User's Manual

Multichannel Analyzer Module

WE7562

YOKOGAWA
Yokogawa Meters & Instruments Corporation

IM 707562-01E
2nd Edition

Product Registration

Thank you for purchasing YOKOGAWA products.

YOKOGAWA provides registered users with a variety of information and services.
Please allow us to serve you best by completing the product registration form accessible from our homepage.

http://tmi.yokogawa.com/

Thank you for purchasing the WE7562 Multichannel Analyzer Module for the WE7000 PC-Based Measurement Instruments.
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 WE7562. This manual assumes that you will be using the WE7000 Control Software that is included with the measuring station.
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.	Note
WE7000 User's Manual	IM 707003-01E	User's manual for the WE7000.

To ensure correct use, please read this manual thoroughly before beginning operation. After reading the manual, keep it in a convenient location for quick reference whenever a question arises during operation.

Notes

- **The contents of this manual describe WE7000 Control Software Ver. 5.2.0.0 and module software Ver. 5.02. The operating procedures and screen contents described in this manual may differ from those in other versions of the 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 the permission of Yokogawa Electric Corporation is strictly prohibited.

Trademarks

- Microsoft, Internet Explorer, MS-DOS, Windows, Windows NT, Windows 2000, Windows Me, and Windows XP are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- Adobe, Acrobat, and PostScript are trademarks of Adobe Systems Incorporated.
- For purposes of this manual, the TM and ® symbols do not accompany their respective trademark names or registered trademark names.
- Other company and product names are trademarks or registered trademarks of their respective holders.

Revisions

1st Edition: December 2006
2nd Edition: July 2007

2nd Edition: July 2007 (YK)

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.

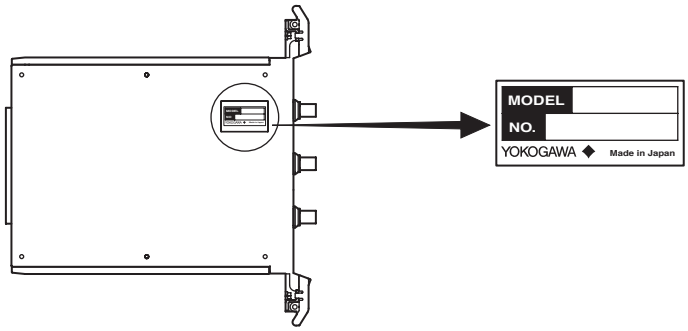
Measurement Module

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

- **MODEL**

Model	Notes
707562	Multichannel Analyzer Module

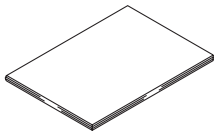
- **NO. (Instrument Number)**
  When contacting the dealer from which you purchased the instrument, please give them these numbers.



Standard Accessories

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

User's Manual (this manual) (1)
IM 707562-01E



Waste Electrical and Electronic Equipment

Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC
(This directive is only valid in the EU.)
This product complies with the WEEE Directive (2002/96/EC) marking requirement. This marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category
With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a “Monitoring and Control instrumentation” product.

Do not dispose in domestic household waste. When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

How to Use This Manual

Structure of the Manual

This user's manual consists of the following sections:

Chapter	Title	Description
1	**Explanation of Functions**	Explains the system configuration, functions, and setup operations.
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	**Specifications**	Explains the specifications of the module.
Index		

Conventions Used in This Manual

- **Unit**
  k Denotes 1000. Example: 100 kHz
  K Denotes 1024. Example: 720 KB

- **Bolded Characters**
  Characters written in bold mainly refer to on-screen elements and hardware controls.

- **Symbols**
  The following symbols are used in this manual.

Improper handling or use can lead to injury to the user or damage to the instrument. The same symbol appears in the corresponding place in the manual to identify those instructions.

WARNING Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

CAUTION Calls attentions to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

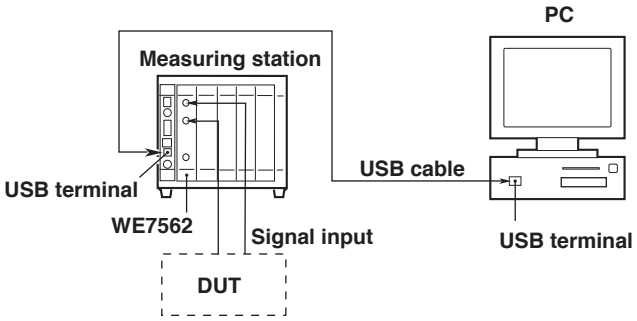
Note Calls attention to information that is important for proper operation of the instrument.

Contents

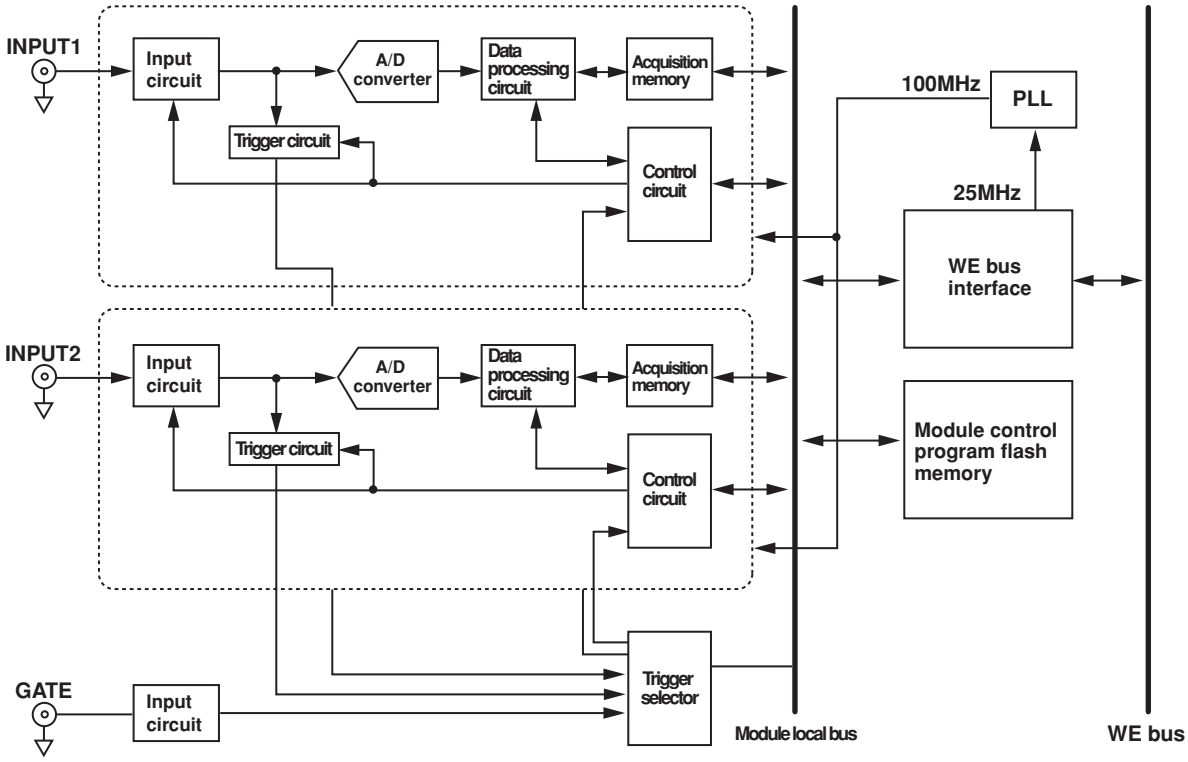
1.1 System Configuration, Block Diagram, and Principles of Peak Measurement (Digital Sampling System)

System Configuration

The following is an example in which the WE7562 Multichannel Analyzer Module is installed into the measuring station and the measuring station is connected to the PC with a USB cable.



Block Diagram



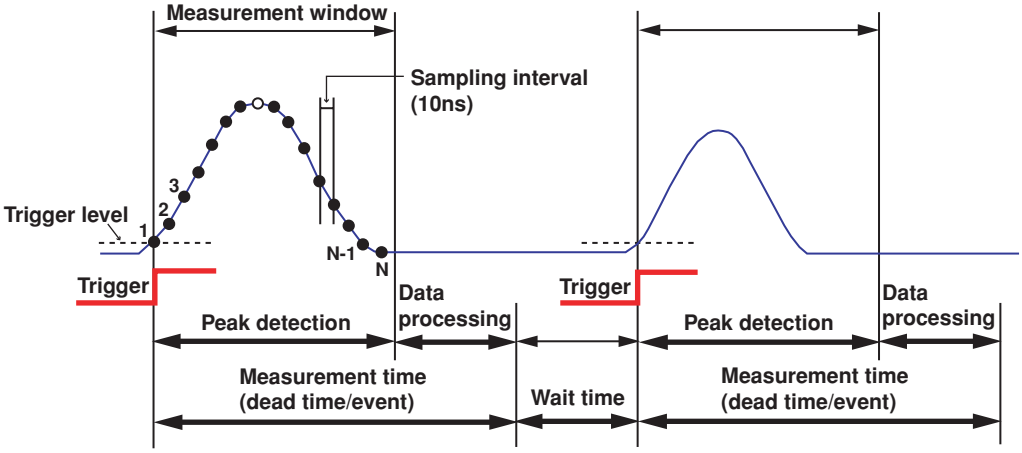
Description of Operation

The WE7562 measures the peak value (voltage peak) of the input signal and performs analysis and statistical processing. The module has two identical signal input circuits that operate independently. The input signal is attenuated and buffered by the input circuit to match the full range of the A/D converter. The signal is then input to the A/D converter and passed to the trigger circuit where the trigger signal for starting the peak detection is generated.

The digital data that is A/D converted at a sampling clock of 100 MHz is processed according to the measurement mode that is selected by the data processing circuit and stored in the acquisition memory. Using the trigger signal, the control circuit instructs the data processing circuit to start the peak detection, analyze, and perform statistical processing as well as store the measured results to the acquisition memory. The data in the acquisition memory is read from the PC through the communication interface. The data can be read even while the measurement is in progress.

Principles of Peak Measurement (Digital Sampling System)

The WE7562 incorporates an original principle in the peak measurement. The peak detection process is described below.



Using the point where the input signal exceeds the trigger level[*1] that is set in conjunction with the LLD (Lower Level Discriminator) as the starting point, the WE7562 determines the maximum value of the input signal level that is sampled within the specified measurement time (window time) as the peak value and processes the data according to the selected operation mode (PHA, MCS, or LIST). The time needed for the peak measurement (dead time for each event) is the sum of the window time used to detect the peak and the data processing time (180 ns, typical value[*2]). The window time must be set to match the pulse width of the input signal that you are trying to measure, but it is also the determining factor of the dead time.

*1 The trigger level is set approximately equal to 80% of the specified LLD level.

*2 Typical value represents a typical or average value. It is not a warranted value.

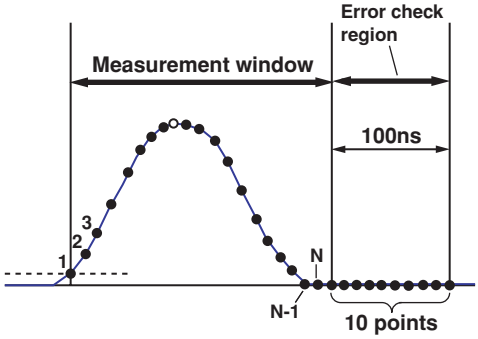
Note

- For details on the dead time, see appendix 3, “Statistics Display.”
- Trigger event refers to an event that is established at the point the measurement operation such as the actual peak detection is started according to the signal supplied by the trigger source. Trigger events do not occur during the dead time period or a period during which trigger occurrence is restricted by the gate function even if a signal is supplied from the trigger source.

Window Time Setting and Error Check Function

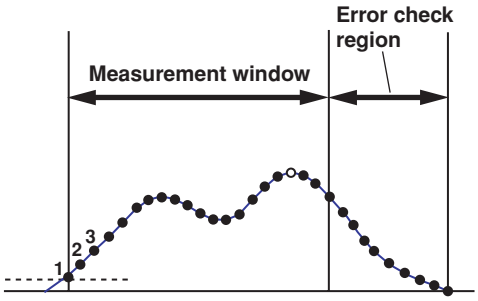
The WE7562 incorporates a digital sampling system for the peak detection. The WE7562 compares the size of each data point that is sampled during the measurement window period and processes the maximum data that is held as the peak value of the event at the end of the measurement window period.

Signal example in which a peak is contained within the measurement window



If a signal having two peaks in the measurement window is applied, the larger of the two peak values is determined to be the peak value of the event, and the other peak value is discarded.

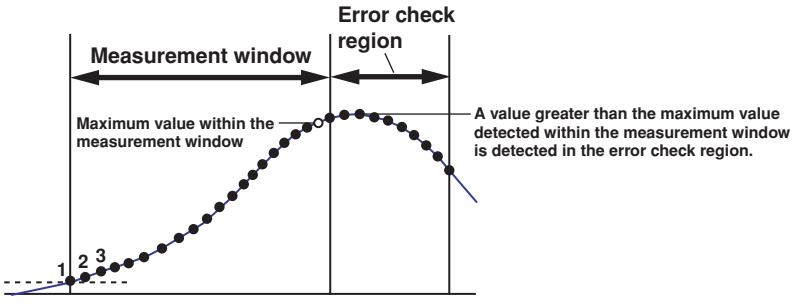
Signal example in which two peaks are contained within the measurement window



The second peak value (larger of the two values) is processed as the measured value.

If the window time is not set appropriately for the input signal (too short) or if a signal with an abnormal waveform is applied, the WE7562 may not be able to detect the correct peak within the measurement window. The WE7562 is equipped with an error check function that distinguishes between these abnormal events and normal events. Sampled data (10 points) in the 100-ns area (error check region) following the measurement window period is used for the error check. If a value greater than the maximum value detected within the measurement window is detected in the error check region, the event is judged as an error event. If the error check function is ON, events that are judged as an error are processed differently from a normal event according to the selected operation mode (PHA, MCS, or LIST). If the error check function is OFF, the maximum value within the measurement window is processed as the measured value.

Example in which the window time is set shorter than the signal width



The measurement window is short

If the error check function is ON, error events are processed differently from normal events.
If the error check function is OFF, the maximum value within the measurement window is processed as the measured value as with an normal event.

Note

Set the window time sufficiently wider than the width of the input signal. If a shaper amplifier is used in the previous stage, four times the shaping time is a rough estimate. The WE7562 allows you to set the window time while you view the input waveform by using the built-in waveform viewer of the WE Control Software. For a description of the built-in waveform viewer, see the WE7562 on-line help that is provided with the WE7000 Control Software.

1.2 Data Handling of Different Operation Modes and Measurement Modes

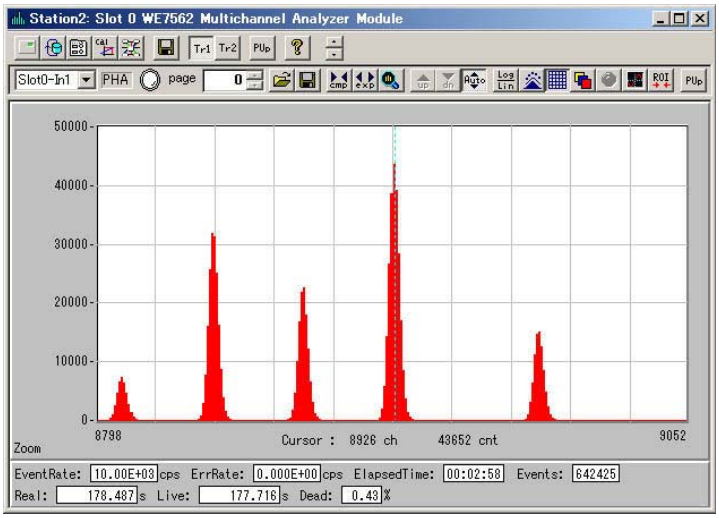
The WE7562 Multichannel Analyzer has the following three operation modes: PHA, MCS, and LIST. This section explains each operation mode and how the data is handled in each operation mode.

Operation Mode

You can set different operation modes in each of the two inputs on the WE7562.

PHA (Pulse-Height Analysis) Mode

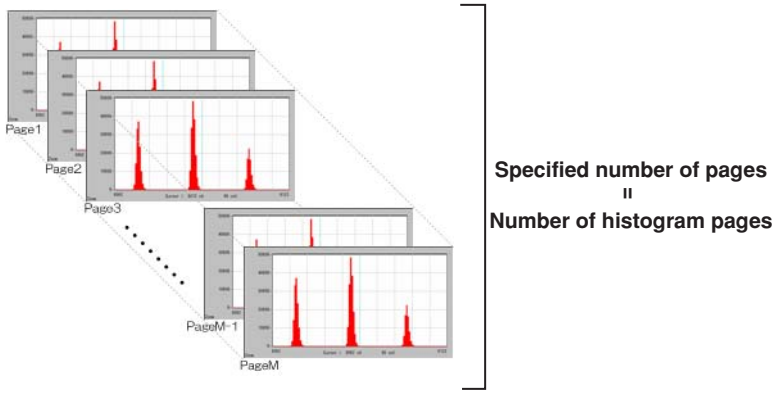
The WE7562 measures a pulse signal (event) with peak values at wide intervals and selects the events whose peak value fall within the preset region of interest (ROI). The WE7562 expresses the result in a histogram (spectrum) with the peak values along the horizontal axis and the number of events along the vertical axis and stores the data in the internal memory.



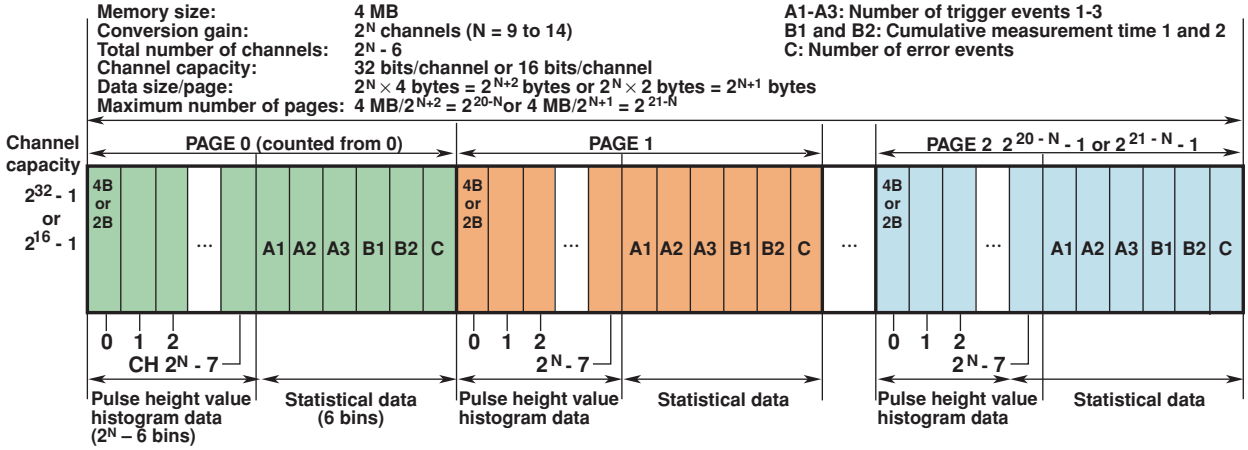
- **Page Function**

  In PHA mode, multiple pages of histograms can be generated by using the page function. You can select the time, cumulative number of events, external signal, or overflow of a channel as a condition for updating the page. You can also update the page at an arbitrary time by using the page up button.

  Page function concept



- **Data Structure in PHA Mode**



The value N in the above figure is the bit-converted values of the total number of AD channels in the following table.

Total number of AD channels	16384	8192	4096	2048	1024	512
Bit-converted value (N)	14	13	12	11	10	9

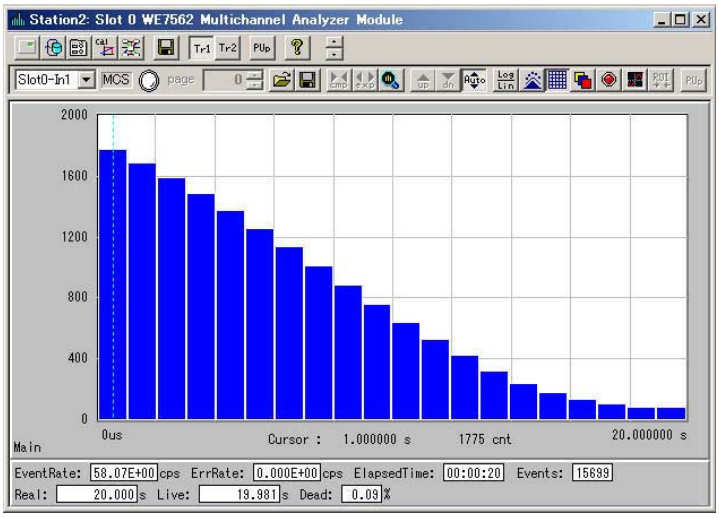
- Channels
  The histogram data of peak values (the number of events per channel) is stored in channel 1 to channel 2^N-7. If the ROI function is OFF, channel 0 is used as an underflow bin (events whose measured value is less than channel 0), and channel 2^N-7 is used as an overflow bin (events whose measured value is greater than channel 2^N-7). The data size is equal to the selected channel capacity.
- Trigger event
  The trigger event is 40-bit data having the following data structure.
  Number of trigger events 1: Stores the number of trigger events (upper 8 bits).
  Number of trigger events 2: Stores the number of trigger events (middle 16 bits).
  Number of trigger events 3: Stores the number of trigger events (lower 16 bits).
  The data size is 16 bits regardless of the selected channel capacity. If the channel capacity is set to 32 bits, zeroes are inserted in the upper 16 bits of the channel.
  The number of trigger events is calculated as follows:
  Number of trigger events = (number of trigger events 1) × 2^{32} + (number of trigger events 2) × 2^{16} + (number of trigger events 3)
- Cumulative measurement time
  The cumulative measurement time is 32-bit data having the following data structure.
  Cumulative measurement time 1: Stores the cumulative measurement time (upper 16 bits).
  Cumulative measurement time 2: Stores the cumulative measurement time (lower 16 bits).
  The data size is 16 bits regardless of the selected channel capacity. If the channel capacity is set to 32 bits, zeroes are inserted in the upper 16 bits of the channel.
  The unit of the cumulative measurement time is 1 ms. The cumulative measurement time is calculated as follows:
  Cumulative measurement time = (cumulative measurement time 1) × 2^{16} + (cumulative measurement time 2) ms
- Number of error events
  Stores the number of error events. The data size is equal to the selected channel capacity.

Note

The number of events and the number of error events of each channel that exceeds the channel capacity is not added to the histogram data. The maximum number of events that can be stored is 65535 and 4294967295 if the channel capacity is set to 16 bits/CH and 32 bits/CH, respectively.

MCS (Multi-Channel Scaling) Mode

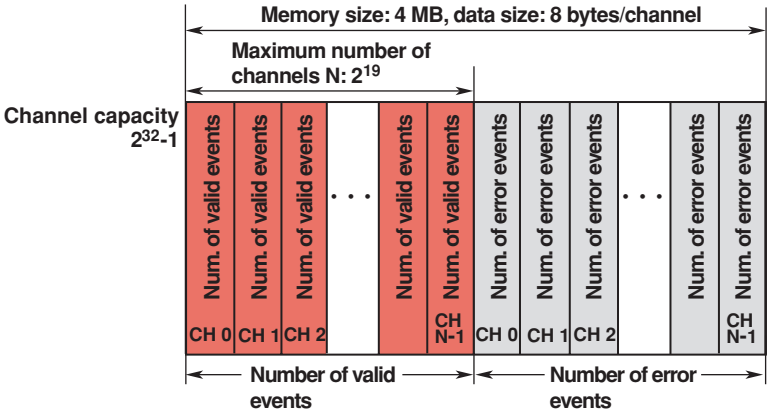
The WE7562 expresses the transition over time of the number of events that occur within a specified unit time (dwell time) in a histogram with the event arrival time (bin of a dwell time width) along the horizontal axis and the number of events along the vertical axis and stores the data in the internal memory.



The MCS mode has the following two measurement modes.

- **Peak Measurement Mode (Peak)**
  Performs peak detection. The WE7562 counts the events within the preset ROI for each dwell time among the measured peak values and stores the result.
- **Counter Mode**
  Peak detection is not performed. The WE7562 records the number of trigger events that occur in each dwell time.

- **Data Structure in MCS Mode**



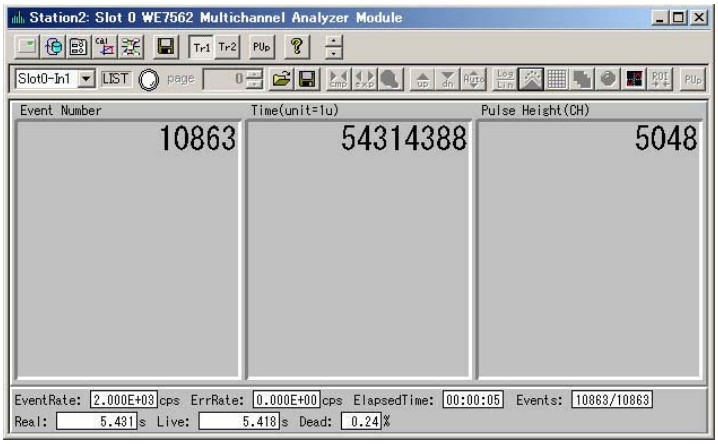
Number of channels

If the number of channels is N, the number of events that occur within each dwell time is recorded to data areas 0 to N-1. The data size is 32 bits.

The number of error events that occurred in each dwell time is recorded to data areas N to 2^N-1 (if the check function is enabled). The data size is 32 bits.

LIST Mode

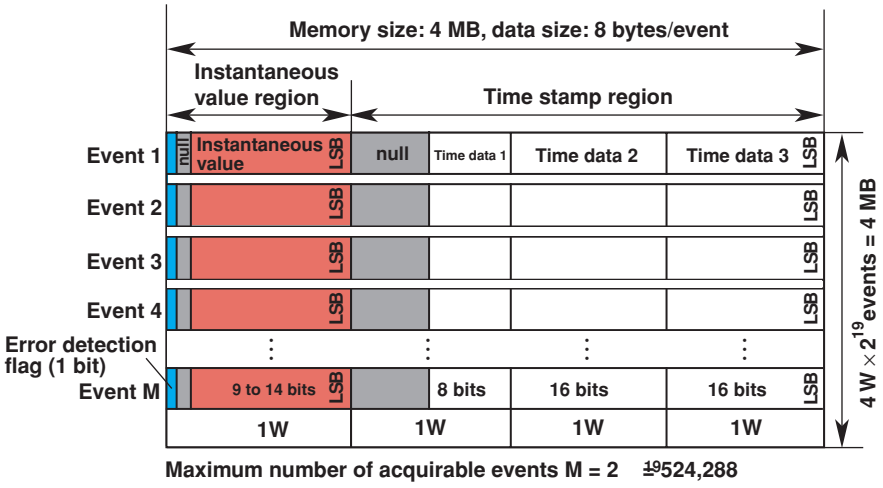
The WE7562 starts the internal timer in sync with the start of the measurement and stores the time of the event occurrence and the measured value for each event in the internal memory.



The LIST mode has the following two measurement modes.

- **Peak Measurement Mode (Peak)**
  Performs peak detection. If the measured peak value is within the preset ROI, the peak detection time or the trigger activation time and the measured peak value are displayed numerically.
- **Instantaneous Value Measurement Mode**
  Peak detection is not performed. The WE7562 measures the instantaneous value at the time the trigger condition is met (excluding self triggers) and numerically displays that value and the trigger activation time.

- **Data Structure in LIST Mode**



Data area

The data size per event is 64 bits. The lower 48 bits are used to store timestamp data, and the upper 16 bits are used to store measured data.

- Time stamp data

  The lower 40 bits of the 48 bits are used.

  The timestamp value is calculated as follows (the time unit depends on the actual setting):

  Timestamp value = (time data 1) × 2^{32} + (time data 2) × 2^{16} + (time data 3)
- Measured data

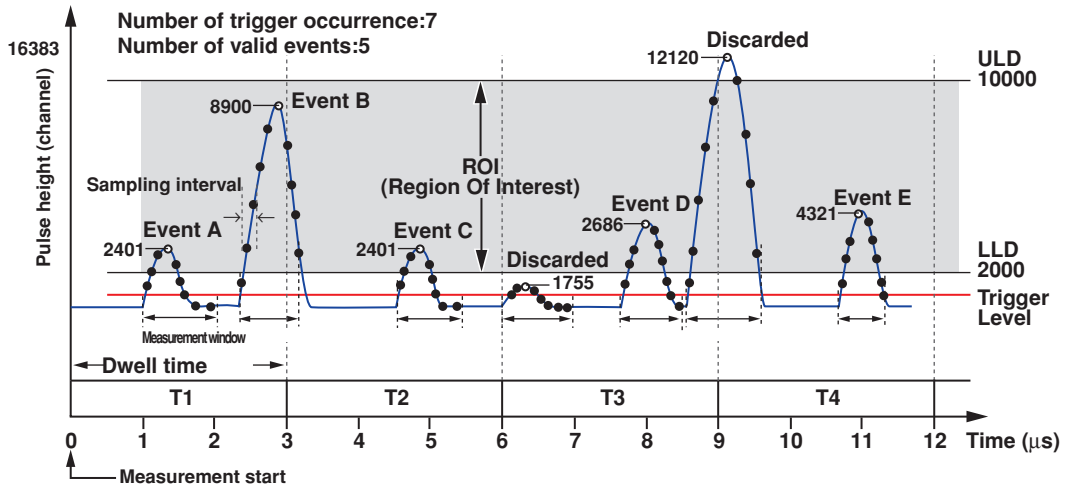
  The lower 9 to 14 bits of the 16 bits are used to store the measured value, the highest 1 bit is used as a flag indicating whether the event is an error (0: no error, 1: error). If the error check function is ON, all error events are discarded, and the flag of all acquired events is zero.

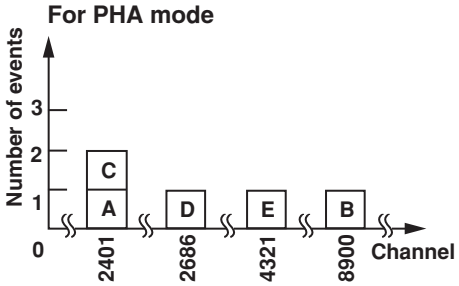
Data Handling of Different Measurement Modes

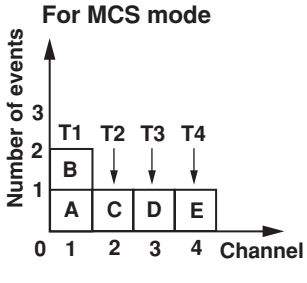
We will look at examples of each operation mode when the measurement is performed using the following conditions.

Peak Measurement Mode (PHA Mode, MCS Mode, and LIST Mode)

- Total number of AD channels: 16384
- ROI: LLD = 2000, ULD = 10000
- Dwell time: 3 μs
- Timestamp resolution: 1 μs
- Timestamp position: Peak position
- Window time: 1 μs





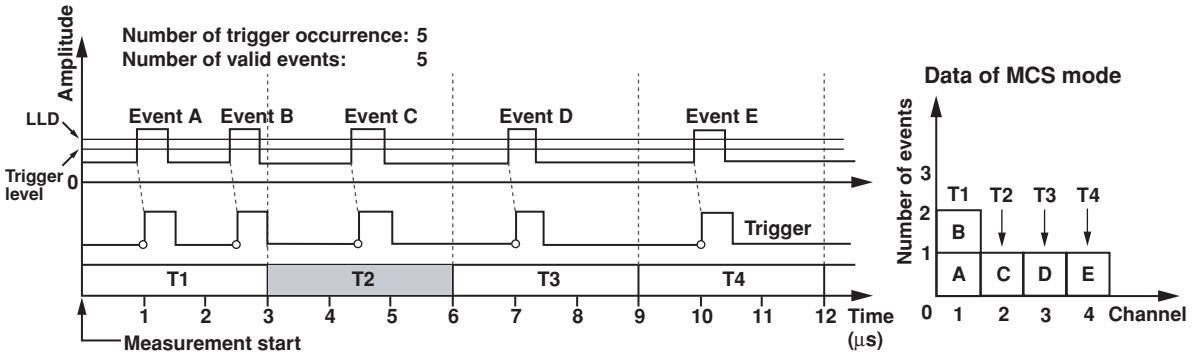


For LIST mode

Event	Time (μs)	Pulse height value (ch)
A	1	2401
B	2	8900
C	4	2401
D	7	2686
E	11	4321

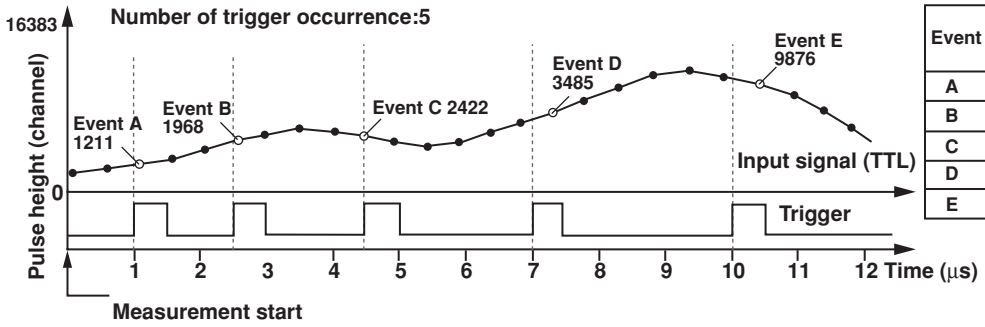
Counter Mode (MCS Mode)

- Trigger source: Self trigger (select INPUT<x> as the trigger source)
- Dwell time: 3 μs
- LLD: 3128 (the trigger level is set to approximately 1.5 V when the total number of AD channels = 16384)



Instantaneous Value Measurement Mode (LIST Mode)

- Total number of AD channels: 16384
- Trigger source: A source other than self
- Timestamp resolution: 1 μs
- Timestamp position: Rising edge of the trigger

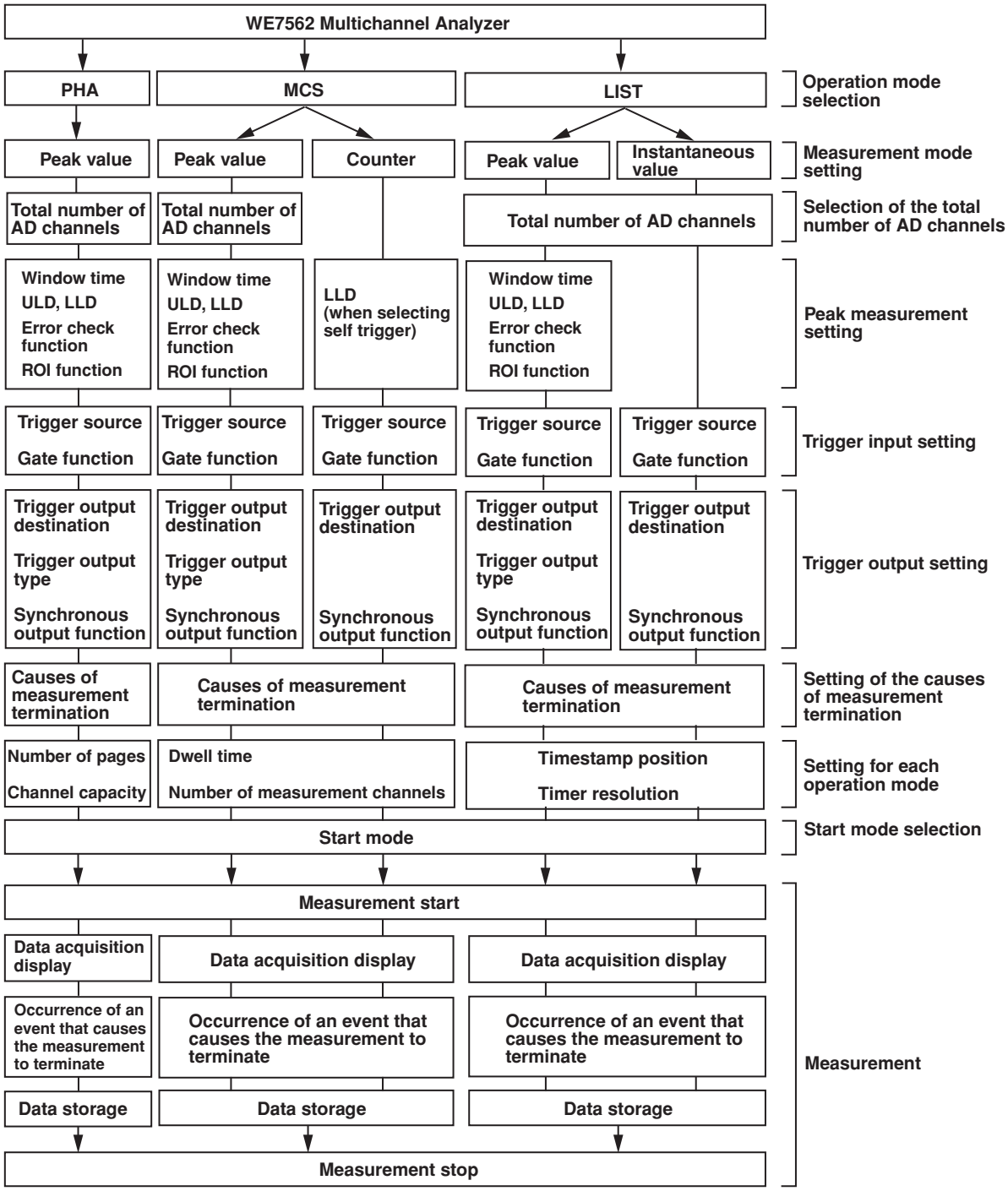


Data of LIST mode

Event	Time (μs)	Pulse height value (ch)
A	1	1211
B	2	1968
C	4	2422
D	7	3485
E	10	9876

1.3 Flow of Setup and Operation

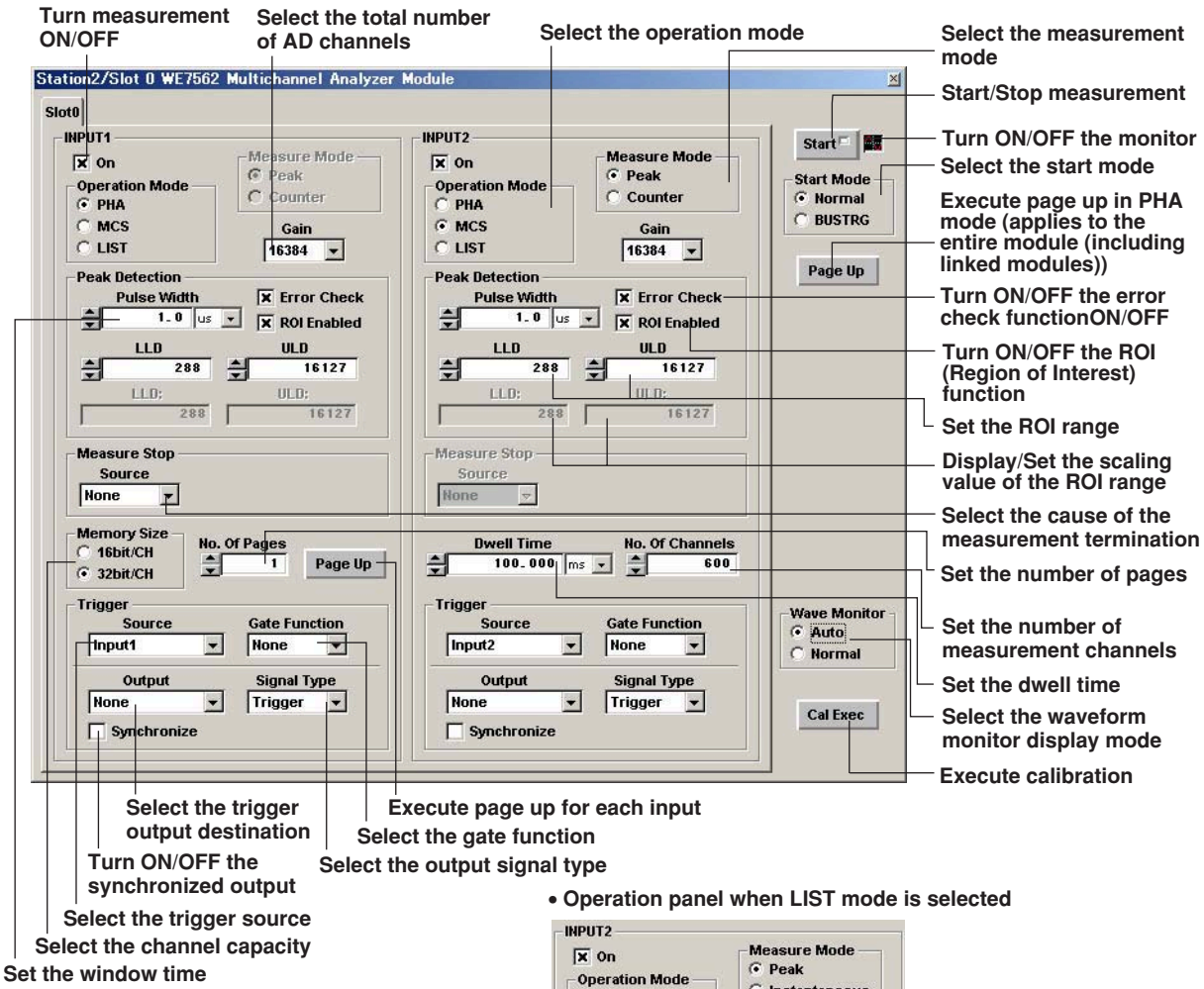
The setup and operation until the measurement is completed on the WE7562 are illustrated in the following flow diagram.



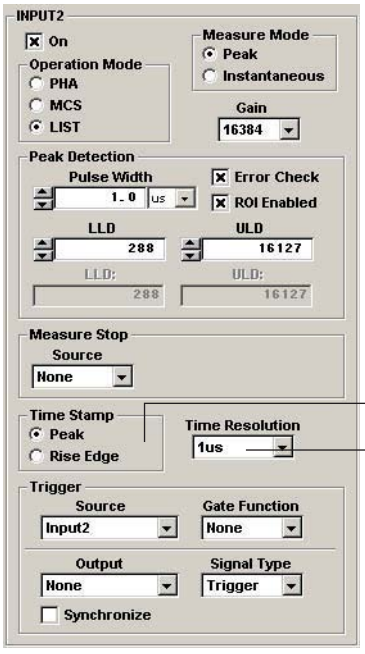
1.4 Operation Panel

The WE7000 Control Software that is installed in the PC is used to control the WE7562 Multichannel Analyzer Module. 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 monitor. For the operations of these items, see the on-line help that is provided with the WE7000 Control Software.

• Operation when PHA mode (INPUT1) and MCS mode (INPUT2) is selected



• Operation panel when LIST mode is selected



1.5 Setting the PHA Mode

Turning ON/OFF the Input to Be Measured

Select the On check box to perform measurements.

Operation Mode

Select PHA.

Total Number of AD Channels (Gain)

Set the total number of AD channels as the measurement unit. You can select the number of channels from 16384, 8192, 4096, 2048, 1024, and 512.

Note

For PHA mode, the last six channels are used to store the number of trigger events, the number of error events, and measurement time information.

Peak Detection

Window Time (Pulse Width)

Set the window time used for the peak detection. The selectable range is 1 μs to 10 ms (100 ns steps).

ROI (Region of Interest) (LLD and ULD)

Set the channel range used to determine whether the detected peak value is counted as an valid event using the LLD (Lower Level Discriminator) and ULD (Upper Level Discriminator). The selectable range depends on the selected total number of AD channels. It is 1 to the total number of AD channels – 7 (where ULD ≥ LLD). If we denote the total number of AD channels as N_{CH}, the operation guaranteed range is $\left(\frac{128 + 160}{16384}\right)N_{CH}$ to $\left(\frac{127 + 16000}{16384}\right)N_{CH}$ for LLD and ULD (where ULD ≥ LLD). This range corresponds to approximately 100 mV to 10 V when converted to voltage levels.

If the scaling function (see section 1.9) is enabled, you can set the LLD and ULD values using scaled values. The specified values are applied to the LLD and ULD above.

Note

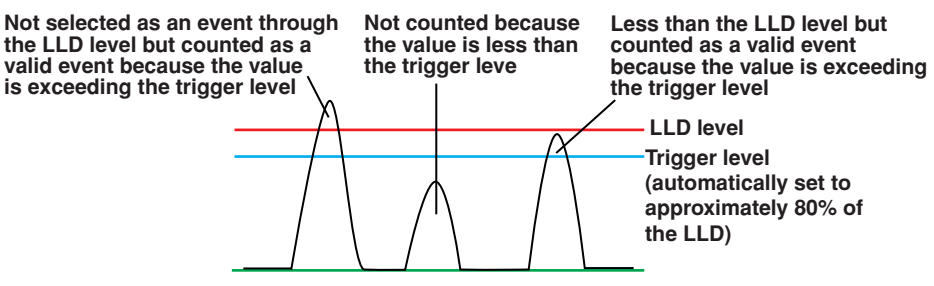
For the operation guaranteed range, see appendix 1, “Operation Range and Operation Guaranteed Range.”

ROI Function (ROI Enabled)

If you select the ROI Enabled check box, the ROI function is enabled. Peak values are counted as valid events only when the value is within the ROI specified above. If the ROI Enabled check box is not selected, the ROI function is disabled. In this condition, ULD carries no meaning. All peak values are counted as valid events.

If you select self trigger, the trigger level is linked to the LLD and set to approximately 80% of the LLD level. The LLD is valid for setting the trigger level even if the ROI function is disabled. However, because events are not selected using the ROI, the measured peak values are counted as valid events if the value is greater than or equal to the trigger level regardless of whether the value is less than the LLD.

When the ROI function is disabled



Error Check Function

Set the error check function for peak detection. If you select the Error Check check box and an error event is detected, the ERROR indicator of the input in which the error event occurred illuminates. Error events are distinguished from valid events, and the statistics are accumulated in a dedicated bin for error events at the end of the histogram memory. If you clear the Error Check check box, the maximum value within the window is handled as the measured value and processed as an valid event even if the correct peak value does not exist within the specified window time.

Trigger

Trigger Source

Select the signal for triggering. The SIGNAL indicator of each input illuminates if a signal is supplied from the selected trigger source and the trigger signal is generated.

Input1/Input2: Self trigger of each input in the module

Gate: Rising edge of the gate signal (TTL, width: ≥ 50 ns, frequency: ≤ 500 kHz) (not selectable if the gate function is enabled or the cause of measurement termination is set to Gate)

SCA<x>*: Signal generated when a peak value is detected within the ROI for input<x> (<x> = 2 for input 1, <x> = 1 for input 2)

* SCA: Single Channel Analysis

Trigger<x>: Signal generated when the trigger condition is met within the ROI for input<x> (<x> = 2 for input 1, <x> = 1 for input 2)

BUSTRG: Bus trigger signal of the WE Bus (BUSTRG1/BUSTRG2) (see 4.6, “Setting the Trigger Source/Time Base Source/Arming” in the WE7000 User’s Manual, IM707003-01E) (not selectable if the start mode (see section 1.8) is set to BUSTRG)

Linked Module: Trigger signal from another linked WE7562

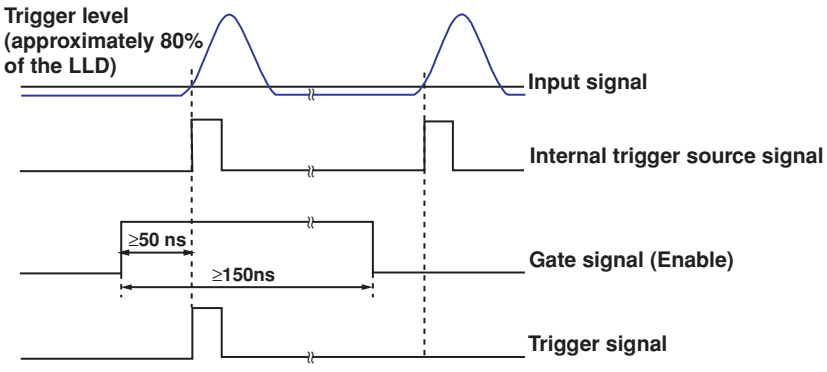
Gate Function

Select the gate function (TTL, width: ≥150 ns, frequency: ≤ 1 MHz) used to determine whether to receive the signal from the trigger source selected above. You cannot set the gate function if the trigger source or the cause of measurement termination (see the next page) is set to Gate.

None: Not use the gate function.

Enable: Receive the signal from the trigger source when a high signal is applied.

Disable: Not receive the signal from the trigger source when a high signal is applied.



Note

Adjust the input time of the external signal for the gate function so that it is at least 50 ns faster than the input signal. Set the signal width to 150 ns or longer.

Trigger Output

Select the output destination of the trigger signal.

None: Not output.

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

Linked Module: Output to another linked WE7562.

Output Signal Type

Select the trigger signal type.

Trigger: Output when the trigger condition is met.

SCA: Output when a peak value is detected within the ROI.

Synchronized Output

If you select the Synchronize check box, the trigger source selected for each input is output only during the measurement period. If you clear the Synchronize check box, the trigger source selected for each input is output at all times regardless of the measurement period.

Note

For details on the trigger, see appendix 2, “Trigger Linking and Application Examples.”

Cause of Measurement Termination (Measure Stop)

Set the cause of measurement termination for measuring in single-page mode. If the number or pages is set greater than 1, the cause specified here is used as a page up condition. When the measurement of the specified number of pages is complete, the measurement stops.

Stop Source and Selectable Range

None: Continue the measurement until the measurement is stopped on the operation panel or monitor.

Time: Stop the measurement when the measurement time reaches the specified time.
Set the measurement time in the range of 1 ms to 4294967295 ms (1 ms steps).

Events: Stop the measurement when the accumulated number of measurement events reaches the specified number.
Set the number of events in the range of 1 to 1099511627775.

OverFlow: Stop the measurement when the number of events of any channel reaches the specified channel capacity.

Gate: Stop the measurement when a rising edge of the gate input signal (TTL, width: ≥ 50 ns, frequency: ≤ 500 kHz) is detected.
Not selectable if the trigger source is set to Gate or if the gate function is enabled.

Note

You can stop the measurement by pressing the Start button on the operation panel or clicking the measurement start/stop button on the monitor. The operation for stopping the measurement from the operation panel or monitor is always valid regardless of the cause of measurement termination.

Channel Capacity (Memory Size)

Set the capacity of the channel used to store the event count data to 16 bits/channel or 32 bits/channel.

Number of Measurement Pages (No. Of Pages)

Set the number of measurement pages. The selectable range of the number of pages depends on the selected total number of AD channels (see page 1-12) and the channel capacity above.

Total Number of AD Channels	Selectable Number of Measurement Pages	
	Channel Capacity 32 bits/CH	Channel Capacity 16 bits/CH
16384	1 to 64	1 to 128
8192	1 to 128	1 to 256
4096	1 to 256	1 to 512
2048	1 to 512	1 to 1024
1024	1 to 1024	1 to 2048
512	1 to 2048	1 to 4096

If the number of page is se to zero, the measurement continues until you stop the measurement on the operation panel or monitor. However, the maximum amount of data can be stored is equal to the remaining number of pages in the histogram memory (maximum number of pages – 1). The most recent data is stored.

Page Up

Click the button to move the page displayed on the monitor to the next page. If the number of measurement pages is set to a non-zero value, the measurement stops when the number of times you click the button reaches the specified number of pages.
There are two types of Page Up buttons: a button that applies to each input and a button that applies to the entire module (including linked modules) (see section 1.4, “Operation Panel”).

Note

The channel number and page number are counted from zero.

1.6 Setting the MCS Mode

Turning ON/OFF the Input to Be Measured

Select the On check box to perform measurements.

Operation Mode

Select MCS.

Measurement Mode

The MCS mode has the following two measurement modes. Select either mode.

Peak: If the ROI function is ON, the peak value is counted as an valid event if the detected peak is within the specified ROI after the trigger condition is met. If the ROI function is OFF, all events for which the trigger condition is met are counted. However, if the error check function is ON, error events and valid events are counted separately.

Counter: Peak measurement is not performed. The event is counted each time the trigger condition is met.

Total Number of AD Channels (Gain) (Valid Only When the Measurement Mode Is Set to Peak or When Self Trigger Is Selected in Counter Mode)

Set the total number of AD channels as the measurement unit. You can select the number of channels from 16384, 8192, 4096, 2048, 1024, and 512.

Note

A/D conversion is not performed in counter measurement mode. However, if the trigger source is set self trigger, the trigger level is set in conjunction with the LLD.

Peak Detection

Window Time (Pulse Width) (Valid Only When the Measurement Mode Is Set to Peak)

Set the window time used for the peak detection. The selectable range is 1 μs to 10 ms (100 ns steps).

ROI(Region Of Interest) (LLD and ULD)

- **If the Measurement Mode Is Set to Peak**

  Set the channel range used to determine whether the detected peak value is counted as an valid event using the LLD (Lower Level Discriminator) and ULD (Upper Level Discriminator). The selectable range depends on the selected total number of AD channels. It is 1 to the total number of AD channels – 7 (where ULD ≥ LLD). If we denote the total number of AD channels as N_{CH}, the operation guaranteed range is $\left(\frac{128 + 160}{16384}\right) N_{CH}$ to $\left(\frac{127 + 16000}{16384}\right) N_{CH}$ for LLD and ULD (where ULD ≥ LLD). This range corresponds to approximately 100 mV to 10 V when converted to voltage levels.

  If the scaling function (see section 1.9) is enabled, you can set the LLD and ULD values using scaled values. The specified values are applied to the LLD and ULD above.

- **If the Measurement Mode Is Set to Counter**

  The LLD is automatically set to a value that causes the trigger level to be approximately 1.5 V. If we denote the total number of AD as N_{CH}, the LLD is derived from the following equation (fractions truncated): $\mathbf{LLD(CH)} \approx \left(\frac{3128}{16384}\right) N_{CH}$.

  However, if this level is not appropriate, you can reset the LLD. The relationship between the LLD and the trigger level V_{TRG}(V) is expressed by the following equation (fractions truncated).

  $$\mathbf{LLD(CH)} \approx \left(\frac{128 + 2000 \times V_{TRG}}{16384}\right) \times N_{CH}$$

  The selectable range of the LLD is 1 to the total number of AD channels – 7.

  If the scaling function (see section 1.9) is enabled, you can set the LLD value using scaled values.

Note

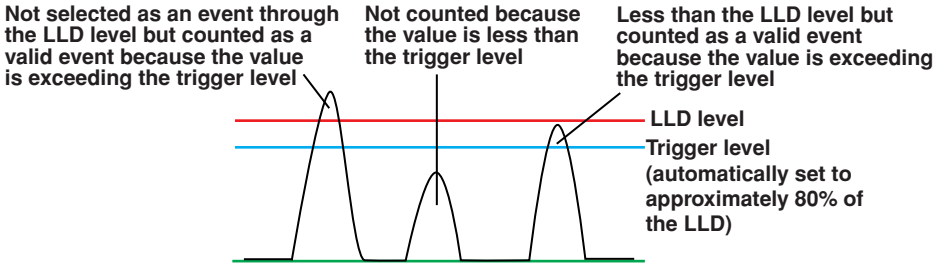
For the operation guaranteed range, see appendix 1, “Operation Range and Operation Guaranteed Range.”

ROI Function (ROI Enabled) (Valid Only When the Measurement Mode Is Set to Peak)

If you select the ROI Enabled check box, the ROI function is enabled. Only the number of peaks within the ROI specified above are counted as valid events. If the ROI Enabled check box is not selected, the ROI function is disabled. The number of all peak values are counted as valid events.

If you select self trigger, the trigger level is linked to the LLD and set to approximately 80% of the LLD level. The LLD is valid for setting the trigger level even if the ROI function is disabled. However, because events are not selected using the ROI, the measured peak values are counted as valid events if the value is greater than or equal to the trigger level regardless of whether the value is less than the LLD.

When the ROI function is disabled



Error Check Function (Valid Only When the Measurement Mode Is Set to Peak)

Set the error check function for peak detection. If you select the Error Check check box and an error event is detected, the ERROR indicator of the input in which the error event occurred illuminates. The number of valid events and the number of error events are counted separately for each dwell time. If you clear the Error Check check box, the peak values that otherwise would not be counted are processed as valid events even if the correct peak value does not exist within the specified window time.

Trigger

Trigger Source

Select the signal for triggering. The SIGNAL indicator of each input illuminates if a signal is supplied from the selected trigger source and the trigger signal is generated.

Input1/Input2: Self trigger of each input in the module

Gate: Rising edge of the gate signal (TTL, width: ≥50 ns, frequency: ≤ 500 kHz) (when the measurement mode is set to Peak) or 10 MHz (when the measurement mode is set to Counter) (not selectable if the gate function is enabled)

SCA<x>*: Signal generated when a peak value is detected within the ROI for input<x> (<x> = 2 for input 1, <x> = 1 for input 2)

* SCA: Single Channel Analysis

Trigger<x>: Signal generated when the trigger condition is met within the ROI for input<x> (<x> = 2 for input 1, <x> = 1 for input 2)

BUSTRG: Bus trigger signal of the WE Bus (BUSTRG1/BUSTRG2) (see 4.6, “Setting the Trigger Source/Time Base Source/Arming” in the WE7000 User’s Manual, IM707003-01E) (not selectable if the start mode (see section 1.8) is set to BUSTRG)

Linked Module: Trigger signal from another linked WE7562

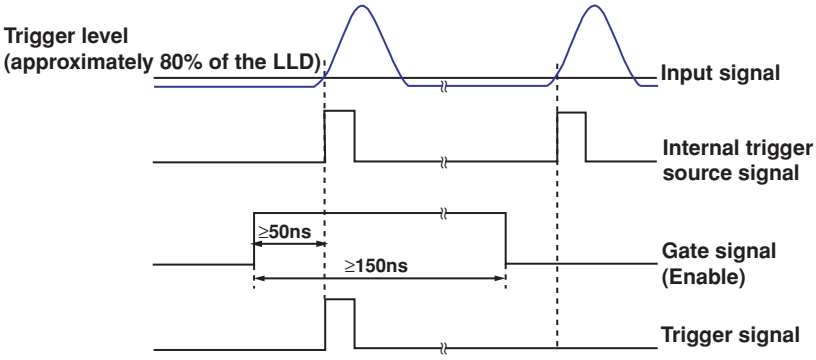
Gate Function

Select the gate function (TTL, width: ≥150 ns, frequency: ≤ 1 MHz) used to determine whether to receive the signal from the trigger source selected above. You cannot set the gate function if the trigger source or is set to Gate.

None: Not use the gate function.

Enable: Receive the signal from the trigger source when a high signal is applied.

Disable: Not receive the signal from the trigger source when a high signal is applied.



Note

Adjust the input time of the external signal for the gate function so that it is at least 50 ns faster than the input signal. Set the signal width to 150 ns or longer.

Trigger Output

Select the output destination of the trigger signal.

None: Not output.

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

Linked Module: Output to another linked WE7562.

Output Signal Type (Valid Only When the Measurement Mode Is Set to Peak)

Select the trigger signal type.

Trigger: Output when the trigger condition is met.

SCA: Output when a peak value is detected within the ROI (valid only when the measurement mode is set to Peak).

Synchronized Output

If you select the Synchronize check box, the trigger source selected for each input is output only during the measurement period. If you clear the Synchronize check box, the trigger source selected for each input is output at all times regardless of the measurement period.

Note

For details on the trigger, see appendix 2, “Trigger Linking and Application Examples.”

Dwell Time

Set the unit time for counting events. The selectable range varies depending on the selected measurement mode.

If the measurement mode is set to Peak: 10 μs to 4294.967295 s (1 μs steps)

If the measurement mode is set to Counter: 1 μs to 4294.967295 s (1 μs steps)

Number of Measurement Channels (No. of Channels)

Set the number of measurement channels. The selectable range is 1 to 524288 s (in 1 channel steps).

Note

The channel number is counted from zero.

Cause of Measurement Termination

In MCS mode, the measurement automatically stops when the measurement time (dwell time × number of measurement channels) elapses. If you want to stop in the middle of the measurement, press the Start button on the operation panel or click the measurement start/stop button on the monitor.

1.7 Setting the LIST Mode

Turning ON/OFF the Input to Be Measured

Select the On check box to perform measurements.

Operation Mode

Select LIST.

Measurement Mode

The LIST mode has the following two measurement modes. Select either mode.

Peak: If the ROI function is ON, the detected peak value and the peak detection time or trigger activation time are displayed numerically if the detected pulse height peak value exists within the specified ROI after the trigger condition is met. If the ROI function is OFF, all events for which the trigger condition is met are displayed. However, if the error check function is ON, the error events are discarded.

Instantaneous: Measures the instantaneous value at the time the trigger conditions is met and displays numerically the measured instantaneous value and the trigger activation time.

Total Number of AD Channels (Gain)

Set the total number of AD channels as the measurement unit. You can select the number of channels from 16384, 8192, 4096, 2048, 1024, and 512.

Peak Detection (Valid Only When the Measurement Mode Is Set to Peak)

Window Time (Pulse Width)

Set the window time used for the peak detection. The selectable range is 1 μs to 10 ms (100 ns steps).

ROI(Region Of Interest) (LLD and ULD)

Set the channel range used to determine whether the detected peak value is counted as an valid event using the LLD (Lower Level Discriminator) and ULD (Upper Level Discriminator). The selectable range depends on the selected total number of AD channels. It is 1 to the total number of AD channels – 7 (where ULD ≥ LLD). If we denote the total number of AD channels as N_{CH}, the operation guaranteed range is $\left(\frac{128 + 160}{16384}\right)N_{CH}$ to $\left(\frac{127 + 16000}{16384}\right)N_{CH}$ for LLD and ULD (where ULD ≥ LLD). This range corresponds to approximately 100 mV to 10 V when converted to voltage levels.

If the scaling function (see section 1.9) is enabled, you can set the LLD and ULD values using scaled values. The specified values are applied to the LLD and ULD above.

Note

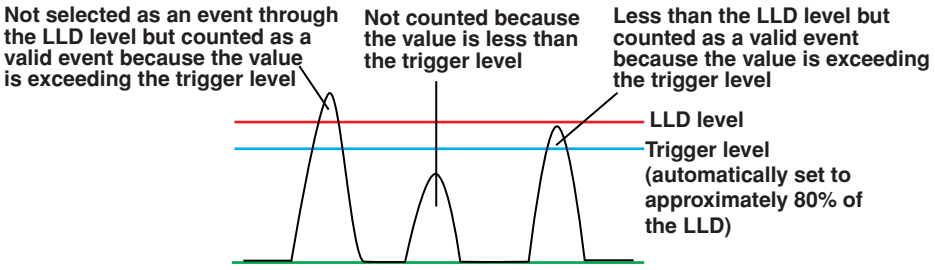
For the operation guaranteed range, see appendix 1, “Operation Range and Operation Guaranteed Range.”

ROI Function (ROI Enabled)

If you select the ROI Enabled check box, the ROI function is enabled. Peak values are counted as valid events only when the value is within the ROI specified above. If the ROI Enabled check box is not selected, the ROI function is disabled. In this condition, ULD carries no meaning. All peak values are counted as valid events.

If you select self trigger, the trigger level is linked to the LLD and set to approximately 80% of the LLD level. The LLD is valid for setting the trigger level even if the ROI function is disabled. However, because events are not selected using the ROI, the measured peak values are counted as valid events if the value is greater than or equal to the trigger level regardless of whether the value is less than the LLD.

When the ROI function is disabled



Error Detection (Error Check)

Set the error check function for peak detection. If you select the Error Check check box and an error event is detected, the ERROR indicator of the respective input illuminates. The detected error events are discarded, and only the valid event data is stored. If the Error Check check box is not selected, all data is stored including the error events. A flag indicating effective (0) or error (1) is included in the stored data.

Trigger

Trigger Source

Select the signal for triggering. The SIGNAL indicator of each input illuminates if a signal is supplied from the selected trigger source and the trigger signal is generated.

Input1/Input2: Self trigger of each input in the module (if the measurement mode is set to Instantaneous, Input1 cannot be selected for input 1 and Input 2 cannot be selected for input 2)

Gate: Rising edge of the gate signal (TTL, width: ≥ 50 ns, frequency: ≤ 500 kHz) (not selectable if the gate function is enabled or the cause of measurement termination is set to Gate)

SCA<x>*: Signal generated when a peak value is detected within the ROI for input<x> (<x> = 2 for input 1, <x> = 1 for input 2, valid only when the measurement mode is set to Peak)

* SCA: Single Channel Analysis

Trigger<x>: Signal generated when the trigger condition is met within the ROI for input<x> (<x> = 2 for input 1, <x> = 1 for input 2)

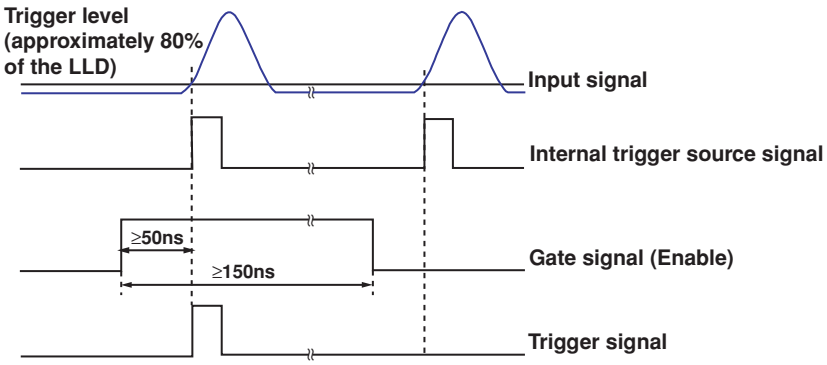
BUSTRG: Bus trigger signal of the WE Bus (BUSTRG1/BUSTRG2) (see 4.6, “Setting the Trigger Source/Time Base Source/Arming” in the WE7000 User’s Manual, IM707003-01E) (not selectable if the start mode (see section 1.8) is set to BUSTRG)

Linked Module: Trigger signal from another linked WE7562

Gate Function

Select the gate function (TTL, width: ≥150 ns, frequency: ≤ 1 MHz) used to determine whether to receive the signal from the trigger source selected above. You cannot set the gate function if the trigger source or the cause of measurement termination (see the next page) is set to Gate.

None: Not use the gate function.
Enable: Receive the signal from the trigger source when a high signal is applied.
Disable: Not receive the signal from the trigger source when a high signal is applied.



Note

Adjust the input time of the external signal for the gate function so that it is at least 50 ns faster than the input signal. Set the signal width to 150 ns or longer.

Trigger Output

Select the output destination of the trigger signal.

None: Not output.
BUSTRG: Bus signal (BUSTRG1/BUSTRG2) of the WE bus.
Linked Module: Output to another linked WE7562.

Output Signal Type

Select the trigger signal type.

Trigger: Output when the trigger condition is met.
SCA: Output when a peak value is detected within the ROI (valid only when the measurement mode is set to Peak).

Synchronized Output

If you select the Synchronize check box, the trigger source selected for each input is output only during the measurement period. If you clear the Synchronize check box, the trigger source selected for each input is output at all times regardless of the measurement period.

Note

For details on the trigger, see appendix 2, “Trigger Linking and Application Examples.”

Cause of Measurement Termination (Measure Stop)

Stop Source and Selectable Range

None: Continue the measurement until the measurement is stopped on the operation panel or monitor.

Time: Stop the measurement when the measurement time reaches the specified time.
Set the measurement time in the range of 1 ms to 4294967295 ms (1 ms steps).

Events: Stop the measurement when the accumulated number of measurement events reaches the specified number.
Set the number of events in the range of 1 to 1099511627775.

Gate: Stop the measurement when a rising edge of the gate input signal (TTL, width: ≥ 50 ns, frequency: ≤ 500 kHz) is detected.
Not selectable if the trigger source is set to Gate or if the gate function is enabled.

Note

- Only the most recent 524288 events of data can be stored in the internal memory. However, continuous measurement exceeding the memory size is possible by using the waveform data save function.*1 For a description of the waveform data save function, see the WE7562 online help.
  - *1 When one input is used, an input signal less than or equal to 100 kcps (typical value*2) is applied, a PC with Intel Pentium4 (3 GHz) is connected using USB2.0, and the data is stored in binary data format.
  - *2 Typical value represents a typical or average value. It is not a warranted value.
- If the number of acquired events reaches 524288 and the data transfer cannot keep up with the data acquisition, an overrun is detected. The measurement stops if an overrun occurs regardless of the selected measurement stop source. However, the data up to that point can be stored.
- You can stop the measurement by pressing the Start button on the operation panel or clicking the measurement start/stop button on the monitor. The operation for stopping the measurement from the operation panel or monitor is always valid regardless of the cause of measurement termination.

Timestamp Position (When the Measurement Mode Is Set to Peak)

Select the position for including the timestamp data.

Peak: Include the peak detection time

Rise Edge: Include the trigger activation time

Time Resolution

Select the timer resolution for timestamps from 100 ns, 200 ns, 500 ns, 1 μs, 5 μs, 10 μs, 100 μs, and 1 ms.

1.8 Common Settings

The following functions are common to all operation modes of the WE7562.

Start Mode

Selecting the Start Mode

There are two modes for starting the measurement.

Normal: Normal start (start = measurement start).

BUSTRG: Start the measurement when the bus trigger signal (BUSTRG1/BUSTRG2) of the measuring station is detected.

The selected start mode is applied to all inputs including those of the linked modules.

Note

If you set the start mode to BUSTRG, you cannot set the trigger source to BUSTRG.

Setting the Trigger Source/Time Base Source Setup Dialog Box

If you set the start mode to BUSTRG, connect the BUSTRG1 or BUSTRG2 signal to the measurement module in the trigger setting dialog box, and click the [Start] button on the operation panel to set the WE7562 in the BUSTRG signal wait state. If the modules are linked, set the trigger on the measurement module acting as the master module to apply the setting to all linked modules. If a start signal is supplied to the BUSTRG line, the measurement starts in sync with the rising edge of the start signal. For details on the settings on the trigger source/time base source/arming setting dialog box, see section 4.6, “Setting Trigger Source/Time Base Source/Arming” in the WE7000 User’s Manual (IM707003-01E).

Display Mode of the Wave Monitor

The WE7562 is equipped with a built-in waveform viewer that allows you to visually check the presence/absence of the input signal, the waveform quality, and the LLD/ULD and pulse width (window time) settings. The following two waveform display modes are available.

Normal: Displayed when a trigger signal occurs.

Auto: Displayed when a trigger signal occurs or when a trigger signal does not occur within the display update interval.

Note

- For the operation of the built-in waveform viewer, see the WE7562 on-line help that is provided with the WE7000 Control Software.
- For details on setting the display update interval, see the WE7562 online help.

Calibration (CAL Exec)

Click the CAL Exec button to automatically calibrate the A/D conversion gain, ground level offset, and trigger level. Perform calibration with the measurement stopped.

1.9 Displaying the Measured Data, Automatically Saving the Measured Values, and Scaling the Waveform Data

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.

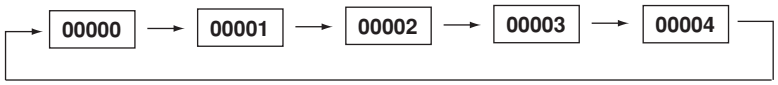
Displaying the Waveform Data

On the WE7562, the waveform data is automatically displayed in the monitor of the WE7000 Control Software when the measurement is started from the operation panel in the default settings.

Automatically Saving the Measured Values

In addition to saving the displayed data on the monitor, the measured values can be saved automatically. There are two methods of automatically saving the measured values.

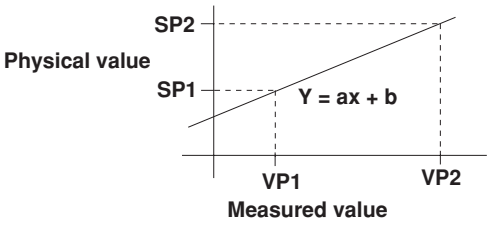
- Cyclic
  You specify the number of files, and the data is saved in a cyclic pattern within the specified number of files until the measurement is stopped. The newest data is not the file with the largest file number, but the file to which the data was saved immediately before stopping the measurement.



- File number limit
  You specify the number of files, and the data is saved up to the specified number and then the operation stops.

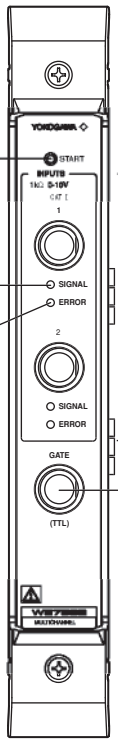
Scaling the AD Channels

You can 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, and the waveform data is displayed.



1.10 Names and Functions of Sections

Front Panel



Start indicator
Illuminates when measurement is started.

Sampling indicator
Illuminates when a trigger signal occurs.

Error indicator
Illuminates when an error event occurs when the error check function is turned ON.

Input connector
Equipped with two BNC input terminals.

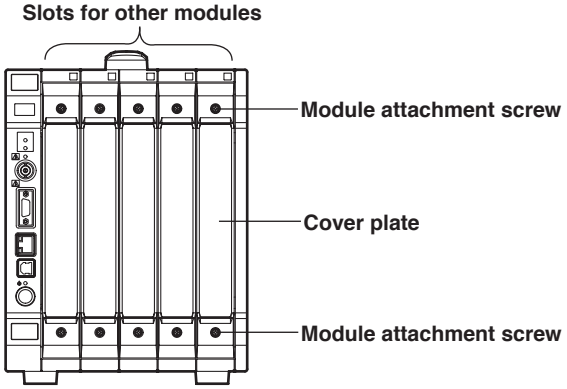
Gate signal input connector
Terminal used to input external gate signals.

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, and then loosen the module attachment screws (2 locations) and remove the cover plate from the slot where the module is going to be installed.

*The following figure shows an example of the measuring station WE500.



Installing the Multichannel Analyzer Module

WARNING

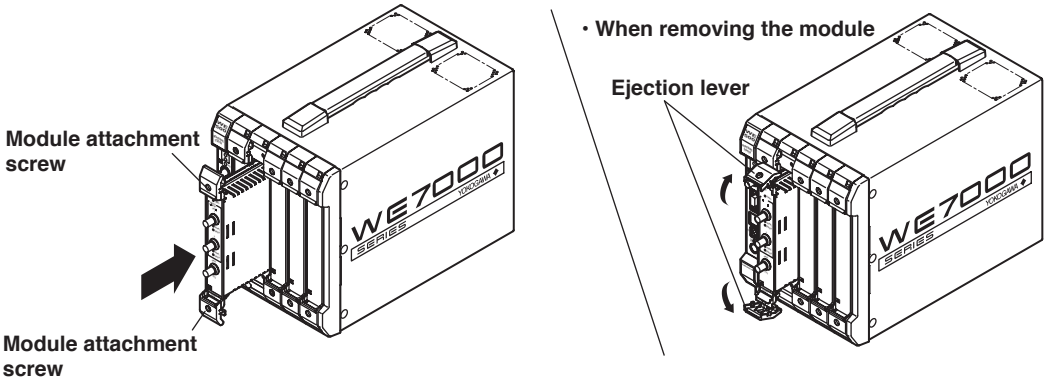
- Make sure to fasten the top and bottom attachment screws. If you connect the input signal cable without fastening the attachment screws, the protective grounding of the measurement module provided by the power cord is compromised and may cause electric shock.

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.>

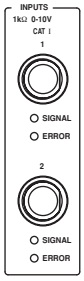


Note

To synchronize multiple multichannel analyzer modules for measurement (module linking), install the modules in adjacent slots.

2.2 Connecting the Input Cable

Connecting the Input Signal Cable



A BNC cable is used to apply the signal to be measured to the input. Connect the BNC cable to the input terminal (BNC terminal marked INPUTS 1 or 2) on the front panel of the module. The input impedance is approximately 1 kΩ.

CAUTION

- The maximum input voltage is –2 V to +12 V (DC+ACpeak). Applying a voltage exceeding this maximum can damage the internal circuitry.

Connecting the Gate Signal Input Cable

Connect a signal input cable to the gate signal input connector (BNC terminal marked GATE) if you are (1) using an external signal for the trigger source, (2) using an external signal for the cause of measurement termination (including the page up source when using the page function in PHA mode), or (3) using an external signal to gate the trigger signal.

Note that the signal detection method varies depending on the function as follows:

Trigger source: Detects the rising edge.
Cause of measurement termination: Detects the rising edge.
Gate function: Detects the level.

CAUTION

- The maximum input voltage is –3 V to +8 V. Applying a voltage exceeding this maximum can damage the internal circuitry.

Follow the specifications below for the input signal applied to the gate signal input connector.

Item	
Input format	Non-isolated, unbalanced (TTL)
Input H level	2.2 min
Input L level	0.5 Vmax
Input impedance	10 kΩ (typical value*)
Maximum input frequency	10 MHz (when used by the trigger source) 1 MHz (when used by the gate function) 500 kHz (when used by the stop source)
Minimum input pulse width	50 ns (when used by the trigger source or stop source) 150 ns (when used by the gate function)

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

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.

Problem	Probable Cause/Corrective Action	Reference Page
The 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 arming is not set properly or the measuring station is likely to have malfunctioned. 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.	2-1, *
Waveform data cannot be acquired.	Check that the signal input lines are properly connected.	2-3
Measured values are not correct.	Check whether the ambient temperature and humidity are within the allowed ranges. If you did not allow a warm-up time of 30 minutes, try measuring again after the warm-up time has passed.	4-9
Trigger does not activate.	Check whether the trigger setting is adequate for the input source in the operation panel. 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.	1-13, 1-17, 1-20
The monitor does not appear.	Check to see that the monitor ON/OFF button, located to the right of the [Start] button of the operation, is not set to OFF.	1-11

* See the WE7000 User's Manual (IM 707003-01E).

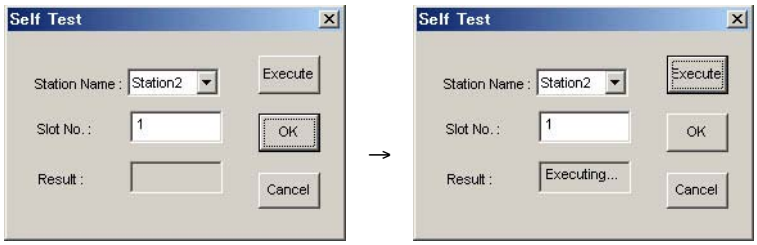
3.2 Self Test

If you believe that the module is not operating correctly, perform the self test according to the following procedure with nothing connected to the input terminals of the module being tested and the external trigger input terminal/external I/O connector of the measuring station.

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 **Execute**.
   "Executing..." is displayed in the Result display box.



Verifying Test Results

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

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 Performance Specifications

Number of Signal Inputs

2

Input Format

Non-isolated unbalanced input

Connector Type

BNC

Input Signal

0 V to +10 V, Gaussian (σ > 500 ns) equivalent

Input Coupling

DC

Input Impedance

1 kΩ (typical value*)

Peak Detection System

Digital sampling system (100 MS/s)

A/D Conversion Characteristics (value immediately after performing calibration after warm-up (30 minutes) at an ambient temperature of 23 ± 5°C and an ambient humidity of 50 ± 10%RH)

Total Number of AD Channels	Integral Nonlinearity	Differential Nonlinearity (Typical Value*)	Residual Noise	Temperature Coefficient (±5°C to +40°C)	Offset
16384	±0.03%	±10%	3 CHrms	±(60 ppm + 1 CH)/°C	128±3 CH
8192	±0.03%	±5%	1.5 CHrms	±(60 ppm + 0.5 CH)/°C	64±2 CH
4096	±0.03%	±2.5%	0.8 CHrms	±(60 ppm + 0.25 CH)/°C	32±1 CH
2048	±0.03%	±2%	0.4 CHrms	±(60 ppm + 0.13 CH)/°C	16±1 CH
1024	±0.03%	±1%	0.2 CHrms	±(60 ppm + 0.06 CH)/°C	8±1 CH
512	±0.03%	±1%	0.1 CHrms	±(60 ppm + 0.03 CH)/°C	4±1 CH

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

PHA Mode

Total Number of AD Channels

Select 16384, 8192, 4096, 2048, 1024, or 512.

Channel Capacity

Select 32 bits/CH or 16 bits/CH.

Page Function

The selectable number of measurement pages depends on the number of channels and channel capacity.

Total Number of AD Channels	Selectable Number of Measurement Pages	
	Channel Capacity 32 bits/CH	Channel Capacity 16 bits/CH
16384	1 to 64	1 to 128
8192	1 to 128	1 to 256
4096	1 to 256	1 to 512
2048	1 to 512	1 to 1024
1024	1 to 1024	1 to 2048
512	1 to 2048	1 to 4096

Peak Detection

- **Window time (pulse width)**
  1 μs to 10 ms (100 ns steps).
- **ROI (Region Of Interest)**
  Set using LLD (Lower Level Discriminator) and ULD (Upper Level Discriminator).
  Selectable range: 1 to total number of AD channels – 7 (ULD ≥ LLD)
  Operation guaranteed range: $\left(\frac{128+160}{16384}\right) N_{CH}$ to $\left(\frac{127+16000}{16384}\right) N_{CH}$ where N_{CH} is the total number of AD channels (ULD ≥ LLD)
  You can set the LLD and ULD using scaled values when using the scaling function.

- **ROI Function ON/OFF**
  Select whether to count only the peak values that are within the specified ROI as valid events (ON) or count all events as valid events (OFF).
  If the ROI function is OFF and self trigger is selected, the measured peak values are counted as valid events if they are greater than or equal to the trigger level (automatically set to approximately 80% of the LLD level) even if the value is less than the LLD.
- **Error Check Function ON/OFF**
  Select whether to accumulate the error events in the bin dedicated to errors at the end of the histogram memory (stops counting if an overflow occurs) and exclude them from the peak data (ON) or handle the maximum value within the window as an valid event (measured value) (OFF).

Trigger

- **Trigger Source**
  Input1 and Input2 (self trigger)
  Gate (TTL, width: ≥ 50 ns, frequency: ≤ 500 kHz, not selectable if the gate function is enabled or the cause of measurement termination is set to Gate)
  SCA<x>* (signal generated when a peak value is detected within the ROI in input<x>)
  Trigger<x>* (signal generated when the trigger condition is met in input <x>)
  BUSTRG (bus trigger signal (BUSTRG1/BUSTRG2) of the measuring station, not selectable if the start mode is set to BUSTRG)
  Linked Module (trigger signal from another linked WE7562)
  * <x> = 2 for input 1 and <x> = 1 for input 2.
- **Gate Function**
  Enable or disable for the trigger source
  (TTL, width: ≥ 150 ns, frequency: ≤ 1 MHz)
  Not selectable if the trigger source or the cause of measurement termination is set to Gate.
- **Trigger Output Destination**
  BUSTRG or linked module.
- **Output Signal Type**
  Trigger or SCA
- **Synchronous Output Function ON/OFF**
  Select whether the trigger signal is output during the measurement period (ON) or output at all times (OFF).

Cause of Measurement Termination

None (continue the measurement until the measurement is stopped on the operation panel or monitor)

Time (stop the measurement when the measurement time reaches the specified time)
Selectable range of the measurement time: 1 ms to 4294967295 ms (1 ms steps)

Events (stop the measurement when the accumulated number of measurement events reaches the specified number)
Selectable range of the number of events: 1 to 1099511627775

OverFlow (measurement stops when the number of events of any channel exceeds the upper limit of the channel capacity)

Gate (measurement stops when a rising edge of the gate signal (TTL, width: ≥ 50 ns, frequency: ≤ 500 kHz) is detected.
Not selectable if the trigger source is set to Gate or if the gate function is enabled..

Page Up

Switches the page displayed on the monitor. Specify zero to switch infinite number of times.

Maximum input event rate

500 kcps/input

MCS Mode

Measurement Mode

Peak: Counts the events with peak values within the ROI.

Counter: Counts the number of trigger occurrence.

Channel Capacity

32 bits/CH

Total Number of AD Channels (Valid Only When the Measurement Mode = Peak or When the Measurement Mode = Counter and Self Trigger Is Selected)

Select 16384, 8192, 4096, 2048, 1024, or 512.

Peak Detection

- **Window Time Setting (Valid Only When the Measurement Mode = Peak)**
  Selectable range: 1 μs to 10 ms (100 ns steps).
- **ROI (Region Of Interest)**
  If the Measurement Mode Is Set to Peak
  Set using LLD (Lower Level Discriminator) and ULD (Upper Level Discriminator).
  Selectable range: 1 to total number of AD channels – 7
  Operation guaranteed range: $\left(\frac{128+160}{16384}\right) N_{CH}$ to $\left(\frac{127+16000}{16384}\right) N_{CH}$ where N_{CH} is the total number of AD channels (ULD 3 LLD)
  Set the LLD and ULD using scaled values when using the scaling function.
- **If the Measurement Mode Is Set to Counter**
  Automatically set to a value that causes the trigger level to be approximately 1.5 V.
  $LLD(CH) \approx \left(\frac{3128}{16384}\right) N_{CH}$ (fractions truncated) where N_{CH} is the total number of AD channels.
  The LLD can be reset. The relationship between the LLD and the trigger level V_{TRG}(V) is given by
  $LLD(CH) \approx \left(\frac{128 + 2000 \times V_{TRG}}{16384}\right) \times N_{CH}$ (fractions truncated)
  Selectable range: 1 to total number of AD channels – 7
  Set the LLD using scaled values when using the scaling function.
- **ROI Function ON/OFF (Valid Only When the Measurement Mode = Peak)**
  Select whether to count only the peak values that are within the specified ROI as valid events (ON) or count all events as valid events (OFF).
  If the ROI function is OFF and self trigger is selected, the measured peak values are counted as valid events if they are greater than or equal to the trigger level (automatically set to approximately 80% of the LLD level) even if the value is less than the LLD.
- **Error Check Function ON/OFF (Valid Only When the Measurement Mode = Peak)**
  Select whether to count the number of valid events and the number of error events separately for each dwell time (ON) or count all events as valid events (OFF).

Trigger

- **Trigger Source**
  Input1 and Input2 (self trigger)
  Gate (TTL, width: ≥ 50 ns, frequency ≤ 500 kHz (when the measurement mode = Peak), ≤ 10 MHz (when the measurement mode = Counter), not selectable if the gate function is enabled))
  SCA<x>* (signal generated when a peak value is detected within the ROI for input<x>)
  Trigger<x>* (signal generated when the trigger condition is met in input <x>)
  BUSTRG (bus trigger signal (BUSTRG1/BUSTRG2) of the measuring station, not selectable if the start mode is set to BUSTRG)
  Linked Module (trigger signal from another linked WE7562)
  * <x> = 2 for input 1 and <x> = 1 for input 2.
- **Gate Function**
  Enable or disable for the trigger source
  (TTL, width: ≥ 150 ns, frequency: ≤ 1 MHz)
  Not selectable if the trigger source or the cause of measurement termination is set to Gate.
- **Trigger Output Destination**
  BUSTRG or linked module.

- **Output Signal Type (Valid Only When the Measurement Mode = Peak)**
  Trigger or SCA
- **Synchronous Output Function ON/OFF**
  Select whether the trigger signal is output during the measurement period (ON) or output at all times (OFF).

Dwell Time

If the measurement mode is set to Peak: 10 μs to 4294.967295 s (1 μs steps)
If the measurement mode is set to Counter: 1 μs to 4294.967295 s (1 μs steps)

Number of Measurement Channels

Selectable range: 1 to 524288(1 channel steps)

Cause of Measurement Termination

The measurement automatically stops when the measurement time (dwell time × number of measurement channels) elapses.

Maximum input event rate

500 kcps/input (peak measurement mode) or 10 Mcps/input (counter mode)

LIST Mode

Measurement Mode

Peak: Measures the peak value and the peak detection time or trigger activation time and records them for each event.
Instantaneous: Measures the instantaneous value at the time the trigger conditions is met and records the measured instantaneous value and the trigger activation time for each event.

Total Number of AD Channels

Select 16384, 8192, 4096, 2048, 1024, or 512.

Memory Capacity

524288 events (continuous measurement exceeding the memory size is possible by using the waveform data save function).[*1]

[*1] When one input is used, an input signal less than or equal to 100 kcps (typical value[*2]) is applied, a PC with Intel Pentium4 (3 GHz) is connected using USB2.0, and the data is stored in binary format.

[*2] Typical value represents a typical or average value. It is not a warranted value.

Maximum input event rate

500 kcps/input (number of acquired events ≤ 524288)

Peak Detection (Valid Only When the Measurement Mode = Peak)

- **Window Time Setting**
  Selectable range: 1 μs to 10 ms (100 ns steps).
- **ROI (Region Of Interest)**
  Set using LLD (Lower Level Discriminator) and ULD (Upper Level Discriminator).
  Selectable range: 1 to total number of AD channels – 7
  Operation guaranteed range: $\left(\frac{128 + 160}{16384}\right) N_{CH}$ to $\left(\frac{127 + 16000}{16384}\right) N_{CH}$ where N_{CH} is the total number of AD channels (ULD 3 LLD)
  Set the LLD and ULD using scaled values when using the scaling function.
- **ROI Function ON/OFF**
  Select whether to count only the peak values that are within the specified ROI as valid events (ON) or count all events (OFF).
  If the ROI function is OFF and self trigger is selected, the measured peak values are counted as valid events if they are greater than or equal to the trigger level (automatically set to approximately 80% of the LLD level) even if the value is less than the LLD.
- **Error Check Function ON/OFF**
  Select whether to discard the number of error events (ON) or handle all events as valid events (OFF).

Trigger

- **Trigger Source**
  Input1 or Input2 (self trigger. If the measurement mode is set to Instantaneous, Input1 cannot be selected for input 1 and Input 2 cannot be selected for input 2)
  Gate (TTL, width: ≥ 50 ns, frequency: ≤ 500 kHz, not selectable if the gate function is enabled or the cause of measurement termination is set to Gate)
  SCA<x>* (signal generated when a peak value is detected within the ROI for input<x>)
  Trigger<x>* (signal generated when the trigger condition is met in input <x>)
  BUSTRG (bus trigger signal (BUSTRG1/BUSTRG2) of the measuring station, not selectable if the start mode is set to BUSTRG)
  Linked Module (trigger signal from another linked WE7562)
  * <x> = 2 for input 1 and <x> = 1 for input 2.
- **Gate Function**
  Enable or disable for the trigger source
  (TTL, width: ≥ 150 ns, frequency: ≤ 1 MHz)
  Not selectable if the trigger source or the cause of measurement termination is set to Gate.
- **Trigger Output Destination**
  BUSTRG or linked module.
- **Output Signal Type (Valid Only When the Measurement Mode = Peak)**
  Trigger or SCA
- **Synchronous Output Function ON/OFF**
  Select whether the trigger signal is output during the measurement period (ON) or output at all times (OFF).

Cause of Measurement Termination

None (continue the measurement until the measurement is stopped on the operation panel or monitor)

Time (stop the measurement when the measurement time reaches the specified time)
Selectable range of the measurement time: 1 ms to 4294967295 ms (1 ms steps)

Events (stop the measurement when the accumulated number of measurement events reaches the specified number)
Selectable range of the number of events: 1 to 1099511627775

Gate (measurement stops when a rising edge of the gate signal (TTL, width: ≥ 50 ns, frequency: ≤ 500 kHz) is detected.
Not selectable if the trigger source is set to Gate or if the gate function is enabled..

Measurement stops if the number of acquired events reaches 524288 and the data transfer cannot keep up with the data acquisition (overrun) regardless of the cause of measurement termination. However, the data up to that point can be stored.

Time Stamp Position Setting (Valid Only When the Measurement Mode = Peak)

Peak: Records the peak detection time.

Rise Edge: Records the trigger activation time.

Timer Resolution for Timestamps

Select 100 ns, 200 ns, 500 ns, 1 μs, 5 μs, 10 μs, 100 μs, or 1 ms.

WE Module Link Function

Complete synchronous operation of up to 18 inputs and trigger link function.

Acquisition Mode

Trigger

Memory Length

2 MW/input

Time Base Source

The module's internal clock

Internal Timebase Period

10 ns

Time Base Accuracy

Depends on the reference clock accuracy of the measuring station
707001/707002: ±100 ppm
707003/707004: ±15 ppm

Gate Signal Input

Number of Inputs
1
Input Format
Non-isolated, unbalanced input (TTL)
Connector Type
BNC
Input H Level
2.2 Vmin
Input L Level
0.5 Vmax
Input Impedance
10 kΩ (typical value*)
Maximum Input Frequency
10 MHz (when used by the trigger source)
1 MHz (when used by the gate function)
500 kHz (when used by the stop source)
Minimum Input Pulse Width
50 ns (when used by the trigger source or stop source)
150 ns (when used by the gate function)

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

4.2 Default Values (Factory Default Settings)

Common Settings

Operation Mode:	PHA mode
Start Mode:	Normal
Wave Monitor:	Auto

Settings in PHA Mode

On (input to be measured ON/OFF):	INPUT1 On, INPUT2 Off
Gain (total number of AD channels):	16384 (for both INPUT1 and INPUT2)
Pulse Width (window time):	1.0 μs (for both INPUT1 and INPUT2)
LLD (Lower Level Discriminator):	288 (for both INPUT1 and INPUT2)
ULD (Upper Level Discriminator):	16127 (for both INPUT1 and INPUT2)
ROI Enabled (ROI function):	On (for both INPUT1 and INPUT2)
Error Check:	On (for both INPUT1 and INPUT2)
Trigger Source:	Input1 (for INPUT1) and Input2 (for INPUT2)
Gate Function:	None (for both INPUT1 and INPUT2)
Trigger Output:	None (for both INPUT1 and INPUT2)
Signal Type (output signal type):	Trigger (for both INPUT1 and INPUT2)
Synchronize (synchronous output):	Off (for both INPUT1 and INPUT2)
Measure Stop Source (Cause of Measurement Termination):	None (for both INPUT1 and INPUT2)
Memory Size (Channel Capacity):	32 bits/CH (for both INPUT1 and INPUT2)
No. Of Pages (number of measurement pages):	1 (for both INPUT1 and INPUT2)

Settings in MCS Mode

On (input to be measured ON/OFF):	INPUT1 On and INPUT2 Off
Measure Mode:	Peak (for both INPUT1 and INPUT2)
Gain (total number of AD channels):	16384 (for both INPUT1 and INPUT2)
Pulse Width (window time):	1.0 μs (for both INPUT1 and INPUT2)
LLD (Lower Level Discriminator):	288 (for both INPUT1 and INPUT2)
ULD (Upper Level Discriminator):	16127 (for both INPUT1 and INPUT2)
ROI Enabled (ROI function):	On (for both INPUT1 and INPUT2)
Error Check:	On (for both INPUT1 and INPUT2)
Trigger Source:	Input1 (for INPUT1) and Input2 (for INPUT2)
Gate Function:	None (for both INPUT1 and INPUT2)
Trigger Output:	None (for both INPUT1 and INPUT2)
Signal Type (output signal type):	Trigger (for both INPUT1 and INPUT2)
Synchronize (synchronous output):	Off (for both INPUT1 and INPUT2)
Dwell Time:	100 ms (for both INPUT1 and INPUT2)
No. Of Channels (number of measurement channels):	600 (for both INPUT1 and INPUT2)

Settings in LIST Mode

On (input to be measured ON/OFF):	INPUT1 On and INPUT2 Off
Measure Mode:	Peak (for both INPUT1 and INPUT2)
Gain (total number of AD channels):	16384 (for both INPUT1 and INPUT2)
Pulse Width (window time):	1.0 μs (for both INPUT1 and INPUT2)
LLD (Lower Level Discriminator):	288 (for both INPUT1 and INPUT2)
ULD (Upper Level Discriminator):	16127 (for both INPUT1 and INPUT2)
ROI Enabled (ROI function):	On (for both INPUT1 and INPUT2)
Error Check:	On (for both INPUT1 and INPUT2)
Trigger Source:	Input1 (for INPUT1) and Input2 (for INPUT2)
Gate Function:	None (for both INPUT1 and INPUT2)
Trigger Output:	None (for both INPUT1 and INPUT2)
Signal Type:	Trigger (for both INPUT1 and INPUT2)
Synchronize (synchronous output):	Off (for both INPUT1 and INPUT2)
Measure Stop Source (Cause of Measurement Termination):	None (for both INPUT1 and INPUT2)
Time Stamp (timestamp position):	Peak (for both INPUT1 and INPUT2)
Time Resolution:	1 μs (for both INPUT1 and INPUT2)

4.3 General Specifications

Safety Standards

Complies with CSA C22.2 No.61010-1 and EN61010-1, conforms to JIS C1010-1

- Measurement category I[*1]
- Pollution degree 2[*2]

[*1] Measurement Category describes a number which defines transient stresses from the circuit to which they are connected during measurement or test. It implies the regulation for impulse withstand voltage. Measurement Category is applied to the measuring circuit.

Measurement category I
Measurement category I is for measurements performed on circuits not directly connected to MAINS.

Note 1 Examples are measurements on circuits not derived from MAINS, and specially protected (internal) MAINS derived circuits.

[*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).

EMC Standards

Emission

Complying standard: EN55011 Group 1 Class A
This product is a Class A (for Industrial 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.

Immunity

Complying standard:	EN61326 commercial environment
Influence in the immunity environment:	Noise increase ≤ ±0.5% of the total number of AD channels
Maximum cable length:	30 m

Standard Operating Conditions

Ambient temperature: 23±5°C, ambient humidity: 50±10% RH,
Supply voltage/frequency error: Within 1% of rating, and after the warm-up time has passed

Warm-up Time

At least 30 minutes

Maximum Allowable Input Voltage

Signal Input (Input1/Input2)

–2 V to +12 V (DC+ACPeak)

Gate Input

–3 V to +8 V

Operating Conditions

Same as those of the measuring station

Storage Conditions

Temperature: –20°C to 60°C
Humidity: 20% to 80%RH

Power Consumption

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

Weight

Approx. 0.8 kg,

External Dimensions

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

Number of Used Slots

1

Standard Accessories

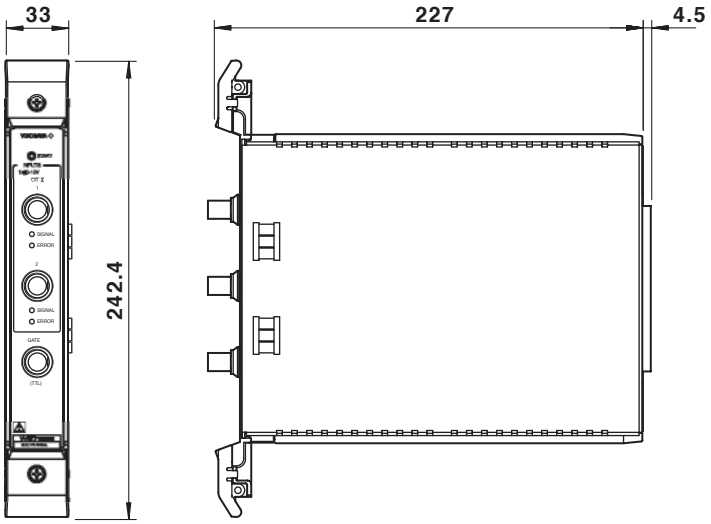
User's Manual (this manual) (1)

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

4.4 External Dimensions

Unit: mm

Multichannel Analyzer Module (WE7562)



Unless otherwise specified, tolerance is ±3% (however, tolerance is ±0.3 mm when below 10 mm).

Appendix 1 Operation Range and Guaranteed Channel Operation Range

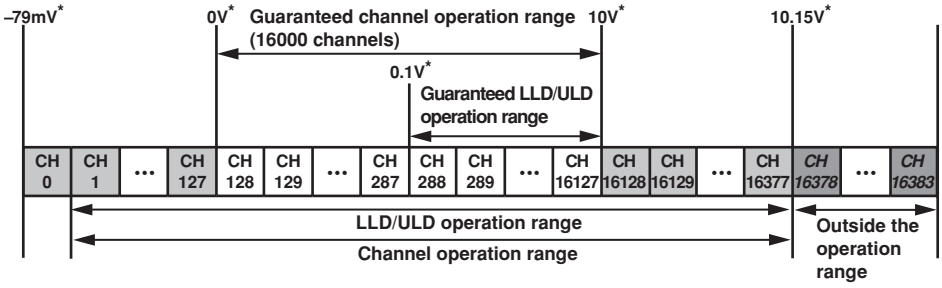
The detailed operation range and the guaranteed channel operation range with respect to the total number of AD channels are given below.

Total Number of AD Channels	Channel Operation Range (CH)	Guaranteed Channel Operation Range and Span (CH)		Selectable ULD/LLD Range (CH)	Guaranteed ULD/LLD Operation Range (CH)
16384	1 to 16377	128 to 16127	16000	1 to 16377	288 to 16127
8192	1 to 8185	64 to 8063	8000	1 to 8185	144 to 8063
4096	1 to 4089	32 to 4031	4000	1 to 4089	72 to 4031
2048	1 to 2041	16 to 2015	2000	1 to 2041	36 to 2015
1024	1 to 1017	8 to 1007	1000	1 to 1017	18 to 1007
512	1 to 505	4 to 503	500	1 to 505	9 to 503
Voltage conversion (typical value[*1])	–79 mV to 10.15 V[*2]	0 V to 10 V	10 V	–79 mV to 10.15 V[*2]	100 mV to 10 V

The converted voltage is a typical value[*1] obtained immediately after performing calibration after warm-up (30 minutes) at an ambient temperature of 23 ± 5°C and an ambient humidity of 50 ± 10%RH.

- The relationship between the number of channels and the voltage level V_{Level} in volts (typical value[*1]) is given by
  Number of channels $\approx \left(\frac{128 + 1600 \times V_{Level}}{16384}\right)$ × (total number of AD channels) (CH).
- Span (1600/16384) × (total number of AD channels) of the channel corresponds to 1 V typical value[*1]).
- The information that the channel indicates when the ROI function is OFF (including the instantaneous value measurement mode of LIST mode) is as follows:
  Channel 0: For underflow events (events whose measured value is less than or equal to zero).
  Channel "total number of AD channels – 7": For overflow events (events whose measured value is greater than or equal to "total number of AD channels – 7."

Operation Range and Guaranteed Operation Range When the Total Number of AD Channels Is 16384



- When converted to voltage levels, the span of 1600 channels corresponds to approximately 1 V (typical value[*1]).
- Channels 16378 to 16383 are not used.
- The information that the channel indicates when the ROI function is OFF is as follows:
  Channel 0: For underflow events (events whose measured value is less than or equal to channel 0).
  Channel 16377: For overflow events (events whose measured value is greater than or equal to channel 16377).

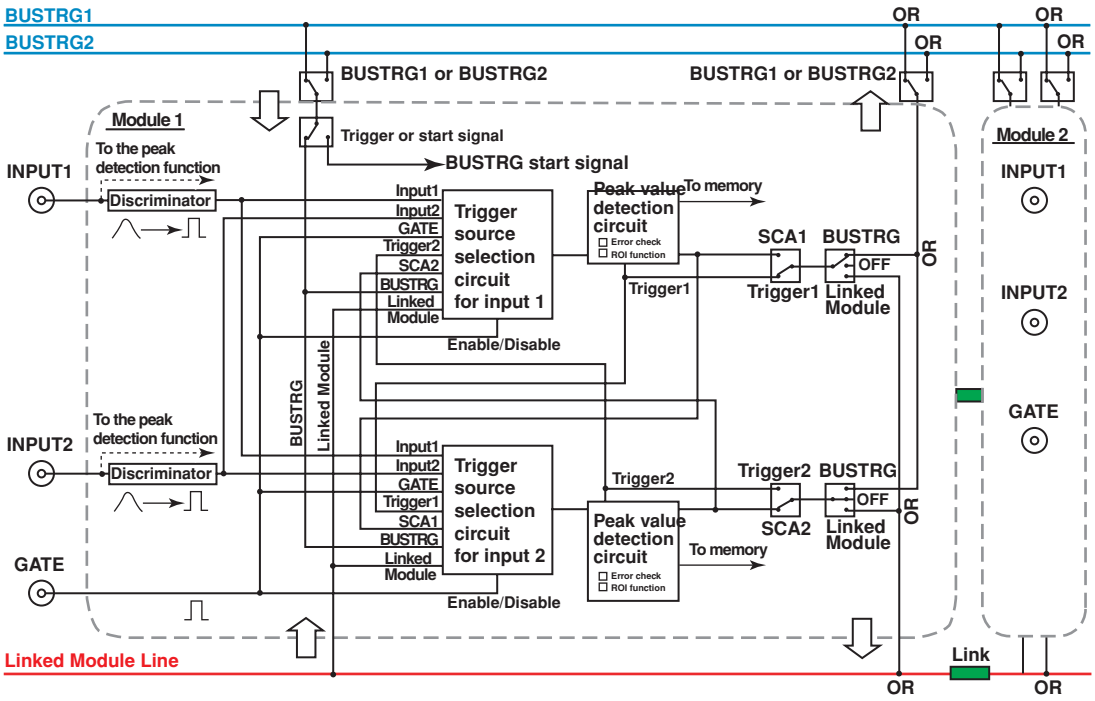
[*1] The voltage level is a typical value. The typical value is a representative or standard value. It is not a warranted value.

[*2] When the total number of AD channels is 16384

Appendix 2 Trigger Link Function and Application Examples

Trigger Link Function

WE7562 Trigger System



Trigger Source

The following seven trigger sources are available. You can set the trigger source for each input on the WE7562.

- Input1
  Self trigger of input 1.
- Input2
  Self trigger of input 2.
- Trigger<x>[*1]
  The signal that is output when the trigger condition is met on input<x>. The signal is not output if the measurement of the previous event is in progress even if a signal is supplied from the trigger source.
- SCA<x>[*1]
  The signal that is output when a peak value is detected within the ROI for input<x>. If the error check function of input<x> is ON, the signal is not output for events in which an error is detected. Valid only when input<x> is set to peak measurement mode.
- Gate
  External input signal.
- BUSTRG
  Input signal from the BUSTRG line.
- Linked Module
  Input signal from the Linked Module line.

[*1]* <x> = 2 for input 1 and <x> = 1 for input 2.

Note

The following limitations apply to the trigger source selection depending on the setting conditions.

- Gate cannot be selected if the gate function is enabled or if the cause of measurement termination is set to Gate.
- BUSTRG cannot be selected if the start mode is set to BUSTRG.
- Self trigger cannot be selected (Input1 for input 1 and Input2 for input 2) if instantaneous value measurement mode is selected in LIST mode.

Input1/Input2/Trigger<x>/SCA<x> is used to link the trigger signals between inputs in the same module. For example, the self trigger signal of input 2 can be used as a trigger source for input 1 or the SCA signal generated in input 2 can be used as a trigger source signal for input 1.
Gate is used to receive an external signal as the trigger source. The WE7562 gate function operates by detecting the rising edge of the pulse signal applied to the Gate terminal.
BUSTRG/Linked Module is used to receive a signal from outside the module as the trigger source. BUSTRG is used to receive a signal supplied externally via the trigger terminal of another module in the station or that of the station as the trigger source. The signal is exchanged on the BUSTRG (BUSTRG1 or BUSTRG2) line.
Linked Module is used to link the trigger among the linked WE7562 modules. The signal is exchanged on the Linked Module line dedicated to the WE7562 module.

Trigger Output

The following three output destinations are available. The WE7562 allows the trigger signal to be output to the BUSTRG or Linked Module line for each input.

- None
  Output off.
- BUSTRG
  Output to the BUSTRG line.
- Linked Module
  Output to the Linked Module line.

You can select the output signal type from either of the following:

- Trigger
  Output when the trigger condition is met on the relevant input.
- SCA
  Output when a peak value is detected within the ROI on the relevant input. This is selectable only in the peak measurement mode. If the error check function is ON, the signal is not output for events in which an error is detected.

Note

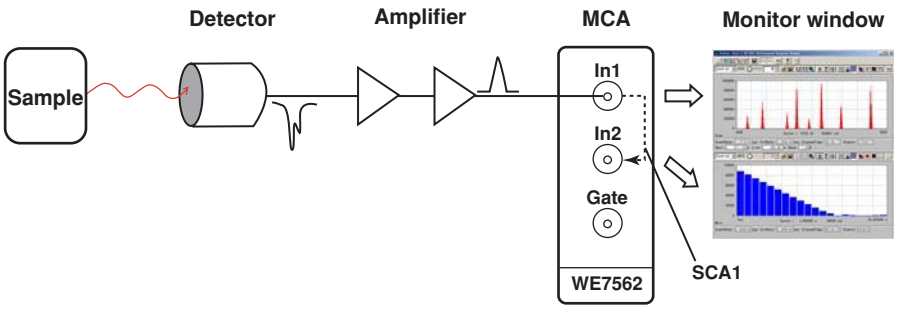
- The Linked Module line is a module linkage signal line dedicated to the WE7562. To achieve signal linking between modules, you must link the modules on the WE7000 Control Software in advance. For a description of module linking, see the station help of the WE Control Software or section 4.6, “Setting the Trigger Source/Time Base/Arming” in the WE7000 User’s Manual (IM707003-01E).
- The WE7562 takes the OR of the output signals on the BUSTRG and Linked Module lines. However, if multiple signals occur with a time offset less than or equal to 250 ns, the WE7562 may not be able to distinguish the individual signals.

Trigger Link Example

Example of a Trigger Link within the Same Module

Example 1

Measure in PHA mode and monitor the number of acquired events in MCS mode



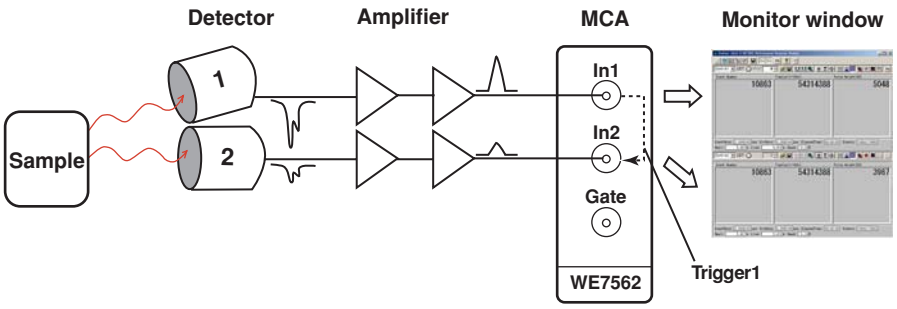
Setup Example

1. Prepare a WE7562 module.
2. Connect the signal from the detector to input 1.
3. Set the measurement conditions of each input as shown in the following table.

Module	Input	Mode	Trigger Source
1	1	PHA	Input1 (self)
1	2	MCS-Counter	SCA1

Example 2

Acquire two events that occur simultaneously using two detectors and measure each pulse height value data in LIST mode



Setup Example

1. Prepare a WE7562 module.
2. Connect the signal from the detectors 1 and 2 to input 1 and input 2, respectively.
3. Set the measurement conditions of each input as shown in the following table.

Module	Input	Mode	Trigger Source	ROI	Error Check	Window Time
1	1	LIST	Input1 (self)	OFF	OFF	Tw* + 100 ns
1	2	LIST	Trigger1	OFF	OFF	Tw*

* Window time specified on input 2.

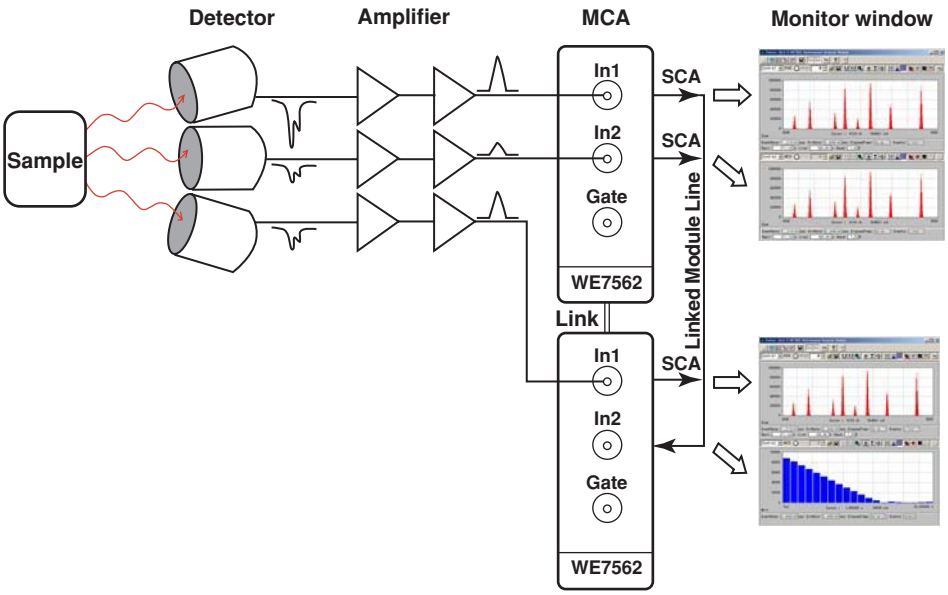
Note

If the ROI function or the error check function is enabled, events in which a peak is detected outside the ROI and events that are judged as errors are discarded even if a trigger signal occurs. To align the number of acquired events between inputs, turn OFF the ROI and error check functions. Be sure to set the windows time of the input acting as a master longer than the window time of the input acting as a slave by at least 100 ns. If the window time of the master is shorter than that of the slave, the slave is in the middle of processing when the peak detection processing on the master is completed. Thus, the slave may fail to acquire the event.

Example of Trigger Linking between Modules

Example 1

- Measure the signal from three detectors independently in PHA mode.
- Monitor the total number of occurred events in MCS mode.



Setup Example

1. Link two WE7562 modules.
2. Connect the three signals from the detector to input 1 and input 2 of module 1 and input 1 of module 2.
3. Set the trigger conditions of each input as shown in the following table.

Module	Input	Mode	Trigger Source	Trigger Output	Output Destination
1	1	PHA	Input1 (self)	SCA	Linked Module
	2	PHA	Input2 (self)	SCA	Linked Module
2	1	PHA	Input1 (self)	SCA	Linked Module
	2	MCS-Counter	Linked Module	None	N/A

Explanation

In the example above, the signal from each detector is measured using the self trigger. The SCA signal that is generated in each input is output to the Linked Module line. Module 2 receives this signal via input 2, and performs the measurement in MCS mode. The trigger signal is exchanged using the Linked Module line dedicated to the WE7562, but a similar operation can be achieved by using the BUSTRG line.

Note

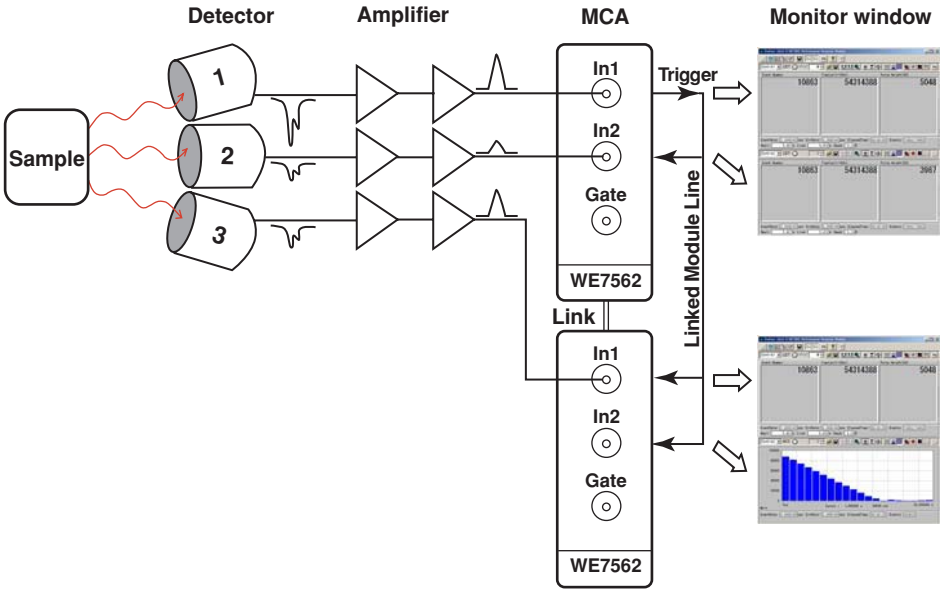
- The module link is set on the WE7000 Control Software. For a description of module linking, see the station help of the WE Control Software or section 4.6, “Setting the Trigger Source/ Time Base/Arming” in the WE7000 User’s Manual (IM707003-01E).
- The WE7562 takes the OR of the input signals on the Linked Module lines. However, if multiple events occur with a time offset less than or equal to 250 ns, the WE7562 may not be able to distinguish the individual signals.

App

Appendix

Example 2

- Measure in LIST mode the events acquired by detector 1 and the events that occur in conjunction with that event (signals from detectors 2 and 3).
- Monitor the number of occurred events in MCS mode.



Setup Example

1. Link two WE7562 modules.
2. Connect the signals from the detectors 1, 2, and 3 to input 1 and input 2 of module 1 and input 1 of module 2, respectively.
3. Set the measurement conditions of each input as shown in the following table.

Module	Input	Mode	Trigger Source	Trigger Output	Output Destination	ROI	Error Check	Window Time
1	1	LIST	Input1 (self)	Trigger	Linked Module	OFF	OFF	Tw*+100ns
1	2	LIST	Linked Module	None	N/A	OFF	OFF	Tw*
2	1	LIST	Linked Module	None	N/A	OFF	OFF	Tw*
2	2	MCS-Counter	Linked Module	None	N/A	N/A	N/A	N/A

* Window time set on input 2 of module 1 and input 1 of module 2.

Explanation

In the example above, the signal from detector 1 (master) is measured using the self trigger, and this trigger signal is used to measure the signals from detectors 2 and 3 (slave). The trigger signal is exchanged using the Linked Module line dedicated to the WE7562, but a similar operation can be achieved by using the BUSTRG line.

Note

- The module link is set on the WE7000 Control Software. For a description of module linking, see the station help of the WE Control Software or section 4.6, “Setting the Trigger Source/ Time Base/Arming” in the WE7000 User’s Manual (IM707003-01E).
- If the ROI function or the error check function is enabled, events in which a peak is detected outside the ROI and events that are judged as errors are discarded even if a trigger signal occurs. To align the number of acquired events between inputs, turn OFF the ROI and error check functions. Be sure to set the windows time of the input acting as a master longer than the window time of the input acting as a slave by at least 100 ns. If the window time of the master is shorter than that of the slave, the slave is in the middle of processing when the peak detection processing on the master is completed. Thus, the slave may fail to acquire the event.

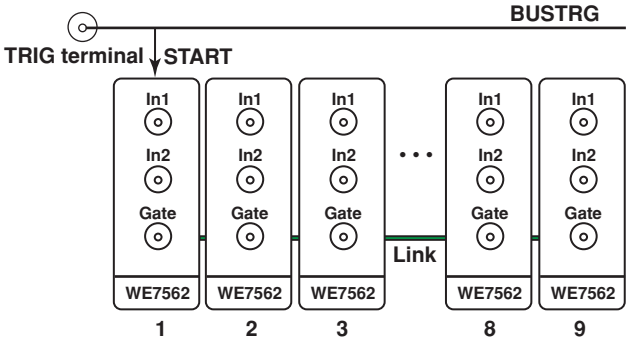
BUSTRG Start Function

The following two start modes are available for starting the measurement (see section 1.8): Normal and BUSTRG. In Normal mode, the measurement starts when you instruct the WE7000 to start. In BUSTRG mode, the measurement starts in sync with the signal supplied via the BUSTRG line. If you instruct the WE7562 to start when BUSTRG mode selected, the module enters the start signal input wait state. The measurement starts when the module receives a signal from BUSTRG. This function is called the BUSTRG start function.

By using the BUSTRG start function, you can control the measurement start time of the WE7562 module using a signal from another module in the same station or an external signal.

Setup Example of BUSTRG Mode

- Measure the signal from 18 detectors.
- Control the measurement start time using an external signal.



Setup Example

1. Link nine WE7562 modules.
2. Connect the signal from detectors 1 to 18 to each input.
3. Set the start mode to BUSTRG, and set the BUSTRG to “from BUSTRG to the module.”
4. Set the TRIG terminal on the front panel of the measuring station to “from TRIG terminal to BUSTRG.”
5. After setting the measurement conditions, set the modules in the measurement start state.
6. When an external signal is supplied to the TRIG terminal, the measurement of all modules starts at once.

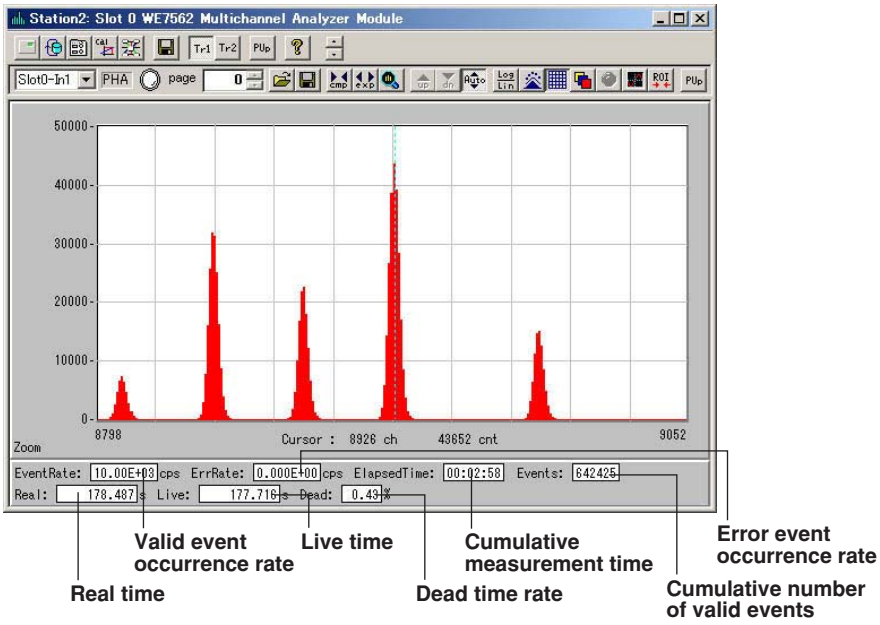
Note

- The trigger source cannot be set to BUSTRG if the start mode is set to BUSTRG.
- To use the BUSTRG mode, you must set the BUSTRG to “from BUSTRG to the module” in the trigger setting dialog box of the WE7000 Control Software in advance (see section 4.6, “Setting the Trigger Source/Time Base/Arming” in the WE7000 User’s Manual (IM707003-01E)).
- To supply the start signal externally (TRIG terminal), you must set the TRIG terminal to “from TRIG terminal to BUSTRG” in the trigger setting dialog box of the WE7000 Control Software in advance (see section 4.6, “Setting the Trigger Source/Time Base/Arming” in the WE7000 User’s Manual (IM707003-01E)).
- If the WE7562 modules are linked, set the start mode for each link unit. If multiple unlinked modules are installed, set the start mode on each module.

Appendix 3 Statistics Display

This section explains the statistical values that are displayed on the monitor screen of the WE7562.

Details of Statistics Display



Valid Event Occurrence Rate (EventRate)

Displays the occurrence rate of valid events (the number of valid events that occurred per second) regardless of whether the measurement is in progress. The valid event occurrence rate is calculated using the following equation using screen update interval ΔT and number of valid events that occurred during the interval ΔN.

EventRate = ΔN/ΔT (cps, counts per second)

Valid events indicate the following events.

- **For Peak Measurement**
  Peak values that are detected in the ROI and not judged as errors.
  (This number matches the number of trigger events if the ROI and error check functions are OFF.)
- **For Counter Mode of MCS and Instantaneous Mode of LIST**
  Events for which the trigger condition is met.

Error Event Occurrence Rate (ErrRate)

Displays the occurrence rate of error events (the number of error events that occurred per second) regardless of whether the measurement is in progress. The error event occurrence rate is calculated using the following equation using screen update interval ΔT and number of error events that occurred during the interval ΔNerr.

ErrRate = ΔNerr/ΔT (cps, counts per second)

The error rate is always zero in counter mode of MCS mode and instantaneous value measurement mode of LIST mode in which peak measurement is not performed, because error events do not occur. The error rate is always zero also if the error check function is OFF in peak measurement mode, because error events are not counted.

Cumulative Measurement Time (ElapsedTime)
Displays the elapsed time of measurement from the start of the measurement. If the number of pages is set to 1 in PHA mode or if the operation mode is set to MCS or LIST, the elapsed time of measurement from the start of the measurement is displayed. If the number of pages is set to zero (repetitive measurement) or greater than or equal to 2 in PHA mode, the elapsed time of measurement for the page is displayed. This is because the elapsed time of measurement is reset to zero when Page Up is carried out.
If the cause of the measurement termination is set to Time, the specified measurement time is displayed in the denominator.

Cumulative Number of Valid Events (Events)
Displays the cumulative number of valid events from the start of the measurement.

Cumulative number of valid events indicates the following:

- **For Peak Measurement**
  Cumulative number of events of peak values that are detected in the ROI and not judged as errors.
  (This number matches the number of trigger events if the ROI and error check functions are OFF.)
- **For Counter Mode of MCS and Instantaneous Mode of LIST**
  Cumulative number of events for which the trigger condition is met.

If the number of pages is set to 1 in PHA mode or if the operation mode is set to MCS or LIST, the cumulative number of events from the start of the measurement is displayed. If the number of pages is set to zero (repetitive measurement) or greater than or equal to 2 in PHA mode, the cumulative number of events for the page is displayed. This is because the cumulative number of events is reset to zero when Page Up is carried out.
If the cause of measurement termination is set to Time, the specified number of events is displayed in the denominator.

Real Time (Real)
Displays the elapsed time of measurement from the start of the measurement in unit of seconds. If the number of pages is set to 1 in PHA mode or if the operation mode is set to MCS or LIST, the elapsed time of measurement from the start of the measurement is displayed. If the number of pages is set to zero (repetitive measurement) or greater than or equal to 2 in PHA mode, the elapsed time of measurement for the page is displayed. This is because the elapsed time of measurement is reset to zero when Page Up is carried out. This value is the same as the cumulative measurement time (ElapsedTime) excluding the display format.
Real time is not displayed if the peak measurement is not performed (counter measurement mode in MCS mode or instantaneous value measurement mode in LIST mode).
For details on the definition of real time, see page App-11.

Live Time (Live)
Displays the live time of measurement from the start of the measurement in unit of seconds. If the number of pages is set to 1 in PHA mode or if the operation mode is set to MCS or LIST, the live time from the start of the measurement is displayed. If the number of pages is set to zero (repetitive measurement) or greater than or equal to 2 in PHA mode, the live time for the page is displayed. This is because the live time is reset to zero when the page is updated.
Live time is not displayed if the peak measurement is not performed (counter measurement mode in MCS mode or instantaneous value measurement mode in LIST mode).
For details on the definition of live time, see page App-11.

Dead Time Rate (Dead)

Displays the instantaneous value of the dead time rate during measurement. The dead time rate is determined using the following equation using screen update interval ΔT, the number of trigger events during that time ΔNtrg, and dead time TP per trigger.

Dead = 100 × (TP × ΔNtrg)/ΔT (%)

When the measurement is completed, the cumulative dead time rate calculated using real time TR and the number of trigger events Ntrg is displayed.

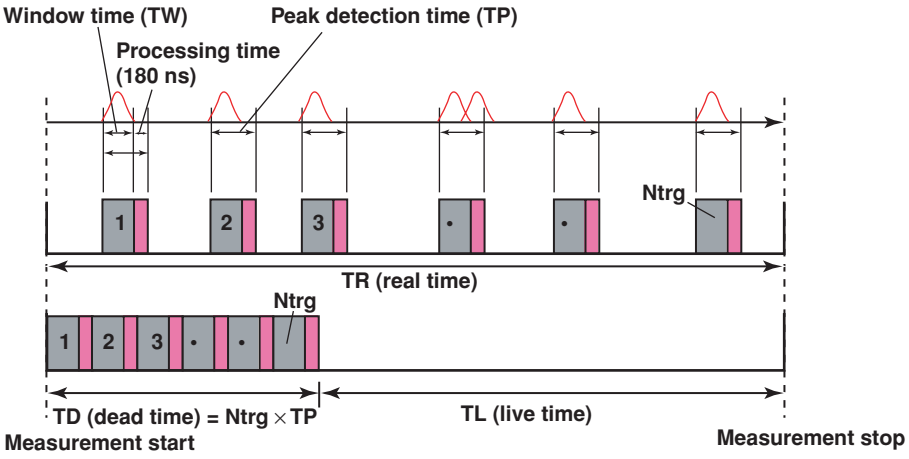
Dead = 100 × (TP × Ntrg)/TR (%)

Dead time rate is not displayed if the peak measurement is not performed (counter measurement mode in MCS mode or instantaneous value measurement mode in LIST mode).

For details on the definition of dead time, see page App-11.

Definitions of Real Time, Live Time, and Dead Time

Various statistics and times are described below.



Ntrg: Number of trigger events (number of times peak detection was performed)
TW: Window time (user-defined value)
TP: Peak detection time (sum of the window time and the processing time of 180 ns)
TR: Real time (cumulative elapsed time from the start of the measurement)
TD: Dead time (cumulative time of peak detection)
TL: Live time (cumulative live time since the start of the measurement)
DF: Dead time rate (ratio of the dead time with respect to the real time)

Dead Time Data

The dead time that occurs per event (which is equal to the peak detection time), TP, is the sum of the specified window time and the internal processing time (fixed to 180 ns).

TP = TW + 180 ns **+180 ns is the internal processing time/event**

Live time is the value obtained by subtracting the total dead time from the real time (total measurement time) TR.

TL = TR – TP × Ntrg (s)

Dead time rate (rate of the dead time in the total measurement time) DF is expressed as a percentage of the dead time in the real time.

DF = 100 × (TP × Ntrg)/TR (%)

The dead time display during the measurement shows the instantaneous value of the dead time rate per screen update (instantaneous DF value). The instantaneous DF value is defined as follows:

- Here we denote the real time TR and the number of trigger events Ntrg at a given point (i^{th} time of the screen display) as TR(i) and Ntrg(i), respectively.
- We denote the real time TR and the number of trigger events Ntrg at a given point ($i+1^{th}$ time of the screen display) as TR(i+1) and Ntrg(i+1), respectively.

If we define the differences ΔNtrg and ΔT as follows:

ΔNtrg = Ntrg(i+1) – Ntrg(i) **Amount of increase in the number of trigger events Ntrg since the previous display.**

ΔT = TR(i+1) – TR(i) **Amount of increase in the real time TR since the previous display.**

the instantaneous DF value when the $i+1^{th}$ screen is displayed can be determined using the following equation.

Instantaneous DF value = 100 × (ΔNtrg × TP)/ΔT (%)

Note

The real time, live time, and dead time are calculated using time information of 1-ms resolution. Therefore, if the measurement time is less than or equal to the resolution, the values may not be calculated correctly.

Index