User's Manual

AQ23011A, AQ23012A Frame Features Guide

YOKOGAWA
Yokogawa Test & Measurement Corporation

IM AQ23011A-01EN
1st Edition

Thank you for purchasing the AQ23011A or AQ23012A Frame. The AQ2300 Series consists of the AQ23011A/AQ23012A Frame and several modules. The frame can control the source and measure modules installed in its frame.
This user's manual explains the features of the AQ2300 Series including its modules. To ensure correct use, please read this manual thoroughly before beginning operation. Keep this manual in a safe place for quick reference.
The manuals for this instrument are listed on page iii. Please read all manuals.

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

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

Notes

- The contents of this manual are subject to change without prior notice as a result of improvements to the product's performance and functionality. Refer to our website to view our latest manuals.
- The figures given in this manual may differ from those that actually appear on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
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Revisions

- 1st Edition: October 2024

Manuals

The following manuals, including this one, are provided as manuals for this instrument. Please read all manuals.

Manuals included with the product

Manual Title	Manual No.	Description
AQ23011A, AQ23012A Frame Getting Started Guide	IM AQ23011A-03EN	Provided as a printed manual. Explains the handling precautions, common operations, troubleshooting measures, and specifications of this instrument.
AQ23011A, AQ23012A Frame	IM AQ23011A-92Z1	Document for China
Safety Instruction Manual	IM 00C01C01-01Z1	Safety manual (European languages)

Manuals included in the frame's internal storage

The following manuals are included in the internal storage of the frame (AQ23011A, AQ23012A). Download them to your PC for use. For how to download them, see "How to View the User's Manual" in the Getting Started Guide (IM AQ23011A-03EN).
You can also download them from the YOKOGAWA website.

Manual Title	Manual No.	Description
AQ23011A, AQ23012A Frame Features Guide	IM AQ23011A-01EN	This document. Explains all the instrument's features including its modules, but excluding the remote control features. This single PDF file contains both the Features Guide and the User's Manual.
AQ23011A, AQ23012A Frame User's Manual	IM AQ23011A-02EN	Explains how to operate this instrument. This single PDF file contains both the Features Guide and the User's Manual.
AQ23011A, AQ23012A Frame Communication Interface User's Manual	IM AQ23011A-17EN	This manual explains the instrument's remote control features, how to configure it, and the commands used to control this instrument from a PC through the interface.

The "EN and "Z1" in the manual numbers are the language codes.

Conventions used in this manual

Prefixes k and K

Prefixes k and K used before units are distinguished as follows:

k:	Denotes 1000.	Example: 12 kg, 100 kHz
K:	Denotes 1024.	Example: 720 KB (file size)

Contents

1.1 Overview

Description of this chapter

This chapter explains the SMU features.

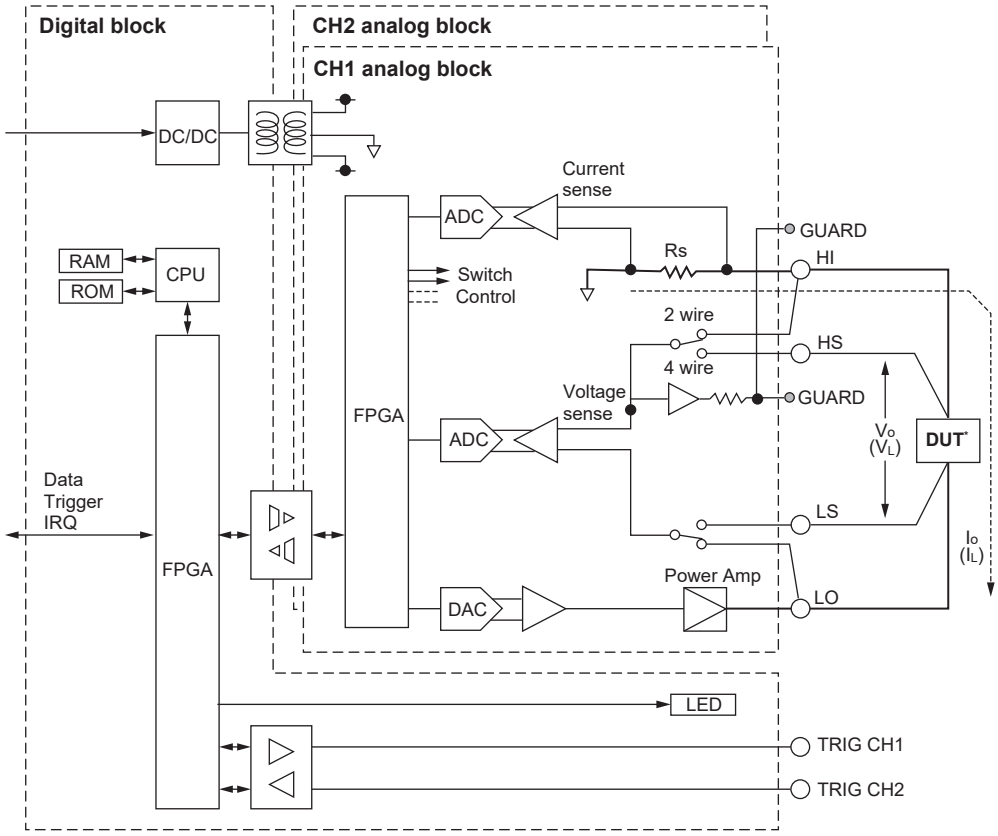
SMU

The following SMUs can be installed in the AQ2300 frame (AQ23011A or AQ23012A).

AQ23811A Source Measure Unit (2CH)

This is a 2-channel SMU.
Each channel can source or measure voltage or current.
The voltage source/measurement range is 6 V.
The current source/measurement range is 200 nA, 2 µA, 20 µA, 200 µA, 2 mA, 20 mA, 200 mA, and 600 mA.
Source and measurement start on their separate assigned triggers.

Block diagram



* DUT: device under test

The SMU consists of a digital block at ground potential and an isolated analog block. CH1 and CH2 of the analog block are mutually isolated. The frame supplies a single power source. The power is supplied to the digital block. The power is also supplied to the analog block but through an isolated power supply.

The digital block consists of a CPU, FPGA, memory, and various interface circuits.

The CPU and FPGA transfers the settings and trigger signals received from the frame to the analog block and sends the measurement information from the analog block to the frame.

The analog block consists of high-speed, high-precision op amps, highly stable resistors, and other components.

The FPGA, responsible for feedback and limiter control of the source function, processes the A/D and D/A converters, switches circuit signal paths, and exchanges data with the digital block's FPGA.

During voltage sourcing, measured voltages are fed back to the output, and the limiter operates according to the results of the measured currents. Likewise, during current sourcing, measured currents are fed back to the output, and the limiter operates according to the results of the measured voltages.

Local sense and remote sense can be switched to perform two-wire or four-wire voltage sensing.

If you want to improve the response deterioration due to transient current leakage caused by capacitive components when the output is changed or reduce leakage current, shield the cable with the GUARD terminal.

1.2 Source

Feature overview

Each channel can source voltage or current. Sweep operation can also be performed to source voltage or current while changing its level.
This section explains the source feature.
Details on sweeping are provided in section 1.4, “Sweep.”
When a source trigger is detected, sourcing starts. Sourcing is executed after the source delay.
There are two source waveforms: DC and pulse. To source pulse signals, set the pulse base and pulse width in addition to the source level.
The output of each channel can be turned on and off. When turned off, source nor measure is possible.

Source mode (Source Mode)

There are two modes: normal source and sweep.
Normal source mode: mode to reflect the source settings to DC sourcing and pulse sourcing
Sweep mode: mode to source with sweeping (linear sweep, log sweep, program sweep)

Source range (Range)

Voltage range

Source range1	Lower limit	Upper limit	Setting resolution	Maximum load current
6 V	–6.0000 V	+6.0000 V	100 µV	±600 mA / ±200 mA*

* Maximum sink load current exceeding ±2 V is up to ±200 mA.

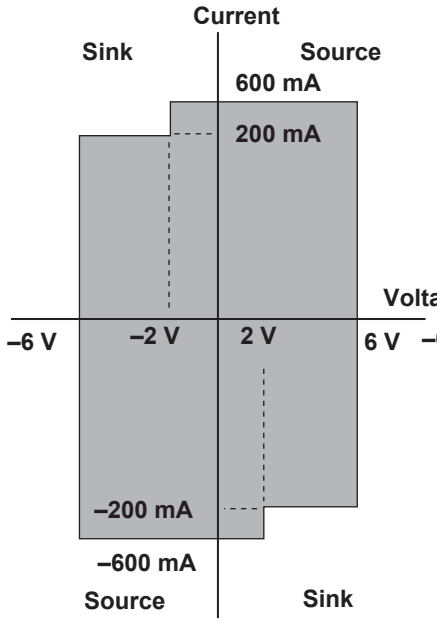
Current range

Source range1	Lower limit	Upper limit	Setting resolution	Max. Load Voltage
200 nA	–200.000 nA	+200.000 nA	1 pA	±6 V
2 µA	–2.00000 µA	+2.00000 µA	10 pA	±6 V
20 µA	–20.0000 µA	+20.0000 µA	100 pA	±6 V
200 µA	–200.000 µA	+200.000 µA	1 nA	±6 V
2 mA	–2.00000 mA	+2.00000 mA	10 nA	±6 V
20 mA	–20.0000 mA	+20.0000 mA	100 nA	±6 V
200 mA	–200.000 mA	+200.000 mA	1 µA	±6 V
600 mA	–600.00 mA	+600.00 mA	10 µA	±6 V / ±2 V*

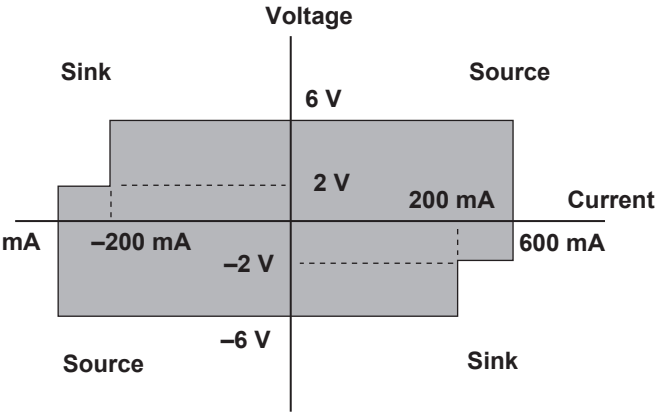
* Maximum sink load voltage exceeding ±600 mA is up to ±2 V.

Source range

Voltage source mode



Current source mode



Operation after changing the source range or level

When the source trigger source is set to None, changing the source value immediately changes the source level.

Otherwise, the source level changes when a source trigger is detected.

Fixed source range and auto source range

There are two types of source ranges: fixed range and auto range.

Fixed source range

The target range is specified manually. You can set the source level within the specified range.

Auto source range

The range is changed automatically to the appropriate setting according to the source level. You can set the source level without thinking about the range. However, the output may be temporarily discontinuous when the range switches. This is valid when the source mode is set to normal.

For AQ23811A voltage sourcing, there is no difference between fixed source range and auto source range because 6 V is the only range available.

Source waveform (Shape)

You can set the source shape to DC or pulse.

DC: The signal is sourced at the specified level until the end.

Pulse: The signal is sourced at the specified level for the specified time period (pulse width).

Load resistance/load capacitance/load inductance (Load Resistance, Load Inductance, Load Capacitance)

The source value can be converged smoothly to the specified output value by setting values appropriate for the source target load.

- Load resistance: Valid for voltage sourcing and current sourcing.
- Load capacitance: Valid for voltage sourcing.
- Load inductance: Valid for current sourcing.

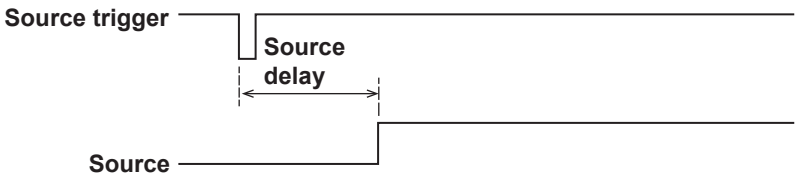
The minimum value is set by default. Change it when adjusting the source waveform.

Source trigger (Source Trigger)

When a source trigger is detected, sourcing starts.
A signal received through a bus trigger (BUS Trigger1 to 9) or the module's trigger terminal (Front) can be assigned as a source trigger.
You can also disable the source trigger and start sourcing from a control on the screen or a communication command.

Source delay (Source Delay)

You can adjust the amount of time to wait after a source trigger is detected until sourcing starts. This can also be used to adjust the timing between channels.



Limiter (Limiter)

The limiter protects the device under measurement. When you set a limit, the source value is controlled so that it does not exceed the limit. This is also valid during sweeping. The upper limit of this setting is the maximum load current or maximum load voltage, mentioned earlier.
The voltage limiter operates during current sourcing and the current limiter during voltage sourcing.
When Absolute is set to ON, the limiter is set at the specified positive and negative levels.

1.3 Measure

Feature overview

This feature measures voltage or current.
When a measurement trigger is detected, measurement operation starts. Measurement is executed after the measurement delay for the specified integration time.
Power or resistance can also be calculated based on the measurement results.

Local sense and remote sense (Wire)

Two wiring systems, 2wire (two-terminal connection or local sense) and 4wire (four-terminal connection or remote sense) are available.
Four-terminal connection (4wire) is effective to measure voltage at high precision when the running current is large and the voltage appearing at the device under measurement is small, such as during low-resistance measurement.

Integration time (Integ Time)

You can set the integration time in units of seconds or integer multiple of the power line cycle (PLC). If you set a long integration time, the measurement takes longer, but the stability of the measured values increases. Setting the integration time to an integer multiple of the power line cycle (nPLC) has the effect of eliminating noise in the power supply frequency components. For high precision measurement, use an integer value (integer multiple of the power line cycle).

Measurement trigger (Measure Trigger)

When a measurement trigger is detected, measurement operation starts.
A signal received through a bus trigger (BUS Trigger1 to 9), a signal received through the module's trigger terminal (Front), the time at which the source value changes (Src Change), or repetition (Cyclic) can be assigned as a measurement trigger.
You can also disable the measurement trigger and start measurement from a control on the screen or a communication command.

Measurement delay (Measure Delay)

You can adjust the amount of time to wait after a measurement trigger is detected until measurement starts. Measurement operation includes ±1 µs of jitter. Measurements made when the waveform of the device under measurement (DUT) is in a transient state will not be stable due to the effects of jitter. Set the measurement delay so that measurement starts after the waveform of the device under measurement becomes sufficiently stable.

Offset (Offset)

Unneeded DC component in measurements can be offset.
The offset can be specified separately for voltage measurement and current measurement.

Math (Math)

This feature calculates power or resistance from the measurement results and shows it on the screen.
If the offset is set to ON, the offset value is also reflected in the calculation.

Storage feature

The specified number of measured data points are saved in internal storage.
The available save formats are binary and ASCII.
Measurement data can also be saved automatically in the specified folder.

1.4 Sweep

Feature overview

Each channel can source or measure voltage or current by sweeping.
Three types of sweeping are available: linear, log, and program.
When a start trigger is detected, sweeping starts.
Sweep sourcing is also possible by using Sweep in Application.
For details on sweeping, see section 3.1, “Sweep”.

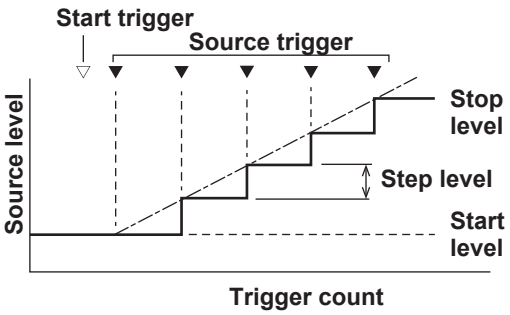
Source mode (Source Mode)

Set the source mode to Sweep to use sweep sourcing.

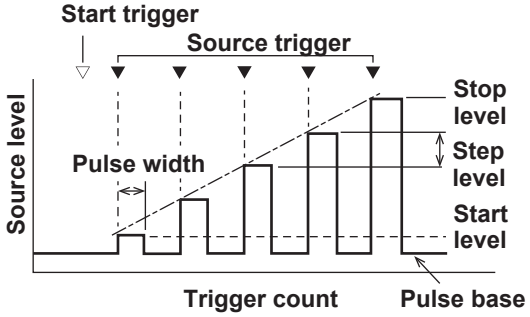
Linear sweep

With the horizontal scale is set to trigger count and the vertical scale to the source level, sweeping is performed from the specified start level to the stop level at the specified step-level steps.

DC output (shape: DC)



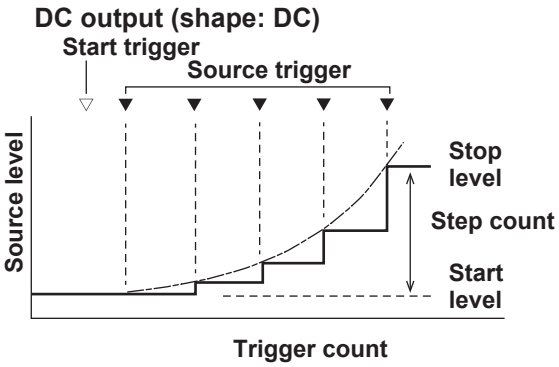
Pulse output (shape: pulse)



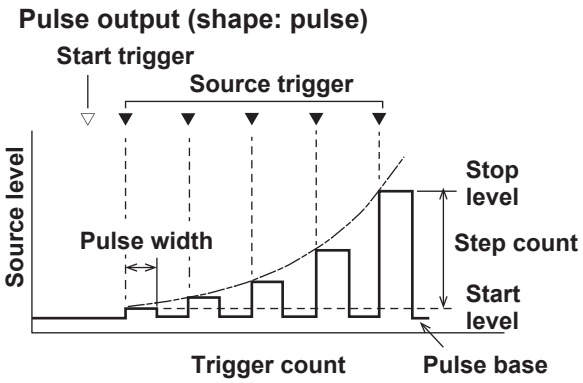
Log sweep

With the horizontal scale is set to trigger count and the vertical scale to the source level, sweeping is performed exponentially in a step pattern obtained by dividing the source levels from the start level to the stop level by the specified step count.

DC output (shape: DC)

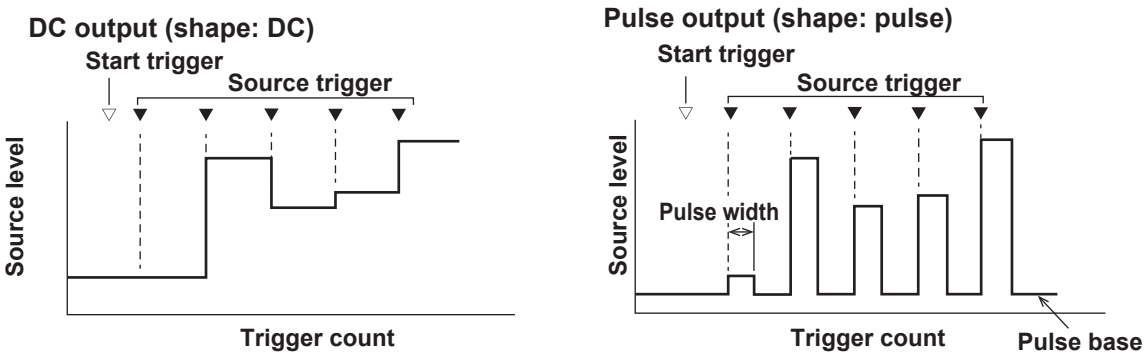


Pulse output (shape: pulse)



Program sweep

A program file (sweep pattern file in CSV format) created on a PC is loaded into the instrument, and sweeping is performed according its pattern.
You can set the step count up to 100001.



For how to create program files, see section 3.1, “Sweep.”

Start trigger (Start Trigger)

The start trigger is used to start sweeping.
You can select a signal received through a bus trigger (BUS Trigger1 to 9) or the module’s trigger terminal (Front), None, or Disable.
If you select None, sweeping starts without the start trigger.
If you select Disable, you can start sweeping using the SART TRIG button or a communication command.

Repeat count (Repeat Count)

Set the sweep repeat count.
The available range is 1 to 1000. You can also specify Infinity. Sweeping starts at the start trigger timing for each repetition.
If you set the count to 5, sweeping will be repeated five times at the start trigger timing, and then the instrument will return to the start-wait state.
If you select Infinity, after sweeping starts, sweeping will be repeated at the start trigger timing until sweeping is stopped or output is turned off.
When repeating a sweep, if the start trigger timing for the next sweep sent after the end of the previous sweep is too early, a start sampling error may occur. In this case, delay the start trigger timing.

1.5 Trigger

Feature overview

The SMU has the following triggers.

- Source trigger
- Measurement trigger
- Sweep start trigger

Trigger settings are available separately for the frame and SMU. The frame trigger settings and SMU trigger settings are not automatically synchronized.

If the trigger settings specified on the frame and those specified on the SMU are in conflict, the settings that are specified last are valid.

Source trigger (Source Trigger)

The source trigger starts the voltage sourcing or current sourcing. Select any of the following trigger sources.

BUS Trigger1 to 9

The external signal received through the trigger input terminal on the frame's rear panel or the frame's internal timer (transmitter) can be assigned to Bus Trigger1 to 9. The aforementioned signal can be used as a trigger by selecting BUS Trigger1 to 9 on the module side.

Signal received through the module's trigger terminal (Front)

A TTL level signal (negative logic). The falling edge is used for the source trigger. This can be used when the module's trigger terminal is set to input.

None

The source value changes simply by changing the setting, without applying a trigger (for DC waveform sourcing when sweeping is off).

Disable

Sourcing starts with the TRIG button on the panel or a communication command.

Measurement trigger (Measure Trigger)

The measurement trigger starts a voltage measurement or a current measurement. Select any of the following trigger sources.

Bus Trigger1 to 9

The external signal received through the frame's trigger input terminal or the frame's internal timer can be assigned to Bus Trigger1 to 9. The aforementioned signal can be used as a measurement trigger by selecting Bus Trigger1 to 9 on the module side.

Signal received through the module's trigger terminal (Front)

A TTL level signal (negative logic). The falling edge is used for the measurement trigger. This can be used when the module's trigger terminal is set to input.

When the source value changes (Src Change)

A measurement trigger occurs when a source trigger is detected.

Cyclic measurement (Cyclic)
A measurement trigger occurs when a measurement is finished. The minimum cycle is approximately 1 ms.

Disable
Measurement starts with the TRIG button on the panel or a communication command.

Start trigger (Start Trigger)

The start trigger starts a sweep operation. Select any of the following trigger sources.

Bus Trigger1 to 9
With the settings on the frame side, the external signal received through the trigger input terminal on the frame's rear panel or the frame's internal timer can be assigned to Bus Trigger1 to 9. The aforementioned signal can be used as a trigger by selecting Bus Trigger1 to 9 on the module side.

Signal received through the module's trigger terminal (Front)
A TTL level signal (negative logic). The falling edge is used for the sweep start trigger. This can be used when the module's trigger terminal is set to input.

None
Sweeping starts without applying a start trigger.

Disable
Sweeping starts with the START TRIG button on the panel or a communication command.

Trigger output (Trigger Output)

Trigger signals can be transmitted through the SMU's front output terminal or the frame.

Front output terminal (Front Output CH1, Front Output CH2)
SMU's front output terminals. Can be assigned to CH1 and CH2. This can be used when the module's trigger terminal is set to output.

Trigger output through the frame connection terminal (Trigger Output1 CH1, Trigger Output2 CH1, Trigger Output1 CH2, Trigger Output2 CH2)
Trigger signals are transmitted through the frame. The logical OR of the signal assigned to CH1 or CH2 is transmitted from Trigger Output1 or Trigger Output2.

Output signal
The following status signals can be transmitted.
- Sweep busy signal (Swp Busy)
- Source busy signal (SrcBusy)
- Measure busy signal (MeasBusy)
- Measure start signal (MeasStart)

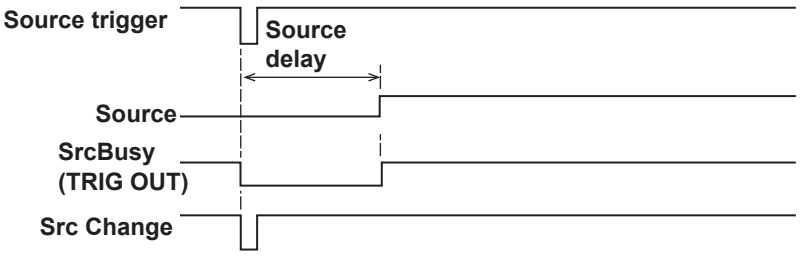
The measure start signal can be transmitted from Front Output CH1 or Front Output CH2.

Status signals

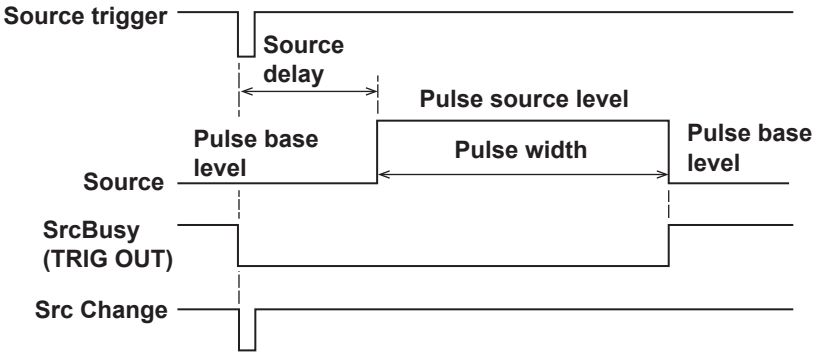
The status signals transmitted from each output terminal are negative-logic signals with a minimum pulse width of 10 µs. The output timings of SrcBusy, SwpBusy, and MeasBusy are as follows.

SrcBusy, Src Change

SrcBusy indicates that a signal is being sourced. It is set to low with a source trigger. It is also set to low when sourcing is started with a communication command.
During DC sourcing, SrcBusy is set to high after the source delay. Even when the source delay is set to 1 µs, the pulse width of the status signal is sustained for at least 10 µs.
Src Change is a signal that is generated when a source trigger is detected. It is an internal signal used as a measurement trigger and cannot be transmitted from a terminal.

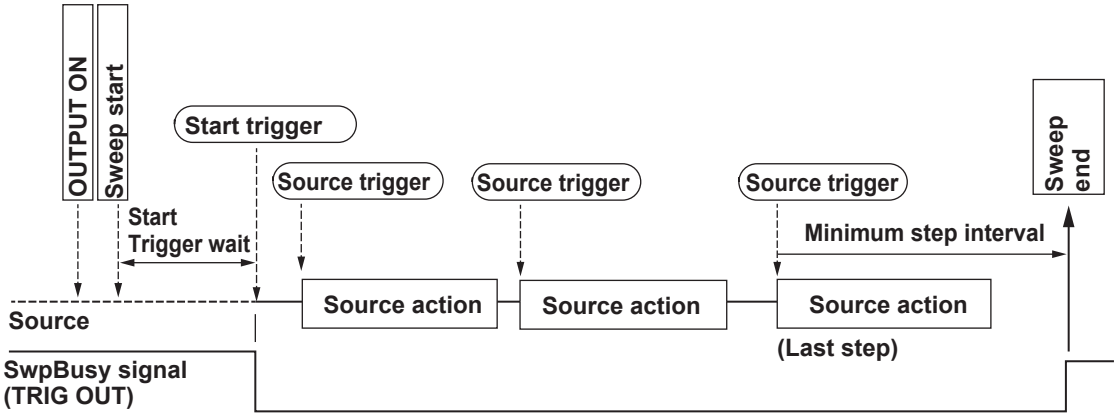


During pulse sourcing, SrcBusy is set to high at the end of a pulse.



SwpBusy

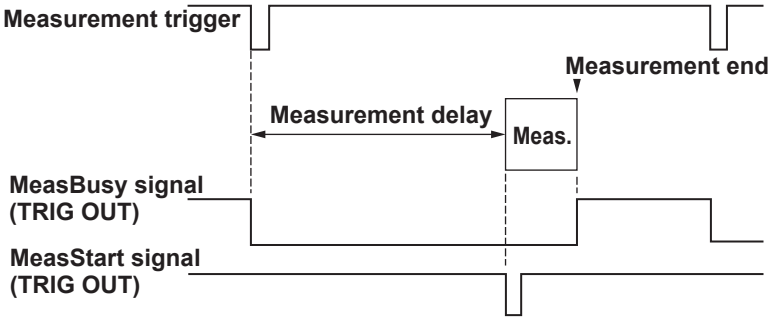
SwpBusy indicates that sweeping is in progress. It is set to low with a start trigger. It is set to high when the minimum step interval, which is an internal instrument setting, elapses after producing the last step.



MeasBusy, MeasStart

MeasBusy indicates that a measurement is in progress. It is set to low with a measurement trigger. It is set to high when a measurement is completed (the specified integral count of measurements are acquired).

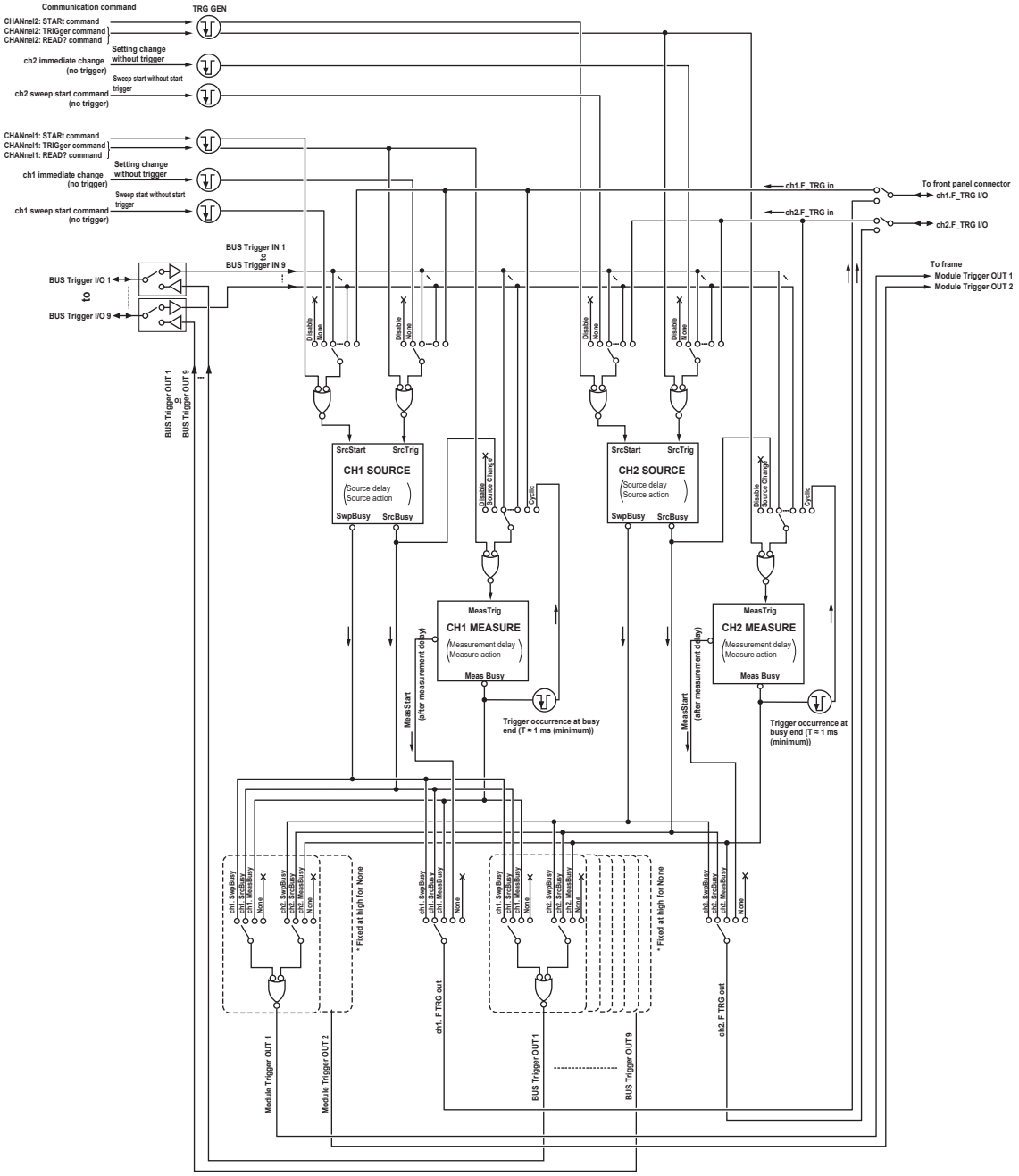
Meas Start is a negative-logic signal with a pulse width of 10 µs. It is generated when a measurement starts.



Synchronizing modules

Signals can be generated or measurements can be started in sync by assigning the same trigger source for the source and measurement start triggers of multiple modules.

Trigger block diagram



1.6 Other Features

Setup file save/load feature

Settings of each SMU can be saved and loaded from files.

Zero-set function

The zero-set function is used to calibrate the source level offset drift caused by temperature changes and other factors for each SMU channel.

2.1 Trigger Overview

Trigger signals can be used to start a measurement, sourcing, or sweeping. They can also be used to output the frame's internal timer signal (transmitter) or measurement-in-progress or sourcing-in-progress signals in order to synchronize with other devices.
The trigger signals you can use include external signals received through the frame's trigger input terminal, frame's internal timer (transmitter), and external signals received through a module's input terminal.
Bus triggers (BUS Trigger1 to BUS Trigger9) and trigger output (Trigger Output) are used to exchange trigger signals between the frame and modules.

Frame

On the frame, the input signal received through the trigger input terminals Trig IN1 and Trig IN2 on the frame's rear panel and the timer (transmitter) can be assigned to the bus triggers (BUS Trigger1 to BUS Trigger9). On a module, this bus trigger signal can be used as a trigger signal.

Modules

Modules can use the following signals as triggers.

Measurement trigger (Measure Trigger)
Measurement starts by using the following signals as trigger sources.

- BUS Trigger1 to BUS Trigger9: Bus trigger
- Front: Input signal received through a module's trigger input terminal
- Src Change: Source trigger detection
- Cyclic: Measurement completion signal (when measuring continuously). The minimum cycle is approximately 1 ms.

Source trigger (Source Trigger)
Sourcing starts by using the following signals as trigger sources. When Source Mode is set to Sweep, it functions as a step trigger.

- BUS Trigger1 to BUS Trigger9: Bus trigger
- Front: Input signal received through a module's trigger input terminal

Sweep start trigger (Start Trigger)
Sweeping starts by using the following signals as trigger sources.

- BUS Trigger1 to BUS Trigger9: Bus trigger
- Front: Input signal received through a module's trigger input terminal

2.2 Trigger Signal

Signals that can be used as triggers

The following signals can be used as triggers.

External signal received through the Trig IN1 or Trig IN2 terminal on the frame's rear panel (Trig IN1, Trig IN2)

A TTL level signal (negative logic).

In the application sweep settings, this signal can be selected as a source start trigger or step trigger. In the module settings, this signal can be assigned to BUS Trigger1 to 9 and selected as a bus trigger.

It can be used as a source trigger, measurement trigger, sweep start trigger, or sweep step trigger. Further, this signal can be transmitted from the trigger output terminals (Trig OUT1, Trig OUT2) on the frame's rear panel.

External signal received through a module's front panel terminal (Front)

A TTL level signal (negative logic).

In the module settings, this signal can be used as a source trigger, measurement trigger, sweep start trigger, or sweep step trigger.

Source value change (Src Change)

This signal is an internal signal that indicates changes in the SMU source value. It is an internal signal used as a measurement trigger and cannot be transmitted from a terminal.

Internal timer (transmitter)

The frame's internal timer can be used as a trigger.

In the application sweep settings, this signal can be selected as a step trigger. In the module settings, this signal can be assigned to BUS Trigger1 to 9 and selected as a bus trigger.

It can be used as a source trigger, measurement trigger, sweep start trigger, or sweep step trigger.

External output signals

The following signals can be transmitted from the frame's and modules' output terminals.

External signal received through the Trig IN1 or Trig IN2 terminal on the frame's rear panel (Trig IN1, Trig IN2)

The signal received through the frame's Trig IN1 or Trig IN2 terminal can be transmitted from the frame's Trig OUT1 or Trig OUT2 terminal via the bus trigger.

Internal timer

The frame's internal timer (transmitter) signal can be transmitted from the frame's Trig OUT1 or Trig OUT2 terminal via the bus trigger.

Status signals

The status signals of a module's channels can be transmitted.

- Sweep busy signal (Swp Busy)
- Source busy signal (SrcBusy)
- Measure busy signal (MeasBusy)
- Measure start signal (MeasStart)

Status signals can be transmitted from the module's front terminal or frame's Trig OUT1 or Trig OUT2 terminal. Note that measurement start signals can only be transmitted from the module's front terminal.

Status signals

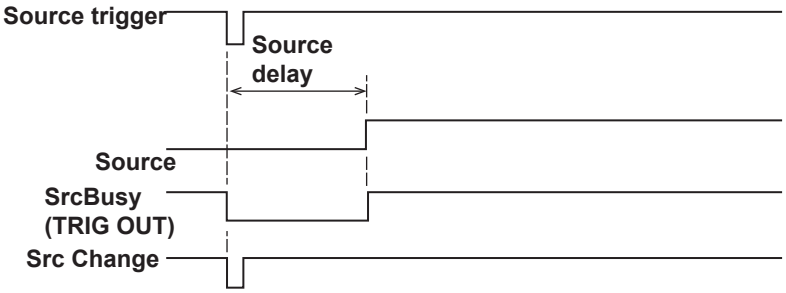
The status signals transmitted from each output terminal are negative-logic signals with a minimum pulse width of 10 µs. The output timings of SwpBusy, SrcBusy, and MeasBusy are as follows.

SrcBusy, Src Change

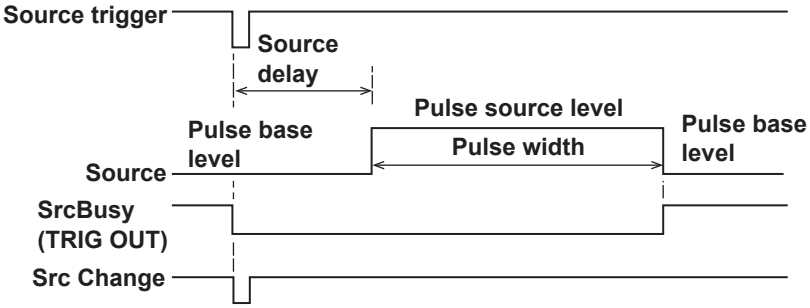
SrcBusy indicates that a signal is being sourced. It is set to low with a source trigger. It is also set to low when sourcing is started with a communication command.

During DC sourcing, it is set to high after the source delay. Even when the source delay is set to 1 µs, the pulse width of the status signal is sustained for at least 10 µs.

Src Change is a signal that is generated when a source trigger is detected. It is an internal signal used as a measurement trigger and cannot be transmitted from a terminal.

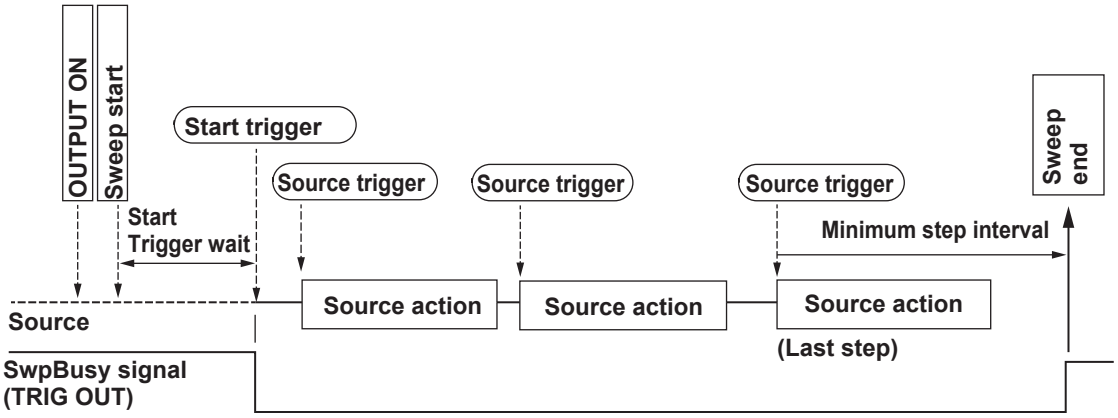


During pulse sourcing, it is set to high at the end of a pulse.



SwpBusy

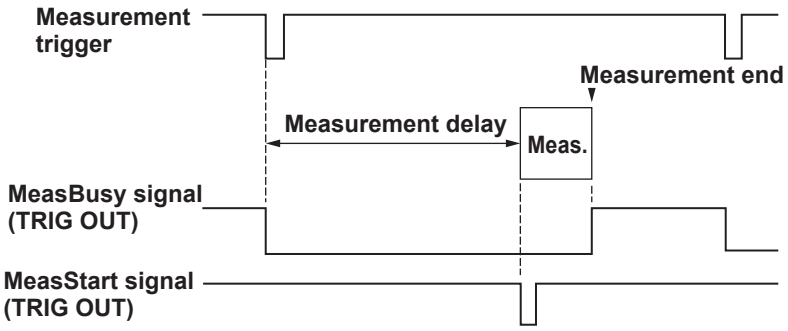
SwpBusy indicates that sweeping is in progress. It is set to low with a start trigger. It is set to high when the minimum step interval, which is an internal instrument setting, elapses after producing the last step.



MeasBusy, MeasStart

MeasBusy indicates that a measurement is in progress. It is set to low with a measurement trigger. It is set to high when a measurement is completed (the specified integral count of measurements are acquired).

Meas Start is a negative-logic signal with a pulse width of 10 µs. It is generated when a measurement starts.

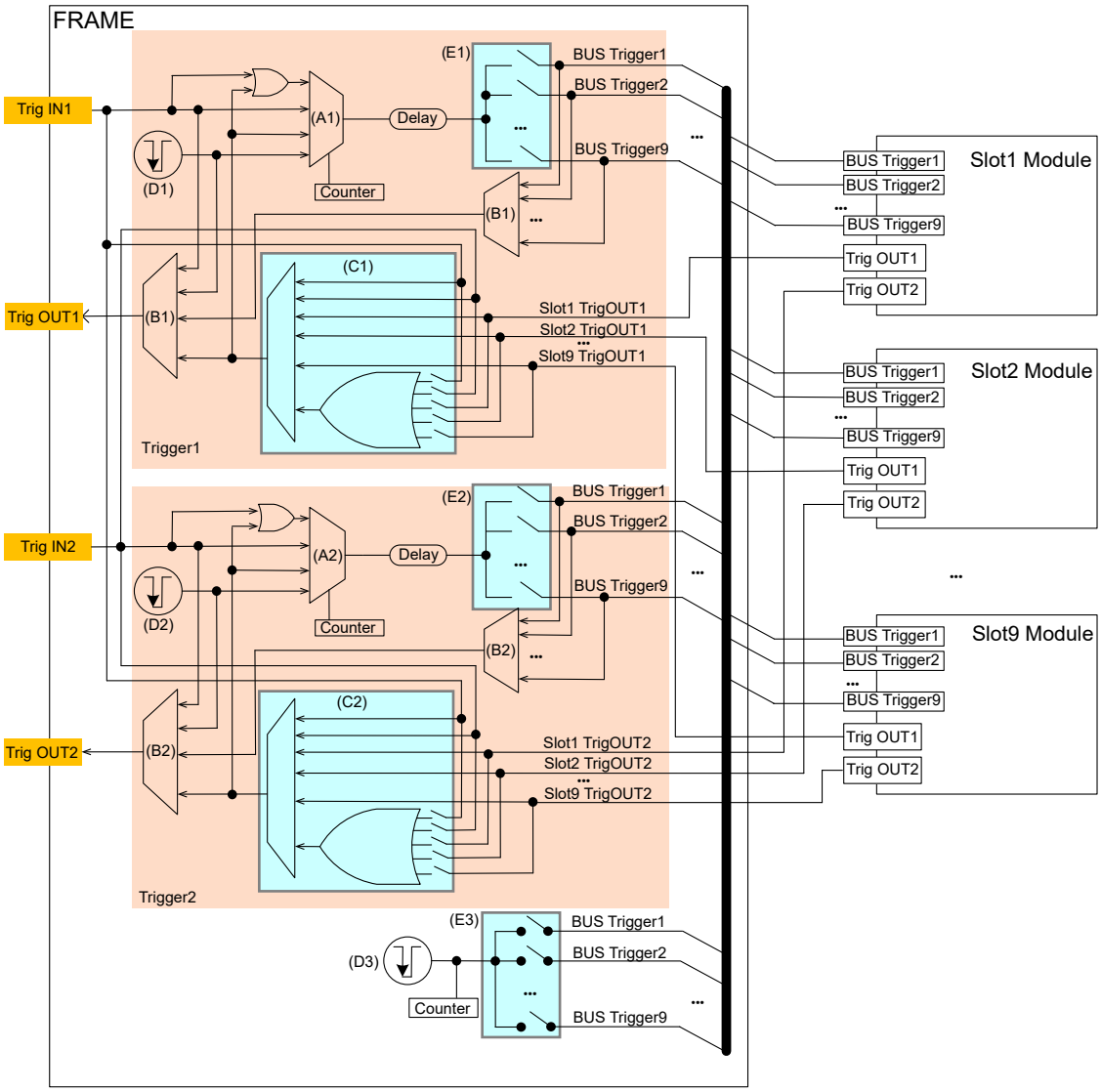


Synchronizing modules

Signals can be generated or measurements can be started in sync by assigning the same trigger source for the source and measurement triggers of multiple modules.

2.3 Trigger System Schematic

The schematic diagram of the instrument's trigger system is shown below.



Frame

Trig IN1/Trig IN2: frame's trigger input terminals

Trig OUT1/Trig OUT2: frame's trigger output terminals

Modules

BUS Trigger1 to BUS Trigger9: connected to the frame through slot connection terminals

Trig OUT1/Trig OUT2: connected to the frame through slot connection terminals

3.1 Sweep

Sweep of application provides simple settings to synchronize the sweep operation of the SMU with the measurement of other channels. To configure the sweep operation in more detail, use the module settings.

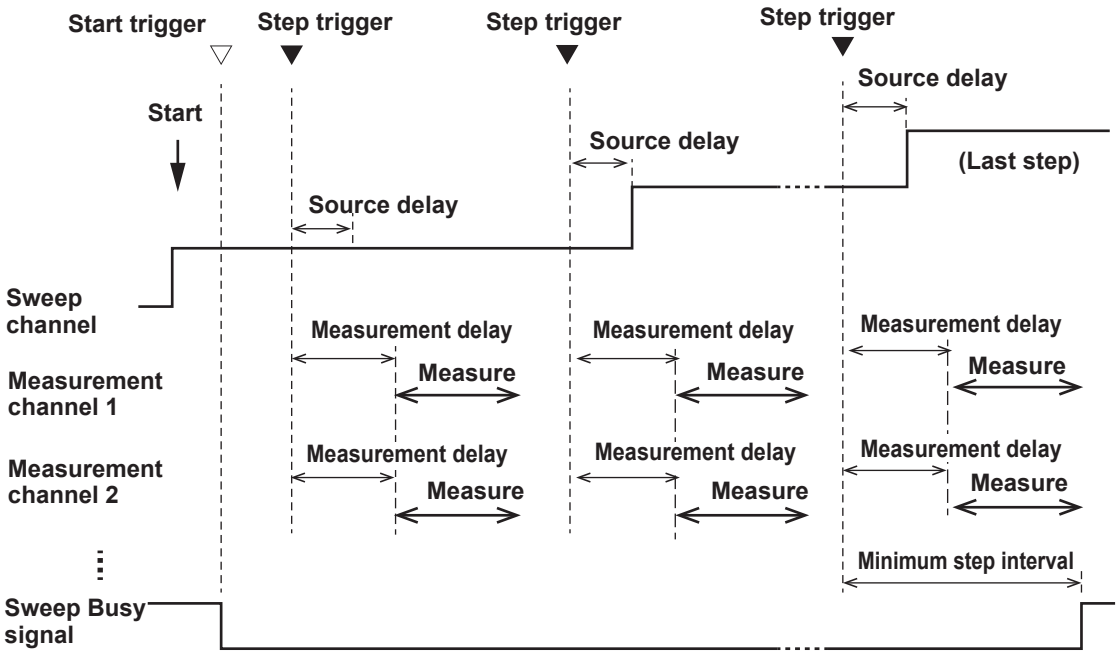
Overview

Sweep is an operation that repeats the source operation with a single source trigger. This requires a start trigger for starting the sweep operation (see chapter 2, “Trigger”) in addition to the source trigger for starting the source operation.

When sweeping starts, the instrument enters a start trigger wait sate. When it receives a start trigger, it enters a step trigger wait state. After sweeping starts, the instrument repeats the source action for the specified number of counts (1 to 1000, or infinity) while changing the source level every time a step trigger (Step Trigger or Source Trigger) is received. When sweeping finishes, the instrument enters the sweep start wait state once again. To stop sweeping and make the instrument transition the start trigger wait state, use the STOP SWEEP button.

The SwpBusy (Sweep Busy) signal can be transmitted from a module’s output terminals (Front Output1 and Front Output2) or the frame’s output terminals (Trig OUT1 and Trig OUT2). When this signal output is at low level, it indicates that sweeping is in progress. You can use this signal to synchronize other devices with the SMUs’ sweep operations.

One sweep channel and several measurement channels can be synchronized on multiple SMUs installed in slots.

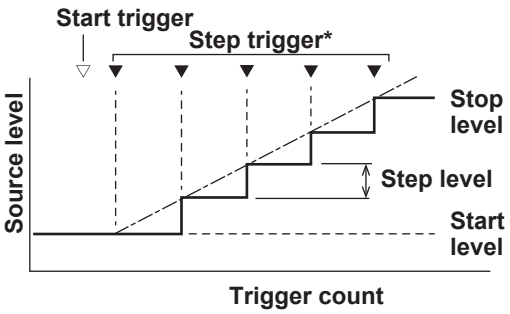


When started, the start level value or pulse level value is generated from the sweep channel.

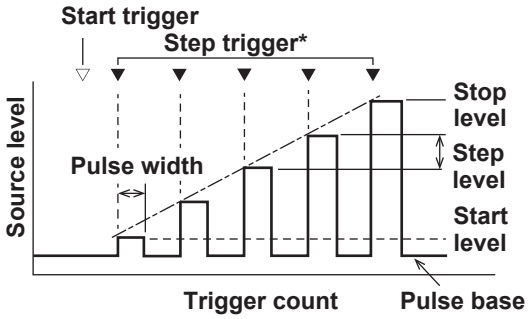
Linear sweep

With the horizontal scale is set to trigger count and the vertical scale to the source level, sweeping is performed from the specified start level to the stop level at the specified step-level steps.

DC output (shape: DC)



Pulse output (shape: pulse)

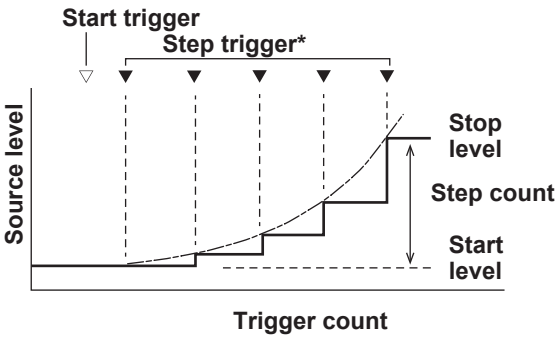


*** Set with Source Trigger when using module settings**

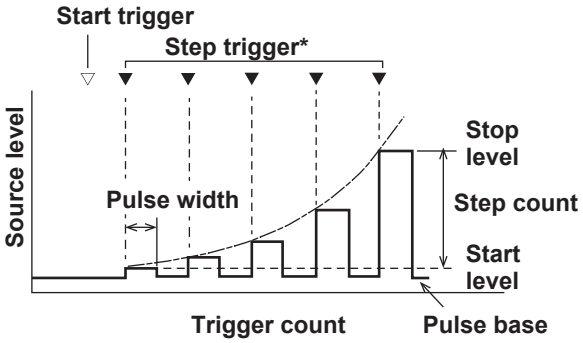
Log sweep

With the horizontal scale is set to trigger count and the vertical scale to the source level, sweeping is performed exponentially in a step pattern obtained by dividing the source levels from the start level to the stop level by the specified step count.

DC output (shape: DC)



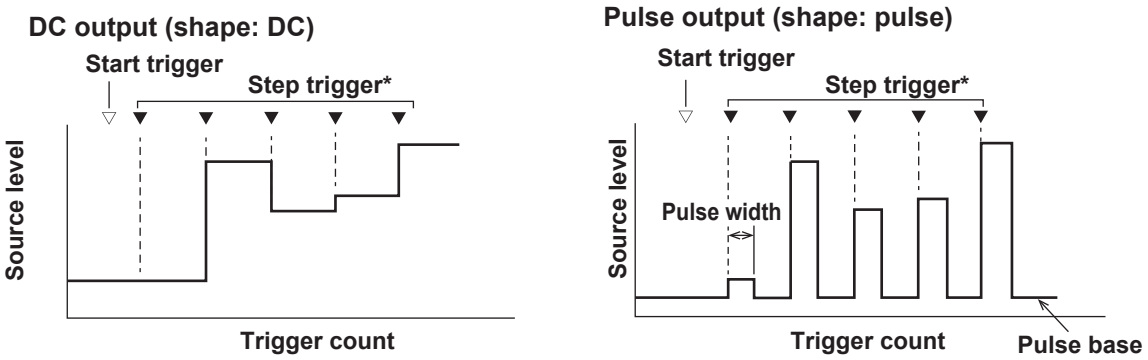
Pulse output (shape: pulse)



*** Set with Source Trigger when using module settings**

Program sweep

A program file (sweep pattern file in CSV format) created on a PC is loaded into the instrument, and sweeping is performed according its pattern.
You can set the step count up to 100001. If the number of sweep pattern steps exceeds 100001, only the first 100001 steps are loaded.



*** Set with Source Trigger when using module settings**

How to create program files

Program files are created in comma-separated (CSV) format.
A program file consists of a condition block that defines sweep conditions and a level definition block that defines the source levels.

```
ProgramSweepFile
Func, V
SrcRange, 6
Limit, 0.2, -0.2
Shape, PULSE
PlsWidth, 0.05
Base, 0.1

1.23
2.34
5.45
```

Condition block

Level definition block

Condition block

The following items are included in the condition block.

Label	Description	Value	Required	Notes
Func	Source function	V or I	✓	
SrcRange	source range	Range in units of volts when Func is V Range in units of amperes when Func is I	✓	
Limit	limiter	Limiter value in units of amperes when Func is V Limiter value in units of volts when Func is V The first value is the upper limiter and the second the lower limiter.		When omitted, the limiter is off.
Shape	source waveform	DC or PULSE		DC when omitted
PlsWidth	Pulse width	Pulse width in units of seconds		Required when Shape is PULSE
Base	Pulse sweep base level	Level in units of volts when Func is V Level in units of amperes when Func is I		Required when Shape is PULSE

Level definition block

Source levels are defined.

- Include the source level of a single step in each row.
- Up to 100001 levels can be defined.
- The level is in units of volts when the source function is V and amperes when the source function is I.

Notes on creating program files

- Case-insensitive.
- Use CR+LF or LF for the line feed code.
- The first row is fixed to “ProgramSweepFile.” If this is not followed, an error will occur.
- Lines that only contain a line feed are ignored.
- If required items are not present, an error will occur.

Source level setting range and resolution (AQ23811A)

Voltage sweep level

source range	Setting range	Setting resolution
6 V	–6.0000 V≤X≤6.0000 V	100 µV

Current sweep level

source range	Setting range	Setting resolution
200 nA	–200.000 nA≤X≤200.000 nA	1 pA
2 µA	–2.00000 µA≤X≤2.00000 µA	10 pA
20 µA	–20.0000 µA≤X≤20.0000 µA	100 pA
200 µA	–200.000 µA≤X≤200.000 µA	1 nA
2 mA	–2.00000 mA≤X≤2.00000 mA	10 nA
20 mA	–20.0000 mA≤X≤20.0000 mA	100 nA
200 mA	–200.000 mA≤X≤200.000 mA	1 µA
600 mA	–600.00 mA≤X≤600.00 mA	10 µA

Sweep shape (Shape)

The two available sweep shapes are DC and pulse.

DC: A constant value is sourced until a step trigger occurs.

Pulse: A pulse waveform is sourced with the specified pulse width.

Load capacitance, load inductance, and load resistance (Capacitance/Inductance/Resistance)

The source value can be converged smoothly to the specified output value by setting values appropriate for the source target load.

- Load capacitance: Valid for voltage sourcing.
- Load inductance: Valid for current sourcing.
- Load resistance: Valid for voltage and current sourcing.

The minimum value is set by default. Change it when adjusting the source waveform.

Start trigger (Start Trigger)

Sweeping starts by using the external signal received through TrigIN1 or TrigIN2 on the frame's rear panel as a trigger.

When a start trigger is not assigned, sweeping starts when measurement is started from the panel. This is the same setting as the Sweep Start Trigger in the module settings. However, in the module settings, the start trigger is specified with a bus trigger that TrigIN1 or TrigIN2 has been assigned to. If you want to assign BUS Trigger1 to 9 or a module's trigger input to the start trigger, configure Sweep in the module settings.

Step trigger (Step Trigger)

The step trigger specifies when the sweep moves to the next step. The following signals can be assigned to the step trigger.

- External signal received through frame's TrigIN1 or TrigIN2
- Frame's internal timer (Cyclic)
- Internal signal indicating measurement completion (Fastest)

In the module settings, the start trigger is specified with a bus trigger that TrigIN1, TrigIN2, or Timer has been assigned to.

Fastest is only available in the application.

Measure (Measure)

Measurement starts when a step trigger is detected.
In the sweep settings of application, up to 17 channels can be set to measurement channels (when nine 2-channel SMUs are installed in a 9-slot frame).
You can set the bias current, bias voltage, integration time, measurement delay, math (power or resistance), and limiter.

Bias function (Bias Function, Bias Level)
The bias function can be used to source a bias current or bias voltage across the measurement terminals.
However, since using the bias function affects the measured value, turn it off unless bias current or bias voltage is required.

Integration time (Integ Time)
If you set a long integration time, the measurement takes longer, but the stability of the measured values increases. Setting the integration time to an integer multiple of the power line cycle (nPLC) has the effect of eliminating noise in the power supply frequency components. For high precision measurement, use an integer value.

Measurement delay (Measure Delay)
Measurement delay is the wait time from measurement trigger detection to measurement operation. You can adjust the timing between the measurement trigger and the measurement operation by changing this setting. Measurement operation includes ±1 μs of jitter. Measurements made when the waveform of the device under measurement (DUT) is in a transient state will not be stable due to the effects of jitter. Set the measurement delay so that measurement starts after the waveform of the device under measurement becomes sufficiently stable.

Math (Math)

Power (Electric Power) or resistance (Resistance) is computed from the measured voltage and current.

Either power or resistance can be computed.

Limiter (Limiter)

The limiter can be turned on to control the source value so that measure values do not exceed the specified upper or lower limits.

The setting range and resolution of each range are as follows.

Setting	Measurement range	Setting range	Setting resolution
Voltage limiter upper limit	6 V	0.0050 V to 6.0000 V	100 µV
Voltage limiter lower limit	6 V	–6.0000 V to –0.0050 V	100 µV
Current limiter upper limit	200 nA	10.000 nA to 200.000 nA	1 pA
	2 µA	0.20001 µA to 2.00000 µA	10 pA
	20 µA	2.0001 µA to 20.0000 µA	100 pA
	200 µA	20.001 µA to 200.000 µA	1 nA
	2 mA	0.20001 mA to 2.00000 mA	10 nA
	20 mA	2.0001 mA to 20.0000 mA	100 nA
	200 mA	20.001 mA to 200.000 mA	1 µA
	600 mA	200.01 mA to 600.00 mA	10 µA
Current limiter lower limit	200 nA	–200.000 nA to –10.000 nA	1 pA
	2 µA	-2.00000 µA to -0.20001 µA	10 pA
	20 µA	-20.0000 µA to -2.0001 µA	100 pA
	200 µA	-200.000 µA to -20.001 µA	1 nA
	2 mA	–2.00000 mA to –0.20001 mA	10 nA
	20 mA	–20.0000 mA to –2.0001 mA	100 nA
	200 mA	–200.000 mA to –20.001 mA	1 µA
	600 mA	–600.00 mA to –200.01 mA	10 µA

Repeat count (Repeat)

Set the sweep repeat count.

The available range is 1 to 1000. You can also specify Infinity. If set to 0, the value is set to infinity.

For example, if you set the count to 5, sweeping will be repeated five times, and then the instrument will return to the start-wait state. If you select Infinity, after sweeping starts, sweeping will be repeated until sweeping is stopped or output is turned off.

Automatic saving of measured results

Results measured with the sweep function are saved automatically.

The file format is binary (.bin) or CSV (.csv).

An example of the CSV format is provided below.

Sweep Application Result Data
Date Time, 2024/08/14 16:37:05 — **Date and time**

Slot-Chan, , 1-1, 1-2 — **Slot number, channel number**
Model, AQ23811A, AQ23811A,···· — **Module model**
Integral Time(S), +1.00000000E-00E, +1.00000000E-00E — **Integration time**
Upper Limit (V), +3.4500000000E-001, +3.4500000000E-001
Lower Limit (V), -3.4500000000E-001, -3.4500000000E-001 — **Limit**

Data Points, 100

,	,	Slot1-1,	, ,	Slot1-2,	
Sweep No,	Data No,	Voltage(V),	Current(A),	Power(W),	Voltage(V), ····
0,	0,	+1.23400000E-001,	+2.3400000E-002,	2.87820000E-003,	+1.23400000E-001,····
,	1,	+1.23400000E-001,	+2.3400000E-002,	2.87820000E-003,	+1.23400000E-001,····
,	2,	+1.23400000E-001,	+2.3400000E-002,	2.87820000E-003,	+1.23400000E-001,····
….					
,	99,	+1.23400000E-001,	+2.3400000E-002,	2.87820000E-003,	+1.23400000E-001,····
1,	0,	+1.23400000E-001,	+2.3400000E-002,	2.87820000E-003,	+1.23400000E-001,····
,	1,	NaN,	NaN	NaN,	+1.23400000E-001,····
,	2,	+1.23400000E-001,	+2.3400000E-002,	2.87820000E-003,	+1.23400000E-001,····
….					
,	99,	+1.23400000E-001,	+2.3400000E-002,	2.87820000E-003,	+1.23400000E-001,····

Data block

4.1 Data That Can Be Saved

The instrument can store the following types of data in its internal storage or USB storage.

- Measurement data
- Program sweep's program files
- Error log
- Frame's setup data, modules' setup data
- Screen images

Measurement data

Measured data of each module can be saved.
The save format is binary (.BIN), or CSV (.CSV).

Program sweep's program files

The format is CSV (.CSV).
For how to create program files, see section 3.1, "Sweep."

Error log

Errors that occur are saved automatically to a log file.
The save format is text.
The extension is .LOG.

Setup data

Settings for the frame and modules can be saved.
Save setup data can also be loaded.
The extensions are as follows:
AQ23811A(SMU): .811
Frame: .FRM
The file name can be set as desired.

Screen image data

Screen images can be saved in PING format (.PNG).
File name: AQ2300_SC_xxx.PNG
xxx: automatically assigned sequence number (000 to 999)

4.2 File Operations

The following file operations can be performed on the instrument's internal storage and USB storage connected to the instrument via USB.

- Creating folders
- Renaming and deleting folders and files
- Copying files

Creating folders

Folders can be created with names of your choice.
Measurement data and setup data can be saved in the created folders.

Renaming Folders and Files

Folder and files can be renamed.
Note that changing the extension may result in the instrument not being able to recognize the file.

Copying and deleting folders and files

Folders and files can be copied to a different folder or be deleted.

5.1 Remote Connection

The instrument can be connected and controlled from a PC.
HiSLIP, GPIB, and USB cannot be used simultaneously.

RawSocket

Direct transmission is possible through a TCP socket connection.
A single instrument can be connected to a single PC.
IPV4 and IPv6 are supported.

Item	Specifications
Simultaneous connections	1
Port	Variable
Protocol	IPv4/TCP, IPv6/TCP

HiSLIP

A protocol mainly used for controlling instruments.
A single instrument can be connected to a single PC.
IPv4 and IPv6 are supported.

Item	Specifications
Simultaneous connections	1
Standard	IVI High-Speed LAN Instrument Protocol 1.1
Protocol	IPv4/TCP, IPv6/TCP
Communication library	Tmctl, NI-VISA

GP-IB

The instrument is controlled using GP-IB.

Address (Address)

- You can set the value in the range of 0 to 30.
- Each device that can be connected via GP-IB has a unique address within the GP-IB system. This address is used to distinguish between different devices. Therefore, you must assign a unique address to the instrument when connecting it to a PC or other device.
- When the controller is communicating with the instrument or with other devices through GP-IB, do not change the address.

Notes on connections

- Multiple cables can be used to connect multiple devices. However, no more than 15 devices, including the controller, can be connected on a single bus.
- When connecting multiple devices, you must assign a unique address to each device.
- Use cables that are 2 m or shorter in length to connect devices.
- Keep the total length of the cables under 20 m.
- When devices are communicating, have at least two-thirds of the devices on the bus turned on.
- To connect multiple devices, use a star or daisy-chain configuration. Loop and parallel configurations are not allowed.

USB

The instrument is controlled using USB.

A USB driver is necessary to connect the instrument to a PC through a USB port.

• Install the YOKOGAWA USB driver in your PC.

• Do not use USB drivers (or software) supplied by other companies.

For information about how to obtain the YOKOGAWA USB driver, contact your nearest YOKOGAWA dealer. You can also access the YOKOGAWA USB driver download page from our member site (https://myportal.yokogawa.com/) and download the driver.

Item	Specifications
USB Class	USB TMC(Test and Measurement Class)
Protocol	USB 2.0
Communication library	Tmctl
Other	Device search feature support

5.2 Network Configuration

The instrument is connected to a network using Ethernet.

IPv4 and IPv6 are supported.

DHCP server is also supported.

If DHCP set to ON, you do not need to set the IP address, subnet mask, or default gateway.

Item	Specifications
Speed	10M/100M/1000M
Protocol	IPv4, IPv6, HiSLIP, SMB, SSH, TCP(RawSocket)

5.3 Other Features

Interlock (Inter Lock)

Locks (Disables) the output from modules installed in the instrument.
Modules do not produce output if the included interlock connector plug (A1288JA) is not connected to the remote interlock connector on the rear panel of this instrument or if Inter Lock is set to Lock.
A password is required to clear the interlock. The default password is 12345.

Setting the date and time (Time/Date)

You can set the date and time of this instrument.

Turning the beep sound on and off (Volume)

You can turn on or off the beep sound that is generated when you operate the touch panel.

Display (Display)

You can set the LCD backlight brightness, mode, and screen background brightness.

LCD

The LCD backlight brightness can be adjusted in the range of 0 (darkest) to 8 (brightest).
Setting it to 0 turns off the backlight.

Theme

The screen theme can be set to light or dark.

File sharing (File Sharing)

The instrument's internal storage and external storage connected to the instrument can be read or written to from a PC or similar device through a network.
User authentication is performed using a user name and password.

System information (System Information)

You can view system information such as the instrument's firmware version and hardware version.

Viewing and saving log information (System Log)

The following information can be saved internally as a log and viewed later. Log information can also be zipped and saved to USB and other storage connected to the instrument.

System log

- Time firmware was started and power frequency
- Time firmware was shutdown
- Time restart took place
- Update time, version
- Time module was updated, module type, firmware version
- Time network was connected, configuration
- Time clock was set, set time
- Time remote control took place, configuration
- Time fan alarm occurred
- Time temperature alarm occurred, temperature
- Time interlock state changed, state
- Time beep sound was set, setting
- Backlight time, setting
- Time self-test was executed, test results
- Time module was installed, slot number, module type, serial number (S/N)
- Time module was removed, slot number

User log

- Time operation error occurred, error code, error location (frame or slot number)
- Time application was started, application type
- Time application was closed, application type

Self-test (Self Test)

Self-tests can be carried out on the DRAM, file system, and battery, and the results can be viewed.

Initializing settings

The frame settings and module settings can be initialized.
There are two modes for initializing the frame settings: a mode for initializing the settings including network settings and the internal storage and another mode for initializing the settings except network settings and the internal storage.

Reset all Module

All module settings are initialized.

Reset Frame Setting

Frame settings are initialized. Remote settings and network settings are not initialized.

Reset Frame to factory default

Frame settings are initialized to factory default values, and the frame is restarted. Remote settings and network settings are also initialized. All data in the internal storage are also deleted.

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T

U

V

User's Manual

AQ23011A, AQ23012A Frame

YOKOGAWA
Yokogawa Test & Measurement Corporation

IM AQ23011A-02EN
1st Edition

Thank you for purchasing the AQ23011A or AQ23012A Frame. The AQ2300 Series consists of the AQ23011A/AQ23012A Frame and several modules. The frame can control the source and measure modules installed in its frame.
This user's manual explains the operating procedures of the AQ2300 Series including its modules. To ensure correct use, please read this manual thoroughly before beginning operation. Keep this manual in a safe place for quick reference.
The manuals for this instrument are listed on the next page. Please read all manuals.

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

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

Notes

- The contents of this manual are subject to change without prior notice as a result of improvements to the product's performance and functionality. Refer to our website to view our latest manuals.
- The figures given in this manual may differ from those that actually appear on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
- Copying or reproducing all or any part of the contents of this manual without the permission of YOKOGAWA is strictly prohibited.

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1st Edition: October 2024 (YMI)

Revisions

- 1st Edition: October 2024

Manuals

The following manuals, including this one, are provided as manuals for this instrument. Please read all manuals.

Manuals included with the product

Manual Title	Manual No.	Description
AQ23011A, AQ23012A Frame Getting Started Guide	IM AQ23011A-03EN	Provided as a printed manual. Explains the handling precautions, common operations, troubleshooting measures, and specifications of this instrument.
AQ23011A, AQ23012A Frame	IM AQ23011A-92Z1	Document for China
Safety Instruction Manual	IM 00C01C01-01Z1	Safety manual (European languages)

Manuals included in the frame's internal storage

The following manuals are included in the internal storage of the frame (AQ23011A, AQ23012A). Download them to your PC for use. For how to download them, see "How to View the User's Manual" in the Getting Started Guide (IM AQ23011A-03EN).
You can also download them from the YOKOGAWA website.

Manual Title	Manual No.	Description
AQ23011A, AQ23012A Frame Features Guide	IM AQ23011A-01EN	Explains all the instrument's features including its modules, but excluding the remote control features. This single PDF file contains both the Features Guide and the User's Manual.
AQ23011A, AQ23012A Frame User's Manual	IM AQ23011A-02EN	This document. Explains how to operate this instrument. This single PDF file contains both the Features Guide and the User's Manual.
AQ23011A, AQ23012A Frame Communication Interface User's Manual	IM AQ23011A-17EN	This manual explains the instrument's remote control features, how to configure it, and the commands used to control this instrument from a PC through the interface.

The "EN and "Z1" in the manual numbers are the language codes.

Conventions used in this manual

Prefixes k and K

Prefixes k and K used before units are distinguished as follows:

k:	Denotes 1000.	Example: 12 kg, 100 kHz
K:	Denotes 1024.	Example: 720 KB (file size)

Contents

1.1 Source (Source)

"Source range," "Source waveform," "Limiter," "Source trigger,"
"Load resistance/load capacitance/load inductance,"
"Source delay," "Zero-set function" in the Features Guide

Procedure

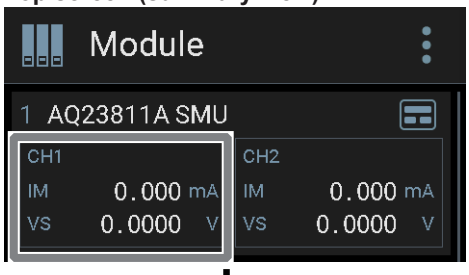
Setting the voltage source and current source

You can set the voltage source and current source on the summary view or detail view.

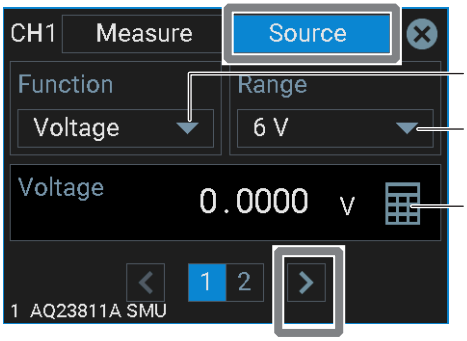
Summary view

1. Tap a channel view (area inside the frame shown below) on the top screen (summary view).
2. Tap the Source tab on the CH screen. A CH source screen appears. The settings are the same as those described in "Setting the CH source (detail view)."

Top screen (summary view)



CH source screen (page 1/2)

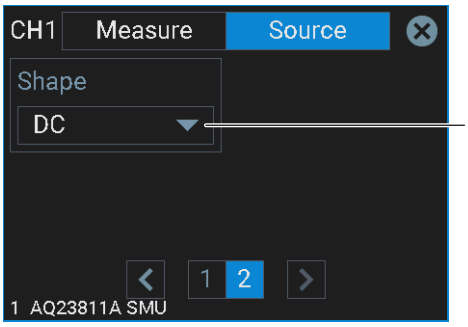


Switch the source function (Voltage, Current).

See "Selecting the source range" in "Setting the CH source (detail view)."

Set the source level.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

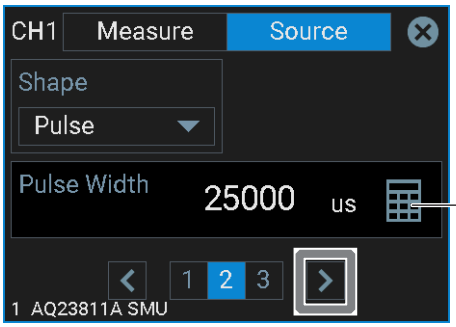
CH source screen (page 2/2)



Select the source waveform (DC, Pulse).

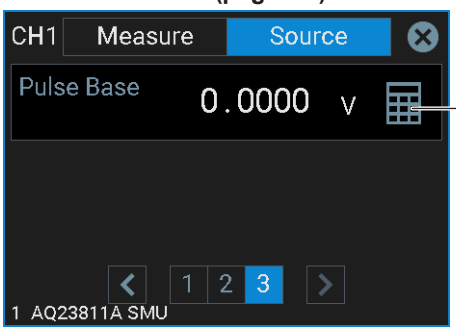
When the source waveform is Pulse

CH source screen (page 2/3)



Set the pulse width.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

CH source screen (page 3/3)

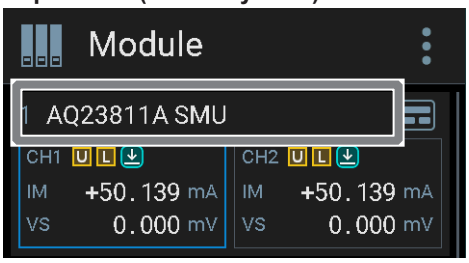


Set the pulse base.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

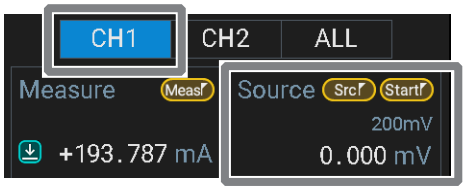
Detail view

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Source (area inside the frame shown below). A CH source screen appears.

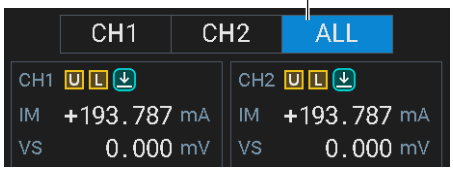
Top screen (summary view)



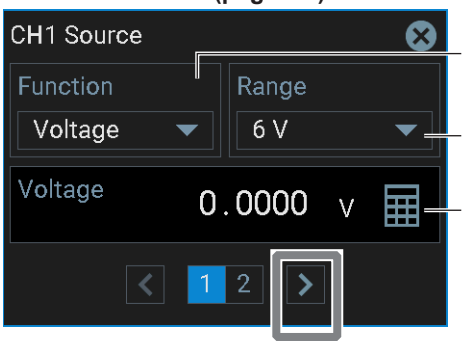
Detail view



If ALL is selected, you cannot set Source (view only).



CH source screen (page 1/2)

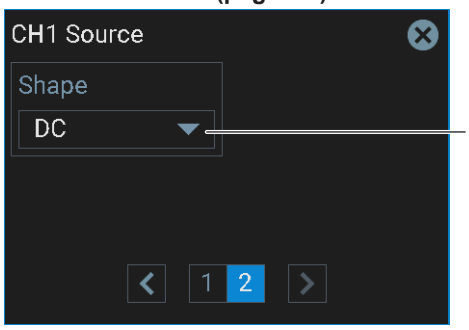


Switch the source function (Voltage, Current).

See "Selecting the source range."

Set the source level.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

CH source screen (page 2/2)



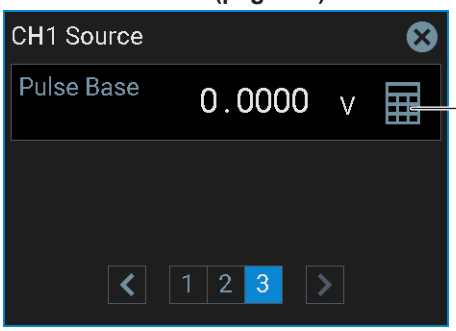
Select the source waveform (DC, Pulse).

When the source waveform is Pulse

CH source screen (page 2/3)

Set the pulse width.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

CH source screen (page 3/3)

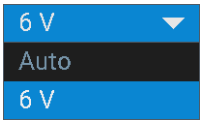


Set the pulse base.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Selecting the source range

4. Tap the Range pull-down button. The following menu appears.

When the source function is Voltage



Select the range.

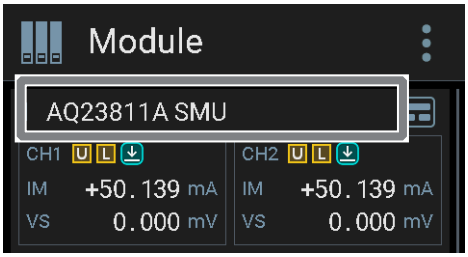
When the source function is Current

Select the range.

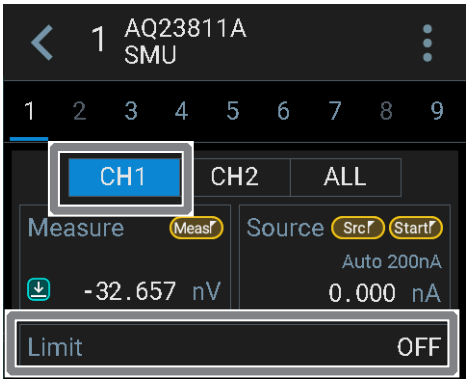
Setting the limiter

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap **Limit** (area inside the frame shown below). A limiter setting screen appears.

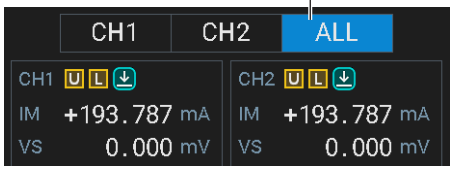
Top screen (summary view)



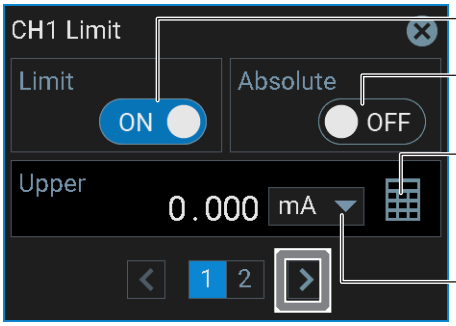
Detail view



Setting is not possible when ALL is selected.



Limiter setting screen (page 1/2)



Turns the limiter on and off

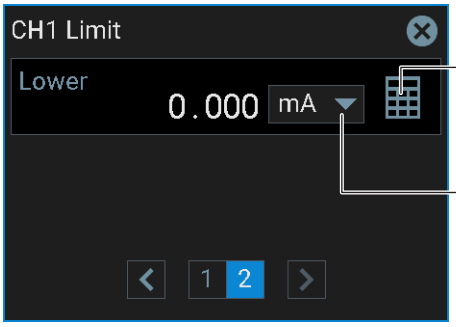
Turns absolute on and off

Set the high limiter value.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Set the unit of the high limiter value.

When absolute is off

Limiter setting screen (page 2/2)

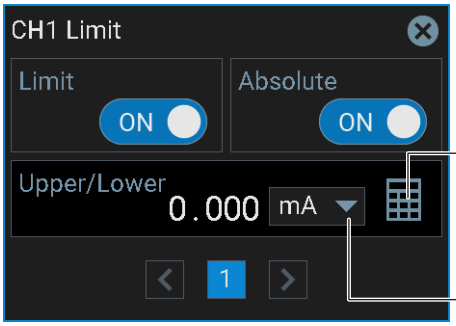


Set the low limiter value.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Set the unit of the low limiter value.

When absolute is on

Limiter setting screen

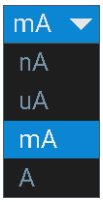


Set the high limiter value and low limiter value.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Set the unit of the limiter value.

Setting the unit of the limiter value

When the source function is Voltage



Select the unit.

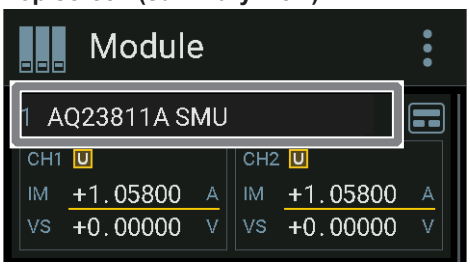
When the source function is Current

Select the unit.

Selecting the source trigger source

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap **Source Config** (area inside the frame shown below). A source setting screen appears.

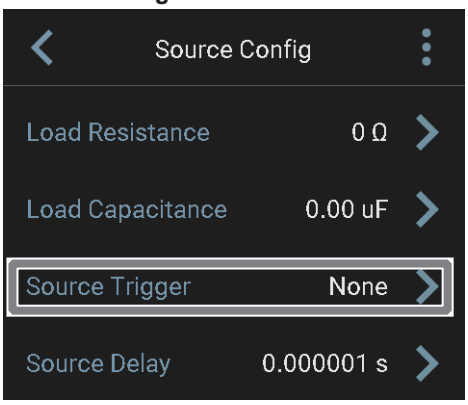
Top screen (summary view)



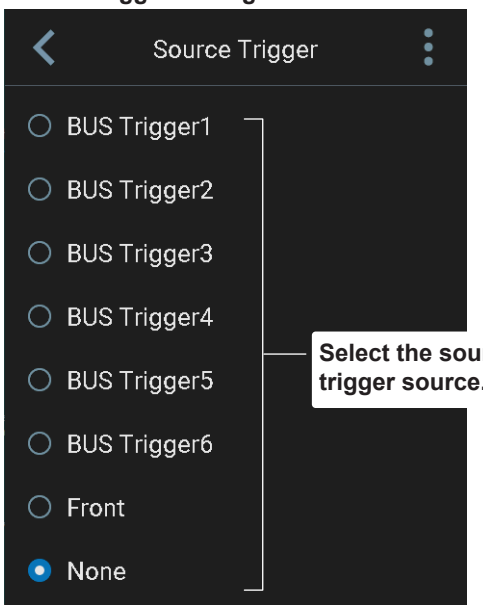
Detail view

If you select ALL, CH1 and CH2 can be configured.

Source setting screen



Source trigger setting screen

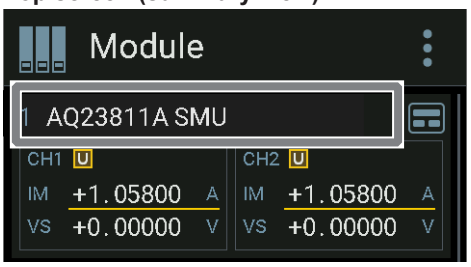


Select the source trigger source.

Setting the source delay

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap **Source Config** (area inside the frame shown below). A source setting screen appears.

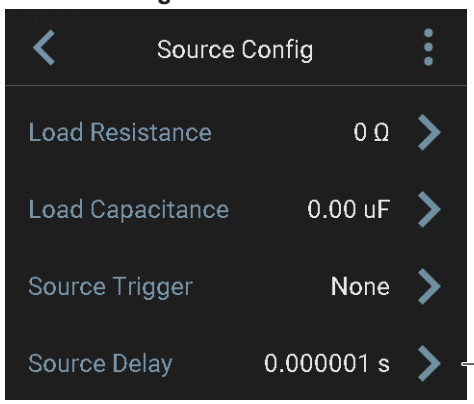
Top screen (summary view)



Detail view

If you select ALL, CH1 and CH2 can be configured.

Source setting

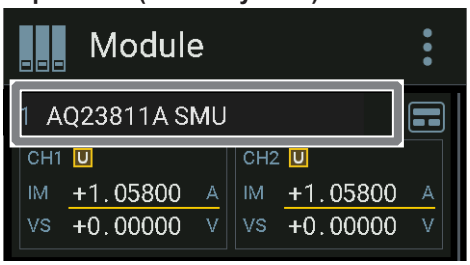


Set the source delay value.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Setting the load resistance and load capacitance (when the source function is voltage)

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap **Source Config** (area inside the frame shown below). A source setting screen appears.

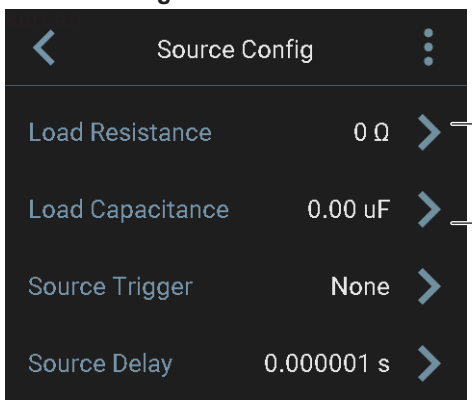
Top screen (summary view)



Detail view

If you select ALL, CH1 and CH2 can be configured.

Source setting



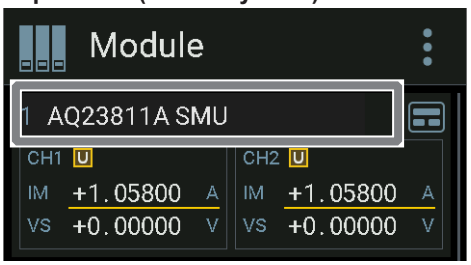
Set the load resistance.
This is not common with the load resistance of current source. For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Set the load capacitance.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Setting the load resistance and load inductance (when the source function is current)

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap **Source Config** (area inside the frame shown below). A source setting screen appears.

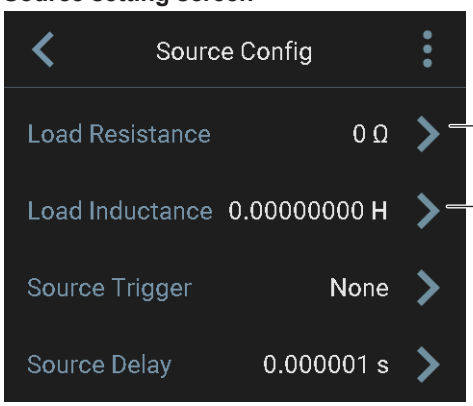
Top screen (summary view)



Detail view

If you select ALL, CH1 and CH2 can be configured.

Source setting screen



Set the load resistance.
This is not common with the load resistance of voltage source. For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Set the load inductance.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

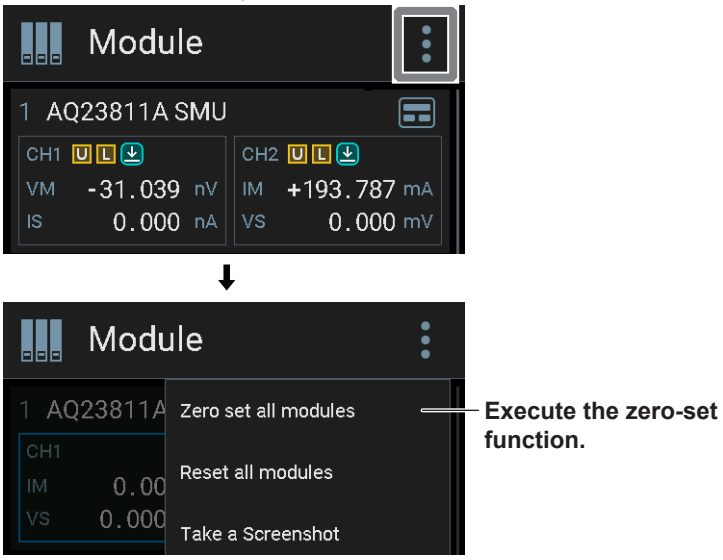
Zero-set function

You can execute the zero-set function on the summary view or detail view.
On the summary view, the zero-set function can be executed on all modules.
On the detail view, the zero-set function can be executed on each channel.

Summary view

On the top screen (summary view), tap the menu icon ( ).

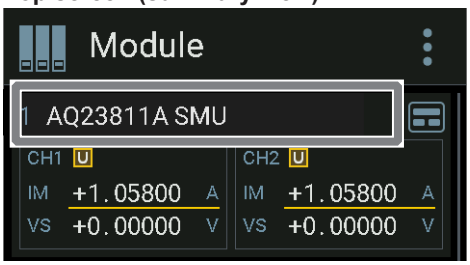
Top screen (summary view)



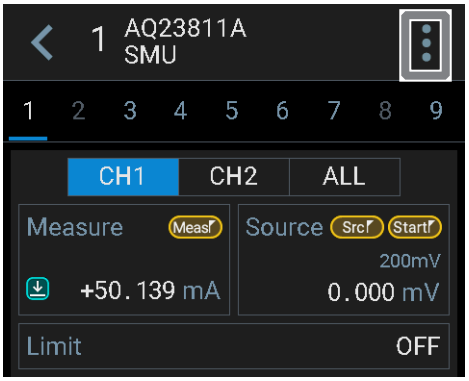
Detail view

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap the menu icon (area inside the frame shown below).

Top screen (summary view)



Detail view

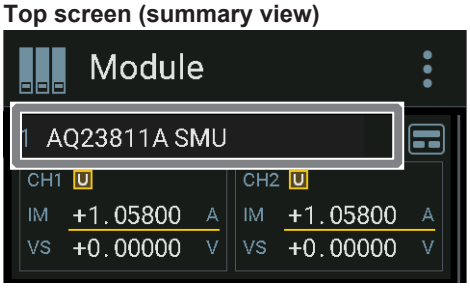


Execute the zero-set function.

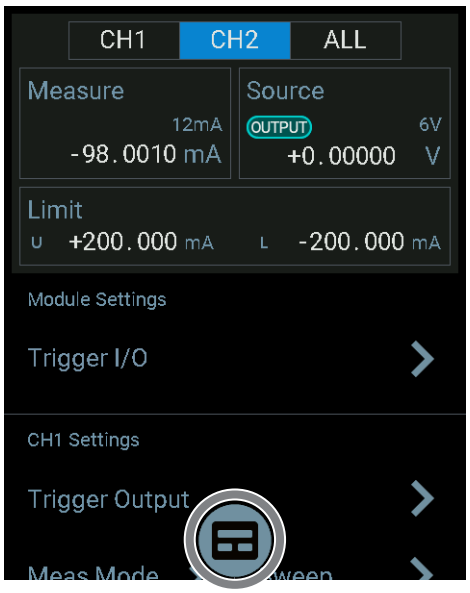
Turning the output on and off

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap the action button (area inside the frame shown below). An action screen appears.

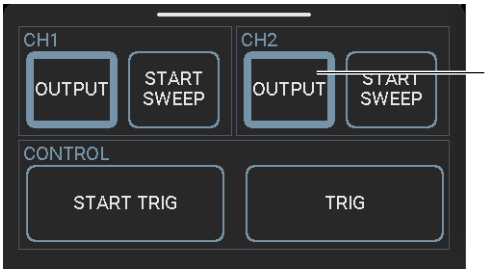
Top screen (summary view)



Detail view

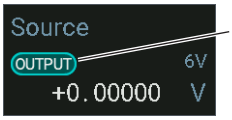


Action screen



Turns output on and off
To turn the output on, hold down for about 2 seconds.
To turn the output off, tap it once.

Button when turned on



Source screen shows "OUTPUT" when turned on.

Explanation

Source function (Function)

There are two functions: voltage and current.

<<Supported commands>>

Function	Command
Switch the source function	:SOURce[m][:CHANnel[d]]:FUNCtion

Source range (Range)

Voltage source range

Source range	Range generated	Resolution
6 V	–6.0000 to 6.0000 V	100 µV

Current source range

Source range	Range generated	Resolution
200 nA	–200.000 to 200.000 nA	1 pA
2 µA	–2.00000 to 2.00000 µA	10 pA
20 µA	–20.0000 to 20.0000 µA	100 pA
200 µA	–200.000 to 200.000 µA	1 nA
2 mA	–2.00000 to 2.00000 mA	10 nA
20 mA	–20.0000 to 20.0000 mA	100 nA
200 mA	–200.000 to 200.000 mA	1 µA
600 mA	–600.00 to 600.00 mA	10 µA

Note

- If you change the range while a capacitive or inductive load such as a capacitor or coil is connected, an abnormal load may be detected due to the energy build-up in the load, and the output may turn off.
- If the range is changed, a glitch will occur in the output for several µs to several hundred µs. To avoid this glitch, use a fixed range appropriate for the required maximum value rather than using auto range.
- The preset source level never change as a result of changing the range. However, if the fraction is rounded within the range generated of the new range or the level falls outside the range generated, the level is set to the maximum value of the new range (minimum value in the case of negative polarity).
- If you enter a source level exceeding the set range, the maximum value within the range generated is assigned.

<<Supported commands>>

Function	Command
Voltage range	:SOURce[m][:CHANnel[d]][:VOLTage]:RANGe
Current range	:SOURce[m][:CHANnel[d]][:CURRent]:RANGe

Limiter (Limit)

Turning the limiter on and off

ON: The limiter is activated at the specified limiter value.

OFF: The limiter is activated at the maximum or minimum value of the range generated. The limiter value is not displayed.

Absolute

ON: Set to the same absolute limiter value but different polarities

Example High limiter value: +1.00000 mA
Low limiter value: –1.00000 mA

OFF: Set to the specified limiter values with different polarities

Example High limiter value: +1.50000 mA
Low limiter value: –1.00000 mA

Setting the limiter value

In voltage source mode, the current limiter is enabled. In current source mode, the voltage limiter is enabled.

A limiter range suitable for the specified limiter value is selected automatically.

Voltage limiter upper limit

Source range	Setting range	Setting resolution
6 V	0.0050 V to 6.0000 V	100 µV

Voltage limiter lower limit

Source range	Setting range	Setting resolution
6 V	–6.0000 V to –0.0050 V	100 µV

Current limiter upper limit

Source range	Setting range	Setting resolution
200 nA	10.000 nA to 200.000 nA	1 pA
2 µA	0.20001 µA to 2.00000 µA	10 pA
20 µA	2.0001 µA to 20.0000 µA	100 pA
200 µA	20.001 µA to 200.000 µA	1 nA
2 mA	0.20001 mA to 2.00000 mA	10 nA
20 mA	2.0001 mA to 20.0000 mA	100 nA
200 mA	20.001 mA to 200.000 mA	1 µA
600 mA	200.01 mA to 600.00 mA	10 µA

Current limiter lower limit

Source range	Setting range	Setting resolution
200 nA	–200.000 nA to –10.000 nA	1 pA
2 µA	–2.00000 µA to –0.20001 µA	10 pA
20 µA	–20.0000 µA to –2.0001 µA	100 pA
200 µA	–200.000 µA to –20.001 µA	1 nA
2 mA	–2.00000 mA to –0.20001 mA	10 nA
20 mA	–20.0000 mA to –2.0001 mA	100 nA
200 mA	–200.000 mA to –20.001 mA	1 µA
600 mA	–600.00 mA to –200.01 mA	10 µA

Display When a Limiter Is Activated

High limiter activated indication (U) when the high limiter is activated.

Low limiter activated indication (L) when the low limiter is activated.

Note

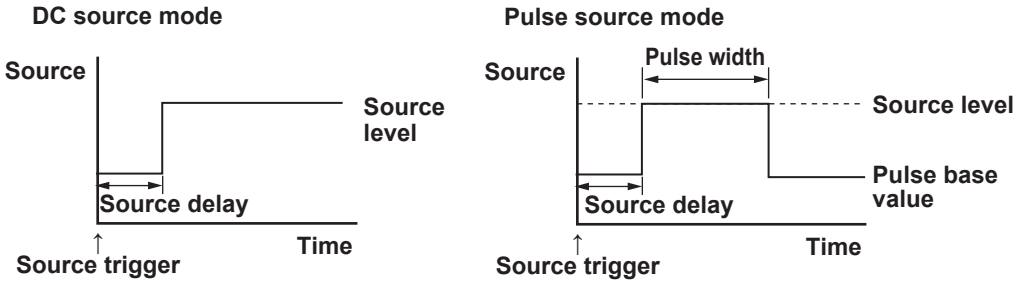
- If the limit value is set outside the range generated of the selected range, the limiter is activated at the maximum and minimum values of the source range. For example, during voltage sourcing, if the source range is set to +6 V, the source value to +6 V, and the limiter value to ±650 mA, the limiter is activated at +600 mA and –200 mA.
- If the limiter range is changed, a glitch will occur in the output.

<<Supported commands>>

Function	Command
Turn the voltage limiter on and off	:SOURce[m][:CHANnel[d]][:VOLTage]:PROTection[:STATe]
Turn absolute on and off	:SOURce[m][:CHANnel[d]][:VOLTage]:PROTection:LINKage
Set the voltage limiter value	:SOURce[m][:CHANnel[d]][:VOLTage]:PROTection:LEVel
Set the voltage limiter upper limit	:SOURce[m][:CHANnel[d]][:VOLTage]:PROTection:UPPer
Set the voltage limiter lower limit	:SOURce[m][:CHANnel[d]][:VOLTage]:PROTection:LOWer
Turn the current limiter on and off	:SOURce[m][:CHANnel[d]][:CURRent]:PROTection[:STATe]
Turn absolute on and off	:SOURce[m][:CHANnel[d]][:CURRent]:PROTection:LINKage
Set the current limiter value	:SOURce[m][:CHANnel[d]][:CURRent]:PROTection:LEVel
Set the current limiter upper limit	:SOURce[m][:CHANnel[d]][:CURRent]:PROTection:UPPer
Set the current limiter lower limit	:SOURce[m][:CHANnel[d]][:CURRent]:PROTection:LOWer

Source waveform (Shape)

There two modes: DC source and pulse source.



If you select pulse source mode, set the pulse base value (see “Setting the pulse base”) and pulse width (see “Setting the pulse width”).

<<Supported commands>>

Function	Command
Source waveform	:SOURce[m][:CHANnel[d]]:SHAPe

Source level

See the Range generated column in the tables under fixed range in “Setting the source range.”

Note

The following effects result from the following output capacitance that exists between the instrument’s OUTPUT Hi and OUTPUT Lo terminals.

- If the load changes drastically such as when a short circuit occurs in voltage source mode, a large transient discharge current is generated from the output capacitance.
- If a voltage source (such as a power supply, amplifier, or signal generator) is connected as a load, the load voltage source may be unstable due to the output capacitance.
- If the source range is not set to auto range, the source level is limited to the range generated in that range.

<<Supported commands>>

Function	Command
Voltage level	:SOURce[m][:CHANnel[d]][:VOLTage]:LEVel
Current level	:SOURce[m][:CHANnel[d]][:CURRent]:LEVel

Source trigger source (Source Trigger)

This is the signal source that starts the source operation. Select from the following options.

BUS Trigger1 to 9: trigger signal assigned to the bus trigger

Front: trigger signal received through the trigger input terminal on the front panel

None: Source value changes simply by changing the setting, without applying a trigger.

Disable: trigger generated using a panel control or communication command

Note

- A trigger sampling error occurs if a new source trigger is generated while a source operation (source busy) is in progress.
- If the source trigger source is set to bus trigger 1 to 9, the bus trigger output setting in the trigger route setting is invalid.
- If the source trigger source is set to Front on a 2-channel model, the trigger output on the front panel is disabled.
- If the source waveform is set to Pulse, the source value does not change unless a source trigger is generated even if the source trigger source is set to None.

<<Supported commands>>

Function	Command
Set the source trigger source	:SOURce[m][:CHANnel[d]]:TRIGger

Source delay (Source Delay)

Source delay is the wait time from when a trigger is detected to when the source operation is carried out. Set the source delay to adjust for the phase differences between channels when synchronizing multiple channels or to correct the external trigger signal timing.

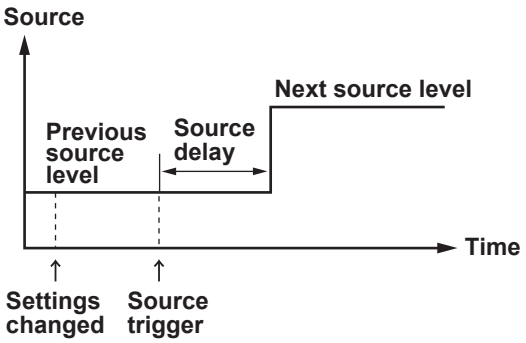
Setting range

1 µs to 1.000000 s

Relationship between sourcing and source delay

DC source mode (sweep off)

After changing the settings using the panel control or communication commands, when a source trigger is detected, the actual settings are changed when the source delay elapses.

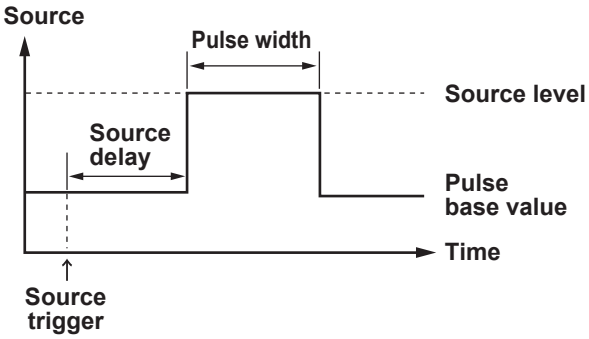


If the source trigger is set to None, after the source value is changed, the actual source value changes when the source delay elapses.

If the source trigger is set to Disable, after changing the source value, the actual source value changes when the source delay elapses after you tap TRIG on the panel or after a trigger is generated using a communication command.

Pulse source mode (sweep off)

The pulse base value is generated in the steady-state. The source level is generated over the pulse width when the source delay elapses after the source trigger is detected.

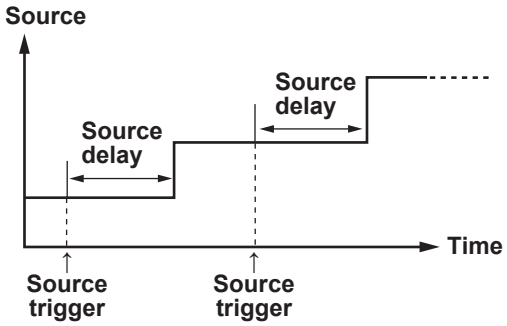


If the source trigger is set to None, the source value does not change unless a source trigger is generated even if the source value is changed.

If the source trigger is set to Disable, after changing the source value, the actual source value changes when the source delay elapses after you tap TRIG on the panel or after a trigger is generated using a communication command.

Linear sweep, log sweep, and program sweep

A preset sweep pattern step is executed when the source delay elapses after the source trigger is detected.



<<Supported commands>>

Function	Command
Set the source delay	:SOURce[m][:CHANnel[d]]:DELay

Pulse base setting range (Pulse Base)

See the Range generated column in the tables under fixed range in “Setting the source range.”

Note

When the source range is set to auto range, a range is selected that suits to the larger of the absolute source level or the absolute pulse base value.

<<Supported commands>>

Function	Command
Set the current pulse base level	:SOURce[m][:CHANnel[d]][:CURRent]:PULSe:BASE

Pulse width (Pulse Width)

Pulse width setting range

50 µs to 1 s

<<Supported commands>>

Function	Command
Set the current pulse width	:SOURce[m][:CHANnel[d]][:CURRent]:PULSe:WIDTh

Load resistance, load capacitance, and load inductance (Load Resistance, Load Capacitance, Load Inductance)

When the function is set to voltage, set the capacitance and resistance. When the function is set to current, set the inductance and resistance. The source value can be converged smoothly to the specified output value by setting values appropriate for the source target load.
The minimum value is set by default. Change it when adjusting the source waveform.

<<Supported commands>>

Function	Command
Set the load capacitance	:SOURce[m][:CHANnel[d]]:VOLTage:RESPonse:CAPacitance
Set the load inductance	:SOURce[m][:CHANnel[d]]:CURRent:RESPonse:INDuctance
Set the load resistance (for voltage source)	:SOURce[m][:CHANnel[d]]:VOLTage:RESPonse:RESistance
Set the load resistance (for current source)	:SOURce[m][:CHANnel[d]]:CURRent:RESPonse:RESistance

Zero-set function (Zero set all modules, CH1 ZeroSet, CH2 ZeroSet)

The zero-set function is executed to calibrate the source level offset drift caused by temperature changes and other factors.

Note

- The zero-set function performs measurements on all ranges for calibration. As a result, source and measurement operations are interrupted for a few seconds while calibration is in progress.
- The results of calibration are lost when the power is turned off.

<<Supported commands>>

Function	Command
Execute the zero-set function	:SOURce[m][:CHANnel[d]]:CORRection:ZERO
Zero-set on all SMUs	:SOURce[m][:CHANnel[d]]:CORRection:ZERO:ALL

Turning the output on and off (Output)

The output relay switches between on and off.

Note

When the output relay operates, the source level is set to zero.

- When the output is turned on
  The output relay turns on with the source level set to zero. After the output relay switches, the source level is changed to the specified source level.
- When the output is turned off
  The source level is set to zero, and then the output relay is turned off.

<<Supported commands>>

Function	Command
Turn the output on and off	:OUTPut[m][:CHANnel[d]][:STATe]

1.2 Measure (Measure)

“Local sense and remote sense,” “Integration time,” “Measurement trigger,” “Measurement delay” in the Features Guide

Procedure

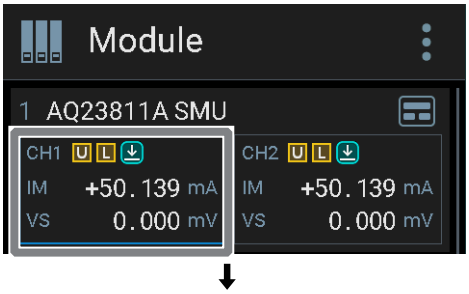
Setting the voltage measurement and current measurement

You can set the voltage measurement and current measurement on the summary view.

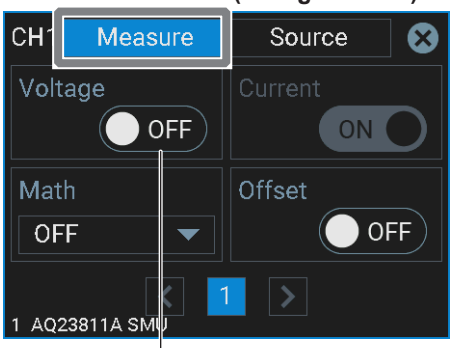
Summary view

1. Tap a channel view (area inside the frame shown below) on the top screen (summary view).
2. Tap the Measure tab on the CH screen. A CH measurement screen appears.

Top screen (summary view)

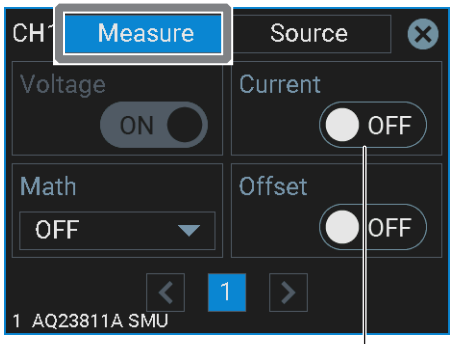


CH measure screen (voltage source)



Switch voltage measurement (ON, OFF).

CH measure screen (current source)

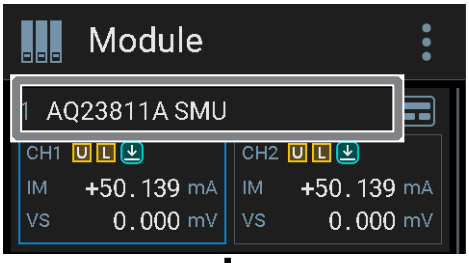


Switch current measurement (ON, OFF).

Setting the connection method

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Measure Config (area inside the frame shown below). A Measure Config screen appears.

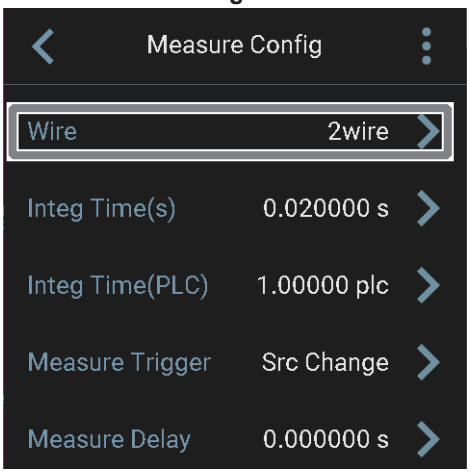
Top screen (summary view)



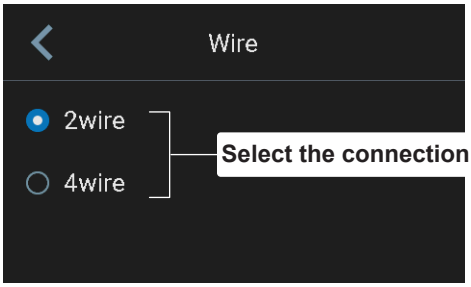
Detail view

If you select ALL, CH1 and CH2 can be configured.

Measurement setting screen



Connection type setting screen

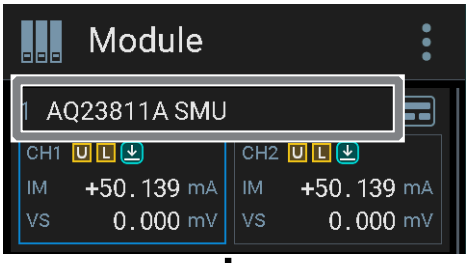


Select the connection type.

Setting the integration time

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Measure Config (area inside the frame shown below). A Measure Config screen appears.

Top screen (summary view)



Detail view

If you select ALL, CH1 and CH2 can be configured.

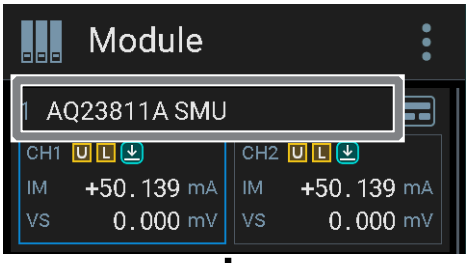
Measurement setting screen

Set the integration time.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

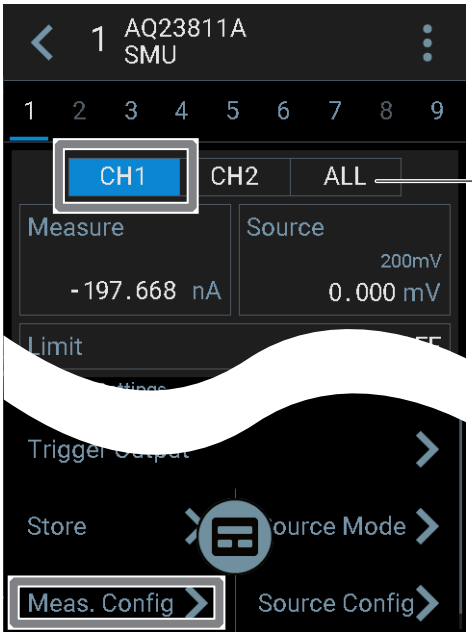
Set the measurement trigger source

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Measure Config (area inside the frame shown below). A Measure Config screen appears.

Top screen (summary view)

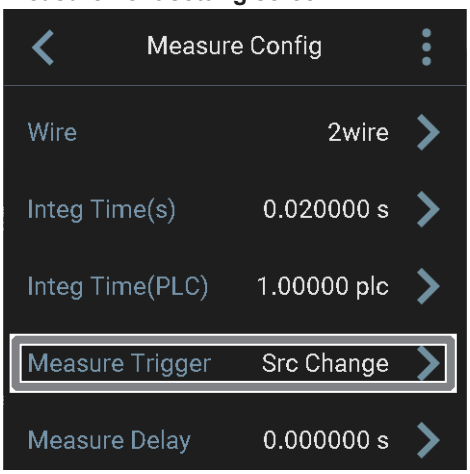


Detail view

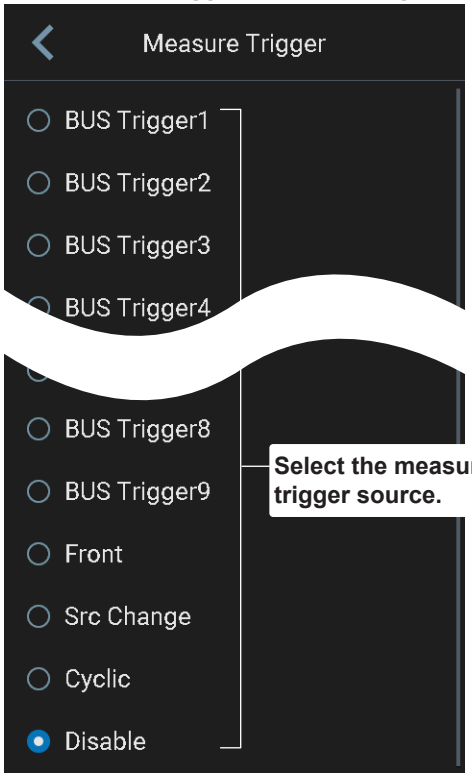


If you select ALL, CH1 and CH2 can be configured.

Measurement setting screen



Measurement trigger source setting screen

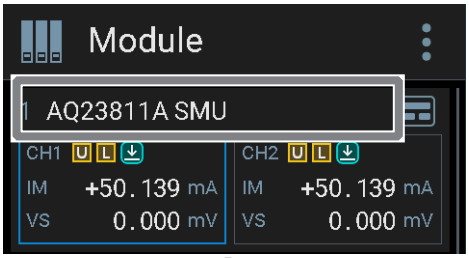


Select the measurement trigger source.

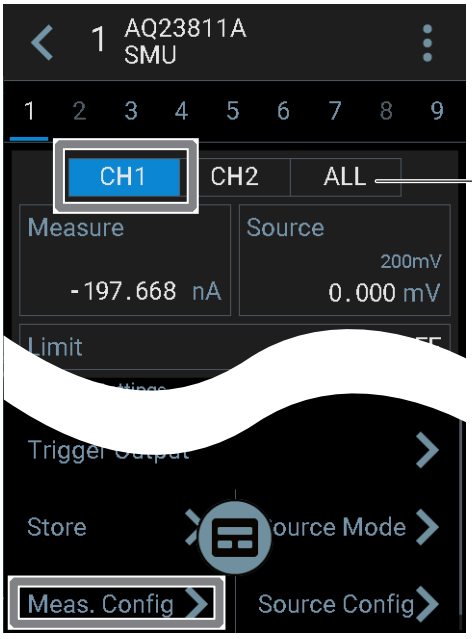
Setting the measurement delay

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Measure Config (area inside the frame shown below). A Measure Config screen appears.

Top screen (summary view)

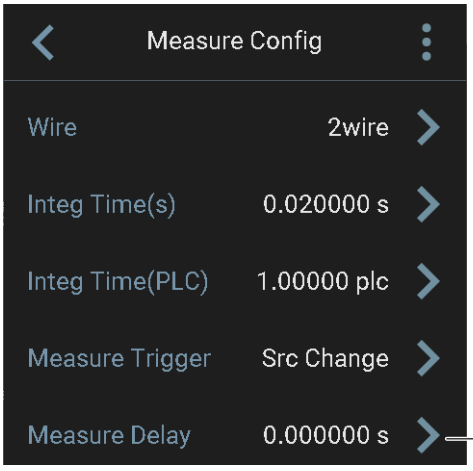


Detail view



If you select ALL, CH1 and CH2 can be configured.

Measurement setting screen



Set the measurement delay.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Explanation

Setting the voltage measurement and current measurement

When the source function is set to voltage, you can turn voltage measurement on and off. Current measurement is fixed at on.
When the source function is set to current, you can turn current measurement on and off. Voltage measurement is fixed at on.

<<Supported commands>>

Function	Command
Turn the voltage measurement on and off	:SENSe[m][:CHANnel[d]]:VOLTage[:STATe]
Turn the current measurement on and off	:SENSe[m][:CHANnel[d]]:CURRent[:STATe]

Setting the connection method (Wire)

The connection method can be set to 2wire or 4wire.
2wire: Two-wire voltage measurement (local sense)
4wire: Four-wire voltage measurement (remote sense)

<<Supported commands>>

Function	Command
Set the connection method	:SENSe[m][:CHANnel[d]]:REMote

Setting the integration time (Integ Time(s), Integ Time(PLC))

The integration time can be set in units of μs or PLC. The stability of measured values increases as the integration time is set longer. However, the measurement time will be longer. Setting the integration time to an integer multiple of the power line cycle (nPLC) has the effect of eliminating noise in the power supply frequency components. For high precision measurement, use an integer value.

* PLC = Power Line Cycles

Setting in units of μs

Setting range: 2 μs to 1.000000 s
Resolution: 1 μs

Setting in units of PLC

When the power line cycle is 50 Hz: 0.00010 to 50 plc
When the power line cycle is 60 Hz: 0.00012 to 60 plc

<<Supported commands>>

Function	Command
Set the integration time in units of μs	:SENSe[m][:CHANnel[d]]:ITIMe
Set the integration time in units of PLC	:SENSe[m][:CHANnel[d]]:NPLC

Setting the measurement trigger source (Measure Trigger)

The measurement trigger is a signal source that is used to start measurement. Select from the following options.

BUS Trigger1 to 9: bus trigger

Front: input signal received through a trigger input terminal on a module's front panel

SrcChange: source signal change

Cyclic: measurement completion signal (when measuring continuously. Continuous measurement for at least approximately 1 ms)

Disable: trigger generated using a panel control or communication command

<<Supported commands>>

Function	Command
Set the measurement trigger	:SENSe[m][:CHANnel[d]]:TRIGger

Setting the measurement delay (Measure Delay)

Measurement delay is the wait time from when a trigger is detected to when the measurement operation is carried out. Set this delay if you want to insert a delay after the source level is changed until the measurement is actually started to allow the DUT to stabilize.

Setting range: 0 µs to 1 s

Resolution: 1 µs

Note

The time from when the source trigger is applied to when the source level stabilizes varies depending on the load, source range, and limiter level. When you adjust the length of the measurement delay, keep these in mind in addition to the time needed for the DUT to stabilize after the source level is applied.

<<Supported commands>>

Function	Command
Set the measurement delay	:SENSe[m][:CHANnel[d]]:DELay

1.3 Sweep

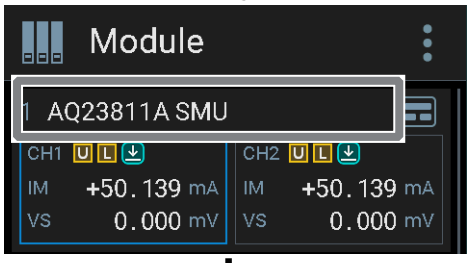
"Sweep," "Start trigger," "Repeat count" in the Features Guide

Procedure

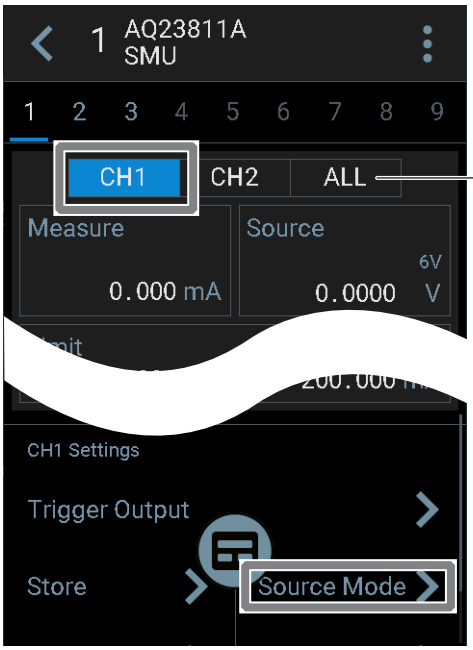
Setting the source mode to sweep

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Source Mode (area inside the frame shown below). A Source Mode screen appears.

Top screen (summary view)

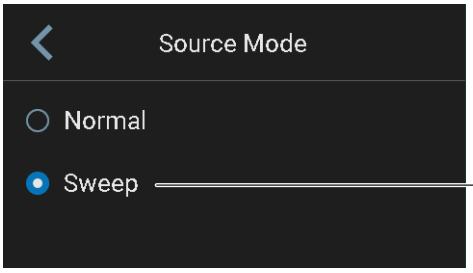


Detail view



If you select ALL, CH1 and CH2 can be configured.

Source mode screen

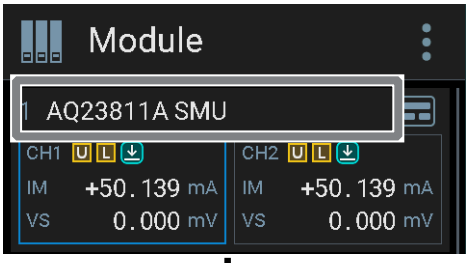


Select Sweep.

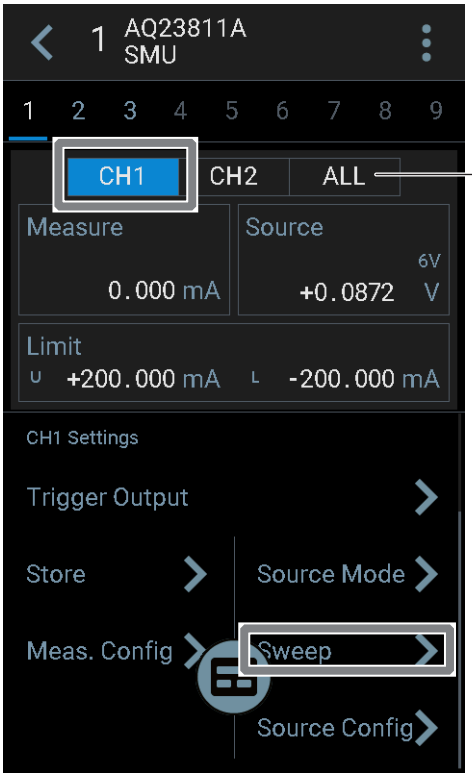
Selecting the sweep mode

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

Top screen (summary view)



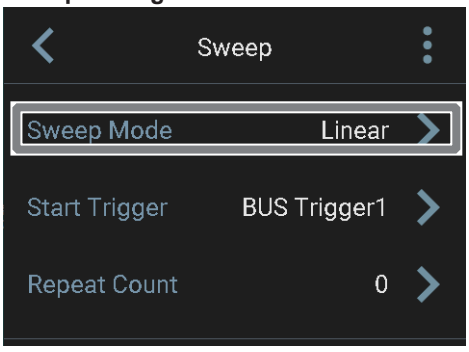
Detail view



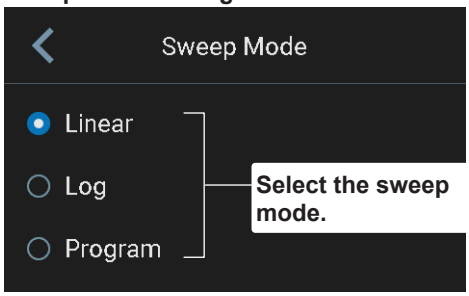
If you select ALL, CH1 and CH2 can be configured.

*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

Sweep setting screen



Sweep mode setting screen

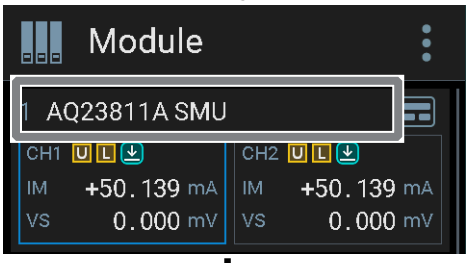


Linear sweep

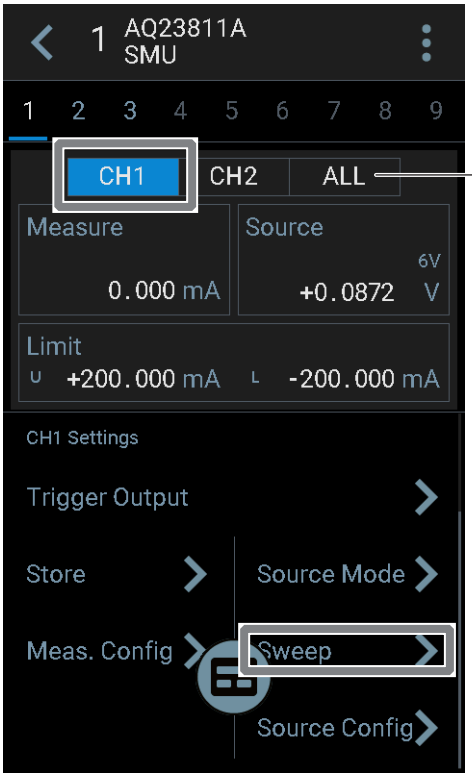
Setting the start trigger

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

Top screen (summary view)



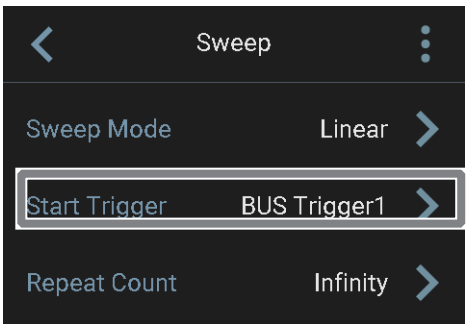
Detail view



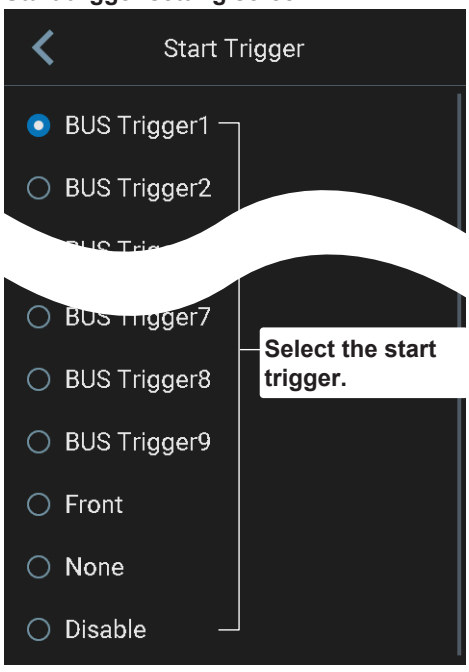
If you select ALL, CH1 and CH2 can be configured.

*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

Sweep setting screen



Start trigger setting screen

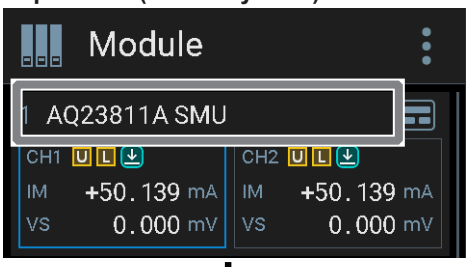


Select the start trigger.

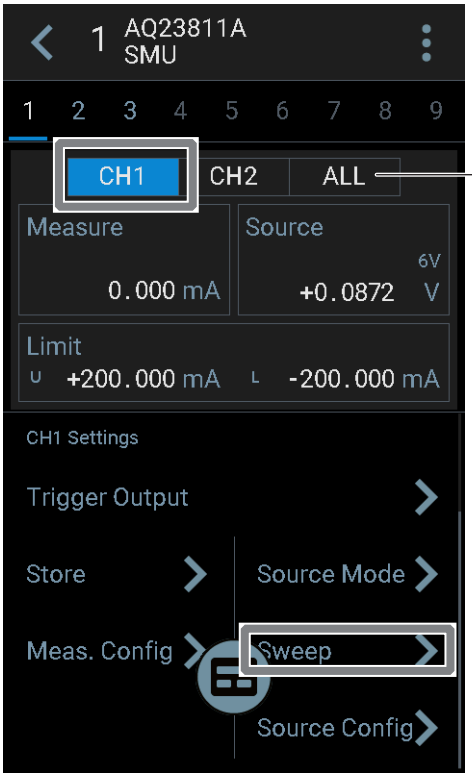
Setting the repeat count

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

Top screen (summary view)



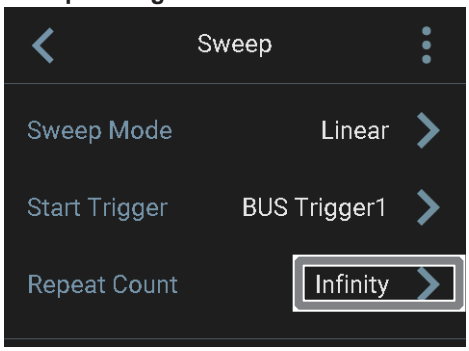
Detail view



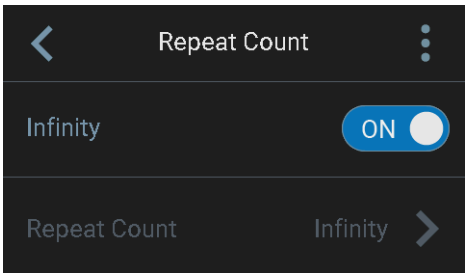
If you select ALL, CH1 and CH2 can be configured.

*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

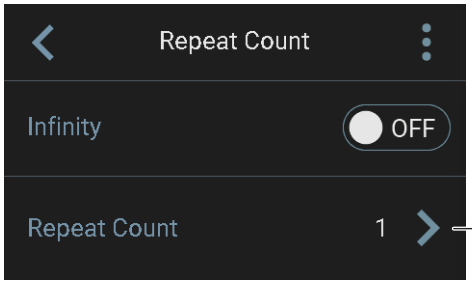
Sweep setting screen



To repeat indefinitely, set Infinity to ON.



To specify the repeat count, set Infinity to OFF.

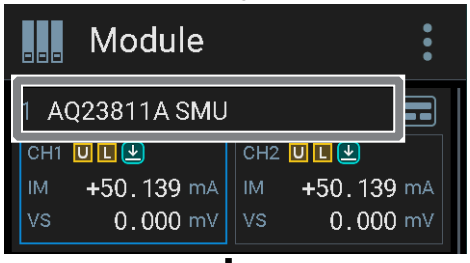


Set the repeat count
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

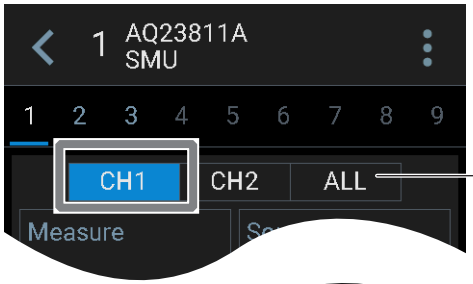
Start level, stop level, step level

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

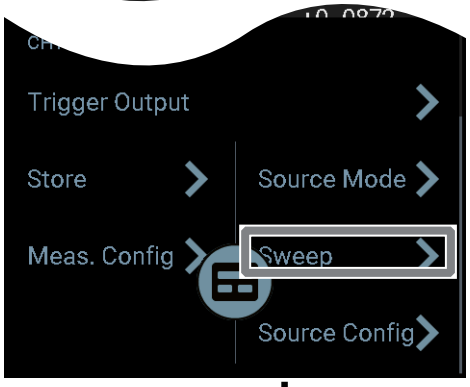
Top screen (summary view)



Detail view



If you select ALL, CH1 and CH2 can be configured.



*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

Sweep setting screen

Set the start level.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Set the stop level.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

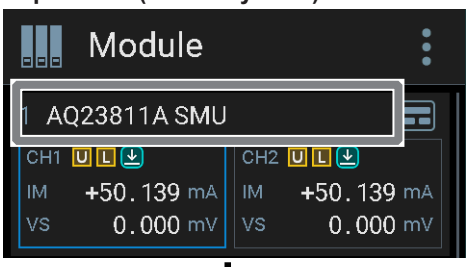
Set the step level.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Log sweep

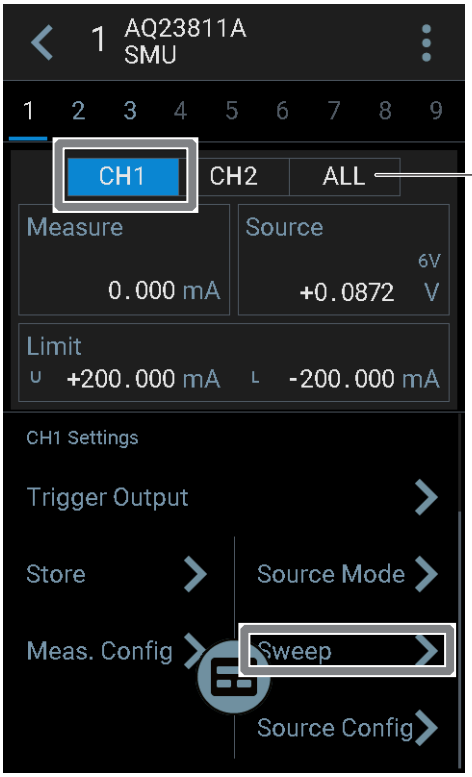
Setting the start trigger

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

Top screen (summary view)



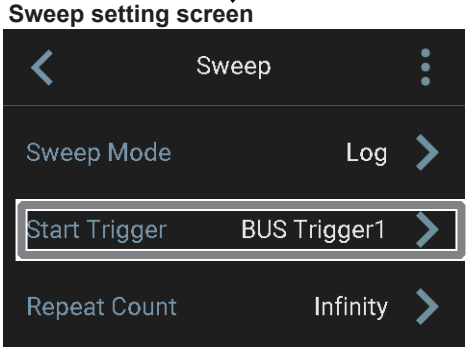
Detail view



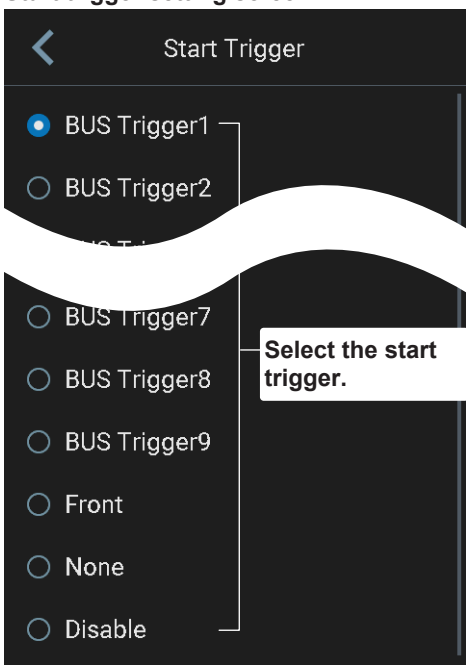
If you select ALL, CH1 and CH2 can be configured.

*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

Sweep setting screen



Start trigger setting screen

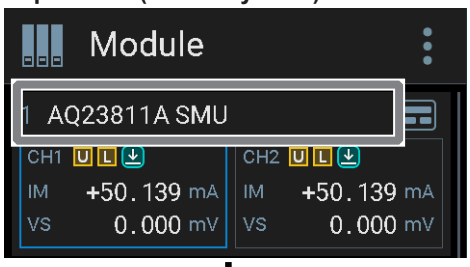


Select the start trigger.

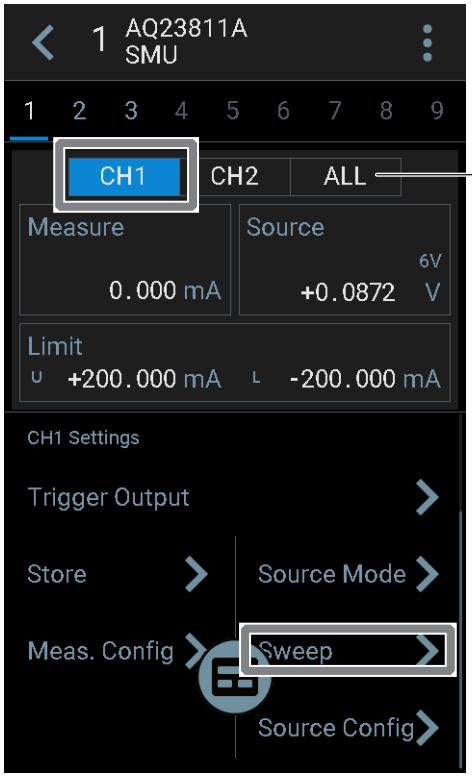
Setting the repeat count

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

Top screen (summary view)



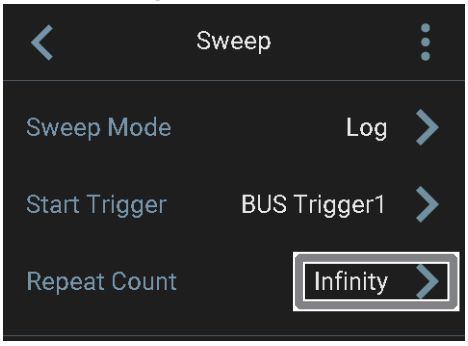
Detail view



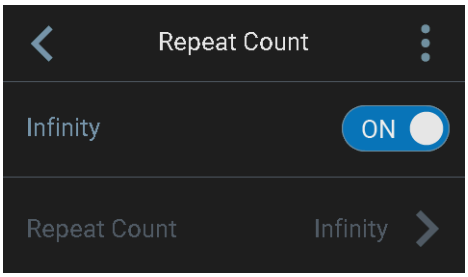
If you select ALL, CH1 and CH2 can be configured.

*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

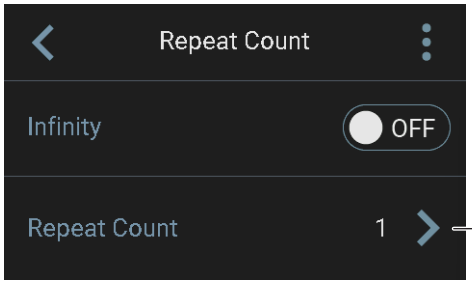
Sweep setting screen



To repeat indefinitely, set Infinity to ON.



To specify the repeat count, set Infinity to OFF.

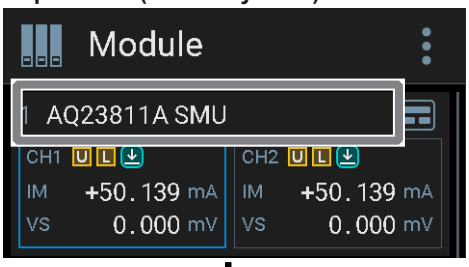


Set the repeat count.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Setting the start level, stop level, and log points

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

Top screen (summary view)

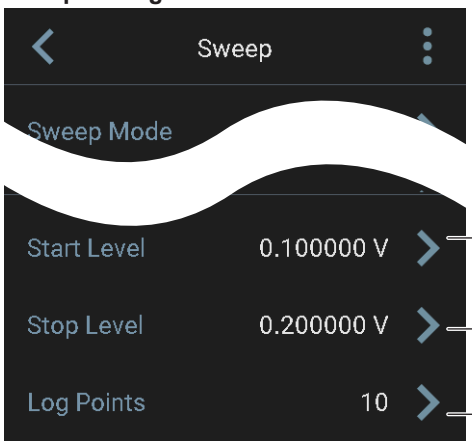


Detail view

If you select ALL, CH1 and CH2 can be configured.

*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

Sweep setting screen



Set the start level.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Set the stop level.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

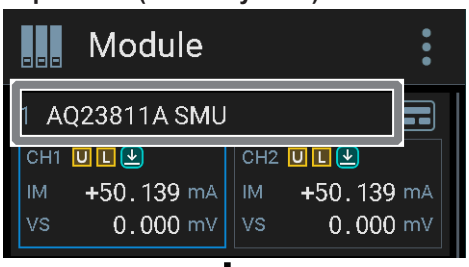
Set the log points.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Program sweep

Setting the start trigger

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

Top screen (summary view)



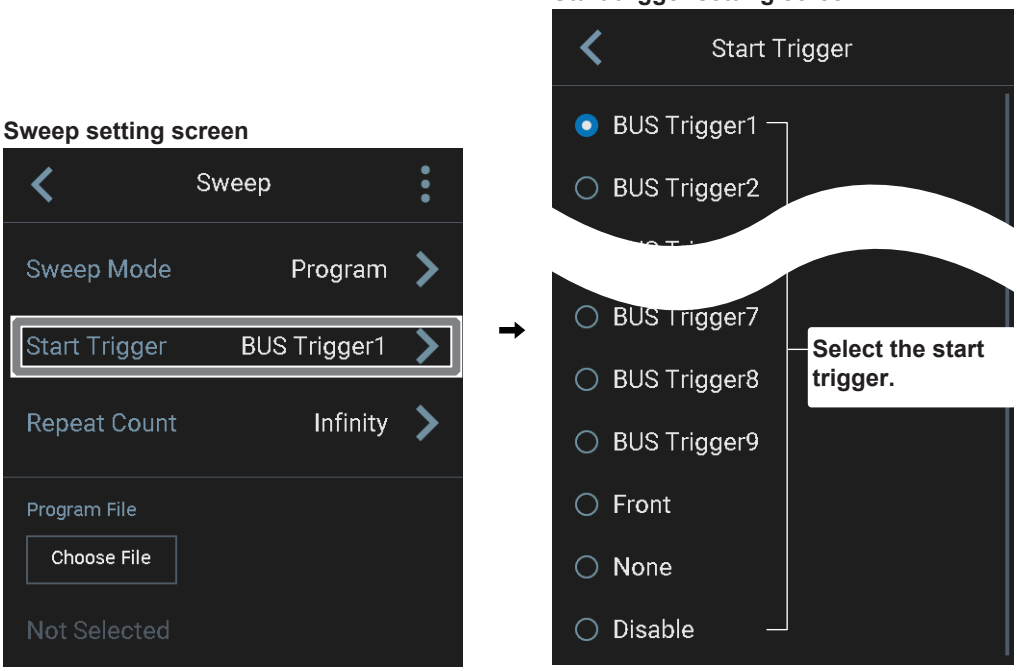
Detail view

If you select ALL, CH1 and CH2 can be configured.

*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

Start trigger setting screen

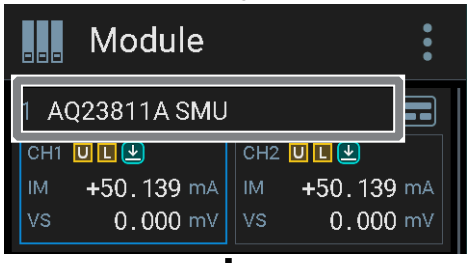
Sweep setting screen



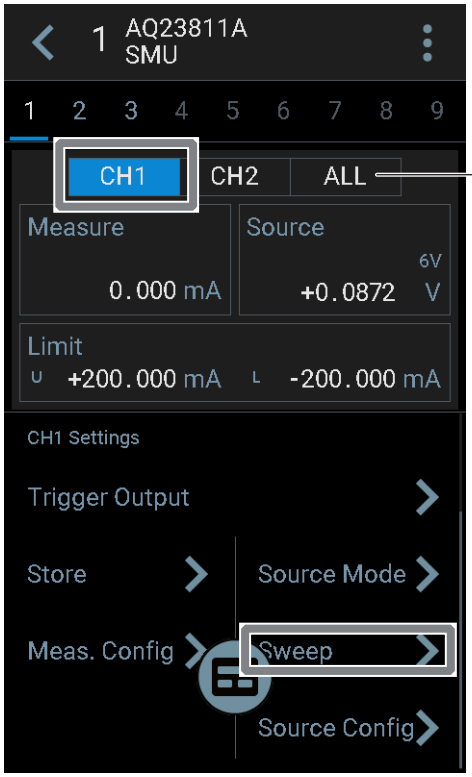
Setting the repeat count

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

Top screen (summary view)



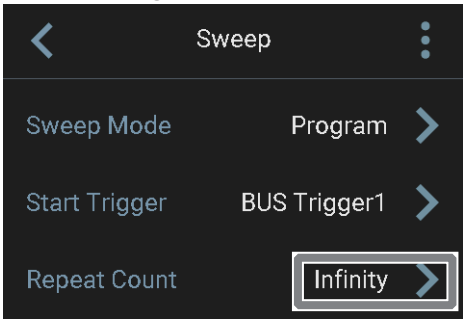
Detail view



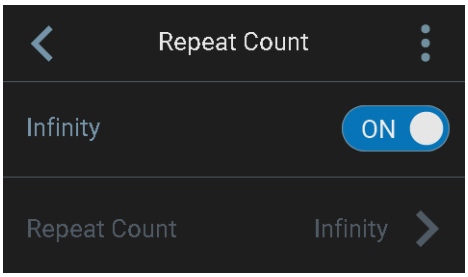
If you select ALL, CH1 and CH2 can be configured.

*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

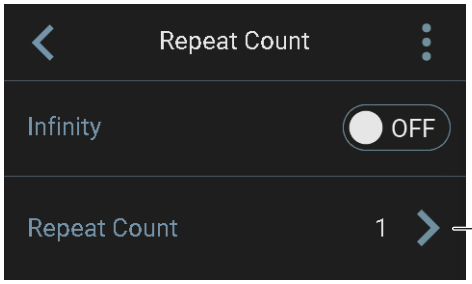
Sweep setting screen



To repeat indefinitely, set Infinity to ON.



To specify the repeat count, set Infinity to OFF.

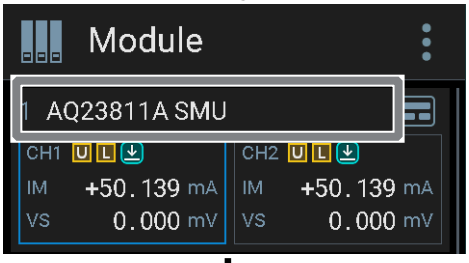


Set the repeat count.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

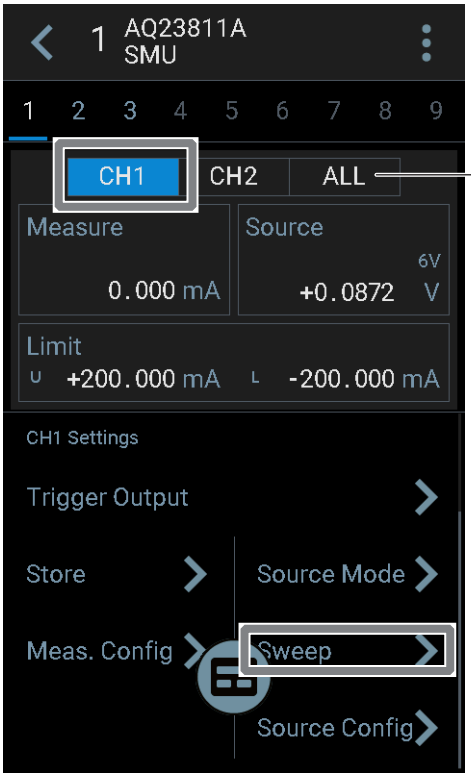
Selecting a program file

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Sweep (area inside the frame shown below). A Sweep setting screen appears.

Top screen (summary view)



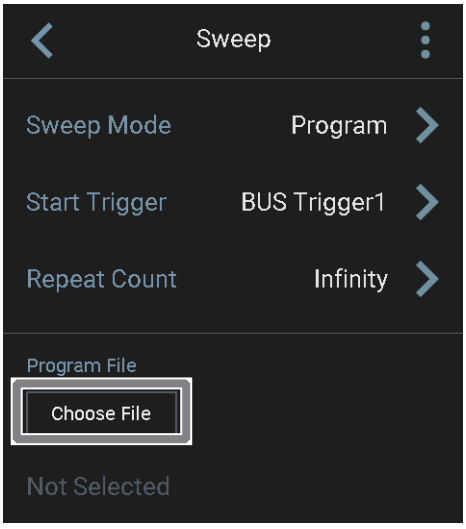
Detail view



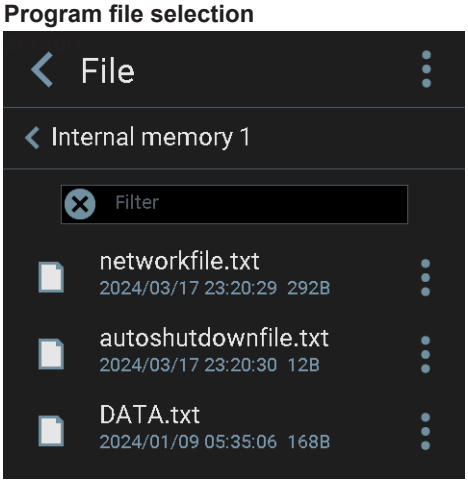
If you select ALL, CH1 and CH2 can be configured.

*** If "Sweep" is not displayed, drag the bottom of the screen up to scroll.**

Sweep setting screen



Program file selection

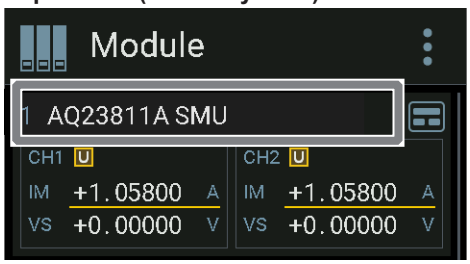


Starting and stopping sweeping

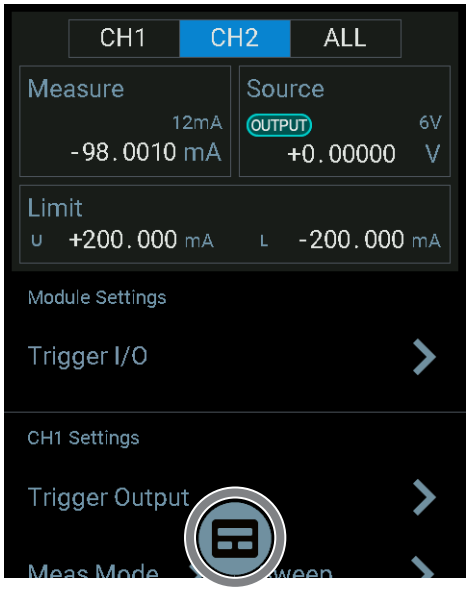
When sweeping starts, the instrument enters a trigger wait state.

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap the action panel button (area inside the frame shown below). An action panel appears.

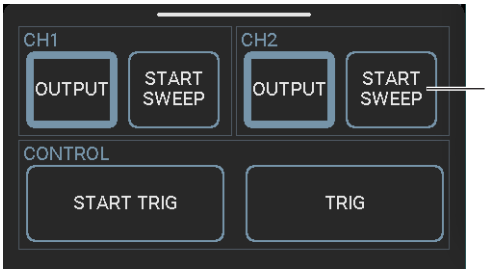
Top screen (summary view)



Detail view



Action screen



Starts and stops sweeping

Explanation

Setting the source mode (Source Mode) to sweep

Set the source mode to Sweep to use the sweep function.

<<Supported commands>>

Function	Command
Set the source mode	:SOURce[m][:CHANnel[d]]:MODE

Selecting the sweep mode (Sweep Mode)

Set the sweep mode to linear, log, or program.

Note

Log sweep cannot be performed in the following cases:

- When the signs of the start level and stop level are different
- When the start level or stop level is zero

Start trigger (Start Trigger)

When a start trigger is detected while sweeping is in progress, the instrument enters the source trigger wait state. When a source trigger is detected, the source value changes.

BUS Trigger1 to 9: bus trigger

Front: input signal received through a trigger input terminal on a module's front panel

None: Sweeping starts without applying a start trigger.

Disable: trigger generated using a panel control or communication command

Note

- If the start trigger is set to bus trigger 1 to 9, the bus trigger output setting in the trigger route setting is invalid.
- If the start trigger is set to Front, the front panel output is disabled.

<<Supported commands>>

Function	Command
Set the start trigger	:SOURce[m][:CHANnel[d]][:VOLTage]:SWEep:STARt

Repeat count (Repeat Count)

Set the repeat count in the range of 1 to 1000 or infinity (Infinity). If you select Infinity, after sweeping starts, sweeping will be repeated until sweeping is stopped or output is turned off.

<<Supported commands>>

Function	Command
Set the repeat count	:SOURce[m][:CHANnel[d]]:SWEep:COUNt

Start level, stop level, step levelStart Level, Stop Level, Step Level)

Setting range and resolution of start level and stop level for voltage sourcing

Source range	Setting range	Setting resolution
6V	–6.0000 V ≤ X ≤ 6.0000 V	100 µV

Setting resolution of start level and stop level for current sourcing

Source range	Setting range	Setting resolution
200nA	–200.000 nA ≤ X ≤ 200.000 nA	1 pA
2µV	–2.00000 µA ≤ X ≤ 2.00000 µA	10 pA
20µV	–20.0000 µA ≤ X ≤ 20.0000 µA	100 pA
200µV	–200.000 µA ≤ X ≤ 200.000 µA	1 nA
2mA	–2.00000 mA ≤ X ≤ 2.00000 mA	10 nA
20mA	–20.0000 mA ≤ X ≤ 20.0000 mA	100 nA
200mA	–200.000 mA ≤ X ≤ 200.000 mA	1 µA
600mA	–600.00 mA ≤ X ≤ 600.00 mA	10 µA

<<Supported commands>>

Function	Command
Set the voltage start level	:SOURce[m][:CHANnel[d]][:VOLTage]:SWEep:STARt
Set the voltage stop level	:SOURce[m][:CHANnel[d]][:VOLTage]:SWEep:STOP
Set the voltage step level	:SOURce[m][:CHANnel[d]][:VOLTage]:SWEep:STEP
Set the current start level	:SOURce[m][:CHANnel[d]][:CURRent]:SWEep:STARt
Set the current stop level	:SOURce[m][:CHANnel[d]][:CURRent]:SWEep:STOP
Set the current step level	:SOURce[m][:CHANnel[d]][:CURRent]:SWEep:STEP

Setting the log points (Log Points)

Set this for log sweep.

Set the value in the range of 2 to 100,001.

<<Supported commands>>

Function	Command
Set the voltage step count for log sweep	:SOURce[m][:CHANnel[d]][:VOLTage]:SWEep:POINts

Program file

For details on program files, see section 3.1 in the Features Guide (IM AQ23011A-03EN).

Note

A program pattern can contain up to 100,001 steps.

<<Supported commands>>

Function	Command
Specify the program sweep file	:SOURce[m][:CHANnel[d]]:SWEep:Program:FILE

1.4 Trigger

"Trigger" in the Features Guide

Procedure

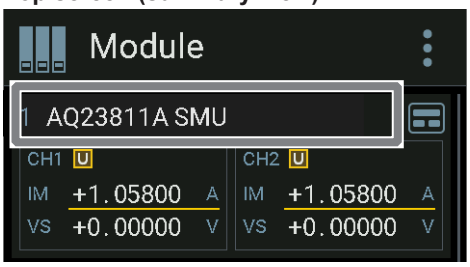
Generating source triggers

This section explains how to generate triggers using panel control (generating triggers using trigger signals is not covered here).

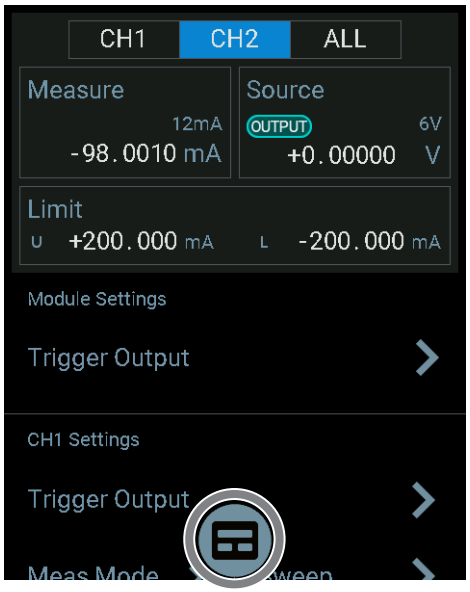
For generating source triggers using trigger signals, see section 1.1, "Source."

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap the action panel button (area inside the frame shown below). An action panel appears.

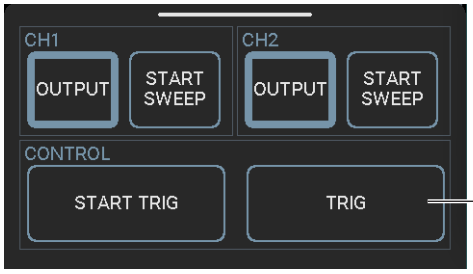
Top screen (summary view)



Detail view



Action screen



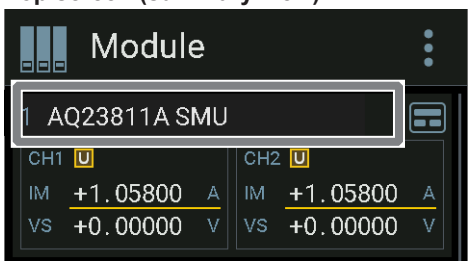
Generate a source trigger.

Generating sweep start triggers

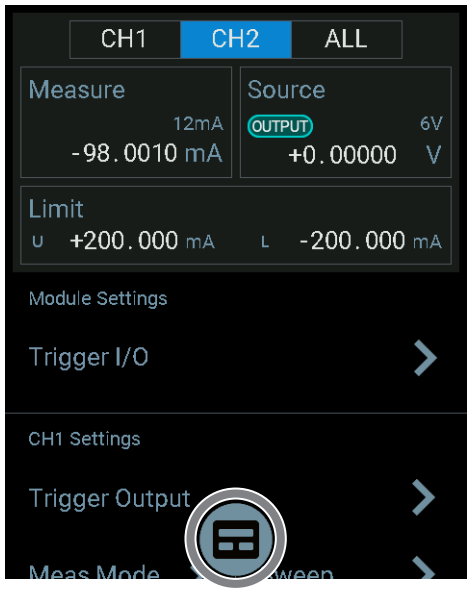
This section explains how to generate start triggers using panel control (generating start triggers using trigger signals is not covered here).
For generating start triggers using trigger signals, see section 1.3, “Sweep.”

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap the action panel button (area inside the frame shown below). An action panel appears.

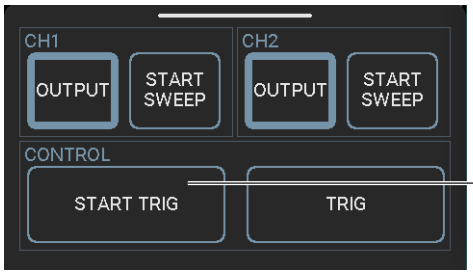
Top screen (summary view)



Detail view



Action screen

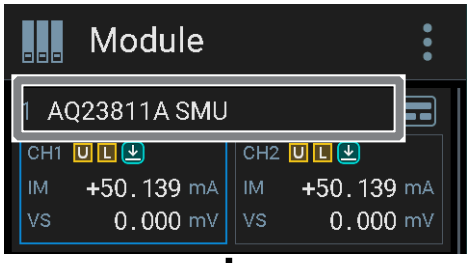


Generate a sweep start trigger.

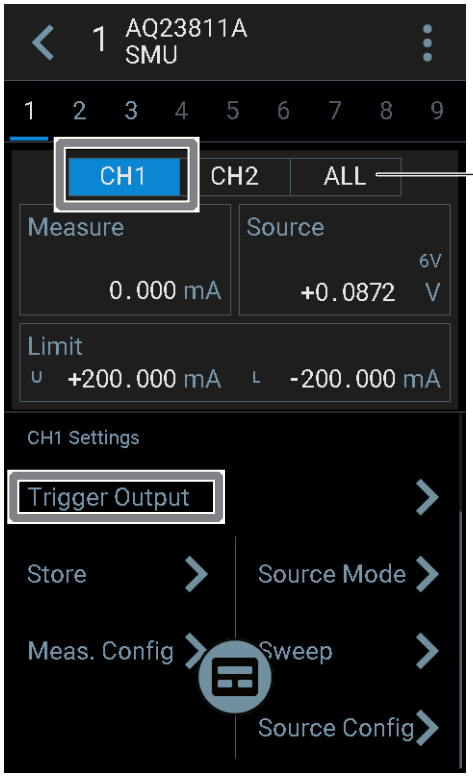
Setting the trigger output

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap Trigger Output (area inside the frame shown below). A Trigger Output setting screen appears.

Top screen (summary view)

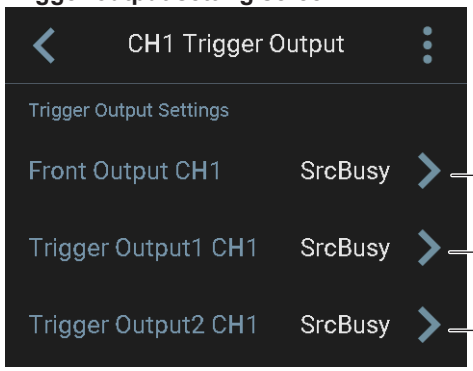


Detail view



If you select ALL, CH1 and CH2 can be configured.

Trigger output setting screen

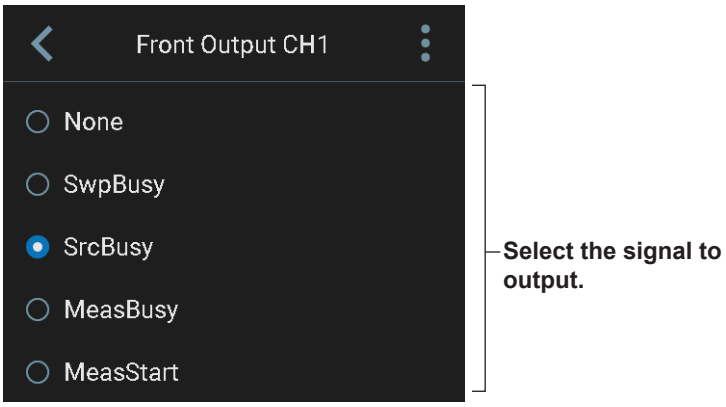


See “Setting the front panel trigger output.”

See “Setting trigger outputs 1 and 2.”

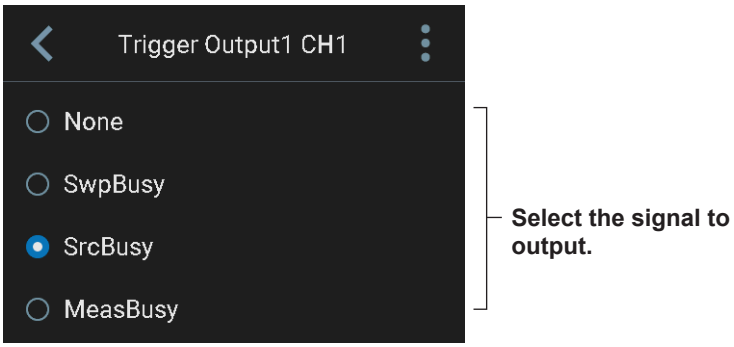
Setting the front panel trigger output (Front Output)

4. Tap the Front Output CH pull-down button. The following menu appears.



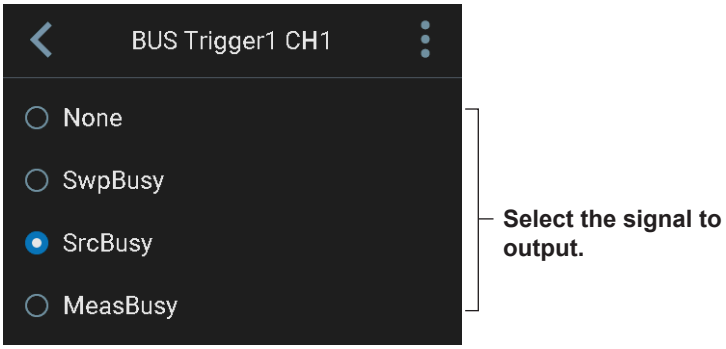
Setting trigger outputs 1 and 2 (Trigger Output 1, 2)

4. Tap the Trigger Output1 CH or Trigger Output2 CH pull-down button. The following menu appears.



Setting BUS Trigger1 to 9 (BUS_Trigger set to Output)

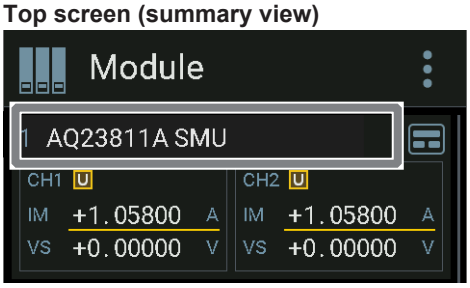
4. Tap a displayed BUS Trigger1 to 9 pull-down button. The following menu appears.



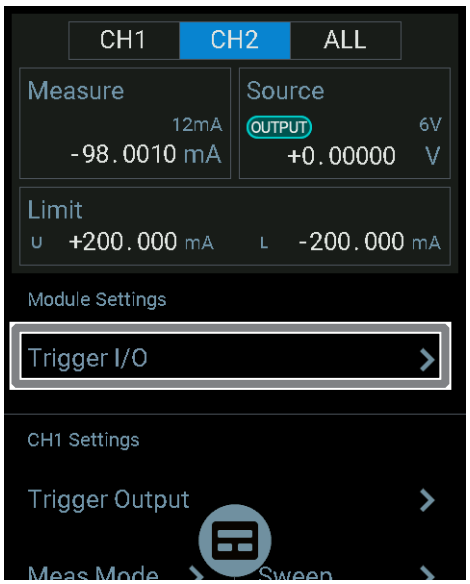
Switching the BUS trigger input/output

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap BUS Trigger I/O (area inside the frame shown below). A BUS Trigger I/O setting screen appears.

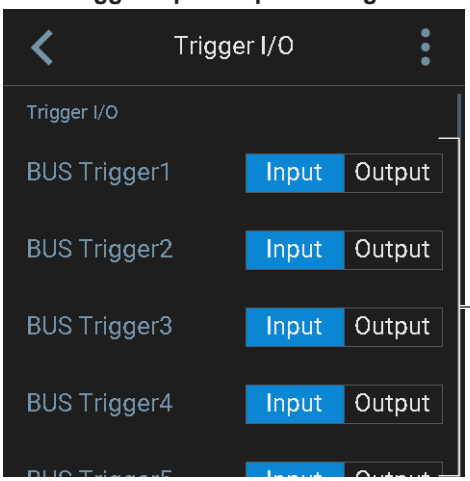
Top screen (summary view)



Detail view



BUS trigger input/output setting screen



Switch input and output.

The BUS Triggers set to Output appear in the Trigger Output setting screen where you can set the signal you want to output.

Explanation

Generating source triggers (TRIG)

In addition to generating source triggers using trigger signals, source triggers can be generated at any time using communication commands.
When Source Trigger is set to Disable, the specified source value is generated by tapping the TRIG button on the screen.

<<Supported commands>>

Function	Command
Generate a trigger (specific module/channel)	:TRIGger[m]:[CHANnel[d]]
Generate a trigger (all modules)	*TRG

Generating sweep start triggers (START TRIG)

In addition to generating start triggers specified in sweeping, sweep start triggers can be generated at any time using communication commands.
To enable start triggers, a sweep needs to be running in advance tap START SWEEP on the screen. For details, see section 1.3, “Sweep.”

<<Supported commands>>

Function	Command
Generate a start trigger	:TRIGger[m]:[CHANnel[d]]:STARt

Setting the trigger output (Trigger Output)

You can select a trigger output within a module.

Setting the front panel trigger output

None: no trigger
SwpBusy: outputs sweep busy signals
SrcBusy: outputs source busy signals
MeasBusy: outputs measurement busy signals
MeasStart: outputs measurement start signals

<<Supported commands>>

Function	Command
Switch the front terminal input/output	:ROUTE[m]:CHANnel[d]:FRONt
Set the front terminal output	:ROUTE[m]:CHANnel[d]:FRONt:OUTPut:TYPE

Setting trigger outputs 1 and 2 (Trigger Output 1, 2)

Setting BUS Triggers 1 to 9 set to Output

None: no trigger

SwpBusy: sweep busy signal output from frame to module

SrcBusy: source busy signal output from module to frame

MeasBusy: measurement busy signal output from module to frame

<<Supported commands>>

Function	Command
Select trigger output1's output	:ROUTE[m]:CHANnel[d]:TOUT1:OUTPut:TYPE
Select trigger output2's output	:ROUTE[m]:CHANnel[d]:TOUT2:OUTPut:TYPE

Switching BUS trigger input/output (Trigger I/O)

You can switch the bus trigger input/output.

Input: input from frame to module

output: output from module to frame

<<Supported commands>>

Function	Command
Set the bus trigger input/output	:ROUTE[m]:BUS[n]

1.5 Math

"Math, " "Offset" in the Features Guide

Procedure

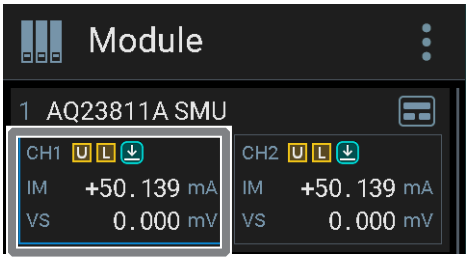
Setting the MATH function

You can set the MATH function on the summary view.

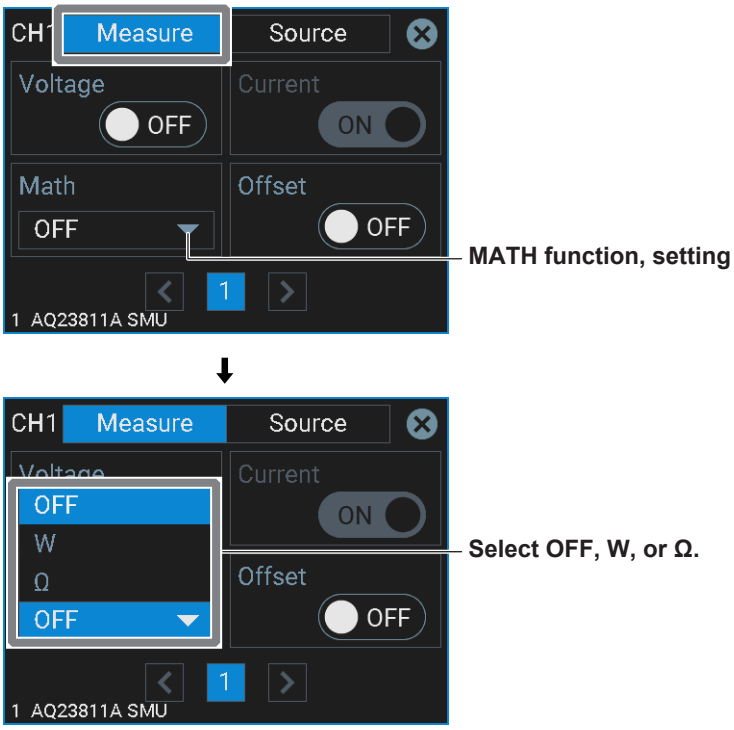
Summary view

1. Tap a channel view (area inside the frame shown below) on the top screen (summary view).
2. Tap the Measure tab on the CH screen. A CH measurement screen appears.

Top screen (summary view)



CH measure screen



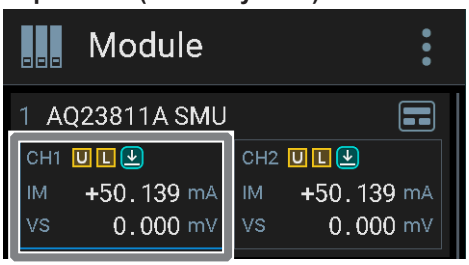
Setting the offset

You can set the offset on the summary view or detail view. You can also set it on the measurement setting screen of the detail view. (See “Setting the offset (measurement setting screen.”))

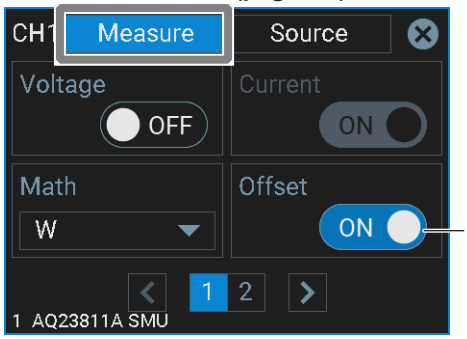
Summary view

1. Tap a channel view (area inside the frame shown below) on the top screen (summary view).
2. Tap the Measure tab on the CH screen. A CH measurement screen appears. The settings are the same as those described in “Setting the CH measurement (detail view).”

Top screen (summary view)

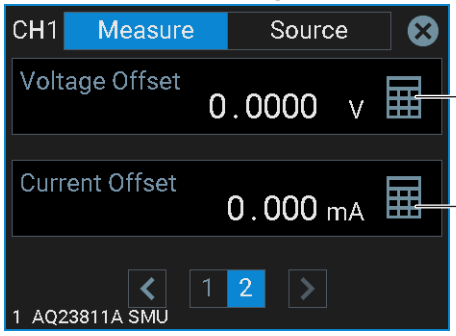


CH measure screen (page 1/2)



Switch the offset (ON, OFF).

CH measure screen (page 2/2)



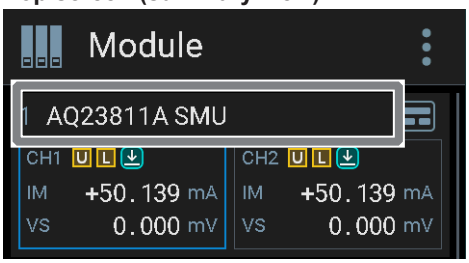
Set the voltage offset.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Set the current offset.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

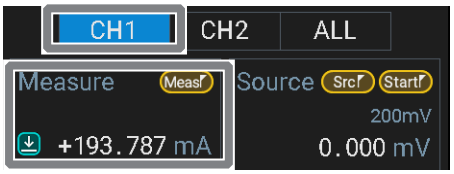
Detail view

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**. A CH measurement screen appears.

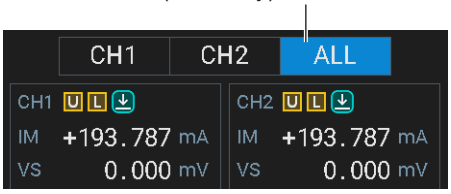
Top screen (summary view)



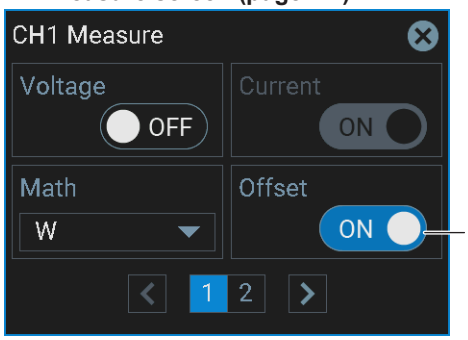
Detail view



If ALL is selected, you cannot set Measure (view only).

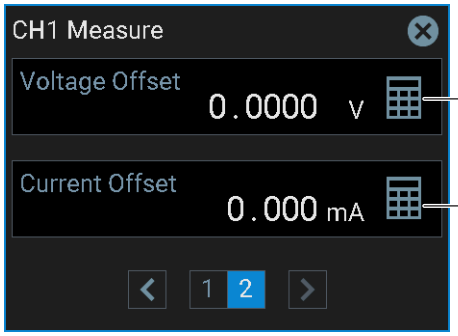


CH measure screen (page 1/2)



Switch the offset (ON, OFF).

CH measure screen (page 2/2)



Set the voltage offset.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Set the current offset.
For how to enter numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Explanation

Setting the MATH function (Math)

If you set the math value to power or resistance, the calculated value is displayed in the summary view and the measurement display area of the detail view. The following settings are available.

- OFF: The math function is disabled.
- W: Power is determined through calculation.
- Ω: Resistance is determined through calculation.

The MATH display format is shown below.

MATH value	Unit	Display format
Power	μW to W	Six digits including the integer part and fractional part The unit will be adjusted so that the fractional part is three to five digits.
Resistance	pΩ to TΩ	

<<Supported commands>>

Function	Command
Set the MATH function type	:CALCulate[m][:CHANnel[d]]:MATH

Setting the offset (Offset)

If you set an offset, a value obtained by adding the offset to the measured value is displayed.
The offset setting range is as follows:
Voltage offset: ±9.99999E±12 V
Current offset: ±9.99999E±12 A

Voltage source

- The voltage offset is displayed according to the voltage source range setting below.
- The current offset is displayed according to the current measurement range.

Range	Unit	Display format	
		Maximum number of integer digits	Number of fractional digits
6 V	V	1	4

Current source

- The current offset is displayed according to the current source range setting below.
- The voltage offset is displayed according to the voltage measurement range.

Range	Unit	Display format	
		Maximum number of integer digits	Number of fractional digits
200 nA	nA	3	3
2 µA	µA	1	5
20 µA	µA	2	4
200 µA	µA	3	3
2 mA	mA	1	5
20 mA	mA	2	4
200 mA	mA	3	3
600 mA	mA	3	2

<<Supported commands>>

Function	Command
Turn offset math on and off	:CALCulate[m][:CHANnel[d]]:NULL[:STATe]
Set the voltage offset	:CALCulate[m][:CHANnel[d]]:NULL:VOLTage
Set the current offset	:CALCulate[m][:CHANnel[d]]:NULL:CURRent

1.6 Saving and Loading Data

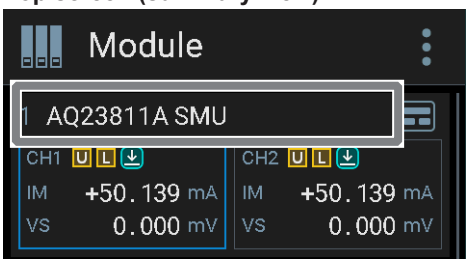
"Data that can be saved," "File operations" in the Features Guide

Procedure

Saving a setup file

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. Tap the menu icon (area inside the frame shown below).

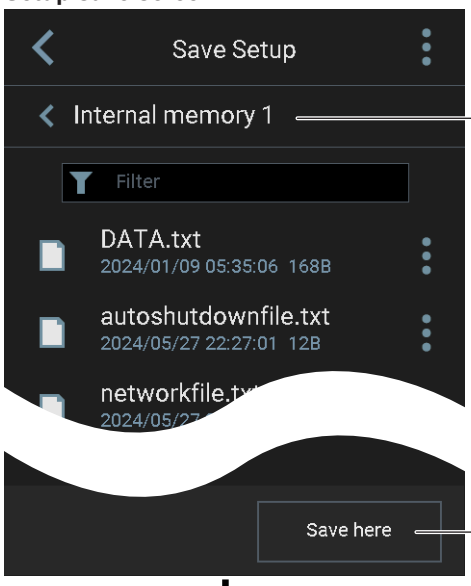
Top screen (summary view)



Detail view

Save a setup file.

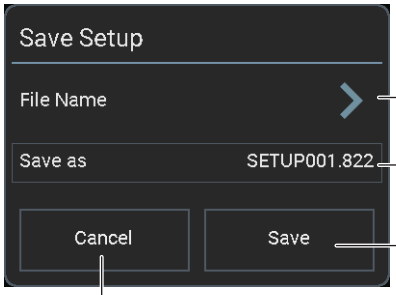
Setup save screen



Specify the save location.

Click to save to this location.

Setup save screen



Specify the file name.
For how to enter text, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

Specified file name

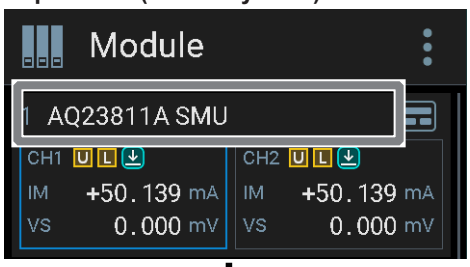
Saves by overwriting

Cancels saving

Loading a setup file

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. Tap the menu icon (area inside the frame shown below).

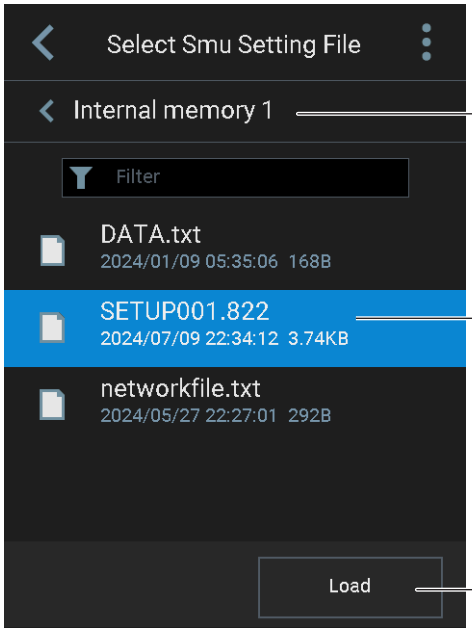
Top screen (summary view)



Detail view

Load a setup file.

Setup load screen



Specify the load source.

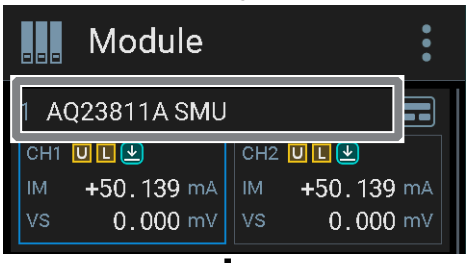
Click to select the file to load.

Load

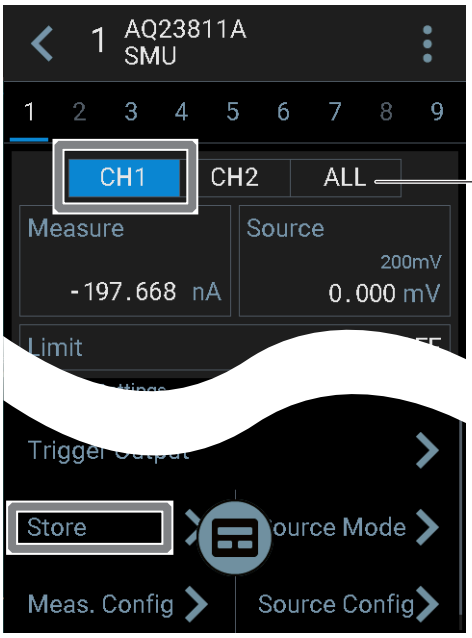
Storing and saving measurement data

1. Tap a module name (area inside the frame shown below) on the top screen (summary view).
2. On the detail view, tap **CH1** or **CH2**.
3. On the detail view, tap **Store** (area inside the frame shown below). An storage screen appears.

Top screen (summary view)

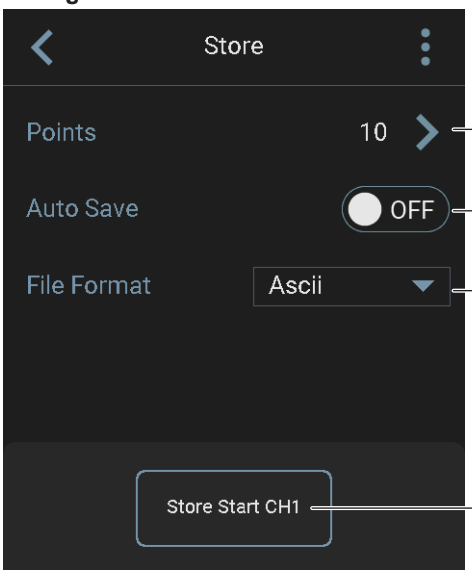


Detail view



If you select ALL, CH1 and CH2 can be configured.

Storage screen



Number of data points to acquire

Turns the auto save feature on and off
If you select ON, see “Setting the auto save feature.”

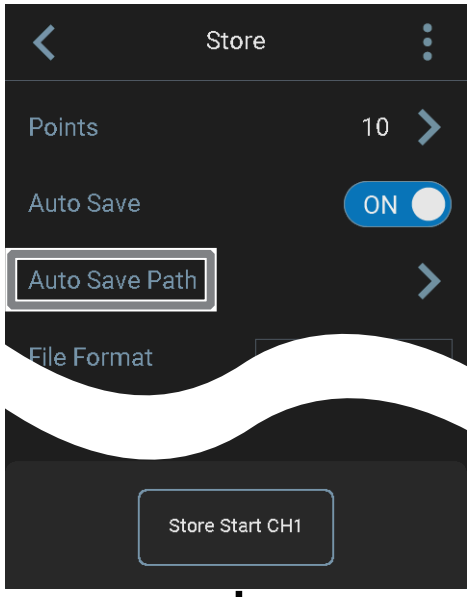
Data file format

Starts storing

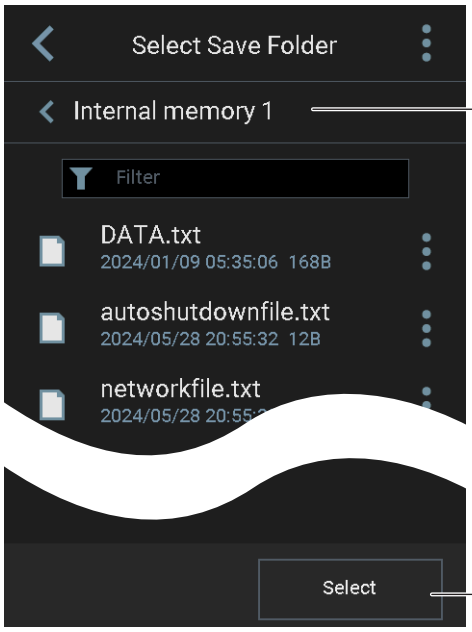
Setting the auto save feature (Auto Save)

Measurement data is saved automatically to a file in the specified folder.

4. On the save location folder selection screen, tap Auto Save Path (area inside the frame shown below). An save location folder selection screen appears.



Save location folder selection screen



Specify the save location.

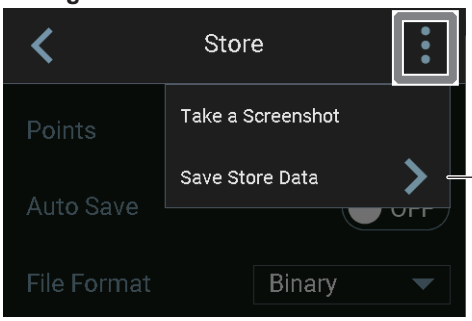
Specify the save location.

Saving stored measurement data (Save Store Data)

Stored measurement data is saved to a file in the specified folder.

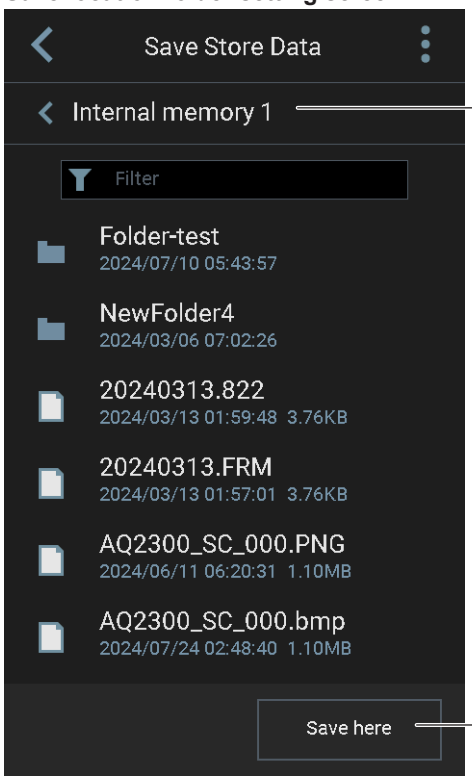
4. After storing the data, tap the menu icon (area inside the frame shown below).

Storage screen



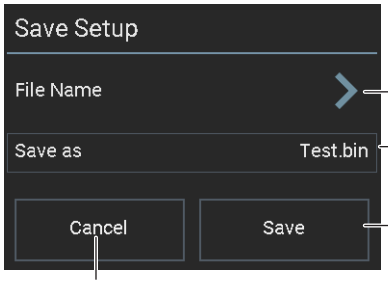
Save a setup file.

Save location folder setting screen



Save location folder

Starts saving



Set the file name.

Assigned file name

Starts saving

Cancels the operation

For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03EN).

5. After you tap Save, a file name setting screen appears. Enter a file name, and save the data.

Explanation

Saving and loading setup files (Save Setup/Load Setup)

Each module setup can be saved to a file. Setup can also be loaded. If you save a setup with the output turned on, the output will be off when you load that file.
Setup files of other modules cannot be loaded.
Setup files are saved with a ".811" extension.

<<Supported commands>>

Function	Command
Save a setup file	:MMEMory:SAVE:SETTing
Load a setup file	:MMEMory:LOAD:SETTing

Storing and saving measurement data (Store/Save Store Data)

Measurement data of each channel can be stored in the instrument at any time. Stored data can be saved to a file in a specified folder.
When the auto save feature is turned on, measurement data is saved to a file every time the specified number of data points are acquired.

Auto save feature (Auto Save)

The names assigned to files saved automatically are as follows:

Save location folder name/smustore_slot number_channel number_sequence number. extension

Save location folder name: name of the specified folder
Slot number: 1 to 9
Channel number: 1 or 2
Serial number: 000000 to 999999
Extension: bin or csv

Example: data/smustore_1_1_000123.bin

<<Supported commands>>

Function	Command
Turn the storage feature on and off	:TRACe[m][:CHANnel[d]][:STATe]
Set the number of data points to acquire	:TRACe[m][:CHANnel[d]]:POINts
Specify the data file format	:TRACe[m][:CHANnel[d]]:DATA:FORMat
Save the acquired data to a file	:TRACe[m][:CHANnel[d]]:DATA:SAVE
Turn the auto save feature on and off	:TRACe[m][:CHANnel[d]]:DATA:SAVE:AUTO
Save location folder name of the auto save feature	:TRACe[m][:CHANnel[d]]:DATA:SAVE:AUTO:FILE

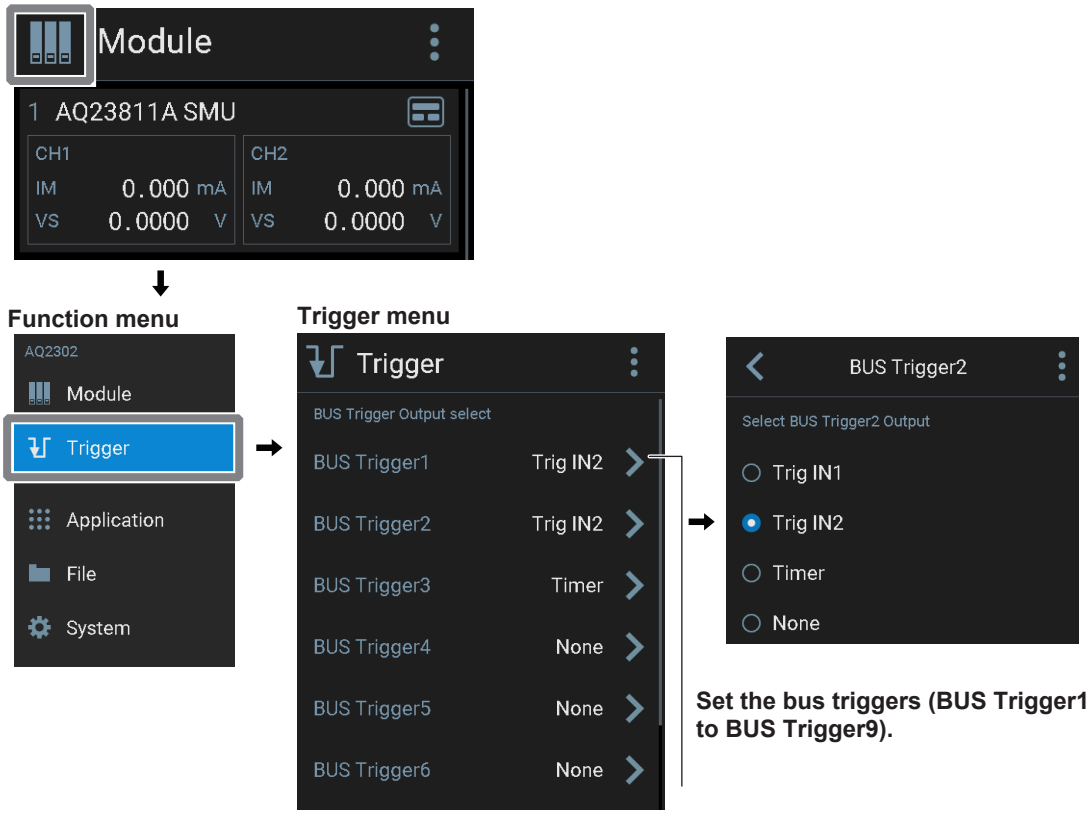
2.1 Bus Trigger

"Trigger Function" in the Features Guide

Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **Trigger**. A trigger menu appears.
3. Tap **BUS Trigger1** to **BUS Trigger9** to set the bus trigger.

Top screen (summary view)



Explanation

Set the signal to run through the bus trigger. Trigger signals are provided to each module through the bus trigger.

Select from the following four options.

Trig IN1: Signal received through the Trig IN1 terminal runs.

Trig IN2: Signal received through the Trig IN2 terminal runs.

Timer: Signal flows according to the internal timer.

None: Bus trigger is not used by the frame (it can be used on the modules.)

Note

Trig IN1 and Trig IN2 correspond to outputs A1 and A2 in section 2.3, “Trigger System Schematic” of the Features Guide (IM AQ23011A-01EN). Normally, the signal from the frame’s trigger input terminal is transmitted, but it can be changed with a remote command.

<<Supported commands>>

Function	Command
Select the bus trigger output	:TRIGger[:SEQuence]:SOURce:BUS[n]

2.2 Trigger Output

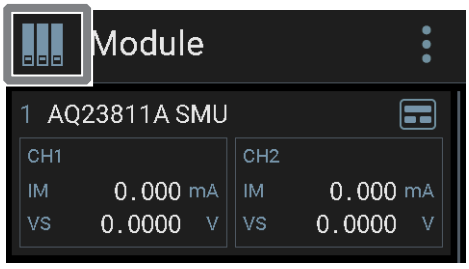
"Trigger Function" in the Features Guide

Procedure

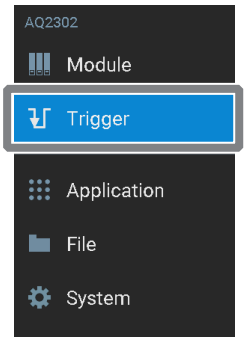
1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **Trigger**. A trigger menu appears.
3. Scroll the screen to show the Trig Out Settings menu.

   Tap **Trig Out1** or **Trig Out2** to set Trig Out1 or Trig Out2.

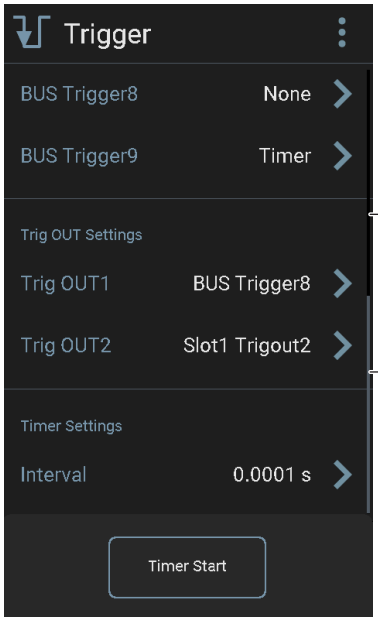
Top screen (summary view)



Function menu



Trigger menu



Set Trig Out.

Explanation

Set the signal to output from the frame's Trig Out1 or Trig Out2 terminal.
Select from the following signals.

Trig Out1

Trig IN1: signal received through Trig IN 1
BUS Trigger1 to BUS Trigger9: signal assigned to BUS Trigger1 to BUS Trigger9
All Slot Trigout1: logic OR of the signals output from Trigout1 of all modules
Slot1 Trigout1 to Slot9 Trigout1: signal output from Trigout1 of Slot1 to Slot9

Trig Out2

Trig IN2: signal received through Trig IN 2
BUS Trigger1 to BUS Trigger9: signal assigned to BUS Trigger1 to BUS Trigger9
All Slot Trigout2: logic OR of the signals output from Trigout2 of all modules
Slot1 Trigout2 to Slot9 Trigout2: signal output from Trigout2 of Slot1 to Slot9

<<Supported commands>>

Function	Command
Select TRIG OUT1	:TRIGger[:SEQuence]:SOURce:OUTPut1
Select TRIG OUT2	:TRIGger[:SEQuence]:SOURce:OUTPut2

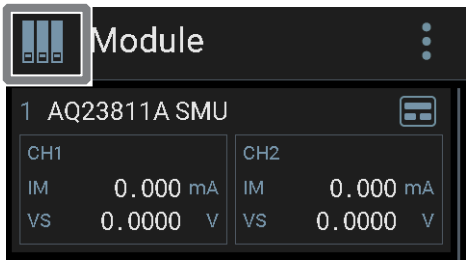
2.3 Timer

"Trigger Function" in the Features Guide

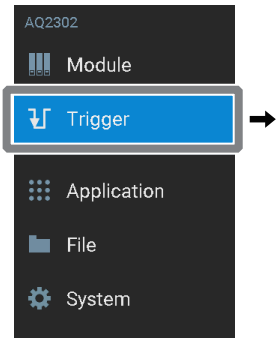
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **Trigger**. A trigger menu appears.
3. Scroll the screen to show the Timer Settings menu.
4. Tap **Interval**. On the screen that appears, set the time interval to generate the timer (transmitter) signal.
5. Tap **Timer Start**. The timer starts. The button changes to Timer Stop. To stop the timer, tap **Timer Stop**.

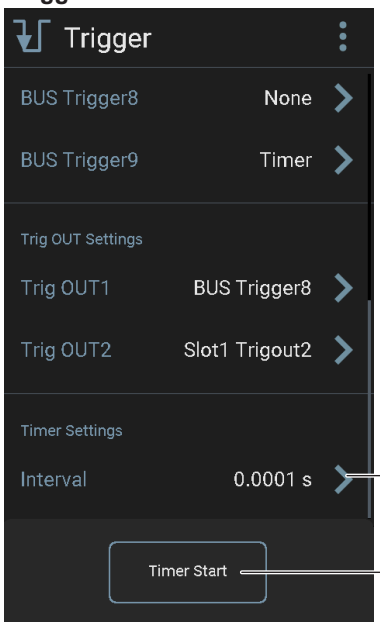
Top screen (summary view)



Function menu



Trigger menu



Set the signal source interval. For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

Starts the timer

Explanation

The frame's internal timer (transmitter) signal is transmitted to the bus trigger.
Measurement and sourcing can be synchronized to the frame's timer by assigning the timer as the modules' measurement trigger or source trigger.

<<Supported commands>>

Function	Command
Set the timer	:TRIGger[:SEQuence]:TIMer:Period<timer>,<period>
Set the timer generation count	:TRIGger[:SEQuence]:TIMer:COUNt<timer>,<count>
Start or stop the timer	:TRIGger[:SEQuence]:TIMer[:STATe]<timer>,0|1|STOP|STARt

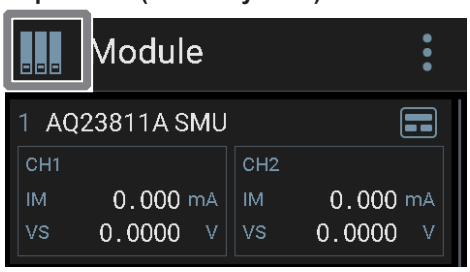
3.1 Sweep

"Sweep" in the Features Guide

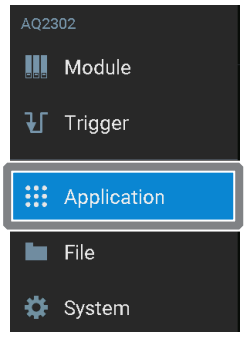
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **Application**. An Application menu appears.
3. Tap **Sweep**. A Sweep menu appears.

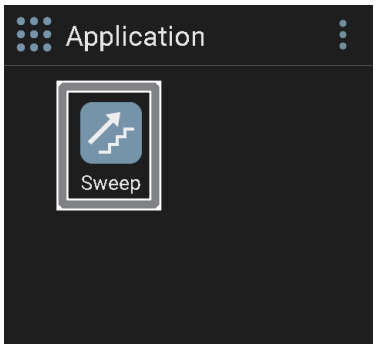
Top screen (summary view)



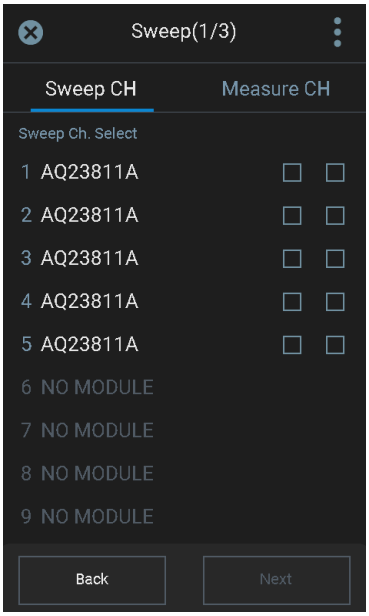
Function menu



Application menu



Sweep menu



Setting the sweep channels and measurement channels

4. Tap the **Sweep CH** tab, and select the sweep channel check boxes.

The left check box of each module corresponds to CH1 and the right to CH2.

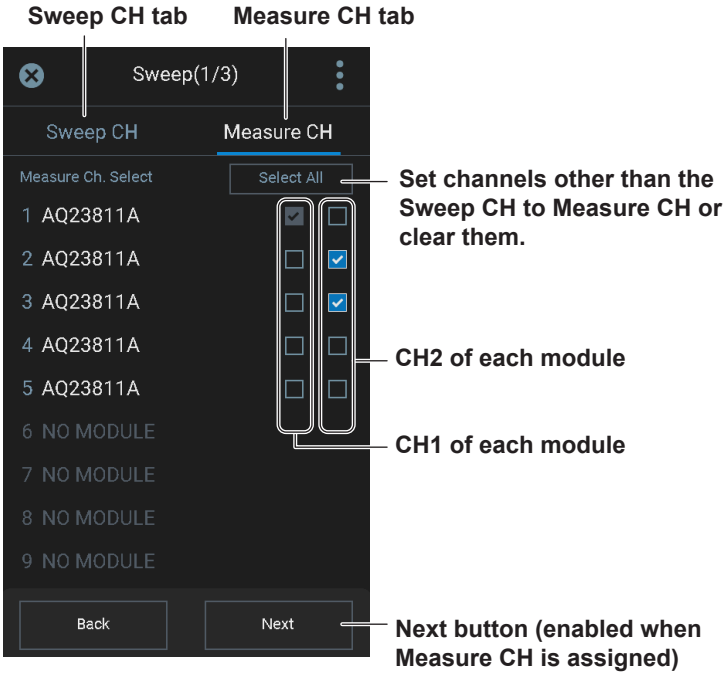
Only one channel can be set as a sweep channel.

5. Tap the **Measure CH** tab, and select the measurement channel check boxes.

Up to 17 channels can be set to measurement channels (when nine 2-channel SMUs are installed in a 9-slot frame).

Tap **Select All** to select or unselect all channel check boxes except the sweep channels.

When you set measurement channels, the Next button at the bottom of the screen is enabled.



6. Tap **Next**. A Sweep (2/3) menu appears.

Setting the repeat count (Repeat)

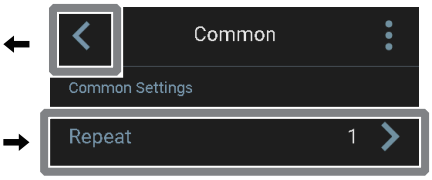
7. Tap **Common**. A Common menu appears.

8. Tap **Repeat**. A screen appears for setting the repeat count.

Set the sweep repeat count.

Sweep (2/3) menu

Common menu



For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

Setting the Source (Source)

7. Tap **Source**. A Source menu appears.

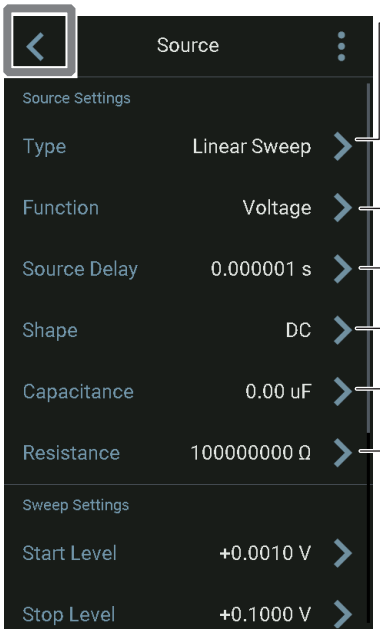
8. Enter the various settings.

You can view the items that do not fit on the screen by scrolling the screen up.

When the sweep shape (Shape) is set to DC

Sweep (2/3) menu

Source menu



Set the sweep type (Linear Sweep/Log Sweep/Program Sweep).

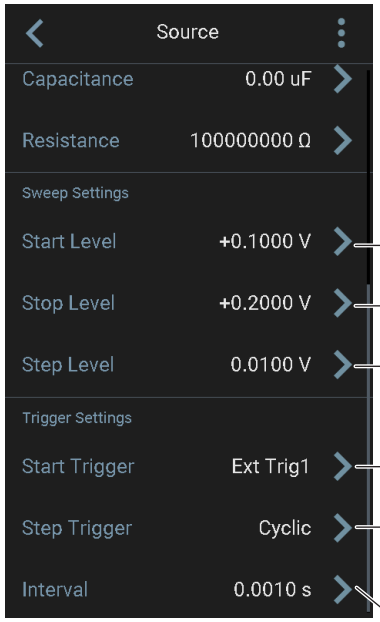
Set the function (Voltage/Current).

Set the source delay.

Set the sweep waveform (DC/Pulse).

Set the capacitance (Inductance when the function is set to Current).

Set the resistance.



Set the start level.

Set the stop level.

Set the step level (Log Points when Sweep Type is set to Log).

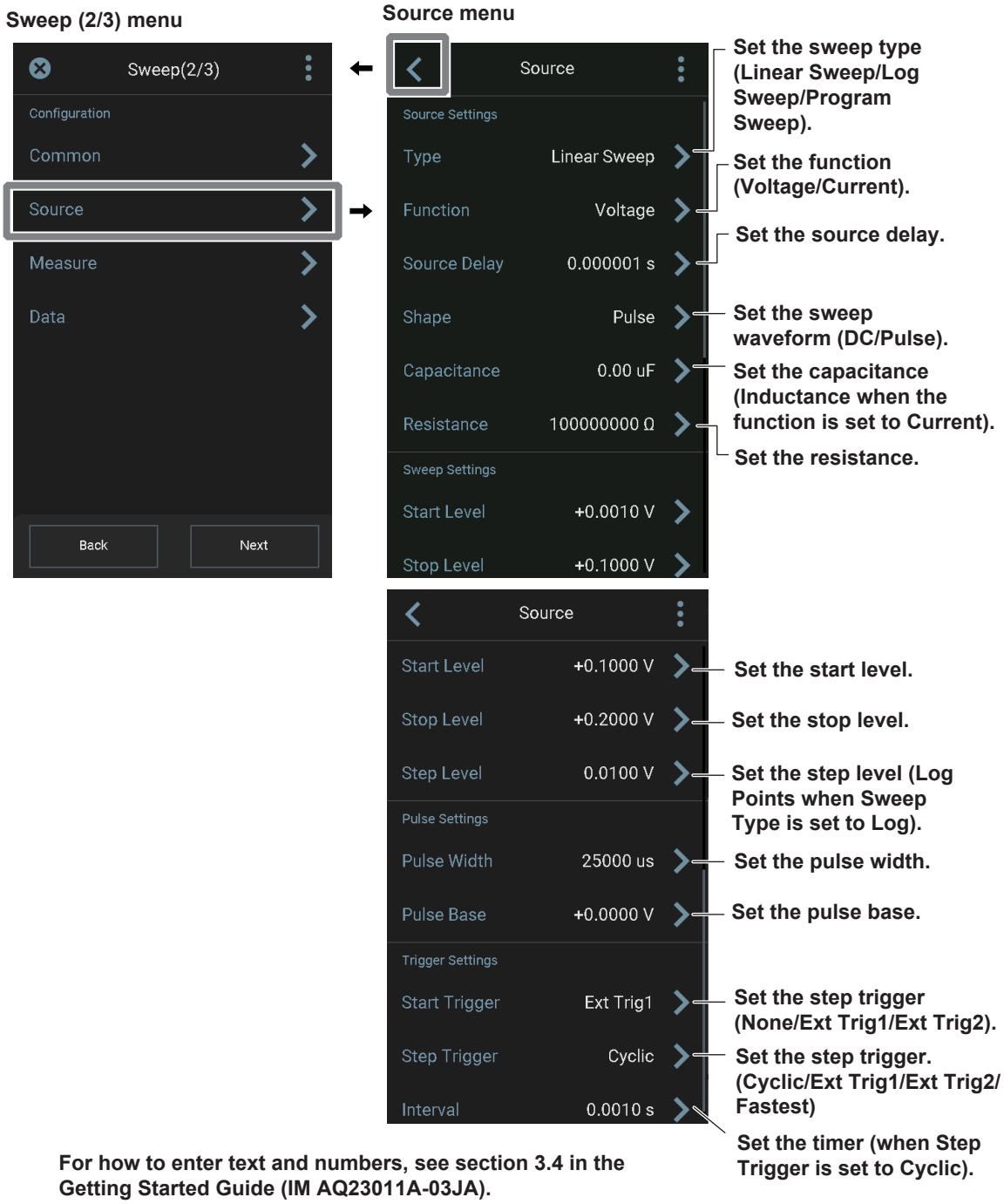
Set the step trigger (None/Ext Trig1/Ext Trig2).

Set the step trigger. (Cyclic/Ext Trig1/Ext Trig2/ Fastest)

Set the timer (when Step Trigger is set to Cyclic).

For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

When the sweep shape (Shape) is set to Pulse



For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

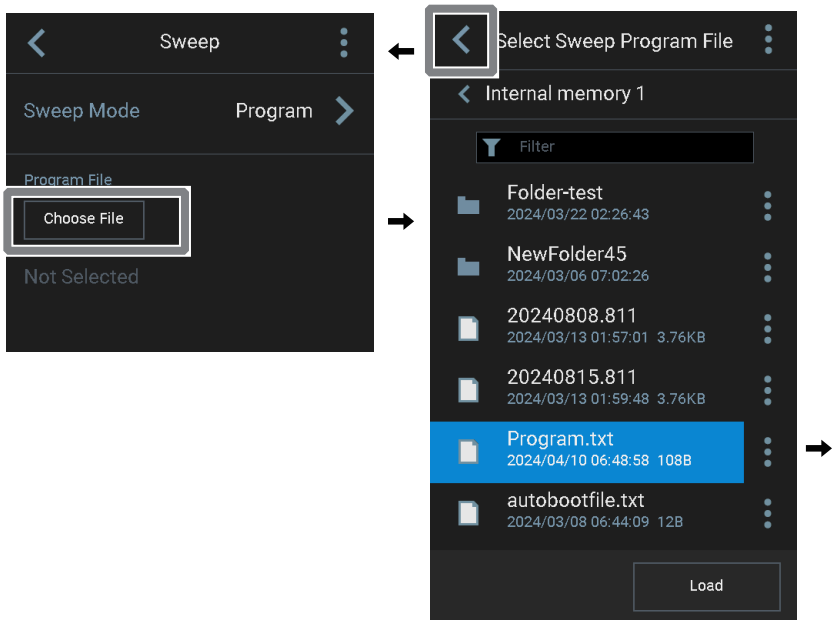
Selecting a program file

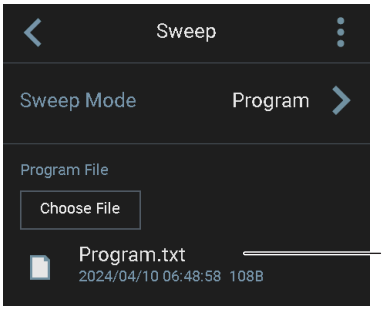
When the sweep type is set to Program Sweep, select a program file saved in the instrument's internal storage.

9. Set Type to Program Sweep to display a menu for selecting a program file.

Tap **Choose File**. A list appears showing the files in the internal storage.

10. Select a program file from the folder containing the program files, and tap **Load**. The selected program file is loaded.





Loaded program sweep file

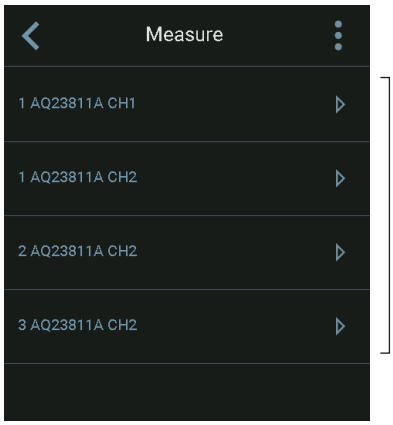
Configuring the measurement (Measure)

7. Tap **Measure**. Channels set to measurement channels are displayed.

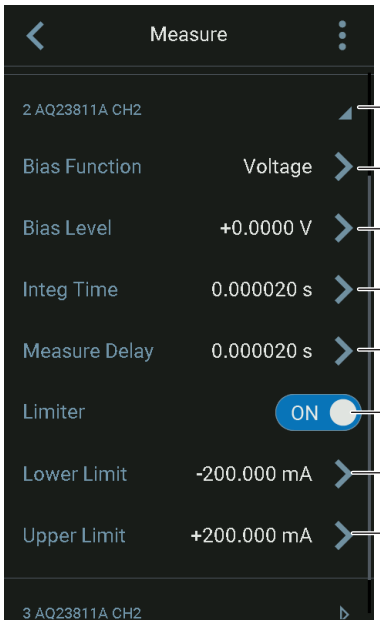
8. Tap the channel you want to edit. A Measure menu appears.

9. On the displayed setup menu, enter the various settings.

You can view the items that do not fit on the screen by scrolling the screen up.



Measuring channels (indicated with slot number, module name, and channel number)



Closes the setting menu

Set the bias function (Voltage, Current).

Set the bias level.

Set the integration time.

Set the measurement delay.

Turns limiter on and off

Set the lower limiter limit.

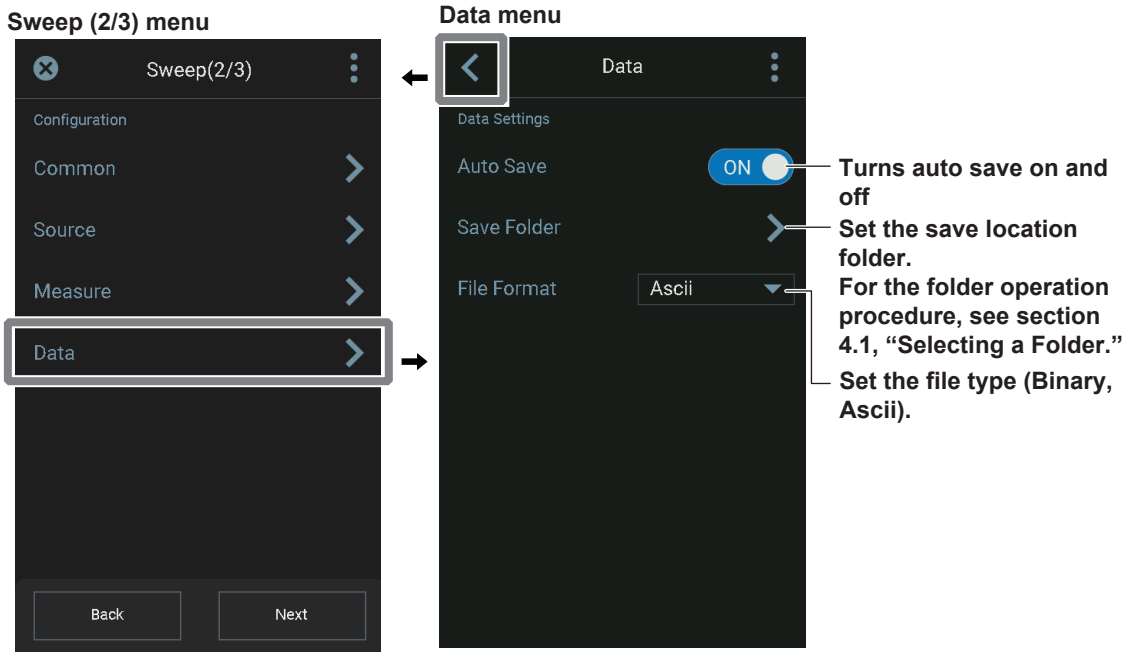
Set the upper limiter limit.

For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

Saving measurement data

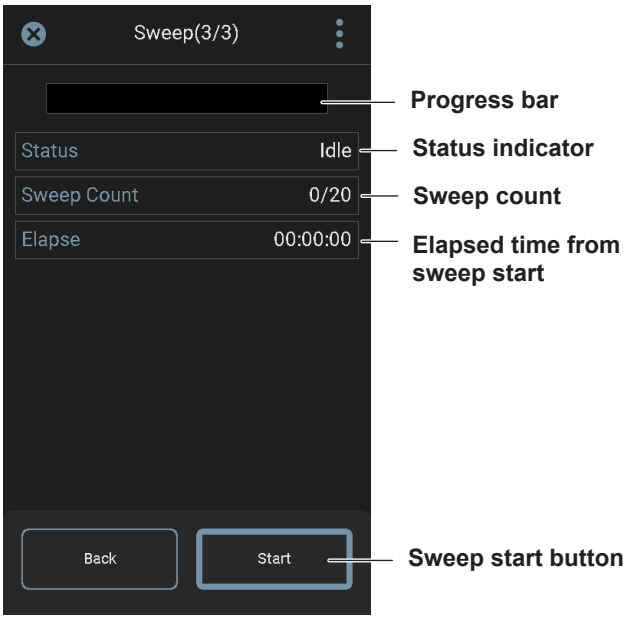
7. Tap **Data**. A Data menu appears.
8. Turn Auto Save on or off.

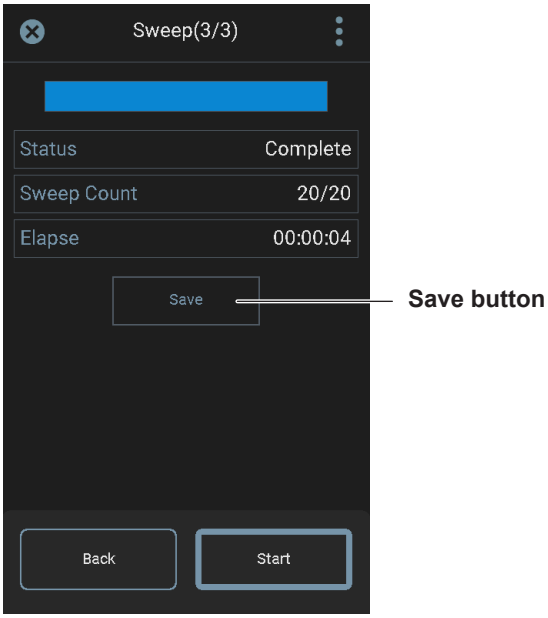
   If you select on, measurement data is saved automatically.
9. Tap Save Folder, and set the save location.



Starting a sweep

7. Tap **Next**. The Sweep3/3 menu appears.





8. Hold down **Start** until the entire Start button changes color. The Start button changes to Stop.

The state indicator changes from Idle to Running.

When a start trigger is detected, sweeping starts automatically.

To stop sweeping, tap Stop.

9. When sweeping is completed, the state indicator changes to Complete, and a Save button appears.

To save the measurement data, tap **Save**.

A file control screen appears. Save the measurement data to the folder you specify.

Explanation

Sweep channel (Sweep CH)

The sweep channel is the channel used to source voltage or current.
A single channel can be selected from all the modules installed in the frame.

<<Supported commands>>

Function	Command
Select the channel to sweep	:APPLication:MDSelect:SWEEP:SOURce

Measurement channels (Measure CH)

Measurement channels are channels used to measure voltage or current in sync with sweeping.
You can set multiple channels.

<<Supported commands>>

Function	Command
Select the channels to measure	:APPLication:MDSelect:SWEEP:MEASure

Common settings (Common)

Set the sweep repeat count.
The setting range is 0 to 100.

<<Supported commands>>

Function	Command
Set the repeat count	:APPLication:PARameter:SWEEP:REPeat

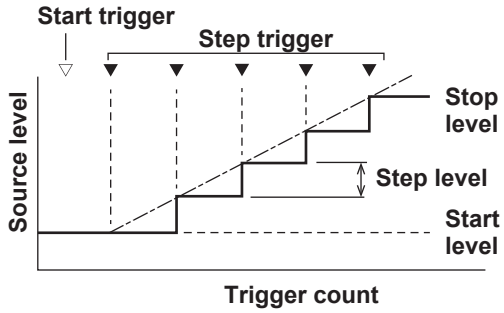
Source (Source)

Configure sweeping.

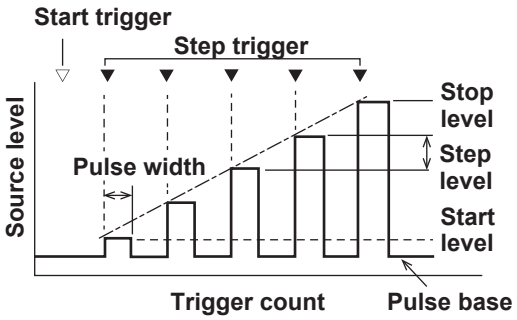
The following sweep waveforms are available based on the sweep-type and sweep-shape combinations.

Sweep type: Linear Sweep

Shape: DC output

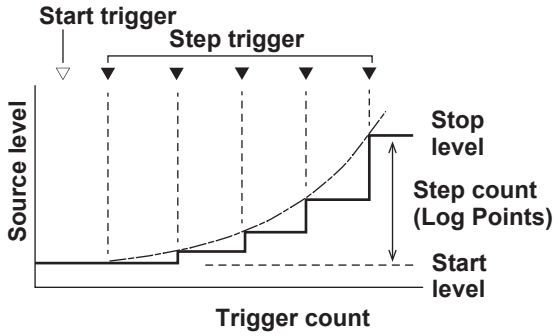


Shape: pulse output

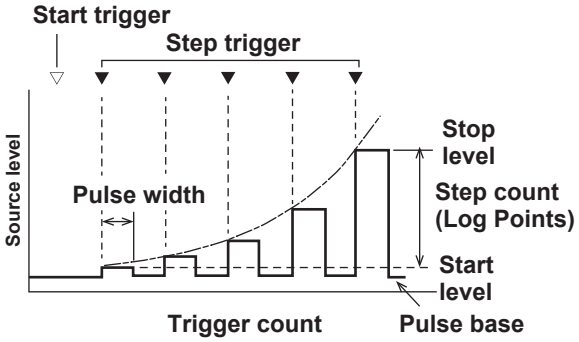


Sweep type: Log Sweep

Shape: DC output

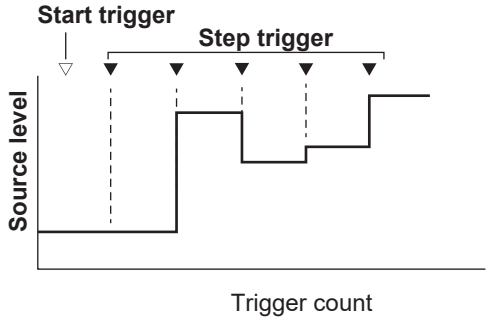


Shape: pulse output

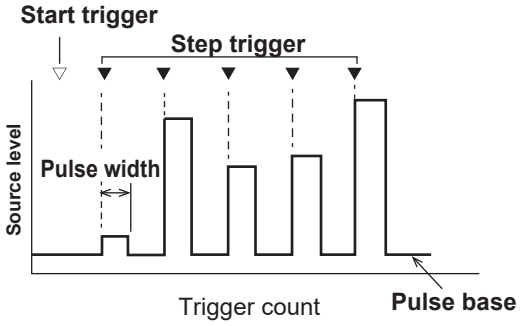


Sweep type: Program Sweep

Shape: DC output



Shape: pulse output



Sweep type (Type)

Set the sweep type to Linear Sweep, Log Sweep, or Program Sweep.

Sweep function (Function)

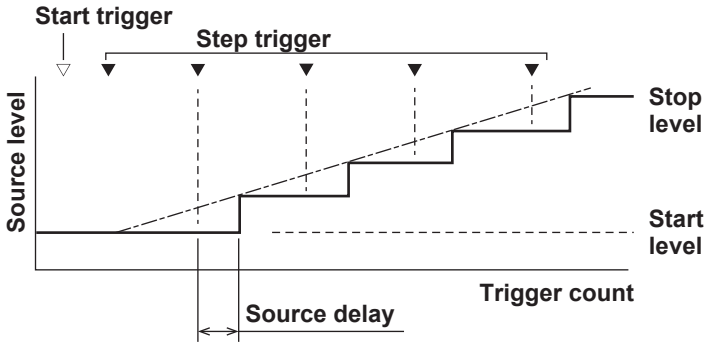
Select voltage source or current source.

Source delay (Source Delay)

Set the time between the detection of the trigger and the sourcing of voltage or current.

Sweep type: Linear Sweep

Shape: DC output



Sweep shape (Shape)

Set whether to output a constant value (DC) or pulse (Pulse) that changes by the step level at every step trigger from the start level to stop level.

Load capacitance, load inductance, and load resistance (Capacitance/ Inductance/Resistance)

When the function is set to voltage, set the capacitance and resistance. When the function is set to current, set the inductance and resistance. The source value can be converged smoothly to the specified output value by setting values appropriate for the source target load. The minimum value is set by default. Change it when adjusting the source waveform.

Start level (Start Level)

Set the sweep start level. When a start trigger is detected, the source value changes to the start level.

Stop level (Stop Level)

Set the sweep stop level.

During DC output, when the source value reaches the stop level, the stop level is maintained until the next start trigger is detected or sweeping is completed.

Step level (Step Level)

Set the step level when Type is set to Linear Sweep.

Sets the amount of change in the source value when a step trigger is detected.

Step count (Log Points)

Set the step count when Type is set to Log Sweep.

Sets how many divisions to sweep between Start Level and Stop Level. The setting range is 2 to 100001.

Pulse width (Pulse Width)

Set the pulse width when Shape is set to Pulse.
Set the pulse width for performing pulse sweeps.

Pulse base (Pulse Base)

Set the pulse width when Shape is set to Pulse.
Set the pulse base level.

Start trigger (Start Trigger)

Set the trigger for starting a sweep. Select None, Ext Trig1, or Ext Trig2.
None: Start sweeping from the panel or by using a communication command.
Ext Trig1, Ext Trig2: Sweeping starts with a signal received through the external trigger signal input terminal.
This is the same setting as the Sweep Start Trigger in the module settings. If you want to set Ext Trig1 or Ext Trig2 to Start Trigger in the module settings, set the bus trigger that Ext Trig1 or Ext Trig2 is assigned to Start Trigger.

Step trigger (Step Trigger)

Set the trigger for changing the source value. Select Cyclic, Ext Trig1, Ext Trig2, or Fastest.
Cyclic: The source value changes based on the internal timer.
Ext Trig1, Ext Trig2: The source value changes based on the signal received through the external trigger signal input terminal.
Fastest: The source value changes when both the Measure Busy and Source Busy signals become not busy.
This is the same setting as Source Trigger of Source in the module settings. If you want to set Ext Trig1 or Ext Trig2 to Source Trigger in the module settings, set the bus trigger that Ext Trig1 or Ext Trig2 is assigned to Source Trigger.

Interval (Interval)

Sets the interval of the signal generated by the internal timer (transmitter). This parameter is required when the step trigger is set to Cyclic.

<<Supported commands>>

Function	Command
Set the sweep type (Program, Log, or Linear)	:APPLication:PARameter:SWEEP:TYPE
Set the source function	:APPLication:PARameter:SWEEP:FUNCtion
Set the source delay	:APPLication:PARameter:SWEEP:SDELay
Set the source waveform	:APPLication:PARameter:SWEEP:SHAPe
Set the start level	:APPLication:PARameter:SWEEP:STARt
Set the stop level	:APPLication:PARameter:SWEEP:STOP
Set the step level	:APPLication:PARameter:SWEEP:STEP
Set the step count	:APPLication:PARameter:SWEEP:COUNt
Set the program file	:APPLication:PARameter:SWEEP:PROGram:FILE
Set the pulse width	:APPLication:PARameter:SWEEP:PULSe:WIDTh
Set the pulse base level	:APPLication:PARameter:SWEEP:PULSe:BASE
Select the start trigger	:APPLication:PARameter:SWEEP:TRIGger:STARt
Select the step trigger	:APPLication:PARameter:SWEEP:TRIGger:STEP
Set the trigger timer interval	:APPLication:PARameter:SWEEP:TRIGger:INTerval
Set the load capacitance	:APPLication:PARameter:SWEEP:VOLTage:RESPonse:CAPacitance
Set the load resistance (for voltage source)	:APPLication:PARameter:SWEEP:VOLTage:RESPonse:RESistance
Set the load inductance	:APPLication:PARameter:SWEEP:CURRent:RESPonse:INDuctance
Set the load resistance (for current source)	:APPLication:PARameter:SWEEP:CURRent:RESPonse:RESistance

Measure (Measure)

Measurement is performed simultaneously with sweeping. You can change the source value by sweeping and measure the output (voltage, current) of the DUT in response to the change.

Bias function (Bias Function, Bias Level)

When measuring a device that requires bias voltage or bias current, the voltage or current can be generated from the measurement terminals.

The bias function cannot be applied to the channel set to Sweep CH.

Note

If bias voltage and bias current are not required, set Bias Level to 0.

The bias voltage or bias current is added to the measured values.

Integration time (Integ Time)

Set the measurement integration time.

If you set a long integration time, the measurement takes longer, but the stability of the measured values increases.

For high precision measurement, specify a time value that is an integer multiple of the power line cycle.

Measurement delay (Measure Delay)

Set the time from trigger detection to the start of measurement.

Limiter (Limiter, Lower Limit, Upper Limit)

When the limiter is turned on, the source value is controlled so that the measured values do not exceed the set range.

When the voltage or current generated from a SMU module of this instrument is applied to the DUT and its output is measured, the source value from the SMU can be controlled so that the output values of the DUT dot not exceed the limit value.

Even during sweeping, the source value is maintained at a value that does not cause the measured values to exceed the setting range.

Use Lower Limit to set the lower measurement limit and Upper limit to set the upper measurement limit.

<<Supported commands>>

Function	Command
Set the BIAS Function	:APPLication:PARameter:SWEEP:MEASure:BIAS:FUNCtion
Set the bias level	:APPLication:PARameter:SWEEP:MEASure:BIAS:LEVel
Set the integration time (s)	:APPLication:PARameter:SWEEP:MEASure:ITIMe
Set the integration time (plc)	:APPLication:PARameter:SWEEP:MEASure:NPLC
Set the measurement delay	:APPLication:PARameter:SWEEP:MEASure:DELay
Turn the limiter on and off	:APPLication:PARameter:SWEEP:PROTection[:STATe]
Set the limiter upper limit	:APPLication:PARameter:SWEEP:PROTection:UPPer
Set the limiter lower limit	:APPLication:PARameter:SWEEP:PROTection:LOWer

Auto saving measurement data (Data)

When Auto Save is set to ON, measurement data is saved automatically in binary format after sweeping is completed.
When set to OFF, you can select whether to save the measurement data at the end of each sweep.
Set the file format to Binary or Ascii.

<<Supported commands>>

Function	Command
Set auto file saving	:APPLication:PARameter:SWEep:ASAVe
Auto file save folder	:APPLication:PARameter:SWEep:ASAVe:PATH
Set the file format	:APPLication:PARameter:SWEep:ASAVe:FORMat

Sweep state indication (Status)

The progress of the sweep is indicated.
Idle: ready
Running: in progress
Complete: sweep complete

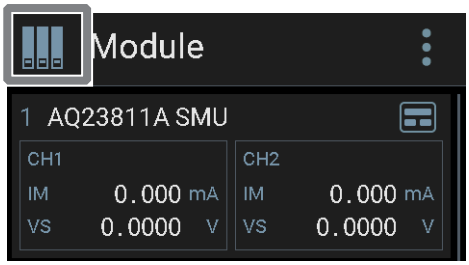
4.1 Selecting a Folder

"File Operations" in the Features Guide

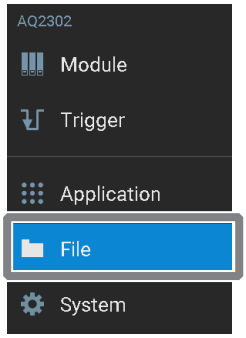
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **File**. A File menu appears.
3. Tap **Location**. The internal storage device and external storage device connected to the instrument are shown.

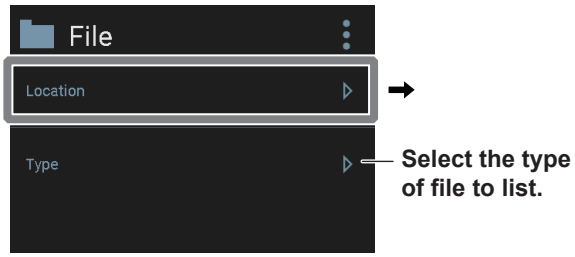
Top screen (summary view)



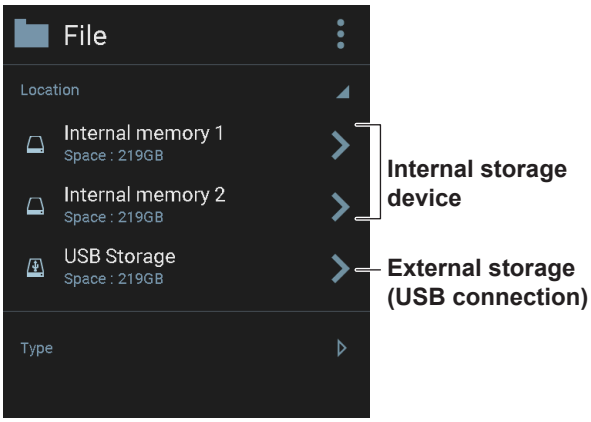
Function menu



File menu

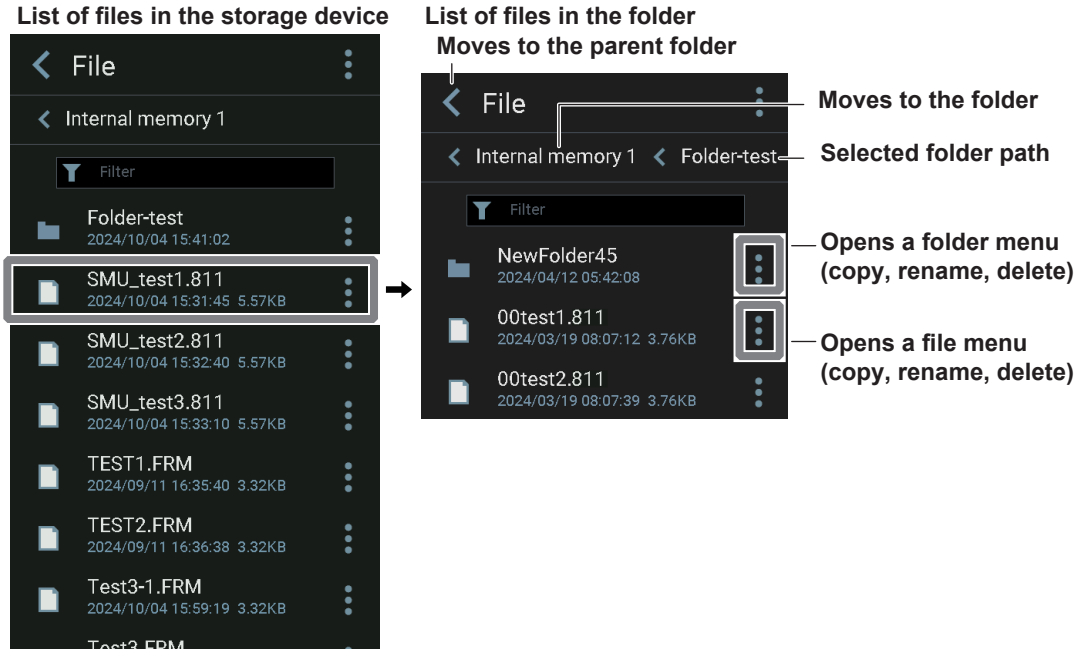


List of storage devices



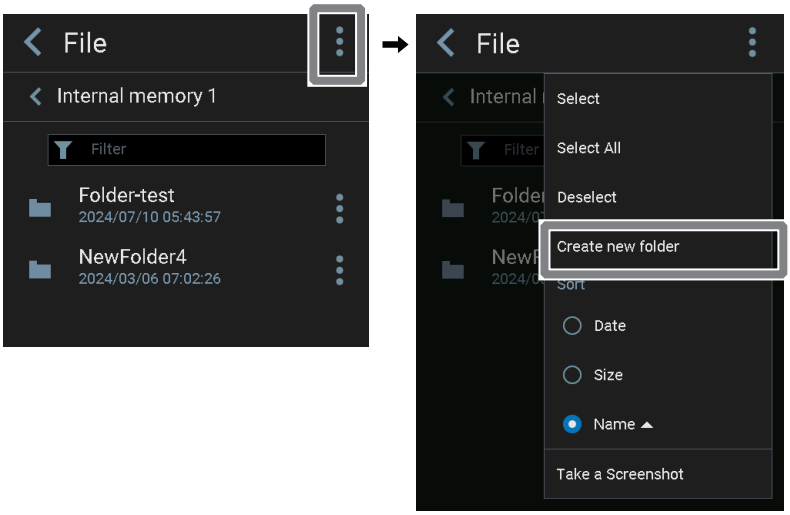
4. Tap the storage device you want to control. A list of folders and files in the storage device appears.
5. To specify a folder, tap the folder in the storage device.

   To return to the parent folder, tap **<** next to the file display.



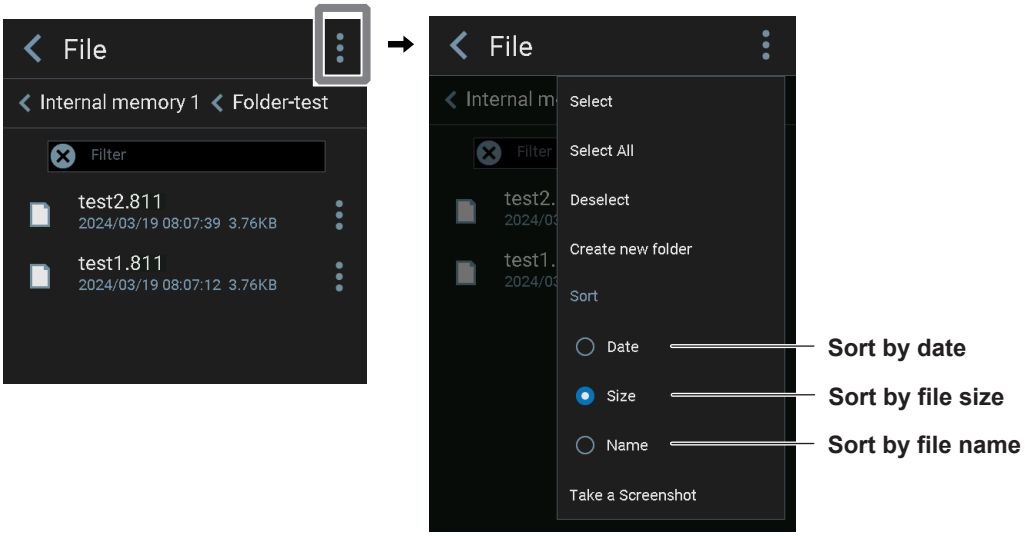
Creating a folder

4. Select a storage device or folder you want to create a folder in. A list of files appears.
5. Tap the File menu icon ( ). A file operation menu appears.
6. Tap **Create new folder**. A folder name setting screen appears. Enter a folder name, and tap Enter to create the folder.



Sorting the file list

4. Select a storage device or folder. A list of files appears.
5. Tap the File menu icon ( ). A file operation menu appears.
6. Tap **Date**, **Size**, or **Name**. The file list is sorted in ascending or descending order by date, file size, or file name. To change the order, select Date, Size, or Name again.

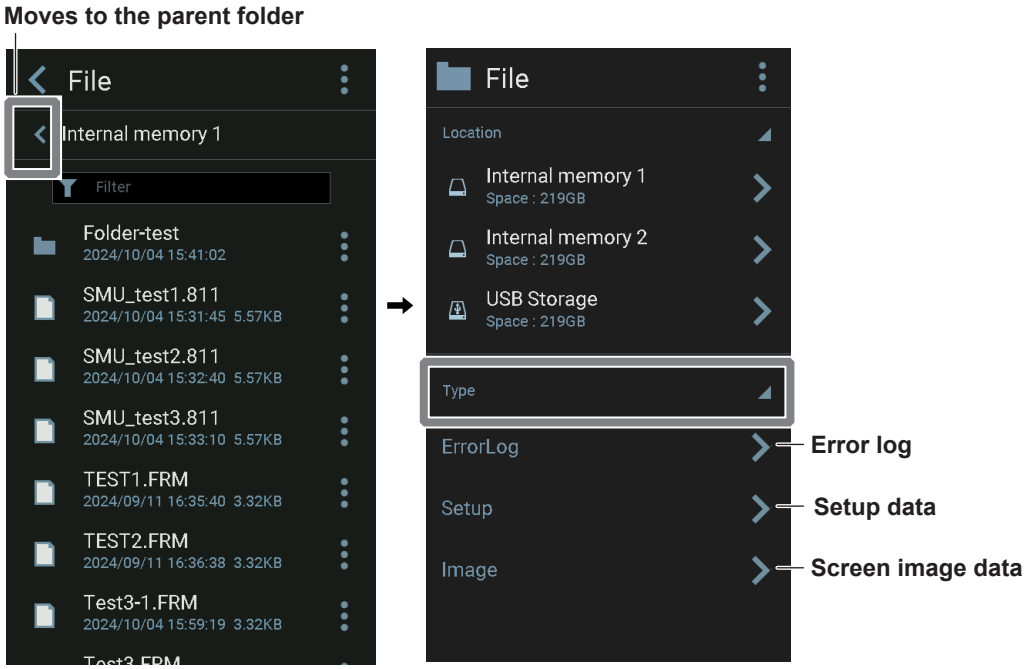


Selecting the type of files to display

You can set the type of files to display.

4. Return to the first File screen (screen show in step 3).
5. Tap **Type**. The file type is displayed.
6. Tap the type of file you want to list. The list view displayed in step 4 will change to show only the selected type of file.

   If you change the folder, the type setting will be cleared.



Searching folder and files using filters

Filters can be applied to display only the desired folders and files.

1. Tap the filter condition input area on the screen where the filter mark is displayed.

   A text input screen appears.
2. Enter the filter condition. An asterisk can be used as a wildcard.

   Filtering by *.811 will show files with a .811 extension.

Explanation

Selecting a Folder

You can select a folder in the instrument's internal storage device (Internal Memory1 or Internal Memory2) or external storage device connected to the instrument via USB.

<<Supported commands>>

Function	Command
Change the current drive	:MMEMory:CDRive
Create a folder	:MMEMory:MDIRectory

Sorting files

Sorting is possible by timestamp (Date), file size (Size), and file name (Name).

Selecting the type of file to list

Only files of a specified type from the files in the selected folder can be displayed.
The types of files that can be selected are error log (ErrorLog), setup data (Setup), and screen image data (Image).

Searching folder and files (filtering)

Use filters to display only the folders and files that match your criteria.
A wildcard (asterisk) can be used.
To set multiple filter conditions, separate each condition with a comma.

4.2 Renaming, Copying, and Deleting Folders and Files

"File Operations" in the Features Guide

Procedure

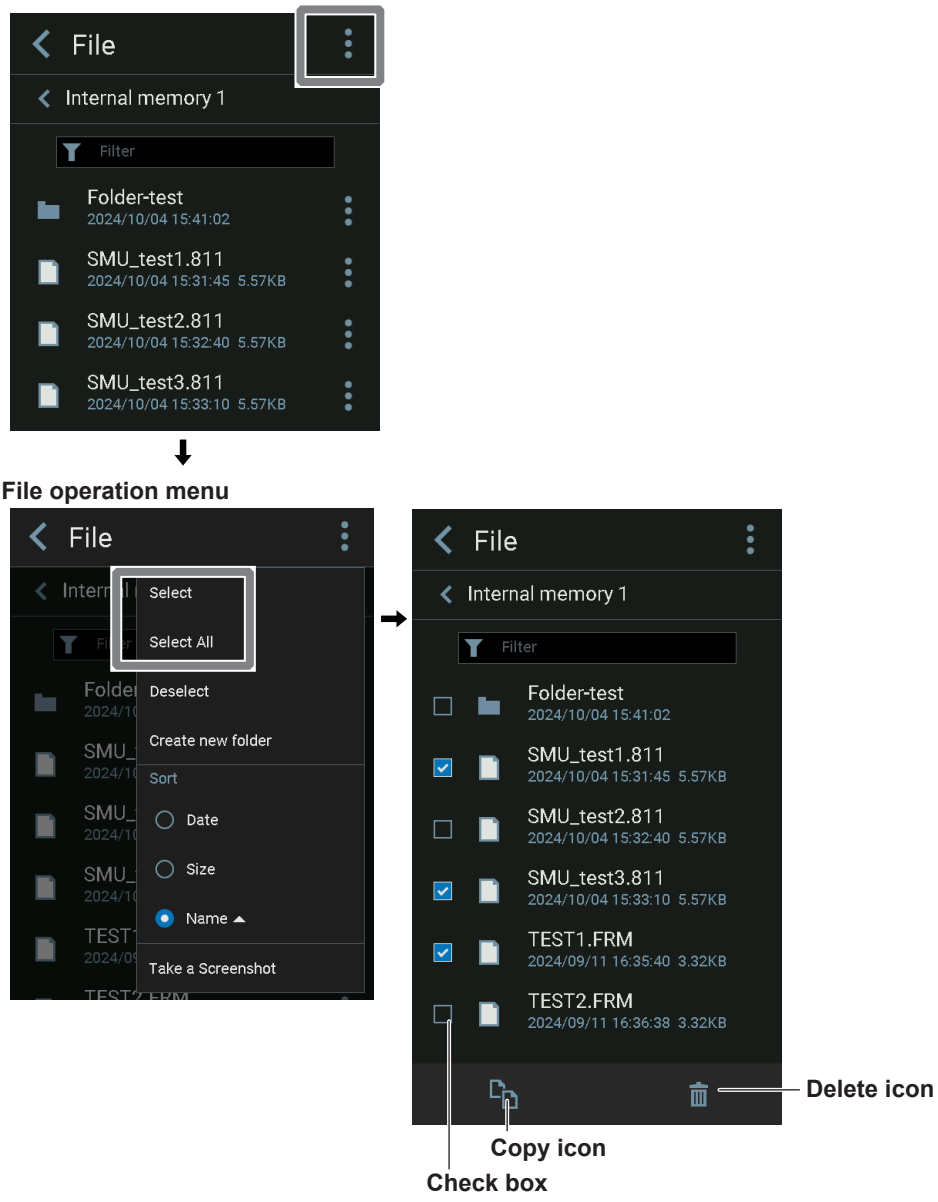
Copying and deleting folders and files

1. Select the folder containing the folder or files you want to manipulate according to section 4.1, "Selecting a Folder".

Copying or deleting multiple files or folders

2. Tap the File menu icon ( ). A file operation menu appears.
3. Tap **Select** or **Select All**. Check boxes appear next to folder and file names, and copy and delete icons appear at the bottom of the file list.

   When you tap Select All, all check boxes will be selected.



4. Tap the check boxes to select files and folders you want to manipulate.

To unselect files and hide the check boxes, tap **Deselect** on the file operation menu.

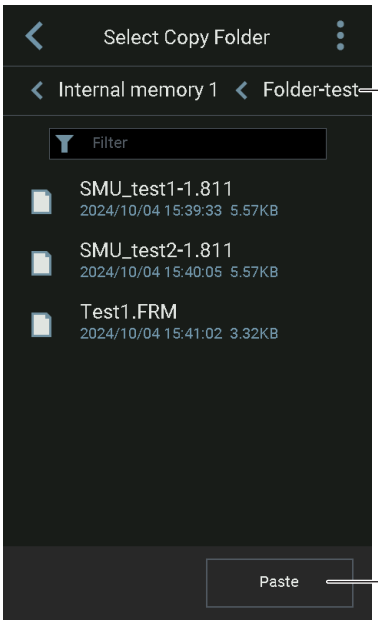
5. To copy the selected folders and files to another folder, tap the copy icon.

A Paste button appears.

To delete the selected files, tap the delete icon. A confirmation message appears.

6. To copy folders and files, select the copy destination folder, and tap **Paste**.

To delete folders and files, tap **OK** for the confirmation message. To not delete them, tap **Cancel**.

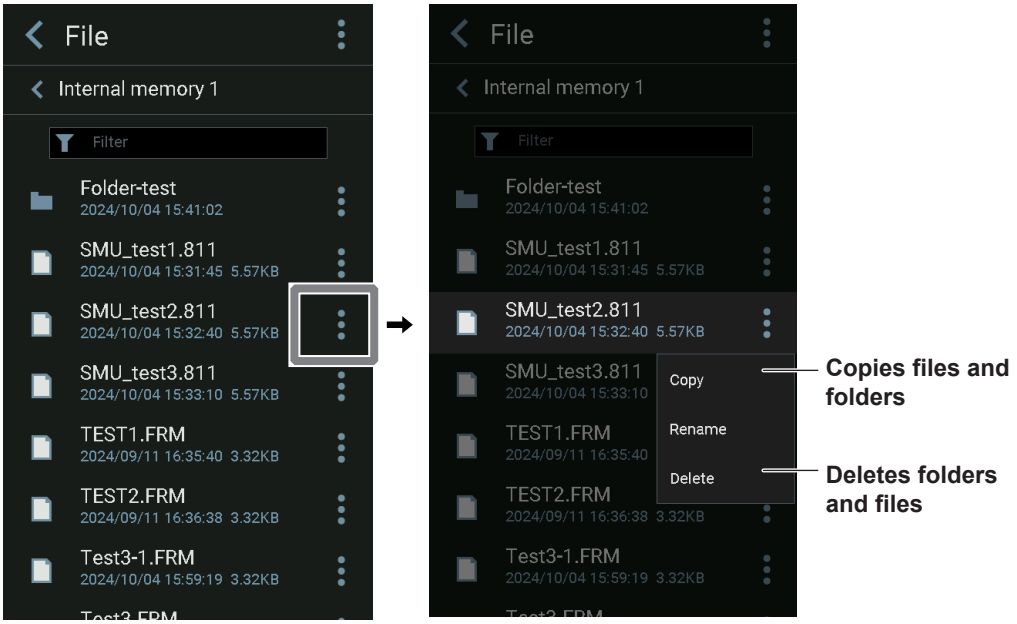


Copying or deleting one folder or one file at a time

2. Tap the menu icon ( ) to the right of name of the folder or file you want to copy or delete.
3. To copy the folder or file, tap **Copy**. A Paste button appears.

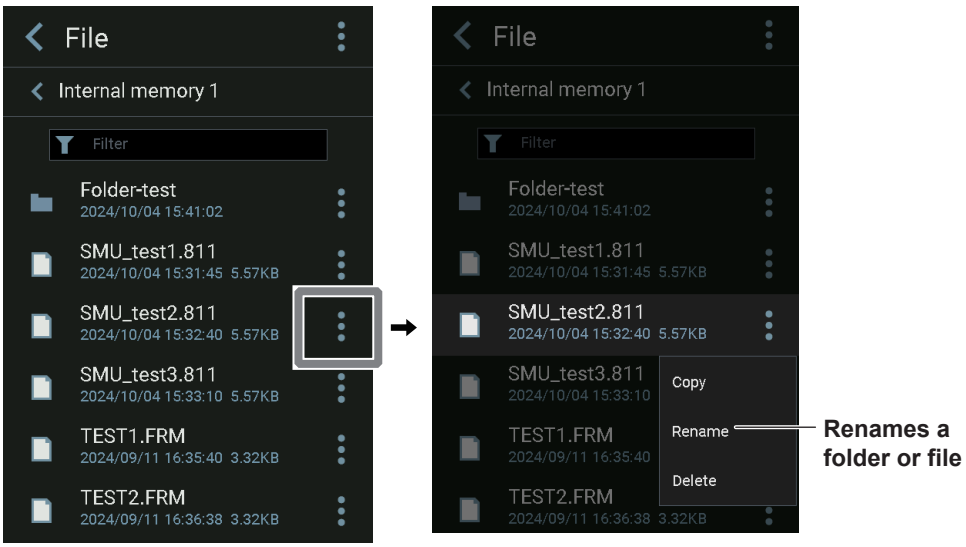
   To delete the folder or file, tap **Delete**. A confirmation message appears.
4. To copy folders and files, select the copy destination folder, and tap **Paste**.

   To delete folders and files, tap **OK** for the confirmation message. To not delete them, tap **Cancel**.



Renaming a folder or file

1. Select the folder containing the folder or files you want to manipulate according to section 4.1, “Selecting a Folder”.
2. Tap the menu icon ( ) to the right of name of the folder or file you want to change.
3. Tap **Rename**. A folder or file name input screen appears.
4. Enter the new folder or file name on the screen.

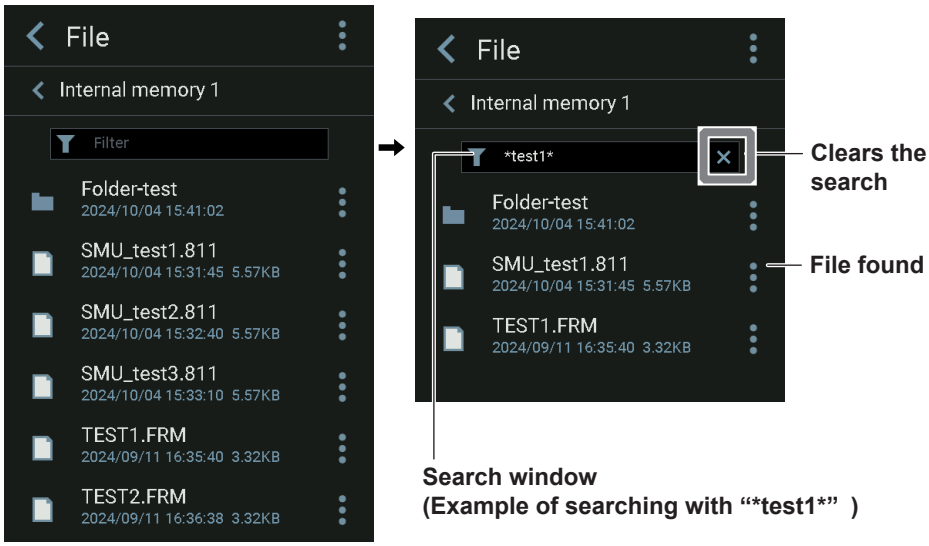


For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

File searching

1. Select the folder containing the files you want to manipulate according to section 4.1, “Selecting a Folder”.
2. Tap the search window. A window appears for entering a search string.
3. Enter a search string on the screen.
4. Files that include the search string appear.

   To clear the search, tap X of the search window.



For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

Explanation

The following operations can be performed on the files and folders in the instrument's internal storage device or external storage device connected to the instrument via USB.

- Create a folder
- Copy folders and files
- Rename folders and files
- Delete folders and files
- Sort the list
- Search files

<<Supported commands>>

Function	Command
Copy the specified file	:MMEMory:COPY<SrcFileName>,[INTernal|EXTernal],<DstFileName>,[INTernal|EXTernal]
Delete the specified file	:MMEMory:DELete<FileName>,[INTernal|EXTernal]

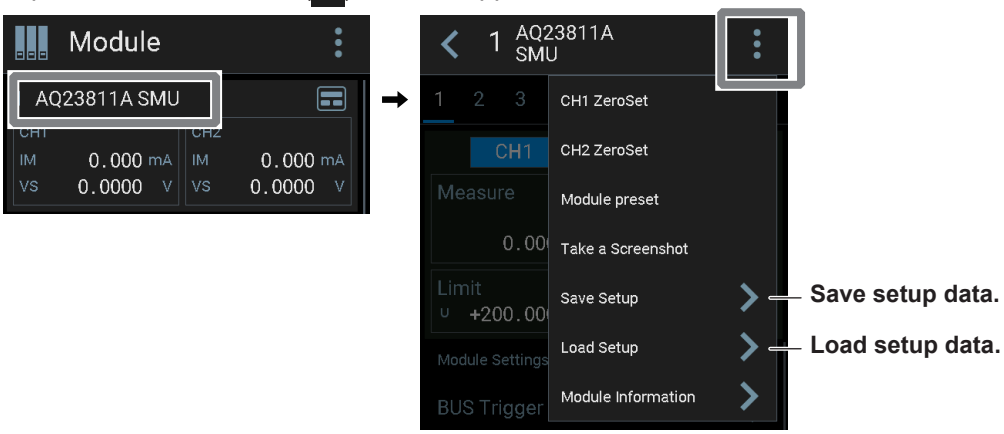
4.3 Saving and Loading Setup Files

"Data That Can Be Saved" in the Features Guide

Procedure

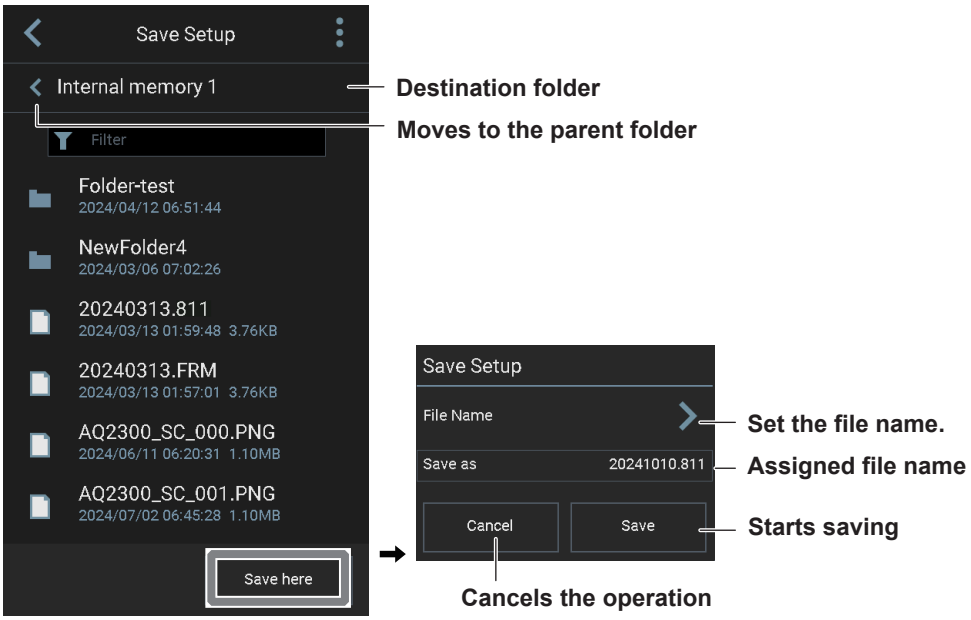
Saving and loading setup data of a module

1. On the top screen (summary view), tap the name of the module you want to save the setup data of. A detail view appears.
2. Tap the menu menu icon ( ). A menu appears.



Saving setup data

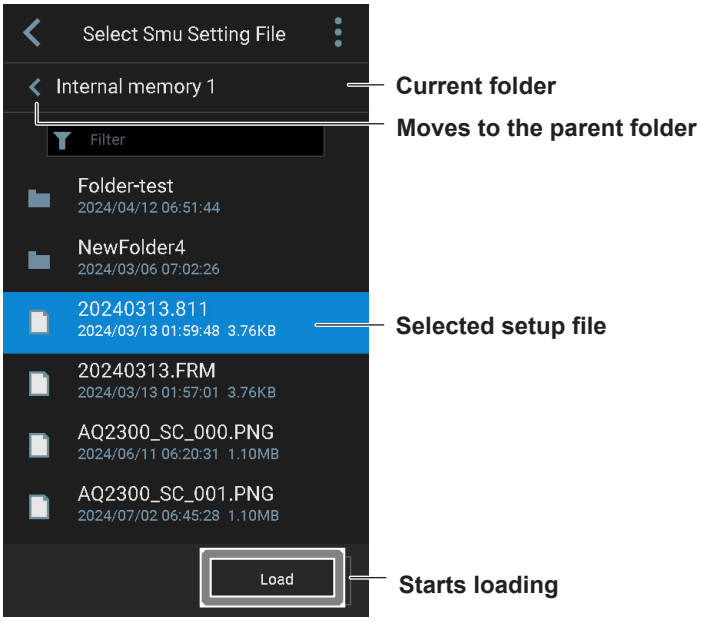
3. Tap **Save Setup**. A list of files in the selected folder appears.
4. Select the save location folder.
5. Tap **Save here**. A file name setting menu appears.
6. Set any file name.
7. Tap **Save**. The setup data is saved. To cancel saving, tap **Cancel**.



For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

Loading setup data

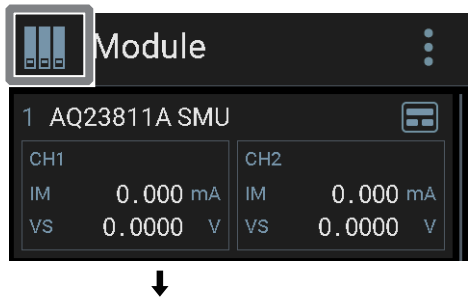
3. Tap **Load Setup**. A list of files in the selected folder appears.
4. Select the folder containing the setup file you want to load.
5. Tap the setup data you want to load.
6. Tap **Load**. The setup data is loaded.



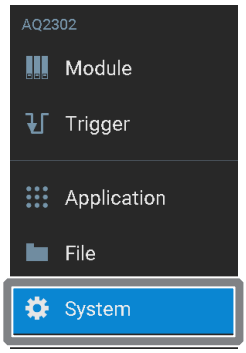
Saving and loading setup data of the frame

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.
3. Tap the menu menu icon ( ). A menu appears.

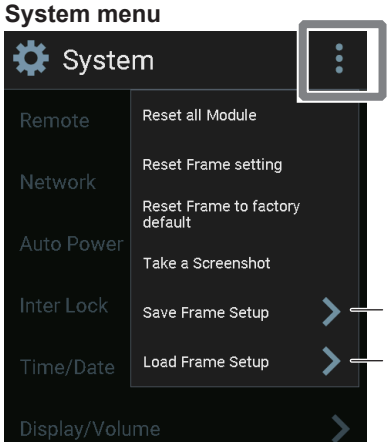
Top screen (summary view)



Function menu



System menu

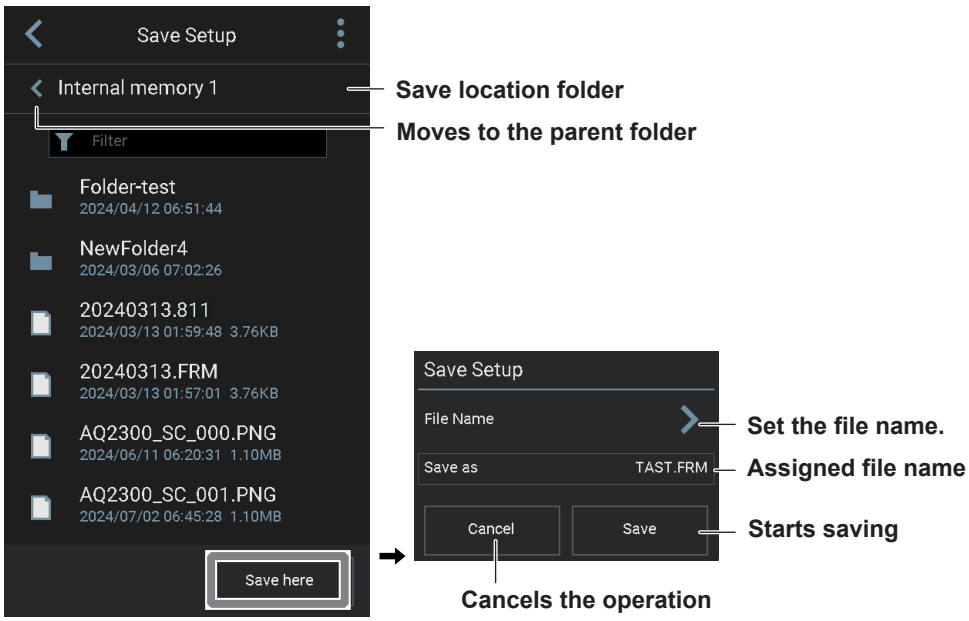


Save setup data.

Load setup data.

Saving setup data

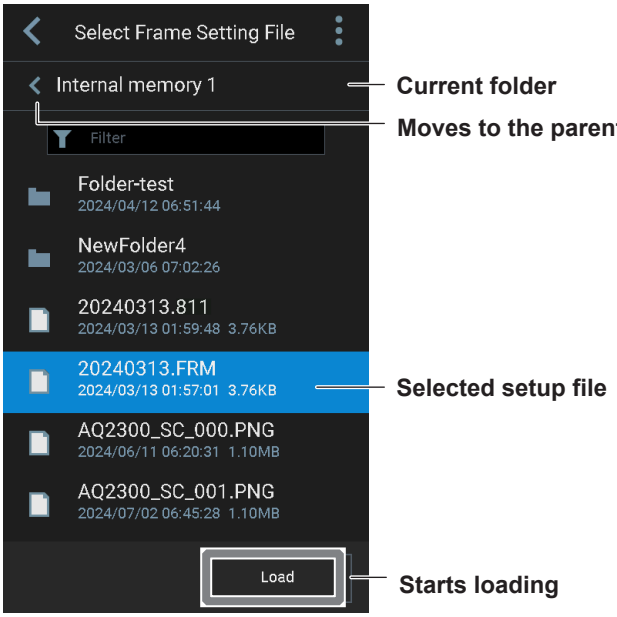
4. Tap **Save Frame Setup**. A list of files in the selected folder appears.
5. Select the save location folder.
6. Tap **Save here**. A file name setting menu appears.
7. Set any file name.
8. Tap **Save**. The setup data is saved. To cancel saving, tap **Cancel**.



For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

Loading setup data

4. Tap **Load Setup**. A list of files in the selected folder appears.
5. Select the folder containing the setup file you want to load.
6. Tap the setup data you want to load.
7. Tap **Load**. The setup data is loaded.



Explanation

You can save setup data to a file.
Files saved in the past can be loaded to source and measure under the same source and measurement conditions.
Extension of an AQ23811A module's setup file: .811
Extension of the frame's setup file: .FRM

<<Supported commands>>

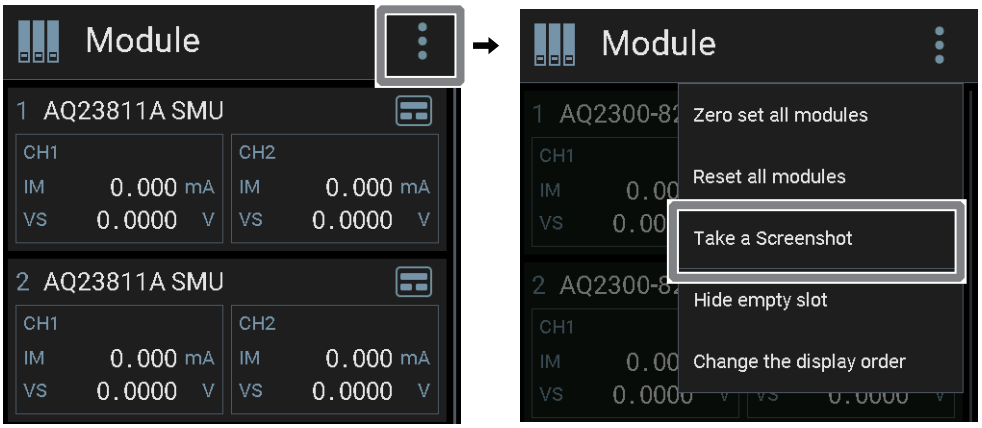
Function	Command
Save a setup file	:MMEMory:SAVE:SETTing
Load a setup file	:MMEMory:LOAD:SETTing

4.4 Screenshots

"Data That Can Be Saved" in the Features Guide

Procedure

1. At the screen you want to take a screenshot of, tap the menu icon ( ). A control menu appears.
2. Tap **Take a Screenshot**. A screenshot is taken, and a message appears telling you that the file has been saved.
3. Tap **OK**.



Explanation

You can take screenshots of the displayed screen and save them as PING files (.PNG).
The save location is the folder selected through file operation.
File name: AQ2300_SC_xxx.PNG
xxx: automatically assigned sequence number (000 to 999)

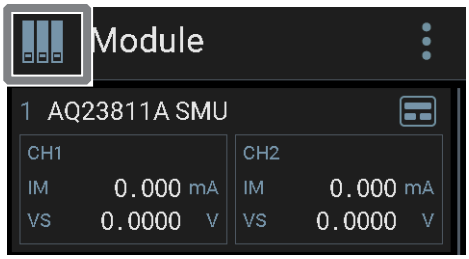
5.1 Remote Connection

"Remote Connection" in the Features Guide

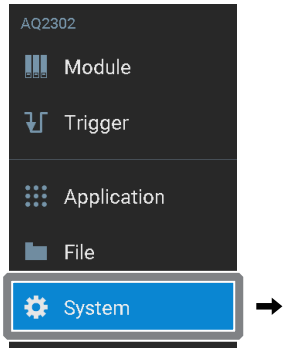
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.

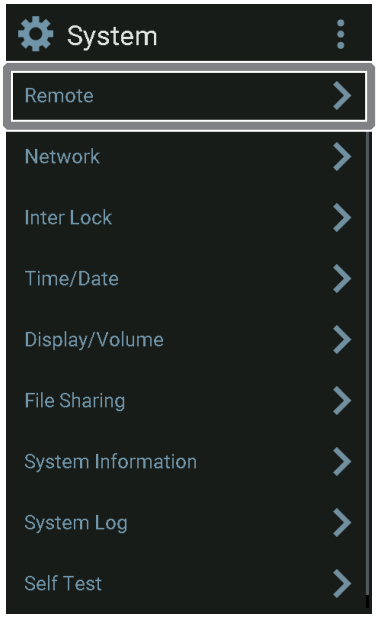
Top screen (summary view)



Function menu



System menu



3. Tap **Remote**. A Remote menu appears.
4. Tap the item you want to edit. On the setup menu that opens, enter the various settings.

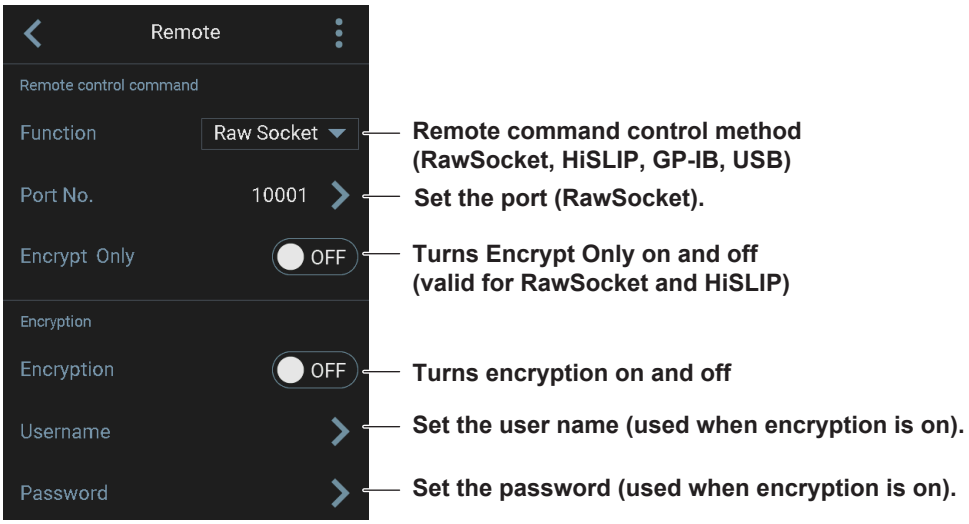
   RawSocket: Port No., Encrypt Only, and Encryption settings

   HiSLIP: Encrypt Only and Encryption settings

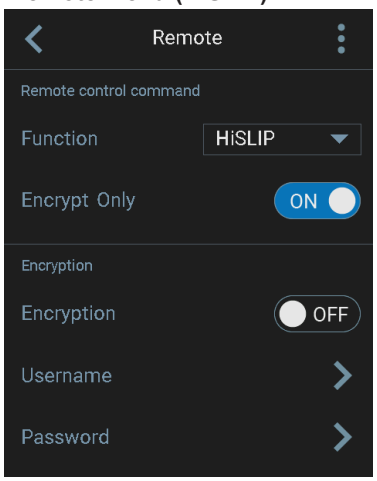
   GP-IB: GP-IB address and Encryption settings

   USB: Encryption setting

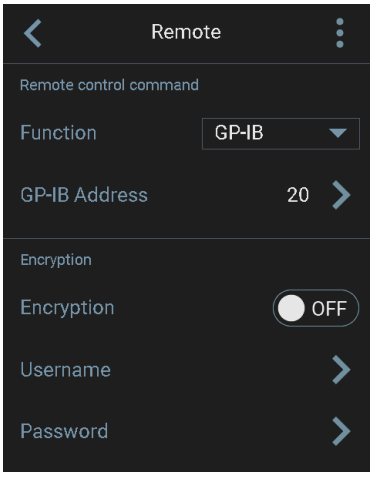
Remote menu (Raw Socket)



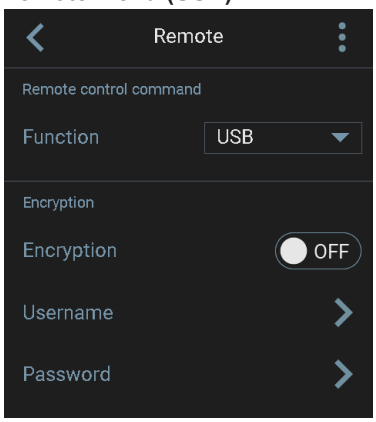
Remote menu (HiSLIP)



Remote menu (GP-IB)



Remote menu (USB)



For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

Explanation

Remote Control (Remote Control Command)

Control method (Function)

Set how to control the instrument with remote commands.

Select a method from the following:

RawSocket: Direct transmission is possible through TCP Socket. IPv4/TCP and IPv6/TCP protocols are supported.

HiSLIP: A protocol mainly used for controlling instruments. IPv4/TCP and IPv6/TCP protocols are supported.

GP-IB: Communication is performed through GP-IB.

USB: Communication is performed through USB.

Encryption (Encrypt Only)

Set whether to use only encrypted paths or also use unencrypted paths for communication with the PC when controlling via remote commands.

When set to ON, only encrypted paths are used. To enhance communication path security, set this to ON.

When set to OFF, unencrypted paths can also be used.

This setting is valid when the control method is RawSocket or HiSLIP.

Encryption (Encryption)

Turning encryption on and off (Encryption)

Set whether to encrypt communication data.

User name (Username)

Enter a user name for encryption.

Password (Password)

Enter a password for encryption.

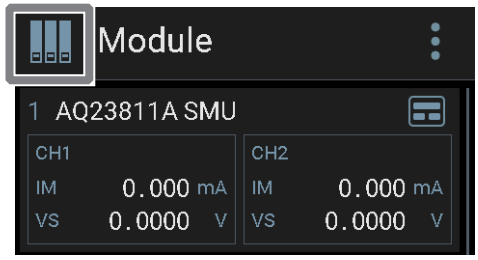
5.2 Network

“Network Configuration” in the Features Guide

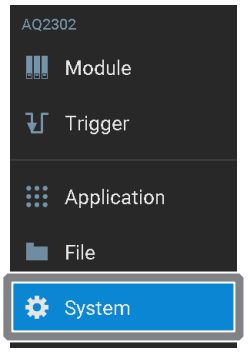
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.

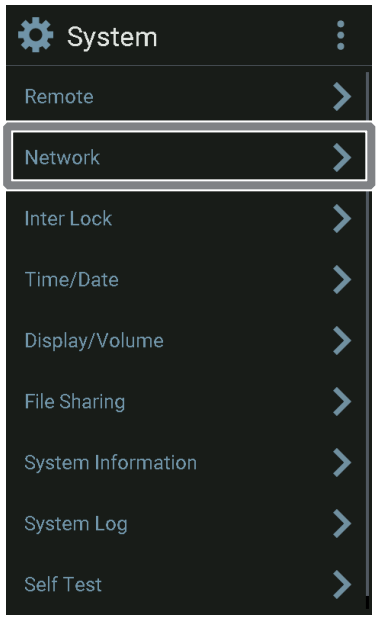
Top screen (summary view)



Function menu



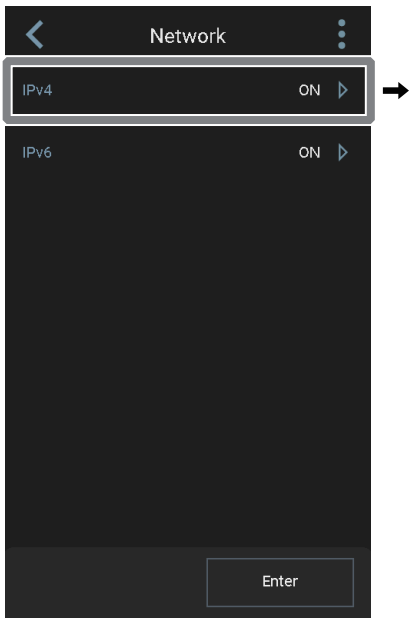
System menu



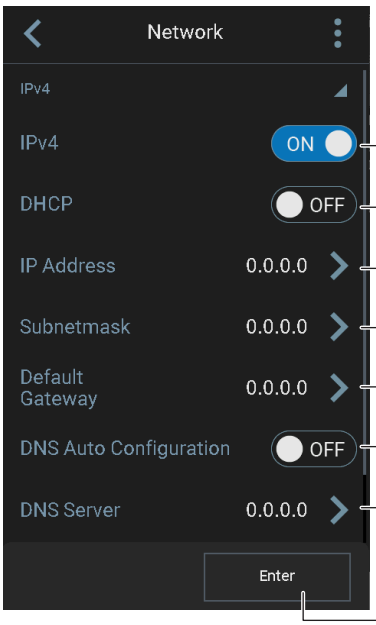
3. Tap**Network**. A Network menu appears.
4. Tap IPv4 or IPv6 according to the network you are connecting to. A setup menu opens.
5. Tap the item you want to edit. On the setup menu that opens, enter the various settings.

   You can view the items that do not fit on the screen by scrolling the screen up.

Network menu



IPv4 menu



Turns IPv4 on and off

Turns DHCP on and off

Set the IP address (valid when DHCP is set to OFF)

Set the subnet mask (valid when DHCP is set to OFF)

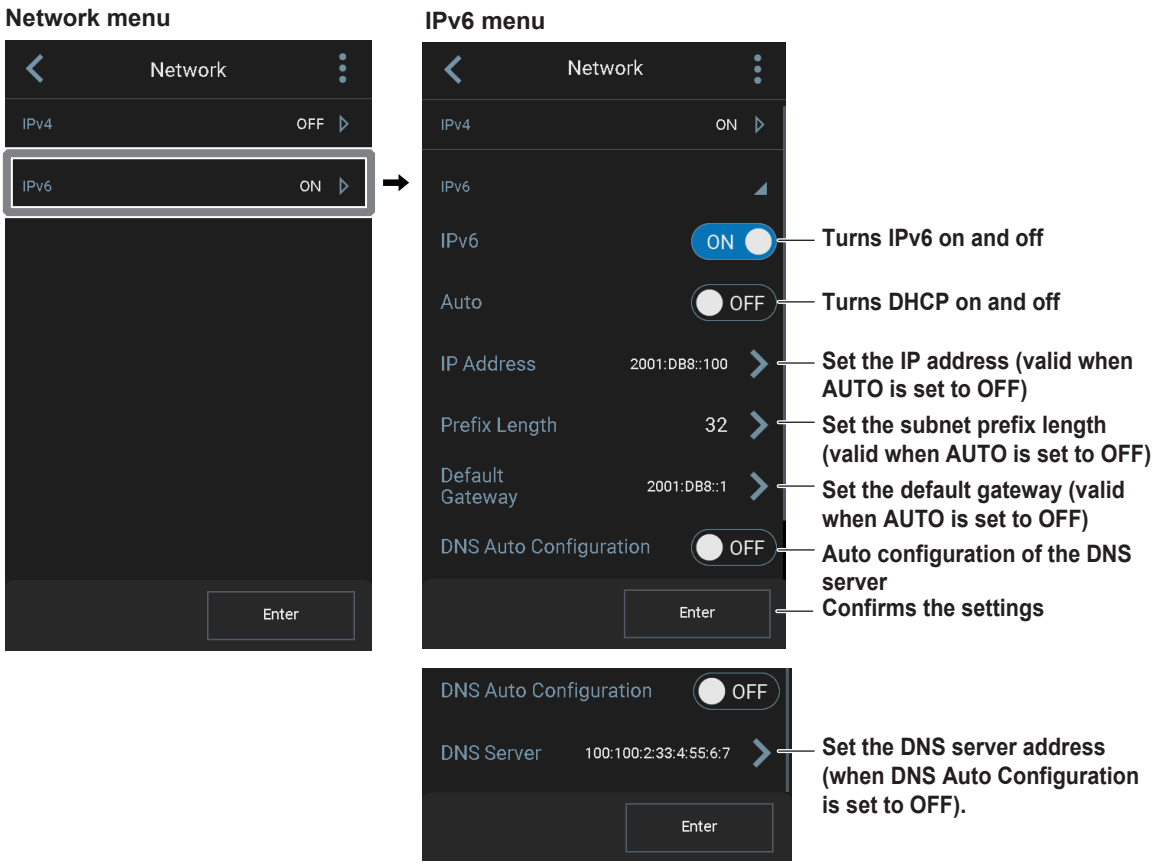
Set the default gateway (valid when DHCP is set to OFF)

Auto configuration of the DNS server

Set the DNS server address (when DNS Auto Configuration is set to OFF).

Confirms the settings

For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).



For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

6. Tap **Enter**. The settings will be confirmed.

Explanation

Setting the TCP/IP parameters

Configure IPv4 and IPv6 according to the network that this instrument is connected to.
If both IPv4 and IPv6 are enabled, either one will be selected automatically according to the network that this instrument is connected to.

IPv4

If a DHCP server is available on the network that the instrument is connected to, an IP address is automatically assigned to the instrument. In this case, set DHCP to ON.

IPv6

“AUTO” is usually used, but you can also set a fixed IP address manually.
If you are setting the IP address manually, set also the subnet prefix length and default gateway.
Set the IP address and default gateway in hexadecimal notation.

For details about the network that you intend to connect the instrument to, contact your network administrator.

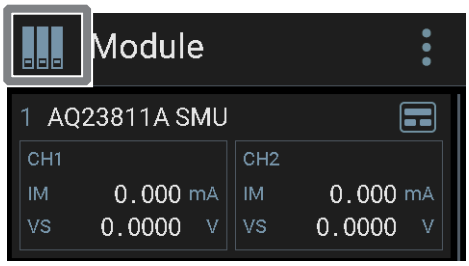
5.3 Interlock

"Other Features" in the Features Guide

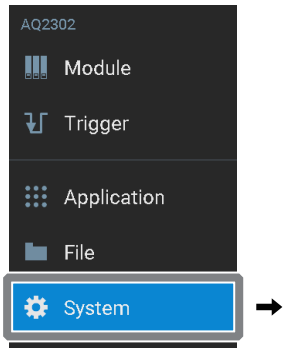
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.

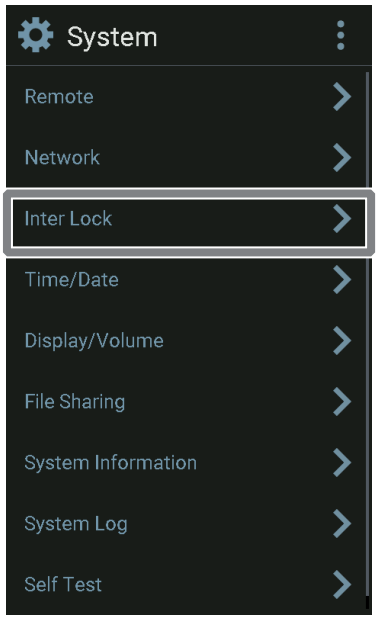
Top screen (summary view)



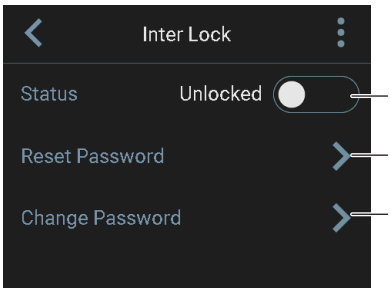
Function menu



System menu



3. Tap **Inter Lock**. An Inter Lock menu appears.



Set the interlock.

Initialize the interlock password.

Change the interlock password. For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

4. Set **Status** to **Locked** or **Unlocked**.

   When changing from Locked to Unlocked, a password input screen will appear. Enter the password, and tap **Enter**.

Initializing the password

4. Tap **Reset Password**. A password input screen appears. Enter the current password, and tap **Enter**. The password will be initialized.

Changing the password

4. Tap **Change Password**. A password input screen appears. Enter the current password, and tap **Enter**.
5. Enter a new password, and tap **Enter**. The password will be changed.

Explanation

When the interlock is enabled, SMUs cannot source signals.
This prevents voltage or current from being sourced by the SMU module.
The default password is “12345.”

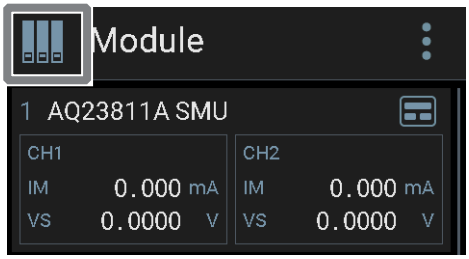
5.4 Turning the Beep Sound On and Off

"Other Features" in the Features Guide

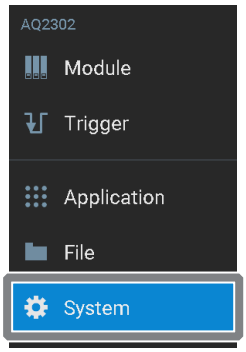
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.

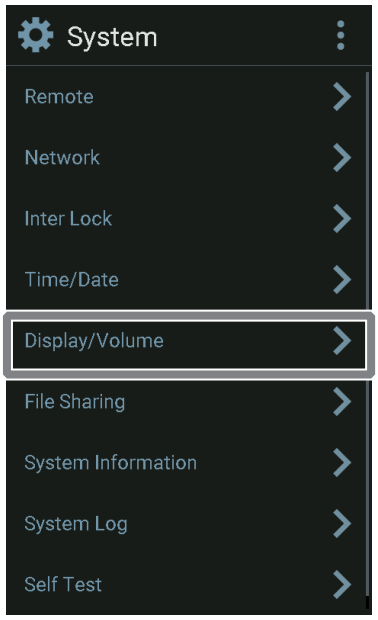
Top screen (summary view)



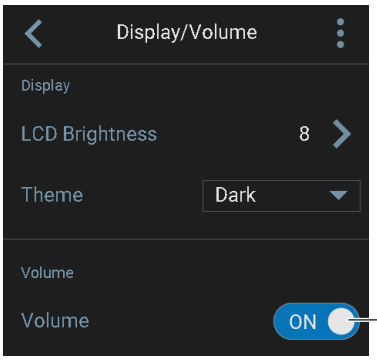
Function menu



System menu



3. Tap **Display/Volume**. The Display/Volume menu appears.



Turns the beep sound on and off

Explanation

The beep sound that is generated such as when the touch panel is accessed can be turned on or off.

<<Supported commands>>

Function	Command
Turn the beep sound on or off	:SYSTem:BEEP

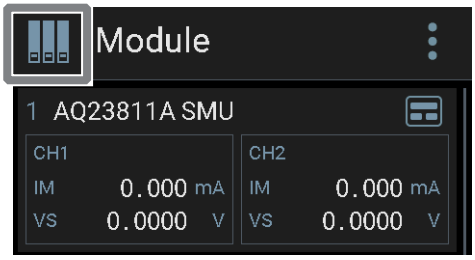
5.5 Screen Brightness

"Other Features" in the Features Guide

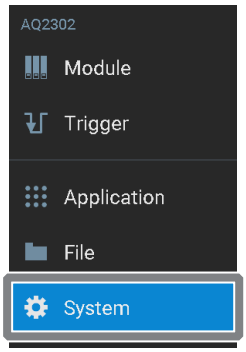
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.

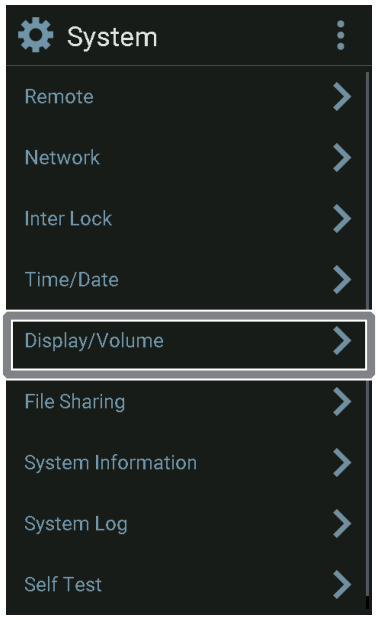
Top screen (summary view)



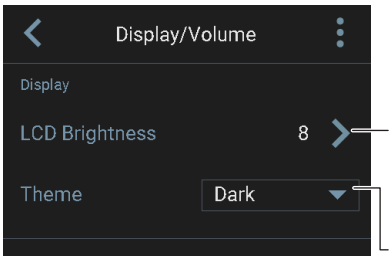
Function menu



System menu



3. Tap **Display/Volume**. The Display/Volume menu appears.



Set the LCD brightness (0 to 8). For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

Set the background color (Dark, Light).

4. Tap **LCD Brightness** or **Theme**. On the screen that appears, set the LCD brightness or background color.

Explanation

You can set the screen brightness and background color.

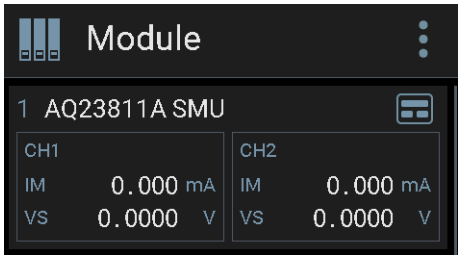
Setting the LCD brightness

Set the LCD brightness in the range of 0 (darkest) to 8 (brightest).

Setting the background color

Set the screen background color to Dark or Light. The default setting is Dark.

Dark



Light

<<Supported commands>>

Function	Command
Set the LCD brightness (set the backlight)	:SYSTem:DISPlay:BACKlight<integer>

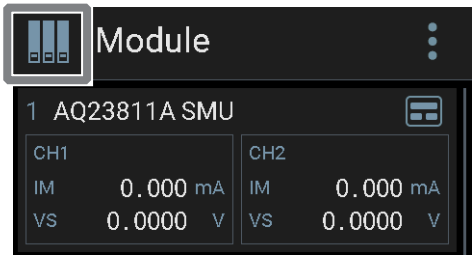
5.6 File Sharing

"Other Features" in the Features Guide

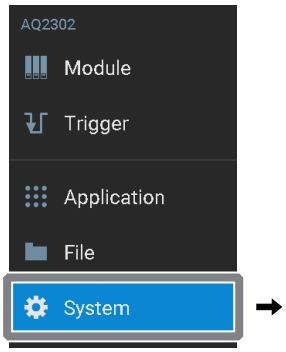
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.

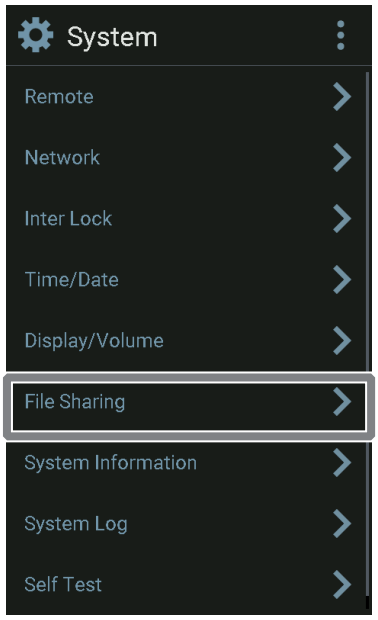
Top screen (summary view)



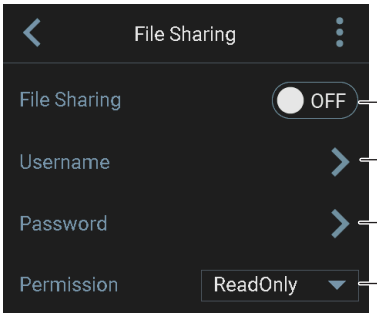
Function menu



System menu



3. Tap **File Sharing**. A File Sharing menu appears.



Turns file sharing on and off

Set the user name for file sharing.

Set the password for file sharing.

Set the controls to allow (Read Only, ReadWrite).

For how to enter text and numbers, see section 3.4 in the Getting Started Guide (IM AQ23011A-03JA).

4. Tap each item. On the screen that appears, turn file sharing on or off, set the user name and password, and select the controls to allow.

Explanation

When file sharing is turned on, the instrument's internal storage and external storage connected to the instrument can be controlled from a PC or similar device through a network. The following restrictions can be set for the control.

ReadOnly: The files in the instrument's storage device can be read, but writing is not allowed.

ReadWrite: The files in the instrument's storage device can be read, and files can be written to it.

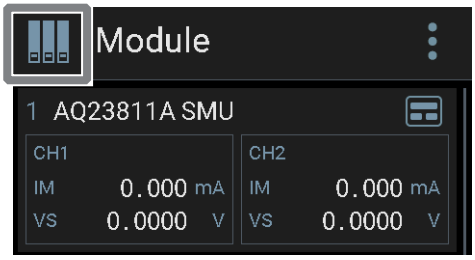
5.7 Initializing Settings

"Other Features" in the Features Guide

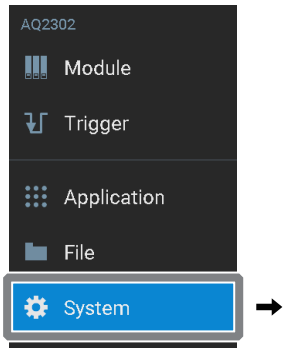
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.

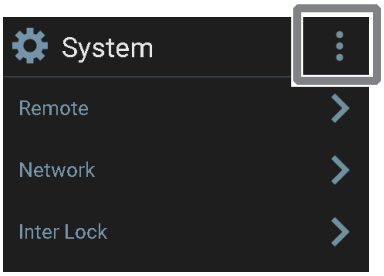
Top screen (summary view)



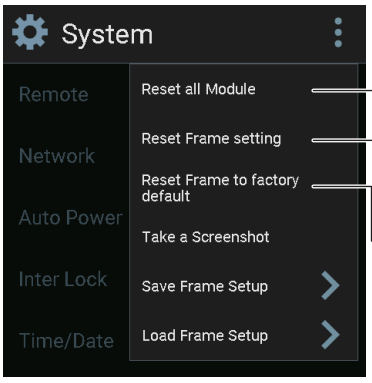
Function menu



System menu



3. Tap the top menu icon . A menu appears.



Initializes the settings of all modules

Initializes the frame settings (except for remote settings, network settings, and internal storage device)

Initializes the frame settings (including remote settings, network settings, and internal storage device)

4. Tap the settings you wan to initialize. A confirmation message appears for executing the initialization.
5. To proceed, tap OK. Initialization is executed.

   To cancel, tap Cancel.

   If you select Reset Frame to factory default, the data in the internal storage device will be deleted. Copy any necessary data to a separate storage device in advance.

Explanation

The frame settings and module settings can be initialized.
There are two modes for initializing the frame settings: a mode for initializing the settings including network settings and the internal storage and another mode for initializing the settings except network settings and the internal storage.

Reset all Module
All module settings are initialized.

Reset Frame Setting
Frame settings are initialized. Remote settings and network settings are not initialized.

Reset Frame to factory default
Frame settings are initialized to factory default values, and the frame is restarted. Remote settings and network settings are also initialized. All data in the internal storage are also deleted.

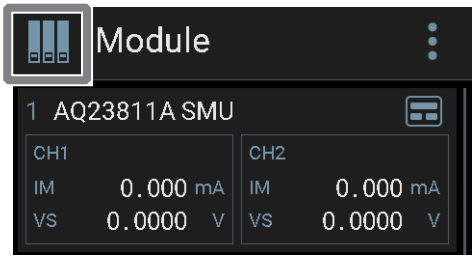
5.8 Displaying and Saving Log Information

“Other Features” in the Features Guide

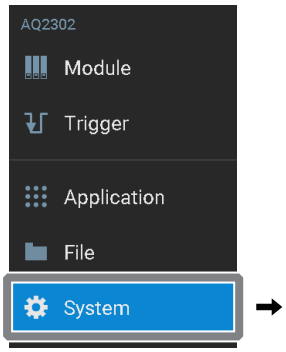
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.

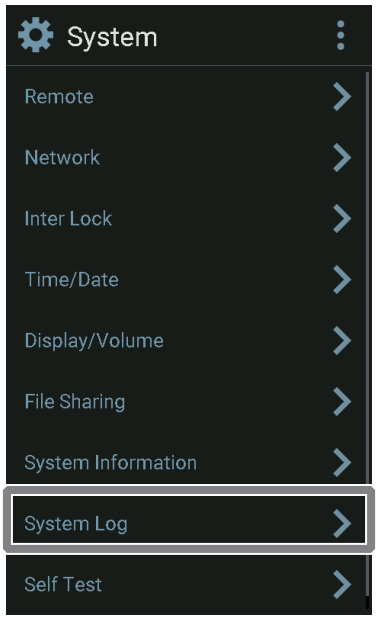
Top screen (summary view)



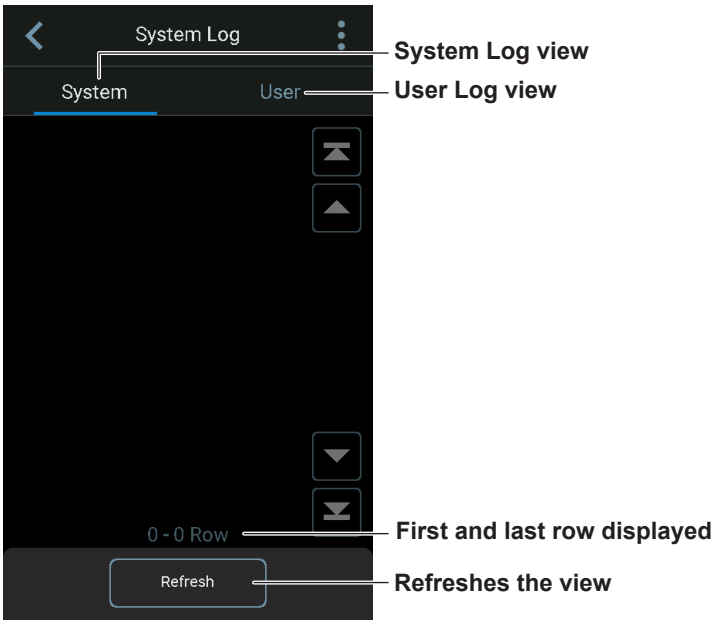
Function menu



System menu



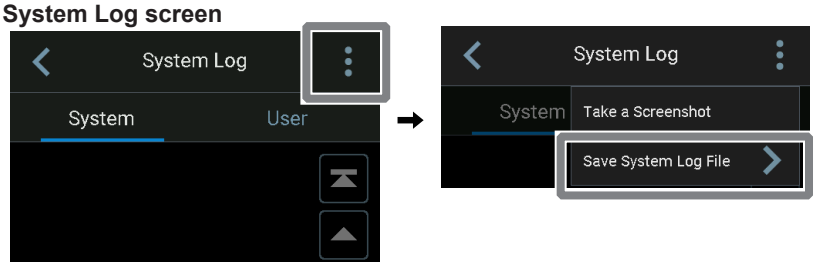
3. Tap **System Log**. A System Log appears.



Saving the log information

4. On the System Log screen, tap the menu icon ( ). A menu appears.

System Log screen



5. Tap **Save System Log File**. A list of files in the selected folder appears.

6. Select the save location folder.

7. Tap **Save here**. A file name setting menu appears.

8. Set any file name.

9. Tap **Save**. Log information is saved to a file in ZIP format. To cancel saving, tap **Cancel**.

Explanation

The following information is saved and displayed as System Log and User Log.
System Log and User Log can also be combined and saved to a file.

Group	Item	Description
System	F/W Boot	Time firmware was started and power frequency
	Shutdown	Time firmware was shutdown
	Reboot	Time restart took place
	F/W Update	Update time, version
	Module Update	Time module was updated, module type, firmware version
	Network Configuration	Time network was connected, configuration
	Clock Setting	Time clock was set, set time
	Remote Control Setting	Time remote control took place, configuration
	Fan alarm	Time fan alarm occurred
	Temperature alarm	Time temperature alarm occurred, temperature
	Interlock State Change	Time interlock state changed, state
	Beep Setting	Time beep sound was set, setting
	Backlight Setting	Backlight time, setting
	Diag	Time self-test was executed, test results
	Module Insert	Time module was installed, slot number, module type, serial number (S/N)
	Module Remove	Time module was removed, slot number
User	Error	Time operation error occurred, error code, error location (frame or slot number)
	Application Start	Time application was started, application type
	Application End	Time application was closed, application type

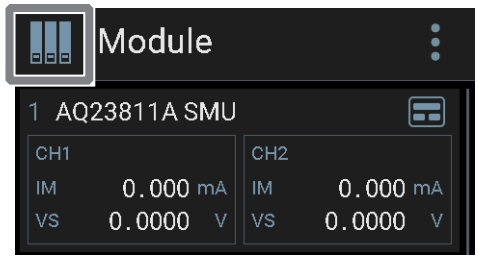
5.9 Self-Test

"Other Features" in the Features Guide

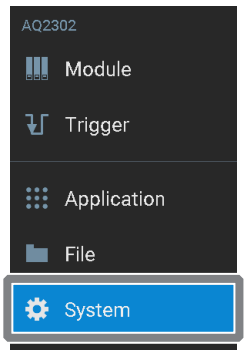
Procedure

1. On the top screen (summary view), tap the function icon ( ). A function menu appears.
2. Tap **System**. A System menu appears.

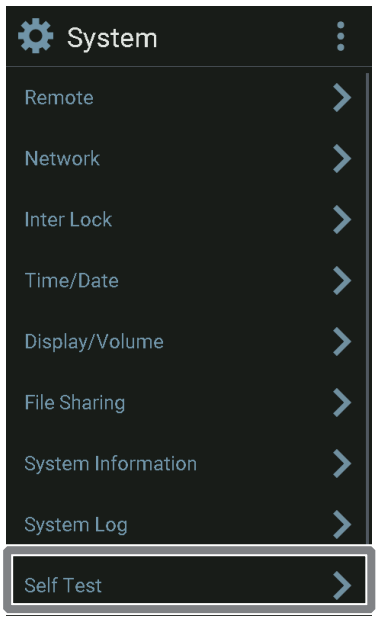
Top screen (summary view)



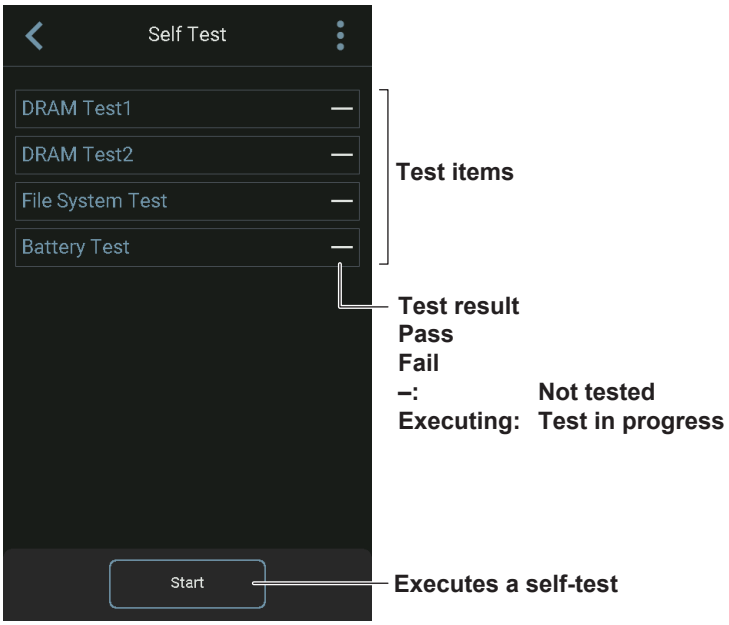
Function menu



System menu



3. Tap **Self Test**. A Self Test screen appears.



Explanation

Self-tests can be carried out on the DRAM, file system, and battery, and the results can be viewed. If Fail appears, servicing is required. Contact your nearest YOKOGAWA dealer.

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