

TA720
Time Interval Analyzer
USER'S MANUAL

Product Registration

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Thank you for purchasing the YOKOGAWA TA720 Time Interval Analyzer.
This User's Manual contains useful information about the precautions, functions, and operating procedure of the instrument. 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.

The following manual is also provided in addition to this manual. Read them along with this manual.

| Manual Title | Manual No. | Description |
|---|---------------|---|
| TA720 Communication Interface User's Manual | IM 704510-17E | Describes the communication functions of the communication interface. |

Notes

- 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. The figures given in this manual may differ from the actual screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.
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- The TCP/IP software of this product and the document concerning the TCP/IP software have been developed/created by YOKOGAWA based on the BSD Networking Software, Release 1 that has been licensed from California University.

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Revisions

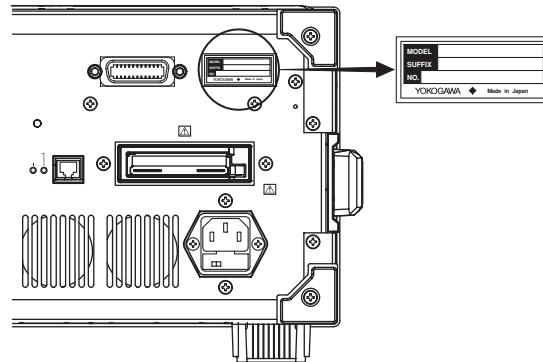
- 1st Edition September 2002

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.

TA720

Check that the model name and suffix code given on the name plate on the rear panel match those on the order.



MODEL

704510

SUFFIX

| | SUFFIX | Description |
|------------|--------|---|
| Power cord | -D | UL/CSA Standards Power Cord (Part No.: A1006WD) [Maximum Rated Voltage: 125 V, Maximum Rated Current: 7 A] |
| | -F | VDE Standard Power Cord (Part No.: A1009WD) [Maximum Rated Voltage: 250 V, Maximum Rated Current: 10 A] |
| | -Q | BS Standard Power Cord (Part No.: A1054WD) [Maximum Rated Voltage: 250 V, Maximum Rated Current: 10 A] |
| | -R | SA Standard Power Cord (Part No.: A1024WD) [Maximum Rated Voltage: 240 V, Maximum Rated Current: 10 A] |
| Options | /C10 | Ethernet + PC card drive |
| | /E3 | FET probe (700939), 2 probes |

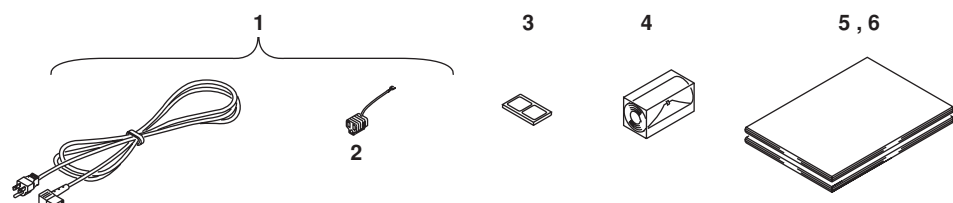
NO. (Instrument Number)

When contacting the dealer from which you purchased the instrument, please give them the instrument number.

Standard Accessories

The standard accessories below are supplied with the instrument.

| Part Name | Model/Part Number | Q'ty | Description |
|-----------------------|-------------------|------|---|
| 1. Power cord | A1006WD | 1 | See SUFFIX above. |
| 2. Rubber feet | A9088ZM | 2 | Two rubber feet in one set |
| 3. Printer roll paper | B9850NX | 1 | Thermalsensible paper, total length of 30 m |
| 4. User's Manual | IM 704510-01E | 1 | User's manual (this manual) |
| 5. User's Manual | IM 704510-17E | 1 | Communication interface user's manual |
| 6. Power fuse | A1351EF | 1 | A spare, attached to the fuse holder |



Optional Accessories (Sold Separately)

The following optional accessories are sold separately.

For information and ordering, contact your nearest YOKOGAWA dealer.

| Part Name | Model/Part Number | Minimum Q'ty | Description |
|------------------|--------------------------|---------------------|----------------------------|
| BNC cable | 366924 | 1 | BNC-BNC, length: 1 m |
| BNC cable | 366925 | 1 | BNC-BNC, length: 2 m |
| Rubber feet | A9088ZM | 2 | Two rubber feet in one set |
| Rack mount kit | 751535-E4 | 1 | For EIA |
| Rack mount kit | 751535-J4 | 1 | For JIS |

Spare Parts (Sold Separately)

The spare parts below are available for purchase separately.

| Part Name | Model/Part Number | Minimum Q'ty | Description |
|--------------------|--------------------------|---------------------|---|
| Printer roll paper | B9850NX | 5 | Thermalsensible paper, total length of 30 m |
| Power fuse | A1351EF | 2 | 250 V, 3.15 A |

Safety Precautions

This instrument is an IEC safety class I instrument (provided with terminal for protective earth grounding).

The general safety precautions described herein must be observed during all phases of operation. If the instrument is used in a manner not specified in this manual, the protection provided by the instrument may be impaired. Yokogawa Electric Corporation assumes no liability for the customer's failure to comply with these requirements.

The following symbols are used on this instrument.



“Handle with care.” To avoid injury, death, or damage to the instrument, the operator must refer to the explanation in the User's Manual or Service Manual.



Alternating current



ON (power)



OFF (power)



ON (power) state



OFF (power) state

Make sure to comply with the precautions below. Not complying might result in injury or death.

WARNING

- **Power Supply**
Before connecting the power cord, ensure that the source voltage matches the rated supply voltage of the instrument and that it is within the maximum rated voltage of the provided power cord.
 - **Power Cord and Plug**
To prevent the possibility of electric shock or fire, be sure to use the power cord supplied by YOKOGAWA. The main power plug must be plugged into an outlet with a protective earth terminal. Do not invalidate this protection by using an extension cord without protective earth grounding.
 - **Protective Grounding**
Make sure to connect the protective earth to prevent electric shock before turning ON the power. The power cord that comes with the instrument is a three-pin type power cord. Connect the power cord to a properly grounded three-pin outlet.
 - **Necessity of Protective Grounding**
Never cut off the internal or external protective earth wire or disconnect the wiring of the protective earth terminal. Doing so poses a potential shock hazard.
 - **Defect of Protective Grounding**
Do not operate the instrument if the protective earth or fuse might be defective. Make sure to check them before operation.
 - **Fuse**
To avoid the possibility of fire, only use a fuse that has a rating (voltage, current, and type) that is specified by the instrument. When replacing a fuse, turn OFF the power switch and unplug the power cord. Never short the fuse holder.
 - **Do Not Operate in an Explosive Atmosphere**
Do not operate the instrument in the presence of flammable liquids or vapors. Operation in such environments constitutes a safety hazard.
 - **Do Not Remove Covers**
The cover should be removed by YOKOGAWA's qualified personnel only. Opening the cover is dangerous, because some areas inside the instrument have high voltages.
 - **External Connection**
Securely connect the protective grounding before connecting to the item under measurement or an external control unit.
-

Structure of the Manual

This user's manual consists of the following sections:

Chapter 1 Names and Functions of Parts

Describes the names of each part of the instrument and its function. For keys, references are given to sections (or pages) in the manual where operating procedures are explained.

Chapter 2 Explanation of Functions

Describes the measurement principles and functions of the instrument. Operating procedures are not given in this chapter. However, reading this chapter will help you understand the operating procedures given in the chapters that follow.

Chapter 3 Before Starting Measurements

Describes handling precautions, how to install the instrument, how to connect the power supply, how to turn ON/OFF the power switch, how to connect cables and probes, and how to set the date and time.

Chapter 4 Common Operations

Describes basic setup procedures, how to start/stop the acquisition of the input signal, and basic operations of the keys and rotary knob.

Chapter 5 Setting the Sampling Mode and Measurement Function

Describes how to set the sampling mode and measurement function.

Chapter 6 Setting Measurement Conditions

Describes how to set measurement conditions such as gates, sampling interval, arming, inhibit, block sampling, input coupling, input impedance, trigger mode, trigger, and reference clock.

Chapter 7 Basic Display Setup

Describes how to configure the displays such as histograms, time variations, lists, and statistics.

Chapter 8 Detailed Display Setup

Describes how to set the single, multi, or auto mode of each window, how to change the scale, and how to read the measurement results using markers.

Chapter 9 Statistical Calculation and Inter-Symbol Interference Analysis

Describes how to set the range and items of statistical calculation and how to use the inter-symbol interference analysis function.

Chapter 10 Storing Setup Information to the Internal Memory and Recalling Setup Information

Describes how to store and recall setup information from the internal memory.

Chapter 11 Saving/Recalling Data and Outputting Screen Images

Describes how to save setup information, measured results, and computed results to a floppy disk, PC card, or network drive, how to recall saved data, how to output screen images, how to delete data, how to format the storage medium, and other operations.

Chapter 12 Ethernet Communications (Option)

Describes how to connect to the network and the setup procedure when connecting to the network.

Chapter 13 Other Functions

Describes how to initialize the settings, how to calibrate the instrument, how to output external signals, how to confirm current conditions, how to set the LCD, and other operations.

Chapter 14 Troubleshooting and Maintenance

Describes the possible causes of problems and their appropriate corrective actions.

Describes the messages that are displayed on the screen. Describes how to log errors, perform self-tests, adjust the time base, carry out performance tests, and replace fuses.

Chapter 15 Specifications

Summarizes the specifications of the instrument in tables.

Index

Gives an index.

Conventions Used in This Manual

Unit

k: Denotes "1000." Example: 680 kHz

K: Denotes "1024." Example: 720 KB (Storage capacity of floppy disks)

Safety Markings

The following markings are used in this manual.



Danger. Refer to corresponding location on the instrument. This symbol appears on dangerous locations on the instrument which require special instructions for proper handling or use. 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 injury or death 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.

Symbol Marks Used for Descriptions of Operations

On pages that describe the operating procedures in chapters 3 through 14, the following symbols are used to distinguish the procedures from their explanations.

Procedure

Describes the keys used during operation and the operating procedures. In some cases, you may not have to follow the steps in the order they are given.

Explanation

Describes the details of the settings and the restrictions that exist with the operating procedure. A detailed description of the function is not provided in this section. See chapter 2 for a detailed description of the functions.

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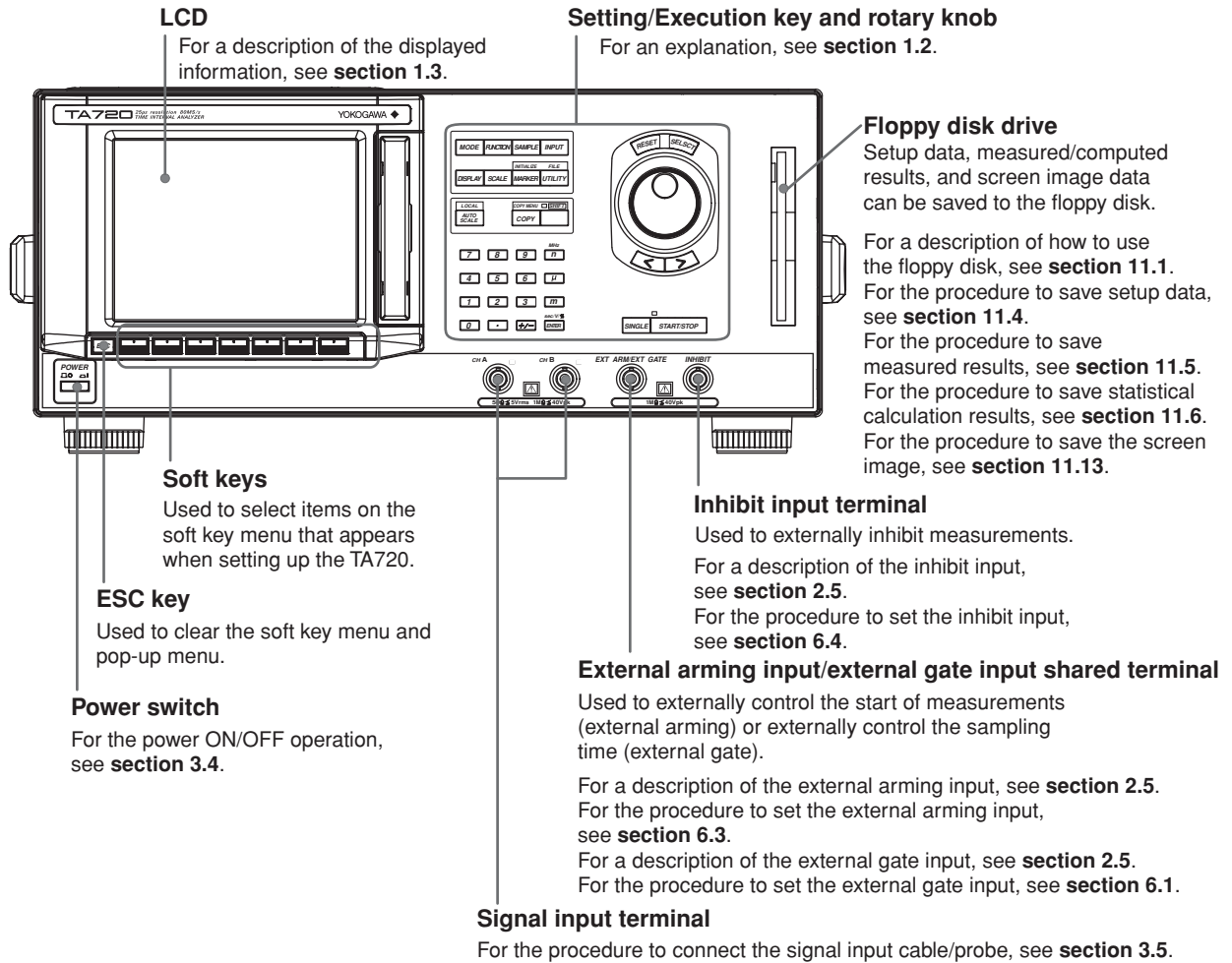
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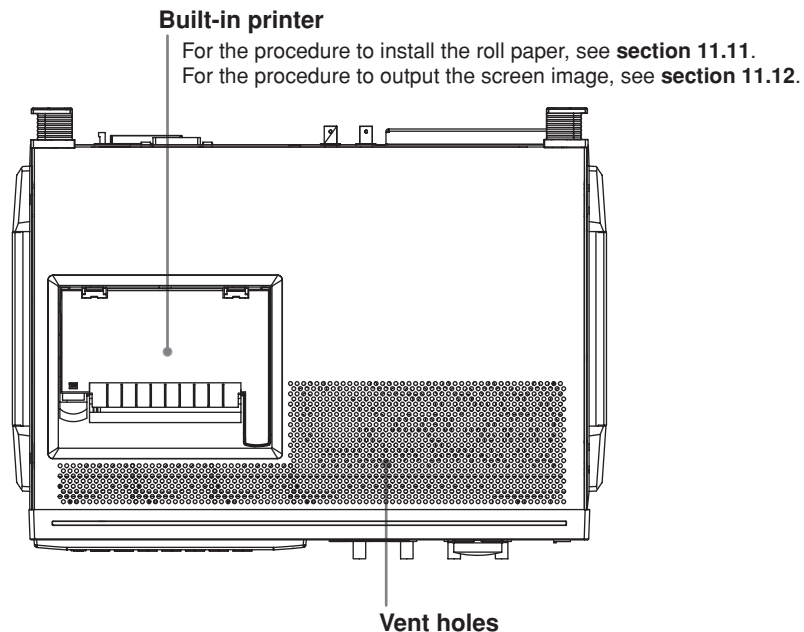
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1.1 Front Panel and Rear Panel

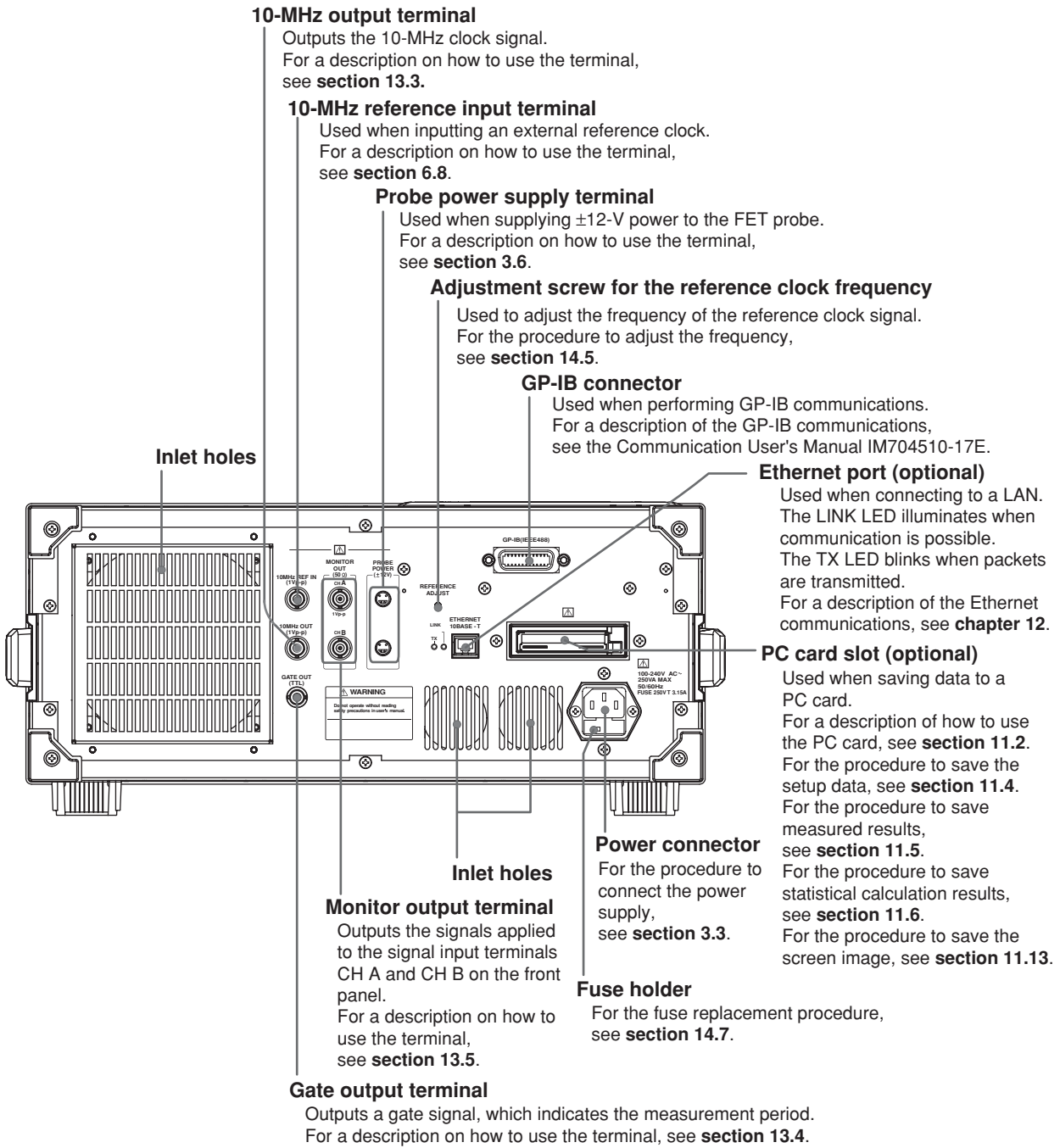
Front Panel



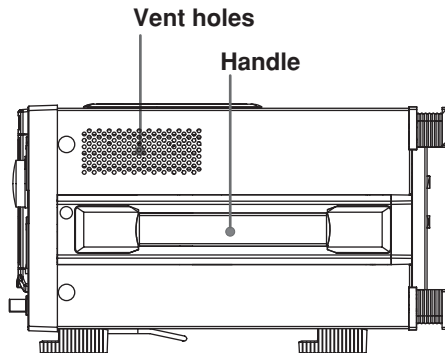
Top Panel



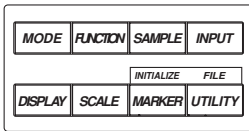
Rear Panel



Right Side Panel



1.2 Setting/Execution Key and Rotary Knob



MODE Key (Section 5.1)

Shows a menu used to set the sampling mode.

FUNCTION Key (Sections 5.2 to 5.8)

Shows a menu used to select the measurement function and the measurement conditions for each measurement function.

SAMPLE Key (Sections 6.1 to 6.5 and 6.8)

Shows a menu used to set the gate, block sampling, arming, inhibit, and reference clock.

INPUT Key (Sections 6.6 and 6.7)

Shows a menu used to set the input coupling, input impedance, and trigger mode.

DISPLAY Key (Sections 7.1 to 7.4, 8.1 to 8.3, and 8.6)

Shows a menu used to set the display format, statistical computation items, window, and inter-symbol interference analysis.

SCALE Key (Section 8.4)

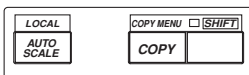
Shows a menu used to set manual scaling.

MARKER(INITIALIZE) Key (Sections 8.5 and 13.1)

Shows a menu used to set markers that are used to retrieve measured results. Pressing the SHIFT key followed by this key shows a menu used to initialize the settings.

UTILITY(FILE) Key (Sections 3.7, chapter 10, sections 11.3 to 11.10, 12.2 to 12.5, 13.2, 13.6, 13.7, 14.3, and 14.4)

Shows a menu used to set communication parameters, setup data store/recall, self test, calibration, and other items. Pressing the SHIFT key followed by this key shows a menu related to the storing or recalling of the setup data, measured results, and statistical computation result and other items.



AUTO SCALE(LOCAL) Key (Section 8.4)

Executes auto scaling. Pressing the SHIFT key followed by this key clears the remote mode using the communication interface.

COPY(COPY MENU) Key (Sections 11.12 and 11.13)

Outputs the screen image data to the built-in printer or a storage medium. Pressing the SHIFT key followed by this key shows a setup menu related to the output of the screen image data.

SHIFT Key

Pressing this key once causes the LED to the left of the SHIFT marking to illuminate. Then, pressing the MARKER (INITIALIZE) key, UTILITY (FILE), AUTO SCALE (LOCAL) key, or COPY (COPY MENU) key enables the function indicated in the parentheses of each key.



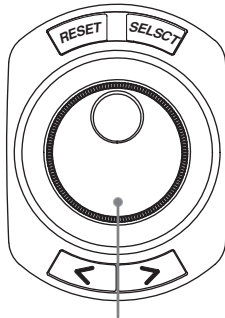
SINGLE Key (Section 4.2)

Makes a single measurement.

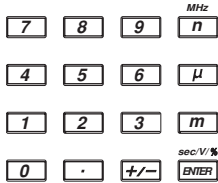
START/STOP Key (Section 4.2)

Pressing the key once starts repetitive measurements. Pressing the key again stops the measurement. The measurement indicator (LED above the START/STOP key) illuminates while measurement is in progress.

1.2 Setting/Execution Key and Rotary Knob



Rotary Knob



Rotary Knob (Section 4.3 and 4.4)

Used to set a value, move the cursor, select files, and etc. The rotary knob can be used when a “☉” or “☽” mark is shown on the menu (the numeric keys can also be used).

SELECT Key (Section 4.3 and 4.4)

Used to set the item that is selected using the rotary knob and for other purposes.

RESET Key (Section 4.3 and 4.4)

This key is pressed when setting a value entered through the numeric keys and when confirming the value.

<> Key

Used to move along the digits when setting a value and for other purposes.

Numeric Keys (Sections 4.3 and 4.4)

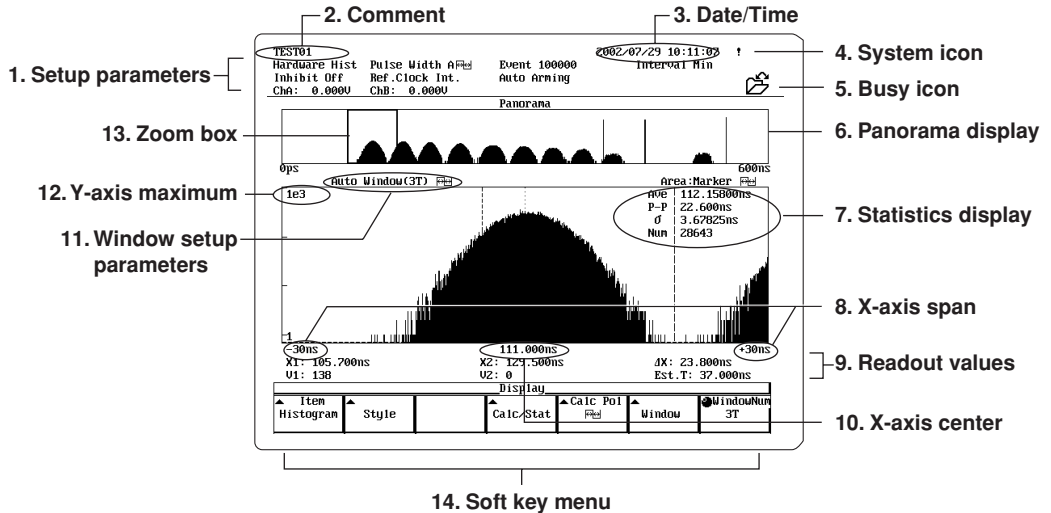
Used when entering values. Press the “0” to “9”, and “.” keys to enter the value and decimal point (as necessary), and press the “ENTER” key to set the value. To set prefix symbols n, μ, or m or units MHz, sec, V, and % when entering a value, press the key with the corresponding marking. If a sign is required, press the +/- key.

Note

To enter the MHz unit, the SHIFT key must be pressed first.

1.3 Display

Histogram Display in Hardware Histogram Mode (For a description of the histogram display, see page 2-13)



1. Setup parameters

Shows the sampling mode, measurement function, gate, sampling interval, inhibit, reference clock, arming, trigger level, and other parameters of the measured result.


2. Comment


Shows the comment that is added to the screen image when the image is printed such as on the built-in printer. For the procedure for entering the comment, see section 11.13, "Saving the Screen Image."

3. Date/Time (For the setup procedure, see section 3.7, "Setting the Date and Time")

4. System icon


Appears when there is a message or when the system is faulty.


 : Appears when there is an error message or a warning message. For the procedure for displaying the error message, see section 14.3, "Displaying the Error Log."


 : Appears when the lithium battery is flat or the system is faulty. Perform the self-test when this icon appears. For the procedure for executing the self test, see section 14.4, "Self Test."


5. Busy icon


Appears during the following operations.

 : Blinks when any of the floppy disk, PC card, or network drive is being accessed. For the procedure for saving and recalling the data, see chapter 11, "Saving and Recalling Data and Outputting the Screen Image."

 : Blinks while the screen image is being printed on the built-in printer. For a description of the printer output of the screen image, see section 11.12, "Printer Output of the Screen Image."

 : Blinks while data is being processed such as when performing computation.

 : Illuminates when the communication with an FTP server is established with the TA720 acting as an FTP client. For a description of the FTP client function, see section 12.3, "Setting the Network Drive (FTP Client Function)."

 : Illuminates when the TA720 is connected to the LAN as an FTP server and communication is taking place with an FTP client. For a description of the FTP server function, see section 12.4, "Accessing the PC Card or Floppy Disk (FTP Server Function)."

6. Panorama display

Displays the entire measured data. For a description of the panorama display, see page 2-17; for the procedure for turning ON/OFF the panorama display, see section 7.1, "Setting the Histogram Display."

7. Statistics display

Statistical values can also be displayed along with the histogram display. For a description of the statistical computation, see page 2-21. For the procedure for turning ON/OFF the statistics display, see section 7.1, "Setting the Histogram Display."

8. X-axis span (X span)

It is possible to set the window range (scale) to be displayed. For the procedure for changing the scale values, see section 8.4, "Changing the Scale Values of the Histogram Display and Time Variation Display."

9. Readout values

Shows the readout values of the X1 and X2 markers. For a description of reading the measured results using markers, see page 2-19; for the procedure for reading the values using the cursors, see section 8.5, "Reading the Measured Results Using Markers."

10. X-axis center

It is possible to set the center value of the X-axis of the histogram display. For the procedure for changing the scale values, see section 8.4, "Changing the Scale Values of the Histogram Display and Time Variation Display."

11. Window setup parameters

Shows the window mode, constant T, and the polarity of the measurement function. For the procedure for setting the window, see section 8.1, "Setting the Single Window," 8.2, "Setting the Multi Window," or 8.3, "Setting the Auto Window."

12. Y-axis maximum

It is possible to set this value using the log scale or linear scale. For the procedure for changing the scale values, see section 8.4, "Changing the Scale Values of the Histogram Display and Time Variation Display."

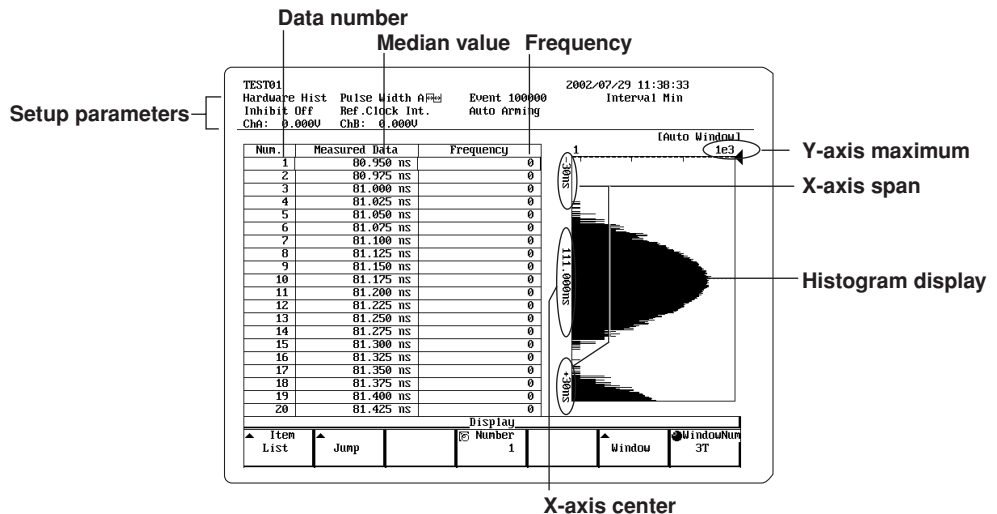
13. Zoom box

The waveform in the zoom box is displayed zoomed in the main window.

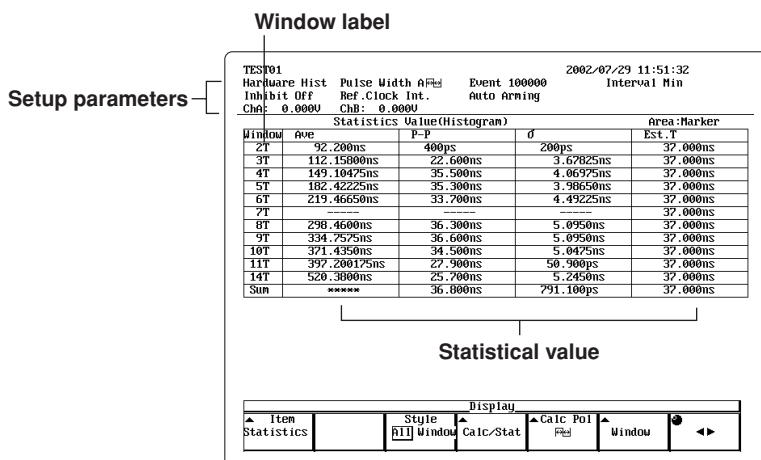
14. Soft key menu

Corresponds to the soft key on the front panel.

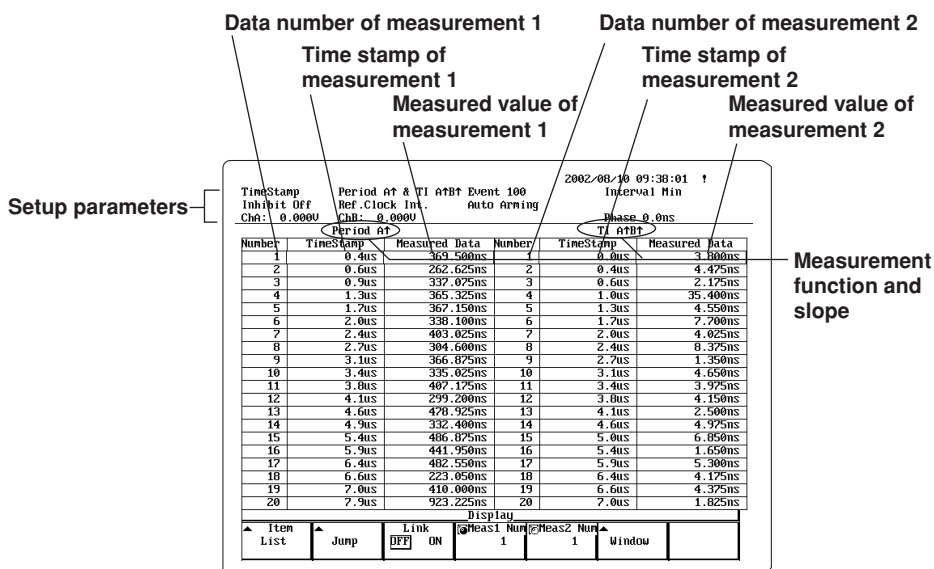
List Display in Hardware Histogram Mode (For a description of the list display, see page 2-14)



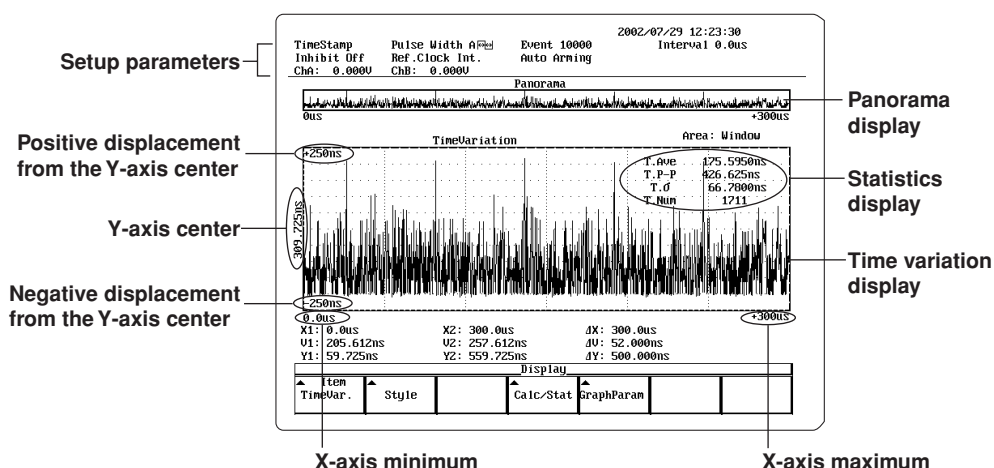
Statistics Display in Hardware Histogram Mode (For a description of the statistics display, see page 2-16)



List Display in Time Stamp Mode (For a description of the list display, see page 2-14)

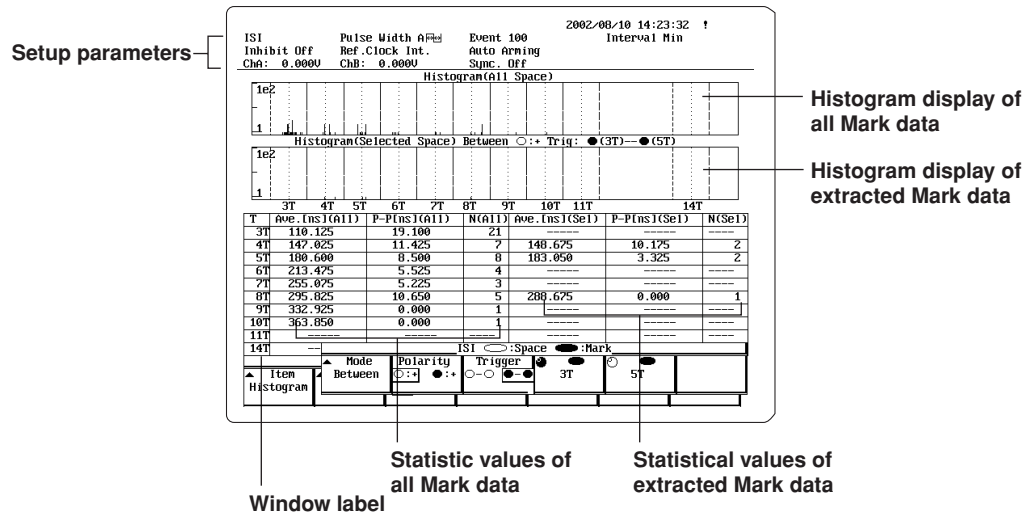


Time Variation Display in Time Stamp Mode (For a description of the time variation display, see page 2-15)



1.3 Display

Histogram Display in Inter-symbol Interference Analysis Mode (For a description of the inter-symbol interference analysis, see page 2-24)



2.1 Functional Differences from the TA520

Sampling Mode (See page 2-4.)

On the TA520, the inter-symbol interference analysis function was a part of the time stamp mode. However, on the TA720, the inter-symbol interference analysis mode is provided separately from the time stamp mode.

Note

On the TA520, inter-symbol interference analysis could be made after making measurements in the time stamp mode. However, on the TA720, switching the mode clears the measured value.

Measurement Function (See page 2-5.)

Dual measurement (period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval*, and pulse width A & pulse width B*) is possible on the TA720.

* Pulse width A→A-to-B time interval in the inter-symbol interference analysis mode

** Pulse width A→pulse width B in the inter-symbol interference analysis mode

Phase Adjustment for A-to-B Time Interval Measurement (See page 2-12.)

The phase of the CH B input signal can be shifted with respect to the CH A input signal in the A-to-B time interval measurement.

Histogram Display in Time Stamp Mode (See page 2-13.)

On the TA520, multi window setting, auto window setting, panorama display, and histogram sum were only possible on the histogram display in hardware histogram mode. These are now possible on the histogram display in time stamp mode.

Symbol Search Function (See page 2-20.)

A specified symbol (1T to 16T) can be searched on the multi window or auto window in the list display of the time stamp mode or inter-symbol interference mode.

“Deviation” or “ σ ” Graph on the Histogram Display (See page 2-14.)

The statistical value “deviation” or “ σ ” can be displayed on a graph in place of a list of statistics of each window when all window display of multi window or auto window is used in hardware histogram mode or time stamp mode.

Missed Sampling Detection Function in Inter-symbol Interference Analysis Mode (See page 2-25.)

A function for detecting dropouts in sampling is provided for measurements in the inter-symbol interference analysis mode.

Sync Function in Inter-symbol Interference Analysis Mode (See page 2-25.)

Analysis can be performed from the searched measured value pattern using the symbol search function.

Ethernet Communications and PC Card Slot (Optional Functions) (See page 2-26.)

It is possible to connect the TA720 to the Ethernet network and save the TA720 data to an FTP server or access the PC card or floppy disk installed in the TA720 from a PC. In addition, the TA720 can be controlled from a PC via the Ethernet interface.

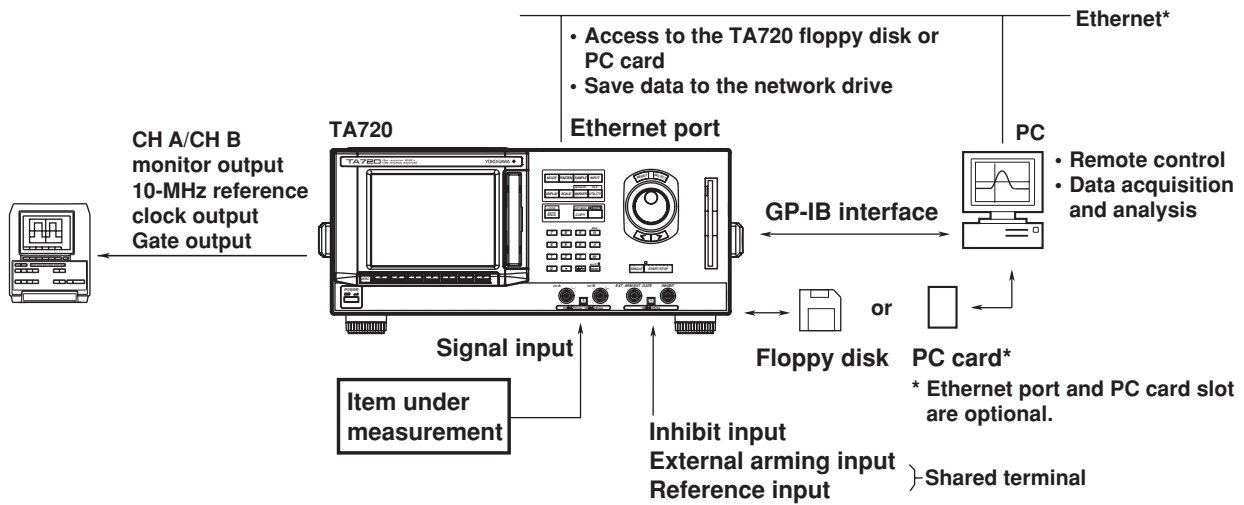
Functions That Have Been Removed

The following functions that were available on the TA520 have been removed.

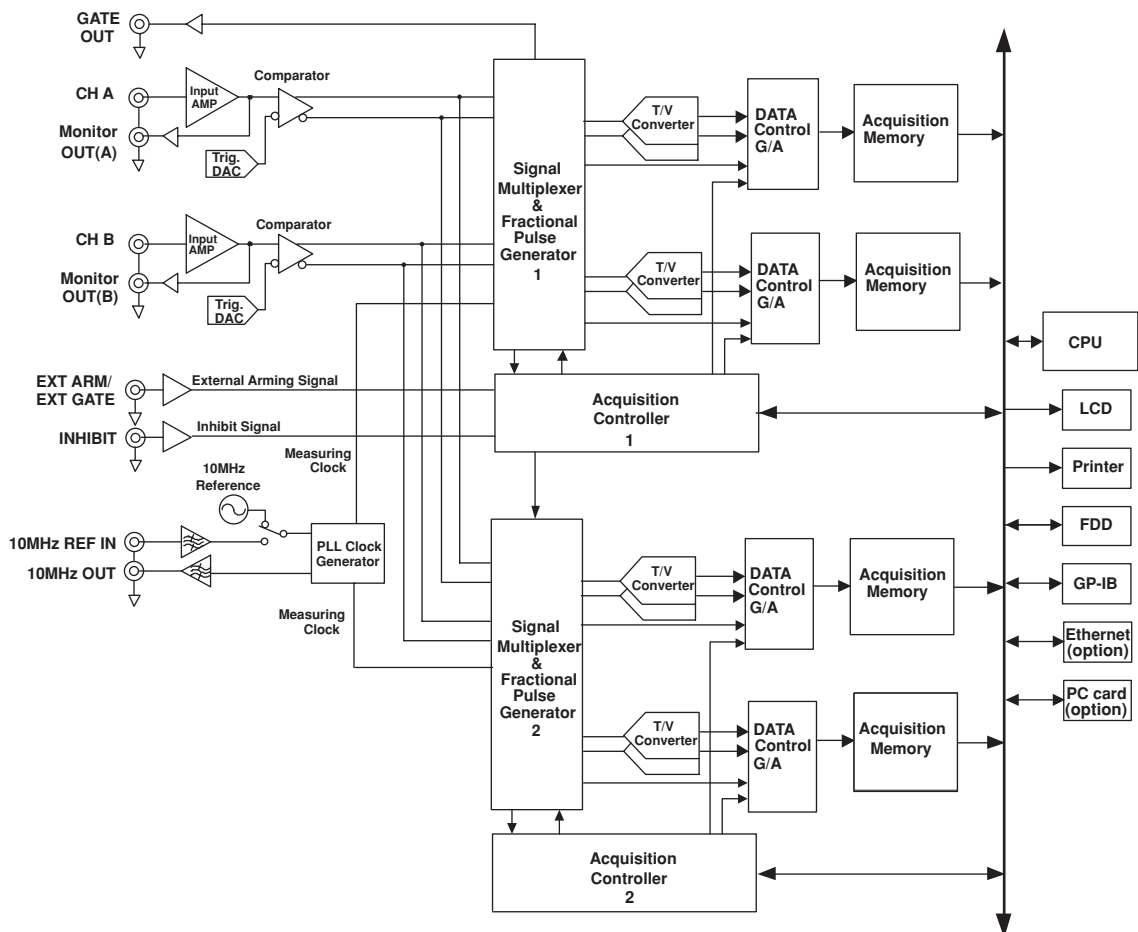
- SCSI interface (option)
- Internal Hard Disk (option)
- Built-in floppy disk format type: 640 KB/1.2 MB

2.2 System Configuration, Block Diagram, and Principles of Pulse Width Measurement

System Configuration



TA720 Block Diagram



Signal flow

A signal that is input to the input terminal (CH A/CH B) is converted to a low-impedance signal by the input amplifier (Input AMP). It is then passed to the comparator where it is converted to a binary signal. The signal from the input amplifier is also output as a monitor signal (Monitor OUT(A)/Monitor OUT(B)).

The binarized signal is selected as a measurement signal according to the measurement function by the signal multiplexer 1 and 2. In addition, the fractional pulse generator 1 and 2 generate fractional parts of the measurement signal with respect to the measurement clock as fractional pulses. The fractional pulses are passed to the time-to-voltage converter (T/V converter). The time of the fractional pulse is measured in 25-ps resolution by the T/V converter, then the fractional pulse time is sent to the data control gate array (G/A) where measurement data is created.

As shown in the diagram, two identical circuits are provided after the signal multiplexer. The data is generated alternately by the two circuit systems. When making dual measurements, each system performs measurements independently. The acquisition controller controls the overall acquisition process. Acquisition controller 1 also controls the external arming signal or inhibit signal.

In the time stamp mode and inter-symbol interference analysis mode, both the measured values and time stamp data (elapsed time) are acquired in the acquisition memory. In the hardware histogram mode, only the frequencies of occurrence of each measured value are acquired in the acquisition memory.

The retrieved data is read by the CPU where it is used as statistical calculation data or displayed on the LCD. In addition, the measured results can be printed on the built-in printer or saved to a floppy disk or PC card (optional).

Either the signal from the internal crystal oscillator (compensated against temperature drift) or an external input reference signal (signal from the REFERENCE IN terminal) can be used as the reference clock. The measurement clock uses the frequency multiples of this reference clock. In either case, the signal passed through a 10-MHz bandpass filter is output externally as a 10-MHz signal (10MHz OUT). The gate output (GATE OUT) terminal outputs binary signals indicating the measurement interval (time over which the signal is being acquired).

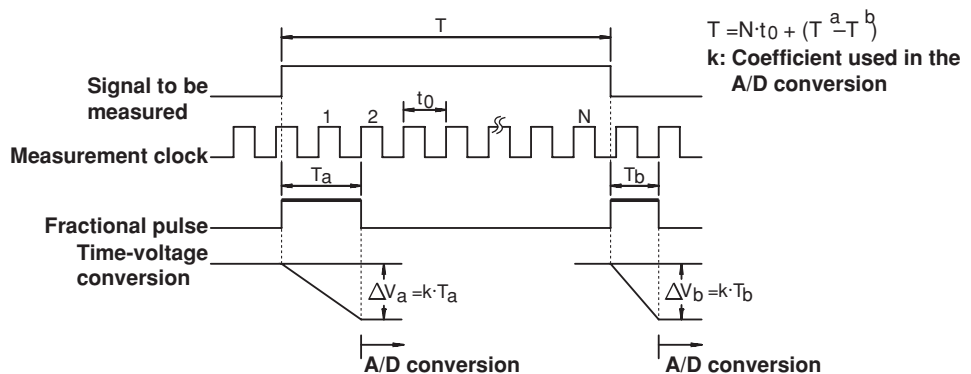
The TA720 can be controlled using a PC via the GP-IB or Ethernet (optional) interface.

Measurement Principle (Pulse Width Measurement Example)

Time shorter than the period of the reference clock is called fractional time. In general, since the signal being measured and the measurement clock are not synchronized, fractional time exists at both the beginning and the end of measurements. This TA720 generates a “fractional pulse” which is a pulse signal amounting to the sum of the fractional time and one cycle of the reference clock. If the pulse width of the signal being measured, the period of the measurement clock, and the times of the fractional pulses are expressed as T , t_0 , T_a , and T_b , respectively, pulse width T can be broken into two terms: integer multiple of the measurement clock, $N \cdot t_0$, and the time of the fractional pulses, T_a , T_b (see the equation below).

$$T = N \cdot t_0 + (T_a - T_b)$$

The TA720 converts the time (T_a , T_b) of the fractional pulse that it generated at the beginning and end of the measurement to voltage values. The voltage values are then converted to digital values using a 7-bit A/D converter, measuring the fractional pulse time at 25-ps time resolution per LSB. Pulse width T is derived by substituting the measured fractional pulse time into T_a and T_b in the above equation.



2.3 Sampling Mode

Sampling Mode (See section 5.1 for the operating procedure)

There are three sampling modes: time stamp mode, hardware histogram mode, and inter-symbol interference analysis mode. The sampling method (data acquisition method), the display format after measurements, and methods of analysis and calculation vary depending on the sampling mode. For details on the display format, see section 2.6 “Displaying the Measured/Calculated Results.”

Time Stamp Mode (TS)

In this mode, the elapsed times of measurement (time stamp*) and measured values are stored in the acquisition memory. Based on the acquired data, the measured and computed results can be displayed in four formats: histogram, list (time stamps and measured values), time variation, and statistics. The maximum number of data points that can be acquired in the memory (maximum sample size) is 1,024,000 (512,000 when using dual measurement function), and the maximum sampling time is 320 s.

* Time stamp refers to the time elapsed from the time arming (see page2-9) is activated to the time the measurement of a sample is completed.

| TimeStamp | Measured Data |
|-----------|---------------|
| 141.0 us | -5.125 ns |
| 141.2 us | 15.250 ns |
| 141.3 us | -1.750 ns |
| 141.4 us | 15.325 ns |

Hardware Histogram Mode (HH)

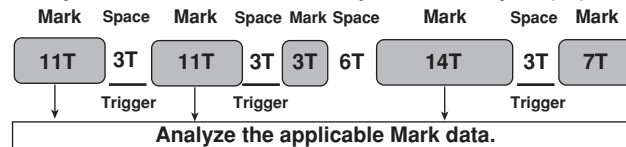
The measured values and the frequencies of occurrence of those values are acquired in the acquisition memory. Based on the acquired data, the measured and computed results can be displayed in three formats: histogram, list (measured values and frequency), and statistics. The maximum sample size is 10⁹, and the maximum sampling time is 3200 s.

| Measured Data | Frequency |
|---------------|-----------|
| -2.450 ns | 10 |
| -2.425 ns | 12 |
| -2.400 ns | 8 |
| -2.375 ns | 13 |
| -2.350 ns | 17 |
| -2.325 ns | 14 |

Inter-symbol Interference Analysis Mode (ISI)

As with the time stamp mode, the time stamps and measured values are stored in the acquisition memory. Based on the acquired data, the data before and after the specified space or mark is extracted, and the measured and computed results are displayed in either of two formats: histogram and statistics or list (time stamps and measured values). The maximum sampling size and maximum sampling time are the same as those for the time stamp mode.

Analyze the Mark data immediately before the Space(3T)



Comparison of the Main Functions

| | TS | HH | ISI |
|------------------------|------|------|---|
| Histogram display | Yes | Yes | Yes (statistics are also displayed at the bottom) |
| List display | Yes | Yes | Yes (time variation is also displayed at the right) |
| Time variation display | Yes | No | No |
| Statistics display | Yes | Yes | No |
| Measurement function | All* | All* | 3 types** |

* 7 types: period, A-to-B time interval, pulse width, period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, pulse width A & pulse width B

** Pulse width, pulse width A→A-to-B time interval, pulse width A→pulse width B

2.4 Measurement Function (Measurement Item)

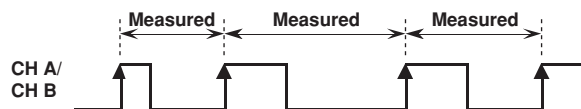
The measurement functions that can be executed vary depending on the sampling mode as follows.

- When in time stamp mode or hardware histogram mode
 - Single measurement function
 - Period, A-to-B time interval, or pulse width
 - Dual measurement function
 - Period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, and pulse width A & pulse width B
- When in inter-symbol interference analysis mode
 - Single measurement function
 - Pulse width
 - Dual measurement function
 - Pulse width A→A-to-B time interval and pulse width A→pulse width B

Period (see section 5.2 for the operating procedure)

Measures the pulse interval (time between rising edges or falling edges) of the CH A or CH B input signal. Period measurement cannot be selected in inter-symbol interference analysis mode. The slope for detecting the edge that determines the measurement start or end point can be set to the rising or falling edge of the signal.

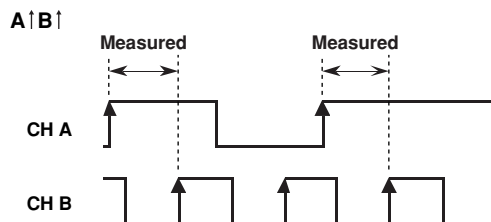
Example when the slope is set to rising edge (\uparrow)



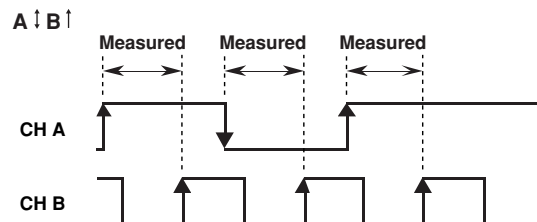
A-to-B Time Interval (TI) (see section 5.3 for the operating procedure)

Measures the time between the specified edge of the CH A input signal and the specified edge of the CH B input signal. Time interval cannot be selected in inter-symbol interference analysis mode. The slope for detecting the edge can be selected from six combinations of the CH A and CH B slopes. For the selectable slopes, see section 5.3, "Setting the Time Interval Measurement."

Example when the slope of channel A and B are both rising



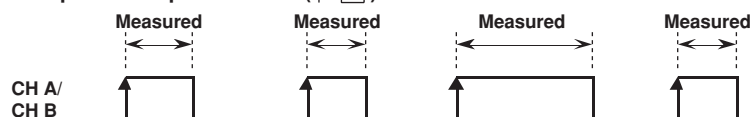
Example when the slope of channel A is both rising and falling and the slope of channel B is rising



Pulse Width (see section 5.4 for the operating procedure)

Measures the pulse width on the positive side (from the rising edge to the next falling edge) of the CH A or CH B input signal or the pulse width on the negative side (from the falling edge to the next rising edge). The polarity, which specifies which pulse width is to be measured, can be set to positive ($\uparrow\downarrow$), negative ($\downarrow\uparrow$), or both ($\uparrow\downarrow\uparrow\downarrow$). However, the polarity is fixed to both ($\uparrow\downarrow\uparrow\downarrow$) in inter-symbol interference analysis mode.

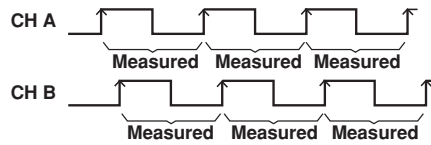
Example for the positive side ($\uparrow\downarrow$)



Period A & Period B (Per.&Per.) (see section 5.5 for the operating procedure)

Measures the period of the input signals of CH A and CH B simultaneously. Period A & period B cannot be selected in inter-symbol interference analysis mode. The slope can be set to the rising edges of the CH A and CH B signals or the falling edges.

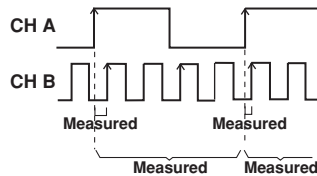
When set to A↑ B↑



Period A & A-to-B Time Interval (Period&TI) (see section 5.6 for the operating procedure)

Measures the period of the CH A input signal and the A-to-B time interval simultaneously. Period A & A-to-B time interval cannot be selected in inter-symbol interference analysis mode. You can select whether to measure “the period of the rising edge of the CH A signal” and “the time interval of the rising edges of the CH A and CH B signals” or “the period of the falling edge of the CH A signal” and “the time interval from the falling edge of the CH A signal to the rising edge of the CH B signal.”

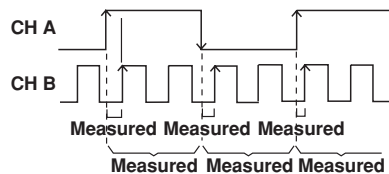
When set to A↑ A↑ B↑



Pulse Width A & A-to-B Time Interval(PW&TI)/Pulse Width A→A-to-B Time Interval(PW→TI) (see section 5.7 for the operating procedure)

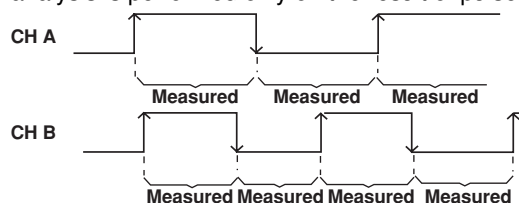
Measures the pulse width of the CH A input signal and the A-to-B time interval simultaneously. The polarity of the pulse width measurement of the CH A input signal is fixed to both (↔). The slope of the A-to-B time interval measurement can be set to the rising/falling edge of the CH A signal to the rising or falling edge of the CH B signal. However, in inter-symbol interference analysis mode, the slope for the A-to-B time interval measurement can be selected from six combinations of the CH A and CH B slopes. In inter-symbol interference analysis mode, the A-to-B time interval is extracted based on the measured data of pulse width A (↔). Therefore, inter-symbol interference analysis is performed only on the result of the A-to-B time interval.

When set to A↔ A↓ B↑



Pulse Width A & Pulse Width B(PW&PW)/Pulse Width A→Pulse Width B(PW→PW) (see section 5.8 for the operating procedure)

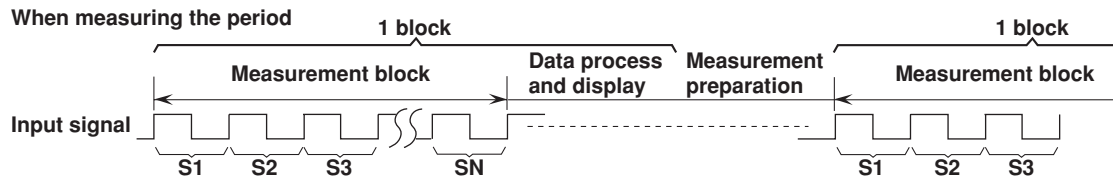
Measures the pulse width of the input signals of CH A and CH B simultaneously. The polarity of the pulse width measurement is fixed to both (↔) for both CH A and CH B. In inter-symbol interference analysis mode, the pulse width B (↔) is extracted based on the measured data of pulse width A (↔). Therefore, inter-symbol interference analysis is performed only on the result of pulse width B.



2.5 Setting Measurement Conditions

Measurement Block

The TA720 repeats the process of making measurements, processing data, and displaying the result. The “measurement block” refers to the smallest unit of measurement that is handled in one cycle of the process. As shown in the figure below, if the number of samples (number of data points) acquired in one cycle of the process is N, then “one measurement block” refers to measuring, processing, and displaying N samples of data. The range of the measurement block is specified using gates (see the next page).



Continuous Measurement Conditions

As shown in the figure above, measurements (such as on the period) can be measured continuously within a single measurement block. However, continuous measurement is possible only when the input signal meets the following conditions.

- **Single measurement function (sample rate: 80 MS/s)**

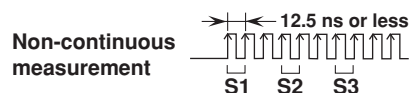
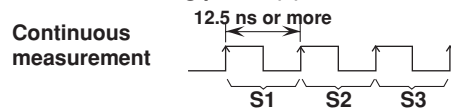
Period or pulse width measurement:

Measurement edge interval is 12.5 ns or more.

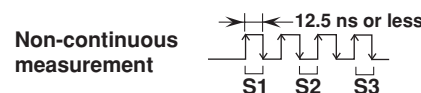
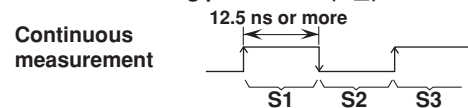
A-to-B time interval measurement:

Measurement edge interval of the CH A input signal is 12.5 ns or more and the measurement edge of the CH B input signal to the measurement edge of the CH A input signal is 0 ns or more.

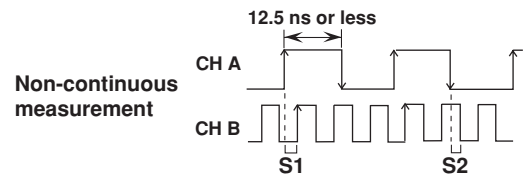
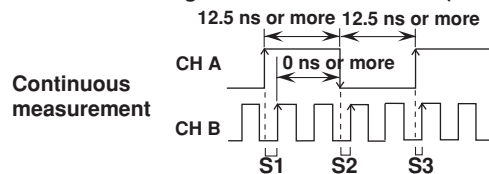
- When measuring period (↑)



- When measuring pulse width (↔)



- When measuring the A-to-B time interval (A↑B↑)



- **Dual measurement function (sample rate: 50 MS/s)**

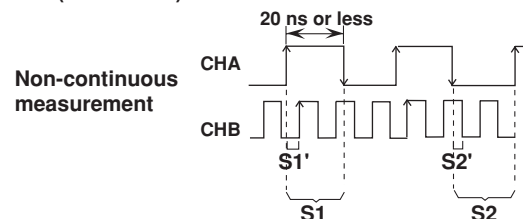
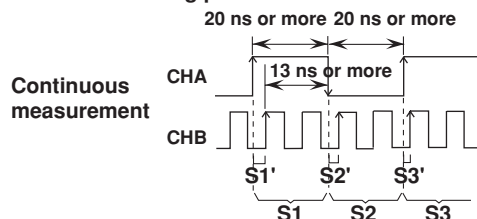
Pulse A & pulse B or pulse width A & pulse width B measurement:

The measurement edge interval of the CH A and CH B input signals are 20 ns or more.

A-to-B time interval measurement:

Measurement edge interval of the CH A input signal is 20 ns or more and the measurement edge of CH B to the measurement edge of the CH A is 13 ns or more.

- When measuring pulse width A & A-to-B time interval (A↔A↑B↑)



Gate (Gate Mode) (see section 6.1 for the operating procedure)

The range of the measurement block is specified using one of the following gates.

Event Gate (Event)

One sample is called one event, and the range of the measurement block is specified in terms of the number of events (event size). The selectable range of event size varies depending on the sampling mode and measurement function as follows.

When in time stamp mode or inter-symbol interference analysis mode

- Period, A-to-B time interval, or pulse width: 2 to 1024000
- Other measurement functions: 1 to 512000

When in hardware histogram mode

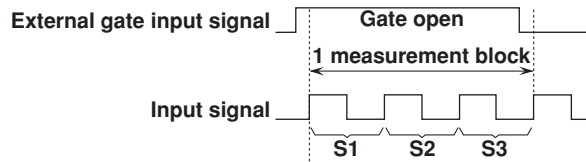
- Period, A-to-B time interval, or pulse width: 2 to 10^9
- Other measurement functions: 1 to 10^9

Time Gate (Time)

The range of the measurement block is specified using the gate time. The gate time can be set within the maximum sampling size of each sampling mode in the range of 1 μ s to 10 s (resolution: 100 ns).

External Gate (External)

The range of the measurement block is specified by applying an external gate signal and using the its ON/OFF (open/close of the gate) states. You can select the polarity of the gate signal for opening the gate. The allowable time that the gate can stay open is within the maximum sample size of each sampling mode in the range of 1 μ s to 320 s.



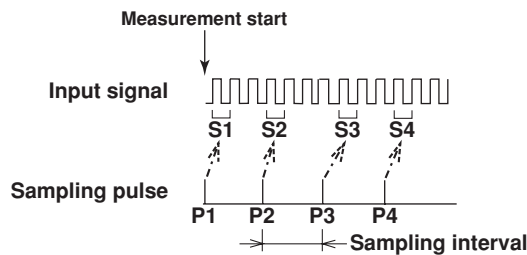
Note

The external gate input terminal is shared with the external arming input terminal.

Sampling Interval (Interval) (see section 6.2 for the operating procedure)

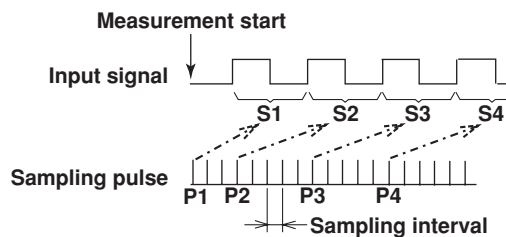
When using a single measurement function in time stamp mode, measurements can be made by allowing a certain time interval between each measurement by setting the sampling interval. The selectable range of sampling interval is 0 μ s to 1 s (resolution: 1 μ s).

Example when the measurement function is set to period



Continuous measurement results if the sampling interval is set to 0 μ s or when the measurement edge is longer than the sampling interval.

Example when the measurement function is set to period



Arming and Arming Delay (Delay Mode) (see section 6.3 for the operating procedure)

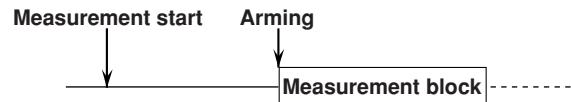
The act of creating a trigger for starting a measurement of the measurement block is called activating an arming. There are two arming modes.

Auto Arming

Arming is activated at the same time as measurement start (START key or START communication command), and measurement starts.

External Arming

After measurement start (START key or START communication command) arming is activated by applying an external arming signal, and measurement starts. You can select the slope (rising or falling edge) of the arming signal for activating arming. The input level of the arming signal can be selected from TTL (1.4 V), TTL/10 (0.14 V), and 0 V.



In the case of external arming, the starting of the measurement can be delayed by a specified time or events after an arming is activated (arming delay). When the measurement function is set to period A & period B or pulse width A & pulse width B (pulse width A → pulse width B), the arming delay can be specified independently for CH A and CH B.

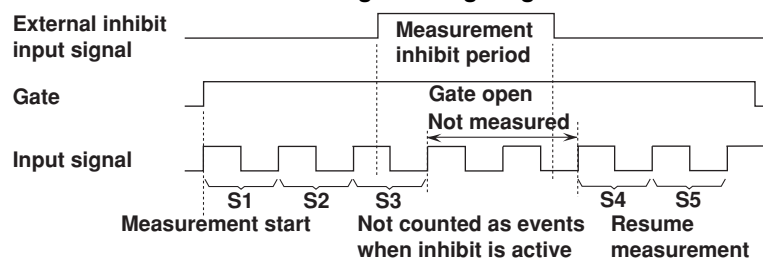
- Time delay
The starting of the measurement is delayed by a specified time (selectable range: 1 μ s to 10 s).
- Event delay
The starting of the measurement is delayed by a specified number of events (selectable range: 1 to 1 to 10⁶).

Inhibit (see section 6.4 for the operating procedure)

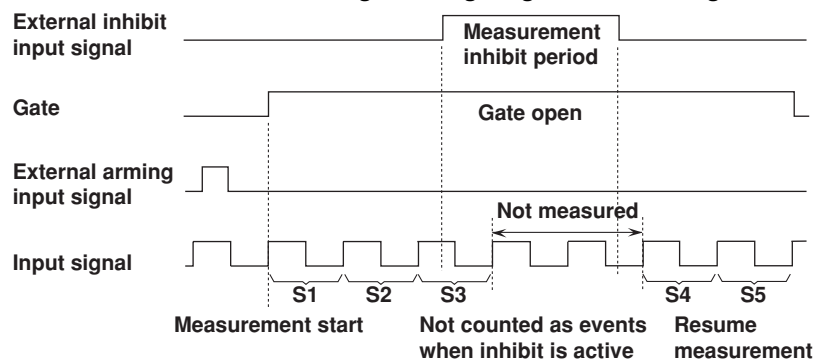
Measurement inhibit period within the gate can be specified by applying an external inhibit signal. The measurement inhibit period can be specified even while the gate is open or during measurement after arming activation. The maximum allowable measurement inhibit period is the maximum sampling time (see page 2-4). You can select the polarity of the inhibit signal for setting the measurement inhibit period. The input level of the inhibit signal can be selected from TTL (1.4 V), TTL/10 (0.14 V), and 0 V.

The following examples show the relationship between the inhibit signal and gating/arming.

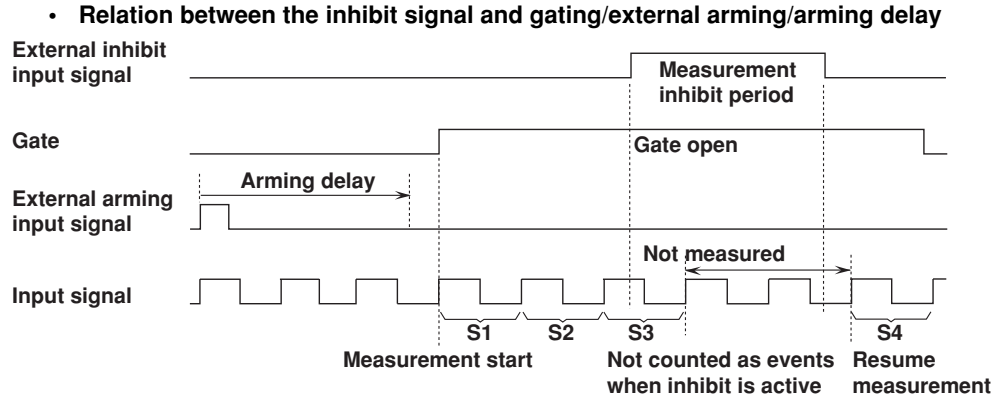
• Relation between the inhibit signal and gating



• Relation between the inhibit signal and gating/external arming



2.5 Setting Measurement Conditions



Block Sample (see section 6.5 for the operating procedure)

When using a single measurement function in time stamp mode or hardware histogram mode, “single block measurement” can be repeated a specified number of times (block sampling). In block sampling, “single block measurement” is repeated a specified number of times first. Then, “data processing and display” are performed collectively.

Also, in block sampling, you can set a pause time, defined as the period of time between block measurements. The pause time is set in terms of the time or the number of events. The display and analyzed items of data that has been block sampled varies depending on the sampling mode as follows.

When in time stamp mode

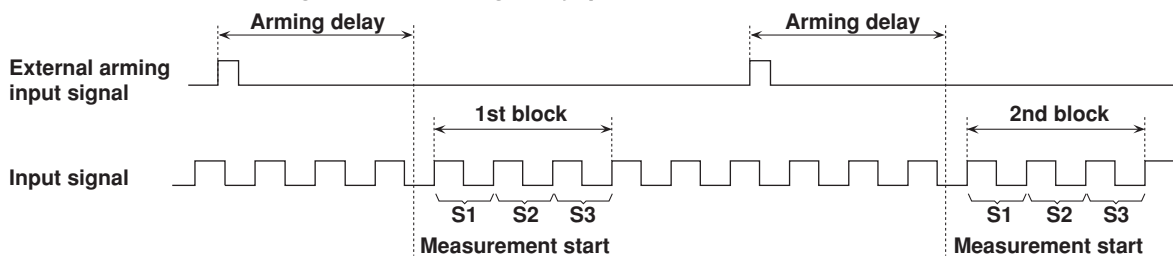
The histogram, list, or time variation for each measurement block can be displayed and statistical calculations can be performed. The maximum selectable block size (number of repetitions: N) is 250. However, the block size can be set up to 1000 if there is no pause time.

When in hardware histogram mode

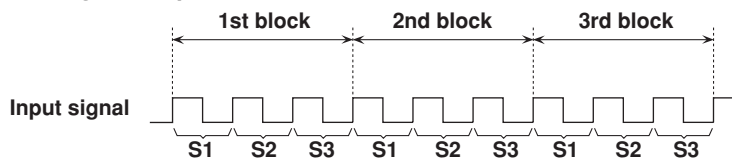
Histogram or list of all measurement blocks can be displayed and statistical calculations can be performed on them. Lists and statistical calculations on each block are not allowed. The maximum selectable block size (number of repetitions: N) is 1000.

The relationship between the pause time and arming during block sampling is shown below.

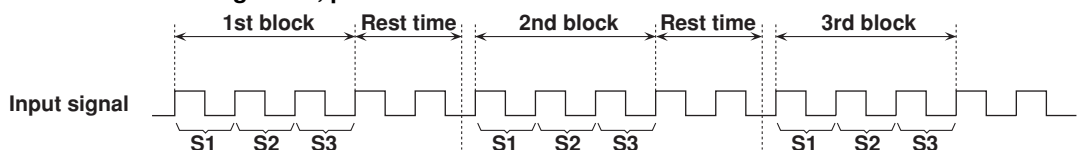
Arming: Ext/with arming delay, pause time: OFF



• Arming: Auto, pause time: OFF



• Arming: Auto, pause time: enabled



Impedance (see section 6.6 for the operating procedure)

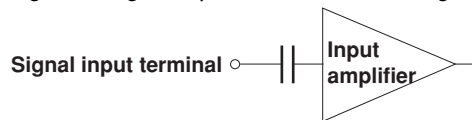
The input impedance must be matched to the output impedance of the item being measured to reduce the attenuation and distortion of the measured signal. The input impedance of CH A and CH B inputs can be independently set to 50 Ω or 1 M Ω .

Input Coupling (see section 6.6 for the operating procedure)

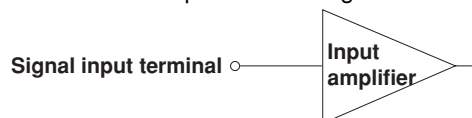
If you wish to measure just the amplitude (AC component) of an input signal or a signal riding on top of a certain DC voltage, measurements can be facilitated if the DC component is removed from the signal. In other cases, you may wish to measure the signal as-is without removing the DC component of the signal. To accommodate these situations, the input coupling setting is changed before the signal is applied to the input amplifier. The following types of input coupling are available:

AC

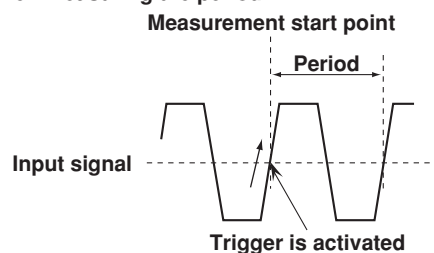
The signal is input through a capacitor. This setting is used to remove the DC component from the input signal in order to measure just the amplitude of a signal or a signal riding on top of a certain DC voltage.

**DC**

The signal is input directly to the amplifier. This setting is used when measuring both the AC and DC components of a signal.

**Trigger Mode (Trigger)/Trigger Level (Level) (see section 6.6 for the operating procedure)**

The act of determining the measurement start point when measuring a single sample on the TA720 is called “activating a trigger.” For example, when the measurement start point of the period is set to the rising edge of the input signal, the measurement start point is when the input signal changes from below a specified level (trigger level) to above the level.

When measuring the period

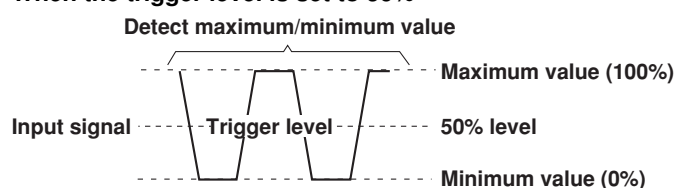
The following three modes are available in setting the trigger level.

Manual Trigger

The trigger level is set to the value that is specified using the rotary knob or the numeric keys.

Single Auto Trigger

Taking the maximum and minimum values of the input signal during the first measurement block to be 100% and 0%, respectively, the trigger level is set to the specified percentage level. The trigger level for all following blocks is set to this level.

When the trigger level is set to 50%

2.5 Setting Measurement Conditions

Repeat Auto Trigger

Taking the maximum and minimum values of the input signal during the first measurement block to be 100% and 0%, respectively, the trigger level is set to the specified percentage level. Unlike the single auto trigger, the trigger level is reset for each measurement block.

Phase Adjustment for A-to-B Time Interval Measurements (Phase Adj) (see section 6.7 for the operating procedure)

The phase of CH B can be shifted with respect to CH A for the following measurement functions: A-to-B time interval, period A & A-to-B time interval, pulse width A & A-to-B time interval (pulse width A→A-to-B time interval). The phase shift can be used to correct the offset of the phase of the CH B input signal with respect to the CH A input signal due to causes such as the differences in the cable when measuring the A-to-B time interval. The selectable range is 0.0 to 10.0 ns (resolution: 0.1 ns).

Reference Clock Selection (Ref. Clock) (see section 6.8 for the operating procedure)

The TA720 performs measurements using the internal 10-MHz reference clock as the time reference. An external 10-MHz clock signal can be used in place of the internal clock.

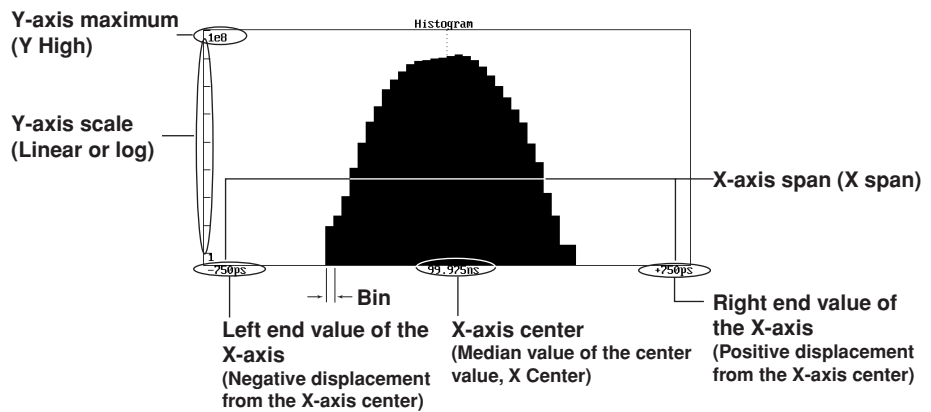
2.6 Displaying the Measured/Calculated Results

Histogram Display (see section 7.1 for the operating procedure)

By displaying the histogram (frequency distribution) of the measured data, you can see the data distribution. Histogram display is possible in all sampling modes. This section describes the histogram display in time stamp mode and hardware histogram mode. For a description of the histogram display in inter-symbol interference analysis mode, see “Inter-symbol Interference Analysis” on page 2-24.

Setting the Scale Value

To display the histogram of the measured data, scale values such as the X-axis center (X Center), X-axis span (X Span), Y-axis maximum (Y High), and Y-axis scale (Y Axis) must be specified. You can select whether to set these values according to the measured data automatically or manually. When using the dual measurement function, the scale values can be set independently for the histogram display of each measurement function. For the procedure for setting the scale values, see section 8.4, “Changing the Scale Values of the Histogram Display and Time Variation Display.”

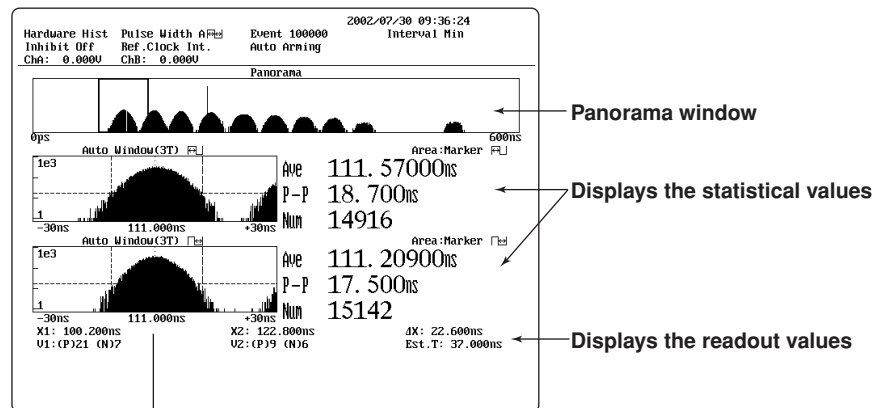


Frequency Distribution

Each value of the X-axis represents a median value or a displacement with the X-axis span divided into 600 sections (bins) (25 ps if the value is smaller than 25 ps). The histogram is drawn by accumulating the number of samples that fall in each bin. For example, if the bin is “505 ns to 515 ns,” the median value is 510 ns for that bin. The samples that fall in that bin are handled as 510 ns, the median value.

Various Display Formats

In addition to histograms, panorama window (see page 2-17) can be displayed. The histogram display frame can also be reduced to half the size to display statistics (see page 2-21) and readouts (readout values using markers, see page 2-19) in the blank space.



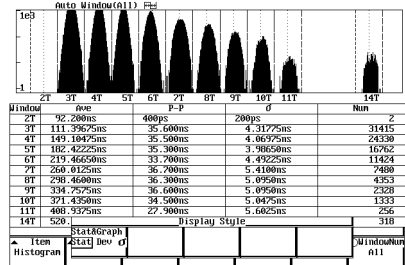
Displays the histogram using half size and overlap OFF

2.6 Displaying the Measured/Calculated Results

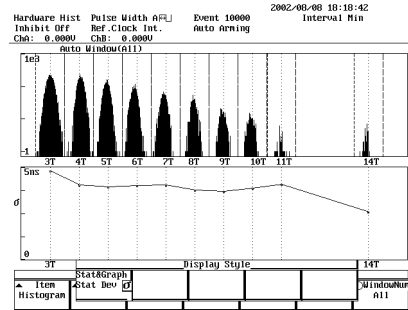
Statistics Display on the Histogram Display

In addition to histograms, the list of statistics of each window or the graph of the statistical value “deviation” or “ σ ” can be displayed when all window display of multi window or auto window is used in hardware histogram mode or time stamp mode.

Statistics display of all windows



Graph display of “ σ ”



List Display (see section 7.2 for the operating procedure)

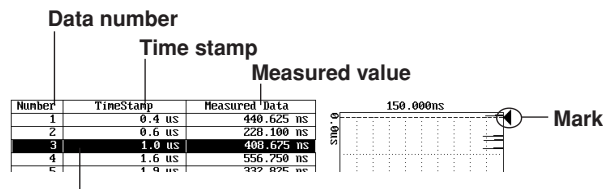
The measured value can be displayed numerically in tables. List display is possible in all sampling modes. On the list display, you can move and display different parts of the list using the jump function which can move to the top, center, or end of the data or by specifying the data number.

Below is a description of the differences in the list display in time stamp mode and hardware histogram mode.

When in time stamp mode

Time stamps (elapsed times of measurement) and measured values are listed in the measurement range of a single block as specified by the gate. When using block sampling, time stamps (elapsed times of measurement) and measured values can be displayed by specifying a measurement block number.

When measuring a single measurement function, the time variation waveform is displayed on the right side. The specified data number is highlighted, and a dotted line and a ◀ mark is displayed at the position of the time variation waveform corresponding to the data number.

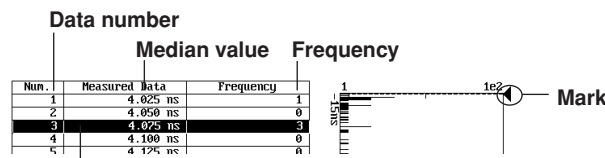


Specified data is displayed highlighted

When in hardware histogram mode

The measured values (the median values of the histogram) and the frequencies are listed within the range of the width of the X-axis (X Span) of the histogram display. When using the multi-window or auto window function, the list is displayed for each window (3T, 4T, All, etc.).

When measuring a single measurement function, the histogram is displayed on the right side. The specified data number is highlighted, and a dotted line and a ◀ mark is displayed on the histogram corresponding to the data number.



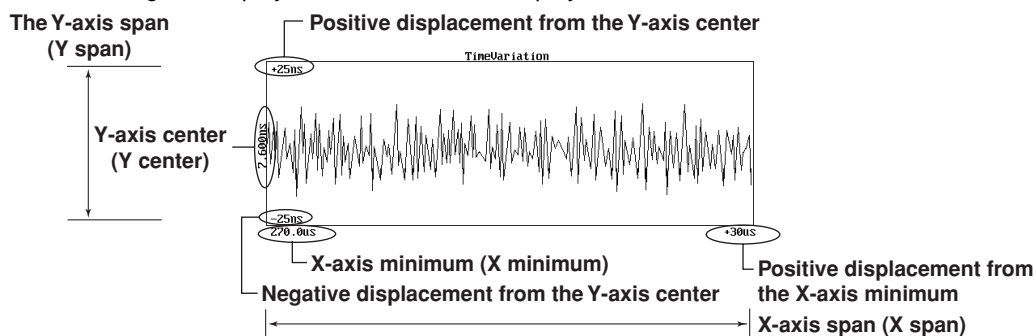
Specified data is displayed highlighted

Time Variation Display (TimeVar.) (see section 7.3 for the operating procedure)

In time stamp mode, the changes in the measured value with respect to the elapsed time from arming (time variation) can be displayed based on the measured values and time stamps stored in the acquisition memory.

Setting the Scale Value

In time variation display, the following scale values must be specified: X-axis minimum (X Minimum), X-axis span (X Span), Y-axis center (Y Center), and Y-axis span (Y Span). You can select whether to set these values according to the measured data automatically or manually. See section 8.4, "Changing the Scale Values of the Histogram Display and Time Variation Display."

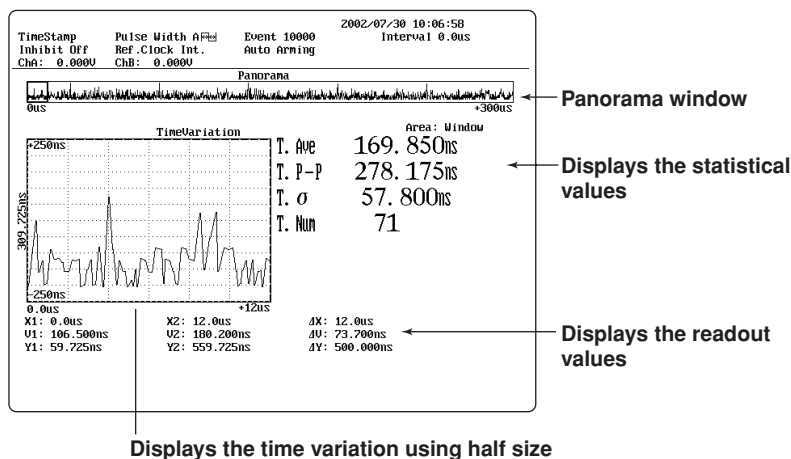


Reading Measured Values Using Markers

Measured values can be read using markers. For a description of this function, see "Reading the Measured Results Using Markers" on page 2-19.

Various Display Formats

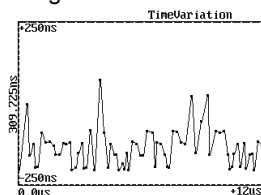
In addition to time variation, panorama window (see page 2-17) can be displayed. The display frame can also be reduced to half the size to display statistics (see page 2-21) and readouts (see page 2-19) in the blank space. When using the dual measurement function, you can select whether to display the waveform of only one of the measurement functions or both waveforms.



Displays the time variation using half size

Display Method

You can turn ON/OFF the grid, select whether to connect between data points using a line, and the dot type of the measured values. The following figure is an example when the grid is turned OFF and the dot type is set to mark.



Statistics Display (see section 7.4 for the operating procedure)

In time stamp mode or hardware histogram mode, statistical parameters within a specified area can be computed, and the results can be displayed in a list.

This section mainly describes the display of the statistical calculation results. For a description of the area for performing statistical calculations and the statistical calculation parameters, see section 2.7, "Statistical Calculation and Inter-symbol Interference Analysis."

The displayed results vary depending on the sampling mode.

When in time stamp mode

You can select to calculate the statistics from the histogram or time variation.

When calculating from the histogram

When calculating from time variation

Statistical calculation Area for performing parameters statistical calculation

| Statistics Value(Histogram) | |
|-----------------------------|-------------|
| Item | Value |
| Ave | 164.5950ns |
| Max | 299.700ns |
| Min | 94.475ns |
| P-P | 205.225ns |
| σ | 52.0575ns |
| σ /Ave | 31.628282% |
| σ /T | 136.995245% |
| Dev | 14.5950ns |
| Num | 9370 |

Statistical values

Statistical calculation Area for performing parameters statistical calculation

| Statistics Value(TimeVariation) | |
|---------------------------------|-----------|
| Item | Value |
| T. Ave | 169.850ns |
| T. Max | ***** |
| T. Min | ***** |
| T. P-P | 278.175ns |
| T. σ | 57.800ns |
| T. (σ /Ave) | ***** |
| T. P-P/Ave | ***** |
| T. RF | ***** |
| T. Num | 71 |

Statistical values

Depending on the above selection, the statistical parameters that can be calculated vary.

- When histogram is selected
Average, Maximum, Minimum, Peak-Peak, σ , σ /Average, σ /T, Deviation, Deviation/T, Median, Mode
- When time variation is selected
T.Average, T.Maximum, T.Minimum, T.Peak-Peak, T. σ , T.(σ /Average), T.(P-P/Average), T.RF

The area for performing statistical calculation can be set to Window (entire window), Marker (area enclosed by markers), or Block (measurement block). In addition, when the area for performing the statistical calculation is set to Block, and the source from which the statistics are calculated is set to time variation (T.V.) on block-sampled data, the statistics can be displayed for each block.

When in hardware histogram mode

Below are the statistical parameters that can be calculated. For a description of the statistical calculation parameters, see section 2.7, "Statistical Calculation and Inter-symbol Interference Analysis."

Average, Maximum, Minimum, Peak-Peak, s, s/Average, s/T, Deviation, Deviation/T, Median, Mode

The area for performing statistical calculation can be set to Window (entire window) or Marker (area enclosed by markers).

When using multi window with Window selected

When using multi window with ALL selected

Statistical calculation Area for performing parameters statistical calculation

| Statistics Value(Histogram) | |
|-----------------------------|-------------|
| Item | Value |
| Ave | 111.40150ns |
| Max | 132.700ns |
| Min | 95.000ns |
| P-P | 37.700ns |
| σ | 4.31700ns |
| σ /Ave | 3.875108% |
| σ /T | 11.360337% |
| Dev | -2.59850ns |
| Num | 31413 |

Statistical values

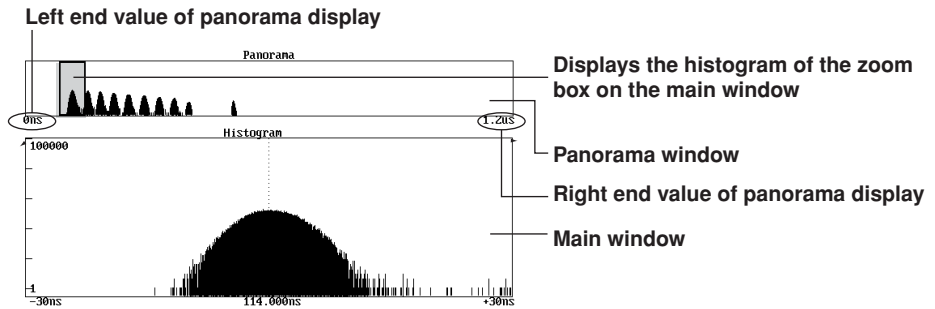
| Statistics Value(Histogram) | | | | |
|-----------------------------|-------------|------------|------------------|-----------|
| Window | σ /T | Dev | Dev/ σ /T | Median |
| 1T | — | — | — | — |
| 2T | 2.765289% | 17.550ns | 46.184211% | 93.590ns |
| 3T | 11.360337% | -2.59850ns | 6.838210% | 111.400ns |
| 4T | 10.947512% | -2.85425ns | 7.510954% | 149.200ns |
| 5T | 11.747475% | -7.36200ns | 19.311246% | 182.500ns |
| 6T | 12.865886% | -8.33525ns | 21.935012% | 219.600ns |
| 7T | 14.288145% | -5.8825ns | 15.482383% | 268.100ns |
| 8T | 13.823888% | -5.9820ns | 14.215837% | 298.500ns |
| 9T | 14.558456% | -6.8800ns | 18.106616% | 334.900ns |
| 10T | 13.589583% | -8.1800ns | 21.525367% | 372.000ns |
| 11T | 13.913823% | -8.7200ns | 22.940637% | 409.300ns |
| 12T | — | — | — | — |
| 13T | 3.265813% | 17.250ns | 45.419423% | 511.200ns |
| 14T | 12.134651% | -10.7600ns | 28.319680% | 521.300ns |
| Sum | 13.489934% | ***** | ***** | ***** |

Window label Statistical values

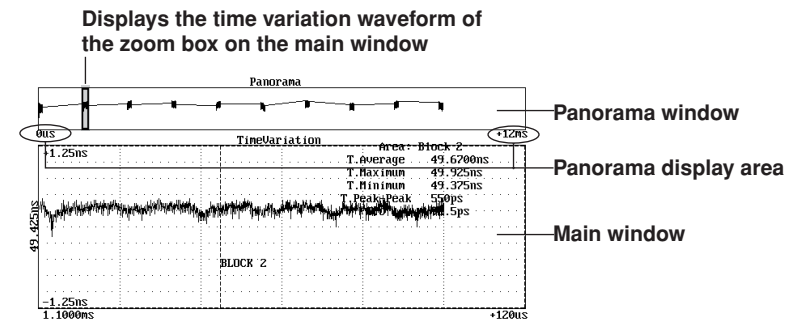
Panorama Display (see sections 7.1 and 7.3 for the operating procedure)

When showing the histogram display or time variation display, window displaying all the measured data (called panorama window) can be shown at the top section of the main window. On the panorama window, the histogram shown in the main down is indicated with a zoom box.

Histogram display



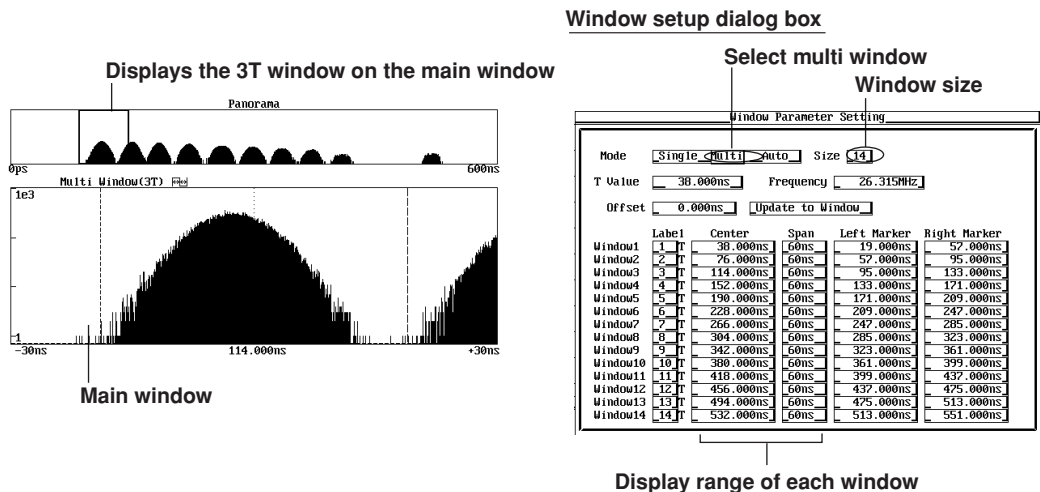
Time variation display



Multi Window Function (see section 8.2 for the operating procedure)

When the distribution of the data of one measurement block is distributed over multiple center values on the X-axis, multiple histograms are created. You can simultaneously display all the histograms in the main window. However, you can also set multiple windows and display each histogram in its own window and observe it in detail. The function that allows for the setting of multiple windows and the display of the histogram of each window is called the multi window function. Up to 14 window sizes (windows) can be specified. In addition, the display range (scale value) can be arbitrary set for each window.

By using this function in conjunction with the panorama display, you can easily see which histogram among the various windows is being displayed or set.



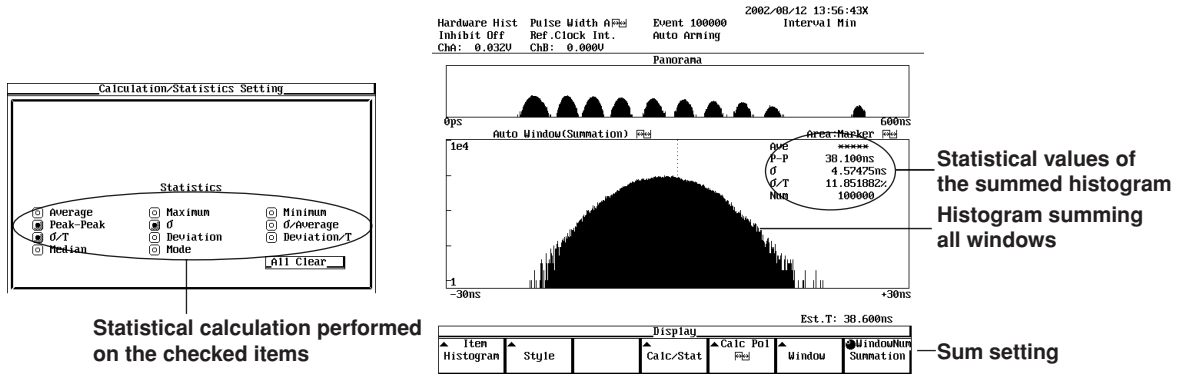
2.6 Displaying the Measured/Calculated Results

Summation display

The histograms (enclosed by the X1 and X2 markers) of all windows that have been set with the multi window function can be summed and displayed in one window. The center values of the X-axis of the histogram of each window are aligned and the frequencies of each bin are summed.

Only the histograms in the area enclosed by the markers are summed.

You can compare the data distribution between each histogram and calculate the statistics of all histograms at once.



Auto Window Function (see section 8.3 for the operating procedure)

This function automatically sets the window when the RLL (Run Length Limited) code is set to the following modulation methods. The clock period T is measured, and the X-axis values are automatically set.

The following modulation methods are supported.

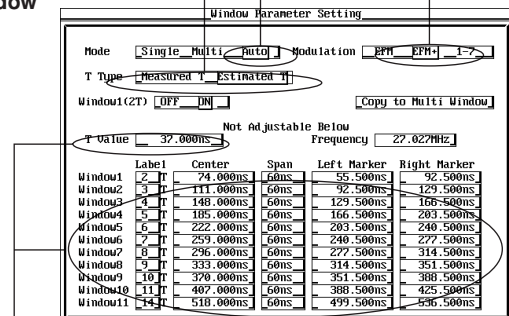
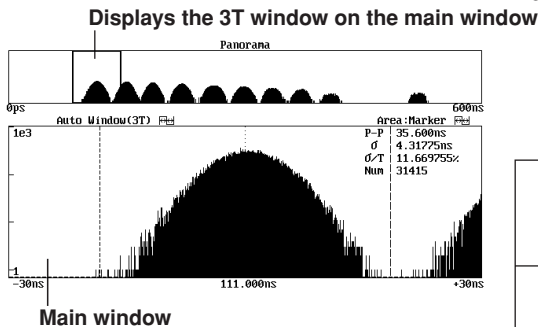
- EFM modulation
- EFM+ modulation
- 1-7 modulation

There are two methods of automatic setting.

- Measured T: Apply the input signal to CH A and the read-out clock signal to CH B. The value of T is measured from the period of the clock signal.
- Estimated T: The value of T is estimated from the average value of the input signal. This method is used when the clock signal cannot be applied. The value T is derived from the average value of each modulation method using the following coefficients.
 - EFM modulation: Approx. 4.79T
 - EFM+ modulation: Approx. 4.72T
 - 1-7 modulation: Approx. 3.30T

Window setup dialog box

Select the auto measurement method Auto window Select the modulation type



Automatically set the T value and the X-axis value of each window

Summation Display

Like the multi window, summation display is also possible on the auto window.

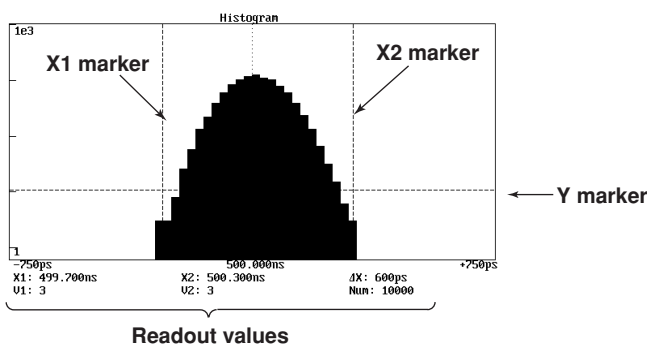
Reading the Measured Results Using Markers (see section 8.5 for the operating procedure)

On the histogram display and time variation display, markers can be displayed to read measured values and other parameters.

For histogram displays

Three markers, X1, X2, and Y can be displayed, and the following values (readouts) can be read.

| | | | |
|--------------|---|-----|---|
| X1: | X coordinate (measured value) of the X1 marker | V1: | Y coordinate (frequency of occurrence of the X1 marker) |
| X2: | X coordinate (measured value) of the X2 marker | V2: | Y coordinate (frequency of occurrence of the X2 marker) |
| ΔX : | $X2 - X1$ | | |
| Num: | Number of samples used in the statistical calculation | | |

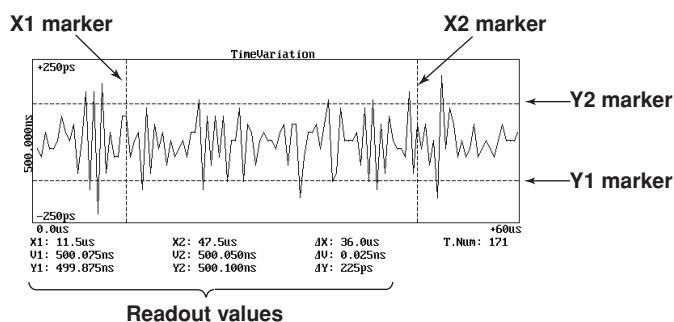
**Note**

The Y marker on the histogram display is used to set the area for performing the statistical calculation (see page 2-21).

For time variation displays

Four markers, X1, X2, Y1, and Y2 can be displayed, and the following values (readouts) can be read.

| | | | |
|--------------|---|--------------|--|
| X1: | X coordinate (time stamp) of the X1 marker | V1: | Y coordinate (measured value) of the X1 marker |
| X2: | X coordinate (time stamp) of the X2 marker | V2: | Y coordinate (measured value) of the X2 marker |
| ΔX : | $X2 - X1$ | ΔV : | $ V2 - V1 $ |
| Y1: | Y coordinate (measured value) of the Y1 marker | Y2: | Y coordinate (measured value) of the Y2 marker |
| ΔY : | $ Y2 - Y1 $ | | |
| T.Num: | Number of samples used in the statistical calculation | | |

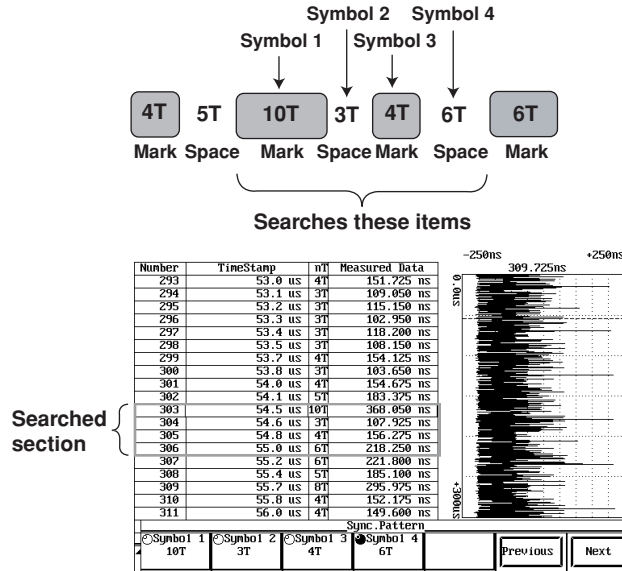
**Note**

During time variation display, if there are multiple data points at the marker position, the average value is displayed. If there is no data at the marker position, an asterisk (*) is displayed.

2.6 Displaying the Measured/Calculated Results

Symbol search (Sync Pattern) (see section 8.6 for the operating procedure)

When the window mode is set to multi window or auto window on the list display of the time stamp mode or inter-symbol interference analysis mode, a specified symbol can be searched as shown in the following figure. Up to 4 continuous symbols can be specified (14 specified Ts between 1T and 16T are applicable), and combinations can be searched.



2.7 Statistical Calculation and Inter-Symbol Interference Analysis

Statistical Calculation (see section 9.1 for the operating procedure)

The statistical calculation values can be displayed in a list format on the statistics display as well as on the time variation display and histogram display.

This section describes the area for performing the statistical calculation, constant T, and the statistical calculation parameter settings used to determine the statistical calculation values.

Setting the Area for Performing Statistical Calculation

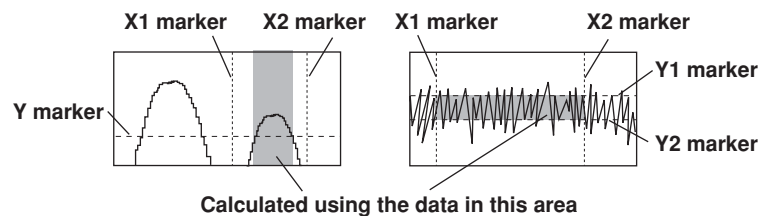
You can select whether to calculate the statistics using the measured values in the window area or the area enclosed by markers. The window area is determined by the scale value of the measured value axis on the histogram display; it is determined by the scale value of the time stamp axis on the time variation display.

If the time variation is displayed on data that was block sampled in the time stamp mode, you can also select the [Block] on which to calculate the statistics.

If you are using the multi window or auto window function, the statistics are calculated over the area enclosed by markers for each window.

• When calculating the statistics over an area enclosed by markers

- For histogram display
- For time variation display



Setting the Slope (Calculation Slope)/Polarity (Calculation Polarity)

You can specify the slope and polarity for the statistical calculation only for the following measurement functions.

The statistics can be calculated separately on data having the specified slope or polarity.

- A-to-B time interval measurements, when the slope setting is either $A \uparrow B \uparrow$ or $A \uparrow B \downarrow$.
- Pulse width measurements, when the polarity setting is $\square \rightarrow \square$.
- Pulse width A & A-to-B time interval measurement.
- Pulse width A & pulse width B measurement.

Setting Constant T

The T value used when calculating the jitter (statistical value) or "Deviation/T" (statistical calculation parameter) (see the next page) is set as constant T. When the item being measured is an optical disk, this value corresponds to the period of the read clock signal. You cannot change the value of T when using the auto window function since it is automatically set.

Differences in the Statistical Calculation due to the Differences in the Sampling Mode and Display Format

There are some statistical values that differ in their equation depending on the sampling mode (see "Statistical Calculation Parameters" on the following pages). In addition, statistics can be calculated based on the measured values (during time stamp mode) or histogram (during hardware histogram mode).

In the time stamp mode, you can select to calculate the statistics on the time variation or on the histogram. The following differences exist between the time variation display and the histogram display.

Time variation: You can set the area over which to calculate the statistics with the time stamp and measured value.

Histogram: You can set the area over which to calculate the statistics with the measured value (median value) and the frequency of occurrence.

Statistical Calculation Parameters

In the following equations, n is the number of samples, X_i is the measured value of each sample, and X_j (only for histograms) is the median value of each bin of the histogram. If the statistics are calculated on the time variation, "T." is placed in front of the statistical calculation parameter names.

- **Average**

Calculates the average value of the measured values.

$$\text{Average} = \frac{1}{n} \sum_{i=1}^n X_i$$

- **Maximum**

Indicates the maximum measured value.

$$\text{Maximum} = [X_i]_{\max}$$

- **Minimum**

Indicates the minimum measured value.

$$\text{Minimum} = [X_i]_{\min}$$

- **Peak-Peak**

Calculates the difference between the maximum and minimum values.

$$\text{Peak} - \text{Peak} = \text{Maximum} - \text{Minimum}$$

- **Standard deviation (σ)**

Calculates the standard deviation of the measured values. This indicates the degree to which the values are spread out from the average value.

$$\sigma = \sqrt{\frac{1}{n} \sum_{i=1}^n (X_i - \text{Average})^2}$$

- **Flutter ($\sigma/\text{Average}$)**

Calculates the flutter. This indicates the spread in the values in terms of a percentage of the average value.

$$\sigma/\text{Average} = \frac{\sigma}{\text{Average}} \times 100 (\%)$$

- **σ/T (only for histograms)**

Calculates the histogram jitter using the specified constant T . Indicates the spread of the values in terms of a percentage of the value T .

$$\sigma/T = \frac{\sigma}{T} \times 100 (\%)$$

- **Deviation (only for histograms)**

X_{CENTER} is the center value of the x axis in the window (see page 2-13).

Indicates the deviation of the measured average value with respect to X_{CENTER} .

$$\text{Deviation} = \text{Average} - X_{\text{CENTER}}$$

- **Deviation/ T (only for histograms)**

Indicates the deviation of the measured average value with respect to X_{CENTER} in terms of a percentage of the value T .

$$\text{Deviation}/T = \frac{|\text{Average} - X_{\text{CENTER}}|}{T} \times 100 (\%)$$

- **Median (only for histograms)**

Indicates the median of the histogram.

$$\text{Median} = [X_j]_{\text{Median}}$$

- **Mode (only for histograms)**

Indicates the median value with the highest frequency of occurrence (most frequent value).

$$\text{Mode} = [X_j]_{\text{Mode}}$$

- **T.(P-P/Average) (only for time variation)**

Indicates the spread in the Peak-to-Peak values in terms of a percentage of the average value.

$$T.(P-P/Average) = \frac{P-P}{Average} \times 100$$

- **T.RF (only for time variation)**

Calculates the average value of T.(P-P/Average) of all blocks that were block sampled.

N is the total number of blocks. P-P_k is the Peak-to-Peak value of each block, and AVE_k is the average value of each block.

$$T.RF = \frac{1}{N} \sum_{k=1}^N \left(\frac{P-P_k}{AVE_k} \times 100 \right)$$

When in hardware histogram mode

In the equation below, n is the number of bins in the histogram. A bin of a histogram refers to a bar (section) that indicates the frequency of occurrence on the histogram. X_i is the median value of each bin of the histogram. Depending on the span setting of the X-axis, the interval width of each bin becomes 25 ps in which case X_i becomes the measured value. For details, see "Histogram Display" on page 2-13.

- **Average**

Calculates the average value of the histogram. P_i is the relative frequency*.

$$Average = \sum_{i=1}^n X_i \times P_i$$

* If the total number of samples on which the statistics are being calculated is N, and the frequency of occurrence (number of samples) of a certain bin is N_i, then the relative frequency becomes P_i = N_i/N.

- **Maximum**

Indicates the maximum median value.

$$Maximum = [X_i]_{max}$$

- **Minimum**

Indicates the minimum median value.

$$Minimum = [X_i]_{min}$$

- **Peak-Peak**

Calculates the difference between the maximum and minimum values.

$$Peak - Peak = Maximum - Minimum$$

- **Standard deviation (σ)**

Calculates the standard deviation of the histogram. This indicates the degree to which the values are spread out from the average value. P_i is the relative frequency.

$$\sigma = \sqrt{\sum_{i=1}^n (X_i - Average)^2 \times P_i}$$

- **Flutter (σ/Average)**

Calculates the flutter of the histogram. This indicates the spread in the values in terms of a percentage of the average value.

$$\sigma/Average = \frac{\sigma}{Average} \times 100 (\%)$$

- **σ/T**

Calculates the histogram jitter using the specified constant T. Indicates the spread of the values in terms of a percentage of the value T.

$$\sigma/T = \frac{\sigma}{T} \times 100 (\%)$$

2.7 Statistical Calculation and Inter-Symbol Interference Analysis

- **Deviation**

X_{CENTER} is the center value of the x axis in the window (see page 2-13). Originally, X_{CENTER} represented the value around which the measured data would be distributed. Indicates the deviation of the measured average value with respect to X_{CENTER} .
 Deviation = Average - X_{CENTER}

- **Deviation/T**

Indicates the deviation of the measured average value with respect to X_{CENTER} in terms of a percentage of the value T.
 Deviation/T = $\frac{|Average - X_{CENTER}|}{T} \times 100 (\%)$

- **Median**

Indicates the median of the histogram.
 Median = $[X_i]_{Median}$

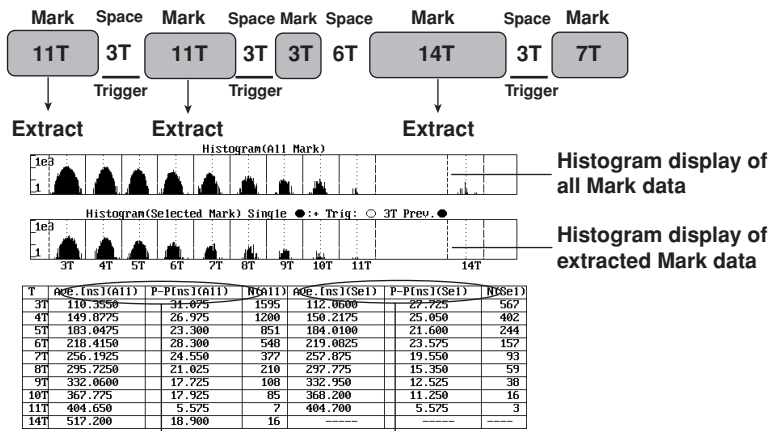
- **Mode**

Indicates the median value with the highest frequency of occurrence (most frequent value).
 Mode = $[X_i]_{Mode}$

Inter-symbol Interference Analysis (ISI) (see section 9.2 for the operating procedure)

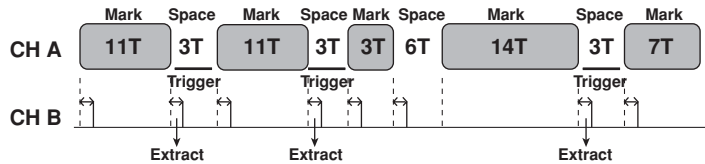
When the sampling mode is set to inter-symbol interference analysis mode, the data around the spaces and marks of the specified condition can be extracted. The data can be displayed in a histogram format or their statistics can be calculated. In addition, the histograms and statistics of all marks and spaces of the measured data can be displayed at the same time. In the dual measurement function, the following inter-symbol interference analysis is possible.

Analysis Example of Pulse Width (Extracting the mark data before the 3T space)

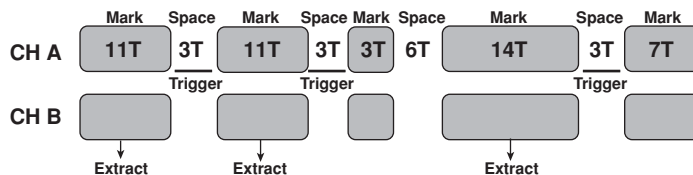


Statistic values of all Mark data Statistical values of extracted Mark data

Analysis Example of Pulse Width A→A-to-B Time Interval (Extracting the A-to-B interval from the front edge of the 3T space)



Analysis Example of Pulse Width A→Pulse Width B (Extracting the mark data of CH B before the 3T space of CH A)



Sync Function

In inter-symbol interference analysis mode, inter-symbol interference analysis can be performed beginning with the symbol pattern specified by the symbol search function (see page 2-20).

For example, this function allows the analysis to start from where the measured patterns of pulse width A and pulse width B match if the data pattern sequence is offset between pulse width A and pulse width B in the pulse width A→pulse width B measurement.

Measurement without using the Sync function

The data of pulse A and pulse B may not match.

| 2002/08/02 14:33:11 | | | | | | | | | | | |
|---------------------|-----------------|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| ISI | | PU A | | PU B | | Event 1000 | | Interval Min | | Interval Max | |
| Inhibit Off | Ref. Clock Int. | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† |
| ChA: -0.021U | ChB: -0.025U | Sync: Off | ChA: 0.Event 113 | ChB: 0.Event 115 | ChA: 0.Event 113 | ChB: 0.Event 115 | ChA: 0.Event 113 | ChB: 0.Event 115 | ChA: 0.Event 113 | ChB: 0.Event 115 | ChA: 0.Event 113 |
| Pulse Width A | | | Pulse Width B | | | Pulse Width A | | | Pulse Width B | | |
| Number | TimeStamp | NT | Measured Data | Number | TimeStamp | NT | Measured Data | Number | TimeStamp | NT | Measured Data |
| 1 | 7.8 us | 2T | 51.600 ns | 1 | 8.0 us | 6T | 44.775 ns | 1 | 8.1 us | 4T | 20.600 ns |
| 2 | 7.9 us | 3T | 53.200 ns | 2 | 8.0 us | 4T | 28.650 ns | 2 | 8.1 us | 9T | 67.025 ns |
| 3 | 7.9 us | 3T | 21.825 ns | 3 | 8.1 us | 6T | 45.025 ns | 3 | 8.2 us | 4T | 29.125 ns |
| 4 | 7.9 us | 5T | 36.525 ns | 4 | 8.1 us | 4T | 28.550 ns | 4 | 8.2 us | 6T | 44.500 ns |
| 5 | 8.0 us | 6T | 44.725 ns | 5 | 8.1 us | 9T | 66.950 ns | 5 | 8.3 us | 4T | 20.600 ns |
| 6 | 8.0 us | 4T | 28.700 ns | 6 | 8.2 us | 4T | 29.075 ns | 6 | 8.3 us | 5T | 38.100 ns |
| 7 | 8.0 us | 6T | 45.025 ns | 7 | 8.2 us | 6T | 44.475 ns | 7 | 8.3 us | 3T | 19.600 ns |
| 8 | 8.1 us | 4T | 28.525 ns | 8 | 8.2 us | 4T | 28.600 ns | 8 | 8.3 us | 4T | 32.300 ns |
| 9 | 8.2 us | 9T | 66.975 ns | 9 | 8.3 us | 5T | 38.200 ns | 9 | 8.4 us | 6T | 42.400 ns |
| 10 | 8.2 us | 4T | 29.075 ns | 10 | 8.3 us | 3T | 19.650 ns | 10 | 8.4 us | 5T | 36.725 ns |
| 11 | 8.2 us | 6T | 44.500 ns | 11 | 8.3 us | 4T | 32.150 ns | 11 | 8.5 us | 14T | 103.575 ns |
| 12 | 8.3 us | 4T | 28.625 ns | 12 | 8.4 us | 6T | 42.525 ns | 12 | 8.6 us | 4T | 30.300 ns |
| 13 | 8.3 us | 5T | 38.175 ns | 13 | 8.4 us | 5T | 36.550 ns | 13 | 8.6 us | 3T | 19.800 ns |
| 14 | 8.3 us | 3T | 19.625 ns | 14 | 8.5 us | 14T | 103.575 ns | 14 | 8.6 us | 7T | 53.675 ns |
| 15 | 8.3 us | 4T | 32.275 ns | 15 | 8.5 us | 4T | 30.375 ns | 15 | 8.6 us | 3T | 19.900 ns |
| 16 | 8.4 us | 6T | 42.550 ns | 16 | 8.6 us | 3T | 19.800 ns | 16 | 8.7 us | 3T | 23.750 ns |
| 17 | 8.4 us | 5T | 36.525 ns | 17 | 8.6 us | 7T | 53.725 ns | 17 | 8.7 us | 5T | 38.975 ns |
| 18 | 8.5 us | 14T | 103.700 ns | 18 | 8.7 us | 3T | 19.950 ns | 18 | 8.7 us | 5T | 38.575 ns |
| 19 | 8.6 us | 4T | 30.275 ns | 19 | 8.7 us | 3T | 23.725 ns | 19 | 8.7 us | 5T | 38.575 ns |
| 20 | 8.6 us | 3T | 19.950 ns | 20 | 8.7 us | 5T | 35.950 ns | 20 | 8.8 us | 3T | 20.175 ns |

Measurement using the Sync function

The pattern of pulse width A and pulse width B can be matches starting with the "14T-4T-3T" pattern

| 2002/08/02 14:33:54 | | | | | | | | | | | |
|---------------------|-----------------|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| ISI | | PU A | | PU B | | Event 1000 | | Interval Min | | Interval Max | |
| Inhibit Off | Ref. Clock Int. | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† | Ext. Arming† |
| ChA: -0.021U | ChB: -0.025U | Sync: On | ChA: 0.Event 113 | ChB: 0.Event 115 | ChA: 0.Event 113 | ChB: 0.Event 115 | ChA: 0.Event 113 | ChB: 0.Event 115 | ChA: 0.Event 113 | ChB: 0.Event 115 | ChA: 0.Event 113 |
| Pulse Width A | | | Pulse Width B | | | Pulse Width A | | | Pulse Width B | | |
| Number | TimeStamp | NT | Measured Data | Number | TimeStamp | NT | Measured Data | Number | TimeStamp | NT | Measured Data |
| 8 | 8.1 us | 4T | 28.650 ns | 4 | 8.1 us | 4T | 20.600 ns | 4 | 8.1 us | 4T | 20.600 ns |
| 9 | 8.2 us | 9T | 67.000 ns | 5 | 8.1 us | 9T | 67.025 ns | 5 | 8.1 us | 9T | 67.025 ns |
| 10 | 8.2 us | 4T | 29.150 ns | 6 | 8.2 us | 4T | 29.125 ns | 6 | 8.2 us | 4T | 29.125 ns |
| 11 | 8.2 us | 6T | 44.550 ns | 7 | 8.2 us | 6T | 44.500 ns | 7 | 8.2 us | 6T | 44.500 ns |
| 12 | 8.3 us | 4T | 20.650 ns | 8 | 8.3 us | 4T | 20.600 ns | 8 | 8.3 us | 4T | 20.600 ns |
| 13 | 8.3 us | 5T | 38.125 ns | 9 | 8.3 us | 5T | 38.100 ns | 9 | 8.3 us | 5T | 38.100 ns |
| 14 | 8.3 us | 3T | 19.700 ns | 10 | 8.3 us | 3T | 19.600 ns | 10 | 8.3 us | 3T | 19.600 ns |
| 15 | 8.3 us | 4T | 32.225 ns | 11 | 8.3 us | 4T | 32.300 ns | 11 | 8.3 us | 4T | 32.300 ns |
| 16 | 8.4 us | 6T | 42.575 ns | 12 | 8.4 us | 6T | 42.400 ns | 12 | 8.4 us | 6T | 42.400 ns |
| 17 | 8.4 us | 5T | 36.650 ns | 13 | 8.4 us | 5T | 36.725 ns | 13 | 8.4 us | 5T | 36.725 ns |
| 18 | 8.5 us | 14T | 103.625 ns | 14 | 8.5 us | 14T | 103.575 ns | 14 | 8.5 us | 14T | 103.575 ns |
| 19 | 8.6 us | 4T | 30.325 ns | 15 | 8.6 us | 4T | 30.300 ns | 15 | 8.6 us | 4T | 30.300 ns |
| 20 | 8.6 us | 3T | 19.875 ns | 16 | 8.6 us | 3T | 19.800 ns | 16 | 8.6 us | 3T | 19.800 ns |
| 21 | 8.6 us | 7T | 53.625 ns | 17 | 8.6 us | 7T | 53.675 ns | 17 | 8.6 us | 7T | 53.675 ns |
| 22 | 8.7 us | 3T | 19.925 ns | 18 | 8.6 us | 3T | 19.900 ns | 18 | 8.6 us | 3T | 19.900 ns |
| 23 | 8.7 us | 3T | 23.800 ns | 19 | 8.7 us | 3T | 23.750 ns | 19 | 8.7 us | 3T | 23.750 ns |
| 24 | 8.7 us | 5T | 35.975 ns | 20 | 8.7 us | 5T | 35.975 ns | 20 | 8.7 us | 5T | 35.975 ns |
| 25 | 8.8 us | 5T | 38.550 ns | 21 | 8.7 us | 5T | 38.575 ns | 21 | 8.7 us | 5T | 38.575 ns |
| 26 | 8.8 us | 3T | 20.175 ns | 22 | 8.8 us | 3T | 20.175 ns | 22 | 8.8 us | 3T | 20.175 ns |

"14T-4T-3T" pattern

When the function is set to pulse width or pulse width A→A-to-B time interval, inter-symbol interference analysis is performed beginning with the specified symbol pattern.

Missed Sampling Fill Function

Continuous measurement is a must in inter-symbol interference analysis mode.

Therefore, dropouts in the measured values are filled (with asterisks) according to the following conditions in the sampling of the dual measurement function. Measured data and analysis results are displayed only if the following conditions are met.

Maximum number of dropout samples that can be filled: 256

Conditions for filling the samples: When the dropout sampling interval is 100 ns or more
If a dropout of the measured value occurs, the dropout can be verified on the list display as shown below. This also prevents erroneous extraction due to the offset or dropout in the data sequence.

Measured data failed to be acquired

| Pulse Width A | | | | | | Pulse Width B | | | | | |
|---------------|-----------|-----|---------------|--------|-----------|---------------|---------------|--------|-----------|----|---------------|
| Number | TimeStamp | NT | Measured Data | Number | TimeStamp | NT | Measured Data | Number | TimeStamp | NT | Measured Data |
| 57 | 1.9 us | 5T | 37.675 ns | 57 | 1.9 us | 5T | 37.050 ns | 57 | 1.9 us | 5T | 37.050 ns |
| 58 | 1.9 us | 2T | 17.475 ns | 58 | 1.9 us | 2T | 18.575 ns | 58 | 1.9 us | 2T | 18.575 ns |
| 59 | ***** | *** | ***** | 59 | 2.0 us | 4T | 30.450 ns | 59 | 2.0 us | 4T | 30.450 ns |
| 60 | ***** | *** | ***** | 60 | 2.0 us | 7T | 48.625 ns | 60 | 2.0 us | 7T | 48.625 ns |
| 61 | 2.1 us | 4T | 29.200 ns | 61 | 2.1 us | 4T | 28.975 ns | 61 | 2.1 us | 4T | 28.975 ns |
| 62 | 2.1 us | 2T | 18.000 ns | 62 | 2.1 us | 2T | 18.450 ns | 62 | 2.1 us | 2T | 18.450 ns |

Note

Continuous measurement is a must in inter-symbol interference analysis mode. When the polarity/slope is A ↗ A ↑ B ↑ or A ↘ A ↓ B ↓ in the pulse width→A-to-B time interval measurement, the continuous measure condition that states "the time from the measurement edge of CH B to the measurement edge of CH A is 13 ns or more" (see section 2.5) is sometimes difficult to be met. In such case, the continuous measurement condition is sometimes met by changing the polarity/slope to A ↗ A ↑ B ↓, A ↘ A ↓ B ↑, A ↗ A ↓ B ↓, or A ↘ A ↑ B ↓.

2.8 Other Functions

External Signal Input/Output

In addition to input terminals for measurement, input/output terminals for exchanging signals with external devices are provided on the front and rear panels. For the locations of the terminals, see section 1.1, "Front Panel and Rear Panel."

10-MHz Reference Input (see section 6.8 on how to use it)

The TA720 generates a reference clock signal internally for making measurement, but an external signal applied to the 10MHz REF IN terminal on the rear panel can be used in place of the internal clock signal.

10-MHz Output (see section 13.3 on how to use it)

The internal reference clock signal or the externally applied reference clock signal is passed through a 10-MHz band-pass filter and is continuously output from the 10MHz OUT terminal.

Monitor Output (see section 13.5 on how to use it)

The signal applied to the input terminal is voltage divided to approximately half its value and output from this terminal.

This signal can be used to check the waveform when phase correcting a probe. Which channel's input signal is output varies depending on the measurement function.

External Arming Input/External Gate Input/Inhibit Input

These signal inputs are used to externally control the measurement functions of the instrument. The external arming input terminal is shared with the external gate input terminal. For the functionality of the external arming and inhibit input signals, see section 2.5, "Setting Measurement Conditions."

Storing and Recalling Setup Data (see chapter 10 for the operating procedure)

Up to 32 sets of setup data can be stored in the internal non-volatile memory. The stored setup data can also be recalled to set up the instrument. This function is useful when the same setup is used often.

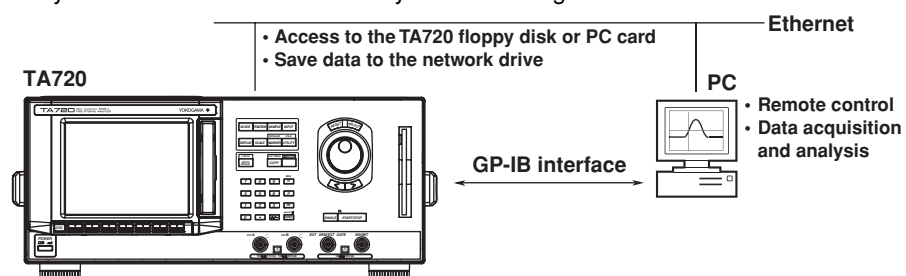
Saving and Recalling Data to/from the Floppy Disk or PC Card (see chapter 11 for the operating procedure)

The TA720 comes with a floppy disk drive as standard. A PC card slot is also provided as an option.

The setup data and measured data can be saved to the floppy disk or PC card and recalled when necessary. An image of the screen can also be saved in TIFF, BMP, or PostScript format. You can create reports by pasting the screen image data to a document created using a word processor.

Communications (see chapter 12 and the Communication Interface User's Manual for the operating procedure)

The Ethernet interface (optional) or the GP-IB interface can be used to perform communications with other devices such as a PC. Data can be saved on a network drive via the Ethernet interface or the floppy disk or PC card of the TA720 can be accessed from a PC. In addition, the measured data can be output to a PC via the Ethernet interface or GP-IB interface to be analyzed or the TA720 can be externally controlled using communications.



Printer Output of the Screen Image (see section 11.12 for the operating procedure)

The image displayed on the screen can be printed on the built-in printer.

Initializing the Settings (see section 13.1 for the operating procedure)

The setup data can be reset to their factory default settings.

Calibration (see section 13.2 for the operating procedure)

Using the internal calibration signal, the offset voltage of the input amplifier and the conversion factors of the time and voltage converters can be calibrated. Calibration is performed when the ambient environment (temperature and humidity) changes drastically.

Changing the Beep and Click Sounds (see section 13.7 for the operating procedure)

A beep sound is heard when an error occurs. The beep sound can be turned OFF. You can also select to turn ON or OFF the click sound that is heard when the rotary knob is turned.

Error Logging (see section 14.3 for the operating procedure)

When a data error such as a data overflow or a communication error occurs, a ? (warning mark) is displayed at the upper right corner of the screen. In such case, the message is logged. All the messages can be viewed collectively as an error log later on.

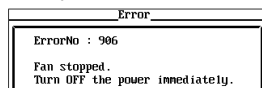
Self Test (see section 14.4 for the operating procedure)

If you are in doubt as to whether the instrument has malfunctioned, you can run a self-test before contacting a YOKOGAWA dealer. You can run checks on the circuit board, the keys, the display, and other functions.

3.1 Handling Precautions

Safety Precautions

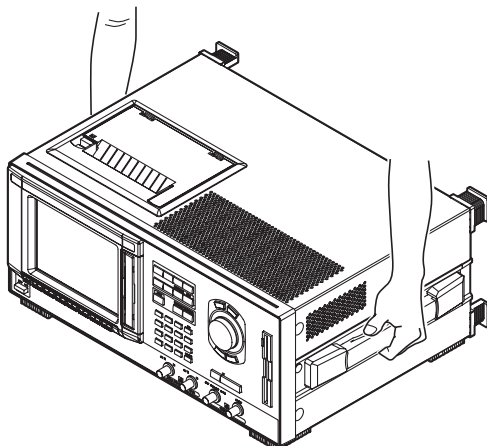
- When using the TA720 for the first time, make sure to read the “Safety Precautions” given on pages iv and v.
- Do not remove the cover from the instrument. Some sections inside the instrument have high voltages that are extremely dangerous. For internal inspection or adjustment, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.
- Never continue to use the instrument if there are any symptoms of trouble such as strange odors or smoke coming from the instrument. In such cases, immediately turn OFF the power and unplug the power cord. If such an irregularity occurs, contact your dealer or the nearest YOKOGAWA representative, as listed on the back cover of this manual.
- If the following error message is displayed, immediately turn OFF the power. The cooling fan has stopped. From the rear panel, check for and remove any foreign object that may be obstructing the cooling fan. If the same error message appears when you turn ON the power switch again, it is probably a malfunction. In this case, contact your nearest YOKOGAWA dealer.



- Nothing should be placed on top of the power cord. The power cord should also be kept away from any heat sources. When unplugging the power cord from the outlet, never pull by the cord itself. Always hold and pull by the plug. If the power cord is damaged, contact your dealer for replacement. Refer to page ii for the part number of the appropriate power cord when placing an order.

General Handling Precautions

- Never place any objects containing water on top of the instrument. Such act can lead to malfunction.
- Do not apply shock or vibration. Such act can lead to malfunction. Take extra caution because the built-in floppy disk drive is sensitive to vibration and shock. In addition, applying shock to the input/output terminal or the connected cable can cause electrical noise to enter or output from the instrument.
- Do not bring charged objects near the input/output terminals. Such act can lead to malfunction.
- If you are not going to use the instrument for a long period of time, unplug the power cord from the outlet.
- When carrying the instrument, unplug the power cord and cables. The instrument weighs approximately 12 kg. To carry the instrument, use the handle as shown in the figure below, and move it with care.



3.1 Handling Precautions

- Be careful not to scratch the surface of the LCD with sharp objects. Such act can lead to malfunction.
- When cleaning the case or the operation panel, first remove the power cord from the outlet. Then, wipe with a dry, soft cloth. Do not use volatile chemicals such as benzene or thinner for cleaning, as this may lead to discoloration or deformation.

3.2 Installing the TA720

Installation Conditions

Install the instrument in a place that meets the following conditions.

Ambient Temperature and Humidity

Use the instrument in the following environment:

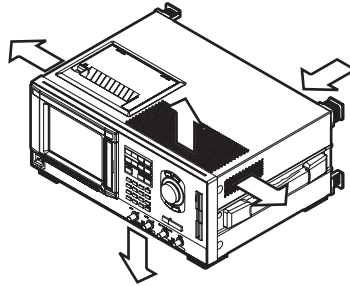
- Ambient temperature: 5 to 40°C
However, in order to obtain highly accurate measurements, operate the instrument in the $23 \pm 5^\circ\text{C}$ temperature range.
- Ambient humidity: 20 to 80% RH
No condensation should be present. However, in order to obtain highly accurate measurements, operate the instrument in the $50 \pm 10\%$ RH range.

Note

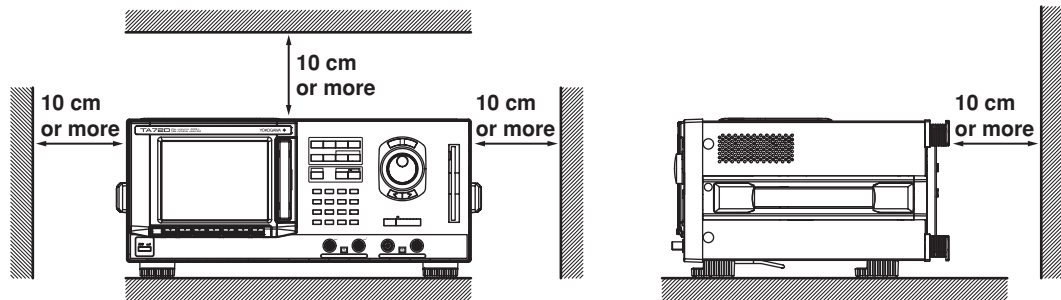
Condensation may occur if the instrument is moved to another place where the ambient temperature is higher, or if the temperature changes rapidly. In such case, let the instrument adjust to the new environment for an hour before using it.

Well-Ventilated Location

There are vent holes on the top, bottom, and side panels of the instrument. The rear panel contains an inlet holes for the cooling fan.



To prevent internal overheating, allow for enough space around the instrument (see the figure below) and do not block the vent and inlet holes.



Do not install the instrument in the following places:

- In direct sunlight or near heat sources.
- Where an excessive amount of soot, steam, dust, or corrosive gas is present.
- Near strong magnetic field sources.
- Near high voltage equipment or power lines.
- Where the level of mechanical vibration is high.
- In an unstable place.

Storage Location

When storing the instrument, avoid the following places:

- Where the relative humidity is 80% or more.
- In direct sunlight.
- Where the temperature is 60°C or higher.
- Near a high humidity or heat source.
- Where the level of mechanical vibration is high.
- Where corrosive or explosive gas is present.
- Where an excessive amount of soot, dust, salt, and iron are present.
- Where water, oil, or chemicals may splash.

It is recommended that the instrument be stored in an environment where the temperature is between 5 and 40°C and the relative humidity is between 20 and 80% RH.

Installation Position



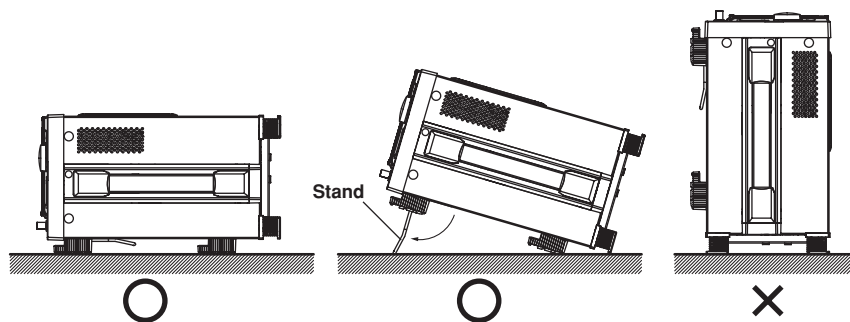
WARNING

To avoid the possibility of fire, never use the instrument with the rear side facing down, as the cooling vents will be obstructed. There are inlet holes for the cooling fan on the rear panel. Placing the instrument with the rear side down can cause a fire when the instrument malfunctions. If you must use the instrument with the rear panel down, place a metal plate or a flame-resistant barrier (grade UL94V-1 or higher) beneath the instrument.

Place the instrument in a horizontal position or inclined position using the stand as shown in the center of the figure below.

When using the stand, pull it forward until it locks (perpendicular to the bottom surface of the instrument). If you are installing the instrument on a slippery surface, attach the rubber feet (four pieces, included in the package) to the feet.

If you are not using the stand, return it to the original position while pressing the leg section of the stand inward.



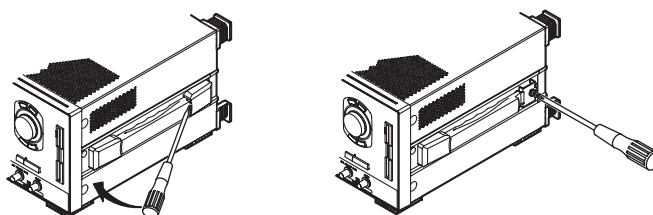
Rack Mount

To rack mount the instrument, use the rack mount kit that is sold separately.

| Part Name | Model | Remarks |
|----------------|-----------|---------|
| Rack mount kit | 751535-E4 | For EIA |
| Rack mount kit | 751535-J4 | For JIS |

An outline of the attachment procedures is given below. For details regarding the attachment procedures, see the instructions that are included with the rack mount kit.

1. Remove the handles on both sides of the instrument.
2. Remove the four feet on the bottom of the instrument.
3. Remove the two plastic rivets and the four seals covering the rack mount attachment holes on both sides of the instrument near the front.
4. Place seals over the feet and handle attachment holes.
5. Attach the rack mount kit.
6. Mount the instrument on the rack.



Note

- When rack mounting the instrument, allow at least 2 cm of space between the bottom side of the instrument and the installation surface to prevent internal overheating. For the spacing of other sides, allow at least 10 cm of space as described on page 3-3.
- Make sure to have adequate support for the bottom of the instrument. However, do not block the vent holes in the process.

3.3 Connecting to the Power

Before Connecting the Power

Make sure that you observe the following points before connecting the power. Failure to do so may cause electric shock or damage to the instrument.



WARNING

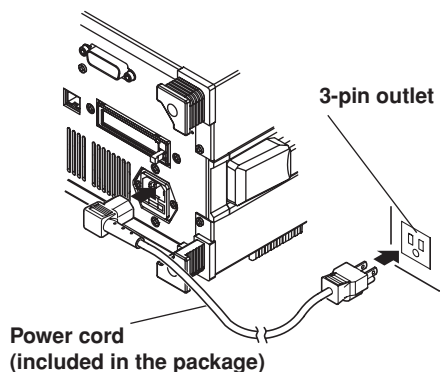
- Before connecting the power cord, ensure that the source voltage matches the rated supply voltage of the instrument and that it is within the maximum rated voltage of the provided power cord.
- Connect the power cord after checking that the power switch of the instrument is turned OFF.
- To prevent the possibility of electric shock or fire, always use the power cord supplied by YOKOGAWA.
- Make sure to perform protective grounding to prevent the possibility of electric shock. Connect the power cord to a three-pin power outlet with a protective earth terminal.
- Do not use an extension cord without protective earth ground. Otherwise, the protection function will be compromised.

Connection Procedure

1. Check that the power switch on the front panel is OFF.
2. Connect the power cord plug to the power connector on the rear panel. (Use the power cord that came with the package.)
3. Connect the plug on the other end of the power cord to the outlet that meets the conditions below. The AC outlet must be of a three-pin type with a protective earth ground terminal.

| Item | Specifications |
|--|--------------------------------|
| Rated supply voltage* | 100 to 120 VAC, 200 to 240 VAC |
| Permitted supply voltage range | 90 to 132 VAC, 180 to 264 VAC |
| Rated supply voltage frequency | 50/60 Hz |
| Permitted supply voltage frequency range | 48 to 63Hz |
| Maximum power consumption (when using the printer) | 250 VA |

* The TA720 can use a 100-V or a 200-V system for the power supply. The maximum rated voltage of the power cord varies depending on its type. Check that the voltage supplied to the TA720 is less than or equal to the maximum rated voltage of the provided power cord (see page ii) before using it.



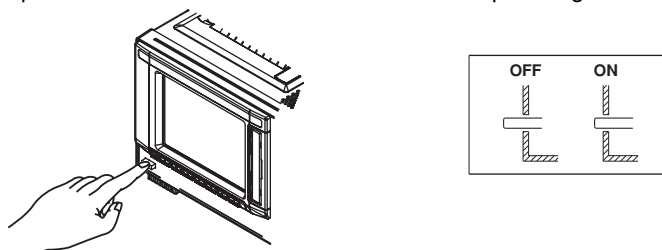
3.4 Turning ON/OFF the Power Switch

Items to be checked before turning ON the power

- Is the instrument properly installed? See section 3.2, “Installing the TA720”
- Is the power cord properly connected? See section 3.3, “Connecting to the Power”

Location of the Power Switch and ON/OFF Operation

The power switch is located at the lower left section of the front panel. The power switch is a push button. Press once to turn it “ON” and press again to turn it “OFF.”



Note

Allow at least 10 s when turning ON the power switch after turning it OFF. Otherwise, the screen may not show anything. In such case, turn OFF the power switch again, wait at least 10 s, and then turn ON the power switch.

Power ON Operation

The following initial operation is carried out when the power switch is turned ON. Front panel key operations are disabled during this period. When the initial operation is complete, the display screen (screen that appears when the DISPLAY key is pressed) appears.

- ROM Check
- DRAM Check
- SRAM Check
- SRAM Cal Check: Calibration data check

Note

If the instrument does not operate as described above when the power switch is turned ON, turn OFF the power switch and check the following points.

- Check that the power cord is plugged in properly.
- Is the correct voltage coming to the power outlet? See section 3.3.

If the TA720 still fails to power up when the power switch is turned ON after checking these points, it is probably a malfunction. Please contact your nearest YOKOGAWA dealer as listed on the back cover of this manual for repairs.

For Making Accurate Measurements

In the installation condition indicated in section 3.2, allow the instrument to warm up for at least 30 minutes after the power switch is turned ON

Shutdown Operation

When the power switch is turned OFF, the setup data is stored, but measured results and statistical calculation results are not. Save necessary data beforehand such as to a floppy disk (section 11.5 and 11.6).

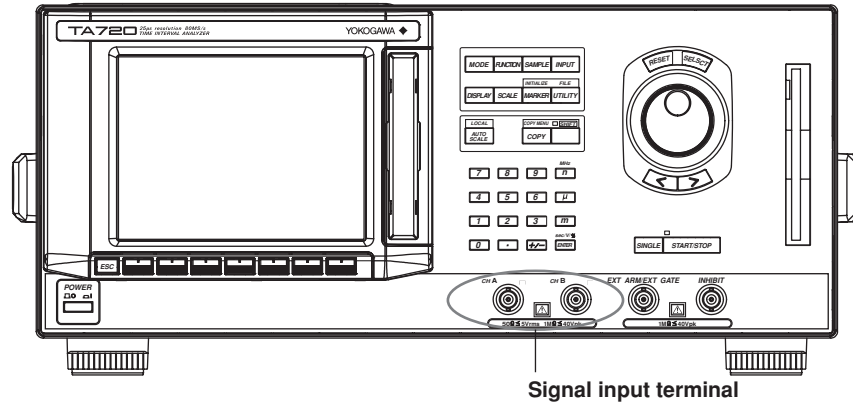
Note

The lithium battery that is used to store data has a limited life span. If the lithium battery is low, the TA720 no longer operates properly such as the improper indication of date/time, or inability to store/recall measured data. If such symptoms appear, execute a self test (see section 14.4). If a warning message “Low Battery” is indicated as a result of the self test, the lithium battery must be replaced quickly. The user cannot replace the battery. For battery replacement, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

3.5 Connecting Cables and Probes

Location of Signal Input Terminals

The input terminals are located at the lower section of the front panel. Connect a cable with a BNC connector or a probe.



Specifications of the Signal Input Section

Connector type: BNC

Number of channels: 2

Input impedance: $50\ \Omega$ or $1\ M\Omega$, $23\ pF$ (typical value*)

Maximum input voltage

- For input impedance of $50\ \Omega$: $5\ V_{rms}$
- For input impedance of $1\ M\Omega$:
 $40\ V$ (DC+ACpeak) for $DC \leq \text{input frequency} \leq 100\ kHz$
 $\{3.5/f+5\}\ V$ (DC+ACpeak) for $100\ kHz \leq \text{input frequency} \leq 200\ MHz$, where f is the frequency in MHz

Ground: Connect to the case ground

* Typical values represent typical or average values. It is not strictly warranted.



CAUTION

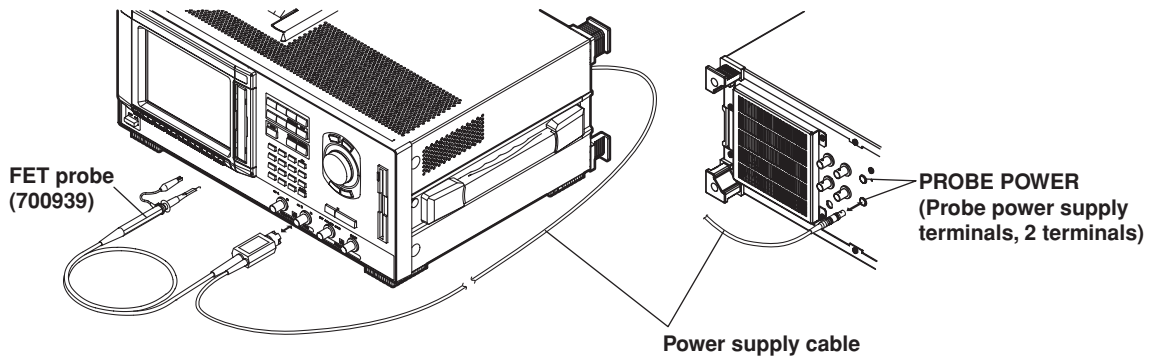
Do not apply a voltage exceeding the maximum input voltage to the input terminal of the TA720. This may cause damage to the input section.

Note

When connecting a probe to the TA720 for the first time, perform phase correction of the probe as described in section 3.6, "Calibrating the Probe (Phase Correction)." Failure to do so will cause unstable gain across different frequencies, thereby preventing correct measurement. Phase correction of the probe must be performed on each channel.

When Using an FET Probe (700939)

Use the probe power supply terminal (output voltage: ± 12 V) on the rear panel of the TA720 to supply power to the FET probe.

**CAUTION**

Do not use the probe power supply terminal (2 terminals) on the rear panel of the TA720 for purposes other than supplying power to YOKOGAWA's FET probe (700939). Otherwise, damage to the TA720 or connected instrument may result.

3.6 Calibrating the Probe (Phase Correction)

Items Required

The following items are required.

Compensation Signal

- Frequency: 1 kHz
- Voltage (waveform amplitude): 1 Vp-p
- Waveform type: Rectangular wave
- Output impedance: 1M Ω
- Recommended signal: CAL signal of DL1700 Series Digital Oscilloscope (YOKOGAWA)

Waveform Monitor

- Frequency characteristics: DC to 250 MHz (–3 dB point)
- Input coupling: DC
- Input impedance: 50 Ω
- Recommended instrument: DL1700 Series Digital Oscilloscope (YOKOGAWA)

The connection procedure and operation when the recommended signal is connected to the recommended instruments are described below.

Connecting the instrument

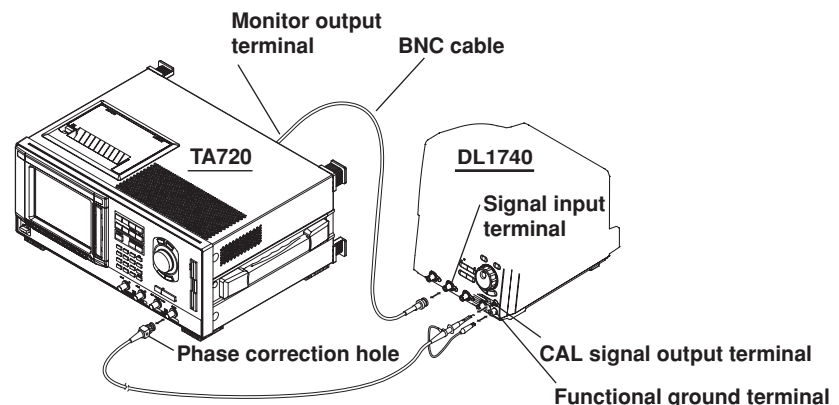


CAUTION

- Do not apply a voltage exceeding the maximum input voltage to the signal input terminal of the TA720. This may cause damage to the input section.
- Do not apply external voltage to the CAL signal output terminal of the DL1700 Series Digital Oscilloscope or the monitor output terminal of the TA720. This may cause damage to the internal circuitry.

Check that the TA720 and the DL1700 Series Digital Oscilloscope are turned OFF and connect them as shown in the figure.

1. Connect the monitor output terminals on the rear panel of the TA720 (CH A and CH B) to the signal input terminals of the DL1700 Series Digital Oscilloscope using BNC cables.
For details on how to use the monitor output of the TA720, see section 13.5, “Monitor Output.”
2. Connect the BNC end of the probe to be phase corrected to the signal input terminal of the TA720.
3. Connect the other end of probe to the CAL signal output terminal of the DL1700 Series Digital Oscilloscope and the ground wire to the functional ground terminal.



Procedure

1. Turn ON the power to the TA720 and the DL1700 Series Digital Oscilloscope.
2. Set the waveform acquisition conditions of the DL1700 Series Digital Oscilloscope so that approximately two periods of the waveform can be viewed in its entirety. For the procedure, see the user's manual for the DL1700 Series Digital Oscilloscope.
3. Insert a flat-blade screwdriver to the phase correction hole of the probe and turn the variable capacitor to make the displayed waveform on the waveform monitor a correct rectangular wave (see explanation).

Explanation**The Necessity of Phase Correction of the Probe**

If the input capacity of the probe is not within the adequate range, the gain across different frequencies will not be uniform. Consequently, a correct waveform cannot be input to the measurement circuit of the TA720. However, the input capacity of each probe is not necessarily all the same. Therefore, the probe has a variable capacitor (trimmer) that allows the input capacity to be adjusted. This adjustment is called phase correction.

When using the probe for the first time, make sure to perform phase correction. The appropriate input capacity varies depending on the channel of the TA720. Therefore, phase correction must also be performed when the connected channel is changed.

Compensation Signal

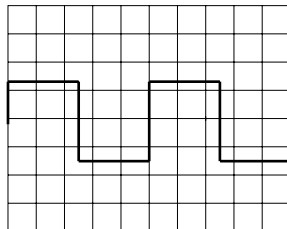
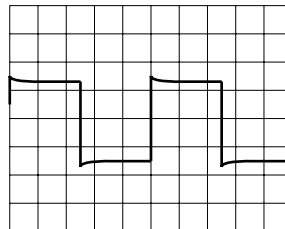
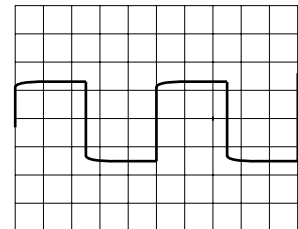
Waveform type: Rectangular wave

Frequency: 1 kHz

Voltage: 1 Vp-p

Differences in the Waveform Caused by the Phase Correction of the Probe

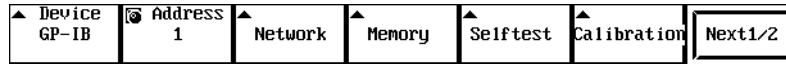
Correct waveform

Over compensated
(the gain in the high
frequency region is up)Under compensated
(the gain in the high
frequency region is low)

3.7 Setting the Date/Time

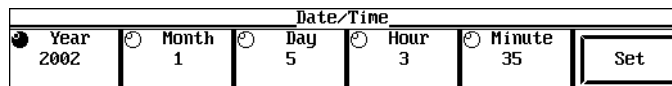
Procedure

1. Press the **UTILITY** key to display the Utility menu.

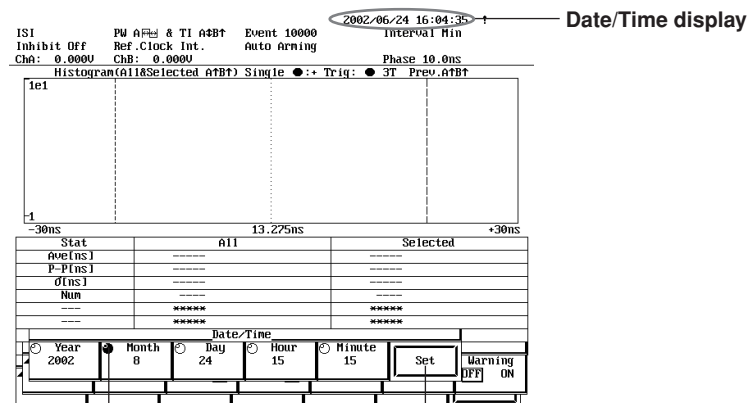


2. Press the soft keys in the following sequence: Next 1/2 > Config > Date/Time. The Date/Time setup menu appears.

If Next2/2 is displayed, press the soft keys in the following sequence: Config > Date/Time.



3. Press the soft key corresponding to the item you wish to set.
4. Turn the rotary knob to set the value.
5. Press the **Set** soft key to confirm the date/time.



Pressing the setup parameter soft key highlights the rotary knob icon. Confirm the date/time

Explanation

Setting the Date/Time

- Year
Selectable range: 2002 to 2079
- Month
Selectable range: 1 to 12
- Day
Selectable range: 1 to 31
- Hour
Selectable range: 0 to 23
- Minute
Selectable range: 0 to 59

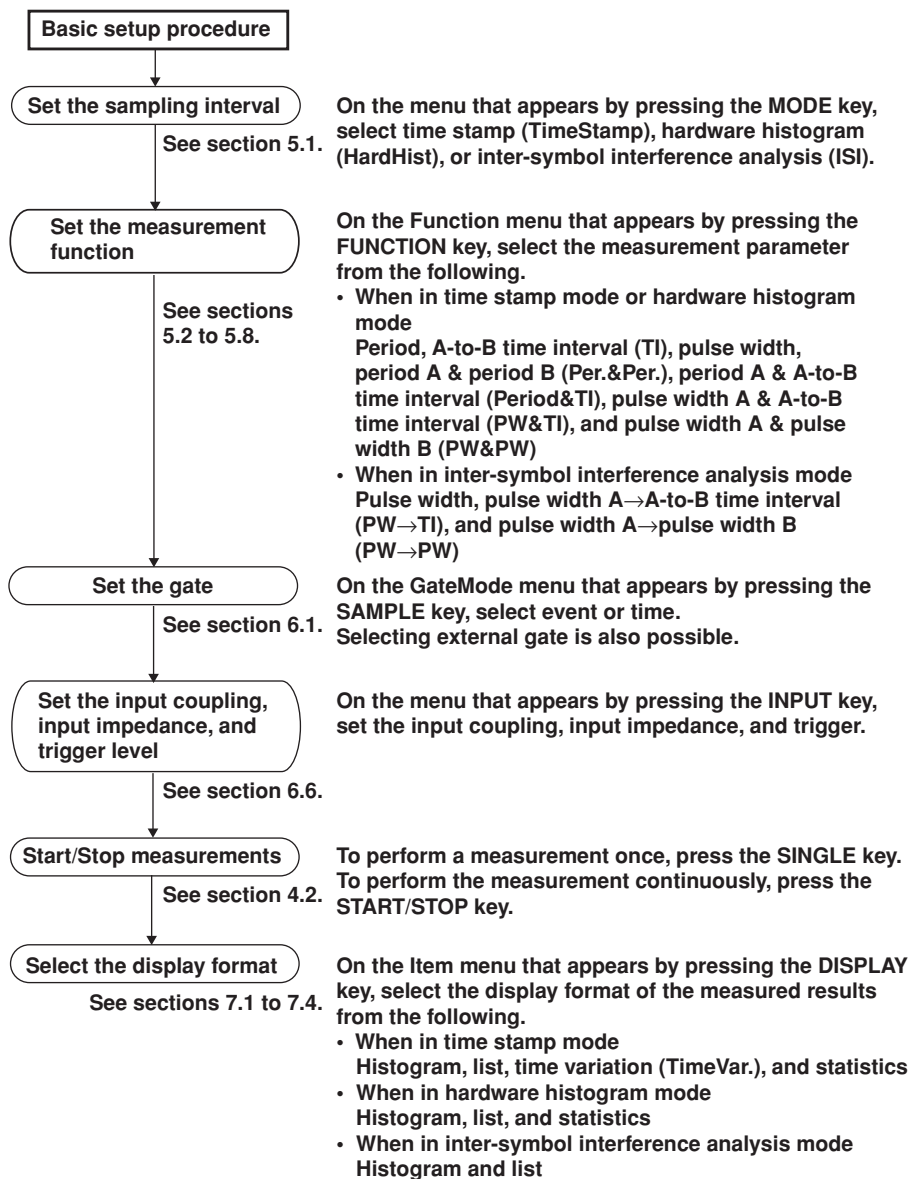
Seconds are also displayed on the screen, but you cannot set them. Seconds will be set to 00 when you press the Set soft key.

Using the Date/Time

The date/time is displayed at the upper right section of the screen (see the figure above), and is also used to log the date/time when data is saved.

4.1 Basic Setup Procedure

This section describes the basic setup procedure.



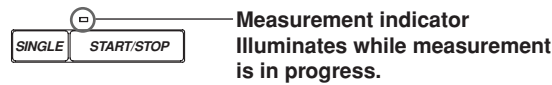
Note

Default settings are shown below. For other default settings, see chapter 13.1, "Initializing the Settings."

- Sampling mode: Hardware histogram
- Measurement function: Period
- Gate: Event (number of events: 100)
- Input coupling: DC
- Input impedance: 1 MΩ
- Trigger: Manual (trigger level: 0.000 V)
- Display format: Histogram

4.2 Starting/Stopping Measurements

Procedure



Single Measurement

Press the **SINGLE** key.

Measurement stops after making a single measurement.

To stop the measurement, press **START/STOP**. If you press the **SINGLE** key while measurement is in progress, the measurement is restarted.

Continuous Measurement

- **Starting the measurement**

Press the **START/STOP** key.

The measurement indicator turns ON.

- **Stopping the measurement**

Press **START/STOP** again.

The measurement indicator turns OFF.

Explanation

Single Measurement

- **When block sampling is OFF**

Measurement is performed once over the range specified by a single gate (1 block) and the display of the measurement results is updated.

- **When block sampling is ON**

Measurement is performed the number of times specified by block size. When the measurement of all blocks is complete, the display of the measured results is updated.

Continuous Measurement

- **When block sampling is OFF**

Repeats the single block measurement. When the measurement of a block is complete, the display of the measured results is updated.

- **When block sampling is ON**

Repeats the measurement of the specified block size. Each time the measurement of all blocks is complete, the display of the measured results is updated.

Note

- Measurement cannot be started when the storage medium is being accessed.
- For the setup procedure of the gate, see section 6.1.
- For the setup procedure of turning ON/OFF block sampling and the block size, see section 6.5.
- If the measurement is stopped in the middle of the measurement block by pressing the **START/STOP** key, the measured data up to the point when the key was pressed is acquired, and the measurement stops.
- If the measurement conditions are changed while measurement is in progress, measurement is restarted. Measurement conditions are items that are set mainly by pressing the **MODE**, **FUNCTION**, **SAMPLE**, and **INPUT** keys.
- The **CHA/CHB** input indicator is provided above the signal input terminal. If this indicator is not blinking, the signal may not be entering the TA720. Check the trigger level setting (see section 6.6), the cable connection, and the signal source.
If the **CHA/CHB** indicator does not blink even when a signal is properly applied to the signal input terminal of the TA720, it is probably a malfunction. Please contact your nearest YOKOGAWA dealer as listed on the back cover of this manual for repairs.

4.3 Basic Operation of Keys and Rotary Knob

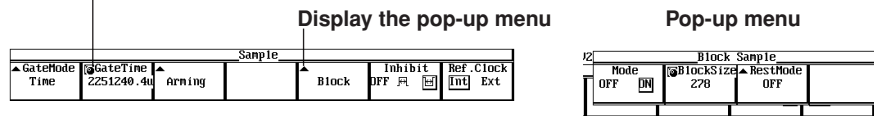
Setting keys

Pressing the setting key such as the MODE key or FUNCTION key shows a soft key menu at the bottom section of the screen.

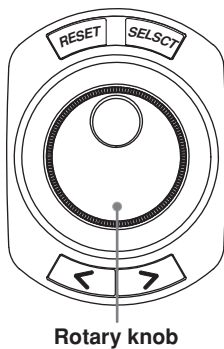
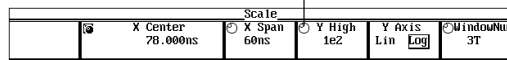
Description of the Icons on the Soft Key Menu.

- ▲ : Press the soft key to open a pop-up menu or pop-up window.
- ⊗ : The value can be set using both the numeric keys and the rotary knob. For the procedure of setting values, see the next page.
- ⊙ : The value can be selected using the rotary knob.

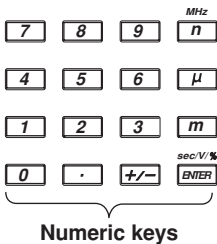
Set using the numeric keys and rotary knob



Set using the rotary knob



Rotary knob

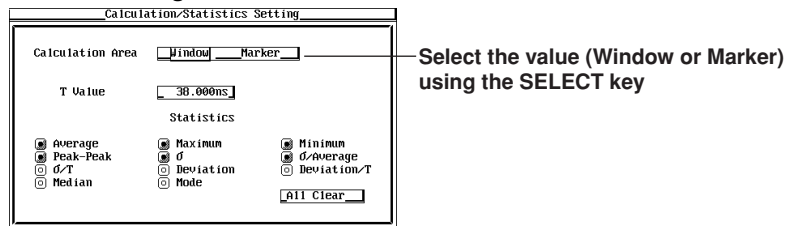


Numeric keys

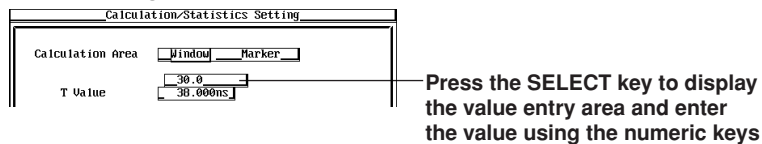
Setting Parameters Using the Rotary Knob and SELECT Key

In a pop-up window as shown in the following figure, select the entry box using the rotary knob (when selected, the entry box/item name changes to a dark blue color) and set the value according to the following procedure.

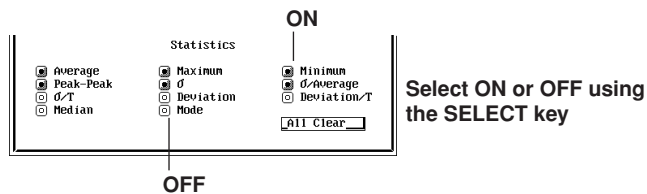
• When selecting the value



• When setting the value



• When selecting ON/OFF using the option button



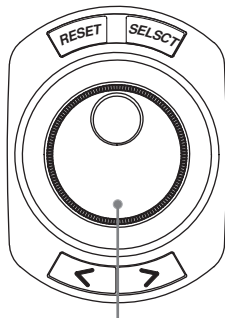
Using the RESET Key

This key is used to clear the entire value that is being entered (or that has already been entered). It is useful when you wish to clear a file name or comment entirely and start over.

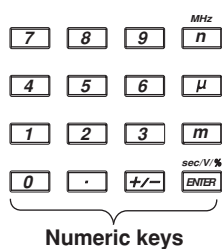
Using the ESC Key

This key clears the soft key menu. If a pop-up menu or pop-up window is displayed, it is cleared.

4.4 Entering Values and Character Strings







Rotary knob




Numeric keys

Setting Values Using the Rotary Knob

When a  mark or  mark appears on the soft key, set the value using the rotary knob. If the value consists of many digits, you can use the arrow keys ( ) below the rotary knob to move among the digits (the current digit is highlighted). You can also turn the rotary knob to increase the value of the current digit and cause a carry over.

Setting Values Using the Numeric Keys

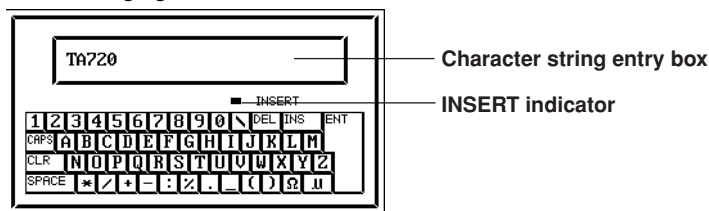
If a  icon is displayed on the soft key menu, press a numeric key to display a value entry area (see the previous page). After entering the value, press a unit key or the ENTER key to confirm the setting.

If you press another key before pressing a unit key or the ENTER key, the value that you were trying to enter is not confirmed, and the screen returns to the original condition. If you press the RESET key above and to the left of the rotary knob before confirming the value, the value is cleared.

The left arrow key below the rotary knob acts as a backspace key.

Setting Character Strings (Using the Keyboard)

Pressing the SELECT key that is above and to the right of the rotary knob when the entry box of a file name or comment is selected displays a keyboard on the screen as shown in the following figure.



Character string entry box

INSERT indicator

Procedure for Setting Character Strings

1. Turn the rotary knob to highlight the character you wish to enter.
If a character string is already entered such as a file name, use the arrow keys to move the cursor (highlighted section) to the position you wish to make an entry. If you wish to clear the entire character string that is already entered, press the RESET key that is above and to the left of the rotary knob.
2. Press the SELECT key to display the selected character in the character string entry box.
3. Repeat steps 1 and 2 to enter all the characters in the character string entry box.
4. Move the cursor to [ENT] on the keyboard and press the SELECT key that is above and to the right of the rotary knob.
The character string is confirmed and the keyboard disappears.

Functions of the Keys Other than the Characters on the Keyboard

- DEL: Deletes the character immediately before the cursor.
- INS: Switches the insert/overwrite mode. When in insert mode, the INSERT indicator on the keyboard illuminates.
- CLR: Clears all the characters that are displayed.
- SPACE: Enters a space.
- ENT: Confirms the displayed characters.
- CAPS: Switches between upper case and lower case.

The Number and Types of Characters That Can Be Used for File Names

| | Number of Characters | Characters That Can Be Used |
|-----------|----------------------|--------------------------------------|
| File name | 1 to 8 characters | 0-9, A-Z, %, _, (,), – (minus sign) |
| Comment | 0 to 25 characters | All characters (including spaces) |

Note

- You can reset the specified value to the default value (factory default setting). For a description of the initialization procedure and the default values, see section 13.1. Use caution because all the settings will be reset to default.

When Using Numeric Keys

- If you attempt to set a value exceeding the resolution of each parameter, the value will be truncated.
- If you attempt to enter a value exceeding the maximum value of a parameter, it will be set to the maximum value. If you attempt to enter a value smaller than the minimum value of a parameter, it will be set to the minimum value.

When Using the Keyboard

- The keyboard can be used along with the numeric keys. The numeric keys that can be used along with the keyboard are as follows:
0 to 9, ., ENTER, RESET keys (same as CLR on the keyboard)
 - File names are not case-sensitive. Comments are case-sensitive. In addition, the following five file names cannot be used due to limitations of MS-DOS.
AUX, CON, PRN, NUL, and CLOCK
 - When using the GP-IB interface commands to enter a file name, the following symbols that do not exist on the keyboard of this instrument can be used.
!, #, \$, %, ^, @, ~, {, }
-

5.1 Setting the Sampling Mode

For a functional description, see 2.3.

Procedure

1. Press the **MODE** key to display the Mode menu.

| Mode | | |
|-----------|----------|-----|
| TimeStamp | HardHist | ISI |

2. Press the soft key corresponding to the desired sampling mode.
The corresponding screen appears.

Explanation

Selecting the Sampling Mode

Select from the following:

- TimeStamp: Acquires the measured values and elapsed measurement time (time stamp) to the memory.
- HardHist (Hardware Histogram): Acquires the measured values and the frequency of occurrence of those values to the memory.
- ISI (Inter-symbol interference): Select this mode when performing inter-symbol interference analysis. As with the time stamp mode, the time stamps and measured values are acquired in the memory.

Note

- Changing the sampling mode clears the data that has been acquired to the memory up to that point.
- If changing the sampling mode causes the settings to be inappropriate for the sampling mode (measurement function, display format, etc.), the settings are changed to appropriate values.

5.2 Setting the Period Measurement

For a functional description, see 2.4.

Procedure

1. Press the **FUNCTION** key to display the Function menu.

| Function | | |
|-----------------|--------------------|-----------------|
| ▲Function TI | Channel ChA-ChB | ▲ Slope A#B↑ |

2. Press the **Function** soft key to display the Function selection menu.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

3. Press the **Period** soft key.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

Selecting the Measurement Channel

4. Press the **Channel** soft key to select ChA or ChB.

| Function | | |
|---------------------|--------------------|--------------|
| ▲Function Period | Channel ChA ChB | Slope ↑ ↓ |

Selecting the Slope

5. Press the **Slope** soft key to select ↑ or ↓.

Explanation

Selecting the Measurement Channel

Select CH A or CH B.

Selecting the Slope

Select from the following:

- ↑: Measures from the rising edge to the next rising edge of the input signal.
- ↓: Measures from the falling edge to the next falling edge of the input signal.

Measurement Range of the Period

Varies depending on the sampling mode.

- When in time stamp mode: 6 ns to 20 ms
- When in hardware histogram mode: 6 ns to 3.2 μs

Continuous Measurement Conditions

When the measurement edge interval is greater than or equal to 12.5 ns, measurements are made continuously.

When measuring period (↑)



Note

- Changing the measurement function clears the data that has been acquired to the memory up to that point.
- Since period measurement is not possible when the sampling mode is set to inter-symbol interference analysis mode (ISI), Period does not appear as a possible selection in the Function selection menu.

5.3 Setting the A-to-B Time Interval Measurement

For a functional description, see 2.4.

Procedure

1. Press the **FUNCTION** key to display the Function menu.

| Function | | |
|------------|---------|-------|
| ▲ Function | Channel | Slope |
| Period | ChA ChB | ↑ ↓ |

2. Press the **Function** soft key to display the Function selection menu.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

3. Press the **TI** soft key.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

Selecting the Slope

4. Press the **Slope** soft key to display the Slope selection menu.
5. Press the soft key corresponding to the desired slope.

| Slope | | | | | |
|-------|------|------|------|------|------|
| A↑B↑ | A↓B↑ | A↕B↑ | A↑B↓ | A↓B↓ | A↕B↓ |

Explanation

Selecting the Slope

- **A↑B↑**: Measures from the rising edge of CH A to the next rising edge of CH B.
- **A↓B↑**: Measures from the falling edge of CH A to the next rising edge of CH B.
- **A↕B↑**: Measures from the rising edge of CH A to the next rising edge of CH B and from the falling edge of CH A to the next rising edge of CH B, alternately.
- **A↑B↓**: Measures from the rising edge of CH A to the next falling edge of CH B.
- **A↓B↓**: Measures from the falling edge of CH A to the next falling edge of CH B.
- **A↕B↓**: Measures from the rising edge of CH A to the next falling edge of CH B and from the falling edge of CH A to the next rising falling of CH B, alternately.

Measurement Range of A-to-B Time Interval

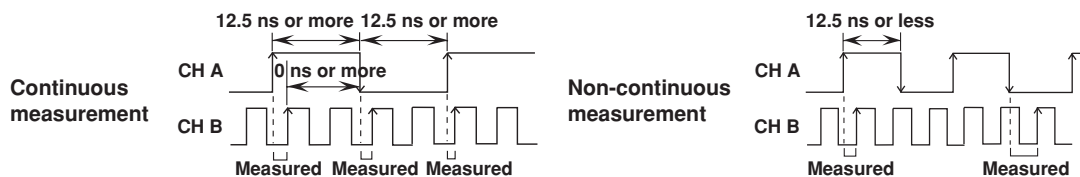
Varies depending on the sampling mode.

- When in time stamp mode: 0 ns to 20 ms
- When in hardware histogram mode: 0 ns to 3.2 μs

Continuous Measurement Conditions

When the time from previous A-to-B time interval measurement to the next edge of the CH A input signal is greater than or equal to 0 ns and the time from the previous CH A input signal edge is greater than or equal to 12.5 ns, measurements are made continuously.

When measuring the A-to-B time interval (**A↕B↑**)



5.3 Setting the A-to-B Time Interval Measurement

Note

- When using the $A \downarrow B \uparrow$ slope, histograms and statistical values can be displayed separately for the measured values of $A \uparrow B \uparrow$ or $A \downarrow B \uparrow$ and $A \downarrow B \uparrow$. When using the $A \downarrow B \downarrow$ slope, histograms and statistical values can be displayed separately for the measured values of $A \uparrow B \downarrow$ or $A \downarrow B \downarrow$ and $A \downarrow B \downarrow$.
 - Changing the measurement function clears the data that has been acquired to the memory up to that point.
 - Since A-to-B time interval measurement is not possible when the sampling mode is set to inter-symbol interference analysis mode (ISI), TI does not appear as a possible selection in the Function selection menu.
-

5.4 Setting the Pulse Width Measurement

For a functional description, see 2.4.

Procedure

1. Press the **FUNCTION** key to display the Function menu.

| Function | | |
|-----------|---------|-------|
| ▲Function | Channel | Slope |
| Period | ChA ChB | ↑ ↓ |

2. Press the **Function** soft key to display the Function selection menu.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

3. Press the **Pulse Width** soft key.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

Selecting the Measurement Channel

4. Press the **Channel** soft key to select ChA or ChB.

| Function | | |
|-------------|---------|--------|
| ▲Function | Channel | ▲Slope |
| Pulse Width | ChA ChB | ↑ ↓ |

Selecting the Polarity

5. Press the **Polarity** soft key to display the Polarity selection menu.
6. Press the soft key corresponding to the desired polarity.

| Polarity | | |
|----------|---|----|
| ↑ | ↓ | ↑↓ |

Explanation

Selecting the Measurement Channel

Select CH A or CH B.

Selecting the Polarity

Select from the following:

- : Measures the positive side (from the rising edge to the next falling edge).
- : Measures the negative side (from the falling edge to the next rising edge).
- : Measures the positive side and negative side alternately.

Measurement Range of Pulse Width

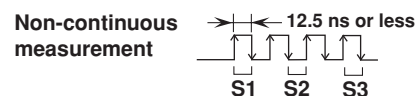
Varies depending on the sampling mode.

- When in time stamp mode: 6 ns to 20 ms
- When in hardware histogram mode: 6 ns to 3.2 μs
- When in inter-symbol interference analysis mode: 10 ns to 3.2 μs

Continuous Measurement Conditions





When the measurement edge interval is greater than or equal to 12.5 ns, measurements are made continuously.

When measuring pulse width ()



5.4 Setting the Pulse Width Measurement

Note

- When the polarity is set to , histograms and statistical values can be displayed separately for the measured values of  or  and .
 - Changing the measurement function clears the data that has been acquired to the memory up to that point.
-

5.5 Setting the Period A & Period B Measurement

For a functional description, see 2.4.

Procedure

1. Press the **FUNCTION** key to display the Function menu.

| Function | | |
|------------|---------|-------|
| ▲ Function | Channel | Slope |
| Period | ChA ChB | ↑ ↓ |

2. Press the **Function** soft key to display the Function selection menu.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

3. Press the **Per.&Per.** soft key.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

Selecting the Slope

4. Press the **Slope** soft key to select A↑B↑ or A↓B↓.

| Function | | |
|------------|---------|-------------|
| ▲ Function | Channel | Slope |
| Per.&Per. | ChA ChB | A↑ B↑ A↓ B↓ |

Explanation

Selecting the Slope

Select from the following:

- A↑B↑: Simultaneously measures from the rising edge to the next rising edge of the CH A input signal and from the rising edge to the next rising edge of the CH B input signal.
- A↓B↓: Simultaneously measures from the falling edge to the next falling edge of the CH A input signal and from the falling edge to the next falling edge of the CH B input signal.

Measurement Range of the Period

Varies depending on the sampling mode.

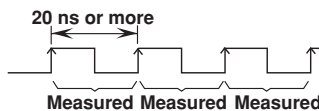
- When in time stamp mode: 6 ns to 20 ms
- When in hardware histogram mode: 6 ns to 3.2 μs

Continuous Measurement Conditions

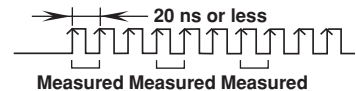
When the measurement edge interval is greater than or equal to 20 ns on each channel, measurements are made continuously.

When set to A↑B↑

Continuous measurement



Non-continuous measurement



Note

- Changing the measurement function clears the data that has been acquired to the memory up to that point.
- Since period A & period B measurement is not possible when the sampling mode is set to inter-symbol interference analysis mode (ISI), Per.&Per. does not appear as a possible selection in the Function selection menu.

5.6 Setting the Period A & A-to-B Time Interval Measurement

For a functional description, see 2.4.

Procedure

1. Press the **FUNCTION** key to display the Function menu.

| Function | | |
|-----------|---------|-----|
| ▲Function | Channel | |
| Period | ChA | ChB |
| | Slope | |
| | ↑ | ↓ |

2. Press the **Function** soft key to display the Function selection menu.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

3. Press the **Period&TI** soft key.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

Selecting the Slope

4. Press the **Slope** soft key to display the Slope selection menu.

| Slope | |
|---------|---------|
| A↑ A↑B↑ | A↓ A↓B↑ |

5. Press the soft key corresponding to the desired slope.

Explanation

Selecting the Slope

Select from the following:

- A↑ A↑B↑: Simultaneously measures from the rising edge to the next rising edge of the CH A input signal and from the rising edge of the CH A input signal to the first rising edge of the CH B input signal.
- A↓ A↓B↑: Simultaneously measures from the falling edge to the next falling edge of the CH A input signal and from the falling edge of the CH A input signal to the first rising edge of the CH B input signal.

Measurement Range of the Period

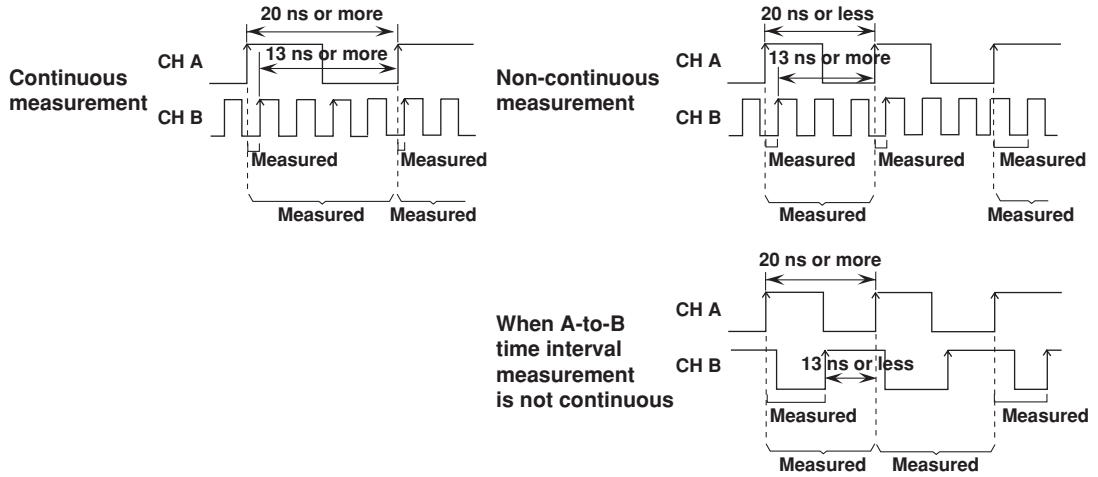
Varies depending on the sampling mode.

- When in time stamp mode
 - Period measurement: 6 ns to 20 ms
 - A-to-B time interval measurement: 0 ns to 20 ms
- When in hardware histogram mode
 - Period measurement: 6 ns to 3.2 μs
 - A-to-B time interval measurement: 0 ns to 3.2 μs

Continuous Measurement Conditions

When the measurement edge interval of the CH A input signal is 20 ns or more and the measurement edge of CH B to the measurement edge of the CH A is 13 ns or more, measurements are made continuously.

When set to $A \uparrow A \uparrow B \uparrow$



Note

- Changing the measurement function clears the data that has been acquired to the memory up to that point.
- Since period A & A-to-B time interval measurement is not possible when the sampling mode is set to inter-symbol interference analysis mode (ISI), Period&TI does not appear as a possible selection in the Function selection menu.

5.7 Setting the Pulse Width A & A-to-B Time Interval Measurement

For a functional description, see 2.4.

Procedure

1. Press the **FUNCTION** key to display the Function menu.

| Function | | |
|-----------|---------|-------|
| ▲Function | Channel | Slope |
| Period | ChA ChB | ↑ ↓ |

2. Press the **Function** soft key to display the Function selection menu.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

3. Press the **PW&TI** soft key.

When the sampling mode is set to inter-symbol interference analysis (ISI), the soft key is displayed as PW→TI.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

Selecting the Polarity/Slope

4. Press the **Slope** soft key to select the Slope selection menu.

- When in time stamp mode or hardware histogram mode

| Slope | | | |
|-------|--|-------|-------|
| | | A↔A↑↑ | A↔A↓↓ |

- When in inter-symbol interference analysis mode

| Slope | | | | | |
|-------|-------|-------|-------|-------|-------|
| A↔A↑↑ | A↔A↓↑ | A↔A↓↑ | A↔A↑↓ | A↔A↓↓ | A↔A↑↓ |

Explanation

Selecting the Polarity/Slope

When in time stamp mode or hardware histogram mode, select from the following:

- **A↔A↑↑**: Measures from the rising edge to the next rising edge and from the falling edge to the next falling edge of the CH A input signal. At the same time, measures from the rising edge or falling edge of the CH A input signal to the first rising edge of the CH B input signal.
- **A↔A↓↓**: Measures from the rising edge to the next rising edge and from the falling edge to the next falling edge of the CH A input signal. At the same time, measures from the rising edge or falling edge of the CH A input signal to the first falling edge of the CH B input signal.

Four additional selections are available in inter-symbol interference analysis mode.

- **A↔A↑↑**: Measures from the rising edge to the next rising edge and from the falling edge to the next falling edge of the CH A input signal. At the same time, measures from the rising edge of the CH A input signal to the first rising edge of the CH B input signal.
- **A↔A↓↑**: Measures from the rising edge to the next rising edge and from the falling edge to the next falling edge of the CH A input signal. At the same time, measures from the falling edge of the CH A input signal to the first rising edge of the CH B input signal.

5.7 Setting the Pulse Width A & A-to-B Time Interval Measurement

- $A \uparrow B \downarrow$: Measures from the rising edge to the next rising edge and from the falling edge to the next falling edge of the CH A input signal. At the same time, measures from the rising edge of the CH A input signal to the first falling edge of the CH B input signal.
- $A \uparrow B \uparrow$: Measures from the rising edge to the next rising edge and from the falling edge to the next falling edge of the CH A input signal. At the same time, measures from the falling edge of the CH A input signal to the first falling edge of the CH B input signal.

Measurement Range of the Pulse Width A & A-to-B Time Interval Measurement

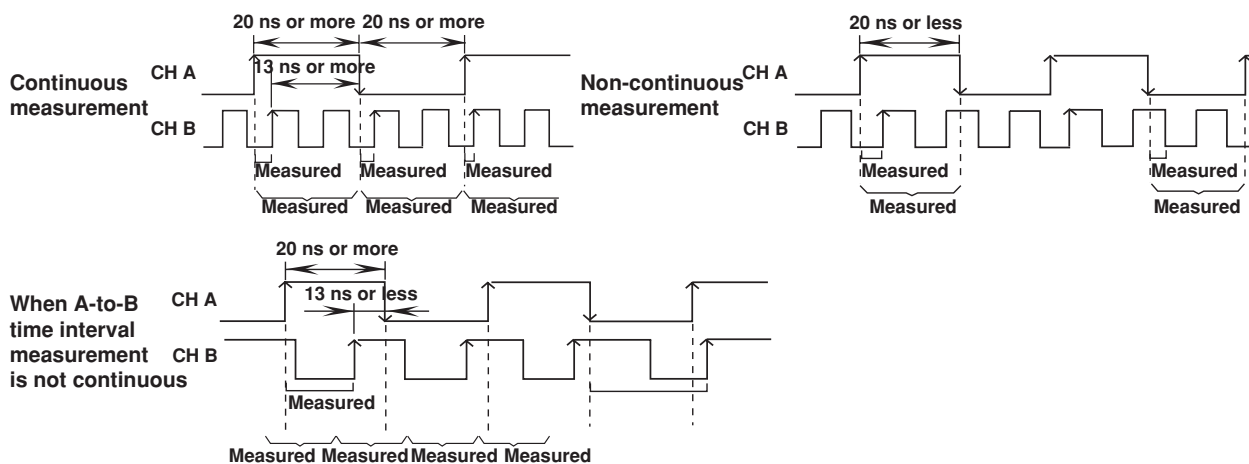
Varies depending on the sampling mode.

- When in time stamp mode
 - Pulse width A measurement: 6 ns to 20 ms
 - A-to-B time interval measurement: 0 ns to 20 ms
- When in hardware histogram mode
 - Pulse width A measurement: 6 ns to 3.2 μ s
 - A-to-B time interval measurement: 0 ns to 3.2 μ s
- When in inter-symbol interference analysis mode
 - Pulse width A measurement: 10 ns to 3.2 μ s
 - A-to-B time interval measurement: 0 ns to 3.2 μ s

Continuous Measurement Conditions

When the measurement edge interval of the CH A input signal is 20 ns or more and the measurement edge of CH B to the measurement edge of the CH A is 13 ns or more, measurements are made continuously.

When set to $A \uparrow B \downarrow$



Note

- When the polarity/slope is set to both polarities, histograms and statistical values can be displayed separately for the measured values of each polarity/slope.
- When set to $A \uparrow B \downarrow$
Separates $A \uparrow B \uparrow$, $A \uparrow B \downarrow$, and $A \downarrow B \downarrow$
- When set to $A \downarrow B \downarrow$
Separates $A \downarrow B \uparrow$, $A \downarrow B \downarrow$, and $A \uparrow B \downarrow$
- Changing the measurement function clears the data that has been acquired to the memory up to that point.

5.8 Setting the Pulse Width A & Pulse Width B Measurement

For a functional description, see 2.4.

Procedure

1. Press the **FUNCTION** key to display the Function menu.

| Function | | |
|-----------|---------|-------|
| ▲Function | Channel | Slope |
| Period | ChA ChB | ↑ ↓ |

2. Press the **Function** soft key to display the Function selection menu.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

3. Press the **PW&PW** soft key.

When the sampling mode is set to inter-symbol interference analysis (ISI), the soft key is displayed as PW→PW.

| Function | | | | | | |
|----------|----|-------------|-----------|-----------|-------|-------|
| Period | TI | Pulse Width | Per.&Per. | Period&TI | PW&TI | PW&PW |

The following menu appears.

| Function | | |
|-----------|---------|-------------|
| ▲Function | Channel | Polarity |
| PW&PW | ChA ChB | A [↑] B [↑] |

Explanation

Polarity

Only the following setting is available.

A [↑] B [↑]: Measures from the rising edge to the next rising edge and from the falling edge to the next falling edge of the CH A input signal. At the same time, measures from the rising edge to the next rising edge and from the falling edge to the next falling edge of the CH B input signal.

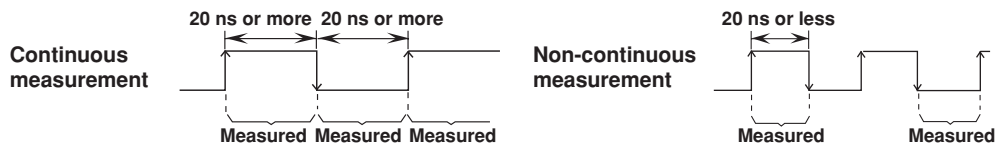
Measurement Range of Pulse Width

Varies depending on the sampling mode.

- When in time stamp mode: 6 ns to 20 ms
- When in hardware histogram mode: 6 ns to 3.2 μs
- When in inter-symbol interference analysis mode: 10 ns to 3.2 μs

Continuous Measurement Conditions

When the measurement edge interval is greater than or equal to 20 ns on each channel, measurements are made continuously.



Note

- Histograms and Statistical Values can be displayed separately for the measured data of **A [↑] B [↑]**, **A [↑] B [↓]**, **A [↓] B [↑]**, and **B [↓] B [↓]**.
- Changing the measurement function clears the data that has been acquired to the memory up to that point.

6.1 Setting the Gate

For a functional description, see 2.5.

Procedure

1. Press the **SAMPLE** key to display the Sample menu.

| Sample | | | | | | | |
|------------|-------------|----------|--|--|--|---------|------------|
| ▲ GateMode | Ⓢ EventSize | ▲ Arming | | | | Inhibit | Ref. Clock |
| Event | 10000 | | | | | OFF | Int Ext |

Selecting the Gate Mode

2. Press the **GateMode** soft key to display the Gate Mode selection menu.

| Gate Mode | | |
|-----------|------|----------|
| Event | Time | External |

3. Press the soft key corresponding to the desired gate mode.

- **When event gate is selected**

4. Set the number of events (Event Size) using the rotary knob or numeric keys.

| Sample | | | | | | | |
|------------|-------------|----------|--|--|--|---------|------------|
| ▲ GateMode | Ⓢ EventSize | ▲ Arming | | | | Inhibit | Ref. Clock |
| Event | 10000 | | | | | OFF | Int Ext |

- **When time gate is selected**

4. Use the rotary knob or numeric keys to enter the gate time.

| Sample | | | | | | | |
|------------|------------|----------|--|--|--|---------|------------|
| ▲ GateMode | Ⓢ GateTime | ▲ Arming | | | | Inhibit | Ref. Clock |
| Time | 1.0u | | | | | OFF | Int Ext |

- **When external gate is selected**

Selecting the Input Signal Polarity

4. Press the **Polarity** soft key to select the input signal polarity.

| Sample | | | | | | | |
|------------|----------|--|--|--|--|---------|------------|
| ▲ GateMode | Polarity | | | | | Inhibit | Ref. Clock |
| External | | | | | | OFF | Int Ext |

Selecting the Gate Level

5. Press the **INPUT** key to display the Input menu.

| Input | | | | | | | |
|-----------|-----------|----------|-----------|---------|--|--|--|
| ▲ Setting | Impedance | Coupling | ▲ Trigger | Ⓢ Level | | | |
| ChA | 50Ω | AC | Manual | 0.000V | | | |

6. Press the **Setting** soft key to display the Input Setting menu.

7. Press the **Arm/Gate** soft key.

| Input Setting | | | |
|---------------|-----|----------|---------|
| ChA | ChB | Arm/Gate | Inhibit |

8. Press the **Level** soft key to display the Level selection menu.

| Level | | |
|-------|-----|--------|
| 0V | TTL | TTL/10 |

9. Press the soft key corresponding to the desired level.

Explanation**Selecting the Gate Mode**

Select the gate mode that defines the gate (range of the measurement block) from the following:



- Event (event size)

Set the event size within the following range (resolution: 1). However, when block sampling (Block) is ON and the rest time (RestMode) is set to RestTime or RestEvent, the resolution is 2.

 - Time stamp mode or inter-symbol interference analysis mode
 - Single measurement function: 2 to 1024000
 - Dual measurement function: 1 to 512000
 - Hardware histogram mode
 - Single measurement function: 2 to 10^9
 - Dual measurement function: 1 to 10^9
- Time (gate time)

Set the gate time within the following range (resolution: 100 ns).
 $1 \mu\text{s} \leq \text{gate time} \leq 10 \text{ s}$
- External (external gate input)

Select the input signal polarity from the following:

 - : Measurement is performed while a positive polarity signal is being applied to the external gate input terminal (EXT ARM/EXT GATE).
 - : Measurement is performed while a negative polarity signal is being applied to the external gate input terminal (EXT ARM/EXT GATE).

Note

- The measurement of a single block is terminated when the time from arming reaches the maximum sampling time before the specified event size is reached.
- The measurement of a single block is terminated when the event size of a single block reaches the maximum event size of the sampling mode before the specified gate time elapses.
- The measurement of a single block is terminated when the maximum sampling size of the sampling mode is reached or when the maximum sampling time elapses even if the external gate remains open for an extended time.
- Block sampling is turned OFF when external gate is selected. In addition, arming is set to Auto.

Input Method of the External Gate Signal

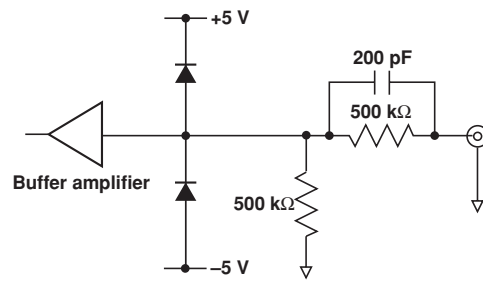
Apply a signal to the terminal marked EXT ARM/EXT GATE on the front panel (the terminal is shared with the external arming) according to the following specifications.

- Input impedance: 1 M Ω (typical value*)
 - Input coupling: DC
 - Gate level: Using the above procedure, select 0 V, TTL (1.4 V), or TTL/10 (0.14 V).
 - Maximum input voltage: 40 V (DC+ACpeak)
 - Minimum input pulse width: 30 ns
 - Setup time: 60 ns (must precede the measurement signal by at least 50 ns for the gate to be valid).
 - Allowable gate open time: 1 μs to 320 s (except within the maximum sampling size of the sampling mode)
- * Typical value represents a typical or average value. It is not strictly warranted.

**CAUTION**

Applying a voltage that exceeds the maximum input voltage indicated above to the external gate input terminal can damage the instrument.

External gate signal input circuit



6.2 Setting the Sampling Interval

For a functional description, see 2.5.

Procedure

1. Press the **SAMPLE** key to display the Sample menu.
Interval appears only when the sampling mode is set to time stamp and the measurement function is set to period, A-to-B time interval (TI), or pulse width.

| Sample | | | | | | |
|------------|-------------|----------|------------|---------|---------|-----------|
| ▲ GateMode | Ⓞ EventSize | ▲ Arming | Ⓞ Interval | ▲ Block | Inhibit | Ref.Clock |
| Event | 1023999 | | 0us | | OFF | Int Ext |

2. Press the **Interval** soft key.
3. Set the sampling interval using the rotary knob or numeric keys.

| Sample | | | | | | |
|------------|-------------|----------|------------|---------|---------|-----------|
| ▲ GateMode | Ⓞ EventSize | ▲ Arming | Ⓞ Interval | ▲ Block | Inhibit | Ref.Clock |
| Event | 1023999 | | 41us | | OFF | Int Ext |

Explanation

Setting the sampling interval

Set the sampling interval in the following range.

0 μ s to 1 s (resolution: 1 μ s)

When 0 μ s is selected, sampling is performed at the following interval.

- Single measurement function: 12.5 ns

Note

- The sampling interval is fixed to 0 μ s when in hardware histogram mode and inter-symbol interference analysis mode.
- The time resolution of the time stamp does not change even when the sampling interval is changed. It is always 0.1 μ s.
- When auto window is enabled, the constant T type (T Type) is set to Estimated T, and the sampling interval is set to a value greater than or equal to 1 μ s, an error message appears and Estimated T is changed to Measured T.

6.3 Setting the Arming

For a functional description, see 2.5.

Procedure

1. Press the **SAMPLE** key to display the Sample menu.
If GateMode is set to External, Arming does not appear.

| Sample | | | | | |
|---------------------|--------------------|--------|---------|----------------|----------------------|
| ▲ GateMode Event | Ⓢ EventSize 100 | Arming | ▲ Block | Inhibit OFF | Ref.Clock Int Ext |

2. Press the **Arming** soft key to display the Arming selection menu.

| Arming | | | | |
|--------------------|--|--|--|--|
| Source Auto Ext | | | | |

Selecting the Arming Source

3. Press the **Source** soft key to select Auto or Ext.
If Auto is selected, the following procedure is not necessary. If block sampling (Block) is ON and RestMode is set to Time or Event, Ext cannot be selected.

| Arming | | | | |
|--------------------|--------------|--------------------|--|--|
| Source Auto Ext | Slope ↑ ↓ | ▲ DelayMode OFF | | |

- **When External Arming (Ext) Is Selected**

Selecting the Slope

4. Press the **Slope** soft key to select ↑ or ↓.

Selecting the Arming Delay Type

5. Press the **DelayMode** soft key to display the DelayMode selection menu.
6. Press the soft key corresponding to the desired arming delay type.

| DelayMode | | |
|-----------|------|-------|
| OFF | Time | Event |

Setting the Delay Time (When the arming delay type is set to Time)

7. Set the delay time using the rotary knob or numeric keys.

| Arming | | | | |
|--------------------|--------------|---------------------|-------------------|--|
| Source Auto Ext | Slope ↑ ↓ | ▲ DelayMode Time | Ⓢ D.Time 1.0us | |

Setting the Event Size (When the arming delay type is set to Event)

7. Set the event size using the rotary knob or numeric keys.

| Arming | | | | |
|--------------------|--------------|----------------------|----------------|--|
| Source Auto Ext | Slope ↑ ↓ | ▲ DelayMode Event | Ⓢ D.Event 1 | |

Selecting the External Arming Input Level

8. Press the **INPUT** key to display the Input menu.

| Input | | | | | |
|------------------|----------------------|-------------------|---------------------|-------------------|--|
| ▲ Setting ChA | Impedance 50Ω 1MΩ | Coupling AC DC | ▲ Trigger Manual | Ⓢ Level 0.000V | |

9. Press the **Setting** soft key to display the Input Setting menu.
10. Press the **Arm/Gate** soft key.

| Input Setting | | | |
|---------------|-----|----------|---------|
| ChA | ChB | Arm/Gate | Inhibit |

11. Press the **Level** soft key to display the Level selection menu.

12. Press the soft key corresponding to the desired level.



Explanation

Selecting the Arming Source

Select from the following:

- Auto: Arming is activated at the same time measurement is started (auto arming)
- Ext: Arming is activated through an external arming input signal after the measurement is started

Input Method of the External Arming Signal

Apply a signal to the terminal marked EXT ARM/EXT GATE on the front panel (the terminal is shared with the external gate).

- Input impedance: 1 MΩ (typical value*)
- Input coupling: DC
- Arming level: Using the above procedure, select 0 V, TTL (1.4 V), or TTL/10 (0.14 V).
- Maximum input voltage: 40 V (DC+ACpeak)
- Minimum input pulse width: 30 ns
- Setup time: 60 ns (must precede the input signal by at least 60 ns for the arming to be valid).

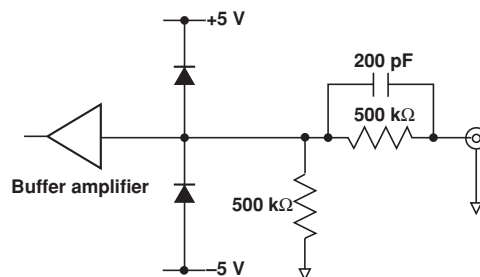
* Typical value represents a typical or average value. It is not strictly warranted.



CAUTION

Applying a voltage that exceeds the maximum input voltage indicated above to the external arming input terminal can damage the instrument.

External arming input circuit



Selecting the Slope

Select from the following. Selection is made only when using external arming.

- ↑: Arming is activated on the rising edge of the signal applied to the external arming input terminal.
- ↓: Arming is activated on the falling edge of the signal applied to the external arming input terminal.

Selecting the Arming Delay Type

Select from the following. Selection can be made only when using external arming.

- OFF: Arming delay selection and setting is not possible. Arming delay is not executed.
- Time: Measurement starts after the specified time of delay.
Selectable range of delay time: 1.0 μ s to 1.0000000 s (100 ns steps)
- Event: Measurement starts after the specified event size.
Selectable range of event size: 1 to 1000000 (resolution: 1)

The arming delay can be set separately for each channel for the measurement functions of period A & period B and pulse width A & pulse width B (pulse width A \rightarrow pulse width B).

Note




- The event that is delayed is the event size of the input signal of the measurement channel. However, for time interval measurement, the event size of CH A input signal is used.
- When the polarity/slope is set to $\square \rightarrow \square$, $A \uparrow B \uparrow$, $A \square \rightarrow \square$, $A \uparrow B \square$, $A \square \rightarrow \square$, $A \uparrow B \square$, $A \square \rightarrow \square$, or $B \square \rightarrow \square$ and the arming delay type is set to Event, one event is equal to a delay of one period.
- If arming delay is set to a value other than OFF, RestMode of block sampling cannot be specified.

6.4 Setting Inhibit

For a functional description, see 2.5.




Procedure

- Press the **SAMPLE** key to display the Sample menu.
Inhibit does not appear when the sampling mode is set to inter-symbol interference analysis and dual measurement function is used.

| Sample | | | | | | |
|---------------------|--------------------|----------|--|---------|--|--|
| ▲ GateMode Event | Ⓢ EventSize 100 | ▲ Arming | | ▲ Block | Inhibit OFF   | Ref.Clock  Ext |



Selecting the Polarity

- Press the **Inhibit** soft key to select the polarity.

| Sample | | | | | | |
|---------------------|------------------------|----------|--|--|--|--|
| ▲ GateMode Event | Ⓢ EventSize 1023999 | ▲ Arming | | | Inhibit OFF   | Ref.Clock  Ext |

Selecting the Inhibit Input Level

- Press the **INPUT** key to display the Input menu.

| Input | | | | | | |
|------------------|--|--|---------------------|-------------------|--|--|
| ▲ Setting ChA | Impedance 50Ω  | Coupling AC  | ▲ Trigger Manual | Ⓢ Level 0.000U | | |

- Press the **Setting** soft key to display the Input Setting menu.
- Press the **Inhibit** soft key.

| Input Setting | | | |
|---------------|-----|----------|----------------|
| ChA | ChB | Arm/Gate | Inhibit |



- Press the **Level** soft key to display the Level selection menu.
- Press the soft key corresponding to the desired level.

| Level | | |
|-------|------------|--------|
| 0V | TTL | TTL/10 |

Explanation

Selecting the Polarity

Select from the following. When set to OFF, the inhibit input is invalid.

- : Inhibits measurements while a positive signal is being applied to the inhibit input terminal.
- : Inhibits measurements while a negative signal is being applied to the inhibit input terminal.

Note

The time in which the inhibit input is valid is within the maximum sampling time from arming activation.

Input Method of the Inhibit Signal

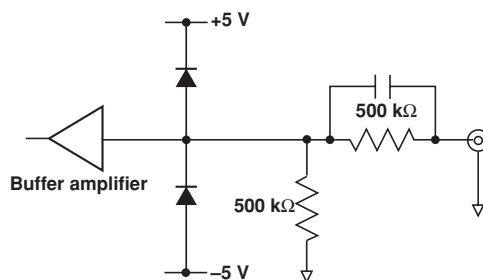
Apply a signal to the terminal marked INHIBIT on the front panel.

- Input impedance: 1 MΩ (typical value*)
- Input coupling: DC
- Inhibit level: Using the above procedure, select 0 V, TTL (1.4 V), or TTL/10 (0.14 V).
- Maximum input voltage: 40 V (DC+ACpeak)
- Minimum input pulse width: 30 ns
- Setup time: 30 ns (must precede the input signal by at least 30 ns for the inhibit to be valid).

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

**CAUTION**

Applying a voltage that exceeds the maximum input voltage indicated above to the inhibit input terminal can damage the instrument.

Inhibit signal input circuit

6.5 Setting the Block Sampling

For a functional description, see 2.5.

Procedure

- Press the **SAMPLE** key to display the Sample menu.
Block does not appear when the sampling mode is set to inter-symbol interference analysis mode (because block sampling cannot be performed).

| Sample | | | | | | |
|------------|-------------|----------|------------|---------|---------|------------|
| ▲ GateMode | Ⓞ EventSize | ▲ Arming | Ⓞ Interval | ▲ Block | Inhibit | Ref. Clock |
| Event | 1023999 | | 0us | | OFF | Int Ext |

- Press the **Block** soft key to display the Block Sample selection menu.

| Block Sample | | | |
|--------------|----|--|--|
| Mode | | | |
| OFF | ON | | |

- Press the **Mode** soft key to select **ON**.

| Block Sample | | | |
|--------------|-------------|------------|--|
| Mode | Ⓞ BlockSize | ▲ RestMode | |
| OFF | 2 | OFF | |

Setting the Number of Measurement Blocks

- Set the number of measurement blocks using the rotary knob or numeric keys.

Setting the Rest Time

- Press the **RestMode** soft key to display the RestMode selection menu.

| RestMode | | |
|----------|------|-------|
| OFF | Time | Event |

- Press the appropriate soft key to select the rest mode.

• When Rest Mode Is Set to Time

- Press the **RestTime** soft key.
- Set the rest time using the rotary knob or numeric keys.

| Block Sample | | | |
|--------------|-------------|------------|------------|
| Mode | Ⓞ BlockSize | ▲ RestMode | Ⓞ RestTime |
| OFF | 2 | Time | 1.4us |

• When Rest Mode Is Set to Event

- Press the **RestEvent** soft key.
- Set the event size to rest using the rotary knob or numeric keys.

| Block Sample | | | |
|--------------|-------------|------------|-------------|
| Mode | Ⓞ BlockSize | ▲ RestMode | Ⓞ RestEvent |
| OFF | 2 | Event | 6 |

Explanation

Selectable Range of Number of Blocks

- When in time stamp mode
The selectable range varies depending on the arming source and rest mode as follows.

| Rest mode \ Arming source | Auto | Ext |
|---------------------------|----------|-----------|
| | OFF | 2 to 1000 |
| Time | 2 to 250 | – |
| Event | 2 to 250 | – |

- When in hardware histogram mode: 2 to 1000

Note

-
- The total sample size of all blocks is within the maximum sampling size.
 - Block sampling cannot be performed when using the dual measurement function, when using the external gate, or when in inter-symbol interference analysis mode.
-

Setting the Rest Time

Select from the following:

OFF: No rest time.

RestTime: Set the rest time in terms of time.

Selectable range: 1.0 μ s to 1.0000000 s (100 ns steps)

RestEvent: Set the rest time in terms of the event size

Selectable range: 1 to 1000000

Note

-
- When the rest mode is set to event or time, external arming (EXT) cannot be used.
 - When the rest time is set in terms of the event size and the rest time is less than 500 ns, the rest time is set to 500 ns.
-

6.6 Setting the Input Coupling, Input Impedance, and Trigger

For a functional description, see 2.5.

Procedure

1. Press the **INPUT** key to display the Input menu.

| Input | | | | | | |
|-----------------------|------------------|----------------|--|----------------|--|--|
| ▲ Setting Arm/Gate | Impedance 1MΩ | Coupling DC | | ▲ Level TTL | | |

Selecting the Source Channel

2. Press the **Setting** soft key to display the Input Setting menu.
3. Press the **ChA** or **ChB** soft key.

| Input Setting | | | |
|---------------|-----|----------|---------|
| ChA | ChB | Arm/Gate | Inhibit |

Selecting the Input Impedance

4. Press the **Impedance** soft key to select the input impedance.

| Input | | | | | | |
|------------------|----------------------|-------------------|---------------------|-----------------|--|--|
| ▲ Setting ChA | Impedance 50Ω 1MΩ | Coupling AC DC | ▲ Trigger Manual | Level 0.000V | | |

Selecting the Input Coupling

5. Press the **Coupling** soft key to select the input coupling.

Selecting the Trigger Mode

6. Press the **Trigger** soft key to display the Trigger menu.

| Trigger | | |
|---------|------------|------------|
| Manual | SingleAuto | RepeatAuto |

7. Press the soft key corresponding to the desired trigger mode.

Setting the Trigger Level

8. Press the **Level** soft key and then set the trigger level using the rotary knob or numeric keys.

| Input | | | | | | |
|------------------|----------------------|-------------------|-------------------------|--------------|--|--|
| ▲ Setting ChA | Impedance 50Ω 1MΩ | Coupling AC DC | ▲ Trigger RepeatAuto | Level 60% | | |

Explanation

Selecting the Source Channel

Select the channel, CH A or CH B, for setting the input conditions.

Selecting the Input Impedance

Select 50 Ω or 1 MΩ.

Note

The input impedance of the external arming input (EXT ARM), external gate input (EXT GATE), and inhibit input (INHIBIT) is fixed to 1 MΩ.

Select the Input Coupling

Select AC or DC.

Note

The frequency characteristics vary depending on the input impedance and input coupling settings. For a description of the frequency characteristics, see page 15-1.

Select the Trigger Mode.

Select from the following.

- **Manual:** Trigger is activated on the specified trigger level (voltage).
- **SingleAuto:** Taking the maximum and minimum values of the input signal during the first measurement block to be 100% and 0%, respectively, the trigger level is set to the specified percentage level. The trigger level for all following blocks is set to this level.
- **RepeatAuto:** Taking the maximum and minimum values of the input signal during the first measurement block to be 100% and 0%, respectively, the trigger level is set to the specified percentage level. Unlike the single auto trigger, the trigger level is reset for each measurement block.

Setting the Trigger Level

The selectable range varies depending on the trigger mode as follows:

- When the trigger mode is set to Manual: -5 V to $+5\text{ V}$ (1 mV steps)
- When the trigger mode is set to SingleAuto or RepeatAuto: 0 to 100% (1% step)

6.7 Adjusting the Phase during Time Interval Measurement

For a functional description, see 2.5.

Procedure

1. Press the **INPUT** key to display the Input menu.

| Input | | | | | | |
|-----------------------|------------------|----------------|--|----------------|--|--|
| ▲ Setting Arm/Gate | Impedance 1MΩ | Coupling DC | | ▲ Level TTL | | |

2. Press the **Setting** soft key to display the Input Setting menu.
3. Press the **ChB** soft key.

| Input Setting | | | |
|---------------|-----|----------|---------|
| ChA | ChB | Arm/Gate | Inhibit |

4. Press the **Phase Adj** soft key.
Phase Adj appears only for the measurement functions of A-to-B time interval, period A & A-to-B time interval, and pulse width A & A-to-B time interval (pulse width A→A-to-B time interval).

| Input | | | | | | |
|------------------|------------------|----------------|----|---------------------|-------------------|----------------------|
| ▲ Setting ChB | Impedance 50Ω | Coupling AC | DC | ▲ Trigger Manual | ☑ Level 0.000V | ☑ Phase Adj 0.0ns |

5. Set the phase time using the rotary knob or numeric keys.

| Input | | | | | | |
|------------------|------------------|----------------|----|---------------------|-------------------|----------------------|
| ▲ Setting ChB | Impedance 50Ω | Coupling AC | DC | ▲ Trigger Manual | ☑ Level 0.000V | ☑ Phase Adj 0.5ns |

Explanation

Selectable Range of Phase Time

Shift the phase of the CH B input signal in the following range.

0 to 10.0 ns (resolution is 0.1 ns)

Note

The phase of the CH B input signal is adjusted so that the X-axis center of the histogram is positioned at the center of the main window.

6.8 Settings When Applying an External Reference Clock Signal

For a functional description, see 2.5.

Procedure

1. Press the **SAMPLE** key to display the Sample menu.

| Sample | | | | | | | |
|------------|-------------|----------|--|--|--|----------------|-------------|
| ▲ GateMode | Ⓞ EventSize | ▲ Arming | | | | Inhibit | Ref .Clock |
| Event | 512000 | | | | | OFF [OFF] [ON] | [Int] [Ext] |

2. Press the **Ref.Clock** soft key to select Ext.

| Sample | | | | | | | |
|------------|-------------|----------|--|--|--|----------------|-------------|
| ▲ GateMode | Ⓞ EventSize | ▲ Arming | | | | Inhibit | Ref .Clock |
| Event | 512000 | | | | | OFF [OFF] [ON] | [Int] [Ext] |

Explanation

Selecting the Reference Clock

Select Ext when applying a reference clock signal externally. To set the reference clock back to the internal signal, select Int.

- Int: Uses the internal reference clock signal for operation.
- Ext: Uses the external reference clock signal for operation.

Input Method of the External Reference Clock Signal

Apply a reference clock signal to the reference input terminal marked REF IN on the rear panel according to the following specifications.

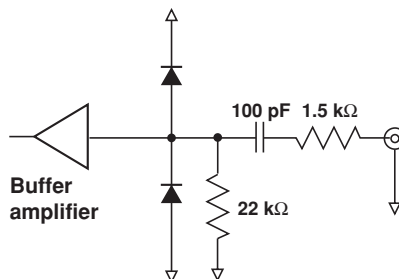
- Input frequency range: 10 MHz \pm 10 Hz
- Input impedance: 1 k Ω or more
- Input coupling: AC
- Input level: 1 V_{p-p} or more
- Maximum input voltage: \pm 10 V
- Connector type: BNC



CAUTION

Applying a voltage that exceeds the maximum input voltage indicated above to the reference input terminal can damage the instrument.

Reference input circuit



7.1 Setting the Histogram Display

For a functional description, see 2.6.

Procedure

1. Press the **DISPLAY** key to display the Display menu.

| Display | | | | | |
|---------|--------|--|----------|--|----------|
| ▲ Item | ▲ Jump | | ☑ Number | | ▲ Window |
| List | | | 1 | | |

2. Press the **Item** soft key to display the Item selection menu.
3. Press the **Histogram** soft key.

| Item | | | |
|------------------|------|----------|------------|
| Histogram | List | TimeVar. | Statistics |

Setting the Display Style

4. Press the **Style** soft key to display the Display Style menu.
- When in time stamp mode or hardware histogram mode
 - When using multi window or auto window and Window is set to a value other than All

5. Press the **Graph Size** soft key to set the display size of the histogram to Half or Full.

| Display Style | | | | |
|---------------|------------|----------|------------|---------|
| Graph Size | Statistics | Panorama | Both Graph | Overlap |
| Half Full | OFF ON | OFF ON | OFF ON | OFF ON |

6. Press the **Statistics, Panorama, Both Graph, and Overlap** soft key to set each item ON or OFF.
Both Graph and Overlap may not appear depending on the measurement conditions. For the conditions in which they are displayed, read the explanation below.

- When using multi window or auto window and Window is set to All

5. Press the **Stat&Graph** soft key to select Stat, Dev, or σ .

| Display Style | | | |
|-------------------|--|--|--|
| Stat&Graph | | | |
| Stat Dev σ | | | |

- When in inter-symbol interference analysis mode

5. Press the **Overlap** soft key to select ON or OFF.

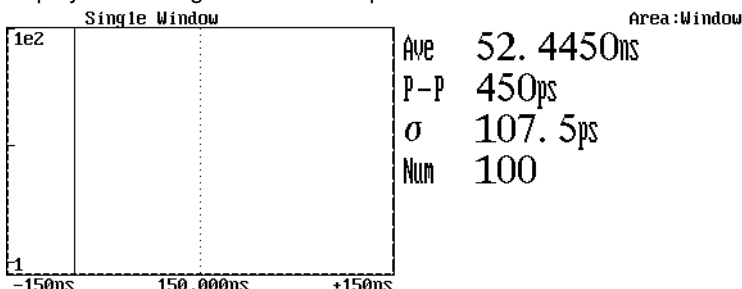
| Display Style | | | |
|---------------|--|--|---------|
| | | | Overlap |
| | | | OFF ON |

Explanation

Display Size of the Histogram (Graph Size)

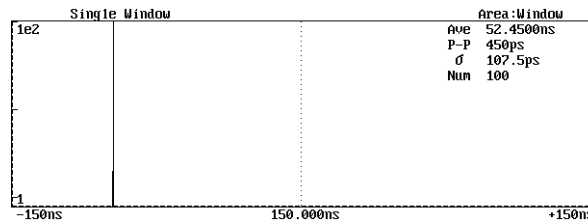
Select either of the following.

Half: Displays the histogram at a size equal to the left half of the main window.



7.1 Setting the Histogram Display

Full: Displays the histogram main window over the entire screen.

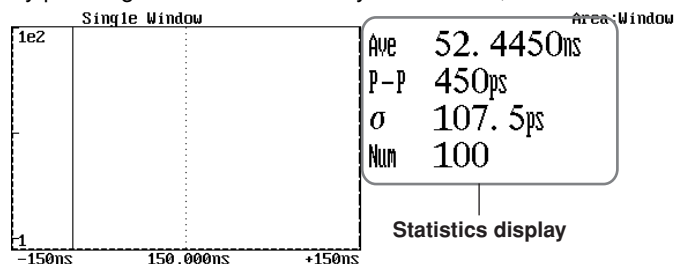


Setting the Display Style

Turns ON/OFF the display items other than the histograms.

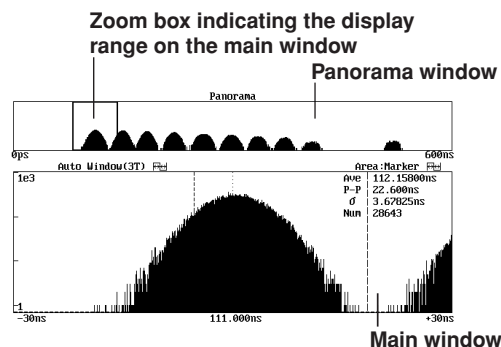
- **Statistics: Turning ON/OFF the Statistics Display**

When the size of histogram main window is set to Half, the statistical values are displayed outside the window; when the size is set to Full, the values are displayed within the window. The statistical parameters are set using a dialog box that appears by pressing the Calc/Stat soft key. For details, see section 7.4.



- **Panorama: Turning ON/OFF the Panorama Display**

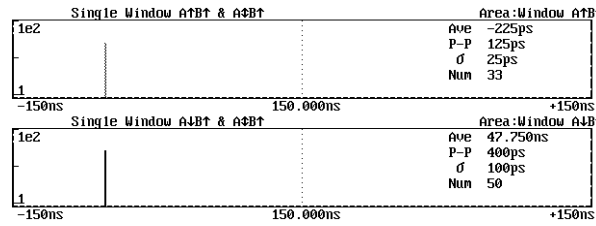
When turned ON, a panorama window is displayed above the histogram main window. At this point, the histogram main window is reduced in size vertically.



- **Both Graph: Turns ON/OFF the measured results of both polarities of pulse width, A-to-B time interval, pulse width A & A-to-B time interval, or pulse width A & pulse width B measurement.**

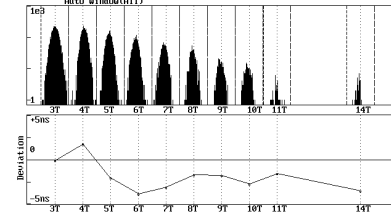
The ON/OFF setting is valid only in the following cases.

- A-to-B time interval measurement with the slope set to $A \uparrow B \uparrow$ or $A \uparrow B \downarrow$, the calculated polarity is set to $A \uparrow B \uparrow / A \downarrow B \uparrow / A \uparrow B \uparrow \& A \downarrow B \uparrow$ or $A \uparrow B \downarrow / A \downarrow B \downarrow / A \uparrow B \downarrow \& A \downarrow B \downarrow$.
- Pulse width measurement with the polarity set to $\left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \left[\begin{array}{|c|} \hline \rightarrow \\ \hline \end{array} \right]$ and the calculated slope is $\left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right]$, $\left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \left[\begin{array}{|c|} \hline \rightarrow \\ \hline \end{array} \right]$, or $\left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \& \left[\begin{array}{|c|} \hline \rightarrow \\ \hline \end{array} \right]$.
- Pulse width A & A-to-B time interval measurement with the polarity/slope set to $A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] A \uparrow B \uparrow$ and the calculated polarity is set to $A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \& A \uparrow B \uparrow / A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \& A \downarrow B \uparrow / A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] A \uparrow B \uparrow \& / A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] A \downarrow B \uparrow$ or with the polarity slope set to $A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] A \uparrow B \downarrow$ and the calculated polarity is set to $A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \& A \uparrow B \downarrow / A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \& A \downarrow B \downarrow / A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] A \uparrow B \downarrow \& / A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] A \downarrow B \downarrow$.
- Pulse width A & pulse width B measurement with the calculated polarity set to $A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \& B \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right]$, $A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \& B \left[\begin{array}{|c|} \hline \rightarrow \\ \hline \end{array} \right]$, or $A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] B \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] \& A \left[\begin{array}{|c|} \hline \leftarrow \\ \hline \end{array} \right] B \left[\begin{array}{|c|} \hline \rightarrow \\ \hline \end{array} \right]$.

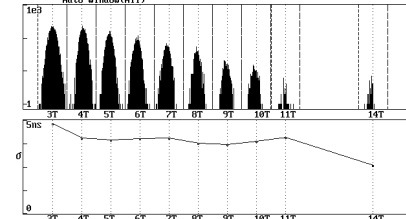


- Overlap: Turn ON/OFF the overlapped display of the measurement results of the pulse widths of both polarities and A-to-B time interval.**
 Sets whether the histograms of the measured results of positive polarity and the histograms of the measured results of the negative polarity are displayed overlapped (ON) or displayed separately in the top and bottom windows (OFF). The settings is valid only in the following cases:
 - A-to-B time interval measurement with the slope set to $A \uparrow B \uparrow$ or $A \uparrow B \downarrow$ and the calculated polarity is set to $A \uparrow B \uparrow \& A \downarrow B \uparrow$ or $A \uparrow B \downarrow \& A \downarrow B \downarrow$.
 - Pulse width measurement with the polarity set to $\left[\leftarrow \rightarrow \right]$ and the calculated slope is $\left[\leftarrow \right]$ & $\left[\rightarrow \right]$.
- Stat&Graph: Selects the display when All window is enabled.**
 By default, when multi window or auto window is enabled and Window is set to All, histogram of all windows are displayed at the top section of the screen and the list of statistical values at the bottom section. In this setting, the graph of deviation or the graph of σ can be displayed in place of the list of statistical values.

For Deviation



For σ



Use of Color on Histogram Displays

As shown in the table below, the color used to display the results vary depending on the measurement function and slope/polarity. Sections where pink and light blue overlap are displayed in violet.

| | Pink | Light blue | Orange |
|---|--|--|--|
| Period measurement | — | — | \uparrow/\downarrow |
| A-to-B time interval measurement $A \uparrow B \uparrow / A \downarrow B \uparrow / A \uparrow B \downarrow / A \downarrow B \downarrow$ | — | — | $A \uparrow B \uparrow / A \downarrow B \uparrow / A \uparrow B \downarrow / A \downarrow B \downarrow$ |
| A-to-B time interval measurement $A \uparrow B \uparrow / A \uparrow B \downarrow$ | $A \uparrow B \uparrow / A \uparrow B \downarrow$ | $A \downarrow B \uparrow / A \downarrow B \downarrow$ | $A \uparrow B \uparrow / A \uparrow B \downarrow$ |
| Pulse width measurement $\left[\leftarrow \rightarrow \right]$ | — | — | $\left[\leftarrow \rightarrow \right]$ |
| Pulse width measurement $\left[\leftarrow \right]$ | $\left[\leftarrow \right]$ | $\left[\rightarrow \right]$ | $\left[\leftarrow \rightarrow \right]$ |
| Period A & period B measurement | — | — | \uparrow/\downarrow |
| Period A & A-to-B time interval measurement | — | — | $A \uparrow A \uparrow B \uparrow / A \downarrow A \downarrow B \downarrow$ |
| Pulse width A & A-to-B time interval measurement | Meas1: $\left[\leftarrow \rightarrow \right]$ Meas2: $A \uparrow B \uparrow / A \uparrow B \downarrow$ | Meas1: $\left[\leftarrow \right]$ Meas2: $A \downarrow B \uparrow / A \downarrow B \downarrow$ | Meas1: $\left[\leftarrow \rightarrow \right]$ Meas2: $A \uparrow B \uparrow / A \uparrow B \downarrow$ |
| Pulse width A & pulse width B measurement | Meas1: $\left[\leftarrow \right]$ Meas2: $\left[\rightarrow \right]$ | Meas1: $\left[\leftarrow \right]$ Meas2: $\left[\rightarrow \right]$ | Meas1: $\left[\leftarrow \rightarrow \right]$ Meas2: $\left[\leftarrow \rightarrow \right]$ |

7.2 Setting the List Display

For a functional description, see 2.6.

Procedure

1. Press the **DISPLAY** key to display the Display menu.

| Display | | | | | | |
|---------------------|---------|--|-------------|-----------------------|----------|--|
| ▲ Item Histogram | ▲ Style | | ▲ Calc/Stat | ▲ Calc Pol [F] [G] | ▲ Window | |

2. Press the **Item** soft key to display the Item selection menu.
3. Press the **List** soft key.

| Item | | | |
|-----------|------|----------|------------|
| Histogram | List | TimeVar. | Statistics |

Specifying the Displayed Data

• When using single measurement function

4. Specify the data number you wish to display using the rotary knob or numeric keys.
The data corresponding to the specified number is moved to the center of the list and displayed highlighted. In the time variation window or histogram window, a cursor is displayed at the position corresponding to the specified number.

| Display | | | | | | |
|----------------|--------|--|---------------|--|----------|--|
| ▲ Item List | ▲ Jump | | Ⓢ Number 1 | | ▲ Window | |

• When using the dual measurement function

4. Press the **Link** soft key to turn ON/OFF the linked operation of specifying the data.
5. Press the **Meas1 Num** or **Meas2 Num** soft key.
6. Specify the data number you wish to display using the rotary knob or numeric keys.

| Display | | | | | | |
|----------------|--------|------------------|------------------|------------------|----------|--|
| ▲ Item List | ▲ Jump | Link [OFF] ON | Ⓢ Meas1 Num 1 | Ⓢ Meas2 Num 1 | ▲ Window | |

Jumping to the Top, Bottom, or Center Position

4. Press the **Jump** soft key to display the Jump menu.
5. Press the soft key corresponding to the desired position.
Center appears only when in hardware histogram mode.
When the **Top** soft key is pressed, the first line of the list shows the measured data of number 1. When the **Bottom** soft key is pressed, the last line of the list shows the measured data of the last number. When the **Center** soft key is pressed, the center of the list shows the measured data of the center number.

| Jump | | |
|------|--------|--------|
| Top | Bottom | Center |

Specifying the Block Number (when in time stamp mode using block sampling)

4. Press the **Block Num** soft key.
5. Specify the number of the measurement block you wish to display in a list using the rotary knob.

| Display | | | | | | |
|----------------|--------|--|---------------|--|----------|-------------------|
| ▲ Item List | ▲ Jump | | Ⓢ Number 1 | | ▲ Window | Ⓢ Block Num 12 |

Symbol Search (only when in time stamp mode or inter-symbol interference analysis mode)

For the operating procedure, see section 8.6, "Symbol Search".

Explanation

List Display

The number of items that can be displayed at once in a list is 20 data points of a single measurement function. The data number is a sequence number that is assigned to the measured data starting from 1.

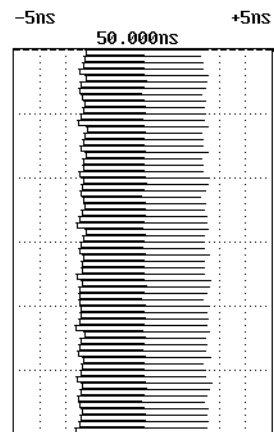
- **When in time stamp mode**

Displays the data number, time stamp, and measured value in the list. When using the dual measurement function, two columns are used. When using the single measurement function, the left side of the screen shows the list and the right side shows the time variation vertically.

The broken line and mark on the time variation window indicates the data that is highlighted in the list.

- Display example when using the single measurement function

| Number | TimeStamp | Measured Data |
|--------|-----------|---------------|
| 1 | 0.0 us | 52.500 ns |
| 2 | 0.0 us | 47.775 ns |
| 3 | 0.1 us | 52.225 ns |
| 4 | 0.1 us | 47.725 ns |
| 5 | 0.2 us | 52.300 ns |
| 6 | 0.2 us | 47.650 ns |
| 7 | 0.3 us | 52.300 ns |
| 8 | 0.3 us | 47.525 ns |
| 9 | 0.4 us | 52.500 ns |
| 10 | 0.4 us | 47.750 ns |
| 11 | 0.5 us | 52.475 ns |
| 12 | 0.5 us | 47.575 ns |
| 13 | 0.6 us | 52.400 ns |
| 14 | 0.6 us | 47.525 ns |
| 15 | 0.7 us | 52.250 ns |
| 16 | 0.7 us | 47.600 ns |
| 17 | 0.8 us | 52.425 ns |
| 18 | 0.8 us | 47.700 ns |
| 19 | 0.9 us | 52.350 ns |
| 20 | 0.9 us | 47.650 ns |



- Display example when using the dual measurement function

| Pulse Width A [P] | | | Pulse Width B [P] | | |
|-------------------|-----------|---------------|-------------------|-----------|---------------|
| Number | TimeStamp | Measured Data | Number | TimeStamp | Measured Data |
| 1 | 0.0 us | 51.625 ns | 1 | 0.0 us | 52.450 ns |
| 2 | 0.0 us | 48.425 ns | 2 | 0.0 us | 47.800 ns |
| 3 | 0.1 us | 51.775 ns | 3 | 0.1 us | 52.400 ns |
| 4 | 0.1 us | 48.125 ns | 4 | 0.1 us | 47.525 ns |
| 5 | 0.2 us | 51.800 ns | 5 | 0.2 us | 52.400 ns |
| 6 | 0.2 us | 48.500 ns | 6 | 0.2 us | 47.800 ns |
| 7 | 0.3 us | 51.550 ns | 7 | 0.3 us | 52.275 ns |
| 8 | 0.3 us | 48.425 ns | 8 | 0.3 us | 47.725 ns |
| 9 | 0.4 us | 51.675 ns | 9 | 0.4 us | 52.475 ns |

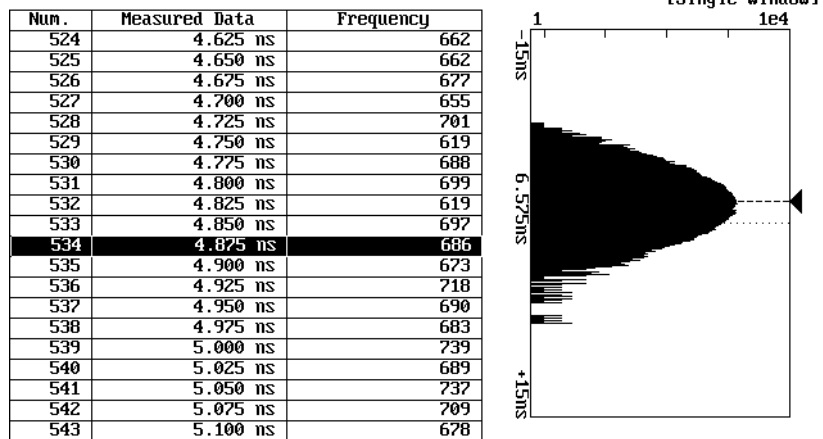
7.2 Setting the List Display

- **When in hardware histogram mode**

Displays the data number, median value of the measured values, and frequency of occurrence in the list. When using the dual measurement function, two columns are used. When using the single measurement function, the left side of the screen shows the list and the right side shows the histogram vertically.

The broken line ◀ and mark on the histogram variation window indicates the data that is highlighted in the list.

- Display example when using the single measurement function



- Display example when using the dual measurement function

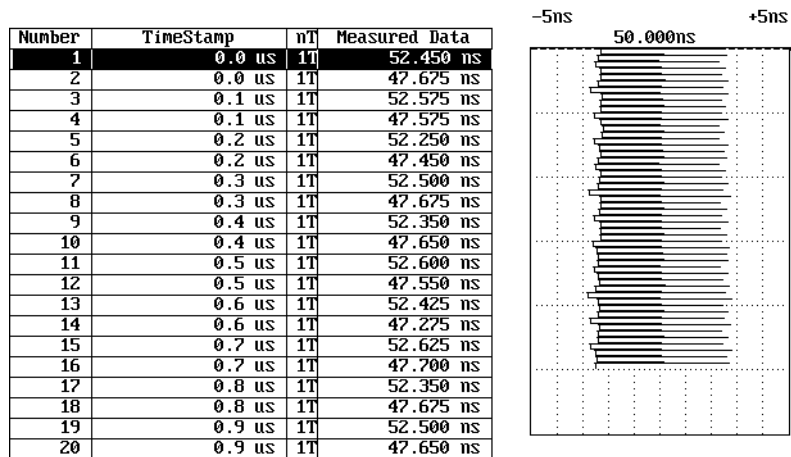
| [Meas1] Period A† | | | [Meas2] Period B† | | |
|-------------------|---------------|-----------|-------------------|---------------|-----------|
| Num. | Measured Data | Frequency | Num. | Measured Data | Frequency |
| 6001 | 149.750 ns | 0 | 6001 | 149.750 ns | 0 |
| 6002 | 149.775 ns | 0 | 6002 | 149.775 ns | 0 |
| 6003 | 149.800 ns | 0 | 6003 | 149.800 ns | 0 |
| 6004 | 149.825 ns | 0 | 6004 | 149.825 ns | 0 |
| 6005 | 149.850 ns | 0 | 6005 | 149.850 ns | 0 |
| 6006 | 149.875 ns | 0 | 6006 | 149.875 ns | 0 |
| 6007 | 149.900 ns | 0 | 6007 | 149.900 ns | 0 |
| 6008 | 149.925 ns | 0 | 6008 | 149.925 ns | 0 |
| 6009 | 149.950 ns | 0 | 6009 | 149.950 ns | 0 |

- **When in inter-symbol interference analysis mode**

Displays the data number, time stamp, nT, and measured value in the list. When using the dual measurement function, two columns are used. When using the single measurement function, the left side of the screen shows the list and the right side shows the time variation vertically.

The broken line and mark on the time variation window indicates the data that is highlighted in the list.

- Display example when using the single measurement function



- Display example when using the dual measurement function

| Pulse Width A | | | | TI A/B | | | |
|---------------|-----------|----|---------------|--------|-----------|-----|---------------|
| Number | TimeStamp | nT | Measured Data | Number | TimeStamp | nT | Measured Data |
| 1 | 0.0 us | 1T | 51.950 ns | 1 | 0.0 us | --- | -100 ps |
| 2 | 0.1 us | 1T | 47.850 ns | 2 | 0.1 us | --- | -300 ps |
| 3 | 0.1 us | 1T | 52.000 ns | 3 | 0.2 us | --- | -175 ps |
| 4 | 0.2 us | 1T | 47.975 ns | 4 | 0.3 us | --- | -325 ps |
| 5 | 0.2 us | 1T | 51.900 ns | 5 | 0.3 us | --- | -275 ps |
| 6 | 0.3 us | 1T | 47.975 ns | 6 | 0.4 us | --- | -350 ps |
| 7 | 0.3 us | 1T | 51.875 ns | 7 | 0.6 us | --- | -200 ps |
| 8 | 0.3 us | 1T | 48.050 ns | 8 | 0.7 us | --- | -325 ps |
| 9 | 0.4 us | 1T | 51.975 ns | 9 | 0.8 us | --- | -275 ps |

Specifying the Data to Be Displayed in the List

The number of data points that can be displayed at once on the screen is 20. The displayed data can be scrolled using the rotary knob. It is also possible to specify the desired measured data directly to quickly display the data around the measured data you wish to view. You can specify the measured data using the following methods.

- **Specify by data number**

When using the dual measurement function, you can specify the measured data for each measurement function. If Link is turned ON, the data numbers of the both measurement functions can be changed by changing the data number of either measurement function using the rotary knob, keeping the difference between the data numbers constant.

- **Jumping to the Specified Position**

It is possible to move to the first line of the list (Top), the last line of the list (Bottom), and the line corresponding to the center position in the histogram display (Center).

Specifying the Block Number (only in time stamp mode)

When block sampling is used, the list can be displayed for each block. When a desired block number is specified, the first data point of the specified block becomes the top data point in the list. Specifying a block number of 0 shows all the data.

Note

If a ▲ or ▼ mark is displayed on the time variation window, perform scaling again.

Symbol Search

For a description of the symbol search operation, see section 8.6, "Symbol Search."

7.3 Setting the Time Variation Display

For a functional description, see 2.6.

Procedure

The following operation is not possible when in hardware histogram mode or inter-symbol interference analysis mode (because time variation display is not possible).

1. Press the **DISPLAY** key to display the Display menu.

| Display | | | | |
|-----------|---------|--|-------------|------------|
| ▲ Item | ▲ Style | | ▲ Calc/Stat | ▲ Calc Pol |
| Histogram | | | F1&F2 | Window |

2. Press the **Item** soft key to display the Item selection menu.
3. Press the **TimeVar.** soft key.

| Item | | | |
|-----------|------|----------|------------|
| Histogram | List | TimeVar. | Statistics |

Setting the Display Style

4. Press the **Style** soft key to display the Display Style menu.

| Display Style | | | | |
|---------------|------------|----------|---------|-------------|
| Graph Size | Statistics | Panorama | Overlap | Wave |
| Half Full | OFF DN | OFF DN | OFF DN | M1 M2 M1&M2 |

5. Press the **Graph Size** soft key to set the display size of the time variation window to Half or Full.
6. Press the **Statistics**, **Panorama**, and **Overlap** soft key to set each item ON or OFF.
Overlap appears only when using the dual measurement function.
7. Press the **Wave** soft key to select M1, M2, or M1&M2.
Wave appears only when using the dual measurement function. Select M1 when displaying only the Meas1 waveforms, M2 when displaying only the Meas2 waveforms, or M1&M2 to display both waveforms.

Settings Related to the Display Style of the Time Variation Waveforms

8. Press the **Graph Param** soft key to display the Graph Parameter menu.

| Graph Parameter | | |
|-----------------|---------|------------|
| Grid | Connect | Dot Type |
| OFF DN | OFF DN | Pixel Mark |

9. Press the **Grid** or **Connect** soft key to select ON or OFF.
10. Press the **Dot Type** key to select Pixel or Mark.

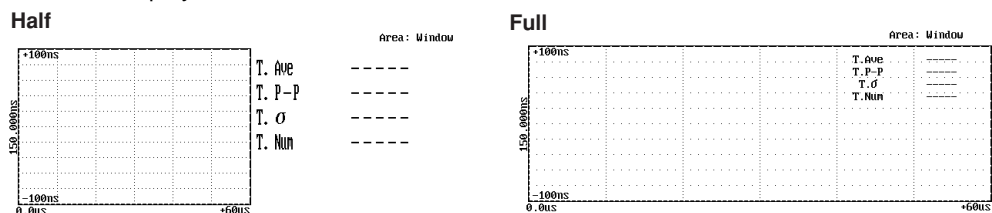
Explanation

Time Variation Display Size (Graph Size)

Select either of the following.

Half: Displays the time variation at a size equal to the left half of the main window.

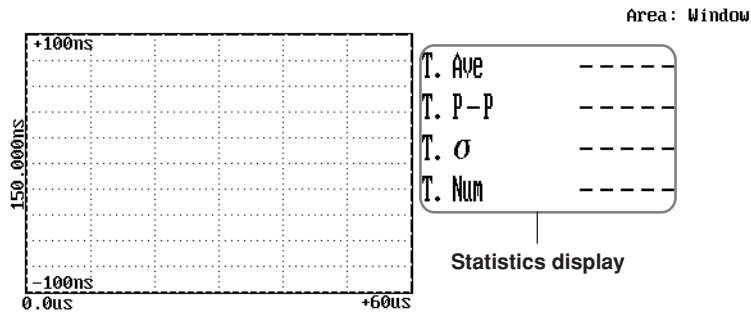
Full: Displays the time variation main window over the entire screen.



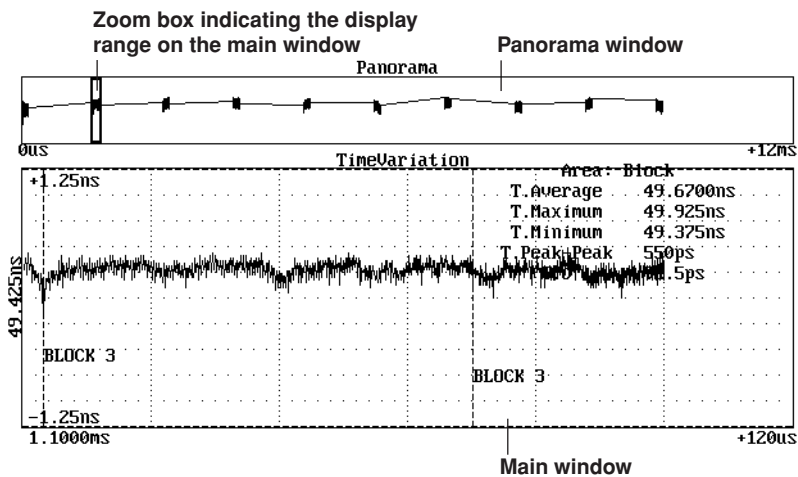
Setting the Display Style

Turns ON/OFF the display items other than the time variation.

- Statistics: Turning ON/OFF the statistics display
 When the size of time variation main window is set to Half, the statistical values are displayed outside the window; when the size is set to Full, the values are displayed within the window. The statistical parameters are set using the Calculation/Statistics Setting dialog box (see section 9.1).



- Panorama: Turning ON/OFF the panorama display
 When turned ON, a panorama window is displayed above the time variation main window.



Settings Related to the Display Format of the Time Variation Waveforms (Graph Parameter)

The following items can be specified.

- Grid: Turns ON/OFF the grid.
- Connect: Sets whether to linearly interpolate between data points.
- Dot Type: Sets whether to set the dot type to pixel or mark.



Use of Color When Using the Dual Measurement Function

The waveforms of Meas1 are displayed in orange. The waveforms of Meas2 are displayed in light blue. The waveforms where both overlap are displayed in violet.

- **Changing the Displayed Blocks and Displayed Statistical Parameters when All Is Selected**

6. Press the ◀▶ soft key and then change the statistical parameters to be displayed using the rotary knob.

- **Specifying the Displayed Block when Window Is Selected**

6. Press the **WindowNum** soft key and then specify the window to be displayed using the rotary knob.

| Display | | | | | | | |
|------------|------|------|-------|-------------|--------|-----------|----|
| ▲ Item | Stat | Item | Style | ▲ Calc/Stat | Window | WindowNum | 1T |
| Statistics | Hist | T.V. | All | Window | | | |

- **Selecting the Displayed Item When the Statistical Calculation Item Is Set to T.V. (only when block sampling is ON)**

5. Press the **Style** soft key to select All or Block.

| Display | | | | | | | |
|------------|------|------|-------|------------|-----------|----|--|
| ▲ Item | Stat | Item | Style | ▲ Calc Pol | Window | ◀▶ | |
| Statistics | Hist | T.V. | All | Window | Calc/Stat | | |

- **Changing the Displayed Blocks and Displayed Statistical Parameters when All Is Selected**

6. Press the ▲▼ soft key and then change the block number to be displayed using the rotary knob.

| Display | | | | | | | |
|------------|------|------|-------|-------------|----|----|--|
| ▲ Item | Stat | Item | Style | ▲ Calc/Stat | ▲▼ | ◀▶ | |
| Statistics | Hist | T.V. | All | Block | | | |

7. Press the ◀▶ soft key and then change the statistical parameters to be displayed using the rotary knob.

- **Specifying the Displayed Block when Block Is Selected**

6. Press the **Block Num** soft key and then specify the number of the block you wish to display using the rotary knob.

| Display | | | | | | | |
|------------|------|------|-------|-------------|-----------|----|--|
| ▲ Item | Stat | Item | Style | ▲ Calc/Stat | Block Num | 20 | |
| Statistics | Hist | T.V. | All | Block | | | |

Explanation

Selecting the Statistical Calculation Item (Stat Item)

When in time stamp mode, select the statistical calculation item from the following. The statistical calculation items when in hardware histogram mode are the measured value and the frequency of occurrence.

- Hist: Sets the area of the statistical calculation items using the measured value and frequency (see section 9.1)
- T.V.: Sets the area of the statistical calculation items using the time stamp and measured (see section 9.1)

Selecting the Display Style

- **When the statistical calculation item is set to Hist (measured value and frequency)**

When using multi window or auto window, select how the statistical calculation is displayed from the following:

- All: Lists the statistical values of all windows.
The maximum number of statistical parameters that can be displayed is 4, but you can scroll through the parameters to be displayed using the rotary knob. Only the parameters with check marks in the Calculation/Statistics Setting dialog box are displayed.
- Window: Displays all the statistical values for each window.
The following styles are available: Statistical values of each window (3T, 4T, etc.) specified using the Window Parameter Setting dialog box, Summation (sum of all windows. Peak-peak, σ , σ/T are displayed), and All (“- - - -” is displayed for all).

7.4 Setting the Statistics Display

Display Examples

- Hardware histogram mode, measurement function: pulse width A, polarity: positive, display style: All

2002/08/02 09:21:05
Interval Min

Hardware Hist Pulse Width A [P] Event 100
Inhibit Off Ref. Clock Int. Auto Arming
ChA: 0.000U ChB: 0.000U BlockSize 100 RestOff

| Window | Ave | P-P | σ | Area:Marker |
|--------|------------|----------|-----------|-------------|
| 2T | | | | |
| 3T | 111.6675ns | 34.700ns | 4.5925ns | 4.112376% |
| 4T | 149.8100ns | 27.700ns | 3.9400ns | 2.630130% |
| 5T | 182.4250ns | 20.100ns | 3.6950ns | 2.025075% |
| 6T | 217.5250ns | 26.700ns | 4.1375ns | 1.902157% |
| 7T | 255.1050ns | 26.900ns | 3.8400ns | 1.505347% |
| 8T | 294.3750ns | 20.700ns | 3.9100ns | 1.328178% |
| 9T | 330.9675ns | 17.300ns | 3.4900ns | 1.054364% |
| 10T | 367.5550ns | 15.900ns | 3.2075ns | 0.872887% |
| 11T | 403.725ns | 14.400ns | 3.625ns | 0.898735% |
| 14T | 515.175ns | 15.200ns | 3.725ns | 0.723872% |
| Sun | ***** | 35.200ns | 4.76225ns | ***** |

| Display | | | | | |
|------------|------------|-----------|--------|--|--|
| Item | Style | Calc/Stat | Window | | |
| Statistics | All Window | | | | |

- Hardware histogram mode, measurement function: pulse width A, polarity: positive, display style: Window

2002/08/02 09:21:19
Interval Min

Hardware Hist Pulse Width A [P] Event 100
Inhibit Off Ref. Clock Int. Auto Arming
ChA: 0.000U ChB: 0.000U BlockSize 100 RestOff

| Item | Value: A [P] |
|---------------|--------------|
| Ave | 111.6675ns |
| P-P | 34.700ns |
| σ | 4.5925ns |
| σ /Ave | 4.112376% |
| σ /T | 12.386244% |
| Est. T | 37.075ns |
| Nun | 3148 |

| Display | | | | | |
|------------|------------|-----------|--------|------------|--|
| Item | Style | Calc/Stat | Window | Window/Nun | |
| Statistics | All Window | | | 3T | |

- Time stamp mode, measurement function: pulse width A, statistical calculation item: Hist, display style: All

2002/08/02 09:20:22
Interval 0.0us

TimeStamp Pulse Width A [P] Event 100
Inhibit Off Ref. Clock Int. Auto Arming
ChA: 0.000U ChB: 0.000U BlockSize 100 RestOff

| Window | Ave | P-P | σ | Area:Marker |
|--------|------------|----------|-----------|-------------|
| 2T | | | | |
| 3T | 111.6975ns | 35.500ns | 4.6250ns | 4.141333% |
| 4T | 149.8450ns | 33.925ns | 3.9900ns | 2.663247% |
| 5T | 182.2825ns | 29.250ns | 3.7800ns | 2.073734% |
| 6T | 217.6175ns | 33.500ns | 4.2125ns | 1.935547% |
| 7T | 255.3925ns | 28.725ns | 4.0450ns | 1.583928% |
| 8T | 294.2900ns | 25.325ns | 3.9250ns | 1.334147% |
| 9T | 331.2575ns | 20.600ns | 3.4825ns | 1.051413% |
| 10T | 367.6975ns | 15.650ns | 3.1650ns | 0.860788% |
| 11T | 405.050ns | 16.200ns | 4.475ns | 1.103589% |
| 14T | 515.800ns | 15.450ns | 3.275ns | 0.636944% |
| Sun | ***** | 36.100ns | 4.84150ns | ***** |

| Display | | | | | |
|------------|-----------|------------|-----------|--------|--|
| Item | Stat Item | Style | Calc/Stat | Window | |
| Statistics | HIST T.U. | All Window | | | |

- Time stamp mode, measurement function: pulse width A, statistical calculation item: Hist, display style: Window

2002/08/02 09:20:41

TimeStamp Pulse Width A[P] Event 100 Interval 0.0us
 Inhibit Off Ref. Clock Int. Auto Arming
 ChA: 0.000u ChB: 0.000u BlockSize 100 RestOff

| Item | Value A[P] |
|---------------|------------|
| Ave | 111.6975ns |
| P-P | 35.500ns |
| σ | 4.6250ns |
| σ /Ave | 4.141333% |
| σ /T | 12.451526% |
| Est. T | 37.150ns |
| Num | 3042 |

| Display | | | | | | |
|------------|------|------|------------|-----------|--------|-----------|
| Item | Stat | Item | Style | Calc/Stat | Window | WindowNum |
| Statistics | HIST | T.V. | All Window | | | 3T |

- Time stamp mode, measurement function: pulse width A & pulse width B, polarity: both, statistical calculation item: Hist, display style: All

2002/08/02 09:21:52

TimeStamp PW A[P] & PW B[P] Event 10000 Interval Min
 Inhibit Off Ref. Clock Int. Auto Arming
 ChA: 0.000u ChB: 0.000u

| Statistics Value(Histogram) | | | | | | |
|-----------------------------|-----------|----------|-----------|----------|----------|----------|
| Window | A[P] Ave | A[P] P-P | A[P] Ave | A[P] P-P | B[P] Ave | B[P] P-P |
| 3T | 111.510ns | 31.825ns | 111.200ns | 30.775ns | | |
| 4T | 149.470ns | 24.650ns | 152.347ns | 33.150ns | | |
| 5T | 182.310ns | 25.425ns | 184.732ns | 21.850ns | | |
| 6T | 217.510ns | 33.050ns | 221.870ns | 28.350ns | | |
| 7T | 255.250ns | 23.375ns | 263.730ns | 26.250ns | | |
| 8T | 293.600ns | 20.675ns | 302.505ns | 19.875ns | | |
| 9T | 331.460ns | 18.550ns | 338.765ns | 18.875ns | | |
| 10T | 368.225ns | 14.900ns | 376.675ns | 20.825ns | | |
| Sum | ***** | 35.400ns | ***** | 34.800ns | | |

| Window | B[P] Ave | B[P] P-P | B[P] Ave | B[P] P-P |
|--------|-----------|----------|-----------|----------|
| 3T | 111.787ns | 31.075ns | 110.932ns | 30.750ns |
| 4T | 149.785ns | 24.625ns | 152.120ns | 33.150ns |
| 5T | 182.597ns | 25.375ns | 184.475ns | 21.925ns |
| 6T | 217.807ns | 32.875ns | 221.647ns | 28.300ns |
| 7T | 255.537ns | 23.325ns | 263.425ns | 26.150ns |
| 8T | 293.892ns | 20.750ns | 302.270ns | 19.900ns |
| 9T | 331.752ns | 18.650ns | 338.512ns | 18.875ns |
| 10T | 368.525ns | 14.825ns | 376.425ns | 20.850ns |
| Sum | ***** | 35.300ns | ***** | 34.800ns |

| Display | | | | | | |
|------------|------|------|------------|-----------|---------------|--------|
| Item | Stat | Item | Style | Calc/Stat | Calc Pol | Window |
| Statistics | HIST | T.V. | All Window | | A/B/B/A/B/B/B | |

- Time stamp mode, measurement function: pulse width A & pulse width B, polarity: both, statistical calculation item: Hist, display style: Window

When the polarity is set to both, each polarity is displayed separately as shown below.

2002/08/02 09:22:06

TimeStamp PW A[P] & PW B[P] Event 10000 Interval Min
 Inhibit Off Ref. Clock Int. Auto Arming
 ChA: 0.000u ChB: 0.000u

| Statistics Value(Histogram) | | |
|-----------------------------|------------|------------|
| Item | Value A[P] | Value A[P] |
| Ave | 111.510ns | 111.200ns |
| P-P | 31.025ns | 30.775ns |
| σ | 4.8450ns | 4.3650ns |
| Num | 1522 | 1574 |

| Statistics Value(Histogram) | | |
|-----------------------------|------------|------------|
| Item | Value B[P] | Value B[P] |
| Ave | 111.787ns | 110.932ns |
| P-P | 31.075ns | 30.750ns |
| σ | 4.8450ns | 4.3650ns |
| Num | 1522 | 1574 |

| Display | | | | | | |
|------------|------|------|------------|-----------|---------------|--------|
| Item | Stat | Item | Style | Calc/Stat | Calc Pol | Window |
| Statistics | HIST | T.V. | All Window | | A/B/B/A/B/B/B | |

- When the Statistical Calculation Item Is Set to T.V. (Time Stamp and Measured Value)

When the data is block sampled, the statistical calculation area is set to Block, and the statistical calculation item is set to time variation (T.V.), the display style of the statistical calculation can be selected from the following.

- All: Lists the statistical values of all blocks. The maximum number of statistical parameters that can be listed is 4; the maximum number of blocks is 18. You can scroll through the blocks and statistical parameters in the list using the rotary knob for ▲▼ and ◀▶.
- Block: Displays all the statistical values for each block.

7.4 Setting the Statistics Display

Display Examples

- Time stamp mode, measurement function: pulse width A, polarity: positive, statistical calculation item: T.V., display style: All

2002/08/02 09:19:40
Interval 0.0us

TimeStamp Pulse Width A [F] Event 100
Inhibit Off Ref. Clock Int. Auto Arming
ChA: 0.000V ChB: 0.000V BlockSize 100 RestOff

Area: Block

| Block | T. Ave | T. Max | T. Min | T. P-P |
|-------|-------------|-----------|-----------|-----------|
| ALL | 173.75675ms | 521.250ms | 54.625ms | 466.625ms |
| 1 | 168.4225ms | 366.675ms | 103.625ms | 263.050ms |
| 2 | 175.1025ms | 374.675ms | 54.625ms | 320.050ms |
| 3 | 176.9225ms | 366.425ms | 97.950ms | 270.475ms |
| 4 | 167.4525ms | 363.725ms | 106.400ms | 257.325ms |
| 5 | 165.1050ms | 513.800ms | 103.400ms | 410.400ms |
| 6 | 163.4575ms | 399.125ms | 102.800ms | 296.325ms |
| 7 | 184.0890ms | 334.900ms | 105.250ms | 229.650ms |
| 8 | 183.6175ms | 510.875ms | 99.000ms | 411.875ms |
| 9 | 182.1025ms | 368.000ms | 104.125ms | 263.875ms |
| 10 | 183.4925ms | 370.750ms | 105.650ms | 265.100ms |
| 11 | 173.2575ms | 512.250ms | 102.500ms | 409.750ms |
| 12 | 182.9875ms | 408.575ms | 107.550ms | 301.025ms |
| 13 | 172.6375ms | 367.100ms | 103.575ms | 263.525ms |
| 14 | 172.2850ms | 514.975ms | 95.125ms | 419.850ms |
| 15 | 176.9200ms | 369.975ms | 103.450ms | 266.525ms |
| 16 | 178.1875ms | 517.875ms | 104.675ms | 413.200ms |
| 17 | 176.9675ms | 402.775ms | 105.325ms | 297.450ms |
| 18 | 172.7975ms | 335.975ms | 102.000ms | 233.975ms |

Display

| Item | Stat | Item | Style | Calc/Stat | Block |
|--------------|--------|--------|-------------|-----------|-------|
| ▲ Statistics | ▲ Hist | [T.V.] | [All] Block | ▲ ▼ | ⊞ ◀ ▶ |

- Measurement function: pulse width, statistical calculation item: T.V., display style: Block

2002/08/02 09:19:24
Interval 0.0us

TimeStamp Pulse Width A [F] Event 100
Inhibit Off Ref. Clock Int. Auto Arming
ChA: 0.000V ChB: 0.000V BlockSize 100 RestOff

Area: Block 1

| Item | Value A [F] |
|------------|-------------|
| T. Ave | 168.4225ms |
| T. Max | 366.675ms |
| T. Min | 103.625ms |
| T. P-P | 263.050ms |
| T. σ | 62.1400ms |
| T. (σ/Ave) | 36.894730% |
| T. P-P/Ave | 156.183668% |
| T. RF | 177.974940% |
| T. Num | 100 |

Display

| Item | Stat | Item | Style | Calc/Stat | Block Num |
|--------------|--------|--------|-------------|-----------|-----------|
| ▲ Statistics | ▲ Hist | [T.V.] | [All] Block | ▲ ▼ | ⊞ 1 |

Note

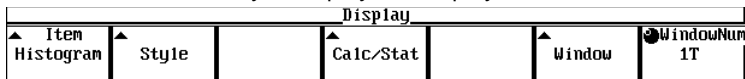
- For the procedure of setting the statistical calculation parameters, see section 9.1, "Setting the Range and Parameters of Statistical Calculation."
- If the statistical calculation parameter is displayed but the parameter is not been calculated, "*****" is displayed.
- If the measured data is invalid or the measured data does not exist, "- - - -" is displayed.

8.1 Setting the Single Window

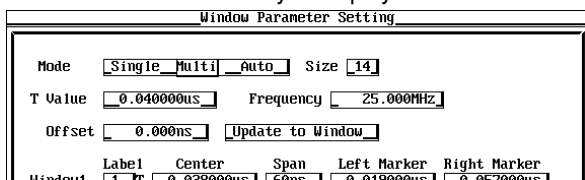
For a functional description, see 2.6.

Procedure

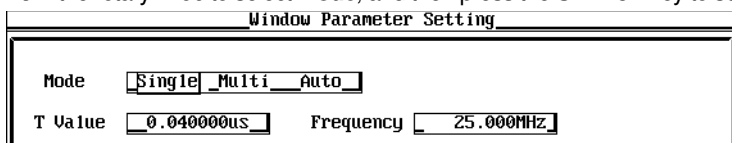
1. Press the **DISPLAY** key to display the Display menu.



2. Press the **Window** soft key to display the Window Parameter Setting dialog box.



3. Turn the rotary knob to select **Mode**, and then press the SELECT key to select **Single**.



Selecting the Setup Item (only for dual measurement function)

4. Turn the rotary knob to select **Item**, and then press the SELECT key to select **Meas1** or **Meas2**.

Setting Constant T

Setting Constant T Directly

5. Turn the rotary knob to select **T Value**, and then press the SELECT key to show the value entry area.
6. Enter the desired constant using the numeric keys.

Setting Constant T by Frequency

5. Turn the rotary knob to select **Frequency**, and then press the SELECT key to show the value entry area.
6. Enter the desired frequency using the numeric keys.

Copying Settings

7. Turn the rotary knob to select **Copy to Meas2** or **Copy to Meas1**, and then press the SELECT key.
If you selected Meas1 in step 4, Copy to Meas2 appears; if you selected Meas2, Copy to Meas1 appears.

Explanation

Window Mode: Single

This mode is used when performing analysis using a single window.

Setting Constant T

Constant T can also be set using the frequency, which is an inverse of constant T rounded to a resolution of 25 ps.

- Selectable range of constant T: 1 ns to 250 ns (25 ps steps)
- Selectable range when setting constant T using the frequency: 4 MHz to 1000 MHz

8.2 Setting the Multi Window

For a functional description, see 2.6.

Procedure

1. Press the **DISPLAY** key to display the Display menu.

| Display | | | | | |
|-----------|---------|--|-------------|--|----------|
| ▲ Item | ▲ Style | | ▲ Calc/Stat | | ▲ Window |
| Histogram | | | | | |

2. Press the **Window** soft key to display the Window Parameter Setting dialog box.

| Window Parameter Setting | | | |
|--|--|-----------|---|
| Mode | <input type="text" value="Single"/> <input type="text" value="Multi"/> <input type="text" value="Auto"/> | Item | <input type="text" value="Meas1"/> <input type="text" value="Meas2"/> |
| T Value | <input type="text" value="0.040000us"/> | Frequency | <input type="text" value="25.000MHz"/> |
| <input type="text" value="Copy To Meas2"/> | | | |

3. Turn the rotary knob to select **Mode**, and then press the SELECT key to select **Multi**.

| Window Parameter Setting | | | | | |
|--------------------------|---|---|--|-------------|---|
| Mode | <input type="text" value="Single"/> <input checked="" type="text" value="Multi"/> <input type="text" value="Auto"/> | Size | <input type="text" value="14"/> | Item | <input type="text" value="Meas1"/> <input type="text" value="Meas2"/> |
| T Value | <input type="text" value="0.040000us"/> | Frequency | <input type="text" value="25.000MHz"/> | | |
| Offset | <input type="text" value="0.000ns"/> | <input type="text" value="Update to Window"/> | <input type="text" value="Copy To Meas2"/> | | |
| | Label | Center | Span | Left Marker | Right Marker |
| Window1 | 1 T | 0.038000us | 60ns | 0.019000us | 0.057000us |
| Window2 | 2 T | 0.076000us | 60ns | 0.038000us | 0.076000us |
| Window3 | 3 T | 0.114000us | 60ns | 0.057000us | 0.114000us |
| Window4 | 4 T | 0.152000us | 60ns | 0.076000us | 0.152000us |
| Window5 | 5 T | 0.190000us | 60ns | 0.095000us | 0.190000us |
| Window6 | 6 T | 0.228000us | 60ns | 0.114000us | 0.228000us |
| Window7 | 7 T | 0.266000us | 60ns | 0.133000us | 0.266000us |
| Window8 | 8 T | 0.304000us | 60ns | 0.152000us | 0.304000us |
| Window9 | 9 T | 0.342000us | 60ns | 0.171000us | 0.342000us |
| Window10 | 10 T | 0.380000us | 60ns | 0.190000us | 0.380000us |
| Window11 | 11 T | 0.418000us | 60ns | 0.209000us | 0.418000us |
| Window12 | 12 T | 0.456000us | 60ns | 0.228000us | 0.456000us |
| Window13 | 13 T | 0.494000us | 60ns | 0.247000us | 0.494000us |
| Window14 | 14 T | 0.532000us | 60ns | 0.266000us | 0.532000us |

Setting the Window Size

4. Turn the rotary knob to select **Size**, and then press the SELECT key to show the value entry area.
5. Enter the size using the numeric keys.

Selecting the Setup Item (only for dual measurement function)

6. Turn the rotary knob to select **Item**, and then press the SELECT key to select **Meas1** or **Meas2**.

Setting Constant T

• Setting Constant T Directly

7. Turn the rotary knob to select **T Value**, and then press the SELECT key to show the value entry area.
8. Enter the desired constant using the numeric keys.
After entering the value, press the n key or m key.

• Setting Constant T by Frequency

7. Turn the rotary knob to select **Frequency**, and then press the SELECT key to show the value entry area.
8. Enter the desired frequency using the numeric keys.
After entering the value, press the SHIFT+n (MHz) key.

Setting the Window Offset Value

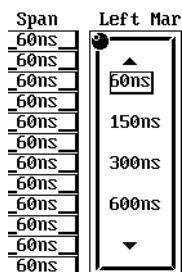
9. Turn the rotary knob to select **Offset**, and then press the SELECT key to show the value entry area.
10. Enter the desired offset using the numeric keys.
After entering the value, press the n key or μ key.

Updating the Window

11. Turn the rotary knob to select **Update to Window**, and then press the SELECT key.
The center, span, and marker values are updated.

Setting Window Values

12. Turn the rotary knob to select one of the parameters, **Label**, **Center**, **Left Marker**, or **Right Marker**, for the target window. Then, enter the value using the numeric keys.
13. Turn the rotary knob to select **Span**, and then press the SELECT key to show the span selection window.
14. Turn the rotary knob to select the span.

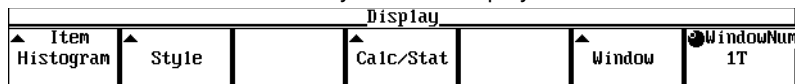


Copying Settings

15. Turn the rotary knob to select **Copy to Meas2** or **Copy to Meas1**, and then press the SELECT key.
If you selected Meas1 in step 6, Copy to Meas2 appears; if you selected Meas2, Copy to Meas1 appears.

Selecting the Window to Be Displayed

16. Press the ESC key to close the Window Parameter Setting dialog box.
17. Press the **WindowNum** soft key from the Display menu.



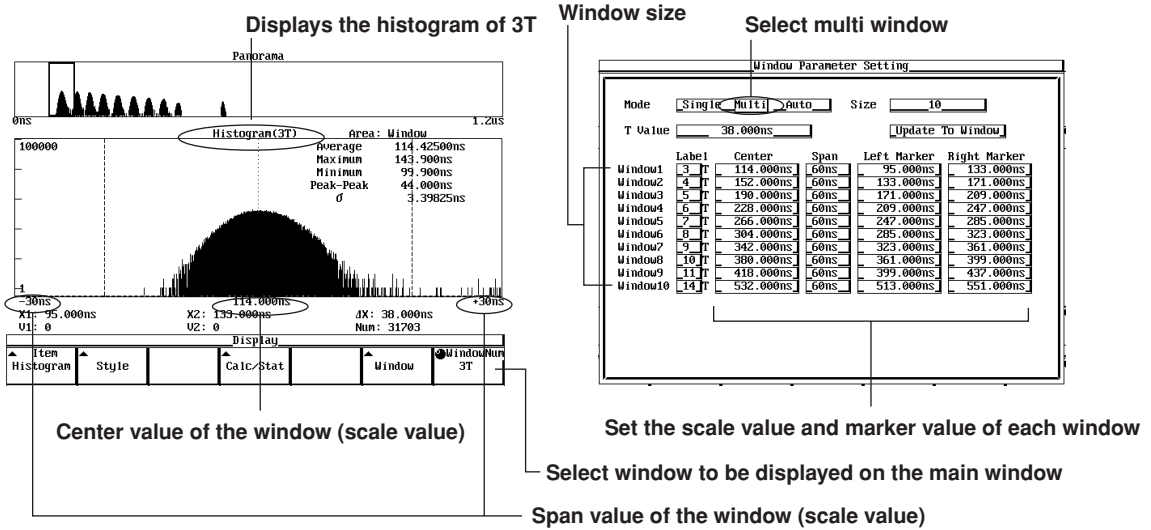
18. Turn the rotary knob to select the window to be displayed.

8.2 Setting the Multi Window

Explanation

Window Mode: Multi

Multiple windows of different sizes can be specified. This mode is used when multiple histograms are present simultaneously and constant T is known.



Setting the Window Size

Set the number of windows that will be displayed.

Selectable range: 1 to 14

Constant T(T Value)

Set the interval of the center value of each window as a T value. Constant T can also be set using the frequency, which is an inverse of constant T rounded to a resolution of 25 ps.

- Selectable range of constant T: 1 ns to 250 ns (25 ps steps)
- Selectable range when setting constant T using the frequency: 4 MHz to 1000 MHz

Setting the Window Offset

Set the window offset.

Selectable range: -100 ns to 300 ns

Update to Window

The constant T value is applied to the center, span, left marker, and right marker values of each window as follows:

Center: $T \times [\text{Label}] + \text{Offset}$

Span: Window span that is greater than T and closest to T

Left Marker: $\text{Center} - (T/2)$

Right Marker: $\text{Center} + (T/2)$

Example When $T=38$ ns, $\text{Offset}=10$ ns, and the Window1 label is 3, the X-axis setting of Window1 is as follows:

$$\text{Center} = 38 \times 3 + 10 = 124 \text{ [ns]}$$

$$\text{Span} = 38 (<60) = 60 \text{ [ns]}$$

$$\text{Left Marker} = 124 - 38/2 = 105 \text{ [ns]}$$

$$\text{Right Marker} = 124 + 38/2 = 143 \text{ [ns]}$$

Setting the X-Axis of the Window

The setting of the following parameters can be changed for each window.

- Label: Window name (selectable range is 1 to 16)
- Center: Center value
- Span: Window span
- Left Marker: Position of the X1 marker
- Right Marker: Position of the X2 marker

Statistical calculation is performed on the area enclosed by Left Marker and Right Marker.

For details on the selectable range of each parameter, see section 8.4.

Selecting the Window to Be Displayed (WindowNum)

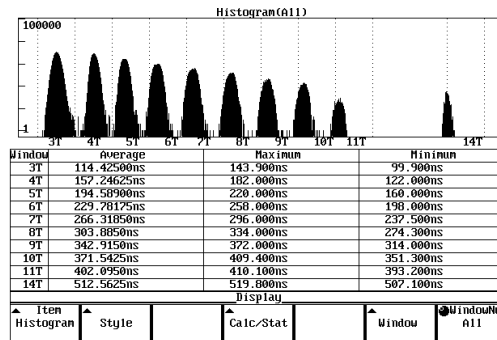
Select the window to be displayed from below.

[Label]T: Window set using the Window Parameter Setting dialog box.

All: Shows the histogram of all windows and a list the statistical values for each window.

Summation: Sums the histogram of all windows and displays the result.

When window is set to All display



Displays the top three parameters whose statistical calculation has been turned ON using the Calc/Stat soft key

Note

- The center and span values can also be entered for each window on the soft key menu that is displayed when the SCALE key is pressed.
- The left marker and right marker values can be entered on the soft key menu that is displayed when the MARKER key is pressed.

8.3 Setting the Auto Window

For a functional description, see 2.6.

Procedure

1. Press the **DISPLAY** key to display the Display menu.

| Display | | | | | |
|------------------|---------|--|-------------|--|----------|
| ▲ Item Histogram | ▲ Style | | ▲ Calc/Stat | | ▲ Window |

2. Press the **Window** soft key to display the Window Parameter Setting dialog box.

| Window Parameter Setting | | | |
|--|--|-----------|---|
| Mode | <input type="text" value="Single"/> <input type="text" value="Multi"/> <input type="text" value="Auto"/> | Item | <input type="text" value="Meas1"/> <input type="text" value="Meas2"/> |
| T Value | <input type="text" value="0.040000us"/> | Frequency | <input type="text" value="25.000MHz"/> |
| <input type="button" value="Copy To Meas2"/> | | | |

3. Turn the rotary knob to select **Mode**, and then press the SELECT key to select **Auto**.

| Window Parameter Setting | | | | | |
|--------------------------|--|---|---|--|--|
| Mode | <input type="text" value="Single"/> <input type="text" value="Multi"/> <input type="text" value="Auto"/> | Modulation | <input type="text" value="EFM"/> <input type="text" value="EFM+"/> <input type="text" value="1-7"/> | | |
| T Type | <input type="text" value="Measured T"/> <input type="text" value="Estimated T"/> | Meas Item | <input type="text" value="Meas1"/> <input type="text" value="Meas2"/> | | |
| Window1(2T) | <input type="text" value="OFF"/> <input type="text" value="ON"/> | <input type="button" value="Copy to Multi Window"/> | | | |
| Not Adjustable Below | | | | | |
| T Value | <input type="text" value="38.000ns"/> | Frequency | <input type="text" value="26.316MHz"/> | | |
| | Label | Center | Span | Left Marker | Right Marker |
| Window2 | <input type="text" value="3"/> T | <input type="text" value="76.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="57.000ns"/> | <input type="text" value="95.000ns"/> |
| Window3 | <input type="text" value="4"/> T | <input type="text" value="114.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="95.000ns"/> | <input type="text" value="133.000ns"/> |
| Window4 | <input type="text" value="5"/> T | <input type="text" value="152.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="133.000ns"/> | <input type="text" value="171.000ns"/> |
| Window5 | <input type="text" value="6"/> T | <input type="text" value="190.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="171.000ns"/> | <input type="text" value="209.000ns"/> |
| Window6 | <input type="text" value="7"/> T | <input type="text" value="228.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="209.000ns"/> | <input type="text" value="247.000ns"/> |
| Window7 | <input type="text" value="8"/> T | <input type="text" value="266.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="247.000ns"/> | <input type="text" value="285.000ns"/> |
| Window8 | <input type="text" value="9"/> T | <input type="text" value="304.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="285.000ns"/> | <input type="text" value="323.000ns"/> |
| Window9 | <input type="text" value="10"/> T | <input type="text" value="342.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="323.000ns"/> | <input type="text" value="361.000ns"/> |
| Window10 | <input type="text" value="11"/> T | <input type="text" value="380.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="361.000ns"/> | <input type="text" value="399.000ns"/> |
| Window11 | <input type="text" value="14"/> T | <input type="text" value="418.000ns"/> | <input type="text" value="60ns"/> | <input type="text" value="399.000ns"/> | <input type="text" value="437.000ns"/> |

Selecting the Modulation Type

4. Turn the rotary knob to select **Modulation**, and then press the SELECT key to select **EFM**, **EFM+**, or **1-7**.

Selecting the Constant T Type

5. Turn the rotary knob to select **T Type**, and then press the SELECT key to select **Measured T** or **Estimated T**.

Selecting the Setup Item (only for dual measurement function)

6. Turn the rotary knob to select **Item**, and then press the SELECT key to select **Meas1** or **Meas2**.

Turning ON/OFF 2T/1T

7. Turn the rotary knob to select **Window1(2T)** or **Window1(1T)**, and then press the SELECT key to select **OFF** or **ON**.

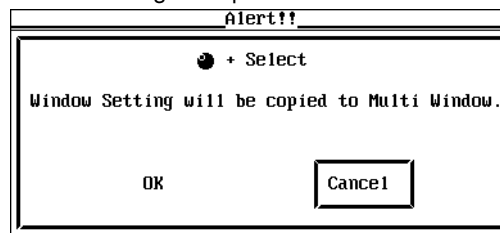
Windows1(2T) is turned ON/OFF if the modulation type is set to EFM or EFM+;

Windows1(1T) is turned ON/OFF if the modulation type is set to 1-7.

Copying the Auto Window Settings to the Multi Window or Single Window Settings

8. Turn the rotary knob to select **Copy to Multi Window** or **Copy to Single Window**, and then press the SELECT key.

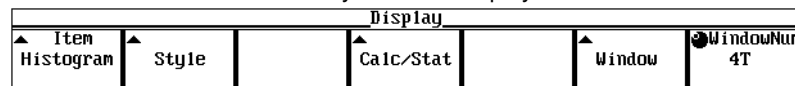
An Alert dialog box opens.



9. Turn the rotary knob to select **OK**, and then press the SELECT key. Settings such as the center, span, marker, and constant T values are copied to the multi window or single window.

Selecting the Window to Be Displayed

10. Press the ESC key to close the Window Parameter Setting dialog box.
11. Press the **WindowNum** soft key from the Display menu.



12. Turn the rotary knob to select the window to be displayed.

Explanation**Window Mode: Auto**

In this mode, the constant T value is automatically determined according to the input data and the window size is automatically set. This mode is used when multiple histograms are present simultaneously and the constant T value is not fixed (CD in CAV format) or when the constant T value cannot be determined.

Selecting the Modulation Type

Select from the following.

- EFM: Modulation type used in CDs.
- EFM+: Modulation type used in DVDs. It is also called 8-16 modulation.
- 1-7: 1-7 RLL modulation type. Used in rewritable disks.

The TA720 provides the following windows for each modulation type.

| Modulation Type | Window | Window Size |
|-----------------|----------------|---------------------|
| EFM | 3T to 11T | 9 (When 2T is OFF) |
| EFM+ | 3T to 11T, 14T | 10 (When 2T is OFF) |
| 1-7 | 2T to 9T | 8 (When 1T is OFF) |

8.3 Setting the Auto Window

Selecting the Method of Calculating Constant T (T Type)

Select either of the following.

- Measured T: Automatically measures the constant T value from the CH B clock input signal.
- Estimated T: Estimates the value of T from the input signal and modulation type.

However, possible selections vary depending on the sampling mode and measurement function as follows.

| Measurement Function | HH Mode | TS Mode with Interval = 0 μ s | TS Mode with Interval = Other than 0 μ s | ISI Mode |
|--------------------------------------|--------------------------------|-----------------------------------|--|---------------------------|
| Period | Selectable | Selectable | Measured T only | None |
| A-to-B time interval | Selectable | Selectable | Measured T only | None |
| Pulse width | Selectable | Selectable | Measured T only | Selectable |
| Period A & period B | Estimated T only ^{*1} | Estimated T only ^{*1} | Cannot be set | None |
| Period A & A-to-B time interval | Selectable ^{*2} | Selectable ^{*2} | Cannot be set | None |
| Pulse width A & A-to-B time interval | Selectable ^{*2} | Selectable ^{*2} | Cannot be set | Selectable ^{*2} |
| Pulse width A & pulse width B | Estimated T only ^{*1} | Estimated T only ^{*1} | Cannot be set | Estimated T ^{*3} |

*1 Estimated T is determined independently for CH A and CH B.

*2 In Measured T the time for 1024 cycles within the measurement gate time is measured after the measurement of CH B period (clock) is started and the time of 1 period (clock) is determined. In Estimated T, the clock value is estimated by measuring the average value of CH A and dividing by a known coefficient.

*3 Estimated T is determined for CH A, and the value is also used for CH B.

Note

If constant T is set to Measured T in period or pulse width measurement, set the measurement channel to CH A.

Setting the X-Axis of the Window

The values of the following parameters are automatically set from the modulation type and the constant T value.

- Period measurement, pulse width measurement, period A & period B measurement, and Meas1 of period A & A-to-B time interval measurement, Meas1 of pulse width A & A-to-B time interval measurement, and pulse width A & pulse width B measurement
Center: $T \times \text{Label}$
Span (window span): Window span that is greater than T and closest to T
Left Marker: $\text{Center} - T/2$
Right Marker: $\text{Center} + T/2$
- A-to-B time interval measurement, Meas2 of period A & A-to-B time interval measurement, or Meas2 of pulse width A & A-to-B time interval measurement
Center: $T/2$
Span (window span): Window span that is greater than T and closest to T
Left Marker: $\text{Center} - T/2$
Right Marker: $\text{Center} + T/2$

Note

The following parameters in the dialog box cannot be set.

T Value, Label, Center, Span, Left Marker, and Right Marker

Copying the Auto Window Settings to the Multi Window (Copy to Multi Window)

Copies the X-axis setting that is set automatically based on the T value that is automatically measured to the multi window. This is used when you wish to perform successive measurements using the value that is automatically measured.

For the measurement functions of period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, and pulse width A & pulse width B, both Meas1 and Meas2 are copied.

Copying the Auto Window Settings to the Single Window (Copy to Single Window)

Copies the X-axis setting that is set automatically based on the T value that is automatically measured to the single window. This function can be used only for A-to-B time interval measurement.

Selecting the Window to Be Displayed

Select the window to be displayed from below.

[Label]T: Window set using the Window Parameter Setting dialog box.

All: Shows the histogram of all windows and a list the statistical values for each window.

Summation: Sums the histogram of all windows and displays the result.

Note

- When making time interval measurements, only T/2 can be selected for WindowNum. All and Summation cannot be selected.
 - Meas2 of multi window for pulse width A & A-to-B time interval or period A & A-to-B time interval always displays Window1.
-

8.4 Changing the Scale Value of the Histogram and Time Variation Displays

For a functional description, see 2.6.

Procedure

Auto Scaling

Press the **Auto SCALE** key.

Note

Auto scaling cannot be performed in the following cases.

- When auto window is specified in hardware histogram mode.
- When multi window or auto window is specified in time stamp mode.
- When in inter-symbol interference analysis mode.

Manual Scaling

1. Press the **SCALE** key to display the Scale menu.

| Scale | | | | | | |
|-----------------|---|----------------------|------------------|-----------------|-------------------|-------------------|
| ▲ Link Meas1 | Ⓜ | X Center 76.000ns | Ⓢ X Span 60ns | Ⓢ Y High 1e2 | Y AXIS Lin Log | Ⓢ WindowNum 3T |

Selecting the Scaling Item (only for dual measurement function)

2. Press the **Link** soft key to display the Link menu.

| Link | | |
|-------|-------|------|
| Meas1 | Meas2 | Link |

3. Press the **Meas1**, **Meas2**, or **Link** soft key to select the item to be scaled.

Setting the X-Axis Center

4. Press the **X Center** soft key and then set the center value using the rotary knob or numeric keys.

| Scale | | | | | | |
|-----------------|---|-----------------------|------------------|-----------------|-------------------|-------------------|
| ▲ Link Meas1 | Ⓜ | X Center 106.000ns | Ⓢ X Span 60ns | Ⓢ Y High 1e2 | Y AXIS Lin Log | Ⓢ WindowNum 3T |

Selecting the X-Axis Span

5. Press the **X Span** soft key, and then turn the rotary knob to select the span value.

| Scale | | | | | | |
|-----------------|---|-----------------------|-------------------|-----------------|-------------------|-------------------|
| ▲ Link Meas1 | Ⓜ | X Center 106.000ns | Ⓢ X Span 150ns | Ⓢ Y High 1e2 | Y AXIS Lin Log | Ⓢ WindowNum 3T |

Selecting the Y-Axis Maximum

6. Press the **Y High** soft key, and then turn the rotary knob to select the Y-axis maximum.

| Scale | | | | | | |
|-----------------|---|-----------------------|-------------------|-----------------|-------------------|-------------------|
| ▲ Link Meas1 | Ⓜ | X Center 106.000ns | Ⓢ X Span 150ns | Ⓢ Y High 1e5 | Y AXIS Lin Log | Ⓢ WindowNum 3T |

Selecting the Y-Axis Scale Type

7. Press the **Y Axis** soft key to select Lin or Log.

| Scale | | | | | | |
|-----------------|---|-----------------------|-------------------|--------------------|-------------------|-------------------|
| ▲ Link Meas1 | Ⓜ | X Center 106.000ns | Ⓢ X Span 150ns | Ⓢ Y High 100000 | Y AXIS Lin Log | Ⓢ WindowNum 3T |

Explanation

Auto Scaling

The X-axis and Y-axis is automatically set to values that are appropriate for the measured data. The following limitations are present depending on the combination of the sampling mode and window mode.

| | TimeStamp | HardHist | ISI |
|---------------|-----------|----------------|---|
| Single window | Yes | Yes | – |
| Multi window | No | Yes for Y-axis | No (Yes for A-to-B interval measurement only) |
| Auto window | No | Yes for Y-axis | No |

TimeStamp: time stamp mode, HardHist: hardware histogram mode,
ISI: inter-symbol interference analysis mode

Manual Scaling

X-axis and Y-axis scaling can be specified. The items that are specified vary depending on the sampling mode and display format.

- **Histogram display when in hardware histogram mode or time stamp mode (multi window or auto window)**

Selectable range of the X-axis center: –50 ns to 3.200000000 μs (25 ps steps)

X-axis span selection: Select from 1.5, 3, 7.5, 15, 30, 60, 150, 300, 600 ns, 1.5, 3, and 6 μs

Y-axis maximum selection: 10, 20, 40, 100, 200, 400, 1000, 2000, 4000, 10000, 20000, 40000, 100000, 200000, 400000, 1e6, 1e7, 1e8, and 1e9 (Lin)
1e1, 1e2, 1e3, 1e4, 1e5, 1e6, 1e7, 1e8, and 1e9 (Log)

Y-axis scale type selection: Select from Lin (linear) or Log (logarithmic).

- **Histogram display when using single window in time stamp mode**

Selectable range of the X-axis center: –50 ns to 20.000000000 μs (25 ps steps)

X-axis span selection: Select from 1.5, 3, 7.5, 15, 30, 60, 150, 300, 600 ns, 1.5, 3, 7.5, 15, 30, 60, 150, 300, 600 μs, 1.5, 3, 7.5, 15, and 30 ms

Y-axis maximum selection: 10, 20, 40, 100, 200, 400, 1000, 2000, 4000, 10000, 20000, 40000, 100000, 200000, 400000, 1e6, 1e7, 1e8, 1e9 (Lin)
1e1, 1e2, 1e3, 1e4, 1e5, 1e6, 1e7, 1e8, 1e9 (Log)

Y-axis scale type selection: Select from Lin (linear) or Log (logarithmic).

- **Time variation display in time stamp mode**

Selectable range of the X-axis minimum: 0 to 320.0000000 μs (100 ns steps)

X-axis span selection: Select from 6, 12, 30, 60, 120, 300, 600 μs, 1.2, 3, 6, 12, 30, 60, 120, 300, 600 ms, 1.2, 3, 6, 12, 30, 60, 120, 300, 600 s

Selectable range of Y-axis center: –50 ns to 20.000000000 μs (25 ps steps)

Y-axis span selection: Select from 500 ps, 1, 2.5, 5, 10, 20, 50, 100, 200, 500 ns, 1, 2, 5, 10, 20, 50, 100, 200, 500 μs, 1, 2, 5, 10, 20 ms

The following limitations are present in manual scaling.

| | TimeStamp | HardHist | ISI |
|--------------------|----------------|----------------|-----------------------|
| Single window | Yes | Yes | – |
| Multi window (nT) | Yes | Yes | Yes for X-axis center |
| Multi window (SUM) | Yes for Y-axis | Yes for Y-axis | – |
| Multi window (ALL) | Yes for Y-axis | Yes for Y-axis | – |
| Auto window (nT) | Yes for Y-axis | Yes for Y-axis | – |
| Auto window (SUM) | Yes for Y-axis | Yes for Y-axis | – |
| Auto window (ALL) | Yes for Y-axis | Yes for Y-axis | – |

TimeStamp: time stamp mode, HardHist: hardware histogram mode,
ISI: inter-symbol interference analysis mode

For dual measurement function, scaling can be specified on either Meas1 or Meas2 or both (Link).

8.5 Reading Measured Results Using Markers

For a functional description, see 2.6.

Procedure

Displaying Markers

- Press the **MARKER** key to display the Marker menu.
The menu item does not appear in inter-symbol interference mode since markers cannot be used.

| Marker | | | | | | |
|--------|------------------|--|--|--|--|-----------------|
| | Marker OFF ON | | | | | WindowNum 4T |

- Press the **Marker** soft key to select **ON**.

| Marker | | | | | | |
|----------------|------------------|-------------------|-------|---------------|----------------|-----------------|
| ▲ Link Link | Marker OFF ON | X Marker X1 X2 | X1&X2 | Y Marker 0 | Movement ▶▶ | WindowNum 4T |

Selecting the Marker Control Item (only for dual measurement function)

- Press the **Link** soft key to display the Link menu.

| Link | | |
|-------|-------|------|
| Meas1 | Meas2 | Link |

- Press the **Meas1**, **Meas2**, or **Link** soft key to select the item to be scaled.

Selecting the Movement Speed of Markers

- Press the Movement soft key to select ▶ or ▶▶.
To decrease the marker speed, select ▶; to increase the speed, select ▶▶.

| Marker | | | | | | |
|----------------|------------------|-------------------|-------|---------------|----------------|-----------------|
| ▲ Link Link | Marker OFF ON | X Marker X1 X2 | X1&X2 | Y Marker 0 | Movement ▶▶ | WindowNum 4T |

Moving the X1 or X2 Marker Individually

- Press the **X Marker** soft key to select X1 or X2.

| Marker | | | | | | |
|----------------|------------------|-------------------|-------|---------------|----------------|-----------------|
| ▲ Link Link | Marker OFF ON | X Marker X1 X2 | X1&X2 | Y Marker 0 | Movement ▶▶ | WindowNum 4T |

- Turn the rotary knob to select the marker.
The measured value and frequency at the marker position are shown below the main window.

Moving the X1 and X2 Markers Simultaneously

- Press the **X1&X2** soft key.

| Marker | | | | | | |
|----------------|------------------|-------------------|-------|---------------|----------------|-----------------|
| ▲ Link Link | Marker OFF ON | X Marker X1 X2 | X1&X2 | Y Marker 0 | Movement ▶▶ | WindowNum 4T |

- Turn the rotary knob to move the X1 and X2 markers simultaneously.

Explanation

Turning ON/OFF the Marker Display

Markers can be used to read out data. Readout values are displayed in the area below the main window. The marker and readout value displays can be turned ON/OFF also by using Style of the DISPLAY key. For dual measurement function, markers are displayed on both Meas1 and Meas2 windows. Marker operation can be performed on either window or both windows (Link)

Marker Type

- X Marker (X1, X2): On the histogram display, the measured value and frequency at the X-axis coordinate of markers X1 and X2 are displayed. On the time variation display, the time stamp and measured value are displayed.
- Y Marker: Markers used to set the area for performing the statistical calculation. The markers are valid when the statistical calculation area is set to Marker. On the time variation display, two Y markers, Y1 and Y2, are displayed.

Movement Range of the X1 Marker

Left of the X2 marker within the window (including the position of the X2 marker).

Movement Range of the X2 Marker

Right of the X1 marker within the window (including the position of the X1 marker).

Selecting the Movement Speed of Markers

- ▶: Moves 1 dot at a time in the window.
- ▶▶: Moves 5 dots at a time in the window.

Selectable Range of the Y Marker (for Histogram Display)

0 to 1000000000 (1e9)

Movement Range of the Y1 Marker (for time variation display)

Below the Y2 marker within the window (including the position of the Y2 marker).

Movement Range of the Y2 Marker (for time variation display)

Above the Y1 marker within the window (including the position of the Y1 marker).

Note

- When measurement is performed on the auto window, the specified positions are invalidated, and the marker positions are automatically set.
- If there are multiple data points at the marker position in the time variation display, the average value is displayed.
- If there is no data at the marker position in the time variation display, an asterisk (*) is displayed.
- If the Y marker value is greater than the Y-axis maximum (Y High) in histogram display, the Y-marker is not displayed.

8.6 Symbol Search

For a functional description, see 2.6.

Procedure

1. Press the **DISPLAY** key to display the Display menu.

| Display | | | | | |
|---------------------|---------|--|-------------|----------|---------------------|
| ▲ Item Histogram | ▲ Style | | ▲ Calc/Stat | ▲ Window | ● Window Num T/2 |

2. Press the **Item** soft key to display the Item selection menu.

| Item | | | |
|-----------|------|----------|------------|
| Histogram | List | TimeVar. | Statistics |

3. Press the **List** soft key.

| Display | | | | | |
|----------------|--------|--|---------------|-------------|-------------------|
| ▲ Item List | ▲ Jump | | ☑ Number 1 | ▲ Sync Pat. | ▲ Window |
| | | | | | ☑ Block Num 12 |

4. Press the **Window** soft key to display the Window Parameter Setting dialog box.
5. Set the multi window or auto window according to the procedures given in section 8.2, "Setting the Multi Window" or 8.3, "Setting the Auto Window."

| Window Parameter Setting | |
|--|--|
| Mode | <input type="checkbox"/> Single <input type="checkbox"/> Multi <input checked="" type="checkbox"/> Auto |
| Modulation | <input type="checkbox"/> EFM <input type="checkbox"/> EFM+ <input type="checkbox"/> 1-7 |
| T Type | <input type="checkbox"/> Measured T <input type="checkbox"/> Estimated T |
| <input type="button" value="Copy to Single Window"/> | |
| T Value | <input type="text" value="0.038000us"/> <small>Not Adjustable Below</small> |
| Frequency | <input type="text" value="26.316MHz"/> |
| Window | Center <input type="text" value="0.038000us"/> Span <input type="text" value="60ns"/> Left Marker <input type="text" value="0.019000us"/> Right Marker <input type="text" value="0.057000us"/> |

6. Press the ESC key to close the Window Parameter Setting dialog box.
7. Press the **Sync Pat.** soft key to display the Sync Pattern menu.

| Sync Pattern | | | | | |
|--------------------|--------------------|--------------------|--------------------|---|-------------------------------------|
| ● Symbol 1 None | ○ Symbol 2 None | ○ Symbol 3 None | ○ Symbol 4 None | | |
| | | | | <input type="button" value="Previous"/> | <input type="button" value="Next"/> |

8. Press one of the **Symbol 1** to **Symbol 4** soft keys and turn the rotary knob to select the symbol you wish to search.

| Sync Pattern | | | | | |
|------------------|------------------|------------------|------------------|---|-------------------------------------|
| ○ Symbol 1 3T | ○ Symbol 2 5T | ○ Symbol 3 4T | ● Symbol 4 2T | | |
| | | | | <input type="button" value="Previous"/> | <input type="button" value="Next"/> |

Setting the Link (only for dual measurement function)

9. Press the **Link** soft key to select M1, M2, or Link.

| Sync Pattern | | | | | |
|------------------|------------------|------------------|------------------|---|-------------------------------------|
| ○ Symbol 1 4T | ○ Symbol 2 6T | ○ Symbol 3 5T | ● Symbol 4 3T | Link M1 <input checked="" type="checkbox"/> Link | |
| | | | | <input type="button" value="Previous"/> | <input type="button" value="Next"/> |

Executing the Search

10. To search forward, press the **Next** soft key. To search backward, press the **Previous** soft key.

When the Next soft key is pressed, the highlighted section moves from the current line to the data line that is found in the forward direction. When the Previous soft key is pressed, the highlighted section moves from the current line to the data line that is found in the backward direction. If the symbol is not found, an error message "Sync pattern does not exist." appears.

Explanation**Conditions That Allows Symbol Search**

Symbol search is possible only when using the multi window or auto window with the sampling mode set to time stamp or inter-symbol interference analysis.

Setting the Link

When using the dual measurement function (period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, or pulse width A & pulse width B), select whether to search one of the measurement functions or both measurement functions simultaneously.

M1: When you wish to search only the data in the left list.

M2: When you wish to search only the data in the right list.

Link: When you wish to search data in both lists (left and right) simultaneously.

Note

When the measurement function is set to period A & A-to-B time interval or pulse width A & A-to-B time interval, M2 search is not possible. If you attempt to perform the search, an error message "Sync pattern does not exist." appears.

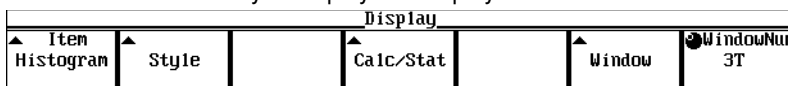
9.1 Setting the Range and Parameters of Statistical Calculation

Procedure

For a functional description, see 2.7.

For details on the settings related to the statistical calculation other than the calculation range and calculation parameters, see section 7.4, “Setting the Statistics Display.”

1. Press the **DISPLAY** key to display the Display menu.



For Histogram Display and Statistics Display

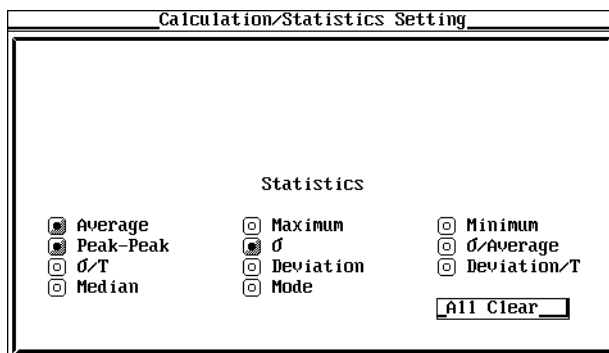
2. Press the **Calc/Stat** soft key to display the Calculation/Statistics dialog box.

- **When Using the Multi Window or Auto Window**

3. Turn the rotary knob to select the parameter you wish to calculate, and then press the **SELECT** key.

If you press the **SELECT** key on a parameter that is already selected, it is deselected (the parameter will not be calculated).

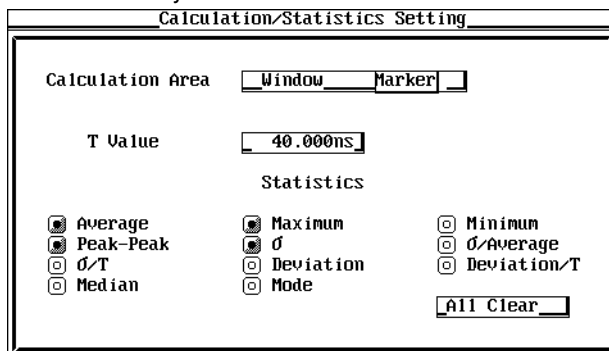
Selecting **All Clear** and pressing the **SELECT** key sets all parameters to not be calculated.



- **When Using the Single Window**

Selecting the Statistical Calculation Area

3. Turn the rotary knob to select the **Calculation Area** parameter and then press the **SELECT** key to select **Window** or **Marker**.



9.1 Setting the Range and Parameters of Statistical Calculation

Setting Constant T

- Turn the rotary knob to select **T Value**, and then press the SELECT key to show the value entry area.

When using the dual measurement function (period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, or pulse width A & pulse width B measurement), settings for Meas1 and Meas2 are available, because the constant is set for each measurement function.

- Set constant T using the numeric keys.

Setting the Statistical Calculation Parameter

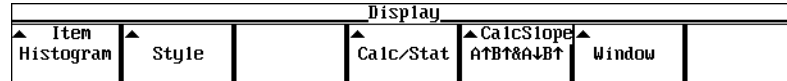
- Turn the rotary knob to select the parameter you wish to calculate, and then press the SELECT key.

If you press the SELECT key on a parameter that is already selected, it is deselected (the parameter will not be calculated).

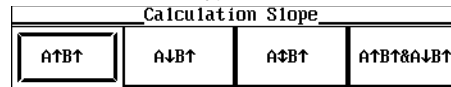
Selecting All Clear and pressing the SELECT key sets all parameters to not be calculated.

Selecting the Calculation Polarity (Only when polarity can be selected. See the explanation.)

- Press the ESC key to close the Calculation/Statistics Setting dialog box.



- Press the **CalcSlope** (or **Calc Pol**) soft key to display the Calculation Slope (or Calculation Polarity) menu.



- Press the soft key corresponding to the polarity you wish to set.

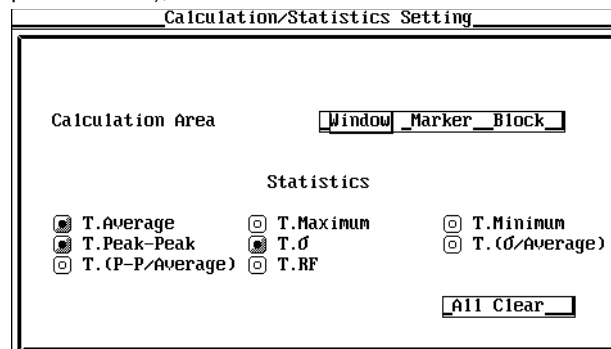
For Time Variation Display

- Press the **Calc/Stat** soft key to display the Calculation/Statistics Setting menu.

• Selecting the Statistical Calculation Area

- Turn the rotary knob to select the **Calculation Area** parameter and then press the SELECT key to select **Window**, **Marker**, or **Block**.

When using the dual measurement function (period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, and pulse width A & pulse width B), Block is not available.

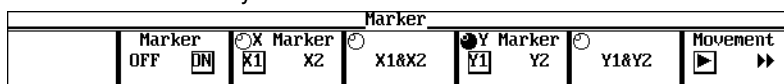


• **Setting the Statistical Calculation Parameter**

4. Turn the rotary knob to select the parameter you wish to calculate, and then press the SELECT key.
If you press the SELECT key on a parameter that is already selected, it is deselected (the parameter will not be calculated).
Selecting All Clear and pressing the SELECT key sets all parameters to not be calculated.

Setting the Calculation Area Using Markers (When Marker is selected for the statistical calculation area)

1. Press the **MARKER** key to display the Marker menu.
2. Press the **Marker** soft key to select **ON**.



3. Press the **X Marker** or **Y Marker** soft key and turn the rotary knob to move the marker to set the calculation area.

Explanation

Setting the Statistical Calculation Area

Select the area for performing statistical calculation from the below. However, Block is selectable only when using the single measurement function (period, A-to-B time interval, or pulse width measurement) on the time variation display.

- Window: Entire displayed window.
- Marker: Area enclosed by X1, X2, Y1, and Y2 markers.
- Block: Specified block when performing block sampling (all the data when block sampling is OFF).

Note

The window for the histogram display is determined by the scale of the measured axis (X-axis). The window for the time variation display is determined by the scale of the time stamp axis (X-axis).

Statistical Computation Parameters

Select from below. The calculated parameters and the calculated area differ between histogram display and time variation display. For details on each calculation parameter, see page 2-22.

Histogram Display

- Average
- Maximum
- Minimum
- Peak-Peak
- σ
- σ/T
- $\sigma/\text{Average}$
- Deviation
- Deviation/T
- Median
- Mode

Time Variation Display

- T.Average
- T.Maximum
- T.Minimum
- T.Peak-Peak
- T. σ
- T.($\sigma/\text{Average}$)
- T.(P-P/ Average)
- T.RF

Note

The measured values of calculation parameters that are not turned ON are displayed using asterisks (*****) on the statistics display.

Constant T(T Value)

Constant T is set only for histogram display.
Selectable range: 1 ns to 250 ns (25 ps steps)

Selecting the Calculation Polarity/Slope

Statistical calculation can be performed on the data of the specified slope or polarity. The positive slope/polarity, the histogram of the slope/polarity, and both slopes/polarities are displayed in red, light blue, and orange, respectively.

You can make the selection in the following cases.

A-to-B time interval measurement with the slope set to A↑B↑

- **A↑B↑**: Calculates the statistics on the data from the rising edge of CH A to the first rising edge of CH B.
- **A↓B↑**: Calculates the statistics on the data from the falling edge of CH A to the first rising edge of CH B.
- **A↑B↓**: Calculates the statistics on the data from the rising or falling edge of CH A to the first rising edge of CH B.
- **A↑B↑&A↓B↑**: Calculates the statistics on the data from the rising edge of CH A to the first rising edge of CH B and from the falling edge of CH A to the first rising edge of CH B.

A-to-B time interval measurement with the slope set to A↑B↓

- **A↑B↓**: Calculates the statistics on the data from the rising edge of CH A to the first falling edge of CH B.
- **A↓B↓**: Calculates the statistics on the data from the falling edge of CH A to the first falling edge of CH B.
- **A↑B↑**: Calculates the statistics on the data from the rising or falling edge of CH A to the first falling edge of CH B.
- **A↑B↓&A↓B↓**: Calculates the statistics on the data from the rising edge of CH A to the first falling edge of CH B and from the falling edge of CH A to the first falling edge of CH B.

Pulse width measurement with the polarity set to $\overleftrightarrow{\square}$

- $\overleftrightarrow{\square}$: Calculates the statistics only on the positive side.
- $\overleftarrow{\square}$: Calculates the statistics only on the negative side.
- $\overleftrightarrow{\square}$: Calculates the statistics on the sum of the positive and negative polarities.
- $\overleftrightarrow{\square} \& \overleftarrow{\square}$: Calculates the statistics on the positive side and negative side.

Pulse width A & A-to-B time interval measurement with the polarity set to $\overleftrightarrow{\square}$ A↑B↑

- $\overleftrightarrow{\square}$ A↑B↑: Calculates the statistics only on the positive side.
- $\overleftarrow{\square}$ A↓B↑: Calculates the statistics only on the negative side.
- $\overleftrightarrow{\square}$ A↑B↑: Calculates the statistics on the sum of the positive and negative polarities.
- $\overleftrightarrow{\square}$ A↑B↓& $\overleftarrow{\square}$ A↓B↓: Calculates the statistics on the positive side and negative side.

Pulse width A & A-to-B time interval measurement with the polarity set to $\overleftrightarrow{\square}$ A↑B↓

- $\overleftrightarrow{\square}$ A↑B↓: Calculates the statistics only on the positive side.
- $\overleftarrow{\square}$ A↓B↓: Calculates the statistics only on the negative side.
- $\overleftrightarrow{\square}$ A↑B↓: Calculates the statistics on the sum of the positive and negative polarities.
- $\overleftrightarrow{\square}$ A↑B↑& $\overleftarrow{\square}$ A↓B↑: Calculates the statistics on the positive side and negative side.

Pulse width A & pulse width B measurement with the polarity set to $\overleftrightarrow{\square}$ A↑B↑

- $\overleftrightarrow{\square}$ $\overleftrightarrow{\square}$: Calculates the statistics only on the positive side.
- $\overleftarrow{\square}$ $\overleftarrow{\square}$: Calculates the statistics only on the negative side.
- $\overleftrightarrow{\square}$ $\overleftrightarrow{\square}$: Calculates the statistics on the sum of the positive and negative polarities.
- $\overleftrightarrow{\square}$ $\overleftrightarrow{\square}$, $\overleftrightarrow{\square}$ $\overleftarrow{\square}$: Calculates the statistics on the positive side and negative side.

9.2 Setting the Inter-symbol Interference Analysis

For a functional description, see 2.7.

Procedure

Selecting the Inter-symbol Interference Analysis Mode

1. Press the **MODE** key to display the Mode selection menu.
2. Press the **ISI** soft key.

| Mode | | |
|-----------|----------|-----|
| TineStamp | HardHist | ISI |

Selecting the Measurement Function

3. Press the **FUNCTION** key to display the Function menu.

| Function | | |
|-------------|---------|----------|
| ▲Function | Channel | Polarity |
| Pulse Width | ChA ChB | [Fwd] |

4. Press the **Function** soft key to display the Function selection menu.

| Function | | | | | |
|----------|--|-------------|--|---------|---------|
| | | Pulse Width | | | |
| | | | | PW → TI | PW → PW |

5. Press the soft key corresponding to the measurement you wish to select. PW→TI indicates pulse width A→A-to-B time interval measurement; PW→PW indicates pulse width A→pulse width B measurement. If you select PW→TI, press the **Slope** soft key to select the polarity/slope (see section 5.7 for details).

Selecting the Histogram Display

6. Press the **DISPLAY** key to display the Display menu.

| Display | | | | | | |
|---------|-------|--------|-----------|-----------|--------|------------|
| ▲Item | ▲Jump | Link | Meas1 Num | Meas2 Num | Window | ▲Sync.Pat. |
| List | | OFF ON | 1 | 1 | | |

7. Press the **Item** soft key to display the Display Item menu.

| Item | |
|-----------|------|
| Histogram | List |

8. Press the **Histogram** soft key.

| Display | | | | | | |
|-----------|--------|--------|------------|--------------|---------|--|
| ▲Item | ▲Style | Sync | ▲Calc/Stat | ▲ISI Setting | ▲Window | |
| Histogram | | OFF ON | | | | |

Selecting the Display Style

9. Press the **Style** soft key to display the Display Style menu.

| Display Style | | | |
|---------------|--|--|---------|
| | | | Overlap |
| | | | OFF ON |

10. Press the **Overlap** soft key to select **ON** or **OFF**.

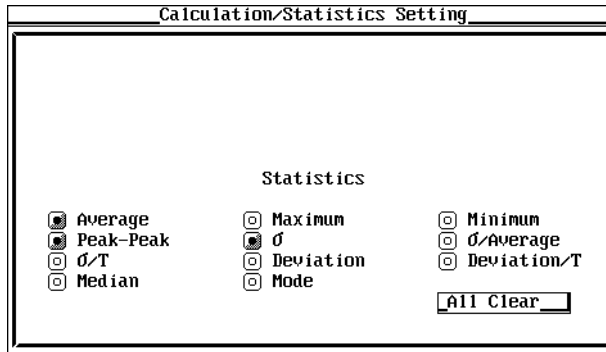
Turning ON/OFF the Sync Function

11. Press the **Sync** soft key to turn ON or OFF the Sync function. If the Sync function is turned ON, symbol search setting for the list display is necessary. For the setup procedure, see section 8.6, "Symbol Search".

| Display | | | | | | |
|-----------|--------|--------|------------|--------------|---------|--|
| ▲Item | ▲Style | Sync | ▲Calc/Stat | ▲ISI Setting | ▲Window | |
| Histogram | | OFF ON | | | | |

Selecting the Statistical Calculation Parameters to Be Listed

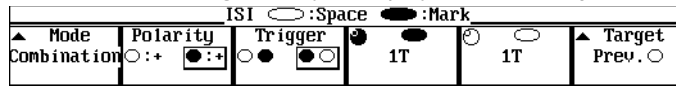
12. Press the **Calc/Stat** soft key to display the Calculation/Statistics Setting dialog box.



13. Turn the rotary knob to select the statistical calculation parameter to be displayed in the list, and then press the SELECT key.

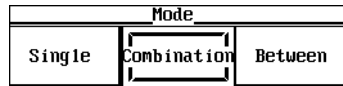
• **Pulse Width or Pulse Width A→Pulse Width B measurement**

14. Press the **ISI Setting** soft key to display the ISI Setting menu.



Selecting the Extraction Mode

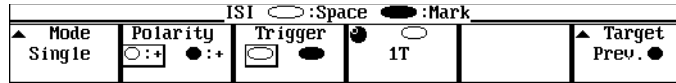
15. Press the **Mode** soft key to display the Mode selection menu.



16. Press one of the soft keys **Single**, **Combination**, or **Between**.

Setting the Polarity of Mark/Space

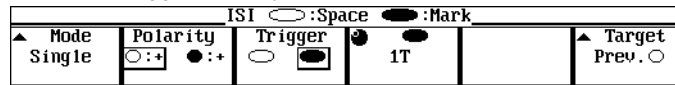
17. Press the **Polarity** soft key to select whether spaces will be positive (○:+) or marks will be positive (●:+).



• **When the extraction mode is set to Single**

Selecting the trigger

18. Press the **Trigger** soft key to select ○ or ●.



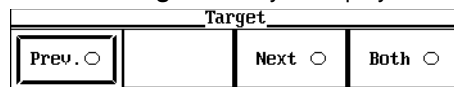
Selecting the Window to Be Used as a Trigger

19. Press the ○ or ● soft key and then turn the rotary knob to select the window to be used as a trigger.



Selecting the Data to Be Extracted

20. Press the **Target** soft key to display the Target selection menu.



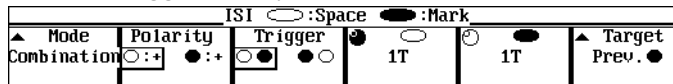
21. Select **Prev....**, **Next....**, or **Both....**



- When the extraction mode is set to **Combination**

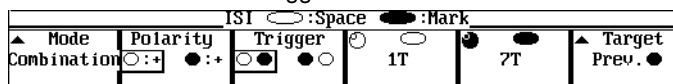
Selecting the trigger

18. Press the **Trigger** soft key to select ○● or ●○.



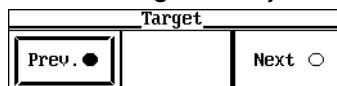
Selecting the Window to Be Used as a Trigger

19. Press the ○ or ● soft key and then turn the rotary knob to select the window to be used as a trigger.

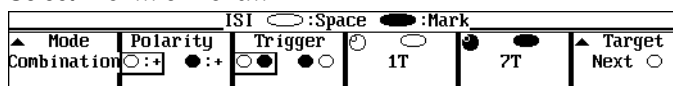


Selecting the Data to Be Extracted

20. Press the **Target** soft key to display the Target selection menu.



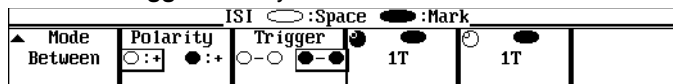
21. Select **Prev...** or **Next...**



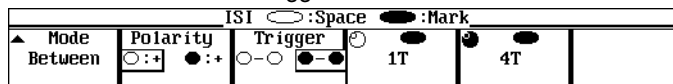
- When the extraction mode is set to **Between**

Selecting the trigger

18. Press the **Trigger** soft key to select ○-○ or ●-●.



19. Press the ○ or ● soft key and then turn the rotary knob to select the window to be used as a trigger.



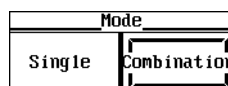
- **Pulse width A→A-to-B time interval measurement**

14. Continuing from step 11 above, press the **ISI Setting** soft key to display the ISI Setting menu.



Selecting the Extraction Mode

15. Press the **Mode** soft key to display the Mode selection menu.

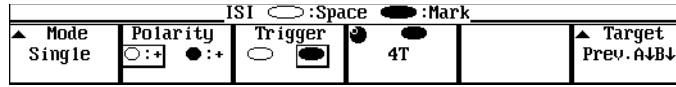


16. Press the **Single** or **Combination** soft key.



Setting the Polarity of Mark/Space

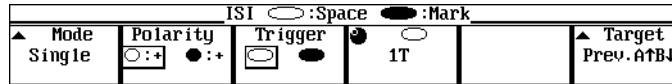
17. Press the **Polarity** soft key to select whether spaces will be positive (○:+) or marks will be positive (●:+).



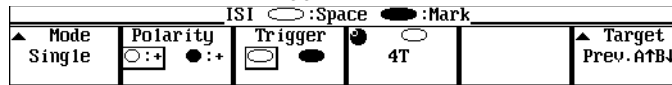
- When the extraction mode is set to Single

Selecting the trigger

18. Press the **Trigger** soft key to select ○ or ●.

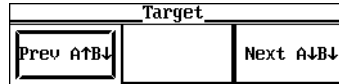


19. Press the ○ or ● soft key and then turn the rotary knob to select the window to be used as a trigger.

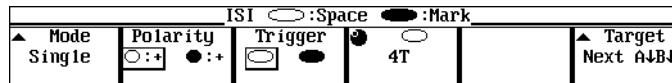


Selecting the data to be extracted (only when Target has selections)

20. Press the **Target** soft key to display the Target selection menu.



21. Select **Prev...** or **Next...**



- When the extraction mode is set to Combination

Selecting the trigger

18. Press the **Trigger** soft key to select ○● or ●○.



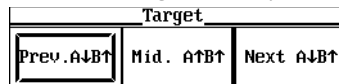
Selecting the Window to Be Used as a Trigger

19. Press the ○ or ● soft key and then turn the rotary knob to select the window to be used as a trigger.

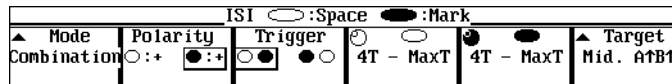


Selecting the data to be extracted (only when Target has selections)

20. Press the **Target** soft key to display the Target selection menu.



21. Select **Prev...**, **Mid...**, or **Next...**



Explanation**Selecting the Display Style**

By turning OFF Overlap, the histogram of the extracted data and that of all spaces or marks can be displayed separately.

Turning ON/OFF the Sync Function

Select ON to start analyzing from the searched pattern using the symbol search function or OFF to analyze the all the measured values. For the setup procedure of the symbol search function, see section 8.6, "Symbol Search".

Statistical Parameters That Are Listed

The statistics of all marks (spaces) and extracted data and the number of samples are listed for each window. The statistical calculation parameters are set using the Calculation/Statistics Setting dialog box (see page 9-6). However, only the top two parameters are displayed.

Selecting the Extraction Mode

Select from the following.



- **Single:** Activates the trigger on a Space or Mark and analyzes the data around the trigger.
- **Combination:** Uses the sequence of a space followed by a mark or a mark followed by a space as a trigger and analyzes the data around it.
- **Between:** Uses a mark or a space existing between two spaces or two marks as a trigger and analyzes the data between them.

Selecting the Polarity of Mark/Space







Select whether spaces will be positive (+) or marks will be positive (+).

Selecting the Trigger/Selecting the Data to Be Extracted

You can select which mark or space will be used as a trigger. The types of trigger that can be selected vary depending on the extraction mode.

The data around or between triggers can be extracted, but the data that can be extracted vary depending on the extraction mode as shown below. In the table below,  represents a space and  represents a mark. On the TA720, you can select which window will be marks and which will be spaces.

- **Pulse width measurement or pulse width A→pulse width B measurement.**

| Mode | Trigger | Target | Explanation |
|-------------|---|-----------------------|---|
| Single |  | Prev. ●/Next ●/Both ● | Extracts the data immediately before or after the trigger or both |
| |  | Prev. ○/Next ○/Both ○ | |
| Combination |  | Prev. ●/Next ○ | Extracts the data immediately before or after the trigger |
| |  | Prev. ○/Next ● | |
| Between |  | – | Extracts the data between two spaces |
| |  | – | Extracts the data between two marks |

9.2 Setting the Inter-symbol Interference Analysis

Pulse width A & A-to-B time interval measurement.

Slope = $A \uparrow \rightarrow A \uparrow B \uparrow$

| Mode | Polarity | Trigger | Target | Explanation |
|-------------|----------|---------|---|---|
| Single | | | Prev. $A \uparrow B \uparrow$ | Extracts the front edge or back edge of the trigger |
| | | | Next $A \uparrow B \uparrow$ | |
| | | | Next $A \uparrow B \uparrow$ | |
| | | | Prev. $A \uparrow B \uparrow$ | |
| Combination | | | Prev. $A \uparrow B \uparrow$ /Next $A \uparrow B \uparrow$ | Extracts the front edge, middle edge, or back edge of the trigger |
| | | | Mid. $A \uparrow B \uparrow$ | |
| | | | Mid. $A \uparrow B \uparrow$ | |
| | | | Prev. $A \uparrow B \uparrow$ /Next $A \uparrow B \uparrow$ | |

Slope = $A \downarrow \rightarrow A \downarrow B \uparrow$

| Mode | Polarity | Trigger | Target | Explanation |
|-------------|----------|---------|---|---|
| Single | | | Next $A \downarrow B \uparrow$ | Extracts the front edge or back edge of the trigger |
| | | | Prev. $A \downarrow B \uparrow$ | |
| | | | Prev. $A \downarrow B \uparrow$ | |
| | | | Next $A \downarrow B \uparrow$ | |
| Combination | | | Mid. $A \downarrow B \uparrow$ | Extracts the front edge, middle edge, or back edge of the trigger |
| | | | Prev. $A \downarrow B \uparrow$ /Next $A \downarrow B \uparrow$ | |
| | | | Prev. $A \downarrow B \uparrow$ /Next $A \downarrow B \uparrow$ | |
| | | | Mid. $A \downarrow B \uparrow$ | |

Slope = $A \uparrow \rightarrow A \uparrow B \downarrow$

| Mode | Polarity | Trigger | Target | Explanation |
|-------------|----------|---------|---|---|
| Single | | | Prev. $A \uparrow B \downarrow$ /Next $A \downarrow B \uparrow$ | Extracts the front edge or back edge of the trigger |
| | | | Prev. $A \downarrow B \uparrow$ /Next $A \uparrow B \downarrow$ | |
| | | | Prev. $A \downarrow B \uparrow$ /Next $A \uparrow B \downarrow$ | |
| | | | Prev. $A \uparrow B \downarrow$ /Next $A \downarrow B \uparrow$ | |
| Combination | | | Prev. $A \uparrow B \downarrow$ /Mid. $A \downarrow B \uparrow$ /Next $A \uparrow B \downarrow$ | Extracts the front edge, middle edge, or back edge |
| | | | Prev. $A \downarrow B \uparrow$ /Mid. $A \uparrow B \downarrow$ /Next $A \downarrow B \uparrow$ | |
| | | | Prev. $A \downarrow B \uparrow$ /Mid. $A \uparrow B \downarrow$ /Next $A \downarrow B \uparrow$ | |
| | | | Prev. $A \uparrow B \downarrow$ /Mid. $A \downarrow B \uparrow$ /Next $A \uparrow B \downarrow$ | |

Slope = $A \downarrow \rightarrow A \downarrow B \downarrow$

| Mode | Polarity | Trigger | Target | Explanation |
|-------------|----------|---------|---|---|
| Single | | | Prev. $A \uparrow B \downarrow$ | Extracts the front edge or back edge of the trigger |
| | | | Next $A \uparrow B \downarrow$ | |
| | | | Next $A \uparrow B \downarrow$ | |
| | | | Prev. $A \uparrow B \downarrow$ | |
| Combination | | | Prev. $A \uparrow B \downarrow$ /Next $A \uparrow B \downarrow$ | Extracts the front edge, middle edge, or back edge of the trigger |
| | | | Mid. $A \uparrow B \downarrow$ | |
| | | | Mid. $A \uparrow B \downarrow$ | |
| | | | Prev. $A \uparrow B \downarrow$ /Next $A \uparrow B \downarrow$ | |

Slope = $A \downarrow \rightarrow A \downarrow B \uparrow$

| Mode | Polarity | Trigger | Target | Explanation |
|-------------|----------|---------|---|---|
| Single | | | Next $A \downarrow B \downarrow$ | Extracts the front edge or back edge of the trigger |
| | | | Prev. $A \downarrow B \downarrow$ | |
| | | | Prev. $A \downarrow B \downarrow$ | |
| | | | Next $A \downarrow B \downarrow$ | |
| Combination | | | Mid. $A \downarrow B \downarrow$ | Extracts the front edge, middle edge, or back edge of the trigger |
| | | | Prev. $A \downarrow B \downarrow$ /Next $A \downarrow B \downarrow$ | |
| | | | Prev. $A \downarrow B \downarrow$ /Next $A \downarrow B \downarrow$ | |
| | | | Mid. $A \downarrow B \downarrow$ | |

Slope = $A \rightarrow B$

| Mode | Polarity | Trigger | Target | Explanation |
|-------------|----------|---------|--------------------------------|---|
| Single | | | Prev. A↑B↓/Next A↓B↓ | Extracts the front edge or back edge of the trigger |
| | | | Prev. A↓B↓/Next A↑B↓ | |
| | | | Prev. A↓B↓/Next A↑B↓ | |
| | | | Prev. A↑B↓/Next A↓B↓ | |
| Combination | | | Prev. A↑B↓/Mid. A↓B↓/Next A↑B↓ | Extracts the front edge, middle edge, or back edge of the trigger |
| | | | Prev. A↓B↓/Mid. A↑B↓/Next A↓B↓ | |
| | | | Prev. A↓B↓/Mid. A↑B↓/Next A↓B↓ | |
| | | | Prev. A↑B↓/Mid. A↓B↓/Next A↑B↓ | |

Use of Color in Histogram Displays

- Histogram of the extracted data
 - Data for $A \rightarrow B$ or $A \leftarrow B$: Red
 - Data for $A \rightarrow B$ or $A \leftarrow B$: Blue
- Histogram of all spaces or marks
 - Data for $A \rightarrow B$ or $A \leftarrow B$: Pink
 - Data for $A \rightarrow B$ or $A \leftarrow B$: Light blue

Note

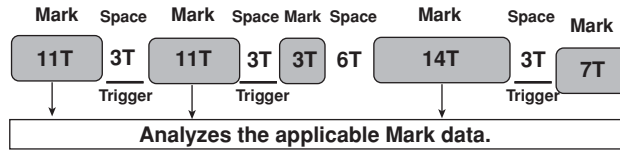
In “pulse width A→pulse width B” or “pulse width A→A-to-B time interval” measurement, if continuous measurement fails 256 times, analysis is not possible. In this case, a warning message is displayed, and the data becomes invalid.

9.3 Examples of Inter-symbol Interference Analysis

Pulse Width Measurement

When the trigger is set to Single (Space)

Analyzes the Mark data immediately before the Space (3T)



Setting

Mode: ISI

Function: PulseWidth

> Slope:

Display > Window: setting suitable for the measured signal

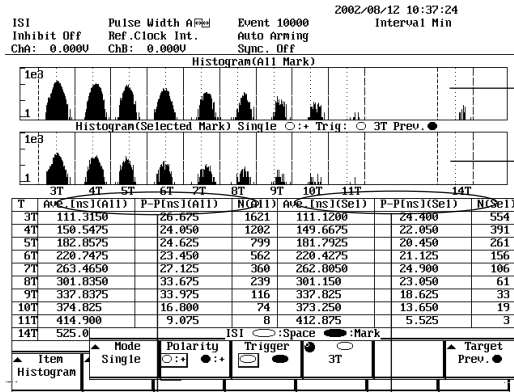
> ISI Setting > Mode: Single

> Polarity: +

> Trigger:

> 3T

> Target: Prev



Histogram display of all Mark data

Histogram display of extracted Mark data

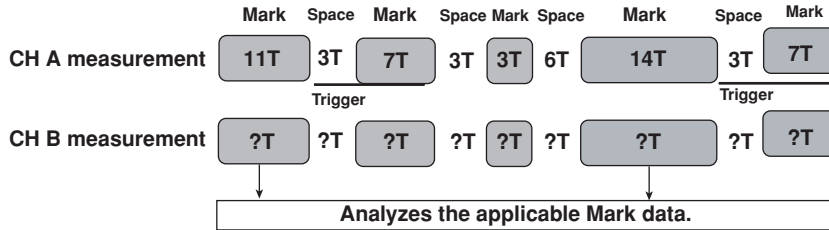
Set "analyze the Mark data immediately before the Space(3T)"

Statistical values of all Mark data Statistical values of the extracted Mark data

Pulse Width A→Pulse Width B Measurement

When the trigger is set to **Combination (Space/Mark)**

Analyzes the Mark data of CH B immediately before the Space (3T)→Mark (7T) combination pattern of CH A



Setting

Mode: ISI

Function: PWA → PWB

> Slope: A B

Display > Window: Window setting suitable for the measured signal

> ISI Setting > Mode: Combination

> Polarity: +

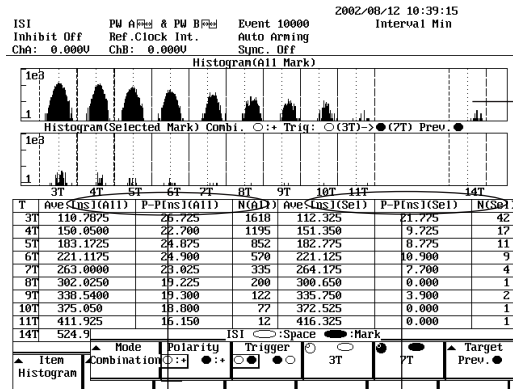
> Trigger:

> 3T

> 7T

> Target: Prev.

> Sync: OFF



Histogram display (Displays all Mark data and extracted Mark data overlapped)

Set "analyze the Mark data immediately before the Space(3T) and Mark(7T) sequence"

Statistical values of all Mark data

Statistical values of the extracted Mark data

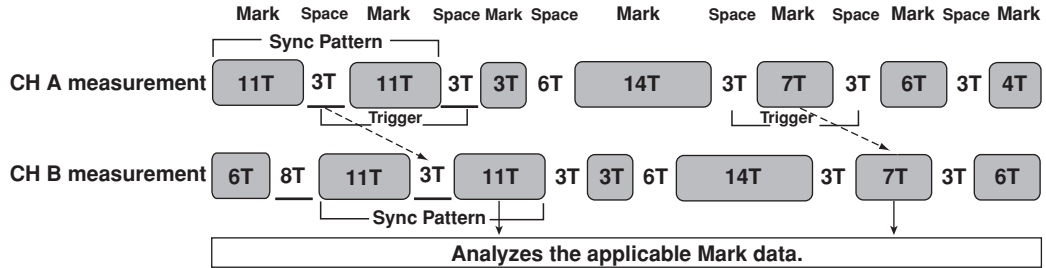
Note

In the pulse width A→pulse width B measurement function in inter-symbol interference analysis mode, the constant T value of the window setting for MEAS1 (measured results of CH A) applies also to Meas2.

9.3 Examples of Inter-symbol Interference Analysis

When the trigger is set to Between (Space-Space) and the data of ChA and ChB are offset

Analyzes the Mark data of ChB that is in between Space (3T)-Space (3T) of ChA by specifying the analysis start point using the symbol (Sync Pattern) search.



Setting

Mode: ISI

Function: PWA→PWB

> Slope: A B

Display > Window: Window setting suitable for the measured signal

> Item: List (to set the Sync Pattern)

> Sync Pattern: Set the start pattern of ISI analysis

> Item: Histogram (to display the ISI analysis results)

> Sync: ON

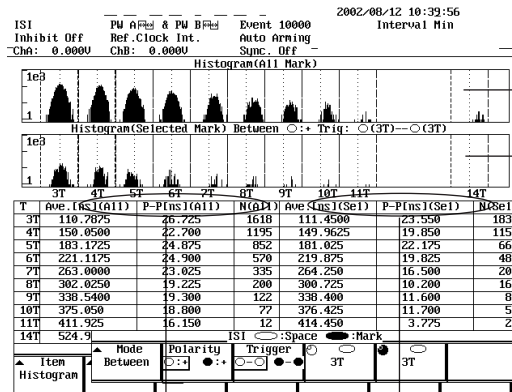
> ISI Setting > Mode: Between

> Polarity: + -

> Trigger: - -

> : 3T

> : 3T



Histogram display of all Mark data

Histogram display of extracted Mark data

Set "analyze the Mark data between two Spaces(3T)"

Statistical values of all Mark data

Statistical values of the extracted Mark data

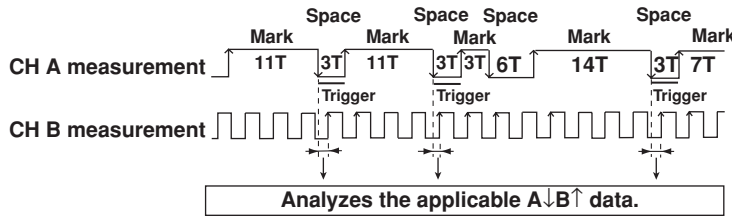
Note

In the pulse width A→pulse width B measurement function in inter-symbol interference analysis mode, the constant T value of the window setting for MEAS1 (measured results of CH A) applies also to Meas2.

Pulse Width A→A-to-B Time Interval Measurement

When the trigger is set to Single (Space)

Analyzes the A↓B↑ data from the front edge of Space (3T)



Setting

Mode: ISI

Function: PWA→TI

> Slope: PW \leftarrow \rightarrow A↑B↓ or PW \leftarrow \rightarrow A↓B↑

Display > Window: Window setting suitable for the measured signal

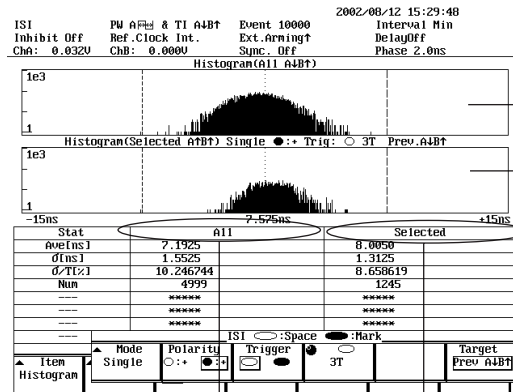
> ISI Setting > Mode: Single

> Polarity: ●:+

> Trigger: ○

> ○: 3T

> Target: Prev A↓B↑ (indicates the front edge of 3T Space)



Histogram display of all Mark data

Histogram display of extracted Mark data

Set "analyze the A↓B↑ data, the front edge of Space(3T)-Mark(7T) sequence"

Statistical values of the extracted Mark data
Statistical values of all Mark data

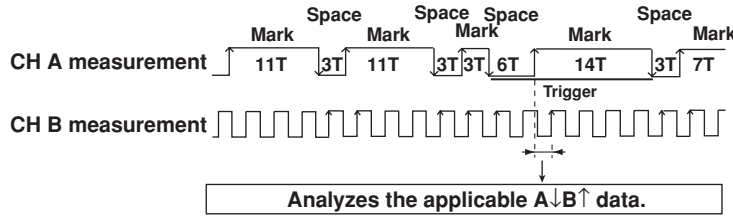
Note

Due to the limitation of the continuous measurement conditions, signals can be acquired at higher speeds when PWA→A↑B↑ or PWA→A↓B↑ is selected as compared to when PWA→A↑B↑ is selected (see "Continuous Measurement Conditions" on page2-7).

9.3 Examples of Inter-symbol Interference Analysis

A↑ to B↑ Measurement Excluding the Minimum Mark or Space

Analyzes the A↑ to B↑ data excluding the minimum Mark or Space (3T)



Setting

Mode: ISI

Function: PWA→TI

> Slope: A \downarrow B \uparrow or A \uparrow B \downarrow

Display > Window: Window setting suitable for the measured signal

> ISI Setting > Mode: Combination

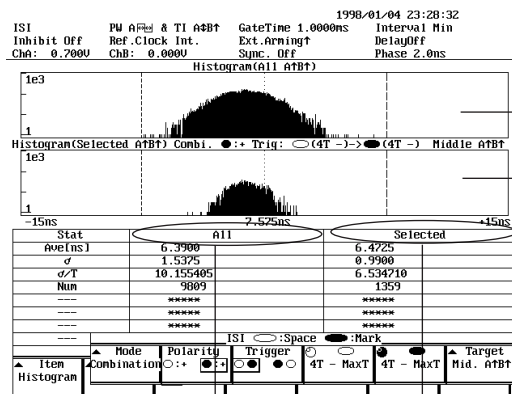
> Polarity: +

> Trigger:

> : 4T-MaxT (specify all Spaces greater than 4T)

> : 4T-MaxT (specify all Marks greater than 4T)

> Target: Mid. A↑B↑



Histogram display of all Mark data

Histogram display of extracted Mark data

Set "analyze A↑B↑ data of Space (4T-Max) and Mark (4T-Max)"

Statistical values of all Mark data
Statistical values of the extracted Mark data

Note

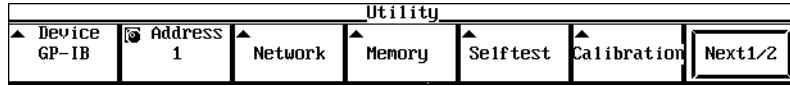
Due to the limitation of the continuous measurement conditions, signals can be acquired at higher speeds when A \downarrow B \uparrow or A \uparrow B \downarrow is selected as compared to when Slope: A \downarrow B \uparrow is selected (see "Continuous Measurement Conditions" on page2-7).

10.1 Storing the Setup Parameters to the Internal Memory

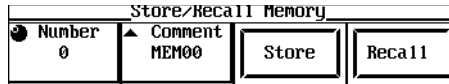
For a functional description, see 2.8.

Procedure

1. Press the **UTILITY** key to display the Utility menu.

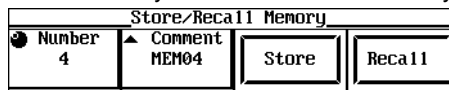


2. Press the **Memory** soft key to display the Memory menu.



Selecting the Memory Number

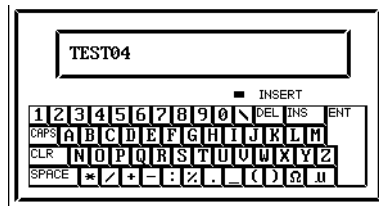
3. Turn the rotary knob to select the memory number.



Setting a Comment

4. Press the **Comment** soft key to display the keyboard, and enter the characters for the comment.

By default, MEM + a 2-digit memory number is specified as in MEM05.
For the procedure to set the character string, see section 4.4.



Executing the Store Operation

5. Press the **Store** soft key to execute the store operation.

Explanation

Settings That Are Stored

Measurement conditions and display parameters that are set using the following keys are stored.

MODE key, FUNCTION key, SAMPLE key, INPUT key, DISPLAY key, SCALE key, and MARKER key

Selecting the Memory Number

Select from the following 32 memory numbers. If the setup parameters are already stored at the selected number, the previous data is overwritten.

0 to 31

Setting a Comment

The maximum number of characters for a comment is 10. A comment can be entered for each memory number.

Note

- The stored setup parameters are not cleared even if you initialize the settings on the TA720.
- For details on parameters that are not stored, see page 13-3.

10.2 Recalling Setup Parameters

For a functional description, see 2.8.

Procedure

1. Press the **UTILITY** key to display the Utility menu.

| Utility | | | | | |
|-------------------|----------------|-----------|----------|------------|---------------|
| ▲ Device GP-IB | Ⓞ Address 1 | ▲ Network | ▲ Memory | ▲ Selftest | ▲ Calibration |
| | | | | | Next1/2 |

2. Press the **Memory** soft key to display the Memory menu.

| Store/Recall Memory | | | |
|---------------------|--------------------|-------|--------|
| ● Number 0 | ▲ Comment MEM00 | Store | Recall |

Selecting the Memory Number

3. Turn the rotary knob to select the memory number containing the setup parameters you wish to recall.

| Store/Recall Memory | | | |
|---------------------|--------------------|-------|--------|
| ● Number 4 | ▲ Comment MEM04 | Store | Recall |

Executing the Recall Operation

4. Press the **Recall** soft key to recall the setup parameters.

Explanation

Recalled Parameters

When setup parameters are recalled, the TA720 setup is changed to the stored setup parameters.

Selecting the Memory Number

Select from the following 32 memory numbers.

0 to 31

11.1 Using the Floppy Disk

Setup parameters, measured results, statistical calculation results, and screen images can be saved to the floppy disk. On models with the optional "Ethernet interface + PC card drive (/C10 option)," data saved to the floppy disk can be accessed from a PC via the Ethernet network.

Floppy Disks That Can Be Used

The following types of 3.5" floppy disks can be used. Formatting is also possible on the TA720.

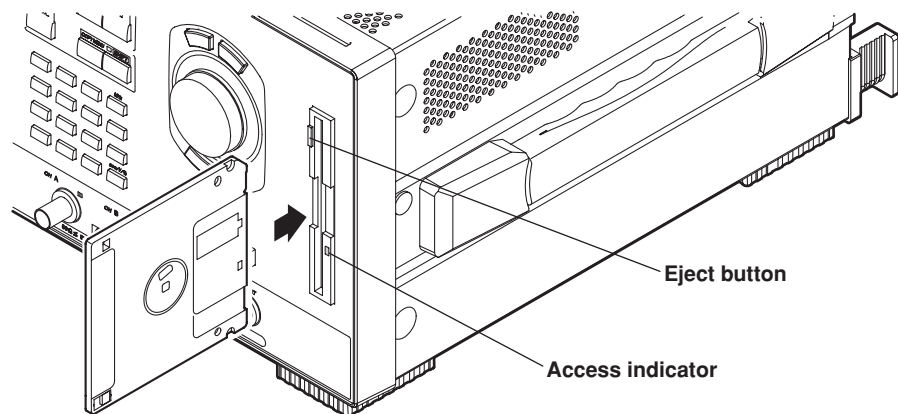
- 2HD: Formatted to 1.44 MB using MS-DOS.
- 2DD: Formatted to 720 KB using MS-DOS.

Inserting the Floppy Disk into the Floppy Disk Drive

With the label facing left, insert the disk into the floppy disk drive. Insert the disk until the eject button pops out.

Removing the Disk from the Floppy Disk Drive

Check that the access indicator is not illuminated and press the eject button.



CAUTION

Removing the floppy disk while the access indicator is blinking can damage the magnetic head of the floppy disk drive or destroy the data on the floppy disk.

General Handling Precautions of Floppy Disks

For the general handling precautions of the floppy disk, read the instruction manual that came with the floppy disk.

11.2 Using the PC Card (Optional)

On models with the optional "Ethernet interface + PC card drive (/C10 option)," setup parameters, measured results, statistical calculation results, and screen image can be saved to the PC card. Data saved to the PC card can be accessed from a PC via the Ethernet network.

PC Cards That Can Be Used

The TA720 supports flash ATA cards (PC card TYPE II) and compact flash (using the PC card TYPE II adapter). However, the use of micro drives by attaching a PC card adapter or a PC card type HDD is not possible.

For details, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

Note

Note that the PC card that is used with the TA720 may not be recognized by some PC types.

Installing the PC Card

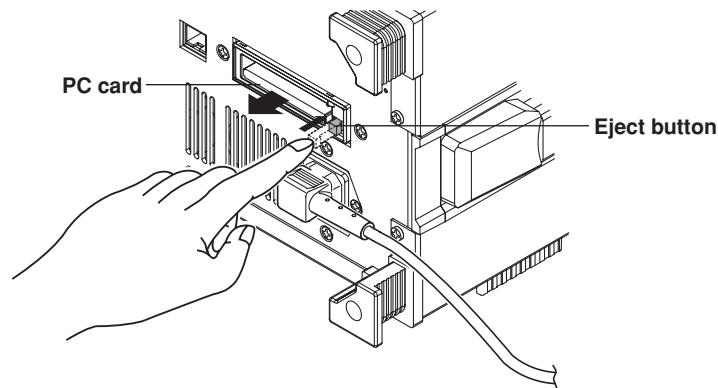
The PC card slot is located on the rear panel of the TA720.

With the label of the PC card facing up, insert the card securely into the PC card drive. An electric sound is heard when the PC card is recognized.

Ejecting the PC card

Check that the PC card is not being accessed, and eject the PC card.

To eject the PC card, press the eject button once to force the button to pop out. Then, press the eject button again. When the PC card is ejected, an electric sound (different from the sound of installation) is heard.



CAUTION

- The TA720 may malfunction if the PC card is frequently inserted and ejected (inserted and ejected within a 5-s time period).
 - Removing the PC card while it is being accessed may destroy the data on the PC card.
-

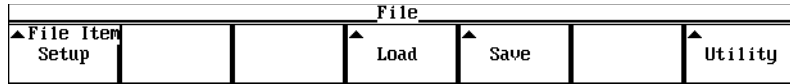
General Handling Precautions of PC Cards

For the general handling precautions of the PC card, read the instruction manual that came with the PC card.

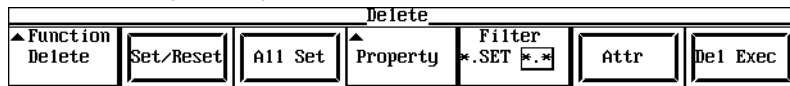
11.3 Formatting the Storage Medium

Procedure

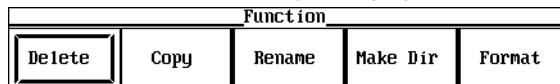
1. Press the **SHIFT+UTILITY(FILE)** key to display the File menu.



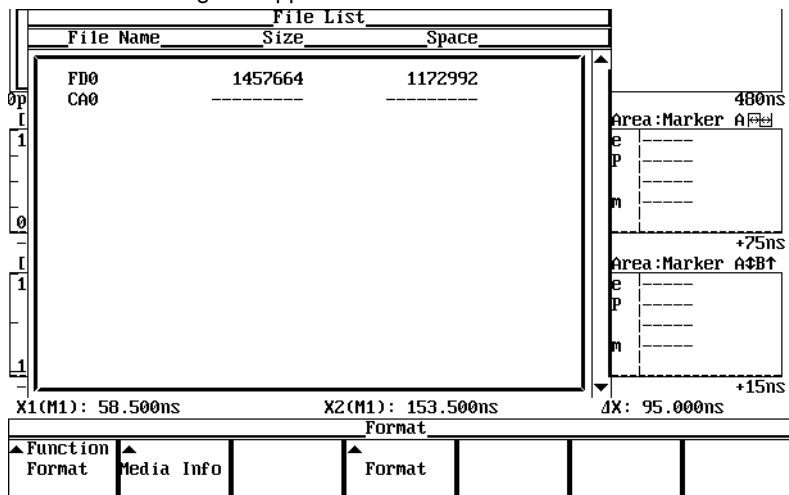
2. Press the **Utility** soft key.



3. Press the **Function** soft key to display the Function menu.

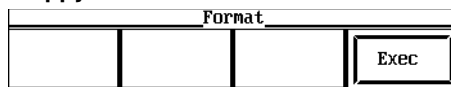


4. Press the **Format** soft key.
The File List dialog box appears.

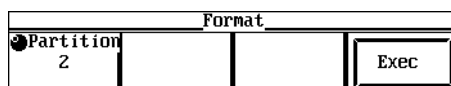


5. On the File List dialog box, turn the rotary knob to select the storage medium to be formatted.
Select FD0 for a floppy disk, CA0 for a PC card. Press the **Media Info** soft key to list information such as the total size of the storage medium.
6. Press the **SELECT** key to display the Format menu.

Floppy disk




PC card





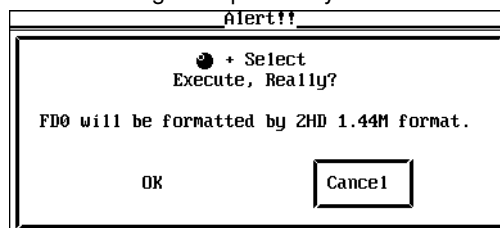
CAUTION

- Do not remove the storage medium or turn OFF the power while formatting the disk (while  is blinking). Such acts can damage the storage medium or destroy the data on the storage medium.
- If the TA720 cannot recognize a formatted storage medium, format the storage medium again on the TA720. Note that all the data on the storage medium are cleared when the storage medium is formatted. Make sure to back up important data beforehand.

Floppy disk

7. Press the **Exec** soft key.

An Alert dialog box opens for you to confirm the format operation.



To cancel the format operation, select Cancel and press the SELECT key.

8. Turn the rotary knob to select **OK**, and then press the SELECT key. Formatting is executed.

PC card

7. Turn the rotary knob to set the number of partitions.
8. Press the **Exec** soft key.

An Alert dialog box opens for you to confirm the format operation.



To cancel the format operation, select Cancel and press the SELECT key.

9. Turn the rotary knob to select **OK**, and then press the SELECT key. Formatting is executed.

Explanation

Formatting a Floppy Disk

When using a new floppy disk, you must format it. Only a logical format is performed. It takes approximately 30 s to format a storage medium.

Formatting a PC Card and Setting Partitions

The PC card is formatted to IBM-compatible format. It takes a few seconds to format a PC card.

The number of partitions that can be specified is 1 to 4.

Listing the Storage Medium Information

A list of information about the selected storage medium is displayed.

- **Media Name:** Name of the storage medium.
- **Media Size:** Total size.
- **Used Space:** Size of the used area.
- **Vacant Space:** Size of the free area.
- **Partition Size:** Number of partitions

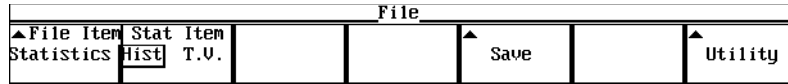
Note

- If you format a storage medium that has data stored on it, all the data are cleared when the storage medium is formatted. Use caution when formatting a storage medium.
 - Floppy disks that are formatted to formats other than those listed above cannot be used.
 - If an error message is displayed after the format operation, the floppy disk may be damaged.
 - Disks that are formatted using MS-DOS on a PC can also be used.
 - Format operation cannot be executed when the FTP server function or FTP client function is in use.
-

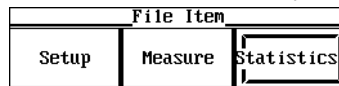
11.4 Saving and Recalling Setup Parameters

Procedure

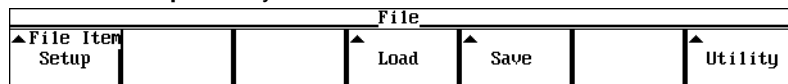
1. Press the **SHIFT+UTILITY(FILE)** key to display the File menu.



2. Press the **File Item** soft key to display the File Item selection menu.

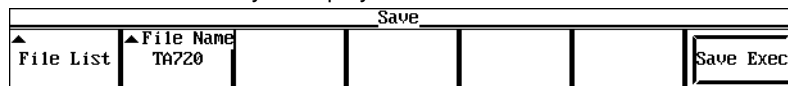


3. Press the **Setup** soft key.



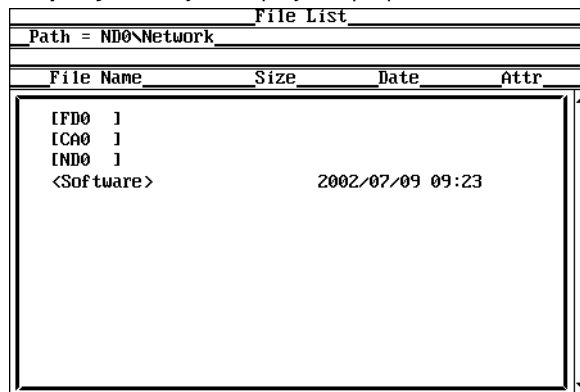
Saving Setup Parameters

4. Press the **Save** soft key to display the Save menu.



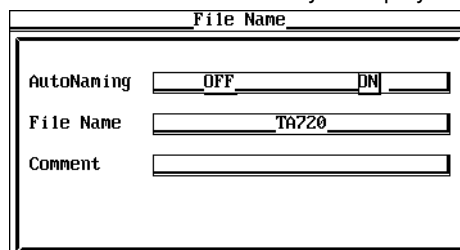
Setting the Save Destination Directory

5. Press the **File List** soft key to display the File List.
6. Turn the rotary knob to select the save destination storage medium (indicated with []) and press the SELECT key.
7. Likewise, select the directory (indicated with < >).
[Path=.....] shows the selected storage medium/directory.
To show only the files with the .SET extension on the file name list, press the **Filter** soft key to select [*.*]. To show all the files, select [*.*]. Press the **Property** soft key to display the properties of the file that is selected in the list.

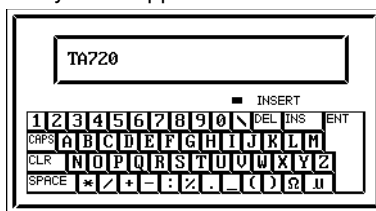


Setting the File Name

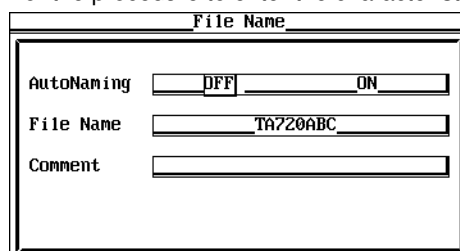
8. Press the **File Name** soft key to display the File Name dialog box.



9. Turn the rotary knob to select **AutoNaming**. Press the SELECT key to select **ON** or **OFF**.
10. Turn the rotary knob to select **File Name** and press the SELECT key. A keyboard appears on the screen.



11. Use the rotary knob and SELECT key to enter the file name. For the procedure to enter the character string, see section 4.4.



12. As necessary, select **Comment** and enter the comment string in a similar fashion.

Executing the Save Operation

13. Press the **Save Exec** key. When the Save Exec key is pressed, the setup parameters are saved to the directory shown in [Path=.....]. While the data is being saved, the soft key name changes to Abort. Press the **Abort** soft key before the save operation completes to abort the save operation.

Recalling the Setup Parameters

4. After step 3, press the **Load** soft key to display the File List.
5. Turn the rotary knob to select the storage medium (indicated with []) to be recalled and press the SELECT key.
6. Likewise, select the directory (indicated with < >). [Path=.....] shows the selected storage medium/directory. To show only the files with the .SET extension on the file name list, press the **Filter** soft key to select [*]. To show all the files, select [*.*]. Press the **Property** soft key to display the properties of the file that is selected in the list.

| File Name | Size | Date | Attr |
|--------------|-------|------------------|------|
| [FD0] | | | |
| [CA0] | | | |
| [ND0] | | | |
| TA720003.SET | 16709 | 2002/07/23 09:15 | R/W |
| TA720002.SET | 16709 | 2002/07/23 09:14 | R/W |
| TA720001.SET | 16709 | 2002/07/23 09:13 | R/W |
| TA720000.SET | 16709 | 2002/07/22 17:47 | R/W |


7. Turn the rotary knob to select the setup parameter file. Setup parameter files are files with the .set extension.

Executing the Recall Operation

8. Press the **Load Exec** soft key.
While the data is being recalled, the soft key name changes to **Abort**. Press the **Abort** soft key before the recall operation completes to abort the recall operation.



CAUTION

Do not remove the storage medium or turn OFF the power while setup parameters are being saved or recalled (while  is blinking). Such acts can damage the storage medium or destroy the data on the storage medium.

Explanation

Setup Parameters That Are Saved

Measurement conditions and display parameters that are set using the following keys are saved.

MODE key, FUNCTION key, SAMPLE key, INPUT key, DISPLAY key, SCALE key, and MARKER key

Save Destination Storage Medium

Setup parameters can be saved to the following three types of storage medium.

FDO: Floppy disk

CA0: PC card (when the number of partitions is 1)

CA0-1: PC card (when the number of partitions is 2 or more)

ND0: Network drive

Data Size

The data size of a single set of setup parameters is approximately 20 KB.

Entering a File Name or a Comment

- Enter a file name using up to 8 characters. Enter a comment using up to 25 characters.
- A file name must be assigned. Comments are optional.
- You cannot save to a file name that already exists in the same directory (overwriting not allowed).
- The file name is common with other saved data, except the extension. When saving setup parameters, .set extension is automatically attached.

Auto Naming Function

When Auto Naming is turned ON, files with a three digit number from 000 to 499 are automatically created when saving the data. You can specify a common name (up to five characters, TA720 by default) that is placed before the number.

Properties

Lists the file size, saved date/time, attribute, and comment of the selected file.

Note

- Saving and Recalling of setup parameters are not possible while measurement is in progress (while the START/STOP indicator is illuminated).
 - When renaming a file (see section 11.9), you can specify the name using up to 25 characters. However, if the number of characters excluding the extension exceeds 8, only the first 7 characters and the extension are displayed as in TA72000>.SET. Characters exceeding 7 characters are indicated as >.
 - If you change the extension of the file such as on a PC, the file can no longer be loaded.
 - Up to 35 characters can be displayed in [Path]. If this number is exceeded, an error occurs (error number: 601).
-

11.5 Saving and Recalling Measured Results

Procedure

1. Press the **SHIFT+UTILITY(FILE)** key to display the File menu.

| File | | | | | |
|------------|-----------|------|--|--------|-----------|
| ▲File Item | Stat Item | | | ▲ Save | ▲ Utility |
| Statistics | Hist | T.U. | | | |

2. Press the **File Item** soft key to display the File Item selection menu.

| File Item | | |
|-----------|---------|------------|
| Setup | Measure | Statistics |

3. Press the **Measure** soft key.

| File | | | | | |
|------------|-----------|-----|--|--------|-----------|
| ▲File Item | Data Type | | | ▲ Save | ▲ Utility |
| Measure | Ascii | Bin | | | |

Saving the Measured Results

Selecting the Data Type

4. Press the **Data Type** soft key to select Ascii or Bin.

| File | | | | | |
|------------|-----------|-----|--------|--------|-----------|
| ▲File Item | Data Type | | ▲ Load | ▲ Save | ▲ Utility |
| Measure | Ascii | Bin | | | |

5. Press the **Save** soft key to display the Save menu.

| Save | | | | | |
|-------------|-------------|--|--|--|-----------|
| ▲ File List | ▲ File Name | | | | Save Exec |
| | TA720 | | | | |

Setting the Save Destination Directory

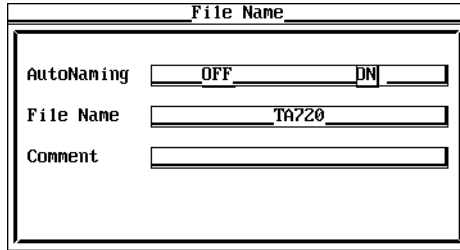
6. Press the **File List** soft key to display File List.
7. Turn the rotary knob to select the save destination storage medium (indicated with []) and press the SELECT key.
8. Likewise, select the directory (indicated with < >).
[Path=.....] shows the selected storage medium/directory.

To show only the files with the .WVF extension on the file name list, press the **Filter** soft key to select [* .WVF]. To show all the files, select [*.*]. Press the **Property** soft key to display the properties of the file that is selected in the list.

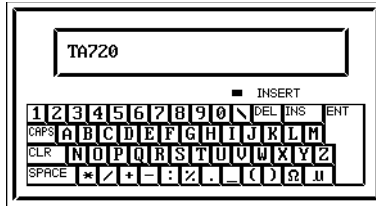
| File List | | | | |
|-------------------|--------|------------------|------|--|
| Path = FD0 | | | | |
| Space 865280 byte | | | | |
| File Name | Size | Date | Attr | |
| [FD0] | | | | |
| [Ca0] | | | | |
| [ND0] | | | | |
| <TheV01u>> | | 2002/06/25 10:03 | | |
| <RESOURCE.FRK> | | 2002/06/25 09:58 | | |
| PWT11E4B.WVF | 184413 | 2002/06/20 14:18 | R/W | |
| PWT11E4.WVF | 184413 | 2002/06/20 14:17 | R/W | |
| T11E4.WVF | 104413 | 2002/06/20 14:16 | R/W | |
| PW1E4.WVF | 104413 | 2002/06/20 14:14 | R/W | |

Setting the File Name

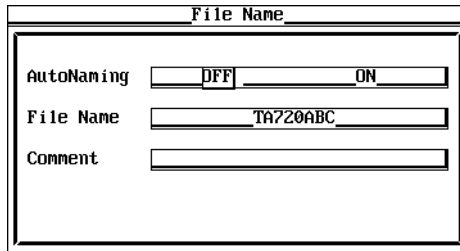
9. Press the **File Name** soft key to display the File Name dialog box.



10. Turn the rotary knob to select **AutoNaming**. Press the SELECT key to select **ON** or **OFF**.
11. Turn the rotary knob to select **File Name** and press the SELECT key. A keyboard appears on the screen.



12. Use the rotary knob and SELECT key to enter the file name. For the procedure to enter the character string, see section 4.4.



13. As necessary, select **Comment** and enter the comment string in a similar fashion.

Executing the Save Operation

14. Press the **Save Exec** soft key. When the Save Exec soft key is pressed, the measured results are saved to the directory shown in [Path=.....]. While the data is being saved, the soft key name changes to Abort. Press the **Abort** soft key before the save operation completes to abort the save operation.

Recalling the Measured Results

4. After step 3, press the **Data Type** soft key to select Bin.

| File Item | | Data Type | | File | | |
|-----------|-------|-----------|--|------|------|---------|
| Measure | Ascii | Bin | | Load | Save | Utility |

5. Press the **Load** soft key to display the File List.
6. Turn the rotary knob to select the storage medium (indicated with []) to be recalled and press the SELECT key.
7. Likewise, select the directory (indicated with < >). [Path=.....] shows the selected storage medium/directory. To show only the files with the .WVF extension on the file name list, press the **Filter** soft key to select [*.WVF]. To show all the files, select [*.*]. Press the **Property** soft key to display the properties of the file that is selected in the list.

| File Name | Size | Date | Attr |
|--------------|--------|------------------|------|
| [FD0] | | | |
| [CA0] | | | |
| [ND0] | | | |
| PWT11E4B.WVF | 184413 | 2002/06/20 14:18 | R/W |
| PWT11E4 .WVF | 184413 | 2002/06/20 14:17 | R/W |
| T11E4 .WVF | 104413 | 2002/06/20 14:16 | R/W |
| PW1E4 .WVF | 104413 | 2002/06/20 14:14 | R/W |


- Turn the rotary knob to select the measured results file. Measured results files are files with the .wvf extension.

Executing the Recall Operation

- Press the **Load Exec** soft key. While the data is being recalled, the soft key name changes to Abort. Press the **Abort** soft key before the recall operation completes to abort the recall operation.



CAUTION

Do not remove the storage medium or turn OFF the power while measured results are being saved or recalled (while  is blinking). Such acts can damage the storage medium or destroy the data on the storage medium.

Explanation

Save Destination Storage Medium

Measured results can be saved to the following three types of storage medium.

- FD0: Floppy disk
- CA0: PC card (when the number of partitions is 1)
- CA0-1: PC card (when the number of partitions is 2 or more)
- ND0: Network drive

Data Type and Extension

The measured results can be saved to either of the data types below.

- Bin
 - The measured results are saved as binary data. The saved data can be recalled on the TA720. A measurement data file with .wvf extension and a header file with .hdr extension are saved. The header file is a file containing information that is necessary when analyzing the saved measured data.
- Ascii
 - ASCII data in CSV format (.csv extension). The saved data cannot be recalled on the TA720.
 - When in hardware histogram mode
 - The median values and frequencies of the data in the window on the histogram display are saved as text data. After the data is saved, the data cannot be recalled on the TA720.
 - When in time stamp mode or inter-symbol interference analysis mode
 - All the data (time stamps and measured values) of the measurement block are saved as text data. After the data is saved, the data cannot be loaded on the TA720.

11.5 Saving and Recalling Measured Results

Example when data is saved in Ascii format

| | A | B | C | D | E |
|----|------------|--------------------|-----------|------------|--------------|
| 1 | Header Siz | 14 | | | |
| 2 | Model Nam | TA720 | | | |
| 3 | Comment | | | | |
| 4 | Mode | TimeStamp | | | |
| 5 | Function | Period&PeriodChA B | | | |
| 6 | | [Meas1] | | [Meas2] | |
| 7 | BlockMode | " OFF" | | OFF | |
| 8 | BlockSize | ? | | ? | |
| 9 | BlockNumt | ? | | ? | |
| 10 | DataSize | 10000 | | 10000 | |
| 11 | Date | 2002/7/23 | | | |
| 12 | Time | 15:44:52 | | | |
| 13 | TraceName | TimeStamp1 | MeasureDs | TimeStamp2 | MeasureData2 |
| 14 | Unit | s | s | s | s |
| 15 | | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 |
| 16 | | 2.00E-06 | 1.00E-06 | 2.00E-06 | 1.00E-06 |
| 17 | | 3.00E-06 | 1.00E-06 | 3.00E-06 | 1.00E-06 |
| 18 | | 4.00E-06 | 1.00E-06 | 4.00E-06 | 1.00E-06 |

Data Size

The size varies depending on the data type as follows.

- Bin format

Data measured in hardware histogram mode

The data size varies depending on the measurement function and other items as shown in the table below.

| Measurement 1 | Measurement 2 | Measurement 3 | Measurement 4 |
|--|------------------------|------------------------|------------------------|
| Approx. 152 to 536 KB | Approx. 408 to 1561 KB | Approx. 280 to 1048 KB | Approx. 793 to 3098 KB |
| Measurement 1: Period, A-to-B time interval (polarity is $A \uparrow B \uparrow$, $A \downarrow B \uparrow$, $A \uparrow B \downarrow$, or $A \downarrow B \downarrow$), pulse width (polarity is $\left[\begin{array}{ c } \hline \leftarrow \rightarrow \\ \hline \end{array} \right]$ or $\left[\begin{array}{ c } \hline \leftarrow \rightarrow \\ \hline \end{array} \right]$) | | | |
| Measurement 2: A-to-B time interval (polarity is $A \uparrow B \uparrow$ or $A \downarrow B \downarrow$), period, or pulse width (polarity is $\left[\begin{array}{ c } \hline \leftarrow \rightarrow \\ \hline \end{array} \right]$) | | | |
| Measurement 3: Period A & period B or period A & A-to-B time interval | | | |
| Measurement 4: Pulse width A & A-to-B time interval, pulse width A & pulse width B | | | |

Data measured in time stamp mode or inter-symbol interference analysis mode

- Single measurement function: Approx. $8 \times$ the number of samples + approx. 24 KB
- Dual measurement function: Approx. $16 \times$ the number of samples + approx. 24 KB
- Ascii format

The data size varies greatly depending on the sampling mode, measurement function, sample size, histogram display, and other settings. The maximum size is approximately 33 M for time stamp mode, single measurement function, and sample size of 1024000.

Entering a File Name or a Comment

- Enter a file name using up to 8 characters. Enter a comment using up to 25 characters.
- A file name must be assigned. Comments are optional.
- You cannot save to a file name that already exists in the same directory (overwriting not allowed).
- The file name is common with other saved data, except the extension.

Auto Naming Function

When Auto Naming is turned ON, files with a three digit number from 000 to 499 are automatically created when saving the data. A common name (up to five characters, TA720 by default) is attached before the number.

Properties

Lists the file size, saved date/time, attribute, and comment of the selected file.

| Property |
|------------------------------|
| File Name : TA720.WVF |
| File Size : 184737 byte |
| Date/Time : 2002/07/23 14:56 |
| Attribute : R/W |

Note

- Saving and Recalling of measured results are not possible while measurement is in progress (while the START/STOP indicator is illuminated).
- When measured results are recalled, the TA720 settings are changed to the those that correspond with the recalled measured results.
- When renaming a file (see section 11.9), you can specify the name using up to 25 characters. However, if the number of characters excluding the extension exceeds 8, only the first 7 characters and the extension are displayed as in TA72000>.SET. Characters exceeding 7 characters are indicated as >.
- If you change the extension of the file such as on a PC, the measured results can no longer be recalled.

11.6 Saving the Statistical Calculation Results

Procedure

1. Press the **SHIFT+UTILITY(FILE)** key to display the File menu.

| | | | | | |
|------------|-----------|------|--|--------|-----------|
| File | | | | | |
| ▲File Item | Stat Item | | | ▲ Save | ▲ Utility |
| Statistics | Hist | T.V. | | | |

2. Press the **File Item** soft key to display the File Item selection menu.

| | | |
|-----------|---------|------------|
| File Item | | |
| Setup | Measure | Statistics |

3. Press the **Statistics** soft key.

| | | | | | |
|------------|-----------|------|--|--------|-----------|
| File | | | | | |
| ▲File Item | Stat Item | | | ▲ Save | ▲ Utility |
| Statistics | Hist | T.V. | | | |

Saving the Statistical Calculation Results

Selecting the Data Type (only in time stamp mode)

4. Press the **Stat Item** soft key to select Hist or T.V.

| | | | | | |
|------------|-----------|------|--|--------|-----------|
| File | | | | | |
| ▲File Item | Stat Item | | | ▲ Save | ▲ Utility |
| Statistics | Hist | T.V. | | | |

5. Press the **Save** soft key to display the Save menu.

| | | | | | |
|------|------------|--|-----------|-----------|-----------|
| Save | | | | | |
| | ▲File Name | | ▲Property | Filter | Save Exec |
| | TA720ABC | | | *.CSV *.* | |

Setting the Save Destination Directory

6. Press the **File List** soft key to display File List.
7. Turn the rotary knob to select the save destination storage medium (indicated with []) and press the SELECT key.
8. Likewise, select the directory (indicated with < >).

[Path=.....] shows the selected storage medium/directory.

To show only the files with the .CSV extension on the file name list, press the **Filter** soft key to select [*.CSV]. To show all the files, select [*.*]. Press the **Property** soft key to display the properties of the file that is selected in the list.

| | | | |
|--------------|--------|------------------|------|
| File List | | | |
| Path = ND0 | | | |
| File Name | Size | Date | Attr |
| [FD0] | | | |
| [CA0] | | | |
| [ND0] | | | |
| <Network > | | 2002/07/23 08:44 | |
| <Software> | | 2002/07/22 19:24 | |
| TA720000.CSV | 630375 | 2002/07/23 15:15 | |

Setting the File Name

9. Press the **File Name** soft key to display the File Name dialog box.

10. Turn the rotary knob to select **AutoNaming**. Press the SELECT key to select **ON** or **OFF**.
11. Turn the rotary knob to select **File Name** and press the SELECT key. A keyboard appears on the screen.


12. Use the rotary knob and SELECT key to enter the file name. For the procedure to enter the character string, see section 4.4.

13. As necessary, select **Comment** and enter the comment string in a similar fashion.

Executing the Save Operation

14. Press the **Save Exec** key.
- When the Save Exec key is pressed, the statistical calculation results are saved to the directory shown in [Path=.....]. While the data is being saved, the soft key name changes to Abort. Press the **Abort** soft key before the save operation completes to abort the save operation.

**CAUTION**

Do not remove the storage medium or turn OFF the power while statistical calculation results are being saved or recalled (while  is blinking). Such acts can damage the storage medium or destroy the data on the storage medium.

Explanation

Save Destination Storage Medium

Statistics calculation results can be saved to the following three types of storage medium.

- FDO: Floppy disk
- CA0: PC card (when the number of partitions is 1)
- CA0-1: PC card (when the number of partitions is 2 or more)
- ND0: Network drive

Data Type and Extension

The data is saved to a file in CSV format with .csv extension. The data cannot be recalled on the TA720.

| | A | B | C | D | E |
|----|-------------|------------|----------|----------|--------|
| 1 | HeaderSize | 12 | | | |
| 2 | Model | TA720 | | | |
| 3 | Comment | | | | |
| 4 | Mode | TimeStamp | | | |
| 5 | Function | PulseWidth | ChA | | |
| 6 | BlockMode | ON | | | |
| 7 | BlockSize | 1000 | | | |
| 8 | Calculation | "Block" | | | |
| 9 | Date | 2002/7/23 | | | |
| 10 | Time | 17:06:13 | | | |
| 11 | TraceName | T.AVE | T.MAX | T.Min | T.P-P |
| 12 | Unit | s | s | s | s |
| 13 | | | | | |
| 14 | BLOCK1 | 5.00E-07 | 5.00E-07 | 5.00E-07 | 5.00E- |
| 15 | BLOCK2 | 5.00E-07 | 5.00E-07 | 5.00E-07 | 4.75E- |
| 16 | BLOCK3 | 5.00E-07 | 5.00E-07 | 5.00E-07 | 3.50E- |
| 17 | BLOCK4 | 5.00E-07 | 5.00E-07 | 5.00E-07 | 5.75E- |

Data Size

- When in time stamp mode
 - Statistical values of the histogram: Approx. 11 KB maximum
 - Statistical values of time variation (no block sampling): Approx. 1 KB maximum
 - Statistical values of time variation (block sampling): Approx. 120 KB maximum
- When in hardware histogram mode: Approx. 11 KB maximum
- When in inter-symbol interference analysis mode: Approx. 6 KB maximum

Entering a File Name or a Comment

- Enter a file name using up to 8 characters. Enter a comment using up to 25 characters.
- A file name must be assigned. Comments are optional.
- You cannot save to a file name that already exists in the same directory (overwriting not allowed).
- The file name is common with other saved data, except the extension.

Auto Naming Function

When Auto Naming is turned ON, files with a three digit number from 000 to 499 are automatically created when saving the data. You can specify a common name (up to five characters, TA720 by default) that is placed before the number.

Properties

Lists the file size, saved date/time, attribute, and comment of the file.

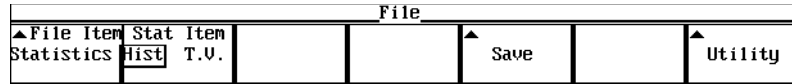
Note

- Saving of statistical calculation results is not possible while measurement is in progress (while the START/STOP indicator is illuminated).
- When renaming a file (see section 11.9), you can specify the name using up to 25 characters. However, if the number of characters excluding the extension exceeds 8, only the first 7 characters and the extension are displayed as in TA72000>.SET. The file name can be confirmed using properties.

11.7 Deleting Files and Directories

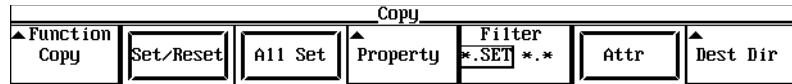
Procedure

1. Press the **SHIFT+UTILITY(FILE)** key to display the File menu.

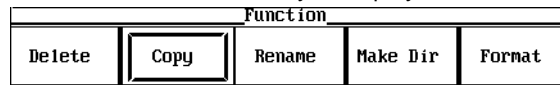


2. Press the **Utility** soft key.

When Function is set to Copy, the menu appears as follows.



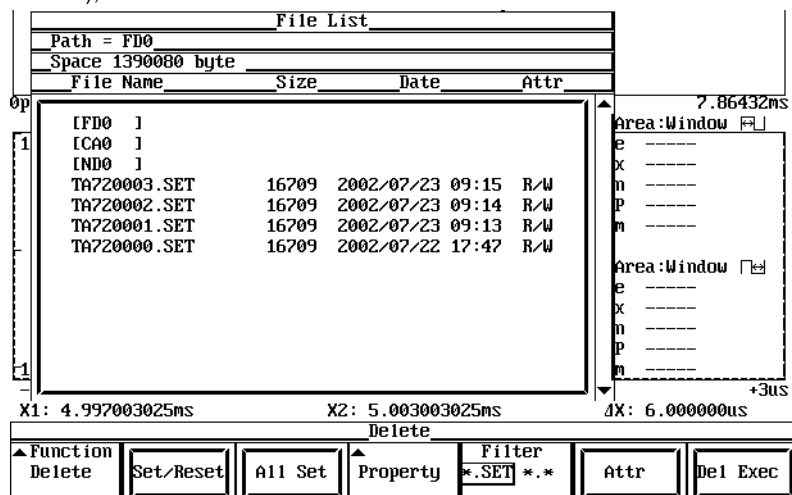
3. Press the **Function** soft key to display the Function menu.



4. Press the **Delete** soft key to display the File List and Delete menus.

To limit the type of files to be displayed, press the **Filter** soft key to select *.XXX. The XXX section of *.XXX varies depending on the File Item setting in the File menu as follows.

Setup: *.SET, Measure: *.WVF (when Data Type is Bin) or *.CSV (when Data Type is Ascii), or Statistics: *.CSV



Setting the Directory Containing the File or Directory to Be Deleted

5. Turn the rotary knob to select the storage medium (indicated with []) and press the SELECT key.
6. Likewise, select the directory (indicated with < >). [Path=.....] shows the selected storage medium/directory.

Selecting the Files to Be Deleted

- Turn the rotary knob to select the file or directory you wish to delete and press the **SET/RESET** soft key.

An asterisk appears to the left of the file name. Press the **Set/Reset** soft key again to remove the asterisk.

To delete all the files that are displayed, press the **All Set** soft key. Press the **All Reset** soft key again to reset the selection. The asterisk marks disappear.

| File List | | | | |
|--------------------|-------|------------------|------|--|
| Path = FD0 | | | | |
| Space 1390000 byte | | | | |
| File Name | Size | Date | Attr | |
| IFD0] | | | | |
| ICA0] | | | | |
| IND0] | | | | |
| * TA720003.SET | 16709 | 2002/07/23 09:15 | R/W | |
| TA720002.SET | 16709 | 2002/07/23 09:14 | R/W | |
| * TA720001.SET | 16709 | 2002/07/23 09:13 | R/W | |
| TA720000.SET | 16709 | 2002/07/22 17:47 | R/W | |

If you wish to prevent a file from being deleted, select the file, press the **Attr** soft key, and set the file attribute to R (read only). Pressing the Attr soft key again resets the attribute to R/W (read and write).

If you wish to view the file attribute before deleting the file, press the **Property** soft key.

| Property |
|------------------------------|
| File Name : TA720002.SET |
| File Size : 16709 byte |
| Date/Time : 2002/07/23 09:14 |
| Attribute : R |

Executing the Delete Operation

- Press the **Del Exec** soft key.


All files with asterisks are deleted.

Note

When Filter is set to *.WVF and you delete measured result data files (files with .wvf extension), the corresponding header files (files with .hdr extension) are also deleted.



CAUTION

Do not remove the storage medium or turn OFF the power while files are being deleted (while  is blinking). Such acts can damage the storage medium or destroy the data on the storage medium.

Explanation

Specifying the Files to Be Listed (Filter)

The type of files to be listed can be specified.

- *.XXX: Displays only the files with the type of data (Setup, Measure, or Statistics) specified by File Item in the File menu.
- *.*: Displays all the files in the storage medium.

Changing the File Attribute (Attr)

The following attribute on a file saved to a floppy disk or PC card can be changed one file at a time. You cannot change a directory attribute. If you set the attribute to R, the file cannot be deleted. Set the attribute to R for files you do not wish to delete.

- R/W: Read and write (default setting).
- R: Read only.

Selecting the Files or Directories to Be Deleted

Press the Set/Reset or All Set soft key to place asterisks to the left of the file names and directory names shown in the file list. Files with asterisks will be deleted.

Properties

Lists the file size, saved date/time, attribute, and comment of the selected file.

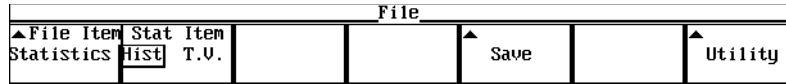
Note

-
- Files cannot be deleted while measurement is in progress (while the START/STOP indicator is illuminated).
 - Data that is deleted cannot be recovered. Make sure you erase the correct files.
 - You can not delete directories if there are files in them.
 - If an error occurs while deleting multiple files, the files after the error occurrence are not deleted.
-

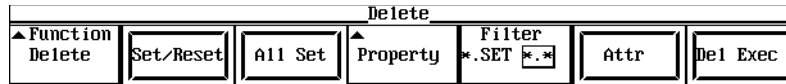
11.8 Copying Files

Procedure

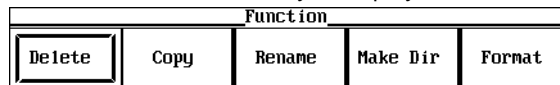
1. Press the **SHIFT+UTILITY(FILE)** key to display the File menu.



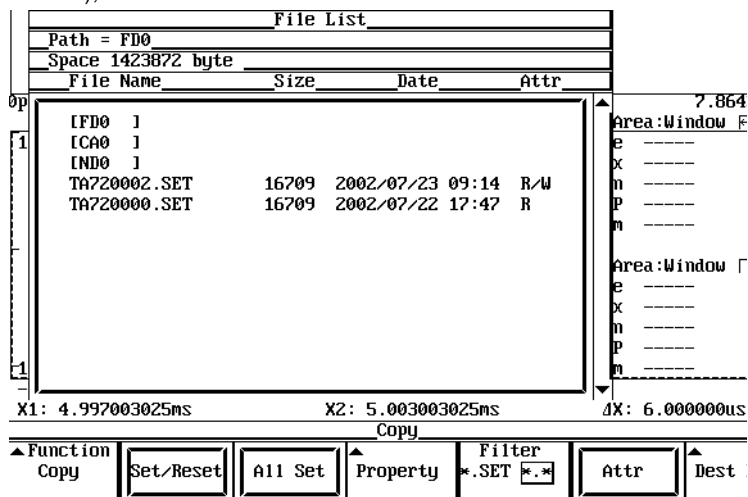
2. Press the **Utility** soft key.
When Function is set to Delete, the menu appears as follows.



3. Press the **Function** soft key to display the Function menu.



4. Press the **Copy** soft key to display the File List and Copy menus.
To limit the type of files to be displayed, press the **Filter** soft key to select *.XXX.
The XXX section of *.XXX varies depending on the File Item setting in the File menu as follows.
Setup: *.SET, Measure: *.WVF (when Data Type is Bin) or *.CSV (when Data Type is Ascii), or Statistics: *.CSV



Setting the Directory Containing the Copy Source Files

5. Turn the rotary knob to select the storage medium (indicated with []) and press the SELECT key.
6. Likewise, select the directory (indicated with < >) containing the copy source files. [Path=.....] shows the selected storage medium/directory.

Selecting the Copy Source Files

7. Turn the rotary knob to select the copy source file and press the **SET/RESET** soft key.

An asterisk appears to the left of the file name. Press the **Set/Reset** soft key again to remove the asterisk.

To copy all the files that are displayed, press the **All Set** soft key. Press the **All Reset** soft key again to reset the selection. The asterisk marks disappear.

| File List | | | | |
|--------------------|-------|------------------|------|--|
| Path = FD0 | | | | |
| Space 1390080 byte | | | | |
| File Name | Size | Date | Attr | |
| [FD0] | | | | |
| [CA0] | | | | |
| [ND0] | | | | |
| * TA720003.SET | 16709 | 2002/07/23 09:15 | R/W | |
| TA720002.SET | 16709 | 2002/07/23 09:14 | R/W | |
| * TA720001.SET | 16709 | 2002/07/23 09:13 | R/W | |
| TA720000.SET | 16709 | 2002/07/22 17:47 | R/W | |


Setting the Copy Destination Directory

8. Press the **Dest Dir** soft key.
A File List used to set the copy destination directory appears.
9. Turn the rotary knob to select the storage medium (indicated with []) and press the **SELECT** key.
10. Likewise, select the copy destination directory (indicated with < >).
[Path=.....] shows the selected storage medium/directory.

Executing the Copy Operation

11. Press the **Copy Exec** soft key.
All files with asterisks are copied.

**CAUTION**

Do not remove the storage medium or turn OFF the power while files are being copied (while  is blinking). Such acts can damage the storage medium or destroy the data on the storage medium.

Explanation**Specifying the Files to Be Listed (Filter)**

The type of files to be listed can be specified.

- *.XXX: Displays only the files with the type of data (Setup, Measure, or Statistics) specified by File Item in the File menu.
- *.*: Displays all the files in the storage medium.

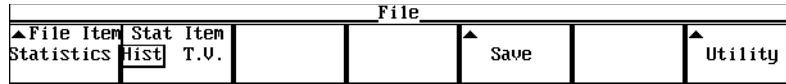
Note

- Files cannot be copied while measurement is in progress (while the START/STOP indicator is illuminated).
- If an error occurs while copying multiple files, the files after the error occurrence are not copied.
- You cannot copy files if files with the same file name exist at the copy destination.
- You cannot copy the same files to another directory after copying the files. Select the files to be copied again and copy them.
- When Filter is set to *.WVF and you copy measured result data files (files with .wvf extension), the corresponding header files (files with .hdr extension) are also copied.

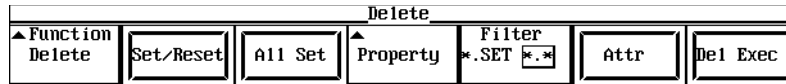
11.9 Renaming Files and Directories

Procedure

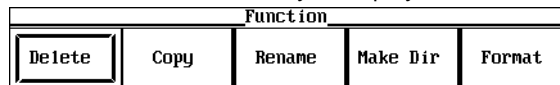
1. Press the **SHIFT+UTILITY(FILE)** key to display the File menu.



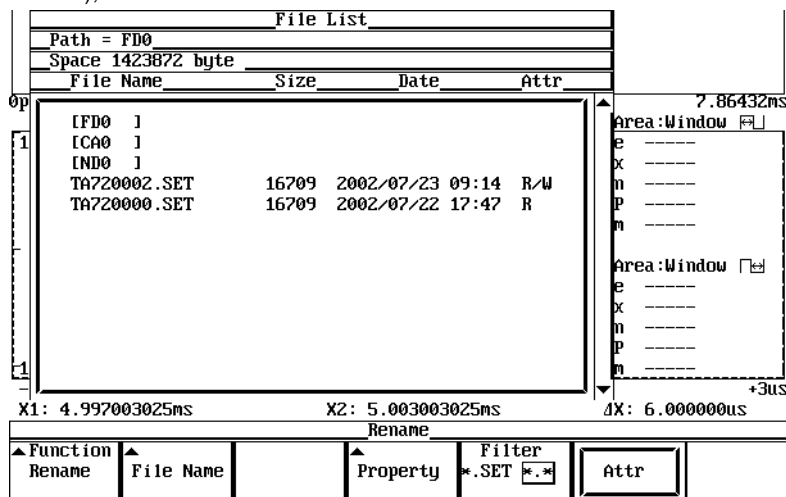
2. Press the **Utility** soft key.
When Function is set to Delete, the menu appears as follows.



3. Press the **Function** soft key to display the Function menu.



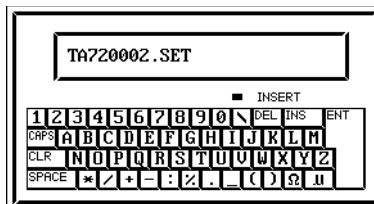
4. Press the **Rename** soft key to display the File List and Rename menus.
To limit the type of files to be displayed, press the **Filter** soft key to select *.XXX.
The XXX section of *.XXX varies depending on the File Item setting in the File menu as follows.
Setup: *.SET, Measure: *.WVF (when Data Type is Bin) or *.CSV (when Data Type is Ascii), or Statistics: *.CSV



Setting the Directory Containing the File or Directory to Be Renamed

5. Turn the rotary knob to select the storage medium (indicated with []) and press the SELECT key.
6. Likewise, select the directory (indicated with < >).
[Path=.....] shows the selected storage medium/directory.
7. Turn the rotary knob to select the file or directory you wish to rename and press the **File Name** soft key.

8. Change the file name using the keyboard.
Change the file name according to the procedure given in section 4.4.
Press the Enter key on the keyboard to apply the new name.



Explanation

Specifying the Files to Be Listed (Filter)

The type of files to be listed can be specified.

- *.XXX: Displays only the files with the type of data (Setup, Measure, or Statistics) specified by File Item in the File menu.
- *.*: Displays all the files in the storage medium.

Changing the File Name or Directory Name

Change the file name and directory name using up to 25 characters including the extension. However, files and directories on the network drive (optional function) cannot be renamed. In addition, if the number of characters excluding the extension exceeds 8 characters on the file list displayed on the TA720, only the first 7 characters and extension are displayed as in TA72000>.SET (only the first 7 characters for directories). Do not change the extension of files used on the TA720. If you do, the files will no longer be usable on the TA720.

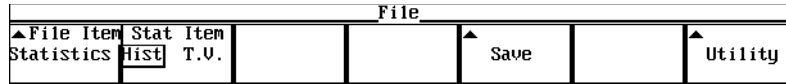
Note

- Files cannot be renamed while measurement is in progress (while the START/STOP indicator is illuminated).
- When Filter is set to *.WVF and you rename a measured result data file (a file with .wvf extension), the corresponding header file (a file with .hdr extension) is also renamed.
- Characters exceeding 7 characters are displayed as >. To check the characters exceeding 7 characters, select Property to display all the characters.

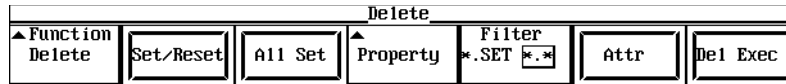
11.10 Creating Directories

Procedure

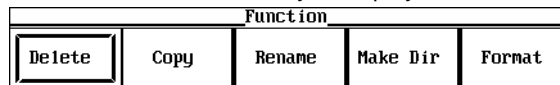
1. Press the **SHIFT+UTILITY(FILE)** key to display the File menu.



2. Press the **Utility** soft key.
When Function is set to Delete, the menu appears as follows.

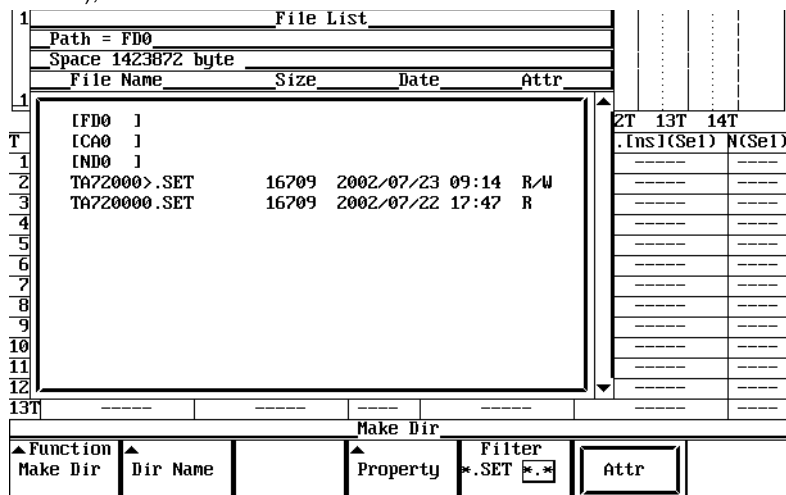


3. Press the **Function** soft key to display the Function menu.



4. Press the **Make Dir** soft key to display the File List and Make Dir menus.
To limit the type of files to be displayed, press the **Filter** soft key to select *.XXX.
The XXX section of *.XXX varies depending on the File Item setting in the File menu as follows.

Setup: *.SET, Measure: *.WVF (when Data Type is Bin) or *.CSV (when Data Type is Ascii), or Statistics: *.CSV

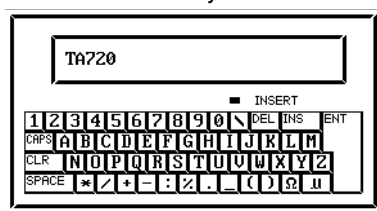


Setting the Parent Directory in Which the New Directory Will Be Created

5. Turn the rotary knob to select the storage medium (indicated with []) and press the SELECT key.
6. Likewise, select the parent directory (indicated with < >) in which the new directory will be created.
[Path=.....] shows the selected storage medium/directory.

Creating the Directory

7. Press the **Dir Name** soft key to display a keyboard screen.
Enter the directory name according to the procedure given in section 4.4.
Press the **Enter** key to create the directory.

**Explanation****Creating Directories**

A new directory can be created on the floppy disk, PC card, or network drive. Note the following points when creating a directory.

- Enter the directory name using up to 8 characters.
- A directory created on a network drive cannot be renamed from the TA720. Deleting the directory is possible.
- When renaming a directory on a floppy disk or PC card (see section 11.9), up to 25 characters can be used. However, if the number of characters exceed 7 characters, the characters exceeding 7 characters are displayed as > as in <TA72000>. The file name can be confirmed using properties.
- If a directory with a same name already exists in the same directory, the directory cannot be created.

Note

Directories cannot be created while measurement is in progress (while the START/STOP indicator is illuminated).

11.11 Installing the Printer Roll Paper

Printer Roll Paper

The TA720 uses a dedicated roll paper provided by YOKOGAWA. Do not use other types of roll paper. When you are using the printer for the first time, use the roll paper that came with the package. Order extra rolls from your nearest YOKOGAWA dealer as listed on the back cover of this manual.

Part No.: B9850NX
Specifications: Thermal-sensitive paper, 30 m
Minimum Q'ty: 5 rolls

Roll Paper Handling

The paper is a thermal-sensitive paper that changes color with the application of heat. Take note of the following points.

Storage Precautions

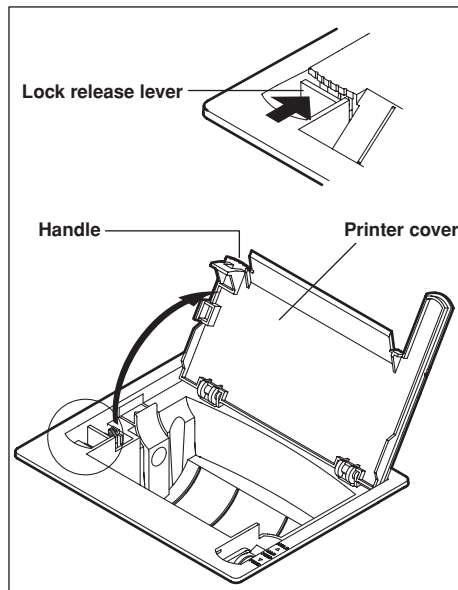
The paper starts changing color at around 70°C. It is affected by heat, humidity, light, and chemicals regardless of whether the paper has been used.

- Store the paper rolls in a cool, dry, and dark place.
- After opening the package, use it quickly.
- If the paper is left in contact with plastic film (such as a vinyl chloride film or Scotch tape) containing plasticizers for an extended time, the paper will lose some of its ability to reproduce color. If you are going to store the paper in a folder, for example, use a folder made of polypropylene.
- When using glue on the paper, do not use glue containing organic solvents such as alcohol or ether, as they will change the color of the paper. Such act can lead to malfunction.
- For prolonged storage, we suggest you copy the roll paper. Due to the characteristics of the thermal-sensitive paper, the recording section may lose color over time.

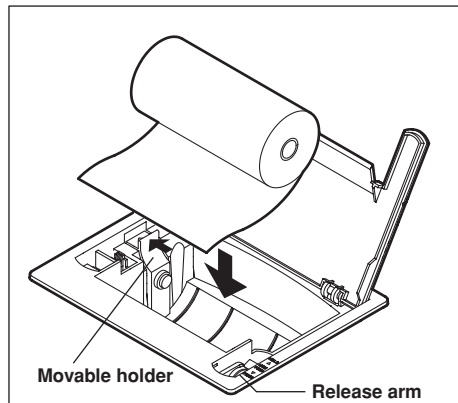
Handling Precautions

- Be sure to use only genuine paper rolls provided by YOKOGAWA.
- Touching the paper with sweaty hands can leave finger print marks or blur the printing.
- Rubbing the surface with a hard object can cause the paper to change color due to the heat caused by friction.
- If chemicals, oil, or other liquids come in contact with the paper, the paper may change color or the printing may fade.

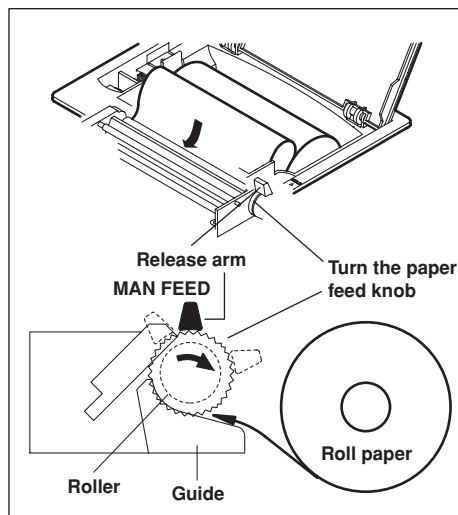
Installation Procedure



While pressing the lock release lever to the OPEN direction, lift the handle on the left side of the printer cover to open the printer cover.

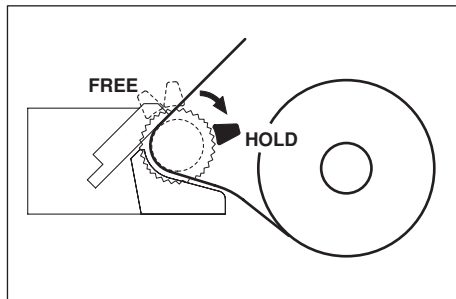


Move the release arm, located on the right near the front, to the MAN FEED position. Hold the roll paper so that the inner side of the roll paper (the side that is not glossy) is showing on top and set the core to the right holder while pressing the movable holder on the left side of the roll paper storage place to the left. Then, release the movable holder.



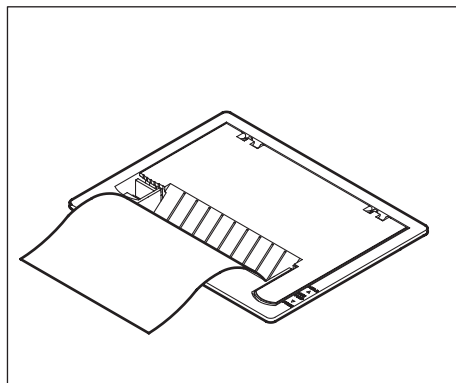
Insert the edge of the roll paper evenly in the space between the roller and the black guide, then rotate the paper feed knob away from you until about 10 cm of the paper is showing from the top of the roller.

11.11 Installing the Printer Roll Paper



Move the release arm to the FREE position and straighten out the paper. Then, move the release arm to the HOLD position.

The printing will fail with an error message, if the release arm is in the FREE or MAN FEED position during operation.



Pull the printer cover back to its original position and close the cover. Make sure that the edge of the roll paper is showing from the opening of the printer cover.

Push the printer cover down firmly until it clicks into place.

Note

After installing the roll paper, make sure that the paper is feeding properly according to the steps given on the next page. If the paper is not being fed evenly, continue to feed the paper for approximately 30 cm. The paper will straighten out.

11.12 Printing the Screen Image

Procedure

1. Press the **SHIFT+COPY (COPY MENU)** key to display the Copy menu.

| Copy | | | | | |
|-----------------|-------------|-------------------------|------------------|--------------------|-------|
| ▲ Copy to Drive | ▲ File List | ▲ File Name TA720ABC | ▲ Format TIFF | ▲ Half Tone OFF | Abort |

2. Press the **Copy to** soft key to display the Copy Destination menu.

| Copy Destination | |
|------------------|-------|
| Printer | Drive |

3. Press the **Printer** soft key to set the print destination to the built-in printer.

| Copy | | | | | |
|-------------------|--|--|-----------|-----------|-------|
| ▲ Copy to Printer | | | ▲ Comment | PaperFeed | Abort |

Paper Feeding

4. Press the **Paper Feed** soft key to execute paper feeding.

Setting a Comment

5. Press the **Comment** soft key to display a keyboard screen.
6. Enter the comment using the keyboard.
For the procedure to enter the character string, see section 4.4.

Executing the Printer Output

7. Display the screen you wish to print.
8. Press the **START/STOP** key to stop the data acquisition.
The waveform acquisition is in progress when the indicator above **START/STOP** is illuminated.
9. Press the **COPY** key.
The screen image is printed on the built-in printer.
To abort the printing of the screen image, press the **Abort** soft key on the **Copy** menu.

Explanation

Setting a Comment

Since the comment (up to 25 characters) is displayed at the upper left corner of the screen, it can also be printed.

Paper Feeding

You can feed the paper to check whether the roll paper has been loaded properly or to skip dirty sections.

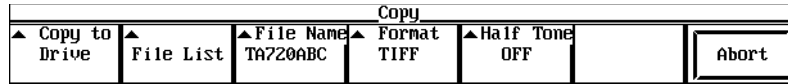
Note

- Printing is not possible while measurement is in progress (while the **START/STOP** indicator is illuminated).
- Paper feeding is not possible while measurement is in progress.
- When waveforms are overlapped, the waveform color on the screen changes temporarily while printing is in progress.

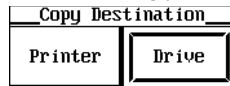
11.13 Saving the Screen Image

Procedure

1. Press the **SHIFT+COPY (COPY MENU)** key to display the Copy menu.



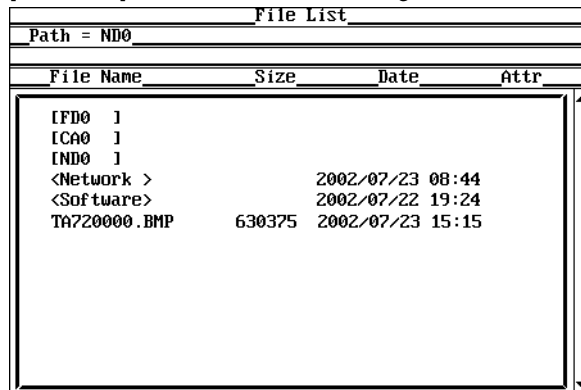
2. Press the **Copy to** soft key to display the Copy Destination menu.



3. Press the **Drive** soft key.

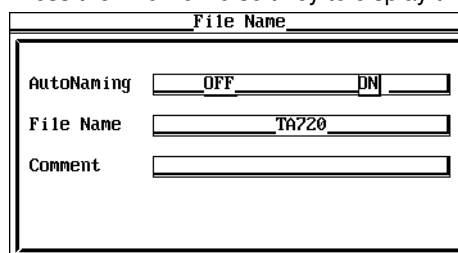
Setting the Save Destination Directory

4. Press the **File List** soft key to display File List.
5. Turn the rotary knob to select the save destination storage medium (indicated with []) and press the SELECT key.
6. Likewise, select the directory (indicated with < >).
[Path=.....] shows the selected storage medium/directory.



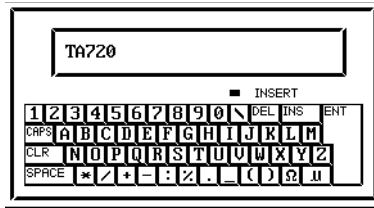
Setting the File Name

7. Press the **File Name** soft key to display the File Name dialog box.

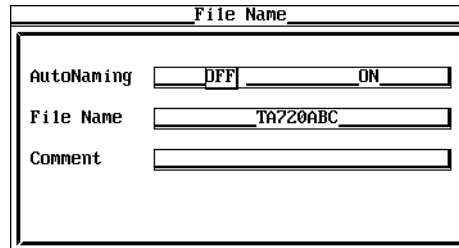


8. Turn the rotary knob to select **AutoNaming**. Press the SELECT key to select **ON** or **OFF**.

- Turn the rotary knob to select **File Name** and press the SELECT key.
A keyboard appears on the screen.

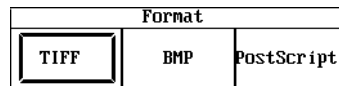


- Use the rotary knob and SELECT key to enter the file name.
For the procedure to enter the character string, see section 4.4.



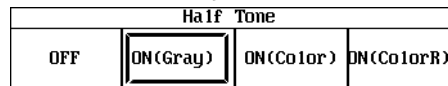
Selecting the Data Format

- Press the **Format** soft key to display the Format menu.
- Press the **TIFF**, **BMP**, or **PostScript** soft key.



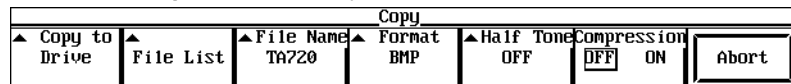
Selecting the half Tone (when the data format is TIFF or BMP)

- Press the **Half Tone** soft key.
- Press the **ON (Gray)**, **ON (Color)**, **ON (ColorR)**, or **OFF** soft key.



Compressing the Data (only when the data format is BMP)

- Press the **Compression** soft key to select **ON**.




Executing the Save Operation

- Display the screen you wish to save.
- Press the COPY key.
To abort the save operation, press **SHIFT + COPY (COPY MENU)** to display the Copy menu and press the **Abort** soft key



CAUTION

Do not remove the storage medium or turn OFF the power while the screen image data is being saved (while  is blinking). Such acts can damage the storage medium or destroy the data on the storage medium.

Explanation

Save Destination Storage Medium

Screen images can be saved to the following three types of storage medium.

- FDO: Floppy disk
- CA0: PC card (when the number of partitions is 1)
- CA0-1: PC card (when the number of partitions is 2 or more)
- NDO: Network drive

Output Data Format and Extension

Data in the following formats can be saved to a specified storage medium. The extension, which is added automatically, and the file size (reference value with half tone OFF and no data compression) are also indicated.

| Output Data Format | Extension | File Size |
|--------------------|-----------|--------------------------------|
| TIFF | .TIF | Approx. 38 KB (approx. 302 KB) |
| BMP | .BMP | Approx. 38 KB (approx. 302 KB) |
| PostScript | .PS | Approx. 78 KB |

The value inside the parentheses is the file size when half tone is ON.

Half Tone (for TIFF and BMP formats)

On (Gray) is a tint of 16 gray levels; ON (Color) is 256 colors. No gradation is used for OFF.

Entering a File Name or a Comment

- Enter a file name using up to 8 characters.
- Enter a comment using up to 25 characters. Comments are displayed at the upper left corner of the screen and can be saved as a screen image.
- You cannot save to a file name that already exists in the same directory (overwriting not allowed).
- The file name is common with other saved data, except the extension.

Compressing the Data (only when the data format is BMP)

For BMP format, data can be compressed using RLE and saved. However, data in BMP format cannot be compressed if half one is OFF.

Auto Naming Function

When Auto Naming is turned ON, files with a three digit number from 000 to 499 are automatically created when saving the screen image. A common name (up to five characters, specified by File Name) is attached before the number.

Note

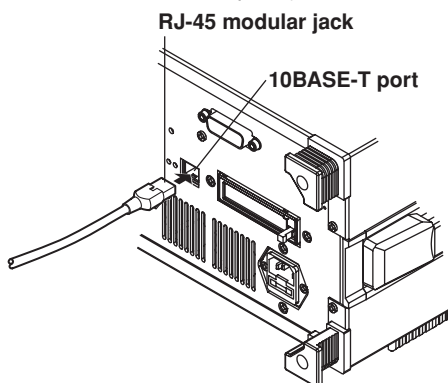
-
- Screen images cannot be saved while measurement is in progress (while the START/STOP indicator is illuminated).
 - When renaming a file (see section 11.9), you can specify the name using up to 25 characters. However, if the number of characters excluding the extension exceeds 8, only the first 7 characters and the extension are displayed as in TA72000>.SET. The file name can be confirmed using properties.
 - If waveforms are overlapped when outputting the screen image with half tone set to OFF or in PostScript format, the waveform color on the screen changes temporarily.
-

12.1 Connecting to the Ethernet Network

Connection Procedure

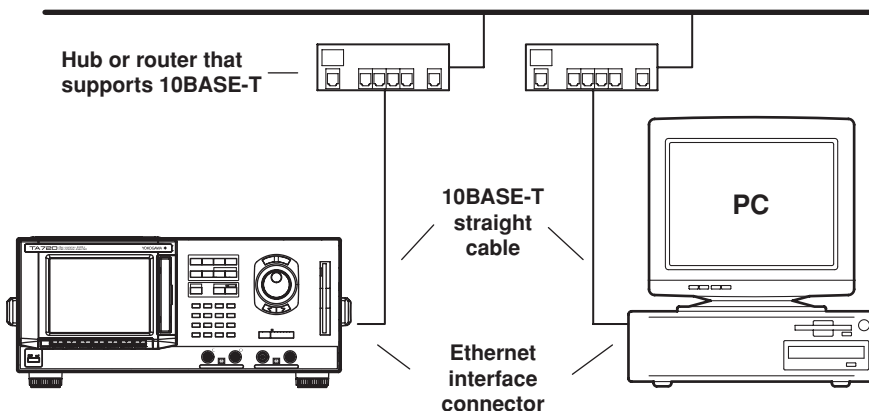
Connector

Connect to the Ethernet port (10BASE-T connector) on the rear panel.



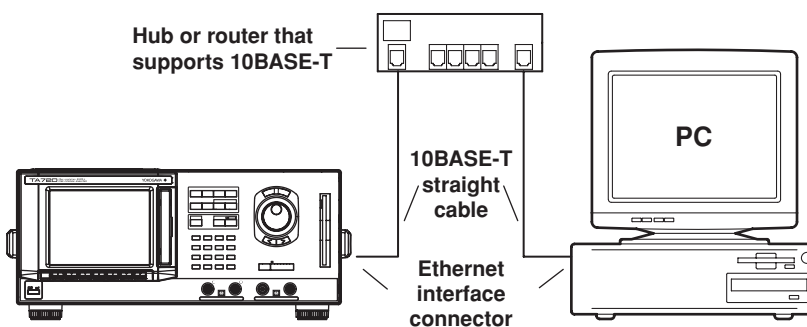
Connecting to the Network

Connect the TA720 to the network via a hub or router as shown below. If the connector type is different, use an adapter or other similar devices.



One-to-One Connection with a PC

Connect the TA720 via a network switch such as a hub as shown below.



Note

- When connecting the TA720 and a PC in a one-to-one configuration, use a 10BASE-T/100BASE-TX auto switching NIC or a 10BASE-T NIC on the PC side.
- Avoid connecting the TA720 and a PC directly without going through a hub. Operation is not warranted for direct connection.

12.2 Setting the TCP/IP

Procedure

1. Press the **UTILITY** key to display the Utility menu.

| Utility | | | | | | |
|-------------------|----------------|-----------|----------|------------|---------------|---------|
| ▲ Device GP-IB | Ⓞ Address 1 | ▲ Network | ▲ Memory | ▲ Selftest | ▲ Calibration | Next1/2 |

2. Press the **Network** soft key to display the Network menu.

| Network | | | | | | |
|----------|------------|--|-------------|--|----------|----------|
| ▲ TCP/IP | ▲ FTP User | | ▲ Net Drive | | ▲ Others | Log List |

3. Press the **TCP/IP** soft key to display the TCP/IP setting dialog box.

| | |
|----------------|--|
| DHCP | <input checked="" type="checkbox"/> ON |
| IP Address | <input type="text" value="0.0.0.0"/> |
| Net Mask | <input type="text" value="255.255.255.0"/> |
| Gate Way | <input type="text" value="0.0.0.0"/> |
| DNS | <input type="checkbox"/> ON |
| Domain Name | <input type="text"/> |
| DNS Server1 | <input type="text" value="0.0.0.0"/> |
| DNS Server2 | <input type="text" value="0.0.0.0"/> |
| Domain Suffix1 | <input type="text"/> |
| Domain Suffix2 | <input type="text"/> |

Turning DHCP ON/OFF

4. Turn the rotary knob to move the cursor to **DHCP** and press the SELECT key to select **ON** or **OFF**.

If you set DHCP to ON, you do not have to set the IP address, subnet mask, default gateway below. To set up the DNS, proceed to step 11.

If you do not wish to set up the DNS, check the network cable connection and restart the TA720. The IP address, subnet mask, and default gateway are automatically configured.

Setting the IP Address

If DHCP was set to Off in step 4, set the IP address.

5. Turn the rotary knob to the desired digit of **IP Address** and press the SELECT key to display the value entry area.
6. Use the rotary knob to set the IP address.

Setting the Subnet Mask

If DHCP was set to Off in step 4, set the subnet mask.

7. Turn the rotary knob to the desired digit of **Net Mask** and press the SELECT key to display the value entry area.
8. Use the rotary knob to set the subnet mask.

Setting the Default Gateway

If DHCP was set to Off in step 4, set the default gateway.

9. Turn the rotary knob to the desired digit of **Gate Way** and press the SELECT key to display the value entry area.
10. Use the rotary knob to set the default gateway.

Setting the DNS

11. Turn the rotary knob to move the cursor to **DNS**.
12. Press **SELECT** to display the DNS setting menu.
13. Press the **SELECT** key to select **ON**, **OFF**, or **AUTO** (AUTO can be specified only when DHCP is ON). When DNS is set to AUTO, the domain name and DNS server name are automatically configured by power-cycling the TA720. If DNS is set to ON, the domain name, DNS server name, and domain suffix are displayed. If DNS is set to OFF, check the network cable connection and power cycle the TA720.
14. Turn the rotary knob to move the cursor to **Domain Name**.
15. Press the **SELECT** key to display the keyboard.
16. Enter the domain name using the keyboard. For the procedure to enter the character string, see section 4.4.
17. Turn the rotary knob to the desired digit of **DNS Server1** and press the **SELECT** key to display the value entry area.
18. Use the rotary knob to set the IP address of the primary DNS server.
19. Likewise, set the IP address of the secondary DNS server in DNS Server2.
20. Turn the rotary knob to move the cursor to **Domain Suffix1**.
21. Press the **SELECT** key to display the keyboard.
22. Enter the primary domain suffix using the keyboard.
23. Likewise, set the secondary domain suffix in Domain Suffix2.

Turning ON/OFF the Power

24. To apply the new settings, the TA720 must be power cycled. After all the settings are complete, turn the power to the TA720 OFF, then back ON again.

Explanation

To use the Ethernet communication functions of the TA720, the following settings are required.

Setting the IP Address, Subnet Mask, Default Gateway, DHCP, and DNS

Consult your system or network administrator in setting these parameters.

- **DHCP (Dynamic Host Configuration Protocol)**

If DHCP is enabled, the following items are automatically configured.

IP Address, Subnet Mask, Default Gateway, and DNS settings

To use DHCP, the network must have a DHCP server.

Consult your network administrator to see if DHCP can be used.

If DHCP is used, a different IP address may be assigned to the TA720 each time the power is turned ON. Therefore, you must be careful when using the FTP server function of the TA720.

- **IP Address (Internet Protocol Address)**

Set the IP address to assign to the TA720. The default setting is [0.0.0.0].

The IP address is used to uniquely identify a device on the Internet when using TCP/IP. The address is a 32-bit value expressed in four octets (each 0 to 255), each separated by a period as in [192.168.111.24]. A unique ID must be acquired from the network administrator.

If DHCP can be used, the IP address is automatically assigned.

- **Subnet Mask**

Set the mask value used when determining the subnet network address from the IP address. The default setting is [255.255.255.0]. Consult your network administrator for the appropriate value. You may not need to set the value.

If DHCP can be used, the subnet mask is automatically assigned.

- **Default Gateway**

Specify the IP address of the default gateway that is used when communicating with other devices on a different segment (network unit). The default setting is [0.0.0.0]. Consult your network administrator for the appropriate value. You may not need to set the value.

If DHCP can be used, the default gateway is automatically assigned.

- **DNS (Domain Name System)**

DNS is a system used to associate names used on the Internet called host names and domain names to IP addresses. (Given AAA.BBBBB.com, AAA is the host name and BBBBB.com is the domain name. Instead of using the IP address, which is a sequence of numbers, host name and domain name can be used to access the network.

In the case of the TA720, the host name of the destination can be specified using a name instead of an IP address when using the network drive function or network printer function.

You set the domain name, the DNS server address ([0.0.0.0] by default), and the domain suffix. In networks that support DHCP, these settings can be configured automatically.

- **DNS Server**

Up to two DNS server addresses can be specified (primary and secondary). If the primary DNS server is down, the secondary DNS server is automatically looked up for the mapping of the host name/domain name and IP address.

- **Domain Suffix**

When the IP address corresponding to the server name with the aforementioned domain name is not found, the system may be set up to search using a different domain name. Enter this alternate domain name as the domain suffix. You can specify up to two domain suffixes, Domain Suffix1 (primary) and Domain Suffix2 (secondary).

Note

- If you changed settings related to the Ethernet network, the TA720 must be power cycled.
 - If the TA720 is turned ON with the DHCP function enabled without an Ethernet cable connected, communications and file functions may not operate properly. In this case, turn DHCP OFF and power cycle the TA720.
-

12.3 Setting the Network Drive (FTP Client Function)

Procedure

1. Press the **UTILITY** key to display the Utility menu.


| Utility | | | | | | |
|-------------------|----------------|-----------|----------|------------|---------------|---------|
| ▲ Device GP-1B | Ⓜ Address 1 | ▲ Network | ▲ Memory | ▲ Selftest | ▲ Calibration | Next1/2 |

2. Press the **Network** soft key to display the Network menu.

| Network | | | | | | |
|----------|------------|--|-------------|--|----------|----------|
| ▲ TCP/IP | ▲ FTP User | | ▲ Net Drive | | ▲ Others | Log List |

3. Press the **Net Drive** soft key to display the Net Drive Setup dialog box.

| Net Drive Setup | |
|-------------------------|----------------------|
| FTP Server | abcde.yokogawa.co.jp |
| Login Name | abcde |
| Password | ***** |
| Time Out(sec) | 15 |
| Connect Disconnect | |

4. Turn the rotary knob to move the cursor to **FTP Server** and press the SELECT key to display the keyboard.
5. Enter the FTP server address using the keyboard.
If you are using DNS, you can specify the server by name.
6. Turn the rotary knob to move the cursor to **Login Name** and press the SELECT key to display the keyboard.
7. Enter the login name using the keyboard.
For the procedure to enter the character string, see section 4.4.
8. Turn the rotary knob to move the cursor to **Password** and press the SELECT key to display the keyboard.
9. Enter the password corresponding to the login name using the keyboard.
Password is not required if Login Name is anonymous.
10. Turn the rotary knob to move the cursor to **Timeout** and press the SELECT key to set the timeout time.
11. Turn the rotary knob to move the cursor to **Connect** and press the SELECT key to establish a connection.
When the connection is established,  is displayed at the upper right corner of the screen.
12. For the operation of files that follows the above procedure, see the procedures in sections 11.4 to 11.10.
On the File List that is displayed when files are managed, the network drive is indicated as ND0.

Explanation

Notes on Setting the FTP Server

- Set the list output (string returned by the dir command) to UNIX format.
- Set the home directory and its subdirectories to allow writing.

12.3 Setting the Network Drive (FTP Client Function)

Notes on Setting the FTP Client Function

- The client cannot move above the home directory.
- The newest file is not necessarily displayed at the top of the file list.
- File and directory names that exceed 8 characters, the characters beyond the 7th character are displayed as >. The entire file name can be confirmed by viewing properties.
- Depending on the server, "<..>" that indicates a higher directory may not be displayed.
- The time information in the file list will not be displayed correctly for the following cases.
 - On Windows NT when the time stamp is displayed using am and pm.
 - Servers that return characters other than ASCII characters in the list
- The following operations cannot be performed.
 - Turning file protect ON and OFF on saved files.
 - Formatting a network drive.
 - Copying between network drives.
 - Renaming a file on the network.
- This function cannot be used when the FTP server function or file operation function is used.
- To use this function, configure the TCP/IP settings beforehand according to section 12.2, "Setting up the TCP/IP."
- To apply new settings that are made while the connection is up, drop the connection using Disconnect and reconnect.
- If you are disconnected by the server when using the FTP client, you will be automatically reconnected if you perform a file operation.

12.4 Accessing the PC Card or Floppy Disk (FTP Server Function)

Procedure

1. Press the **UTILITY** key to display the Utility menu.

| Utility | | | | | | |
|-------------------|----------------|-----------|----------|------------|---------------|---------|
| ▲ Device GP-1B | ▲ Address 1 | ▲ Network | ▲ Memory | ▲ Selftest | ▲ Calibration | Next1/2 |

2. Press the **Network** soft key to display the Network menu.

| Network | | | | | | |
|----------|------------|--|-------------|--|----------|----------|
| ▲ TCP/IP | ▲ FTP User | | ▲ Net Drive | | ▲ Others | Log List |

3. Press the **FTP User Account** soft key to display the User setting window.

| User | |
|---------------|--|
| User Name | <input type="text" value="anonymous"/> |
| Password | <input type="text"/> |
| Time Out(sec) | <input type="text" value="600"/> |

4. Turn the rotary knob to move the cursor to **User Name** and press the SELECT key to display the keyboard.
5. Enter the user name using the keyboard.
Specify anonymous if you wish to allow access to all users. To restrict access, enter the user name using up to 15 characters.
6. Turn the rotary knob to move the cursor to **Password** and press the SELECT key to display the keyboard.
7. Enter the password using the keyboard using up to 15 characters.
Enter the password again for confirmation. If the user name is set to anonymous, you do not have to enter the password.
8. Turn the rotary knob to move the cursor to **Time Out** and press the SELECT key to display the value entry area.
9. Use the rotary knob to enter the timeout time.
10. Execute an FTP client software on the PC or workstation.
Perform file operations using the user name specified in step 5.
Press the **Log List** soft key to display date/time, user name, and IP address of the last 25 accesses.

Explanation

Number of Characters of the Login Name and Password


Up to 15 characters.

Timeout Time

When the TA720 (FTP server) is accessed from an FTP client and there is no access to the TA720 for a specified period, the network connection is automatically closed.

12.4 Accessing the PC Card or Floppy Disk (FTP Server Function)

Notes on Using the FTP Server Function

- The TA720 supports only a single client.
- When the TA720 is accessed from the PC or workstation (login),  is displayed at the upper right corner of the screen.
- This function cannot be used when the FTP client function or file operation function is used.
- The root directory of the floppy disk is indicated as FD0; the root directory of the PC card drive is indicated as CA0.
- The log list is cleared when the power is turned OFF.
- To use this function, configure the TCP/IP settings beforehand according to section 12.2, "Setting the TCP/IP."
- To apply the new settings, the TA720 must be power-cycled.

12.5 Checking the MAC address and Turning ON/OFF the FTP Passive Mode

Procedure

Checking the Ethernet Option and MAC Address

1. Press the **UTILITY** key to display the Utility menu.

| Utility | | | | | | |
|-------------------|----------------|-----------|----------|------------|---------------|---------|
| ▲ Device GP-IB | Ⓞ Address 1 | ▲ Network | ▲ Memory | ▲ Selftest | ▲ Calibration | Next1/2 |

2. Press the **Next1/2** soft key to display the next menu.

| Utility | | | | | | |
|----------|-------------|--|-------------|-------|-----------|---------|
| ▲ Config | ▲ SetupInfo | | ▲ Error Log | ▲ LCD | ▲ Version | Next2/2 |

3. Press the **Version** soft key to display the Version Information dialog box. Ether indicates the presence of the Ethernet option and MAC:000064_844_FA6 (example) is the MAC address.

| Version Information | |
|---------------------|------------------------------|
| Model | : 704510/C10 |
| Option | |
| PC Card I/F | : Yes |
| Ether | : Yes MAC : 000064_844_FA6 |
| Printer Headrank | : No Write |
| Version | : 1.00 |
| Link Date | : 2002/08/08 14:00:10 |

Turning ON/OFF the FTP Passive Mode

1. Press the **UTILITY** key to display the Utility menu.

| Utility | | | | | | |
|-------------------|----------------|-----------|----------|------------|---------------|---------|
| ▲ Device GP-IB | Ⓞ Address 1 | ▲ Network | ▲ Memory | ▲ Selftest | ▲ Calibration | Next1/2 |

2. Press the **Network** soft key to display the Network menu.

| Network | | | | | | |
|----------|------------|--|-------------|--|----------|----------|
| ▲ TCP/IP | ▲ FTP User | | ▲ Net Drive | | ▲ Others | Log List |

3. Press the **Others** soft key to display the Others menu.

| Others | |
|-------------|--|
| FTP Passive | <input type="checkbox"/> OFF <input type="checkbox"/> ON |

4. Use the SELECT key to select **ON** or **OFF**.

Explanation

MAC Address

The MAC address is a hardware address that is assigned to the TA720 for identification purposes on the network.

Note

The MAC address is displayed only when the Ethernet interface is installed. If XXXXXX_XXX_XXX is displayed for the MAC address even when the Ethernet interface is installed, contact your nearest YOKOGAWA dealer.

12.5 Checking the MAC address and Turning ON/OFF the FTP Passive Mode

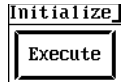
Turning ON/OFF the FTP Passive Mode

Turn this function ON when using the TA720 behind a firewall that requires the passive mode. The default setting is OFF.

13.1 Initializing the Settings

Procedure

1. Press the **SHIFT+MARKER (INITIALIZE)** key to display the Initialize menu.



2. Press the **Execute** soft key.
An Alert dialog box opens.
3. Turn the rotary knob to select **OK**, and then press the SELECT key.
To cancel the initialization, select Cancel and press the SELECT key.





Explanation

Initial Settings

When initialization is executed, the settings are reset as follows:

| Item | Setting |
|------------------------|--|
| MODE key | Hard Hist |
| FUNCTION key | |
| Function | Period |
| Channel/Slope | A↑(Period) A↑A↑B↑(Period&TI) A↑B↑(TI) A←→A↑B↑(PW&TI) ←→(Pulse Width) A←→B←→(PW&PW) A↑B↑(Per.&Per.) |
| SAMPLE key | |
| Gate Mode | Event Gate |
| Event Num | 100 |
| Gate Time | 1 μs |
| External Gate Polarity | |
| Sample Interval | 0 μs |
| Arming | Auto |
| Ext Arm Slope | ↑ |
| Arming Delay | OFF |
| Delay Event | 1 |
| Delay Time | 1 μs |
| Block | OFF |
| Block Size | 2 |
| Rest Mode | OFF |
| Rest Event | 1 |
| Rest Time | 1 μs |
| Inhibit | OFF |
| Ref.Clock | Internal |

13.1 Initializing the Settings

| Item | Setting |
|--|--|
| INPUT key | |
| (both CHA and CHB) | |
| Impedance | 1 M Ω |
| Coupling | DC |
| Trigger Mode | Manual |
| Manual Level | 0.000 V |
| Auto Level | 50% |
| (CHB) | |
| Phase Adj | 0.0 ns |
| (for both EXT ARM/EXT GATE and INHIBIT) | |
| Impedance | 1 M fixed |
| Coupling | DC fixed |
| Trigger Level | TTL |
| DISPLAY key | |
| Display Item | Histogram |
| Histogram Style Graph Size | Full |
| Histogram Style Statistics | On |
| Histogram Style Panorama | On |
| Histogram Style Both Graph | On |
| Histogram Style Overlap | On |
| Histogram Style Stat&Graph | Stat |
| Histogram Calc/Stat Calculation Area | Window |
| Histogram Calc/Stat Calculation Polarity | Pos&Neg |
| Histogram Calc/Stat Average | On |
| Histogram Calc/Stat Maximum | Off |
| Histogram Calc/Stat Minimum | Off |
| Histogram Calc/Stat Peak-Peak | On |
| Histogram Calc/Stat σ | On |
| Histogram Calc/Stat σ /Average | Off |
| Histogram Calc/Stat σ /T | Off |
| Histogram Calc/Stat Deviation | Off |
| Histogram Calc/Stat Deviation/T | Off |
| Histogram Calc/Stat Median | Off |
| Histogram Calc/Stat Mode | Off |
| Histogram Window Size | 14 |
| Histogram Window Mode | Single |
| Histogram Window Meas Item | Meas1 |
| Histogram Window T Value | 38.000 ns |
| Histogram Window Offset | 0.000 ns |
| Histogram Window Frequency | 26.315 MHz |
| Histogram Window Modulation | EFM+ |
| Histogram Window Window1 (2T) | OFF |
| Histogram Window T Type | Measured T |
| Histogram Window Number | 1T (WINDOW1) |
| Histogram ISI Setting Mode | Single |
| Histogram ISI Polarity |  |
| Histogram ISI Trigger |  |
| Histogram ISI Trigger Mark | 1T (WINDOW1) |
| Histogram ISI Trigger Space | 1T (WINDOW1) |
| Histogram ISI Target | Prev Mark |
| List Number | 1 |
| List Link | Off |
| List Search Symbol 1 | None |
| List Search Symbol 2 | None |
| List Search Symbol 3 | None |
| List Search Symbol 4 | None |
| List Search Link | M1 |
| TimeVariation Display Style Graph Size | Full |
| TimeVariation Display Style Statistics | On |
| TimeVariation Display Style Panorama | On |
| TimeVariation Display Style Overlap | On |
| TimeVariation Display Style Wave | M1&M2 |
| TimeVariation Graph Param Grid | On |
| TimeVariation Graph Param Connect | On |
| TimeVariation Graph Param Dot Type | Pixel |

| Item | Setting |
|--|--------------|
| TimeVariation Calc/Stat Calc/Area | Window |
| TimeVariation Calc/Stat T.Average | On |
| TimeVariation Calc/Stat T.Maximum | Off |
| TimeVariation Calc/Stat T.Minimum | Off |
| TimeVariation Calc/Stat T.Peak-Peak | On |
| TimeVariation Calc/Stat T. σ | On |
| TimeVariation Calc/Stat T. σ /Average | Off |
| TimeVariation Calc/Stat T.P-P/Average | Off |
| TimeVariation Calc/Stat T.RF | Off |
| TimeVariation Block Number | 0 |
| Statistics Stat Item | Hist |
| Statistics Style | All |
| Scale Link (Per&Per) | Link |
| Scale Link (Per&TI) | Meas1 |
| Scale Link (PW&TI) | Meas1 |
| Scale Link (PW&PW) | Link |
| Scale X Center (Histogram) | 150.000 ns |
| Scale X Span (Histogram) | 300 ns |
| Scale Y High (Histogram) | 100 |
| Scale Y Axis (Histogram) | Log |
| Scale X Minimum (TimeVariation) | 0.0 μ s |
| Scale X Span (TimeVariation) | 60 μ s |
| Scale Y Center (TimeVariation) | 150 ns |
| Scale Y Span (TimeVariation) | 200 ns |
| Marker Link (Per&Per) | Link |
| Marker Link (Per&TI) | Meas1 |
| Marker Link (PW&TI) | Meas1 |
| Marker Link (PW&PW) | Link |
| Marker X1 (Histogram) | 0 |
| Marker X2 (Histogram) | 300 ns |
| Marker Y1 (Histogram) | 0 |
| Marker Movement | ► |
| Marker X1 (TimeVariation) | 0.0 μ s |
| Marker X2 (TimeVariation) | 60.0 μ s |
| Marker Y1 (TimeVariation) | 50.0 μ s |
| Marker Y2 (TimeVariation) | 250 ns |

Items That Cannot Be Initialized

The following items are not initialized. They are also not stored.

| Item | Factory Default Settings |
|---|-------------------------------|
| Setup information stored to the internal memory | Initial settings above |
| Date/Time | Date/Time of factory shipment |
| Beep sound | ON |
| Click sound | ON |
| Warning display | ON |
| LCD brightness | 4 |
| LCD auto off | OFF |
| LCD auto off time | 10 min |
| Communication control device | GP-IB |
| GP-IB settings | |
| Gpib Address | 1 |
| Endian | LSBFirst |
| Start Data | 1 |
| End Data | 1 |
| Data Type | Ascii |
| Data Select | Time Stamp |
| File related items | |
| File Item | Setup |
| Data Type | Ascii |
| Stat Item | Hist |
| Auto Naming | OFF |
| File Name | "TA720" |
| Comment | "" |

13.1 Initializing the Settings

| Item | Factory Default Settings |
|-------------------------------|---|
| Utility | |
| Function | Delete |
| Filter | *.* |
| Partition Num | 1 |
| Ethernet related items | |
| Network | |
| TCP/IP | |
| DHCP | Off |
| IP Address | 0.0.0.0 |
| Net Mask | 255.255.255.0 |
| Gate Way | 0.0.0.0 |
| DNS | Off |
| Domain Name | "" |
| DSN Server1 | 0.0.0.0 |
| DSN Server2 | 0.0.0.0 |
| Domain Suffix1 | "" |
| Domain Suffix2 | "" |
| FTP User | |
| User Name | anonymous |
| Password | "" |
| Time Out | 600 s |
| Net Drive | |
| FTP Server | "" |
| Login Name | anonymous |
| Password | "" |
| Time Out | 15 s |
| Others | |
| FTP Passive | OFF |
| Copy related items | |
| Copy to | Printer |
| Image | Copy |
| Image Format | TIFF |
| Half Tone | OFF (black and white) |
| Compression | OFF |
| Calibration | Calibration value calibrated under standard operating conditions |

Note

- When initialization is executed, operations such as measurement and calculation are aborted.
- To initialize all the settings (reset to factory default settings), turn ON the power while holding down the RESET key. Note that if the power is turned ON while the RESET key is held down, the setup parameters that are stored in the internal memory are also initialized.

13.2 Calibration

For a functional description, see 2.8.

Procedure

1. Press the **UTILITY** key to display the Utility menu.

| Utility | | | | | | |
|-------------------|----------------|-----------|----------|------------|---------------|---------|
| ▲ Device GP-IB | Ⓜ Address 1 | ▲ Network | ▲ Memory | ▲ Selftest | ▲ Calibration | Next1/2 |

2. Press the **Calibration** soft key to display the Calibration menu.

| Calibration | | | | | | |
|-------------|--|--|--|--|--|------|
| | | | | | | Exec |

3. Press the **Exec** soft key.
The calibration results are listed.

| Calibration | | |
|------------------------|-------------|------|
| < Calibration Result > | | |
| DC | Calibration | PASS |
| T/V | Calibration | PASS |
| Phase | Calibration | PASS |
| Func | Calibration | PASS |

Explanation

Calibrated Items

The following items are automatically calibrated using the internal calibration signal.

- Offset voltage of the input amplifier (DC calibration)
- Conversion coefficient of the time-to-voltage converter (T/V calibration)
- Delay line that sets the phase between channels during A-to-B time interval measurement
(Phase calibration)
- Measurement function (Function calibration)

Executing Calibration

Perform calibration when the operating environment (temperature, humidity, etc.) of the TA720 changes drastically.

If the power is turned OFF, the calibration data is reset to factory default values (see page 13-3).

Calibration Results

If the calibration is successful, PASS is displayed; if it fails, FAIL is displayed. If FAIL is displayed, perform a self test (see section 14.4) to diagnose the TA720.

Note

When executing calibration, leave the input terminals (CH A and CH B) open.

13.3 10-MHz Output

For a functional description, see 2.8.

Connecting the Cable

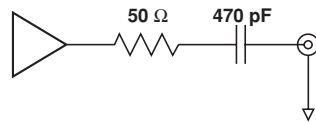
Connect a BNC cable to the 10MHz OUT terminal on the rear panel.

Explanation

When the power is ON, a signal of the following specifications are output from the 10MHz OUT terminal at all times.

- Output frequency: 10 MHz (typical value*)
- Output impedance: 50 Ω (typical value*)
- Output coupling: AC
- Output level: 1 Vp-p when the input impedance on the receiving side is 50 Ω .
 - * Typical value represents a typical or average value. It is not strictly warranted.

10-MHz output circuit



CAUTION

Do not apply external voltage to the 10MHz OUT terminal. Doing so can cause damage to the TA720.

13.4 Gate Output

For a functional description, see 2.8.

Connecting the Cable

Connect a BNC cable to the GATE OUT terminal on the rear panel.

Explanation

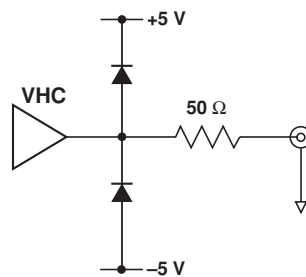
When the gate is open, the TTL level signal from the GATE OUT terminal is set high.



CAUTION

Do not apply external voltage to the GATE OUT terminal. Doing so can cause damage to the TA720.

Gate output circuit



13.5 Monitor Output

For a functional description, see 2.8.

Connecting the Cable

Explanation

Connect BNC cables to MONITOR OUT terminals (CH A and CH B) on the rear panel.

Signals corresponding to the CH A and CH B input signals are output from the CH A and CH B monitor output terminals, respectively. However, the monitor output method varies depending on the measurement function as follows.

- Period measurement or pulse width measurement: Outputs only the signal applied to the selected channel.
- Other measurements: Outputs signals applied to both CH A and CH B.

The signal is output according to the following specifications.

- Output impedance: 50Ω (typical value*)
- Output level: Approx. $1/4$ the input signal (within $\pm 5\text{ V}$) when the input impedance of the receiving monitor device is 50Ω .

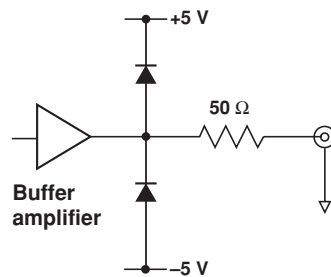
* Typical value represents a typical or average value. It is not strictly warranted.



CAUTION

Do not apply external voltage to the MONITOR OUT terminal. Doing so can cause damage to the TA720.

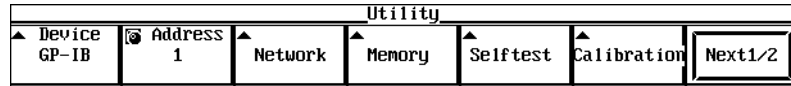
Monitor output circuit



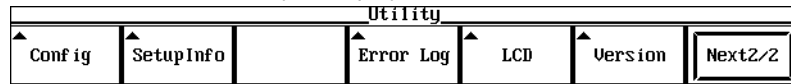
13.6 Viewing the Setup Conditions and ROM Version of the TA720

Procedure

1. Press the **UTILITY** key to display the Utility menu.

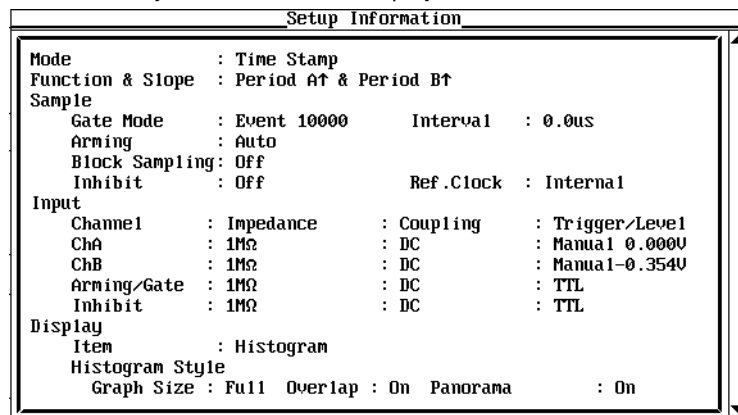


2. Press the **Next1/2** soft key to display the next menu.



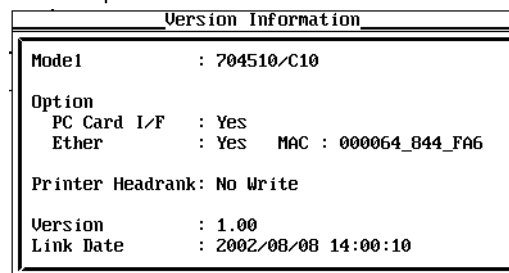
- **Checking the Setup Conditions of the TA720**

3. Press the **Setup Info** soft key to display the Setup Information dialog box. Turn the rotary knob to scroll the displayed contents.



- **Checking the ROM Version**

3. Press the **Version** soft key to display the Version Information dialog box. An example of Version Information is shown below.



Explanation

Setup Conditions That Can Be Displayed

Measurement conditions and display parameters that are set using the following keys can be displayed.

MODE key, FUNCTION key, INPUT key, DISPLAY key, SCALE key, MARKER key, and UTILITY key

ROM Version

The model and suffix code of the TA720 and the software version can be displayed.

13.7 Turning ON/OFF the Beep Sound, Click Sound, and Warning Display, and Setting LCD

Procedure

1. Press the **UTILITY** key to display the Utility menu.

| Utility | | | | | | |
|-----------------|--------------|---------|--------|----------|-------------|---------|
| Device GP-1B | Address 1 | Network | Memory | Selftest | Calibration | Next1/2 |

- **Changing the Operation Sound, Click Sound and Setting the Warning Display**
2. Press the **Config** soft key to display the Configuration menu.

| Configuration | | | | | | |
|---------------|--|--|--|--|--|---|
| Date/Time | | Beep OFF <input type="checkbox"/> ON <input type="checkbox"/> | ClickSound OFF <input type="checkbox"/> ON <input type="checkbox"/> | | | Warning OFF <input type="checkbox"/> ON <input type="checkbox"/> |

- **Turning ON/OFF the click sound**
 3. Press the **Beep** soft key to select **ON** or **OFF**.
 - **Turning ON/OFF the click sound**
 3. Press the **Click Sound** soft key to select **ON** or **OFF**.
 - **Turning ON/OFF the warning display**
 3. Press the **Warning** soft key to select **ON** or **OFF**.
2. Press the **LCD** soft key to display the LCD menu.

| LCD | | | | | | |
|---------|--|--|--|--|-------------|--|
| LCD Off | | Auto Off OFF <input type="checkbox"/> ON <input type="checkbox"/> | | | Bright 4 | |

- **Setting auto off**
 3. Press the **Auto Off** soft key to select **ON**.
 4. Press the **Time** soft key to set the time until the backlight turns OFF.

| LCD | | | | | | |
|---------|--|--|---------------|--|-------------|--|
| LCD Off | | Auto Off OFF <input type="checkbox"/> ON <input type="checkbox"/> | Time 14min | | Bright 4 | |

- **Setting the backlight brightness**
 3. Press the **Bright** soft key and the turn the rotary knob to select the brightness.

| LCD | | | | | | |
|---------|--|--|---------------|--|-------------|--|
| LCD Off | | Auto Off OFF <input type="checkbox"/> ON <input type="checkbox"/> | Time 14min | | Bright 7 | |

- **Turning OFF the backlight**
 3. Press the **LCD OFF** soft key.
When the soft key is pressed, the backlight turns OFF. If any key is pressed in this condition, the backlight turns back ON.

Explanation

Turing ON/OFF the Beep Sound

Specify whether to generate a beep sound when a warning message is displayed on the screen. The default setting is ON.

Turning ON/OFF the Click Sound

Specify whether to generate a click sound when the rotary knob is turned. The default setting is ON.

Turning ON/OFF the Warning Display

Specify whether to display warning messages.
The default setting is ON.

Setting the LCD

The following settings can be changed.


- Backlight auto off
If there is no key operation for a specified time, the backlight automatically turns OFF.
The time until the backlight turns OFF can be set in the range of 1 min to 60 min.
- Backlight brightness
The brightness can be set using 8 levels (0 to 7). The lifetime of the backlight can be prolonged by turning OFF the backlight when it is not necessary.
- Backlight ON/OFF (LCD OFF)
Turns ON/OFF the LCD backlight.

Note

If a warning occurs, the message is recorded in the error log, even when the warning display is turned OFF.

14.1 Troubleshooting

- For the appropriate corrective actions when a message is shown on the screen, see the next section.
- If servicing is necessary, or if the instrument is not operating correctly after performing the following corrective actions, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

| Problem | Probable Cause | Corrective Action | Reference Section |
|--|--|---|-------------------|
| The power cannot be turned ON. | Using a power supply outside the ratings. | Use a correct power supply. | 3.3 |
| | The fuse is blown. | Check for the cause, and if there is no problem replace it with a new fuse. | 14.7 |
| Nothing is displayed. | The screen is set extremely dark. | Adjust the brightness of the LCD screen. | 13.7 |
| | The screen is cold. | The ambient temperature should be at least 5°C. | – |
| The display is odd. | The system is not operating properly. | Power-cycle the TA720. | – |
| Keys do not work. | The TA720 is in the remote mode. | Set the TA720 in the local mode. | * |
| Cannot make measurements. | Incorrect trigger level. | Set a proper trigger level. | 6.6 |
| | Measurement channel is not selected. | Check the channel. | 5.2 to 5.8 |
| | Exceeding measurement range. | Check the measurement range. | 5.2 to 5.8 |
| | Incorrect arming setting. | Check the arming setting. | 6.3 |
| | Incorrect inhibit setting. | Check the inhibit setting. | 6.4 |
| Cannot save to the specified medium. | Incorrect reference signal. | Check the reference signal. | 6.8 |
| | The storage medium is not formatted. | Format the storage medium. | 11.3 |
| | The storage medium is not properly inserted. | Insert the storage medium properly. | 11.1, 11.2 |
| | The storage medium is write-protected. | Remove the write-protection. | – |
| | Insufficient free space on the storage medium. | Delete unneeded files or use another storage medium. | 11.7 |
| | Attempted to save while the measurement is in progress. | Save after the measurement completes or stop the measurement. | 11.4 to 11.6 |
| Cannot load from the specified medium. | The storage medium is not properly inserted. | Insert the storage medium properly. | 11.1, 11.2 |
| | Attempted to load while the measurement is in progress. | Load after the measurement completes or stop the measurement. | 11.4 to 11.6 |
|  is blinking at the top right corner of the screen. | The lithium battery is dead. The system is not operating properly. | Perform a self test. | 14.4 |
| Cannot print to the built-in printer. | The roll paper is not installed. | Install the roll paper. | 11.11 |
| | The release arm position is incorrect. | Move the release arm to the HOLD position. | 11.11 |
| | The printer head is damaged or has worn out. | Servicing required. | – |
| | Attempted to print while the measurement is in progress. | Print after the measurement completes or stop the measurement. | 11.12 |
| Unable to recognize the medium. | Incorrect format on the storage medium. | Format the storage medium. | 11.3 |
| | The storage medium is damaged. | – | – |
| Cannot change settings or control the operation of the TA720 via the communication interface. | The address of the TA720 used by the program is different from the specified address. | Match the address. | * |
| | The interface is not used in a way that conforms to the electrical or mechanical specifications. | Use it in a way that conforms to the specifications. | * |

* See the Communication Interface User's Manual (IM704510-17E).

14.2 Messages

The following three types of messages can appear in the center of the screen.

- Error messages
Displayed when an invalid operation is attempted or when the instrument is behaving abnormally.
- Warning messages
Displayed when the instrument is in a state in which the user needs to be warned.
Example: Measurement data overflow
- Alert messages
Displayed in cases such as before formatting a disk.

Error in Execution (600 to 799)

| Error No. | Message | Description | Page |
|-----------|---|--|------------------------------------|
| 601 | Invalid path name. | The path name is not correct. | |
| 602 | No floppy disk or PC Card inserted. | No floppy disk or card is inserted. | 11-1, 11-2 |
| 604 | Media failure. | The storage media is abnormal. | – |
| 605 | File not found. | The specified file does not exist. | – |
| 606 | Media is protected. | Attempting to write to a write-protected storage medium. | – |
| 607 | Media was removed while accessing. | The storage medium was removed while it was being accessed. | – |
| 609 | File already exists. | A file with the same name already exists. | 11-8, 11-12, 11-16 11-23, 11-32 |
| 610 | Contains invalid Characters. | Invalid characters are being used. | 4-4 |
| 611 | Media full. | There is not enough free space on the medium. (Directory entry) | – |
| 612 | Media full. | There is not enough free space on the medium. | – |
| 613 | Directory is not empty. | Attempted to delete a directory that is not empty. | 11-19 |
| 614 | File is protected. | Attempted to delete a write-protected file. | 11-19 |
| 615 | Physical format error. | Physical format error occurred. | – |
| 616-620 | File system failure. | File system is abnormal. | – |
| 621 | File is damaged. | Accessed a damaged file. | – |
| 622-641 | File system failure. | File system is abnormal. | – |
| 646-654 | Media failure. | The storage media is abnormal. | – |
| 656-663 | File system failure. | File system is abnormal. | – |
| 665 | Cannot load this file format. | Attempted to load a file that was not saved by the TA720. | 11-8, 11-12 |
| 666 | File is now being accessed. Please wait. | File is being accessed. Wait until it is finished. | – |
| 668 | Cannot find .HDR file. | There is no .HDR file. | 11-11 |
| 671 | Stop measurement before accessing file. | When accessing a file, stop the measurement. | 4-2 |
| 672 | Data to be saved doesn't exist. | There are no data to be saved. | – |
| 680 | Illegal printer head position. | Move the release arm to the HOLD position. | 11-28 |
| 681 | Out of paper. | The roll paper is empty. | 11-26 |
| 682 | Printer over heat. | The printer has overheated. | – |

| Error No. | Message | Description | Page |
|-----------|--|---|-----------------------------|
| 683 | Printer not warm enough. | The printer temperature is too low. | – |
| 685 | Printer time out. | Printer has timed out. | – |
| 701 | Stop measurement before using internal printer. | Stop the measurement to make printouts. | 11-29 |
| 708 | Cannot output data while measuring. | Data cannot be saved while the measurement is in progress. | 11-8, 11-12, 11-16 11-32 |
| 710 | Internal printer in use. Please wait. | Printing. Please wait. | – |
| 711 | Image data failure. | The image data is abnormal. | – |
| 712 | Cannot compress this image. | This screen image cannot be compressed. | 11-32 |
| 750 | Cannot connect to the server. Confirm the network settings and connection. | Cannot connect to the server. | 12-3 |
| 751 | Not yet connected to the ftp server. Confirm the network settings and connection. | Not yet connected to the FTP server. Check the communication settings. | 12-3 |
| 752 | This ftp function in not supported. | This function is not supported. | – |
| 753 | FTP Error: Pwd Confirm network settings and connections. | This function is not supported. | – |
| 754 | FTP Error: Cwd Confirm network settings and connections. | This function is not supported. | – |
| 755 | FTP Error: Rm Confirm network settings and connections. | This function is not supported. | – |
| 756 | FTP Error: List Confirm network settings and connections. | This function is not supported. | – |
| 757 | FTP Error: Mkdir Confirm network settings and connections. | This function is not supported. | – |
| 758 | FTP Error: Rmdir Confirm network settings and connections. | This function is not supported. | – |
| 759 | FTP Error: Get Confirm network settings and connections. | This function is not supported. | – |
| 760 | FTP Error: Put Confirm network settings and connections. | This function is not supported. | – |
| 761 | FTP Error: GetData Confirm network settings and connection. | This function is not supported. | – |
| 762 | FTP Error: PutData Confirm network settings and connections. | This function is not supported. | – |
| 763 | FTP Error: AppendData Confirm network settings and connections. | This function is not supported. | – |
| 764 | FTP Error: Client Handle Confirm network settings and connections. | This function is not supported. | – |
| 765 | FTP Error: Others Confirm network settings and connections. | This function is not supported. | – |

Error in Setting (800 to 899)

| Error No. | Message | Description | Page |
|-----------|--|--|------------------------------------|
| 800 | Incorrect date and time. | The specified date/time is incorrect. | 3-12 |
| 801 | Illegal file name. | The file name is not correct. | 11-8, 11-12, 11-16 11-23, 11-32 |
| 812 | Sync pattern does not exist. | The searched pattern was not found. | 8-14 |
| 813 | Measured T cannot be entered using this function. | Measured T cannot be specified using this function. | 8-8 |
| 814 | Estimated T cannot be entered. Please set the sampling interval to the 0us. | Estimated T cannot be specified. Set the sampling interval to 0 μ s. | 8-8 |

14.2 Messages

| Error No. | Message | Description | Page |
|-----------|--|--|-----------|
| 815 | Sampling interval cannot be entered while Estimated T. | Sampling interval cannot be specified when using Estimated T. Changed to Measured T or switch the window mode. | 8-8 |
| 816 | Cannot be specified in this measurement item. | Cannot be specified in this measurement item. | – |
| 817 | External Arming and block rest time/event cannot be used together. | External Arming and block rest time/event cannot be used together. | 6-5, 6-11 |

Error in System Operation (900 and higher)

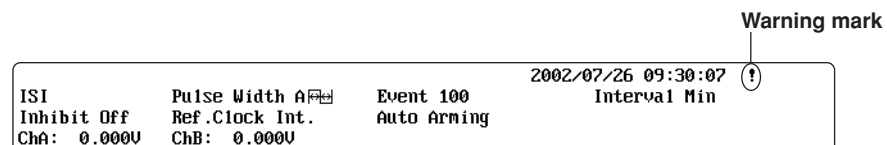
| Error No. | Message | Description | Page |
|-----------|---|---|------|
| 906 | Fan stopped. Turn OFF the power immediately. | The cooling fan has stopped. Turn OFF the power immediately. | – |
| 912 | Fatal error in communications driver. | Communication driver error. | – |
| 914 | A communications time-out has occurred. | Communication timeout error. | – |

Warning Messages (0 to 99)

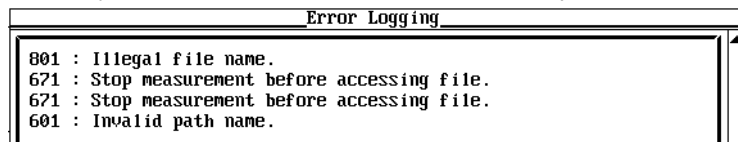
| Error No. | Message | Description | Page |
|-----------|--|--|--------------|
| 50 | Sample number overflowed. | The number of samples exceeded the measurable number of samples. | 15-1 |
| 51 | Time stamp data overflowed. | The time stamp data has exceeded the maximum sampling time. | 15-1 |
| 52 | Measurement data overflowed. | Measured data exceeded the measurement range. | 15-2 to 15-4 |
| 53 | Measured T failure. | Failed to measure auto window T. | 8-8 |
| 54 | Estimated T failure. | Failed to estimate auto window T. | 8-8 |
| 55 | Rest time is too short. | Rest time is too short. | 6-11 |
| 56 | No reference clock. | No reference clock is applied. | 6-15 |
| 57 | Failure during continuous measurement. | Failed continuous measurement. | 2-7 |
| 58 | ISI analysis impossible. | Inter-symbol interference analysis cannot be performed. | 9-11 |
| 59 | Sync pattern not found. | No match pattern found. | 8-14 |

Warning Mark

As shown in the figure below, a warning mark appears when there is an error message or warning message.



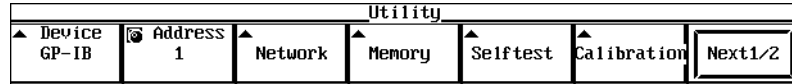
In this case, press the **Error Log** soft key in the menu that appears by pressing the UTILITY key. An error log is displayed and you can view the list of error messages and warning messages. If there are many messages and they do not fit in the window, turn the rotary knob to scroll the list. For details on the operation, see the next section.



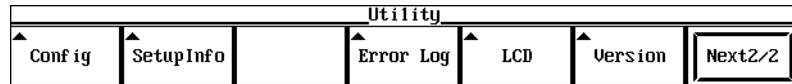
14.3 Displaying the Error Log

Procedure

1. Press the **UTILITY** key to display the Utility menu.



2. Press the **Next1/2** soft key to display the 2/2 menu.



3. Press the **Error Load** soft key to display the error log.

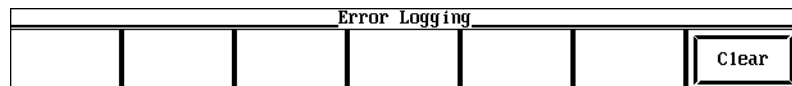
If there are many messages and they do not fit in the window, turn the rotary knob to scroll the messages.



Clearing the Error Messages

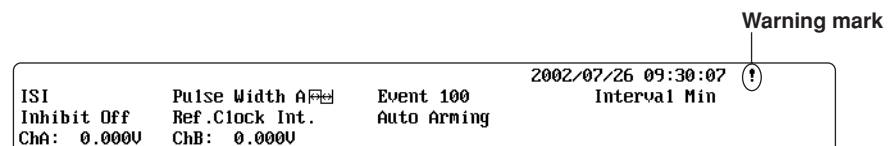
4. Press the **Clear** soft key on the **Error Logging** menu.

The messages are cleared and the **!** mark at the upper right corner of the screen is also cleared.



Explanation

When an operation error, a communication error, or a warning occurs, the TA720 creates an error message list and displays a **!** mark at the upper right corner of the screen. The details of the message can be viewed by displaying the error log.



You must press the **Clear** soft key on the Error Logging menu and clear the message list to clear the **!** mark from the screen.

Note

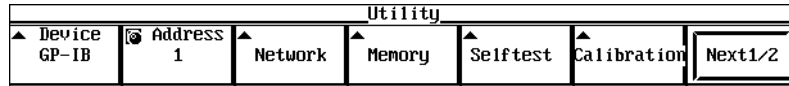
Warning messages cannot be cleared using the **Clear** soft key. Warning messages are automatically cleared when the cause of the warning is resolved such as by restarting the measurement.

14.4 Self Test

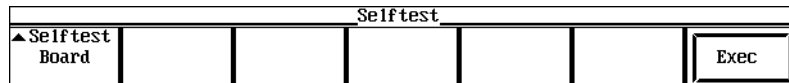
Procedure

Before taking the following steps, remove all the cables that are connected to the terminals on the front and rear panels, and stop the measurement.

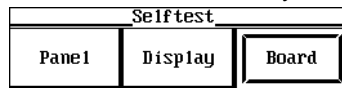
1. Press the **UTILITY** key to display the Utility menu.



2. Press the **Selftest** soft key to display the Selftest menu.

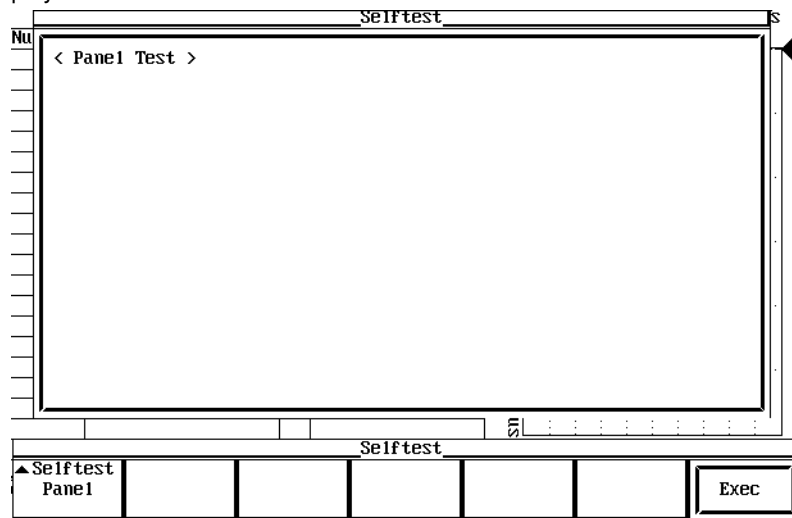


3. Press the **Selftest** soft key to display the Selftest selection menu.



- **Testing the Keys and Rotary Knob**

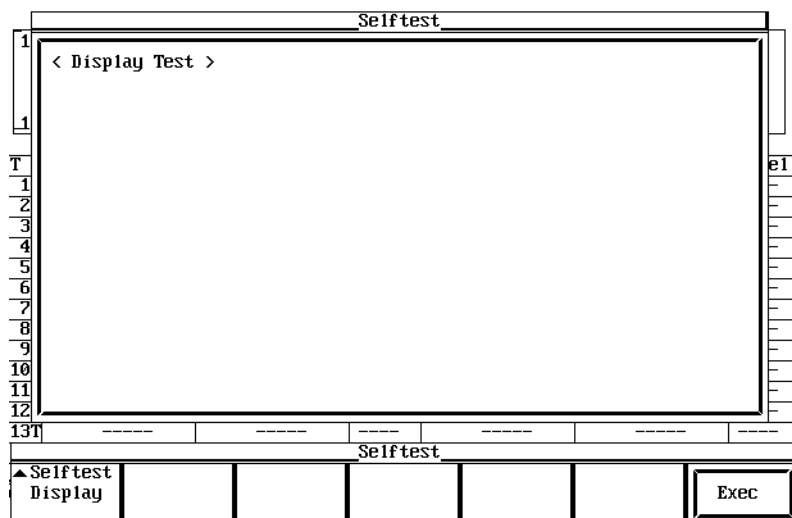
4. Press the **Panel** soft key.
A menu used to start the test and a window that indicates the test results are displayed.



5. Press the **Exec** soft key to execute the test.
6. Press each key and check that the name of the key is displayed.
7. Turn the rotary knob to the left and right and check that the name of the direction is displayed correctly.
8. Press the ESC key twice to quit the test.

- **Testing the Display**

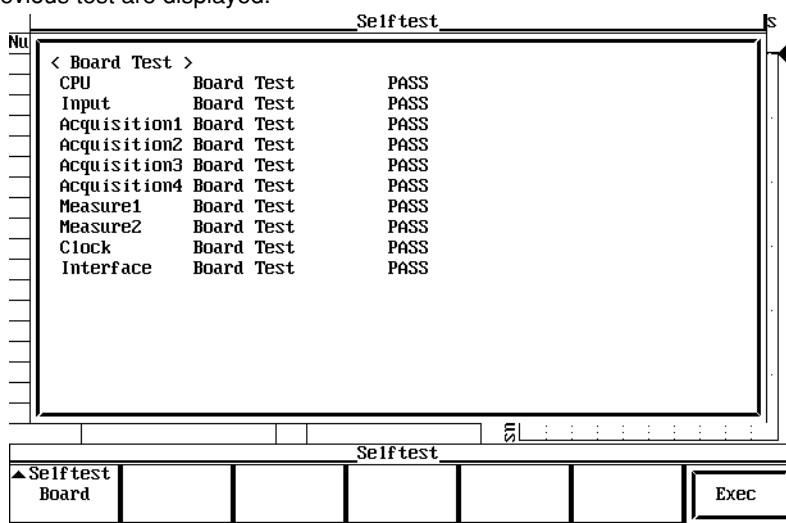
4. Press the **Display** soft key.
A menu used to start the test and a window containing the text "<Display Test>" are displayed.



5. Press the **Exec** soft key to start the test.
Text indicating the test items and test details is displayed.
6. Press the arrow keys to display the test item and the test details alternately and check that color dropout and other abnormalities are not present on the display.
7. Turn the rotary knob to check that the brightness of the LCD changes.
8. Press the ESC key to quit the test.

• **Testing the Board**

4. Press the **Board** soft key.
A menu used to start the test and a window that indicates the results of the previous test are displayed.



5. Press the **Exec** soft key to start the test.
The board test starts, and the results are displayed.
PASS should appear on all items.

Explanation

When a Failure Is Found from the Test

It is probably a malfunction. Please contact your nearest YOKOGAWA dealer as listed on the back cover of this manual for repairs.

Text Indicating the Results of the Board Test

If a failure is found, FAIL or the following character string appears in place of PASS. In either case, servicing is required. Please contact your nearest YOKOGAWA dealer as listed on the back cover of this manual for repairs.

- Low Battery: The lithium battery has reached the end of its service life.
 The battery must be replaced.
- Calibration Data Lost: The internal calibration value may have been lost.
 Recalibration is required.
- ROM Error/DRAM Error/: Error may have occurred in the internal memory.
 SRAM Error

Note

When executing a self test, leave the input terminals (CH A and CH B) open.

14.5 Adjusting the Time Base



CAUTION

- Do not apply a voltage exceeding the maximum input voltage to the input terminals of each instrument. This may cause damage to the input section.
- Do not apply external voltage to the output terminals of each instrument. This may cause damage to the internal circuitry.

Instruments Required

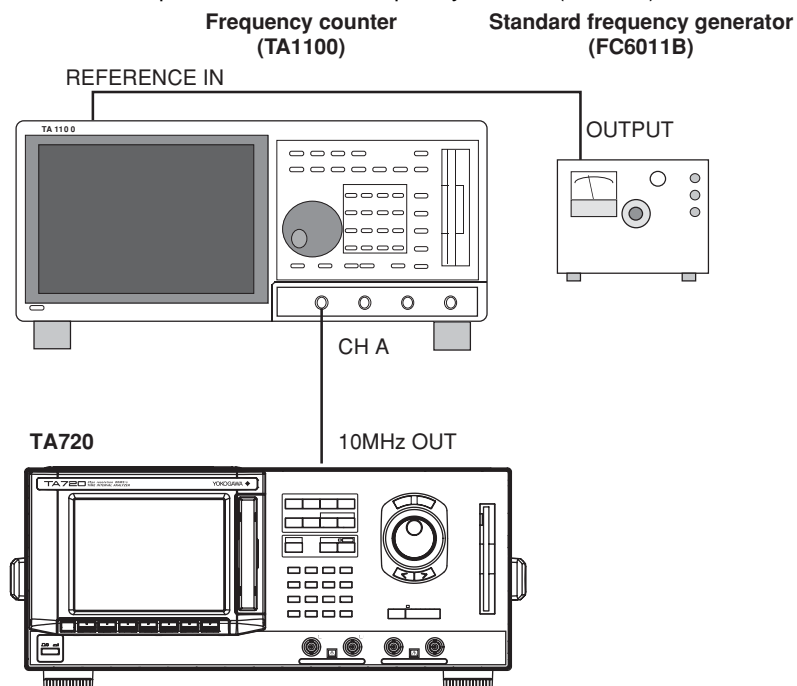
Prepare the following instruments.

- **Standard frequency generator**
 - Frequency accuracy: 0.1 ppm or better
 - Recommended instrument: FC6011B Rb Atomic Oscillator (by Fujitsu), or HP5065A (by Agilent Technologies)
- **Frequency counter**
 - Frequency resolution: 1 Hz or better
 - Recommended instrument: TA1100 Time Interval Analyzer (by YOKOGAWA)

The procedure for adjusting the time base (reference clock) using the recommended instruments is described below.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the standard frequency generator to the REFERENCE IN (rear panel) terminal of the frequency counter (TA1100) and measure using the external reference frequency.
- Using a BNC cable, connect the 10MHz OUT terminal on the rear panel of the TA720 to the CH A input terminal of the frequency counter (TA1100).



14.5 Adjusting the Time Base

Instrument Settings

- TA720: None
- TA1100:
 - Function: Frequency A
 - Gate time: 1 ms
 - Number of samples: 1
 - Sampling mode: FREE
 - Display: NUMERIC
 - Input Setting CH A: DC coupling, ATT=OFF, 50 Ω , trigger level = 0 V
 - REFERENCE: EXTERNAL
 - Rb atomic oscillator: None

Adjustment Procedure

- Adjust the TA720 after 30 minutes of warm-up.
- Turn the REFERENCE ADJUST on the rear panel of the TA720, and adjust it so that the read-out value of the frequency counter is within the following range.
9.999995 MHz to 10.000005 MHz (10 MHz \pm 5 Hz, within \pm 0.5 ppm)

14.6 Performance Test



CAUTION

- Do not apply a voltage exceeding the maximum input voltage to the input terminal of each instrument. This may cause damage to the input section.
- Do not apply external voltage to the output terminals of instruments. This may cause damage to the internal circuitry.

Testing the Trigger Voltage Accuracy

Instruments Required

Prepare the following instruments.

DC voltage generator

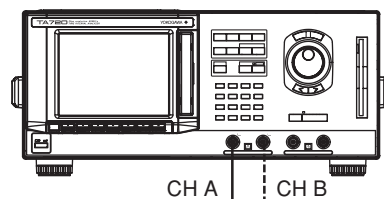
- Voltage accuracy: 1 mV or better
- Recommended instrument: 7651 programmable DC voltage/current source (by YOKOGAWA)

The procedure for testing the trigger voltage accuracy using the recommended instruments is described below.

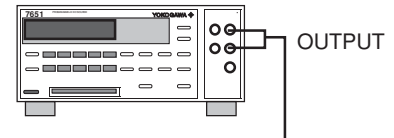
Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the DC voltage generator to the input terminal (CH A/CH B) of the TA720.

TA720



DC voltage generator (7651)



Instrument Settings

- TA720: Input settings: DC coupling, 1 M Ω , trigger level = 0 V
- 7651: Output level: 4.000 V, 0 V, -4.000 V

Test Method

- Calibrate the TA720 after 30 minutes of warm-up.
- This test compares the applied DC voltage to the trigger level (slice level) set by the TA720 and checks the error in the trigger level.
- The actual detection of the trigger level is done by monitoring the input indicator of the TA720.

Test Procedure

1. Connect the output of the 7651 to TA720 CH A.
2. Set the output level of the 7651 to 4.000 V.
3. Set the trigger level of the TA720 to 4.100 V.
4. Set the TA720 in the measurement start condition.
5. Decrease the trigger level of the TA720 in 5-mV steps. Gradually decrease the trigger level and record the voltage at which the input indicator illuminates as VL.
6. Set the trigger level of the TA720 to 3.900 V.

14.6 Performance Test

7. Increase the trigger level of the TA720 in 5-mV steps. Gradually increase the trigger level and record the voltage at which the input indicator illuminates as VH.
8. The trigger voltage is derived by taking the average of VL and VH. Confirm that this voltage is within the allowable range.
$$VTRIG = (VL + VH)/2$$
9. Perform similar tests by setting the output of the DC voltage generator to 0.000 V and -4.000 V.
10. Repeat steps 1 to 9 for CH B.

Test Result

- CH A

| Voltage of the 7651 | VL | VH | VTRIG | Allowable Range |
|---------------------|----|----|-------|----------------------|
| 4.000 V | | | | 3.950 V to 4.050 V |
| 0.000 V | | | | -0.010 V to 0.010 V |
| -4.000 V | | | | -4.050 V to -3.950 V |

- CH B

| Voltage of the 7651 | VL | VH | VTRIG | Allowable Range |
|---------------------|----|----|-------|----------------------|
| 4.000 V | | | | 3.950 V to 4.050 V |
| 0.000 V | | | | -0.010 V to 0.010 V |
| -4.000 V | | | | -4.050 V to -3.950 V |

Note

If noise is present due to the influence from the outside environment, connect a 1- μ F capacitor between the signal line and ground.

Testing the Input Sensitivity

Instruments Required

Prepare the following instruments.

Synthesized signal generator

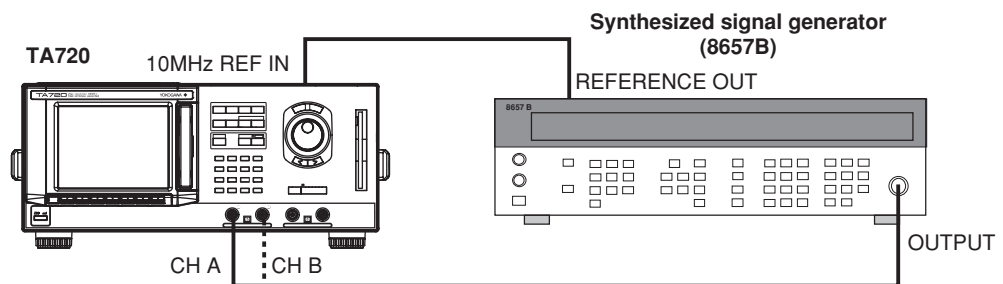
- Frequency range: 10 MHz to 170 MHz or higher
- Output level: 720 mV_{rms} or higher
- Output level accuracy: 0.15 dB or better
- Recommended instrument: 8657B Synthesized signal generator or equivalent (by Agilent Technologies)

The procedure for testing the input sensitivity using the recommended instruments is described below.

When using the recommended instruments, calibrate the instruments so that the output level accuracy is 0.15 dB or better.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the synthesized signal generator to the input terminal (CH A/CH B) of the TA720.



Instrument Settings

- TA720
 - Sampling mode: Hardware histogram mode
 - Input settings: DC coupling, 50 Ω (both CH A and CH B), trigger level = 0 V
 - Function: Period A, B
 - Gate: Event, 1000000
 - Reference: External
 - X Center, X Span:

| Input Frequency | X Center | X Span |
|-----------------|----------|--------|
| 10 MHz | 100 ns | 15 ns |
| 166.6 MHz | 6 ns | 15 ns |

- Y High: 10⁶
- 8657B
 - Frequency: 10 MHz, 166.6 MHz
 - Level: 35 mV_{rms}

Test Method

- Test the TA720 after 30 minutes of warm-up.
- Set the frequency of the 8657B to the values given in the table below, and check that the measured values (mean value and standard deviation) are within the allowable range using the period measurement function on the TA720. Perform the same test on both CH A and CH B.

14.6 Performance Test

Test Result

- CH A↑

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|--|----------------|---------------------|--------------------|-----------------|
| Generator Frequency | | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | | 99.7 ns to 100.3 ns | | 280 ps or less |
| 166.6 MHz | | | 5.7 ns to 6.3 ns | | 120 ps or less |

- CH A↓

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|--|----------------|---------------------|--------------------|-----------------|
| Generator Frequency | | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | | 99.7 ns to 100.3 ns | | 280 ps or less |
| 166.6 MHz | | | 5.7 ns to 6.3 ns | | 120 ps or less |

- CH B↑

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|--|----------------|---------------------|--------------------|-----------------|
| Generator Frequency | | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | | 99.7 ns to 100.3 ns | | 280 ps or less |
| 166.6 MHz | | | 5.7 ns to 6.3 ns | | 120 ps or less |

- CH B↓

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|--|----------------|---------------------|--------------------|-----------------|
| Generator Frequency | | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | | 99.7 ns to 100.3 ns | | 280 ps or less |
| 166.6 MHz | | | 5.7 ns to 6.3 ns | | 120 ps or less |

When the results of all the tests above are within the allowable range, the input sensitivity is taken to be 100 mVpp.

Testing the Frequency Measurement

Instruments Required

Prepare the following instruments.

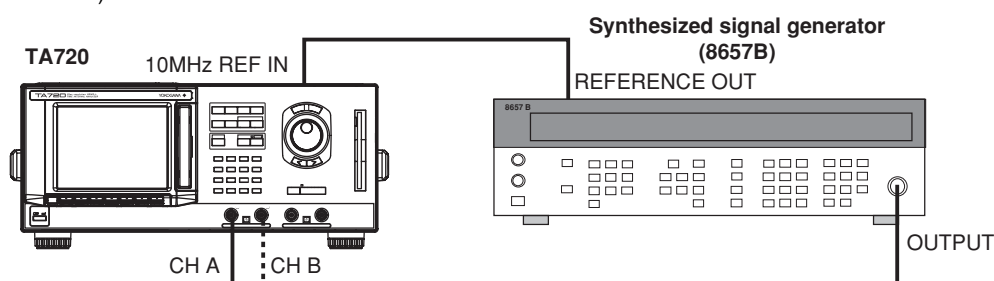
Synthesized signal generator

- Frequency range: 10 MHz to 170 MHz or higher
- Output level: 720 mV_{rms} or higher
- Output level accuracy: 1.5 dB or better
- Recommended instrument: 8657B Synthesized signal generator or equivalent (by Agilent Technologies)

The procedure for testing the frequency measurement using the recommended instruments is described below.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the synthesized signal generator to the input terminal (CH A/CH B) of the TA720.



Instrument Settings

- TA720
 - Sampling mode: Hardware histogram mode
 - Input settings: DC coupling, 50 Ω (both CH A and CH B), trigger level = 0 V
 - Function: Period A, B
 - Gate: Event, 1000000
 - Reference: External
 - X Center, X Span:

| Input Frequency | X Center | X Span |
|-----------------|----------|--------|
| 10 MHz | 100 ns | 15 ns |
| 166.6 MHz | 6 ns | 15 ns |

- Y High: 10⁶
- 8657B
 - Frequency: 10 MHz, 166.6 MHz
 - Level: 360 mV_{rms}

Test Method

- Test the TA720 after 30 minutes of warm-up.
- Set the frequency of the 8657B to the values given in the table below, and check that the measured values (mean value and standard deviation) are within the allowable range using the period measurement function on the TA720. Perform the same test on both CH A and CH B.

14.6 Performance Test

Test Result

- CH A↑

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|----------------|---------------------|----------------|--------------------|--|
| Generator Frequency | Measured Value | Allowable Range | Measured value | Allowable Range | |
| 10 MHz | | 99.7 ns to 100.3 ns | | 120 ps or less | |
| 166.6 MHz | | 5.7 ns to 6.3 ns | | 100 ps or less | |

- CH A↓

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|----------------|---------------------|----------------|--------------------|--|
| Generator Frequency | Measured Value | Allowable Range | Measured value | Allowable Range | |
| 10 MHz | | 99.7 ns to 100.3 ns | | 120 ps or less | |
| 166.6 MHz | | 5.7 ns to 6.3 ns | | 100 ps or less | |

- CH B↑

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|----------------|---------------------|----------------|--------------------|--|
| Generator Frequency | Measured Value | Allowable Range | Measured value | Allowable Range | |
| 10 MHz | | 99.7 ns to 100.3 ns | | 120 ps or less | |
| 166.6 MHz | | 5.7 ns to 6.3 ns | | 100 ps or less | |

- CH B↓

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|----------------|---------------------|----------------|--------------------|--|
| Generator Frequency | Measured Value | Allowable Range | Measured value | Allowable Range | |
| 10 MHz | | 99.7 ns to 100.3 ns | | 120 ps or less | |
| 166.6 MHz | | 5.7 ns to 6.3 ns | | 100 ps or less | |

Testing the Pulse Width Measurement

Instruments Required

Prepare the following instruments.

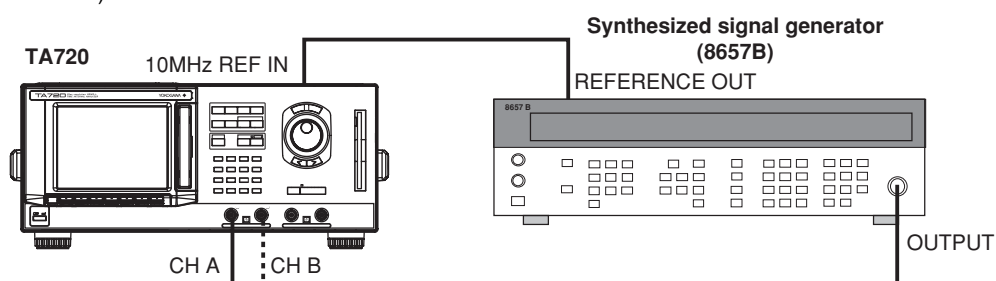
Synthesized signal generator

- Frequency range: 10 MHz to 90 MHz or higher
- Output level: 720 mV_{rms} or higher
- Output level accuracy: 1.5 dB or better
- Recommended instrument: 8657B Synthesized signal generator or equivalent (by Agilent Technologies)

The procedure for testing the pulse width measurement using the recommended instruments is described below.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the synthesized signal generator to the input terminal (CH A/CH B) of the TA720.



Instrument Settings

- TA720
 - Sampling mode: Hardware histogram mode
 - Input settings: DC coupling, 50 Ω (both CH A and CH B), trigger level = 0 V
 - Function: Pulse width A, B
 - Gate: Event, 1000000
 - Reference: External
 - X Center, X Span:

| Input Frequency | X Center | X Span |
|-----------------|----------|--------|
| 10 MHz | 50 ns | 15 ns |
| 83.3 MHz | 6 ns | 15 ns |

- Y High: 10⁶
- 8657B
 - Frequency: 10 MHz, 83.3 MHz
 - Level: 360 mV_{rms}

Test Method

- Test the TA720 after 30 minutes of warm-up.
- Set the frequency of the 8657B to the values given in the table below, and check that the measured values (mean value and standard deviation) are within the allowable range using the pulse width measurement function on the TA720. Perform the same test on both CH A and CH B.

14.6 Performance Test

Test Result

- CH A 

| Synthesized Signal | | | | |
|---------------------|----------------|--------------------|--------------------|-----------------|
| Generator Frequency | Average | | Standard Deviation | |
| | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | 48.4 ns to 51.6 ns | | 120 ps or less |
| 83.3 MHz | | 5.0 ns to 7.0 ns | | 100 ps or less |

- CH A 

| Synthesized Signal | | | | |
|---------------------|----------------|--------------------|--------------------|-----------------|
| Generator Frequency | Average | | Standard Deviation | |
| | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | 48.4 ns to 51.6 ns | | 120 ps or less |
| 83.3 MHz | | 5.0 ns to 7.0 ns | | 100 ps or less |

- CH B 

| Synthesized Signal | | | | |
|---------------------|----------------|--------------------|--------------------|-----------------|
| Generator Frequency | Average | | Standard Deviation | |
| | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | 48.4 ns to 51.6 ns | | 120 ps or less |
| 83.3 MHz | | 5.0 ns to 7.0 ns | | 100 ps or less |

- CH B 

| Synthesized Signal | | | | |
|---------------------|----------------|--------------------|--------------------|-----------------|
| Generator Frequency | Average | | Standard Deviation | |
| | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | 48.4 ns to 51.6 ns | | 120 ps or less |
| 83.3 MHz | | 5.0 ns to 7.0 ns | | 100 ps or less |

Testing the A-to-B Time Interval Measurement

Instruments Required

Prepare the following instruments.

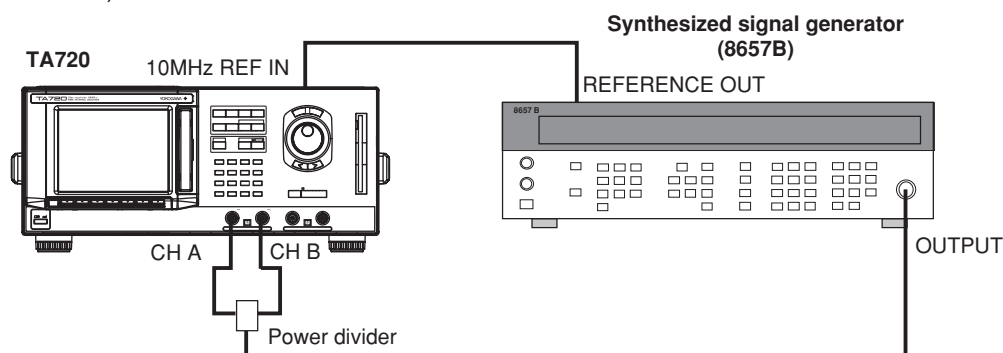
Synthesized signal generator

- Frequency range: 10 MHz to 170 MHz or higher
- Output level: 720 mV_{rms} or higher
- Output level accuracy: 1.5 dB or better
- Recommended instrument: 8657B Synthesized signal generator or equivalent (by Agilent Technologies)
- Power divider
 - Characteristic impedance: 50 Ω
 - Recommended instrument: 70-0966 Power Divider (by YOKOGAWA)

The procedure for testing the A-to-B time interval measurement using the recommended instruments is described below.

Connecting the Instruments

- Check that the power switch is turned OFF on all instruments before connecting the instruments.
- Connect the output of the synthesized signal generator to the input terminal (CH A/CH B) of the TA720.



Instrument Settings

- TA720
 - Sampling mode: Hardware histogram mode
 - Input settings: DC coupling, 50 Ω (both CH A and CH B), trigger level = 0 V
 - Function: A-to-B time interval
 - Gate: Event, 1000000
 - Reference: External
 - X Center, X Span:
 - A↑B↑ or A↓B↓ with CH B delay of 2.5 ns

| Input Frequency | X Center | X Span |
|-----------------|----------|--------|
| 10 MHz | 2 ns | 15 ns |
| 166.6 MHz | 2 ns | 15 ns |

- A↑B↓ or A↓B↑ with CH B delay of 0 ns

| Input Frequency | X Center | X Span |
|-----------------|----------|--------|
| 10 MHz | 50 ns | 15 ns |
| 166.6 MHz | 3 ns | 15 ns |

- Y High: 10⁶
- 8657B
 - Frequency: 10 MHz, 166.6 MHz
 - Level: 720 mV_{rms}

14.6 Performance Test

Test Method

- Test the TA720 after 30 minutes of warm-up.
- Set the frequency of the 8657B to the values given in the table below, and check that the measured values (mean value and standard deviation) are within the allowable range using the A-to-B time interval measurement function on the TA720.

Test Result

- A↑B↑

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|--|----------------|------------------|--------------------|-----------------|
| Generator Frequency | | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | | 0.9 ns to 4.1 ns | | 120 ps or less |
| 166.6 MHz | | | 1.5 ns to 3.5 ns | | 100 ps or less |

- A↓B↓

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|--|----------------|------------------|--------------------|-----------------|
| Generator Frequency | | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | | 0.9 ns to 4.1 ns | | 120 ps or less |
| 166.6 MHz | | | 1.5 ns to 3.5 ns | | 100 ps or less |

- A↑B↓

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|--|----------------|--------------------|--------------------|-----------------|
| Generator Frequency | | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | | 48.4 ns to 51.6 ns | | 120 ps or less |
| 166.6 MHz | | | 2.0 ns to 4.0 ns | | 100 ps or less |

- A↓B↑

| Synthesized Signal | | Average | | Standard Deviation | |
|---------------------|--|----------------|--------------------|--------------------|-----------------|
| Generator Frequency | | Measured Value | Allowable Range | Measured value | Allowable Range |
| 10 MHz | | | 48.4 ns to 51.6 ns | | 120 ps or less |
| 166.6 MHz | | | 2.0 ns to 4.0 ns | | 100 ps or less |

14.7 Replacing the Power Fuse



WARNING

- To prevent the possibility of fire, only use a fuse with the specified rating (current, voltage, and type).
- When replacing a fuse, turn OFF the power switch and unplug the power cord.
- Never short the fuse holder.

Specified Rating

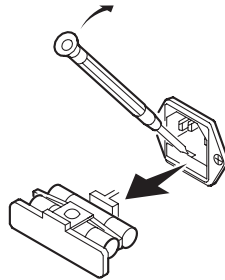
The TA720 uses the following power fuse.

- Maximum rated voltage: 250 V
- Maximum rated current: 3.15 A
- Type: Time lag
- Standard: UL/VDE certified
- Part No.: A1351EF

Replacement Procedure

Replace the power fuse according to the procedure below.

1. Turn OFF the power switch.
2. Remove the power cord from the power connector.
3. Insert the tip of a flat-blade screw driver in the dented section of the fuse holder on the power connector side, turn it in the direction of the arrow, and remove the fuse holder.
4. Remove the blown fuse that is attached to the tip of the fuse holder.
5. Attach a new fuse to the fuse holder and attach the fuse holder back in the original place.



Note

The fuse inside the case cannot be replaced by the user. If you believe the fuse inside the case is blown, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual. The ratings of the fuse that is used inside the case are shown below.

| Location | Maximum Rated Voltage | Maximum Rated Current | Type | Standard |
|-------------|-----------------------|-----------------------|----------|----------------------------|
| Motherboard | 250 V | 6.3 A | Time lag | VDE/SEMKO/ UL certified |

14.8 Recommended Replacement Parts

The one-year warranty applies only to the main unit of the instrument (starting from the day of delivery) and does not cover any other items nor expendable items (items which wear out). The replacement period for expendable items varies depending on the conditions of use. Refer to the table below as a general guideline. Contact your nearest YOKOGAWA dealer for replacement parts.

| Parts Name | Recommended Replacement Period |
|----------------------------------|--|
| Built-in printer | Under normal usage, 120 rolls of paper (part No.: B9850NX) |
| LCD backlight | 3 years |
| Cooling fan | 3 years |
| Backup battery (lithium battery) | 3 years |

15.1 Signal Input and Trigger

| Item | Specifications |
|---|--|
| Number of input channels | 2 (CH A and CH B) |
| Input coupling | DC/AC |
| Input connector | BNC connector |
| Input impedance | 50Ω/1 MΩ, 23pF (typical value ^{*1}) |
| Frequency characteristics | <ul style="list-style-type: none"> When the input coupling is DC: DC to 250 MHz (typical value^{*1}) When the input coupling is AC and <ul style="list-style-type: none"> Input impedance is 50 Ω: 680 kHz to 250 MHz (typical value^{*1}) Input impedance is 1 MΩ: 35 Hz to 250 MHz (typical value^{*1}) |
| Internal jitter | 100 ps rms |
| Minimum input pulse width | 3 ns (2.2 ns for CH B when measuring A-to-B time interval) |
| Operating voltage range | -5 to 5 V |
| Maximum input voltage | <ul style="list-style-type: none"> When the input impedance is 50 Ω: 5 V_{rms} When the input impedance is 1 MΩ and <ul style="list-style-type: none"> DC ≤ input frequency ≤ 100 kHz: 40 V (DC+AC_{peak}) 100 kHz ≤ input frequency ≤ 100 MHz: {3.5/f+5} V (DC+AC_{peak}), where f is the frequency in MHz Overvoltage category: I and II |
| Input sensitivity ^{*2} | 100 mV _{p-p} |
| Input amplifier noise | 400μV _{rms} (typical value ^{*1}) |
| Cross talk when using the dual measurement function ^{*3} | -40 dB (typical value ^{*1}) |
| Trigger | <ul style="list-style-type: none"> Trigger mode: Select from single auto trigger, repeat auto trigger, and manual trigger. Trigger level (when using manual trigger) <ul style="list-style-type: none"> Selectable range: -5 to 5 V Accuracy^{*4}: ±(10 mV + 1% of the specified value) Resolution: 1 mV Trigger level (when using single auto trigger or repeat auto trigger) <ul style="list-style-type: none"> Selectable range: 0% to 100% Resolution: 1% Input condition when using single auto trigger or repeat auto trigger: Continuous signal between 1 kHz and 50 MHz Setup time of single auto trigger and repeat auto trigger: 0.7 s (typical value^{*1}) |
| Phase Adjustment | Function used to adjust the phase difference of CH B with respect to CH A when measuring A-to-B time interval, period A & A-to-B time interval, or pulse width A & A-to-B time interval Selectable range: 0 to 10.0 ns (resolution: 0.1 ns) |
| Sampling | <ul style="list-style-type: none"> Sampling mode: Select from time stamp mode, hardware histogram mode, and inter-symbol interference analysis mode Maximum sample rate <ul style="list-style-type: none"> When using the single measurement function^{*5}: 80 MS/s continuous (12.5 ns interval) When using the dual measurement function^{*3}: 50 MS/s continuous (20 ns interval) Maximum sample size (maximum number of data points) <ul style="list-style-type: none"> When in time stamp mode or inter-symbol interference analysis mode: 1,024,000 (512,000 when using the dual measurement function^{*3}) When in hardware histogram mode: 10⁹ Sampling interval (setting only when using the single measurement function^{*5} in time stamp mode) <ul style="list-style-type: none"> 0μs to 1 s (resolution: 1 μs) Maximum sample rate when 0 μs is selected Longest sampling time <ul style="list-style-type: none"> When in time stamp mode or inter-symbol interference analysis mode: 320 s (time from when arming is activated) When in hardware histogram mode: 3200 s (time from when arming is activated) |
| Update rate ^{*1} | 400 ms (hardware histogram mode) Update rate when the sampling size (event size) is 1000 and period of a 1-MHz sine wave is measured. |

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

*2 Measured value under standard operating conditions with input coupling set to DC and input impedance set to 50 Ω after the warm-up time has elapsed.

*3 Period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, pulse width A & pulse width B, pulse width A→A-to-B time interval, or pulse width A→pulse width B measurement.

*4 Measured value under standard operating conditions with input coupling set to DC and input impedance set to 1 MΩ after the warm-up time has elapsed.

*5 Period, A-to-B time interval, or pulse width measurement.

15.2 Measurement Functions (Measurement Items)

| Item | Specifications |
|----------------------------------|--|
| Measurement function | <ul style="list-style-type: none"> When in time stamp mode or hardware histogram mode <ul style="list-style-type: none"> Single measurement function Period, A-to-B time interval, and pulse width Dual measurement function Period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, and pulse width A & pulse width B When in inter-symbol interference analysis mode <ul style="list-style-type: none"> Single measurement function Pulse width Dual measurement function Pulse width A→A-to-B time interval and pulse width A→pulse width B |
| Display resolution | <ul style="list-style-type: none"> When in time stamp mode: 25 ps When in hardware histogram mode, inter-symbol interference analysis mode, or time stamp mode when using multi window display: 25 ps or (X span of the histogram/600) whichever is greater |
| Period measurement | <ul style="list-style-type: none"> Measurement range <ul style="list-style-type: none"> When in time stamp mode: 6 ns to 20 ms When in hardware histogram mode: 6 ns to 3.2 μs Measurement resolution ±100 ps rms^{*1} ±√2 × trigger error^{*2} Accuracy^{*3} Measurement resolution ± (frequency stability of the time base × measured value) ± 300-ps systematic error Slope: Select from ↑ or ↓ |
| A-to-B time interval measurement | <ul style="list-style-type: none"> Measurement range <ul style="list-style-type: none"> When in time stamp mode: 0 ns to 20 ms When in hardware histogram mode: 0 ns to 3.2 μs Measurement resolution <ul style="list-style-type: none"> When the slope is set to A↑B↑, A↓B↑, A↑B↓, or A↓B↓: ±100 ps rms^{*1} ± A input trigger error^{*2} ± B input trigger error^{*2} When the slope is set to A↑B↑ or A↓B↓: ±100 ps rms^{*1} ± A input trigger error^{*2} ± B input trigger error^{*2} ± trigger level timing error^{*4} Accuracy^{*3} <ul style="list-style-type: none"> When the slope is set to A↑B↑, A↓B↑, A↑B↓, or A↓B↓: Measurement resolution ± trigger level timing error ± (frequency stability of the time base × measured value) ± 1-ns systematic error When the slope is set to A↑B↑ or A↓B↓: Measurement resolution ± (frequency stability of the time base × measured value) ± 1-ns systematic error Slope: Select from A↑B↑/A↓B↑, A↓B↑, A↑B↓, A↓B↓, and A↑B↓ Continuous measurement condition: The time to the next A signal edge after the A-to-B time interval measurement is greater than equal to 0 ns and the time from the previous A signal edge is greater than or equal to 12.5 ns |

*1 100 ps rms or the display resolution whichever is greater when in hardware histogram mode, inter-symbol interference analysis mode, or time stamp mode using multi window display.

*2 The trigger error, A input trigger error, B input trigger error, rising edge trigger error, and falling edge trigger error defined by the following equation.

$$\frac{\sqrt{X^2 + W^2 + E_n^2}}{SR} \quad X: \text{Input amplifier noise, } W: \text{Cross talk noise (0.01} \times \text{the signal amplitude of the other channel [Vrms])}$$











$$\text{En: Noise in the signal being measured [Vrms], SR: Slew rate of the input signal [V/s]}$$

*3 Measured value under standard operating conditions as described in General Specifications after the warm-up time has elapsed.

*4 The trigger level timing error is defined by the following equation.

$$\pm \left(\frac{8\text{mV}}{\text{Slew rate of the start signal}} - \frac{8\text{mV}}{\text{Slew rate of the stop signal}} \right) \pm \frac{\text{Trigger level setting accuracy}}{\text{Slew rate of the start signal}} \pm \frac{\text{Trigger level setting accuracy}}{\text{Slew rate of the stop signal}}$$

15.2 Measurement Functions (Measurement Items)

| Item | Specifications |
|---|--|
| Pulse width measurement | <ul style="list-style-type: none"> Measurement range <ul style="list-style-type: none"> When in time stamp mode: 6 ns to 20 ms When in hardware histogram mode: 6 ns to 3.2 μs When in inter-symbol interference analysis mode: 10 ns to 3.2 μs Measurement resolution <ul style="list-style-type: none"> When the polarity is set to  or : $\pm 100 \text{ ps rms}^{-1} \text{ rising edge trigger error}^2 \pm \text{falling edge trigger error}^2$ When the polarity is : $\pm 100 \text{ ps rms}^{-1} \text{ rising edge trigger error}^2 \pm \text{falling edge trigger error}^2 \pm \text{trigger level timing error}^3$ Accuracy⁴ <ul style="list-style-type: none"> When the polarity is set to  or : Measurement resolution \pm trigger level timing error \pm (frequency stability of the time base \times measured value) \pm 1-ns systematic error When the polarity is : Measurement resolution \pm (frequency stability of the time base \times measured value) \pm 1-ns systematic error Polarity: Select from , , and  ( only when in inter-symbol interference analysis mode) |
| Period A & period B measurement | <ul style="list-style-type: none"> Measurement range <ul style="list-style-type: none"> When in time stamp mode: 6 ns to 20 ms When in hardware histogram mode: 6 ns to 3.2 μs Measurement resolution $\pm 100 \text{ ps rms}^{-1} \pm \sqrt{2} \times \text{trigger error}^2$ Accuracy⁴ <ul style="list-style-type: none"> Measurement resolution \pm (frequency stability of the time base \times measured value) \pm 300-ps systematic error Slope: Select from A\uparrow&B\uparrow or A\downarrow&B\downarrow |
| Period A & A-to-B time interval measurement | <ul style="list-style-type: none"> Measurement range <ul style="list-style-type: none"> When in time stamp mode <ul style="list-style-type: none"> Period measurement: 6 ns to 20 ms A-to-B time interval measurement: 0 ns to 20 ms When in hardware histogram mode <ul style="list-style-type: none"> Period measurement: 6 ns to 3.2 μs A-to-B time interval measurement: 0 ns to 3.2 μs Measurement resolution <ul style="list-style-type: none"> Period measurement: $\pm 100 \text{ ps rms}^{-1} \pm \sqrt{2} \times \text{trigger error}^2$ A-to-B time interval measurement: $\pm 100 \text{ ps rms}^{-1} \pm \text{A input trigger error}^2 \pm \text{B input trigger error}^2$ Accuracy⁴ <ul style="list-style-type: none"> Period measurement: Measurement resolution \pm (frequency stability of the time base \times measured value) \pm 300-ps systematic error A-to-B time interval measurement: Measurement resolution \pm trigger level timing error \pm (frequency stability of the time base \times measured value) \pm 1-ns systematic error Slope: Select from A\uparrow&A\uparrowB\uparrow or A\downarrow&A\downarrowB\uparrow Continuous A-to-B time interval measurement condition: The time to the next A signal edge after the A-to-B time interval measurement is greater than equal to 13 ns and the time from the previous A signal edge is greater than or equal to 20 ns |

*1 100 ps rms or the display resolution whichever is greater when in hardware histogram mode, inter-symbol interference analysis mode, or time stamp mode using multi window display.

*2 The trigger error, A input trigger error, B input trigger error, rising edge trigger error, and falling edge trigger error defined by the following equation.

























$$\frac{\sqrt{X^2 + W^2 + E_n^2}}{\text{SR}} \quad \begin{array}{l} X: \text{Input amplifier noise, } W: \text{Cross talk noise (} 0.01 \times \text{the signal amplitude of the other channel [Vrms])} \\ E_n: \text{Noise in the signal being measured [Vrms], SR: Slew rate of the input signal [V/s]} \end{array}$$

*3 The trigger level timing error is defined by the following equation.

$$\pm \left(\frac{8\text{mV}}{\text{Slew rate of the start signal}} - \frac{8\text{mV}}{\text{Slew rate of the stop signal}} \right) \pm \frac{\text{Trigger level setting accuracy}}{\text{Slew rate of the start signal}} \pm \frac{\text{Trigger level setting accuracy}}{\text{Slew rate of the stop signal}}$$







*4 Measured value under standard operating conditions as described in General Specifications after the warm-up time has elapsed.

15.2 Measurement Functions (Measurement Items)

| Item | Specifications |
|---|---|
| Pulse A & A-to-B time interval measurement and pulse A→A-to-B time interval measurement | <ul style="list-style-type: none"> Measurement range <ul style="list-style-type: none"> Time stamp mode or inter-symbol interference analysis mode Pulse width measurement: 6 ns to 20 ms, A-to-B time interval measurement: 0 ns to 20 ms Hardware histogram mode Pulse width measurement: 6 ns to 3.2 μs, A-to-B time interval measurement: 0 ns to 3.2 μs Inter-symbol interference analysis mode Pulse width measurement: 10 ns to 3.2 μs, A-to-B time interval measurement: 0 ns to 3.2 μs Measurement resolution <ul style="list-style-type: none"> Pulse width measurement <ul style="list-style-type: none"> When the polarity is set to  or : ±100 ps rms⁻¹ rising edge trigger error^{*2} ± falling edge trigger error^{*2} When the polarity is : ±100 ps rms⁻¹ rising edge trigger error^{*2} ± falling edge trigger error^{*2} ± trigger level timing error^{*3} A-to-B time interval measurement <ul style="list-style-type: none"> When the slope is set to A↑B↑, A↓B↑, A↑B↓, or A↓B↓: ±100 ps rms⁻¹ ± A input trigger error^{*2} ± B input trigger error^{*2} When the slope is set to A↑B↑ or A↓B↓: ±100 ps rms⁻¹ ± A input trigger error^{*2} ± B input trigger error^{*2} ± trigger level timing error^{*3} Accuracy^{*4} <ul style="list-style-type: none"> Pulse width measurement <ul style="list-style-type: none"> When the polarity is set to  or : Measurement resolution ± (frequency stability of the time base × measured value) ± trigger level timing error^{*3} ± 1-ns systematic error When the polarity is : Measurement resolution ± (frequency stability of the time base × measured value) ± 1-ns systematic error A-to-B time interval measurement <ul style="list-style-type: none"> When the slope is set to A↑B↑, A↓B↑, A↑B↓, or A↓B↓: Measurement resolution ± (frequency stability of the time base × measured value) ± trigger level timing error^{*3} ± 1-ns systematic error When the slope is set to A↑B↑ or A↓B↓: Measurement resolution ± (frequency stability of the time base × measured value) ± 1-ns systematic error Polarity/Slope <ul style="list-style-type: none"> When in time stamp mode or hardware histogram mode: Select from  & A↑B↑ and  & A↓B↓ When in inter-symbol interference analysis mode: Select from  & A↑B↑,  & A↓B↓,  & A↑B↓,  & A↓B↑,  & A↓B↓, and  & A↑B↑ Continuous A-to-B time interval measurement condition: The time to the next A signal edge after the A-to-B time interval measurement is greater than equal to 13 ns and the time from the previous A signal edge is greater than or equal to 20 ns |
| Pulse width A & pulse width B measurement and pulse width A→pulse width B measurement | <ul style="list-style-type: none"> Measurement range <ul style="list-style-type: none"> When in time stamp mode: 6 ns to 20 ms When in hardware histogram mode: 6 ns to 3.2 ms When in inter-symbol interference analysis mode: 10 ns to 3.2 μs (20 ns to 3.2 μs for pulse width B) Measurement resolution <ul style="list-style-type: none"> When the polarity is set to  or : ±100 ps rms⁻¹ rising edge trigger error^{*2} ± falling edge trigger error^{*2} When the polarity is : ±100 ps rms⁻¹ rising edge trigger error^{*2} ± falling edge trigger error^{*2} ± trigger level timing error^{*3} Accuracy^{*4} <ul style="list-style-type: none"> When the polarity is set to  or : Measurement resolution ± (frequency stability of the time base × measured value) ± trigger level timing error^{*3} ± 1-ns systematic error When the polarity is : Measurement resolution ± (frequency stability of the time base × measured value) ± 1-ns systematic error Polarity: Select from , , and  ( only when in inter-symbol interference analysis mode) |
| | <p>*1 100 ps rms or the display resolution whichever is greater when in hardware histogram mode, inter-symbol interference analysis mode, or time stamp mode using multi window display.</p> <p>*2 The trigger error, A input trigger error, B input trigger error, rising edge trigger error, and falling edge trigger error defined by the following equation.</p> $\frac{\sqrt{X^2 + W^2 + E_n^2}}{SR}$ <p>X: Input amplifier noise, W: Cross talk noise (0.01 × the signal amplitude of the other channel [Vrms]) En: Noise in the signal being measured [Vrms], SR: Slew rate of the input signal [V/s]</p> <p>*3 The trigger level timing error is defined by the following equation.</p> $\pm \left(\frac{8\text{mV}}{\text{Slew rate of the start signal}} - \frac{8\text{mV}}{\text{Slew rate of the stop signal}} \right) \pm \frac{\text{Trigger level setting accuracy}}{\text{Slew rate of the start signal}} \pm \frac{\text{Trigger level setting accuracy}}{\text{Slew rate of the stop signal}}$ <p>*4 Measured value under standard operating conditions as described in General Specifications after the warm-up time has elapsed.</p> |

15.3 Gate, Arming, and Inhibit

The specifications for inter-symbol interference analysis mode conform to the specifications for time stamp mode.

| Item | Specifications |
|---------|--|
| Gate | <ul style="list-style-type: none"> Gate types: Select from EVENT, TIME, and EXTERNAL When using the dual measurement function^{*2}, the measurement terminates when the gate of each measurement closes. Selectable range of the event size when using event gate (within the longest sampling time) <ul style="list-style-type: none"> Time stamp mode or inter-symbol interference analysis mode <ul style="list-style-type: none"> Single measurement function^{*3}: 2 to 1024000 Dual measurement function^{*2}: 1 to 51200 (for each measurement) Hardware histogram mode <ul style="list-style-type: none"> Single measurement function^{*5}: 2 to 10⁹ Dual measurement function^{*2}: 1 to 10⁹ (for each measurement) Selectable range of gate time when set to time gate (within the maximum event size of each sampling mode) 1 μs \leq gate time \leq 10 s (resolution is 100 ns) Allowable time and polarity when set to external gate Allowable time: 1 μs to 320 s (except within the maximum event size of the sampling mode) Polarity: Select from  and  External gate input (shared with external arming) <ul style="list-style-type: none"> Connector type: BNC Input coupling: DC input impedance: 1 MΩ (typical value^{*1}) Trigger level: TTL (1.4 V), TTL/10 (0.14 V), or 0 V Maximum input voltage: 40 V (DC + AC_{peak}) Minimum input pulse width: 30 ns Setup time: 60 ns (must precede the measurement signal by at least 60 ns for the gate to be valid). |
| Arming | <ul style="list-style-type: none"> Arming source: Select from AUTO and EXT (external) External arming (EXT) setting <ul style="list-style-type: none"> Selectable range of delay time when set to time delay (set the time for each measurement when using the dual measurement function^{*2}) 1 μs \leq delay time \leq 1 s (resolution is 100 ns) Selectable range of the event size when set to event delay (Set the value for each measurement when using period A & period B or pulse width A & pulse width B measurement. Event delay is possible when the frequency of event occurrence is less than or equal to 50 MHz.) 1 to 10⁶ (resolution: 1) Slope: Select from  and  External arming input (shared with external gate) <ul style="list-style-type: none"> Connector type: BNC Input coupling: DC input impedance: 1 MΩ (typical value^{*1}) Trigger level: TTL (1.4 V), TTL/10 (0.14 V), or 0 V Maximum input voltage: 40 V (DC + AC_{peak}) Minimum input pulse width: 30 ns Setup time: 60 ns (must precede the measurement signal by at least 60 ns for the arming to be valid). |
| Inhibit | <ul style="list-style-type: none"> Active time <ul style="list-style-type: none"> When in time stamp mode: 1 μs to 320 s When in hardware histogram mode: 1 μs to 3200 s Polarity: Select from  and  Inhibit input <ul style="list-style-type: none"> Connector type: BNC Input coupling: DC input impedance: 1 MΩ (typical value^{*1}) Trigger level: TTL (1.4 V), TTL/10 (0.14 V), or 0 V Maximum input voltage: 40 V (DC + AC_{peak}) Minimum input pulse width: 30 ns Setup time: 30 ns (must precede the measurement signal by at least 30 ns for the inhibit to be valid). |

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

*2 Period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, pulse width A & pulse width B, pulse width A \rightarrow A-to-B time interval, or pulse width A \rightarrow pulse width B measurement.

*3 Period, A-to-B time interval, or pulse width measurement.

15.4 Block Sampling

| Item | Specifications |
|---|--|
| Selectable range of the number of blocks | <ul style="list-style-type: none"> Time stamp mode <ul style="list-style-type: none"> When the arming source is EXT and the rest mode is OFF or when the arming source is AUTO and the rest mode is event or time: 2 to 250 When the arming source is AUTO and the rest mode is OFF: 2 to 1000 When in hardware histogram mode: 2 to 1000 <p>The total sample size of all blocks is within the maximum sampling size (see page 15-1).</p> |
| Block rest mode | Select from OFF, Time, and Event |
| Selectable range of the block rest time | 1 μ s to 1 s (resolution: 100 ns, accuracy: \pm 200 ns) |
| Selectable range of the block rest event size | 1 to 10 ⁶ (resolution: 1, rest time: 500 ns or more, frequency of event occurrence: 50 MHz or less, accuracy: \pm 1 event) |
| Restriction on use | Cannot be specified when using the dual measurement function ^{*2} , external gate, or when in inter-symbol interference analysis mode. When the rest mode is set to event or time, external arming (EXT) cannot be used. |

*1 Period, A-to-B time interval, or pulse width measurement.

*2 Period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, or pulse width A & pulse width B measurement.

15.5 Inter-symbol Interference Analysis Function

| Item | Specifications |
|---------------------------|--|
| Function | Function used to extract the data around the spaces and marks of the specified condition, display the histogram, and calculate statistics. |
| Measurement Function | Pulse width, pulse width A→A-to-B time interval, pulse width A→pulse width B (Inhibit function cannot be used when using the dual measurement function ^{*1}) |
| Minimum input pulse width | 10 ns (pulse width B is 20 ns) |
| Data extraction mode | Select from Single, Combination and Between |
| Data extraction condition | Select from nT, nT to maxT, and minT to nT (n: arbitrary value between 1 and 16) |
| Trigger | Select mark or space |
| Target | Select the analysis data with respect to the trigger from Prev., Middle, Next, or Both |
| Missed sampling fill | Function used to fill the dropouts in sampling when using the dual measurement function ^{*1} Maximum number of dropout samples that can be filled: 256 Conditions for filling the samples: When the dropout sampling interval is 100 ns or more |
| Sync function | Turn ON/OFF the function which starts the analysis from where the symbol search function found the desired symbol |

*1 Pulse width A→A-to-B time interval or pulse width A→pulse width B measurement

15.6 Display

| Item | Specifications |
|---|--|
| Display | <ul style="list-style-type: none"> Display size: 6.4 inches Display resolution: 640 (H) × 480 (V) dots Display defect: 0.01% or less with respect to all the display dots |
| Display format | <ul style="list-style-type: none"> When in time stamp mode: <ul style="list-style-type: none"> Select from histogram, list, time variation, and statistics displays When in hardware histogram mode <ul style="list-style-type: none"> Select from histogram, list, and statistics displays When in inter-symbol interference analysis mode <ul style="list-style-type: none"> Select histogram or list |
| Selection of the item to be analyzed when using the dual measurement function ^{*1} | <ul style="list-style-type: none"> MEAS1: Displays the measurement result of measurement function 1 MEAS2: Displays the measurement result of measurement function 2 |

*1 Period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, pulse width A & pulse width B, pulse width A→A-to-B time interval, or pulse width A→pulse width B measurement.

| Item | Specifications |
|---|--|
| Histogram display | <ul style="list-style-type: none"> • Scale: Sets the X-axis and Y-axis of the histogram <ul style="list-style-type: none"> • Selectable range of X center (X-axis center) <ul style="list-style-type: none"> When in time stamp mode: -50 ns to 20.000000000 ms (resolution: 25 ps) When in hardware histogram mode: -50 ns to 3.20000000 μs (resolution: 25 ps) • X Span <ul style="list-style-type: none"> When in time stamp mode: Select from 1.5, 3, 7.5, 15, 30, 60, 150, 300, 600ns, 1.5, 3, 6, 15, 30, 60, 150, 300, 600 ms, 1.5, 3, 6, 15, and 30 ms When in hardware histogram mode: Select from 1.5, 3, 7.5, 15, 30, 60, 150, 300, 600 ns, 1.5, 3, 6 μs • Y axis (scale type): Select Lin (linear) or Log (logarithmic) • Y High (Y-axis maximum) <ul style="list-style-type: none"> • When the Y-axis scale is linear: Select from 10, 20, 40, 100, 200, 400, 1000, 2000, 4000, 10000, 20000, 40000, 100000, 200000, 400000, 1e⁶, 1e⁷, 1e⁸, and 1e⁹ • When the Y-axis scale is logarithmic: Select from 1e¹, 1e², 1e³, 1e⁴1e⁵, 1e⁶, 1e⁷, 1e⁸, and 1e⁹ • Readout: Read out the value by positioning the X marker (marker display can be turned ON/OFF) <ul style="list-style-type: none"> Specify the statistical calculation area by specifying a frequency for the Y marker (marker display can be turned ON/OFF) • Statistics display (can be turned ON/OFF) <ul style="list-style-type: none"> • Area: Select the area for performing statistical calculation from Window or Marker <ul style="list-style-type: none"> • A-to-B time interval measurement $A \uparrow B \uparrow$: <ul style="list-style-type: none"> Select the slope from $A \uparrow B \uparrow$, $A \downarrow B \uparrow$, $A \uparrow B \downarrow$, and $A \downarrow B \downarrow$ • A-to-B time interval measurement $A \downarrow B \downarrow$: <ul style="list-style-type: none"> Select the slope from $A \uparrow B \downarrow$, $A \downarrow B \downarrow$, $A \uparrow B \uparrow$, $A \downarrow B \uparrow$ & $A \uparrow B \downarrow$ • Pulse width measurement \overleftrightarrow{A}: Select the polarity from \overleftrightarrow{A}, \overleftrightarrow{A}, \overleftrightarrow{A}, and \overleftrightarrow{A} & \overleftrightarrow{A} • Pulse width A & A-to-B time interval measurement \overleftrightarrow{A} & $A \uparrow B \uparrow$: <ul style="list-style-type: none"> Select from \overleftrightarrow{A} & $A \uparrow B \uparrow$, \overleftrightarrow{A} & $A \downarrow B \uparrow$, \overleftrightarrow{A} & $A \uparrow B \downarrow$, \overleftrightarrow{A} & $A \downarrow B \downarrow$, \overleftrightarrow{A} & $A \uparrow B \uparrow$, \overleftrightarrow{A} & $A \downarrow B \uparrow$, \overleftrightarrow{A} & $A \uparrow B \downarrow$, and \overleftrightarrow{A} & $A \downarrow B \downarrow$ • Pulse width A & A-to-B time interval measurement \overleftrightarrow{A} & $A \downarrow B \downarrow$: <ul style="list-style-type: none"> Select from \overleftrightarrow{A} & $A \uparrow B \downarrow$, \overleftrightarrow{A} & $A \downarrow B \downarrow$, \overleftrightarrow{A} & $A \uparrow B \uparrow$, \overleftrightarrow{A} & $A \downarrow B \uparrow$, \overleftrightarrow{A} & $A \uparrow B \downarrow$, and \overleftrightarrow{A} & $A \downarrow B \downarrow$ • Pulse width A & pulse width B measurement: <ul style="list-style-type: none"> Select from \overleftrightarrow{A} & \overleftrightarrow{B}, \overleftrightarrow{A} & \overleftrightarrow{B}, \overleftrightarrow{A} & \overleftrightarrow{B}, \overleftrightarrow{A} & \overleftrightarrow{B}, \overleftrightarrow{A} & \overleftrightarrow{B}, and \overleftrightarrow{A} & \overleftrightarrow{B} • Selectable range of T Value (T value of statistical calculation: 1 ns to 250 ns (resolution: 25 ps) • Multi window: Data analysis of multiple histograms <ul style="list-style-type: none"> Selectable range of window size: 1 to 14 • Auto window: Automatic data analysis of multiple histograms • Histogram sum (only when using the multi window or auto window) <ul style="list-style-type: none"> Sums the frequencies of all specified windows for each bin around the X-axis center of each window • Display style <ul style="list-style-type: none"> Switch the graph size between half and full, turn ON/OFF the statistics display, turn ON/OFF the panorama display, turn ON/OFF the both polarities/both edges graph (Both Graph), and turn ON/OFF the overlap of each polarity graph Select Stat, Dev, or σ when in hardware histogram mode or time stamp mode using the all display of the multi window or auto window |
| Time variation display (only when in time stamp mode) | <ul style="list-style-type: none"> • Scale: Sets the X-axis and Y-axis of the time variation. <ul style="list-style-type: none"> • Selectable range of X Min (X-axis minimum): 0 to 320.0000000 s (resolution: 100 ns) • Selectable range of X Span: Select from 6, 12, 30, 60, 120, 300, 600 μs, 1.2, 3, 6, 12, 30, 60, 120, 300, 600 ms, 6, 12, 30, 60, 120, 300, and 600 s • Selectable range of Y Center (Y-axis center): -50 ns to 20.000000000 ms (resolution: 25 ps) • Y Span: Select from 500 p, 1, 2.5, 5, 10, 20, 50, 100, 200, 500 ns, 1, 2, 5, 10, 20, 50, 100, 200, 500 μs, 1, 2, 5, 10, and 20 ms • Readout: Read the value by positioning the X and Y markers • Statistics display (can be turned ON/OFF) <ul style="list-style-type: none"> Area: Select the area for performing statistical calculation from Window, Marker, and Block • Display style <ul style="list-style-type: none"> Switch the graph size between half and full, turn ON/OFF the statistics display, turn ON/OFF the panorama display, turn ON/OFF the overlap of measured waveforms (when using the dual measurement function^{*1}), select the display waveform (MEAS1, MEAS2, or MEAS1 & MEAS2) • Display parameters: Turn ON/OFF the grid and interpolation, switch the plot mark between Pixel and Mark • Time resolution of the X-axis (time stamp): 100 ns |
| List display | <ul style="list-style-type: none"> • When in time stamp mode or inter-symbol interference analysis mode <ul style="list-style-type: none"> • Lists the time stamps, corresponding measured values, and symbols • Can be displayed for each block when block sampling is used • Display data scrolling • Symbol search function available (forward and backward search) <ul style="list-style-type: none"> Number of symbols to be searched: Select from 1 to 4 • When in hardware histogram mode <ul style="list-style-type: none"> • Lists the measured values (median values) and corresponding frequencies • Display data scrolling |

*1 Period A & period B, period A & A-to-B time interval, pulse width A & A-to-B time interval, or pulse width A & pulse width B

15.6 Display/15.7 Auto Window Function/15.8 Rear Panel Input/Output

| Item | Specifications |
|--------------------|---|
| Statistics display | <ul style="list-style-type: none"> When in time stamp mode <ul style="list-style-type: none"> When the calculated item is histogram Statistical calculation parameters: Average, Maximum, Minimum, Peak-Peak, σ, σ/Average, σ/T, Deviation, Deviation/T, Median, Mode, Number When calculation item is time variation Statistical calculation parameters: T.Average, T.Maximum, T.Minimum, T.Peak-Peak, T.σ, T.(σ/Average), T.(P-P/Average), T.RF, and T.Number When in hardware histogram mode <ul style="list-style-type: none"> Statistical calculation parameters: Average, Maximum, Minimum, Peak-Peak, σ, σ/Average, σ/T, Deviation, Deviation/T, Median, Mode, Number |

15.7 Auto Window Function

| Item | Specifications |
|-----------------------------|---|
| Function | Measures T. Value and automatically sets the size, scale, and area of each window according to the modulation type |
| Modulation type | EFM, EFM+, and 1-7 |
| T. Value calculation method | Measured T: Automatically sets the constant T value from the average value of the CH B clock input signal (T resolution: 25 ps) |
| Operation Condition | Estimated T: Estimates the constant T value from the input signal and modulation type. Measured T: CH B input 1025 cycles or more Estimated T: Data rate 80 MS/s or less, sampling time 1.6 s or less (when measuring pulse width or A-to-B time interval) Data rate 50 MS/s or less, sampling time 1.6 s or less (when measuring pulse width A & A-to-B time interval, pulse width A & pulse width B) |
| T measurement range | 7 ns to 250 ns |

15.8 Rear Panel Input/Output

| Item | Specifications |
|----------------------------|--|
| Reference input | Connector type: BNC Input coupling: AC Input impedance: 1 k Ω or more Input frequency range: 10 MHz \pm 10 Hz Input level: 1 V _{p-p} or higher Maximum input voltage: \pm 10 V |
| 10-MHz output | Connector type: BNC Output coupling: AC Output impedance: 50 Ω (typical value ^{*1}) Output frequency: 10 MHz (typical value ^{*1}) Output level ^{*2} : 1 V _{p-p} or higher |
| Monitor output (CH A/CH B) | Connector type: BNC Output impedance: 50 Ω (typical value ^{*1}) Output level ^{*2} : Approx. 1/4 the input signal (\pm 5 V or less) |
| Probe power terminal | Number of output terminals: 2 (Usable probe: FET probe (700939)) Output voltage: \pm 12 V |
| Gate output | Connector type: BNC Output level: TTL |

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

*2 Level when the input impedance on the receiving side is 50 Ω .

15.9 GP-IB Interface

| Item | Specifications |
|--|--|
| Interface | GP-IB |
| Electrical and mechanical specifications | Conforms to IEEE St'd 488-1978 (JIS C 1901-1987). |
| Mechanical specifications | SH1, AH1, T6, L4, SR1, RL1 PP0, DC1, DT1, C0 |
| Protocol | Conforms to IEEE St'd 488.2-1992 |
| Code | ISO (ASCII) code |
| Mode | Addressable mode |
| Address | 0 to 30 |
| Clear remote mode | Remote mode can be cleared using the LOCAL (SHIFT+AUTO SCALE) key (except during Local Lockout). |

15.10 Time Base

| Item | Specifications |
|------------------------------|---|
| Internal reference frequency | Temperature-compensated crystal oscillator, 10 MHz |
| Frequency stability | Aging rate: ± 1.5 ppm/year Temperature characteristics: 2.5 ppm in the range of 5 to 40°C with 25°C as the reference. Frequency accuracy at factory shipment: ± 0.5 ppm |
| External adjustment | Possible |

15.11 Internal Memory Function

| Item | Specifications |
|------|--|
| | 32 sets of setup parameters can be stored/recalled to/from the non-volatile memory |

15.12 Built-in Printer

| Item | Specifications |
|-----------------|-------------------------|
| Printing system | Thermal line dot system |
| Dot density | 8 dots/mm |
| Paper width | 112 mm |
| Printing width | 104 mm |

15.13 Built-in Floppy Disk Drive

| Item | Specifications |
|------------------|---------------------------------------|
| Drive type | 3.5-inch floppy disk type |
| Number of drives | 1 |
| Format type | 720 KB or 1.44 MB (MS-DOS compatible) |

15.14 PC Card Drive (Optional)

| Item | Specifications |
|-----------------|---|
| Number of slots | 1 |
| Supported cards | Flash ATA memory card (PC card TYPE II) |

15.15 Ethernet Communications (Optional)

| Item | Specifications |
|--|---|
| Communication port | 1 |
| Electrical and mechanical specifications | Conforms to IEEE802.3 |
| Transmission system | Ethernet (10BASE-T) |
| Transmission rate | 10 M bps |
| Communication protocol | TCP/IP |
| Supported services | FTP server, FTP client (network drive), DHCP, DNS |
| Connector type | RJ-45 connector |

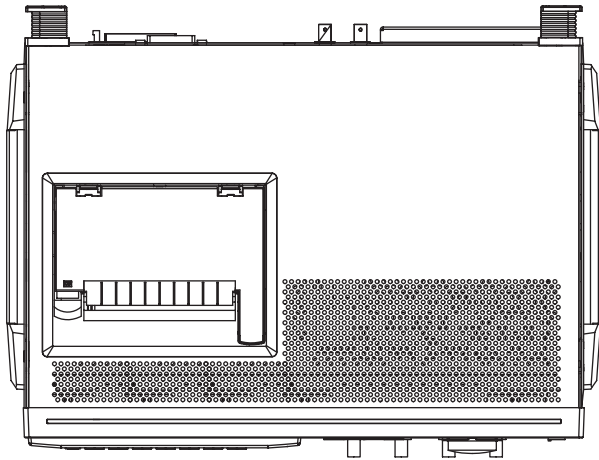
15.16 General Specifications

| Item | Specifications |
|--|--|
| Electrical and mechanical specifications | <ul style="list-style-type: none">• Ambient temperature: $23 \pm 5^{\circ}\text{C}$• Ambient humidity: $50 \pm 10\% \text{ RH}$• Supply voltage/frequency error: Within 1% of rating |
| Operating altitude | 2,000 m or less |
| Warming up | Approx. 30 minutes |
| Storage conditions | <ul style="list-style-type: none">• Temperature: -20 to 60°C• Humidity: 20 to 80%RH (no condensation) |
| Operating conditions | <ul style="list-style-type: none">• Temperature: 5 to 40°C• Humidity: 20 to 80%RH (no condensation) |
| Rated supply voltage | 100 to 120 VAC, 200 to 240 VAC |
| Permitted supply voltage range | 90 to 132 VAC, 180 to 264 VAC |
| Rated supply voltage frequency | 50/60 Hz |
| Permitted supply voltage frequency range | 48 to 63Hz |
| Maximum power consumption | 250 VA |
| Withstanding voltage | 1.5 kVAC, 10 mA or less for one minute (between power supply and case) |
| Insulation resistance | 500 VDC, 10 M Ω or more (between power supply and case) |
| Signal ground | The ground of all input and output connectors is connected to the case ground. |
| External dimensions | Approx. 426 (W) \times 177 (H) \times 300 (D) mm (projections excluded) |
| Weight | Approx. 12 kg (main unit only) |
| Cooling method | Forced air cooling |
| Installation position | Horizontal (stacking prohibited) |
| Battery backup | Setup parameters and time are backed up using the internal lithium battery. |
| Fuse ^{*1} | Maximum rated voltage: 250 V, maximum rated current: 3.15 A, type: time lag, standard: UL/VDE certified Part number: A1351EF |
| Standard accessories | Power cord (1), rubber feet (4), printer roll paper, user's manual (this manual) (1), communication interface user's manual (1) |

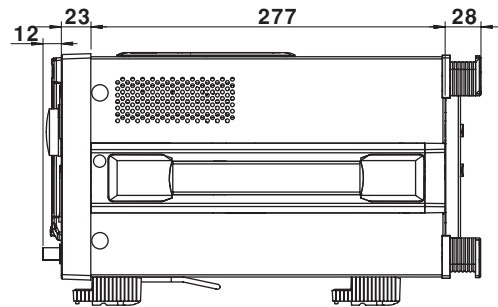
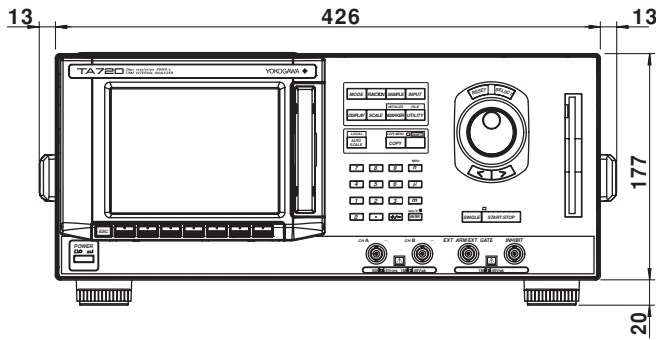
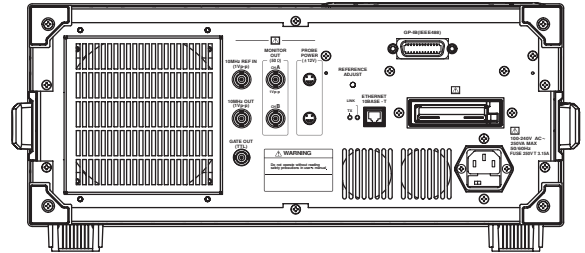
*1 There is also another fuse inside the unit, but the user cannot replace it. If you believe the fuse inside the unit is blown, contact your nearest YOKOGAWA dealer as listed on the back cover of this manual.

15.17 External Dimensions

Unit: mm



Rear View



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

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