User's Manual

1 GS/s Digital Oscilloscope Module
WE7311

IM 707311-01E
1st Edition

Thank you for purchasing the 1 GS/s Digital Oscilloscope Module WE7311 for the PC-based measurement instruments, WE7000.

This User's Manual contains useful information about the function, connection to the measuring station, operations of the software on the PC, and troubleshooting of the WE7311. This manual does not describe the operations of the operation panel or waveform monitor that is displayed on the WE7000 Control Software. For the operations of these items, see the on-line help that is provided with the WE7000 Control Software.

The manual listed below contains general information about the WE7000 (primarily describes the operations of the measuring station, the optical interface module, the optical interface card, and the WE7000 Control Software) and is included with the measuring station.

Manual Title	Manual No.
WE7000 User's Manual	IM707001-01E

To ensure correct use, please read this manual thoroughly before operation.
Keep this manual in a safe place for quick reference in the event a question arises.

Notes

- **The contents of this manual describe WE7000 Control Software Ver. 4.0.2.0 and module software Ver. 3.07. If you are using another version of the software, the operating procedures or the figures given in this manual may differ from the actual software.**
- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
- Copying or reproducing all or any part of the contents of this manual without YOKOGAWA's permission is strictly prohibited.

Trademarks

- Microsoft, Windows, and Windows NT are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- Adobe and Acrobat are trademarks of Adobe Systems Incorporated.
- Other product names are trademarks or registered trademarks of their respective holders.

Revisions

1st Edition: August 2000

Checking the Contents of the Package

Unpack the box and check the contents before operating the instrument. If some of the contents are not correct or missing or if there is physical damage, contact the dealer from which you purchased them.
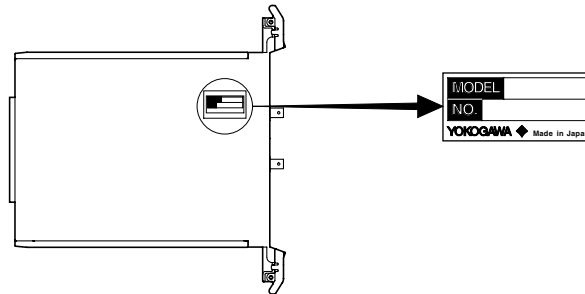
Measurement Module

Check that the model name given on the name plate matches those on the order.

MODEL

Model	Description
707311	WE7311 1 GS/s Digital Oscilloscope Module

NO.

When contacting the dealer from which you purchased the instrument, please quote the instrument No.
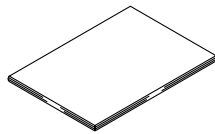

Standard Accessories

The following standard accessories are supplied with the instrument. Check that all contents are present and that they are undamaged.

User's Manual (1)
IM707311-01E

Module link connector (1 set, 3 parts)
B9952RB

Optional Accessories (Sold Separately)

Name	Model	Description
Module link connector	B9952RB	Sold in units of 1 set (3 parts)
Passive probe	700944	Bandwidth: 300 MHz, attenuation: 10:1, input resistance: 10 MΩ

How to Use This Manual

Structure of the Manual

This User's Manual consists of the following 4 chapters and an index.

Chapter	Title	Description
1	Explanation of Functions	Explains the system configuration and functions.
2	Hardware Preparation	Explains how to install the module into the measuring station and how to connect the input.
3	Troubleshooting and Maintenance	Explains the procedures for troubleshooting and self testing.
4	Specification	Explains the specifications of the module.
Index		Index of contents.

Conventions Used in this Manual

Unit

k ...... Denotes 1000. Example: 100 kHz

K ...... Denotes 1024. Example: 720 KB

Displayed characters

Alphanumeric characters enclosed with [ ] usually refer to characters or settings that are displayed on the screen.

Symbols

The following symbol marks are used to attract the operator's attention.

⚠ A symbol mark affixed to the instrument. Indicates danger to personnel or instrument, and the operator must refer to the User's Manual. The symbol is used in the User's Manual to indicate the reference.

WARNING Describes precautions that should be observed to prevent injury or death to the user.

CAUTION Describes precautions that should be observed to prevent minor or moderate injury, or damage to the instrument.

*Note* Provides important information for the proper operation of the instrument.

Contents

1.1 System Configuration and Block Diagram

System Configuration

The following is an example in which the 1 GS/s Digital Oscilloscope Module WE7311 is installed into the measuring station and the measuring station is connected to the PC with the optical fiber cable. In addition to connecting the measuring station to a PC using the optical fiber cable, you can also connect them via Ethernet or using a serial cable.
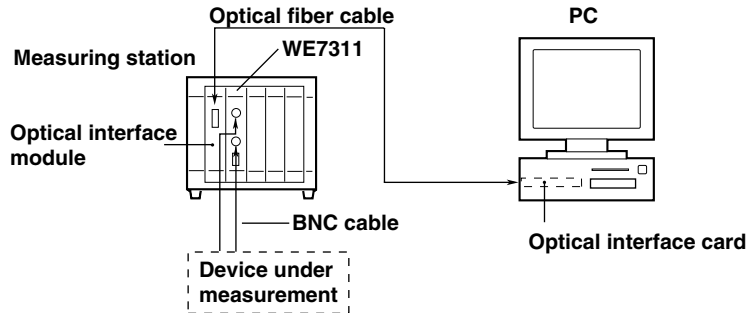
Block Diagram
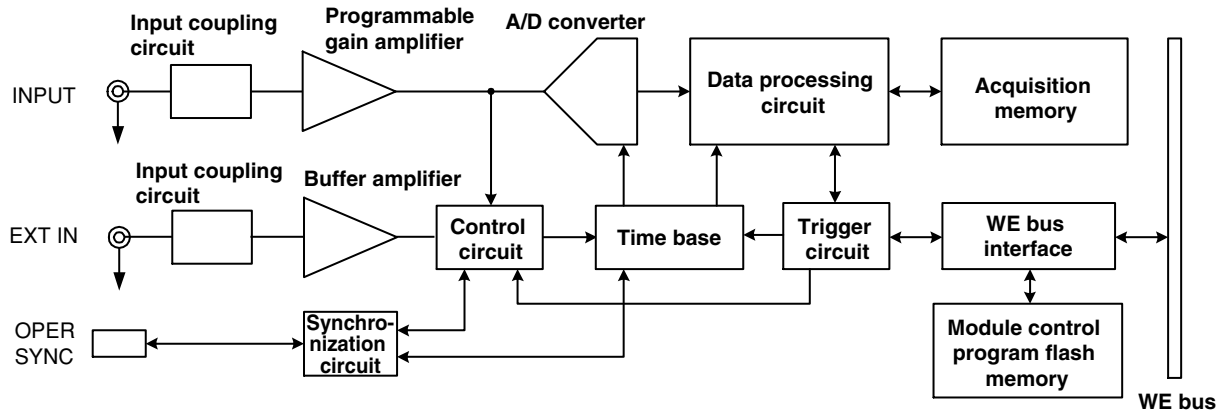
Description of Operation

The signal applied to the [INPUT] terminal is converted to a level best-suited to the A/D converter according to various settings such as input coupling, probe attenuation, voltage sensitivity, and offset voltage. At the A/D converter, the input signal is sampled by synchronizing to the clock generated by the time base (1 GHz maximum). The digital data are processed according to various settings such as memory partition and trigger in the data processing circuit and written to the acquisition memory at the sample rate corresponding to the time axis setting.

The data stored in the acquisition memory can be read by a PC via communications according to the control program that is stored in the module.
You can input external trigger signal, external sampling clock, or external reference clock to the [EXT IN] terminal. These signals are passed to the trigger circuit or the time base circuit.

By connecting the [OPER SYNC] terminals of adjacent WE7311 modules using the link connector, you can perform synchronized measurements across multiple modules.
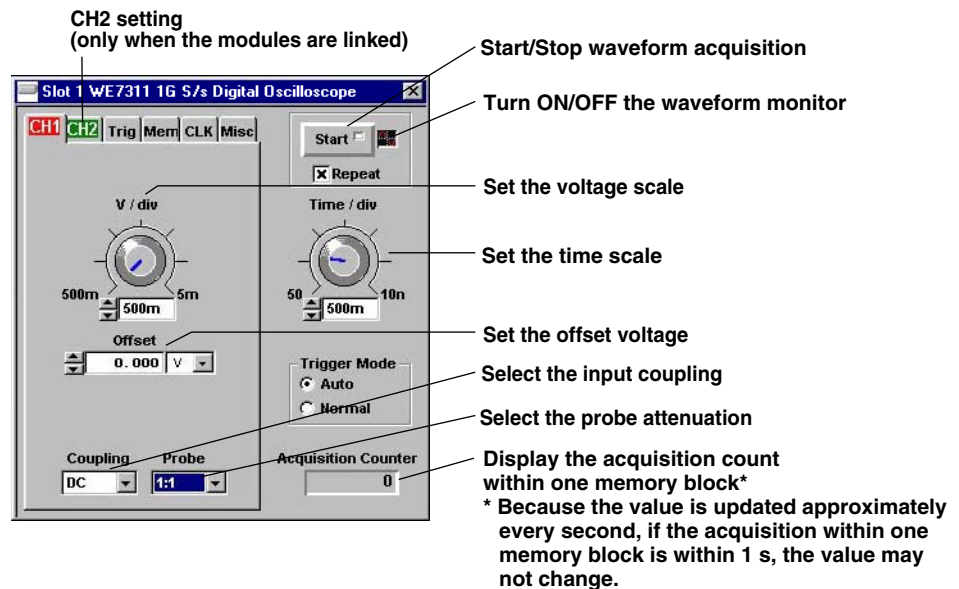
1.2 Operation Panel

The WE7000 Control Software that is installed in the PC is used to control the 1 GS/s Digital Oscilloscope Module WE7311. The WE7000 Control Software displays operation panels similar to those shown in the figure below. This User's Manual does not explain the operations of the operation panel or waveform monitor. For the operations of these items, see the on-line help that is provided with the WE7000 Control Software.

Switching the operation mode

CH1 CH2 Trig Mem CLK Misc — **[Misc] tab**

Operation Mode — **Switch the operation mode**
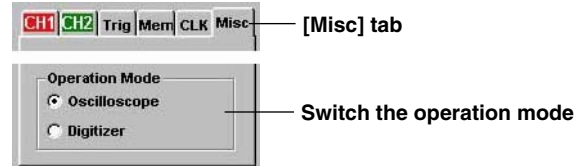
Starting/Stopping waveform acquisition in the oscilloscope mode and setting the input conditions of the waveform and time scale

CH2 setting (only when the modules are linked)

Start/Stop waveform acquisition

Turn ON/OFF the waveform monitor

Set the voltage scale

Set the time scale

Set the offset voltage

Select the input coupling

Select the probe attenuation

Display the acquisition count within one memory block*

* Because the value is updated approximately every second, if the acquisition within one memory block is within 1 s, the value may not change.

Starting/Stopping waveform acquisition in the digitizer mode and setting the input conditions of the waveform and time scale

Select the measurement range   Set the offset voltage

Start/Stop waveform acquisition

Turn ON/OFF waveform monitor

Select the input coupling

CH2 setting (when the modules are linked)

Select the sampling interval

Display the "Probe attenuation selection" section

Display the acquisition count within one memory block*

* Because the value is updated approximately every second, if the acquisition within one memory block is within 1 s, the value may not change.

1

Explanation of Functions

Display when the [Option] button is clicked

Slot 3 WE7311 1G S/s Digital Oscilloscope

| CH | Trig | Mem | CLK | Misc |

	Range	Offset	Coupling	Probe
CH1	2.5V	0.000 V	DC	1:1
CH2	2.5V	0.000 V	DC	1:1

— **Select the probe attenuation**

Setting the time base

[CLK] tab

CH1 CH2 Trig Mem CLK Misc

Sampling CLK Source
- Internal
- External 1M
- External 50

— **Select the sampling clock source**

Reference CLK Source
- Internal
- External 1M
- External 50
- BUSCLK
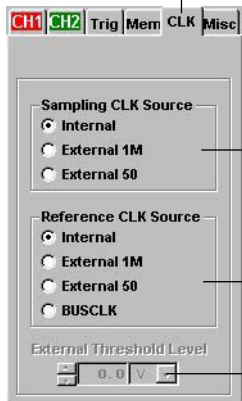
— **Select the reference clock source**

External Threshold Level
0.0 V

— **Set the threshold of the external input clock**

Setting memory-related parameters

[Mem] tab

CH1 CH2 Trig Mem CLK Misc
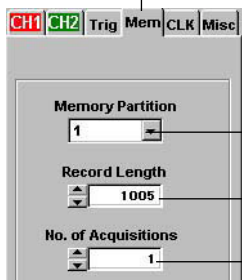
Memory Partition
1

— **Set the number of memory partitions**

Record Length
1005

— **Set the record length**

No. of Acquisitions
1

— **Set the number of acquisitions**

Setting the Trigger

Trigger Mode
- Auto
- Normal

— **Select the trigger mode**

• For the oscilloscope mode

[Trig] tab

CH1 CH2 Trig Mem CLK Misc

Source
CH1

— **Select the trigger source**

Level
0.00 mV

— **Set the trigger level**
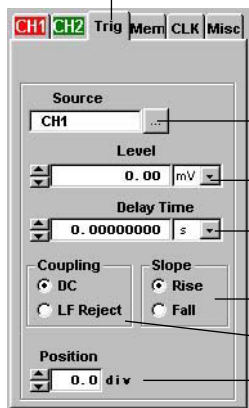
Delay Time
0.00000000 s

— **Set the delay time**

Coupling
- DC
- LF Reject

Slope
- Rise
- Fall

— **Select the trigger slope**

— **Select the trigger coupling**

Position
0.0 div

— **Set the trigger position**

• For the digitizer mode

[Trig] tab
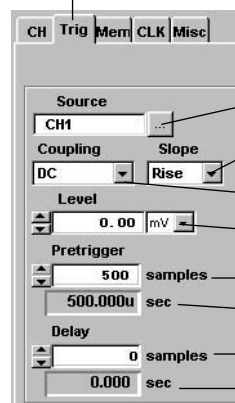
CH Trig Mem CLK Misc

Source
CH1

— **Select the trigger source**

Coupling
DC

Slope
Rise

— **Set the trigger slope**

— **Select the trigger coupling**

Level
0.00 mV

— **Set the trigger level**

Pretrigger
500 samples
500.000u sec

— **Set the pretrigger**

— **Display the pretrigger time**

Delay
0 samples
0.000 sec

— **Set the amount of trigger delay**

— **Display the delay time**

1.3 Acquiring the Waveform

Selecting the Operation Mode

You can use the Digital Oscilloscope Module WE7311 not only as a digital oscilloscope, but also as a digitizer.

The setup data when the module is used as a digital oscilloscope module (oscilloscope mode) and when it is used as a digitizer (digitizer mode) vary as indicated below.

	Setup Data of the Oscilloscope Mode	Setup Data of the Digitizer Mode
Waveform acquisition condition	Input coupling	Input coupling
	Offset voltage	Offset voltage
	Probe attenuation	Probe attenuation
	Voltage sensitivity (V/div)	**Measurement range (input voltage range)**
	Time axis setting (Time/div)	**Sampling interval**
	Sampling clock source	Sampling clock source
	Reference clock source	Reference clock source
	Threshold of the external clock	Threshold of the external clock
	Number of memory partitions	Number of memory partitions
	Record length	Record length
	Number of acquisitions	Number of acquisitions
Trigger condition	Trigger mode	Trigger mode
	Trigger source	Trigger source
	Trigger coupling	Trigger coupling
	Trigger slope	Trigger slope
	Trigger level	Trigger level
	Trigger position	**Amount of pretrigger**
	Delay time	**Amount of delay**

Note

The [Operation Mode] option button used to switch the operation mode is disabled while waveform acquisition is in progress. It is enabled when you click the [Start] button to stop the waveform acquisition.

Starting/Stopping Waveform Acquisition

Click the [Start] button. If the [Repeat] check box is selected, the waveform data are repeatedly acquired until the [Start] button is pressed again. If it is not selected, acquisition stops when the waveform is acquired once (to all blocks when the memory is partitioned). Depending on the combination of the number of acquisitions and record length, waveform data can no longer be acquired repeatedly when the record length exceeds a certain value (see page 1-8). In this case, the [Repeat] check box appears grayed.

Note

To start the acquisition of waveform data using the arming signal, use the trigger source/time base source/arming setting dialog box of the WE7000 Control Software and set the arming. For details on setting the arming signal, see section 4.6, "Setting the Trigger Source/Time Base Source/Arming" in the WE7000 User's Manual.

Input Coupling

Select the input coupling from the following.

AC/AC 50

The input signal is coupled to the attenuator of the analog input circuit through a capacitor. Use this setting if you wish to observe just the amplitude of an AC signal or a signal relative to a given reference voltage.

Select [AC] to set the input impedance to 1 MΩ, [AC 50] to set the input impedance to 50 Ω.

DC/DC 50

The input signal is directly coupled to the attenuator of the analog input circuit.

Use this setting if you wish to observe the entire input signal (DC component and AC component).

Select [DC] to set the input impedance to 1 MΩ, [DC 50] to set the input impedance to 50 Ω.

GND

Input signal is coupled to the ground not to the attenuator of the vertical control circuit. This setting allows you to check the ground level on the waveform monitor.

⚠️

CAUTION

If you select "AC" or "DC" for the input coupling, make sure to apply a signal in which the voltage of the signal component below 10 kHz is less than or equal to ±42 V (DC+ACpeak).

If you select "AC 50" or "DC 50" for the input coupling, apply a signal with a voltage less than or equal to ±5 VDC (500 mW) or 5 Vrms. If the voltage of the input signal exceeds this allowed range, the protective circuit is activated, and the input coupling is automatically switched to "GND."

Probe Attenuation

When using a probe, attenuation setting on the module must be set equal to the probe attenuation so that the measured voltage can be read directly. This module has the following attenuation settings: 1:1, 10:1, 100:1, and 1000:1.

Voltage Sensitivity (V/div) (Only during the Oscilloscope Mode)

The vertical sensitivity is set by assigning a voltage value to one grid square (1 div) on the waveform monitor (V/div). The value of the vertical sensitivity setting is multiplied by the probe attenuation (as explained above) and displayed. The vertical sensitivity changes by switching the attenuator to different values of attenuation. It is changed in steps as given by "10 mV/div, 20 mV/div, and 50 mV/div" and set within the range from 5 mV/div to 500 mV/div (when the probe attenuation is 1:1).

Measurement Range (Only during the Digitizer Mode)

The following measurement ranges can be specified. The settings below are those when the probe attenuation is 1:1.

Setting	Measurable Range(Accuracy Guaranteed Measurement Range)*	Display Range	Displaying Resolution
25 mV	−25 to 25 mV	−0.0250 to 0.0250 V	0.1 mV
50 mV	−50 to 50 mV	−0.0500 to 0.0500 V	0.1 mV
100 mV	−100 to 100 mV	−0.1000 to 0.1000 V	0.1 mV
250 mV	−250 to 250 mV	−0.2500 to 0.2500 V	0.1 mV
500 mV	−500 to 500 mV	−0.5000 to 0.5000 V	0.1 mV
1 V	−1 to 1 V	−1.000 to 1.000 V	1 mV
2.5 V	−2.5 to 2.5 V	−2.500 to 2.500 V	1 mV

* The measurable range is the voltage after the offset voltage is added.

Offset Voltage

If the input coupling is set to [DC] or [DC 50], you can cancel the specified offset voltage from the input signal. The ranges shown below are values when the probe attenuation is set to "1:1." If the probe attenuation is 1:10 multiply these values by 10. If it is 100:1 multiply by 100. If it is 1000:1 multiply by 1000.

Range during the oscilloscope mode

Voltage Sensitivity	Selectable Range	Resolution*
5 mV to 50 mV/div	−2.0000 V to +2.0000 V	0.1 mV
100 mV to 500 mV/div	−20.000 V to +20.000 V	1 mV

Range during the digitizer mode

Measurement Range*	Selectable Range*	Resolution*
25 mV to 250 mV	−2.0000 V to +2.0000 V	0.1 mV
500 mV to 2.5 V	−20.000 V to +20.000 V	1 mV

Time Axis Setting (Time/div) (Only during the Oscilloscope Mode)

Under the initial setting, the sampling timing of waveform data is controlled by the clock signal generated from the time base circuit within the module. When using this internal clock, the time axis is set in terms of the time per one grid square (1 div) on the waveform viewer. The range is from "10 ns/div to 50 s/div." The time span displayed on the waveform viewer is calculated by "time axis setting × 10," because the time axis displays 10 div.

> ***Note***
> * This setting is void if the sampling clock source is set to anything other than [Internal].
> * The sampling interval and the record length displayed on the waveform viewer (display record length) change according to the time axis setting. For the relationship between the time axis setting and display record length, see section 4.5, "Setting Time Axis/Sampling Interval/ Relationship of Record length of display data."

Sampling Interval (Only during the Digitizer Mode)

You can select the sampling interval in the range from 1 ns to 10 ms (available settings are 1, 2, 5 and their tenfold multiples).

Time Base

This setting is common to the oscilloscope and digitizer modes.

> ***Note***
> * If you are using the internal clock, do not apply an external signal to the EXT IN terminal on the front panel of the module. Doing so may cause unstable measurements.
> * If clock source is set to "External 50" and the input voltage exceeds the allowed range, it switches to "External 1M."
> * To use external input [External 1M]/[External 50] when multiple modules are linked, apply the clock signal to the CH1 module when modules 2 through 4 are linked and CH5 module when modules 5 through 8 are linked.

Sampling Clock Source

When the reference clock source is set to internal clock and the trigger mode is normal, the waveform data can be sampled using the external input clock signal or a signal output from another module in addition to the clock signal that is generated within the module. Select the source from the following list of choices. The input frequency range of the external clock signal is from 10 MHz to 500 MHz.

Internal: Internal clock

External 1M: Input signal from the module's "EXT IN" terminal (when the input impedance is 1 MΩ)

External 50: Input signal from the module's "EXT IN" terminal (when the input impedance is 50 Ω)

Reference clock source

You can input a 10-MHz external clock signal that will be used as a sampling clock reference. Select the source from the following list of choices:

Internal: Internal clock

External 1M: Input signal from the module's "EXT IN" terminal (when the input impedance is 1 MΩ)

External 50: Input signal from the module's "EXT IN" terminal (when the input impedance is 50 Ω)

BUSCLK: Input signal (CMNCLK) according to the trigger source/time base source/ arming setting (see section 4.6, "Setting the Trigger Source/Time Base Source/Arming" in the WE7000 User's Manual (IM707001-01E)).

Threshold level of the external input clock (External threshold level)

When using the input signal from the "EXT IN" terminal, set the threshold level in the range from "–2.0 to 2.0 V" (in 0.1 V steps).

Memory Partition

You can divide the acquisition memory into multiple blocks and acquire the waveform data to the memory blocks in order every time the trigger occurs. You can divide the memory into 1/2/4/8/16/32/64/128/256/512/1024/2048/4096 partitions.

Record Length

The maximum record length (the number of acquired data points) when the memory is not partitioned is 2 Mwords (2,000,000 points). The following table shows the selectable range:

Memory Partition	Selectable Range
1	100 to 2000000
2	100 to 1000000
4	100 to 520000
8	100 to 240000
16	100 to 120000
32	100 to 64000
64	100 to 32000
128	100 to 16000
256	100 to 7200
512	100 to 3600
1024	100 to 1600
2048	100 to 600
4096	100

Note

The record length of the data displayed on the waveform monitor (display record length) varies depending on the time axis setting. For the relationship between the time axis setting and display record length, see section 4.5, "Setting Time Axis/Sampling Interval/Relationship of Record length of display data."
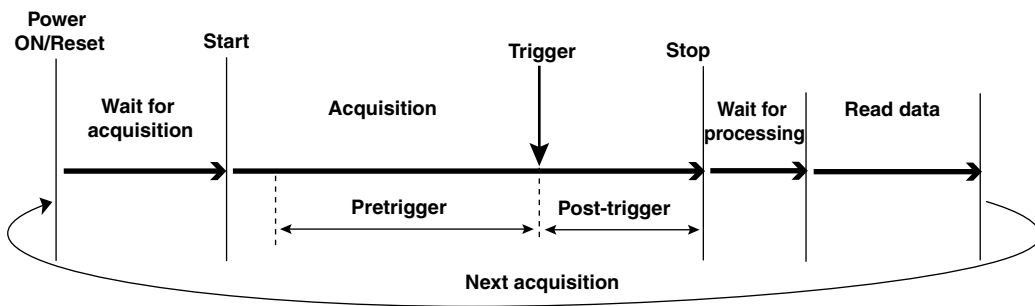
Number of Acquisitions

When the trigger mode (see next page) is [Normal] and the memory is partitioned, you can set the number of acquisitions (acquisition of waveform data). The range is from "1 to the number of memory partitions."
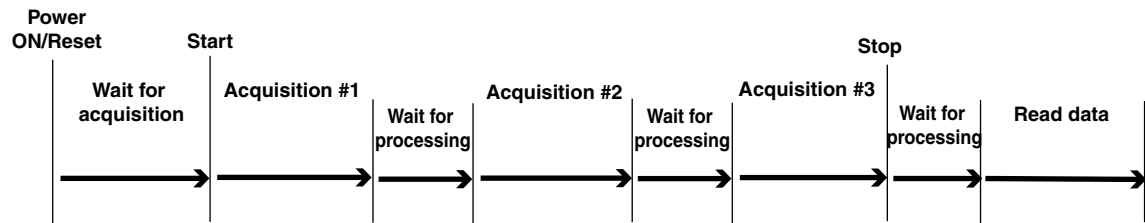
If you set the number of acquisitions numerous times, the "sequential store acquisition" mode in which the waveform data are acquired to the memory block in order is activated (see figure below). In the "sequential store acquisition" mode, the reading of the data is performed after the data are acquired to each memory block. Thus, the pause time between acquisitions can be made short. The pause time in this case is approximately 1 ms minimum (typical value).

In contrast, if you set the number of acquisition once, the "single acquisition" mode is activated (see figure below). If you select the [Repeat] check box of acquisition start, single acquisition is repeated. However, every time the acquisition of waveform data is complete, the operation to read the data for in order to display the waveform is repeated.

• Single acquisition

Power ON/Reset	Start		Trigger	Stop		
Wait for acquisition	Acquisition				Wait for processing	Read data
		Pretrigger	Post-trigger			

Next acquisition

• Sequential store acquisition

Power ON/Reset	Start				Stop		
Wait for acquisition	Acquisition #1	Wait for processing	Acquisition #2	Wait for processing	Acquisition #3	Wait for processing	Read data

When the number of acquisitions and record length are equal to the values shown in the figure below, waveform data cannot be acquired repeatedly. However, acquisition of waveform data in the sequential store acquisition mode is possible.

Number of Acquisitions	Total Record Length*
100 or less	1,000,001 or more
350 or less	900,001 or more
600 or less	800,001 or more
850 or less	700,001 or more
1100 or less	600,001 or more
1350 or less	500,001 or more
1600 or less	400,001 or more
1850 or less	300,001 or more
2100 or less	200,001 or more
2350 or less	100,001 or more

* Number of acquisitions × record length

1.4   Setting the Trigger

Trigger Mode

Auto mode

If a trigger occurs within a specified amount of time (referred to as the timeout period), the waveform display is updated. If the trigger does not occur within "the pretrigger time (100 ms minimum) + 10 ms," the waveform display is automatically updated.

Normal mode

The waveform display is updated only when the trigger occurs. The waveform display is not updated if the trigger does not occur.

Trigger Source

Select the signal for triggering. Select the signal from the following.

BUSTRG: Bus signal (BUSTRG1/(BUSTRG2) of the WE bus

External 1M: Input signal from the module's "EXT IN"* terminal (when the input impedance is 1 MΩ)

External 50: Input signal from the module's "EXT IN"* terminal (when the input impedance is 50 Ω)

CHx: Input signal of each channel (x is the channel number)

  * When the trigger source modules are linked, apply the trigger source signal to the "EXT IN" terminal of the module corresponding to CH1.

Note

If the clock source is set to "External 50" and the input voltage exceeds the allowed range, it switches to "External 1M."

Trigger Coupling

When you select "CHx" or "External 1M/50" as the trigger source, you can select the input coupling of the signal that will be used as the trigger. Select the input coupling most suitable for the trigger source signal. The following two types of input coupling are available for the trigger source signal.

DC

Select this setting when using the source as is with no processing of the signal. The signal input according to the input coupling setting becomes the trigger source signal. If the input coupling is set to [AC] or [AC 50], the signal with the DC component removed becomes the trigger source.

LF Reject

Select this setting when using the signal with the low frequency components (less than or equal to 50 kHz) removed for the trigger source.

Trigger Slope

When the trigger source is set to the input signal, you can select the trigger type from the following list of choices.

Rise

With this setting, the trigger occurs when the input signal changes from below the trigger level to above the trigger level.

Fall

With this setting, the trigger occurs when the input signal changes from above the trigger level to below the trigger level.

Trigger Level

The trigger level is set for each channel. During the oscilloscope mode, the range is the voltage corresponding to 5.0 times the voltage sensitivity. During the digitizer mode, the range is the voltage in the measurable range determined by the measurement range. The range when the trigger is activated using the external input signal (External 1M/50) is "±4 V" (in 0.1 V steps).

## Trigger Position (Only during the Oscilloscope Mode)

The trigger position specifies the position in the waveform, acquired in the acquisition memory, that indicates the point at which the trigger occurred. The point at which the trigger occurred is called the trigger point. If the trigger delay is set to 0 s, the trigger point and trigger position match. When the trigger position is 0 div, the trigger position is at the center of the acquired waveform's time axis. In this case, you can observe the pretrigger section of the waveform before the trigger point. This is possible because sampling data are constantly acquired to the acquisition memory once the waveform acquisition is started (the newest data continuously overwrites the oldest data). When the trigger occurs, the data in the memory are retained and displayed on the waveform monitor. Set the trigger position in the range "±5 div."

Amount of Pretrigger (Only during the Digitizer Mode)

You can acquire the waveform data before the trigger point into the acquisition memory. Set how many points before the trigger point to begin the acquisition in the range, "0 to specified record length."

Trigger Delay Time/Amount of Trigger Delay

Normally, the waveform around the trigger point is displayed. However, by using this function, you can display the waveform that is acquired the specified amount of time after the trigger point. In the oscilloscope mode, set the delay time in the range, "1 ns to 300 s." In the digitizer mode, set the delay in terms of the number of samples in the range, "0 to 200,000,000 (the maximum value is the value corresponding to 300 s when converted into delay time)."
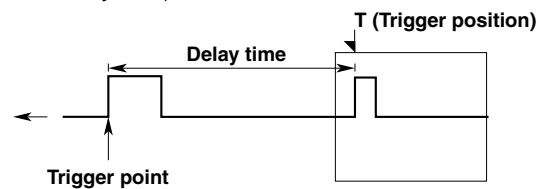
1.5   Auto Setup and Calibration

Auto Setup

This function automatically sets the conditions for acquiring the waveform, trigger settings, and other settings to suit the signal being measured. This is useful when the characteristics of the signal being measured are unknown. However, the auto setup function may not work depending on the measurement signal.

Input conditions for auto setup

Frequency: Approx. 40 Hz to 40 MHz

Frequency: Approx. 50 mV or more (when probe attenuation setting is 1:1)

Type: Repetitive waveform (repetition of the waveform cannot be complex)

Setup data after executing auto setup

• Operation mode: Same as before
• Settings related to the vertical axis
  • Voltage sensitivity/measurement range: Set so that the positive or negative peak voltage falls within 4 divisions.
  • Probe attenuation: Same as before
  • Input coupling: DC
  • Offset: 0 V
  • Probe attenuation: Same as before
• Settings related to the horizontal axis
  • Time scale: Set so that two to four periods of the input signal with the longest period can be observed (in the oscilloscope mode).
  • Sampling interval: Set so that two periods of the input signal with the longest period can be observed (in the digitizer mode).
  If none of the input signals of the channels do not meet the conditions above, the time scale is set to 10 ms/div or the sampling interval set to 10 ms.
• Settings related to the trigger
  • Mode: Auto
  • Slope: Rise
  • Coupling: DC
  • Position: 0 div (in the oscilloscope mode), pretrigger: 0 (in the digitizer mode)
  • Delay time: 0 s (in the oscilloscope mode), delay: 0 (in the digitizer mode)
• Settings related to the time base
  • Sampling clock source: Internal
  • Reference clock source: Internal
• Settings related to the memory
  • Record length: 10000
  • Number of memory partitions: 1
  • Number of acquisitions: 1

Calibration

When you click the [Cal Exec] button under [Calibration] of the Misc operation panel, the ground level offset, the gain of the A/D converter, and the threshold level of the trigger are calibrated. If you select the [Auto Cal] check box, calibration is automatically executed 1) three minutes after turning ON the power, 2) after ten minutes, 3) after 30 minutes, 4) every 30 minutes there after, or the first time the time axis setting (Time/div) or sampling interval is changed after the first three minutes has elapsed. The calibration may take more than a minute to complete.

1.6 Other Functions

The following functions are functions of the WE7000 Control Software. For the operations of these items, see the on-line help that is provided with the WE7000 Control Software.

Waveform Display

The waveform is displayed on the waveform monitor of the WE7000 Control Software.

Automatic Saving of Waveform Data

Besides saving the data displayed on the waveform monitor, you can also have the waveform data automatically saved using a trigger. There are two methods of saving the data.

- Cyclic
  You specify the number of files and the data are saved in a cyclic pattern within the specified number of files until the measurement is stopped. The newest data are not the file with the largest file number, but the file to which the data were saved immediately before stopping the measurement.
- File number limit
  You specify the number of files and the data are saved up to the specified number and then the operation stops.

Converting the Waveform Data

Waveform data that are saved can be converted to ASCII data in CSV format (*.csv) or to a physical value in 32-bit floating point format (conforming to IEEE754-1985) (*.wvf). This file conversion can also be performed on data saved with the waveform monitor.
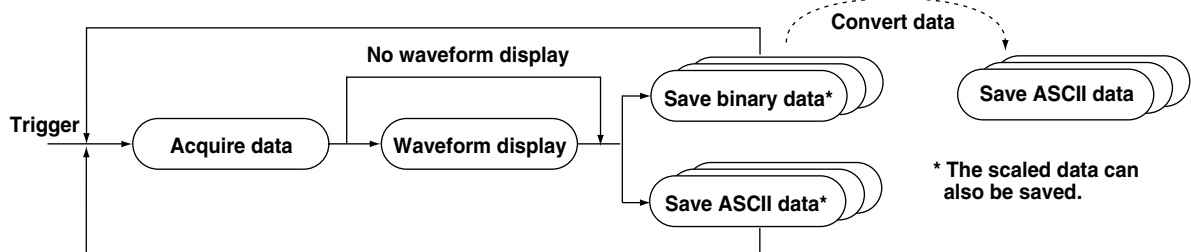
Scaling the Measured Data (Only during the Digitizer Mode)

Set the measured values at any two points (VP1 and VP2) and their corresponding physical values (SP1 and SP2) or set the scaling coefficient (a) and offset value (b) to define the scale conversion equation (Y=ax+b). The measured values are converted to physical values according to this equation. The waveform can be displayed, or the waveform data can be saved. This function allows you to set labels and units to the scaled values. When using the oscilloscope mode, the scale conversion function cannot be used. However, you can assign labels to the measured waveforms.
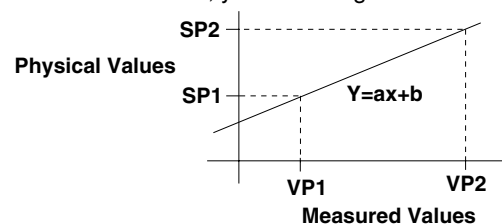
1.7 Synchronizing to Other Modules Using the Bus Trigger/Time Base Signal

Input/Output of Bus Trigger Signals

The trigger signal detected within the 1 GS/s Digital Oscilloscope Module WE7311 can be output to the two trigger signal buses (BUSTRG1/BUSTRG2) in the measuring station. Conversely, the bus trigger signals on the bus can be passed in to trigger the module.

To output the trigger signal detected within the WE7311 to the bus, you must set the trigger source to the input signal or the EXT IN signal (see 1.4, "Setting the Trigger"). The time delay for the bus trigger signal to be output after the trigger is detected within the module is approximately 35 ns (typical value*). The module outputs "True" to the bus from the time it detects the trigger to the time it finishes acquiring the data. In other words, the time duration in which the module outputs "True" is the duration in which the module acquires the data after the trigger.

To trigger the WE7311 by using the bus trigger signal, set the trigger source to "BUSTRG" and set the WE7311 to input the bus trigger signal in the trigger source/time base source/arming setting dialog box (see 4.6, "Setting the Trigger Source/Time Base Source/Arming" in the WE7000 User's Manual, IM707001-01E). The WE7311 is triggered when the bus trigger signal changes from "False" to "True." The maximum time delay from the time the bus trigger signal changes to the time the WE7311 is actually triggered is approximately (0 ns + the sampling period of the WE7311) (typical value*).

 * Typical value represents a typical or average value. It is not strictly guaranteed.

Input/Output of Time Base Signals

The WE7311 can perform sampling by using the time base signal in the measuring station as a reference clock. The frequency of the time base signal is 10 MHz only. In addition, the internal reference clock signal can be output and used as a time base signal in the measuring station. The frequency of the output signal is 10 MHz only.
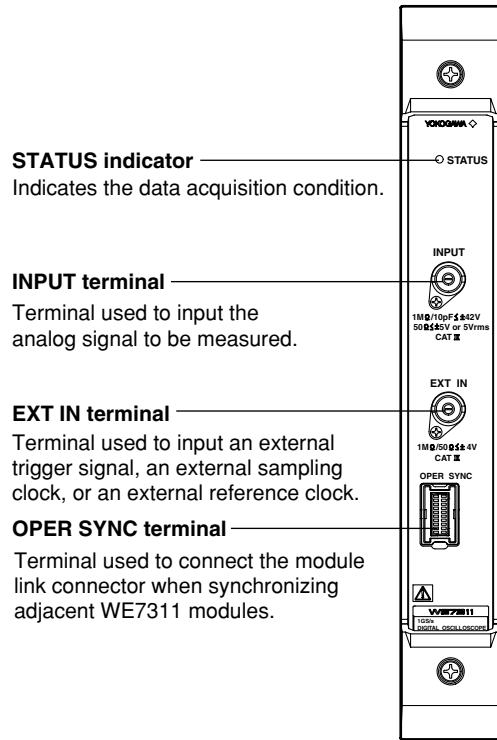
Controlling the Timing of the Start of the Measurement (Arming)

When the arming signal (ARM) bus is connected to the measurement module in the trigger source/time base source/arming setting dialog box, clicking the [Start] button on the operation panel causes the module to enter the arming signal wait state. The measurement starts when the arming signal becomes [True].
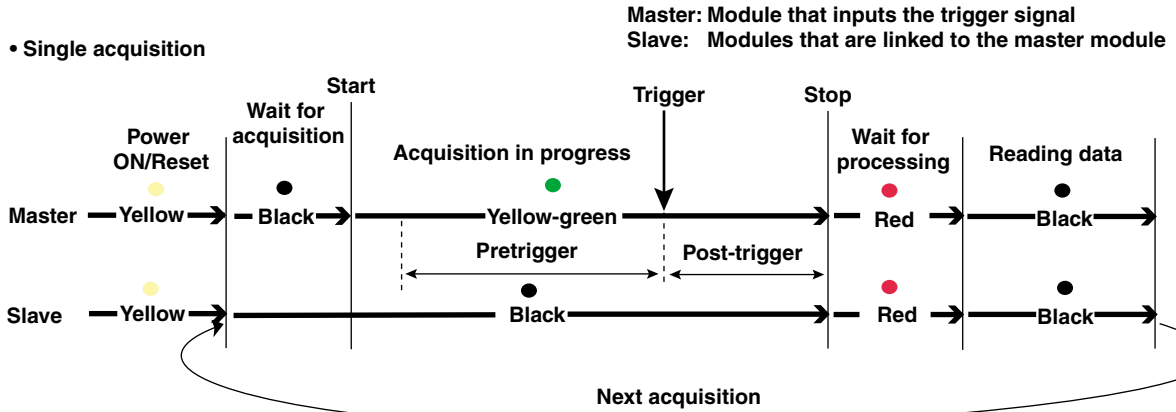
If [Repeat] of the [Start] button is checked, the module enters the arming signal wait state after each measurement. When the arming signal becomes [True] again, the module acquires the next measurement.

1.8 Names and Function of Parts

Front Panel

STATUS indicator
Indicates the data acquisition condition.

INPUT terminal
Terminal used to input the analog signal to be measured.

EXT IN terminal
Terminal used to input an external trigger signal, an external sampling clock, or an external reference clock.

OPER SYNC terminal
Terminal used to connect the module link connector when synchronizing adjacent WE7311 modules.

STATUS Indicator Display

Master: Module that inputs the trigger signal
Slave: Modules that are linked to the master module

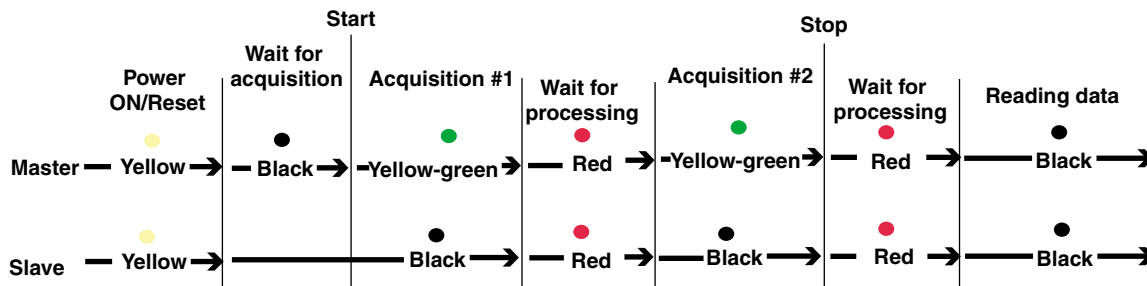• Single acquisition

• Sequential store acquisition

2.1 Installing the Module into the Measuring Station

Preparing to Install the Module

The measuring station comes with each slot covered with a cover plate as shown in the figure below. Verify that the power supply is not connected to the measuring station, then loosen the module attachment screws (2 locations) and remove the cover plate from the slot where the module is going to be installed. Please note that the slot on the left end is dedicated to the communication module and therefore this module cannot be installed there.

* The following figure shows an example of the measuring station WE400.

Slot dedicated to the optical interface module

Slots for other modules

Module attachment screw

Cover plate

Module attachment screw
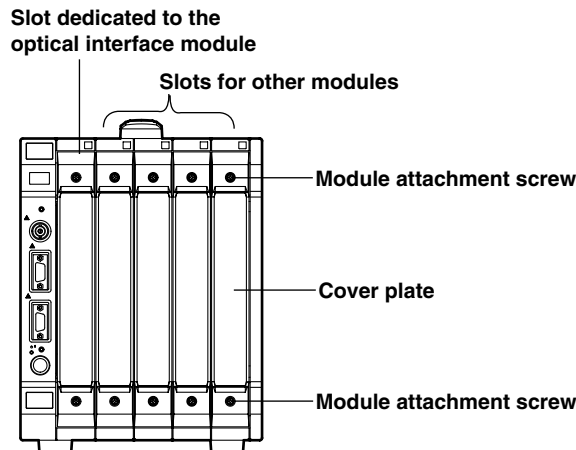
Installing the Digital Oscilloscope Module

WARNING

Make sure to fasten the top and bottom attachment screws. If you connect the input signal cable without fastening the attachment screws, the protective grounding of the measurement module provided by the power cord is compromised and may cause electric shock.

CAUTION

- To avoid damaging the instrument when installing modules, make sure to turn OFF the standby power switch of the measuring station.
- Be careful not to get your fingers caught in the ejection lever when inserting the module. In addition, do not put your hand inside the slot, because there are protrusions along the module guide that may injure your fingers.
- Do not remove the cover plates from unused slots. It can cause overheating and malfunction. The cover plates are also needed to minimize the influence of electromagnetic interference.

Insert the module along the guide rail of the slot from which you removed the cover plate. Insert the module until it clicks into the connector. Be careful not to get your fingers caught in the ejection lever while inserting the module. When the module is securely inserted, fasten the module attachment screws (tightening torque: 0.6 to 0.7 N-m). To remove the module, loosen the module attachment screws and pull the ejection lever from the inside to the outside. This will force the module out of the slot.

<There is an illustration on the next page.>

When removing the module

Ejection lever

Module attachment screw

**Module attachment screw**
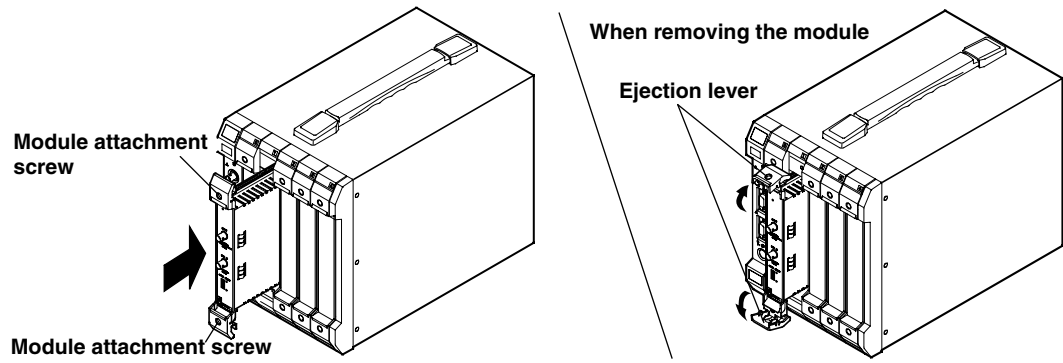
Note

When synchronizing multiple digital oscilloscope modules (linking modules) for making measurements, you must install the digital oscilloscope modules in adjacent slots and connect the [OPER SYNC] terminals using the module link connector that is included in the package.

2.2 Connecting the Input Cable

Connecting the Input Cable for the Signal Being Measured

INPUT

1MΩ/10pF≤42V
50Ω≤5V or 5Vrms
CAT II
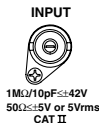
Connect the cable used to input the signal to be measured such as a probe to the INPUT terminal (BNC terminal) on the front panel of the module.

The input impedance is "1 MΩ±1% and approximately 10 pF" or "50 Ω±1%."

CAUTION

The maximum input voltage must conform to the following:
- When the input impedance is 1 MΩ and the frequency is less than or equal to 10 kHz: 42 V (DC+ACpeak)
- When the input impedance is 50 Ω: ±5 VDC (500 mW) or 5 Vrms

Applying a voltage exceeding this maximum can damage the input section. If the frequency is above 10 kHz, the input section may be damaged even when the voltage is below the values specified above.

Note

If you are connecting the probe for the first time, make sure to perform phase correction of the probe by connecting to a probe compensation signal generator. Failure to do so may result in unstable gain across different frequencies, thereby preventing correct measurement. Please note that if the object being measured is directly connected to the instrument without using a probe, correct measurements may not be possible due to loading effects.

Connecting the External Clock/External Trigger Input Cable

EXT IN

1MΩ/50Ω≤±4V
CAT II

When using a clock signal from an external source to sample the input signal instead of using the internal clock signal or when using an external trigger signal, connect the input cable to the EXT IN terminal (BNC terminal) on the front panel of the module.

CAUTION

Applying a voltage outside the allowable input range can damage the input section.

Note

If you are using the internal clock, do not apply an external signal to the EXT IN terminal on the front panel of the module. Doing so may cause unstable measurements.

The input signal should conform to the following specifications.

For external sampling clock input/external reference clock input

| Item	Specification
Input impedance	1 MΩ or 50 Ω
External sampling clock input frequency range	10 MHz to 500 MHz
Minimum voltage of external sampling clock input	3 Vp-p
External reference clock input frequency	10 MHz
Minimum voltage of external reference clock input	800 mVp-p
Allowable input voltage range	±4V

* When multiple modules are linked, apply the clock signal to the CH1 module when modules 2 through 4 are linked and CH5 module when modules 5 through 8 are linked.

For external trigger input

Item	Specification
Input impedance	1 MΩ or 50 Ω
Input frequency bandwidth	DC to 400 MHz
Allowable input voltage range	±4 V (minimum voltage: 3 Vp-p)

* Typical value represents a typical or average value. It is not strictly guaranteed.
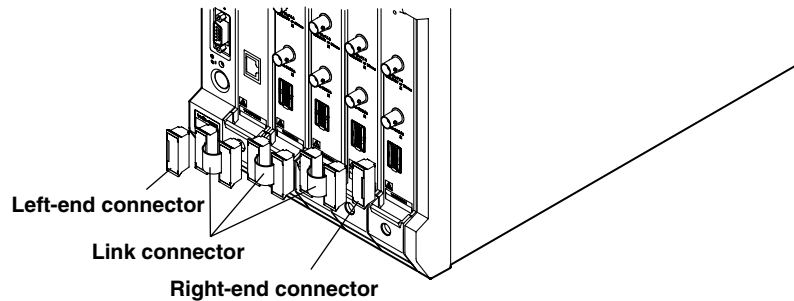
Connecting the Module Link Connector
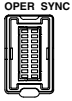
When synchronizing the operation of multiple WE7311 modules, install the modules in adjacent slots and connect the module link connector (Model: B9952RB) that is included in the package to each OPER SYNC terminal. For each module, three connectors, a left-end connector (connector indicated as LEFT), a link connector (connector indicated as CENTER) and a right-end connector (connector indicated as RIGHT), are provided.

As shown in the figure below, first connect the left-end connector to the left connection section of the OPER SYNC terminal of the module on the left end. Next, connect the link connector to the right connection section of the OPER SYNC terminal of the same module and the left connection section of the OPER SYNC terminal of the adjacent module. If you are linking three or more modules, repeat the last step. Finally, connect the right-end connector to the right connection section of the OPER SYNC terminal of the module on the right end.

Note

You must connect the module link connector when using the WE7311 modules in linked operation. When the modules are installed in adjacent slots, the initial setting of the WE7000 Control Software will be linked operation.

Before connection

Left-end connector
Link connector
Right-end connector

Connected condition

Left-end connector
Link connector
Right-end connector
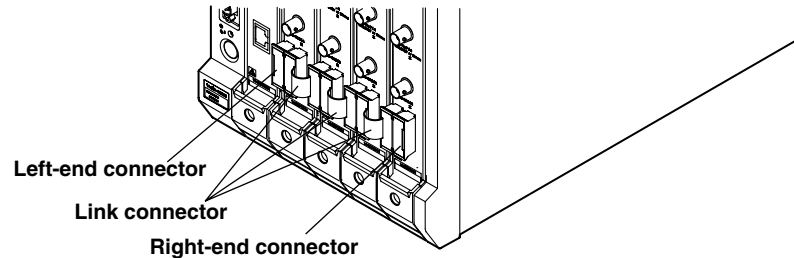
CAUTION

Make sure to turn OFF the standby power switch of the measuring station when connecting the link connectors. In addition, when removing the module, remove the link connector first. Otherwise, the OPER SYNC terminal of the module or the module link connector may be damaged.

3.1 Troubleshooting

- If servicing is necessary, or if the instrument is not operating correctly after performing the following corrective actions, contact your nearest YOKOGAWA dealer.
- To verify that the module is operating correctly, perform the self test as described on the next page.

Description	Probable Cause/Corrective Action	Reference Page
Linked operation does not work.	When performing linked operation of modules, check whether or not the module link connector is properly connected.	2-4
Module does not operate.	Check to see that the module is installed correctly into the station. Also, install the module into another slot, and check whether it will operate there. If it operates in the other slot, the measuring station is likely to have malfunctioned.	2-1, *
	If the module is installed correctly and does not operate, the connector might be bad or the IC may have malfunctioned. In either case, contact your nearest YOKOGAWA dealer to have it repaired.	–
Waveform data cannot be acquired.	Check that each signal line is properly connected to the INPUT terminal (BNC terminal).	2-3
Noise enters the input signal.	If the signal line and the AC power supply line are close to each other, move them apart. Also make sure that the signal line is away from the noise source.	–
	Change to a shielded signal cable if you are not already using one.	–
Measured values are not correct.	Check whether the ambient temperature and humidity are within the allowed ranges.	4-9
	If you did not allow a warm-up time of 30 minutes, try measuring again after the warm-up time has passed.	–
	Do a calibration.	1-11
	Compensate the probe.	
	Check that the probe attenuation setting is correct.	1-5
Trigger does not activate	Check whether the trigger setting is adequate for the input source in the trigger operation panel.	1-9
	If you are using the bus trigger signal, verify that the settings are correct in the trigger source/time base source/arming setting dialog box of the WE7000 Control Software.	
The waveform monitor does not appear.	Check to see that the waveform monitor ON/OFF button, located to the right of the [Start] button of the operation panel, is not set to OFF.	1-2

* See the WE7000 User's Manual (IM 707001-01E).

3

Troubleshooting and Maintenance

3.2   Self Test

If you believe that the module is not operating correctly, perform the self test according to the following steps:

Executing self test

1. Select [Self Test] from the [System] menu of the WE7000 Control Software.

2. In the [Self Test] dialog box that appears, select the station name and enter the slot number corresponding to the module, and click the [Execute] button.
   "Executing..." is displayed in the [Result] display box.
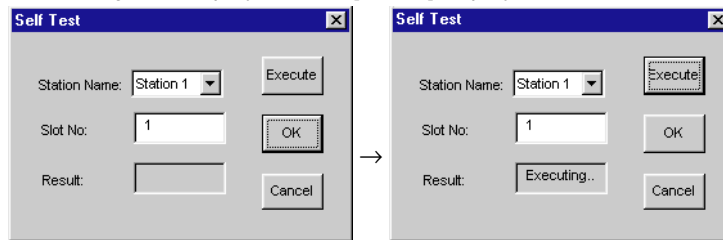
Verifying Test Results

If a value other than "0" is displayed in the "Result" display box of the "Self Test" dialog box, the module is probably malfunctioning. Please contact your nearest YOKOGAWA dealer for repairs.

Note
It may take more than a minute before the result of the self test is displayed.

3.3 Maintenance

Maintenance of Parts

There are no parts in this module that require periodic replacement.

Calibration

We recommend that you calibrate the measurement module once a year to assure its measurement accuracy. Please contact your nearest YOKOGAWA dealer to have the module calibrated.

4.1 Specifications of the Measurement Input Section

Number of Input Channels

1

Input Coupling

DC (1 M/50 Ω), AC (1 M/50 Ω), and GND

Input Connector

BNC connector

Input Impedance

1 MΩ±1% (approx. 10 pF) or 50 Ω±1%

Input Voltage Range

When in oscilloscope mode: 5 mV/div to 500 mV/div (in 1-2-5 steps)

When in digitizer mode: ±25 mV to ±2.5 V range (in 1-2.5-5 steps)

Vertical Resolution

8 bits

Maximum Input Voltage

When the input impedance is 1 MΩ: ±42 V (DC±ACpeak <10 kHz)

When the input impedance is 50 Ω: ±5 VDC (500 mW) or 5 Vrms[1]

Overvoltage Category CAT I and II

Frequency Characteristics[2][3]

For 10 mV/div to 500 mV/div or ±50 mV to ±2.5 V range: DC to 400 MHz

For 5 mV/div or ±25 mV range: DC to 250 MHz

–3dB point in the low frequency region during AC coupling: 10 Hz or less

Voltage Axis DC Accuracy[2]

±(2% of input voltage range (full scale) + offset voltage accuracy)

DC Offset Range

For 5 mV/div to 50 mV/div or ±25 mV to ±250 mV range: ±2 V (0.1 mV resolution)

For 100 mV/div to 500 mV/div or ±500 mV to ±2.5 V range: ±20 V (1 mV resolution)

Offset Voltage Accuracy[2]

For 5 mV/div to 50 mV/div or ±25 mV to ±250 mV range: ±(1% of the specified value + 1 mV)

For 100 mV/div to 500 mV/div or ±500 mV to ±2.5 V range: ±(1% of the specified value + 10 mV)

Residual Noise Level

For 5 mV/div to 50 mV/div or ±25 mV to ±250 mV range: ±2.0 mV or ±2 LSB, whichever is larger (typical value[4])

For 100 mV/div to 500 mV/div or ±500 mV to ±2.5 V range: ±20 mV or ±2 LSB, whichever is larger (typical value[4])

Significant Bits

> 6.5 bits (DC-50 MHz) (typical value[4])

> 6.0 bits (50 MHz-100 MHz) (typical value[4])

Skew between Modules[5]

Within 1 sampling interval

Isolation between Channels[5]

–40 dB@100 MHz (typical value[4] in the same range)

---

*1 When overvoltage is applied, the protective circuit is activated, and the input coupling is switched to GND.

*2 Value measured with the time base set to internal clock under standard operating conditions after warm-up time has elapsed and after calibration.

*3 The –3 dB point when the input coupling is set to DC50 Ω with a 100-kHz sine wave with an amplitude corresponding to ±3 divisions used as a reference.

*4 Typical value represents a typical or average value. It is not strictly guaranteed.

*5 Measured using the same range with the time base set to internal clock under linked operation.

4

Specification

4.2 Specifications of the Trigger Section

Trigger Mode

        NORMAL: Acquire the waveform only when a trigger occurs.

        AUTO: Automatically acquire the waveform if the trigger does not occur for a prescribed time period.

Trigger Source

Input signal (includes input signal from linked WE7311 modules), external input (EXT IN), and bus trigger (BUSTRG1/BUSTRG2) signal of the WE bus

Trigger Coupling

DC, LF Rejection (approx. 50 kHz)

Trigger Type

Edge

Trigger Slope

Rising edge or falling edge

Trigger Level Range

Within the input voltage range (when using DC coupling, 0.5% resolution)

Trigger Sensitivity

DC to 1 MHz: 10% of the input voltage range (full scale)

DC to 300 MHz: 20% of the input voltage range (full scale)

DC to 400 MHz: 70% of the input voltage range (full scale)

Trigger Level Accuracy[1]

±5% of the input voltage range (full scale)

Trigger Position (During the Oscilloscope Mode)

±5 div

Pretrigger (During the Digitizer Mode)

0 to 100% of the acquisition sample

Trigger Delay

During the oscilloscope mode: 0 up to 300 s

During the digitizer mode: 0 to 200 M samples (however, the maximum value is the value corresponding to 300 s when converted into delay time)

Trigger Output

Able to output the acquisition trigger to the trigger bus (BUSTRG1/BUSTRG2) of the WE bus.

Output Trigger Input Impedance[2]

1 MΩ or 50 Ω

External Trigger Input Frequency Bandwidth[2]

DC to 400 MHz

External Trigger Input Voltage Range[2]

±4 V (minimum voltage: 3 Vp-p)

External Trigger Level Range

±4 V (0.1 V resolution)

---

[1] Value measured with the time base set to internal clock under standard operating conditions after warm-up time has elapsed and after calibration.

[2] The external trigger input and external clock input share the same connector.

4.3 Time Axis

Time Axis Range (During Oscilloscope Mode)
> 10 ns/div to 50 s/div (in 1-2-5 steps)

Sampling Interval (During the Digitizer Mode)
> 1 ns to 10 ms (in 1-2-5 steps) (For API, 1-2-2.5-4-5 steps)

Time Axis Accuracy[1]
> ±(25 ppm + 1 sampling interval)

External Clock Input/Output[2]
> Able to input an external input signal (EXT IN) as a sampling clock.
>
> Able to input an external input signal (EXT IN) or the time base (CMNCLK) signal of the WE bus as a reference clock.
>
> Able to output the 10-MHz internal reference clock to the time base (CMNCLK) of the WE bus.

External Clock Input Impedance
> 1 MΩ or 50 Ω

External Clock Input Voltage Range
> ±4 V

External Clock Input Threshold
> ±2 V (0.1 V resolution)

External Sampling Clock Input Frequency Range/Minimum Voltage
> 10 MHz to 500 MHz/3 Vp-p

External Reference Clock Input Frequency Range/Minimum Voltage
> 10 MHz/800 mVp-p

[1] Value measured with the time base set to internal clock under standard operating conditions after warm-up time has elapsed and after calibration.
[2] The external clock input and the external trigger input share the same connector.

4

Specification

4.4 Functional Specifications

Record Length

　　100 to 2 Mword (1 word unit, 1,000,001 words or more are only for single acquisition)

Sequential Store

　　Memory partition (1 to 4096, 2^n steps), store count can be specified.

Auto Setup

　　Automatically sets the voltage axis, time axis, trigger level, etc.

Calibration

　　Auto calibration and manual calibration available

4.5 The Relationship between the Time Axis Setting/ Sampling Interval/Display Data and Record Length

The ▭ section indicates ranges in which the display record length is shorter than the record length.

Time/div	Record Length: 100 to 199		Record Length: 200 to 499		Record Length: 500 to 999	
	Sample Interval (s)	Displayed Record Length	Sample Interval (s)	Displayed Record Length	Sample Interval (s)	Displayed Record Length
50 s						
20 s						
10 s						
5 s						
2 s						
1 s						
500 ms					10 m	500
200 ms			10 m	200	4 m	500
100 ms	10 m	100	5 m	200	2 m	500
50 ms	5 m	100	2.5 m	200	1 m	500
20 ms	2 m	100	1 m	200	400 μ	500
10 ms	1 m	100	500 μ	200	200 μ	500
5 ms	500 μ	100	250 μ	200	100 μ	500
2 ms	200 μ	100	100 μ	200	40 μ	500
1 ms	100 μ	100	50 μ	200	20 μ	500
500 μs	50 μ	100	25 μ	200	10 μ	500
200 μs	20 μ	100	10 μ	200	4 μ	500
100 μs	10 μ	100	5 μ	200	2 μ	500
50 μs	5 μ	100	2.5 μ	200	1 μ	500
20 μs	2 μ	100	1 μ	200	400 n	500
10 μs	1 μ	100	500 n	200	200 n	500
5 μs	500 n	100	250 n	200	100 n	500
2 μs	200 n	100	100 n	200	40 n	500
1 μs	100 n	100	50 n	200	20 n	500
500 ns	50 n	100	25 n	200	10 n	500
200 ns	20 n	100	10 n	200	4 n	500
100 ns	10 n	100	5 n	200	2 n	500
50 n	5 n	100	2.5 n	200	1 n	500
20 n	2 n	100	1 n	200	1 n	200
10 n	1 n	100	1 n	100	1 n	100

4

Specification

The ▭ section indicates ranges in which the display record length is shorter than the record length.

Time/div	Record Length: 1000 to 1999		Record Length: 2000 to 4999		Record Length: 5000 to 9999	
	Sample Interval (s)	Displayed Record Length	Sample Interval (s)	Displayed Record Length	Sample Interval (s)	Displayed Record Length
50 s						
20 s						
10 s						
5 s					10 m	5000
2 s			10 m	2000	4 m	5000
1 s	10 m	1000	5 m	2000	2 m	5000
500 ms	5 m	1000	2.5 m	2000	1 m	5000
200 ms	2 m	1000	1 m	2000	400 μ	5000
100 ms	1 m	1000	500 μ	2000	200 μ	5000
50 ms	500 μ	1000	250 μ	2000	100 μ	5000
20 ms	200 μ	1000	100 μ	2000	40 μ	5000
10 ms	100 μ	1000	50 μ	2000	20 μ	5000
5 ms	50 μ	1000	25 μ	2000	10 μ	5000
2 ms	20 μ	1000	10 μ	2000	4 μ	5000
1 ms	10 μ	1000	5 μ	2000	2 μ	5000
500 μs	5 μ	1000	2.5 μ	2000	1 μ	5000
200 μs	2 μ	1000	1 μ	2000	400 n	5000
100 μs	1 μ	1000	500 n	2000	200 n	5000
50 μs	500 n	1000	250 n	2000	100 n	5000
20 μs	200 n	1000	100 n	2000	40 n	5000
10 μs	100 n	1000	50 n	2000	20 n	5000
5 μs	50 n	1000	25 n	2000	10 n	5000
2 μs	20 n	1000	10 n	2000	4 n	5000
1 μs	10 n	1000	5 n	2000	2 n	5000
500 ns	5 n	1000	2.5 n	2000	1 n	5000
200 ns	2 n	1000	1 n	2000	1 n	2000
100 ns	1 n	1000	1 n	1000	1 n	1000
50 n	1 n	500	1 n	500	1 n	500
20 n	1 n	200	1 n	200	1 n	200
10 n	1 n	100	1 n	100	1 n	100

Time/div	Record Length: 10000 to 19999		Record Length: 20000 to 49999		Record Length: 50000 to 99999	
	Sample Interval (s)	Displayed Record Length	Sample Interval (s)	Displayed Record Length	Sample Interval (s)	Displayed Record Length
50 s					10 m	50000
20 s			10 m	20000	4 m	50000
10 s	10 m	10000	5 m	20000	2 m	50000
5 s	5 m	10000	2.5 m	20000	1 m	50000
2 s	2 m	10000	1 m	20000	400 μ	50000
1 s	1 m	10000	500 μ	20000	200 μ	50000
500 ms	500 μ	10000	250 μ	20000	100 μ	50000
200 ms	200 μ	10000	100 μ	20000	40 μ	50000
100 ms	100 μ	10000	50 μ	20000	20 μ	50000
50 ms	50 μ	10000	25 μ	20000	10 μ	50000
20ms	20 μ	10000	10 μ	20000	4 μ	50000
10 ms	10 μ	10000	5 μ	20000	2 μ	50000
5 ms	5 μ	10000	2.5 μ	20000	1 μ	50000
2 ms	2 μ	10000	1 μ	20000	400 n	50000
1 ms	1 μ	10000	500 n	20000	200 n	50000
500 μs	500 n	10000	250 n	20000	100 n	50000
200 μs	200 n	10000	100 n	20000	40 n	50000
100 μs	100 n	10000	50 n	20000	20 n	50000
50 μs	50 n	10000	25 n	20000	10 n	50000
20 μs	20 n	10000	10 n	20000	4 n	50000
10 μs	10 n	10000	5 n	20000	2 n	50000
5 μs	5 n	10000	2.5 n	20000	1 n	50000
2 μs	2 n	10000	1 n	20000	1 n	20000
1 μs	1 n	10000	1 n	10000	1 n	10000
500 ns	1 n	5000	1 n	5000	1 n	5000
200 ns	1 n	2000	1 n	2000	1 n	2000
100 ns	1 n	1000	1 n	1000	1 n	1000
50 n	1 n	500	1 n	500	1 n	500
20 n	1 n	200	1 n	200	1 n	200
10 n	1 n	100	1 n	100	1 n	100

The ▢ section indicates ranges in which the display record length is shorter than the record length.

Time/div	Record Length: 100000 to 199999		Record Length: 200000 to 499999		Record Length: 500000 to 999999	
	Sample Interval (s)	Displayed Record Length	Sample Interval (s)	Displayed Record Length	Sample Interval (s)	Displayed Record Length
50 s	5 m	100000	2.5 m	200000	1 m	500000
20 s	2 m	100000	1 m	200000	400 μ	500000
10 s	1 m	100000	500 μ	200000	200 μ	500000
5 s	500 μ	100000	250 μ	200000	100 μ	500000
2 s	200 μ	100000	100 μ	200000	40 μ	500000
1 s	100 μ	100000	50 μ	200000	20 μ	500000
500 ms	50 μ	100000	25 μ	200000	10 μ	500000
200 ms	20 μ	100000	10 μ	200000	4 μ	500000
100 ms	10 μ	100000	5 μ	200000	2 μ	500000
50 ms	5 μ	100000	2.5 μ	200000	1 μ	500000
20 ms	2 μ	100000	1 μ	200000	400 n	500000
10 ms	1 μ	100000	500 n	200000	200 n	500000
5 ms	500 n	100000	250 n	200000	100 n	500000
2 ms	200 n	100000	100 n	200000	40 n	500000
1 ms	100 n	100000	50 n	200000	20 n	500000
500 μs	50 n	100000	25 n	200000	10 n	500000
200 μs	20 n	100000	10 n	200000	4 n	500000
100 μs	10 n	100000	5 n	200000	2 n	500000
50 μs	5 n	100000	2.5 n	200000	1 n	500000
20 μs	2 n	100000	1 n	200000	1 n	200000
10 μs	1 n	100000	1 n	100000	1 n	100000
5 μs	1 n	50000	1 n	50000	1 n	50000
2 μs	1 n	20000	1 n	20000	1 n	20000
1 μs	1 n	10000	1 n	10000	1 n	10000
500 ns	1 n	5000	1 n	5000	1 n	5000
200 ns	1 n	2000	1 n	2000	1 n	2000
100 ns	1 n	1000	1 n	1000	1 n	1000
50 n	1 n	500	1 n	500	1 n	500
20 n	1 n	200	1 n	200	1 n	200
10 n	1 n	100	1 n	100	1 n	100

Time/div	Record Length: 1000000 to 1999999		Record Length: 2000000 to	
	Sample Interval (s)	Displayed Record Length	Sample Interval (s)	Displayed Record Length
50 s	500 μ	1000000	250 μ	2000000
20 s	200 μ	1000000	100 μ	2000000
10 s	100 μ	1000000	50 μ	2000000
5 s	50 μ	1000000	25 μ	2000000
2 s	20 μ	1000000	10 μ	2000000
1 s	10 μ	1000000	5 μ	2000000
500 ms	5 μ	1000000	2.5 μ	2000000
200 ms	2 μ	1000000	1 μ	2000000
100 ms	1 μ	1000000	500 n	2000000
50 ms	500 n	1000000	250 n	2000000
20ms	200 n	1000000	100 n	2000000
10 ms	100n	1000000	50 n	2000000
5 ms	50 n	1000000	25 n	2000000
2 ms	20 n	1000000	10 n	2000000
1ms	10 n	1000000	5 n	2000000
500 μs	5 n	1000000	2.5 n	2000000
200 μs	2 n	1000000	1 n	2000000
100 μs	1 n	1000000	1 n	1000000
50 μs	1 n	500000	1 n	500000
20 μs	1 n	200000	1 n	200000
10 μs	1 n	100000	1 n	100000
5 μs	1 n	50000	1 n	50000
2 μs	1 n	20000	1 n	20000
1 μs	1 n	10000	1 n	10000
500 ns	1 n	5000	1 n	5000
200 ns	1 n	2000	1 n	2000
100 ns	1 n	1000	1 n	1000
50 n	1 n	500	1 n	500
20 n	1 n	200	1 n	200
10 n	1 n	100	1 n	100

4

Specification

4.6 Default Values (Factory Default Settings)

Vertical axis/horizontal axis/trigger settings of the oscilloscope mode

V/div (voltage sensitivity): 500 mV/div

Offset (offset voltage): 0 V

Coupling (input coupling): DC

Probe (probe attenuation): 1:1

Time/div (time axis): 1 ms

Trig Mode: Auto

Source (trigger source): CH1

Level (trigger level): 0 V

Delay Time (trigger delay): 0 s

Coupling (trigger coupling): DC

Slope (trigger slope): Rise

Position (trigger position): 0.0 div

Vertical axis/horizontal axis/trigger settings of the digitizer mode

Range (measurement range): 2.5 V

Offset (offset voltage): 0 V

Coupling (input coupling): DC

Sampling Interval: 1 us

Trig Mode: Auto

Source (trigger source): CH1

Coupling (trigger coupling): DC

Slope (trigger slope): Rise

Level (trigger level): 0 V

Pretrigger: 500 samples

Delay (trigger delay): 0 samples

Time base settings

Sampling CLK Source (sampling clock source): Internal

Reference CLK Source (reference clock source): Internal

Conditions on acquiring the waveform

Memory Partition: 1

Record Length: 10000

No. of Acquisitions: 1

Other settings

Auto Cal (auto calibration): Off

Repeat (repetitive measurement): On

4.7　General Specifications

Safety Standard

Complies with CSA C22.2 No.1010.1 and EN61010-1, conforms to JIS C1010-1.
- Overvoltage category CAT I and II[*1]
- Pollution degree 1 and 2[*2]

EMC standards

Emission

Complying standard

　EN55011 Group 1 Class A

　This product is a Class A (for commercial environment) product. Operation of this
　product in a residential area may cause radio interference in which case the user is
　required to correct the interference.

Cable requirement

　Double shielded coaxial cables (3D-2W BNC cable) with 50 Ω terminated.

Immunity

Complying standard

　EN50082-2

Influence in the immunity environment

　Noise increase: $\leq\pm$30 mV

Testing condition

　1 GS/s; 50mV/div; Normal Sampling Mode; Input 3 m duble shielded cable (3D-2W)
　with 50 Ω terminated.

Standard Operating Conditions

Ambient temperature: 23$\pm$2$°$C

Ambient humidity: 50$\pm$10%

After warm-up time has passed

Warm-up Time

At least 30 minutes

Operating Conditions

Same as those of the measuring station

Storage Conditions

Temperature: –20 to 60$°$C

Humidity: 20 to 85% (no condensation)

Power Consumption

18 VA (typical value* at 100 V/50 Hz)

External Dimensions

Approx. 33 (W) x 243 (H) x 232 (D) mm (projections excluded)

Weight

Approx. 0.8 kg

Number of Used Slots

1

Standard Accessories

Module link connector (1 set), User's Manual (1 piece)

Optional Accessories (Sold Separately)

Module link connector (part number: B9952RB, 1 set), passive probe (model: 700944)

[1] Overvoltage Categories define transient overvoltage levels, including impulse withstand voltage levels.

Overvoltage Category I: Applies to equipment supplied with electricity from a circuit containing an overvoltage control device.

Overvoltage Category II: Applies to equipment supplied with electricity from fixed installations like a distribution board.

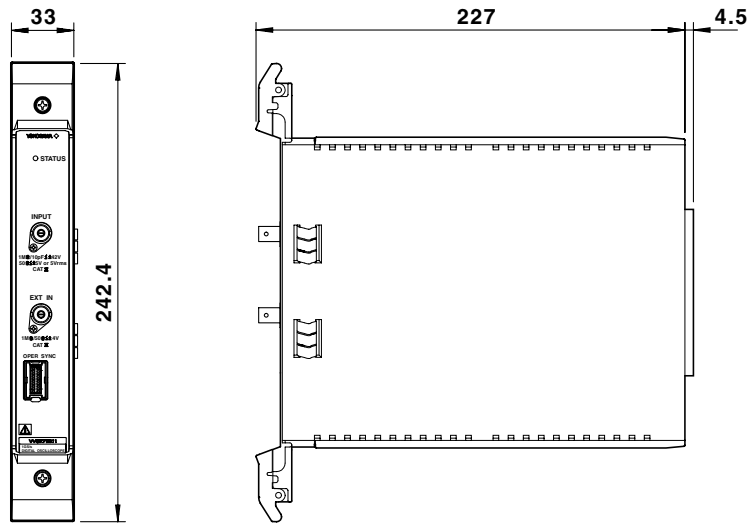[2] Pollution Degree: Applies to the degree of adhesion of a solid, liquid, or gas which deteriorates withstand voltage or surface resistivity.

Pollution Degree 1: Applies to closed atmospheres (with no, or only dry, non-conductive pollution).

Pollution Degree 2: Applies to normal indoor atmospheres (with only non-conductive pollution).

[3] Typical value represents a typical or average value. It is not strictly guaranteed.

4.8   Dimensional Drawings

Unit: mm

Index