## Instruction Manual

# 4-CH, 100 kS/s Strain Module
# WE7245

**YOKOGAWA ◆**

Yokogawa Electric Corporation

Thank you for purchasing the 4-CH, 100 kS/s Strain Module WE7245 for the PC-based measurement instrument, WE7000.

This User's Manual contains useful information about the function, connection to the measuring station, and troubleshooting of the WE7245. This manual assumes that you will be using the WE7000 Control Software that is included with the measuring station.

For general information about the WE7000 (primarily the operations of the measuring station, the optical interface module, the optical interface card, and the WE7000 Control Software) see the following manual that is included with the measuring station.

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

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

## Notes

- **The contents of this manual describe WE7000 Control Software Ver. 4.0.2.0 and module software Ver 3.03. If you are using another version of the software, the operating procedures or the figures given in this manual may differ from the actual software.**
- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
- Copying or reproducing all or any part of the contents of this manual without YOKOGAWA's permission is strictly prohibited.

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## Revisions

1st Edition: March 2000
2nd Edition: August 2000

# Checking the Contents of the Package

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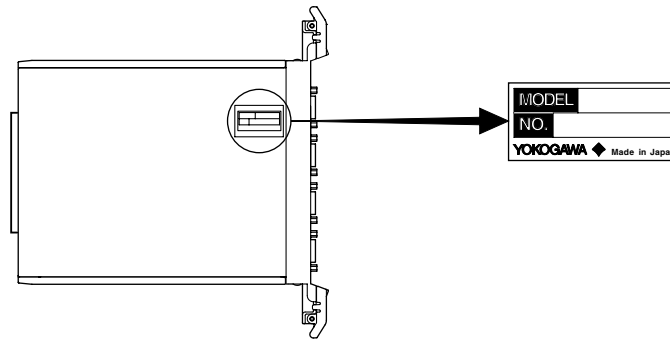
## Measurement Module

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

**MODEL**

| Model | Suffix Code | Description |
|-------|-------------|-------------|
| 707245 | | WE7245 4-CH, 100 kS/s Strain Module |
| | /HE | English help message |

**NO.**

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



## Standard Accessories

The following standard accessories are supplied with the instrument. Check that all contents are present and that they are undamaged.
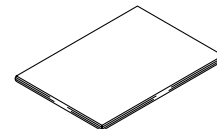
**D-Sub connector (9 pins, male)**
**4 pieces**
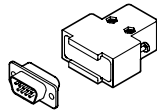
**Clanp filter**
**4 pieces**

**User's Manual (this manual) 1 piece**
**IM707245-01E**



## Spare Parts (Sold Separately)

| Part Name | Part Number |
|-----------|-------------|
| Bridge head, for connecting the strain gauge D-Sub connector (9 pins, male) | A1520JD/A1618JD |
| Clamp filter | A1190MN |

## Optional Accessories (Sold Separately)

| Part Name | Part Number | Description |
|-----------|-------------|-------------|
| Dedicated bridge head | 700967 | Bridge resistance 120 Ω, with a dedicated cable (5 m) |
| Dedicated bridge head | 700968 | Bridge resistance 350 Ω, with a dedicated cable (5 m) |

# How to Use This Manual

## Structure of the Manual

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

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

## Conventions Used in This Manual

**Unit**

k   k: Denotes 1000. Example: 100 kHz

K   K: Denotes 1024. Example: 720 KB

**Displayed characters**

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

**Symbols**

The following symbols are used in this manual.

Affixed to the instrument. Indicates danger to personnel or instrument and the operator must refer to the User's Manual. The symbol is used in the User's Manual to indicate the reference.

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

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

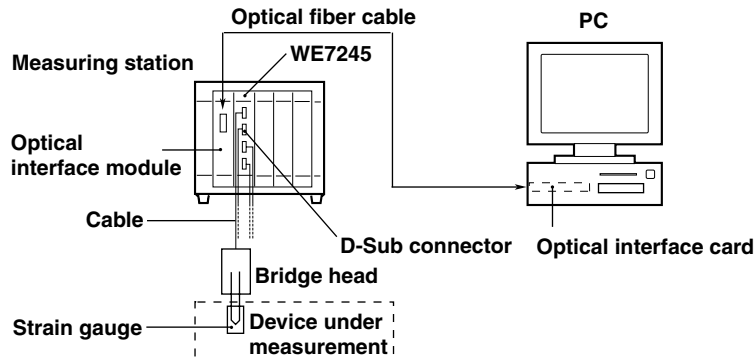*Note*   Provides important information for the proper operation of the instrument.
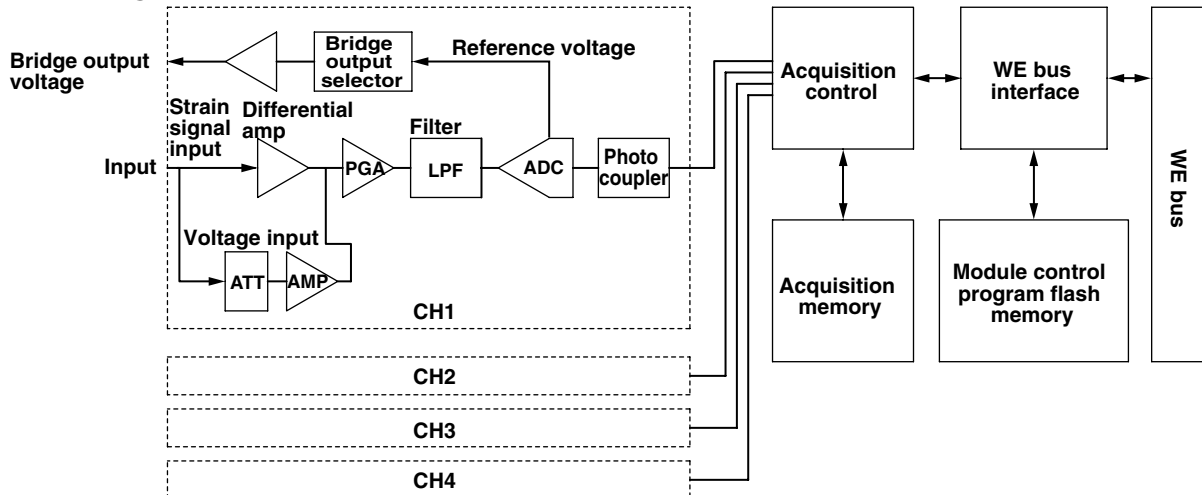
# Contents

# 1.1   System Configuration and Block Diagram

## System Configuration

The following is an example in which the 4-CH, 100 kS/s Strain Module WE7245 is installed into the measuring station and the measuring station is connected to the PC with the optical fiber cable.



## Block Diagram



### Description of operation

This module is capable of measuring strain and voltage. The strain signal (output voltage due to strain) and voltage inputs differ in their path up to the programmable gain amplifier (PGA).  For strain signal input, a bridge head is connected to the input connector. At the bridge, unbalance corresponding to the amount of strain of the connected strain gauge is present. Therefore, when the bridge voltage is supplied from the module to the channels, unbalanced voltage results at the bridge output. This voltage is input to the module, amplified by the differential amplifier, and passed to the programmable gain amplifier. For voltage input, the voltage applied to each channel goes through the attenuator (ATT) as necessary, then amplified.  It is, then, passed to the programmable gain amplifier where the voltage amplitude is adjusted.  Then, the signal passes through the low pass filter (LPF) and enters the A/D converter (ADC). In the A/D converter, the input signal is sampled by synchronizing to the clock provided by the time base and converted to digital data. The digital data is then isolated by the photo coupler, and stored in the acquisition memory according to the sampling interval and the trigger condition settings.  The data in the acquisition memory can be read from the PC.

# 1.2 Operation Panel

The WE7000 Control Software that is installed in the PC is used to control the 4-CH, 100 kS/s Strain Module WE7245. The WE7000 Control Software displays operation panels similar to those shown in the figure below. This User's Manual does not explain the operations of the operation panel or waveform monitor. For the operations of these items, see the on-line help that is provided with the WE7000 Control Software.

# 1.3   Setting the Measurement Conditions

### Turning ON/OFF the Measurement Channel

Measurement is made only on the channels that have the [On] check box selected. If [1CH] or [2CH] is selected in the section "Selecting the Number of Measurement Channels" as described later, only the specified number of channels can be checked.

### Measurement Range Unit (Range Unit)

Set the unit for the item being measured.

**When measuring the strain**

µSTR or mV/V

**When measuring the voltage**

V

### Measurement Range (Range)

Two types of input signals can be measured: output voltage due to strain and normal voltage.

You can select from the following measurement ranges:

**Strain measurement (when the measurement range unit is set to µSTR)**

| Setting | Measurable Range (Accuracy Guaranteed Measurement Range) |
|---|---|
| 1000 µSTR | ±1000 µSTR |
| 2000 µSTR | ±2000 µSTR |
| 5000 µSTR | ±5000 µSTR |
| 10000 µSTR | ±0000 µSTR |
| 20000 µSTR | ±20000 µSTR |

* µSTR denotes $10^{-6}$ strain.

**Strain measurement (when the measurement range unit is set to mV/V)**

| Setting | Measurable Range (Accuracy Guaranteed Measurement Range) |
|---|---|
| 0.5 mV/V | ±0.5 mV/V |
| 1 mV/V | ±1 mV/V |
| 2 mV/V | ±2 mV/V |
| 5 mV/V | ±5 mV/V |
| 10 mV/V | ±10 mV/V |

**Voltage measurement**

| Setting | Measurable Range (Accuracy Guaranteed Measurement Range) |
|---|---|
| 100 mV | ±100 mV |
| 200 mV | ±200 mV |
| 500 mV | ±500 mV |
| 1 V | ±1 V |
| 2 V | ±2 V |
| 5 V | ±5 V |
| 10 V | ±10 V |
| 20 V | ±20 V |

### *Note*

The "data" value is the measurement data obtained through single-gauge measurement.

Data obtained through two- or four-gauge measurement needs to be properly altered, or by using the scaling function, before being used.

## Bridge Voltage (Excitation)

Select the voltage to be applied to the bridge head from the following.  If you selected [V] for the measurement range unit, "OFF" becomes an available option.

| Setting | Gauge Resistance |
| --- | --- |
| 2 V | 120 to 1000 Ω |
| 5 V | 350 to 1000 Ω |
| 10 V | 350 to 1000 Ω |

*Note*

When using a bridge resistance of 120 Ω, set the bridge voltage to 2 V.

## Gauge Factor

You can set the gauge factor of the strain gauge.

Range: 1.800 to 2.300 (in 0.001 steps)

The gauge factor is a unique constant defined for the strain gauge.  It is usually described in the manual for the strain gauge.

## Execute Balancing

Click this button when adjusting the unbalance in the bridge resistance. Always execute balancing, when the bridge voltage or gauge factor is changed or a new channel that is turned ON is added.  Execute balancing after the warm-up time has passed for the instrument (including the modules).  Balancing takes a few seconds to complete. For channels that have been balanced properly, the data value turns to a black color. Otherwise, it is displayed in red. If any of the channels fails to balance properly, the indicator to the left of the [Balance] button turns red.
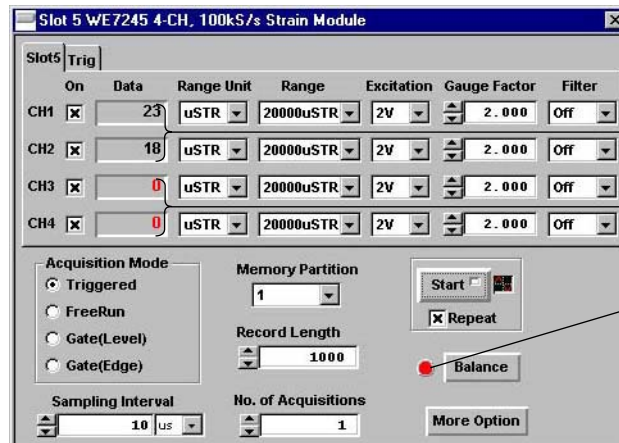


Channel that has been balanced properly (black characters)

Channel that has not been balanced properly (red characters)

Turns red when there is a channel that failed to balance properly.

The data related to the balancing operation can be stored by selecting [Station] - [Update Preset] in the station window. When the module is started up the next time, measurements will be made using the stored balancing data.

*Note*

• When balancing, connect the bridge head or the strain gauge transducer to the relevant channel and apply zero load.
• The displayed value is meaningless during the time period after the bridge is balanced until the start of the measurement. If the value is displayed in black, it indicates that the balancing was successful.  If the value is displayed in red, it indicates that the balancing failed.

## Input Filter

You can eliminate high frequency noise from the input signal. Select 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, or OFF.

## Acquisition Method (Acquisition Mode)

Select the measurement data acquisition method from the following four modes:

**Triggered**

Upon clicking the [Start] button, the measured data are acquired to the acquisition memory according to the specified trigger condition.  After acquiring the specified record length of data, the operation stops. If the [Repeat] check box* is selected, the operation repeats until the next time the [Start] button is clicked.

  * [Repeat] check box appears only when the expression "optimal number of memory partitions >= $2 \times$ number of measurements" is satisfied. The "optimal number of memory partitions" refers to the number of partitions that is used as a matter of convenience inside the module. In some cases, the memory can be partitioned into smaller sections depending on the record length and the number of channels. In such cases, the maximum possible number of partitions is determined, and this value is taken to be the "optimal number of memory partitions." The optimal number of memory partitions is the largest value of $2^n$ which is smaller than "4,194,304/(the number of channels specified for the channel mode $\times$ the record length)." For example, if the channel mode is 2CH and the record length is 10000, the calculation is 4,194,304/($2 \times 10000$) which is approximately 210.  In this case, the optimal number of partitions is 128. Thus, if the number of acquisitions is less than or equal to 64, the [Repeat] check box appears.  If it is larger than 64, the check box does not appear. If the optimal value exceeds "256", the number of partitions is set to "256". Note that if the number of acquisitions [No. of Acquisitions] is set to "0", then the [Repeat] check box does not appear.

**Free Run**

Upon clicking the [Start] button, the measured data are acquired immediately to the acquisition memory.  If the [Start] button is clicked again, the operation stops.

**Gate (Level)**

The measurement data are acquired during the time that the specified trigger condition is satisfied (gate period). If the specified record length of data is acquired before the gate period ends, the acquisition stops at that point. The operation repeats the number of times specified by the number of acquisitions. If you stop the measurement before this number is reached, the operation stops immediately.
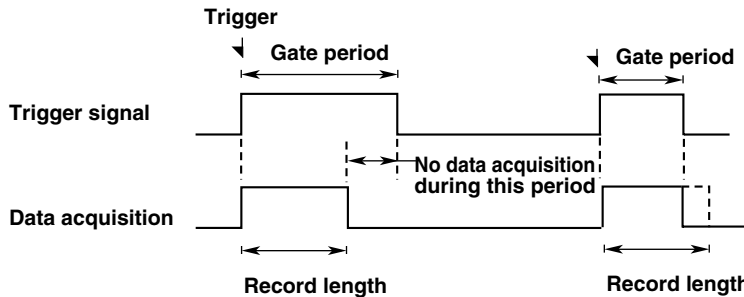


**Gate (Edge)**

Data acquisition starts when the specified trigger condition is satisfied and pauses when the trigger condition is no longer satisfied. When the trigger condition is satisfied again, data acquisition starts at a new memory block.  The operation repeats the number of times specified by the number of acquisitions. If you stop the measurement before this number is reached, the operation stops immediately.
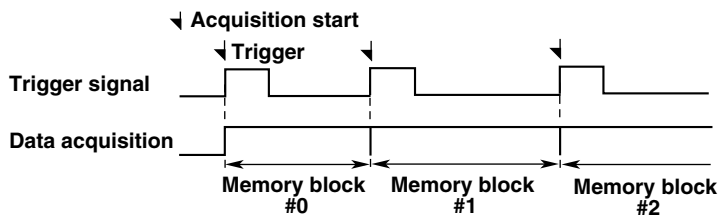
## Sampling Interval

**During trigger/gate mode**
You can select the sampling interval in the range from 10 μs to 10 s (in 1 μs steps).
**During free run mode**
You can select the sampling interval in the range from 1 ms to 10 s (in 1 μs steps).

## Memory Partition (Valid Only during Trigger Mode)

During the trigger mode, you can divide the acquisition memory into multiple blocks and acquire the data to the memory blocks in order every time the trigger occurs. You can divide the memory into 1/2/4/8/16/32/64/128/256 partitions. When using memory partitions, if the measurement is stopped before reaching the number of acquisitions, the data in the memory block that was being written at that time are invalid.

## Record Length (Valid Only During Trigger/Gate (Level) Mode)

The term "record length" refers to the number of data points acquired in the acquisition memory. The maximum record length (number of acquired data points) when the memory is not partitioned is 4 Mwords for 1 channel, 2 Mwords for 2 channels and 1 Mword for 3 or 4 channels.
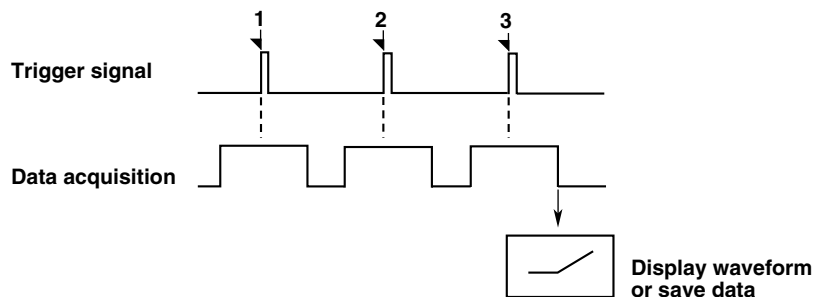
The range during the trigger mode is "100 to 4 M/the number of memory partitions," "100 to 2 M/the number of memory partitions," and "100 to 2 M/the number of memory partitions" when the number of measurement channels is 1, 2, and 3 or 4, respectively. The range during the gate (level) mode is "2 to the maximum record length."
The record length is set to "Maximum record length/the number of memory partitions" when "0" is specified in the trigger mode. The range during the gate (level) mode is "2 to the maximum record length." The record length is set to the "Maximum record length" when "0" is specified in the gate (level) mode. In this case, the memory is partitioned according to the satisfied and unsatisfied conditions of the trigger. The maximum number of memory blocks that can be created in this way is 256.

For the minimum record length, "the record length × sampling interval" cannot be less than 5 ms. When using the internal clock as the time base, the record length is set to the minimum allowed value when a value below this minimum value is specified. However, this restriction is not enforced when using the external clock as the time base. In this case, the value is set to the specified value, but proper measurements may be impeded.

## Number of Acquisitions

You can specify the number of times to acquire the data when using the trigger or gate mode. The range is from 1 to 32,768 times. However, if the specified record length is greater than or equal to "the maximum record length/2," you can only specify one for the number of acquisitions. If you select 0, the acquisition of data continues until the measurement is stopped or the specified record length of data is acquired. After acquiring the number of acquisitions of data or if the acquisition is stopped, the waveform of the measured data is displayed. For example, if you set the number of acquisitions to "3" in the trigger mode, the module operates as follows.

If you set a number less than the number of memory partitions in the trigger mode, you will have to specify the number of memory blocks to use. If you set a number larger than the number of memory partitions, the data are acquired until the specified number is reached or until the specified record length is reached. In the gate mode, measured data are acquired by taking the specified record length to be one block. When the specified record length is "maximum record length/256" or less and the number of acquisitions is set to 256 or less, all of the acquired data are saved. But, if the number of acquisition is set above 256, the acquired data beyond the 256th acquisition overwrites the previous data starting from the first acquisition. If the record length is set above "maximum record length/256" points, the data are overwritten when the number of acquisitions exceeds (maximum record length/specified record length).

*Note*

- If the number of acquisitions is greater than the number of memory partitions in the trigger mode, only the last "number of memory partitions" blocks of measured data are saved. In addition, you can only specify "1" for the number of acquisitions if the number of memory partitions is set to "1."
- If (number of acquisitions × record length × number of measurement channels*) is "4 M" points or less, and the number of acquisitions exceeds 256, then only the last 256 blocks of measured data are saved. If (the number of acquisitions × record length × the number of measurement channels*) exceeds "4 M" points, only the last "4 M/(record length × the number of measurement channels)" blocks of measured data are saved. (* When the number of measurement channels is "3," it is considered to be "4.")
- If the specified record length is greater than or equal to "the maximum record length/2" in the gate mode, you can only specify "1" for the number of acquisitions.

## Number of Measurement Channels (CH Mode)

The maximum record length can be changed by restricting the number of measurement channels. The number of measurement channels can be set to 4 channels (no restriction), 2 channels, or 1 channel. The maximum record length is set to 1 Mword for 4 channels, 2 Mwords for 2 channels, and 4 Mwords for 1 channel.

## Time Base

You can select whether to sample the input signal with the specified sampling interval based on the module's internal clock or to sample with the time base signal (CMNCLK) of the measuring station (BUSCLK setting).

* For setting procedures, see section 4.6, "Setting the Trigger Source/Time Base/Arming" in the WE7000 User's Manual (IM707001-01E).

## Linear Scaling

Linear scaling can be specified on measurement channels that are turned ON.
You can select the linear scaling from the following four choices:
Clicking the [More Option] button on the operation panel causes the operation panel to expand and the linear scaling setting list box to be displayed.
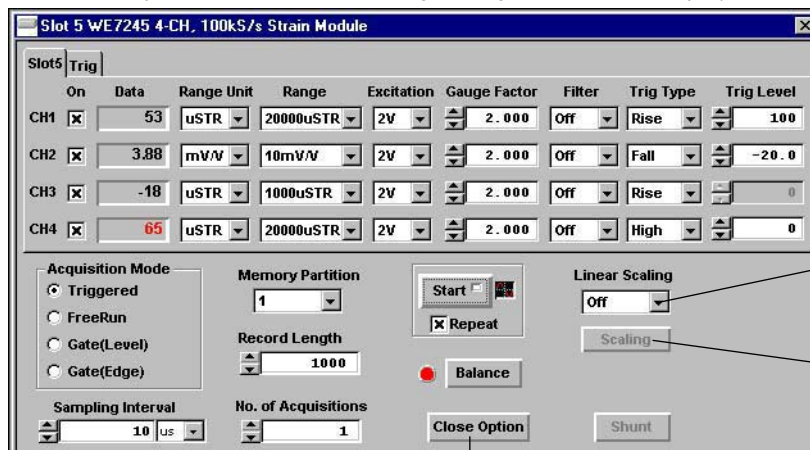


Select the linear scaling method

Set the measurement conditions/switch the linear scaling setting

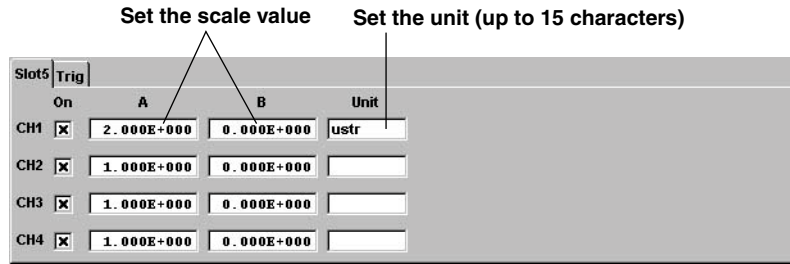Switch expanded/reduced display of the operation panel
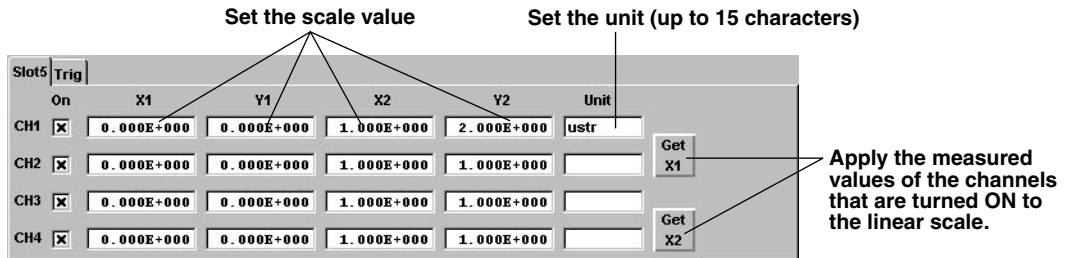
**OFF**

No linear scaling

**Ax+B**

Specify the scaling coefficient A and offset B and perform linear scaling.

The following dialog box appears. Linear scaling is performed only on the channels that have the [On] check box selected. Set the scaling constant (A), offset value (B), and unit. The selectable range for the scaling constant (A) and offset value (B) is "–1.000E+030 to +1.000E+030." The values specified in this dialog box also apply to [Ax+B] in the [Convert Scale] dialog box of the [Active Module] menu.

Set the scale value        Set the unit (up to 15 characters)

| Slot5 | Trig | | | |
|---|---|---|---|---|
| | **On** | **A** | **B** | **Unit** |
| **CH1** | ☒ | 2.000E+000 | 0.000E+000 | ustr |
| **CH2** | ☒ | 1.000E+000 | 0.000E+000 | |
| **CH3** | ☒ | 1.000E+000 | 0.000E+000 | |
| **CH4** | ☒ | 1.000E+000 | 0.000E+000 | |

**P1-P2**

The following dialog box appears. Linear scaling is performed only on the channels that have the [On] check box selected. Set arbitrary measured values (X1 and X2), arbitrary scale values (Y1 and Y2), and the unit. If the [Get X1] or [Get X2] button is clicked while the measurement is in progress, the measured values of the channels that have X1 and X2 turned ON are applied to the linear scaling. The selectable range for the arbitrary measured values (X1 and X2) and arbitrary scale values (Y1 and Y2) is "–1.000E+030 to +1.000E+030." The values specified in this dialog box also apply to [p1-p2] in the [Convert Scale] dialog box of the [Active Module] menu.

Set the scale value        Set the unit (up to 15 characters)

| Slot5 | Trig | | | | | |
|---|---|---|---|---|---|---|
| | **On** | **X1** | **Y1** | **X2** | **Y2** | **Unit** |
| **CH1** | ☒ | 0.000E+000 | 0.000E+000 | 1.000E+000 | 2.000E+000 | ustr |
| **CH2** | ☒ | 0.000E+000 | 0.000E+000 | 1.000E+000 | 1.000E+000 | | Get X1 |
| **CH3** | ☒ | 0.000E+000 | 0.000E+000 | 1.000E+000 | 1.000E+000 | |
| **CH4** | ☒ | 0.000E+000 | 0.000E+000 | 1.000E+000 | 1.000E+000 | | Get X2 |

**Apply the measured values of the channels that are turned ON to the linear scale.**

*The scale conversion equation (y=Ax+B) is derived from these four values.

Scale value        y=Ax+B

P2:Y2
P1:Y1

P1        P2

P1:X1   P2:X2

Measured value

Measurement range
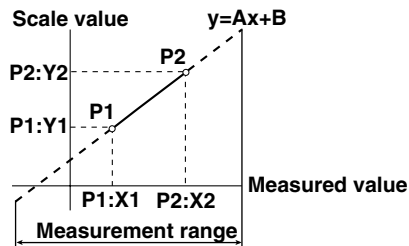
**Shunt**

The following dialog box appears. Shunt calibration is performed only on the channels that have the [Cal] check box selected. After setting arbitrary scale values to Y1 and Y2, click the [Shunt] button to carry out the shunt calibration. The measured values during the shunt calibration are displayed in X1 and X2. You can also set arbitrary values to X1 and X2. The range for X1 and X2 is from "–1.000E+30 to +1.000E+30." After setting the measure values and scale values, set the [Unit] as necessary.

**Set the scale value**          **Set the unit (up to 15 characters)**

| Slot6 Trig | | | | | | |
|---|---|---|---|---|---|---|
| | **Cal** | **X1** | **Y1** | **X2** | **Y2** | **Unit** |
| **CH1** | ☒ | 0.000E+000 | 0.000E+000 | 4.001E+000 | 1.000E+003 | LBS |
| **CH2** | ☐ | 0.000E+000 | 0.000E+000 | 1.000E+000 | 1.000E+000 | |
| **CH3** | ☐ | 0.000E+000 | 0.000E+000 | 1.000E+000 | 1.000E+000 | |
| **CH4** | ☐ | 0.000E+000 | 0.000E+000 | 1.000E+000 | 1.000E+000 | |

***Note***

• If you accidentally select [Shunt] while selecting [Ax+B] or [P1-P2] for linear scaling and click the [Shunt] button, set the linear scaling values again.

The data related to the shunt calibration can be stored by selecting [Station] - [Update Preset] in the station window. When the module is started up the next time, measurements will be made using the shunt calibration data.

When the linear scaling method is selected, the [Scaling] button at the bottom of the [Linear Scaling] list box changes to [Measure]. To return from linear scaling settings to measurement condition settings, click the [Measure] button. This button is active except when the linear scaling method is set to [Off].

***Note***

If the value of A or B is changed while "Ax+B" is selected when setting the linear scale, the values of Y1 and Y2 of "P1-P2" and "Shunt" change accordingly. If X1, X2, Y1, or Y2 of "P1-P2" or "Shunt" is changed, the A and B values of "Ax+B" also change in a similar fashion.

## Setting the Linear Scaling from the Conver Scale Menu

The linear scaling function is synchronized to [Convert Scale] of the [Active Module] menu in the station window. The values specified in this dialog box apply to [P1-P2] and [Ax+B] of [Linear Scaling].  In the dialog box shown in the figure below, select the type of scale conversion.  If you wish to convert the scale on the waveform display as well as save the converted data, check the [Save Physical Values] box and check the box to the left of the appropriate channel number [CHx]. Depending on the selected type of scale conversion, set the scale value (VP1, SP1, VP2, SP2 or a, b), the label, and the unit. If you do not check the [Save Physical Values] box, the waveform display will be converted, but raw data will be saved to the file.  If the [Save Physical Values] check box is selected, but the box to the left of the channel number [CHx] is not selected, raw data will used for both displaying and saving.  For an explanation of the scale conversion equation, see "Converting Waveform Data" in section 1.5, "Monitor Panel, Waveform Display, Automatic Saving of Measured Data, File Conversion, and Other Settings."

**A display example when scale conversion type is set to [P1-P2]**



**A display example when scale conversion type is set to [ax+b]**

# 1.4  Setting the Trigger

**Trigger Source**

Select the signal for triggering.   The choices are shown below.

Internal   :  Input signal (includes input signals from 4-CH, 100 kS/s Strain Modules that are linked)

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

**Trigger Type**

When the trigger source is set to the input signal, select the trigger type from the following list of choices.  Only [High], [Low], and [Off] can be selected in the gate (level) mode.

Rise  :  Rising (edge trigger)

Fall   :  Falling (edge trigger)

Both :  Both rising and falling (edge trigger)

High :  High level (state trigger)

Low  :  Low level (state trigger)

Off    :  No trigger

**Trigger Level**

The procedure to set the trigger level differs depending on the trigger type that is selected. The selectable range of voltage is the measurable range determined by the measurement range. It is set for each channel. When measuring strain, the resolution is 100 $\mu$STR and 10 $\mu$STR for $\pm$20000 $\mu$STR/$\pm$10000 $\mu$STR and $\pm$5000 $\mu$STR/$\pm$2000 $\mu$STR/$\pm$1000 $\mu$STR measurement ranges, or 100 $\mu$V, 10 $\mu$V, 1 $\mu$V for $\pm$10 mV/V, $\pm$5 mV/V / $\pm$2.5 mV/V / $\pm$1 mV/V, and $\pm$0.5 mV/V measurement ranges, respectively. When measuring voltage, the resolution is 1 mV, 10 mV, and 100 mV for $\pm$100 mV/$\pm$200 mV/ $\pm$500 mV, $\pm$1 V/$\pm$2 V/$\pm$5 V, and $\pm$10 V/$\pm$20 V measurement ranges, respectively.

**Trigger Combination**

Select one of the following list of choices.

**OR trigger**

The trigger occurs if any one of the trigger conditions specified for the input signal of each channel is satisfied.

**AND trigger**

The trigger occurs when all of the trigger conditions specified for the input signal of each channel are satisfied.

**Pretrigger (Valid Only during Trigger Mode)**

You can acquire the measured data before the trigger point into the acquisition memory. Set how many points before the trigger point to begin the acquisition in the range, "0 to specified record length – 2."

**Trigger Hold Off and Overlapped Acquisition**

Select the trigger hold off period that is used to temporarily stop the detection of the next trigger once a trigger occurs. With the factory default setting, the next trigger detection does not occur until the measured data are stored in the acquisition memory (overlapped detection disabled). Therefore, the hold off period is set in the range "the record length to 4,194,304". If the overlapped acquisition is enabled, however, the hold off period can be set in the range from "1 to 4,194,304."  In some cases, the measurement stops when the trigger hold off is set less than or equal to 1/255 of the record length. In this case, set the value above 1/255 of the record length.

**Manual Trigger**

If you select the trigger mode or the gate mode, triggers can be generated at arbitrary times. The method used to acquire the data after the trigger is activated varies depending on the mode. However, this function is not supported on the WE7000 Control Software. It can be used with the WE Control API (sold separately, model: 707741).

# 1.5 Monitor Panel, Waveform Display, Automatic Saving of Waveform Data, File Conversion, and Other Settings

The following functions are functions of the WE7000 Control Software.

For the operations of the following functions, see the on-line help that is provided with the WE7000 control Software.

## Displaying Data on the Monitor Panel

On the WE7245, you can switch the display to a monitor panel that displays only the measured values.

## Displaying the Waveform

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

## Automatic Saving of Waveform Data

Besides saving the data displayed on the waveform monitor, you can also have the waveform data automatically saved using a trigger or save the data continuously in free run mode.

### During trigger/gate mode

There are two methods of saving the data.

- Cyclic

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

```
  ┌─→ 00000 → 00001 → 00002 → 00003 → 00004 ─┐
  └──────────────────────────────────────────┘
```
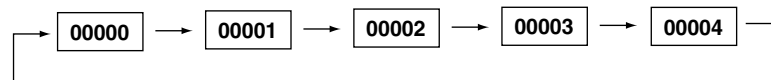
- File number limit

  You specify the number of files and the data are saved up to the specified number and then the operation stops.

### During free run mode

You can select to save the data to one file or to multiple files by specifying the number of data points.

## Converting the Waveform Data

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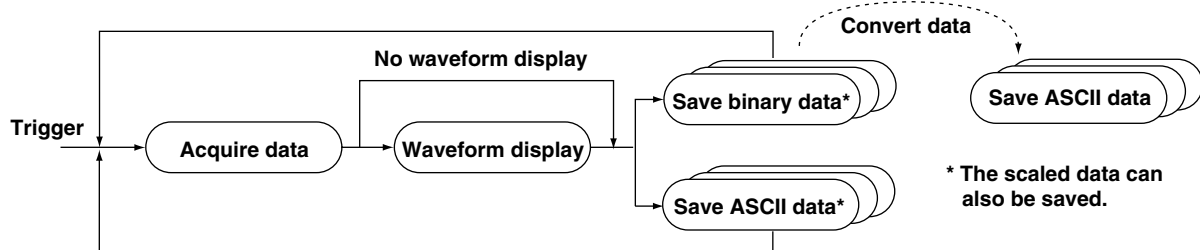
## Scaling the Measured Data

Set the measured values at any two points (VP1 and VP2) and their corresponding physical values (SP1 and SP2). The values at these four points define the scale conversion equation ($Y=ax+b$). The measured values are converted to physical values according to this equation, and the waveform display and saving operations are carried out.
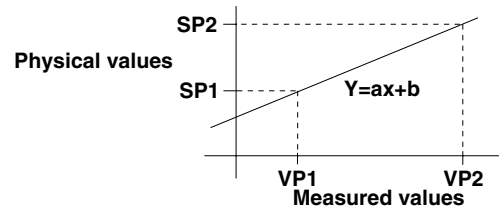


This scaling function is the same function as when [Ax+B] or [P1-P2] is selected for linear scaling (see page 3-8). Since the two functions are linked, changing either one changes the other as well.

# 1.6 Synchronizing to Other Modules Using the Bus Trigger/Time Base Signal

### Input/Output of Bus Trigger Signals

The 4-CH, 100 kS/s Strain Module WE7245 can output bus trigger signals based on the results of comparing the input signal with the threshold (see 1.4, "Setting the Trigger" for details on how to set the trigger). Because the comparison between the input signal and the threshold is done in sync with the time base signal, the bus trigger signal changes in sync with the time base signal and "True" is output during the time the trigger conditions are satisfied.

**When the trigger conditions are satisfied when the input signal is above the threshold**



* This value is a typical value (not strictly guaranteed).
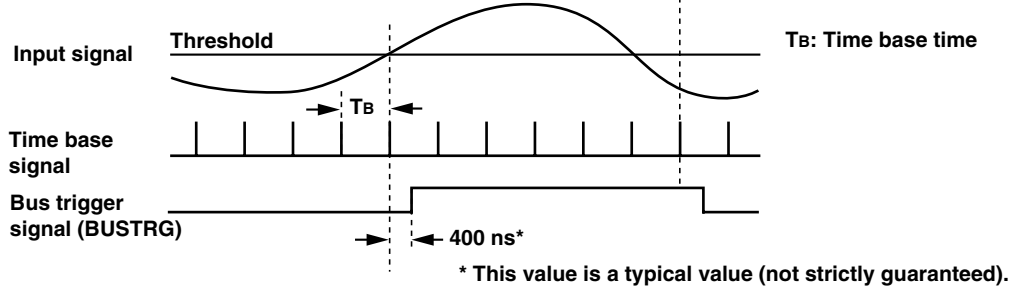
The WE7245 can also acquire data by following the bus trigger signal. If the bus trigger signal becomes "True" between the "False" to "True" edge and the "True" to "False" edge of the time base signal, then the trigger is considered to have been satisfied by the data sampled with the time base signal. Note the following when making multiple acquisitions in the trigger mode: Because the bus trigger signal is detected on the level of the signal, if the duration in which the bus trigger signal remains "True" is longer than the hold off period, the next acquisition starts after the hold off period.
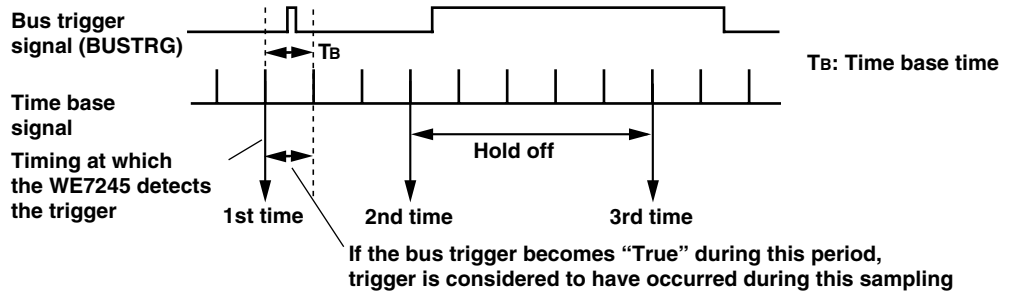


In addition, the WE7245 can output a bus trigger signal upon detecting a trigger within the module, and receive the results of the AND/OR computation on the bus to activate the trigger.

### Input/Output of Time Base Signals

While the data acquisition is in progress, the time base signal generated by the internal clock of the WE7245 can be output to the time base signal bus (CMNCLK) in the measuring station. The time difference between the internal clock and the time base signal (CMNCLK) is approximately 100 ns (Typical*). Conversely, the WE7245 can input and synchronize to the time base signal (CMNCLK) on the bus in order to sample the input signal. If the period of the time base signal is shorter than the range setting of the sampling interval (see section 1.2, "Setting the Conditions for Acquiring the Waveform"), the time base signal is sometimes ignored and the sampling does not occur. The delay from the time the time base signal enters the WE7245 to the time the sampling starts is approximately 80 ns (typical value*).

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

### Controlling the Timing of the Start of the Measurement (Arming)

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

# 1.7  Names and Function of Sections

**Front Panel**

**Sampling indicator**
Turns ON when the input
signal is sampled.

**Input connector**
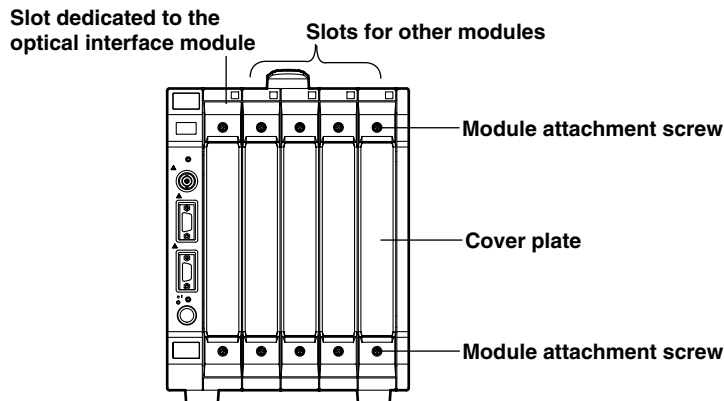4-channel D-Sub input
connector is provided.
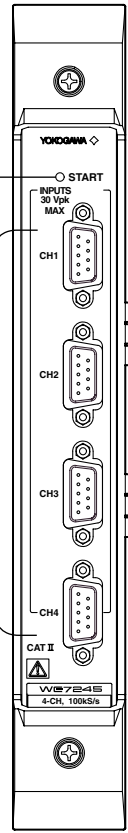
# 2.1   Installing the Module into the Measuring Station

**2**

### Preparing to Install the Module

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

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

**Slot dedicated to the optical interface module**

**Slots for other modules**

**Module attachment screw**

**Cover plate**

**Module attachment screw**

### Installing the Strain Module

⚠

## WARNING

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

⚠

## CAUTION

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

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

To remove the module, loosen the module attachment screws and pull the ejection lever from the inside to the outside. This will force the module out of the slot.

<There is an illustration on the next page.>

**When removing the module**

**Ejection lever**

**Module attachment screw**

**Module attachment screw**
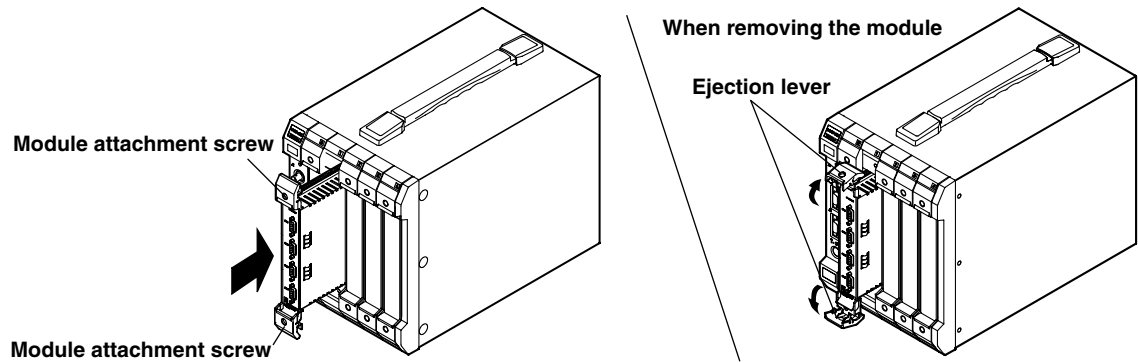
*Note*

When synchronizing multiple strain modules for measurement (module linking), install the multiple strain modules in adjacent slots.

# 2.2 Connecting the Bridge Head

A strain gauge bridge (bridge head) or a strain gauge transducer is connected to the strain module.

This section will mainly describe the procedures and precautions related to the connection of the bridge head (Model 700967 or 700968) that is sold separately. For the connection of other strain gauge bridges or strain gauge type converters, see the respective manuals.

⚠️

### CAUTION

Applying a voltage that exceeds the values indicated below to the strain module may damage the input section.
Maximum input voltage (between input terminals)
$\pm 30$ V (DC+ACpeak)
Maximum allowable common mode voltage (between each terminal and earth ground)
42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)

## Connecting the Strain Gauge

The bridge head 700967 or 700968 supports six types of connection methods: single-gauge method, single-gauge three-wire method, adjacent-side two-gauge method, opposite-side two-gauge method, opposite-side two-gauge three-wire method, and four-gauge method. For details, see the manual (IM700968-01U) that came with the bridge head 700967 or 700968.

If you are using a strain gauge bridge or a strain gauge transducer other than the bridge head 700967 or 700968, see the respective manuals.

### Connecting the shunt resistance

The strain module has a shunt calibration function. Use 700967/700968 for the bridge head. For the connection procedure, see the User's Manual (IM700968-01U) that is provided with the bridge head. For the shunt calibration procedure, see section 3.3, "Setting the Linear Scaling." If you are using a different bridge, see the respective manual.
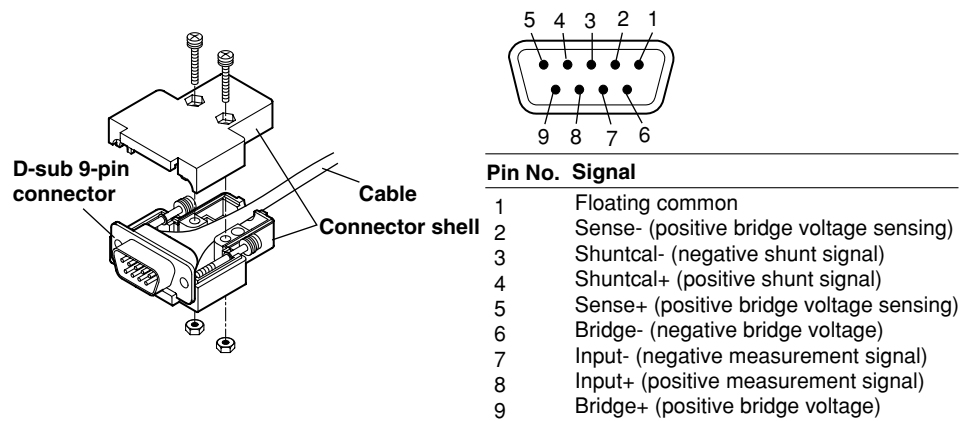
## Connecting the Strain Module and the Bridge Head

### When using the bridge head 700967 or 700968

Using the cable that came with the bridge head 700967 or 700968, connect the strain module and the bridge head.
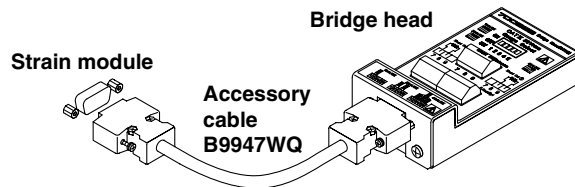


### When using the D-Sub connector that came with the package

You can create your own cable by using the D-Sub 9-pin connector that came with the package and use the cable to connect a strain gauge bridge or a strain gauge transducer to the strain module.



| Pin No. | Signal |
|---------|--------|
| 1 | Floating common |
| 2 | Sense- (positive bridge voltage sensing) |
| 3 | Shuntcal- (negative shunt signal) |
| 4 | Shuntcal+ (positive shunt signal) |
| 5 | Sense+ (positive bridge voltage sensing) |
| 6 | Bridge- (negative bridge voltage) |
| 7 | Input- (negative measurement signal) |
| 8 | Input+ (positive measurement signal) |
| 9 | Bridge+ (positive bridge voltage) |

*Note*

To suppress electromagnetic disturbanve, attach the accessory clamp filters on the connecting cables near the input connectors of the WE7245 module.

## Connection When Measuring the Voltage

You can create your own cable by using the D-Sub 9-pin connector that came with the package and use the cable to input a voltage to the strain module for making measurements. Refer to the pin arrangements in the above figure and connect the number 8 and number 2 pin to the cable. The number 8 pin will be the positive side. When using a shielded cable, connect the shield to the number 1 pin. Be aware that the pin to which the measurement signal is to be applied is different for strain measurement and voltage measurement.

*Note*

- When creating your own cable, we recommend that you use a shielded cable in order to shut out external noise.
- When creating a cable, make sure to use the D-Sub 9-pin connector and the connector shell that came with the package. Otherwise, the connector may not fit properly.
- For strain measurements, we recommend you use YOKOGAWA's bridge head 700967 or 700968 and the dedicated cable (5 m) that came with it.

## ⚠ CAUTION

Take extra care when wiring the connectors. If the wiring is shorted or erroneous, it can damage this instrument or other instruments that are connected to this instrument.

# 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 |
|---|---|---|
| Module does not operate. | Check to see that the module is installed correctly into the station. Also, install the module into another slot, and check whether it will operate there. If it operates in the other slot, the measuring station is likely to have malfunctioned. If the module is installed correctly and does not operate, the connector might be bad or the IC may have malfunctioned. In either case, contact your nearest YOKOGAWA dealer to have it repaired. | 2-1, * |
| Waveform data cannot be acquired. | Check to see that the cable wires are connected properly to the input connector. | 2-3, 2-4 |
| Noise enters the input signal. | If the signal line and the AC power supply line are close to each other, move them apart. | - |
| Balancing cannot be achieved. | Check to see that the bridge head or strain gauge is connected properly. | 2-3, 2-4 |
| 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. | 4-4 |
| | Check that the output impedance of the signal source is less than the allowable signal resistance. | 4-1 |
| | If you created your own cable using the connector that came with the package, check the wiring once again. The pin to which the measurement signal is to be applied is different for strain measurement and voltage measurement. | 2-4 |
| | Check to see that the bridge voltage that matches the bridge resistance is selected. When using a bridge resistance of 120 $\Omega$, set the bridge voltage to 2 V. | 1-4 |
| Triggering does not work. | Check whether the trigger setting is adequate for the input source in the trigger operation panel. | 1-2, 1-11 |
| | If you are using the bus trigger signal, verify that the settings are correct in the trigger source/time base/arming setting dialog box of the WE7000 Control Software. | * |
| The waveform monitor does not appear. | Check to see that the [Waveform monitor ON/OFF] button, located to the right of the [Start] button of the operation, is not set to OFF. | 1-2 |

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

**3**

**Troubleshooting and Maintenance**

# 3.2 Self Test

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

## Executing Self Test

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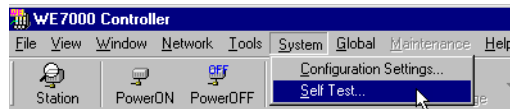
    

2.  In the [Self Test] dialog box that appears, select the station name and enter the slot number corresponding to the module, and click the [Execute] button.
    "Executing..." is displayed in the [Result] display box.
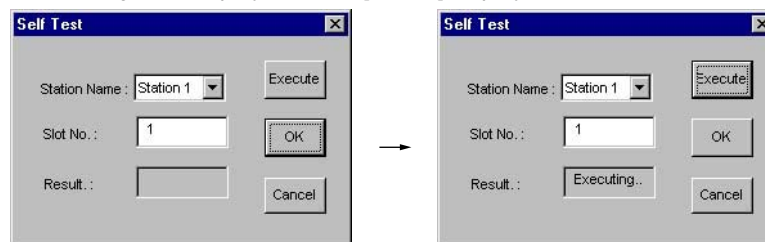
    

## Verifying Test Results

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

# 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 Input Channels**

4

**Input Format**

Isolated differential input (strain measurement), isolated unbalanced input (voltage measurement), isolation between channels and between the input and ground (strain and voltage measurement)

**Frequency Bandwidth**

DC to 20 kHz

**A/D Resolution**

15 bits (includes the sign)

**Maximum Sampling Rate**

100 kS/s

**Allowable Signal Resistance**

1 k$\Omega$ or less

**Input Filter**

Low-pass filter, filter can be turned ON/OFF

Cut-off frequency: 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, OFF (20 kHz) (Typical value*)

Cut-off characteristics: –18 dB/octave

**Input Terminal**

D-sub 9-pin connector (female)

**Strain Measurement**

**Measurement range/Accuracy (Ambient temperature: 23$\pm$5$°$C Ambient humidity: 50$\pm$10%RH, after the warm-up time has passed, filter is 10Hz, after balancing, measurement range is for when the gauge factor is 2)**

When the measurement range unit is set to $\mu$STR

| Setting | Measurable Range |
|---|---|
| $1000\times10^{-6}$ strain | $\pm1000\times10^{-6}$ strain |
| $2000\times10^{-6}$ strain | $\pm2000\times10^{-6}$ strain |
| $5000\times10^{-6}$ strain | $\pm5000\times10^{-6}$ strain |
| $10000\times10^{-6}$ strain | $\pm10000\times10^{-6}$ strain |
| $20000\times10^{-6}$ strain | $\pm20000\times10^{-6}$ strain |

When the measurement range unit is set to mV/V

| Setting | Measurable Range |
|---|---|
| 0.5 mV/V | $\pm$0.5 mV/V |
| 1 mV/V | $\pm$1 mV/V |
| 2 mV/V | $\pm$2 mV/V |
| 5 mV/V | $\pm$5 mV/V |
| 10 mV/V | $\pm$10 mV/V |

The accuracy varies depending on the selected bridge voltage as shown below.

| Accuracy | Temperature Coefficient | Notes |
|---|---|---|
| $\pm$(0.25% of rdg +18 $\times 10^{-6}$ strain) | $\pm$(120 ppm of rdg +2.4 $\times 10^{-6}$ strain)/$°$C | When the bridge voltage is 2 V |
| $\pm$(0.25% of rdg +36 $\times 10^{-6}$ strain) | $\pm$(120 ppm of rdg +3.6 $\times 10^{-6}$ strain)/$°$C | When the bridge voltage is 5 V |
| $\pm$(0.25% of rdg +84 $\times 10^{-6}$ strain) | $\pm$(120 ppm of rdg +8.4 $\times 10^{-6}$ strain)/$°$C | When the bridge voltage is 10 V |

**Applicable Gauge Resistance**

120 to 1000 $\Omega$ (bridge voltage 2 V)

350 to 1000 $\Omega$ (bridge voltage 5 or 10 V)

**Gauge Factor**

2 (scaling possible)

### Bridge Voltage

2, 5, and 10 V (Output current of 35 mA or less, typical value)

### Balancing Method

Electronic auto balance

Balance range:  ±10000 µstrain (Typical value*)

Balance mode:  All channels at once

### Shunt Calibration

Built-in relay contact for shunt calibration

### Voltage Measurement

**Measurement range/Accuracy (Ambient temperature: 23±5°C, Ambient humidity: 50±10%RH, after the warm-up time has passed, filter is 10Hz)**

| Setting | Measurable Range | Accuracy | Temperature Coeffecient |
|---|---|---|---|
| 100 mV | ±100 mV | ±(0.06% of rdg + 0.4 mV) | ±(60 ppm of rdg + 48 µV)/°C |
| 200 mV | ±200 mV | ±(0.06% of rdg + 0.4 mV) | ±(60 ppm of rdg + 48 µV)/°C |
| 500 mV | ±500 mV | ±(0.06% of rdg + 0.4 mV) | ±(60 ppm of rdg + 48 µV)/°C |
| 1 V | ±1 V | ±(0.06% of rdg + 0.4 mV) | ±(60 ppm of rdg + 48 µV)/°C |
| 2 V | ±2 V | ±(0.06% of rdg + 0.6 mV) | ±(60 ppm of rdg + 48 µV)/°C |
| 5 V | ±5 V | ±(0.06% of rdg + 4 mV) | ±(60 ppm of rdg + 0.36 mV)/°C |
| 10 V | ±10 V | ±(0.06% of rdg + 4 mV) | ±(60 ppm of rdg + 0.36 mV)/°C |
| 20 V | ±20 V | ±(0.06% of rdg + 6 mV) | ±(60 ppm of rdg + 0.36 mV)/°C |

### Acquisition Method

Trigger, free run, gate (level), gate (edge)

### Memory Length of Acquisition Memory

4 Mwords

### Memory Partition (Partition Possible Only When Trigger Mode Is Selected)

Select from 1/2/4/8/16/32/64/128/256 partitions

### Maximum Record Length

1 MWord/CH (when using 3CH/4CH), 2 MWords/CH (when using 2CH), and 4 MWords/CH (when using 1CH)

### Time Base Source

Module's internal clock or the time base signal (CMNCLK) of the measuring station (WE bus)

### Trigger Source

Input signal (AND/OR between channels is possible) or the bus trigger (BUSTRG1/BUSTRG1) signal of the measuring station

### Trigger Level

**Resolution**

When measuring the strain:   100 µSTR at ±20000 µSTR/±10000 µSTR range, 10 µSTR at ±5000 µSTR/±2000 µSTR/±1000 µSTR range
100 µV/V at ±10 mV range, 10 µV/V at ±5 mV/V/±2.5 mV/V/±1 mV/V range, 1 µV/V at ±0.5 mV range

When measuring the voltage: 1 mV at ±100 mV/±200 mV/±500 mV range, 10 mV at ±1 V/±2 V/±5 V range, 100 mV at ±10 V/±20 V range

**Hysteresis width**

3% of (upper limit of range - lower limit of range) (Typical value*)

**Setting Accuracy**

3% of (upper limit of range - lower limit of range) (Typical value*)

### Pre-trigger Amount

Set in the range from 0 to (the record length - 2)

---

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

---

# 4.2 Default Values (Factory Default Settings)

On (measurement ON/OFF): On (CH1 to CH4)
Range Unit (measurement range unit): μSTR
Range (measurement range): 20000 μSTR
Excitation (bridge voltage): 2 V
Gauge Factor: 2.000
Filter (input filter): Off
Acquisition Mode (acquisition method): Triggered
Sampling Interval: 0.000010 s
Memory Partition: 1
Record Length: 1000
No. of Acquisitions: 1
Trig Type: Rise (CH1), Off (CH2 to CH4)
Trig High (trigger level): 0 V
Linear Scaling: Off
Trig Source: Internal
Trig Combination: OR
Pretrigger: 0 samples
Hold Off: 1000 samples
Time Base: Internal
CH Mode (Number of measurement channels): 4CH
Overlapped Acquisition: Off
Repeat (repetitive measurement): On

**4**

Specifications

# 4.3 General Specifications

**Safety Standard**

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

**EMC standards**

**Emission**

Complying standard

EN55011 Group 1 Class A

This product is a Class A (for 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

EN50082-2

Influence in the immunity environment

Noise increase: $\leq\pm20000$ $\mu$STR when in strain measurement mode

$\leq\pm1\%$ of FULL SPAN (measurement range) when in voltage measurement mode

Testing condition

When in strain measurement mode: 10 $\mu$s, input 5 m accessory cable with the bridge head 700968.

When in voltage measurement mode: 10 $\mu$s, input 5 m accessory cable.

**Warm-up Time**

At least 30 minutes

**Maximum Allowable Input Voltage**

$\pm30$ V (DC+ACpeak)

**Maximum Floating Voltage**

30 VACrms, 42.4 Vpeak or 60 VDC (Overvoltage Category: CAT I and II)

Between the common terminal of each channel and the case and between input channels for all voltages above.

**Common Mode Rejection Ratio**

Signal source resistance of 1 k$\Omega$ or less between the input terminal and the case at 50/60 Hz.

Strain measurement range:  80 dB or greater (converted to voltage when the bridge voltage is 2 V and the gauge factor is 2)

Voltage range: 65 dB or greater

**Operating Conditions**

Same as those of the measuring station

**Storage Conditions**

Temperature: –20 to 60°C

Humidity: 20 to 80%RH (no condensation)

**Power Consumption**

15 VA (typical value[*2] at 100 V/50 Hz)

**Weight**

Approx. 1 kg

**External Dimensions**

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

**Number of Used Slots**

1

## Standard Accessories

D-Sub 9-pin connector (male) (4)

Clamp filter (4)

User's Manual (this manual) (1)

## Spare Parts

A1520JD/A1618JD bridge head, D-Sub 9-pin connector (male) for connecting the strain gauge

A1190MN Clamp filter

## Related Accessories

700967    Dedicated bridge head (Bridge resistance 120 $\Omega$, with a dedicated cable (5 m))

700968    Dedicated bridge head (Bridge resistance 350 $\Omega$, with a dedicated cable (5 m))

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

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

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

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

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

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

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

**4**

Specifications

# 4.4  Dimensional Drawings

**4-CH, 100 kS/s Strain Module (WE7245)**
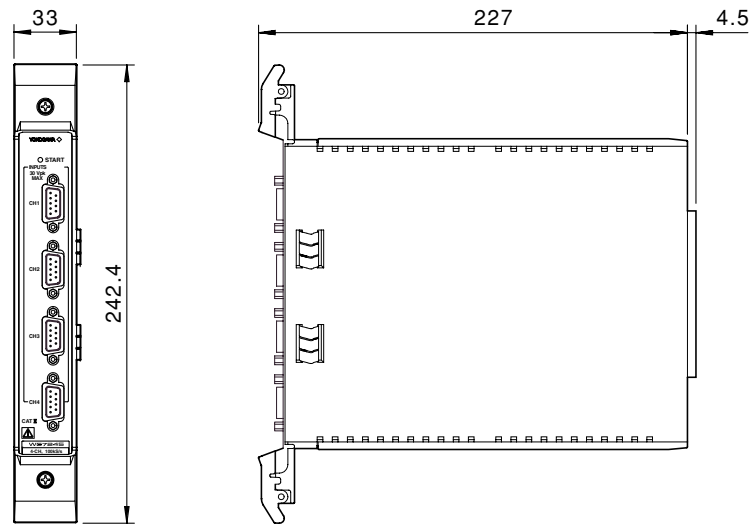


If not specified, the tolerance is ±3%.  However, in cases of less than 10 mm, the tolerance is ±0.3 mm.

# Index