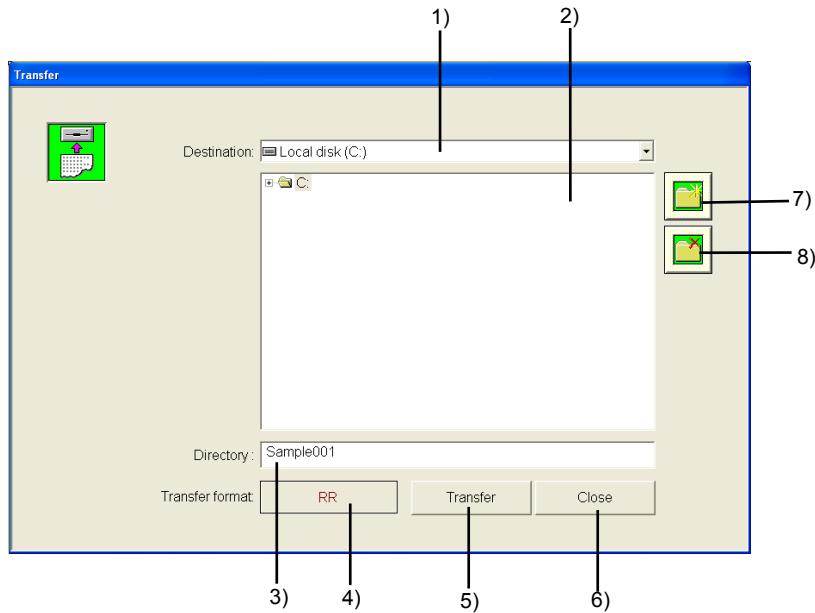
Transfer

The analyzed result can be transferred to an external media.
The following formats are available for the transfer file.

- RR : RR data
- Summary : Summary
- Arrhythmia list : Arrhythmia list
- SpO₂ : SpO₂ data list
- ST : ST data



Select a patient data from the patient data list, and click on the **Transfer** button.
The “Transfer” window will be displayed.



1) Destination Drop-down Box

Select the destination drive for the file output.

2) Destination Directory Tree

Displays the directory tree for the destination drive.

3) Directory

Enter the directory name to save the file.

4) Transfer Format

Select the output file format.

5) Transfer Button

Starts the output process.

6) Close Button

Ends the output process.

7) "Create Directory" Button

Creates a new directory.

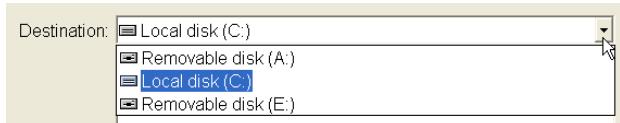
8) "Delete Directory" Button

Deletes the selected directory.

■Select the Output Directory

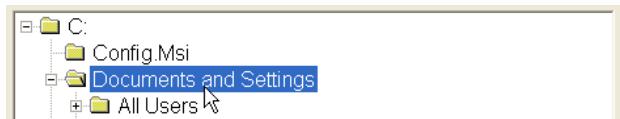
The directory for the file output is set.

●Select Destination Drive



The output destination drive can be selected from the drop-down box. In the drop-down box, the list of usable drive for the currently used PC will be displayed.

●Select Output Directory



The output directory can be selected from the output directory tree.

 **Memo** To expand or collapse the subordinate directory, click “+” or “-” or double-click on the directory name.

■Set the Directory name to save the File

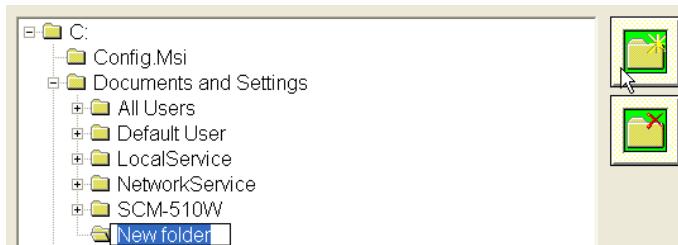
Set the directory name to which the file will be saved under the selected output directory. The file name is created with the following priority.

- Name
- Patient ID (If the name is not input)
- Transfer Time (If the name and patient ID are not input)
- User-configured Directory



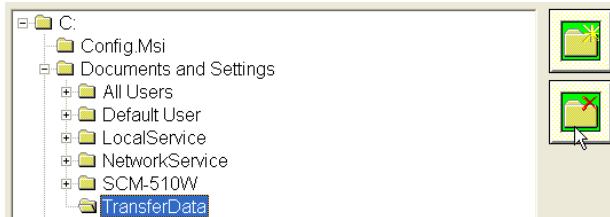
To change the default file name, enter the file name using the keyboard.

■Create Directory

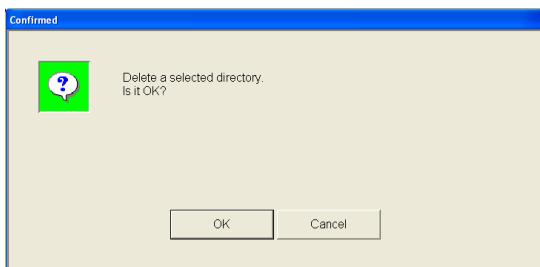


Clicking the “Create Directory” icon will create a new directory under the selected directory. Enter the directory name, and click the directory tree to finalize the input.

■Delete Directory

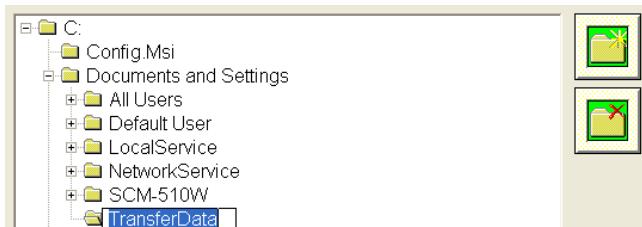


To delete the directory, select the directory, and click the “Delete Directory” icon.



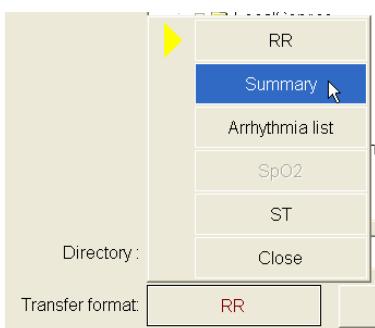
If a subordinate directory or file exists inside the selected directory, a confirmation message will be displayed. Clicking [OK] will delete the directory, and clicking [Cancel] will not delete the directory.

■Change Directory Name



Select the directory and press the F2 key, or right-click on the selected directory. Enter the directory name using the keyboard, and click the directory tree to finalize the input.

■Select Transfer Format



Click the “Transfer format” box to display the pop-up menu.
Select the output format from the pop-up menu.

Memo If the ECG is not recorded, the selections of “RR”, “Summary”, “Arrhythmia list” and “ST” will be dimmed, and it cannot be selected.

Memo If SpO₂ is not recorded, the selection of “SpO₂” will be dimmed, and it cannot

be selected.

■To Start the Transfer Process



Click the **Transfer** button.



When the file transfer starts, a progress window will be displayed. The selected output directory will be saved as default for the next file transfer.

The file name and file size for each transfer format is as follows.

<i>Transfer Format</i>	<i>File Name</i>	<i>File Size</i>
RR ^{(*)1}	RR0001/RR_00.CSV~	Approx. 1.3MByte
Summary	RST.CSV	Approx. 2KByte
Arrhythmia list	ART.CSV	Approx. 3KByte
SpO ₂ ^{(*)1)(*)2}	SP0001/SPO ₂ _00.CSV~	Approx. 700KByte
ST ^{(*)1}	ST0001/ST_00.CSV~ ST0001/ST_MIN.CSV	Approx. 4.0MByte

(*)1) : As more than one data file of one-hour each will be transferred for RR, SpO₂, and ST outputs, a unique directory will be created under the selected output directory to transfer these files.

(*)2) : The SpO₂ recording duration is 8 hours.

Memo The above file size is for 4 hours of recorded data. The file size will differ according to the recorded duration.

■To Cancel the Transfer Process



Click the **Close** button.

■Data Structure of Text File

The transfer file is in text format so that the data can be read on the commercially available spreadsheet software. In this section, the items on the worksheet when the output file is read on the spreadsheet software are listed. Microsoft Excel is used as an example for the worksheet.

 **Memo** Excel is a registered trademark of Microsoft Corporation in the US.

●RR

	A	B	C	D	E
1	RR_00.CSV	SCM-510W(V01-01)	02/11/2007 15:03:49		
2	Sample002	2		49 Male	03/10/2006 21:56:50
3	Total beats	28834			
4	Extracted date	03/10/2006 21:56:50			
5	Extracted beats	233			
6					
7	Time	Beat judgement code	RR interval		
8	21:56	N		809	
9	21:56	N		808	
10	21:56	N		808	
11	21:56	N		792	
12	21:56	N		792	
13	21:56	N		800	

The items on the worksheet are as follows.

- [A1] File Name
- [B1] System Name, Version No.
- [C1] Date, Time of File Output
- [A2] Patient Name
- [B2] Patient ID
- [C2] Patient Age
- [D2] Patient Sex
- [E2] Recorded Date
- [A3] Total Beats, Title
- [B3] Number of Total Beats
- [A4] Date/Time of the File, Title
- [B4] Recorded Date/Time of the First Data
- [A5] Number of Beats of the File, Title
- [B5] Number of Beats of the File
- [A7] Time, Title
- [B7] Beat Judgment Code, Title
- [C8] RR Interval, Title
- [A8] Output Data Time
- [B8] Beat Judgment Code
- [C8] RR Interval

From the 9th line onward, the same content as with the 8th line will continue for the corresponding beat.

 **Memo** When transferring the data to the spreadsheet software, use comma (,) for the delimiter, and use double quote ("") for quoting the character string. The continuing two delimiters should be treated as one character.

 **Memo** A spreadsheet software other than Microsoft Excel 2000 can also be used to read the data, but the data may be misaligned depending on the spreadsheet software.

●Summary

	A	B	C	D	E
1	RST.CSV	SCM-510W(V01~01)	02/11/2007 15:04:01		
2	Sample002		2	49 Male	03/10/2006 21:56:50
3					
4	Heart beat information	Max. HR		90 bpm	11 / 02:26:00
5		Mean HR		60 bpm	
6		Min. HR		50 bpm	11 / 04:11:25
7		Total beats	28834 beats		
8		N. Normal	28711 beats		
9		V. VPC	8 beats		
10		S. SVPC	7 beats		
11		? Other	108 beats		
12		P. Pace	0 beats		
13		F. Fusion	0 beats		
14		X. User defined beat	0 beats		
15					
16	Arrhythmia information	VPC	Event nb	Max.	
17		V-Run		0	
18					
19		V-Couplet		0	
20		R on T <= 250ms		0	
21		Bigeminy		0	
22		Trigeminy		0	
23		V-Single		8	
24					
25		SVPC	Event nb	Max.	
26		Pause >= 2.0Second		0	
27		V-Run <= 75%		0	
28					
29		V-Couplet <= 75%		0	
30		V-Single <= 75%		7	43% 11 / 03:01:11
31					
32	ST information	ch.1 Max. ST	+0.12mV	(+5.9mV/s)	10 / 22:42:22
33		ch.1 Mean ST	+0.05mV		
34		ch.1 Min. ST	-0.04mV	(+3.4mV/s)	10 / 22:56:25
35		ch.2 Max. ST	+0.16mV	(+6.4mV/s)	10 / 21:57:56
36		ch.2 Mean ST	+0.07mV		
37		ch.2 Min. ST	-0.01mV	(+0.5mV/s)	10 / 22:04:21
38		ch.3 Max. ST			
39		ch.3 Mean ST			
40		ch.3 Min. ST			
41		Base point (Level):	56 ms		
42		Base point (Slope):	56 ms		
43		Measure point:	96 ms		



The ch.3 data of the ST information will be output only for the 3-channel recorded data.

The data of the channel not specified for ST measurement will be also left blank.

The items of the work sheet are as follows.

- [A1] File Name
- [B1] System Name, Version No.
- [C1] Date/Time of File Output
- [A2] Patient Name
- [B2] Patient ID
- [C2] Patient Age
- [D2] Patient Sex
- [E2] Recorded Date
- [A4] HR Information, Title
- [B4] Maximum HR, Title
- [C4] Maximum HR
- [D4] Maximum HR, Unit
- [E4] Maximum HR, Time
- [B5] Average HR, Title
- [C5] Average HR
- [D5] Average HR, Unit
- [B6] Minimum HR, Title
- [C6] Minimum HR, Number
- [D6] Minimum HR, Unit
- [E6] Minimum HR, Time

- [B7] Total Beats
- [C7] Total Beats, Number
- [D7] Total Beats, Unit
- [B8] Normal HR, Title
- [C8] Normal HR
- [D8] Normal HR, Unit
- [B9] Ventricular Premature Contraction, Title
- [C9] Ventricular Premature Contraction, Number
- [D9] Ventricular Premature Contraction, Unit
- [B10] Supraventricular Premature Contraction, Title
- [C10] Supraventricular Premature Contraction, Number
- [D10] Supraventricular Premature Contraction, Unit
- [B11] Other HR, Title
- [C11] Other HR, Number
- [D11] Other HR, Unit
- [B12] Pacemaker Beat, Title
- [C12] Pacemaker Beat, Number
- [D12] Pacemaker Beat, Unit
- [B13] Fusion Beat, Title
- [C13] Fusion Beat, Number
- [D13] Fusion Beat, Unit
- [B14] User Defined HR, Title
- [C14] User Defined HR, Number
- [D14] User Defined HR Unit
- [A16] Arrhythmia Information, Title
- [B16] Ventricular Arrhythmia, Title
- [C16] Number of Events, Title
- [D16] Maximum Value, Title
- [B17] Run, Title
- [C17] Run, Number
- [D17] Run, Max. Value
- [E17] Run, Time of Max. Value
- [D18] Run, Max. Value (instant)
- [E19] Run, Time of Max. Value (instant)
- [B19] Couplet, Title
- [C19] Couplet, Number
- [B20] RonT (Threshold), Title
- [C20] RonT, Number
- [B21] Bigeminy, Title
- [C21] Bigeminy, Number
- [D21] Bigeminy, Max. Value
- [E21] Bigeminy, Time of Max. Value
- [B22] Trigeminy, Title
- [C22] Trigeminy, Number
- [D22] Trigeminy, Max. Value
- [E22] Trigeminy, Time of Max. Value
- [B23] Single, Title
- [C23] Single, Number
- [B25] Supraventricular Arrhythmia, Title
- [C25] Number of Events, Title
- [D25] Maximum Value, Title
- [B26] Pause (Threshold), Title
- [C26] Pause, Number
- [D26] Pause, Max. Value
- [E26] Pause, Time of Max. Value
- [B27] Run (Threshold), Title
- [C27] Run, Number
- [D27] Run, Max. Value

- [E27] Run, Time of Max. Value
- [D28] Run, Max. Value (instant)
- [E28] Run, Time of Max. Value (instant)
- [B29] Couple, Threshold
- [C29] Couple, Number
- [B30] Single (Threshold), Title
- [C30] Single, Number
- [D30] Single, Max. Value
- [E30] Single, Time of Max. Value
- [A32] ST Information, Title
- [B32] Ch.1 Max. ST, Title
- [C32] Ch.1 Max. ST Value (Slope)
- [D32] Ch.1 Max. ST Value (Level)
- [E32] Ch.1 Max. ST Value, Time
- [B33] Ch.1 Ave. ST, Title
- [C33] Ch.1 Ave. ST Value (Slope)
- [D33] Ch.1 Ave. ST Value (Level)
- [B34] Ch.1 Min. ST, Title
- [C34] Ch.1 Min. ST Value (Slope)
- [D34] Ch.1 Min. ST Value (Level)
- [E34] Ch.1 Min. ST Value, Time
- [B35] Ch.2 Max. ST, Title
- [C35] Ch.2 Max. ST Value (Slope)
- [D35] Ch.2 Max. ST Value (Level)
- [E35] Ch.2 Max. ST Value, Time
- [B36] Ch.2 Ave. ST, Title
- [C36] Ch.2 Ave. ST Value (Slope)
- [D36] Ch.2 Ave. ST Value (Level)
- [B37] Ch.2 Min. ST, Title
- [C37] Ch.2 Min. ST Value (Slope)
- [D37] Ch.2 Min. ST Value (Level)
- [E37] Ch.2 Min. ST Value, Time
- [B38] Ch.3 Max. ST, Title
- [C38] Ch.3 Max. ST Value (Slope)
- [D38] Ch.3 Max. ST Value (Level)
- [E38] Ch.3 Max. ST Value, Time
- [B39] Ch.3 Ave. ST, Title
- [C39] Ch.3 Ave. ST Value (Slope)
- [D39] Ch.3 Ave. ST Value (Level)
- [B40] Ch.3 Min. ST, Title
- [C40] Ch.3 Min. ST Value (Slope)
- [D40] Ch.3 Min. ST Value (Level)
- [E40] Ch.3 Min. ST Value, Time
- [B41] Level Reference Point, Title
- [C41] Level Reference Point, Threshold
- [B42] Slope Reference Point, Title
- [C42] Slope Reference Point, Threshold
- [B43] Measurement Reference Point, Title
- [C43] Measurement Reference Point, Threshold

●Arrhythmia List

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1 ARTCS V	SCM-510W(V01-01)	02/11/2007 15:04:05															
2 Sample 002		2	49	Male	03/10/2006 21:56:50												
3																	
4 Time		HR[bpm]	Total beats				Ventricular										
5	Min.	Mean	Max.	Best Nb.	V-Run	V-Couplet	R on T	Bigeminy	Trigeminy	V-Single	Best Nb.	Pause	S-Run	S-Couplet	S-Single	Af	
6 21:56	70	75	84	333	0	0	0	0	0	0	0	0	0	0	0	0	
7 22:00	61	70	87	4054	3	0	0	0	0	0	3	1	0	0	0	0	
8 23:00	58	63	78	3809	0	0	0	0	0	0	0	0	0	0	0	0	
9 0:00	62	64	78	3659	0	0	0	0	0	0	0	0	0	0	0	0	
10 1:00	53	56	74	3404	0	0	0	0	0	0	0	0	0	0	0	0	
11 2:00	52	62	90	3675	1	0	0	0	0	0	1	0	0	0	0	0	
12 3:00	52	56	73	3263	0	0	0	0	0	0	0	3	0	0	0	2	
13 4:00	50	57	84	3449	3	0	0	0	0	0	3	2	0	0	0	0	
14 5:00	51	56	76	3188	1	0	0	0	0	0	1	1	0	0	0	1	
15 Total	556	50	60	90	28834	8	0	0	0	0	8	7	0	0	0	7	
16 Total																	

The items on the worksheet are as follows.

- [A1] File Name
- [B1] System Name, Version No.
- [C1] Date, Time of File Output
- [A2] Patient Name
- [B2] Patient ID
- [C2] Patient Age
- [D2] Patient Sex
- [E2] Recorded Day
- [A4] Time, Title
- [C4] HR, Title
- [B5] Minimum Value, Title
- [C5] Mean Value, Title
- [D5] Maximum Value, Title
- [E4] Number of Total Beats, Title
- [I4] Ventricular Title, Title
- [F5] Number of Beats, Title
- [G5] Run, Title
- [H5] Couplet, Title
- [I5] “R on T”, Title
- [J5] Bigeminy, Title
- [K5] Trigeminy, Title
- [L5] Single, Title
- [O4] Supraventricular, Title
- [M5] Number of Beats, Title
- [N5] Pause, Title
- [O5] Run, Title
- [P5] Couplet, Title
- [Q5] Single, Title
- [R4] Atrial Fibrillation, Title
- [R5] Atrial Fibrillation, Unit
- [A6] Time
- [B6] Minimum HR
- [C6] Average HR
- [D6] Maximum HR
- [E6] Total Beats
- [F6] (Ventricular) Beats, Number
- [G6] (Ventricular) Run, Number
- [H6] (Ventricular) Couplet, Number
- [I6] (Ventricular) “R on T”, Number
- [J6] (Ventricular) Bigeminy, Number
- [K6] (Ventricular) Trigeminy, Number
- [L6] (Ventricular) Single, Number
- [M6] (Supraventricular) Beats, Number
- [N6] (Supraventricular) Pause, Number
- [O6] (Supraventricular) Run, Number
- [P6] (Supraventricular) Couplet, Number

- [Q6] (Supraventricular) Single, Number
- [R6] Atrial Fibrillation, Time

For 7th to 30th lines, the same content as with the 6th line will continue for the recorded duration (each hour).

- [A31] Recording End Time
- [A32] Total: Title
- [B32] Total: Minimum HR
- [C32] Total: Average HR
- [D32] Total: Maximum HR
- [E32] Total: Total Beats
- [F32] Total: (Ventricular) Beats, Number
- [G32] Total: (Ventricular) Run, Number
- [H32] Total: (Ventricular) Couplet, Number
- [I32] Total: (Ventricular) R on T, Number
- [J32] Total: (Ventricular) Bigeminy, Number
- [K32] Total: (Ventricular) Trigeminy, Number
- [L32] Total: (Ventricular) Single, Number
- [M32] Total: (Supraventricular) Beats, Number
- [N32] Total: (Supraventricular) Pause, Number
- [O32] Total: (Supraventricular) Run, Number
- [P32] Total: (Supraventricular) Couplet, Number
- [Q32] Total: (Supraventricular) Single, Number
- [R32] Total: Atrial Fibrillation Event, Time

● SpO₂

	A	B	C	D	E
1	SPO2_00.CSV	SCM-510W(V01-01)	02/11/2007 15:04:10		
2	Sample002		2	49 Male	03/10/2006 21:56:50
3					
4	Time	SpO ₂	Pulse	Status	
5	21:56:50		99	74	
6	21:56:51		99	74	
7	21:56:52		99	74	
8	21:56:53		98	74	
9	21:56:54		99	74	
10	21:56:55		100	74	

The items on the worksheet are as follows.

- [A1] File Name
- [B1] System Name, Version No.
- [C1] Date, Time of File Output
- [A2] Patient Name
- [B2] Patient ID
- [C2] Patient Age
- [D2] Patient Sex
- [E2] Recorded Day
- [A4] Time, Title
- [B4] SpO₂, Title
- [C4] Pulse Rate, Title
- [D4] Status, Title
- [A5] Time
- [B5] SpO₂
- [C5] Pulse Rate
- [D5] Error during recording

From the 6th line onwards, the same content as with the 5th line will continue for the recorded duration.

If “E” is output on “Status” column, it indicates a recording error generated at that time.

● ST

Two types of ST measurement, ST measurement for each beat and ST measurement for each minute, will be output.

■ ST measurement for each beat (ST_nn.CSV)

	A	B	C	D	E	F	G	H
1	ST_00.CSV	SCM-510W(V01-01)	02/11/2007 15:04:20					
2	Sample002		2	49 Male	03/10/2006 21:56:50			
3	Total beats		28834					
4	Extracted date	03/10/2006 21:56:50						
5	Extracted beats	233						
6	Base point (Level)		56 Base point (Slope)		56 Measure point		96	
7								
8			ch1			ch2		
9	Time	Beat judgement code	ST level	ST slope	Status	ST level	ST slope	Status
10	21:57 N			0.09	2.5 CHANGE	0.12	3.4 CHANGE	
11	21:57 N			0.08	2.2 UPDATE	0.12	3.4 UPDATE	
12	21:57 N			0.07	2.2 UPDATE	0.1	2.9 UPDATE	
13	21:57 N			0.07	2.2 UPDATE	0.09	2.9 UPDATE	
14	21:57 N			0.07	2.5 UPDATE	0.11	3.2 UPDATE	

 **Memo** The ch.3 data of the ST information will be output only for the 3-channel recorded data.

The data of the channel not specified for ST measurement will be also left blank.

The items on the worksheet are as follows.

- [A1] File Name
- [B1] System Name, Version No.
- [C1] Date, Time of File Output
- [A2] Patient Name
- [B2] Patient ID
- [C2] Patient Age
- [D2] Patient Sex
- [E2] Recorded Data
- [A3] Total Beats, Title
- [B3] Total Beats
- [A4] Date/Time of the File, Title
- [B4] Date/Time of the First Recorded Data
- [A5] Number of Beats of the File, Title
- [B5] Number of Beats of the File
- [A6] Level Reference Point, Title
- [B6] Level Reference Point, Threshold
- [C6] Slope Reference Point, Title
- [D6] Slope Reference Point, Threshold
- [E6] Measurement Point, Title
- [F6] Measurement Point, Threshold
- [C8] Ch.1, Title
- [F8] Ch.2, Title
- [I8] Ch.3, Title
- [A9] Time, Title
- [B9] Beat Judgment Code, Title
- [C9] ST Level, Title
- [D9] ST Slope, Title
- [E9] Status, Title
- [F9] ST Level, Title
- [G9] ST Slope, Title
- [H9] Status, Title
- [I9] ST Level, Title
- [J9] ST Slope, Title
- [K9] Status, Title
- [A10] Time
- [B10] Beat Judgment Code
- [C10] (Ch.1) ST Level
- [D10] (Ch.1) ST Slope
- [E10] (Ch.1) Status
- [F10] (Ch.2) ST Level
- [G10] (Ch.2) ST Slope
- [H10] (Ch.2) Status
- [I10] (Ch.3) ST Level
- [J10] (Ch.3) ST Slope
- [K10] (Ch.3) Status

From the 11th line onward, the same content as with the 10th line will continue for the corresponding beat.

For the “Status” column, the following comment will be output.

- “UPDATE” : Average Update Beat
- “CHANGE” : Average Change Beat
- “SUPPORT” : Average Support Beat

■ ST measurement for each minute (ST_MIN.CSV)

A	B	C	D	E	F	G	H	I	J	K	L	M
1 ST_MIN.CSV	SCM-510W(V01-01)	02/11/2007 15:04:30										
2 Sample 002	2	49	Male	03/10/2006 21:56:50								
3 Data Nb.	481											
4 Base point (Level)	56	Base point (Slope)		56 Measure point		96						
5												
6	ch.1 Min. ST			ch.1 Mean ST		ch.1 Max. ST		ch.2 Min. ST		ch.2 Mean ST		ch.2 Max. ST
7 Time	ST level	ST slope	ST level	ST slope	ST level	ST slope	ST level	ST slope	ST level	ST slope	ST level	ST slope
8 21:56	0	0	0	0	0	0	0	0	0	0	0	0
9 21:57	0.06	3.2	0.07	3.4	0.09	2.5	0.04	1.7	0.1	3.5	0.16	6.4
10 21:58	0.06	2.7	0.07	2.8	0.08	3.4	0.08	2.2	0.1	3.8	0.15	5.9
11 21:59	0.05	2.7	0.06	3	0.07	2.9	0.07	2.2	0.08	2.5	0.09	2.7
12 22:00	0.06	2.9	0.06	2.8	0.07	2.9	0.07	2	0.08	2.3	0.09	2.7



Memo The ch.3 data of the ST information will be output only for the 3-channel recorded data.

The data of the channel not specified for ST measurement will be also left blank.

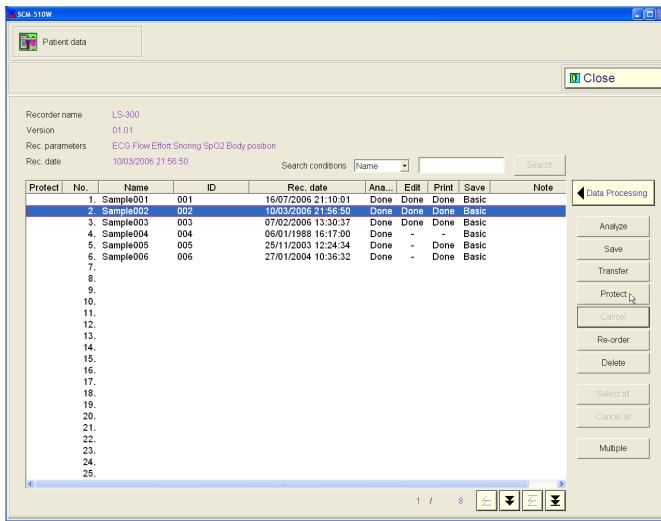
The items on the worksheet are as follows.

- [A1] File Name
- [B1] System Name, Version No.
- [C1] Date, Time of File Output
- [A2] Patient Name
- [B2] Patient ID
- [C2] Patient Age
- [D2] Patient Gender
- [E2] Recorded Day
- [A3] Number of Data, Title
- [B3] Number of Data
- [A4] Level Reference Point, Title
- [B4] Level Reference Point, Threshold
- [C4] Slope Reference Point, Title
- [D4] Slope Reference Point, Threshold
- [E4] Measurement Point, Title
- [F4] Measurement Point, Threshold
- [B6] Ch.1 Min. ST, Title
- [D6] Ch.1 Ave. ST, Title
- [F6] Ch.1 Max. ST, Title
- [J6] Ch.2 Min. ST, Title
- [L6] Ch.2 Ave. ST, Title
- [F6] Ch.2 Max. ST, Title
- [N6] Ch.3 Min. ST, Title
- [P6] Ch.3 Ave. ST, Title
- [R6] Ch.3 Max. ST, Title
- [A7] Time, Title
- [B7] ST Level, Title
- [C7] ST Slope, Title
- [D7] ST Level, Title
- [E7] ST Slope, Title
- [F7] ST Level, Title
- [G7] ST Slope, Title
- [H7] ST Level, Title
- [I7] ST Slope, Title
- [J7] ST Level, Title
- [K7] ST Slope, Title
- [L7] ST Level, Title
- [M7] ST Slope, Title
- [N7] ST Level, Title
- [O7] ST Slope, Title

[P7] ST Level, Title
[Q7] ST Slope, Title
[R7] ST Level, Title
[S7] ST Slope, Title
[B8] (Ch.1 Min. ST) ST Level
[C8] (Ch.1 Min. ST) ST Slope
[D8] (Ch.1 Ave. ST) ST Level
[E8] (Ch.1 Ave. ST) ST Slope
[F8] (Ch.1 Max. ST) ST Level
[G8] (Ch.1 Max. ST) ST Slope
[H8] (Ch.2 Min. ST) ST Level
[I8] (Ch.2 Min. ST) ST Slope
[J8] (Ch.2 Ave. ST) ST Level
[K8] (Ch.2 Ave. ST) ST Slope
[L8] (Ch.2 Max. ST) ST Level
[M8] (Ch.2 Max. ST) ST Slope
[N8] (Ch.3 Min. ST) ST Level
[O8] (Ch.3 Min. ST) ST Slope
[P8] (Ch.3 Ave. ST) ST Level
[Q8] (Ch.3 Ave. ST) ST Slope
[R8] (Ch.3 Max. ST)ST Level
[S8] (Ch.3 Max. ST) ST Slope

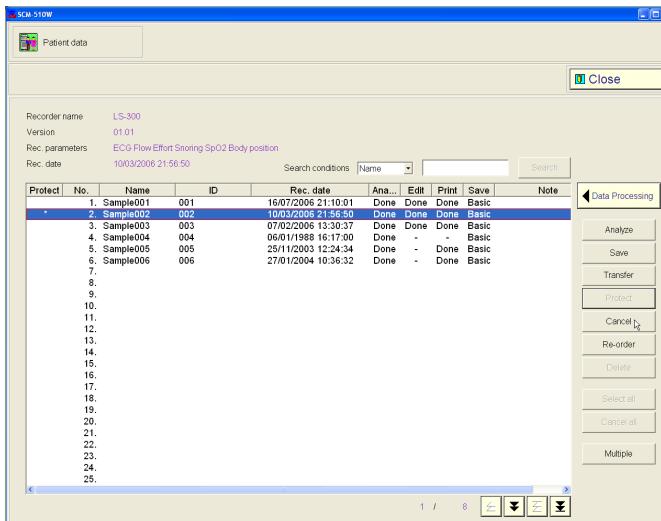
From the 9th line onward, the same data as with the 8th line will continue for the recorded duration.

Protection / Cancellation of Protection

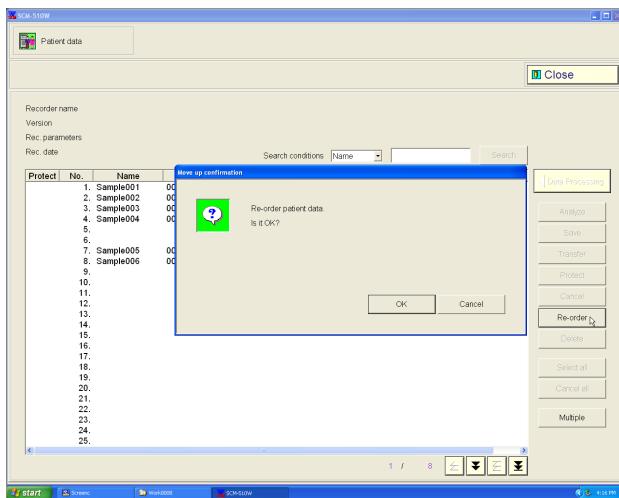


To protect the data, select a patient data from the list, and click **Protect**.

To cancel the protection, select the patient data from the list, and click **Cancel**.

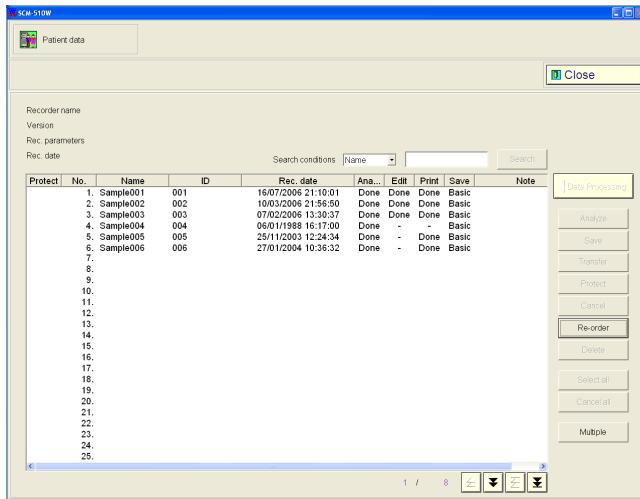


Re-order

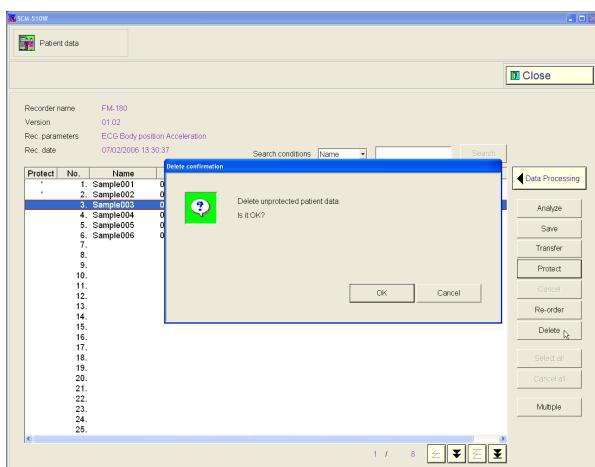


Clicking the **Re-order** button on the “Patient data” window will display a confirmation message, “Re-order patient data. Is it OK?”

- | | |
|--------|---|
| OK | : Re-orders the patients on the list. |
| Cancel | : Returns to the “Patient data” window. |

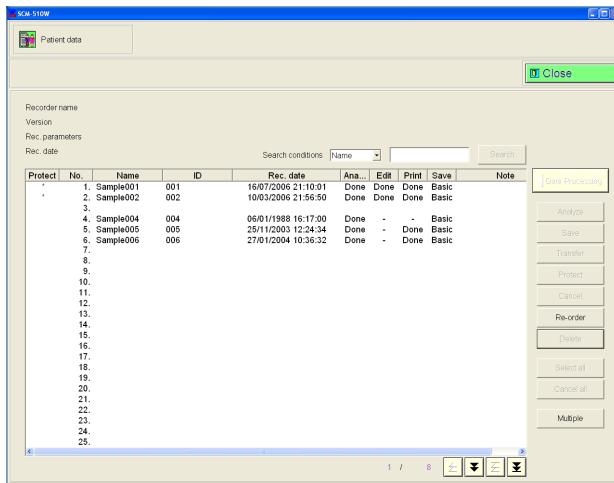


Delete

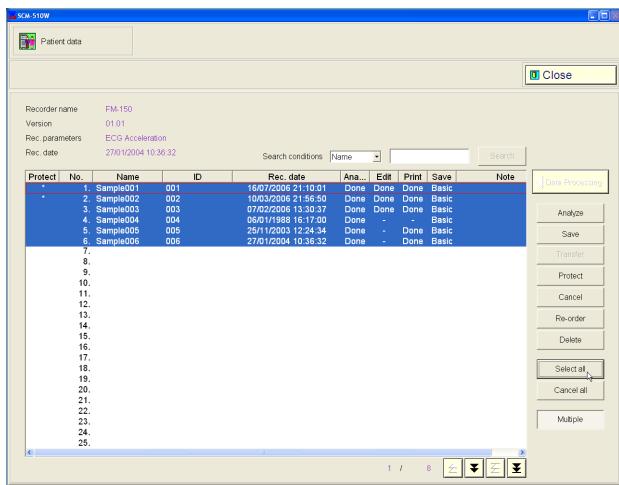


To delete data, select a patient data from the patient list, and click the **Delete** button. A confirmation message, “Delete unprotected patient data. Is it OK?” will be displayed. The patient data can be selected by clicking on the data in the list. More than one patient can be selected. By using the “Shift” key, the selection by range is also possible.

- OK** : Deletes the selected patient data which is not protected.
Cancel : Returns to the “Patient data” window.



Select All / Cancel All

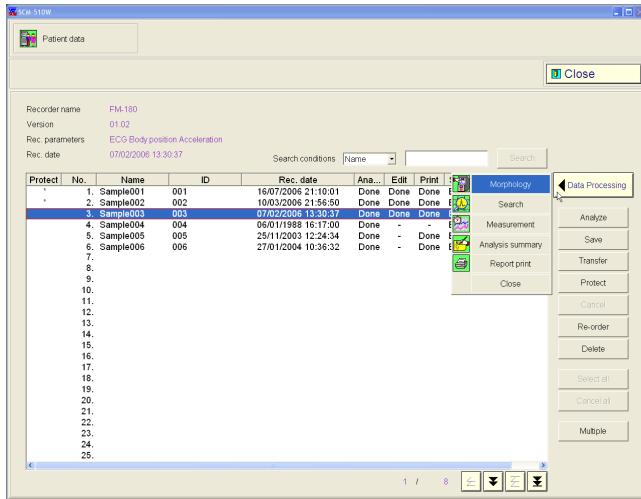


Clicking the **Multiple** button on the “Patient data” window will activate the **Select all** and **Cancel all** buttons.

Clicking the **Select all** button will select all the patient data on the list.
To cancel the selection, click **Cancel all**.

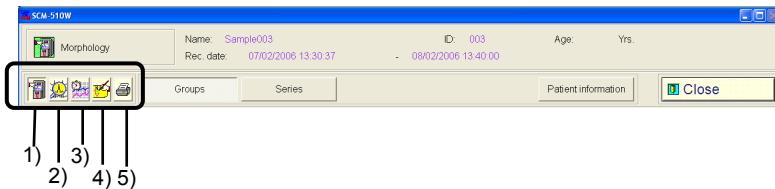
6. 3 Data Processing

Five types of data processing, “Morphology”, “Search”, “Measurement”, “Analysis summary” and “Report print” can be performed on the “Patient data” window.



Select a patient data from the patient data list, and click the [Data Processing] button.
Select the process from the displayed pop-up window.

Memo The pop-up menu can be also displayed by right-clicking on the list.



When the entire process menu is displayed, clicking one of the icons displayed on the upper left will display its process menu.

1) Morphology

Performs the morphology analysis on the patient data.

2) Search

Searches for a patient data.

3) Measurement

Measures the patient data.

4) Analysis Summary

Displays the analysis summary of the patient data.

5) Report print

Prints the patient data.

Click [Patient information] during data processing to open the patient information window.

6. 4 Morphology

On the SCM-510W, the R wave heartbeats will be classified by QRS morphology and numbered. For example, a heartbeat judged as “V (Ventricular Premature Contraction)” will be classified by QRS morphology and numbered as V1, V2, and V3.

There are two methods to examine the morphology waveforms. One method is to examine the reference waveform for each morphology group, and the other is to examine the waveforms within the same morphology group. When examining the morphology waveforms, misjudgment of the heartbeat or incorrect morphology classification can be corrected. Unlike the edit process on the search menu, this method allows to edit all beats within the same morphology group all at once.

●Group (Reference Waveform for Each Morphology Group)

Displays the first generated waveform of each morphology group.

●Series (Waveforms within the Same Morphology Group)

Displays the waveforms within the same morphology group.

Morphology Classification

The morphology can be classified into eight types. These can be classified automatically or created or classified by the editing process.

●Automatically Classified

- N Normal Beat
- V Ventricular Premature Contraction
- S Supraventricular Premature Contraction
- ? Other Beat
- P Pacemaker Beat
- F Fusion Beat

●Created or Classified by Editing Process

- X User-defined heartbeat
- A Artifact

“? (Other Beat)” refers to heartbeats other than “N (Normal Beat)”, “V (Ventricular Premature Contraction)” and “S (Supraventricular Premature Contraction)”.

“X (User-defined heartbeat)” allows the user to define the morphology. For procedure, refer to “3.5 Table Settings.”

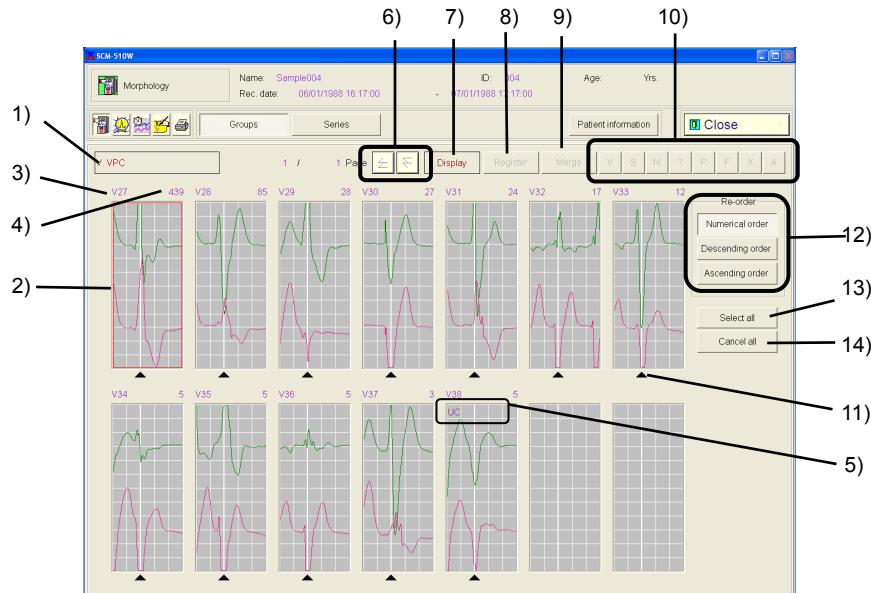
“A (Artifact)” is used when a noise is detected and prevents this morphology to be treated as heartbeat.

The heartbeats will be classified to “P (Pacemaker beat)” or “F (Fusion beat)” only if a check mark is inserted for pacemaker information. For procedure to set the pacemaker information, refer to “Chapter 5 Reading Card.”

Morphology Groups

Clicking the **Morphology** button on the data processing window will display the “Groups” window with the morphology list.

On the “Groups” window, batch change, merge, change R wave position, and register can be performed.



1) Morphology Type Selection Box

Select the morphology type.

2) Morphology Waveform Area

Displays the reference waveform of each morphology. These are the first waveform generated for each morphology (14 types) and are displayed for a total of 1 second (400msec before the R wave, 600msec after the R wave).

3) Morphology Group No.

4) Total Heartbeat within the Morphology Group

5) Information

The following information will be displayed.

Edit : Indicates that the morphology is edited.

Reg : Indicates that the morphology is registered.

Learn : Indicates that the heartbeat is in process of learning.

UC : Indicates that the morphology is unclassified as the maximum number of morphology types has already been registered.

6) Page Switch Arrow

Switches the page to the previous or next page.

7) **Display** Button

Changes the waveform gain and polarity.

8) **Register** Button

Registers the morphology.

9) **Merge** Button

Merges the waveforms.

10) Morphology Type Button

Changes the morphology type all at once.

11) ▲ Mark

Move the R wave position by dragging this mark.

12) Re-order Buttons

Reorders the morphology.

13) **Select all** Button

Selects all the reference waveforms for each morphology group.

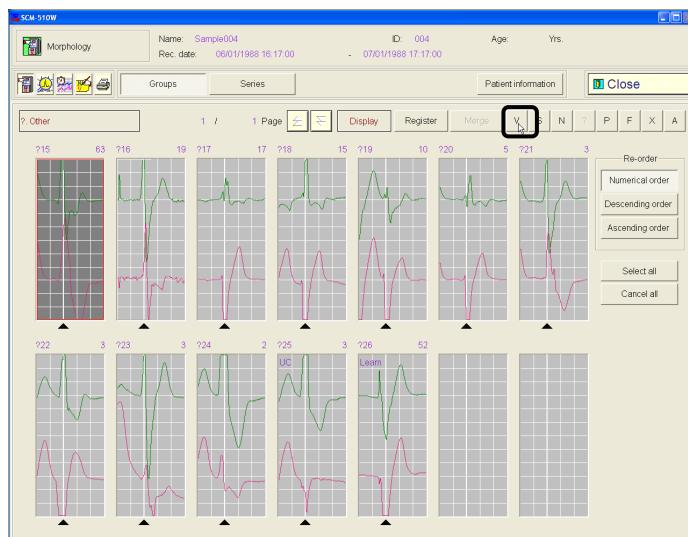
14) **Cancel all** Button

Cancels the selection of all the reference waveforms for each morphology group.

■Batch Change

All the heartbeats within the same morphology group can be changed to other morphology group all at once.

For example, if “?15” is changed to “V”, all the heartbeats included in “?15” will become “V15”.



Select the waveform (or waveforms) of which you wish to change the morphology type using the mouse, and click the morphology type button. A progress window will be displayed.

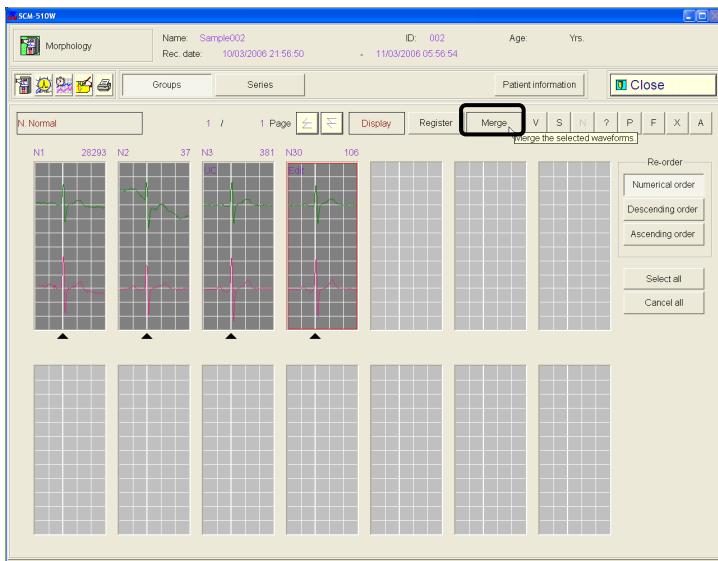
The waveforms can be selected by range using the “Shift” key.

The morphology type button for the waveform(s) to be changed will be masked.

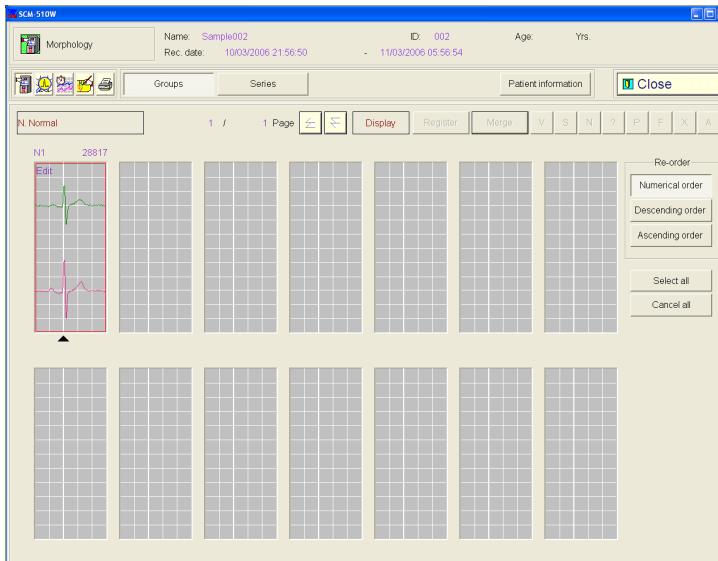
■ Merge

The waveforms with similar shapes can be merged into one morphology group.

For example, if the waveform shapes of the N1, N2, and N3 are very similar, performing a merge process on N1, N2, and N3 will reclassify N1 and N2 to the morphology group of N3.

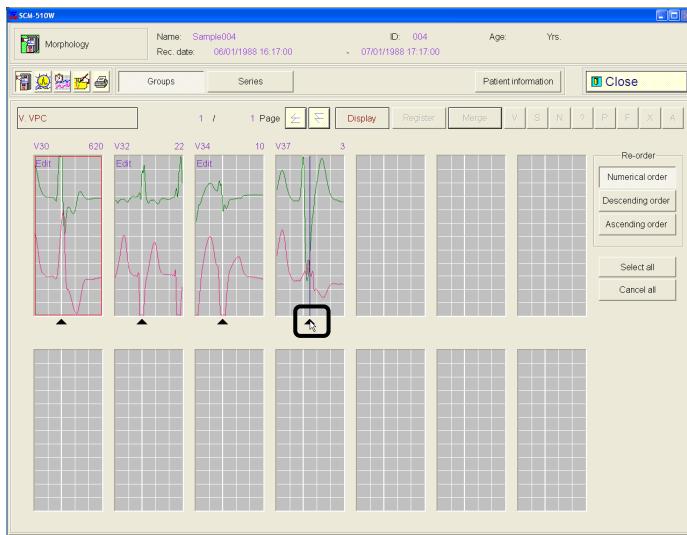


Select the waveform using the mouse, and click the **Merge** button on the “Groups” window to start the merge process. A progress window will be displayed. Using the “Shift” key allows to select the waveforms by range. The waveforms will be merged to the waveform selected last.



■Change R Wave Position

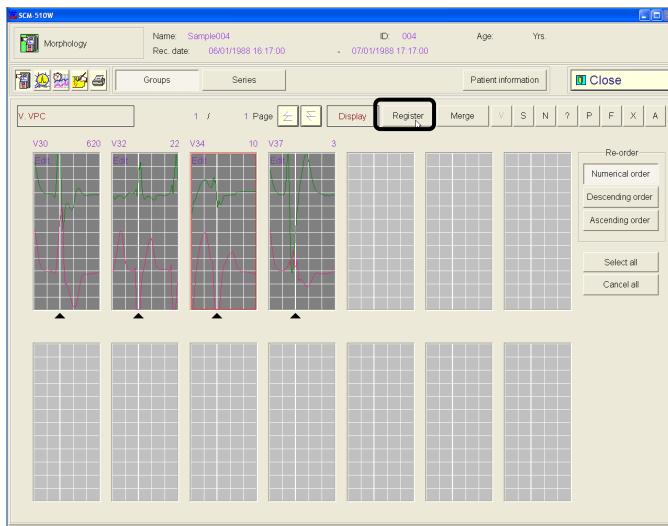
The R wave position of the heartbeat within the morphology group can be changed.



Drag the ▲ mark under the morphology waveform area to move the R wave position.
The R wave position for all the heartbeats within the same morphology group will be changed.

■Register

During the morphology process, the necessary morphology group can be registered.



Select a waveform using the mouse, and click **Register** on the “Groups” window to register the waveform.

To cancel the registration, select the waveform and click **Cancel**.

If the registered waveform and unregistered waveform are selected at the same time, the only button available will be **Register**.

Morphology Series

Clicking the **[Series]** button during the morphology process will display the waveforms within the same morphology group.

24 waveforms of 1 sec (25.0 mm/sec mode) duration will be displayed.

Clicking the **[Zoom]** button will enlarge the waveform display. The enlarged waveform will be displayed for 10-sec (25.0mm/sec mode) or 5-sec (50.0mm/sec mode).

Waveform List



1) Morphology Number

2) Morphology Group Selection Button

Select the morphology group to display.

3) Page Switch Arrow

Switches the page to the previous or next page.

4) [Display] Button

Changes the waveform gain and polarity.

5) [List] Button

Lists the waveform display.

6) [Zoom] Button

Displays the waveform in enlarged format.

7) Morphology Type Button

Changes the morphology type of the selected waveform.

8) ▲ Mark

Move the R wave position by dragging this mark.

9) [Select all]

Selects all the waveforms within the morphology group.

10) [Cancel all]

Cancels the selection of all the waveforms within the morphology group.

Zoom Waveform



1) Morphology Number

2) Morphology Group Selection Button

Select the morphology group to display.

3) Beat Switch Arrow

Switches the beat to the previous or next beat.

4) **Display**

Changes the waveform gain and polarity.

5) **List**

Displays the waveform list.

6) **Zoom**

Displays the zoom waveform.

7) Morphology Type Button

Changes the morphology type of the selected waveform.

8) ▲ Mark

Move the R wave position by dragging this mark. .

9) Histogram

Displays the histogram for the displayed morphology.

10) Display format

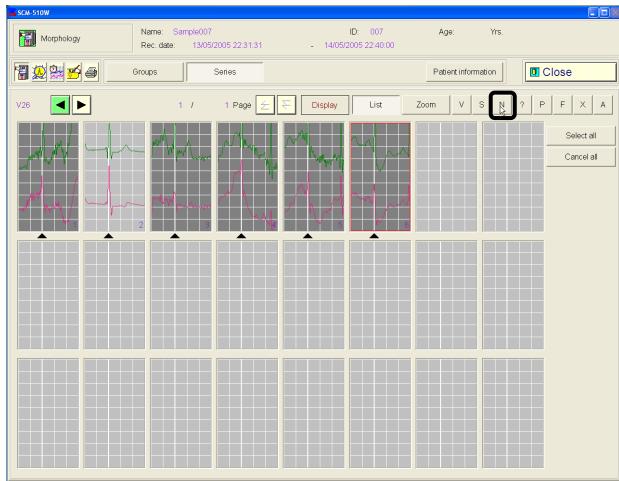
The waveform display format (paper speed) is displayed.

25.0mm/s and 50mm/s can be selected by clicking the display format area.

■ Changing the Morphology Type

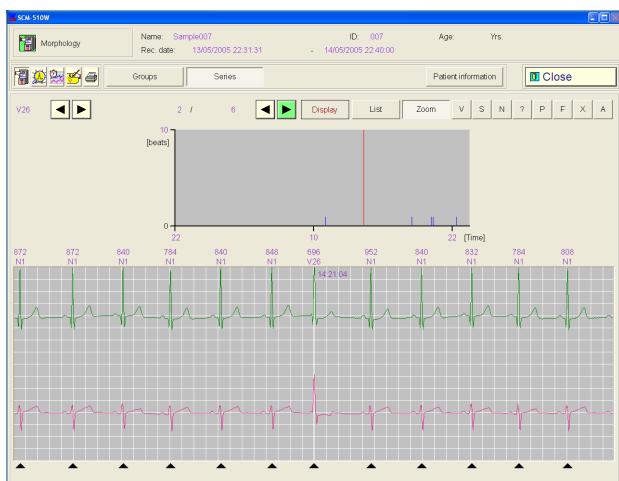
Part of the heartbeats can be changed to other morphology type.

■ Waveform List



Select the waveform (or waveforms) of which you wish to change the morphology type using the mouse, and click the morphology type button. A progress window will be displayed.
Using the “Shift” key allows to select multiple waveforms.

■ Full-Scale Waveform

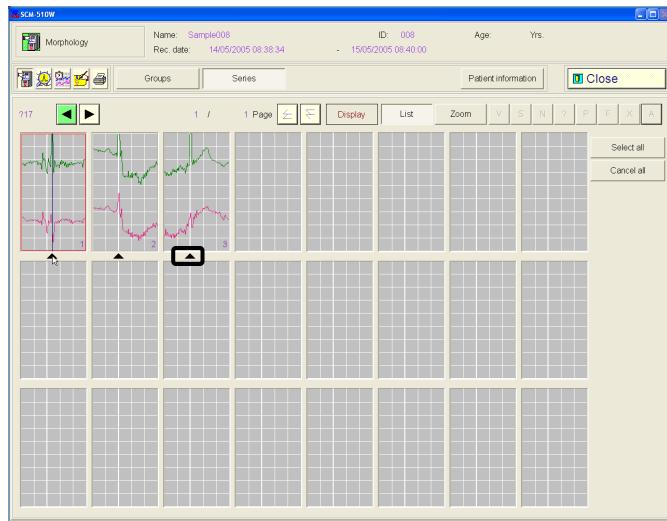


Select the waveform (or waveforms) of which you wish to change the morphology type from the histogram, and click the morphology type button. A progress window will be displayed.

■ Changing the R Wave Position

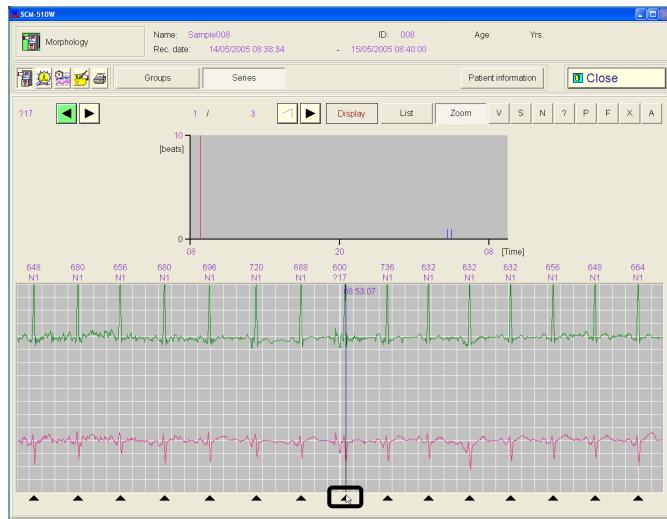
The R wave position of the heartbeat within the morphology group can be changed.

● Waveform List



Drag the ▲ mark on the “List” window to move the R wave position.

● Full-Scale Waveform

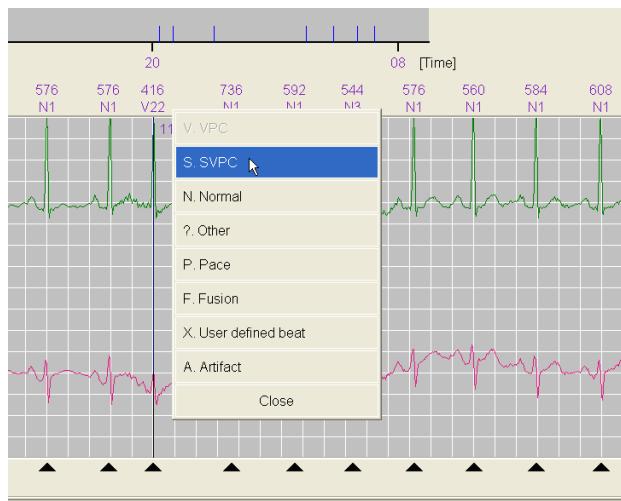


Drag the ▲ mark on the full-scale waveform window to move the R wave position.

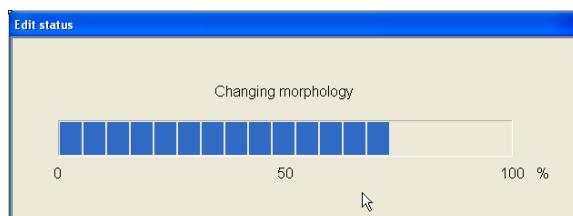
■Edit Beat Judgment Code

On the full-scale waveform window, the beat judgment code of 5 seconds before and after the morphology waveform can be edited. When you find an erroneous beat judgment on the zoom waveform, you can revise it with each heartbeat.

- 1) Click the beat judgment code to display the pop-up window.



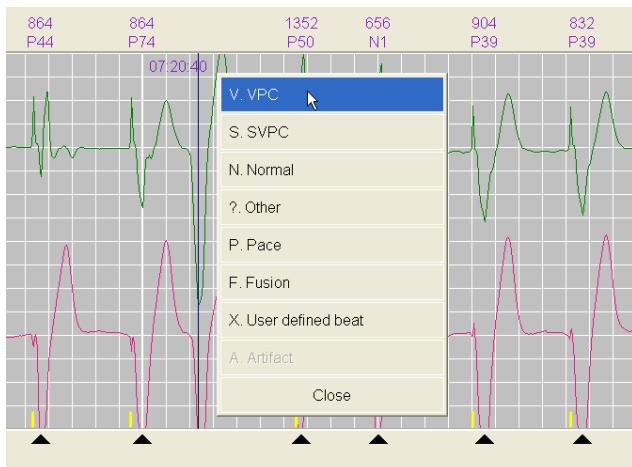
- 2) Selecting one of the beat judgment code will display the progress window and starts the editing process.



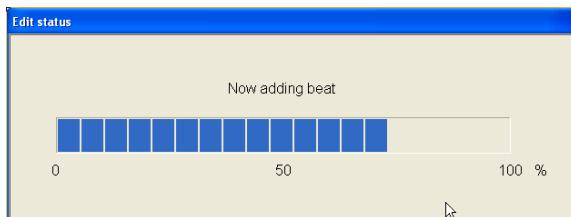
■Add Beat

On the full-scale waveform window, heartbeats can be added to the waveform of 5 seconds before and after the morphology waveform. When you find a heartbeat, which is not acknowledged as an heartbeat on the full-scale waveform window, you can add R wave position and beat judgment code to the waveform.

- 1) Click on the waveform where you wish to add a heartbeat. R wave position cursor and pop-up window of beat judgment code selection will be displayed.



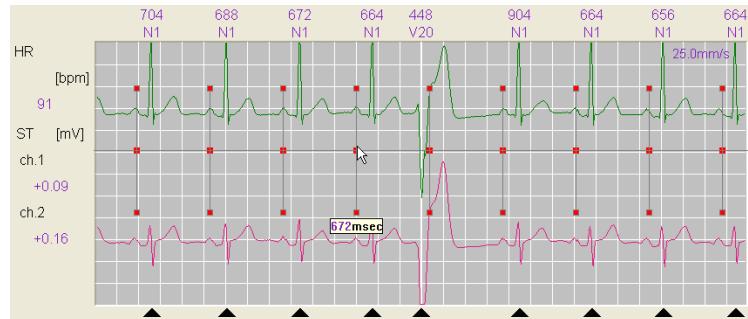
- 2) Selecting one of the beat judgment code will display the progress window and start the adding process.



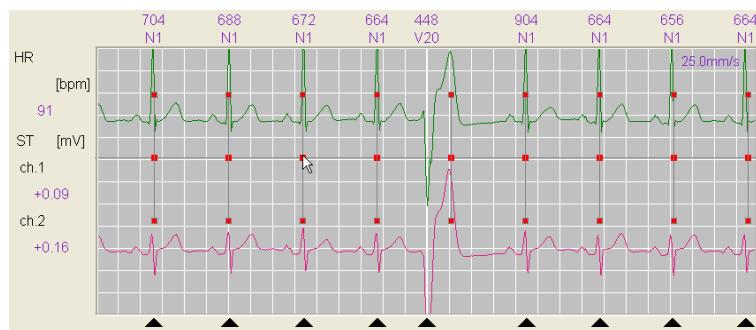
■ Divider

On the zoom waveform window, a divider can be displayed.

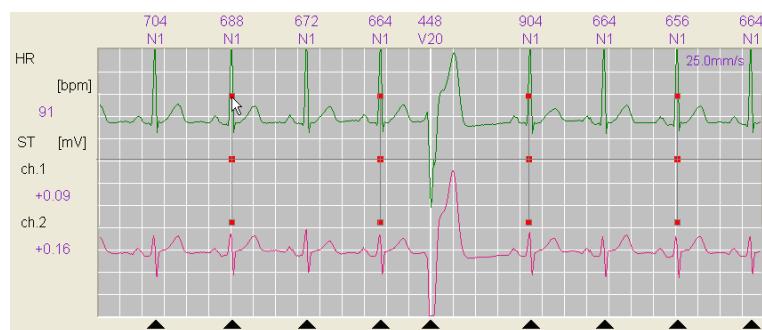
- 1) On the zoom waveform display area, right-click and drag the mouse to set the divider width. Releasing the right button will display the divider.



- 2) The divider can be dragged by right-clicking on the displayed red dot.



- 3) The display width of the divider can be changed by dragging the red dot.



- 4) Pressing the [ESC] key or scrolling the waveform will erase the divider.



■Information Window

On the zoom waveform window, detailed information for each beat can be displayed.

- 1) Right-clicking on the ▲ mark will display a detailed information window for that beat. The information window will disappear when you release the right button.



Memo The body position will be displayed only if the information is recorded with a holter recorder.

6. 5 Search

On the “Search” window, specific waveform can be searched from the read / analyzed data. If erroneous judgment on the heartbeat or on the R wave position is found during the search process, it can be corrected by using the editing procedure. The edit procedure can be performed on the specified segment or on each beat.

Search Method Types

There are four main types of search method.

●Event Search

Searches specific waveform by arrhythmia event type. This method can be used to examine the generated arrhythmia type and waveform and the waveforms before and after the arrhythmia. For details, refer to “6-23 Event Search.”

●Trend Search

Searches specific waveform by HR and ST trend. This method can be used to examine the waveform where HR or ST level change is irregular. For details, refer to “6-28 Trend Search.”

●RR Search

Searches specific waveform by RR interval. This method can be used to examine the waveform with short or long RR interval. For details, refer to “6-31 RR Search.”

●Registered Wave Search

Searches specific waveform by registered waveform. This method can be used to examine the registered waveform. For details, refer to “6-34 Registered Wave Search.”

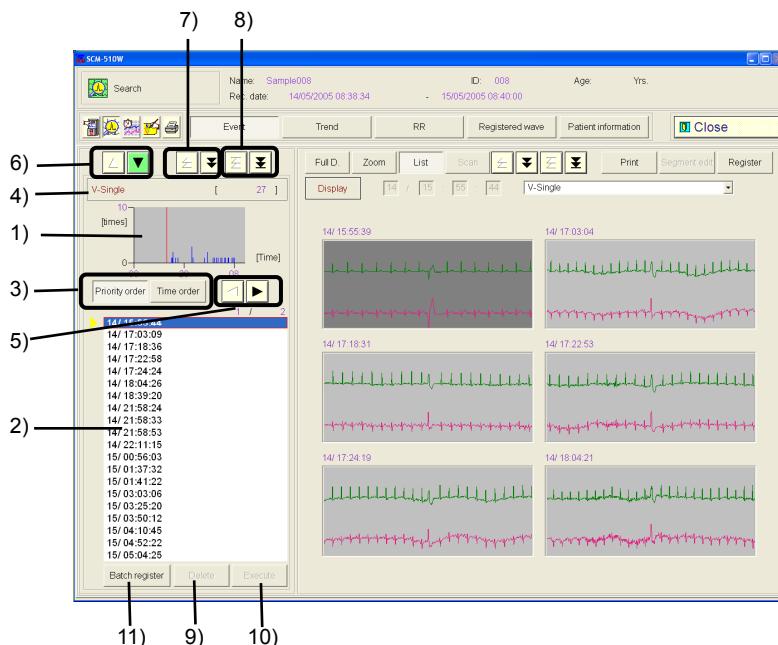
Main Search Window

The analysis result of the patient will be graphically displayed on the “Main Search” window.



Event Search

The event search procedure searches the waveform for event occurrence and the waveform before and after the event occurrence from the arrhythmia event list. On the waveform list window, the waveform can be easily verified during the search procedure. In addition, the “Pause” event can be deleted. To search for event, click the **Event** button.



1) Histogram

Displays the histogram (in priority order or time order).

2) Event List

Displays the list of the time of event occurrence.

3) Priority order / Time order

Select the order of data display for the histogram and list display.

4) Event Selection Button

Select the displaying event.

5) ▶ / ▷ Button

Moves the histogram display to the right or left.

6) ▲ / ▼ Button

Moves the selection on the list up or down.

7) Page Switch Arrow

Switches the page to the previous or next page.

8) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the list.

9) Delete

Enables the delete process when the pause event is displayed.

10) Execute

Deletes the selected event when the delete process is enabled.

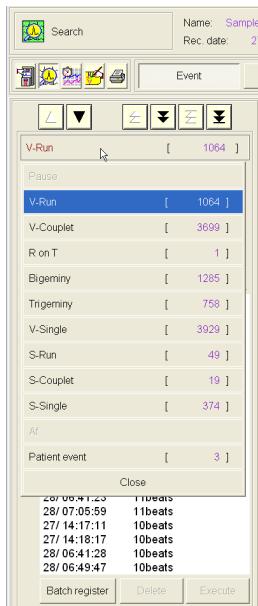
11) Batch Register

Registers multiple events all at once. Four events can be registered according to the event priority order.

The following 12 types of event used on the SCM-510W are.

- Pause : The heartbeat with RR interval equal to or more than the threshold level of pause.
- V-Run : VPC continuing for three beats or more.
- V-Couplet : VPC continuing for two beats or more.
- R on T : The combination of non-VPC and VPC, with RR interval of VPC equal to or less than "R on T" threshold.
- Bigeminy : VPC and non-VPC alternately continuing for five beats or more.
- Trigeminy : The combination of VPC and two beats of non-VPC continuing for seven beats or more.
- V-Single : VPC which does not apply to other VPC events (V-Run, V-Couplet, R on T, Bigeminy, Trigeminy).
- S-Run : Supraventricular premature contraction continuing for three beats or more.
- S-Couplet : Supraventricular premature contraction continuing for two beats or more.
- S-Single : Supraventricular premature contraction which does not apply to other supraventricular premature contraction events (S-Run, S-Couplet).
- AF : The range where AF is added by the "Edit" procedure.
- Patient E : The time when the "Event" switch on the recorder is pressed.

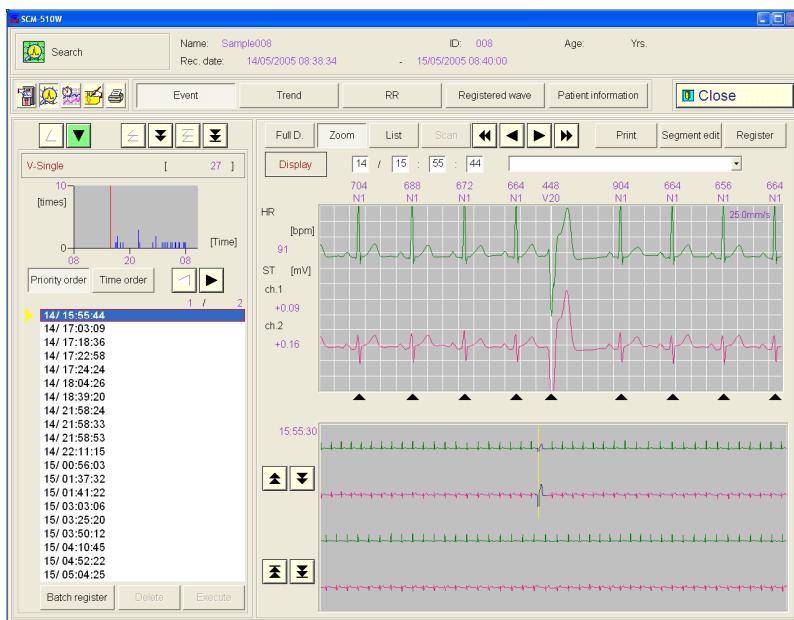
■Event Selection



The searching event can be selected from the event selection drop-down box.

Selecting one of the events from this drop-down box will display the list of event occurrence time for the selected event.

■Waveform Display for Event Search



Click the event occurrence time on the event list. The list cursor will move to the selected event. At the same time, the waveform for the selected event will be displayed on the waveform window.

Full disclosure

: The waveform starting from the selected event occurrence time will be displayed. The cursor will move to the event occurrence time, and the background color during the event occurrence will be highlighted.

Waveform List

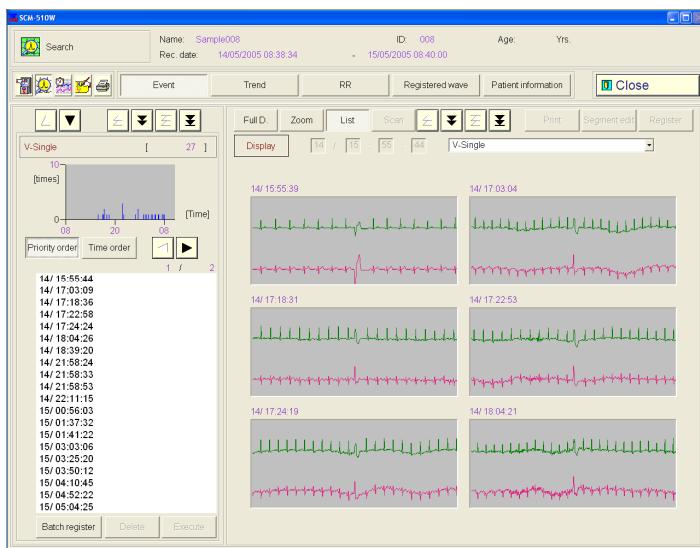
: Six waveforms can be displayed at the same time. The background color of the selected waveform will change to a different color from other waveforms.

Zoom

: The enlarged waveform of 3 seconds (25.0mm/s), 1.5 seconds (50.0mm/s) before and after the selected event will be displayed.

Use the buttons to sequentially display the waveforms of the next or previous event. The cursor on the list will also move to the corresponding event.

■Waveform List for Event Search



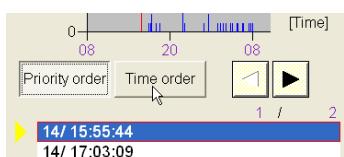
The waveform list window allows you to verify six event waveforms all at once. If there are more than six waveforms, click the page switch arrow to display the next page.

■Priority Order and Time Order

The event list can be displayed in the order of time or priority, which can be selected as necessary. If **Time Order** is selected, the events will be listed in the order of event occurrence time. If **Priority Order** is selected, the events will be listed in the order of event priority. The priority of the events is as follows.

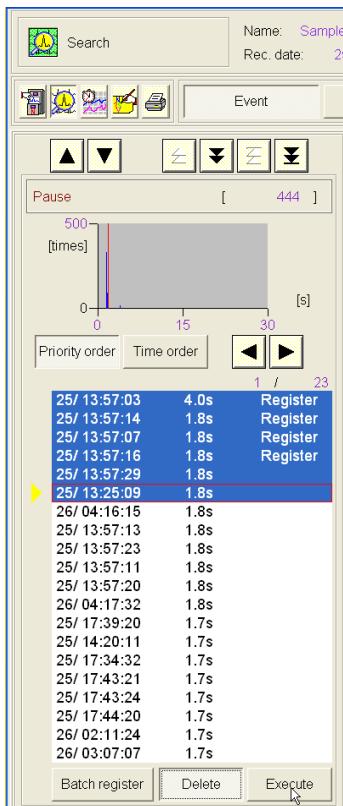
- Pause : In the order starting from the longer RR interval
- V-Run : In the order starting from the larger number of “Run”.
- R on T : In the order starting from the shorter RR interval
- Bigeminy : In the order starting from the larger number of heartbeats
- Trigeminy : In the order starting from the larger number of heartbeats
- S-Run : In the order starting from the larger number of “Run”
- S-Single : In the order starting from the shorter RR interval
- AF : In the order starting from longer duration

To change the order of the event list, click the **Time Order** or **Priority Order** button shown below the histogram.



■ Deleting “Pause” Event

When ECG data with low amplitude or noise is analyzed, R-wave will be judged as noise, and “Pause” events may be generated. In such case, these “Pause” events can be deleted during the search process.



● Procedure to delete “Pause” Event

Select “Pause” from the event selection drop-down box.

Click the **Delete** button to enable the delete operation.

Select the “Pause” event(s) you wish to delete from the event list.

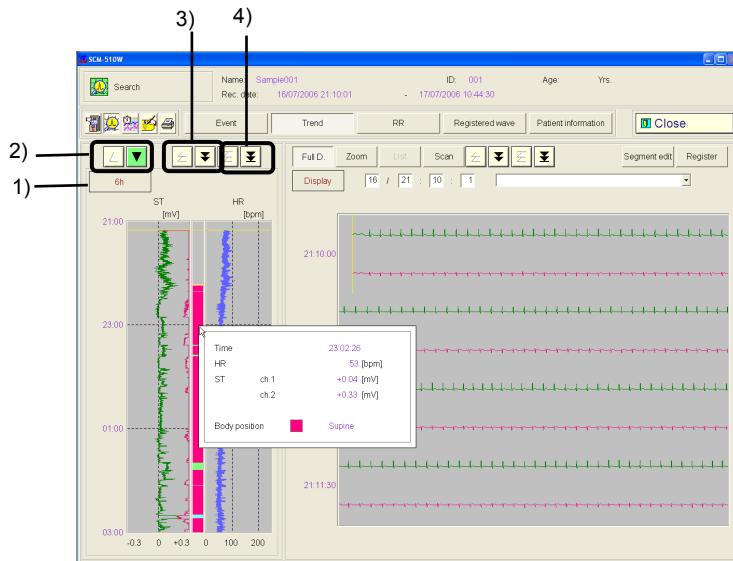
Use the “Shift” key to select more than one event.

After the selection, click the **Execute** button. The selected event(s) will be deleted.

The new event list with the event(s) deleted will be displayed.

Trend Search

The trend search process allows you to examine the waveform where HR trend and ST trend largely changes. To search the trend, click the **Trend** button.



1) Time Range Selection

Select the displaying time range.

2) ▲ ▼ Button

Moves the cursor up or down in 6 seconds intervals.

3) Page Switch Arrow

Switches the page to the previous or next page.

4) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the list.

5) Information Window

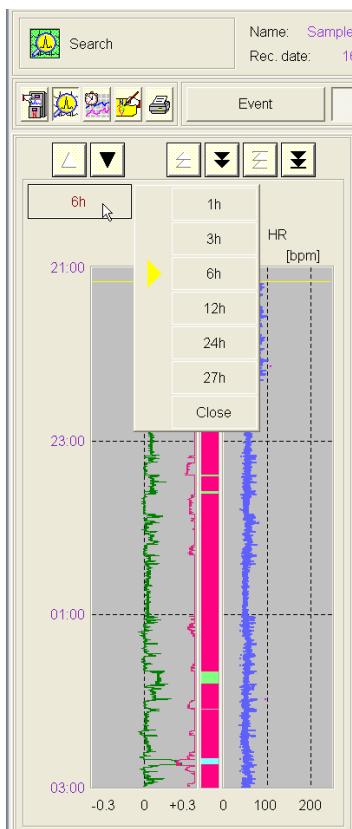
By right-clicking on the trend display, displays detailed information of that time.



Memo The body position trend will be displayed only if the information is recorded for that patient.

■Time Range of Trend Display

The displaying time range for the trend display can be changed.

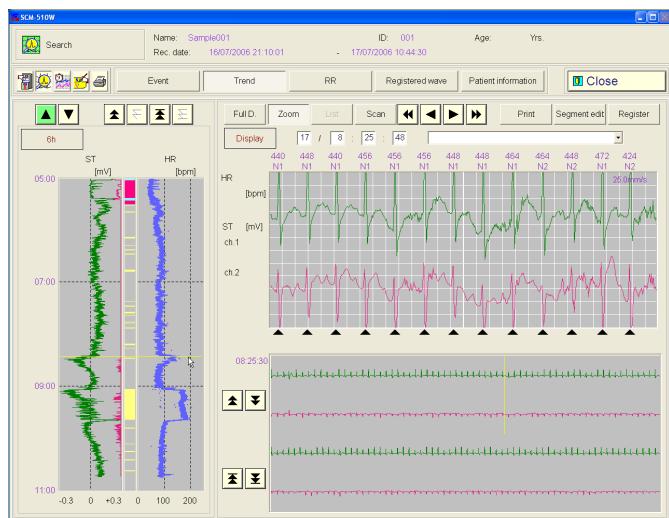


The time range for the trend display can be selected from the “Time range” list box.
The selections are as follows.

- 1 h
- 3 h
- 6 h
- 12 h
- 24 h
- 27 h

To maximize the waveform display, select “1 hour” for the displaying time range.

■Waveform Display for Trend Search



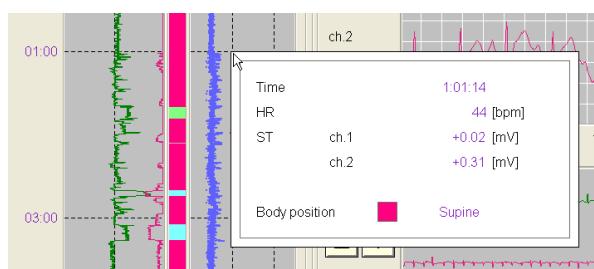
Click the area on the HR and ST trends where you wish to display the waveform. The trend cursor will move to the selected position, and the waveform for the selected position will be displayed in the waveform window.

The trend cursor time will indicate the same time with the cursor on the full disclosure waveform. The displayed waveforms are as follows.

- | | |
|-----------------|--|
| Full disclosure | : The waveform starting from the selected time on the trend will be displayed. The cursor will be displayed to indicate the selected time. |
| Zoom | : The enlarged waveform of 3 seconds (25.0mm/s), 1.5 seconds (50.0mm/s) before and after the selected time on the trend will be displayed. |
| Scan | : Starting from the selected time on the trend, the waveform overlapped for five beats each will be displayed. |

■Information Window Display

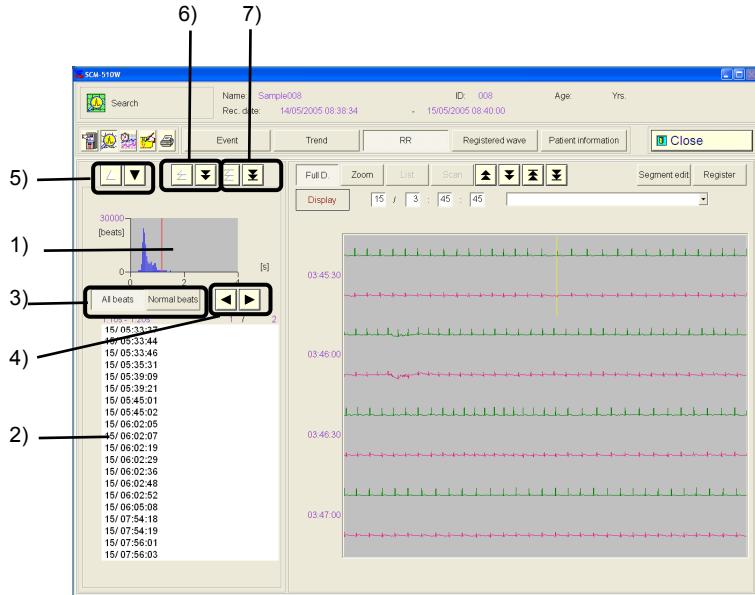
By right-clicking the mouse on the trend display, detailed information for that time will be displayed. Also, by dragging the mouse while the information window is displayed will renew the data on the information window to the data at the cursor position.



Memo The body position will be displayed only if the information is recorded with a holter recorder.

RR Search

The RR search method searches the waveform for short or long RR interval from the RR histogram of 40 msec intervals and RR interval list. To search the RR interval, click the **RR** button.



1) RR Histogram

Displays the RR histogram of 40 msec intervals.

2) RR List

Displays the list of the selected RR interval time on the histogram.

3) **All beats** / **Normal beats**

Select the beats to be counted for RR search from all beats or normal beats.

4) **◀ ▶** Button

Moves the histogram display to the right or left.

5) **▲ ▼** Button

Moves the selection on the list up or down.

6) Page Switch Arrow

Switches the page to the previous or next page.

7) Jump to Top/Bottom Arrow

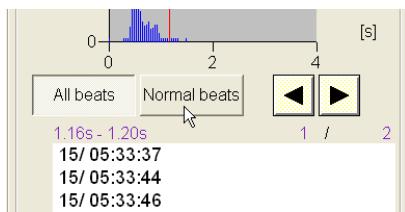
Jumps to the top or bottom of the list.

■All Beats / Normal Beats

The beats to be used for RR search process can be selected from **All beats** and **Normal beats**.

All beats : 40 msec RR interval for all beats will be used for RR search process.

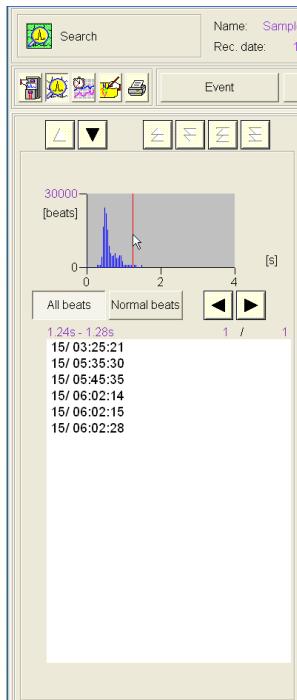
Normal beats : 40 msec RR interval for the beats other than VPC beat and the beat next to it will be used for RR search process.



Click **All beats** or **Normal beats**. The histogram and RR interval list for each case will be displayed.

■Searching on the Histogram

To search the RR, first select the RR interval from the RR histogram.

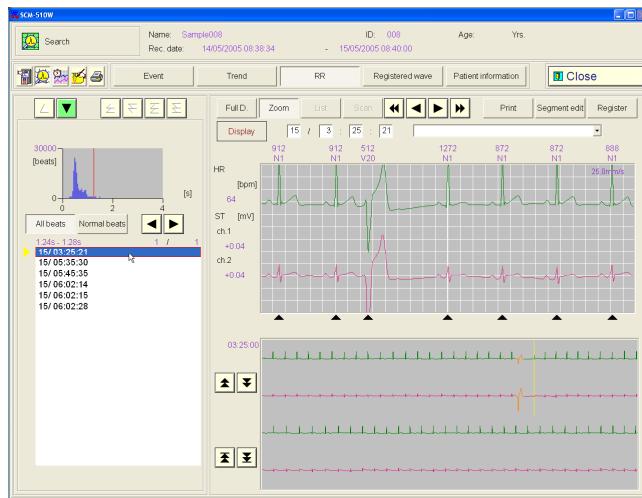


Click the RR interval on the RR histogram.

The cursor will move to the clicked position, and the time of the selected heartbeat will be displayed in the RR list.

Use the **◀** **▶** buttons to shift the cursor position to the left and right. The position where there is no data will be skipped.

■Waveform Display for RR Search



Click the RR interval time data on the list. The list cursor will move to the clicked data. At the same time, the waveform for the selected data will be displayed on the waveform window.

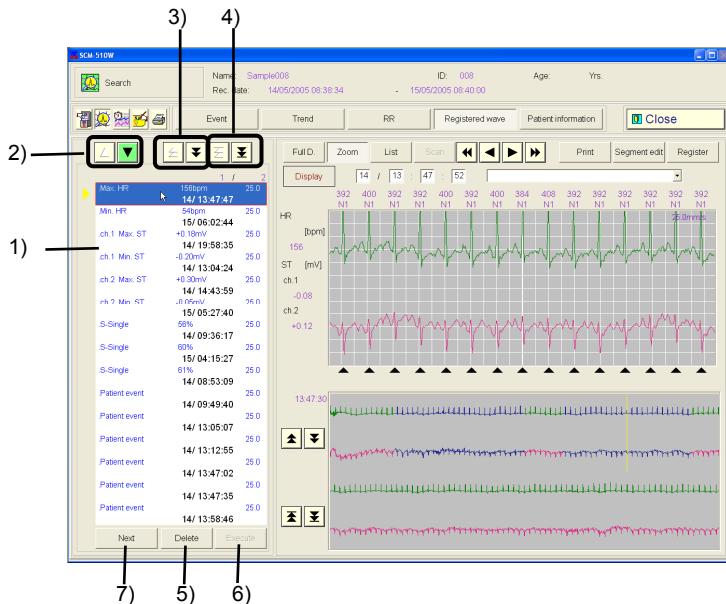
- | | |
|-----------------|--|
| Full Disclosure | : The waveform starting from the selected time will be displayed.
The cursor will be displayed to indicate the selected time. |
| Zoom | : The enlarged waveform of 3 seconds (25.0mm/s), 1.5 seconds (50.0mm/s) before and after the selected time will be displayed. |

Use the **▲** **▼** buttons to sequentially display the waveforms of the previous or next data time. The cursor on the list will also move to the corresponding data.

Registered Waveform Search

This search method searches the registered waveform. The registered waveform searched can be deleted, or comment can be added or corrected for the registered waveform.

To search the registered waveform, click the **Registered wave** button.



1) Registered Waveform List

Displays the list of registered waveform.

2) ▲ ▼ Button

Moves the selection on the list up or down.

3) Page Switch Arrow

Switches the page to the previous or next page.

4) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the list.

5) Delete

Enables the delete operation.

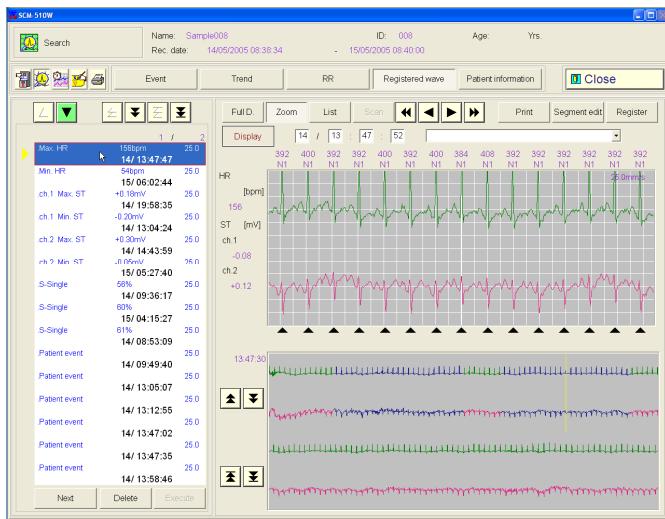
6) Execute

Deletes the selected waveform on the list when the delete operation is enabled.

7) Next

Registers the next choice of maximum/minimum HR and ST for analysis.

■Waveform Display for Registered Waveform Search



Click the registered waveform time data on the list. The list cursor will move to the clicked data. At the same time, the waveform for the selected data will be displayed on the waveform window.

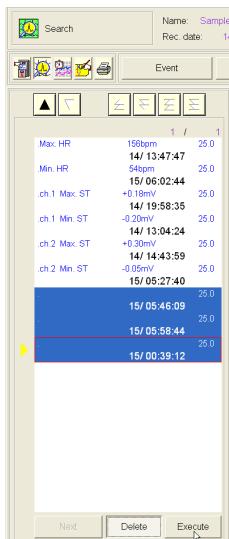
- | | |
|-----------------|--|
| Full Disclosure | : The waveform starting from the selected time will be displayed.
The cursor will be displayed to indicate the selected time. |
| List | : Six waveforms will be displayed at the same time. |
| Zoom | : The enlarged waveform of 3 seconds (25.0mm/s), 1.5 seconds (50.0mm/s) before and after the selected time will be displayed. |

Use the buttons to sequentially display the waveforms of the previous or next data time.

The cursor on the list will also move to the corresponding data.

■Delete Registered Waveform

During the search process, registered waveform can be deleted.



●Procedure to delete Registered Waveform

Click the **Delete** button to enable the delete operation.

Select the registered waveform you wish to delete from the list.

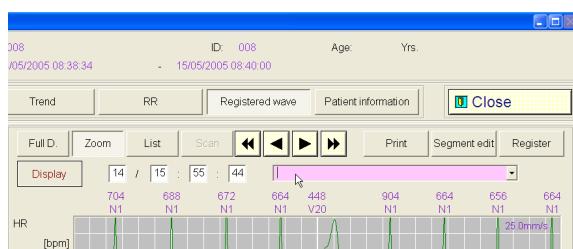
Use the “Shift” key to select more than one event.

After the selection, click on the **Execute** button. The selected registered waveform will be deleted.

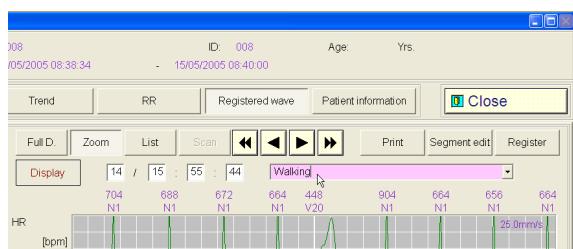
The new event list with the event deleted will be displayed.

■Input Comment

Comment for the registered waveform can be revised or can be entered.



Click the comment box displayed above the waveform.

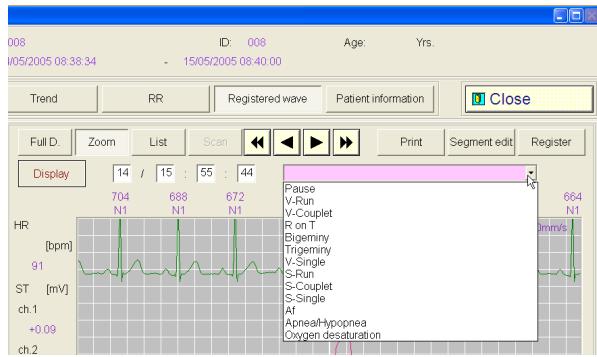


Enter or revise the comment inside the box.

Maximum of 32 characters can be entered for the comment.

Preset character strings can be also selected from the master table.

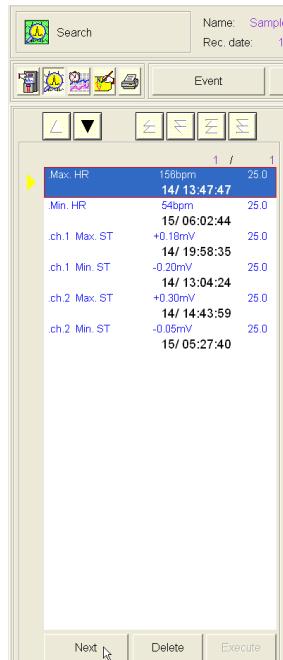
For procedure on how to preset the comment character strings, refer to “3.5 Table Setting.”



To select from the preset character strings, click the ▼ button shown on the right of the comment box.

■Registering the Next Choice

The next registering choice of maximum/minimum heart rate and ST for analysis can be selected.



Select the time data from the registered waveform list, and click on the **Next** button. The data will be registered as next registering choice.

The waveforms that can be registered as next choice are as follows.

- Maximum Heart Rate
- Minimum Heart Rate
- Maximum ST for each channel
- Minimum ST for each channel

Waveform Display

On the “Search” window, compressed waveform, zoom waveform, and waveform list can be displayed.

Full Disclosure (Full D.)

Displays the waveform in 30 s/line or 60 s/line.

Full-Scale Waveform

Displays 6 seconds (25.0mm/s format) or 3 seconds (50.0mm/s format) of waveform.

Waveform List

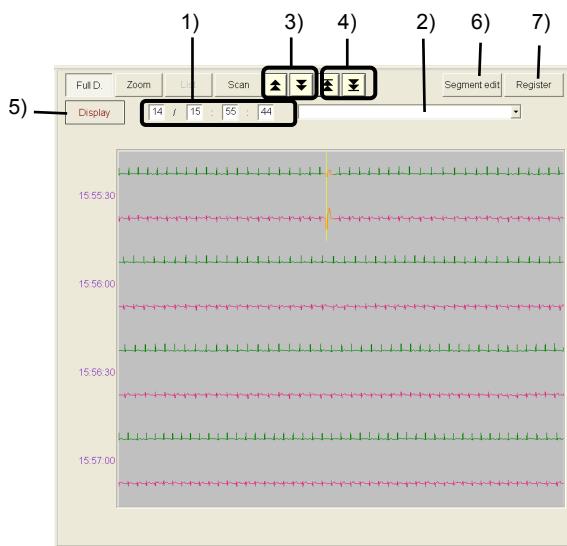
Displays 6 waveforms at event search and registered waveform search.

Scan

Displays the waveform with R wave position fixed and overlapped for five beats each. When the reading process is started, the waveform will be displayed one beat each. This can be displayed during the trend search process.

■Full Disclosure

Clicking the **Full D.** button on the “Search” window will display 2 minutes of full disclosure waveform in 30 sec/line. The display can be also switched to one channel display with 1 min/line, which displays the compressed waveform of maximum 30 minutes.



1) Time

Displays the waveform for the time entered.

2) Comment

Displays the event type or comment for the selected event during the event search or registered wave search process.

3) Page Switch Arrow

Switches the page to the previous or next page.

4) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the full disclosure waveform.

5) **Display**

Changes the waveform size, polarity, display channel, and display format.

6) Segment edit

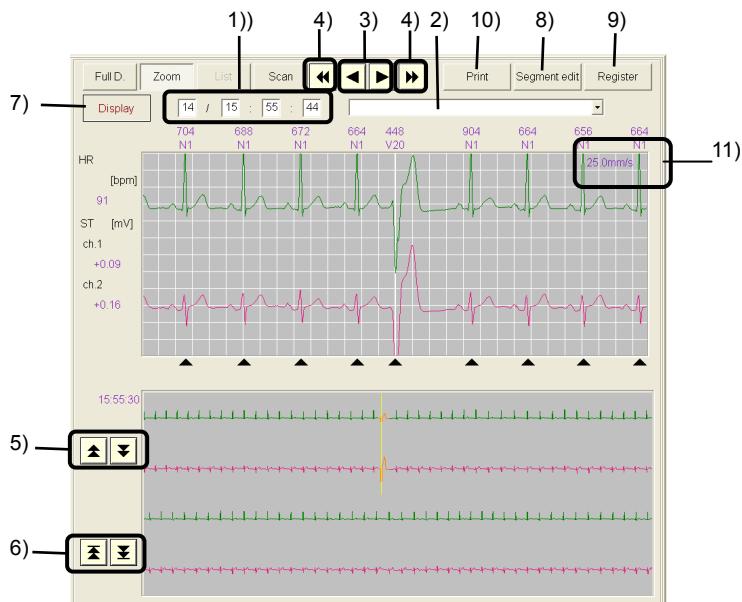
Enables the segment edit process.

7) Register

Enables the registering process.

■Full-Scale Waveform

Clicking the **Zoom** button on the “Search” window will display 6 seconds (25.0mm/s format) or 3 seconds (50.0mm/s format) of full-scale waveform.



1) Time

Displays the waveform for the time entered.

2) Comment

Displays the event type or comment for the selected event during the event search or registered wave search process.

3) ▶◀ ▶▶ Button

Shifts the waveform display by one beat to the right or left.

4) Page Switch (Right/Left) Arrow

Displays the previous or next page of the zoom waveform.

5) Page Switch Arrow

Switches the page to the previous or next page.

6) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the full disclosure waveform.

7) Display

Changes the waveform size and polarity of the waveform. Also changes the display channel and display format of the compressed waveform.

8) Segment edit

Enables the segment edit process.

9) Register

Registers the displayed full-scale waveform. The registering time duration will depend on the report printing paper orientation.

Paper Orientation	Registering Time Duration
Portrait	3 seconds before and 11 seconds after the center of waveform.
Landscape	5 seconds before and after the center of waveform.

10) Print

Prints the displayed full-scale waveform.

The printing time duration will depend on the report printing paper orientation.

Paper Orientation	Registering Time Duration
Portrait	3 seconds before and 11 seconds after the center of waveform.
Landscape	5 seconds before and 15 seconds after the center of waveform.

11) Display format

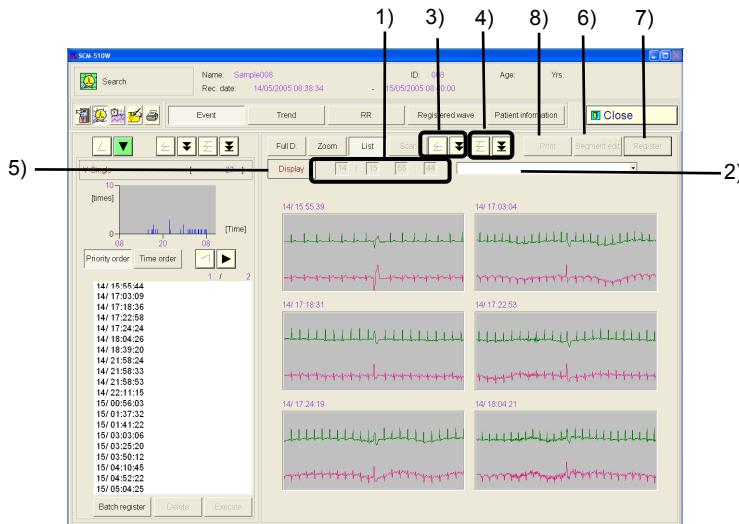
The waveform display format (paper speed) is displayed.

25.0mm/s and 50mm/s can be selected by clicking the display format area.

Even if 50.0mm/s is selected in the display format, the registered waveforms and the printed waveforms will be in 25.0mm/s format.

■Waveform List

By clicking the **List** button on the “Search” window, six waveforms will be displayed.



1) Time

Displays the time of the displayed waveform. The time cannot be changed.

2) Comment

Displays the event type or comment for the selected event during the event search or registered wave search process.

3) Page Switch Arrow

Switches the page to the previous or next page.

4) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the waveform list.

5) Display

Changes the waveform gain and polarity.

6) Segment edit

This key is dimmed.

7) Register

This key is dimmed.

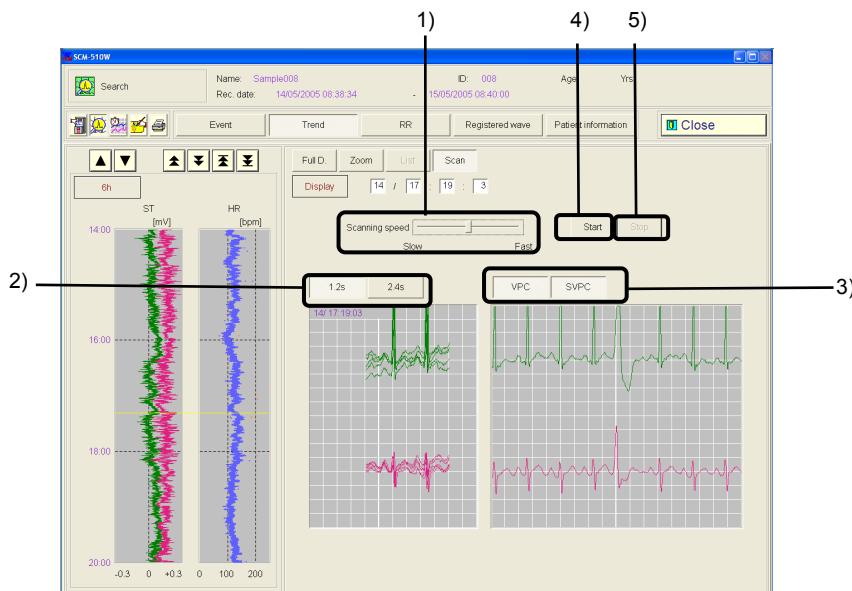
8) **Print**

Prints the selected waveform.

When a waveform is not selected, this key is dimmed.

■ Scan

Click the **Scan** button on the “Search” window to display the “Scan” window. On the “Scan” window, the waveform will be displayed with the R wave position fixed and overlapped for five beats each. By starting the scan process, the waveform will shift by one beat. If VPC or SVPC is acknowledged during the scan process, the waveform displayed will remain beside the scanned waveform area to allow easy verification.



1) Scanning Speed Slider

Select seven levels of scanning speed from “Slow” to “Fast” by moving the slider to the left and right.

2) Waveform Display Duration Selection

Select the waveform display duration from 12 seconds or 24 seconds.

3) Arrhythmia Waveform Display Check Box

Select the arrhythmia waveform display from VPC and/or SPVC.

4) **Start** Button

Starts the automatic reading.

5) **Stop** Button

Stops the automatic reading.

Edit Procedure Types

If the beat judgment or R wave position is incorrect, or a beat that has not detected R wave is found during the search process, the edit procedure allows to correct them.

The following four types of editing procedures are.

- **Edit Specified Segment**

Edits the specified segment.

- **Edit Beat Judgment Code**

Edits the beat if erroneously judged.

- **Add Beat**

Adds the beat if not detected as R wave.

- **Change R wave Position**

Adjusts the R wave position.

For the edit process of specified segment, the following four types of editing procedures are.

- **Change Beat Judgment Code**

Changes the beats of the specified segment to other beat judgement code.

- **Add Atrial Fibrillation Event**

Changes the beats of the specified segment to atrial fibrillation.

- **Delete Atrial Fibrillation Event**

Deletes the atrial fibrillation event of the specified segment.

- **Delete Block**

Deletes the beat judgment information of the specified segment.

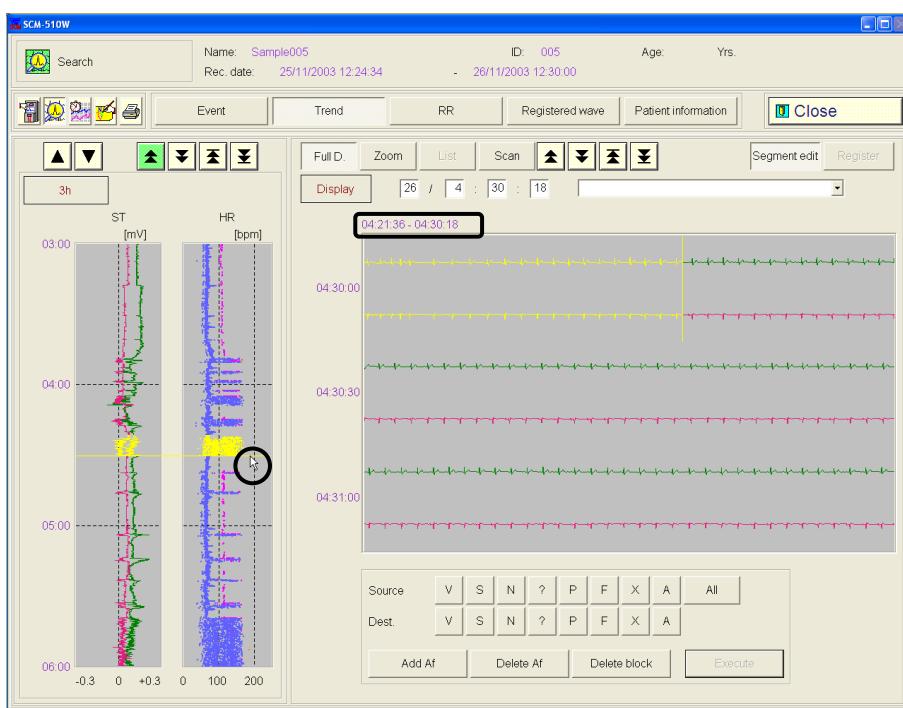
■Editing Specified Segment

The edit procedure can be performed on the specified segment.

Click the **Segment edit** button. The “Segment edit” window will be displayed and enables edit process on the specified segment.

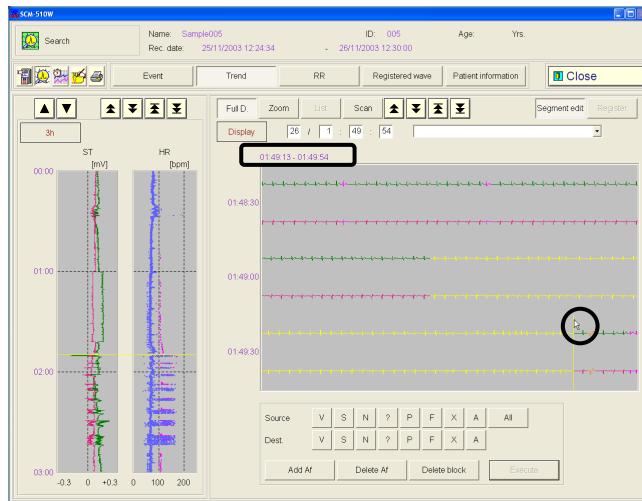


After displaying the “Segment edit” window, specify the segment on the full disclosure waveform or trend.



■ Changing Beat Judgment Code

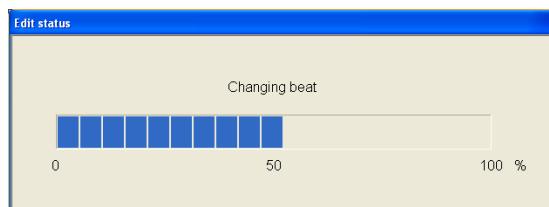
- 1) Click **Segment edit**, and specify the segment on the full disclosure waveform.



- 2) Select the current beat judgment code and new beat judgment code you wish to change.
More than one selection is possible for the current beat judgment code. **All** will change all beats within the specified segment.

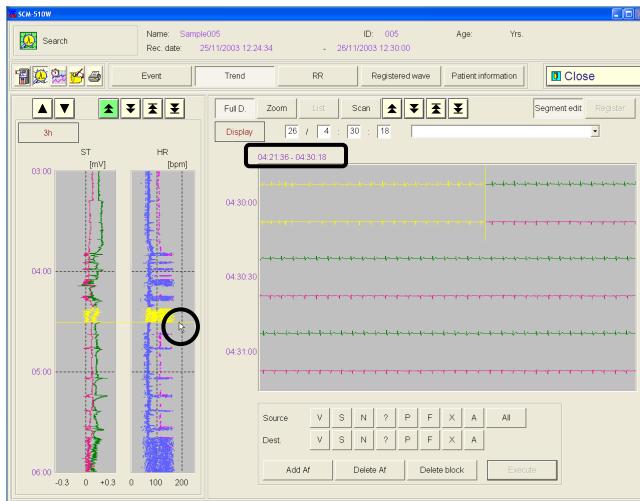


- 3) Clicking the **Execute** button after the selection will display the progress window and start the editing process.



■ Deleting / Adding Atrial Fibrillation Event

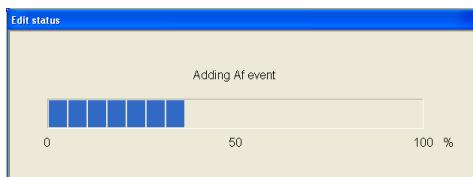
- 1) Click [Segment edit], and specify the segment on the full disclosure waveform or trend.



- 2) Select [Add Af] or [Delete Af].



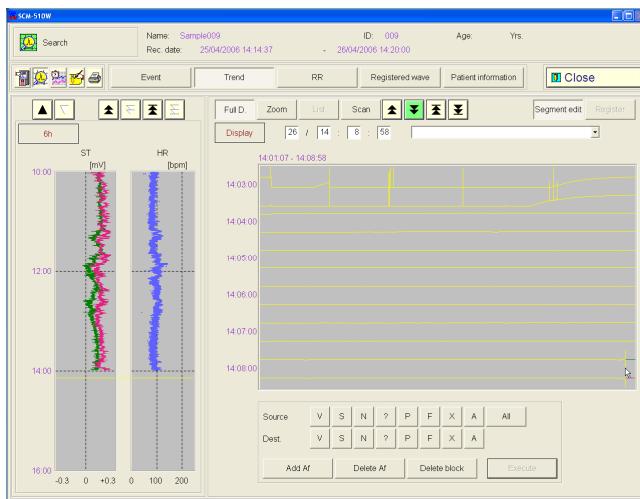
- 3) Clicking the [Execute] button after the selection will display the progress window and start the editing process.



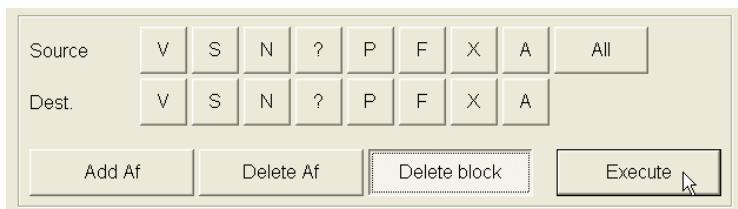
Memo All supraventricular premature contraction beats ("S") within the segment to which AF is added will be automatically changed to normal beats ("N").

■ Deleting Block

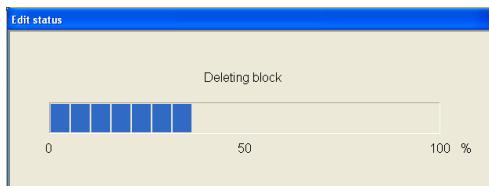
- 1) Click **Segment edit**, and specify the segment on the full disclosure waveform or trend.



- 2) Select **Delete block**.



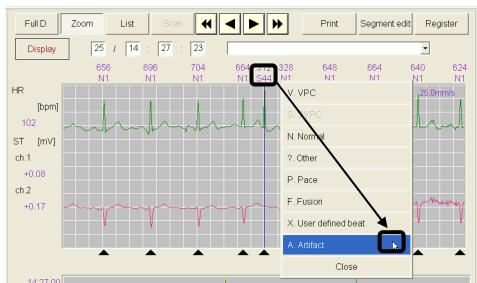
- 3) Clicking the **Execute** button after the selection will display the progress window and start the editing process.



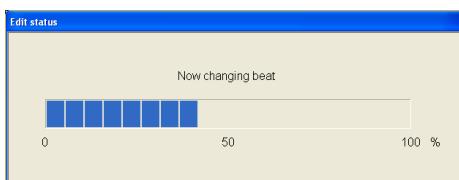
Changing Beat Judgment Code

If an erroneous judgment of the beat on the zoom waveform display is found, it can be changed to other beat judgment code.

- 1) Clicking on the beat judgment code will display the window of beat judgment code selection.



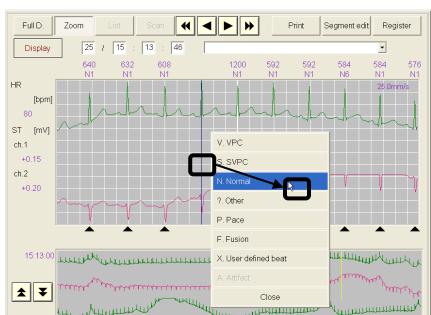
- 2) Selecting one of the beat judgment code from the window will display the progress window and start the editing process.



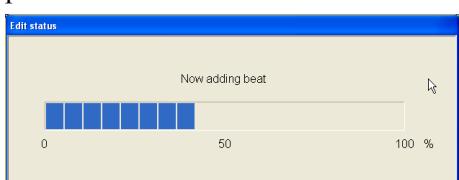
Adding Beat

When a heartbeat which is not acknowledged as a heartbeat on the zoom waveform window is found, an R wave position and beat judgment code can be added to the waveform.

- 1) Click on the waveform where you wish to add a heartbeat. R wave position cursor and pop-up window of beat judgment code selection will be displayed.



- 2) Selecting one of the beat judgment code will display the progress window and start the editing process.



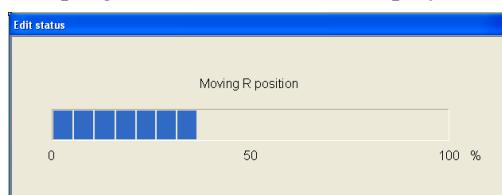
Changing R Wave Position

If the R wave position is erroneously displayed on the zoom waveform, it can be adjusted by one beat.

- 1) Dragging the ▲ mark below the enlarged waveform will display a cursor indicating the R wave position.



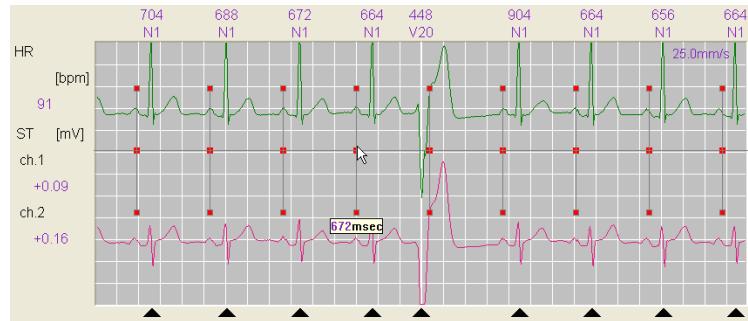
- 2) Move the R wave position by dragging the ▲ mark using the mouse.
The progress window will be displayed and start to change the R wave position.



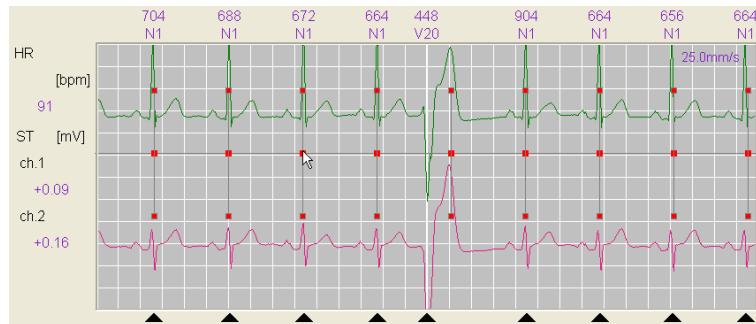
Divider

On the zoom waveform display, a divider can be displayed.

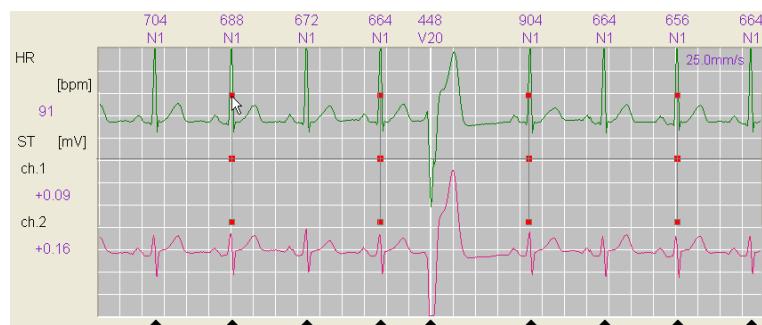
- 1) On the zoom waveform display area, right-click and drag the mouse to set the divider width. Releasing the right button will display the divider.



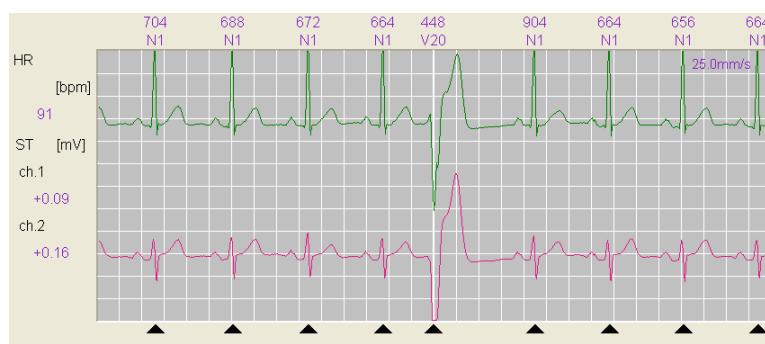
- 2) The divider can be dragged by right-clicking on the displayed red dot.



- 3) The display width of the divider can be changed by dragging the red dot.



- 4) Pressing the **ESC** key or scrolling the waveform will erase the divider.



Information Window

On the zoom waveform window, detailed information for each beat can be displayed.

- 1) Right-clicking on the ▲ mark will display the detailed information window for the beat.
The information window will disappear when the right button is released.



Memo The body position will be displayed only if the information is recorded for the patient.

6. 6 Measurement

On the SCM-510W, HRV measurement, Lorenz plot, SAS measurement, and pacemaker measurement can be performed.

Type of Measurements

Five types of measurement can be performed on the data, which was read and analyzed/edited, or on data other than recorded ECG data.

●HRV Measurement

By performing HRV measurement, heart rate variability, which is one of the indicators to understand the autonomic activity, can be checked.

●Lorenz Plot

By performing Lorenz plot, distribution of RR interval and arrhythmia occurrence can be visually checked.

●SAS Measurement

By performing SAS measurement, screening test of Sleep Apnea Syndrome can be performed on the respiration data recorded on the LS-300.

●Pacemaker Measurement

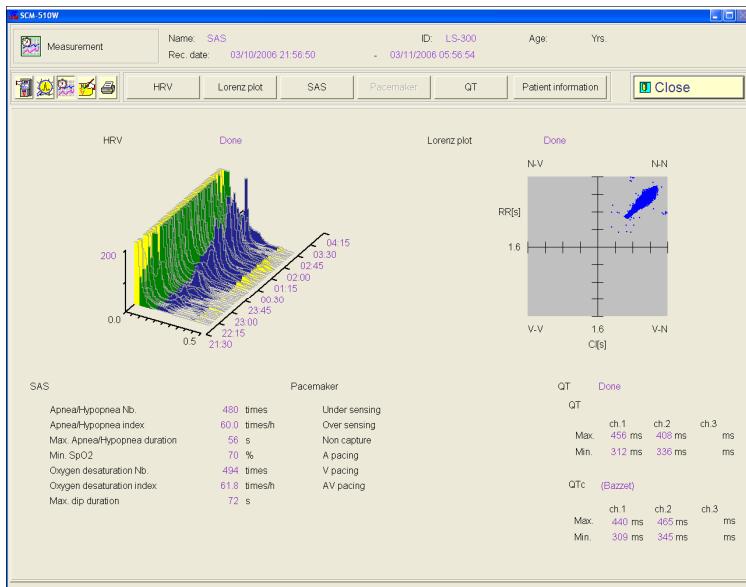
By performing pacemaker measurement, pacemaker operation status and pacing spike occurrence can be checked on the data when pacemaker information is recorded.

●QT Measurement (Option)

By performing QT measurement, QT interval from the average waveform is measured, and the presence of long QT syndrome can be checked.

Main Measurement Window

On the main “Measurement” window, the measurement result will be displayed.



HRV Measurement

By performing HRV measurement, heart rate variability, which is one of the indicators to understand the autonomic activity, can be checked.

Click the **HRV** button or double-click the HRV measurement result display area.

If performing the HRV measurement for the first time, the “Measurement settings” window will open. If the HRV measurement has previously been performed, the measurement result (power spectrum) will be displayed.

■ Measurement Settings

● Measurement Algorithm

The algorithm for the HRV measurement can be selected.



- The measurement algorithm can be selected from the drop-down box.
The selections are as follows.

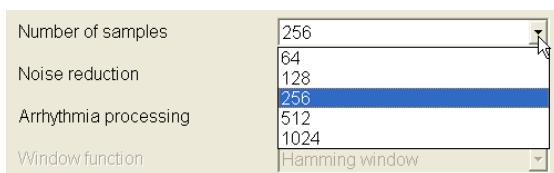
FFT : Fast Fourier Transform

MEM : Maximum Entropy Method

 **Memo** For details of FFT and MEM algorithms, refer to P6-90 “Details of the Measurement Algorithm.”

● Number of Samples

The number of samples to perform the HRV measurement can be selected.



- The number of samples can be selected from the drop-down box.
The selections are as follows.

64

128

256

512

1024

 **Memo** Depending on the number of samples, minimum resolution of the power spectrum that can be measured will change.

●Effective Samples

“Effective samples” is a percentage of beats after arrhythmia processing and noise reduction to the total beats within the measurement range. If this percentage is equal to or less than the set “Effective samples” percentage, it will be judged that there are not enough effective beats within the measurement range, and RR spectrum measurement will not be performed.

Effective samples %

 **Memo** “Effective samples” is a percentage of effective beats to the total beats within the specified seconds for “Number of samples” during spline interpolation process.

- Click the “Effective samples” box, and enter the percentage of effective samples.
The adjustable range is 10 ~ 100%.

 **Memo** The unit of “Effective samples” is %.

- If an improper value is entered, an error message will be displayed.
Close the message window by clicking the **Close** button, and enter a proper value.

●Added Samples

When the beats are removed by arrhythmia processing and noise reduction, the necessary beats can be added from the next measurement range. “Added samples” is a percentage of added beats to the total beats within the measurement range. If this percentage is equal to or greater than the set “Added samples” percentage, it will be judged that there are too many added beats outside the measurement range, and RR spectrum measurement will not be performed.

Added samples %

 **Memo** “Added samples” is a percentage of added beats to the total beats within the specified seconds for “Number of samples” during spline interpolation process.

- Click the “Added samples” box, and enter the percentage of added samples.
The adjustable range is 10 ~ 100%.

 **Memo** The unit for “Added samples” is %.

- If an improper value is entered, an error message will be displayed. Close the message window by clicking the **Close** button, and enter again a proper value.

●Noise Reduction

The method and threshold for noise reduction can be selected.



Memo For details of the noise reduction procedure, refer to P6-95 "Noise Reduction Method."

- The noise reduction method can be selected from the drop-down box.

The selections are as follows.

- Length : If the RR interval is longer than the specified duration (sec.), the beat will be removed as noise.
- Ratio : If the percentage to the weighed average of RR interval is less than the specified percentage (%), the beat will be removed as noise.
- OFF : Noise reduction will not be performed.

- Click the "Length" or "Ratio" box, and enter a value.

The adjustable ranges of "Length" and "Ratio" are as follows.

- Length : 1 ~ 99 (sec.)
- Ratio : 1 ~ 99 (%)

Memo If "Length" is selected for "Noise reduction," the unit, "sec." will be displayed beside the box, and if "Ratio" is selected, "%" will be displayed. If "OFF" is selected, the box and unit will not be displayed.

- If an improper value is entered, an error message will be displayed. Close the message window by clicking the **Close** button, and enter a proper value.

●Arrhythmia Processing

The arrhythmia processing method for the beats other than "N (Normal heartbeat)" can be selected.



Memo For details of the arrhythmia processing method, refer to P6-94 "Arrhythmia Processing Method."

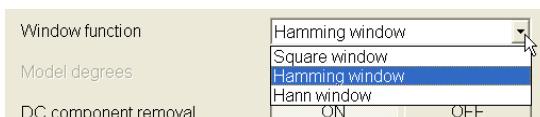
- The arrhythmia processing method can be selected from the drop-down box.

The selections are as follows.

- Delete except N : Deletes the data before and after a non-normal beat, and adjusts the opened space.
- Interpolate except N : Replaces the data before and after a non-normal beat with the arithmetic average of those data.
- OFF : The non-normal beat will not be deleted for the arrhythmia process.

●Window Function

When the measurement algorithm used is FFT, the window function to be used can be selected.



The window function setup can be performed only when the measurement algorithm used is “FFT.” If “MEM” is selected for the measurement algorithm, window function selection will not be displayed. For details of the window function, refer to P6-90 “Window Function.”

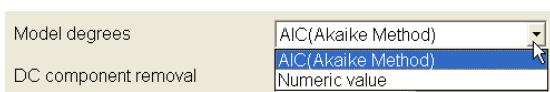
- The window function can be selected from the drop-down box.

The selections are as follows.

Square Window
Hamming Window
Hann Window

●Model Degrees

When the measurement algorithm used is “MEM,” the censored value (degree) for the used prediction error filter can be set.



The “Model degrees” setting can be performed only when the measurement algorithm used is “MEM.” If “FFT” is selected for the measurement algorithm, “Model degrees” selection will not be displayed. For details of the “Model degrees,” refer to P6-91 “Model Degree.”

- The model degree can be selected from the drop-down box.

The selections are as follows.

AIC (Akaike Method)
Numeric Value

- If “Numeric value” is selected for “Model degrees,” click the box and enter a value using the keyboard. The adjustable range is 0 ~ 999.



The numeric value box for the model degrees will be displayed only when “Numeric value” is selected for “Model degree.”

●DC Component Removal

Whether to remove the DC component or not can be selected. The data after the removal of DC component will show the difference from the average RR interval within the measurement range.



For details of the DC component removal method, refer to P6-96 “DC Component Removal.”

- **ON** will remove the DC component.

●Spline Interpolation

Whether to re-sample the data using spline interpolation for creating a data row with equal time interval for FFT and MEM, can be selected.

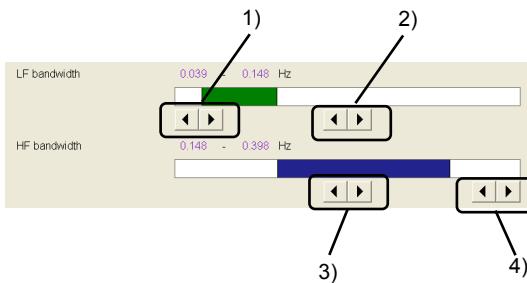


Memo For details of the data preprocessing method, refer to P6-97 "Data Preprocessing Method."

- When **[ON]** is selected, spline interpolation will be used to re-sample data at 125 msec interval to create a data row with equal time interval.

●LF/HF Bandwidth

The frequency band of LF range and HF range for the HRV measurement result can be set.



1) LF Bandwidth Lower Limit Buttons

Set the lower limit of LF bandwidth.

2) LF Bandwidth Upper Limit Buttons

Set the upper limit of LF bandwidth.

3) HF Bandwidth Lower Limit Buttons

Set the lower limit of HF bandwidth.

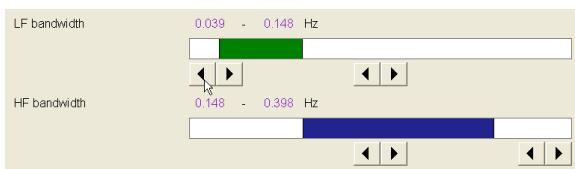
4) HF Bandwidth Upper Limit Buttons

Set the upper limit of HF bandwidth.

The adjustable ranges are as follows.

LF bandwidth : 0 ~ 0.5 (c/b or Hz)

HF bandwidth : 0 ~ 0.5 (c/b or Hz)



- Use the buttons to adjust the upper and lower limits. The adjusted values will be displayed above the bar.

Memo The lower and upper limits cannot be set outside the adjustable range. Also, LF range and HF range cannot be overlapped.

●Measurement Interval

The measurement interval to measure the trend of power spectrum, frequency domain, and time domain can be selected.

Measurement interval	5Minute
----------------------	---------

 **Memo** The same measurement interval and measurement count will be used for power spectrum, time domain, and frequency domain.

- The measurement interval can be selected from the drop-down box.
The selections are as follows.

1 min

2 min

5 min

10 min

30 min

60 min

 **Memo** ■ The unit of “Measurement interval” is “minutes.”
■ If the sample number is large, short measurement interval cannot be selected.
For the relationship between the sample number and measurement interval,
refer to P6-91 “Power Spectrum Trend Calculation.”

●Measurement Count

The number of measurement data for power spectrum, time domain, and frequency domain can be set. This will be the number of representing values plotted on the trend graph.

Measurement count	280
-------------------	-----

- Click the “Measurement count” box and enter a value.
The adjustable range is 1 ~ 999.

- If an improper value is entered, an error message will be displayed.
Close the message window by clicking the **Close** button, and enter again a proper value.

 **Memo** For details of the measurement count and power spectrum trend display, refer to P6-91 “Power Spectrum Trend Calculation.”

●Averaging

Whether to use the average value for power spectrum measurement can be set.
When using the average value, set also the data displacement amount.

Averaging	1
	OFF
	1
	1/2
	1/4

 **Memo** For details of the power spectrum trend averaging method, refer to P6-91 “Power Spectrum Trend Calculation.”

- The data displacement amount can be selected from the drop-down box.
The selections are as follows.

OFF

1

1/2

1/4

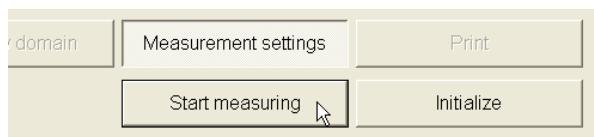
■ Initializing the Measurement Settings

The settings on the “Measurement settings” window can be initialized to factory default by clicking the [Initialize] button.

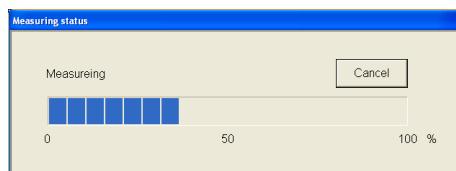
The default settings are as follows.

Measurement Algorithm	:	MEM
Measurement Samples	:	256
Effective Samples	:	50
Added Samples	:	50
Noise Reduction	:	Length: 3 sec. / Ratio: 70%
Arrhythmia Processing	:	Delete except N
Window Function	:	Hamming Window
Model Degrees	:	AIC (Akaike Method) / Numeric data: 40 degrees
DC Component Removal	:	ON
Spline Interpolation	:	ON
LF Bandwidth	:	0.039 ~ 0.148Hz
HF Bandwidth	:	0.148 ~ 0.398Hz
Measurement Interval	:	5
Measurement Count	:	300
Averaging	:	1

■ Starting / Canceling the Measurement



- Click the [Start measuring] button. The measuring status bar will be displayed.

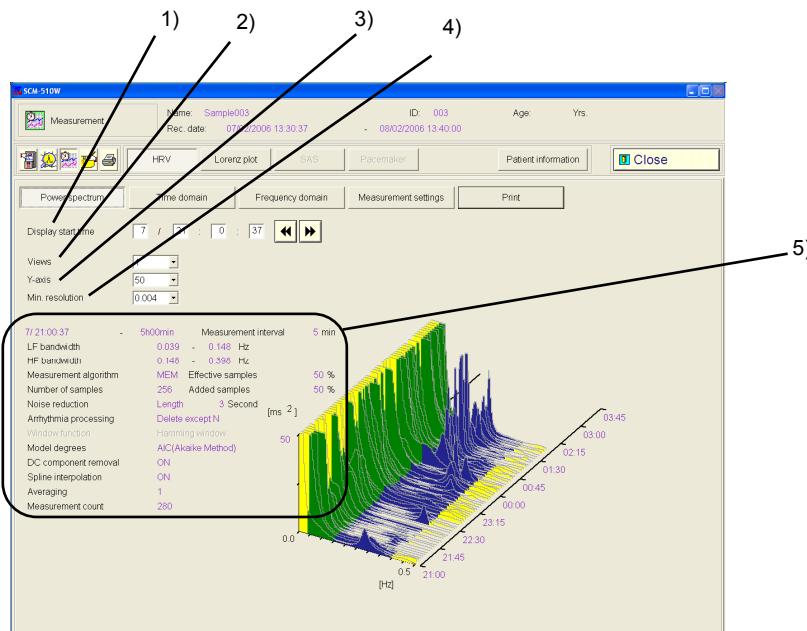


Memo The measurement result window displaying the power spectrum trend will be automatically displayed when the measurement completes.

- To cancel the measurement, click the [Cancel] button on the measuring status window. When the measurement has stopped, the measurement result ending at the stopped point will be displayed.

■Power Spectrum

Click the **Power spectrum** button on the “HRV measurement” window. The measurement result will be displayed in three-dimensional power spectrum.



1) Display Starting Time

Select a display starting time.

2) Views

Select viewing direction from 3 levels.

3) Y-axis

Select Y-axis scale.

4) Min. Resolution

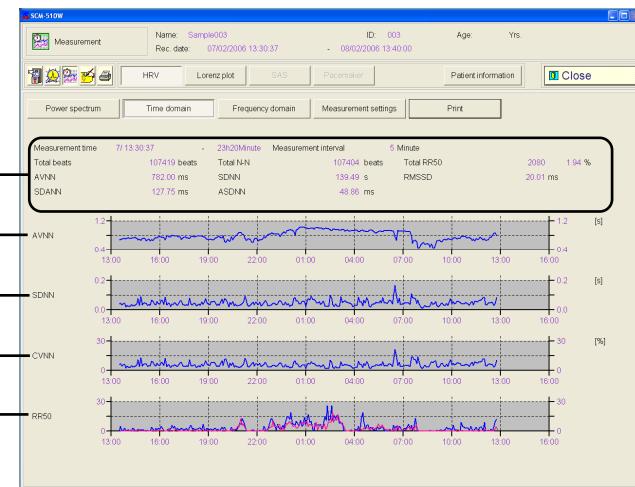
Select the minimum resolution.

5) Measurement Setting

Displays the current setting for the measurement.

■ Time Domain

Click the **Time domain** button on the “HRV measurement” window. The trend for the measurement result will be displayed.



1) Measured Data

Displays the measurement time, measurement interval, total beats, total N-N, total RR50, AVNN, SDNN, RMSSD, SDANN, and ASDNN.

2) AVNN

Displays the N-N mean value for each section in trend.

3) SDNN

Displays the N-N standard deviation for each section in trend.

4) CVNN

Displays the N-N variation coefficient for each section in trend.

5) RR50

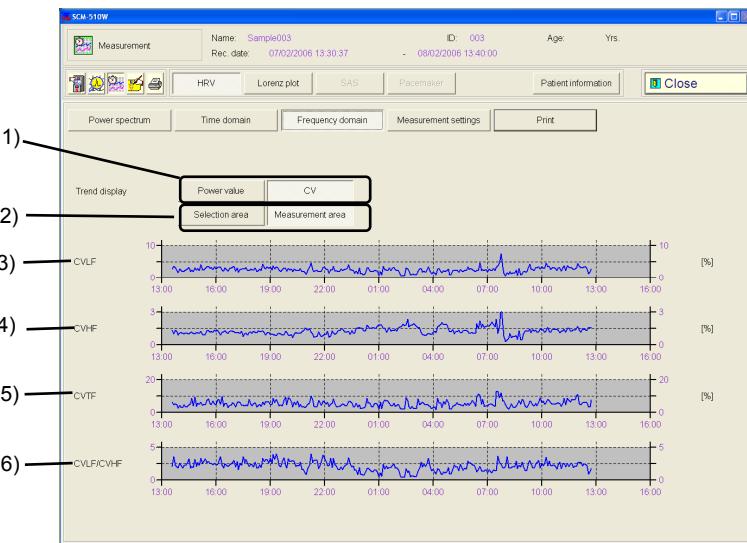
Displays RR50+ and RR50- for each section in trend.

RR50+ : Color selected on “System setting”.

RR50- : Pink

■Frequency Domain

Click the **Frequency domain** button on the “HRV measurement” window. The measurement result will be displayed in trend.



1) Trend Display

Select the displaying trend format from **Power value** and **CV**.

2) Display Area

Select the trend displaying area from **Selection area** and **Measurement area**.

3) LF Component, CVLF Trend

Displays the LF component power level trend if **Power value** is selected for “Trend display”, and CVLF trend if **CV** is selected.

4) HF Component, CVHF Trend

Displays the HF component power level trend if **Power value** is selected for “Trend display”, and CVHF trend if **CV** is selected.

5) TF Component, CVTF Trend

Displays the TF component power level trend if **Power value** is selected for “Trend display”, and CVTF trend if **CV** is selected.

6) LF/HF, CVLF/CVHF Trend

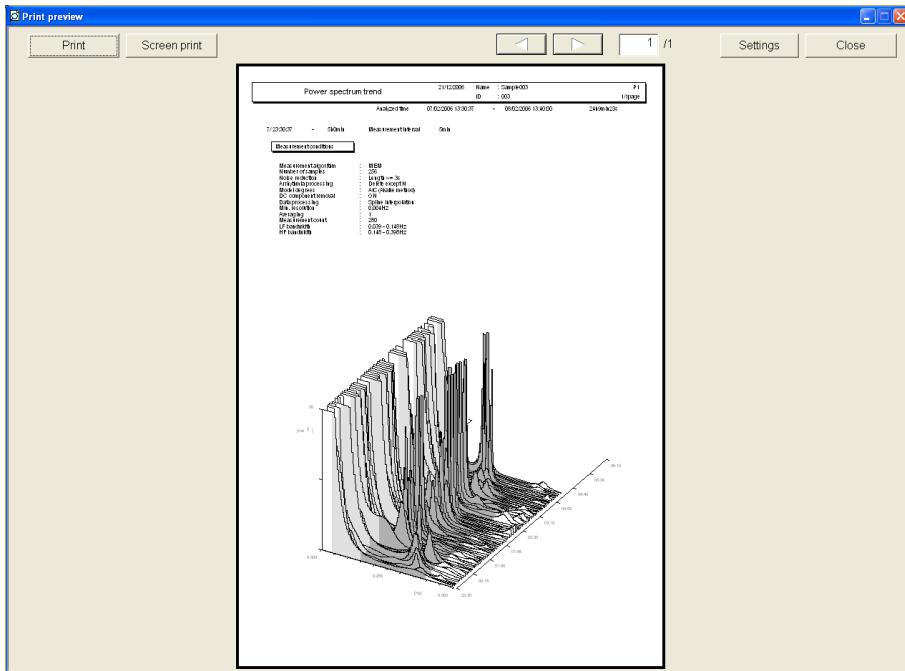
Displays the LF/HF component power level trend if **Power value** is selected for “Trend display”, and CVLF/CVHF trend if **CV** is selected.

■Print

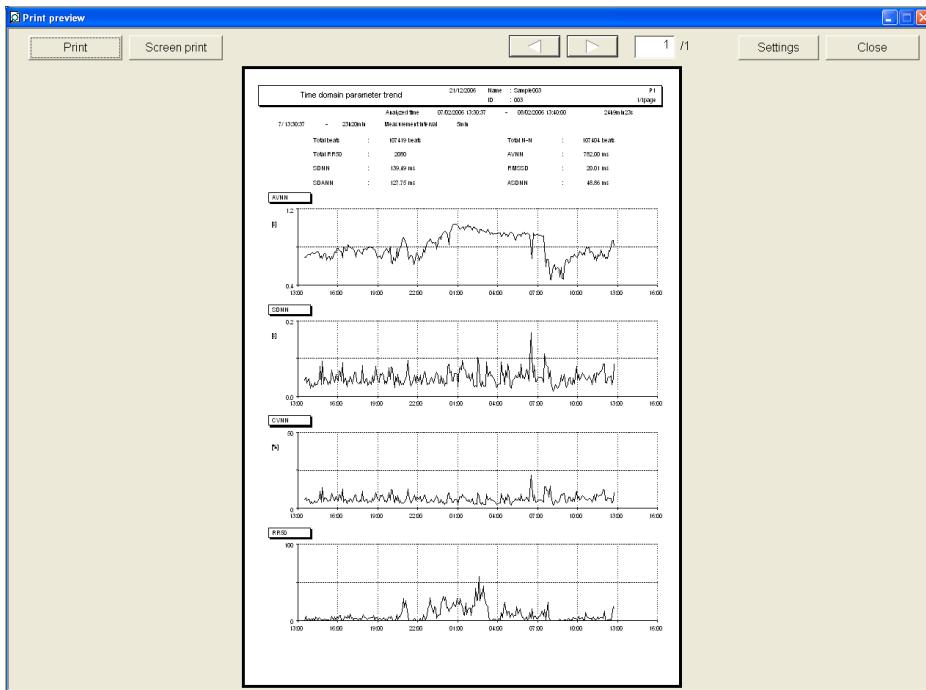
Clicking the **Print** button on the “Power spectrum,” “Time domain,” and “Frequency domain” window will display the print preview for each display. By clicking the **Print** button on the preview screen, the data will be output to the printer.

On the “Measurement setting” window, the **Print** button will be masked.

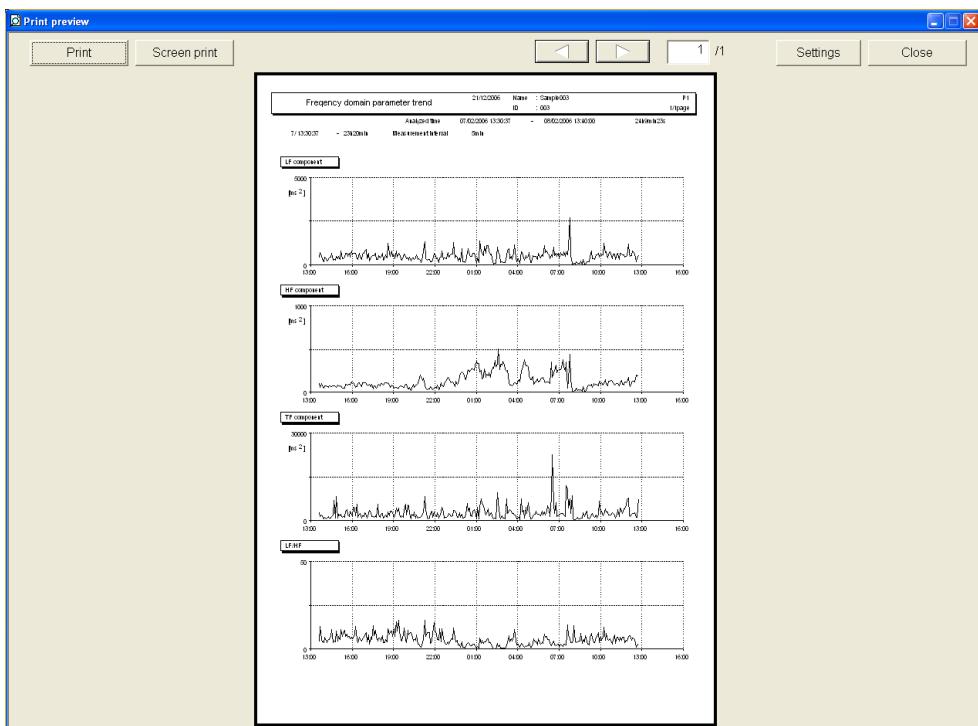
●Power Spectrum Trend



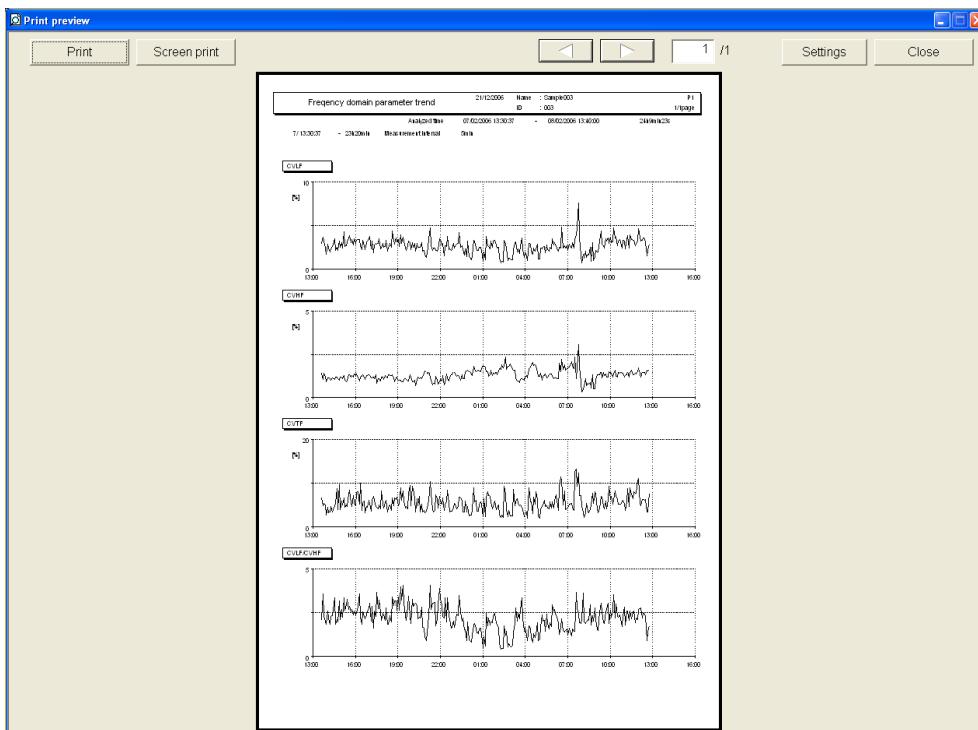
●Time Domain Parameter Trend



●Frequency Domain Parameter Trend (Power Value)



●Frequency Domain Parameter Trend (CV)



■Terminology / Calculation Method of Frequency Band

●LF Bandwidth, LF Component

“LF bandwidth” is a low-frequency range for RR power spectrum, and “LF component” is a power level for the entire LF bandwidth.

Clinically, LF component is the BP regulation rhythm detected near 0.1Hz and reflects the activity of both sympathetic nerve and parasympathetic nerve.

●HF Bandwidth, HF Component

“HF bandwidth” is a high-frequency range for the RR power spectrum, and “HF component” is a power level for the entire HF bandwidth.

Clinically, HF component is the respiratory fluctuation rhythm detected near 0.25Hz and reflects the parasympathetic nerve activity.

●TF Bandwidth, TF Component

“TF bandwidth” is the measurable frequency range, and “TF component” is the power level for the entire TF bandwidth. TF bandwidth differs depending on whether the spline interpolation is performed for data preprocessing.

When spline interpolation is performed:

The data acquired from spline interpolation will be the raw data sampled at 125ms interval, and the sampling frequency is 8Hz. The frequency spectrum that can be actually calculated will be up to half of the sampling frequency according to the sampling theorem. Therefore, the TF bandwidth will be 0 ~ 4Hz.

When spline interpolation is not performed:

The raw data of equal interval will be created by just simply arranging the data at equal intervals ignoring the RR interval data and beat generated position. If this interval is defined as 1 cycle, the sampling frequency will be 1 cycle/beat (c/b). Therefore, the TF bandwidth will be 0 ~ 0.5c/b.

●Frequency Component Ratio (LF/HF)

This is the ratio of the LF component and HF component, which can be used as one of the indicators for sympathetic nerve.

LF/HF can be calculated with the following formula.

$$\text{LF/HF} = (\text{LF component}) \div (\text{HF component})$$

●Average RR Interval for CVF Calculation

This is the average RR interval for calculating CVLF, CVHF, and CVTF.

If spline interpolation is not performed at data preprocessing, this will be the average RR interval within the measurement range. If spline interpolation is performed, this will be the average RR interval of the re-sampled data at 125 ms.

●CVLF

This is the variation coefficient of LF component.

CVLF can be calculated with the following formula.

$$\text{CVLF} = \text{SQRT} (\text{LF component}) \div (\text{Average RR interval for CVF calculation})$$

*SQRT: Square Root

●CVHF

This is the variation coefficient of HF component.

CVHF can be calculated with the following formula.

$$\text{CVHF} = \text{SQRT} (\text{HF component}) \div (\text{Average RR interval for CVF calculation})$$

*SQRT: Square Root

●CVTF

This is the variation coefficient of TF component.

CVTF can be calculated with the following formula.

$$\text{CVTF} = \text{SQRT} (\text{TF component}) \div (\text{Average RR interval for CVF calculation})$$

*SQRT: Square Root

●Variation Coefficient Ratio (CVLF/CVHF)

This is the ratio of CVLF and CVHF.

CVLF/CVHF can be calculated with the following formula.

$$\text{CVLF/CVHF} = \text{CVLF} \div \text{CVHF}$$

●Power Spectrum Resolution

The power spectrum resolution indicates the measure of the power to resolve the power spectrum in frequency unit. The minimum resolution is indicated as “1/number of measured samples.”

■Terminology / Calculation Method of Time Domain

●Total Number of Beats

This is the total number of beats from the measurement starting time to the last beat of the measurement section.

●Total Number of N-N

This is the number of patterns composed of two successive normal beats (beat judgment code: N) within the whole measurement section. When there are three successive normal beats, the number of N-N will be 2.

●Total Number of N-N-N

This is the number of patterns composed of three successive normal beats (beat judgment code: N) within the whole measurement section. When there are four successive normal beats, the number of N-N-N will be 2.

●Average N-N [AVNN] for the Whole Measurement Section

This is the average N-N interval for the N-N patterns in the whole measurement section.

Average N-N interval for the whole section can be calculated with the following formula.

$$AVNN = \left(\sum_{i=1}^n (N-N \text{ interval})_i \right) \div (\text{Total Number of N-N})$$

*n: Total Number of N-N

●Standard Deviation of N-N [SDNN] for the Whole Measurement Section

This is the N-N standard deviation for the whole measurement section.

It can be calculated with the following formula.

$$SDNN = \text{SQRT} \left(\sum_{i=1}^n (N-N \text{ interval})_i^2 \div (\text{Total Number of N-N}) - AVNN^2 \right)$$

*n: Total Number of N-N, SQRT: Square Root

●Root-Mean-Square Successive Difference [RMSSD] of N-N

This is the root-mean-square value of the difference between two (2) N-N intervals (absolute value) for the N-N-N pattern in the whole measurement section.

It can be calculated with the following formula.

$$\text{N-N Difference (Absolute Value)} [\text{NND}] = | NN_n - NN_{n-1} |$$

* NN_n, NN_{n-1}: Two (2) N-N intervals of N-N-N pattern

$$RMSSD = \text{SQRT} \left(\sum_{i=1}^n NND_i^2 \div (\text{Total Number of NND}) \right)$$

*n: Total Number of NND, SQRT: Square Root

●Standard Deviation of Average N-N Interval [SDANN]

This is the standard deviation of the average N-N interval for the whole measurement section.

It can be calculated with the following formula.

$$SDANN = \text{SQRT} \left(\left(\sum_{i=1}^n AVNN_i^2 \div (\text{Number of Measurement Sections}) \right) - \left(\sum_{i=1}^n AVNN_i \div (\text{Number of Measurement Sections}) \right)^2 \right)$$

*n: Total Number of NND, SQRT: Square Root

●Average of Standard Deviation of N-N Intervals [ASDNN]

This is the average value of N-N standard deviation for the whole measurement section. It can be calculated with the following formula.

$$\text{ASDNN} = \sum_{i=1}^n \text{SD} \div (\text{Number of Measurement Sections})$$

*n: Number of Measurement Sections

●Total RR50+

This is the total count of the N-N-N pattern in the whole measurement section where the difference between the preceding and the succeeding N-N intervals is +50 msec or more.

●Total RR50-

This is the total count of the N-N-N pattern in the whole measurement section where the difference between the preceding and the succeeding N-N intervals is -50 msec or less.

●Total RR50Total

This is the total count of the N-N-N pattern in the whole measurement section where the absolute value of the difference between the preceding and the succeeding N-N intervals is +50 msec or more. The sum of "Total RR50+" and "Total RR50—" will be "Total RR50Total."

●Total RR50%

This is the percentage of "Total RR50Total" to the total number of N-N-N.

It can be calculated with the following formula.

$$\text{Total RR50\%} = ((\text{Total RR50Total}) \div (\text{Total number of N-N-N})) \times 100$$

●Number of N-N in Each Measurement Section

This is the number of N-N patterns in each measurement section. If the pattern crosses the boundary to the next measurement range, it will be counted in the next measurement range.

●Number of nonN-N in Each Measurement Section

This is the number of nonN-N in each measurement section. If the nonN-N crosses the boundary to the next measurement section, it will be counted in the next measurement section.

●Number of N-N-N in Each Measurement Section

This is the number of N-N-N patterns in each measurement section. If the pattern crosses the boundary to the next measurement section, it will be counted in the next measurement section.

●Average N-N Interval [AVNN] in Each Measurement Section

This is the average N-N interval for the N-N pattern in each measurement section.

It can be calculated with the following formula.

$$\text{AVNN} = \sum_{i=1}^n (\text{N-N interval}) \div (\text{Number of N-N in Each Section})$$

*n: Number of N-N in Each Section

●Standard Deviation of N-N Interval [SDNN] in Each Measurement Section

This is the standard deviation of N-N interval in each measurement section.

It can be calculated with the following formula.

$$SDNN = \text{SQRT} \left(\sum_{i=1}^n (\text{N-N interval})_i^2 \div (\text{Number of N-N in Each Section}) - AVNN^2 \right)$$

*n: Number of N-N in Each Section, SQRT: Square Root

●Coefficient of Variation [CVNN] in Each Measurement Section

This is the variation coefficient of RR interval in each measurement section.

It can be calculated with the following formula.

$$CVNN = (SDNN \div AVNN) \times 100 [\%]$$

●Sect. RR50+

This is the total count of the N-N-N pattern in each measurement section where the difference between the preceding and the succeeding N-N intervals is +50 msec or more.

●Sect. RR50-

This is the total count of the N-N-N pattern in each measurement section where the difference between the preceding and the succeeding N-N intervals is -50 msec or less.

●Sect. RR50Total

This is the total count of the N-N-N pattern in each measurement section where the absolute value of difference between the preceding and the succeeding N-N intervals is +50 msec or more. The sum of "Sect. RR50+" and "Sect. RR50-" will be "Sect. RR50Total".

●Sect. RR50%

This is the percentage of "Sect. RR50Total" to the number of N-N-N in each measurement section. It can be calculated with the following formula.

$$\text{Sect. RR50\%} = ((\text{Sect. RR50Total}) \div (\text{Number of N-N-N in Each Section})) \times 100$$

■Details of the Measurement Algorithm

●Fast Fourier Transform (FFT)

Fast Fourier Transform (FFT) is an algorithm, which quickly obtains Fourier component by spectral estimation called Discrete Fourier Transform (DFT). It is not a spectral estimation itself even though it is commonly said that “FFT = spectral estimation.” DFT (Discrete Fourier Transform) is a method to obtain spectral measurement of digital discrete signal by computing the Fourier transform of that signal.

The following characteristics of the FFT algorithm are.

- Linear estimation method is used.
- Computation time is short.
- It covers wide frequency range and enables to obtain relatively a good spectrum.
- The stability degrades as the number of data decreases.
- The provided data is perceived as a part of infinite function to estimate the spectrum.
- When infinite function is extended, window function is used to reduce unnecessary harmonic component caused by the discontinuous point.

●Maximum Entropy Method (MEM)

Maximum Entropy Method (MEM) is a method to estimate auto-correlation function of unknown part without increasing the entropy under the constraint of Wiener-Khintchine relation, which assumes that Fourier transform of the spectrum is a correlation function.

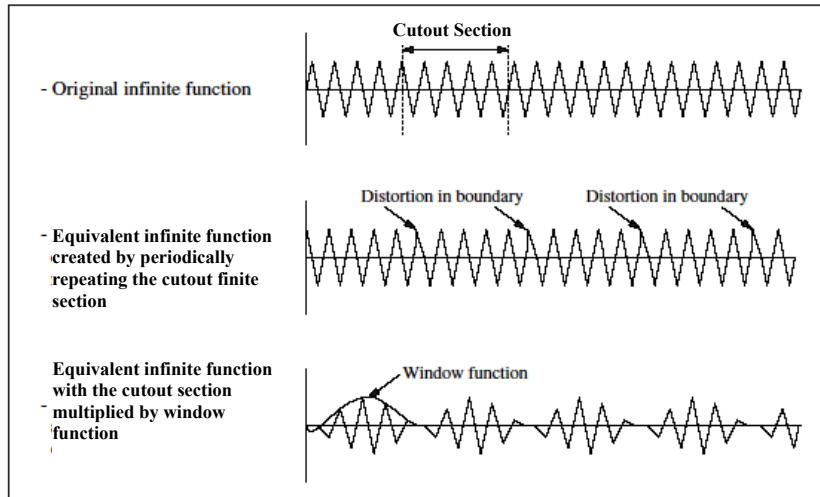
There is also a similar spectral estimation method called autoregressive (AR) model method. This method assumes that the establishment process can be expressed by autoregressive model, and performs spectral estimation by applying the monitored waveform to it. Only the estimation method of auto-correlation function is different with the MEM method.

The following characteristics of the MEM algorithm are.

- Nonlinear estimation method is used.
- Computation time is long compared to FFT.
- Spectral resolution is high.
- Even if the number of data is very few, a stable spectrum with high resolution can be obtained.
- The spectrum is estimated by using only the provided data.
- The spectral variance cannot be estimated.
- The censored value (degree) of prediction error filter is difficult to determine.

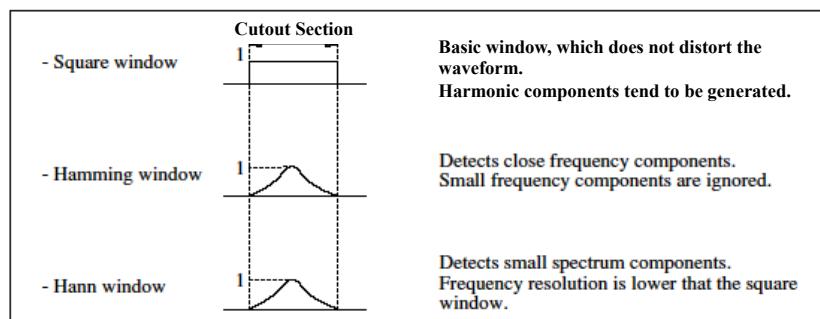
●Window Function

An infinite period function is used for the Fourier transform, but the actual data on which the frequency measurement is performed is a finite interval data. Therefore, the cutout finite interval data is periodically repeated to create an equivalent infinite period function to perform Fourier transform. This causes distortion in shape to the boundary of finite interval and generates unnecessary harmonic components. To avoid this, a weighing function is applied throughout the cutout section of the original data to reduce the harmonic components at the boundary. This weighing function is called the “window function.”



As there are numerous types of window function, three common types that are user-selectable are used on this system.

As the boundary is attenuated using window function, the signal power level drops. Therefore, a correction is made to the power level, which is calculated as final result.



● Model Degree

Model degree is a censored value (degree) of prediction error filter for MEM (Maximum Entropy Method). The degree can be obtained by AIC (Akaike's Information Criteria), or numeric value can be directly input as degree value.

- AIC (Akaike's Information Criteria) : Obtains the degree with the minimum final prediction error.
- Numeric value input : Enters a numeric value for the degree.

For the random variation with sharp spectrum line, final prediction error of Akaike method will not clearly indicate a minimum value.

The optimum degree at this time is said to be as follows.

$$\text{Degree} \approx (2 \sim 3) \sqrt{N}$$

*N: sample number, SQRT: Square Root

● Power Spectrum Trend Calculation

The power spectrum trend is a time trend of the power spectrum for each measurement section. The calculation method to obtain power spectrum representing each measurement section differs depending on whether averaging is performed or not.

Without averaging:

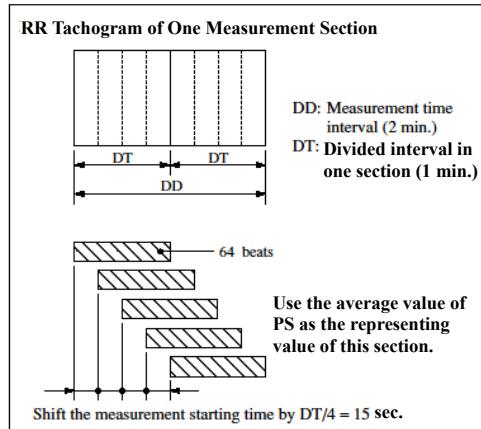
When averaging is not performed, power spectrum is measured by using only the measurement samples starting from the beginning of each measurement section. That is, for long measurement section, power spectrum is measured using only the data at the beginning part of each section.

With averaging:

When averaging is performed, the power spectrum is first measured using the measurement samples starting from the beginning of the measurement section. Then, it is measured by displacing in the amount of “displacement value × divided interval in one section.” This displacement process is performed for the total number of additions. By averaging the power spectrum obtained with this procedure, the power spectrum representing each section can be obtained.

Ex) Average Condition

No. of Measurement Samples	:	64 beats
Measurement Interval	:	2 min.
Divided Interval in One Section	:	1 min.
No. of Divisions in One Section	:	2
Displacement	:	1/4
Total Number of Additions	:	5



“Divided Interval in One Section” and “Total Number of Additions” are determined by the “Number of Measurement Samples,” “Measurement Interval,” and “Displacement” as shown in the following table.

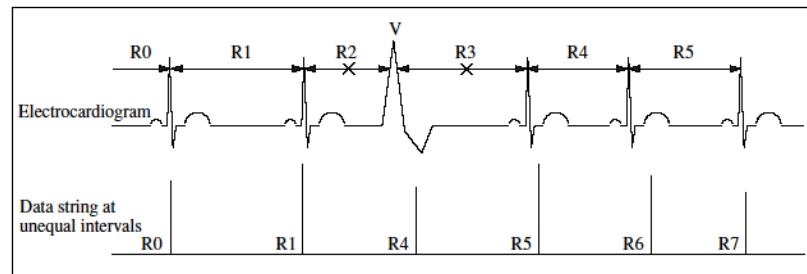
No. Of Measurement Samples	Measurement Interval (min.)	Maximum Measurement Duration (hr.)	Divided Interval in One Section (min.)	No. of Divisions in One Section	Displacement	Total Number of Additions
64	1	16	1	1	0	1
	2	24	1	2	1/4	5
	5	24	1		1/2	3
	10	24	1	10	1	2
	30	24	1		1/4	17
	60	24	1		1/2	9
	2	24	2		1	5
	5	24	2		1/4	37
	10	24	2		1/2	19
	30	24	2		1	10
128	60	24	1	30	1/4	117
	2	24	2		1/2	59
	5	24	2		1	30
	10	24	2		1/4	237
	30	24	2		1/2	119
	60	24	2		1	60
	2	24	5		0	1
	5	24	5		1/4	7
	10	24	5		1/2	4
	30	24	5		1	2
256	60	24	2	15	1/4	17
	5	24	2		1/2	9
	10	24	2		1	5
	30	24	2		1/4	57
	60	24	2		1/2	29
	2	24	5		1	15
	5	24	5		1/4	117
	10	24	5		1/2	59
	30	24	5		1	30
	60	24	5		0	1
512	5	24	10	1	1/4	5
	10	24	10	3	1/2	3
	30	24	10		1	2
	60	24	10		1/4	21
	2	24	5	6	1/2	11
	5	24	5		1	6
1024	10	24	15		1/4	45
	30	24	15		1/2	23
	60	24	15		1	12
	2	24	10		0	1
	5	24	10		1/4	9
	10	24	10		1/2	5

■ Details of Data Processing

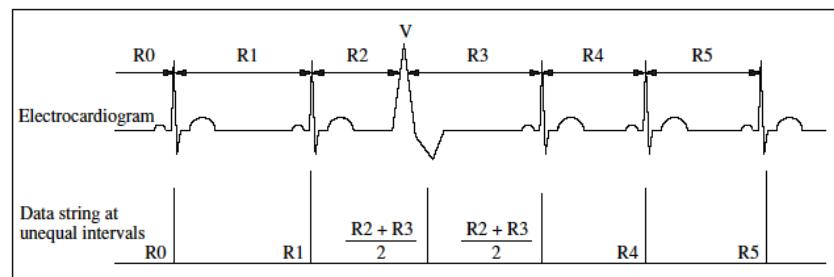
● Arrhythmia Processing Method

For RR spectrum measurement, it is preferable that beats other than N (normal beat) do not mix into the measurement range. But this is not possible in some cases. For such cases, there are three types of process that can be selected to perform on the non-normal beats.

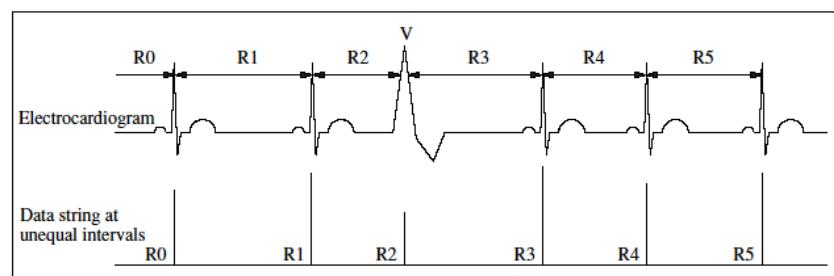
- Delete except N : Deletes the data before and after a non-normal beat, and adjusts the opened space. The data lacked by adjusting the opened space will be filled from the succeeding data to maintain constant number of data.



- Interpolate except N : Replaces the data before and after a non-normal beat with the arithmetic average of those data.



- OFF : No processing will be performed.



●Noise Reduction Method

[Specified-Length Removal]

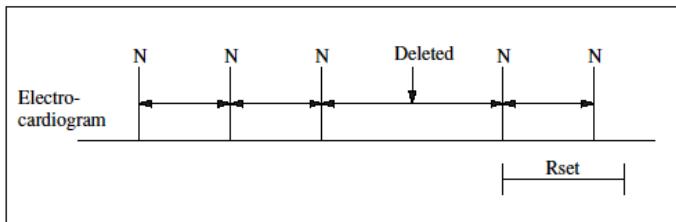
The “Specified-Length Removal” method removes the data, which is longer than the specified noise level (threshold) as noise beat. This method is suitable when the recording quality of ECG signal is relatively good, or when it is verified in advance that the noise has not interfered. On the other hand, this method cannot remove the noise data such as non-detected R-wave when heart rate is high and interpolated noise mis-detected as R-wave.

The following is the formula for this method.

$R_{set} \leq R_i$: will remove noise beat

$R_{set} > R_i$: will not remove noise beat

* R_{set} : noise level, R_i : each RR data



[Specified-Ratio Removal]

The “Specified-Ratio Removal” method removes the data, which has varied more than the specified noise level (threshold) as noise beat. By always observing the ratio to the weighed average value, it is able to pick up the sudden change and removes the noise beat, which cannot be removed with the “Specified-Length Removal” method. In addition, as the RR interval change caused by the sudden change of the heart rate will not be seen as a noise beat, it also observes the ratio to one previous beat. Therefore, this method is suitable when the variation range of the heart rate of 24 hours is large.

The formula for this method is shown as follows.

1) Ratio to weighted average [Rra]

- When $R_i \leq R_{av}$

$$Rra = (R_i \div R_{av}) \times 100 [\%]$$

- When $R_i > R_{av}$

$$Rra = (R_{av} \div R_i) \times 100 [\%]$$

- When $R_{set} \geq Rra$, the beat will be a candidate to be removed.

* R_{set} : noise level, R_i : RR interval of processing object beat, R_{av} : weighted average of RR interval

2) Ratio to previous beat [Rrb]

- When $R_i \leq R_{i-1}$

$$Rrb = (R_i \div R_{i-1}) \times 100 [\%]$$

- When $R_i > R_{i-1}$

$$Rrb = (R_{i-1} \div R_i) \times 100 [\%]$$

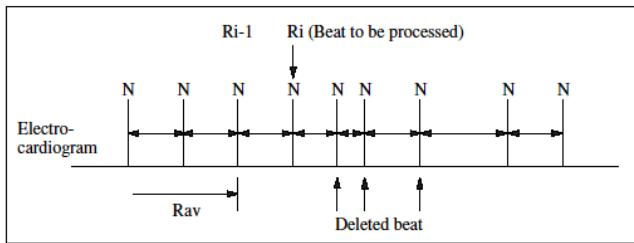
- When $R_{set} \geq Rrb$, the beat will be a candidate to be removed.

* R_{set} : noise level, R_i : RR interval of processing object beat, R_{i-1} : RR interval of one previous beat

3) Beat Removal Judgment Method

- When the beat is judged as a candidate to be removed for both 1) and 2), it will be removed.

- When the beat is not judged as a candidate to be removed for 1), 2), or both, it will not be removed.



Weighed Average Used for Noise Removal

To pick up sudden change of time-series RR data and remove it as noise beat, the “Specified-Ratio Removal” algorithm uses weighted average.

The weighted average is obtained with the following formula.

1) Weighed Ratio:

The effective data (R_i) whose noise is removed is added just before the data with 1:4 ratio to the weighted average (Rav'), and sequentially updates the weighted average (Rav).

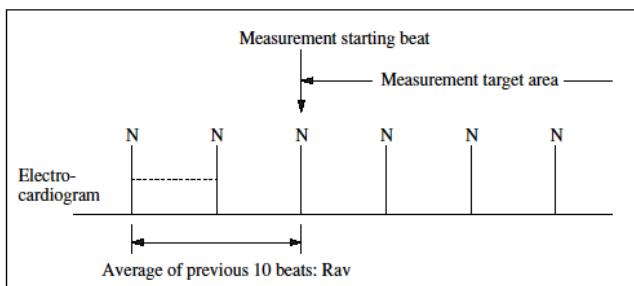
$$Rav = ((Rav' \times 4) + R_i) \div 5$$

* $i = 1, 2, 3, \dots$, number of measurements

The weighted average will be updated from the measurement starting beat (first effective beat).

2) Initial Value:

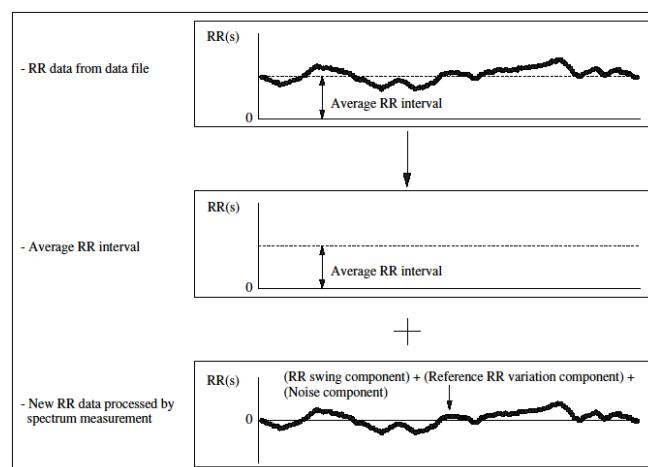
For the initial value of the weighted average, the average value of 10 beats before the measurement starting beats will be used. However, the beats judged as a candidate to be removed by formula 2) above or the beats judged to be other than normal beat (N) will not be used.



If 10 beats before the measurement starting beat cannot be acquired, the insufficient beats will be acquired from the data within the measurement object range. The condition for effective beat is the same as for the beat before the measurement starting beat.

●DC Component Removal

The RR interval fluctuates with reference to the RR interval determined by the heartbeat. Therefore, the power value of the reference RR interval (average RR interval) will be very large compared to the power value of the fluctuation component. As this may affect the frequency component near 0 at spectrum measurement, the frequency component near 0 by average RR interval can be removed.

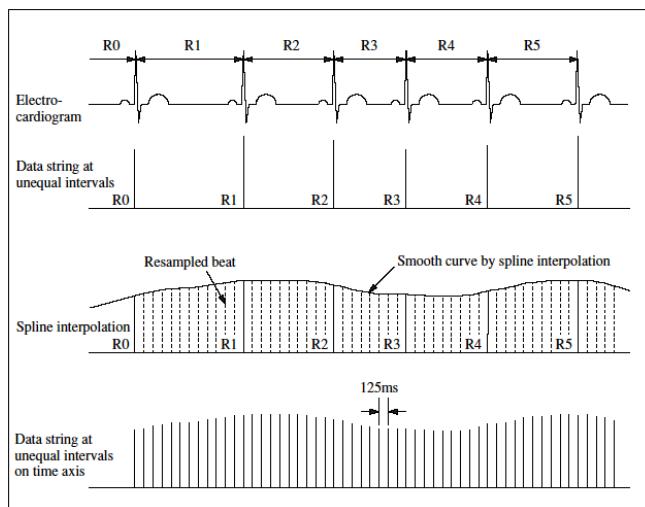


●Data Preprocessing Method

FFT and MEM use equal interval data string, which changes in the amplitude direction. However, RR interval of actual ECG is not an equal interval data. Therefore, unequal interval data string with a length of ECG RR interval in amplitude direction will be created and converted to equal interval data string to perform the measurement. There are two types of data preprocessing method to perform this: spline interpolation and non-processing.

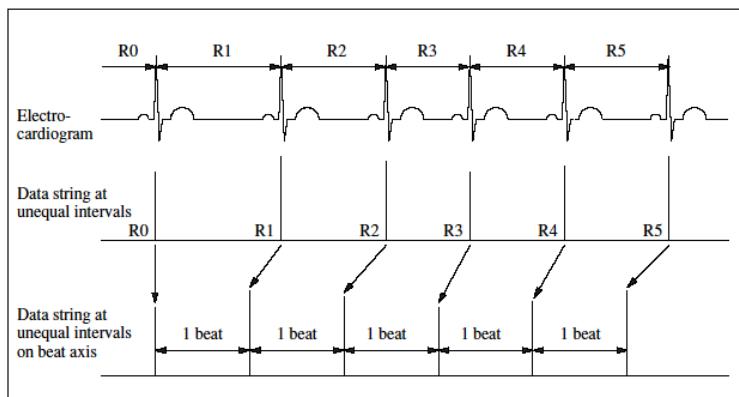
• Spline Interpolation:

An equal interval data string on time axis is created by connecting the peaks of unequal interval data string with smooth curve using third-order spline interpolation and by resampling at 125 ms interval. The time to acquire the number of samples set at measurement settings is fixed, and the number of acquiring beats changes depending on the heart rate. To reduce the distortion at both ends of the measurement section by spline interpolation, the smooth curve is obtained by 10 effective beats before and after the measurement section.



• Non-processing:

An equal interval data string on beat axis is created by simply arranging the unequal interval data at equal intervals. The number of beats for the measurement samples set under measurement settings is fixed, and acquiring time changes depending on the heart rate.



■Measurement Setting

Setup Item	Selections	Default Setting
Measurement Algorithm	FFT MEM	MEM
Measurement Samples	64 128 256 512 1024	256
Effective Samples	10 ~ 100	50
Added Samples	0 ~ 100	50
Arrhythmia Processing	Delete except N Interpolate except N OFF	Delete except N
Window Function	Square Window Hamming Window Hann Window	Hamming Window
Model Degrees	AIC (Akaike Method) Numeric Value	AIC (Akaike Method)
Model Degree Value (When “Numeric value” is selected for “Model degrees”)	0 ~ 999	40
Noise Reduction Method	Length Ratio OFF	Length
Noise Reduction Threshold	Length: 1 ~ 99 Ratio: 1 ~ 99	Length: 3 sec. Ratio: 70%
DC Component Removal	ON OFF	ON
Data Preprocessing (Spline Interpolation)	ON OFF	ON
LF Bandwidth	Upper: 0 ~ 0.5 c/b (Hz) Lower: 0 ~ 0.5 c/b (Hz)	Upper: 0.039 Hz Lower: 0.148 Hz
HF Bandwidth	Upper: 0 ~ 0.5 c/b (Hz) Lower: 0 ~ 0.5 c/b (Hz)	Upper: 0.148 Hz Lower: 0.398 Hz
Measurement Interval	1 2 5 10 30 60	5
Measurement Count	1 ~ 999	300
Averaging	OFF 1 1/2 1/4	1

Lorenz Plot

By performing Lorenz Plot measurement, the distribution of RR interval and arrhythmia can be visually checked.

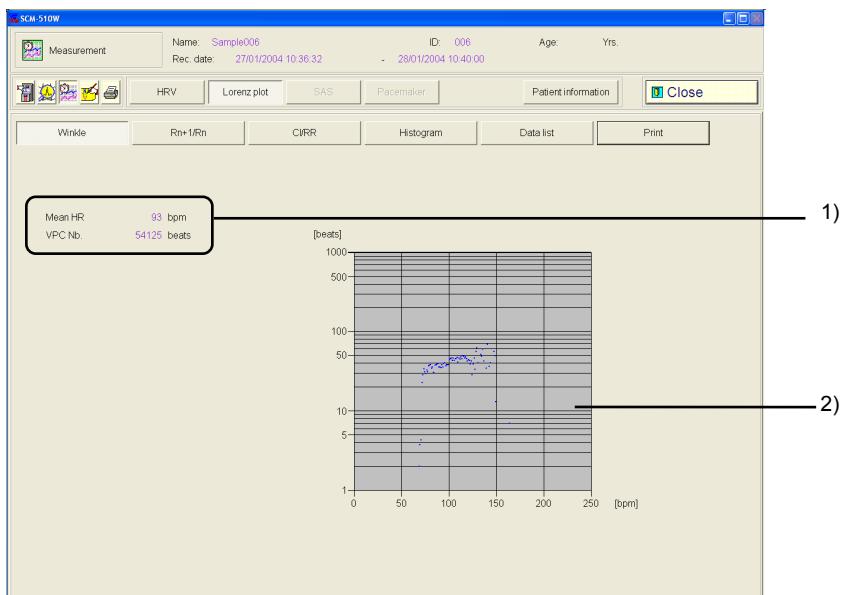
Click on the **Lorenz Plot** button or double-click the Lorenz Plot measurement results in the display area on the main measurement window to open the Lorenz Plot display.

First, open the “Winkle” window.

“N” used for Lorenz Plot is the heartbeat other than ventricular premature contraction (VPC).

■Winkle

Clicking the **Winkle** button on the “Lorenz plot” window will display the “Winkle” window. The ventricular premature contraction (VPC) distribution for the average heart rate of 1 minute will be displayed in single logarithmic plot.



1) Data Information

Displays the average heart rate and number of VPC.

2) Winkle Display

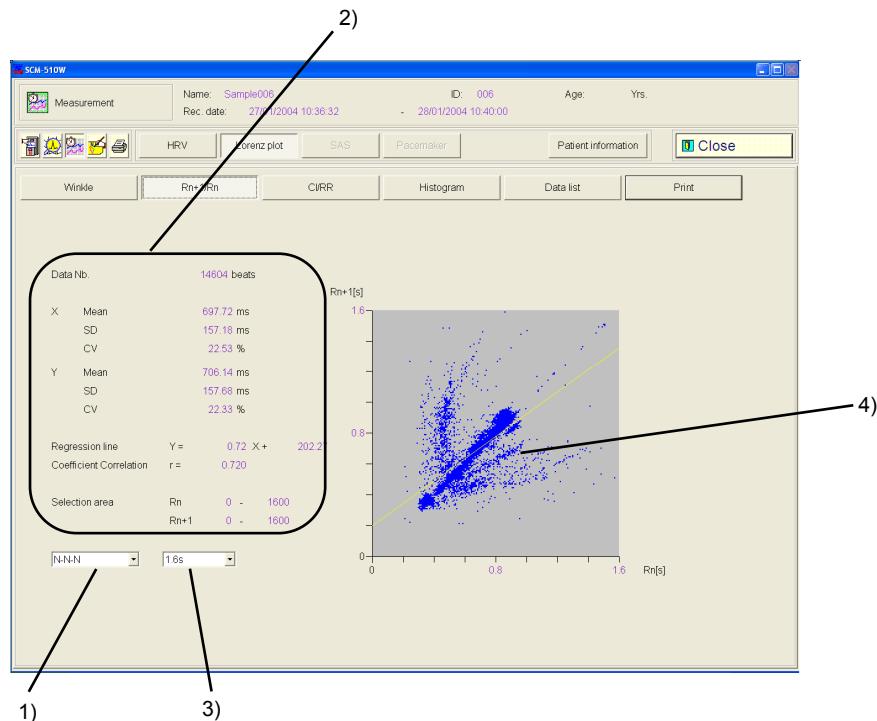
Displays the number of VPC for the average heart rate in single logarithmic plot.

The X-axis shows the average heart rate per minute and is displayed in 1 (beat/min.) step in the range of 0 ~ 250 (beat/min.). The Y-axis shows the number of VPC per minute for each heart rate.

Memo The weighed average value is used for the average heart rate.

■ R_{n+1}/R_n

Clicking the **Rn+1/Rn** button on the “Lorenz plot” window will display the “Rn+1/Rn” window. The time relationship between the first half of the instantaneous RR interval Rn [s] and the latter half of the instantaneous RR interval Rn+1 [s] of the continuous three-beat code pattern (e.g., N-N-N) will be plotted.



1) Beat Code Pattern Selection Drop-down Box

Select the beat code pattern for Rn+1/Rn display.

2) Data Information Display Area

Automatically calculates and displays the number of data and other data information for the selected range.

3) Scale Selection Drop-down Box

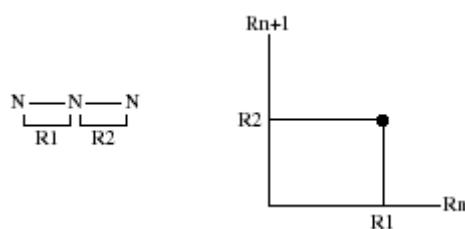
Select the scale for R_{n+1}/R_n display.

4) R_{n+1}/R_n Display Area

Plots the time relationship between the first half of the instantaneous RR interval Rn [s] and the latter half of the instantaneous RR interval Rn+1 [s] for the selected beat code pattern.

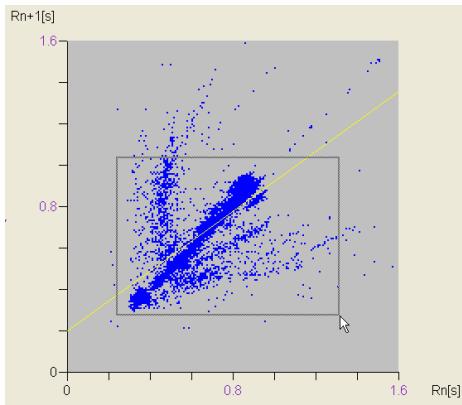
The X-axis displays the instantaneous RR interval Rn [s] for the first half of the selected beat code pattern, and Y-axis displays the instantaneous RR interval $Rn+1$ [s] for the latter half of the selected beat code pattern.

(Plot Example) Beat Code Pattern of N-N-N

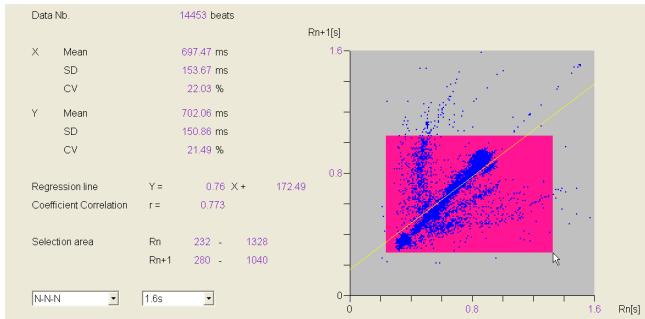


●Automatic Data Calculation for the Selected Data Range

Specifying the data range by dragging the Rn+1/Rn display part will automatically calculate the number of data present, average value, standard deviation, variation coefficient, regression line formula, coefficient correlation, and selection area. This information will be shown in the data information display area.



■ Drag and specify the data range to calculate.



■ After specifying the data range, releasing the mouse button will display the calculated result in the data information display area.

- Number of Data : Displays the number of data present in the selected data range.
- X Mean : Displays the average value of Rn data (X-axis) in the selected data range.
- SD : Displays the standard deviation of Rn data (X-axis) in the selected data range.
- CV : Displays the standard deviation of Rn data (X-axis) in the selected data range divided by average value.
- Y Mean : Displays the average value of Rn+1 data (Y-axis) in the selected data range.
- SD : Displays the standard deviation of Rn+1 data (Y-axis) in the selected data range.
- CV : Displays the standard deviation of Rn+1 data (Y-axis) in the selected data range divided by average value.

Regression Line

- ($Y=aX+b$) : The data of the selected range is expressed as one approximate line.
 If there is no data or only one data in the selected range, the regression line formula will not be calculated, and the regression line will not be displayed in the Rn+1/Rn display area.

Coefficient of Correlation :

The dispersion of the data in the selected range on the regression line is indicated. When “a (slope)” of regression line formula ($Y=aX+b$) is positive value (upward slope), and all data within the selected range are present on the regression line, the correlation coefficient will be $r = 1$. As the dispersion of the data in the selected range on the regression line increases, the correlation coefficient decreases. When “a (slope)” of regression line formula ($Y=aX+b$) is negative value (downward slope), and all data within the selected range are present on the regression line, the correlation coefficient will be $r = -1$. Therefore, the correlation coefficient varies in the range of $-1 \leq r \leq 1$.

Selection Area

- Rn : Displays Rn data (X-axis) of the selected data range.
- Rn+1 : Displays Rn+1 data (Y-axis) of the selected data range.

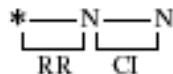


Memo When the data range is not selected, all data in the Rn+1/Rn display area will be used for the calculation. If there is no data in the selected range, average value, standard deviation, variation coefficient, regression line formula, and coefficient correlation will not be calculated, and each data display area will be left blank.

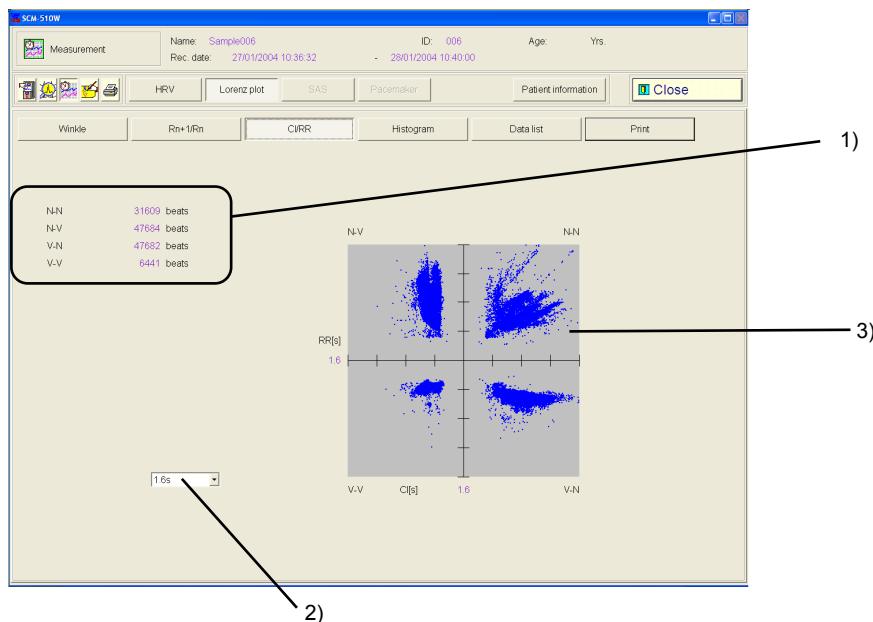
■ CI/RR

Clicking the **CI/RR** button on the “Lorenz plot” window will open the “CI/RR” window.

The relationship between CI (Coupling Interval) and the instantaneous RR interval for the continuous two-beat code pattern (e.g., N-N) will be plotted.



The time starting from one beat before the beat code pattern to the beat code pattern is the instantaneous RR interval, and the time between the beat code patterns is CI (Coupling Interval).



1) Data Information Display Area

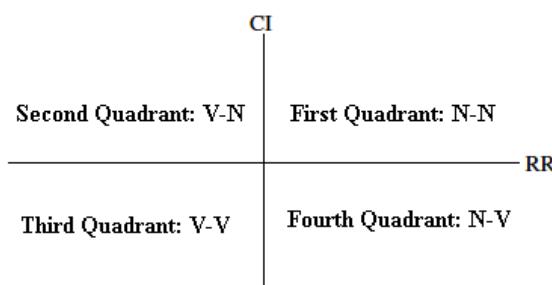
Displays the total number of beats for each beat code pattern.

2) Scale Selection Drop-down Box

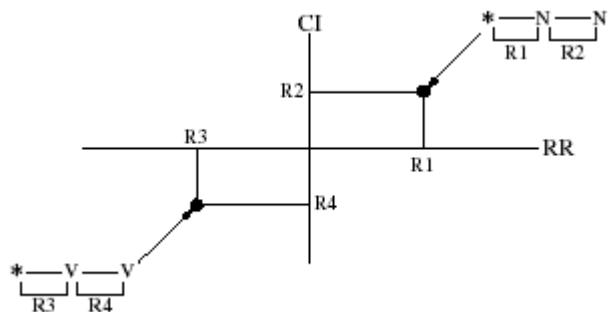
Select the scale for CI/RR display.

3) CI/RR Display Area

Plots the relationship between the instantaneous RR interval and CI (Coupling Interval) for each beat code pattern of N-N, V-N, N-V, and V-V.

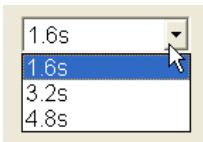


The X-axis shows the instantaneous RR interval, and Y-axis shows CI. Depending on the beat code pattern of the continuous two beats, the plotted quadrant will differ. The following shows a plot example.



● Scale Selection

The scale for CI/RR display can be changed simultaneously for X-axis and Y-axis.



- The scale can be selected from the drop-down box.

The selections are as follows.

- 1.6 s
- 3.2 s
- 4.8 s

CI/RR will be displayed with the selected scale.



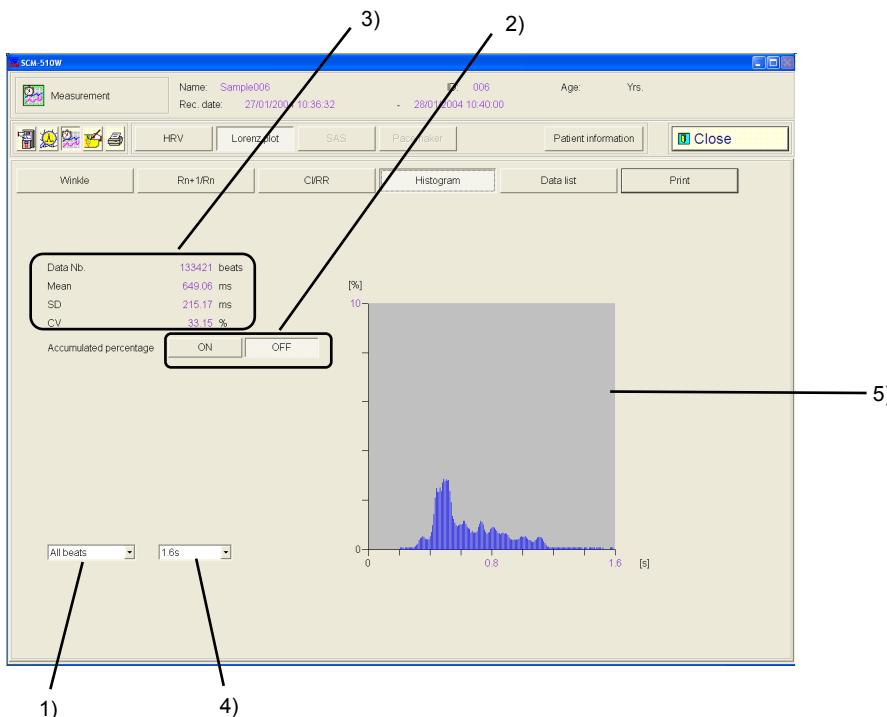
Memo ■ The unit of scale is “seconds.”

- When the scale is changed for the CI/RR display, the scale for the Rn+1/Rn display and the histogram display will be also changed.
- The default setting is “1.6 s.”

■Histogram

Clicking the **Histogram** button on the “Lorenz plot” window will display the “Histogram” window.

The occurrence frequency of the continuous two-beat code pattern for instantaneous RR interval will be displayed in the histogram.



1) Beat Code Pattern Selection Drop-down Box

Select the beat code pattern to display the histogram.

2) Accumulated Percentage

Select whether or not to display the accumulated percentage overlapped to the histogram.

3) Data Information Display Area

Displays the number of data, average value, standard deviation, and variation coefficient of the displayed histogram.

Memo The variation coefficient is standard deviation for all data divided by average value and displayed in percentage (%).

4) Scale Selection Drop-down Box

Select the scale for the histogram display.

5) Histogram Display Area

Displays the selected beat code pattern in the histogram. The X-axis shows the instantaneous RR interval and Y-axis shows the beat code pattern occurrence frequency for each instantaneous RR interval displayed in percentage. When “Accumulated percentage” is set to ON, the percentage will be displayed overlapped to the histogram.

●Beat Code Pattern Selection

Select the beat code pattern to display the histogram.



- Select the beat code pattern from the drop-down box.

The selections are as follows.

All beats

N-N

N-V

V-N

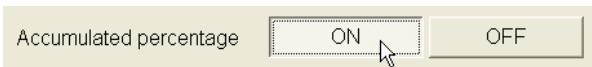
V-V

The histogram of the selected beat code pattern will be displayed.

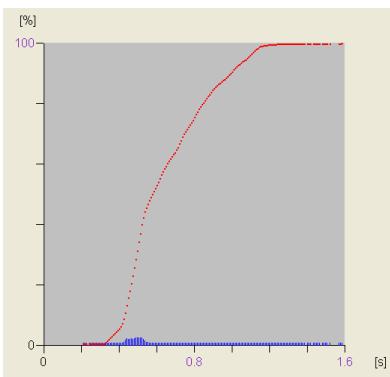
 **Memo** When “All beats” is selected, the histogram for all beats will be displayed regardless of the beat code pattern.

●Accumulated Percentage

Whether or not to display the accumulated percentage on the histogram can be selected.



- Click **ON** or **OFF** for “Accumulated percentage.”

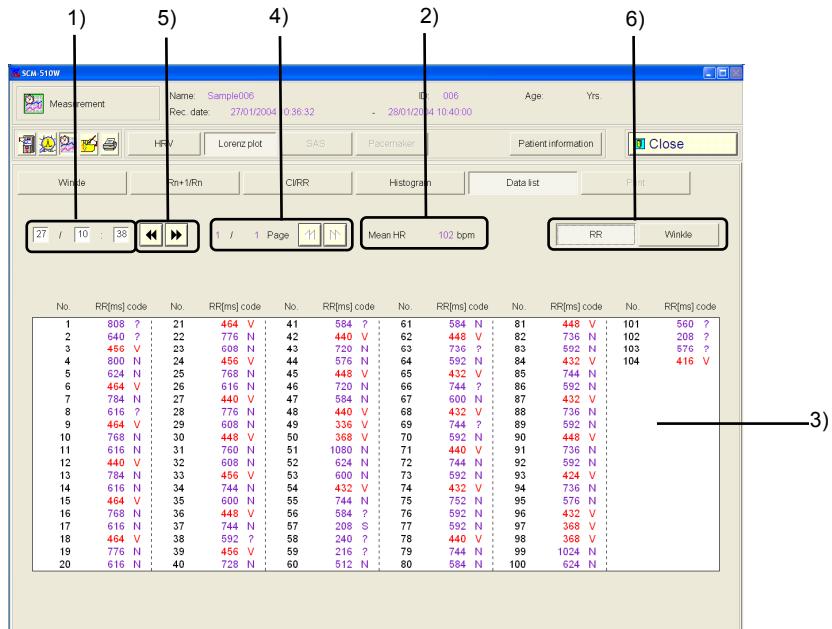


The accumulated percentage can be also plotted overlapped to the histogram. This will allow to check the instantaneous RR interval data for the selected beat code pattern in accumulated percentage distribution.

 **Memo** When only histogram is displayed, maximum scale of Y-axis is automatically calculated from the maximum value of the histogram. But if accumulated percentage is also displayed, maximum scale of Y-axis is fixed to 100%. Therefore, the histogram will be displayed small.

■Data List

Clicking the [Data list] button on the “Lorenz plot” window will display the “Data list” window. RR data for the selected time duration will be displayed in list format.



1) Data Time

Enter the time to display the list.

2) Mean HR

Displays the mean heart rate for the displayed data list.

Memo The weighted average value is used for the mean heart rate.

3) Data List Display Area

Displays RR data for the specified time in list format.

4) Page Switch Arrow

Switches the page if there is more than one page of data list.

5) Time Change Arrow

Switches the displayed data list by 1 minute.

Memo For Winkle display, “data time,” “mean HR,” and “time change arrow” will not be displayed.

6) Display Selection

Switches the data display between [RR] and [Winkle].

●RR Display

One-minute RR data of the specified time will be displayed in list format.

No.	RR[msec] code										
1	808 ?	21	464 V	41	584 ?	61	584 N	81	448 V	101	560 ?
2	640 ?	22	776 N	42	440 V	62	448 V	82	736 N	102	208 ?
3	456 N	23	464 ?	43	720 N	63	736 ?	83	560 ?	103	576 ?
4	800 N	24	456 V	44	576 N	64	584 ?	84	432 V	104	416 V
5	624 N	25	768 N	45	448 V	65	432 V	85	744 N		
6	464 V	26	616 N	46	720 N	66	744 ?	86	592 N		
7	784 N	27	440 V	47	584 N	67	600 N	87	432 V		
8	616 ?	28	776 N	48	440 V	68	432 V	88	736 N		
9	464 V	29	608 N	49	336 V	69	744 ?	89	592 N		
10	768 N	30	440 V	50	368 N	70	592 N	90	448 V		
11	616 N	31	760 N	51	1000 N	71	440 N	91	736 N		
12	440 V	32	608 N	52	624 N	72	744 N	92	592 N		
13	784 N	33	456 V	53	600 N	73	592 N	93	424 V		
14	616 N	34	744 N	54	432 V	74	432 V	94	736 N		
15	464 V	35	600 N	55	744 N	75	752 N	95	576 N		
16	768 N	36	448 V	56	584 ?	76	592 N	96	432 V		
17	616 ?	37	744 N	57	200 S	77	592 N	97	368 V		
18	464 V	38	592 ?	58	240 S	78	440 N	98	368 V		
19	776 N	39	456 V	59	216 ?	79	744 N	99	1024 N		
20	616 N	40	728 N	60	512 N	80	584 N	100	624 N		

One-beat data is displayed as follows.

(Data No.) – (RR interval) – (Beat Judgment Code)

The beat judgment code is classified as follows.

- N : Normal Heartbeat
- V : Ventricular Premature Contraction
- S : Supraventricular Premature Contraction
- P : Pacemaker Beat
- F : Fusion Beat
- ? : Other Heartbeat
- X : User-defined Heartbeat

 **Memo** The data judged as "V (Ventricular Premature Contraction)" will be displayed in red.

●Winkle Display

One-minute heart rate and number of VPC will be displayed in list format.

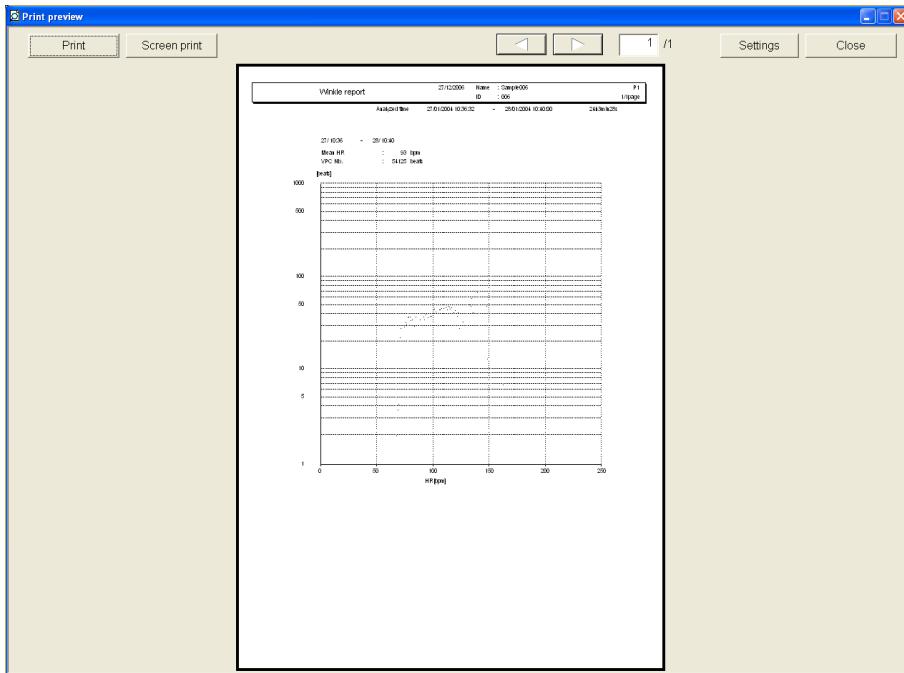
	HR [bpm]	VPC Nb.	HR [bpm]	VPC Nb.	HR [bpm]	VPC Nb.	HR [bpm]	VPC Nb.	HR [bpm]	VPC Nb.	HR [bpm]			
27/20.36	82	0;	90	45;	81	40;	72	0;	81	41;	79	40		
	83	0;	91	44;	79	8;	73	0;	79	21;	79	40		
	81	1;	96	33;	75	12;	73	0;	78	32;	79	39		
	83	4;	95	45;	81	37;	74	1;	80	39;	79	46		
27/20.40	92	2;	27/21.00	88	43;	27/21.20	70	27/21.40	74	2;	27/22.00	78	17;	
	96	38;	84	46;	81	22;	75	1;	80	40;	80	40		
	84	5;	90	37;	81	22;	75	1;	82	41;	80	40		
	91	35;	94	48;	75	1;	73	0;	82	41;	80	40		
	88	26;	84	41;	74	2;	75	0;	82	38;	80	40		
	88	28;	91	46;	77	3;	77	0;	81	40;	80	40		
	93	41;	88	44;	74	0;	76	2;	79	39;	79	36		
	87	27;	82	17;	75	0;	76	0;	79	39;	82	41		
	92	33;	82	33;	75	2;	77	11;	80	39;	81	40		
	89	33;	80	10;	75	0;	83	39;	79	40;	79	39		
27/20.50	91	31;	27/21.10	76	11;	27/21.30	75	0;	27/21.50	78	3;	27/22.10	80	40;
	85	27;	81	41;	75	5;	77	7;	80	37;	79	39		
	88	43;	81	20;	77	5;	80	40;	80	40;	80	40		
	101	44;	77	4;	72	2;	81	40;	80	40;	84	43		
	107	48;	80	11;	74	1;	81	25;	80	41;	81	41		
	95	45;	79	18;	72	1;	76	20;	79	39;	79	39		

■Print

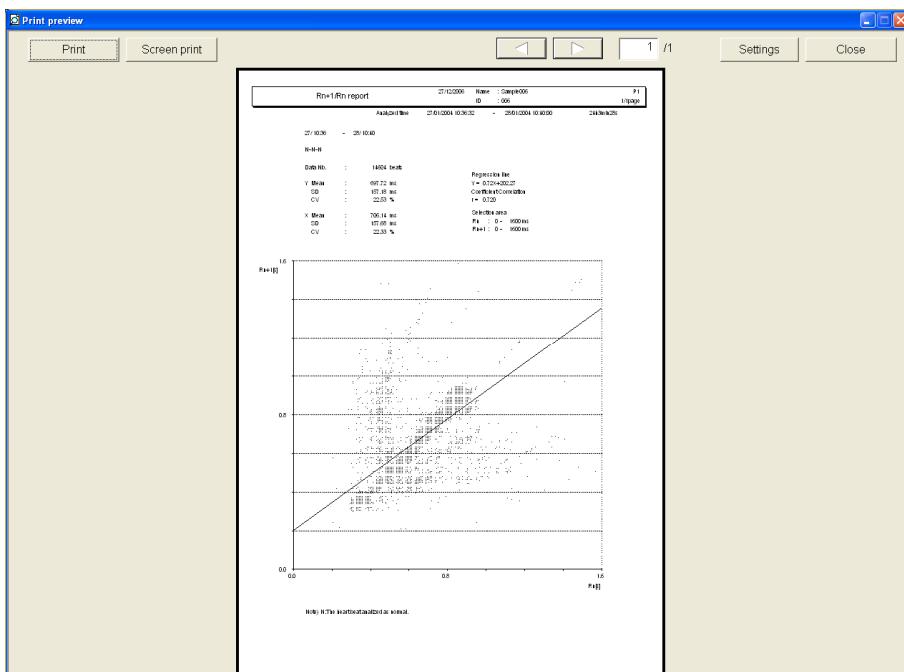
Clicking the **Print** button on each of the “Winkle,” “Rn+1/Rn,” “CI/RR,” and “Histogram” window will display the print preview. By clicking the **Print** button on this preview screen, the data will be output to the printer.

On the “Data list” window, the **Print** button will be masked.

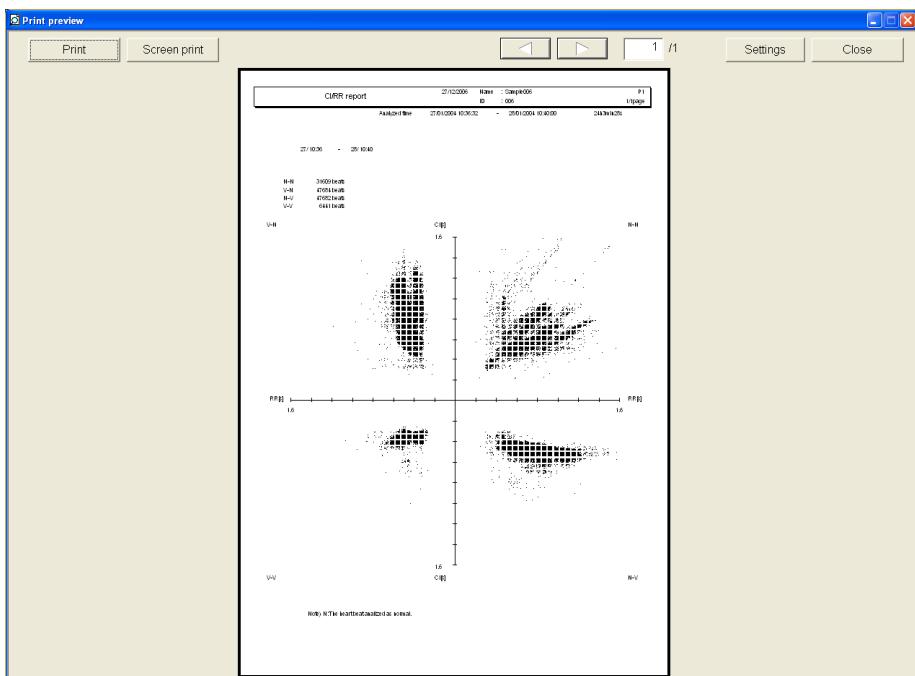
●Winkle Report



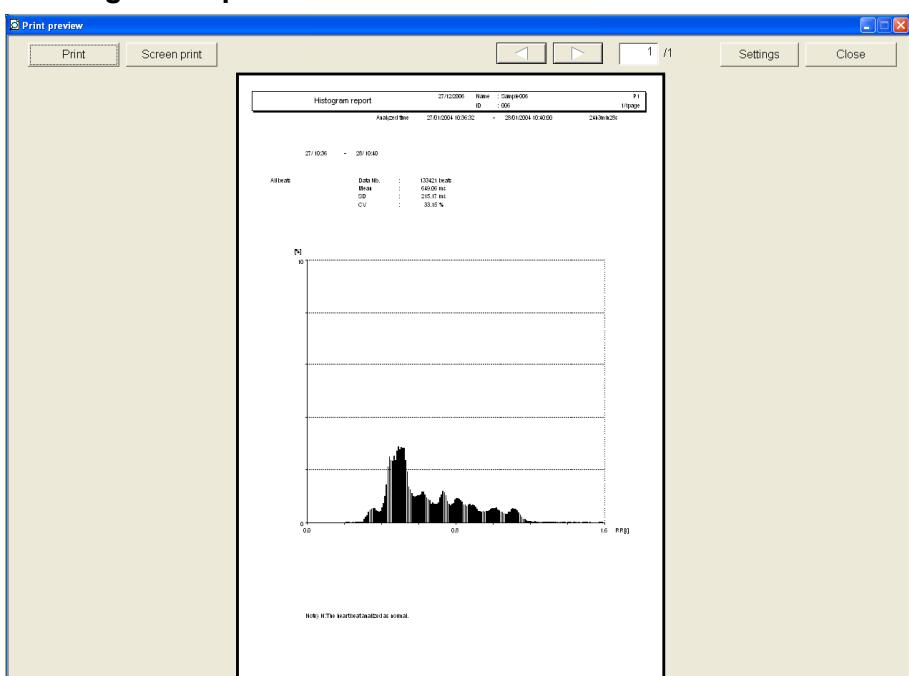
●Rn+1/Rn Report



●CI/RR Report



●Histogram Report



SAS Measurement

By performing SAS measurement, the Sleep Apnea Syndrome screening test can be performed using the respiration data recorded on the LS-300.

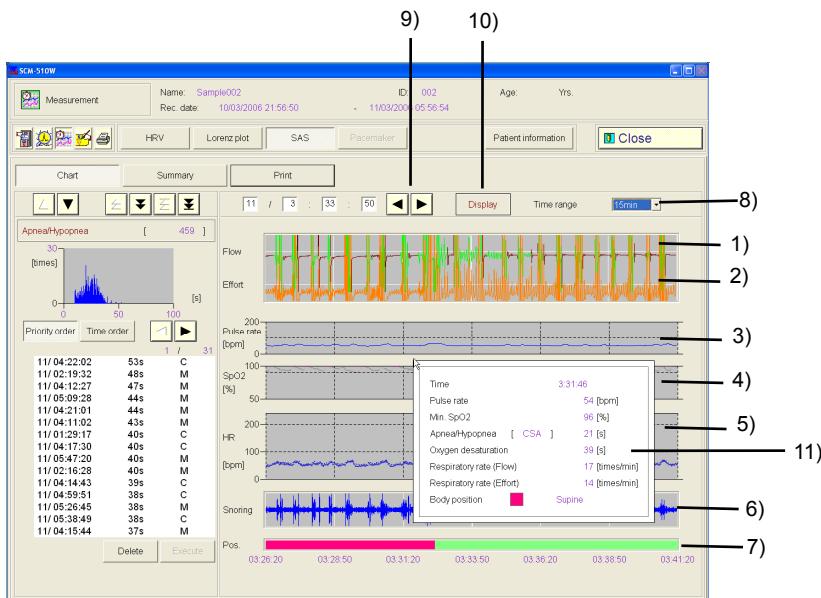
Click the **SAS** button or double-click the SAS measurement result area on the main measurement window to display the “SAS measurement” window.

First, open the “Data Chart” window.

■ Data Chart

Clicking the **Chart** button on the “SAS measurement” window will display the “Data Chart” window.

On the “Data Chart” window, all recorded data including the waveform data can be viewed.



1) Flow

Displays the respiratory waveform (flow) or respiratory rate (flow) trend.

2) Effort

Displays the respiratory waveform (effort).

3) Pulse Rate

Displays the pulse rate trend.

4) SpO₂ Trend

Displays the SpO₂ trend.

5) ECG

Displays the ECG waveform or instantaneous HR trend.

6) Snoring

Displays the tracheal sound waveform.

7) Body Position

Displays the body position of each time in different colors.

8) Time Range Selection Drop-down Box

Select the displaying time range.

9) Page Switch Arrow

Switches the page to the previous or next page.

10) **Display** Button

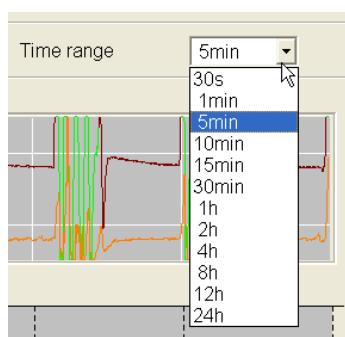
Changes the size/scale and polarity of the waveform.

11) Detailed Information Window

Displays a detailed information window of that time by right-clicking on the list data or on the trend display area.

■ Time Range Selection

The time range to display on one screen can be selected.



- Select the time range from the drop-down box.
The selections are as follows.

30 s
1 min
5 min
10 min
15 min
30 min
1 h
2 h
4 h
8 h
12 h
24 h

The data will be displayed with the selected time range.

Depending on the time range, the displayed items will differ for some parameters.
The following table shows the displayed items for each parameter according to the time range.

	30 minutes or less	1 hour or more
Flow	Respiratory Waveform (Flow)	RR (Flow) trend of 1 minute
Effort	Respiratory Waveform (Effort)	RR (Effort) trend of 1 minute
Snoring	Tracheal Sound Waveform	Tracheal Sound Waveform
ECG	ECG Waveform (5 min or less)	HR Trend (10 min. or more)
Pulse Rate	Instantaneous Pulse Rate Trend	Average Pulse Rate of 1 minute
SpO ₂	Instantaneous SpO ₂ Trend	Minimum SpO ₂ trend of 1 minute
Body Position	Color display of body position	Color display of body position

For Flow, Effort, and ECG, waveform or trend will be displayed depending on the time range.
If the time range is 30 sec or 1 min, the recognition point of Flow and Effort will be displayed with “▲” mark.

 **Memo** If the displaying time range is set to 1 hour or more, only the Flow trend will be displayed in the respiratory waveform display area.

■Editing the Respiration Data

The respiration recognition point can be moved, added, or deleted if any error is found.

●Editing Type

The following five types of procedure for editing the respiration data are.

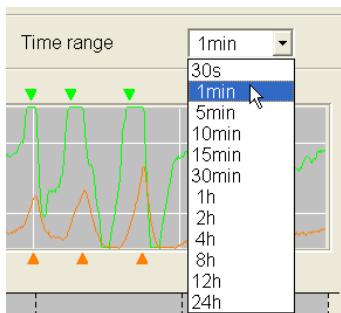
- Moving the Respiration Recognition Point
The respiration recognition point can be moved when it is incorrect.
- Adding a Respiration Recognition Point
A respiration recognition point can be added when it is missing.
- Deleting a Respiration Recognition Point.
A respiration recognition point can be deleted when incorrect point is present.
- Adding an Apnea Event (Flow/Effort)
Apnea event can be added for the range where the apnea detection is missing.
- Deleting Data by Section
Incorrect data for the section where the sensor is detached can be deleted.

●Moving the Respiration Recognition Point

The respiration recognition point can be moved only when the trend display time range is set to 30 seconds or 1 minute.

- 1) Select “30s” or “1min” from the “Time Range” drop-down box.

The display will change to the selected time range, and “▼” marks indicating the respiration recognition points will be displayed on the Flow and Effort waveforms.

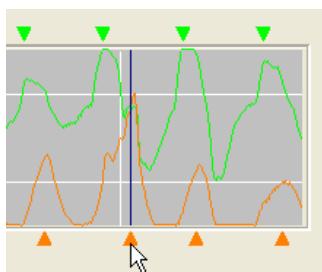


- 2) Click the page switch arrow to display the waveform to where you wish to move the respiration recognition point.

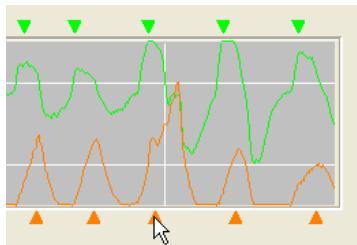


- 3) Drag the “▼” mark on the Flow or Effort waveform to the left or right.

Memo You cannot move the “▼” mark to the point where the time difference between the previous or next “▼” mark is equal to or less than 1 second.



- 4) Release the mouse button on the point where you wish to move the “▼” mark. The respiration recognition point will be changed to the new position, and the associated apnea/hypopnea event information will be automatically updated.



●Adding a Respiration Recognition Point

The respiration recognition point can be added only when the trend display time range is set to 30 seconds or 1 minute.

- 1) Select “30s” or “1min” from the “Time Range” drop-down box.

The display will change to the selected time range, and “▼” marks indicating the respiration recognition points will be displayed on the Flow and Effort waveforms.



- 2) Click the page switch arrow to display the waveform to where you wish to add a respiration recognition point.



- 3) On the Flow waveform or Effort waveform, click the point where you wish to add the respiration recognition point. On the displayed pop-up menu, click “Add resp.”

The respiration recognition point cannot be added to a point where the time difference between the next or previous recognition points is equal to or less than 1 second. In such case, the pop-up menu will not be displayed.



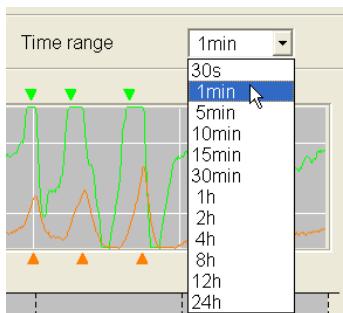
- 4) The respiration recognition point will be added to the selected point, and the associated apnea/hypopnea event information will be automatically updated.

● Deleting a Respiration Recognition Point

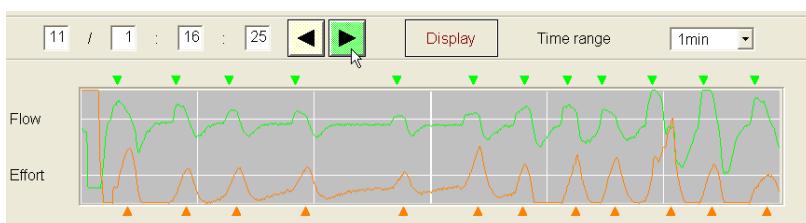
The respiration recognition point can be deleted only when the trend display time range is set to 30 seconds or 1 minute.

- 1) Select “30s” or “1min” from the “Time Range” drop-down box.

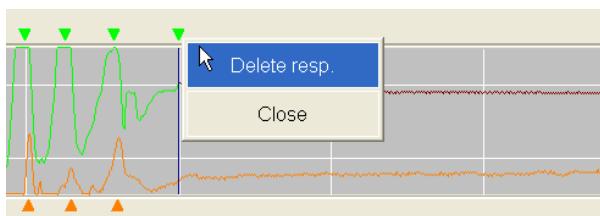
The display will change to the selected time range, and “▼” marks indicating the respiration recognition points will be displayed on the Flow and Effort waveforms.



- 2) Click the page switch arrow to display the waveform from where you wish to delete the respiration recognition point.



- 3) On the Flow waveform or Effort waveform, click the point where you wish to delete the respiration recognition point. On the displayed pop-up menu, click “Delete resp.”



- 4) The selected respiration recognition point will be deleted, and the associated apnea/hypopnea event information will be automatically updated.

●Adding an Apnea/Hypopnea Event (Flow/Effort)

Apnea/hypopnea event can be added for the specified time range.

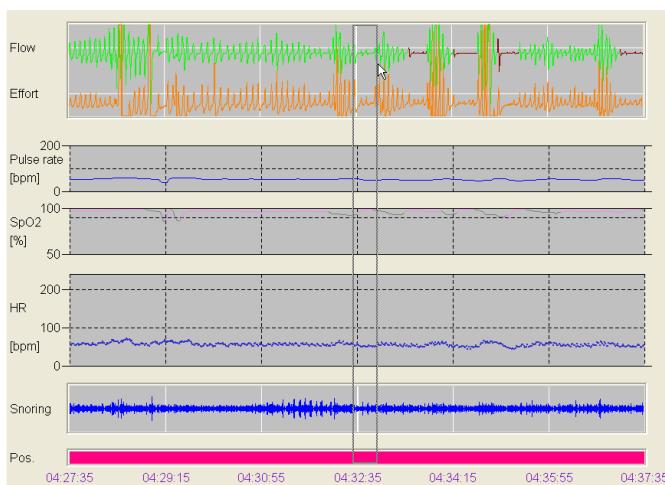
- 1) Select “5min” or more from the “Time Range” drop-down box.



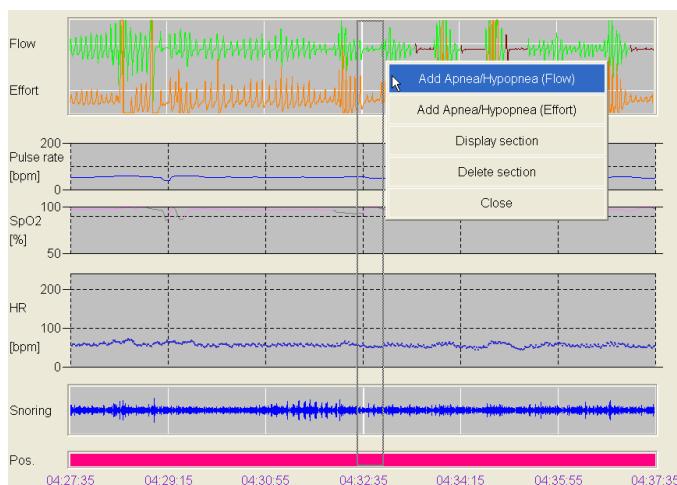
- 2) Click the page switch arrow to display the waveform to where you wish to add an apnea event.



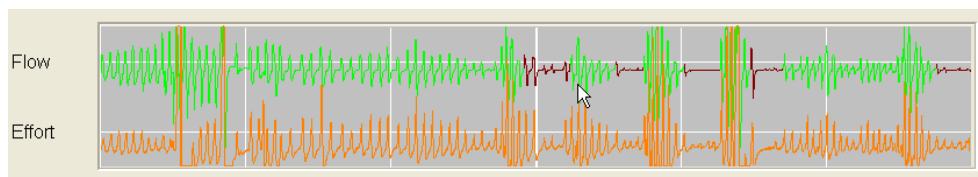
- 3) Drag the area where you wish to add the apnea/hypopnea event. The dragged area will be surrounded with a frame.



- 4) Select “Add Apnea/Hypopnea (Flow)” or “Add Apnea/Hypopnea (Effort)” from the pop-up menu.



- 5) The respiration recognition point for the selected area will be deleted and apnea/hypopnea event will be added.

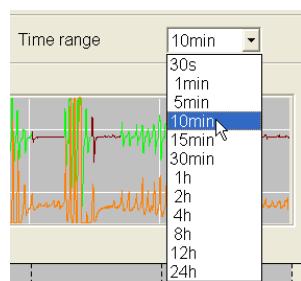


● Deleting Data by Section

The data of a specified section can be deleted. This process will also delete the following information.

- Respiration Recognition Point of Flow Waveform
- Respiration Recognition Point of Effort Waveform
- Pulse Rate
- SpO₂ Value
- Body Position
- Apnea/Hypopnea Event
- Oxygen Desaturation Event

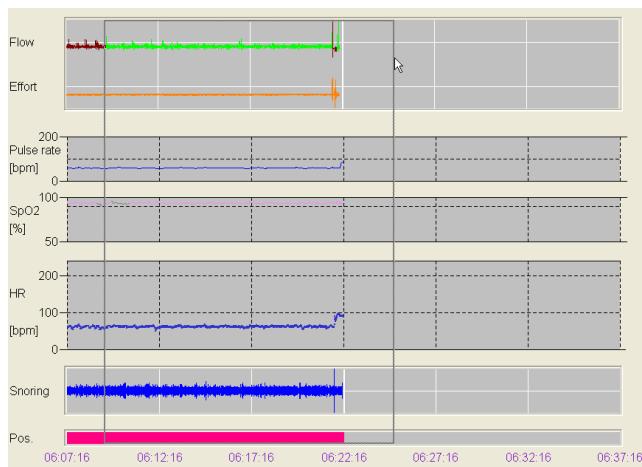
- 1) Select “5min” or “30min” from the “Time Range” drop-down box.



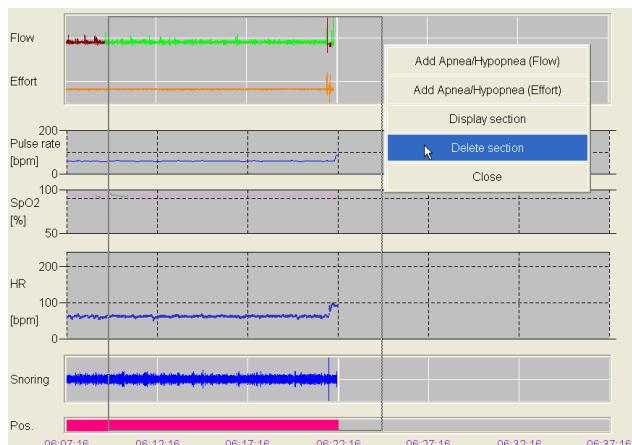
2) Click the page switch arrow to display the waveform from where you wish to delete the data.



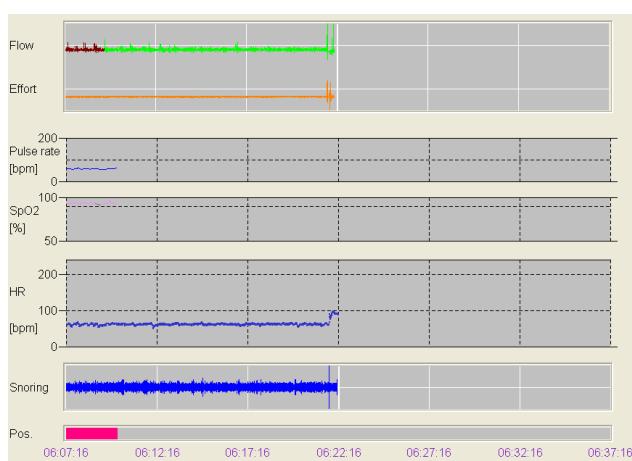
3) Drag the area where you wish to delete the data. The dragged area will be surrounded with a frame.



4) Click "Delete section" on the displayed pop-up menu.



5) The data of the selected section will be deleted.



■Summary

Clicking the **Summary** button on the “SAS measurement” window will display the “Summary” window.

On the “Summary” window, the following information will be displayed for the section displayed on the “Chart” window or for a specified section.

●Histogram

Displays the occurrence frequency of apnea/hypopnea and oxygen desaturation for the specified time.

●Respiration Event Distribution Graph

Displays the relationship between the occurrence frequency of apnea/hypopnea and the oxygen desaturation event to respiration event (apnea/hypopnea, oxygen desaturation) duration.

●% SpO₂ Distribution Graph

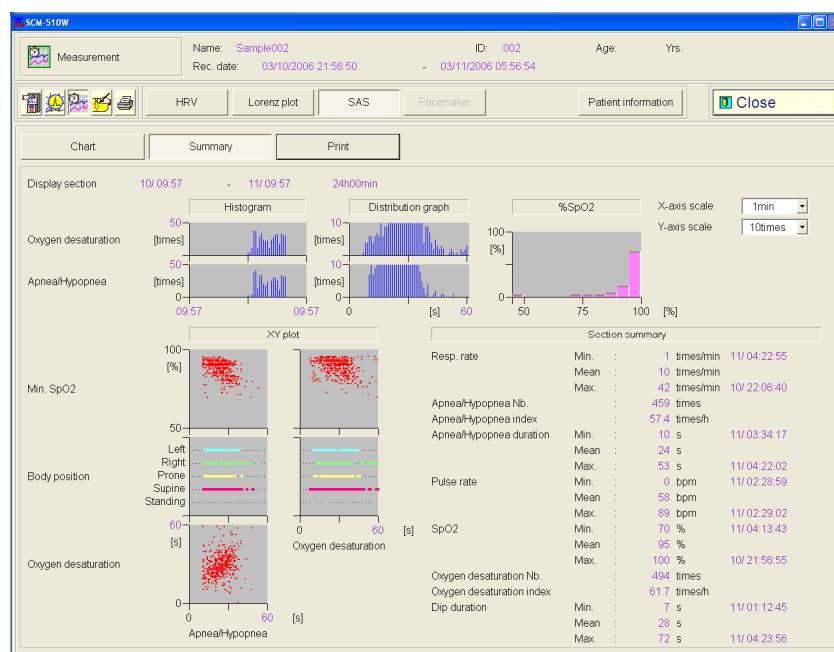
Displays the occurrence percentage (%) of SpO₂.

●X-Y Plot

Displays the relationship of apnea/hypopnea duration, dip duration, minimum SpO₂, and body position by X-Y plot.

●Section Summary

Displays the summary of the apnea/hypopnea events or oxygen desaturation events.

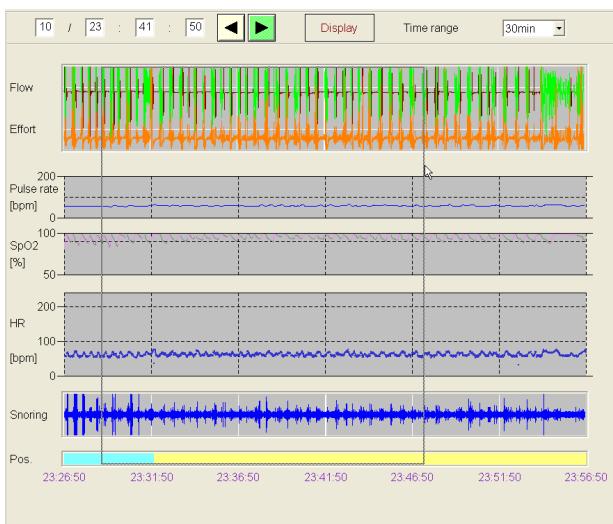


■Specifying a Section

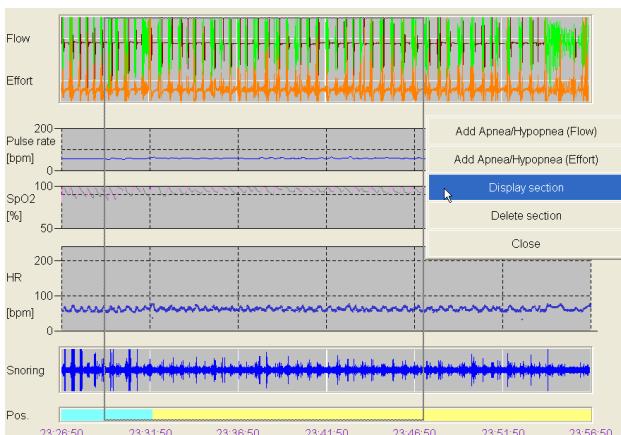
On the “Summary” window, normally, the section information for the range displayed on the “Chart” window will be displayed. But, it is also possible to narrow the range of the summary by dragging the display area on the “Chart” window.

●Specifying a Section on “Chart” Window

- 1) Use the page switch arrow to display the waveform where you wish to specify a section.
By setting a long time range, it will make it easier to specify a section.



- 2) Drag the area where you wish to display the section information. The dragged area will be surrounded with a frame.



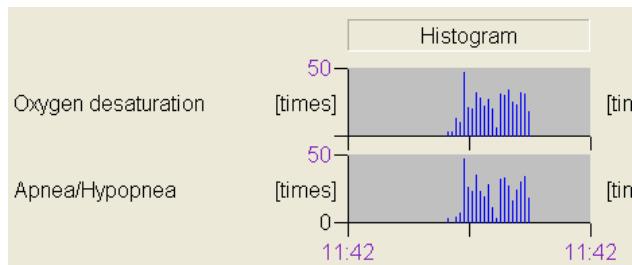
- 3) On the displayed pop-up menu, click “Display section.” The section information will be displayed. The area can be dragged by one-minute interval. The area from the dragging start point to the end point will be the selected section.



- Be cautious not to select “Delete section” on the pop-up menu as it will delete the data for the section.
■As the section is selectable by one-minute interval, it cannot be selected if the time range is set to “30s” or “1min”.

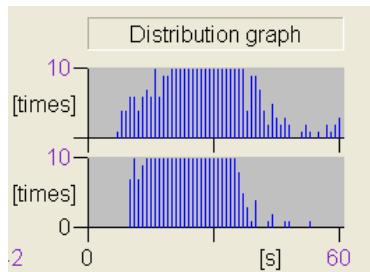
■ Histogram

The histogram shows the time on the X-axis, and occurrence frequency of apnea/hypopnea and oxygen desaturation event on the Y-axis. The occurrence frequency of each event for the selected section can be verified.



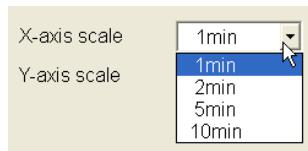
■ Respiration Event Distribution Graph

The respiration event distribution graph shows the duration of apnea/hypopnea and oxygen desaturation event on the X-axis, and their occurrence frequency on the Y-axis. The occurrence frequency by duration of each event can be verified.



● X-axis Scale Selection

The maximum scale for the X-axis can be selected.



■ Select the maximum scale for the X-axis from the drop-down box.

The selections are as follows.

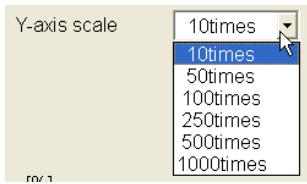
- 1 min
- 2 min
- 5 min
- 10 min

The distribution graph of apnea/hypopnea event and oxygen desaturation event will be displayed with the selected scale.

Memo The distribution above the maximum scale will be displayed collectively on the right side of the distribution graph.

●Y-axis Scale Selection

The maximum scale for the Y-axis can be selected.



■ Select the maximum scale for the Y-axis from the drop-down box.

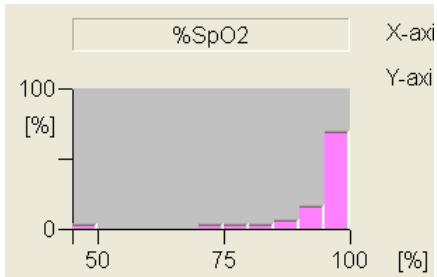
The selections are as follows.

- 10 times
- 50 times
- 100 times
- 250 times
- 500 times
- 1000 times

The distribution graph of apnea/hypopnea event and oxygen desaturation event will be displayed with the selected scale.

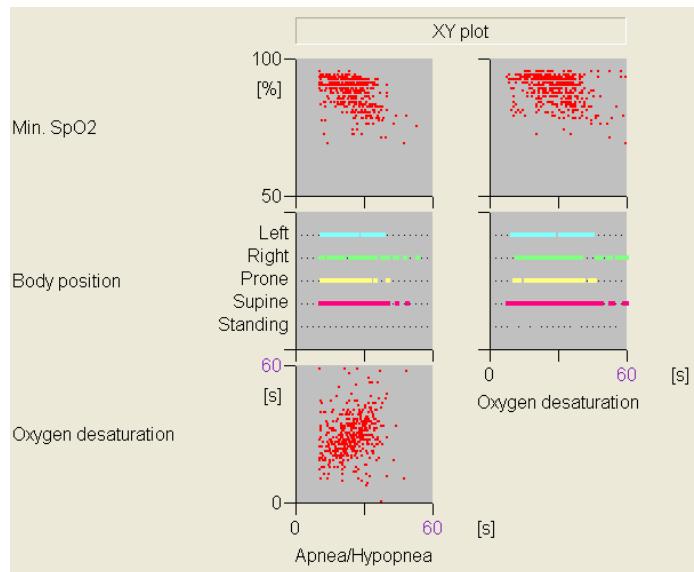
■%SpO₂ Distribution Graph

The %SpO₂ distribution graph shows SpO₂ value on the X-axis, and occurrence percentage of each SpO₂ value on the Y-axis. On the X-axis, the SpO₂ value from 50% to 100% are divided into 10 parts, and the SpO₂ value below 50% will be collectively displayed on the left side of the distribution graph.



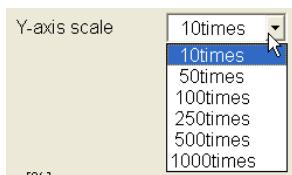
■ X-Y Plot

The X-Y plot shows apnea/hypopnea duration, oxygen desaturation duration on the X-axis, and minimum SpO₂ value, body position, and oxygen desaturation duration on the Y-axis. The correlation between the parameters can be verified.



● X-axis Scale Selection

The maximum scale of the X-axis can be selected.



- Select the X-axis scale from the drop-down box.

The selections are as follows.

- 1 min
- 2 min
- 5 min
- 10 min

The X-Y plot will be displayed with the selected scale.

■Section Summary

On the “Section summary” window, respiration and SpO₂ information will be displayed.

Section summary			
Resp. rate	Min. :	1 times/min	11/04:22:55
	Mean :	10 times/min	
	Max. :	42 times/min	10/22:06:40
Apnea/Hypopnea Nb.	:	459 times	
Apnea/Hypopnea index	:	57.4 times/h	
Apnea/Hypopnea duration	Min. :	10 s	11/03:34:17
	Mean :	24 s	
	Max. :	53 s	11/04:22:02
Pulse rate	Min. :	0 bpm	11/02:28:59
	Mean :	58 bpm	
	Max. :	89 bpm	11/02:29:02
SpO ₂	Min. :	70 %	11/04:13:43
	Mean :	95 %	
	Max. :	100 %	10/21:56:55
Oxygen desaturation Nb.	:	494 times	
Oxygen desaturation index	:	61.7 times/h	
Dip duration	Min. :	7 s	11/01:12:45
	Mean :	28 s	
	Max. :	72 s	11/04:23:56

●The displayed Items for the Section Summary

【Respiration Information】

• Respiration Rate (Min, Mean, Max)

Displays the minimum, mean, and maximum respiration rates per minute for the selected section. The minimum and maximum rates are obtained from the instantaneous respiration interval. The time of occurrence will be also displayed.

• Apnea/Hypopnea Nb.

Displays the number of apnea/hypopnea events occurred for the selected section.

• Apnea/Hypopnea Index

Displays the number of apnea/hypopnea occurrence per hour for the selected section.

• Apnea/Hypopnea Duration (Min, Mean, Max)

Displays the minimum, mean, and maximum durations of apnea/hypopnea occurred in the selected section will be displayed. For the minimum and maximum durations, the time of occurrence will be also displayed.

【SpO₂ Information】

• Pulse Rate (Min, Mean, Max)

Displays the minimum, mean, and maximum pulse rates for the selected section. For the minimum and maximum pulse rates, the time of occurrence will be also displayed.

• SpO₂ (Min, Mean, Max)

Displays the minimum, mean, and maximum SpO₂ values for the selected section. For the minimum and maximum values, the time of occurrence will be also displayed.

• Oxygen Desaturation Nb.

Displays the number of oxygen desaturation occurred for the selected section.

• Oxygen Desaturation Index

Displays the number of oxygen desaturation occurred per hour for the selected section.

• Dip Duration (Min, Ave, Max)

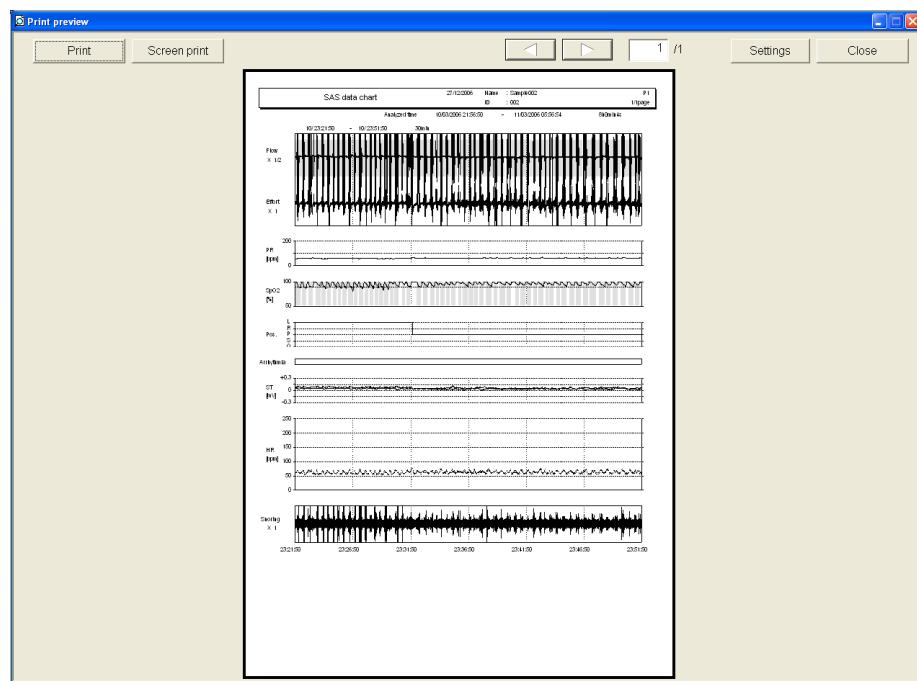
Displays the minimum, mean, and maximum durations of oxygen desaturation occurred for the selected section. For the minimum and maximum durations, the time of occurrence will be also displayed.

On the “Section summary” window, some data may be left blank depending on the recorded parameters and measured results. The data will be left blank in the same condition with the analysis result window.

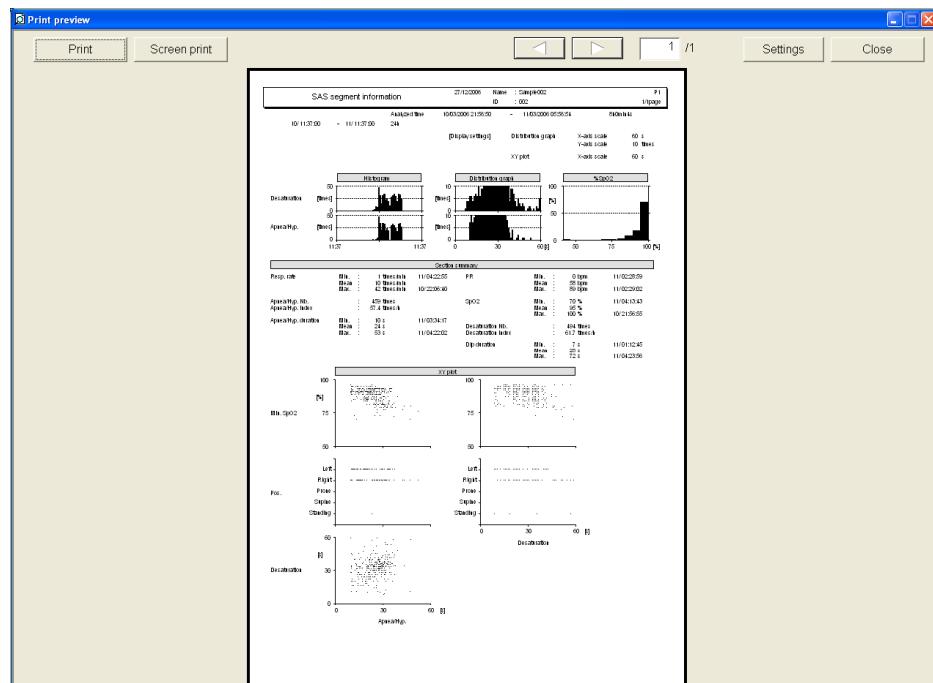
■ Print

Clicking the **Print** button on the “Chart” or “Summary” window will display the print preview for each display. By clicking the **Print** button on the preview screen, the data will be output to the printer.

● SAS Data Chart



● SAS Segment Information



Pacemaker Measurement

By performing pacemaker measurement, pacemaker operation status and pacing spike occurrence can be checked on the data when pacemaker information is recorded.

Click the **Pacemaker** button or double-click the pacemaker measurement result area on the main measurement window to display the “Pacemaker measurement” window.

If performing the pacemaker measurement for the first time, the “Measurement settings” window will open. If the pacemaker measurement has previously been performed, the previous measured result will be displayed.

■Measurement Settings

Click the **Measurement settings** button on the “Pacemaker measurement” window, to display the “Measurement settings” window. On the “Measurement settings” window, thresholds to judge the pacing classification (A pacing, V pacing, and AV pacing) and failure information (non-capture, under sensing, and over sensing) can be set.

The setup items for the pacing measurement are as follows.

• Pacing Classification

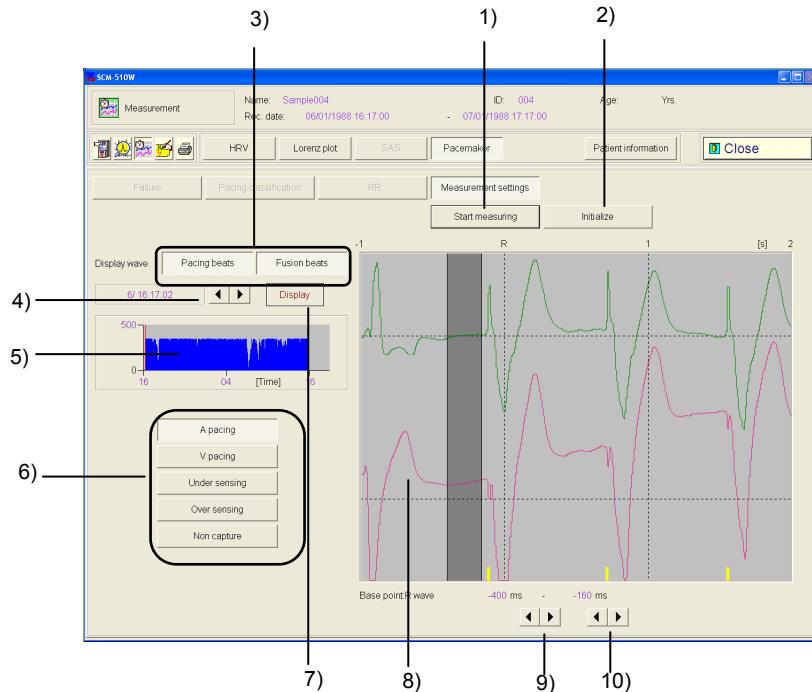
- A pacing : The range judged as A pacing.
- V pacing : The range judged as V pacing.

• Failure Information

- Non-capture : The range starting from the spike judged as non-capture to the next heartbeat.
- Under sensing : The range judged as under sensing.
- Over sensing : The range judged as over sensing.



- A pacing : Atrial pacing
- V pacing : Ventricular pacing
- AV pacing : Both atrial and ventricular pacing
- Non-capture : Pacing beat is not detected although the pacing spike is present.
- Under sensing : The pacemaker could not detect the spontaneous heartbeat and generated a pacing spike.
- Over sensing : The pacemaker detects T-wave and noise as spontaneous heartbeat and does not generate a pacing spike. For other beats which the pacemaker does not generate pacing spike will be also judged as “Over sensing.”



1) **[Start measuring]**

Starts the pacing measurement with the current measurement setting.

2) **[Initialize]**

Initializes the measurement setting to the factory default setting.

3) **Display Wave Selection**

Select the displaying waveform from **Pacing beats**, **Fusion beats**, or both.

4) **Display Time** **Buttons**

Change the displaying time for the histogram and waveform display area using these buttons.

5) **Histogram**

Displays the number of occurrence of pacing beat or fusion beat for the recorded duration in the histogram.

6) **Threshold Setting Parameter**

Select the parameter to set the threshold.

7) **[Display]**

Selects sensitivity and polarity for the displaying waveform.

8) **Waveform Display Area**

Displays pacing beat or fusion beat waveform.

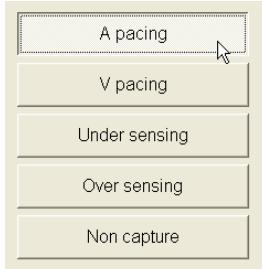
9) **Lower Limit** **Buttons**

Adjusts the lower threshold level.

10) **Upper Limit** **Buttons**

Adjusts the upper threshold level.

●Threshold Setup for Pacing Classification / Failure Information



Select the pacing classification or failure information to set the threshold.



Adjust the lower and upper threshold levels using the buttons.

Set each threshold according to the following condition.

• Pacing Classification

- A pacing : It will be judged as “A pacing” when pacing spike is only present within the threshold.
- V pacing : It will be judged as “V pacing” when pacing spike is only present within the threshold.
- AV pacing : It will be judged as “AV pacing” when pacing spike is present within both thresholds (A pacing and V pacing).

• Failure Information

- Non-capture : It will be judged as “Non-capture” when the interval from the pacing spike to the next pacing spike or to the R-wave of the next spontaneous heartbeat is equal to or above the threshold.

Memo Except for “Non-capture,” the thresholds can be adjusted in 8 msec intervals.

- Under sensing : It will be judged as “Under sensing” when pacing spike is present within the threshold.
- Over sensing : It will be judged as “Over sensing” when the first pacing spike or R-wave of spontaneous heartbeat after the R-wave is within the threshold.

Refer to the followings for the adjustable threshold range.

- Pacing Classification

- A pacing : -1000 ~ 0 msec from R wave

- V pacing : -1000 ~ 120ms from R wave

- Failure Information

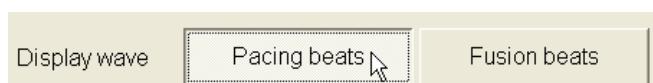
- Non-capture : 150 ~ 2000ms from spike

- Under sensing : 0 ~ 2000ms from R wave

- Over sensing : 0 ~ 2000ms from R wave

●Selecting the Displaying Waveform

The displayed waveform for the waveform display area and histogram can be selected from pacing beats, fusion beats, or both.



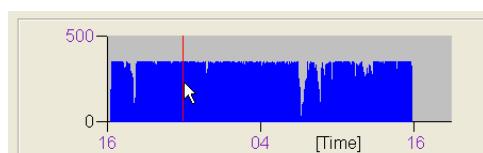
Click **Pacing beats** to display pacemaker beat or click **Fusion beats** to display fusion beat. By clicking both **Pacing beats** and **Fusion beats**, both pacemaker beat and fusion beat will be displayed. Either one of the two must be selected.

●Changing the Display Time

The display time for the waveform display area can be changed.

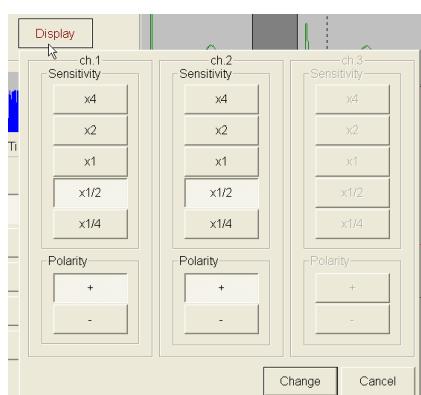


By clicking the **◀** **▶** buttons for the display time, the previous or next pacing beat / fusion beat will be displayed.



Directly clicking on the histogram will also change the display time.

●Changing Waveform Sensitivity / Polarity

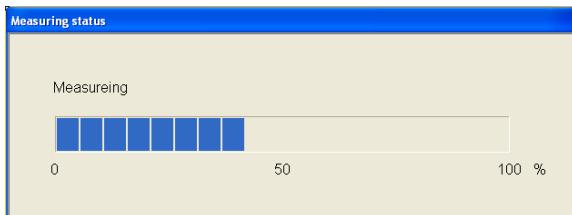


Click on the **Display** button to display the waveform sensitivity and polarity selection window. Select the sensitivity and polarity for the displayed waveform.

●Starting Measurement



Click on the **Start measuring** button to start the measurement. The detection of pacing classification and failure information will start with the set threshold.



When the measurement starts, a progress window will be displayed. Upon completion of the measurement, the display will switch to “Failure” window.

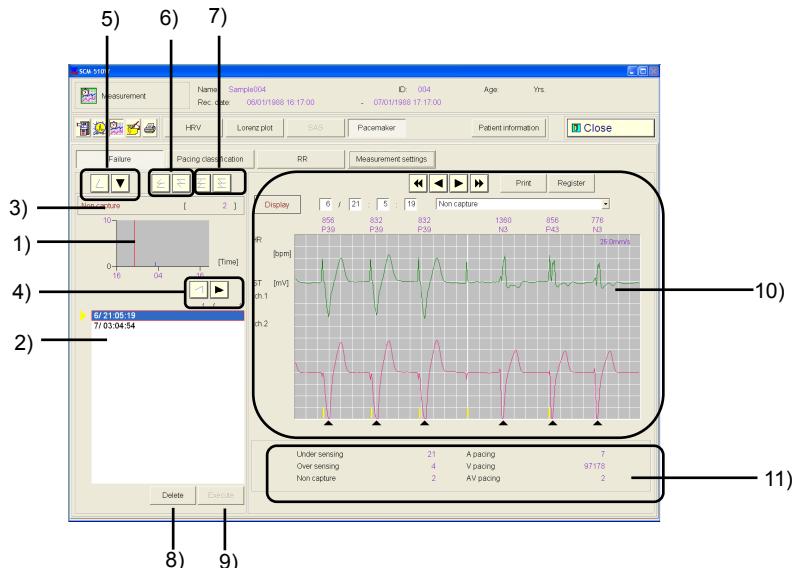
●Initializing Measurement Settings



Clicking the **Initialize** button will initialize the measurement setting to factory default setting.

■Failure

Click the **Failure** button on the “Pacemaker measurement” window to display the “Failure” window. On the “Failure” window, the failure of non-capture, under sensing, and over sensing detected by pacemaker measurement can be searched.



1) Histogram

Displays the number of occurrence of failure information in the histogram.

2) Failure Information List

Displays the list of failure occurrence time.

3) Failure Information Selection Drop-down Box

Selects the failure information to be displayed from the drop-down box.

4) ▶◀ ▶▶ Buttons

Moves the histogram display to the left or right.

5) ▲ ▼ Buttons

Moves the selection on the list up or down.

6) Page Switch Arrow

Switches the page to the previous or next page.

7) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the list.

8) Delete

Enables the delete operation.

9) Execute

When the delete operation is enabled, deletes the selected waveform on the list.

10) Full-Scale Display

Displays the full-scale waveform for the selected failure information.

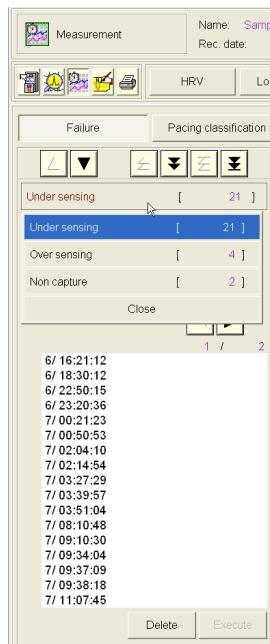
11) Pacemaker Measurement Result

Displays the pacemaker measurement result of failure information and pacing classification.

The following three types of failure information displayed on the “Failure” window are.

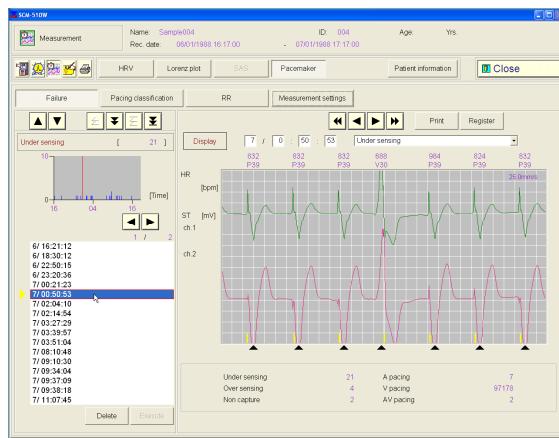
- Non-capture : Pacing beat is not detected although the pacing spike is present.
- Under sensing : The pacemaker cannot detect the spontaneous heartbeat and generated pacing spike.
- Over sensing : The pacemaker detects T-wave and noise as spontaneous heartbeat and does not generate pacing spike. For other beats which pacemaker does not generate pacing spike will be also judged as “Over sensing”.

●To Select the Displaying Failure Information



To change the displaying failure information, select the new failure information from the drop-down box. The display will switch to the new selected failure information display.

●Waveform Display for Failure Information

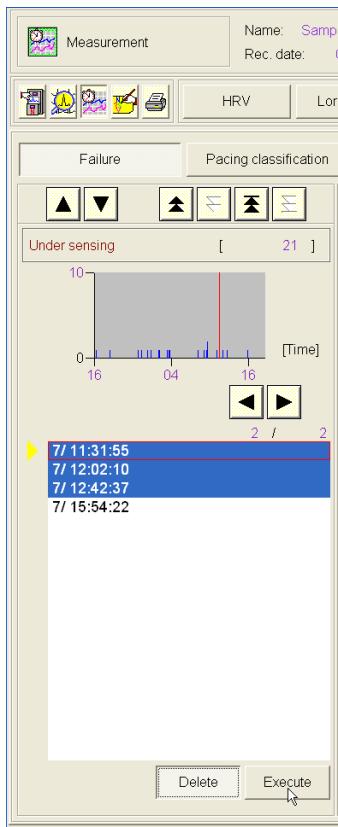


Click the failure occurrence time on the event list. The list cursor will move to the selected time. At the same time, the waveform of 3 seconds (25.0mm/s format) or 1.5 seconds (50.0mm/s format) before and after the selected time will be displayed on the waveform window.

Use the **▲** **▼** buttons to sequentially display the waveforms of the next or previous failure information. The cursor on the list will also move to the corresponding failure information.

● Deleting Failure Information

If you find misjudgment of failure information during the search process, you can delete that failure information.



Click the **Delete** button to enable the delete operation.

Select the occurrence time of failure information you wish to delete from the list.

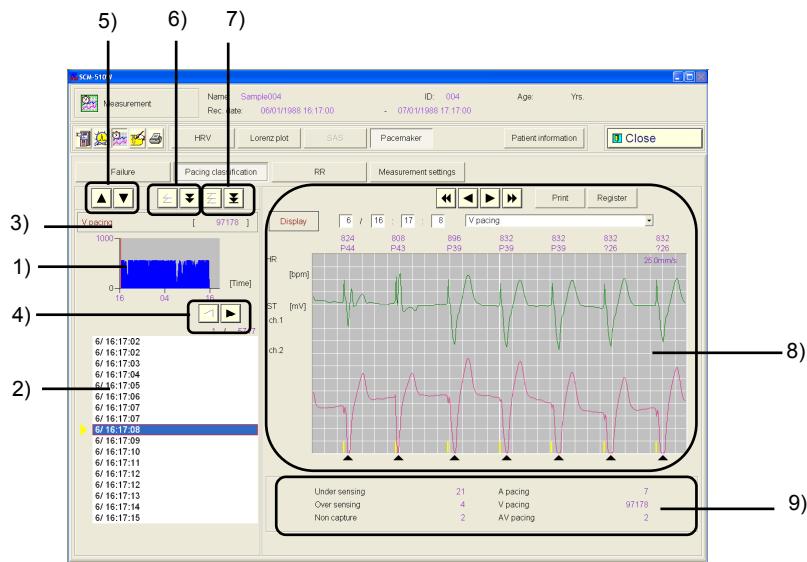
Use the “Shift” key to select more than one failure information.

After the selection, click the **Execute** button. The selected failure information will be deleted.

The new failure information list with the information deleted will be displayed.

■Pacing Classification

Click the **Pacing classification** button on the “Pacemaker measurement” window to display the “Pacing classification” window. On the “Pacing classification” window, A pacing, V pacing, and AV pacing detected by the pacemaker measurement can be easily searched using the list.



1) Histogram

Displays the occurrence frequency of each pacing classification in histogram.

2) Pacing Classification List

Displays the list of pacing occurrence date/time.

3) Pacing Classification Selection Drop-down Box

Select the displaying pacing classification from the drop-down box.

4) Buttons

Moves the histogram display to the left or right.

5) Buttons

Moves the selection on the list up or down.

6) Page Switch Arrow

Switches the page to the previous or next page.

7) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the list.

8) Full-Scale Waveform Display

Displays the full-scale waveform for the selected pacing classification.

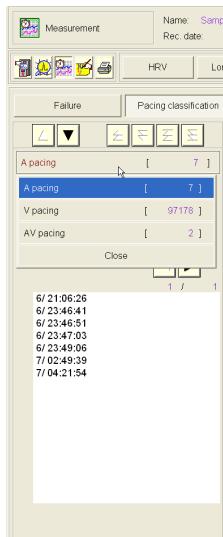
9) Pacemaker Measurement Result

Displays the pacemaker measurement result of failure information and pacing classification.

The following three types of pacing classification are.

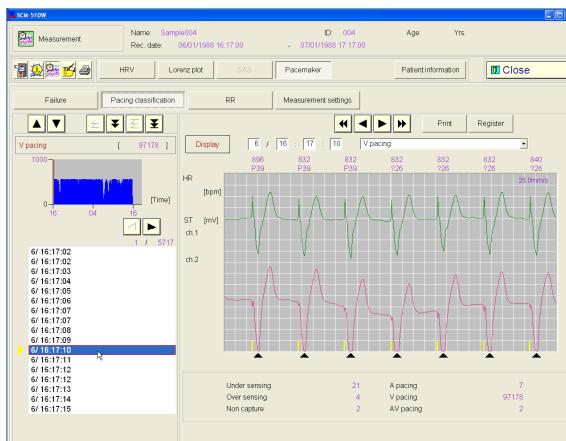
- A pacing : Atrial pacing is detected.
- V pacing : Ventricular pacing is detected.
- AV pacing : Both atrial and ventricular pacings are detected.

●To Select the Displaying Pacing Classification



To change the displaying pacing classification, select the new pacing classification from the drop-down box. The display will switch to the new selected pacing classification display.

●Waveform Display for Pacing Classification

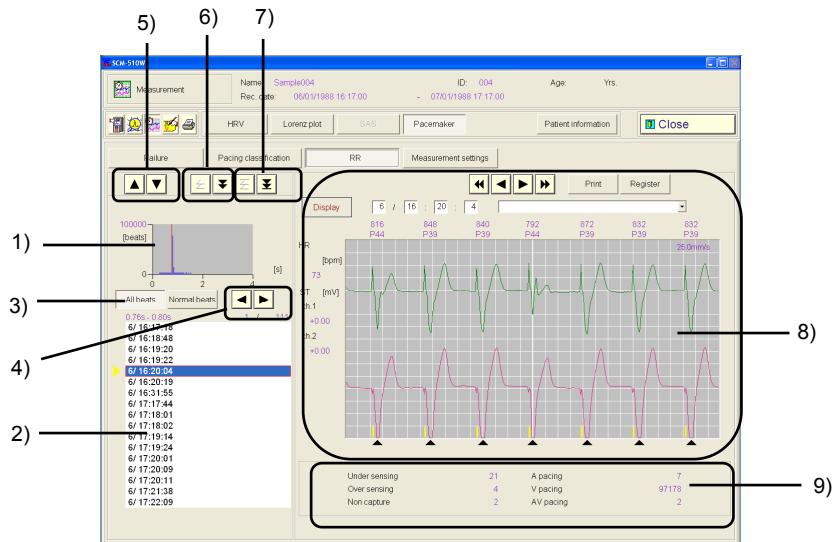


Click the pacing occurrence time on the event list. The list cursor will move to the selected time. At the same time, the waveform of 3 seconds before and after the selected time will be displayed on the waveform window.

Use the buttons to sequentially display the waveforms of the next or previous pacing classification. The cursor on the list will also move to the corresponding pacing classification.

■RR Search

Clicking the **RR** button on the “Pacemaker measurement” window will display the RR search window. For details, refer also to “Chapter 6.5 Search / RR Search.”



1) Histogram

Displays RR data of 40 ms interval.

2) RR Data List

Displays the date/time of RR data in list format.

3) All beats / Normal beats

Select the beats to count the RR data from “All beats” and “Normal beats.”

4) Page Switch Arrow Buttons

Moves the histogram display to the left or right.

5) Jump to Top/Bottom Arrow Buttons

Moves the selection on the list up or down.

6) Page Switch Arrow

Switches the page to the previous or next page.

7) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the list.

8) Full-Scale Waveform Display

Displays the full-scale waveform for the selected RR data.

9) Pacemaker Measurement Result

Displays the pacemaker measurement result of failure information and pacing classification.

●RR Search Operation

For operation procedure on the “RR search” window, refer to P6-49 “RR Search.”

●Full-Scale Waveform

For operation procedure on the full-scale waveform window, refer to P6-57 “Full-Scale Waveform.”

QT measurement

The QT measurement measures the QT interval from the average waveform (15 seconds of the waveform) and the presence of long QT syndrome. T end measurement uses the slope intercept method.

Click the **QT** button or double-click the QT measurement result area on the main measurement window to display the “QT measurement” window.

If performing the QT measurement for the first time, the “Measurement settings” window will open. If the QT measurement has previously been performed, the previous measured result will be displayed.



Memo

The QT measurement function is activated via the password authentication. If the function QT is not activated, then the **QT** button will not be displayed.

■Activate the QT measurement function

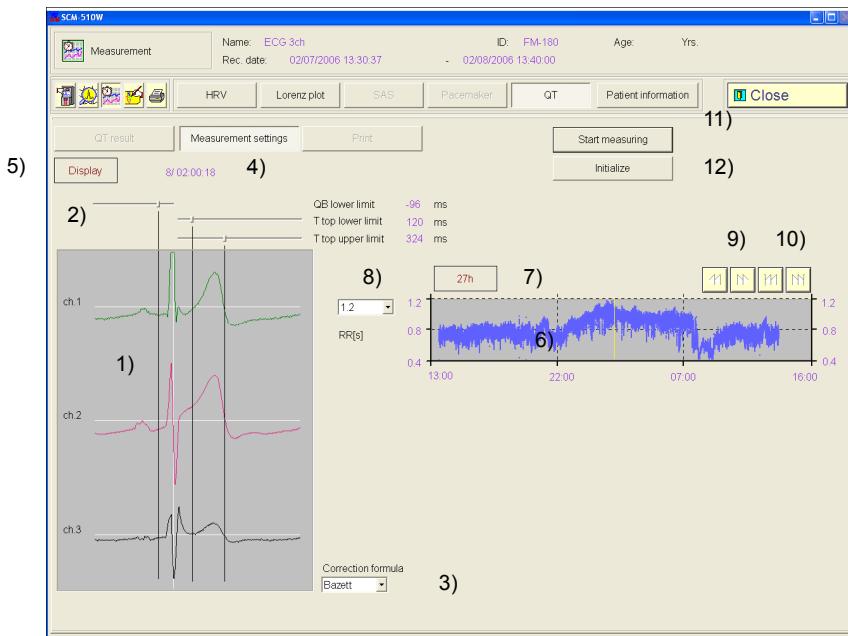
The QT measurement function is activated via the password authentication under “System settings”. If not activated, the QT button will not be displayed and QT measurement cannot be done.

Please read “Chapter 3.4 System settings ■Activate optional functions” on how to activate the QT measurement function.

■Measurement Settings

In the QT measurement settings window, the QB lower limit and T top limits can be set. Moreover, the correction formula to which QTc is obtained can be set.

If performing the QT measurement for the first time, the “Measurement settings” window will open.



1) ECG waveform

The ECG waveform is used to set the threshold for the QT measurement.

2) Measurement threshold

The QT measurement thresholds (QB and T top limits) are set.

3) Correction formula selection

Select the correction formula to obtain QTc.

4) Waveform display time

Displays the time of the ECG waveform.

5) Display button

Sensitivity and polarity of the ECG can be changed.

The content of the display and the way of operation is similar to the previous measurements.

6) RR trend

The RR interval trend is displayed. It is used in order to check the threshold of the ECG over 24 hours (depending on the time range selection).

7) Time Range Selection

Select the displaying time range.

8) Scale selection

Change the value for the maximum RR trend scale.

9) Page Switch Arrow

Switches the page to the previous or next page.

10) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the trend.

11) **Start measuring** Button

Starts the QT measurement with the current measurement setting.

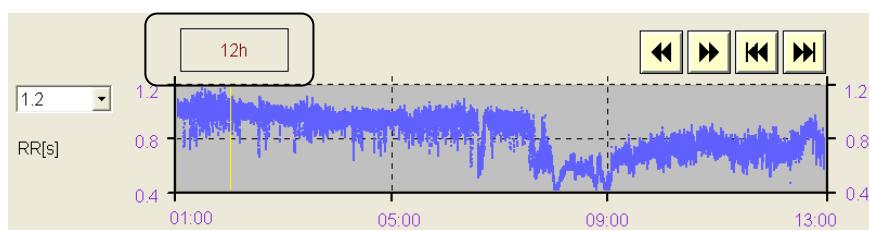
12) **Initialize** Button

Initializes the measurement setting to the factory default setting.

● RRtrend

The RR trend is used to display the ECG waveform to set the QT measurement threshold. Please confirm that the measurement threshold is inside the range when selecting short and long RR intervals under the RR trend.

The displaying time range for trend display can be changed.

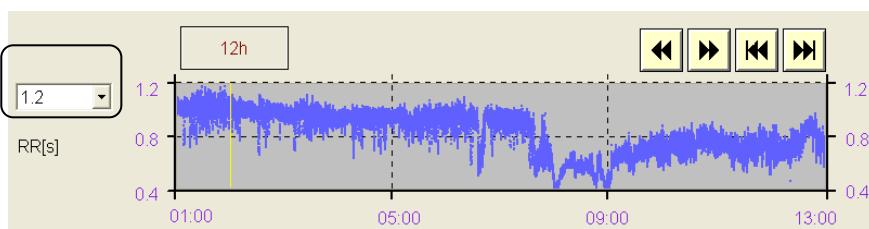


■ The time range for trend display can be selected from the “Time range” list box.

The selections are as follows.

- 1 h
- 3 h
- 6 h
- 12 h
- 24 h
- 27 h

To maximize the trend display, select “1 h” for the displaying time range.
It is possible to change the value of the Y-axis scale.



■ Select the maximum scale for the Y-axis from the drop-down box.

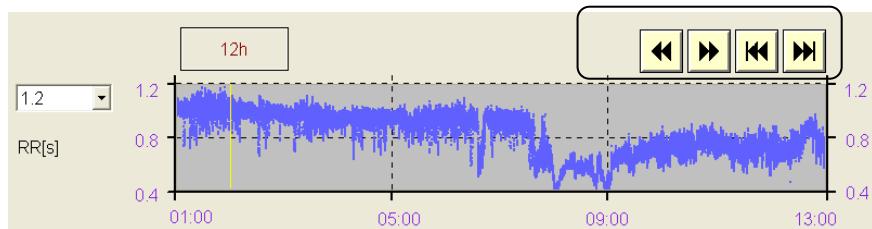
The selections are as follows.

- 1.2s
- 1.9s



Memo When the scale is set to 1.2s, the minimum value is 0.4s. And when the scale is set to 1.9s, the minimum value is 0.3s.

The trend display time can be moved.



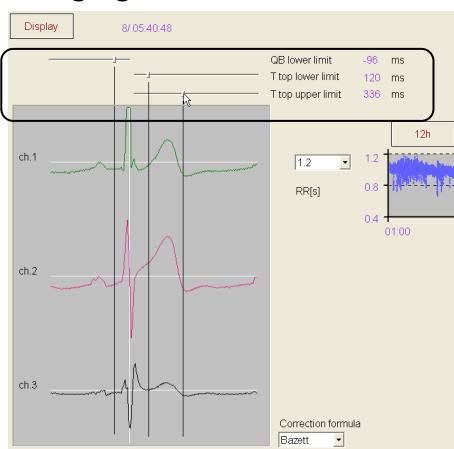
Switches the page to the previous or next page using the page switch arrows.

●RR trend and ECG waveform

If you click anywhere under the RR trend, a cursor will be displayed at the selected point. The selected ECG waveform will be displayed for that point and the time will be updated.



●Changing the QT measurement threshold



The threshold for the QT measurement are shown below:

QB lower limit : -500[ms] – Rwave

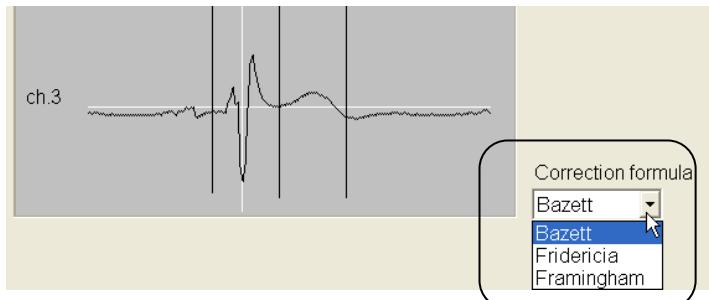
T top lower limit : 40[ms] – 800[ms]

T top upper limit : 40[ms] – 800[ms] (however, it should be above the T top lower limit)

Memo The T top upper limit cannot be set with a value smaller than the T top lower limit.

- Drag the slider to the left or right while looking at the ECG waveform to change the threshold of QB and T top. The slider can be moved with 8ms interval.

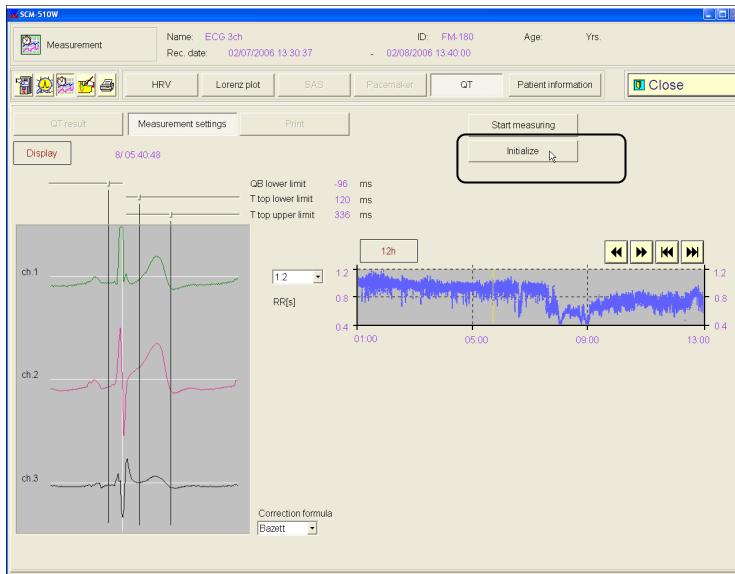
The correction formula to obtain QTc can be selected.



- Select the correction formula to obtain QTc from the drop down box.
Select from the following correction formula shown below:

Bazett	: $QTc = QT / \sqrt{RR}$
Fridericia	: $QTc = QT / \sqrt[3]{RR}$
Framingham	: $QTc = QT + (1-RR)*0.154$

● Initialization of the set threshold



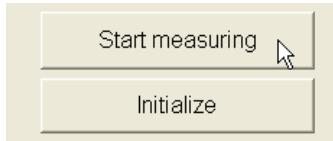
The QT measurement threshold will be set back to default factory settings.

- To return to the default factory settings, click the **Initialize** button.

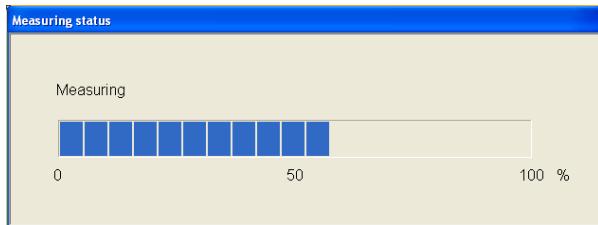
The default factory settings for the threshold are as follow:

QB lower limit	: -96[ms]
T top lower limit	: 120[ms]
T top upper limit	: 500[ms]
Correction formula	: Bazett

●Starting Measurement



- Click the **Start measuring** button to start the measurement. QT/QTc interval from the average waveform (15 seconds of the waveform) is measured.



When the measurement starts, a progress window will be displayed. Upon completion of measurement, the display will switch to the “QT result” window.

■ QT result



1) Display channel

Select the channel to display the QT measurement results.

2) Display measurement value

Select whether QT or QTc is displayed.

Moreover, when QTc is selected, the correction formula on the right side of the measurement is displayed.

3) RR trend

Displays the trend of RR intervals.

4) QT trend

Displays the trend of QT or QTc.

5) Average waveform

Five average waveforms for QT measurement are displayed from the top in time series. From the average waveform displayed in the center, the QB and T end value can be edited.

6) QB and T end sliders

The position where QB and T end are measured can be edited back and forth from the average waveform displayed in the center.

7) Delete button

When the average waveform displayed in the center is overlaid with noise, the measurement result can be deleted.

8) QT histogram

Displays the QT or QTc histogram. Used to check the short and long QT intervals.

9) QT/RR graph

The relation between QT/QTc and RR interval is plotted.

10) Maximum QT waveform

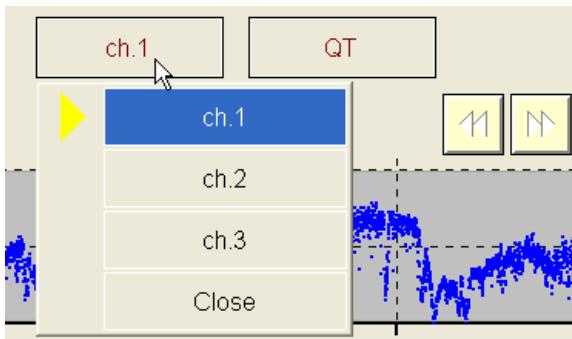
The maximum QT or QTc waveform and its measurement value are displayed.

11) Minimum QT waveform

The minimum QT or QTc waveform and its measurement value are displayed.

● Switch the display channel and measurement value

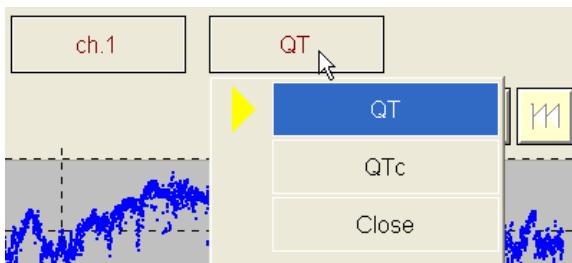
Display channel and measurement value (QT or QTc) for the QT measurement result can be changed.



- Click in the upper part of the screen (channel display) to change the displayed channel. Select the channel from the pop up menu to which the QT measurement result will be displayed.
Selection can be done for the following displayed channels:

ch.1
ch.2
ch.3

Memo Ch. 3 in the pop up menu cannot be selected, when the data has been recorded on 2ch.

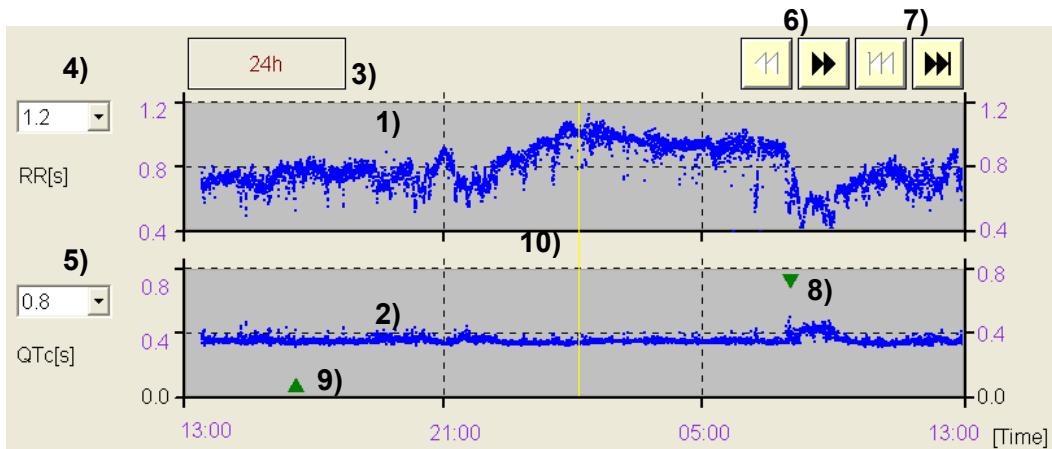


- Click in the upper part of the screen (Measurement display) to change the displayed measurement. Select the measurement from the pop up menu to be displayed.
Selection can be done for the following displayed measurements:

QT
QTc

When QTc is selected, the correction formula on the right side of the measurement will be displayed. However, when QT is selected, nothing will be displayed.

●Display and operation of the trend



1) RR trend

Displays the RR interval trend. In the RR interval display, only the heart beat of the RR interval for the QT measurement average target will be displayed.

2) QT trend

Displays the QT or QTc trend. The trend will change depending on the selected measurement value.

3) Time Range Selection

Select the displaying time range.

4) Selection of RR trend scale

Change the value for the maximum RR trend scale.

5) Selection of QT trend scale

Change the value for the maximum QT trend scale.

6) Page Switch Arrow

Moves to the previous or next page of the RR/QT trend. When clicking, it will move to the right or left by 1/3 of the display.

7) Jump to Top/Bottom Arrow

Jumps to the top or bottom of the RR/QT trend.

8) Maximum QT value

The mark “▼” is displayed for the maximum value of QT or QTc.

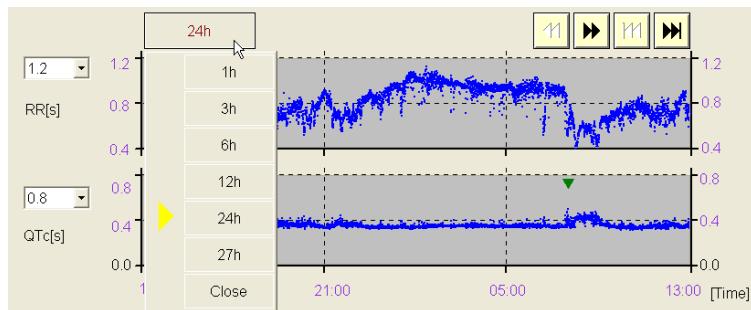
9) Minimum QT value

The mark “▲” is displayed for the minimum value of QT or QTc.

10) Trend cursor

The current position is displayed by the cursor. The average waveform will be displayed where the cursor is positioned.

The displaying time range for the trend display can be changed.



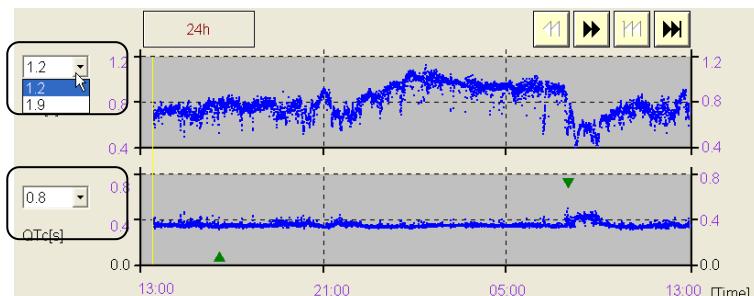
- The time range for the trend display can be selected from the “Time range” list box.
The selections are as follows.

1 h
3 h
6 h
12 h
24 h
27 h

To maximize the trend display, select “1 h” for the displaying time range.

Changing the trend scale

It is possible to change the Y- axis scale of the RR/QT trend.



- Select the maximum scale for the Y-axis from the drop-down box.

The selections are as follow:

RR trend

1.2s
1.9s

QT trend

0.2s
0.4s
0.8s
1.6s

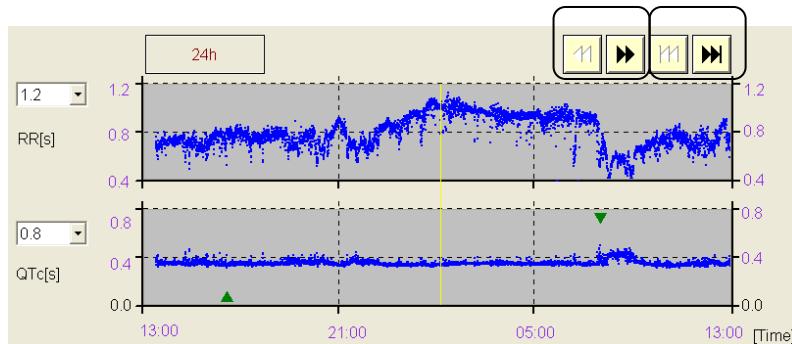


Memo When the RR trend scale is set to 1.2s, the minimum value is 0.4s. And when the scale is set to 1.9s, the minimum value is 0.3s.

The value set for Y-axis will not change when either the measurement value of QT or QTc is displayed.

When the trend scale is changed, the QT histogram and QT/RR graph scale will change too (synchronized).

Moving in the trend display

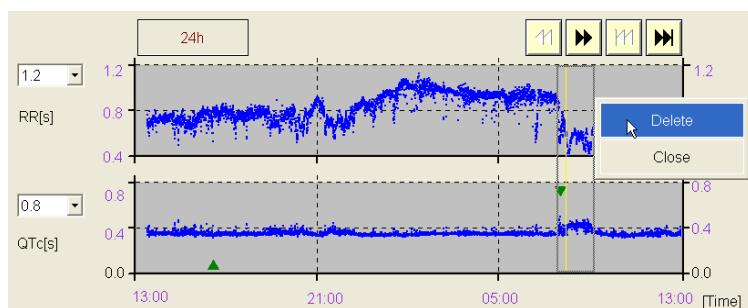


- Using the page switch arrows, move back and forth inside the trend display.
When clicking it will move to the right or left by 1/3 of the display.

Click on the Top/Bottom arrows to jump to the top or bottom of the trend.

Delete a measurement section from the trend

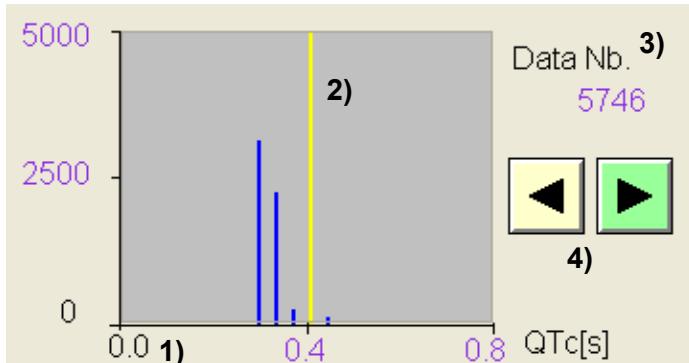
The measurement of QT and QTc varies when noise is superimposed to the waveform. In this case, a section and measurement values can be selected on the trend and be deleted.



- Use the mouse to select the section by dragging the mouse over the trend. The selection will be displayed in the RR or QT trend. Release the button of the mouse to display the pop up menu and then click "Delete".

The section from the trend will be removed and the measurement values of QT or QTc will be deleted.

●Display and operation of the Histogram



1) QT histogram

Displays the totaled QT or QTc histogram

2) Histogram cursor

Displays the cursor position for the checked QT or QTc.

3) Number of data (total)

Displays the total measurement value of QT or QTc for the histogram.

4) [◀] [▶] Buttons

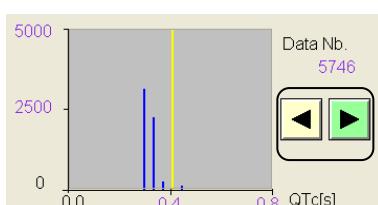
Moves the histogram display to the left or right.

Move the histogram's cursor

In the histogram, short and long QT/QTc values may be wrong due to noise in the background. Checking the short and long QT/QTc values in the histogram and then editing them, allows to correctly obtain the maximum and minimum QT.

The confirmation of the total measurement results in the histogram is as follow.

- 1) Move the cursor by clicking on the QT/QTc value to be checked.



- 2) By clicking the buttons [◀] [▶], the short and long interval of QT measurement can be checked one at the time on the average waveform or the trend.

When the button [◀] is clicked, after displaying the QT measurement for the current position of the cursor, the cursor will move to the left.

When the button [▶] is clicked, after displaying the QT measurement for the current position of the cursor, the cursor will move to the right.



Memo The cursor cannot be positioned outside a result (histogram bar). When clicking the mouse inside the histogram, the cursor will be displayed to the nearest result.

When reaching the extremities (long or short interval) of the result (bar) using the buttons [◀] [▶], the respective button will be masked.

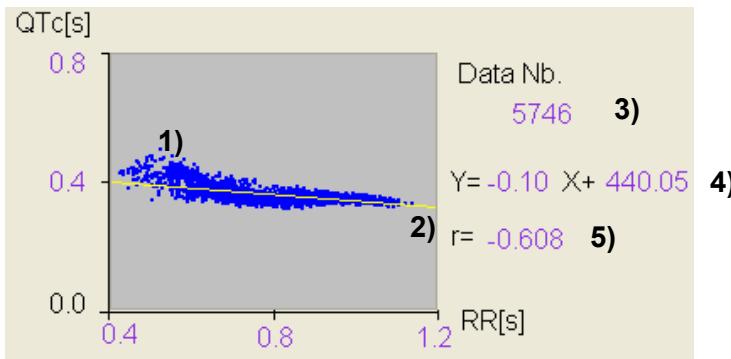
A similar operation can be done using the keys \leftarrow \rightarrow on the keyboard instead of the \blacktriangleleft \triangleright buttons.

Histogram and other screen connection

Every time you click on the buttons \blacktriangleleft \triangleright , the average waveform and trend will be updated.

● QT/RR graph display

The QT/RR graph is the representation of the relation between QT/QTc and RR interval. There are no operations in the QT/RR graph.



1) QT/RR graph

It is a graph where the relation between QT/QTc and RR is plotted.

2) Regression line

Displays the regression line of plotted data.

3) Number of plotted data

Displays the total measurement value inside the QT/QTc and RR scale.

4) Regression line formula

Displays the formula for the regression line.

5) Coefficient of correlation

Displays the correlation coefficient of QT/QTc and RR.

●Display and operation of maximum/minimum QT interval.

The maximum/minimum QT screens display the maximum/minimum QT/QTc interval and its measurement value.

It is possible to check and edit the maximum/minimum QT/QTc interval from the automatic measurement.



1) Maximum QT wave

Displays the maximum QT/QTc wave.

2) Minimum QT wave

Displays the minimum QT/QTc wave.

3) QB position

A line is drawn at the QB position.

4) T end position

A line is drawn at the T end position.

5) Maximum QT value and time

Displays the maximum value of QT/QTc and its time.

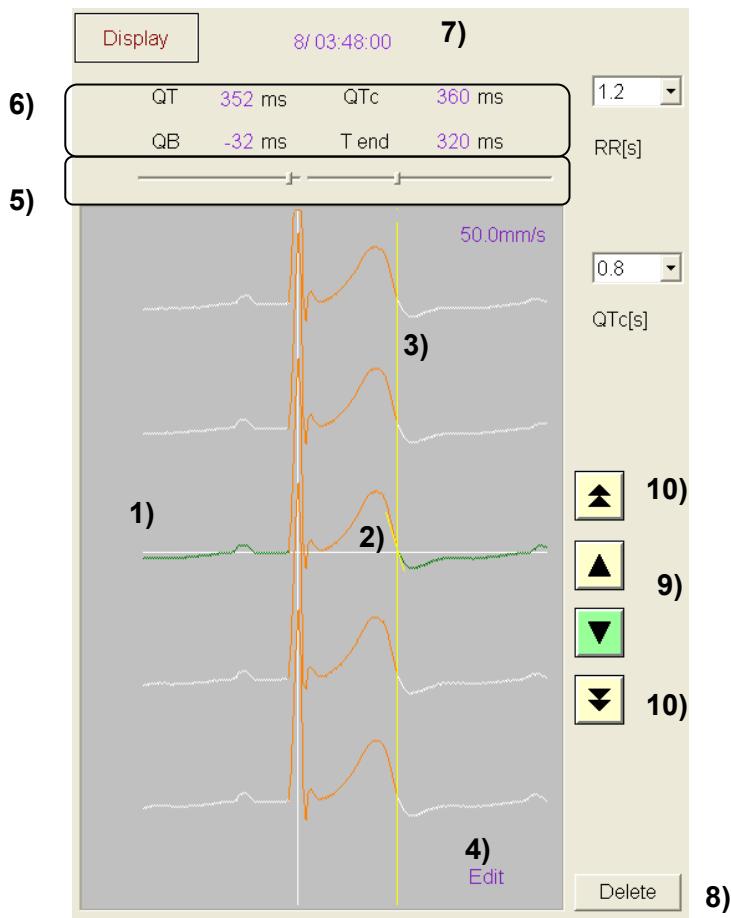
6) Minimum QT value and time

Displays the minimum value of QT/QTc and its time.

Max./Mini. QT interval display and other screen connection

When you click inside the Max./Mini. QT interval display area, the trend and the average waveform displays will be updated.

●Display and operation of the Average waveform



1) Average waveform

Displays the average waveform used to measure QT. Each average waveform is the average (15s) of the waveform. And it is possible to edit the waveform displayed at the center.

2) Tangent when T end is measured

The automatic measurement of T end used the slope intercept method. Displays the tangent line obtained from the automatic measurement.

3) QB and T end cursors

Displays the cursor for QB and T end position.

4) “Edit” mark

Displays “Edit” when editing the QB or T end.

5) QB and T end sliders

If neither QB nor T end is measured correctly, it is possible to adjust them with the sliders. Moreover, QB and T end from the R wave is displayed.

6) QT/QTc measurement value

Displays the QT/QTc value of the average waveform displayed in the center.

7) Waveform display time

Displays the time of the average waveform displayed in the center.

8) [Delete] button

Deletes the measurement value of the average waveform displayed in the center.

9) Buttons

Moves the average waveform up and down by 1 waveform.

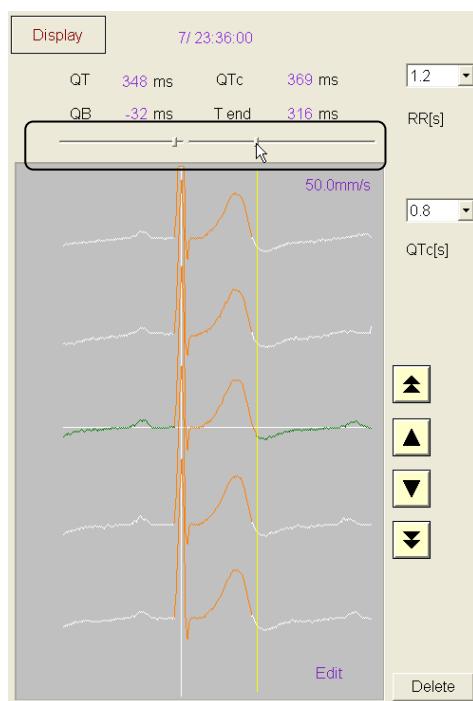
A similar operation can be done using the keys   on the keyboard instead of the   buttons.

10) Page Switch Arrow

Switches the page to the previous or next page.

Editing QB and T end

Sometimes with the automatic measurement, detection of QB and T end position is wrong due to noise in the background. In this case, it is possible to edit the QB and T end position of the centered average waveform.

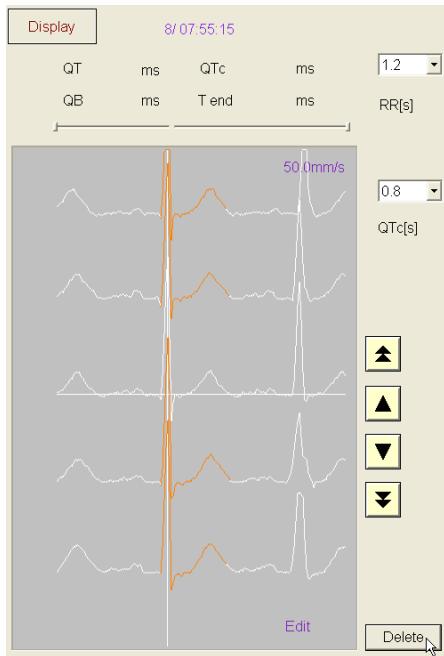


The sliders in the upper part of the average waveform are used to edit the QB and T end position. The editing waveform will become the average waveform displayed in the center.

- Drag the sliders of QB and T end to the right and left. Displays the cursor position where the slider is dragged or clicked. Move the cursors into the correct position for QB and T end. Especially, please edit the T end position referring to the average waveform when you decide the position of T end.
- When you move the QB or T end position, editing, “Edit” will be displayed on the bottom right of the average waveform. Moreover, during editing, the tangent will not be displayed during automatic detection.

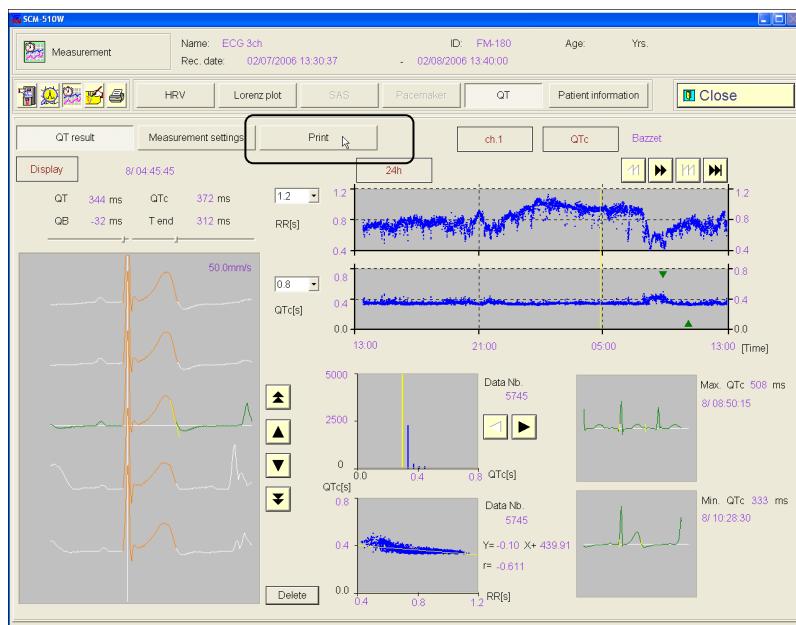
Delete a measurement value

The measurement value of one average waveform can be deleted. This function is used when the noise makes the judgment of QT interval difficult.

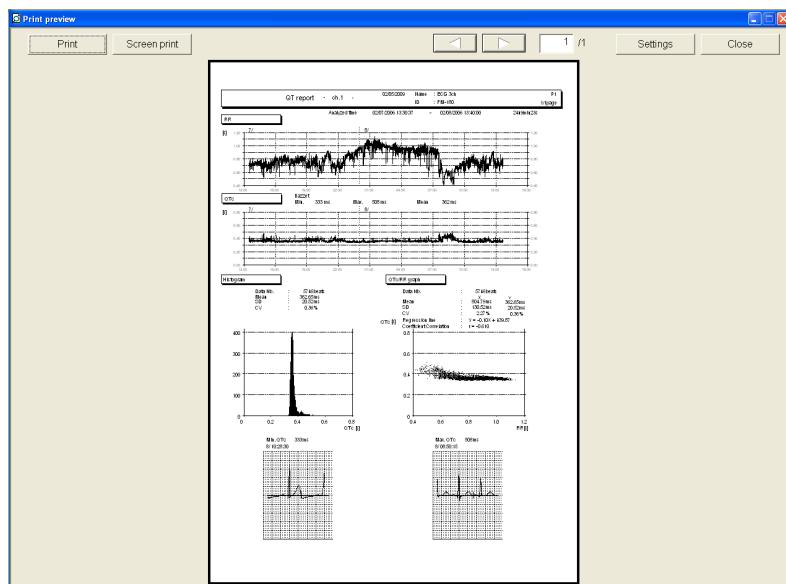


- Use the buttons **▲**, **▼** to move the average waveform in the center and then delete the measurement value.
- Click the **[Delete]** button.
After deletion, the values for QT, QTc, QB and T end will be blank. Also the color of the waveform will change. And the sliders move to the outside.

● Print of the QT measurement result



- To print the QT measurement result, click on the **Print** button.
A print preview will be displayed with the current channel and measurement value (QT or QTc) selected.



- Please click on the **Print** button to print out the report displayed.

6. 7 Analysis Summary

On the “Analysis Summary” window, analysis result and arrhythmia occurrence list will be displayed and you can edit the numeric value.

Types of Analysis Summary

The analyzed result can be verified and edited on the “Analysis summary” window.

●Summary

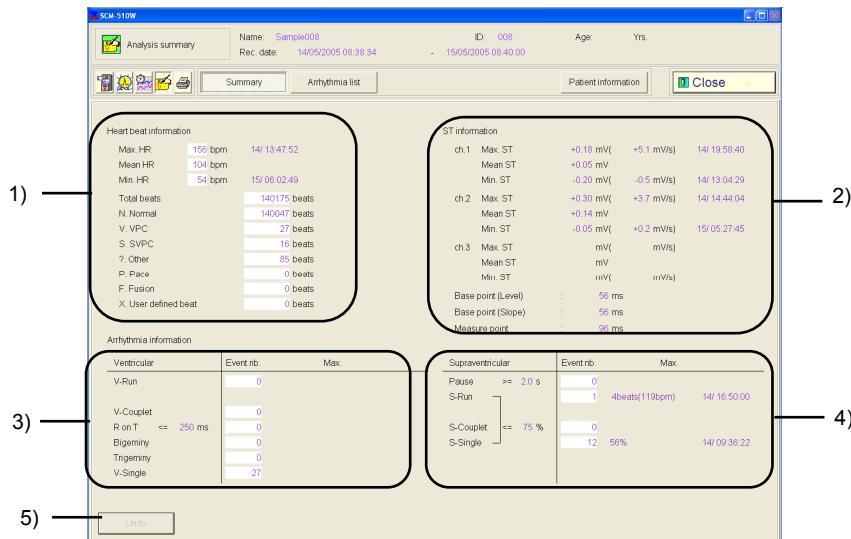
The summary of the analyzed result will be displayed and you can edit the numeric value.

●Arrhythmia List

The arrhythmia occurrence of every hour will be displayed and you can edit the numeric value.

Summary

Click on the **Summary** button to open the “Summary” window.



1) Heart Beat Information

Displays the analyzed result of the heartbeat information.

2) ST Information

Displays the analyzed result of the ST information.

3) Ventricular Arrhythmia Information

Displays the analyzed result of the ventricular arrhythmia information.

4) Supraventricular Arrhythmia Information

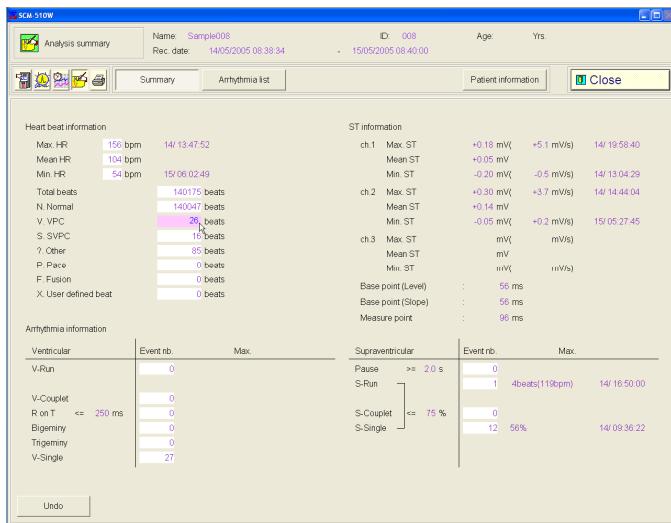
Displays the analyzed result of the supraventricular arrhythmia information.

5) **Undo** Button

Undo the edited numeric value to go back to the original analyzed result.

The edit procedure can be performed for the numeric value with white background.

■Editing the Numeric Value



To edit the data, click on the numeric value you wish to edit.
Enter the new value, and press “Enter” on the keyboard.
After the numeric value is changed, editing this patient will not be possible.

Arrhythmia List

Clicking on the **Arrhythmia list** button will open the “Arrhythmia List” window.

1) 2) 3) 4)

5) [Print](#)

Time	Hr:Min Min	Mean Max	Total leads	Lead No.	V-Rule	V-Coupled	R on V	Bgmetry	Trigency	V-Single	Beat Hb	Pause	S-Rule	S-Coupled	S-Single	Ar	[s]	
08:00	72	95	129	5561	0	0	0	0	0	0	0	0	1:	0	0	0	1	0
09:00	72	99	129	5805	0	0	0	0	0	0	0	0	1:	0	0	0	0	0
10:00	80	102	123	6025	0	0	0	0	0	0	0	0	1:	0	0	0	1	0
11:00	89	102	123	6025	0	0	0	0	0	0	0	0	1:	0	0	0	1	0
12:00	95	118	160	6494	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	85	115	136	6779	1	0	0	0	0	0	0	1	0	0	0	0	0	0
14:00	96	119	148	6990	0	0	0	0	0	0	0	0	4:	0	0	0	0	0
15:00	72	99	123	6479	4	0	0	0	0	0	4	0	0	0	0	0	0	0
16:00	98	113	163	6887	0	0	0	0	0	0	2	0	0	0	0	0	0	0
17:00	95	116	140	6831	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	111	124	142	7351	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	108	128	152	7535	3	0	0	0	0	0	3	0	0	0	0	0	0	0
20:00	104	130	144	7709	1	0	0	0	0	0	0	1	1:	0	0	0	1	0
21:00	75	98	132	5311	0	0	0	0	0	0	0	0	1	0	0	0	1	0
22:00	76	98	110	5118	1	0	0	0	0	0	1	0	0	0	0	0	0	0
23:00	73	78	89	4962	2	0	0	0	0	0	2	0	0	0	0	0	0	0
24:00	66	73	100	4364	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00:00	60	67	85	4047	3	0	0	0	0	0	3	0	0	0	0	0	0	0
01:00	56	66	88	3715	0	0	0	0	0	0	2	1:	0	0	0	1	0	0
02:00	56	66	88	3881	3	0	0	0	0	0	3	2:	0	0	0	2	0	0
03:00	54	64	83	3863	2	0	0	0	0	0	2	2:	0	0	0	2	0	0
04:00	57	64	82	3875	2	0	0	0	0	0	2	1:	0	0	0	1	0	0
05:00	58	61	106	3208	1	0	0	0	0	0	1	0	0	0	0	0	12	0
Total	54	104	156	140175	27	0	0	0	0	0	27	16	0	1:	0	12	0	0

1) Heart Beat Information

Displays the analyzed result of the heartbeat information for each hour.

2) Ventricular Arrhythmia Information

Displays the analyzed result of the ventricular arrhythmia information for each hour.

3) Supraventricular Arrhythmia Information

Displays the analyzed result of the supraventricular arrhythmia information for each hour.

4) Atrial Fibrillation Information

Displays the analyzed result of the atrial fibrillation for each hour

5) **Undo** Button

Undo the edited numeric value to go back to the original analyzed result.

The edit procedure can be performed for the numeric value with white background.

■ Editing the Numeric Value

Analysis summary		Name: Sample008	ID: 008	Age:	Yrs.															
		Rec. date: 14/05/2005 08:38:34	15/05/2005 08:40:00																	
		Summary			Arhythmia list															
		Patient information			 Close															
Time	HR(Spmin)	Min	Mean	Max	Total beats	Beat No.	V-Run	V-Coupled	R-on-T	Biometry	Trigeminy	V-Single	Beat No.	Pause	S-Run	S-Coupled	S-Single	Ar [s]		
09:05: 69	83	107	1760	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
09:06: 72	95	129	5561	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
09:07: 72	99	128	5805	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:08: 80	100	122	6000	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
09:09: 80	103	122	6098	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
13:05: 97,	127	156	7479	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00: 95	118	150	6946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00: 85	115	136	6779	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
17:00: 80	117	149	7470	4	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0
17:05: 98	117	153	6887	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
19:00: 95,	116	140	6831	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00: 95	116	140	6831	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:05: 108	128	153	7353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00: 94	120	140	7077	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0
23:00: 90	107	122	6311	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
00:00: 75	86	110	5118	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
00:01: 66	73	100	4394	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
00:03: 60	67	89	4018	3	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0
00:04: 59	70	98	4176	2	0	0	0	0	0	0	0	2	1	0	0	0	0	0	1	0
00:05: 56	66	89	3989	3	0	0	0	0	0	0	0	0	3	2	0	0	0	0	2	0
00:06: 54	64	83	3843	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0
00:07: 57	64	82	3875	2	0	0	0	0	0	0	1	2	1	0	0	0	0	0	1	0
00:08: 55	64	82	3875	2	0	0	0	0	0	0	1	2	1	0	0	0	0	0	1	0
00:08: 55	64	82	3875	2	0	0	0	0	0	0	1	2	1	0	0	0	0	0	1	0
00:08: 55	64	82	3875	2	0	0	0	0	0	0	1	2	1	0	0	0	0	0	1	0
00:08: 55	64	82	3875	2	0	0	0	0	0	0	1	2	1	0	0	0	0	0	1	0
00:08: 55	64	82	3875	2	0	0	0	0	0	0	1	2	1	0	0	0	0	0	1	0
Total	54	104	156	140175	27	0	6	0	0	0	0	27	16	0	1	0	0	12	0	0

To edit the data, click on the numeric value you wish to edit.

To edit the data, click on the numeric value you wish to Enter the new value, and press “Enter” on the keyboard.

After the numeric value is changed, editing this patient will not be possible.

6. 8 Print

After the read / analyzed data is edited by morphology, the results can be printed in report format or by specifying a time for the waveforms.

Types of Printing

The edited results of read/analyzed data can be output to the printer.

● Report Printing

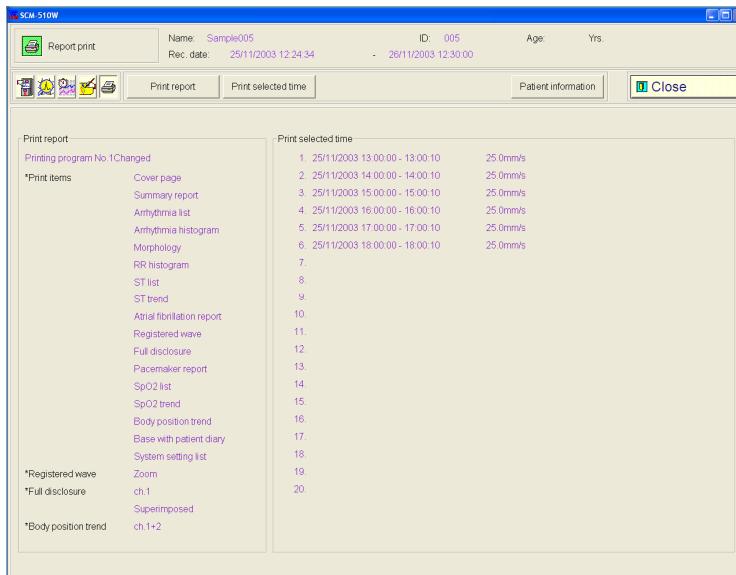
Full disclosure waveform and analysis result reports can be printed.

● Time Selected Printing

Full-scale waveforms of 25.0 mm/s or 12.5 mm/s can be printed for a specific time.

Main Print Window

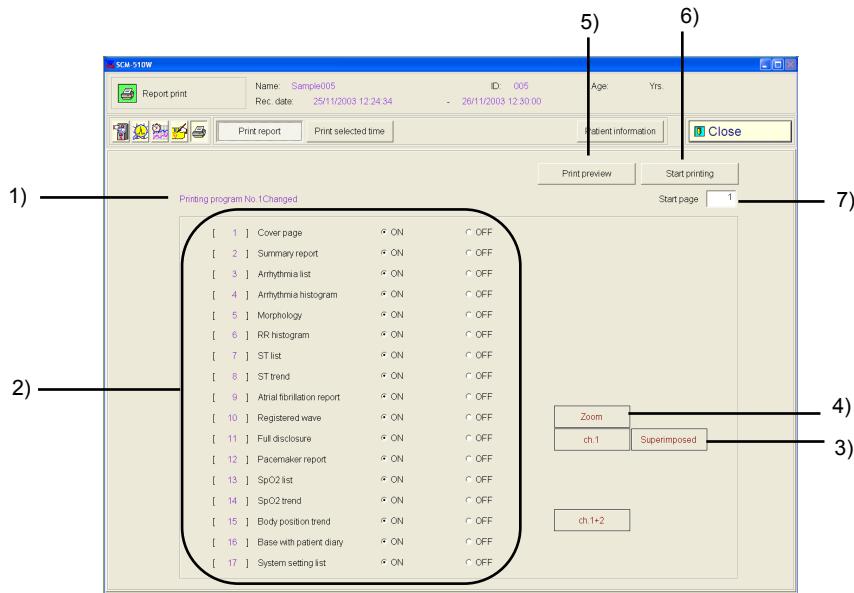
On the main print window, the current print settings will be displayed.



Print Report

On the “Print report” window, ON/OFF of each report type and print details such as channel and waveform format can be selected.

On the preview screen, the print out can be verified before printing.



1) Printing Program No.

Displays the program number selected on the “Report settings” window.

2) Report Types

Select “ON” or “OFF” for each report type.

3) Channel for Full Disclosure Waveform

Select the channel for full disclosure waveform.

4) Waveform Format

Select the waveform format.

5) Print preview Button

Displays the “Print preview” window.

6) Start printing Button

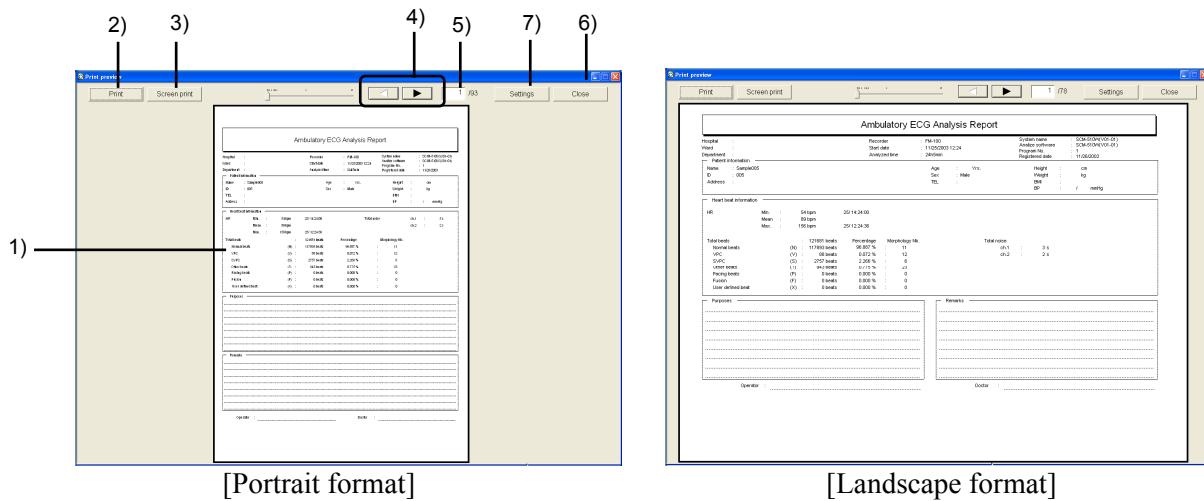
Starts printing.

7) Page Number Input Box

Enter the starting page number to print.

■ Print Preview

The preview display allows to verify the print image before printing.



1) Print Preview

Displays the print image.

2) Print Button

Starts printing the report.

3) Screen print Button

Starts printing the displayed page.

4) Page Switch Arrow

Displays the previous or next page.

5) Page Number Input Box

Displays the page number of the displayed preview. It is also possible to enter the page number you wish to display.

6) Close Button

Closes the preview window.

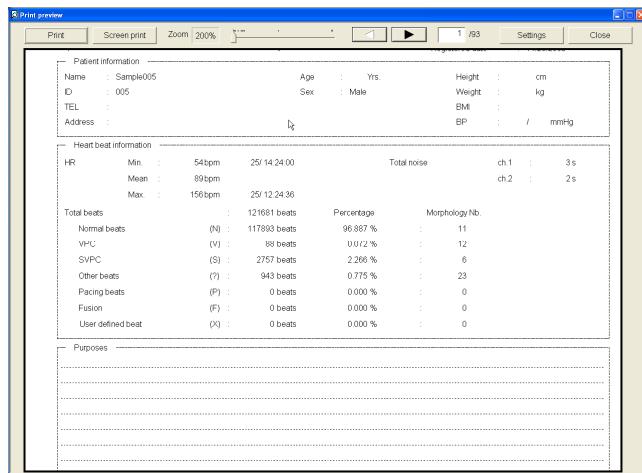
7) Settings Button

Selects whether or not to print the RR interval, patient name, patient ID, and printing date.

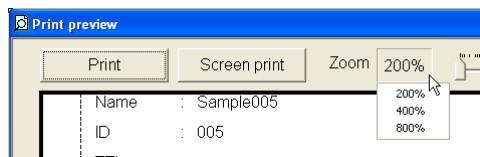
■Zoom Display

On the preview window, part of the display can be zoomed.

Double-click on the part where you wish to zoom. The display will enlarge with the selected part at the center.

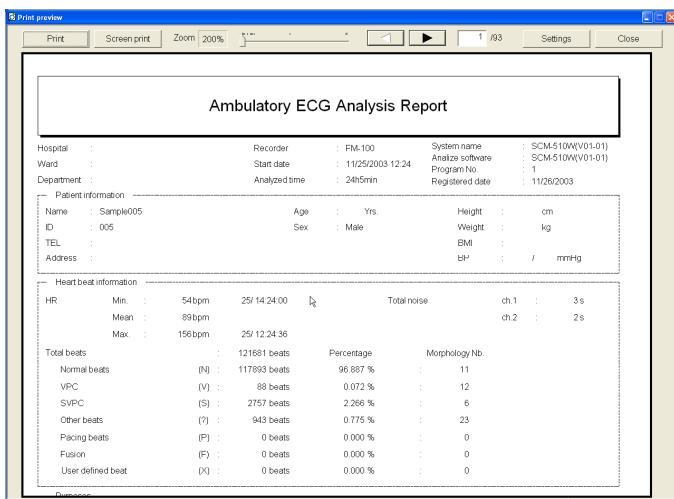


To cancel the zoom display, double-click again.



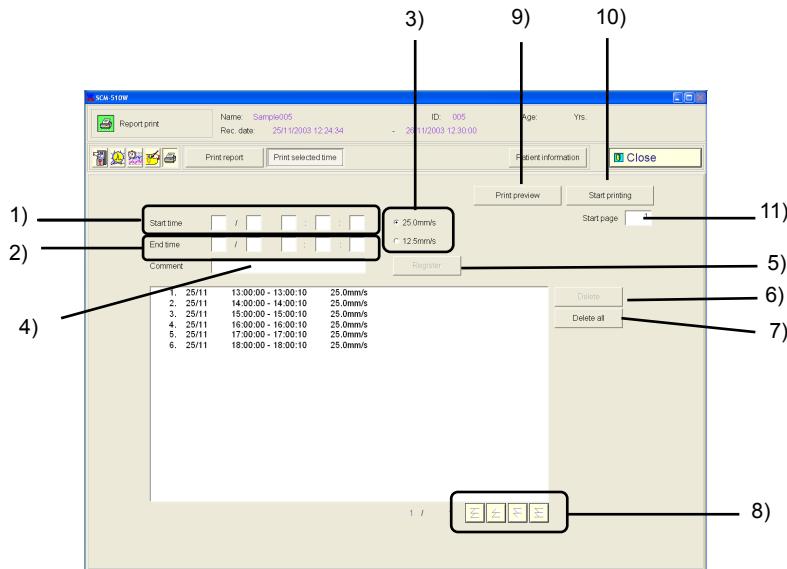
The zoom percentage can be selected from the drop-down box.

You can move the display location by dragging the display area.



Print Selected Time

The full-scale waveform of 25.0 mm/s or 12.5 mm/s can be printed for a specific time. Maximum of 99 waveforms for the specified time can be printed.



1) Start Time

Enter the start time for the printing full-scale waveform.

2) End Time

Enter the end time for the printing full-scale waveform. If not entered, a waveform of 10 seconds for 25.0 mm/s, 1 minute for 12.5 mm/s will be printed.

3) Print Format

The print format of the waveform can be selected from 25.0 mm/s or 12.5 mm/s.

4) Comment

Enter a comment.

5) Register Button

Registers the time entered for the printing waveform to the list.

6) Delete Button

Deletes the selected item from the registered list.

7) All delete Button

Deletes all the items from the registered list.

8) Page Switch Arrow

Switches the page of the registered list.

9) Print preview Button

Displays the "Print preview" window.

10) Start printing Button

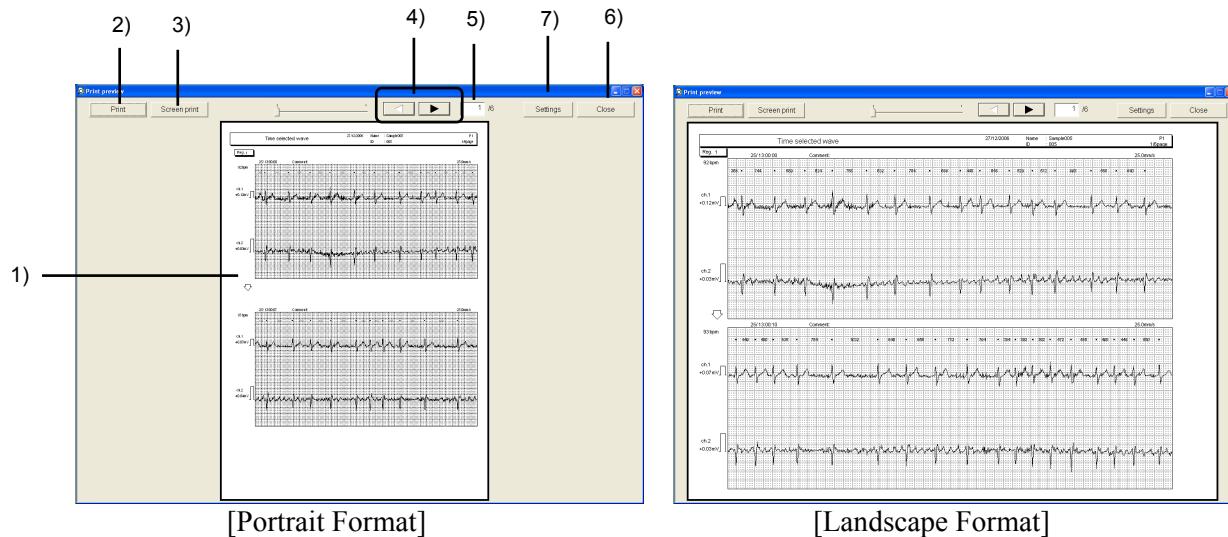
Starts the report printing.

11) Page Number Input Box

Enter the starting page number to print.

■ Print Preview

The preview display allows to verify the print out before printing.



1) Print Preview

Displays the print image.

2) Print Button

Starts printing the report.

3) Screen print Button

Starts printing the displayed page.

4) Switch Page Arrow

Displays the previous or next page.

5) Page Number Input Box

Displays the page number of the displayed preview. It is also possible to enter the page number you wish to display.

6) Close Button

Closes the preview window.

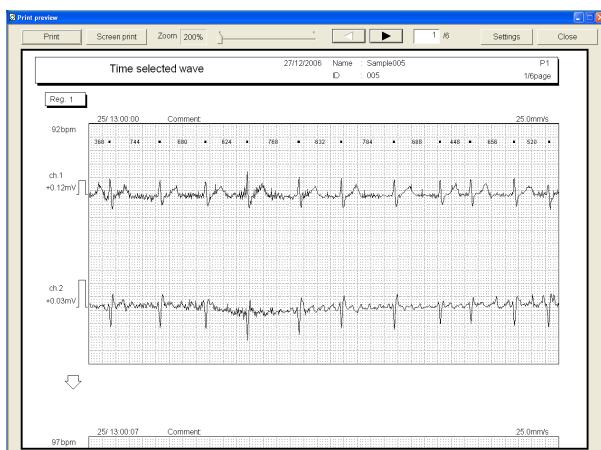
7) Settings Button

Selects whether or not to print the RR interval, patient name, patient ID, and printing date.

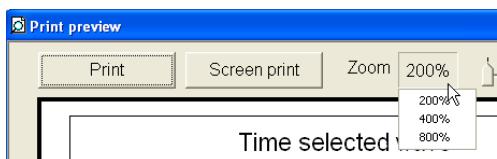
■Zoom Display

On the preview window, part of the display can be zoomed.

Double-click on the part where you wish to zoom. The display will enlarge with the selected part at the center.



To cancel the zoom display, double-click again.



The zoom percentage can be selected from the drop-down box.

You can move the display location by dragging the display area.



Chapter 7

Removable Disk

7. 1 Removable Disk	7-2
7. 2 Media Number Registration	7-4
Procedure to Register the Media Number.....	7-5
7. 3 Searching Data	7-6
“Search” Window	7-6
After Searching the Data.....	7-7
7. 4 Loading Data	7-8
Working on the Removable Disk Data	7-8
7. 5 Other Operations on the Removable Disk Data.....	7-9
Redisplay	7-9
Delete	7-10
Select All / Cancel All	7-11

7. 1 Removable Disk

The ECG data and analysis result can be stored on a removable disk.

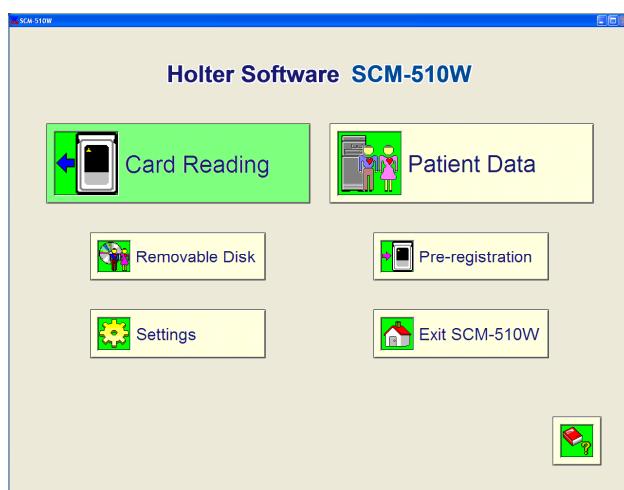
The following removable disk device can be used on the SCM-510W. Other devices cannot be used.

DVD-RAM Drive

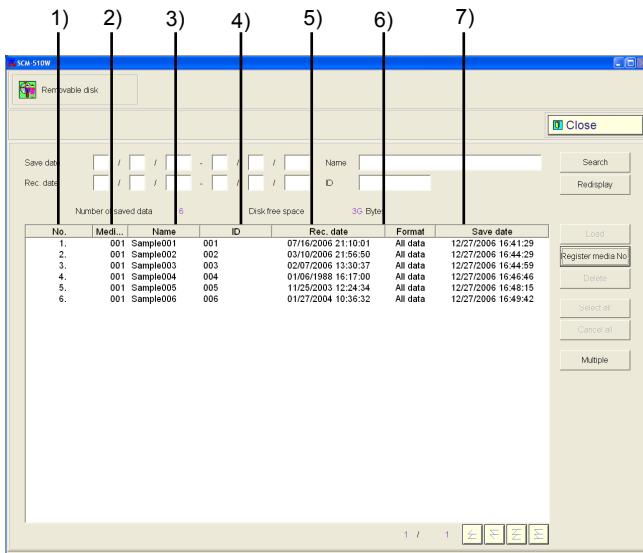
The media that can be used are as follows.

Single Side 2.6G, Single Side 4.7G : DVD-RAM media

The format function is not provided on the SCM-510W. Refer to the operation manual of the removable disk device to format the media.



Click the **Removable Disk** button on the “Initial” window, to display the “Removable disk” window.



The following items displayed on the “Removable disk” window are.

1) No.

Displays the removable disk number. The numbers are sequentially assigned to the removable disk from No.1.

2) Media No.

Displays the media number.

3) Name

Displays the stored name.

4) ID

Displays the stored ID.

5) Rec. date

Displays the recording start date/time.

6) Format

Displays the stored format (All data, Basic, IC card).

7) Save date

Displays the stored date/time.

7. 2 Media Number Registration

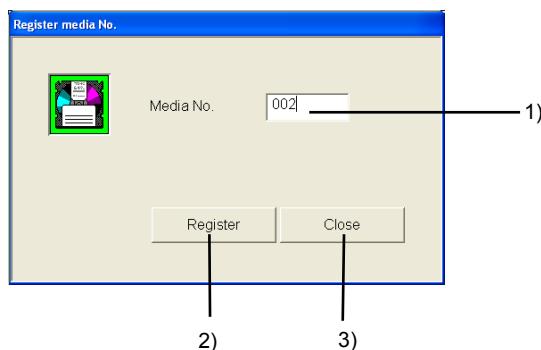
Registering the media number will simplify the process to search a patient data later.

To perform the media number registration, the media needs to be formatted.

If using a unformatted media, refer to the operation manual of the used external storage device and format the media.

To perform media number registration, all recorded data on the media needs to be erased.
If there are data recorded on the media, delete all files using Explorer or format the media.

Click the **Register media No.** button on the “Removable disk” window, to display the “Register media no.” window.



1) Media No. Box

Area to enter the media no.

Maximum of 10 letters can be entered.

2) Register

Registers the entered media no.

3) Close

Closes the “Register media no.” window.

Procedure to Register the Media Number

- 1) Insert a media to the DVD drive.

Check if the media is formatted using the Explorer, etc.

If unformatted, refer to the operation manual of the used external storage device and format the media.

- 2) Click the **Register media No.** button on the “Removable disk” window, to open the “Register media no.” window.



- 3) Enter the media number in the “Media No.” box.



- 4) Click on the **Register** button, to register the entered media number.



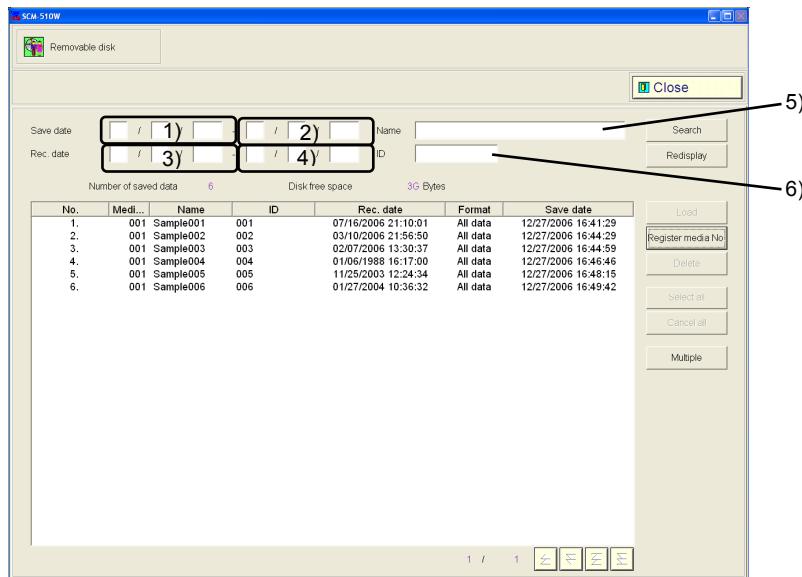
7. 3 Searching Data

On the “Search” window, specific patient information can be searched from the stored data on the removable disk.

For example, the patient data of which only the ID is known can be searched using this function.

“Search” Window

On the “Search” window, the data can be searched by the stored date, recorded date, name, or ID. The data that matches all search conditions will be searched. If all search conditions are left blank, all data will be displayed.



1) Save date (From)

Searches the data, which was stored after the entered date.

2) Save date (To)

Searches the data, which was stored before the entered date.

3) Rec. date (From)

Searches the data, which was recorded after the entered date.

4) Rec. date (To)

Searches the data, which was recorded before the entered date.

5) Name

Searches the data, which includes the entered character string.

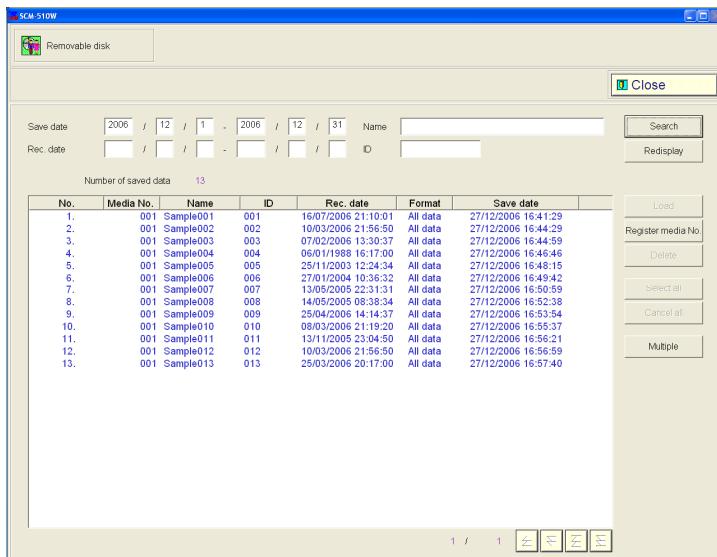
6) ID

Searches the data, which includes the entered character string.

After Searching the Data

The patient data that matched the search condition will be displayed in list format.

 **Memo** The searched result will be displayed in blue letters.

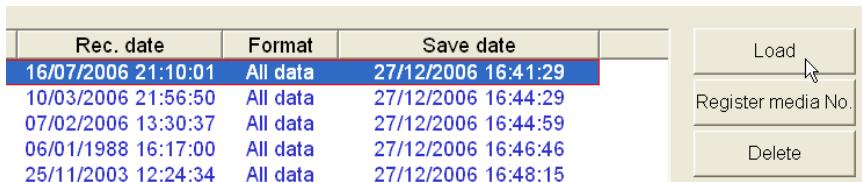


The screenshot shows the SCM-510W software interface with a search results window. The search criteria at the top are: Save date: 2006/12/1 - 2006/12/31, Name: [empty], Rec. date: [empty], ID: [empty]. The 'Search' button is highlighted in blue. To the right are 'Close', 'Redisplay', and other buttons like 'Load', 'Register media No.', 'Delete', 'Select all', 'Cancel all', and 'Multiple'. Below the search area is a table titled 'Number of saved data 13'. The table columns are: No., Media No., Name, ID, Rec. date, Format, and Save date. The data rows are:

No.	Media No.	Name	ID	Rec. date	Format	Save date
1.	001	Sample001	001	16/07/2006 21:10:01	All data	27/12/2006 16:41:29
2.	001	Sample002	002	10/03/2006 21:56:50	All data	27/12/2006 16:44:29
3.	001	Sample003	003	07/02/2006 13:30:37	All data	27/12/2006 16:44:59
4.	001	Sample004	004	06/01/1988 16:17:00	All data	27/12/2006 16:46:46
5.	001	Sample005	005	25/11/2003 12:24:34	All data	27/12/2006 16:48:15
6.	001	Sample006	006	27/01/2004 10:36:32	All data	27/12/2006 16:49:42
7.	001	Sample007	007	13/05/2005 12:23:13	All data	27/12/2006 16:50:59
8.	001	Sample008	008	14/05/2005 08:38:34	All data	27/12/2006 16:52:38
9.	001	Sample009	009	25/04/2006 14:14:37	All data	27/12/2006 16:53:54
10.	001	Sample010	010	08/03/2006 21:19:20	All data	27/12/2006 16:55:37
11.	001	Sample011	011	13/11/2005 23:04:50	All data	27/12/2006 16:56:21
12.	001	Sample012	012	10/03/2006 21:56:50	All data	27/12/2006 16:56:59
13.	001	Sample013	013	25/03/2006 20:17:00	All data	27/12/2006 16:57:40

The above example shows the searched result for the data that were stored in December 2006. The searched data on the list can be loaded or deleted.

- 1) Select a data. More than one data can be selected by clicking **[Multiple]**.



The screenshot shows the software interface with a single row of data selected. The selected row is highlighted in blue and contains: Rec. date: 16/07/2006 21:10:01, Format: All data, Save date: 27/12/2006 16:41:29. To the right are buttons: 'Load' (highlighted in blue), 'Register media No.', and 'Delete'.

Rec. date	Format	Save date
16/07/2006 21:10:01	All data	27/12/2006 16:41:29
10/03/2006 21:56:50	All data	27/12/2006 16:44:29
07/02/2006 13:30:37	All data	27/12/2006 16:44:59
06/01/1988 16:17:00	All data	27/12/2006 16:46:46
25/11/2003 12:24:34	All data	27/12/2006 16:48:15

- 2) Click **[Load]** or **[Delete]**. A message to insert the media will be displayed.



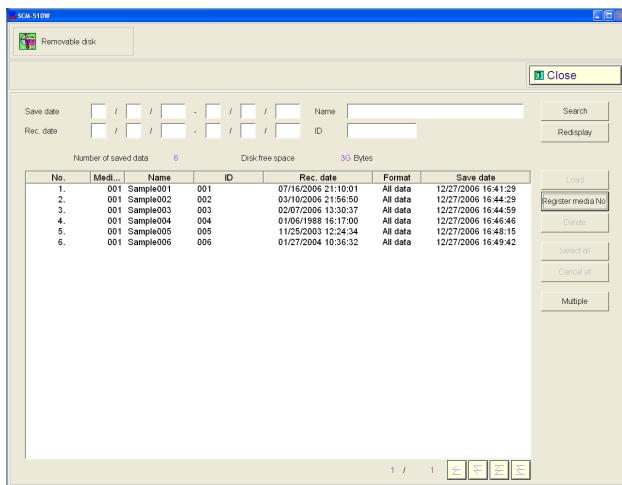
- 3) Follow the message and insert the media into the drive.
- 4) Once the access lamp of the drive turns off, click **[OK]**.
The load process or delete process will start.
To cancel the operation, click **[Cancel]**.

7. 4 Loading Data

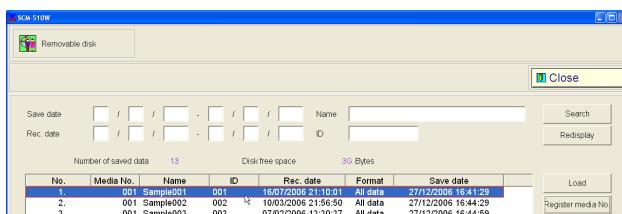
Working on the Removable Disk Data

The SCM-510W is not capable to directly operate the data stored in a removable disk. To work on the data stored in a removable disk, the data needs to be loaded to the hard disk first. The free space on the hard disk will be searched from No.1 to load the data.

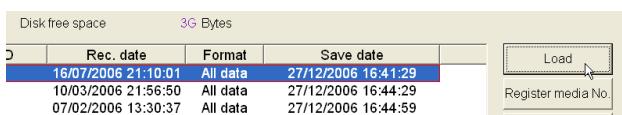
- 1) Insert a media or search the data, and display the data list.



- 2) Select a data by clicking on it.



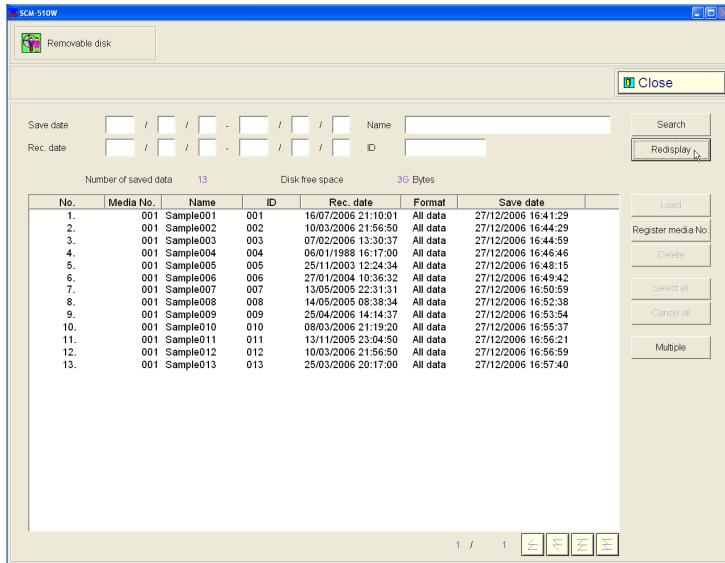
- 3) Click **Load**. If the list is displayed directly from the media, the loading process will immediately start.



If the list is displayed after searching the data, a message to insert the media will be displayed. Insert the media and click **OK**. Then the loading process will start.

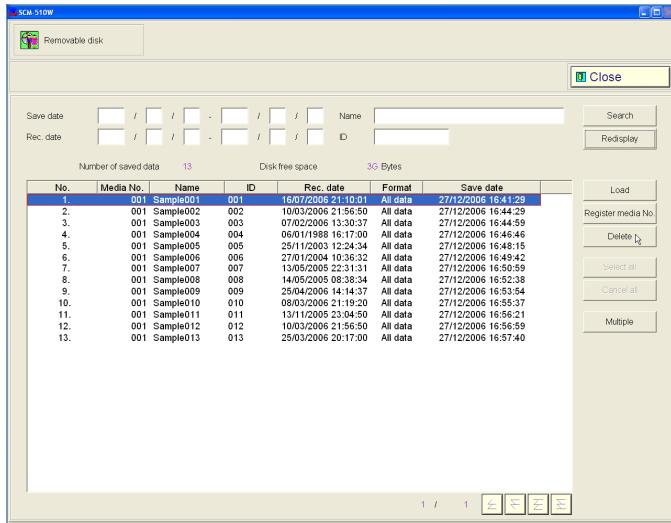
7. 5 Other Operations on the Removable Disk Data

Redisplay



If the media is exchanged while the “Removable disk” window is displayed, the displayed data will not change. To display the data of the inserted media, click **Redisplay**.

Delete



To delete stored data, select the data you want to delete on the “Removable disk” window, and click **Delete**.

A confirmation message will be displayed.

To select the data, click on the data in the list. More than one data can be selected.

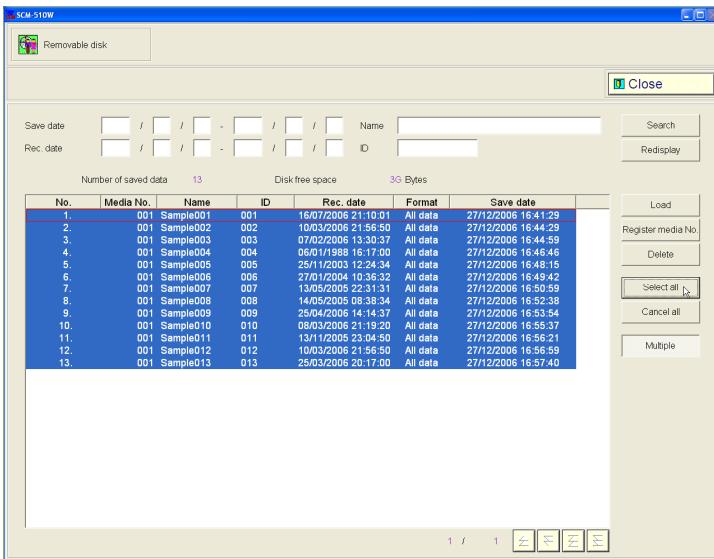
By using the “Shift” key, selection by range is also possible.

- | | |
|---------------|---|
| OK | : Deletes all the selected data. |
| Cancel | : Returns to the “Removable disk” window. |

The delete process on the “Removable disk” window, will only delete the management data on the database or media.

Therefore, this delete process will not increase the free space on the media.

Select All / Cancel All



To select all the stored data on the list, click **Select all** on the “Removable disk” window.
To cancel the selection, click **Cancel all**.

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Chapter 8

Default Settings

8. 1 Analysis and Measurement Settings.....	8–2
Analysis Settings.....	8–2
Arrhythmia Threshold.....	8–2
ST Threshold	8–2
Pacemaker Threshold.....	8–2
SAS Threshold.....	8–2
8. 2 Report Settings	8–3
8. 3 System Settings	8–4
8. 4 Table Settings.....	8–5

8. 1 Analysis and Measurement Settings

Three types of analyzing programs can be set. The default settings (except title) are the same for all three analyzing programs.

Analysis Settings

Setup Item	Selections	Default Setting
Noise Reduction	High Normal	Normal
T-wave Mask	200 ~ 500 ms	300 ms

Arrhythmia Threshold

Setup Item	Selections	Default Setting
Pause	1.5 ~ 5.0 s	2.0 s
R on T	200 ~ 500 ms	250 ms
SPVC	35 ~ 90%	75%

ST Threshold

Setup Item	Selections	Default Setting
Base Point (Level)	296 ~ 0 ms before the R wave	56 ms
Base Point (Slope)	0 ~ 496 ms after the R wave	56 ms
Measure Point	0 ~ 496 ms after the R wave	96 ms

Pacemaker Threshold

Setup Item	Selections	Default Setting
Pacing Beat Range	-400 ms from the R-wave	-300 ms
R-wave	-400 ~ 100 ms	-60 ms
Fusion Beat Range	+100 ms from the R-wave	+10 ms

SAS Threshold

Setup Item	Selections	Default Setting
Apnea / Hypopnea	4 ~ 30 s	10 s
Oxygen Desaturation:		
Dip level	0 ~ 10%	4%
Rise level after dip	0 ~ 10%	2%

8. 2 Report Settings

Three types of patterns can be set.

Setup Item	Selections	Default Setting		
Print Report		1	2	3
Cover Page	ON / OFF	OFF	ON	ON
Summary Report	ON / OFF	OFF	ON	ON
Arrhythmia List	ON / OFF	OFF	ON	ON
Arrhythmia Histogram	ON / OFF	OFF	ON	ON
Morphology	ON / OFF	OFF	ON	ON
RR Histogram	ON / OFF	OFF	ON	ON
ST List	ON / OFF	OFF	ON	ON
ST Trend	ON / OFF	OFF	ON	ON
AF Report	ON / OFF	OFF	ON	ON
Registered Wave	ON / OFF	OFF	ON	ON
Full Disclosure	ON / OFF	OFF	ON	OFF
Pacemaker Report	ON / OFF	OFF	ON	ON
SpO ₂ List	ON / OFF	OFF	ON	ON
SpO ₂ Trend	ON / OFF	OFF	ON	ON
Base with Patient Diary	ON / OFF	OFF	ON	ON
System Setting List	ON / OFF	OFF	ON	ON
Waveform Format	Zoom List	Zoom		
Channel of Full Disclosure Waveform	ch. 1 ch. 2 ch. 3 ch. 1+2 ch. 1+3 ch. 2+3 ch. 1+2+3	ch. 1		

8. 3 System Settings

Setup Item	Selections	Default Setting
Patient Data Drive	Automatically recognized fixed drive	C:
Card Reader Drive	Other drive	– (None)
Removable Disk Drive	Other drive	– (None)
Color Setting No.	1 or 2	1

8. 4 Table Settings

Setup Item	Selections	Default Setting
Hospital	Max. 50 data, 32 characters each	None
Ward	Max. 50 data, 24 characters each	None
Department	Max. 50 data, 24 characters each	None
Doctor	Max. 50 data, 24 characters each	None
Operator	Max. 50 data, 24 characters each	None
Symptoms	Max. 50 data, 32 characters each	None
Disorders	Max. 50 data, 32 characters each	None
Medications	Max. 50 data, 32 characters each	None
Purposes	Max. 50 data, 64 characters each	None
Remarks	Max. 50 data, 64 characters each	None
Leads	Max. 50 data, 4 characters each	CC5, CM5, NASA
User Defined Beat	One data of maximum 8 characters	User Defined Beat
Comment	Max. 50 data, 32 characters each	Pause, V-Run, V-Couplet, R on T, Bigeminy, Trigeminy, V-Single, S-Run, S-Couplet, S-Single, Af, Apnea/Hypopnea, Oxygen desaturation

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Appendix

1. Event.....	Appendix–2
Ventricular Arrhythmia Event.....	Appendix–2
Supraventricular Arrhythmia Event.....	Appendix–3
Other Arrhythmia Event.....	Appendix–4
Patient Event	Appendix–4
Priority of the Event.....	Appendix–4
2. Abbreviations.....	Appendix–5

1. Event

Ventricular Arrhythmia Event

The ventricular arrhythmia is an event of ventricular premature contraction (VPC) heartbeat.

●V-Run

VPC continuing for three beats or more.

●V-Couplet

VPC continuing for two beats.

●R on T



The combination of non-VPC and VPC, with RR interval of VPC equal to or less than “R on T” threshold.

Threshold range of “R on T”: 200 ~ 350ms

Y : RR interval equal to or less than the threshold level

●Bigeminy



VPC and non-VPC alternately continuing for five beats or more.

●Trigeminy



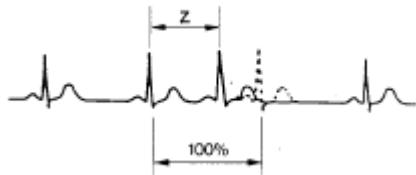
The combination of VPC and two beats of non-VPC continuing for seven beats or more.

●V-Single

VPC which does not apply to other VPC events (V-Run, V-Couplet, R on T, Bigeminy, Trigeminy).

Supraventricular Arrhythmia Event

The supraventricular arrhythmia is an event of supraventricular premature contraction heartbeat.



The heartbeat is defined as supraventricular premature contraction if the RR interval of non-VPC is equal to or less than the threshold level of supraventricular premature contraction, assuming that the mean value of normal RR interval is 100%.

Threshold range of supraventricular premature contraction: 35 ~ 90%

z: Equal to or less than the threshold level

●S-Run

Supraventricular premature contraction continuing for three beats or more.

●S-Couplet

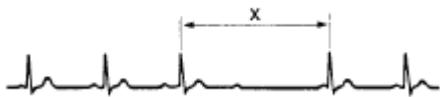
Supraventricular premature contraction continuing for two beats.

●S-Single

Supraventricular premature contraction which does not apply to other supraventricular premature contraction events (S-Run, S-Couplet).

Other Arrhythmia Event

●Pause



The heartbeat with RR interval equal to or less than 30 seconds and equal to or more than the “Pause” threshold level.

Threshold Range of Pause : 2.0 ~ 5.0 s

x : Equal to or less than 30 seconds and equal to or more than the “Pause” threshold level

Patient Event

Patient event is the time when the “Event” switch is pressed on the Fukuda Denshi recorder.

Priority of the Event

Pause	: In the order starting from the longer RR interval
V-Run	: In the order starting from the larger number of “Run”
R on T	: In the order starting from the shorter RR interval
Bigeminy	: In the order starting from the larger number of heartbeats
Trigeminy	: In the order starting from the larger number of heartbeats
S-Run	: In the order starting from the larger number of “Run”
S-Single	: In the order starting from the shorter RR interval ratio

2. Abbreviations

The following is the list of abbreviations used for the SCM-510W.

Abbreviation	Original Term
A pacing	Atrial pacing
Af	Atrial fibrillation
ASDNN	Average of Standard Deviation of NN intervals
AV pacing	Atrial and Ventricular pacing
AVNN	Average of NN intervals
BMI	Body Mass Index
BP	Blood pressure
c/b	cycle/beat
CI	Coupling Interval/RR interval
CSA	Central Sleep Apnea
CV	Coefficient of Variance
CVNN	Coefficient of Variance of NN intervals
ECG	Electrocardiogram
Effort	Effort respiration
Full D.	Full Disclosure
FFT	Fast Fourier Transformation
Flow	Nasal and oral airflow
HF	High Frequency
HR	Heart Rate
HRV	Heart Rate Variability
Hyp.	Hypopnea
LF	Low Frequency
Max.	Maximum
MEM	Maximum Entropy Method
Min.	Minimum
MSA	Mixed Sleep Apnea
NC	Non capture
OS	Over Sensing
OSA	Obstructive Sleep Apnea
Rec.	Recording
Resp. rate	Respiration rate
RMSSD	Root Mean Square Successive Difference of NN intervals
RR	RR interval

Abbreviation	Original Term
SAS	Sleep Apnea Syndrome
SD	Standard Deviation
SDANN	Standard Deviation of Average NN intervals
SDNN	Standard Deviation of NN intervals
SVPC	Supraventricular Premature Contraction
TEL	Telephone number
US	Under Sensing
V pacing	Ventricular pacing
VPC	Ventricular Premature Contraction
Yrs.	Years



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