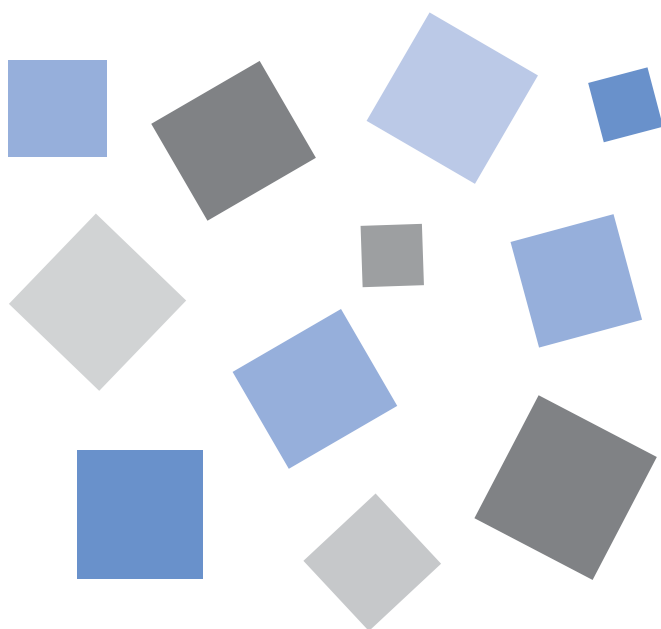


WR300

THERMAL ARRAYCORDER

USER'S MANUAL

MANUAL NO. WR300-UM-152



GRAPHTEC

Introduction

Thank you for purchasing a WR300 Series Thermal Arraycorder. Please read this manual thoroughly before attempting to use your new product to ensure that you use it correctly and to its full potential.

Notes on Use

Be sure to read all of the following notes before attempting to use the WR300 Series Thermal Arraycorder.

1. Note on the CE Marking

The WR300 Series complies with the EN61326 (1997+A1:1998+A2:2001 Class A) standard based on the EMC directive (89/336/EMC). It also conforms to the EN61010-1 (1993/A2:1995) standard based on the LV directive (72/73/EEC).

Although the WR300 Series complies with the above-mentioned standards, be sure to use it correctly in accordance with the instructions and notes provided in its User's Manual.

Moreover, use of the WR300 Series by incorrect procedures may result in damage to the WR300 Series or may invalidate its safeguards. Please confirm all of its notes regarding use and other related information to ensure correct use.

2. Warning

This is a Class A product according to the EMC directive.

In a domestic environment, this product may cause radio interference or may be affected by radio interference to the extent that proper measurement cannot be performed.

3. Notes for Safe Operation

- (1) Be sure to use the Graphtec-supplied AC power cable. In environments where there is a lot of noise or where the power supply is unstable, we recommend that you ground the WR300 Series.
- (2) When a high-voltage signal cable has been connected to the main unit's analog signal input terminal, avoid touching the leads of the input terminal's signal cable to prevent electrical shock due to high voltage.
- (3) Ensure that the WR300 Series power source is positioned so that it can easily be disconnected.

4. Notes on Functions and Performance

- (1) Be sure to connect the main unit to an AC power supply that conforms to the rated range. Connection to a non-rated power supply may cause the main unit to overheat and break down.
- (2) Do not block the vent on the main unit. Continued operation with the vent blocked may cause the main unit to overheat and break down.
- (3) To avoid malfunctions and other damage, avoid using the WR300 Series in the following locations.
 - Places exposed to high temperature and/or high humidity, such as in direct sunlight or near heating equipment. (Operating range - Temperature: 0 to 40°C, Humidity: 30 to 80% RH)
 - Locations subject to excessive salt spray or heavy fumes from corrosive gas or solvents.
 - Excessively dusty locations.
 - Locations subject to strong vibrations or shock.
 - Locations subject to surge voltages and/or electromagnetic interference.
- (4) Use the chart paper supplied by Graphtec. The print quality cannot be guaranteed if other paper types are used.
- (5) If the main unit becomes soiled, wipe it off using a soft, dry cloth. Use of organic solvents (such as thinner or benzene) causes deterioration and discoloration of the outer casing.

- (6) In the course of use, the thermal head gradually becomes soiled which will lower the print quality. If this happens, it is recommended to clean it using the optional B-368 head cleaner kit. If the print quality does not improve even after using the head cleaner, contact your sales representative or nearest Graphtec vendor.
- (7) Do not use the WR300 Series in the vicinity of other devices which are susceptible to electromagnetic interference.
- (8) Measured results may not conform to the stated specifications if the WR300 Series is used in an environment which is subject to strong electromagnetic interference.
- (9) Insofar as possible, position the WR300 Series input signal cables away from any other cables which are likely to be affected by electromagnetic interference.
- (10) For stabilized measurement, allow the WR300 Series to warm up for at least 30 minutes after turning it on.

To Ensure Safe and Correct Use

- To ensure safe and correct use of the WR300 Series, read this Manual thoroughly before use.
- After having read this Manual, keep it in a handy location for quick reference as needed.
- Do not permit small children to touch the WR300 Series.
- The following describes important points for safe operation. Please be sure to observe them strictly.

Conventions Used in This Manual

To promote safe and accurate use of the WR300 Series as well as to prevent human injury and property damage, safety precautions provided in this manual are ranked into the five categories described below. Be sure you understand the difference between each of the categories.



DANGER

This category provides information that, if ignored, is highly likely to cause fatal or serious injury to the operator.



WARNING

This category provides information that, if ignored, is likely to cause fatal or serious injury to the operator.



CAUTION

This category provides information that, if ignored, could cause physical damage to the WR300 Series.



HIGH TEMPERATURE

This category provides information that, if ignored, is likely to cause burns or other injury to the operator due to contact with high temperature.





ELECTRICAL SHOCK



This category provides information that, if ignored, is likely to expose the operator to electrical shock.

Description of Safety Symbols





The  symbol indicates information that requires careful attention (which includes warnings). The point requiring attention is described by an illustration or text within or next to the  symbol.



The  symbol indicates action that is prohibited. Such prohibited action is described by an illustration or text within or next to the  symbol.



The  symbol indicates action that must be performed. Such imperative action is described by an illustration or text within or next to the  symbol.

Safety Precautions

WARNING

Be sure to securely connect the WR300 Series power cord.

- After checking that the Power switch is turned off, connect the power cord's female plug to the WR300 Series and then connect its male plug into the electrical socket.
- Use of the WR300 Series without the power cord securely plugged into the electrical socket may result in electrical shock due to current leakage.
- For grounding, use a ground wire with a diameter of at least 0.75 mm². When using the WR300 Series in an environment where grounding is not possible, ensure that the voltage to be measured is no greater than 50 V (DC or rms).



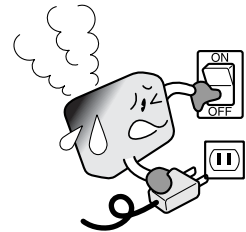
Securely connect the power cord
Make sure that the socket has a good
protective ground

If the WR300 Series generates smoke, is too hot, emits a strange odor, or otherwise functions abnormally, turn off its power and unplug its power cord from the electrical socket.

- Use of the WR300 Series in such status may result in a fire hazard or electrical shock.
- After checking that smoke is no longer being generated, contact your sales representative or nearest Graphtec vendor to request repair.
- Never try to perform repair yourself. Repair work by inexperienced personnel is extremely dangerous.



Amateur repair
prohibited

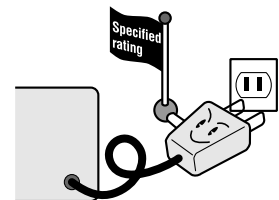


Before turning on the WR300 Series, ensure that the electric socket's supply voltage conforms to the WR300 Series power rating.

- Use of a different supply voltage may cause damage to the WR300 Series or a fire hazard due to electrical shock or current leakage.



Use of a different
supply voltage
prohibited



Never disassemble or remodel the WR300 Series.

- Such action may cause a fire hazard due to electric shock or current leakage.
- Contact with a high-voltage component inside the WR300 Series may cause electric shock.
- If repair is required, contact your sales representative or nearest Graphtec vendor.



No disassembly



Avoid using the WR300 Series in extremely dusty or humid places.

- Such use may cause a fire hazard due to electrical shock or current leakage.



Use prohibited



Watch out for
electrical shock



Safety Precautions

WARNING

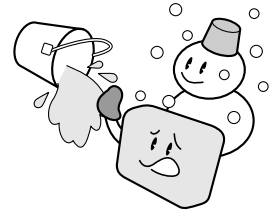
Avoid using the WR300 Series in places where it may be exposed to water such as bathrooms, locations exposed to wind and rain, and so on.



Avoid water



Watch out for
electrical shock



Prevent dust or metallic matter from adhering to the power supply connector.

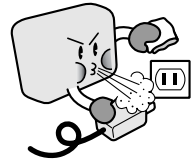
- Adhesion of foreign matter may cause a fire hazard due to electrical shock or current leakage.



No foreign matter



Watch out for
electrical shock

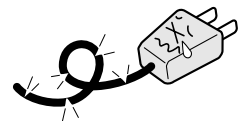


Never use a damaged power cord.

- Use of a damaged cord may result in a fire hazard due to electrical shock.
- If the cord becomes damaged, order a new one to replace it.



Unplug the power
cord from the socket

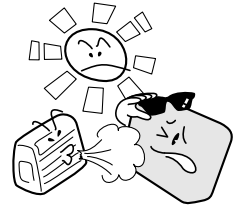


Safety Precautions

CAUTION

Do not use or store the WR300 Series in a location exposed to direct sunlight or the direct draft of an air conditioner or heater.

- Such location may impair the WR300 Series performance.



Do not place coffee cups or other receptacles containing fluid on the WR300 Series.

- Fluid spilling inside the v may cause a fire hazard due to electrical shock or current leakage.



Avoid fluids



Watch out for electrical shock

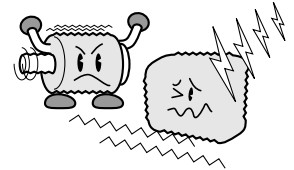


Do not use the WR300 Series in a location subject to excessive mechanical vibration or electrical noise.

- Such location may impair the WR300 Series performance.



Use prohibited

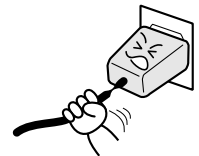


To insert or disconnect the power cord or a signal input cable, grasp the power cord's plug or the signal input cable's connector.

- Pulling the cord/cable itself damages the cord/cable, resulting in a fire hazard or electrical shock.



No pulling

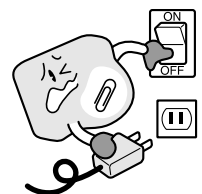


If fluid or foreign matters enters inside the WR300 Series, turn off the Power switch and disconnect the power cord from the electrical socket.

- Use in such status may cause a fire hazard due to electrical shock or current leakage.
- Contact your sales representative or nearest Graphtec vendor to request repair.



Unplug the power cord from the socket



Do not input voltage that exceeds the permissible input voltage range that is specified on the WR300 Series label.

- Exceeding the specified voltage input range may cause electrical shock or a fire hazard.



Use prohibited

Safety Precautions



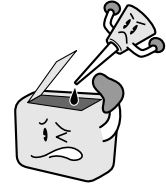
CAUTION

Do not attempt to lubricate the WR300 Series mechanisms.

- Such action may cause the WR300 Series to break down.



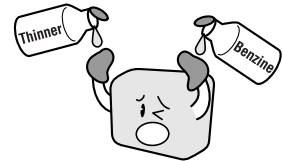
No lubrication

**Never clean the WR300 Series using a volatile solvent (such as thinner or benzene).**

- Such action may impair the WR300 Series performance.
- Clean off any soiled areas using a soft dry cloth.



No volatile solvents



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CHAPTER 1

General Description

This chapter provides a general description of the WR300/310 and its features.

- 1.1 Overview**
- 1.2 Features**
- 1.3 Operating Environment**
- 1.4 Notes on Temperature Measurement**
- 1.5 Notes on Using the Monitor**
- 1.6 Changing the Display Language**
- 1.7 Protecting the Thermal Head**

1.1 Overview

The WR300/310 Thermal Arraycorder is a compact, lightweight recorder that comes with a large-screen color display panel and a large-capacity hard disk (models with a built-in hard disk only).

The WR300/310 employs a large-screen color LCD (Liquid Crystal Display) for its display panel and a thermal printhead in its printer unit, enabling high-speed display and high-speed recording.

Moreover, use of the PCMCIA card and the large-capacity hard disk* permits direct storage of a large volume of measured data.

***WR310 only**

1.2 Features

Input

- (1) The adoption of plug-in type amp units lets you choose amps to suit a variety of objects for measurement.
- (2) The recorder is equipped with dedicated keys that enable amp-related settings to be specified using interactive menu screens.

Display

- (1) With the 8.4-inch TFT color liquid crystal display, you can confirm the waveforms of measured data and each channel's settings at a glance.

Recording

- (1) Recording on chart paper, up to a maximum chart speed of 50 mm/second, demonstrates its full power during realtime waveform recording of high-speed events.
- (2) The recording zone for each channel can be separately set, enabling revision of the recording format to suit individual applications.

Data Capture

- (1) Concurrently with recording, a large volume of measured data can be saved at high speed to a PCMCIA card or large-capacity hard disk*.
- (2) Even after saving a large volume of data, use of the Search function lets you easily retrieve the required portion of the data.

***WR310 only**

Data Control & Processing

- (1) The software provided lets you set conditions and monitor data on a computer using the USB or TCP/IP interface.
- (2) Captured data can be read from the OPS023 software to files and displayed for processing.
- (3) Data can be transferred off-line to a computer using memory media (PCMCIA cards).

1.3 Operating Environment

This section explains the operating environment for the WR300/310.

Ambient Operating Conditions

- (1) Ambient temperature and humidity (the WR300/310 must be operated within the following ranges.)
 - Temperature range: 0 to 40°C
 - Humidity range: 30 to 80% RH
- (2) Environment (do not use in the following locations.)
 - Locations in direct sunlight or with high humidity, such as near heaters
 - Locations exposed to salty air, corrosive gases, or organic solvents
 - Dusty locations
 - Locations subject to vibration or impact
 - Locations subject to voltage surge or electromagnetic interference such as lightning or electric furnaces
- (3) Installation category (over-voltage category)
 - The WR300/310 conforms to the IEC664 installation category I

CHECKPOINT

If condensation occurs...

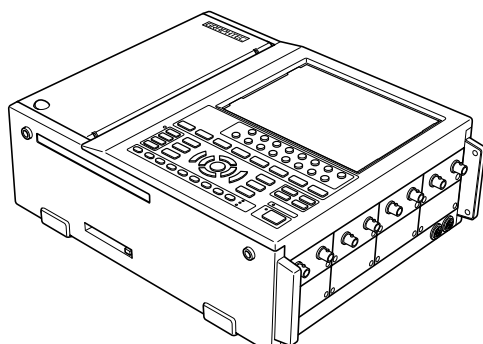
Condensation occurs in the form of water droplets on the device surfaces and interior when the WR300/310 is moved from a cold to a warm location. Using the WR300/310 with condensation will cause malfunctioning. Wait until the condensation has disappeared before turning on the power.

Warming-up Before Use

The WR300/310 should be allowed to warm up with the power turned on for approximately 30 minutes to ensure that it operates according to the specified performance.

Configuration When in Use

The WR300/310 must always be laid flat when in use.



WR300-8

CAUTION

Do not block the air vent on the WR300/310, as this will cause malfunctioning.

1.4 Notes on Temperature Measurement

Please observe the following precautions when using the WR3-M AMP (voltage/temperature amp) to perform temperature measurement.

- (1) Do not block the air vents. Always provide a space of at least 30 cm on all sides of the WR300/310.
- (2) For stabilized temperature measurement, allow the WR300/310 to warm up for at least 30 minutes after turning it on.
- (3) Exposure of the WR3-M AMP's (voltage/temperature amp) input terminals to direct drafts, direct sunlight, or abrupt changes in temperature may impair the equilibrium of the input parts and result in measurement errors. To measure temperature in such an environment, take appropriate countermeasures such as changing the installation site of the WR300/310.

1.5 Notes on Using the Monitor

The monitor is an LCD display unit, and so the display will vary depending on the operating environment.



If the screen saver function is used, it will operate and clear the screen if no operations are performed during the preset time. If the screen saver operates, press any key to restore the display.



- Condensation may form on the LCD screen if the WR300/310 is moved from a cold to a warm location. If this occurs, wait until the LCD screen warms up to room temperature.
- The LCD screen is manufactured to extremely high precision. Black dots may appear, or red, blue, and green dots may not disappear. Likewise, streaks may appear when viewed from certain angles. These phenomena are due to the LCD screen construction, and are not signs of a fault.

1.6 Changing the Display Language

You can choose English, French, or Japanese as the language displayed on the screen. The default display language is set to English (US) when the WR300/310 is shipped overseas. To change the display language, see the instructions in "Changing the Display Language".

1.7 Protecting the Thermal Head

This recorder is provided with a circuit for protecting the thermal printhead. When the solid-fill area of recording is large, this circuit protects the thermal printhead by lowering the print density so that current above a stipulated level will not flow to the thermal printhead.

As soon as the solid-fill area of recording is decreased, the print density automatically resumes its usual level.

In the event that the print density fluctuates too often, reduce the solid-fill area of recording by such means as changing the Record Format setting, lowering the print density, and so on.

CHAPTER 2

Checks and Preparation

This chapter explains how to check the WR300/310's external casing and accessories, and how to prepare the WR300/310 for operation.

- 2.1 Checking the Outer Casing**
- 2.2 Checking the Accessories**
- 2.3 WR300/310 Part Names and Functions**
- 2.4 Monitor Part Names and Functions**
- 2.5 Control Panel Part Names and Functions**
- 2.6 Amplifier Part Names and Functions**
- 2.7 Installing or Removing an Amp**
- 2.8 The Printer Units and Compatible Chart Paper**
- 2.9 Loading Chart Paper**
- 2.10 Inserting and Removing a PCMCIA Card**
- 2.11 Connecting the Power Cable and Turning on the Power**
- 2.12 Connecting to a PC**
- 2.13 Remote Functions and Connector Pin Assignments**
- 2.14 Assembling the Remote Connector**
- 2.15 Using the IRIG Terminals (WR310 only)**

2.1 Checking the Outer Casing

After unpacking, check the WR300/310's outer casing before use. In particular, please check for the following:

- Surface scratches
- Other flaws such as stains or dirt

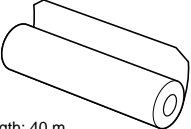
2.2 Checking the Accessories

After unpacking, check that the following standard accessories are included. The accessories included will differ depending on the model purchased.

Standard Accessories

Thermal paper 4ch : PR230(100 mm)
8/16ch : PR231A(200 mm)


1 roll



Roll length: 40 m

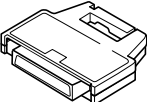
Roll paper bobbins

2



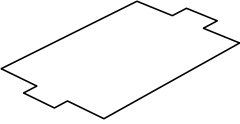
REMOTE connector

1




LCD Protector

1



CD-ROM

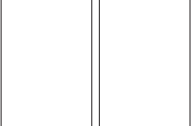
1



Contains: User's Manual, Application Software

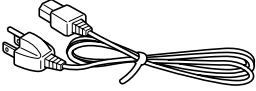
QuickStart Guide

2



AC cable (RSC-110)

1



Additional Accessories

When the long-length Z-fold chart paper unit is included

Z-fold chart paper (PZ231A)

1 pack

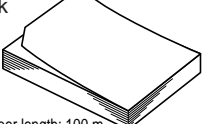
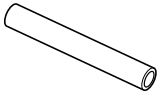


Chart paper length: 100 m

Long-length pipe

1



When the internal Z-fold chart paper unit is included

Z-fold chart paper 4ch : PZ230(100 mm)
8/16ch : PZ233(200 mm)

1 pack

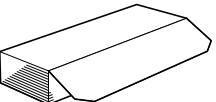
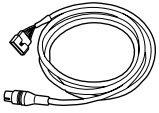

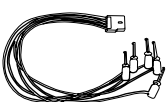


Chart paper length: 40 m

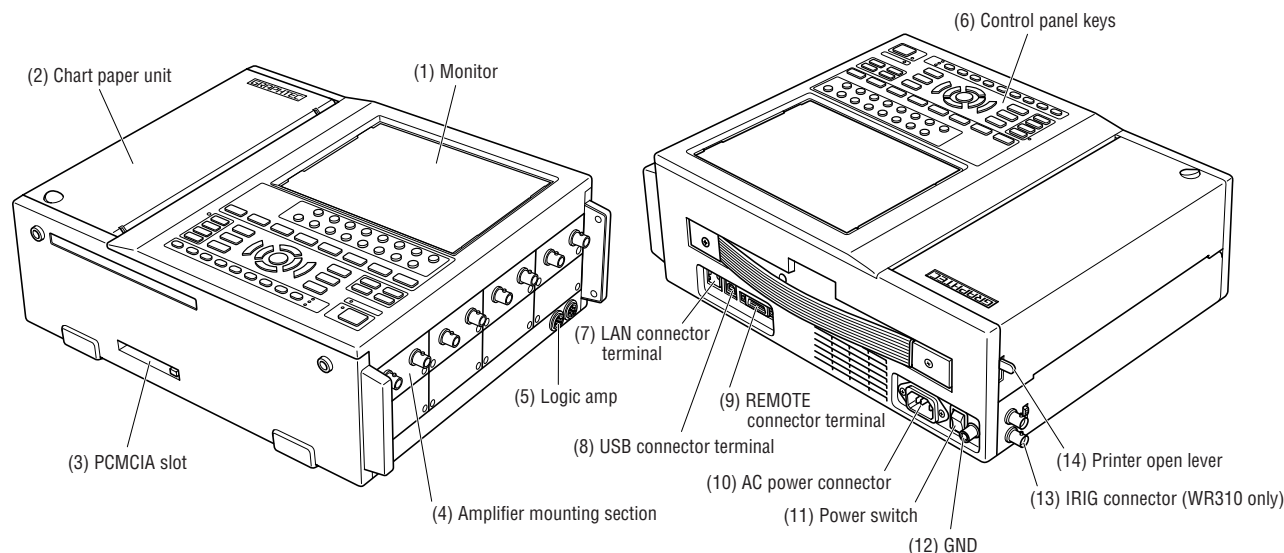
Options

Probe set (RIC-10) 4-ch models: 1 of each, 8-ch models: 2 of each, 16-ch models: 4 of each

Logic input cable (RIC-07)	Alligator-clip cable (RIC-08)	IC-clip cable (RIC-09)
		

2.3 WR300/310 Part Names and Functions

This section describes the names and functions of the WR300/310's parts.

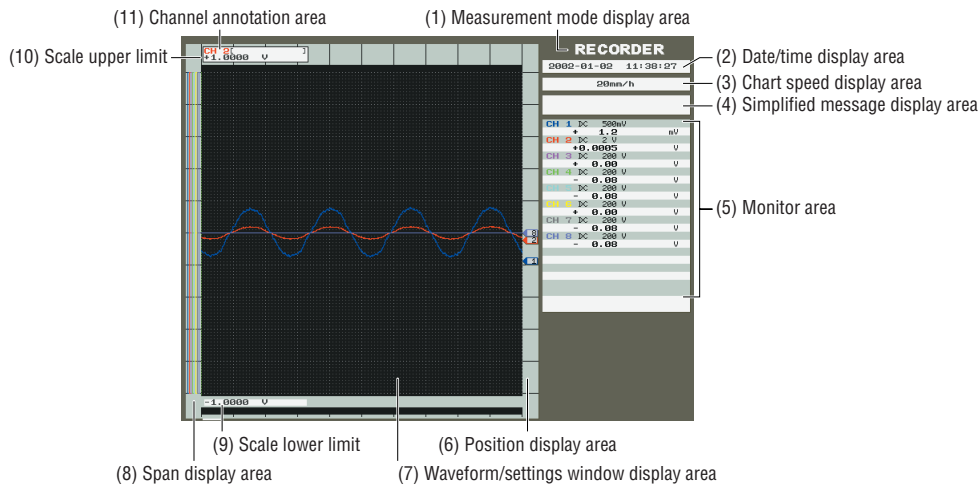


- (1) Monitor Displays the setting menus and measurement data.
- (2) Chart paper unit Holds the roll paper and the Z-fold paper for internal use. If you want to use long-length (100-m) Z-fold paper, the external long-length Z-fold paper unit is required.
- (3) PCMCIA slot Used for inserting the PCMCIA card.
- (4) Amplifier mounting section
..... Used for mounting the preamplifiers.
- (5) Logic amp This is the logic amplifier.
- (6) Control panel keys Used for the main operations, including settings, and starting and stopping measurement.
- (7) LAN connector terminal
..... Terminal for LAN connection.
- (8) USB connector terminal
..... Terminal for USB connection.
- (9) REMOTE connector terminal
..... Terminal for the Remote interface connector.
- (10) AC power connector Terminal for connecting the AC power cable.
- (11) Power switch Switch for turning on the power.
- (12) GND Used when a ground connection is required.
- (13) IRIG connector (WR310 only)
..... Signal input/output terminal for IRIG time codes.
- (14) Printer open leve Used to open the printer cover when loading chart paper.



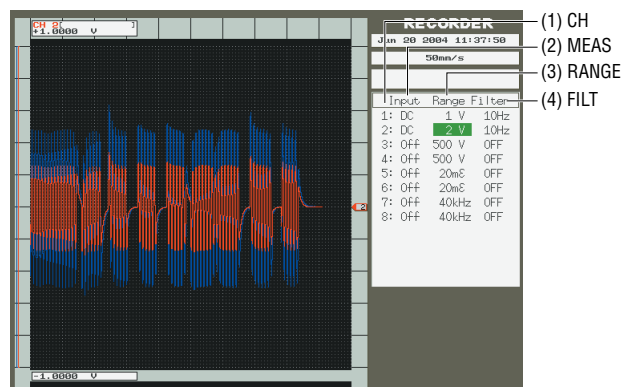
To provide protection for the LCD screen, attach the LCD protector provided as a standard accessory.

2.4 Monitor Part Names and Functions



- (1) Measurement mode display area .. Displays the measurement mode currently set.
- (2) Date/time display area Displays the current date and time. Moreover, displays IRIG time code information when IRIG settings have been enabled.
- (3) Chart speed display area Displays the chart speed currently set.
- (4) Simplified message display area .. Displays the system status.
For example, "Awaiting trigger" is displayed when waiting for a trigger signal.
- (5) Monitor area Displays the input signal values for each channel.
- (6) Position display area Displays the input signal positions for each channel.
- (7) Waveform/settings window display area
..... Displays the measurement signal waveforms. The menu windows are also displayed when the MENU key is pressed.
- (8) Span display area Displays the zone width (span) for the range set.
- (9) Scale lower limit Displays the lower limit of the scale set for each channel.
- (10) Scale upper limit Displays the upper limit of the scale set for each channel.
- (11) Channel annotation Displays the user annotation set for each channel.

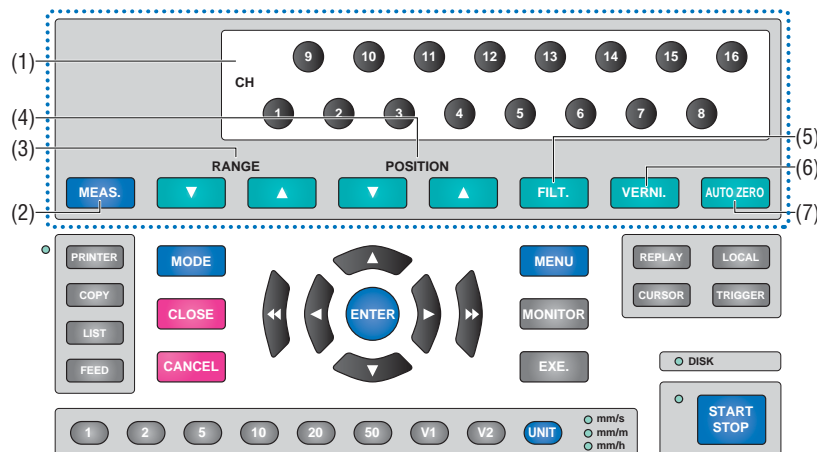
Direct Settings (Selecting the Measurement Parameters)



- (1) CH keys: Press to select the channel(s) for which measurement conditions can be specified.
- (2) MEAS. key: Selects the input coupling status for each preamplifier. Each time you press this key, the input coupling status changes.
- (3) RANGE [Δ] and [∇] keys: Select the measurement range for each channel. Each time you press a RANGE key, the measurement range changes.
- (4) FILT. key: Selects the filter mode. Each time you press the FILT. key, the filter mode changes.

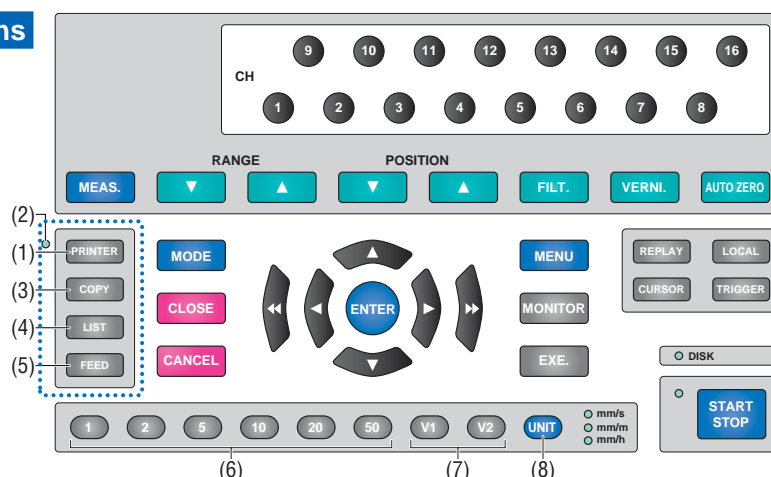
2.5 Control Panel Part Names and Functions

Direct Channel Operations



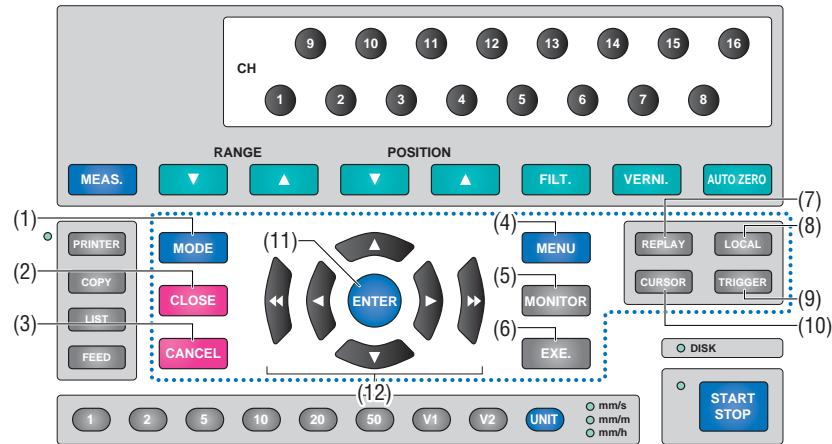
- (1) CH keys Select the channel number(s) for which measurement conditions can be specified.
- (2) MEAS. key Selects the input coupling status.
- (3) RANGE keys The [Δ] and [∇] keys select the measurement range.
- (4) POSITION keys The [Δ] and [∇] keys specify the recording position. The position can also be specified by using the MENU functions when the relevant menu is displayed.
- (5) FILT. key Selects the filter mode.
- (6) VERNI. key Selects the Vernier function.
- (7) AUTO ZERO key Automatically moves the recording position to the origin point (cannot be used for temperature measurement).

Printer Operations



- (1) PRINTER key Press this key to initiate recording of measured data.
- (2) PRINTER LED Lights when recording to chart paper is enabled.
- (3) COPY key Press this key to make a copy of the screen display.
- (4) LIST key Press this key to print a list of the currently selected measurement conditions on chart paper.
- (5) FEED key Press this key to advance the chart paper, without recording measured data.
- (6) CHART SPEED keys Press one of these keys to set the chart speed to the value indicated on the key.
- (7) V1/V2 keys Press V1 or V2 to change the chart speed to the chart speed set for V1 or V2.
- (8) Unit key Use to specify the chart speed as mm/s, mm/min, or mm/hr.

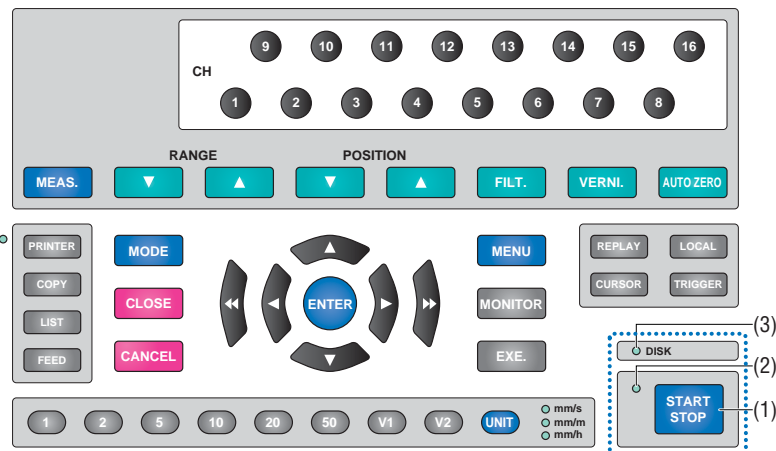
Detailed Setting Operations



- (1) MODE key Selects the measurement mode. Each time you press this key, the measurement mode switches between RECORDER and FFT modes. It is also used to exit the REPLAY mode.

RECORDER ↔ FFT
- (2) CLOSE key Closes the setting window.
- (3) CANCEL key Cancels the selected setting(s) displayed in each setting window.
- (2) + (3) KEY LOCK Hold down the (2) CLOSE key and the (3) CANCEL key simultaneously for at least three seconds to enable key lock status. To cancel key lock status, hold down the same keys again for at least three seconds.
- (4) MENU key Switches through the setting windows.
- (5) MONITOR key Displays the settings for each channel on the monitor.
- (6) EXE. key Press this key when "Press EXE." is indicated as a selection in a setting mode.
- (7) REPLAY key Replays the captured data.
- (8) LOCAL key Press this key to switch from online status to offline status.
- (9) TRIGGER key When the trigger mode is set to MANUAL, press this key to activate the trigger and initiate measurement.
- (10) CURSOR key Used for data analysis when REPLAY data is displayed.
- (11) ENTER key Press this key when "Press ENTER" is indicated as a selection in a setting mode.
- (12) Direction keys These keys move the cursor on the screen in the direction indicated. For fast cursor movement, use the [<<] and [>>] keys.

Measurement Status Operations



- (1) START/STOP key Press this key to start measurement or to stop measurement when measurement is in progress.
- (2) START LED Lights when measurement is initiated.
- (3) DISK LED Lights when the media is accessed.

2.6 Amplifier Part Names and Functions

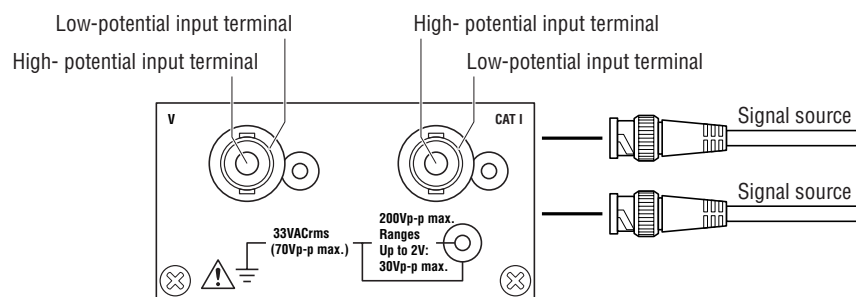
This section describes the various amplifiers that can be installed in the WR300/310, with details of the signal input cable connections.

The following five different amplifier types are available.

- V amplifier: for voltage measurement (WR3-V AMP)
- M amplifier: for voltage and temperature measurement (WR3-M AMP)
- DCB amplifier: for strain measurement (WR3-DCB AMP)
- FV amplifier: for frequency measurement (WR3-FV AMP)
- Logic amplifier: for logic measurement

V amplifier

This section describes the V amplifier and how to connect the input signal cable. The V amplifier is used for voltage measurement.



High- potential input terminal Terminal for connecting the high- potential input signal

Low- potential input terminal Terminal for connecting the low- potential input signal

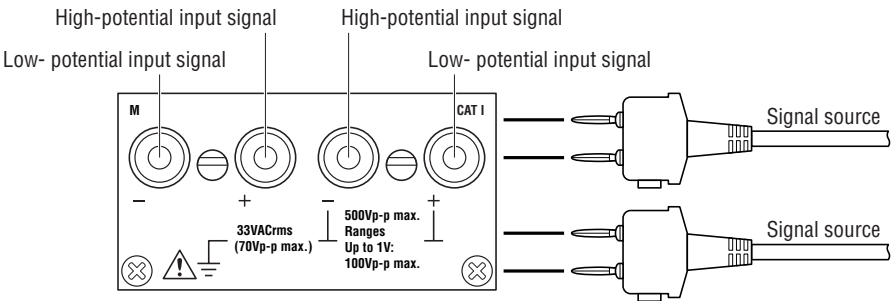
Item	Description
Input format	Independent unbalanced input for each channel
Measurement range	50 mV to 200 V FS
Max sampling interval	1 μ s
Frequency response	DC coupling: DC to 200 kHz AC coupling: 10 Hz to 200 kHz
Permissible input voltage	[Between +/– terminals] 5 V to 200 V range: 200 V DC (DC + ACp-p) 50 mV to 2 V range: 30 V DC (DC + ACp-p) [Between input and GND terminals] 33 V AC rms

CHECKPOINT

- When measuring, connect the WR300/310 GND terminal to the signal source GND terminal. Noise will occur at the input terminal if the GND terminals are not connected.
- Do not connect the cables with high voltage present (more than 42.4 Vp-p). There is a risk of electric shock or short circuit if accidentally touched.
- Do not alter the adjustment knobs next to the V amplifier input terminals.

M amplifier

This section describes the M amplifier and how to connect the input signal cable. The M amplifier is used for voltage and temperature measurement.



* When using signals from thermocouples, clamp the bared wires securely.

High- potential terminal Terminal for connecting the high- potential input signal

Low- potential terminal Terminal for connecting the low- potential input signal

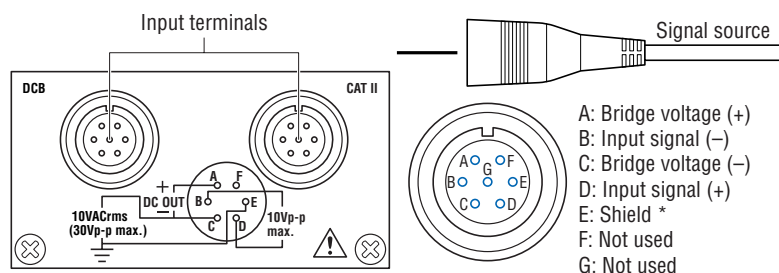
Item	Description	
Input format	Independent unbalanced input for each channel	
Measurement range	Voltage: 20 mV to 500 V FS Temperature: K, J, T, R, E, B	
Max sampling interval	10 μs	
Frequency response	DC coupling: DC to 20 kHz AC coupling: 10 Hz to 20 kHz	
Permissible input voltage	[Between +/- terminals]	5 V to 500 V range : 500 V DC (DC + ACp-p)
		20 mV to 1 V range: 100 V DC (DC + ACp-p)
	[Between input and GND terminals]	33 V AC rms

CHECKPOINT

- When measuring, connect the WR300/310 GND terminal to the signal source GND terminal. Noise will occur at the input terminal if the GND terminals are not connected.
- Do not connect the cables with high voltage present (more than 42.4 Vp-p). There is a risk of electric shock or short circuit if accidentally touched.

DCB amplifier

This section describes the DCB amplifier and how to connect the input signal cables. The DCB amplifier is used for strain measurement.



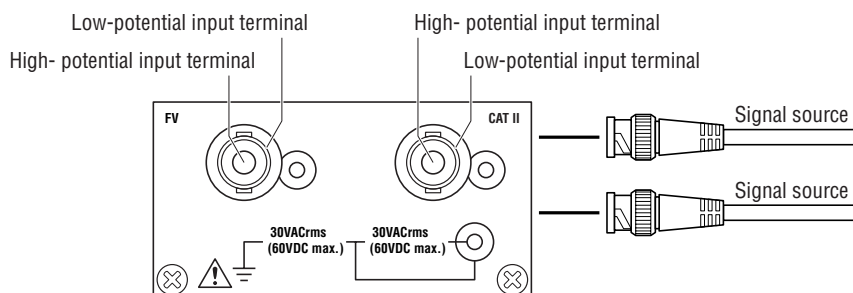
* The shield is connected to the circuitry's reference potential, and is insulated from the GND level.

Input terminal The input terminal connector is a Tajimi PRC03-23A10-7F (receptacle). The corresponding plug (PRC03-12A10-7M10.5) should be connected to this.

Item	Description
Input format	Independent balanced input for each channel (NDIS strain input connector)
Measurement range	Voltage: 1,000 to 20,000 $\times 10^{-6}$ strain FS (1/2/5 steps)
Max permissible input	Differential input 10 V DC (DC + ACp-p) In-phase voltage 10 V AC rms
A/D	Sampling interval: 10 μ s Resolution: 16-bit (out of which 14 are internally acknowledged)
Frequency band	DC to 20 kHz (+1/-3 dB)

FV Amplifier

This section describes the FV amplifier and how to connect the input signal cables. The FV amplifier is used for frequency measurement.



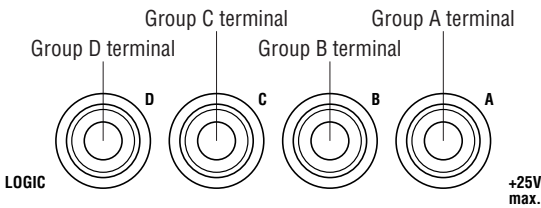
High- potential input terminal ... Terminal for connecting the high- potential input signal

Low- potential input terminal Terminal for connecting the low- potential input signal

Item	Description
Input format	Independent unbalanced input for each channel (floating system) (BNC terminals)
Measurement range	200 Hz to 40 kHz FS (1/2/4/5 steps)
Max permissible input	Between +/- terminals 60 V DC (DC + ACp-p) Between floating terminals 30 V AC rms
A/D	Sampling interval: 4 μ s (250 kHz) Resolution: 12-bit (out of which 10 are internally acknowledged)
Minimum pulse width	2.5 μ s

Logic amplifier

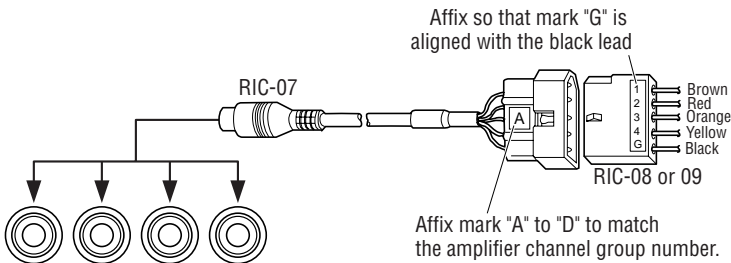
This section describes the logic amplifier and how to connect the input signal cables. The logic amplifier is used for logic measurement.



- Group A terminal Terminal for inputting logic signals via channels A1 to A4.
- Group B terminal Terminal for inputting logic signals via channels B1 to B4.
- Group C terminal Terminal for inputting logic signals via channels C1 to C4.
- Group D terminal Terminal for inputting logic signals via channels D1 to D4.

Item	Description
No. of channels	8 (4 channels per terminal x 2)
Input voltage range	0 to +25 V max (single wire ground input)
Max sampling interval	1 μs
Threshold level	TTL (+1.4 V), CMOS (+2.5 V), Contact (+5.0 V)

- (1) Connect the round connector on the RIC-07 logic cable to the A to D signal input terminals on the logic input amplifier.
Connect the other end to the RIC-08 alligator clip cable or RIC-09 IC clip cable depending on the measuring point configuration.

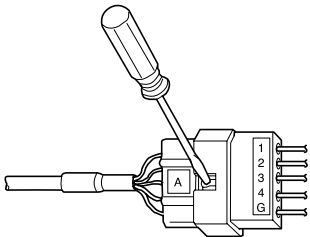


- (2) Perform connections to the measurement points of the RIC-08 alligator-clip cable or RIC-09 IC-clip cable as indicated in the table below.

Terminal color	Cable color	Channel
Red	Brown	1
	Red	2
	Orange	3
	Yellow	4
Black	Black	Common

CHECKPOINT

To remove the RIC-07 logic input cable, RIC-08 alligator-clip cable, or RIC-09 IC-clip cable after finishing measurement, insert a blade screwdriver into the connector as shown below to unlatch the cable.



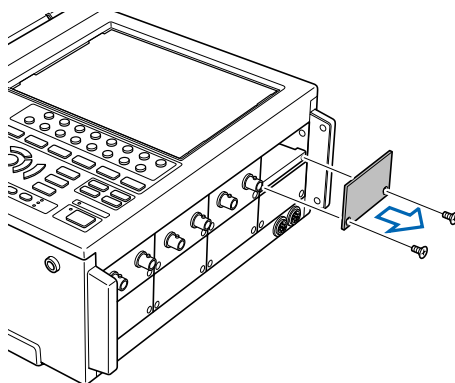
2.7 Installing or Removing an Amp

This section explains the procedures for installing or removing an analog amp. To remove an amp, perform the installation procedure in reverse. Moreover, when pulling out an amp, be sure to grasp the amp panel to pull the amp out and off.

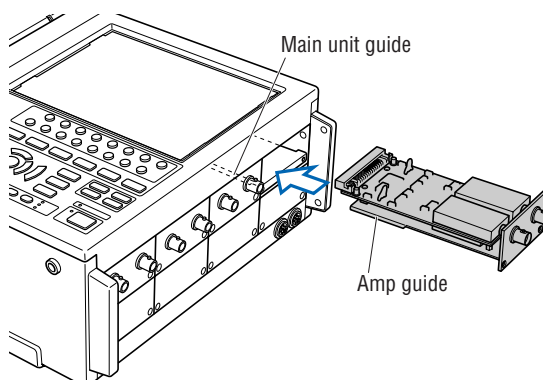
CAUTION

- Always turn off the recorder before installing or removing an amp.
- Whenever handling an amp, pay due attention to avoid static electricity and so on.

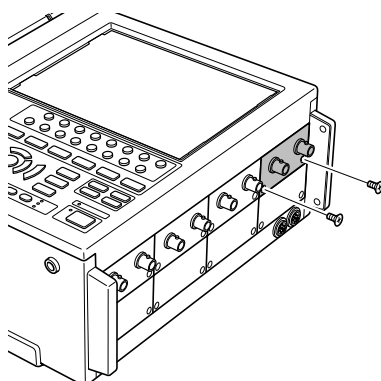
- (1) Remove the setscrews that secure the analog amp slot's cover and then remove the cover.



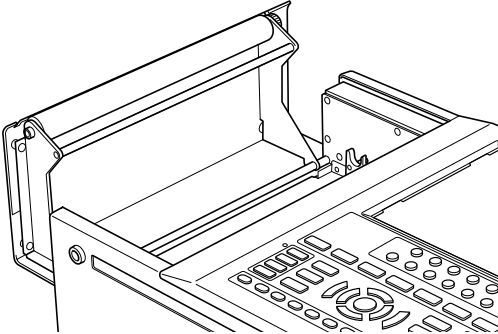
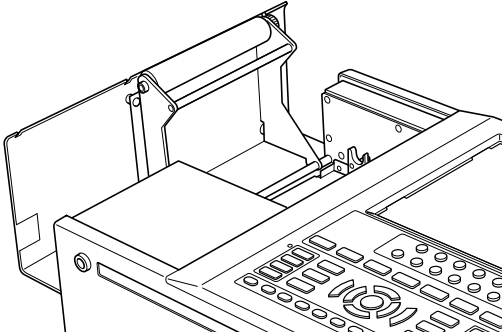
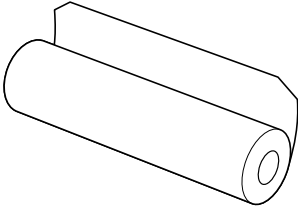
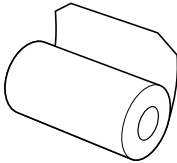
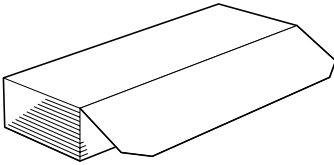
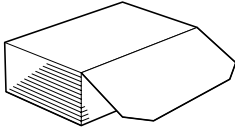
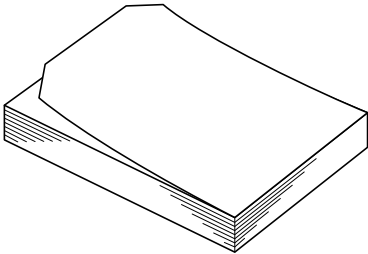
- (2) Select an amp suitable for the type of measurements to be performed and insert it in the slot by aligning the amp's guide with the main unit guide.



- (3) Secure the amp in place by tightening the setscrews.



2.8 The Printer Units and Compatible Chart Paper

		8-ch/16-ch models (WR300/310) Width: 200 mm	4-ch model (WR300) Width: 100 mm
Chart paper	Printer unit		
	Roll paper (40-m length)	<div>PR231A </div>	<div>PR230 </div>
	Z-fold paper (20-m length, option)	<div>PZ233  *Z-fold paper unit required</div>	<div>PZ230  *Z-fold paper unit required</div>
	Long-length Z-fold paper (100-m length, option)	<div>PZ231A  *Long-length Z-fold paper unit required</div>	

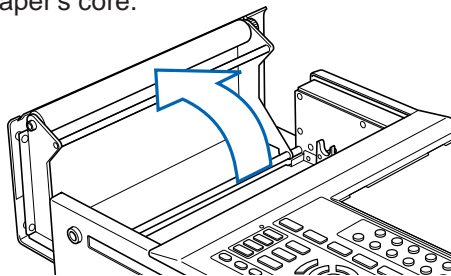
2.9 Loading Chart Paper

CHECKPOINT

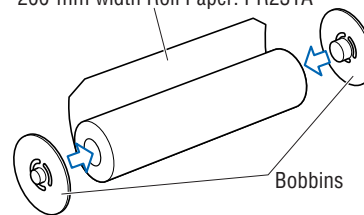
- The thermally sensitive surface of the chart paper is the outer surface for roll paper, and the inner surface for Z-fold paper. Data will not be recorded if the paper is loaded in reverse.
- The last meter of the chart paper is marked with a red line to indicate that the end of the chart paper is near. In addition, the remaining length of the chart paper is printed in meter units, at 10-cm intervals, along the edge of the chart paper.

Loading Roll Paper

- (1) Lower the printer open lever and open the printer cover. Insert the roll paper bobbins into both sides of the roll paper's core.

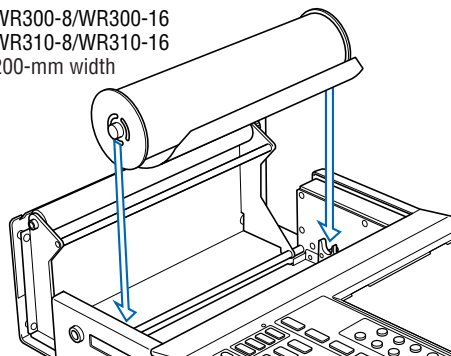


100-mm width Roll Paper: PR230
200-mm width Roll Paper: PR231A

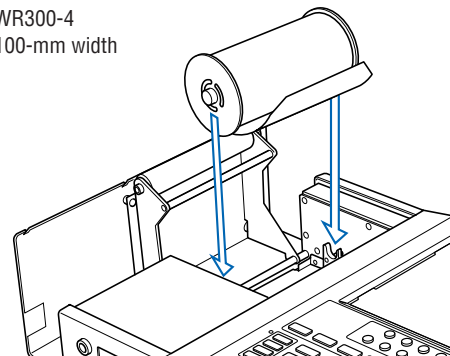


- (2) Load the roll in the recorder.

WR300-8/WR300-16
WR310-8/WR310-16
200-mm width



WR300-4
100-mm width



High Temperature

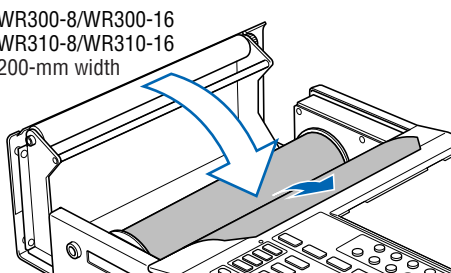
Right after recording, the thermal head may be very hot and cause burns or other injuries if accidentally touched. Before replacing the chart paper, allow the thermal head to adequately cool down.

CAUTION

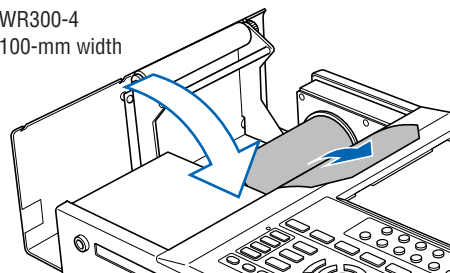
When loading the chart paper, take care not to damage the thermal head. Recording will not be performed correctly if the thermal head is damaged.

- (3) Pull the leading edge of the paper out of the printer cover's paper outlet, and then close the printer cover firmly.

WR300-8/WR300-16
WR310-8/WR310-16
200-mm width



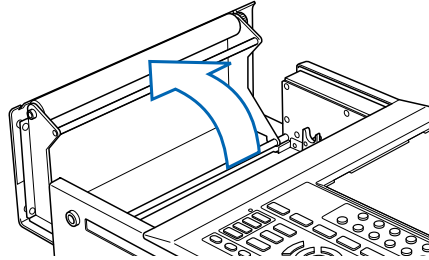
WR300-4
100-mm width



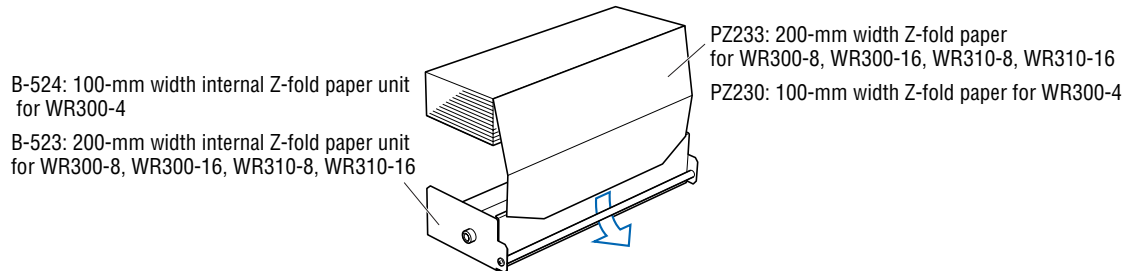
- (4) Press the FEED key to feed the paper approximately 10 cm, and make sure that there is no slack in the paper before starting measurement.

Loading Z-fold Paper Internally (Option)

- (1) Lower the printer open lever and open the printer cover.



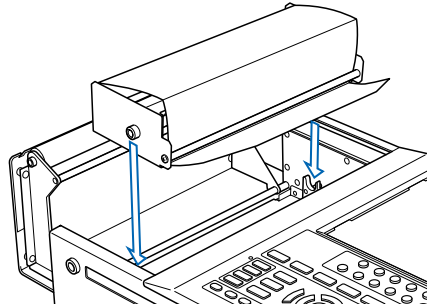
- (2) Pull the paper's leading edge out of the chart paper outlet of the internal Z-fold unit.



CAUTION

- When using an internal Z-fold unit, use PZ230 or PZ233 Z-fold paper.
- Recording cannot be performed unless the chart paper's thermal-sensitive surface contacts the thermal head. Be sure to load the chart paper correctly.

- (3) Mount the Z-fold paper unit in the recorder. At this time, make sure that there is sufficient paper to extend past the printer cover.



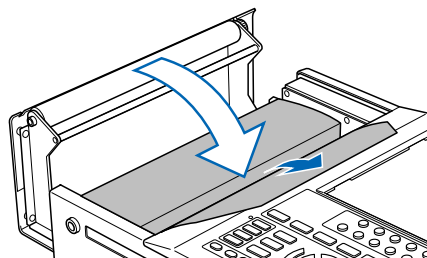
High Temperature

Right after recording, the thermal head may be very hot and cause burns or other injuries if accidentally touched. Before replacing the chart paper, allow the thermal head to adequately cool down.

CAUTION

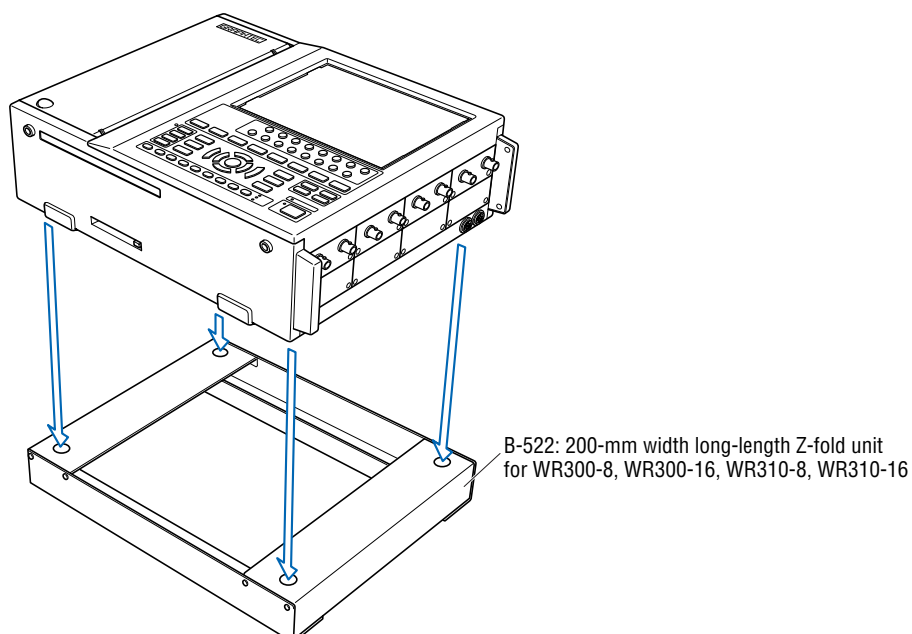
When loading the chart paper, take care not to damage the thermal head. Recording will not be performed correctly if the thermal head is damaged.

- (4) Pull the leading edge of the paper out of the printer cover's paper outlet, and then close the printer cover firmly.

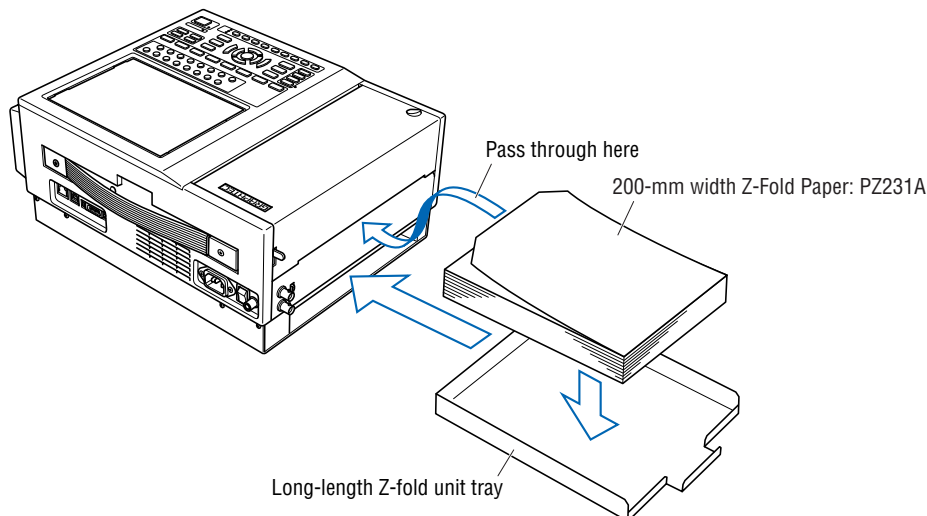


Loading Z-Fold Paper in the Long-Length Z-Fold Unit (Option)

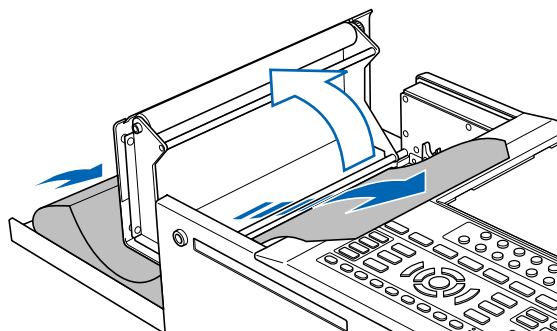
- (1) Mount the main unit onto the long-length Z-fold unit. As shown below, fit the main unit's rubber feet into the round openings on the top surface of the long-length Z-fold unit.



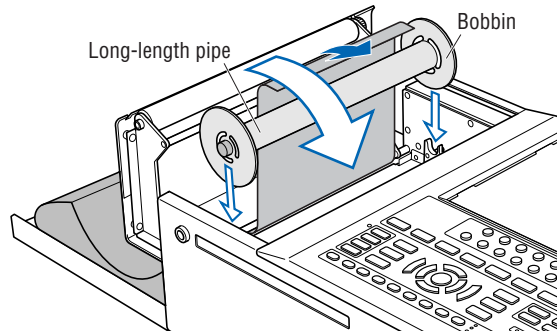
- (2) Load the chart paper in the long-length Z-fold unit tray and then insert the tray into the long-length Z-fold unit. At this time, do not insert the tray fully. Leave part of the tray outside of the unit.



- (3) Lower the printer open lever, open the printer cover, insert the leading edge of the Z-fold paper in into the space below the main unit's printer cover, and then pull it out as shown.



- (4) Assemble the guide shaft by attaching a bobbin to each end of the long-length pipe provided as shown below. Pass the paper over the guide shaft. Pull the leading edge of the paper out of the printer cover's paper outlet, and then close the printer cover firmly.



⚠ High Temperature

Right after recording, the thermal head may be very hot and cause burns or other injuries if accidentally touched. Before replacing the chart paper, allow the thermal head to adequately cool down.

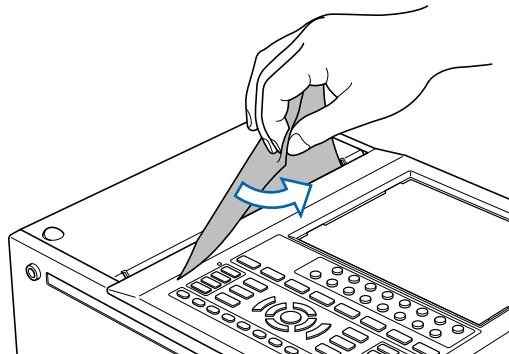
⚠ CAUTION

When loading the chart paper, take care not to damage the thermal head. Recording will not be performed correctly if the thermal head is damaged.

- (5) In the Customize Settings window, select "Use" for 100m Z-fold Chart Unit" (see Section 3.13).

Cutting the Chart Paper

To cut off a length of chart paper, hold the leading edge so that it faces the control panel, and then pull it in the direction shown by the arrow so that it passes along the edge of the cutter.



2.10 Inserting and Removing a PCMCIA Card

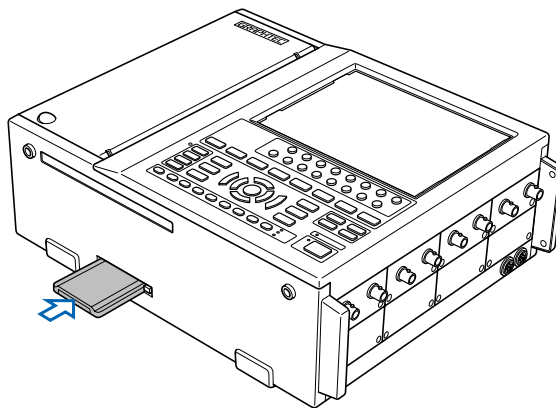
This section describes how to insert a PCMCIA card.

CAUTION

- Adequate precautions against static electricity must be taken when handling PCMCIA cards.
- Do not remove a PCMCIA card during a data capture operation, as this may damage the card.

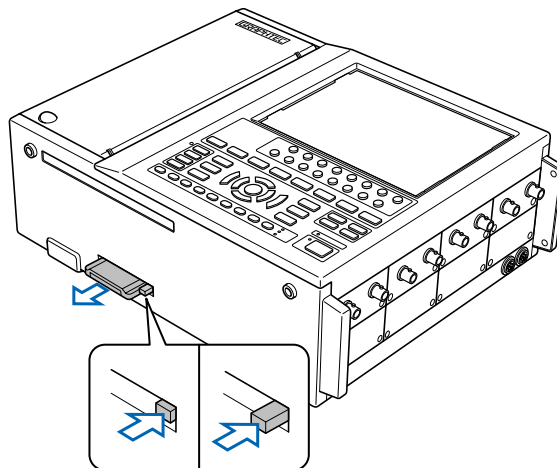
Inserting a PCMCIA Card

Insert the PCMCIA card into the slot as far as it will go.



Removing a PCMCIA Card

Press the eject button next to the PCMCIA card slot so that the button protrudes. Press it once more to eject the PCMCIA card.

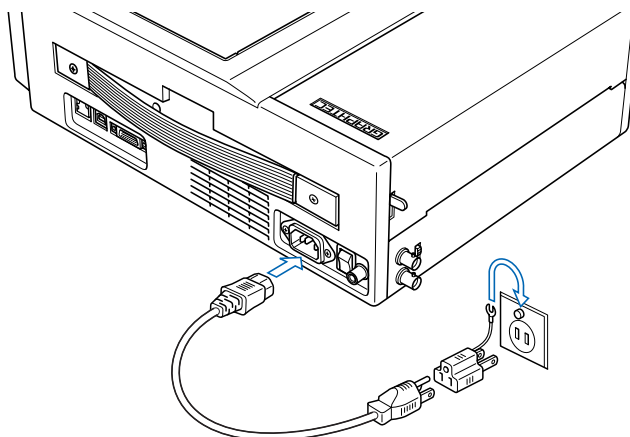


2.11 Connecting the Power Cable and Turning on the Power

This section describes how to connect the power cable and turn on the power. The connection method will vary depending on the type of power supply used.

Connecting to an AC Power Supply

- (1) Insert the AC cable's female plug into the recorder's AC connector, and then insert the male plug into an electrical socket.



- (2) To operate the recorder on the AC power supply, turn on the main unit's AC POWER switch.



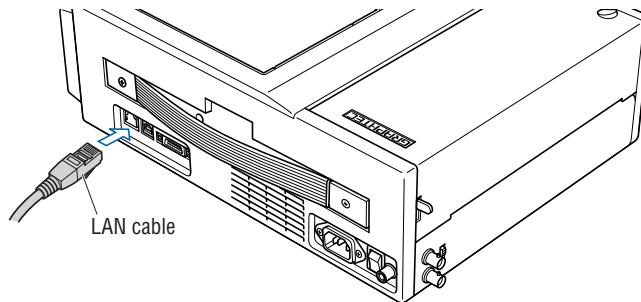
- Be sure to connect the GND terminal while referring to the "Safety Precautions" at the front of this manual. It must also be connected when connecting an external device so that both the recorder and that device will share the same GND level.
 - The WR300/310 is designed to switch automatically between 100 VAC and 200 VAC power supplies. Make sure that the power cable you use has the correct rating.
-

2.12 Connecting to a PC

The WR300 can be connected to a PC via a LAN cable or a USB cable.

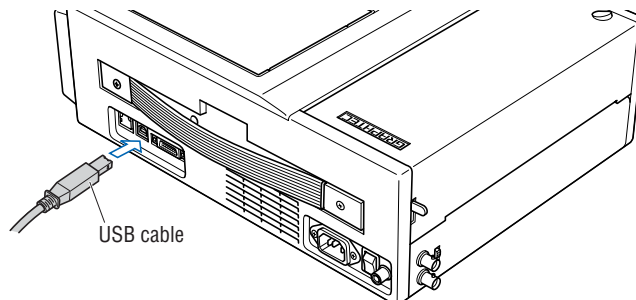
Connection Using a LAN Cable

Use the LAN cable to connect the WR300 to a PC.



Connection Using a USB Cable

Use the USB cable to connect the WR300 to a PC.

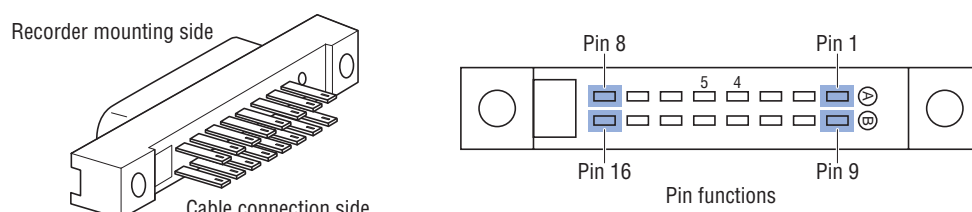


If the USB cable is used, the USB driver must be installed in your PC. Please refer to Section 5.4, "Installing the Software" for the installation procedure.

2.13 Remote Functions and Connector Pin Assignments

This section describes the remote functions and connector pin assignments. Using the remote functions enables the recorder to be operated remotely via electrical signals supplied externally. The control signals used are the CMOS type 0V (low-level) and -5V (high-level) signals.

Connector pin numbers



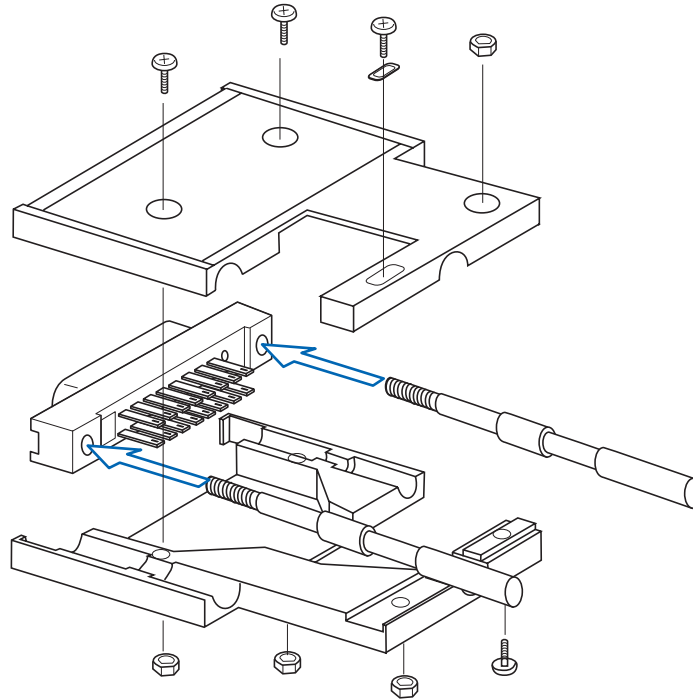
Pin functions

Terminal No.	Name	Function	Remarks
1	START/STOP (Level operation)	Measurement START/STOP L level: Measurement starts H level: Measurement stops Pulse width: At least 1 s Repeat cycle: At least 1 s	Input: CMOS type (0/+5V)
2	START/STOP (Edge operation)	Measurement START/STOP Measurement starts and stops repeatedly whenever the L level is reached. Pulse width: At least 1 s Repeat cycle: At least 1 s	
3	EXT. FEED	Chart feed Amount fed per pulse: 0.03125 mm Max. high frequency: 660 pps (20 mm/s)	
4	EXT. TRIGGER	Trigger activation A trigger is activation whenever the L level is reached. L level pulse width: At least 10 ms	
5	EXT. SAMPLE	Data capture cycle Data is captured whenever the L level is reached. Pulse width: At least 500 ns Repeat cycle: At least 10 μ s	
6	TRIGGER Output	Trigger output A CMOS type "L" pulse signal is output whenever a trigger is activation. Output pulse: At least 10 ms	Output: CMOS type (0/+5V)
9-12 14, 15	GND	GND Line	

2.14 Assembling the Remote Connector

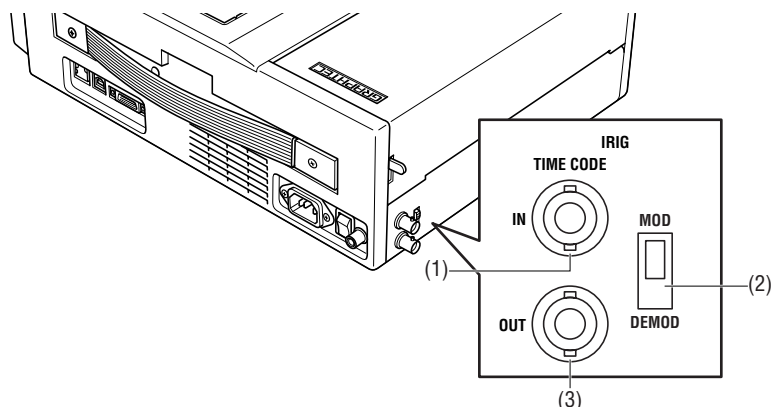
This section describes the assembly procedure for the remote connector. The signal cables are connected to the connector pins.

Assembly diagram



2.15 Using the IRIG Terminals (WR310 only)

The IRIG function supports two time codes (IRIG-B, IRIG-E), and enables recording of the time codes input.



- (1) TIME CODE IN This is the IRIG signal input terminal.
- (2) MOD/DEMOD Switch This enables switching between the IRIG AC/DC signals (Modulated/
Demodulated)
MOD: AC carrier input signals
DEMOD: TTL level signals
- (3) TIME CODE OUT Output is performed via this terminal when the signals are demodulated (TTL
signals)

When a time code has been received correctly, an asterisk mark [*] is displayed on the screen and the time the code was input is printed. If a time code error occurred, the asterisk mark [*] is not displayed and the recorder's internal clock time is printed.

Example of printing (system annotation printing and screen display)

```

2004-04-01 * 00:00:01
|         |
|         | Time printing
|         | Time code receipt status
|         |
|         | Date printing

```



The date printed is the date specified in the recorder settings. The IRIG settings are made in the Option Settings window (see Section 3.12).

CHAPTER 3

Recorder Mode

This chapter describes the Recorder Mode.

- 3.1 Recorder Mode Menu Tree Structure
- 3.2 Amp Settings
- 3.3 Memory Settings
- 3.4 Trigger Settings
- 3.5 Record Settings
- 3.6 Data Replay Settings
- 3.7 Format Settings
- 3.8 EU Settings
- 3.9 Annotation Settings
- 3.10 Calculation Settings
- 3.11 System Settings
- 3.12 Option Settings
- 3.13 Customize Settings
- 3.14 System Information
- 3.15 Recorder Mode REPLAY Menu Tree Structure
- 3.16 Replay Settings
- 3.17 Cursor Settings and Cursor Position
- 3.18 Search Settings
- 3.19 Execute Operations
- 3.20 Calculation

3.1 Recorder Mode Menu Tree Structure

Menu	Item		Details	Section		
1. Amp Settings	AMP		The installed amps are displayed	3.2		
	Input					
	Range					
	Filter					
	Misc.		Zero point adjustment, Auto balance, Other			
	Scaling		The Scaling status (including the units is displayed)			
	Lower-SPAN-Upper Unit					
	Logic					
	Threshold					
2. Memory Settings	Memory	Common Settings	Capture Destination	3.3		
			Sampling Interval			
			Time Scale			
			Program Block			
		Data Memory Settings	Block Size			
			Capture Time		The time is displayed	
			Memory Chain			
			Calculation Processing			
		Capture Block				
	Auto Save					
	Disk	Common Settings	Sampling Interval			
			Time Scale			
		Data Disk Settings	File Name			
3. Trigger Settings	Common Settings		Function	3.4		
			Time Gate			
			Action			
	Start Condition		Source			
			Pre-trigger			
	Stop Condition		Source			
4. Record Settings	Record Settings		Function	3.5		
			Chart Speed			
			V1 Setting			
			V2 Setting			
			Waveform Display Mode			
			Channel ID			
			Memory		Function	
					Output Mode	
					Waveform Display Mode	
					Channel ID	
			Print Record Settings		Scale Print	
	List Print					
	5. Data Replay Settings	Memory	Replay Source Settings		Replay Source	3.6
Replay Block						
Data Save Conditions			Sampling Interval	The data capture sampling interval is displayed		
			Time Scale	The time scale axis unit is displayed		
			No. of Data	The number of data points is displayed		
Replay View Settings			Replay CH			
			Output Ratio			
Data Save						
Disk			Replay Source Settings		Replay Source	
		File Name				
		Data Save Conditions		Sampling Interval	The data capture sampling interval is displayed	
				Time Scale	The time scale axis unit is displayed	
				No. of Data	The number of data points is displayed	
	Replay View Settings		Replay CH			
Output Ratio						

Menu	Item		Details	Section
6. Format Settings	Format Settings	Grid		3.7
		Envelope		
		Priority Display		
		• Priority CH		
	Zone Settings	Zone Preset		
		• Zone		
		• Color		
		• Width		
		• Trace		
	Logic Zone	Group A		
		Group B	8-, 16-ch only	
		Group C	16-ch only	
		Group D	16-ch only	
7. EU Settings*	Function			3.8
	Lower- EU –Upper Unit	When the setting is 4-point	Meas. value (upper/lower)	
			EU value (upper/lower)	
			Dec pt	
			Unit	
			Select	
			Choose	
			Span	
		When the setting is Offset	Meas. value (upper/lower)	
			EU value (upper/lower)	
			Unit	
			Select	
			Choose	
			Span	
8. Annotation Settings*	Common Settings	Print Interval		3.9
		Length		
		Flying Annotation		
	Title Annotation			
	CH Annotation			
9. Calculation Settings	Calculation	Statistical Calculation		3.10
		Arithmetical Calculation		
		FFT Calculation		
10. System Settings	Settings	Save Current Settings		3.11
		Load Settings From Disk		
		Return to Default Settings		
	Disk Operation	File List		
		File Copy		
		File Rename		
		File Delete		
11. Option Settings	Option Settings	Disk Initialize		3.12
		Screen Saver		
		Background Color		
		Power On Start		
		Printer		
		Date/Time		
	New Line Code			
	Device ID			
	IRIG			
	TCP/IP Settings	IP Address		
		Subnet Mask		
		Port Number		
12 Customize Settings	Customize Settings	Language		3.13
		100m Z-fold Chart Unit		
		Echo Back		
		Trigger Level Setting		
		DCB AMP Calibration Mode		
		Room Temp. Compensation		
		Execute Settings		
13. System Information	FPGA			3.14
	Firmware			
	Network			

3.2 Amp Settings

	(1)	(2)	(3)	(4)	(5)	(6)
Menu Index	AMP Settings					
1. Amp Settings	CH:	AMP	Input	Range	Filter	Misc.
2. Memory Settings	1:	V	DC	500mV	500 Hz	▼
3. Trigger Settings	2:	V	DC	1 V	500 Hz	▼
4. Record Settings	3:	V	DC	2 V	500 Hz	▼
5. Replay Settings	4:	V	Off	200 V	Off	▼
6. Format Settings	5:	V	Off	200 V	Off	▼
7. EU Settings	6:	V	Off	200 V	Off	▼
8. Annotation Settings	7:	V	Off	200 V	Off	▼
9. Calculation	8:	V	Off	200 V	Off	▼
10. System Settings	CH:	Scaling	Lower-SPAN-Upper	Unit		
11. Option Settings	1:	On	- 515.4 + 273.2	V		▼
12. Customize Settings	2:	Off	-0.5000 +0.5000	V		▼
13. System Information	3:	Off	-1.0000 +1.0000	V		▼
	4:	Off	-100.00 +100.00	V		▼
	5:	Off	-100.00 +100.00	V		▼
	6:	Off	-100.00 +100.00	V		▼
	7:	Off	-100.00 +100.00	V		▼
	8:	Off	-100.00 +100.00	V		▼
	Logic:	Disable		Threshold		▼
[POSITION] Key						
▲ : Menu Up						
▼ : Menu Down						
	(9)			(10)		

Amp Settings

- (1) CH Indicates the channel number.
- (2) AMP Displays the type of amplifier installed
V : WR3-V (Voltage) amp
M : WR3-M (Multi-input) amp
DCB : WR3-DCB (DC strain) amp
FV : WR3-FV (Frequency-to-voltage conversion) amp
- (3) Input Selects the input coupling status. The available settings vary with the type of amp installed.
Available Settings: WR3-V amp
Off : No signal input is accepted.
AC : Used for measuring an alternating-current component of signal input that also contains a direct-current component.
DC : Used for measuring direct-current voltage.
GND : Measures the 0-V line instead of measuring changes in the signal input.
CAL : Generates a calibration voltage that is 1/2 full scale of the currently selected range instead of measuring the input voltage.
Available Settings: WR3-M amp
Off : No signal input is accepted.
AC : Used for measuring an alternating-current component of signal input that also contains a direct-current component.
DC : Used for measuring direct-current voltage.
TEMP : Used for measuring temperature.
GND : Measures the 0-V line instead of measuring changes in the signal input.
CAL : Generates a calibration voltage that is 1/2 full scale of the currently selected range instead of measuring the input voltage.
Available Settings: WR3-DCB amp
Off : Select this setting if you do not wish to perform measurement.
DC : Select DC to measure the strain sensor's output voltage in DC coupling status.
ZERO : Select ZERO to check the zero-point position
CAL+ : Select CAL+ to check the "+1/2 full-scale" position of the measurement range.
CAL- : Select CAL- to check the "-1/2 full-scale" position of the measurement range.

Available Settings: WR3-FV amp

Off : No signal input is accepted

DC : The FV amp regards 0 V as the threshold value for distinguishing between High and Low signals.

OC : The FV amp regards 2.5 V as the threshold value for distinguishing between High and Low signals.

- (4) Range Specifies the range of signal input to be measured. The available settings vary with the type of amp installed and the INPUT setting. Please refer to Appendix A for the available ranges for each amp type.



When the AUTO setting is selected, the measurement range is automatically selected to suit the signal input. The selected range is determined by the input voltage level at the time the AUTO setting is selected.

- (5) Filter Selects the filter status.



- Use the Line filter setting to cut off noise (50/60 Hz) from the power line when such noise is affecting the signal input.
- The other filters are low-pass filters. The setting of each lowpass filter is -3dB (typical).

- (6) Misc. Additional settings may be required according to the type of amp installed. Specify the additional settings as necessary.

WR3-V amp, WR3-M amp, WR3-FV amp

Zero point auto adjustment, zero point adjustment reset, zero point voltage value

WR3-DCB amp

Auto balance, rated output, setting of calibration values

Scaling, Lower - SPAN - Upper, Unit

These items are not available in FFT mode.

- (7) Scaling Displays the setting status of this function in the EU Settings window.



The scaling function cannot be turned on or off using this setting. Scaling on/off functions and other scaling settings should be set using the EU Settings window.

- (8) Lower - SPAN - Upper Unit

..... Set the span of signals to be measured within the currently selected measurement range. The table below lists the standard SPAN values that can be specified. When setting SPAN values, be sure to set the Upper SPAN value so that it is greater than the Lower SPAN value. When the ENTER key is pressed while this parameter is selected by the cursor, the following window appears.

	(e)	(a)	(b)	(c)	(d)
Span Settings					
Upper:		+250.0		[+250.0]	
Lower:		-250.0		[-250.0]	
Unit:		[V] [V]	(f)
Reverse:		Off			(g)
[Enter]select/[Exec]register					

(a) Input the Upper-limit SPAN value here. When the Scaling setting is On, this SPAN setting is also scaled.

(b) Input the Lower-limit SPAN value here. When the Scaling setting is On, this SPAN setting is also scaled.

- (c) Displays the original Upper SPAN value prior to scaling, if the Scaling setting is On. If the Scaling setting is Off, the same value as (1) is displayed here.
- (d) Displays the original Lower SPAN value prior to scaling, if the Scaling setting is On. If the Scaling setting is Off, the same value as (2) is displayed here.
- (e) Displays the unit of the selected Range (display only; the setting cannot be changed).
- (f) Displays the original prior to scaling (display only; the setting cannot be changed).
- (g) Displays the Upper and Lower SPAN values in reverse.

Available SPAN Settings

Voltage ranges: WR3-V and WR3-M amps

Range	Maximum SPAN		Minimum SPAN	
	[mV]	[V]	[mV]	[V]
	Lower to Upper SPAN	Lower to Upper SPAN	Upper SPAN minus Lower SPAN	
1	–	-1.1000 to +1.1000	–	100 mV
2	–	-2.2000 to +2.2000	–	200 mV
5	–	-5.500 to +5.500	–	500 mV
10	–	-11.000 to +11.000	–	1 V
20	-22.000 to +22.000	-22.000 to +22.000	2 mV	2 V
50	-55.000 to +55.000	-55.00 to +55.00	5 mV	5 V
100	-110.00 to +110.00	-110.00 to +110.00	10 mV	10 V
200	-220.00 to +220.00	-220.00 to +220.00	20 mV	20 V
500	-550.00 to +550.00	-550.0 to +550.0	50 mV	50 V

Note: The 500-V range is available for the WR3-M amp only.

Temperature ranges: WR3-M amp

Range	Maximum SPAN	Minimum SPAN
	Lower to Upper SPAN	Upper SPAN minus Lower SPAN
K	-200.0 to +1300.0	50°C
J	-200.0 to +1100.0	50°C
T	-200.0 to +400.0	50°C
R	0.0 to +1600.0	50°C
E	-200.0 to +800.0	50°C
B	600.0 to +1700.0	50°C

Strain ranges: WR3-DCB amp

Range	Maximum SPAN	Minimum SPAN
	Lower to Upper SPAN	Upper SPAN minus Lower SPAN
1 mε	-1.1000 to +1.1000	0.1 mε
2 mε	-2.2000 to +2.2000	0.2 mε
5 mε	-5.500 to +5.500	0.5 mε
10 mε	-11.000 to +11.000	1 mε
20 mε	-22.000 to +22.000	2 mε

Note: m = 1000 με is shown.

Frequency ranges: WR3-FV amp

Range	Maximum SPAN	Minimum SPAN
	Lower to Upper SPAN	Upper SPAN minus Lower SPAN
200 Hz	-220.00 to +220.00	20 Hz
400 Hz	-440.0 to +440.0	40 Hz
500 Hz	-550.0 to +550.0	50 Hz
1 kHz	-1.1000 to +1.1000	100 Hz
2 kHz	-2.2000 to +2.2000	200 Hz
4 kHz	-4.400 to +4.400	400 Hz
5 kHz	-5.500 to +5.500	500 Hz
10 kHz	-11.000 to +11.000	1 kHz
20 kHz	-22.000 to +22.000	2 kHz
40 kHz	-44.00 to +44.00	4 kHz



The span can be physically set to anywhere between -270.0°C to +2000°C regardless of the temperature range that has been set. However, the actual span that can be used for each range is shown in the above table.

Notes on Logic

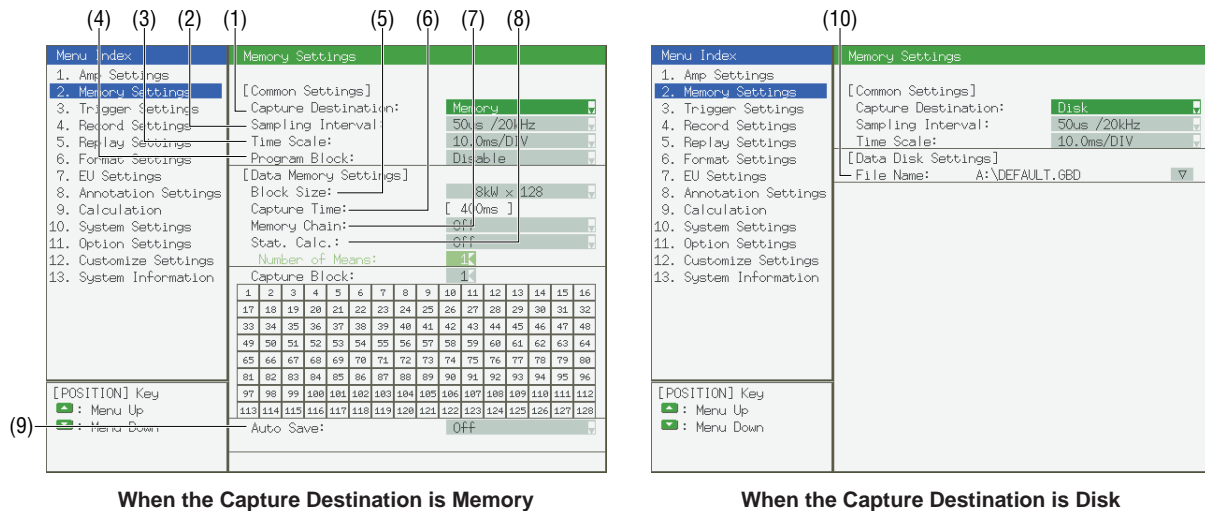
- (9) Logic Can only be set when the logic amplifier is installed. Sets the logic amplifier to "Enable" (used) or "Disable" (not used).



Logic signals can only be displayed and printed when this setting is enabled and the "Logic zone" setting is "On" in the Format Settings window.

- (10) Threshold Can only be set when the logic amplifier is installed. Sets the logic signal High/Low level threshold values.
- +1.4 V (TTL) : High level only when a logic signal greater than approximately 1.4 V is input.
 - +2.5 V (CMOS) : High level only when a logic signal greater than approximately 2.5 V is input.
 - +5.0 V (Contact) : High level only when a logic signal greater than approximately 5.0 V is input.

3.3 Memory Settings



[Common Settings]: These are the common settings for capturing measured data.

(1) Capture Destination .. Selects the destination for saving measured data.

Memory : Saves the measured data in the recorder's internal memory.

Disk : Saves the measured data to an internal hard disk (WR310 only) or PCMCIA card.



Disk cannot be selected in FFT mode or when the Waveform Display mode is XY.

(2) Sampling Interval Selects the interval for sampling data during measurement. The window shows the Sampling Interval as a time interval (on the left) and a frequency (on the right). Available settings vary with the Capture Destination setting.



- When different types of amps are installed and measurement is conducted using the fastest Sampling Interval setting of the amp with the highest Sampling Interval setting, each amp with a slower Sampling Interval setting will sample data using its own fastest Sampling Interval setting and any data between its own sampling intervals will be regarded as measured data of identical value.

- However, if an M amp is installed and you have selected TEMP for the input for even just one channel, the maximum sampling interval will be 10 μ s.

[Sample measurement]

Installed amp types : WR3-V amp, WR3-M amp

Sampling interval : 1 μ s



Maximum Capture Speeds When Capturing Data to Memory

When the Capture Destination is Memory, the maximum data capture speed is the maximum sampling interval for the amplifier:

- WR3-V amp : 1 μ s
- WR3-DCB amp : 10 μ s
- Logic amp : 1 μ s
- WR3-M amp : 10 μ s
- WR3-FV amp : 4 μ s

Maximum Capture Speeds When Capturing Data to Disk

The maximum capture speed when capturing data to disk varies depending on the maximum sampling interval, the number of channels, and on the memory device. When data capture is performed at a Sampling Interval setting higher than those listed in the table, some of the measured data may be skipped during data capture. If this happens, the "Skipped" message and a count of the number of data points skipped appear at the bottom of the Monitor window during data capture. In such case, change the Sampling Interval setting to a lower value.

Conditions		Memory device	
Amplifier	Channels	Hard disk*	PCMCIA Card
WR3-V amp	8CH	1 μs	5 ms
	16CH	2 μs	
WR3-M amp	8CH	10 μs	
	16CH	10 μs	
WR3-DCB amp	8CH	10 μs	
	16CH	10 μs	
WR3-FV amp	8CH	4 μs	
	6CH	4 μs	
Logic amp	16CH	Depends on the analog amps	

* WR310 only



To ensure optimum data capture at the specified sampling interval, or if skipping occurs frequently during data capture, save your data files to another memory device and then reformat the disk.

- (3) Time Scale Sets the time per division on the screen
- (4) Program Block This parameter can only be set when the Capture Destination setting is Memory. When the Block Size setting is other than 1MW x 1, set the Program Block setting to Reserve before using one of the functions for calculation or the Waveform Judgment function, which will cause the final Memory Block No. to be used as the destination for saving the result of a calculation.



When the Program Block setting is Reserve, even if the final Memory Block No. contains data, such data will be overwritten.

[Data Memory Settings]: These are the settings for capturing data to the internal memory.

- (5) Block Size This parameter, which can only be set when the Capture Destination setting is Memory, selects the number of blocks in the WR300/310's internal memory. By partitioning the internal memory according to the amount of time spent on measurement, you can change the capacity of the internal memory.
1 MWord x 1, 512 kWords x 2, 256 kWords x 4, 128 kWords x 8, 64 kWords x 16, 32 kWords x 32, 16 kWords x 64, 8 kWords x 128
- (6) Capture Time This parameter, which is only displayed when the Capture Destination setting is Memory, indicates the time required for capturing data in the WR300/310's internal memory. The total time equals the Sampling Interval setting multiplied by the Block Size setting.

Example:

Sampling Interval : 4 μ s

Block Size : 8 kW x 128

Capture Time : 8 kW x 4 μ s x 1 = 32 ms

- (7) Memory Chain This parameter, which can only be set when the Capture Destination setting is Memory, selects the method for capturing data in partitioned memory blocks.
- Off : Repeatedly captures data to the specified Block No.
- Sequential Block : Repeatedly captures and overwrites data in ascending order from the specified Block No. (proceeding to Block 1 after the highest Block No.) until measurement is completed.
- Empty Block : Captures data in ascending order from the specified Block No. (proceeding to Block 1 after the highest Block No.), terminating data capture when no empty blocks remain.

- (8) Stat. Calc. This parameter selects the On/Off status of statistical calculation, provided that both of the following conditions are met:
- The Capture Destination setting is Memory; and
 - The Block Size setting is other than 1 MW x 1.
- Arithmetic averaging is used as the method for statistical calculation. Statistical calculation calculates the arithmetic mean between the data captured in the specified Memory Block (which varies with the Memory Chain and Memory Block settings) and the data captured at the final Block No., and then saves the calculated result at the final Block No. This operation is performed the number of times specified by the Number of Means parameter.
- Available Settings
- Off : Disables statistical calculation.
- On : Enables statistical calculation. When On is selected, a submenu appears for setting the frequency of arithmetic averaging.



- The result of a Statistical Calculation operation will be saved to the final Memory Block No.
 - Data captured to the specified Memory Block is constantly overwritten so that only the most recent data is saved. Please note that earlier data will not be retained.
-

- (9) Auto Save This parameter, which can only be set when the Capture Destination setting is Memory, selects the On/Off status of the Auto Save function. When Auto Save is On, the data captured in internal memory is automatically saved to the PCMCIA card or to the built-in hard disk.

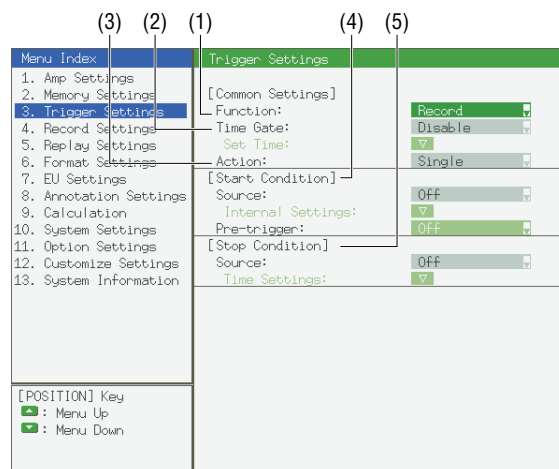


- A block containing data and an empty block can be distinguished by the color used to display them.
- Block No.**
- Green : A block containing data.
- Gray : An empty block
- Blue : A block containing the result of a calculation operation and so forth.
- To erase captured data, change the setting of the block size. All the captured data will be erased.
-

[Data Disk Settings]: These are the settings for capturing data to the hard disk (WR310 only) or PCMCIA card.

- (10) File Name (Disk) This parameter can only be specified in the following case:
- Either a hard disk drive or a PCMCIA card drive is installed; and
 - The Capture Destination setting is Disk.
- This parameter specifies the destination folder, and destination file name. The extension differs according to the save destination as follows:
- PCMCIA card : ".GBD"
- HDD : ".GDT"

3.4 Trigger Settings



- (1) Function This specifies the Action after Triggering,
 Record : After Triggering, the measured data is displayed on the screen or recorded on chart paper.
 Memory : After Triggering, the data is captured to internal memory, the hard disk drive (WR310 only), or the PCMCIA card.



If you have selected Memory, data is captured to the Capture Destination in the Memory Settings menu.

- (2) Time Gate Specifies the wait time for the trigger signal.



The Time Gate setting only affects the [Start Condition] and cannot be used for the [Stop Condition]. The timing of the Time Gate function is based on the WR300/310's internal clock.

- Disable : Disables the Time Gate function.
- Relative Time : Specifies the interval for awaiting trigger signal input as a relative time period which begins when the START key is pressed. When this setting is selected, a submenu for setting the time interval appears.
- Absolute Time : Specifies the time wait interval as absolute starting and stopping times. When this setting is selected, a submenu for setting the time interval appears.
- Set Time : Can only be set when the Time Gate setting is Relative Time or Absolute Time.
 - Set Mode : Selects the mode for setting the Time Gate parameter's wait interval.
 - Start Time : Enables only the starting time.
 - Start & Stop : Enables the starting and stopping times.



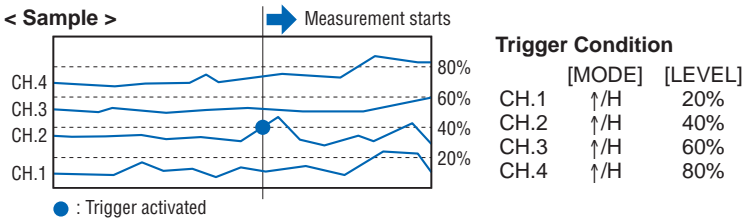
- When the Time Gate setting is Relative Time, both the starting and ending times must be specified relative to the starting time of measurement in the range of 0000:00:01 to 9999:59:59 (hours:minutes:seconds).



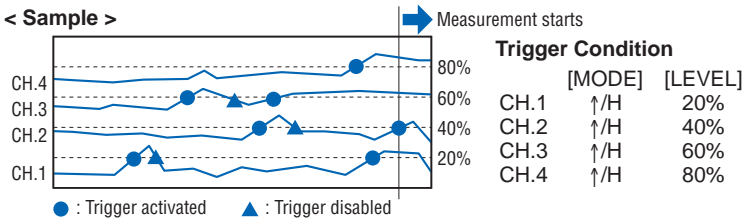
- When the Time Gate setting is Absolute Time, both the starting and ending times must be specified. The following table describes the relationship between the absolute starting and ending times.

Starting time	Ending time	Operation
Current time or earlier	Current time or earlier	The Time Gate function is disabled
Current time or earlier	After current time	Only the ending time is recognized.
After current time	Current time or earlier	Only the starting time is recognized.
After current time	After current time	Both the starting and ending times are recognized, but the starting time cannot be set later than the ending time.

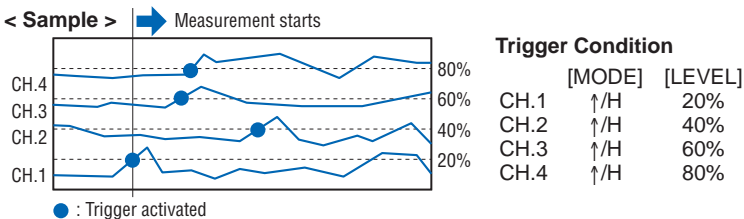
- (3) Action This parameter selects whether the specified operation will be triggered only once or repeatedly.
Single : The specified operation is triggered once and then the trigger is disarmed.
Repeat : Until the STOP key is pressed, the specified operation is repeatedly performed whenever its trigger condition is satisfied.
- (4) Start Condition The Start Condition parameters specify the trigger condition that must be met in order to initiate measurement.
- Source Selects the trigger type to be used for initiating measurement.
Off : When the Source setting is Off, no trigger is used. Instead, measurement is initiated by pressing the Start key.
Internal : When the Source setting is Internal, after the Start key has been pressed, measurement is initiated when the specified trigger condition is satisfied.
Manual : When the Source setting is Manual, press the Trigger key to satisfy the trigger condition and initiate measurement.
 - Combination This parameter can only be set when the Source setting is Internal. It selects how a trigger condition is satisfied and the target channel(s).
LEVEL OR : The start of measurement is triggered when one channel satisfies the trigger condition.



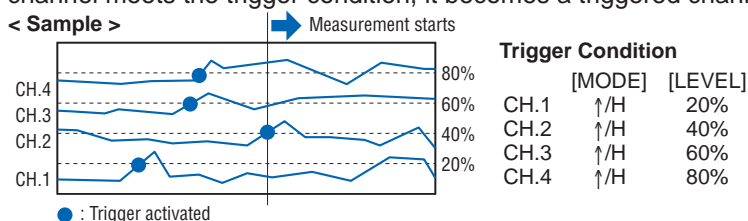
LEVEL AND : The start of measurement is triggered when all of the target channels satisfy the trigger condition.



EDGE OR : After all of the target channels have reached a level that does not satisfy the trigger condition, the start of measurement is triggered when any one of the target channels satisfies the trigger condition.



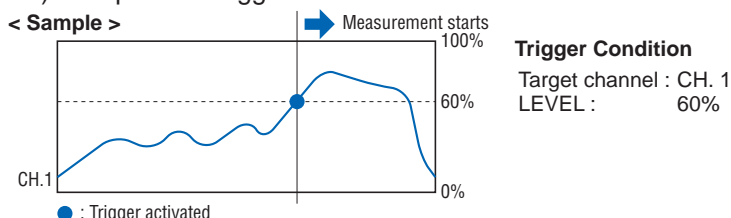
EDGE AND : After all of the target channels have reached a level that does not satisfy the trigger condition, the start of measurement is triggered when all of the target channels satisfy the trigger condition. Moreover, once a channel meets the trigger condition, it becomes a triggered channel.



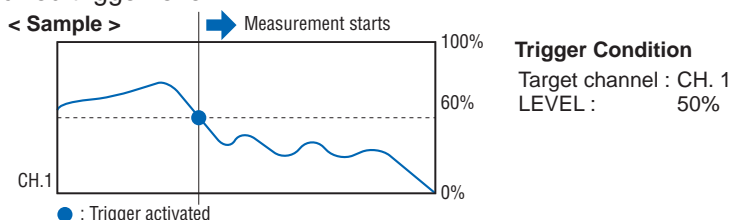
- Mode This parameter can only be set when the Function setting is Record and the Source setting is Internal. It selects the trigger condition for each channel according to the Combination setting.

Off : When a channel's MODE setting is OFF, it will not be affected by the currently selected COMBINATION setting.

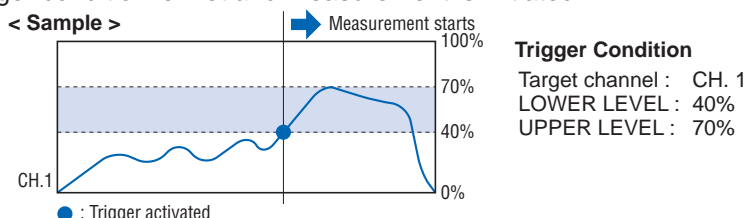
▲/H : This Mode setting cannot be used by any channel for which the Range parameter is a temperature setting. When the MODE setting is ▲/H, the start of measurement is triggered when the signal input rises to (or rises above*) the specified trigger level.



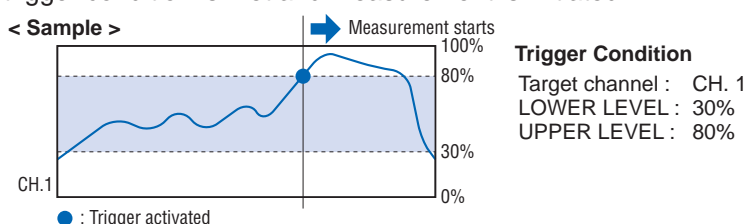
▼/L : This Mode setting cannot be used by any channel for which the Range parameter is a temperature setting. When the MODE setting is ▼/L, the trigger is activated when the signal input falls to (or falls below*) the specified trigger level.



Win In : It specifies the lower and upper limits of the trigger level for each channel. When the signal input goes within (or is within*) both limits, the trigger condition is met and measurement is initiated.



Win Out : It specifies the lower and upper limits of the trigger level for each channel. When the signal input goes outside (or is outside*) both limits, the trigger condition is met and measurement is initiated.



* When the Combination setting is Level OR or Level AND.

- Lower - Level - Upper

..... Specifies the trigger level for the input signal in a range from 0 to 100% (Lower SPAN limit: 0%, Upper SPAN limit: 100%).

When the Mode setting is ↑/H or ↓/L:

Specify one Trigger Level in the range of -100% to +100% in 1% steps (where the current Range setting's lower limit is -100% and its upper limit is +100%).

Example : When the Range setting is 5V
-5V equals -100%, and +5V equals +100%.

When the Mode setting is Win In or Win Out:

Specify two Trigger Levels in the range of -100% to +100% in 1% steps (where the current Range setting's lower limit is -100% and its upper limit is +100%). Specify the upper and lower limits so that the difference between them is at least 5%.

Example : When the Range setting is 5V
-5V equals -100%, and +5V equals +100%.

CAUTION

The trigger level is always set to a °C value, even if °F has been selected for the the temperature range. Take care when setting this value.

The Logic setting (only if a logic amp is installed):

X : Excludes the logic amp's channels as trigger channels.

L : Activates the trigger at Low-level signal input.

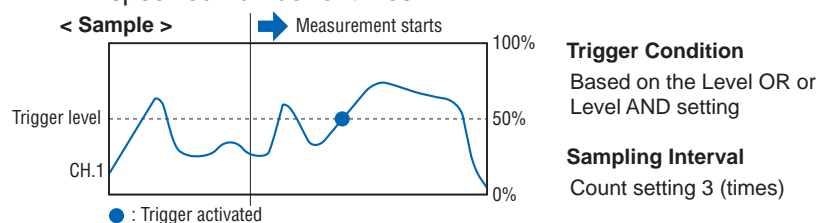
H : Activates the trigger at High-level signal input.

CHECKPOINT

The permissible range of the logic amp's L and H values varies with the Threshold setting in the AMP Settings window.

- Trigger Counter Can only be set when the Combination setting is Level OR or Level AND. When the recorder is in trigger armed status, this function can be set to make the recorder ignore trigger signal input during a fixed interval. This function is provided with a choice of two parameters, Count and Filt.

Count : Measurement is started when the trigger condition has been satisfied the specified number of times.



- Pre-trigger This parameter can only be set when the Function setting is Memory. It specifies the pre-trigger period as a percentage.

CHECKPOINT

- Based on the position where the trigger condition is satisfied as the reference point, the Pretrigger function initiates data capture before or after that reference point. A Pretrigger setting of 100% equals the total capture time (the Sampling Interval setting x Block Size setting).

- The Pre-trigger time when the Capture Destination is the hard disk or PCMCIA card is calculated using the formulas below. Furthermore, the memory capacity for Pre-trigger varies according to the memory device used for the capture destination.

– Hard disk pre-trigger memory capacity: 24 MW

– PCMCIA pre-trigger memory capacity : 1 kW

When there is a temperature measurement channel (when TEMP has not been selected for any channel on the AMP Settings window)

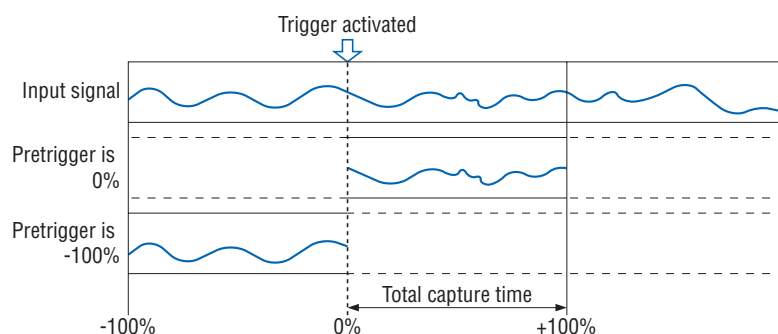
Pre-trigger memory capacity x sampling speed ÷ number of channels ÷ 2 = the pre-trigger time

When there is no temperature measurement channel (when TEMP has been selected for any channel on the AMP Settings window)

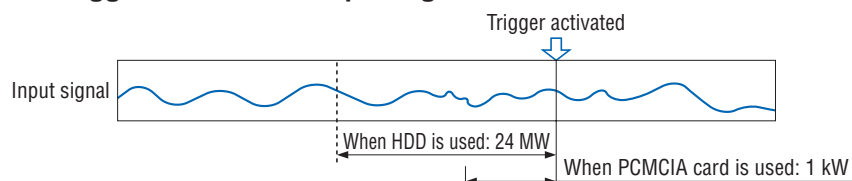
Pre-trigger memory capacity x sampling speed ÷ number of channels = the pre-trigger time

Example: Capture to hard disk, 1 μs sampling speed, 8-ch input, voltage only
24 MW x 1 μs ÷ 8 = approx. 3 s

Pre-trigger action when capturing data to the internal memory



Pre-trigger action when capturing data to the hard disk or PCMCIA card



- (5) Stop Condition These parameters specify the trigger condition that must be met in order to stop measurement. Similar to the Start Condition parameters, various conditions can be set by specifying the Stop Condition parameters. For a description of the Stop Condition parameters, please refer to the description for the Start Condition parameters.

Additional Function

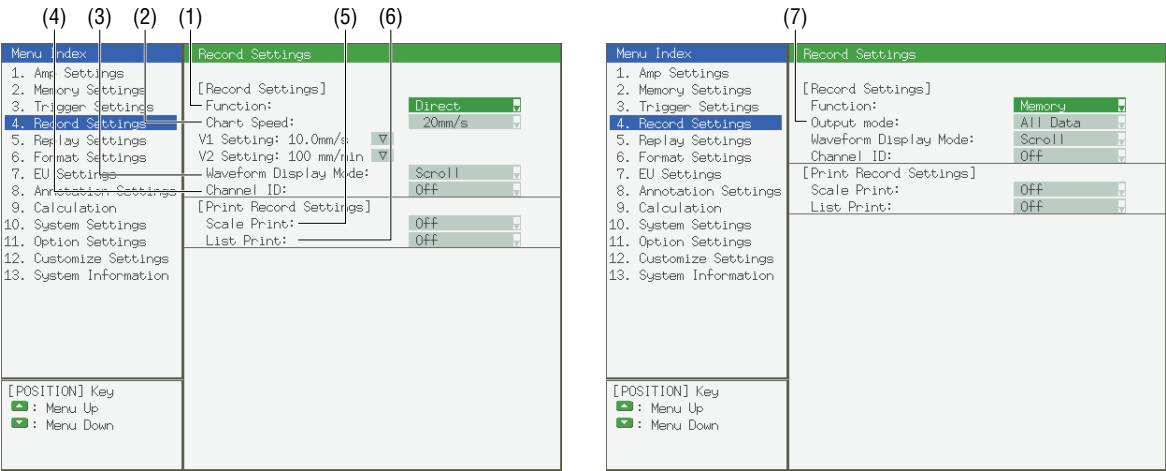
"Time" has been added to the Source settings. After the Start Condition has been met to start measurement, this function stops measurement after the specified time has elapsed. The Stop trigger cannot be used if Pretrigger is used.

Possible Combinations of Source Settings

The table below describes the operation resulting from different combinations of Source settings for the Start Condition and Stop Condition.

Source of Start Condition	Source of Stop Condition	Operation
Off	Off	After measurement is started by pressing the START key, it is stopped by pressing the STOP key.
	Internal	After measurement is started by pressing the START key, it is stopped when the specified Stop Condition is met.
	Manual	After measurement is started by pressing the START key, it is stopped by pressing the TRIGGER key.
	Time	After measurement is started by pressing the START key, it is stopped after the specified time interval.
Internal	Off	After measurement is started according to the specified Start Condition, it is stopped by pressing the STOP key.
	Internal	After measurement is started when the specified Start Condition is met, it is stopped when the specified Stop Condition is met.
	Manual	After measurement is started when the specified Start Condition is met, it is stopped by pressing the TRIGGER key.
	Time	After measurement is started when the specified Start Condition is met, it is stopped after the specified time interval.
Manual	Off	After measurement is started by pressing the TRIGGER key, it is stopped by pressing the STOP key.
	Internal	After measurement is started by pressing the TRIGGER key, it is stopped when the specified Stop Condition is met.
	Manual	After measurement is started by pressing the TRIGGER key, it is also stopped by pressing the TRIGGER key.
	Time	After measurement is started by pressing the TRIGGER key, it is stopped after the specified time interval.

3.5 Record Settings



When the Function setting is Direct

When the Function setting is Memory

- (1) Function Selects the operation to be performed upon activation of a trigger.
Direct : Records and displays the measured data.
Memory : Saves the measured data to the internal memory, hard disk (WR310 only), or to the PCMCIA card (data is not displayed or recorded directly). Waveform data is not displayed during measurement. Display after measurement has ended depends on the output mode selected and the settings made.



When the Function setting is Memory, it is synchronized with the Function setting in the Trigger Settings.

- (2) Chart Speed This parameter selects the screen scroll speed and the speed for feeding the chart paper. It can only be set when the Function setting is Direct.
V1, V2 Setting: Set the chart speed.
- (3) Waveform Display Mode This function can only be used when Function has been set to Direct. It specifies the display scrolling method.
Scroll : Scrolls the display to match waveform movement.
Fixed : Updates the waveform one screen at a time.
XY : XY display is only enabled when the Function setting is Memory. Please see Section 3.19 "Execute XY Display" for details on the settings.
- (4) Channel ID This function can only be used when Function has been set to Direct. Identifying channel numbers are printed alongside the analog waveforms being printed on the chart paper.

[Print Record Settings]: The Scale Print and List Print settings are made here.

- (5) Scale Prin Scale printing is performed when Function has been set to Disk, or when Function has been set to Memory and the Output Mode setting is All Data or One Frame. (In such case, scale printing is performed prior to printing the measured data. When recording has been completed, the scale with respect to the recording area is printed.)
Direct : Scale printing is performed after recording has been completed.
Memory : Scale printing is performed prior to printing the measured data.

- (6) List Print After recording is completed, a list of the WR300/310's currently selected settings is printed.
- (7) Output Mode This parameter selects whether or not to replay data after it has been measured and saved to memory. It can only be set when the Function setting is Memory.
- All Data : Replays all of the captured data.
- One Frame : Replays only one frame of the captured data.
- No Output : Simply saves the measured data (without replaying it).
-



This One Frame function can be used most effectively when used in combination with the Output Ratio function of the MEMORY key's Data Replay Settings window.

3.6 Data Replay Settings

(2) (1) (3) (4) (5)

Menu Index	Data Replay Settings															
1. Amp Settings	[Replay Source Settings]															
2. Memory Settings	Replay Source: Memory															
3. Trigger Settings	Replay Block: 1															
4. Record Settings																
5. Replay Settings	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
6. Format Settings	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
7. EU Settings	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
8. Annotation Settings	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
9. Calculation	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
10. System Settings	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
11. Option Settings	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112
12. Customize Settings	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
13. System Information																
[Data Save Conditions]																
Sampling Interval: ---																
Time Scale: ---																
No. of Data: ---																
[Replay View Settings]																
Replay CH: All CH																
Output Ratio: x 1																
Data Save																
[POSITION] Key																
Menu Up																
Menu Down																

(6) (7) (8)

When the Capture Destination is Memory

(9) (3) (4) (5)

Menu Index	Data Replay Settings															
1. Amp Settings	[Replay Source Settings]															
2. Memory Settings	Replay Source: Disk															
3. Trigger Settings	File Name: [Not Specified]															
4. Record Settings																
5. Replay Settings	[Data Save Conditions]															
6. Format Settings	Sampling Interval: ---															
7. EU Settings	Time Scale: ---															
8. Annotation Settings	No. of Data: ---															
9. Calculation																
10. System Settings	[Replay View Settings]															
11. Option Settings	Replay CH: All CH															
12. Customize Settings	Output Ratio: x 1															
13. System Information																
[POSITION] Key																
Menu Up																
Menu Down																

When the Capture Destination is Disk

[Replay Source Settings]: Specifies the capture destination of the measured data.

- (1) Replay Source Selects the source for loading measured data.
 Memory : Loads captured data from the WR300/310's internal memory.
 Disk : Selects the replay source when the replay data is located within a hard disk (WR310 only) or a PCMCIA card.
- (2) Replay Block This parameter, which can only be set when the Replay Source setting is Memory, selects the Block No. that contains the data to be loaded. Any block that is displayed in solid green can be selected. After a block is selected by this parameter, it becomes red.

[Data Save Conditions]: Displays the conditions that were used to save the data being loaded. The conditions appear as soon as the Replay Block setting is specified. The displayed data cannot be changed.

- (3) Sampling Interval Displays the Sampling Interval setting used to save the data being loaded. The displayed data cannot be changed.
- (4) Time Scale Displays the time scale used when the data was captured.
- (5) No. of Data Displays the No. of Data points used to save the data being loaded. The displayed data cannot be changed.

[Replay View Settings]: Sets the display conditions for replaying captured data.

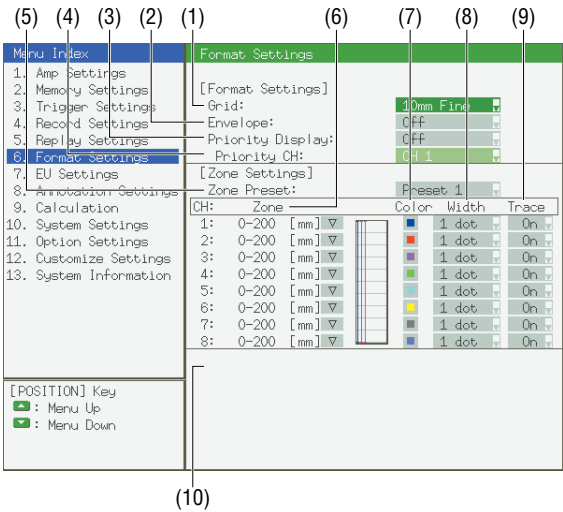
- (6) Replay CH Selects the source channel(s) for loading data.
 All CHs : Loads the data of all channels
 Selected CH(s) : Loads the data of only the specified channel. If you select Selected CH(s), also specify the target channel number at the CH parameter.
- (7) Output Ratio Selects the magnification ratio of the time axis for use in data replay.
 x 1/10, x 1/8, x 1/5, x 1/4, x 1/2, x 1, x 2, x 4, x 5, x 8, x 10, Screen Width



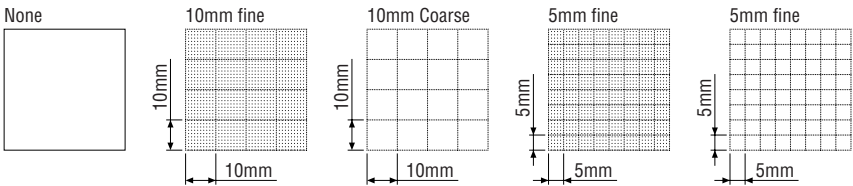
The Screen Width setting enlarges or reduces the data so that it will all fit into the 10 div screen for viewing.

- (8) Data Save This parameter, which can only be set when the Replay Source setting is Memory, lets you save data to a hard disk (WR310 only) or a PCMCIA card. This parameter specifies the file format, destination drive letter, folder name, and file name. You have a choice of two file formats: BINARY or TEXT.
- (9) File Name This parameter, which can only be set when the Replay Source setting is Disk, specifies the source drive, folder, and file name where the data to be replayed is stored. You can select any file which has a file name extension of ".GDT" or ".GBD".
- Set Channel This parameter, which can only be set when the Replay CH is Selected CH(s), specifies the channel(s), for replay.

3.7 Format Settings



(1) Grid Selects the grid pattern for use when displaying and plotting waveforms. The grid patterns that can be selected differ according to the display mode set at the Record Settings window.



(2) Envelope This parameter can only be set when the Function setting is Direct. Selects the On/Off status of the Envelope function.



When fast-frequency signals are concurrently measured with slow-frequency signals, recording on chart paper products dark results for fast-frequency signals and hardly legible results for slow-frequency signals. If this happens, enable this function to increase the legibility of slow-frequency signals.

(3) Priority Display Selects the On/Off status of the Waveform Priority Display function to determine whether or not to place priority on a certain channel during waveform display.



When On is selected as the Priority Display setting, a submenu appears for specifying the priority channel number during waveform display (Priority CH).

(4) Priority CH This parameter, which can only be set when the Priority Display setting is On, selects the target channel number for priority display.

(5) Zone Preset Sets the waveform display and recording formats.

Preset 1 to 7 : Display and recording are performed in the fixed formats. After selecting your preferred preset, the Zone specification items are displayed.

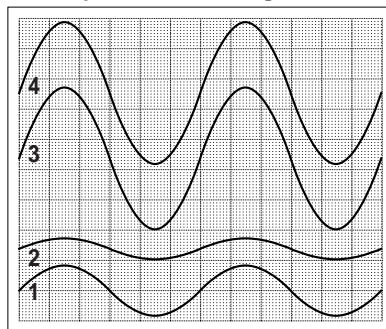
Custom : Lets you specify the display and recording formats when you make the settings.

- (6) Zone Selects the display and recording formats for each channel. If you have selected a preset format using Zone Preset and then make specifications for Zone, the Preset display will automatically switch to the Custom display.



The Zone settings enable you to specify display and recording at any location, which means that you can freely overlap waveforms. In addition, you can specify the start point as xx mm from the bottom of the chart paper, and then specify the waveform recording width from that point.

< Example of Zone Settings >



100-mm wide chart paper

CH No.	Zone Specification
	(4 channels)
1	0-20 [mm]
2	20-10 [mm]
3	30-50 [mm]
4	50-50 [mm]

200-mm wide chart paper

CH No.	Zone Specification
	(8, 16 channels)
1	0-40 [mm]
2	40-20 [mm]
3	60-100 [mm]
4	100-100 [mm]

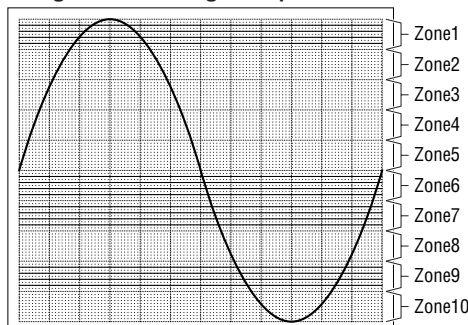
- (7) Color Selects the color of waveform display for each channel. Besides 32 existing colors to choose from, you can also create an original color. In this case, a submenu for color editing appears.
- (8) Width This parameter selects the line width for waveform recording according to channel. (only when the optional printer is installed printer function has been enabled)
1 dot (about 0.125 mm) to 8 dots (about 1 mm)



Depending on the signal input, recording may not be possible at the selected Width setting.

- (9) Trace Selects the on/off status of waveform display and recording.
- (10) Logic Zone This parameter can only be used when Logic has been enabled in the Amp Settings window. It selects the display and recording zones for logic waveforms and the line color for displaying the waveforms by Logic Group. Zones from 1 to 10 can be specified. The Color setting can be set to one of 32 colors. It is also possible to create an original color besides the existing 32 colors. In this case, a submenu for color editing appears.

< Logic Zone Setting example >

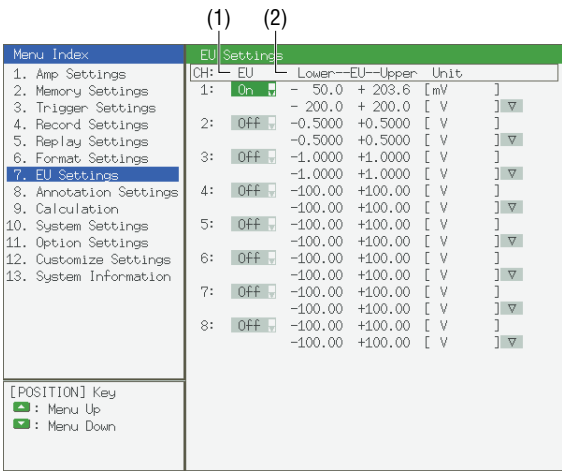


Logic Group	
A	: Zone 1
B	: Zone 6
C	: Zone 7
D	: Zone 9

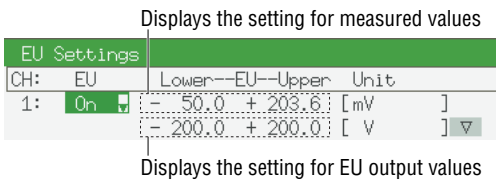


The screen display appears as shown above, but if it is printed out on chart paper, the positions in the upper half of the display become zone setting positions.

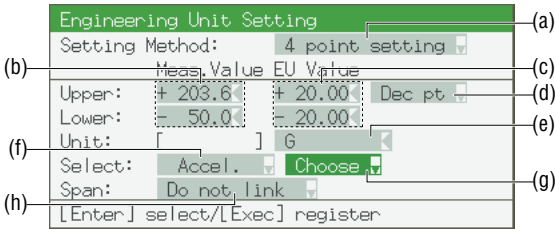
3.8 EU Settings



- (1) EU Selects the On/Off status of the EU function.
- (2) Lower - EU - Upper Unit
..... Specifies the span of the measurement range that will be scaled for a channel in EU On status. When this parameter is selected, a submenu for numeric input appears to let you specify the LOWER and UPPER limits of scaling.



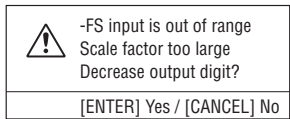
If the ENTER key is pressed here, the following window is displayed.



- (a) Setting Method : Selects the method for specifying scaling.
4 point setting : Specifies the output (upper- and lower-limit) values that respectively correspond to the measured data's upper- and lower-limit values.
- Offset setting : Specifies the offset relative to the input values.



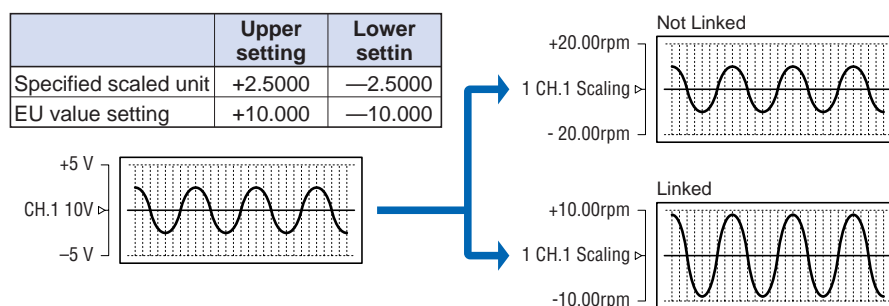
The Scaling operation is calculated using a ratio of the Meas. Value or EU Value settings. If a ratio value that the recorder cannot process is specified, the message below appears.



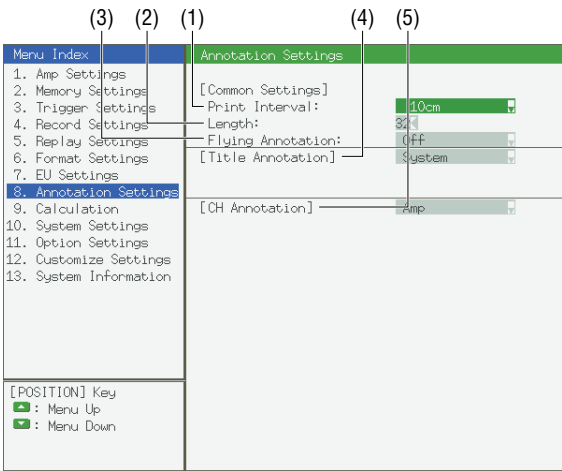
If this message appears, follow the instructions by either reducing the number of digits to be output by one or changing the Meas. Value and/or EU Value settings while leaving the number of digits unchanged.

- (b) Meas. Value : Specifies the numeric value(s) to be scaled according to the Setting Method setting.
- If the Setting Method setting is 4 point setting, set two points (the Upper and Lower parameters).
 - If the Setting Method setting is Offset setting, specify one point (the Meas. Value parameter).
- (c) EU Value : Specifies scaled output, which varies with the Setting Method setting.
- Specifies two points (the Upper and Lower parameters) if the Setting Method setting is 4 point setting.
 - Specifies one point (the Meas. Value parameter) if the Setting Method setting is Offset setting.
- (d) Dec pt : This parameter specifies the decimal point position of the numeral to be specified as the EU value(s). (Specified only if the Setting Method setting is 4 point setting.)
- (e) Unit : Selects the scaled unit, which can be specified as a user-defined character string consisting of alphanumerics. This Unit parameter can also be specified by selecting the Select Unit setting.
- (f) Select : Selects the type of engineering unit.
- (g) Choose : Selects the scaled unit. The unit displayed here is the type of unit selected by the Select setting. To specify a unit that is not displayed here, specify a user-defined character string as the Unit setting. Moreover, the setting specified here is displayed as the Unit setting.
- (h) Span : Selects whether or not to link the specified scaled unit to the SPAN settings.
- Linked : Links the specified scaled unit to the SPAN settings. The method of linking varies with the Setting Method setting.
- 4 point setting :The specified EU Value settings become the Upper and Lower SPAN settings.
 - Offset setting :The SPAN settings are shifted by the offset specified by the Meas. Value setting.
- Do not link : The SPAN settings specified by the Lower-SPAN-Upper settings in the AMP Settings window take effect.

Setting Example



3.9 Annotation Settings

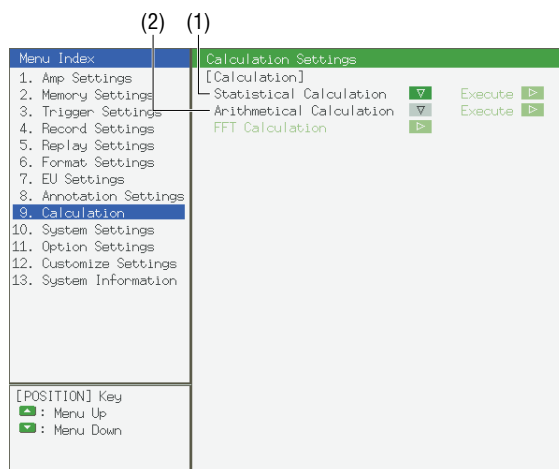


- (1) Print Interval Sets the print interval for annotation printing between 10 and 100 cm.
- (2) Length Sets the number of characters for annotation printing between 10 and 32.
- (3) Flying Annotation Sets flying annotation on or off. When set to "On", annotation print control is possible from a PC.
- (4) Title Annotation Prints a title at the top of the chart paper.
- Off : Disables the Title Annotation function.
- System : Prints the date, starting time, and chart speed.
- User : Prints a user-defined character string as the title. When this setting is selected, a submenu appears for inputting the title character string, so input a title that is no longer than the number of characters specified by the Length setting.
- System & User : Prints the information described under the System setting and then prints a user-defined character string as the title.
- (5) CH Annotation Prints a commentary character string for each channel.
- Off : Disables the CH Annotation function.
- Amp : Prints the currently selected Range, Input, Filter and Span settings for each channel.
- User : Prints a user-defined character string for each channel. When this setting is selected, a submenu appears for inputting a channel-specific comment, so input a character string that is no longer than the Length setting.
- Amp & User : Prints the information described under the Amp setting and then prints a user-defined comment.
- Value : Prints the measured values.



- When the CH Annotation setting is Amp & User, the print interval and the number of characters printed are respectively determined by the Print Interval and Length settings.
- When the CH Annotation setting is Value, the measured value at the position indicated by the ▽ symbol where the title is usually printed is printed. The print interval of the ▽ symbols is determined by ▽ the Print Interval setting.

3.10 Calculation Settings



(1) Statistical Calculation

..... The Statistical Calculation function performs calculation on the captured memory data and Readout data specified by the cursors.

Standard Deviation (n):

Displays the standard deviation of the cursor-defined range of data.

$$\sigma = \sqrt{(\sum D^2 - (\sum D)^2/n)/n} \quad (n - 1) \quad \text{D: Data, n: No. of data points}$$

Standard Deviation (n-1):

Displays the standard deviation of the cursor-defined range of data.

$$\sigma = \sqrt{(\sum D^2 - (\sum D)^2/n)/(n - 1)} \quad (n - 1) \quad \text{D: Data, n: No. of data points}$$

Maximum and Minimum Values (Min/Max):

Displays the maximum and minimum values within the cursor-defined range of data.

Maximum minus Minimum Value (P-P):

Displays the difference between the maximum value and minimum value (peak-to-peak value) within the cursor-defined range of data.

RMS Value:

Displays the root mean square within the cursor-defined range of data.

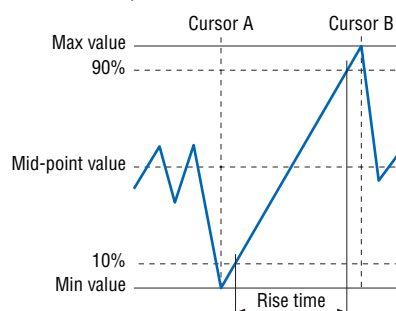
$$\text{R.M.S.} = \sqrt{\sum D^2/n} \quad \text{D: Data, n: No. of data points}$$

Rise Time :

Displays the rise time of a waveform displayed within a cursor-defined range of waveform data. The calculation of the rise time varies with the direction of the cursors.

When the cursors are in the time axis direction

After determining the maximum and minimum values within a cursor-defined range of data, the target waveform is that which first passes their mid-point value. Assuming that the minimum and maximum values are respectively 0% and 100%, the Rise Time is calculated within the range of 10% to 90%.

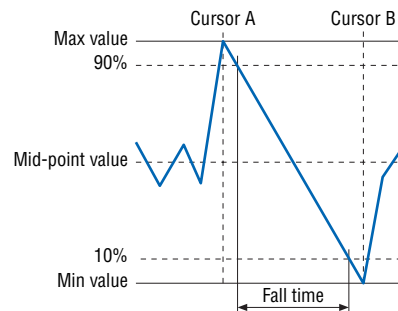


Fall Time :

Displays the fall time of a waveform displayed within a cursor-defined range of waveform data. The calculation of the Fall Time varies with the direction of the cursors.

When the cursors are in the time axis direction

After determining the maximum and minimum values within a cursor-defined range of data, the target waveform is that which first passes their mid-point value. Assuming that the maximum and minimum values are respectively 100% and 0%, the Fall Time is calculated within the range of 90% to 10%.

**Average :**

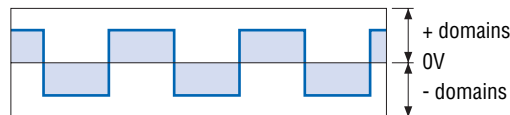
Displays the purely arithmetic mean of data points within a cursor-defined range.

Area :

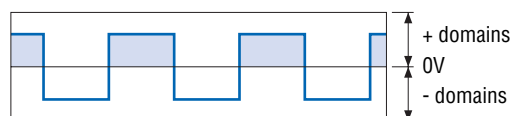
Displays the area within the cursor-defined range. When this parameter is selected, a sub-menu for specifying the calculation method is displayed. There are four methods as described below.

Y-T Mode

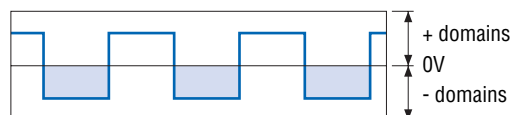
Normal : Sets the area of the cursor-defined range of data as the difference between respective areas of the positive and negative domains, centering on the baseline (0 V) of measured data.



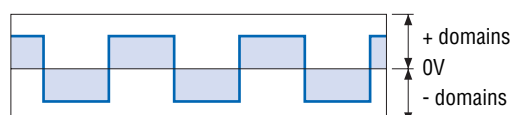
Positive : Sets the area of a cursor-defined range of data as the total sum of positive domains, centering on the baseline (0 V) of the measured data.



Negative : Sets the area of a cursor-defined range of data as the total sum of negative domains, centering on the baseline (0 V) of the measured data.



Absolute : Sets the area of a cursor-defined range of data as the total sum of both positive and negative domains, centering on the baseline (0 V) of the measured data.



(2) Arithmetical Calculation

..... This parameter can only be specified when the Capture Destination setting is Memory. The Arithmetical Calculation function performs calculation on the captured memory data and replay data specified by the cursors. The calculation results are saved to the final memory block number. Please refer to the items below for details on the settings.

Function : Selects the On/Off status of calculation functions for each channel.

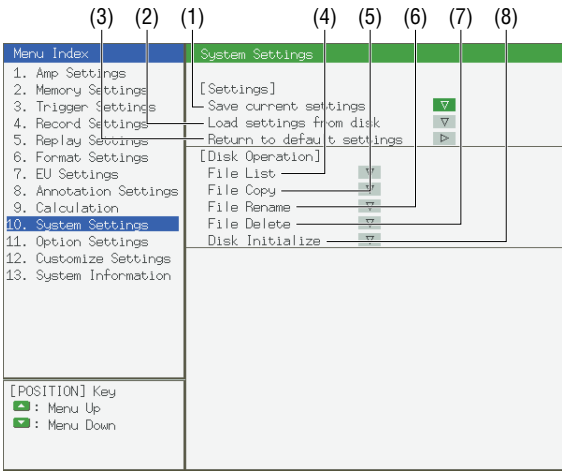
On : Enables the calculation functions.

Off : Disables the calculation functions.



When a channel's Function setting is On, the Lower-Span-Upper and Unit settings specified at the AMP. Settings window for that channel become invalid. Therefore, set the Span and Unit values using the Lower-Span-Upper and Unit parameters described in the following.

3.11 System Settings



[Settings]: Saves or loads settings or returns them to their factory default settings.

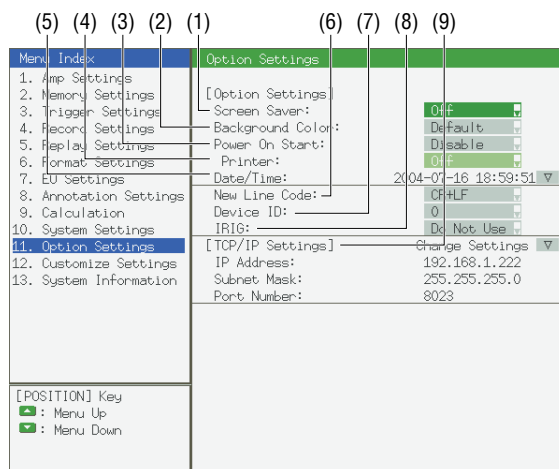
- (1) Save Current Settings Saves the currently selected settings. When this setting is selected, a submenu appears for selecting the destination memory device and file name.
- (2) Load Settings From Disk Loads a set of settings from disk. When this setting is selected, a submenu appears for specifying the source path and file name.
- (3) Return To Default Settings Returns the currently selected settings to their factory default settings.

[Disk Operation]: Performs various types of disk operations, such as displaying a file directory, copying or renaming files, and so on.

- (4) File List Lists a directory of the files in the specified disk. When this setting is selected, a submenu appears for selecting the target drive and directory.
- (5) File Copy Copies the specified file. When this setting is selected, a submenu appears for specifying the source file and destination file of the File Copy operation.
- (6) File Rename Renames the specified file. When this setting is selected, a submenu appears for selecting the file you wish to rename and its new file name.
- (7) File Delete Deletes the specified file. When this setting is selected, a submenu appears for selecting the name of the file to be deleted.
- (8) Disk Initialize Reformats the hard disk* or the PCMCIA card.
 - Initialize Mode This parameter can only be selected when the hard disk* or PCMCIA unit is installed. It selects whether to reformat the drive or to reformat the hard disk*. If a hard disk* is not installed, the Initialize Mode setting is fixed to Drive Format.
 - Drive Format : Formats the disk in the designated disk drive. When this setting is selected, additional parameters appear for selecting the drive letter, the disk format, and format type.
 - Drive : This parameter, which can only be set when the Initialize Mode setting is Drive Format, selects the drive to be formatted.
 - Format : This parameter selects the disk format, Super Floppy or HDD.
 - Type : This parameter selects the type of formatting method, Quick Format or Standard Format.
 - Volume Label : This parameter, which can only be set when the Initialize Mode setting is Drive Format, specifies the volume label of the disk to be formatted. Specify a volume label of up to 12 characters.

* Hard disk: WR310 only

3.12 Option Settings



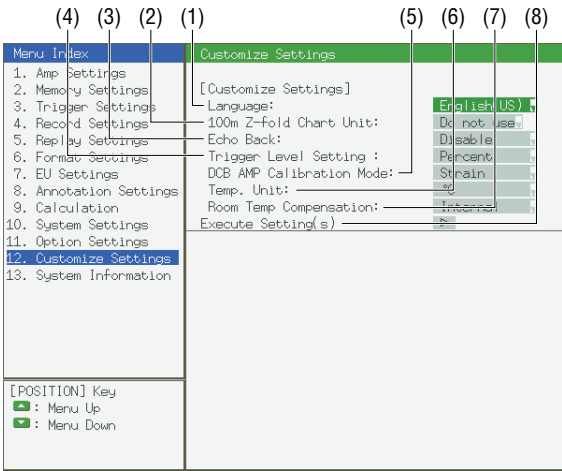
- (1) Screen Saver Turns off the display if the WR300/310 is not operated within the specified interval, thus prolonging the product life of the display.



Press any key to redisplay the screen.

- (2) Background Color Sets the color of the screen background.
- (3) Power On Start Initiates measurement as soon as the WR300/310 is turned on.
 Disable : Disables the Power On Start function.
 Enable : Enables the Power On Start function. When this setting is selected, the PRINTER submenu appears which is described below.
- (4) Printer Selects whether or not to start printing as soon as the WR300/310 is turned on. This parameter can only be set when the POWER ON START setting is Enable.
 Off : Printing does not start as soon as the WR300/310 is turned on.
 On : Printing starts as soon as the WR300/310 is turned on.
- (5) Date/Time Displays a submenu for setting the current date and time.
- (6) New Line Code Sets the CR+LF/CR/LF.
- (7) Device ID Sets the ID number for the WR300/310.
- (8) IRIG Sets the time code (IRIG-B or IRIG-E) when the IRIG function is used.
- (9) TCP-IP settings Sets the TCP-IP. To change the settings, select "Change Settings". The current conditions set are displayed below this item. (Settings can only be viewed for confirmation here, and cannot be changed.)
- Change Settings Changes the TCP-IP settings.
 IP Address : Sets the IP address.
 Subnet Mask : Sets the subnet mask.
 Port Number : Sets the port number.

3.13 Customize Settings



(1) Language Sets the WR300/310's display language. If you change the language, perform the Execute Settings operation to register the change.
Japanese, English (US), English (UK), French



The only difference between English (US) and English (UK) is the way the date is displayed.

(2) 100m Z-fold Chart Unit This function can be specified as Use or Do not use.

(3) Echo Back This function can be specified as Enable or Disable. If you change the setting, perform the Execute Settings operation to register the change.

(4) Trigger Level Setting Displays the setting in % units, and also enables the display to be switched to display voltage units.



If you use temperature ranges for the M amp channels, the settings will automatically be displayed as temperature units.

(5) DCB AMP Calibration Mode This sets the type of signal when performing calibration for the strain amp. You can select either Strain or Voltage. If you change the setting, perform the Execute Settings operation to register the change.

(6) Temperature unit °C : Celsius display
°F : Fahrenheit display



When °F is selected, the EU function is automatically set to ON.

(7) Room Temp. Compensation This parameter enables room temperature compensation settings when thermocouples are used. You can select either Internal or External room temperature compensation. The Internal setting is normally used. If you change the setting, perform the Execute Settings operation to register the change.

(8) Execute Settings Executes any changes made to settings on the Customize Settings menu.



If you change any of the settings in this window, be sure to perform the Execute Settings operation to register the change, and then turn the power off and on again. If a change is not registered, the setting will be not changed.

3.14 System Information

This section describes the System Information window, an example of which is shown below. Please refer to this window for information on your WR300/310 unit.

Menu Index	System Information
1. Amp Settings	[FPGA] System Control: Ver. 1 Memory Control: Ver. 1 Trigger Control: Ver. 0 16Ch Control: Ver.15 Print Control: Ver. 0
2. Memory Settings	
3. Trigger Settings	
4. Record Settings	
5. Replay Settings	
6. Format Settings	[Firmware] Main CPU Firmware: Ver.0.92 Operation System: Ver. 1.11 Printer CPU Firmware: Ver.0.92
7. EU Settings	
8. Annotation Settings	
9. Calculation	[Network] MAC Address : 00.03.76.00.00.00
10. System Settings	
11. Option Settings	
12. Customize Settings	
13. System Information	
[POSITION] Key ▲ : Menu Up ▼ : Menu Down	

3.15 Recorder Mode REPLAY Menu Tree Structure

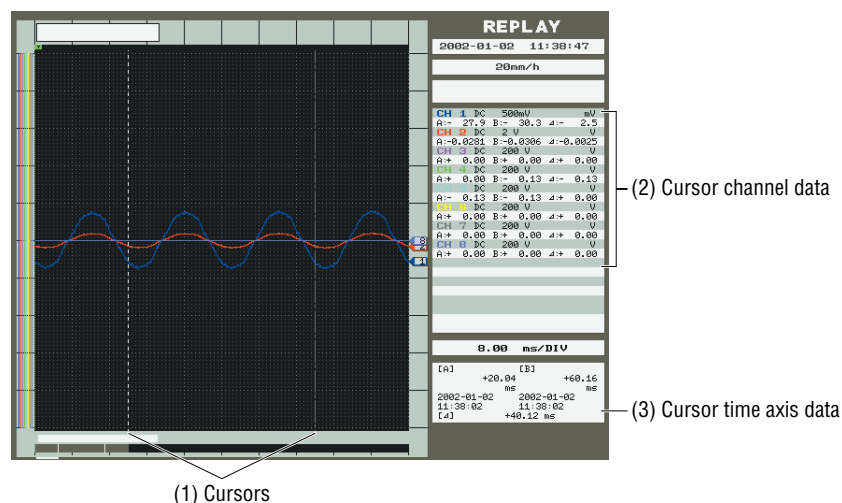
Menu	Item		Section
1. Cursor Settings	Cursor Settings	Mode	3.17
		Select	
		Sync. Mode	
	Cursor Position	Move to Selected Position	
		Move to First Data	
		Move to Last Data	
		Move to Trigger Point	
		Call Other Cursor	
		Load Cursor Position	
		Save Cursor Position	
2. Search Settings	Settings	Next Level Match	3.18
		Prev. Level Match	
	Combination	Mode	
		Lower-Level-Upper	
		Logic	
		Logic Pattern	
	Trigger Counter		
3. Execute	Action	Expansion/Compression	3.19
		Printer Output (Between Cursors)	
		Printer Output (All Data).	
		Save to Disk (Between Cursors)	
	XY Display	XY Settings	
		Execute XY Display	
4. Calculation Functions	Calculation	Statistical Calculation	3.20
		Arithmetical Calculation	
		FFT Calculation	
5. Amp Settings	Scaling		
	Lower-Span-Upper		
6. Memory Settings	Same as the Recorder mode's "Memory Settings"		3.3
7. Trigger Settings	Same as the Recorder mode's "Trigger Settings"		3.4
8. Record Settings	Same as the Recorder mode's "Record Settings"		3.5
9. Data Replay Settings	Same as the Recorder mode's "Data Replay Settings"		3.6
10. EU Settings	Same as the Recorder mode's "EU Settings"		3.8

3.16 Replay Settings

This section describes the Replay Settings window, an example of which is shown below.

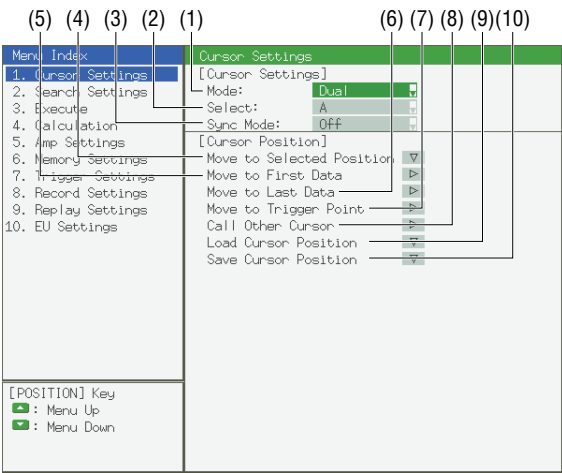
CAUTION

When replaying data from a PCMCIA card, do not replace the card with another one even after the data replay operation has been completed. The replacement procedure may damage the card. If you need to replace the card, press the MODE key to return the WR300/310 to the measurement status.



- (1) Press the CURSOR key to display the A (B) cursor, and A,B cursors.
- (2) When the cursors are displayed, the data for those cursors is displayed.
- (3) If only one cursor is displayed, the time data for that cursor is displayed. If two cursors are displayed, their time data and the time data between the cursors is displayed.

3.17 Cursor Settings and Cursor Position



[Cursor Setting]

- (1) Mode Specifies the cursor display method
- (2) Select Selects the cursor you want to move
- (3) Sync. Mode This parameter can be selected when Dual has been specified for Mode. The distance between the two cursors is maintained during cursor movement.

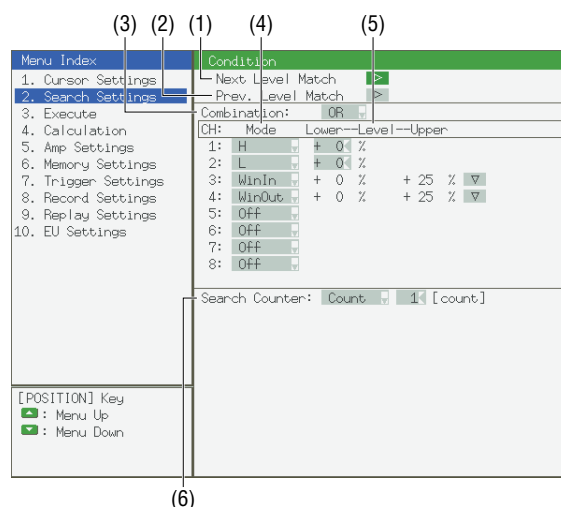


Press the CURSOR key (see Section 2.5, "Control Panel Part Names and Functions" to display the cursors.

[Cursor Position]: This parameter moves the cursor to the selected position within the data being replayed, loads/saves the cursor position, and so on.

- (4) Move to Selected Position Moves the cursor to the selected position within the data being replayed using one of three methods.
Position : Moves the cursor to the position of the specified time from the current position.
Time : Moves the cursor to the position of the specified time. Specify a time that was captured along with the measured data during data capture.
% : Moves the cursor to the position specified as a percentage of the entire data (which represents 100%).
- (5) Move to First Data Moves the cursor to the beginning of the data being replayed.
- (6) Move to Last Data Moves the cursor to the end of the data being replayed.
- (7) Move to Trigger Point Moves the cursor to the trigger point of the data being replayed.
- (8) Call Other Cursor Summons the other cursor within the same screen as the currently displayed cursor. However, this function can only be used when the cursor mode is DUAL.
- (9) Load Cursor Position Loads a previously saved cursor position and then moves the cursor to that position.
- (10) Save Cursor Position Saves the cursor's current position. The cursor position is saved under the name of "Position number: n." Up to 10 cursor positions can be saved.

3.18 Search Settings



[Search Settings]: These settings enable a search of the displayed Replay data to be performed. The Search settings are as follows.

- (1) Next Level Match The next point in the data after the current data that satisfies the search condition is displayed on the screen.
- (2) Prev. Level Match The previous point in the data after the current data that satisfies the search condition is displayed on the screen.
- (3) Combination Selects the method for satisfying the Level condition.
 - OR : Searches for the position where a single channel among the target channels satisfies the search condition (which has not yet been met any other channel).
 - AND : Searches for the position where all of the target channels satisfy the search condition.
- (4) Mode Selects the Level condition.
 - Off : Set this condition for any channel that is to be excluded from the Data Search operation.
 - H : The Level condition is satisfied when an input waveform exceeds the specified Level value.
 - L : The Level condition is satisfied when an input waveform falls below the specified Level value.
 - Win In : Sets the Lower-limit and Upper-limit levels for each channel. The Level condition is met when a captured waveform goes inside both the specified Lower-limit and Upper-limit levels.
 - Win Out : Sets the Lower-limit and Upper-limit levels for each channel. The Level condition is met when a captured waveform goes outside both the specified Lower-limit and Upper-limit levels.
- (5) Lower - Level - Upper Sets the search levels for captured data. Set the level in a range of -100% to +100% in 1% steps. If the Mode setting is Win In or Win Out, be sure to set the difference between the Lower and Upper Levels to 5% or more. (The Lower limit of the specifiable range is -100% and its Upper limit is +100%).
Example: For a 5 V range: -5V = -100%, +5V = +100%

CAUTION

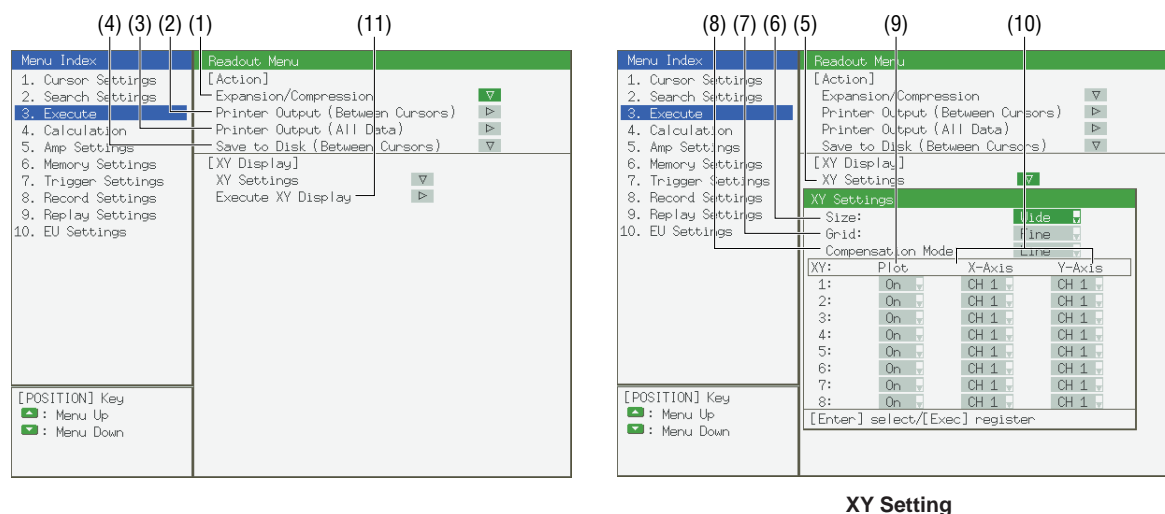
The level is always set to a °C value, even if °F has been selected for the temperature range. Take care when setting this value.

- (6) Trigger Counter This function determines how many times or how long to ignore the targeted point(s) from the time the Level condition is first satisfied until the condition selected by the Trigger Counter parameter is satisfied.
- Count : Searches for the position which has satisfied the Level condition for the specified number of times.
1 to 255 [count]
- Filter : Searches for the position which has satisfied the Level condition for at least the specified time interval. The actual time is the product of this Filter setting and the Sample Interval setting.
1 to 255



When the search condition is met, the status of the targeted point changes from a "no match" point to a "matched" point. Once the starting point satisfies the search condition, that point is ignored until it no longer satisfies it.

3.19 Execute Operations



XY Setting

[Action]: Performs various operations for waveforms, such as expansion, compression, printout, and calculation.

(1) Expansion/Compression

- Expands or compresses the display of waveforms being replayed.
- Between Cursors: Expands or compresses the cursor-defined segment of the waveform display to fit the screen's width.
- Fixed Scale : Expands or compresses the waveform by the ratio selected from the choices below.
- Expansion : Can be set to any integer from 1 to 10.
- Compression : Can be set to any fraction with a numerator of 1 from 1/1 to 1/1000.
- Free Scale : Expands or compresses the waveform by the desired magnification ratio from 1/1000 to 10. The User Scale value is specified as the time unit per division.

(2) Printer Output (Between Cursors)

- This parameter prints the cursor-defined segment of the waveform display onto chart paper. This function is only available when the cursor mode is set to "Dual".

(3) Printer Output (All Data)

- This parameter prints all waveform data being replayed onto chart paper.

(4) Save to Disk (Between Cursors)

- Saves the cursor-defined segment of the waveform enclosed again to the internal hard disk or PCMCIA card. This function is only available when the cursor mode is set to "Dual".

[XY Display]: Displays the captured data in XY format when XY Display is selected

(5) XY Settings Specifies the parameter settings for X-Y display.

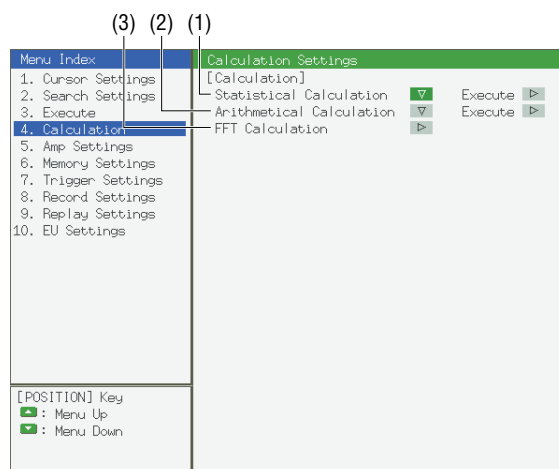
(6) Size Sets the display screen size to Narrow or Wide.

(7) Grid Sets the grid.

- Fine : Displays the main grid and sub-grid lines.
- Coarse : Displays only the main grid lines.

- (8) Compensation mode
..... Sets the compensation mode.
Line: Displays the waveform as a solid line.
Dot : Displays the waveform as a dotted line.
- (9) Plot Switches the specified XY number on or off.
- (10) X-Axis, Y-Axis Sets the channels to display for both the X-axis and Y-axis.
Example: For the same X-axes, set all to CH1, then assign required channel numbers to the Y-axis.
- (11) Execute XY Display
..... Displays the data in XY format when the XY settings have been made.

3.20 Calculation



[Calculation]: The settings for calculations are performed here.

(1) Statistical Calculation

..... This parameter can only be specified when the Capture Destination setting is Memory. The Statistical Calculation function performs calculation on the captured memory data and replay data specified by the cursors. The calculation results are displayed on the screen.

Function : Selects the function used for area statistical calculation.

Available Settings	Function Submenu parameters
Standard Deviation (n)	
Standard Deviation (n-1)	
Max, Min Values (Min/Max)	
Max - Min Value (P-P)	
RMS Value	
Rise Time	
Fall Time	
Average	
Area	Normal
	Positive
	Negative
	Absolute

Standard Deviation (n):

Displays the standard deviation of the cursor-defined range of data.

$$\sigma_n = \sqrt{(\sum D^2 - (\sum D)^2/n)/n} \quad (n - 1) \quad D: \text{Data, } n: \text{No. of data points}$$

Standard Deviation (n-1):

Displays the standard deviation of the cursor-defined range of data.

$$\sigma_{n-1} = \sqrt{(\sum D^2 - (\sum D)^2/n)/(n - 1)} \quad (n - 1) \quad D: \text{Data, } n: \text{No. of data points}$$

Maximum and Minimum Values (Min/Max):

Displays the maximum and minimum values within the cursor-defined range of data.

Maximum minus Minimum Value (P-P):

Displays the difference between the maximum value and minimum value (peak-to-peak value) within the cursor-defined range of data.

RMS Value:

Displays the root mean square within the cursor-defined range of data.

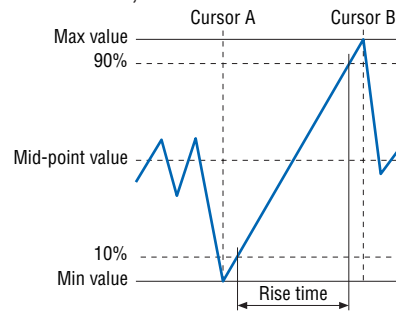
$$R.M.S. = \sqrt{\sum D^2/n} \quad D: \text{Data, } n: \text{No. of data points}$$

Rise Time :

Displays the rise time of a waveform displayed within a cursor-defined range of waveform data. The calculation of the rise time varies with the direction of the cursors.

When the cursors are in the time axis direction

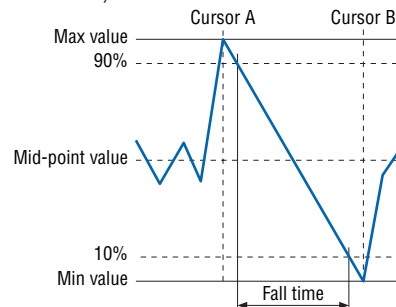
After determining the maximum and minimum values within a cursor-defined range of data, the target waveform is that which first passes their mid-point value. Assuming that the minimum and maximum values are respectively 0% and 100%, the Rise Time is calculated within the range of 10% to 90%.

**Fall Time :**

Displays the fall time of a waveform displayed within a cursor-defined range of waveform data. The calculation of the Fall Time varies with the direction of the cursors.

When the cursors are in the time axis direction

After determining the maximum and minimum values within a cursor-defined range of data, the target waveform is that which first passes their mid-point value. Assuming that the maximum and minimum values are respectively 100% and 0%, the Fall Time is calculated within the range of 90% to 10%.

**Average :**

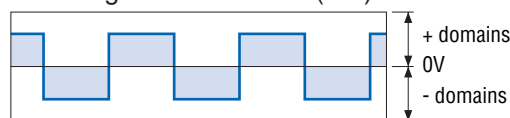
Displays the purely arithmetic mean of data points within a cursor-defined range.

Area :

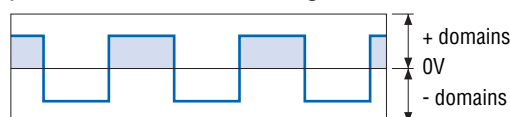
Displays the area within the cursor-defined range. When this parameter is selected, a sub-menu for specifying the calculation method is displayed. There are four methods as described below.

Y-T Mode

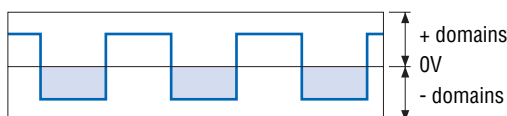
Normal : Sets the area of the cursor-defined range of data as the difference between respective areas of the positive and negative domains, centering on the baseline (0 V) of measured data.



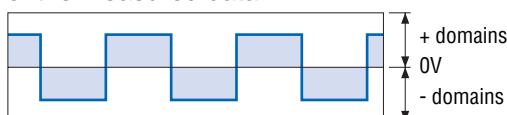
Positive : Sets the area of a cursor-defined range of data as the total sum of positive domains, centering on the baseline (0 V) of the measured data.



Negative : Sets the area of a cursor-defined range of data as the total sum of negative domains, centering on the baseline (0 V) of the measured data.



Absolute : Sets the area of a cursor-defined range of data as the total sum of both positive and negative domains, centering on the baseline (0 V) of the measured data.



Execute Executes the details set for Statistical Calculation.

(2) Arithmetical Calculation

..... This parameter can only be specified when the Capture Destination setting is Memory. The Arithmetical Calculation function performs calculation on the captured memory data and replay data specified by the cursors. The calculation results are saved to the final memory block number. Please refer to the items below for details on the settings.

Function : Selects the On/Off status of calculation functions for each channel.

On : Enables the calculation functions.

Off : Disables the calculation functions.



When a channel's Function setting is On, the Lower-Span-Upper and Unit settings specified at the AMP. Settings window for that channel become invalid. Therefore, set the Span and Unit values using the Lower-Span-Upper and Unit parameters described in the following.

Formula Settings:

This parameter can only be set for a channel for which the Function setting is On. It specifies a numerical formula containing up to 32 terms.

Symbol	Definition	Symbol	Definition
+	Addition	INT	Integration
-	Subtraction	DINT	Double integration
*	Multiplication	SIN	Sine
/	Division	COS	Cosine
MEAN	Moving mean	TAN	Tangent
LOG	Logarithm	ASIN	Arc sine
EXP	Exponential mean	ACOS	Arc cosine
ABS	Absolute value	ATAN	Arc tangent
DIF	Differentiation	PI	pi (π)
DDIF	Double differentiation	INTA	Integration
SQRT	Square root	DINTA	Double Integration

• MEAN (Moving Mean)

Because the MEAN function permits averaging of data corresponding to a specified number of points, noise can be eliminated from data containing interference. The number of points to be averaged can be set from 1 to 128.

• DIF (Differentiation) and DDIF (Double Differentiation)

Differentiation and double differentiation operations use Lagrange's five-order interpolation formula. With a five-order interpolation formula, the data of one point is obtained from the values of five points before or after that point. Calculation is performed, however, for the first point by using its five subsequent points and for the final point by using its five preceding points.

- INT (Integration) and DINT (Double Integration)
Perform the same functions as an integration amp (DC is not integrated).
- SIN (Sine) and COS (Cosine)
The result of a SIN or COS operation is displayed within the range of -1 and +1. The angle is calculated in the counter-clockwise direction for positive values or the clockwise direction for negative values.
- ASIN (Arc Sine), ACOS (Arc Cosine), and ATAN (Arc Tangent)
If the absolute value of the target data of an ASIN or ACOS operation is 1 or more, any value equal to +1 or higher is processed as +1 and any value equal to -1 or lower is processed as -1. For ASIN, ACOS, and ATAN operations, the calculated result is displayed as an angle (RAD) ranging from $-\pi/2$ to $+\pi/2$.
- INTA (Integration) and DINTA (Double Integration)
Integration and double integration operations use a trapezoidal formula. With a trapezoidal formula, the average of the target point and its previous point is multiplied by Delta t to obtain the area, after which all the data preceding the target point are added.
- Regarding the permissible numeric range
If a calculation results in a numeric value (absolute value) that is lower than 1.17×10^{-38} or higher than 1.7×10^{38} , an underflow or overflow state will occur and that value will be rounded off to the closest limit value or to zero.

Number of means :

This parameter sets the number of means for Mean calculation.

Lower - SPAN - Upper Unit:

This parameter can only be set for those channels for which Function is On. SPAN settings can be performed for those channels that were set to On for Calculation settings.

Execute Executes the details set for Arithmetical Calculation.

(3) FFT Calculation Performs FFT calculation on the cursor-specified data. If you select FFT Calculation, the mode will switch to FFT mode. Please make the settings in the Record Settings window. (Please refer to Chapter 4, FFT Mode for details.)

CHAPTER 4

FFT Mode

This chapter describes the FFT Mode.

- 4.1 FFT Menu Tree Structure**
- 4.2 FFT Mode Settings**
- 4.3 Record Settings**
- 4.4 FFT Mode REPLAY Menu Tree Structure**
- 4.5 REPLAY Menu**

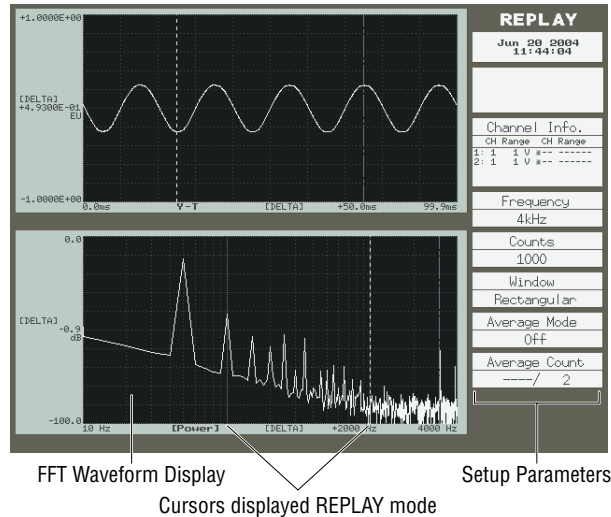
4.1 FFT Menu Tree Structure

Menu	Item		Details	Section	
1. Amp. Settings	AMP		Same as Recorder mode [Amp. Settings]	3.2	
	Input				
	Range				
	Filter				
	Misc.				
2. Memory Settings	Common Settings	Capture Destination	Fixed to Memory	3.3	
		Sampling Interval			
		Time Scale	Not used		
	Data Memory Settings	Block Size			
		Capture Time	Not used		
		Memory Chain			
		Calculation Processing	Not used		
	Capture Block				
	Auto Save		Not used		
3. Trigger Settings	Common Settings	Function		3.4	
		Time Gate			
		Action			
		Trigger Display Point	Not used		
	Start Condition	Source			
4. Record Settings	Record Settings	Frequency		4.3	
		Counts			
		Window			
		Average Mode			
		Ave. Count			
		Display Format			
		Grid			
		Zone	Function		
	Ch. A/B				
	X/Y				
	RMS				
	Ch. A Calc.				
	Ch. B Calc				
	5. Data Replay Settings	Memory	Replay Source Settings		Replay Source
Replay Block				Displayed when Memory	
File Name				Displayed when Disk	
Replay Conditions			Sampling Interval	Displayed when Memory	
			Time Scale		
			Count		
Replay View Settings			Not used		
		Data Save			
		Disk		Replay Source Settings	Replay Source
File Name					
6. Format Settings	No menu available for Format Settings				
7. EU Settings*	No EU Settings menu available in FFT mode			3.8	
8. Annotation Settings*	No Annotation Settings menu available in FFT mode			3.9	
9. Calculation Settings*	No Calculation Settings menu available in FFT mode			3.10	
10. System Settings*	No System Settings menu available in FFT mode			3.11	
11. Option Settings*	No Option Settings menu available in FFT mode			3.12	
12 Customize Settings*	No Customize Settings menu available in FFT mode			3.13	
13.System Information*	No System Information menu available in FFT mode			3.14	

* Some of the menu contents are the same as those of the Recorder mode. Please refer to Chapter 3, Recorder Mode, for details. Please note that there are some settings that cannot be made in FFT mode, even if there are explanations provided in Chapter 3.

4.2 FFT Mode Settings

This section describes the procedures and restrictions for using FFT mode.



Before using FFT Mode

This section describes the procedures and restrictions before using FFT mode.

FFT Mode Setting Windows

All menus other than the Record Settings window and Readout Menu window shown below are the same as those in Recorder mode, except for the following restrictions. For details of common menus, please refer to Chapter 3, "Recorder Mode Settings".

Usage Methods

Usage method 1 :

In FFT mode, data is captured in the internal memory when measurement starts, and is displayed using the analysis method set.

Usage method 2 :

After capturing data in Recorder mode, switch to FFT mode using the MODE key and press the REPLAY key to display the data using the analysis method set.

Usage method 3 :

After data capture has been completed in Recorder mode, FFT calculation can be performed by selecting FFT calculation in the Readout menu. Only in this case is it possible to return to Recorder mode.

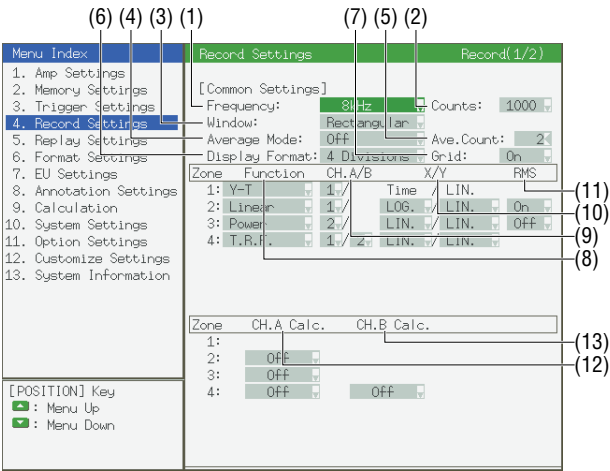
Restrictions

- Span cannot be set.
- Annotation printing is not possible.
- The data Capture Destination can be specified as internal memory only.
- Arithmetical and statistical calculation are not possible.
- Replay CH selection and Output Ratio selection cannot be performed during data replay.
- The Format Settings window cannot be displayed.
- The trigger stop conditions cannot be used.

CAUTION

FFT calculation results cannot be printed out on chart paper. Press the COPY key to make a copy of the display screen. Note that the amplifiers do not include an anti-aliasing function, and so aliasing phenomena may occur when data measured in Recorder mode is subjected to FFT processing.

4.3 Record Settings



- (1) Frequency This parameter sets the analysis frequency, in the range 0.08 Hz to 400 kHz (depends on the amps installed).
- (2) Counts This parameter specifies the number of analysis points captured during measurement. It can be specified as either 1000 points or 2000 points.
- (3) Window This parameter specifies the window, which can be specified as Hanning or Rectangular.



- The Window Parameter
Under normal conditions, signal input that can be subjected to FFT analysis will continue infinitely. Out of such infinitely continuous input signals, the Window parameter lets you conduct FFT analysis of the signal input only during a limited time interval, which is called a "window." In the WR300's FFT mode, the Window length and the Frequency setting are related as follows.

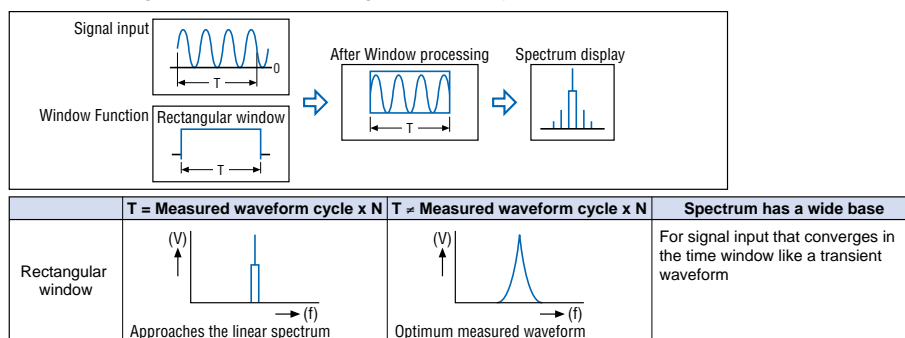
$$\text{Window length} = \frac{0.4}{\text{Frequency setting [Hz]}} \times \text{Counts setting [seconds]}$$

(The Counts setting in the WR300's FFT mode can be either 1000 or 2000.)

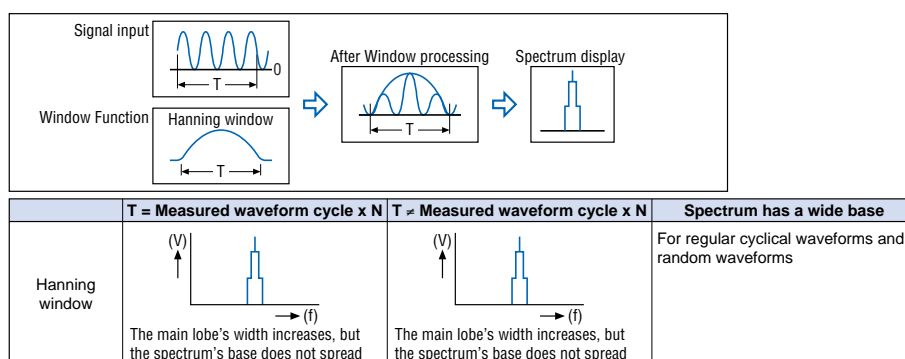
- The Impact of the Window on Analyzed Results
It is common knowledge that the result of FFT analysis on signal input that has been extracted by a window will match the result of a Fast Fourier Transformation operation on infinitely repeated signal input of the window length. As a result, except in cases when the window length is equal to an integral multiple of the signal input's cycle, ordinary signal input may generate a non-continuous segment due to extraction by the window. Since this non-continuous segment did not exist in the original signal input, if FFT analysis is executed in this status, the non-continuous segment will affect the result of FFT analysis. Due to the WR300's operating principles, it is not possible to eliminate the error caused by the window, but you can minimize the error by using an appropriate window.

Rectangular Window:

No operation is performed for the signal input extracted by the window. When using ordinary continuous waveforms, use of a window to extract a specific range of signal input will cause an error. With this Rectangular Window, however, you can obtain results that are not adversely affected by the window in the case of transient waveforms that attenuate inside the window or of signal input with a window length that is an integral multiple of the signal input's cycle.

**Hanning Window:**

To prevent the generation of non-consecutive points due to the use of a window to extract a specific range of signal input, the Hanning window gradually decreases the signal input to become zero at the starting and end points of the window. Because the signal input becomes zero at both ends of the window, you can minimize the adverse impact of using a window to extract a specific range of signal input, even when you have extracted a continuous waveform.



- (4) Average Mode This parameter sets the Average Mode processing, and can be set to one of four settings: Off, Summation, Exponential, or Peak Hold.



The green waveform represents the measured data, while the white waveform represents the averaged results.

- (5) Ave. Count This parameter specifies the number of samples to be averaged, and can be specified in the range of 2 to 9999.



Averaging cannot be performed on data that was captured in Recorder mode and then output and analyzed in FFT mode.

- (6) Display Format The Display Format parameter can be set to one of four settings: 1 Division, 2 Divisions, 4 Divisions, or Nyquist.

- (7) Grid The Grid parameter for display and recording can be specified as either On or Off.

- (8) Function The analysis function can be specified as Y-T, Linear spectrum, Power spectrum, P.S.D., Cross spectrum, Transfer function, or Coherence.



Description of the Function settings

The time-axis data "x(i), where i = 0, 1, ... N-1" is subjected to a Fast Fourier Transformation and its result is represented as:

$X(i) = X_R(i) + jX_I(i)$, Where: i = 0, 1...N-1, j = an imaginary unit

An FFT analysis of time-axis data, which consists of real numbers, results in multiple elements containing information that indicates the amplitude and phase.

• Y-T

The X axis is fixed to time and the Y axis is fixed to LIN. Just as in Recorder mode, you can detect changes in the signal input with respect to the time axis.

• Linear (Linear Spectrum)

Based on the result of FFT analysis of time-axis data, either the amplitude or phase is displayed.

	Y axis	Display	
		RMS = Off	RMS = On
Amplitude	LIN.	$\sqrt{X_R(i)^2 + X_I(i)^2}$ [V]	$\sqrt{\frac{X_R(i)^2 + X_I(i)^2}{2}}$ [V _{rms}]
	LOG.	$10 \log X_R(i)^2 + X_I(i)^2$ [dBV]	$10 \log \frac{X_R(i)^2 + X_I(i)^2}{2}$ [dBV _{rms}]
Phase	Phase	$\tan^{-1} \frac{X_I(i)}{X_R(i)}$ [deg]	
FFT result of measured signals : $X(i) = X_R(i) + jX_I(i)$			

- The amplitude is the voltage of the reference wave height value.
- When the RMS setting is On, the root-mean-square value is displayed instead.
- When the Y (axis) setting is LOG., the display is identical to that for the Power Spectrum setting shown in the following table.
- When the Y (axis) setting is LOG., the reference value is either 0 dB = 1 V or 0 dBV_{rms} = 1 V_{rms}.

• Power (Power Spectrum)

Based on the result of FFT analysis of time-axis data, the power spectrum of each frequency component is displayed.

	Y axis	Display	
		RMS = Off	RMS = On
Amplitude	LIN.	$X_R(i)^2 + X_I(i)^2$ [V]	$\frac{X_R(i)^2 + X_I(i)^2}{2}$ [V _{rms} ²]
	LOG.	$10 \log X_R(i)^2 + X_I(i)^2$ [dBV]	$10 \log \frac{X_R(i)^2 + X_I(i)^2}{2}$ [dBV _{rms}]
Phase	Phase	$\tan^{-1} \frac{X_I(i)}{X_R(i)}$ [deg]	
FFT result of measured signals : $X(i) = X_R(i) + jX_I(i)$			

- The amplitude is the voltage of the reference wave height value.
- When the RMS setting is On, the root-mean-square value is displayed instead.
- When the Y (axis) setting is LOG., the display is identical to that for the Linear Spectrum setting shown in the preceding table.
- When the Y (axis) setting is LOG., the reference value is similarly either 0 dB = 1 V² or 0 dBV_{rms} = 1 V_{rms}².
- When the Y (axis) setting is Phase, the Phase display is identical to that for the Linear Spectrum setting shown in the preceding table.

- P.S.D. (Power Spectrum Density)

The "Power Spectrum Density" refers to the power spectrum per unit frequency. The result of FFT analysis is an integral value of the power spectrum that is distributed along a bandwidth (the width of the frequency resolution) that is determined by the selected frequency for FFT analysis (the Frequency setting) and the selected number of points to be analyzed (the Counts setting). When the signals of a power spectrum form a continuous spectrum, therefore, the resulting value varies with the currently selected Frequency and Counts settings. In the case of signals of a spectrum that is distributed along a wide bandwidth, using a Function setting of P.S.D. will allow you to obtain measured values that are unrelated to the Frequency and Counts settings.

	Y axis	Display	
		RMS = Off	RMS = On
Amplitude	LIN.	$\frac{X_R(i)^2 + X_I(i)^2}{\Delta f}$ [V ² /Hz]	$\sqrt{\frac{S_R(i)^2 + S_I(i)^2}{2}}$ [V _{rms} ²]
	LOG.	$10 \log \frac{X_R(i)^2 + X_I(i)^2}{\Delta f}$ [dBV/Hz]	$10 \log \frac{X_R(i)^2 + X_I(i)^2}{2\Delta f}$ [dBV _{rms} /Hz]
Phase	Phase	$\tan^{-1} \frac{X_I(i)}{X_R(i)}$ [deg]	
FFT result of measured signals : $X(i) = X_R(i) + jX_I(i)$			
Δf : Analysis band width		Δf	$\frac{\text{Frequency setting}}{\text{Counts setting } 0.4}$ [Hz]

- The amplitude is the voltage of the reference wave height value.
- When the RMS setting is On, the root-mean-square value is displayed instead.
- When the Y (axis) setting is LOG., the reference value is either 0 dB/Hz = 1 V²/Hz or 0 dBV_{rms}/Hz = 1 V_{rms}²/Hz.
- When the Y (axis) setting is Phase, the Phase display is identical to that for the Linear Spectrum setting shown in the preceding table.

- Cross (Cross Spectrum)

This cross spectrum is the product of the spectrum of two signals for a specific frequency component. It indicates the correlation and relative power of both signals. When the Function setting is Cross, the cross spectrum of the signal input and signal output is measured and averaged. Compared with only measuring the power spectrum of the signal output, therefore, you can substantially lower the impact of noise, even for a system in which noise mixes into the signal input.

	Y axis	Display	
		RMS = Off	RMS = On
Amplitude	LIN.	$\sqrt{S_R(i)^2 + S_I(i)^2}$ [V ²]	$\sqrt{\frac{S_R(i)^2 + S_I(i)^2}{2}}$ [V _{rms} ²]
	LOG.	10 logS _R (i) ² + S _I (i) ² [dBV]	10 log $\frac{S_R(i)^2 + S_I(i)^2}{2}$ [dBV _{rms}]
Phase	Phase	$\tan^{-1} \frac{X_I(i)}{X_R(i)}$ [deg]	
FFT result of measured signals : X(i) = X _R (i) + jX _I (i) Y(i) = Y _R (i) + jY _I (i) S _R (i) = X _R (i)Y _R (i) + X _I (i)Y _I (i) S _I (i) = X _R (i)Y _I (i) - X _I (i)Y _R (i)			

- The amplitude is the voltage of the reference wave height value.
- When the RMS setting is On, the root-mean-square value is displayed instead.
- When the Y (axis) setting is LOG., the reference value is either 0 dB = 1 V² or 0 dBV_{rms} = 1 V_{rms}².

- T.R.F. (Transfer Function)

This function expresses the frequency characteristics of the input and output of a transfer system. It can be used to obtain the ratio of the signal input's power spectrum to the cross spectrum of the signal input and signal output. Similar to the Cross Spectrum setting, the T.R.F. setting conducts averaging to reduce the impact of noise mixing into the system's signal input. Because the transfer function is measured throughout the entire range of the FFT analysis frequency specified by the Frequency setting, however, you must input signals that will contain the frequency components of the entire bandwidth of the FFT analysis frequency.

	Y axis	Display
Amplitude	LIN.	$\frac{\sqrt{S_R(i)^2 + S_I(i)^2}}{X_R(i)^2 + X_I(i)^2}$
	LOG.	$20 \log \frac{\sqrt{S_R(i)^2 + S_I(i)^2}}{X_R(i)^2 + X_I(i)^2} \text{ [dB]}$
Phase	Phase	$\tan^{-1} \frac{S_I(i)}{S_R(i)} \text{ [deg]}$
FFT result of signal input : $X(i) = X_R(i) + jX_I(i)$ FFT result of signal output : $Y(i) = Y_R(i) + jY_I(i)$ $S_R(i) = X_R(i)Y_R(i) + X_I(i)Y_I(i)$ $S_I(i) = X_R(i)Y_I(i) - X_I(i)Y_R(i)$		

- When the Y (axis) setting is LOG., the reference value is 0 dBV = 1.
- The Phase value is identical to that of Phase Value of the Cross Spectrum setting shown in the preceding table.
- In the WR300's FFT mode, the CH.A and CH.B parameters correspond to X(i) and Y(i), respectively.

- Coherence (Coherence function)

The Coherence function is obtained by calculating the ratio of [the product of the input and output power spectra] to the [the amplitude squared of the cross spectrum of the signal input and signal output]. The result expresses the causal relationship between the system's input and output signals. The value of the coherence function ranges from 0 to 1. "1" indicates that all signal output derives its power from the signal input, and "0" indicates that the power of the signal output is totally unrelated to the signal input. By measuring the coherence function, you can check the reliability of measuring the T.R.F. or other functions. When averaging is not performed, all values of the coherence function will become 1. When using the coherence function, be sure to also perform averaging.

	Y axis	Display
Amplitude	LIN.	$\frac{S_R(i)^2 + S_I(i)^2}{(X_R(i)^2 + X_I(i)^2)(Y_R(i)^2 + Y_I(i)^2)}$
FFT result of signal input : $X(i) = X_R(i) + jX_I(i)$ FFT result of signal output : $Y(i) = Y_R(i) + jY_I(i)$ $S_R(i) = X_R(i)Y_R(i) + X_I(i)Y_I(i)$ $S_I(i) = X_R(i)Y_I(i) - X_I(i)Y_R(i)$		

- In this recorder's FFT mode, the CH.A and CH.B parameters correspond to X(i) and Y(i), respectively.

CH.A/B This parameter specifies the channels for each analysis method.



Aliasing may cause the input frequency to differ from the analyzed result.

< Aliasing >

Because the WR300 conducts measurement by using an analog-to-digital converter to sample signals, if the frequency of the signal input becomes greater than 50% of the frequency of the sampling interval, a phenomenon occurs in which the WR300 inadvertently measures a frequency that has not been input. This phenomenon is called "aliasing".

X/Y This parameter sets the X and Y axis scales. The scales that can be selected vary according to the current Function setting.

When the Function setting is Y-T, the settings are fixed to:

X axis: Time; Y axis: LIN.

When the Function setting is Linear, Power, P.S.D., Cross, or Transfer:

X axis: LIN. or LOG.; Y axis: LIN., LOG., or Phase

When the Function setting is Coherence, the settings are fixed to:

X axis: LIN; Y axis: LIN.

RMS The RMS parameter only requires setting when a zone's Function parameter is Linear, Power, P.S.D., or Cross. RMS can be specified as On or Off.



When RMS is specified as On, the Y axis is displayed as an RMS scale.

CH. A Calc., CH. B Calc.

..... These parameters only require setting for channels where the Function parameter has been set as Linear, Power, P.S.D., Cross, Transfer, or Coherence. Calculation can be specified as Off, DIF., DDIF., INT., or DINT.

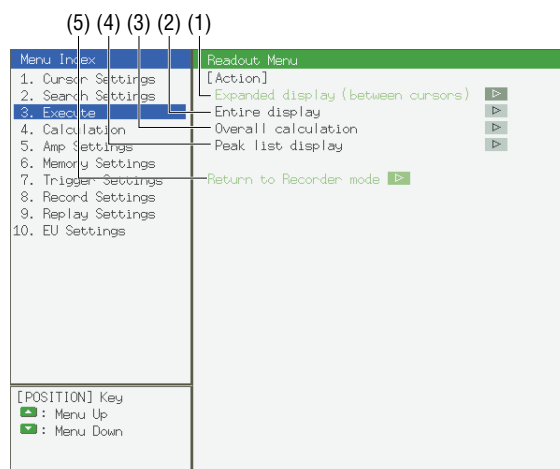
4.4 FFT Mode REPLAY Menu Tree Structure

Menu	Item		Details	Section
1. Cursor Settings and Cursor Position* ¹	Cursor Settings	Mode	Same as Recorder mode Replay Settings [Cursor Settings]	3.16
		Select		
		Sync. Mode		
2. Search Settings	The Search Menu is not displayed in FFT mode.			
3. Execute	Action	Expanded display (between cursors)		4.5
		Entire display		
		Overall calculation.		
		Peak list display		
		Return to Recorder mode	Only displayed when FFT calculation is performed on data measured in Recorder mode	
4. Calculation Functions	The calculation menu is not displayed in FFT mode.			
5. Amp Settings	Not used			
6. Memory Settings* ²	Same as the FFT mode's "Memory Settings"			3.3
7. Trigger Settings* ²	Same as the FFT mode's "Trigger Settings"			3.4
8. Record Settings* ²	Same as the FFT mode's "Record Settings"			3.5
9. Data Replay Settings* ²	Same as the FFT mode's "Data Replay Settings"			3.6
10. EU Settings* ²	Same as the FFT mode's "EU Settings"			3.8

*1: Some of the menu contents are the same as those of the RECORDER mode's REPLAY menu. Please refer to Chapter 3, Recorder Mode, for details. Please note that there are some settings that cannot be made in FFT mode, even if there are explanations provided in Chapter 3.

*2: Some of the menu contents are the same as those of the FFT and RECORDER mode's REPLAY menu. Please refer to Chapter 3, Recorder Mode, for details. Please note that there are some settings that cannot be made in FFT mode, even if there are explanations provided in Chapter 3.

4.5 REPLAY Menu



- (1) Expanded display (between cursors)
 Displays the enlarged waveform between the cursors.
- (2) Entire display Returns to the full display of the enlarged waveform in the expanded display.
- (3) Overall calculation Displays the overall calculation value.
- (4) Peak list display Displays the list of peak values. This setting is only available when the Display format is set to "1 Division", "2 Divisions", or "4 Divisions".
- (5) Return to Recorder mode
 This parameter is not available when measuring in FFT mode. Select "Return to Recorder mode" in this window and press the ENTER key to return to Recorder mode.

CHECKPOINT

- The marks before the setting range for each channel in the channel information identify whether the captured waveform fits within the scale or is outside the scale.
 - Black mark : Data that fits within the scale.
 - Red mark : Overscale data
- Return to Recorder mode is only available when FFT mode is entered from the Recorder mode FFT Calculation function.

CHAPTER 5

Application Software







This chapter describes the installation and measurement procedures for the WR300 when the OPS023 Application Software is used.

- 5.1 Procedures from Installation to Measurement**
- 5.2 Software System Requirements**
- 5.3 Connecting to a PC**
- 5.4 Installing the Software**
- 5.5 Setting the IP Address and Device ID**
- 5.6 Menu Configuration and System Settings**
- 5.7 Measurement Parameter Setting Procedures**
- 5.8 Printer Functions**
- 5.9 Measurement/Monitoring Procedures and Save/Scroll/Cursor Functions**
- 5.10 Opening Captured Data Files and Saving WR300-Captured Data to a PC**
- 5.11 Converting the Data Format and Saving the Data**
- 5.12 Report Function**
- 5.13 Exiting OPS023**

5.1 Procedures from Installation to Measurement

This section describes the procedures and system requirements for installing the application software and using it for measurements.

Procedures from Installation to Measurement

Step	Setting For details		Section
1	Install USB driver		5.4
2	Install OPS023		
3	Set IP address and ID No.		5.5
4	Set data saving destination		5.6
5	Set default color settings		
6	Set OPS023 communication	Set IP address/ID No. of WR300 to be connected using 	
		Check connection destination using 	
		Connect using 	
7	Synchronize date/time		5.7
8	Set measurement conditions	Make Amplifier settings	
		Make Trigger Settings	
		Make Memory settings	
		Make Span settings	
		Make EU settings	
		Make Format settings	
		Save/Load Setup Parameters	
9	Start measurement/monitoring	[Start Measurement] Start measurement using 	5-8
		[Start Monitoring] Start monitoring using 	
10	Stop measurement/monitoring	Stop measurement/monitoring using 	
11	Save measurement data		
12	Scroll measurement data		
13	Search		
14	2-screen		
15	Convert data format and save		

Function Differences Between the Monitor and the OPS023

Item	WR300	OPS023
FFT mode	Yes	No
Fixed display mode	Yes	No
2-screen display	No	Yes
Report file	No	Yes
Data conversion	TXT only	CSV, TXT, GBD, DADiSP

5.2 Software System Requirements

Make sure that the computer on which you plan to install the software meets the following requirements.

Item	System requirements
OS	Windows 2000, XP
CPU	Pentium 4, 1.7 GHz or higher
Memory	256 MB or more
HDD	10 MB for installing software Additional space required for data storage
Display	800 x 600 pixels or higher 65535 colors or more (16-bit or more)
Other	TCP/IP port, USB port CD-ROM drive (for installing from CD)



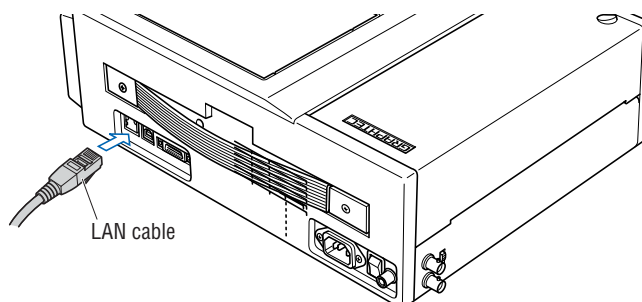
Even when using a PC that meets the system requirements, measurement data may not be captured correctly depending on the PC status (e.g. running other applications or the storage media used). Exit all other applications before capturing data to the hard disk.

5.3 Connecting to a PC

The WR300 can be connected to a PC via a LAN or USB cable.

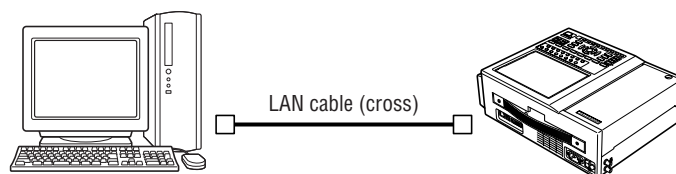
Connection Using a LAN Cable

Use the LAN cable to connect the WR300 to a PC.



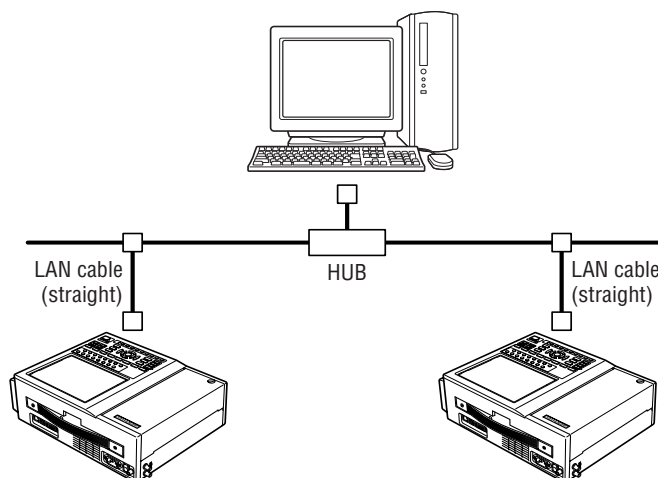
Connecting the WR300 to a PC directly

When connecting the WR300 to a PC directly, connect using a cross cable as shown below.



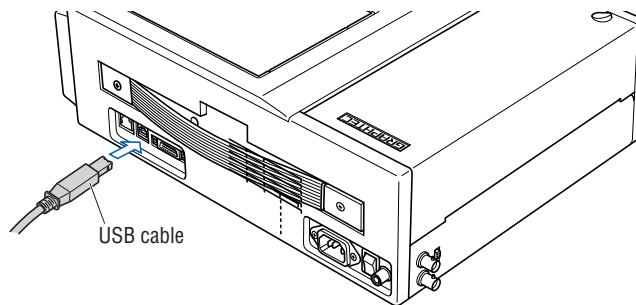
Connecting via a network

When connecting via a network, connect via a hub using straight cables as shown below.



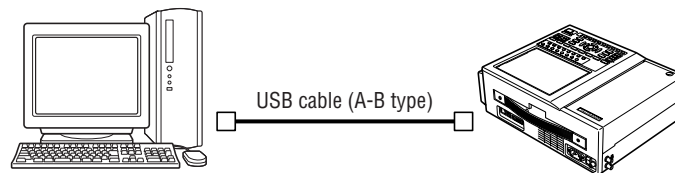
Connection Using a USB Cable

Use the USB cable to connect the WR300 to a PC.



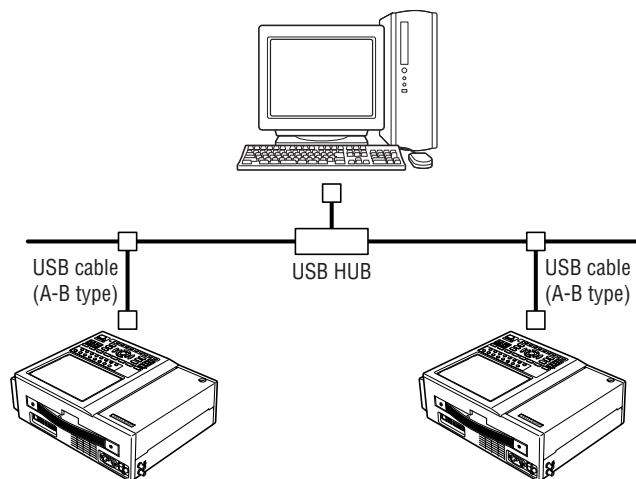
Connecting the WR300 to a PC directly

When connecting the WR300 to a PC directly, connect using an A-B type cable as shown below.



Connecting via a network

When connecting via a network, connect via a USB hub using A-B type cables as shown below.



When connecting via a USB cable, a USB driver must be installed in your computer. Please refer to Section 5.4, "Installing the Software", for the installation procedure.

5.4 Installing the Software

This section describes how to install the USB driver, the system setting tools, and OPS023.

Checking the version of your USB driver (when already installed)

This section describes how to view the version of the USB driver.

- (1) Opening "Device Manager."
Select "Control Panel" → "System" → "Hardware" tab or right-click "My Computer," select "Properties" → "Hardware" tab → "System Properties" window, then click the "Device Manager" button.
- (2) In the "Device Manager" window, open "USB (Universal Serial Bus) Controller." Confirm that "Graphtec WR300" is shown. Right-click it and select "Properties."
- (3) Updating the driver
Select the "Driver" tab and click the "Driver Details" button.
- (4) Select [...\GTCUSBR.SYS] to view the version of the driver file.

Installing the USB driver

This section describes how to install the USB driver.

- (1) Insert the WR300 User Guide CD-ROM provided into the PC CD-ROM drive.
- (2) Connecting the WR300 to the PC
Connect the WR300 to the PC using the USB cable, then turn the power on.
- (3) Installing the USB driver
Window XP: Driver software is to be installed for the first time.
 Driver software is already installed.
Windows 2000: Driver software is to be installed for the first time.
 Driver software is already installed.

Windows XP: Driver software is to be installed for the first time.

Installing the USB driver

- (1) Detecting the hardware
Connect the USB cable to the PC and WR300. The "Found New Hardware" message appears.
- (2) Starting the wizard
In the "Found New Hardware Wizard" window, select "Install from a list or specific location (Advanced)" under "What do you want the wizard to do?" and click "Next."
- (3) In the "Please choose your search and installation options." window, select "Don't search. I will choose the driver to install." and click "Next."
- (4) In the "Select the device driver you want to install for this hardware." window, click "Have Disk."
- (5) In the "Install from Disk" window, browse the CD-ROM under "Copy manufacturer's files from," select "USB DRIVER" → "GTCUSBR.INF" and click "OK."
- (6) In the "Select the device driver..." window, "Graphtec WR300" appears in the "Model" box. Select it and click "Next."
- (7) Installing the driver
Windows XP starts installing the driver.
- (8) Completing installation
The "Completing the Found New Hardware Wizard" window appears. Click "Finish" to exit the wizard.

Windows XP: Driver software is already installed.

Updating the USB driver

- (1) Opening "Device Manager"
Select "Control Panel" → "System" → "Hardware" tab or right-click "My Computer," select "Properties" → "Hardware" tab → "System Properties" window, then click the "Device Manager" button.
- (2) In the "Device Manager" window, open "USB (Universal Serial Bus) Controller." Confirm that "Graphtec WR300" is shown. Right-click it and select "Properties."
- (3) Updating the driver
Select the "Driver" tab and click "Update Driver."
- (4) Starting the update wizard
The "Hardware Update Wizard" appears. Select "Install from a list or specific location (Advanced)" under "What do you want the wizard to do?" and click "Next."
- (5) In the "Please choose your search and installation options." window, select "Don't search. I will choose the driver to install." and click "Next."
- (6) In the "Select the device driver you want to install for this hardware." window, click "Have Disk."
- (7) In the "Locate File" window, browse the CD-ROM, select "USB DRIVER" → "GTCUSBR.INF" and click "Open."
- (8) Return to the "Select the device driver..." window and click "Next."
- (9) Installing the driver
Windows XP starts installing the driver. Depending on the OS setting, "The software you are installing for this hardware has not passed Windows Logo testing to verify its compatibility with Windows XP" message may appear. Simply click "Continue Anyway."
- (10) Completing installation
The "Completing the Hardware Update Wizard" window appears. Click "Finish" to exit the wizard.

Windows 2000: Driver software is to be installed for the first time.

Installing the USB driver

- (1) Starting the wizard
Connect the USB cable to the PC and WR300. The "Found New Hardware Wizard" appears.
- (2) In the "Found New Hardware Wizard" window, select "Search for a suitable driver for my device (Recommended)" under "What do you want the wizard to do?" and click "Next."
- (3) In the "Locate Driver File" window, select "CD-ROM drive" under "Optional search locations" and click "Next."
- (4) Browse the CD-ROM, select "USB DRIVER" → "GTCUSBR.INF" and click "OK."
- (5) "The wizard found a driver" message appears. Click "Next."
- (6) Completing installation
The "Completing the Found New Hardware Wizard" window appears. Click "Finish" to exit the wizard.

Windows 2000: Driver software is already installed.

Updating the USB driver

- (1) Opening "Device Manager"
Select "Control Panel" → "System" → "Hardware" tab or right-click "My Computer," select "Properties" → "Hardware" tab → "System Properties" window and click the "Device Manager" button.
- (2) In the "Device Manager" window, open "USB (Universal Serial Bus) Controller." Confirm that "Graphtec WR300" is shown. Right-click it and select "Properties."

- (3) Updating the driver
Select the "Driver" tab and click "Update Driver."
- (4) Starting the update wizard
"Upgrade Device Driver Wizard" appears. Click "Next."
- (5) In the "Install Hardware Device Drivers" window, select "Display a list of the known drivers for this device so that I can choose a specific driver." under "What do you want the wizard to do?" and click "Next."
- (6) In the "Select a Device Driver" window, click "Have Disk."
- (7) In the "Locate File" window, browse the CD-ROM, select "USB DRIVER" → "GTCUSBR.INF" and click "OK."
- (8) Return to the "Select a Device Driver" window and click "Next."
- (9) In the "Start Device Driver Installation" window, click "Next."
- (10) Completing installation
The "Completing the Upgrade Device Driver Wizard" window appears. Click "Finish" to exit the wizard.

Installing OPS023

This section describes how to install the application software and the system setting tools used to set and control the WR300.

- (1) Insert the WR300 User Guide CD-ROM provided into the PC CD-ROM drive, and browse the CD-ROM contents.
- (2) Click the Taskbar's Start button, then click the Run... icon to open the 'Run' window.
- (3) Enter the CD-ROM drive name and \English\OPS021\SETUP.EXE as the name of the file you wish to open. If the disk is in drive D, for example, enter "D:\English\OPS021\SETUP.EXE" in the box to launch the installer.
- (4) Continue, following the instructions on the screen.



Be sure to observe the following points when connecting the WR300 to a PC.

- Do not connect any devices apart from a mouse or a keyboard to any of the other USB terminals on your PC.
 - Set the PC's power-saving functions to Off.
 - Set the Screen Saver to Off.
 - Set the anti-virus software auto update and scan scheduler functions to Off. Also, set the Windows auto update and scheduler functions to Off.
-

5.5 Setting the IP Address and Device ID

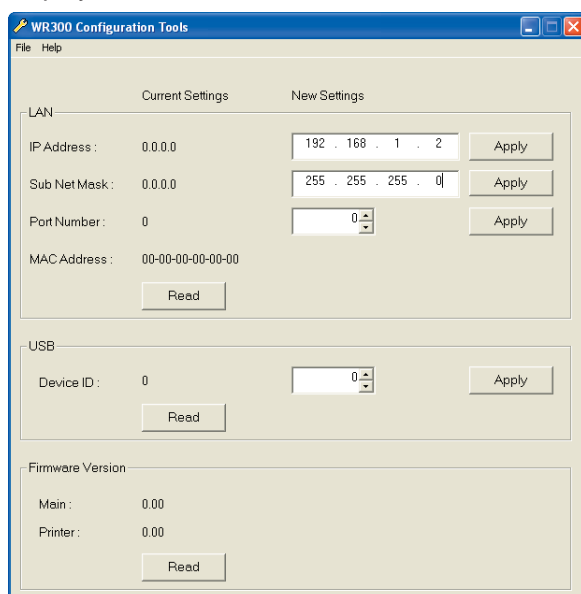
The WR300 Configuration Tools window is used to set the IP address, Sub Net Mask, Port Number, and Device ID.

- These can also be set using the WR300. For details, see Section 3.12, "Option Settings".
- IP Address : Used when measuring via a network.
- Sub Net Mask : Used when measuring via a network.
- Mac Address : Used when setting the Mac Address.
- Port Number : Used when measuring via a network.
- Device ID : Used when measuring via USB.
- Firmware version : Used to check each firmware version.



- When setting the IP address and port or device ID using the WR300 Configuration Tools, the WR300 should be connected directly to the PC using a USB cable.
- When using more than one WR300, they should be connected separately, and not via a USB hub.

- (1) Connect the WR300 to the PC using a USB cable.
- (2) Select "Start" → "Programs" → "OPS023" → "Wr Config" to launch the WR300 Configuration Tools and display the window as shown below.

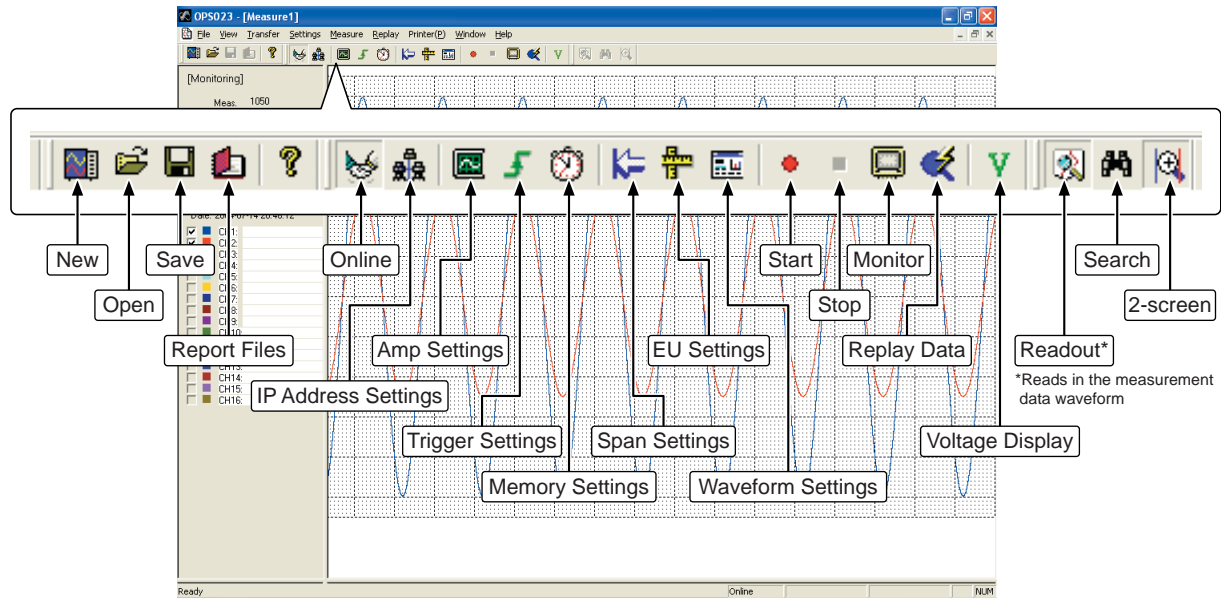


- (3) LAN settings
Click "Read" to display the current setting. To set a new IP address, Sub Net Mask and/or Port Number, enter the new setting(s) and then click "Apply".
- (4) USB settings
Click "Read" to display the current setting. To set a new Device ID, enter the new Device ID and then click "Apply".
- (5) Firmware Version
Click "Read" to display the Main and Printer version numbers. Use this function to check the version number(s) of your equipment.
- (6) After setting, exit from WR300 Configuration Tools.

5.6 Menu Configuration and System Settings

Starting the Software

Click "Start" → "Programs" → "OPS023" to launch OPS023. Once started, the following window is displayed.



Menu Configuration

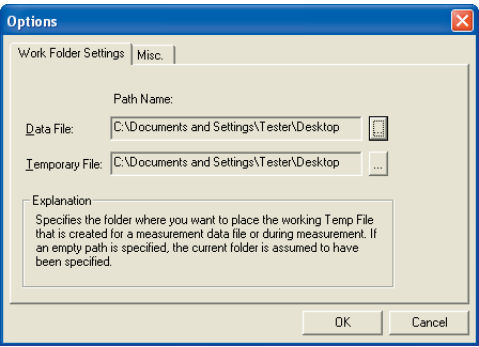
Level →			
Menu Name	Selections or pull-down menus	Selections or pull-down menus	Selections or pull-down menus
File	New		
	 Open		
	Close		
	 Save		
	Convert Data and Save		
	Batch Conversion		
	Load Settings		
	Save Settings		
	Make Report		
	Exit		
View	Tool Bar		
	Status Bar		
	Meas. Tool Bar		
	Replay Tool Bar		
	Voltage Display On/Off		
Transfer	 Online		
	WR300 Registration		
	Connection Interface	TCP/IP	
		USB	
	File Transfer	Get WR300 files (sub-window)	
	Replay Data	File Select	
Settings	Input Settings	 Amp Settings	Name/Input/Range/Filter
		 Trigger Settings	Trigger settings
		 Memory Settings	Memory and sampling rate settings
	Meas. Parameters	 Span Settings	
		 EU Settings	
		 Format Settings	
	Options	Work Folder Settings (sub-window)	Data file/Temp. file
	Default Color	Misc. (sub-window)	
	Sync. Date and Time		
Measure	 Start		
	 Stop		
	 Monitor		
	 Replay Display		
Printer	Function		
	Feed		
	Screen Copy		
Replay	Start Readout/Stop Readout		
	Select cursor	Cursor 1	
		Cursor 2	
	Search	Search/Jump	
	 2-screen display		



Measurement Data Save Destination Settings and Other Settings

The Options window enables you to specify the destination for saving measurement data and to make other settings.
Click "Options" in "Settings" on the menu bar to display the following window. Set the required details and click "OK".

Measurement data save destination settings

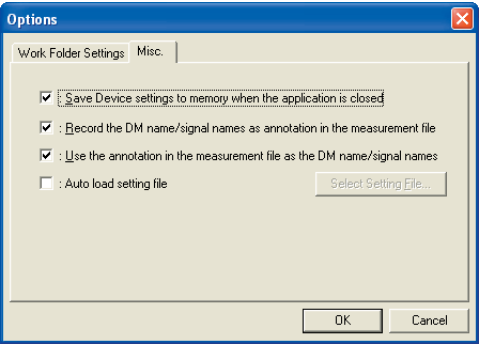
To set the destination for saving measurement data, click the "Work Folder Settings" tab. The save destination settings include data file and temporary file settings.



- Data File Sets the destination for saving captured data. Click  to display the setting window.
- Temporary File Sets the destination for temporarily saving measurement data. Click  to display the setting window.

Misc. settings

For other settings, click the "Misc." tab. This automatically opens the setting file specified when connecting to the WR300 and sets these setting parameters in the WR300.



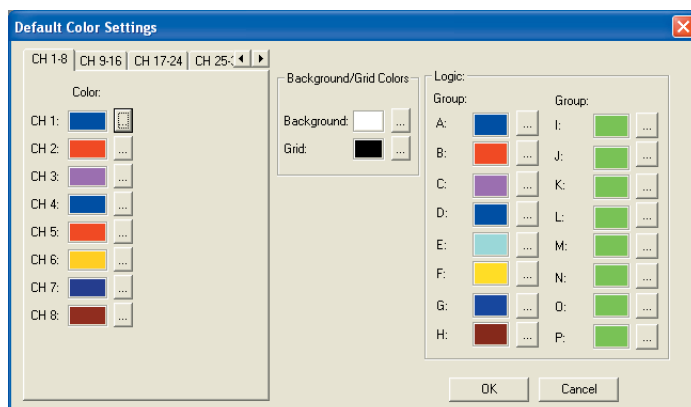
Default Color Settings

The Default Color Settings window sets the default waveform display colors when the software is first started. The details set are used when the network/USB connection is reset and then reconnected. These settings are retained within the system memory. Set to the desired colors.

Click "Default Color" in "Settings" on the menu bar to display the following window. Set the required details and click "OK".



To alter the colors temporarily, use "Format Settings" described in Section 5.7.





CH * - * Displays the channel group to be set.

Color Sets the waveform display color for each channel. Click to display the setting window.

Background/Grid Colors

..... Sets the background and grid colors for the measurements window.

- Background Sets the background color for the measurements window. Click  to display the setting window.
- Grid Sets the grid color for the measurements window. Click  to display the setting window.


Logic Sets the logic waveform display color.

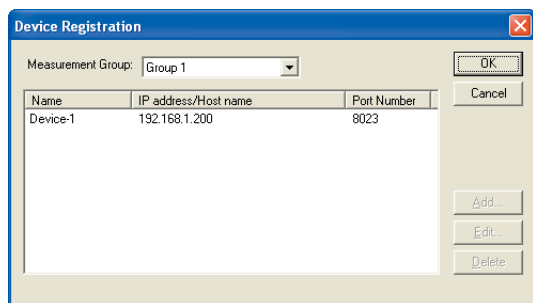
- Group A to P Sets the waveform display color for each logic channel. Click to display the setting window. Group A corresponds to logic channels 1 to 4 for the first unit.

	1st unit	2nd unit	---
8-channel model	A, B	C, D	---
16-channel model	A, B, C, D	E, F, G, H	---

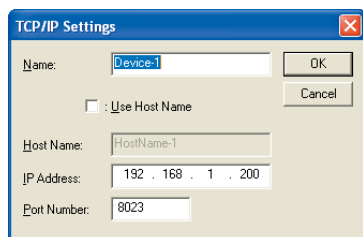
OPS023 Transfer Settings

The procedure for setting the transfer (communication) parameters is described below. The IP address for the WR300 when used on a network should be determined in consultation with the network administrator.

- (1) Setting window display
Select the interface to be used in "Interface" in "Transfer" on the menu bar.
- (2) Setting window display
Select "Device Registration" in "Transfer" on the menu bar or click  with the mouse to display the registration window shown below.



- (3) Settings
Click "Add" to display the following TCP/IP Settings window. Set the items required, and click "OK" to close the TCP/IP Settings window.



Host Name Sets the host name for the WR300 connected. (Any name can be entered.)

IP Address Sets the IP address for the WR300 connected. (When using network)

Port Number Sets the port number for the WR300 connected. (When using network)

Device ID Sets the ID number for the WR300 connected. (When using USB)

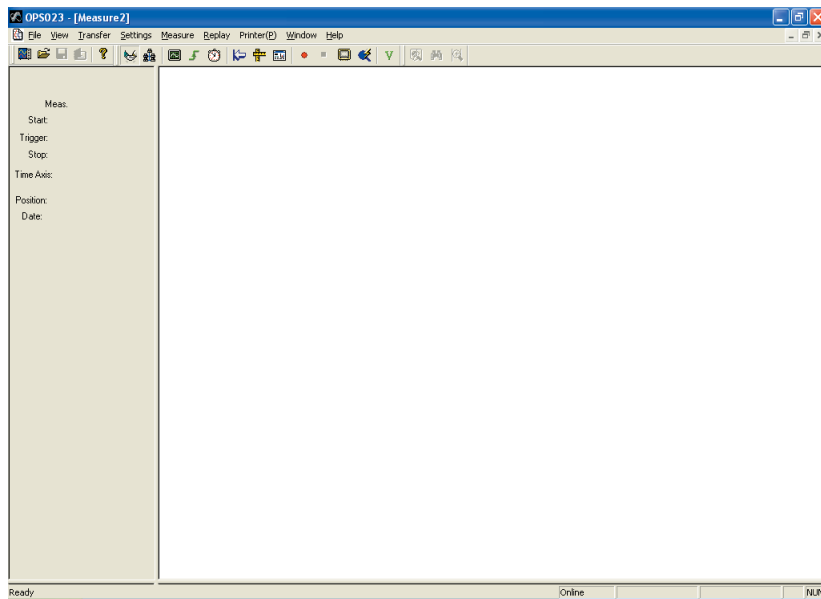


- Checking the "Specify address with host name" box allows the WR300 to be specified using the host name instead of its IP address. The host name and IP address must be registered beforehand in order to use this function. Consult with the network administrator.
- The WR300 IP address and port number can be checked on the WR300 Option Settings window if the optional monitor is installed. To check, clear the "REMOTE" indicator, if it is illuminated, by pressing the "LOCAL" key on the WR300.


- (4) Setting registration
If the details displayed on the screen are correct, click "OK" to close the registration window. If the details have not been set correctly, select the particular parameters and either click "Edit" to reset them, or click "Delete" to delete them. Then click "Add" again to set the new settings.

(5) New measurements

To start measurements, click "New" in the File menu. A new window is displayed.



(6) Online

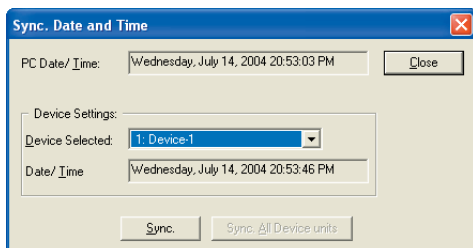
To switch online, click "Online" in "Transfer" on the menu bar or click  with the mouse.



The WR300 cannot be controlled using this software when in Replay mode.

Synchronizing the Date and Time

The Date and Time Settings window enables adjustment of the WR300 date and time to match the PC. Click "Sync. Date and Time" in "Settings" on the menu bar to display the setting window as shown below. Set the parameters and click "Sync". (Synchronizes the time for all WR300 units if multiple units are connected.)



PC Date/Time Displays the PC time and date setting. This cannot be changed.


Device Settings Sets the WR300 time.

Device Selected Selects the WR300 for setting among those connected over a network.

Date/Time Displays the date and time for the WR300 selected.

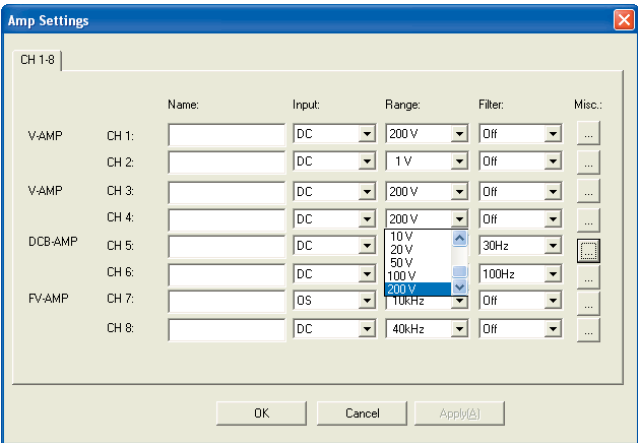
5.7 Measurement Parameter Setting Procedures

Amplifier Settings

The Amp Settings window enables the setting of the amplifier parameters. Click "Amp Settings" in "Input Settings" in "Settings" on the menu bar, or click  to display the Amp Settings window as shown below. Set the parameters, click "Apply", and then click "OK".



The Amp Settings window contains the same details as those shown on the WR300 monitor screen. For details, see Section 3.2, "Amp Settings".



CH * to CH * Displays the amplifier units mounted in the WR300. Select the number of the amplifier unit to be set.

Name Sets the names for each channel.



The name entered must fit within the input box. The name settings are reset to the default settings if the network connection is reset. This window is used to change the names temporarily.

Input Sets the input type for each channel. The input types that can be set will vary depending on the type of amplifier installed.

Range Sets the range for each channel. The ranges that can be set will vary depending on the type of amplifier installed.


Filter Sets the filter for each channel. The filter types that can be set will vary depending on the type of amplifier installed.

Misc. Additional settings may be required according to the type of amp installed. Specify the additional settings as necessary.

- WR3-V amp, WR3-M amp, WR3-FV amp
 - Zero point auto adjustment, zero point adjustment reset, zero point voltage value
- WR3-DCB amp
 - Auto balance, rated output, setting of calibration values

Trigger Settings

The Trigger Settings window enables the setting of the trigger parameters.

Click "Trigger Settings" in "Input Settings" in "Settings" on the menu bar, or click  to display the Trigger Settings window as shown below. Set the parameters and click "OK".



The Trigger Settings window contains the same details as those shown on the WR300 monitor screen. For details, see Section 3.4, "Trigger Settings".


- Action Sets whether the trigger action ends after one time or is repeated.
- Pre-trigger Sets the pre-trigger time. This can be set only when Function is set to "Memory".
- Time Gate Settings Sets the time gate.
- Time Gate Sets the trigger signal standby time.
- Set Time Sets the time gate validity period.
- Start Time/End Time Sets the time gate times. This can be set only when Time Gate is set to "Relative" or "Absolute".
- Start, Stop Sets the trigger start and stop conditions.
- Source Sets the trigger type.
- Combination Sets the trigger combination for each channel. This can be set only when Source is set to "Internal".
- Mode Sets the trigger mode for each channel. This can be set only when Source is set to "Internal".
- Lower - Level - Upper Sets the trigger level for each channel. This can be set only when Source is set to "Internal".

CAUTION

The trigger level is always set to a °C value, even if °F has been selected for the the temperature range. Take care when setting this value.

- Logic Enables triggering for a logic signal. The parameter can only be specified when a logic amplifier is installed.
- Count This function ignores trigger signals for a preset time while awaiting a trigger. This is effective only when Combination is set to "Level OR" or "Level AND".

Memory Settings

The Memory Settings window enables the capture destination to be specified. Click "Memory Settings" in "Input Settings" in "Settings" on the menu bar, or click  to display the Memory Settings window as shown below. Set the parameters and click "OK".



The Memory Settings window contains the same details as those shown on the WR300 monitor screen. For details, see Section 3.3, "Memory Settings".

Memory Settings

Common Settings

Capture Destination: MEM

Path Name: C:\

File Name: DEFAULT

Capture Block: 1

Sampling Interval: 100us / 10kHz

Time Scale: 5ms / DIV

Number of CH: 8

Capture Block List

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112
113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128

Data Memory Settings

Block Size: 4kW x 128

Capture Time: 400 ms

Memory Chain: off

Auto Save: off

File Name:


OK

Cancel

- Common Settings Section for the basic data capture settings.
- Capture Destination Sets the capture destination.
- Path Name Sets the path name for data capture. It can only be specified when the capture destination is Disk.
- File Name Sets the file name for data capture. It can only be specified when the capture destination is Disk.
- Auto File Name Updates the Auto File Name
- Capture Block Sets the memory block number for data capture. This can be set only when Capture Destination is set to "Memory".
- Sampling Interval Sets the interval for data capture. The maximum capture rate will vary depending on the capture destination.
- Time Scale Sets the time per division.
- Number of CH Selects the number of channels for data capture. It can only be specified for a 16-channel model when the capture destination is Disk.
- Data Memory Settings ... Set when data is captured to the internal memory.
- Block Size Sets the number of internal memory divisions. This can be set only when Capture Destination is set to "Memory". The internal memory capacity can be altered by dividing the internal memory to suit the measurement time.
- Capture Time Automatically displays the data capture time. This setting is displayed only when Capture Destination is set to "Memory".
Capture Time = Sampling Interval x Block Size
- Memory Chain Sets the method for capturing to divided memory blocks. This can be set only when Capture Destination is set to "Memory".
- Auto Save Sets Auto Save on or off. Auto Save automatically saves data captured in the internal memory to the PCMCIA or hard disk (WR310 only).
- File Name Sets the filename used for auto saving.

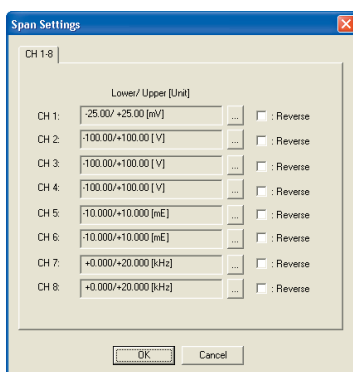
Span Settings

The Span Settings window enables the setting of the Span parameters.


Click "Span Settings" in "Meas. Parameter Settings" in "Settings" on the menu bar, or click  to display the Span Settings window as shown below. Set the parameters and click "OK".



The Span Settings window contains the same details as those shown on the WR300 monitor screen. For details, see Section 3.2, "Amp Settings".




CH * to CH * Displays the amplifier units mounted in the WR300. Select the number of the amplifier unit to be set.

Lower/Upper [Unit] Sets the span upper/lower limits and units for each channel. Click  to display the setting window.

Reverse Displays the waveform with the span upper/lower limits reversed.

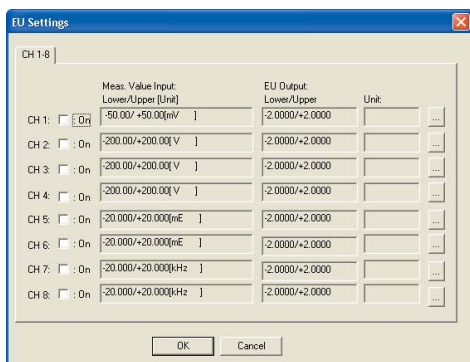
EU Settings

The EU Settings window enables the setting of the Engineering Unit parameters.

Click "EU Settings" in "Meas. Parameter Settings" in "Settings" on the menu bar, or click  to display the EU Settings window as shown below. Set the parameters and click "OK".




The EU Settings window contains the same details as those shown on the WR300 monitor screen. For details, see Section 3.8, "EU Settings".



CH * to CH * Displays the amplifier units mounted in the WR300. Select the number of the amplifier unit to be set.

CH * Selects the channel for scaling conversion. This is on when checked.


Meas. Value Input Lower/Upper Unit

Sets the upper and lower limits for the input signal. Click  to display the setting window.

EU Output Lower/Upper Unit

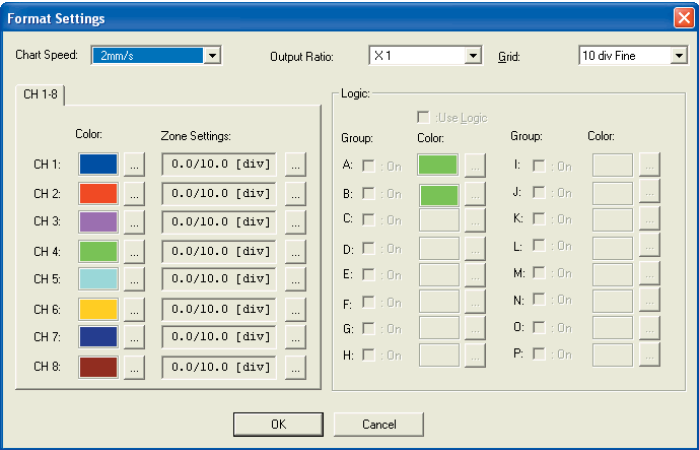
Sets the value to be converted. Click  to display the setting window.




Format Settings

The Format Settings window enables the setting of the waveform display format. Click "Format Settings" in "Meas. Parameter Settings" in "Settings" on the menu bar, or click  to display the Format Settings window as shown below. Set the parameters and click "OK".



The Format Settings window contains the same details as those shown on the WR300 monitor screen. For details, see Section 3.7, "Format Settings".




- Chart Speed Selects the chart speed for the window displayed.
- Output Ratio Sets the expansion/compression ratio along the time axis to replay data. The ratio is selectable from 1, 1/2, 1/4, 1/5, 1/8, 1/10, 1/20, 1/40, 1/50, 1/80, 1/100, and full-screen width.
- Grid Selects the grid type displayed on the screen. The grid can be selected from 10 div Fine, 10 div Coarse, or None.
- CH * to CH * Displays the channel group for setting.
- Color Sets the waveform display color for each channel. Click  to display the setting window.
 - Zone Settings Sets the zone start position and display width for the waveform displayed. Click  to display the setting window.
- Logic Sets the logic channel displays when a logic amplifier is mounted.
- Use Logic Check this box when using a logic amplifier.
 - On Sets on or off for each logic group. To select "On", check the box.
 - Color Sets the waveform display color for each logic channel. Click  to display the setting window.





These settings will be reset to the default values if the network/USB connection is reset. To store the display colors in the system, use "Default Color Settings" described earlier.

Start/Stop/Monitor/Replay


Start

Click "Measure" → "Start" on the menu bar or click  to start measurement. The Min/Max waveform data is displayed on the screen while data is being captured into memory of the WR300 or another storage medium.

Stop

Click "Measure" → "Stop" on the menu bar or click  to stop measurement. When measurement is started by clicking , the Min/Max data on the screen will be saved automatically.

Monitor

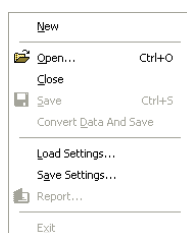
Click "Measure" → "Monitor" on the menu bar or click  to start measurement. The waveform is only displayed on the monitor screen and is not captured.

Replay

Click "Measure" → "Replay" on the menu bar or click  to display data captured on the WR300. When the display format is set to 1/1 magnification, about 50 data/div will be read out and displayed. When full-screen width is selected, the "Reading measurement data..." message will appear on the screen during the reading and display of all data.

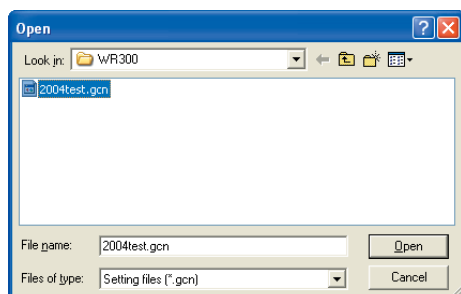
Loading and Saving Setup Parameters

This section describes how to load and save measurement settings. Click "File" on the menu bar to display the Settings window.



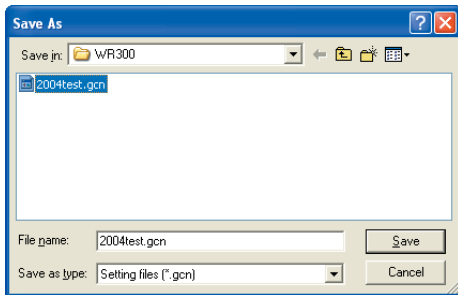
Load Settings....

To load previously saved settings, click "Load Settings" to display the files saved in the destination folder in the "Open" window. Select the file you want to load (*.gcn) and then click the "Open" button to display the file condition settings.



Save Settings....

When you have finished making the settings and want to save those settings to a file, select "Save Settings...", assign a File name, and then click the "Save" button to save them to the designated file.



5.8 Printer Functions

The printer functions enable computer control of the WR300 chart speed and output of a hard copy of the screen.



These functions can only be used when chart paper is loaded in the WR300.

Function	Enables or disables WR300 printer output OFF: Data is not output to chart paper even if measurement has been initiated. ON: Data is output to the chart paper as soon as measurement is initiated.
Feed	Selects the length of paper to be fed before the start of recording. Select from 1, 2, 5, 10, 15, or 20 cm.
Screen copy	Makes a hard copy of the currently displayed WR300 screen data.

5.9 Measurement/Monitoring Procedures and Save/Scroll/Cursor Functions

Starting Measurement to Saving Data

This section describes how to start and stop measurement.



- It is possible to monitor data on the screen without performing data capture. Click "Monitor" in "Measurement" on the menu bar, or click .
- Previously measured data can also be displayed at the same time while measurement is in progress. Before starting measurement, click "Open" in "File" on the menu bar, or click to display the file specification window. Specify the file to display, and click "Open".

- (1) Set whether the channel information displayed on the left-hand side of the measurement window is displayed as Name or Voltage. The default setting is Name. To display voltage, click "Voltage Display" in "View" on the menu bar, or click .

[Name display]

CH 1: test 1
CH 2: test 2
CH 3: test 3
CH 4: test 4
CH 5: test 5
CH 6: test 6
CH 7: test 7
CH 8: test 8

[Voltage display]

Position: 1027
Date: Jan 23 2003 13:30:00
CH 1: +1.3301 V
CH 2: +2.9352 V
CH 3: +1.3506 V
CH 4: +1.8773 V
CH 5: +2.6742 V
CH 6: +2.3307 V
CH 7: +1.5911 V
CH 8: +1.9013 V

- (2) To start data capture and measurement, click "Start" in "Measurement" on the menu bar, or click . Measurement starts and the waveform is displayed on the screen.



The measurement data displayed on the PC screen will vary depending on the WR300 capture destination.

- For capture to internal memory:
Measurement data will be displayed on the PC screen when the WR300 internal memory blocks become full.
- For capture to PCMCIA/HDD:
Measurement data will be displayed on the PC screen from the start. However, the data displayed will be the Min/Max data at 100 ms intervals. The data will be captured to the WR300 internal PCMCIA or hard disk at the same time.

- (3) To stop measurements, click "Stop" in "Measurement" on the menu bar, or click . To save the measurement data, see "Saving Measurement Data" below.

Saving Measurement Data

To save measured data, click "Save" in "File" on the menu bar, or click , and display the Save window. Specify the save destination and click "Save".



To save data unchanged after completing measurements, follow the message and select "Yes". The Save window is then displayed.


If the save destination is internal memory, the file extension will be .gbd. However, if the save destination is a PCMCIA card or the HDD, the data will become averaged Min/Max values and the file extension will be .gmd. If the data is not averaged Min/Max values, transfer the data captured in the WR300 as explained in "Saving Data Captured in the WR300 to a PC" in Section 5.10.

Scrolling Measurement Data

The measurement data scroll function is useful for replaying data after measurements have been completed, or for replaying saved data. The waveform can be scrolled using the horizontal scroll bar below the waveform display area.

Cursor Functions

The cursors can be displayed as follows. The cursor position is indicated by the digital readout on the right-hand side of the screen.


- (1) First cursor
Either click the mouse on the measurement data display area, or click "Start Readout" in "Replay" on the menu bar and then click "Select Cursor 1 or 2" in "Cursor selection" in "Start Readout" in "Replay" or click . The cursor is moved by dragging with the mouse.
- (2) Second cursor
Select the cursor number not yet selected in "Cursor selection" in "Replay" on the menu bar. Move the cursor by dragging with the mouse after selecting the cursor number in "Cursor selection" in "Replay" on the menu bar.

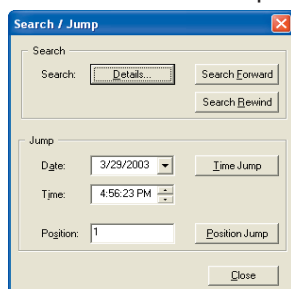


To quit the cursor display, either click "End Readout" in "Replay" on the menu bar, or click .

Searching and Jumping to Specific Points

This section describes how to search through cursor-displayed data.

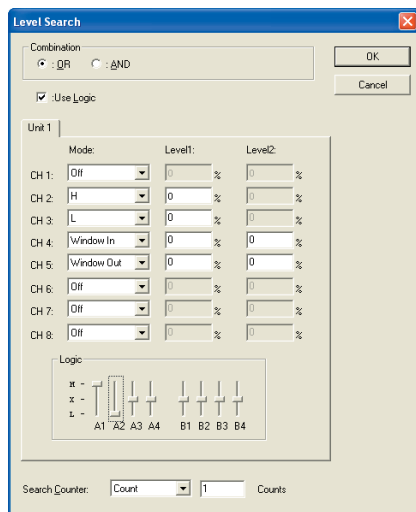
- (1) Display the Search window.
Click "Search" in "Replay" on the menu bar or click  to display the Search/Jump window.



- (2) There are three search methods: Level, Date/Time (Time Jump) and Measured Point (Position Jump).
Search: Level Search
Click the Details button in the above window to display the Level Search window

CAUTION

The level is always set to a °C value, even if °F has been selected for the the temperature range. Take care when setting this value.



- Combination Selects the method for satisfying the Level condition
- OR Searches for the position where a single channel among the target channels satisfies the search condition
 - AND Searches for the position where all of the target channels satisfy the search condition.
- Use Logic Adds logic signals to the search conditions
- Mode Sets the search mode for each channel
- H The search condition is satisfied when the position exceeds the level set in Level 1.
 - L The search condition is satisfied when the position falls below the level set in Level 1.
 - Window In The search condition is satisfied when the position goes inside both the levels set in Level 1 and Level 2.
 - Window Out The search condition is when the position goes outside both the specified levels set in Level 1 and Level 2.
- Logic Sets the search level for each logic channel
- H Searches for the High position.
 - X Set this condition for any channel to be excluded.
 - L Searches for the Low position.
- Search Counter This function sets the number of points to be considered invalid until the search conditions are satisfied.
- Counts Searches for the position where the trigger condition has been satisfied the specified number of times. The setting range is 1 to 255.
 - Filter Searches for the position where the search conditions are satisfied for the set time or longer. The actual time is the product of the sampling interval and filter settings.



When the search condition is met, the status of the targeted point changes from a "no match" point to a "matched" point. Once the starting point satisfies the search condition, that point is ignored until it no longer satisfies it.

- Jump Date/Time, Position
- Specify the date and time, and then click the Time Jump button to jump to the specified date and time. Specify the measured point, and then click the Position Jump button to jump to that position.

2-Screen Display

This allows you to view measurement data on a dual screen.

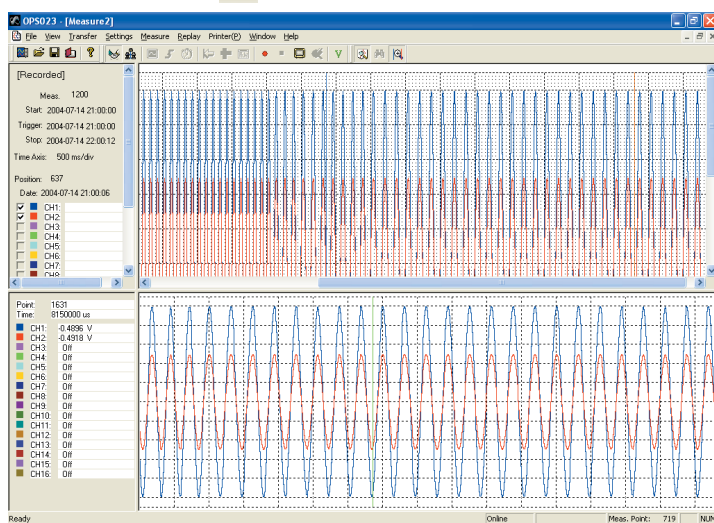


The following data files cannot be used for this operation:

- Data that was captured with an automatically-generated file name (files with a .gmd extension).
- Data that was captured using multiple WR300 units connected together (files with a .gmd extension).

Displaying Measured Data on a Dual Screen

Display the cursors on data you have directly measured on the screen. Click "Measure" → "2-screen" on the menu bar or click to automatically read and display data between the cursors (captured on the WR300).



Displaying Replayed Data on a Dual Screen

Click "Measure" → "Replay" on the menu bar or click and select a file in the WR300. After the selected file data appears, display two cursors and click "Measure" → "2-screen" on the menu bar or click . The data (captured on the WR300) is automatically read and displayed.

Using Data Files Captured on a PC

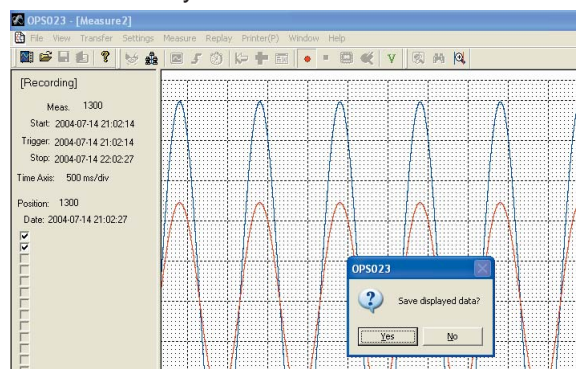
Confirm that the PC and WR300 are disconnected from the network to avoid an error.

A: Files with extension gbd or gdt

Select a file and display the cursors. Click "Measure" → "2-screen" on the menu bar or click to display data between the cursors.


B: Files with extension gmd

Select a file and display the cursors. Click "Measure" → "2-screen" on the menu bar or click . "The PC must be connected to the WR300. Do you want to connect to the WR300?" message appears. Click "Yes" to automatically read out data on the WR300 and display the waveform on the screen.



5.10 Opening Captured Data Files and Saving WR300-Captured Data to a PC

Opening Captured Data Files on a PC

Click "Open" in "File" on the menu bar or click , select the directory and display file type, and then select the file to be converted. The file specification window is displayed. The files that can be selected are gbd data files created using a WR300 series device. Other files cannot be selected. The waveform (selection range) window may not be displayed if there is insufficient virtual memory.



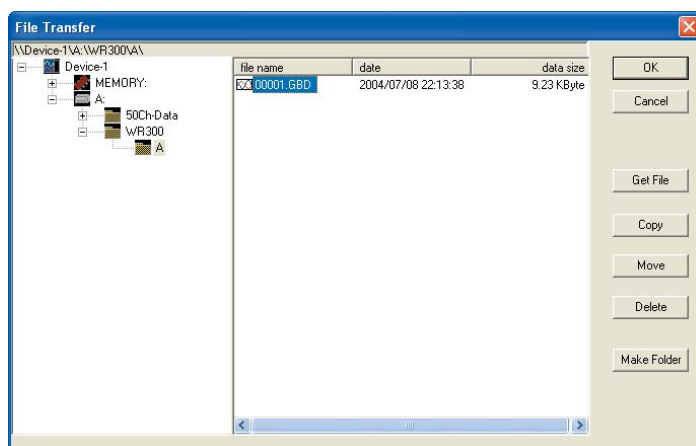
To display more than one item of data, click "File" → "Open" and repeat this operation.

Extensions

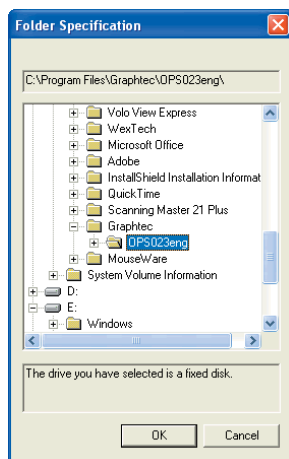
- " .gbd" : Memory data or data selected by cursors and saved
- " .gdt" : Data directly written to the hard disk or PCMCIA or data measured in real time
- " .gmd" : Data displayed on the PC and saved

Saving Data Captured in the WR300 to a PC

- (1) Select "File Transfer" in "Transfer" on the menu bar to display the File Select window.

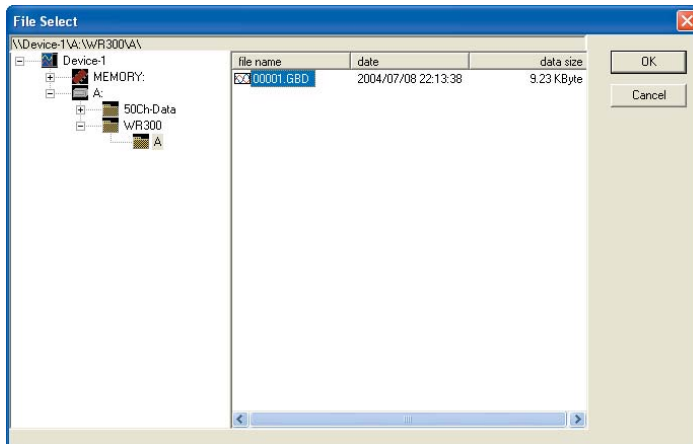


- (2) Select the capture destination on the left-hand side of the screen. To select, double-click the capture destination drive or folder.
- (3) Select the file to be acquired in the right-hand side of the screen, and click on "Get File".
- (4) Set the data capture destination and click "OK" to start transferring the data. The data will be saved using the name stored in the WR300. This will be the capture block number when saving to memory.



Displaying Data Captured in the WR300 on a PC

- (1) Select "Replay Data" in "Transfer" on the menu bar to display the File Select window.

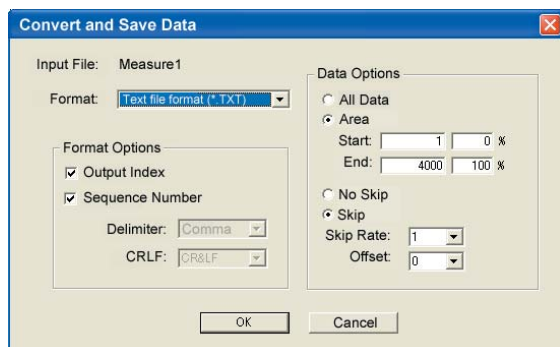


- (2) Select the file to be replayed. At the left side of the screen, select the capture destination drive to display the saved files at the right-hand side of the screen.
- (3) Select the file to be replayed on the right-hand side of the screen, and then click "OK" to replay the data.

5.11 Converting the Data Format and Saving the Data

Convert and Save Data

Converted data can be saved by selecting "Convert and Save Data" in "File" on the menu bar, selecting the directory, and selecting Input File, Format, Format Options, and Data Options.



Input File Displays the data name specified in "Open".

Format The output file format can be selected from among the following.

- Spreadsheet format (* .CSV)
..... Delimits data with commas or CRLF, and encloses comments in double quotation marks. The default output file name will be the original file name with the extension changed to "CSV".
- DADiSP format (* _DADISP.DAT)
..... Format that can be read in by the "DADiSP" data analysis software. The default output file name will be the original file name with the extension changed to "DADISP.DAT".
- Text file format (* .TXT)
..... This format can be specified as "Delimiter" or "CRLF" in the format options. The default output file name will be the original file name with the extension changed to "TXT".
- GBD format (* .GBD)
..... Converts a "GDT" file to a "GBD" file.

Format Options Selects the format details.

- Output Index Selects whether or not to add an index when spreadsheet (* .CSV) or text file (* .TXT) formats are selected. Check the box to add an index.
- Sequence Number .. Selects whether or not to add a sequence number when spreadsheet (* .CSV) or text file (* .TXT) formats are selected. Check the box to add a sequence number.
- Delimiter Selects the delimiter character (for separating adjacent data in groups recorded at the same time) used when text file (* .TXT) format is selected. The delimiter character can be a tab, comma, space, or semicolon.
- CRLF Selects the line-break character (for inserting between data groups recorded at the same time) used when text file (* .TXT) format is selected. The line-break character can be CR&LF, CR, or LF.

Data Options Selects the data options.

- All Data All data displayed is converted.
- Area Specifies the range to be converted. This is applied when the item checkbox is checked. Specification is not possible when no files are specified, or for multiple files. The range can be specified by specifying the start and finish sample points, or by specifying as a percentage. The two methods are linked, but fractional percentages cannot be specified. This setting affects the number of sample points recorded in the output file header.



When a range is selected with two cursors displayed, the range is automatically entered.

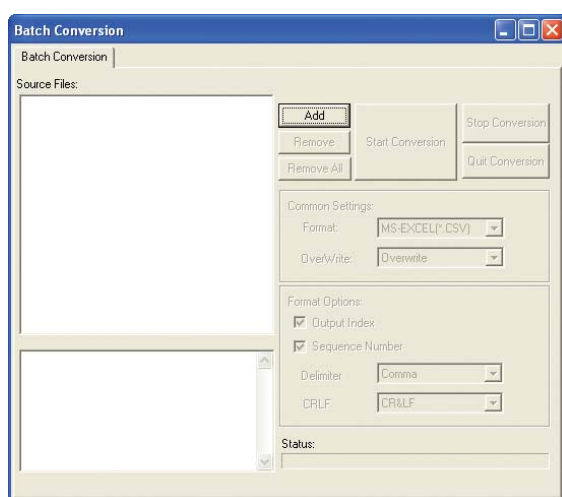
- No Skip The displayed data or cursor specification is converted directly.
- Skip This setting affects the number of sample points and sampling interval recorded in the output file header.
- Skip Rate Skips the number of samples in accordance with the capture sampling time when converting.
 - Offset This function offsets the data to be converted when using skip conversion. The offset always affects the start of the device data saved rather than the range specification conversion start point.

Batch Conversion

By selecting "Batch Conversion" in "File" on the menu bar, converted data can be selected as multiple data files and changed all as one batch into the format you specified for "Format".



Waveform display, channel specification, range specification, etc., cannot be performed. Only data with a ".DAT", ".GDT", or ".GBD" extension can be converted.



- Add Selects the filenames for converting into different formats. The selected files are added to the Input Files list. To select multiple files, click on each file while holding down the Ctrl key, or while holding down the Shift key.
- Remove Removes a file from the Input Files list (the file itself is not actually deleted, only removed from the list). Select the file you want to remove from the list by clicking on it, and then click on the [Remove] button to remove it.
- Remove All Removes all the files from the Input Files list (the files themselves are not actually deleted, only removed from the list).
- Start Conversion Converts all the files registered in the Input Files list to the specified format, and then saves the data. Specify your preferred directory so that all the converted files will be saved to that directory.
- Stop Conversion Stops data conversion of only the file that is currently being converted.
- Quit Conversion Stops data conversion of the file that is currently being converted, as well as the files that conversion was specified for, but have not yet been converted.
- Common Settings Selects the Format and OverWrite details.
- Format The output file format can be selected from among the following.


- Spreadsheet format (* .CSV)
..... Delimits data with commas or CRLF, and encloses comments in double quotation marks. The default output file name will be the original file name with the extension changed to "CSV".
- DADiSP format (* _DADISP.DAT)
..... Format that can be read in by the "DADiSP" data analysis software. The default output file name will be the original file name with the extension changed to "DADISP.DAT".
- Text file format (* .TXT)
..... This format can be specified as "Delimiter" or "CRLF" in the format options. The default output file name will be the original file name with the extension changed to "TXT".
- GBD format (* .GBD)
..... Converts a "GDT" file to a "GBD" file.
- OverWrite..... Selects whether or not to overwrite an existing file with the same name. There are three settings as follows.
Do not overwrite: If a file with the same name exists, that file will not be overwritten.
Confirm before overwriting : A confirmation window is displayed each time a file with the same name as an existing file is specified for conversion.
Overwrite without confirming : Any file with the same name is automatically overwritten.

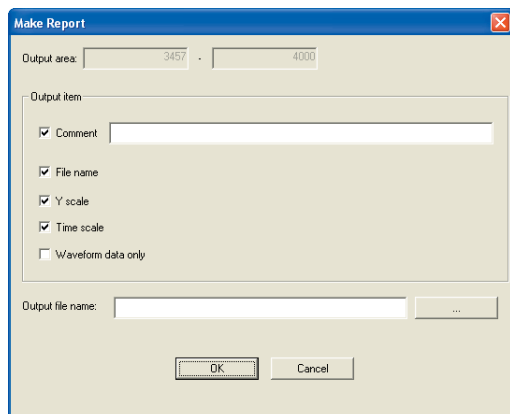
Format Options Selects the format details.

- Output Index Selects whether or not to add an index when spreadsheet (* .CSV) or text file (* .TXT) formats are selected. Check the box to add an index.
- Sequence Number .. Selects whether or not to add a sequence number when spreadsheet (* .CSV) or text file (* .TXT) formats are selected. Check the box to add a sequence number.
- Delimiter Selects the delimiter character (for separating adjacent data in groups recorded at the same time) used when text file (* .TXT) format is selected. The delimiter character can be a tab, comma, space, or semicolon.
- CRLF Selects the line-break character (for inserting between data groups recorded at the same time) used when text file (* .TXT) format is selected. The line-break character can be CR&LF, CR, or LF.

5.12 Report Function

This section describes the functions for creating a report using captured data. The waveform displayed on the screen is saved as a BMP or WMF file format (the amp settings for each channel are included).

- (1) Select "Make Report" in "File" on the menu bar or click  to display the Make Report window.



- (2) Output area settings

These are used to create a report file to save information together with the waveform.

Comment : Saves the comment at the same time

File name : Saves the file name at the same time

Y scale : Saves the Y axis scale at the same time

Time scale : Saves the time scale at the same time

Waveform data only : Saves the waveform data only. To save the trigger times and the cursor point data values at the same time, decheck this box.

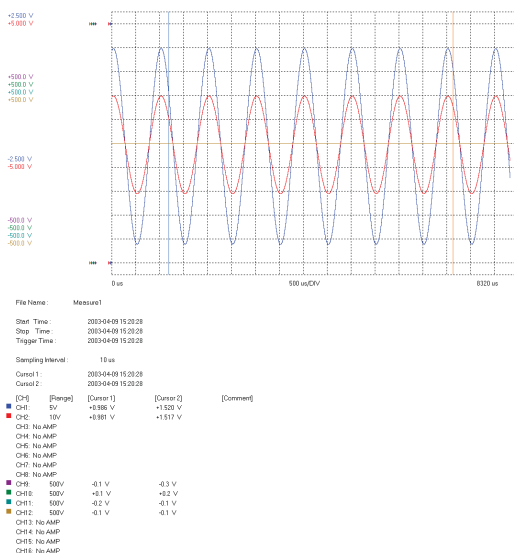
- (3) Output file name

Specifies the name for the report file



Data displayed on a dual screen cannot be used for a report. Only single-screen data can be used. Compress the waveform using the display ratio, and then use the data. If the saved data is not displayed correctly, change your monitor's Colors setting to 32 colors and then save the data.

Report Display



5.13 Exiting OPS023

Select "Exit" in "File" on the menu bar to exit from OPS023.



If you are online, switch to offline status before exiting from OPS023.

CHAPTER 6

Specifications

This chapter describes the basic specifications for the WR300/310.

- 6.1 WR300 Series Model Configuration Chart**
- 6.2 Basic Specifications**
- 6.3 Plug-in Amplifier Specifications**
- 6.4 Options/Accessories/Supplies Charts**
- 6.5 External Dimensions**

6.1 WR300 Series Model Configuration Chart

	WR300			WR310	
No. of channels	4	8	16	8	16
100-mm roll paper	Yes	No	No	No	No
100-mm Z-fold paper (for internal use)	Opt.	No	No	No	No
Internal 100-m Z-fold unit	Opt.	No	No	No	No.
200-mm roll paper	No	Yes	Yes	Yes	Yes
200-mm Z-fold paper (for internal use)	No	Opt.	Opt.	Opt.	Opt.
Internal 200-m Z-fold unit	No	Opt.	Opt.	Opt.	Opt
100-mm Z-fold paper (long-length)	No	Opt.	Opt.	Opt.	Opt.
Long-length 200-mm Z-fold unit	No	Opt.	Opt.	Opt.	Opt.
Logic amp	4-ch	8-ch	16-ch	8-ch	16-ch
IRIG	No	No	No	Yes	Yes
40-GB hard disk	No	No	No	Yes	Yes

Opt: Option

6.2 Basic Specifications

Main Unit Specifications

Item	Details
Analog input	4-ch model: 2 slots, 8-ch model: 4 slots, 16-ch model: 8 slots (amplifier units can be intermixed)
Logic input	4-ch model: 4 channels, 8-ch model: 8 channels, 16-ch model: 16 channels
PC interface	LAN, USB
Memory capacity	1 Mword per channel
Internal memory	40 GB 2.5-inch hard disk ^{*1} , PCMCIA slot (Type II)
Isolation voltage	Between the AC power supply and casing: 1 minute at 1,500 V AC
Insulation resistance	Between the AC power supply and casing: 20 MΩ at 500 V DC
Backup functions	Setting conditions: EEPROM, Clock: Lithium batteries
Operating environment	0°C to 40°C, 30% to 80% RH (5°C to 35°C when using hard disk or printer)
Operating noise levels	Standby: 60 dBA max.
Rated power supply	100 to 120 V AC/200 to 240 V AC, 50/60 Hz (automatically selected for the voltage being used)
Power consumption	4-channel model: approx. 100 VA, 8-ch model: approx. 120 VA, 16-channel model: approx. 140 VA (when the print density is 50% and the printer is being used)
External dimensions (approximate)	380 mm (W) x 296 mm (D) x 125 mm (H), (excluding rubber feet and protrusions)
Weight (approximate)	4-ch model: 5.6 kg (including 2 amplifiers, excluding options) 8-ch model: 6.1 kg (including 4 amplifiers, excluding options) 16-ch model: 6.8 kg (including 8 amplifiers, excluding options)

^{*1}: WR310 only

Data Capture Function Specifications

Function	Item	Details
Internal capture	Captured data	Measurement conditions, measurement data
	Capture capacity	Memory
		PCMCIA card
		Hard disk ^{*1}
	Sampling interval	Memory
		PCMCIA card
		Hard disk ^{*1}
	Memory banks (Block) ^{*2}	1, 2, 4, 8, 16, 32, 64, 128
Network capture	Capture start specification	After a trigger, capture starts simultaneously with waveform recording (can be set On/Off)
	Captured data	Measurement conditions, measurement data
	Capture capacity	Depends on PC connected
	Sampling interval	Depends on amplifier
	Transfer data details	During measurement
		After measurement
	Data backup ^{*2}	Memory, PCMCIA card, hard disk (data capture capacity and sampling interval are the same as for Internal capture).
	Capture start specification	After a trigger, capture starts simultaneously with waveform recording (can be set On/Off)

^{*1}: WR310 only

^{*2}: When using memory



If the power supply is cut off during data capture, the data being captured becomes invalid.

Monitor and Printer Specifications

Item		Details
Display screen		8.4-inch color TFT LCD
Display details		Setting windows, mode measurement values
Thermal printer		4-ch model: 100 mm wide, 8 dots per mm 8-ch/16-ch models: 200 mm wide, 8 dots per mm
Measurement mode		Recorder mode, FFT mode
Recorder mode	Display format	Display format: Y-T Display direction: Horizontal scroll No. of display zones: Zone specification, fixed format
	Digital display	Digital display of measured values for up to 8 channels on right-hand side of screen
	Display method	Scroll, Fixed
	Print details	Waveforms and screen copy
	Chart speed	1, 2, 2.5, 5, 10, 20, 25, 50 mm/s 1, 2, 2.5, 5, 10, 20, 25, 50, 100 mm/min, mm/h
	Printing accuracy	Y: $\pm 0.3\%$ ± 1 dot, T: $\pm 2\%$ ± 0.5 mm
	Annotation printing	System annotation: (System, User, System & User, OFF) Channel annotation: (Amp, User, Amp & User, Value, OFF)
	No. of annotation characters	10 to 32 characters
	Annotation printing interval	10 cm to 100 cm in 10-cm steps
	Captured data replay	Waveform display/scroll, Waveform zoom-in/zoom-out, Cursor function, Calculation function, Data search function
	Waveform expansion/	Time axis fixed zoom-in/zoom-out: x 10 to x 1/1000 (data between specified cursors)
	compression functions	Time axis variable zoom-in/zoom-out: data between specified cursors Voltage axis variable zoom-in/zoom-out: data between specified cursors
	Cursor functions	Cursor readout function/Scroll function/Zoom function
	Calculation functions	Arithmetic operations/Moving average/Log/Index mean/Absolute value/Differential and integral (two types of integral)/Second differential (two types of second integral)/Sine/Cosine/Tangent/Arcsine/Arccosine/Arctangent/Pi (π)
	Data search	Date/Time: Data search from specified time/date Level: Data search above (below) specified level
FFT mode	Analysis functions	Auto-correlation: Linear spectrum, power spectrum, power spectrum density, RMS spectrum Cross-correlation: Cross spectrum, transfer function, coherence function
	Analysis frequencies	400 kHz, 200 kHz, 100 kHz, 80 kHz, 40 kHz, 20 kHz, 10 kHz, 8 kHz, 5 kHz, 4 kHz, 2 kHz, 1 kHz, 800 Hz, 500 Hz, 400 Hz, 200 Hz, 100 Hz, 80 Hz, 40 Hz, 20 Hz, 10 Hz, 8 Hz, 5 Hz, 4 Hz, 2 Hz, 1 Hz, 0.8 Hz, 0.5 Hz, 0.4 Hz, 0.2 Hz, 0.1 Hz, 0.08 Hz
	Number of analysis channels	4 ch
	Window functions	Hanning window, rectangular window
	Number of sampling points	1,000 points, 2,000 points
	Averaging	Summation, exponential, peak hold
	Display format	1 Division, 2 Divisions, 4 Divisions, Nyquist
	Print details	Screen copy

Trigger Specifications

Item	Details
Time gate	OFF, Relative time, Absolute time
Action	Single, Repeat
[Start condition] source	OFF: Start triggered by pressing the START key Internal: Start triggered by a combination of measured signals Manual: Start triggered by pressing the TRIGGER key External: Start triggered by a TRIGGER IN signal from the remote connector
[Stop condition] source	OFF: Stop triggered by pressing the STOP key Internal: Stop triggered by a combination of measured signals Manual: Stop triggered by pressing the TRIGGER key External: Stop triggered by a TRIGGER IN signal from the remote connector Time: Stops measurement at preset time
Combination	Level OR, Level AND, Edge OR, Edge AND
Judgment mode	Edge: Rise time (↑), Fall time (↓) Level: H (High), L (Low) Window: IN, OUT, OFF
Level	−100% to +100% of setting range in 1% steps
Trigger Counter (when the Combination setting is Level)	Number of times: 1 to 255 Filter: Product of the Sampling Interval and the Number of Times settings (can only be set when the Function setting is Memory).
Pretrigger	Internal memory: 0% to 100% in 1% steps PCMCIA card, HDD: On/Off
Logic trigger	Pattern: H (High), L (Low), X (Don't care) Judgment mode: When the pattern is matched

Software Specifications

Item	Details
Compatible operating system	Windows 2000/XP
Functions	Measurement conditions setting, data measurement, file conversion, report creation
Measurement condition settings	WR300/310 control, communication conditions setting
Measurement function	Recorder mode
Display format	Y-T
Display direction	Horizontal scroll
No. of display zones	Zone specification
Digital display	Digital display of measured values for up to 8 channels on left-hand side of screen
Display method	Scroll, fixed
Captured data replay	Waveform display/scroll/waveform expansion/compression
Cursor functions	Cursor readout, data search
File conversion	TEXT, CSV, DADiSP, GBD
Report creation	Report creation mode or waveform screen copy and paste

6.3 Plug-in Amplifier Specifications

WR3-V Amplifier (for voltage measurement) Specifications

Item	Details
No. of channels	2 channels per unit
Input configuration	Independent unbalanced input for each channel (floating ground)
Input resistance	1 M Ω \pm 1%
Input coupling	AC, DC, GND, CAL, (1/2 F.S.), OFF
Measurement range	50, 100, 200, 500 mV/F.S. 1, 2, 5, 10, 20, 50, 100, 200 V/F.S.
Input filters	Line: 1.5 Hz (–3 dB) at –6 dB/oct Low-pass : 5 Hz, 10 Hz, 50 Hz, 500 Hz, 5 kHz, 50 kHz (–3 dB) at –6 dB/oct
Accuracy (23 \pm 3°C)	\pm 0.25% of F.S.
Temperature coefficients	Zero point: 0.02% of F.S. /°C Gain: 0.02% of F.S. /°C
Insulation resistance	100 M Ω (at 500 V DC)
Isolation voltage	Between input terminal and casing: 1 minute at 1,000 V AC
Permissible signal source resistance	Max. 1 k Ω
A/D converter	Sampling interval: 1 μ s A/D resolution: 12 bits
Common mode rejection ratio	80 dB (typ) (50/60 Hz, Signal source resistance: max. 500 Ω)
Signal/noise ratio	–46 dB (typ) 200(Vp-p at 50 mV range (with +/– shorted)
Frequency response	DC coupling: DC to 200 kHz (+/–3 dB Typ.) AC coupling: 10 Hz to 200 kHz (+1/–4.5 dB Typ.)
Max permissible input voltage	Between +/– terminals: 5 V to 200 V range : 200 V DC (DC + ACp-p) 50 mV to 2 V range: 30 V DC (DC + ACp-p) Between input terminals and GND: 33 V AC rms
Input terminal type	BNC

WR3-M Amplifier (for voltage/temperature measurement) Specifications

Item	Details
No. of channels	2 channels per unit
Input configuration	Independent unbalanced input for each channel (floating ground)
Input resistance	1 M Ω \pm 1% constant
Input coupling	AC, DC, TEMP., GND, CAL (1/2 F.S.), OFF
Measurement range	[Voltage] 20, 50, 100, 200, 500 mV 1, 2, 5, 10, 20, 50, 100, 200, 500 V Auto [Temperature] TC-K: -200 to 1300 °C TC-J: -200 to 1100 °C TC-T: -200 to 400 °C TC-R: 0 to 1600 °C TC-E: -200 to 800 °C TC-B: 600 to 1700 °C
Input filters	[Line] 1.5 Hz (-3 dB) at -6 dB/oct. [Low-pass] 5, 10, 30, 50, 500Hz, 5 kHz (-3 dB) at -6 dB/oct.
Accuracy (23°C \pm 3 °C) (Temperature accuracy includes reference contact compensation accuracy)	[Voltage] \pm 0.25% of F.S. [Temperature] < TC-K, J, E > -200 °C to 0 °C: \pm (1% of rdg + 3.5 °C) Other: \pm (0.2% of rdg + 3.5 °C) < TC-T > -200 °C to 0 °C : \pm (0.8% of rdg + 3 °C) Other: \pm (0.2% of rdg + 3 °C) < TC-R > 0 °C to 200 °C: \pm 9.5 °C 200 °C to 800 °C: \pm 6.5 °C Other: \pm (0.2% of rdg + 4.5 °C) < TC-B > 600 °C to 700 °C: \pm 9.5 °C Other: \pm (0.2% of rdg + 5.5 °C) Note: When the display is °F (Fahrenheit), the temperature accuracy is the corresponding °C temperature accuracy given above multiplied by a factor of 1.8.
Temperature coefficient	Zero point: 0.01% of F.S./ °C Gain: 0.02% of F.S./ °C
Insulation resistance	100 M Ω (at 500 V DC)
Isolation voltage	Between input terminal and casing: 1 minute at 1,000 V AC
Permissible signal source resistance	Max. 1 k Ω
Input bias current	2nA (typ.)
A/D converter	Sampling interval: 10 μ s A/D resolution: 16 bits (out of which 14 are internally acknowledged)
Common mode rejection ratio	100 dB typ (120 dB with Line Filter on)
Signal/noise ratio	-46 dB (typ) 100 μ VP-P at 20 mV range (with +/- shorted)
Frequency response	DC coupling: DC to 20 kHz (+1/- 3 dB Typ.) AC coupling: 10 Hz to 20 kHz (+1/- 4.5 dB Typ.)
Max permissible input voltage	Between +/- terminals: 2 V to 500 V range : 500 V DC (DC + AC _{P.P}) 20 mV to 1 V range: 100 V DC (DC + AC _{P.P}) Between input terminals and GND: 33 V AC rms
Input terminal type	Banana connector (two connectors)

WR3-DCB Amplifier (for strain measurement) Specifications

Item		Details
No. of channels		2 channels per unit
Input terminals/format		Independent balanced input for each channel (NDIS strain input connectors)
Input coupling		DC, CAL+, CAL-, ZERO, OFF
Measurement range		Voltage: 1000 to 20,000 x 10 ⁻⁶ strain FS (1/2/5 steps)
Max permissible input	Differential input	10 VDC (DC+ACp-p)
	Sync voltage	100 VACrms
Insulation resistance		Min. 100 MΩ (at 500 V DC)
Isolation voltage		Between input terminal and casing: 1 minute at 1,000 V AC
A/D converter		Sampling interval: 10 μs Resolution: 16 bits (out of which 14 are internally acknowledged)
Common mode rejection ratio		80 dB typ (50/60 Hz)
Signal/noise ratio		Max. 50 x 10 ⁻⁶ strain (2 V DC, 350 Ω)
Input resistance		Approx. 10 MΩ (5 M + 5 M)
Accuracy (23 °C ±3 °C)		±(0.3% of F.S. +1.2 x 10 ⁻⁶ strain)
Frequency bandwidth		DC to 20 kHz (+1/-3 dB)
Stability	Zero point	±1.2 x 10 ⁻⁶ strain/ °C ±10 x 10 ⁻⁶ strain/8 h ±10 x 10 ⁻⁶ strain/0.5 h (initial drift / from 10 s after power on)
	Gain	±0.02% of F.S./ °C 0.10% of F.S./8h
Filters	Line	1.5 Hz (+1/-3 dB) at -6 dB/oct
	L.P.F	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz (-3dB) at -12 dB/oct
Gauge ratio		2.0 fixed
Gauge resistance		120 to 1000 Ω
Bridge voltage	Voltage	DC 2 V
	Accuracy	±0.2%
	Stability	±0.01%/ °C
Balance adjustment	Method	Auto balance adjustment method
	Accuracy	±10 x 10 ⁻⁶ strain
	Range	Resistance ±2% (10,000 x 10 ⁻⁶ strain)

WR3-FV Amplifier (for frequency measurement) Specifications

Item		Details
Input terminals/format		Independent unbalanced input for each channel (floating ground)
Input coupling		DC (0 V reference), OC (+2.5 V reference), OFF
Measurement range		200 Hz to 40 kHz F.S. (1/2/4/5 steps)
Max permissible input	Between +/- terminals	DC 60 V (DC+ACp-p)
	Between floating terminals	30 VACrms
A/D converter		Sampling interval: 4 μs (250 kHz) Resolution : 12 bits (out of which 14 are internally acknowledged)
Input resistance		DC: Approx. 100 k Ω OC: Approx. 10 k Ω
Accuracy		±0.5% of F.S.
Max. input frequency		40 kHz
Min pulse width		Min. 2.5 μs
Min. voltage		Min. ±1 V relative to the reference value
Low-pass filters		100 Hz, 1 kHz, 10 kHz (-3 dB) at -6 dB/oct

Logic Amplifier (for measurement of logic signals) Specifications

Item	Details
No. of channels	4-ch model: (4 channels/logic input terminal x 1) 8-ch model: (8 channels/logic input terminal x 2) 16-ch model: (16 channels/logic input terminal x 4)
Input voltage range	0 to 25 V max. (single ground input)
Threshold level	TTL (+1.4 V), CMOS (+2.5 V), Contact (+5.0 V)
Sampling interval	1 μ s max. (irrespective of analog amplifiers installed)
Trigger setting	8-channel pattern trigger
Display/Recording	On/Off switchable for each group (1 group: 4 channels)
Display/Record position specification	Display/Recording position can be specified for each group in each zone

IRIG (Time Code) Specifications (WR310 only)

Item	Details
Input signal type	Modulated, demodulated
Output signal type	Demodulated
Input signal format	IRIG-B, IRIG-E
Print record	System annotation printing
Display	Asterisk mark [*] displayed when time code received When a time code has not been received, the recorder's internal time is displayed The year displayed is the internal function clock
Input connector	BNC

6.4 Options/Accessories/Supplies Charts

Units

Unit	Model No.	Details
Voltage measurement amplifier	WR3-V AMP	Can be added later
Voltage/temperature measurement amplifier	WR3-M AMP	Can be added later
DC strain measurement amplifier	WR3-DCB AMP	Can be added later
Frequency measurement amplifier	WR3-FV AMP	Can be added later
200-mm long-length Z-fold unit	B-522	Can be added later
100-mm internal Z-fold unit	B-523	Can be added later
200-mm internal Z-fold unit	B-524	Can be added later

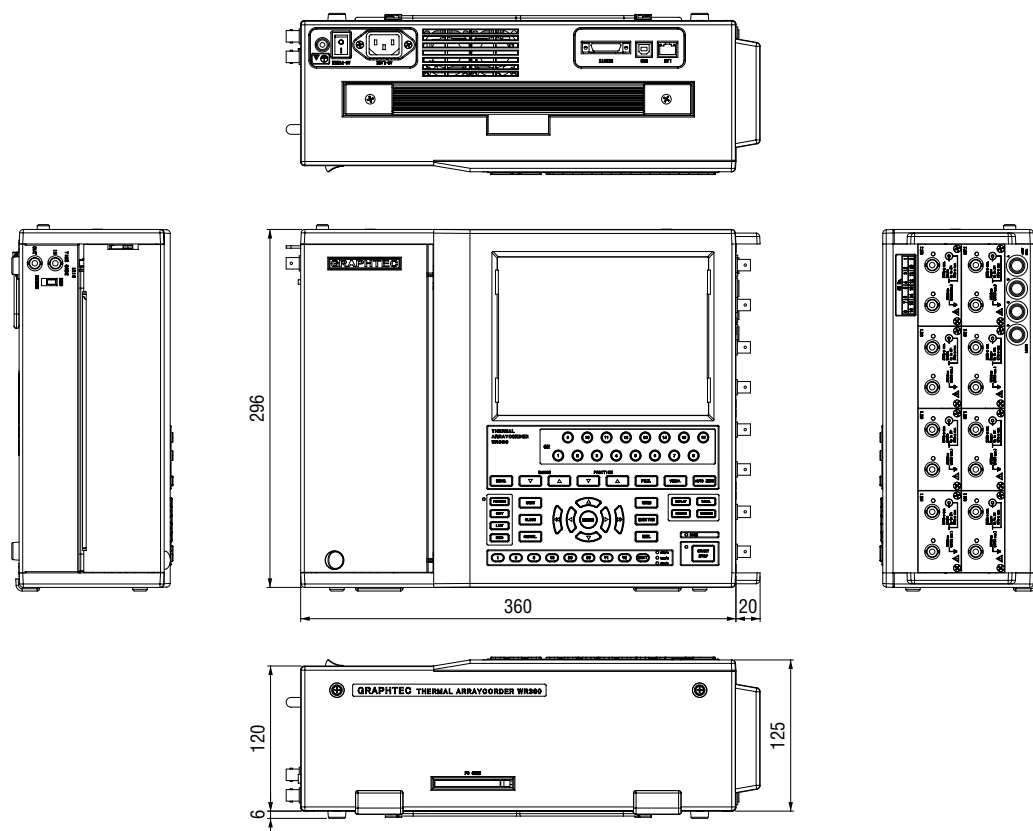
Accessories

Accessories	Model No.	Details
Input cable (8-cable set)	B-331	2-pin cable (banana terminal) bare tips
Input cable (16-cable set)	B-335	2-pin cable (banana terminal) bare tips
Clamp adapter (1200 A)	CM-102	
Digital clamp meter	CM-111	
Logic amplifier probe	RIC-07	
Alligator clip cable	RIC-08	
IC clip cable	RIC-09	
Probe set (Set RIC-07 to 09)	RIC-10	
Floating voltage input probe	CM-105	
Voltage conversion probe	CM-106	
Clamp meter temperature probe	RIC-110	
Line separator	CM-108	
Safety adapter	SMA-102	High-voltage BNC-to-banana conversion adapter

Supplies

Supplies	Model No.	Min. Qty.	Details
Roll paper (thermal recording paper)	PR230	5 rolls	100-mm wide, 40-m length
Z-fold paper (thermal recording paper)	PZ230	5 packs	100-mm wide, 40-m length
Roll paper (thermal recording paper)	PR231A	10 rolls	200-mm wide, 40-m length
Z-fold paper (thermal recording paper)	PZ233	5 packs	200-mm wide, 40-m length
Z-fold paper (thermal recording paper)	PZ231A	5 packs	200-mm wide, 100-m length
Head cleaner	B-368	1 set	For cleaning the thermal recording head

6.5 External Dimensions



The dimensional diagram shown above is for the WR310-16 model.

Dimensional precision: ± 5 mm
Unit: mm

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The specifications, etc., in this manual are
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