SL1000
Acquisition Software

USER'S MANUAL

Thank you for purchasing the SL1000 High-Speed Data Acquisition Unit. This user's manual explains the functions and operating procedures of the SL1000 Acquisition Software. To ensure correct use, please read this manual thoroughly before beginning operation.

After reading the manual, keep it in a convenient location for quick reference whenever a question arises during operation.

List of Manuals

The following manuals, including this one, are provided as manuals for the SL1000. Please read all of them.

Manual Title	Manual No.	Description
SL1000 High-Speed Data Acquisition Unit User's Manual	IM 720120-01E	Explains all functions and procedures of the SL1000 excluding the communication functions.
SL1000 Acquisition Software User's Manual	IM 720120-61E	This manual. Explains all functions and procedures of the Acquisition Software used to configure and control the SL1000.
SL1000 Input Module User's Manual	IM 720120-51E	Explains the specifications of the input modules that can be installed in the SL1000.
Precautions Concerning the Modules	IM 701250-04E	The manual explains the precautions concerning the modules.
701992 Xviewer Install Manual	IM 701992-02E	This manual explains how to install the Xviewer* setup software.
SL1000 High-Speed Data Acquisition Unit	IM 720120-92	Document for China

The "E" in the manual numbers are the language codes.

* The Xviewer user's manual is included in the Xviewer help.

Contact information of Yokogawa offices worldwide is provided on the following sheet.

Document No.	Description
PIM 113-01Z2	List of worldwide contacts

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions. The figures given in this manual may differ from those that actually appear on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
- Copying or reproducing all or any part of the contents of this manual without YOKOGAWA's permission is strictly prohibited.
- The TCP/IP software of this product and the document concerning the TCP/IP software have been developed/created by YOKOGAWA based on the BSD Networking Software, Release 1 that has been licensed from University of California.

Trademarks

- Microsoft, Internet Explorer, Windows, Windows 7, Windows 8, and Windows 10 are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- Adobe, Acrobat, and PostScript are trademarks of Adobe Systems Incorporated.
- MATLAB is a registered trademark of The MathWorks, Incorporated in the United States.
- For purposes of this manual, the ® and TM symbols do not accompany their respective registered trademark names or trademark names.
- Other company and product names are registered trademarks or trademarks of their respective holders.

Revisions

- 1st Edition: September 2007
- 2nd Edition: September 2008
- 3rd Edition: May 2009
- 4th Edition: July 2012
- 5th Edition: September 2013
- 6th Edition: June 2014
- 7th Edition: October 2015
- 8th Edition: July 2017
- 9th Edition: October 2017
- 10th Edition: August 2018

Terms and Conditions of the Software License

Yokogawa Electric Corporation and Yokogawa Test & Measurement Corporation, Japanese corporations (hereinafter called "Yokogawa"), grants permission to use this Yokogawa Software Program (hereinafter called the "Licensed Software") to the Licensee on the conditions that the Licensee agrees to the terms and conditions stipulated in Article 1 hereof.

You, as the Licensee (hereinafter called "Licensee"), shall agree to the following terms and conditions for the software license (hereinafter called the "Agreement") based on the use intended for the Licensed Software.

Please note that Yokogawa grants the Licensee permission to use the Licensed Software under the terms and conditions herein and in no event shall Yokogawa intend to sell or transfer the Licensed Software to the Licensee.

Licensed Software Name: SL1000 Acquisition Software

Article 1 (Scope Covered by these Terms and Conditions)

1.1 The terms and conditions stipulated herein shall be applied to any Licensee who purchases the Licensed Software on the condition that the Licensee consents to agree to the terms and conditions stipulated herein.

1.2 The "Licensed Software" herein shall mean and include all applicable programs and documentation, without limitation, all proprietary technology, algorithms, and know-how such as a factor, invariant or process contained therein.

Article 2 (Grant of License)

2.1 Yokogawa grants the Licensee, for the purpose of single use, non-exclusive and non-transferable license of the Licensed Software.

2.2 The Licensee is, unless otherwise agreed in writing by Yokogawa, not entitled to copy, change, sell, distribute, transfer, or sublicense the Licensed Software.

2.3 The Licensed Software shall not be copied in whole or in part except for keeping one (1) copy for back-up purposes. The Licensee shall secure or supervise the copy of the Licensed Software by the Licensee itself with great, strict, and due care.

2.4 In no event shall the Licensee dump, reverse assemble, reverse compile, or reverse engineer the Licensed Software so that the Licensee may translate the Licensed Software into other programs or change it into a man-readable form from the source code of the Licensed Software. Unless otherwise separately agreed by Yokogawa, Yokogawa shall not provide the Licensee the source code for the Licensed Software.

2.5 The Licensed Software and its related documentation shall be the proprietary property or trade secret of Yokogawa or a third party which grants Yokogawa the rights. In no event shall the Licensee be transferred, leased, sublicensed, or assigned any rights relating to the Licensed Software.

2.6 Yokogawa may use or add copy protection in or onto the Licensed Software. In no event shall the Licensee remove or attempt to remove such copy protection.

2.7 The Licensed Software may include a software program licensed for re-use by a third party (hereinafter called "Third Party Software", which may include any software program from affiliates of Yokogawa made or coded by themselves.) In the case that Yokogawa is granted permission to sublicense to third parties by any licensors (sub-licensor) of the Third Party Software pursuant to different terms and conditions than those stipulated in this Agreement, the Licensee shall observe such terms and conditions of which Yokogawa notifies the Licensee in writing separately.

2.8 In no event shall the Licensee modify, remove or delete a copyright notice of Yokogawa and its licenser contained in the Licensed Software, including any copy thereof.

Article 3 (Restriction of Specific Use)

3.1 The Licensed Software shall not be intended specifically to be designed, developed, constructed, manufactured, distributed or maintained for the purpose of the following events:
   a)   Operation of any aviation, vessel, or support of those operations from the ground;,
   b)   Operation of nuclear products and/or facilities;,
   c)   Operation of nuclear weapons and/or chemical weapons and/or biological weapons; or
   d)   Operation of medical instrumentation directly utilized for humankind or the human body.

3.2 Even if the Licensee uses the Licensed Software for the purposes in the preceding Paragraph 3.1, Yokogawa has no liability to or responsibility for any demand or damage arising out of the use or operations of the Licensed Software, and the Licensee agrees, on its own responsibility, to solve and settle the claims and damages and to defend, indemnify or hold Yokogawa totally harmless, from or against any liabilities, losses, damages and expenses (including fees for recalling the Products and reasonable attorney's fees and court costs), or claims arising out of and related to the above-said claims and damages.

Article 4 (Warranty)

4.1 The Licensee shall agree that the Licensed Software shall be provided to the Licensee on an "as is" basis when delivered. If defect(s), such as damage to the medium of the Licensed Software, attributable to Yokogawa is found, Yokogawa agrees to replace, free of charge, any Licensed Software on condition that the defective Licensed Software shall be returned to Yokogawa's specified authorized service facility within seven (7) days after opening the Package at the Licensee's expense. As the Licensed Software is provided to the Licensee on an "as is" basis when delivered, in no event shall Yokogawa warrant that any information on or in the Licensed Software, including without limitation, data on computer programs and program listings, be completely accurate, correct, reliable, or the most updated.

4.2 Notwithstanding the preceding Paragraph 4.1, when third party software is included in the Licensed Software, the warranty period and terms and conditions that apply shall be those established by the provider of the third party software.

4.3 When Yokogawa decides in its own judgement that it is necessary, Yokogawa may from time to time provide the Licensee with Revision upgrades and Version upgrades separately specified by Yokogawa (hereinafter called "Updates").

4.4 Notwithstanding the preceding Paragraph 4.3, in no event shall Yokogawa provide Updates where the Licensee or any third party conducted renovation or improvement of the Licensed Software.

4.5 THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY AND PERFORMANCE, WRITTEN, ORAL, OR IMPLIED, AND ALL OTHER WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED BY YOKOGAWA AND ALL THIRD PARTIES LICENSING THIRD PARTY SOFTWARE TO YOKOGAWA.

4.6 Correction of nonconformity in the manner and for the period of time provided above shall be the Licensee's sole and exclusive remedy for any failure of Yokogawa to comply with its obligations and shall constitute fulfillment of all liabilities of Yokogawa and any third party licensing the Third Party Software to Yokogawa (including any liability for direct, indirect, special, incidental or consequential damages) whether in warranty, contract, tort (including negligence but excluding willful conduct or gross negligence by Yokogawa) or otherwise with respect to or arising out of the use of the Licensed Software.

Article 5 (Infringement)

5.1 If and when any third party should demand injunction, initiate a law suit, or demand compensation for damages against the Licensee under patent right (including utility model right, design patent, and trade mark), copy right, and any other rights relating to any of the Licensed Software, the Licensee shall notify Yokogawa in writing to that effect without delay.

5.2 In the case of the preceding Paragraph 5.1, the Licensee shall assign to Yokogawa all of the rights to defend the Licensee and to negotiate with the claiming party. Furthermore, the Licensee shall provide Yokogawa with necessary information or any other assistance for Yokogawa's defense and negotiation. If and when such a claim should be attributable to Yokogawa, subject to the written notice to Yokogawa stated in the preceding Paragraph 5.1, Yokogawa shall defend the Licensee and negotiate with the claiming party at Yokogawa's cost and expense and be responsible for the final settlement or judgment granted to the claiming party in the preceding Paragraph 5.1.

5.3 When any assertion or allegation of the infringement of the third party's rights defined in Paragraph 5.1 is made, or when at Yokogawa's judgment there is possibility of such assertion or allegation, Yokogawa will, at its own discretion, take any of the following countermeasures at Yokogawa's cost and expense.
   a)   To acquire the necessary right from a third party which has lawful ownership of the right so that the Licensee will be able to continue to use the Licensed Software;
   b)   To replace the Licensed Software with an alternative one which avoids the infringement; or
   c)   To remodel the Licensed Software so that the Licensed Software can avoid the infringement of such third party's right.

5.4 If and when Yokogawa fails to take either of the countermeasures as set forth in the preceding subparagraphs of Paragraph 5.3, Yokogawa shall indemnify the Licensee only by paying back the price amount of the Licensed Software which Yokogawa has received from the Licensee. THE FOREGOING PARAGRAPHS STATE THE ENTIRE LIABILITY OF YOKOGAWA AND ANY THIRD PARTY LICENSING THIRD PARTY SOFTWARE TO YOKOGAWA WITH RESPECT TO INFRINGEMENT OF THE INTELLECTUAL PROPERTY RIGHTS INCLUDING BUT NOT LIMITED TO, PATENT AND COPYRIGHT.

Terms and Conditions of the Software License

Article 6 (Liabilities)

6.1 If and when the Licensee should incur any damage relating to or arising out of the Licensed Software or service that Yokogawa has provided to the Licensee under the conditions herein due to a reason attributable to Yokogawa, Yokogawa shall take actions in accordance with this Agreement. However, in no event shall Yokogawa be liable or responsible for any special, incidental, consequential and/or indirect damage, whether in contract, warranty, tort, negligence, strict liability, or otherwise, including, without limitation, loss of operational profit or revenue, loss of use of the Licensed Software, or any associated products or equipment, cost of capital, loss or cost of interruption of the Licensee's business, substitute equipment, facilities or services, downtime costs, delays, and loss of business information, or claims of customers of Licensee or other third parties for such or other damages. Even if Yokogawa is liable or responsible for the damages attributable to Yokogawa and to the extent of this Article 6, Yokogawa's liability for the Licensee's damage shall not exceed the price amount of the Licensed Software or service fee which Yokogawa has received. Please note that Yokogawa shall be released or discharged from part or all of the liability under this Agreement if the Licensee modifies, remodels, combines with other software or products, or causes any deviation from the basic specifications or functional specifications, without Yokogawa's prior written consent.

6.2 All causes of action against Yokogawa arising out of or relating to this Agreement or the performance or breach hereof shall expire unless Yokogawa is notified of the claim within one (1) year of its occurrence.

6.3 In no event, regardless of cause, shall Yokogawa assume responsibility for or be liable for penalties or penalty clauses in any contracts between the Licensee and its customers.

Article 7 (Limit of Export)

Unless otherwise agreed by Yokogawa, the Licensee shall not directly or indirectly export or transfer the Licensed Software to any countries other than those where Yokogawa permits export in advance.

Article 8 (Term)

This Agreement shall become effective on the date when the Licensee receives the Licensed Software and continues in effect unless or until terminated as provided herein, or the Licensee ceases using the Licensed Software by itself or with Yokogawa's thirty (30) days prior written notice to the Licensee.

Article 9 (Injunction for Use)

During the term of this Agreement, Yokogawa may, at its own discretion, demand injunction against the Licensee in case that Yokogawa deems that the Licensed Software is used improperly or under severer environments other than those where Yokogawa has first approved, or any other condition which Yokogawa may not permit.

Article 10 (Termination)

Yokogawa, at its sole discretion, may terminate this Agreement without any notice or reminder to the Licensee if the Licensee violates or fails to perform this Agreement. However, Articles 5, 6, and 11 shall survive even after the termination.

Article 11 (Jurisdiction)

Any dispute, controversies, or differences between the parties hereto as to interpretation or execution of this Agreement shall be resolved amicably through negotiation between the parties upon the basis of mutual trust. Should the parties fail to agree within ninety (90) days after notice from one of the parties to the other, both parties hereby irrevocably submit to the exclusive jurisdiction of the Tokyo District Court (main office) in Japan for settlement of the dispute.

Article 12 (Governing Law)

This Agreement shall be governed by and construed in accordance with the laws of Japan. The Licensee expressly agrees to waive absolutely and irrevocably and to the fullest extent permissible under applicable law any rights against the laws of Japan which it may have pursuant to the Licensee's local law.

Article 13 (Severability)

In the event that any provision hereof is declared or found to be illegal by any court or tribunal of competent jurisdiction, such provision shall be null and void with respect to the jurisdiction of that court or tribunal and all the remaining provisions hereof shall remain in full force and effect.

How to Use This Manual

Structure of the Manual

This user's manual consists of the following sections.

Chapter	Title	Description
1	**What the Acquisition Software Can Do**	Gives an overview of the Acquisition Software and the details of its functions.
2	**Installation**	Explains how to install and uninstall the Acquisition Software and how to install the USB driver.
3	**Connecting to an SL1000**	Explains how to connect the SL1000 Data Acquisition Unit to your PC.
4.	**Setting the Measurement Conditions**	Explains how to set the measurement conditions, trigger functions, GO/NO-GO judgment functions, and alarm functions for each input module and how to start measurements.
5	**Recording Measured Data**	Explains how to record the measured data.
6	**Display**	Explains how to display waveforms of measured data and how to set the screen.
7	**Analysis**	Explains the automated measurement of waveform parameters and how to read measured values using cursors.
8	**Saving, Loading, and Transferring Data**	Explains how to display waveforms of data measured in the past, how to save the SL1000's measured data to your PC, how to save setup data, how to load previous setup data, how to save computed data and screen captures of measured waveforms, how to average and save measured data, and how to transfer files between the SL1000 and your PC.
9	**Other Functions**	Explains how to set the clock, the start-up and exit options, as well as how to perform a self-test, key lock, initialization, calibration, and the like.
10	**File Operation**	Explains how to merge files, how to divide files, how to accelerate waveform displaying, how to convert data to CSV files, and so on.
11	**Error Messages**	Lists various error messages.
12	**Specifications**	Lists the specifications of the Acquisition Software.
Appendix		Explains the relationship between the number of data points and acquisition count, the relationship between the maximum number of measured points and measuring time, and the relationship between the number of channels and sample rate.
Index		

Contents

1

2

3

4

5

6

7

8

9

10

11

12

App

Index

Contents

1.1   Overview of This Software

The Acquisition Software is used to connect to an SL1000 via the USB interface or the optional Ethernet interface and record and display data that the SL1000 has measured. The Acquisition Software allows you to do the following:
• Set measurement and record conditions of an SL1000.
• Start and stop measurements on an SL1000.
• Start and stop recording.
• Display waveforms of the measured data, cursor values, and waveform parameters.
• Synchronize the operation of up to eight linked SL1000s.
• Start the Xviewer (accompanying software) and display waveforms of data saved in the past (excluding the /XV0 option)

Signal and Data Flow

The signal and data flow between this software and the SL1000 is described below.
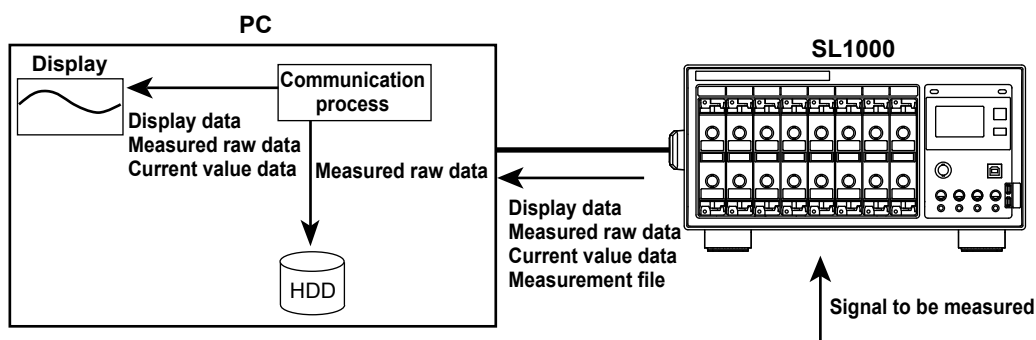
Display Data

P-P compression data that the SL1000 creates for displaying waveforms. The data is sent to your PC in unit of measuring groups. For a description of display groups, see section 1.5.

Measured Raw Data

All the measured data that the SL1000 acquired. The data is sent to your PC in unit of measuring groups to save the data on the hard disk of your PC. For a description of measuring groups, see section 1.2.
The data is used in data analysis such as cursor measurements and waveform parameter computations.

Current Value Data

The current values that the SL1000 calculated. The data is sent immediately upon a request from your PC.

Measurement and Recording

This software refers to the task of acquiring measured data into the internal memory of an SL1000 as measurement and the task of saving the measured data that has been acquired to the internal memory of an SL1000 as files on your PC's hard disk or the internal hard disk of an SL1000 while making measurements as recording.

The measured data acquired in the internal memory of an SL1000 is cleared when the power is turn ON/OFF or when measurement is resumed. The waveform screen of this software displays waveforms of measured data acquired to the internal memory of an SL1000 after applying P-P compression.
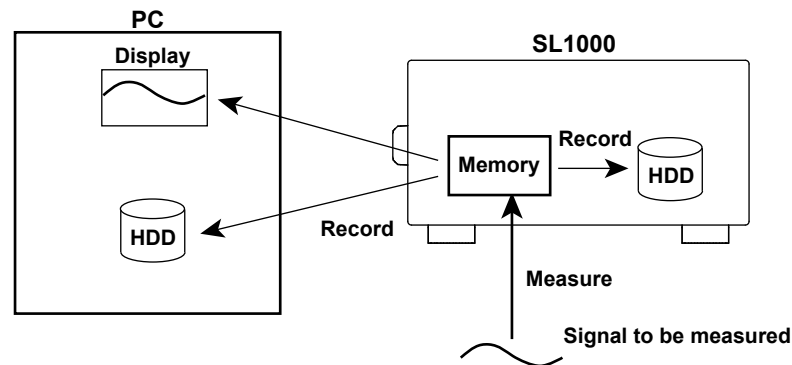

After the measurement stops, all the measured data acquired in the internal memory of an SL1000 can be saved as a single file on your PC. This task is referred to as saving not recording in which data is saved while the measurement is in progress.

Connecting to an SL1000

The USB can be used to connect your PC directly to an SL1000 or the optional Ethernet interface can be used to connect to an SL1000 over the network.

Only a single SL1000 can be connected to a single PC.

> **Note**
> - Remove the USB or Ethernet cable that is connecting the SL1000 to the PC only after you have exited the Acquisition Software or after you have disconnected the communication between the SL1000 and the PC.
> - In the default setting of the SL1000, the DHCP function is turned ON. You can immediately connect an SL1000 to your PC by connecting the SL1000 to a network with a DHCP server.
> - An exclusive driver is necessary to connect using the USB. If an SL1000 is connected to your PC via the USB, an installation wizard starts. Install the driver according to the instructions on the screen. For details, see section 2.3, "Installing the USB Driver."
> - You cannot connect both Ethernet and USB interfaces simultaneously to an SL1000. You cannot connect to the SL1000 that this software is connected to via USB, using the accompanying Xviewer (excluding /XV0) application nor using FTP.
> - When connecting an SL1000 to the PC, disable the PC standby mode. If it is enabled, the connection between the SL1000 and the PC may be disconnected.

Synchronous Operation

You can synchronize the operation of up to eight SL1000s by connecting them using the following synchronous connecting cable that are sold separately: 720901-01 (1 m in length) or 720901-02 (3 m in length).

For instructions on how to connect the SL1000s to your PC for synchronous operation and for details on the sync I/O connectors (SYNC IN and SYNC OUT), see the *SL1000 High-Speed Data Acquisition Unit User's Manual* (IM 720120-01E).
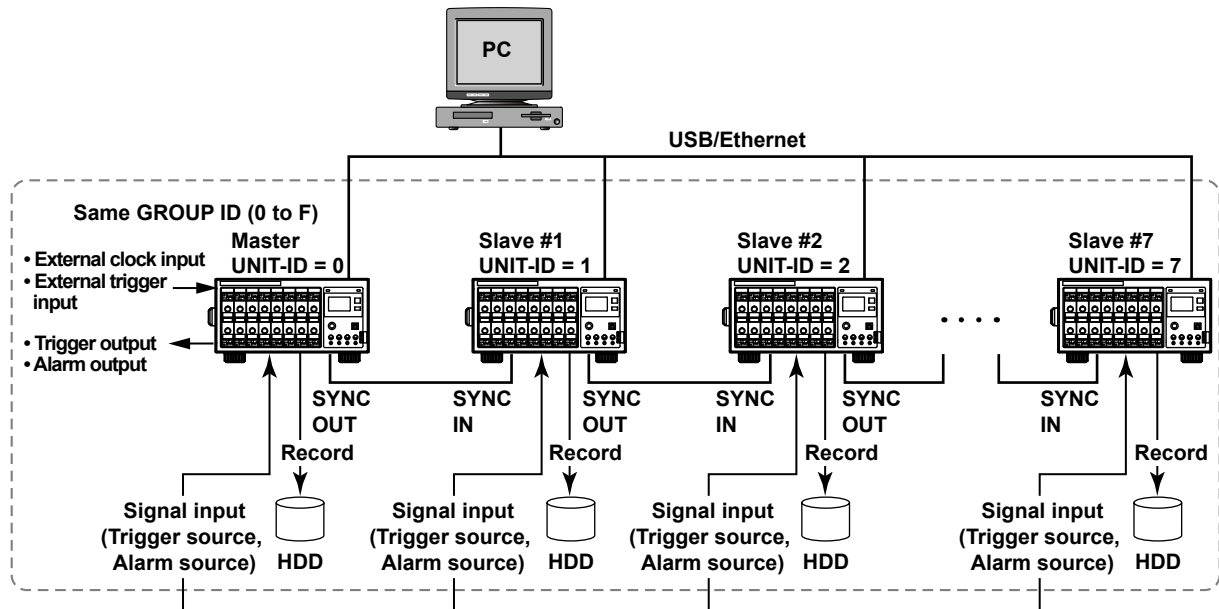
Trigger sources and alarm sources can be combined between units (using AND or OR logic).

The external clock input and external trigger input synchronize with the signals from the master unit. Trigger sources and alarm sources are combined using AND or OR logic between units, and are transmitted from the master unit's trigger output and alarm output. The slave units' external clock input, external trigger input, trigger output, and alarm output are invalid.

Synchronized Items

* Measurement and recording start and stop
* Clock
  Slave units synchronize to the master unit's external or internal clock.
* Time (The time of the slave unit is synchronized with the time of the master unit.)
* Triggering
  The AND or OR logic of the master unit's external trigger input and slave units' trigger sources.
  When the SL1000 triggers, the trigger signal is transmitted from the master unit's trigger output.
* Alarms
  The AND or OR logic of the slave units' channel alarm conditions or the OR logic of the slave units' system alarm conditions.
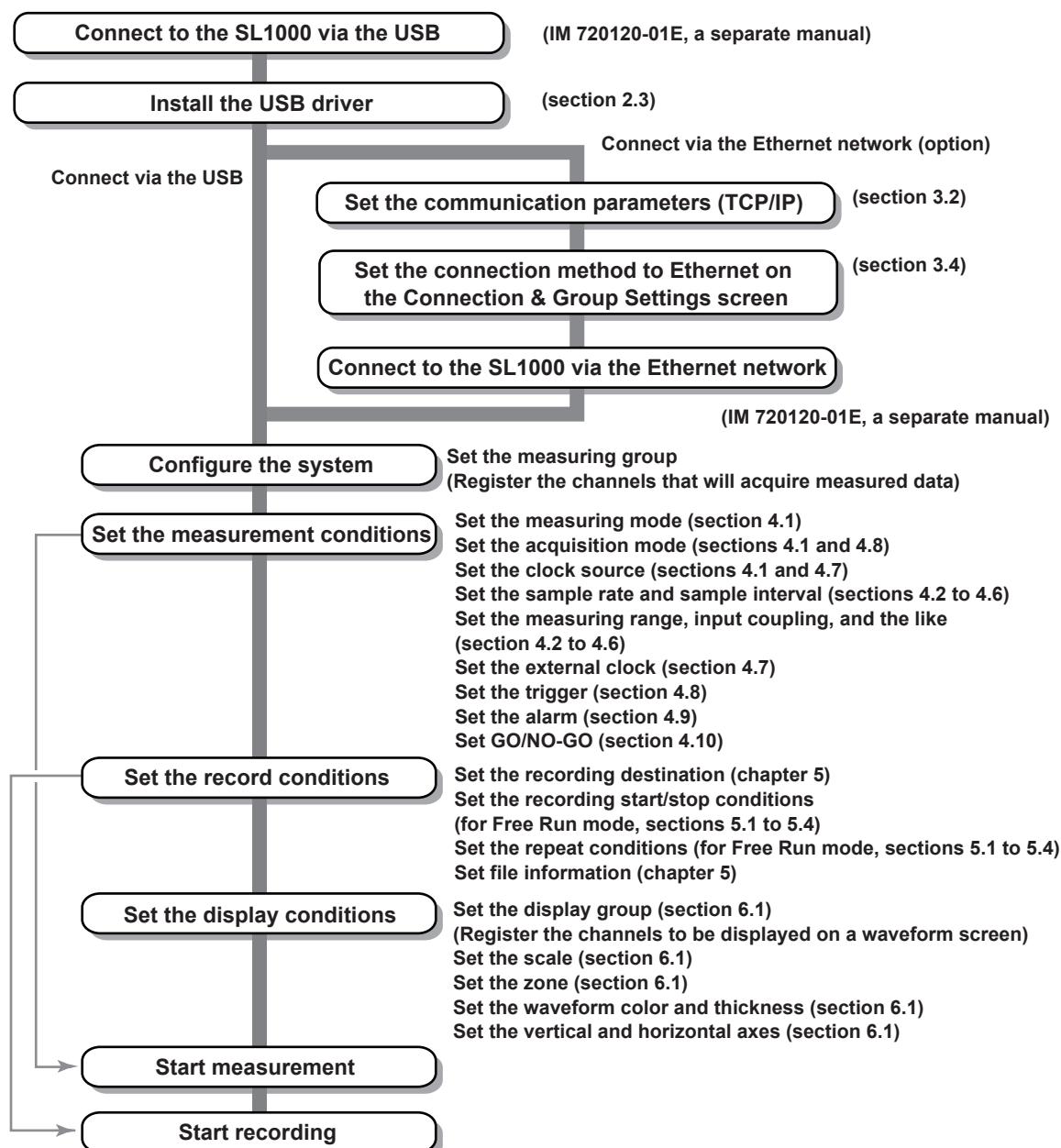 When an alarm occurs, an alarm signal is transmitted from the master unit's alarm output.
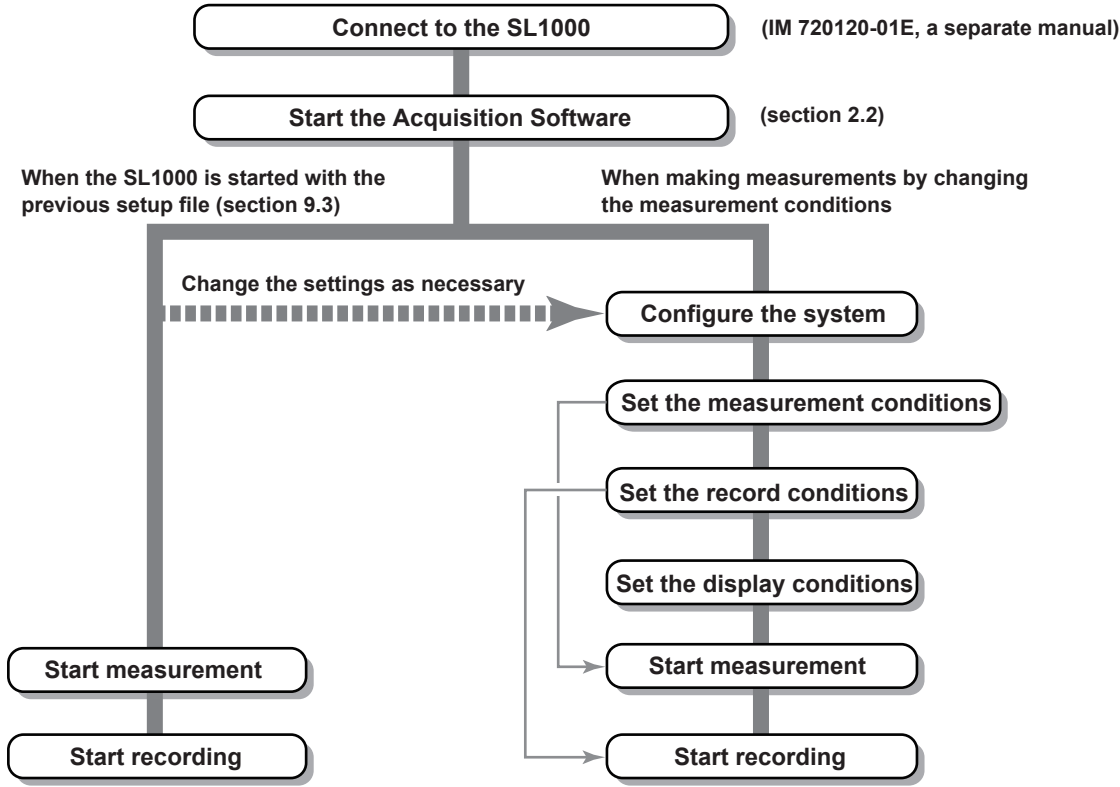* Detection of sync cable disconnection and of units powering-off

Note

- You cannot specify Single (N) of Triggered Mode.
- You cannot set the auto recording destination to PC HDD+Unit HDD.
- You cannot set the GO/NO-GO judgment output.
- When the save destination is set to Unit HDD, the recording files are saved to each unit's hard disk.
- To perform synchronous operation, set the master and slave units to the same group ID (from 0 to F). Set the master unit's unit ID to 0, and slave units' unit IDs in ascending order from 1 to 7. For details, see section 4.1 in the *SL1000 High-Speed Data Acquisition Unit User's Manual* (IM 720120-01E).
- Connect or disconnect the synchronous connecting cable only after (1) you have exited the Acquisition Software or disconnected the communication between the SL1000 and PC and (2) you have turn the SL1000 off.

Workflow

The workflow to make measurements using the Acquisition Software varies depending on whether it is the first time that you are connecting to the SL1000.

If Connecting to the SL1000 for the First Time

Connect to the SL1000 via the USB	(IM 720120-01E, a separate manual)
Install the USB driver	(section 2.3)

Connect via the USB

Connect via the Ethernet network (option)

Set the communication parameters (TCP/IP)	(section 3.2)
Set the connection method to Ethernet on the Connection & Group Settings screen	(section 3.4)
Connect to the SL1000 via the Ethernet network	

(IM 720120-01E, a separate manual)

Configure the system — Set the measuring group (Register the channels that will acquire measured data)

Set the measurement conditions
Set the measuring mode (section 4.1)
Set the acquisition mode (sections 4.1 and 4.8)
Set the clock source (sections 4.1 and 4.7)
Set the sample rate and sample interval (sections 4.2 to 4.6)
Set the measuring range, input coupling, and the like (section 4.2 to 4.6)
Set the external clock (section 4.7)
Set the trigger (section 4.8)
Set the alarm (section 4.9)
Set GO/NO-GO (section 4.10)

Set the record conditions
Set the recording destination (chapter 5)
Set the recording start/stop conditions (for Free Run mode, sections 5.1 to 5.4)
Set the repeat conditions (for Free Run mode, sections 5.1 to 5.4)
Set file information (chapter 5)

Set the display conditions
Set the display group (section 6.1) (Register the channels to be displayed on a waveform screen)
Set the scale (section 6.1)
Set the zone (section 6.1)
Set the waveform color and thickness (section 6.1)
Set the vertical and horizontal axes (section 6.1)

Start measurement

Start recording

What the Acquisition Software Can Do

If Reconnecting to the SL1000

Connect to the SL1000   (IM 720120-01E, a separate manual)

Start the Acquisition Software   (section 2.2)

When the SL1000 is started with the previous setup file (section 9.3)

When making measurements by changing the measurement conditions

Change the settings as necessary ▶ Configure the system

Set the measurement conditions

Set the record conditions

Set the display conditions

Start measurement

Start recording

Start measurement

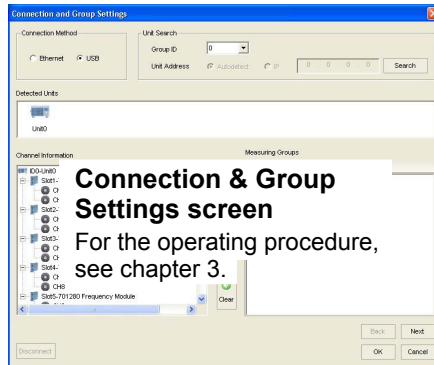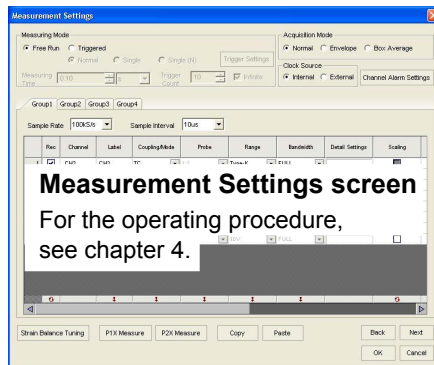Start recording

* For details on each setup item, see the operation flow diagram "Connecting to the SL1000 for the First Time."
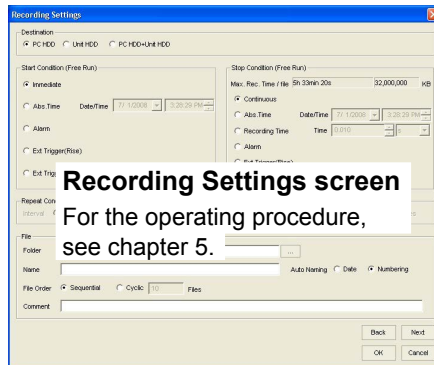
Setup in Wizard Format

The basic setup consisting of connection and group settings, measurement settings, recording settings, and display settings can be specified easily using dialog boxes in wizard format. You can also specify the connection and group settings, measurement settings, recording settings, and display settings individually using the toolbar or menu bar.
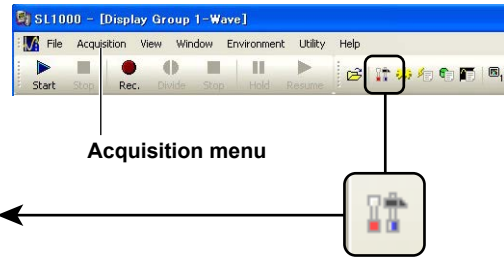

Connection & Group Settings screen

For the operating procedure, see chapter 3.

Acquisition menu

[NEXT] [Back]

Measurement Settings screen

For the operating procedure, see chapter 4.

Acquisition menu

[NEXT] [Back]

Recording Settings screen

For the operating procedure, see chapter 5.

Acquisition menu

[NEXT] [Back]

Display Settings screen

For the operating procedure, see chapter 6.
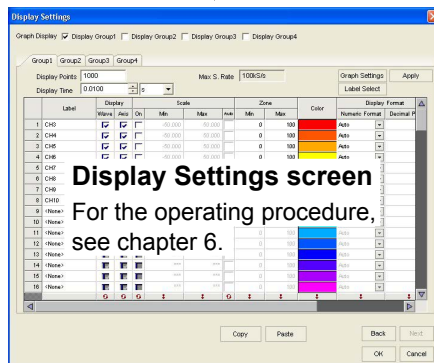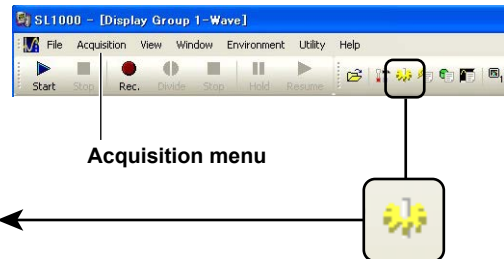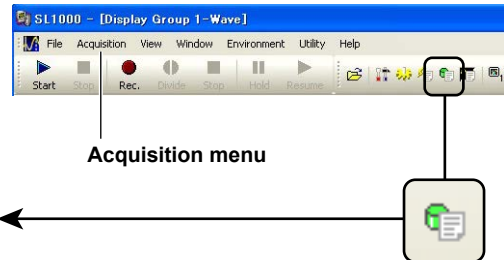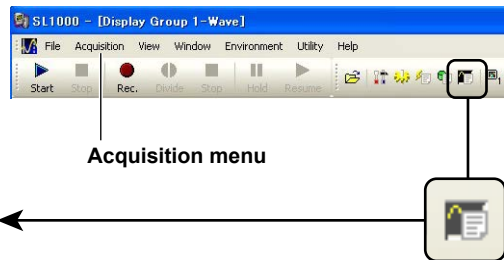
Acquisition menu

1.2 Connection & Group Settings

Connection Method

Select USB or Ethernet for the interface used to communicate the SL1000. This software can communicate with the SL1000 that is connected to the selected interface.

The Ethernet interface can be used on an SL1000 with the /C10 option.

Searching for an SL1000

Search for an SL1000 that is to communicate with your PC.

If connected using the USB, you can search for an SL1000 by specifying a group ID.

If connected using the Ethernet interface, you can search by specifying a group ID and IP address.

Group ID

A number assigned to the SL1000. Group IDs are used to identify different SL1000s connected to the network.

There are 16 group IDs: 0 to 9 and A to F.

You can also search for an SL1000 without specifying a group ID.

To perform synchronous operation, set the master and slave units to the same group ID.

Unit ID

A number assigned to the SL1000.

The unit ID cannot be specified when searching.

To perform synchronous operation, set the unit ID of the master unit to 0, and the unit ID of the slave units to 1 to 7 in ascending order.
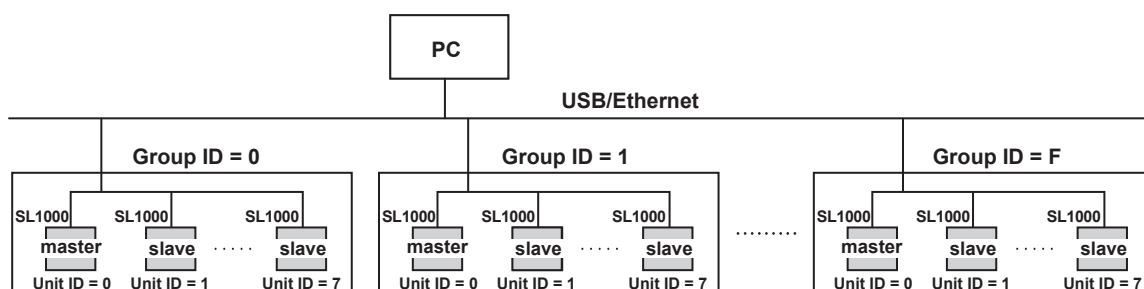
For details on the group ID and unit ID, see the *SL1000 High-Speed Data Acquisition Unit User's Manual* (IM 720120-01E).

IP Address

You can search by specifying an IP address assigned to the SL1000.

Measuring Groups

Modules installed in a connected SL1000 are registered to measuring groups according to the sample rate used to make measurements. Up to four measuring groups can be set up.

Measurement is performed only on modules that are registered to measuring groups.

Below is an example of how modules can be registered to measuring groups.

SL1000

Measuring group 1

Measuring group 4

Measuring group 3

Measuring group 2
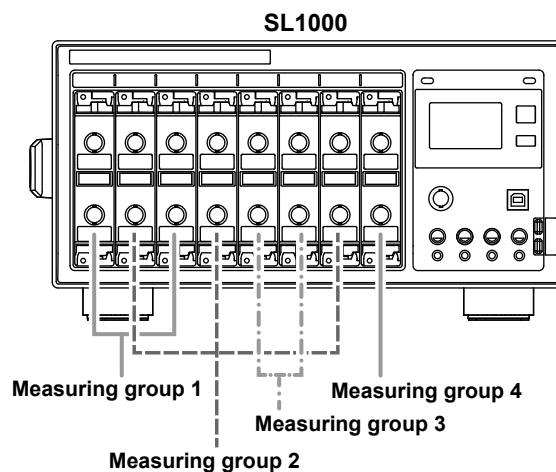
1.3 Measurement Settings

Measuring Mode

There are two measuring modes: Free Run and Triggered.

Free Run Mode

Data is acquired immediately upon starting a measurement. The SL1000 continues to acquire data until the measurement is stopped.

The measured data can also be recorded to the hard disk of the SL1000 or your PC at a specified time or when an alarm occurs.

The following functions are not available in Free Run mode.

- GO/NO-GO function
- Automated measurement of waveform parameters
- Zoom on a particular section of the waveform

Triggered Mode

After starting the measurement, the SL1000 acquires data when a trigger condition is met. After acquiring data over the specified measuring time, data acquisition stops. You can also record the measured data acquired in Triggered Mode to the hard disk of the SL1000 or your PC.

If Triggered Mode is used, you can perform automated measurement of waveform parameters and zoom in on waveforms.

For details on triggers, see section 1.6, "Triggering."

The following functions are not available in Triggered Mode.

- Channel alarm
- Recording start and end condition settings

Acquisition Mode

When acquiring measured data in the internal memory of the SL1000, it is possible to perform processing on data and display waveforms based on the processed data. The following three types of data processing are available.
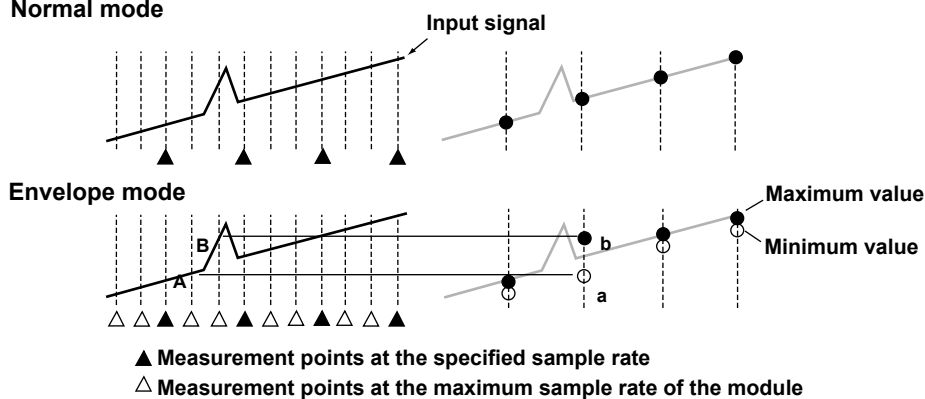
Normal Mode

In this mode, measured data is acquired without special processing.

Envelope Mode

If measuring at a sample rate lower than the maximum sampling rate of each input module, the SL1000 samples data at 100 S/s internally, determines the maximum and minimum values among the measured values over each sample interval at the specified sample rate, and acquires them as pairs.

This mode is effective when you want to avoid aliasing because the sample rate is essentially kept high. It is also effective when you want to detect glitches (pulse signals which rise very fast) or display an envelope of a modulating signal.


Normal mode
Input signal

Envelope mode
Maximum value
Minimum value

▲ Measurement points at the specified sample rate
△ Measurement points at the maximum sample rate of the module

Input modules with a maximum sample rate less than 100 MS/s cannot acquire data at certain points even if the internal sampling rate is 100 MS/s. The data at points that cannot be sampled will take on the same value as the previous measured data. Envelope Mode has no effect if measuring at a sample rate higher than the maximum sample rate of the input module.

Box Average Mode

This mode is available on the 701250 (HS10M12), 701255 (NONISO_10M12), 720210 (HS100M12), 720211 (HS100M12), and 720250 (HS10M12). In this mode, the SL1000 determines the moving average of the data sampled at the maximum sample rate and acquires and displays the resultant data. Box averaging is effective in eliminating small amounts of noise from the input signal. It can also remove noise from a single-shot signal.
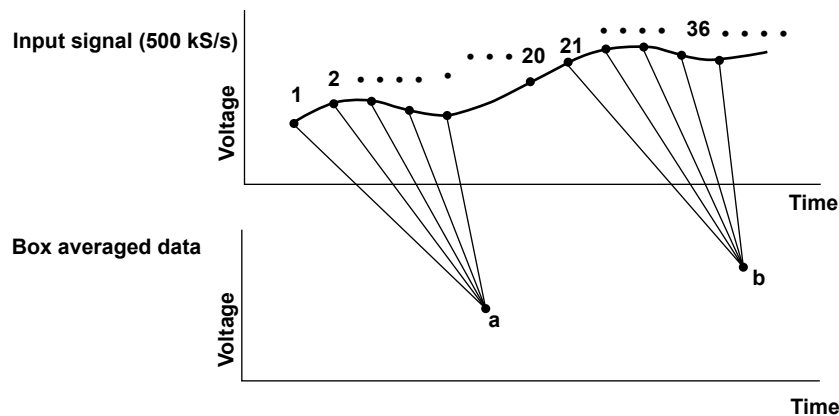
Clock Source

Internal Clock

The sampling timing of the measured data is controlled using the clock signal (internal clock) that is generated from the internal time-base circuit of the SL1000.

External Clock

The sampling timing of the measured data is controlled using a clock signal applied externally. This mode is available when the acquisition mode is set to Normal.
The external clock input is useful for observing a signal whose period varies or for observing waveforms by synchronizing to the clock signal of the signal being measured. The maximum frequency that can be used for the external clock varies depending on the module.

720210, 720211:	5 MHz
701250, 701251, 701255, 720250:	1 MHz
701267, 701270, 701271, 701275:	100 kHz
701281, 720281, 720268:	1 MHz
701261, 701262:	100 kHz when measuring voltage
	500 Hz when measuring temperature
701265, 720266:	500 Hz

If an external clock that exceeds the maximum frequency is applied, the data is sampled at the maximum frequency, and the measured data at times when data cannot be sampled is set to the same value as the previous sampled data.
When using an external clock, the time axis unit becomes the number of measured points, not time. Therefore, the measuring time is set and the cursor measurement values are displayed in terms of the number of measured points.
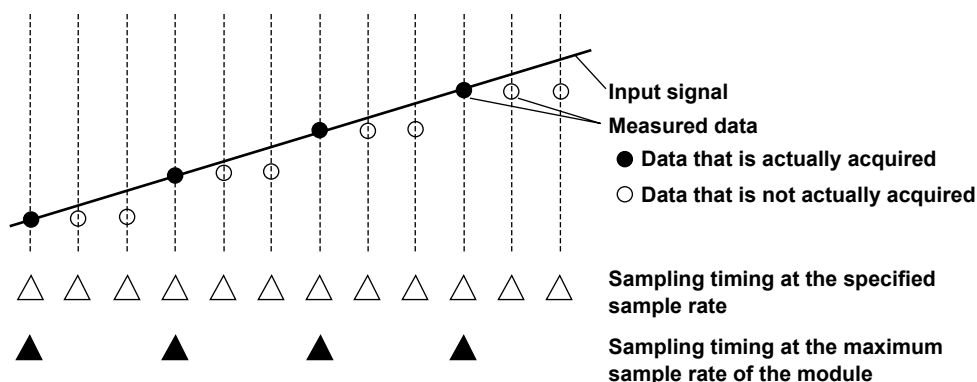
Sample Rate and Sample Interval

You can set the sample rate or sample interval for each measuring group.

The sample rate (the number of samples per second in unit of S/s) is related to the sample interval as follows:

Sample rate = 1/sample interval

The maximum sample rate varies depending on the module. If you set a sample rate that exceeds the maximum sample rate of a module, data cannot be acquired at the specified sample rate. The data at times when data cannot be acquired is set to the same value as the previous acquired data.
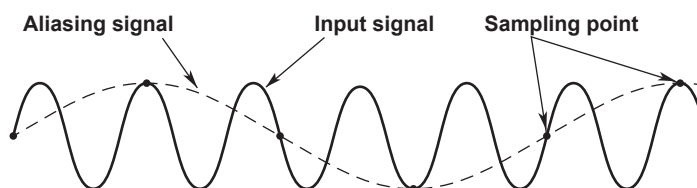

- Input signal
- Measured data
- ● **Data that is actually acquired**
- ○ **Data that is not actually acquired**

△ Sampling timing at the specified sample rate

▲ Sampling timing at the maximum sample rate of the module

Note

If the sample rate of measuring group 1 is set to 50 MS/s, 5 MS/s, 500 kS/s, 50 kS/s, 5 kS/s, 500 S/s, or 50 S/s, the sample rate of other groups cannot be set to the next lower sample rate. For example, if the sample rate of measuring group 1 is set to 500 kS/s, the sample rate of other measuring groups cannot be set to 200 kS/s (the next lower sample rate).

The SL1000 can display waveforms correctly for frequencies less than one-half the sample rate as defined by the Nyquist sampling theorem.*

* If the sample rate is comparatively low with respect to the input signal frequency, the harmonics contained in the signal are lost. In this case, some of the harmonics will appear at low frequencies due to the effects described by the Nyquist sampling theorem. This phenomenon is called aliasing. You can avoid aliasing by acquiring waveforms with the acquisition mode set to envelope.

Aliasing signal   Input signal   Sampling point

Input Coupling

If you want to measure only the amplitude of an AC signal, measurement is easier if the DC component is removed from the input signal. On the other hand, there are times when you want to check the ground level or measure the entire input signal (both the DC and AC components). You can change the input coupling setting to meet your application needs. By changing this setting, the way in which the vertical control circuit (voltage axis) receives the input signal is switched. The following types of input coupling are available.

DC

The input signal is directly coupled to the attenuator of the vertical control circuit. Select DC if you want to measure the entire input signal (DC and AC components).

AC (Only When Measuring the AC Voltage)

The input signal is coupled to the attenuator of the vertical control circuit through a capacitor. Select AC if you want to measure only the amplitude of the AC signal, eliminating the DC components from the input signal.

GND

Input signal is coupled to the ground not to the attenuator of the vertical control circuit. Select GND to check the ground level on the screen.
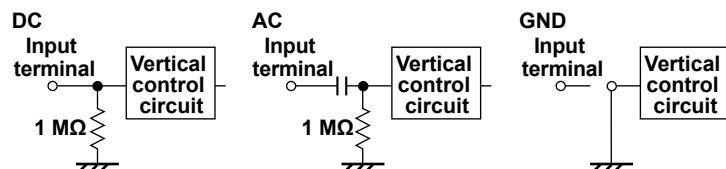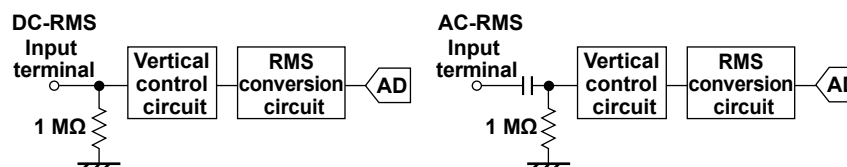

TC (Only When Measuring the Temperature)

Select TC if you are measuring the temperature using the 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), 701265 (TEMP/HPV), or 720266 (TEMP/HPV).

DC-RMS

Using the 701267 (HV (with RMS)) or 720268 (HV (with RMS/AAF)), both the DC and AC components of the signal are converted to rms values and displayed. An RMS conversion circuit is connected to the vertical control circuit of the same input coupling circuit used when the coupling is set to DC.

AC-RMS

Using the 701267 (HV (with RMS)) or 720268 (HV (with RMS/AAF)), only the AC component of the signal is converted to rms values and displayed. An RMS conversion circuit is connected to the vertical control circuit of the same input coupling circuit used when the coupling is set to AC.

ACCL (Only When Measuring Acceleration)

Select ACCL when measuring acceleration on the 701275 (ACCL/VOLT).

Probe Attenuation and Current-to-Voltage Conversion Ratio

For voltage (current) measurement, a probe is normally used in connecting the circuit being measured to the signal input terminal. Using a probe has the following advantages.

- Prevents disturbing the voltage and current of the circuit being measured.
- Applies the signal with no distortion.
- Expands the measurable voltage (current) range of the SL1000.

When using a probe, the attenuation setting on the SL1000 must be set equal to the probe attenuation or current-to-voltage conversion ratio so that the measured voltage (current) can be read directly.

Set the probe attenuation for the accessory probes (sold separately) as follows:

- Isolated probe (700929):   10:1
- Current probe (700937 and 701933):   10 A:1 V
- Current probe (701930 and 701931):   100 A:1 V
- 10:1 Passive Probe for the DL750/DL750P (701940):   10:1

The SL1000 has the following attenuation settings: 1:1, 10:1, 100:1, 1000:1, 1 A:1 V,[1] 10 A:1 V,[2] and 100 A:1 V.[3] If you are using a probe other than the ones provided as accessories (sold separately), set the attenuation ratio on the SL1000 according to the attenuation of the probe.

1 Output voltage rate: 1 V/A
2 Output voltage rate: 0.1 V/A
3 Output voltage rate: 0.01 V/A

Note

Use a probe that matches the input capacity of each module. Otherwise, the capacity cannot be adjusted.

Measuring Range

Set the measuring range according to the input signal.
Select a TC type when measuring temperature.

Bandwidth Limit

You can set a upper bandwidth limit on the analog signal for each channel. This allows you to observe waveforms with noise components above the specified frequency removed.

Linear Scaling

The measured data can be scaled to any physical value and displayed.
When measuring the voltage (current), strain, or frequency (number of rotations, period, duty cycle, power supply frequency, pulse width, pulse integration, and velocity), there are two methods of linear scaling: "aX+b" and "P1-P2."

aX+b

The results obtained from the following computation based on the specified scaling coefficient a and offset b are displayed as cursor measurement values and automated measurement values of waveform parameters. You can also assign a unit to the result of linear scaling.

$$Y = aX + b$$

P1-P2

Specify arbitrary scale values (P1Y and P2Y) for the measured values of two arbitrary points (P1X and P2X). The scale conversion equation (y = ax + b) is derived from these four values.

- Range of measured values (P1X and P2X): −9.99990E+25 to +9.99990E+25
- Range of scaled values (P1Y and P2Y): −9.99990E+25 to +9.99990E+25
- Initial setting of scale values: P1X +0.0000E+00, P1Y +0.0000E+00
  P2X +1.0000E+00, P2Y +1.0000E+00
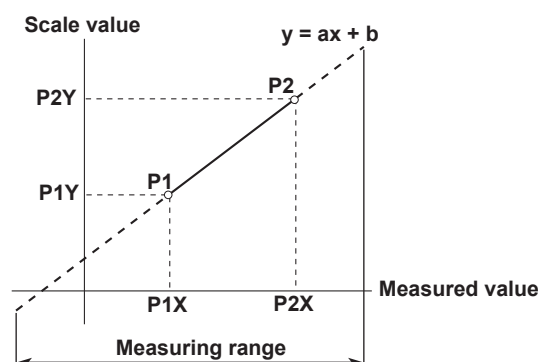
Inversion

When measuring voltage or strain, the waveform can be displayed with the vertical axis inverted around the ground level or the strain balance level as shown below.
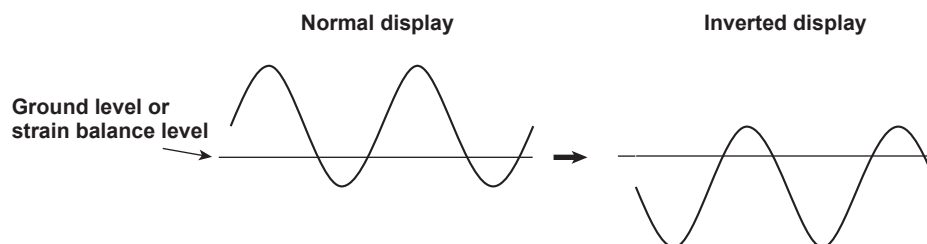
RMS Measurement

If the module is 701267 (HV (with RMS)) or 720268 (HV (with RMS/AAF)), you can observer the RMS value of the input signal.

AC-RMS

This setting is used when you want to observe only the rms values of the AC signal, eliminating the DC components from the input signal.

Example

If the rms value of a 2-Vpeak sinusoid input signal is measured, a DC waveform at approximately 1.4 V is displayed (see right figure).
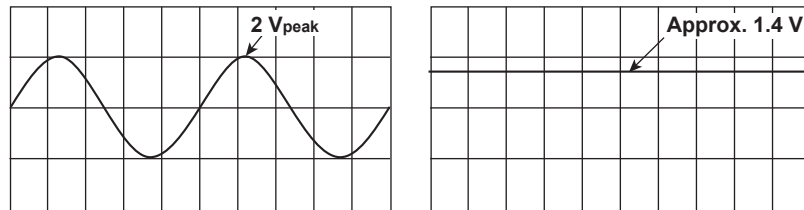
The rms value is derived from the following equation:

$$\sqrt{\frac{1}{T}\int_0^T u(t)^2\,dt}$$ where u(t) is the input signal and T is one period of the input signal.

Given $u(t) = V_m\sin\omega t$ where V_m is the peak value, ω is the angular velocity (which is equal to $2\pi f$ where f is the frequency of the sinusoid signal), the rms value, Vrms, is

$$V_{rms} = \sqrt{\text{The average of } u(t)^2 \text{ over one cycle}} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi}(V_m\sin\omega t)^2\,d\omega t} = \frac{V_m}{\sqrt{2}}$$
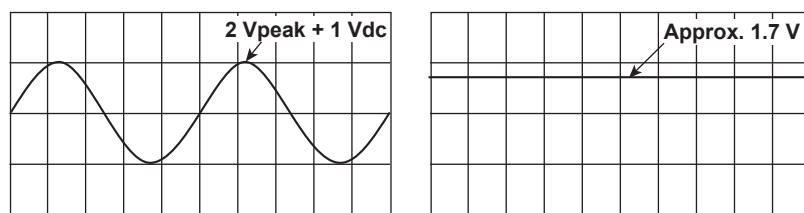
As in the above example, when V_m is 2 V, the rms value, Vrms, is approximately 1.4 V.

DC-RMS

This setting is used when you want to observe the rms values of both the DC and AC components of the input signal.

Example

If the rms value of a 2-Vpeak sinusoid input signal riding on top of a 1-V DC component is measured, a DC waveform at approximately 1.7 V is displayed (see right figure).

If the DC component is expressed as Vdc and the AC component as $u(t) = V_m\sin\omega t$, the rms value, Vrms (+DC), of the sinusoid input signal riding on top of the DC component is derived from the following equation:

$$V_{rms(+DC)} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi}(V_m\sin\omega t + V_{dc})^2\,d\omega t} = \sqrt{\left(\frac{V_m}{\sqrt{2}}\right)^2 + (V_{dc})^2}$$

As in the above example, when Vdc is 1 V and V_m is 2 V, the rms value, Vrms (+DC), is approximately 1.7 V.

Temperature Measurement

Thermocouple Type

The following types of thermocouples are available.

K, E, J, T, L, U, R, S, B, N, W, and Au7Fe

Selectable Temperature Units

You can select °C or K.

Reference Junction Compensation (RJC)

The voltage generated by a thermocouple depends on the temperature of the point of measurement and the reference junction temperature. In this case, the function used to compensate the temperature on the measurement instrument to the cold junction is referred to as reference junction compensation.

You can turn ON/OFF the internal RJC circuit of the SL1000.

ON: Use this setting to enable the reference junction compensation by the internal RJC circuit.

OFF: Select this setting when checking the temperature measurement value or when using an external reference junction (0 °C).

Burnout

Specify the behavior when the thermocouple input detects a burnout.

ON: Fix the measured value to the upper limit of the measurement range of each thermocouple if a burnout is detected.

OFF: Not detect burnouts.

Strain Measurement

You can measure strain by connecting a strain gauge bridge (bridge head) or a strain gauge transducer to the strain module (701270 (STRAIN_NDIS) or 701271 (STRAIN_DSUB)).

Relationship between the Strain (μSTR) and the Transducer Output (mV/V)

The SL1000 allows the unit to be changed between "the strain unit (μSTR: ×10^{-6} strain)" and "the output unit of the strain gauge transducer (mV/V)[1]." The default setting is "strain (μSTR)." The following relationship exists between μSTR and mV/V.

　(mV/V) = 0.5 × (μSTR)/1000

Example

　500(μSTR) → 0.5 × 500(μSTR)/1000 = 0.25 (mV/V)

Gauge Factor If mV/V Is Selected

　K = 2

You can set the gauge factor to any value on the SL1000. However, if there are no specifications on the strain gauge transducer, set K to 2.

If K is not 2, e is derived in the SL1000 using the following equation.

　e = (4/K) × (V/E)

　　e: Measured value of the strain gauge transducer [mV/V]

　　V: Voltage measured on the bridge [V]

　　E: Voltage applied to the bridge [V]

　　K: Gauge factor

If you switch the unit, the unit of all related parameters of the channel is switched accordingly.

* Scale
* Trigger level
* Values of automated measurement of waveform parameters and cursor measurements, etc.

In addition, the 701271 (STRAIN_DSUB) supports shunt calibration.[2]

　　1　The unit corresponding to the output of the strain gauge transducer. A value expressing the transducer output per volt applied to the bridge in mV. You can set the bridge voltage (excitation: voltage applied to the bridge) from 2 V, 5 V, and 10 V on the SL1000. However, since the mV/V value is a converted value, the measured value is basically constant.

　　2　Shunt calibration refers to the act of correcting the gain of the strain measurement by connecting a known resistance (shunt calibration resistance) to the strain gauge in parallel.

For a description of the basic defining equation of strain and shunt calibration, see the *SL1000 High-Speed Data Acquisition Unit User's Manual* (IM 720120-01E)

Acceleration Measurement

The Acceleration Module (with AAF) (701275 (ACCL/VOLT)) measures acceleration using the output signal from an acceleration sensor. Direction connection is possible to a built-in amplifier type acceleration sensor. (A charge output type acceleration sensor that does not have a built-in amplifier cannot be connected directly to the 701275 (ACCL/VOLT). For details on how to connect acceleration sensors, see the *SL1000 High-Speed Data Acquisition Unit User's Manual* (IM 720120-01E).)

Note

The 701275 (ACCL/VOLT) can also measure voltage.

Current Supply to Acceleration Sensors

The 701275 (ACCL/VOLT) can supply 4 mA of current to the acceleration sensor when measuring acceleration.

Note

If you supply current to the acceleration sensor before it is connected to the item under measurement, the internal circuit of the acceleration sensor may be damaged. Be sure to supply current after connecting the acceleration sensor.

Filter

If you set the bandwidth limit to Auto, the anti-aliasing filter (AAF) and low-pass filter are enabled depending on the sample rate to eliminate high-frequency noise from the input signal. Using the anti-aliasing filter when measuring voltage allows elimination of aliasing noise. For details on the bandwidth limit, see section 4.2.

Note

The filter is effective not only during acceleration measurement but also during voltage measurement.

Frequency Measurement

The Frequency Module (701281 (FREQ) or 720281 (FREQ)) measures frequency, number of rotations, period, duty cycle, power supply frequency, pulse width, pulse integration, and velocity.

Measured Item

Frequency

Frequency F (Hz) = 1/Tw (s)

Measurable range: 0.01 Hz to 500 kHz

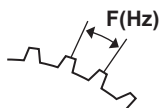#### RPMs/RPSs

RPMs = Frequency (Hz)/the number of pulses per rotation (Nr) × 60

Measurable range: 0.01 rpm to 100000 rpm

RPSs = Frequency (Hz)/the number of pulses per rotation (Nr)

Measurable range: 0.001 rps to 2000 rps

Nr: The number of
    pulses per rotation
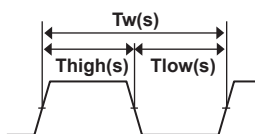
Period

Period (s) = Tw (s)

Measurable range: 2 µs to 50 s

Duty

Duty cycle (%) = Thigh (s)/Tw (s) or

Duty cycle (%) = Tlow (s)/Tw (s)
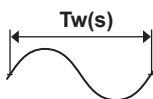
Measurable range: 0% to 100%

Power Supply Frequency

Power supply frequency (Hz) = 1/Tw (s)

Resolution:0.01 Hz

Measurable range: (50 Hz, 60 Hz, 400 Hz) ±20 Hz

Pulse Width

Pulse width (s) = Thigh (s) or

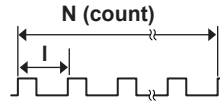pulse width (s) = Tlow (s)

Measurable range: 1 µs to 50 s

Pulse Integration (Distance/Flow Rate)

Pulse integrated value = N (count) × physical amount per pulse (I)

Set the physical amount per pulse (I) to distance or flow rate.

A suitable user-defined unit can be assigned to the specified physical amount.

Measurable range: up to 2×10^9 counts

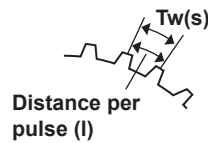### Velocity

Velocity (km/h) = Distance per pulse I (km)/Tw (s) × 3600

Velocity (m/s) = Distance per pulse I (m)/Tw (s)

The distance and unit can be defined by the user (angular velocity, etc.).

Measurable range: F (=1/Tw) = 0.01 Hz to 500 kHz

Decelerating Prediction and Stop Prediction

The 701281 (FREQ) or 720281 (FREQ) automatically performs internal computation and displays waveforms by predicting the deceleration curve and stop point even when the input pulse is suddenly cut off. This function allows the measurement of waveforms of deceleration behavior that is close to the actual physical phenomenon in applications in which the deceleration behavior of an object that have inertia is measured such as in the brake test of automobiles.

Decelerating Prediction

The deceleration curve is computed according to the following equation using the elapsed time after the pulse input stops (Δt).

Frequency (f) = 1/period (Δt)

The decelerating prediction starts after a pulse period (T) of the pulse one period before the pulse input stopped elapses after the pulse input stopped.

Stop Prediction

The function determines the stop point at a constant time after the pulse input stops, and the frequency is set to 0. The time from the point when the pulse input stops to the point when the function determines that the object has stopped can be set to ×1.5, ×2, ×3, ... , ×9, and ×10 (10 settings) of the pulse period (T) of the pulse one period before the pulse input stopped.
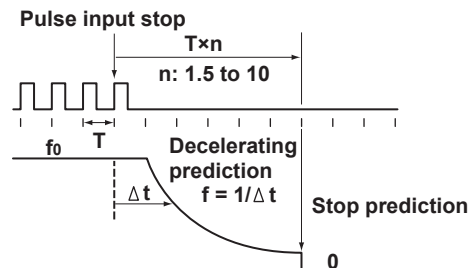
Filter

Smoothing filter (moving average)

The frequency module can display waveforms by taking the moving average of the data in realtime. The order of moving average can be set in terms of time in the range of 0.0 ms to 1 s (up to 25000th order). The order of moving average is equal to the specified time divided by 40 μs.

The smoothing filter has the following characteristics.

• Converts a waveform that changes in steps to a smooth waveform.

• Improves the resolution by reducing the measurement jitter. The resolution improves especially when measuring high frequencies or when expanding the display using the offset function. Consequently, highly accurate measurements can be made.

• Can be used on all measurement parameters of the frequency module.
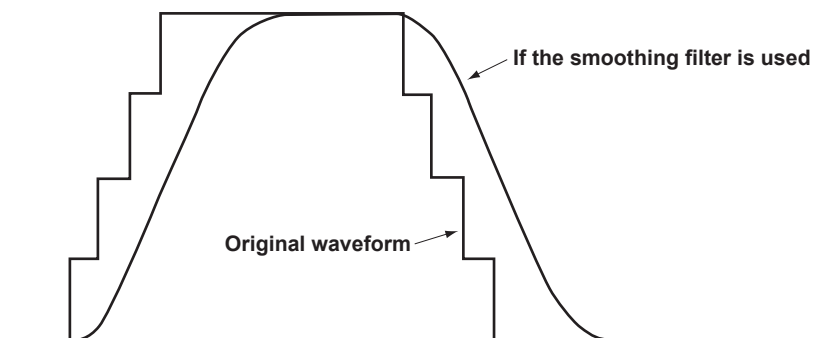
Pulse Average

Measures the input pulse by dividing the pulse by the specified number of pulses (1 to 4096 pulses). The pulse average has the following characteristics.

• If pulse dropouts are present or pulse interval is fluctuating within a period, measurements can be made by eliminating the effects from the dropout or fluctuation (fluctuating component of the waveform used to measure the frequency or period).

• The measured result is displayed as a value per input pulse even when pulse average is used. Therefore, there is no need to perform scaling again.

• Can be used when measuring frequency, number of rotations, period, power supply frequency, pulse integration, and velocity.
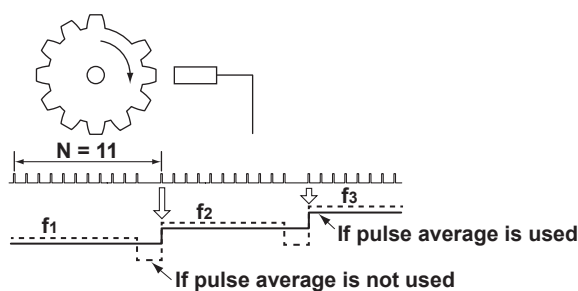
Offset Function

The 701281 (FREQ) or 720281 (FREQ) allows you to set the center of observation (offset value) and expand the area around the offset value for close observation. It allows you to measure the fluctuation around a certain frequency. You can set an offset value up to 100 times the measuring range (500 kHz maximum).

1.4 Recording Settings

Recording Methods

There are two recording methods. One method is to record automatically according to the specified conditions (auto recording). The other method is to save the measured data that has been acquired in the memory of the SL1000 through file operation after the measurement is finished (saving of waveform data).

Auto Recording

The measured data is automatically recorded to a specified hard disk.
You can select the recording destination from the following three destinations:
- PC HDD: Records to the hard disk of the PC in which this software was installed.
- Unit HDD: Records to the hard disk of the SL1000.
- PC HDD+Unit HDD: Records both to the hard disk of your PC and to the hard disk of the SL1000.

The free space on the hard disk of your PC and the SL1000 can be displayed on the screen.

> **Note**
> During synchronous operation, you cannot select PC HDD+Unit HDD.

Saving the Waveform Data

The measured data acquired in the internal memory of the SL1000 is saved to your PC.
All the measured data in the memory is saved as a single file.
The data saved to the hard disk of the SL1000 can be copied to the hard disk of your PC using the accompanying Xviewer (except the /XV0 option) or the FTP function (/C10 option).

Averaging and Saving History Data

The measured data acquired in the internal memory of the SL1000 is averaged and saved to your PC. From the measured data in the memory, you select the data (up to 5000 waveforms) to average, and the data is saved as a single file.
The saved averaged waveforms can also be displayed on the screen using the accompanying Xviewer (except the /XV0 option).

Recording Start and Stop Conditions (Auto Recording)

The recording start and stop conditions vary depending on the measuring mode.

In Free Run Mode

You can select the following recording start and stop conditions.

Recording start condition

Immediate: Starts recording as soon as it is ready to record.
Abs.Time: Starts recording at a specified time if it is ready to record.
Alarm: Starts recording when an alarm occurs if it is ready to record.
External trigger: Starts recording when the SL1000 is ready to record and it receives a recording control signal (edge signal or gate signal) through the trigger input terminal. (Rise) indicates rising edge trigger, and (Fall) indicates falling edge trigger.
*   The SL1000 will be ready to record if you click the Start Recording button or choose Start Recording from the Acquisition menu.

Recording stop condition

Continuous: Continues to record until recording is manually stopped.

Abs.Time: Continues to record to a specified time.

Recording time: Continues to record for a specified time. When measuring with an external clock, measurement is performed up to a specified number of measured points.

Alarm: Continues to record until the alarm is cleared.

External trigger: Stops recording when the SL1000 receives a recording control signal (edge signal or gate signal) through the trigger input terminal. (Rise) indicates rising edge trigger, and (Fall) indicates falling edge trigger.

In Trigger Mode

The SL1000 will start measuring or recording if the trigger conditions are met when the SL1000 is ready to record.[*] When a specified measuring time arrives, measurement and recording will stop. The SL1000 can also start measuring or recording after a given time elapses from when the trigger condition is met.

* The SL1000 will be ready to record if you click the Start Recording button or choose Start Recording from the Acquisition menu.

Repeat Condition (Auto Recording)

When recording the measured data repetitively, you can specify the repeat count and the repeat interval.

Record Interval

The record interval can be specified only if the recording start condition is set to Immediate or Abs. Time and the recording stop condition is Recording Time. You can specify the time (the number of measured points if measuring using an external clock signal) from when the recording is started until the next recording is started. This is available when the measuring mode is set to Free Run.

Record Count

The number of recordings. You can set it if

• The recording stop condition is set to Recording time.

• The recording start and stop conditions are set to Alarm.

• The recording start and end conditions are both External Trigger (Rise) or both External Trigger (Fall).

The record count is valid when the measuring mode is set to Free Run.

Relationship between Measurement and Recording (Auto Recording)

Free Run Mode

The recording of the measured data is enabled when measurement is in progress. Examples of the measurement state, recording start and stop conditions, and repeat conditions are given below.

If Recording Start Condition Is Immediate and Recording Stop Condition Is Continuous
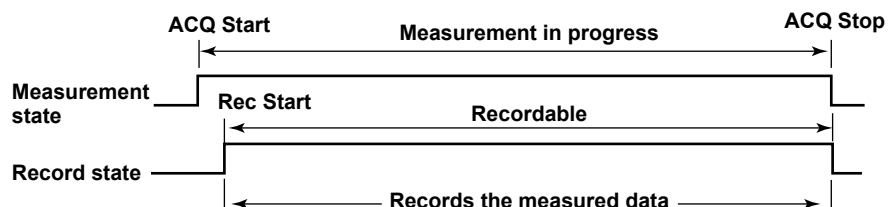
Recording Start and Stop Conditions Other Than Those Above

If Recording Is Stopped before the Recording Stop Condition Is Met

Relationship with the Repeat Condition

- **If repeat interval is set for the repeat condition**
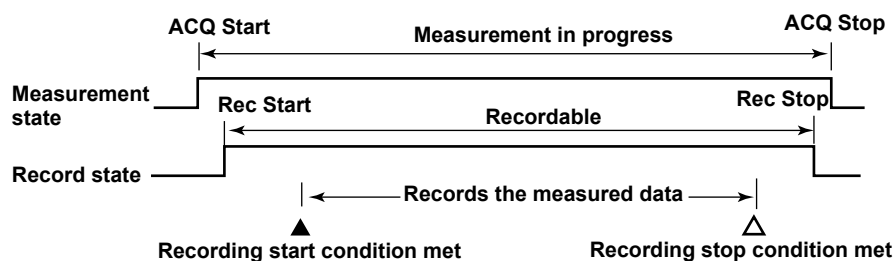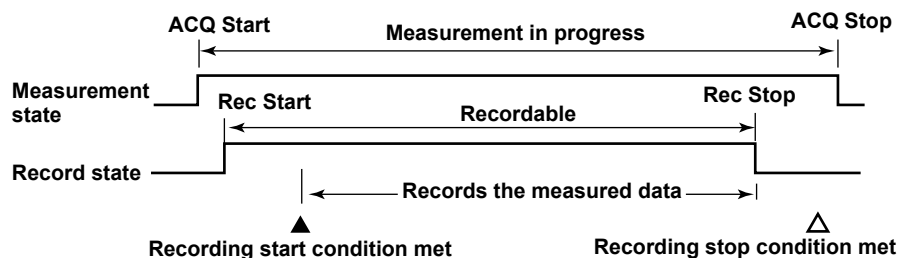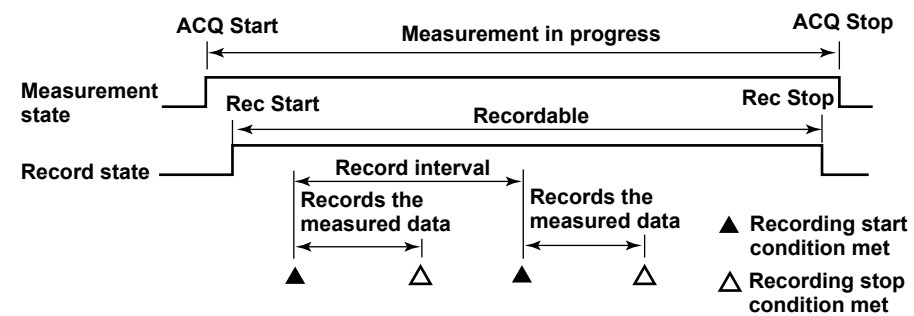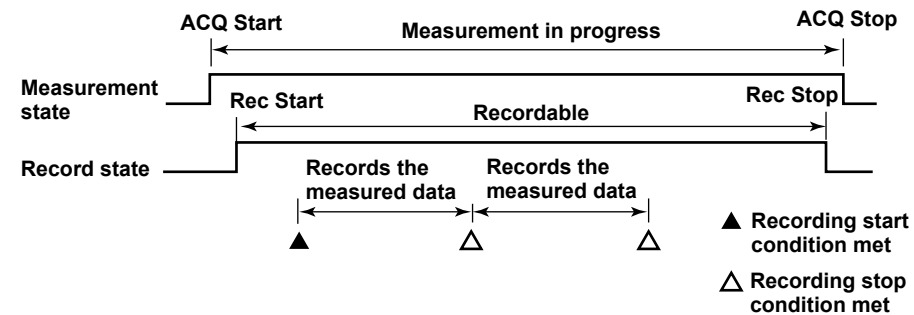 **(If the recording start condition is set to Immediate or Abs. Time and the recording stop condition is Recording Time)**

ACQ Start   Measurement in progress   ACQ Stop

Measurement state

Rec Start   Recordable   Rec Stop

Record state

Record interval

Records the measured data   Records the measured data

▲ Recording start condition met

△ Recording stop condition met

- **If repeat interval is not set for the repeat condition**

ACQ Start   Measurement in progress   ACQ Stop

Measurement state

Rec Start   Recordable   Rec Stop

Record state

Records the measured data   Records the measured data

▲ Recording start condition met

△ Recording stop condition met

Note

To record measured data continuously, set the interval of the repeat condition to OFF when the recording start condition is set to Immediate or Abs.Time and the recording stop condition is set to Recording Time.

Triggered Mode

Measurement and recording are performed for a specified time if a trigger occurs when the SL1000 is ready to measure and record.
If a trigger occurs when the SL1000 is not ready to record, only measurement is performed.

ACQ Start   Measurable   ACQ Stop

Measurement state

Rec Start   Recordable   Rec Stop

Record state

Measures/records over the specified time   Measures/records over the specified time

▲ Trigger condition met
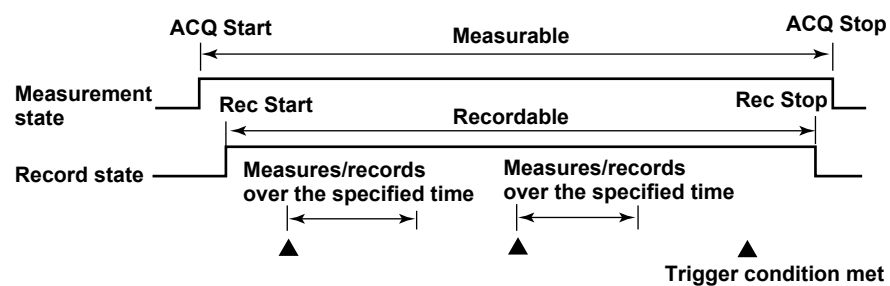
File Name and Recording Destination

To Use the Date/Time in the File Name

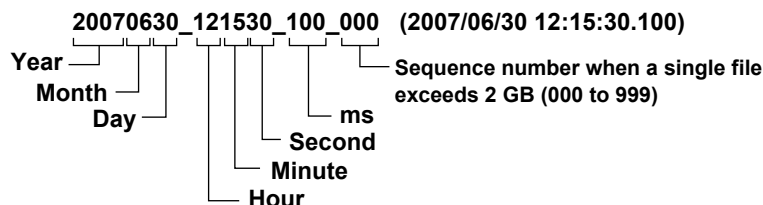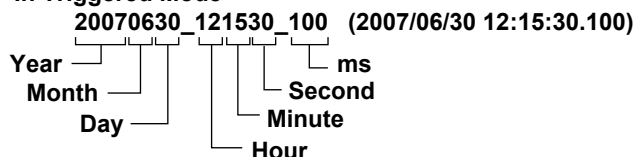The date/time (ms unit) of the recording is used for the file name. An arbitrary file name cannot be specified.
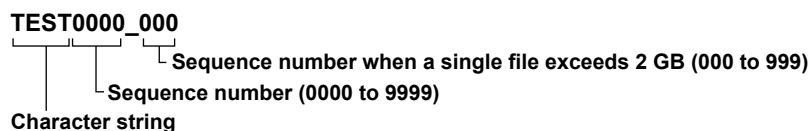
In Free Run Mode

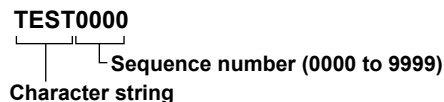**20070630_121530_100_000** **(2007/06/30 12:15:30.100)**

Year
Month
Day
ms
Second
Minute
Hour
Sequence number when a single file exceeds 2 GB (000 to 999)

In Triggered Mode

20070630_121530_100 **(2007/06/30 12:15:30.100)**

Year
Month
Day
ms
Second
Minute
Hour

To Use a Sequence Number in the File Name

A sequence number is added to a file name that you specify.

In Free Run Mode

TEST0000_000

Sequence number when a single file exceeds 2 GB (000 to 999)
Sequence number (0000 to 9999)
Character string

In Triggered Mode

TEST0000

Sequence number (0000 to 9999)
Character string
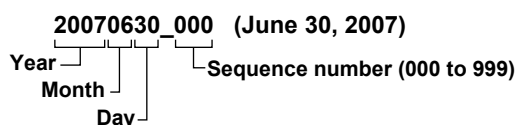
Recording Destination

When recording to the hard disk of your PC, you can specify the save destination folder. This software creates a folder with the following name within the specified folder and saves the data.

20070630_000 **(June 30, 2007)**

Year
Month
Day
Sequence number (000 to 999)

File Order

There are two methods for recording measured data to the hard disk of your PC or the SL1000: sequential and cyclic.

Sequential

Records the files sequentially to the hard disk. This method is useful if you want to retain the old data. If the number of recordings is large, the free space on the hard disk may run out.

Cyclic

Records the specified number of files. If the specified number is exceeded, the file is overwritten in order from the oldest one. This method is useful if the free space on the hard disk is low.

1.5   Display Settings

Display Group

The data measured on measuring channels that are registered to measuring groups can be divided into four groups (display groups) to be displayed. Channels of different measuring groups can be registered in a same display group. A single group can contain up to 16 channels (up to 128 channels when eight units are linked during synchronous operation). The same channel can also be registered to multiple groups.

The measured data of channels in the same group (display group 1) can be compared using cursor values and values obtained through automated measurement of waveform parameters.

Note

If the maximum sample rate among the measuring channels registered to a single display group is 50 MS/s, 5 MS/s, 500 kS/s, 50 kS/s, 5 kS/s, 500 S/s, or 50 S/s, a measurement channel with the next lower sample rate cannot be registered to the same display group. For example, if the maximum sample rate among the channels registered to a display group is 500 kS/s, a channel with the sample rate set to 200 kS/s (the next lower sample rate) cannot be registered to the same group.

Scale

You can set the display range. If linear scaling is set on the channel, the range is specified using a scaled value.

It is also possible to automatically set a scale based on the measured data.

Zone

You can set the position to display the waveform.

The display position is set in terms of a percentage of the screen.

This feature keeps waveforms from overlapping when displaying multiple waveforms on a single screen.

The following example shows the case when the display zone of waveform A is set to 30% to 100% and that of waveform B is set to 0% to 70%.
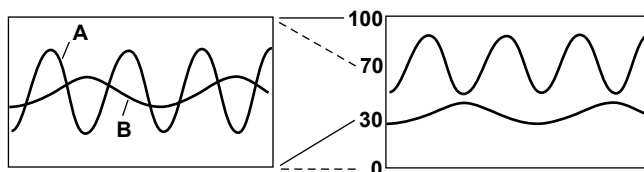
Displays Other Than Waveforms

Current Value Display

The current measured value is displayed using a bar graph, digital display (numeric), analog meter, or thermometer.

Current values are measured data that this software retrieves from the SL1000 at 100-ms intervals (Free Run mode) or 1-s intervals (Triggered mode).

Numeric Value Display

Displays the measured values at the cursor position, waveform parameter values (measure value), and GO/NO-GO judgment result.

1.6   Triggering

Trigger Mode

The trigger mode defines the method in which measured data is acquired when a trigger occurs. The following three modes are available.

Single Mode

When a trigger occurs, the SL1000 acquires measured data once for the specified measuring time. This mode is suitable for observing a single-shot signal.

Normal Mode

The SL1000 acquires measured data each time a trigger occurs. After acquiring data for the specified number of times, the SL1000 stops the acquisition. If the acquisition count is set to infinite, data acquisition continues until the measurement is stopped.
After acquiring the measured data as a result of trigger occurrence, the SL1000 does not accept the next trigger until the internal processing of the data is completed.
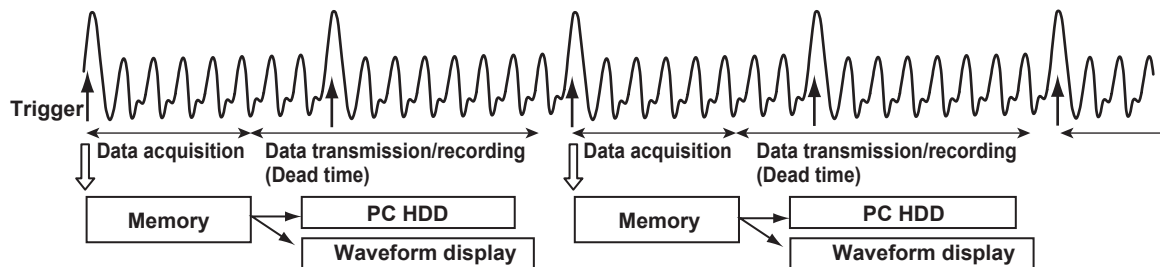
Single (N) Mode

The SL1000 acquires measured data each time a trigger occurs. You can select whether to acquire the data the specified number of times and stop or acquire data infinite times. The SL1000 acquires measured data whenever a trigger occurs even if the internal processing of data is not completed.
If the acquisition count is specified, the maximum number of acquisitions is 5000 or the number of acquisitions determined by the number of channels, sample rate, and measuring time, whichever is less.
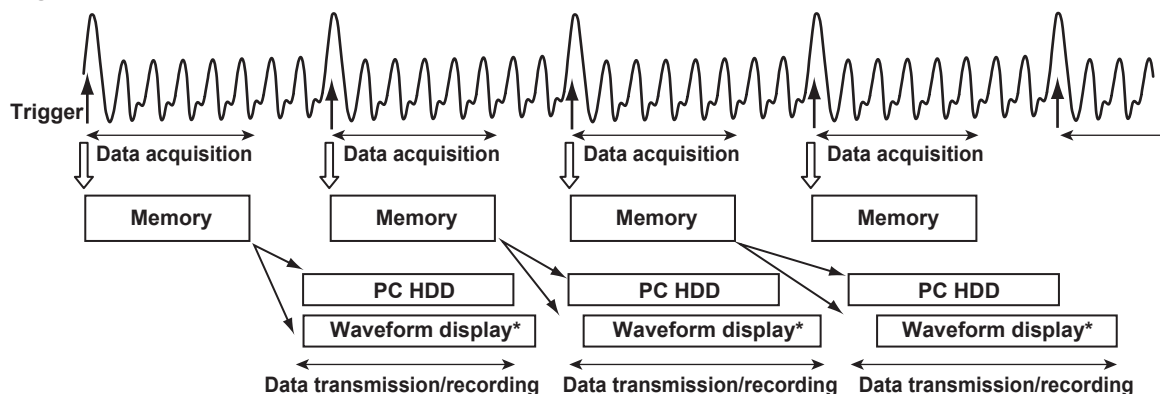
Note
During synchronous operation, you cannot select Single (N) mode.

Normal mode

Data acquisition and data transfer/recording are synchronous.

Single (N) mode

Data acquisition and data transfer/recording are asynchronous.

    *: The software may not be able to display the acquired data, depending on the internal processing time and trigger timing.

Trigger Class

The following two trigger classes are available.

Simple
A trigger is generated on a single trigger condition.

Combination
A trigger occurs when all or any of the multiple trigger conditions are met. Combination is valid if the trigger sources are channels.

Trigger Source

The following three trigger sources are available.

Channel
Generates a trigger on an input signal or the external trigger signal. A trigger can be generated on a combination of trigger sources consisting of multiple channels and external trigger signal.

Line
Generates a trigger on the rising edge of the power signal that is being supplied to the SL1000. Waveforms synchronized to the commercial power supply frequency (50 Hz or 60 Hz) can be observed.

Time
Generates a trigger at specified time intervals (1 min to 24 hours) from a specified time.

Trigger Pattern, Trigger Level, and Hysteresis

Trigger Pattern

Select Rise (rising edge), Fall (falling edge), Both (both rising and falling edges), H (high), L (low), IN, OUT, IN (L), or OUT (L).

Rise (Rising Edge), Fall (Falling Edge), and Both (Both Rising and Falling Edges)

A trigger is generated when the trigger source level becomes greater than or equal to the trigger level; less than or equal to the trigger level; or both.

Rising edge   **Falling edge**

Trigger level
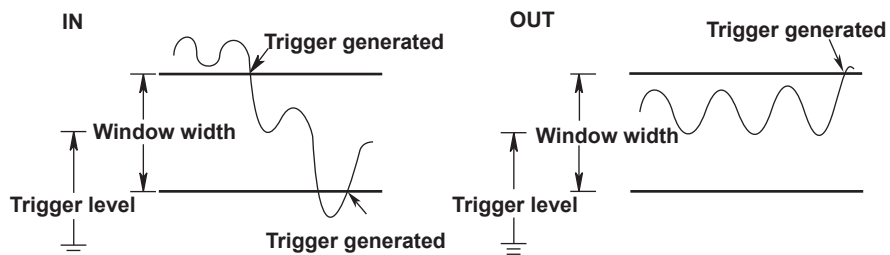
Trigger generated   Trigger generated
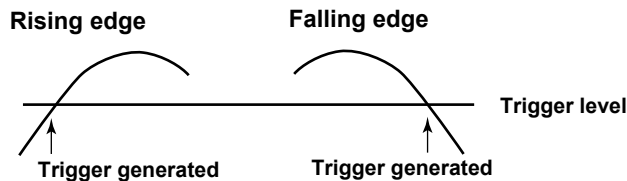
H (High) and L (Low)

A trigger is generated when the trigger source level is greater than or equal to the trigger level (H) or less than or equal to the trigger level (L).

IN/OUT

A certain level width (window) is set and a trigger is generated when the trigger source level enters this level width (IN) or exits from this level width (OUT).

IN   Trigger generated   **OUT**   Trigger generated

Window width   Window width

Trigger level   Trigger level
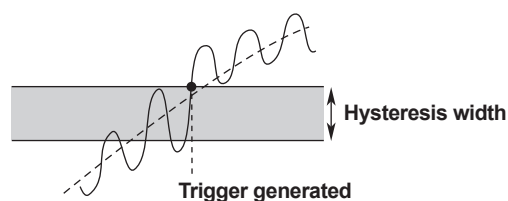
Trigger generated

IN(L)/OUT(L)

A certain level width (window) is set and a trigger is generated when the trigger source level is within this level width (IN (L)) or outside this level width (OUT (L)).

Trigger Level

Trigger level refers to the level that is used to determine the trigger pattern (rising/falling edge of the signal) and the like.

Hysteresis

If there is insufficient trigger level width such as when noise is present in the trigger source, the trigger point fluctuates each time a trigger is generated. This causes the displayed waveforms to be unstable. To solve this problem, a specified margin (trigger hysteresis) is added to the trigger level. You can set the trigger hysteresis to Low (small hysteresis width), Middle (medium hysteresis width), or High (large hysteresis width). The hysteresis width varies depending on the input module.

Hysteresis width

Trigger generated

Pre-trigger, Trigger Delay, and Hold Off

Trigger Point and Trigger Position

Trigger point refers to the point where a trigger is generated. Trigger position refers to the position where measurement is started after a trigger is generated. Normally, the trigger point and the trigger position are the same. However, if you set a trigger delay (explained later), the trigger position will be after the trigger point by the delay amount.

Pre-trigger

The section before the trigger positions is called *pre-trigger section*. Waveforms before the trigger position can be displayed by measuring the pre-trigger section.

Specify the pre-trigger section as a percentage of the measuring time. If measuring using an external clock, specify the pre-trigger section as a percentage of the number of data points.

Trigger Delay

Setting a trigger delay allows displaying of waveforms that are acquired a specified time (delay) after the trigger is generated. The function is invalid if the trigger source is set to Time or if the SL1000 is measuring using an external clock.

The selectable range of trigger delay is 0 to 10 s.
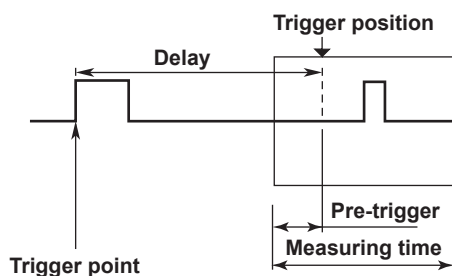
Hold Off

Hold off refers to the act of temporarily stopping the detection of the next trigger once a trigger has been generated. This function is useful when observing a pulse train signal, such as a PCM code, and you want to acquire the waveform in sync with the repeat interval as shown below. The function is invalid if the trigger source is set to Time or if the SL1000 is measuring using an external clock.
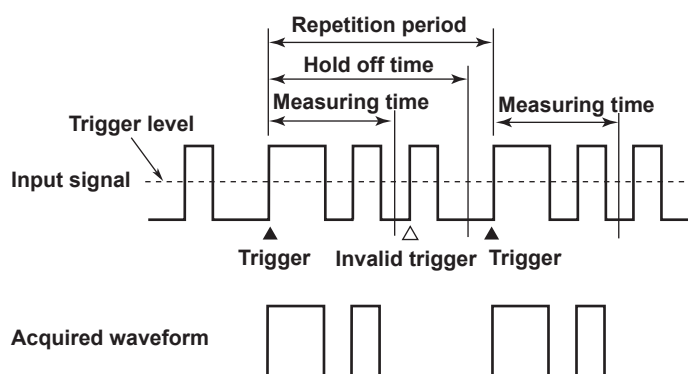
The selectable hold off range is 0 to 10 s.

Recording of Measured Data in Triggered Mode

If measuring in Triggered Mode, the recording start and stop conditions of measured data as explained in section 1.4 are invalid. Measured data is recorded to the specified hard disk each time a trigger occurs after recording is started. When the measurement caused by a specified trigger stops, recording also stops.

Manual Trigger

After starting the measurement, data can be acquired at any time by pressing the manual trigger button.
This function is available only when the measuring mode is set to Triggered Mode.
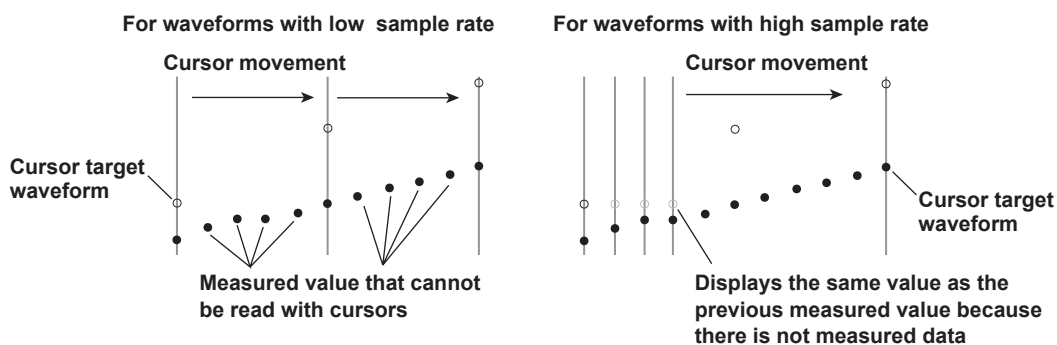
1.7 Analysis Function

Cursor Measurement

There are two types of cursors: horizontal cursors and vertical cursors. Two cursors are displayed for each type of cursor. The measured values at the two cursor positions and the difference between the cursors can be displayed.

You can move the cursor directly by dragging it or by using the left and right arrow keys on the keyboard. If you are dragging the cursor, the cursor moves in steps of screen dots.

If you are using the left and right arrow keys, the vertical cursor moves over the measured data. The speed at which the cursor moves varies depending on the number of measured data points displayed on the screen.

If the number of measured data points is greater than the number of dots on the waveform screen, the cursor moves on all the measured data points that are displayed at the dot before moving to the next dot. Therefore, the cursor will move slower.

If multiple waveforms with different sample rates are displayed on the same screen, the cursor moves according to the sample rate of the cursor target waveform.

For waveforms with low sample rate

Cursor movement

Cursor target waveform

Measured value that cannot be read with cursors

For waveforms with high sample rate

Cursor movement

Cursor target waveform

Displays the same value as the previous measured value because there is not measured data

Waveform Parameter Measurements

If measuring in Triggered Mode, the following parameters can be measured automatically.

Voltage Axis Parameters

P-P: P-P value (Max – Min) [V] (Peak to peak value)[*]

Max: Maximum voltage [V] (Maximum)[*]

Min: Minimum voltage [V] (Minimum)[*]

RMS: RMS value $\frac{1}{\sqrt{n}}\{\Sigma(xi)^2\}^{1/2}$ [V]

Average: Average voltage $\frac{1}{n}\Sigma xi$ [V]

Standard deviation:
$$\{\frac{\Sigma xi^2}{n} - (\frac{\Sigma xi}{n})^2\}^{1/2} \text{ [V]}$$

Under shoot: (Low – Min)/(High – Low) × 100 [%]

Over shoot: (Max – High)/(High – Low) × 100 [%]

High: High voltage [V]

Low: Low voltage [V]

Amplitude: (High – Low) [V]

Middle: (Max + Min)/2

* The characters inside the parentheses are measurement item names used when displaying the measured values.

Max

High

Over shoot

P-P

Under shoot

Low

Min

Time Axis Parameters

Rise: Rise time [s]

Fall: Fall time [s]

Freq: Frequency [Hz] 1/Period

Period: Period [s]

Avg Freq: Average frequency within the measuring range [Hz]
(Average frequency)[*]

Avg Period: Average period within the measuring range [s]
(Average period)[*]

+Width: Time width above the mesial value [s]
(Plus width)[*]

–Width: Time width below the mesial value [s]
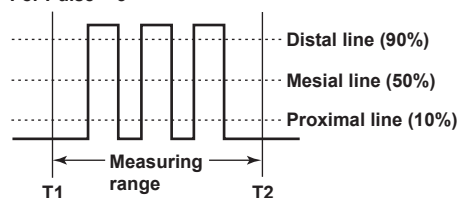(Minus width)[*]

Duty: Duty cycle + Width/Period × 100[%]

* The characters inside the parentheses are measurement item names used when displaying the measured values.
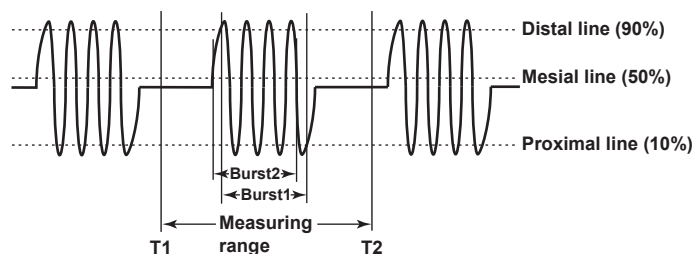

Pulse count

For Pulse = 3
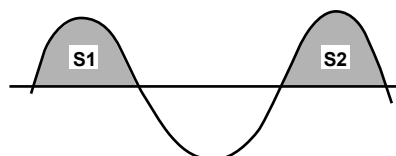

Burst1, Burst2: Burst width [s]

Other Parameters

Int1TY: The area under the positive amplitude

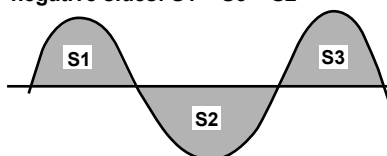Int2TY: The area under the positive amplitude – the area under the negative amplitude

Int1TY
Total area for positive side only: S1 + S2

Int2TY
Total area for both positive and negative sides: S1 + S3 – S2

1.8 Alarms

There are two types of alarms: channel alarm and system alarm.

Channel Alarm (for Free Run Mode)

An alarm is generated when the measured data meets a specified condition.

Source Channels

The alarm source can be set to any channel registered in a measuring group. You can also specify multiple channels for the source and make the alarm go off when all channels meet the condition (AND) or when any channel meets the condition (OR).

Alarm Patterns

There are 4 alarm patterns.

H: An alarm is generated when the measured value of the source channel is greater than a specified level.

L: An alarm is generated when the measured value of the source channel is less than a specified level.

IN(L): An alarm is generated when the measured value of the source channel is within a specified range.

OUT(L): An alarm is generated when the measured value of the source channel is outside a specified range.
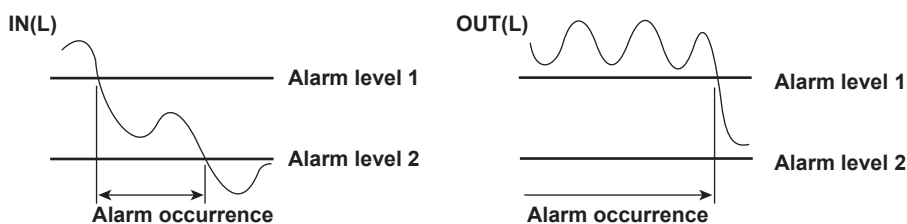
Hysteresis

Like triggers, a certain width (hysteresis) can be set on the alarm level. You can select the hysteresis from Low, Middle, and High.

System Alarm

When a system error occurs, the SL1000 transmits an alarm signal from the rear-panel alarm terminal. You can set an alarm that combines multiple system alarms.
The following errors are detected.

HDD Full: An alarm is generated if the hard disk for recording the measured data runs out.

Acq Memory Overrun: An alarm is generated if the memory buffer acquiring the measured data overruns during auto recording.

Fan Stop: An alarm is generated if the cooling fan of the SL1000 stops.

Sync. Failure Detection: An alarm is generated when a synchronous connecting cable is disconnected during synchronous operation.

System alarms are always sent to the PC. The Acquisition Software displays a message that describes the system alarm details and also displays the details in the error information area.

Alarm Output

The terminal on the SL1000 rear panel can be used to transmit a TTL logic signal when an alarm occurs. The SL1000 cannot transmit both the channel alarm and system alarm simultaneously.

In the case of a channel alarm, the SL1000 can be configured so that the signal level remains even when the alarm condition is cleared after an alarm occurrence (hold) or so that the signal level is returned to the original level when the alarm condition is cleared (nonhold).

In the case of a system alarm, the signal level remains even when the alarm condition is cleared after an alarm occurrence (hold).

Alarms during synchronous operation are generated from the master SL1000 unit (whose unit ID is zero).

Recording Start and Stop Conditions

An alarm occurrence can be used as a condition for starting or stopping the recording. For details on recording, see section 1.4.

1.9 GO/NO-GO Judgment (for Triggered Mode)

GO/NO-GO judgment is performed on whether a value obtained through automated measurement of waveform parameters is within a specified range. It is also possible to execute an action such as data recording or buzzer based on the judgment result.
This function is useful if you want to inspect signals and track down abnormal symptoms on an electronic equipment production line .
This function is available only when the measuring mode is set to Triggered Mode.

Note

You cannot configure GO/NO-GO judgment during synchronous operation.

Criteria

Specify upper and lower limits for each parameter. The SL1000 judges whether the waveform parameter is within or outside the specified range. You can also specify multiple waveform parameters (up to 16) and perform judgment when all conditions are met (AND) or when any condition is met (OR).
The judgment area can be set to all the measured data that have been acquired or the measured data between cursors.

Judgment Action

The following action can be executed based on the GO/NO-GO judgment result.
Save Data
Records the measured data in binary format to the hard disk specified in the recording settings. Data is stored to a destination or file specified in Recording Settings.

Buzzer
Sounds the buzzer on the SL1000.

1.10 X-Y Display

You can view the correlation between two input signal levels by assigning the level of a waveform to the X-axis (horizontal axis) and assigning the level of another waveform to the Y-axis (vertical axis). X-Y waveforms are displayed in a different window from the window that displays normal waveforms.
You can display up to four display groups of X-Y waveforms.
This feature is available on software versions 2.10 and later.

X-Axis and Y-Axis

X-Axis
Any channel registered in a measuring group can be assigned to the X-axis.

Y-Axis
Channels whose sample rate is the same as that of the X-axis and that have their waveform display set to ON in their display condition settings are assigned to the Y-axis.

Number of Data Points to Draw

You can set the number of data points to draw to 2K, 10K, or 100K.

In Triggered Mode
If the number of measured data points is less than the specified number of data points to draw, the SL1000 uses all the measured data to draw the waveform.
If the number of measured data points is greater than the specified number of data points to draw, the SL1000 draws the waveform by reducing the number of data points to the specified number. This reduction is done by taking the midpoint of the maximum and minimum values of multiple measured data points.
The cursor measurement values are displayed using the measured raw data that is stored internally.

> ### Note
> - When displaying data measured in Triggered mode on the X-Y display, if the number of measured data points is greater than the number of data points to draw, the SL1000 displays the waveform by taking the midpoint of maximum and minimum values of the measured data points. When taking cursor measurements, the cursors may be displayed off of the X-Y waveform because the cursors are displayed according to the measured data.
> - If there are too many waveforms or too many data points drawn on the X-Y display, the waveform display updating and waveform recording may slow down.

In Free Run Mode
If the number of measured data points is less than the specified number of data points to draw, the SL1000 uses all the measured data to display the waveform.
If the number of measured data points is greater than the specified number of data points to draw, the SL1000 displays as much of the most recent measured data as is specified by the number of data points to draw.

Display Area

In Triggered Mode
You can select the range of the X-Y display from the following.
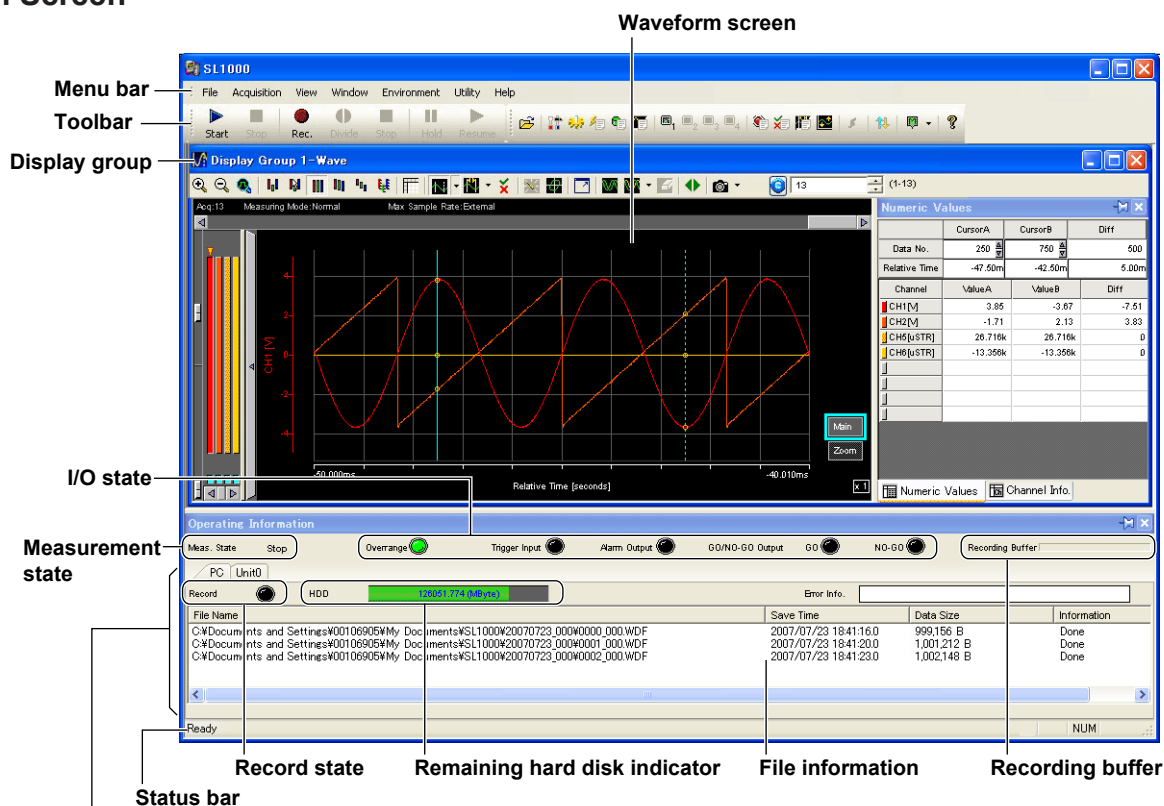Main: The X-Y display shows the measured data of normal waveforms.
Zoom: The X-Y display shows the measured data of zoomed waveforms.

In Free Run Mode
The X-Y display shows the measured data of normal waveforms.

1.11 Screen Description

Main Screen

Waveform screen

Menu bar
Toolbar
Display group

I/O state

Measurement state

Record state   Remaining hard disk indicator   File information   Recording buffer

Status bar

Information about the hard disk of your PC or the internal hard disk of the SL1000

Information about the Hard Disk of Your PC or the Internal Hard Disk of the SL1000

Displays information about the hard disk of your PC or the internal hard disk of the SL1000. You can switch the displayed hard disk using tabs.

File Information

Displays the file name, save time, data size, and the like of the measured data or setup data that are saved.

Record State

The lamp is red while recording to the hard disk.

Remaining Hard Disk Indicator

Displays the remaining hard disk space as Mbyte. If the remaining space falls low, the bar turns red.

Measurement State

Displays the current measurement state such as Measuring, Wait Trigger, and Stop.
When the measuring time is greater than or equal to 1 s: Pre Trigger, Wait Trigger, Post Trigger, and Stop
When the measuring time is less than 1 s: Wait Trigger, Measuring, and Stop

Recording Buffer

Displays a bar that indicates buffer usage. The closer the recording buffer usage gets to overrunning the buffer, the longer the blue bar becomes. For example, this situation occurs when recording cannot keep up with the measured data.

I/O State

Over-Range
Turns red when an over-range occurs.
Double-click to display an over-range list screen showing a list of channels that over-range is occurring on.

Trigger Signal State
The lamp is yellow if the trigger condition is met or if an external trigger signal is being applied.
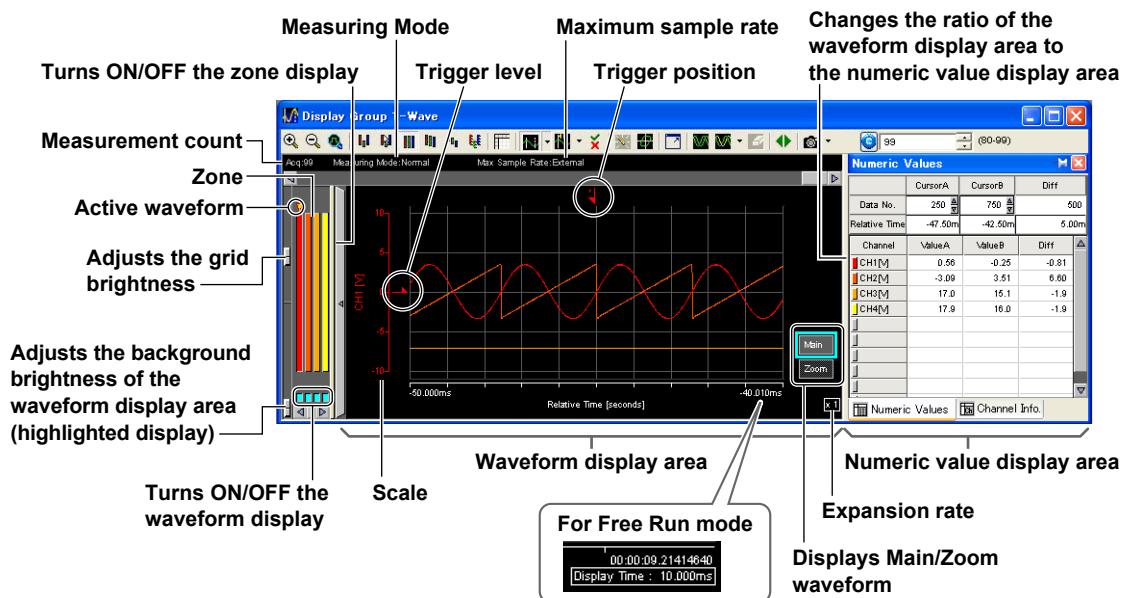
Alarm Output State
The lamp is red while an alarm is being output.
Displays the master output state during synchronous operation.

GO/NO-GO Judgment Output State
The GO lamp is green if GO is being output. The NO-GO lamp is red if NO-GO is being output.

Waveform Screen

Active Waveform
The waveform with a triangle mark is the active waveform.

Scale
Displays the scale according to the display settings. If zones specified with overlapping scales, the scale of the active waveform is displayed.

Measuring Mode
Displays "Free Run," or the Trigger Mode's "Normal," "Single," "Single (N)."

Maximum Sample Rate
Displays the measuring group 1 sample rate.

Adjusting the Trigger Position and Trigger Level
Drag the markers to set the trigger position and trigger level.

Adjusting the Brightness of the Grid (Graticule)
Drag the knob to change the brightness of the grid.

Adjusting the Background Brightness of the Waveform Display Area (Highlighted Display)

Slide the knob to change the background of the waveform display from black to white in steps

Turn ON/OFF the Waveform Display

Click this area to turn ON/OFF the channel display. Channels that are displayed are indicated in light blue.

Turning ON/OFF the Zone Display (Sliding Window)

Move the pointer over this area and click when this area changes to light purple to turn ON/OFF the zone display area.

Main Waveform or Zoom Waveform

The displayed waveform is indicated by the blue frame.

Changing the Ratio of the Waveform Display Area to the Cursor Value Display Area

Drag when the pointer changes to a left-right arrow to change the ratio of the display areas.

Time Display

In Free Run mode, the displayed time range is displayed along with the elapsed time.

X-Y Waveform Screen
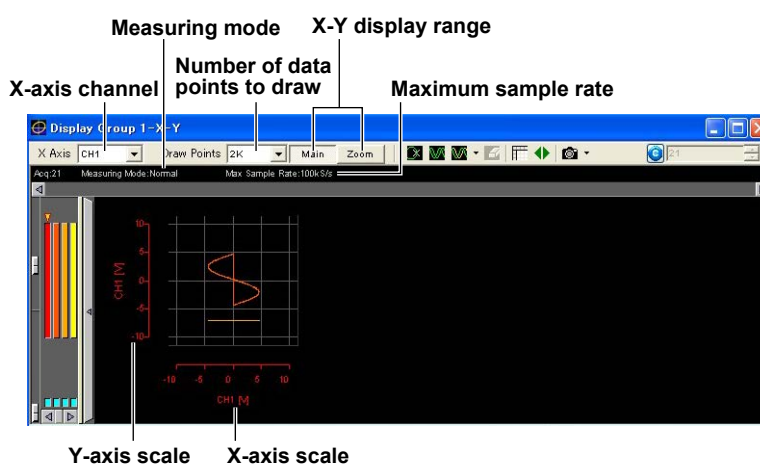
Scale

The scale that you set in the respective display conditions is displayed for the X- and Y-axes. If multiple channels are registered to the Y-axis, the scale of the active waveform is displayed.
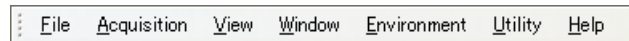
Measuring Mode

Displays "Free Run," or the Trigger Mode's "Normal," "Single," or "Single (N)."

Maximum Sample Rate

Displays the X-axis channel's sample rate.

Menu Bar

File   Acquisition   View   Window   Environment   Utility   Help

File Menu

A menu used to save and load setup files, to save and load waveform data, to save measured data, to load image data, to transfer files, and so on.

Acquisition Menu

A menu used to enter connection & group settings, measurement settings, trigger settings, recording settings, display settings, alarm settings, GO/NO-GO settings, and measure settings as well as execute auto setup, manual trigger, measurement start/stop, recording start/stop/divide, and display hold/resume.

View Menu

A menu used to list alarm history, to show and hide operating information, to set waveform zooming, to set waveform zones, to configure measured value display, to show and hide instantaneous values, to show and hide full-screen display, to show and hide the toolbar, and to show and hide the status bar.

Window Menu

A menu used to set the waveform screen. This menu appears when the waveform screen is displayed.

Environment Menu

A menu used to enter environment settings and communication settings, perform a self-test, display the system information of the SL1000, enable the key lock on the SL1000, initialize the SL1000, and calibrate the SL1000.
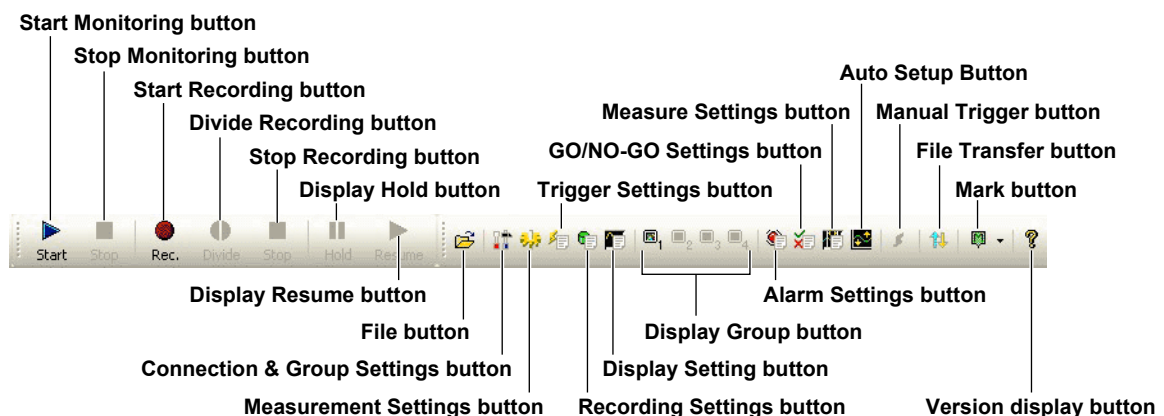
Utility Menu

A menu used to start the included Xviewer software (excluding models with the /XV0 option) and to start the File Utility.

Help Menu

A menu used to display help and software version.

Toolbar

Click the buttons on the toolbar to execute a certain operation or display a setup menu.

Start Monitoring button
Stop Monitoring button
Start Recording button
Divide Recording button
Stop Recording button
Display Hold button

Auto Setup Button
Measure Settings button
GO/NO-GO Settings button
Trigger Settings button
Manual Trigger button
File Transfer button
Mark button

Display Resume button
File button
Connection & Group Settings button
Measurement Settings button

Alarm Settings button
Display Group button
Display Setting button
Recording Settings button
Version display button

1.12   Other Functions

Redisplaying the Measured Data

The measured data recorded in the past can be displayed.

Xviewer that is included with this software is used to display the measured data (Xviewer is not included with the /XV0 option).

For details on Xviewer, see the user's manual.

Processing Waveform Data Files

The file utility function allows you to merge and divide waveform data files (.wdf extension) that have been recorded using the SL1000 and to convert waveform data files to CSV or binary files. It also allows you to process files so that waveform display is accelerated on Xviewer for smooth data analysis.

Saving the Setup File

The setup entered using this software can be saved.

You can also open a setup file saved in the past to change the software settings.

Transferring Files

You can transfer files between the SL1000 and a PC. You can collectively transfer data that has been recorded in synchronous operation mode or transfer data one unit at a time.

Marking Waveforms (Versions 2.10 and later)

When taking measurements using the internal clock in Free Run mode, you can set marks on the waveform.

Each mark can display up to 16 characters, and you can set up to 128 marks. You can edit, delete, and change the color of the marks that you have already set.

You can display a list of all the marks that are set to the displayed waveform, and you can display the waveform at the position of the mark that you specify from the list. Additionally, if you record measured data that has marks set in it or save such data to file, the mark information is also saved. You can also display the marks together with the waveform in Xviewer.

However, you cannot save just the mark information as a text file.

Accumulating Waveforms (Versions 2.10 and later)

You can accumulate waveforms on the screen, retaining the old waveforms. This is useful when you want to observe fluctuations in the measured data.

You can display the trace of the waveform when you are using the X-Y display in Free Run mode.

Taking Snapshots (Versions 2.10 and later)

You can change the display color of the waveforms that you want to keep on the screen and retain just those waveforms. This is useful when you want to compare waveforms.

Automatically Displaying Waveforms from Memory (Versions 2.10 and later)

You can set the SL1000 to automatically display the measured data in the unit's acquisition memory.

In Triggered mode, the SL1000 can also move the zoom area automatically to scroll the zoomed waveform.

1.13 Basic Operation

This section explains the basic operation of this software.

Text Box

You can directly type a value or text. Click the box to show the text cursor or highlight an existing value and type from your keyboard.

Text cursor

Option Button

You can select one of the option buttons.

Option button

Check Box

You can select multiple items from the available items. Clicking a selected check box clears it.

Check box

Drop-Down List Box

Click ▾ by the box to display a list of available choices.

Drop-down list box

Selecting Lines

To select a line on a setup screen displayed in table format, click the beginning of the line. To select all lines, click the upper left corner of the table. To select consecutive lines, click the first line you want to select and press the last line while holding down the Shift key.

Click here to select or deselect all lines

Selected lines

1

Collectively Selecting or Clearing the Check Boxes of the Selected Items

On a setup screen displayed in table format, you can collectively select or clear the check boxes in a selected range.

Select multiple lines containing the check boxes you want to manipulate as described earlier.

Click ⟨⟩ at the bottom of the check box items to collectively select or clear the check boxes in the selected range.

Select or clear the check boxes collectively

Selected lines

Click here to collectively select or clear the check boxes of the selected lines.

Setting the Value of the First Line in the Selected Range to the Other Lines in the Selected Range

On a setup screen displayed in table format, you can set the values in the selected range to the same value as the value of the first line in the selected range.

Select multiple lines containing the values you want to manipulate as described earlier.

Click ↧ at the bottom of the items. The values in the selected range are set to the value of the first line in the selected range.

Set to the same value as the first line in the selected range

Selected lines

Click here to set the values in the selected range to the same value as the first line in the selected range

2.1 Recommended PC System

Install this software on a PC with the following specifications.

Operating system
Windows 7, Windows 8, Windows 8.1, or Windows 10

CPU
Pentium 4, 1 GHz or better

Memory
At least 1 GB

Hard Disk
At least 500 MB of free space (at least 40 GB recommended when using the auto recording function)

Communication Interface
USB2.0
Ethernet 1000BASE-T (if the /C10 option is installed in the SL1000)

CD-ROM Drive
A CD-ROM drive is required to install this software program.

CRT and Mouse
Display: XGA or better
Color: 65536 colors or better
The mouse must be compatible with Windows 7, Windows 8, Windows 8.1, or Windows 10.

2.2 Installing or Uninstalling the Acquisition Software

Installing the Acquisition Software

1. Start Windows and log on with administrator privileges.

2. Load the Acquisition Software installation disk into the CD-ROM drive.
   The installer automatically starts and the setup starts.

3. A screen appears for you to select the software you want to install. Select the **SL1000 Acquisition Software** check box.

   If you also want to install Xviewer, select the **Xviewer** check box.
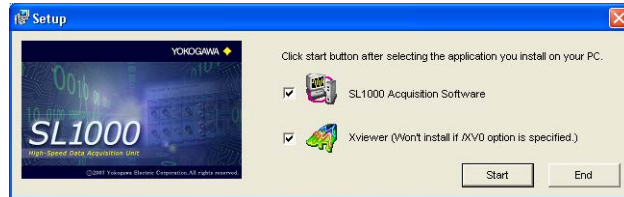
4. Click **Next** according to the instructions on the screen.
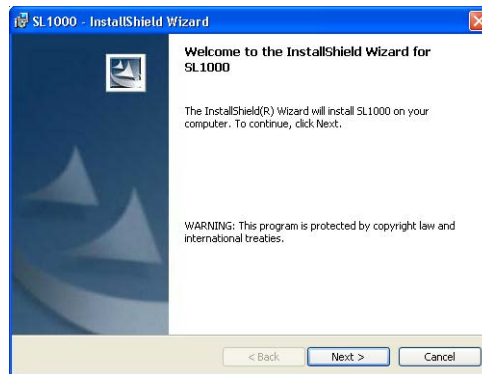
5. A screen for setting the installation destination is displayed. The default setting is C:\Program Files\Yokogawa\SL1000. To change the destination, click **Change** and select the desired directory. Check the installation destination and click **Next**.
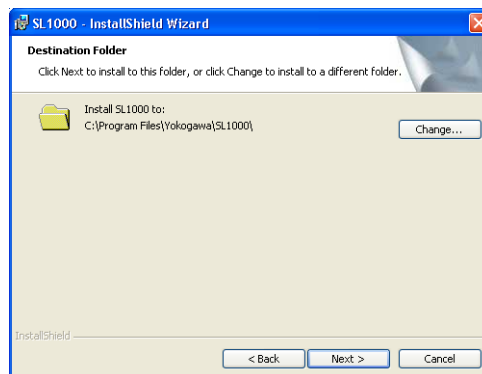
6. A screen prompting you to start the installation is displayed. If there is no problem with the installation settings, click **Install**. You can change the installation settings by clicking **Back** to return to the previous screens. Click **Cancel** to cancel the installation.

7. The software installation starts.

If the software installation completes successfully, the following screen will be displayed.

Click **Finish** to finish the installation.

You are finished with the installation if you are using a model with the /XV0 option, which does not contain Xviewer. Yokogawa > SL1000 is added to the Start > Programs menu of Windows, and a shortcut icon is created on the desktop.

If Xviewer is included in your package, a message appears asking if you want to install Xviewer. To install the program, click **OK**. The Xviewer installer starts. For the procedure to install Xviewer, see the *Xviewer User's Manual*.

Note

• You need a license number to install Xviewer. The license number is indicated on the CD case.
• When you install the SL1000 Acquisition Software, the SL1000 File Utility is also installed. Likewise, when you uninstall the SL1000 Acquisition Software, the SL1000 File Utility is also uninstalled.

Uninstalling the Acquisition Software

1. On the task bar, click the Start button and choose Control Panel.

2. Double-click **Add or Remove Programs** from the Control Panel.

3. Select SL1000 in the Add or Remove Programs window and click **Remove**.

4. A confirmation dialog box for removing the program opens. Click **Yes** to delete the program. Clicking **No** will cancel the removal operation.

5. The software program is uninstalled.

2.3　Installing the USB Driver

A dedicated USB driver (YKMUSB) or IVI driver (VISA) is necessary to connect the SL1000 to your PC using the USB.
Install the dedicated USB driver (YKMUSB) according to the following procedure.

1. Connect the SL1000 to your PC using a USB cable.

The installation wizard for the USB driver starts (only when the SL1000 is connected to the PC for the first time).

Note

- To connect a different SL1000 to the PC, you must install a new USB driver.
- Refer to the following manual in the installation CD.
  \YKMUSB\IMB9852UT-01E_050.pdf
- The USB driver is included in "YKMUSB" folder.

2. Select "No, not this time" for the connection to Windows Update and click **Next**.
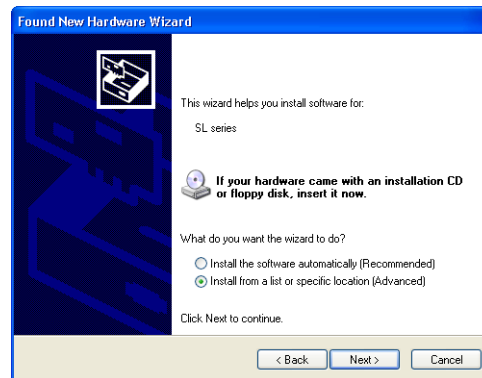
3. Select "Install from a list or specific location" and click **Next**.
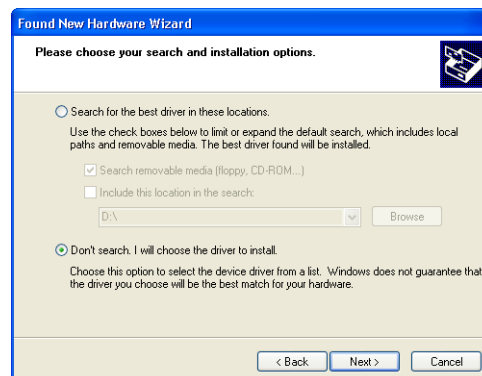
4. Select "Don't search. I will choose the driver to install" for the installation options and click **Next**.

A screen for selecting the device driver to be installed is displayed.
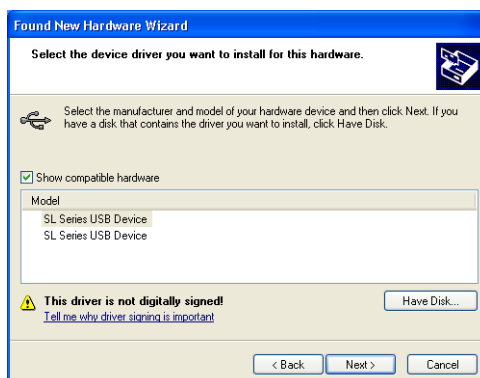
5. Click **Have Disk**.
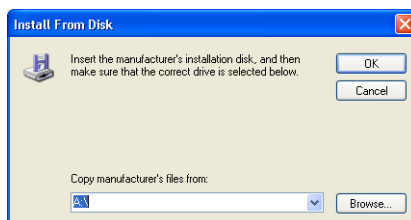
6. Click **Browse**.

A screen for specifying the device driver to be installed is displayed.
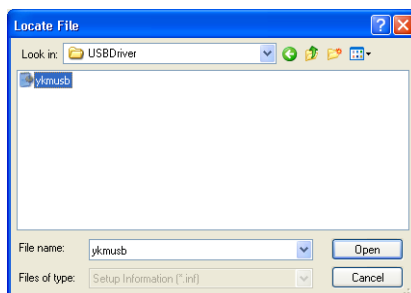
7. In the usbdriver folder in the installation folder of the Acquisition Software, select the ykmusb.inf file and click **OK**.

2

Installation Procedure
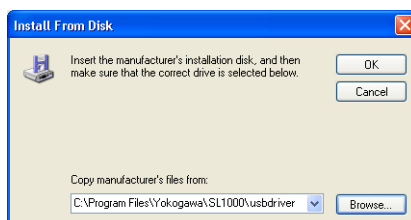
8. Check that the path you specified in step 7 is displayed under Copy manufacture's files from, and click **OK**.
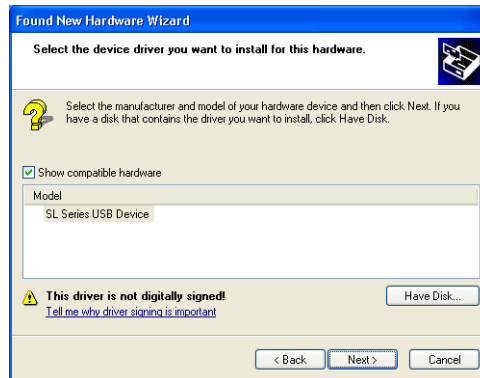
9. Click **Next**. The installation starts. When the installation is complete, the wizard completion screen is displayed.

10. Click **Finish**.

2.4 Starting and Exiting the Acquisition Software

Starting the Software

Double-click the SL1000 icon on the desktop.
The Acquisition Software starts.

Start-up Operation

If the Acquisition Software is started for the first time or in the normal case, a dialog box asking whether you want to start the setting wizard opens.

To always start the setting wizard, select the **Show Setting Wizard at startup** check box. You can start the software using the setup file that was saved previously by setting the start-up options in the environment settings (see section 9.3). In some cases, the settings cannot be updated using the same conditions such as when the module configuration has been changed from the previous time. In such case, the message shown below is displayed, and you can select what to do next.
This also applies when you manually load the settings from a setup file saved previously to update the software and SL1000 settings.

Message Screen Example

Message

Corrective action
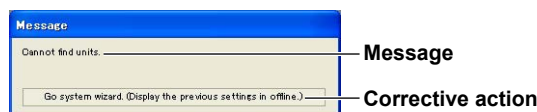
Messages and Their Descriptions

The messages that may appear at start-up are described below.

Message	Description
Cannot find units.	SL1000s cannot be detected using the search conditions used the last time the software was exited or the search conditions of the setup file. Below are some possible reasons. • The communication connector is disconnected. • If the connection method is Ethernet, the specified TCP/IP address and the TCP/IP address of the SL1000 are different. • The group ID of the SL1000 has been changed.
Connected unit is remotely controlled by other applications. Please connect it after ending the application remotely controlled.	The SL1000 is being controlled from another PC. This software cannot make the connection.
Configuration of the system are different.	The connection and group settings that existed when the software was exited the last time or those of the setup file are different from those of the connected SL1000. If you change, add, or remove the modules installed in the SL1000, the software considers the connection and group settings to be different. However, if you add a module to an empty slot to the right of the right most slot in which a module is installed, the software does not consider the connection and group settings to be different. The software also does not consider the connection and group settings to be different if only the channels registered in measuring groups have changed.
On measuring Units are found.	The connected SL1000 is measuring.
On recording Units are found.	The connected SL1000 is recording.

Message	Description
Current Firm Version is not supported, you will not be able to connect.	The SL1000 unit firmware version is not supported by this software. Update the SL1000 unit to the latest version. (See the software and SL1000 unit firmware version compatibility table.)

- **Software and SL1000 unit firmware version compatibility table**

Software version of this software	SL1000 unit firmware version
1.01 to 1.08	1.01 or later but earlier than 1.09
1.09	1.09 or later but earlier than 2.00
2.01 to 2.02	2.01 or later but earlier than 2.04
2.10 to 2.16	2.04 or later but earlier than 2.20
2.20 to 2.24	2.20 or later but earlier than 2.30
2.30 or later	2.30 or later

Downloading the latest version:

http://tmi.yokogawa.com/products/data-acquisition-equipment/high-speed-data-acquisition/sl1000-high-speed-data-acquisition-unit/

Corrective Action

The corrective action that is displayed along with the message is described below.

Corrective Action	Description
Go system wizard. (Display the previous settings in offline.)	The software loads only the settings without connecting to the SL1000 and displays the Connection & Group Settings screen. You can change the settings such as the measurement conditions offline. Search SL1000s on the Connection & Group Settings screen. If an SL1000 is found, the settings on the SL1000 is updated with the settings you specified offline. However, connection is not possible if the connection and group settings of the detected SL1000 and those specified offline are different. If the detected SL1000 is measuring or recording, the message "On measuring (recording) Units are found" is displayed. Select Get settings from the SL1000 or Stop measuring and send settings to the SL1000.
Get settings from the unit.	Discard the channel assignments to measuring groups or individual channel settings that were loaded and receive the channel assignments to measuring groups or individual channel settings from the SL1000. The measurement or recording on the SL1000 continues.
Stop measuring and send settings to the unit.	If the SL1000 is measuring, the settings cannot be updated. Therefore, stop the measurement and update the SL1000 settings using the settings of this software.
Stop recording and send settings to the unit.	If the SL1000 is recording, the settings cannot be updated. Therefore, stop the recording and update the SL1000 settings using the settings of this software.

If Start Monitoring or Start Recording is specified in the start-up options in the environment settings, measurement or recording is started after you carry out the start-up operation.

Exiting the Software

On the File menu, choose Exit. The setup data is automatically saved.

Operation When the Software Exits

The measurement is stopped when the software is exited or the measurement continues even after the software is exited according to the exit options in the environment settings.

3.1 Connecting Using the USB

Connect the SL1000 to your PC using a USB cable.

If you are connecting the SL1000 to your PC for the first time after purchase, you must install the USB driver. Install the USB driver according to the procedures given in section 2.3, "Installing the USB Driver."

1. Click the **Connection & Group Settings** button or choose **Connection & Group Settings** from the Acquisition menu.

Display the Acquisition menu

Connection & Group Settings button

2. Set the connection method to USB.

3. Specify the group ID of the SL1000 to be connected and click the **Search** button. The software searches for the specified SL1000 and makes a connection. The channel configuration of the connected SL1000 is displayed.

The group ID is a group identification number that can be assigned to each SL1000. For details, see IM720120-01E.

Unit's Name

Select USB

Specify the group ID to search using the group ID

Execute the search

Displays the found SL1000s

Move to the Measurement Settings screen

Channel configuration of the connected SL1000s

Cancel the settings and close the screen

Apply the settings and close the screen
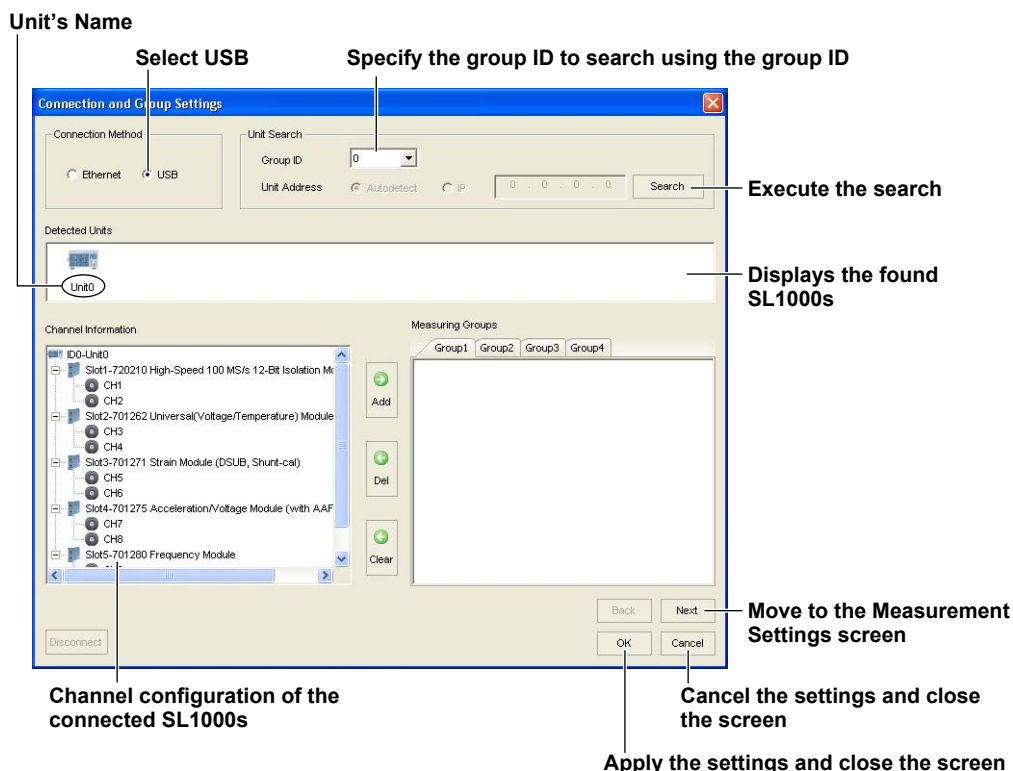
Note

If the channel configuration of the SL1000 is not displayed, the connection may have failed. Check the USB cable connection and perform the search again.

3.2 Specifying Communication Settings (When Using the Optional Ethernet Interface)

If you are connecting to the SL1000 using the Ethernet interface, you must specify the communication settings of the SL1000.

These settings are not necessary if you are connecting the SL1000 using the USB or if you are connecting the SL1000 using the Ethernet interface with the default settings (with DHCP turned ON).

The settings are specified over a USB connection.

Connecting the SL1000 to Your PC

Connect the SL1000 to your PC using a USB cable.

If you are connecting the SL1000 to your PC for the first time after installing this software, you must install the USB driver. Install the USB driver according to the procedures given in section 2.3, "Installing the USB Driver."

Specifying the Communication Settings Using This Software

After starting this software, choose **Communication Settings** from the Environment menu. The Communication Settings screen appears.

If the PC is already connected to the SL1000, disconnect it first.

Select the group ID and the unit ID of the SL1000 that you want to specify communication settings for

Settings not necessary (see section 9.11)

Turn DHCP ON or OFF
You are done with the settings if you turn DHCP ON.

Set the IP address, subnet mask, and default gateway (when DHCP is OFF)

Cannot be set

Settings not necessary (see section 8.3)

IP Address

If the DHCP server function is turned ON, you do not need to set the IP address, subnet mask, and default gateway.

If the DHCP server function is turned OFF, set the IP address, subnet mask, and default gateway according to the target network.

If the DHCP server function is turned ON in a network that allows a DHCP server to be used, the IP address and other parameters are automatically assigned when the SL1000 is connected to the network.

FTP Account

If you are accessing the hard disk of the SL1000 using FTP, set the user name, password, and timeout value for using FTP.

Set the user name using up to 15 alphanumeric characters. The default setting is "anonymous."

Set the password using up to 15 alphanumeric characters. If the user name is anonymous, the password is meaningless. The default setting is " " (null).

The selectable range of timeout is 0 to 3600 s.

Note

You cannot specify communication settings if the SL1000 is connected to the PC via the Ethernet interface. Connect the SL1000 to your PC via USB.

3

Connecting to the SL1000

3.3. Connecting Using the Ethernet Interface (Option)

1. Click the **Connection & Group Settings** button or choose **Connection & Group Settings** from the Acquisition menu.

Display the Acquisition menu

Connection & Group Settings button
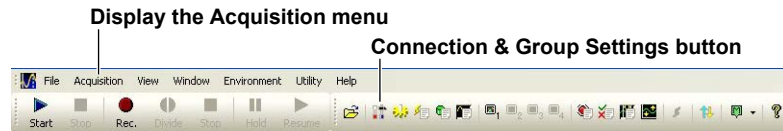
2. Set the connection method to Ethernet.

3. Specify the group ID or IP address of the SL1000 to be connected and click the **Search** button. The software searches for the specified SL1000 and makes a connection. The channel configuration of the connected SL1000 is displayed.

The group ID is a group identification number that can be assigned to each SL1000. For details, see IM720120-01E.

Select this option button to search without specifying an IP address

Specify the group ID to search using the group ID

Select this option button to search by specifying an IP address

Select Ethernet

Execute the search

Displays the found SL1000s

Move to the Measurement Settings screen

Channel configuration of the connected SL1000s

Cancel the settings and close the screen

Apply the settings and close the screen
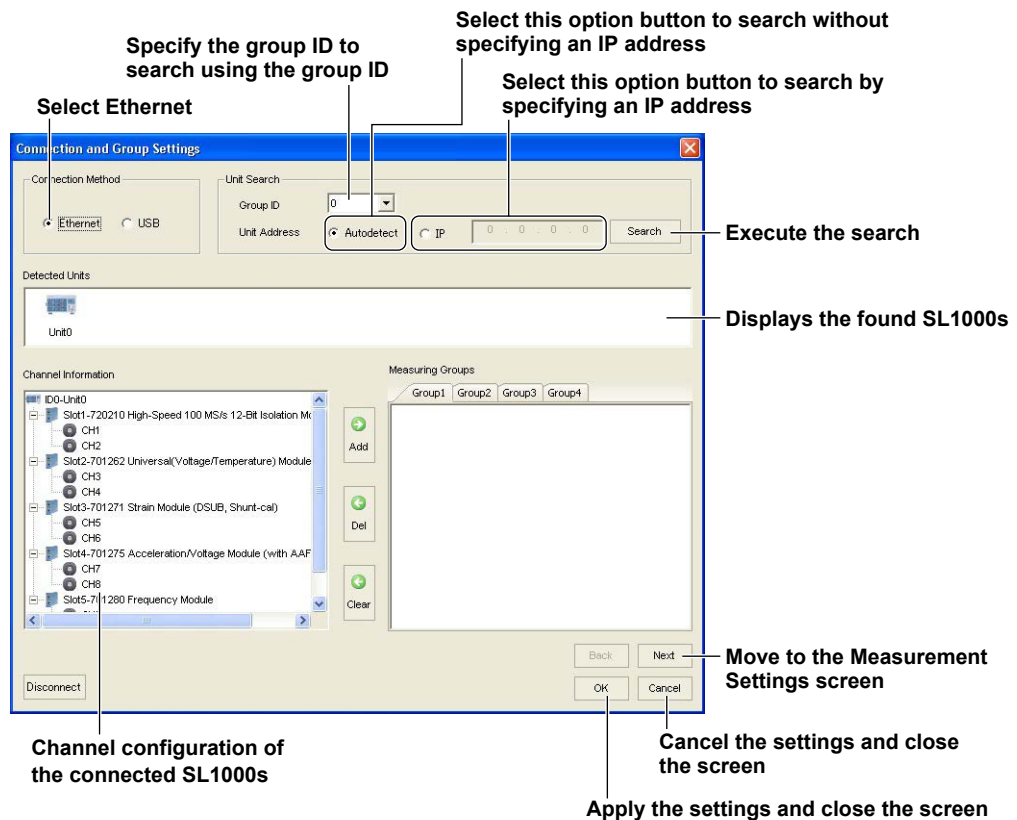
Note

• If the channel configuration of the SL1000 is not displayed, the connection may have failed. Check the Ethernet cable connection and perform the search again.

• If you are connecting to the SL1000 using the Ethernet interface, you must set the IP address and other parameters of the SL1000 in advance. For details, see section 3.2.

3.4 Configuring the System

System Configuration for Independent Operation
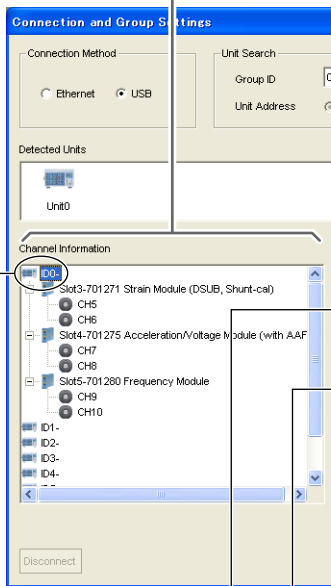
1. Connect to the SL1000 according to the procedures given in section 3.1 or 3.3.

2. Register measuring channels in unit of modules to measuring groups. There are four measuring groups (1 to 4).

   Because the sample rate is set in unit of measuring groups, register modules that will measure at the same sample rate to the same measuring group.
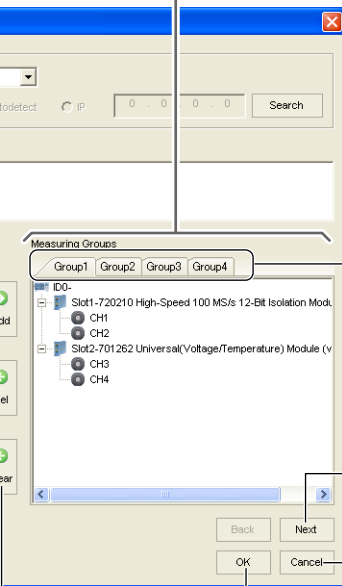
   The data measured on the measuring channels that are registered here can be acquired on the SL1000.

Drag this item (SL1000) to the Measuring Groups area to collectively register the modules in the SL1000

Modules that are not registered to a measuring group (not to be measured)

Measuring Group area Shows the modules (to be measured) that are registered to a measuring group

Measuring Group tab

Move to the Measurement Settings screen

Cancel the settings and close the screen

Apply the settings and close the screen

Clear button Delete all modules registered in the measuring group

Delete button Delete the selected modules in the measuring group

Add button Add the selected module to a measuring group

Registration

Select a module you want to register from the unregistered modules on the left side of the screen and click the **Add** button or drag the module to the Measuring Groups area. The measured data on the modules registered to measuring groups is measured, recorded, and displayed.

Note

- The sample rate of measuring group 1 can be set higher than the sample rate of other measuring groups. We recommend that you register the modules that are to measure at a high sample rate to measuring group 1.
- Register at least one master module to measuring group 1.

Deleting Channels

To delete a measuring channel, select a module in the measuring group area and click the **Delete** button or drag the module to the Channel Information area.

Click the **Clear** button to delete all the measurement modules in the Measuring Groups area.

System Configuration for Synchronous Operation

You can link up to eight SL1000s and perform synchronous measurement. For instructions on how to connect the SL1000s for synchronous operation, see the SL1000 Acquisition Unit User's Manual IM720120-01E. Connect the SL1000s for synchronous operation before starting system configuration.

1. Connect to the SL1000 according to the procedures given in section 3.1 or 3.3.

2. Register measuring channels in unit of modules to measuring groups. There are four measuring groups (1 to 4). Register at least one master module to measuring group 1.

Because the sample rate is set in unit of measuring groups, register modules that will measure at the same sample rate to the same measuring group.

The data measured on the measuring channels that are registered here can be acquired on the SL1000.

Indication when the SL1000s are connected for synchronous operation
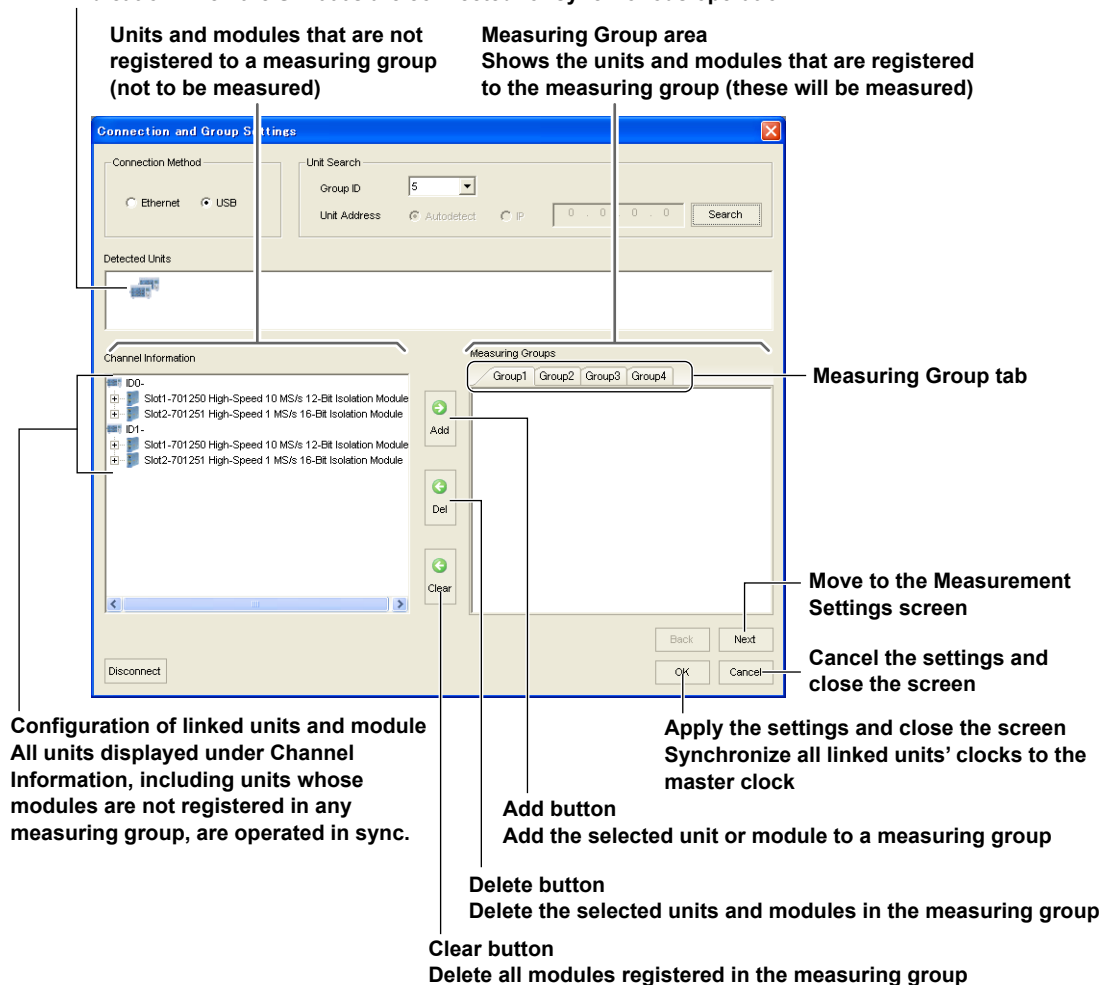
Units and modules that are not registered to a measuring group (not to be measured)

Measuring Group area
Shows the units and modules that are registered to the measuring group (these will be measured)

Measuring Group tab

Move to the Measurement Settings screen

Cancel the settings and close the screen

Configuration of linked units and module All units displayed under Channel Information, including units whose modules are not registered in any measuring group, are operated in sync.

Apply the settings and close the screen Synchronize all linked units' clocks to the master clock

Add button
Add the selected unit or module to a measuring group

Delete button
Delete the selected units and modules in the measuring group

Clear button
Delete all modules registered in the measuring group

Registration

Select a module you want to register from the unregistered modules on the left side of the screen and click the Add button or drag the module to the Measuring Groups area. The measured data on the modules registered to measuring groups is measured, recorded, and displayed.

Note

- The sample rate of measuring group 1 can be set higher than the sample rate of other measuring groups. We recommend that you register the modules that are to measure at a high sample rate to measuring group 1.
- Register at least one master module to measuring group 1.

Clearing Synchronous Operation

To clear synchronous operation and switch to independent operation, turn off all slave units (all SL1000s except the one with unit ID zero), and reconnect only the master unit according to the procedure described in "System Configuration for Independent Operation" on page 3-5.

Note

- Start and stop synchronous operation on the master unit.
- If you want to use synchronous operation after you turn off the SL1000s, you must reconfigure the system. If you do not want to reconfigure the system, select the Previous Settings check box under Start-up Options in Environment Settings (see section 9.3 for details).

4.1   Setting the Measuring Mode and Acquisition Mode

1. Click the **Measurement Settings** button or choose **Measurement Settings** on the Acquisition menu.

Display the Acquisition menu

Measurement Settings button

Set the measuring mode
To measure in Triggered mode, see section 4.8.

Set the measuring time (Triggered mode)

Set the trigger count (Triggered mode)

Set the trigger condition (Triggered mode)

Set the acquisition mode

To use the channel alarm in Free Run mode, see section 4.9.

Set to internal clock
To use an external clock, see section 4.7.
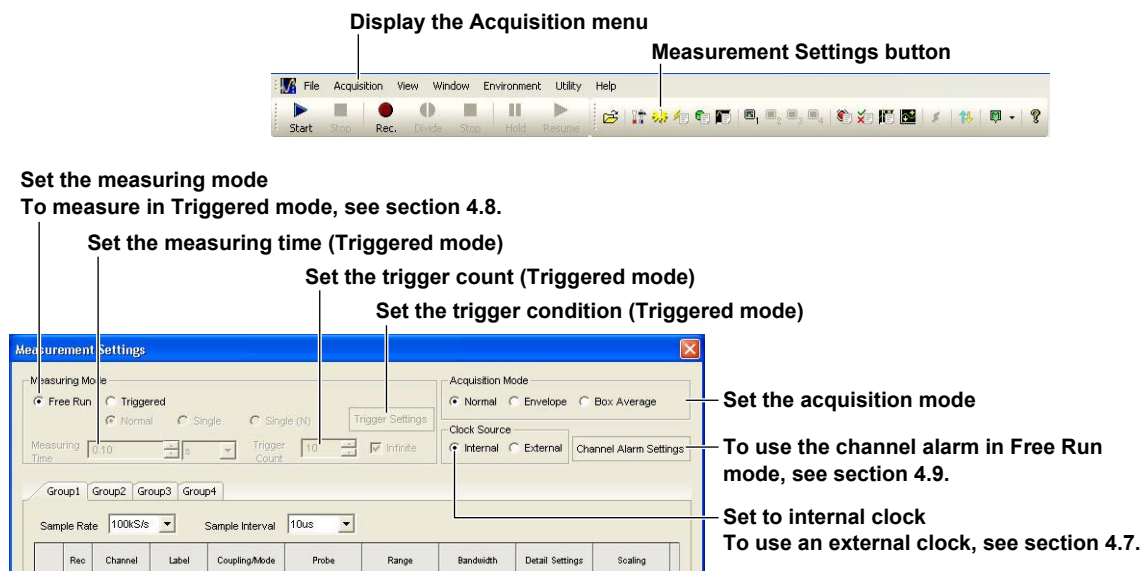
Setting the Measuring Mode

Select Free Run or Triggered.

Free Run: Acquires data at the same time measurement is started and continues to acquire data until the measurement is stopped.

Triggered: Acquires data when a trigger occurs after starting the measurement. To measure in Triggered Mode, see section 4.8.

In Triggered Mode, set the mode (Normal, Single, or Single (N)), the measuring time, and the trigger count. The selectable range is determined by the number of measuring channels and sample rate.

Setting the Acquisition Mode

Select Normal, Envelope, or Box Average.
For a detailed explanation of each mode, see section 1.3.

Normal Mode
Sampled data is stored in the acquisition memory without special processing.

Envelope Mode
The maximum and minimum values are determined every data acquisition interval, which is based on the specified sample rate, from the data sampled at 100 MS/s. The maximum and minimum values are acquired and an envelope waveform is displayed.

Box Average Mode
Acquires values that have been moving averaged at the data acquisition interval, which is based on the specified sample rate, from the data sampled at 100 MS/s. This mode is available on the 701250, 701255, 720210, 720211, and 720250 modules.

Setting the Clock Source

Select Internal or External.
If you are using an external clock, see section 4.7.

4.2 Measuring the Voltage and Current

Set the measurement conditions for measuring voltage using the voltage measurement module (701250, 701251, 701255, 701267, 701261, 701262, 701265, 701275, 720210, 720211, 720250, 720268, or 720266).

1. Click the **Measurement Settings** button or choose **Measurement Settings** on the Acquisition menu.

Display the Acquisition menu

Measurement Settings button

Measuring Group tab

Set the sample rate and sample interval

Set the measuring range
The selectable ranges vary depending on the probe ttenuation setting

Set the bandwidth limit

Detail setting

Turning ON/OFF scaling

Scroll bar

Move to the Connection & Group Settings screen (see chapter 3)

Move to the Recording Settings screen (see chapter 5)

Cancel the settings and close the screen

Apply the settings and close the screen

Set the label

Measuring channels

Turn recording ON/OFF

Copy and paste settings in unit of lines

Set the probe attenuation

Set the input coupling

Set the unit (when scaling is ON)

Linear scaling by specifying two points

Linear scaling by specifying slope a and offset b of equation y = ax + b

Scroll bar

Set P2X to the measured value when the button is clicked

Set P1X to the measured value when the button is clicked

Measuring Group Tab

Select the measuring group for which to set the measurement conditions.

Setting the Sample Rate and Sample Interval

Set the sample rate or sample interval for each measuring group. Setting the sample rate automatically sets the corresponding sample interval and vice versa.

The sample rate or sample interval can be determined from the following equation.

Sample rate = 1/sample interval

You can select the sample rate (sample interval) from 100 MS/s (10 ns), 50 MS/s (20 ns), 20 MS/s (50 ns), 10 MS/s (100 ns), 5 MS/s (200 ns), 2 MS/s (500 ns), 1 MS/s (1 μs), 500 kS/s (2 μs), 200 kS/s (5 μs), 100 kS/s (10 μs), 50 kS/s (20 μs), 20 kS/s (50 μs), 10 kS/s (100 μs), 5 kS/s (200 μs), 2 kS/s (500 μs), 1 kS/s (1 ms), 500 S/s (2 ms), 200 S/s (5 ms), 100 S/s (10 ms), 50 S/s (20 ms), 20 S/s (50 ms), 10 S/s (100 ms), and 5 S/s (200 ms).

Note

- If the sample rate of measuring group 1 is set to 50 MS/s, 5 MS/s, 500 kS/s, 50 kS/s, 5 kS/s, 500 S/s, or 50 S/s, the sample rate of other groups cannot be set to the next lower sample rate. For example, if the sample rate of measuring group 1 is set to 500 kS/s, the sample rate of other measuring groups cannot be set to 200 kS/s (the next lower sample rate).
- Set the sample rate of measuring group 1 higher than the sample rate of other measuring groups.
- If measuring in Triggered Mode, the selectable range of measuring time varies depending on the sample rate of measuring group 1 and the number of registered channels. For details, see section 4.8.
- When you confirm a new sample rate (by clicking OK, Next, or Back) in Free Run mode, the previous measured data in the memory and the waveform display are cleared.

Maximum Sample Rate of Each Module

If the sample rate is set higher than the maximum sample rate of a module, data is updated only at the maximum sample rate of the module. Consequently, all of the data within the data update interval of the module are the same data. The maximum sample rate of each module is as follows:

Module	When Using Internal Clock	When Using External Clock
701250, 701255, 720250	10 MS/s	1 MS/s
701251	1 MS/s	1 MS/s
701267, 701270, 701271, 701275	100 kS/s	100 kS/s
701261, 701262 (when measuring voltage)	100 kS/s	100 kS/s
701261, 701262 (when measuring temperature)	500 S/s	500 S/s
701281, 720281, 720268	1 MS/s	1 MS/s
701265, 720266	500 S/s	500 S/s
720210, 720211	100 MS/s	5 MS/s

Rec (Turn Recording ON/OFF)

To record the measured data on a registered channel, select the check box.

Measuring channel

Displays the registered measuring channel numbers.

Label (Name of the Measuring Channel)

You can assign names to measuring channels. Click the Label box of the measuring channel you want to name to display the text cursor or to highlight the existing name. Then, type the name. You can specify up to eight characters for the name. By default, the channel number of the slot is assigned for the name.

The channel names specified here are used in setting the waveform display conditions and on the waveform screen.

Setting the Coupling/Mode

Select how the input signal is coupled to the vertical control circuit from the list below.

AC: Acquires only the AC component of the input signal.
DC: Acquires all the components (DC and AC) of the input signal.
GND: Checks the ground level.

To measure rms values using the 701267 or 720266, select AC-RMS or DC-RMS. For details on rms measurement, AC-RMS, and DC-RMS, see page 1-12.

For the 701265 or 720266, select DC or GND.

Input Coupling Settings and Frequency Characteristics

The frequency characteristics when AC or DC is specified are shown below.

Note that low-frequency signals and signal components are not acquired if AC is selected as indicated in the figure below.
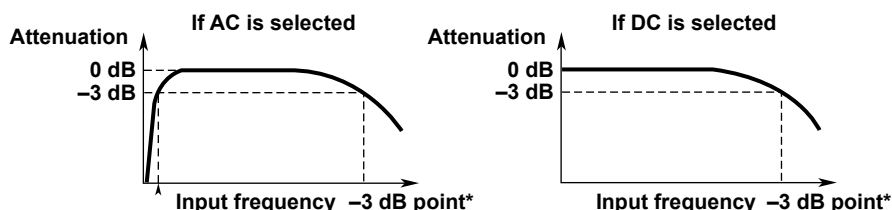
The lower frequency –3 dB point when using AC coupling*

> *   The value varies for each input module. For details, see the *SL1000 Input Module User's Manual* (IM 720120-51E).

Setting the Probe (Probe Attenuation)

Select the probe attenuation from the following according to the type of probe that you are using.

1:1, 10:1, 100:1, 1000:1, 1 A:1 V, 10 A:1 V, 100 A:1 V

1:1 to 1000:1 represent the probe attenuations for voltage probes.

1 A:1 V, 10 A:1 V, and 100 A:1 V represent the output voltage rates of current probes.

The probe attenuation is fixed to 1:1 on the 701261, 701262, 701265, 720266, and 720268.

> *Note*
>
> If the probe type is not set correctly, the voltage and scale values of the input signals will not be displayed correctly. For example, if you set the attenuation to 1:1 when you are actually using a 10:1 probe, the displayed value for the waveform amplitude will be 1/10th the actual value.

Range (Setting the Measuring Range)

Set the measuring range according to the signal applied to the module. The measuring range varies depending on the module and probe attenuation setting. The measuring ranges when the probe attenuation is 1:1 are as follows:

Input Module	Measuring Range
701250 (HS10M12), 720250 (HS10M12)	50 mV to 200 V
701251 (HS1M16)	10 mV to 200 V
701255 (NONISO_10M12)	50 mV to 200 V
701267 (HV (with RMS)), 720268 (HV (with RMS/AAF))	200 mV to 2 kV
701261 (UNIVERSAL)	50 mV to 200 V
701262 (UNIVERSAL (AAF))	50 mV to 200 V
701265 (TEMP/HPV), 720266 (TEMP/HPV)	1 mV to 100 V
701275 (ACCL/VOLT)	50 mV to 100 V
720210 (HS100M12), 720211 (HS100M12)	100 mV to 200 V

Setting the Bandwidth Limit

High frequency components can be eliminated from the input signal. The bandwidth varies depending on the input module as follows:

Input Module	Bandwidth Limit
701250 (HS10M12), 701255 (NONISO_10M12), 720250 (HS10M12)	500 Hz, 5 kHz, 50 kHz, 500 kHz, and Full
701251 (HS1M16)	400 Hz, 4 kHz, 40 kHz, and Full
701267 (HV (with RMS))	100 Hz, 1 kHz, 10 kHz, and Full
701261 (UNIVERSAL),[1] 701262 (UNIVERSAL (AAF)),[1] 701265 (TEMP/HPV)	2 Hz, 8 Hz, 30 Hz, and Full
701261 (UNIVERSAL),[2] 701262 (UNIVERSAL(AAF)), 701275 (ACCL/VOLT)	40 Hz, 400 Hz, 4 kHz, Auto (other than 701261), and Full
720210 (HS100M12), 720211 (HS100M12)	10 kHz, 20 kHz, 40 kHz, 80 kHz, 160 kHz, 640 kHz, 1.28 MHz, 2 MHz, and Full
720266 (TEMP/HPV)	0.1 Hz, 1 Hz, 8 Hz, and Full
720268 (HV (with RMS/AAF))	400 Hz, 4 kHz, 40 kHz, Auto, and Full

1   When measuring temperature
2   When measuring voltage, Auto cannot be selected on the 701261.

For example, frequency bandwidth limits of 400 Hz, 4 kHz, and 40 kHz are available on the 701251 (HS1M16). The frequency characteristics when the bandwidth is limited are shown below. If Full is selected, the maximum bandwidth of the input module is used.

Approx. 400 Hz   Approx. 4 kHz   Approx. 40 kHz   FULL
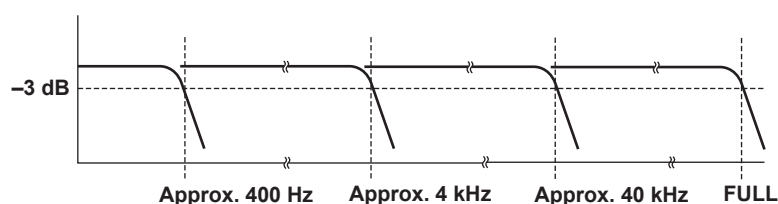
Bandwidth Limit on the 701262 (UNIVERSAL (AAF)) and 701275 (ACCL/VOLT)

If voltage is being measured on the 701262 (UNIVERSAL (AAF)) or if you set the bandwidth limit on the 701275 (ACCL/VOLT) to Auto, the anti-aliasing filter and low-pass filter settings are set to values shown below according to the sample rate.

Sample Rate	Anti-Aliasing Filter	Low-Pass Filter
200 kS/s or higher	40 kHz	OFF
100 kS/s	40 kHz	OFF
50 kS/s	20 kHz	OFF
20 kS/s	8 kHz	OFF
10 kS/s	4 kHz	4 kHz
5 kS/s	2 kHz	4 kHz
2 kS/s	800 Hz	4 kHz
1 kS/s	400 Hz	400 Hz
500 S/s	200 Hz	400 Hz
200 S/s	80 Hz	400 Hz
100 S/s	40 Hz	40 Hz
50 S/s	20 Hz	40 Hz
5 S/s to 20 S/s	20 Hz	40 Hz
2 S/s or lower	20 Hz	40 Hz
Ext sample	40 kHz	OFF

For example, for sample rates between 100 kS/s to 50 kS/s, the cutoff frequency of the anti-aliasing filter is set to 40% of the sample rate.

4

Specifying Measurement Settings

Detail Setting

Specify detailed settings for each channel.

Click the Detail Setting box of a desired channel to open the detail setting screen.

For the 701250, 701251, 701255, 701267, 720210, 720211, 720250, and 720268

Set the input coupling
Set the probe attenuation
Set the measuring range
Set the bandwidth limit
Waveform inversion

Cancel the settings and close the screen
Apply the settings and close the screen

Change the channel to be set
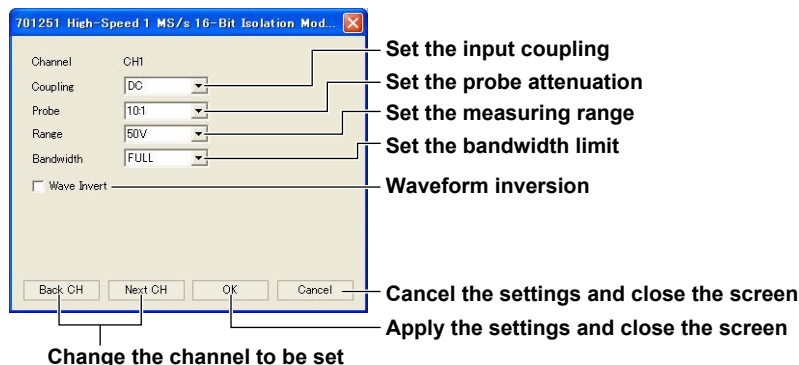
For the 701261, 701262, 701265 and 720266

Set the input coupling (Set to DC or GND)
Set the measuring range
Set the bandwidth limit
Waveform inversion

Cancel the settings and close the screen
Apply the settings and close the screen

Change the channel to be set

For the 701275

Set the input coupling (Set to DC, AC, or GND)
Set the probe attenuation
Set the measuring range
Set the bandwidth limit
Waveform inversion

Cancel the settings and close the screen
Apply the settings and close the screen

Change the channel to be set

For details on the input coupling, probe attenuation, bandwidth limit, and measuring range, see the items described earlier.

Wave Invert

Inverts the waveform around zero.

Cursor measurements, automated measurement of waveform parameters, and computation are performed on the inverted waveform.

Note

The trigger function is executed on the original waveform even if the waveform is inverted.

Setting the Scaling (Linear Scaling)

Select the check box to enable linear scaling.

Acquires the measured data by linear scaling the data.

There are two linear scaling methods. One method is to set the the measured values of any two points and their corresponding scaled values (P1-P2) and the other method is to specify the scaling coefficient a and offset value b (aX+b).
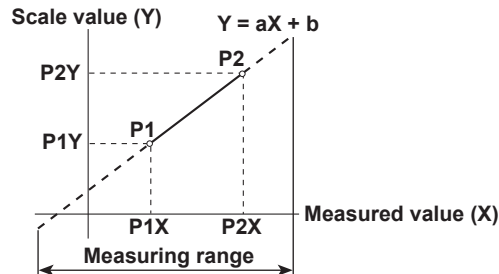
Setting the Unit

A unit can be assigned to the linearly scaled values. Click the Unit box of the measuring channel you want to set to display the text cursor or to highlight the existing unit. Then, type the unit.

Set the unit using up to four characters.

P1-P2

Specify arbitrary scale values (P1Y and P2Y) for the measured values of two arbitrary points (P1X and P2X). The scale conversion equation (y = ax + b) is derived from these four values.

- Range of measured values (P1X and P2X):   −9.99990E+25 to +9.99990E+25
- Range of scaled values (P1Y and P2Y):   −9.99990E+25 to +9.99990E+25
  However, you cannot set measured or scaled values P1 and P2 that would make value a in the scaling equation zero or an incalculable value.

The aX+b setting changes along with the P1-P2 setting.

You can also directly assign the current measured value to P1X or P2X.

aX+b

The results obtained from the following computation based on the specified scaling coefficient a and offset b are displayed as cursor measurement values and automated measurement values of waveform parameters.

$Y = aX + b$ (where X is the measured value and Y is the linear scaling result)
However, coefficient a cannot be set to zero.

The P1-P2 setting changes along with the aX+b setting.

Assigning a Measured Value to P1X or P2X

You can directly assign the current measured value to P1X or P2X to set the linear scaling.

After selecting the channel you want to set, click **P1X Measure** or **P2X Measure**. The measured value when you click the button is assigned to P1X or P2X. This feature is convenient if you want to assign sensor output values to P1Y and P2Y so that measured results will be scaled to sensor output values.

You cannot execute this function while the SL1000 is measuring or recording.

4

Specifying Measurement Settings

4.3 Measuring the Temperature

Set the measurement conditions for measuring the temperature using the Universal Module (701261 or 701262) or Temperature, High Precision Voltage Isolation Module (701265 or 720266).

1. Click the **Measurement Settings** button or choose **Measurement Settings** on the Acquisition menu.

Display the Acquisition menu

Measurement Settings button

Measuring Group tab

Set the sample rate and sample interval

Set the thermocouple type

Set the bandwidth limit

Detail setting

Scroll bar

Move to the Connection & Group Settings screen (see chapter 3)

Move to the Recording Settings screen (see chapter 5)

Cancel the settings and close the screen

Apply the settings and close the screen

Copy and paste settings in unit of lines

Set the label

Measuring channels

Turn recording ON/OFF   Set the input coupling (Set to TC)

Measuring Group, Sample Rate, and Sample Interval

The settings for the Measuring Groups tab, Sample Rate, and Sample Interval are the same as described in section 4.2, "Measuring the Voltage and Current." See page 4-2.

Rec (Turn Recording ON/OFF)

To record the measured data on a registered channel, select the check box.

Measuring channel

Displays the registered measuring channel numbers.

Label (Name of the Measuring Channel)

You can assign a name to measuring channels. Click the Label box of the measuring channel you want to name to display the text cursor or to highlight the existing name. Then, type the name. You can set up to eight characters for the name. By default, the channel number of the slot is assigned for the name.
The channel names specified here are used in setting the waveform display conditions and on the waveform screen.

Setting the Coupling/Mode

Set the coupling/mode to TC.

Setting the Range (Thermocouple Type)

Set the range according to the thermocouple that you are using.

Select the thermocouple from below.

If the input terminal is open, the displayed value is set to a value less than or equal to the lower limit of the measuring range.

Type	Measuring Range	Type	Measuring Range
K	–200 to 1300°C	R	0 to 1700°C
E	–200 to 800°C	S	0 to 1700°C
J	–200 to 1100°C	B	400 to 1800°C
T	–200 to 400°C	N	0 to 1300°C
L	–200 to 900°C	W	0 to 2300°C
U	–200 to 400°C	Au7Fe	0 to 280 K

Setting the Bandwidth Limit

High frequency components can be eliminated from the input signal. Select 2 Hz, 8 Hz, 30 Hz, or Full on the 701261, 701262, and 701265. Select 0.1 HZ, 1 Hz, 8 Hz, or Full on the 720266. For details, see section 4.2, "Measuring the Voltage and Current."

4

Specifying Measurement Settings

Detail Setting

Specify detailed settings for each channel.

Click the Detail Setting box of a desired channel to open the detail setting screen.

Set the input coupling (Set to TC)
Set the thermocouple type
Set the bandwidth limit
Sets the temperature unit
Set the RJC
Set the burnout

Cancel the settings and close the screen
Change the channel to be set   Apply the settings and close the screen
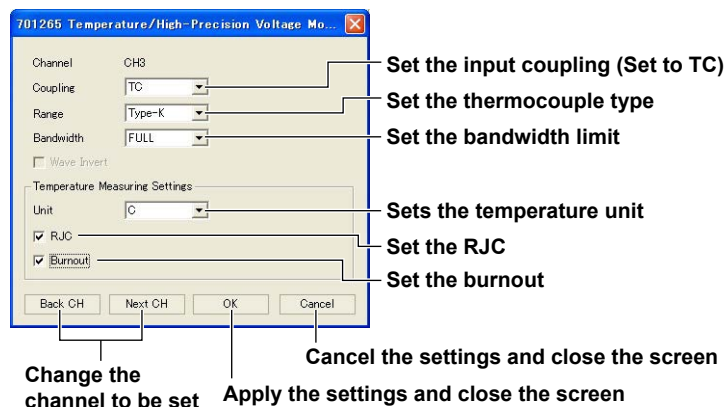
Unit

Select the temperature unit from °C and K. The default setting is °C.

RJC

The SL1000 normally performs reference junction compensation with the built-in
RJC circuit when measuring temperature with the thermocouple. When checking the
temperature measurement value, or when using an external reference junction (0°C), the
internal reference junction compensation needs to be disabled.
Select the check box to use the internal reference junction compensation.
In normal cases, use the internal reference junction compensation.

Note

If a voltage corresponding to a certain temperature t is applied at the input with the RJC
turned OFF and the measured temperature does not match temperature t, the SL1000 may be
damaged. Contact your nearest YOKOGAWA dealer.

Burnout

This function is used to accurately detect a burnout in the thermocouple. If you select the
check box and the thermocouple measurement input detects a burn out, the measured
value is fixed to the upper limit of the measurement range of each thermocouple. By
default, this setting is turned OFF (do not detect burn outs).

Note

Linear scaling and inverted display are not available in temperature measurements.

4.4 Measuring the Strain

Set the measurement conditions for measuring the strain on the Strain Module (701270 or 701271).

1. Click the **Measurement Settings** button or choose **Measurement Settings** on the Acquisition menu.

Display the Acquisition menu

Measurement Settings button

Measuring Group tab **Set the sample rate and sample interval**

Set the measuring range

Set the bandwidth limit
Detail setting
Turning ON/OFF linear scaling

Scroll bar

Move to the Connection & Group Settings screen (see chapter 3)

Move to the Recording Settings screen (see chapter 5)

Cancel the settings and close the screen

Apply the settings and close the screen

Copy and paste settings in unit of lines

Set the label
Measuring channels
Turn recording ON/OFF
Set the probe attenuation
Set the input coupling

Set the unit (when scaling is ON)

Linear scaling by specifying two points

Linear scaling by specifying slope a and offset b of equation y = ax + b

Scroll bar

Execute strain balance
Set P1X to the measured value when the button is clicked
Set P2X to the measured value when the button is clicked

Measuring Group, Sample Rate, and Sample Interval

The settings for the Measuring Groups tab, Sample Rate, and Sample Interval are the same as described in section 4.2, "Measuring the Voltage and Current." See page 4-2.

Rec (Turn Recording ON/OFF)

To record the measured data on a registered channel, select the check box.

Measuring channel

Displays the registered measuring channel numbers.

Label (Name of the Measuring Channel)

You can assign a name to measuring channels. Click the Label box of the measuring channel you want to name to display the text cursor or to highlight the existing name. Then, type the name. You can set up to eight characters for the name. By default, the channel number of the slot is assigned for the name.

The channel names specified here are used in setting the waveform display conditions and on the waveform screen.

Setting the Coupling/Mode

Set the range unit to "the strain unit ($\times 10^{-6}$ strain): μSTR" or "the output unit of the strain gauge transducer: mV/V." The default value is μSTR. The following equation is used to derive the mV/V range.

(mV/V) = 0.5 × (μSTR)/1000

Range (Setting the Measuring Range)

Select from the following:

- If μSTR Is Selected

  500 μSTR, 1000 μSTR, 2000 μSTR, 5000 μSTR, 10000 μSTR, and 20000 μSTR

  For details on the measuring range, see the separate user's manual for the module.

- If mV/V Is Selected

  0.25 mV/V, 0.5 mV/V, 1 mV/V, 2.5 mV/V, 5 mV/V, and 10 mV/V

  For details on the measuring range, see the *SL1000 Input Module User's Manual* (IM 720120-51E).

> *Note*
>
> Be sure to execute balancing if you change the measuring range.

Setting the Bandwidth Limit

High frequency components can be eliminated from the input signal. Select 10 Hz, 100 Hz, 1 kHz, or Full. For details, see section 4.2, "Measuring the Voltage and Current."

Detail Setting

Specify detailed settings for each channel.
Click the Detail Setting box of a desired channel to open the detail setting screen.

701271 Strain Module (DSUB, Shunt-cal)

- Set the range unit
- Set the measuring range
- Set the bandwidth limit
- Set the bridge voltage
- Set the gauge factor
- **Execute strain balance**

Set the shunt calibration (701271)
To perform shunt calibration, select the Scaling check box.

P1:X: Input value when the relay circuit is OFF (setting normally not necessary)
P1:Y: Value corresponding to P1:X when the relay circuit is OFF (normally 0)
P2:X: Input value when the relay circuit is ON (shunt resistance, setting normally not necessary)
P2:Y: Strain value corresponding to the shunt resistance when the relay circuit is ON

Change the channel to be set

Execute shunt calibration
Cancel the settings and close the screen
Apply the settings and close the screen

Selecting the Bridge Voltage

You can select the voltage to be applied to the bridge head.
- 2V: When the bridge head resistance (bridge resistance) is 120 Ω to 1000 Ω
- 5V:* When the bridge resistance is 350 Ω to 1000 Ω
- 10V:* When the bridge resistance is 350 Ω to 1000 Ω
* The bridge voltage can be set to 5 V or 10 V only if the following conditions are met.
  - The bridge resistance is 350 Ω or greater.
  - A strain gauge transducer that supports the bridge voltage of 5 V or 10 V.

The bridge voltage cannot be changed while data acquisition is in progress.

Setting the Gauge Factor

You can set the gauge factor of the strain gauge.
Selectable range: 1.90 to 2.20 (the resolution is 0.01)
The gauge factor is a unique constant defined for the strain gauge. It is usually described in the manual for the strain gauge. The gauge factor cannot be changed while data acquisition is in progress.

- **Gauge Factor If mV/V Is Selected**

This software allows you to set the gauge factor to any value. However, if there are no specifications given on the strain gauge transducer, set the gauge factor to 2.00. If the gauge factor is not 2.00, e is derived in the SL1000 using the following equation.

$$e = (4/K) \times (V/E)$$

e: Measured value of the strain gauge transducer [mV/V]
V: Voltage measured on the bridge [V]
E: Voltage applied to the bridge [V]
K: Gauge factor

Executing Strain Balancing

Balancing automatically compensates the unbalanced portion of the bridge resistance.
Balancing takes a few seconds.

Executable range of balancing: ±10000 µSTR (if set to µSTR)
±5 mV/V (if set to mV/V)

Note

Perform balancing by connecting a bridge box or strain gauge transducer and without applying a load to the strain gauge.

Shunt Calibration (Only on the 701271(STRAIN_DSUB))

The 701271 Strain Module (STRAIN_DSUB) supports shunt calibration.

Shunt calibration is used to correct the gain of strain measurements by inserting a known resistance (shunt calibration resistance (shunt resistance)) in parallel with the strain gauge. It is a type of scaling. Strain Module 701271 (STRAIN_DSUB) has a built-in relay circuit for shunt calibration.

To execute shunt calibration, a bridge head that supports shunt calibration (701957/701958) is necessary.

• **When correcting the gain on the negative side (normal)**
Shunt calibration relay circuit (built into the strain module)
Turns ON/OFF automatically when shunt calibration is executed.

Bridge+

120 Ω

In+

Bridge voltage

In−

120 Ω

120 Ω

Bridge−

Shunt resistor
(Implemented in the bridge head)
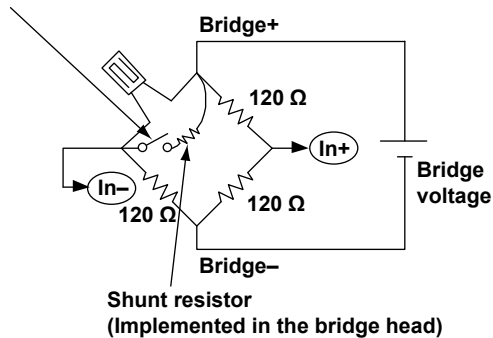
• **When correcting the gain on the positive side**
Shunt calibration relay circuit (built into the strain module)
Turns ON/OFF automatically when shunt calibration is executed.

Bridge+

120 Ω

In+

Bridge voltage

In−

120 Ω

120 Ω

Bridge−

Shunt resistor,
when correcting the positive side
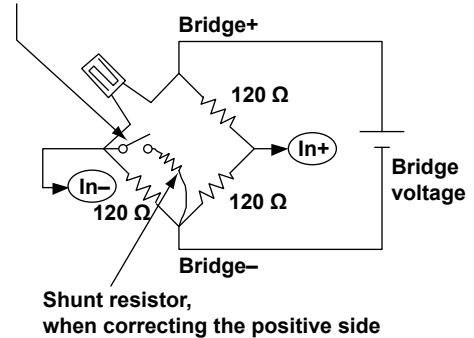
Note

- In a normal shunt calibration, set only P2:Y (P1:Y is 0).
- Scale the strain value using a shunt resistor. P1:X is the input value when a shunt resistor is not connected. P1:Y is the strain value corresponding to P1:X. P2:X is the input value when a shunt resistor is connected. P2:Y is the strain value corresponding to the shunt resistance. The line connecting points P1 and P2 is used to perform scaling.
- When shunt calibration is executed, the relay circuit for shunt calibration built into the strain module is turned ON/OFF to automatically set P1:X and P2:X to the input value when the shunt resistor is connected and the input value when the shunt resistor is not connected, respectively.
- If you change P1:X, P1:Y, P2:X, or P2:Y, the linear scaling setting is also changed.
- Executing Shunt Cal Exec changes P1:X and P2:X to the current input values.

In addition to the normal shunt calibration (when the shunt calibration relay circuit is ON), the this software allows the setting of a zero point when the built-in relay circuit is OFF. This function is effective when the strain value is not 0 after the execution of balancing.

P1:X: If shunt calibration is executed, the input value when the relay circuit is OFF is applied.

P1:Y: Sets the value (usually 0) when the relay circuit is OFF.

P2:X: If shunt calibration is executed, the input value when the relay circuit is ON is applied.

P2:Y: Sets the strain value corresponding to the shunt resistance when the relay circuit is ON.

• Shunt calibration
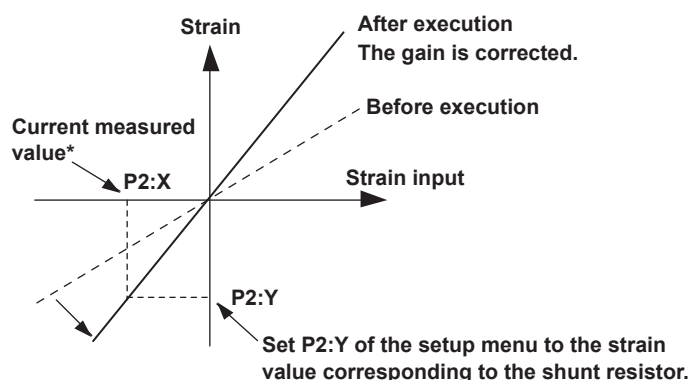
* Automatically obtained when shunt calibration is executed.

For details on shunt calibration, see the *SL1000 Input Module User's Manual* (IM 720120-51E).

Note

- If executing shunt calibration, select an appropriate range so that the measured values do not exceed the range when the shunt calibration relay circuit is ON. The SL1000 attempts shunt calibration within the current specified range.
- If shunt calibration fails (the measured value exceeds the range, for example), an error message is displayed. If this happens, change the range and execute shunt calibration again.

Setting the Scaling (Linear Scaling)

Select the check box to enable linear scaling.

Acquires the measured data by linear scaling the data.

For details on linear scaling, see page 4-7.

Precautions to Be Taken When Making Strain Measurements

- Be sure to execute balancing when making strain measurements.
- Select a bridge voltage of 5 V or 10 V when the bridge resistance is greater than or equal to 350 Ω. If a bridge voltage of 5 V or 10 V is applied when the bridge resistance is less than 350 Ω, correct measurements will not be made.
- If using a strain gauge transducer, use a bridge voltage in the recommended voltage range of the transducer.
- Correction cannot be executed if a strain gauge bridge (bridge head) or a strain gauge transducer is not connected to the channel on which balancing is to be executed.
- If balancing fails on any of the specified channels, an error message will be displayed.
- If the SL1000 is turned ON, a new strain gauge is connected, or the measuring range, bridge voltage, or gauge factor is changed, balancing must be performed again before making further measurements.
- If you switch the unit, the unit of all related parameters of the channel is switched accordingly (trigger level, measured values of automated measurement parameters, cursor measurement values, etc.).

4

4.5 Measuring the Acceleration

Set the measurement conditions for measuring the acceleration on the Acceleration Module (701275).

1. Click the **Measurement Settings** button or choose **Measurement Settings** on the Acquisition menu.

Display the Acquisition menu

Measurement Settings button

Measuring Group tab

Set the sample rate and sample interval

Set the measuring range

Set the bandwidth limit

Detail setting

Scroll bar

Move to the Connection & Group Settings screen (see chapter 3)

Move to the Recording Settings screen (see chapter 5)

Cancel the settings and close the screen

Apply the settings and close the screen

Copy and paste settings in unit of lines

Set the label

Measuring channels

Turn recording ON/OFF

Set the input coupling (Set to ACCL)

Measuring Group, Sample Rate, and Sample Interval

The settings for the Measuring Groups tab, Sample Rate, and Sample Interval are the same as described in section 4.2, "Measuring the Voltage and Current." See page 4-2.

Rec (Turn Recording ON/OFF)

To record the measured data on a registered channel, select the check box.

Measuring channel

Displays the registered measuring channel numbers.

Label (Name of the Measuring Channel)

You can assign a name to measuring channels. Click the Label box of the measuring channel you want to name to display the text cursor or to highlight the existing name. Then, type the name. You can set up to eight characters for the name. By default, the channel number of the slot is assigned for the name.

The channel names specified here are used in setting the waveform display conditions and on the waveform screen.

Setting the Coupling/Mode

Set the coupling/mode to ACCL.

Setting the Range (Gain)

Set the gain in the range from ×0.1 to ×100.

Setting the Bandwidth Limit

High frequency components can be eliminated from the input signal. Select 40 Hz, 400 Hz, 4 kHz, Auto, or Full. For details, see section 4.2, "Measuring the Voltage and Current."

Detail Setting

Specify detailed settings for each channel.
Click the Detail Setting box of a desired channel to open the detail setting screen.

Set the input coupling (Set to ACCL)
Set the measuring range
Set the bandwidth limit
Set the bias
Set the sensitivity
Set the unit

Cancel the settings and close the screen
Change the channel to be set
Apply the settings and close the screen
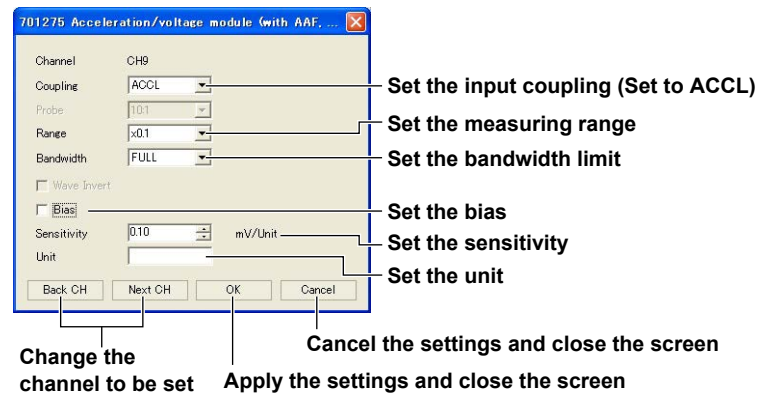
Setting the Bias

If the bias is turned ON, a 4-mA bias current is supplied to the acceleration sensor. Do not connect the acceleration sensor with the bias turned ON.

Setting the Sensitivity

Set the sensitivity of the acceleration sensor in the range of 0.10 mV/Unit to 2000.00 mV/Unit.

Setting the Unit

Set the unit using up to four characters. The default setting is m/s^2.

4.6 Measuring the Frequency, Number of Rotations, Period, Duty Cycle, Power Supply Frequency, Pulse Width, Pulse Integration, and Velocity

Set the measurement conditions for measuring the frequency on the Frequency Module (701281 or 720281).

1. Click the **Measurement Settings** button or choose **Measurement Settings** on the Acquisition menu.

Display the Acquisition menu

Measurement Settings button

Measuring Group tab   Set the sample rate and sample interval

Detail setting

Turning ON/OFF linear scaling

Scroll bar

Move to the Connection & Group Settings screen (see chapter 3)

Move to the Recording Settings screen (see chapter 5)

Cancel the settings and close the screen

Apply the settings and close the screen

Set the label

Measuring channels

Turn recording ON/OFF

Copy and paste settings in unit of lines

Set the unit (when scaling is ON)

Linear scaling by specifying two points

Linear scaling by specifying slope a and offset b of equation y = ax + b

Scroll bar

Set P2X to the measured value when the button is clicked

Set P1X to the measured value when the button is clicked

Settings Common to the Frequency, Number of Rotations, Period, Duty Cycle, Power Supply Frequency, Pulse Width, Pulse Integration, and Velocity Measurements

Measuring Group, Sample Rate, and Sample Interval

The settings for the Measuring Groups tab, Sample Rate, and Sample Interval are the same as described in section 4.2, "Measuring the Voltage and Current." See page 4-2.

Rec (Turn Recording ON/OFF)

To record the measured data on a registered channel, select the check box.

Measuring channel

Displays the registered measuring channel numbers.

Label (Name of the Measuring Channel)

You can assign a name to measuring channels. Click the Label box of the measuring channel you want to name to display the text cursor or to highlight the existing name. Then, type the name. You can set up to eight characters for the name. By default, the channel number of the slot is assigned for the name.

The channel names specified here are used in setting the waveform display conditions and on the waveform screen.

Setting the Scaling (Linear Scaling)

Select the check box to enable linear scaling.

Acquires the measured data by linear scaling the data.

For details on linear scaling, see page 4-7.

> **Note**
>
> The coupling, probe, range, and bandwidth limit of the frequency module can be set on the detail setting screen.

Detail Setting
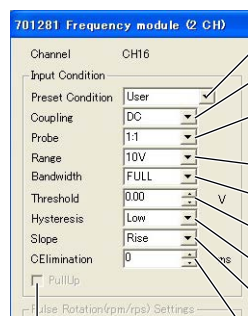
Specify detailed settings for each channel.

Click the Detail Setting box of a desired channel to open the detail setting screen.

Set the input conditions

Set the measurement conditions

Set the measurement conditions (The setup items vary depending on the measurement items)

Cancel the settings and close the screen

Apply the settings and close the screen

Change the channel to be set

4

Specifying Measurement Settings
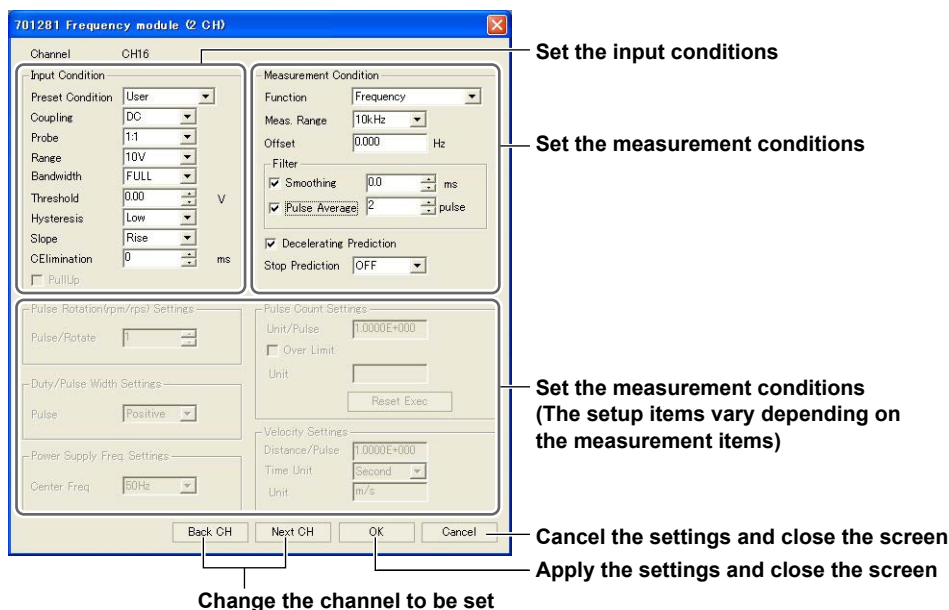
Set the input conditions

Select the preset

Set the input coupling (when the preset is user defined)

Set the probe (when the preset is Logic 5V (3V/12V/24V), ZeroCross, or user defined)

Set the voltage range (when the preset is ZeroCross or user defined)

Set the bandwidth limit

Set the threshold level (when the preset is user defined)

Set the hysteresis

Set the slope (when the preset is Logic 5V (3V/12V/24V), Pull-up 5V, or user defined)

Set the chattering elimination time

Set the pull-up (when the preset is Pull-up 5V)

Preset

Select from the following presets according to the sensor that you are using.

- Logic 5V: 5-V logic signal, 5-V output sensor, and sensor with TTL output
- Logic 3V: 3-V logic signal and 3-V output sensor
- Logic 12V: 12-V driven relay/sequence circuit and 12-V driven sensor
- Logic 24V: 24-V driven relay/sequence circuit and 24-V driven sensor
- Pull -up 5V: Open-collector output sensor and contact circuit
- ZeroCross: Sensor/Encoder that outputs positive and negative voltages and sensor that outputs sine waves
- AC100V: When measuring a supply voltage of 100 VAC using the isolated probe (700929)
- AC200V: When measuring a supply voltage of 200 VAC using the isolated probe (700929)
- EM Pickup: Power-generating electromagnetic pickup
- User: Any sensor

Select a preset to automatically enter settings appropriate for the signal (Some items need to be manually entered). If you select User, all the setup items can be set as desired. For details on the settings of each preset, see the *SL1000 Input Module User's Manual* (IM 720120-51E).

- Logic 5V, Logic 3V, Logic 12V, and Logic 24V
  Use this preset when the output from the sensor or the like changes in the range of 0 V to 5 V (or 3 V, 12 V, or 24 V: supply voltage applied to the sensor). The voltage range is automatically set to the optimum voltage range, and the threshold level is automatically set to one-half the voltage.
- Pull -up 5V
  Use this preset when the sensor output is open collector or contact output. The pull-up function is enabled only when this preset is selected. The pull-up voltage is approximately 5 V, and the pull-up resistor is 10 kΩ. If pull-up is turned ON, set the input voltage in the range of 0 V to 5 V. If the input voltage exceeds this range, the protection circuit will be tripped and the pull-up resistor will be automatically cut off.
- ZeroCross
  Use this preset when the input voltage changes around 0 V. The input coupling is automatically set to AC, and the threshold level is automatically set to 0 V. When setting the voltage range, be sure that the maximum amplitude does not exceed the voltage range.

- AC100V and AC200V
  Use this preset when measuring the supply voltage of 100-V or 200-V power supply systems. The probe type is automatically set to 10:1; the voltage range is automatically set to a value suitable for the input voltage and probe factor; and the coupling is automatically set to AC. Be sure to use the isolated probe (700929) when measuring the power supply voltage.
- EM Pickup (Electromagnetic Pickup)
  Use this preset when connecting the electromagnetic pickup directly. The voltage range is automatically set to ±1 V, and the threshold level is automatically set to 0 V.
- User (User-Defined)
  Use this preset if you want to set the input conditions freely. Pull-up cannot be specified.

Note

- If measuring high voltage exceeding 42 V (AC+DCpeak) on the 701281 (FREQ) or 720281 (FREQ), be sure to use the isolated probe (700929).
- Use EM Pickup only when connecting the electromagnetic pickup.
- The SL1000 does not support electromagnetic pickups that require power supply or those that require terminators at the output. For these types of electromagnetic pickup, furnish appropriate measures at the sensor end.
- The output from the electromagnetic pickup must be within 42 V_{P-P}. The minimum sensitivity is 0.2 V_{P-P}.
  If the output is less than the minimum sensitivity, the measured values may be unstable.
- If using the pull-up function, do not let the voltage exceed the 0 to 5 V range. If the voltage exceeds the range, the protection circuit will be tripped, and the pull-up circuit will be cut off.

Setting the Input Coupling

Set the coupling to DC or AC. You can change the setting only if the preset is set to User.

Setting the Probe (Probe Attenuation)

Set the probe attenuation to 1:1 or 10:1. You can change the setting only if the preset is set to Logic 5V (3V/12V/24V), ZeroCross, or User.

Setting the Range

Set the voltage range to ±1 V, ±2 V, ±5 V, ±10 V, ±20 V, or ±50 V. You can change the setting only if the preset is set to ZeroCross or User.

Setting the Bandwidth Limit

Set the bandwidth limit to 100 Hz, 1 kHz, 10 kHz, 100 kHz, or Full. You can change the setting on all presets. However, if the preset is set to AC100V or AC200V, the bandwidth limit cannot be set to Full.

4

Specifying Measurement Settings

Setting the Threshold Level

Set the threshold level used to determine the period within the voltage range. You can change the setting only if the preset is set to User.
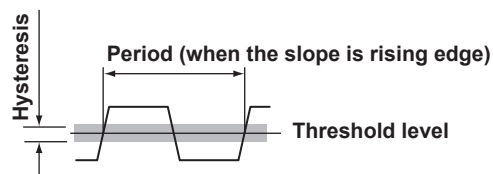
Setting the Hysteresis

Set Hys (hysteresis) to Low, Middle, or High. You can change the setting on all presets.

If Changing the Slope Setting

Set the slope to Rise or Fall.
You can change the setting only if the preset is set to Logic 5V (3V/12V/24V), Pull-up 5V, or User.

Setting the Chatter Elimination Function

You can change the setting on all presets. This function eliminates the chatter that occurs such when the contact input is turned ON/OFF. This allows changes in the signal over the specified time to be ignored. Set the interval in the range of 0 to 1000 ms (1-ms resolution). This function applies to both the rising and falling slopes.

Setting the Pull-Up

If the preset is set to Pull-up 5V, set whether to use pull-up.
If using pull-up, set the input voltage in the range of 0 V to 5 V. If a voltage exceeding this range is applied, the internal protection circuit will cut off the pull-up circuit.

Internal equivalent circuit when using pull-up

Measuring the Frequency

Set the measurement item (Set to frequency)

Set the measuring range (frequency range)

Set the offset

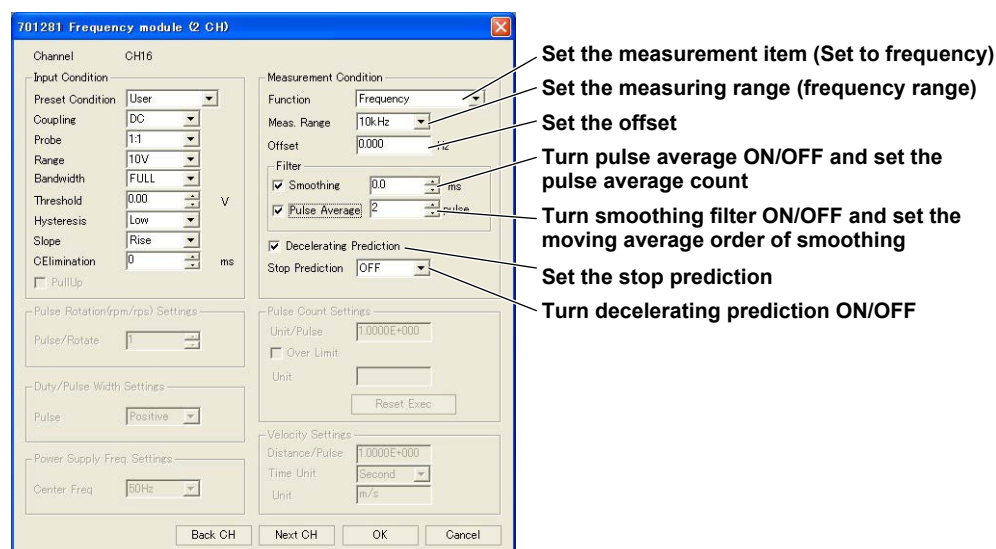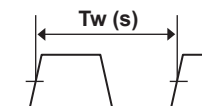Turn pulse average ON/OFF and set the pulse average count

Turn smoothing filter ON/OFF and set the moving average order of smoothing

Set the stop prediction

Turn decelerating prediction ON/OFF
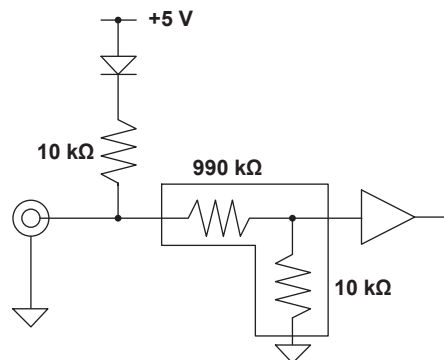
Setting the Measurement Item

Set the function to Frequency. The measurable range of frequencies is 0.01 Hz to 500 kHz.
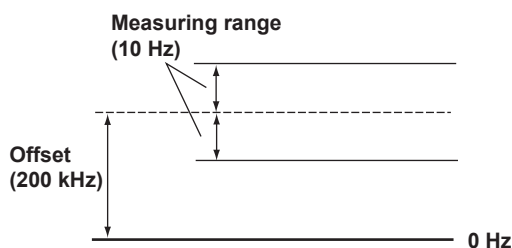
Frequency (Hz) = 1/Tw (s)

Setting the Measuring Range (Frequency Range)

Set the measuring range of frequency according to the frequency of the signal to be measured. The selectable range is 1 Hz to 500 kHz in 1-2-5 steps.

Setting the Offset

Set the offset value in the range 0 to 100 times the measuring range or 0 to 200 kHz. The frequency in the measuring range indicated above can be measured around the specified offset value.

Below is an example for a measuring range of 10 Hz and offset of 200 kHz.

Setting the Smoothing Filter

The SL1000 performs moving average of the order that is determined from a specified time.

Moving average order = the specified time/40 μs (the specified time: 0.0 to 1000.0 ms)

Setting the Pulse Average

Measures the input pulse by dividing the pulse by the specified number of pulses (1 to 4096 pulses). Specify 1 to not perform pulse averaging.

4

Specifying Measurement Settings

Turning Decelerating Prediction ON/OFF

Select ON to automatically compute and predict the deceleration curve from the elapsed time after the pulse stops. Select OFF to not perform decelerating prediction.

Setting the Stop Prediction

Set the time from the point when the pulse input stops to the point when the function determines that the object has stopped. The time can be set to ×1.5, ×2, ×3, ... , ×9, and ×10 (10 settings) of the pulse period (T) of the pulse one period before the pulse input stopped.
Select OFF to not perform stop prediction.

Measuring the Number of Rotation

Set the measurement item (Set to Rotation Pulse (rpm) or Rotation Pulse (rps))

Set the measuring range (rotation pulse range)

Set the offset

Turn smoothing filter ON/OFF and set the moving average order of smoothing

Turn pulse average ON/OFF and set the pulse average count

Set the stop prediction

Turn decelerating prediction ON/OFF

Set the number of pulses per rotation

Setting the Measurement Item

Set the function to Rotation Pulse (rpm) or Rotation Pulse (rps). The measurable range of rotations is 0.01 rpm to 100000 rpm or 0.001 rps to 2000 rps.

RPMs = Frequency (Hz)/the number of pulses per rotation (Nr) × 60

RPSs = Frequency (Hz)/the number of pulses per rotation (Nr)

F (Hz)
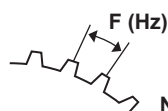
Nr: The number of pulses per rotation (1 to 99999)

Setting the Measuring Range (Rotation Pulse Range)

Set the measuring range of rotations according to the rotations of the signal to be measured.

The selectable range is 1 rpm to 100000 rpm in 1-2-5 steps or 0.1 rps to 2000 rps in 1-2-5 steps.

Setting the Offset

Set the offset value.

The rotations in the measuring range indicated above can be measured around the specified offset value.

For Rotation Pulse (rpm): 0 to 100 times the rotation pulse range value or 0 to 50 krpm

For Rotation Pulse (rps): 0 to 100 times the rotation pulse range value or 0 to 1000 rps

Setting the Smoothing Filter

The SL1000 performs moving average of the order that is determined from a specified time.

Moving average order = the specified time/40 μs (the specified time: 0.0 to 1000.0 ms)

Setting the Pulse Average

Measures the input pulse by dividing the pulse by the specified number of pulses (1 to 4096 pulses). Specify 1 to not perform pulse averaging.
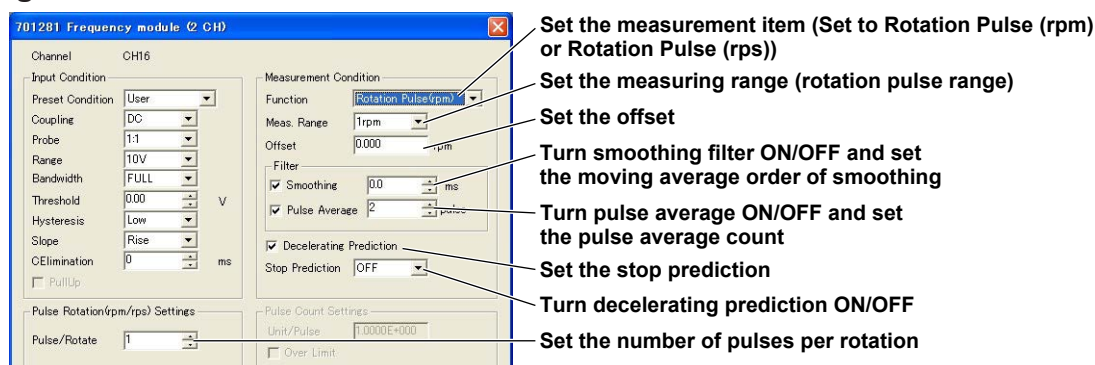
Turning Decelerating Prediction ON/OFF

Select ON to automatically compute and predict the deceleration curve from the elapsed time after the pulse stops. Select OFF to not perform decelerating prediction.

Setting the Stop Prediction

Set the time from the point when the pulse input stops to the point when the function determines that the object has stopped. The time can be set to ×1.5, ×2, ×3, ... , ×9, and ×10 (10 settings) of the pulse period (T) of the pulse one period before the pulse input stopped. Select OFF to not perform stop prediction.

Setting the Number of Pulses per Rotation

Set the number of pulses per rotation of the measured signal in the range of 1 to 99999 to determine the number of rotations.

4

Specifying Measurement Settings

Measuring the Period

Set the measurement item (Set the period)

Set the measuring range (period range)

Set the offset

Turn smoothing filter ON/OFF and set
the moving average order of smoothing

Turn pulse average ON/OFF and set
the pulse average count

Set the stop prediction

Turn decelerating prediction ON/OFF

Setting the Measurement Item

Set the function to Period. The measurable range of period is 2 µs to 50 s.

Period (s) = Tw (s)

Tw (s)
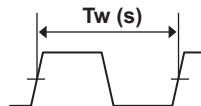
Setting the Measuring Range (Period Range)

Set the measuring range of period according to the period of the signal to be measured.
The selectable range is 100 µs to 50 s in 1-2-5 steps.

Setting the Offset

Set the offset value in the range 0 to 1000 times the measuring range or 0 to 50 s.
The period in the measuring range indicated above can be measured around the
specified offset value.

Setting the Smoothing Filter

The SL1000 performs moving average of the order that is determined from a specified
time.

Moving average order = the specified time/40 µs (the specified time: 0.0 to 1000.0 ms)

Setting the Pulse Average

Measures the input pulse by dividing the pulse by the specified number of pulses (1 to
4096 pulses). Specify 1 to not perform pulse averaging.

Turning Decelerating Prediction ON/OFF

Select ON to automatically compute and predict the deceleration curve from the elapsed
time after the pulse stops. Select OFF to not perform decelerating prediction.
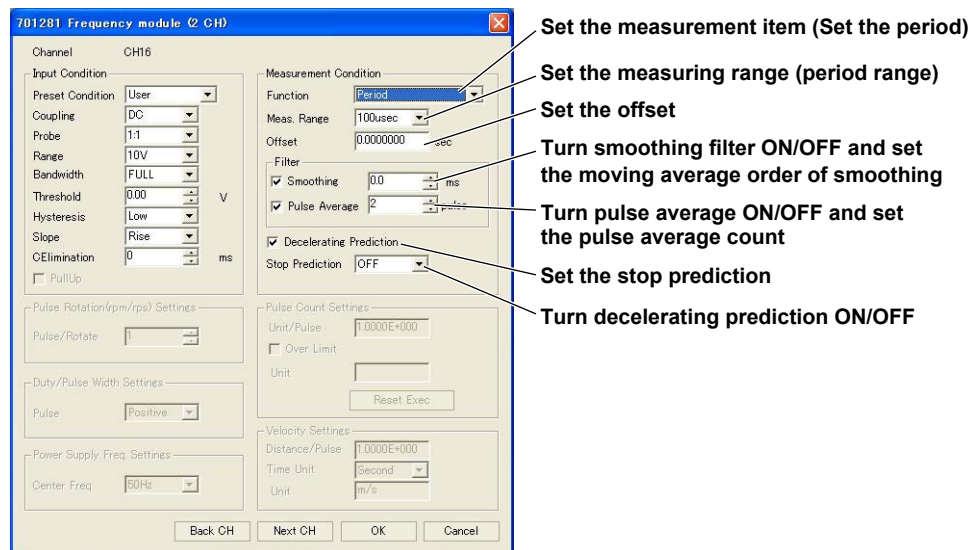
Setting the Stop Prediction

Set the time from the point when the pulse input stops to the point when the function
determines that the object has stopped. The time can be set to ×1.5, ×2, ×3, ... , ×9, and
×10 (10 settings) of the pulse period (T) of the pulse one period before the pulse input
stopped.
Select OFF to not perform stop prediction.

Measuring the Duty Cycle

Set the measurement item (Set to duty cycle)
Set the measuring range (duty cycle range)
Set the offset
Turn smoothing filter ON/OFF and set the moving average order of smoothing
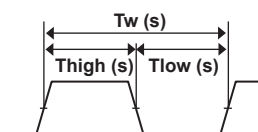
Set the measurement pulse
Set the duty cycle of the positive or negative pulse
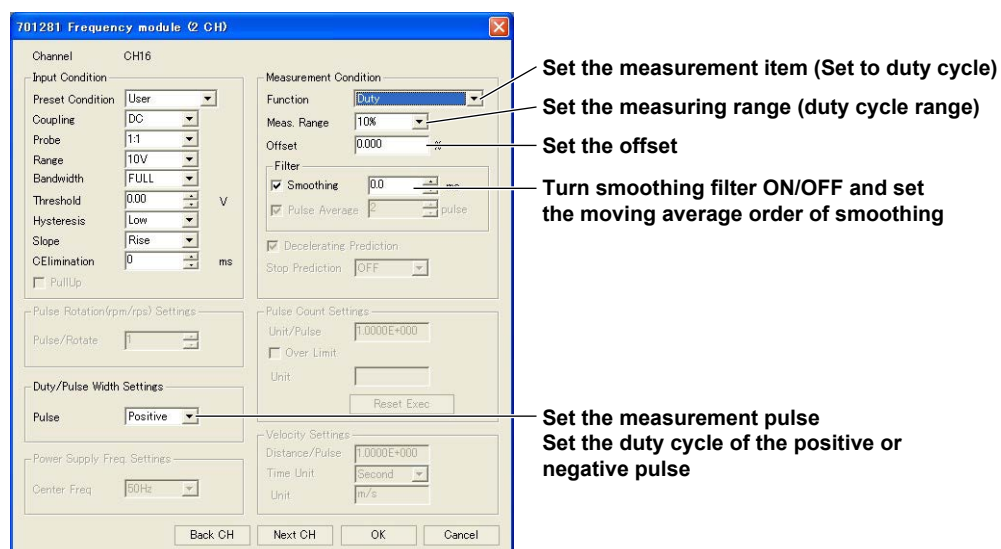
Setting the Measurement Item

Set the function to Duty. The measurable range of duty cycle is 0 to 100%.

Duty cycle = Thigh (s)/Tw (s) (if the measured pulse is positive)

Duty cycle = Tlow (s)/Tw (s) (if the measured pulse is negative)

Setting the Measuring Range (Duty Cycle Range)

Set the measuring range of duty cycle according to the duty cycle of the signal to be measured.

Select 10, 20, 50, 100, or 200%.

Setting the Offset

Set the offset value.

The duty cycle in the measuring range indicated above can be measured around the specified offset value.

Selectable range: 0 to 100%

Setting the Smoothing Filter

The SL1000 performs moving average of the order that is determined from a specified time.
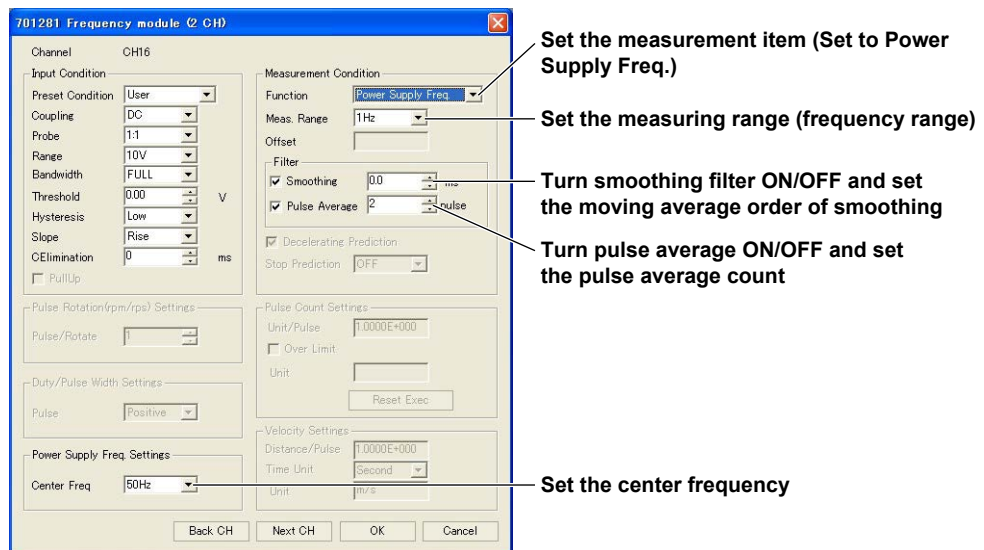
Moving average order = the specified time/40 μs (the specified time: 0.0 to 1000.0 ms)

Setting the Measurement Pulse

Set whether to measure the duty cycle of the pulse width above the threshold level (positive) or the duty cycle of the pulse width below the threshold level (negative).

4

Specifying Measurement Settings

Measuring the Power Supply Frequency

Set the measurement item (Set to Power Supply Freq.)

Set the measuring range (frequency range)

Turn smoothing filter ON/OFF and set the moving average order of smoothing

Turn pulse average ON/OFF and set the pulse average count
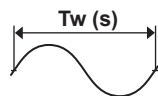
Set the center frequency

Setting the Measurement Item

Set the function to Power Supply Freq.

The measurable range of power supply frequencies is (50 Hz, 60 Hz, or 400 Hz) ± 20 Hz.

Power supply frequency (Hz) = 1/Tw (s)

Resolution: 0.01 Hz

Setting the Measuring Range (Frequency Range)

Set the measuring range of power supply frequency according to the frequency of the signal to be measured.

Select 1, 2, 5, 10, or 20 Hz.

Measurement can be made in the range center frequency ± measuring range.

Setting the Smoothing Filter

The SL1000 performs moving average of the order that is determined from a specified time.

Moving average order = the specified time/40 μs (the specified time: 0.0 to 1000.0 ms)

Setting the Pulse Average

Measures the input pulse by dividing the pulse by the specified number of pulses (1 to 4096 pulses). Specify 1 to not perform pulse averaging.

Setting the Center Frequency

Set the center frequency of the measuring range.

Select 50, 60, or 400 Hz.

Measuring the Pulse Width

Set the measurement item (Set to Pulse Width)

Set the measuring range (pulse width range)

Set the offset

Turn smoothing filter ON/OFF and set the moving average order of smoothing
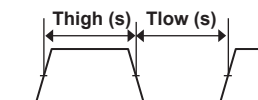
Set the measurement pulse
Set the pulse width of the positive or negative pulse

Setting the Measurement Item

Set the function to Pulse Width. The measurable range of pulse widths is 1 µs to 50 s.

Pulse width = Thigh (s) (if the measured pulse is positive)
Pulse width = Tlow (s)   (if the measured pulse is negative)

Setting the Measuring Range (Pulse Width Range)

Set the measuring range of pulse width according to the pulse width of the signal to be measured.

The selectable range is 100 µs to 50 s in 1-2-5 steps.

Setting the Offset

Set the offset value.

The pulse width in the measuring range indicated above can be measured around the specified offset value.

Selectable range: 0 to 100 times the pulse width range or 0 to 50 s

Setting the Smoothing Filter

The SL1000 performs moving average of the order that is determined from a specified time.
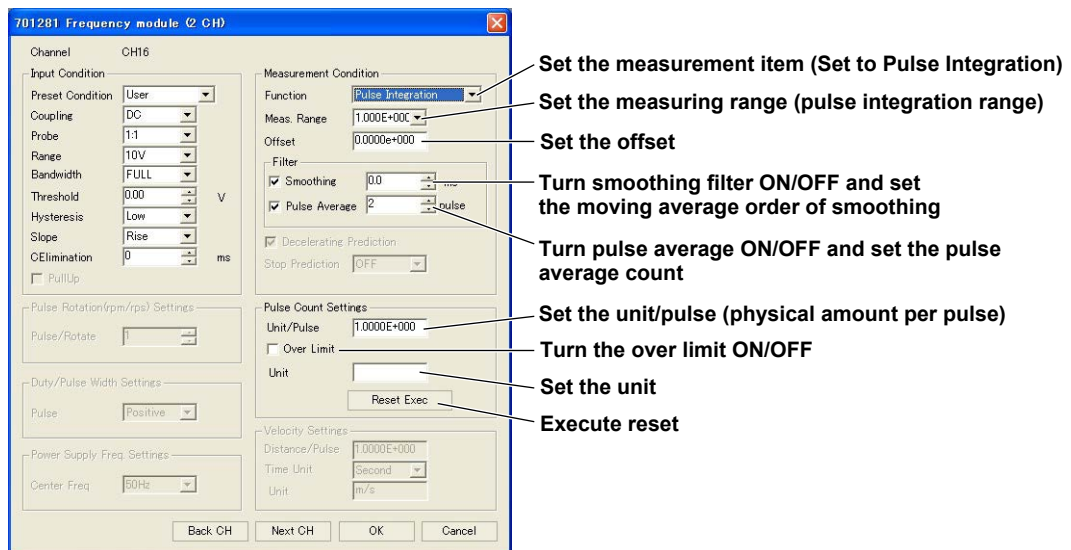
Moving average order = the specified time/40 µs (the specified time: 0.0 to 1000.0 ms)

Setting the Measurement Pulse

Set whether to measure the pulse width above the threshold level (positive) or the pulse width below the threshold level (negative).

4

Specifying Measurement Settings

Measuring the Pulse Integration

Set the measurement item (Set to Pulse Integration)
Set the measuring range (pulse integration range)
Set the offset
Turn smoothing filter ON/OFF and set
the moving average order of smoothing
Turn pulse average ON/OFF and set the pulse
average count
Set the unit/pulse (physical amount per pulse)
Turn the over limit ON/OFF
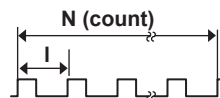Set the unit
Execute reset

Setting the Measurement Item

Set the function to Pulse Integration. The measurable range of pulse integration is 0 to
2×10^9 counts.

Pulse integrated value = N (count) × physical amount per pulse (I)
Set the physical amount per pulse (I) to distance or flow rate.

N (count)

I

Setting the Measuring Range (Pulse Integration Range)

Set the measuring range of pulse integration according to the pulse integration of the
signal to be measured.
The selectable range is 100.0E-21 to 5.0E+21 in 1-2-5 steps.

Setting the Offset

Set the offset value. Pulse integration in the measuring range indicated above is
performed around the specified offset value.
Selectable range: 100 times the pulse integration range or 1.0000E+22

Setting the Smoothing Filter

The SL1000 performs moving average of the order that is determined from a specified
time.
Moving average order = the specified time/40 µs (the specified time: 0.0 to 1000.0 ms)

Setting the Pulse Average

Measures the input pulse by dividing the pulse by the specified number of pulses (1 to
4096 pulses). Specify 1 to not perform pulse averaging.

Setting the Unit/Pulse

Set the physical amount per pulse in the range of –9.9999E+30 to 9.9999E+30.

Setting the Over Limit

Turn over limit ON to reset the pulse count automatically when the range is exceeded.
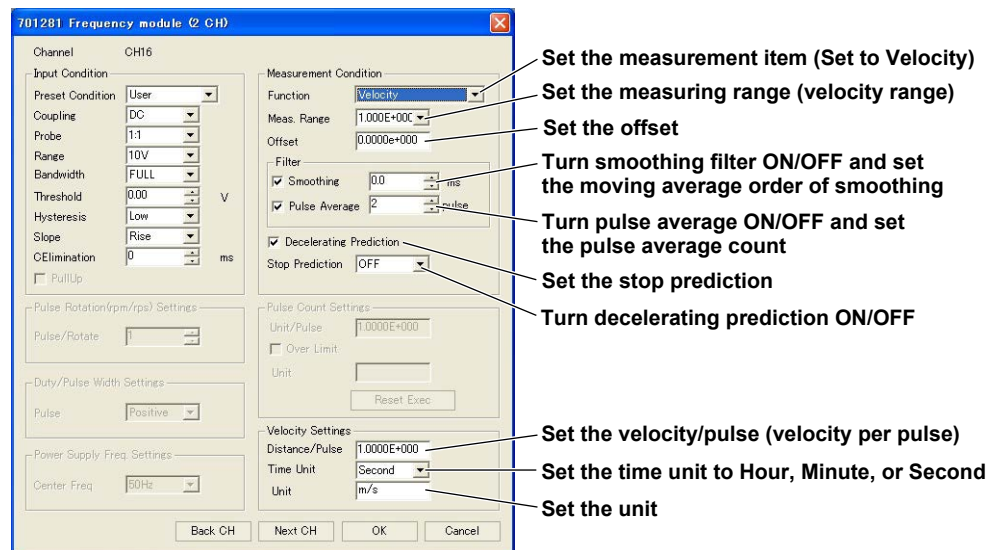
Setting the Unit

If necessary, set the unit of the pulse integrated value using up to four characters.

Execute Reset

Resets the integrated value. Use this to reset the value that has been integrated up to now.

Measuring the Velocity

- Set the measurement item (Set to Velocity)
- Set the measuring range (velocity range)
- Set the offset
- Turn smoothing filter ON/OFF and set the moving average order of smoothing
- Turn pulse average ON/OFF and set the pulse average count
- Set the stop prediction
- Turn decelerating prediction ON/OFF
- Set the velocity/pulse (velocity per pulse)
- Set the time unit to Hour, Minute, or Second
- Set the unit

Setting the Measurement Item

Set the function to Velocity. The velocity corresponding to the pulse signal is measured.

The measurable frequency range of the pulse signal is 0.01 Hz to 500 kHz.

Velocity (km/h) = Distance per pulse l (km)/Tw (s) × 3600

Velocity (m/s) = Distance per pulse l (m)/Tw (s)

Tw (s)

Distance per pulse (l)

Set the measuring range (velocity range)

Set the measuring range of velocity according to the velocity of the signal to be measured.

The selectable range is 100.0E-21 to 5.0E+21 in 1-2-5 steps.

Setting the Offset

Set the offset value in the range 0 to 100 times the measuring range or 0 to 1.0000E+22. The velocity in the measuring range indicated above can be measured around the specified offset value.

Setting the Smoothing Filter

The SL1000 performs moving average of the order that is determined from a specified time.

Moving average order = the specified time/40 μs (the specified time: 0.0 to 1000.0 ms)

Setting the Pulse Average

Measures the input pulse by dividing the pulse by the specified number of pulses (1 to 4096 pulses). Specify 1 to not perform pulse averaging.

Turning Decelerating Prediction ON/OFF

Select ON to automatically compute and predict the deceleration curve from the elapsed time after the pulse stops. Select OFF to not perform decelerating prediction.

Setting the Stop Prediction

Set the time from the point when the pulse input stops to the point when the function determines that the object has stopped. The time can be set to ×1.5, ×2, ×3, ... , ×9, and ×10 (10 settings) of the pulse period (T) of the pulse one period before the pulse input stopped.
Select OFF to not perform stop prediction.

Setting the Distance/Pulse

Set the distance per pulse in the range of $-9.9999E+30$ to $9.9999E+30$.

Setting the Time Unit

Set the time unit to hour, minute, or second.
The output is automatically converted to a velocity with respect to the specified time.
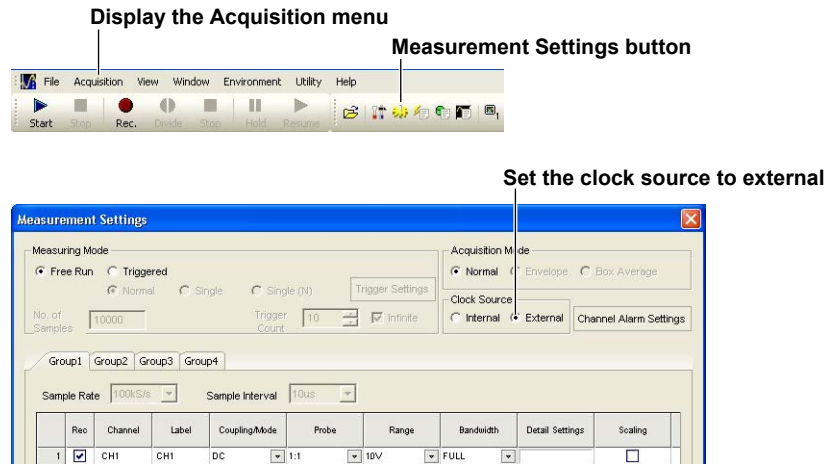
Setting the Unit

Set the unit of velocity using up to four characters. The default setting is m/s.

4

Specifying Measurement Settings

4.7 Making Measurements Using an External Clock Signal

The SL1000 can acquire data at the rising edges of an external clock signal that it receives.

1. Click the **Measurement Settings** button or choose **Measurement Settings** on the Acquisition menu.

Display the Acquisition menu

Measurement Settings button

Set the clock source to external

Clock Source

By setting the clock source to external, the SL1000 can acquire data at the rising edges of an external clock signal that it receives.

Apply a signal of the following specifications to the external clock signal I/O terminal of the SL1000.

Item	Specifications
Frequency range	See Note below
Input level	TTL (0 to 5 V)
Valid edge	Rising edge
Minimum pulse width	100 ns or more for high and low
External clock frequency range	5 MHz maximum
Rise/Fall time of the clock	100 ns or less

Note

The upper frequency limit of the external clock varies depending on the module.

If the external clock frequency exceeds the upper frequency limit of the module, sampling is executed at the upper frequency limit.

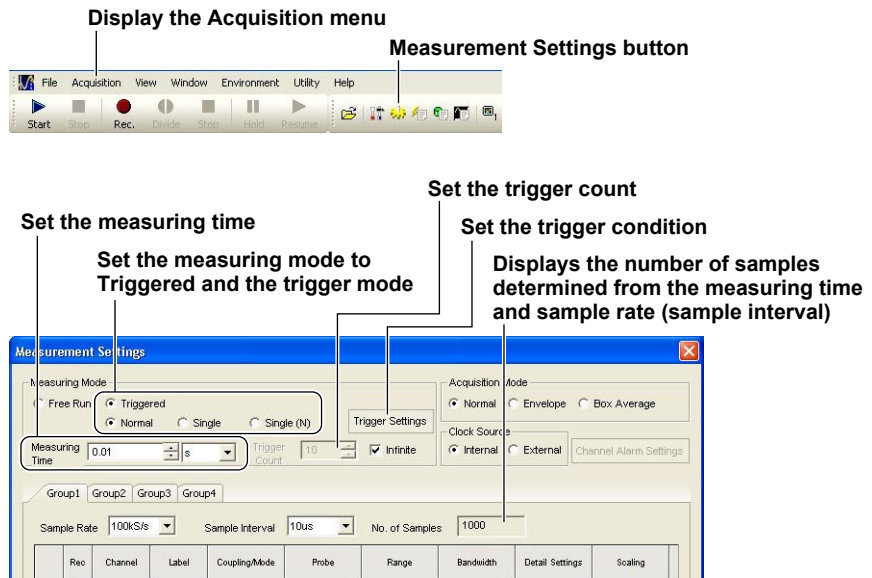|	
701250, 701251, 701255, 720250:	1MHz
701267, 701270, 701271, 701275:	100kHz
701281, 720281, 720268:	1MHz
701261, 701262 When measuring voltage:	100kHz
When measuring temperature:	500Hz
701265, 720266:	500Hz
720210, 720211:	5MHz

Notes When Sampling Using the External Clock Signal

- The ACQ mode cannot be set to Envelope or Box Average.
- No function is provided for frequency-dividing the clock signal.
- The time measured by the cursor measurement or automated measurement of waveform parameters is expressed in the number of pulses of the clock signal. No unit is displayed.
- You cannot set the trigger delay or hold off.

4.8 Making Measurements Using Triggers

The SL1000 can acquire data by using the measured waveform, power supply signal of the SL1000, time, or external trigger signal as triggers.

1. Click the **Measurement Settings** button or choose **Measurement Settings** on the Acquisition menu.

Display the Acquisition menu

Measurement Settings button

Set the trigger count

Set the measuring time

Set the trigger condition

Set the measuring mode to Triggered and the trigger mode

Displays the number of samples determined from the measuring time and sample rate (sample interval)

Setting the Triggered Mode

Select Normal, Single, or Single (N).

Normal: When a trigger occurs, the SL1000 acquires data for a specified time. After internal processing is completed, the SL1000 will accept the next trigger. The SL1000 will not accept a trigger while the internal processing is in progress even if the trigger condition is met.
After acquiring the data for the specified trigger counts, the SL1000 stops the measurement.

Single: The SL1000 acquires the data for a single trigger that occurs. After internal processing is completed, the SL1000 stops the measurement.

Single (N): The SL1000 acquires the data if the next trigger condition is met even if the internal processing of the data acquired from the previous trigger is still in progress. The SL1000 will accept all triggers when the trigger condition is met, but buffer overflow may occur.

Note
You cannot select Single (N) during synchronous operation.
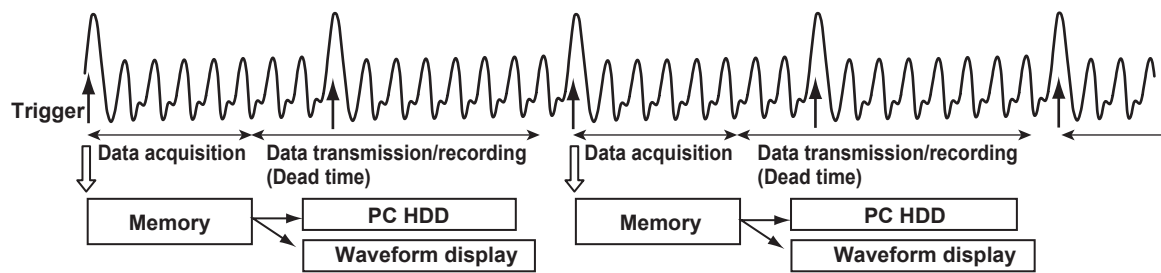
Trigger Count
If the trigger mode is set to Normal or Single (N), the SL1000 will acquire the data the specified number of times. If Infinite is selected, the SL1000 continues to acquire data until the measurement is stopped.

If the trigger mode is Single (N), the maximum trigger count that you can set is 5000. However, this limit may be lower depending on the number of channels, sample rate, and measuring time.
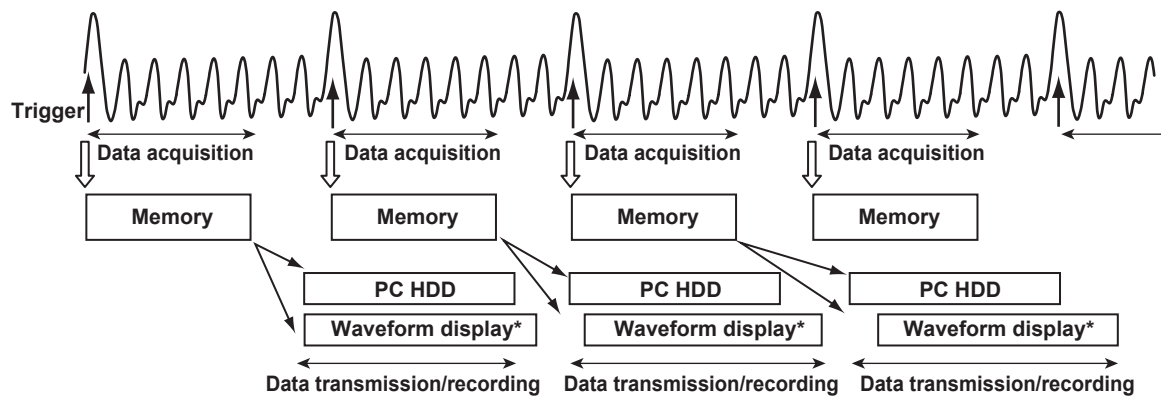
Normal mode

Trigger

Data acquisition | Data transmission/recording (Dead time) | Data acquisition | Data transmission/recording (Dead time)

| Memory | → | PC HDD |
| | | Waveform display |

| Memory | → | PC HDD |
| | | Waveform display |

Data acquisition and data transfer/recording are synchronous.

Single (N) mode

Trigger

Data acquisition | Data acquisition | Data acquisition | Data acquisition

| Memory | | Memory | | Memory | | Memory |

| PC HDD | | PC HDD | | PC HDD |
| Waveform display* | | Waveform display* | | Waveform display* |

Data transmission/recording | Data transmission/recording | Data transmission/recording

Data acquisition and data transfer/recording are asynchronous.

*: The software may not be able to display the acquired data, depending on the internal processing time and trigger timing.

Setting the Measuring Time

Set the measuring time value, and select the unit. The SL1000 acquires data for a specified time after it receives a trigger.

The selectable range varies depending on the sample rate and the number of channels.

Maximum measuring time (s) = Number of measured points/sample rate

Minimum measuring time (seconds) = 1000/sample rate

The number of measured points changes as follows depending on the number of channels (see appendix 2 for details).

Number of Registered Channels	Maximum number of measured points(single mode)	Maximum number of measured points (modes other than single)
2	50000000	10000000
4	25000000	10000000
8	10000000	5000000
10, 12, 14, 16	5000000	2500000

Example

Selectable range of measuring time when the number of registered channels is 4 and the sample rate is 100 S/s

1000/100 to 25000000/100 = 10 s to 250000 s

Selectable range of measuring time when the number of registered channels is 5 and the sample rate is 5 MS/s

1000/5000000 to 10000000/5000000 = 0.0002 s to 2 s

The measuring time resolution is the minimum measuring time at the lowest sample rate among the four measuring groups. However, if the number of measured points (measuring time × measuring group 1 sample rate) is greater than or equal to 100000 or greater than or equal to 400000 and there are measuring groups whose sample rate is greater than or equal to 10 MS/s, the resolution is as follows:

Sample Rate	Resolution (s)
100 MS/s	0.005 (the number of measured points is greater than or equal to 500000)
50 MS/s	0.01 (the number of measured points is greater than or equal to 500000)
20 MS/s	0.005 (the number of measured points is greater than or equal to 100000)
10 MS/s	0.01 (the number of measured points is greater than or equal to 100000)

If there are multiple measuring groups that meet the above conditions, the resolution is equal to the least common multiple of the resolutions corresponding to the sample rates set for those measuring groups. For example, if there are measuring groups with sample rates set to 100 MS/s and 50 MS/s, the resolution is the least common multiple of 0.005 s and 0.01 s which is 0.01 s.

Note

If the trigger mode is set to Normal or Single (N) and the measuring time setting exceeds the maximum measuring time, the trigger mode will be changed to Single. For details on the maximum measuring time, see appendix 2.

Setting the Trigger Conditions

Click the **Trigger Settings** button to display the Trigger Settings screen.

Set the trigger class **Set the trigger source**

Set the trigger conditions
The settings vary depending on the trigger class and trigger source

Apply the settings and close the screen

Cancel the settings and close the screen

Set the pre-trigger **Set the trigger delay** **Set the hold off**

Applying Triggers Using the Measured Waveform or External Trigger Signal

Trigger Class

Select Simple or Combination.

Simple: A trigger is generated on a single trigger condition.

Combination: A trigger is generated on the logical condition of multiple trigger sources.

Trigger Source

Select Channel. The trigger source is fixed to Channel if the trigger class is Combination.

If the trigger class is set to combination

Set the logical condition

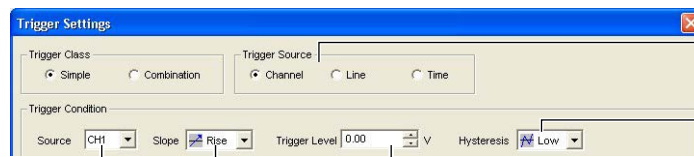**Select the trigger source**

Set the trigger pattern

Set the trigger level

Set the window width (If the trigger pattern is set to IN, OUT, IN(L), or OUT(L))

Set the hysteresis

Copy the trigger source settings

Paste the trigger source settings

If the trigger class is set to simple

Set the trigger source to Channel

Select the trigger hysteresis

Select the trigger slope

Select the trigger level

Select the trigger source

Logical Condition

If the trigger class is set to combination, set the logical condition of the trigger sources.

OR: A trigger is generated if any of the trigger conditions of the specified trigger sources is met.

AND: A trigger is generated if all of the trigger conditions of the specified trigger sources are met.

Trigger Source

You can select the trigger source from all the channels registered in measuring groups and external trigger. The external trigger is displayed as EXT.

If the trigger class is combination, set the channels that you want to use as trigger sources to ON. If the trigger class is simple, select the channel you want to use as a trigger source from the drop-down list.

Trigger Pattern (Trigger Slope; If the trigger class is set to simple)

Rise: A trigger is generated when the trigger source changes from below the trigger level to above the trigger level (rising edge). This pattern can also be selected for the external trigger.

Fall: A trigger is generated when the trigger source changes from above the trigger level to below the trigger level (falling edge). This pattern can also be selected for the external trigger.

Both: A trigger is generated on both the rising and falling edges.

H: A trigger is generated when the trigger source is greater than or equal to the trigger level.

L: A trigger is generated when the trigger source is less than or equal to the trigger level.

IN: A trigger is generated when the trigger source enters a range between two trigger levels from the outside.

OUT: A trigger is generated when the trigger source exits from a range between two trigger levels from the inside.

IN(L):   A trigger is generated when the trigger source is within a range between two trigger levels.

OUT(L): A trigger is generated when the trigger source is outside a range between two trigger levels.

*   H, L, IN, OUT, IN(L), and OUT(L) can be set when the trigger class is combination.

Trigger Level

When measuring voltage
    Selectable range: Within the positive and negative voltage range
    Resolution: 1/1000 of the voltage range

When measuring temperature
    Selectable range: Measurable range of each thermocouple (up to 280 K for Au7Fe)
    Resolution: 0.1°C or 0.1 K (set within the measurement range (varies depending on the thermocouple type)
    For a description of the measurement range of thermocouples, see section 4.3.

When measuring strain
    Selectable range: ±(Measurable range)
    Resolution: 1 µSTR or 0.0005 mV/V

4

Specifying Measurement Settings

When measuring acceleration
  Selectable range: ±(Measurable range)
  Resolution: 0.01 (Unit)

When measuring frequency
 Selectable range: Offset value ± (each measuring range[*])
  Resolution: See the table below.

Measured Item	Resolution
Frequency, rotations, period, and pulse width	1/20000 of the measuring range[*] when the measuring range is a power of 10. 1/10000 of the measuring range[*] when the measuring range is 2 or 5 times a power of 10. The minimum resolutions are as follows: 0.001 Hz for frequency, 0.001 rpm or 0.1 rps for rotations, 1 µs for period, and 1 µs for pulse width.
Duty cycle and power supply frequency	1/10000 of the measuring range The minimum resolution for power supply frequency is 0.001 Hz.
Pulse integration and velocity	Depends on the measuring range

*   Each measuring range of frequency, number of rotations, period, duty cycle, power supply frequency, pulse width, pulse integration, and velocity. For details, see section 4.6.

You can also set the trigger level by dragging the trigger level arrow on the screen. However, you cannot change it while recording is in progress.

Drag to move
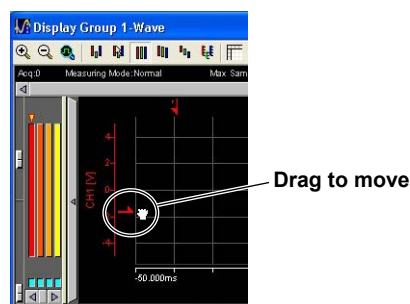
Window Width

Set the window width if the trigger pattern is set to IN, OUT, IN(L), or OUT(L).
The selectable range is from the resolution to the absolute value of the maximum selectable trigger level. The resolutions are as follows:

Measured Item	Resolution
Voltage, frequency, number of rotations, period, duty cycle, power supply frequency, pulse width, pulse integration, and velocity	1/100 of the measuring range
Temperature	0.1°C or 0.1 K
Strain	1 µSTR or 0.0005 mV/V
Acceleration	(100/measuring range)/sensitivity The minimum resolution is 0.01 unit.

Hysteresis

Sets a width to the trigger level or window so that triggers are not generated by small changes in the trigger signal. Select the trigger hysteresis from Low, Middle, and High of the measuring range.

Copying and Pasting Settings

If the trigger class is set to Combination, the trigger source settings can be copied and pasted to other trigger sources.
Click the line number of the trigger source you want to copy to select the line.
Click the **Copy** button.
Select the destination trigger source line, and click the **Paste** button.

Generating Triggers on the Power Signal

Set the trigger class   Set the trigger source to Line
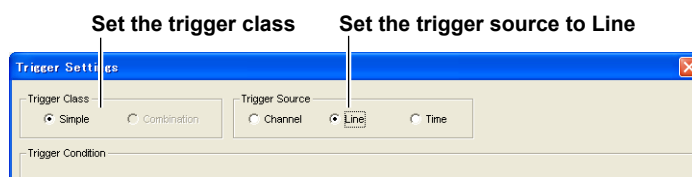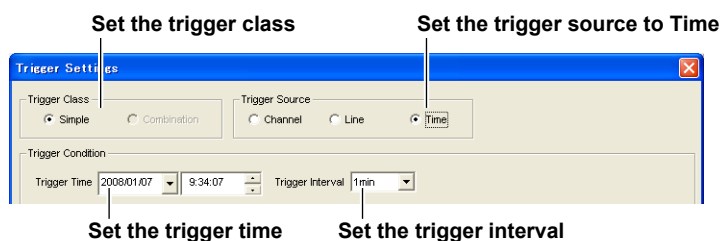

Trigger Source
Set the trigger source to Line.
A trigger is generated on the rising edge of the power supply signal that is being supplied to the SL1000. Waveforms synchronized to the commercial power supply frequency (50 Hz or 60 Hz) can be observed.

Trigger Mode and Trigger Class
The trigger class is fixed to simple.

Generating Triggers on the Time

Set the trigger class   Set the trigger source to Time

Set the trigger time   Set the trigger interval

Trigger Source
Set the trigger source to Time.
Triggers are generated at specified time intervals from a specified time.

Trigger Mode and Trigger Class
The trigger class is fixed to simple.

Reference Time for Generating Triggers
Set the date and time for generating the trigger.

Time Interval for Generating Triggers
Select from the following intervals.
1min, 2min, 3min, 4min, 5min, 6min, 7min, 8min, 9min, 10min, 15min, 20min, 25min, 30min, 40min, 45min, 50min, 1hour, 2hour, 3hour, 4hour, 5hour, 6hour, 7hour, 8hour, 9hour, 10hour, 11hour, 12hour, 18hour, and 24hour

Notes on Time Triggers
• Depending on the time interval setting, a trigger may occur while the waveform is being acquired or during the pre-trigger period (a preparation period for observing the waveform before the trigger time). In this happens, the trigger is ignored.
• If the specified time is in the past, triggers are generated from a time in the future that satisfies the following expression: the specified time + time interval × N where N is an integer.
• If you specify the acquisition count, the waveforms are acquired the specified number of times. If it is set to infinite, the waveforms are acquired until the measurement is stopped.
• The trigger delay and hold off time settings are invalid for Time Trigger.

4

Specifying Measurement Settings

Setting the Pre-Trigger, Trigger Delay, and Hold Off

Set the pre-trigger   Set the trigger delay   Set the hold off
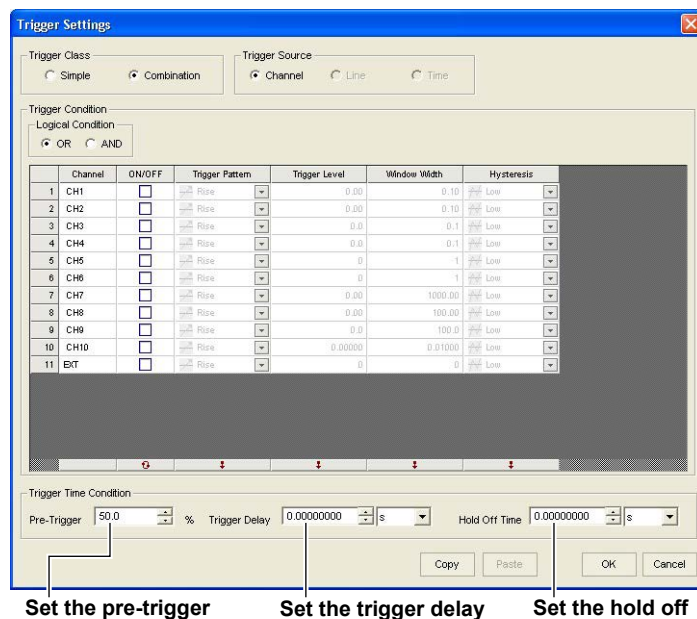
Setting the Pre-Trigger

Set the pre-trigger percentage by considering the measuring time to be 100%. The selectable range is 0 to 100%, and the resolution is 0.1%. If measuring using an external clock signal, set the pre-trigger in terms of the number of data points. The selectable range is 0 to the number of measured points –1.

You can also set the pre-trigger by dragging the trigger position on the screen. However, you cannot change it while recording is in progress. If you change it while measurement is stopped, the previous position is indicated in white.

Previous trigger position (displayed only when measurement is stopped)
Current trigger position

Drag to move
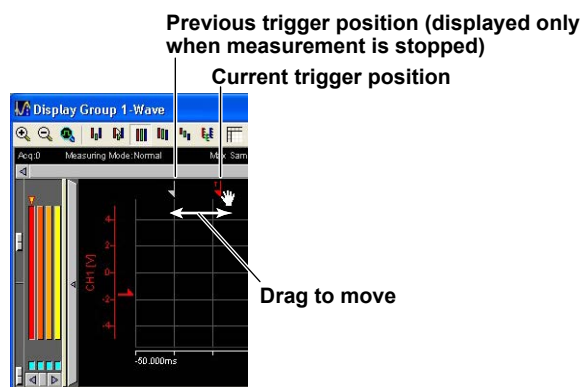
Setting the Trigger Delay

Set the delay time from the trigger point. The selectable range is 0 to 10 s (the default setting is 0 s). The resolution is 10 ns if the sample rate of measuring group 1 is greater than or equal to 10 MS/s and 1/(the sample rate of measuring group 1) * 1/10 if the sample rate of measuring group 1 is less than or equal to 5 MS/s.
The relationship between the pre-trigger and trigger delay is as follows:

Trigger position

Trigger delay

Pre-trigger

Trigger point

Measuring time
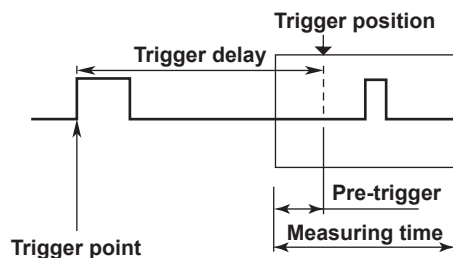
Hold Off Time

This function prevents a trigger from being generated for a specified time, even if the trigger conditions are met during this time. The selectable range is 0 s to 10 s (the default setting is 0 s), and the resolution is 10 ns.

If the trigger pattern is set to rising edge
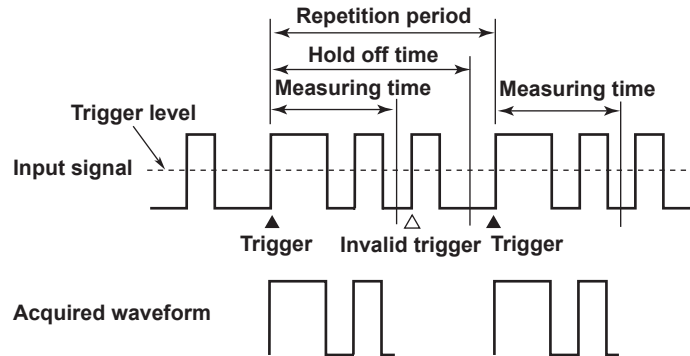
If you are setting the hold off time a value greater than or equal to 50 ms, set the trigger mode to Normal.

Using Manual Triggers

Manual triggers allows you to generate a trigger at any time to perform measurement and recording.
Click the **Manual Trigger** button or choose **Manual Trigger** on the Acquisition menu.
A trigger is generated, and the SL1000 will acquire the data.

Manual Trigger button
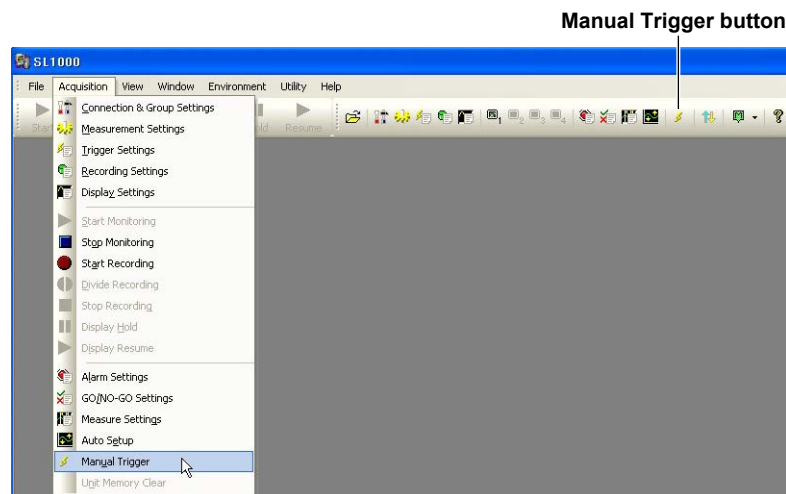
4.9 Setting the Alarm

The SL1000 can generate an alarm based on the measured waveform level or the system status of the SL1000 and transmit an alarm signal from its alarm terminal.

1. Click the **Alarm Settings** button or choose **Alarm Settings** on the Acquisition menu.
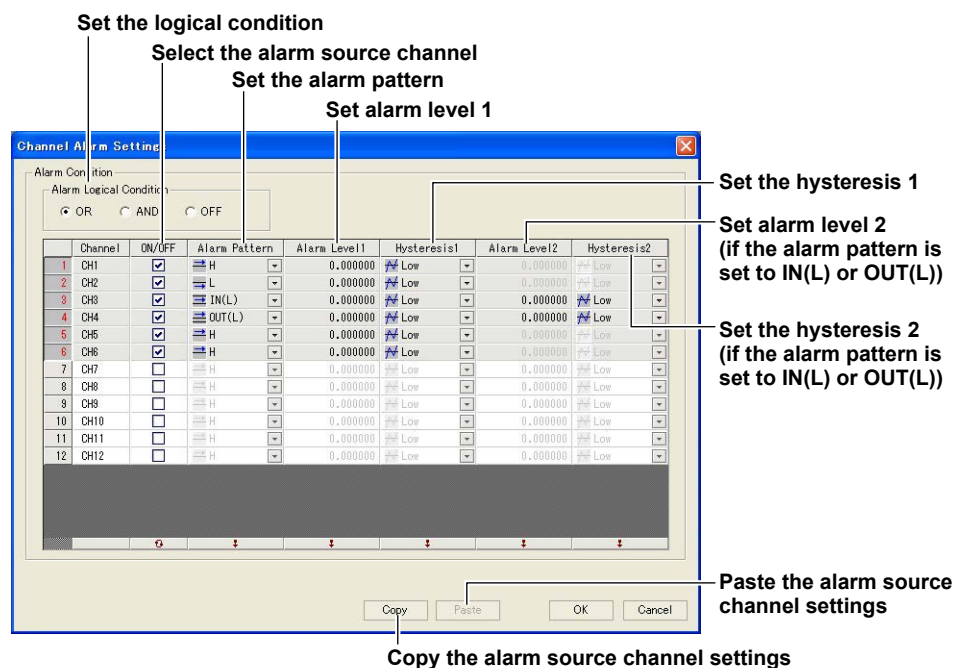
Alarm Settings button
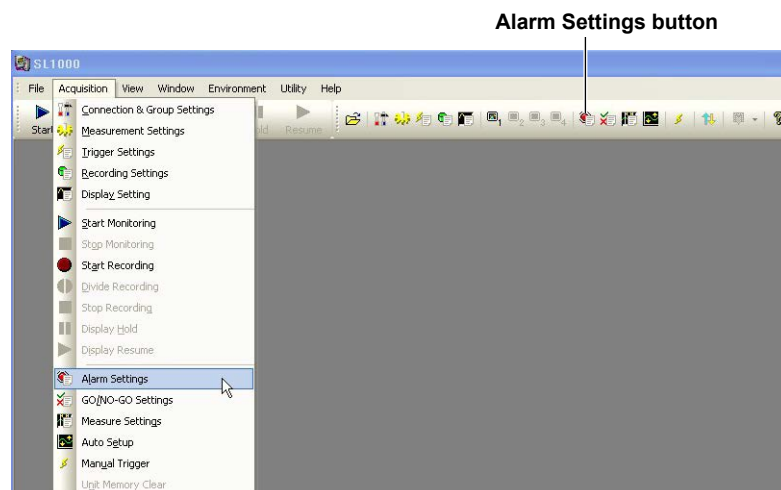
The Alarm Settings screen opens.

Generate alarms on the measured waveform level

Generate alarms on system conditions

Set the alarm output

Cancel the settings and close the screen

Apply the settings and close the screen
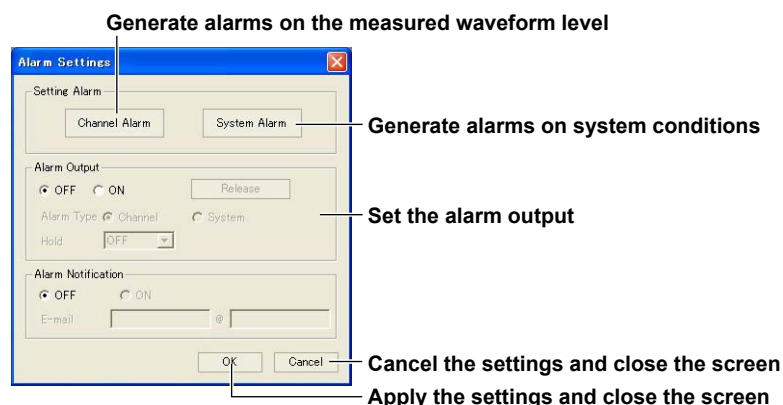
Generating Alarms on the Measured Waveform Level (Channel Alarm in Free Run Mode)

Click the **Channel Alarm** button. The Channel Alarm Settings screen opens.
You can also display the same screen by clicking the **Channel Alarm Settings** button on the Measurement Settings screen.

Channel alarm settings

Set the logical condition
Select the alarm source channel
Set the alarm pattern
Set alarm level 1

Set the hysteresis 1

Set alarm level 2
(if the alarm pattern is
set to IN(L) or OUT(L))

Set the hysteresis 2
(if the alarm pattern is
set to IN(L) or OUT(L))

Paste the alarm source
channel settings

Copy the alarm source channel settings

Logical Condition

Set the alarm logical condition if multiple channels are selected for the alarm source.

OR: An alarm is generated if any of the alarm conditions of the specified channels is met.

AND: An alarm is generated if all of the alarm conditions of the specified channels are met.

OFF: Turns the channel alarm OFF.

ON/OFF

You can select the alarm source from all the channels registered in measuring groups.

Note

The Channel Alarm Settings screen displays all channels, including modules that are linked for synchronous operation.

Alarm Pattern

H: An alarm is generated when the alarm source is greater than or equal to the alarm level.

L: An alarm is generated when the alarm source is less than or equal to the alarm level.

IN(L): An alarm is generated when the alarm source is within the range between two alarm levels.

OUT(L): An alarm is generated when the alarm source is outside the range between two alarm levels.

Alarm Level

If the alarm pattern is IN(L) or OUT(L), set both alarm levels 1 and 2. Make sure that alarm level 1 is greater than alarm level 2.

You can also set the alarm level by dragging it on the screen.

The selectable range of alarm levels is the same as that of trigger levels.

Copying and Pasting Settings

The alarm settings can be copied and pasted to other channels.

Click the line number of the channel you want to copy to select the line.
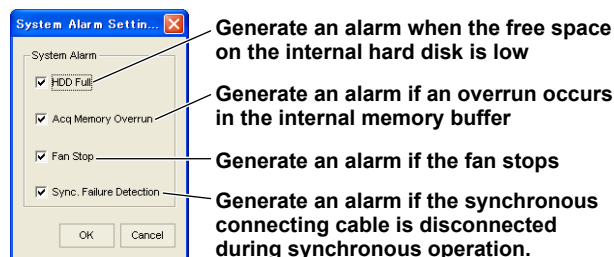
Click the **Copy** button.

Select the destination channel line, and click the **Paste** button.

4

Specifying Measurement Settings

Generating Alarms Based on the SL1000 System Status

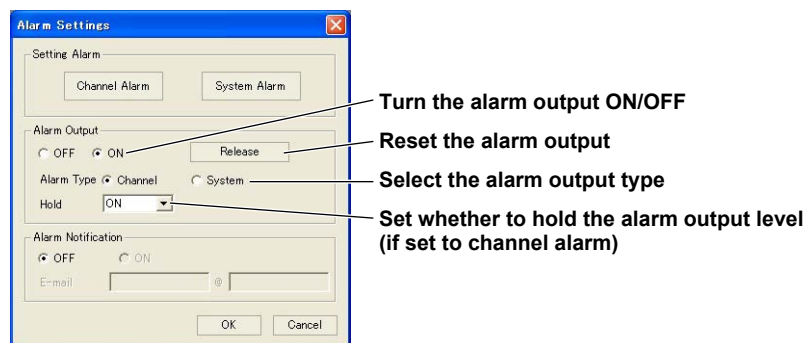On the Alarm Settings screen, select the system alarm that you want to enable.

Generate an alarm when the free space on the internal hard disk is low

Generate an alarm if an overrun occurs in the internal memory buffer

Generate an alarm if the fan stops

Generate an alarm if the synchronous connecting cable is disconnected during synchronous operation.

You can set the alarm by combining the following three items.

HDD Full: An alarm is generated if the free space on the internal hard disk of the SL1000 falls low.

Acq Memory Overrun: An alarm is generated if the internal memory buffer of the SL1000 overflows.

Fan Stop: An alarm is generated if the cooling fan of the SL1000 stops.

Sync. Failure Detection An alarm is generated when a synchronous connecting cable is disconnected during synchronous operation of the SL1000.

Notes on the Alarm Function

The SL1000 may fail to detect alarms if alarms occur at intervals less than or equal to 500 ms.

Alarm Output

Turn the alarm output ON/OFF

Reset the alarm output

Select the alarm output type

Set whether to hold the alarm output level (if set to channel alarm)

Turning the Alarm Output ON/OFF

ON: When an alarm occurs, the SL1000 (the master unit with unit ID zero during synchronous operation) generates an alarm signal from the alarm output terminal.

OFF: Does not transmit an alarm signal even if an alarm occurs.

Alarm Type

Select whether to transmit channel alarms or system alarms.

Output Release

Releases the alarm output state.

Note

Only the master unit generates an alarm during synchronous operation.

Output Hold

ON: Holds the alarm signal level once an alarm occurs. Selecting **Release** returns
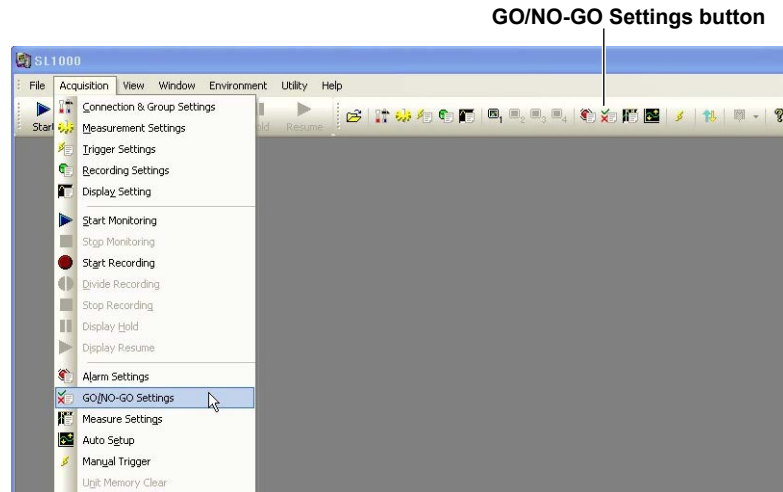the alarm signal to its original level.

OFF: When an alarm occurs, an alarm signal is output. When the alarm clears, the
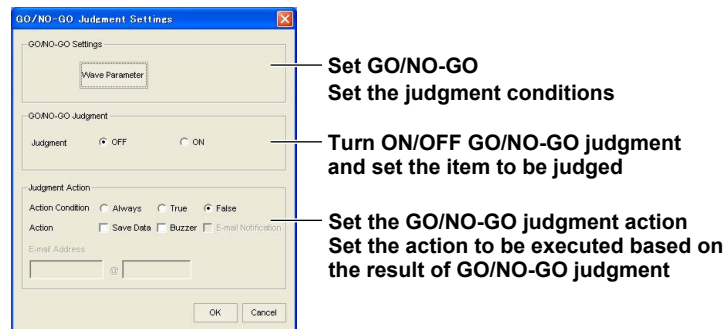alarm signal also returns to its original level.

ON (hold)

Alarm level

Alarm
occurrence

No alarm

OFF (not hold)

Alarm level

Alarm
occurrence

No alarm

4

Specifying Measurement Settings
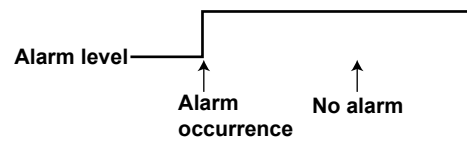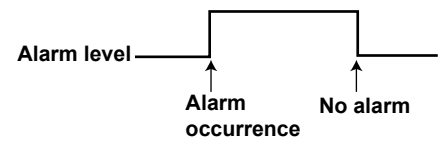
4.10 Setting the GO/NO-GO Judgment (for Triggered Mode)

The SL1000 performs GO/NO-GO judgment on whether the value of a waveform parameter is within a specified range and executes a given action based on the judgment result.

1. Click the **GO/NO-GO Settings** button or choose **GO/NO-GO Settings** on the Acquisition menu.

GO/NO-GO Settings button

The GO/NO-GO Judgment Settings screen opens.

Set GO/NO-GO
Set the judgment conditions

Turn ON/OFF GO/NO-GO judgment and set the item to be judged

Set the GO/NO-GO judgment action
Set the action to be executed based on the result of GO/NO-GO judgment

Note

You cannot configure GO/NO-GO judgment during synchronous operation.

Setting the Parameter Judgment Conditions

Click the **Wave Parameter** button.
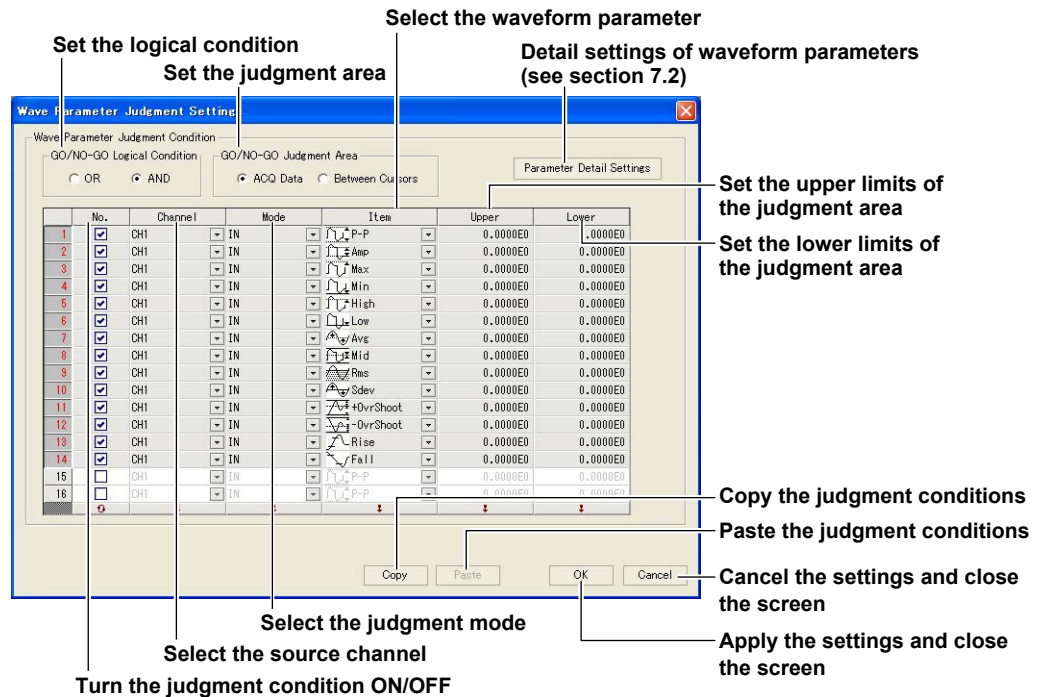
Logical Condition

Set the logical condition if you selected multiple judgment conditions.

OR: Executes the judgment action if any of the specified judgment conditions is met.

AND: Executes the judgment action if all of the specified judgment conditions are met.

Judgment Area

ACQ Data: Judges on all acquired data.

Between Cursors: Judges data between two cursors.
For a description of cursors, see section 7.1.

Parameter Detail Settings

You can set the distal, mesial, and proximal lines. These settings are the same as the settings for waveform parameters in section 7.2. For details, see section 7.2. These settings are synchronized with the waveform parameter settings of section 7.2.

No.

You can set up to 16 judgment conditions. The judgment conditions for the numbers whose check box is selected are enabled.

Channel

Select the source channel of the waveform parameter. You can select from channel registered in measuring groups.

Mode

Set the condition of the value of the specified waveform parameter with respect to the specified range for performing GO/NO-GO judgment.

IN: Judges GO if the value of the specified waveform parameter is within the specified range.

OUT: Judges GO if the value of the specified waveform parameter is outside the specified range.

4

Specifying Measurement Settings

Parameter

You can select from the waveform parameters given in section 7.2. The value of the selected waveform parameter is used to perform GO/NO-GO judgment. For details on waveform parameters, see section 7.2.

Upper and Lower Limits

Set the range used to perform GO/NO-GO judgment on the specified waveform parameter. You can set the limits between –9.9999E+30 to 9.9999E+30 depending on the parameter.

Copying and Pasting Settings

The settings of a GO/NO-GO judgment number can be copied to another GO/NO-GO judgment number.
Click the GO/NO-GO judgment number you want to copy to select the line.
Click the **Copy** button.
Select the line of the destination GO/NO-GO judgment number, and click the **Paste** button.

GO/NO-GO Judgment

Turns ON/OFF the GO/NO-GO judgment.

GO/NO-GO Settings

Select Wave Parameter.

Judgment Action

Always: Always executes the action.
True: Executes the action when the specified GO condition is met.
False: Executes the action when the specified GO condition is not met.
If Always is specified in Triggered Mode, the specified action is executed each time a trigger occurs.

Action

Save Data: Saves the waveform data in binary format to the recording destination (SL1000 internal hard disk (option) or hard disk of your PC) specified in Recording Settings. The extension is .wdf.
The file name follows the auto naming setting specified in Recording Settings. For details on auto naming, see chapter 5.
Buzzer: Sounds a buzzer.

Notes When Action Is Set to Save Data

*   The maximum number of files that can be created in a single directory is 1000. Avoid placing files in the save destination folder before starting the GO/NO-GO judgment.
*   If the auto naming of file names is set to Date, creating files takes a long time when the number of saved files becomes large. Select NumberingDate if you are creating many files.

4.11   Performing Auto Setup

The measuring range of channels registered to measuring group 1 can be automatically set according to the measured signal. Auto setup is applied only to channels in measuring group 1.

1. Click the **Auto Setup** button or choose **Auto Setup** on the Acquisition menu.

Auto Setup button
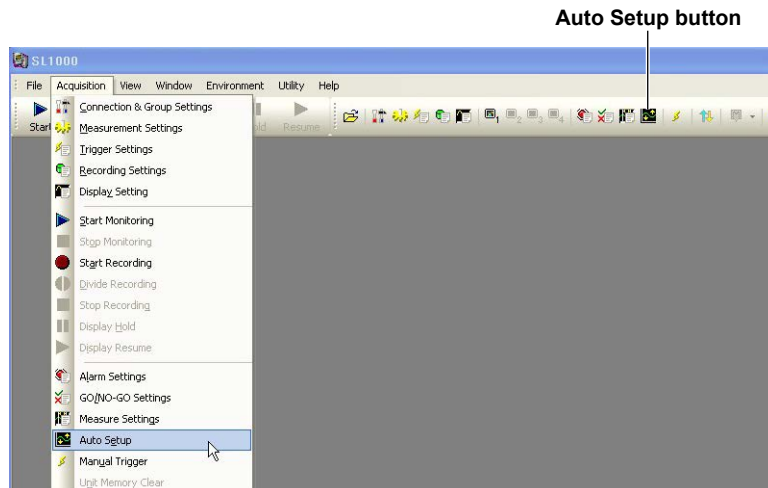
2. Select the channel to be automatically set up, and click **Execute**. Auto setup is executed, and the measurement settings are changed.

Select the channels
Execute auto setup
Cancel auto setup (restore the original settings)
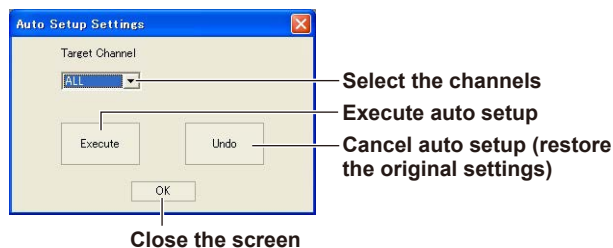
Close the screen

If ALL is selected, auto setup is executed on all channels registered in measuring groups.

Note

- You can only cancel auto setup immediately after you execute auto setup while the Auto Setup Settings screen is open. If you close the Auto Setup Settings screen with the OK button, you will not be able to cancel.
- During synchronous operation, you can select linked SL1000 channels as channels on a single SL1000.

4.12 Starting and Stopping the Measurement

Starting the Measurement

Click the **Start Monitoring** button or choose **Start Monitoring** on the Acquisition menu.

Display the Acquisition menu

Stop Monitoring button

Start Monitoring button
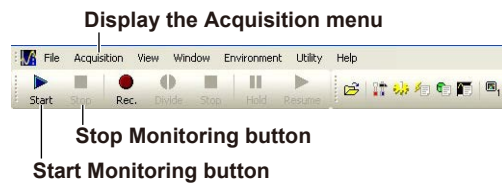
When the measurement is started, the SL1000 acquires the data in its internal memory.
If the waveform display is enabled, the waveform is displayed.
If using the trigger function, the SL1000 enters the trigger-wait state.

Note

Starting the measurement does not cause the measured data to be recorded to the hard disk of the SL1000 or your PC.
To record the measured data, start the recording (see chapter 5).

Stopping the Measurement

Click the **Stop Monitoring** button or choose **Stop Monitoring** on the Acquisition menu.
If you stop the measurement while recording or display updating is in progress, the recording and display updating also stop.

5.1   Recording Measured Data Immediately as the Measurement Is Started (Free Run Mode)

The SL1000 will immediately record data if the measuring mode is Free Run and it is ready to record.

1. Click the **Recording Settings** button or choose **Recording Settings** from the Acquisition menu.

Display the Acquisition menu   **Recording Settings button**
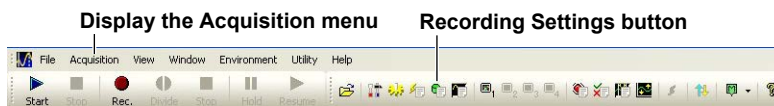
The Recording Settings screen opens.

Set the recording start condition
Set to Immediate

Setting the recording destination   **Displays the maximum recording time (size) per file**

Set the recording stop condition

Set the repeat conditions of recording (depends on the start and stop conditions)

Set the file to be recorded

Move to the Display Settings screen (see chapter 6)

Cancel the settings and close the screen

Apply the settings and close the screen

Move to the Measurement Settings screen (see chapter 4)

Destination

Set the data recording destination.

PC HDD: Records to the hard disk of the PC that this software was installed to.

Unit HDD: Records to the internal hard disk of the SL1000.

PC HDD+Unit HDD: Records both to the hard disk of your PC and to the internal hard disk of the SL1000.

The internal hard disk of the SL1000s is an option. Unit HDD and PC HDD+Unit HDD are valid on models with this option.

Note

• In the case of PC HDD + Unit HDD, the same data is recorded to the PC and to the SL1000. However, if you start recording by pressing the START/STOP key on the SL1000, data will only be recorded to the SL1000 until the PC receives recorded data. Once the PC receives recorded data, the same data is recorded to the PC and to the SL1000.

• During synchronous operation, you cannot select PC HDD+Unit HDD.

5

Recording Measured Data

Start Condition

Select the recording start condition from the available choices below. Select Immediate.

Immediate: Starts recording as soon as it is ready to record.[*] You can select whether to record until the recording is stopped, record until a specified time, record for a specified recording time, or record until an alarm occurs.

Abs.Time: Starts recording at a specified time if it is ready to record.[*] You can select whether to record until the recording is stopped, record until a specified time, record for a specified recording time, or record until an alarm occurs.

Alarm: Starts recording if an alarm occurs when it is ready to record.[*] You can select whether to record until the recording is stopped, record for a specified recording time, or record until the alarm is released.

Ext trigger: When Ext Trigger (Rise) is specified, recording starts when the SL1000 receives a rising edge of the external trigger signal. When Ext Trigger (Fall) is specified, recording starts when the SL1000 receives a falling edge of the external trigger signal. You can select whether to continue recording until you manually stop it or to stop recording when an external trigger occurs.

* The SL1000 will be ready to record if you click the Start Recording button or choose Start Recording from the Acquisition menu.

Stop Condition

Select the recording stop condition from the available choices below. If the recording start condition was set to Immediate, select Continuous, Abs.Time, Recording Time, Alarm or Ext Trigger.

Continuous: Continues to record until the recording is stopped.

Abs.Time: Stops recording at a specified time.

Recording Time: Stops the recording after a specified time elapses from the start of the recording. The selectable range is as follows:
  • Recording Time (When using the internal clock)
    0.1^* to 2000000000 points/maximum sample rate (s) (if the recording interval is set to OFF)
    0.001^* to 2000000000 points/maximum sample rate (s) (if the recording interval is not set to OFF)
  • Recording Points (When using an external clock)
    10 to 2000000000 points
  * The recording time must be long enough so that at least 1 data point can be measured. If the sample rate is 5 S/s, the recording time must be greater than or equal to 0.2 s.

Alarm: If the recording start condition is not set to Alarm, the recording stops when an alarm occurs. If the recording start condition is set to Alarm, the recording stops when the alarm is released. The alarm must be set in advance according to the procedure in section 4.9.

Ext trigger: When Ext Trigger (Rise) is specified, recording stops when the SL1000 receives a rising edge of the external trigger signal. When Ext Trigger (Fall) is specified, recording stops when the SL1000 receives a falling edge of the external trigger signal.

If you select Abs.Time or Recording Time, set the date/time or time. You can click the arrow to select from the list or click the box to type the value directly.

Record Interval

If the recording start condition is set to Immediate, you can set the interval only if the recording stop condition is set to Recording Time.

The recording is repeated at the specified interval from the start of the recording.

Set the recording interval to OFF or to a value in the range of 1 to 86400 s. When using an external clock, you can set the recording interval in the range of 2 to 1000000 points.
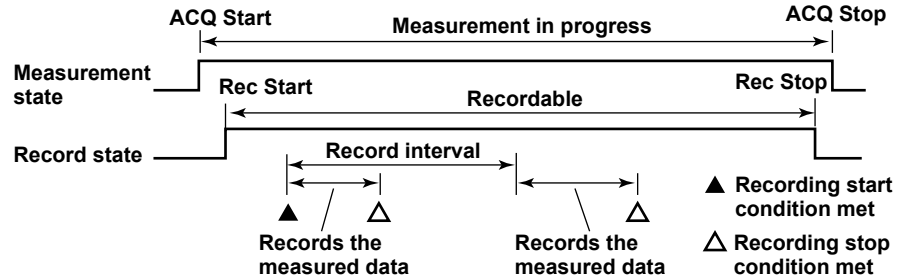
If the record interval is set to OFF, the next recording starts immediately after the previous recording is finished.

> **Note**
> If the recording interval is set to OFF and the recording stop condition is set to a recording time less than or equal to 1 s, the SL1000 may not be able to keep up with the recording operation, and a buffer overrun may occur.

No. of Recordings

Set the number of times to repeat the recording. You can set a value in the range of 1 to 100000.

If set to Infinite, the recording is repeated until you click the Stop Recording button or choose Stop Recording from the Acquisition menu.

Folder

Set the recording folder on the PC hard disk. You do not have to set the folder, if you are recording only to the internal hard disk of the SL1000.

Click **...** to open a dialog box for browsing folders.

By default, data is recorded to the SL1000 folder that is created in My Documents. Measured data is saved to a folder named according to the date within the folder specified here. The folder name is the date followed by a sequence number. The name of the date folder is the same between the PC and the SL1000.
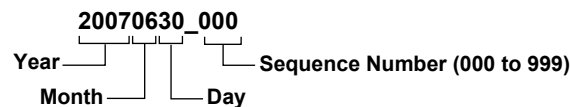
A folder can contain up to 1000 files. If the number of files exceeds 1000, a new folder with an incremented sequence number is created. However, if File Order is set to Cyclic (see below), the specified number of files can be saved even if the number of files exceeds 1000.

5

Recording Measured Data

Name

Set the file name. A sequence number is automatically appended to the specified file name. You do not have to set the name if you are using the date for auto naming.
If a file that data is being recorded to exceeds 2 GB, the file will be automatically divided into 2 GB segments. Up to 12 GB (six files) can be recorded.
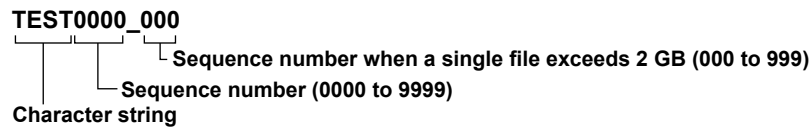
Auto Naming
- Using the Date/Time in the File Name
  The date/time (ms unit) of the recording is used for the file name. An arbitrary file name cannot be specified. You cannot use this function when File Order is set to Cyclic.
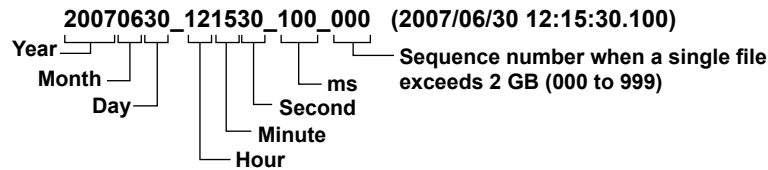
  20070630_121530_100_000   (2007/06/30 12:15:30.100)
  Year
  Month
  Day
  Hour
  Minute
  Second
  ms
  Sequence number when a single file exceeds 2 GB (000 to 999)

- Using a Sequence Number in the File Name
  A sequence number is added to a file name that you specify.

  TEST0000_000
  Character string
  Sequence number (0000 to 9999)
  Sequence number when a single file exceeds 2 GB (000 to 999)

During synchronous operation, if the recording destination is PC HDD, the unit ID is added to the front of the file name. For example, for unit ID0, the name of the file in the above example becomes "0_TEST0000_000."

Note

- Files that are divided into 2-GB segments are managed as one file. You can view all of the data (up to 2 GB per channel) using Xviewer that is included with this software (excluding the /XV0 option).
- When displaying waveforms on Xviewer, select the file with the sequence number 000 when files are divided as a result of a file exceeding 2 GB. You cannot open the file if you select a file with the sequence number 001 or later.
- You cannot use date and time for file names during synchronous operation. File names only take on sequence numbers.
- If the destination is PC HDD + Unit HDD and the trigger mode is Single(N), the names of the files saved to the PC may be different than that saved to the SL1000, depending on the names of files remaining on the hard disk.
- If the file size per channel per file exceeds 2 G samples (indicated by Max. Rec. Time/file on the Recording Settings screen), the SL1000 temporarily stops recording and restarts recording to a different file. No data dropout occurs during this process.

File Order

You can limit the number of files that are recorded to the specified destination.

Sequential: Records files until there is no more free space on the destination hard disk. When the number of files in one folder exceeds 1000, the Acquisition Software records to a new folder.

Cyclic: You can specify the number of files to be recorded to the destination hard disk. If the number of files reaches this number, recording continues by overwriting the oldest files. Set the number of files in the range of 1 to 1000. File names only take on sequence numbers.

Note

In Cyclic mode, files are numbered from 0000 each time you start recording. Therefore, old files with the same name are overwritten. If you want to keep the old files, select Sequential.

Comment

Enter any necessary comments using up to 250 characters.

Starting the Recording

Click the **Start Recording** button or choose **Start Recording** from the Acquisition menu. The SL1000 will be ready to record, and it will start recording if the recording start condition is met.

Start Recording button

5.2 Recording Measured Data from a Specified Time (Free Run Mode)

This section explains how to record data at a specified time.

1. Click the **Recording Settings** button or choose **Recording Settings** from the Acquisition menu.

Display the Acquisition menu   **Recording Settings button**

The Recording Settings screen opens.

Set the recording start condition
Set to Abs.Time

Set the recording destination (section 5.1)
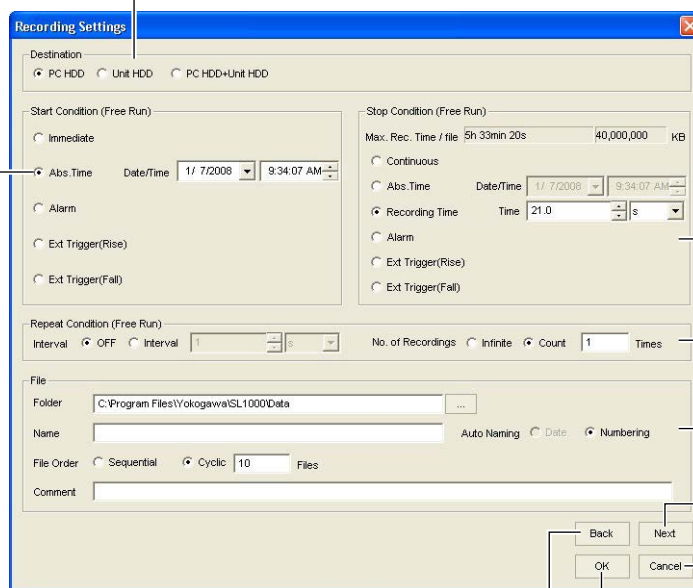
- **Set the recording stop condition**
- **Set the repeat conditions of recording (depends on the start and stop conditions)**
- **Set the file to be recorded (see section 5.1)**
- **Move to the Display Settings screen (see chapter 6)**
- **Cancel the settings and close the screen**
- **Apply the settings and close the screen**
- **Move to the Measurement Settings screen (see chapter 4)**

Destination

Set the data recording destination.
For details, see section 5.1.

Start Condition

Select the recording start condition. Here, select Abs.Time. For details, see section 5.1.

Abs.Time: Starts recording at a specified time if it is ready to record.[*] You can select whether to record until the recording is stopped, record until a specified time, record for a specified recording time, or record until an alarm occurs.

* The SL1000 will be ready to record if you click the Start Recording button or choose Start Recording from the Acquisition menu.

To set the start time, click the arrow to select from the list or click the box to type the value directly.

Stop Condition

Select the recording stop condition. If the recording start condition was set to Abs.Time, select Continuous, Abs.Time, Recording Time, Alarm, or Ext Trigger. For details, see section 5.1.

Continuous: Continues to record until the recording is stopped.

Abs.Time: Stops recording at a specified time.

Recording Time: Stops the recording after a specified time elapses from the start of the recording. The selectable range is as follows:
- Recording Time (When using the internal clock)
  0.1 to 2000000000 points/maximum sample rate (s) (if the recording interval is set to OFF)
  0.001 to 2000000000 points/maximum sample rate (s) (if the recording interval is not set to OFF)
- Recording Points (When using an external clock)
  10 to 2000000000 points

Alarm: Stops the recording if an alarm occurs. The alarm must be set in advance according to the procedure in section 4.9.

Ext trigger: When Ext Trigger (Rise) is specified, recording stops when the SL1000 receives a rising edge of the external trigger signal. When Ext Trigger (Fall) is specified, recording stops when the SL1000 receives a falling edge of the external trigger signal.

If you select Abs.Time or Recording Time, set the date/time or time. You can click the arrow to select from the list or click the box to type the value directly.

Record Interval

If the recording start condition is set to Abs.Time, you can set the interval only if the recording stop condition is set to Recording Time. For details, see section 5.1.

Note

If the recording interval is set to OFF and the recording stop condition is set to a recording time less than or equal to 1 s, the SL1000 may not be able to keep up with the recording operation, and a buffer overrun may occur.

No. of Recordings

If the recording start condition is set to Abs.Time and the recording stop condition is set to Recording Time, set the repeat count. For details, see section 5.1.

Folder, Name, File Order, and Comment

These settings are common regardless of the recording method. See section 5.1.

Starting the Recording

Click the **Start Recording** button or choose **Start Recording** from the Acquisition menu. The SL1000 will be ready to record, and it will start recording if the recording start condition is met.

Start Recording button

5.3 Recording Measured Data from When an Alarm Occurs (Free Run Mode)

This section explains how to record data when an alarm occurs.

1. Click the **Recording Settings** button or choose **Recording Settings** from the Acquisition menu.

Display the Acquisition menu　　　**Recording Settings button**

The Recording Settings screen opens.

Set the recording start condition
Set to Alarm

Set the recording destination (section 5.1)
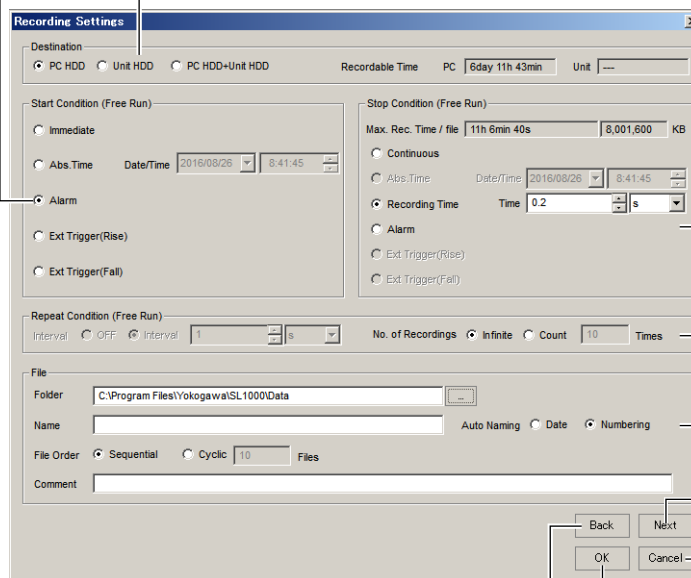
- Set the recording stop condition
- Set the repeat conditions of recording (depends on the start and stop conditions)
- Set the file to be recorded (see section 5.1)
- Move to the Display Settings screen (see chapter 6)
- Cancel the settings and close the screen
- Apply the settings and close the screen
- Move to the Measurement Settings screen (see chapter 4)

Destination

Set the data recording destination.
For details, see section 5.1.

Start Condition

Select the recording start condition. Here, select Alarm. For details, see section 5.1.

Alarm: Starts recording if an alarm occurs when it is ready to record.[*] You can select whether to record until the recording is stopped, record for a specified recording time, or record until the alarm is released.

* The SL1000 will be ready to record if you click the Start Recording button or choose Start Recording from the Acquisition menu.

Stop Condition

Select the recording stop condition. If the recording start condition was set to Alarm, select Continuous, Recording Time, or Alarm. For details, see section 5.1.

Continuous: Continues to record until the recording is stopped.

Recording Time: Stops the recording after a specified time elapses from the start of the recording.
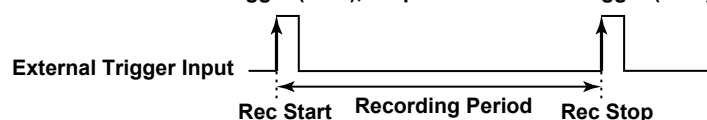
The selectable range is as follows:

- Recording Time (When using the internal clock)
  0.1 to 2000000000 points/maximum sample rate (s)
- Recording Points (When using an external clock)
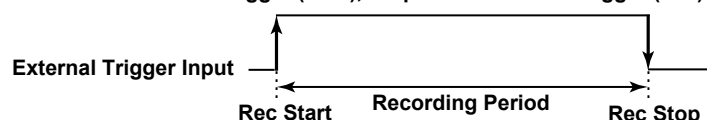 10 to 2000000000 points

Alarm: Stops the recording if the alarm is released. The alarm must be set in advance according to the procedure in section 4.9.

If you select Recording Time, set the time. You can click the arrow to select from the list or click the box to type the value directly.

If the recording stop condition is set to Alarm, data is recorded while the alarm status continues.
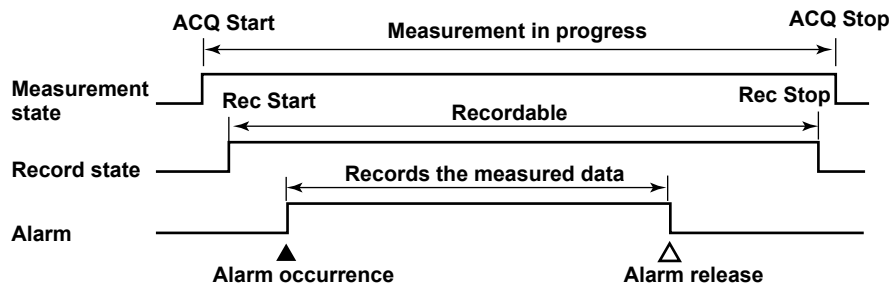
No. of Recordings

If the recording stop condition is set to Recording Time or Alarm, set the repeat count. For details, see section 5.1.

Folder, Name, File Order, and Comment

These settings are common regardless of the recording method. For details, see section 5.1.

Starting the Recording

Click the **Start Recording** button or choose **Start Recording** from the Acquisition menu. The SL1000 will be ready to record, and it will start recording if the recording start condition is met.
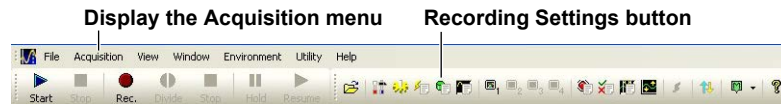

Start Recording button

Note

If alarms occur consecutively at intervals less than or equal to 1 s, the SL1000 may not be able to keep up with the recording operation, and a buffer overrun may occur.

5

Recording Measured Data

5.4 Recording by Applying External Trigger Signals (in Free Run Mode)

This section explains how to record data by applying external trigger signals when the measurement mode is set to Free Run.

1. Click the **Recording Settings** button or choose **Recording Settings** from the Acquisition menu.

Display the Acquisition menu   Recording Settings button
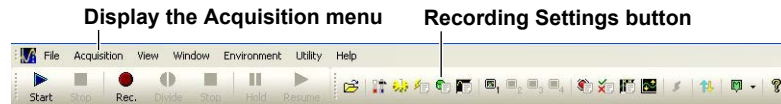
The Recording Settings screen opens.

Set the recording start condition
Set to Ext Trigger (Rise) or Ext Trigger (Fall)

Set the recording destination (section 5.1)
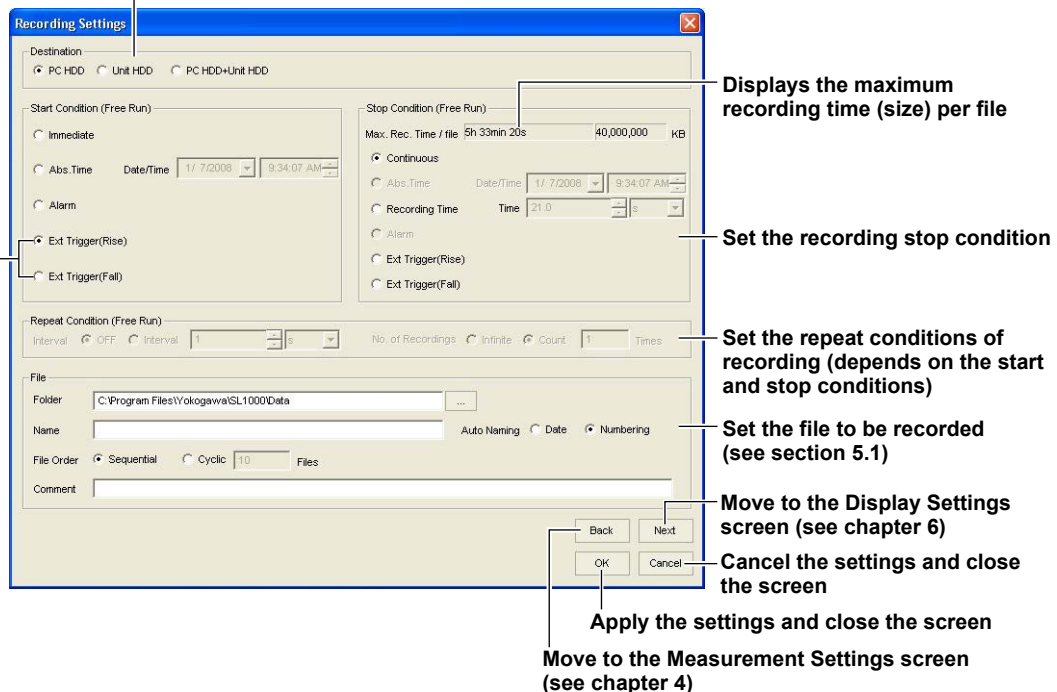
Displays the maximum recording time (size) per file

Set the recording stop condition

Set the repeat conditions of recording (depends on the start and stop conditions)

Set the file to be recorded (see section 5.1)

Move to the Display Settings screen (see chapter 6)

Cancel the settings and close the screen

Apply the settings and close the screen

Move to the Measurement Settings screen (see chapter 4)

Destination

Set the data recording destination.

For details, see section 5.1.

Start Condition

Select the recording start condition. Here, select Ext Trigger (Rise) or Ext Trigger (Fall).

For details, see section 5.1.

Ext trigger: When Ext Trigger (Rise) is specified, recording starts when the SL1000 receives a rising edge of the external trigger signal. When Ext Trigger (Fall) is specified, recording starts when the SL1000 receives a falling edge of the external trigger signal.

Stop Condition

Select the recording stop condition. If the recording start condition was set to Ext Trigger (Rise) or Ext Trigger (Fall), select Continuous, Recording Time, Ext Trigger (Rise), or Ext Trigger (Fall). For details, see section 5.1.

Continuous: Continues to record until the recording is stopped.

Recording Time: Stops the recording after a specified time elapses from the start of the recording.

The selectable range is as follows:
- Recording Time (When using the internal clock)
  0.1 to 2000000000 points/maximum sample rate (s)
- Recording Points (When using an external clock)
  10 to 2000000000 points

Ext trigger: When Ext Trigger (Rise) is specified, recording stops when the SL1000 receives a rising edge of the external trigger signal. When Ext Trigger (Fall) is specified, recording stops when the SL1000 receives a falling edge of the external trigger signal.

If you select Recording Time, set the time. You can click the arrow to select from the list or click the box to type the value directly.

• **Start Condition: Ext Trigger (Rise), Stop Condition: Ext Trigger (Rise)**

External Trigger Input

Rec Start   Recording Period   Rec Stop

• **Start Condition: Ext Trigger (Rise), Stop Condition: Ext Trigger (Fall)**

External Trigger Input

Rec Start   Recording Period   Rec Stop

No. of Recordings

If the recording stop condition is set to Recording Time, Ext Trigger (Rise) or Ext Trigger (Fall) set the repeat count. For details, see section 5.1.

Folder, Name, File Order, and Comment

These settings are common regardless of the recording method. For details, see section 5.1.

Starting the Recording

Click the **Start Recording** button or choose **Start Recording** from the Acquisition menu. The SL1000 will be ready to record, and it will start recording if the recording start condition is met.

Start Recording button

Note

If triggers occur consecutively at intervals less than or equal to 1 s, the SL1000 may not be able to keep up with the recording operation, and a buffer overrun may occur.

5 Recording Measured Data

5.5 Recording in Triggered Mode

This section explains how to record data if the measuring mode is set to Triggered Mode. You must set the measuring mode to Triggered Mode on the Measurement Settings screen in advance.

For details on the trigger settings, see section 4.8.

1. Click the **Recording Settings** button or choose **Recording Settings** from the Acquisition menu.

Display the Acquisition menu   **Recording Settings button**

The Recording Settings screen opens.

Set the recording destination (section 5.1)

Set the file to be recorded (see section 5.1)

Move to the Display Settings screen (see chapter 6)

Cancel the settings and close the screen

Apply the settings and close the screen

Move to the Measurement Settings screen (see chapter 4)
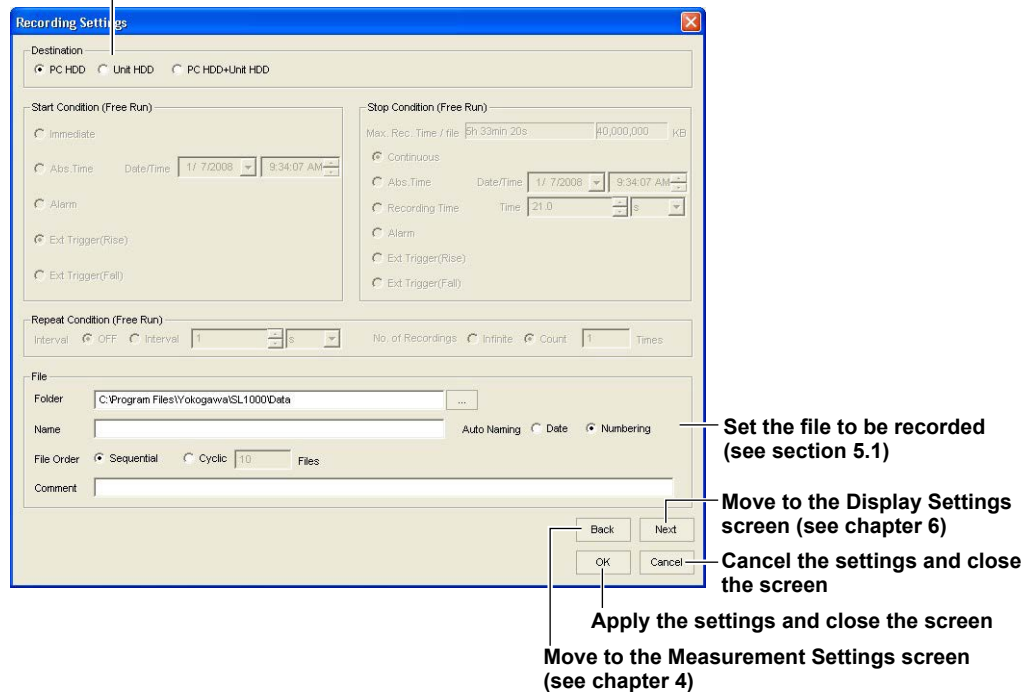
Auto Recording

Set the data recording destination.
For details, see section 5.1.

Folder, Name, File Order, and Comment

These settings are common regardless of the recording method. For details, see section 5.1.

The three-digit number that is added to the end of a file name when data is recorded in Free Run mode is not added in Triggered mode.

Starting the Recording

Click the **Start Recording** button or choose **Start Recording** from the Acquisition menu. The SL1000 will be ready to record. The SL1000 starts recording if a trigger occurs in this state.

Display the Acquisition menu

Start Recording button
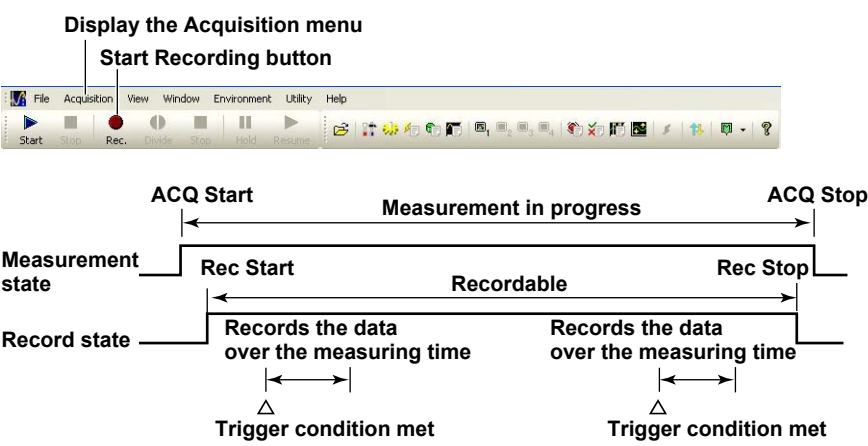
Data can be recorded for the trigger count specified in the trigger settings.

If a trigger delay or pre-trigger is specified, the recording starts according to those settings. For details on the trigger delay and pre-trigger settings, see section 4.8.

Note

- If triggers occur consecutively at intervals less than or equal to 1 s when the trigger mode is set to Single (N) and the trigger count is set to infinite, the SL1000 may not be able to keep up with the recording operation, and a buffer overrun may occur.
- When recording in Triggered mode, the number of points recorded is 0.1% greater than the number of measured points that is specified in the measurement conditions. For example, if the number of measured points is set to 10000, the number of points recorded is 10010.

Manual Trigger

Manual trigger allows you to start recording from any point.

Click the Start Monitoring button or the Start Recording button so that the SL1000 is ready to measure or record.

Click the **Manual Trigger** button or choose **Manual Trigger** from the Acquisition menu. A trigger is generated when you click the Manual Trigger button or choose Manual Trigger from the Acquisition menu.

Manual Trigger button

5

Recording Measured Data
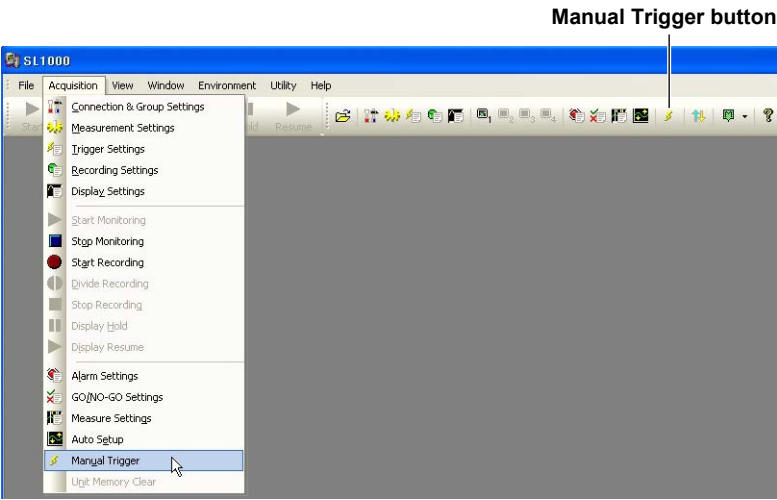
5.6 Recording to Divided Files

The measured data being recorded can be saved to divided files.

1. Click the **Divide Recording** button or choose **Divide Recording** from the Acquisition menu.

The file containing recorded measurement data is divided when you click the Divide Recording button.

Display the Acquisition menu

Divide Recording button
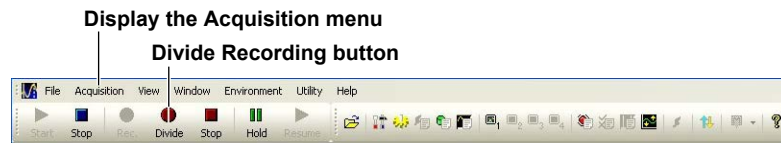
After division, Recording will continue using the same conditions as before.

Note

You cannot record to divided files during synchronous operation.

Name

If auto naming is set to Numbering, the sequence number is incremented by one.
If auto naming is set to Date, the file name is set to the date/time when the Divide Recording button was clicked.
For details on file names, see section 5.1.

6.1   Setting the Display Conditions

The Acquisition Software can display the measured waveforms of channels registered to display groups. There are settings that apply to all display groups and settings that apply to individual channels.

Setting Display Groups

1. Click the **Display Settings** button or choose **Display Settings** from the Acquisition menu.

Display the Acquisition menu   **Display Setting button**

The Display Settings screen opens.

Display group tab
Select the display group to be shown

Set the display range (for Free Run mode)
Graph settings (line width, time axis unit, etc.)

Apply the settings to the displayed waveform

Set the channels to display

Set the display conditions for each channel

Move to the Recording Settings screen (see chapter 5)

Cancel the settings and close the screen

Select the channel to be registered in a display group
Click this box and select from a list of displayed labels

Apply the settings and close the screen
Display the waveform screen

Copy and paste settings for each channel

Graph Settings

Turn ON/OFF the alarm level display (for Free Run mode)

Select the waveform line width

Turn ON/OFF the mark that indicates the most recent data (for Free Run mode)

Select the horizontal (time) axis

Set the time axis scaling (if the time axis unit is set to Points)

Set the horizontal (time) axis unit
Set the scaling factor
Select the waveform display interpolation format
Cancel the settings and close the screen
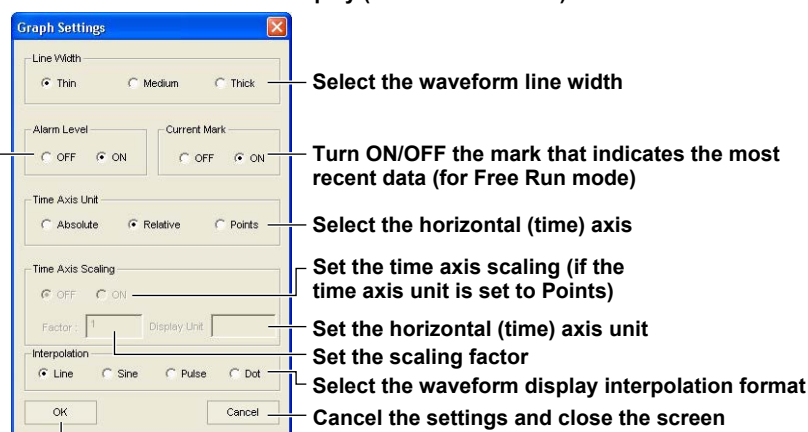
Apply the settings and close the screen

Setting the Display Range (for Free Run mode)

To measure in Free Run mode, you must set the X-axis range to be displayed. Set the range in terms of the display time (internal clock) or the number of displayed points. The maximum sample rate among the channels registered to the display group is displayed on the setting screen.

In Triggered mode, all the measured data are displayed.

Setting the Display Time (When Measuring Using the Internal Clock)

Set the display range of the X-axis in the following range.

Longest sample interval × 10 to M/fastest sample rate

Longest sample interval: The longest sample interval among measuring groups 1 to 4.

M: 16000000 (2 channels), 8000000(3 to 4 channels)

4000000 (5 to 8 channels), 2000000 (9 to 16 channels)

Maximum sample rate: The maximum sample rate among measuring groups 1 to 4

The resolution is equal to the longest sample interval × 10. However, if the number of displayed points (display time × maximum sample rate) exceeds 400000 points and channels measuring with sample rates greater than or equal to 10 MS/s are registered in the display group, the resolution is equal to the time corresponding to 400000 points.

You cannot set this value when the SL1000 is measuring using an external clock.

Setting the Number of Displayed Points

Set the display range of the X-axis in terms of the number of data points.

Graph Settings

Set the following items.

Line Width

Set the waveform line width to Thin, Medium, or Thick.

Alarm Level (Free Run Mode)

Set whether to display the alarm level of the channel alarm.

Current Mark (Free Run Mode)

Set whether to display the mark that indicates the most recent measured data.

Time Axis Unit

Set whether to display the time axis in absolute time, relative time from the start of the measurement, or using the number of displayed points.

Time Axis Scaling (When the Time Axis Unit Is Set to Points)

Set whether to scale the time axis display. If scaling the display, set the factor per displayed point as well as the display unit. Set the factor in the range of 0.001 to 1000. Set the display unit using up to 10 characters.

Interpolation

Set the interpolation format used to connect sampled data points for displaying the waveform.

Line: Interpolates between two points using a straight line.

Sine: Interpolates between two points using the sin x/x function.

Pulse: Interpolates between two points in a staircase pattern.

Dot: Does not perform interpolation.

Line	Sine	Pulse	Dot
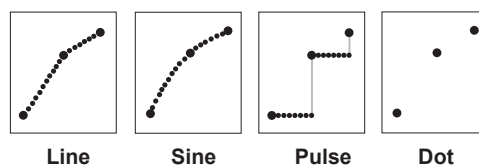
Registering the Displayed Channels

Clicking a label box shows a list of labels of the measuring channels that are registered to measuring groups. Select any measuring channel. The label list shows the label names specified in the measurement settings. You can register up to 16 measurement channels (up to 128 channels when eight units are linked for synchronous operation). The same measuring channel can also be registered to multiple display groups.

To not register a measuring channel, select None from the label list.

By default, a display group will contain the labels that are registered to the measuring group of the same number.

Selecting the Labels to Display

Click Select Labels to Display to show a list of labels for the measurement channels that are registered to a measuring group. You can select any measurement channels from the list of labels that appears. You can also collectively turn all channels on or off. If the display group already contains measurement channels, the channels in the group are changed to those specified here.

Select the channels to display
Displays the channels using labels

Cancel the settings and close the screen

Apply the settings and close the screen
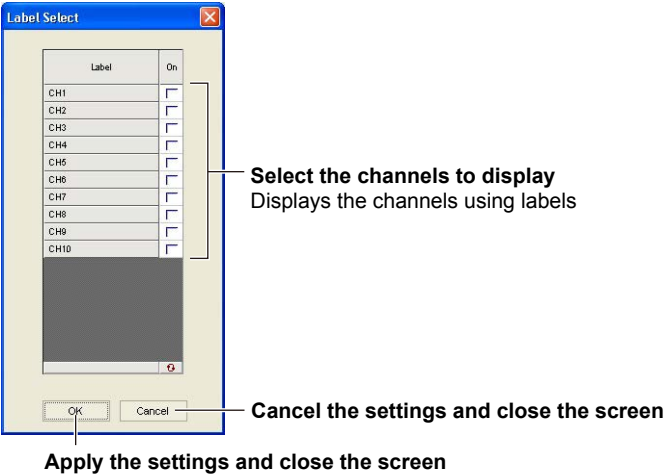
If the maximum sample rate among the registered measuring channels is 50 MS/s, 5 MS/s, 500 kS/s, 50 kS/s, 5 kS/s, 500 S/s, or 50 S/s, a measuring channel with the next lower sample rate cannot be registered to the same display group. For example, if the maximum sample rate among the registered measuring channels is 500 kS/s in a display group, a measuring channel with a sample rate of 200 kS/s (the next lower sample rate) cannot be registered to that group.

Note
The sample rate can be specified at the measuring group level. Up to four measuring groups can be set up.

6

Display

Setting Each Channel

Set the minimum value of the scale

Set the maximum value of the scale

Turn ON/OFF the scale (display range) setting (measuring range if OFF)

Automatically set the scale

Set the minimum value of the zone (display position)

Turn the axis display ON/OFF

Set the maximum value of the zone (display position)

Turn ON/OFF the waveform display

Set the waveform color

Auto button

Scroll bar

Set the number of decimal places of the numeric display

Turn the current value display ON/OFF

Set the numeric display format

Set the display style of the current values

Scroll bar

Turning ON/OFF the Waveform Display and Axis Display

Set whether to show or hide the waveforms and coordinate axes of channels registered to display groups.

Setting the Scale

Set the scale (display range of the vertical axis).

Turning the Scale ON/OFF

Select the On check box to set the scale. If the check box is not selected, the measuring range becomes the display range.

Minimum and Maximum Values of the Scale

Can be set when the scale is ON. The selectable range is –1E+30 to 1E+30.

Automatically Setting the Scale

Click the Auto button to automatically set to the scale best suited to the measured data.

Setting Zones

Set the zones (display positions). You can display waveforms so that they don't overlap or move the waveforms to positions that allow easy comparison.
The settings specified here are valid when waveforms are displayed using User Zone or Edit Zone on the waveform screen. For details on User Zone and Edit Zone, see section 6.2.

Minimum and Maximum Values of Zones

Set the minimum and maximum values of zones as a percentage of the vertical span of the waveform screen.

> **Note**
>
> You can also set zones easily by using buttons on the waveform screen. For details, see section 6.2.

Setting the Waveform Color

Clicking a color box opens a color setting screen. You can set any color.

Setting the Display Format

Set the numeric display format.

Numeric Format

Select Floating, Exp, Hex, or Auto.

Decimal Places

Set the number of decimal places.

Current Value

Current values can be displayed at the same time as waveforms.

Turning the Display ON/OFF

Turn ON/OFF the current value display.

CV Type

Set the display style of current values to Digital, Meter, Bar, or Thermometer.
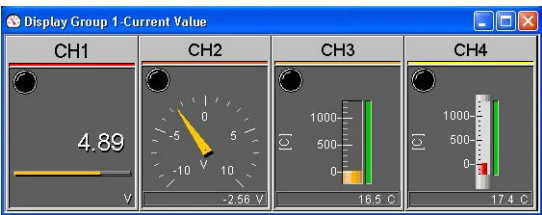
Digital   Analog meter   Bar graph   Thermometer

6.2 Operating the Screen

Displaying the Waveform Screen

Clicking **OK** on the Display Settings screen in section 6.1 shows the waveform screens of display groups whose Graph Display check box is selected.

To show a waveform screen that is not shown, click the corresponding **display group** button on the toolbar.
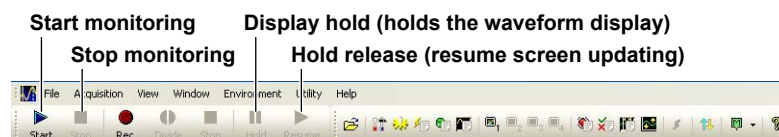
Display group button
Select the active waveform display screen
or display the waveform screen

Waveform screen
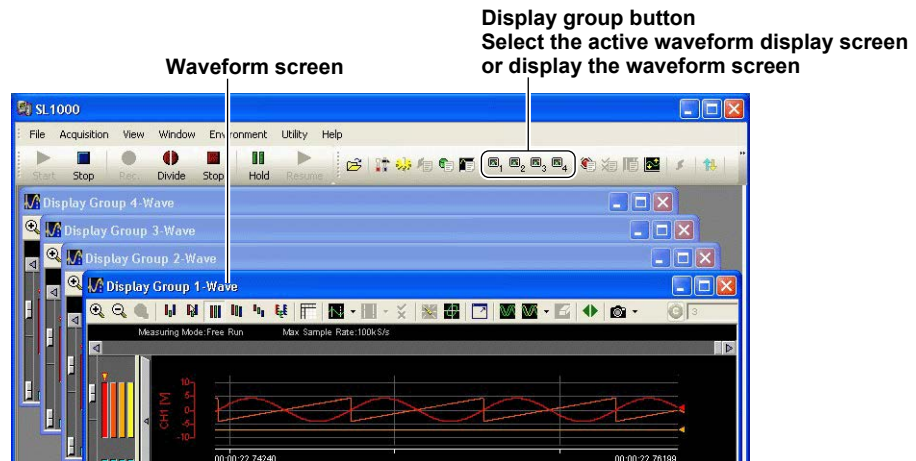
Display Updating

When measurement is started, the waveforms of channels registered to display groups are shown.

If measuring in Triggered mode, waveforms are displayed when a trigger occurs.

You can stop and resume the display updating by clicking the Display Hold and Display Resume buttons, respectively. You can read measured values using cursors and view past waveform data while the display is held.

Start monitoring   **Display hold (holds the waveform display)**
Stop monitoring   **Hold release (resume screen updating)**
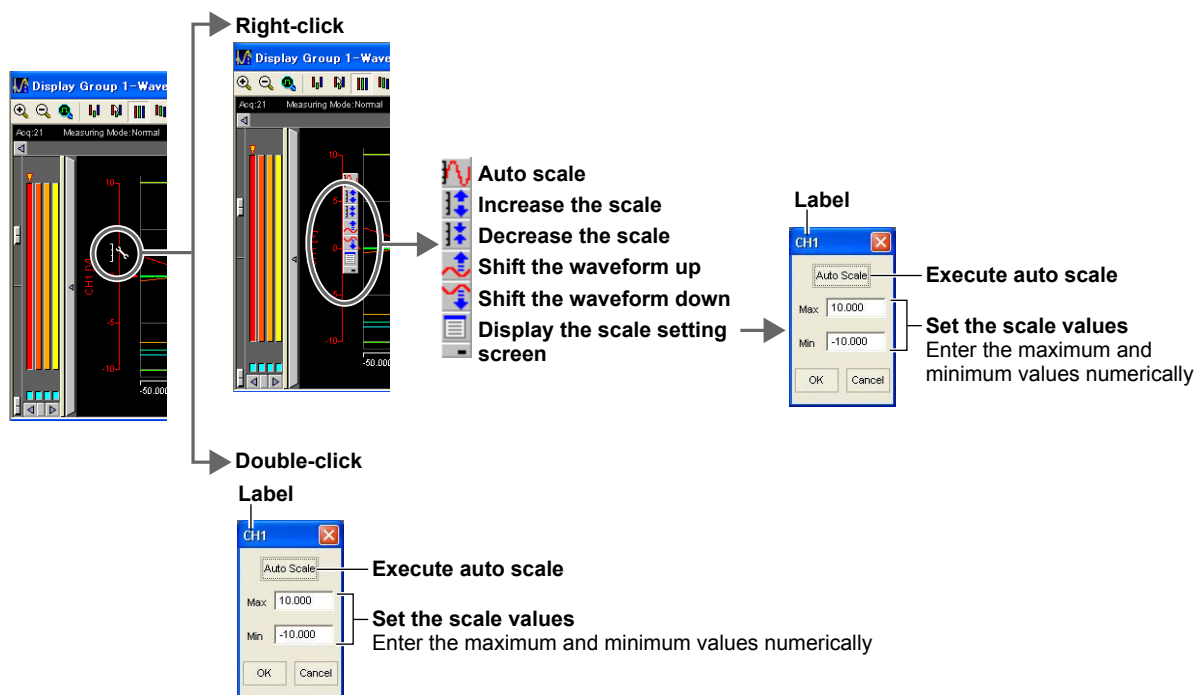

Note

- The data continues to be acquired to the internal memory of the SL1000 even if the display is held.
- When the display is held, the displayed data may be overwritten, because the SL1000 continues to measure data during this period. If this happens, the display hold feature will be automatically released.
- When displaying data measured at sample rates greater than or equal to 10 MS/s, the Acquisition Software may not be able to display the waveforms of all channels, depending on the number of displayed groups, the number of channels, the PC performance, and the CPU load on the PC. If this happens, the message "Failed to display some channels because of the higher sample rate." appears.
  Lower the CPU load by lowering the sample rate, decreasing the number of displayed channels, and so on.
- The display update may slow down during auto recording, because the recording operation takes precedence.

Operating Waveform Screens

X-Y Display (Version 2.10 or later)
Full screen display
Accumulate (Version 2.10 or later)
Snapshot (Version 2.10 or later)
Clear accumulation or snapshots
Auto Play (Version 2.10 or later)
Take a waveform screen capture (take a screen snapshot)
Clear the SL1000 memory

Display the current values
Display the GO/NO-GO judgment result
Display the waveform parameter values
Display the cursor values
Display the numeric value display area
Display all scales
Change the zone

Expand or reduce the waveform (see section 6.3)
Acquisition count

Zone bar

Adjust the brightness of the scale in the waveform display area (slide the knob)

Invert the background color of the waveform display area (slide the knob)

Trigger level
Trigger position
Show/hide the zone bar display area (click here)
Turn the waveform display ON/OFF (click here)

Changing the Display Scale on the Screen

You can change the display scale on the screen while measurement is in progress or when measurement is stopped. Place the cursor over the scale on the screen so that the ⌇🔧 icon appears. Right-click to display the scale adjustment tool buttons, or double-click to display the scale setting screen.

Right-click

Auto scale
Increase the scale
Decrease the scale
Shift the waveform up
Shift the waveform down
Display the scale setting screen

Label

Execute auto scale

Set the scale values
Enter the maximum and minimum values numerically

Double-click

Label

Execute auto scale

Set the scale values
Enter the maximum and minimum values numerically

6

Display

Displaying Multiple Display Groups

If displaying waveforms of multiple display groups, you can cascade the windows of each display group or tile them.
From the Window menu, choose **Cascade**, **Tile Horizontally**, or **Tile Vertically**. The Window menu appears when a waveform screen is displayed.
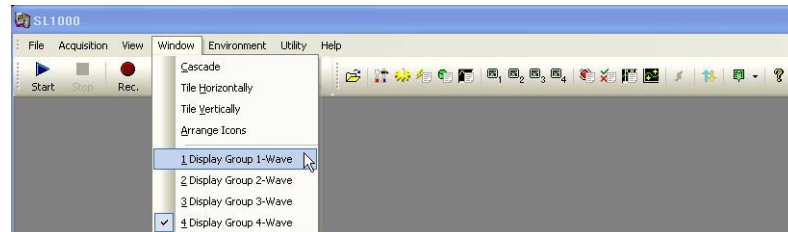
Arranging Minimized Waveform Screens

To arrange the minimized waveform screens, choose **Arrange Icons** from the Window menu.

Changing the Zones

To display waveforms using zones that have been specified in the display settings, click the **User Zone** button, or choose **User Zone** from the View menu.
To change the zones specified in the display settings, click the **Edit Zone** button, or choose **Edit Zone** from the View menu, and drag the top and bottom edges of the bars vertically.
The zones that you change using **Edit Zone** are applied to the zones in the display settings.
Click the **Full Zone** button to display all waveforms in a full zone (0 to 100%). Click the **Slide Zone** button to display the slid waveforms. Click the **Auto Zone** button, or choose **Auto Zone** from the View menu to display all waveforms so that they do not overlap. If Full Zone, Slide Zone, or Auto Zone is selected, the display settings are not affected.
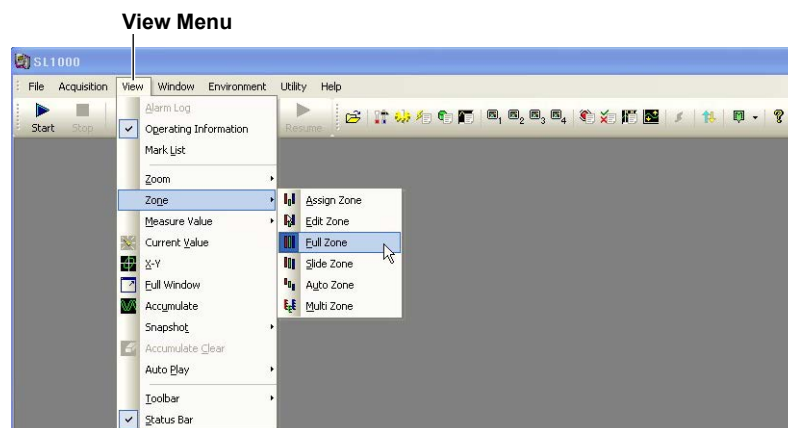
View Menu

Auto Zone button
Slide Zone button
Full Zone button
Edit Zone button
Assign Zone button

For edit zone

Drag this to change the zone

Displaying All Waveforms Overlapped

To display all scales, click the **Multi Zone** button, or choose **Multi Zone** from the View menu.

Multi Zone button

Selecting the Active Waveform

Click the bar of the waveform to be activated. A triangular mark is displayed above the bar, and the waveform is activated. The displayed scale is the scale of the active waveform.

Active waveform mark

Displaying the Current Values

Click the **Current Value** button while the display is being updated. The current values are displayed.

If the measuring mode is Free Run, the channel alarm status is also displayed.

Current Value button

Channel alarm status (Free Run mode)
Black : Alarm not set
Green: Alarm not occurring
Red: Alarm occurring
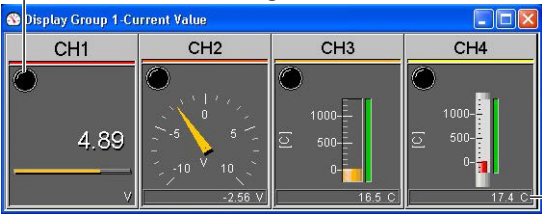
Numeric display

Digital   Analog meter   Bar graph   Thermometer

6

Display

Displaying Channel Settings, Cursor Values, and Measured Waveform Parameter Values

To show the area that displays channel settings, cursor values, and measured waveform parameter values, click the **numeric value display** button, or choose **Measure Value** > **Numeric Values** from the View menu.

To temporarily hide the display areas, click 🔲 shown below. The Channel Info. and Numeric Values tabs appear at the right of the display frame. Place the pointer over these words to display the corresponding display area. If you move the pointer outside the display area, the display area closes.

If you click Channel Info. or Numeric Values when the display area is hidden, the display area remains shown even when you move the pointer outside the display area. If you click a location outside the display area, the display area becomes hidden. To switch between cursor values and measured waveform parameters when the numeric value display area is shown, click the **Cursor Display** button or **Measure display** button, or choose **Cursor Display** or **Measure display** from the View menu.

View menu

Close the numeric value display area

Numeric value display button

Cursor button

Measure display button

Click 🔲 to hide the display area

Numeric value display area

The numeric value display area is hidden.

Click 🔲 to keep the numeric value display area showing (The icon changes to 🔲)

Point or click Numeric Values

Point or click an area outside the numeric value display area
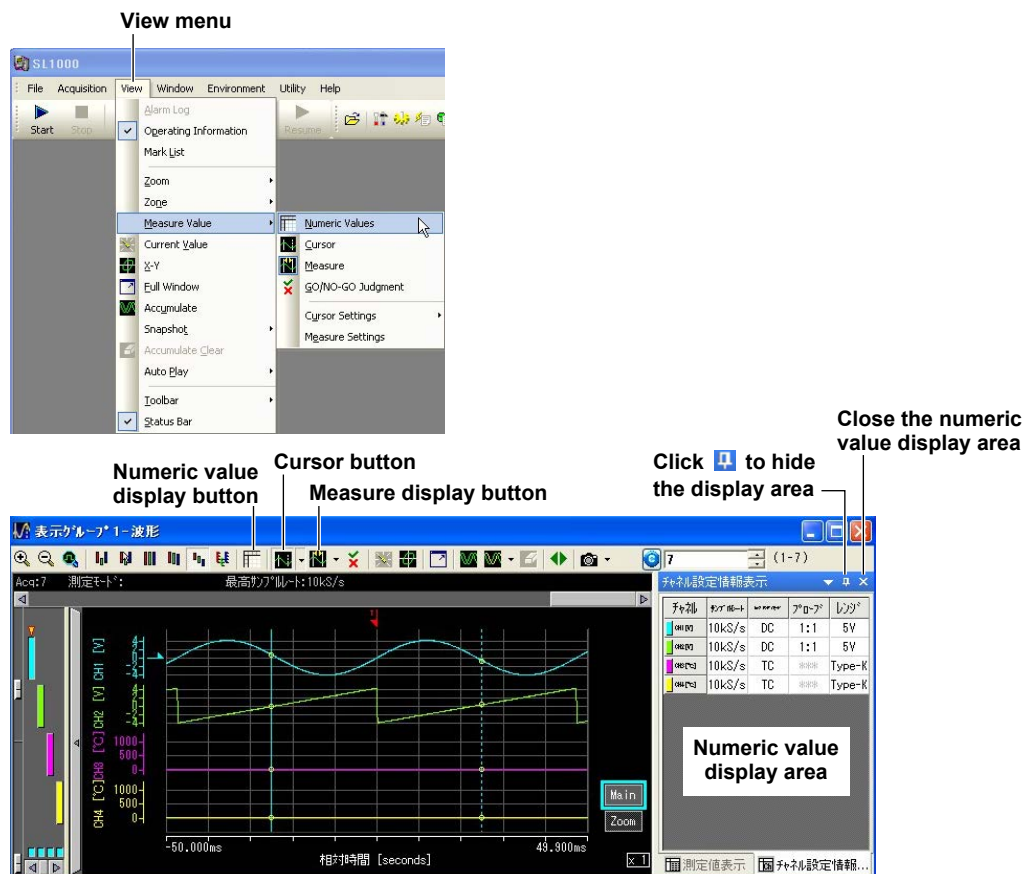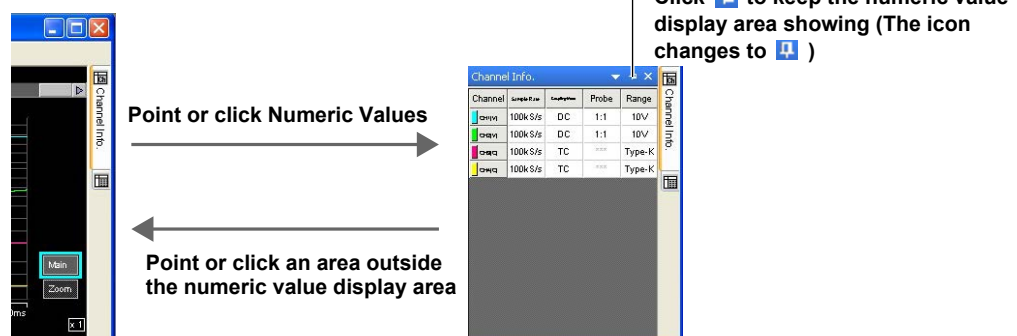
Changing the Size of the Screen

Move the pointer over the screen frame and drag when the pointer changes to an arrow.
To resize the screen to full screen click the **Full Screen** button on the toolbar. Clicking the Full Screen button again when the screen is displayed in full screen causes the screen to return to its original size.

Full screen button

Displaying Past Data

When the display is held or measurement is stopped, you can display past data stored in the SL1000 memory by changing the waveform display position.
Moving the scroll bar of a waveform screen changes the position of the displayed waveform and displays the past waveform. Move the scroll bar to the left to view older data and to the right to view newer data.
In Free Run mode, you can go back as far as the oldest data stored in the SL1000 memory.
In Triggered mode, you can view history data up to the last 5000 waveforms by specifying the waveform number (acquisition number).

Change the display position using the scroll bar   **Specify the waveform number (acquisition number) to view past data**
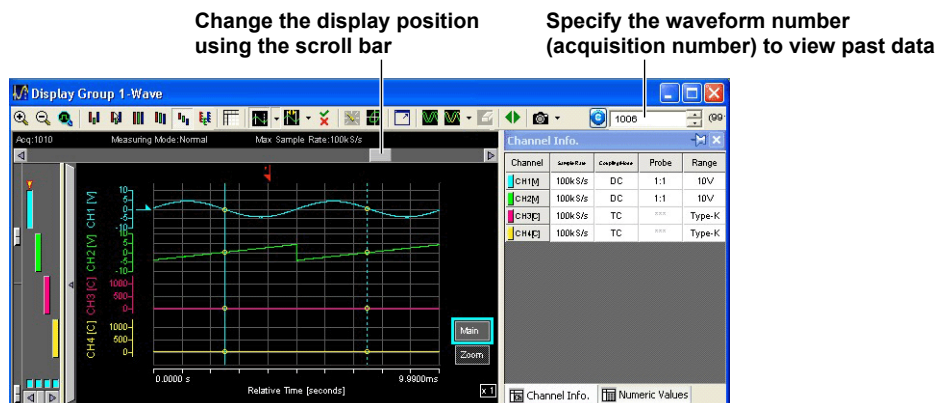
Displaying Past Average Data (history data averaged and saved)
(version 2.41 and later)

The waveforms of history data averaged and saved can be displayed using the accompanying Xviewer (except the /XV0 option).
For the procedure to average and save, see section 8.4.

Xviewer (for the startup procedure, see section 6.5)
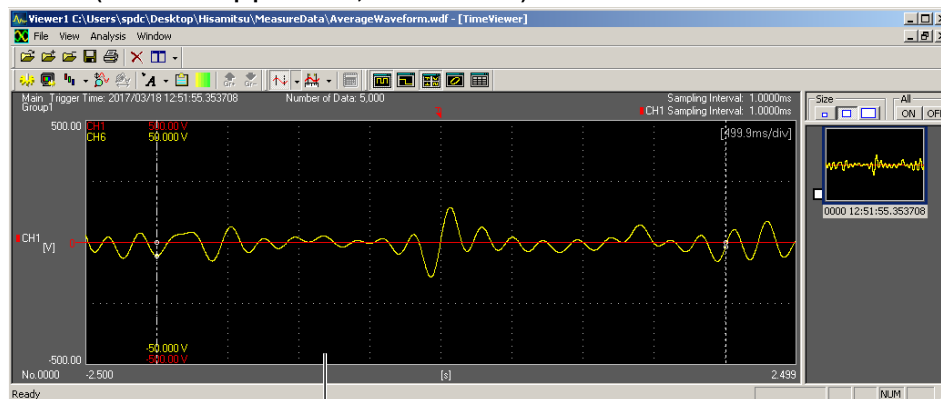
Displaying the history waveform of averaged and saved data

Scrolling Automatically (Versions 2.10 and later)

When measurement is stopped, the SL1000 can scroll the waveform display position automatically.

Click the **Auto Play** button, or choose **Auto Play** > **Auto Play** from the View menu.

The auto play screen appears.

Auto Play button

View menu

Show or hide the auto play screen
Display the oldest data
Play data towards older data
Stop
Play data towards more recent data
Display the most recent data
Set the play speed
Select the play source (in triggered mode)
  History data: History waveform
  Zoom cursor: Zoom position

Triggered mode   Go to beginning Reverse Stop Play Go to end

Free Run mode

Set the play speed

Play source settings

Clearing the SL1000 Memory (in Triggered mode)

You can clear past measured data that is remaining in the SL1000 memory. Click the unit's memory **clear** button or choose **Unit Memory Clear** from the Acquisition menu.

Acquisition menu   **Clear button**
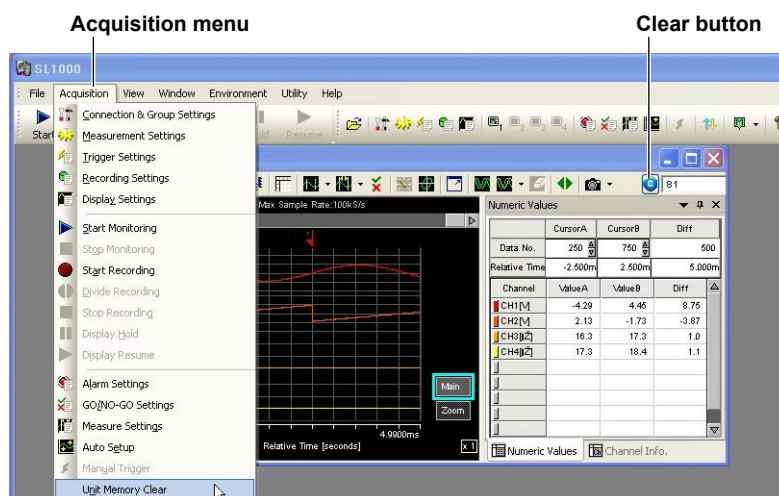
Note

•   History data refers to measured data that is acquired each time the trigger condition is met when measuring in Triggered mode. Up to the most recent 5000 data waveforms can be saved.

•   If past measured data is overwritten while the display is held, the display hold feature will be automatically released.

6.3 Expanding and Reducing Waveforms
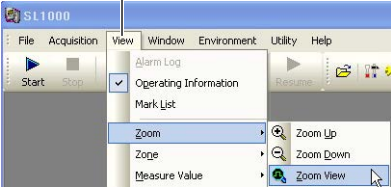
The displayed waveforms can be expanded or reduced.

Triggered Mode
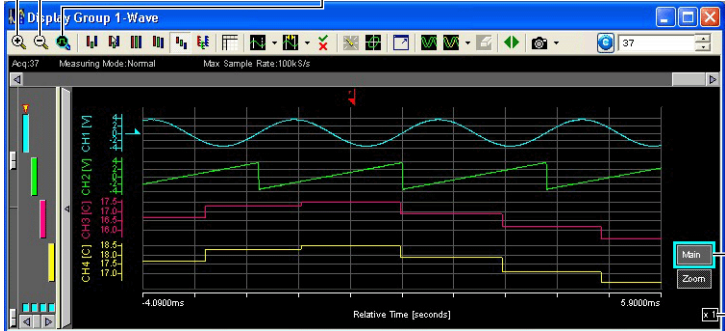
Click the **Zoom View** button on the waveform screen, or choose **Zoom** > **Zoom View** from the View menu to display main waveforms and zoom waveforms in separate waveform display areas. The main waveform display area displays the zoom cursor, and the zoom waveform display area displays the zoom waveforms obtained by expanding the waveforms within the zoom cursor. Click the button again to only display the zoom waveforms. Click the button yet another time to only display the original main waveforms. When zoom waveforms are displayed, if you click the **Zoom Up** or **Zoom Down** button or choose **Zoom Up** or **Zoom Down** from the View menu, the zoom cursor width changes, and the zoom waveforms are expanded or reduced.

The selectable zoom rates vary depending on the number of measured points. You can move the zoom position by dragging the left or right edge of the zoom cursor or by dragging the zoomed waveform directly.

Free Run Mode

To expand or reduce waveforms along the time axis, click **Zoom Up** or **Zoom Down** on the waveform display screen, or choose **Zoom Up** or **Zoom Down** from the View menu.

View menu

Zoom up   **Zoom down**

Display points

Zoom up

Zoom down

Expand waveforms along the time axis   **Display points**

Reduce waveforms along the time axis   **Display points**
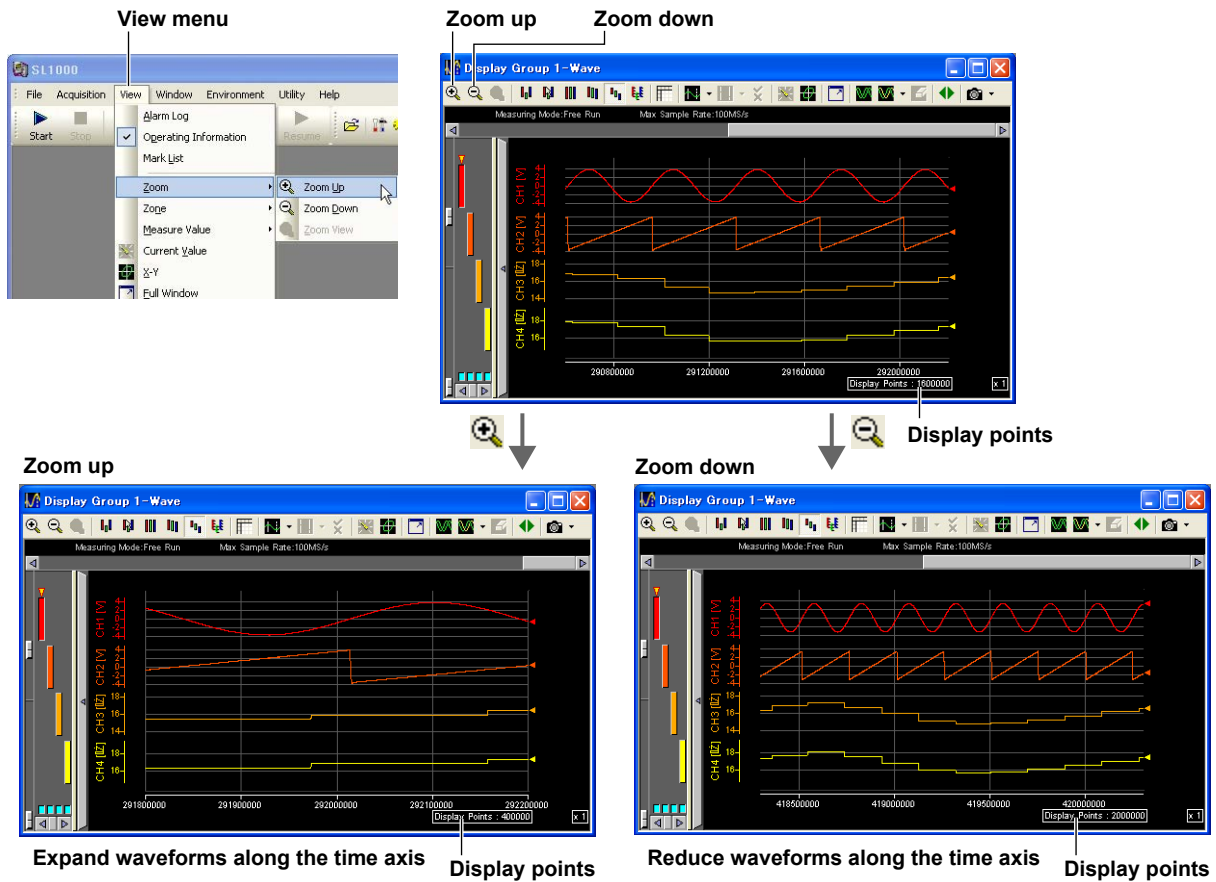
Note

You can use the mouse wheel to increase and decrease the Triggered mode zoom factor or the Free Run mode display time.

6

Display

6.4 Displaying the Measured Data That Has Been Saved (Excluding the /XV0 Option)

Measured data that has been saved can be displayed. This function is not available on models with the /XV0 option.
From the File menu, choose **Load Waveform**.
Select the data to be displayed.
The extension to measured data files is .wdf.
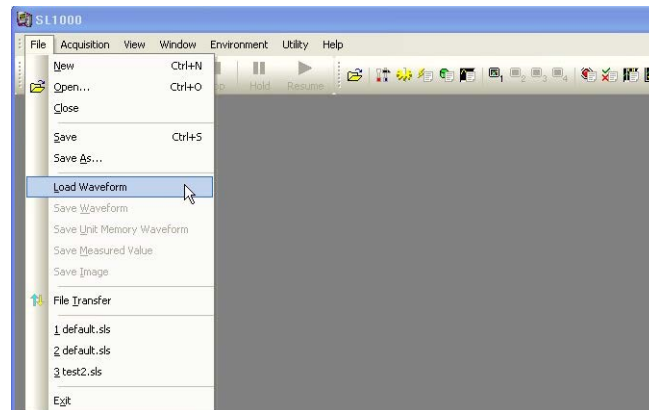
The measured data that has been saved is displayed using Xviewer, a software provided with the SL1000. Carrying out the procedure above automatically starts Xviewer.
For details on the Xviewer operation, see the user's manual.

Note

- You can install Xviewer when you install this software.
- For the procedure to save the measured data, see section 8.1.
- Xviewer can only display 2 G samplings of a measured data file containing more than 2 G samplings of data per channel.

6.5   Starting Xviewer (Excluding the /XV0 Option)

Use the accompanying software, Xviewer, to display measured data that has been saved or to perform computations on the measured data (/XV1 option).
From the Utility menu, choose **Xviewer**.
For details on the Xviewer operation, see the *701992 Xviewer User's Manual*.

Note

- If you open a saved measured data by choosing Open from the File menu or if you double-click a file containing operation information, Xviewer will automatically start.
- You cannot simultaneously connect to a single SL1000 using the Ethernet and USB interfaces. Therefore, you cannot use Xviewer to connect to an SL1000 that is connected to this software via the USB interface. (Xviewer is available on all models except those with the /XV0 option.)

6.6 Displaying the Alarm Log (Free Run Mode)

You can view a list of alarms that occurred in the past.

This function is valid in Free Run mode.

From the View menu, choose **Alarm Log.**
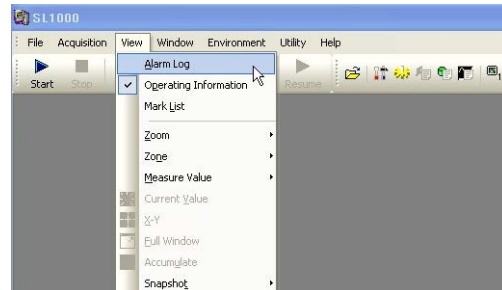
The alarm log appears.

The alarms that occurred are displayed according to the alarm conditions that you specified before starting measurement (see section 4.9).

Channel number on which the alarm occurred

Pattern on which the alarm occurred

Unit number on which the alarm occurred

Measured value when the alarm occurred

Displays "Alarm" while the alarm is occurring and "Release" when the alarm is released.

Date and time when the alarm occurred

Date and time when the alarm was released

Display the waveform for the selected alarm position

Close the alarm log

Delete the selected alarm log

Alarm Log during Synchronous Operation

Units on which alarms occurred

The time on the master unit (Unit0)

Channels on which alarms occurred

Analysis

If you click Analyze or double-click an alarm when the corresponding channel's waveform is displayed, the waveform position where the alarm occurred will appear. If a cursor is displayed, the cursor will move to the alarm occurrence position.

This command is valid when the SL1000 is not measuring.

Selected alarm

Selected alarm occurrence position
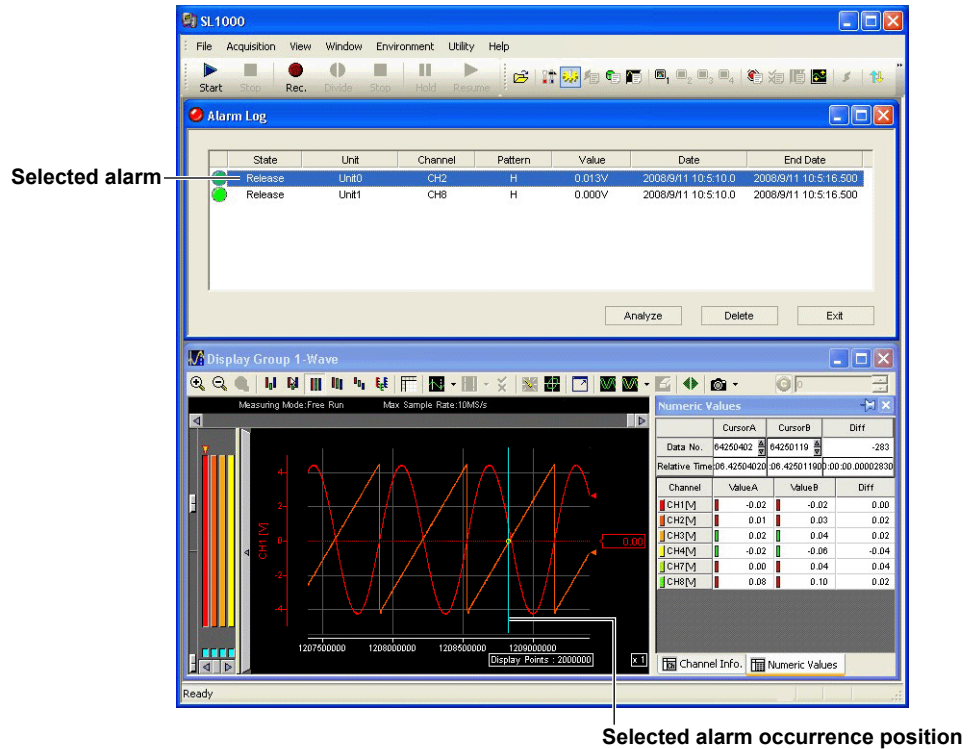
Note

- Up to 2000 alarm logs can be displayed. If more than 2000 alarms occur, the log is deleted in order from the oldest one.
- The alarm log is reset each time you start measurement.

6

Display

# 6.7 Accumulating Waveforms and Displaying Snapshots

You can use the accumulation display to accumulate waveforms and use snapshots to retain waveforms on the screen.

Accumulate

After you start measurement, click the **Accumulate** button, or choose **Accumulate** from the View menu.

The most recent waveform is accumulated over the existing waveforms, which are not erased from the display.

To stop accumulation, click the **Accumulate** button again, or choose **Accumulate** from the View menu.

View menu   **Accumulate button**   **Clear button**
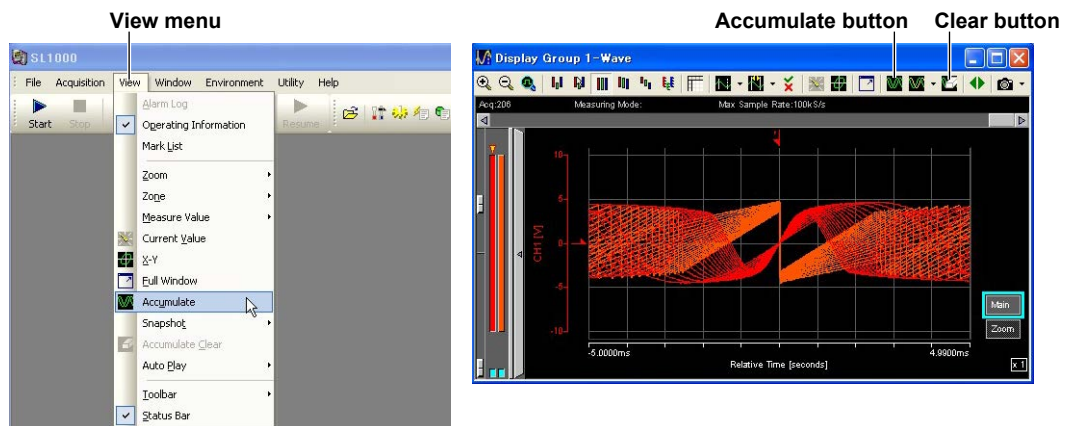
Clearing Accumulated Waveforms

Click the **Clear** button to clear the accumulated waveforms.

Note

- If you click the Accumulate button and then automatically display waveforms from memory, you can accumulate past waveforms.
- You cannot adjust the window size while accumulated waveforms are displayed.
- If you change the waveform display area (for example, by turning the numeric value display on or off) while accumulated waveforms are displayed, all accumulated waveforms will be cleared.

Snapshot

After you start measurement, click the **Snapshot** button, or choose **Snapshot** from the View menu.
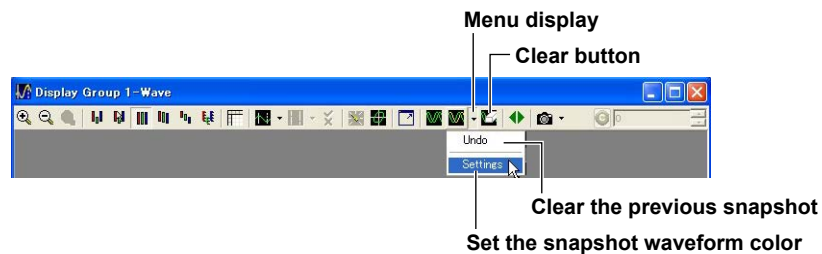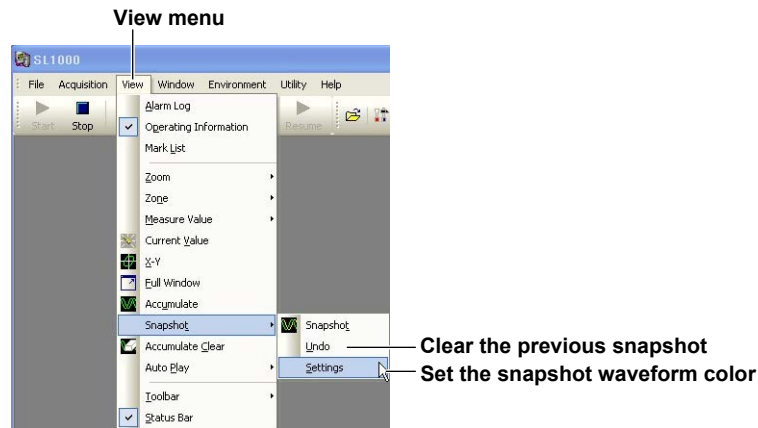
The waveform that was displayed at the time that you clicked the Snapshot button is retained on the screen.

View menu   **Snapshot button**
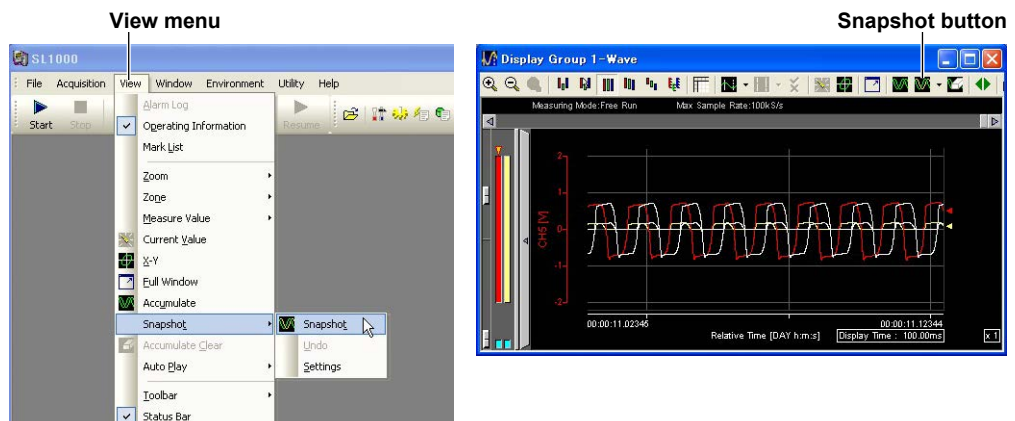
Clearing the Previous Snapshot

To clear a snapshot, click the arrow on the right of the Snapshot button, and choose **Undo**.

The most recent snapshot is cleared.

Changing the Snapshot Waveform Color

To change the snapshot waveform color, click the arrow on the right of the Snapshot button, and choose **Settings**. Specify the color on the snapshot settings screen that appears.

Clearing Snapshot Waveforms

Click the **Clear** button to clear all of the displayed snapshot waveforms.

Note

- You cannot adjust the window size while snapshot waveforms are displayed.
- If you change the waveform display area (for example, by turning the numeric value display on or off) while snapshot waveforms are displayed, all snapshot waveforms will be cleared.

6.8   Setting Marks

You can set marks at specific locations on a waveform screen.
You can only set marks in Free Run mode and when the clock source is set to internal.
You can also edit, delete, and display a list of the set marks. Additionally, if you record measured data that has marks set in it or save such data to file, the mark information is also saved. If you use Xviewer to display the waveform, the marks are also displayed. Xviewer is included with all models, with the exception of /XV0 models.

Setting Marks

While the Display is Updating

After you start measurement in Free Run mode, click the **Mark** button. A dialog box appears. Type the string that you want the mark to display, and click **OK**.
The mark is set at the position where you clicked the Mark button at.
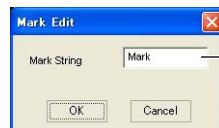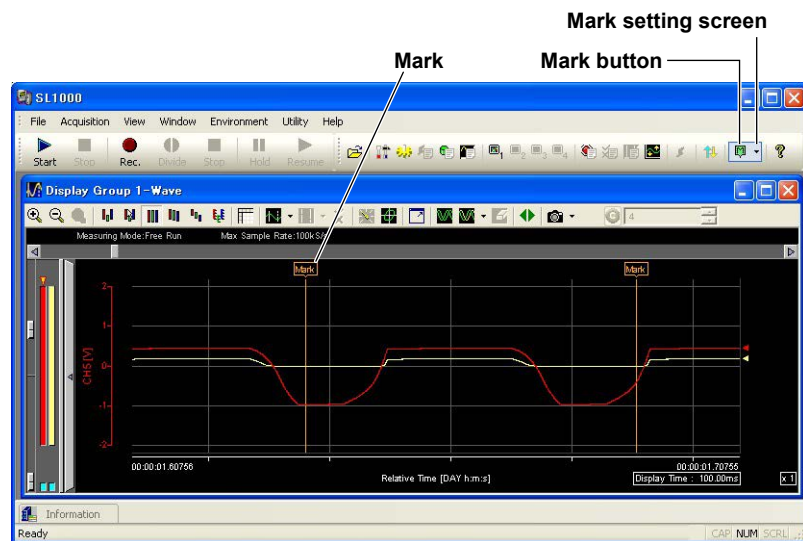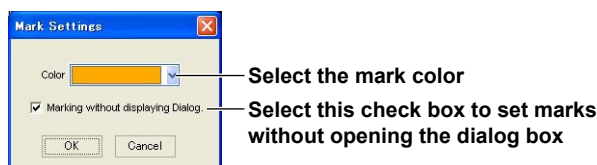

Note
- There is a feature (described later) on the mark setting screen that allows you to set a mark without opening the dialog box. If a mark is set without opening the dialog box when you click the Mark button, this feature is enabled.
- If you move the pointer over a mark, the marked time (point) information appears.

While the Display is Stopped or Held

While the SL1000 is displaying waveforms, click the top of the waveform display area at the position where you want to set a mark. The above dialog box appears. Type the string that you want the mark to display, and click **OK**.

Setting Marks without Opening the Dialog Box and Setting the Mark Color

Click the arrow on the right of the Mark button. The mark setting screen appears.

Select the mark color

Select this check box to set marks without opening the dialog box

Note

- Recorded data does not reflect any edits to the marks that are done after you record the data. Edits include setting marks, changing existing marks, and deleting existing marks. To save such edited data, save the measured data from the file menu.
- You can enter up to 16 characters for the string that you want the mark to display.
- You can set up to 128 marks.

Editing Marks

Double-click the mark that you want to edit. The mark editing screen appears.

You can also display the mark editing screen by right-clicking the mark that you want to edit and choosing **Edit**.

Deleting Marks

To delete a mark, right-click the mark, and choose **Delete**.

Displaying a List of Marks

You can display a list of the marks set for the currently displayed waveform by using one of the following methods.

- Click the arrow on the right of the Mark button, and choose **Mark List**.
- Choose **Mark List** from the View menu.
- Right-click a mark, and choose **Mark List**.

If you double-click a mark on the mark list, the waveform at the position of the specified mark is displayed.
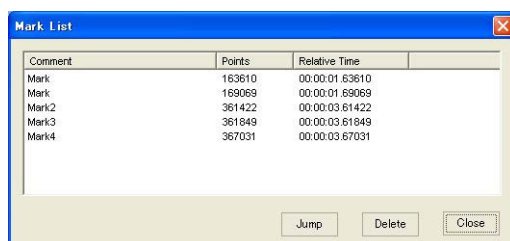
Note

The information displayed on the mark list depends on the time axis unit setting in the display condition settings.

When the time axis unit is Relative, the relative time and the number of data points are displayed. When the time axis unit is Absolute, the absolute time and the number of data points are displayed. When the time axis unit is Points, only the number of data points is displayed.

6.9 Displaying X-Y Waveforms

You can display X-Y waveforms that have a channel assigned to the X-axis, and channels from the same measuring group assigned to the Y-axis.
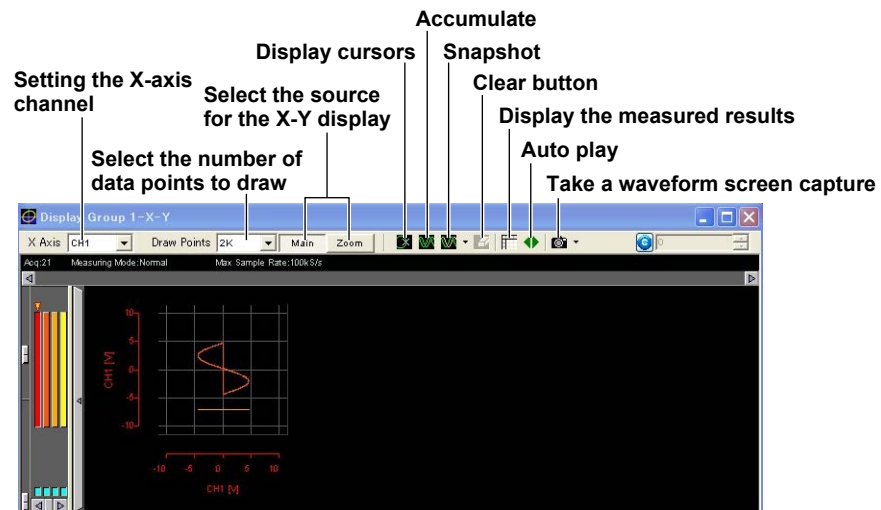
Displaying X-Y Waveforms

Click the **X-Y** button, or choose **X-Y** from the View menu. The X-Y waveforms appear in a different window.
The range of the X-Y display is either the range of the normal waveform display (T-Y display) or the range of the zoomed waveform.
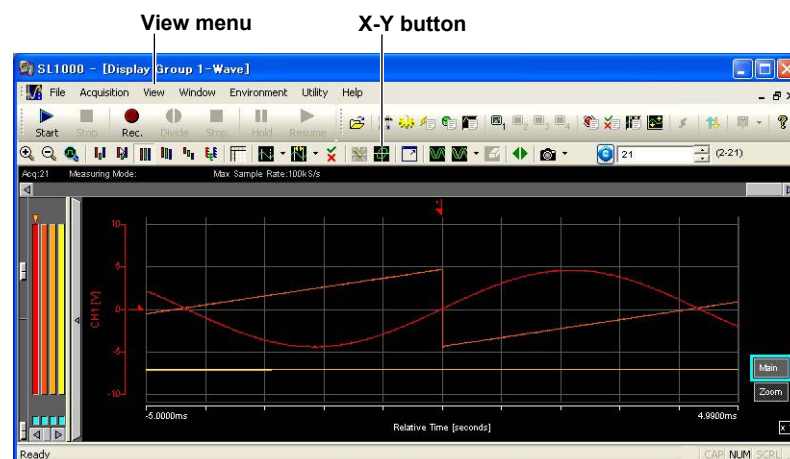
X-Y Display

Maximum Number of Data Points to Draw

You can set the maximum number of data points to draw to 2K (2000), 10K (10000), or 100K (100000). If the number of measured data points is less than the specified number of data points to draw, the SL1000 uses all the measured data that is within the source range to draw the waveform. If the number of measured data points is greater than the specified number of data points to draw, the method used to draw the waveform differs according to the measuring mode.

• In Triggered Mode
The SL1000 draws the waveform by reducing the number of data points to the specified number. This reduction is done by taking the midpoint of the maximum and minimum values of multiple measured data points that are acquired over a set period of time.

• In Free Run Mode
The SL1000 draws the waveform with as much of the most recent measured data as is specified by the number of data points to draw.

Drawing Area (in Triggered mode)

Main: The display range of the normal T-Y waveform is used as the display source.
Zoom: The zoomed range is used as the display source.

Cursor Display

You can display cursors on top of X-Y waveforms, but you cannot move these cursors. To move the cursors, move the corresponding T-Y waveform cursors.

Note

• As with normal T-Y waveforms, you can perform the following operations on X-Y waveforms. Perform cursor measurements, take snapshots, accumulate waveforms, display measured values, save screen captures, and automatically display waveforms from memory.

• In Triggered mode, even if the number of measured data points is greater than the number of data points to draw, the value from the acquired measured data is used when displaying cursor measurements or measured values.

• When displaying data measured in Triggered mode on the X-Y display, if the number of measured data points is greater than the number of data points to draw, the SL1000 displays the waveform by taking the midpoint of maximum and minimum values of the measured data points. When taking cursor measurements, the cursors may be displayed off of the X-Y waveform because the cursors are displayed according to the measured data.

• The channels assigned to the Y-axis are channels that are in the same measuring group as the channel assigned to the X-axis and their waveform display is set to ON in their display condition settings. If you do not want to display a waveform, set its waveform display to OFF or move the waveform to a different display group.

• If there are too many waveforms or too many data points drawn on the X-Y display, the waveform display updating and waveform recording may slow down.
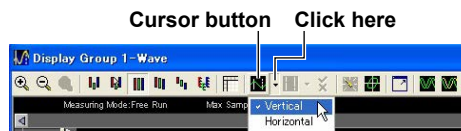
6

Display

7.1   Reading Measured Values Using Cursors

When a waveform is displayed, you can use cursors to read measured values.

Selecting the Cursor

There are two types of cursors: vertical and horizontal.

1. Click the arrow on the right of the Cursor button.

Select the cursor type from the displayed list.

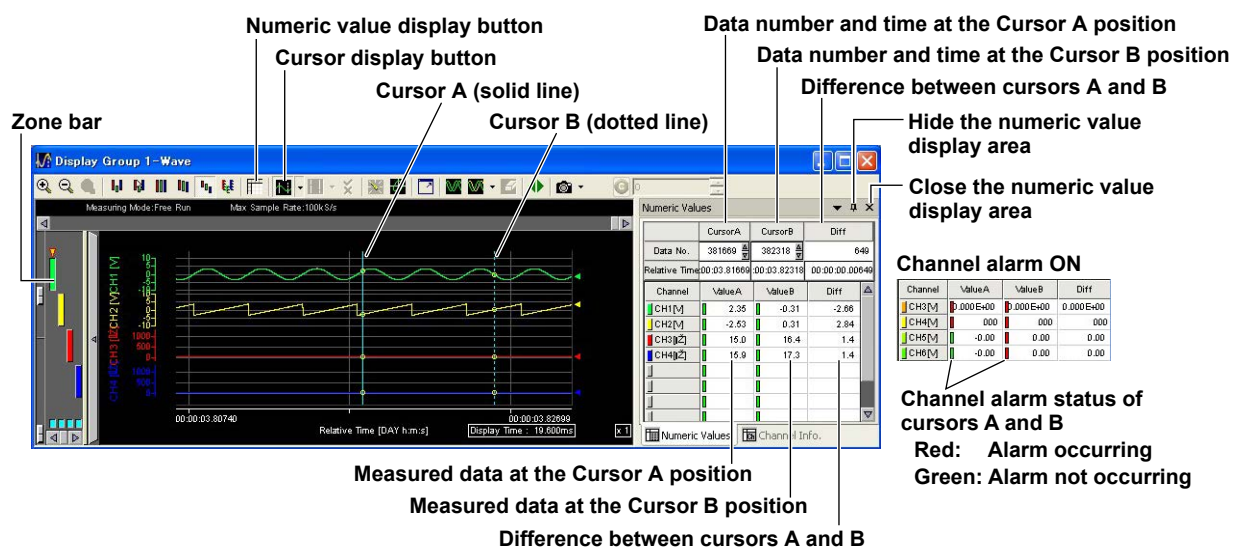**Cursor button   Click here**

Displaying the Cursors

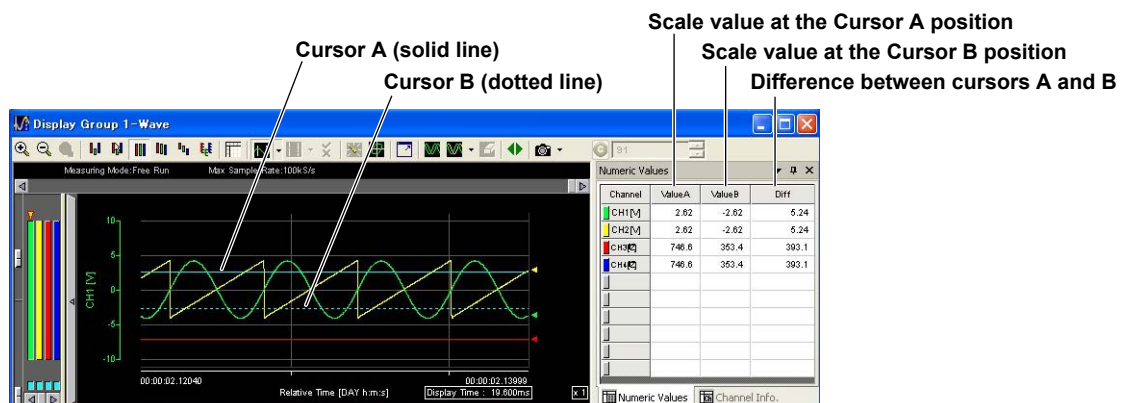**2.** Click the **Cursor** button to display the cursors.

To display cursor values, click the **Numeric Value Display** button.
The cursor values are displayed to the right of the waveform screen.
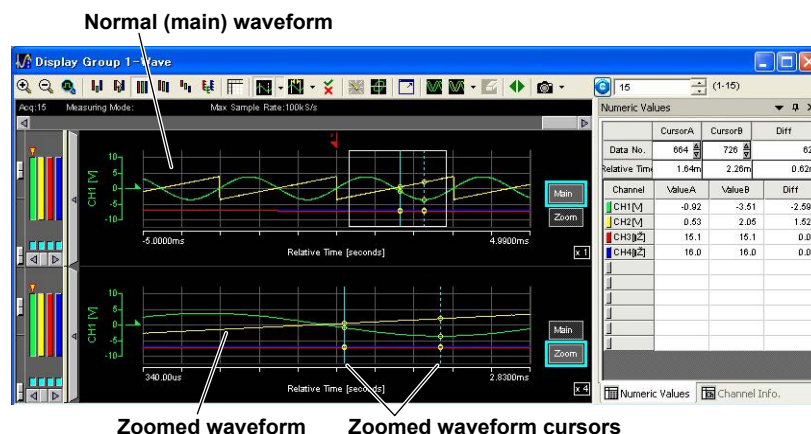
Vertical Cursors

Numeric value display button
Cursor display button
Cursor A (solid line)
Cursor B (dotted line)
Zone bar

Data number and time at the Cursor A position
Data number and time at the Cursor B position
Difference between cursors A and B
Hide the numeric value display area
Close the numeric value display area
Channel alarm ON

Channel alarm status of cursors A and B
Red: Alarm occurring
Green: Alarm not occurring

Measured data at the Cursor A position
Measured data at the Cursor B position
Difference between cursors A and B

Horizontal Cursors

Cursor A (solid line)
Cursor B (dotted line)

Scale value at the Cursor A position
Scale value at the Cursor B position
Difference between cursors A and B

7

Analysis

Zoomed Waveform Cursors in Triggered Mode

Normal (main) waveform

Zoomed waveform   Zoomed waveform cursors

Note

To temporarily hide the numeric value display area, click the 🔲 mark. The numeric value display area closes and the words "Numeric Values" appear on the display frame. Moving the pointer over these words displays the numeric value display area. At this point the mark is changed to 🔲.

If you click 🔲, the icon changes to 🔲, tabs for switching between display areas appear at the bottom of the display area, and the selected display area remains displayed.

Moving the Cursors

Move the cursor by dragging it. The cursor moves on the measured points. If you double-click on the waveform display, cursors A and B will move to 25% and 75% positions on the horizontal axis, respectively.

Pressing the left and right arrow keys on your PC keyboard moves the cursor over the measured data one point at a time. This feature is useful if multiple data points exist within the time corresponding to a dot on the display, such as when measurement is performed at a fast sample rate.

If data measured at different sample rates is displayed in the same waveform screen, the cursor moves at the measured data interval of the active waveform. Be sure to activate a waveform when reading measured values from it using cursors. The active waveform is indicated by a triangular mark that is displayed above the zone bar.

For a zoomed waveform in Triggered mode, if a cursor is displayed at the zoom position, the cursor will also appear on the zoomed waveform. The normal waveform cursor and zoomed waveform cursor move concurrently. If you double-click on the zoom display, cursors A and B will move to 25% and 75% positions on the horizontal axis in the zoom display, respectively.

Notes on Cursor Measurements

- If waveforms measured in different measuring groups are displayed in the same display group, waveforms with different sample rates will be displayed on a single screen. If you are measuring these waveforms using vertical cursors, the cursor values of the waveform that does not have a measured point at the cursor position will be displayed using the measured value at the closest cursor position.
- Data cannot be acquired if measurement is performed at a sample rate that exceeds the maximum sample rate of a module. When the data cannot be acquired, it is set to the same value as the previously acquired data. Therefore, the measured value may not change even if you move the vertical cursor.
- If waveforms are displayed using Auto zone (see section 6.2), horizontal cursors cannot be used.

7.2 Computing Waveform Parameters (Triggered Mode)

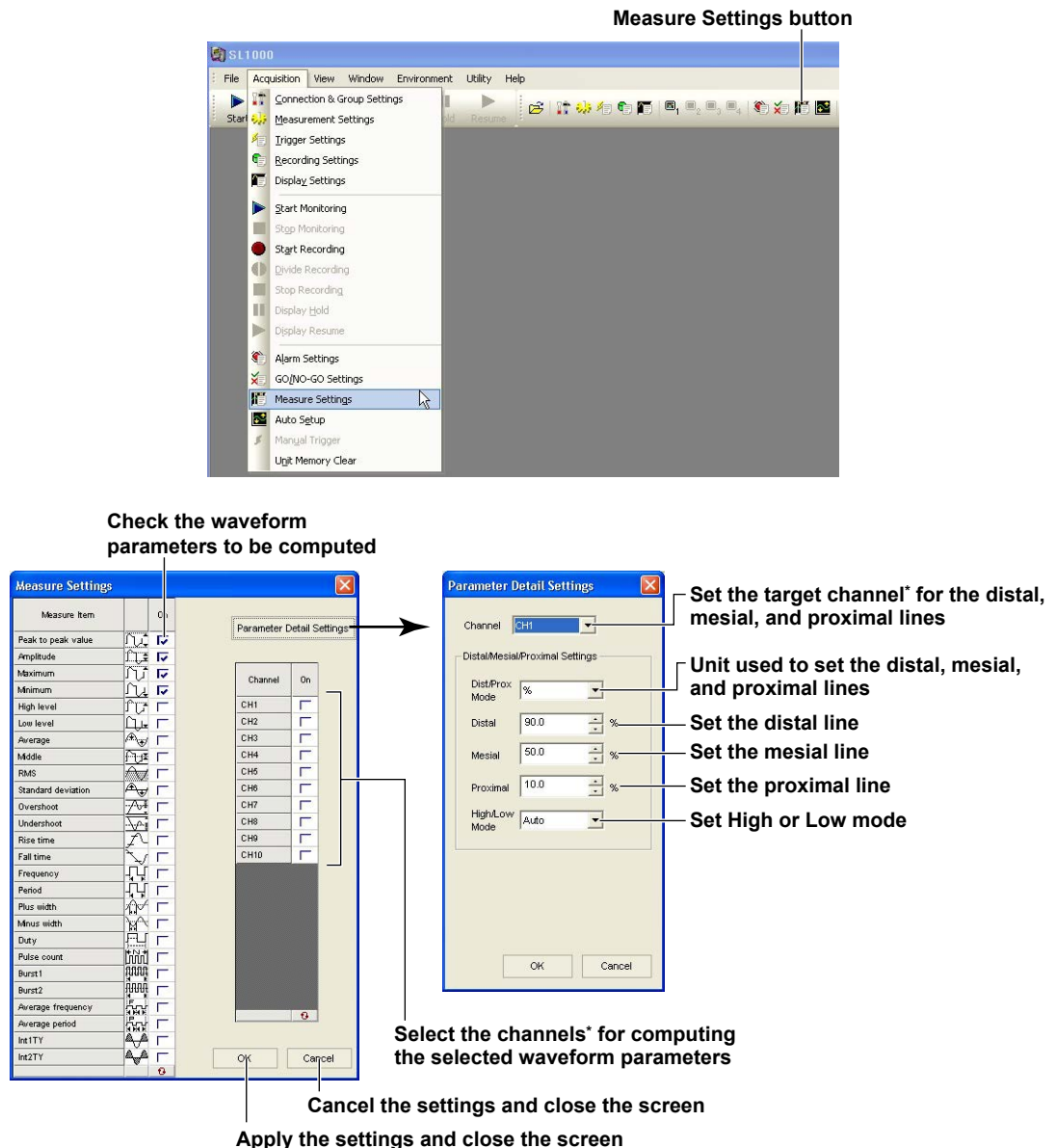This section explains how to automatically compute 26 types of waveform parameters and display the computed results.

This function is available when the measuring mode is set to Triggered Mode.

Selecting the Waveform Parameters to Be Computed

The waveform parameters selected here will be computed.

1. Click the **Measure Settings** button on the toolbar or choose **Measure Settings** from the Acquisition menu.

A screen for setting the waveform parameters to be computed is displayed.

Measure Settings button

Check the waveform parameters to be computed

Set the target channel* for the distal, mesial, and proximal lines

Unit used to set the distal, mesial, and proximal lines

Set the distal line

Set the mesial line

Set the proximal line

Set High or Low mode

Select the channels* for computing the selected waveform parameters

Cancel the settings and close the screen

Apply the settings and close the screen

* You can select up to 128 channels when eight units are linked for synchronous operation.

Parameter Detail Settings

Specify settings related to the distal, mesial, and proximal lines as well as high and low levels for each channel.

Dist/Mesial/Prox Mode

Select the method of assigning the three levels that are used as references in measurements such as the rise and fall times.

*   %

    Assuming the high and low levels of a channel to be 100.0% and 0.0%, respectively, set the desired distal, mesial, and proximal values as percentages.

Selecting the High/Low Assignment Method (High/Low Mode)

High indicates the 100% level in measurements such as the rise or fall time, and Low indicates the 0% level. Select how the high and low levels are assigned from the following two methods.

*   Auto

    The higher amplitude level is set to high and the lower level is set to low based on the frequency of occurrence of waveform voltage levels within the measuring range, taking into account the effects of ringing and spikes. This method is best-suited for measuring rectangular waveforms and pulse waveforms.

*   MAX-MIN

    Sets High to the maximum value of the measuring range, and sets Low to the minimum value. This method is best-suited for measuring sine waveforms, ramp waveforms, etc. It is not suited for measuring waveforms with ringing and spikes.

Computed Parameters

The following waveform parameters are computed.

Voltage Axis Parameters

P-P: P-P value (Max – Min) [V] (Peak to peak value)[*]

Max: Maximum voltage [V] (Maximum)[*]

Min: Minimum voltage [V] (Minimum)[*]

RMS: RMS value $\frac{1}{\sqrt{n}}\{\Sigma(xi)^2\}^{1/2}$ [V]

Average: Average voltage $\frac{1}{n}\Sigma xi$ [V]

Under shoot: (Low – Min)/(High – Low) × 100 [%]

Over shoot: (Max – High)/(High – Low) × 100 [%]

High: High voltage [V]

Low: Low voltage [V]

Amplitude: (High – Low) [V]

Middle: (Max + Min)/2

Standard deviation:

$$\{\frac{\Sigma xi^2}{n} - (\frac{\Sigma xi}{n})^2\}^{1/2} \text{ [V]}$$
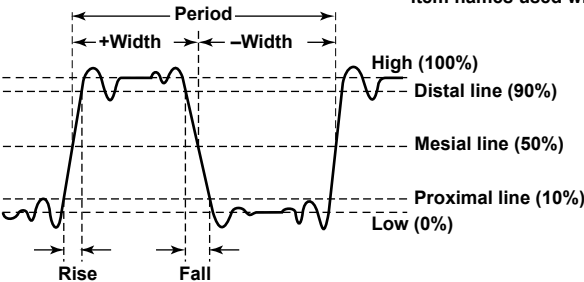
[*] The characters inside the parentheses are measurement item names used when displaying the measured values.

Time Axis Parameters

Rise: Rise time [s]
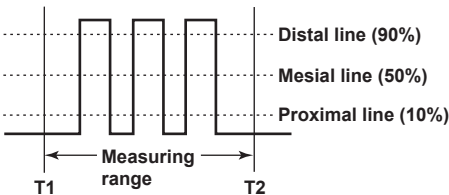
Fall: Fall time [s]

Freq: Frequency [Hz] 1/Period

Period: Period [s]

Avg Freq: Average frequency within
            the measuring range [Hz]
(Average frequency)[*]

Avg Period: Average period within the measuring range [s]
(Average period)[*]

+Width: Time width above the mesial value [s]
(Plus width)[*]

−Width: Time width below the mesial value [s]
(Minus width)[*]

Duty: Duty cycle + Width/Period × 100[%]

  [*] The characters inside the parentheses are measurement
       item names used when displaying the measured values.
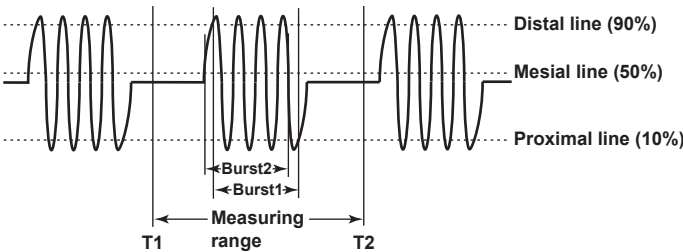

Pulse count

For Pulse = 3
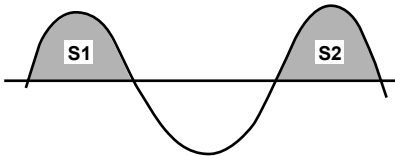

Burst1, Burst2: Burst width [s]

Other Parameters

Int1TY: The area of the positive amplitude

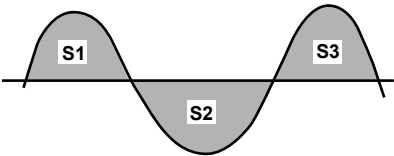Int2TY: The area of the positive amplitude – the area of the negative amplitude

Int1TY
Total area for positive side only: S1 + S2

Int2TY
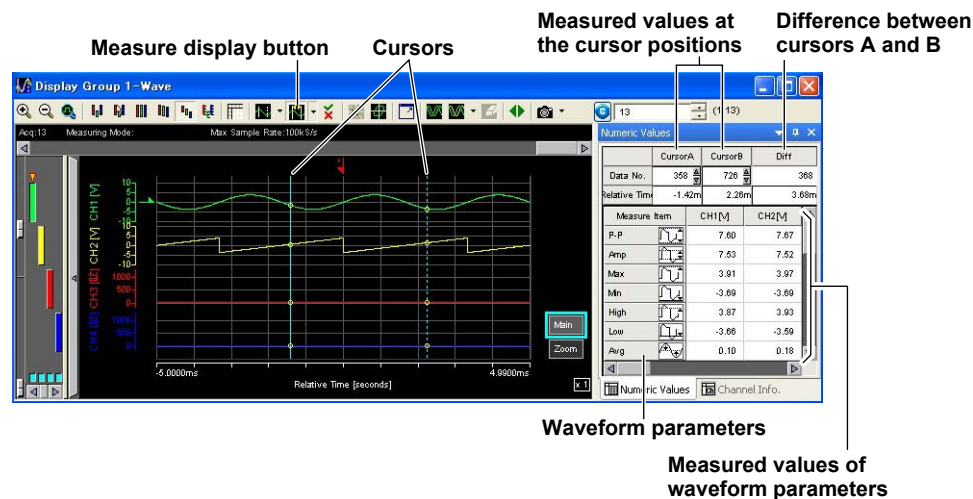**Total area for both positive and
negative sides: S1 + S3 – S2**

Setting the Computing Range

On the waveform screen of display group 1, click the **Measure Display** button. Cursors for setting the computing range appear.

The range between the cursors is the computing range. Drag the cursors to set the computing range.
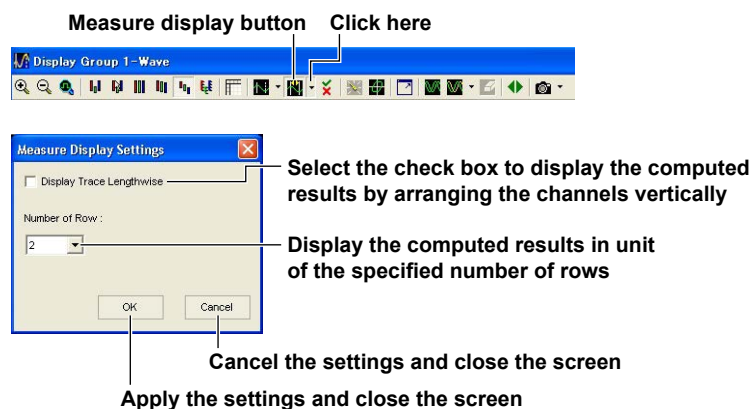

Measure display button **Cursors** **Measured values at the cursor positions** **Difference between cursors A and B**

Waveform parameters

Measured values of waveform parameters

The data number and time at the cursor positions are displayed in the cursor value display area.

Note

• Computation is not performed on channels whose measured points in the computing range exceed 10 M.

• Waveform parameter values are displayed only on the waveform screen of display group 1. The Measure Display button is disabled on the waveform screens of display groups other than display group 1.

Selecting the Computed Results to be Displayed

On the waveform display screen of display group 1, click the arrow next to the Measure display button. A dialog box used to select the computed results to be displayed and display format appears.

Measure display button **Click here**

Select the check box to display the computed results by arranging the channels vertically

Display the computed results in unit of the specified number of rows

Cancel the settings and close the screen

Apply the settings and close the screen

Displaying Computed Results

When measurement is started, the waveform parameter values in the numeric value display area in the waveform screen of display group 1 are updated.
If the waveform parameter values are not displayed, click the **Measure Display** button in the waveform screen of display group 1. The waveform parameter values will be displayed.

Measure display button
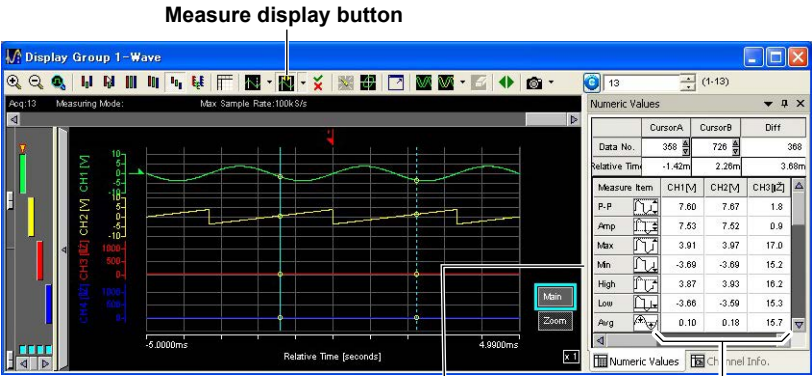
Drag the frame to change the ratio of the waveform display area to the numeric value display area

Displayed in unit of the specified number of rows (Example when set to 3 rows)

If the channels are arranged vertically
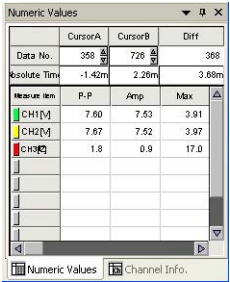
Note

- Waveform parameter values are displayed only in the waveform screen of display group 1.
- If the P-P value on the waveform parameter source channel is less than 5% of the range, time axis waveform parameters cannot be computed.
- Computation on time-related waveform parameters (rise time, fall time, period, plus width, minus width, Burst1, and Burst2) may not be possible if the sample rate is too low for the target waveform. If this is the case, "*sampling interval value*>" will appear for the computed result.
- When the display is held, waveform parameter computation is not performed, and "***" appears.

8.1   Saving and Loading Measured Data

The auto recording function explained in chapter 5 records measured data to a specified hard disk automatically as soon as measurement and recording are started. This chapter explains how to save measured data that has already been acquired to any location and how to display the measured data that has been saved.

Saving Measured Data

With measurement stopped, choose **Save Waveform** from the File menu.
Specify the destination and file name. The measured data is saved in .wdf format

File Format
YOKOGAWA waveform file: The extension is .wdf. You can display the waveform in Xviewer.

ASCII file: The extension is .csv. The data is saved in comma-separated, ASCII format. This applies to versions 2.10 and later.

Binary file: The extension is .bin. The data is saved in floating-point format. You can load the file into data analysis software such as MATLAB. This applies to versions 2.10 and later.
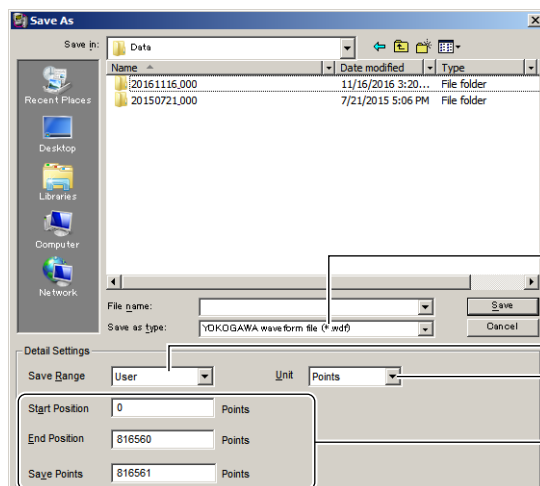
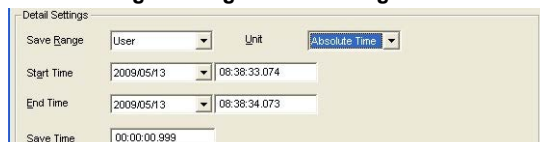**Select the file format**

Set the range to save

Set the unit to use when setting the range to save (when you select to manually specify the range)

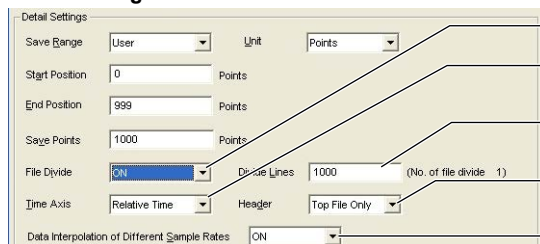**Set the range to save (when you select to manually specify the range)**

When setting the range to save using relative time

When setting the range to save using absolute time

When saving a file in ASCII format

Select whether or not to divide files

Select whether or not to add time axis information

Set the division unit to use when dividing files

Select whether or not to add header information

Select whether or not to interpolate data with different sample rates

8

Saving, Loading, and Transferring Data

The Range to Save (Versions 2.10 and later)

You can set the range to save.

All:
In Free Run mode, the SL1000 saves all the measured data that is stored in the SL1000 unit's internal memory. In Triggered mode, the SL1000 saves the measured data that is displayed at the time that you save the data.

Display:
The SL1000 saves the measured data that is in the displayed range. You can select this option when the SL1000 is in Free Run mode.

Zoom Display:
The SL1000 saves the measured data that is in the zoomed range. You can select this option when the SL1000 is in Triggered mode.

Cursor:
The SL1000 saves the measured data that is between the cursors. You can select this option when cursors are displayed.

User:
The SL1000 saves the measured data that is in the specified range. Set the range of data to save using points or time.

> Data points:
> Set the range of data to save using points. Specify the range of data to save by specifying the start point and the end point or the number of data points to save.
>
> Absolute time:
> Set the range of data to save using date and time. Specify the start time and the end time or the length of time.
>
> Relative time:
> Set the range of data to save by specifying the relative time from the start of measurement. Specify the start time and the end time or the length of time.

When saving data to a file in ASCII format, you can include header or time-axis information. You can also divide the file. These operations are the same as when you convert files using the File Utility. For details, see section 10.6, "Converting Waveform Data Files to CSV or Binary Files."

In Free Run mode, measured data stored in the SL1000 memory is saved. In Triggered mode, measured data shown on the display is saved.

Note

- If waveforms of different display groups are displayed in Triggered mode, the data of the display group that is shown in the active window is saved.
- During synchronous operation, the SL1000 saves measured data to a file for each unit whose channel is selected for recording. "0-" (the unit number and hyphen) is added in front of the specified file name.
- When saving data in Triggered mode with the range to save set to All, the number of points saved is 0.1% greater than the number of measured points that is specified in the measurement conditions. For example, if the number of measured points is set to 10,000, the number of points saved is 10,010.
  When you save data under any other conditions, the number of measured points set in the measurement conditions are saved.
- In version 2.10 or later, mark data is also saved to the text file. The file name is the same as that of the measured data file.
- If you save data at different sample rates in Free Run mode, the maximum measuring time given in appendix 2 may be exceeded on channels whose sample rate is set high.
  In such cases, as much of the most recent data as is specified by the maximum measuring time is saved.

Loading Measured Data

On the File menu, choose **Open**.

In the Open dialog box, select YOKOGAWA waveform file (*.wdf) for the Files of Type, and specify the file you want to open.

Xviewer, a software appliocation provided with the SL1000, starts, and the waveform is displayed.

For details on operating the Xviewer application, see the user's manual.

Note

- Waveforms cannot be displayed on a PC without Xviewer installed. If you have a model without Xviewer (/XV0 option), please purchase Xviewer separately.
- If you load a measured data file that contains mark data into Xviewer version 1.44 or later, the marks will be displayed.
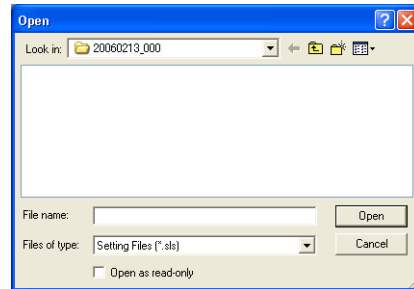
8.2　Saving and Loading Setup Data

The settings of this software and the SL1000 can be saved to a file, and setup data saved in the past can be loaded to change the settings.

Saving Setup Data

From the File menu, choose **Save As** or **Save.**

To save by specifying a name, set Save as type in the Save As dialog box to Setting Files (*.sls) and specify the destination and file name.

Note ───

One setup file is created during synchronous operation as well.

──

Loading Setup Data

From the File menu, choose **Open**.

In the Open dialog box, select Setting Files (*.sls) in the Files of Type list, and specify the file you want to open.

If the settings of the selected setup file differ from those of the connected SL1000 system, a message is displayed along with corrective actions that can be taken. Select any of the corrective actions.

For details, see section 2.4.

The corrective actions and their descriptions are given below.

| Corrective Action	Description
Go system wizard. (Display the previous settings in offline.)	The software loads only the settings without connecting to the SL1000 and displays the Connection & Group Settings screen. You can change the settings, such as the measurement conditions, offline. Search for SL1000s on the Connection & Group Settings screen. If an SL1000 is found, the settings on the SL1000 are updated with the settings you specified offline. However, updating is not possible if the connection and group settings of the detected SL1000 and those specified offline are different. If the detected SL1000 is measuring or recording, the message "On measuring (recording) Units are found" is displayed. Select Get settings from the unit or Stop measuring and send settings to the unit.
Get settings from the unit.	Discard the channel assignments to measuring groups or individual channel settings that were loaded and receive the channel assignments to measuring groups or individual channel settings from the SL1000. The measurement or recording on the SL1000 continues.
Stop measuring and send settings to the unit.	If the SL1000 is measuring or recording, the settings cannot be updated. Therefore, stop the measurement or recording and update the SL1000 settings using the settings of this software.

8.3 Saving the SL1000's Data to Your PC

There are two ways to save the data of the SL1000. One is to save using the File menu. The other is to use the FTP function.

Saving All the Waveform Data in the Internal Memory of the SL1000 to Your PC

From the File menu, choose **Save Unit Memory Waveform**.
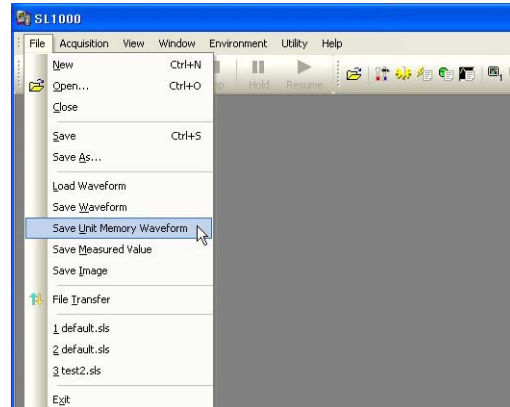
Set the destination and file name.
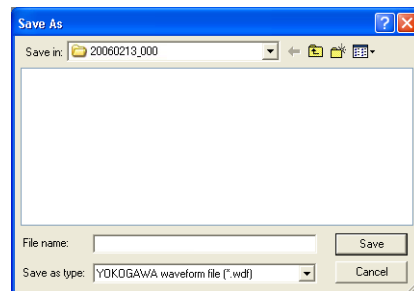
All the measured data in the internal memory of the SL1000 are saved to the PC. The measured data that is saved is the measured data from when the measurement was started until the measurement was stopped in Free Run mode and the history data measured in Triggered mode.

Note

- History data is the measured data that is acquired each time the trigger condition is met after measurement is started in Triggered mode. The data of up to the most recent 5000 waveforms can be saved.
- When a measurement is started, previously acquired measured data is cleared.
- To average history data measured in trigger mode and save it as a single waveform data file, see section 8.4.

Saving Data Using FTP

You can save the data on the internal hard disk (option) of the SL1000 to your PC using the FTP function.
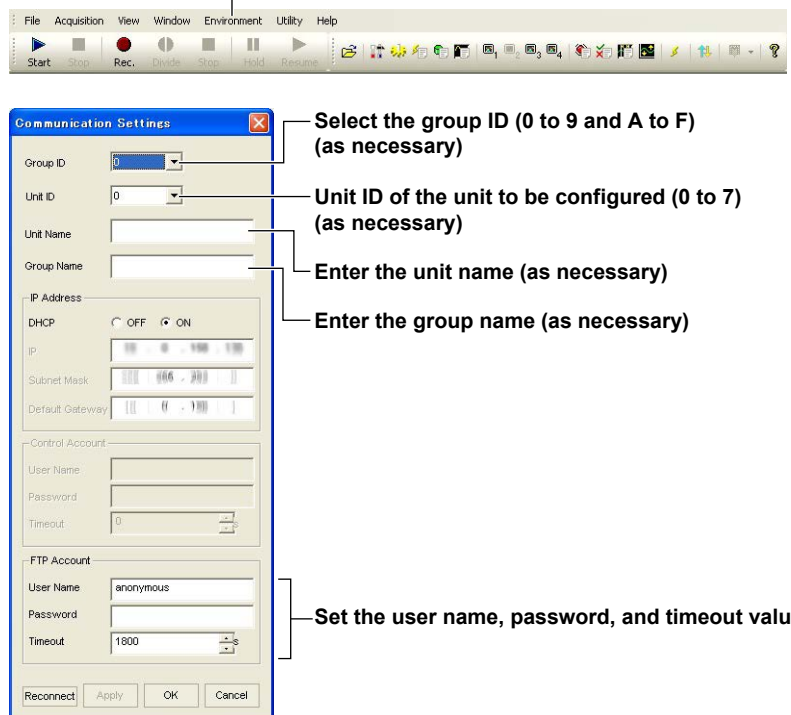This function is valid if the SL1000 is connected to your PC via the Ethernet interface (option).
Your PC must also have an FTP client installed.

From the Environment menu, choose **Communication Settings**.
Set the FTP account.

Show the Environment menu

Select the group ID (0 to 9 and A to F) (as necessary)

Unit ID of the unit to be configured (0 to 7) (as necessary)

Enter the unit name (as necessary)

Enter the group name (as necessary)

Set the user name, password, and timeout value

Start an FTP client on your PC, type the IP address of the SL1000 you want to connect to as well as the user name and password that you specified in the FTP account settings, and connect to the SL1000 on the network.
Use your FTP client to download the desired files to your PC.

Note

You cannot connect both Ethernet and USB interfaces simultaneously to an SL1000. You cannot connect to the SL1000 that this software is connected to via USB, using FTP.

8

Saving, Loading, and Transferring Data

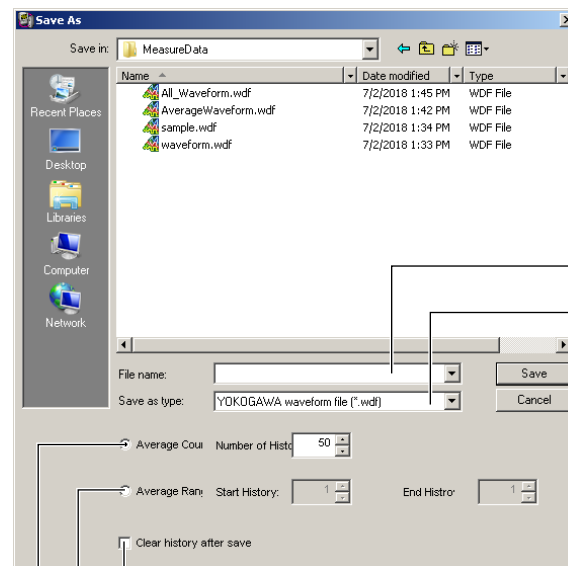## 8.4 Averaging and Saving History Data

This section explains how to average multiple data values recorded in section 5.5 and save them to a single file.

Averaging and Saving History Data

When measurements are complete, on the File menu, click **Save Average** Waveform.
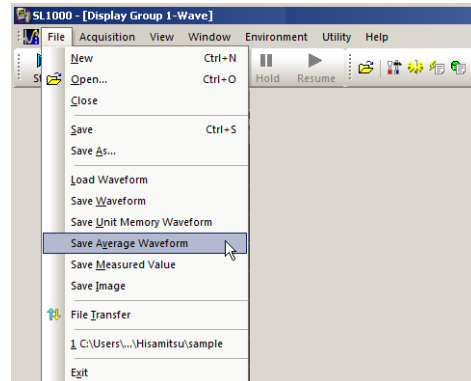
Set the save destination, file name, and averaging conditions.

Enter the file name.

Select the file format.

Select this check box to clear the history data after averaging and saving the data.

Set the average range.
The maximum number of history data entries in the average range is 5000.
    : Start history
      Set the acquisition number of the first history data to be averaged.
    : End history
      Set the acquisition number of the last history data to be averaged.

Set the average count.
  : Number of history (1 to 5000)
    Set the number of history data entries to be averaged.

Entering the File Name

There are no identification symbols that indicate saved averaged data, so enter a file name that allows you to identify it.

File Format

YOKOGAWA waveform file: The extension is .wdf. You can display the waveform in Xviewer. ASCII files and binary files are not supported.
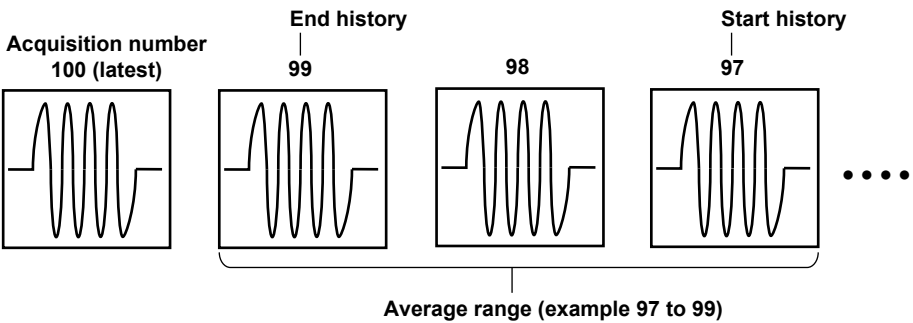
Setting the Average Count

The specified average count (number of history entries) of history data from the last acquisition number (latest data) is averaged and saved.
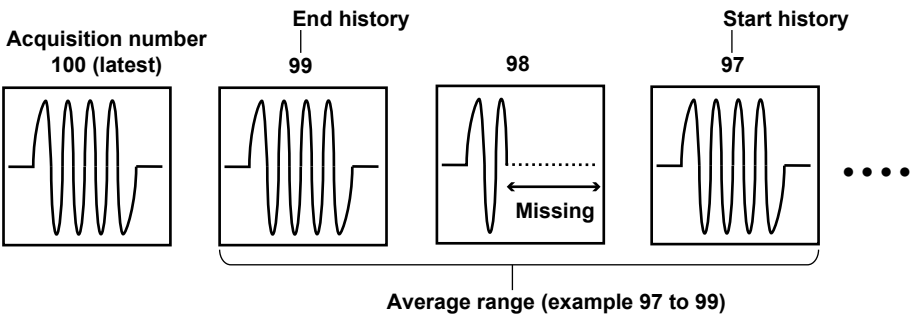

Average count (example: 4)
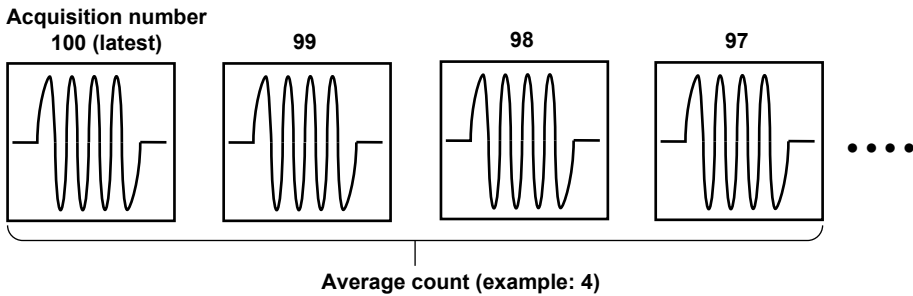
Setting the Average Range

The specified average range of data from Start history (oldest data) to End history (newest data) is averaged and saved.

Average range (example 97 to 99)

Averaging When There Is Missing Data

If the history data specified by the average count or range contains partially recorded data, data excluding those in the unrecorded sections is averaged and saved.

Average range (example 97 to 99)

In the above example, the average count is 3, but because there is missing data in the history data of acquisition number 98, the average count of the section with missing data is 2 (97 and 99 are averaged).
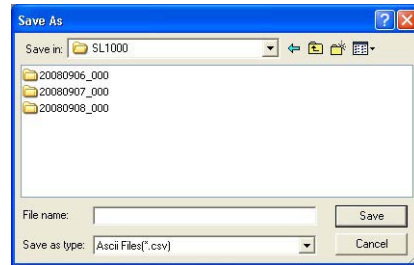
Note

- History data recorded on the same channel can be averaged and saved.
- The save average function is valid during independent operation.
- Save average is performed on channels whose Rec check box in the measurement settings (section 4.2, for example) is selected.

8

Saving, Loading, and Transferring Data

8.5 Saving Computed Data

This section explains how to save the computed results of waveform parameters that were analyzed in chapter 7.

Saving Computed Data

When measurement is finished, choose **Save Measured Value** from the File menu. Set Save as type in the Save As dialog box to ASCII Files (*.csv), and specify the destination and file name. The computed data is saved to a text file in CSV format.

Example of a Computed Data File

Note

- Computed data contains the computed results of waveform parameters that were enabled at the start of measurement. It does not contain the results of computations that were performed while measurement was stopped.
- Computed data is cleared if:
  - You execute Clear Unit Memory.
  - You add or delete source channels or waveform parameters to compute.
- During synchronous operation, one file that contains the computed data of all linked units is saved.

8.6 Saving Waveform Screen Captures

You can save screen captures of waveforms during measurement or after measurement is stopped.
You can choose the command from the File menu or click the Snapshot button.

Saving Waveform Screen Captures

From the File menu, choose **Save Image**.
Set the file type to Bitmap Image (*.bmp) or PNG Image (*.png), and specify the destination and file name.
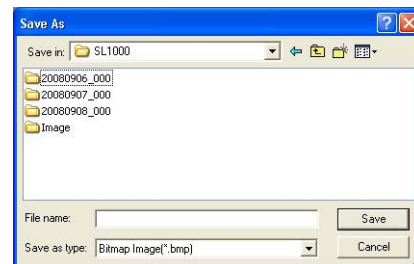
Taking a Snapshot with the Snapshot Button

1. Click the arrow on the right of the Snapshot button.
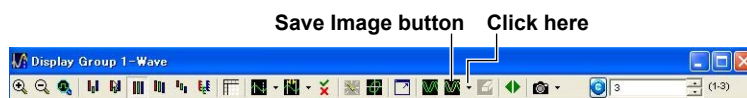
2. Set the file type to BMP or PNG, and specify the destination. The file will be named automatically.
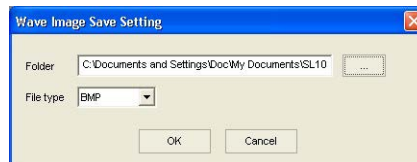
3. Click the **Snapshot** button.

Every time you click the Snapshot button from this point, the waveform screen capture is saved to the specified destination.

File Name

When you take screen captures using the snapshot button, a file name that consists of the display group number followed by a sequence number is automatically assigned to the saved files. When the sequence number exceeds 99999, it returns to 00000, and old data is overwritten.

D1_00000

Sequence number (00000 to 99999)

Display group number (D1 to D4)

8

Saving, Loading, and Transferring Data

8.7 Transferring Files between the SL1000s and the PC

This section explains how to transfer files that have been recorded in synchronous operation mode collectively to the PC or how to transfer files between one SL1000 and the PC by specifying files and folders.

Using the File Transfer Function

Click the File Transfer button, or choose **File Transfer** from the File menu.

Show the File menu   **File Transfer button**

The File Transfer screen appears in a separate window.

Sync. transfer mode (valid only during synchronous operation)
Single transfer mode
Upload
Download
Refresh with the Latest Data
Delete   **Move to a higher-level folder**
Create a folder   **Close the File Transfer screen**
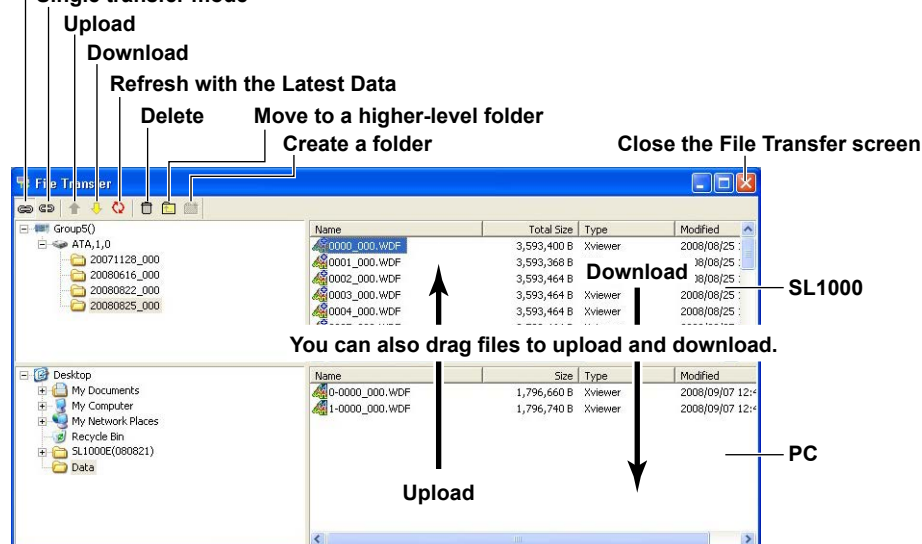
Sync. Transfer Mode

This mode is only valid in synchronous operation mode. The files of all linked units are transferred collectively to the PC with a single operation.

Single Transfer Mode

Transfer files one unit at a time.

Upload

Transfers files from the PC to the SL1000.

Download

Transfers files from the SL1000 to the PC.

How Files Appear and How They Are Transferred

In Sync. transfer mode, files and folders at the same absolute path in each linked unit's file system are consolidated and displayed under the appropriate group ID.

If a file exceeds 2 GB and is divided into multiple files using sequence numbers, the first file with the name "0000_000.WDF" is displayed. A ⊕ is shown on the icon of this file.
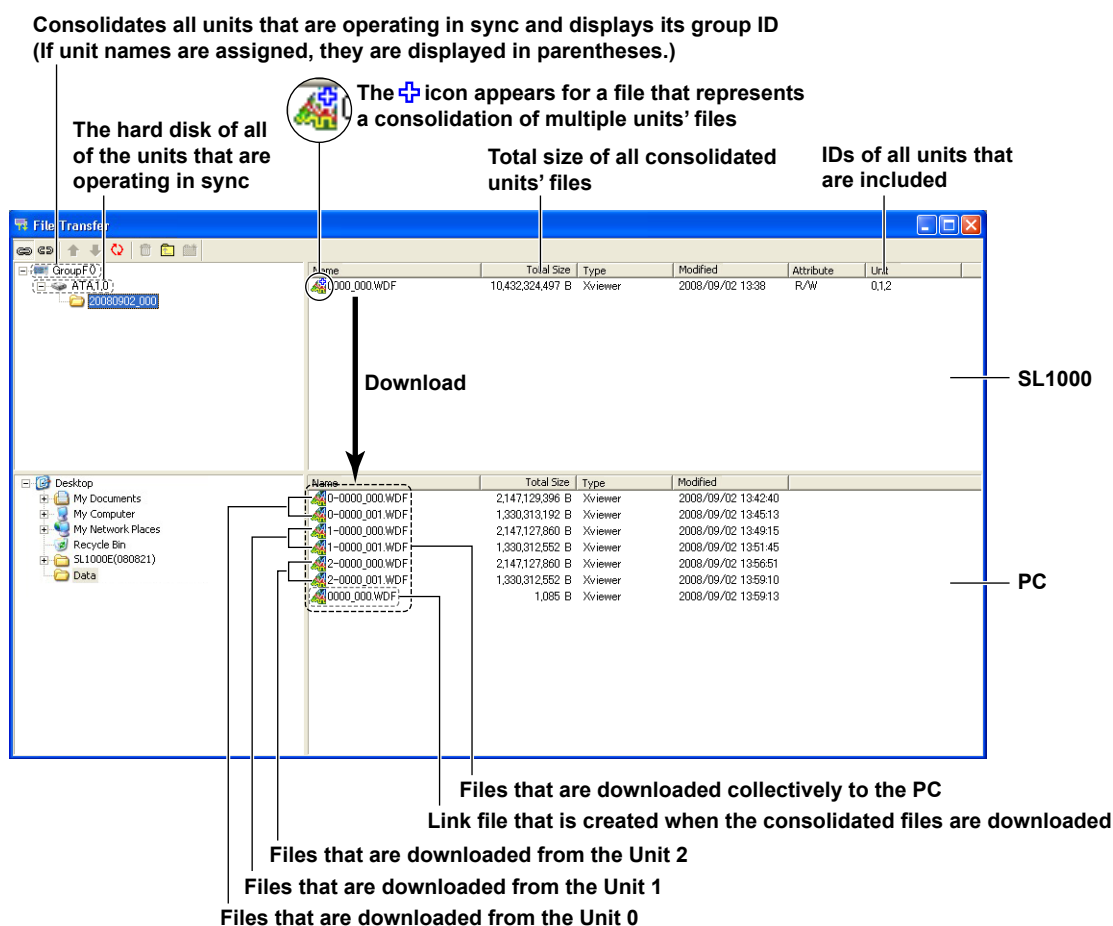
When you download a file that represents multiple files that have been consolidated, all of the consolidated units' files are transferred to the PC. The ID of the unit that contains the files is added to the front of the names of the downloaded files. For example, if the unit ID is zero, the file name is "0-0000.WDF" ("0-0000_000.WDF" if the file size exceeds 2 GB and the file is divided).

If the Auto File Merge (Synchronous Operation) check box under Start-up Options in Environment Settings is selected, a link file that merges the downloaded files is created in the same folder. The name of the link file is the same as that of the corresponding file in the unit. However, if a file exceeds 2 GB, a sequence number is added, and the file name is "0000_000.WDF."

Consolidates all units that are operating in sync and displays its group ID
(If unit names are assigned, they are displayed in parentheses.)

The ⊕ icon appears for a file that represents a consolidation of multiple units' files

The hard disk of all of the units that are operating in sync

Total size of all consolidated units' files

IDs of all units that are included

Download

SL1000

PC

Files that are downloaded collectively to the PC
Link file that is created when the consolidated files are downloaded
Files that are downloaded from the Unit 2
Files that are downloaded from the Unit 1
**Files that are downloaded from the Unit 0**

Note

- You cannot delete, upload, or create a folder on the SL1000s while recording is in progress.
- You cannot download the file that is being recorded to.
- You cannot download files that have been automatically divided when a recording file size exceeds 2 GB until the recording of all divided files is finished.
- In Sync. transfer mode, you cannot upload files from the PC to the SL1000s or create folders on the SL1000s.

8

Saving, Loading, and Transferring Data

9.1   Synchronizing the Clock with Your PC

You can synchronize the clock of the SL1000 to your PC's clock.
This is effective when you want to make measurements by minimizing the time difference between the measured data and the PC.

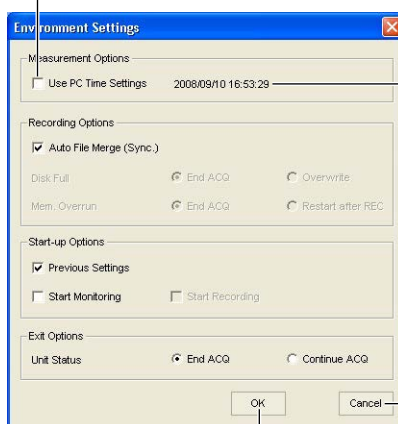*1.* From the Environment menu, choose **Environment Settings**.
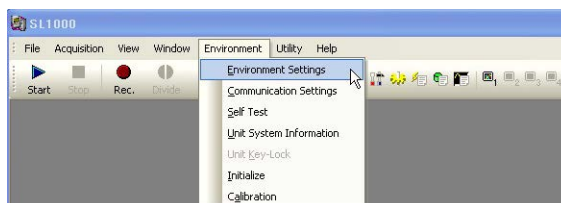
2. Select the **Use PC Time Settings** check box.

3. Click **OK**.
When you click the OK button, the SL1000 clock is synchronized to the PC's clock. From this point, the clock is synchronized every time you start measurement.

Displays the date/time of SL1000

Select the check box to synchronize with the date/time of your PC

Cancel the settings and close the screen

Click OK
**Changes to the date/time of your PC when starting the measurement**

Note

The date/time on the SL1000 is set to the date/time in Japan by factory default.

9.2 Automatically Merging Recorded Files (Only during synchronous operation)

This section explains how to automatically create a link file that virtually merges (see section 10.3 for details) recording files of all units operating in sync.

1. From the Environment Menu, choose **Environment Settings**.
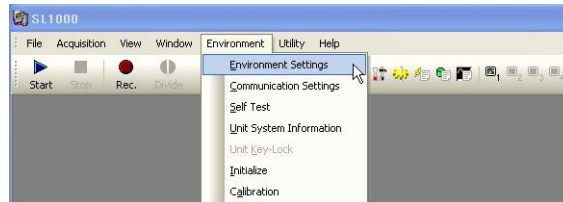
2. Select the **Auto File Merge (Synchronous Operation)** check box.

3. Click **OK**.
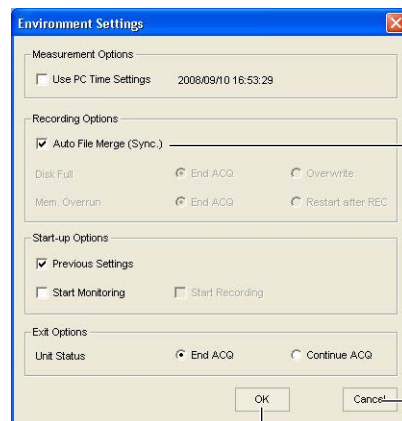
When the recording destination is set to PC HDD, select the check box to automatically create a link file that virtually merges during synchronous operation.

Cancel the settings and close the screen

Apply the settings and close the screen

Auto File Merging

This setting is valid when the recording destination is set to PC HDD. This function automatically creates a link file that virtually merges the files of all units operating in sync. For example, if three SL1000s are operated in sync, the following files are created on each unit: 0_0000.wdf, 1_0000.wdf, and 2_0000.wdf. At this point, a link file named 0000. wdf that virtually merges these files is automatically created.
Auto file merging is enabled by factory default.

Note

- When the Auto File Merge check box is selected, a link file that virtually merges files is also created when you:
  - Choose Save Waveform from the File menu.
  - Execute sync transfer using the file transfer function (see section 8.7 for details).
- If the auto recording destination is set to PC HDD in Free Run mode and you select the Auto File Merge check box, the possibility of recording buffer overrun to occur increases depending on the recording conditions. In these cases, you may be able to avoid recording buffer overrun by clearing the Auto File Merge check box.

9.3 Setting the Software Start-up Options and Exit Options

Set the operation of this software when it is started or closed.

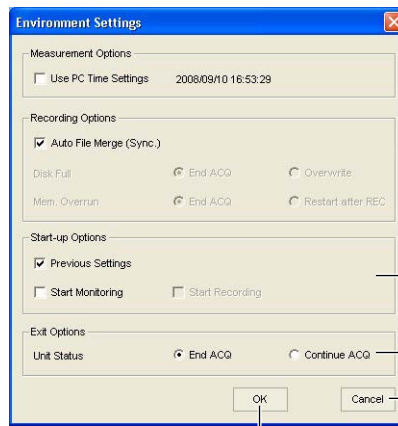1. From the Environment menu, choose **Environment Settings**.
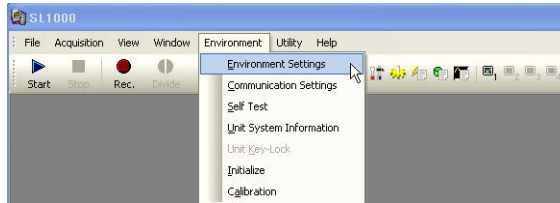
Set the start-up options and exit options.

Set the start-up options
Set the exit options
Cancel the settings and close the screen
Apply the settings and close the screen

Start-up Options

Select from the following:

Previous Settings: Starts the software with the settings that were used when the software was closed the last time.This option is useful if you want to make measurements using the same system configuration as the last time.

Start Monitoring: Starts measuring as soon as this software is started.

Start Recording: Starts measuring and recording as soon as this software is started.

Note

- If you start the software with the Previous Settings check box selected and the system configuration and the settings of the setup file are different, a message and corrective action are displayed as shown below.The message and corrective action vary depending on the conditions.For details, see section 2.4.

Message
Corrective action

- If you select the Start Monitoring check box and the measuring mode at start-up is Triggered mode, the SL1000 will be in the trigger-wait state immediately upon starting the software.
- If you select the Start Recording check box and a recording start condition is specified, the software will start recording when the recording start condition is met after the software starts.

Exit Options

Select either of the following:

End ACQ: When this software is closed, SL1000 will also stop measuring. If the SL1000 is measuring, the confirmation message "Stop Measurement?" is displayed.

Continue ACQ: The SL1000 will continue measuring even when this software is closed. To stop the measurement on the SL1000, press the **START/STOP** key on the SL1000.
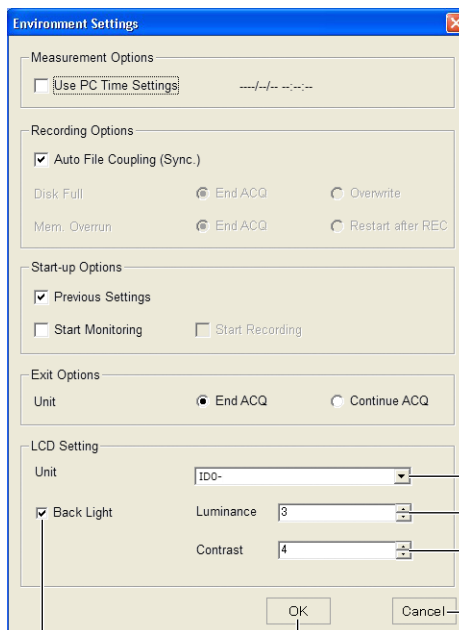
9.4 Adjusting the LCD

You can turn off the LCD and adjust its luminance and contrast. This feature is available on software versions 2.31 and later.

1. On the Environment menu, click **Environment Settings**.
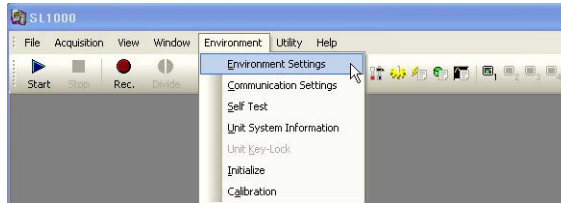
2. Select the unit you want to adjust the LCD of.
The luminance and contrast of the selected unit appear.

If synchronous operation is in progress, you can select **ALL**.
If you select ALL, the luminance and contrast of the master unit appear.
The settings show asterisks if there are slave units whose settings are different from the master unit's.

3. Set the luminance and contrast. Changing a setting also changes the setting of the target unit. If the backlight is off, the luminance setting is void.
If ALL is selected for units operating synchronously, changing a setting changes the setting of all slave units to the same setting as the master.

4. Click **OK**.

Select the unit.

Select the luminance.

Select the contrast.

Cancels the settings other than LCD settings and closes the window

Turns the backlight on and off

Applies the settings other than LCD settings and closes the window (LCD settings are applied immediately when they are changed.)

9.5 Performing a Self-Test

This section explains how to self-test the SL1000. You can self-test each unit during synchronous operation.

Connect to the SL1000 that will be self-tested in the Connection & Group Settings screen in advance.

1. From the Environment menu, choose **Self Test**.
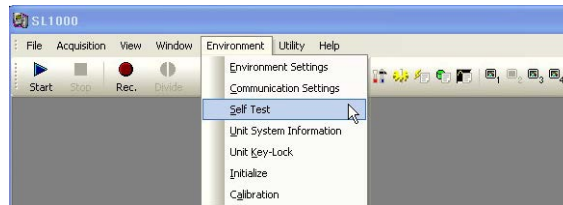
Select the unit ID of the unit to perform the self-test on

Set the SL1000 to key test mode

Clear the SL1000 key test mode

Execute the test

Displays the test result
  PASS
  FAIL

Format the internal hard disk of the SL1000

CPU temperature of the SL1000
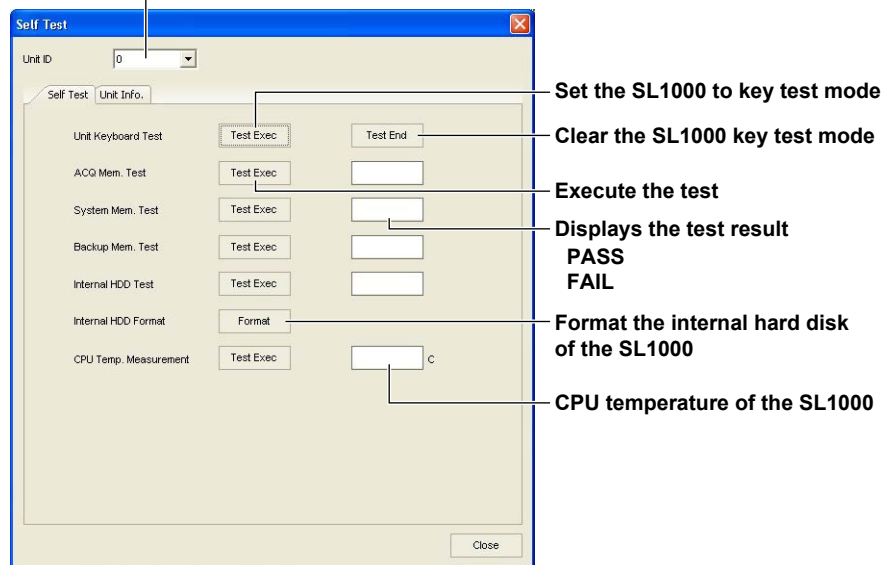
Note

You cannot execute a self-test while the SL1000 is measuring.

Unit Keyboard Test

Pressing the **Test Exec** button sets the SL1000 to panel key test mode.Then, execute a key test on the SL1000.

Pressing the **Test End** button clears the panel key test mode.

Other self-tests cannot be executed while the keyboard test is in progress.

ACQ Mem. Test, System Mem. Test, Backup Mem. Test, and Internal HDD Test

For each SL1000, the self-test is performed on all memory types and the optional internal hard disk.

Internal HDD Format (/HD1 Option)

The internal hard disk of the SL1000 performs a logical format.

Note

If you format the internal hard disk, all the data on the hard disk will be lost.Copy the necessary data to your PC using the file tranfer function, FTP (/C10 option) or Xviewer (all models except /XV0). For details on the file transfer function, see section 8.7. For details on the FTP function, see section 8.3. For information about Xviewer, see the user's manual.

CPU Temperature

Measures and displays the CPU temperature of the SL1000.

9

Other Functions

9.6 Display the SL1000 Information

For each SL1000 unit ID, the version and information about the measurement modules installed in the SL1000 can be displayed.
Connect to the SL1000 that you want to view the information about in the Connection & Group Settings screen in advance.

1. From the Environment menu, choose **Self Test**.
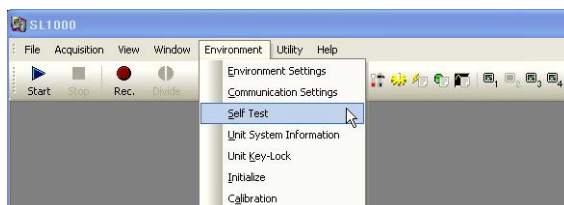
2. Click the **Unit Info.** tab.
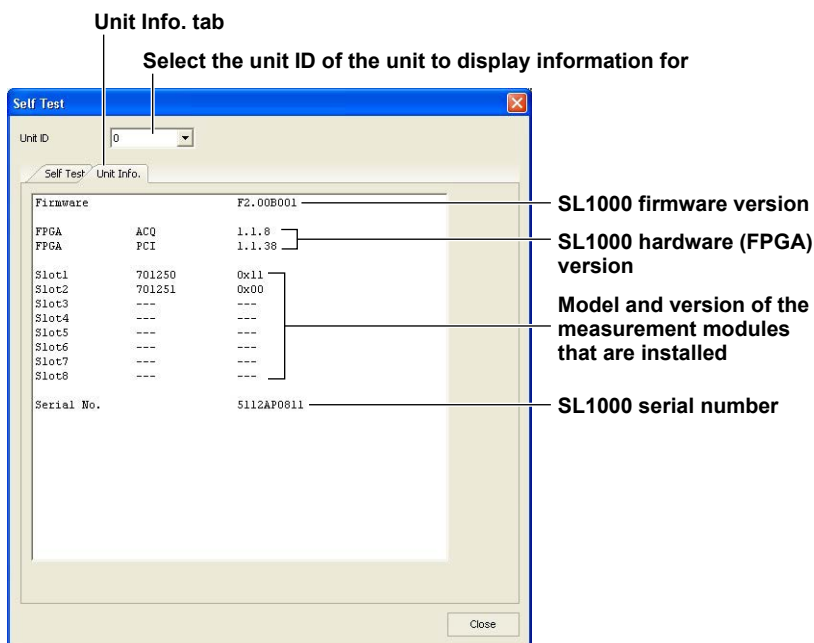
9.7 Displaying the SL1000 System Information

This section explains how to display the measurement, recording, channel, alarm, and other settings of the SL1000 (multiple SL1000s during synchronous operation) that you are connected to.

1. From the Environment menu, choose **Unit System Information**.
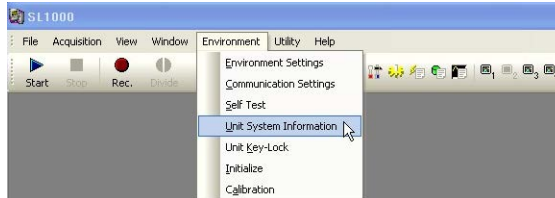
System Information Example
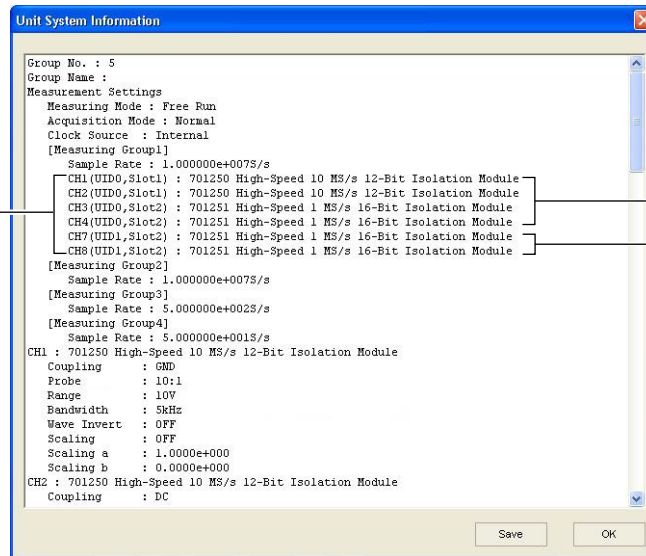
Unit ID0 (UID0) module

Unit ID1 (UID1) module

Displays the measurement channels of all SL1000s (up to 128 channels) during synchronous operation

The SL1000 system information that is displayed can be saved to a text file.

Click the **Save** button and specify the destination and file name.

9.8 Locking the Keys on the SL1000

The panel keys of the connected SL1000 can be locked.

1. From the Environment menu, choose **Unit Key-Lock**.
   If the keys are locked, a check mark appears in front of Unit Key-Lock, and the following icon is displayed on the SL1000.

2. To clear the key-lock, choose **Unit Key-Lock** from the Environment menu again.

   You can also clear the key-lock by holding down the **DISPLAY** key on the SL1000 until the icon disappears.

9.9 Initializing the SL1000 Settings

The settings of the connected SL1000 can be initialized.

1. From the Environment menu, choose **Initialize**.
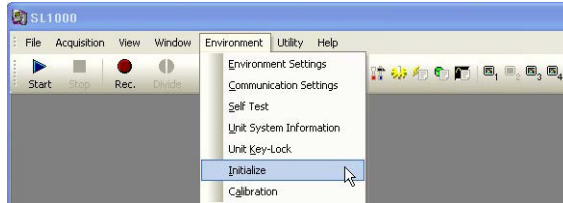
2. Click the **Execute** button to initialize the settings of the connected SL1000.

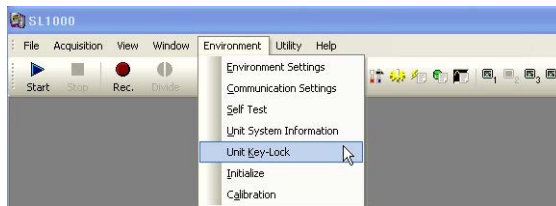   To cancel initialization, click **Undo** with the Initialize screen open.

Close without initializing

Close the screen

Execute initialization
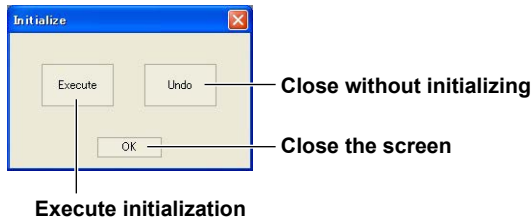
Note

- If you close the Initialize screen, you will not be able to undo it.
- If you execute initialization, the SL1000 will return to factory default settings. However, the following items will not be initialized.
  - Various environment options
  - The connection method (USB/Ethernet) and unit search settings in Connection & Group Settings
  - Ethernet settings (IP address and FTP account settings)
  - Unit name and group name
- If you execute initialization, measuring group registrations of measurement modules will also be initialized. After initialization, register the measurement modules to measuring groups again in the Connection & Group Settings screen.

9

Other Functions

9.10 Calibrating the SL1000

You can calibrate the connected SL1000 or set the auto calibration.

1. From the Environment menu, choose **Calibration**.
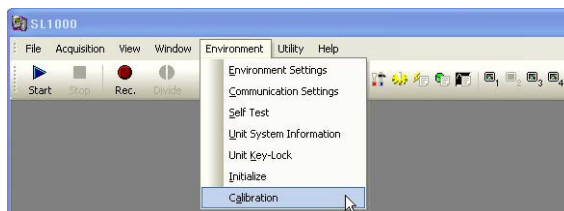
2. To execute calibration, click the **Execute** button.
To set the auto calibration, select **ON** or **OFF**.
If ON is selected, calibration is executed automatically when the SL1000 is started.

Turn ON/OFF auto calibration

Close the screen

Execute calibration
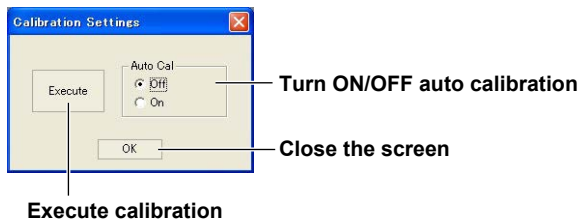
Note

• You cannot execute calibration while the SL1000 is measuring.
• You cannot configure auto calibration during synchronous operation.

9.11 Specifying Communication Settings on SL1000s on the Network (Option)

To configure communication settings, connect to the SL1000 via USB. You can configure communication settings on multiple SL1000s by using a USB hub.

1. From the Environment menu, choose **Communication Settings**.
The Communication Settings screen appears.
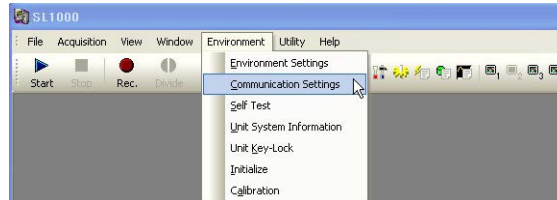
If the error "Cannot find the appropriate unit" is displayed, click **OK**.
The Communication Settings screen will appear.

Check that the SL1000 is connected properly via USB and click **Reconnect** in the Communication Settings screen.

2. Set the group ID and unit address of the network-connected SL1000 that you want to set.
Type the unit name, group name, IP address, and FTP account as necessary, and click the **Apply** button.
The settings are applied to the specified SL1000.

- **Select the group ID (0 to 9 and A to F)**
- **Unit ID of the SL1000 to be configured (0 to 7)**
- **Enter the unit name (up to 32 characters)**
- **Enter the group name (up to 32 characters)**
- **Turn DHCP ON or OFF**
  You are done with the IP address settings if you turn DHCP ON
- **Set the IP address, subnet mask, and default gateway**
- **Set these items to access the SL1000 hard disk from your PC using FTP**
- **Apply Button**
- **Reconnect Button**

To configure another SL1000's communication settings, leave the Communication Settings screen open, and switch the USB connection to the SL1000 unit that you specified using the group ID and unit ID. Then, click **Reconnect**.
You will be able to specify communication settings on the reconnected SL1000.

Note
- You cannot specify communication settings while the SL1000 is measuring.
- When applying communication settings, the connection is temporarily disconnected. Click Reconnect to connect to the specified unit.
- If you click OK after applying the communication settings, the connection is disconnected. To begin taking measurements, connect to the unit from the System Configuration screen.

9

Other Functions

9.12 Displaying the Operating Status, Showing and Hiding the Toolbar and Status Bar, and Undocking the Menu Bar and Toolbar
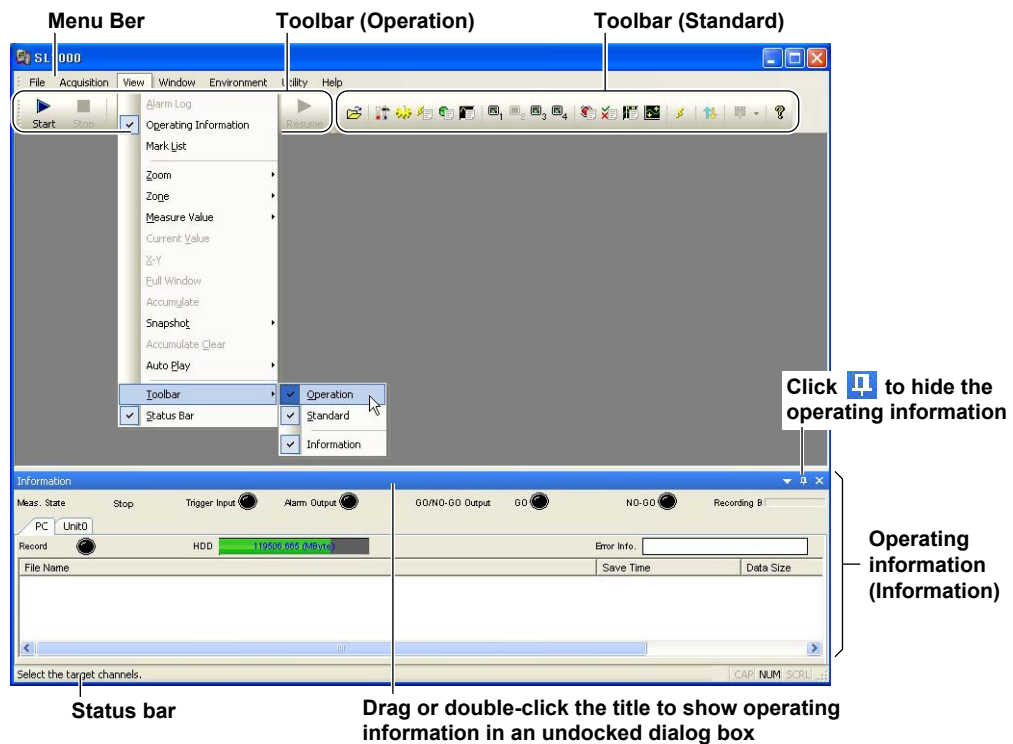
This section explains how to show and hide various buttons, the status bar, and the operating status. It also explains how to undock the toolbar and the operating status display area from the window.

1. From the View menu, click **Standard** (toolbar), **Operation** (toolbar), **Status Bar**, or **Operating Information** to place a check mark by the item you want to show. Items with a check mark are shown.

   To hide an item, click again to clear the check mark.

Menu Ber   Toolbar (Operation)   Toolbar (Standard)

Click to hide the operating information

Operating information (Information)

Status bar

Drag or double-click the title to show operating information in an undocked dialog box

Menu Bar, Toolbar (Standard), and Toolbar (Operation)

Drag the menu bar or a toolbar to show the contents in an undocked dialog box. Drag it back to its original position to dock it to the window. You can change the shape of undocked dialog boxes by dragging their boundary or corner.

Undocked bars
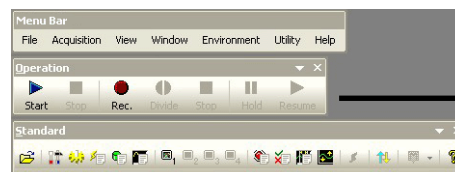
Reshaped, undocked toolbar (operation)
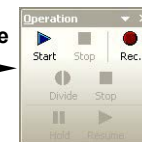
Drag to change shape

Operating Information

Drag or double-click the title to show the contents in an undocked dialog box. After undocking, if you double-click the title again, the dialog box is docked to the window at its original location.

If you click to hide the entire area, the Operating Information tab appears in the status bar. Click here to show the operating information again. Click to fix the dialog box in place.

9.13 Displaying the Software Version

Displaying the SL1000 Acquisition Software Version

1. Click the [?] button, or choose **About SL1000...** from the Help menu to display the SL1000 Acquisition Software version information.

Version information of SL1000 Acquisition software
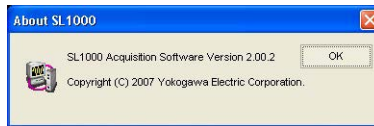
2. Click **OK** to close the dialog box.

Displaying the SL1000 File Utility Version

1. From the Help menu, choose **About SL1000 File Utility** to display the SL1000 File Utility version information.

Version information of SL1000 File Utility

2. Click **OK** to close the dialog box.

9

Other Functions
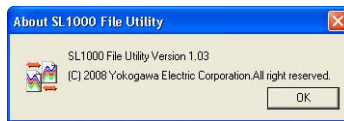
10.1   Starting and Exiting the File Utility

The file utility allows you to process waveform data files that have been recorded using the SL1000 (in .wdf format) so that you can analyze the data smoothly on Xviewer.

Starting the File Utility

From the SL1000 Acquisition Software's Utility menu, choose **File Utility**. You can also double-click the **SL1000 File Utility icon** on the desktop.
The SL1000 File Utility starts.

Starting from the SL1000 Acquisition Software

Using the SL1000 File Utility icon

SL1000 File Utility
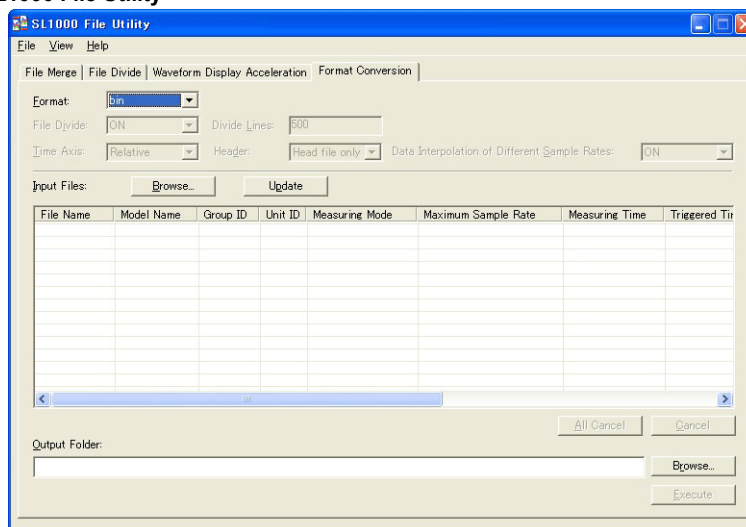
Exiting the File Utility

From the SL1000 File Utility's File menu, choose **Exit**.

10
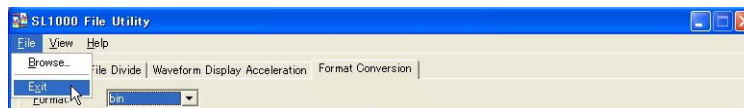
File Operation

10.2 Common Operations

In the File Utility, the file list refers to the list of files that are going to be processed. This section explains the common file list operations that you carry out when you merge files, divide files, accelerate the waveform display, and convert files to CSV.

Selecting the Source Files

Follow the procedure below to display the SL1000 waveform data files (with .wdf extension) that you want to manipulate, in the file list.

1. From the File menu, choose **Browse**, or click **Browse** by Input Files.
The Open dialog box appears.
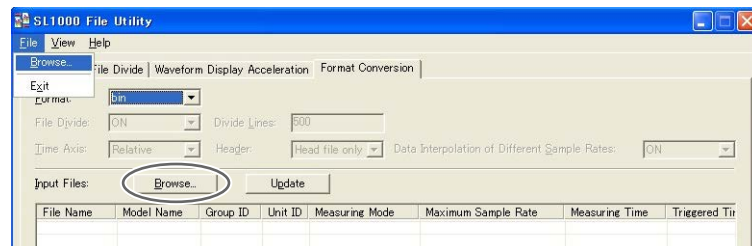
2. Select the files that you want to manipulate, and click **Open**.
The selected files appear in the file list.
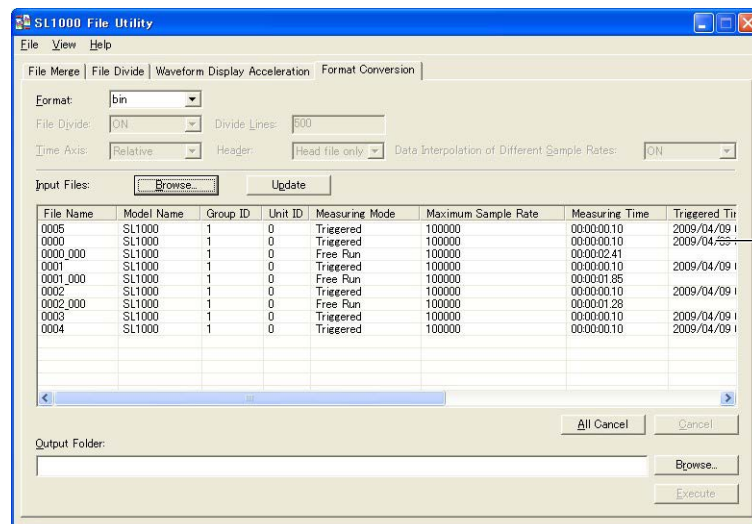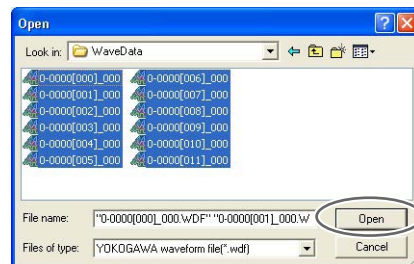
You can also add files to the file list by dragging the appropriate files from a folder to the file list.
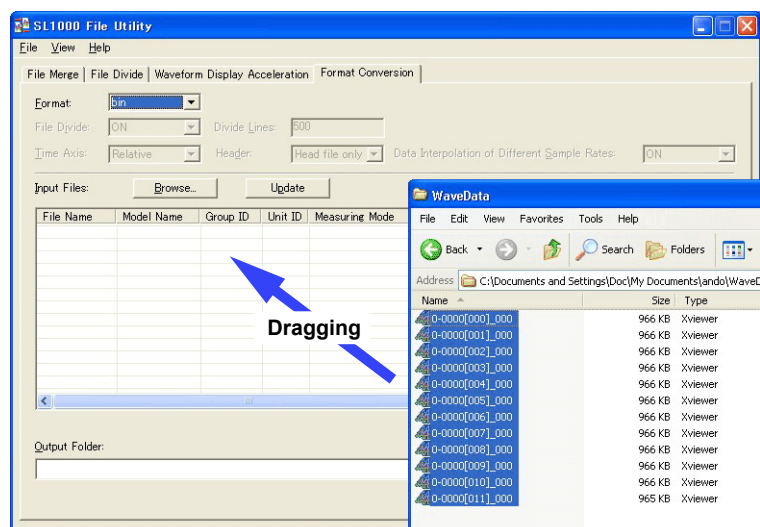
Updating Files

Follow the procedure below to update the files that are registered to the file list with the most recent information.

1. Choose **Update Information** from the View menu, or click **Update** by Input Files.
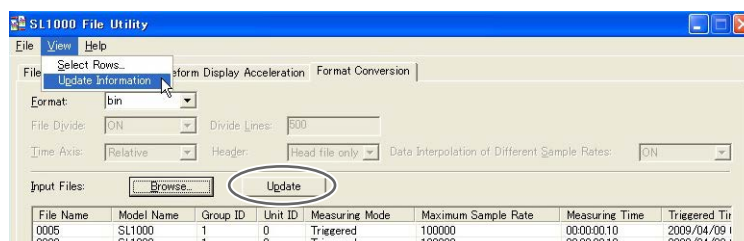
Displaying File Properties

Follow the procedure below to select the items you want to display in the file list. The selected items appear in the file merging, file division, waveform display acceleration, and CSV conversion file lists.

1. From the View menu, choose **Select Rows** to open the Select Rows dialog box.
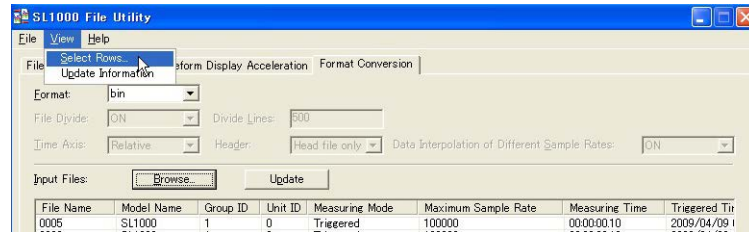
2. Select the check boxes for the items that you want to display, and click **OK**.

The selected items appear in the file list.
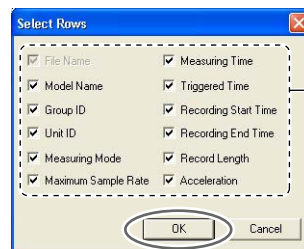
Select the check boxes for the items you want to display in the file list.

The selected items appear in the file list.
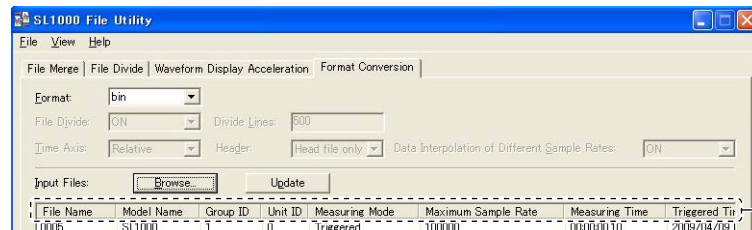
File List Properties

Item	Description
File Name	Displays the names of the files that you are going to manipulate without the .wdf extension.
Model Name	Displays the model name (SL1000).
Group ID	Displays the group ID of the SL1000 that recorded the file in the range of 0 to F.
Unit ID	Displays the unit ID of the SL1000 that recorded the file in the range of 0 to 7.
Measuring Mode	Displays the file's measuring mode (Free Run or Triggered).
Maximum Sample Rate	Displays the file's maximum sample rate. If a file contains data that has been sampled using different sample rates, the fastest sample rate is displayed. If data has been measured using an external clock, the word "External" appears.
Measuring Time	Displays the file's measuring time in 10-ms steps.
Triggered Time	If the file contains data that has been saved in Triggered mode, the time when the SL1000 was triggered is displayed in 10-ms steps. The triggered time does not appear when data is measured in Free Run mode.
Recording Start Time	Displays the file's recording start time in 10-ms steps. This is the recording time of the file's first data value. The recording start time is not displayed if the data has been measured in Triggered mode using an external clock.
Recording End Time	Displays the file's recording end time in 10-ms steps. This is the recording time of the file's last data value. The recording end time is not displayed if the data has been measured using an external clock.

Item	Description
Record Length	Displays the number of data points in the file (the record length per channel). If the file contains data sampled at different sample rates using the SL1000 measuring group feature, the number of points at the maximum sample rate is displayed.
Acceleration	Displays whether or not display data is included in the waveform data file. If display data is included, "Done" appears. Otherwise, "Undone" appears.

Selecting the Files to Manipulate

From the source files in the file list, select the files that you actually want to manipulate.

You can select one file to manipulate by clicking the file you want, or you can select multiple files to manipulate collectively by using the Shift or Ctrl key.

When One file Is Selected

When Multiple Files Are Selected

Note

For file merging, all of the files in the file list are merged; you do not have to select the files that you want to manipulate.

10

File Operation

Sorting the File List

You can sort the files in the file list.

1. You can select files in the file list and drag them to the appropriate position. Then, the files are resorted.

Select a file and drag it to the appropriate position.

The file moves to the specified position.
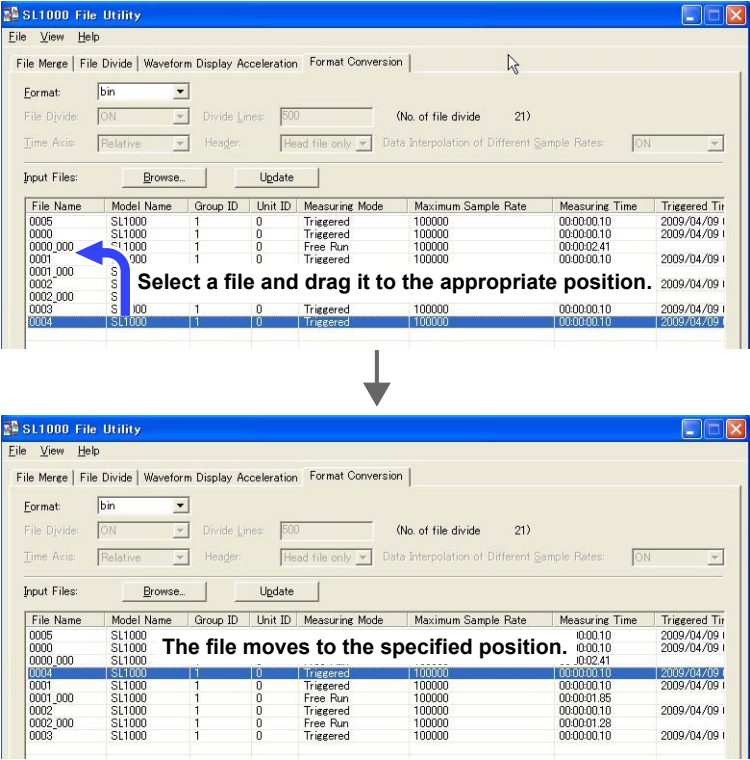
Note

You cannot sort the files if the file merging mode is set to Time Series.

Deleting Files from the File List

Follow the procedure below to delete selected files from the file list.

1. Select the files that you want to delete on the file list, and click **Cancel**, or press the Delete key.

To delete all files from the file list, click **All Cancel**.

Deletes all files

Deletes the selected files
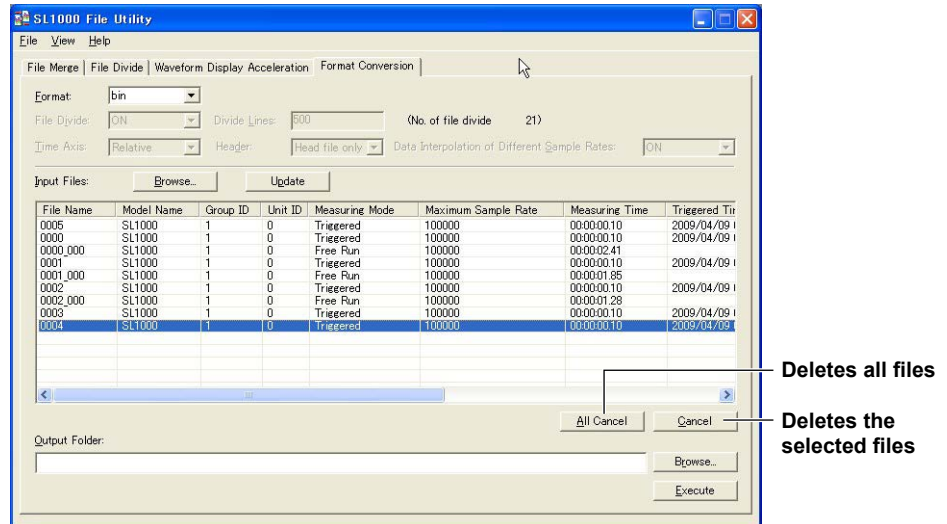
2. Click **Yes** to delete the selected files from the file list.

Deletes the selected files

10

File Operation
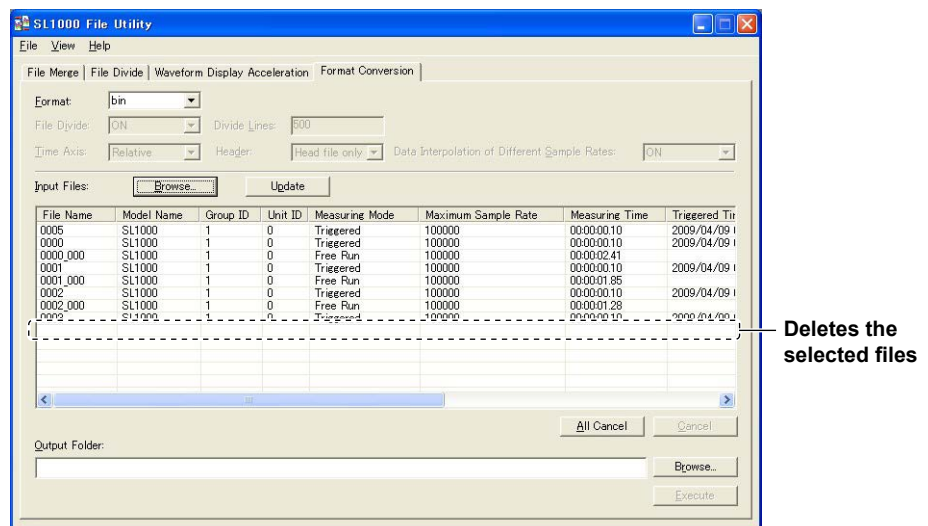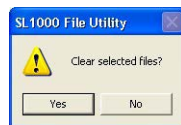
10.3 Merging Files

1. Click the **File Merge** tab.

Merge file creation mode
Time Series: Real file merge
Channel: Link file merge

Select the file merge mode

Merges files in the file list in order from top to bottom

Set the output file name

Execute file merging

Displays the output file if you specify it
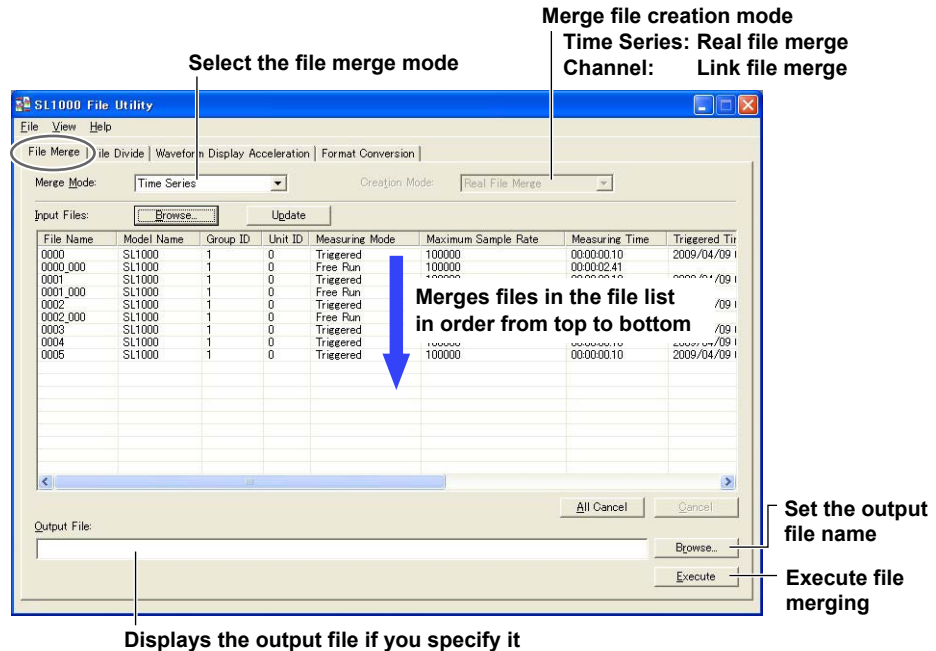
Selecting the Files to Merge

2. Select the files that you want to merge according to the procedure explained in section 10.2.

Selecting the Merge Mode and Creation Mode

3. Set the merge mode to **Time Series** or **Channel**.

The creation mode is fixed to Real File Merge when the merge mode is set to Time Series and to Link File Merge when the merge mode is set to Channel.

To set the output file name, proceed to step 4. Otherwise, proceed to step 6.

Setting the Output File Name

4. Click **Browse** to open the Save As dialog box.

Select the folder
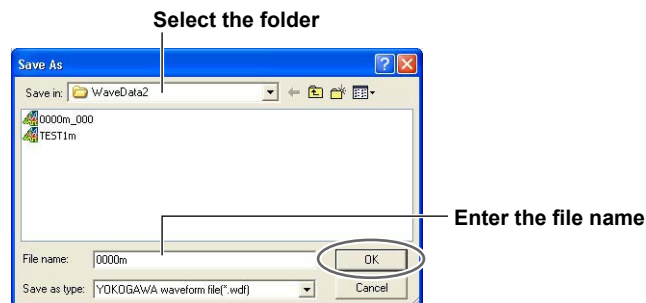
Enter the file name

5. Set the save destination and file name, and then click **OK**.
The dialog box closes.

Executing File Merging

6. Click **Execute** to merge files.

File Merging

The file utility allows you to merge files over time or over channels.

Merging Files over Time

In file merging over time, the file utility merges waveform data files[*] that have been stored with no time spacing between the files. These files are stored on a single SL1000. File merging over time actually merges the files.

* Waveform data files that have been stored through time divided recording (with recording interval set to off)

Real File Merging

Physically concatenates waveform data files that have been stored through time divided recording (with recording interval set to off) and creates a single waveform data file.
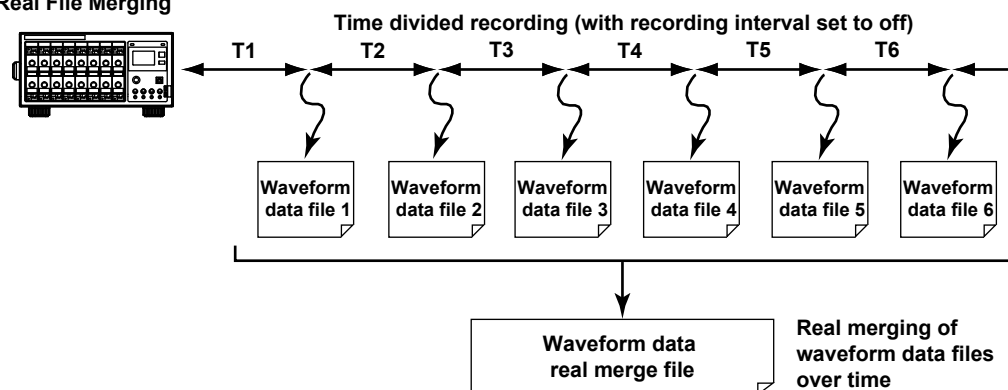
Note

- By merging files over time, you can use Xviewer to perform long-term waveform analysis.
- Files cannot be merged that would cause the number of data samples per channel to exceed 2 G samples.
- If the sample rate is 5 S/s, you can merge files when the time spacing between each file is less than 400 ms. At other sample rates, you can merge files when the time spacing is less than 200 ms.

10

File Operation

Merging Files over Channels

This feature merges waveform data files that have been stored on the SL1000s running in sync operation (up to eight units). File merging over channels merges files virtually using a link file.

Link File Merging

Virtually concatenates waveform data files that have been stored through time divided recording (with recording interval set to off) to create a single link file.

Simultaneous measurement on multiple units
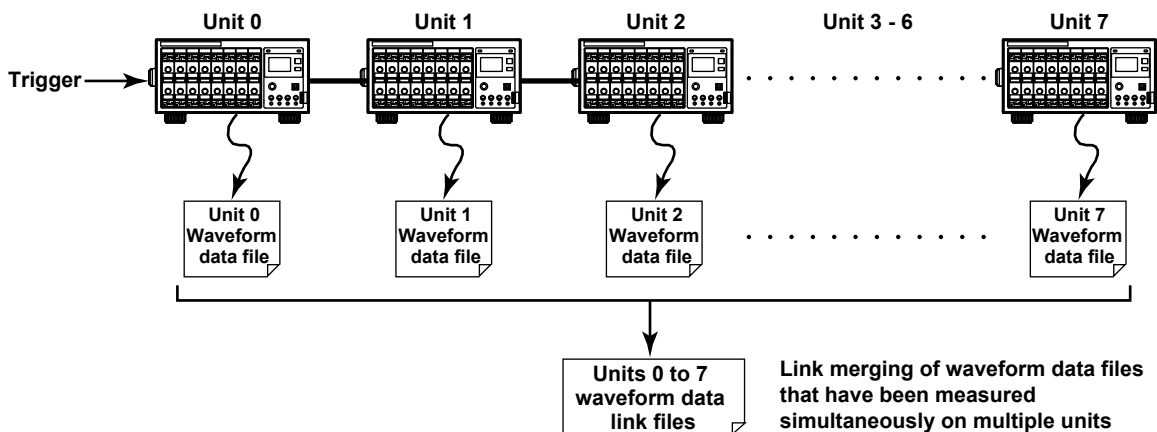
Note

- By merging files over channels, you can use Xviewer to simultaneously analyze multiple channels across multiple units.
- Files that have been merged through linking cannot be remerged, divided, accelerated for waveform displaying, or converted to CSV files.

File Merging

Files in the file list are merged in order from top to bottom.

Number of Files That Can Be Merged

The maximum number of files that can be merged is 128.

Merge Mode

Time Series

Select this option to merge waveform data files over time without any time space in between data files. When the merge mode is set to Time Series, the creation mode is set to Real File Merge. Only files that have been recorded in Free Run mode on the SL1000 can be merged.

Channel

Select this option to merge waveform data files that have been saved on multiple units using synchronous operation. When the merge mode is set to Channel, the creation mode is set to Link File Merge.

Creation Mode

Real File Merge

In this mode, waveform data files are physically merged to create a single file. This mode is used when the merge mode is set to Time Series. The original files remain when real file merging is performed.

Link File Merge

In this mode, a link file that contains information about how files are merged is created. Waveform data files are not physically merged. This mode is used when the merge mode is set to Channel.

Output File Name

When you set the output file name

A file with the specified name is saved to the specified folder.

When merging files over time, "_000" is appended to the specified file name. If the file size exceeds 2 GB as a result of merging, the output files are divided into 2-GB files and saved with the following sequence numbers attached after the specified file name: _000, _001, _002, and so on.

Example: Set the output file name to "TEST"

When the file size is less than 2 GB: "TEST_000.wdf"

When the file size exceeds 2 GB: "TEST_000.wdf"

"TEST_001.wdf"

"TEST_002.wdf"

:

When you do not set the output file name

Files are saved according to the following rules in the folder that contains the first file. If the merged file size exceeds 2 GB, files are divided in the same manner as when you set the output file name.

1) When the first file to be merged is the first file among the automatically divided files in Free Run mode with the name "****_000.wdf," the character "m" is inserted before the last four characters "_000."

"0000_000.wdf"+"0001_000.wdf" → "0000m_000.wdf"

2) For all other cases, the character "m" is added to the end of the first file name or before "_000."

"TEST1.wdf"+"TEST2.wdf"+"TEST3.wdf" → "TEST1m.wdf" (Channel)

"TEST1.wdf"+"TEST2.wdf"+"TEST3.wdf" → "TEST1m_000.wdf" (Time Series)

3) If the merge mode is set to Channel and the file names start with characters that represent the unit ID "*-" (a number from 0 to 7 and a hyphen), the first two characters are deleted. Then, the file name is determined according to rules 1 and 2 above.

"0-0000.wdf"+"1-0000.wdf"+"2-0000.wdf" → "0000m.wdf"

Conditions Necessary for Merging Files

Merging files over time

• Data files must be from the same group and the same unit.

• Data files must have been measured in Free Run mode using the internal clock.

• Data files must contain data sampled at the same maximum sample rate.

• Data files must be continuous in time (there must be no time spacing between subsequent files' data).

Merging files over channels

• Data files must be of the same measurement mode (measurement files in Free Run mode and those of Triggered modes cannot be mixed).

• Data files that were saved using an external clock must have been measured in Triggered mode.

• Data files must contain data with different unit IDs.

• Data files must contain data with the same group ID.

• The maximum sample rates must be the same.

• Data files must contain data with the same recording start time (in Free Run mode) or with the same trigger time (in Triggered mode). Any time errors must be within 1 µs.

10

File Operation

10.4 Dividing Files

> **1.** Click the **File Divide** tab.

Select the file division mode
Select the start position
Set the record length unit and value

Select the file division unit

Valid when the start position is set to Time

Displays the number of files that would result (as a reference)

Set the output folder

Execute the file division operation

Displays the output folder if you specify it

Valid when the start position is set to No. of Points

Selecting the Files to Divide

> **2.** Select the files that you want to divide according to the procedure explained in section 10.2.

Selecting the File Division Mode and Division Unit

> **3.** Set Divide Mode to **Equal Division** or **Clipping**.
>
> **4.** Set Divide Unit to **Time** or **No. of Points**.
>
> If you select Time, proceed to step 5. Otherwise, proceed to step 8.

Selecting the File Division Start Position

> **5.** Set First Data to **First Data**, **Timed** (if Time was selected in step 4), or **No. of Points** (if No. of Points was selected in step 4). If you select First Data, proceed to step 7. If you select Timed or No. of Points, proceed to step 6.

Setting the Start Time or the Number of Points for Dividing Files

> **6.** Set the file division start time (if Time was selected in step 4) or the number of points for dividing files (if No. of Points was selected in step 4).

Setting the File Division Record Length

7. Set the record length unit to **Day**, **Hour**, **Minute**, or **Second** (if Time was selected in step 4) or **Points** (if No. of Points was selected in step 4). Then, set the record length.

To set the output file name, proceed to step 8. Otherwise, proceed to step 10.

Setting the Output Folder

8. Click **Browse** to open the Browse for Folder dialog box.
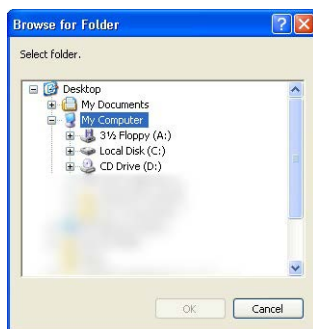
9. Select the save destination folder, and then click **OK**.
The dialog box closes.

Executing the File Division Operation

10. Click **Execute** to divide the files.

Note

If you select one file, that file is divided. If you select multiple files, the selected files are divided based on the first file's file division conditions.

10

File Operation

File Division

This feature divides waveform data files in time. You can divide files evenly or extract a portion of the file.

Equal Division

Divides the waveform data files from the specified start position into even sections based on the specified record length. You can set the start position to the first data point, a specific time, or a specific number of points. You can set the record length to a specific time value or a specific number of points.
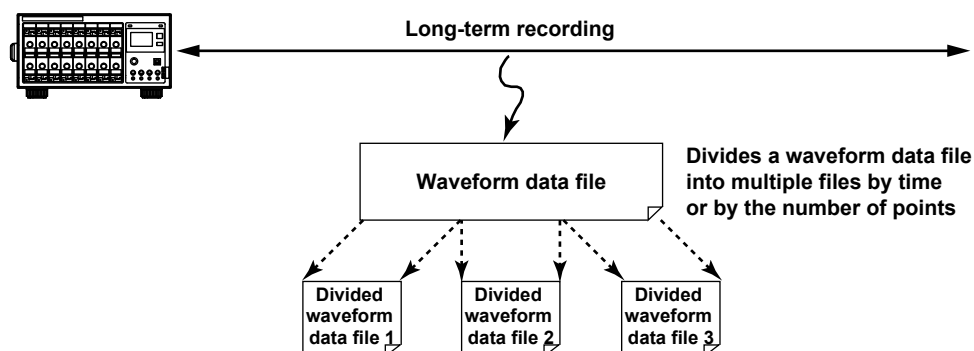
> **Note**
>
> When files are divided evenly, waveform data of a given period can be analyzed quickly using Xviewer.

Clipping

Extracts data from waveform data files from the specified start position for the specified record length. You can set the start position to the first data point, a specific time, or a specific number of points. You can set the record length to a specific time value or a specific number of points.
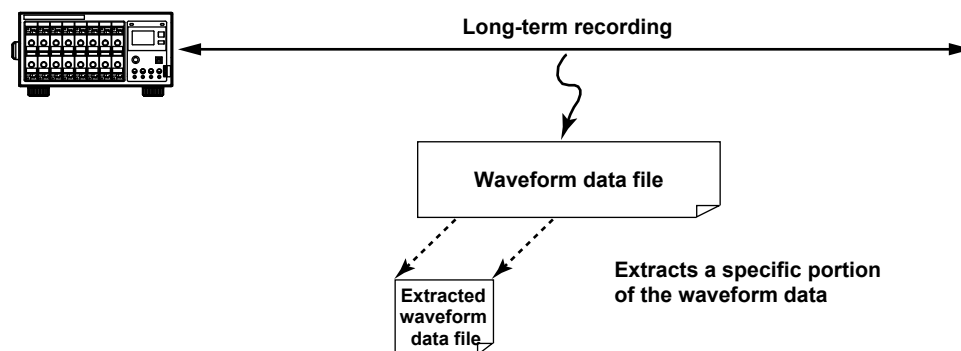
> **Note**
>
> When a portion of a file is extracted, waveform data at a specific time period can be analyzed quickly using Xviewer.

File Division Mode

Equal Division

Divides a specified file into even-sized files.

Clipping

Extracts a specific portion from a specified file to create a single file.

File Division Unit

Time

Divides files by a specific time period. You cannot select files that have been recorded using an external clock on the SL1000.

Points

Divides files by the specified number of data points.

Start Position

First Data

Starts dividing data from the first data point.

Timed

If the file division unit is time, set the start date and time in the following formats: YYYY/MM/DD and HH:MM:SS.

No. of Points

If the file division unit is number of points, set the start point to a value from 1 to 1000000000.

Record Length

Time

If the file division unit is time, set the record length to 1 to 2592000 (unit: day/hour/minute/second).

Points

If the file division unit is number of points, set the record length to a value from 0 to 100000000.

(No. of file divide)

Before the execution of the file division operation, this displays the number of files that would result by dividing the first selected file in the file list using the conditions above as reference .
"---" is displayed when the first selected file cannot be divided using the specified conditions.

Number of File Divisions

The maximum number of file division is 1000.

10

File Operation

Setting the Output Folder

When you specify the output folder

Files are saved to the specified folder according to the following rules. If the divided file size exceeds 2 GB, files are divided into 2-GB files and saved with the following sequence numbers attached after the file name: _000, _001, and so on.

- When the file that you want to divide is the first file among the automatically divided files in Free Run mode with the name "****_000.wdf," a character string that represents division sequence numbers from "[000]" to "[999]" is inserted before the last four characters "_000."

  Example: When "0000_000.wdf" is divided into three files
  - When the size of the divided files is less than 2 GB
    "0000[000]_000.wdf","0000[001]_000.wdf","0000[002]_000.wdf"
  - When the size of the divided files exceeds 2 GB
    "0000[000]_000.wdf","0000[001]_000.wdf","0000[002]_000.wdf"
    "0000[000]_001.wdf","0000[001]_001.wdf","0000[002]_001.wdf"
            :   :   :

- For all other cases, "_000" is appended to the first file name, and a character string that represents division sequence numbers from "[000]" to "[999]" is inserted before "_000."

  Example: When "TEST.wdf"is divided into three files
  - When the size of the divided files is less than 2 GB
    "TEST[000].wdf","TEST[001].wdf","TEST[002].wdf"
  - When the size of the divided files exceeds 2 GB
    "TEST[000]_000.wdf","TEST[001]_000.wdf","TEST[002]_000.wdf"
    "TEST[000]_001.wdf","TEST[001]_001.wdf","TEST[002]_001.wdf"
            :   :   :

When you do not specify the output folder

Files are saved to the folder containing the file you want to divide by using the same rules as when you specify the output folder. If the size of the divided files exceeds 2 GB, files are divided in the same manner as when you set the output folder name.

10.5 Accelerating Waveform Displaying

1. Click the **Waveform Display Acceleration** tab.

Only files whose Acceleration indicates Undone can be accelerated.

Execute waveform display acceleration
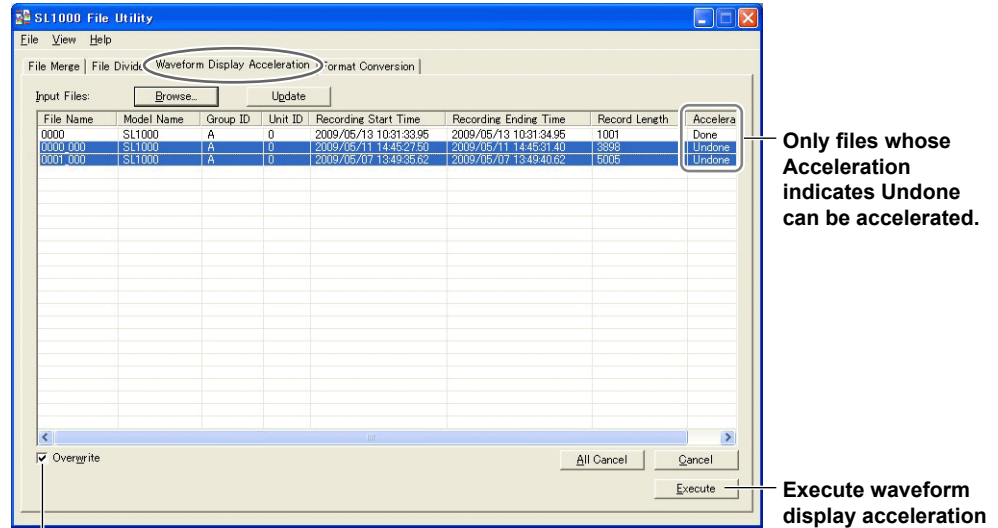
Select this check box to overwrite the original file with the waveform display accelerated file.

Selecting the Files That You Want to Accelerate Waveform Displaying For

2. Select the files that you want to accelerate waveform displaying for according to the procedure explained in section 10.2.

Setting the Overwrite Condition

3. Use the Overwrite check box to select whether or not to overwrite the file.

Executing the Waveform Display Acceleration

4. Click **Execute** to accelerate waveform displaying.

Note

• If you select one file, that file is accelerated. If you select multiple files, the selected files are accelerated collectively.
• You can execute waveform display acceleration on files whose Acceleration indicates Undone. If you attempt to execute waveform display acceleration on files whose Acceleration indicates Done, an error message appears.

10

File Operation

Waveform Display Acceleration

Files that have been stored through time divided recording (with recording interval set to off) on the SL1000 do not contain display data for accelerating waveform displaying on Xviewer.

This feature adds waveform display acceleration data to waveform data files.

Time divided recording (with recording interval set to off)

| Waveform data file 1 | Waveform data file 2 | Waveform data file 3 | Waveform data file 4 |

Adds display data used to accelerate waveform displaying on Xviewer to the waveform data files.

| Display data | Waveform data 1 | Display data | Waveform data 2 | Display data | Waveform data 3 | Display data | Waveform data 4 |
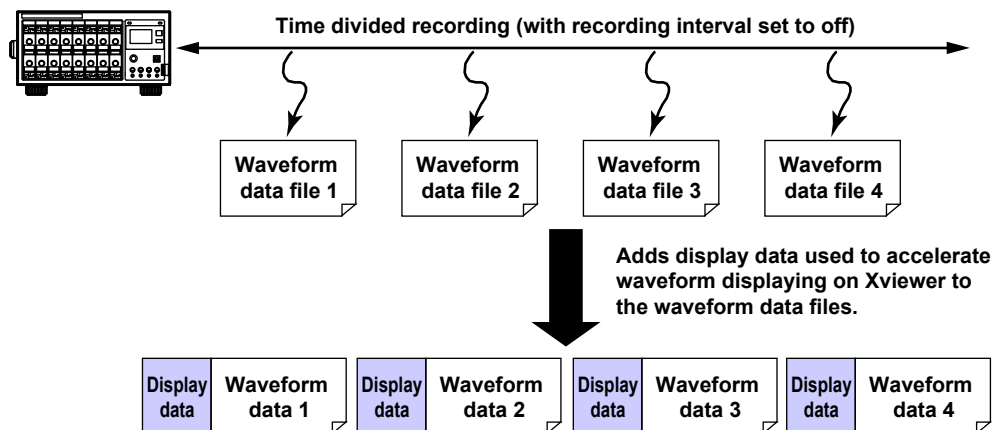
Note

This allows waveform data files that have been stored through time divided recording to be displayed quickly on XViewer.

Setting the Overwrite Condition

The waveform display accelerated files are saved to the following folders with the following file names depending on the overwrite condition.

When the Overwrite check box is selected

The waveform display accelerated file overwrites the original file in the specified folder.

When the Overwrite check box is not selected

Creates an "Acceleration" folder in the folder that contains the specified files, and saves waveform display accelerated files with the same names in the new folder.

10.6 Converting Waveform Data Files to CSV or Binary Files

1. Click the **Format Conversion** tab.

2. Set Format to **csv** or **bin (binary)**.

Select whether or not to add time-axis information (for CSV conversions)

Select whether or not to divide files (for CSV conversions)

Select the format to convert to

Set the division unit to use when dividing files

Select whether or not to add header information (for CSV conversions)

Select whether or not to interpolate data with different sample rates (for CSV conversions)

Select the output folder

Execute the format conversion operation

Displays the output folder if you specify it

Selecting the Files You Want to Convert

3. Select the files that you want to convert according to the procedure explained in section 10.2.

   This is the last step in the binary conversion process. Proceed to step 8.

Setting File Divisions, Time Axis Information, Header Information, and Data Interpolation Used for Different Sample Rates (For CSV conversions)

4. Set File Divide to **ON** or **OFF**. If you set File Divide to ON, set the number of lines for the division unit.

5. Set Time Axis to **Absolute**, **Relative**, or **OFF**.

6. Set Header to **ON** or **OFF**.

7. Set Data Interpolation of Different Sample Rates to **ON** or **OFF**.

Setting the Output Folder

8. Click **Browse**.

The Browse for Folder dialog box appears.

9. Select the save destination folder, and then click **OK**.

The dialog box closes.

Executing the File Conversion Operation

8. Click **Execute**.

The waveform data files are converted to CSV or binary files.

Note

- If you select one file, that file is converted. If you select multiple files, the selected files are converted according to the conditions of the first file.
- If you double-click a single file in the file list, Xviewer runs and displays the waveform that is stored in the file that you double-clicked.
- If you move the pointer over a file name in the file list, the path information for the file appears. If you move the pointer over the recording start time, the recording start time information appears. If you move the pointer over the other attributes in the file list in the same way, the respective attribute information for the file appears.

File Conversion

This feature converts waveform data files (.wdf extension) that have been saved on the SL1000 to CSV (.csv extension) or binary (.bin extension) files.
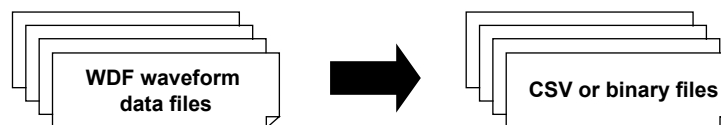
Converts SL1000 WDF waveform data files to CSV or binary files.
Multiple files can be converted collectively.

Note

- By converting files to CSV files, you can reuse the measured results on text-based analysis tools.
- By converting files to binary files, you can reuse the measured results on analysis tools such as MATLAB.

Time Axis Information (For CSV conversions)

Select whether or not to include time axis information in the converted CSV file.

OFF

Does not include time axis information (only measured data).

Absolute

Includes the measured time values (actual time values).

Year/Month/Day Hour:Minute:Second

Example: 2008/07/02 09:37:56.654321, 2008/07/02 09:37:56.654322, 2008/07/02 09:37:56.654323

Relative

• Free Run mode

Includes relative time values based on the first data point.

Example: 0 (first data point), 0.000001, 0.000002

• Triggered mode

Includes relative time values based on the trigger position. Data points before the trigger positions are indicated with negative values, and data points after the trigger point are indicated with positive values.

Example: -0.00499984, 0 (trigger position), 0.00499984

Note

For data points measured using an external clock, data numbers, 0, 1, 2, and so on, are assigned to both absolute and relative time values.

Header (For CSV conversions)

Select whether or not to include header information in the converted CSV file.

ON: Includes header information.

OFF: Does not include header information.

Header Information Items (For CSV conversions)

Items	Description
Model	Indicates the model name (SL1000).
BlockNumber	Indicates the number of measurements. • Free Run mode: Fixed at 1 • Triggered mode: Number of acquisitions (history count)
TraceName	Indicates the SL1000 channel name.
BlockSize	Indicates the number of measured points for the maximum sample rate.
Date	Indicates the recording start date.[*]
Time	Indicates the recording start time.[*]
VUnit	Indicates the vertical (voltage) axis unit.
HResolution	Indicates the horizontal (time) axis resolution.
HUnit	Indicates the horizontal (time) axis unit.

*   The date and time of the first data sample for both Free Run and Triggered modes.

10

File Operation

When absolute time is selected

Header information

Model	SL1000			
BlockNumber	1			
TraceName	CH1	CH2	CH3	CH4
BlockSize	1001	1001	1001	1001
Date	2008/7/28	2008/7/28	2008/7/28	2008/7/28
Time	16:37:27.880	16:37:27.880	16:37:27.880	16:37:27.880
VUnit	V	V	V	V
HResolution	1.00E-03	1.00E-03	1.00E-03	1.00E-03
HUnit	s	s	s	s
2008/7/28 16:37:27.880	8.67E-02	9.33E-02	−720	436.6667
2008/7/28 16:37:27.881	0.14	1.60E-01	−720	436.6667
2008/7/28 16:37:27.882	0.2066667	0.2466667	−720	434.1667
2008/7/28 16:37:27.883	0.2866667	0.28	−720	434.1667
2008/7/28 16:37:27.884	0.3133333	0.34	−720	434.1667
2008/7/28 16:37:27.885	0.3866667	0.3866667	−720	434.1667
2008/7/28 16:37:27.886	0.4533333	0.4533333	−720	434.1667
2008/7/28 16:37:27.887	0.5133333	0.52	−720	434.1667
2008/7/28 16:37:27.888	0.5533333	0.56	−720	434.1667
2008/7/28 16:37:27.889	0.6066667	0.6333333	−720	434.1667
2008/7/28 16:37:27.890	0.68	0.6733333	−720	434.1667
2008/7/28 16:37:27.891	0.6666667	0.7066667	−721.6667	439.1667
2008/7/28 16:37:27.892	0.76	0.7533333	−721.6667	439.1667
2008/7/28 16:37:27.893	0.7933333	0.7866667	−721.6667	439.1667
2008/7/28 16:37:27.894	0.8133333	0.8466667	−721.6667	439.1667
2008/7/28 16:37:27.895	0.8533333	0.8666667	−721.6667	439.1667

Time axis information (absolute time)

When relative time is selected

Model	SL1000			
BlockNumber	1			
TraceName	CH1	CH2	CH3	CH4
BlockSize	1001	1001	1001	1001
Date	2008/7/28	2008/7/28	2008/7/28	2008/7/28
Time	16:37:27.880	16:37:27.880	16:37:27.880	16:37:27.880
VUnit	V	V	V	V
HResolution	1.00E-03	1.00E-03	1.00E-03	1.00E-03
HUnit	s	s	s	s
0	8.67E-02	9.33E-02	−720	436.6667
0.000001	0.14	1.60E-01	−720	436.6667
0.000002	0.2066667	0.2466667	−720	434.1667
0.000003	0.2866667	0.28	−720	434.1667
0.000004	0.3133333	0.34	−720	434.1667
0.000005	0.3866667	0.3866667	−720	434.1667
0.000006	0.4533333	0.4533333	−720	434.1667
0.000007	0.5133333	0.52	−720	434.1667
0.000008	0.5533333	0.56	−720	434.1667
0.000009	0.6066667	0.6333333	−720	434.1667
0.00001	0.68	0.6733333	−720	434.1667
0.000011	0.6666667	0.7066667	−721.6667	439.1667
0.000012	0.76	0.7533333	−721.6667	439.1667
0.000013	0.7933333	0.7866667	−721.6667	439.1667
0.000014	0.8133333	0.8466667	−721.6667	439.1667
0.000015	0.8533333	0.8666667	−721.6667	439.1667

Time axis information (relative time)

Interpolation Data with Different Sample Rates (For CSV conversions)

When there are data points sampled at different sample rates, this setting selects whether or not data points will be interpolated for data sampled at slower sample rates.

ON

Unavailable data is filled by interpolating the data.

OFF

Unavailable data is not filled by interpolating the data.

When data is not interpolated

Model	SL1000	
BlockNumber	1	
TraceName	CH1	CH2
BlockSize	10010	2002
Date	2008/7/2	2008/7/2
Time	10:37:57.000	10:37:57.000
VUnit	V	V
HResolution	1.00E-07	2.00E-06
HUnit	s	s
0	0.1433333	0.1233333
0.0000001	0.19	
0.0000002	0.23	
0.0000003	0.286667	
0.0000004	0.34	
0.0000005	0.386667	0.36
0.0000006	0.44	
0.0000007	0.49	
0.0000008	0.533334	
0.0000009	0.586666	
0.000001	0.64	0.62
0.0000011	0.69	
0.0000012	0.74	
0.0000013	0.783334	
0.0000014	0.836666	
0.0000015	0.876667	0.856667
0.0000016	0.933333	
0.0000017	0.99	
0.0000018	1.03	
0.0000019	1.09	

- **Actual number of sampled points** (BlockSize CH2: 2002)
- **Actual sample rate** (HResolution CH2: 2.00E-06)
- **Leaves unavailable data points blank**

When data is interpolated

Model	SL1000	
BlockNumber	1	
TraceName	CH1	CH2
BlockSize	10010	10010
Date	2008/7/2	2008/7/2
Time	10:37:57.000	10:37:57.000
VUnit	V	V
HResolution	1.00E-07	1.00E-07
HUnit	s	s
0	0.1433333	0.1233333
0.0000001	0.19	0.1233333
0.0000002	0.23	0.1233333
0.0000003	0.286667	0.1233333
0.0000004	0.34	0.1233333
0.0000005	0.386667	0.36
0.0000006	0.44	0.36
0.0000007	0.49	0.36
0.0000008	0.533334	0.36
0.0000009	0.586666	0.36
0.000001	0.64	0.62
0.0000011	0.69	0.62
0.0000012	0.74	0.62
0.0000013	0.783334	0.62
0.0000014	0.836666	0.62
0.0000015	0.876667	0.856667
0.0000016	0.933333	0.856667
0.0000017	0.99	0.856667
0.0000018	1.03	0.856667
0.0000019	1.09	0.856667

- **Total number of sample points after interpolation** (BlockSize CH2: 10010)
- **Matched to the fast sample rate (the actual sample rate is 2.00E-06)** (HResolution CH2: 1.00E-07)
- **Filled with the same data values**

Setting the Output Folder

When you specify the output folder

CSV or binary files are saved to the specified folder.

When you do not specify the output folder

CSV or binary files are saved to the folder that contains the source files. File names are the same as those of the source files. The extension is .csv or .bin.

"0000.wdf"→ "0000.csv"

"0000.wdf"→ "0000.bin"

11.1   Troubleshooting

Problem	Probable Cause/Corrective Action
Unable to connect to the SL1000.	• The USB or Ethernet cable may not be connected properly. Check the cable connection. • If connecting over an Ethernet network, the specified IP address may be different from the actual IP address of the SL1000. Check the IP address assigned to the SL1000 on the SL1000 display. • Connection cannot be established if the SL1000 is turned OFF. Turn SL1000 power switch ON. • The unit ID of the SL1000 may be set to values other than zero. Check the settings on the SL1000. • During synchronous operation, the group ID is not matched or unit IDs are overlapping. Check the SL1000 group ID and unit ID.
Unable to set the external clock.	The ACQ mode may be set to a mode other than Normal. Set the ACQ mode to Normal.
Unable to measure waveform parameters.	The measuring mode may be set to Free Run. Use Triggered mode.
Waveform parameters are not displayed.	If "***" is shown in the waveform parameter display area, you may be trying to display a waveform parameter that is not being measured. Set the SL1000 to measure the parameters that you want displayed.
The waveform zoom cursor does not appear.	The measuring mode may be set to Free Run. Use Triggered mode.
Unable to set a channel alarm.	The measuring mode may be set to Triggered. Use Free Run mode.
Some waveforms are not displayed.	If the sample rate is set to 10 MS/s or higher and there are many displayed channels (especially during synchronous operation), a portion of the channels may not be displayed. A message indicates which channels are not displayed. To display those channels, lower the CPU load by decreasing the number of displayed groups, decreasing the number of displayed channels, lowering the sample rate, and so on.

11

Maintenance

11.2 Messages

SL1000 Unit Error Messages

Error Code	Message	Explanation/Corrective Action
52	Auto setup is in progress. Wait for a moment.	—
53	Auto setup is complete.	—
58	Undoing auto setup. Wait for a moment.	—
59	Auto setup has been undone.	—
66	Automatic strain balancing is in progress. Wait for a moment.	—
67	Automatic strain balancing is complete.	—
69	Calibrating. Wait for a moment.	—
70	Calibration is complete.	—
74	Completed internal HDD format.	—
78	Undoing initialization. Wait for a moment.	—
79	Initialization has been undone.	—
81	The total length of the synchronous connection cables exceeds regulation length.	Appears when the total sync cable length exceeds 10 m. Keep the total cable length less than 10 m.
88	Initializing. Wait for a moment.	—
89	Initialization is complete.	—
703	Unable to undo, because auto setup has not been executed.	Undo is used to undo an auto setup. It becomes available only after executing an auto setup.
713	Auto calibration failure. Check that CH[n] of Slot[n] is available.	Check the input signal of the specified channel.
724	Strain balancing failed. Check that CH[n] of Slot[n] is available.	Check whether the specified channel is connected.
777	Range over occurred during shunt calibration. Check the input voltage or range settings.	Increase the measuring range and execute the calibration again.
806	Cannot change settings during GO/NO-GO. Stop GO/NO-GO first.	Operate the SL1000 after GO/NO-GO judgment is finished.
821	Cannot change trigger delay when external clock is active.	Trigger delay is avaliable to change when internal clock is active.
904	Buffer overrun occurred. It will take [n] seconds to finish recording the rest of the data. Abort recording now?	The tendency for a buffer overrun to occur increases if the sample rate is fast or the number of channels is large. If you abort the recording, the data being recorded will be lost.
905	Buffer overrun occurred on internal hard disk. It will take [n] seconds to finish recording the rest of the data. Abort recording now?	The tendency for a buffer overrun to occur increases if the sample rate is fast or the number of channels is large. If you abort the recording, the data being recorded will be lost.
906	Fan stopped. Measurement and recording will stop. Turn off the power immediately after recording is complete.	Servicing is required.
913	The hard disk is full. Recording to the unit will be stopped. Delete unnecessary files or move files to your PC to free up space.	Delete unnecessary files from the recording destination hard disk. There are two ways to delete files on the SL1000. • Use FTP to delete the files if connected via an Ethernet network. • Connect to the SL1000 using Xviewer and delete files through file manipulation.
941	Probe power is overloaded status. Pull the probe and check the consumption current.	The maximum output current from the SL1000 probe power supply (/P4 option) is 1300 mA. Check the current consumption on the connected probe.
943	Synchronous connection cable came off.	Appears when a sync error is detected during synchronous operation, such as when a sync cable is disconnected. Communication is disconnected when this error occurs. Check the sync cable connections and reconnect.
1001	File access failure. Execute Internal HDD test from the Self Test screen. If the test fails, servicing will be required.	Unable to access the internal hard disk of the SL1000. If the self-test fails, servicing is required.
1002	Invalid file name. Check the input characters.	Check the file name.

Error Code	Message	Explanation/Corrective Action
1003	File name exceeds the maximum number of characters (256). Check the number of input characters.	Check the file name.
1004	The file comments exceed the maximum number of characters (250). Check the number of input characters.	Check the file comments.
1005	Out of disk space. Delete unnecessary files or move files to your PC to free up space.	Delete unneeded files in the recording destination hard disk (PC or SL1000). There are two ways to delete files in the SL1000. • Use FTP if the SL1000 is connected via the Ethernet interface. • Connect to the SL1000 using Xviewer and delete files through file operation.
1117	Reached the maximum file size that can be stored. It will take [n] seconds to finish recording the rest of the data. Abort recording now?	Displayed when the recorded data reaches the maximum savable file size (approx. 12 GB). Measurement also stops when this message is displayed. Wait until the remaining data that has not been recorded is recorded. To cancel recording, click abort.

11

Maintenance

Acquisition Software Error Messages

Message	Explanation/Corrective Action
Cannot find units.	Appears if you start the SL1000 by specifying Previous Settings for the start-up option and the SL1000 cannot be found. Check that: • The SL1000 is connected. • The SL1000 is turned ON.
Measurement in progress.	Appears when an attempt is made to connect to an SL1000 that is measuring. Press the START/STOP key on the SL1000 to stop the measurement first.
The system configuration is different.	Appears if you start the SL1000 by specifying Previous Settings for the start-up option and the system configuration of the SL1000 is different from the previous configuration.
Open the Connection & Group Settings wizard (Display the previous settings offline).	The software starts with the previous settings without connecting to the SL1000.
Go system wizard. (Display the loaded file settings in offline.)	Changes to the settings of the loaded setup file without connecting to the SL1000.
Get settings from the unit.	The settings will be loaded from the SL1000.
Stop measurement?	Appears if the exit option in the environment settings is set to End ACQ and you close the software while the connected SL1000 is measuring.
Redo Connection and Group Settings? Offline settings will be cleared.	This message appears if you search for the SL1000 again while the settings are displayed in offline mode and the system configuration of the software differs from that of the SL1000.
The connected unit is being remotely controlled by another application. Close the other application and connect to the SL1000 unit again.	This message appears if another PC is connected to the detected SL1000. Disconnect the other PC from the SL1000 first and then connect to the SL1000. This message also appears if you try to connect to the SL1000 immediately after the software is terminated by force for some reason. Wait for a few seconds and connect again.
No display data.	Appears if there are no channels to be displayed in the current value display. Select a display channel.
Please set a sample rate less than the sample rate of group 1.	Measuring groups other than measuring group 1 must be set to a lower sample rate than measuring group 1.
Please set a sample interval greater than the sample interval of group 1.	Measuring groups other than measuring group 1 must be set to a longer sample interval than measuring group 1.
If the most significant digit of the sample rate of Group 1 is 5, the next fastest sample rate whose most significant digit is 2 cannot be selected. Select another sample rate or change the sample rate of Group 1.	If the sample rate of Measuring Group 1 is set to a value whose most significant digit is 5 (such as 50 MS/s and 5 M/s), the next fastest sample rate whose most significant digit is 2 (such as 20 MS/s and 2 MS/s) cannot be specified. For example, if the sample rate of Measuring Group 1 is 500 kS/s, the sample rate of other measuring groups cannot be set to 200 kS/s.
If the most significant digit of the sample interval of Group 1 is 5, the next shortest sample rate whose most significant digit is 2 cannot be selected. Select another sample interval or change the sample interval of Group 1.	If the sample interval of Measuring Group 1 is set to a value whose most significant digit is 2 (such as 20 ns and 200 ns), the next shortest interval whose most significant digit is 5 (such as 50 ns and 500 ns) cannot be specified. For example, if the sample interval of Measuring Group 1 is 2 ms, the sample interval of other measuring groups cannot be set to 5 ms.
There are sample rates that are higher than the sample rate of Group 1. Change the sample rate of the relevant groups.	Appears if the sample rate of measuring group 1 is set lower than the sample rate of another measuring group.
There are sample intervals lower than the sample interval of Group 1. Change the sample interval of the relevant groups.	Appears if the sample interval of measuring group 1 is set greater than the sample interval of another measuring group.
Select the target channel on the sheet.	To carry out P1X Measure or P2X Measure, select the channel to be measured in the Measurement Settings screen.
Turn OFF GO/NO-GO judgment.	Appears if GO/NO-GO judgment is ON and the trigger mode is set to Single (N). Set the trigger mode to Normal or Single to perform GO/NO-GO judgment.
Set to other than the Single(N) trigger mode before changing to ON.	Cannot be turned ON when the trigger mode is set to Single(N). Set the trigger mode to Normal or Single.
File divided.	The file has been divided automatically, because the recording file size exceeded 2 GB.
Failed to generate file	Failed to save the data.

Message	Explanation/Corrective Action
Disconnecting the unit.	Appears if you search for and connect to an SL1000 in the Connection & Group Settings screen and then close the Connection & Group Settings screen using the Cancel button. The SL1000 will be disconnected.
Turn OFF GO/NO-GO judgment before starting to record.	Recording is not allowed if GO/NO-GO judgment is ON.
Turn OFF GO/NO-GO judgment before specifying Measure Settings.	Waveform parameter measurement is not allowed if GO/NO-GO judgment is ON.
Failed to load the setup file.	The setup file is corrupt.
Cannot find the appropriate unit. Connect to the unit with USB.	Unable to detect SL1000s whose communication settings can be specified. Check that: • The SL1000 is connected. • The SL1000 is turned ON. • The group ID of the SL1000 is set to zero.
Connection failed.	Appears if the connection to the SL1000 fails when making a reconnection on the Self Test screen.
Cannot find Xviewer. Select Xviewer.	Unable to find Xviewer (a software provided with this software). Specify the location of the Xviewer application.
Stop measurement before changing settings.	You cannot change the settings while the SL1000 is measuring.
Stopping measurement and sending settings to the unit.	Appears in cases such as when the software is started by specifying Previous Settings for the start-up option while the SL1000 is measuring. The software will stop the measurement and send the previous settings to the SL1000.
Recording in progress.	Appears when the software is started by specifying Previous Settings for the start-up option while the SL1000 is recording. Select the action from the choices displayed.
Stop recording?	Appears if the exit option in the environment settings is set to End ACQ and you close the software while the connected SL1000 is recording.
Stop recording before changing settings.	You cannot change the settings while the SL1000 is recording.
Select the recording source channel in Measurement Settings.	Appears if you start recording without selecting a channel to be recorded. Click OK to open the Measurement Settings screen.
To execute this operation, stop measurement first.	Not allowed while the SL1000 is measuring.
To execute this operation, stop recording first.	Not allowed while the SL1000 is recording.
The measuring time must be increased. Change to the minimum time?	The measuring time must be long enough so that the number of samples is greater than or equal to 1000. This message appears if you need to change the measuring time at the new sample rate. If you select Yes, the minimum time for the new sample rate is set. If you select No, the sample rate is set back to the original value.
The measuring time must be decreased. Change to the maximum time?	The maximum measuring time varies depending on the maximum sample rate (Measuring Group 1) and the number of channels. This message appears if you need to change the measuring time at the new sample rate. If you select Yes, the maximum time for the new sample rate is set. If you select No, the sample rate is set back to the original value.
Assign the source channels to measuring groups in Connection & Group Settings.	Appears if you start a measurement without assigning channels to measuring groups. Click OK to open the Connection & Group Settings screen.
Assign at least one master unit's module to Measuring Group 1.	Register at least one master unit module in measuring group 1.
If the most significant digit of the highest sample rate of channels within a display group is 5, a channel set to the next fastest sample rate whose most significant digit is 2 cannot be added to the group. Assign the channel to another display group or reassign the channel with the maximum sample rate.	If the most significant digit of the maximum sample rate within a display group is 5 (such as 50 MS/s and 5 M/s), a channel cannot be registered to the group that is set to the next fastest sample rate whose most significant digit is 2 (such as 20 MS/s and 2 MS/s). For example, if the maximum sample rate of channels registered to Display Group 1 is 500 kS/s, channels with a sample rate set to 200 kS/s cannot be registered to Display Group 1.
If the most significant digit of the highest sample rate of channels within a display group is 5, a channel set to the next fastest sample rate whose most significant digit is 2 cannot be in the same group. Before changing the current channel, add another channel to change the maximum sample rate or remove the channel with the maximum sample rate whose most significant digit is 2 or 5.	If the most significant digit of the maximum sample rate within a same display group is 2 (such as 20 MS/s and 2 M/s), a channel cannot be registered that is set to the next faster sample rate whose most significant digit is 5 (such as 50 MS/s and 5 MS/s). For example, if the maximum sample rate of channels registered to Display Group 1 is 200 kS/s, channels with a sample rate set to 500 kS/s cannot be registered to Display Group 1.

11

Maintenance

Message	Explanation/Corrective Action
When the maximum sample rate of the channel in the same Display Group is a series of 5s, the channel of the sample rate of a series of leading 2s cannot assign in the same Display Group. Please assign another channel to change the maximum sample rate, or omit channels of a series of 5s or 2s, before change the selected channel.	Appears if the error condition above occurs as a result of changing the settings of the current channel.
The maximum measuring time will be exceeded, because the sample rate difference with respect to Group 1 is too large. Select a sample rate that is greater than or equal to xxx.	Appears if the number of samples will be less than 1000 even if measured over the maximum measuring time, because the difference between the new sample rate and that of Measuring Group 1 is too large.
The maximum measuring time will be exceeded, because the sample interval difference with respect to Group 1 is too large. Select a sample interval that is less than or equal to xxx.	Appears if the number of samples will be less than 1000 even if measured over the maximum measuring time, because the difference between the new sample interval and that of Measuring Group 1 is too large.
The maximum measuring time will be exceeded, because the sample rate difference with respect to Group 1 is too large. Change the sample rate of other groups.	Appears if the number of samples will be less than 1000 even if measured over the maximum measuring time, because the difference between the new sample rate of Measuring Group 1 and that of another measuring group is too large.
The maximum measuring time will be exceeded, because the sample interval difference with respect to Group 1 is too large. Change the sample interval of other groups.	Appears if the number of samples will be less than 1000 even if measured over the maximum measuring time, because the difference between the new sample interval of Measuring Group 1 and that of another measuring group is too large.
To change the settings, connect to the unit first.	Appears if you carry out an operation that is invalid when the SL1000 is not connected.
Cannot find the selected path.	Appears if the specified path to the recording folder is invalid.
Cannot find master unit (Unit ID=0). Check the rotary switch in the back of the unit.	Appears when SL1000s are searched for by group ID designation, but a master unit with unit ID set to zero cannot be detected. Set the unit ID to zero using the rotary switch on the rear panel of the SL1000 that you want to connect to.
Overlapping unit ID detected. Check the rotary switch in the back of the unit.	Appears when SL1000s are searched for by group ID designation, and multiple SL1000s with the same unit ID are detected. Set the unit IDs so that they do not overlap with each other using the rotary switch on the rear panel of the SL1000s.
Changing the trigger count, because the trigger count of the Single (N) trigger mode exceeds the maximum value.	Appears if the trigger count exceeds the maximum trigger count as a result of changing the sample rate or measuring time. The maximum trigger count that can be specified varies depending on the sample rate, measuring time, number of channels, and internal memory size.
Changing the trigger mode to Single, because the maximum trigger count will be 1 otherwise.	Appears if the internal memory size is less than the size needed for two measurements at the set sample rate, measuring time, and number of channels.
Connect to the unit first.	Appears if you carry out an operation that can be executed only when connected to the SL1000 such as initializing the settings.
Changing the pre-trigger setting, because the pre-trigger exceeds the number of measurement points.	Appears if the number of measurement points is changed to a value less than the pre-trigger value when measuring using an external clock.
Changing the trigger delay value as follows as a result of the sample rate change.	Changing the sample rate changes the trigger delay resolution. This message appears if the trigger delay value will be changed as a result of the resolution change.
Data save is complete.	Appears when saving of waveform data is completed.
Data to be saved doesn't exist.	Appears when there is no waveform data that can be saved.
File access failure.	—
Holding the display	Appears while holding the waveform display.
Changing the trigger level.	Appears if the trigger level will be changed as a result of the trigger level going out of range due to a range change.
Changing the alarm level.	Appears if the alarm level will be changed as a result of the alarm level going out of range due to a range change.
WARNING: Formatting will erase all data. To format the disk, click OK. To quit, click CANCEL.	Appears when the alarm level goes outside the range due to a range change and the alarm level is adjusted.
Failed to display some channels because of the higher sample rate.	When multiple channels are assigned to a single display group, the displaying of the next set of data starts overwriting the current set of data that is in the process of being displayed. To prevent this from happening, a portion of the channel display is not shown while this message is displayed.

Message	Explanation/Corrective Action
Disconnected the unit.	Appears when the SL1000 is disconnected improperly such as by removing the communication cable or by turning the SL1000 OFF while connected to the SL1000.
All waveform data of the unit memory will be cleared.	Appears when the SL1000 memory is cleared.
Two or more units of the same group ID detected. Turn OFF the power of the overlapping unit once and change group ID in the back of the unit.	—
Formatting internal HDD.	Appears when the hard disk is being formatted through self-test.
Select the target channels.	Appears if you click OK without selecting any measurement channel on the Measurement Settings screen. Select measurement channels.
Select the target measure items.	Appears if you click OK without selecting any measurement item on the Measurement Settings screen. Select measurement items.
Necesarry files not found. Confirm the folder of update file.	Appears if a file required for updating the firmware is not available in the specified folder on the firmware update screen. Select an appropriate folder.
Sync. Failure Detected, and disconnect the unit.	Appears when a sync error is detected after units operating in sync are detected but before they are confirmed (OK or Next has not been clicked) on the Connection & Group Settings screen. A sync error may occur such as when a communication cable or a sync cable is disconnected. Check the connection and reconnect.A unit message (943) appears if the error occurs after confirmation on the Connection & Group Settings screen.
Saving waveform. Wait for a moment.	Appears while saving waveform data.
Number of history is [n]. Continue averaging save ?	Appears when the number of history data entries recorded on this instrument is less than the number of history entries specified by the average count parameter on the Save Average window.
Failed to display some channels because of no data in display time.	Appears when channels are assigned to a single display group from different measuring groups and those channels are set to extremely different sample rates and measured data is not available in a channel set to a low sample rate.
Confirm the input signal of external clock.	Appears if you set the clock source to an external signal and you start measurement without applying the external clock. Check the external clock input.
Cannot find File Utility. Select File Utility.	Appears when the File Utility is not found. The File Utility is installed along with the Acquisition Software. Reinstall the Acquisition Software.
A synchronous cable is not correctly connected. Please confirm the connection of synchronous cable.	Appears such as when slave units have been detected but sync cables are not connected. Check the sync cable connections and search again.
xxx files transferred.	Displays the progress of the file transfer between the PC and an SL1000.
Transfer complete in xxx.	Displays the estimated remaining time to transfer files between the PC and an SL1000.
Completed all file transfer.	Appears when a file transfer between the PC and an SL1000 is completed.
Invalid folder name. Check the input characters.	Appears when the name of the new folder that you created contains invalid characters in the file transfer screen. Enter a proper folder name.
xxx already exists. Overwrite?	A overwrite confirmation message appears when the transfer destination contains files with the same name as those that you are trying to transfer when you execute file transfer between the PC and an SL1000.
xxx files deleted.	Displays the progress when deleting files or folders in the file transfer screen.
Completed all file deletion.	Appears when deleting of files or folders is complete in the file transfer screen.
Delete selected file/directory?	Appears when you execute the deletion of files or folders in the file transfer screen.
Fail to download. xxx is on recording.	Appears when you try to transfer between the PC and an SL1000 a file that is currently being recorded to.
Aborting file deletion.	Appears when you cancel the operation while files or folders are being deleted in the file transfer screen.

11

Maintenance

11.2 Messages

Message	Explanation/Corrective Action
PC HDD is full. Download was cancelled.	Appears when the total transfer source data size exceeds the PC's free space when you execute file transfer from an SL1000 to the PC.
HDD is full. Upload was cancelled.	Appears when the total transfer source data size exceeds the SL1000's free space when you execute file transfer from the PC to an SL1000.
xxx was not transferred successfully. Download will be aborted.	Displays the file name when a file transfer from an SL1000 to the PC fails.
xxx was not transferred successfully. Upload will be aborted.	Displays the file name when a file transfer from the PC to an SL1000 fails.
Acquisition Software does not support the firmware version of the unit. Software update is necessary.	Appears when the Acquisition Software version is incompatible with the SL1000 firmware. Update the Acquisition Software.
The detected unit is measuring on the synchronous operation.	Appears when the master unit is in synchronous operation mode when only the master has been detected during unit searching. Change the search conditions so that slave units that are operating in sync can be detected, and search again.
Load as the setting for synchronous operation.	Appears when you connect to an SL1000 that is operating in sync and you load a setup file that was saved during independent operation. This message also appears when the Previous Settings check box is selected in Environment Settings, exited the software the last time in independent operation mode, and then started the software in synchronous operation mode.
Select trigger channel.	Appears when you close the Trigger Settings screen when you have set the logical condition to AND in combination trigger and have not selected a trigger source channel. Select the trigger source channel.
Select alarm channel.	Appears when you close the Channel Alarm Settings screen when you have set the logical condition to AND and have not selected an alarm channel. Select the alarm channel.
Accumulated/Snapshot waveforms will be cleared to resize a waveform area.	Appears when the size of the area that is used to draw the waveform changes. To clear all the accumulated and snapshot waveforms, click OK; otherwise, click Cancel.
Accumulated waveforms are displayed. Clear accumulation to resize the window.	Appears when you change the window size while accumulated or snapshot waveforms are displayed. To change the window size, clear all the accumulated waveforms and snapshot waveforms.
Cannot set marks more than the maximum number of marks (128).	Appears when you set the 129th mark. Delete marks that you no longer need, and set the mark again.
Current Firm Version is not supported, you will not be able to connect.	Appears when the Acquisition Software version is incompatible with the SL1000 firmware. Update the Acquisition Software or the SL1000 firmware.

File Utility Error Messages

Function	Message	Explanation/Corrective Action
Common	Cannot load this file format. Select files saved using the SL1000.	These files do not contain waveform data that has been measured using the SL1000. Check the files.
	Failed to load files. Waveform files may be corrupt. Check the files.	Waveform files may be corrupt. Check the files.
	Not enough memory.	Insufficient PC memory. Close other applications.
	Unsupported DLL version. Check that it is the latest version.	The waveform data acquisition DLL (SL1000.DLL) version may be old. Check that you have the latest version of SL1000.DLL.
	Invalid folder or file name.	An unavailable folder may have been specified, or invalid characters may have been used. Check the folder name and file name.
	Cannot create a folder.	You may be specifying an area where folders cannot be created, or the disk may be write-protected. Check the folder path and the disk write-protection attribute.
	The output folder cannot be set to "%s." Select another folder.	The output destination is set to an area that is prohibited by the system. Change the output destination.
File Merge	Cannot merge files due to conflicting measurement conditions. Check the measurement conditions.	File merging conditions are not met. Check the merging conditions on page 10-11 and the file list.
	The number of files to be combined exceeds the maximum number of files (128). Keep the number of files to be combined within the maximum allowed number.	Same as left
	Cannot merge files measured in Free Run mode using an external clock.	Same as left
	Cannot merge files over the time axis measured in Trigger mode using an external clock.	Same as left
	Cannot merge WDF files stored on different drives. Select WDF files stored on the same drive.	Same as left
	Failed to merge files.	Files could not be merged due to insufficient free disk space or corrupted waveform data. Check the free disk space and the files to merge.
	Cannot create files contain more than 2 G samples per channel.	The number of samples per channel in the files that you want to merge exceeds 2 G points. Select files for merging so that the number of points does not exceed 2 G points.
File Divide	An error occurred during File Divide.	Multiple errors may have occurred in the file division process. Click Detail to check the error details.
	Cannot divide a file because the file size is less than the dividing recording length. Change the dividing record length.	Same as left
	Cannot divide a file because of the file saved in Triggered mode. Select files saved in Free Run mode.	Same as left
	The number of file divisions exceeds the maximum number of files (1000). Increase the dividing record length or change the file size so that the maximum number of files is not exceeded.	Same as left
	Cannot divide a file because the specified time for dividing the file is not contained in the recording time. Change the time for dividing the files.	Same as left

11

Maintenance

Function	Message	Explanation/Corrective Action
File Divide	Set the record length to a value from 1 to 2592000.	The specified time value exceeds the allowable record length range. Check the value.
	Set the record length to a value from 1 to 1000000000.	The specified point value exceeds the allowable record length range. Check the value.
	Set the first data to a value from 1 to 1000000000.	The specified point value exceeds the allowable record length range. Check the value.
	Failed to divide a file.	Files could not be divided due to insufficient free disk space or corrupted waveform data. Check the free disk space and the source files that you want to divide.
Waveform Display Acceleration	An error occurred during Waveform Display Acceleration.	Multiple errors may have occurred in the waveform display acceleration process. Click Detail to check the error details.
	This file already converted for Waveform Display Acceleration. Select files not converted.	Same as left
	Cannot convert file for Waveform Display Acceleration, because the file was saved in Triggered mode. Select waveform data files saved in Free Run mode.	Same as left
File Conversion	An error occurred during File Conversion.	Multiple errors may have occurred in the file conversion process. Click Detail to check the error details.

12.1   Connection to the SL1000

Item	Specifications
Maximum connectable 1000s	1 unit (Up to eight units during synchronous operation)
Connection type	USB or Ethernet (option)

12.2   Measurement Functions

Item	Specifications	
Measurement control	Measurement start and stop	
Measuring groups	4	
Measuring Channels	During single operation:	Up to 16 channels total among 4 measuring groups (register up to 16 channels to a single group)
	During synchronous operation:	Up to 128 channels total from four measuring groups (up to 128 channels can be registered to a single measuring group)
Measuring mode	Free Run and Triggered	
ACQ mode	Normal, Envelope, and Box Average	
Clock source	Internal and external	
Time axis accuracy	±0.005% (under standard operating conditions)	
External clock input	Frequency range: Up to 5 MHz	
Sample rate	5 S/s, 10 S/s, 20 S/s, 50 S/s, 100 S/s, 200 S/s, 500 S/s, 1 kS/s, 2 kS/s, 5 kS/s, 10 kS/s, 20 kS/s, 50 kS/s, 100 kS/s, 1 MS/s, 2 MS/s, 5 MS/s, 10 MS/s, 20 MS/s, 50 MS/s, and 100 MS/s	
Sample interval	1/sample rate	
Maximum record length (internal memory)	Varies depending on the measuring mode and the number of modules used in measurement	
	In Free Run mode	1 module : 32 MW/ch
		2 modules : 16 MW/ch
		3 to 4 modules : 8 MW/ch
		5 to 8 modules : 4 MW/ch
	In Trigger mode	
	Normal/ Single (N)	1 module : 10 MW/ch
		2 modules : 10 MW/ch
		3 to 4 modules : 5 MW/ch
		5 to 8 modules : 2.5 MW/ch
	Single	1 module : 50 MW/ch
		2 modules : 25 MW/ch
		3 to 4 modules : 10 MW/ch
		5 to 8 modules : 5 MW/ch

Measuring time (for Triggered mode)

Single mode

Measuring Channel Number[1]	Measuring Time (s)
2	1000/maximum sample rate[2] to 50000000/maximum sample rate[2]
4	1000/maximum sample rate[2] to 25000000/maximum sample rate[2]
6, 8	1000/maximum sample rate[2] to 10000000/maximum sample rate[2]
10 to 16:	1000/maximum sample rate[2] to 5000000/maximum sample rate[2]

1   Measuring Channel Number: 2, 4, 6, 8, 10, 12, 14, 16
2   The sample rate of Measuring Group 1.

Normal or Single (N) mode

Measuring Channel Number[1]	Measuring Time (s)
2	1000/maximum sample rate[2] to 10000000/maximum sample rate[2]
4	1000/maximum sample rate[2] to 10000000/maximum sample rate[2]
6, 8	1000/maximum sample rate[2] to 5000000/maximum sample rate[2]
10 to 16:	1000/maximum sample rate[2] to 2500000/maximum sample rate[2]

1   Measuring Channel Number: 2, 4, 6, 8, 10, 12, 14, 16
2   The sample rate of Measuring Group 1.

12

Specifications

Item	Specifications	
Measurement points (for external clock)		
	Measuring Channel Number[1]	**Measuring Time**
	2	10 to 50000000
	4	10 to 25000000
	6, 8	10 to 10000000
	10 to 16	10 to 5000000
	1 Measuring Channel Number: 2, 4, 6, 8, 10, 12, 14, 16	

12.3   Trigger Function

Item	Specifications
Trigger mode	Normal, Single, and Single (N)
Trigger count	2 to infinity
Trigger class	Simple and Combination
Simple trigger	
Trigger source	CH1 to CH16[1], EXT (signal applied to the TRIG IN terminal), LINE (commercial power source signal connected to the SL1000), and time (a specified time)
Trigger slope	CH1 to CH16[1]: Rising, falling, and rising/falling EXT: Rising and falling LINE: Fixed to rising edge Set the date (year/month/day), time (hour/minute/second), and time interval (1 min to 24 h) if triggering with time.
Combination trigger	
Trigger source	CH1 to CH16[1] and EXT (signal input from the TRIG IN terminal)
Trigger slope	CH1 to CH16[1]: Rising, falling, rising/falling, H, L, IN, OUT, IN(L), and OUT(L) EXT: Rising and falling
Selectable range of trigger levels	±Measuring range around 0
Hysteresis	Low, Middle, and High
Hold off time	0 to 10 s
Pre-trigger	0 to 100% (0 to the number of measured points – 1 for external clock)
Trigger delay	0 to 10 s
Manual trigger	Controlled from the toolbar

1   Up to CH128 during synchronous operation

12.4　Recording Function

Item	Specifications		
Recording control	Recording start and stop and manual division		
Recording destination	PC hard disk, internal hard disk, and PC + internal hard disk (the internal hard disk is an option)		
Maximum real-time hard disk recording speed[2]	PC hard disk: 1.6 MS/s (=100 kS/s x 16 channels > 10 kS/s x 128 channels		
	(1 s recording time or longer, or 1 s recording interval or longer		
	For recording that uses alarms or external trigger signals		
	Recording using alarms:		The time spacing between the end of one recording to the next alarm signal that starts the recording operation. The time spacing must be at least 1 s.
	Recording using external trigger signals:		The time spacing between the end of one recording to the next trigger signal. The time spacing must be at least 2 s.)
Record conditions	For FreeRun mode: Immediate, Abs. Time, Time Divided, Alarm, and External Trigger		
	For Trigger Mode:　Each Trigger		
Recording time and recording points (for Free Run mode)	For internal clock:	0.1 to 2000000000 points/maximum sample rate (s) (if the recording interval is set to OFF)	
		0.001 to 2000000000 points/maximum sample rate (s) (if the recording interval is not set to OFF)	
	For external clock: 10 to 2000000000 points		
Record interval (for Free Run mode)	For internal clock:　None, 1 to 86400 (s) (1 day)		
	For external clock:　None, 2 to 1000000 points		
No. of recordings	1 to 100000 and infinite		
File designation	Folder designation, file name designation, auto naming (date and sequence number), and comments		
File order	Sequential and cyclic		
File format	YOKOGAWA original binary format (.wdf extension)		

1　Cannot be used during synchronous operation

2　The maximum speed is a reference value. The actual speed varies depending on the measurement conditions and the PC performance.

12

Specifications

12.5 Functions

GO/NO-GO Function (Triggered Mode)

Item	Specifications
Mode	Waveform parameters
Operating conditions	Always, True, and False
Judgment action	Data save and buzzer
Output logic	AND, OR
GO/NO-GO judgment range	ACQ data and data between cursors
Judgment number	1 to 16
Channel	Ch1 to Ch16
Judgment criteria	In and Out
Judgment parameters	P-P, Amp, Max, Min, High, Low, Avg., Middle, RMS, Sdev, +OvrShoot, -OvrShoot, Rise, Fall, Freq, Period, +Width, -Width, Duty, Pulse Cnt., Burst1, Burst2, AvgFreq, AvgPeriod, Int1TY, and Int2TY
Judgment range	Judgment high and low limits (−9.9999+E30 to +9.9999+E30)

Alarm Function

Item	Specifications
Alarm types	System alarm, channel alarm (for Free Run mode)
Alarm output logic[1]	AND, OR
Alarm channel[1]	Ch1 to Ch16
Alarm pattern[1] (Channel alarm)	H, L, IN(L), and OUT(L)
Alarm level[1] (Channel alarm)	±Measuring range around 0
Alarm hysteresis[1] (Channel alarm)	Low, Middle, and High
System alarm	Fan stop, ACQ memory buffer overrun, hard disk full, and sync. failure detection
Alarm output[1]	Hold and nonhold
Alarm detection	The time from an alarm occurrence to alarm release or the time from an alarm release to alarm occurrence is greater than or equal to 500 ms.

1   Free Run Mode

Display Functions

Item	Specifications
Display group assignment	Channel assignment to display groups (up to 4 groups)
Waveform display format	T-Y
Zoom (for Triggered mode)	Time-axis zoom display, zoom cursor Display format: Main/Zoom/Main + Zoom
Roll display	Displays when Triggered mode is Single, and 1 s Measuring time is or longer.
Displayed time	Maximum sample interval × 10 to channel record length/maximum sample rate
Current value display	Digital, bar graph, meter, and thermometer
Display scale	OFF (= measuring range), user-defined scale, and auto scale
Display axis setting	Multi zone, Slide zone, and Edit zone
Graph settings	Background color, grid color, line width, alarm level display, current mark, X-axis display format, X-axis scaling, X-axis unit, etc.
Waveform dot connection	Line, Sine, Pulse, Dot (no interpolation)
Accumulation display[1]	Accumulates T-Y and X-Y waveforms
Snapshot[1]	The waveform that is currently being displayed can be retained on the screen as a snapshot waveform. Display color setting and snapshot waveform deletion
X-Y Display[1]	X-axis channel settings, selection of main or zoomed waveform (in Triggered mode), and selection of the number of data points to draw (2K, 10K, 100K)
Mark display[1]	Setting of marks (up to 128 marks, each mark can display up to 16 characters), display color setting, mark editing, deletion of marks, mark list, collectively saving mark data with the same file name as the waveform data, and loading mark data into Xviewer

Item	Specifications
Display control	Display hold and hold release
Unit operation status monitor	Measurement status, recording status, trigger status, alarm output status, GO/NO-GO output status, free disk space, recording buffer status, error information, and recorded file information
Alarm history list	List of the following items Channel alarm status, alarm generation unit, alarm generation channel, alarm pattern, alarm measured value, alarm occurrence time, and alarm end time Waveform analysis of alarm locations

1   Versions 2.10 and later

Waveform Analysis Function

Item	Specifications
Cursor	Readouts from the horizontal cursors, vertical cursors, cursors by sample rate Readouts from the horizontal cursors, vertical cursors, and cursors by sample rate, and X-Y waveform cursors (X-Y cursors must be moved on T-Y waveforms)[1]
Zoom (Triggered mode)	Time-axis zoom display, zoom cursor
Past data/history waveform analysis	Displays past data stored in the SL1000 memory (in Free Run mode) Displays up to 5000 history waveforms (in Triggered mode) View past data/history waveform using a scroll bar, load history waveform by specifying an acquisition number, clear history waveforms Auto play:[1] Automatically displays past data or history waveforms. In Triggered mode, zoomed waveforms scroll automatically. Auto play, reverse play, stop, go to oldest data, go to most recent data, and play speed adjustment
Waveform parameter measurement (Triggered mode)	Compute 26 waveform parameters for each channel in display group P-P, maximum, minimum, rms, average, standard deviation, undershoot, overshoot, high, low, amplitude, (maximum + minimum)/2, rise time, fall time, frequency, period, average frequency, average period, time width greater than or equal to the mesial value, time width less than or equal to the mesial value, duty ratio, pulse count, burst width (Burst1, Burst2), area (Int1TY, Int2TY)

1   Versions 2.10 and later

File Function

Item	Specifications
Setup file	Load and save Acquisition Software settings
Waveform data file	Load (Xviewer), save (file format: wdf, csv, or bin; range to save:[1] all, display, cursor, zoom display, and user), save all data (up to 5000 history waveforms), and save averaged data[2]
Waveform screen capture file	Screen capture data format: BMP or PNGWaveform parameters (Triggered mode) Saves waveform parameters in CSV format
Waveform parameter (for Triggered mode)	Save waveform parameters (*.csv)
Unit file operation	File operations on the unit's internal hard disk (download, upload, delete, create folder, rename, and collective transfer during synchronous operation)

1   Versions 2.10 and later
2   Versions 2.41 and later

File Utility Function

Item	Specifications
File merging	Merge waveform data files over time[1] or over channels
File division	Divides waveform data files and extracts a portion of the data
Waveform display acceleration	Adds display data to the waveform data files. The display data is used to accelerate waveform displaying on Xviewer.
File format	Converts waveform data files (.wdf extension) to ASCII (.csv extension) or binary (.bin extension)[2] files

1   In Free Run mode only
2   Versions 2.10 and later

12

Specifications

Other Features

Item	Specifications
Auto setup	Automatically sets the voltage and time axis for the waveform registered to measuring group 1 (in Triggered mode) Auto setup cancellation
Initialization	Resets the settings to factory default values Initialization cancellation
Calibration	Auto calibration[1] and manual calibration available
Environment settings	Measurement options, recording option[2] startup options, and end options
Communication settings (during USB connection)	Set the group name, unit name, IP address, FTP account
Self-test	SL1000 keyboard test, ACQ memory test, system memory test, backup memory test, internal hard disk test, internal hard disk formatting, CPU temperature measurement, SL1000 version display
SL1000 system information display	Lists the SL1000 system information and detailed measurement/recording parameters
SL1000 key lock	Control the SL1000 key lock and release
Unit information display	Displays the unit's firmware version and serial number

1   Cannot be used during synchronous operation

2   During synchronous operation only

Appendix 1 Number of Data Points and Acquisition Count

If measuring with the trigger mode set to Single (N), the number of data points that can be acquired to the SL1000 internal memory varies depending on the number of channels registered to the measuring group, sample rate, and acquisition time.

Number of Data Points (N)[1]	Acquisition Count			
	Number of Measuring Channels			
	10 to 16	6 to 8	4	2
Minimum number of points[2] ≤ N ≤ 1 k	5000	5000	5000	5000
1 k < N ≤ 2.5 k	2977	5000	5000	5000
2.5 k < N ≤ 5 k	1597	3195	5000	5000
5 k < N ≤ 10 k	818	1637	3275	5000
10 k < N ≤ 25 k	326	654	1309	2620
25 k < N ≤ 50 k	162	326	654	1309
50 k < N ≤ 100 k	80	162	326	654
100 k < N ≤ 250 k	31	64	130	261
250 k < N ≤ 500 k	15	31	64	130
500 k < N ≤ 1 M	7	15	31	63
1 M < N ≤ 2.5 M	2	5	11	24
2.5 M < N ≤ 5 M	1	2	5	11
5 M < N ≤ 10 M		1	2	5
10 M < N ≤ 25 M			1	1
25 M < N ≤ 50 M				1
50 M < N ≤ 100 M				
100 M < N ≤ 250 M				
250 M < N ≤ 500 M				
500 M < N ≤ 1 G				
1 G < N ≤ 2 G				

1 The number of data points can also be determined from the following equation.
  For internal clock
      The number of data points = sample rate (S/s) × measuring time (s)
      1 k = 1000
      1 M = 1000 k = 1000 × 1000
      1 G = 1000000 k = 1000000 × 1000
  For external clock
      The number of data points = the set number of measured points
2 For internal clock: 1000 points
  For external clock: 10 points

Appendix 2 Maximum Number of Measured Points and Measuring Time

The tables below list the maximum number of measured points that can be saved to the internal memory and the measuring time for Free Run and Triggered modes.

Free Run Mode Maximum Number of Measured Points That Can Be Saved to 128 MW Memory and Measuring Time (unit: s)

Number of Measuring Channels		2CH	4CH	6CH	8CH	10CH	12CH	14CH	16CH
Maximum Number of Measured Points /ch		32 M	16 M	8M	8 M	4 M	4 M	4 M	4 M
Maximum Sample Rate	100 MS/s	0.32	0.16	0.08	0.08	0.04	0.04	0.04	0.04
	50 MS/s	0.64	0.32	0.16	0.16	0.08	0.08	0.08	0.08
	20 MS/s	1.6	0.8	0.4	0.4	0.2	0.2	0.2	0.2
	10 MS/s	3.2	1.6	0.8	0.8	0.4	0.4	0.4	0.4
	5 MS/s	6.4	3.2	1.6	1.6	0.8	0.8	0.8	0.8
	2 MS/s	16	8	4	4	2	2	2	2
	1 MS/s	32	16	8	8	4	4	4	4
	500 kS/s	64	32	16	16	8	8	8	8
	200 kS/s	160	80	40	40	20	20	20	20
	100 kS/s	320	160	80	80	40	40	40	40
	50 kS/s	640	320	160	160	80	80	80	80
	20 kS/s	1600	800	400	400	200	200	200	200
	10 kS/s	3200	1600	800	800	400	400	400	400
	5 kS/s	6400	3200	1600	1600	800	800	800	800
	2 kS/s	16000	8000	4000	4000	2000	2000	2000	2000
	1 kS/s	32000	16000	8000	8000	4000	4000	4000	4000
	500 S/s	64000	32000	16000	16000	8000	8000	8000	8000
	200 S/s	160000	80000	40000	40000	20000	20000	20000	20000
	100 S/s	320000	160000	80000	80000	40000	40000	40000	40000
	50S/s	640000	320000	160000	160000	80000	80000	80000	80000
	20 S/s	1600000	800000	400000	400000	200000	200000	200000	200000
	10 S/s	3200000	1600000	800000	800000	400000	400000	400000	400000
	5 S/s	6400000	3200000	1600000	1600000	800000	800000	800000	800000

Normal or Single(N) Triggered Mode Maximum Number of Measured Points per Acquisition and Measuring Time (unit: s)

Number of Measuring Channels	2CH	4CH	6CH	8CH	10CH	12CH	14CH	16CH
Maximum Number of Measured Points /ch	10 M (×5)	10 M (×2)	5M(×2)	5M(×2)	2.5M(×2)	2.5M(×2)	2.5M(×2)	2.5M(×2)
100 MS/s	0.1	0.1	0.05	0.05	0.025	0.025	0.025	0.025
50 MS/s	0.2	0.2	0.1	0.1	0.05	0.05	0.05	0.05
20 MS/s	0.5	0.5	0.25	0.25	0.125	0.125	0.125	0.125
10 MS/s	1	1	0.5	0.5	0.25	0.25	0.25	0.25
5 MS/s	2	2	1	1	0.5	0.5	0.5	0.5
2 MS/s	5	5	2.5	2.5	1.25	1.25	1.25	1.25
1 MS/s	10	10	5	5	2.5	2.5	2.5	2.5
500 kS/s	20	20	10	10	5	5	5	5
200 kS/s	50	50	25	25	12.5	12.5	12.5	12.5
100 kS/s	100	100	50	50	25	25	25	25
50 kS/s	200	200	100	100	50	50	50	50
20 kS/s	500	500	250	250	125	125	125	125
10 kS/s	1000	1000	500	500	250	250	250	250
5 kS/s	2000	2000	1000	1000	500	500	500	500
2 kS/s	5000	5000	2500	2500	1250	1250	1250	1250
1 kS/s	10000	10000	5000	5000	2500	2500	2500	2500
500 S/s	20000	20000	10000	10000	5000	5000	5000	5000
200 S/s	50000	50000	25000	25000	12500	12500	12500	12500
100 S/s	100000	100000	50000	50000	25000	25000	25000	25000
50 S/s	200000	200000	100000	100000	50000	50000	50000	50000
20 S/s	500000	500000	250000	250000	125000	125000	125000	125000
10 S/s	1000000	1000000	500000	500000	250000	250000	250000	250000
5 S/s	2000000	2000000	1000000	1000000	500000	500000	500000	500000

(Maximum Sample Rate — row labels in the first value column)

The value in parentheses by the maximum number of measured points is the corresponding number of triggers in Single (N) mode.

Single Trigger Maximum Number of Measured Points for One Acquisition and Measuring Time (unit: s)

Number of Measuring Channels	2CH	4CH	6CH	8CH	10CH	12CH	14CH	16CH
Maximum Number of Measured Points /ch	50 M	25M	10M	10M	5M	5M	5M	5M
100 MS/s	0.5	0.25	0.1	0.1	0.05	0.05	0.05	0.05
50 MS/s	1	0.5	0.2	0.2	0.1	0.1	0.1	0.1
20 MS/s	2.5	1.25	0.5	0.5	0.25	0.25	0.25	0.25
10 MS/s	5	2.5	1	1	0.5	0.5	0.5	0.5
5 MS/s	10	5	2	2	1	1	1	1
2 MS/s	25	12.5	5	5	2.5	2.5	2.5	2.5
1 MS/s	50	25	10	10	5	5	5	5
500 kS/s	100	50	20	20	10	10	10	10
200 kS/s	250	125	50	50	25	25	25	25
100 kS/s	500	250	100	100	50	50	50	50
50 kS/s	1000	500	200	200	100	100	100	100
20 kS/s	2500	1250	500	500	250	250	250	250
10 kS/s	5000	2500	1000	1000	500	500	500	500
5 kS/s	10000	5000	2000	2000	1000	1000	1000	1000
2 kS/s	25000	12500	5000	5000	2500	2500	2500	2500
1 kS/s	50000	25000	10000	10000	5000	5000	5000	5000
500 S/s	100000	50000	20000	20000	10000	10000	10000	10000
200 S/s	250000	125000	50000	50000	25000	25000	25000	25000
100 S/s	500000	250000	100000	100000	50000	50000	50000	50000
50 S/s	1000000	500000	200000	200000	100000	100000	100000	100000
20 S/s	2500000	1250000	500000	500000	250000	250000	250000	250000
10 S/s	2592000	2500000	1000000	1000000	500000	500000	500000	500000
5 S/s	2592000	2592000	2000000	2000000	1000000	1000000	1000000	1000000

(Maximum Sample Rate — row labels in the first value column)

Maximum Recording Time per File in Free Run Mode (in seconds)

The maximum recording time per file is 2 G samples per channel.

The maximum recording time is calculated using the following equation.

Sample rate	Time[1]
100 MS/s	20 (20 s)
50 MS/s	40 (40 s)
20 MS/s	100 (1 min 40 s)
10 MS/s	200 (3 min 20 s)
5 MS/s	400 (6 min 40 s)
2 MS/s	1000 (16 min 40 s)
1 MS/s	2000 (33 min 20 s)
500 kS/s	4000 (1 h 6 min 40 s)
200 kS/s	10000 (2 h 46 min 40 s)
100 kS/s	20000 (5 h 33 min 20 s)
50 kS/s	40000 (11 h 6 min 40 s)
20 kS/s	100000 (1 day 3 h 46 min 40 s)
10 kS/s	200000 (2 day 7 h 33 min 20 s)
5 kS/s	400000 (4 day 15 h 6 min 40 s)
2 kS/s	1000000 (11 day 13 h 46 min 40 s)
1 kS/s	2000000 (23 day 3 h 33 min 20 s)
500 S/s	4000000 (46 day 7 h 6 min 40 s)
200 S/s	10000000 (115 day 17 h 46 min 40 s)
100 S/s	20000000 (231 day 11 h 33 min 20 s)
50 S/s	40000000 (1 year 97 day 23 h 6 min 40 s)
20 S/s	100000000 (3 years 62 day 9 h 46 min 40 s)
10 S/s	200000000 (6 years 124 day 19 h 33 min 20 s)
5 S/s	400000000 (12 years 249 day 15 h 6 min 40 s)

☐ Settings that exceed the SL1000 recording performance (1.6 MS/s): Buffer overrun may occur.

☐ Settings that exceed the SL1000 recording performance (1.6 MS/s) depending on the recording conditions: Buffer overrun may occur depending on the units that will be recording, the recording destination, and the number of channels that will be recording.

1 Recording times that exceed 30 days are calculated values.

Appendix 3 Number of Channels and Measurement Group Sample Rate

In Triggered mode, the minimum sample rate that you can specify on measuring groups 2 to 4 varies depending on the number of measurement channels and the measuring group 1 sample rate.

See the following table.

Measuring Group 1 Sample Rate	Minimum Sample Rate (S/s) That Can Be Set to Other Groups		
	4ch[1]	6ch, 8ch[1]	10ch, 12ch, 14ch, 16ch
100 MS/s	5 k	10 k (20 k[2])	50 k
50 MS/s	5 k	5 k	20 k
20 MS/s	1 k	2 k	5 k
10 MS/s	500	1 k	2 k
5 MS/s	200	500	1 k
2 MS/s	100	200	500
1 MS/s	50	100	200
500 kS/s	20	50	100
200 kS/s	10	20	50
100 kS/s	5	10	20
50 kS/s	5	5	10
20 kS/s	5	5	5
10 kS/s	5	5	5
5 kS/s	5	5	5
2 kS/s	5	5	5
1 kS/s	5	5	5
500 S/s	5	5	5
200 S/s	5	5	5
100 S/s	5	5	5
50 S/s	5	5	5
20 S/s	5	5	5
10 S/s	5	5	5
5 S/s	5	5	5

1   The number of measurement channels during synchronous operation is equal to the maximum number of channels used by a unit among all the linked units.

2   If the number of measuring channels is six or eight and the sample rate of measuring group 2, 3, or 4 is 50 MS/s, the minimum sample rate for other measuring groups will be 20 kS/s.

Index

Index