RA3100
Omniace

Instruction Manual

A&D Company, Ltd.

1WMPD4004444G

CAUTION

(1) Turn off the power when the operation is abnormal.
If it is impossible to trace the causes of an abnormal operation, please contact our sales representative.

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

(3) This manual is copyrighted with all rights reserved. This manual may not be reproduced, modified, or translated without the written permission of A&D Company, Limited. No parts of this manual may be transcribed without permission.

(4) Please let us know if there are any points that are unclear or missing in this manual.

(5) A&D Company, Limited. will not be held responsible for any damages or loss of income caused by the operation of this device or any direct, indirect, special, or inevitable damages caused by defects in the product, even if there is notice that the corresponding damages may occur. We will also not be held responsible for any third party claims of rights. At the same time, we will not be held responsible for any loss of data. We will not be held responsible for any of such points as those indicated in item (4).

© 2020 A&D Company, Limited.

- Omniace is a registered trademark of A&D Company, Limited.
- Microsoft, Windows, and Windows 10 IoT are trademarks or registered trademarks of Microsoft Corporation in the United States and other countries.
- Product names and company names in this manual are trademarks or registered trademarks of their respective owners in Japan and other countries.
- Software owned by Adobe Corporation in the United States is used based on the SIL Open Font License.

Introduction

We thank you for your purchase of our data acquisition product OMNIACE RA3100 (hereinafter "the RA3100" or "this product"). This instruction manual explains cautions and methods for handling the RA3100 and its optional input modules. Please read this manual before operating this instrument. If you encounter any problems in the manual, please contact our company.



<Instruction manual on CD>

Manual	Contents
RA3100 Instruction Manual	This manual Explains how to handle and configure the RA3100.

Examining Contents in Package

When Opening Package

When opening the package in a warm room during the cold season, open the package after it has reached room temperature to avoid any operational failure due to condensation on the surface of this product.

Examining Contents in Package

This instrument is delivered after a thorough examination at the factory prior to shipment. However, please examine this product's condition and verify that no obvious shipping damage has occurred after opening the package. Also, examine the specifications of the input units and accessories. If there are any missing or damaged items, please contact our sales representative.

<Contents of RA3100 Package>

Name	Model/document number	Quantity	Remarks
Omniace main unit	RA3100	1	AC 100 V to 240 V
Simple Instruction Manual	1WMPD4004445	1	Describes cautions on use and operation methods
Instruction Manual CD-ROM	1WMEK4010464	1	Includes the RA3100 Instruction Manual
AC power cable		1	The cable selected at ordering this product.
Thermal recording paper	YPS-106	1 roll	30 m roll recording paper (5 rolls per box)
Recording paper holder	5633-1794	2	Recording paper both edges x 1 each

<Contents in Module Package>

Name	Model/document number	Quantity	Remarks
2ch Voltage Module	RA30-101	Any one module	
4ch Voltage Module	RA30-102		
2ch High Speed Voltage Module	RA30-103		
2ch AC Strain Module	RA30-104		
16ch Logic Module	RA30-105		
2ch Temperature Module	RA30-106		Two sensor connector sets included
2ch High Voltage Module	RA30-107		
2ch Frequency Module	RA30-108		
2ch Acceleration Module	RA30-109		
Remote control module	RA30-112		
4ch Voltage Module	RA30-113		
"Before Using This Product"	1WMPD4004140		

To Safely Use Products

Safety Measures - Warnings and Cautions

- This product is designed and tested to conform to the EN61010 standard.
- This product is manufactured with safety in mind. However, accidents may occur due to misuse by the user. To avoid such accidents, read this manual carefully before use. Observe the following warning and cautions when using this product. The following statements are used in this manual to call the readers' attention.
- Be sure to observe the following instructions when using this product. The warranty does not cover damages resulting from the actions against instructions, cautions, or warnings mentioned in this manual. Besides, there are a lot of actions that are "cannot" and "do not". It is impossible to write all such descriptions in this manual. Accordingly, assume any actions to be "impossible" except the actions explicitly described as "possible".

Meaning of Warning Signs

⚠WARNING	This indicates a condition or practice that could result in personal injury or loss of life, or may result in light injury or physical damage if this equipment is misused due to neglect of a Warning.
⚠CAUTION	This indicates a condition or practice that could result in light injury or damage to the equipment or other property if this equipment is misused due to neglect of a Caution.

Meaning of Symbols

	△ symbols indicate cautions (including warnings). Specific precautions are indicated inside figures (in the example on the left, a warning about electrocution).
	⃠ symbols indicate prohibited actions. Specific prohibited actions are indicated inside ⃠ or with nearby text or pictures. The example on the left indicates that disassembly is prohibited.
	● symbols indicate actions that must be taken. Specific actions that must be taken are indicated inside ● or with nearby text or pictures. The example on the left indicates an action that must be taken.

⚠WARNING

Power

- Make sure that the power supply is within the rating indicated on the rating plate attached to this product.
  If any voltage exceeding the rated voltage was supplied, there would be risk of damage to this product, or even a fire. Also, in order to prevent electric shock and hazards such as a fire, be sure to use only the AC power cable supplied with this product.

⚠WARNING

Protective Grounding

- ❑ Be sure to ground this product before supplying power. Grounding is necessary to use this product safely, as well as to protect the user and peripheral equipment from injury or damage. Be sure to observe the following instructions:
- ❑ The AC power cable included with this product contains a ground lead. Connect the power cable into only a 3-pin AC outlet with a ground pole.
- ❑ When grounding, do not connect the grounding lead to a water pipe, as water pipes are not necessarily conductive to the earth. Never connect the ground lead to a gas pipe either, as it is extremely dangerous.
- ❑ While the power is supplied to this product, do not cut or remove the protective grounding line. Otherwise, safety of this product is not guaranteed.

Overvoltage Category (Installation Category)

- ❑ This product's Overvoltage Category is Category II. Do not use this product with higher categories, as connecting it to the line of a distribution board, etc. (CAT III) or the lead-in wire of a main power line (CAT IV) may lead to device failure.

Measurement Category

- ❑ The measurement input terminal Measurement Category of this product differs according to the installed modules.
  Use this product for measurement within the Measurement Category that meets the module specifications. Do not use it with a Measurement Category that exceeds the module specifications.

Connection of Input Signals

- ❑ Be sure to ground the grounding terminal of this product before connecting to the measurement target. Also, when connecting this product to another measurement instrument, be careful not to exceed the maximum allowable common mode input voltage range.
  A voltage exceeding the range can cause damage to this product.

Use in Gaseous Atmosphere

- ❑ Never use this product in a flammable or explosive atmosphere, or an atmosphere containing steam. Use in such atmosphere will result in danger to users and this product.

Disassembling the Frame

- ❑ It is dangerous to remove the frame of this product due to the high-voltage parts inside.
  The frame must not be removed from this product other than by our service engineers.

Fuse at AC Power Supply Block

- ❑ The fuse for this product cannot be replaced by the customer because it is located inside the main unit. Please contact our sales representative if the fuse may be blown.

Handling of Back-up Battery (Cautions when Disposing)

- ❑ This product includes a coin-type lithium battery (primary cell).
- ❑ When disposing of this product, please contact an A&D sales representative or distributor (see the end of this document for details).

⚠CAUTION

Caution in Handling

When using this product, always follow the precautions below. Improper handling may lead to erroneous operations and damages.

- ❑ Users who are not familiar with the operation of this product should avoid using it.
- ❑ Use this product at locations that satisfy the overvoltage requirement, the Category II (CAT II) of the safety standard for electrical measurement instruments in EN61010-1.
- ❑ This product has a Pollution Degree of 2.
- ❑ This product is a Class A product for industrial environments.
  Use in household environments may cause electromagnetic interference. In such cases, the user must implement appropriate countermeasures.
- ❑ Store this product in the following storage environments. Avoid storing in places where the temperature could rise over the storage temperature and where there is direct sunlight exposure such as inside an automobile.
  Storage temperature range: -20 to 60°C Storage humidity range: 20 to 85% RH (without condensation)
- ❑ Use this product in the following operating environments.
  Operating temperature range: 0 to 40°C Operating humidity range: 35 to 85% RH (without condensation)
- ❑ Do not use this product at the following locations. In addition, carefully check the environment when using this product.
  - ■ Locations where the temperature and humidity rise due to direct sunlight or heaters
  - ■ Wet locations
  - ■ Locations where salt, oil, or corrosive gases exist
  - ■ Dusty locations
  - ■ Locations subject to strong vibrations
  - ■ Locations with a strong electromagnetic field
  - ■ This product is provided with ventilation openings in order to prevent overheating.
    Ensure that the ventilation openings remain unobstructed by covers or materials. Otherwise, the internal temperature of this product rises, causing malfunctions.
  - ■ Do not place highly combustible objects such as paper near this product.
- ❑ Be careful of power voltage fluctuations. Do not use this product when these are likely to exceed the rated voltage.
- ❑ If the power supply includes a lot of noise or high-voltage inductive noise, use noise filters to avoid operation errors.
- ❑ A solid-state drive is installed in this product.
  Please don’t power off during normal operation of the SSD (while data is being saved/read), due to the risk of data destruction.

⚠CAUTION

- This product uses an electrostatic capacitive touch panel.
  Press the touch panel gently with your bare fingertip. The touch screen may not react if you are wearing gloves. Also do not use a sharp object or push with higher pressure than necessary. Pressing three or more locations at once may cause misoperations. Be sure to press only one location when making a selection or two locations with pinching in/pinching out.
- LCD display
  This product has a TFT color LCD for display. There may be cases where the light of pixels does not come on or off in the LCD. In addition, the LCD includes unevenness slightly due to temperature changes. Please be aware that these cases are not disorders.
- Use the chart recording paper specified by A&D. Use of a chart that is not recommended may cause failure in printing or shorten the life of the thermal head.
- Recording straight line waveforms or waveforms in solid black in the same position for an extended period of time may shorten the life of the elements in that part of the thermal head. It is recommended that the waveform recording position is occasionally changed.
- Printing a waveform in solid black for an extended period of time causes printing waste of the recording paper to remain in the thermal head, and may prevent printing. Periodically clean the thermal head.
- When storing this product for an extended period of time, the recording paper feeding platen may become deformed if the printer cover is locked and cause printing irregularities, but this does not indicate product failure.
- When storing recording paper for an extended period of time before recording, remove the recording paper from the main unit and insert it in a plastic bag, or as-is if it is still in its original packaging, and then store it in a dark location with a temperature of 25°C or less and humidity of 70% RH or less.
- When storing recording paper for an extended period of time after recording, file it in a dark location with a temperature of 25°C or less and humidity of 70% RH or less. When using a file folder, make sure that it is made of a material that does not include plasticizer (such as polyethylene or polypropylene).
- If the recording paper touches the following materials or products, the printing surface may change color, lose color, or exhibit otherwise poor color performance.
  Vinyl chloride products, organic compounds, adhesive tape, pencil eraser, rubber mats, magic markers, felt-tip pens, correction fluid, carbon, diazo photosensitive paper, hand cream, hairdressing products, cosmetic products, or leather products such as a wallet
- Do not insert a pointed or sharp object into the ventilation openings of this product.
- To clean this product, first turn off the power, place it in a well-ventilated location, and wipe this product using soft cloth moistened with ethanol. Do not use benzene, petroleum solvents, or chemically treated cloths, as they can cause deformation or discoloration.
- When transporting this product, use the package and packaging material supplied at factory shipment, or use a package and packaging material more shock-resistant than those supplied.
- We recommend a periodical calibration to maintain the accuracy of the input units. More reliable measurements are possible by calibrating the input units once a year (extra cost option).

⚠CAUTION

Windows 10 IoT

This product adopts Windows 10 IoT as its operating system. Please read and understand the following instructions carefully before use.

- License

  The Windows 10 IoT operating system used in this product is provided with a license for embedded use only.
  This product cannot function as a general purpose PC, and it is limited exclusively for RA3100 use.
  The embedded system of this product is not allowed to be duplicated and used.

- Power on/off

  This product enters the standby state when the AC power cable is connected, where it consumes a tiny amount of standby power. When the Power switch on the panel is pressed, the main power starts and this product enters the monitoring state.
  When turning off the power, confirm that the internal SSD of this product is not being accessed.
  When the Power switch is pressed, the [Shutdown] screen is displayed. Tap【Yes】to shutdown this product. Directly removing the power cable to turn off the power may damage the data on the SSD and make the SSD unable to be used.
  When this product will not be used for an extended period of time, remove the power cable after the shutdown process is complete.

- Use on a Network

  Please consult your network administrator to make sure that other tasks are not affected by connecting this product to the network.

- Computer Viruses

  This product does not include any virus search or removal software other than the standard Windows functions, in order to ensure it maintains adequate performance. Take care when connecting this product to a network or external media.

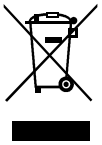
- Other

  We do not assume any responsibility or provide support for malfunctions if programs that are not provided by us are installed into the system, the operating system settings are changed, or programs are forcibly terminated via an input device such as a keyboard or mouse.

Disposing of the Used Product

In the European Union

EU-wide legislation as implemented in each Member State requires that used electrical and electronic products carrying the mark (right) must be disposed of separately from normal household waste. This includes electrical accessories, such as chargers or AC adapters.
The mark on the electrical and electronic products only applies to the current European Union Member States.



Outside the European Union

If you wish to dispose of used electrical and electronic products outside the European Union, please contact your local authority and ask for the correct method of disposal.

FCC Compliance Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Symbols in This Manual

Terms and symbols used in this manual denote as follows.

⚠**WARNING**	This indicates a condition or practice that could result in personal injury or loss of life, or may result in light injury or physical damage if this equipment is misused due to neglect of a Warning.
⚠**CAUTION**	This indicates a condition or practice that could result in light injury or damage to the equipment or other property if this equipment is misused due to neglect of a Caution.
Note	This indicates a condition or practice that could result in incorrect operation or damage to data if this equipment is misused due to neglect of a Note.
Tips	This indicates measurement limitations and additional explanations.
☞	Reference page
	A tap is the act of lightly touching an item such as a key displayed on the screen with a finger. Example Used for selecting or setting screen keys.
	A swipe is the act of pressing the screen with a finger and moving it in a specific direction. Example Used on screens such as the [Thumbnail] screen and [Channel Setup] screen.
	A pinch in is the act of touching the screen with two fingers and moving those fingers closer to each other, and reduces the screen. Example Used to reduce the content displayed on the screen, waveform amplitude, or time axis, etc.
	A pinch out is the act of touching the screen with two fingers and moving those fingers apart from each other, and enlarges the screen. Example Used to enlarge the content displayed on the screen, waveform amplitude, or time axis, etc.
☐ key	Enclosed characters represent a key name on the operation panel. Example START key
【 】key	Text enclosed in【 】indicates touch panel keys displayed on the screen. Example【CH】key
[ ] screen	Text enclosed in [ ] indicates the text of items on the screen. Example [Module 1]
k (lower case) K (upper case)	Example 1 kg = 1000 g 1 KB = 1024 bytes

Warranty

Warranty - General

We ship our products after conducting quality control, which covers from design to manufacturing. It is, however, possible that failures may occur in this products. If this product does not operate correctly, please make a check of the power supply, cable connections, or other conditions before returning this product to us.

For repair or calibration, contact our sales agency. Before returning, be sure to inform us of the model (RA3100), serial number, and problematic points.

The following is our warranty.

Limited Warranty

1. Warranty period: One year from our shipment.
2. Warranty scope: The warranty only covers the main unit of this product.
   We will repair the defects of our product free of charge within the warranty period; however, this warranty does not apply in the following cases.
   - ❑ Damage or faults caused by incorrect use
   - ❑ Damage or faults caused by fire, earthquake, traffic accident, or other natural disasters
   - ❑ Damage or faults caused by a repair or modification that is carried out by someone other than a service representative of A&D
   - ❑ Damage or faults caused by use or storage in environmental conditions that should be avoided
   - ❑ Periodical calibration
   - ❑ Damage or faults caused during transportation.
   - ❑ The thermal printing head may not be covered by the warranty even within the warranty period, depending on the usage conditions.
     Usage conditions: 30 million printing pulses or more or recording length 30 km or longer
   - ❑ The internal SSD, fan, and backup coin-type battery are treated as consumables and not covered by the warranty.
   - ❑ Data recorded on the SSD and external media is not covered by the warranty, regardless of the cause and type of product failure. Make sure to back up your recorded data.
3. Liability: We do not assume any liability for equipment other than A&D equipment.

CONTENTS

INTRODUCTION 3
EXAMINING CONTENTS IN PACKAGE 4
TO SAFELY USE PRODUCTS 5
DISPOSING OF THE USED PRODUCT 9
FCC COMPLIANCE INFORMATION 10
SYMBOLS IN THIS MANUAL 11
WARRANTY 12
1. NAME AND FUNCTION OF EACH BLOCK 21
1.1. Name of Each Block 21
1.2. Display Block 23
1.3. Operation Panel 24
1.4. Screen and Setup Menu 27
1.4.1. Waveform Monitor 27
1.4.2. Side menu 28
1.4.3. Control Bar 29
1.4.4. Sub Menu 31
1.4.5. Graph Scale 32
1.5. Screen Input Operations 33
1.5.1. Rotary Knob 33
1.5.2. Numeric Value Input Dialog 33
1.5.3. Selection Palette Dialog 34
1.5.4. Software Keyboard 34
2. PRE-MEASUREMENT PROCEDURES 35
2.1. Before Switching On the Power 35
2.1.1. Installation and Usage Environment 35
2.1.2. Installing Optional Modules 37
2.1.3. Paper Loading 38
2.1.4. Connecting an External Device 42
2.2. Turning the Power On/Off 43
2.2.1. Connecting the AC Power Cable 43
2.2.2. Turning On the Power 43
2.2.3. Confirming Normal Startup 44
2.2.4. Setup Date and Time 44
2.2.5. Preparing for More Precise Measurements 44
2.2.6. Turning Off the Power 44
3. FLOW OF MEASUREMENT 45
3.1. Flow of Measurement 45
4. CONFIGURING MEASUREMENT 46
4.1. Selecting the Measurement Mode 46
4.1.1. Characteristics 46
4.1.2. Comparison of Measurement Mode Functions 46

4.1.3. Selection Method 47
4.2. Connecting the Input Cable 48
4.3. Setting the Input Channel 50
4.3.1. Channel setup sub menu (for RA30-101) 50
4.3.2. Setup the input channels 51
4.3.3. Batch Execution 56
4.3.4. Digital Display 57
4.3.4.1. Customization 58
4.3.4.2. Configuration Method 59
4.4. Selecting the Recording Method 61
4.4.1. Recording to Recording Paper Only 61
4.4.2. Recording to a File and Recording Paper 61
4.5. Recording Devices 62
4.5.1. Features of Recording Devices 62
4.5.2. Setup the Sampling Speed 63
4.5.3. Chart Speed 64
4.5.4. Maximum Recordable Times 65
4.5.4.1. Recording Device: PRINTER (Data Format: P-P) 65
4.5.4.2. Recording Device: SSD (Data Format: NORMAL) 66
4.5.4.3. Recording Device: SSD (Data Format: P-P) 67
4.5.4.4. Recording Device: MEMORY (Data Format: NORMAL) 68

5. TRIGGER SETUP 69
5.1. Trigger Types 69
5.2. Memory trigger 69
5.2.1. Memory Trigger Setup 69
5.3. Pre-Trigger 72
5.3.1. Pre-Trigger Setup 72
5.4. Start Trigger 73
5.4.1. Start Trigger Setup 73
5.5. Stop Trigger 74
5.5.1. Stop Trigger Setup 74

6. MEASURING INPUT SIGNALS 75
6.1. State Transition of Main Unit Operation 75
6.2. Waveform Monitor 76
6.2.1. Selecting the Recording Device 76
6.2.2. Sampling speed 77
6.2.3. Pausing the Waveform Monitor (PAUSE) 77
6.2.4. Cursors 78
6.2.5. X-Y Waveform and FFT Analysis 80
6.2.6. Trigger Synchronization 81
6.3. Pen Recording 82
6.3.1. Pen Recording 82
6.3.2. Pen Recording Operations 82
6.3.3. Waveform Printing 83
6.4. Recording 84
6.4.1. Recording Setup 84
6.4.2. Starting and Ending Recording 98

6.4.3. Scrolling Back during Recording 99
7. PLAYBACK RECORDED DATA 100
7.1. Select Recorded Data 100
7.2. Playback Screen 102
7.2.1. Selecting the Recording Device 102
7.2.2. Zooming In/Out during Playback 103
7.2.3. Thumbnails 104
7.2.4. Cursor 106
7.2.5. Printing Out 108
7.2.6. Selecting a Memory Block 109
7.2.7. Changing Settings during Playback 110
7.3. X-Y Waveform 111
7.3.1. X-Y Display Setup 111
7.3.2. X-Y Control 112
7.4. FFT Analysis 113
7.5. Search Function 115
7.5.1. Search Types and Operations 115
7.5.2. Search Method Types and Settings 117
7.5.3. Peak Value Search (MIN-MAX) 120
7.5.4. Peak Value Search (Maximum/Minimum) 120
7.5.5. Peak Value Search (Local Maximum/Local Minimum) 120
7.5.6. Level Search (LEVEL UP/LEVEL DOWN) 123
7.5.7. Window Search (INTO WIN/OUT WIN) 126
7.5.8. Logic Search 129
7.5.9. Trigger Search 130
7.5.10. Mark Search 130
7.5.11. Min. - Max. List 131
7.5.12. Min. - Max. Side Menu 132
7.5.13. Search Display Menu 133
7.6. Jump Function 134
7.6.1. Jump Types and Operations 134
7.6.2. Jump Condition Types and Settings 135
7.6.3. Data beginning, center, end 136
7.6.4. Date Setup 136
7.6.5. Time Setup 137
7.6.6. POINT(samples) 137
7.6.7. Cursor 138
7.7. Statistical Calculation 139
7.7.1. Statistical Calculation 139
7.7.2. CSV Output of Statistical Calculation Results 142
7.7.3. Methodology for Statistical Calculation 143
7.8. CSV Output 145
7.9. PDF Output 147
8. SETUP DETAILS 149
8.1. Create a config file 150
8.2. Recording Setup 151
8.2.1. Recording 151

8.2.2. Channel List 152
8.2.2.1. Common Setup 153
8.2.2.2. Conversion (Physical Quantity Conversion) 154
8.2.2.3. Sheet 155
8.2.2.4. Setup Unique to Module Types 155
8.2.3. Sheet Setup 156
8.2.3.1. Graph 156
8.2.3.2. SHEET1/ SHEET2/ SHEET3 158
8.2.4. Printer 160
8.2.4.1. Printing Setup 160
8.2.4.2. Header, Annotations, and Footer (Text to Print) 163
8.2.5. Other 169
8.3. Main Unit Setup 171
8.3.1. Environment Setup 171
8.3.2. Communication Setup 173
8.3.2.1. Communication 173
8.3.2.2. Data transfer 179
8.3.3. Display Setup 181
8.3.4. Other 182
8.3.4.1. CSV Format 182
8.3.4.2. Other 183
8.4. Management 184
8.4.1. File Management 184
8.4.1.1. Record 184
8.4.1.2. Image 189
8.4.1.3. Config 191
8.4.1.4. CSV 194
8.4.1.5. PDF 197
8.4.2. Maintenance 200
8.4.3. Operation History 203
8.4.4. Version Management 204
9. USING OPTIONAL MODULES 205
9.1. 2ch Voltage Module (RA30-101) 205
9.1.1. Overview 205
9.1.2. Setting the Input Channel 205
9.1.3. Measurement Setup 206
9.1.4. Reference Materials 208
9.2. 4ch Voltage Module (RA30-102) 209
9.2.1. Overview 209
9.2.2. Setting the Input Channel 209
9.2.3. Measurement Setup 210
9.2.4. Reference Materials 212
9.3. 2ch High Speed Voltage Module (RA30-103) 213
9.3.1. Overview 213
9.3.2. Setting the Input Channel 213
9.3.3. Measurement Setup 214
9.3.4. Reference Materials 216
9.4. 2ch AC Strain Module (RA30-104) 217

9.4.1. Overview....217
9.4.2. Connection Method....217
9.4.3. Setting the Input Channel....218
9.4.4. Measurement Setup....220
9.4.5. Reference Materials....222
9.5. 16ch Logic Module (RA30-105)....232
9.5.1. Overview....232
9.5.2. Setting the Input Channel....232
9.5.3. Measurement Setup....235
9.5.4. Reference Materials....236
9.5.5. Options....238
9.6. 2ch Temperature Module (RA30-106)....242
9.6.1. Overview....242
9.6.2. Setting the Input Channel....242
9.6.3. Measurement Setup....243
9.6.4. Reference Materials....245
9.6.5. Spare Parts....249
9.7. 2ch High Voltage Module (RA30-107)....250
9.7.1. Overview....250
9.7.2. Setting the Input Channel....250
9.7.3. Measurement Setup....251
9.7.4. Reference Materials....253
9.8. 2ch Frequency Module (RA30-108)....254
9.8.1. Overview....254
9.8.2. Relationship between Channels and Settings....254
9.8.3. Setting the Input Voltage and Measurement Mode....255
9.8.4. Measurement Setup....256
9.8.4.1. Setting the Input Voltage....256
9.8.4.2. Setting the Measurement Mode....258
9.8.5. Reference Materials....266
9.9. 2ch Acceleration Module (RA30-109)....267
9.9.1. Overview....267
9.9.2. Setting the Input Channel....267
9.9.3. Measurement Setup....268
9.9.4. Cables....272
9.9.4.1. Installing the Included Ferrite Core....272
9.9.5. Reference Materials....273
9.10. Remote Control Module (RA30-112)....276
9.10.1. Overview....276
9.10.2. Installation....276
9.10.3. Channel setting....277
9.10.4. Output terminal for waveform confirmation....278
9.10.5. Measurement Setup....278
9.10.6. Reference Materials....279
9.10.7. Options....284
9.11. 4ch Voltage Module (RA30-113)....288
9.11.1. Overview....288
9.11.2. Setting the Input Channel....288

9.11.3. Measurement Setup 289
9.11.4. Reference Materials 291
10. APPENDIX 292
10.1. Version Information 292
10.2. Sampling Data Format 293
10.2.1. NORMAL Sampling 293
10.2.2. P-P Sampling 293
10.3. Sampling 294
10.3.1. Internal Sampling 294
10.3.2. External Sampling 294
10.3.3. Relationship between Sampling Speed and Chart Speed 294
10.4. Scale Conversion (Physical Quantity Conversion) 295
10.5. Wave Inversion 296
10.5.1. Use in Conjunction with Scale Conversion 296
10.6. FFT Analysis 297
10.6.1. Analysis Function 297
10.6.2. AVG process 300
10.6.3. Units of Analysis Results 302
10.7. Connecting to This Product via a Web Browser 303
10.7.1. Computer System Requirements 303
10.7.2. Preparations 303
10.7.3. Connection Method 303
10.7.4. Remote Screen 304
10.7.5. Info Screen 305
10.7.6. Remotely Operating the RA3100 from a Web Browser 306
10.7.7. Switching the Web Browser Display Language 307
10.8. Downloading the Data of this Product via FTP 308
10.8.1. Preparations 308
10.8.2. Download Method 308
10.9. Transferring Data 309
10.9.1. Procedure 309
10.9.2. Sampling Data 310
10.9.2.1. Data Format 310
10.9.3. Measurement data block 311
10.9.3.1. Measurement Data 311
10.9.3.2. Order and Data Length of Measurement Data 312
10.10. Remote Control 313
10.10.1. Starting/Stopping Recording 313
10.10.2. Starting/Stopping Pen Recording 314
10.10.3. Starting/Stopping Feeding 315
10.11. Relationship between AD Count Value and Measured Value 316
10.12. Converting AD Count Values to Physical Quantities 318
10.13. CSV Files 319
10.13.1. CSV File Format 319
10.13.2. CSV File Name 324
10.14. Delete then Save Function for Recorded Data 325
10.14.1. Operation 326
10.14.2. Maximum Recordable Time for the Delete then Save Function 327

10.14.2.1. Recording device: PRINTER (data format: P-P) 327
10.14.2.2. Recording device: SSD (data format: NORMAL) 327
10.14.2.3. Recording device: SSD (data format: P-P) 328

11. MAINTENANCE 329
11.1. Managing/Handling Recording Paper and Printer Recorded Data 329
11.1.1. Replacing Recording Paper and Monitoring Remaining Paper 329
11.1.2. Storing Recording Paper 330
11.1.3. Printer Block Errors 330
11.2. Backing Up Recorded Data 331
11.2.1. Internal SSD Errors 331
11.3. Display Cleaning 331
11.4. Thermal Head Cleaning/Life 332
11.4.1. Cleaning 332
11.4.2. Life 332
11.5. Platen Roller Maintenance 332
11.6. Power Outages 332
11.7. Battery Replacement 332
11.8. Fan Replacement 333
11.9. Cautions for Disposing This Product 333
11.10. Troubleshooting and Inspection 334

12. SPECIFICATIONS 336
12.1. General Specifications 336
12.1.1. Main Unit Basic Specifications 336
12.1.2. General Specifications 337
12.2. Functional Specifications 339
12.2.1. Measurement Function 339
12.2.2. SSD Recording 340
12.2.3. Memory Recording 340
12.2.4. Printer Recording 341
12.2.5. Pen Recording 341
12.2.6. Trigger Function 342
12.2.7. Waveform Monitor Function 343
12.2.8. Y-T waveform 344
12.2.9. X-Y Waveform 345
12.2.10. FFT Analysis 346
12.2.11. Calculation Functions 346
12.2.12. Setup/Record management 347
12.2.13. File Output 349
12.2.14. Interface Specifications 349
12.2.15. Communication Setup 350
12.2.15.1. COM 350
12.2.15.2. LAN 350
12.2.15.3. List of Network Port Numbers Used 351
12.2.16. Other Setup (Maintenance/Operation History/Version Management) 351
12.3. Module Specifications 352
12.3.1. 2ch Voltage Module (RA30-101) 352
12.3.2. 4ch Voltage Module (RA30-102) 353

12.3.3. 2ch High Speed Voltage Module (RA30-103) 354
12.3.4. 2ch AC Strain Module (RA30-104) 355
12.3.5. 16ch Logic Module (RA30-105) 356
12.3.6. 2ch Temperature Module (RA30-106) 357
12.3.7. 2ch High Voltage Module (RA30-107) 359
12.3.8. 2ch Frequency Module (RA30-108) 361
12.3.9. 2ch Acceleration Module (RA30-109) 364
12.3.10. Remote Control Module (RA30-112) 367
12.3.11. 4ch Voltage Module (RA30-113) 369
12.4. Exterior 370
12.4.1. Main Unit Exterior 370
12.4.2. 2ch Voltage Module (RA30-101) Exterior 371
12.4.3. 4ch Voltage Module (RA30-102) Exterior 372
12.4.4. 2ch High Speed Voltage Module (RA30-103) Exterior 373
12.4.5. 2ch AC Strain Module (RA30-104) Exterior 374
12.4.6. 16ch Logic Module (RA30-105) Exterior 375
12.4.7. 2ch Temperature Module (RA30-106) Exterior 376
12.4.8. 2ch High Voltage Module (RA30-107) Exterior 377
12.4.9. 2ch Frequency Module (RA30-108) Exterior 378
12.4.10. 2ch Acceleration Module (RA30-109) Exterior 379
12.4.11. Remote Control Module (RA30-112) Exterior 380
12.4.12. 4ch Voltage Module (RA30-113) Exterior 381

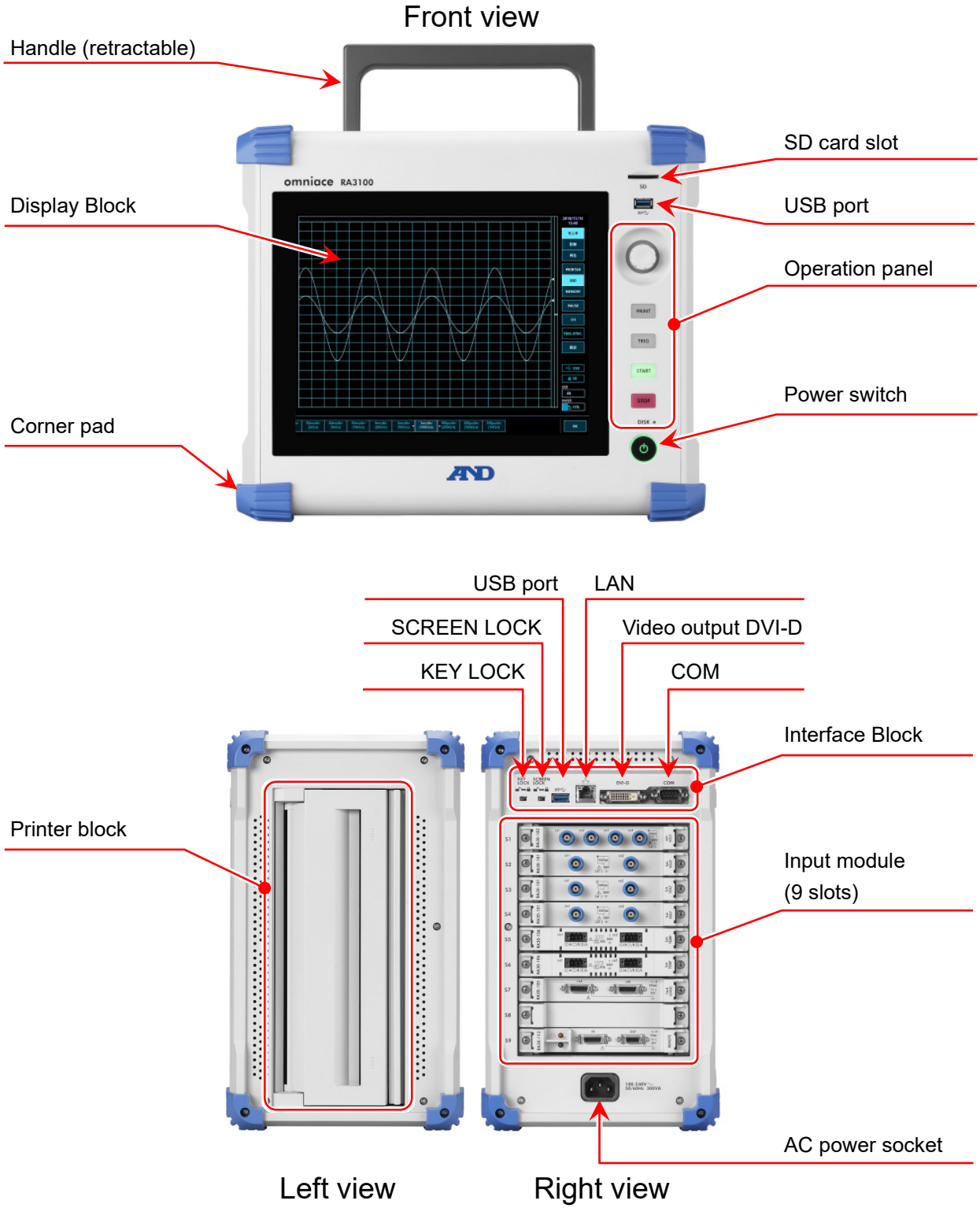
13. OPTIONS 382
13.1. List of Cables 382
13.2. List of Probes/Clamp Meters 383
13.3. Accessory 384
13.4. List of Spare Parts 384
13.5. PC Software 384

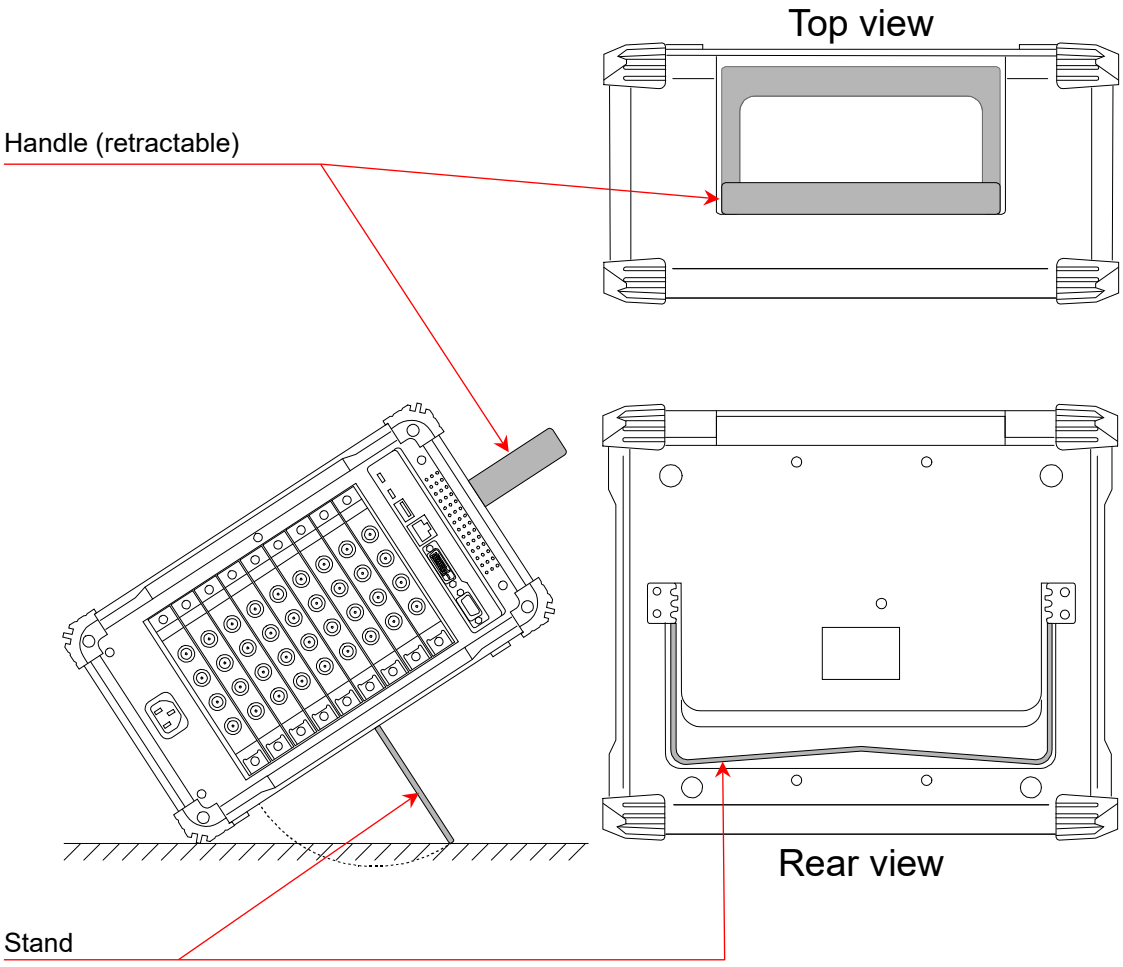
SOFTWARE LICENSE INFORMATION 385

1. Name and Function of Each Block

This product consists of the following blocks.

1.1. Name of Each Block

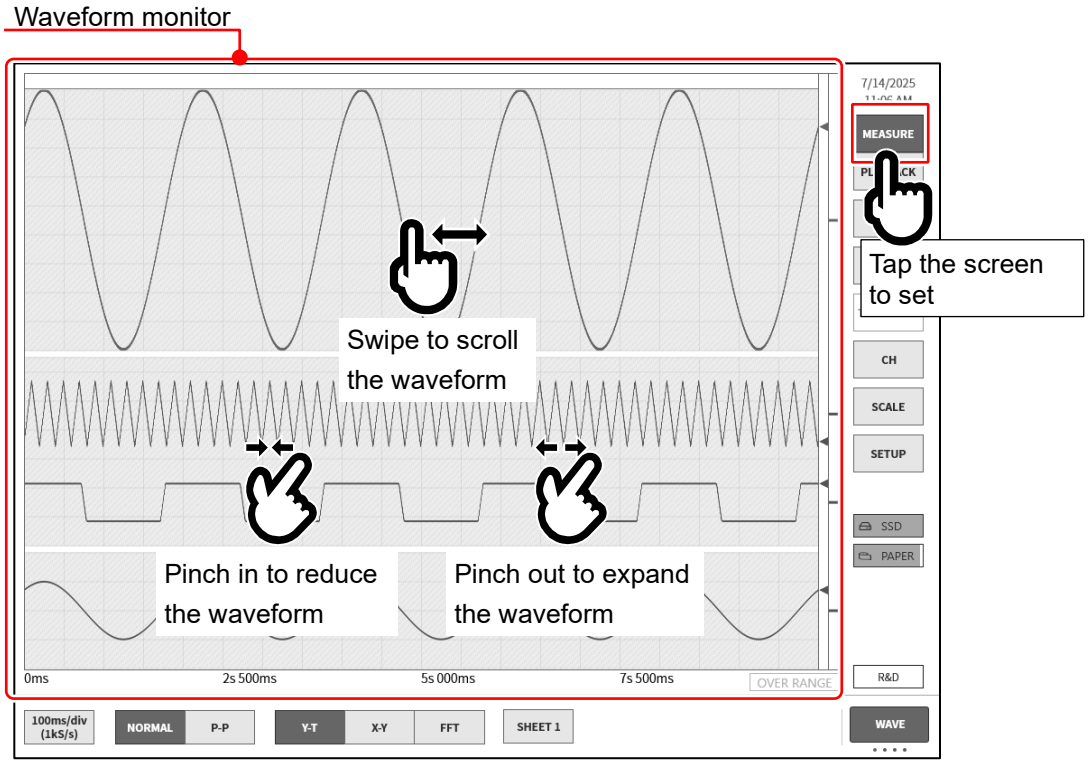



Top view
Handle (retractable)
Rear view
Stand

1.2. Display Block

This product has a TFT color LCD display with touch panel.

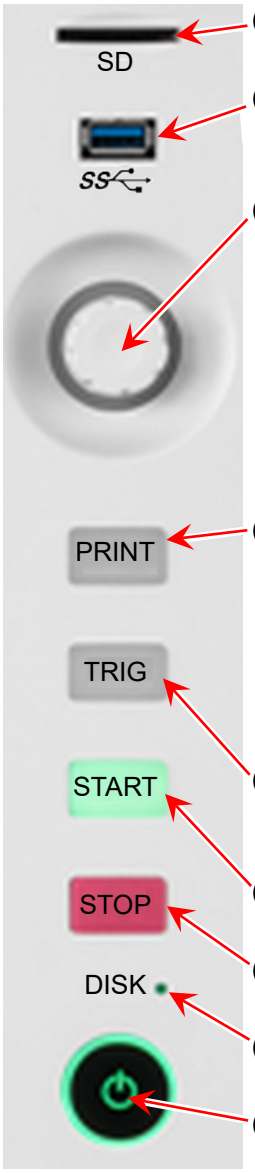
The LCD displays the waveform monitor and setup keys, and users can configure setup by directly touching the panel.



Note

❑ This product uses an electrostatic capacitive touch panel. The touch screen may not react if you are wearing gloves.

1.3. Operation Panel



(1) SD card slot
Used to save recorded data to an SD memory card, etc.

(2) USB port
Used to save recorded data to USB memory, etc. in the same manner as to an SD memory card.

(3) Rotary knob
Used to select the module ranges and setting values by turning it clockwise and counterclockwise.
When the rotary knob is enabled, the area around the knob lights in the blue color of the normal mode.
Push the rotary knob to switch the area around the knob to the orange of the fine adjustment mode.
Push it again to return the area around the knob to the blue color of the normal mode.

(4) PRINT key
Press this in the measurement state to start pen recording and again to end recording.
Press it during playback to print the waveform between cursors A and B on the monitor.
Press and hold it to print a copy of the screen (screenshot), which can be saved to the main unit or external media in the .png file format.

(5) TRIG key
Press the key to output a forced trigger.
The TRIG LED lights when a trigger is detected.

(6) START key
Starts recording.

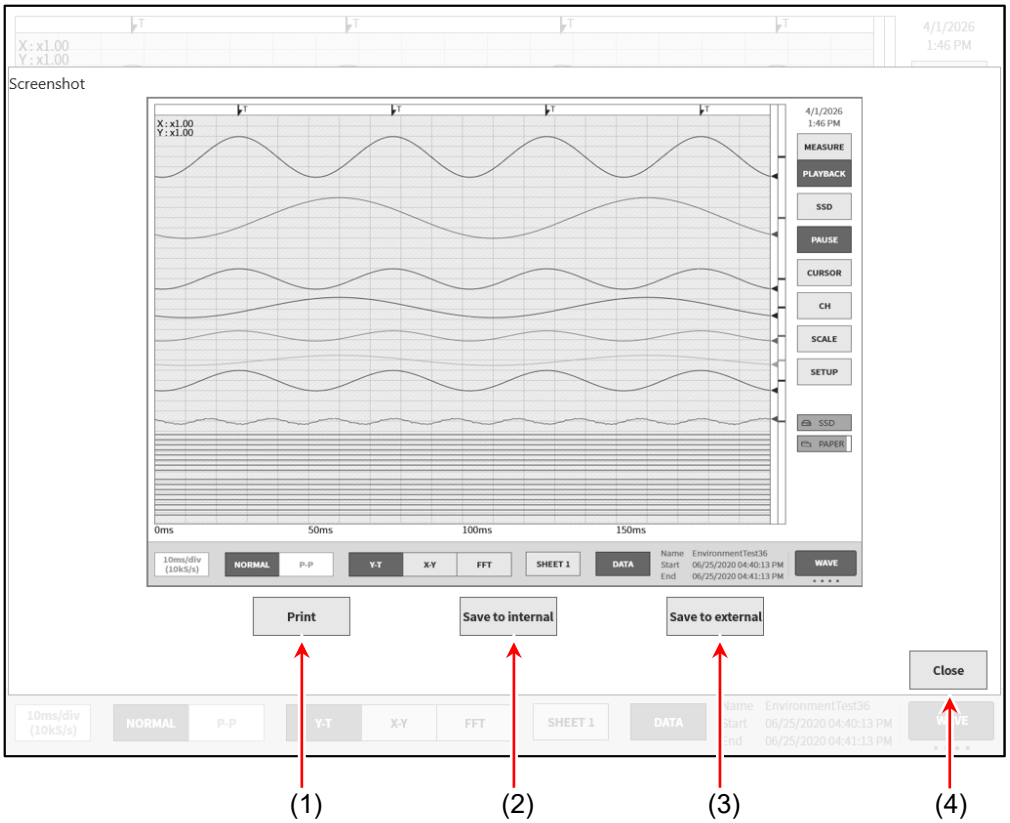
(7) STOP key
Ends recording.

(8) DISK access light
The LED lights when accessing the internal SSD (for reading or writing).

(9) Power switch
Turns the power of the main unit on/off.
The [Shutdown] screen is displayed when turning the power off. Press the【OK】key to complete the shutdown process.
If this Power switch is pressed again while the [Shutdown] screen is displayed, this product automatically shuts down.

Screenshot

You can press and hold the PRINT key to capture a screenshot image for printing or saving to a file.



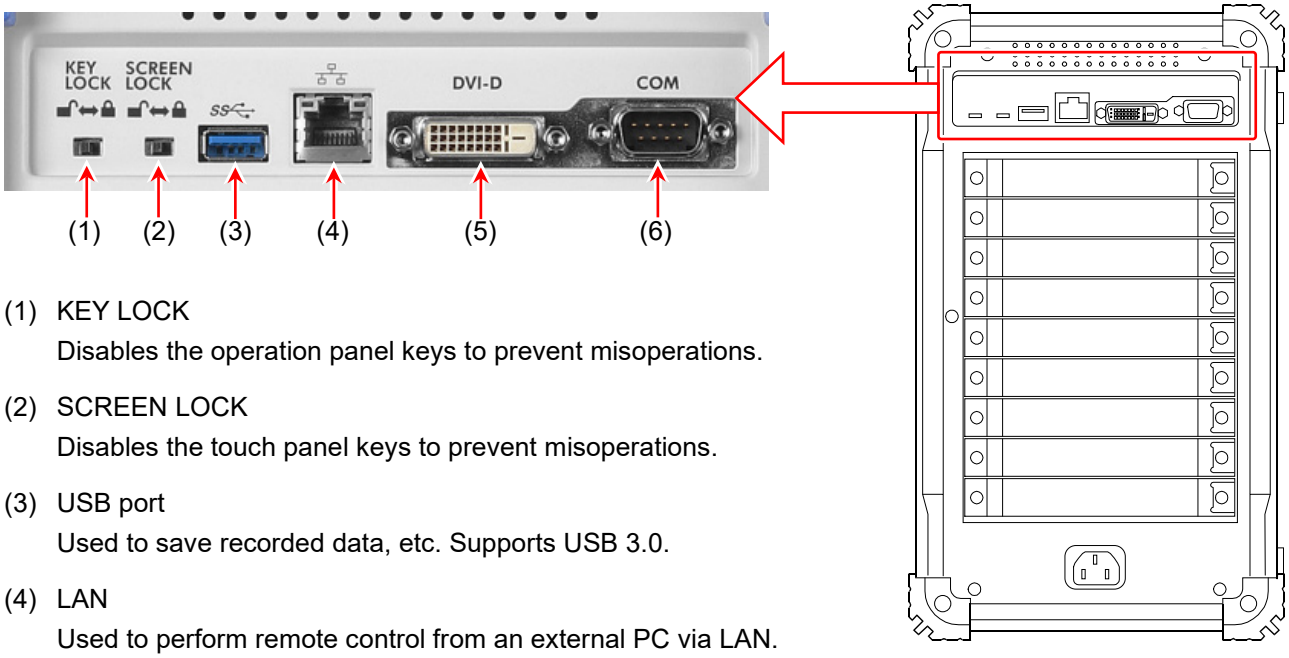
(1) Print: Prints to recording paper.

(2) Save to internal: Saves to the internal SSD.

(3) Save to external: Saves to external media (such as an SD memory card or USB stick). Tap the key to display a dialog box for selecting the external media to save to.

(4) Close： Closes the screen.

1.4. Interface Block



(1) KEY LOCK
Disables the operation panel keys to prevent misoperations.

(2) SCREEN LOCK
Disables the touch panel keys to prevent misoperations.

(3) USB port
Used to save recorded data, etc. Supports USB 3.0.

(4) LAN
Used to perform remote control from an external PC via LAN.

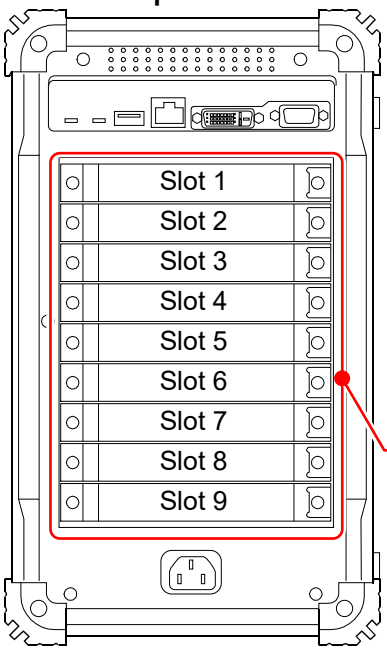
(5) DVI-D
The video output terminal.

Note

- Connect an external monitor with the power off.

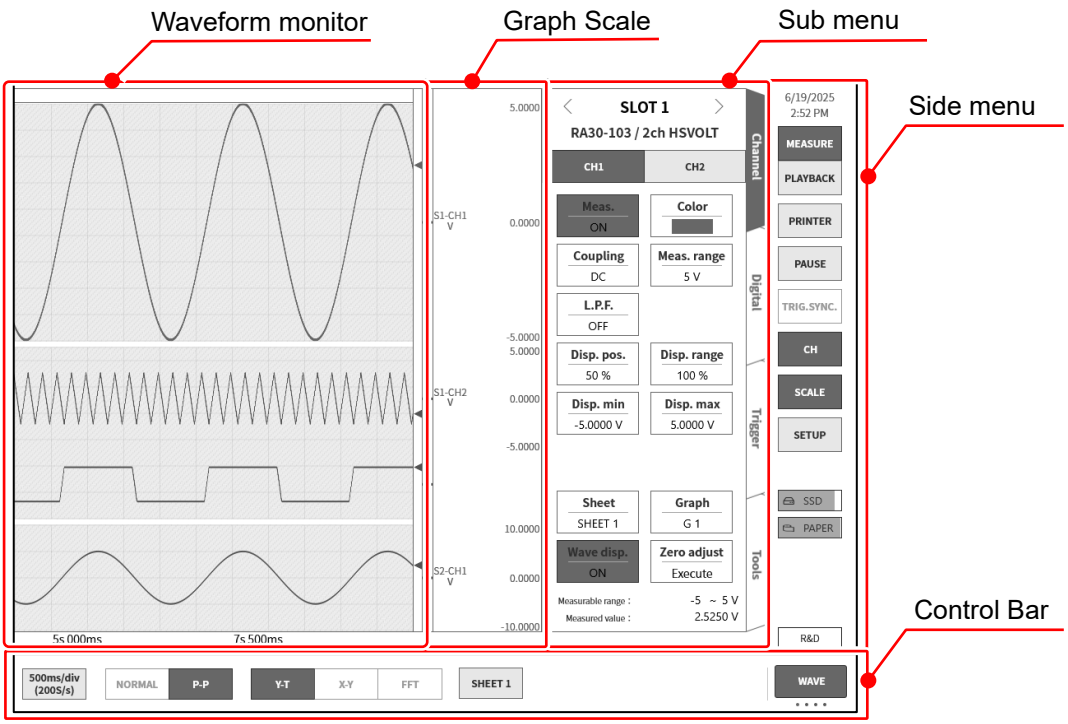
(6) COM
Used to perform remote control from an external PC via RS-232C.

1.5. Input Module Block



- Up to nine modules can be installed to the input module block of this product.
- For information on using each module, see "9. Using Optional Modules" and "12. Specifications".
- Standard signal input modules can be installed in any of Slot 1 to Slot 9.
- Select and install a module according to the target for measurement.
- The RA30-112 (remote control module) can only be installed to Slot 9.

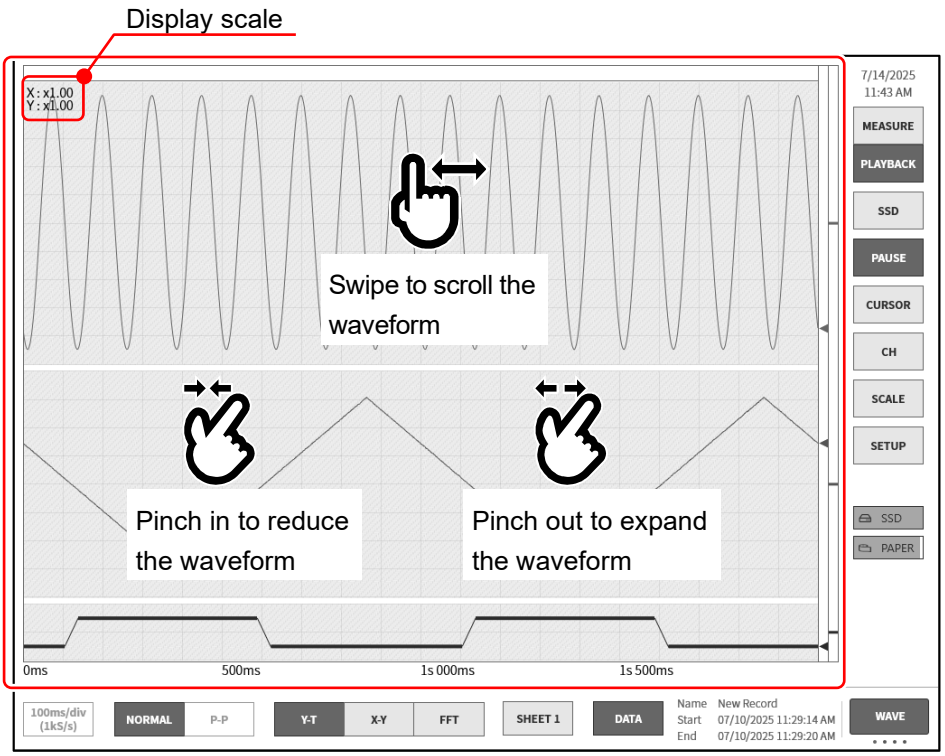
1.6. Screen and Setup Menu



1.6.1. Waveform Monitor

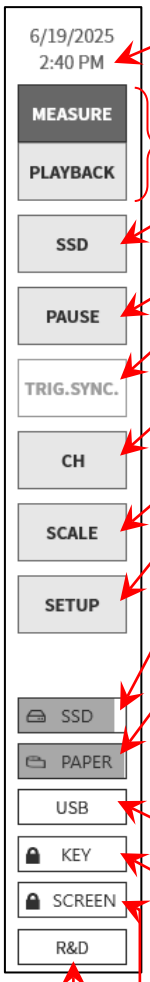
The waveform monitor displays the current input waveform or the playback waveform of recorded data. You can pinch in/out the waveform monitor during pause or playback to zoom the waveform in or out, or swipe the screen to scroll the waveform.

☞ For details, see "6.2. Waveform Monitor".



1.6.2. Side menu

The side menu provides keys for switching the displayed screen, viewing the state of the product, and opening the screen for configuring the main unit and the input modules.



(1) Time: Displays the current time

(2) MEASURE/PLAYBACK: Switches the displayed waveform

MEASURE: Displays the current input waveform.

PLAYBACK: Displays the playback waveform of recorded data.

(3) Recording device:
Select PRINTER, SSD, or MEMORY as the recording device to display.

(4) PAUSE: Pauses the waveform displayed on the waveform monitor.

(5) TRIG.SYNC: Updates the input waveform display of a memory recording by synchronizing it with a trigger.

(6) CH: Opens the sub menu to configure the channel setup, digital display, and trigger setup.

(7) SCALE: Displays or hides the graph scale.

(8) SETUP: Opens the setup menu to configure the detailed settings of this product (recording setup, main unit setup, and management).

(9) SSD: Displays the remaining space on the internal SSD. Displayed in red when the remaining capacity is at 30% or lower.

(10) PAPER: Displays the remaining amount of recording paper in the printer block. Displayed in red when the remaining recording paper capacity is at 30% or lower. Press and hold this key to initialize the recording paper type (roll paper or Z-fold paper) and usage amount. When replacing the recording paper, press and hold this key to initialize the remaining amount of recording paper.

(11) SD / USB : Displays [SD] when an SD memory card is inserted, [USB] if USB memory is inserted, or [SD / USB] if both are inserted.

(12) KEY: Displayed when the KEY LOCK switch on the side of the main unit is set to on to disable the operation panel keys.

(13)SCREEN: Displayed when the SCREEN LOCK switch on the side of the main unit is set to on to disable the display touch panel.

(14)R&D / MFG : Displays either [R&D] or [MFG], depending on the measurement mode.
For the MFG mode, the data transfer status (●, ■, □, or !) is displayed.

1.6.3. Control Bar

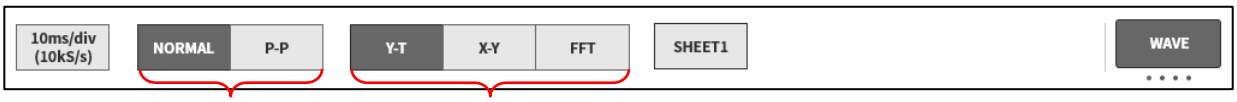
The control bar provides a menu for frequently used functions, such as waveform display control of sampling, etc., thumbnail display, cursor display, and printer operations.

Tap the (5)【Display switch】key on the right edge of the control bar to switch the functions in the order indicated below.

【WAVE】⇒【THUMBNAIL】⇒【CURSOR】⇒【PEN REC】

WAVE (waveform)

When the【MEASURE】key is selected in the side menu



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

(1) Sampling speed : Selects the sampling speed (20 MS/s to 10 S/min, EXT, or AnySpeed). The speed selection range differs according to the recording device (printer, SSD, or memory).

(2) Data format : Selects either NORMAL or P-P as the format for the recorded data. Only P-P is available for printer recording. Only NORMAL is available for memory recording.

(3) Waveform format : Selects Y-T, X-Y, or FFT as the waveform format. X-Y display and FFT analysis are only available when SSD recording is set.

(4) Sheet selection : Selects the waveform set to display on the screen.

(5) Display switch : Switches in the order【WAVE】→【THUMBNAIL】→【CURSOR】→【PEN REC】.

When the【PLAYBACK】key is selected in the side menu



(1) (2) (3) (4) (5) (6) (7)

(1) Sampling speed : Displays the sampling speed of the recorded data.

(2) Data format : Displays either NORMAL or P-P as the format for the recorded data.

(3) Waveform format : Selects Y-T, X-Y, or FFT as the waveform format. X-Y display and FFT analysis are only available when SSD recording is set.

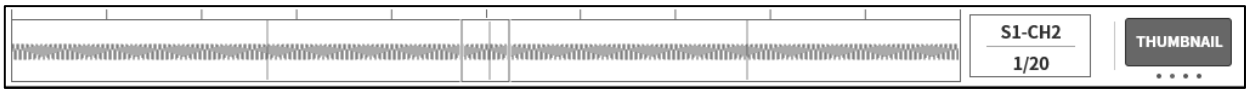
(4) Sheet selection : Selects the waveform set to display on the screen.

(5) DATA : Selects and play back recorded data.

(6) DATA information : The information of the displayed playback data.

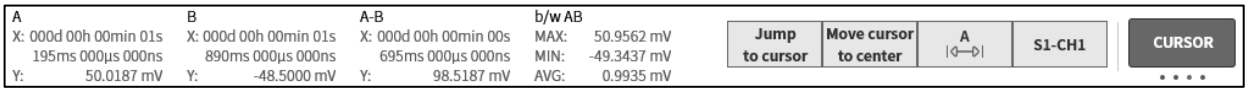
(7) Display switch : Switches the functions in the order【WAVE】→【THUMBNAIL】→【CURSOR】→【PEN REC】.

THUMBNAIL



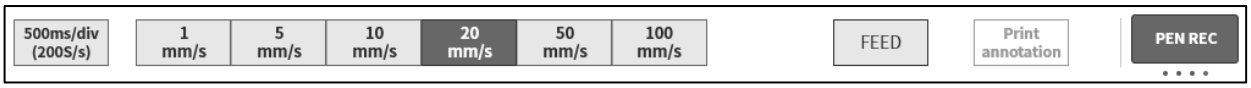
See "7.2.3. Thumbnails".

CURSOR



See "7.2.4. Cursor".

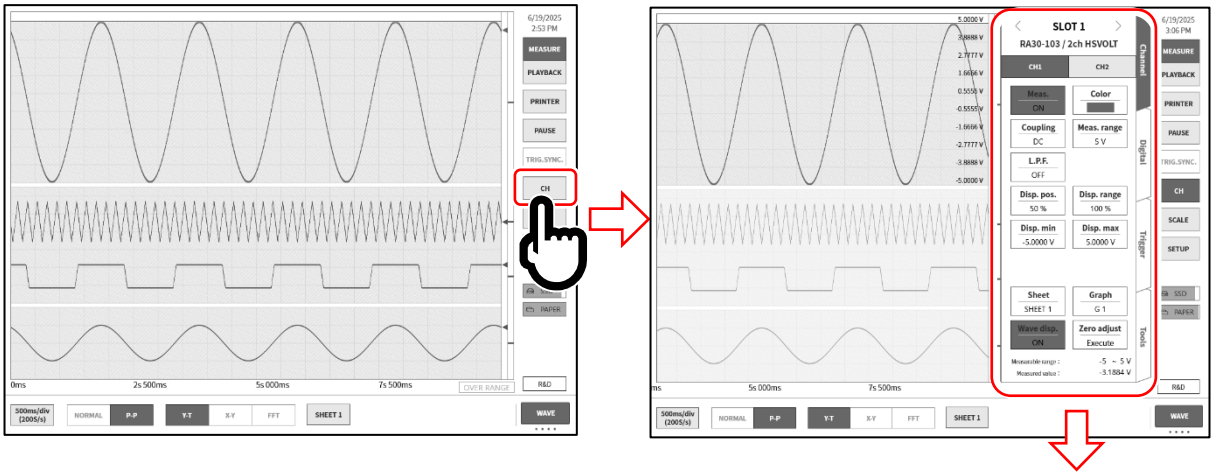
PEN REC (pen recording)

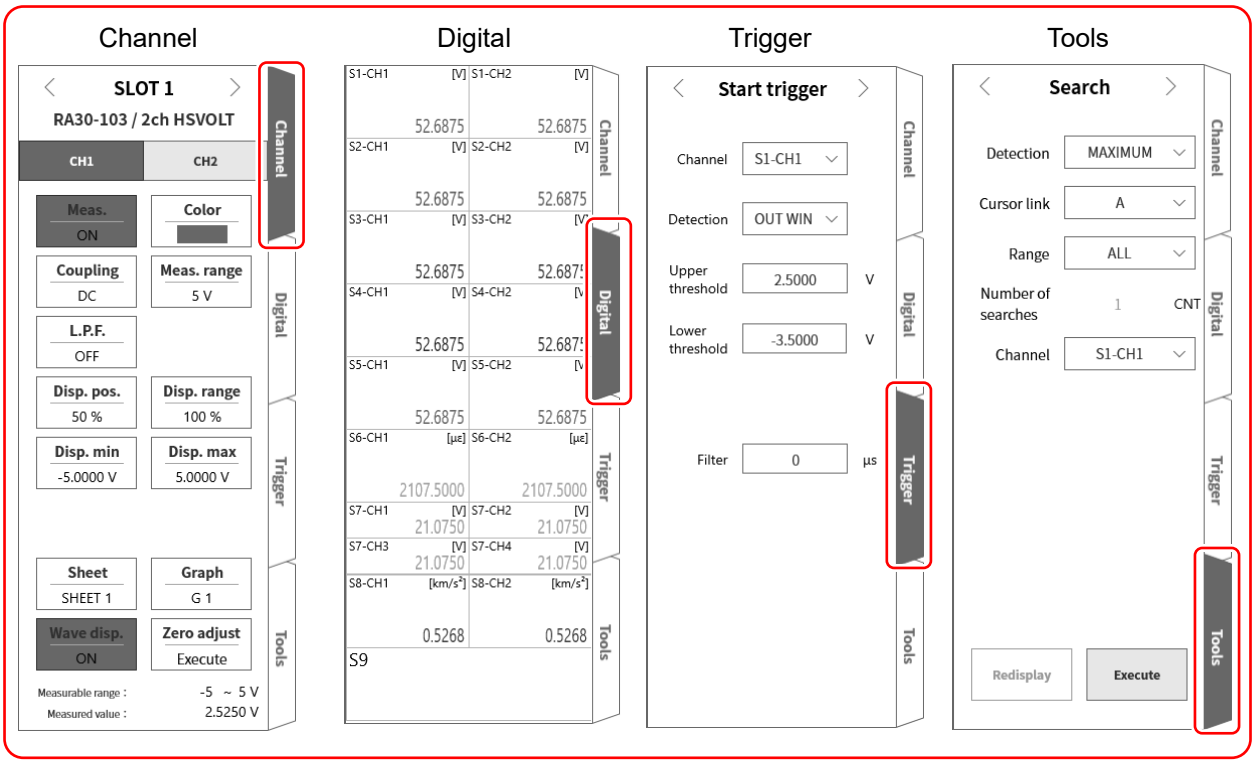


See "6.3.1. Pen Recording".

1.6.4. Sub Menu

Tap the【CH】key on the side menu to display the sub menu.
The sub menu provides a digital display, menus for configuring modules and triggers, and a search/jump function used when playing back recorded data.



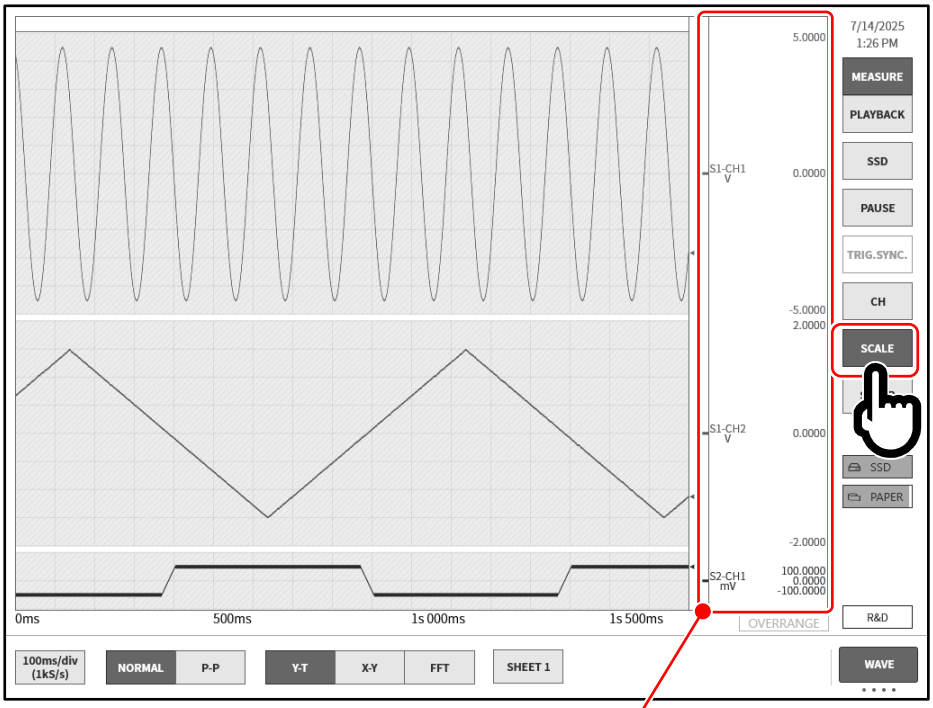


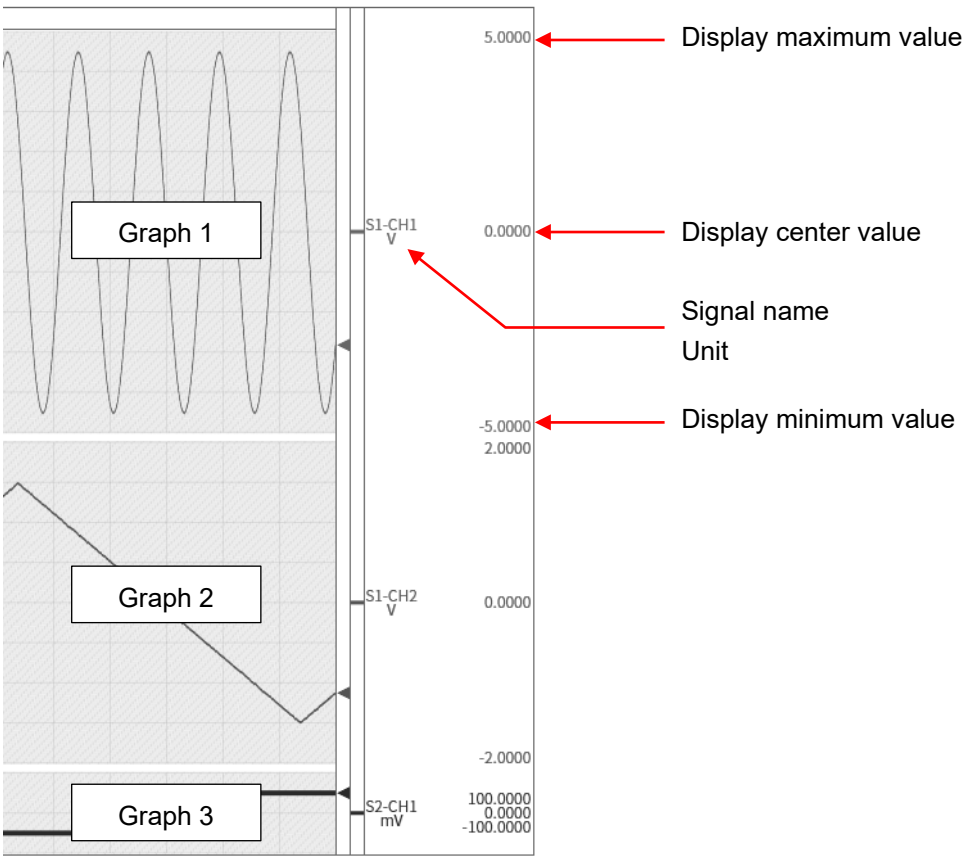
1.6.5. Graph Scale

Tap the【SCALE】key in the side menu to display the graph scale.

The graph scale can be displayed by selecting one channel of the analog input module for each graph.

☞ For details, see "8.2.3.2. SHEET1／SHEET2／SHEET3".

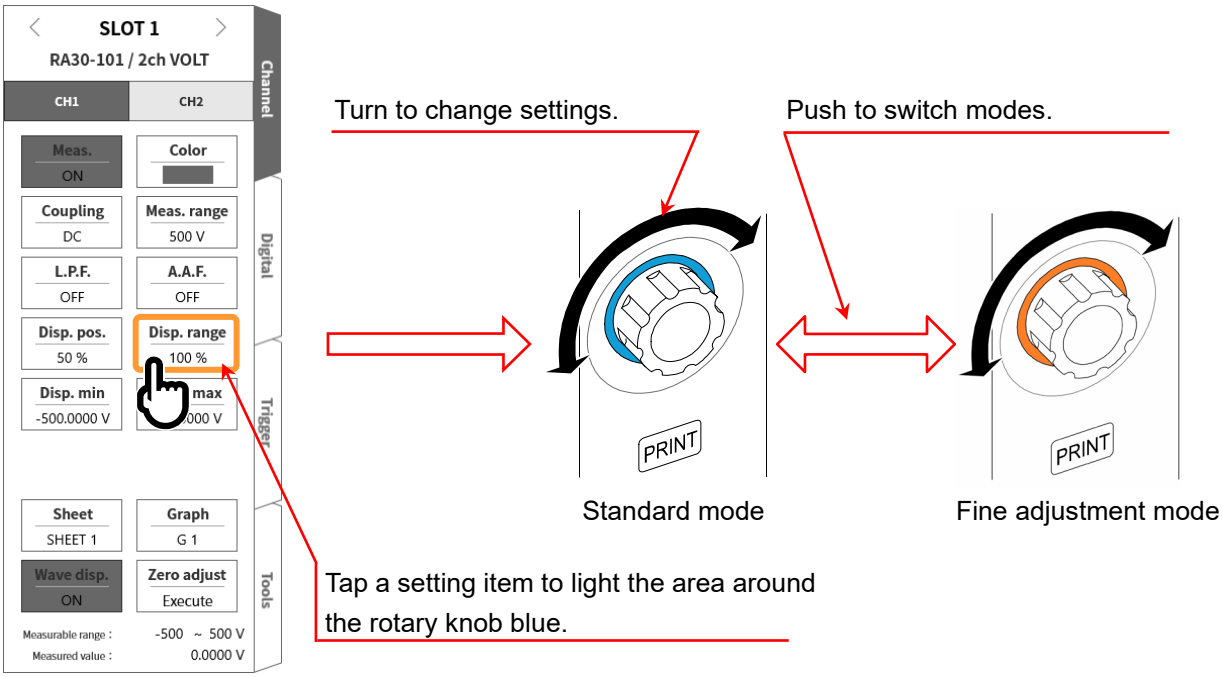




1.7. Screen Input Operations

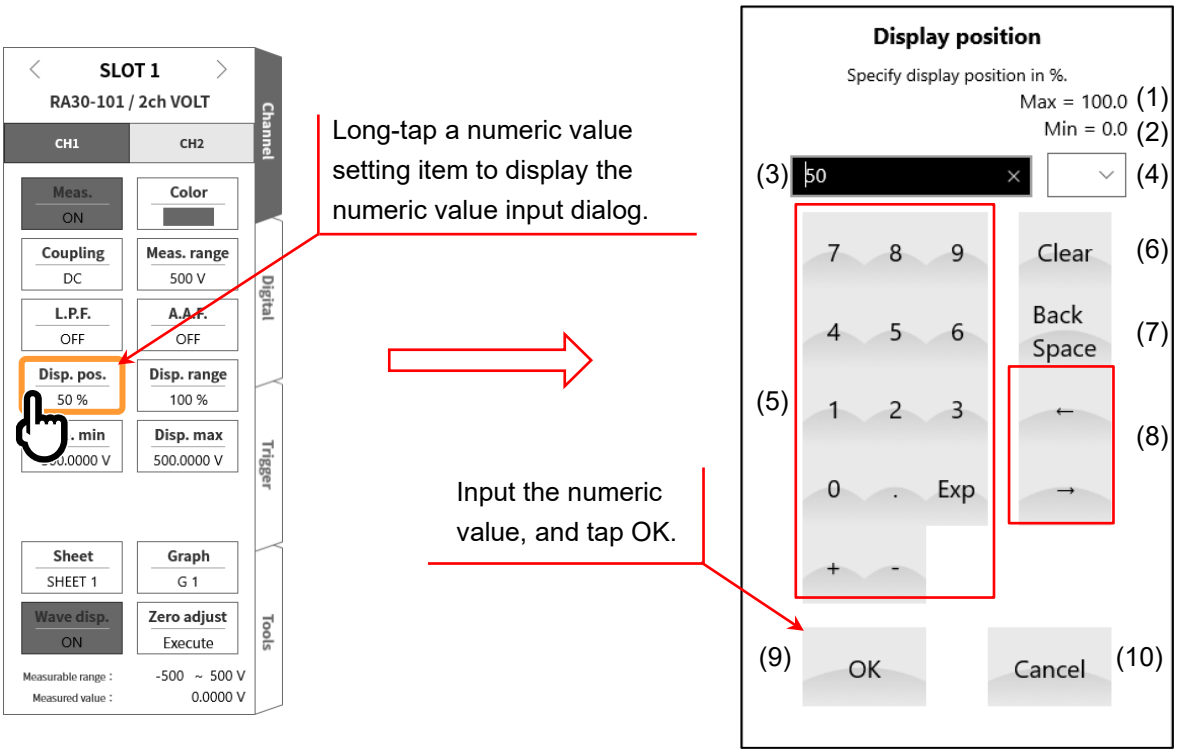
1.7.1. Rotary Knob

Turn the rotary knob clockwise or counterclockwise to change numeric values and selections.
The rotary knob is enabled when the area around it is lit. The area lights blue in the standard mode and orange in the fine adjustment mode.
You can push the rotary knob to switch modes.



1.7.2. Numeric Value Input Dialog

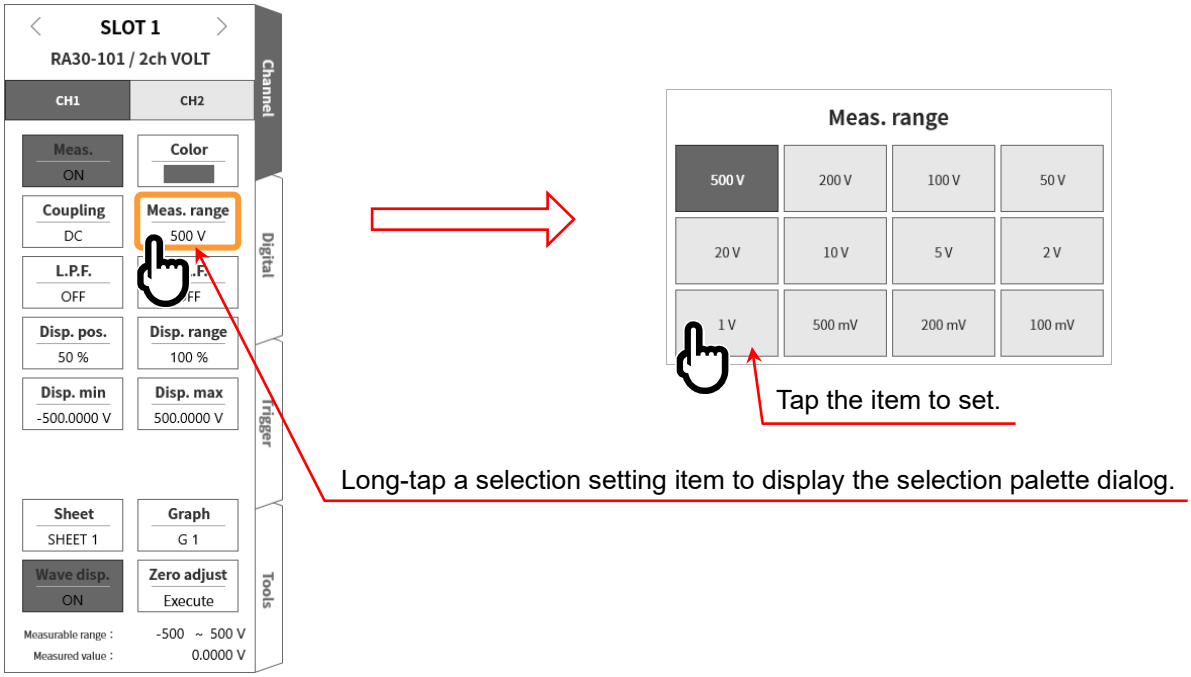
This dialog enables you to use numeric keys to input numeric values.



(1) Max: Displays the maximum value that can be input.
(2) Min: Displays the minimum value that can be input.
(3) Display window: Displays the numeric value that has been input.
(4) Prefix: Enables you to select G, M, k, (none), m, μ, or n as the prefix to use for numeric value input.
(5) Input keys: Enables you to input numbers, decimal points, exponential Es, plus symbols, and minus symbols in the position of the text cursor.
(6) Clear: Deletes the text in the display window.
(7) Back Space: Deletes one character to the left of the text cursor.
(8) Input position operations:
Moves the text cursor position left or right.
(9) OK: Reflects the numeric value that has been input and closes the dialog box.
(10) Cancel: Closes the dialog box without reflecting the numeric value that has been input.

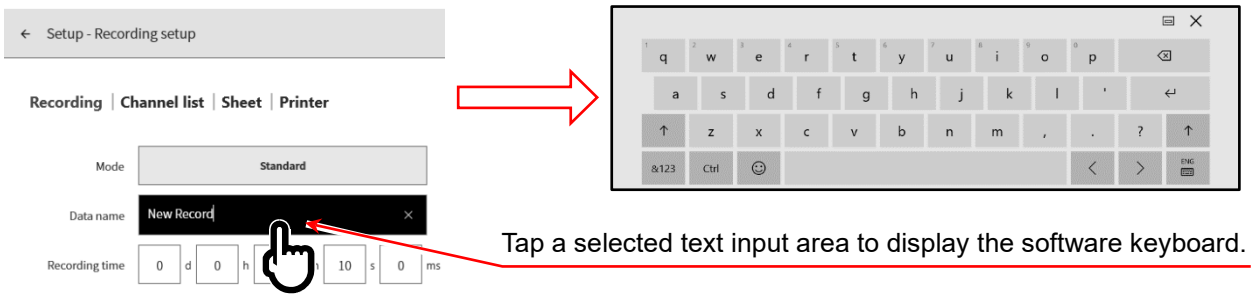
1.7.3. Selection Palette Dialog

This dialog enables you to select the item to set from a list.



1.7.4. Software Keyboard

The software keyboard enables you to input text.



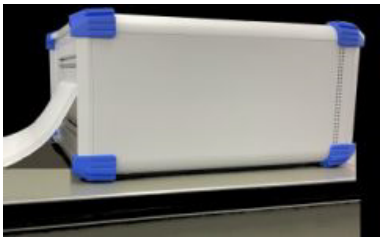
2. Pre-Measurement Procedures

2.1. Before Switching On the Power

The preparations for using this product and the cautions are explained below.

2.1.1. Installation and Usage Environment

Use this product on a flat, level surface.
When using the printer, install it so that the recording paper is level as indicated in the figure on the right.



⚠CAUTION

Cautions Regarding the Installation Environment

- ❑ Use this product at locations that satisfy the installation requirement, the Category II (CAT II) of the safety standard for electrical measurement instruments in EN61010-1.
- ❑ This product has a Pollution Degree of 2.
- ❑ Use this product in the following operating environments.
  Operating temperature range: 0 to 40°C Operating humidity range: 35 to 85% RH (without condensation)
- ❑ Do not use this product at the following locations. In addition, carefully check the environment when using this product.
  - ■ Locations where the temperature and humidity rise due to direct sunlight or heaters
  - ■ Wet locations
  - ■ Locations where salt, oil, or corrosive gases exist
  - ■ Dusty locations
  - ■ Locations subject to strong vibrations
  - ■ Locations with a strong electromagnetic field
  - ■ This product is provided with ventilation openings in order to prevent overheating.
    Ensure that the ventilation openings remain unobstructed by covers or materials. Otherwise, the internal temperature of this product rises, causing malfunctions.



  - ■ Do not place highly combustible objects such as paper near this product.

⚠WARNING

- ❑ Module installation/removal and replacement must be performed after disconnecting all the cables connected to the module, turning off the power switch of the main unit, and disconnecting the power cable.
- ❑ Insert the module along the guide rails, and securely fix the two knurled screws with a Phillips head screwdriver. Incomplete module installation may lead to failure.
- ❑ Module disassembly is extremely dangerous. It must not be performed other than by our service engineers, as it may also lead to failure and prevent performance from being guaranteed.
- ❑ Make sure to install an empty panel on slots where no module is installed. Failure to do so may lead to failure due to the intrusion of foreign material or dust. (Empty panels are shipped together with the RA series main unit.)
- ❑ When storing the module, place it inside an anti-static bag and packaging box like those it was shipped with, as static electricity may lead to failure. This product can be stored in the range of -20 to 60°C and 20 to 85% RH (without condensation).
- ❑ Connect the input signal to the module after connecting the power cable of the RA series main unit where the module is installed to a 3-pole AC outlet, grounding it, and then turning on the power of the main unit.
  High voltage may already be applied as the input signal. Set the measurement range of the module to the maximum and connect the input cable to the module before connecting to the signal source. Take care to not directly touch the conductors when connecting to the signal source, in order to prevent electrocution.
- ❑ A dedicated input cable for each module is provided to meet the specifications such as the measurement category and insulation with stand voltage. Use the dedicated input cable for the type of measurement.

⚠CAUTION

- ❑ When transporting this product and modules, use the package and packaging material supplied at factory shipment, or use a package and packaging material more shock-resistant than those supplied.
- ❑ We recommend a periodical calibration to maintain the accuracy of the input units. More reliable measurements are possible by calibrating the input units once a year (extra cost option).

2.1.2. Installing Optional Modules

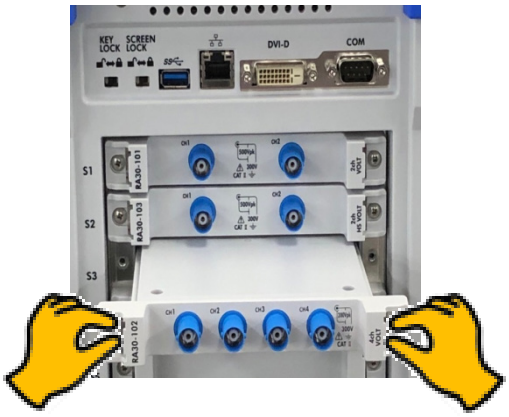
Installation Procedure

Step 1. Turn the power OFF.

Step 2. Disconnect the power cable.

Step 3. Grip the handles on both edges and insert the module straight in along the guide rails.
The module type should be on the operation panel side.

Step 4. Tighten the screws on both edges with a Phillips head screwdriver (No. 2).





Removal Procedure

Step 1. Turn the power OFF.

Step 2. Remove the connected input cable.

Step 3. Disconnect the power cable.

Step 4. Loosen the screws on both edges with a Phillips head screwdriver.

Step 5. Grip the handles on both edges and pull the module straight out.

Step 6. Install an empty panel if the slot will not be used.

2.1.3. Paper Loading

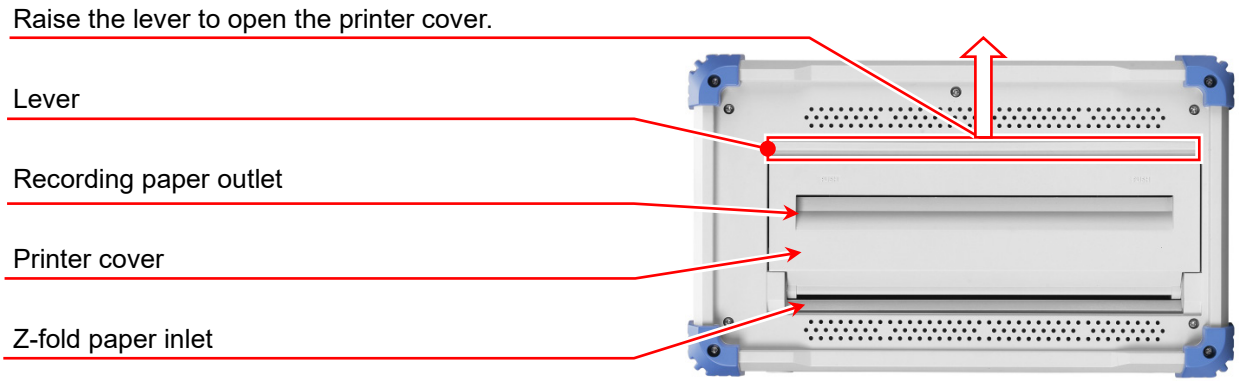
The procedure for loading recording paper to the printer block is indicated below.

Load the recording paper to this product. There are two types of recording paper: paper rolls and Z-fold paper.

For information on loading Z-fold paper, see "Loading Z-fold Paper (Recording Paper)".

⚠CAUTION

- ❑ Use only the recording paper prepared exclusively for this product (YPS106 or YPS108 for paper roll and YPS112 for Z-fold paper) by our company. The quality of recording may not be guaranteed if other recording paper is used, as paper feed problems may occur or the print quality may be reduced.
- ❑ Do not use the portion of the new roll where the recording paper tip is covered with tape, as colors may not be printed normally on this area.



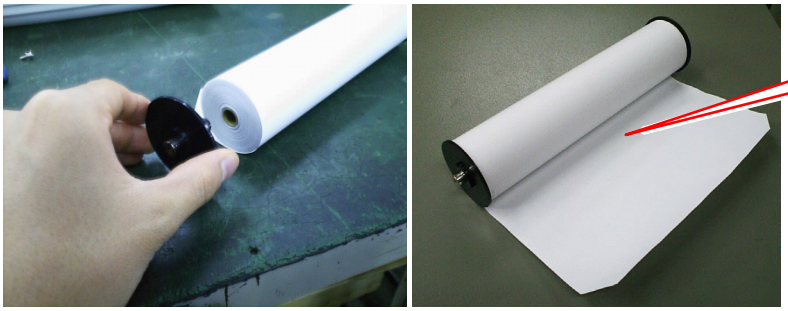
Loading Roll Paper (Recording Paper)

Step 1. Attach the paper holders to the paper roll.

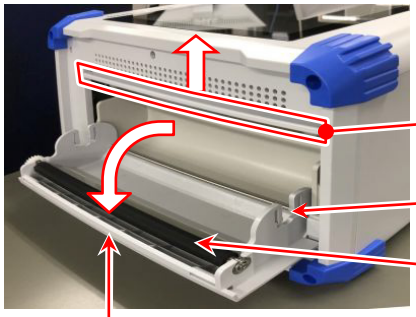
Attach a paper holder to both ends of the paper roll. If there is a gap between the recording paper and the paper holder, the recording paper may not be able to be loaded or the recording position may be shifted.

If there is a gap between the recording paper and the paper holder, the recording paper may not be able to be loaded or the recording position may be shifted. When loading a partially used roll, trim the edges for ease of loading, as shown in the figure.

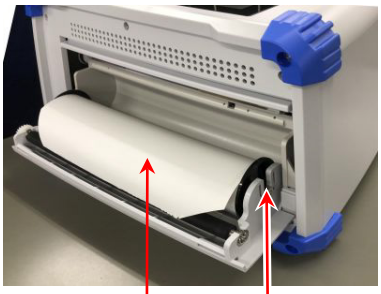
The inside of the roll paper is the back side and the outside is the thermal surface that is printed on.



Step 2. Open the printer cover by raising the lever of the printer block.



Step 3. Load the paper following the guide of this product, and press the paper holders into the guide until a click is heard.



Note

- Be sure the paper roll is loaded so that the thermally sensitive side is faced toward you; if this side is faced away, the paper cannot be printed.
  If the recording paper is not loaded securely, printing problems may occur or the recording paper may meander.

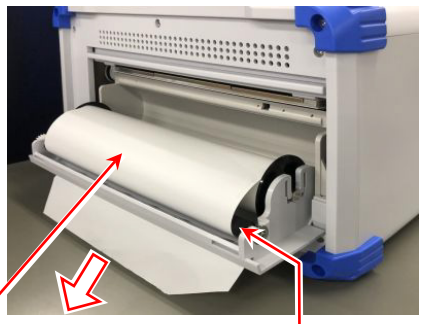
Check the winding direction carefully
Push it in so that the thermally sensitive side is faced up

Insert the paper holders into the guide of the printer block

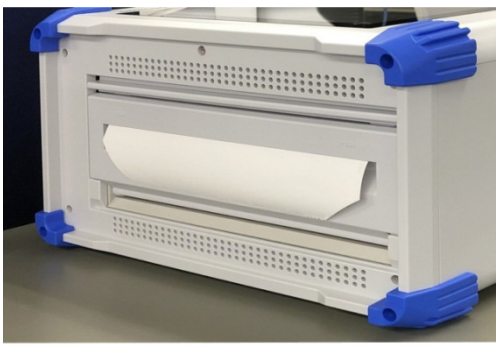
Step 4. Feed the recording paper to the recording paper outlet. Insert the recording paper from above the platen roller of the printer block (black roller) from the recording paper outlet of the printer cover and pull it out about 10 cm.

Step 4-1. Feed the paper to the recording paper outlet from above the platen roller.

Step 4-2. Pull the recording paper out from the recording paper outlet about 10 cm.

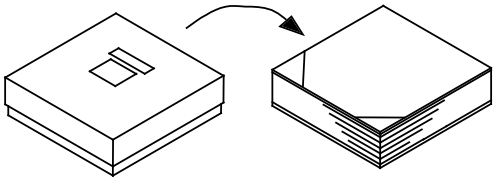


Step 5. Close the printer cover.
After pulling the paper, close the cover firmly pressing down on both sides (until a click is heard). Pull the paper out keeping it straight. When using without both sides of the paper pushed into the recording section, recording cannot be performed correctly.



Loading Z-fold Paper (Recording Paper)

To use Z-fold paper (YPS112), a Z-fold paper case (RA30-551, sold separately) is required.

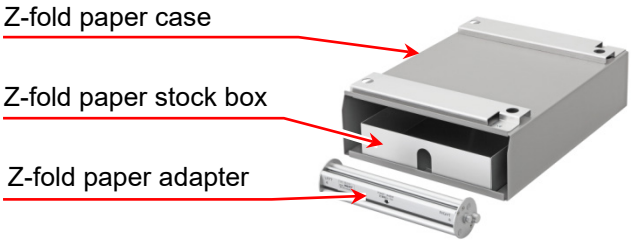


<Z-fold paper> YPS112

- ❑ Length: 200 m
- ❑ Folded width: 30 cm
- ❑ To indicate how much paper is remaining, a page number (669 to 000) is printed on each page.

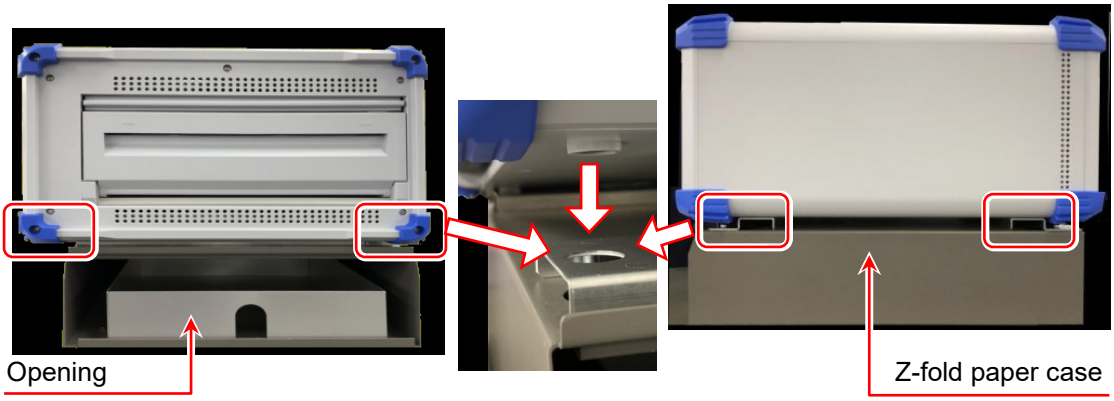
<Z-fold paper box> RA30-551

- ❑ Z-fold paper case: Approx. 3 kg
- ❑ Z-fold paper stock box: Approx. 300 g
- ❑ Z-fold paper adapter: Approx. 200 g



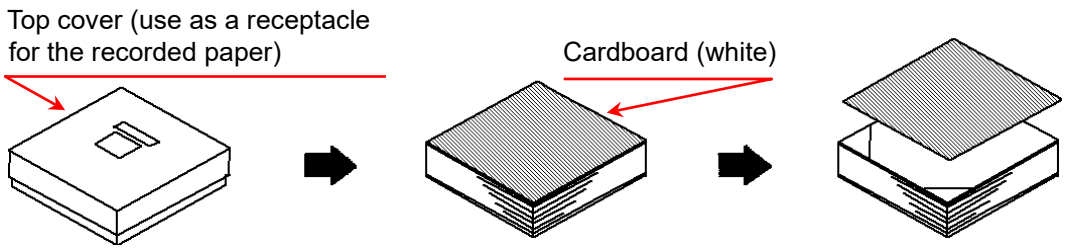
The procedures for loading the Z-fold paper are explained as follows.

Step 1. Place this product on top of the paper case.
With the paper case opening and the printer block facing the same direction, align the metal fittings of the case with the legs of this product.

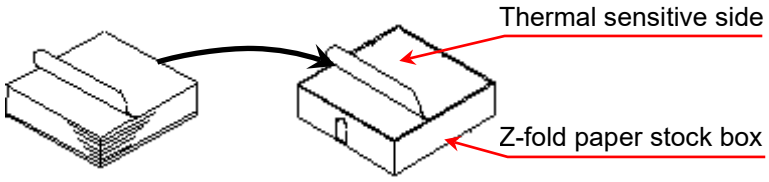


Step 2. Put the paper in the case.

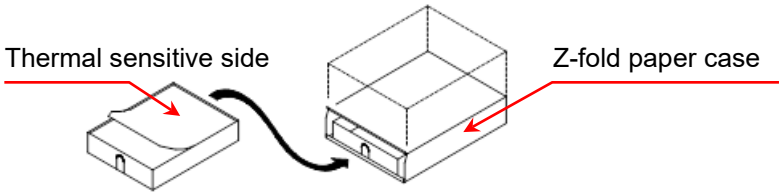
Step 2-1. Remove the contents from the case, open the plastic bag and take out the piece of cardboard covering the paper. Use the top cover of the case as a receptacle for the recorded paper.



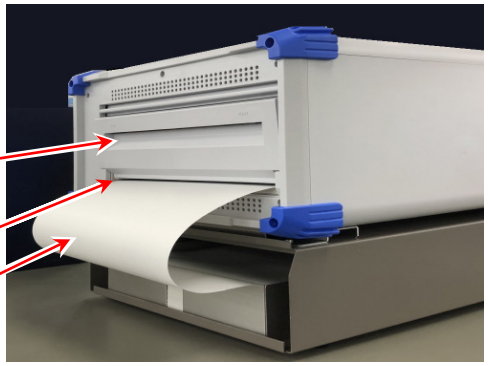
Step 2-2. Place the paper in the stock box with the thermally sensitive side (the side with blue numbers printed on the edges) facing up.



Step 2-3. Position the stock box so the thermal sensitive side of the paper is facing up and insert the box into the case opening.

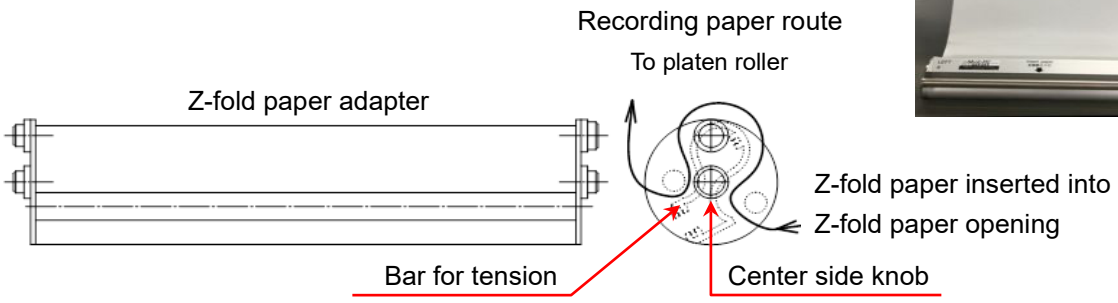


Step 3. Open the printer block by raising the lever of the printer cover.
After opening the printer cover, insert the paper pulled out from the case into the opening under the printer cover.

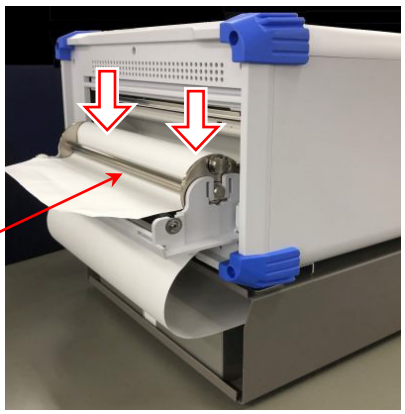


Step 4. Thread the paper through the Z-fold paper adapter.
Thread the paper inserted into the opening under the printer cover through the Z-fold paper adapter as shown in the figure.





Step 5. Attach the Z-fold paper adapter to the recording paper guide of the printer cover.
Insert the Z-fold paper adapter with paper threaded into the recording paper guide (the U-shaped groove) of this product with the center knob facing down, and push it in until it clicks.

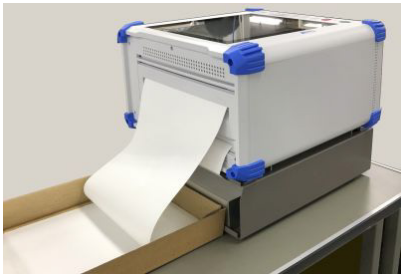


Step 6. Pull out the paper.
Pull out the paper threaded into the Z-fold paper adapter about 10 cm under the bar for tension.

Step 7. Feed the paper to the recording paper outlet.
Insert the paper threaded into the Z-fold paper adapter from above the platen roller of the printer block (black roller) from the recording paper outlet of the printer bar and pull it out about 10 cm.



Step 8. Close the printer cover.
When the paper has been fed through, pull it straight out so that it does not sag, and close the printer cover securely.



Note

❑ Place the cover of the box containing the paper on the printer side of this product to use as a paper receptacle. To ensure smooth paper output, fold one or two sheets into the receptacle before use. Note that although Z-fold paper usually folds automatically as it is output, some environmental conditions, such as a humid atmosphere or the setting location, may cause the paper not to fold normally.

2.1.4. Connecting an External Device

Connect the DVI-D, LAN, and COM ports of this product with the power off.

Note

❑ If you remove or insert the DVI-D cable after the power has been turned on, the screen may not be displayed, which will make it impossible to operate this product.

2.2. Turning the Power On/Off

2.2.1. Connecting the AC Power Cable

Be sure to check the following points before connecting the AC power cable to this product.

- ❑ Make sure that the power supply matches the rating indicated on the rating plate attached to this product.
- ❑ Ensure modules are inserted securely.

⚠WARNING

- ❑ This product must be grounded before turning on the power.
- ❑ This grounding protection is for the safety of this product, as well as for that of the user and peripheral equipment.
  - ■ If the AC power cable that comes with this product is connected to a 3-pin power outlet equipped with a protective conductor pin, this product is automatically grounded.
  - ■ Do not use an extension cable without protective grounding.
  - ■ Do not use this product when protective grounding cannot be performed using a power outlet that matches the supplied AC power cable.

Note

- ❑ AC power cable

  The AC power cable that is included in this product (1KO6165-200: 125-V AC system, 2 m) is a 3-pin type which has a round pin at the center for protective grounding.

2.2.2. Turning On the Power

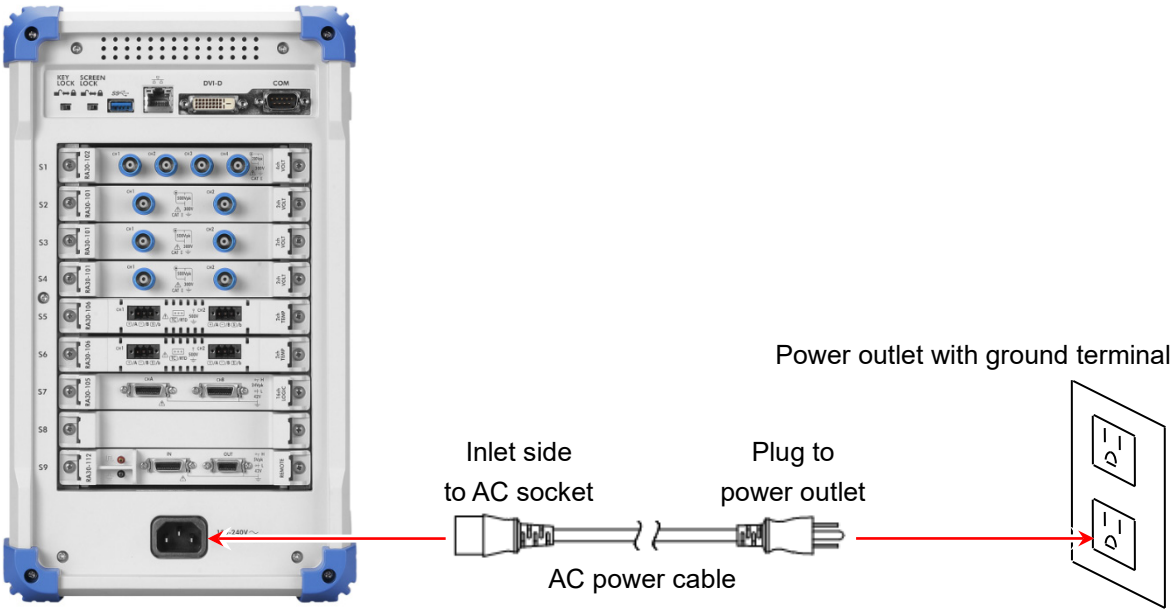
Step 1. Perform the check indicated below.

<Items to check before turning on the power>

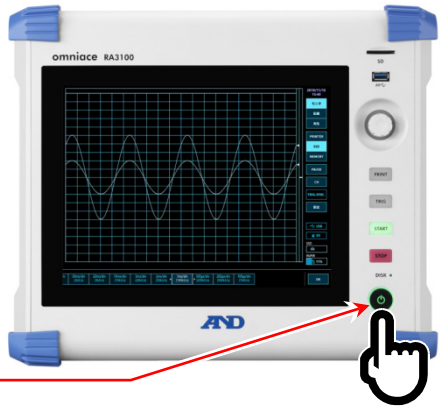
- ❑ Is this product installed in a safe location?
- ❑ Is the usage environment OK?
- ❑ Is the top of the touch panel free from any writing implements or tools, etc.?

Step 2. Upon confirming that all of the above check items are fine, connect the inlet side of the AC power cable to the AC socket of this product.

Step 3. Connect the plug of the AC power cable to the power outlet.



Step 4. Turn the power switch of this product on.
When the Power switch on the operation panel of this product is turned on, the green LED lights up and the power turns on.

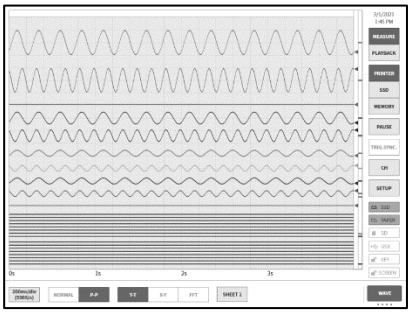


Note

- Standby current flows to this product when the AC power cable is connected to the power outlet.
  Remove the power cable when this product will not be used for an extended period of time.

2.2.3. Confirming Normal Startup

The monitor screen of the RA3100 is displayed about one minute after turning the power on.



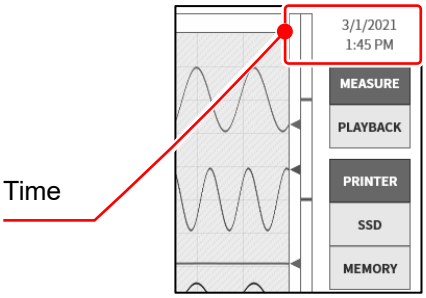
Note

- Do not touch the touch panel until the waveform monitor is displayed. Doing so may lead to erroneous operations.
- Immediately after purchase or initializing the main unit, measurement is turned off for all channels and no waveform is displayed.

2.2.4. Setup Date and Time

The current time is displayed on the top right of the screen, but if it differs greatly from the actual time, the time can be adjusted.

See "8.3.1. Environment Setup".



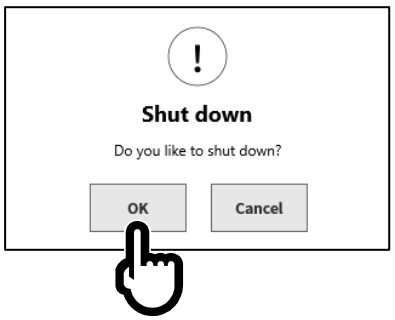
2.2.5. Preparing for More Precise Measurements

Warm up this product for about 60 minutes after turning on the power in order to perform more precise measurements.
After the warm up is complete, perform zero adjust for the voltage module and initial balancing for the AC strain module.

See "4. Configuring Measurement".

2.2.6. Turning Off the Power

Step 1. When the Power switch on the operation panel is pressed while the power is on, the shutdown process starts and the [Shutdown] dialog box indicated below is displayed on the center of the screen. Tap the【OK】key to shutdown this product. Tap the【Cancel】key to continue without turning off the power.
If the Power switch is pressed again while the [Shutdown] dialog box is displayed, this product automatically shuts down.



⚠CAUTION

- Make sure to shutdown this product to turn off the power, as directly removing the power cable from the power outlet without shutting down can damage the files in the internal storage.

3. Flow of Measurement

This product records and play back input signals following the procedures described below.

3.1. Flow of Measurement

Perform the check before applying power and turn on the power.	"Chapter 2" ⇨	Confirm that this product has been set in a safe place, and that all the accessories are properly attached.
Select the measurement mode.	"Chapter 4.1" ⇨	Select the R&D mode (for research and development) or the MFG mode (for manufacturers).
Lower the measurement range, and connect the signal.	"Chapter 4.2" ⇨	Note that applying a voltage greater than the maximum allowable input voltage of each input module may cause damage to the main unit or internal components. Connect the signal after confirming that the maximum allowed input voltage is not exceeded.
Set the input channel while viewing the waveform monitor.	"Chapter 4.3" ⇨	Setup the input channel settings to the conditions for recording. Set the measurement range, filter, display position, and display range, etc.
Configure the monitor display.	"Chapter 4.3" ⇨	Configure the graph division, digital display, and graph scale, etc. to make the monitor display easier to view.
Select the recording method.	"Chapter 4.4" ⇨	Select to record to recording paper only or to both a file and recording paper.
Set the recording device and sample speed according to the target for measurement.	"Chapter 4.5" ⇨	Set the sampling speed and the recording device to save, as well as the recording time, speed of input signal changes (frequency), and whether to perform analysis after recording, etc. Printer : Low-speed long-term measurement with only the waveform recorded SSD : Medium-speed long-term measurement for various uses Memory : High-speed enlarged display of transient phenomena and abrupt phenomena
Set the triggers.	"Chapter 5" ⇨	Set the triggers for starting recording.
Start and end recording.	"Chapter 6" ⇨	Press the START key on the operation panel to start recording. Measurement stops when the specified time or data count is recorded or when the STOP key is pressed.
Playback and analysis.	"Chapter 7" ⇨	Use the【PLAYBACK】key on the side menu to playback recorded data, the【DATA】key on the control bar to select data, and the【X-Y】key and【FFT】key on the control bar to perform data analysis.

4. Configuring Measurement

4.1. Selecting the Measurement Mode

You can select one of two measurement modes: the R&D mode for research and development, which has various functions and excellent versatility, and the MFG mode for manufacturers, which limits some functions for improved data transfer and recording start/stop response speed.

Tips

- The R&D mode is recommended for those that want to adjust waveform analysis and settings while recording, and the MFG mode is recommended for those that want to perform continuous recording with settings determined in advance.

4.1.1. Characteristics

R&D mode

- Nine types of recording modes (start trigger, interval, etc.)
- Simultaneous recording to three recording devices (printer, SSD, and memory)
- XY and FFT waveform display
- Waveform pausing and enlargement/reduction
- Playback of recorded data

MFG mode

- External transfer of measured data (TCP/UDP)
- Improved response speed for starting/stopping recording
- Delete then save function for recorded data
- Repeat recording (supported in the custom recording mode)

4.1.2. Comparison of Measurement Mode Functions

		R&D mode	MFG mode
Recording	Recording modes	10	3 *2
	Printer recording	✔	✔
	SSD recording	✔	✔
	Memory recording	✔	
	Pen recording	✔	✔ *1
	Response speed for starting/stopping recording	Standard	High speed
Waveforms	Y-T waveform	✔	✔ *1
	X-Y waveform	✔	
	FFT waveform	✔	
	Time axis scrolling of Y-T waveform	✔	
Function	Playing Back Recorded Data	✔	
	Pausing (cursor, enlargement/reduction)	✔	
	Thumbnails	✔	
	Data transfer		✔ *1
	Delete then save function for recorded data		✔

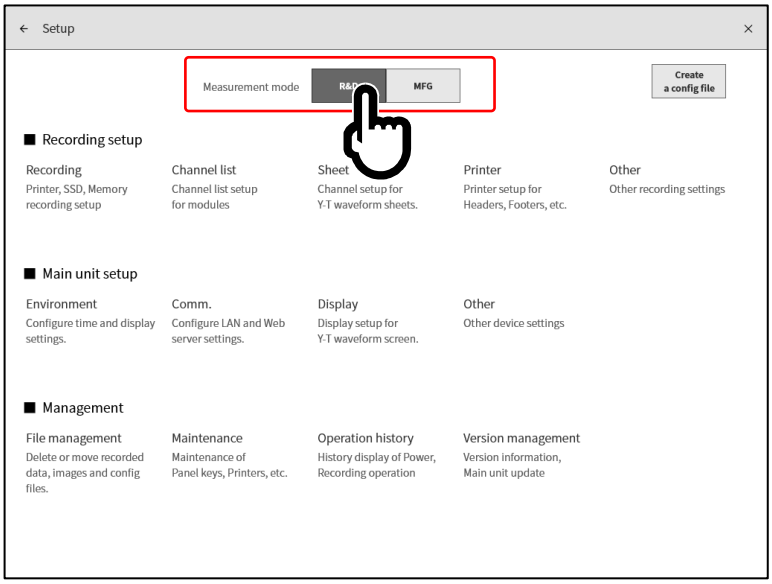
*1 Turning channel measurement on/off causes the waveform screen to be redrawn and will result in measurement data being temporarily lost.

*2 Standard, start trigger, or custom (start trigger, stop trigger, or repeat recording) only

4.1.3. Selection Method

Tap【Setup】in the Side menu to display the settings screen.

Tap【R&D】or【MFG】to select the measurement mode.



4.2. Connecting the Input Cable

When connecting the input cable, set the lowest input sensitivity (set the maximum measurement range).

Also note that applying a voltage greater than the maximum allowable input voltage of each input module may cause damage to the main unit or internal components. Connect the signal after confirming that the maximum allowed input voltage is not exceeded.

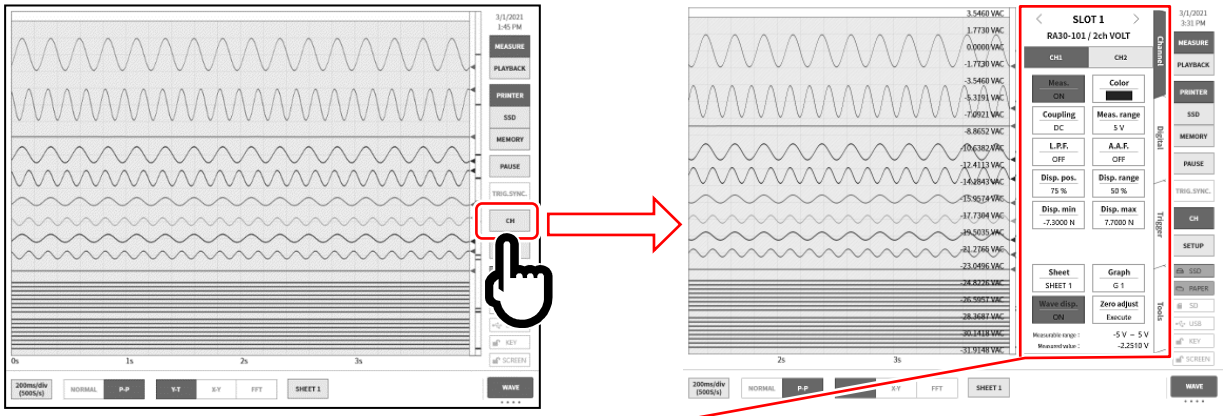
Step 1. The input signal can be displayed and checked in real-time by switching the【MEASURE/ PLAYBACK】key on the side menu to【MEASURE】.

Step 2. Tap the【CH】key on the side menu to display the sub menu.

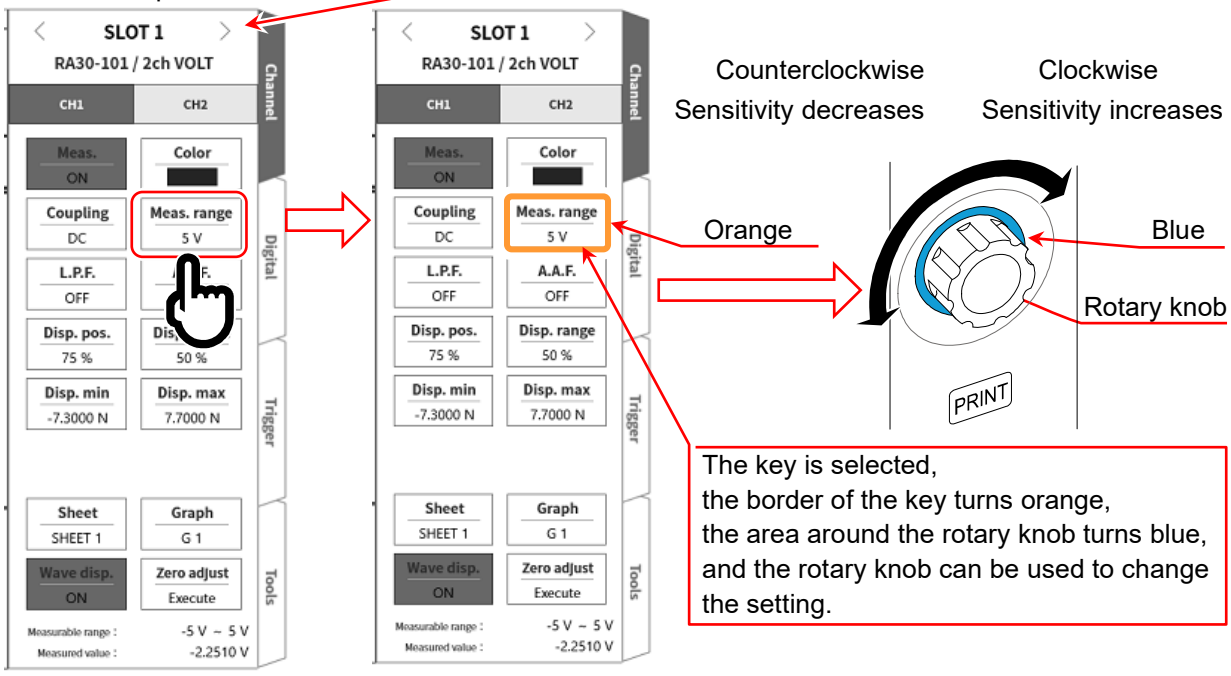
Step 3. Tap the【Channel】tab in the sub menu to display the channel setup sub menu.

Step 4. When the【Meas. range】key is tapped in the channel setup sub menu, the border of the key turns orange.
The area around the rotary knob turns blue, and the rotary knob can be used to change the setting.

Step 5. Turn the rotary knob counterclockwise to set the minimum input sensitivity (set the maximum measurement range).



Channel setup sub menu



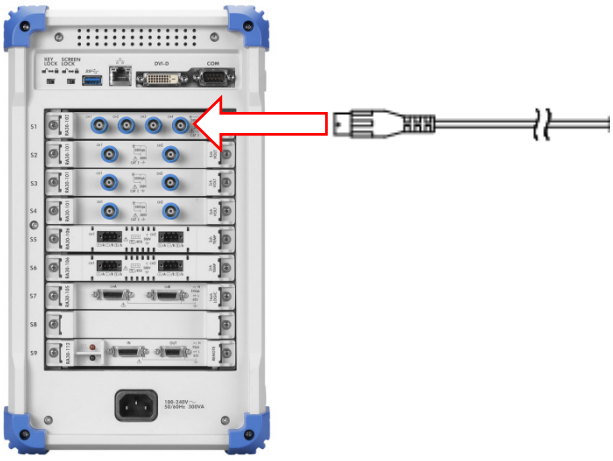
Step 6. Tap the【CHx】tab in the channel setup sub menu to change the displayed channel.

Step 7. To change the display slot of the input module, swipe the channel setup sub menu left or right, or tap the【<】or【>】key on the top.

Step 8. Next, connect the insulation BNC cable (standard) to the BNC terminal of the input module.

⚠WARNING

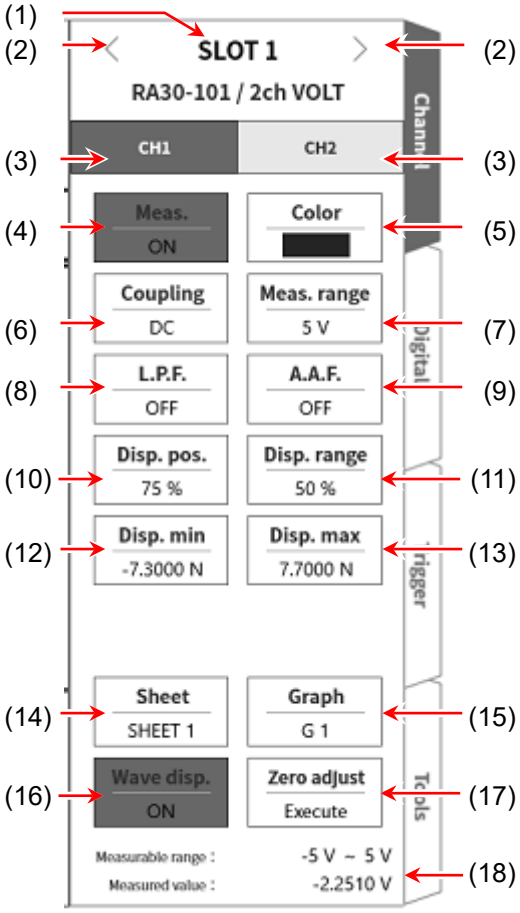
- ❑ Do not input voltages that exceed the maximum allowed input voltage or withstand voltage to an input module.



4.3. Setting the Input Channel

Tap the【Channel】 tab in the sub menu to display the channel setup sub menu.

4.3.1. Channel setup sub menu (for RA30-101)



(1) Slot number, input module type

(2) Change slot: You can change the display slot by swiping this sub menu left or right or tapping the left【<】 and right【>】 key.

(3) Select channel:
Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure and record the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Coupling: Switch the input signal coupling in the order DC → GND → AC.

(7) Meas. range:
Change the measurement range of the input channel. When this key is tapped, the rotary knob is enabled (the LED lights up) and the range can be selected by turning the knob.

(8) L.P.F.: Change the low-pass filter of the input channel. When this key is tapped, the rotary knob is enabled (the LED lights up) and the filter can be selected by turning the knob.

(9) A.A.F.: Turns the anti-aliasing filter of the input channel on or off.

(10) Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area. Specified as a percentage indicating the center position of the display range from the bottom of the graph when the full range of each graph is 100%.

(11) Disp. range: Specifies the display width in the amplitude direction of each graph.
Specified (by tapping the key and turning the knob) as the percentage of the display width with the full range of each graph at 100%.
Example) When 50% is set, the waveform display is 10 div of the total width of 20 div.

(12) Disp. min: Set (by tapping the key and turning the knob) the display lower limit value (scale value) of the bottom of the display range.

(13) Disp. max: Set (by tapping the key and turning the knob) the display upper limit value (scale value) of the top of the display range.

(14) Sheet: Set the monitor display/printer print sheet of the set channel.

(15) Graph: Set the graph.
When this key is tapped, the rotary knob is enabled (the LED lights up) and the graph can be changed by turning the knob.

(16) Waveform display area:
When enabled, the waveform is displayed. When disabled, the waveform is not displayed.

(17) Zero adjust: Cancels the input offset of the input channel. Execute zero cancellation to perform more accurate measurement.

(18) Available measurement range/measurement value:
Displays the current available measurement range and value of the input value.

4.3.2. Setup the input channels

The input waveform is displayed on the monitor when a signal is connected to the input module.
The overall procedure for setting the input channel is indicated below. See the following for details on each step.

Step 1. Set coupling. (When the input module is a voltage module)
Step 2. Set Meas. range according to the target for measurement.
Step 3. Set the input filter.
Step 4. Set the waveform division.
Step 5. Set the display range and display position.
Step 6. Set the display minimum and display maximum.
Step 7. Execute zero adjust.

Step 1. Set Coupling

Select the input coupling using the【Coupling】key in the channel setup sub menu.
Tap the【Coupling】key and turn the rotary knob to change the setting in the order DC → GND → AC.

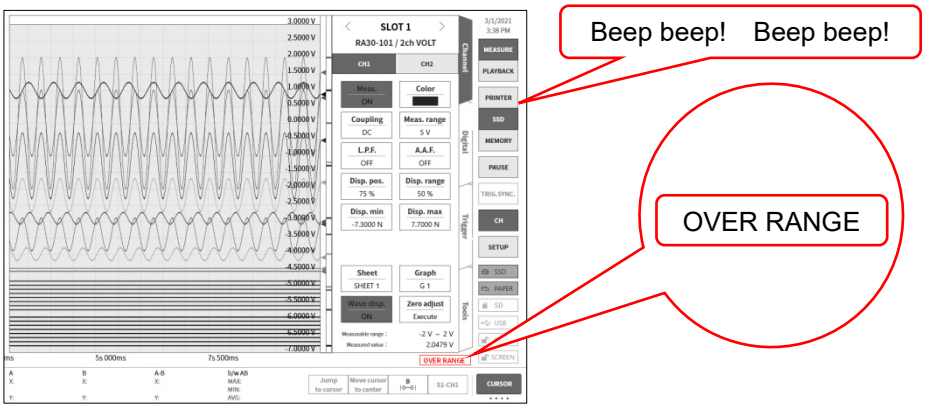
Coupling	Contents
DC	Enables measurement of the actual input signal, including the DC and AC component.
AC	Measures the AC component of the input signal only. Set this when you want to measure only the amplitude of an AC signal, as it cancels the DC offset of the signal.
GND	Connects the channel input to GND without connecting the input signal inside the channel. Enables the input GND level to be checked with waveform monitoring or printer recording.

Step 2. Set the Measurement Range

The input sensitivity can be changed in【Meas. range】in the channel setup sub menu.
The value displayed for the measurement range (RANGE) indicates the input (measurement) maximum value and corresponds to 10 div on the waveform monitor. When the display position is 50%, the full measurement range of ±RANGE (20 div) is displayed.
When the【Meas. range】key is tapped in the channel setup sub menu, the border turns orange, the area around the rotary knob turns blue, and the rotary knob can be changed.
Turn the rotary knob counterclockwise to reduce the sensitivity and clockwise to increase the sensitivity.
The setting values of the measurement range differ according to the type of input module.

Tips

- When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".

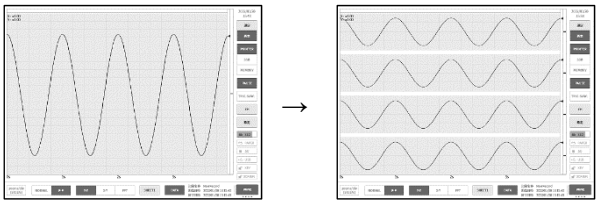


Step 3. Set the Filter

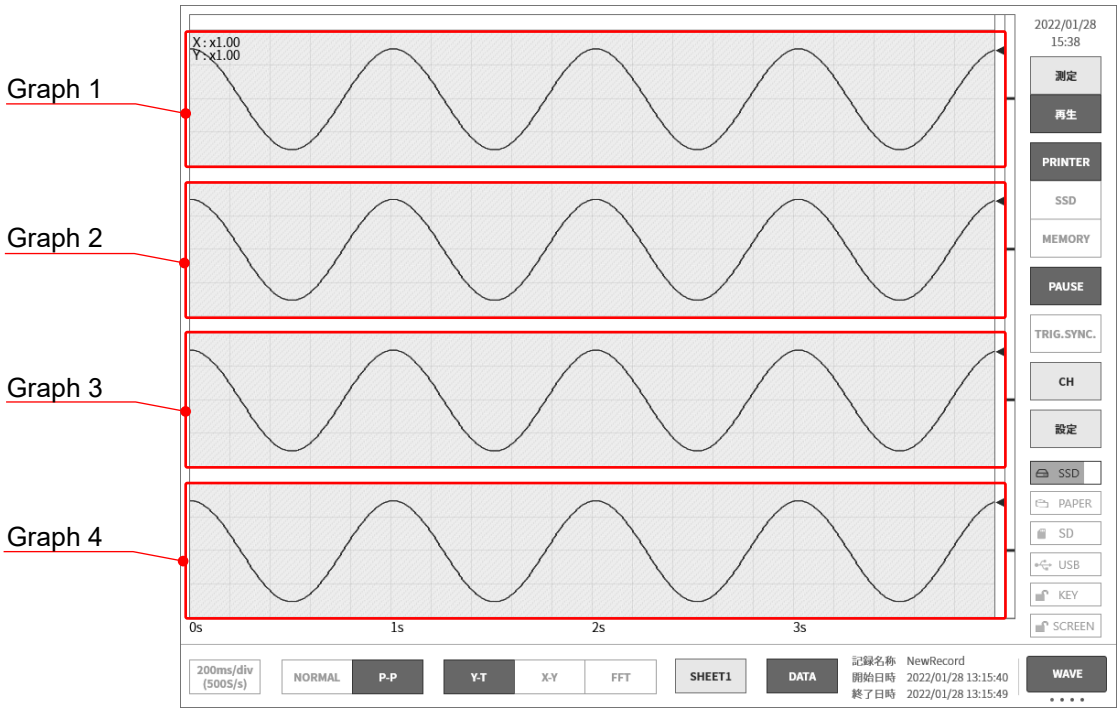
Set the filter of the selected channel.
This cuts out unnecessary frequency components and noise. As the filter differs according to the input module type, set the filter according to the characteristics of the input signal and measurement.
Low-pass filter (L.P.F.)
A gently sloping attenuation filter. Set the cutoff frequency in consideration of the frequency of the input signal.
Anti-aliasing filter (A.A.F.)
A steeply sloping attenuation low-pass filter. Enable this filter to automatically set the filter so that aliasing of the A/D data does not occur due to the sampling speed.

Step 4. Set the Graph Division

"Graph" refers to the area in the Y-T waveform monitor where a channel waveform can be displayed.
The graph area can be divided into 1 to 18 graphs.



1 graph　　4 graphs



Step 5. Set the Display Range and Display Position

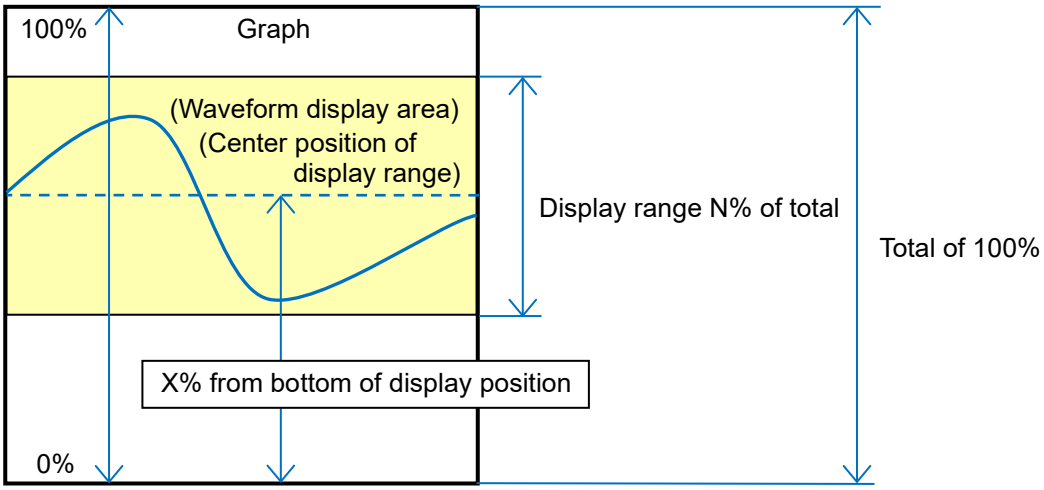
When displaying multiple channels, it may be difficult to recognize them because the waveforms overlap. Reducing the input sensitivity in the measurement range decreases the amplitude and changes the display position, which can stop the waveforms from overlapping and make them easier to recognize, but this also reduces the resolution of the data. The display range and display position settings can be used to change the display scale and display position of the waveform amplitude direction without reducing the resolution of the data of the channel being displayed.

Disp. range: The display width in the amplitude direction of the waveform display area in the graph specified as the percentage of the display width when the full range of each graph in the vertical direction is 100%.
Example) When 40% is set, the waveform display is reduced to 8 div of the total width of 20 div.

Disp. pos.: Specify the position of the graph to display the specified range of the waveform display area. Specified as a percentage indicating the center position of the display range from the bottom of the graph when the full range of each graph in the vertical direction is 100%.

When the【Disp. range】key or【Disp. pos.】key is tapped, the rotary knob is enabled and the setting value can be changed by turning the knob. The key can also be pressed and held to display numeric keys for directly entering values.

Relationship between the display range and display position of the input channel



Step 6. Set the Display Maximum and Display Minimum

If the amplitude of the input signal is smaller than the set range, the signal change may be hard to recognize.

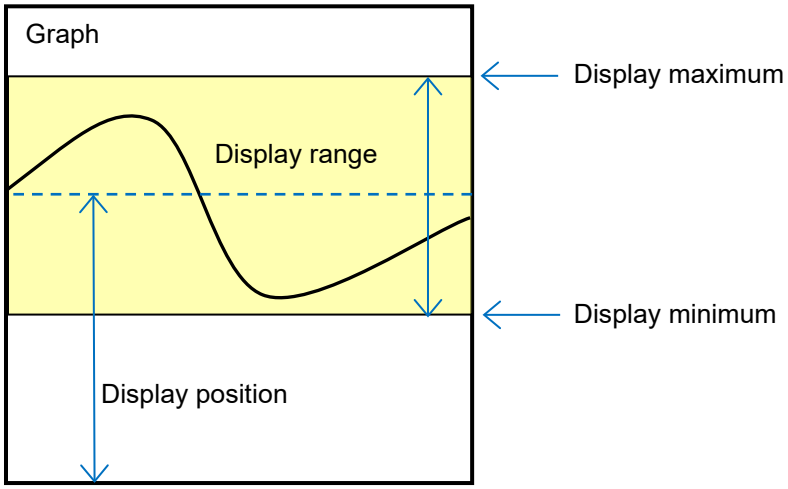
In this case, you can change the scale of the upper limit value and lower limit value for the display range to enlarge the amplitude of the displayed signal.

Disp. max: Set the display upper limit value of the top of the display range.

Disp. min: Set the display lower limit value of the bottom of the display range.

When the【Disp. max】or【Disp. min】key is tapped, the rotary knob is enabled and the setting value can be changed by turning the knob. The key can also be pressed and held to display numeric keys for directly entering values.

Relationship between the display maximum and display minimum of the input channel



Note

- If the sensitivity of the measurement range is increased to enlarge the amplitude, the amplitude of the input signal will only become a little bigger and the range may be exceeded or the input maximum value may not be able to be read, etc.
  If the display is enlarged by changing the scale, the recorded data is recorded until the value set in the measurement range, and the display can only be enlarged.

Step 7. Execute Zero Adjustment

In order to perform measurement with fewer errors, tap the【(17) Zero adjust】key in the channel setup sub menu to perform zero adjustment after the warmup time elapses or after the measurement range, filter, or input coupling has been changed. This function may not be available for some types of input module.

Tips

- After the power is turned on, temperature drift may occur in the input module and cause measurement errors, due to changes in the internal temperature of the RA3100 unit caused by the passing of time or variation in the ambient temperature.
- This function is for canceling internal offset and drift, and does not cancel the offset of the input signal.
- If you want to execute zero adjustment for multiple modules/channels at once, see "4.3.3 Batch Execution".

4.3.3. Batch Execution

You can perform batch operations such as zero adjustment or balance adjustment with measurement enabled for the following modules.

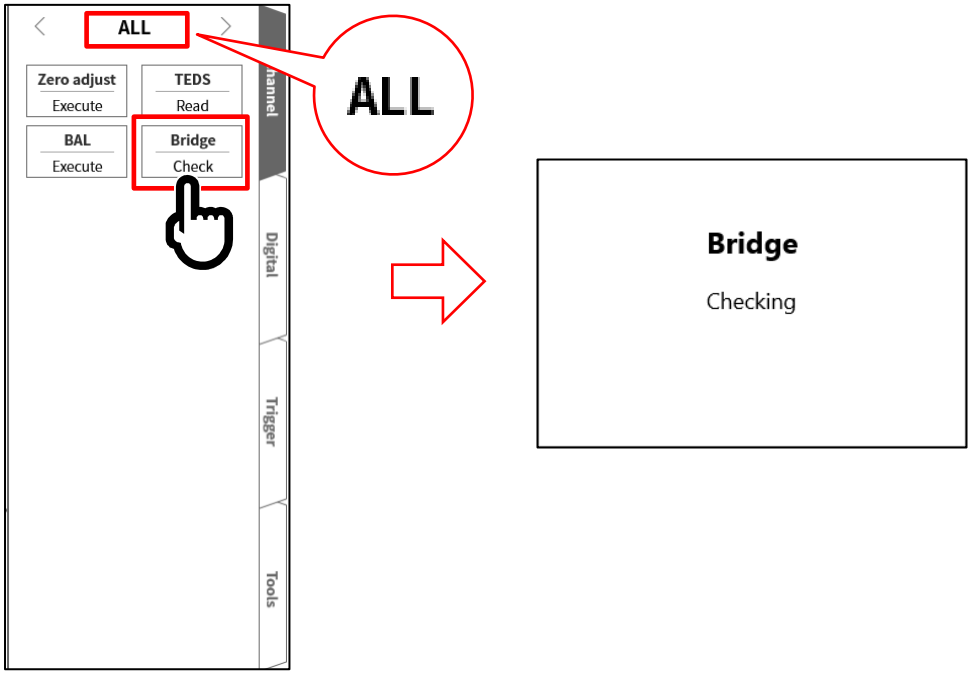
Target Module	Process Executed
RA30-101/102/103/107/113	Zero adjustment
RA30-104	BAL
	Bridge check
RA30-109	TEDS reading

Tips

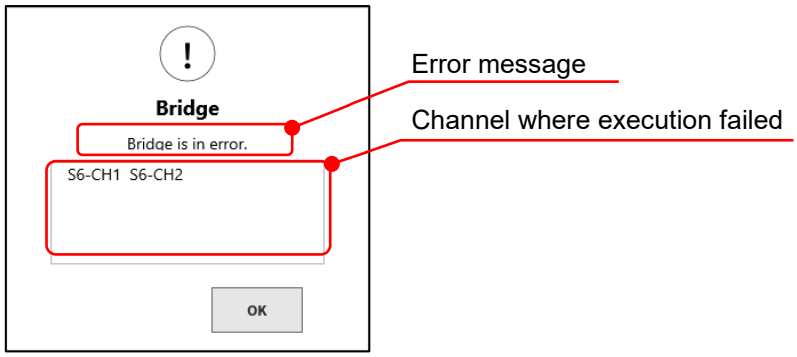
❑ If you want to execute the above processes for a channel with measurement disabled, execute them individually from the channel setup sub menu for each module.

Step 1. Tap the【CH】key on the side menu to display the sub menu.
Step 2. Tap the【Channel】tab in the sub menu to display the channel setup sub menu.
Step 3. Tap the【<】key on the left or【>】key on the right or swipe the sub menu to the left or right to switch the displayed slot to [ALL].
Step 4. Tap a key in the sub menu to start batch execution.
If the process terminates without an error, the dialog box automatically closes.

Channel setup sub menu



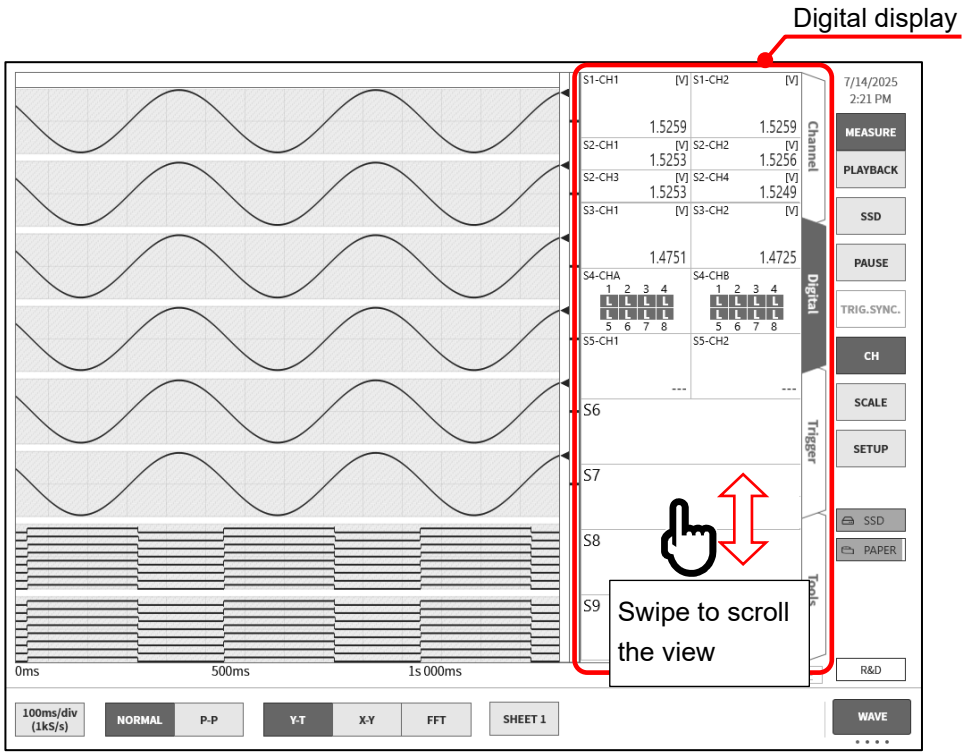
If an error is detected during execution, an error dialog is displayed.



4.3.4. Digital Display

A maximum of 45 measured values, units, or signal names are digitally displayed in the sub menu.

You can customize the items to display. The measured values differ according to the channel type and data format, and the latest values on the right edge of the Y-T waveform are displayed.

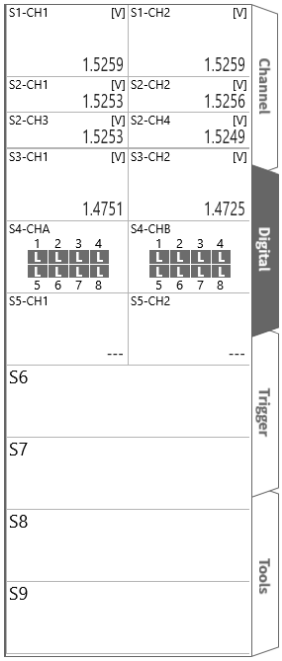


Channel type	Data format	Measured value
Analog	NORMAL	Sample value
	P-P	Maximum value
Logic	NORMAL	Sample value
	P-P	

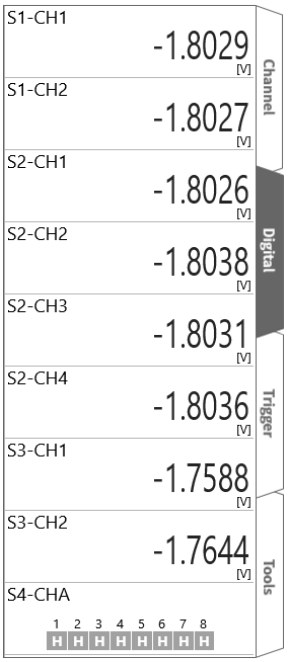
4.3.4.1. Customization

You can create customized screens such as those indicated below. You can display a slot or channel of your choice for each item.

Slot view



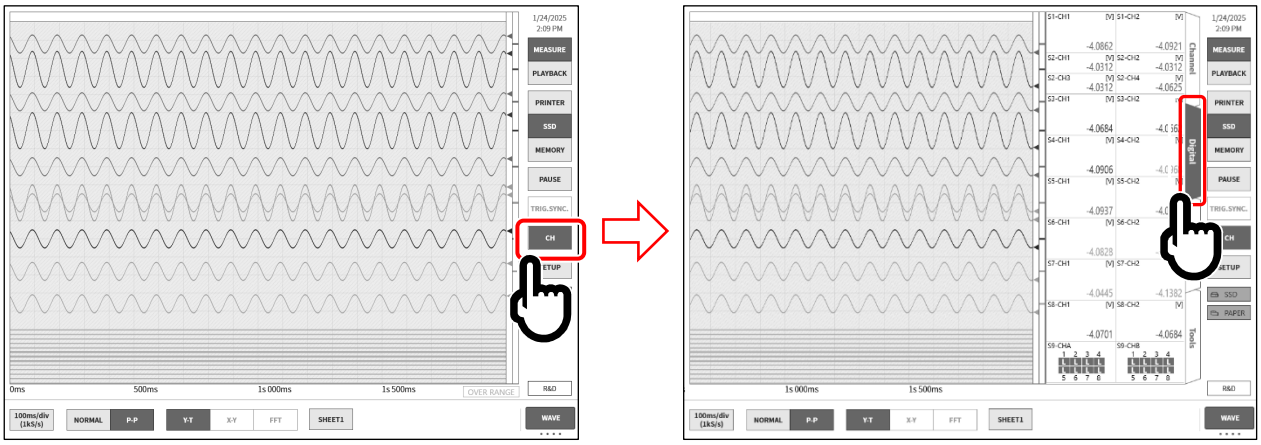
Channel view



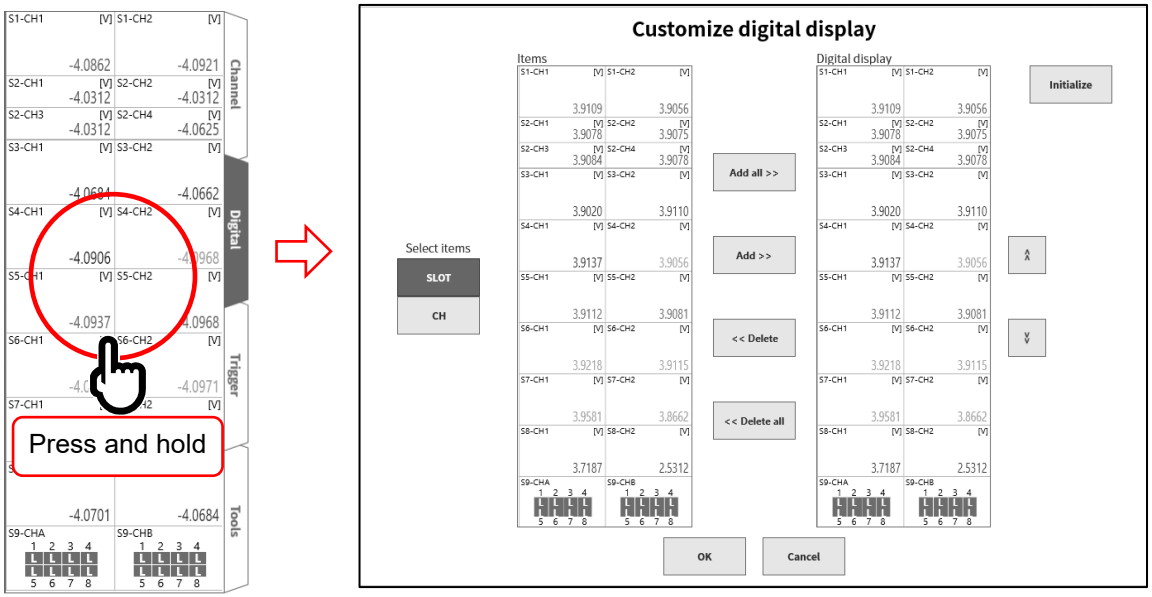
4.3.4.2. Configuration Method

Step 1. Tap the【CH】key in the side menu to display the sub menu.

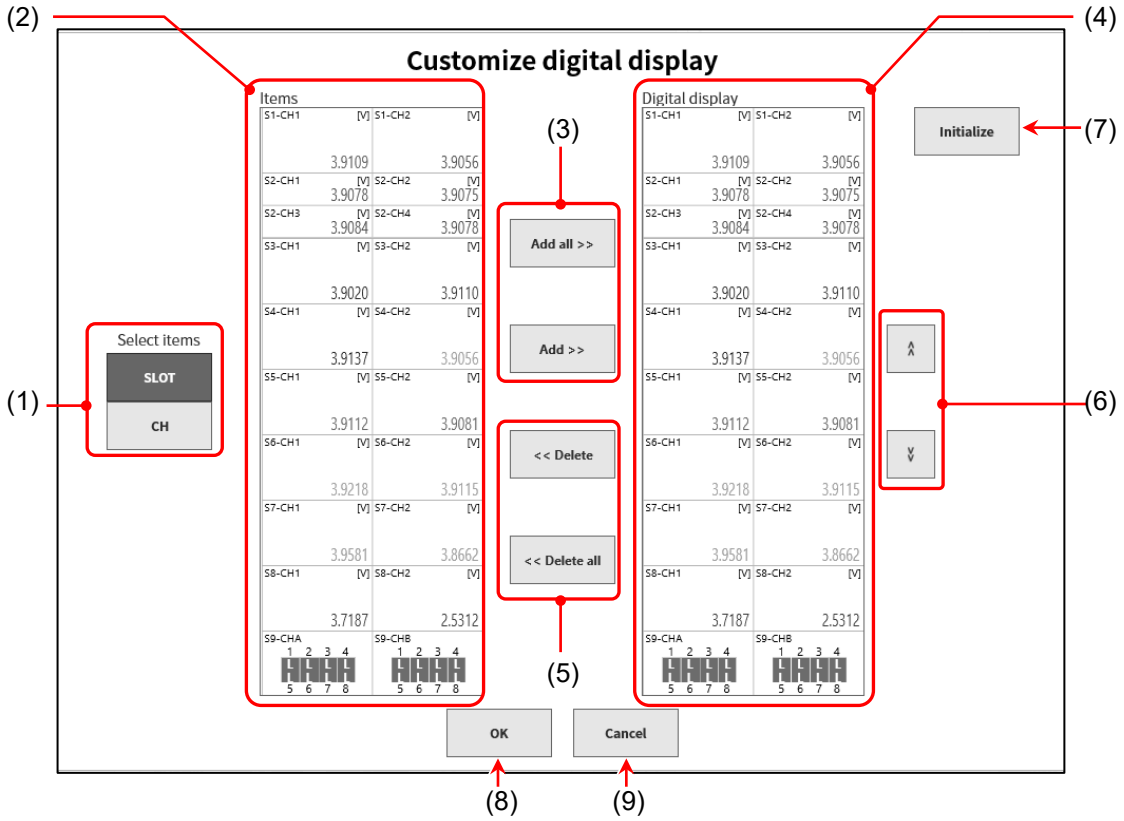
Step 2. Tap the【Digital】tab in the sub menu to display the digital display.



Step 3. Press and hold the digital display to display the [Customize digital display] screen.



Step 4. On the [Customize digital display] screen, you can change the items displayed in the digital display.



(1) Select items : Switches the items displayed in [Items].
Select【SLOT】to display/select items by slot or select【CH】to display/select items by channel.

(2) Items : A list of the attached modules or channels.
Select one item to add.

(3) Add/Add all : Adds the items in [Items] to [Digital display].
Add : Adds the item selected in [Items].
Add all : Adds all the items in [Items].

(4) Digital display : The information displayed in the digital display.
Select one item to delete or move.
Only one of each item can be registered.

(5) Delete/Delete all : Deletes the items in [Digital display].
Delete : Deletes the item selected in [Digital display].
Delete all : Deletes all the items in [Digital display].

(6) ⋀ ⋁ : Moves the position of the item selected in [Digital display].

(7) Initialize : Restores the initial values of the settings in [Digital display] (all slots are displayed again).

(8) OK : Reflects the settings and closes the screen.

(9) Cancel : Closes the screen without reflecting the settings.

Tips

❑ For items with a channel with measurement disabled selected, digital values are displayed as "– – –".
For items with a free slot selected, only the slot/channel number is displayed.

Measurement disabled



Free slot



4.4. Selecting the Recording Method

Select the recording method, depending on whether to save the measurement data to a file.

4.4.1. Recording to Recording Paper Only

Perform "pen recording" to record to recording paper only, without saving a file.



See "4.5.3. Chart Speed", "6.3.1. Pen Recording", and "6.3.3. Text to Print".

4.4.2. Recording to a File and Recording Paper

Save the measurement data to a file and print it to recording paper.

This function provides the following.

- ❑ Nine types of recording modes (start trigger, interval, etc.)
- ❑ Simultaneous recording to three recording devices (printer, SSD, and memory)
- ❑ Enabling/disabling of real-time waveform printing
- ❑ Memory recording via memory triggers at 18 trigger sources
- ❑ Starting recording via start triggers at arbitrary timing
- ❑ Delete then save function for recorded data



See "6.4. Recording".

4.5. Recording Devices

4.5.1. Features of Recording Devices

There are three types of recording device (printer, SSD, and memory).
The available sampling speed range and features of each device are indicated below.

PRINTER	Speed	Low speed sampling: Maximum 1 kS/s
	Features	Enables waveform recording for a maximum of 48 channels of input signals to be recorded to recording paper for a long time. Because waveform recording is performed with P-P sampling, sudden transient phenomena can be recorded even with low speed recording. Recording can be performed to recording paper and the internal SSD simultaneously, at an arbitrary step speed. Sampling can also be performed in synchronization with an external signal. This can be configured with the chart speed.
SSD	Speed	Medium speed sampling : Maximum 1 MS/s
	Features	Records data to the internal SSD with NORMAL or P-P sampling for a long time. If data was recorded with NORMAL sampling. FFT analysis and an X-Y waveform can be displayed in addition to a Y-T waveform.
MEMORY	Speed	High speed sampling : Maximum 20 MS/s
	Features	Records data to the internal memory with NORMAL sampling when a trigger is detected, such as an abnormal waveform. Because data is recorded to the high speed internal memory, data can be recorded at high speed with NORMAL sampling when a trigger is detected, such as an abnormal waveform. By dividing the memory, multiple detected triggers can be recorded individually.

For information on selecting the recording device, see "1.6.2. Side Menu" and "6.4.1. Recording Setup".

4.5.2. Setup the Sampling Speed

An image of the waveform recorded on the selected recording device (PRINTER, SSD, or MEMORY) is displayed on the waveform monitor.

The sampling speed of the image waveform recorded on the selected recording device is displayed on the left edge of the control bar.

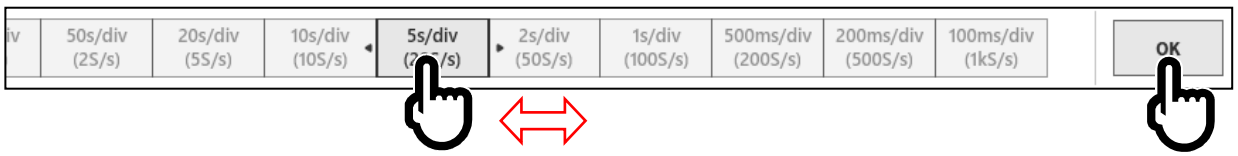




An image of the waveform recorded on the selected device is displayed on the waveform monitor.



Tap to display the selectable sampling speed table.



Tap the sampling speed to display the waveform sampled at that speed.

Swipe the table to the left or right to display the hidden velocity table.

When the sampling speed is decided, tap【OK】on the right edge to close the table.

You can switch the unit for the sampling speed. See "8.2.5 Other".

4.5.3. Chart Speed

When [PRINTER] is selected for the recording device, you can set the sampling speed with the chart speed.

By switching to the chart speed view, you can configure an arbitrary speed or perform a one-touch setting.

Switching to the Chart Speed View

In [Other] in [Recording setup], set [Printer speed] to 【Chart speed】. See "8.2.5 Other".



The sampling speed in the 【WAVE】 control bar switches to the chart speed.



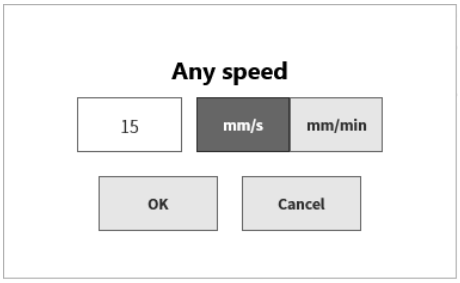
Configuring an Arbitrary Speed

You can configure the chart speed in single increments. Either mm/s or mm/min can be selected for the unit.

Step 1. Select 【Any Speed】 from the sampling speed table, then tap 【OK】.

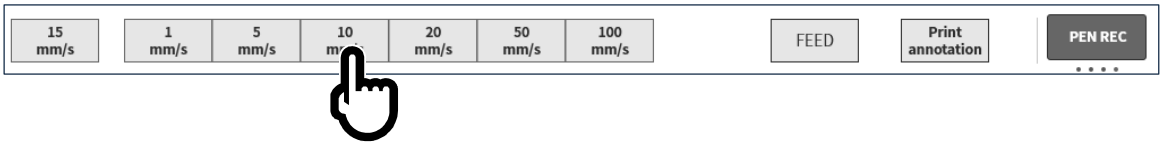


Step 2. In the [Any speed] dialog, configure the speed and unit.



Performing a One-Touch Setting

You can tap the chart speed key of the 【PEN REC】 control bar to change the speed with a single touch.



In [Other] in [Recording setup], register [Printer speed]. See "8.2.5 Other".

4.5.4. Maximum Recordable Times

The maximum recordable times when the internal SSD is empty are indicated in the table below.
The maximum recordable time differs according to the number of channels, the recording device, the sampling speed, and the data format.

4.5.4.1. Recording Device: PRINTER (Data Format: P-P)

<table>
<tr><td rowspan="2">Sampling speed</td><td colspan="5">Number of measurement channels</td></tr>
<tr><td>1 channel</td><td>2 channels</td><td>8 channels</td><td>18 channels</td><td>36 channels</td></tr>
<tr><td>1 kS/s</td><td>100 days</td><td>100 days</td><td>85 days12 hours</td><td>39 days 7 hours</td><td>19 days22 hours</td></tr>
<tr><td>500 S/s</td><td>100 days</td><td>100 days</td><td>100 days</td><td>78 days14 hours</td><td>39 days20 hours</td></tr>
<tr><td>200 S/s</td><td>100 days</td><td>100 days</td><td>100 days</td><td>100 days</td><td>99 days14 hours</td></tr>
<tr><td>100 S/s</td><td colspan="5" rowspan="10">100 days</td></tr>
<tr><td>50 S/s</td></tr>
<tr><td>20 S/s</td></tr>
<tr><td>10 S/s</td></tr>
<tr><td>5 S/s</td></tr>
<tr><td>2 S/s</td></tr>
<tr><td>1 S/s</td></tr>
<tr><td>50 S/min</td></tr>
<tr><td>20 S/min</td></tr>
<tr><td>10 S/min</td></tr>
<tr><td>EXT (external)</td><td colspan="5">500,000,000 points</td></tr>
</table>

4.5.4.2. Recording Device: SSD (Data Format: NORMAL)

Sampling speed	Number of measurement channels				
	1 channel	2 channels	8 channels	18 channels	36 channels
1 MS/s	17 hours 26 minutes	11 hours 37 minutes	3 hours 52 minutes	1 hour 50 minutes	56 minutes 35 seconds
500 kS/s	1 day10 hours	23 hours 15 minutes	7 hours 45 minutes	3 hours 40 minutes	1 hour 53 minutes
200 kS/s	3 days15 hours	2 days10 hours	19 hours 23 minutes	9 hours 11 minutes	4 hours 42 minutes
100 kS/s	7 days 6 hours	4 days20 hours	1 day14 hours	18 hours 22 minutes	9 hours 25 minutes
50 kS/s	14 days12 hours	9 days16 hours	3 days 5 hours	1 day12 hours	18 hours 51 minutes
20 kS/s	36 days 8 hours	24 days 5 hours	8 days 1 hour	3 days19 hours	1 day23 hours
10 kS/s	72 days16 hours	48 days11 hours	16 days 3 hours	7 days15 hours	3 days22 hours
5 kS/s	100 days	96 days22 hours	32 days 7 hours	15 days 7 hours	7 days20 hours
2 kS/s	100 days	100 days	80 days18 hours	38 days 6 hours	19 days15 hours
1 kS/s	100 days	100 days	100 days	76 days12 hours	39 days 7 hours
500 S/s	100 days	100 days	100 days	100 days	78 days14 hours
200 S/s	100 days				
100 S/s					
50 S/s					
20 S/s					
10 S/s					
5 S/s					
2 S/s					
1 S/s					
50 S/min					
20 S/min					
10 S/min					
EXT (external)	500,000,000 points				

4.5.4.3. Recording Device: SSD (Data Format: P-P)

Sampling speed	Number of measurement channels				
	1 channel	2 channels	8 channels	18 channels	36 channels
500 kS/s	23 hours 15 minutes	13 hours 57 minutes	4 hours 6 minutes	1 hour 53 minutes	57 minutes22 seconds
200 kS/s	2 days10 hours	1 day10 hours	10 hours 15 minutes	4 hours 42 minutes	2 hours 23 minutes
100 kS/s	4 days20 hours	2 days21 hours	20 hours 31 minutes	9 hours 25 minutes	4 hours 46 minutes
50 kS/s	9 days16 hours	5 days19 hours	1 day17 hours	18 hours 51 minutes	9 hours 33 minutes
20 kS/s	24 days 5 hours	14 days12 hours	4 days 6 hours	1 day23 hours	23 hours 54 minutes
10 kS/s	48 days11 hours	29 days 1 hour	8 days13 hours	3 days22 hours	1 day23 hours
5 kS/s	96 days22 hours	58 days 3 hours	17 days 2 hours	7 days20 hours	3 days23 hours
2 kS/s	100 days	100 days	42 days18 hours	19 days15 hours	9 days23 hours
1 kS/s	100 days	100 days	85 days12 hours	39 days 7 hours	19 days22 hours
500 S/s	100 days	100 days	100 days	78 days14 hours	39 days20 hours
200 S/s	100 days	100 days	100 days	100 days	99 days14 hours
100 S/s	100 days				
50 S/s					
20 S/s					
10 S/s					
5 S/s					
2 S/s					
1 S/s					
50 S/min					
20 S/min					
10 S/min					
EXT (external)	500,000,000 points				

4.5.4.4. Recording Device: MEMORY (Data Format: NORMAL)

Sampling speed	Number of measurement channels				
	1 channel	2 channels	8 channels	18 channels	36 channels
20 MS/s	1 minute 40 seconds	50 seconds	10 seconds	5 seconds	-
10 MS/s	3 minutes 20 seconds	1 minute 40 seconds	20 seconds	10 seconds	5 seconds
5 MS/s	6 minutes 40 seconds	3 minutes 20 seconds	40 seconds	20 seconds	10 seconds
2 MS/s	16 minutes 40 seconds	8 minutes 20 seconds	1 minute 40 seconds	50 seconds	25 seconds
1 MS/s	33 minutes 20 seconds	16 minutes 40 seconds	3 minutes 20 seconds	1 minute 40 seconds	50 seconds
500 kS/s	1 hour 6 minutes	33 minutes 20 seconds	6 minutes 40 seconds	3 minutes 20 seconds	1 minute 40 seconds
200 kS/s	2 hours46 minutes	1 hour23 minutes	16 minutes 40 seconds	8 minutes 20 seconds	4 minutes 10 seconds
100 kS/s	5 hours33 minutes	2 hours46 minutes	33 minutes 20 seconds	16 minutes 40 seconds	8 minutes 20 seconds
50 kS/s	11 hours 6 minutes	5 hours33 minutes	1 hour 6 minutes	33 minutes20 seconds	16 minutes40 seconds
20 kS/s	1 day 3 hours	13 hours53 minutes	2 hours46 minutes	1 hour23 minutes	41 minutes40 seconds
10 kS/s	2 days 7 hours	1 day 3 hours	5 hours33 minutes	2 hours46 minutes	1 hour23 minutes
5 kS/s	4 days15 hours	2 days 7 hours	11 hours 6 minutes	5 hours33 minutes	2 hours46 minutes
2 kS/s	11 days13 hours	5 days18 hours	1 day 3 hours	13 hours53 minutes	6 hours56 minutes
1 kS/s	23 days 3 hours	11 days13 hours	2 days 7 hours	1 day 3 hours	13 hours53 minutes
500 S/s	46 days 7 hours	23 days 3 hours	4 days15 hours	2 days 7 hours	1 day 3 hours
200 S/s	100 days	57 days20 hours	11 days13 hours	5 days18 hours	2 days21 hours
100 S/s	100 days	100 days	23 days 3 hours	11 days13 hours	5 days18 hours
50 S/s	100 days	100 days	46 days 7 hours	23 days 3 hours	11 days13 hours
20 S/s	100 days	100 days	100 days	57 days20 hours	28 days22 hours
10 S/s	100 days	100 days	100 days	100 days	57 days20 hours
5 S/s	100 days				
2 S/s					
1 S/s					
50 S/min					
20 S/min					
10 S/min					

5. Trigger Setup

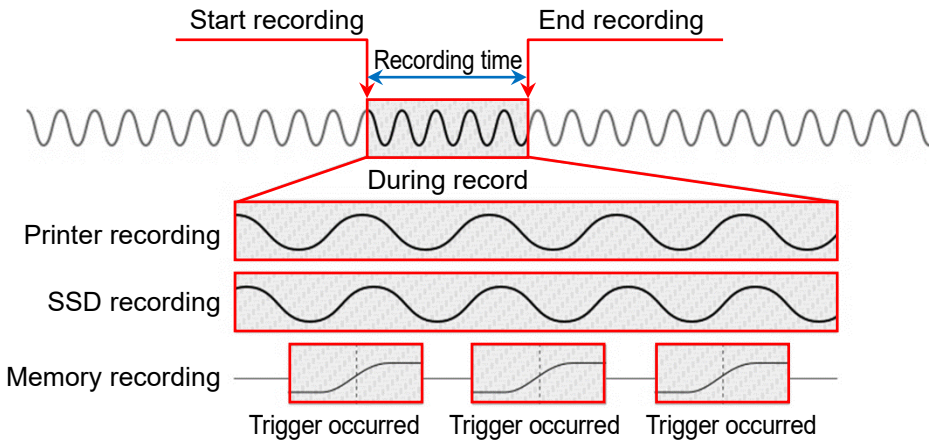
5.1. Trigger Types

This product has three types of triggers: a memory trigger for memory recording, a start trigger for starting recording, and a stop trigger for stopping recording.

5.2. Memory trigger

Memory trigger is a signal for enabling memory recording, and is occurred when the trigger conditions of the channel specified in the trigger source are established.

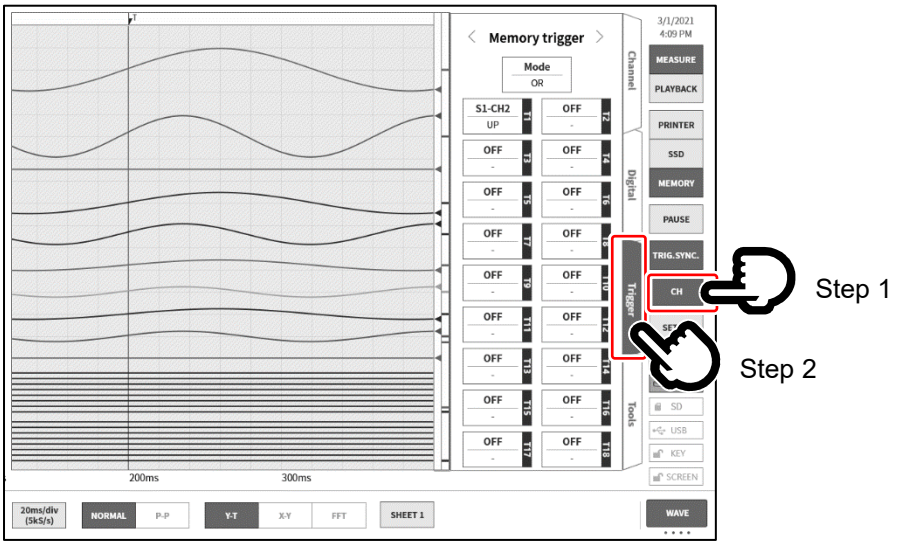
When a trigger is detected, memory recording is performed with the data count set in the pre-trigger and memory block size, which represents a single recording operation. When multiple memory blocks (memory divisions) are set, recording starts for the next block when one block has finished recording. A memory trigger occurs even for a forced trigger or external trigger.



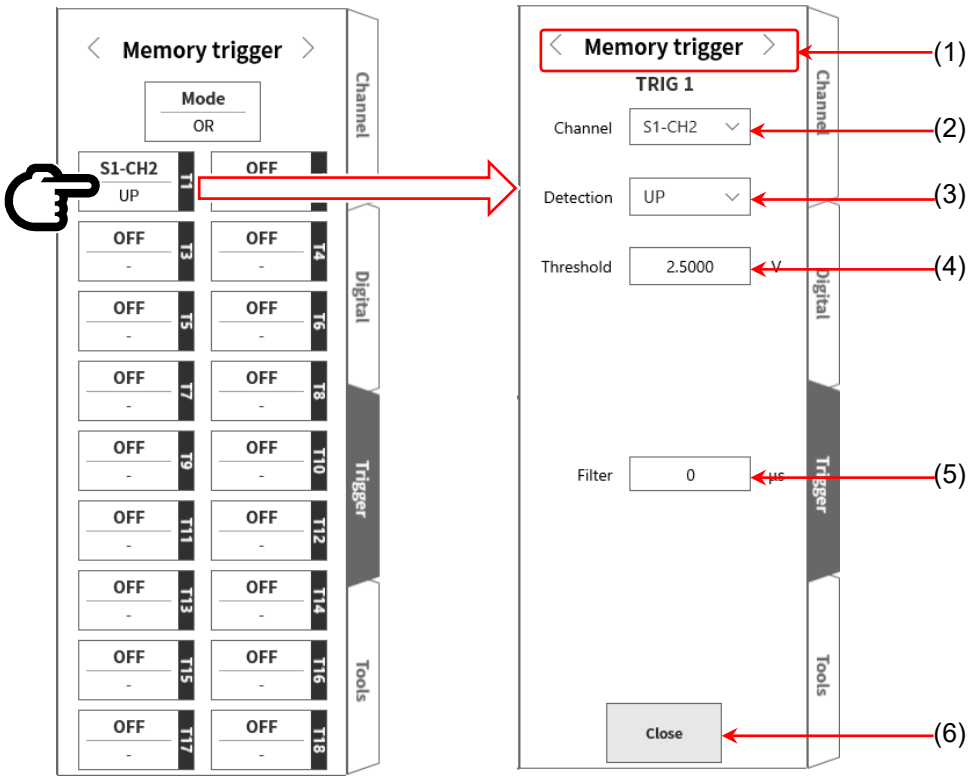
5.2.1. Memory Trigger Setup

Step 1. Tap the【CH】key on the side menu to display the sub menu.

Step 2. Tap the【Trigger】tab in the sub menu to display the trigger setup screen.



Step 3. Up to 18 trigger sources (【T1】 to 【T18】) can be set.
Tap the number of the trigger source to set to display the details screen.



(1) Trigger menu selection:
Switches between the Memory trigger, Start trigger, or Memory block menu

(2) Channel: Selects the TRIGn source channel.

(3) Detection: Selects UP, DOWN, INTO WIN, or OUT WIN for the polarity of the trigger signal.
UP The trigger is detected when the value exceeds the trigger level (threshold).
DOWN The trigger is detected when the value is below the trigger level (threshold).
INTO WIN The trigger is detected when the value enters the range of the upper limit value or lower limit value of the trigger level.
OUT WIN The trigger is detected when the value leaves the range of the upper limit value or lower limit value of the trigger level.

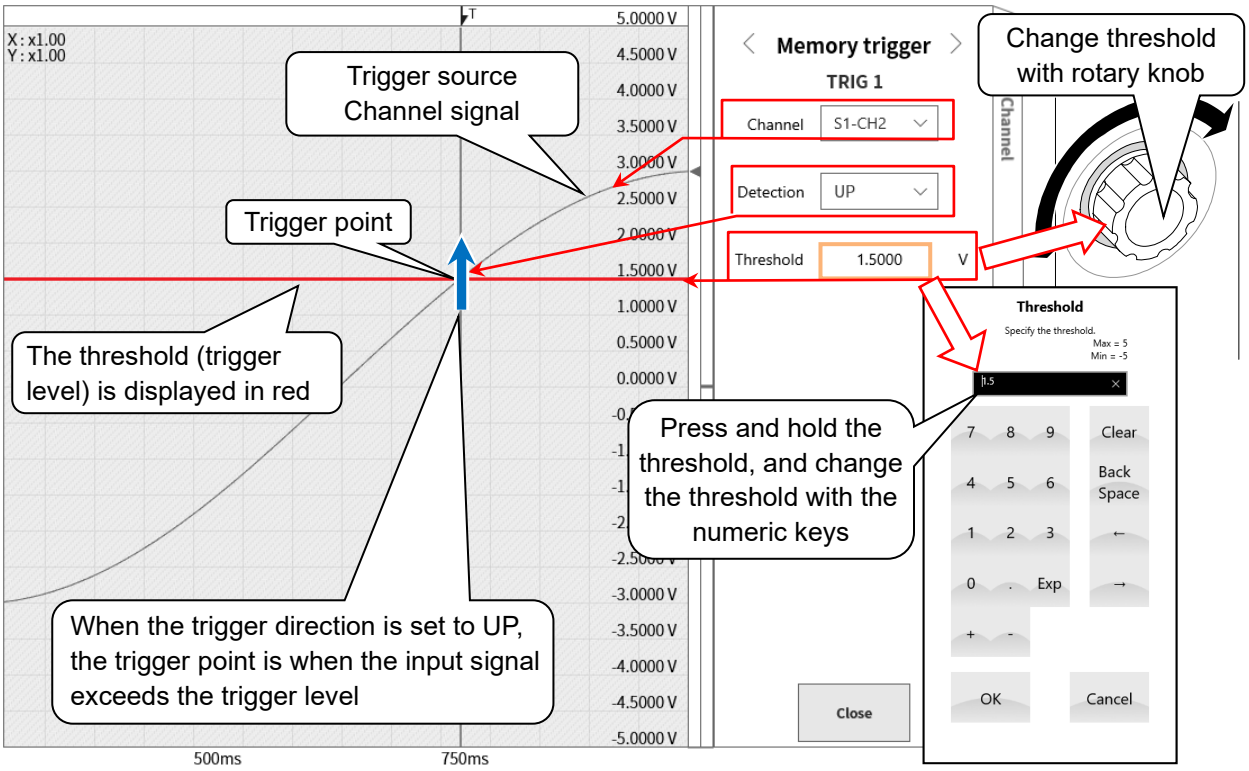
(4) Threshold: Sets the trigger level (threshold).
For INTO WIN / OUT WIN, there are two settings: the upper threshold and lower threshold.

(5) Filter: Sets the filter time for noise removal.

(6) Close: Ends the setting operation and returns to the trigger list.

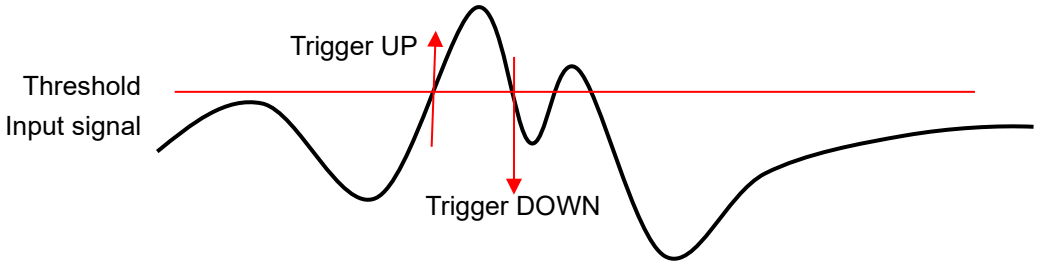
⚠CAUTION

❑ The trigger level is a value relative to the set measurement range. The value also changes when the measurement range is changed.
(Example) When the trigger level is set to 10 mV when the range is 100 mV, and then the measurement range is changed to 200 mV, the trigger level is changed to 20 mV.

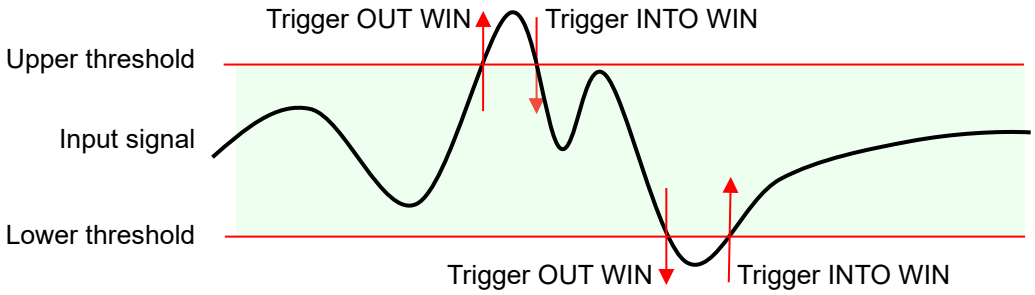


Description of trigger source (3) Detection and (4) Threshold

❑ When the OR/AND trigger is used: (3) Trigger detection when the UP/DOWN trigger is selected for detection.



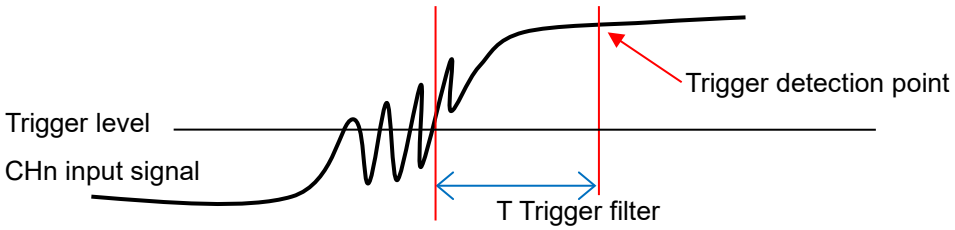
❑ When the window trigger is used: (3) Trigger detection when the INTO WIN / OUT WIN trigger is selected for detection.



Description of trigger source (5) Filter

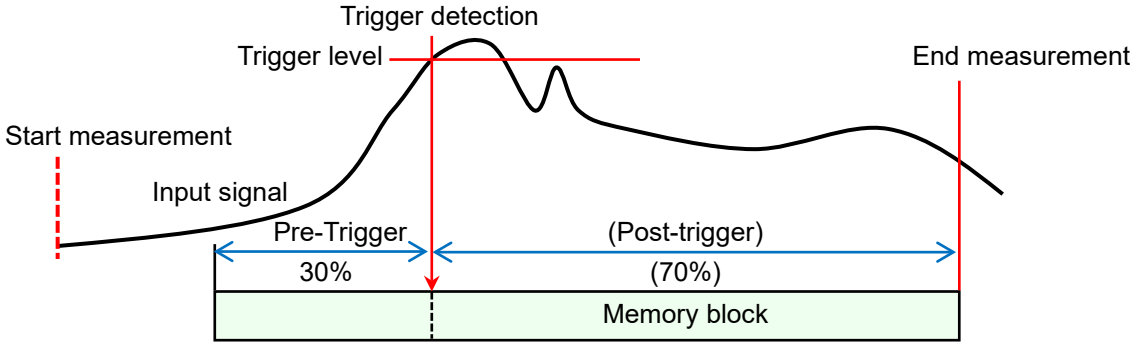
❑ Trigger filter

The trigger filter function ensures that a trigger is detected when the trigger conditions are met for a specified period of time, in order to prevent erroneous trigger detection due to noise or chattering in the signal near the trigger level.



5.3. Pre-Trigger

When performing memory recording, a pre-trigger can be set to adjust the recording length before and after the trigger detection point in the memory block.

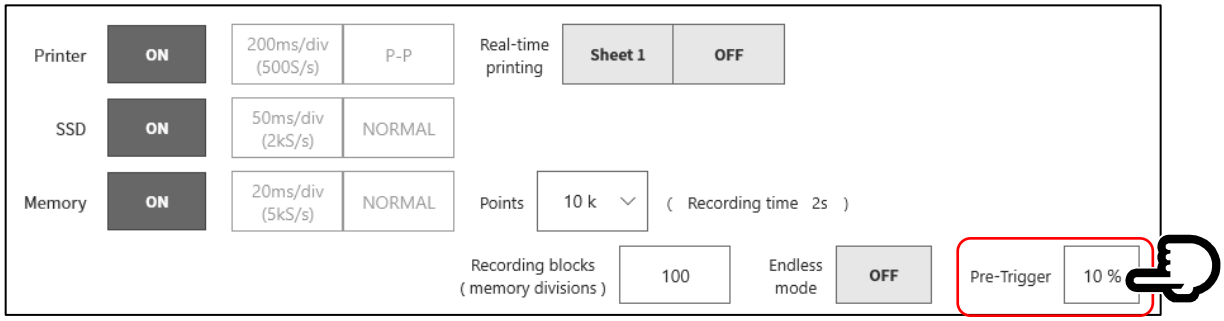


5.3.1. Pre-Trigger Setup

❑ Tap the【SETUP】key on the side menu to display the setup menu.

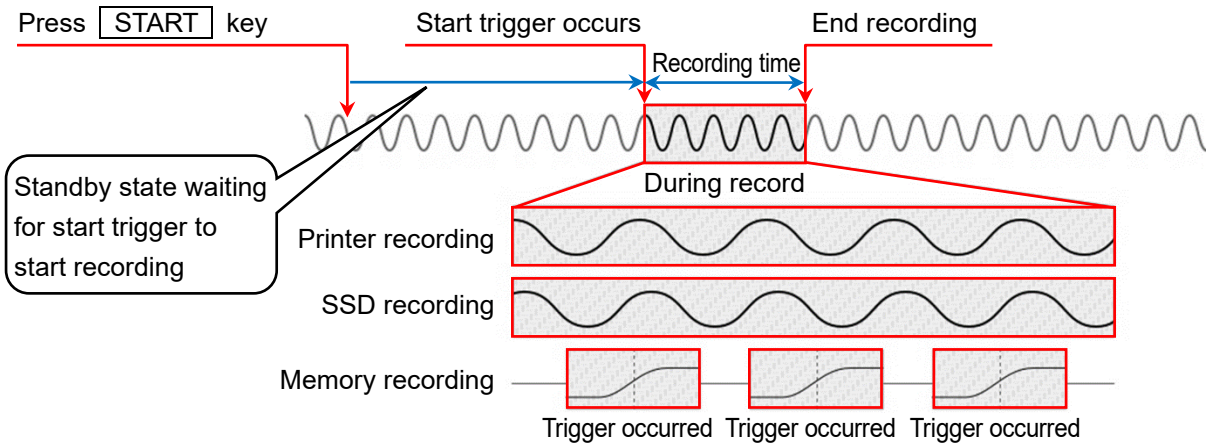
❑ Tap the【Recording】tab in the recording setup to display the recording setup screen.
The recording device settings are displayed below the recording setup.

❑ Tap【Pre-Trigger】on the right of memory recording to set the pre-trigger.



5.4. Start Trigger

A start trigger is a trigger to start recording with an input signal. It enables you to start recording when the trigger conditions are established for the channel specified as the trigger source. A start trigger occurs even for a forced trigger or external trigger.

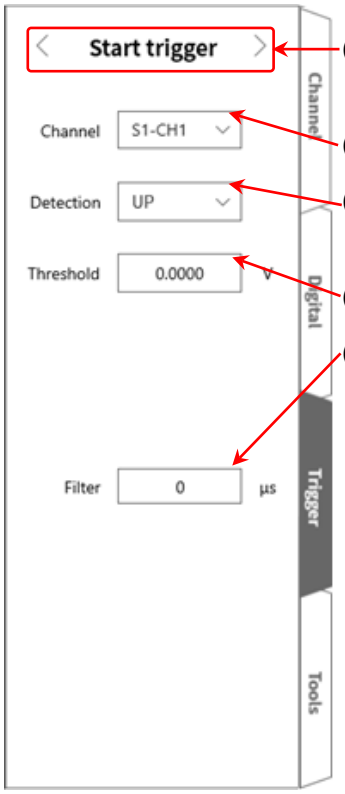


5.4.1. Start Trigger Setup

Step 1. Tap the【CH】key on the side menu to display the sub menu.

Step 2. Tap the【Trigger】tab in the sub menu to display the trigger setup screen.

Step 3. Tap the【trigger menu selection】on the top of the trigger setup screen (1) to display [Start trigger].



(1) Trigger menu selection:
Switches the menu.

(2) Channel: Selects the start trigger source channel.

(3) Detection: Selects UP, DOWN, INTO WIN, or OUT WIN for the polarity of the trigger signal.

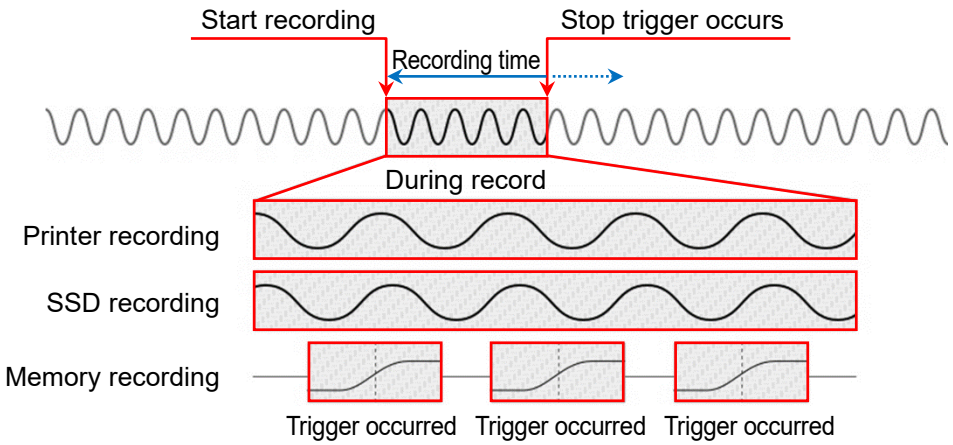
(4) Threshold: Sets the trigger level (threshold).

(5) Filter: Sets the filter time for noise removal.

The setup and operations of (1) to (5) are the same as "5.2 Memory trigger".

5.5. Stop Trigger

A stop trigger is a trigger to stop recording with an input signal. It enables you to stop recording when the trigger conditions are established for the channel specified as the trigger source.

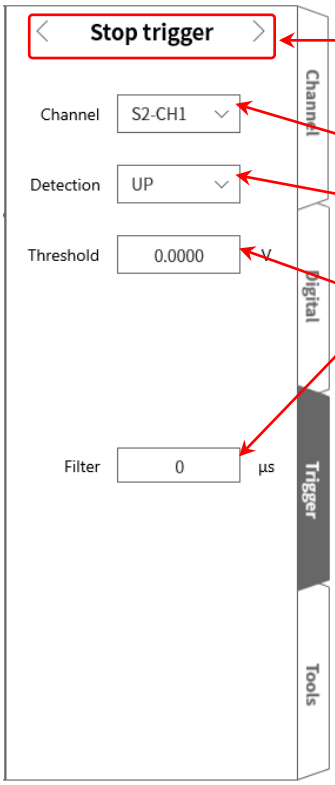


5.5.1. Stop Trigger Setup

Step 1. Tap the【CH】key on the side menu to display the sub menu.

Step 2. Tap the【Trigger】tab in the sub menu to display the trigger setup screen.

Step 3. Tap the【trigger menu selection】on the top of the trigger setup screen (1) to display [Stop trigger].



(1) Trigger menu selection: Switches the menu.

(2) Channel: Selects the stop trigger source channel.

(3) Detection: Selects UP, DOWN, INTO WIN, or OUT WIN for the polarity of the trigger signal.

(4) Threshold: Sets the trigger level (threshold).

(5) Filter: Sets the filter time for noise removal.

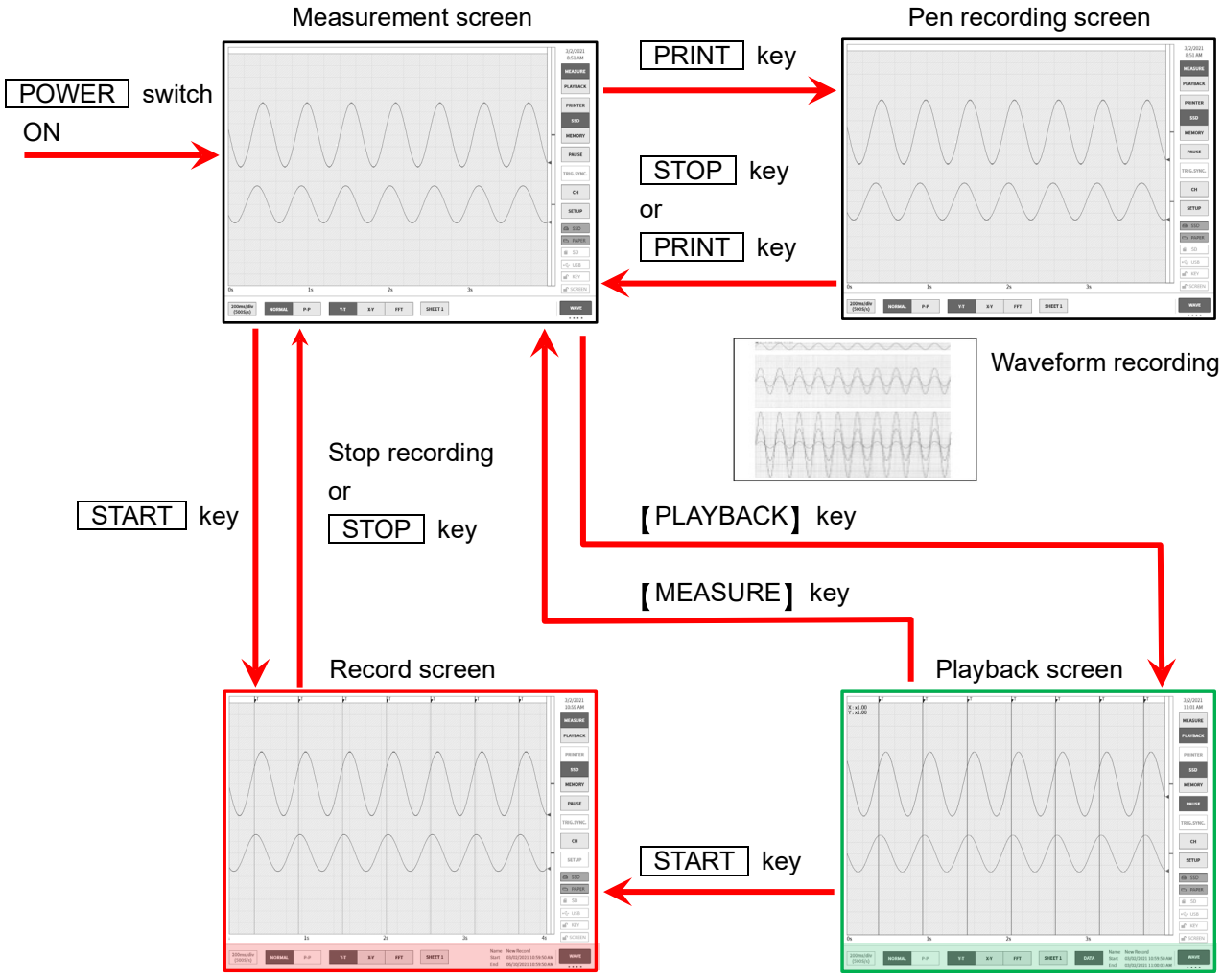
The setup and operations of (1) to (5) are the same as "5.2 Memory trigger".

6. Measuring Input Signals

6.1. State Transition of Main Unit Operation

This product is divided into three states according to the operation state: measure, record, and playback.

The [PRINT] key can also be pressed in the measurement state to perform pen recording (real-time waveform printing).The [START] key can also be pressed in the measure state to perform printer recording, SSD recording, and memory recording.



While recording, the screen is enclosed in a red box and the back color of the control bar changes to red.

During playback, the screen is enclosed in a green box and the back color of the control bar changes to green.

Tips

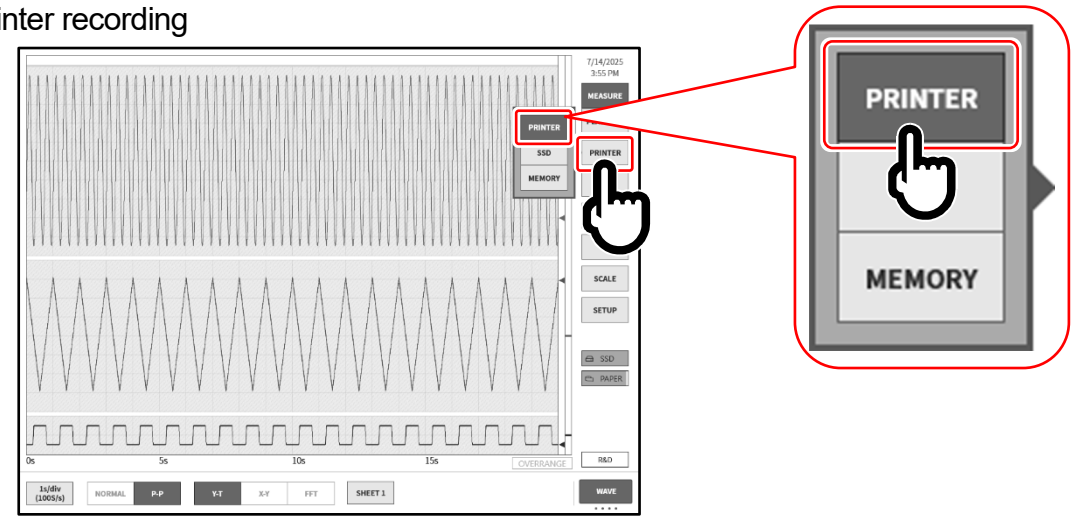
- With software version 1.x.x, this product automatically switches from the recording screen to the playback screen after recording is complete.

6.2. Waveform Monitor

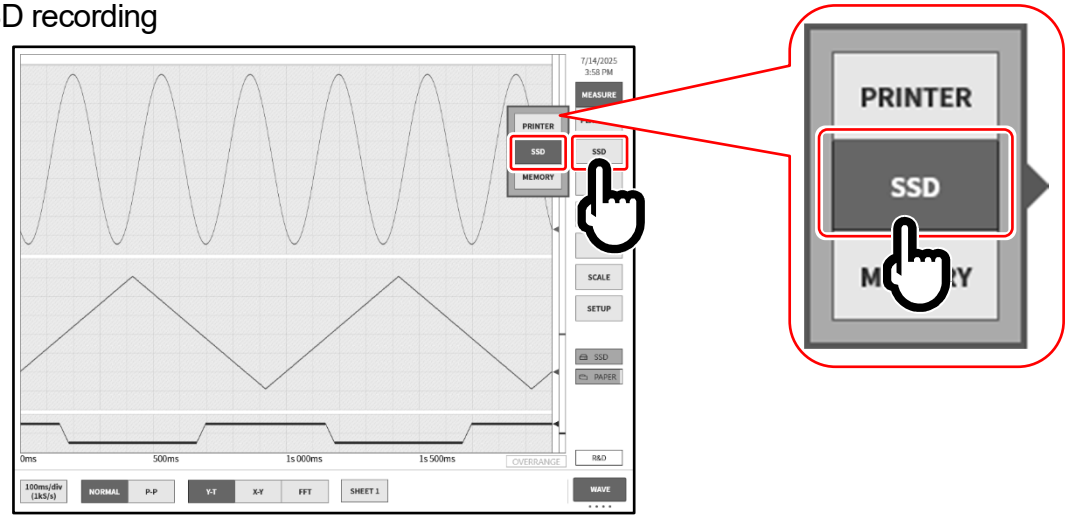
6.2.1. Selecting the Recording Device

Tap the recording device selection key in the side menu to display the image waveform recorded to the selected device on the monitor.

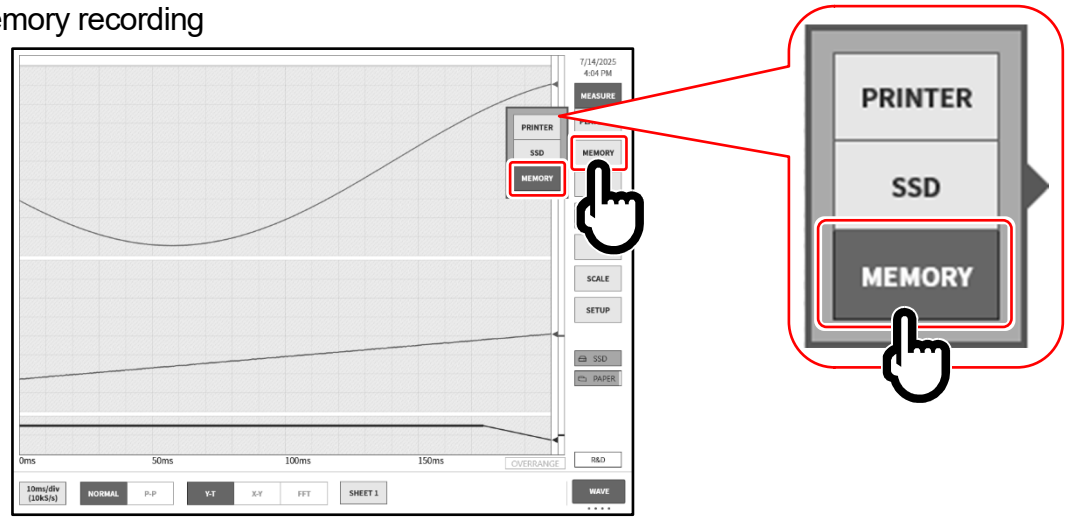
Printer recording



SSD recording



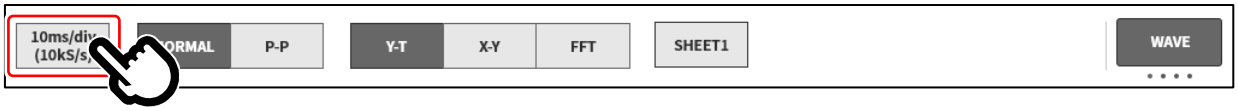
Memory recording



6.2.2. Sampling speed

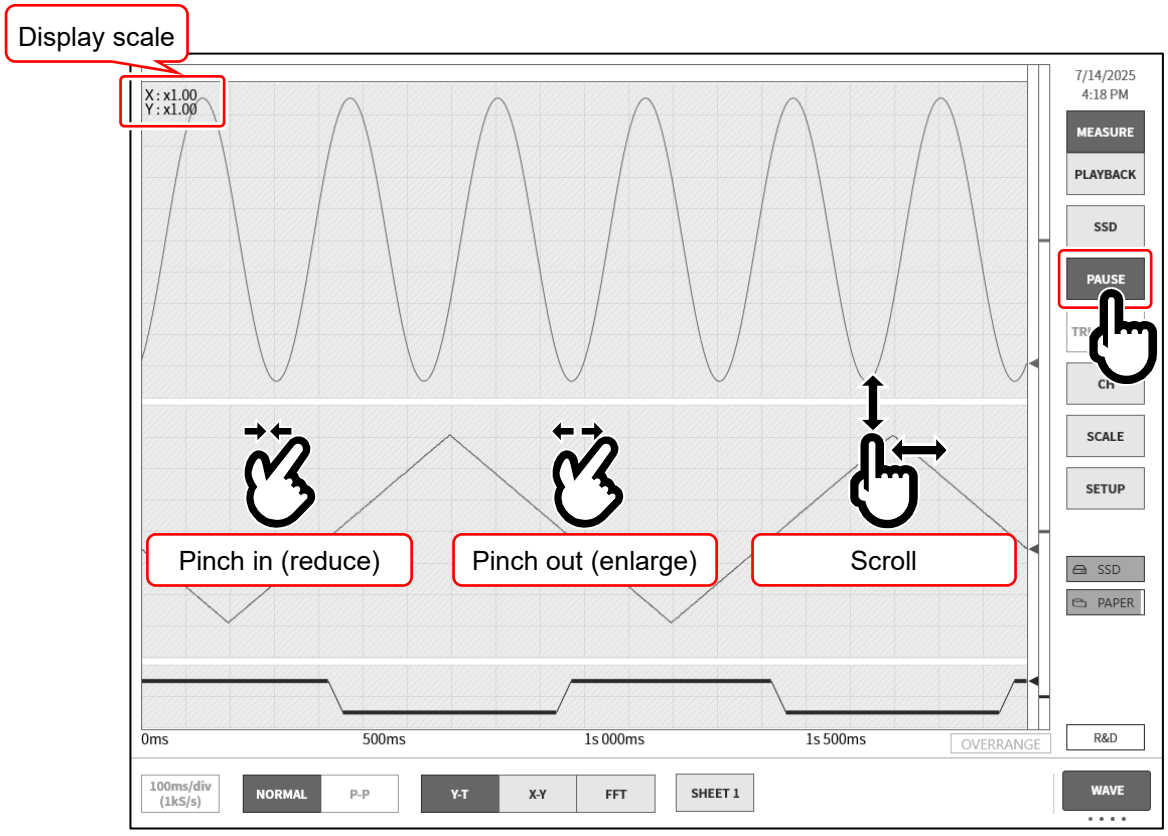
Use the【Sampling speed】key on the left edge of the control bar to change the sampling speed according to the recording device. Set the optimal sampling speed while viewing the waveform monitor.

☞ For details, see "4.5.2. Setup the Sampling Speed".



6.2.3. Pausing the Waveform Monitor (PAUSE)

Tap the【PAUSE】key in the side menu during waveform monitoring to pause the monitor.
You can pinch in/out the waveform monitor in this state to zoom the waveform in or out.
You can also swipe the screen up, down, left, or right with one finger to scroll the view area.

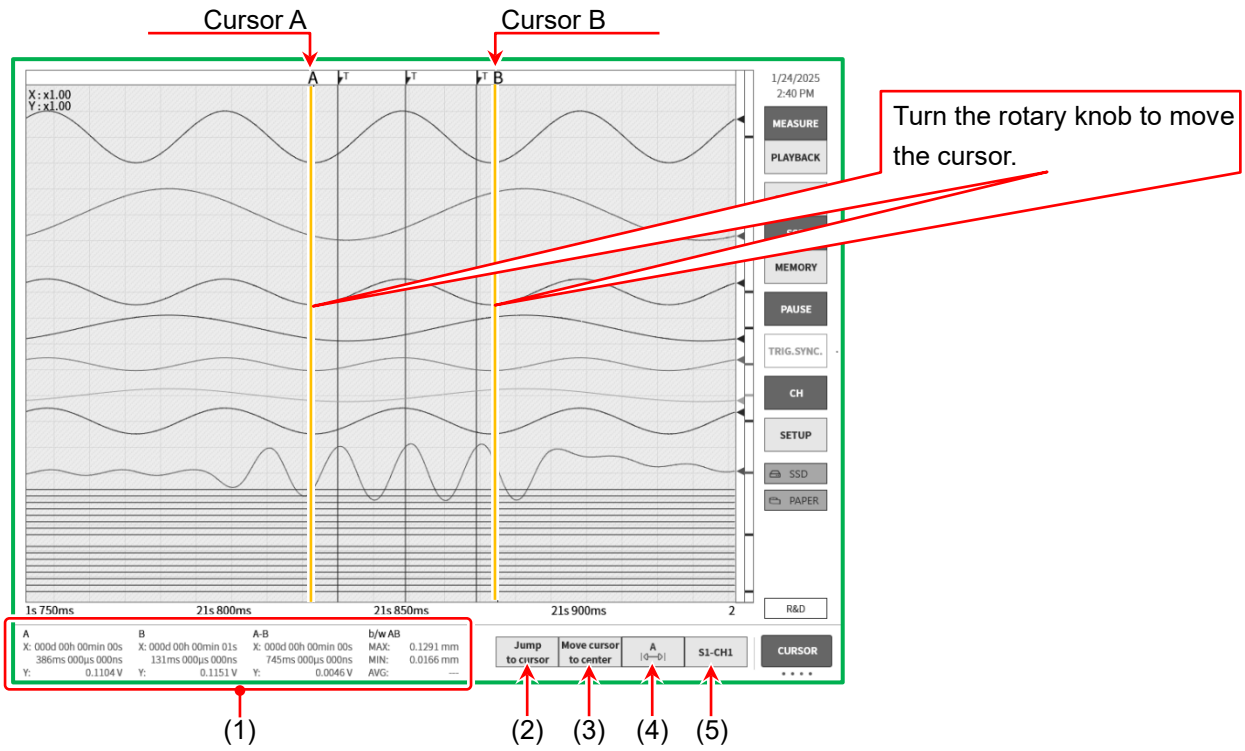


Tips

- ❑ You can tap the PRINT key to print the displayed waveform.
- ❑ You can press and hold the PRINT key to capture a screenshot image for printing or saving to a file.

6.2.4. Cursors

By selecting【CURSOR】with the【Display Switch】key on the bottom right of the control bar while operation is paused, you can display two time axis cursors (Cursor A and Cursor B), which display the cursor value of the selected channel.



(1) Cursor values

A: The recorded information at the position of Cursor A

X: The time since recording started Y: The data value of the selected channel

B: The recorded information at the position of Cursor B

X: The time since recording started Y: The data value of the selected channel

A–B: The difference information between Cursor A and Cursor B

X: The time between Cursor A and Cursor B

Y: The difference in the data value between Cursor A and Cursor B

* Not displayed for a logic channel.

b/w AB: The maximum value (MAX), minimum value (MIN), and average value (AVG) between Cursor A and Cursor B

* The average value is not displayed for P–P sampling.

Tips

- For external sampling, X is displayed as the number of points.
- For P–P sampling, Y is displayed as the maximum data value.
  However, the minimum value (MIN) between A and B is calculated from the minimum data value of A and B.

(2) 【Jump to cursor】key

Tap this key to move the waveform so that the cursor position is in the center of the screen.

(3) 【Move cursor to center】key

Tap this key to move the specified cursor to the center of the monitor.

(4) Cursor selection

Selects the cursor to change the position of. Each time this key is tapped, the selected cursor switches in the order【A】>【B】>【A-B】.

If you select【A】then turn the rotary knob, Cursor A moves.

If you select【B】then turn the rotary knob, Cursor B moves.

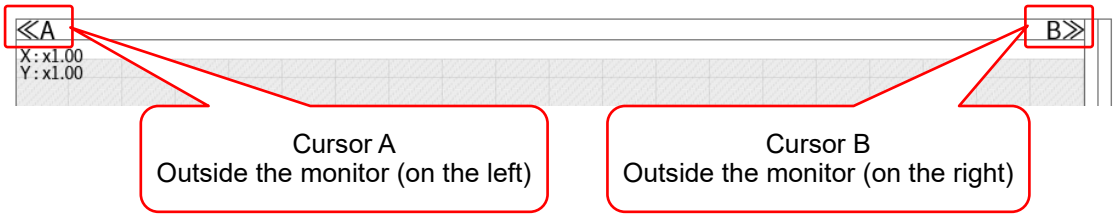
If you select【A-B】then turn the rotary knob, Cursor A and Cursor B move with the distance between the cursors maintained.

Tips

❑ You can also tap the A or B mark above a cursor to select that cursor.

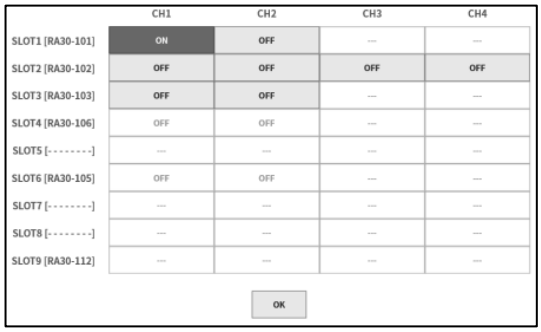


❑ If a cursor is outside the waveform monitor, the << or >> mark is displayed above the cursor.



(5) Channel selection

Selects the channel to display in the cursor position information. Tap the【channel selection】key to display the channel selection screen, which enables you to select the channel to display in the cursor position information.



Tips

❑ A logic channel cannot be selected.

6.2.5. X-Y Waveform and FFT Analysis

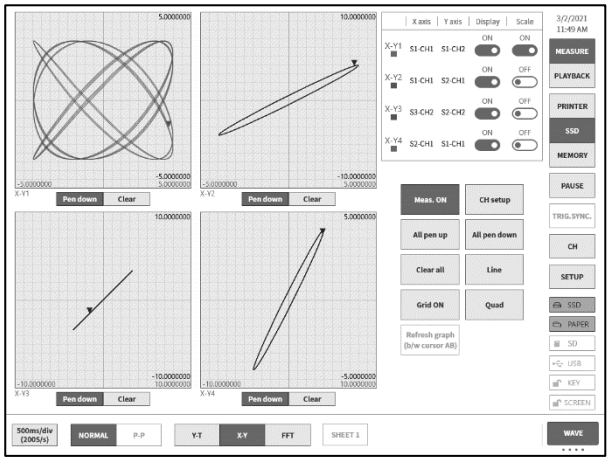
When【SSD】is selected as the recording device and【NORMAL】is selected as the data format, FFT analysis and the X-Y waveform display for the control bar waveform format are enabled.

☞ For details on X-Y waveform display and FFT analysis, see "7.3. X-Y Waveform" and "7.4. FFT Analysis".



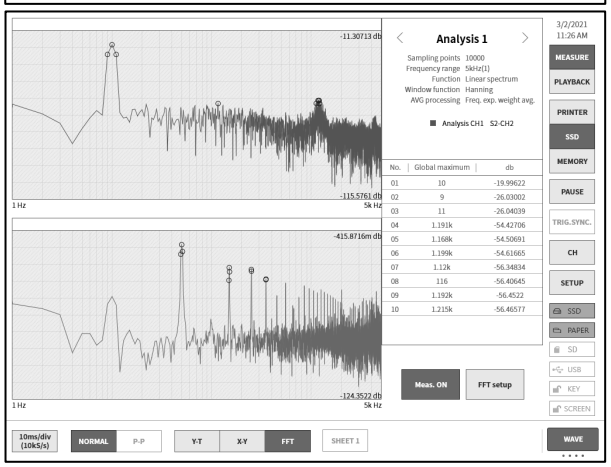
X-Y waveform conditions

Recording device: SSD
Sampling speed: 1 kS/s or lower
Data format: NORMAL
Analog input module: 2 channels or above



FFT analysis conditions

Recording device: SSD
Sampling speed: 1 MS/s or lower
Data format: NORMAL
Analog input module: 1 channel or 2 channels

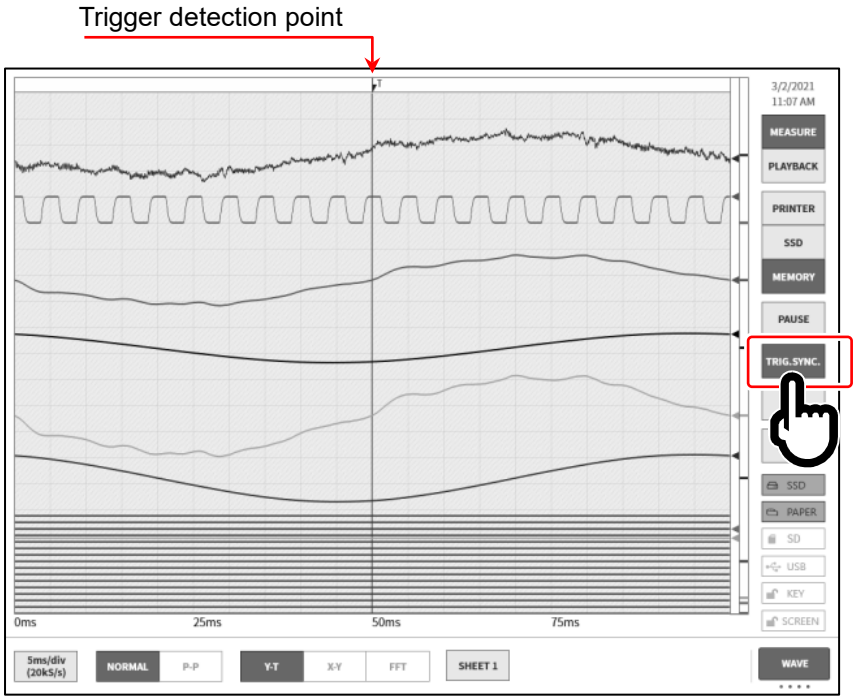


Tips

- ❑ You can tap the PRINT key during a pause to print the displayed waveform.
- ❑ You can press and hold the PRINT key during a pause to capture a screenshot image for printing or saving to a file.

6.2.6. Trigger Synchronization

When the recording device is set to【MEMORY】, a trigger is set, and【TRIG.SYNC.】is enabled, the latest waveform is displayed with the displayed waveform synchronized to trigger detection.

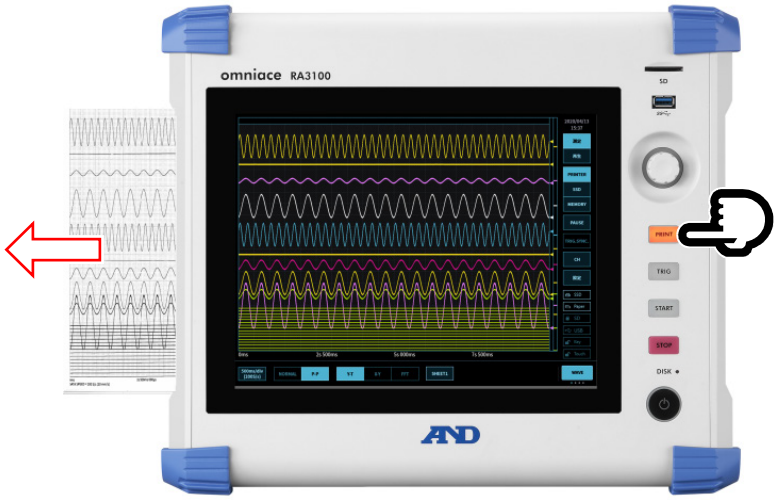


6.3. Pen Recording

Pen recording enables waveform printing to the recording paper without saving the measurement data. This enables single-touch simple and certain waveform recording like a conventional pen recorder.

6.3.1. Pen Recording

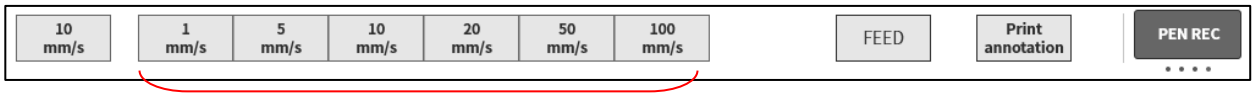
You can press the PRINT key on the operation panel while the measurement screen is displayed to perform real-time waveform recording of the displayed sheet using the printer.
The chart speed (sampling speed) and input module settings can be changed while executing pen recording.



Press the PRINT key on the operation panel to start waveform recording with the printer.

6.3.2. Pen Recording Operations

Tap the menu on the right edge of the control bar and select【PEN REC】to enter the pen recording mode, which enables you to configure the chart speed and perform recording paper operations.



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

(1) Printer speed: Displays the chart speed and sampling speed of printer recording or pen recording.

(2) Chart speed (six items): Enables you to switch to a frequently used chart speed with a single touch. Chart speed keys can be registered with [Chart speed key] in "8.2.5. Other".

(3) FEED: The recording paper is fed (idle feeding) while this is pressed.

(4) Print annotation: Tap this key during waveform recording to print annotation text together with the waveform at a time of your choice. For information on annotation text, see "8.2.4.1. Printing Setup".

Tips

❑ (1) Printer speed and (2) Chart speed can only be operated when the recording device is set to【PRINTER】and the speed unit notation is set to chart speed. Otherwise, the key will be disabled.

6.3.3. Waveform Printing

When printing a waveform, you can print various information to the header, waveform, and footer.

Header: Enables you to print the header text and signal name before waveform recording.

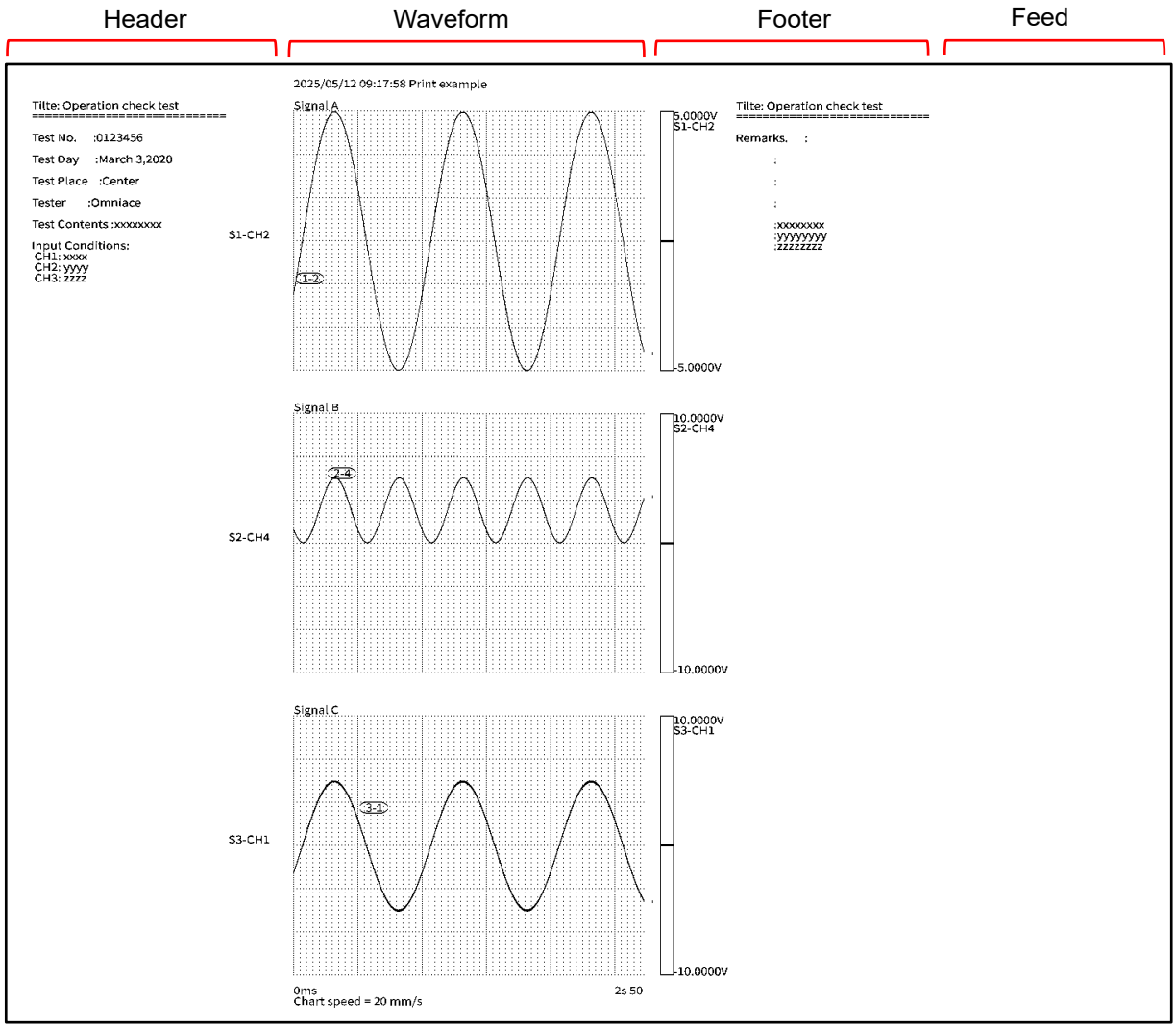
Waveform: Enables you to print the annotation text, grid, date, data name, channel mark, time axis, and recording speed during waveform recording.

Footer: Enables you to print the footer text and scale after waveform recording.

Feed: Enables you to feed the recording paper after footer printing.

For details, see "8.2.4. Printer".

Example of printing:

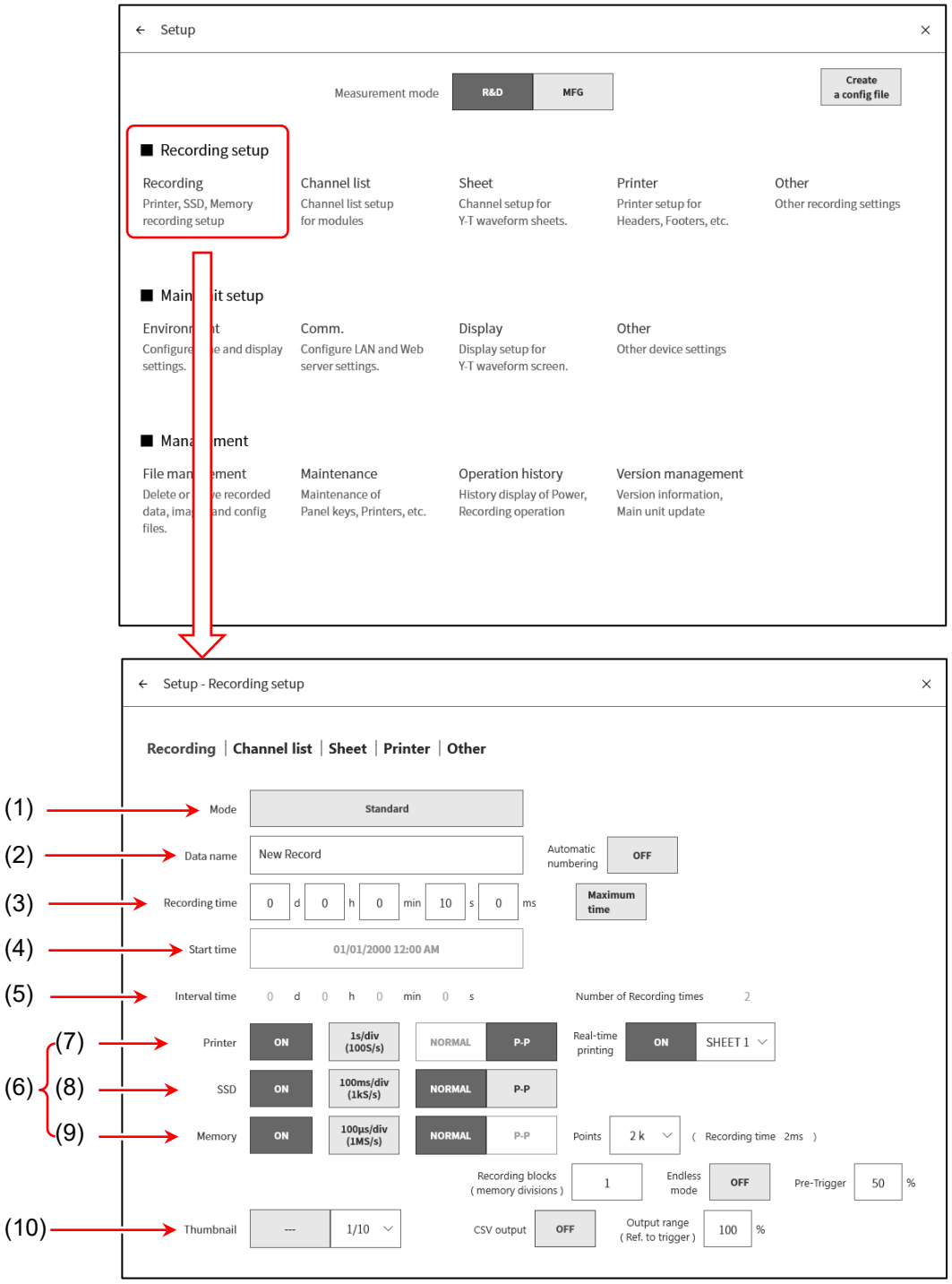


6.4. Recording

This product has three recording devices: printer, memory, or SSD. When recording is enabled for a device, the data recorded to each device is recorded to the SSD while it is recorded to the device.
For the printer, the waveform data (P-P values) printed to the recording paper are also recorded to the SSD.
For the memory, the memory data is recorded to the SSD when memory recording ends.

6.4.1. Recording Setup

Tap【SETUP】→【Recording setup】on the side menu.



(1) Mode: Selects the optimal mode from the ten recording modes.

(2) Data name: Specifies the name of the recorded data.
When [Automatic numbering] is enabled, numbers are automatically appended to the name.

(3) Recording time: Ends recording after recording for the specified time after recording starts.

Maximum time: Automatically sets the recording time based on the free capacity of the SSD. However, if the delete then save function for recorded data is enabled, the recording time is automatically set based on the maximum size of the recorded data.



See "10.14. Delete then Save Function for Recorded Data".

(4) Start time: Starts recording at the specified time after starting measurement with the START key.

(5) Interval time: Performs recording at the specified interval. Recording ends when recording has been performed the number of times specified in [Number of Recording times].

(6) Recording device: Enables/disables recording to the recording device (Printer, SSD, or Memory). The devices can be set independently. When using external sampling, set only the target recording device to [ON].

(7) Printer: Enables/disables printer recording.
When enabled, the P-P data is recorded to the SSD with sampling of printer recording.

Sampling speed: Set the sampling speed or an arbitrary chart speed.



You can switch the unit of the sampling speed and the printer speed (sampling speed/chart speed). See "8.2.5. Other".

Data format: Fixed to P-P.

Real-time printing: When printer recording is enabled, real-time printing to the printer can be enabled/disabled.
When enabled, the waveform of the specified sheet is printed from the printer while saving the data of the printer recording.
When disabled, printing to the printer is not performed.

(8) SSD: Enables/disables [SSD].

Sampling speed: Set the sampling speed.

Data format: Selects either NORMAL or P-P.

(9) Memory: Enables/disables [Memory].

Sampling speed: Set the sampling speed.

Data format: Fixed to NORMAL.

Points: Specifies the sampling count (the data count per channel) to record for each memory recording.

Recording blocks: Specifies the number of blocks (number of memory divisions) to use for memory recording, from 1 to 200.

When [Endless mode] is enabled, set a number of 2 or above.

Endless mode: If [Endless mode] is enabled, the blocks start to be overwritten from the first block when the specified number of memory blocks are full.

Pre-trigger: Specifies the pre-trigger in the memory block, from 0 to 99%.

Example: For a pre-trigger of 20% and a point count of 10k (10,000 points), data for 2,000 points before the trigger and 8,000 points after the trigger is recorded to the memory block. The trigger point is included in the data after the trigger.

CSV output: When [CSV output] is enabled, the data in the memory block is also automatically output to a CSV file after recording finishes.
For information on the format for CSV files, see "10.13.1. CSV File Format".

Output range: Configures the data range to output to the CSV file, from 1 to 100%, based on the trigger point. If you specify 100%, the entire data range of memory recording will be saved to the CSV file.

Example: If memory recording is set to a pre-trigger of 20% and 10,000 points, the number of points will be 5,000 if the output range is set to 50% (1,000 points before the trigger and 4,000 points after the trigger).

Example: If the reference to trigger is 50% and the memory point count is 10k points (2,000 points before trigger and 8,000 points after trigger), 5k points (1,000 points before trigger and 4,000 points after trigger) will be output to the CSV file.

Tips

- The CSV file is saved to the "<date/time of recording (yyyymmdd-HHMMSS)> – 0000" folder.

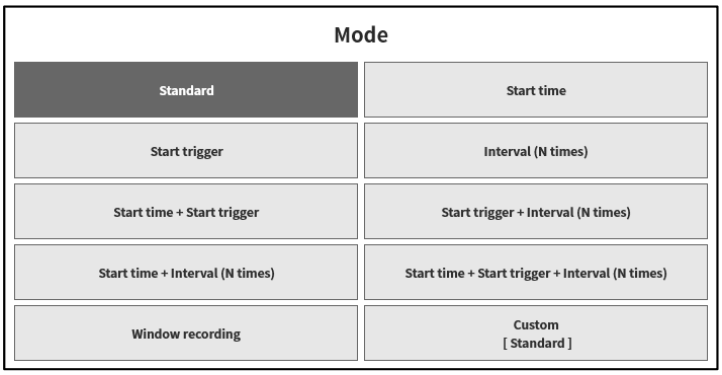
(10) Thumbnail: Specifies the channels to display thumbnails for during recording, and the compression rate.

Mode

This product has ten recording modes to enable complex measurement to be easily set.

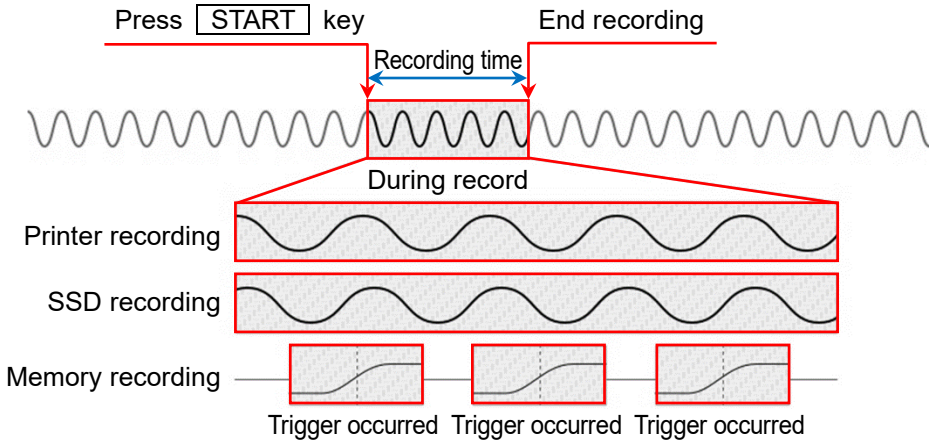
Press the【Mode】key to display an explanation of each recording mode on the monitor and select a mode suitable for the measurement to perform.

You can also press and hold the【Mode】key to select the recording mode from a palette.



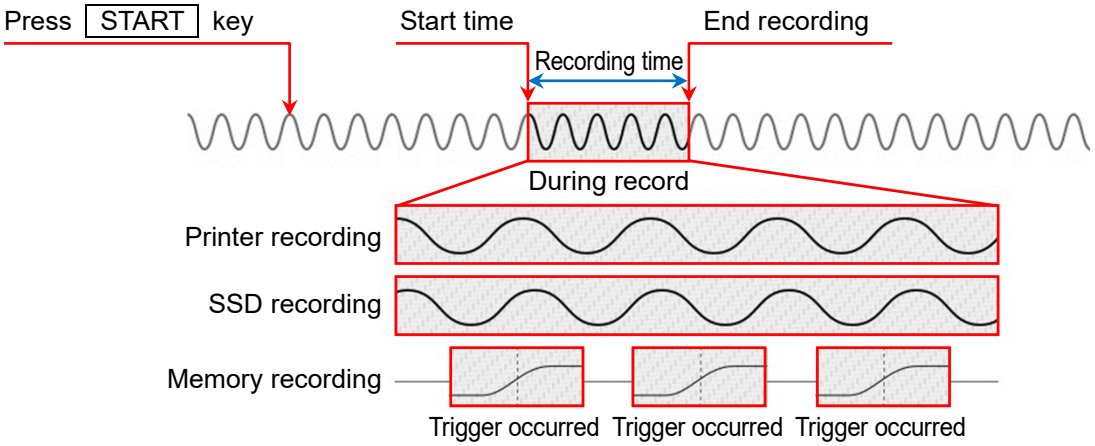
(1) Standard
(2) Start time
(3) Start trigger
(4) Interval (N times)
(5) Start time + Start trigger
(6) Start trigger + Interval (N times)
(7) Start time + interval (N times)
(8) Start time + Start trigger + interval (N times)
(9) Window recording
(10) Custom

(1) Standard



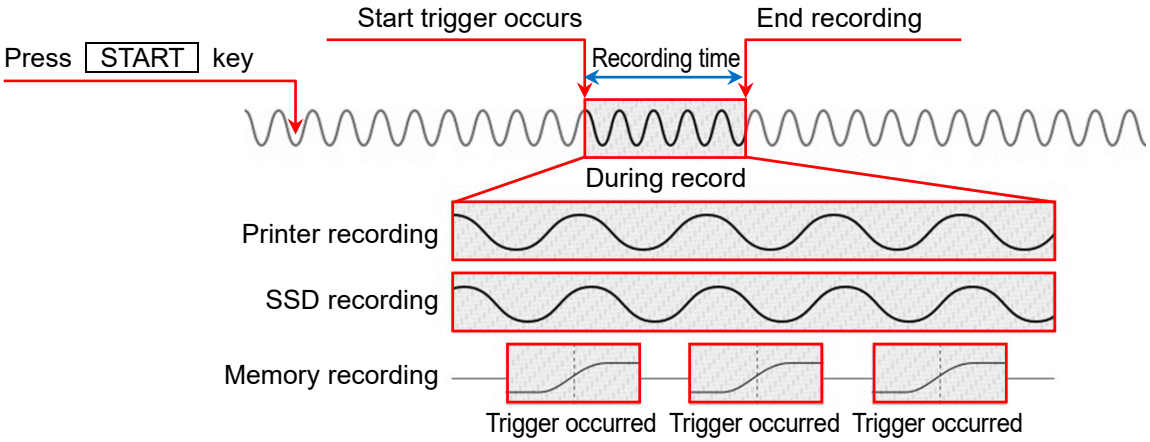
When the START key on the operation panel is pressed, recording to the various devices specified in the【Setup】menu starts, and continues until the time set in【Recording time】in the recording setup elapses or the STOP key on the operation panel is pressed. Memory recording records the input data to memory when the trigger is occurred after recording starts. Data recording is not performed unless a trigger is detected.

(2) Start time



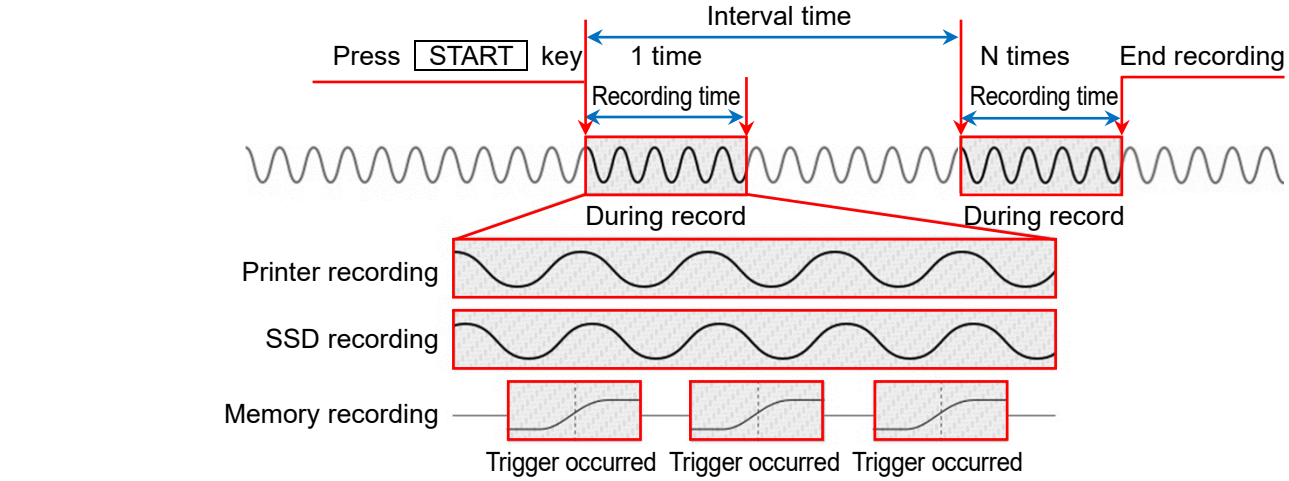
When the START key on the operation panel is pressed, this product enters the recording standby state and recording to the various devices starts at the【Start time】set in the recording setup, and continues until the time set in【Recording time】in the recording setup elapses or the STOP key on the operation panel is pressed.

(3) Start trigger



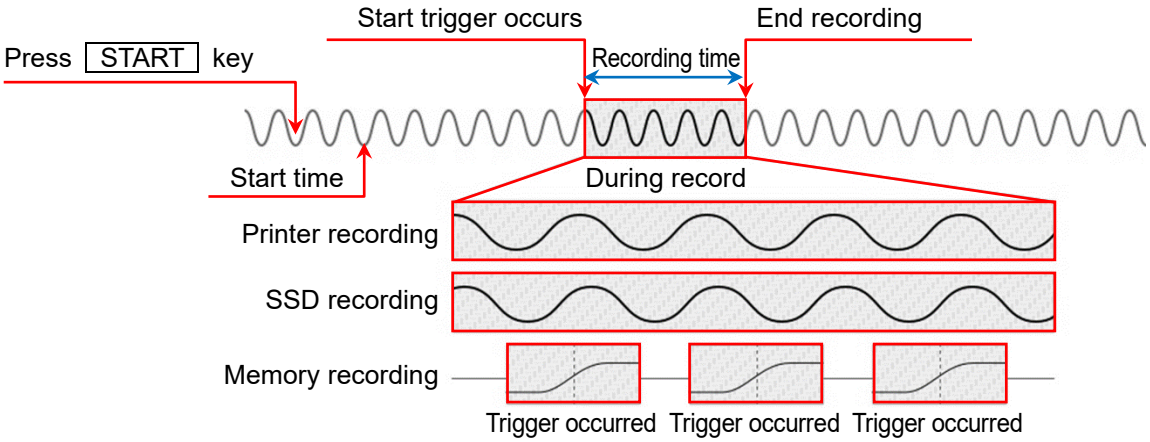
When the START key on the operation panel is pressed, this product enters the recording standby state. Recording to the various devices starts when the channel trigger specified in【Start trigger】is occurred and continues until the time set in【Recording time】in the recording setup elapses or the STOP key on the operation panel is pressed.

(4) Interval (N times)



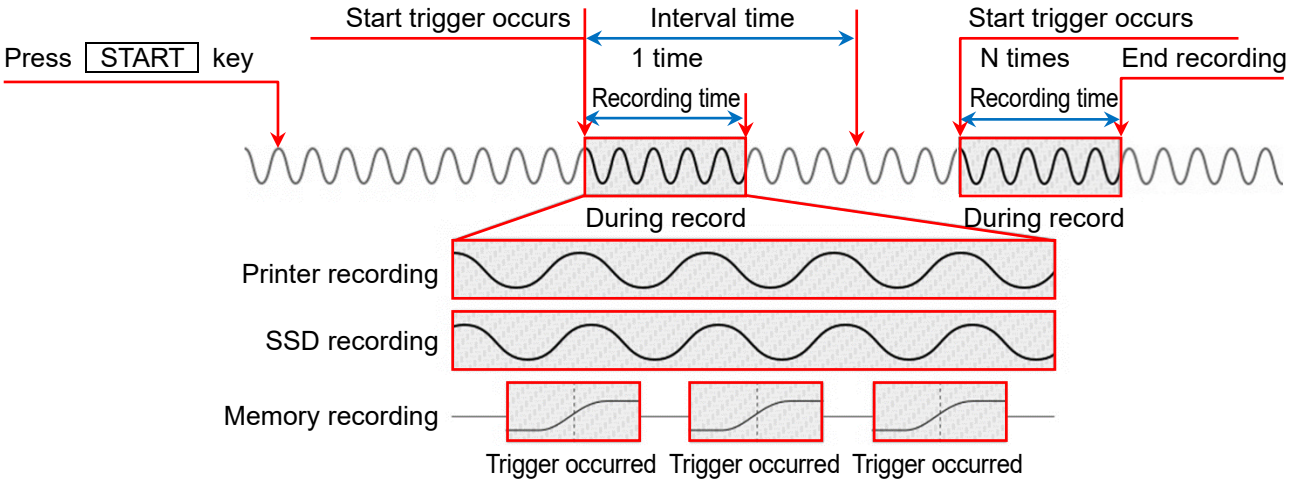
When the START key on the operation panel is pressed, recording to the various devices starts and continues until the time set in【Recording time】in the recording setup elapses, and then the next recording starts when the time in【Interval time】elapses after measurement starts. Measurement ends when recording has been performed the number of times specified in【Number of Recording times】for the interval.

(5) Start time + Start trigger



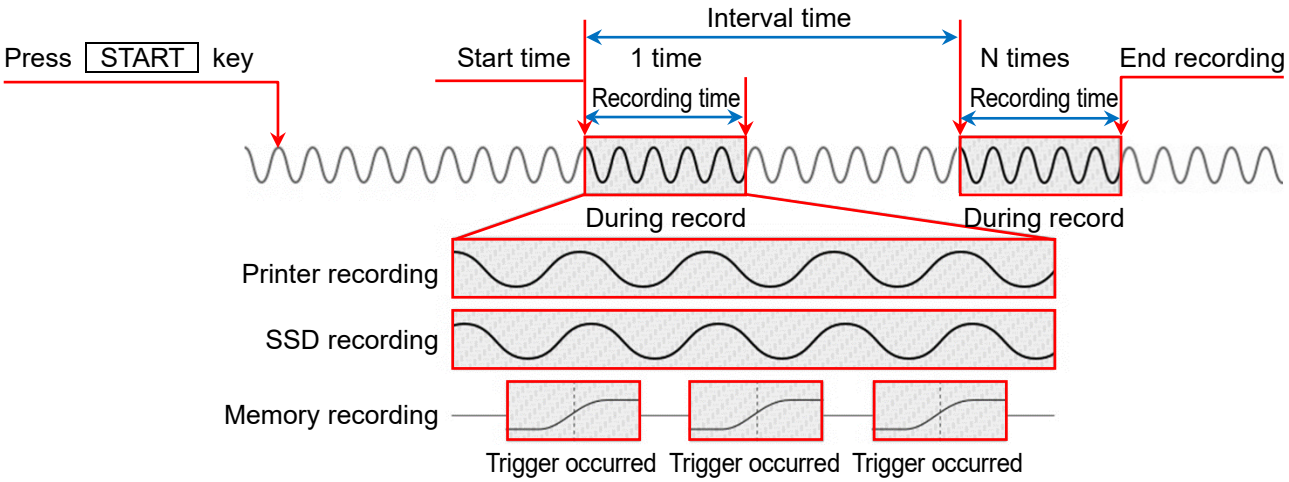
When the START key on the operation panel is pressed, this product enters the recording standby state after the time set in【Start time】. Recording to the various devices starts when the channel trigger specified in【Start trigger】 is occurred, and continues until the time set in【Recording time】 in the recording setup elapses or the STOP key on the operation panel is pressed.

(6) Start trigger + Interval (N times)



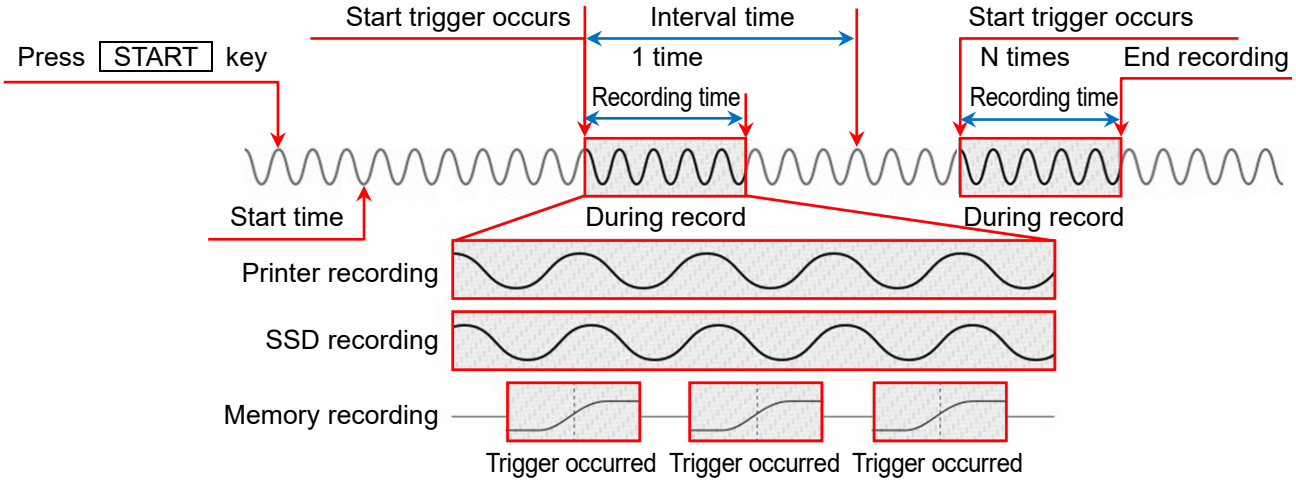
When the START key on the operation panel is pressed, this product enters the recording standby state and recording starts when the channel trigger specified in【Start trigger】 is occurred. Measurement continues until the time set in【Recording time】 in the recording setup elapses, and then the next recording starts when the time in【Interval time】 elapses after recording starts, and this product waits for the next start trigger.

(7) Start time + Interval (N times)



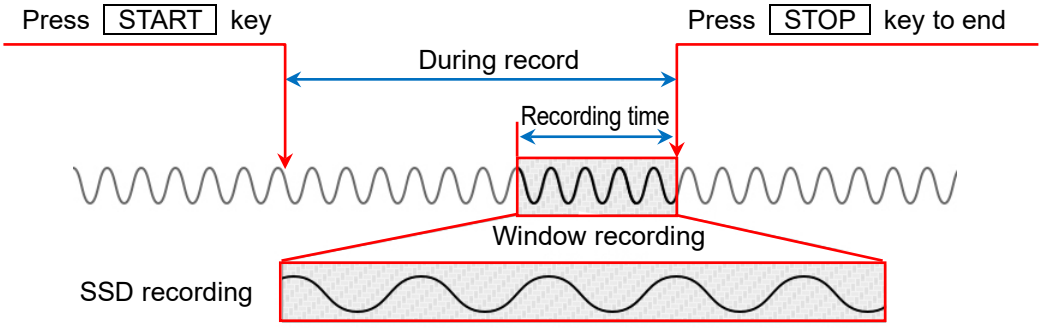
When the START key on the operation panel is pressed, this product enters the recording standby state. Recording starts at the time set in 【Start time】, then continues recording for the time set in 【Recording time】.
Measurement repeats at the interval set in 【Interval time】.

(8) Start time + Start trigger + Interval (N times)



When the START key on the operation panel is pressed, this product enters the recording standby state and starts the procedure indicated in "(6) Start trigger + Interval (N times)" at the time set in 【Start time】.

(9) Window recording



When the START key on the operation panel is pressed, recording to the various devices starts, and continues until the STOP key on the operation panel is pressed. The data of the time set in 【Recording time】 until stop is recorded to the SSD.

(10) Custom

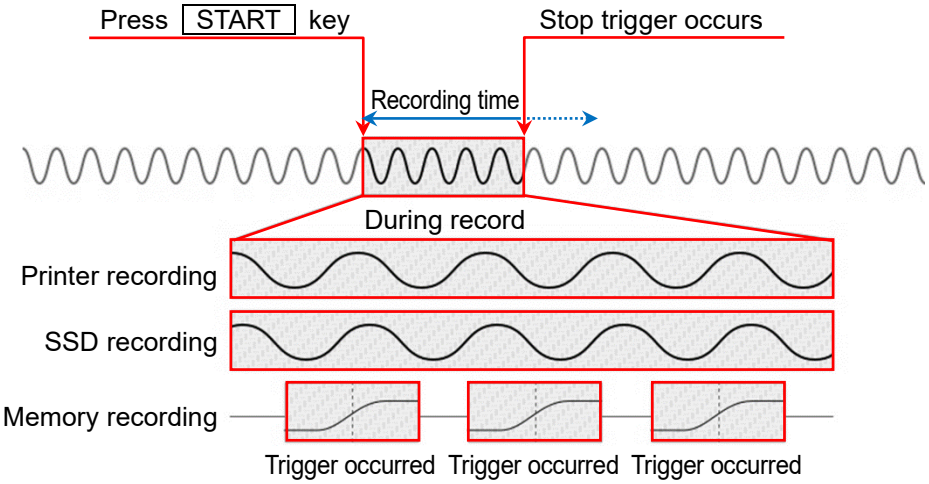
You can use a stop trigger (to stop recording with an input signal) and perform repeat recording (to start the next recording when recording ends). They can also be used in combination with recording modes (1) to (9).

	Custom combinations	Measurement mode *1		Custom ON/OFF *2					
		R&D	MFG	START trigger	STOP trigger	Repeat recording	Interval (N times)	Start time	Window recording
1	Mode (1)	✓	✓						
2	Mode (2)	✓						○	
3	Mode (3)	✓	✓	○					
4	Mode (4)	✓					○		
5	Mode (5)	✓		○				○	
6	Mode (6)	✓		○			○		
7	Mode (7)	✓					○	○	
8	Mode (8)	✓		○			○	○	
9	Mode (9)	✓							○
10	STOP trigger	✓	✓		○				
11	STOP trigger + START trigger	✓	✓	○	○				
12	STOP trigger + Start time	✓			○			○	
13	STOP trigger + Start time + START trigger	✓		○	○			○	
14	Repeat recording		✓			○			
15	Repeat recording + START trigger		✓	○		○			
16	Repeat recording + STOP trigger		✓		○	○			
17	Repeat recording + START trigger + STOP trigger		✓	○	○	○			

*1 A field with "✓" indicates an available measurement mode.

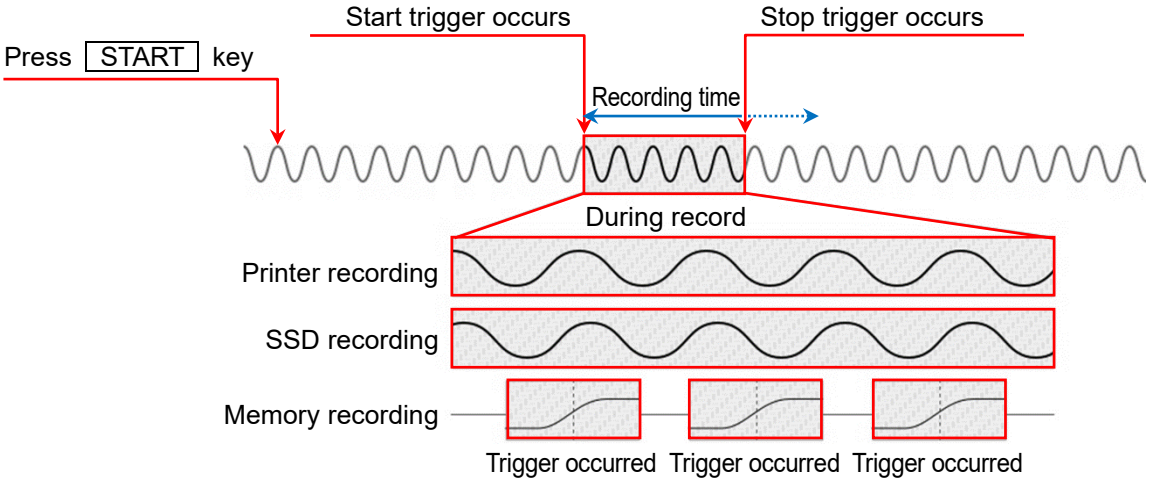
*2 A field with "○" indicates a function enabled on the custom screen, and a blank field indicates a function disabled.

STOP trigger



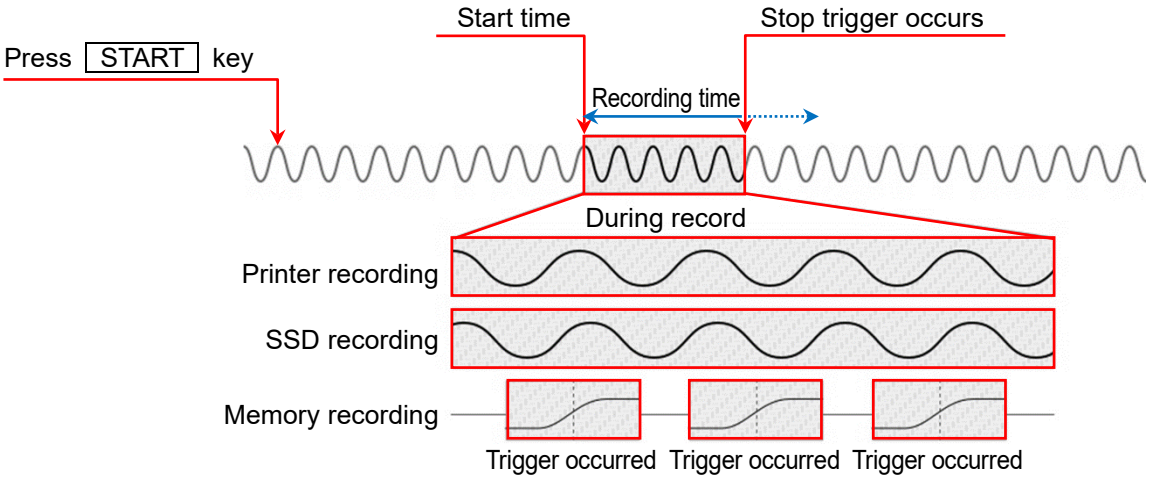
Press the START key on the operation panel to start recording. If a stop trigger occurs, recording stops without waiting for the recording time to end.

STOP trigger + START trigger



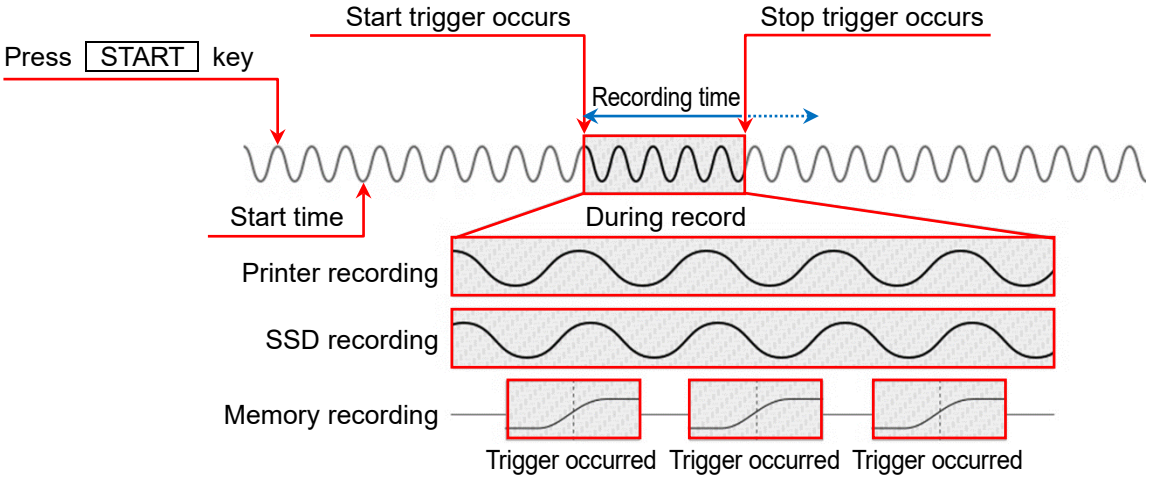
Press the START key on the operation panel to enter the recording standby state, where recording starts when a start trigger occurs. If a stop trigger occurs, recording stops without waiting for the recording time to end.

STOP trigger + Start time



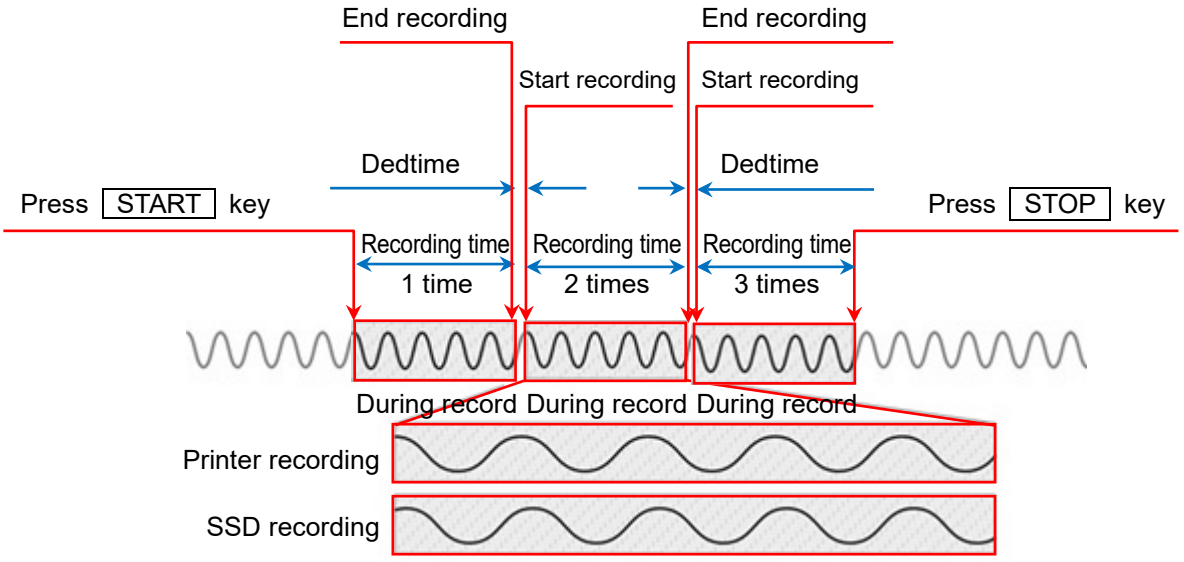
Press the START key on the operation panel to enter the recording standby state, where recording starts at the time specified in 【Start time】. If a stop trigger occurs, recording stops without waiting for the recording time to end.

STOP trigger + Start time + START trigger



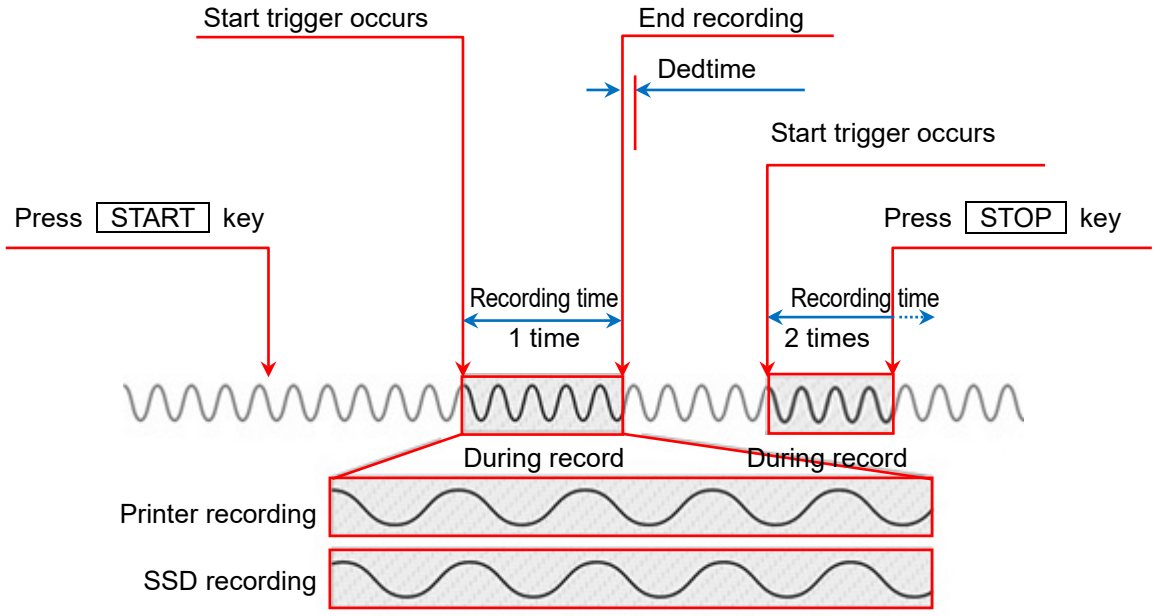
Press the START key on the operation panel to enter the recording standby state, where recording starts when a start trigger occurs after the time specified in 【Start time】. If a stop trigger occurs, recording stops without waiting for the recording time to end.

Repeat recording



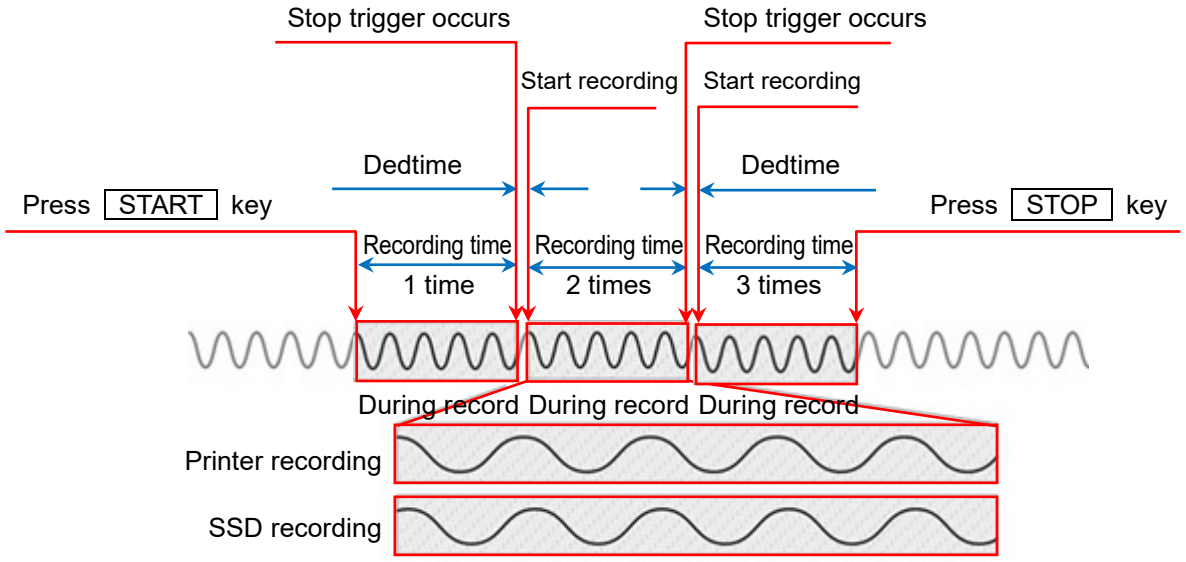
Recording repeats from when the START key on the operation panel is pressed until the STOP key is pressed.
There will be a period between the end of recording and the start of the next recording where nothing will be recorded.
If the number of recorded items exceeds 1,000 or the SSD runs out of free space, recording will stop.

Repeat recording + START trigger



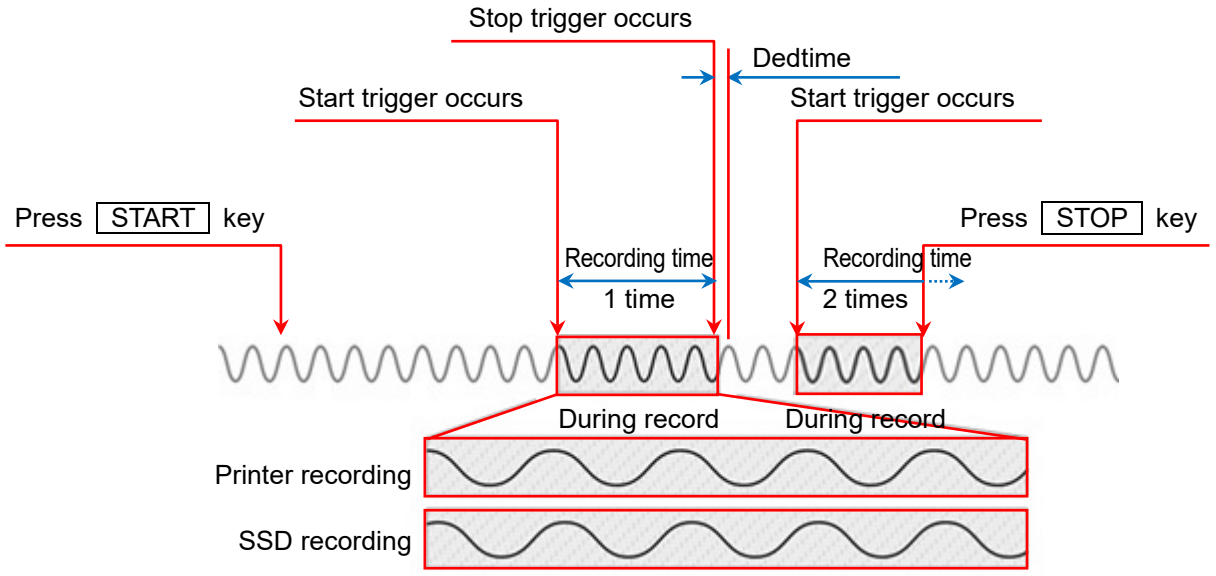
Recording repeats from when the START key on the operation panel is pressed until the STOP key is pressed.
If a start trigger occurs, recording starts. Recording ends at the specified recording time.
There will be a period between the end of recording and the start of the next recording where a start trigger cannot be detected.
If the number of recorded items exceeds 1,000 or the SSD runs out of free space, recording will stop.

Repeat recording + STOP trigger



Recording repeats from when the START key on the operation panel is pressed until the STOP key is pressed.
If a stop trigger occurs, recording stops without waiting for the recording time to end.
There will be a period between the end of recording and the start of the next recording where nothing will be recorded.
If the number of recorded items exceeds 1,000 or the SSD runs out of free space, recording will stop.

Repeat recording + START trigger + STOP trigger



Recording repeats from when the START key on the operation panel is pressed until the STOP key is pressed.
If a start trigger occurs, recording starts. If a stop trigger occurs, recording stops without waiting for the recording time to end.
There will be a period between the end of recording and the start of the next recording where a start trigger cannot be detected.
If the number of recorded items exceeds 1,000 or the SSD runs out of free space, recording will stop.

6.4.2. Starting and Ending Recording

Start recording

When you perform either of the following operations, recording starts and this product switches to the recording screen. The screen is enclosed in a red frame.

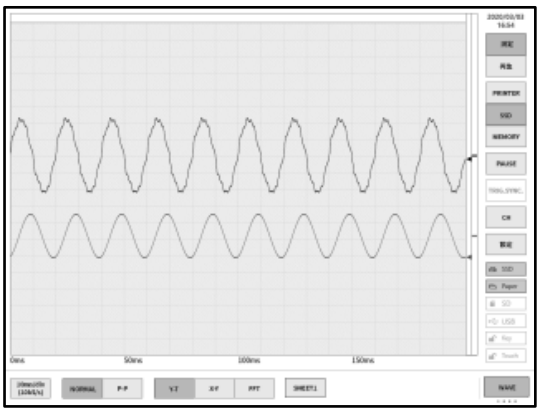
- ❑ Press the START key on the operation panel
- ❑ Set the START/STOP IN signal of the remote control module to LOW
- ❑ Send a start recording command to the LAN or COM port



Stop recording

When you perform either of the following operations, recording ends and this product switches to the measurement screen. The red frame disappears.

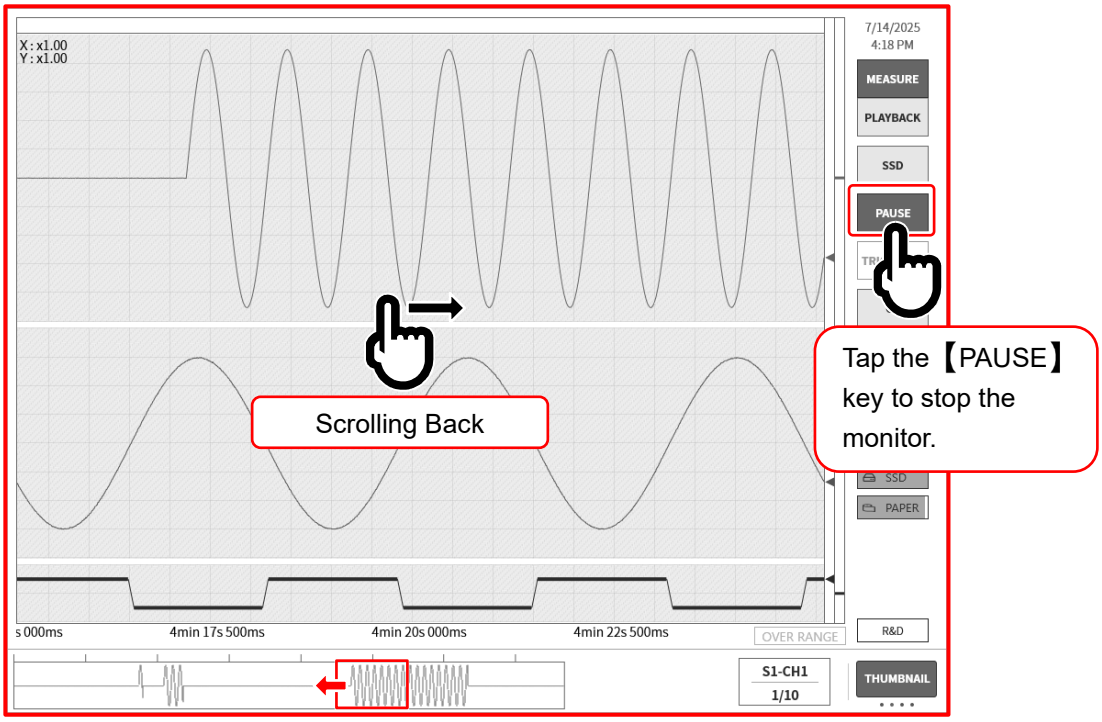
- ❑ Wait for the recording time to end
- ❑ Press the STOP key on the operation panel
- ❑ Set the START/STOP IN signal of the remote control module to HIGH
- ❑ Send an end recording command to the LAN or COM port
- ❑ All memory blocks have been recorded with the recording device set to memory recording only.



6.4.3. Scrolling Back during Recording

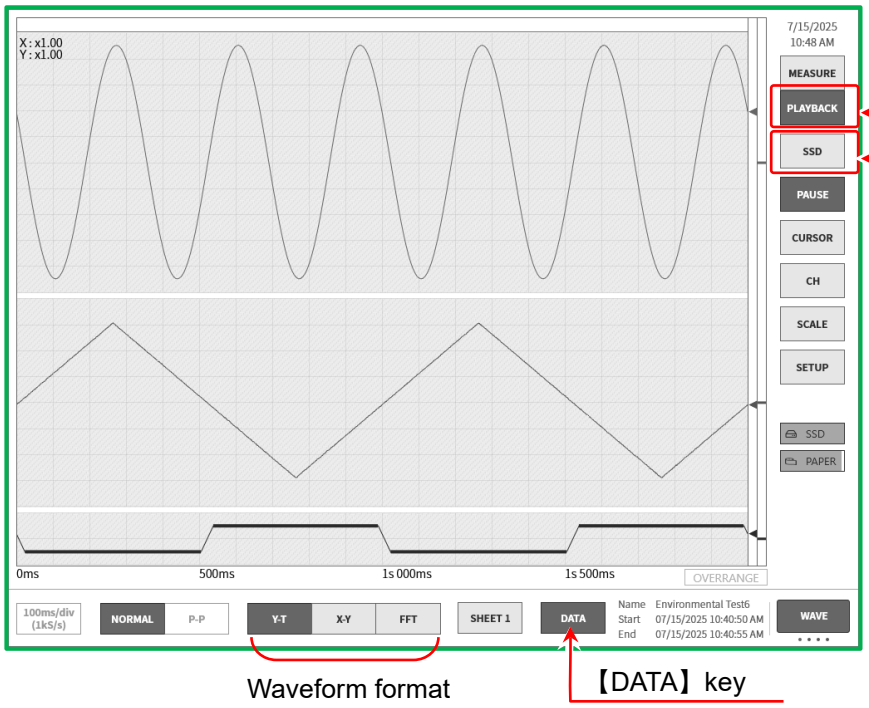
Tap the【PAUSE】key in the side menu during recording to pause the waveform monitor while continuing to record. Swiping the waveform monitor right while it is paused will scroll the waveform back, which enables you to check the past waveform that has already been recorded. You can also scroll the waveform monitor left to display the waveform recorded after pausing.

Tap the【PAUSE】key again to resume the operation of the waveform monitor.



7. Playback Recorded Data

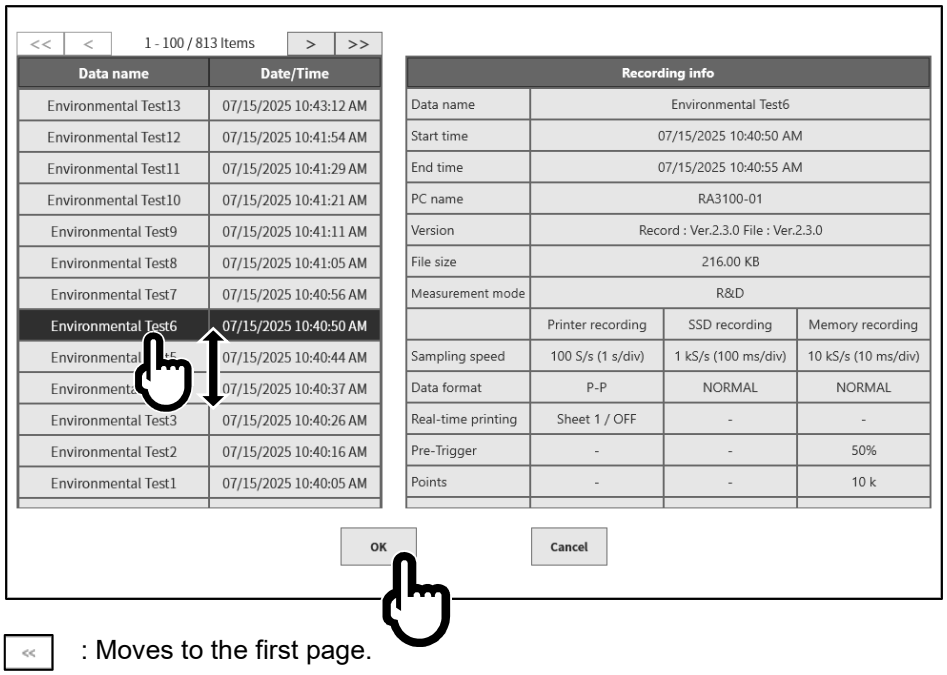
To play back recorded data, tap the【PLAYBACK】key in the side menu to switch the monitor to the playback screen.



7.1. Select Recorded Data

Tap the【DATA】key in the control bar to display up to 100 items of the recorded data list on one page.

Select the data and tap the【OK】key to display that waveform.



<< : Moves to the first page.

>> : Moves to the last page.

< : Moves to the previous page.

> : Moves to the next page.

Data name: The recording name set in the recording settings. Setting an easy-to-understand name when recording makes it easier to search for the data to playback.
Date/Time: The date and time that the data was recorded
Recording info: Displays information on the selected recorded data.

Tips

- Data that stops without recording has "01/01/0001 12:00:00 AM" for both the recording date/time and starting date/time.

Selection procedure

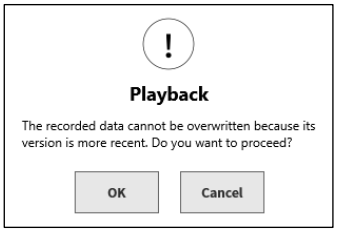
Step 1. Display the Recorded Data List
Tap the【DATA】key on the control bar to display the recorded data list.

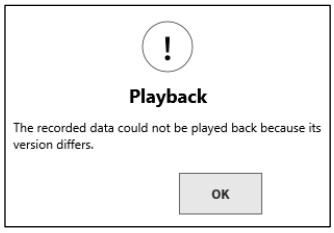
Step 2. Select the Recorded Data
Swipe the list up or down or switch pages to display the recorded data, then tap the data.

Step 3. Play Back the Recorded Data
Tap the【OK】 key to play back the selected recorded data.

Tips

- If the file version of the recorded data differs from the software version of the main unit, this product may be unable to playback the data or be able to playback but unable to overwrite the data.
  This limitation can be overcome by performing a file update if the file version of the recorded data is older than the software version of the main unit, or a system update if the version is newer.



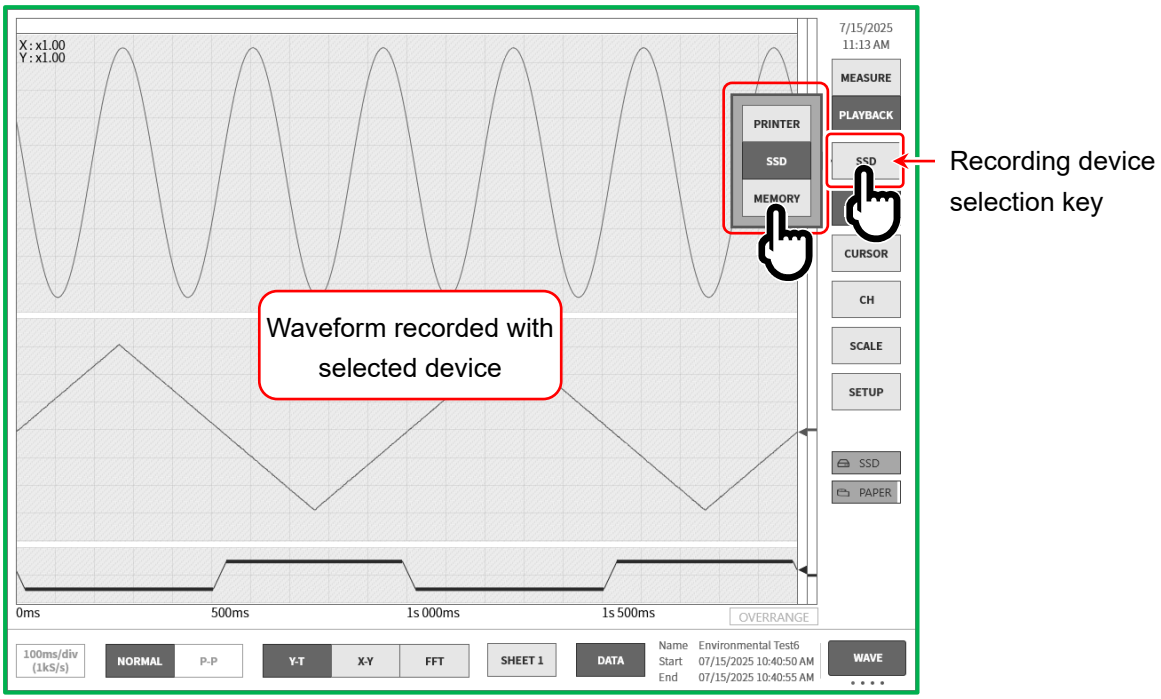


For information on the versions, see "10.1. Version Information".

7.2. Playback Screen

7.2.1. Selecting the Recording Device

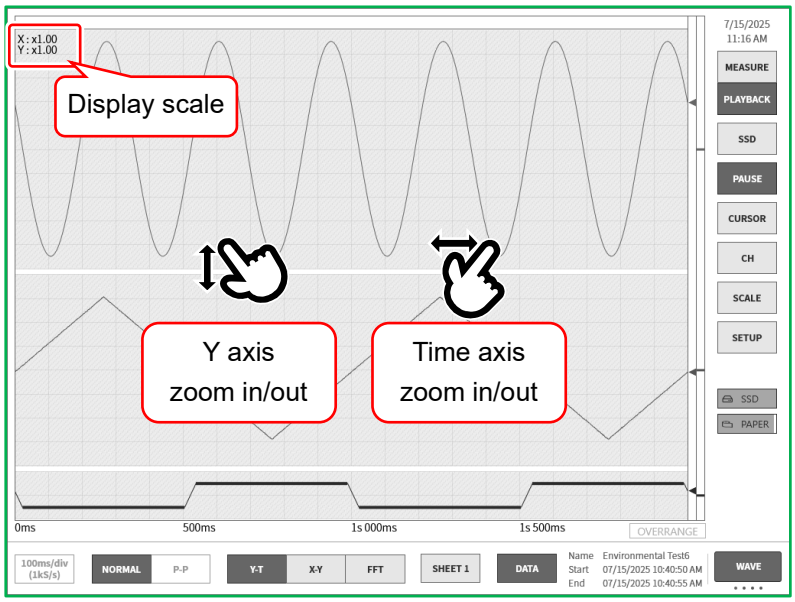
When the recorded data is displayed on the waveform monitor, you can tap the recording device selection key in the side menu to display the waveform recorded to another device.



7.2.2. Zooming In/Out during Playback

Zooming the Waveform In

You can pinch in/pinch out the waveform monitor to freely zoom in/out the waveform in the time axis direction or amplitude direction in the range 1x to 100x. The current display scale is displayed on the top left of the waveform monitor.



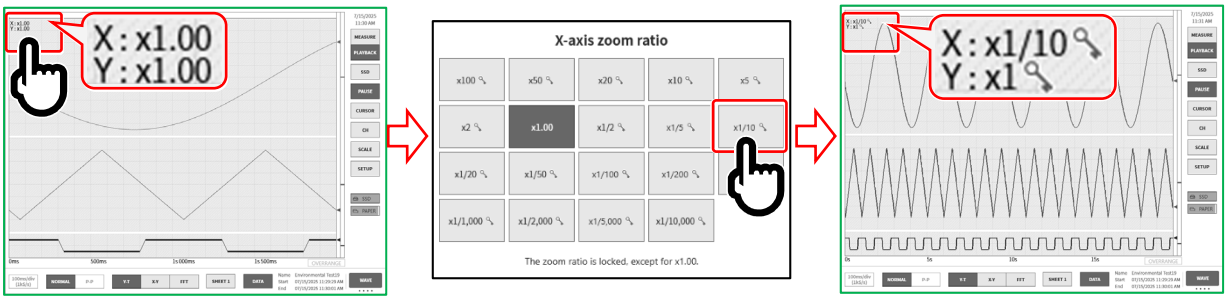
Tips

- The display scale cannot be used when the mark is displayed.

  For details on the mark, see "Enlarging/Reducing the Waveform in the Time Axis".

Enlarging/Reducing the Waveform in the Time Axis

You can tap the display scale on the top left of the waveform monitor to display the selection palette for the display scale. The waveform is displayed with the time axis at the selected scale. The mark is displayed for scales other than x1.00.

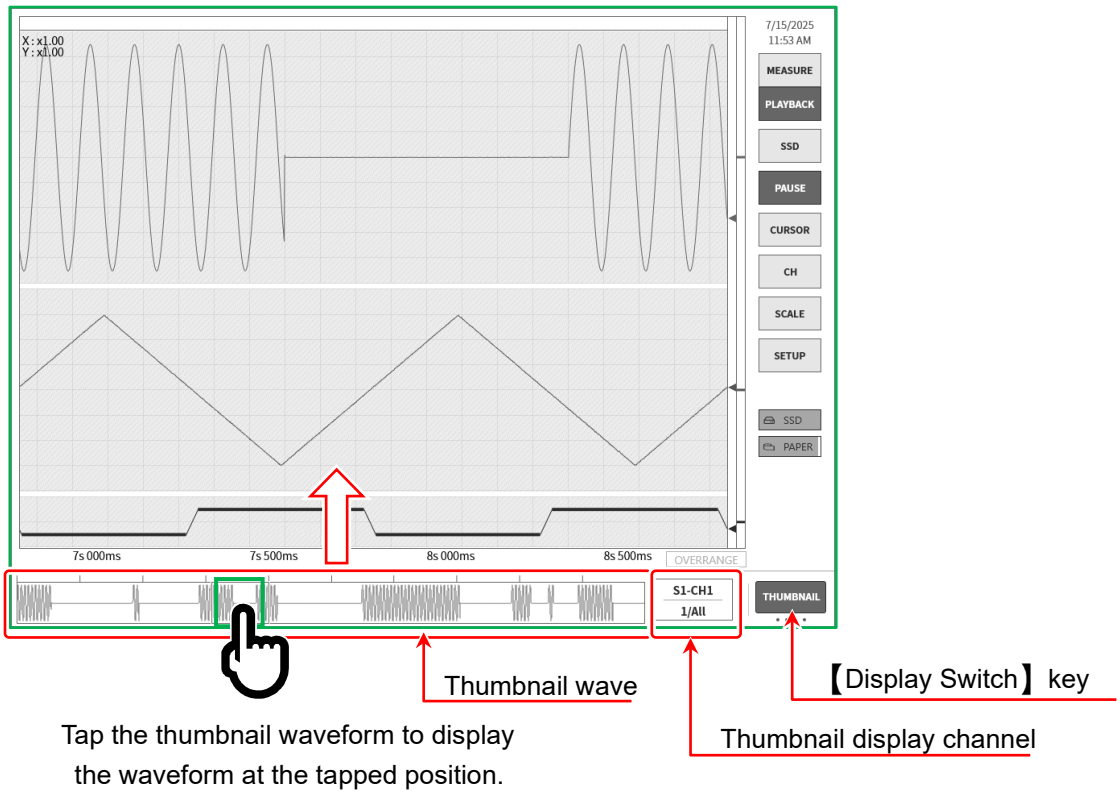


Tips

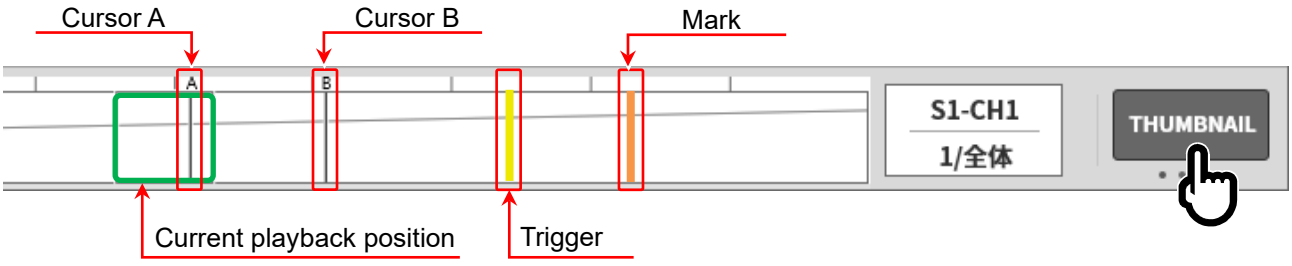
- Pinch out/in operations cannot be performed when the mark is displayed for the display scale.

7.2.3. Thumbnails

You can also select【THUMBNAIL】with the【Display Switch】key to display the Y-T waveform with all the recorded data of the selected channel reduced.



The thumbnail waveform displays the current playback position, and the positions of Cursor A, Cursor B, triggers, and marks.



Tips

- ❑ You can switch between showing and hiding the triggers and marks.

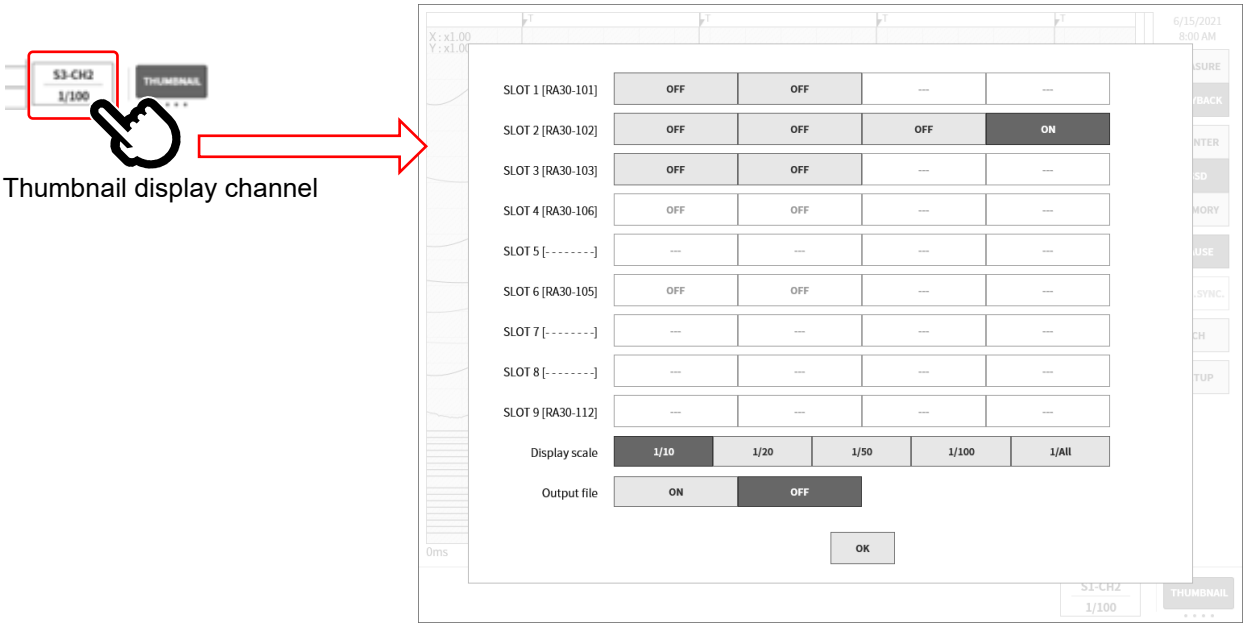
See "8.3.3. Display Setup".

- ❑ The cursors are displayed when cursors are displayed for the Y-T waveform.

See "7.2.4. Cursor".

Thumbnail display channel

Tap the【Thumbnail display channel】key to display the channel selection dialog. Select one channel with analog input module measurement enabled, which you want to display the thumbnail for. A logic channel cannot be selected.



Thumbnail display channel

Display scale: 1/10, 1/20, 1/50, 1/100, 1/All

Specifies the display scale for the thumbnail waveform. The smaller the display scale, the wider the time range that the waveform is displayed for.

During recording, you can select a display scale of 1/10, 1/20, 1/50, or 1/100. During playback, the display scale is fixed to 1/All (which displays all the recorded data as the thumbnail).

Output file: OFF, ON

The thumbnail display reads the recorded data and performs decimation.

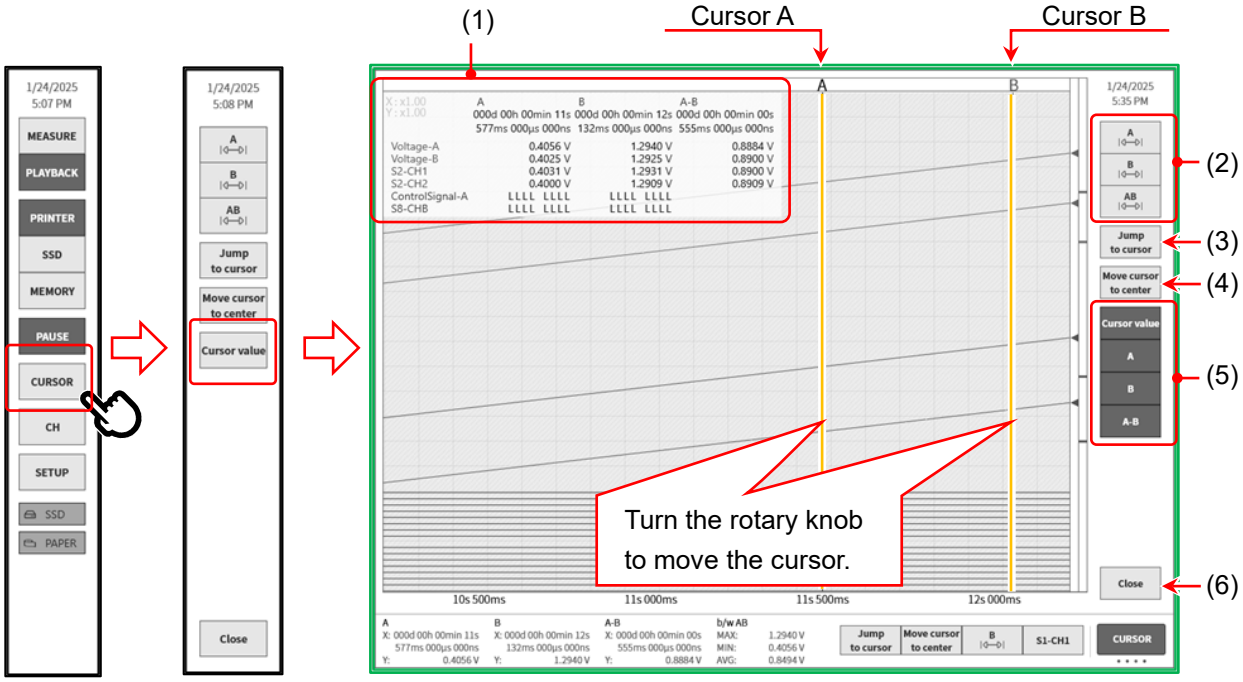
OFF Do not output the thumbnail display data after decimation to the SSD. Decimation occurs each time the recorded data is switched.

ON Output the thumbnail display data after decimation to the SSD. The display process is faster because decimation is not required, but more SSD space is consumed.

7.2.4. Cursor

If you tap the【CURSOR】key in the side menu during Y-T waveform playback, the time axis cursor and cursor menu are displayed for Cursor A and Cursor B.

If you tap the【Cursor value】key in the cursor menu, the cursor values of all channels are displayed on the top left of the Y-T waveform.



(1) List of cursor values

A: The recorded information at the position of Cursor A

X: The time since recording started Y: The data value of the selected channel

B: The recorded information at the position of Cursor B

X: The time since recording started Y: The data value of the selected channel

A–B: The difference information between Cursor A and Cursor B

X: The time between Cursor A and Cursor B

Y: The difference in the data value between Cursor A and Cursor B

* Not displayed for a logic channel.

Channel/signal name:

If a signal name is set, the signal name is displayed.

If a signal name is not set, the channel number is displayed.

Tips

- For external sampling, X is displayed as the number of points.
- For P–P sampling, Y is displayed as the maximum data value.
  However, the minimum value (MIN) between A and B is calculated from the minimum data value of A and B.

(2) Cursor selection

Selects the cursor to change the position of.

If you select【A】then turn the rotary knob, Cursor A moves.

If you select【B】then turn the rotary knob, Cursor B moves.

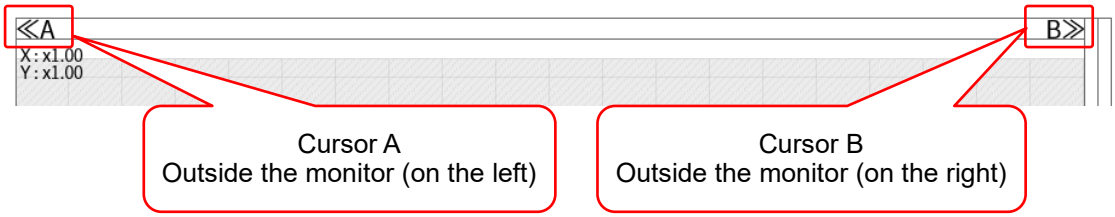
If you select【A-B】then turn the rotary knob, Cursor A and Cursor B move with the distance between the cursors maintained.

Tips

- You can also tap the A or B mark above a cursor to select that cursor.



- If a cursor is outside the waveform monitor, the << or >> mark is displayed above the cursor.



(3) 【Jump to cursor】key

Tap this key to move the waveform so that the cursor position is in the center of the screen.

(4) 【Move cursor to center】key

Tap this key to move the specified cursor to the center of the monitor.

(5) 【Cursor value】key

Tap this key to display the list of cursor values.

Tap the【A】key to display the recording information for the Cursor A position.

Tap the【B】key to display the recording information for the Cursor B position.

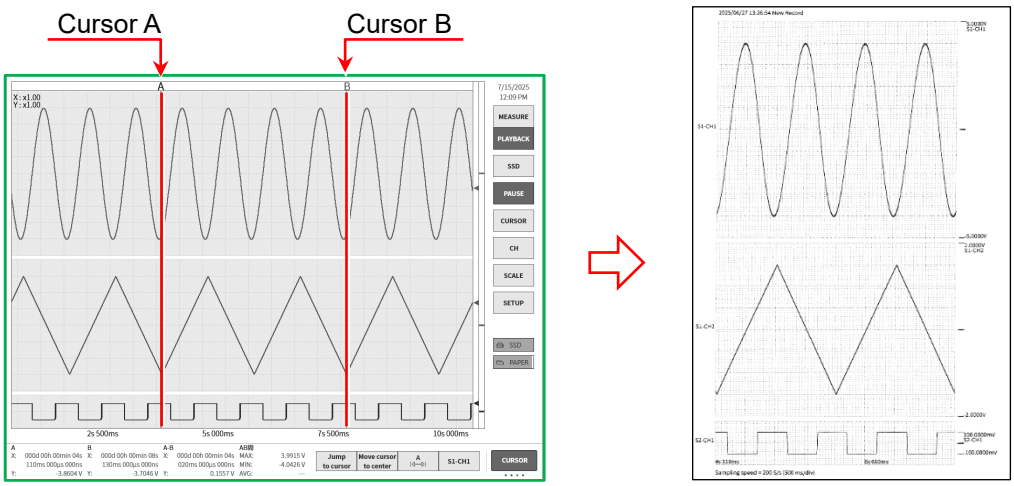
Tap the【A-B】key to display the difference information between Cursor A and Cursor B.

(6) 【Close】key

Closes the cursor menu.

7.2.5. Printing Out

You can press the PRINT key on the operation panel to print the displayed waveform (Y-T, X-Y, or FFT). For a Y-T waveform, the waveform between Cursor A and Cursor B is printed.



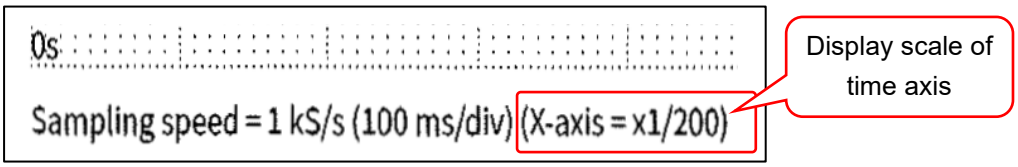
Tips

- Immediately after recorded data is read, cursor A indicates the start of the data and cursor B indicates the end of the data.

If printing is performed while the waveform is reduced (during the time axis compressed view), printing is performed with the compressed waveform.
Information on the compression rate is added to the printed recording speed.

If the waveform has been zoomed in or out with the time scale, it is printed at that display scale.
Information on the display scale is added to the printed recording speed.

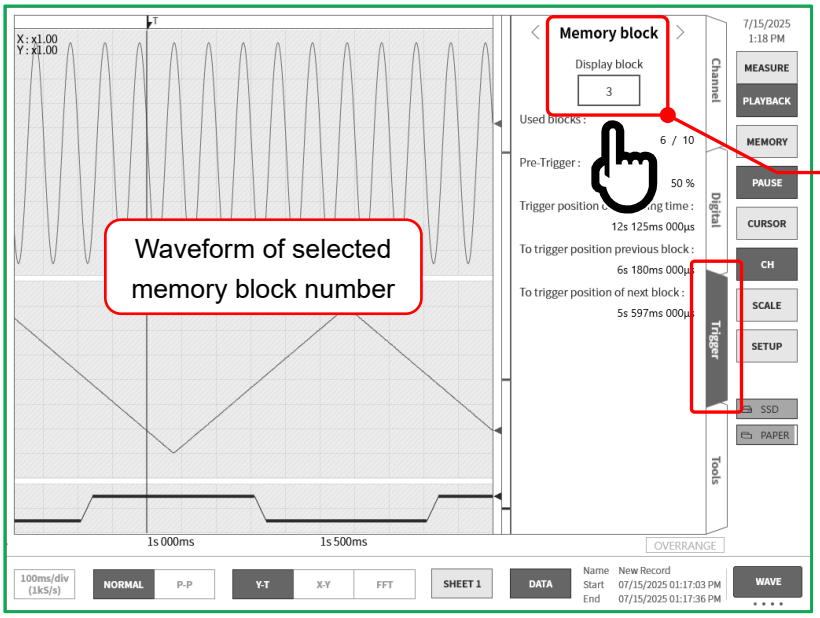
See "7.2.2. Zooming In/Out during Playback".



7.2.6. Selecting a Memory Block

When there is memory data in the recorded data, you can select the memory block to display.

Step 1. Select [MEMORY] for the recording device selection key.
Step 2. Tap the【CH】key on the side menu to display the sub menu.
Step 3. Tap the【Trigger】tab in the sub menu to display the trigger setup screen.
Step 4. Tap the top of the trigger setup screen to display [Memory block].
Step 5. Tap [Display block], then specify the number of the memory block to display.



(1) Display block: Select the memory block to display the waveform for.

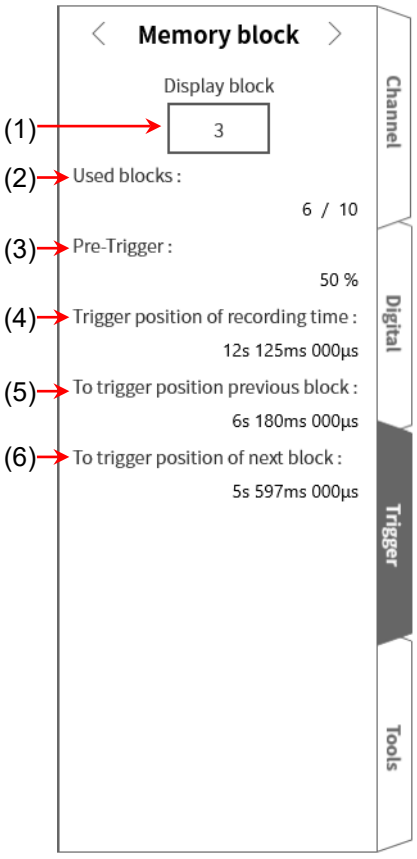
(2) Used blocks: The number of memory blocks set when recording and the number of memory blocks actually used.

(3) Pre-Trigger: The pre-trigger set when recording.

(4) Trigger position of recording time:
The time taken from the start of recording until the selected memory block trigger occurred.

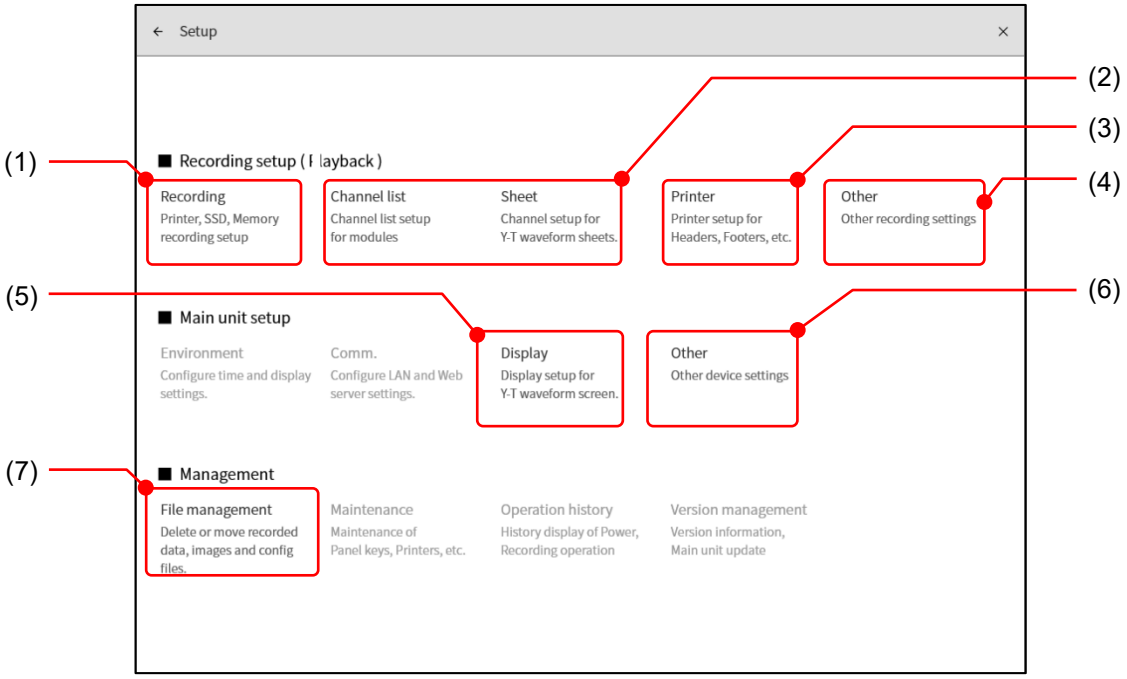
(5) To trigger position previous block:
The time taken from the selected memory block to the trigger of the previous memory block.

(6) To trigger position of next block:
The time taken from the selected memory block to the trigger of the next memory block.



7.2.7. Changing Settings during Playback

If you tap the【SETUP】key in the side menu during playback, you can change the information displayed regarding the data being played back and the display settings of the Y-T waveform.



(1) Recording: Displays the recording setup saved to the recorded data during playback.

For details, see "6.4.1. Recording".

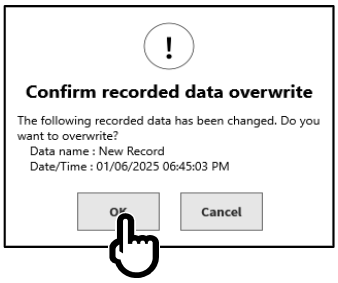
(2) Channel list/Sheet:

Enables you to change the displayed Y-T waveform and physical quantity conversion settings of the recorded data during playback.

For details, see "8.2.2. Channel List" and "8.2.3. Sheet Setup".

Tips

- ❑ This setting is configured for each item of playback data.
- ❑ If this setting is changed, a dialog confirming whether you want to overwrite the data is displayed before closing the playback data. Tap the【OK】key to save the settings.



(3) Printer: Enables you to configure the settings regarding the printer output of the product.

For details, see "8.2.4. Printer".

(4) Other: Enables you to configure other settings regarding the recording of the product.

For details, see "8.2.5. Other".

(5) Display: Enables you to configure the display settings for the Y-T waveform monitor of the product.

For details, see "8.3.3. Display Setup".

(6) Other: Enables you to configure other settings regarding the settings of the product.

For details, see "8.3.4. Other".

(7) File management:

Operations can be performed on the recorded data, image data, and configuration data saved to this product.

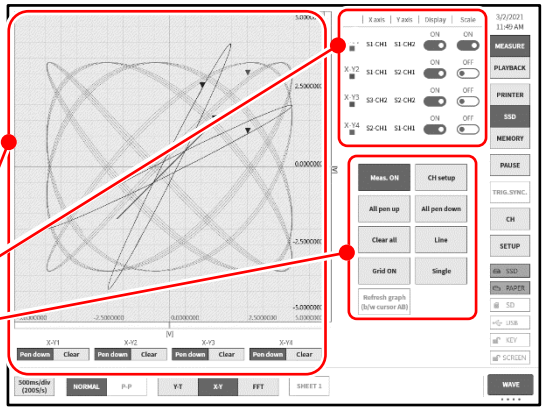
For details, see "8.4.1. File Management".

7.3. X-Y Waveform

Data recorded with the following conditions can be used to display the X-Y waveform if【X-Y】is selected as the waveform format in the control bar. The X-Y waveform enables four waveforms (X-Y1 to X-Y4) to be displayed at the same time.

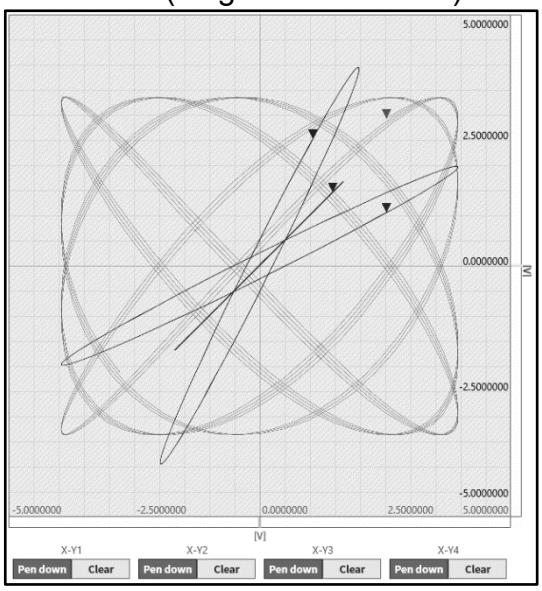
X-Y waveform conditions

Recording device: SSD
Sampling speed: 1 kS/s or lower
Data format: NORMAL
Analog input module: 2 channels or above

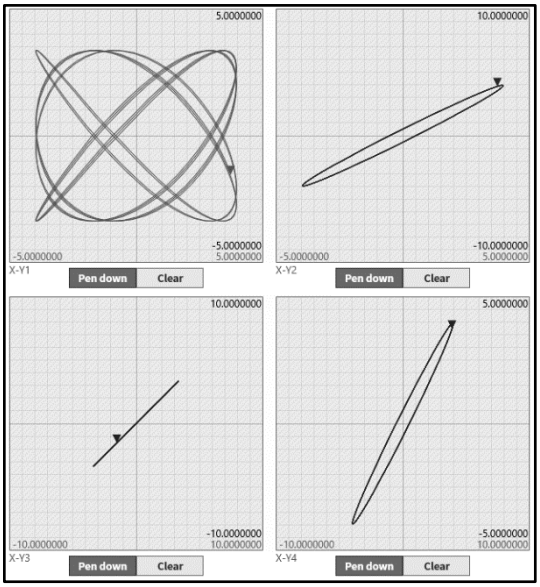


By tapping the【Single/Quad】key for display control, the X-Y waveform can be displayed as four waveforms overlaid on a single screen or as four separate screens.

X-Y waveform (Single screen format)



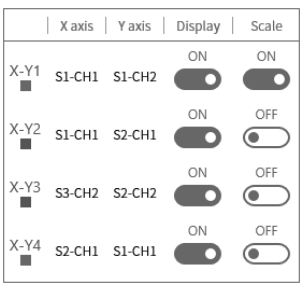
X-Y waveform (Quad screen format)



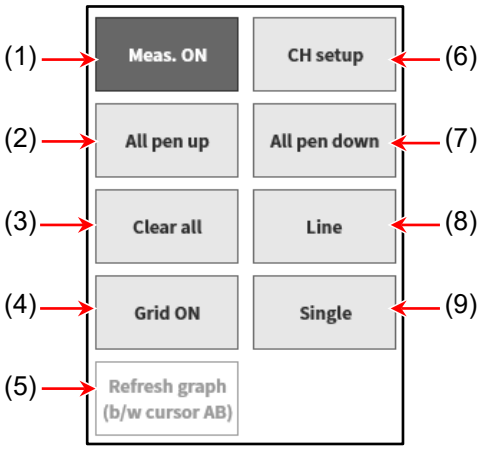
7.3.1. X-Y Display Setup

The horizontal axis of the display settings box indicates the setting state of waveforms X-Y1 to X-Y4 and allows the display to be switched on or off. With the single screen display, specifies the scale of which channel to display.

X axis, Y axis: Display the slot and channel number of each axis.
Display: Switches the X-Y waveform display on/off
Scale: Switches the scale display on/off



7.3.2. X-Y Control



(1) Meas. ON:
Enables/disables X-Y measurement.

(2) All pen up:
Tap this key when the X-Y waveform is displayed on the monitor to pause the X-Y waveform display. This enables unnecessary waveforms to not be inserted when switching the monitored input signal, etc.

(3) Clear all:
Clears all the X-Y waveform and starts the display again.

(4) Grid ON/OFF:
Switches the grid lines of the X-Y waveform display area on or off.

(5) Refresh graph (b/w cursor AB):
Displays the Y-T waveform with the playback mode and displays the X-Y waveform with the range specified by cursors A and B.

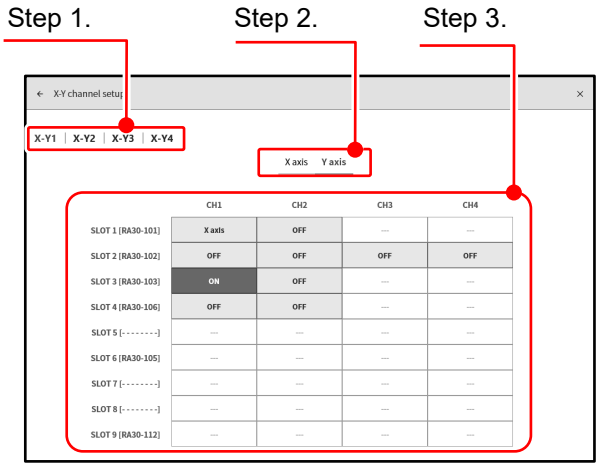
(6) CH setup:
Configures the channel settings for waveforms X-Y1 to X-Y4.
Tap this key to switch to the [X-Y channel settings] screen to configure the X axis and Y axis channel settings for each waveform.

(7) All pen down:
Resumes waveform display when it has been paused with [All pen up].

(8) Dot/Line:
Switches between rendering the X-Y waveform with dots or rendering it with lines.

(9) Single/Quad:
Switches the X-Y waveform display between the single and quad screen display.

X-Y waveform channel setup procedure



Step 1. Waveform selection
Selects waveforms X-Y1 to X-Y4.
When a waveform is tapped it is highlighted and its state is displayed in the channel table.

Step 2. Axis selection
Select the X axis or Y axis.
When an axis is tapped, the channel specified for that axis is highlighted and the display changes to [ON].
[X axis] or [Y axis] is displayed for the channel already set for the other axis.

Step 3. Channel selection
Select the channel.
Tap the channel to set and enable it.

Step 4. When the settings are complete, tap [←] or [x] on the top title bar to return to the original X-Y waveform display.

7.4. FFT Analysis

Data recorded with the following conditions can be used to perform FFT analysis if【FFT】is selected as the waveform format in the control bar. Two types of FFT analysis can be performed at the same time: Analysis1 and Analysis2.

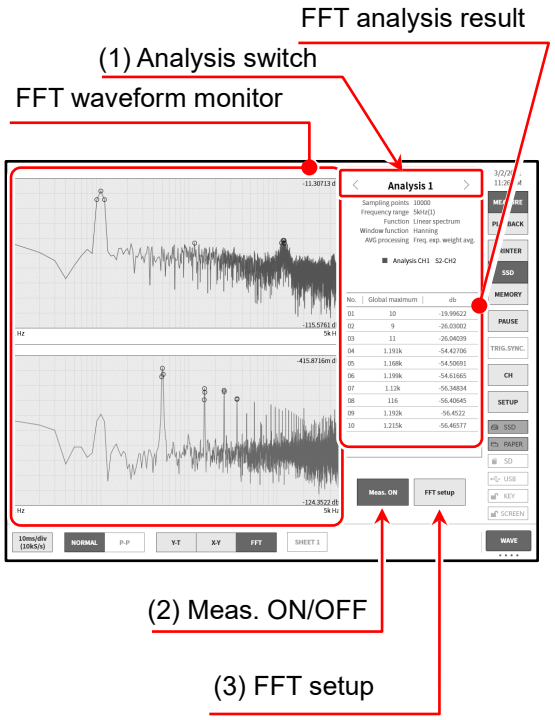
The FFT analysis technology is described in "10.6. FFT Analysis".

The results can be output to a CSV file.

See "7.8. CSV Output" and "Exporting CSV Files".

FFT Analysis

Recording device: SSD
Sampling speed: 1 MS/s or lower
Data format: NORMAL
Analog input module: 1 channel or 2 channel



(1) Analysis switch

Switches the analysis results display between Analysis1 and Analysis2.

Switch the display by tapping the【<】and【>】key on the left or right of the analysis or swiping the analysis results area to the left or right.

(2) Meas. ON/OFF

Enables/disables the execution of FFT analysis.

(3) FFT setup

Tap this key to switch to the FFT setup screen to configure the FFT analysis conditions.

FFT setup

When the settings are complete, tap the【←】key or【X】on the top title bar to return to the original FFT analysis display.



Common settings

Graph display: Select to overlay the analysis waveforms over one screen【Single】or display them separately on two screens【Dual】.

Sampling points: Select the sampling points for analysis. More sampling points means higher resolution for the analysis frequency.

Window function: Select the window function for analysis. Change the setting according to the state of the input signal.

AVG processing: Specify the type of averaging for the analysis results and the number of additions for the averaging.

Analysis settings

Analysis selection: Select Analysis1 or Analysis2.

Analysis Function: Select Analysis1 or Analysis2. The X axis, Y axis, and CH selection are limited by the analysis type. Available setting keys are brighter.

X axis: Sets the X axis of the analysis waveform.

Y axis: Sets the Y axis of the analysis waveform. When manual scaling is disabled, the Y axis is automatically set based on the analysis results. When enabled, the upper limit value and lower limit value of the Y axis scale can be set manually.

Channel setting: Sets the target channel for analysis.【Time scale waveform】to【1/3 octave】in the analysis types are settings only for channel 1 with one channel analysis, and【Cross power spectrum】to【Coherence function】are settings for channel 1 and channel 2 with two channel analysis.

Peak: Extracts the global maximum or local maximum from the analysis results and displays the top 10 points in the results.

7.5. Search Function

The search function searches for recorded data with the specified search conditions and displays the S mark (search mark) and the waveform near the results on the Y-T waveform.

7.5.1. Search Types and Operations

The following five types of searches are available.

Peak value search:	Searches for the minimum-maximum, maximum, minimum, local maximum, and local minimum
Level search:	Searches for conditions above or below the specified threshold
Window search:	Searches inside (IN) or outside (OUT) the specified upper/lower limit range
Trigger point search:	Searches for the recorded trigger point
Mark point search:	Searches for the recorded mark point

Search Procedure

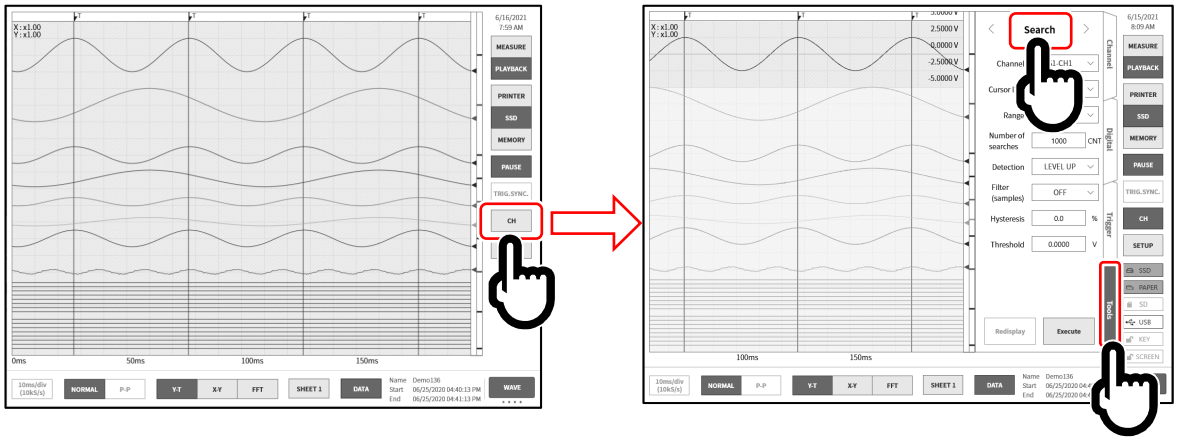
Step 1. Perform the procedure in "7.1. Select Recorded Data."

Step 2. Tap the【CH】key on the side menu to display the sub menu.

Step 3. Tap the【Channel】tab in the sub menu to display the channel setup sub menu.

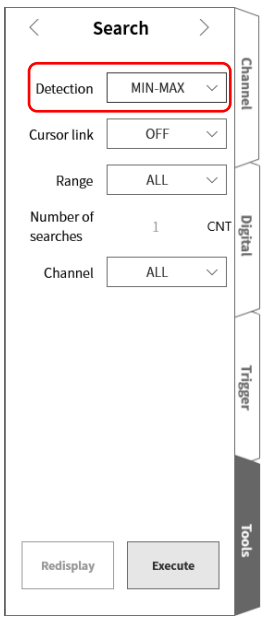
Step 4. Tap the【Tools】tab.

Step 5. Tap the top of the tools screen to display [Search].



Step 6. Set the search criteria such as [Detection], [Cursor link], [Range], and [Number of searches], then tap the【Execute】key.

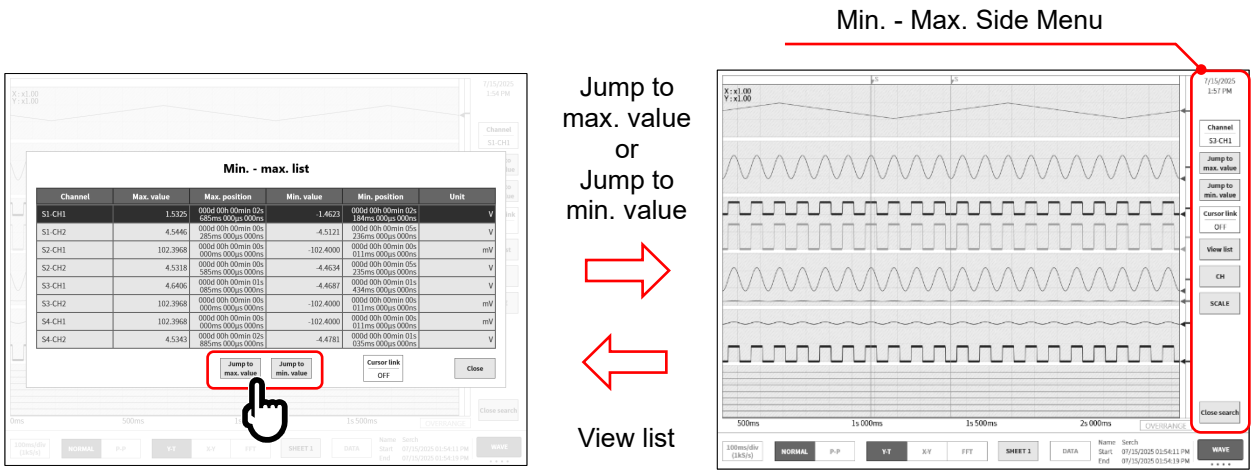
If [Detection] is set to [MIN-MAX], proceed to step 7.1.
Otherwise, proceed to step 7.2.



Step 7.1 When the search is complete, the [Min. - max. list] screen is displayed.

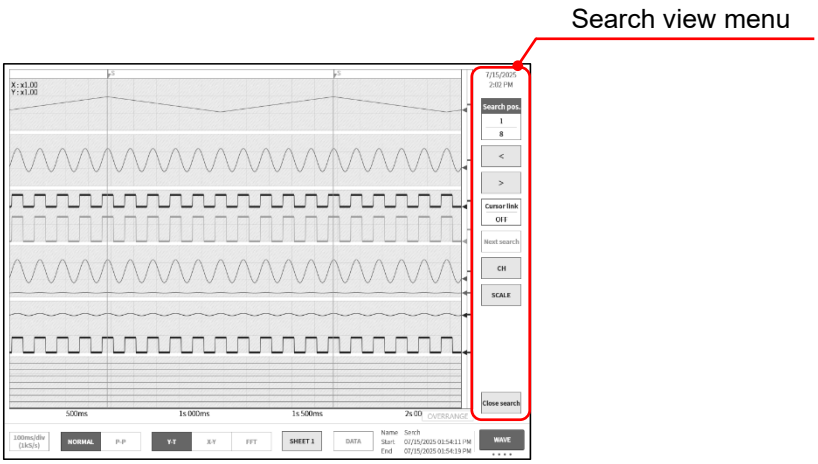
Use the【Jump to max. value】key and【Jump to min. value】key to display the Y-T waveform of the specified channel. You can use the【View list】key in the min. - max. side menu to return to the [Min. - max. list] screen.

See "7.5.11. Min. - Max. List" and "7.5.12. Min. - Max. Side Menu".



Step 7.2 When the search is complete, the side menu switches to the search view menu.

For information on the search view menu, see "7.5.13. Search Display Menu".



7.5.2. Search Method Types and Settings

The table below describes the search criteria settings.

For an analog channel search

Detection (search method)	Channel	Cursor link	Range	Number of searches	Filter	Hysteresis	Threshold	Upper threshold	Lower threshold
MIN-MAX	All	✓	✓	✓					
MAXIMUM	Channel 1 only	✓	✓	✓					
MINIMUM		✓	✓	✓					
MAXIMAL		✓	✓	✓	✓				
MINIMAL		✓	✓	✓	✓				
LEVEL UP		✓	✓	✓	✓	✓	✓		
LEVEL DOWN		✓	✓	✓	✓	✓	✓		
INTO WIN		✓	✓	✓	✓	✓		✓	✓
OUT WIN		✓	✓	✓	✓	✓		✓	✓

For a logic channel search

Detection (search method)	Channel	Cursor link	Range	Number of searches	Filter	Bit pattern
BIT OR	Channel 1 only	✓	✓	✓	✓	✓
BIT AND		✓	✓	✓	✓	✓

For a trigger or mark search

Detection (search method)	Cursor link	Range	Number of searches
TRIGGER	✓	✓	✓
MARK	✓	✓	✓

Conditions where searching cannot be performed

Searches cannot be performed with the following conditions. (The【Execute】key is disabled.)

- ❑ For "Mode"
- ❑ For "X-Y Display"
- ❑ For "FFT Display"
- ❑ When memory recording or search detection is set to "Mark"
- ❑ When the search channel is the logic module and "10.2.2. P-P Sampling"

Conditions for redisplay

The【Redisplay】key is enabled when a search has been executed. The redisplay function displays the same results as the results after search execution.

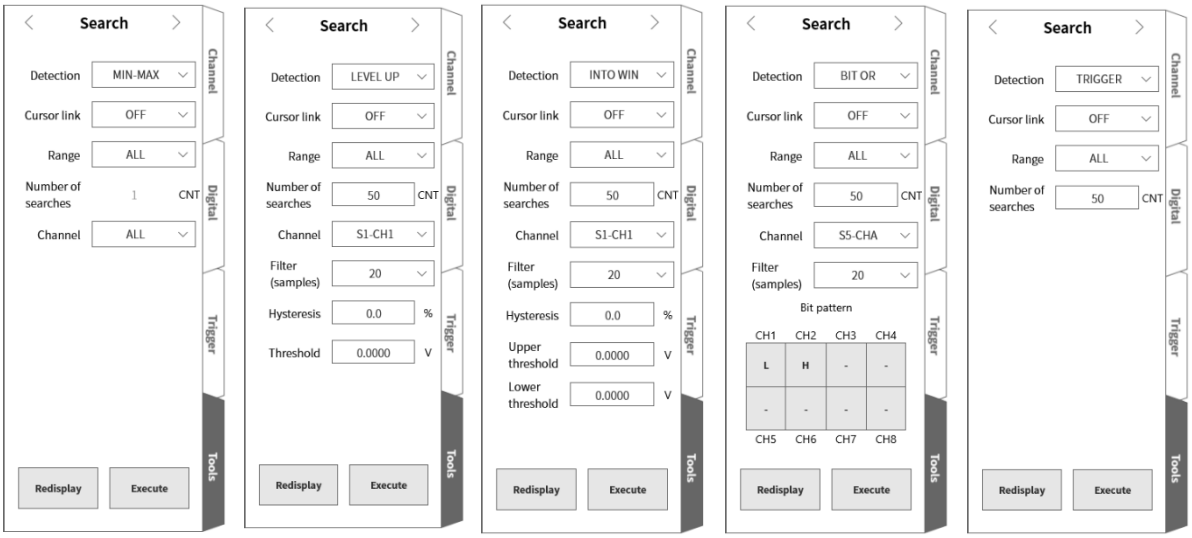


The search results are cleared when one of the following operations are performed. The search results cannot be redisplayed after they are cleared.

- ❑ When the【Execute】key is tapped to start search execution
- ❑ When the【Next search】key is tapped to start search execution
- ❑ When replay data is selected ("7.1. Select Recorded Data")
- ❑ When replay data is deleted (when the recorded data is deleted in "8.4.1. File Management" "Record")

Search setup menu

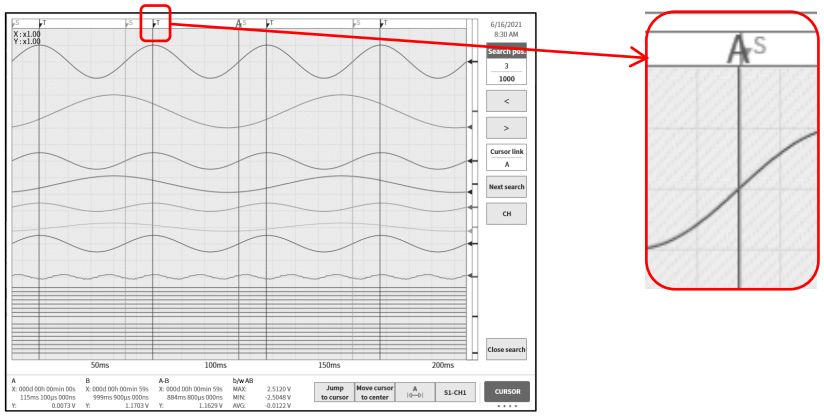
This section provides examples of settings. For information on the method for displaying the search setup menu, see "7.5.1. Search Types and Operations."



Detection: Select MIN-MAX, MAXIMUM, MINIMUM, MAXIMAL, MINIMAL, LEVEL UP, LEVEL DOWN, INTO WIN, OUT WIN, BIT OR, BIT AND, TRIGGER, or MARK.

Cursor link: Select OFF, A, or B.

- OFF: Do not link with the cursor.
- A: Move (link) Cursor A to the S mark line.
- B: Link with Cursor B.
  When the cursor link setting is "B", the jump destination is "CURSOR", and the cursor setting is "A", Cursor B moves to the same point as Cursor A.



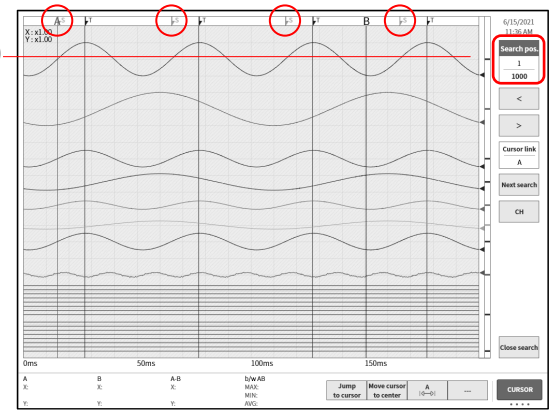
Range: Select All or B/W CURSOR.

- All: All the recorded data is the target and the number of detection results is 1,000. Cursor A moves to the point of the search result where Cursor A is first, according to the cursor link set to A.
- B/W CURSOR: The data between A and B is the target and the number of detection results is 1. Cursor A moves to the point where the search result is Cursor A, according to the cursor link set to A.

☞ The cursor line display must have the "1.6.3. Control Bar" as the【CURSOR】key. See "7.2.4. Cursor" for the cursor settings.

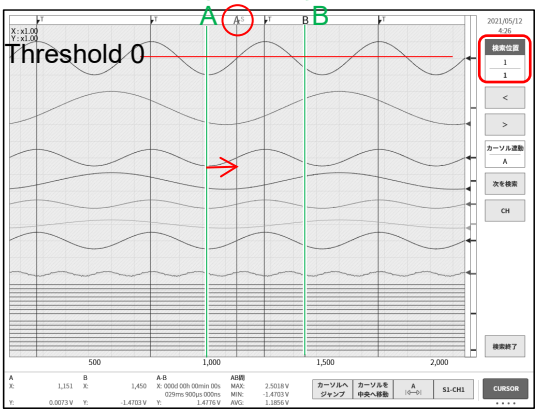
B/W CURSOR (setting before search execution)

Threshold 0



For [ALL]

Threshold 0



For [B/W CURSOR]

The figure above is the search result when the search setting is LEVEL UP and the threshold is set to 0.
The search is executed for the topmost sine wave (1,000 waves or more).
The cursor A-B setting is set to approximately one sine wave, as indicated in the figure above.
The red circle ○ on the top of the image is the S mark indicating the search results.

Number of searches:	Set the maximum number. The search stops when the number of search results exceeds the value set here.
Channel:	Select the channel to search.
Filter:	See "7.5.5. Peak Value Search (Local Maximum/Local Minimum)", "7.5.6. Level Search (LEVEL UP/LEVEL DOWN)", and "7.5.7. Window Search (INTO WIN/OUT WIN)".
Hysteresis:	See "7.5.6. Level Search (LEVEL UP/LEVEL DOWN)" and "7.5.7. Window Search (INTO WIN/OUT WIN)".
Threshold:	See "7.5.6. Level Search (LEVEL UP/LEVEL DOWN)".
Upper threshold:	See "7.5.7. Window Search (INTO WIN/OUT WIN)".
Lower threshold:	See "7.5.7. Window Search (INTO WIN/OUT WIN)".

7.5.3. Peak Value Search (MIN-MAX)

You can search for the maximum and minimum values of all analog channels at once. The search results are displayed in a list. If there are multiple of the same maximum or minimum values, the first point that was detected is displayed.

7.5.4. Peak Value Search (Maximum/Minimum)

You can search for the maximum and minimum values of the specified analog channel. If there are multiple of the same maximum or minimum values, the first point that was detected is displayed.

7.5.5. Peak Value Search (Local Maximum/Local Minimum)

- The detection point is the local maximum  when larger than two adjacent samples or the local minimum  when smaller than two adjacent samples. The detection point also occurs if the next value is the same as the local maximum  or the next value is the same as the local minimum .
- For "10.2.2. P-P Sampling", the maximum data is searched for the local maximum and the minimum data is searched for the local minimum.
  The local maximum/local minimum search function has a filter and the filter length can be set within the following range.
  Filter: OFF, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, or 10000.

Filter role and methodology

- When the filter is set to 10 (samples), 10 samples before and after are searched, for a total search range of 21 samples.

  X^{n-10}, X^{n-9}, ..., X^{n}, X^{n+1}, ..., X^{n+10}

  If multiple local maximums or local minimums exist in these 21 samples, x^{n} is the detection point if X^{n} is the largest local maximum or the smallest local minimum. If a sample other than X^{n} is the local maximum or local minimum, it is not deemed to be the local maximum or local minimum.
  An amount of sample data from the detection point equal to the filter setting is not subject to search, and searching starts from the next sample data, X^{n+11}.

- If there is no sample data equal to the length of the filter before and after the search point, that detection point is disabled. When the filter is set to 10 (samples), searching is performed from the 11th item of sample data.
  If there is no sample data equal to the length of the filter near the end of the search range, that detection point is disabled.

- When the filter setting is disabled, the operation is the same as when the filter is set to 1, which means that all the sample data that meets the above conditions become detection points. See "Search example 1" and "Search example 2".

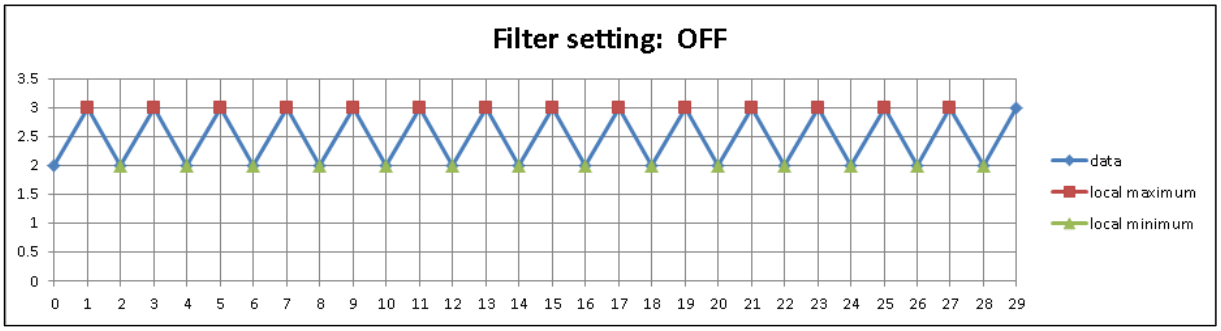
- When the filter is set to 10 (samples), 10 samples before and after are searched, for a total search range of 21 samples. If a target sample point is a local maximum and the largest local maximum within the range, it becomes the detection point. If a sample point is a local minimum and the smallest local minimum within the range, it becomes the detection point. If a local maximum with the same value or multiple local minimums exist in the range, they become detection points. If there is no sample data

equal to the length of the filter before and after the target sample point within that range, that detection point is disabled. See "Search example 3" and "Search example 4".

Search example 1

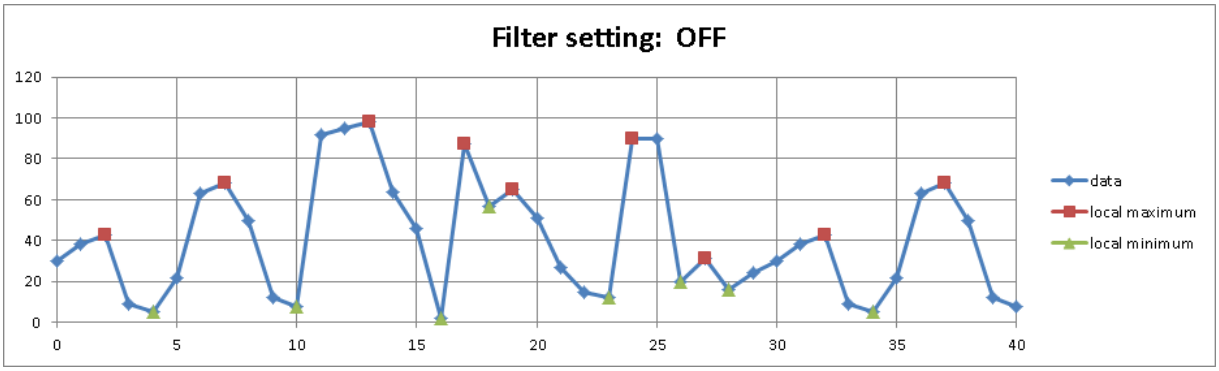
All local maximum points or local minimum points are the detection points.

Because there is no data before the first sample, it will not be a local minimum. The last sample will also not be a local maximum.



Search example 2

The local maximum and local minimum markers are the detection points.



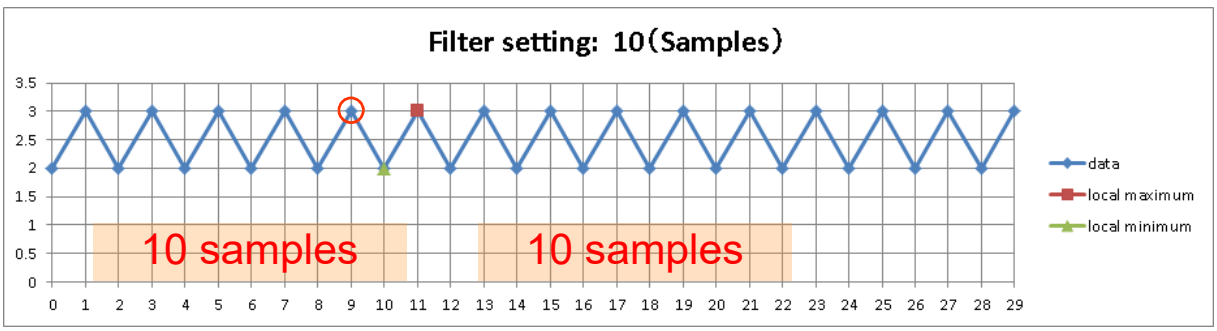
Search example 3

The red circle ○ point is not subject to the search because there are only nine previous samples.

Because the local maximums are valid from the 11th item of sample data, those local maximums are the detection points.

The 13th, 15th, 17th, 19th, and 21st items of sample data are not deemed to be local maximums due to filtering.

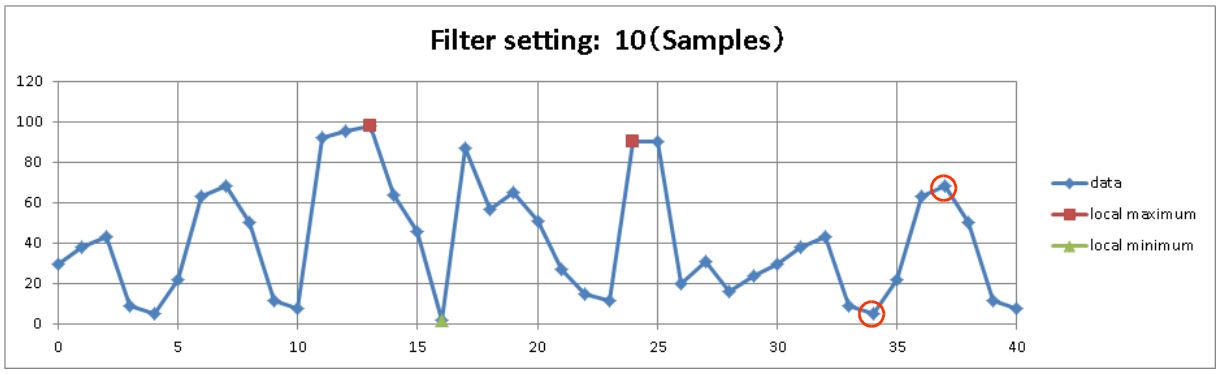
There are no detection points from the 22nd item of data, because there is no data of the filter length after that point.



Search example 4

The local maximum and local minimum markers are the detection points.

The red circle ○ will not be a detection point. This is because there is no data of the filter length after that point.



7.5.6. Level Search (LEVEL UP/LEVEL DOWN)

- Level search with "10.2.1. NORMAL Sampling"
  When LEVEL UP is set, the samples where the condition threshold < data value  is met are the detection points.
  When LEVEL DOWN is set, the samples where the condition threshold > data value  is met are the detection points.

  Level search after point detection
  When LEVEL UP is set, the next detection is not performed until the condition
  data value < threshold - hysteresis is met.
  When LEVEL DOWN is set, the next detection is not performed until the condition
  data value > threshold + hysteresis is met.

- Level search with "10.2.2. P-P Sampling"
  When LEVEL UP is set, the samples where the condition threshold < maximum data value is met are the detection points.
  When LEVEL DOWN is set, the samples where the condition threshold > minimum data value is met are the detection points.

  Level search after point detection
  When LEVEL UP is set, the next detection is not performed until the condition
  maximum data value < threshold - hysteresis is met.
  When LEVEL DOWN is set, the next detection is not performed until the condition
  minimum data value > threshold + hysteresis is met.

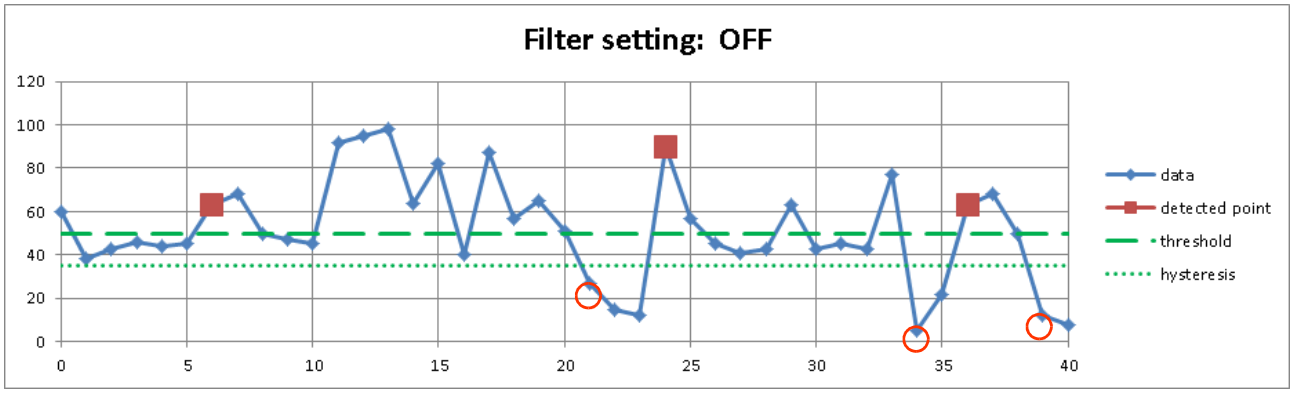
- The function is waiting for detection immediately after a level search starts.
  The level search function has hysteresis and filter settings.

  Filter: OFF, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, or 10000.
  The detection point is the sample after the conditions are established continuously for the set filter length from the point where the search conditions are met.
  When LEVEL UP is set, the detection condition is data value ≥ threshold - hysteresis.
  When LEVEL DOWN is set, the detection condition is
  minimum data value ≤ threshold + hysteresis.
  See "LEVEL UP search example 2".
  The above is for NORMAL recording. For "10.2.2. P-P Sampling", the data value that meets the above condition is the maximum data value or minimum data value.
  OFF has the same meaning as 1.

  Hysteresis: 0.0 to 10.0%, in increments of 0.1
  The ratio to the measurement range.
  When set to 0.1% and the range is 10 V, the hysteresis is 10 mV.

LEVEL UP search example 1

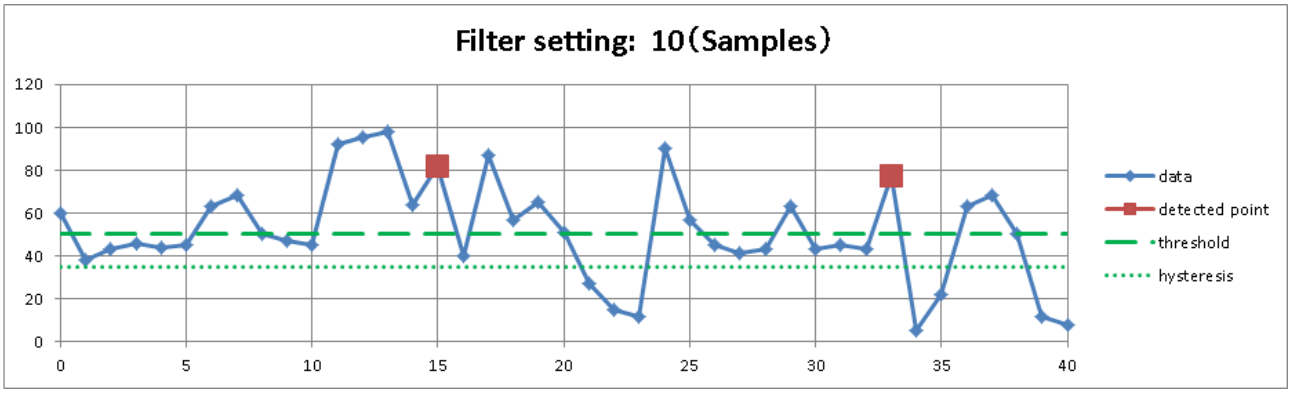
This section is an example of when LEVEL UP is set and filtering is disabled. The ■ marker is the detection point and the ○ red circle is the detection restart point.



LEVEL UP search example 2

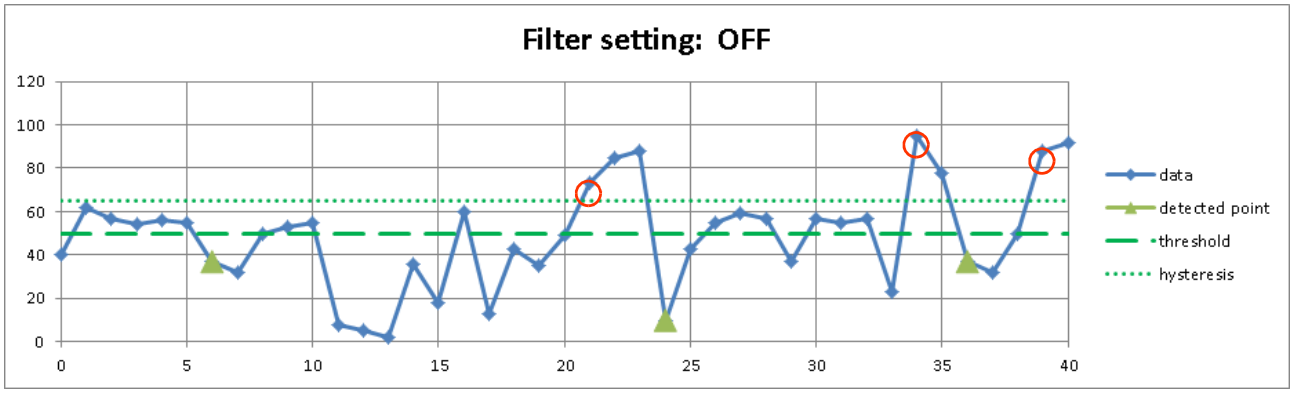
This section is an example of when LEVEL UP is set and filtering is set to 10. The ■ marker is the detection point.

The data is the same as "LEVEL UP search example 1". The first detection point of "LEVEL UP search example 1" is the 6th sample, and the next detection point that meets the detection conditions is the 15th sample (after the 10 point filter).



LEVEL DOWN search example 1

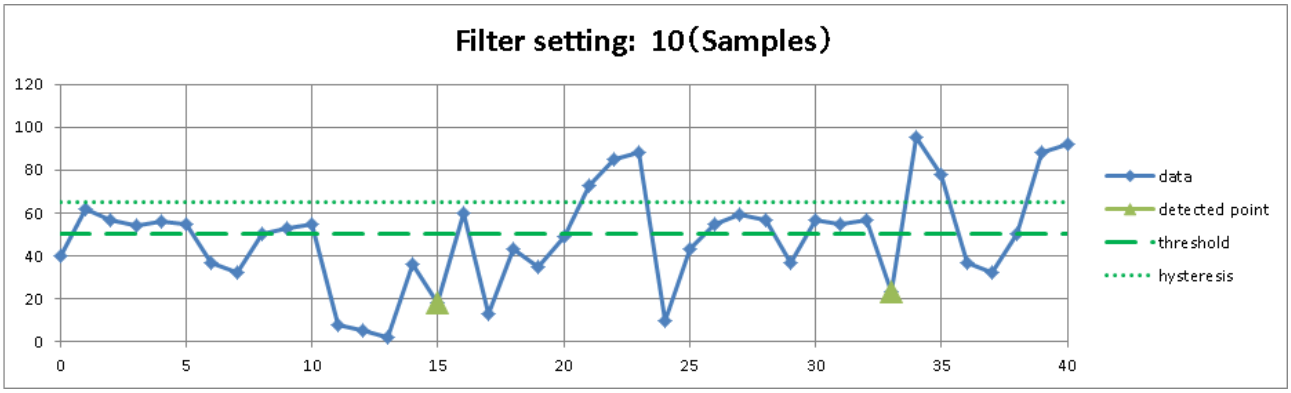
This section is an example of when LEVEL DOWN is set and filtering is disabled. The ▲ marker is the detection point and the ○ red circle is the detection restart point.



LEVEL DOWN search example 2

This section is an example of when LEVEL DOWN is set and filtering is set to 10. The ▲ marker is the detection point.

The data is the same as "LEVEL DOWN search example 1". The first detection point of "LEVEL DOWN search example 1" is the 6th sample, and the next detection point that meets the detection conditions is the 15th sample (after the 10 point filter).



7.5.7. Window Search (INTO WIN/OUT WIN)

❑ Window search with "10.2.1. NORMAL Sampling"

When INTO WIN is set, the samples where the condition lower threshold < data value < upper threshold  is met are the detection points.

When OUT WIN is set, the samples where the condition lower threshold > data value or data value > upper threshold  is met are the detection points.

Window search after point detection

When INTO WIN is set, the next detection is not performed until the condition data value < lower threshold - hysteresis or upper threshold + hysteresis < data value is met.

When OUT WIN is set, the next detection is not performed until the conditions data value > lower threshold + hysteresis and upper threshold - hysteresis > data value are met.

❑ Window search with "10.2.2. P-P Sampling"

When INTO WIN is set, the samples where the conditions lower threshold < maximum data value and minimum data value < upper threshold are met are the detection points.

When OUT WIN is set, the samples where the condition lower threshold > minimum data value or maximum data value > upper threshold is met are the detection points.

Window search after point detection

When INTO WIN is set, the next detection is not performed until the condition maximum data value < lower threshold - hysteresis or upper threshold + hysteresis < minimum data value is met.

When OUT WIN is set, the next detection is not performed until the conditions minimum data value > lower threshold + hysteresis and upper threshold - hysteresis > maximum data value are met.

❑ The function is waiting for detection immediately after a window search starts.

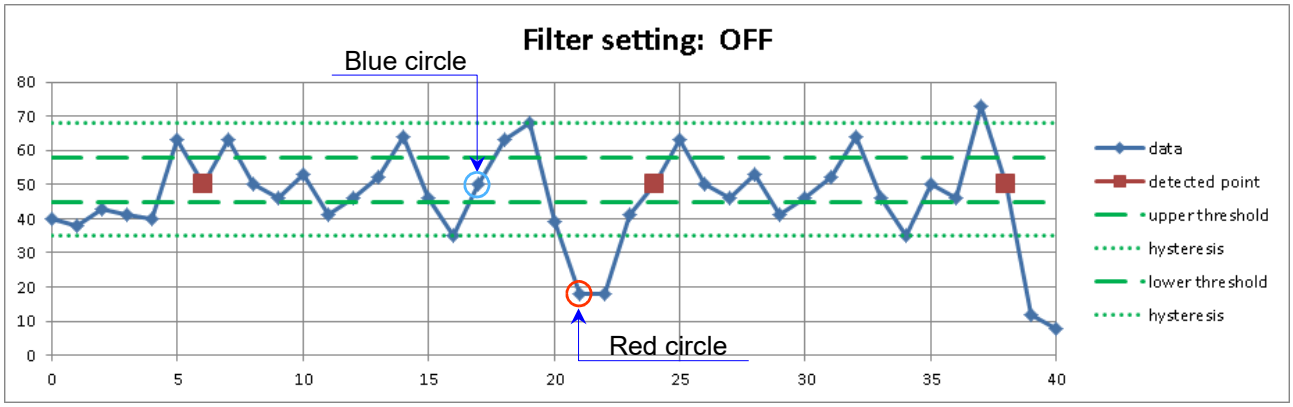
The window search function has hysteresis and filter settings.

Filter: OFF, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, or 10000.
The detection point is the sample after the conditions are established continuously for the set filter length from the point where the search conditions are met.
When INTO WIN is set, the detection conditions are
data value ≥ lower threshold - hysteresis and
upper threshold + hysteresis ≥ data value.
When OUT WIN is set, the detection condition is
data value ≤ lower threshold + hysteresis or
upper threshold - hysteresis ≤ data value.
See "INTO WIN search example 2". The above is for NORMAL recording. For "10.2.2. P-P Sampling", the data value that meets the above condition is the maximum data value or minimum data value. OFF has the same meaning as 1.

Hysteresis: 0.0 to 10.0%, in increments of 0.1
The ratio to the measurement range.
When set to 0.1% and the range is 10 V, the hysteresis is 10 mV.

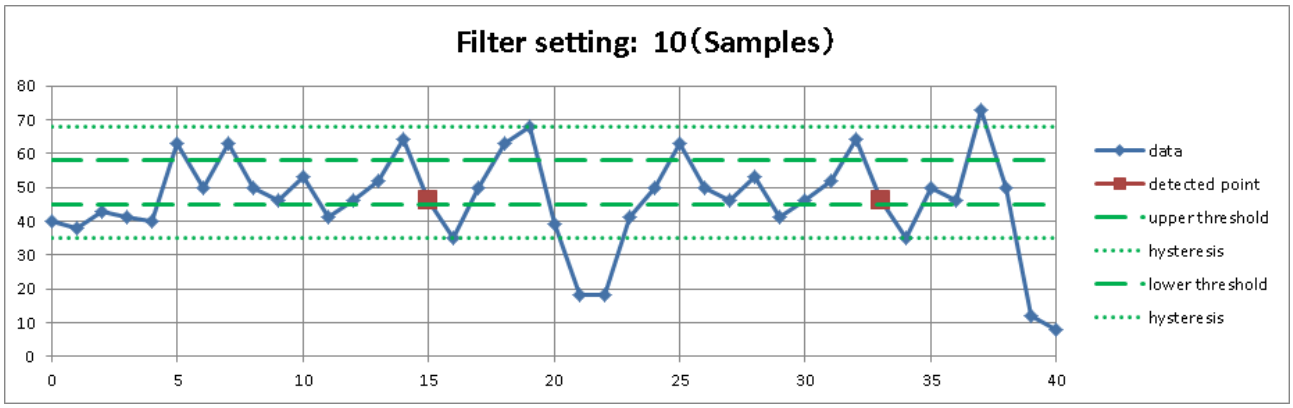
INTO WIN search example 1

This section is an example of when INTO WIN is set and filtering is disabled. The ■ marker is the detection point and the ○ red circle is the detection restart point. The blue circle ○ on the 17th item of data is not a detection point. The sample data value of the 16th item of data does not enter detection standby because it is the same value as hysteresis.



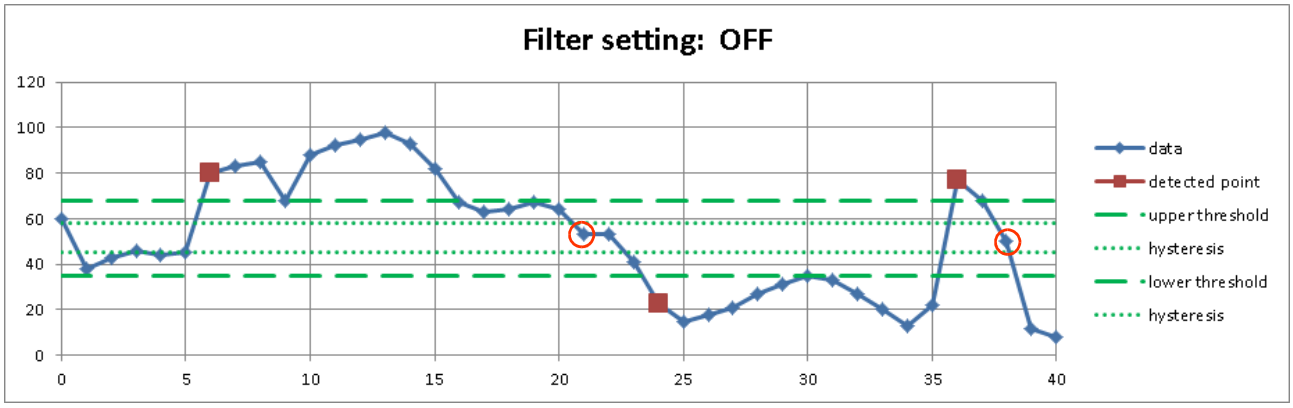
INTO WIN search example 2

This section is an example of when INTO WIN is set and filtering is set to 10. The ■ marker is the detection point. The data is the same as "INTO WIN search example 1". The first detection point of "INTO WIN search example 1" is the 6th sample, and the next detection point that meets the detection conditions is the 15th sample (after the 10 point filter).



OUT WIN search example 1

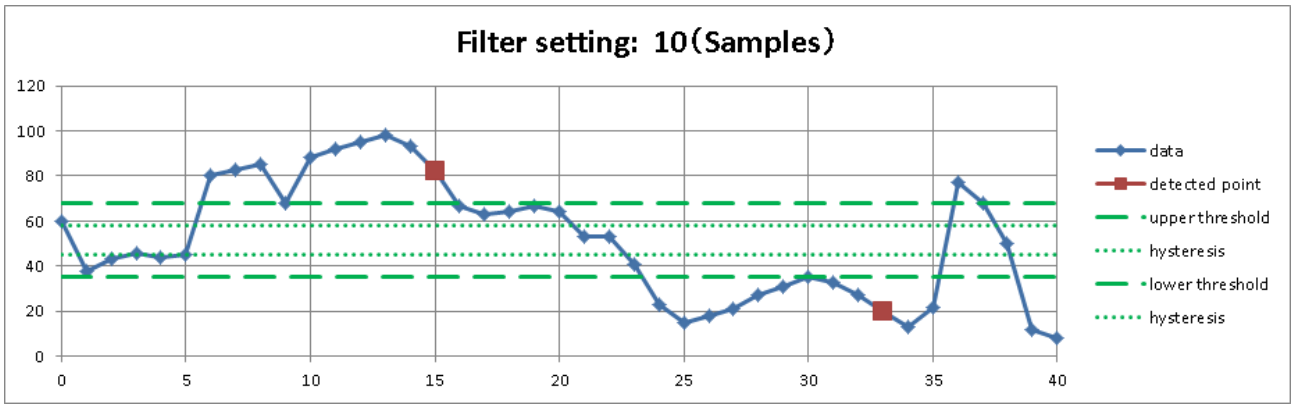
This section is an example of when OUT WIN is set and filtering is disabled. The ■ marker is the detection point and the ○ red circle is the detection restart point.



OUT WIN search example 2

This section is an example of when OUT WIN is set and filtering is set to 10. The ■ marker is the detection point.

The data is the same as "OUT WIN search example 1". The first detection point of "OUT WIN search example 1" is the 6th sample, and the next detection point that meets the detection conditions is the 15th sample (after the 10 point filter).



7.5.8. Logic Search

- ❑ When channels are set for a logic module in the (search) channel settings, the settings of the logic search conditions are displayed.
- ❑ A single logic module is 16 channels (16 bits).
  The channels are divided into two groups (Channel A and Channel B), with CH1 to CH8 corresponding to Channel A and the rest corresponding to Channel B.
  The detection points are the samples where the AND or OR operation in each group can be performed and the setting conditions are met.
- ❑ The input values immediately after starting the search are ignored, even if the conditions are established. The search starts after the data value changes.

* Searches cannot be performed with "10.2.2. P-P Sampling". See "Conditions where searching cannot be performed" in "7.5.2. Search Method Types and Settings".

Bit pattern: – (OFF: Disabled)/L (Low level)/H (High level)
Set the logic establishment conditions for each of the eight logic channels.

Detection: BIT AND/BIT OR

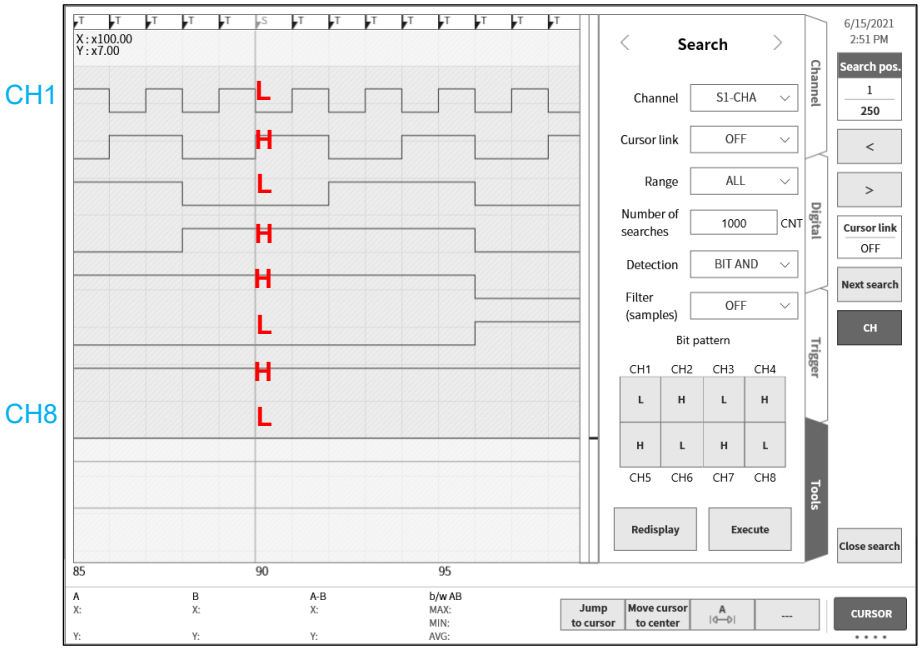
BIT AND The detection points are the samples where all the channels set in "Bit pattern" meet the conditions.

BIT OR The detection points are the samples where any of the channels set in "Bit pattern" meet the conditions.

Filter: OFF, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, or 10000.
The detection point is the sample after the conditions are established continuously for the set filter length from the point where the search conditions are met.
OFF has the same meaning as 1.

Logic search example (BIT AND)

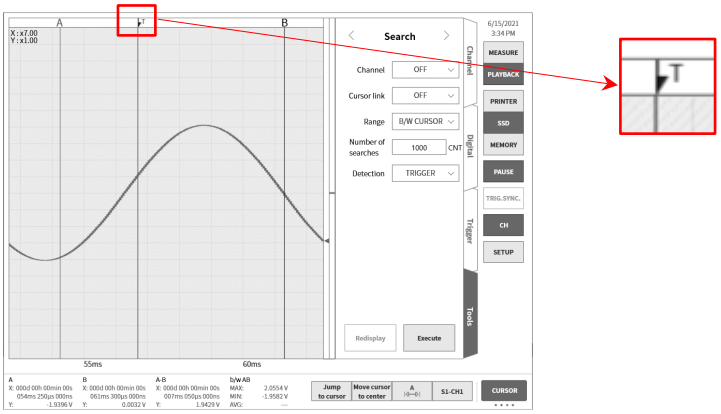
The screen is an example of the BIT AND conditions (Y-T waveform display in execution results).
The logic waveform is S1-CHA, the same as the search channel.
The top waveform on the screen displays CH1 and the bottom waveform displays CH8.
We can see that a search has been performed using the "Bit pattern" condition in the settings.



7.5.9. Trigger Search

Searches for the trigger points (T mark on the top of the Waveform monitor) detected in "5. Trigger Setup " during recording.

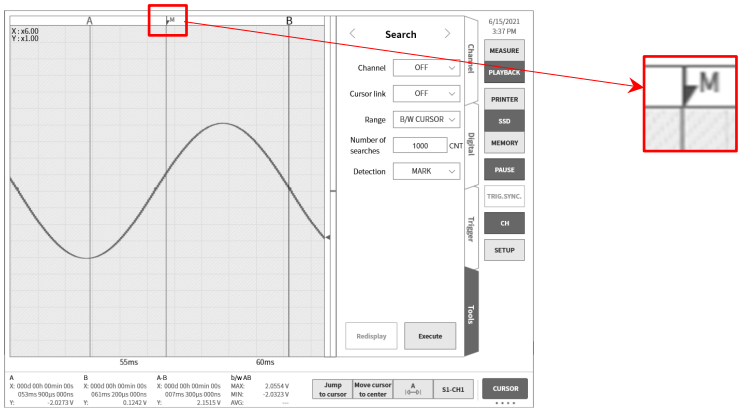
* For a trigger, the S mark on the Y-T waveform is not displayed.



7.5.10. Mark Search

Searches for the detection points (M mark on the top of the Waveform monitor) of the MARK signal in "12.3.10. Remote Control Module (RA30-112)" during recording. For details on the detection points of the MARK signal, see "9.10.6. Reference Materials".

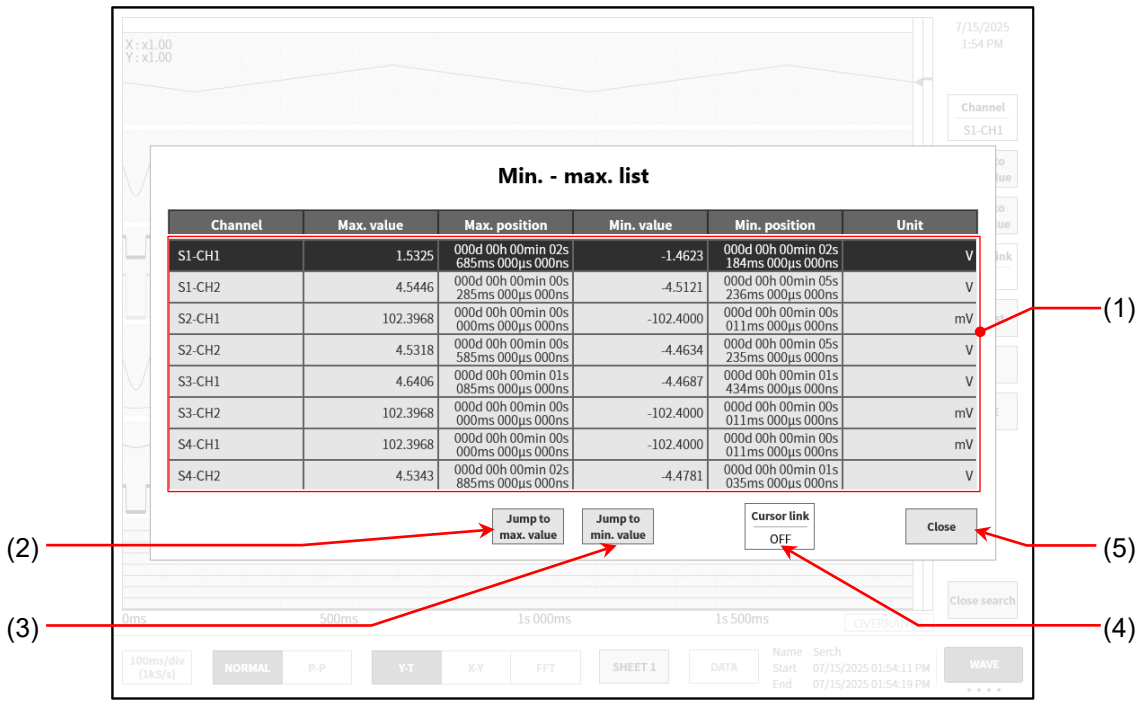
* For a mark, the S mark on the Y-T waveform is not displayed.
* A mark search cannot be performed for memory recording. See "Conditions where searching cannot be performed" in "7.5.2. Search Method Types and Settings".



7.5.11. Min. - Max. List

This screen displays the search results of the minimum values and maximum values for all channels.

For information on searching, see "7.5.1. Search Types and Operations".



(1) Min. - max. list: Displays the search results for all channels.

Channel	Displays the channel number. If a signal name is set, the signal name is displayed.
Max. value	The maximum value of each channel
Max. position	The maximum value position of each channel
Min. value	The minimum value of each channel
Min. position	The minimum value position of each channel
Unit	The unit of each channel

(2) Jump to max. value: Moves the Y-T waveform to the maximum value position of the channel selected in [Min. - max. list].

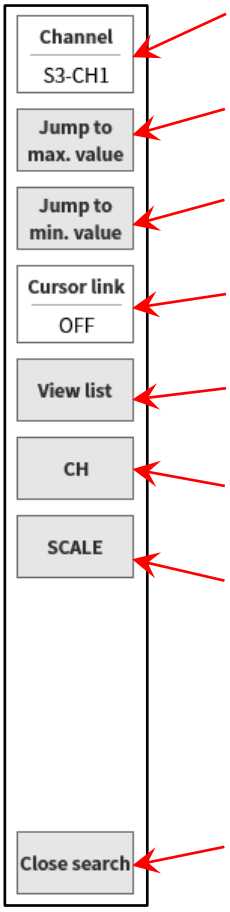
(3) Jump to min. value: Moves the Y-T waveform to the minimum value position of the channel selected in [Min. - max. list].

(4) Cursor link: Select OFF, A, or B.

OFF	Do not link the cursor.
A	Move (link) cursor A to the destination to jump to.
B	Move (link) cursor B to the destination to jump to.

(5) Close: Closes the screen.

7.5.12. Min. - Max. Side Menu



(1) Channel:
Selects the channel to display the S mark for.

(2) Jump to max. value:
Moves the Y-T waveform to the maximum value position of the channel.

(3) Jump to min. value:
Moves the Y-T waveform to the minimum value position of the channel.

(4) Cursor link:
Select OFF, A, or B.

(5) View list:
Displays the [Min. - max. list] screen.

(6) CH:
Displays the sub menu.

(7) SCALE:
Displays the graph scale.

(8) Close search:
Closes the search and returns the search view menu to the regular side menu.

7.5.13. Search Display Menu



(1) Search pos.:
The top number is the search result currently displayed and the bottom number is the total number of search results. For information on changing the displayed search results, see "Method for changing the search results display".

(2) Operation keys for changing the search results display
For information on changing the search results display, see "Method for changing the search results display".

(3) Cursor link
Select OFF, A, or B. Moves (links) the specified cursor to the S mark line. For details, see "Cursor link" in "Search setup menu".

(4) Next search
If more search results exist than the search upper limit, searching is performed again with the last point of the search results as the start point of the search range. The previous search results are deleted when the key is pressed.

(5) CH:
Displays the sub menu. This enables you to check or reset the search settings.

(6) SCALE:
Displays the graph scale.

(7) Close search
Tap the【Close search】key to end the search and return the search display menu to the regular side menu.

Function limitations

The following functions cannot be used while this menu is displayed.

- ❑ Switching the recorded data (between printer recording, SSD recording, and memory recording)
- ❑ Switching the memory block
- ❑ Switching the X-Y display and FFT display

Method for changing the search results display

There are three methods for displaying the search results.
When the search result number is changed, the Y-T waveform follows and the center of the screen becomes the detection point. However, if there is a detection point near the start or end of the recorded data, the center of the screen will not be the detection point because the maximum amount of waveform is displayed.

- ❑ Tap (1) to enable the jog dial.
  The jog dial works in increments of 10 for the standard mode and increments of 1 for the fine adjustment mode.
  For information on each mode, see "1.3. Operation panel".
- ❑ Press and hold (1) to set the numeric input dialog.
- ❑ Tap the【<】key in (2) to move to the previous result or the【>】key to move to the next result.

7.6. Jump Function

Set the following jump conditions to jump to the corresponding location. (The Y-T waveform display is updated.)

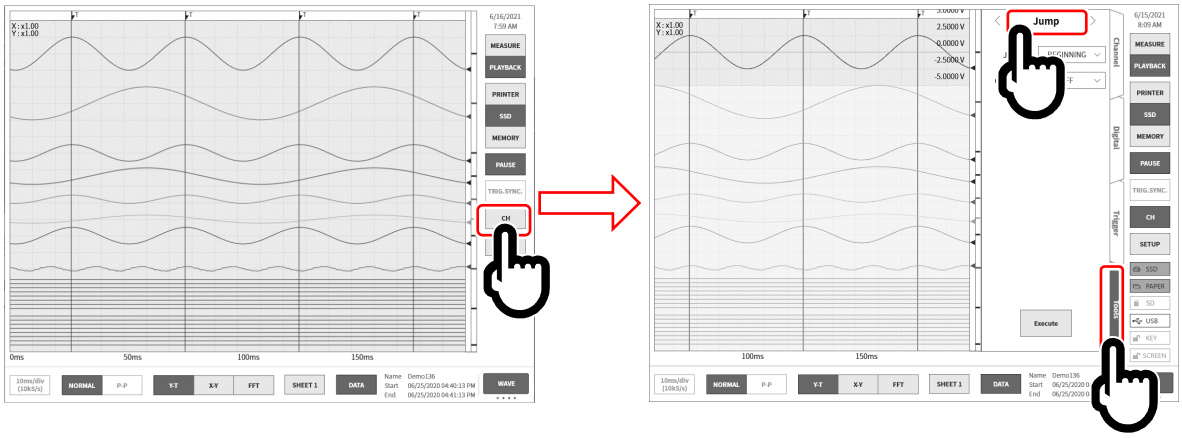
- ❑ BEGINNING: Jumps to the beginning of the recorded data
- ❑ CENTER: Jumps to the center of the recorded data
- ❑ END: Jumps to the end of the recorded data
- ❑ DATE: Jumps to the specified time
- ❑ TIME: Jumps to the specified elapsed time
- ❑ POINT: Jumps to the specified sample point
- ❑ CURSOR: Jumps to Cursor A or Cursor B

7.6.1. Jump Types and Operations

Step 1. Perform the procedure in "7.1. Select Recorded Data."

Step 2. Tap the【CH】key on the side menu to display the sub menu.

Step 3. Tap the【Tools】tab in the sub menu.



Step 4. Tap the top of the tools screen to display [Jump].

Step 5. Configure the jump conditions, then tap the【Execute】key.
When the jump process finishes, the side menu closes and the Y-T waveform at the position specified in the jump conditions is displayed in the center of the monitor screen.

However, if the position specified in the jump conditions is near the start or the end, the specified position may not be in the center of the monitor screen.

7.6.2. Jump Condition Types and Settings

The settings differ for each jump condition (the Jump to setting (main unit screen notation)).
For details, see "7.6.3. Data beginning, center, end", "7.6.4. Date Setup", "7.6.5. Time Setup", "7.6.6. POINT(samples)", "7.6.7. Cursor".

Jump to:

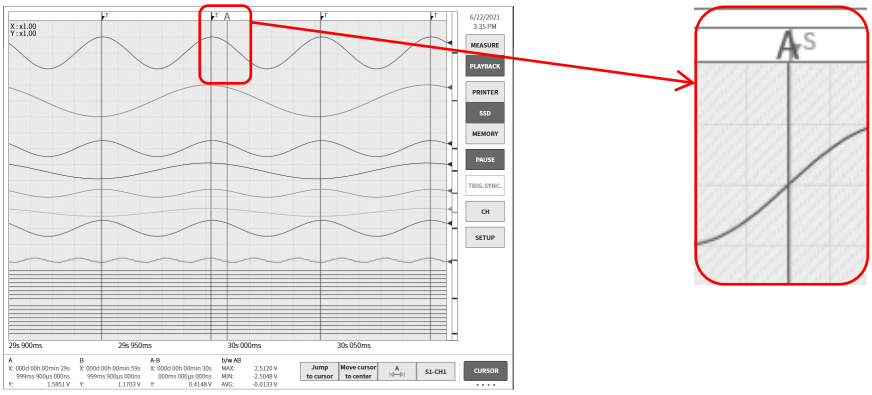
Jump to	Setting item	Setting value
Beginning		
Center		
End		
DATE	Date/Time	Year, month, day, hour, minute, second, millisecond, microsecond, nanosecond
Time	Elapsed time	Day, hour, minute, second, millisecond, microsecond, nanosecond
Point	Sample number	0 to recorded data count - 1
Cursor	Cursor	A, B

Cursor link: Select OFF, A, or B.

OFF Do not link with the cursor.

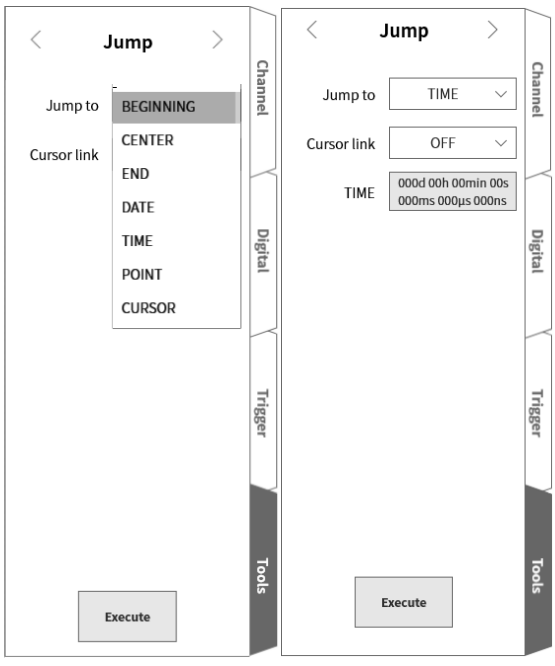
A Move (link) Cursor A to the S mark.

B Link with Cursor B. When the cursor link setting is "B", the jump destination is "CURSOR", and the cursor setting is "A", Cursor B moves to the same point as Cursor A.



For Cursor A

The cursor line display must have the "1.6.3. Control Bar" as the【CURSOR】key.
See "7.2.4. Cursor" for the cursor settings.



Jump setup menu

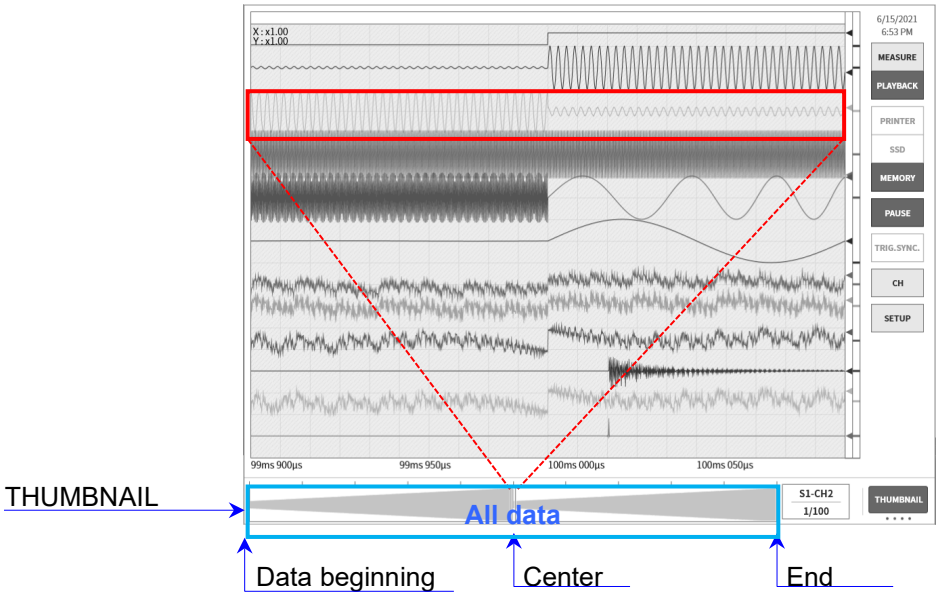
The screen on the right is an example of the jump setup menu.

7.6.3. Data beginning, center, end

The THUMBNAIL waveform displays all data.

The screen shows the result when CENTER is set.

We can see that the center of the data displays the Y-T waveform.



7.6.4. Date Setup

Tap the【Execute】key to jump to the point in "Date Setup".

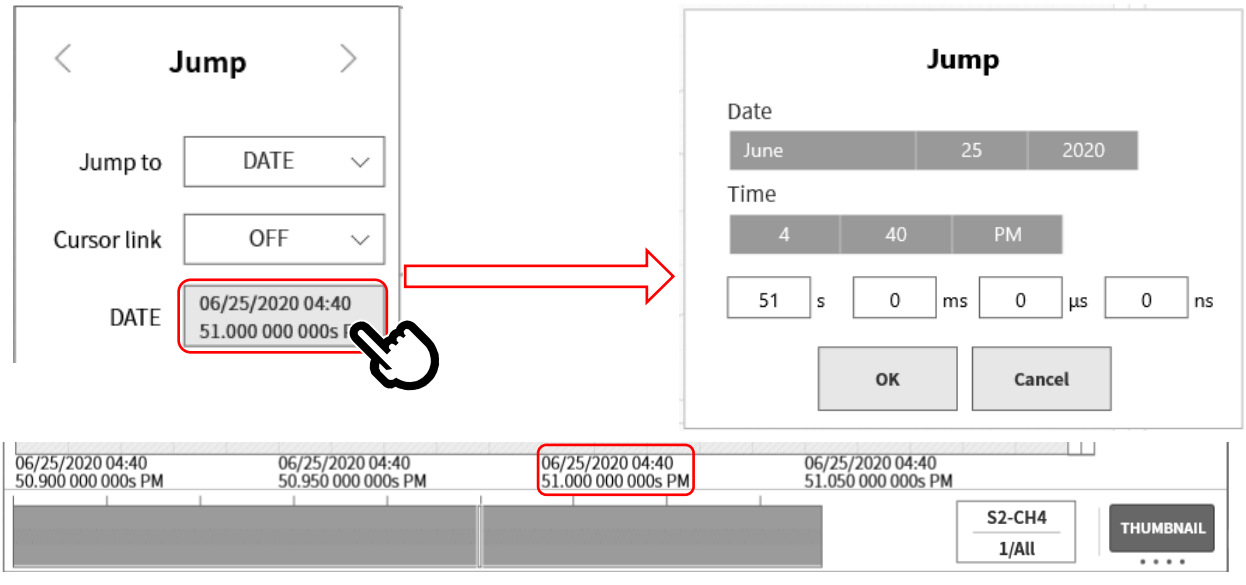
An error dialog is displayed if the setting is outside the recorded data range.

If there is no data at the specified time, the most recent point is jumped to.

Use [X axis notation] in "8.2.5. Other" as the【Date】key.

Date Setup

Tap the red frame to display the setup screen. Tap the date and set the year, month, and day by swiping, then tap the time and set the hour and minute by swiping. Tap the remaining second, millisecond, and microsecond, and use the jog dial to specify the settings or press and hold to specify the settings on the numeric entry screen.



7.6.5. Time Setup

Tap the【Execute】key to jump to the point in "Time Setup". Set the relative time with the beginning of the recorded data as 0.

For memory recording, set the relative time with the beginning of the block as 0. All blocks are targeted.

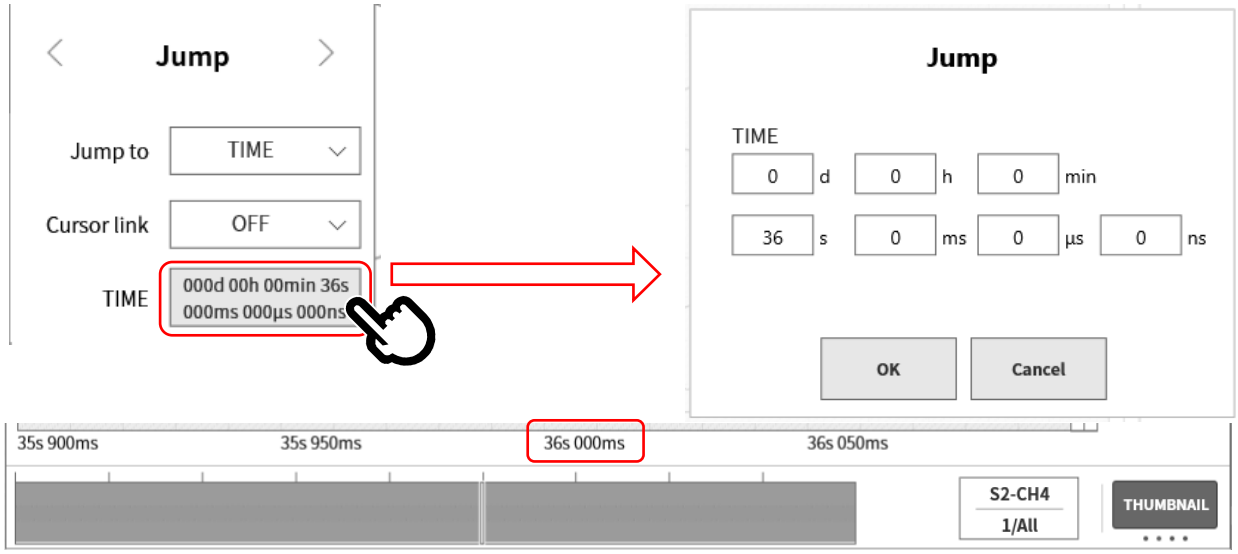
An error dialog is displayed if the setting is outside the recorded data range.

If there is no data at the specified time, the most recent point is jumped to.

Use [X axis notation] in "8.2.5. Other" as the【Time】key.

Time Setup

Tap the red frame to display the setup screen. Tap the day, hour, minute, second, millisecond, and microsecond, and nanosecond, and use the jog dial to specify the settings or press and hold to specify the settings on the numeric entry screen.



7.6.6. POINT(samples)

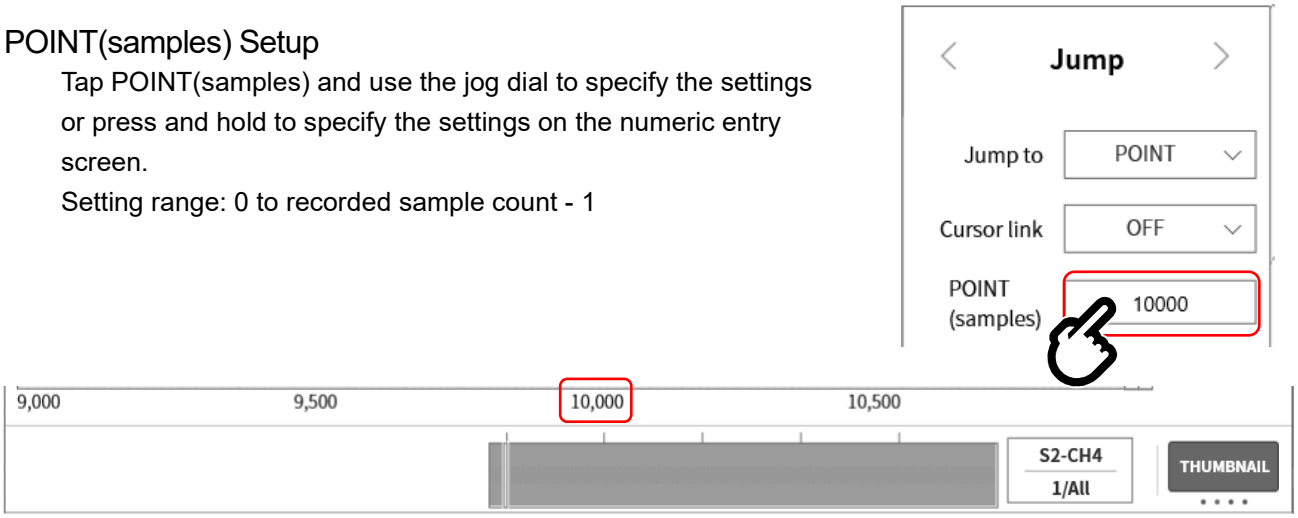
Tap the【Execute】key to jump to the point in "POINT(samples) Setup".

Use [X axis notation] in "8.2.5. Other" as the【Point】key.

POINT(samples) Setup

Tap POINT(samples) and use the jog dial to specify the settings or press and hold to specify the settings on the numeric entry screen.

Setting range: 0 to recorded sample count - 1



7.6.7. Cursor

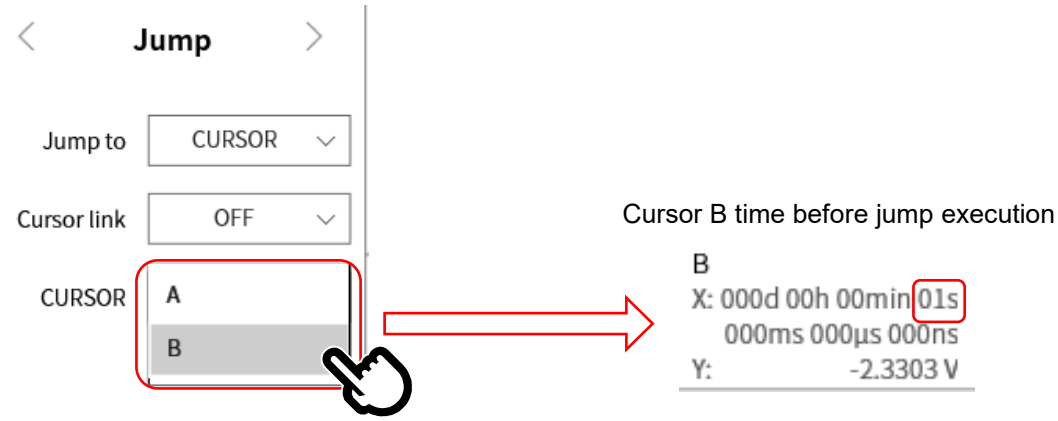
Tap the【Execute】key to jump to the point in "Cursor Setup".

In "7.2.4. Cursor", set Cursor A or Cursor B.

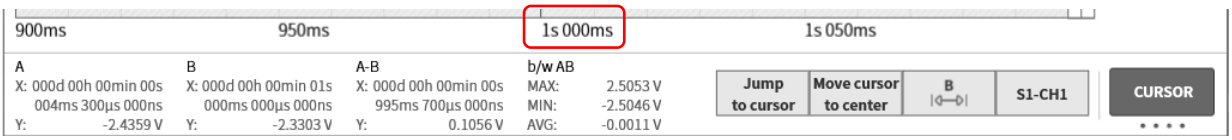
Cursor Setup

Tap the cursor and use the jog dial to specify the settings or press and hold to specify the settings on the numeric entry screen.

Setting range: 0 to recorded sample count - 1



Cursor B (time 1 s) is displayed in the center of the Y-T waveform.



7.7. Statistical Calculation

You can perform calculation such as averaging the playback data of a displayed Y-T waveform. The results can be output to a CSV file.

Statistical calculation conditions

Recording device: SSD or MEMORY
Data format: NORMAL

7.7.1. Statistical Calculation

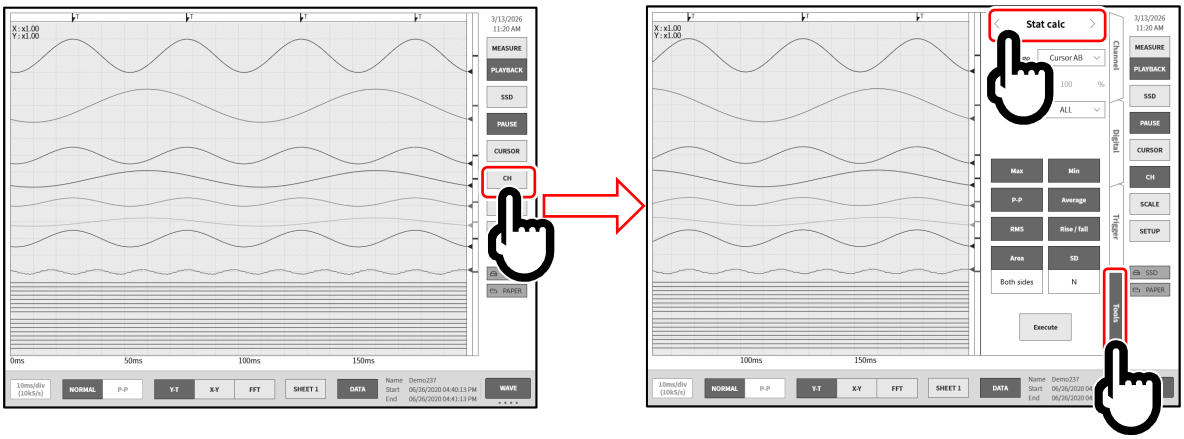
Step 1. Perform the procedure in "7.1. Select Recorded Data".

Step 2. Select [SSD] or [MEMORY] for the recording device selection key.

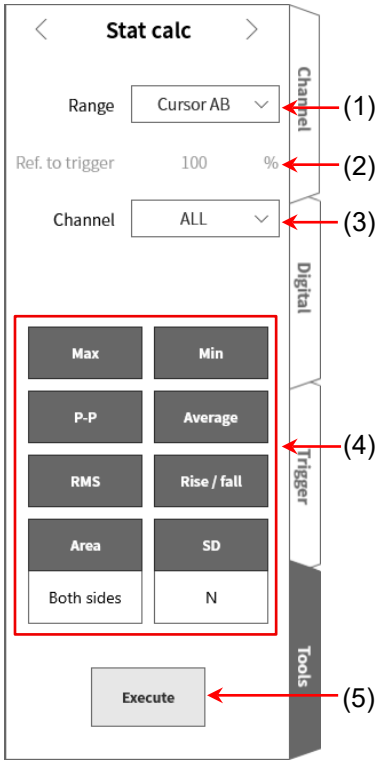
Step 3. Tap the【CH】key in the side menu to display the sub menu.

Step 4. Tap the【Tools】tab in the sub menu.

Step 5. Tap the top of the tools screen to display [Stat calc].



Step 6. Select the range and statistical calculation items.



(1) Range: Select the range for calculation.

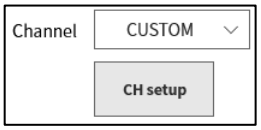
Cursor AB	Outputs the range from cursors A to B.
Whole	Outputs all the recorded data.
Ref. to trigger	Outputs the range based on the trigger. Available when【MEMORY】is selected as the recording device.

(2) Reference to trigger: Available when [Ref. to trigger] is selected for [Output range].
Specifies a percentage from 1 to 100%, based on the trigger.
If 100% is specified, all the memory recording data is the sample size (sample data count) for statistical calculation.

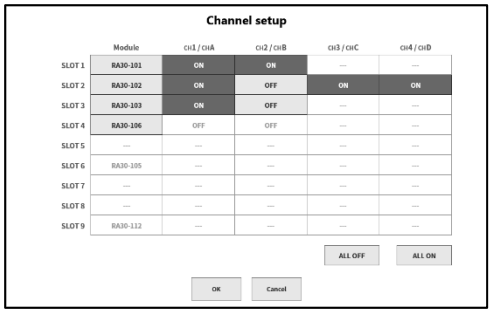
Example: If the reference to trigger is 50% and the memory point count is 10k points (2,000 points before trigger and 8,000 points after trigger), calculation will be performed for 5k points (1,000 points before trigger and 4,000 points after trigger).

(3) Channel:

ALL	All recorded analog channels
CUSTOM	The specified analog channels. The【CH setup】key is displayed.



CH setup: Tap the【CH setup】key to display a dialog box.
Select ON for the channels to perform calculation on.



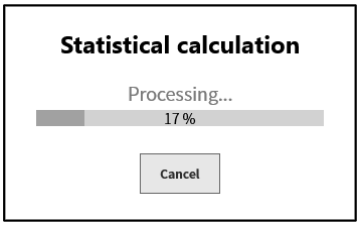
(4) Statistical calculation items:
Select the items for statistical calculation. The following calculation items have calculation parameters.

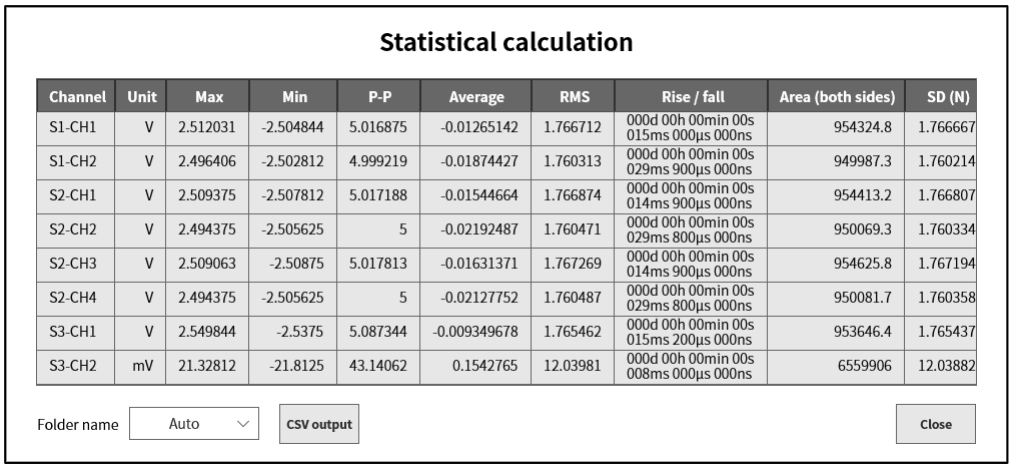
Area	Select the area type. Both sides: The area of both sides combined + side: The area of the positive side - side: The area of the negative side

SD	Select the value of the denominator for standard deviation calculation. N: The sample count of the range for calculation N-1: The value of N minus 1

For details, see "7.7.3. Methodology for Statistical Calculation".

Step 7. When the settings are complete, tap the【Execute】key (5). Calculation starts, and a list of the results is displayed.





Channel	Unit	Max	Min	P-P	Average	RMS	Rise / fall	Area (both sides)	SD (N)
S1-CH1	V	2.512031	-2.504844	5.016875	-0.01265142	1.766712	000d 00h 00min 00s 015ms 000µs 000ns	954324.8	1.766667
S1-CH2	V	2.496406	-2.502812	4.999219	-0.01874427	1.760313	000d 00h 00min 00s 029ms 900µs 000ns	949987.3	1.760214
S2-CH1	V	2.509375	-2.507812	5.017188	-0.01544664	1.766874	000d 00h 00min 00s 014ms 900µs 000ns	954413.2	1.766807
S2-CH2	V	2.494375	-2.505625	5	-0.02192487	1.760471	000d 00h 00min 00s 029ms 800µs 000ns	950069.3	1.760334
S2-CH3	V	2.509063	-2.50875	5.017813	-0.01631371	1.767269	000d 00h 00min 00s 014ms 900µs 000ns	954625.8	1.767194
S2-CH4	V	2.494375	-2.505625	5	-0.02127752	1.760487	000d 00h 00min 00s 029ms 800µs 000ns	950081.7	1.760358
S3-CH1	V	2.549844	-2.5375	5.087344	-0.009349678	1.765462	000d 00h 00min 00s 015ms 200µs 000ns	953646.4	1.765437
S3-CH2	mV	21.32812	-21.8125	43.14062	0.1542765	12.03981	000d 00h 00min 00s 008ms 000µs 000ns	6559906	12.03882

7.7.2. CSV Output of Statistical Calculation Results

You can output the results of statistical calculation to a CSV file.

Step 1. Specify the folder to save the CSV file.



Folder name:

Auto	The results are saved to the "<recording date/time (yyyymmdd-HHMMSS)> – <serial number (xxxx)>_STA" folder
Manual	The results are saved to the specified folder. The folder name is specified after pressing the【CSV output】key.

Tips

- ❑ Up to 40 single-byte alphanumeric characters and some symbols can be entered for the folder name.
  Windows reserved file names or characters cannot be used.

Step 2. When the settings are complete, tap the【CSV output】key.
The CSV file is saved to the specified folder.



Tips

- ❑ A maximum of 1,000 CSV files can be stored in the internal storage.
  When this number has been reached, new CSV files cannot be created.
- ❑ The string "_STA" is appended to the name of the CSV file.

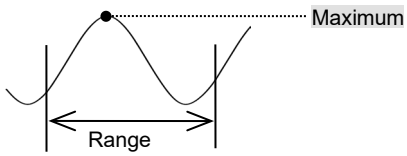
Step 3. Export the file to external media (such as an SD memory card or USB stick).

☞ See "Exporting CSV Files".

7.7.3. Methodology for Statistical Calculation

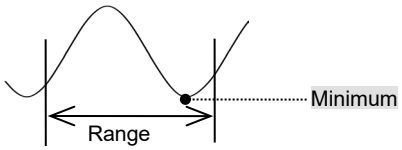
Maximum

The maximum value of the data within the range.



Minimum

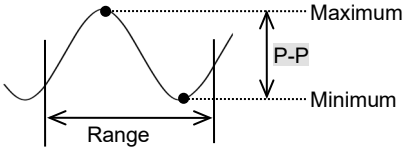
The minimum value of the data within the range.



P-P

Calculates the width (P-P) from the maximum value to the minimum value within the range.

Equation: $\mathrm{P-P} = |\mathrm{Maximum} - \mathrm{Minimum}|$



Average

Calculates the average value (AVE) of the data within the range.

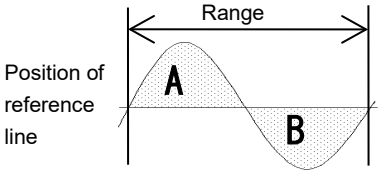
Equation: $\mathrm{AVE} = \frac{1}{\mathrm{n}}\sum \mathrm{D}$

D: Sample data within the range

n: Data count

Area

Calculates the area (AREA) within the range.



1) Both sides

The total area of the positive side of the range combined with the negative side of the range (in the above example, the area of A + B)

Equation: $\mathrm{AREA} = \sum |\mathrm{D}|$

D: Sample data within the range

2) + side

The area of the positive side of the range (in the above example, the area of A)

Equation: $\mathrm{AREA} = \sum(+\mathrm{D})$

D: Sample data within the range

3) - side

The area of the negative side of the range (in the above example, the area of B)

Equation: $\mathrm{AREA} = \sum(-\mathrm{D})$

D: Sample data within the range

Root-mean-square value

Calculates the root-mean-square value (RMS) of the data within the range.

D: Sample data within the range

Equation: $\mathrm{RMS} = \sqrt{\frac{(\sum \mathrm{D})^2}{\mathrm{n}}}$ n: Data count

Standard deviation

Calculates the standard deviation (SD) of the data within the range.

1) N

Calculates the standard deviation (SD) of the data within the range as 1/n.

D: Sample data within the range

Equation: $\mathrm{SD} = \sqrt{\frac{1}{\mathrm{n}}\left\{\sum \mathrm{D}^2 - \frac{(\sum \mathrm{D})^2}{\mathrm{n}}\right\}}$ n: Data count

2) N-1

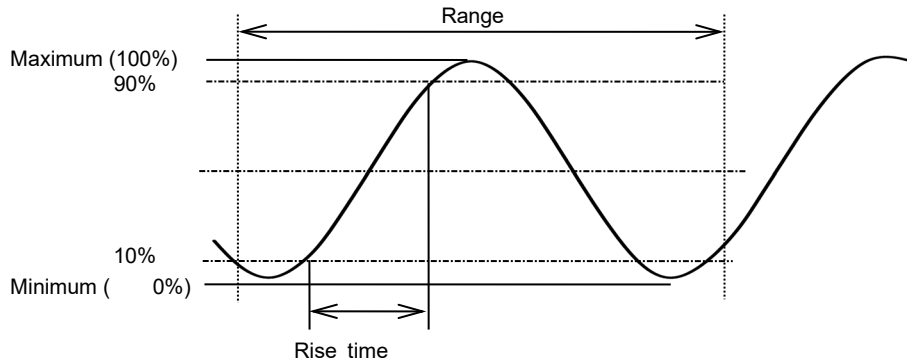
Calculates the standard deviation (SD) of the data within the range as 1/(n-1).

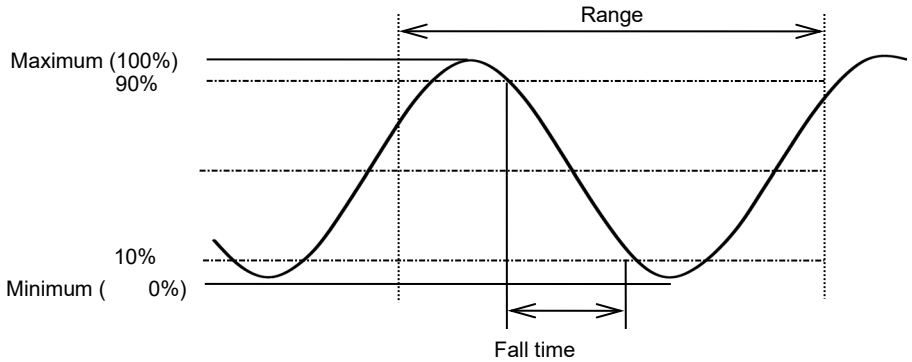
D: Sample data within the range

Equation: $\mathrm{SD} = \sqrt{\frac{1}{\mathrm{n\text{-}1}}\left\{\sum \mathrm{D}^2 - \frac{(\sum \mathrm{D})^2}{\mathrm{n}}\right\}}$ n: Data count

Rise time or fall time

With the maximum value of the range as 100% and the minimum value of the range as 0%, calc ulates the time of 10 to 90% of the first rising or falling waveform.





7.8. CSV Output

You can output the data of a Y-T waveform or FFT analysis to a CSV file.

Step 1. Perform the procedure in "7.1. Select Recorded Data".

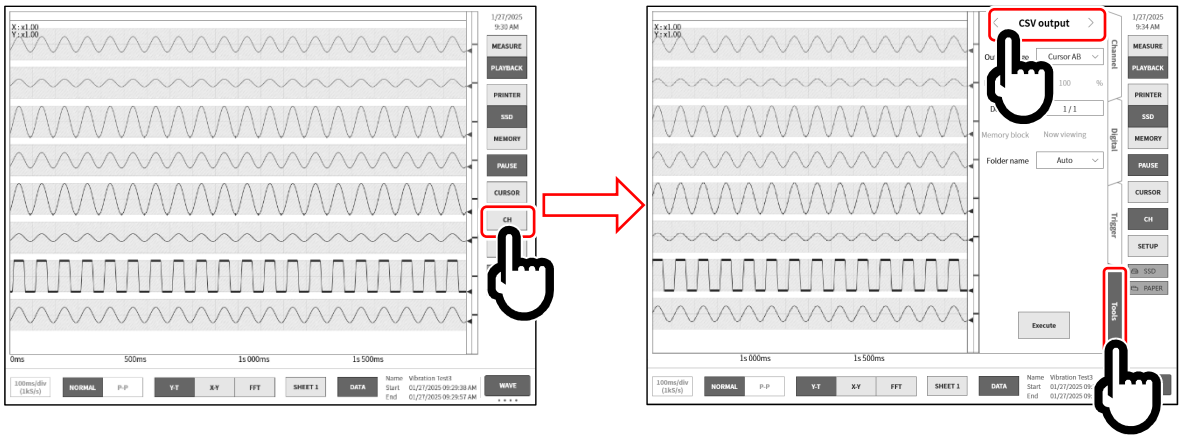
Step 2. Display the waveform of the recording device to save to the CSV file.

Step 3. Tap the【CH】key in the side menu to display the sub menu.

Step 4. Tap the【Tools】tab in the sub menu.

Step 5. Select the【Y-T】key or【FFT】key in the【WAVE】control bar.

Step 6. Tap the top of the tools screen to display [CSV output].



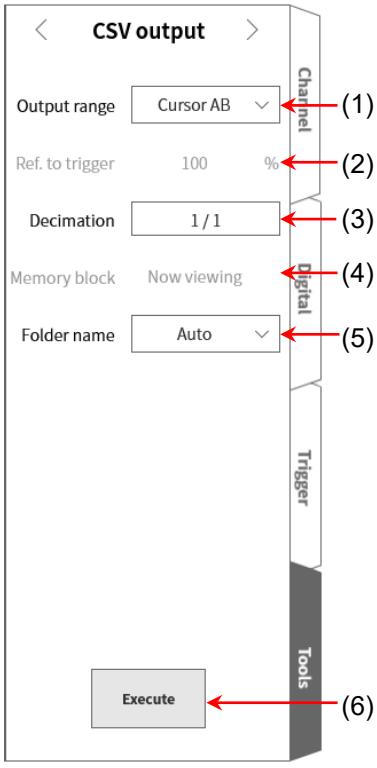
Step 7. Select the conditions for outputting the CSV file in [CSV output].

(1) Output range: Select the range for outputting the data to the CSV file.

Cursor AB	Outputs the data between Cursor A and Cursor B.
All	Outputs all the recorded data.
Ref. to trigger	Outputs the specified range based on the trigger point. This is available when the recording device is set to【MEMORY】.

(2) Ref. to trigger: Only enabled when [Ref. to trigger] is selected for the output range.
Enables you to set the output range based on the trigger point to a value from 1 to 100%.
If you specify 100%, the entire data range of memory recording will be saved to the CSV file.
Example: If the reference to trigger is 50% and the memory point count is 10k points (2,000 points before trigger and 8,000 points after trigger), 5k points (1,000 points before trigger and 4,000 points after trigger) will be output.

(3) Decimation: Specifies the decimation factor of the data.
Select a value from 1/1 (no decimation) to 1/1000.



(4) Memory block: Select the target block to output to a CSV file.
This is available when the recording device is set to 【Execute】.
Now viewing Outputs only the memory block that is currently displayed.
All blocks Outputs all the memory blocks in the recorded data.

For information on changing the displayed block, see "7.2.6. Selecting a Memory Block".

(5) Folder name: Specifies the folder name to save the CSV file to.
Auto Saves the file to the "<date/time of recording (yyyymmdd-HHMMSS)> – <serial number (xxxx)>" folder. For FFT analysis, the string "_FFT" is appended after the serial number.
Manual Saves the file to the folder with the specified name.
Specify the folder name after pressing the 【Execute】 key (6).

Tips

- Up to 40 single-byte alphanumeric characters and some symbols can be entered for the folder name.
  Windows reserved file names or characters cannot be used.

(6) Execute: Starts saving the CSV file.

Step 8. When the settings are complete, tap the 【Execute】 key (6).
The CSV file is saved to the specified folder.



Tips

- If there are already 1,000 CSV files in the main unit, a new CSV file cannot be created.
- For FFT analysis, the string "_FFT" is appended to the CSV file name.

Step 9. Export the file to external media (such as an SD memory card or USB stick).

See "Exporting CSV Files".

7.9. PDF Output

You can output a Y-T waveform to a PDF file.

Step 1. Perform the procedure in "7.1. Select Recorded Data".

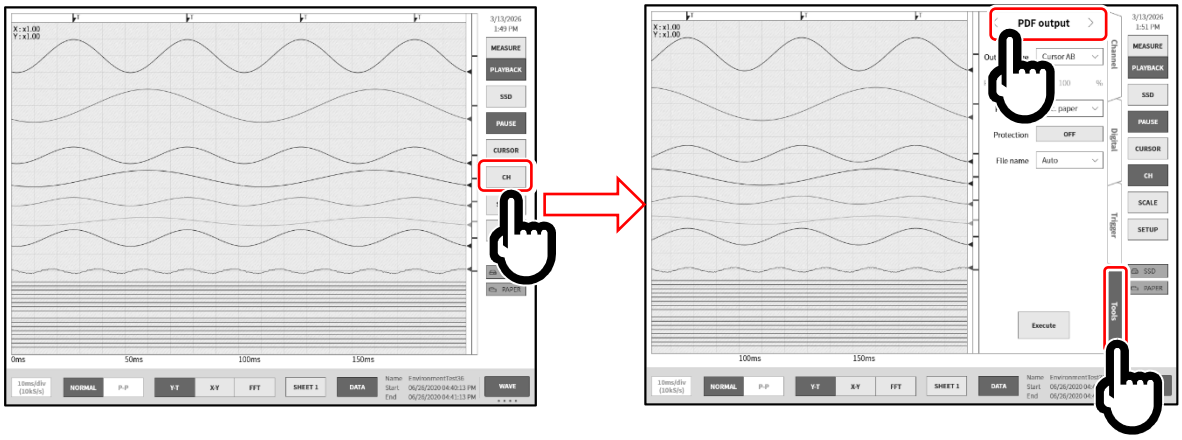
Step 2. Display the recording device waveform to save to the PDF file.

Step 3. Tap the【CH】key in the side menu to display the sub menu.

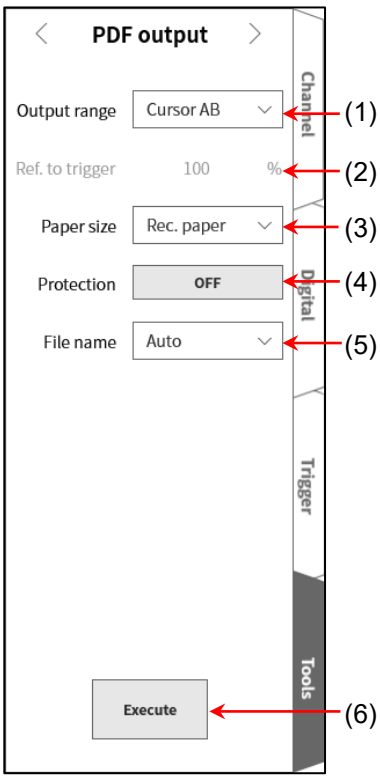
Step 4. Tap the【Tools】tab in the sub menu.

Step 5. Select the【Y-T】key in the【WAVE】control bar.

Step 6. Tap the top of the tools screen to display [PDF output].



Step 7. Select the output conditions for the PDF file in [PDF output].



(1) Output range: Select the range for PDF output.

Cursor AB	Outputs the range from cursors A to B.
Whole	Outputs all the recorded data.
Ref. to trigger	Outputs the range based on the trigger. Available when【MEMORY】is selected as the recording device.

(2) Reference to trigger: Only available when [Ref. to trigger] is selected for [Output range].
Specifies a percentage from 1 to 100% as the output range, based on the trigger.
If 100% is specified, all the data for memory recording is output.

Example: If the reference to trigger is 50% and the memory point count is 10k points (2,000 points before trigger and 8,000 points after trigger), 5k points (1,000 points before trigger and 4,000 points after trigger) will be output.

(3) Paper size: Select recording paper, A3, A4, or Letter.

(4) Protection: Select ON or OFF.

OFF	No restriction
ON	Not editable

(5) File name: Specifies the method for generating the PDF file name.

Auto	<Recording date/time (yyyymmdd-HHMMSS)> – <serial number (xxxx)>
Manual	The specified name The file name is specified after pressing the【Execute】key (6).

Tips

- Up to 40 single-byte alphanumeric characters and some symbols can be entered for the file name. Windows reserved file names or characters cannot be used.

(6) Execute: Starts the process for saving the PDF file.

Step 8. When the settings are complete, tap the【Execute】key (6).
The PDF file is saved to the specified folder.



Tips

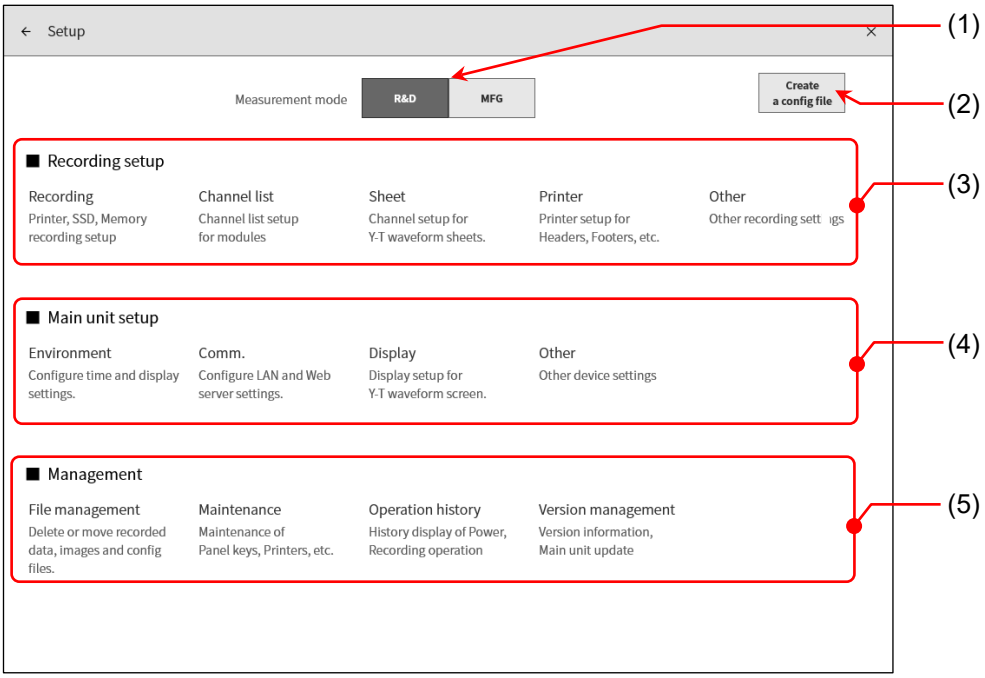
- A maximum of 1,000 PDF files can be stored in the internal storage.
  When this number has been reached, new PDF files cannot be created.

Step 9. Export the file to external media (such as an SD memory card or USB stick).

☞ See "Exporting PDF Files".

8. Setup Details

This chapter describes the function for configuring the various settings from Settings in the side menu.



(1) Measurement mode: Selects the measurement mode. “4.1. Selecting the Measurement Mode”

(2) Create a config file: Creates configuration data containing the measurement mode, recording setup, and main unit setup. “8.1. Create a config file”

(3) Recording Setup: Configures settings related to recording, such as the recording conditions and channel. “8.2. Recording Setup”

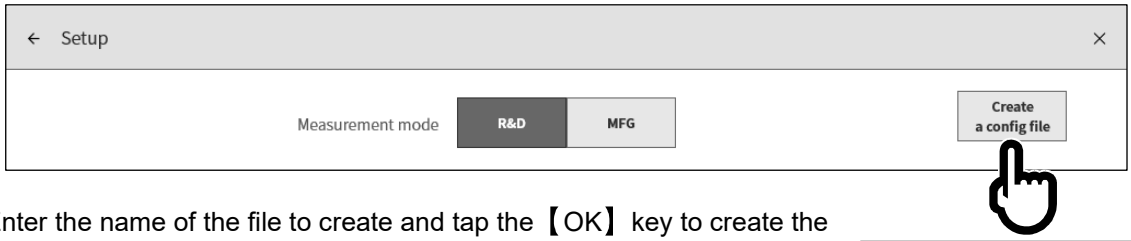
(4) Main Unit Setup: Configures settings related to the main unit, such as the time and communication. “8.3. Main Unit Setup”

(5) Management: Performs management of the main unit, such as file operations and maintenance. “8.4. Management”

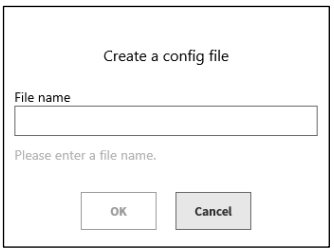
8.1. Create a config file

Create configuration data containing the current measurement mode, recording setup, and main unit setup. The created configuration data is recorded to the SSD in the main unit and displayed in the list for setup management. Settings can be restored from the configuration data.

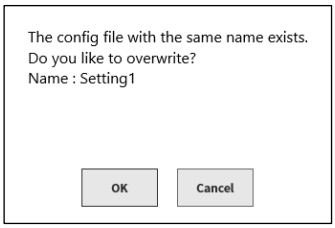
Tap the【Create a config file】key on the setup screen to display the [Create a config file] dialog.



Enter the name of the file to create and tap the【OK】key to create the configuration file.

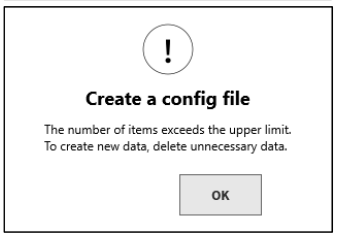


If a configuration file with the same name already exists, a dialog confirming whether you want to overwrite the file is displayed. To overwrite the file, tap the【OK】key. Tap the【Cancel】key to return to the [Create a config file] dialog.



Tips

- Up to 40 single-byte alphanumeric characters can be entered for the file name.
  Windows reserved file names or characters cannot be used.
- If there are already 100 configuration files in the main unit, a new configuration file cannot be created.



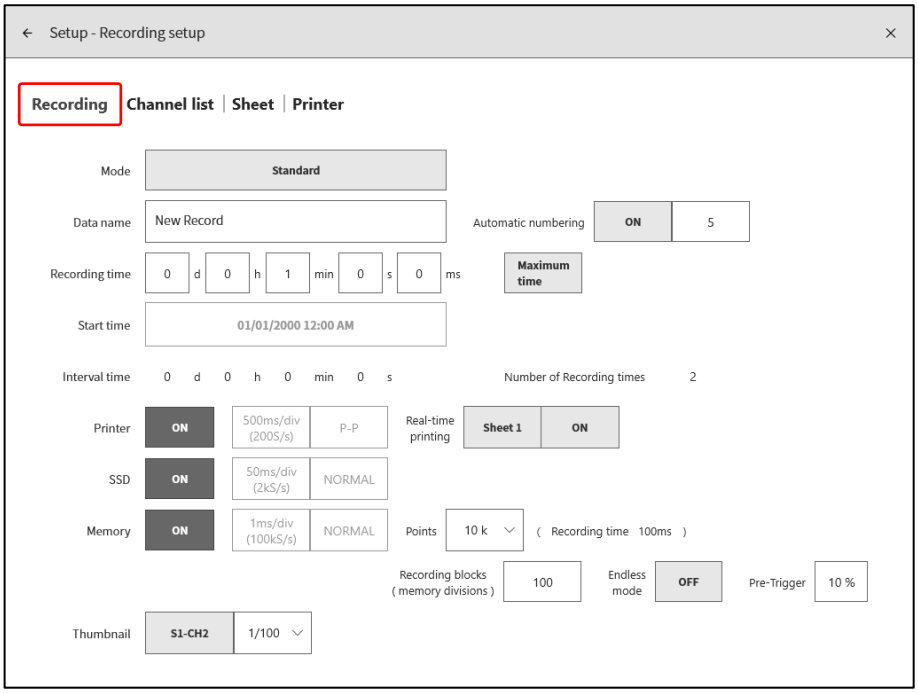
8.2. Recording Setup

Configure【Recording】,【Channel list】,【Sheet】,【Printer】, and【Other】. Tap a settings category to display the detailed settings screen for that category.

8.2.1. Recording

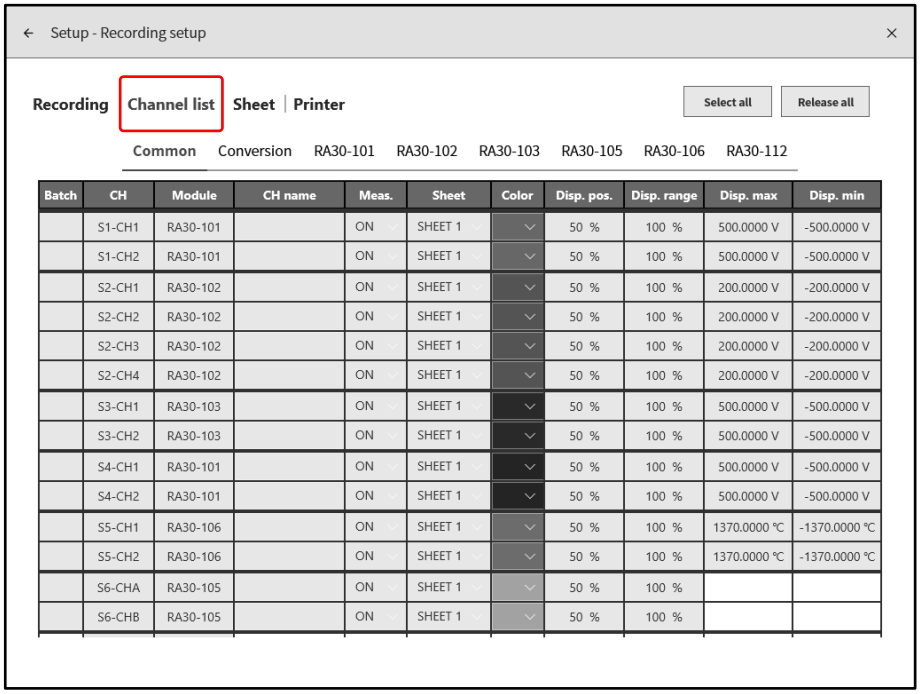
Tap【Recording】in the Recording setup to display a list of the settings related to recording.

☞ For details, see “6.4.1. Recording Setup”.



8.2.2. Channel List

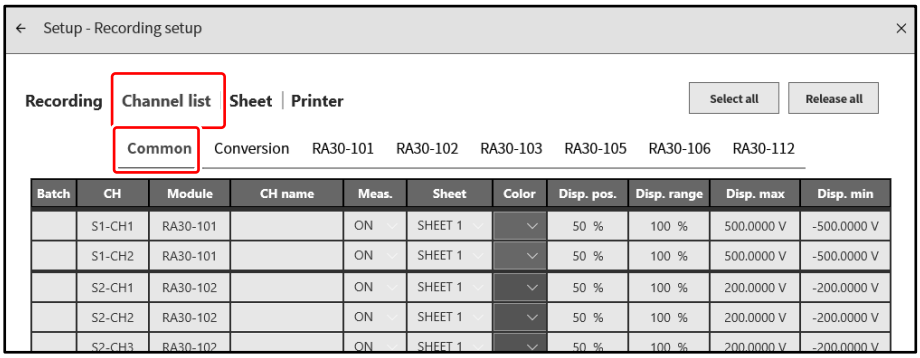
Tap【Channel list】to display a list of the input modules, then tap【Common】,【Conversion】,【Sheet】, or【a module type】above the list to display the corresponding list.



Batch	CH	Module	CH name	Meas.	Sheet	Color	Disp. pos.	Disp. range	Disp. max	Disp. min
	S1-CH1	RA30-101		ON	SHEET 1		50 %	100 %	500.0000 V	-500.0000 V
	S1-CH2	RA30-101		ON	SHEET 1		50 %	100 %	500.0000 V	-500.0000 V
	S2-CH1	RA30-102		ON	SHEET 1		50 %	100 %	200.0000 V	-200.0000 V
	S2-CH2	RA30-102		ON	SHEET 1		50 %	100 %	200.0000 V	-200.0000 V
	S2-CH3	RA30-102		ON	SHEET 1		50 %	100 %	200.0000 V	-200.0000 V
	S2-CH4	RA30-102		ON	SHEET 1		50 %	100 %	200.0000 V	-200.0000 V
	S3-CH1	RA30-103		ON	SHEET 1		50 %	100 %	500.0000 V	-500.0000 V
	S3-CH2	RA30-103		ON	SHEET 1		50 %	100 %	500.0000 V	-500.0000 V
	S4-CH1	RA30-101		ON	SHEET 1		50 %	100 %	500.0000 V	-500.0000 V
	S4-CH2	RA30-101		ON	SHEET 1		50 %	100 %	500.0000 V	-500.0000 V
	S5-CH1	RA30-106		ON	SHEET 1		50 %	100 %	1370.0000 ℃	-1370.0000 ℃
	S5-CH2	RA30-106		ON	SHEET 1		50 %	100 %	1370.0000 ℃	-1370.0000 ℃
	S6-CHA	RA30-105		ON	SHEET 1		50 %	100 %		
	S6-CHB	RA30-105		ON	SHEET 1		50 %	100 %		

8.2.2.1. Common Setup

When【Common】is tapped, the settings common to all input modules are displayed, and you can tap a cell to change the setting value of that cell.



The items in the list are indicated below.

Batch: Enables the batch configuration of the selected channels.
You can tap【Select all】on the top right to select all the channels.

CH: Displays the slot number and channel number, connected with a hyphen.

Module: Displays the model of the input module.

CH name: Displays the user-defined name of the input signal. Tap this field to set the channel name. Press and hold it to display the software keyboard for input.

Meas.: Displays whether input is enabled or disabled. Tap to switch between enabled and disabled.

Color: Displays the waveform color displayed on the waveform monitor. Tap to change the waveform color.

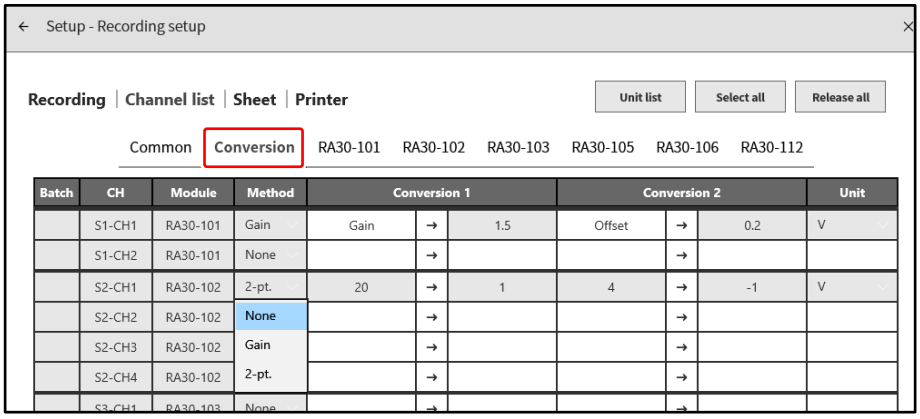
Disp. pos.: Displays the display position set in the channel settings. Tap to change the display position.

Disp. range: Displays the display range set in the channel settings. Tap to change the display range.

Disp. max: Displays the display maximum set in the channel settings. Tap to change the display maximum.

Disp. min: Displays the display minimum set in the channel settings. Tap to change the display minimum.

8.2.2.2. Conversion (Physical Quantity Conversion)



The items in the list are indicated below.

Batch: Enables the batch configuration of the selected channels.
You can tap【Select all】on the top right to select all the channels.

Method: Select [Gain], [2-pt.], or [None] as the conversion method.

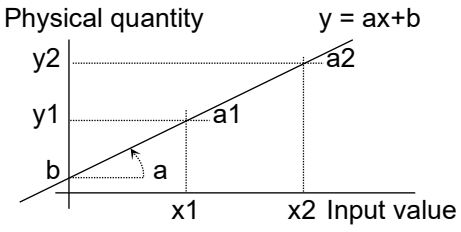
Gain: Applies gain and offset to the input voltage and performs conversion with the primary function y = ax + b.
Conversion1 is gain, Conversion2 is offset

2-pt.: Converts two input voltages to two target physical quantities.
Conversion1 is the first physical conversion value, and Conversion2 is the second physical conversion value

For example, when converting the voltage of a signal input at 4-20 mA with 1 kΩ shunt resistance, the setting for resisting the input voltage value at ±1 V is Conversion1 = 20 → +1, Conversion2 = 4 → 1.

None: Do not perform physical quantity conversion.

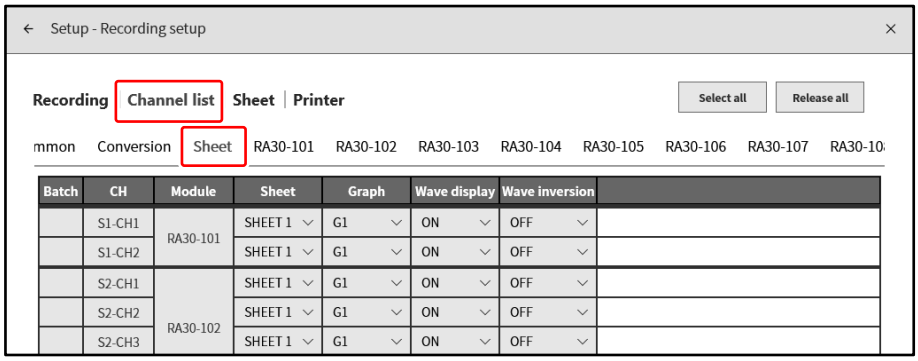
Relationship between 2-pt gain and gain compensation
The relationship between the gain specified by the 2 points a1 (x1, y1) and a2 (x2, y2) and gain a and offset b of y = ax + b is
gain a = (y2 - y1)/(x2 - x1)
offset b = y1 - ax1 = y1 - x1(y2 - y1)/(x2 - x1)



Unit: Sets the unit for the output of the physical quantity conversion. Tap to display the unit table and select the target unit. If the target unit is not in the table, tap the【Unit list】key and change the unit table.

8.2.2.3. Sheet

Tap【Sheet】to display the settings related to the sheet.
You can tap a cell to change the setting value of that cell.



The items in the list are indicated below.

Batch: Enables the batch configuration of the selected channels.
You can tap【Select all】on the top right to select all the channels.

CH: Displays the slot number and channel number, connected with a hyphen.

Module: Displays the model of the input module.

Sheet: Displays the registered sheet number. Tap to switch between【SHEET1】to【SHEET3】.

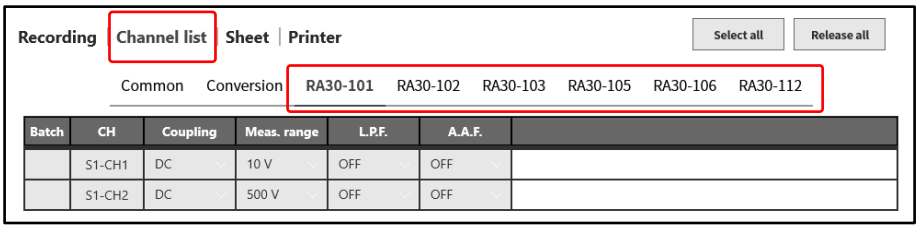
Graph: Enables channels to be assigned to one of up to 18 graphs. Set the graph number for displaying the waveform of the measurement data for each channel. Select from G1 to G18 (Graph 18).

Wave display: When enabled, the waveform is displayed in the waveform monitor. When disabled, the waveform is not displayed.

Wave inversion: When enabled, the waveform is inverted. For information on inverting the waveform, see "10.5. Wave Inversion".

8.2.2.4. Setup Unique to Module Types

Tap the【module type】(RA30-xxx) to display a list of the settings unique to the same type of installed module. For information on the settings for each module, see "9. Using Optional Modules". An example of the RA30-101 is indicated below.



Tap【RA30-101】to display a list of the settings unique to the RA30-101 (2ch Voltage Module).
The items in the list are indicated below.

CH: Displays the slot number and channel number, connected with a hyphen.

Coupling: Displays the state of coupling (DC, AC, or GND) that is set. Tap to set coupling.

Meas. range: Displays the measurement range of the input module. Tap to change the range.

L.P.F.: Displays the low-pass filter setting. Tap to change the filter.

A.A.F.: Displays the antialiasing filter setting. Tap to change the filter.

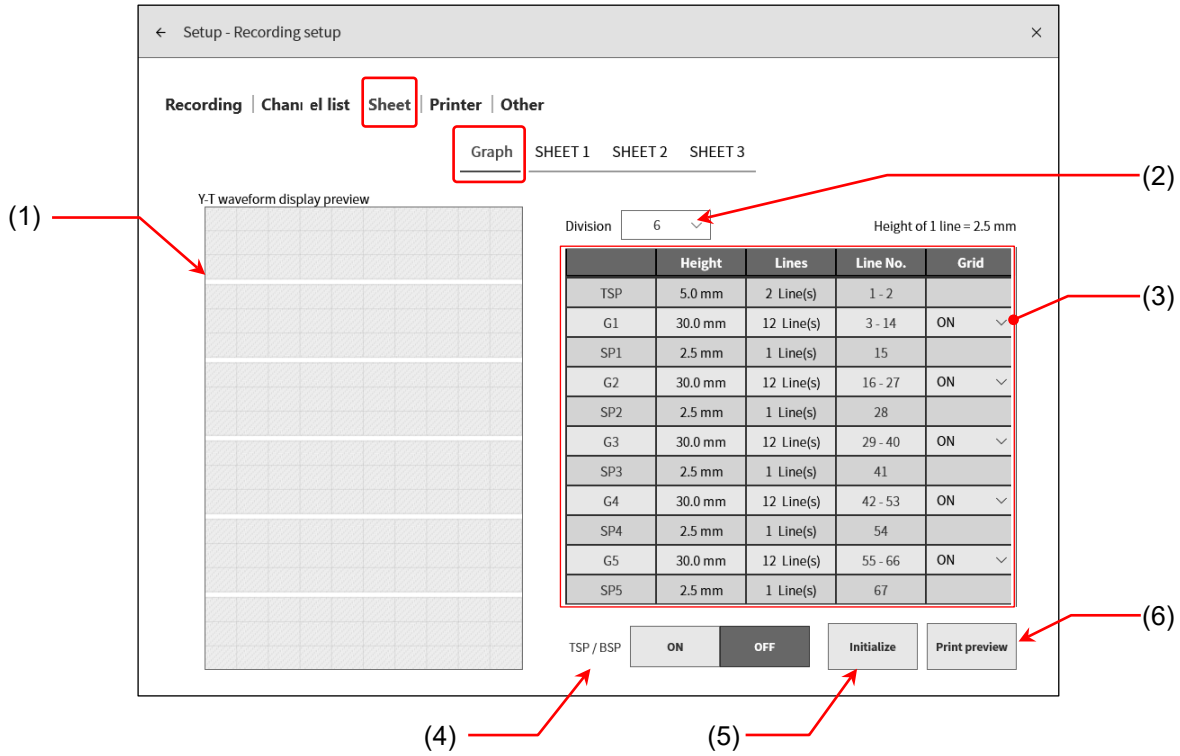
8.2.3. Sheet Setup

Tap【Sheet】in the recording settings to display the graph settings and a list of the monitor display and printer waveform sheet settings.

8.2.3.1. Graph

Tap【Graph】to display the settings related to the number of divisions (number of graphs) of the Y-T waveform.

You can tap a cell to change the setting value of that cell.



(1) Y-T waveform dislplay preview:

Displays a preview of the grid on the Y-T waveform screen when you change settings such as the number of divisions or the height.

(2) Number of divisions:

Selects the number of divisions (number of graphs) of the Y-T waveform. (maximum 18)

(3) Division settings:

Sets the graph height and space height, and enables/disables the grid.

The settings are displayed for the selected number of graphs.

TSP (Top SPace)	Indicates a space on the top.
BSP (Bottom SPace)	Indicates a space on the bottom.
G# (Graph)	Indicates each graph. (# is the graph number)
SP# (SPace)	Indicates the space between each graph. (# is the space number)

Height/number of lines:

Sets the graph (G#) or space (SP#) to print on the recording paper by the height or number of lines.

When setting by height, it is set in increments of 2.5 mm (the height of one line).

Line number: Displays the line number of the print position.

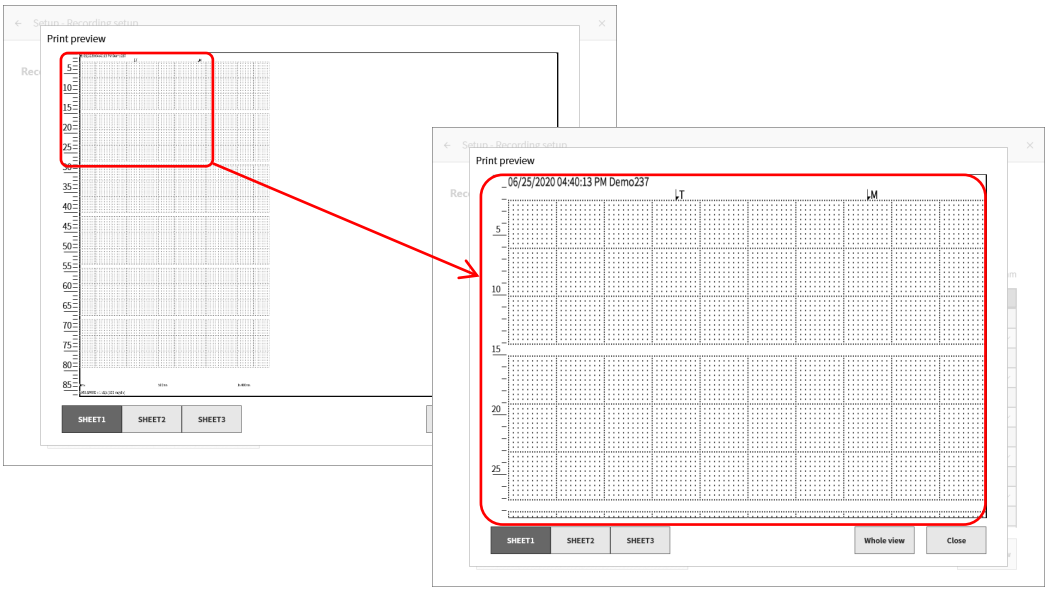
Grid: Enables/disables the displaying/printing of the grid.
To display a grid, enable the grid setting in "8.2.4.1. Printing Setup" or "8.3.3. Display Setup".

(4) TSP/BSP: When it is enabled, the TSP (Top SPace) and BSP (Bottom SPace) settings are also reflected in the waveform monitor.

(5) Initialize: Initializes the division setting of the currently selected division count.

(6) Print preview: Opens a screen displaying a print preview of the Y-T waveform.
This enables you to check the print position of the grid and "Printing Setup" and "Header, Annotations, and Footer (Text to Print)" in "8.2.4. Printer".

Pinch out to enlarge the display. Swipe to move.



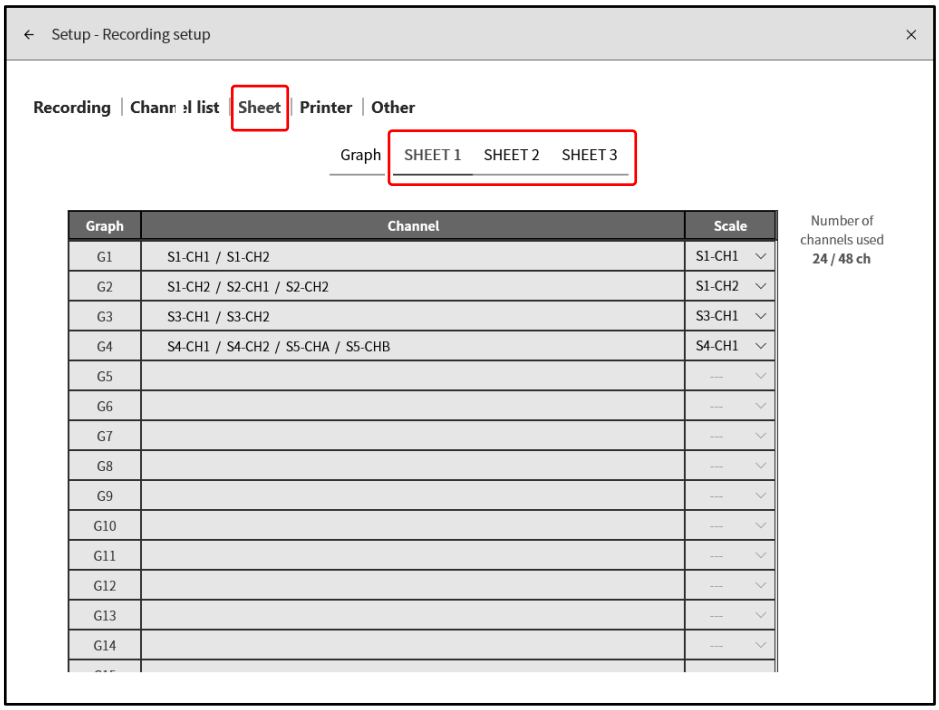
Sheet switching keys:
The【SHEET1】,【SHEET2】,【SHEET3】keys on the bottom left enable you to check the display of each sheet. You can check the signal names and scale values.

Whole view: When the display is enlarged, tap the Whole view key to resize the display to match the height.

Close: Closes the screen.

8.2.3.2. SHEET1/ SHEET2/ SHEET3

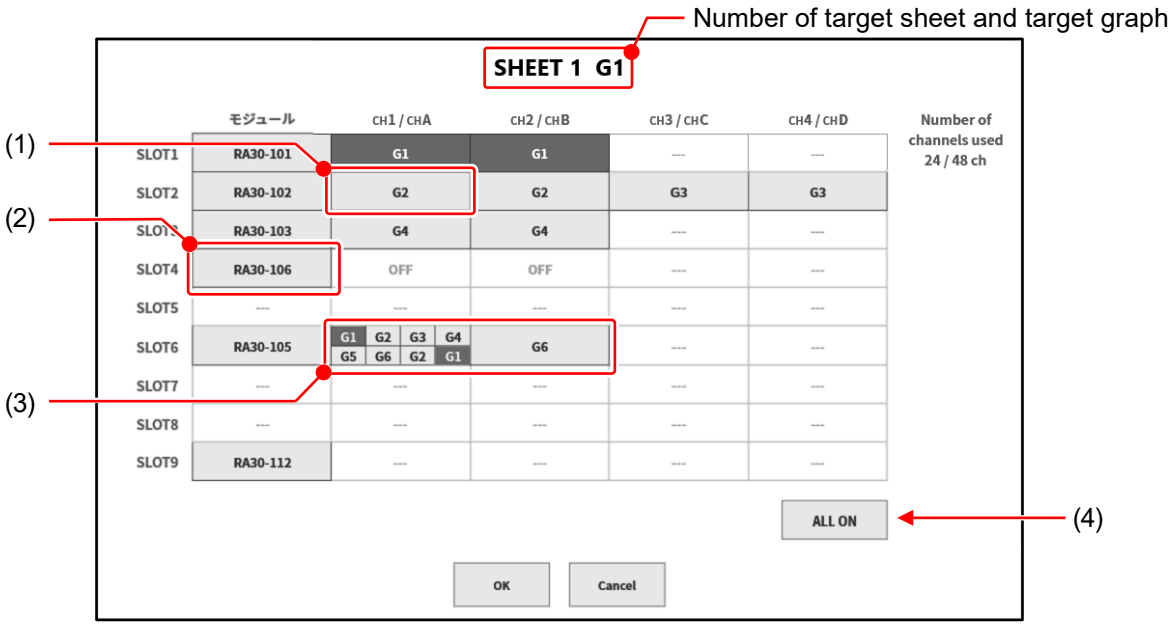
You can assign the input channels and scale to display for the graphs on each sheet.



Assigning the Input Channel

Tap the target sheet to configure and the graph channel field to display the screen for assigning a channel.

You can set a maximum of 48 channels to a single sheet. If the number of channels used exceeds 48, assign the remaining channels to another sheet.



(1)【Analog channel】key: Tap to assign the selected channel to the graph of the sheet.

(2)【Module】key: Tap to assign all channels of the module to the graph of the sheet.

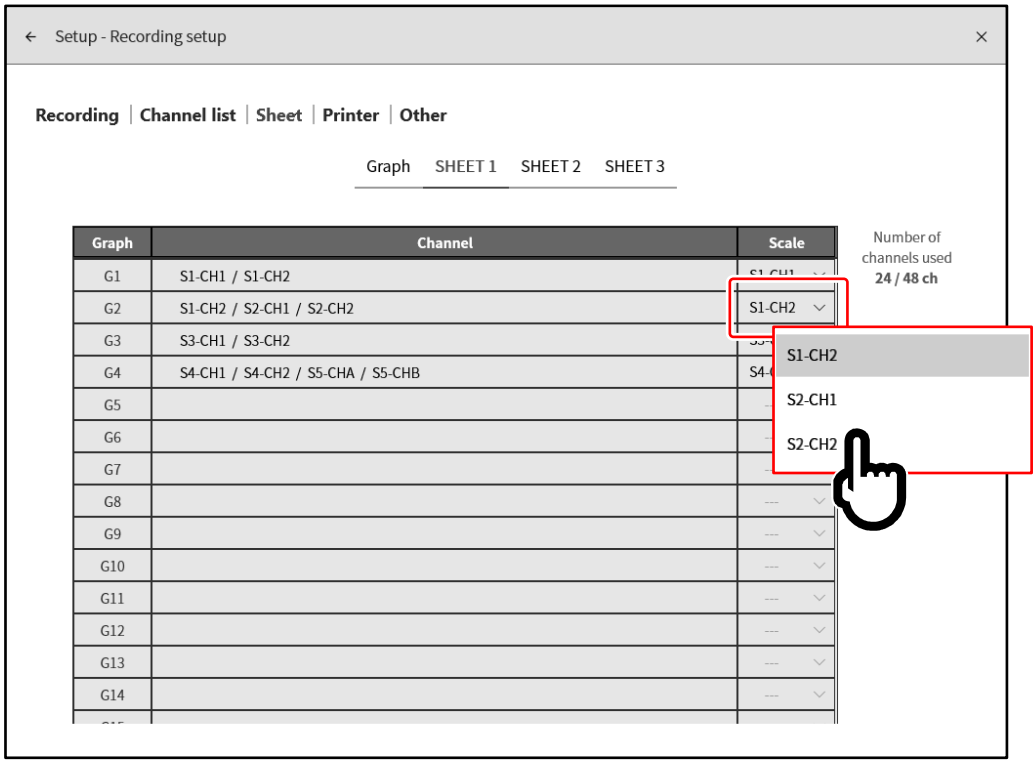
(3)【Logic channel】key: This is displayed for the 16ch Logic Module (RA30-105).
If the signal unit of the logic module is set to "8 CH", tap this to assign the channels to the graphs of the sheet 8 channels at a time (CHA/CHB).
If the signal unit is set to "1 CH", tap the channel key to display the single channel selection dialog box to assign the channels to the graphs of the sheet one channel at a time.



(4)【ALL ON】key: Tap to assign all channels of all modules to the graph of the sheet.

Assigning the Scale

Tap the target sheet to configure and the graph scale field to select the channel to display in the scale from among the analog modules assigned to the graph.

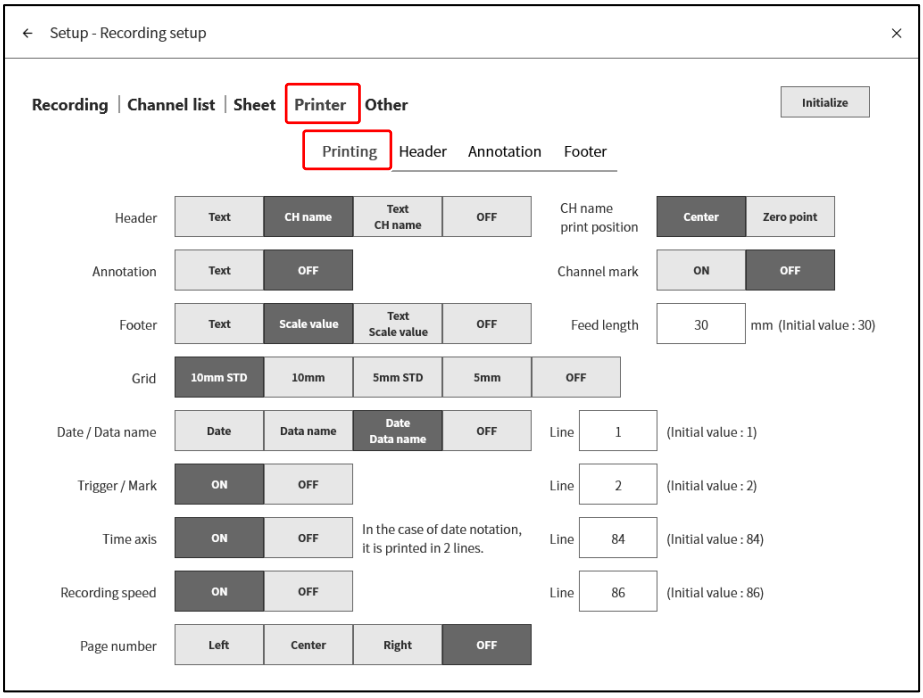


8.2.4. Printer

Tap【Printer】in the recording settings to configure the various print functions for printer output.

8.2.4.1. Printing Setup

Tap【Printing】to configure the various information printed at the same time as the waveform.

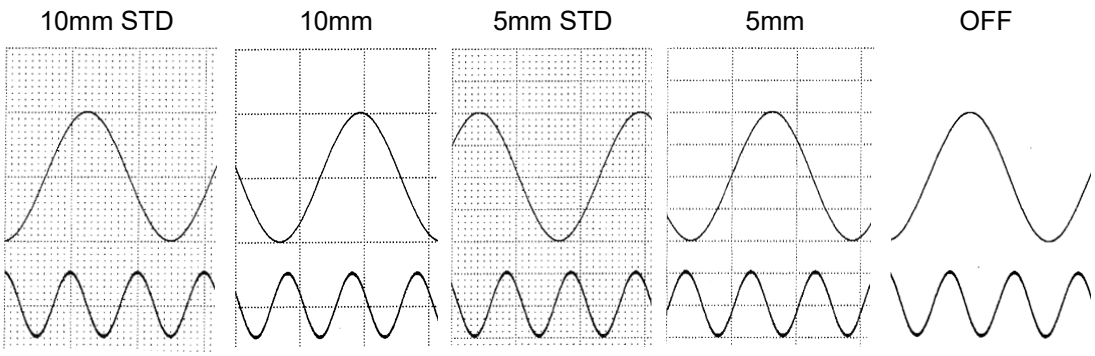


Header: For【Text】,【CH name】, and【Text/CH name】, the signal name and header text are printed before starting to print the waveform.

Annotation: For【Text】, the annotation text is automatically printed over the waveform every 300 mm while printing the waveform. You can also print annotations at arbitrary times by tapping the【Print annotation】key of the【PEN REC】control bar.

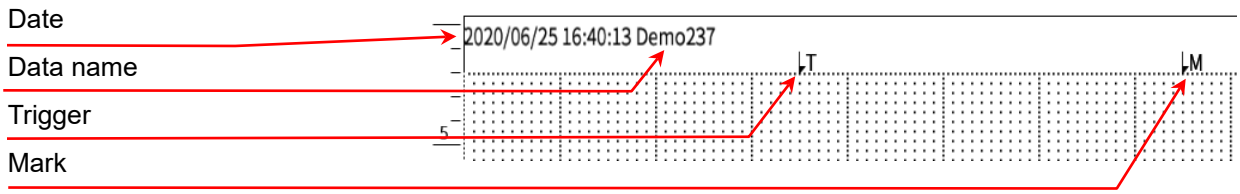
Footer: For【Text】,【Scale value】, and【Text/Scale value】, the scale value and footer text are printed after the printing of the waveform is finished.

Grid: For【10mm STD】,【10mm】,【5mm STD】, and【5mm】, a grid is printed.



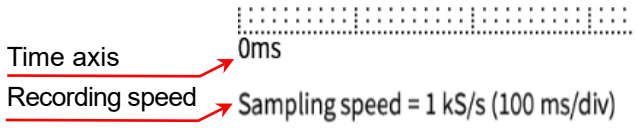
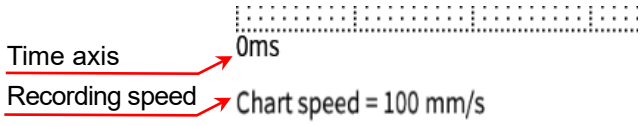
Date / Data name: For【Date】,【Date name】, and【Date / Date name 】, the date and data name are printed.

Trigger / Mark: For【ON】, the T or M mark is printed when a trigger or mark is detected.



Time axis: For【ON】, the time axis scale value is printed. The X axis notation set in "8.2.5. Other" is used as the notation. When the X axis notation is set to "date", two lines are printed. If set for the last line (line 86), only one line is printed.

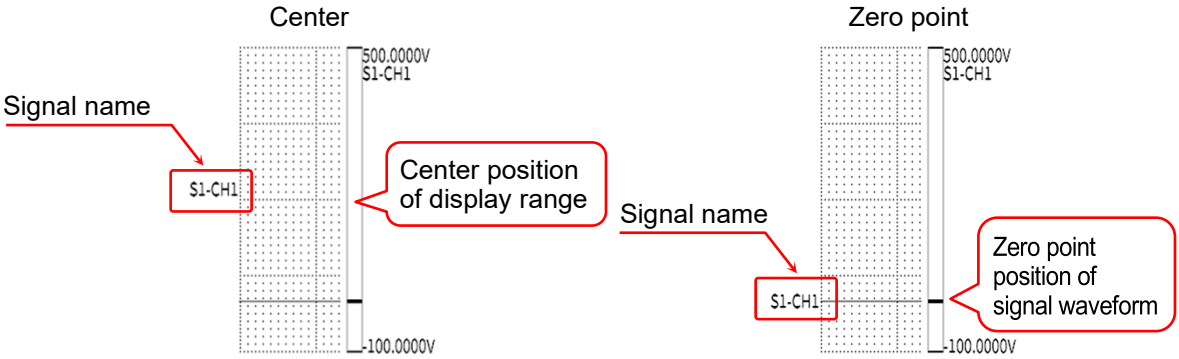
Recording speed: For【ON】,【Sampling speed】 or【Chart speed】 is printed for the printer speed.

Printer speed	Example of printing
Sampling speed (for frequency)	
Chart speed	

Page number: If【Left】,【Center】, or【Right】 is selected, the page number is printed on line 86. It is printed on each page. The page number is automatically printed every 300 mm while printing the waveform.

CH name print position:

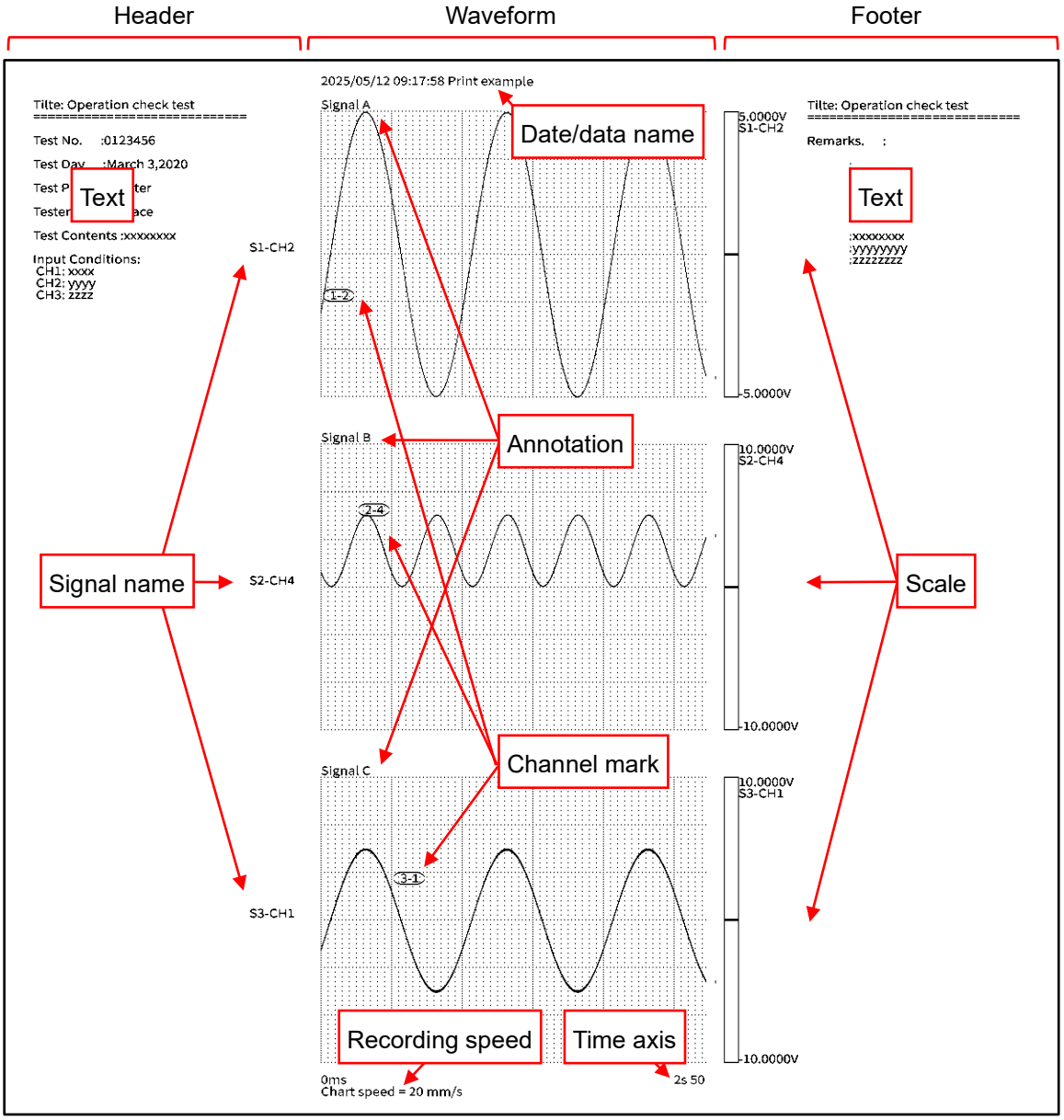
Sets the print position for the signal name. Displayed when the header is set to【CH name】, and【Text/CH name】.



Channel mark: For【ON】, the channel mark is automatically printed near the waveform every 300 mm while printing the waveform.

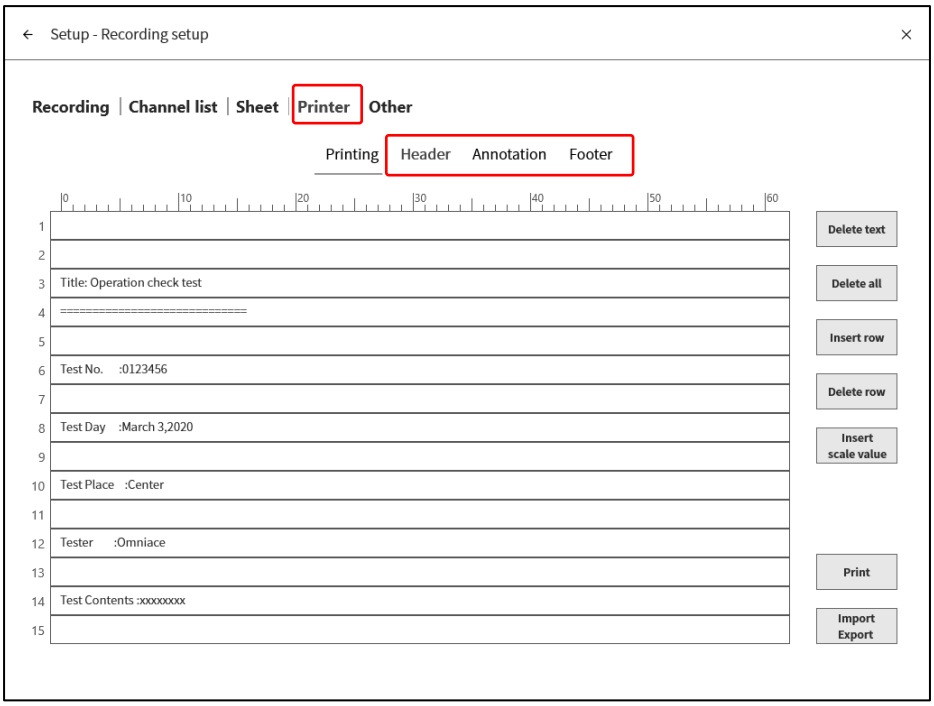
Feed length: Sets the length to feed after all printing is complete, including waveform printing and screen copy (screenshot) printing.

Printing example



8.2.4.2. Header, Annotations, and Footer (Text to Print)

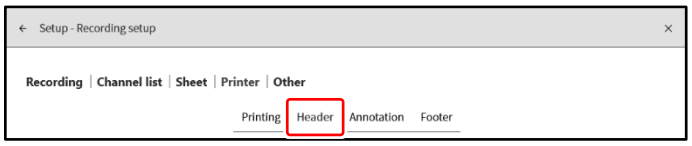
Tap 【Header】, 【Annotation】, or 【Footer】 to display the screen for configuring the text to print. The operation method is the same for the annotations, header, and footer.



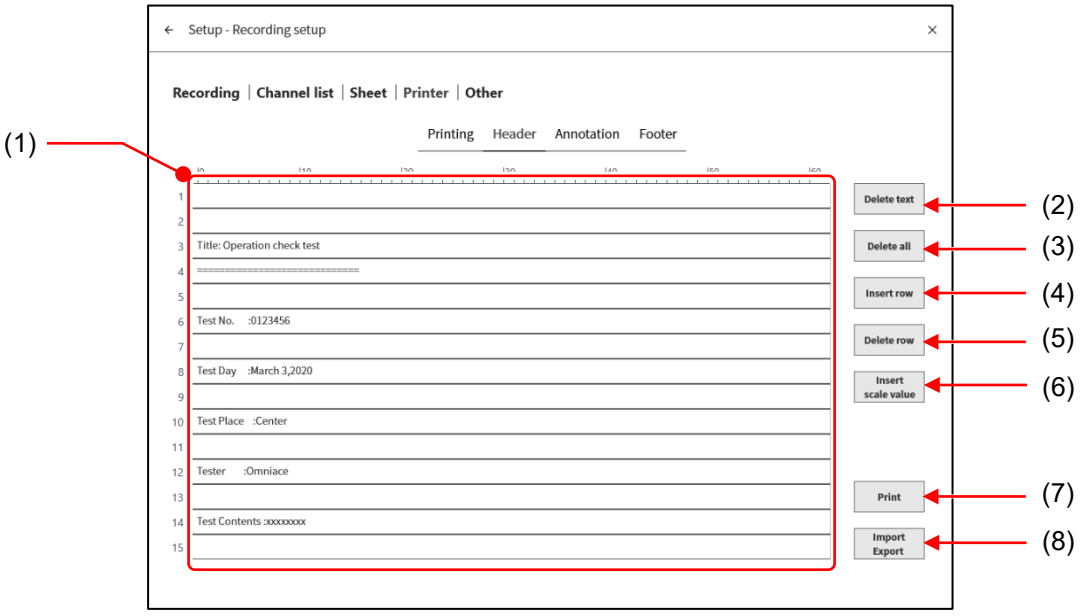
Configuring the Text to Print

The configuration method is the same for the annotations, header, and footer.
In this example, the header text is configured.

Step 1. Select the [Header] tab.



Step 2. Enter the text to print.



(1) Text: Double-tap this to display the software keyboard and enter up to 60 single-byte or double-byte characters for the text to print. The first row is the top edge of the recording paper, and the 86th row is the bottom edge. The Source Han Sans Normal font is used for printing.

(2) Delete text: Deletes the text of the specified row.

(3) Delete all: Deletes all the text.

(4) Insert row: Inserts a row above the specified row.

(5) Delete row: Deletes the specified row and moves the rows below it up one row.

(6) Insert scale value:
Inserts the scale values of the channel.

(7) Print: Prints the text to recording paper.

(8) Import/Export: Exports (backs up) the printed text to external media (such as an SD memory card or USB stick) for storage or imports (reads) the printed text backed up to external media.

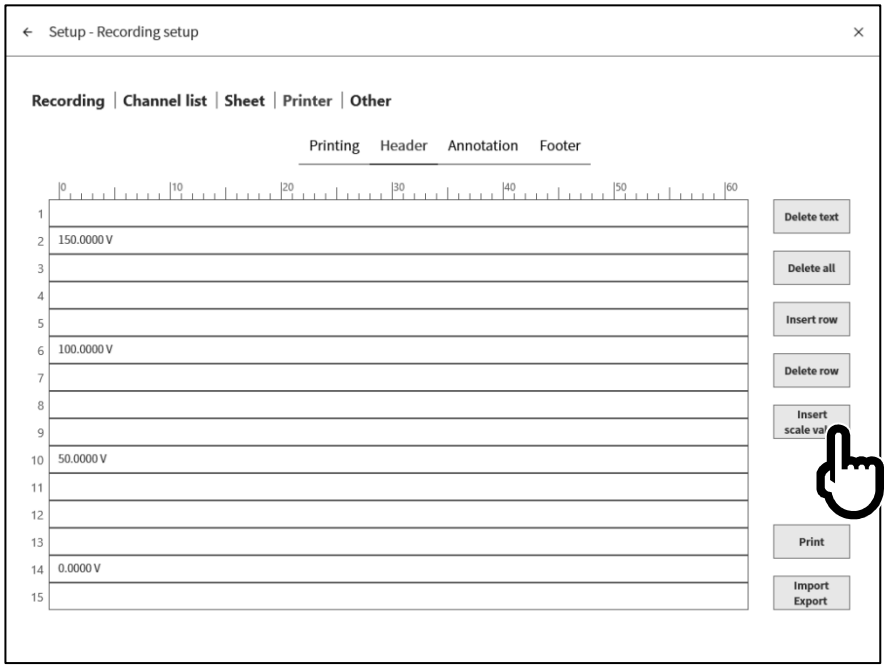
Inserting Scale Values

You can insert scale values to the header, annotations, or footer text based on the current channel settings and sheet settings. The grid is every 1 div for 10 mm STD, 10 mm or every 2 div for 5 mm STD, 5 mm.

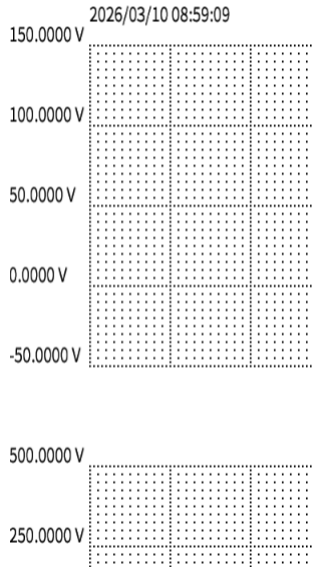
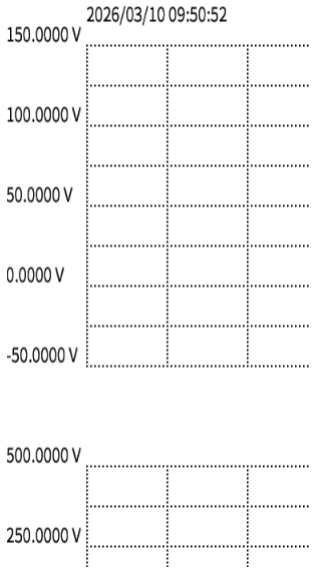
Step 1. Select the【Header】, 【Annotation】, and 【Footer】 tabs.

Step 2. Tap【Delete all】 to clear all the text.

Step 3. Tap【Insert scale value】.



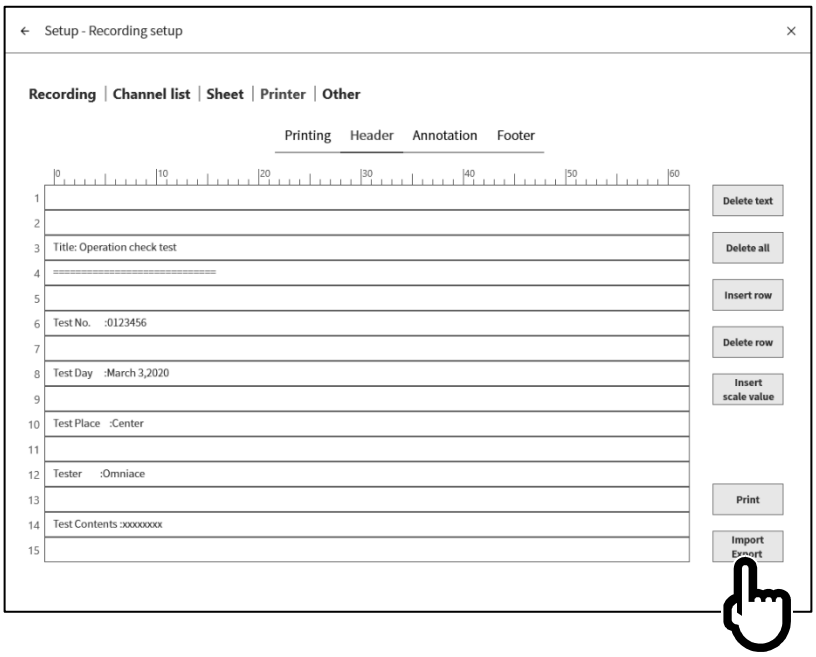
Example of Printing Header Text

10 mm STD grid	5 mm grid
	

Exporting the Text to Print

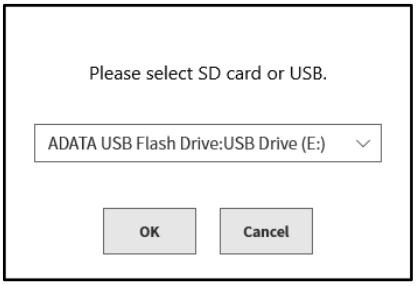
You can save the header, annotation, and footer text configured in the main unit to external media (such as an SD memory card or USB stick).

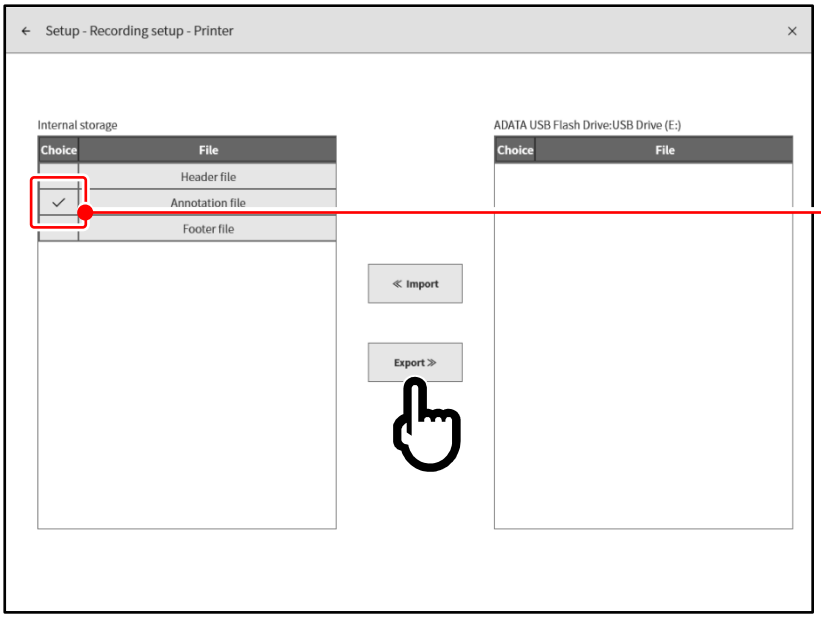
Connect the external storage media to the main unit and confirm that the SD/USB indicator on the side menu activates.



Tap the【Import Export】key to display the external media selection dialog and select the target external media.

Tap the【OK】key to switch to the [Import/Export] screen.





Select the check box for the data to save

Select the check box of the text to save in the list on the left, then tap the【Export】key in the center.

Enter the name of the file to save to, then tap the【OK】key to save the text to the external media with the file name '<specified file name>.txt'.



Tips

- The destination folder of the external media is fixed to '<drive name of external media>¥RA3100¥Text¥'.
  When you execute the export process, the above folder is automatically created.
- Up to 40 single-byte alphanumeric characters can be entered for the file name.
  Windows reserved file names or characters cannot be used in the file name.

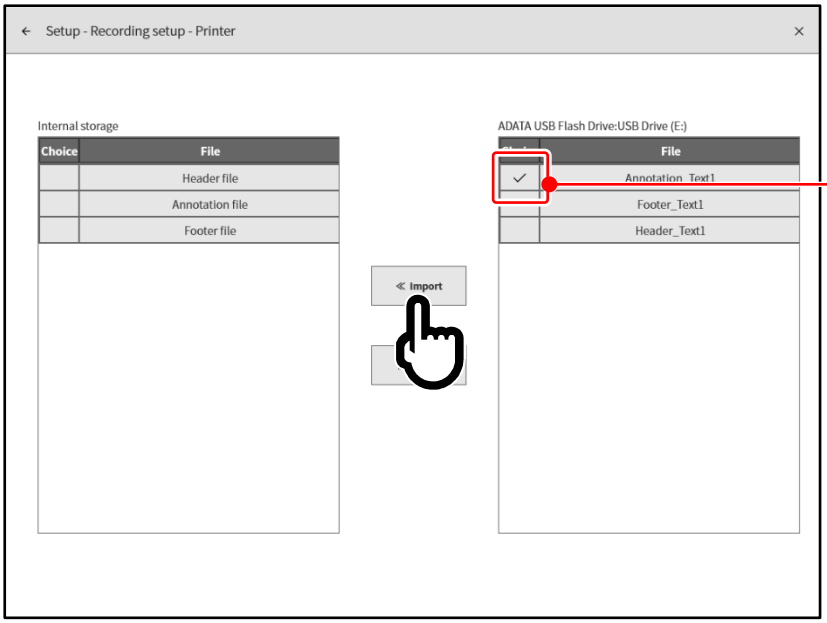
Importing the Text to Print

You can import the header, annotation, or footer text file saved to external media (such as an SD memory card or USB stick) to the main unit.

Tips

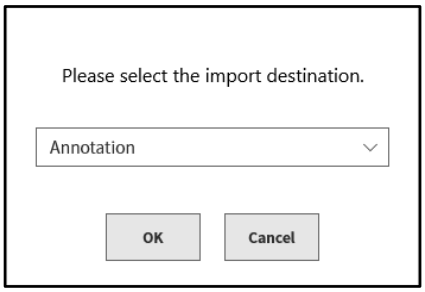
- The source folder of the external media is fixed to '<drive name of external media>¥RA3100¥Text¥'. To import a text file created on a computer to the RA3100, create the above folder and place the file there.

As indicated in "Exporting the Text to Print", connect the external media where the text file is saved to the main unit, then open the [Import/Export] screen.



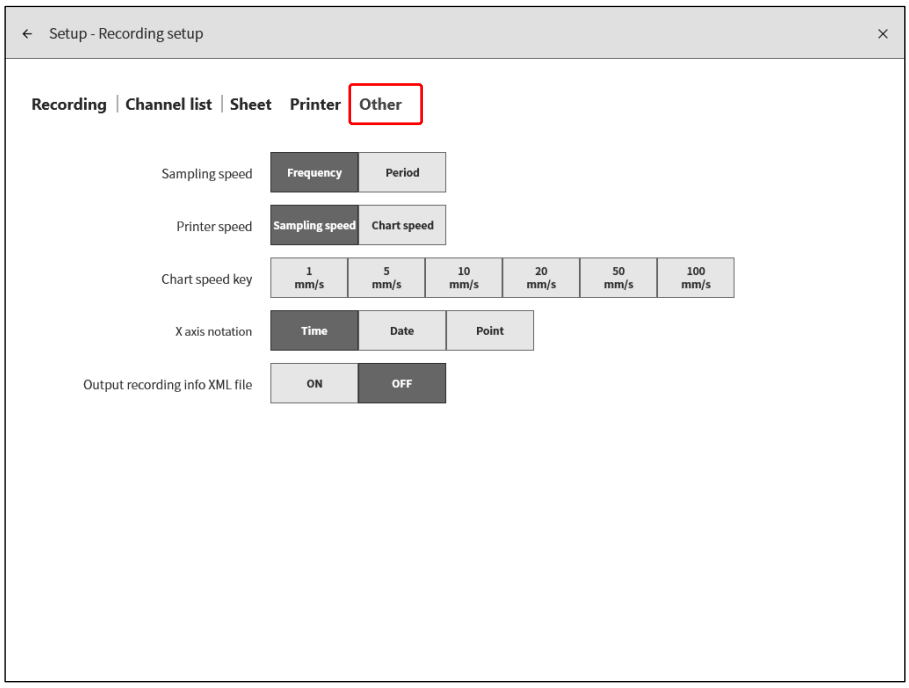
Select the check box of the text file to import in the list on the right, then tap the【Import】key in the center.

A dialog box for selecting the import destination is displayed.
Select the import destination, then tap the【OK】key to import the text file to the main unit.



8.2.5. Other

Tap【Other】in the recording setup to display a list of the settings related to recording.



Sampling speed:

The unit notation of the key indicated inside parentheses changes according to the frequency/period.

Example: Sampling speed of the【WAVE】control bar

For【Frequency】



For【Period】



Printer speed:

The speed unit notation of printer recording changes according to the sampling speed/chart speed.

Example: Sampling speed of the【WAVE】control bar

For【Sampling speed】(in the figure below, sampling speed is set to frequency)



For【Chart speed】



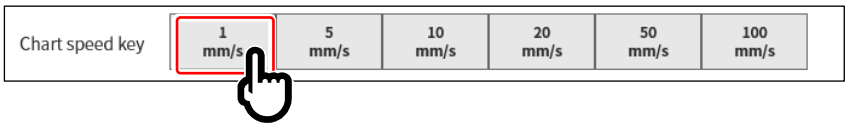
Tips

❑ For【Sampling speed】,【EXT.】(external sampling) can be used.
For【Chart speed】,【Any Speed】(arbitrary chart speed) can be used.

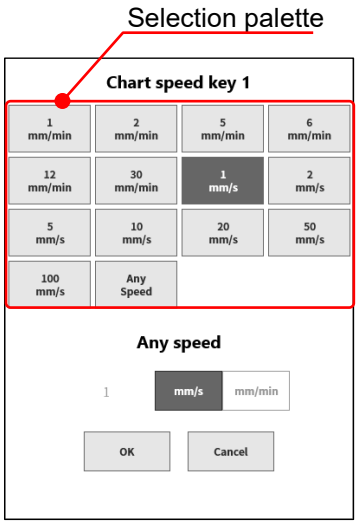
Chart speed key:

Set the chart speeds displayed in the control bar when 【PEN REC】 is selected in the menu on the right edge of the control bar.

Six chart speeds can be configured. The chart speed on the left end is set with 【Chart speed key 1】.



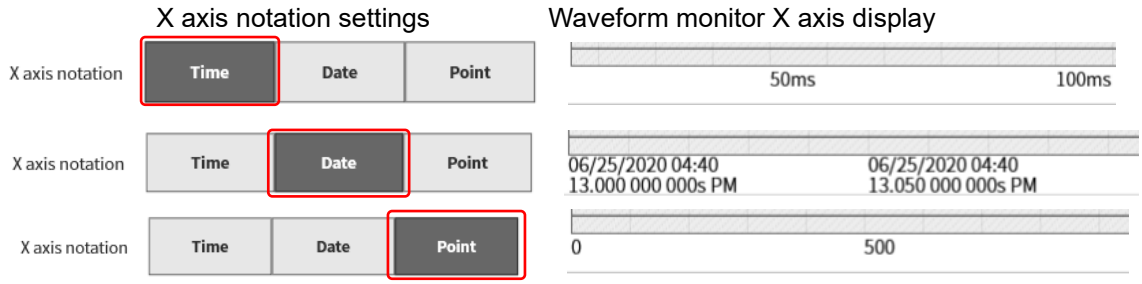
Tap a 【Chart speed key】 to display the setting dialog.



Select the chart speed from the selection palette in the settings dialog.

If you select 【Any Speed】, an arbitrary speed setting is enabled.

X axis notation: Set the time, date, and point.



Output recording info XML file:

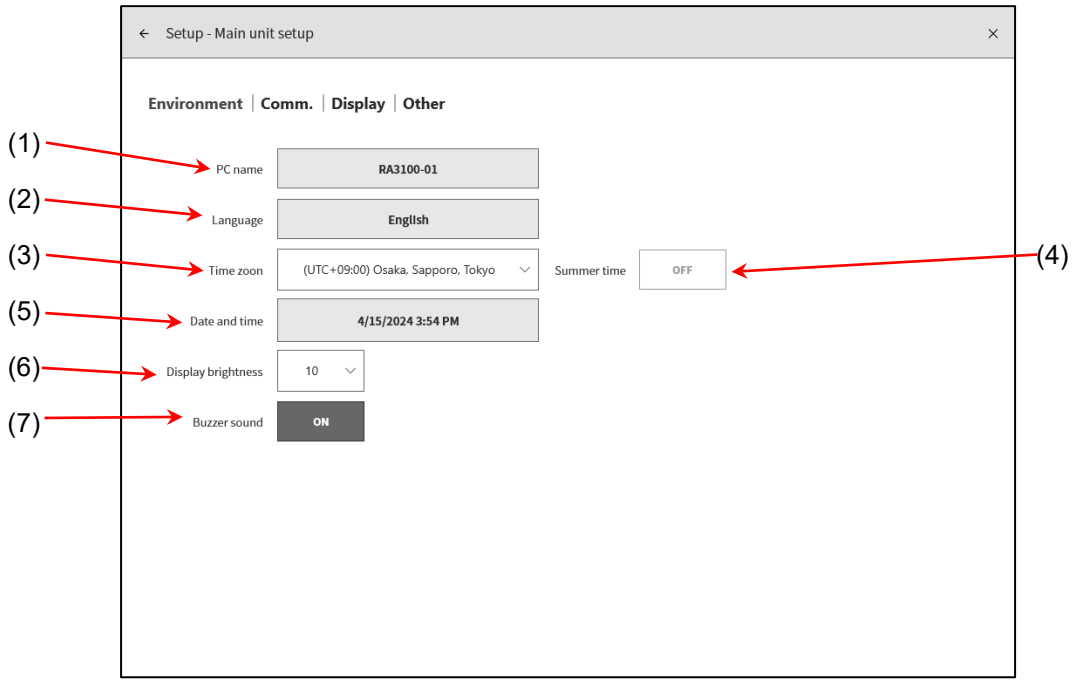
Enable this setting to read the recording file in a custom application. When enabled, an XML format file containing the recording information is added to the recording data.

8.3. Main Unit Setup

Configure【Environment】, 【Comm.】, 【Display】, and 【Other】. Tap a settings category to display the detailed settings screen for that category.

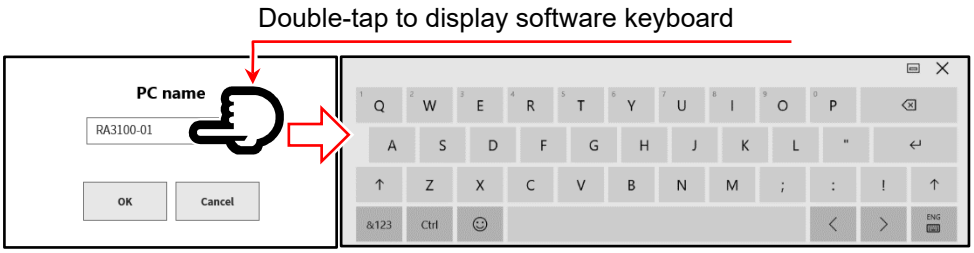
8.3.1. Environment Setup

Tap the【Environment】 in the main unit settings to display the [Environment] screen.
The environment settings of this product can be configured on the [Environment] screen.



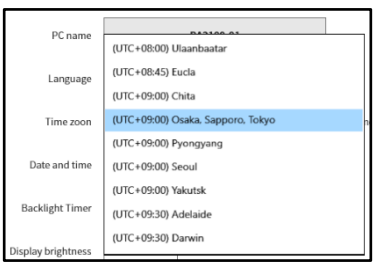
The functions of each item are indicated below.

(1) PC name: Sets the name of this product. Tap the name field to display the [PC name] dialog box for changing the name. Double-tap the name to display the software keyboard.



(2) Language: Select the display language of this product.

(3) Time zone: Sets the time zone of the clock in this product.

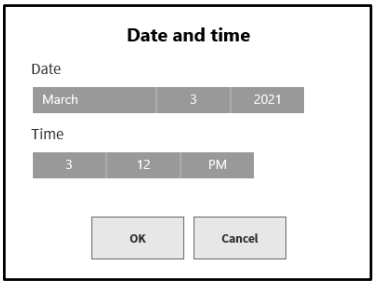


(4) Summer time: Select whether to automatically adjust the time according to daylight saving time.
Can only be selected if the region specified in the time zone uses daylight saving time.

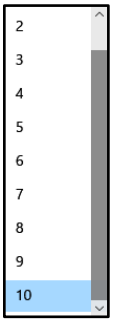
Tips

- ❑ The daylight saving time setting is not reflected in the time axis of the recorded data.

(5) Date and time: Sets the time of this product.
Tap the【Date and time】key to display the [Date and time] dialog box.
Tap and set the year, month, day, hour, and minute.



(6) Display brightness: Changes the screen brightness.
Set a value between 1 and 10.



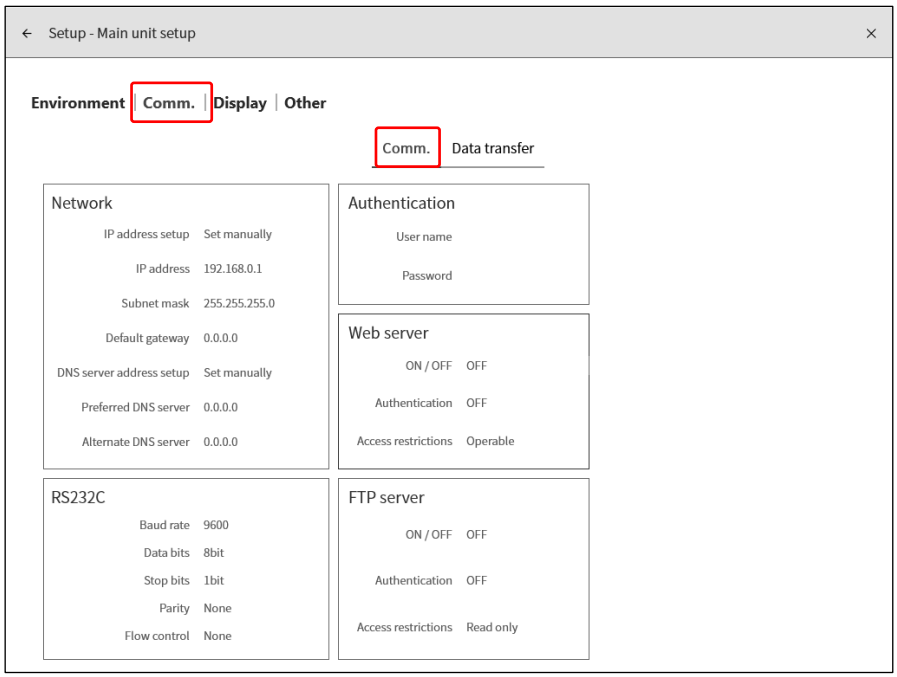
(7) Buzzer sound: Enable this setting to emit a buzzer when the range is exceeded, or disable it to not.

8.3.2. Communication Setup

Tap the【Comm.】 in the main unit settings to display the [Comm.] screen.
The communication, Web server, FTP server, and data transfer settings of this product can be configured on the [Comm.] screen.

8.3.2.1. Communication

Tap the【Comm.】 key in the middle of the [Comm.] screen to display the [Comm.] settings screen.

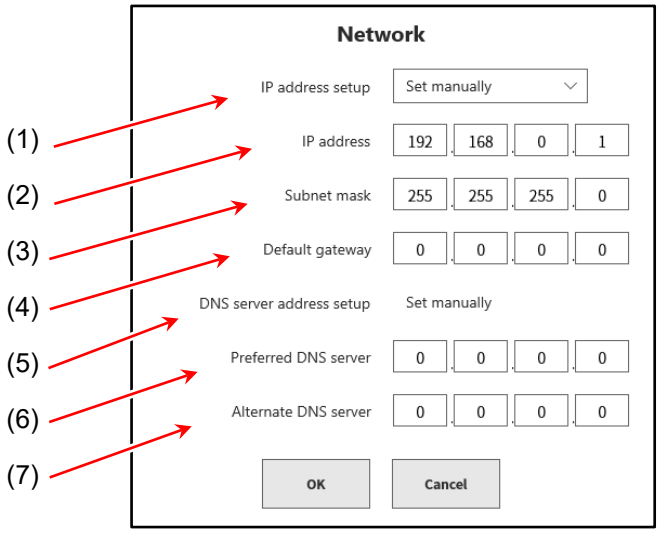


Network Setup

⚠CAUTION

❑ Caution Regarding Network Setup
When connecting this product to an on-premise network, contact the network administrator regarding the network settings.

Tap the【Network】 box on the [Comm.] settings screen to display the network settings dialog box. Tap【OK】 to confirm the settings.



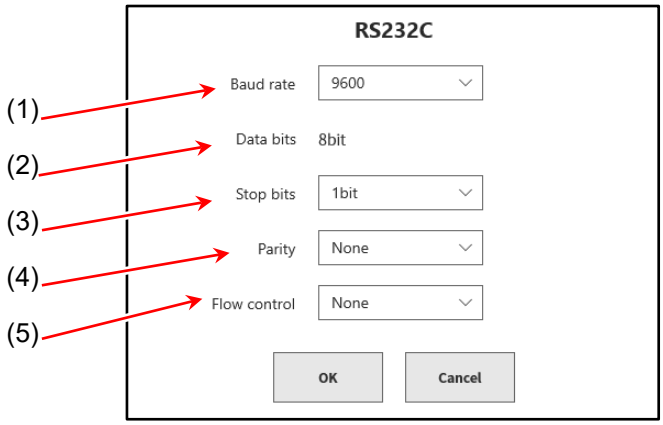
(1)	IP address setup:	Select whether to automatically retrieve (using DHCP) or manually set the IP address of the LAN, etc. The settings in (2) to (4) are not required for automatic retrieval.
(2)	IP address:	Manually sets the IP address of the LAN. Since the IP address is unique to the device, make sure to set a different address when connecting two or more of this product.
(3)	Subnet mask:	The value that defines the IP address range (subnet). Normally set class C. Class C: 255.255.255.000 Class B: 255.255.000.000 Class A: 255.000.000.000
(4)	Default gateway:	Sets the IP address of the gateway device for connecting the network that this product is connected to with external networks.
(5)	DNS server address setup:	Select whether to automatically retrieve or manually set the IP address of the DNS server. The settings in (6) to (7) are not required for automatic retrieval.
(6)	Preferred DNS server:	Sets the IP address of the preferred DNS server on the network.
(7)	Alternate DNS server:	Sets the IP address of the alternate DNS server on the network.

RS-232C Setup

⚠CAUTION

❑ Caution Regarding RS-232C Settings
When using the RS-232C port of this product to communicate with an external device, match the RS-232C settings with those of the host device.

Tap the【 RS-232C】 box on the [Comm.] settings screen to display the RS-232C settings dialog box.
Tap【 OK】 to confirm the settings.



(1) Baud rate: Sets the RS-232C data transmission speed.
Select a baud rate from 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200, 230400, or 460800 bps.

(2) Data bits: The number of bits in one byte of data. Fixed to 8 bits.

(3) Stop bits: The stop bits in one byte of data. Select 1 or 2 bits.

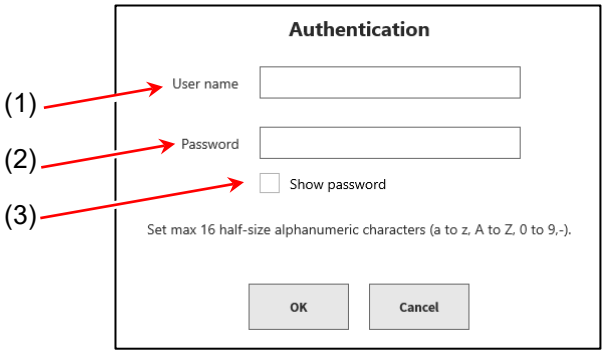
(4) Parity: The parity bit for one byte of data.
Select None, Odd, Even, Mark, or Space.

(5) Flow control: The flow control of communication. Hardware uses control via CTS/RTS for the communication line.
Select None, Xon/Xoff, or Hardware.

Authentication Settings

Authentication settings are used when connecting from the Web browser on a computer or other device (when Web server authentication settings are enabled). When authentication is enabled, connection is only possible by entering the correct user name and password.

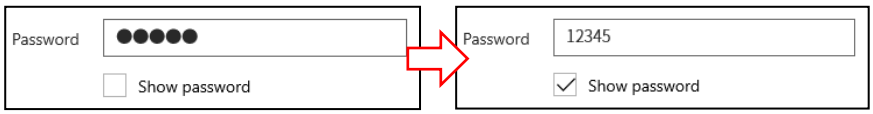
Tap the【Authentication】 box on the [Comm.] screen to display the authentication settings dialog box. Tap【OK】 to confirm the settings.



(1) User name: Set the user name.

(2) Password: Set the password. The characters that are input are masked as black circles.

(3) Show password: Select this check box to display the characters that are input for the password.



Tips

- The available characters for the user name and password are a to z, A to Z, 0 to 9, and hyphen. If any other characters are entered, the【OK】 key is disabled.

Web Server Settings

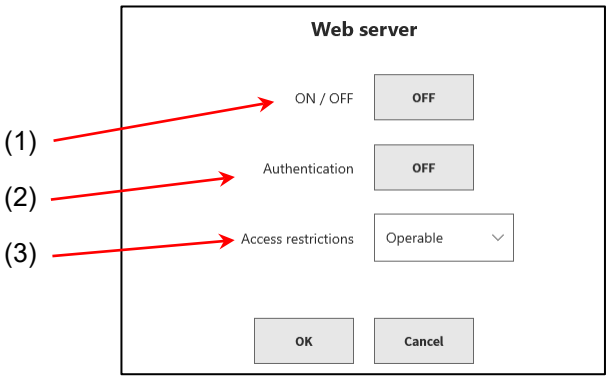
When the Web server function is enabled, you can use the Web browser on a computer or other device to remotely operate, configure, and view the screens of the RA3100.

Note

❑ Caution when Configuring Web Server Settings

Configure the authentication settings as required to prevent unauthorized access.

Tap the【Web server】 box on the [Comm.] screen to display the Web server settings dialog box.
Tap【OK】 to confirm the settings.



(1) ON / OFF: Enables/disables the Web server function.

(2) Authentication: Enables/disables the authentication function.
When enabled, the Web server is used with authentication. (The user name and password in the authentication settings are input from the computer when connecting.)

(3) Access restrictions: Selects the access restrictions for the Web browser.
When Web browser operations are disabled, information can be viewed from the Web browser but no operations are allowed.

☞ For information on connecting to the Web server, see "10.7. Connecting to This Product via a Web Browser".

Tips

❑ The Web server is not available if [Obtain automatically] is selected in the IP address settings of this product.

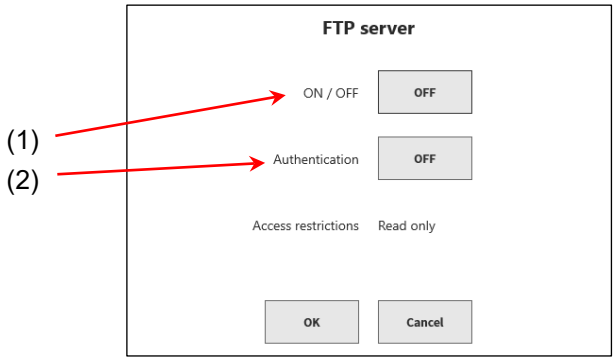
FTP Server Settings

If the FTP server function is enabled, FTP client software can be used to download recorded data, image data, and configuration data.

Note

- ❑ Configure the authentication settings as required to prevent unauthorized access.
- ❑ Download data when recording or pen recording is not being performed.

Tap the【FTP server】box on the [Comm.] screen to display the FTP server settings dialog box.
Tap【OK】to confirm the settings.



(1) ON / OFF: Enables/disables the FTP server function.

(2) Authentication: Sets whether to use basic or anonymous authentication.
When enabled, basic authentication is used. (The user name and password in the authentication settings are input from the client when connecting.)

When disabled, anonymous authentication is used. (Enter "anonymous" as the user name and leave the password blank when connecting from the client.)

For information on connecting to the FTP server and downloading data, see "10.8. Downloading the Data of this Product via FTP".

Tips

- ❑ The FTP server is not available if [Obtain automatically] is selected in the IP address settings of this product.
- ❑ FTP server authentication cannot be used when the following user name or password is set in the authentication settings of this product.
  User name: " " (space), "AND", "Administrator", "DefaultAccount", "Guest" or "WDAGUtilityAccount"
  Password: " " (space)

8.3.2.2. Data transfer

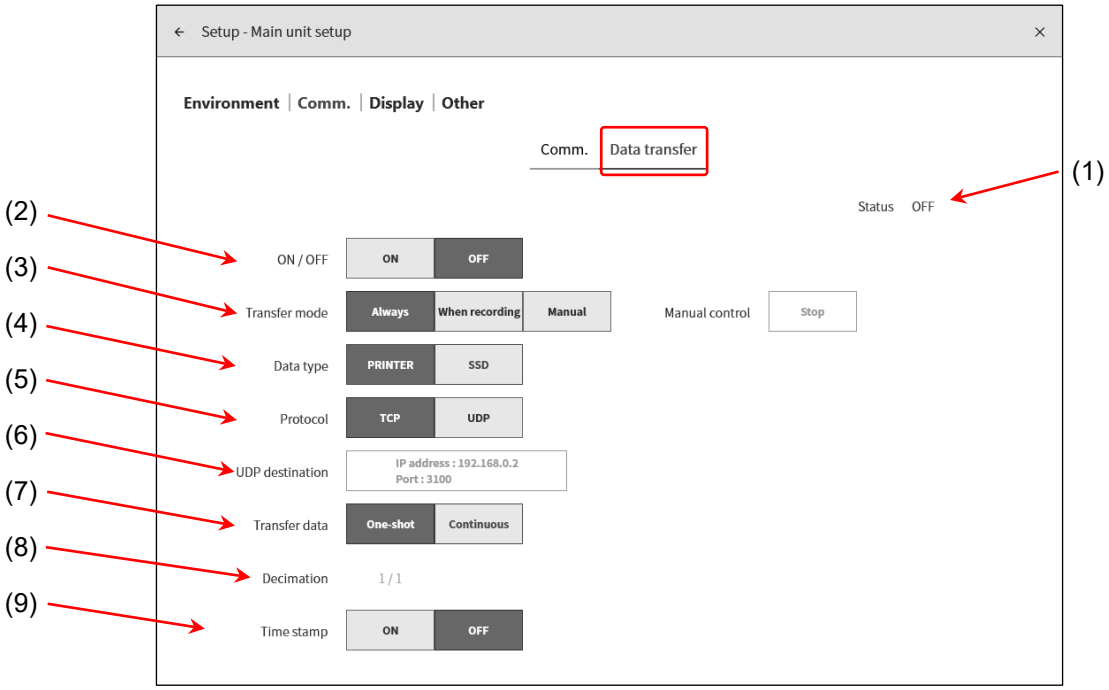
Tap the【Data transfer】key in the middle of the [Comm.] screen to display the [Data transfer] settings screen.

When data transfer is enabled, this product will transfer the sampled measurement data.

☞ For information on retrieving the measurement data, see "10.9. Transferring Data".

Tips

❑ This function can only be used when the measurement mode of this product is set to the MFG mode.



(1) Status: Displays the data transfer status.

Status	Icon	Description
Disabled	(none)	The data transfer function is stopped
Transferring	●	Data is being transferred
Standby	■	A connection has been established with the destination and the data transfer process is waiting to start
Not connected	□	A connection has not been established with the destination
Error	!	An error has occurred in the data transfer process

Tips

❑ A status icon is also displayed for the measurement mode in the side menu. MFG ●

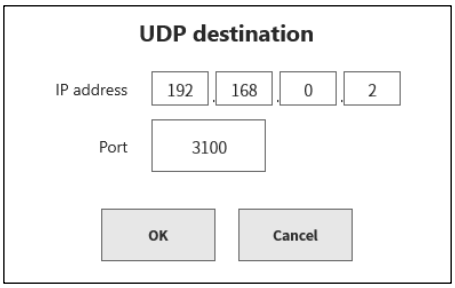
(2) ON / OFF: Enables/disables the data transfer function.

(3) Transfer mode: Set the transfer mode to Always, When recording, or Manual.

Always: Measurement data is always transferred.

When recording: Measurement data is transferred when recording.

Manual: Measurement data is transferred when [Manual control] is set to Start.



(4) Data type: Sets the type of measurement data to transfer.

(5) Protocol: Sets the protocol for communication with the PC.

(6) UDP destination: Sets the IP address and port number of the PC. This is enabled when UDP is set as the protocol.

(7) Transfer data: Sets one-shot or continuous as the type of data to transfer.
- One-shot: Transfers measurement data at a period of approximately 100 ms, regardless of the sampling speed of this product.
- Continuous: Transfers measurement data synchronized with the sampling speed of this product.

(8) Decimation: When [Transfer data] is set to Continuous, sets the decimation of the transfer data.

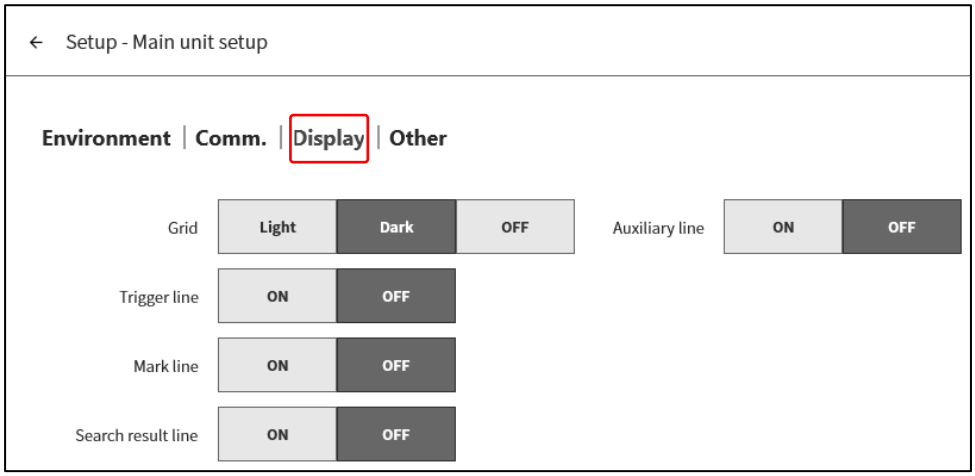
(9) Time stamp: Configures whether to add a time stamp to the transfer data.

Tips

- When [Data type] is set to SSD, the Continuous setting of [Transfer data] can only be used when internal sampling is at 1 kS/s or less.

8.3.3. Display Setup

Tap【Display】 in the main unit setup to display the [Display] screen.



The auxiliary monitor display functions can be set on the [Display] screen.

Grid: Switches the grid lines of the waveform monitor on or off.

Trigger line: Switches the trigger lines for trigger detection on or off.

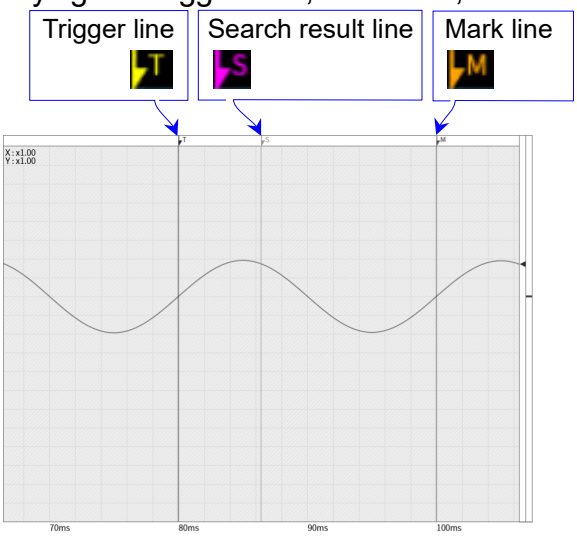
Mark line: Switches the mark lines for mark detection on or off.

* Mark line is available when the optional remote control module is installed.

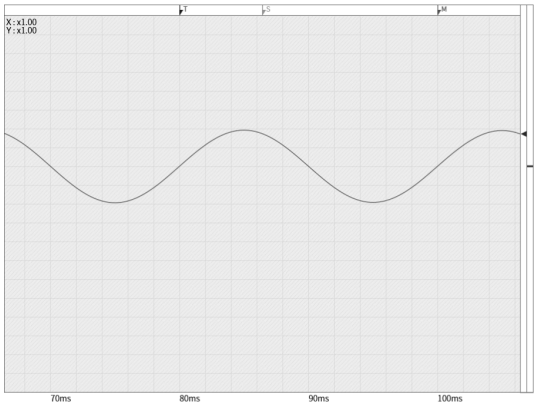
Search result line: Switches the search result line on or off.

Auxiliary line: Switches the grid line auxiliary line on or off. An additional horizontal line is displayed in the center of the grid on the Y axis.

Displaying the Trigger Line, Mark Line, and Search Result Line in the waveform monitor



When enabled



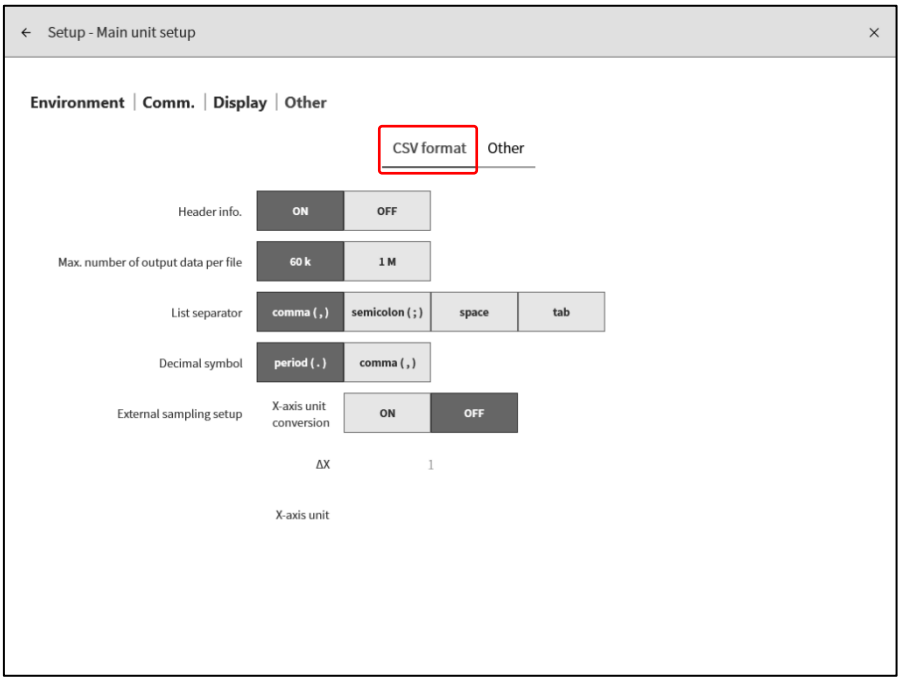
When disabled

8.3.4. Other

Tap【Other】 in the main unit settings to display the [Other setup] screen.
The CSV format and other main unit settings can be configured on the [Other] screen.

8.3.4.1. CSV Format

Tap the【CSV format】 key in the center of the [Other] screen to display the [CSV format] setup screen.



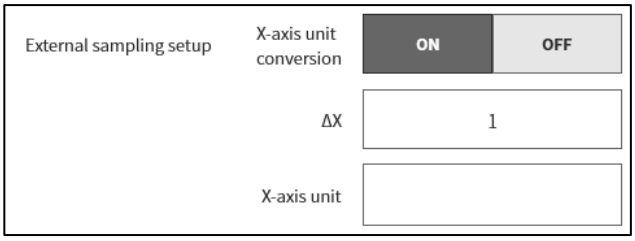
Header info.: If this is enabled, recording information such as the main unit setup, recording setup, and channel configuration is output to the start of the CSV file. If it is disabled, only the time axis (T axis) and signal name/unit are output to the start of the CSV file.

Max. number of output data per file:
Limits the sample count of the measurement data output to a single file.
If the maximum number is exceeded, the CSV file is divided into multiple files.

List separator: Configures the separator symbol.

Decimal symbol: Configures the symbol to use as the decimal point.

External sampling setup:
Enabled when saving the data recorded with external sampling to a CSV file.
You can convert the unit displayed for the X axis to time, angle, or distance, etc.



X-axis unit conversion:
If this is enabled, the X axis unit is output according to the ΔX and X axis unit settings. If it is disabled, the X axis unit is output with the sample count.
ΔX: Enter the number to increase per sample.
X axis unit: Enter the unit. Up to 10 characters can be entered.

For information on the output results after conversion, see "10.13.1 CSV File Format".

8.3.4.2. Other

Tap the【 Other】 key in the center of the [Other] screen to display the [Other] setup screen.



Follow cursor: When enabled, the waveform and cursor are displayed when the cursor moves outside the waveform monitor. When disabled, the cursor moves but the waveform does not when the waveform moves outside the waveform monitor. (The cursor line will no longer be displayed.)

TRIG key: Select the operation to perform when the TRIG key is pressed on the operation panel. If you select TRIG, a trigger occurs. If you select FEED, the recording paper is fed (idle feeding) while the key is pressed.

Delete then save: When enabled, old recorded data is deleted if the number of recorded items exceeds the upper limit or the SSD used for recording does not have enough free space. This setting is only valid when the measurement mode is set to the MFG mode.

8.4. Management

Configure/display【File management】, 【Maintenance】, 【Operation history】, and 【Version management】.
Tap a settings category to display the details screen for that category.

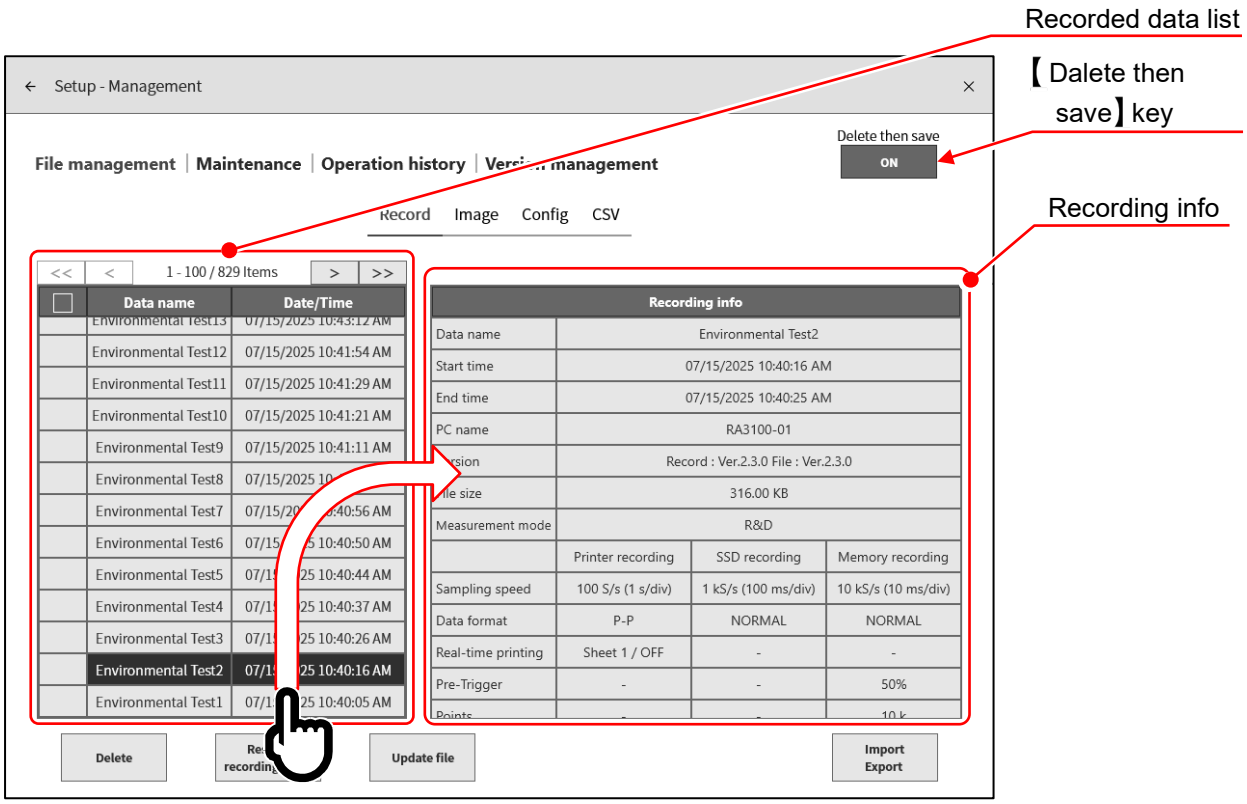
8.4.1. File Management

Tap【File management】 in the management settings to display the [File management] screen.
Operations can be performed on the data saved to this product on the [File management] screen.

8.4.1.1. Record

Tap the【Record】key in the center of the [File management] screen to display the [Recording] management screen.

A list of the recorded data on the internal SSD of this product is displayed on the left side of the [Recording] management screen.
Tap the Data name or Date/Time in the recording data to display [Recording info] for that recorded data on the right.

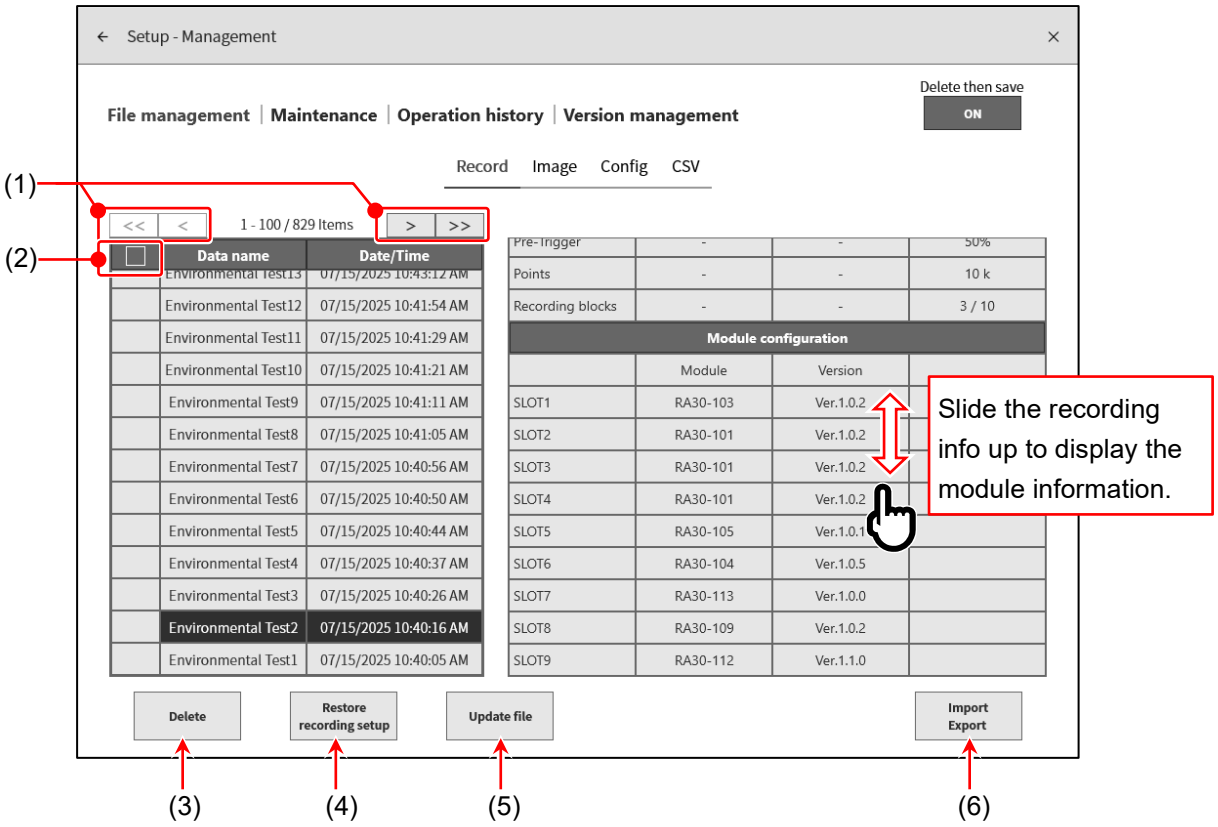


Delete then save: When enabled, old recorded data is deleted if the number of recorded items exceeds the upper limit or the SSD used for recording does not have enough free space. This setting is only valid when the measurement mode is set to the MFG mode.

Tips

- ❑ The key is not displayed when the measurement mode is set to the R&D mode.

Record management Operations



Tap a selection field on the left of the list to display "✓" to select that recorded data as the target for operation. Tap the selection field again to deselect the data.

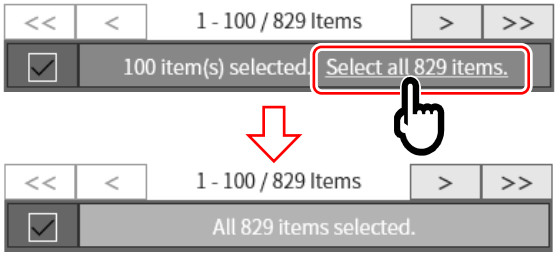
(1) Page switch: Switches the displayed page of the list.

【<】【>】 Displays the previous or next page.

【<<】【>>】 Displays the first or last page.

(2) Select/deselect all: Selects or deselects all the data on the page.

Tap [Select all * items.] to select all the data on all the pages.



(3) Delete: Deletes the selected recorded data.

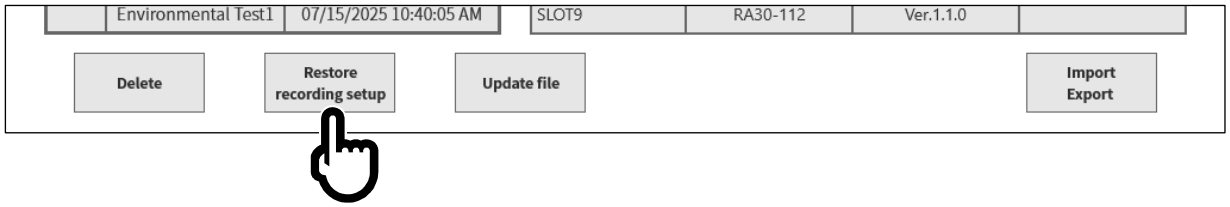
(4) Restore recording setup: Restores the settings saved together with the recorded data to the main unit.

(5) Update file: Updates the file format of old recorded data.

(6) Import/Export: Exports recorded data to external media (such as an SD memory card or USB stick) or imports (reads) the data backed up to external media.

Restoring recording setup

The recording settings of this product are saved together with the recorded data.
Select the data for the recording conditions to restore/set again on the [Recording] management screen, and tap the【Restore setting】key to set the recording conditions to the main unit.



Tips

❑ If the file version of the recorded data differs from the software version of the main unit, this product may be unable to restore the recording setup.
This problem can be solved by performing a file update if the file version of the recorded data is older than the software version of the main unit, or a system update if the version is newer.



☞ For information on the versions, see "10.1. Version Information".

Updating a File

You can update the file format of recorded data that cannot be played back because the file version is too old.
Select the file to update on the [Recording] management screen, and tap the【Update file】key to update the file.

Tips

❑ If you update the file of recorded data with file version 1.x.x., the following items must be set again.
- Feed length
- Output recording info XML file

☞ For information on the versions, see "10.1. Version Information".

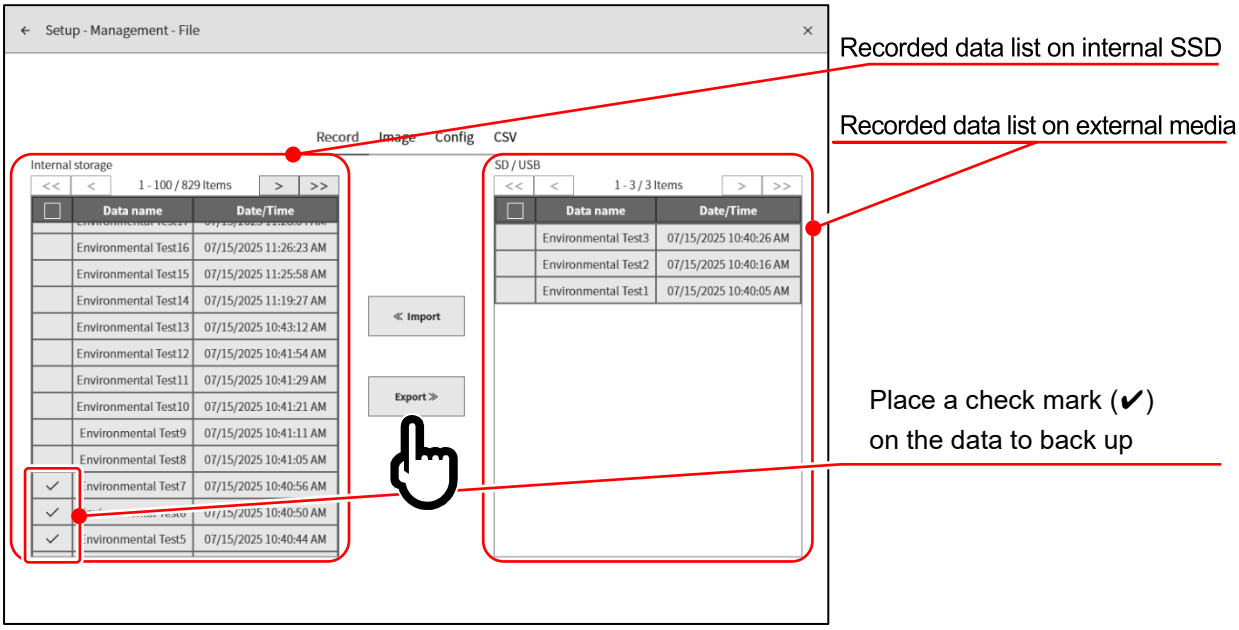
Export - Backing Up Recorded Data

Connect the external storage media (such as SD memory card or USB stick) to the main unit and confirm that the SD/USB indicator on the side menu activates.



Tap the【Import/Export】key on the bottom right of the [Record management] screen to display the external media selection dialog and select the target external media.

Tap【OK】to switch to the [Import/Export] screen.



Place a check mark (✔) in the selection field of the data to back up and tap the【Export】key in the center to export the recorded data.

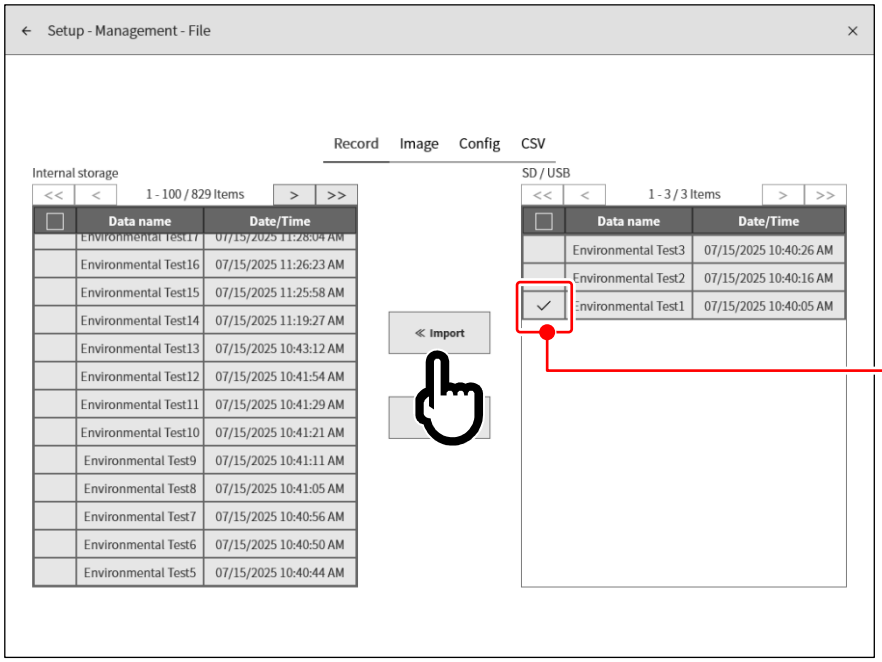
The recorded data that is exported can be displayed as a waveform or converted to a file.

See "13.5. PC Software".

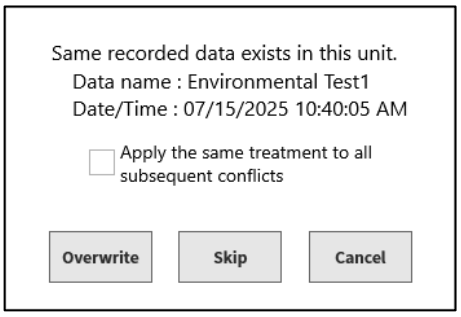
Import - Reading Backup Data

Open the [Import/Export] screen in the same way as when exporting data, and import backup data backed up to external media to the main unit.

When importing, place a check mark (✔) in the recorded data list for external media on the right, and tap the【Import】key in the center.



When the same data as the backup exists in the internal storage, a cautionary dialog box is displayed, and you can select the appropriate operation using the【Overwrite】, 【Skip】, or【Cancel】key.



8.4.1.2. Image

Tap the【Image】 key in the center of the [File management] screen to display the [Image] management screen.

Press and hold the PRINT key on the [Image] management screen to manage the screenshot images of the monitor.

A list of the image data on the internal SSD of this product is displayed on the left side of the screen.

Tap the date field in the list to display a preview of that image on the right.

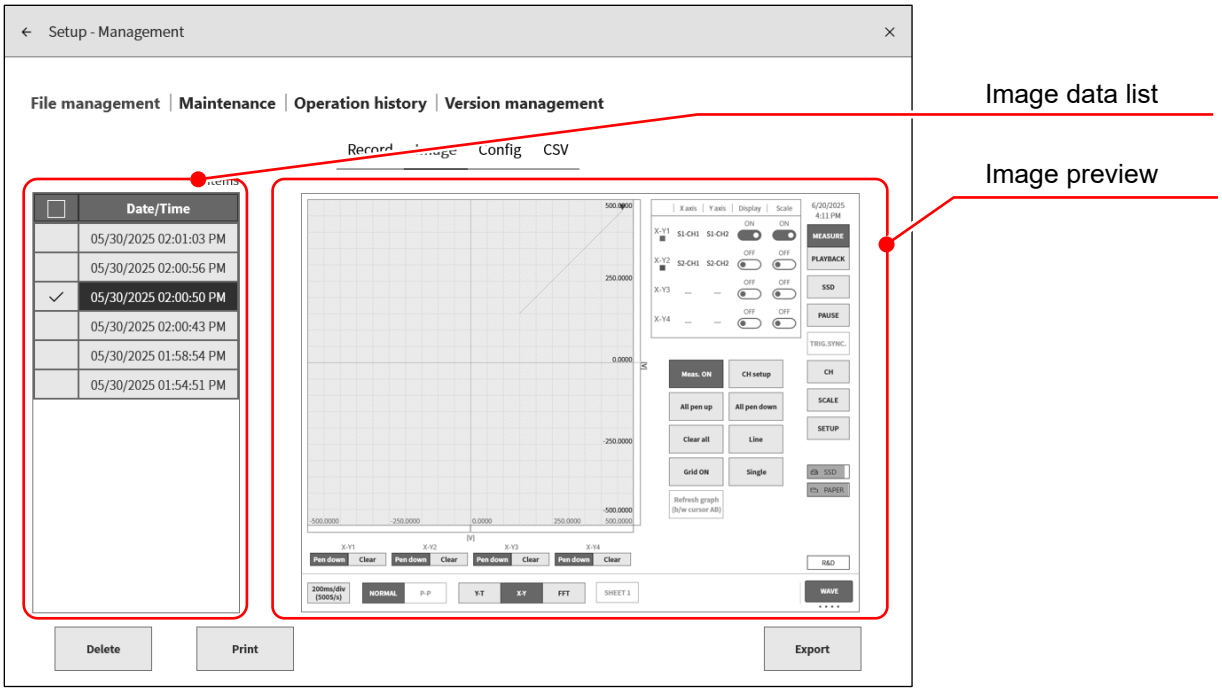
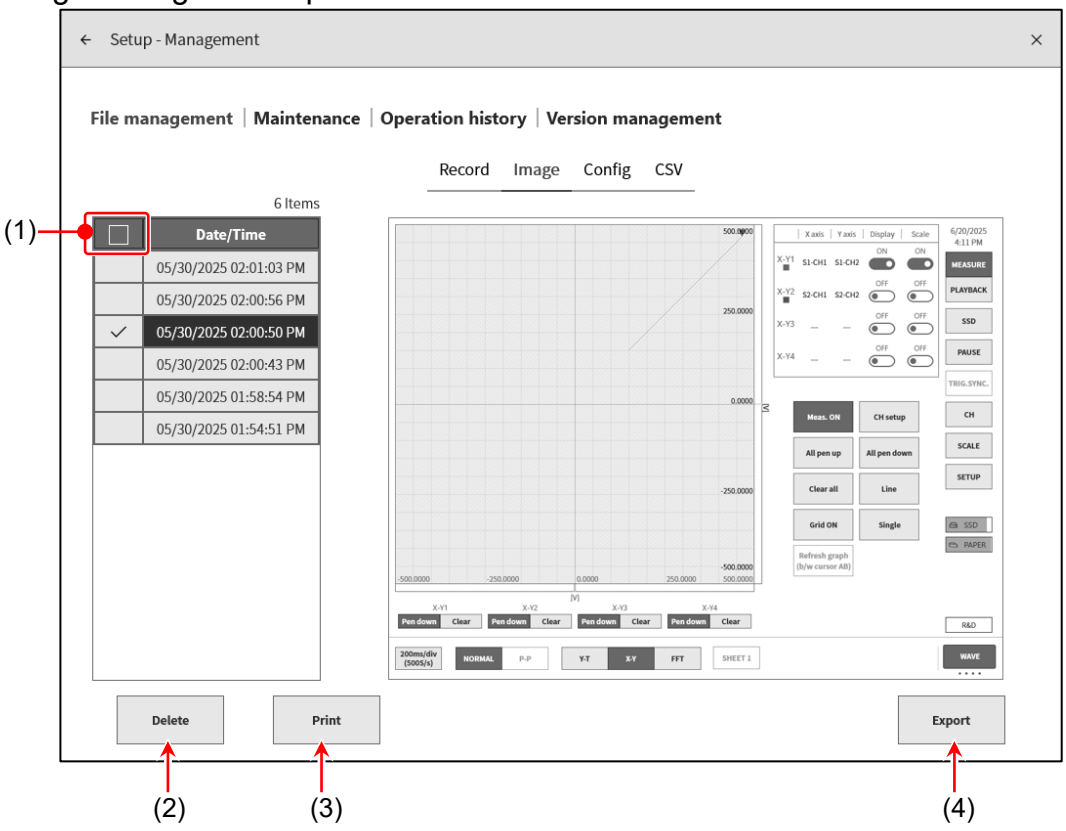


Image Management Operations



Tap a selection field on the left of the list to display "✓" to select that image data as the target for operation. Tap the selection field again to deselect the data.

(1) Select/deselect all:
Selects or deselects all the data.

(2) Delete: Deletes the selected image data.

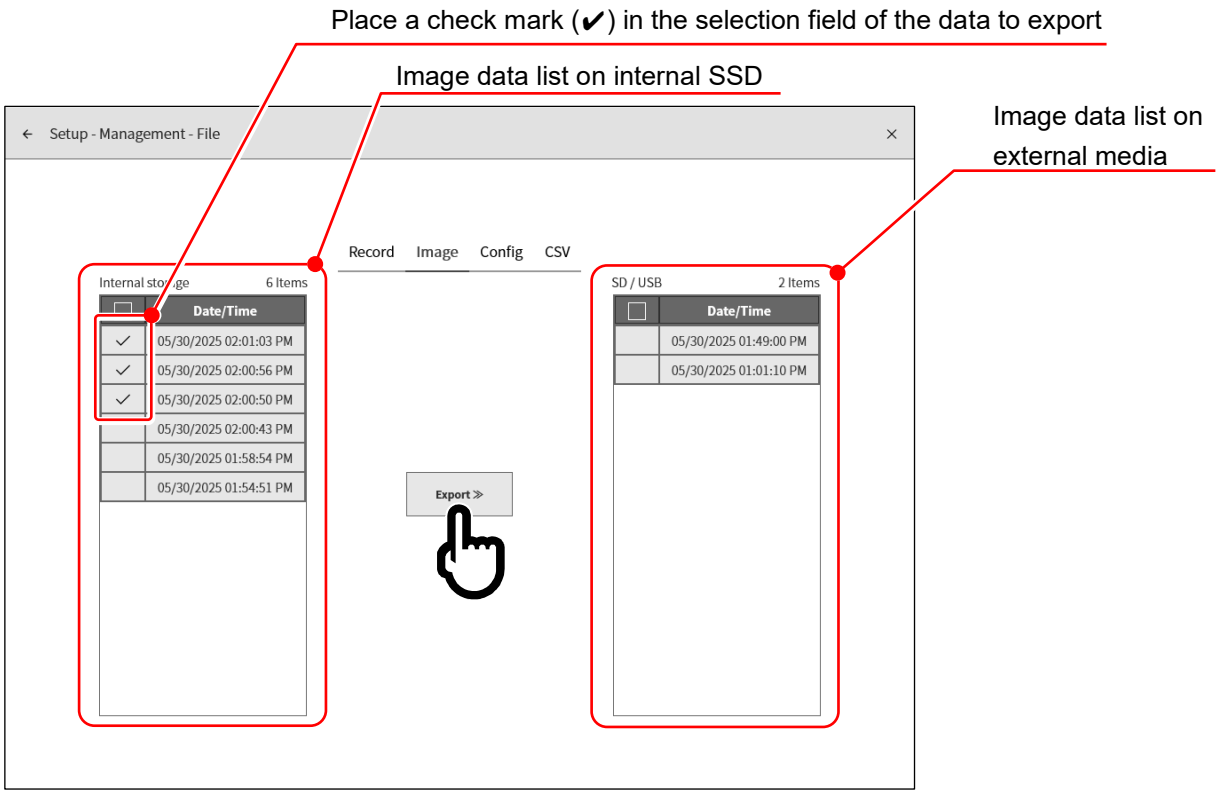
(3) Print: Prints the image data displayed in the preview from the printer.

(4) Export: Exports image data to external media (such as an SD memory card or USB stick).

Exporting Images

Tap the【Export】 key to display the external media selection dialog box and select the target external media. Tap【OK】 to switch to the [Export] screen. Place a check mark (✔) in the selection field of the data to export and tap the【Export】 key in the center to export the recorded data.

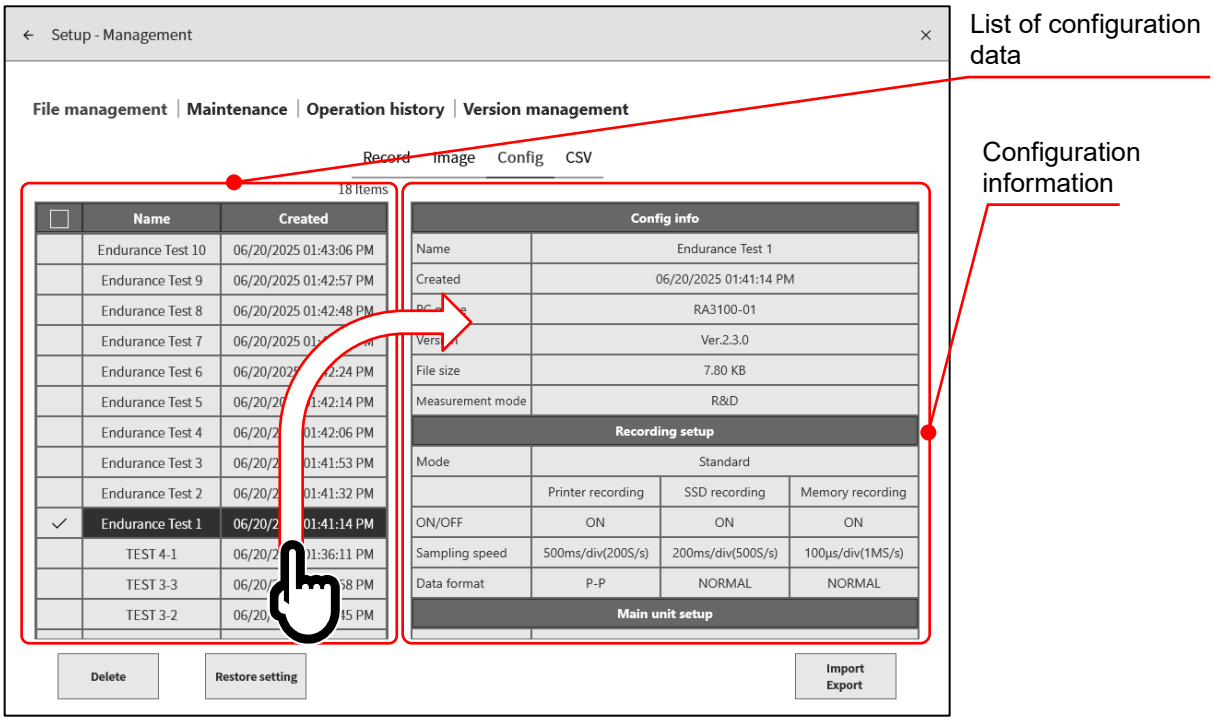




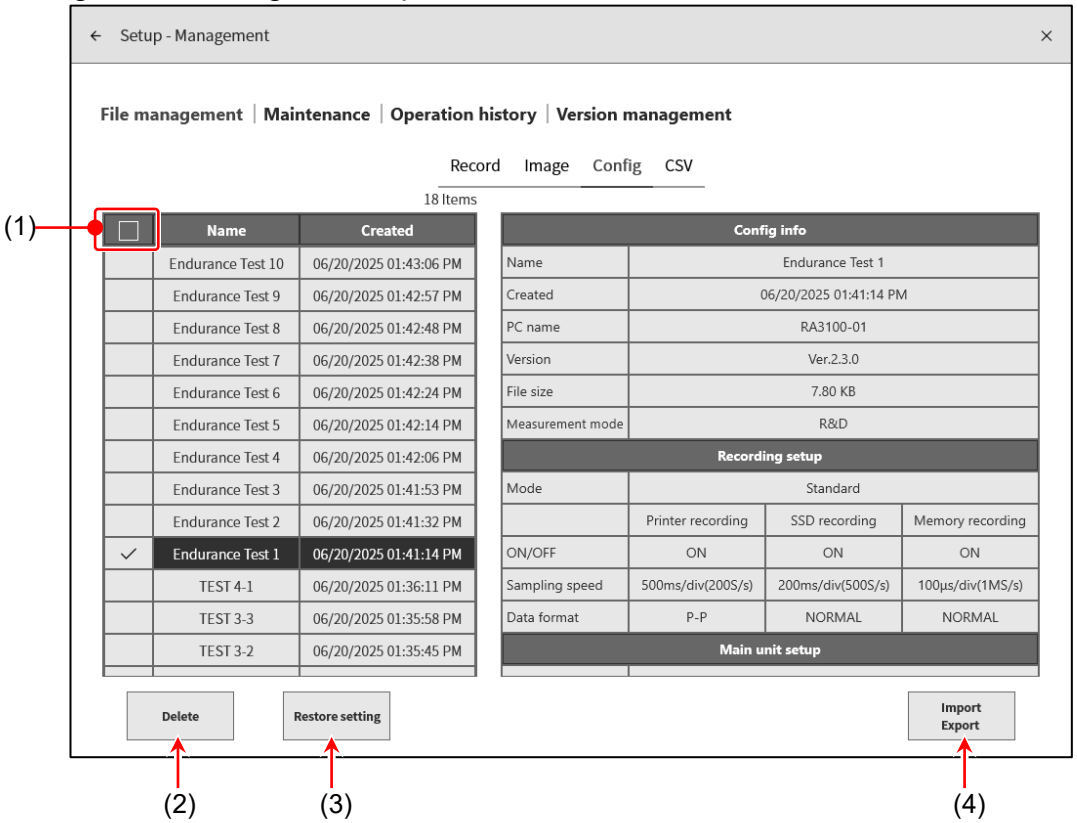
8.4.1.3. Config

Tap the【Config】 key in the center of the [File management] screen to display the [Config] management screen.

The [Config] management screen enables you to manage the configuration data created with [Create a config file].
A list of the configuration data on the internal SSD of this product is displayed on the left side of the screen. Tap the Name or Created field in the list to display the configuration information on the right.



Configuration Management Operations



Tap a selection field on the left of the list to display "✓" to select that setting data as the target for operation. Tap the selection field again to deselect the data.

(1) Select/deselect all: Selects or deselects all the data.

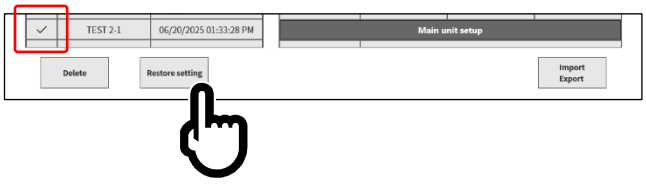
(2) Delete: Deletes the selected recorded data.

(3) Restore setting: Updates the main unit with the configuration information of the selected configuration data.

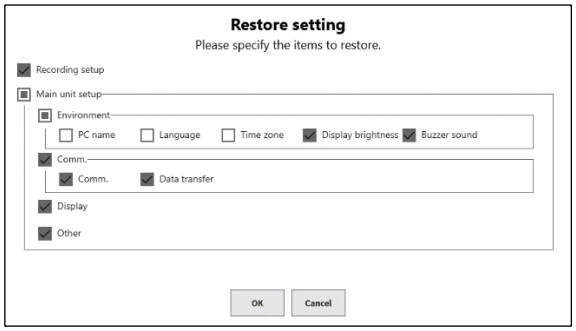
(4) Import/Export: Exports configuration data to external media (such as an SD memory card or USB stick) or imports (reads) the configuration data backed up to external media.

Restore setting:

Select the configuration data to restore/set again on the [Setup] management screen, then tap the【Restore setting】key to display the [Restore setting] dialog.



Select the items to restore, then tap the【OK】key to update the setting values.



Tips

- ❑ The measurement mode is always restored.
- ❑ If you selected to restore the PC name or language, this product shuts down automatically after the data is restored.

Exporting Settings

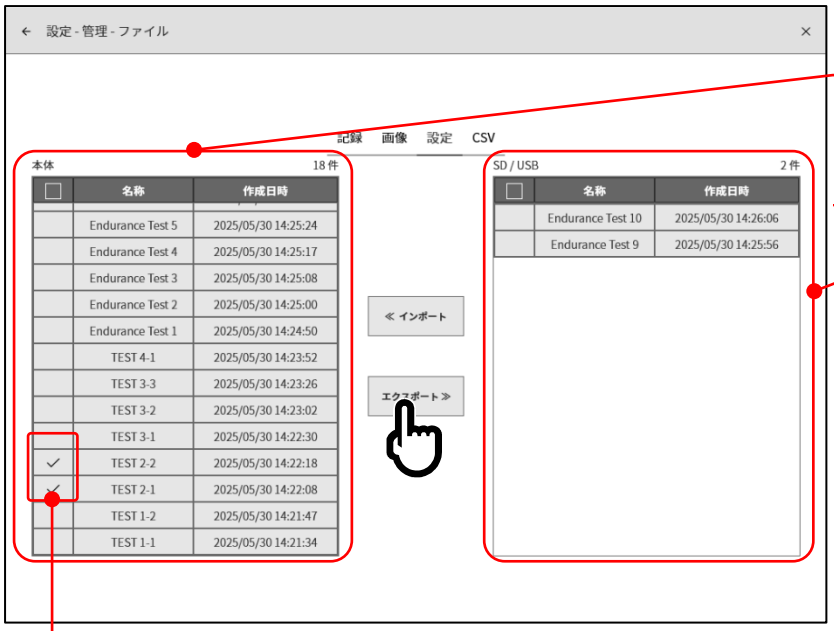
Connect the external storage media (such as SD memory card or USB stick) to the main unit and confirm that the SD/USB indicator on the side menu activates.

Tap the【Import/Export】key on the bottom right of the [Setup] management screen to display the external media selection dialog and select the target external media.



Tap the【OK】key to switch to the [Import/Export] screen.

Place a check mark (✔) in the selection field of the configuration data to back up and tap the【Export】key in the center to export the configuration data.



List of configuration data on internal SSD

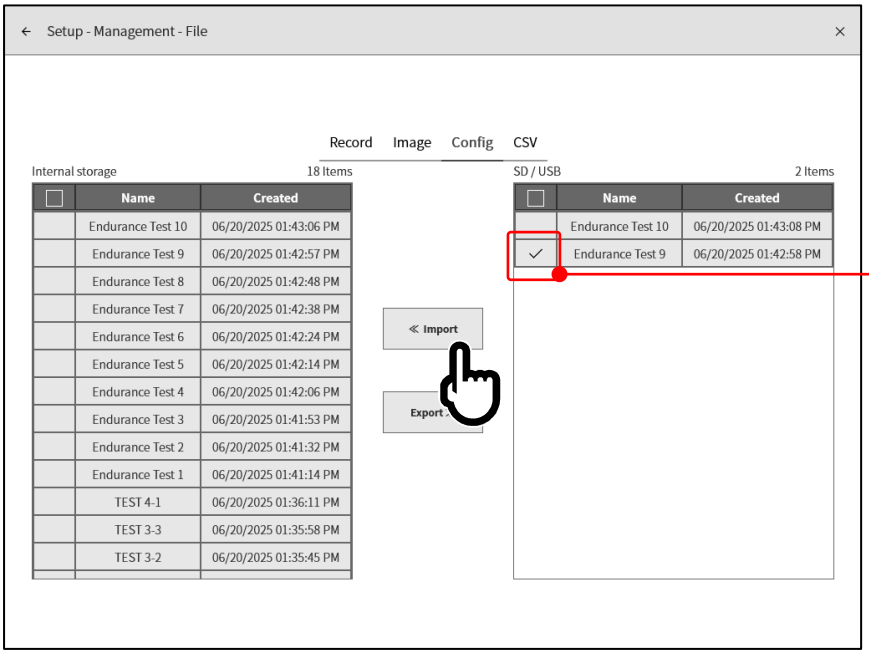
List of configuration data on external media

Place a check mark (✔) on the configuration data to back up

Importing Settings

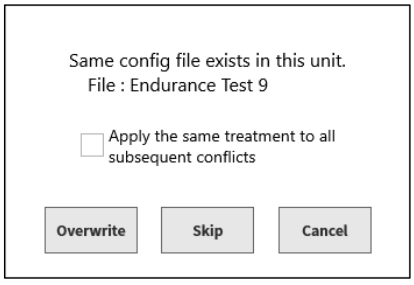
Open the [Import/Export] screen in the same way as when exporting data, and import backup data backed up to external media to the main unit.

When importing, place a check mark (✔) in the configuration data list for external media on the right, and tap the【Import】key in the center.



Place a check mark (✔) in the configuration data to read

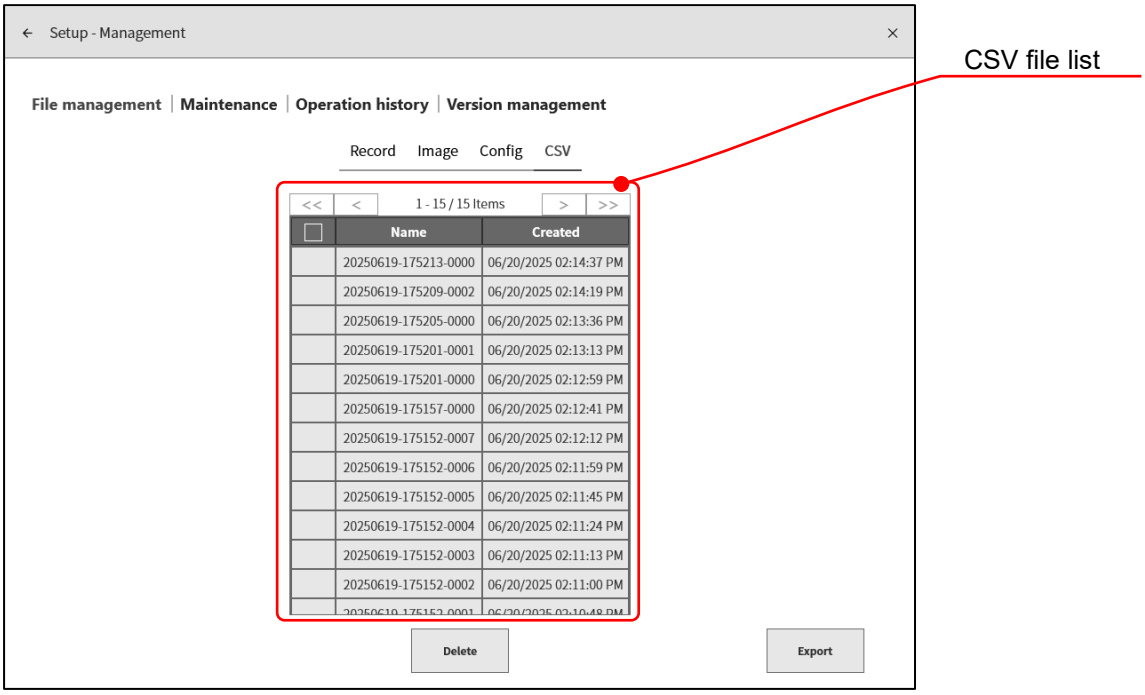
When the same configuration data as the backup exists in the internal storage, a cautionary dialog box is displayed, and you can select the appropriate operation using the【Overwrite】,【Skip】, or【Cancel】key.



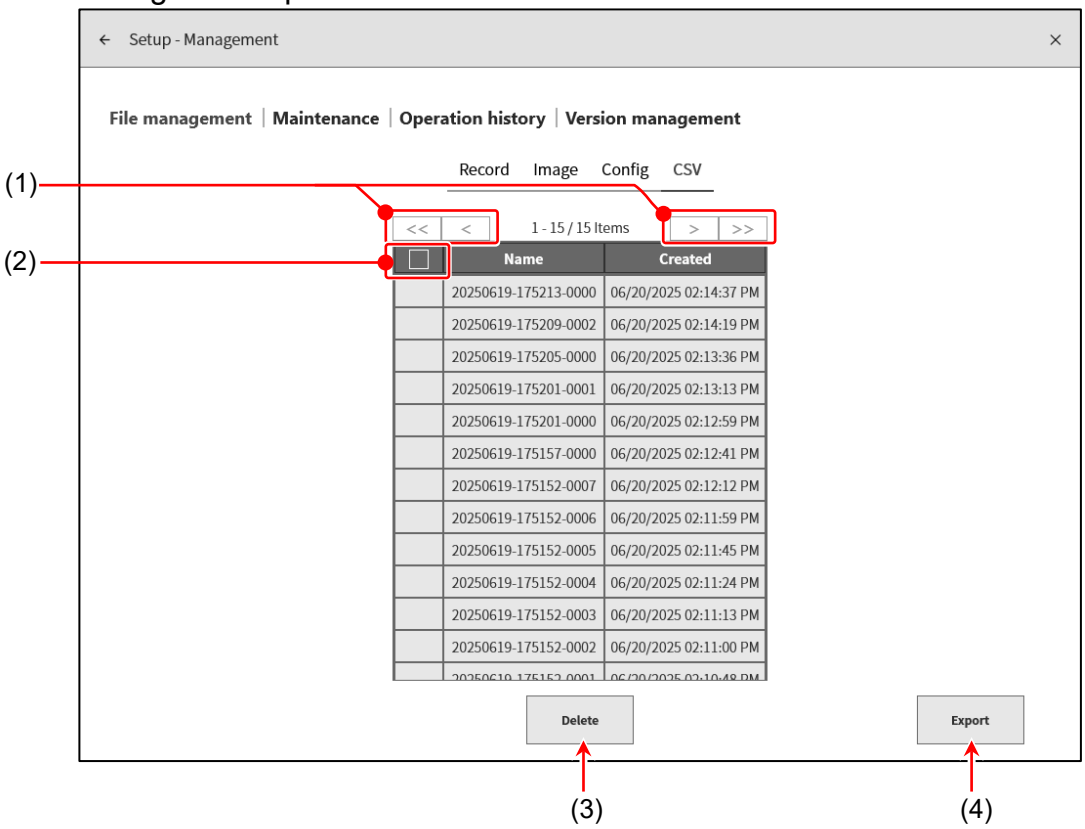
8.4.1.4. CSV

Tap the【CSV】 key in the center of the [File management] screen to display the [CSV] management screen.

A list of the CSV files saved to the internal SSD of the product is displayed in the center of the [CSV] management screen.



CSV Management Operations



Tap a selection field on the left of the list to display "✓" to select that CSV data as the target for operation. Tap the selection field again to deselect the data.

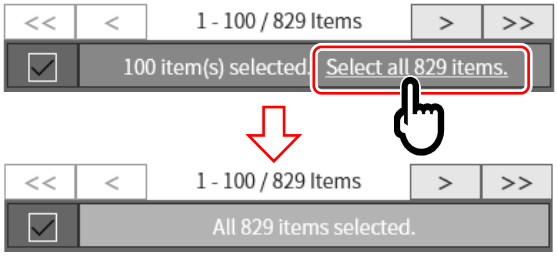
(1) Page switch: Switches the displayed page of the list.

【<】【>】 Displays the previous or next page.

【<<】【>>】 Displays the first or last page.

(2) Select/deselect all: Selects or deselects all the data on the page.

Tap [Select all * items.] to select all the data on all the pages.

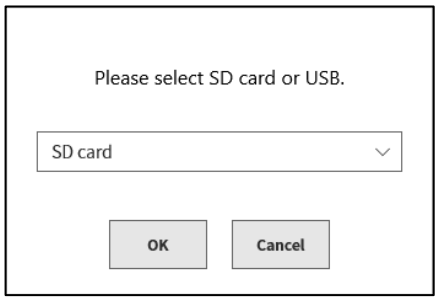


(3) Delete: Deletes the selected CSV file.

(4) Export: Exports the CSV file to external media (such as an SD memory card or USB stick).

Exporting CSV Files

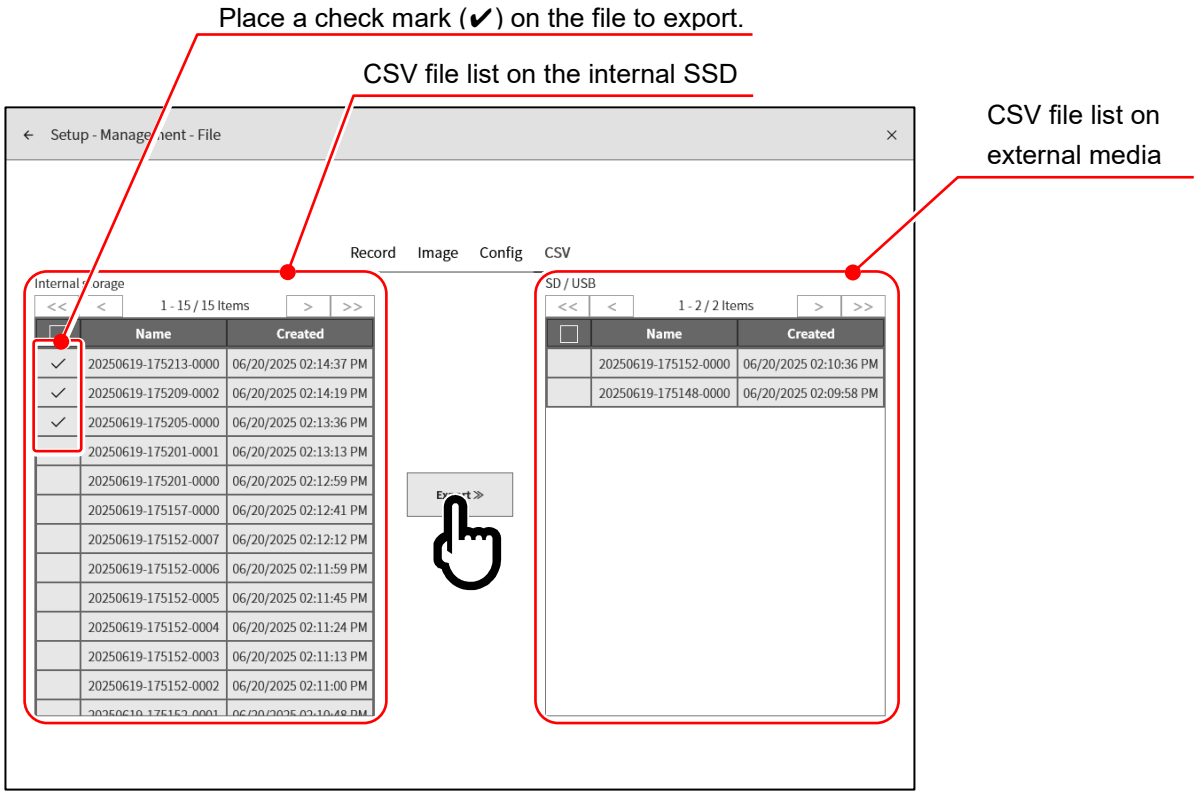
Connect the external storage media (such as SD memory card or USB stick) to the main unit and confirm that the SD/USB indicator on the side menu activates.



Tap the【Export】key on the bottom right of the [CSV] management screen to display the external media selection dialog and select the target external media.

Tap the【OK】key to switch to the [Export] screen.

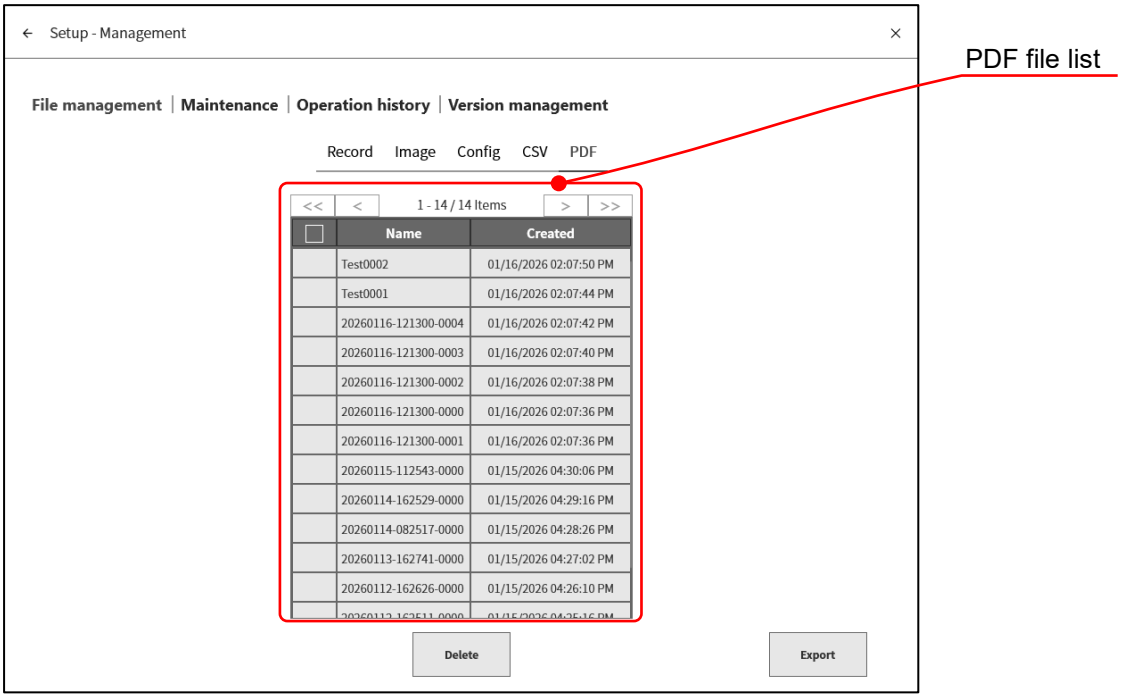
Place a check mark (✔) in the selection field of the file to export and tap the【Export】key in the center to export the CSV file.



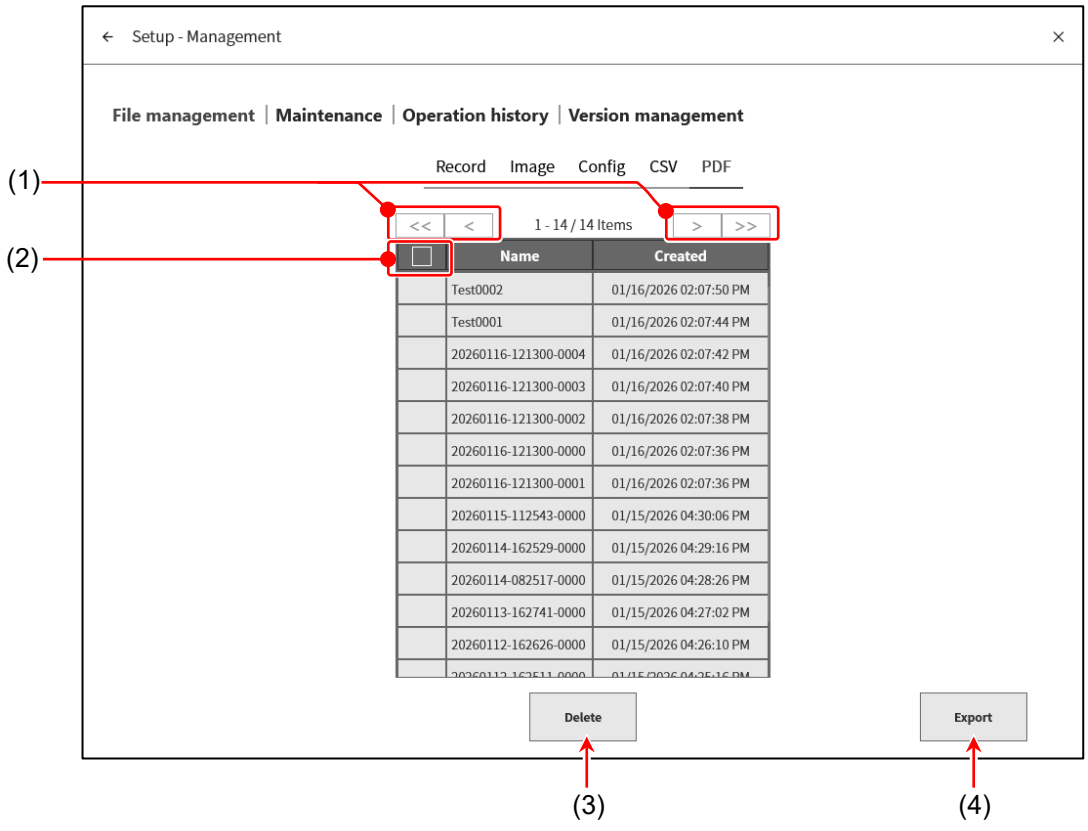
8.4.1.5. PDF

Tap the【PDF】 key in the center of the [File management] screen to display the [PDF] management screen.

A list of the PDF files saved to the internal SSD of the product is displayed in the center of the [PDF] management screen.



PDF Management Operations



Tap a selection field on the left of the list to display "✓" and select that PDF data as the target for operation. Tap the selection field again to deselect the data.

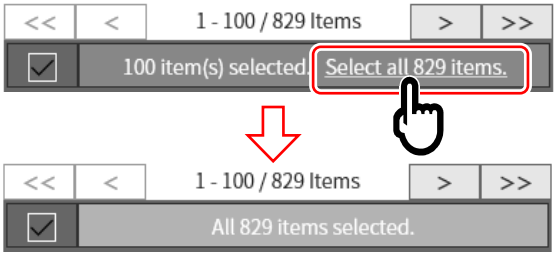
(1) Page switch: Switches the displayed page of the list.

【<】【>】 Displays the previous or next page.

【<<】【>>】 Displays the first or last page.

(2) Select/deselect all: Selects or deselects all the data on the page.

Tap [Select all * items.] to select all the data on all the pages.



(3) Delete: Deletes the selected PDF files.

(4) Export: Exports the PDF files to external media (such as an SD memory card or USB stick).

Exporting PDF Files

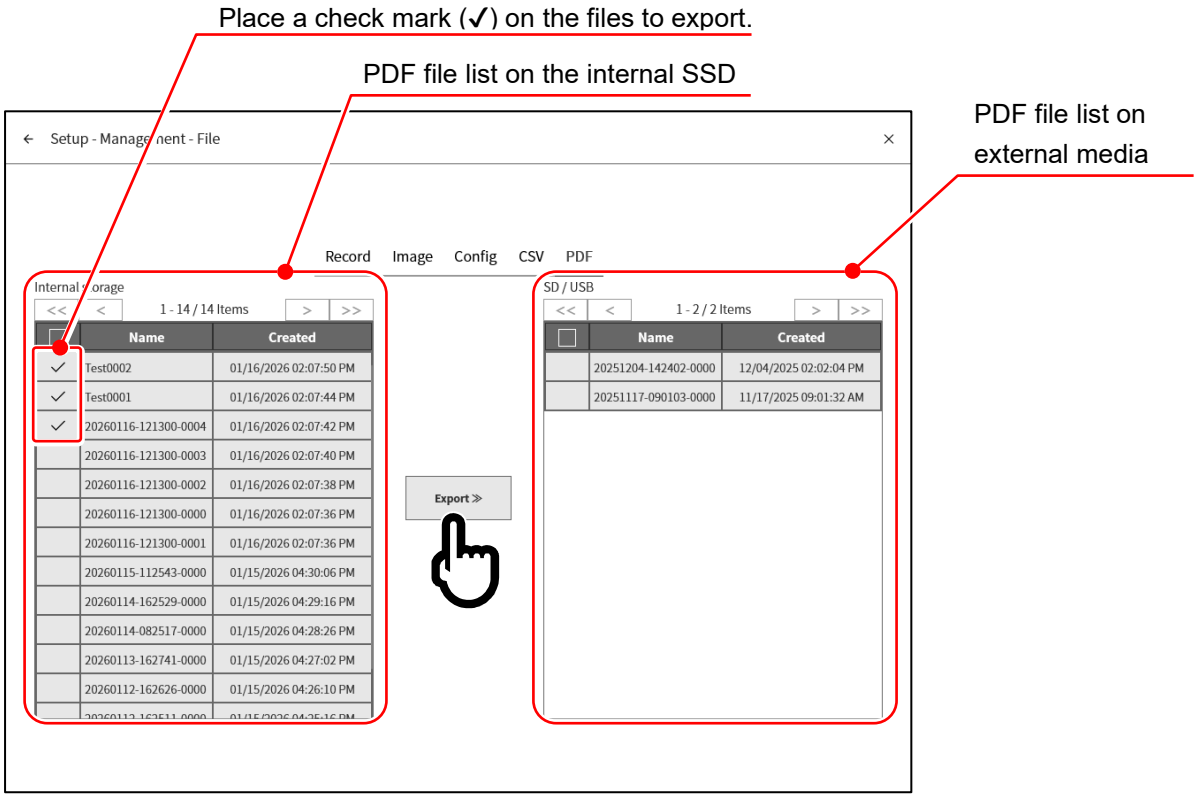
Connect the external storage media (such as SD memory card or USB stick) to the main unit and confirm that the SD/USB indicator on the side menu activates.

Tap the【Export】key on the bottom right of the [PDF] management screen to display the external media selection dialog box and select the target external media.



Tap the【OK】key to switch to the [Export] screen.

Place a check mark (✓) in the selection field of the files to export and tap the【Export】key in the center to export the PDF files.

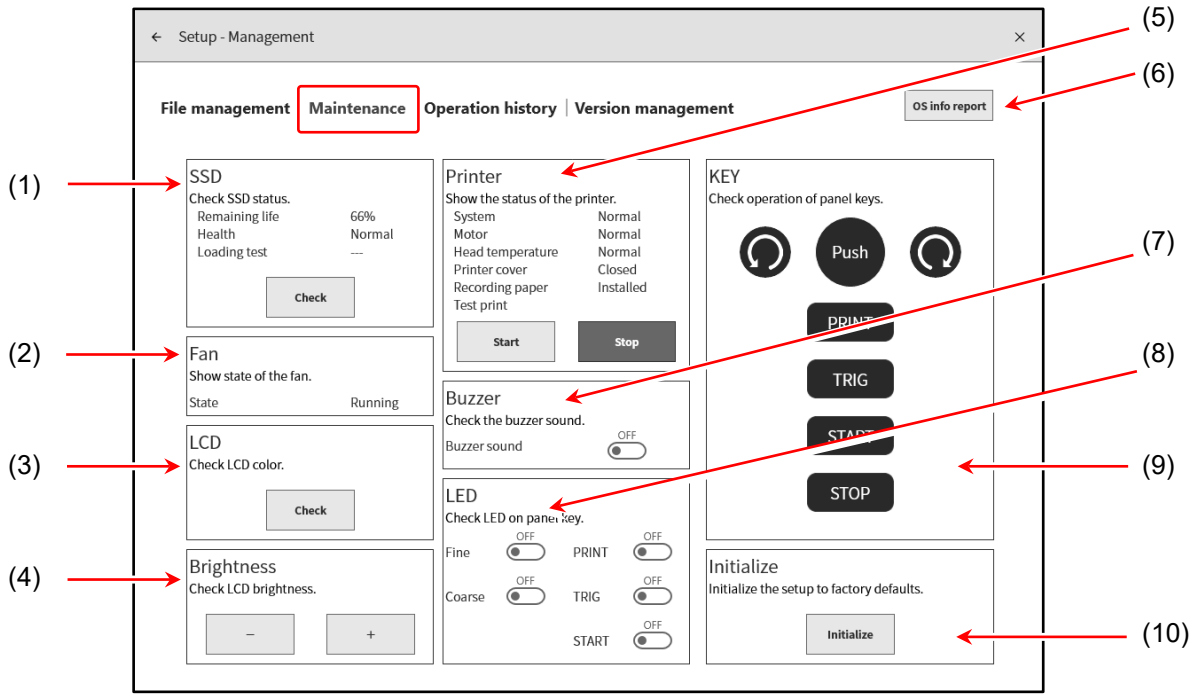


8.4.2. Maintenance

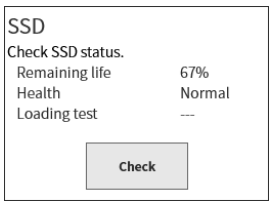
⚠CAUTION

- ❑ If the maintenance check detects an error in this product, please contact our sales representative.
- ❑ When the life remaining is low or the health is no longer normal, it is recommended that you replace the SSD, as data will not be able to be retained in the long term.
- ❑ If [Stop] is displayed for the state of the fan, the fan has failed and needs a repair.
- ❑ The check passes if there are three or less pixel defects in the LCD at the time of delivery. When using this product for an extended period of time, deterioration in the LCD may cause pixel defects.
- ❑ The head temperature may be high after performing printer recording for an extended period of time, which can cause an error. In this case, check again after waiting a while.

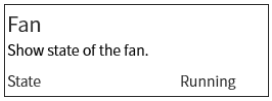
You can tap 【Maintenance】 in [Setup - Management] to display the [Maintenance] screen for performing maintenance on this product.



(1) SSD: Checks the health of the internal SSD.
Tap the 【Check】 key to execute an SSD check and loading test, and display the results.



(2) Fan: Displays the state of the cooling fan.

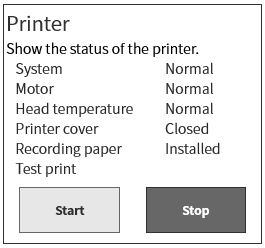


(3) LCD: Displays the state of the LCD.
Tap the 【Check】 key to display the screen for checking, which switches in the order red → green → blue → white → black. Confirm that there are not any large areas with display problems (areas that are always black or white).

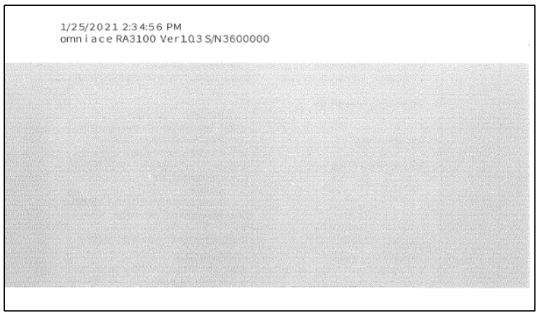
(4) Brightness: Performs a brightness adjustment test on the LCD.
Tap the 【－】 key to make the screen darker.
Tap the 【＋】 key to make the screen lighter.



(5) Printer: Displays the state of printer. You can also press the 【Start】 and 【Stop】 key for test printing to check the printing state of the printer.
Test printing prints the date and time and serial number of the main unit on recording paper, then prints a test pattern over the entire surface of the paper. The test pattern can be used to check for horizontal density variation and damage to the thermal head for printing.

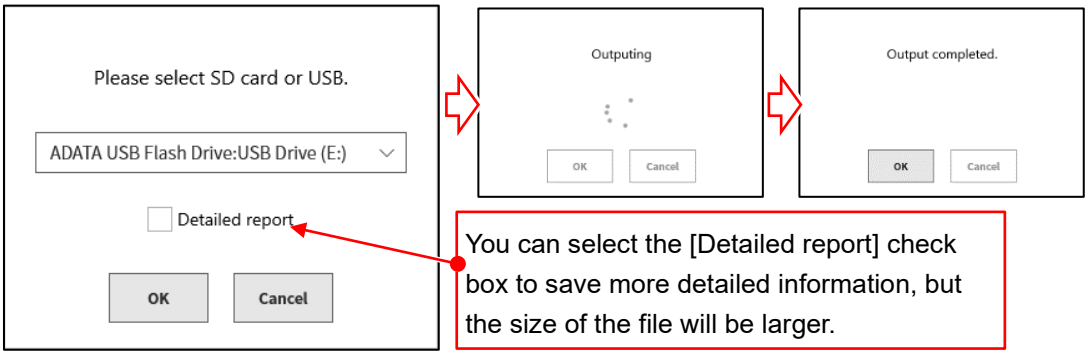


<Example test print>



(6) OS info report:

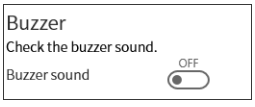
Outputs an OS info report file (information on the operating system of this product) to external media (SD memory card or USB stick, etc.)
Connect external media to the main unit and tap the key to display the dialog box for selecting the output destination, then tap 【OK】 to output the file. It takes several minutes to output the file.



Tips

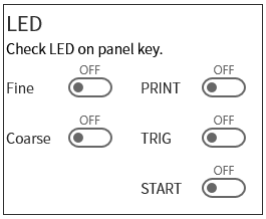
- The OS info report file is used for analysis at A&D when an error occurs with this product or when it does not operate normally. It cannot be used by customers.
- Use external media with at least 100 MB of free space.

(7) Buzzer: Tap the buzzer ON/OFF key to emit a beep to confirm that the buzzer works.



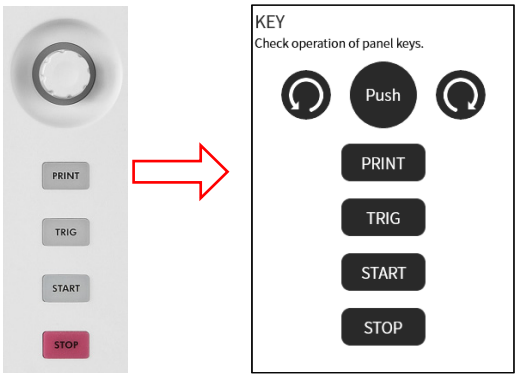
(8) LED: Check the state of the main unit using the LED on the operation panel.
Use the color around the rotary knob to check the fine/coarse setting.

PRINT:	Orange	Fine:	Orange
TRIG:	Blue	Coarse:	Blue
START:	Green		

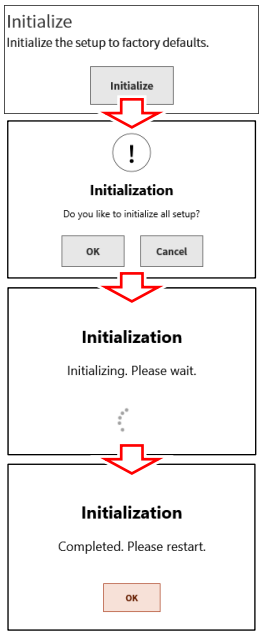


(9) KEY: Use this to check the rotary knob and keys of the operation panel.
The display on the screen is highlighted when a key on the operation panel is pressed or the rotary knob is turned clockwise or counterclockwise.

Operation panel [Maintenance] - KEY



(10) Initialize: Initializes the settings of this product to the factory defaults. Tap the 【Initialize】 key, then tap 【OK】 in the confirmation dialog box displayed for executing initialization. This product automatically shuts down when initialization is complete, so press the Power switch on the front panel to turn on this product.

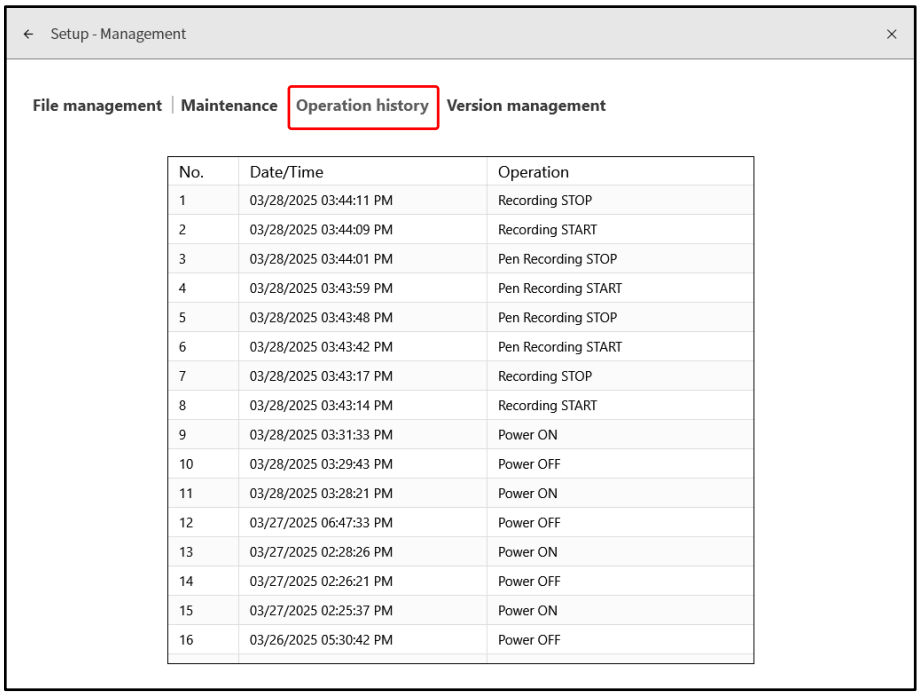


Tips

❑ The following settings are not initialized.
[Language], [Time zone], [Summer time], and [Date and time]

8.4.3. Operation History

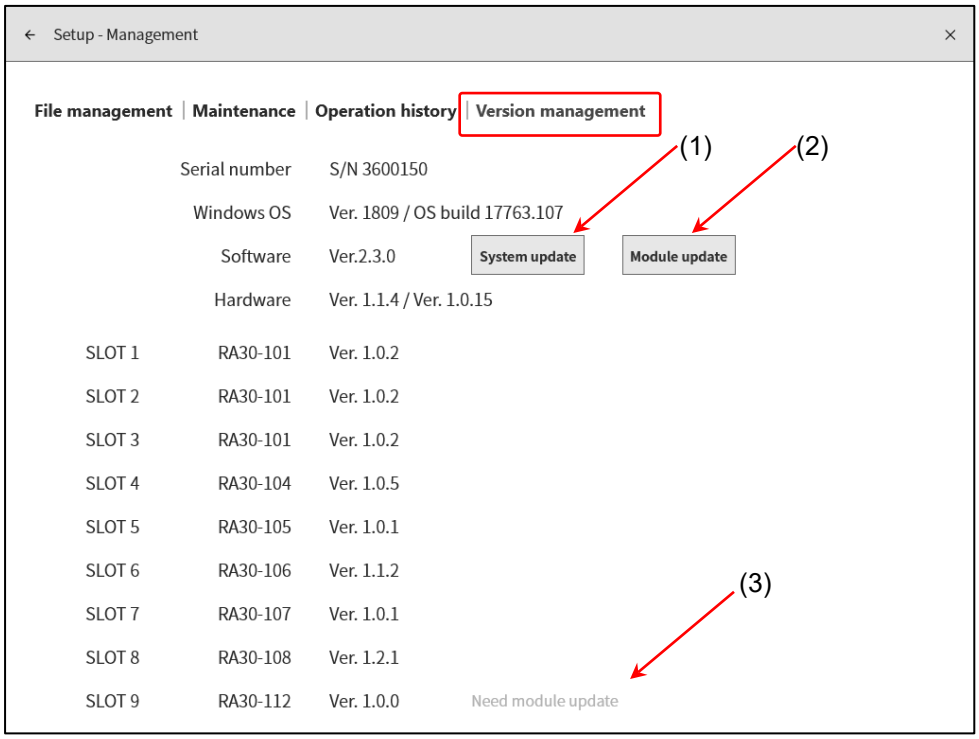
Tap【Operation history】 in [Setup - Management] to display the latest 100 items of operation history for this product.



No.	Date/Time	Operation
1	03/28/2025 03:44:11 PM	Recording STOP
2	03/28/2025 03:44:09 PM	Recording START
3	03/28/2025 03:44:01 PM	Pen Recording STOP
4	03/28/2025 03:43:59 PM	Pen Recording START
5	03/28/2025 03:43:48 PM	Pen Recording STOP
6	03/28/2025 03:43:42 PM	Pen Recording START
7	03/28/2025 03:43:17 PM	Recording STOP
8	03/28/2025 03:43:14 PM	Recording START
9	03/28/2025 03:31:33 PM	Power ON
10	03/28/2025 03:29:43 PM	Power OFF
11	03/28/2025 03:28:21 PM	Power ON
12	03/27/2025 06:47:33 PM	Power OFF
13	03/27/2025 02:28:26 PM	Power ON
14	03/27/2025 02:26:21 PM	Power OFF
15	03/27/2025 02:25:37 PM	Power ON
16	03/26/2025 05:30:42 PM	Power OFF

8.4.4. Version Management

Tap【Version management】 in [Setup - Management] to view or update the version of this product.



(1) System update: Use an SD card or USB memory to update the entire system (software, hardware, and modules).
Download the upgrade file and RA3100 update procedure from the A&D website.

Tips

❑ After performing a system update, it is recommended that you perform a file update on the recorded data.

(2) Module update: Update the module only.
The module is updated to the latest version supported by the software of the main unit.
This product can perform the update by itself. An upgrade file or other file is not required.

(3) Warning display: This is displayed when the versions of the main unit software and module do not match.

- ❑ Need module update:
  This is displayed when the version of the module is older than the main unit software. Click (2) to perform a module update.
- ❑ Need system update:
  This is displayed when the version of the main unit software is older than the module. Click (1) to perform a system update.

Note

❑ Do not turn the power of this product OFF during a system update or module update. Doing so may prevent it from operating normally.

9. Using Optional Modules

This chapter provides an overview of how to use optional modules.

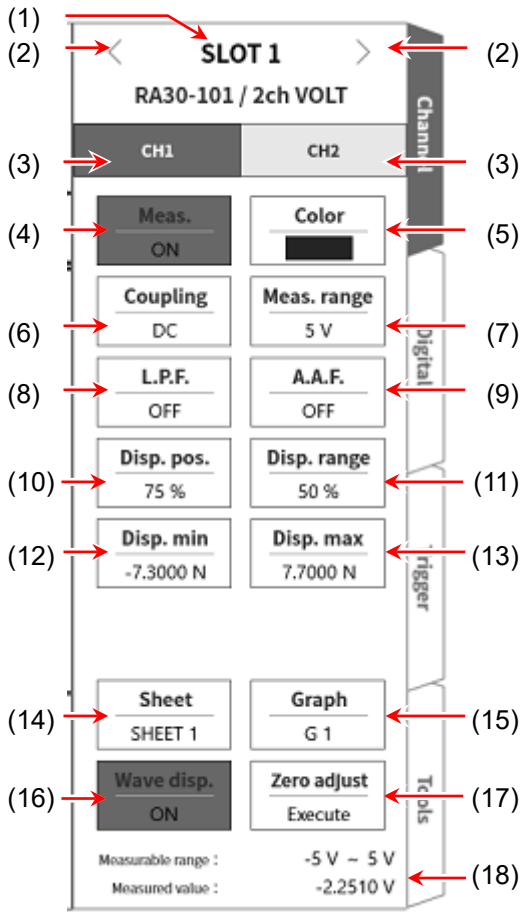
9.1. 2ch Voltage Module (RA30-101)

9.1.1. Overview

This two channel voltage input module samples a DC to 100 kHz signal at 16-bit 1 MS/s within the measurement range of ±100 mV to ±500 V and can perform A/D conversion. It includes an antialiasing filter and analog filter. It is insulated between each channel and between input and output.

9.1.2. Setting the Input Channel

<This section describes the setting switches and setting values of the RA3100 main unit. >



(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel:
Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Coupling: Switch the input signal coupling.

(7) Meas. range: Change the measurement range.

(8) L.P.F.: Change the low-pass filter.

(9) A.A.F.: Turns the anti-aliasing filter of the input channel on or off.

(10) Disp. pos.: Specify the display position.

(11) Disp. range: Specifies the display width in the amplitude direction of each graph.

(12) Disp. min: Set the display lower limit value of the bottom of the display range.

(13) Disp. max: Set the display upper limit value of the top of the display range.

(14) Sheet: Assign the channel to a sheet.

(15) Graph: Assign the channel to a graph.

(16) Waveform display area:
When enabled, the waveform is displayed. When disabled, the waveform is not displayed.

(17) Zero adjust: Cancels the input offset of the input channel. Execute zero cancellation to perform more accurate measurement.

(18) Available measurement range/measurement value:
Displays the current available measurement range and measurement value.

9.1.3. Measurement Setup

Check the slot number and channel, connect the signal to the corresponding input module, and enable the【Meas.】key to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.
Follow the procedure below to set the input channel.

Step 1. Set the input coupling with the【Coupling】key (6).

Coupling	Contents
DC	Enables measurement of the actual input signal, including the DC and AC component.
AC	Measures the AC component of the input signal only. Set this when you want to measure only the amplitude of an AC signal, as it cancels the DC offset of the signal.
GND	Connects the channel input to GND without connecting the input signal inside the channel. Enables the input GND level to be checked with waveform monitoring or printer recording.

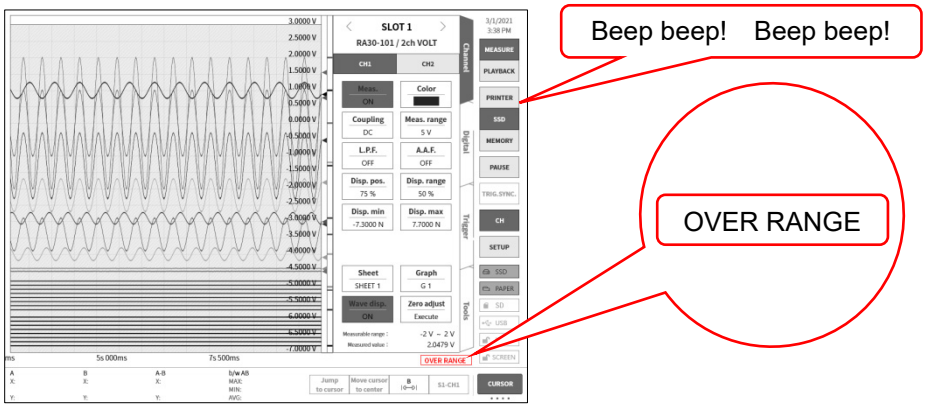
* When switching from DC coupling to AC coupling during measurement, it takes about 12 seconds for the DC component to completely disappear.

Step 2. Set Meas. range according to the target for measurement.
The input sensitivity can be changed with the【Meas. range】key (7) in the channel setup sub menu.
The value displayed for the measurement range (RANGE) indicates the input (measurement) maximum value and corresponds to 10 div on the waveform monitor. When the display position is 50%, ±RANGE (full measurement range) is displayed.
Tap the【Meas. range】key and turn the rotary knob to change the range. Turn the rotary knob counterclockwise to reduce the sensitivity and clockwise to increase the sensitivity.
The following 12 measurement ranges are available.

500 V	200 V	100 V	50 V	20 V	10 V	5 V	2 V	1 V	500 mV	200 mV	100 mV

Tips

❑ When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



Step 3. Set the input filter.

Set the low-pass filter with the【L.P.F.】key (8).

The low-pass filter of this module is a gently sloping attenuation filter that prioritizes the waveform. Set a cutoff frequency about 10 times the effective frequency as a signal to remove the unnecessary high frequency component and noise component.

OFF	3 kHz	300 Hz	30 Hz	3 Hz

Set the antialiasing filter setting with the【A.A.F.】key (9).

A steeply sloping attenuation low-pass filter. Enable this filter to automatically set the cutoff frequency linked with the sampling speed so that aliasing does not occur in the measurement data due to the sampling. This is particularly effective for FFT analysis. The L.P.F. setting is disabled because L.P.F. is used internally.

Step 4. Set the display range and display position.

See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".

Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor

Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 5. Set the display minimum and display maximum.

See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".

Disp. max: Set the display upper limit value of the top of the display range.

Disp. min: Set the display lower limit value of the bottom of the display range.

Step 6. Execute zero adjust.

In order to perform measurement with fewer errors, tap the【(17) Zero adjust】key in the channel setup sub menu to perform zero adjustment after the warmup time elapses or after the measurement range, filter, or input coupling has been changed.

Tips

❑ This function is for canceling internal offset and drift, and does not cancel the offset of the input signal.

9.1.4. Reference Materials

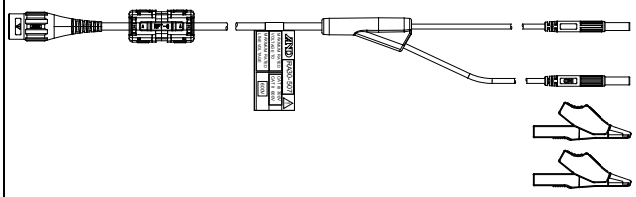
⚠CAUTION

- ❑ Ensure that the voltage between each input and the chassis (GND) and between each channel does not exceed 300 V(DC+ACpeak) . Damage may be caused if the voltage is exceeded.

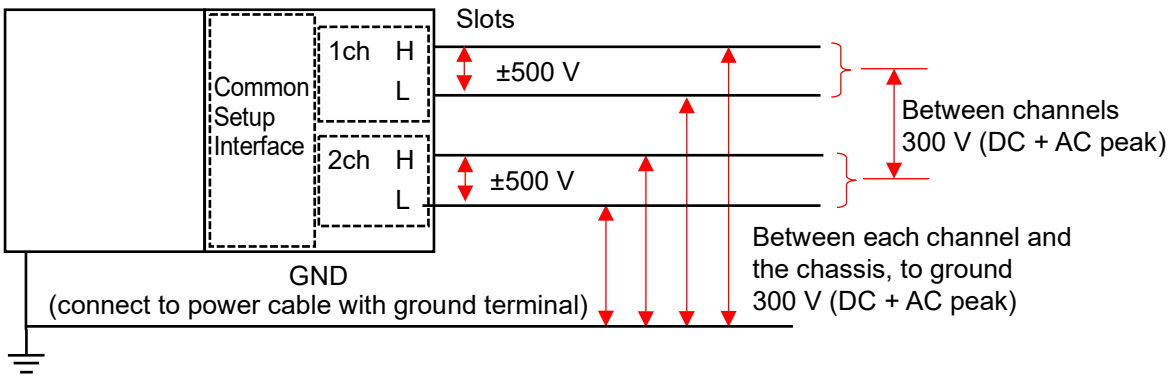
1 Input cable

The input connectors for CH1 and CH2 are insulated BNC connectors. Do not connect metallic BNC plugs, as they may damage the connectors or cause connection problems.
Use the insulated BNC cable indicated below (RA30-507) as the signal input cables.

Recommended cables

Name (type)	Shape/characteristics	
Insulated BNC cable (safety alligator clip) RA30-507		Insulated BNC ⇕ Safety alligator clip Red + Black – Length 1.5 m

2 Maximum rated voltage to ground



9.2. 4ch Voltage Module (RA30-102)

9.2.1. Overview

This four channel voltage input module samples a DC to 100 kHz signal at 16-bit 1 MS/s within the measurement range of ±1 V to ±200 V and can perform A/D conversion. It includes an analog filter for waveform observation. It is insulated between each channel and between input and output.

9.2.2. Setting the Input Channel

<This section describes the setting switches and setting values of the RA3100 main unit. >

(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel:
Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Coupling: Switch the input signal coupling.

(7) Meas. range: Change the measurement range.

(8) L.P.F.: Change the low-pass filter.

(9) Disp. pos.: Specify the display position.

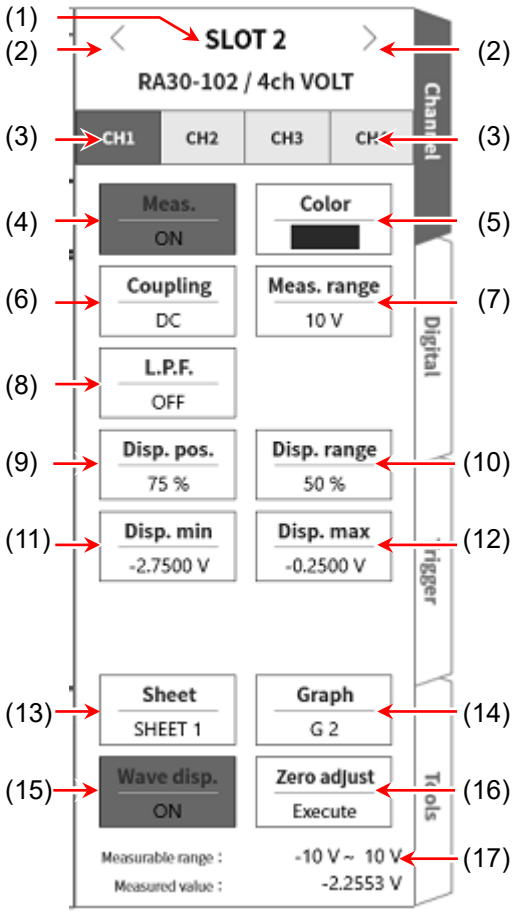
(10) Disp. range: Specifies the display width in the amplitude direction of each graph.

(11) Disp. min: Set the display lower limit value of the bottom of the display range.

(12) Disp. max: Set the display upper limit value of the top of the display range.

(13) Sheet: Assign the channel to a sheet.

(14) Graph: Assign the channel to a graph.



(15) Waveform display:
When enabled, the waveform is displayed in the waveform monitor. When disabled, the waveform is not displayed.

(16) Zero adjust: Cancels the input offset of the input channel. Execute zero cancellation to perform more accurate measurement.

(17) Available measurement range/measurement value:
Displays the current available measurement range and measurement value.

9.2.3. Measurement Setup

Check the slot number and channel, connect the signal to the corresponding input module, and enable 【Meas.】 to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.
Follow the procedure below to set the input channel.

Step 1. Set the input coupling in with the 【Coupling】 key (6).

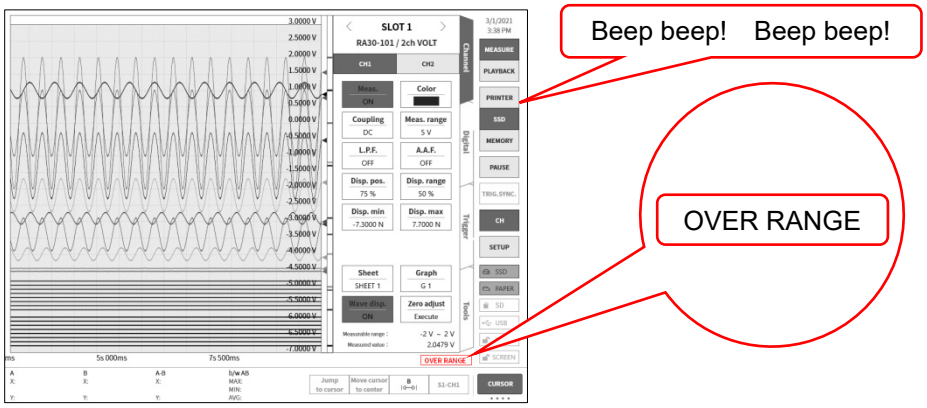
Coupling	Contents
DC	Enables measurement of the actual input signal, including the DC and AC component. Set DC coupling when performing measurement.
GND	Connects the channel input to GND without connecting the input signal inside the channel. Enables the input GND level to be checked with waveform monitoring or printer recording.

Step 2. Set Meas. range according to the target for measurement.
The input sensitivity can be changed with the 【Meas. range】 key (7) in the channel setup sub menu. The value displayed for the measurement range (RANGE) indicates the input (measurement) maximum value and corresponds to 10 div on the waveform monitor. When the display position is 50%, ±RANGE (full measurement range) is displayed.
Tap the 【Meas. range】 key and turn the rotary knob to change the range. Turn the rotary knob counterclockwise to reduce the sensitivity and clockwise to increase the sensitivity. The following 8 measurement ranges are available.

200 V	100 V	50 V	20 V	10 V	5 V	2 V	1 V

Tips

- When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



Step 3. Set the input filter. Set the low-pass filter with the 【L.P.F.】 key (8).
The low-pass filter of this module is a gently sloping attenuation filter that prioritizes the waveform. Set a cutoff frequency about 10 times the effective frequency as a signal to remove the unnecessary high frequency component and noise component.

OFF	3 kHz	300 Hz	30 Hz	3 Hz

Step 4. Set the display range and display position.
See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".
Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor
Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 5. Set the display minimum and display maximum.
See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".
Disp. max: Set the display upper limit value of the top of the display range.
Disp. min: Set the display lower limit value of the bottom of the display range.

Step 6. Execute zero adjust.
In order to perform measurement with fewer errors, tap the【(17) Zero adjust】key in the channel setup sub menu to perform zero adjustment after the warmup time elapses or after the measurement range, filter, or input coupling has been changed.

Tips

❑ This function is for canceling internal offset and drift, and does not cancel the offset of the input signal.

9.2.4. Reference Materials

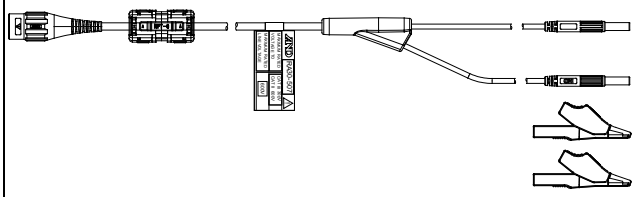
⚠CAUTION

- ❑ Ensure that the voltage between each input and the chassis (GND) and between each channel does not exceed 300 V(DC+ACpeak). Damage may be caused if the voltage is exceeded.

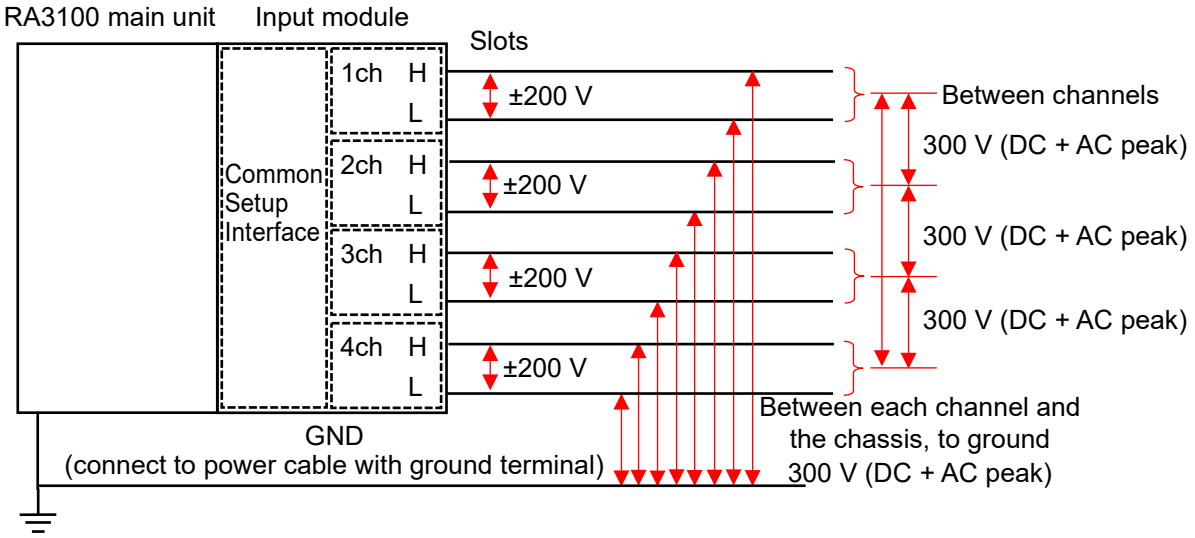
1 Input cable

The input connectors for CH1 to CH4 are insulated BNC connectors. Do not connect metallic BNC plugs, as they may damage the connectors or cause connection problems.
Use the insulated BNC cable indicated below (RA30-507) as the signal input cables.

Recommended cables

Name (type)	Shape/characteristics	
Insulated BNC cable (safety alligator clip) RA30-507		Insulated BNC ⇕ Safety alligator clip Red + Black – Length 1.5 m

2 Maximum rated voltage to ground



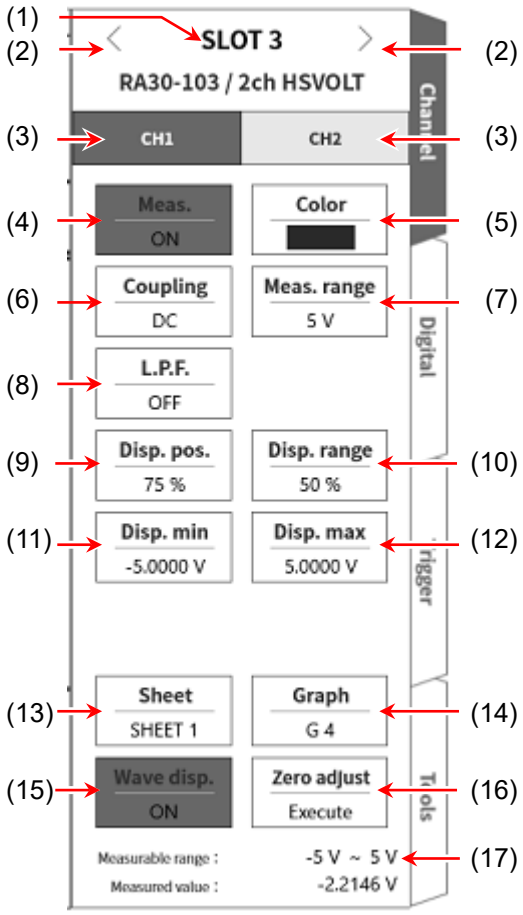
9.3. 2ch High Speed Voltage Module (RA30-103)

9.3.1. Overview

This two channel high voltage input module samples a DC to 5 MHz signal at 16-bit 20 MS/s within the measurement range of ±100 mV to ±500 V and can perform A/D conversion. It includes an analog filter for waveform observation. It is insulated between each channel and between input and output.

9.3.2. Setting the Input Channel

<This section describes the setting switches and setting values of the RA3100 main unit. >



(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel:
Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Coupling: Switch the input signal coupling.

(7) Meas. range: Change the measurement range.

(8) L.P.F.: Change the low-pass filter.

(9) Disp. pos.: Specify the display position.

(10) Disp. range: Specifies the display width in the amplitude direction of each graph.

(11) Disp. min: Set the display lower limit value of the bottom of the display range.

(12) Disp. max: Set the display upper limit value of the top of the display range.

(13) Sheet: Assign the channel to a sheet.

(14) Graph: Assign the channel to a graph.

(15) Waveform display:
When enabled, the waveform is displayed in the waveform monitor. When disabled, the waveform is not displayed.

(16) Zero adjust: Cancels the input offset of the input channel. Execute zero cancellation to perform more accurate measurement.

(17) Available measurement range/measurement value:
Displays the current available measurement range and measurement value.

9.3.3. Measurement Setup

Check the slot number and channel, connect the signal to the corresponding input module, and enable 【Meas.】 to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.

Follow the procedure below to set the input channel.

Step 1. Set the input coupling in with the 【Coupling】 key (6).

Coupling	Contents
DC	Enables measurement of the actual input signal, including the DC and AC component.
AC	Measures the AC component of the input signal only. Set this when you want to measure only the amplitude of an AC signal, as it cancels the DC offset of the signal.
GND	Connects the channel input to GND without connecting the input signal inside the channel. Enables the input GND level to be checked with waveform monitoring or printer recording.

Step 2. Set Meas. range according to the target for measurement.

The input sensitivity can be changed with the 【Meas. range】 key (7) in the channel setup sub menu.

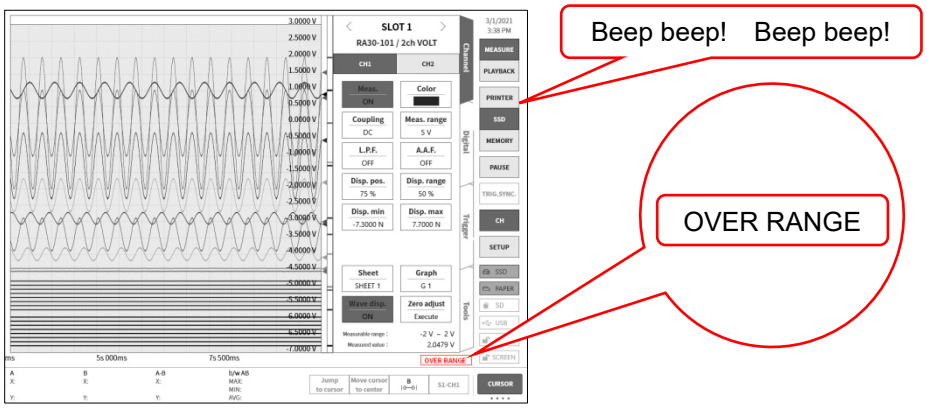
The value displayed for the measurement range (RANGE) indicates the input (measurement) maximum value and corresponds to 10 div on the waveform monitor. When the display position is 50%, ±RANGE (full measurement range) is displayed.

Tap the 【Meas. range】 key and turn the rotary knob to change the range. Turn the rotary knob counterclockwise to reduce the sensitivity and clockwise to increase the sensitivity. The following 12 measurement ranges are available.

500 V	200 V	100 V	50 V	20 V	10 V	5 V	2 V	1 V	500 mV	200 mV	100 mV

Tips

❑ When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



Step 3. Set the input filter. Set the low-pass filter with the【L.P.F.】key (8).
The low-pass filter of this module is a gently sloping attenuation filter that prioritizes the waveform. Set a cutoff frequency about 10 times the effective frequency as a signal to remove the unnecessary high frequency component and noise component.

OFF	500 kHz	50 kHz	5 Hz

Step 4. Set the display range and display position.
See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".
Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor
Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 5. Set the display minimum and display maximum.
See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".
Disp. max: Set the display upper limit value of the top of the display range.
Disp. min: Set the display lower limit value of the bottom of the display range.

Step 6. Execute zero adjust.
In order to perform measurement with fewer errors, tap the【(17) Zero adjust】key in the channel setup sub menu to perform zero adjustment after the warmup time elapses or after the measurement range, filter, or input coupling has been changed.

Tips

❑ This function is for canceling internal offset and drift, and does not cancel the offset of the input signal.

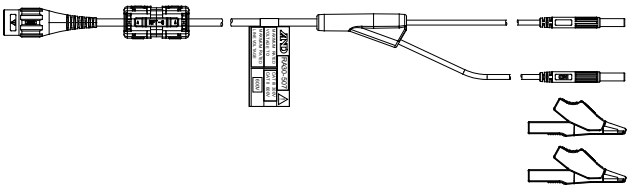
9.3.4. Reference Materials

1 Input cable

The input connectors for CH1 and CH2 are insulated BNC connectors. Do not connect metallic BNC plugs, as they may damage the connectors or cause connection problems.

Use the insulated BNC cable indicated below (RA30-507) as the signal input cables.

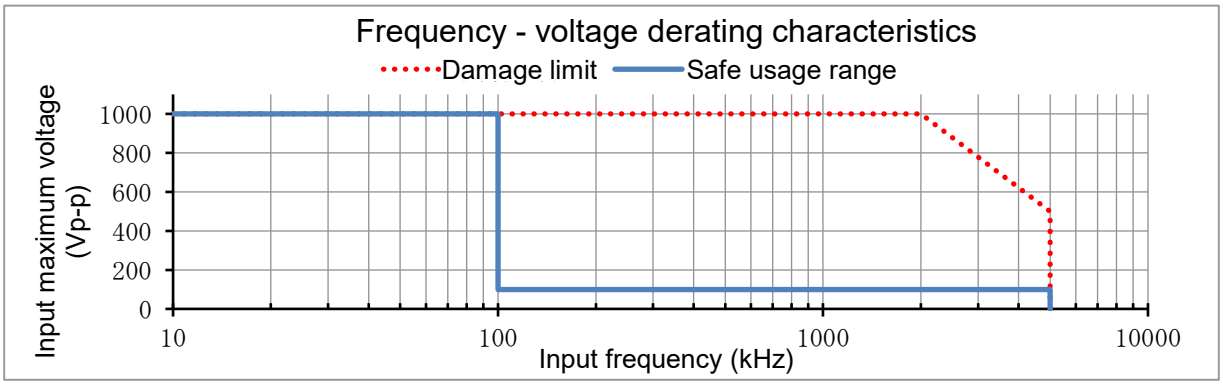
Recommended cables

Name (type)	Shape/characteristics	
Insulated BNC cable (safety alligator clip) RA30-507		Insulated BNC ↕ Safety alligator clip Red + Black – Length 1.5 m

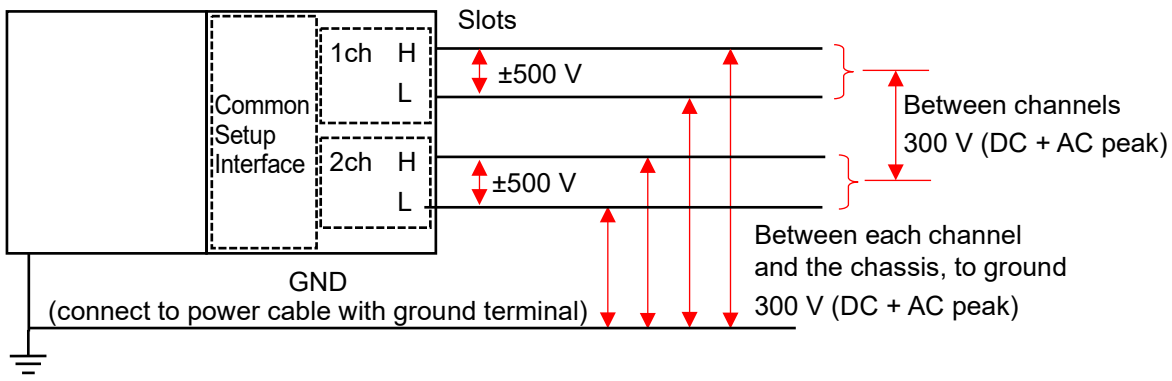
2 Input frequency and input voltage derating characteristics

A maximum of 1000 Vp-p can be input for the voltage and 5 MHz for the frequency, but there are restrictions on the relationship between the voltage and frequency. These set limits to avoid damage to devices and enable safe measurement.

Increased device heat and input voltage may damage the signal source and device.



3 Maximum rated voltage to ground



⚠CAUTION

- Use this product within the safe usage range.
  With 1000 Vp-p 100 kHz, note that the input current will be approximately 21 mA, which will place a load on the signal source.
- Ensure that the voltage between each input and the chassis (GND) and between each channel does not exceed 300 V (DC+ACpeak). Damage may be caused if the voltage is exceeded.

9.4. 2ch AC Strain Module (RA30-104)

9.4.1. Overview

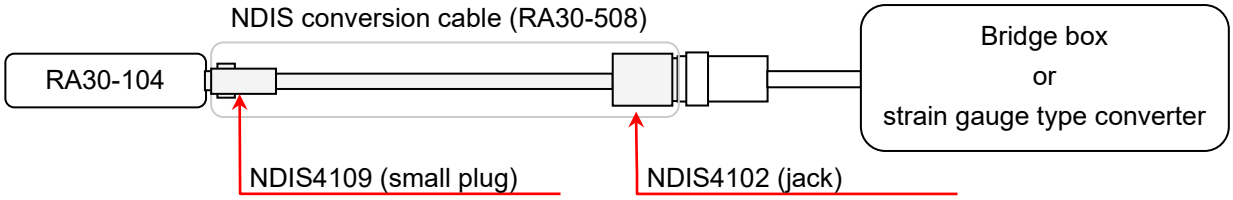
This two channel strain input module samples a strain signal up to 2 kHz DC at 16-bit 100 kS/s within the measurement range of 500(μm/m=με) to 80000 (μm/m=με) and performs A/D conversion. It is used by connecting the output of a strain gauge type converter or strain gauge. It includes an auto balance and simple bridge check function. It is insulated between each channel and between input and output.

Tips

- ❑ When using this module, the Remote Control Module (RA30-112) must be installed to slot 9 of the RA3100 main unit.

9.4.2. Connection Method

The bridge box and strain gauge type converter are connected using the optional NDIS conversion cable (RA30-508).



Tips

- ❑ The nonlinearity, balance adjustment range and balance adjustment precision of this module are defined by the end of the NDIS conversion cable.

Note

- ❑ Hold the connector when inserting or removing the NDIS conversion cable and avoid applying excessive tension on the cable side (by folding, pulling, or twisting the cable).
  Excessive tension may cause the cable to break or be damaged.

9.4.3. Setting the Input Channel

<This section describes the setting switches and setting values of the RA3100 main unit. >

Channel setup sub menu 1

(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel:
Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Channel setup sub menu 2:
Tap this box to display <Channel setup sub menu 2>.

(7) Disp. pos.: Specify the display position.

(8) Disp. range: Specify the display width in the amplitude direction of each graph.

(9) Disp. min: Set the display lower limit value of the bottom of the display range.

(10) Disp. max: Set the display upper limit value of the top of the display range.

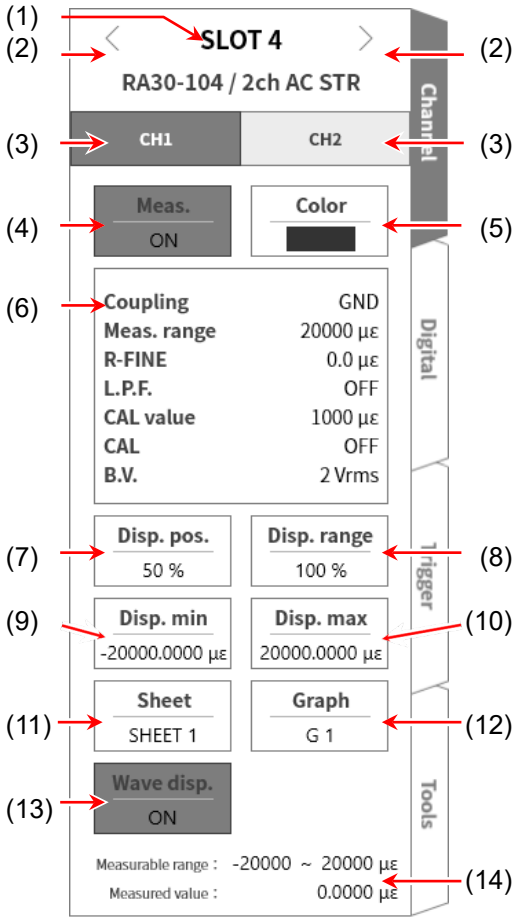
(11) Sheet: Assign the channel to a sheet.

(12) Graph: Assign the channel to a graph.

(13) Wave disp.: When enabled, the waveform is displayed in the waveform monitor. When disabled, the waveform is not displayed.

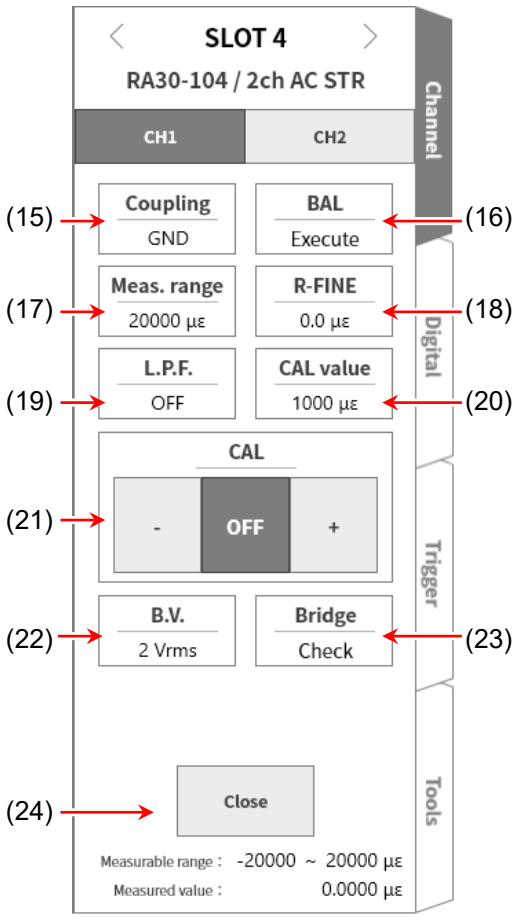
(14) Measurable range/Measured value:
Displays the current available measurement range and measurement value.

<Channel setup sub menu 1>



Channel setup sub menu 2

<Channel setup sub menu 2>



(15) Coupling: Switch the input signal coupling to STRAIN or GND.

(16) BAL: Imbalance in the strain gauge bridge. Also enables you to cancel the imbalanced part. When balancing is performed, [R-FINE] is reset to zero.

(17) Meas. range: Change the measurement range.

(18) R-FINE: Perform balance fine adjustment.

(19) L.P.F.: Change the low-pass filter.

(20) CAL value: Change the setting value of the internal calibrator.
The setting range is 1 to 9999 (μm/m=με).

(21) CAL: Switch the output of the internal calibrator to +, OFF, or -.

+: Outputs the internal calibrator setting value set for the CAL value as a positive value.

−: Outputs the internal calibrator setting value set for the CAL value as a negative value.

OFF: Disables the output of the internal calibrator. (The setting value is still displayed but is not output.)

Tips

- ❑ Disable this after use as a calibration value (when performing measurement).
- ❑ The internal calibrator setting value is added to the input signal.

(22) B.V.: Switch the bridge power voltage.

(23) Bridge: Perform a simple bridge check. If a bridge error is detected, an error message is displayed. (The message "Bridge is in error." is displayed if an error is detected.) If this error message is displayed, check the connection between the bridge and the sensor.

(24) Close: When you tap the Close key, <Channel setup sub menu 2> is closed and <Channel setup sub menu 1> is displayed.

9.4.4. Measurement Setup

Check the slot number and channel, connect the signal to the corresponding input module, and enable the【Meas.】key to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.
Follow the example below to set the input channel.

Step 1. Configure synchronization settings for the chassis bridge power carrier.
Set the OSC of the Remote Control Module (RA30-112) to [Internal].

Tips

❑ For details, see "9.10. Remote Control Module (RA30-112)".
However, if you are concerned about the impact of the beat when using multiple RA3100 main units, follow the procedure in "Chassis Bridge Power Carrier Synchronization" in "9.4.5. Reference Materials" to synchronize the chassis.

Step 2. Set coupling.
Set the coupling using (15)【Coupling】in channel setup sub menu 2.

Coupling	Description
STRAIN	Select this when measuring strain.
GND	Select this when checking the zero level.

Step 3. Set the bridge power.
Set the bridge power using (22)【B.V.】in channel setup sub menu 2.

Bridge power	Description
2 Vrms	Set a bridge power voltage suitable for the strain gauge or strain gauge type converter to connect.
0.5 Vrms	

Tips

❑ The bridge voltage is constantly output.
When measuring particularly large strain, set the bridge voltage to 0.5 Vrms.

Step 4. Perform a simple bridge check.
Perform the simple bridge check using (23)【Bridge Check】in channel setup sub menu 2.
Perform a simple bridge check to check for problems in the connection with the strain gauge or strain gauge type converter. If an error message is displayed, check the connection between the bridge and the sensor.

Tips

❑ A simple bridge check enables bridge edge short circuits and some bridge edge and cable open circuits to be detected. However, it does not enable the location of the short circuit or open circuit to be identified.

Step 5. Set the measurement range.

Set the measurement range using (17)【Meas. range】in channel setup sub menu 2.

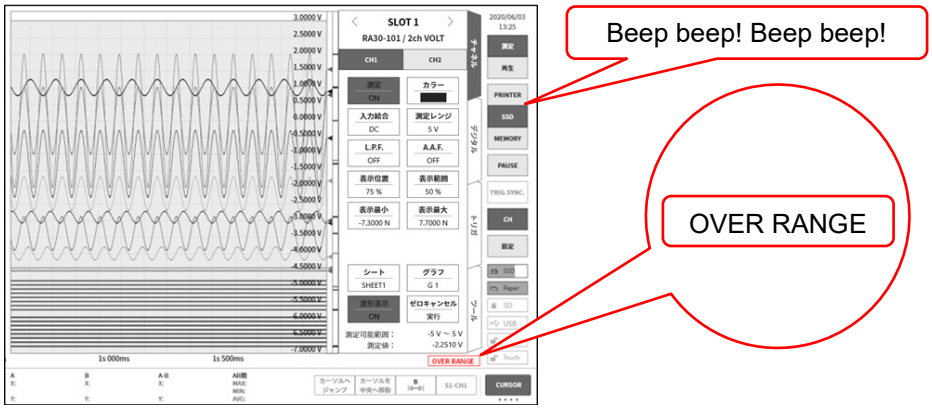
Set a measurement range suitable for the expected input strain size.

The following six ranges are available for each bridge power.

Bridge power	Measurement range (μm/m=με)					
2 Vrms	500	1000	2000	5000	10000	20000
0.5 Vrms	2000	4000	8000	20000	40000	80000

Tips

- When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



Step 6. Set the low-pass filter.

Set the low pass filter using (19)【L.P.F.】in channel setup sub menu 2.

Set a low pass filter to cut out unnecessary frequency components and noise as required. The high frequency components above the set value and noise are removed. Note that setting a lower frequency value causes a delayed response, so this function should be disabled unless it is required.

OFF	300 Hz	100 Hz	30 Hz	10 Hz

Step 7. Set the display range and display position.

See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".

Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor

Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 8. Set the display minimum and display maximum.

See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".

Disp. max: Set the display upper limit value of the top of the display range.

Disp. min: Set the display lower limit value of the bottom of the display range.

Step 9. Execute initial balancing. Execute initial bridge balancing using (16)【BAL】in channel setup sub menu 2. Execute initial bridge balancing when there is no load on the bridge.
If zero cannot be found due to noise or another reason, perform fine adjustment using (18)【R-FINE】in <channel setup sub menu 2>.

Tips

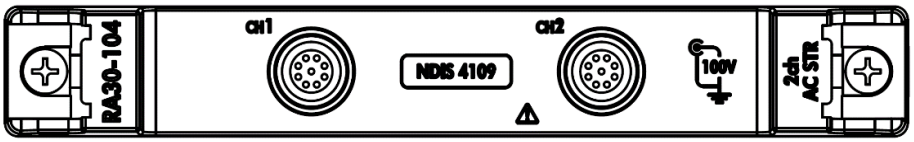
- The imbalance component of the strain gauge bridge includes both resistance imbalance and capacity imbalance, but only the resistance imbalance is canceled by executing【BAL】. The capacity imbalance is automatically canceled on a constant basis.
- If zero deviates when there is no load on the bridge due to environmental changes, execute initial balancing again.

9.4.5. Reference Materials

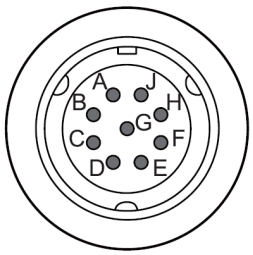
⚠CAUTION

- Do not connect the input terminal to a device other than a bridge box or a strain gauge sensor connected using a gauge type converter. Do not input voltage or current. Doing so may lead to failure.
- Ensure that the voltage between each input and the chassis (GND) and between each channel does not exceed 100 V (DC + AC peak). Damage may be caused if the voltage is exceeded.
- When measuring a location with electric potential, do not touch the metallic parts of the input wire, as electric potential occurs in the cable itself. Doing so may cause electrocution.

1 Front panel

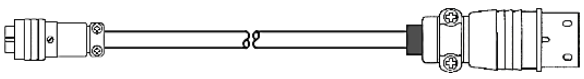


Input connector (NDIS4109 receptacle)

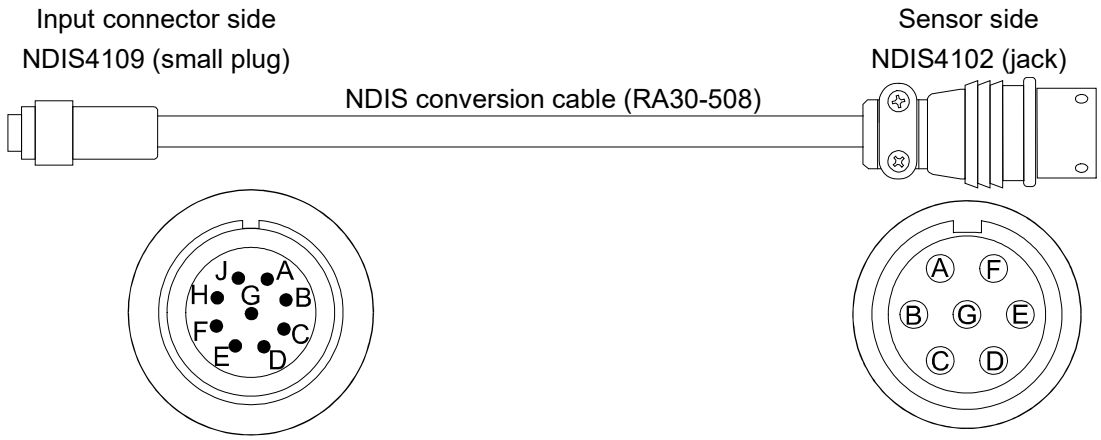


Pin layout	
Pin number	Function
A	Bridge power +
B	Input –
C	Bridge power -
D	Input +
E	Common
F	Not connected
G	
H	
J	

2 Conversion cable
The input connectors for CH1 and CH2 are NDIS4109 connectors.
Use the NDIS conversion cable (RA30-508) indicated below.

Name (type)	Shape/characteristics	
NDIS conversion cable (RA30-508)		NDIS4109 ↕ NDIS4102 Length 0.6 m

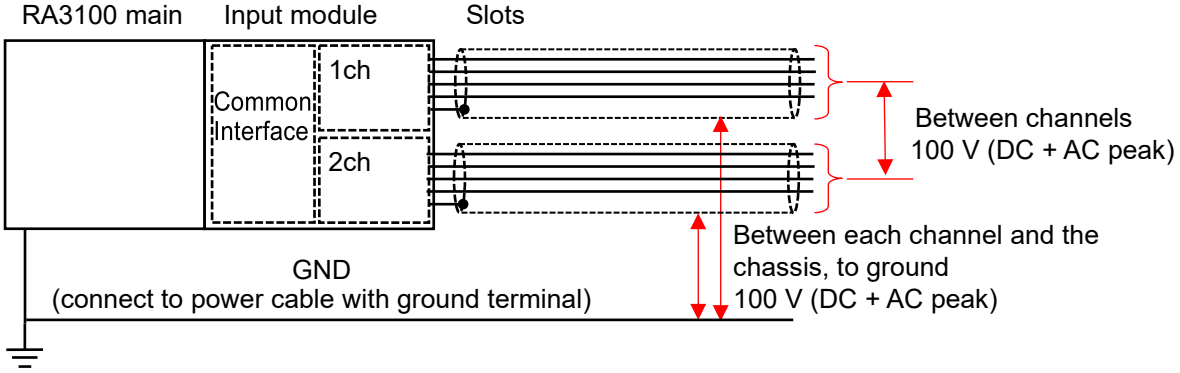
RA30-104



Input connector side pin layout	
Pin number	Function
A	Bridge power +
B	Input –
C	Bridge power –
D	Input +
E	Shield
F	Not connected
G	
H	
J	

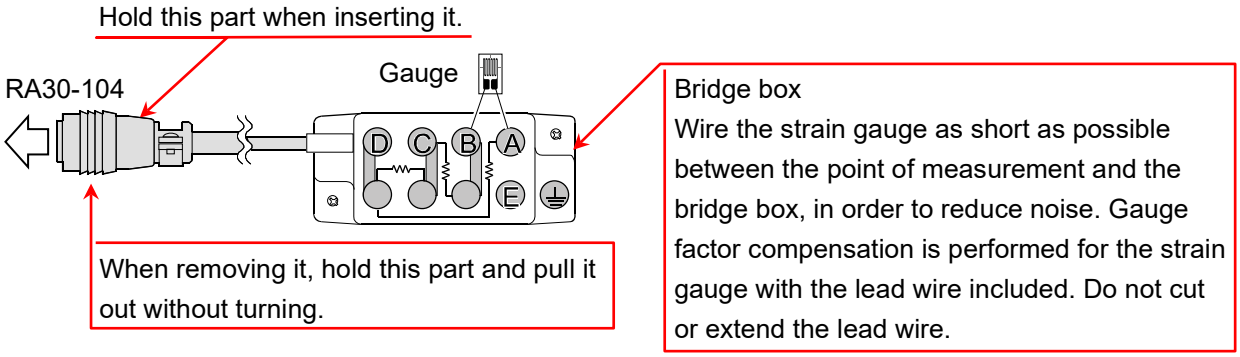
Sensor side pin layout	
Pin number	Function
A	Bridge power +
B	Input –
C	Bridge power –
D	Input +
E	Shield
F	Not connected
G	

3 Maximum rated voltage to ground



4 With bridge box connection

An A&D bridge box is described in this example. The bridge box includes a terminal box, cables, and connectors. The terminal box has a terminal for connecting the strain gauge and three high-performance resistors. A strain gauge is connected to complete the bridge circuit, and a shorting bar is included to achieve various gauge connection methods.

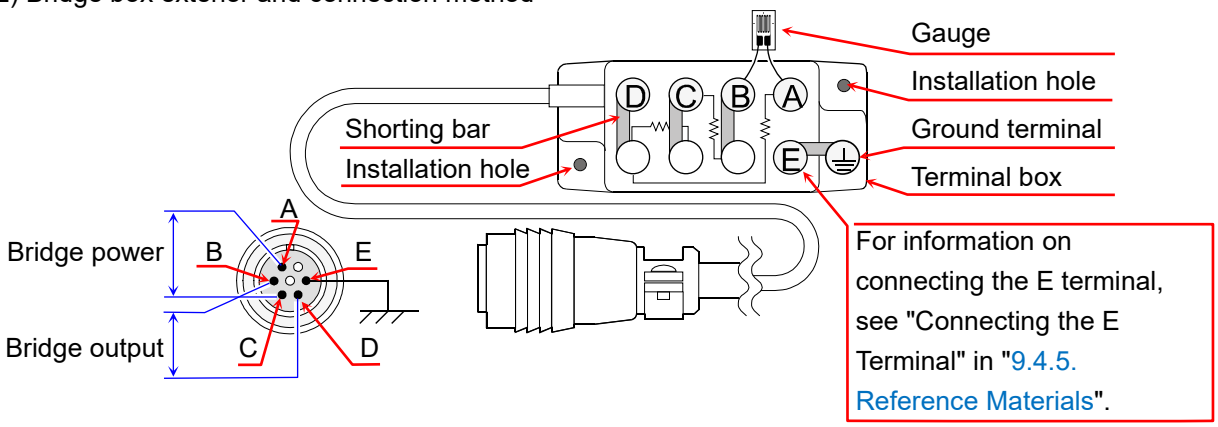


Bridge box exterior (single gauge method)

(1) Installation method

- ❑ Install the bridge box as near the measurement point as possible.
- ❑ To secure it in place, attach screws to the installation holes.
- ❑ Do not install it in locations with a high level of moisture, locations subject to sudden changes in temperature, or locations subject to strong electric fields or strong magnetic fields.
- ❑ When installation is complete, secure the connection cable so that it moves as little as possible.

(2) Bridge box exterior and connection method

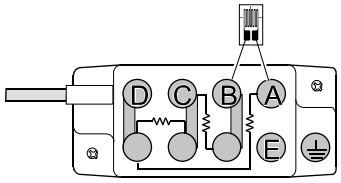


Example bridge box connection (single gauge method)

- ❑ Connector Wiring

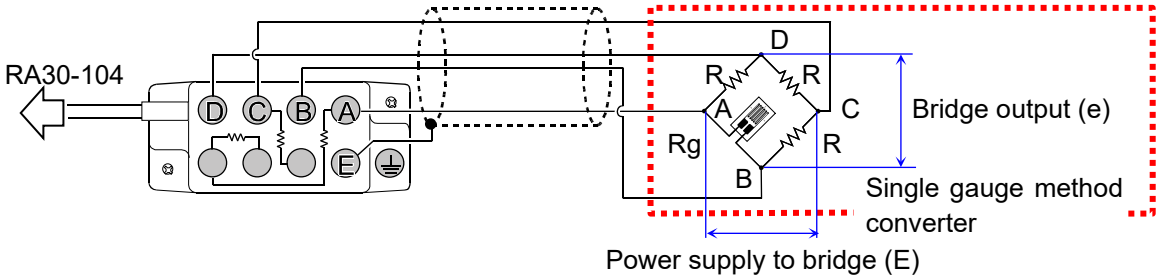
  When wiring the connectors, the A and C terminals supply bridge power and the B and D terminals are input to the RA30-104, as indicated in the figure above.
- ❑ Bridge Box Wiring

  For information on the main bridge circuit and main wiring method for strain measurement, see "Example Bridge Configuration with Strain Bridge" in "9.4.5. Reference Materials".



Example strain gauge connection (single gauge method)

When using a converter via a bridge box, see the figure below.
For information on connecting the E terminal, see "Connecting the E Terminal" in "9.4.5. Reference Materials".



Example converter connection (single gauge method)

❑ Impact of Cable Length

If the cable connecting the bridge box and RA30-104 is too long, the cable conductor resistance will cause the bridge voltage to decrease and cause a difference between the strain value and the value measured with this module. Refer to "Correcting the Measured Strain Value (3) When the cable distance between the bridge box and converter is too long" in "9.4.5. Reference Materials" to perform correction with physical conversion, as required.

❑ Precautions Regarding Lead Wire

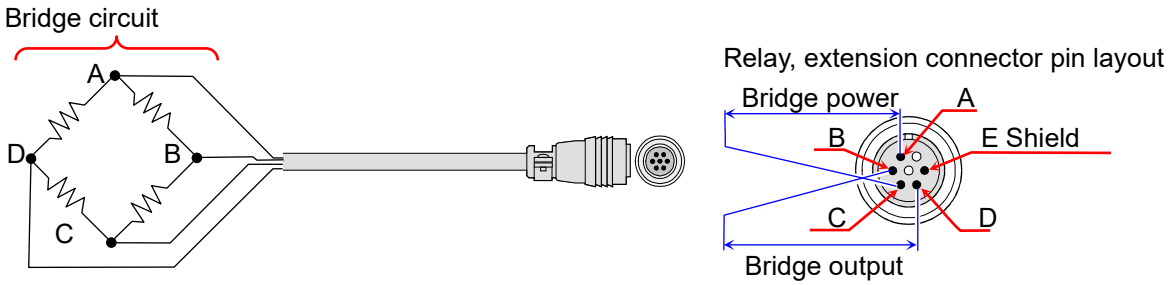
If the lead wire from the strain gauge to the bridge box is too long, the gauge factor will seem to drop and the output linearity will be adversely affected, even if initial balancing is performed. Ensure that the lead wire from the strain gauge is as short as possible (2 m or shorter). Use a strain gauge that includes a lead wire if necessary. The gauge factor of a gauge that includes a lead wire is calibrated with the lead wire, so do not cut or extend the lead wire.

5 Connecting a Converter

Many strain gauge type converters measure by receiving the physical quantity to measure with an elastic body and converting the strain that occurs into an electric quantity. The elastic body is also referred to as the sensor. The sensor is made of a material with a high proportional limit and low creep and hysteresis. The sensor is connected to the strain gauge to form the bridge circuit. Temperature compensation and anti-humidity treatment are performed. For details on converters, see the technical materials of each manufacturer.

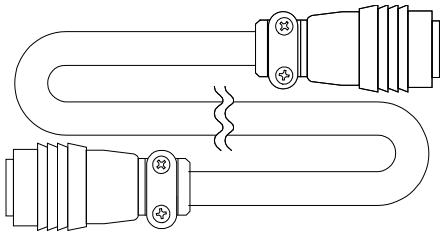
(1) Installation method

When using converters with this product, perform wiring as indicated in the figure.

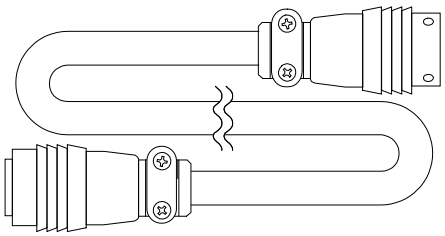


Connection with converter

A&D provides optional relay cables and extension cables for directly connecting converters with a dynamic strain measurement device. A&D relay cables and extension cables are manufactured based on the input connector standards for strain measurement devices issued by The Japanese Society for Non-Destructive Inspection. When the connection cable for a converter has no connector and is a discrete wire, it can also be connected using a bridge box. See "Connection when Using a Bridge Box" in "9.4.5. Reference Materials".



Relay cable (plug⇔plug)



Extension cable (plug⇔jack)

Tips

- Secure the converter as indicated in the instruction manual provided by the manufacturer, as an unstable converter may cause malfunction or noise.
- A converter and connector are normally humidity-proof but ensure that they are insulated and not exposed to water or rain.
- If the distance of the cable from this product to the converter is too long, the bridge voltage will drop and measurement value compensation will be required because of the difference between the measurement value and the voltage output from the bridge. For information on the compensation method, see "Measurement Value Compensation".
- Use a converter with the E terminal of this product and the other A, B, C, and D terminals not connected.
- Do not place the converter and connection cable within a strong electric field or magnetic field.
- Impact of Cable Length
  If the cable connecting the converter and RA30-104 is too long, the cable conductor resistance will cause the bridge voltage to decrease and result in a difference between the strain value and the value measured with this module. Refer to "Correcting the Measured Strain Value (3) When the Cable Distance between the Bridge Box and Converter is Too Long" in "9.4.5. Reference Materials" to perform correction with physical conversion, as required.

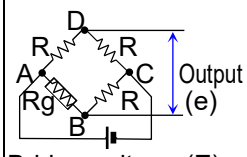
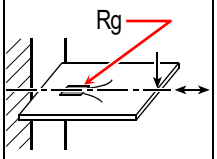
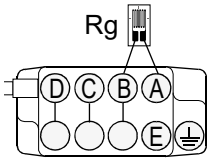
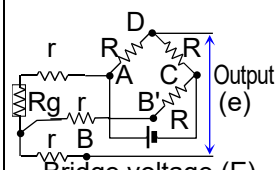
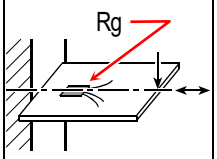
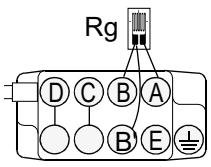
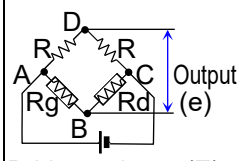
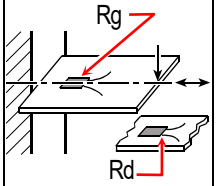
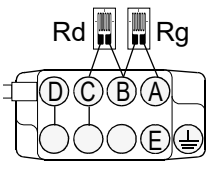
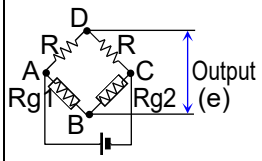
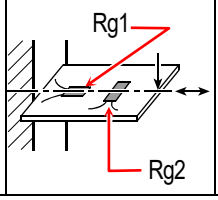
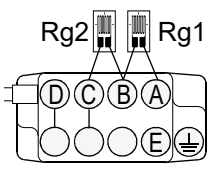
6 Example Bridge Configuration with Strain Bridge

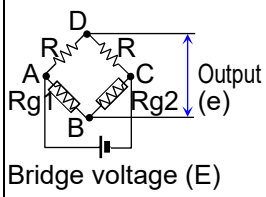
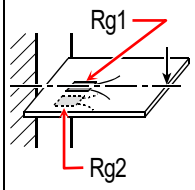
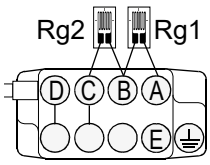
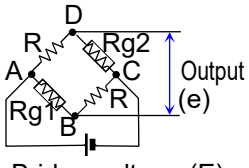
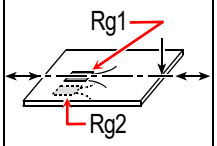
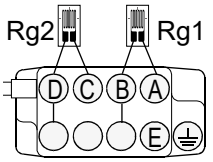
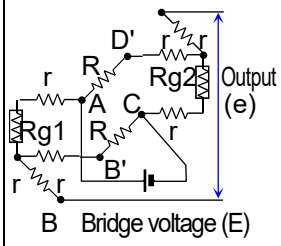
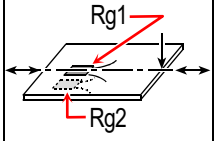
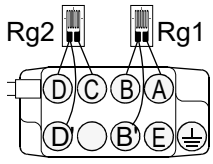
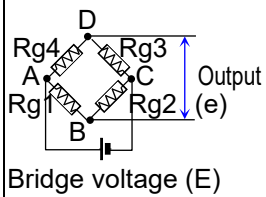
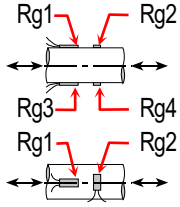
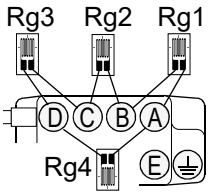
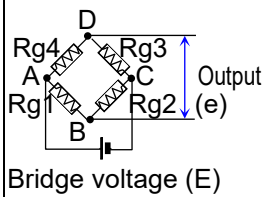
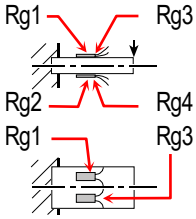
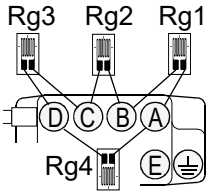
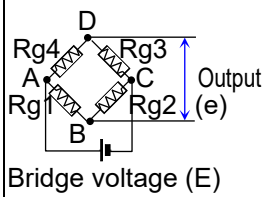
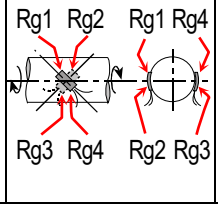
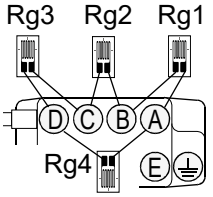
❑ When incorporating a strain gauge in the four edges of a Wheatstone bridge circuit, combinations of 1, 2, and 4 gauges can be used. This enables different combinations where the gauges are separated by the strain received by the strain gauge, such as same sign same value, different sign same value, and different sign constant proportion value. The properties of the bridge can also be effectively utilized to implement measures for temperature compensation, error elimination, and output boosting.
The example bridge configurations here use standard strain gauges. The symbols used are indicated below.

R : Fixed resistance value (Ω)
Rg : Strain gauge resistance value (Ω)
Rd : Dummy gauge resistance value (Ω)
r : Lead wire resistance value (Ω)
e : Output voltage from bridge (V)
K : Gauge factor of strain gauge (2.00)
ε : Strain value (μm/m=με)
E : Bridge applied voltage (V)
ν : Poisson ratio of object to measure
N : Bridge output coefficient via gauge method

❑ For information on attaching strain gauges, the features of gauges, and measurement method with a bridge circuit, see the technical documentation of the strain gauge manufacturer and the "Strain Gauge Testing I", "Strain Gauge Testing II", and "Strain Gauge Testing III" documents issued by The Japanese Society for Non-Destructive Inspection.

❑ The bridge box wiring method below is using an A&D bridge box.

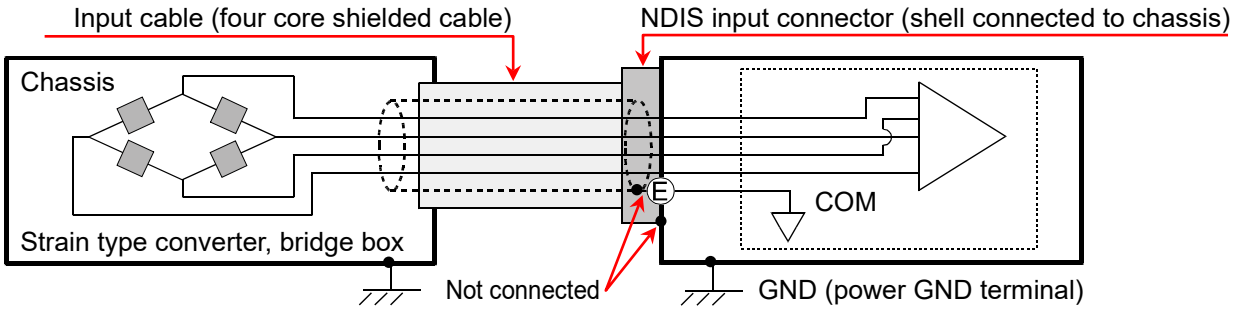
Circuit	Gauge method	Example	Bridge box wiring method	Applications/remarks
	Single gauge method			❑ Simple pulling, compressing, simple bending ❑ Few changes in surrounding temperature ❑ Bridge output coefficient N = 1 Strain value = measurement value / N
	Single gauge Three wire wiring method			❑ Simple pulling, compressing, simple bending ❑ Temperature compensation for strain gauge lead wire ❑ Bridge output coefficient N = 1 Strain value = measurement value / N
	One active/one dummy gauge method			❑ Simple pulling, compressing, simple bending ❑ Temperature compensation via dummy gauge ❑ Bridge output coefficient N = 1 Strain value = measurement value / N
	Double active gauge method			❑ Simple pulling, compressing, simple bending ❑ Temperature compensation ❑ Bridge output coefficient N = 1 + ν Strain value = measurement value / N

Circuit	Gauge method	Example	Bridge box wiring method	Applications/remarks
	Double active gauge method			❑ Bending strain detection ❑ Eliminate pulling or compressing strain ❑ Temperature compensation ❑ Bridge output coefficient N = 2 Strain value = measurement value / N
	Opposite side two active gauge method			❑ Detect pulling or compressing strain only ❑ Eliminate bending strain ❑ The impact of temperature changes is doubled ❑ Bridge output coefficient N = 2 Strain value = measurement value / N
	Opposite side two active gauge three wire wiring method			❑ Detect pulling or compressing strain only ❑ Eliminate bending strain ❑ The impact of temperature changes is doubled ❑ Temperature compensation for strain gauge lead wire ❑ Bridge output coefficient N = 2 Strain value = measurement value / N
	Four active gauge method			❑ Detect pulling or compressing strain only ❑ Eliminate bending strain ❑ Temperature compensation ❑ Bridge output coefficient N = 2 (1 + ν) Strain value = measurement value / N
	Four active gauge method			❑ Bending strain detection only ❑ Eliminate pulling or compressing strain ❑ Temperature compensation ❑ Bridge output coefficient N = 4 Strain value = measurement value / N
	Four active gauge method			❑ Twisting strain detection only ❑ Eliminate pulling, compressing, and bending strain ❑ Temperature compensation ❑ Bridge output coefficient N = 4 Strain value = measurement value / N

7 Connecting the E Terminal

The E terminal of this module is connected to the common terminal (COM) of the strain input insulated from the chassis.

The shell of the NDIS4109 input connector is connected to the chassis.



Tips

❑ When the chassis of the bridge box or strain gauge type converter has GND potential, not connecting the E terminal to the chassis of the bridge box or strain gauge type converter may improve stability and reduce noise.

8 Strain Measurement Value Compensation

(1) When the gauge factor differs

The gauge factor of this product is assumed to be 2.00.

Perform the following compensation calculation when a strain gauge with a gauge factor other than 2.00 is used.

$$\text{Strain value [μm/m=με]} = \frac{2.00}{K} \times \text{measurement value [μm/m=με]}$$

K: Gauge factor of strain gauge used

(2) When the gauge method differs

The measured strain value of this product is that with a gauge factor of 2.00 and the single gauge method.

When the double gauge method or four gauge method is used, compensation calculation is performed according to the formula in "Main gauge methods and measured strain values after compensation". For information on Wheatstone bridge circuits, see "Example Bridge Configuration with Strain Bridge" in "9.4.5. Reference Materials".

Main gauge methods and measured strain values after compensation

Main gauge method		Measured strain value = measured value / bridge output coefficient N
Double gauge method	One active/one dummy	Bridge output coefficient N = 1
	Two active	Bridge output coefficient N = 2, 1 + ν
	Opposite side two active	Bridge output coefficient N = 2
Four gauge method	Four active	Bridge output coefficient N = 4, 2 (1 + ν)
Converter	Four active	Bridge output coefficient N = 1*

* A converter normally uses the four gauge method, but output corresponds to the single gauge method.

(3) When the cable distance between the bridge box and converter is too long

If the cable connecting the bridge box, converter, and RA30-104 is too long, the cable conductor resistance will cause the bridge voltage to decrease and cause a difference between the strain value and the value measured with this module. Perform compensation using the physical quantity conversion function as required.

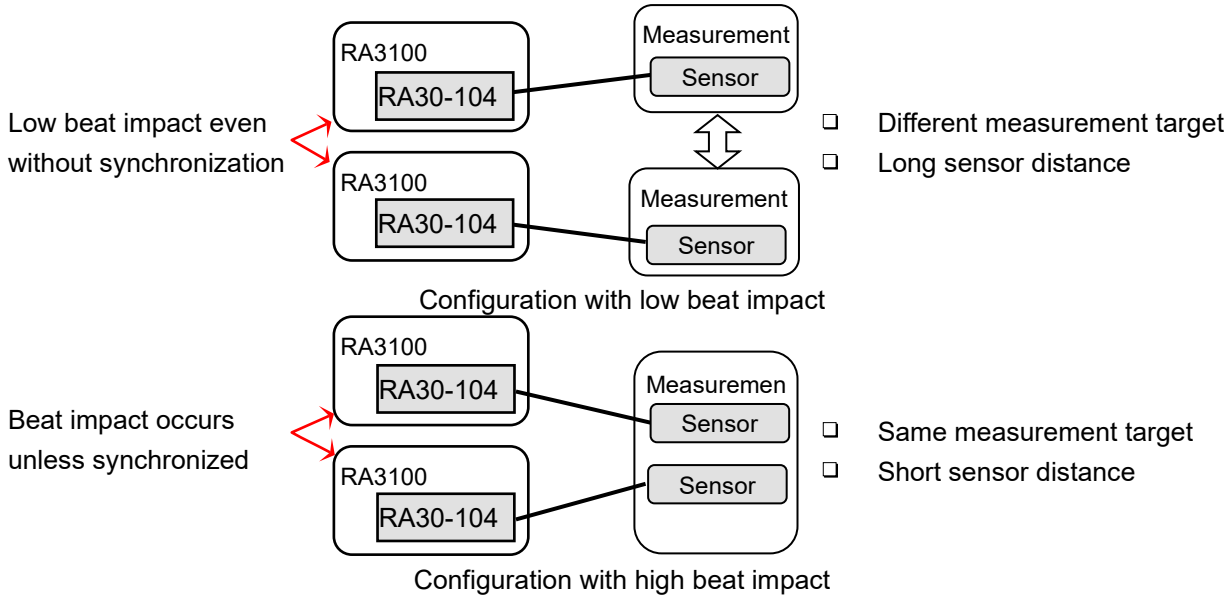
Example of bridge voltage drop

Bridge resistance	Length from NDIS conversion cable connector (jack) top bridge box			
	20 m	50 m	100 m	200 m
120 Ω	-1.2 %	-2.9 %	-5.6 %	-10.6 %
350 Ω	-0.4 %	-1.0 %	-2.0 %	-3.9 %

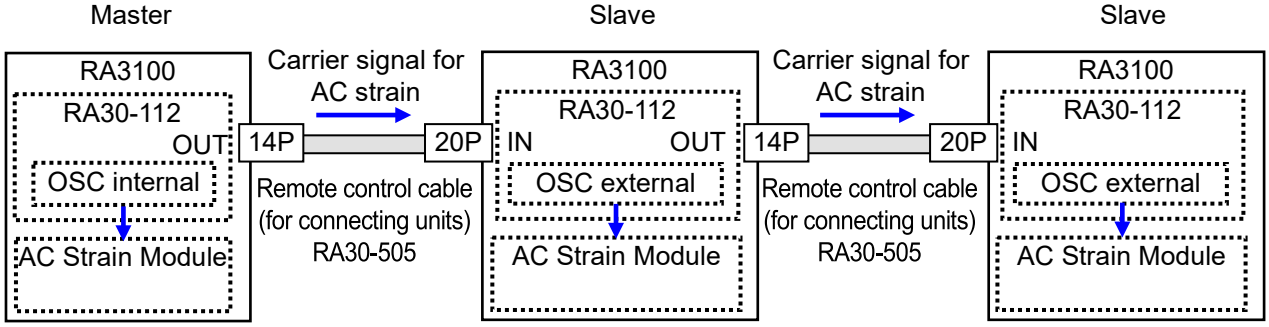
* Example calculated with tin-plated annealed copper wire, 0.5 mm^2, 20°C, 35.73 Ω/km. (When using A&D relay cable and extension cable)

9 Chassis Bridge Power Carrier Synchronization

When using this module (RA30-104) across multiple RA3100 units, it is necessary to synchronize the bridge power supplies. If not, a beat will occur between the bridge power supplies, which can cause an incorrect signal to be measured. The impact of the beat differs according to the target configuration for measurement and the distance between the sensors.



When connecting multiple RA3100 units with chassis synchronization, connect the RA30-112 (Remote Control Module) installed to the RA3100 using the RA30-505 remote control cable (for connecting units).



Connecting multiple (three) RA3100 units with chassis synchronization

9.5. 16ch Logic Module (RA30-105)

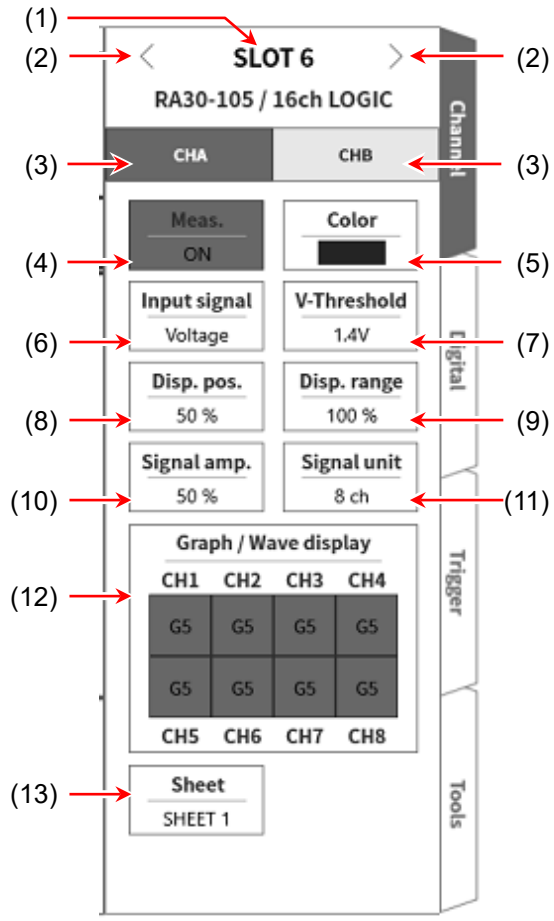
9.5.1. Overview

This module is a logic measurement module that converts 16 channels (8 channels x 2) of input signals into high level or low level logic signals according to a threshold. It supports voltage (high level /low level) detection and non-voltage contact (open/close) of input signals. 16 channel data synchronizes for measurement and recording. The probe that can connect to this module is an optional 1539S floating voltage probe for recording the existence of 100 V or 200 V system voltage and the 1540S and 1543S voltage conversion probes for recording voltage increases and decreases for AC 100 V systems and AC 200 V systems.

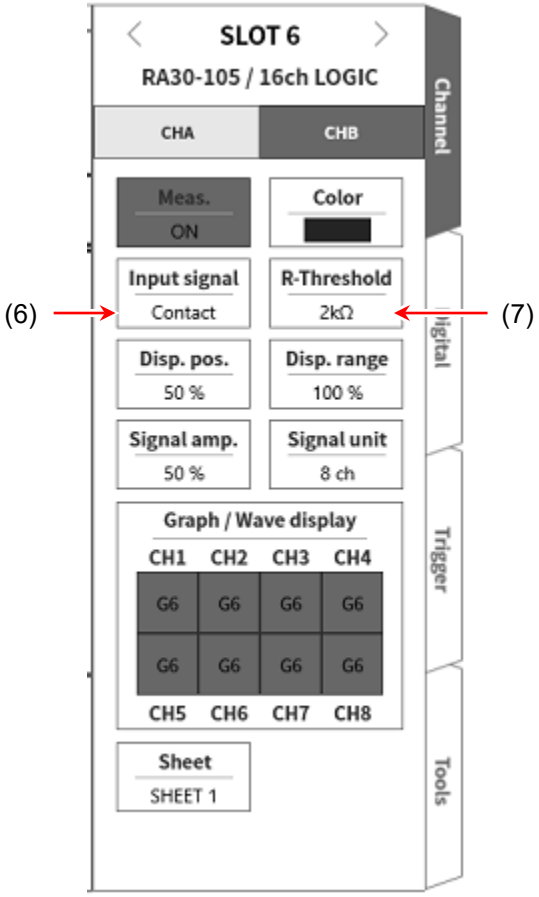
9.5.2. Setting the Input Channel

The Input signal setting of this module differs for voltage and contact, as indicated below.

<Voltage input>



<Contact input>



(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel: Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Input signal: Select voltage or contact. This setting can be selected for both CHA (8 ch) and CHB (8 ch).

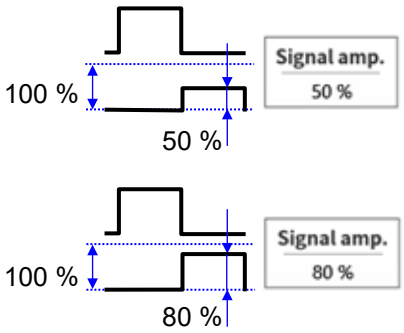
(7) Threshold setting: When【 Input signal】 is set to voltage,【 V-Threshold】 (7) can be set.
Three types of threshold for voltage detection can be selected.
When【 Input signal】 is set to contact,【 R-Threshold】 (7) can be set.
Three types of threshold for contact detection can be selected.

(8) Disp. pos.: Sets the display position for the logic signal of CHA or CHB.
The low level position of CH-4 is the set value.

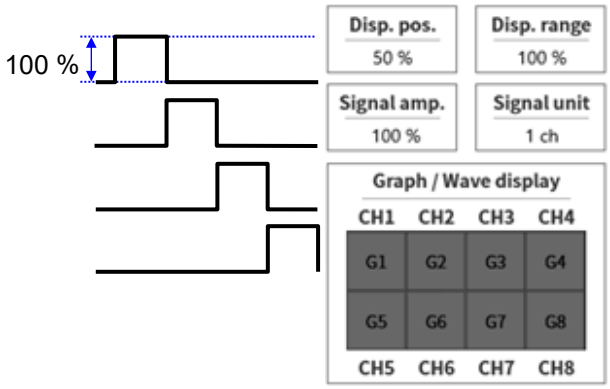
(9) Disp. range: Sets the display amplitude for the logic signal of CHA or CHB.
Specified as the percentage of the display width when the full range of each graph is 100%.
The eight channel signals are displayed at equal intervals and the overall display width can be set.

(10) Signal amplitude: Sets the high level (waveform) height as a percentage to the low level of each channel. An example of the display for each signal unit is indicated in the figure below.

When the signal unit is set to "8 ch"



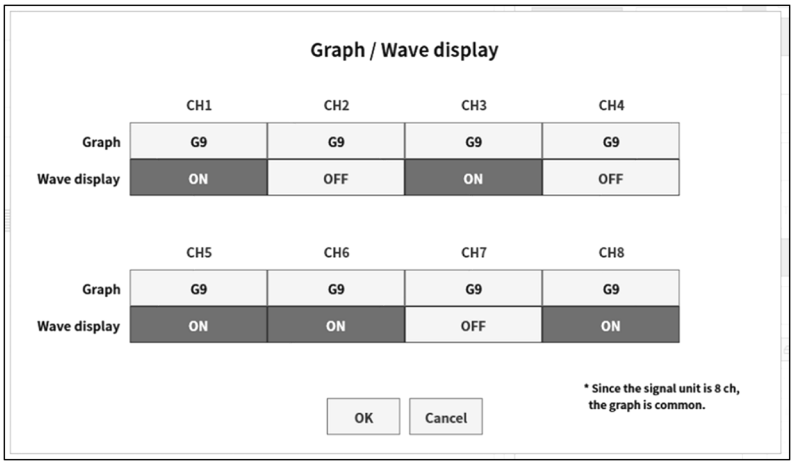
When the signal unit is set to "1 ch"



(11) Signal unit: Sets whether to assign channels to the graph on a single channel basis or eight channel basis.
When the signal unit is set to "8 ch", assign channels on a CHA or CHB basis (eight channels at a time).
When the signal unit is set to "1 ch", assign channels for CH1 to CH8 basis (one channel at a time).
For information on channel assignment, see "SHEET1/SHEET2/SHEET3" in "8.2.3. Sheet Setup".

(12) Graph/Wave display:

Tap inside the Graph/Wave display frame to display the setting dialog.
Set G1 to G18 for the graph using the graph keys.
When waveform display is enabled, the waveform is displayed in the waveform monitor. When disabled, the waveform is not displayed.



(13) Sheet: Assign the channel to a sheet.

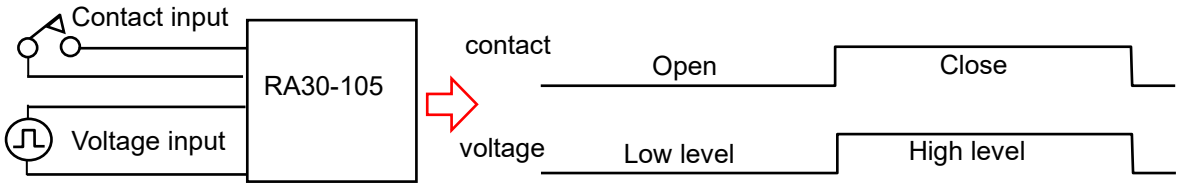
9.5.3. Measurement Setup

⚠CAUTION

- ❑ The maximum voltage input is 24 V.
  Take care, as applying high voltage can damage the module.
  Use the 1539S floating voltage probe when inputting high voltage.

Check the slot number and channel, connect the signal to the corresponding input module, and enable 【Meas.】 to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.
Follow the procedure below to set the input CHA and input CHB.

Step 1. Select voltage or contact in 【Input signal】 (6).
For voltage input, the high / low state of the voltage is displayed as binary data with the waveform indicating the high level / low level.
For contact connection, the open/closed state of the non-voltage contact is displayed as binary data with the waveform indicating the high level/low level.



Step 2. Set 【Threshold value】 (7) according to the target for measurement.
Voltage input

Threshold value	High level	Low level
1.4 V	1.8 V or more	1.0 V or less
2.5 V	3.0 V or more	2.0 V or less
4 V	4.6 V or more	3.4 V or less

Contact input

Threshold value	Open	Short
2 kΩ	2.0 kΩ or more	250 Ω or less
5 kΩ	5.0 kΩ or more	1.5 kΩ or less
9 kΩ	9.0 kΩ or more	3.0 kΩ or less

Tips

- ❑ The state of the input signal cannot be correctly detected if it is outside the detection range.
- ❑ With contact connection, a load current of about 0.5 mA flows.

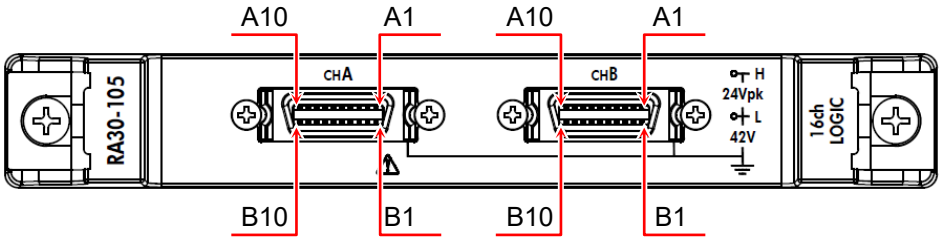
Step 3. Set the channel for monitor display or printer recording in 【Display signal】 (10).

Step 4. Set 【Disp. pos.】 (8) and 【Disp. range】 (9).

9.5.4. Reference Materials

1 Pin layout of input connector

This module can input 16 channels, but eight channels are grouped in CHA and CHB, respectively.
The input, trigger, and waveform display settings are set separately for CHA and CHB.
The connectors are also separate for CHA and CHB.



CHA connector

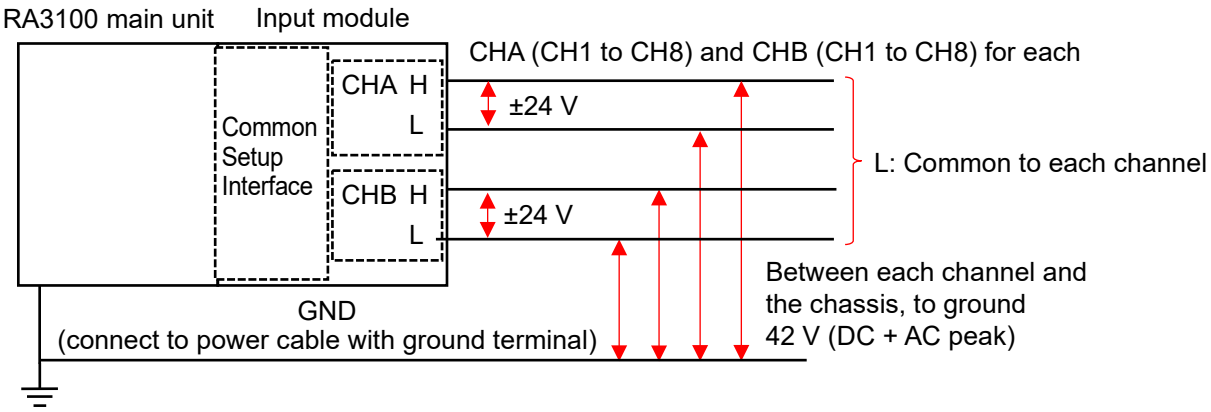
Pin number	Sig name	Pin number	Sig name
A1	+5V	B1	GND
A2	+5V	B2	
A3	CH8	B3	
A4	CH7	B4	
A5	CH6	B5	
A6	CH5	B6	
A7	CH4	B7	
A8	CH3	B8	
A9	CH2	B9	
A10	CH1	B10	

CHB connector

Pin number	Sig name	Pin number	Sig name
A1	+5V	B1	GND
A2	+5V	B2	
A3	CH8	B3	
A4	CH7	B4	
A5	CH6	B5	
A6	CH5	B6	
A7	CH4	B7	
A8	CH3	B8	
A9	CH2	B9	
A10	CH1	B10	

* Connector for input signal: DF02R020NA3 (Japan Aviation Electronics Industry)
* The A series and B series are complementary. GND (B series) is the input common for A series signals.
* The plugs (manufacturer model numbers) corresponding to each input signal connector are indicated below.
  Compatible plug: DF02P020F22A1 (soldered type), DF02P020G28A1 (pressure connected type)

2 Maximum rated voltage to ground



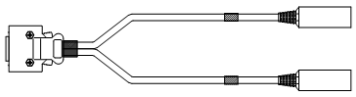
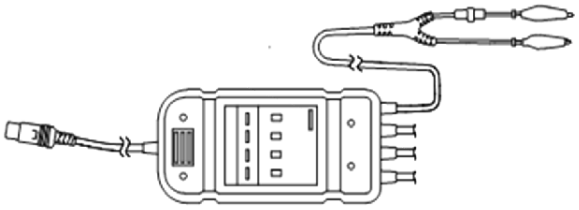
⚠CAUTION

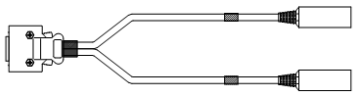
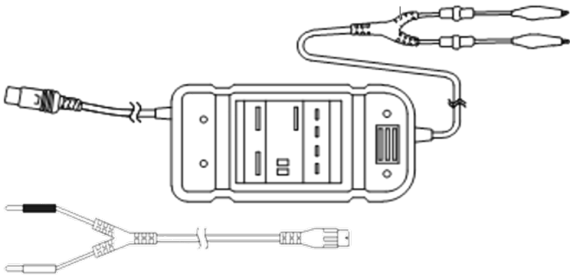
- Ensure that the voltage between each input and the chassis (GND) does not exceed 42 V (DC+ACpeak).Damage may be caused if the voltage is exceeded.
  There is no insulation between the inputs. L (GND) is connected internally.

3 For a probe (1539S/1540S/1543S) connection

(1) Connection method

When using a 1539S floating voltage probe or 1540S/1543S voltage conversion probe in conjunction with this product, use an 8 channel logic cable (RA30-503) to wire the probe as indicated in the figure. Up to two probes can be connected to a single channel.

RA30-105	8 channel logic cable RA30-503	Floating voltage probe 1539S
CHA or CHB		

RA30-105	8 channel logic cable RA30-503	Probe for voltage variation 1540S/1543S
CHA or CHB		

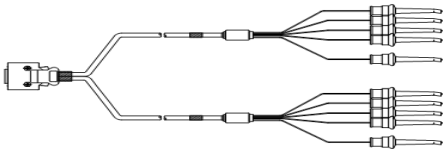
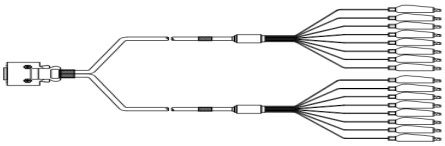
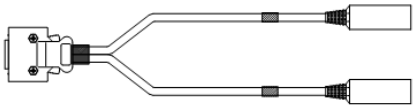
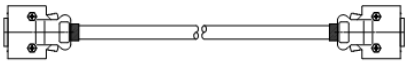
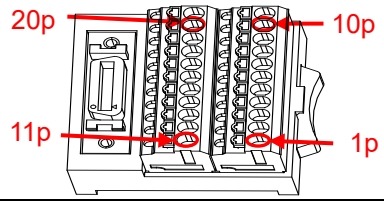
(2) Configuration

Contact the input signal and set the resistance threshold to 2k Ω.

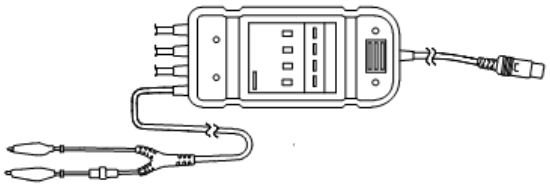
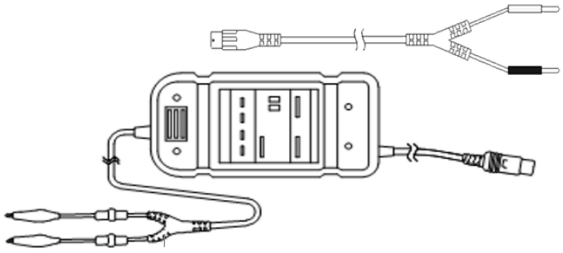
9.5.5. Options

1 Connection cables and terminal blocks

The following cables, terminal blocks, and probes are provided for signal input.

Name (type)	Shape/characteristics	
8 ch logic cable (IC clip) RA30-501		For logic input 20P - 4CH x 2, shared ground 1.5 m
8 ch logic cable (alligator clip) RA30-502		For logic input 20P - 4CH x 2, shared ground 1.5 m
8 channel logic cable (round connector conversion) RA30-503		For 1539S connection 20P - 4CH x 2, shared ground Length 0.3 m
Terminal block connection cable RA30-504		For MDR 20 pole terminal block connection 20P - 20P Length 2 m
Remote control cable (discrete wires) RA30-506		For remote control input Length 2 m
Terminal block AX-PCX-10S20		For MDR 20 pole terminal block (for AWG16-28) 1 to 10: A1 to A10 11 to 20: B1 to B10

2 Probe

Name (type)	Shape/characteristics	
Floating voltage probe 1539S		RA30-105 8 channel logic cable (round connector conversion) Connect with a RA30-503 4 inputs
Probe for voltage variation 1540S: AC100/120V 1543S: AC220/240V		RA30-105 8 channel logic cable (round connector conversion) Connect with a RA30-503 1 input

3 Pin layout

Pin layout of RA30-105 input connectors and correspondence chart of remote control cables and terminal block connection cables.

For the RA30-501/RA30-502 cable

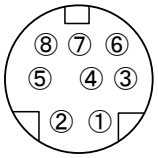
	RA30-105 CHA / CHB connecter	RA30−501 / RA30-502 logic input cable	
Sig name	Pin no	Mark indication	Wire color
GND	B1	CH5-8	Black
GND	B2	CH1-4	Black
CH8	A3	CH5-8	Yellow
GND	B3		
CH7	A4		Orange
GND	B4		
CH6	A5		Red
GND	B5		
CH5	A6		Brown
GND	B6		
CH4	A7	CH1-4	Yellow
GND	B7		
CH3	A8		Orange
GND	B8		
CH2	A9		Red
GND	B9		
CH1	A10		Brown
GND	B10		

For a combination of AX-PCX-10S20 terminal block and RA30-504 cable

	RA30-105 CHA / CHB connecter	Combination of AX-PCX-10S20 terminal block and RA30-504 cable	RA30-506 Remote control cable (discrete wires)		
Sig name	Pin no.	Pin no.	Wire color	Mark color	Mark indication
+5V	A1	1			
GND	B1	11			
+5V	A2	2			
GND	B2	12			
CH8	A3	3	Orange	Red	-
GND	B3	13		Black	-
CH7	A4	4	Light gray	Red	-
GND	B4	14		Black	-
CH6	A5	5	White	Red	-
GND	B5	15		Black	-
CH5	A6	6	Yellow	Red	-
GND	B6	16		Black	-
CH4	A7	7	Pink	Red	-
GND	B7	17		Black	-
CH3	A8	8	Orange	Red	-
GND	B8	18		Black	-
CH2	A9	9	Light gray	Red	-
GND	B9	19		Black	-
CH1	A10	10	White	Red	-
GND	B10	20		Black	-

For a round connector 8 channel logic cable

	RA30-105 CHA / CHB connecter	RA30-503 8 channel logic cable (round connector conversion)	
Sig name	Pin number	Pin number	Mark indication
+5V	A1	6	CH5-8
GND	B1	5	
+5V	A2	6	CH1-4
GND	B2	5	
CH8	A3	4	CH5-8
GND	B3	NC	
CH7	A4	3	
GND	B4	NC	
CH6	A5	2	
GND	B5	NC	
CH5	A6	1	
GND	B6	NC	
CH4	A7	4	CH1-4
GND	B7	NC	
CH3	A8	3	
GND	B8	NC	
CH2	A9	2	
GND	B9	NC	
CH1	A10	1	
GND	B10	NC	



9.6. 2ch Temperature Module (RA30-106)

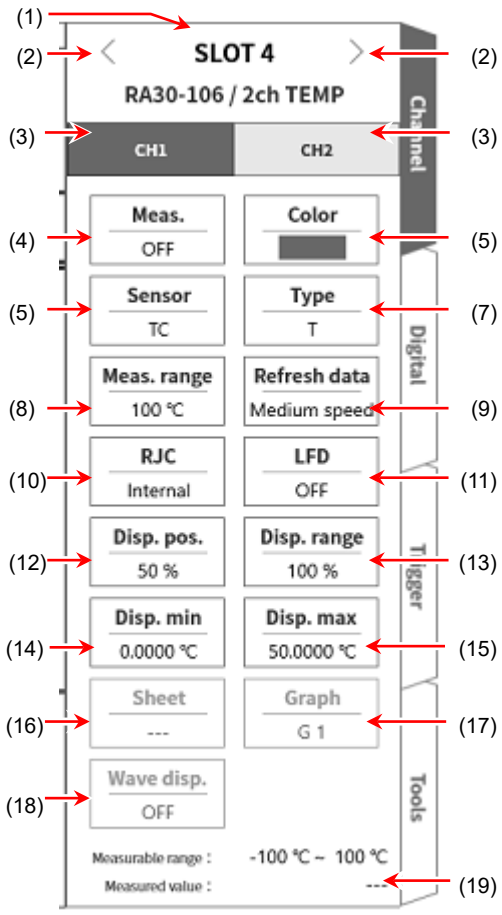
9.6.1. Overview

This module is a two channel temperature measurement module that can set three measurement ranges for each thermocouple (TC) and platinum resistance temperature detector (RTD) sensor, and perform 16-bit sampling with a three-stage data update rate to enable A/D conversion.
It includes functions for switching the internal/external reference junction and checking for disconnections. It is insulated between each channel and between input and output, to safely support general temperature measurement.

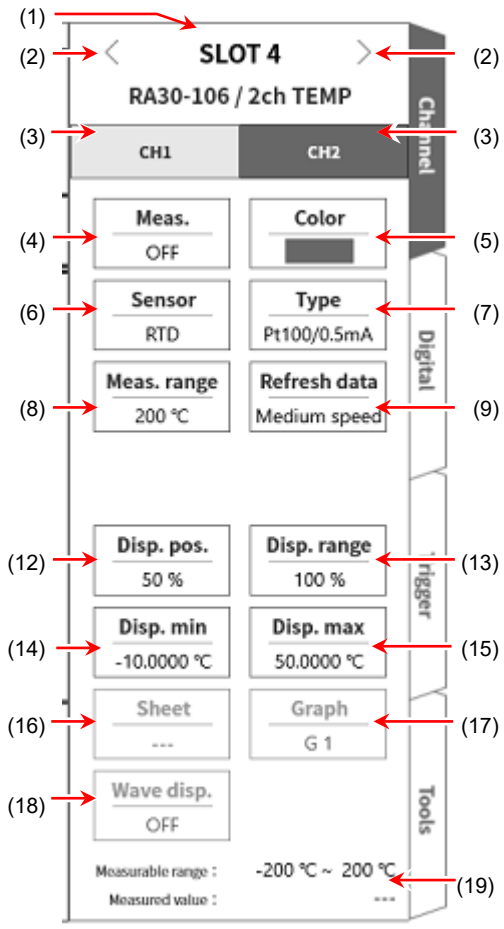
9.6.2. Setting the Input Channel

The settings differ according to whether【Sensor】(6) is set to the thermocouple (TC) or platinum resistance temperature detector (RTD) type.

<TC>



<RTD>



(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel: Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Sensor: Select [TC] or [RTD] as the sensor type.

(7) Type: For a thermocouple (TC) sensor, select K, E, J, T, N, R, S, B, or C as the thermocouple (TC) to connect. For RTD, select Pt100 (1 mA), Pt100 (0.5 mA), or Pt1000 (0.1 mA).

(8) Meas. range: Set the temperature range to measure. Three types of ranges can be selected for each sensor type.

(9) Refresh data: Select low speed (1 s), medium speed (100 ms), or high speed (1.5 ms) as the data update speed.

(10) RJC: Select [Internal] to directly connect the sensor when using a thermocouple (TC). When placing the reference junction (cooling point) outside, select [External] to perform temperature compensation.

(11) LFD: Set [ON] or [OFF]. When set to [ON], the output goes over the scale when there is a disconnection.

(12) Disp. pos.: Specify the display position.

(13) Disp. range: Specifies the display width in the amplitude direction of each graph.

(14) Disp. min: Set the display lower limit value of the bottom of the display range.

(15) Disp. max: Set the display upper limit value of the top of the display range.

(16) Sheet: Assign the channel to a sheet.

(17) Graph: Assign the channel to a graph.

(18) Waveform display area:
When enabled, the waveform is displayed. When disabled, the waveform is not displayed.

(19) Available measurement range/measurement value:
Displays the current available measurement range and measurement value.

9.6.3. Measurement Setup

Check the slot number and channel, and set the sensor type, etc. to use for the corresponding input module.

Follow the procedure below to set the input channel.

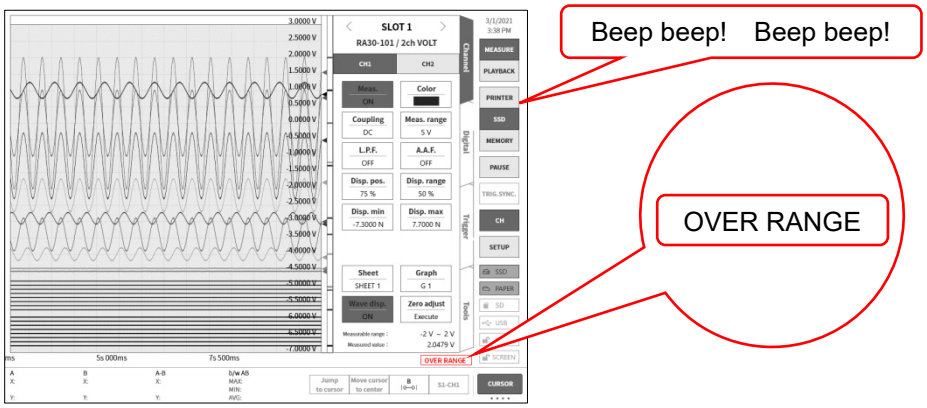
Step 1. Select thermocouple (TC) and platinum resistance temperature detector (RTD) sensor in 【Sensor】, and set the sensor type in 【Type】.

Step 2. Connect the signal and enable 【Meas.】 to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.

Step 3. Set 【Meas. range】 according to the target for measurement.
The value displayed for the measurement range (RANGE) indicates the maximum value of the temperature to input (measure).
For temperature measurement, the minimum value of the measured value differs from +RANGE.
Check the actual measurement range in [Measurable range].

Tips

❑ When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



Step 4. Set the【Refresh data】.
Select high speed, medium speed, or low speed as the data refresh rate.
With low speed (1s), the response speed is slower but there is less variation in data and accurate measurement can be performed.
At medium speed (100 ms), the data is updated 10 times per second. This provides more stable measurement accuracy than with high speed.
With high speed (1.5 ms), the response speed is faster and quickly changing temperatures can be measured. The measurement certainty specifications are also fulfilled with high speed.

Step 5. Set【RJC】.
When connecting a reference junction device such as a ZERO-CON, set it to [External].
When set to [Internal], measure the temperature of the front panel to use as the reference junction.

Step 6. Set【LFD】.

Step 7. Set the display range and display position.
See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".
Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor
Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 8. Set the display minimum and display maximum.
See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".
Disp. max: Set the display upper limit value of the top of the display range.
Disp. min: Set the display lower limit value of the bottom of the display range.

Tips

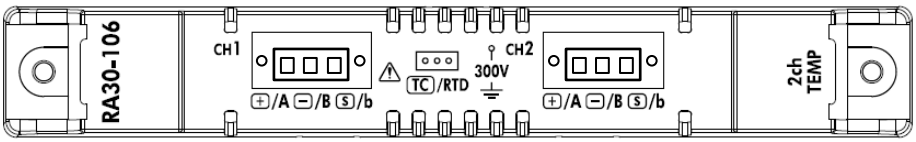
❑ When the sampling speed of this product is lower than the data update time of this module, the same data is output during the update period.

9.6.4. Reference Materials

⚠CAUTION

- ❑ Do not connect something other than a sensor (thermocouple (TC) or platinum resistance temperature detector) to an input terminal.
  (Do not input voltage or current. Doing so may lead to failure.)
- ❑ Ensure that the voltage between each input and the chassis (GND) and between each channel does not exceed 300 V (DC+ACpeak) . Damage may be caused if the voltage is exceeded.
- ❑ When measuring a location with electric potential using a non-insulated thermocouple (TC) or platinum resistance temperature detector, never touch the metallic parts of the input wire, as electric potential occurs in the cable itself.

1 Front panel



2 Thermocouple (TC) sensor connection method

2.1 Connection terminal

After screwing the thermocouple (TC) into the temperature sensor connector, insert it into the connector of the front panel.

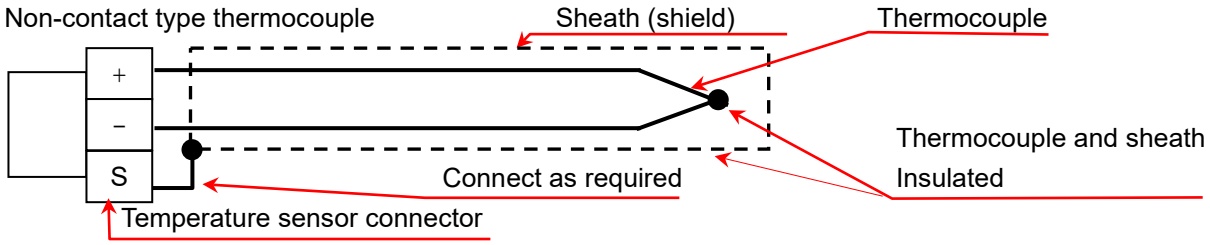
The terminal names of the input connectors are indicated on the left side of the panel as [+], [−], and [S].

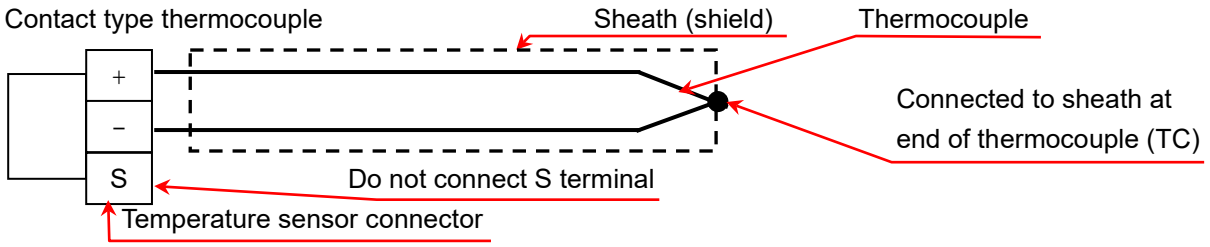
[+]/A terminal	Connect the + side wire of the thermocouple (TC).
[−]/B terminal	Connect the − side wire of the thermocouple (TC).
[S]/b terminal	Terminal for shielding. Connect the sheath (shield) wire of the non-contact type sheathed thermocouple (TC). Leave the S terminal unconnected for the grounded type.

Note

- ❑ When using the non-contact type sensor, the S terminal must be insulated from the + terminal and - terminal.
  If they are connected, correct measurement will not be able to be performed and failure may occur.
- ❑ The thermocouple (TC) has a + and − side. Connect them correctly.
  (Correct measurement will not be able to be performed if the + and − sides are switched.)
- ❑ Make sure the resistance value of the thermocouple (TC) is 1 kΩ or less.
- ❑ Use a compatible extension wire for thermocouple (TC) extension.
- ❑ Connect a single thermocouple (TC) to a single channel.
- ❑ Wire the thermocouple (TC) cable away from the power line and sources of noise.

2.2 Thermocouple (TC) sensor connection diagram





2.3 Types and characteristics of thermocouples (TC)

Thermocouple (TC)	Characteristics	Disadvantages
B	High usage temperature.	Cannot measure low temperatures at or below 0°C.
R, S	Suitable for precise measurement in oxidizing atmospheres and inert gas at high temperatures. Good precision and little variation or deterioration. Used as standard thermocouple (TC).	The electromotive force characteristic has poor linearity. Poor linearity of electromotive force characteristic. Cannot measure low temperatures at or below 0°C.
N	Stable thermo-electromotive force at a wide range of temperatures from low temperature to high temperature	
K	Good linearity of thermo-electromotive force and suitable for oxidizing atmospheres. Most common for industrial use.	Poor linearity of electromotive force characteristic.
E	High thermo-electromotive force.	
J	High thermo-electromotive force, for industrial use and medium range temperatures.	Poor linearity of electromotive force characteristic.
T	Stable thermo-electromotive force and suitable for precision measurement at low temperatures.	Low maximum usage temperature.
C	Suitable for reducing atmospheres, inert gases, and hydrogen gas.	Cannot be used in air.

3 Platinum resistance temperature detector (RTD) sensor connection method

3.1 Connection terminal

After screwing the platinum resistance temperature detector into the temperature sensor connector, insert it into the connector of the front panel. The terminal names of the input connectors are indicated on the right side of the panel as A, B, and b.

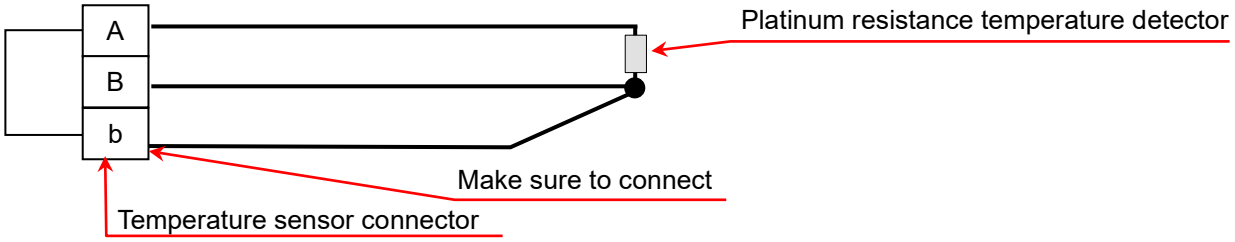
+ /A terminal	Connect the A side wire of the platinum resistance temperature detector (RTD).
– /B terminal	Connect the B side wire of the platinum resistance temperature detector (RTD).
S /b terminal	Connect the b side wire of the platinum resistance temperature detector (RTD).

Note

- ❑ Make sure to use a three-wire type platinum resistance temperature detector (RTD) sensor.
- ❑ Use three equal length cables for RTD extension in order to match the resistance values.
- ❑ Ensure the wire resistance is 10 Ω or less (per wire)

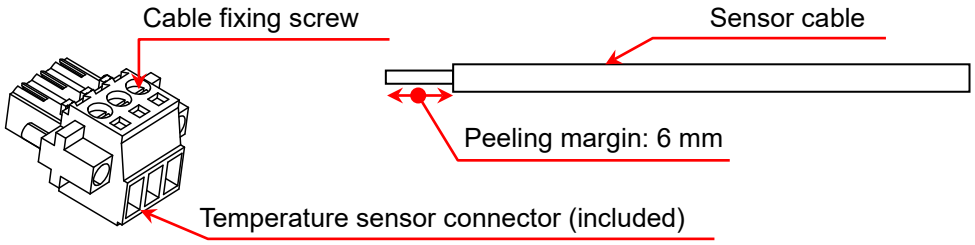
- ❑ Connect a single RTD to a single channel.
- ❑ Wire the RTD cable away from the power line and sources of noise.

3.2 Platinum resistance temperature detector (RTD) three wire sensor connection method



4 Sensor cable connection

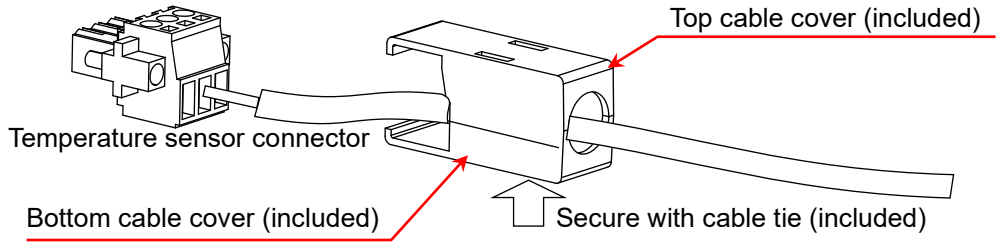
Step 1. Peel the coating of the sensor cable, and connect the cable to the socket.
0.2 sq to 1.5 sq (AWG 24 to AWG 16) wire is supported.
Insert the sensor cable from the right direction and tighten the top screw.
Gently pull the cable and confirm that it does not become disconnected.



Note

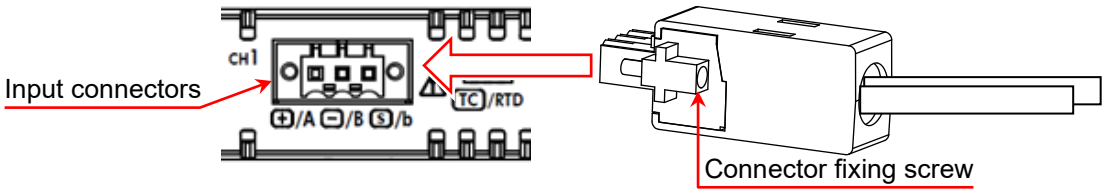
- ❑ Cable fixing screw tightening torque: 0.2 Nm to 0.25 Nm
- ❑ Flat-blade screwdriver blade size: 0.4 m (thickness) x 2.5 mm (width)

Step 2. Insert the top cable cover and bottom cable cover in the socket.
Secure the cable from the bottom cable cover with a cable tie.



Step 3. Connect the socket to the connector of the input panel.

Step 4. Secure the socket to the connector of the input panel using the socket fixing screw.



Note

- ❑ Socket fixing screw tightening torque: 0.2 Nm to 0.25 Nm
- ❑ The cable cover protects the terminal and cable fixing screw areas from static electricity, etc.

5 Reference junction compensation (RJC) when measuring thermocouple (TC)

Reference junction compensation is required when measuring the thermocouple (TC), and can be switched between internal and external compensation with this module.

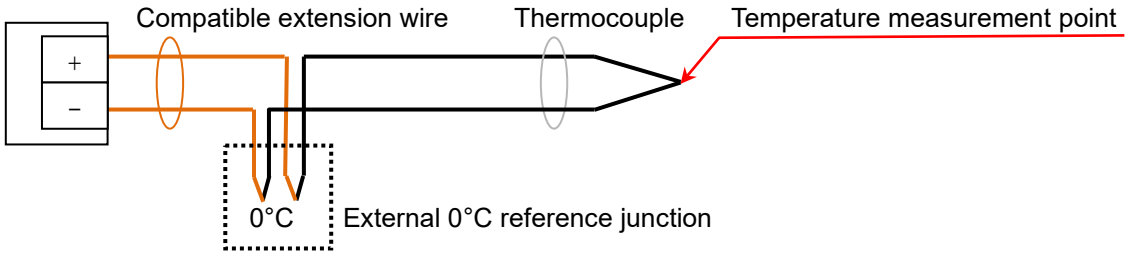
Internal reference junction compensation measures the reference junction temperature at the module front panel.

When external compensation is set, it is necessary to externally perform 0°C reference junction compensation.

Note

- ❑ Perform measurement so that the temperature around the input connectors is stable.
- ❑ If there is a rapid change in the surrounding temperature, wait until the module temperature stabilizes (about one hour) and then start measurement.
- ❑ Ensure that the input connectors are not directly exposed to wind.
- ❑ Do not block the air holes of the front panel.

When performing external reference junction compensation



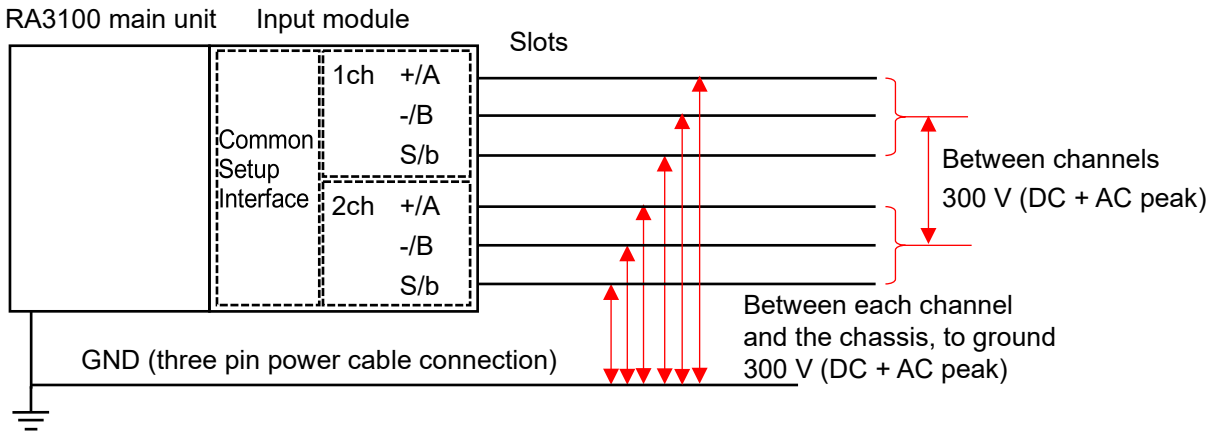
6 LFD function

This module has an LFD function that can be enabled or disabled when performing TC measurement. When enabled, 0.5 μA current is supplied and + side over range output occurs when the sensor is open (at 300 kΩ or higher). (Over range detects the possibility of a disconnection.)

Note

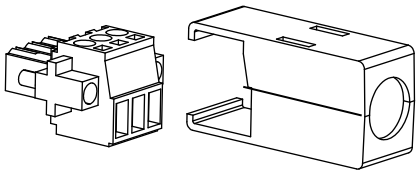
- ❑ When LFD is enabled, a temperature rise error will occur from the power consumption in the thermocouple (TC) resistance because a current of 0.5 μA is constantly supplied.
- ❑ It can be disabled when performing standard measurement to reduce the above error.
- ❑ When the setting is enabled, detection is possible when the open resistance is 300 kΩ or higher.

7 Maximum rated voltage to ground



9.6.5. Spare Parts

Two sets of temperature sensor connectors are included as standard, and they can be connected to an alternate sensor in advance to allow easy changing.

Name (type)	Shape/characteristics	
Temperature sensor connector RA30-555		Top cable cover Bottom cable cover Two sets of cable ties Can be connected/disconnected to/from the input connectors of the connector module for temperature sensor connection

9.7. 2ch High Voltage Module (RA30-107)

9.7.1. Overview

This two channel high voltage input module samples a DC to 100 kHz signal at 16-bit 1 MS/s within the measurement range of ±2 V to ±1000 V and can perform A/D conversion. It has functions for voltage measurement, effective value measurement, and analog filtering. It is insulated between each channel and between each channel chassis.

9.7.2. Setting the Input Channel

<This section describes the setting switches and setting values of the RA3100 main unit. >

(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel:
Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Coupling: Switch the input signal coupling.

(7) Meas. mode: Switch the measurement mode of the input channel from DC to RMS (Fast) to RMS (Mid) to RMS (Slow).

(8) Meas. range: Change the measurement range.

(9) L.P.F.: Change the low-pass filter.

(10) Disp. pos.: Specify the display position.

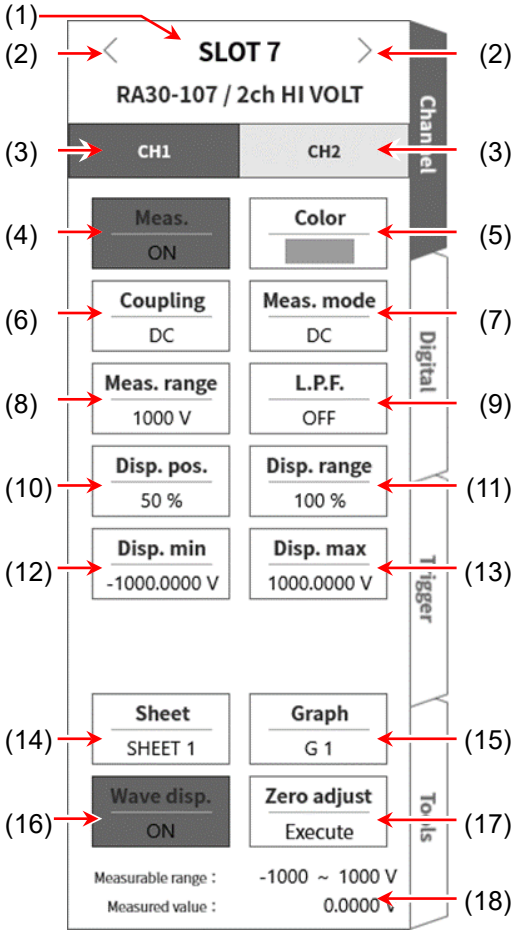
(11) Disp. range: Specify the display width in the amplitude direction of each graph.

(12) Disp. min: Set the display lower limit value of the bottom of the display range.

(13) Disp. max: Set the display upper limit value of the top of the display range.

(14) Sheet: Assign the channel to a sheet.

(15) Graph: Assign the channel to a graph.



(16) Wave disp.: When enabled, the waveform is displayed in the waveform monitor. When disabled, the waveform is not displayed.

(17) Zero adjust: Cancels the input offset of the input channel. Execute zero cancellation to perform more accurate measurement.

(18) Measurable range/Measured value:
Displays the current available measurement range and measurement value.

9.7.3. Measurement Setup

Check the slot number and channel, connect the signal to the corresponding input module, and enable the【Meas.】key to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.
Follow the procedure below to set the input channel.

Step 1. Set the input coupling with the【Coupling】key (6).

Coupling	Description
DC	Enables measurement of the actual input signal, including the DC and AC component.
AC	Measures the AC component of the input signal only. Set this when you want to measure only the amplitude of an AC signal, as it cancels the DC offset of the signal.
GND	Connects the channel input to GND without connecting the input signal inside the channel. Enables the input GND level to be checked with waveform monitoring or printer recording.

Tips

- When switching from DC coupling to AC coupling, it takes a maximum of two seconds for the DC component to completely disappear.

Step 2. Set the measurement mode with the【Meas. mode】key (7).

Measurement mode	Description
DC	Enables measurement of the input signal voltage.
RMS(Fast)	Enables measurement of the input signal effective value. You can select three different response speeds (high speed, medium speed, and low speed).
RMS(Mid)	
RMS(Slow)	

Step 3. Set the measurement range according to the target for measurement.
Set a range at or above the expected maximum value for the input signal.
The input sensitivity can be changed with the【Meas. range】key (8) in the channel setup sub menu.
The following nine measurement mode ranges are available.

DC mode

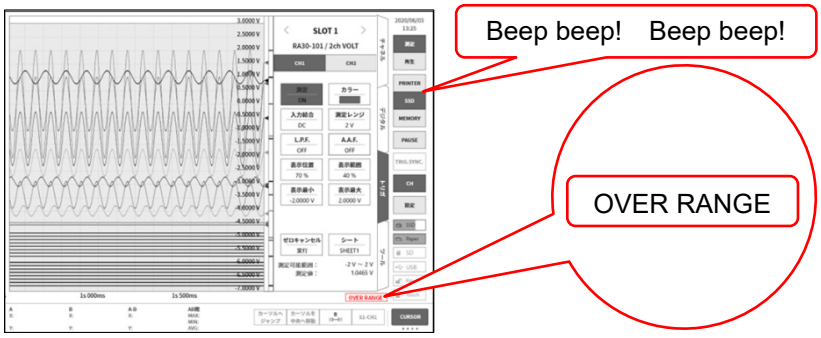
1000 V	500 V	200 V	100 V	50 V	20 V	10 V	5 V	2 V

RMS mode

1000 Vrms	500 Vrms	200 Vrms	100 Vrms	50 Vrms	20 Vrms	10 Vrms	5 Vrms	2 Vrms

Tips

- ❑ The measurement range with the 1000 Vrms range is a maximum of 700 Vrms.
- ❑ When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



Step 4. Set the input filter.

【Set the low-pass filter with the L.P.F.】 key (8).

The low-pass filter of this module is a gently sloping attenuation filter that prioritizes the waveform. Set a cutoff frequency about 10 times the effective frequency as a signal to remove the unnecessary high frequency component and noise component.

OFF	30 kHz	3 kHz	300 Hz	30 Hz	3 Hz

Step 5. Set the display range and display position.

See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".

Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor

Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 6. Set the display minimum and display maximum.

See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".

Disp. max: Set the display upper limit value of the top of the display range.

Disp. min: Set the display lower limit value of the bottom of the display range.

Step 7. Execute zero adjust.

In order to perform measurement with fewer errors, tap the【(17) Zero adjust】 key in the channel setup sub menu to perform zero adjustment after the warmup time elapses or after the measurement range, filter, or input coupling has been changed.

Tips

- ❑ This function is for canceling internal offset and drift, and does not cancel the offset of the input signal.

9.7.4. Reference Materials

⚠CAUTION

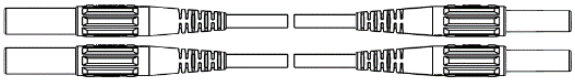
- ❑ Ensure that the voltage between each input and the chassis (GND) and between each channel does not exceed 1000 V (DC + AC peak). Damage may be caused if the voltage is exceeded.

1 Input cable

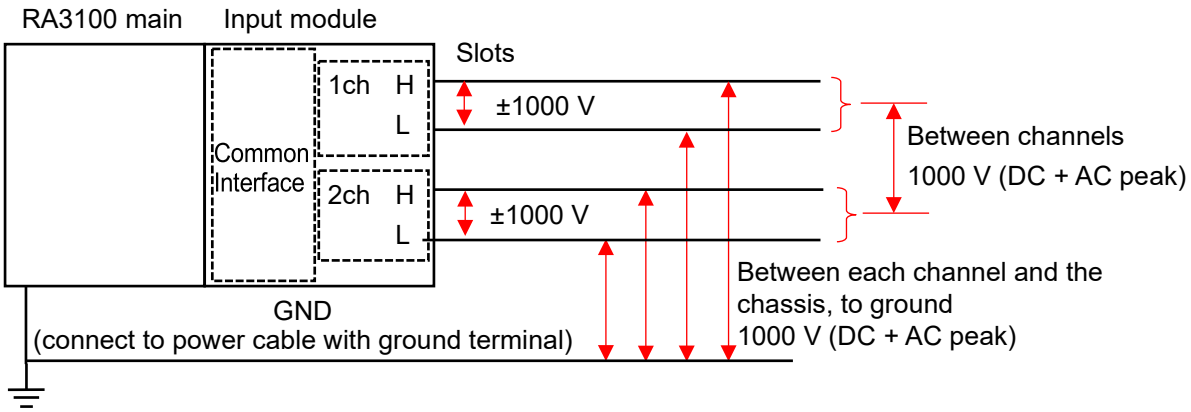
The input connectors for CH1 and CH2 are safety banana terminals.

For safety purposes, use the following high voltage alligator clips/cables for signal input.

Recommended cables

Name (type)	Shape/characteristics	
High voltage alligator clip: RA30-509-01		Alligator clips Red × 1; Black × 1 Standard: CAT III 1000 V
High voltage connection cable: RA30-509-02		Safety banana plugs Red × 1; Black × 1 Length: 2 m Standard: CAT III 1000 V
High voltage extension cable: RA30-509-03		Safety banana plugs/sockets Red × 1; Black × 1 Length: 2 m Standard: CAT III 1000 V

2 Maximum rated voltage to ground



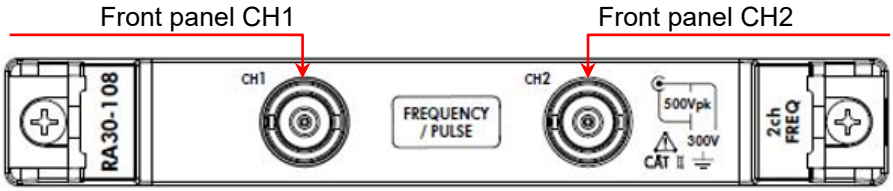
9.8. 2ch Frequency Module (RA30-108)

9.8.1. Overview

This module is a two channel frequency module that can measure the frequency of the input signal within the range ±1 V to ± 500 V. It has nine measurement modes (Period, Frequency, Rotation speed, Power freq., Freq. deviation, Pulse width, Duty cycle, Pulse count, and Pulse integ.) and a function for constantly monitoring the input signal. It is insulated between each channel and between each channel chassis.

9.8.2. Relationship between Channels and Settings

<Front panel>



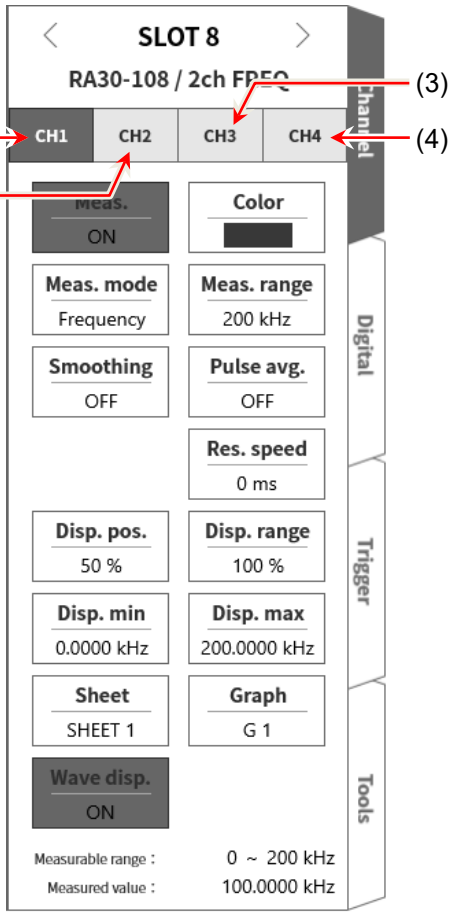
<CH1 to CH4 of RA3100 main unit>

(1) Set the measurement mode for CH1 with front panel CH1.

(2) Set the measurement mode for CH2 with front panel CH2.

(3) Set the input voltage for CH3 with front panel CH1.

(4) Set the input voltage for CH4 with front panel CH2.



The front panel has two channels of BNC connectors, but the RA3100 main unit has a four channel display.
For details on the measurement modes and input voltage, see "9.8.3. Setting the Input Voltage and Measurement Mode".

Tips

- The CH3 (3) setting is valid for CH1.
  The CH4 (4) setting is valid for CH2.

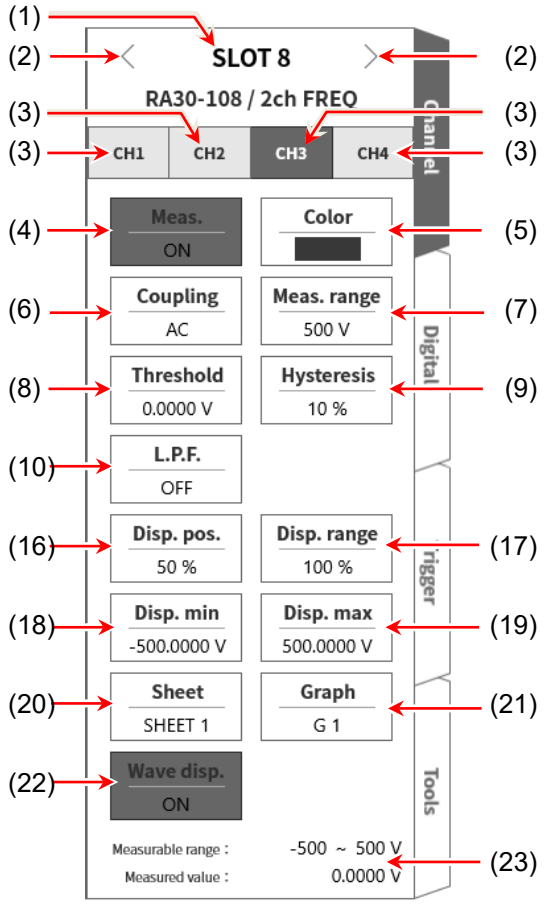
Channel Setting Procedure

Step 1. Setting the input voltage
Set the input voltage for CH1 and CH2 with CH3 (3) and CH4 (4). (Coupling, measurement range, threshold, etc.)

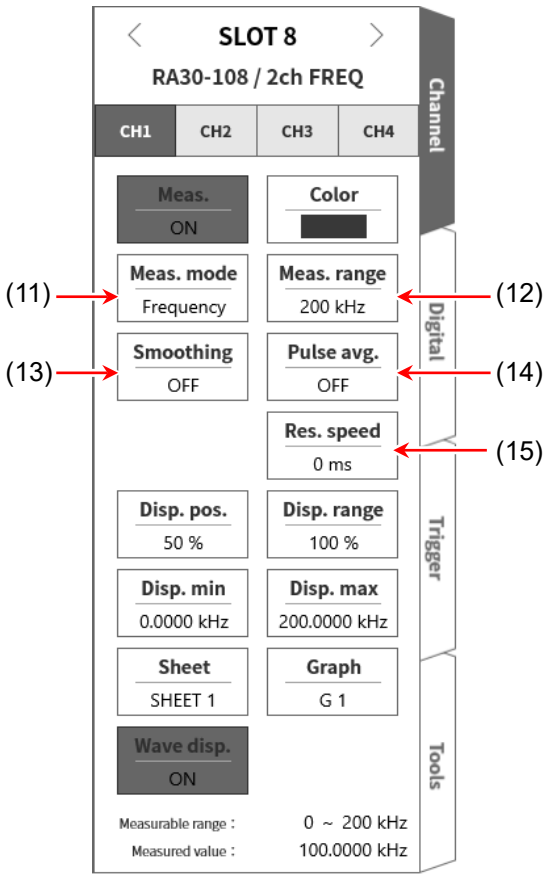
Step 2. Setting the measurement mode
Set the measurement mode for CH1 and CH2 with CH1 (1) and CH2 (2). (Measurement mode, measurement range, etc.)

9.8.3. Setting the Input Voltage and Measurement Mode

<This section describes the setting switches and setting values of the RA3100 main unit. >



<Input voltage setting panel>



<Measurement mode setting panel>

(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel:

Select the channel in the slot.

CH1: CH1 measurement mode CH2: CH2 measurement mode

CH3: CH1 input voltage CH4: CH2 input voltage

(4) Meas. ON/OFF

ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Coupling: Switch the input signal coupling.

(7) Meas. range: Change the measurement range.

(8) Threshold: Set the threshold voltage for detecting the pulse.

(9) Hysteresis: Sets the hysteresis width of the threshold. Set a value that prevents incorrect measurement due to noise.

(10) L.P.F.: Change the low-pass filter.

(11) Meas. mode: Select Period, Frequency, Rotation speed, Pulse width, Duty cycle, Power freq., Freq. deviation, Pulse count, or Pulse integ. as the measurement mode.

(12) Meas. range: Change the measurement range.

(13) Smoothing: Set the count for smoothing the measurement data.

(14) Pulse avg.: Set the average count of the input pulse.

(15) Res. speed: Set the response time for preventing chattering.

(16) Disp. pos.: Specify the display position.

(17) Disp. range: Specify the display width in the amplitude direction of each graph.

(18) Disp. min: Set the display lower limit value of the bottom of the display range.

(19) Disp. max: Set the display upper limit value of the top of the display range.

(20) Sheet: Assign the channel to a sheet.

(21) Graph: Assign the channel to a graph.

(22) Wave disp.: When enabled, the waveform is displayed in the waveform monitor. When disabled, the waveform is not displayed.

(23) Measurable range/Measured value:
Displays the current available measurement range and measurement value.

9.8.4. Measurement Setup

Check the slot number and channel, connect the signal to the corresponding input module, and enable the Meas. key to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.
Follow the procedure below to configure the input voltage setting panel then the measurement mode setting panel.

9.8.4.1. Setting the Input Voltage

Follow the procedure below to configure the input voltage setting panel.

Step 1. Set the input coupling with the【Coupling】 key (6).

Coupling	Description
DC	Enables measurement of the actual input signal, including the DC and AC component.
AC	Measures the AC component of the input signal only. Set this when you want to measure only the amplitude of an AC signal, as it cancels the DC offset of the signal.
GND	Connects the channel input to GND without connecting the input signal inside the channel. Enables the input GND level to be checked with waveform monitoring or printer recording.

Tips

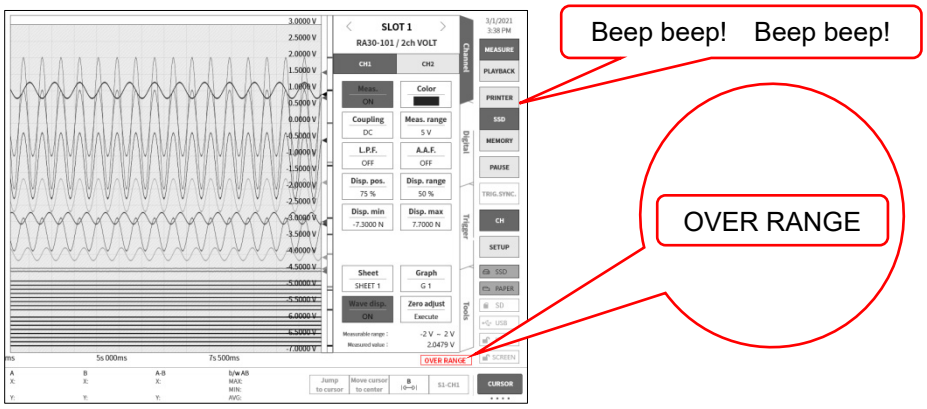
- When switching from DC coupling to AC coupling, it takes a maximum of five seconds for the DC component to completely disappear.

Step 2. Set the measurement range of the input voltage according to the target for measurement.
The input sensitivity can be changed with the【Meas. range】key (7).
The following nine input voltage measurement ranges are available.

500 V	200 V	100 V	50 V	20 V	10 V	5 V	2 V	1 V

Tips

❑ When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



Step 3. Set the threshold.

Set the threshold with the【Threshold】key (8).

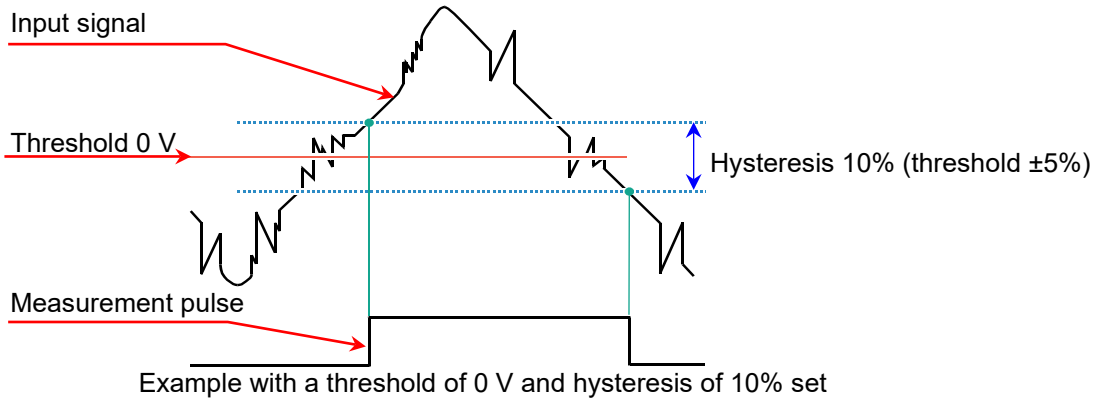
Tap the key to display the threshold line (red) on the waveform monitor. This enables you to change the threshold while checking the input waveform.

Step 4. Set the hysteresis.

Set the hysteresis width of the threshold with the【Hysteresis】key (9).

Tips

❑ By aligning the threshold in the center of the input waveform while checking the input waveform on the waveform monitor, you can perform more accurate measurement. Set a hysteresis value with sufficient distance from the peak voltage of the input waveform.



Example with a threshold of 0 V and hysteresis of 10% set

Step 5. Set the input filter.

Set the low-pass filter with the【L.P.F.】key (10).

The low-pass filter of this module is a gently sloping attenuation filter that prioritizes the waveform. Set a cutoff frequency about 10 times the effective frequency as a signal to remove the unnecessary high frequency component and noise component.

OFF	30 kHz	3 kHz	300 Hz

Step 6. Set the display range and display position.

See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".

Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor

Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 7. Set the display minimum and display maximum.

See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".

Disp. max: Set the display upper limit value of the top of the display range.

Disp. min: Set the display lower limit value of the bottom of the display range.

9.8.4.2. Setting the Measurement Mode

Follow the procedure below to configure the measurement mode setting panel.

Step 1. Set the measurement mode with the【Meas. mode】 key (11).

Measurement mode	Description (unit)		
Period	Measure the period of the measurement pulse.	s	(seconds)
Frequency	Measure the frequency of the measurement pulse.	Hz	(hertz)
Rotation speed	Measure the rotation speed of the measurement pulse.	rpm	(revolutions per minute)
Pulse width	Measure the pulse width of the measurement pulse.	s	(seconds)
Duty cycle	Measure the duty cycle of the measurement pulse.	%	(percent)
Power freq.	Measure the power frequency variation.	Hz	(hertz)
Freq. deviation	Measure the deviation from the center frequency.	%	(percent)
Pulse count	Count the number of measurement pulses within the gate time.	Count	
Pulse integ.	Integrates the number of measurement pulses.	Count	

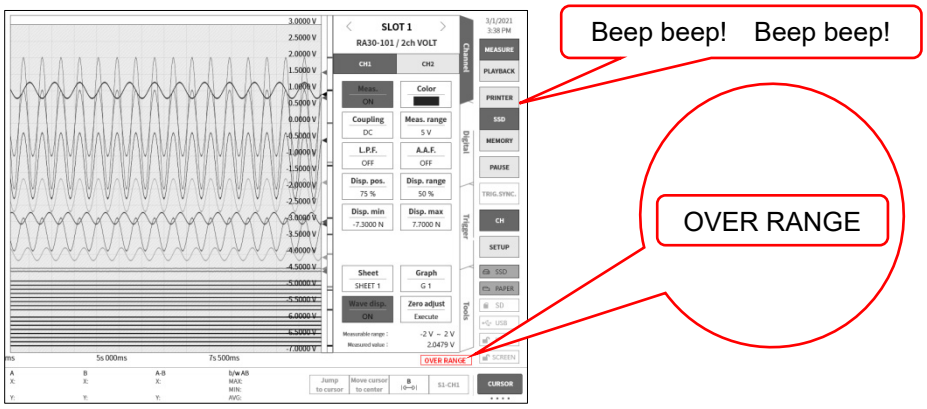
Step 2. Set the measurement range according to the target for measurement.

The measurement range can be changed with the【Meas. range】 key (12).

Measurement mode	Description							
Period	1 ms	2 ms	5 ms	10 ms	20 ms	50 ms	100 ms	200 ms
	500 ms	1 s	2 s	5 s	10 s	20 s	50 s	100 s
Frequency	200 kHz	100 kHz	50 kHz	20 kHz	10 kHz	5 kHz	2 kHz	1 kHz
	500 Hz	200 Hz	100 Hz	50 Hz	20 Hz	10 Hz	5 Hz	2 Hz
Rotation speed	1000 krpm	500 krpm	200 krpm	100 krpm	50 krpm	20 krpm	10 krpm	5 krpm
	2 krpm	1 krpm	500 rpm	200 rpm	100 rpm	50 rpm	20 rpm	10 rpm
Pulse width	1 ms	2 ms	5 ms	10 ms	20 ms	50 ms	100 ms	200 ms
	500 ms	1 s	2 s	5 s	10 s	20 s	50 s	100 s
Duty cycle	100 % (20 Hz)		100 % (200 Hz)		100 % (2 kHz)		100 % (20 kHz)	
Power freq.	400 Hz	60 Hz	50 Hz					
Freq. deviation	±50 %	-						
Pulse count	40,000							
Pulse integ.	50 k	100 k	200 k	500 k	1 M	2 M	5 M	10 M
	20 M	50 M	100 M	200 M	500 M	1000 M	2000 M	-

Tips

- When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



- An overrange does not occur in the Duty cycle mode or Pulse count mode.

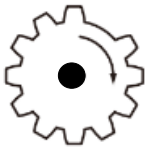
Step 3. Configure the individual settings according to each measurement mode.
The measurement modes include the Period mode, Pulse width mode, Duty cycle mode, Freq. deviation mode, Pulse count mode, and Pulse integ. mode.

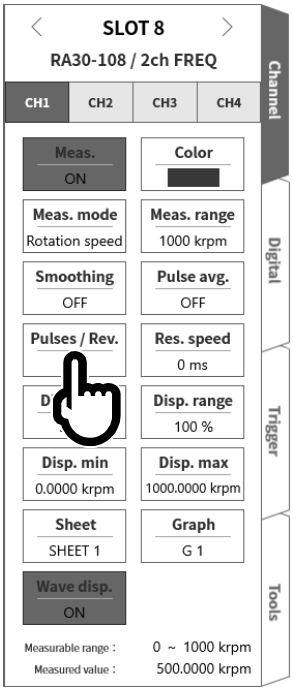
For the Rotation speed mode

Tap the【 Pulses / Rev.】 key, and set the pulse count per revolution.

Tips

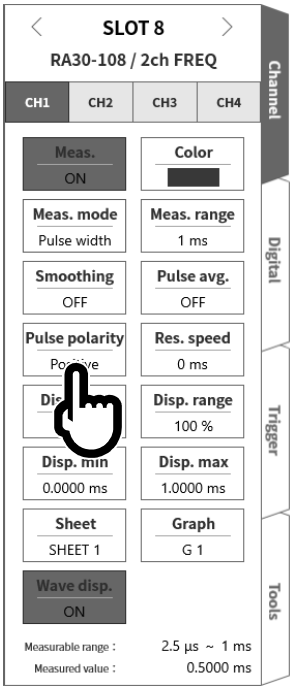
- For the gear on the right, the pulse count for revolution is 11 because the gear has 11 teeth.





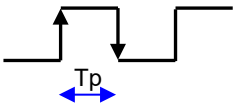
For the Pulse width mode and Duty cycle mode

Tap the【Pulse polarity】key, and set the pulse polarity.

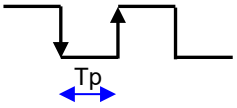


<When the Pulse width mode is set>

Positive: Measure the pulse width (Tp) from the rise to fall of the measurement pulse.

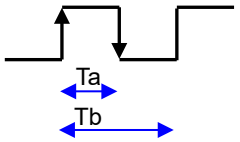


Negative: Measure the pulse width (Tp) from the fall to rise of the measurement pulse.

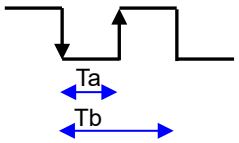


<When the Duty cycle mode is set>

Positive: Measure the pulse ratio (Ta/Tb) from the rise to fall of the measurement pulse.

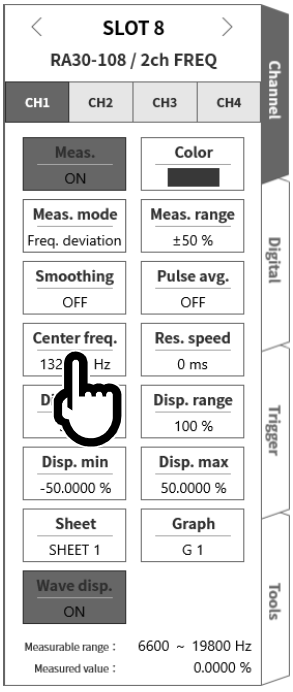


Negative: Measure the pulse ratio (Ta/Tb) from the fall to rise of the measurement pulse.



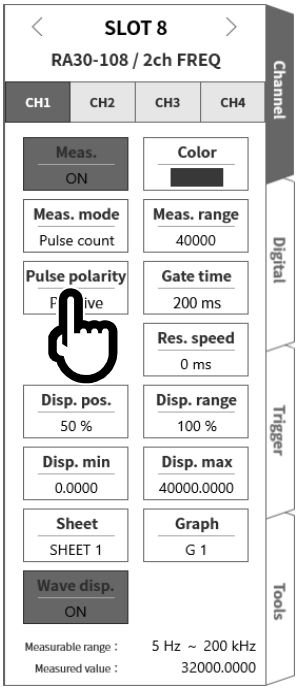
For the Frequency deviation mode

Tap the【Center freq.】key, and set the center frequency.

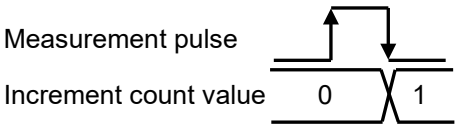


For the Pulse count mode or Pulse integ. mode

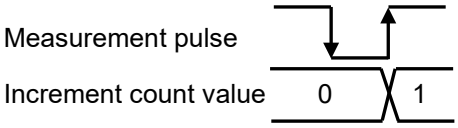
Tap the【 Pulse polarity】 key, and set the pulse polarity.



Positive: Detect from the rise to the fall of the measurement pulse, and increments the count value when the measurement pulse is confirmed.



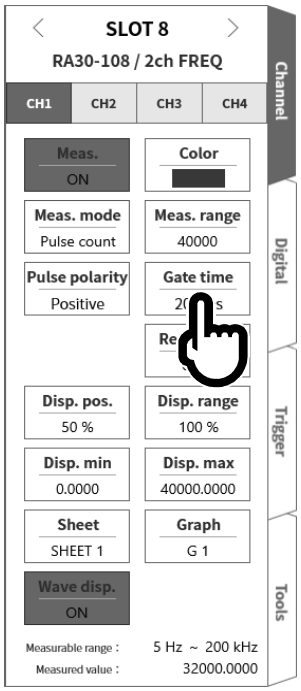
Negative: Detect from the fall to the rise of the measurement pulse, and increments the count value when the measurement pulse is confirmed.



For the Pulse count mode

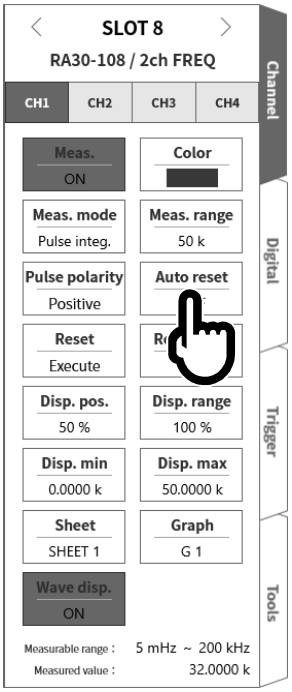
Tap the【 Gate time】 key, and set the gate time.

The number of measurement pulses within the gate time is counted.



For the Pulse integ. mode

Tap the【Auto reset】key, and set the count value reset operation.



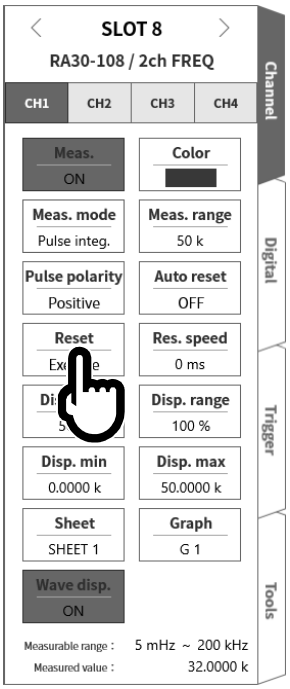
OFF: Stop the count value at the range upper limit.

Start: Reset the count value when recording starts and stop the count value at the range upper limit.

Over: Reset the count value and restart measurement from zero when the count value reaches the range upper limit.

Start & Over: Reset the count value when recording starts. Reset the count value and restart measurement from zero when the count value reaches the range upper limit.

Tap the【Reset】key to reset the count value.



Step 4. Set the pulse average.

The pulse average can be set in the Period mode, Frequency mode, Rotation speed mode, Pulse width mode, Duty cycle mode, Power freq. mode, and Freq. deviation mode. It is effective for eliminating variation in the input signal.

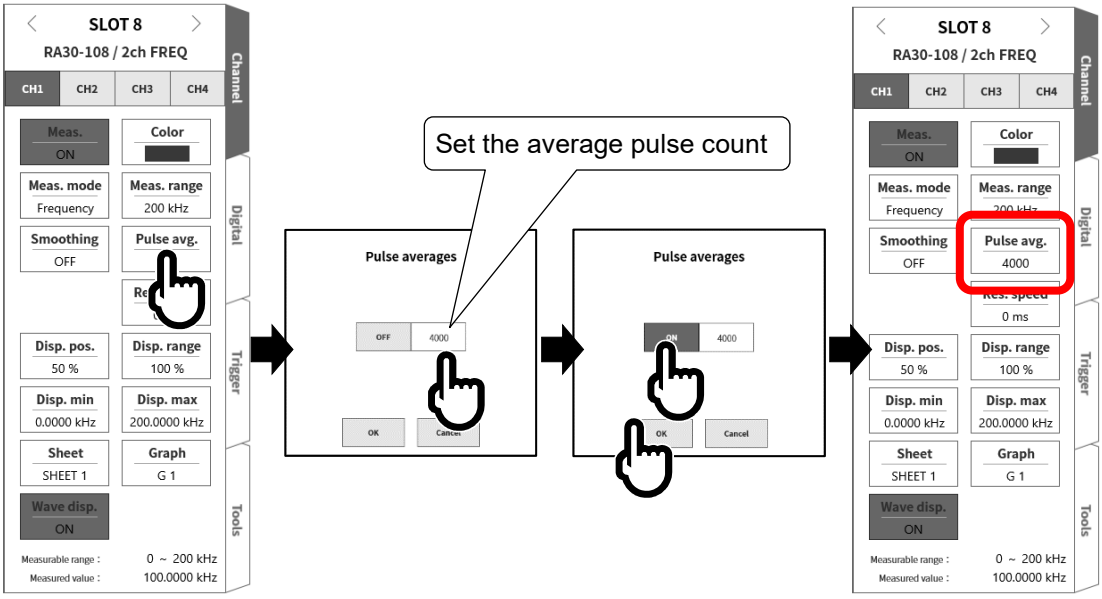
Tips

- ❑ Note that when Pulse avg. is set, data is not output until the set pulse count is measured.

Pulse Average Setting Procedure

Follow the procedure below to set the pulse average.

- ❑ Tap the【Pulse avg.】key.
- ❑ The [Pulse avg.] screen is displayed.
- ❑ Set the average pulse count on the numeric entry screen.
- ❑ Tap【OFF】to select【ON】.
- ❑ Tap【OK】.

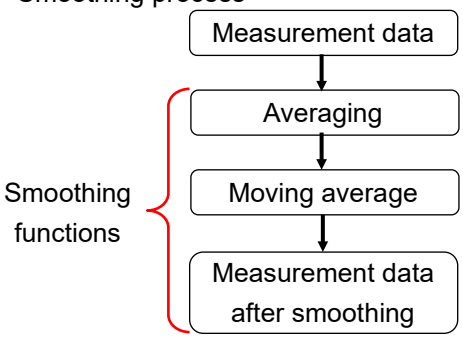


Step 5. Set smoothing.

Smoothing can be set in the Period mode, Frequency mode, Rotation speed mode, Pulse width mode, Duty cycle mode, Power freq. mode, and Freq. deviation mode.

It converts a stepped waveform into a smooth waveform.

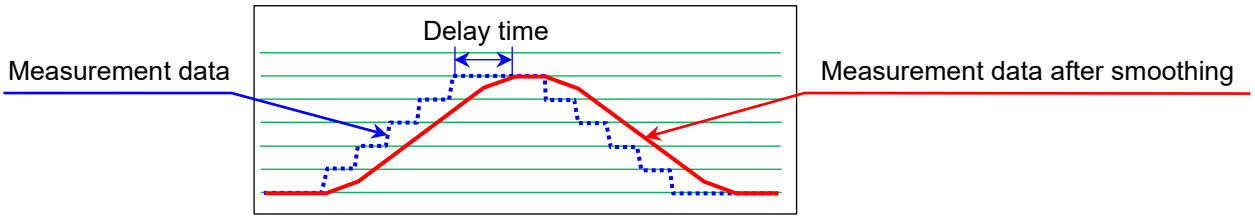
<Smoothing process>



Averaging is performed on the measurement data at the interval defined in the measurement range (40 µs to 4 s).

The moving average is performed the number of times set in the smoothing count (2 to 100).

A delay occurs when smoothing is set.

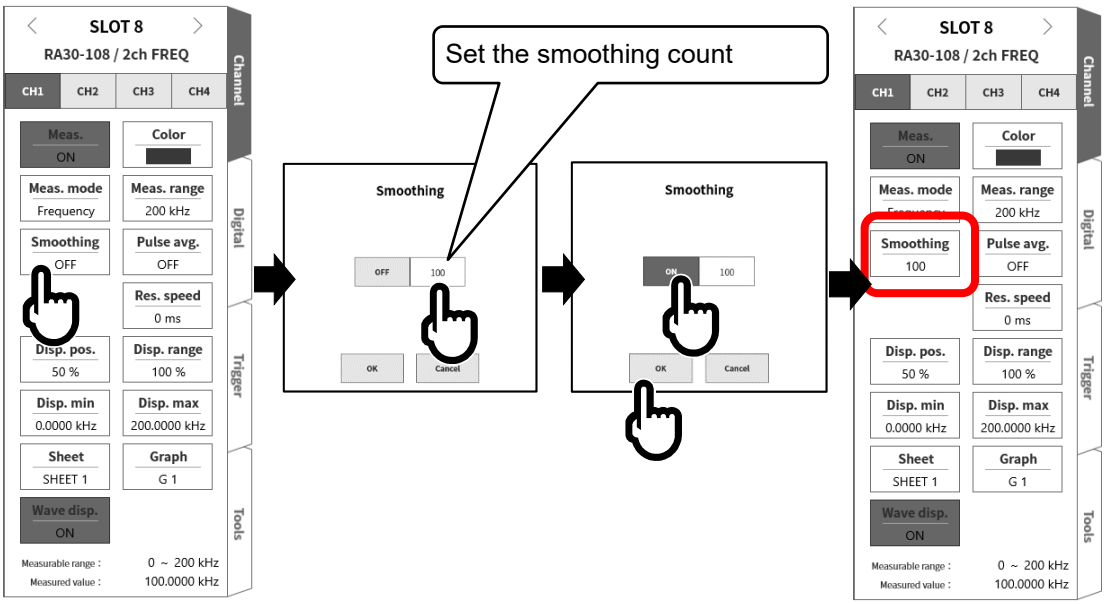


Measurement data waveform after smoothing

Smoothing Setting Procedure

Follow the procedure below to set smoothing.

- ❑ Tap the【Smoothing】key.
- ❑ The [Smoothing] screen is displayed.
- ❑ Set the smoothing count on the numeric entry screen.
- ❑ Tap【OFF】to select【ON】.
- ❑ Tap【OK】.



Tips

❑ The delay time is equal to the averaging time multiplied by the smoothing count.

<Averaging time in each mode when smoothing is set>

Measurement range							Averaging time
Period	Frequency	Rotation speed	Power freq.	Freq. deviation (center frequency range)	Pulse width	Duty cycle	
1 ms	200 kHz	–	–	–	1 ms	100 % (20 kHz)	40 µs
2 ms	100 kHz	–	–	–	2 ms	–	80 µs
–	50 kHz	–	–	–	–	–	160 µs
5 ms	–	–	–	–	5 ms	–	200 µs
10 ms	20 kHz	1000 krpm	–	13000 to 6600 Hz	10 ms	100 % (2 kHz)	400 µs
20 ms	10 kHz	500 krpm	–	6600 to 3300 Hz	20 ms	–	800 µs
–	5 kHz	200 krpm	–	3300 to 1320 Hz	–	–	1.6 ms
50 ms	–	–	–	–	50 ms	–	2 ms
100 ms	2 kHz	100 krpm	–	1320 to 660 Hz	100 ms	100 % (200 Hz)	4 ms
200 ms	1 kHz	50 krpm	400 Hz	660 to 330 Hz	200 ms	–	8 ms
–	500 Hz	20 krpm	–	330 to 132 Hz	–	–	16 ms
500 ms	–	–	–	–	500 ms	–	20 ms
1 s	200 Hz	10 krpm	–	132 to 66 Hz	1 s	100 % (20 Hz)	40 ms
2 s	100 Hz	5 krpm	60/50 Hz	66 to 33 Hz	2 s	–	80 ms
–	50 Hz	2 krpm	–	33 to 13.2 Hz	–	–	160 ms
5 s	–	–	–	–	5 s	–	200 ms
10 s	20 Hz	1 krpm	–	13.2 to 6.6 Hz	10 s	–	400 ms
20 s	10 Hz	500 rpm	–	–	20 s	–	800 ms
–	5 Hz	200 rpm	–	–	–	–	1.6 s
50 s	–	–	–	–	50 s	–	2 s
100 s	2 Hz	100 rpm 50 rpm 20 rpm 10 rpm	–	–	100 s	–	4 s

Step 6. Set the response speed.

From the【Res. speed】key, turn the knob to set the response speed.

This prevents incorrect measurement due to chattering.

Step 7. Set the display range and display position.

See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".

Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor

Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 8. Set the display minimum and display maximum.

See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".

Disp. max: Set the display upper limit value of the top of the display range.

Disp. min: Set the display lower limit value of the bottom of the display range.

9.8.5. Reference Materials

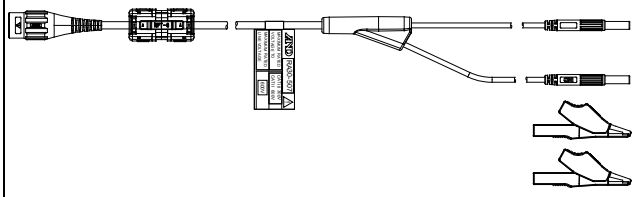
⚠CAUTION

- ❑ Ensure that the voltage between each input and the chassis (GND) and between each channel does not exceed 300 V (DC + AC peak). Damage may be caused if the voltage is exceeded.

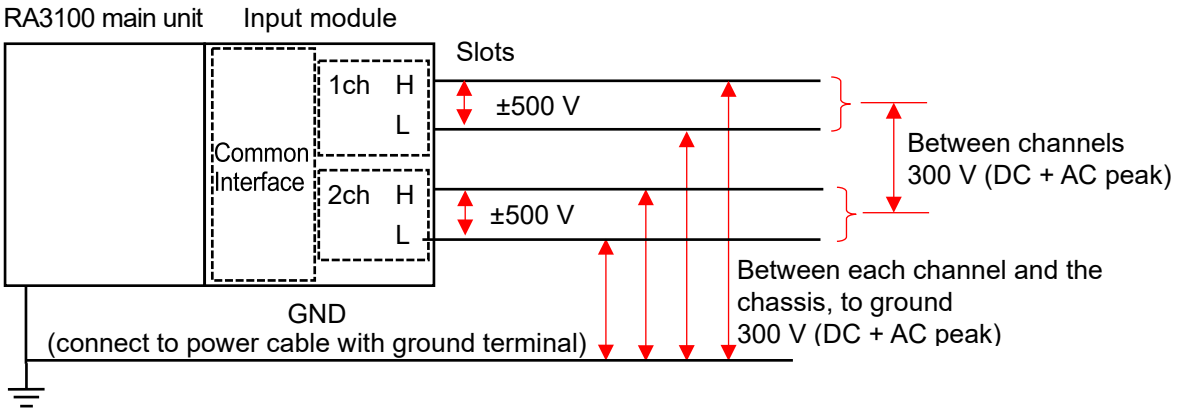
1 Input cable

The input connectors for CH1 and CH2 are insulated BNC connectors. Do not connect metallic BNC plugs, as they may damage the connectors or cause connection problems.
Use the insulated BNC cable indicated below (RA30-507) as the signal input cables.

Recommended cables

Name (type)	Shape/characteristics	
Insulated BNC cable (safety alligator clip) RA30-507		Insulated BNC ⇕ Safety alligator clip Red + Black – Length 1.5 m

2 Maximum rated voltage to ground



9.9. 2ch Acceleration Module (RA30-109)

9.9.1. Overview

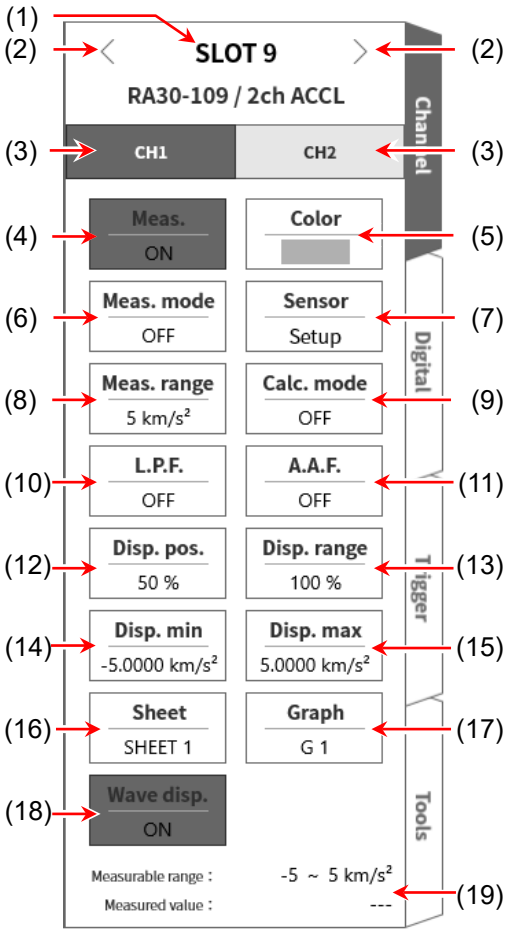
This two channel acceleration module samples an acceleration signal at 16-bit 1 MS/s and performs A/D conversion. In addition to an acceleration sensor incorporating a preamp, it can use a charge converter to support a charge output type acceleration sensor.

Its integration function enables an acceleration signal to be converted to output velocity and displacement, and it also includes functions for analog filtering, antialiasing, effective value calculation, and envelope calculation.

It is insulated between each channel and between each channel chassis.

9.9.2. Setting the Input Channel

<This section describes the setting switches and setting values of the RA3100 main unit. >



(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel:
Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Meas. mode: Switch the measurement mode of the input channel from OFF to Acceleration to Velocity to Displacement.

(7) Sensor: Set the conditions for the sensor to connect.

(8) Meas. range: Change the measurement range of the input channel.

(9) Calc. mode: Switch the calculation mode of the input channel from OFF to Envelope to RMS (Fast) to RMS (Mid) to RMS (Slow).

(10) L.P.F.: Change the low-pass filter.

(11) A.A.F.: Turns the anti-aliasing filter of the input channel on or off.

(12) Disp. pos.: Specify the display position.

(13) Disp. range: Specifies the display width in the amplitude direction of each graph.

(14) Disp. min: Set the display lower limit value of the bottom of the display range.

(15) Disp. max: Set the display upper limit value of the top of the display range.

(16) Sheet: Assign the channel to a sheet.

(17) Graph: Assign the channel to a graph.

(18) Wave disp.: When enabled, the waveform is displayed in the waveform monitor. When disabled, the waveform is not displayed.

(19) Measurable range/Measured value:

Displays the current available measurement range and measurement value.

9.9.3. Measurement Setup

⚠CAUTION

- ❑ Do not connect anything other than an acceleration sensor incorporating a preamp or a charge output type acceleration sensor via a charge converter.
  (Do not input voltage or current. Doing so may lead to failure.)
- ❑ When using an acceleration sensor incorporating a preamp, make sure that it meets the power specifications for sensors.
  Using a sensor that does not meet the specifications may damage the sensor.

Step 1. Turn the power of the main unit OFF or disable the measurement mode using the【Meas. mode】key (6), then connect the charge output type acceleration sensor via a charge converter.

Note

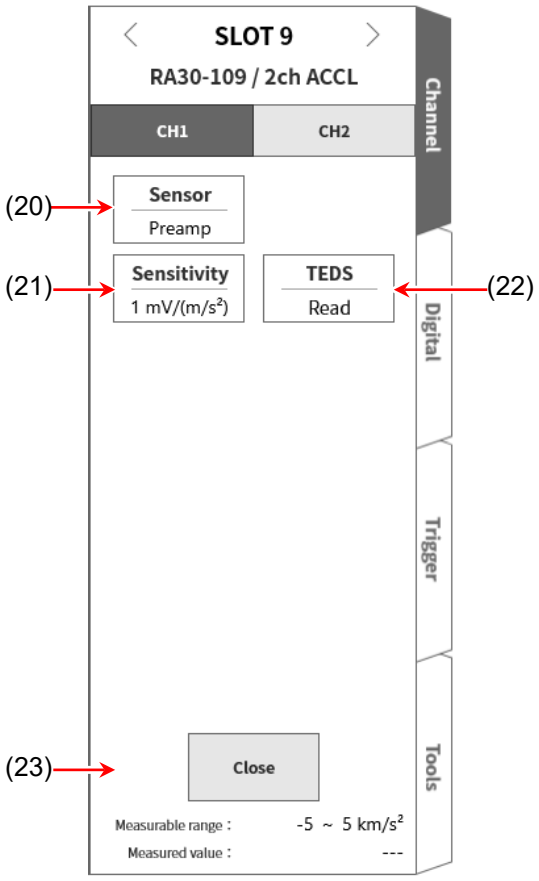
- ❑ If the measurement mode is not disabled, power for the sensor will be output from the BNC connector. Make sure to disable the measurement mode when connecting the sensor, in order to prevent electrocution or damage to the sensor.

Step 2. Connect the sensor, set [Meas. mode] to Acceleration, and enable [Meas.] to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.

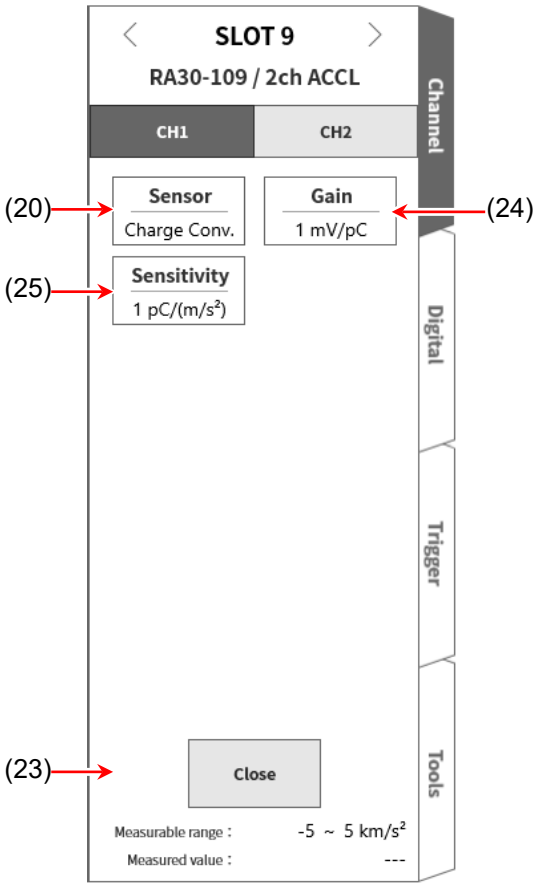
Tips

- ❑ When the power of the sensor is turned on, noise will be emitted for several seconds until the bias voltage of the sensor stabilizes. An overrange may occur due to the noise, but this is normal.

Step 3. Set the type and sensitivity of the sensor to connect.
Tap the【Sensor】key to open the sensor settings sub menu.



<When [Preamp] is selected as the sensor>



<When [Charge Conv.] is selected as the sensor>

<When using an acceleration sensor incorporating a preamp>

- Use the【Sensor】key (20) in the sensor settings sub menu to set the sensor to [Preamp]. Set the sensor sensitivity according to the sensor to use.
- For a sensor compatible with TEDS, tap the【TEDS Read】key (22) to automatically set the sensitivity.
- For a sensor not compatible with TEDS, use the【Sensitivity】key (21) to set the sensitivity indicated on the sensor in mV/(m/s^2). If the sensor sensitivity is indicated in mV/G as a gravitational acceleration, divide the number by 9.8.
- When the settings are complete, use the【Close】key (23) to close the sensor settings sub menu.

<When using a charge output type acceleration sensor>

When using a charge output type acceleration sensor, a charge converter is required.
Follow the procedure below to configure the settings according to the sensor and charge converter to use.

- ❑ Use the【Sensor】key (20) in the sensor settings sub menu to set the sensor to [Charge Conv.].
- ❑ Set the gain according to the sensor and charge converter to use.
- ❑ The gain can be changed with the【Gain】key (24).
  The following three gain ranges are available.
  Set the range closest to the gain indicated on the charge converter.

0.1 mV/pC	1 mV/pC	10 mV/pC

- ❑ Set the sensor sensitivity according to the charge output type acceleration sensor to use.
- ❑ Use the【Sensitivity】key (25) to set the sensitivity indicated on the sensor in pC/(m/s^2).
  If the sensor sensitivity is indicated in pC/G as a gravitational acceleration, divide the number by 9.8.

Tips

- ❑ If the gain of the charge converter to use deviates from the selected range, it is necessary to multiply the sensor sensitivity by that deviation.

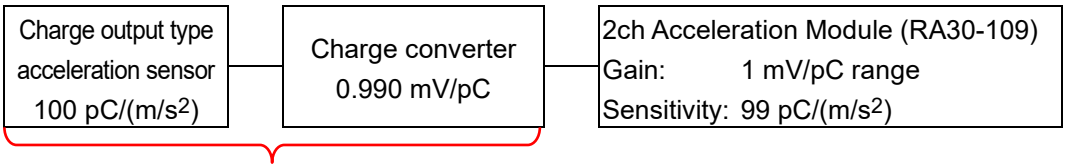
$$\text{Sensor sensitivity to set} = \frac{\text{Gain of charge converter [mV/pC]}}{\text{Range of gain [mV/pC]}} \times \text{sensor sensitivity [pC/(m/s}^2\text{)]}$$

Example If the gain of the charge converter to use is 0.990 mV/pC and the sensor sensitivity of the charge output type acceleration sensor is 100 pC/(m/s^2), set the following values.

- ❑ Use the【Gain】key (24) to set the range to 1 mV/pC, which is the closest to the charge converter gain of 0.990 mV/pC.
- ❑ Calculate the sensor sensitivity to set.

$$\frac{0.990\ [\text{mV/pC}]}{1.0\ [\text{mV/pC}]} \times 100\ [\text{pC/(m/s}^2\text{)}] = 99\ [\text{mV/(m/s}^2\text{)}]$$

- ❑ Use the【Sensitivity】key (25) to set the sensitivity to 99 pC/(m/s^2).



Equivalent to acceleration sensor incorporating a preamp with sensor sensitivity of 99 mV/(m/s^2)

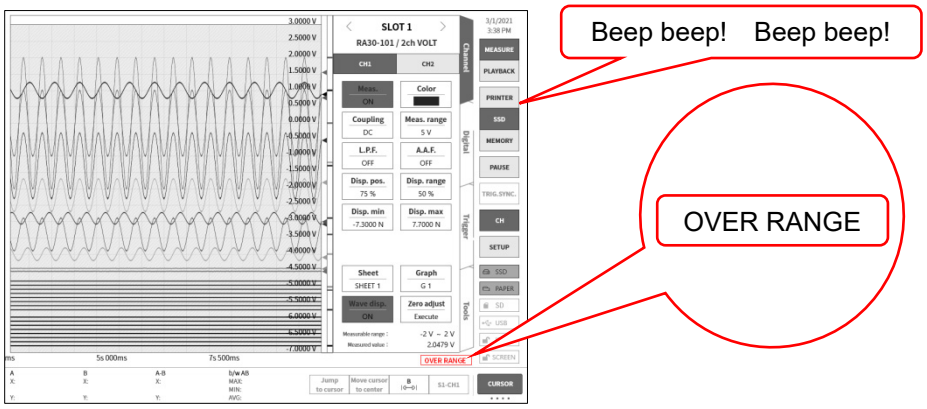
- ❑ When the settings are complete, use the【Close】key (23) to close the sensor settings sub menu.

Step 4. Set the measurement range according to the target for measurement.
The input sensitivity can be changed with the 【Meas. range】 key (8).
The measurement range to set differs according to the value set for the sensor sensitivity.

☞ For details, see "9.9.5. Reference Materials".

Tips

❑ When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



Step 5. Set the measurement mode with the [Meas. mode] key (6).

Measurement mode	Description (unit)	
Acceleration	Measure the acceleration signal.	(m/s^2)
Velocity	Measure the acceleration signal by converting it to velocity.	(m/s)
Displacement	Measure the acceleration signal by converting it to displacement.	(m)

Tips

❑ If an overrange occurs in the acceleration signal, the velocity and displacement cannot be measured correctly.
Make sure to set the velocity and displacement after setting the measurement mode to acceleration and confirming that an overrange has not occurred.

Step 6. Set the input filter.
Set the low-pass filter with the 【L.P.F.】 key (10).
The low-pass filter of this module is a flat attenuation filter with no ripples in the passband. Set a cutoff frequency about 10 times the effective frequency as a signal to remove the unnecessary high frequency component and noise component.

OFF	20 kHz	2 kHz	200 Hz	20 Hz

Set the antialiasing filter setting with the 【A.A.F.】 key (11).
A steeply sloping attenuation low-pass filter. Enable this filter to automatically set the cutoff frequency linked with the sampling speed so that aliasing does not occur in the measurement data due to the sampling. This is particularly effective for FFT analysis. The L.P.F. setting is disabled because L.P.F. is used internally.

Step 7. Use the【Calc. mode】 key (9) to set the calculation mode (RMS calculation or envelope calculation).

Calculation mode	Description
Envelope	Enables measurement of the input signal envelope value. The waveform that passes through the BPF is rectified and smoothed, then the envelope waveform is output. FFT analysis of the output signal is effective for detecting weak signals that appear repeatedly. Use it to detect the repeat period when bearing failure has occurred.
RMS(Fast)	Enables measurement of the input signal effective value. You can select three different response speeds (high speed, medium speed, and low speed). Use it to monitor wideband vibration and trends in vibration variation.
RMS(Mid)	
RMS(Slow)	
OFF	The input signal is measured as it is.

Tips

- If an overrange occurs in the input signal and causes waveform distortion, the velocity and displacement cannot be measured correctly. Set a range that prevents overrange from occurring.
  When the calculation mode is used, overrange occurs at approximately 70% of the set range.

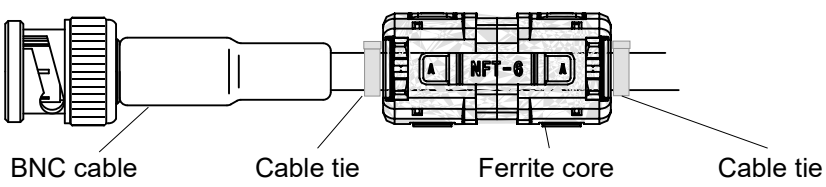
Step 8. Set the display range and display position.
See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".
Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor
Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 9. Set the display minimum and display maximum.
See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".
Disp. max: Set the display upper limit value of the top of the display range.
Disp. min: Set the display lower limit value of the bottom of the display range.

9.9.4. Cables

9.9.4.1. Installing the Included Ferrite Core

Open the ferrite core and clasp it around the BNC cable near the BNC connector on the module side.
Close the ferrite core and secure both ends using commercially-available cable ties.



9.9.5. Reference Materials

⚠CAUTION

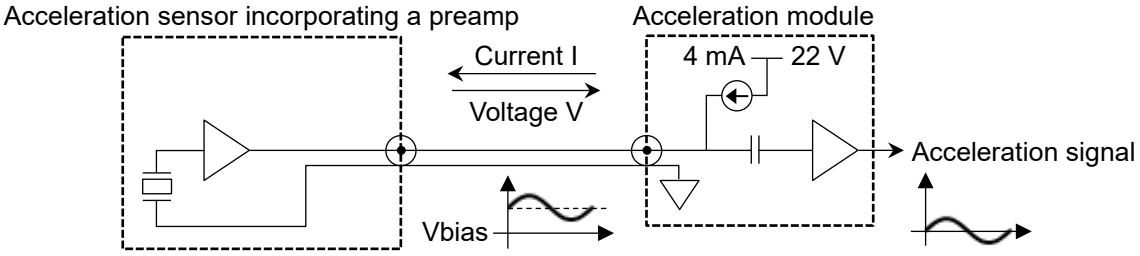
- Ensure that the voltage between each input and the chassis (GND) and between each channel does not exceed 42 V (DC + AC peak). Damage may be caused if the voltage is exceeded.

1 Connecting the Acceleration Sensor

When using an acceleration sensor incorporating a preamp, connect the sensor directly.
When using a charge output type acceleration sensor, connect the sensor via a charge converter.

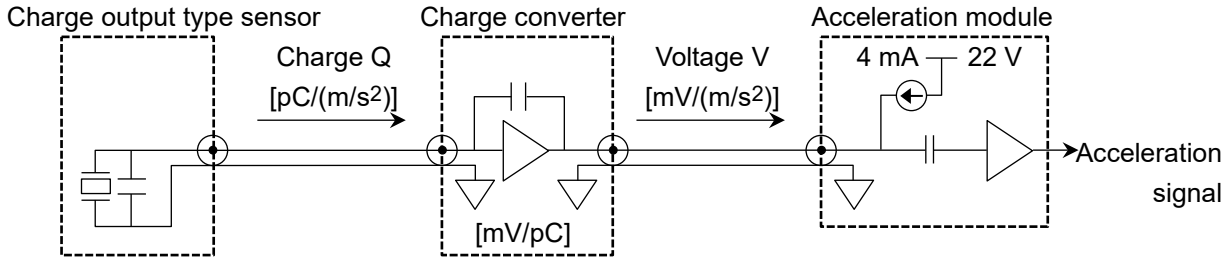
Tips

- The module supplies a constant current to an acceleration sensor incorporating a preamp.
  The sensor outputs the acceleration signal to the same signal wire as an AC voltage signal.
  The module measures the acceleration signal obtained by cutting the DC component from the input signal.



An acceleration sensor incorporating a preamp is a sensor where the charge output type acceleration sensor and preamp (charge converter) are integrated.
Because it outputs a voltage signal with low impedance, it is less susceptible to noise than a charge output type acceleration sensor, and a charge converter is not required. However, it usually has limitations regarding the size and usage temperature, when compared to a charge output type acceleration sensor.

- Charge output type acceleration sensor generates a charge according to the acceleration.
  The generated charge is converted to an AC voltage signal via a charge converter.
  The module supplies a constant current to the charge converter.
  The charge converter outputs the acceleration signal to the same signal wire as an AC voltage signal.
  The module measures the acceleration signal obtained by cutting the DC component from the input signal.

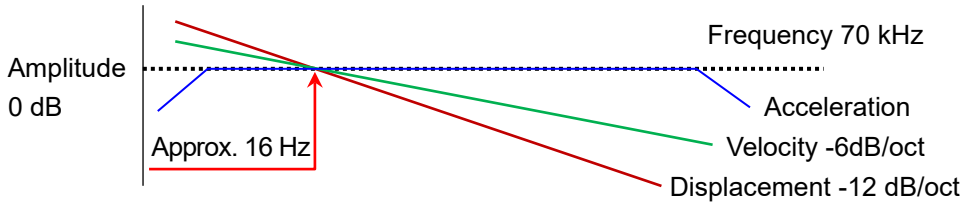


A charge output type acceleration sensor is lightweight and compact, and is suitable for measurement at low or high temperatures.
However, it has high impedance and is susceptible to noise, so caution is required.

2 Measuring the Velocity and Displacement

When the acceleration mode is set, set a measurement range that will prevent overrange from occurring. If an overrange occurs in the acceleration signal and causes waveform distortion, a large error will also occur in the the velocity and displacement.

When the frequency of the acceleration signal is approximately 16 Hz, the measured amplitude does not change, even if the measurement mode is switched to Acceleration, Velocity, or Displacement. However, with other frequency domains, the amplitude of the velocity is measured at a ratio -6 dB/oct smaller than the amplitude of the acceleration and the amplitude of the displacement is measured at a ratio -12 dB/oct smaller than the amplitude of the acceleration.



Tips

❑ The relationship between the acceleration (A), velocity (V), and displacement (D) is indicated below. (f: Input signal frequency)

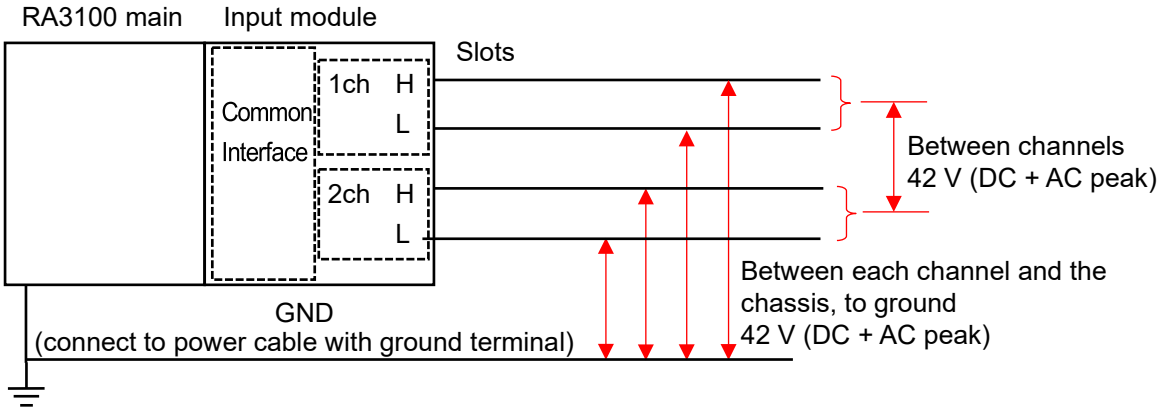
Acceleration	A (m/s^2)
Velocity	V = A/2πf (m/s)
Displacement	D = V/2πf (m)

This module passes through an analog integrator to convert the acceleration signal to velocity and displacement.

As indicated in the formula above, to the amplitude of the acceleration, the amplitude of the velocity is inversely proportional to the frequency of the acceleration signal, and the amplitude of the displacement is inversely proportional to square the frequency of the acceleration signal.

When the amplitude of the acceleration is constant, the attenuation is -6 dB/oct for the velocity and -12 dB/oct for the displacement when at approximately 16 Hz.

3 Maximum rated voltage to ground



4 Available Values for the Measurement Range

The available values for the measurement range differ according to the value set for the sensor sensitivity.

Measurement mode			Sensor sensitivity									Sensor	Gain
			0.100 ~ 0.250	0.251 ~ 0.500	0.501 ~ 1.000	1.001 ~ 2.500	2.501 ~ 5.000	5.001 ~ 10.000	10.001 ~ 25.000	25.001 ~ 50.000	50.001 ~ 100.000	Preamp	
			1.00 ~ 2.50	2.51 ~ 5.00	5.01 ~ 10.00	10.01 ~ 25.00	25.01 ~ 50.00	50.01 ~ 100.00	100.01 ~ 250.00	250.01 ~ 500.00	500.01 ~ 1000.00	Charge Conv.	0.1 mV/pC
			0.100 ~ 0.250	0.251 ~ 0.500	0.501 ~ 1.000	1.001 ~ 2.500	2.501 ~ 5.000	5.001 ~ 10.000	10.001 ~ 25.000	25.001 ~ 50.000	50.001 ~ 100.000		1 mV/pC
			0.0100 ~ 0.0250	0.0251 ~ 0.0500	0.0501 ~ 0.1000	0.1001 ~ 0.2500	0.2501 ~ 0.5000	0.5001 ~ 1.0000	1.0001 ~ 2.5000	2.5001 ~ 5.0000	5.0001 ~ 10.0000		10 mV/pC
Measurement range	Acceleration	Velocity	Displacement										
	1 m/s²	10 mm/s	100 μm								✓		
	2 m/s²	20 mm/s	200 μm							✓	✓		
	3.16 m/s²	31.6 mm/s	316 μm							✓	✓		
	5 m/s²	50 mm/s	500 μm						✓	✓	✓		
	10 m/s²	100 mm/s	1 mm					✓	✓	✓	✓		
	20 m/s²	200 mm/s	2 mm				✓	✓	✓	✓	✓		
	31.6 m/s²	316 mm/s	3.16 mm				✓	✓	✓	✓	✓		
	50 m/s²	500 mm/s	5 mm			✓	✓	✓	✓	✓	✓		
	100 m/s²	1 m/s	10 mm		✓	✓	✓	✓	✓	✓	✓		
	200 m/s²	2 m/s	20 mm	✓	✓	✓	✓	✓	✓	✓			
	316 m/s²	3.16 m/s	31.6 mm	✓	✓	✓	✓	✓	✓				
	500 m/s²	5 m/s	50 mm	✓	✓	✓	✓	✓	✓				
	1 km/s²	10 m/s	100 mm	✓	✓	✓	✓	✓					
	2 km/s²	20 m/s	200 mm	✓	✓	✓	✓	✓					
	3.16 km/s²	31.6 m/s	316 mm	✓	✓	✓	✓						
	5 km/s²	50 m/s	500 mm	✓	✓	✓	✓						
	10 km/s²	100 m/s	1 m	✓	✓	✓							
	20 km/s²	200 m/s	2 m	✓	✓								
	31.6 km/s²	316 m/s	3.16 m	✓									
	50 km/s²	500 m/s	5 m	✓									

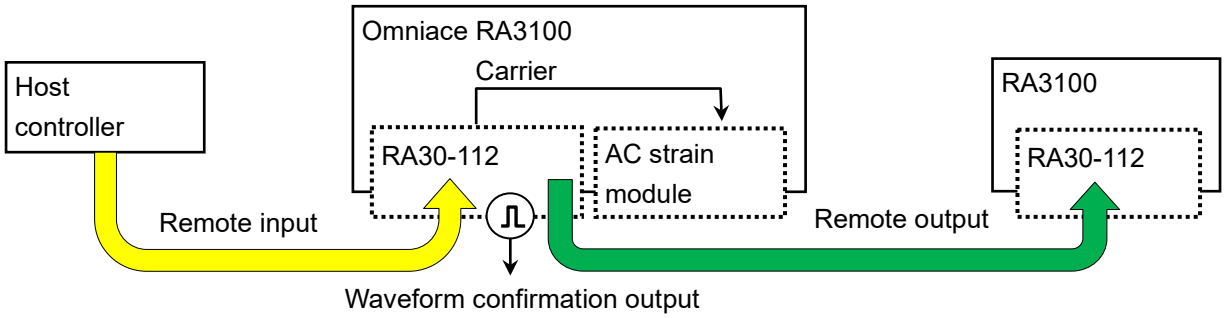
9.10. Remote Control Module (RA30-112)

9.10.1. Overview

The following three major types of functions are included in the RA30-112 remote module.

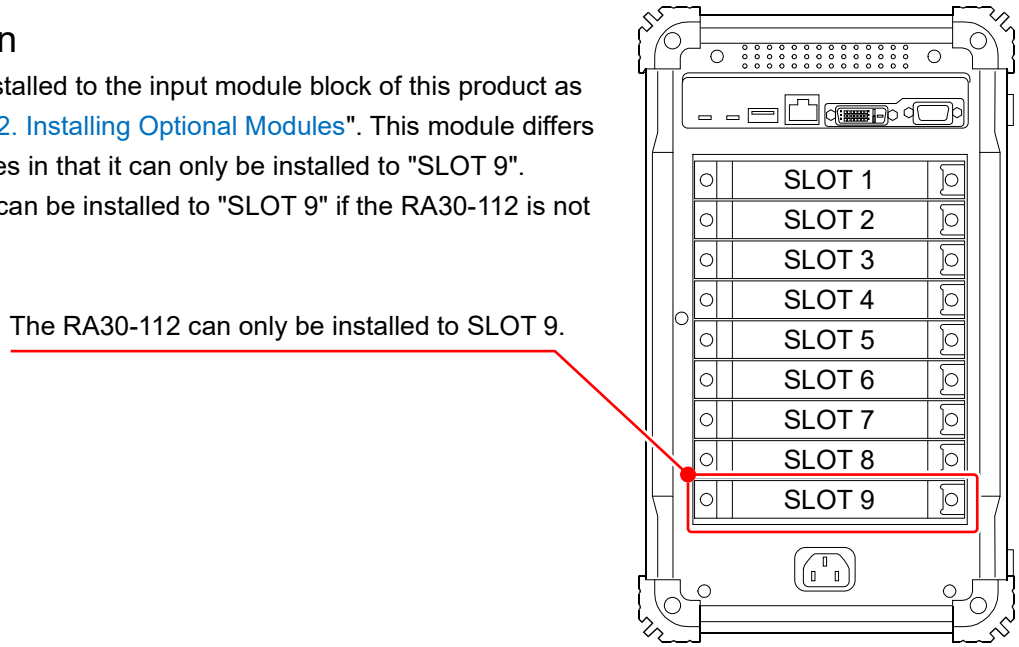
- ❑ Remote function for remotely controlling this product from an external device
- ❑ Carrier function for AC strain module
- ❑ Waveform confirmation output for confirming the voltage input module

The remote function includes both remote input for control from an external device and remote output for performing synchronized operation with another RA3100 and this product acting as the master.



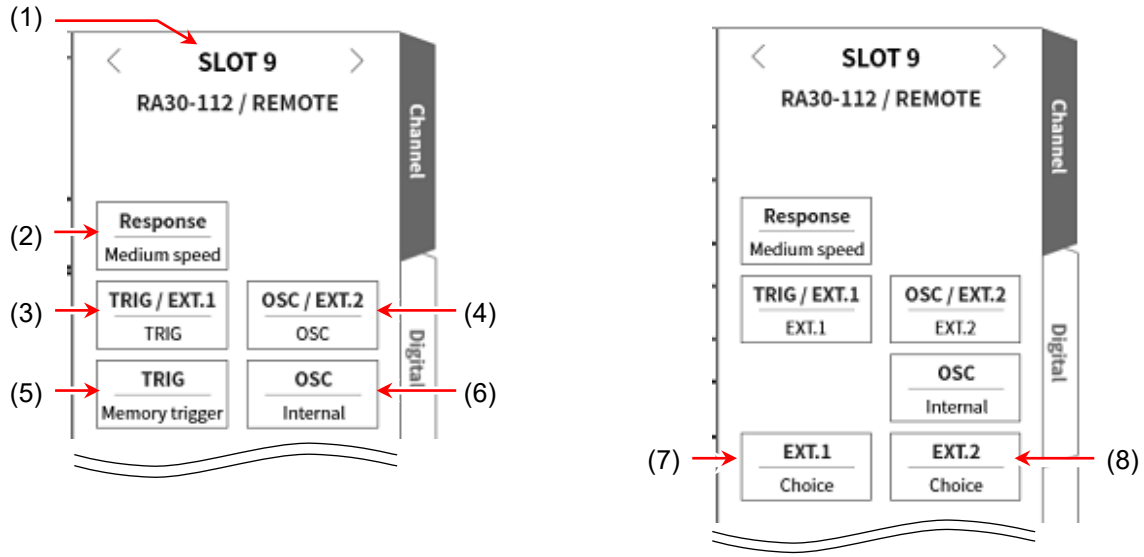
9.10.2. Installation

This module is installed to the input module block of this product as described in "2.1.2. Installing Optional Modules". This module differs from other modules in that it can only be installed to "SLOT 9". (Another module can be installed to "SLOT 9" if the RA30-112 is not installed.)



9.10.3. Channel setting

Tap the【CH】 key on the side menu to display the channel settings menu. "SLOT 9" where the remote module (RA30-112) is installed in slot selection is displayed.
For information on functions, see "9.10.5. Measurement Setup".



(1) Slot number: The slot number of SLOT 9.

(2) Response: Select [High speed], [Medium speed], or [Low speed] for the response speed of the remote input signal.

(3) TRIG/EXT.1: Select [TRIG] or [EXT.1].
Set TRIG in [TRIG] (5) and EXT.1 in [EXT.1] (7).

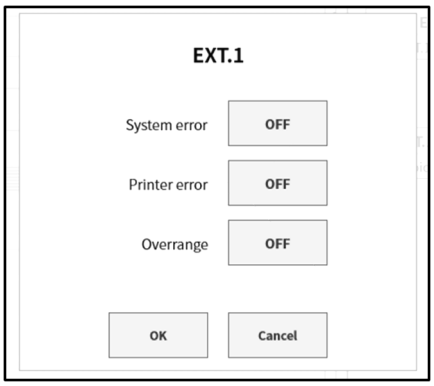
(4) OSC/EXT.2: Select [OSC] or [EXT.2].
Set OSC in [OSC] (6) and EXT.2 in [EXT.2] (8).

(5) TRIG: Sets the TRIG signal for remote input.

(6) OSC: Select "Internal" or "External" as the carrier signal source for the AC strain module.

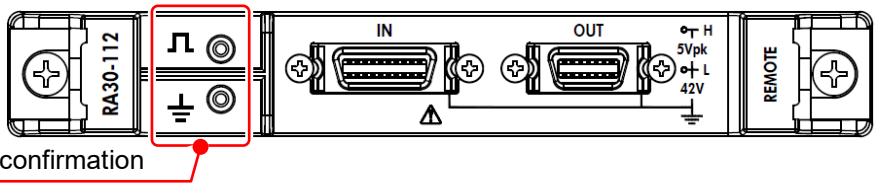
(7) EXT.1: Enables/disables the state of this product set to output externally for system errors, printer errors, and overranges. Tap to display the EXT.1/EXT.2 setting dialog.

(8) EXT.2: The same as EXT.1.



9.10.4. Output terminal for waveform confirmation

A square wave is output from the output terminal of this module at 0 to 5 V and 1 kHz.
This square wave signal can be connected to the voltage input module and waveform monitored to check module operation.



Output terminal for waveform confirmation

9.10.5. Measurement Setup

1 Response

Select [High speed], [Medium speed], or [Low speed] for the response speed of the remote input signal.
In noisy environments, select [Low speed] to perform control with a filter.
The effective pulse width of the input signal is as follows.

- ❑ For high speed response: High level period 1 µs or more, Low level period 1 µs or more
- ❑ For medium speed response: High level period 1 ms or more, Low level period 1 ms or more
- ❑ For low speed response: High level period 10 ms or more, Low level period 10 ms or more

2 OSC

Select the carrier signal source used for the RA3100 main unit when the AC strain module is installed.

Internal: Use the OSC signal generated in the RA3100 main unit where this module is installed. It can also be supplied to another RA3100 connected with synchronization.

External: Supplies the OSC IN signal input from remote input to the implementation module. See the connection diagram in "5 Connection Method."

3 TRIG

Sets the TRIG signal for remote input.

- ❑ OFF: Do not use the TRIG signal for remote input.
- ❑ Start trigger: Input the TRIG signal for remote input as the start trigger.
- ❑ Memory trigger: Input the TRIG signal for remote input as the memory trigger.

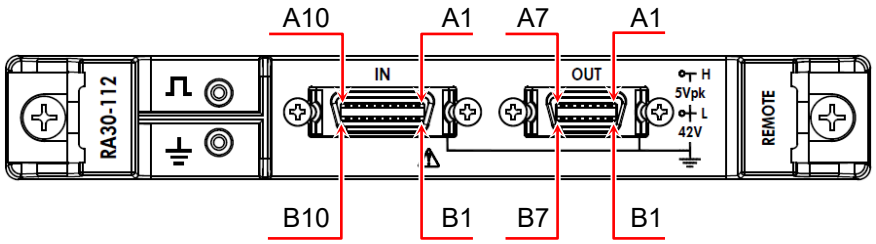
4 EXT.1/EXT.2

These settings output the state of this product externally. When System error, Printer error, or Overrange is enabled, this is output if either one occurs.

- ❑ System error: The state where the software of this product cannot operate normally.
- ❑ Printer error: When a printer communication error, motor error, or head temperature error has occurred, the printer cover is open, or recording paper has run out.
- ❑ Overrange: When an overrange has occurred.

9.10.6. Reference Materials

1 Front panel



2 Pin layout of IN connector

Pin number	Sig name	Pin number	Sig name	Function
A1	NC	B1	GND	–
A2	NC	B2	GND	–
A3	START/ STOP IN (+)	B3	START/ STOP IN (–)	Recording start/stop input Performs printer recording for the period where the signal is at the low level.
A4	MARK IN (+)	B4	MARK IN (–)	Mark input Records a mark on the recording data at the falling edge of this signal.
A5	FEED IN (+)	B5	FEED IN (–)	Feed (idle feeding of recording paper) input Performs idle feeding of printer recording paper for the period where this signal is at the low level.
A6	PRINT IN (+)	B6	PRINT IN (–)	Print input Performs pen recording for the period where the signal is at the low level while stopped. This signal is not received during recording.
A7	NC	B7	GND	–
A8	EXT SMPL IN (+)	B8	EXT SMPL IN (–)	External sampling input Performs sampling at the falling edge of this signal.
A9	TRIG IN (+)	B9	TRIG IN (–)	Trigger input Receives external triggers at the falling edge of this signal.
A10	OSC IN (+)	B10	OSC IN (–)	OSC signal input for AC strain module Supplies this signal to the AC strain module as the carrier signal source.

- ❑ Connector for input signal: DF02R020NA3 (Japan Aviation Electronics Industry)
- ❑ The A series and B series are complementary. GND (B series) is the input common for A series signals.
- ❑ The plugs (manufacturer model numbers) corresponding to each input signal connector are indicated below.
  Compatible plug: DF02P020F22A1 (soldered type), DF02P020G28A1 (pressure connected type)

Note

- ❑ Do not control START/STOP IN, PRINT IN, and FEED IN at the same time.

3 Pin layout of out connector

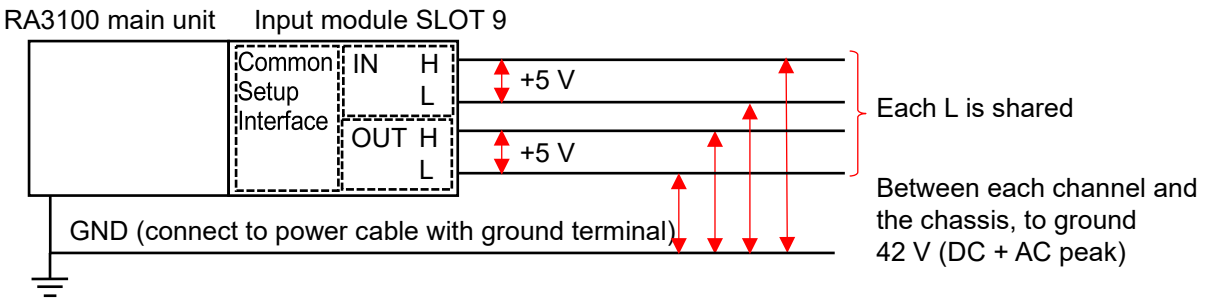
Pin number	Sig name	Pin number	Sig name	Function
A1	START/ STOP OUT (+)	B1	START/ STOP OUT (−)	Recording start/stop output The low level signal is output while this product is recording.
A2	MARK OUT (+)	B2	MARK OUT (−)	Mark output Outputs the MARK IN signal to the MARK OUT signal.
A3	FEED OUT (+)	B3	FEED OUT (−)	Feed (idle feeding of recording paper) output Outputs the FEED IN signal to the FEED OUT signal.
A4	PRINT OUT (+)	B4	PRINT OUT (−)	Print output Outputs the PRINT IN signal to the PRINT OUT signal.
A5	EXT SMPL OUT	B5	EXT SMPL OUT	External sampling output Outputs the EXT SMPL IN signal to the EXT SMPL OUT signal.
A6	TRIG/EXT.1 OUT (+)	B6	TRIG/EXT.1 OUT (−)	Trigger output (TRIG OUT) Outputs the TRIG OUT signal to the low level when a trigger occurs. External output (EXT.1 OUT) Set to the low level when an error such as a system error occurs. See "9.10.3. Channel setting".
A7	OSC/EXT.2 OUT (+)	B7	OSC/EXT.2 OUT (−)	OSC signal for AC strain module output (OSC OUT) This output is used for synchronizing with the AC strain module installed in another RA3100. External output (EXT.2 OUT) Set to the low level when an error such as a system error occurs. See "9.10.3. Channel setting".

Connector for output signal: DF02R014NA3 (Japan Aviation Electronics Industry)

- ❑ The A series and B series are complementary. GND (B series) is the common for A series signals.
- ❑ The plugs (manufacturer model numbers) corresponding to each output signal connector are indicated below.

  Compatible plug: DF02P014F22A1 (soldered type), DF02P014G28A1 (pressure connected type)

4 Maximum rated voltage to ground

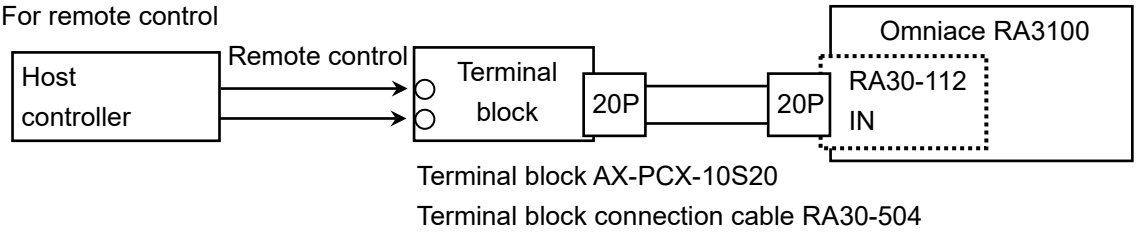


⚠CAUTION

- ❑ Ensure that the voltage between each input/output and the chassis (GND) does not exceed 42 V (DC+ACpeak). Damage may be caused if the voltage is exceeded.
- ❑ There is no insulation between the inputs/outputs.
  L (GND) is connected internally.

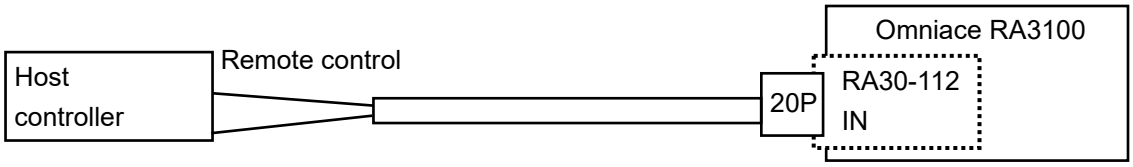
5 Connection method

5.1 For remote control



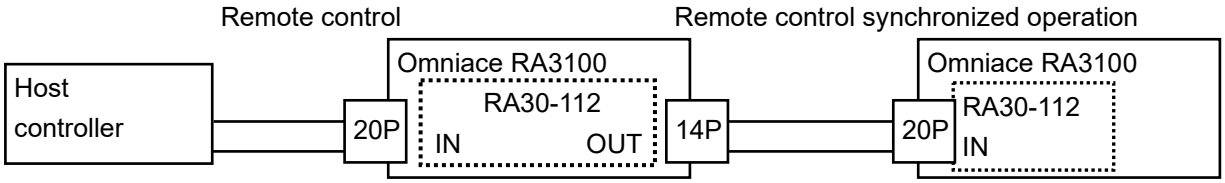
Terminal block AX-PCX-10S20

Terminal block connection cable RA30-504



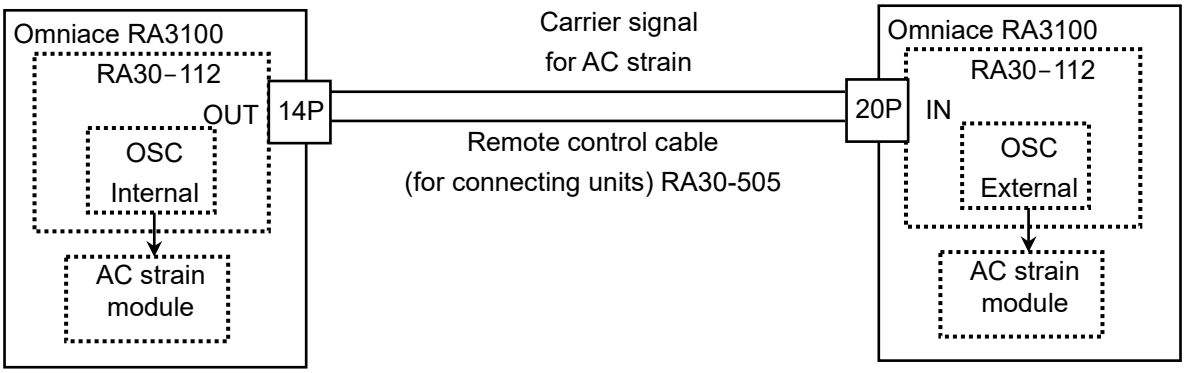
Remote control cable (discrete wires) RA30-506

5.2 When connecting multiple RA3100

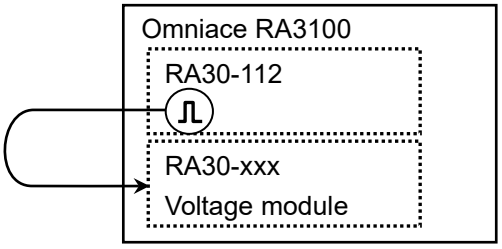


Remote control cable (for connecting units) RA30-505

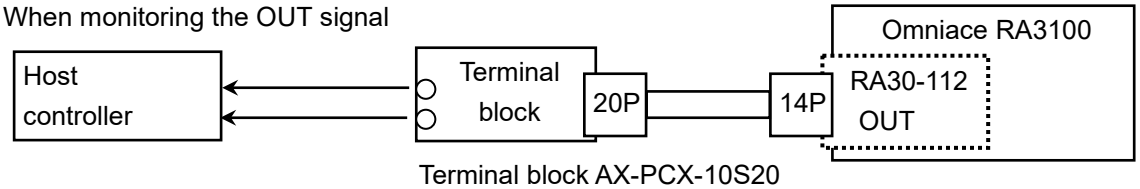
5.3 Carrier signal for AC strain



5.4 Output terminal for waveform confirmation



5.5 When monitoring the OUT signal



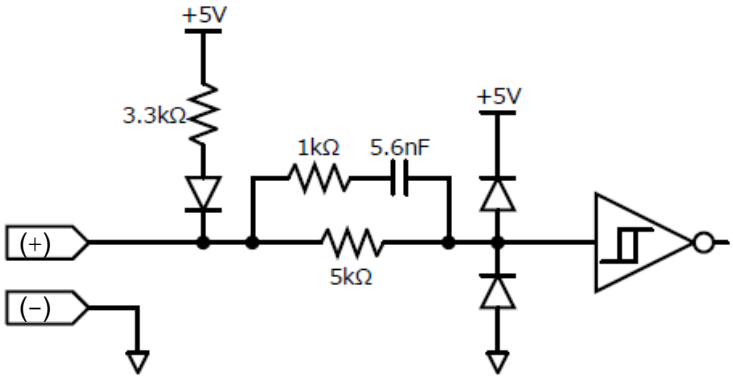
Terminal block AX-PCX-10S20

Remote control cable (for connecting units) RA30-505

6 Equivalent circuit

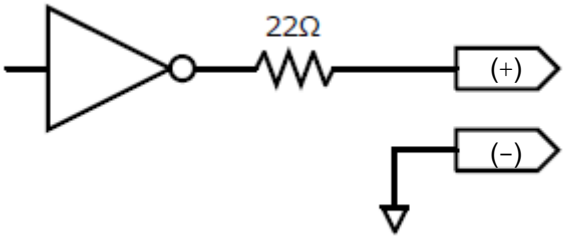
6.1 IN

The equivalent circuit schematic of START/STOP IN, MARK IN, FEED IN PRINT IN, EXT SMPL IN, TRIG IN, ar OSC IN.



6.2 OUT

The equivalent circuit schematic of START/STOP OUT, MARK OUT, FEED OUT, PRINT OUT, EXT SMPL OUT, TRIG/EXT.1 OUT, OSC/EXT.2 OUT.



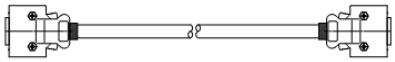
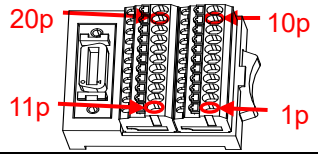
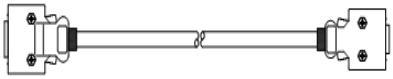
Note

- Ensure that the output current from the OUT connector does not exceed 5 mA per pin. Damage may be caused if the voltage is exceeded.

9.10.7. Options

1 Connection cables and terminal blocks

The following cables and terminal blocks are provided for signal input and synchronized connection.

Name (type)	Shape/characteristics	
Terminal block connection cable RA30-504		For MDR 20 pole terminal block connection 20P - 20P Length 2 m
Terminal block AX-PCX-10S20		For MDR 20 pole terminal block (for AWG16-28)
Remote control cable (discrete wires) RA30-506		For remote control input Length 2 m
Remote control cable (for connecting units) RA30-505		For connecting RA3100 20P - 14P Length 2 m

2 Pin layout

Pin layout of RA30-112 input connectors and correspondence chart of remote control cables and terminal block connection cables.

	RA30-112 input terminal	Combination of AX-PCX-10S20 terminal block and RA30-504 cable	RA30-506 Remote control cable (discrete wires)		
Sig name	Pin no.	Pin no.	Wire color	Mark color	Mark indication
NC	A1	1			
GND	B1	11			
NC	A2	2			
GND	B2	12			
START/STOP IN	A3	3	Orange	Red	–
GND	B3	13		Black	–
MARK IN	A4	4	Light gray	Red	–
GND	B4	14		Black	–
FEED IN	A5	5	White	Red	–
GND	B5	15		Black	–
PRINT IN	A6	6	Yellow	Red	–
GND	B6	16		Black	–
NC	A7	7	Pink	Red	–
GND	B7	17		Black	–
EXT SMPL IN(+)	A8	8	Orange	Red	–
EXT SMPL IN(–)	B8	18		Black	–
TRIG IN(+)	A9	9	Light gray	Red	–
TRIG IN(–)	B9	19		Black	–
OSC IN(+)	A10	10	White	Red	–
OSC IN(–)	B10	20		Black	–

For the RA30-501/RA30-502 cable

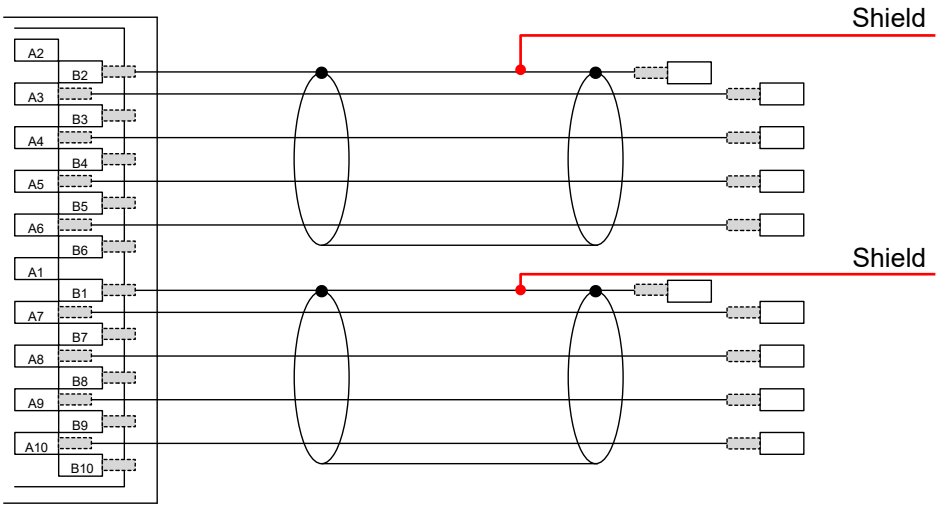
	RA30−112 IN connector	RA30−501 / RA30-502 logic input cable	
Sig name	Pin no.	Mark indication	Wire color
GND	B1	CH5-8	Black
GND	B2	CH1-4	Black
START/STOP IN	A3	CH5-8	Yellow
GND	B3	CH5-8	
MARK IN	A4	CH5-8	Orange
GND	B4	CH5-8	
FEED IN	A5	CH5-8	Red
GND	B5	CH5-8	
PRINT IN	A6	CH5-8	Brown
GND	B6	CH5-8	
NC	A7	CH1-4	Yellow
GND	B7	CH1-4	
EXT SMPL IN (+)	A8	CH1-4	Orange
EXT SMPL IN (−)	B8	CH1-4	
TRIG IN (+)	A9	CH1-4	Red
TRIG IN (−)	B9	CH1-4	
OSC IN (+)	A10	CH1-4	Brown
OSC IN (−)	B10	CH1-4	

❑ Pin layout of RA30-112 OUT connectors and correspondence chart of remote control cables and terminal block connection cables.

	RA30-112 OUT connector	Combination of AX-PCX-10S20 terminal block and RA30-505 cable
Sig name	Pin no.	Pin no.
START/STOP OUT (+)	A1	3
START/STOP OUT (−)	B1	11/13
MARK OUT (+)	A2	4
MARK OUT (−)	B2	14
FEED OUT (+)	A3	5
FEED OUT (−)	B3	15
PRINT OUT (+)	A4	6
PRINT OUT (−)	B4	16
EXT SMPL OUT (+)	A5	8
EXT SMPL OUT (−)	B5	18
TRIG/EXT.1 OUT (+)	A6	9
TRIG/EXT.1 OUT (−)	B6	19
OSC/EXT.2 OUT (+)	A7	10
OSC/EXT.2 OUT (−)	B7	20

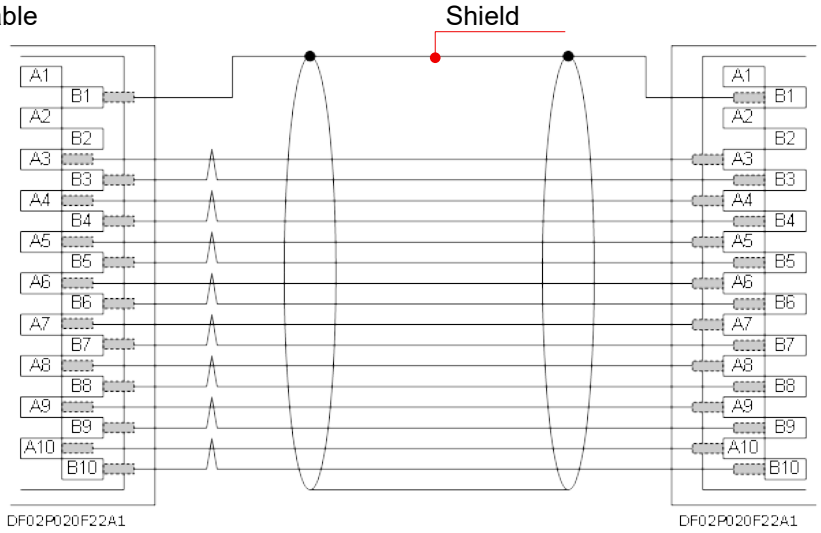
3 Cable Specifications

3.1 RA30-501/RA30-502 cable

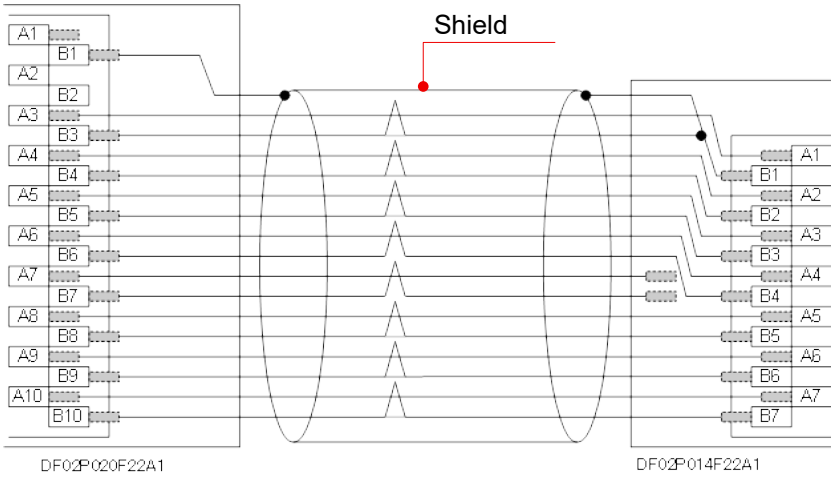


DF02P020F22A1 IC clip/alligator clip

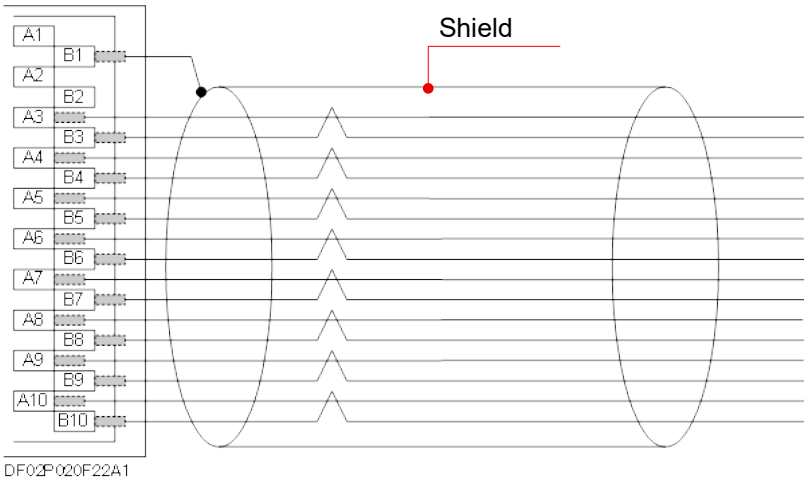
3.2 RA30-504 Cable



3.3 RA30-505 Cable



3.4 RA30-506 Cable



9.11. 4ch Voltage Module (RA30-113)

9.11.1. Overview

This four channel voltage input module samples a DC to 100 kHz signal at 16-bit 1 MS/s within the measurement range of ±2 V to ±500 V and can perform A/D conversion. It includes an analog filter for waveform observation. It is insulated between each channel and between input and output.

9.11.2. Setting the Input Channel

<This section describes the setting switches and setting values of the RA3100 main unit. >

(1) Slot number, input module type

(2) Change slot: Change the slot.

(3) Select channel:
Select the channel in the slot.

(4) Meas. ON/OFF
ON: Measure the input signal.

(5) Color: Change the display color of the waveform monitor.

(6) Coupling: Switch the input signal coupling.

(7) Meas. range: Change the measurement range.

(8) L.P.F.: Change the low-pass filter.

(10) Disp. pos.: Specify the display position.

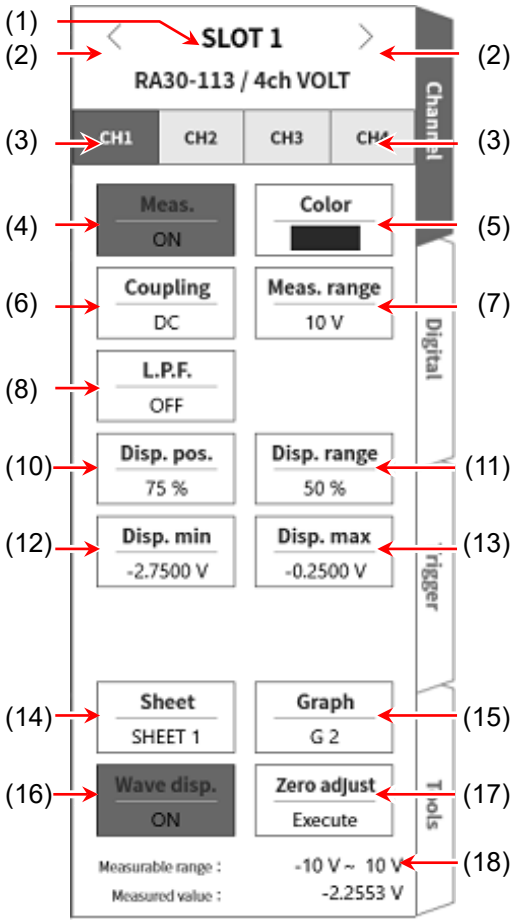
(11)Disp. range: Specifies the display width in the amplitude direction of each graph.

(12) Disp. min: Set the display lower limit value of the bottom of the display range.

(13) Disp. max: Set the display upper limit value of the top of the display range.

(14) Sheet: Assign the channel to a sheet.

(15) Graph: Assign the channel to a graph.



(16) Waveform display:
When enabled, the waveform is displayed in the waveform monitor. When disabled, the waveform is not displayed.

(17) Zero adjust: Cancels the input offset of the input channel. Execute zero cancellation to perform more accurate measurement.

(18) Available measurement range/measurement value:
Displays the current available measurement range and measurement value.

9.11.3. Measurement Setup

Check the slot number and channel, connect the signal to the corresponding input module, and enable 【Meas.】 to display the input waveform on the monitor screen. Perform adjustment for the required signal waveform while viewing the waveform.
Follow the procedure below to set the input channel.

Step 1. Set the input coupling in with the 【Coupling】 key (6).

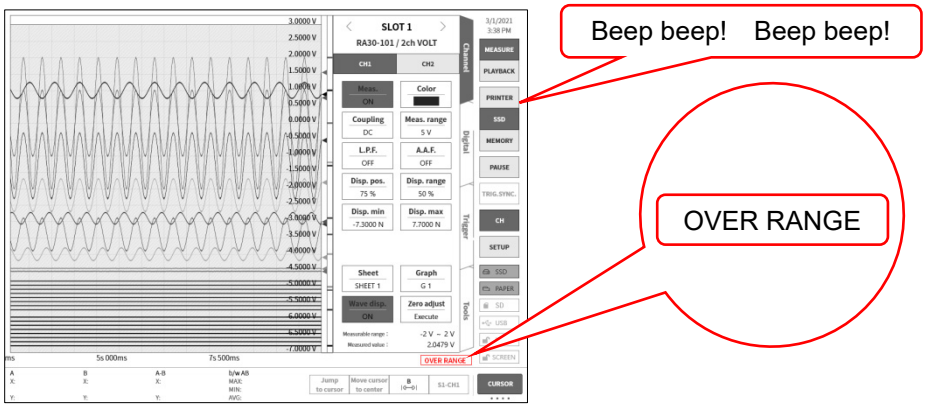
Coupling	Contents
DC	Enables measurement of the actual input signal, including the DC and AC component. Set DC coupling when performing measurement.
GND	Connects the channel input to GND without connecting the input signal inside the channel. Enables the input GND level to be checked with waveform monitoring or printer recording.

Step 2. Set Meas. range according to the target for measurement.
The input sensitivity can be changed with the 【Meas. range】 key (7) in the channel setup sub menu. The value displayed for the measurement range (RANGE) indicates the input (measurement) maximum value and corresponds to 10 div on the waveform monitor. When the display position is 50%, ±RANGE (full measurement range) is displayed.
Tap the 【Meas. range】 key and turn the rotary knob to change the range. Turn the rotary knob counterclockwise to reduce the sensitivity and clockwise to increase the sensitivity. The following 8 measurement ranges are available.

500 V	200 V	100 V	50 V	20 V	10 V	5 V	2 V

Tips

- When the input exceeds the measurement range, "OVER RANGE" is displayed on the bottom right of the screen, and the main unit emits a warning beep. Reduce the sensitivity with the measurement range so that the input signal does not exceed the range. To silence the warning beep, disable the buzzer sound setting. For more information, see the buzzer sound setting in "8.3.1. Environment Setup".



Step 3. Set the input filter. Set the low-pass filter with the【L.P.F.】 key (8).
The low-pass filter of this module is a gently sloping attenuation filter that prioritizes the waveform. Set a cutoff frequency about 10 times the effective frequency as a signal to remove the unnecessary high frequency component and noise component.

OFF	3 kHz	300 Hz	30 Hz	3 Hz

Step 4. Set the display range and display position.
See "Step 5. Set the Display Range and Display Position" in "4.3.2. Setup the input channels".
Disp. range: The display width in the amplitude direction of the waveform display area on the waveform monitor
Disp. pos.: Specify the position of the waveform monitor to display the specified range of the waveform display area.

Step 5. Set the display minimum and display maximum.
See "Step 6. Set the Display Maximum and Display Minimum" in "4.3.2. Setup the input channels".
Disp. max: Set the display upper limit value of the top of the display range.
Disp. min: Set the display lower limit value of the bottom of the display range.

Step 6. Execute zero adjust.
In order to perform measurement with fewer errors, tap the【(17) Zero adjust】 key in the channel setup sub menu to perform zero adjustment after the warmup time elapses or after the measurement range, filter, or input coupling has been changed.

Tips

❑ This function is for canceling internal offset and drift, and does not cancel the offset of the input signal.

9.11.4. Reference Materials

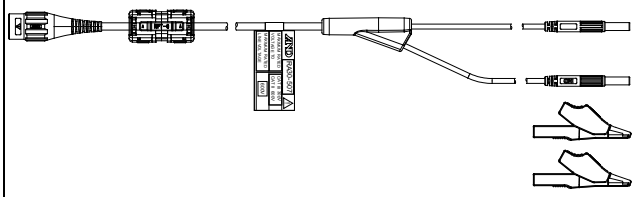
⚠CAUTION

- ❑ Ensure that the voltage between each input and the chassis (GND) and between each channel does not exceed 300 V(DC+ACpeak). Damage may be caused if the voltage is exceeded.

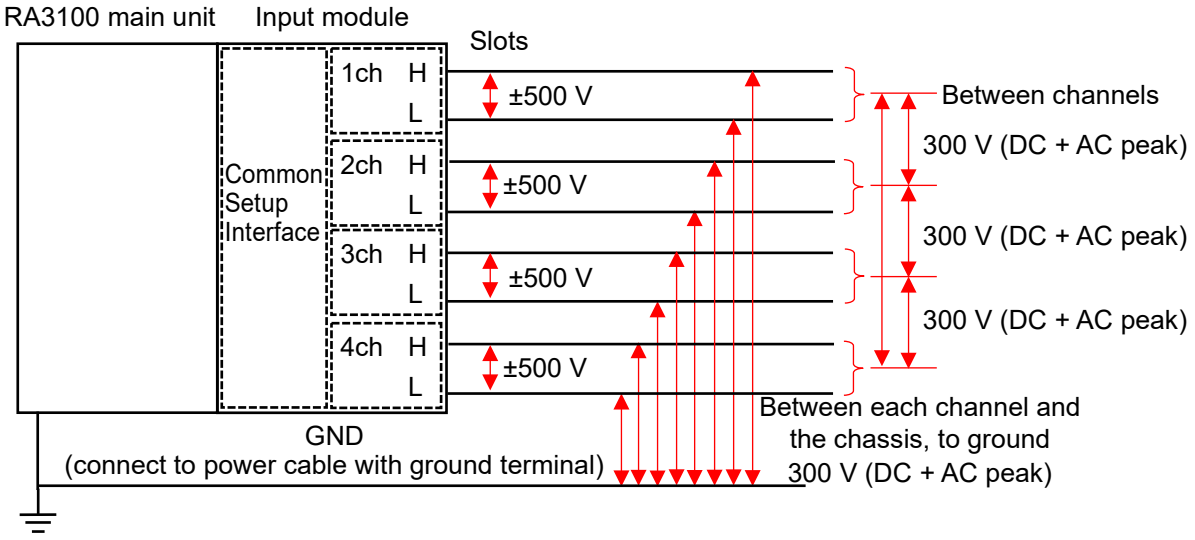
1 Input cable

The input connectors for CH1 to CH4 are insulated BNC connectors. Do not connect metallic BNC plugs, as they may damage the connectors or cause connection problems.
Use the insulated BNC cable indicated below (RA30-507) as the signal input cables.

Recommended cables

Name (type)	Shape/characteristics	
Insulated BNC cable (safety alligator clip) RA30-507		Insulated BNC ⇕ Safety alligator clip Red + Black – Length 1.5 m

2 Maximum rated voltage to ground



10. Appendix

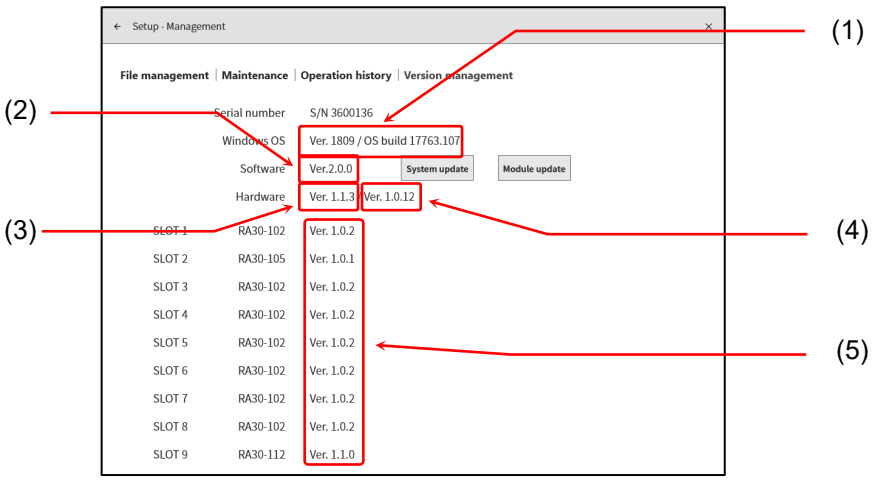
This chapter provides additional explanations of various functions.

10.1. Version Information

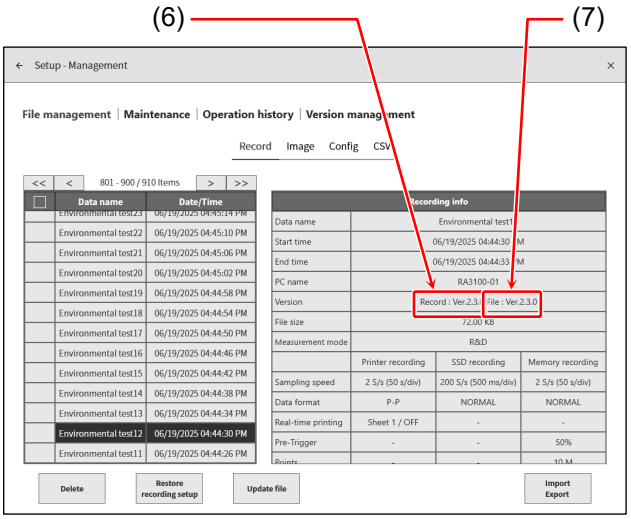
The versions handled on the management screen of this product are as indicated below.

Name	Overview
(1) Windows OS	The version of the embedded Windows 10 IoT operating system
(2) Software	The version of the RA3100 software
(3) Main hardware	The version of the main FPGA
(4) Printer hardware	The version of the printer FPGA
(5) Modules	The versions of the module FPGAs
(6) Recorded data software	The version of the RA3100 software that recorded the data
(7) Recorded data file	The version of the RA3100 software that recorded or updated the file
(8) Configuration data file	The version of the RA3100 software that created the file

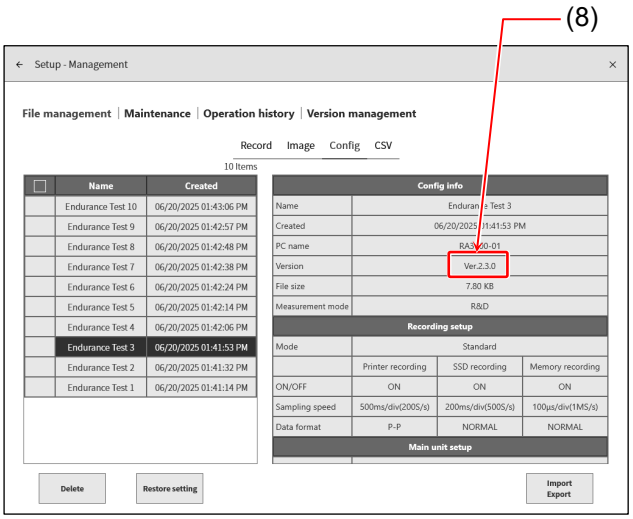
・Version management screen



・File management screen - Record



・File management screen - Config

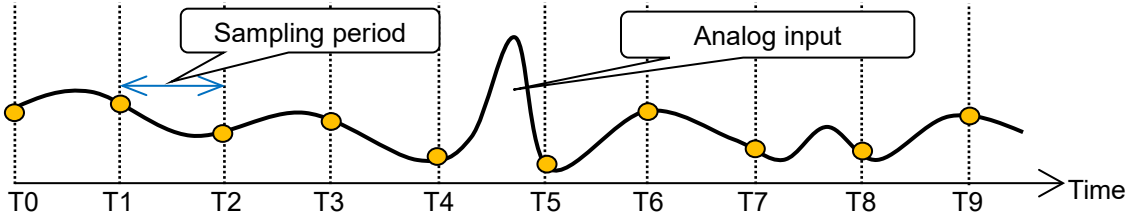


10.2. Sampling Data Format

This product has two data formats: NORMAL sampling and P-P sampling.

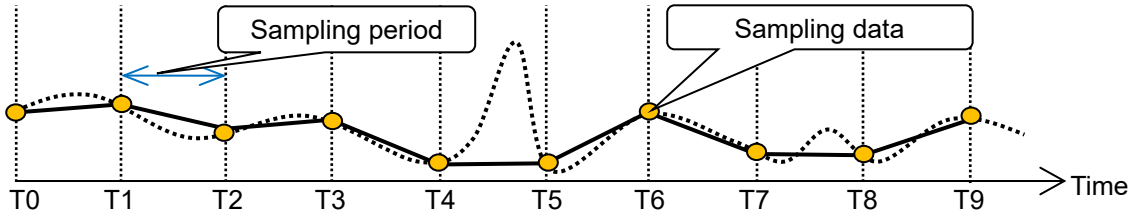
10.2.1. NORMAL Sampling

With NORMAL sampling, the A/D value of the sampling period is recorded as data and used for waveform reproduction and data analysis.

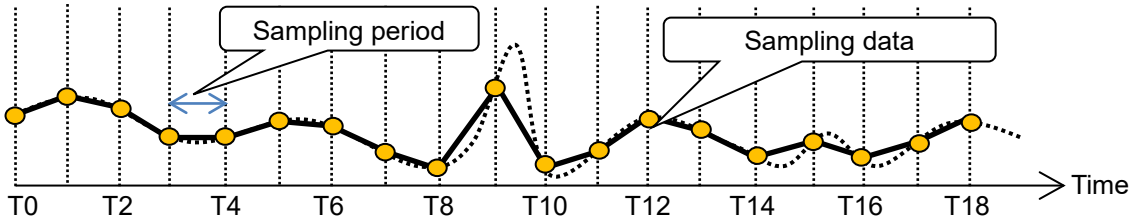


Playback the input waveform from sampling data

If the input signal is too fast for the sampling period, the waveform reproducibility may drop and lead to the unexpected loss of pulses.



Raising the sampling speed improves the waveform reproducibility but increases the recorded data.

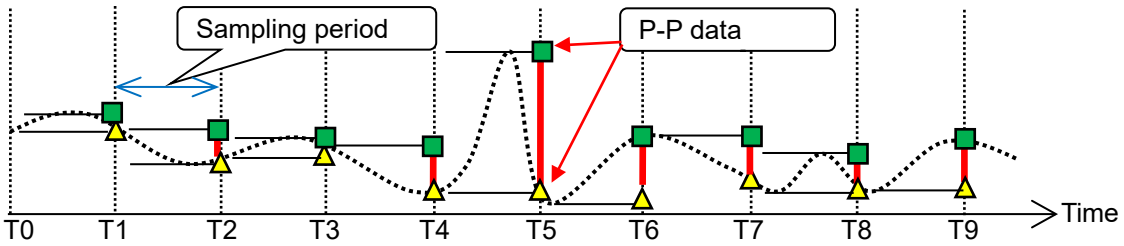


10.2.2. P-P Sampling

P-P sampling performs sampling with the data within the sampling period as the fastest sampling (20 MS/s), to detect the peak values (maximum value and minimum value) and record those peak values as the recorded data.

This data format is suitable for the waveform playback of long-term recording, as it enables waveform reproducibility of a wide band of data, without sudden spike noise, etc.

A disadvantage is that it cannot perform data analysis after recording (average, RMS, FFT, statistical calculation, etc.)



10.3. Sampling

10.3.1. Internal Sampling

The sampling speed can be set for printer recording, SSD recording, and memory recording separately. The maximum sampling speed differs for each recording. For information on specifications, see "12.1.1. Main Unit Basic Specifications".

10.3.2. External Sampling

With pen recording, printer recording, and SSD recording, external sampling is possible, where sampling is performed synchronized to the input of an external clock signal. However, only one device can record, either printer recording or SSD recording.

The clock signal of external sampling is input to the "EXT SMPL IN" terminal of "9.10. Remote Control Module (RA30-112)".

10.3.3. Relationship between Sampling Speed and Chart Speed

The relationship between sampling speed and chart speed is indicated in the table below.

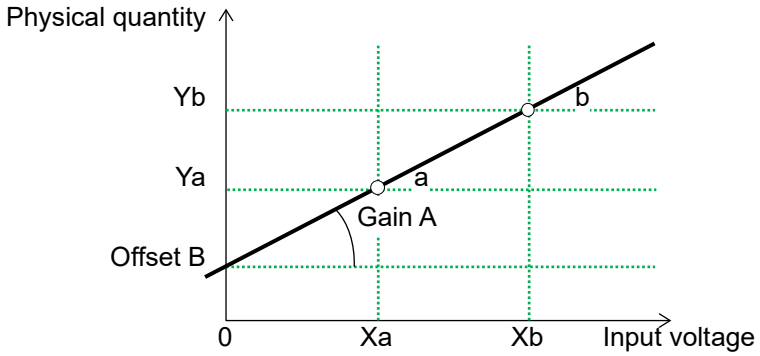
Sampling	Sampling speed		Chart speed
	Frequency	Period	
Internal	100 ms/div (1 kS/s)	100 ms/div (1 ms)	100 mm/s
	200 ms/div (500 S/s)	200 ms/div (2 ms)	50 mm/s
	500 ms/div (200 S/s)	500 ms/div (5 ms)	20 mm/s
	1 s/div (100 S/s)	1 s/div (10 ms)	10 mm/s
	2 s/div (50 S/s)	2 s/div (20 ms)	5 mm/s
	5 s/div (20 S/s)	5 s/div (50 ms)	2 mm/s
	10 s/div (10 S/s)	10 s/div (100 ms)	1 mm/s
	20 s/div (5 S/s)	20 s/div (200 ms)	30 mm/min
	50 s/div (2 S/s)	50 s/div (500 ms)	12 mm/min
	100 s/div (1 S/s)	100 s/div (1 s)	6 mm/min
	2 min/div (50 S/min)	2 min/div (1.2 s)	5 mm/min
	5 min/div (20 S/min)	5 min/div (3 s)	2 mm/min
	10 min/div (10 S/min)	10 min/div (6 s)	1 mm/min
External	EXT.		

10.4. Scale Conversion (Physical Quantity Conversion)

The scale conversion function converts the voltage values output from a sensor, etc. to a physical quantity for direct reading.
This product has two conversion methods. Both methods perform the same conversion, as indicated in the figure.

Method 1 Direct conversion with two point values
The Y = AX + B formula is derived by specifying the input and output values a [Xa, Ya] and b [Xb, Yb] of the two points a and b.

Method 2 Conversion with gain compensation when conversion between physical quantity and sensor output voltage is defined
Gain A and offset B of the sensor input are defined and the formula Y = AX + B is derived.



Example-1	2-pt gain	
	4−20mA transmission	When the sensor side output 4−20 mA (1 − 5 V) is 0 − 10 kg
	Two point method	Conversion 1:1 → 0; Conversion 2:5 → 10 (unit: kg)
Example-2	Gain compensation	
	Vibration sensor	Sensitivity 4.5 N = 1 V
	Sensor type	Gain: 4.5; Offset: 0 (unit: N)

10.5. Wave Inversion

For channels with wave inversion enabled, the waveform and values are inverted. The following functions are processed with inverted values.

- ❑ Y-T waveform
- ❑ X-Y waveform
- ❑ FFT analysis
- ❑ Digital view
- ❑ Cursor
- ❑ Thumbnail
- ❑ Search function
- ❑ Trigger

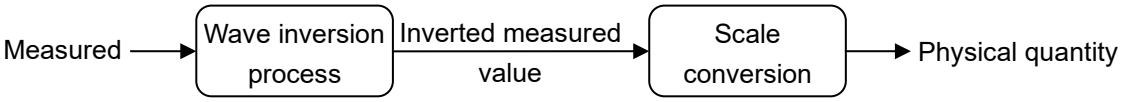
10.5.1. Use in Conjunction with Scale Conversion

Because wave inversion only inverts the measured values, the physical quantity is derived with the formula Y = -AX + B when it is used in conjunction with "10.4. Scale Conversion". Therefore, if the offset is not zero, the value after wave inversion will differ from the inversion of the value before wave inversion.

Example Input voltage: 5 V; Gain: 2; Offset: 10

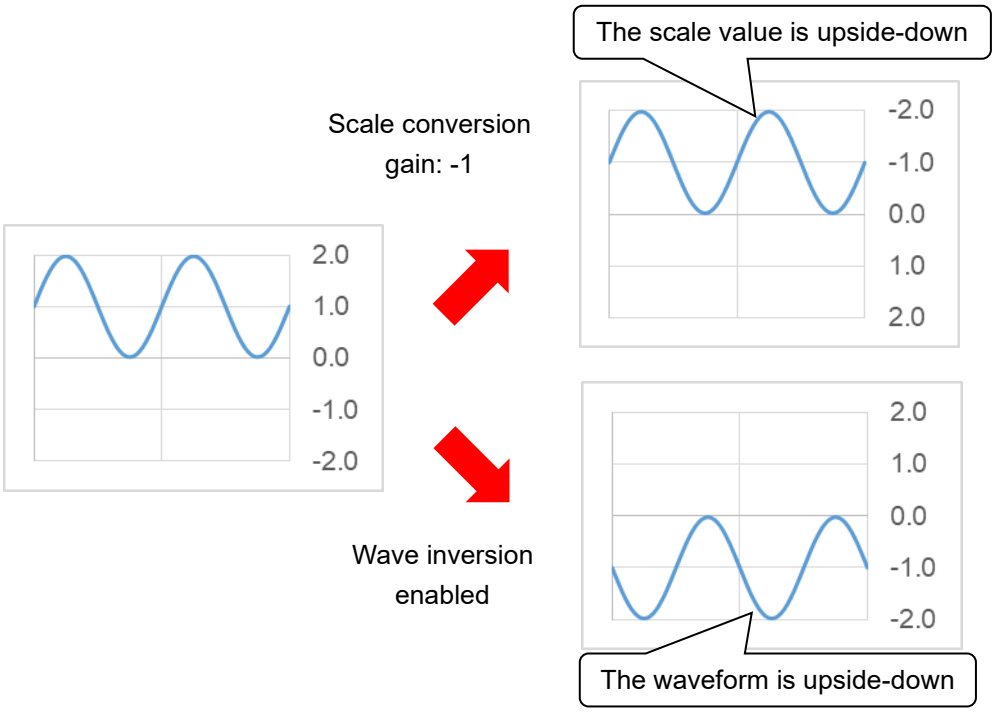
Wave inversion disabled 2 × 5 V + 10 = 20 V

Wave inversion enabled -2 × 5 V + 10 = 0 V



Tips

When wave inversion is used, the waveform is displayed upside-down, but if the gain is set to -1 in scale conversion, only the scale value is displayed upside-down.



10.6. FFT Analysis

10.6.1. Analysis Function

Enables analysis of a time scale waveform and spectrum, etc.

Tips

- Treat the engineering unit as 0 dB.
  (Example) For voltage measurement 1 V = 0 dB
  For RMS measurement 1 Vrms = 0 dB

Time Scale Waveform (One Signal Analysis)

The time domain waveform of the input signal.

Linear Spectrum (One Signal Analysis)

Each frequency component G of the linear spectrum is defined as G = R + jI (with R being the real number part and I being the imaginary number part).

The frequency domain waveform of the input signal enables the amplitude and phase of each frequency component to be understood.

R and I are the result of multiplying the window function peak compensation coefficient k.

$$\mathrm{k} = \frac{N}{\sum_{i=0}^{N-1} W(i)}$$

N: Sampling points; $W(\boldsymbol{i})$: Window function

Real number part	Lin-Rel	R
Imaginary number part	Lin-Img	I
Amplitude	Lin-Amp	$\sqrt{(\mathrm{R}^2 + \mathrm{I}^2)}$
Logarithmic amplitude	Log-Amp	$20 \times \log\sqrt{(\mathrm{R}^2 + \mathrm{I}^2)}$
Phase	Phase	$\tan^{-1}(\mathrm{I}/\mathrm{R})$

RMS Spectrum (One Signal Analysis)

The frequency domain waveform of the input signal enables the amplitude (effective value) and phase to be understood.

R and I are the result of multiplying the window function peak compensation coefficient k.

$$\mathrm{k} = \frac{N}{\sum_{i=0}^{N-1} W(i)}$$

N: Sampling points; $W(\boldsymbol{i})$: Window function

Real number part	Lin-Rel	$\mathrm{R}/\sqrt{2}$
Imaginary number part	Lin-Img	$\mathrm{I}/\sqrt{2}$
Amplitude	Lin-Amp	$\sqrt{(\mathrm{R}^2 + \mathrm{I}^2)}/\sqrt{2}$
Logarithmic amplitude	Log-Amp	$20 \times \log(\sqrt{(\mathrm{R}^2 + \mathrm{I}^2)}/\sqrt{2})$
Phase	Phase	$\tan^{-1}(\mathrm{I}/\mathrm{R})$

Power Spectrum (One Signal Analysis)

Indicates the power (squared value) of the input signal to understand the amplitude information only.

R and I are the result of multiplying the window function peak compensation coefficient k.

$$k = \left(\frac{N}{\sum_{i=0}^{N-1} W(i)} \right)^2$$

N: Sampling points; $W(i)$: Window function

Amplitude	Lin-Amp	$R^2 + I^2$
Logarithmic amplitude	Log-Amp	$10 \times \log(R^2 + I^2)$

Power Spectrum Density (One Signal Analysis)

Indicates the power spectrum by unit frequency Δf.

R and I are the result of multiplying the window function peak compensation coefficient k.

$$k = \left(\frac{N}{\sum_{i=0}^{N-1} W(i)} \right)^2$$

N: Sampling points; $W(i)$: Window function

Amplitude	Lin-Amp	$(R^2 + I^2)/\Delta f \times k1$
Logarithmic amplitude	Log-Amp	$10 \times \log((R^2 + I^2)/\Delta f \times k1)$

$\Delta f = Fs/N$; Fs: Sampling points; $W(i)$: Window function

k1: Window function BW compensation coefficient

Rectangular	1
Hanning	0.666
Hamming	0.731

Cross Power Spectrum (Two Signal Analysis)

The cross power spectrum derives the power between two signals. It is derived as this product of the linear spectrum Gy of the signal to compare and the complex conjugate Gx* of the linear spectrum Gx of the base signal.

Linear spectrum of reference signal	Gx = Rx + jIx, Gx* = Rx – jIx
Linear spectrum of comparison signal	Gy = Ry + jIy
Cross power spectrum	Gyx = Gy × Gx* = (Ry + jIy)(Rx – jIx) = Ryx + jIyx
Cross power spectrum (real number part)	Ryx = (RyRx + IyIx) × k
Cross power spectrum (imaginary number part)	Iyx = (RxIy – RyIx) × k

Ryx and Iyx are the result of multiplying the window function peak compensation coefficient k.

$$k = \left(\frac{N}{\sum_{i=0}^{N-1} W(i)} \right)^2$$

N: Sampling points; $W(i)$: Window function

Real number part	Lin-Rel	Ryx
Imaginary number part	Lin-Img	Iyx
Amplitude	Lin-Amp	$\sqrt{(Ryx^2 + Iyx^2)}$
Logarithmic amplitude	Log-Amp	$10 \times \log(Ryx^2 + Iyx^2)$
Phase	Phase	$\tan^{-1}(Iyx/Ryx)$

Transfer Function (Two Signal Analysis)

The transfer function indicates the frequency characteristics of the input and output of the transfer system.

It is derived as the ratio of the cross power spectrum Gyx and input (reference) power spectrum Gxx.

Transfer function = Hyx = Gyx/ Gxx

Real number part	Lin-Rel	HRyx
Imaginary number part	Lin-Img	HIyx
Amplitude	Lin-Amp	$\sqrt{HRyx^2 + HIyx^2}$
Logarithmic amplitude	Log-Amp	$10 \times \log(\mathrm{HRyx}^2 + \mathrm{HIyx}^2)$
Phase	Phase	$\tan^{-1}(\mathrm{HIyx}/\mathrm{HRyx})$

Coherence Function (Two Signal Analysis)

Expresses a comparison of the power caused by the input signal of the transfer system and the total output power. It is derived from the cross power spectrum Gyx, input (reference) power spectrum Gxx, and output (comparison) power spectrum Gyy.

Amplitude	Lin-Amp	$\lvert Gyx\rvert^2/(\mathrm{Gxx} \times \mathrm{Gyy})$

Note

- The coherence function equals 1 across the entire frequency with a single measurement. Make sure to perform averaging of the frequency axis.

Octave Analysis

1/1 octave band or 1/3 octave band analysis can be performed.

This product derives the power spectrum first and then adds the data in each band range.

Amplitude	Lin-Amp	$\mathrm{Oct} \times \mathrm{k1}$
Logarithmic amplitude	Log-Amp	$10 \times \log\,(\mathrm{Oct} \times \mathrm{k1})$

k1: Window function BW compensation coefficient

Rectangular	1
Hanning	0.666
Hamming	0.731

10.6.2. AVG process

Averaging is not performed when set unless valid settings are specified for the analysis function. The enabled/disabled state of averaging for different analysis settings is indicated in the table.

Analysis	Y axis		AVG method		
			Time axis	Frequency axis	Peak
Time scale waveform	Amplitude	Linear	Enabled	Disabled	Disabled
Linear spectrum	Real number part	Lin-Rel	Disabled	Disabled	Disabled
	Imaginary number part	Lin-Img	Disabled	Disabled	Disabled
	Amplitude	Lin-Amp	Disabled	Enabled	Enabled
	Logarithmic amplitude	Log-Amp	Disabled	Enabled	Enabled
	Phase	Phase	Disabled	Disabled	Disabled
RMS spectrum	Real number part	Lin-Rel	Disabled	Disabled	Disabled
	Imaginary number part	Lin-Img	Disabled	Disabled	Disabled
	Amplitude	Lin-Amp	Disabled	Enabled	Enabled
	Logarithmic amplitude	Log-Amp	Disabled	Enabled	Enabled
	Phase	Phase	Disabled	Disabled	Disabled
Power spectrum	Amplitude	Lin-Amp	Disabled	Enabled	Enabled
	Logarithmic amplitude	Log-Amp	Disabled	Enabled	Enabled
Power spectrum density	Amplitude	Lin-Amp	Disabled	Enabled	Enabled
	Logarithmic amplitude	Log-Amp	Disabled	Enabled	Enabled
Cross power spectrum	Real number part	Lin-Rel	Disabled	Disabled	Disabled
	Imaginary number part	Lin-Img	Disabled	Disabled	Disabled
	Amplitude	Lin-Amp	Disabled	Enabled	Enabled
	Logarithmic amplitude	Log-Amp	Disabled	Enabled	Enabled
	Phase	Phase	Disabled	Disabled	Disabled
Transfer function	Real number part	Lin-Rel	Disabled	Disabled	Disabled
	Imaginary number part	Lin-Img	Disabled	Disabled	Disabled
	Amplitude	Lin-Amp	Disabled	Enabled	Enabled
	Logarithmic amplitude	Log-Amp	Disabled	Enabled	Enabled
	Phase	Phase	Disabled	Disabled	Disabled
Coherence function	Amplitude	Lin-Amp	Disabled	Enabled	Disabled
1/1 octave analysis	Amplitude	Lin-Amp	Disabled	Enabled	Enabled
	Logarithmic amplitude	Log-Amp	Disabled	Enabled	Enabled
1/3 octave analysis	Amplitude	Lin-Amp	Disabled	Enabled	Enabled
	Logarithmic amplitude	Log-Amp	Disabled	Enabled	Enabled

Simple Arithmetic Average

The various elements of the analysis results are averaged using the formula indicated below.

$$S_N = (1/N)\sum_{K=1}^{N} Y_K$$

Exponentially Weighted Average

The averaging process for the frequency component of the analysis results, which performs averaging by exponentially weighting each element to average.

(Example) When the number of additions N = 3

E1 = Y1

E2 = (1 - α) E1 + αY2

E3 = (1 - α) E2 + αY3

α: Weighted average constant α = 1 / N

Frequency Axis Peak Hold

Retains the maximum value of each frequency component.

10.6.3. Units of Analysis Results

The units of the analysis results are indicated below.

Analysis	X axis	Unit
Time scale waveform	Time	s
Other analysis	Frequency	Hz

Analysis	Y axis		Unit
Time scale waveform	Amplitude	Linear	eu
Linear spectrum	Real number part	Lin-Rel	eu
	Imaginary number part	Lin-Img	eu
	Amplitude	Lin-Amp	eu
	Logarithmic amplitude	Log-Amp	db
	Phase	Phase	deg
RMS spectrum	Real number part	Lin-Rel	eu
	Imaginary number part	Lin-Img	eu
	Amplitude	Lin-Amp	eu
	Logarithmic amplitude	Log-Amp	db
	Phase	Phase	deg
Power spectrum	Amplitude	Lin-Amp	eu^2
	Logarithmic amplitude	Log-Amp	db
Power spectrum density	Amplitude	Lin-Amp	eu^2/Hz
	Logarithmic amplitude	Log-Amp	db
Cross power spectrum	Real number part	Lin-Rel	eu^2
	Imaginary number part	Lin-Img	eu^2
	Amplitude	Lin-Amp	eu^2
	Logarithmic amplitude	Log-Amp	db
	Phase	Phase	deg
Transfer function	Real number part	Lin-Rel	No unit
	Imaginary number part	Lin-Img	No unit
	Amplitude	Lin-Amp	No unit
	Logarithmic amplitude	Log-Amp	db
	Phase	Phase	deg
Coherence function	Amplitude	Lin-Amp	No unit
1/1 octave analysis	Amplitude	Lin-Amp	eu
	Logarithmic amplitude	Log-Amp	db
1/3 octave analysis	Amplitude	Lin-Amp	eu
	Logarithmic amplitude	Log-Amp	db

10.7. Connecting to This Product via a Web Browser

When the Web server function is enabled, you can use the Web browser on a computer or other device to remotely operate, configure, and view the screens of the RA3100.

10.7.1. Computer System Requirements

Item	Description
Memory	1 GB or more of free space
Display	Resolution 1920 × 1080 or higher
Web browser	Microsoft Edge® version 79.0.309.65 or later

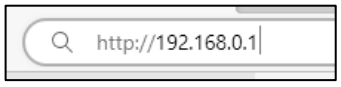
10.7.2. Preparations

(1) Connect the RA3100 and computer with a LAN cable.
(2) Configure the network settings of the RA3100 to enable connection with the computer.
(3) Enable the Web server function of the RA3100.

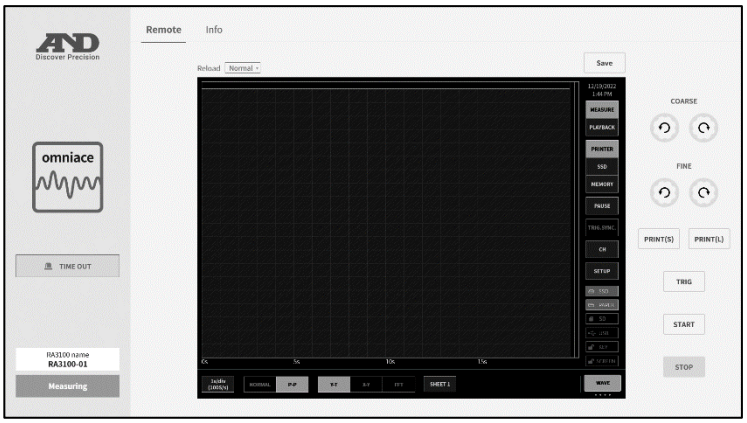
10.7.3. Connection Method

Start the Web browser on the computer and enter "http://" followed by the IP address of the RA3100.

Example When the IP address of the RA3100 is 192.168.0.1



When connection with the RA3100 is complete, the [Remote] screen is displayed in the Web browser.



Tips

❑ If authentication settings are enabled in the Web server function of the RA3100, enter the user name and password to sign in when connecting. Connection is only possible by entering the user name and password set in the RA3100.



10.7.4. Remote Screen

The [Remote] screen is displayed when connection is complete or when the 【Remote】 button is clicked. It enables you to perform remote operations on and view the screens of the RA3100.



(1) Save: Saves an image file (in the PNG format) of the RA3100 screen to the computer.

(2) Reload: Sets the update speed of the RA3100 screen.
Select [Fastest], [Fast], [Normal], or [Slow] for the response speed of the remote input signal.

(3) Info: Switches to the [Info] screen.

(4) Remote: Switches to the [Remote] screen.

(5) RA3100 screen: Displays the RA3100 screen.
You can remotely operate the RA3100 using mouse operations or keyboard operations on the screen. See "10.7.6. Remotely Operating the RA3100 from a Web Browser".

(6) TIME OUT: Displayed when a problem occurs with HTTP communication.

(7) RA3100 name: Displays the PC name of the RA3100.

(8) RA3100 state: Displays the state of the RA3100 (Measuring, During record, etc.)

(9) RA3100 operation panel: Enables you to perform RA3100 panel operations.

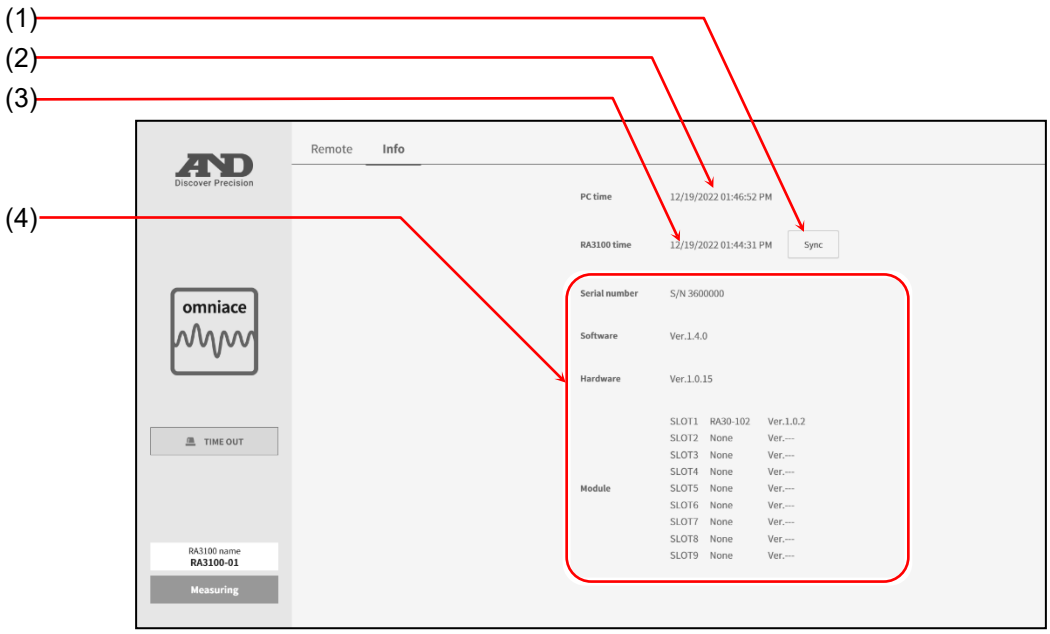
【COARSE】 key:	Standard mode on the rotation knob
【FINE】 key:	Fine adjustment mode on the rotation knob
【PRINT(S)】 key:	PRINT key
【PRINT(L)】 key:	Press and hold PRINT key
【TRIG】 key:	TRIG key
【START】 key:	START key
【STOP】 key:	STOP key

Tips

❑ There is no limit to the number of computers that can connect to the RA3100, but it may take some time for the screen to update when the network is busy. Use a maximum of one computer when Reload is set to Fastest, two computers when set to Fast, three computers when set to Normal, and five computers when set to Slow.

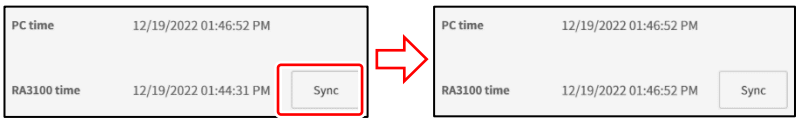
10.7.5. Info Screen

The [Info] screen is displayed when connection is complete or when the【Info】button is clicked. It enables you to check the main unit information of the RA3100 and configure the time and other settings.



(1) Sync: Sync the time of the RA3100 with the time of the computer.

* There may be a difference between the times.



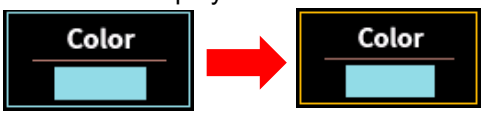
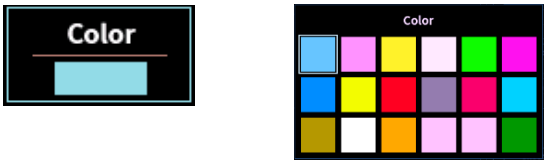
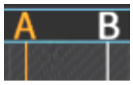
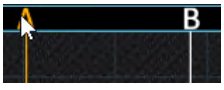
(2) PC time: Displays the time of the computer displaying the Web browser.

(3) RA3100 time: Displays the time of the RA3100.

(4) RA3100 main unit information:
Displays the serial number of the RA3100, the various versions, and the module configuration.

10.7.6. Remotely Operating the RA3100 from a Web Browser

You can remotely operate the RA3100 screen on a Web browser using mouse operations and the Ctrl, Shift, and Alt keys combined with the mouse wheel.

Action	Mouse Operation
Screen Operation	Left-click the mouse to operate the screen of the RA3100.
Change setting (mouse wheel)	Left-click a setting item to change the border of the item to orange and change the setting value using a mouse wheel operation. For example, select [Color] to change the color or select [Disp. pos.] to change the value of the display width ratio. 
Change setting (dialog)	Right-click a setting item to display the dialog corresponding to that setting item. Selection Palette Dialog Select a setting value to reflect the setting and close the dialog. To cancel the changes, click outside the dialog.  Numeric Value Input Dialog Enter the numeric value using button operations on the screen or keyboard input operations. When performing keyboard input, press the [Enter] key to reflect the settings and close the dialog. 
Change X axis scale of waveform	Ctrl key + mouse wheel up: Zoom in Ctrl key + mouse wheel down: Zoom out
Change Y axis scale of waveform	Shift key + mouse wheel up: Zoom in Shift key + mouse wheel down: Zoom out
Move in waveform X axis direction	Mouse wheel up: Move left Mouse wheel down: Move right
Move in waveform Y axis direction	Alt key + mouse wheel up: Move up Alt key + mouse wheel down: Move down
Move cursor	You can move the specified cursor line with mouse wheel operations. Mouse wheel up: Move left Mouse wheel down: Move right  You can directly drag the cursor A or B mark to move it. 
Fine adjustment	Press the z key in conjunction with a mouse wheel operation to make the update step smaller (perform fine adjustment). Example To zoom the X axis of the waveform with fine adjustment: z key + Ctrl key + mouse wheel up

10.7.7. Switching the Web Browser Display Language

The display language of the [Remote] screen and [Info] screen automatically switches according to the language set in the Web browser. The supported languages are Japanese, English, Korean, and Traditional Chinese, and English is displayed if another language is set.

Tips

- The screen of the RA3100 is displayed in the language set in the main unit.

10.8. Downloading the Data of this Product via FTP

If the FTP server function is enabled, FTP client software can be used to download recorded data, image data, and configuration data.

10.8.1. Preparations

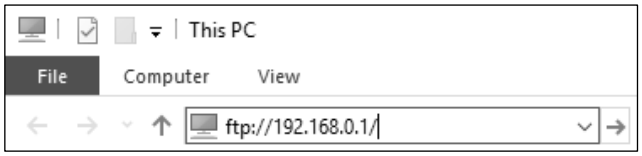
(1) Connect the RA3100 and computer with a LAN cable.
(2) Configure the network settings of the RA3100 to enable connection with the computer.
(3) Enable the FTP server function of the RA3100.

10.8.2. Download Method

In this example, the Explorer of Windows 10 is used.

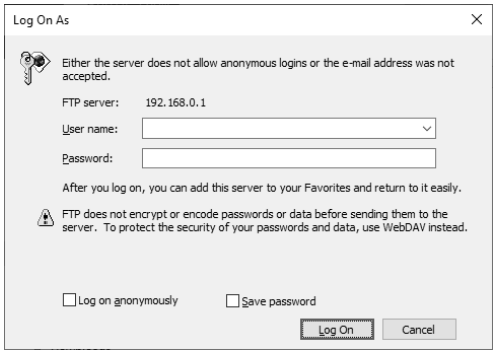
(1) Start the Explorer on the computer and enter "ftp://" followed by the IP address of the RA3100.

Example
When the IP address of the RA3100 is 192.168.0.1

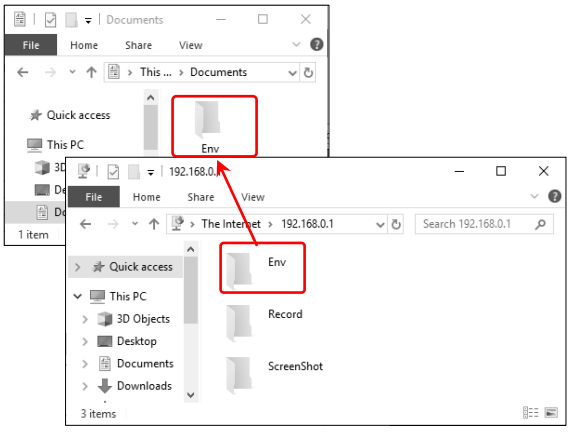


Tips

- If authentication is enabled, the logon screen is displayed. Enter the user name and password configured in the authentication settings.



(2) Drag the files and folders you want to download and drop them at the destination.



Tips

- Configuration data is located in the Env folder, recorded data is located in the Record folder, image data is located in the ScreenShot folder, and CSV files are located in the CSV folder.
- Folders and files preparing for recording may exist in the Record folder.
- The file update date/time may differ from that displayed on the client side.
- A maximum of eight clients can connect to the FTP server at a time.

10.9. Transferring Data

When the data transfer function is enabled, the sample data indicated in ”10.9.2. Sampling Data” is forwarded at the specified transfer period to the PC connected to the RA3100 via a LAN cable.

10.9.1. Procedure

(1) Connect the RA3100 and PC with a LAN cable.
(2) Configure the network settings of the RA3100 to enable connection with the PC.
(3) Enable the data transfer function of the RA3100.
(4) Connect the PC to the RA3100 via TCP or UDP.
(5) After connecting the RA3100 and the PC, the sampling data starts transferring according to the setting of [Transfer mode].

Always:	When a connection is established between the RA3100 and the PC, the sampling data starts transferring.
When recording:	The sampling data is transferred when recording.
Manual:	The transfer process starts and stops with user instructions. This is used by setting [Data transfer] to [Manual control] on the main unit screen or by using the "E29: Manual control of data transfer" communication command.


For information on the port numbers, see "12.2.15.3. List of Network Port Numbers Used".

Note

The data transfer process may be interrupted if RA3100 operations are performed while the data is transferring.

10.9.2. Sampling Data

Sampling data refers to the multiple-channel measurement data for one sample.

10.9.2.1. Data Format

Sampling data is in the binary (little endian) format. The data format is indicated below.

4Byte	Variable length	2Byte
Time stamp	Measurement data block	Measurement status

Name	Type	Data length	Remarks
Time stamp	Unsigned 32-bit Integer	4Byte	Indicates the relative time. Set to 0 when data transfer is enabled. When [Transfer data] is set to One-shot, this is incremented by one for each item of sampling data. When [Transfer data] is set to Continuous, this is incremented by one for each sampling run. Therefore, the values will be noncontinuous if decimation is used. This can be turned on or off using [Time stamp] in 【Data transfer】.
Measurement data block	Differs according to the measurement data	Variable length	The measurement data of channels with measurement enabled for each sampling run. The data length differs according to the data format of the sampling and the number of channels with measurement enabled. For details, see "10.9.3. Measurement data block".
Measurement Status	Unsigned 16-bit Integer	2Byte	Each bit indicates the status of the RA3100 and the input signal of the RA30-112 remote control module, etc as 0 or 1. Bit0 : Trigger — Indicates that a trigger has occurred Bit1 : Mark — Indicates that a mark has occurred Bit2 : Feed — Indicates the input of an RA30-112 FEED IN signal Bit3 : Print — Indicates the input of an RA30-112 PRINT IN signal Bit4 : During record — Indicates that data is being recorded Bit 5 to bit 15 — System reserved

10.9.3. Measurement data block

A measurement data block is a collection of the measurement data from channels with measurement enabled for each sampling run.

10.9.3.1. Measurement Data

Measurement data is two bytes of binary data. Measurement data can be divided into the analog channel data of a module such as an analog input module and the logic channel data of a logic module. The format of the measurement data also differs according to the data format.

For information on the data format, see ”10.2. Sampling Data Format”.

- Analog channel data:

  The measurement data of an analog input module, expressed as a signed two-byte AD count value (integer).

  This is one item of measurement data with the data format set to NORMAL sampling.

2Byte
AD count value

  For P-P sampling, it is two items of measurement data (the minimum value and maximum value of the AD count values).

2Byte	2Byte
AD count value (min)	AD count value (max)

For information on converting AD count values to physical quantities, see "10.12. Converting AD Count Values to Physical Quantities”.

- Logic channel data:

  The logic module values express one signal as one bit, and two-byte measurement data has measurement values for CHA and CHB. If measurement is enabled for either CHA or CHB, the data has the measurement values for both channels.

  The signal order from bit 0 is CHA-CH1, to CHA-CH2, up to CHB-CH8 in bit 15.

  This is 0 or 1 (the level) for 16 channels if the data format is set to NORMAL sampling.

2Byte															
Level															
CHB								CHA							
CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1
Bit15															Bit0

  For P-P sampling, the data includes two items of measurement data, which are the 0 or 1 (the level) for each sampling period and a flag indicating whether the 0 or 1 changed within the sampling period.

2Byte				2Byte			
Level				Flag			
CHB		CHA		CHB		CHA	
CH8	CH1	CH8	CH1	CH8	CH1	CH8	CH1
Bit15			Bit0	Bit15			Bit0

10.9.3.2. Order and Data Length of Measurement Data

The order and data length of the measurement data differs according to the data format of the sampling and the channels of measurement.

An example of the following module configuration is indicated below.

Example) If modules are mounted to the RA3100 with the following configuration

Slot	Module	Channel	Notation	Measurement
1	RA30-101	CH1	S1-CH1	Enabled
		CH2	S1-CH2	Enabled
2	RA30-101	CH1	S2-CH1	Disabled
		CH2	S2-CH2	Enabled
3	RA30-105	CHA	S3-CHA	Enabled
		CHB	S3-CHB	Disabled
4 to 9	Not mounted	---	---	---

❑ When the data format is set to NORMAL sampling:

The measurement data of channels with measurement enabled is output in order. Logic channel data has both CHA and CHB values if measurement is enabled for either CHA or CHB.

2Byte	2Byte	2Byte	2Byte	
S1-CH1	S1-CH2	S2-CH2	S3-CHA	S3-CHB

The data length is derived with the following formula.

Data length (in bytes) = number of analog channel measurements× 2 (bytes)
+ number of logic channel measurements* × 2 (bytes)

* Logic modules are counted in slots, with each item of measurement data having both CHA and CHB values.

The data length of the configuration example is as follows.

3 (channels) × 2 (bytes) + 1 (slot) × 2 (bytes) = 8 (bytes)

❑ When the data format is set to P-P sampling:

The measurement data of channels with measurement enabled is output in order. Analog channel data is ordered with the minimum value before the maximum value. Logic channel data is ordered with the level before the flag and has both CHA and CHB values if measurement is enabled for either CHA or CHB.

2Byte	2Byte	2Byte	2Byte	2Byte	2Byte
S1-CH1 min	S1-CH1 max	S1-CH2 min	S1-CH2 max	S2-CH2 min	S2-CH2 max

2Byte	2Byte
S3-CHA-CHB level	S3-CHA-CHB flag

The data length is derived with the following formula.

Data length (in bytes) = number of analog channel measurements× 2 (bytes) × 2
+ number of logic channel measurements* × 2 (bytes) × 2

* Logic modules are counted in slots, with each item of measurement data having both CHA and CHB values.

The data length of the configuration example is as follows.

3 (channels) × 2 (bytes) × 2 + 1 (slots) × 2 (bytes) × 2 = 16 (bytes)

10.10. Remote Control

This section describes the timing for using the remote control module (RA30-112) to remotely control this product from an external device. For details on the pin layout, etc., see "9.10. Remote Control Module (RA30-112)".

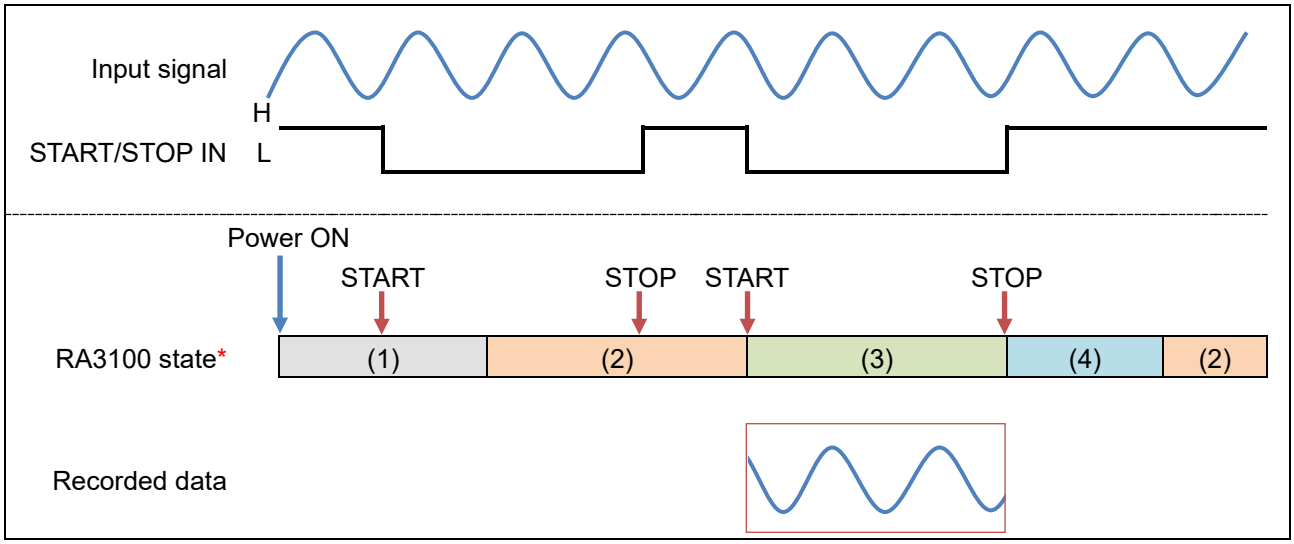
10.10.1. Starting/Stopping Recording

Recording starts when the Low level signal is input to the START/STOP IN of the remote control module. However, depending on the state of this product, recording may not start when a Low level signal is input or recording may not start immediately and instead start after the processing of this product is complete.

❑ If recording does not start

Recording does not start if a Low level signal is input while this product is starting up.

Example: If a Low level signal is input to START/STOP IN while this product is starting up

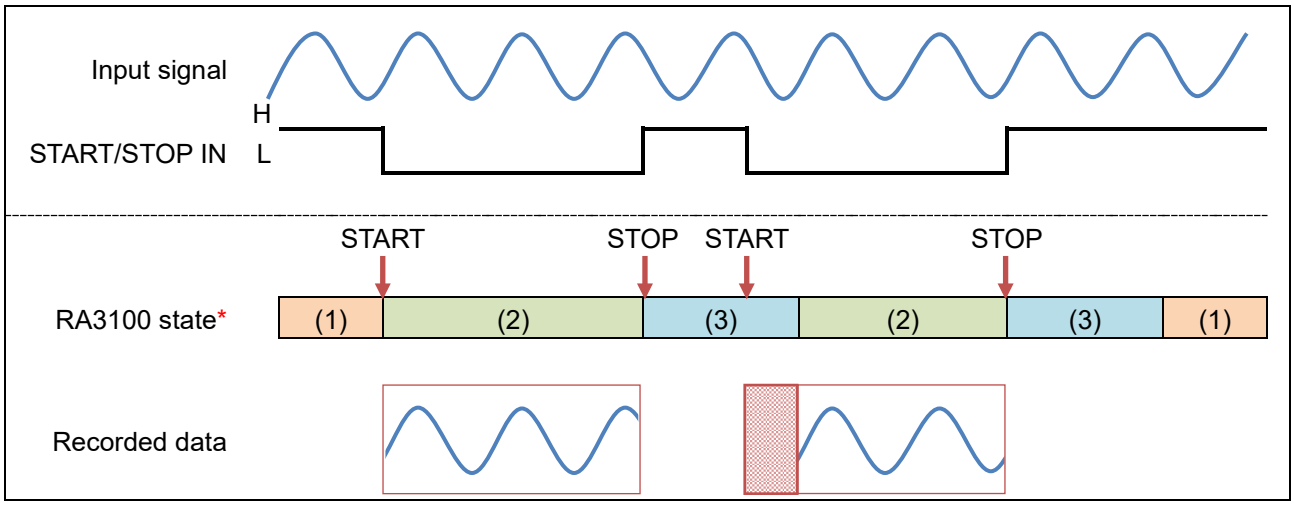


* The states of the RA3100 are (1) Starting up, (2) Measuring, (3) Recording, and (4) Saving recording.

❑ If recording starts after processing is complete

If a Low level signal is input to START/STOP IN while this product is in the state where it is saving recording, printing, or stopping printing, recording starts after processing is complete.

Example: If a Low level signal is input to START/STOP IN while this product is stopping recording



* The states of the RA3100 are (1) Measuring (2) Recording, and (3) Saving recording.

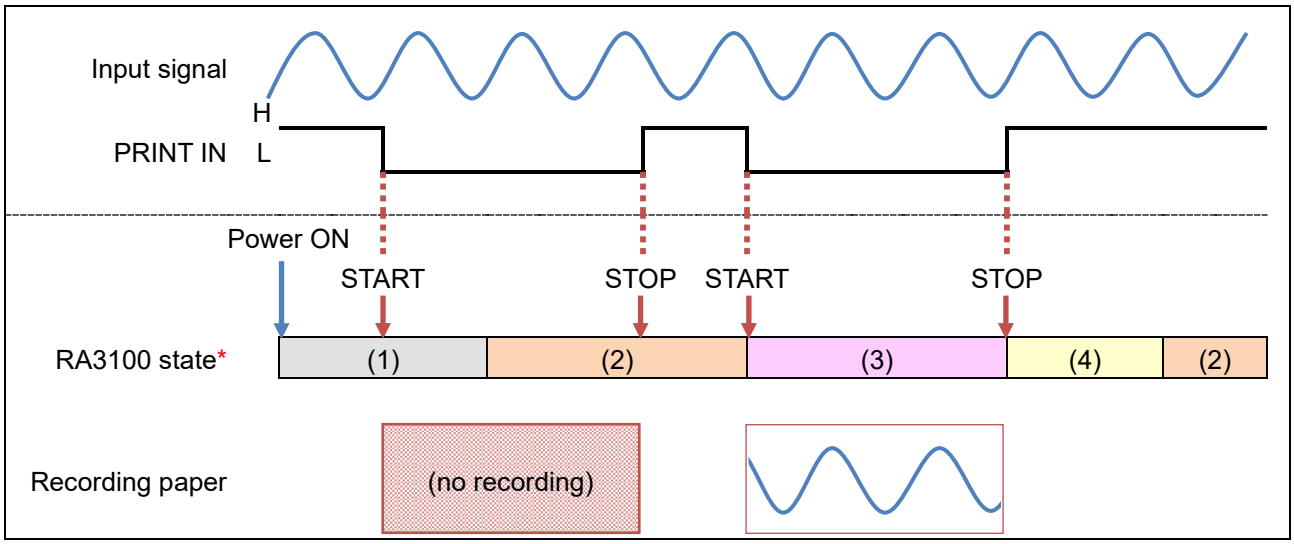
10.10.2. Starting/Stopping Pen Recording

Pen recording starts when the Low level signal is input to the PRINT IN of the remote control module. However, depending on the state of this product, pen recording may not start when a Low level signal is input or pen recording may not start immediately and instead start after the processing of this product is complete.

❑ If pen recording does not start

Pen recording does not start if a Low level signal is input while this product is starting up, recording, or saving recording.

Example: If a Low level signal is input to PRINT IN while this product is starting up

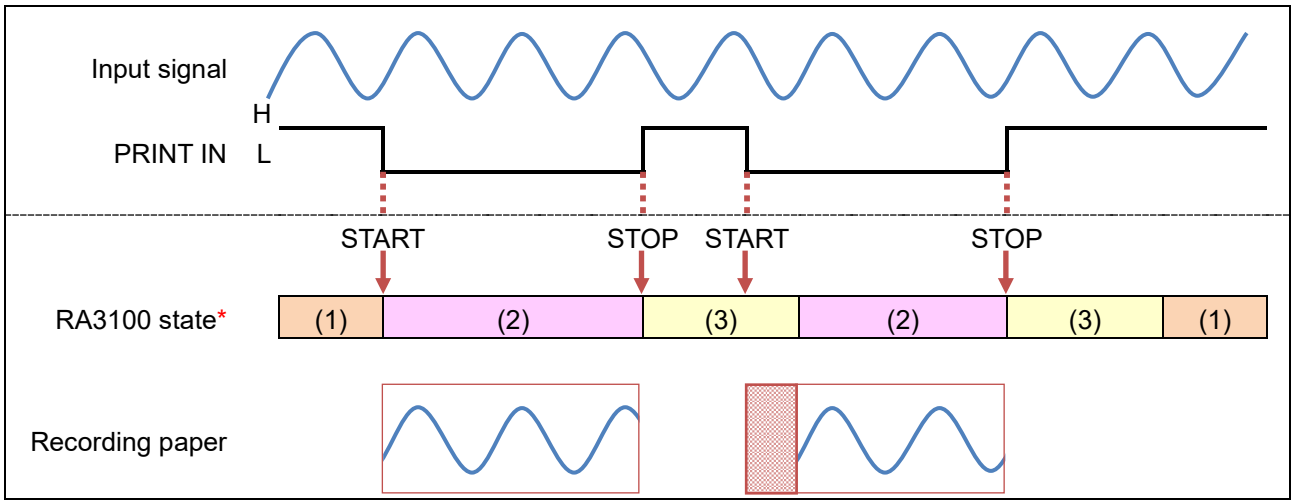


* The states of the RA3100 are (1) Starting up, (2) Measuring, (3) Printing, and (4) Stopping printing.

❑ If pen recording starts after processing is complete

If a Low level signal is input to PRINT IN while this product is in the state where it is printing, or stopping printing, recording starts after processing is complete.

Example: If a Low level signal is input to PRINT IN while this product is stopping printing



* The states of the RA3100 are (1) Measuring, (2) Printing, and (3) Stopping printing.

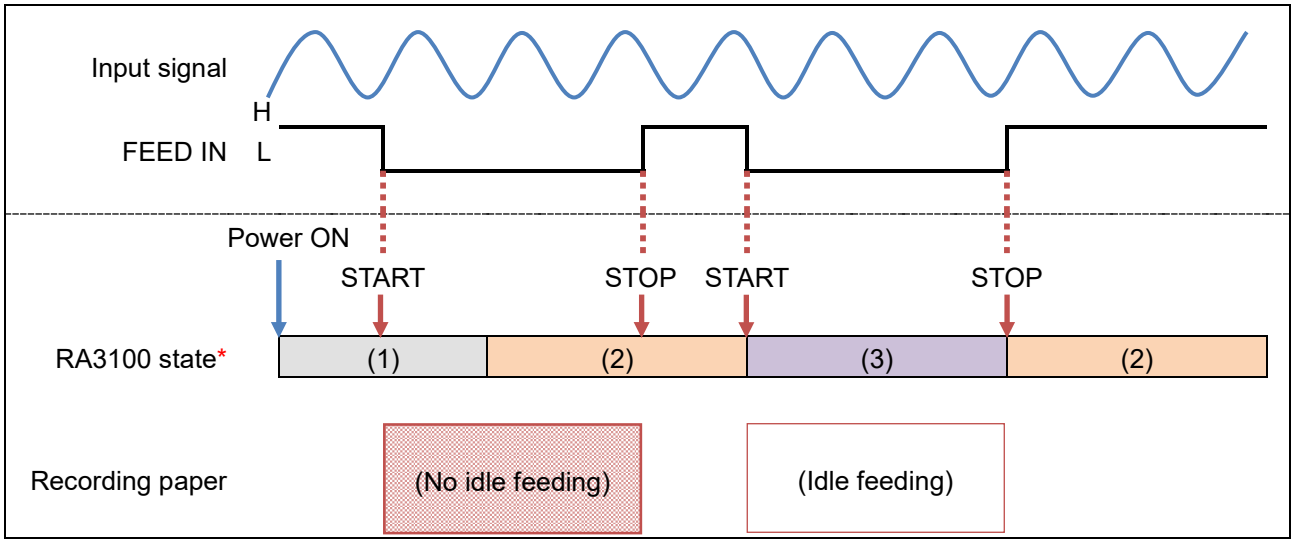
10.10.3. Starting/Stopping Feeding

Feeding (idle feeding of recording paper) starts when the Low level signal is input to the FEED IN of the remote control module. However, depending on the state of this product, feeding may not start when a Low level signal is input or feeding may not start immediately and instead start after the processing of this product is complete.

❑ If feeding does not start

Feeding does not start if a Low level signal is input while this product is starting up.

Example: If a Low level signal is input to FEED IN while this product is starting up



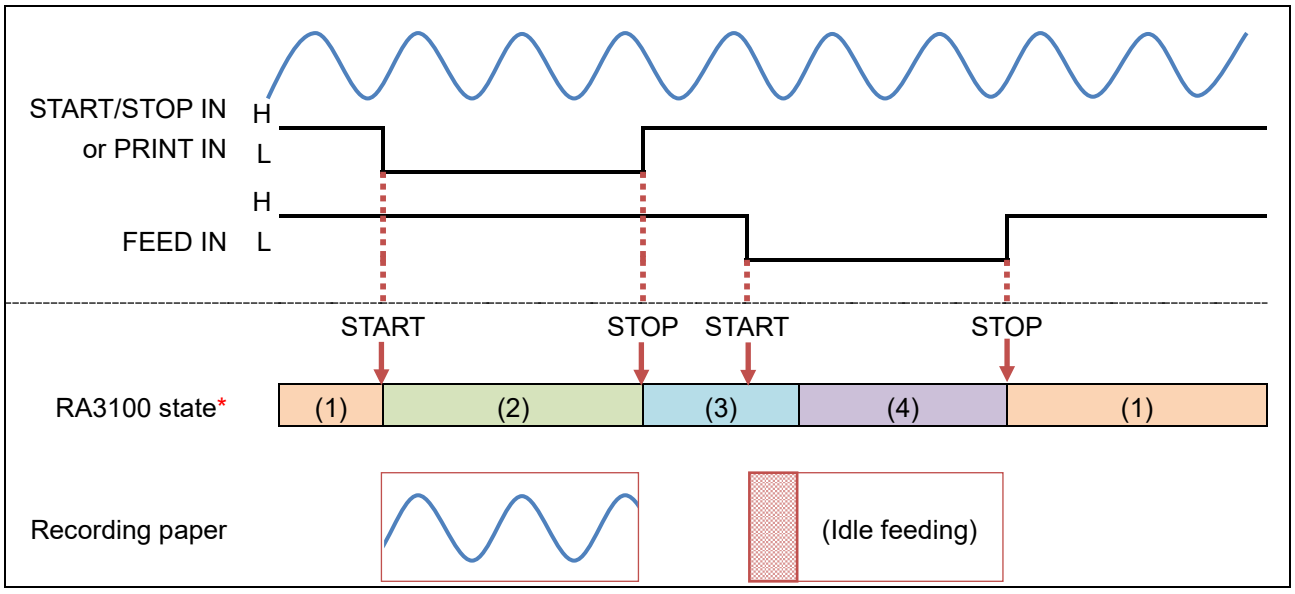
* The states of the RA3100 are (1) Starting up, (2) Measuring, and (3) Feeding.

❑ If feeding starts after processing is complete

If a Low level signal is input to FEED IN while this product is in the state where it is saving recording* or stopping printing, feeding starts after processing is complete.

*For real-time printing.

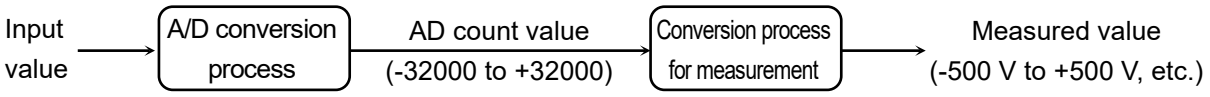
Example: If a Low level signal is input to FEED IN while this product is saving recording



* The states of the RA3100 are (1) Measuring, (2) Recording or printing, (3) Saving recording or stopping printing, or (4) Feeding.

10.11. Relationship between AD Count Value and Measured Value

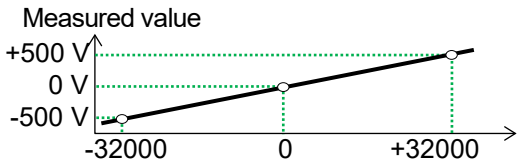
The "AD count value" refers to the measured value of the analog input module after A/D conversion. The AD count value is a signed 16-bit integer.



This value is generally calculated based on the following formula.

$$\text{Measured value} = \frac{\text{AD count value}}{32000} \times \text{measurement range}$$

Example When the AD count value is +12800 with the RA30-101/500 V range, the measured value equals (+12800/32000) × 500 [V] = +200 [V]



Relationship between AD Count Value and Measured Value

The calculation formulas for the measured values of each module and measurement target are indicated in the table below.

Module	Measurement target	AD count value	Calculation formula
RA30-101	Voltage	-32000 to +32000	Measured value = $\frac{\text{AD count value}}{32000}$ x measurement range
RA30-102	Voltage	-32000 to +32000	
RA30-103	Voltage	-32000 to +32000	
RA30-104	Voltage	-32000 to +32000	
RA30-106	Thermocouple (TC)	-32000 to +32000	
	Platinum resistance temperature detector		
RA30-107	DC	-32000 to +32000	
	RMS		
RA30-108	Period	-32000 to +32000	Measured value = $\frac{\text{AD count value} + 32000}{64000}$ x measurement range
	Frequency		
	Rotation speed		
	Pulse width		
	Duty cycle	-32000 to +32000	Measured value = $\frac{\text{AD count value} + 32000}{64000}$ x 100 [%]
	Power freq.	-32000 to +32000	Measured value = $\frac{\text{AD count value}}{32000}$ x deviation + measurement range * Deviation = 20 (with measurement range at 50 Hz/60 Hz) 40 (with measurement range at 400 Hz)
	Freq. deviation	-32000 to +32000	Measured value = $\frac{\text{AD count value}}{64000}$ x 100 [%]
	Pulse count	-32000 to +8000	Measured value = AD count value + 32000

<table>
<tr><th>Module</th><th>Measurement target</th><th>AD count value</th><th>Calculation formula</th></tr>
<tr><td rowspan="2">RA30-108</td><td>Pulse integ.</td><td>-32000 to 18000</td><td>Measured value = (AD count value + 32000) x $\frac{\text{Measurement range}}{50000}$</td></tr>
<tr><td>Voltage</td><td>-32000 to +32000</td><td rowspan="5">Measured value = $\frac{\text{AD count value}}{32000}$ x measurement range</td></tr>
<tr><td rowspan="3">RA30-109</td><td>Acceleration</td><td rowspan="3">-32000 to +32000</td></tr>
<tr><td>Velocity</td></tr>
<tr><td>Displacement</td></tr>
<tr><td>RA30-113</td><td>Voltage</td><td>-32000 to +32000</td></tr>
</table>

10.12. Converting AD Count Values to Physical Quantities

Use the following formula to convert AD count values to physical quantities.

(Formula)

Physical quantity (unit) = AD count × gain + offset

The unit, gain, and offset are obtained with the I09 command for reading the physical quantity calculation coefficient or the <ToPhysical> tag of the recorded information XML file.

Item	Description	Retrieved to	
		I09 command	<ToPhysical> in XML file
Gain	Value multiplied to AD count	A1: Gain	<Gain>
Offset	Value added to AD count	A2: Offset	<Offset>
Unit	Unit of physical quantity	A3: Unit	<Unit>

Example) When the AD count is 12800 and the I09 response is as follows,

Gain : 1.5625E-02
Offset : 0E+00
Unit : V

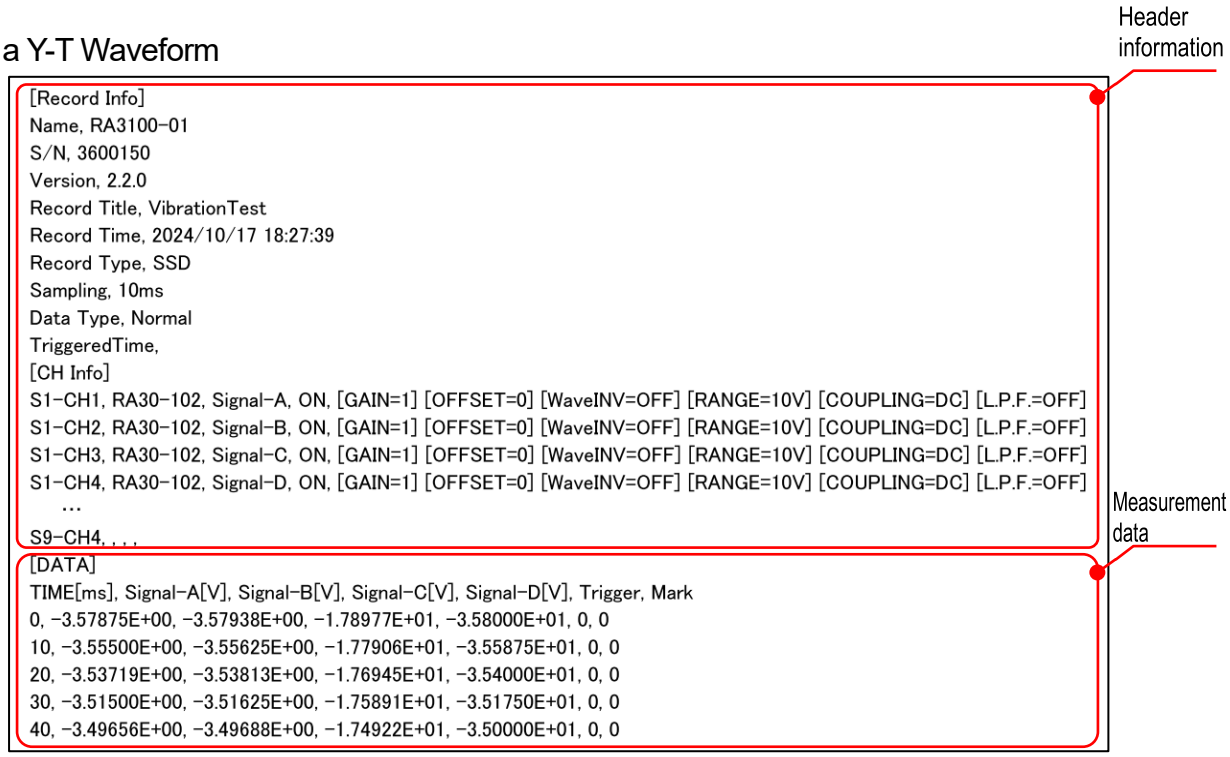
Physical quantity = 12800 × 1.5625E-02 + 0E + 00 = 200 [V]

10.13. CSV Files

10.13.1. CSV File Format

CSV files include the header information for recording/channels and the measurement data of each channel.
Files are output in UTF-8 encoding with BOM.

For a Y-T Waveform



Recording Information in Header Information

Item	Description
[Record Info]	The label of the recorded information
Name	The computer name
S/N	The serial number
Version	The software version
Record Title	The data name
Record Time	The date and time of recording
Record Type	The recording device
Sampling	The sampling period
Data Type	The data format
TriggeredTime	The time since recording started due to a trigger

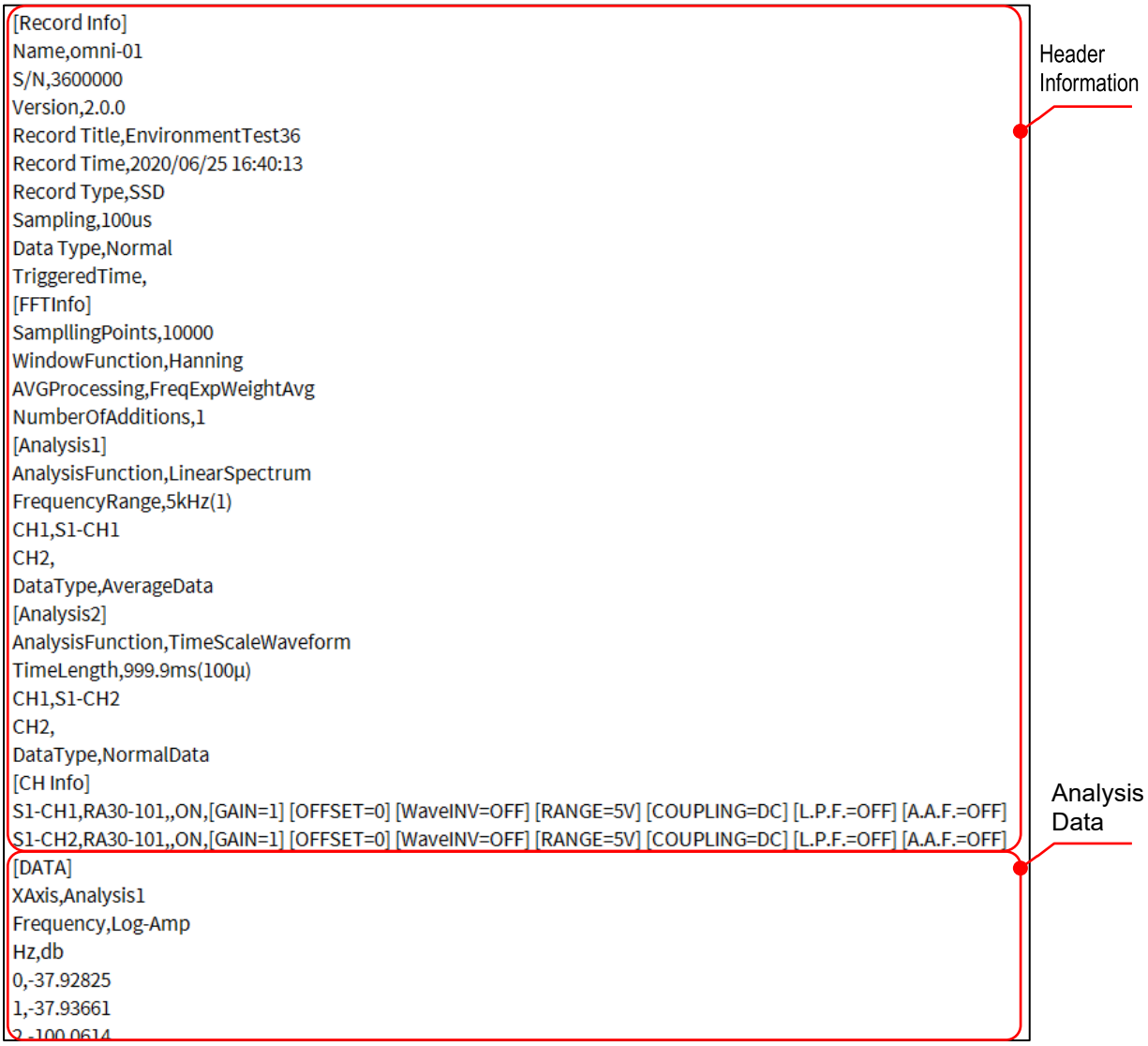
Channel Information in Header Information

Item	Description
[CH Info]	The channel information label
S1-CH1	The channel configuration information ・Module type ・Signal name ・Measurement ON/OFF ・Physical quantity conversion ・Wave inversion setting ・Unique settings for each module (such as coupling, measurement range, or L.P.F)
S1-CH2	
S1-CH3	
S1-CH4	
:	
S9-CH4	

Measurement Data

Item	Description
[DATA]	The measurement data label
Time [ms]	The unit of the time axis
S1-CH1 [V]	The signal name and unit of the channel
:	The measured value of the channel
S1-CH4 [V]	
Trigger	The position where the trigger was detected
Mark	The position where the mark was detected

For FFT Analysis



The recording information and channel information ([Record Info] and [CH Info]) in the header information are the same as for a Y-T waveform.

FFT Analysis Conditions

Item	Description
[FFTInfo]	The FFT setup information label
SamplingPoints	The number of sampling points
WindowFunction	The window function
AVGProcessing	The AVG processing
NumberOfAdditions	The number of additions

FFT Analysis 1 Conditions/FFT Analysis 2 Conditions

Item	Description	
[Analysis1]/[Analysis2]	The Analysis 1 label/Analysis 2 label	
AnalysisFunction	The analysis function of Analysis 1/Analysis 2 When set to OFF, the remaining items are blank	
TimeLength	The time length The number in parentheses is the resolution	If AnalysisFunction is set to "TimeScaleWaveform"
FrequencyRange	The maximum frequency of FFT analysis The number in parentheses is the resolution	If AnalysisFunction is set to something else
CH1	Channel 1 of Analysis 1/Analysis 2	
CH2	Channel 2 of Analysis 1/Analysis 2	
DataType	The AVG processing of Analysis 1/Analysis 2	

Analysis Data

When the X axis is the same

Item	Description	
[DATA]	The measurement data label	
X axis	Analysis1	Analysis 2
<X axis>	<Y axis of Analysis 1>	<Y axis of Analysis 2>
<X axis unit>	<Y axis unit of Analysis 1>	<Y axis unit of Analysis 2>
0	0.001	1E-05
0.01	1E-04	1E-05
...	...	...
10	1E-04	1E-05

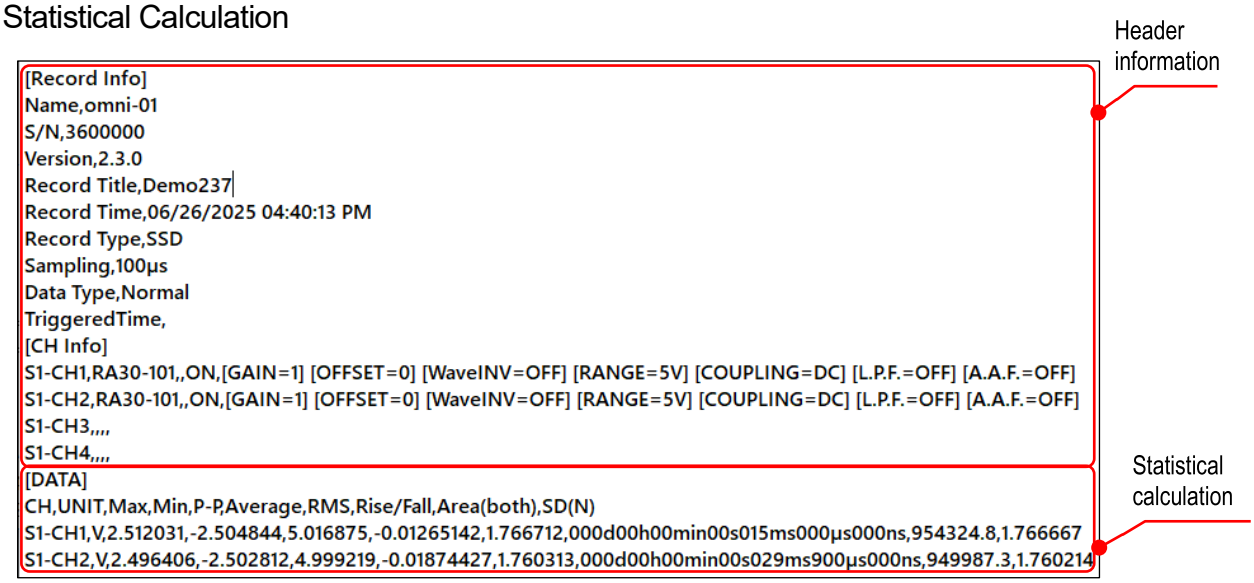
When the X axis differs

Item	Description
[DATA]	The measurement data label
X axis	Analysis1
<X axis>	<Y axis of Analysis 1>
<X axis unit>	<Y axis unit of Analysis 1>
0	0.001
0.01	1E-04
...	...
10	1E-04
X axis	Analysis 2
<X axis>	<Y axis of Analysis 2>
<X axis unit>	<Y axis unit of Analysis 2>
0	1E-05
0.01	1E-05
…	…
10	1E-05

Values of Each Item

Item	Description
<X axis>	Time/Frequency
<X axis unit>	s/Hz
<Y axis>	Linear/Lin-Rel/Lin-Img/Lin-Amp/Log-Amp/Phase
<Y axis unit>	<Channel unit>/<Channel unit>^{2}/<Channel unit>^{2}/Hz/db/deg/blank

For Statistical Calculation



The recording information and channel information ([Record Info] and [CH Info]) in the header information are the same as for a Y-T waveform.

Statistical calculation data

Item	Description
CH	The channel
Unit	The unit
Max	The maximum value
Min	The minimum value
P-P	The difference between the maximum value and minimum value
Average	The average value
RMS	The root-mean-square value
Area(Both)	The area (both sides)
Area(+)	The area (+ side)
Area(-)	The area (- side)
SD(N)	The standard deviation (N)
SD(N-1)	The standard deviation (N-1)
Rise / Fall	The rise or fall

10.13.2. CSV File Name

For a Y-T Waveform

The file name of a CSV file combines the type of recording device and the CSV number.

The CSV number is a serial number.

The recording device	CSV File Name	Example Output
Printer recording	P<CSV number>.csv	P1.csv P2.csv, etc.
SSD recording	S<CSV number>.csv	S1.csv S2.csv, etc.
Memory recording	M<block number>_<CSV number>.csv	M1_1.csv M1_2.csv, etc.

For FFT Analysis

The string "_FFT" is appended to the CSV file name.

For Statistical Calculation

The string "_STA" is appended to the name of the CSV file.

10.14. Delete then Save Function for Recorded Data

This function deletes the oldest recorded data before saving new recorded data.
It is only available with the MFG mode.

Conditions for Delete then Save	The new recorded data must exceed the maximum number of recorded items that can be retained The size of the new recorded data must exceed the free space of the SSD
Maximum size of recorded data	100MB
Maximum recordable time	Because the maximum size of the recorded data is limited, see "10.14.2. Maximum Recordable Time for the Delete then Save Function".

Step 1. If there is recorded data exceeding 100 MB, delete recorded data in file management.
Tap the【SETUP】key >【File management】key in the side menu to open the [File management] screen. Select the target recording in the recording list on the【Recording】tab, then tap the【Delete】key.

Tips

- If the recorded data exceeds 100 MB, recording may not be performed correctly.

See "8.4.1. File Management".

Step 2. Switch to the MFG mode.
Tap the【SETUP】key in the side menu to open the [Setup] screen. Tap the【MFG】key in [Meas. mode].
If [Delete then save] is already enabled, the [Delete then save] dialog is displayed.



See "4.1.3. Selection Method".

Step 3. Enable [Delete then save].
Tap the【File management】key, then enable [Delete then save] on the【Recording】tab.

See "8.4.1. File Management".

Step 4. Configure the recording conditions.
Configure the measurement channel, recording device, sampling speed, and recording time.

Tips

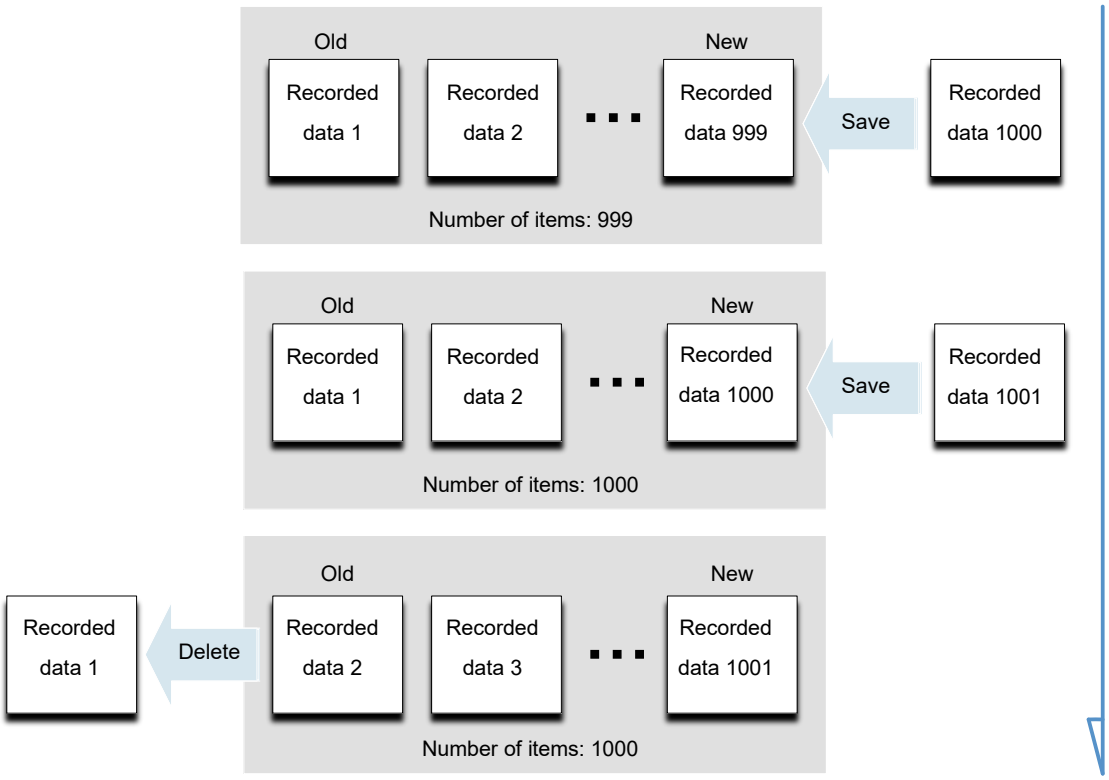
- When [Maximum time] on the【Recording】tab is enabled, the maximum recording time is that for the 100 MB upper limit of the recorded data.

See "6.4.1. Recording Setup".

10.14.1. Operation

When the upper limit on the number of recorded data items is exceeded, this function deletes the oldest recorded data before saving new recorded data.

The same operation is performed when there is not enough free space to save the new recorded data.



10.14.2. Maximum Recordable Time for the Delete then Save Function

The table below indicates the maximum recordable time for the delete then save function.

10.14.2.1. Recording device: PRINTER (data format: P-P)

Sampling speed	Number of measurement channels				
	1 channel	2 channels	8 channels	18 channels	36 channels
1 kS/s	4 hours 48 minutes	2 hours 53 minutes	50 minutes 53 seconds	23 minutes 22 seconds	11 minutes 51 seconds
500 S/s	9 hours 36 minutes	5 hours 46 minutes	1 hour 41 minutes	46 minutes 45 seconds	23 minutes 42 seconds
200 S/s	1 day 0 hours	14 hours 25 minutes	4 hours 14 minutes	1 hour 56 minutes	59 minutes 15 seconds
100 S/s	2 days 0 hours	1 day 4 hours	8 hours 28 minutes	3 hours 53 minutes	1 hour 58 minutes
50 S/s	4 days 0 hours	2 days 9 hours	16 hours 57 minutes	7 hours 47 minutes	3 hours 57 minutes
20 S/s	10 days 0 hours	6 days 0 hours	1 day 18 hours	9 hours 29 minutes	9 hours 52 minutes
10 S/s	20 days 0 hours	12 days 0 hours	3 days 12 hours	1 day 14 hours	19 hours 45 minutes
5 S/s	40 days 1 hour	24 days 0 hours	7 days 1 hour	3 days 5 hours	1 day 15 hours
2 S/s	100 days	60 days 1 hour	17 days 16 hours	8 days 2 hours	4 days 2 hours
1 S/s	100 days	100 days	35 days 8 hours	16 days 5 hours	8 days 5 hours
50 S/min	100 days	100 days	42 days 9 hours	19 days 11 hours	9 days 21 hours
20 S/min	100 days	100 days	100 days	48 days 17 hours	24 days 16 hours
10 S/min	100 days	100 days	100 days	97 days 10 hours	49 days 9 hours

10.14.2.2. Recording device: SSD (data format: NORMAL)

Sampling speed	Number of measurement channels				
	1 channel	2 channels	8 channels	18 channels	36 channels
1 MS/s	25 seconds	17 seconds	5 seconds	2 seconds	1 second
500 kS/s	51 seconds	34 seconds	11 seconds	5 seconds	2 seconds
200 kS/s	2 minutes 9 seconds	1 minute 26 seconds	28 seconds	13 seconds	7 seconds
100 kS/s	4 minutes 19 seconds	2 minutes 53 seconds	57 seconds	27 seconds	14 seconds
50 kS/s	8 minutes 39 seconds	5 minutes 46 seconds	1 minute 55 seconds	54 seconds	28 seconds
20 kS/s	21 minutes 37 seconds	14 minutes 25 seconds	4 minutes 48 seconds	2 minutes 16 seconds	1 minute 10 seconds
10 kS/s	43 minutes 15 seconds	28 minutes 50 seconds	9 minutes 36 seconds	4 minutes 33 seconds	2 minutes 20 seconds
5 kS/s	1 hour 26 minutes	57 minutes 40 seconds	19 minutes 13 seconds	9 minutes 6 seconds	4 minutes 40 seconds
2 kS/s	3 hours 36 minutes	2 hours 24 minutes	48 minutes 3 seconds	22 minutes 45 seconds	11 minutes 41 seconds
1 kS/s	7 hours 12 minutes	4 hours 48 minutes	1 hour 36 minutes	45 minutes 31 seconds	23 minutes 22 seconds
500 S/s	14 hours 25 minutes	9 hours 36 minutes	3 hours 12 minutes	1 hour 31 minutes	46 minutes 45 seconds
200 S/s	1 day 12 hours	1 day 0 hours	8 hours 0 minutes	3 hours 47 minutes	1 hour 56 minutes
100 S/s	3 days 0 hours	2 days 0 hours	16 hours 1 minute	07 hours 35 minutes	3 hours 53 minutes
50 S/s	6 days 0 hours	4 days 0 hours	1 day 8 hours	15 hours 10 minutes	7 hours 47 minutes
20 S/s	15 days 0 hours	10 days 0 hours	3 days 8 hours	1 day 13 hours	19 hours 29 minutes
10 S/s	30 days 0 hours	20 days 0 hours	6 days 16 hours	3 days 3 hours	1 day 14 hours
5 S/s	60 days 1 hour	40 days 1 hour	13 days 8 hours	6 days 7 hours	3 days 5 hours
2 S/s	100 days	100 days	33 days 8 hours	15 days 19 hours	8 days 2 hours
1 S/s	100 days	100 days	66 days 17 hours	31 days 14 hours	16 days 5 hours
50 S/min	100 days	100 days	80 days 2 hours	37 days 22 hours	19 days 11 hours
20 S/min	100 days	100 days	100 days	94 days 20 hours	48 days 17 hours
10 S/min	100 days	100 days	100 days	100 days	97 days 10 hours

10.14.2.3. Recording device: SSD (data format: P-P)

Sampling speed	Number of measurement channels				
	1 channel	2 channels	8 channels	18 channels	36 channels
500 kS/s	34 seconds	20 seconds	6 seconds	2 seconds	1 second
200 kS/s	1 minute 26 seconds	51 seconds	15 seconds	7 seconds	3 seconds
100 kS/s	2 minutes 53 seconds	43 seconds	30 seconds	14 seconds	7 seconds
50 kS/s	5 minutes 46 seconds	3 minutes 27 seconds	1 minute 1 second	28 seconds	14 seconds
20 kS/s	14 minutes 25 seconds	8 minutes 39 seconds	2 minutes 32 seconds	1 minute 10 seconds	35 seconds
10 kS/s	28 minutes 50 seconds	17 minutes 18 seconds	5 minutes 5 seconds	2 minutes 20 seconds	1 minute 11 seconds
5 kS/s	57 minutes 40 seconds	34 minutes 36 seconds	10 minutes 10 seconds	4 minutes 40 seconds	2 minutes 22 seconds
2 kS/s	2 hours 24 minutes	1 hour 26 minutes	25 minutes 26 seconds	11 minutes 41 seconds	5 minutes 55 seconds
1 kS/s	4 hours 48 minutes	2 hours 53 minutes	50 minutes 53 seconds	23 minutes 22 seconds	11 minutes 51 seconds
500 S/s	9 hours 36 minutes	5 hours 46 minutes	1 hour 41 minutes	46 minutes 45 seconds	23 minutes 42 seconds
200 S/s	1 day 0 hours	14 hours 25 minutes	4 hours 14 minutes	1 hour 56 minutes	59 minutes 15 seconds
100 S/s	2 days 0 hours	1 day 4 hours	8 hours 28 minutes	3 hours 53 minutes	1 hour 58 minutes
50 S/s	4 days 0 hours	2 days 9 hours	16 hours 57 minutes	7 hours 47 minutes	3 hours 57 minutes
20 S/s	10 days 0 hours	6 days 0 hours	1 day 18 hours	9 hours 29 minutes	9 hours 52 minutes
10 S/s	20 days 0 hours	12 days 0 hours	3 days 12 hours	1 day 14 hours	19 hours 45 minutes
5 S/s	40 days 1 hour	24 days 0 hours	7 days 1 hour	3 days 5 hours	1 day 15 hours
2 S/s	100 days	60 days 1 hour	17 days 16 hours	8 days 2 hours	4 days 2 hours
1 S/s	100 days	100 days	35 days 8 hours	16 days 5 hours	8 days 5 hours
50 S/min	100 days	100 days	42 days 9 hours	19 days 11 hours	9 days 21 hours
20 S/min	100 days	100 days	100 days	48 days 17 hours	24 days 16 hours
10 S/min	100 days	100 days	100 days	97 days 10 hours	49 days 9 hours

11. Maintenance

The frame must not be removed from this product other than by our service engineers, as this product is a precision device.
This section describes the maintenance of this product.

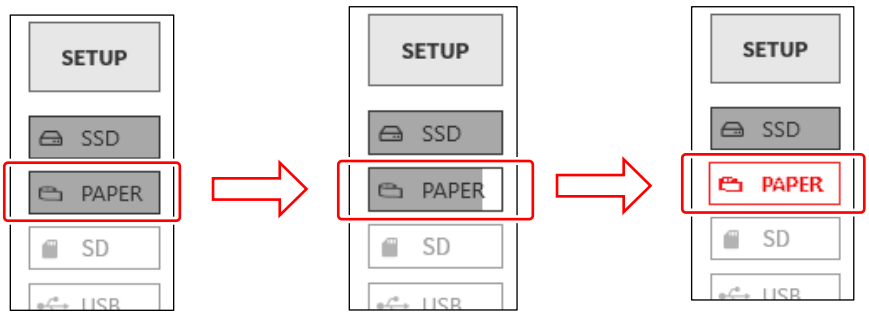
11.1. Managing/Handling Recording Paper and Printer Recorded Data

11.1.1. Replacing Recording Paper and Monitoring Remaining Paper

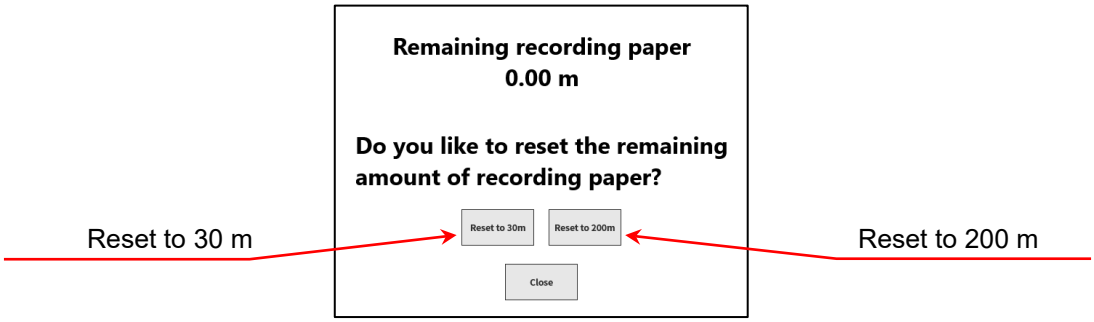
Use the chart recording paper specified by A&D. Use of a chart that is not recommended may cause failure in printing or shorten the life of the thermal head.
Red is printed on the recording paper when the recording paper is running low. The remaining paper monitor (PAPER) is displayed on the side menu of the monitor. Follow these to replace the recording paper.
For information on the replacement method, see "2.1.3. Paper Loading".

Remaining Paper Monitor Operations

<After replacing recording paper> <During use> <No paper remaining>



Reset the remaining paper monitor after replacing the recording paper. Press and hold【PAPER】(remaining paper monitor) on the side menu to display the dialog box for resetting.
Tap【Reset to 30 m】 for a 30 m paper roll (YPS-106 or YPS-108) or【Reset to 200 m】 for a 200 m Z-fold paper (YPS-112), and then tap【CLOSE】.



11.1.2. Storing Recording Paper

Storing Recording Paper before Recording

- ❑ Avoid storing recording paper in high temperature or high humidity environments. Take care as storing it in a high temperature environment for an extended period of time will cause the white background to change color.
- ❑ When storing recording paper, remove it from the main unit and insert it in a plastic bag, or as-is if it is still in its original packaging, and then store it in a dark location with a temperature of 25°C or less and humidity of 70% RH or less.
- ❑ Do not expose it to sunlight for extended periods of time. Take care when performing measurement or storage outdoors, as exposing it to light for an extended period of time will cause the white background to change color.

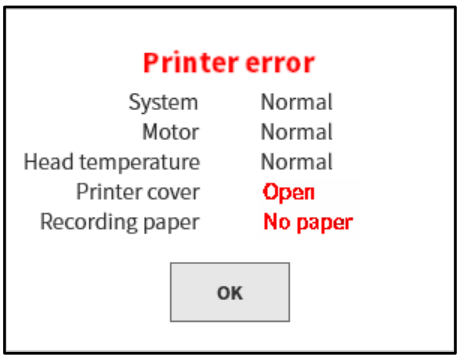
Storing Recording Paper after Recording

- ❑ Avoid storing recorded data in high temperature or high humidity environments or exposing it to sunlight or strong light for an extended period of time, as it may lose color or the white background may change color.
- ❑ When storing recording paper for an extended period of time after recording, file it in a dark location with a temperature of 25°C or less and humidity of 70% RH or less. When using a file folder, make sure that it is made of a material that does not include plasticizer (such as polyethylene or polypropylene).
- ❑ If the recording paper touches the following materials or products, the printing surface may change color, lose color, or exhibit otherwise poor color performance.
  Vinyl chloride products, organic compounds, adhesive tape, pencil erase, rubber mats, magic markers, felt-tip pens, correction fluid, carbon, diazo photosensitive paper, hand cream, hairdressing products, cosmetic products, or leather products such as a wallet
- ❑ Recorded data that has colored cannot be removed by rubbing or wetting it. However, do not rub the recorded data part, as rubbing the recording paper strongly will cause it to color due to the frictional heat.

11.1.3. Printer Block Errors

The state of the following three items is monitored for the printer block to control recording. If an error occurs during recording, the error is displayed on the monitor and recording ends.

- ❑ Existence of recording paper
- ❑ Printer cover lock state
- ❑ Thermal head temperature



Printer error dialog box

Note

- ❑ The thermal head temperature may be high after performing printer recording for an extended period of time, which can cause an error. Take the installation location, printing density, and recording speed into consideration so that no error occurs.

11.2. Backing Up Recorded Data

This product records measured data on the internal SSD. Make sure to periodically perform maintenance (data backup or deletion) on the SSD, because failing to do so may prevent measurement from being performed due to insufficient space.
The SSD remaining capacity monitor (SSD) is displayed on the side menu of the monitor, and maintenance can be performed based on that display.
For information on backing up recorded data and deleting it from the SSD, see “Record” of "8.4.1. File Management ".



<SSD remaining capacity monitor>
Displays the remaining capacity of the internal SSD in the indicator.

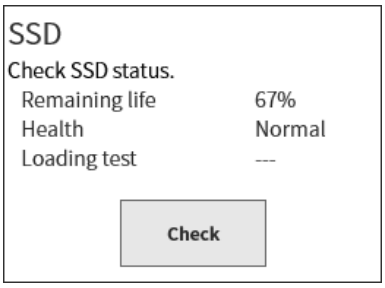
Maintenance procedure

Step 1. Copy the recorded data to back up to external media using the export function.

Step 2. Delete unnecessary recorded data.

11.2.1. Internal SSD Errors

The life of the internal SSD of the recording device greatly varies according to the number of times data has been overwritten.
The health of the SSD can be checked in [Remaining life] and [Health] in【 SSD】 on the [Maintenance] screen.
When the life remaining is close to 0%, please contact our sales representative to replace the SSD.



11.3. Display Cleaning

When the surface of the display is dirty, wipe it clean with a soft, dry cloth or gauze dampened with ethanol.

11.4. Thermal Head Cleaning/Life

11.4.1. Cleaning

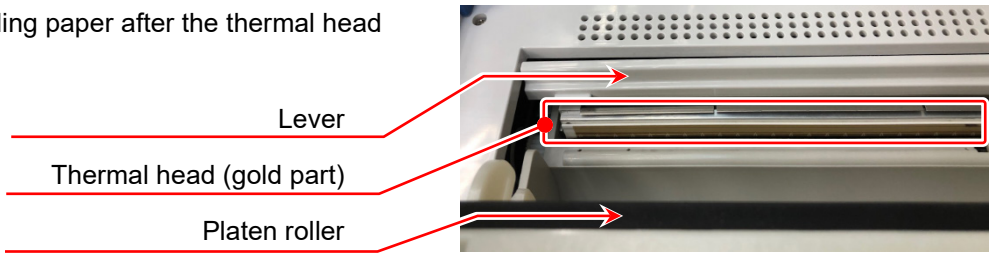
When recording has been performed for an extended period of time, material such as dust or printing waste may adhere to the thermal head thermocouple. This may cause printing to become unclear and reduce the image quality. In this case, follow the procedure below to clean the thermal head.

Step 1. Open the printer cover by pulling the lever of the printer block up.

Step 2. The thermal head can be seen in the top inside of the printer block. The thermocouple is at a line 4.4 mm from the thermal head edge. Clean that line area.

Step 3. Gently wipe it clean with a cotton bud or gauze dampened with ethanol. The recording paper colors when exposed to ethanol, so it is recommended that you remove it from the stock area before cleaning.

Step 4. Load the recording paper after the thermal head dries.



11.4.2. Life

The wear resistance of the thermal head is about 30 km (approximately 1,000 rolls of YPS106 recording paper) or about 30 million printing pulses. Recording quality may not be able to be maintained after that. In this case, please contact our sales representative to replace the thermal head (at an extra cost).

11.5. Platen Roller Maintenance

Foreign material or dust adhering to the platen roller may cause damage to the thermal head or may cause printing to become unclear and reduce the image quality. In this case, gently wipe the platen roller clean using gauze dampened with ethanol.

11.6. Power Outages

If a power outage occurs or the power cable becomes disconnected during recording, the internal SSD may become damaged and unable to be accessed. An UPS (uninterruptible power supply) is recommended to be used.

11.7. Battery Replacement

The life of the backup battery for the internal clock is about 10 years (at 23°C). If the clock resets every time the power is turned on, the battery may need to be replaced.
In this case, please contact our sales representative.

11.8. Fan Replacement

If the internal fan stops due to failure, the internal temperature of this product will rise and may cause damage to other devices inside this product. The state of the fan can be checked in【Fan】 on the [Maintenance] screen.

If an error occurs, please contact our sales representative for a repair.

11.9. Cautions for Disposing This Product

Take care of the following when disposing of this product.

⚠WARNING

- This product includes a coin lithium battery (primary cell) for backup purposes.
- When disposing of this product, please contact an A&D sales representative or distributor (see the end of this document for details).
- Follow national and regional laws when disposing of this product.

11.10. Troubleshooting and Inspection

If this product does not operate normally after performing the indicated countermeasure or a repair is required, output an OS info report file as indicated in (6) in "8.4.2. Maintenance" and contact our sales representative.

Symptom	Possible cause	Countermeasure
The power does not turn on. Nothing is displayed on the screen.	The power cord is not connected to the connector properly.	Connect the power cord properly and turn on the power switch
	The fuse has blown.	The fuse for this product cannot be replaced by the customer because it is located inside the main unit. Please contact our sales representative if the fuse may be blown.
	The screen is set to turn off automatically.	Press any key to turn on the screen.
The touch panel or operation panel keys do not respond.	This product is recording. The start LED is on.	Perform the operation again after pressing stop on the operation panel to stop measurement.
	The SCREEN LOCK or KEY LOCK is switched ON.	Switch OFF the SCREEN LOCK or KEY LOCK on the side of this product.
Printer recording is not performed.	There is no recording paper.	Load recording paper.
	The printer cover is open.	Close the printer cover.
	The thermal head is at an abnormally high temperature.	Use this product in a location at a temperature between 0 and 40°C. Do not continuously print solid black areas.
	Real-time waveform printing is disabled in the recording settings.	Enable real-time waveform printing in the recording settings and start recording.
Memory recording cannot be replayed.	Memory data is not saved because the trigger is not enabled.	Cause a manual trigger using the TRIG key on the operation panel.
Recording does not start when the START key is pressed.	The recording mode is set to trigger start or time start.	Disable the START trigger.
	External sampling recording is enabled.	Press the start key after inputting the signal, as recording cannot start unless a pulse signal is input to the remote terminal.
	Recording paper has not been loaded.	Load recording paper.
	KEY LOCK is switched ON.	Switch OFF the KEY LOCK on the side of this product.
	There is no free space remaining on the SSD.	Delete unnecessary recorded data or CSV files.
	The recorded data has exceeded 1,000 items.	
	The number of CSV files has exceeded 1,000 items.	
	The maximum size of recorded data when the delete then save function is enabled (100 MB) has been exceeded.	Enable [Maximum time] in [Recording] or set [Recording time] to a time at or below the maximum time.

Symptom	Possible cause	Countermeasure
Data cannot be saved to the specified media.	The media has not been formatted.	Format the media.
	There is insufficient free space on the media.	Delete unnecessary files or use new media.
	The media is set to read-only.	Disable the read-only setting of the media.
The media is not recognized.	The format of the media is invalid.	Use the FAT16, FAT32, NTFS, or exFAT file system to format the media.
	The media is damaged.	Use other media.
	The device cannot be recognized as removable media.	Use other media.
The communication interface cannot be used to configure settings and control operation.	The communication parameter settings do not match.	Match the address and communication parameters.
This product does not shut down with the [POWER] switch.	KEY LOCK is switched ON.	Switch OFF the KEY LOCK on the side of this product.
	The main unit software is unable to detect switch operations.	Press and hold the [POWER] switch until the power turns off.

12. Specifications

12.1. General Specifications

12.1.1. Main Unit Basic Specifications

Item	Specifications			
Input block	Number of module slots	9 slots		
	Analog input	Maximum 36 channels		
	Logic input	Maximum 144 channels		
Recording device	Internal SSD	256 GB		
	Internal memory	4 GB		
	Internal printer	216 mm thermal printer		
Recording function	SSD recording	Directly recording to internal SSD		
	Memory recording	Recording high-speed phenomena to memory		
	Printer recording	Directly recording input signals to printer		
Sampling speed	SSD recording	1 MS/s	to	10 S/min
	Memory recording	20 MS/s	to	10 S/min
	Printer recording	1 kS/s (100 mm/s)	to	10 S/min (1 mm/min)
Sampling accuracy	Accuracy	±10 ppm (max) * With an arbitrary chart speed, ±30 ppm (max).		
Printer block	Thermal printer			
	Recording width	216 mm		
	Recording speed	100 mm/s to 1 mm/min		
	Chart speed accuracy	Within ±2 % (25 °C, 65 % RH)		
	Recording paper	219 mm x 30 m	Paper roll	(YPS-106, YPS-108)
		219 mm x 200 m	Z-fold paper	(YPS-112)
Display block	12.1" XGA TFT color LCD (1024 x 768 dots) With electrostatic capacitive touch panel (supporting two point multi-touch)			
Operation panel	Operation panel key	POWER	Power on/off	
		START	Start recording	
		STOP	Stop recording	
		TRIG	Forced trigger	
		PRINT	Start printer recording/screen copy	
	Rotary knob	Change measurement range or waveform position, etc.		
Lock function	Key lock	Operation panel key lock		
	Screen lock	Touch panel key lock		
Interfaces	LAN, USB, SD, COM, DVI-D For details, see "12.2.14. Interface Specifications".			

12.1.2. General Specifications

Item	Specifications		
Power	Rated power voltage	AC 100 to 240 V	
	Allowed range of variation in power voltage	AC 90 to 264 V	
	Rated power frequency	50/60 Hz	
	Allowed range of variation in power frequency	47 to 63 Hz	
	Withstand voltage	Between power and case	1500 V AC for 1 minute
	Insulation resistance	Between power and case	100 MΩ or more at 500 VDC
	Power consumption	For printer recording	300 VA (maximum printing state)
		When recording is stopped	80 VA
		For standby	5 VA (power cord connected and power off)
	Power fuse	Internal (not replaceable)	
Locations for use	Indoor, Pollution Degree 2 *1, elevation 2000 m or lower		
Warmup time	60 minutes or longer		
Operating environment	Temperature	0 to 40 °C	
	Humidity	35 to 85 RH% (without condensation)	
Storage environment	Temperature	-20 to 60 °C	
	Humidity	20 to 85 RH% (without condensation)	
Vibration resistance	Sine wave vibration		
	Vibration frequency	10 to 55 Hz	
	Vibration level	20.0 m/s^2, 3 axis, 20 cycles each	
	Random vibration		
	Vibration frequency	5 to 500 Hz	
	Acceleration rms value	X, Y axis 6.5 m/s^2, Z axis 10.2 m/s^2, 1 hour each	
Backup battery life	Approx. 10 years (ambient temperature 23°C), for clock backup		
Standards	Safety standards	EN61010-1 EN61010-2-30	Overvoltage Category II (CAT II) *2 Measurement Category *3 Dependent on specifications of installed modules
	EMC	EN61326-1 Class A	
Dimensions	Approx. 394 mm (W) x 334 mm (H) x 199 mm (D) *Excluding protrusions		
Mass	9.5 kg or less (main unit only)		
Warranty period	1 year		

*1 The Pollution Degree indicates the level of pollution that can exist in the ambient environment.

Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

Pollution degree 2: Only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is to be expected.

Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is to be expected.

Pollution degree 4: The pollution generates persistent conductivity caused by conductive dust or by rain or snow.

*2 The Overvoltage Category (Installation Category) indicates how much overvoltage (impulse voltage) from an AC power supply an electrical device can withstand. Overvoltage Category II (CAT II) is suitable for devices powered by wire from the switchboard of a building.

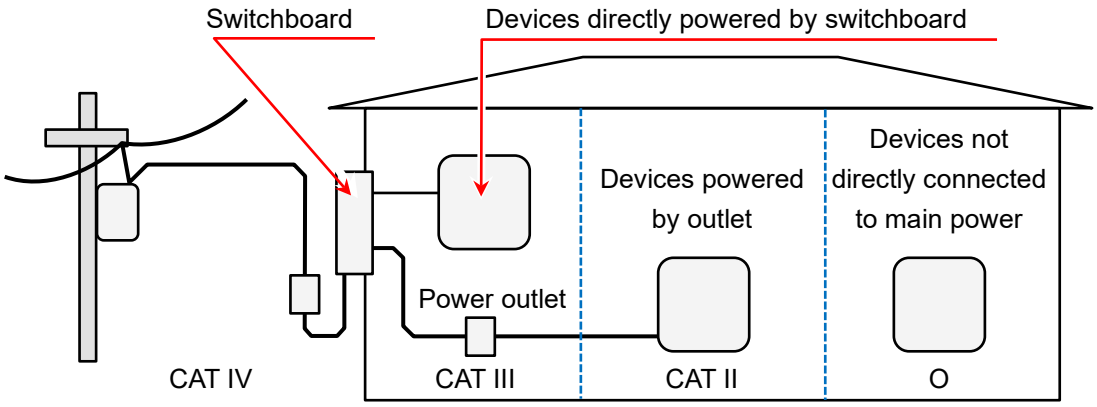
*3 The Measurement Category categorizes a testing or measurement circuit according to the type of main power circuit intended to be connected for testing or measurement, and differs according to the modules installed to this product. Use this product within the Measurement Category that meets the module specifications.

CAT II: Applies to testing and measurement circuits directly connected to the point of use (power outlet or similar location) of a low voltage main power supply system.

CAT III: Applies to testing and measurement circuits connected to the switchboard of the low voltage main power supply system in a building.

CAT IV: Applies to testing and measurement circuits connected to the source of the low voltage main power supply system in a building.

No category (O): Applies to circuits not directly connected to a main power supply.



O : Other circuits not directly connected to main power
CAT II : Measurement Category II
CAT III : Measurement Category III
CAT IV : Measurement Category IV

12.2. Functional Specifications

12.2.1. Measurement Function

Item	Specifications	
Measurement modes	R&D mode	For research and development
	MFG mode	For manufacturers
Recording mode	The recording modes are indicated below. (1) Standard (2) Start time (3) Start trigger (4) Interval (N times) *1 (5) Start time + Start trigger (6) Start trigger + Interval (N times) *1 (7) Start time + Interval (N times) *1 (8) Start time + Start trigger + Interval (N times) *1 (9) Window recording (10) Custom (combination of start time, start trigger, interval time (N times), window recording, stop trigger, and repeat recording)	
Recording device	Recording to SSD, memory, or printer, and recording to various recording devices at the same time	
Display	Y-T waveform	Waveform with amplitude on vertical axis and time on horizontal axis
	X-Y waveform	Waveform with X axis (horizontal) and Y axis (vertical)
	FFT waveform	Waveform for FFT analysis
	Digital value	Displays numeric values for measured values
Sampling speed	Differs according to recording device.	
Maximum recording time	100 days	
Maximum number of recorded items	1,000	

*1 Interval time setting range: <Recording time + 1 minute> to <one day>

12.2.2. SSD Recording

Item	Specifications	
Function	Records the input signal to the internal SSD.	
Recording device	Internal SSD	
Number of channels	Analog	36 channels (max)
	Logic	144 channels (max)
Data format	NORMAL data	Samples and records data at the set sampling speed.
	P-P data	Records the two peak values (max/min) of the data within the set sampling speed period sampled at 20 MS/s.
Sampling speed	1 MS/s to 10 S/min	500 kS/s (max) for P-P data The speed can be set to 1, 2, or 5 series
	External sampling*1	Maximum input frequency: 250 kHz
Information data	Records information related to the recorded data, such as the version of this product, module configuration, channel settings, data format, and recording time.	
Recorded data	Records input data, trigger information, and marks.	
Window recording	Records the last data specified at the recording time when recording stops. Cannot be used in conjunction with memory recording or printer recording.	

*1 Enabled when the Remote Control Module (RA30-112) is installed.
External sampling cannot be recorded to the SSD and printer at the same time.

12.2.3. Memory Recording

Item	Specifications	
Function	Records the input signal to the internal memory.	
Recording device	Internal memory	2 GW *1
	Record blocks (number of memory divisions)	Divided into 1 to 200 user-defined blocks *2
	Points	The number of data items per channel that can be recorded to a recording block 2 kW to 2 GW (selected in step 1-2-5) Channels x points x blocks ≤ 2 GW
Number of channels	Analog	36 channels (max), 18 channels at 20 MS/s
	Logic	144 channels (max)
Data format	NORMAL data	
Sampling speed	20 MS/s to 10 S/min	The speed can be set to 1, 2, or 5 series
Information data	Records information related to the recorded data, such as the version of this product, module configuration, channel settings, data format, and recording time.	
Recorded data	Records input data and trigger information.	
CSV output	Enables the recorded data saved when recording is finished to be automatically saved to a CSV file. Can be used with the standard, start time, start trigger, or start time + start trigger recording modes.	

*1 W (word) refers to a unit of data. 1 W = 2 bytes

*2 The number of memory blocks available for recording with the overwrite mode is the number of recording blocks minus one.

12.2.4. Printer Recording

Item	Specifications	
Function	Simultaneously records the input signal to recording paper and the internal SSD.	
Recording devices	Internal printer	
	Internal SSD	
Channel count	Analog	36 channels (max)
	Logic	144 channels (max) 48 channels (max) when printing realtime waveforms
Data format	P–P	
Recording speed	100 mm/s to 1 mm/min	The recording speed is either a 1, 2, or 5 series speed or an arbitrary chart speed
	External sampling*1	Maximum input frequency: 500 Hz Paper feed length per pulse: 0.1 mm
Printing resolution	Amplitude axis (Y axis)	8 dots/mm
	Time axis (T axis)	20 to 80 dots/mm
Length of each division	Amplitude axis (Y axis)	5 mm or 10 mm
	Time axis (T axis)	10 mm * One division equals 100 samples

*1 Enabled when the Remote Control Module (RA30-112) is installed.
External sampling cannot be recorded to the SSD and printer at the same time.

12.2.5. Pen Recording

Item	Specifications	
Function	Records the input signal to recording paper.	
Recording devices	Internal printer	
Channel count	48 channels (max)	
Data format	P–P	
Recording speed	100 mm/s to 1 mm/min	The recording speed is either a 1, 2, or 5 series speed or an arbitrary chart speed
	External sampling*1	Maximum input frequency: 500 Hz Paper feed length per pulse: 0.1 mm
Printing resolution	Amplitude axis (Y axis)	8 dots/mm
	Time axis (T axis)	20 to 80 dots/mm
Length of each division	Amplitude axis (Y axis)	5 mm or 10 mm
	Time axis (T axis)	10 mm * One division equals 100 samples

*1 Enabled when the Remote Control Module (RA30-112) is installed.

12.2.6. Trigger Function

[Basic trigger function]

Item	Specifications	
Trigger function	Start trigger	Start trigger for recording operation
	Stop trigger	Stop trigger for recording operation
	Memory trigger	Trigger for memory recording
Trigger type	Analog input signal *2	
	Level trigger Window trigger	Trigger when an analog signal transects (rises above/falls below) the set threshold INTO WIN: Trigger when the analog signal enters the upper/lower limit range OUT WIN: Trigger when the analog signal leaves the upper/lower limit range
	Logic input signal *2	
	Bit pattern trigger	Logic signal bit pattern judgment trigger
	Forced trigger	When the trigger key of the operation panel is pressed
	External trigger *1	When the external trigger input signal becomes active *1
Trigger filter	This function generates a trigger if the trigger conditions continue to be established for the specified period of time (to ensure that a trigger is not generated by noise, etc.)	
	Filter time	0 to 100 s
Hysteresis	1% of RANGE	

*1 Enabled when the Remote Control Module (RA30-112) is installed.

*2 Analog input and logical input triggers (triggers from input channels) are collectively referred to as channel triggers.

[Start trigger]

Item	Specifications
Trigger source	Channel trigger, forced trigger, external trigger
Channel trigger specified number of channels	1 channel

[Stop trigger]

Item	Specifications
Trigger source	Channel trigger
Channel trigger specified number of channels	1 channel

[Memory trigger]

Item	Specifications
Trigger source	Channel trigger, forced trigger, external trigger
Channel trigger specified number of channels	18 channels AND/OR setting available

12.2.7. Waveform Monitor Function

Item	Specifications	
Display screen	MEASURE	Displays the waveform of the input signal
	PLAYBACK	Playback the memory, SSD, or printer recorded data
Waveform type	Y-T waveform, X-Y waveform, FFT waveform	
	Enables waveform display for an arbitrary analog signal and logic signal	
	Y-T waveform	Enables 48 channel/sheet signal display
	X-Y waveform	Enables a maximum of four X-Y waveform sets to be displayed *1
	FFT waveform	Enables FFT analysis results to be displayed for a maximum of two channels *1

*1 Enabled for SSD recording with the data format set to NORMAL. Sampling speed limitations apply.

12.2.8. Y-T waveform

Item	Specifications	
Target data	All memory, SSD, and printer recording data	
Display width	20 div x 20 div	
	Time axis (T axis)	1 div = 100 samples
	Amplitude axis (Y axis)	1 div = 1/10 RANGE (with display range at 100%)
	Display area	Specifies the display position, display range, display maximum, and display minimum
Sheet	Enables waveform screens to be managed as three waveform screens (display channel sets)	
Number of graphs	1 to 18	
Display functions	Digital display	Numeric value display of input signal
	Scale	Scale display of amplitude axis
	Grid	Grid display of waveform area
	Trigger/mark	Displays detected trigger/mark
	Pen position	Displays the signal amplitude position
	Zero position	Displays the signal zero position
	Time display	Displays the time information at the bottom of the view area
	Pinch in/out	Enlarges/reduces the display waveform
	Swipe	Change Y-T waveform display position
	Time axis display scale	Zoom in/zoom out time axis of Y-T waveform 100, 50, 20, 10, 5, 2, 1.00, 1/2, 1/5, 1/10, 1/20, 1/50, 1/100, 1/200, 1/500, 1/1000, 1/2000, 1/5000, 1/10000
	Auxiliary line	Display auxiliary line in center of each div of amplitude axis
Cursors	Two cursors are displayed. The signal information (position and value) of the cursor positions, difference information between the cursors, and maximum, minimum, and average between the cursors are displayed. * The maximum, minimum, and average can only be displayed for a single selected channel.	
TRIG.SYNC	Updates the waveform of memory recording in synchronization with a trigger The trigger point is in the center of the waveform monitor	

12.2.9. X-Y Waveform

Item	Specifications	
Target data	SSD recorded data	Data format: NORMAL; Sampling speed: 1 kS/s or lower
X-Y axis	X axis channel:	User-defined analog channel
	Y axis channel:	User-defined analog channel Four waveforms can be set
Sampling speed	1 kS/s (max)	
Display format	Select single screen or quad screen	
	Single	Displays four sets of X-Y waveforms on a single screen
	Quad	Displays a separate X-Y waveform on each of four screens
Pen up	Pauses measurement	The pen up operation can be performed for one waveform at a time or all waveforms at once
Pen down	Resumes measurement	The pen down operation can be performed for one waveform at a time or all waveforms at once
Clear	Clears the displayed waveform	The clear operation can be performed for one waveform at a time or all waveforms at once
Refresh graph	Redraws the X-Y waveform between cursors A and B on the Y-T waveform.	
Display functions	Dot/line	Renders the X-Y waveform with dots or lines
	Scale	Input signal scale display of X axis and Y axis
	Grid	Grid display of waveform area
	Pen position	Displays the input signal position
	Zero position	Displays the signal zero position
	Pinch in/out	Enlarges/reduces the waveform

12.2.10. FFT Analysis

Item	Specifications
Target data	SSD recorded data Data format: NORMAL; Sampling speed: 1 MS/s or lower
Sampling points	Set the analysis sampling points: Select 1000, 2000, 5000, or 10000 points
Frequency range	500 kHz (max), the frequency range is calculated as 0.5 x the sampling speed
Analysis range selection	Selects the analysis range using two cursors.
Window function	Supports amplitude gain using a window function. Hanning, hamming, rectangular
Analysis function	Time scale waveform, linear spectrum, RMS spectrum, power spectrum, power spectrum density, 1/1 octave analysis, 1/3 octave analysis, cross power spectrum, transfer function, coherence function
Analysis count	2
Display format	Single/Dual
X axis scale	Time, linear frequency, log frequency, 1/1 octave, 1/3 octave
Y axis scale	Amplitude, linear real part, linear imaginary part, linear amplitude, log amplitude, phase
Manual scale	Manually sets the X axis and Y axis display area
Averaging	Time simple averaging, frequency simple averaging, frequency exponential weight averaging, frequency axis peak hold, None
Average number of additions	1 to 10
Peak value display	Identifies a maximum of 10 local maximums or global maximums from the analysis results.
Cursor	Displays two cursors for each analysis and displays the X value and Y value of each cursor.
Pinch in/out	Enlarges/reduces the FFT analysis results with pinch in/pinch out operations.

12.2.11. Calculation Functions

Item	Specifications
Statistical Calculation	
Target data	SSD recording (NORMAL format), memory recording
Calculated items	Maximum, minimum, P-P, average, RMS, area (both sides), area (+ side), area (- side), standard deviation (N), standard deviation (N-1), rise/fall

12.2.12. Setup/Record management

Item	Specifications	
Recording Setup		
Recording	Mode	10 types of recording mode display and selection.
	Data name	Data name, automatic numbering.
	Recording time	Recording time setting for one time, maximum time settable from remaining SSD capacity
	Start time	Set the recording start time
	Interval time	Set the Interval time and number of recordings
	Printer	Enable/disable printer recording when performing measurement, sheet selection, enable/disable real-time waveform printing during measurement.
	SSD	Enable/disable SSD recording when performing measurement.
	Memory	Enable/disable memory recording when performing measurement, record blocks, points, endless mode, pre-trigger settings.
	Thumbnails	Configures the channels to display thumbnails for during recording and the view compression rate (1/10 to 1/100).
Channel List	Common	Displays and configures a list of common settings set in modules and the input module installed in this product. Display items: Channel number, module type. Display items and settings: CH name, measurement, color, display position, display range, display maximum, and display minimum.
	Conversion	List of physical conversion for the installed analog input module. Display items and settings: Conversion method (2-pt /gain), conversion value (conversion 1, conversion 2), unit.
	Sheet	Channel registration to Sheet and Graph, Wave display and Wave inversion list view and settings. Display items and settings: Sheet, Graph, Wave display, Wave inversion
	List by input module type	Displays and configures a list of the settings unique to each module. Each item can be configured individually or together.
Sheet	Graph	Settings regarding the division of Y-T waveforms and graph previews.
	SHEET1 to SHEET3	List of registered channels and channel registration to sheets 1 to 3
Printer	Printing	Print settings for the header, annotation, footer, grid, date/data name, trigger/mark, signal name print position, channel mark, time axis, recording speed, page number, and feed length
	Text settings	Inputs and imports/exports text for printing headers, annotations, and footers 60 characters for the text (in the paper feed direction) x 86 lines (waveform amplitude direction)

Item	Specifications	
Recording setup - Other setup	Sampling speed	The sampling speed unit is frequency or period.
	Printer speed	The speed unit for pen recording or printer recording is the sampling speed or chart speed.
	Chart speed key	Enables six chart speeds to be registered.
	X axis notation	Sets the label notation of the X axis scale on the waveform screen. Three types can be set.
	Output recording info XML file	Sets whether to output an XML format file of the recording info to the recorded data.
Environment	PC name	Sets the name of the main unit using 15 characters or less. This name is used for identification purposes on the network and in recorded data.
	Language	English
	Time zone	Sets the time zone (regional standard time).
	Date and time	Sets the current date and time.
	Display brightness	Sets the brightness of the LCD display.
	Buzzer sound	Switches the overrange buzzer on or off
Display	Grid	Switches the grid lines of the waveform screen on or off and configures their brightness.
	Trigger line	Switches the trigger lines of the waveform screen on or off.
	Mark line	Switches the mark lines of the waveform screen on or off.
	Search result line	Switches the search result line of the waveform screen on or off.
	Auxiliary line	Switches the grid line auxiliary line on or off. An additional horizontal line is displayed in the center of the grid on the Y axis.
Main unit setup - Other setup	CSV format	Configures the format for saving CSV files.
	Follow cursor	Sets whether to follow the cursor when the cursor moves outside the waveform monitor.
	TRIG key	Sets the operation performed when the TRIG key on the operation panel is pressed.
	Delete then save	Sets whether to enable the delete then save function when recording
File management	Record	Lists or deletes the data saved to this product, restores the recording setup, and imports/exports data.
	Image	Lists, deletes, and exports image data saved to this product.
	Config	Lists or deletes the configuration saved to this product, restores settings, and imports/exports data.
	CSV	Lists, deletes, and exports CSV files saved to this product.
	PDF	Enables the PDF files saved to the product to be listed, deleted, or exported.
	Delete then save	Sets whether to enable the delete then save function when recording

12.2.13. File Output

Item	Specifications			
Image output		Screenshot		
	File format	PNG		
	Maximum number retained	100		
CSV output		Output recordings and analysis data to the internal storage as a CSV file		
	Target data	Y-T waveform, FFT analysis, statistical calculation		
	Maximum number retained	1,000		
PDF output		Output recording paper data as a PDF file		
	Target data	Y-T waveform		
	Paper	Recording paper	A3 landscape	A4 landscape	Letter landscape
	Paper size (vertical × horizontal)	219.5 × 5,020 mm (max)	297 × 420 mm	210 × 297 mm	216 × 279 mm
	Grid size (length of 1 div)	10 × 10 mm	12.8 × 12.8 mm	8.8 × 8.8 mm	8.6 × 8.6 mm
	Protection function	No restriction or not editable		
	Maximum page count	100 pages		
	Maximum number retained	1,000		
XML output		File for reading recorded information in an external application		
	Output destination	Output to recording folder		

12.2.14. Interface Specifications

Item	Specifications	
LAN	Supported standard	IEEE802.3 (1000BASE-T, 100BASE-TX, 10BASE-T)
	connectors	RJ-45
	Number of ports	1
USB	Supported standard	USB3.0
	connectors	Type-A
	Number of ports	2
SD	Supported standard	SD standard (SD/SDHC/SDXC supported)
	connectors	Slot for SD memory cards
	Number of ports	1
COM	Supported standard	EIA-574
	connectors	D-Sub9
	Number of ports	1
DVI-D	Supported standard	DVI-D (dual link not supported)
	connectors	DVI-D
	Number of ports	1

12.2.15. Communication Setup

12.2.15.1. COM

Item	Specifications	
RS-232C	Baud rate	300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200, 230400, 460800 bps
	Data bits	8 bit
	Stop bits	1, 2 bit
	Parity	None, Odd, Even, Mark, Space
	Flow control	None, XON/XOFF, Hardware (CTS/RTS)
	Function	Communication commands

12.2.15.2. LAN

Item	Specifications	
Network	Connection method	IPv4
	Function	Communication commands, Web server, FTP server, data transfer
Web server	HTTP	Enables RA3100 screen and key operations via a Web browser.
	Authentication	Restricts login via a user name and password
	Access restrictions	Restricts RA3100 operations from a Web Browser
	Screen refresh speed	Refresh speed of the RA3100 screen in the Web browser
	Save screen	Saves the screen of the RA3100 to the PC in the PNG format
	Time synchronization	Synchronizes the date and time of the RA3100 with a PC
FTP server	File transfer	File transfer of recording/image/configuration data
	Authentication	Restricts login via a user name and password
	Access restrictions	Read only
	Maximum number of connections	8
Data transfer	Data transfer	Realtime transfer of measurement data to a PC *1
	Transfer period	100 ms
	Transfer conditions	Always, linked with recording, or manual operation
	Protocols	TCP and UDP
	Transfer data	One-shot: The one latest item of sample data Continuous: Measurement data synchronized with the sampling speed
	Decimation	1/1 to 1/1000 *2
	Maximum number of connections	1

*1 MFG mode only

*2 Continuous transfer data only

12.2.15.3. List of Network Port Numbers Used

Port Number	Protocols	function	Remarks
20	TCP	FTP server	For file transfer
21	TCP	FTP server	For control
80	TCP	Web server (HTTP server)	
3000	TCP	Communication commands	
3100	TCP or UDP	Data transfer	

12.2.16. Other Setup (Maintenance/Operation History/Version Management)

Item	Specifications
SSD check	SSD life remaining, health check, and loading test
Fan check	Displays the state of the internal cooling fan
LCD check	LCD screen check and pixel defect check
Brightness check	LCD back light brightness control check
Printer	Prints a test patter from the printer Printer state check: System, motor, head temperature, printer cover, recording paper
Buzzer	Controls the buzzer on/off to check the buzzer
Panel keys	Press the panel keys to check whether they operate normally
Panel key LED	Turns the panel LEDs on/off to check whether they operate normally
Initialize	Returns the settings of this product to the factory defaults.
Operation history display	Displays the history of the past 100 operations.
Version management	Displays the serial number and version of this product and the version information of each module

12.3. Module Specifications

12.3.1. 2ch Voltage Module (RA30-101)

Item	Specifications	
Number of input channels	2 channels	
Input connectors	Insulated BNC	
Input format	Unbalanced input (insulation between channels and between channels and chassis)	
Coupling	AC/DC/GND	
Input impedance	1 MΩ ±1%	
Measurement range (RANGE)	100, 200, 500 mV 1, 2, 5, 10, 20, 50, 100, 200, 500 V (the measurement range is ±RANGE)	
Measurement probability	±0.3 % of RANGE (23 °C ±5 °C, DC coupling, L.P.F. 3 Hz, after zero adjust)	
Temperature coefficient	±(400 ppm of RANGE)/°C	
Frequency characteristics	DC coupling	DC to 100 kHz (-3 dB to 1 dB) (with L.P.F. and A.A.F. disabled)
	AC coupling	0.3 Hz to 100 kHz (-3 dB to 1 dB) (with L.P.F. and A.A.F. disabled)
Low-pass filter (L.P.F.)	Cutoff frequency	3 Hz, 30 Hz, 300 Hz, 3 kHz, OFF (-1.6 dB ±1 dB)
	Characteristics	Secondary bessel
Anti-aliasing filter (A.A.F.)	Cutoff frequency	20, 40, 80, 200, 400, 800, 2k, 4k, 8k, 20k, 40 kHz, OFF, with 0.4 times the sampling speed of SSD recording set for the cutoff frequency. When 200 kS/s or higher, A.A.F. is disabled.
	Attenuation	-66 dB or less at 1.5 times the cutoff frequency
Input conversion noise	1 mVp-p max (0.1 V range, input short circuit)	
A/D conversion	A/D resolution	16 bits
	Sampling rate	1 MS/s
Common mode rejection ratio	80 dB or higher (50/60 Hz)	
Maximum allowed input voltage	±500 V peak	
Maximum rated voltage to ground	300 V (DC + AC peak) CAT II	
Withstand voltage	AC 3 kV, 1 minute (between channels and between channels and chassis)	
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)	
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)	
Dimensions	Approx. 140 mm (W) x 223 mm (D) x 20 mm (H)	
Mass	Approx. 300 g	
Standards	Safety	EN61010-1, EN61010-2-030
	EMC	EN61326-1, Class A

12.3.2. 4ch Voltage Module (RA30-102)

Item	Specifications	
Number of input channels	4 channels	
Input connectors	Insulated BNC	
Input format	Unbalanced input (insulation between channels and between channels and chassis)	
Coupling	DC/GND	
Input impedance	1 MΩ ±1 %	
Measurement range (RANGE)	1, 2, 5, 10, 20, 50, 100, 200 V (the measurement range is ±RANGE)	
Measurement probability	±0.2 % of RANGE (23 °C ±5 °C, DC coupling, L.P.F. 3 Hz, after zero adjust)	
Temperature coefficient	±(400 ppm of RANGE)/°C	
Frequency characteristics	DC coupling	DC to 100 kHz (-3 dB to 1 dB) (with L.P.F. disabled)
Low-pass filter (L.P.F.)	Cutoff frequency	3 Hz, 30 Hz, 300 Hz, 3 kHz, OFF (-1.6 dB ±1 dB)
	Characteristics	Secondary bessel shape
Input conversion noise	5 mVp-p max (1 V range, input short circuit)	
A/D conversion	A/D resolution	16 bits
	Sampling rate	1 MS/s
Common mode rejection ratio	80 dB or higher (50/60 Hz)	
Maximum allowed input voltage	±200 V peak	
Maximum rated voltage to ground	300 V (DC + AC peak) CAT II	
Withstand voltage	AC 3 kV, 1 minute (between input terminals and chassis, between channels)	
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)	
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)	
Dimensions	Approx. 140 mm (W) x 223 mm (D) x 20 mm (H)	
Mass	Approx. 300 g	
Standards	Safety	EN61010-1, EN61010-2-030
	EMC	EN61326-1, Class A

12.3.3. 2ch High Speed Voltage Module (RA30-103)

Item	Specifications	
Number of input channels	2 channels	
Input connectors	Insulated BNC	
Input format	Unbalanced input (insulation between channels and between channels and chassis)	
Coupling	AC/DC/GND	
Input impedance	1 MΩ ±1%	
Measurement range (RANGE)	100, 200, 500 mV 1, 2, 5, 10, 20, 50, 100, 200, 500 V (the measurement range is ±RANGE)	
Measurement probability	±0.5 % of RANGE (23 °C ±5 °C, DC coupling, L.P.F. 5 Hz, after zero adjust)	
Temperature coefficient	±(500 ppm of RANGE)/°C	
Frequency characteristics	DC coupling	DC to 5 MHz (-3 dB to 1 dB) (with L.P.F. disabled)
	AC coupling	6 Hz to 5 MHz (-3 dB to 1 dB) (with L.P.F. disabled)
Low-pass filter (L.P.F.)	Cutoff frequency	5 Hz, 50 kHz, 500 kHz, OFF (-3 dB ±1 dB)
Input conversion noise	2 mVp-p max (0.1 V range, input short circuit)	
A/D conversion	A/D resolution	14 bits
	Sampling rate	20 MS/s
Common mode rejection ratio	80 dB or higher (50/60 Hz)	
Maximum allowed input voltage	±500 V peak	
Maximum rated voltage to ground	300 V (DC + AC peak) CAT II	
Withstand voltage	AC 3 kV, 1 minute (between channels and between channels and chassis)	
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)	
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)	
Dimensions	Approx. 140 mm (W) x 223 mm (D) x 20 mm (H)	
Mass	Approx. 300 g	
Standards	Safety	EN61010-1, EN61010-2-030
	EMC	EN61326-1, Class A

12.3.4. 2ch AC Strain Module (RA30-104)

Item	Specifications	
Number of input channels	2 channels	
Input connectors	NDIS4109: EPRC07-R9FNDIS	
Input format	Balanced differential input (insulation between channels and between channels and chassis)	
Compatible bridge resistance	120 Ω to 350 Ω	
Gauge ratio	Fixed to 2.00	
Bridge power	0.5, 2 Vrms sine wave 5 kHz	
Balance adjustment range	Resistance	±2 % (10000 (μm/m=με)) or less
	Capacity	2000 pF or less
Balance adjustment precision	±0.3% of RANGE or less	
Temperature coefficient	± (400 ppm of RANGE)/°C	
Measurement range (RANGE)	Bridge power at 2 Vrms	500, 1000, 2000, 5000, 10000, 20000 (μm/m=με)
	Bridge power at 0.5 Vrms	2000, 4000, 8000, 20000, 40000, 80000 (μm/m=με)
Nonlinearity	±0.1% of RANGE or less	
Frequency characteristics	DC to 2 kHz ±10% or less	
Low-pass filter (L.P.F.)	Cutoff frequency	OFF, 10 Hz, 30 Hz, 100 Hz, 300 Hz (-3 dB ±1 dB)
	Characteristics	Secondary Butterworth
Internal calibrator	±1 to 9999 (μm/m=με) Precision ±0.5 % of RANGE or less (23°C ±5 °C)	
Input conversion noise	5 (μm/m=με) p-p max (500 (μm/m=με) range, BV = 2 Vrms, 120 Ω bridge)	
A/D conversion	A/D resolution	16 bit
	Sampling rate	100 kS/s
Auto balance function	Cancel imbalance in the strain gauge bridge.	
Simple bridge check	Enables bridge edge short circuits and some bridge edge and cable open circuits to be detected.	
Maximum rated voltage to ground	100 V (DC + AC peak)	
Withstand voltage	AC 300 V, one minute (between channels and between channels and chassis)	
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)	
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)	
Dimensions	Approx. 140 mm (W) × 223 mm (D) × 20 mm (H)	
Mass	Approx. 300 g	
Standards	Safety	EN 61010-1, EN61010-2-030
	EMC	EN 61326-1, Class A

12.3.5. 16ch Logic Module (RA30-105)

Item	Specifications	
Number of input channels	16 channels	
I/O connectors	8 channels x 2 ports	
Input format	Single input, common input (non-insulated), insulation between input signals and chassis	
Voltage detection	Input range	0 to 24 V
	Threshold	1.4 V (High level 1.8V or more, Low level 1.0 V or less) 2.5 V (High level 3.0V or more, Low level 2.0 V or less) 4 V (High level 4.6V or more, Low level 3.4 V or less)
	Input impedance	1 MΩ ±1 %
Contact detection	Threshold	2 kΩ (Open 2.0 kΩ or more, Short 250 Ω or less) 5 kΩ (Open 5.0 kΩ or more, Short 1.5 kΩ or less) 9 kΩ (Open 9.0 kΩ or more, Short 3.0 kΩ or less)
	Load current	0.5 mA (typ) @ load resistance 0 to 18 kΩ
Response pulse	2 µs or more	
Sampling rate	1 MS/s	
Maximum allowed input voltage	DC 30 V	
Maximum rated voltage to ground	42 V (DC+ACpeak)	
Withstand voltage	AC 300 V, 1 minute (between channels and between channels and chassis)	
Power output for options	+5 V (±5 %)	
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)	
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)	
Dimensions	Approx. 140 mm (W) x 223 mm (D) x 20 mm (H)	
Mass	Approx. 250 g	
Standards	Safety	EN61010-1
	EMC	EN61326-1, Class A

12.3.6. 2ch Temperature Module (RA30-106)

Item	Specifications			
Number of input channels	2 channels			
Input connectors	Removable socket (front panel) Temperature sensor connector coupling wire: 0.2 SQ to 1.5 SQ (AWG24 to AWG16)			
Input format	Unbalanced input (insulation between channels and between channels and chassis)			
Input impedance	5 MΩ or higher			
Adaptive sensor	Thermocouple (TC) type Platinum resistance temperature detector (RTD)	K, E, J, T, N, R, S, B, C (JIS C1602:2015) Pt100, Pt1000 (JIS C1604:2013)		
A/D conversion	A/D resolution Data update rate	16 bits High speed (1.5 ms), Medium speed (100 ms), Low speed (1 s)		
Thermocouple (TC)				
Reference junction compensation method	Internal/external switching mode			
Internal contact compensation temperature	±1 °C (23 °C ±5 °C) ±1.5 °C (full temperature range)			
LFD	Switchable on/off			
Measurement range (RANGE) Measurement probability	Type	Measurement range	Measurement range (°C)	Measurement probability
	K	200 °C	-200 to 200	-200 to 0 °C, ±(0.1 % of RANGE +2 °C)
		600 °C	-200 to 600	0 to 1370 °C, ±(0.1 % of RANGE +1 °C)
		1370 °C	-200 to 1370	
	E	200 °C	-200 to 200	-200 to 0 °C, ±(0.1 % of RANGE +2 °C)
		600 °C	-200 to 600	0 to 1000 °C, ±(0.1 % of RANGE +1 °C)
		1000 °C	-200 to 1000	
	J	200 °C	-200 to 200	-200 to 0 °C, ±(0.1 % of RANGE +2 °C)
		400 °C	-200 to 400	0 to 1100 °C, ±(0.1 % of RANGE +1 °C)
		1100 °C	-200 to 1100	
	T	100 °C	-100 to 100	-200 to 0 °C, ±(0.1 % of RANGE +2 °C)
		200 °C	-200 to 200	0 to 400 °C, ±(0.1 % of RANGE +1 °C)
		400 °C	-200 to 400	
	N	200 °C	-200 to 200	-200 to 0 °C, ±(0.1 % of RANGE +2 °C)
		600 °C	-200 to 600	0 to 1300 °C, ±(0.1 % of RANGE +1 °C)
		1300 °C	-200 to 1300	
	R	200 °C	0 to 200	0 to 400 °C, ±(0.1 % of RANGE +3.5 °C)
		1000 °C	0 to 1000	400 to 1760 °C, ±(0.1 % of RANGE +3 °C)
		1760 °C	0 to 1760	
	S	200 °C	0 to 200	0 to 400 °C, ±(0.1 % of RANGE +3.5 °C)
		1000 °C	0 to 1000	400 to 1700 °C, ±(0.1 % of RANGE +3 °C)
		1700 °C	0 to 1700	
	B	600 °C	400 to 600	400 to 1800 °C, ±(0.1 % of RANGE +3 °C)
		1000 °C	400 to 1000	
		1800 °C	400 to 1800	
	C	600 °C	0 to 600	0 to 400 °C, ±(0.1 % of RANGE +3.5 °C)
		1200 °C	0 to 1200	400 to 2300 °C, ±(0.1 % of RANGE +3 °C)
		2300 °C	0 to 2300	
Temperature coefficient	(Measurement probability x 0.1)/°C			

Item	Specifications				
Platinum resistance temperature detector (RTD)					
Measurement method	Three wire method				
Measurement current	Switch between 0.5 mA and 1 mA (when Pt100) Fixed to 0.1 mA (when Pt1000)				
Measurement range (RANGE) Measurement probability	Type	Measurement range	Measurement range (°C)		Measurement probability
	Pt100	200 °C	-200 to	200	-200 to 850 °C, ±(0.1 % of RANGE +0.5 °C)
		400 °C	-200 to	400	
		850 °C	-200 to	850	
	Pt1000	200 °C	-200 to	200	
		400 °C	-200 to	400	
		850 °C	-200 to	850	
Temperature coefficient	(Measurement probability x 0.1)/°C				
Common mode rejection ratio	50/60 Hz Signal source resistance (100 Ω or less)		100 dB (refresh data: low speed, medium speed) 80 dB (refresh data: high speed)		
Maximum allowed input voltage	30 Vpeak				
Maximum rated voltage to ground	300 V (DC + AC peak)				
Withstand voltage	AC 3 kV, 1 minute (between channels and between channels and chassis)				
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)				
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)				
Dimensions	Approx. 140 mm (W) x 223 mm (D) x 20 mm (H)				
Mass	Approx. 300 g				
Standards	Safety EN61010-1, EN61010-2-030 EMC EN61326-1, Class A				

12.3.7. 2ch High Voltage Module (RA30-107)

Item	Specifications
Number of input channels	2 channels
Input connector	Safety banana terminal
Input format	Balanced differential input (insulation between channels and between channels and chassis)
Coupling	AC/DC/GND
Meas. mode	DC mode (voltage measurement)/RMS mode (effective value measurement)
Input impedance	4 MΩ ±1 %
Response time (RMS mode)	High speed 100 ms ±10 % or less Medium speed 250 ms ±10 % or less Low speed 1000 ms ±10 % or less *1 All of the above are rise 0 % → 90 % of RANGE and fall 100 % → 10 % of RANGE
Measurement range (RANGE)	DC mode: 2, 5, 10, 20, 50, 100, 200, 500, 1000 V (the measurement range is ±RANGE) RMS mode: 2, 5, 10, 20, 50, 100, 200, 500, 1000 Vrms (the measurement range is RANGE*2) Crest factor: 2 (with 2 to 500 Vrms range), 1.4 (with 1000 Vrms range) *2 The maximum measurement range is 700 Vrms at 1000 Vrms
Measurement probability	DC mode: ±0.3 % of RANGE (DC coupling, L.P.F. 3 Hz) RMS mode: DC coupling ±0.3 % of RANGE AC coupling ±0.5 % of RANGE (10 Hz to 1 kHz, sine wave input, with low speed response) ±0.5 % of RANGE (40 Hz to 1 kHz, sine wave input, with medium speed response) ±0.5 % of RANGE (100 Hz to 1 kHz, sine wave input, with high speed response) ±1.5 % of RANGE (1 kHz to 10 kHz, sine wave input) *3 All of the above are at 23 °C ±5 °C, after zero adjust is executed
Temperature coefficient	± (300 ppm of RANGE)/°C
Frequency characteristics	DC coupling DC to 100 kHz (-3 dB to +1 dB) (DC mode, with L.P.F. disabled) AC coupling 1 Hz to 100 kHz (-3 dB to +1 dB) (DC mode, with L.P.F. disabled)
Low-pass filter (L.P.F.)	Cutoff frequency 3 Hz, 30 Hz, 300 Hz, 3 kHz, 30 kHz, OFF (-1.6 dB ±1 dB) Characteristics Secondary vessel
Input conversion noise	20 mVp-p max (2 V range, input short circuit)
A/D conversion	A/D resolution 16 bit Sampling rate 1 MS/s
Common mode rejection ratio	80 dB or higher (50/60 Hz)
Maximum allowed input voltage	±1000 V peak

Item	Specifications	
Maximum rated voltage to ground	1000 V (DC + AC peak) 600 V (DC + AC peak)	CAT II CAT III
Withstand voltage	AC 3 kV, 1 minute (between channels and between channels and chassis)	
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)	
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)	
Dimensions	Approx. 140 mm (W) × 223 mm (D) × 20 mm (H)	
Mass	Approx. 300 g	
Standards	Safety EMC	EN61010-1, EN61010-2-030 EN61326-1, class A

12.3.8. 2ch Frequency Module (RA30-108)

Item	Specifications	
Number of input channels	2 channels	
Number of measurement channels	4 channels	CH1: Meas. mode, CH3: CH1 input volt CH2: Meas. mode, CH4: CH2 input volt
Input connectors	Insulated BNC	
Input format	Unbalanced input (insulation between channels and between channels and chassis)	
Coupling	AC/DC/GND	
Input impedance	1 MΩ ±1 %	
Measurement mode	Period, Frequency, Rotation speed, Pulse width, Duty cycle, Power freq., Freq. deviation, Pulse count, or Pulse integ.	
Input voltage	Measurement range (RANGE)	1, 2, 5, 10, 20, 50, 100, 200, or 500 V
	Measurement probability	±3 % of RANGE (23 ±5 °C, DC coupling, L.P.F. 300 Hz)
	Measurable range	±1, ±2, ±5, ±10, ±20, ±50, ±10, ±200, or ±500 V
Period mode	Measurement range (RANGE)	1, 2, 5, 10, 20, 50, 100, 200 or 500 ms 1, 2, 5, 10, 20, 50, or 100 s
	Measurement probability	±0.5 % rdg (1 ms RANGE) ±0.3 % rdg (2 ms RANG) ±0.1 % rdg (5 ms RANGE) ±0.05 % rdg (10 ms to 100 s RANGE)
	Measurable range	5 µs to 100 s
Frequency mode	Measurement range (RANGE)	2, 5, 10, 20, 50, 100, 200, or 500 Hz 2, 5, 10, 20, 50, 100, 200, or 500 kHz
	Measurement probability	±0.5 % rdg (200 kHz RANGE) ±0.3 % rdg (100 kHz RANGE) ±0.1 % rdg (50 kHz RANGE) ±0.05 % rdg (2 Hz to 20 kHz RANGE)
	Measurable range	0 to 200 kHz
Rotation speed mode	Measurement range (RANGE)	10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 rpm, 50000 rpm, 100, 200, 500, 1000 krpm
	Measurement probability	±0.05 % rdg
	Measurable range	0 to 1000 krpm
Pulse width mode	Measurement range (RANGE)	1, 2, 5, 10, 20, 50, 100, 200, or 500 ms 1, 2, 5, 10, 20, 50, or 100 s
	Measurement probability	±0.25 % rdg (1 ms RANGE) ±0.15 % rdg (2 ms RANGE) ±0.05 % rdg (5 ms to 100 s RANGE)
	Measurable range	2.5 µs to 100 s (minimum pulse width 2.5 µs)

Item	Specifications	
Duty cycle mode	Measurement range (RANGE)	100 % (20 Hz), 100 % (200 Hz), 100 % (2 kHz), 100 % (20 kHz)
	Measurement probability	±0.25 % (1 kHz) to ±5 % (20 kHz) of 100 % (20 kHz) RANGE * ±5% × input frequency/20 kHz ±0.05 % (100 Hz) to ±1 % (2 kHz) of 100 % (2 kHz) RANGE * ±1% × input frequency/2 kHz ±0.05 % (10 Hz) to ±1 % (200 Hz) of 100 % (200 Hz) RANGE * ±1% × input frequency/200 Hz ±0.05 % (1 Hz) to ±1 % (20 Hz) of 100 % (20 Hz) RANGE * ±1% × input frequency/20 Hz
	Measurable duty cycle range	0 to 100 %
	Measurable frequency range	1 kHz to 20 kHz : 100% (20 kHz) RANGE (minimum pulse width 2.5 µs) 100 Hz to 2 kHz : 100% (2 kHz) RANGE (minimum pulse width 5 µs) 10 Hz to 200 Hz : 100% (200 Hz) RANGE (minimum pulse width 50 µs) 1 Hz to 20 Hz : 100% (20 Hz) RANGE (minimum pulse width 500 µs)
Power freq. mode	Measurement range (RANGE)	50 Hz (30 to 70 Hz) 60 Hz (40 to 80 Hz) 400 Hz (360 to 440 Hz)
	Measurement probability	±0.002 % rdg (50 Hz RANGE) ±0.003 % rdg (60 Hz RANGE) ±0.005 % rdg (400 Hz RANGE)
Freq. deviation mode	Measurement range (RANGE)	±50 % (center frequency range 6.6 Hz to 13.2 kHz)
	Measurement probability	±0.05 % rdg
	Measurable range	3.3 Hz to 19800 Hz
Pulse count mode	Measurement range (RANGE)	40000 * Gate time 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s, 30 s, or 60 s
	Measurement probability	±0.003 % rdg
	Measurable range	16.6666 mHz to 200 kHz (minimum pulse width 2.5 µs)
Pulse integ. mode	Measurement range (RANGE)	50, 100, 200, or 500 k 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, or 2000 M
	Measurement probability	±0.002 % rdg
	Measurable range	5 mHz to 200 kHz (minimum pulse width 2.5 µs)

Item	Specifications				
Threshold	Voltage range	1 V RANGE :	-0.4	to	+0.4 V variable (0.01 V increments)
		2 V RANGE:	-0.8	to	+0.8 V variable (0.02 V increments)
		5 V RANGE:	-2	to	+2 V variable (0.05 V increments)
		10 V RANGE:	-4	to	+4 V variable (0.1 V increments)
		20 V RANGE:	-8	to	+8 V variable (0.2 V increments)
		50 V RANGE:	-20	to	+20 V variable (0.5 V increments)
		100 V RANGE:	-40	to	+40 V variable (1 V increments)
		200 V RANGE:	-80	to	+80 V variable (2 V increments)
		500 V RANGE:	-200	to	+200 V variable (5 V increments)
	Hysteresis	1 to 10% of RANGE (1% increments)			
Low-pass filter (L.P.F.)	Cutoff frequency	300 Hz, 3 kHz, 30 kHz, OFF (-1.6 dB ±1 dB)			
	characteristics	Secondary vessel			
A/D conversion	A/D resolution	12 bit			
	Sampling rate	1 MS/s			
Response speed	OFF, 1 to 1000 ms (1 ms increments)				
Deceleration stop process function	If the pulse input is interrupted. calculates the deceleration state in real-time, and gradually sets the measured value to 0 or overrange. Supports measurement in the Period mode, Frequency mode, Rotation speed mode, Pulse width mode, Duty cycle mode, Power freq. mode, and Freq. deviation mode.				
Pulses per revolution	Pulses / Rev.: 1 to 100 Specify the pulse count per revolution. Available in the Rotation speed mode.				
Pulse polarity	Select the polarity of the pulse (positive or negative). Available in the Pulse width mode, Duty cycle mode, Freq. deviation mode, Pulse count mode, and Pulse integ. mode.				
Integrated auto reset (Auto reset)	Automatically resets the measured data of the Pulse integ. mode. The count is reset when recording starts (Start) and when the range upper limit is reached (Over). OFF, Start, Over, Start & Over can be selected.				
Integrated manual reset (Reset)	Manually resets the measured data of the Pulse integ. mode.				
Pulse average processing function	Number for pulse average: 2 to 4096 Available in the Period mode, Frequency mode, Rotation speed mode, Pulse width mode, Duty cycle mode, Power freq. mode, and Freq. deviation mode.				
Smoothing function	OFF, 2 to 100 Available in the Period mode, Frequency mode, Rotation speed mode, Pulse width mode, Duty cycle mode, Power freq. mode, and Freq. deviation mode.				
Maximum allowed input voltage	±500 Vpeak				
Maximum rated voltage to ground	300 V (DC + AC peak) CAT Ⅱ				
Withstand voltage	AC 3 kV, 1 minute (between channels and between channels and chassis)				
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)				
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)				
Dimensions	Approx. 140 mm (W) × 223 mm (D) × 20 mm (H)				
Mass	Approx. 300 g				
Standards	Safety	EN61010-1, EN61010-2-030			
	EMC	EN61326-1, class A			

12.3.9. 2ch Acceleration Module (RA30-109)

Item	Specifications		
Number of input channels	2 channels		
Input connectors	BNC (metallic)		
Input format	Unbalanced input (insulation between channels and between channels and chassis)		
Measurement mode	OFF, Acceleration, Velocity, Displacement		
Sensor supply power	4.2 mA ±5 %, 22.5 V ±5 %		
Measurement range (RANGE)	* All the values below are when using a sensor incorporating a preamp. When using a charge output type acceleration sensor, the sensor sensitivity is the charge converter gain multiplied by the sensor sensitivity of the charge output type acceleration sensor. The measurement range differs according to the sensor sensitivity.		
	Acceleration	1, 2, 3.16, 5, 10, 20, 31.6, 50, 100, 200, 316, 500 m/s^2 1, 2, 3.16, 5,10, 20, 31.6, 50 km/s^2	
		Sensor sensitivity	Measurement range
		0.100 to 0.250 mV/(m/s^2)	500 m/s^2 to 50 km/s^2
		0.251 to 0.500 mV/(m/s^2)	200 m/s^2 to 20 km/s^2
		0.501 to 1.000 mV/(m/s^2)	100 m/s^2 to 10 km/s^2
		1.001 to 2.500 mV/(m/s^2)	50 m/s^2 to 5 km/s^2
		2.501 to 5.000 mV/(m/s^2)	20 m/s^2 to 2 km/s^2
		5.001 to 10.000 mV/(m/s^2)	10 m/s^2 to 1 km/s^2
		10.001 to 25.000 mV/(m/s^2)	5 m/s^2 to 500 m/s^2
		25.001 to 50.000 mV/(m/s^2)	2 m/s^2 to 200 m/s^2
		50.001 to 100.000 mV/(m/s^2)	1 m/s^2 to 100 m/s^2
	Velocity	10, 20, 31.6, 50, 100, 200, 316, or 500 mm/s 1, 2, 3.16, 5, 10, 20, 31.6, 50, 100, 200, 316, or 500 m/s	
		Sensor sensitivity	Measurement range
		0.100 to 0.250 mV/(m/s^2)	5 m/s to 500 m/s
		0.251 to 0.500 mV/(m/s^2)	2 m/s to 200 m/s
		0.501 to 1.000 mV/(m/s^2)	1 m/s to 100 m/s
		1.001 to 2.500 mV/(m/s^2)	500 mm/s to 50 m/s
		2.501 to 5.000 mV/(m/s^2)	200 mm/s to 20 m/s
		5.001 to 10.000 mV/(m/s^2)	100 mm/s to 10 m/s
		10.001 to 25.000 mV/(m/s^2)	50 mm/s to 5 m/s
		25.001 to 50.000 mV/(m/s^2)	20 mm/s to 2 m/s
		50.001 to 100.000 mV/(m/s^2)	10 mm/s to 1 m/s

Item		Specifications	
Measurement range (RANGE)	Displacement	100, 200, 316, or 500 µm 1, 2, 3.16, 5, 10, 20, 31.6, 50, 100, 200, 316, or 500 mm 1, 2, 3.16, or 5 m	
		Sensor sensitivity	Measurement range
		0.100 to 0.250 mV/(m/s^2)	50 mm to 5 m
		0.251 to 0.500 mV/(m/s^2)	20 mm to 2 m
		0.501 to 1.000 mV/(m/s^2)	10 mm to 1 m
		1.001 to 2.500 mV/(m/s^2)	5 mm to 500 mm
		2.501 to 5.000 mV/(m/s^2)	2 mm to 200 mm
		5.001 to 10.000 mV/(m/s^2)	1 mm to 100 mm
		10.001 to 25.000 mV/(m/s^2)	500 µm to 50 mm
		25.001 to 50.000 mV/(m/s^2)	200 µm to 20 mm
		50.001 to 100.000 mV/(m/s^2)	100 µm to 10 mm
Measurement probability	Acceleration	±1% rdg	
	Velocity	±2% rdg	
	Displacement	±3% rdg	
	* All of the above values are at 23 °C ±5 °C, with an 80 Hz sine wave, and L.P.F. A.A.F. disabled		
Temperature coefficient	± (300 ppm of RANGE)/°C		
Frequency characteristics	Acceleration	5 Hz to 20 kHz (-0.5 dB to +0.5 dB) 1.5 Hz to 50 kHz (-1 dB to +1 dB) 1 Hz to 70 kHz (-3 dB to +1 dB)	
	Velocity	15.9 Hz (0 dB ±1 dB) to 1.59 kHz (-40 dB ±1 dB) Characteristics: -6 dB/oct	
	Displacement	15.9 Hz (0 dB ±1 dB) to 159 Hz (-40 dB ±1 dB) Characteristics: -12 dB/oct	
	* All of the above are with L.P.F. disabled		
Low-pass filter (L.P.F.)	Cutoff frequency	OFF, 20 Hz, 200 Hz, 2 kHz, 20 kHz（-3 dB ±1 dB）	
	Characteristics	Tertiary Butterworth	
Anti-aliasing filter (A.A.F.)	Cutoff frequency	OFF, 20, 40, 80, 200, 400, 800, 2k, 4k, 8k, 20k, 40 kHz with 0.4 times the sampling speed of SSD recording set for the cutoff frequency. When 200 kS/s or higher, A.A.F. is disabled.	
	Attenuation	-66 dB or less, at 1.5 times the cutoff frequency	
Input conversion noise	5 m/s^2 p-p max (acceleration 500 m/s^2, sensor sensitivity 0.1 mV/(m/s^2), input short circuit)		
A/D conversion	A/D resolution	16 bit	
	Sampling rate	1 MS/s	

Item		Specifications
RMS calculation function	Response speed	High speed: 300 ms ±10 % or less Medium speed: 600 ms ±10 % or less Low speed: 2.4 s ±10 % or less * All of the above are rise 0 % → 90 % of RANGE and fall 100 % → 10 % of RANGE, with the acceleration mode
	Measurement probability	±1% rdg (10 Hz to 1 kHz, at low speed) ±1% rdg (30 Hz to 1 kHz, at medium speed) ±1% rdg (50 Hz to 1 kHz, at high speed) ±1.5% rdg (1 kHz to 5 kHz)
Envelope calculation function	Band pass filter (1 kHz to 20 kHz) → absolute value modulation → low-pass filter (1 kHz)	
TEDS	IEEE 1451.4 Class 1 compliant (template ID: 25, sensor sensitivity automatically set)	
Common mode rejection ratio	80 dB or higher (50 Hz/60 Hz)	
Maximum rated voltage to ground	42 V (DC + AC peak)	
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)	
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)	
Dimensions	Approx. 140 mm (W) × 223 mm (D) × 20 mm (H)	
Mass	Approx. 300 g	
Standards	Safety	EN61010-1, EN61010-2-030
	EMC	EN61326-1, Class A

12.3.10. Remote Control Module (RA30-112)

Item	Specifications
input connectors	Half pitch connector 20 pin
Output connectors	Half pitch connector 14 pin
External input	Function: Controllable via external signal
Control signals	START/STOP, MARK, FEED, PRINT, TRIG
Input level	High level: 2.1 V to 5.0 V, Low level: 0 V to 0.5 V (active low)
Response speed	Switch between high speed/medium speed/low speed * External sampling input and OSC signal input for AC strain module are not supported
Effective pulse width	For high speed response: High level period 1 µs or more, low level period 1 µs or more For medium speed response: High level period 1 ms or more, low level period 1 ms or more For low speed response: High level period 10 ms or more, low level period 10 ms or more
Maximum allowed input voltage	30 V
Feed	Recording paper idle feeding speed of 50 mm/sec
External output	Functions: START/STOP, TRIG: Active low output during operation period FEED, PRINT, MARK: Output external input signal
Control signals	START/STOP, MARK, FEED, PRINT, TRIG, EXT.1/EXT.2 (outputs the state of this product externally)
Output level	High level: 3.8 V to 5.0 V, Low level: 0 V to 0.5 V (active low)
Output current	Maximum 5 mA (per pin)
Output pulse width (RA3100 main unit output signal)	START/STOP, FEED, PRINT: Active output during operation period TRIG, MARK, for high speed response: 1 µs For medium speed response: 1 ms For low speed response: 10 ms
External sampling input	Enables synchronization via an external sampling signal (either pen recording, printer recording, or SSD recording).
Input level	High level: 2.1 V to 5.0 V, Low level: 0 V to 0.5 V
Effective pulse width	2 µs or more
Maximum input frequency	SSD recording : 250 kHz Printer recording : 500 Hz
Maximum allowed input voltage	30 V
External sampling output	Output external sampling input signal
Output level	High level: 3.8 V to 5.0 V, Low level: 0 V to 0.5 V
Synchronization signal for AC strain input/output	Function : Synchronization signal generator for using AC strain Carrier wave : 0 V to 5 V, square wave, 5 kHz Synchronization : Synchronization possible with other RA3000 product including RA30-112
Output terminal for waveform confirmation	Function: Square wave signal output for confirming the operation of the voltage input module
Output level	0 V to 5 V (±1 %)
Output frequency	1 kHz (±1 %)
Duty ratio	50% (±5 %)

Withstand voltage	AC 300 V, 1 minute (input, between output and chassis)	
Maximum rated voltage to ground	42 V (DC+ACpeak)	
Usage environment	Temperature: 0 to +40 °C,	humidity: 35 to 85 %RH or less (without condensation)
Storage environment	Temperature: -20 to +60 °C,	humidity: 20 to 85 %RH or less (without condensation)
Dimensions	Approx. 140 mm (W) x 223 mm (D) x 20 mm (H)	
Mass	Approx. 250 g	
Standards	Safety	EN61010-1
	EMC	EN61326-1, Class A

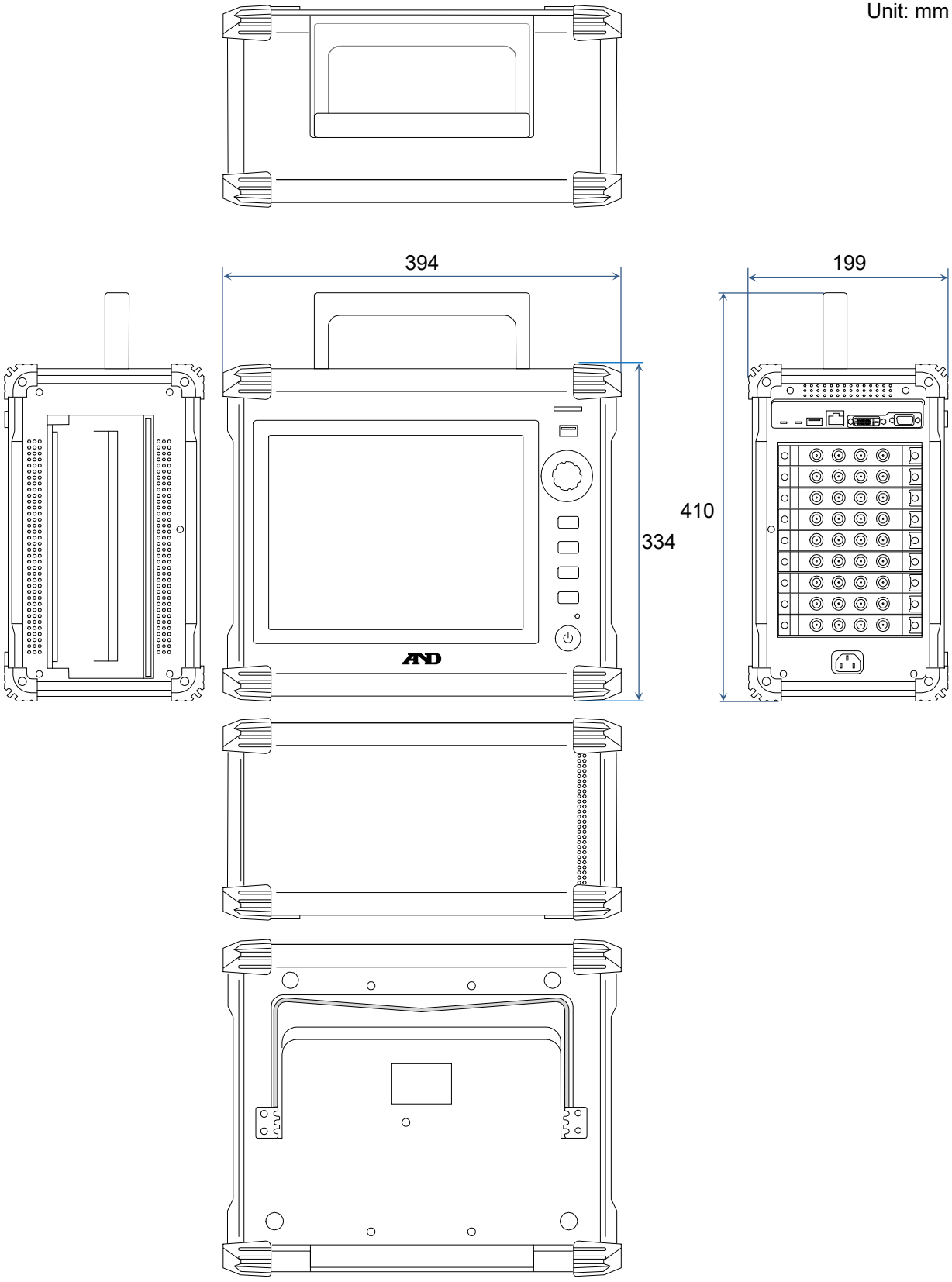
12.3.11. 4ch Voltage Module (RA30-113)

Item	Specifications	
Number of input channels	4 channels	
Input connectors	Insulated BNC	
Input format	Unbalanced input (insulation between channels and between channels and chassis)	
Coupling	DC/GND	
Input impedance	1 MΩ ±1 %	
Measurement range (RANGE)	2, 5, 10, 20, 50, 100, 200, 500 V (the measurement range is ±RANGE)	
Measurement probability	±0.2 % of RANGE (23 °C±5 °C, DC coupling, L.P.F. 3 Hz, after zero adjust)	
Temperature coefficient	±(400 ppm of RANGE)/°C	
Frequency characteristics	DC coupling	DC to 100 kHz (-3 dB to 1 dB) (with L.P.F. disabled)
Low-pass filter (L.P.F.)	Cutoff frequency	3 Hz, 30 Hz, 300 Hz, 3 kHz, OFF (-1.6 dB ±1 dB)
	Characteristics	Secondary bessel shape
Input conversion noise	10 mVp-p max (2 V range, input short circuit)	
A/D conversion	A/D resolution	16 bits
	Sampling rate	1 MS/s
Common mode rejection ratio	80 dB or higher (50/60 Hz)	
Maximum allowed input voltage	±500 V peak	
Maximum rated voltage to ground	300 V (DC + AC peak) CAT II	
Withstand voltage	AC 3 kV, 1 minute (between input terminals and chassis, between channels)	
Usage environment	Temperature: 0 to +40 °C, humidity: 35 to 85 %RH or less (without condensation)	
Storage environment	Temperature: -20 to +60 °C, humidity: 20 to 85 %RH or less (without condensation)	
Dimensions	Approx. 140 mm (W) x 223 mm (D) x 20 mm (H)	
Mass	Approx. 300 g	
Standards	Safety	EN61010-1, EN61010-2-030
	EMC	EN61326-1, Class A

12.4. Exterior

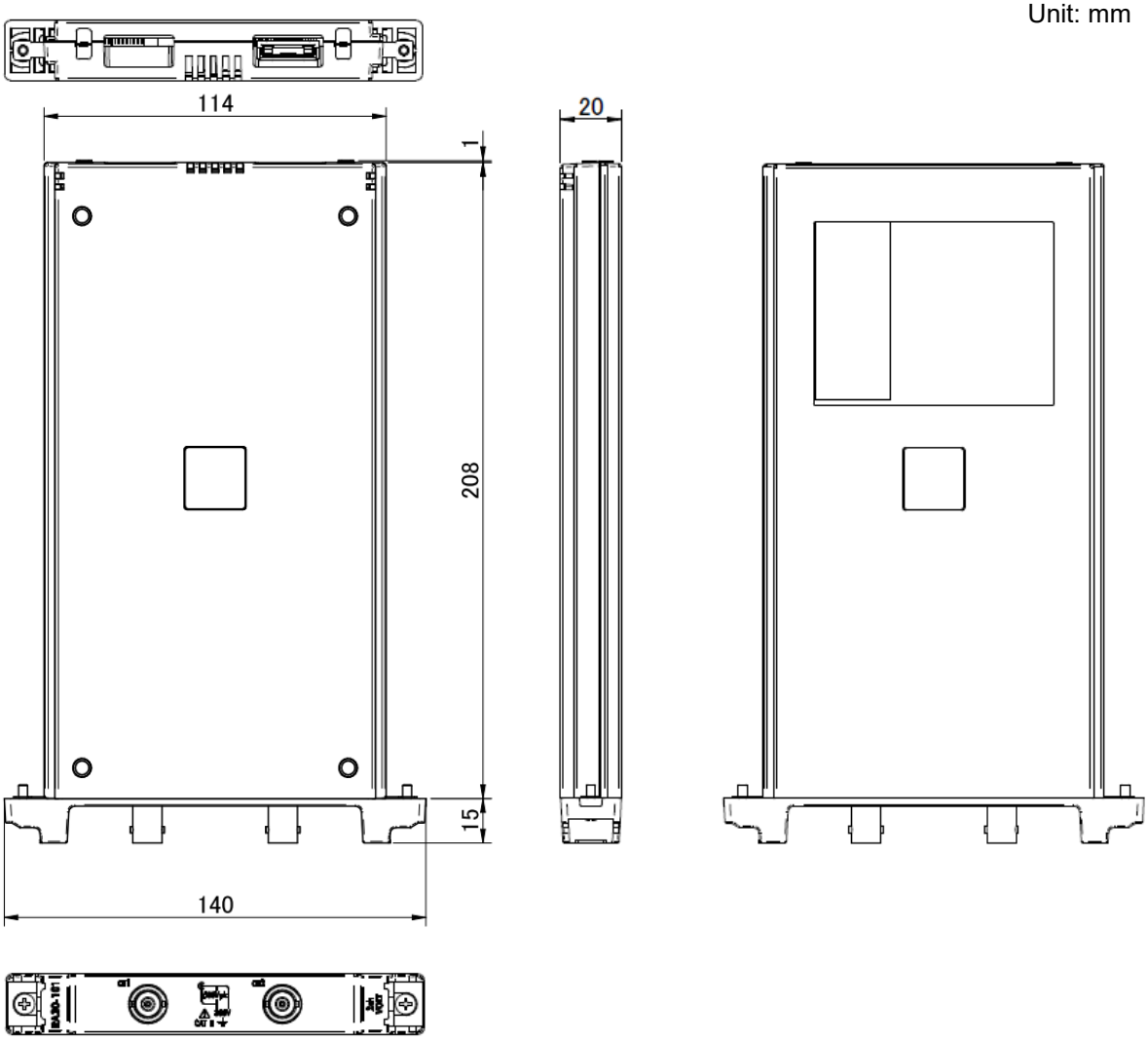
12.4.1. Main Unit Exterior

Unit: mm



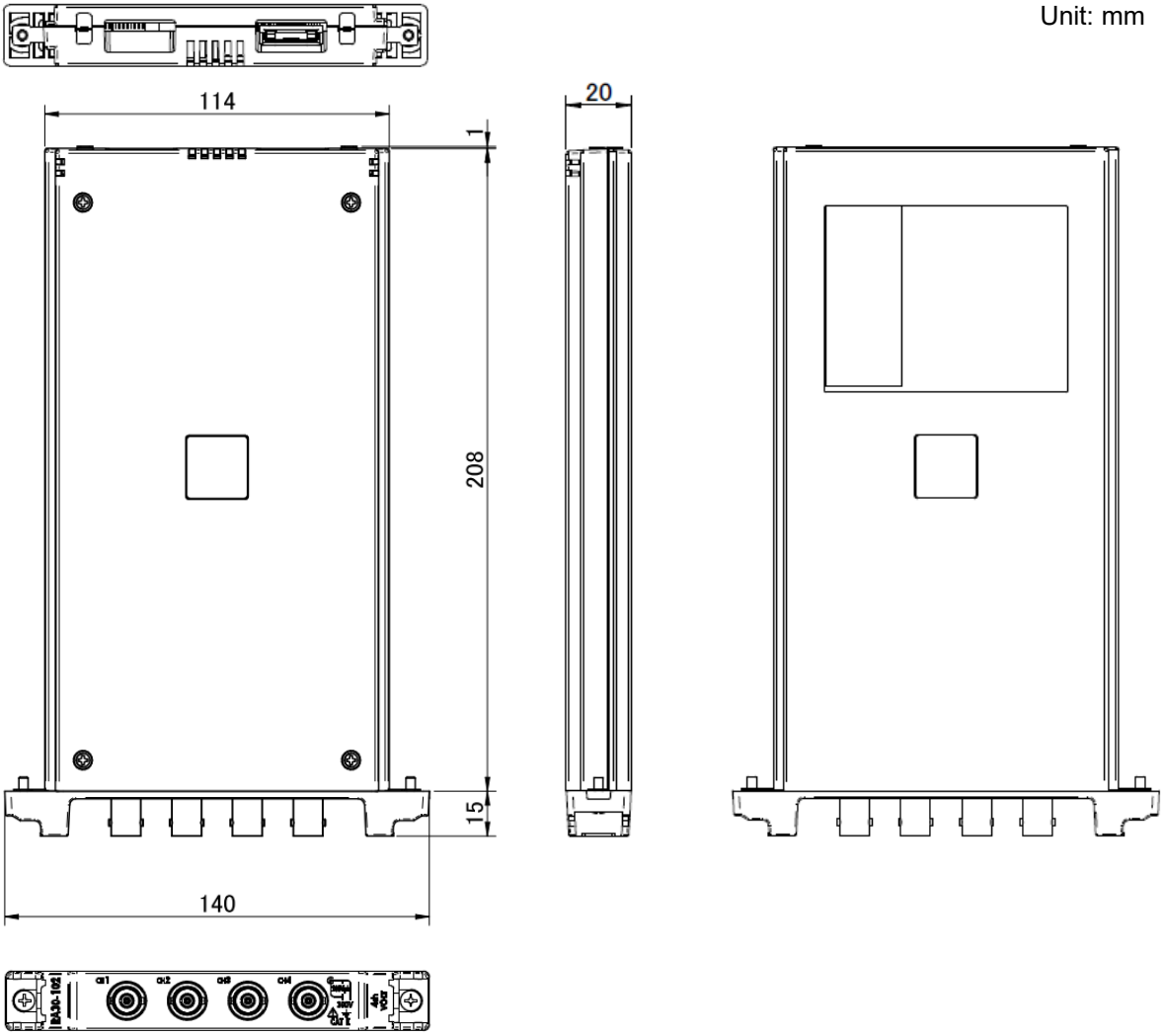
12.4.2. 2ch Voltage Module (RA30-101) Exterior

Unit: mm



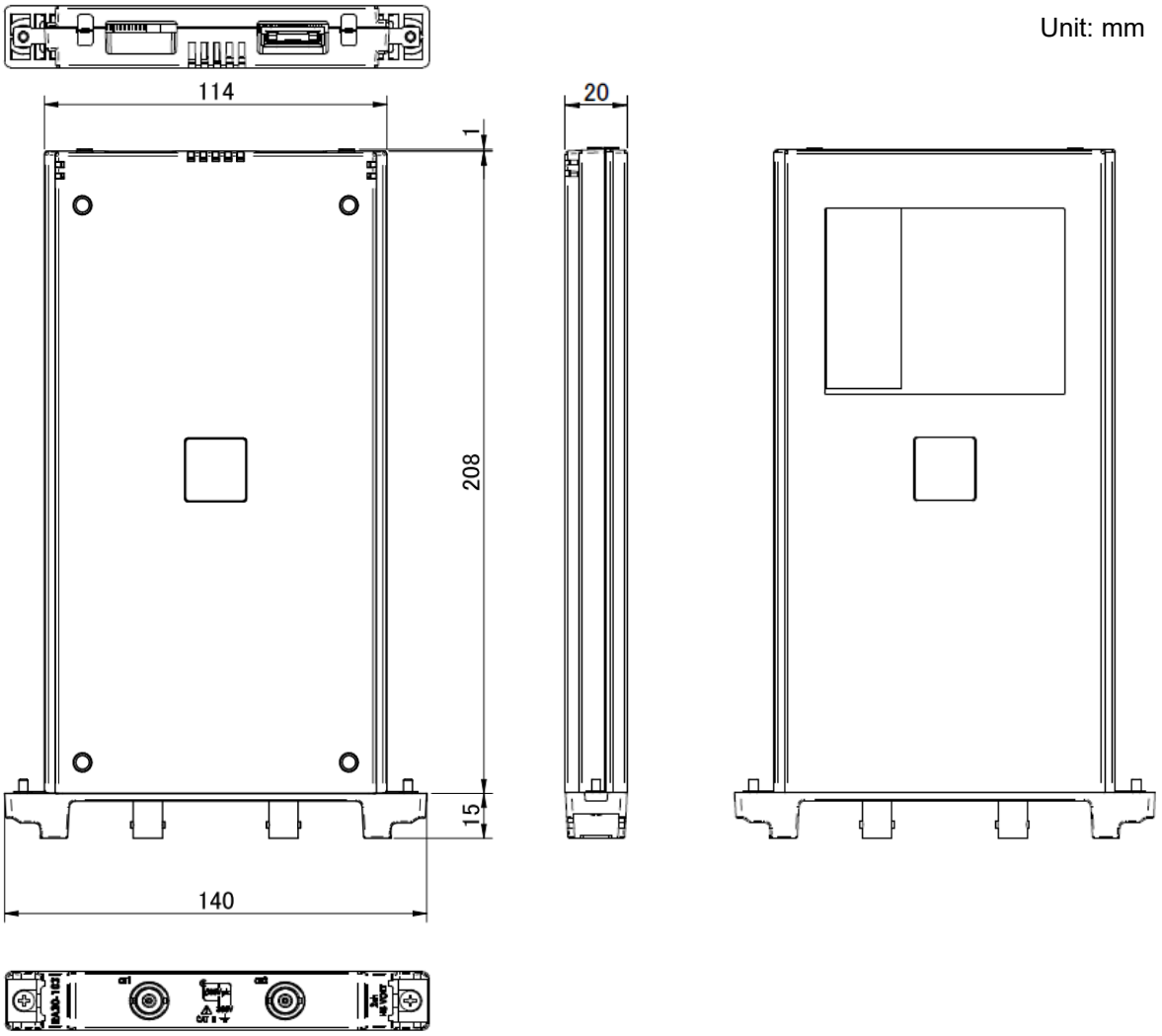
12.4.3. 4ch Voltage Module (RA30-102) Exterior

Unit: mm



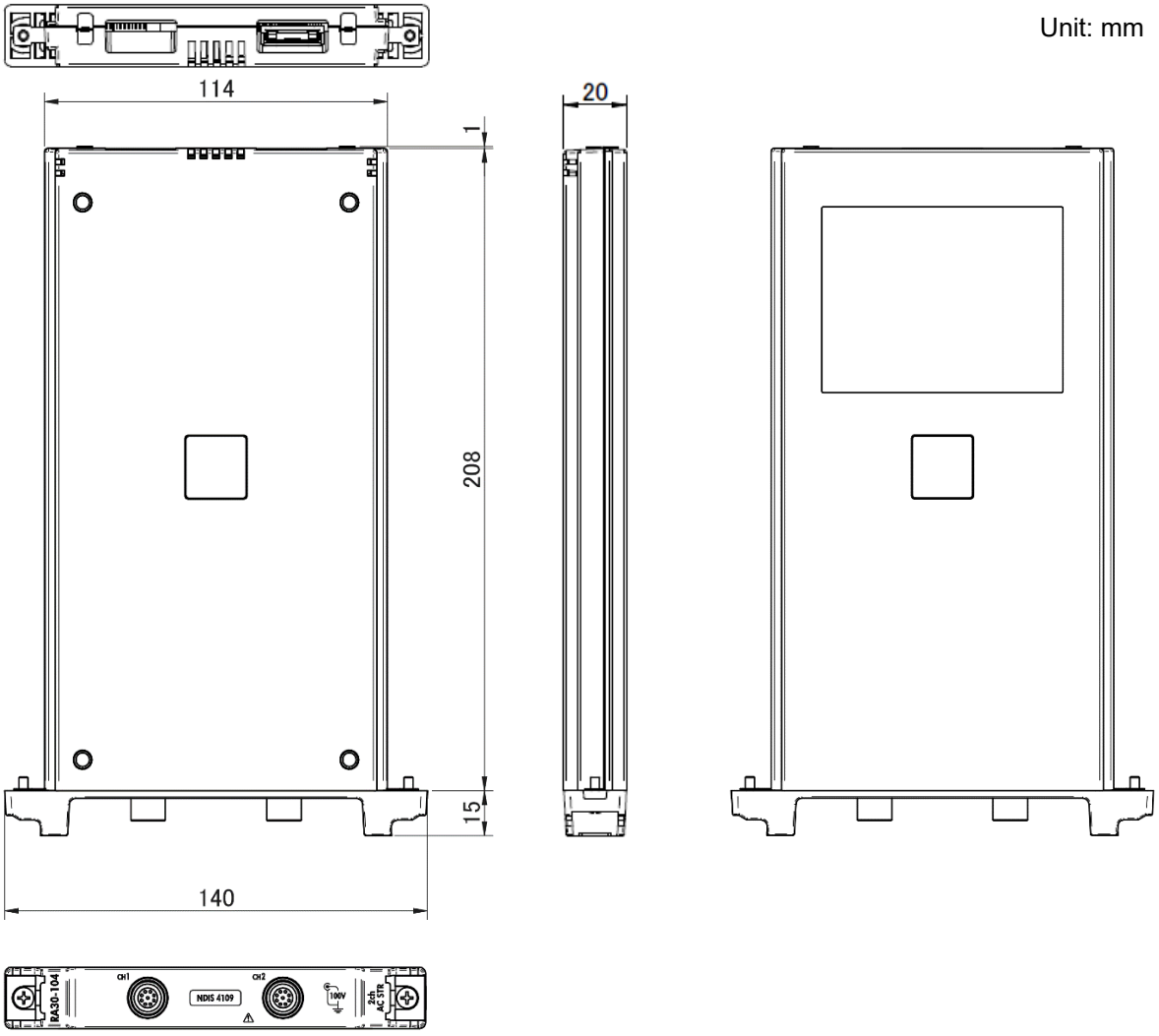
12.4.4. 2ch High Speed Voltage Module (RA30-103) Exterior

Unit: mm



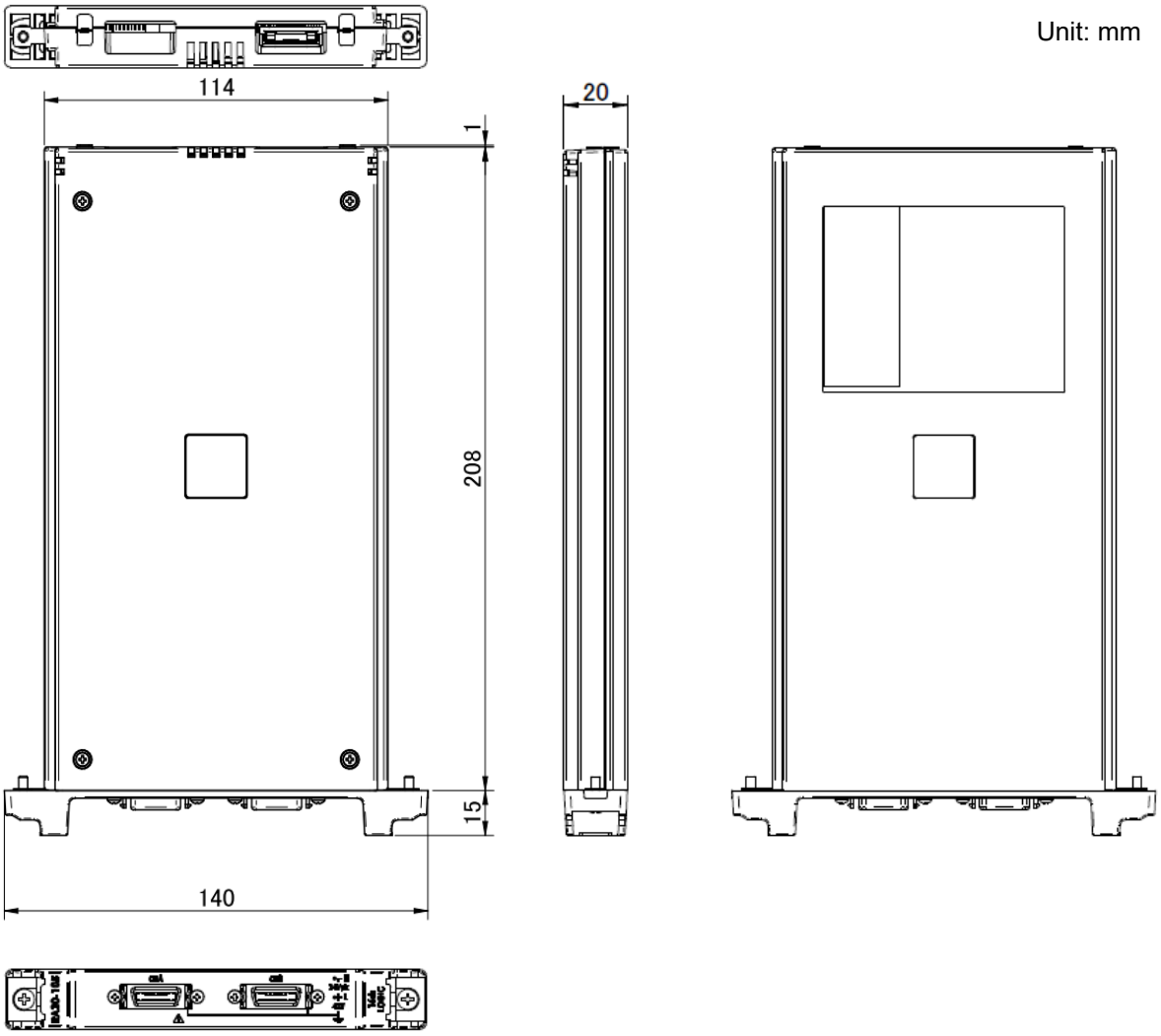
12.4.5. 2ch AC Strain Module (RA30-104) Exterior

Unit: mm



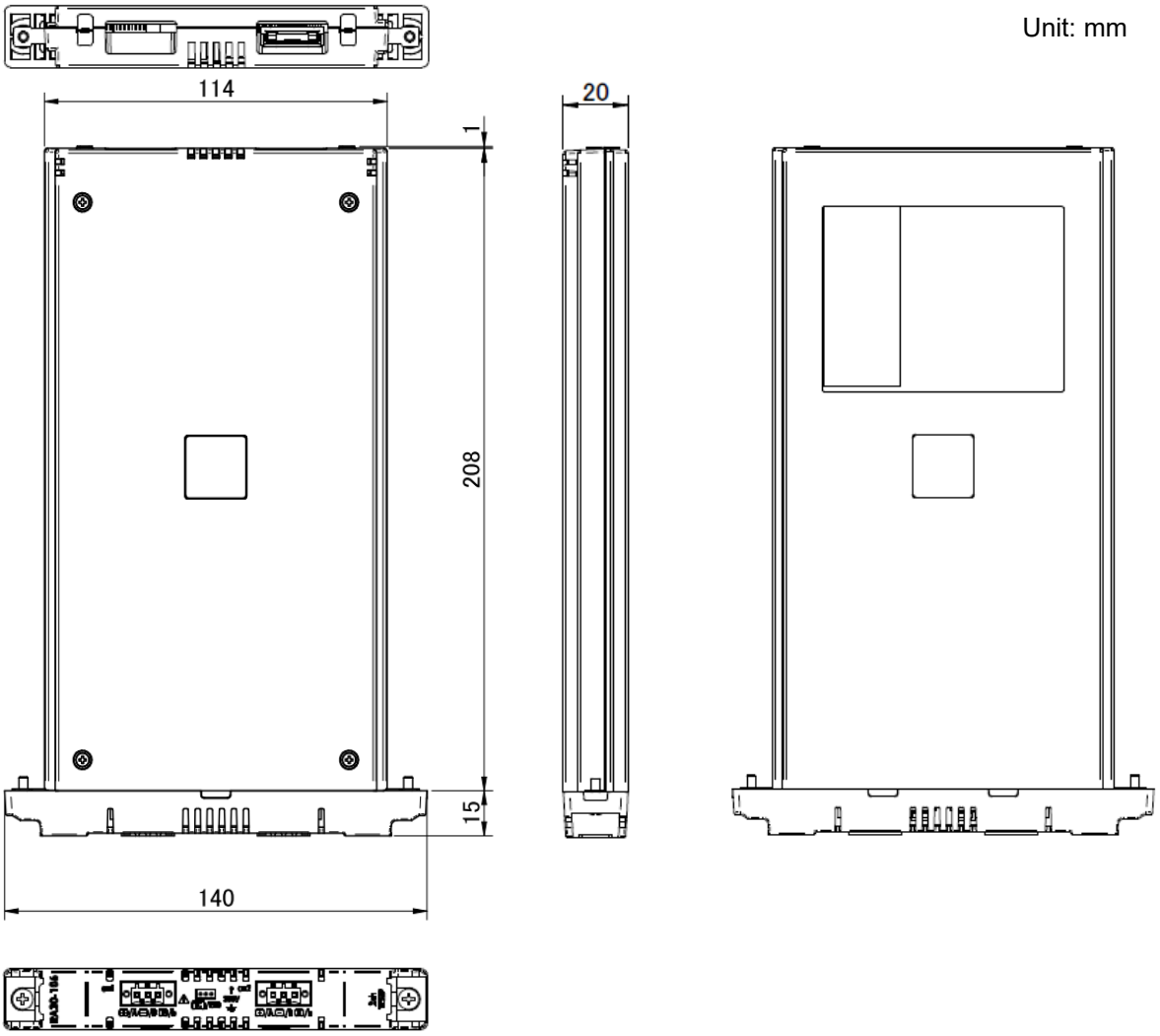
12.4.6. 16ch Logic Module (RA30-105) Exterior

Unit: mm



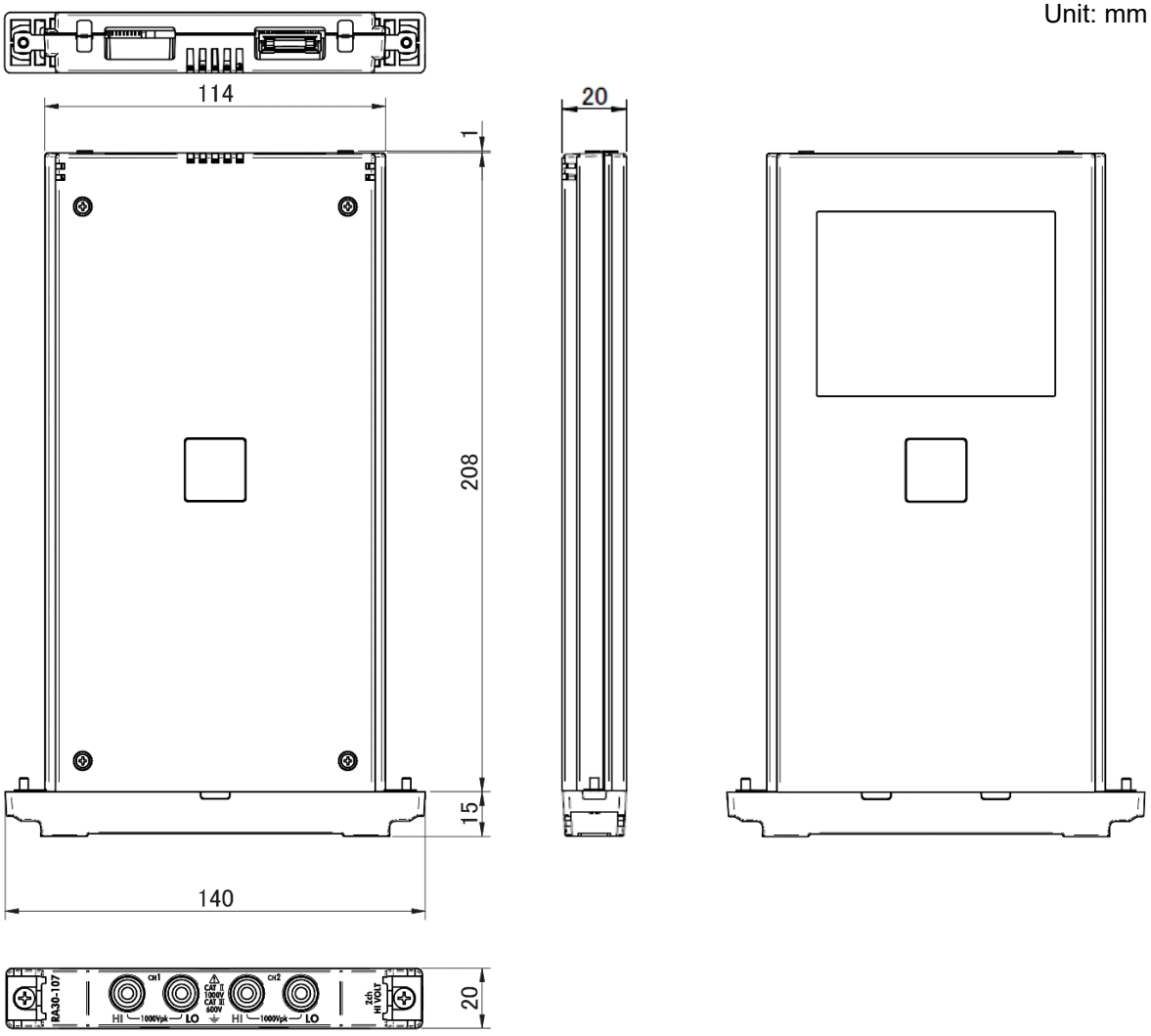
12.4.7. 2ch Temperature Module (RA30-106) Exterior

Unit: mm



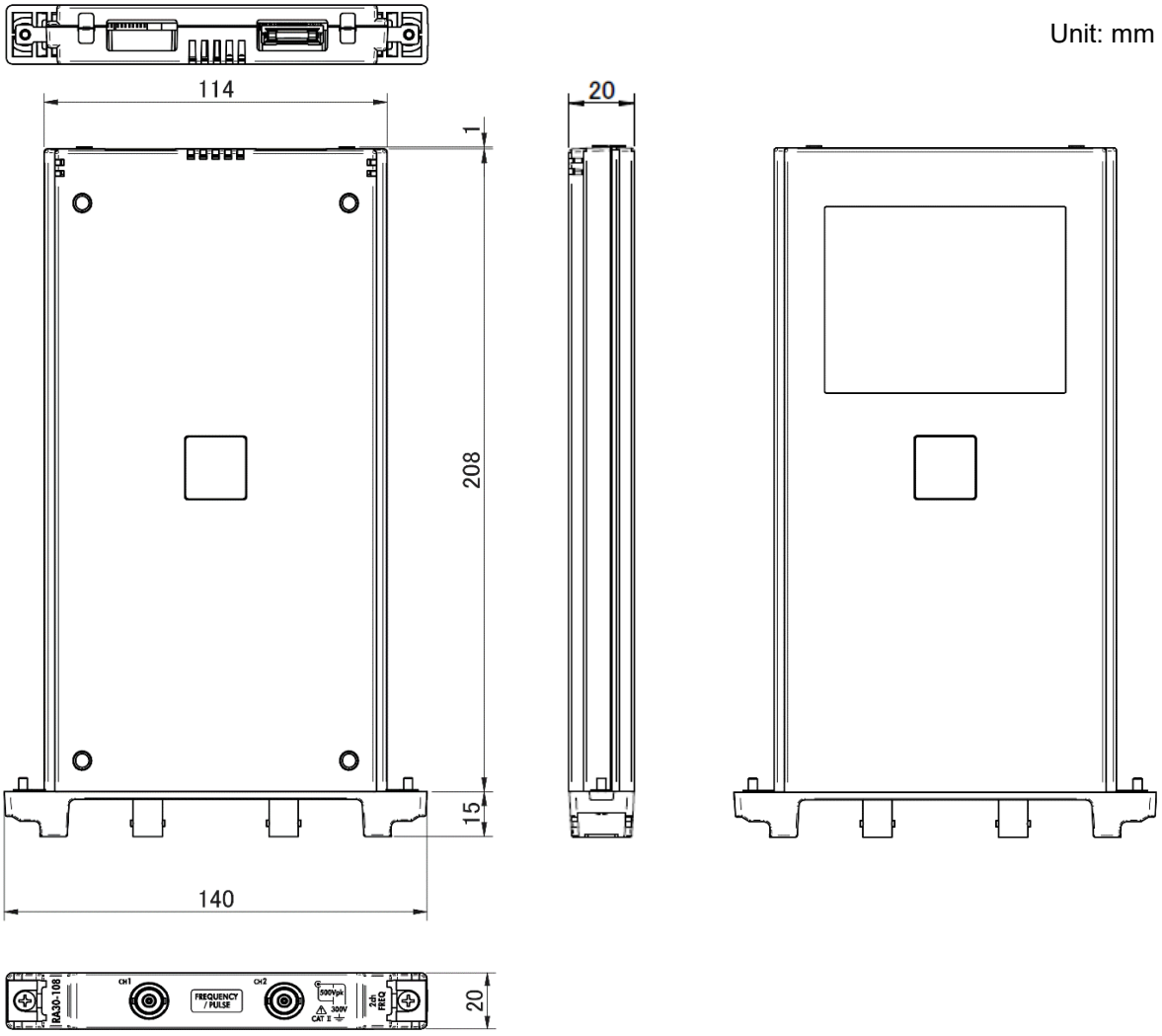
12.4.8. 2ch High Voltage Module (RA30-107) Exterior

Unit: mm



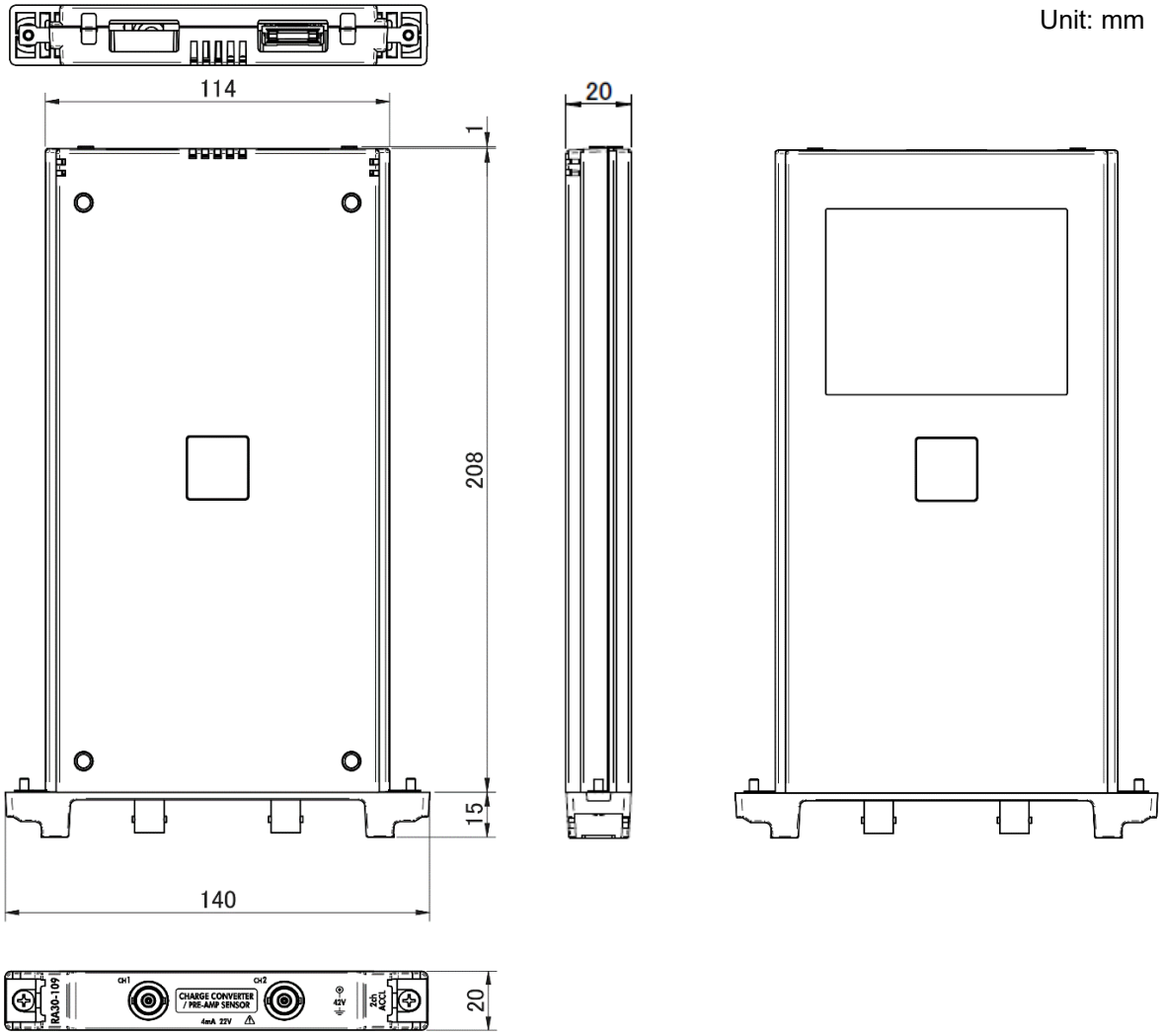
12.4.9. 2ch Frequency Module (RA30-108) Exterior

Unit: mm



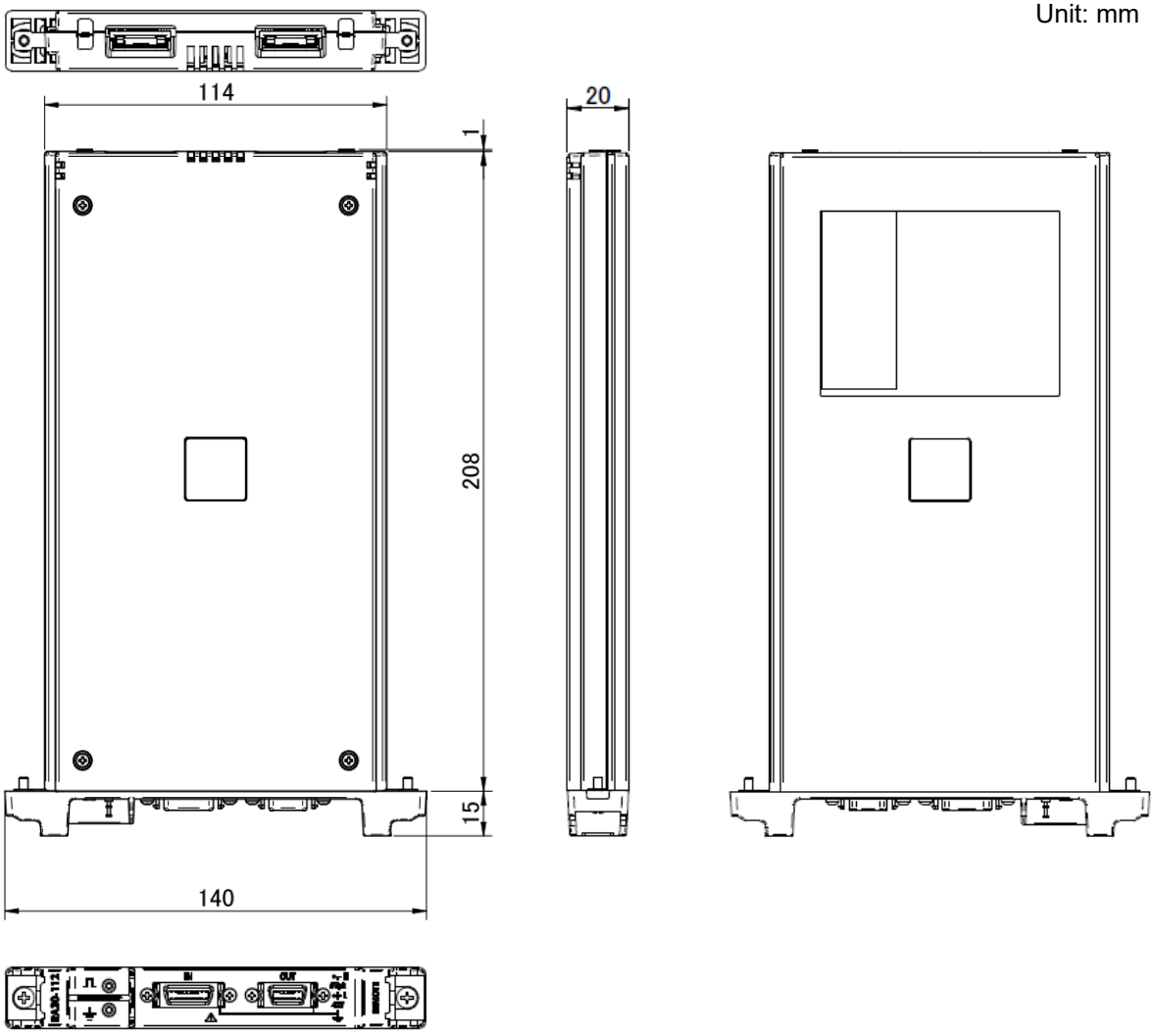
12.4.10. 2ch Acceleration Module (RA30-109) Exterior

Unit: mm



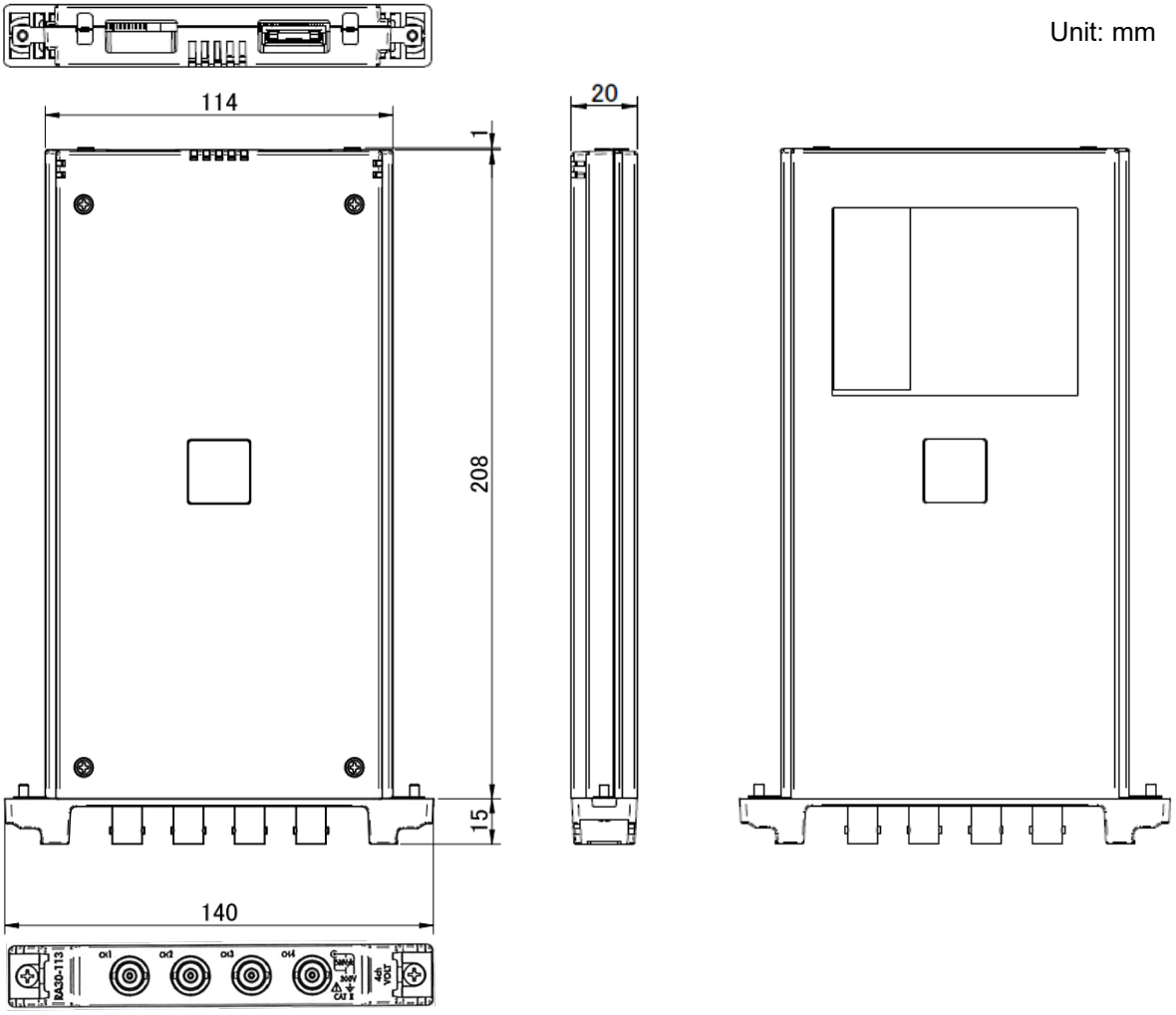
12.4.11. Remote Control Module (RA30-112) Exterior

Unit: mm



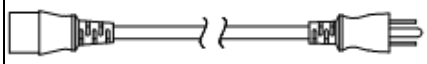
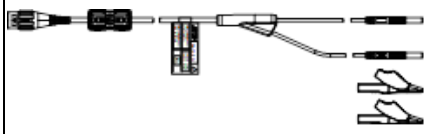
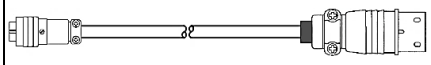
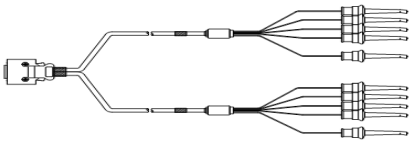
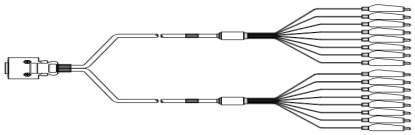
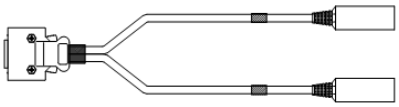
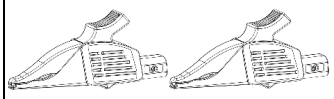
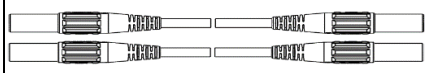
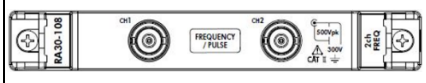
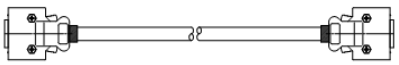
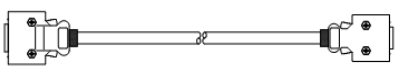
12.4.12. 4ch Voltage Module (RA30-113) Exterior

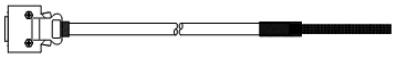
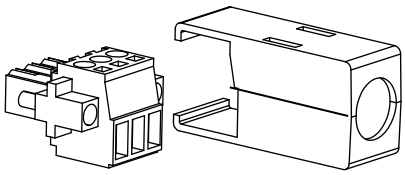
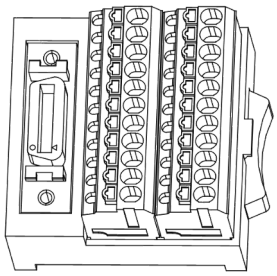
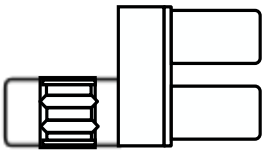
Unit: mm



13. Options

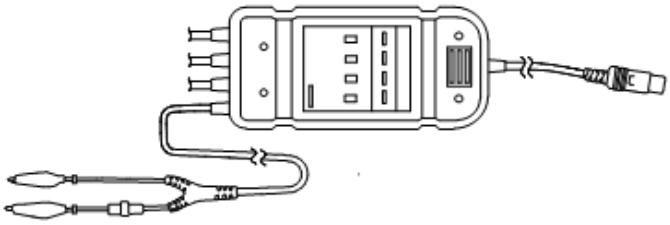
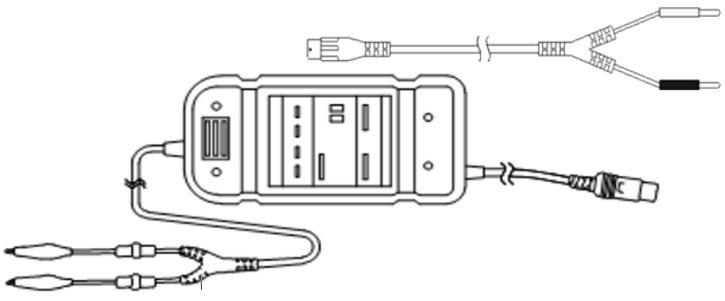
13.1. List of Cables

Name (type)	Shape/characteristics		Remarks
AC power cable 1KO6165-200		AC 125 V system PSE, UL/CSA standard Length 2 m	RA3100 main unit Japan, United States Canada
Insulated BNC cable (alligator clip) RA30-507		Insulated BNC ↕ Safety alligator clip Red + Black - Length 1.5 m	RA30-101 RA30-102 RA30-103 RA30-108 RA30-113 Analog input
NDIS conversion cable (RA30-508)		NDIS4109 ↕ NDIS4102 Length 0.6 m	RA30-104
8 channel logic cable (IC clip) RA30-501		For logic input 20P - 4 CH × 2 Common GND Length 1.5 m	RA30-105
8 channel logic cable (alligator clip) RA30-502		For logic input 20P - 4 CH × 2 Common GND Length 1.5 m	RA30-105
8 channel logic cable (round connector conversion) RA30-503		For 1539S connection 20P - 4 CH × 2 Common GND Length 0.3 m	RA30-105
High voltage alligator clip RA30-509-01		Alligator clips Red × 1; Black × 1 Standard: CAT III 1000 V	RA30-107
High voltage connection cable RA30-509-02		Safety banana plug Red × 1; Black × 1 Length: 2 m Standard: CAT III 1000 V	RA30-107
High voltage extension cable RA30-509-03		Safety banana plug/socket Red × 1; Black × 1 Length: 2 m Standard: CAT III 1000 V	RA30-107
Terminal block connection cable RA30-504		For MDR 20 terminal block connection 20P - 20P Length 2 m	RA30-105 RA30-112
Remote control cable (for connecting units) RA30-505		For connecting RA3100 20P - 14P Length 2 m	RA30-112

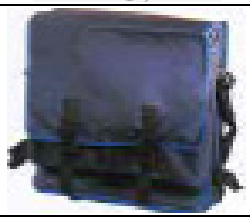
Name (type)	Shape/characteristics		Remarks
Remote control cable (discrete wires) RA30-506		For remote control input 20P - discrete wire Length 2 m	RA30-105 RA30-112
Temperature sensor connector RA30-555		Top cable cover Bottom cable cover Two sets of cable ties	RA30-106
Terminal block AX-PCX-10S20		For MDR 20 pole terminal block (for AWG16-28)	RA30-105 RA30-112
BNC adapter 0243-3021		Safety banana sockets ↕ Insulated BNC ※1	RA30-101 RA30-102 RA30-103 RA30-108 RA30-113 Analog input

*1 When more than one 4 channel voltage module (RA30-102 or RA30-113) is mounted next to each other, cannot be installed for all channels.

13.2. List of Probes/Clamp Meters

Name (type)	Shape	Remarks
Floating voltage probe (1539S)		4 inputs RA30-105
Voltage variation probe (1540S: AC 100/120 V) (1543S: AC 220/240 V)		1 input RA30-105

13.3. Accessory

Name (type)	Name	Shape	Remarks
RA30-551	Z-fold paper box		Z-fold paper adapter Including RA12-301
RA30-552	Dedicated delivery box		
RA23-183	Carrying case		

13.4. List of Spare Parts

Model	Name	Rating	Remarks
YPS106	Recording paper	Paper roll 219.5 mm x 30 m 5 rolls/box	0511-3167 (5 rolls)
YPS108	Recording paper	Paper roll 219.5 mm x 30 m Perforated 300 mm pitch Remaining display print: 300 mm pitch 99 to 00 5 rolls/box	0511-3166 (5 rolls)
YPS112	Recording paper	Z-fold paper 219.5 mm x 200 m folded width 300 mm Remaining display print: 669 to 000 per page 1 book/box	0511-3182
5633-1794	Recording paper holder	2 per set	

13.5. PC Software

The PC software enables the recorded data that is exported to be displayed as a waveform or converted to a file.

PC software	Remarks
RA3100 Viewer	Enables the recorded data that is exported to be displayed as a waveform or converted to a file.
RA3100 File Converter	Enables the recorded data to be converted to a CSV file or ASAM MDF file.

The software can be downloaded from our official website. https://www.aandd.jp/support/industrial/soft_download.html

Software License Information

The software embedded in this product uses software components owned by third parties.
The license information for the software components embedded in this product is indicated below.

SIL Open Font License

Copyright 2014−2021 Adobe (http://www.adobe.com/), with Reserved Font Name 'Source'. Source is a trademark of Adobe in the United States and/or other countries.

This Font Software is licensed under the SIL Open Font License, Version 1.1.

This license is copied below, and is also available with a FAQ at: http://scripts.sil.org/OFL

−−−

SIL OPEN FONT LICENSE Version 1.1 - 26 February 2007

−−−

PREAMBLE

The goals of the Open Font License (OFL) are to stimulate worldwide development of collaborative font projects, to support the font creation efforts of academic and linguistic communities, and to provide a free and open framework in which fonts may be shared and improved in partnership with others.

The OFL allows the licensed fonts to be used, studied, modified and redistributed freely as long as they are not sold by themselves. The fonts, including any derivative works, can be bundled, embedded, redistributed and/or sold with any software provided that any reserved names are not used by derivative works. The fonts and derivatives, however, cannot be released under any other type of license. The requirement for fonts to remain under this license does not apply to any document created using the fonts or their derivatives.

DEFINITIONS

"Font Software" refers to the set of files released by the Copyright Holder(s) under this license and clearly marked as such. This may include source files, build scripts and documentation.

"Reserved Font Name" refers to any names specified as such after the copyright statement(s).

"Original Version" refers to the collection of Font Software components as distributed by the Copyright Holder(s).

"Modified Version" refers to any derivative made by adding to, deleting, or substituting −− in part or in whole −− any of the components of the Original Version, by changing formats or by porting the Font Software to a new environment.

"Author" refers to any designer, engineer, programmer, technical writer or other person who contributed to the Font Software.

PERMISSION & CONDITIONS

Permission is hereby granted, free of charge, to any person obtaining a copy of the Font Software, to use, study, copy, merge, embed, modify, redistribute, and sell modified and unmodified copies of the Font Software, subject to the following conditions:

1) Neither the Font Software nor any of its individual components, in Original or Modified Versions, may be sold by itself.

2) Original or Modified Versions of the Font Software may be bundled, redistributed and/or sold with any software, provided that each copy contains the above copyright notice and this license. These can be included either as stand-alone text files, human-readable headers or in the appropriate machine-readable metadata fields within text or binary files as long as those fields can be easily viewed by the user.

3) No Modified Version of the Font Software may use the Reserved Font Name(s) unless explicit written permission is granted by the corresponding Copyright Holder. This restriction only applies to the primary font name as presented to the users.

4) The name(s) of the Copyright Holder(s) or the Author(s) of the Font Software shall not be used to promote, endorse or advertise any Modified Version, except to acknowledge the contribution(s) of the Copyright Holder(s) and the Author(s) or with their explicit written permission.

5) The Font Software, modified or unmodified, in part or in whole, must be distributed entirely under this license, and must not be distributed under any other license. The requirement for fonts to remain under this license does not apply to any document created using the Font Software.

TERMINATION

This license becomes null and void if any of the above conditions are not met.

DISCLAIMER

THE FONT SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OF COPYRIGHT, PATENT, TRADEMARK, OR OTHER RIGHT. IN NO EVENT SHALL THE COPYRIGHT HOLDER BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, INCLUDING ANY GENERAL, SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF THE USE OR INABILITY TO USE THE FONT SOFTWARE OR FROM OTHER DEALINGS IN THE FONT SOFTWARE.

MEMO

MEMO

MEMO

MEMO

Omniace
RA3100

Instruction Manual 1WMPD4004444G 8th Edition



A&D Company, Limited
3-23-14 Higashi-Ikebukuro, Toshima-ku, Tokyo 170-0013, JAPAN
Telephone: [81] (3) 5391-6132 Fax: [81] (3) 5391-1566

A&D ENGINEERING, INC.
Headquarters Office: 4622 Runway Boulevard, Ann Arbor, Michigan 48108, U.S.A.
Sales Office: 47747 Warm Springs Boulevard, Fremont, California 94539, U.S.A.
Tel: [1] (800) 726-3364 Weighing Support: [1] (888) 726-5931 Inspection Support: [1] (855) 332-8815

A&D INSTRUMENTS LIMITED
Unit 24/26 Blacklands Way, Abingdon Business Park, Abingdon, Oxfordshire OX14 1DY United Kingdom
Telephone: [44] (1235) 550420 Fax: [44] (1235) 550485

A&D AUSTRALASIA PTY LTD
32 Dew Street, Thebarton, South Australia 5031, AUSTRALIA
Telephone: [61] (8) 8301-8100 Fax: [61] (8) 8352-7409

A&D KOREA Limited 한국에이.엔.디(주)
서울특별시 영등포구 국제금융로6길33 (여의도동) 맨하탄빌딩 817 우편 번호 07331
(817, Manhattan Bldg., 33. Gukjegeumyung-ro 6-gil, Yeongdeungpo-gu, Seoul, 07331 Korea)
전화: [82] (2) 780-4101 팩스: [82] (2) 782-4264

OOO A&D RUS ООО "ЭЙ энд ДИ РУС"
Почтовый адрес:121357, Российская Федерация, г.Москва, ул. Верейская, дом 17
Юридический адрес: 117556 г. Москва, Варшавское шоссе, д. 95, корп. 1.
тел.: [7] (495) 937-33-44 факс: [7] (495) 937-55-66

A&D Instruments India Private Limited ऐ&डी इन्स्ट्रूमेन्ट्स इण्डिया प्रा0 लिमिटेड
D-48, उद्योग विहार , फेस –5, गुड़गांव – 122016, हरियाणा , भारत
(D-48, Udyog Vihar, Phase–V, Gurgaon – 122016, Haryana, India)
फोन : [91] (124) 4715555 फैक्स : [91] (124) 4715599

A&D SCIENTECH TAIWAN LIMITED. 艾安得股份有限公司
台湾台北市中山區南京東路 2 段 206 號 11 樓之 2
(11F-2, No.206, Sec.2, Nanjing E.Rd., Zhongshan Dist., Taipei City 10489, Taiwan, R.O.C.)
Tel : [886](02) 2322-4722 Fax : [886](02) 2392-1794

A&D INSTRUMENTS (THAILAND) LIMITED บริษัท เอ แอนด์ ดี อินสทรูเม้นท์ (ไทยแลนด์) จำกัด
168/16 หมู่ที่ 1 ตำบลรังสิต อำเภอธัญบุรี จังหวัดปทุมธานี 12110 ประเทศไทย
(168/16 Moo 1, Rangsit, Thanyaburi, Pathumthani 12110 Thailand)
Tel : [66] 20038911