

PX8000

Precision Power Scope

U S E R ' S M A N U A L

Features Guide

Thank you for purchasing the PX8000 Precision Power Scope (hereinafter, "PX8000" will refer to this products). This manual contains useful information about the features of the PX8000. To ensure correct use, please read this manual thoroughly before beginning operation.

Keep this manual in a safe place for quick reference in the event a question arises.

List of Manuals

The following four manuals, including this one, are provided as manuals for the PX8000. Read them along with this manual.

Manual Title	Manual No.	Description
PX8000 Precision Power Scope Features Guide	IM PX8000-01EN	This manual. This manual explains all the PX8000 features other than the communication interface features.
PX8000 Precision Power Scope User's Manual	IM PX8000-02EN	The manual explains how to operate the PX8000.
PX8000 Precision Power Scope Getting Started Guide	IM PX8000-03EN	Provided as a printed manual. The guide explains the handling precautions, basic operations, and specifications of the PX8000.
PX8000 Precision Power Scope Communication Interface User's Manual	IM PX8000-17EN	The manual explains the PX8000 communication interface features and instructions on how to use them.
Model PX8000 Precision Power Scope	IM PX8000-92Z1	Document for China

The "EN" and "Z1" in the manual number is the language code.

PDF files of all the manuals above are included in the accompanying manual CD.

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

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

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions. The figures given in this manual may differ from the actual screen.
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1 Items That This Instrument Can Measure

The following tables show the items that this product can measure (measurement functions).

In the tables, “Element” and “Wiring Unit” indicate the following:

- Element: Element1, Element2, Element3, Element4
- Wiring unit: ΣA , ΣB

However, the elements and wiring units that you can measure vary depending on how many elements are installed in the PX8000.



- For details about how the values of the measurement functions are determined, see appendix 1 in the features guide, IM PX8000-01EN.
- For explanations of the terms measurement function, element, and wiring unit, see “What Is a Measurement Function?”

[▶ See here.](#)

In the tables, “Yes” and “No” indicate the following:

- Yes: Measured value available
- No: Measured value not available

Measurement Functions Used in Normal Measurement

Voltage

Function	Description	Element	Wiring Unit
Urms	True rms voltage	Yes	Yes
Umn	Rectified mean voltage calibrated to the rms value	Yes	Yes
Udc	Simple voltage average	Yes	Yes
Urmn	Rectified mean voltage	Yes	Yes
Uac	AC voltage component	Yes	Yes
U+pk	Maximum voltage	Yes	No
U-pk	Minimum voltage	Yes	No
CfU	Voltage crest factor	Yes	No

Current

Function	Description	Element	Wiring Unit
Irms	True rms current	Yes	Yes
Imn	Rectified mean current calibrated to the rms value	Yes	Yes
Idc	Simple current average	Yes	Yes
Irmn	Rectified mean current	Yes	Yes
Iac	AC current component	Yes	Yes
I+pk	Maximum current	Yes	No
I-pk	Minimum current	Yes	No
CfI	Current crest factor	Yes	No

Power

Function	Description	Element	Wiring Unit
P	Active power	Yes	Yes
S	Apparent power	Yes	Yes
Q	Reactive power	Yes	Yes
λ	Power factor	Yes	Yes
ϕ	Phase difference	Yes	Yes
Pc	Corrected Power	Yes	Yes
P+pk	Maximum power	Yes	No
P-pk	Minimum power	Yes	No

Frequency

Function	Description	Element	Wiring Unit
fU	Voltage frequency	Yes	No
fI	Current frequency	Yes	No
fPLL	Frequency of PLL ¹	No	No

1 On models with the harmonic measurement option.

Efficiency

Function	Description
η_1 to η_4	Efficiency

User-Defined Functions

Function	Description
F1 to F20	User-defined functions

Harmonic Measurement Functions (Option)

Function	Description	Element	Wiring Unit
U(k)	Rms voltage of harmonic order k	Yes	Yes
I(k)	Rms current of harmonic order k	Yes	Yes
P(k)	Active power of harmonic order k	Yes	Yes
S(k)	Apparent power of harmonic order k	Yes	Yes
Q(k)	Reactive power of harmonic order k	Yes	Yes
$\lambda(k)$	Power factor of harmonic order k	Yes	Yes
$\Phi(k)$	Phase difference between the voltage and current of harmonic order k.	Yes	No
$\Phi U(k)$	Phase difference between the fundamental signal, U(1), and harmonic voltage U(k)	Yes	No
$\Phi I(k)$	Phase difference between the fundamental signal, I(1), and harmonic current I(k)	Yes	No
Z(k)	Impedance of the load circuit	Yes	No
Rs(k)	Series resistance of the load circuit	Yes	No
Xs(k)	Series reactance of the load circuit	Yes	No
Rp(k)	Parallel resistance of the load circuit	Yes	No
Xp(k)	Parallel reactance of the load circuit	Yes	No
Uhdf(k)	Harmonic voltage distortion factor	Yes	No
Ihdf(k)	Harmonic current distortion factor	Yes	No
Phdf(k)	Harmonic active power distortion factor	Yes	No
Uthd	Total harmonic voltage distortion	Yes	No
Ithd	Total harmonic current distortion	Yes	No
Pthd	Total harmonic active power distortion	Yes	No
Uthf	Telephone harmonic factor of the voltage	Yes	No
Ithf	Telephone harmonic factor of the current	Yes	No
Utif	Telephone influence factor of the voltage	Yes	No
Itif	Telephone influence factor of the current	Yes	No
hvf	Harmonic voltage factor	Yes	No
hcf	Harmonic current factor	Yes	No
K-factor	K factor	Yes	No
$\Phi U_i - U_j^1$	Phase difference between the fundamental voltage of element i, $U_i(1)$, and the fundamental voltage of element j, $U_j(1)$.	No	Yes
$\Phi U_i - U_k^1$	Phase difference between $U_i(1)$ and the fundamental voltage of element k, $U_k(1)$	No	Yes
$\Phi U_i - I_i^1$	Phase difference between $U_i(1)$ and the fundamental current of element i, $I_i(1)$	Yes ²	Yes
$\Phi U_j - I_j^1$	Phase difference between $U_j(1)$ and the fundamental current of element j, $I_j(1)$	No	Yes
$\Phi U_k - I_k^1$	Phase difference between $U_k(1)$ and the fundamental current of element k, $I_k(1)$	No	Yes
$\Phi I_i - I_j^1$	Phase difference between $I_i(1)$ and the fundamental current of element j, $I_j(1)$	No	Yes
$\Phi I_j - I_k^1$	Phase difference between $I_j(1)$ and the fundamental current of element k, $I_k(1)$	No	Yes
$\Phi I_k - I_i^1$	Phase difference between $I_k(1)$ and the fundamental current of element i, $I_i(1)$	No	Yes

1 Items That This Instrument Can Measure

- 1 i, j, and k are element numbers. For example, when the number of elements in wiring unit ΣA is three and the wiring system of elements 1, 2, and 3 is three phase, four wire, i is 1, j is 2, and k is 3. $\Phi U_i - U_j$ represents $\Phi U_1 - U_2$, the difference between the fundamental voltage signal of element 1, $U_1(1)$, and the fundamental voltage signal of element 2, $U_2(1)$. In the same way $\Phi U_i - U_k$, $\Phi U_i - I_i$, $\Phi U_j - I_j$, and $\Phi U_k - I_k$ represent to $\Phi U_1 - U_3$, $\Phi U_1 - I_1$, $\Phi U_2 - I_2$, and $\Phi U_3 - I_3$, respectively.
- 2 Setting i to an element, is the same as setting k to 1 in $\Phi(k)$.

Harmonic Measurement Function Orders

The harmonic orders that you can specify are indicated below.

Element Harmonic Measurement Functions

Measurement Function	Characters or Numbers in Parentheses			
	Total	0 (DC)	1	k
U()	Yes	Yes	Yes	2 to 500
I()	Yes	Yes	Yes	2 to 500
P()	Yes	Yes	Yes	2 to 500
S()	Yes	Yes	Yes	2 to 500
Q()	Yes	Fixed at 0	Yes	2 to 500
λ ()	Yes	Yes	Yes	2 to 500
Φ ()	Yes	No	Yes	2 to 500
ΦU ()	No	No	No	2 to 500
ΦI ()	No	No	No	2 to 500
Z()	No	Yes	Yes	2 to 500
R_s ()	No	Yes	Yes	2 to 500
X_s ()	No	Yes	Yes	2 to 500
R_p ()	No	Yes	Yes	2 to 500
X_p ()	No	Yes	Yes	2 to 500
Uhdf()	No	Yes	Yes	2 to 500
Ihdf()	No	Yes	Yes	2 to 500
Phdf()	No	Yes	Yes	2 to 500
Uthd	Yes	No	No	No
Ithd	Yes	No	No	No
Pthd	Yes	No	No	No
Uthf	Yes	No	No	No
Ithf	Yes	No	No	No
Utif	Yes	No	No	No
Itif	Yes	No	No	No
hvf	Yes	No	No	No
hcf	Yes	No	No	No
K-factor	Yes	No	No	No

Functions with parentheses will produce different values depending on which of the following is contained in their parentheses.

- Total: Total value (The total value of all harmonic components from the minimum order to N.*)
For information about how the value is determined, see appendix 1 in the features guide, IM PX8000-01EN.
 - 0(DC): DC value
 - 1: Fundamental harmonic value
 - k: The value of any order from 2 to N.*
- * N is the maximum measurable order. The maximum measurable harmonic order is the smallest of the three orders listed below.
- The specified maximum measurable harmonic order
 - The value determined automatically according to the PLL source frequency (see section 7.5 in the getting started guide, IM PX8000-03EN)

Wiring Unit Harmonic Measurement Functions (Σ functions)

Measurement Function	Characters or Numbers in Parentheses	
	Total	1
U Σ ()	Yes	Yes
I Σ ()	Yes	Yes
P Σ ()	Yes	Yes
S Σ ()	Yes	Yes
Q Σ ()	Yes	Yes
$\lambda\Sigma$ ()	Yes	Yes

Functions with parentheses will produce different values depending on which of the following is contained in their parentheses.

- Total: Total value
- 1: Fundamental harmonic value

Delta Computation Functions

Function	Description
$\Delta U1$	The values returned by the delta computation functions vary depending on the specified delta computation type.
$\Delta U2$	
$\Delta U3$	
$\Delta U\Sigma$	
ΔI	
$\Delta P1$	
$\Delta P2$	
$\Delta P3$	
$\Delta P\Sigma$	

For details about delta computation functions, see “Delta Computation (Δ Measure).”

► [See here.](#)

Auxiliary Input Measurement Functions

When Motor Mode Is Disabled

Function	Description
Aux	Auxiliary input

When Motor Mode Is Enabled

Function	Description
Aux(Speed)	Motor rotating speed
Aux(Torque)	Motor torque
Pm	Mechanical output of the motor (mechanical power)

Synchronous speed and slip can be computed using the user-defined function (User Defined Function) of numeric computation. For details see “User-Defined Functions (User Defined Function)” of numeric computation.

► [See here.](#)

What Is a Measurement Function?

Measurement Function

The physical values (such as rms voltage, average current, power, and phase difference) that the PX8000 measures and displays are called measurement functions. Each measurement function is displayed using symbols that correspond to its physical value. For example, “Urms” corresponds to the true rms voltage.

Input Module

Signal input devices that are installed in the side panel of the PX8000 are called input modules. There are four types of input modules: 760811 (voltage module), 760812/760813 (current modules), and 760851 (AUX module). The combination of the 760811 (voltage module) and the 760812 (current module), or the combination of the 760811 (voltage module) and the 760813 (current module) is called a power measurement element.

Power Measurement Element (Element)

Power measurement element refers to a set of input modules that can receive a single phase of voltage and current to be measured. Power measurement element is called element for short. The PX8000 can contain up to four elements, numbered from 1 to 4. An element number is appended to the measurement function symbol for the measured data that the PX8000 displays, so that you can tell which data belongs to which element. For example, “Urms1” corresponds to the true rms voltage of element 1.

Wiring System

You can specify five wiring systems on the PX8000 to measure the power of various single-phase and three-phase power transmission systems: single-phase, two-wire; single-phase, three-wire; three-phase, three-wire; three-phase, four-wire; and three-phase, three-wire with three-voltage, three-current method.

Wiring Unit

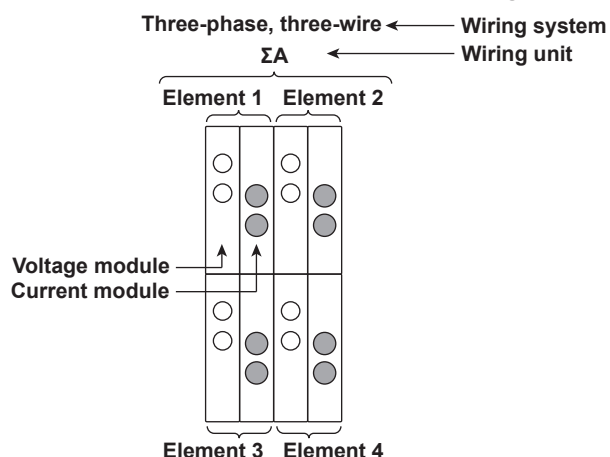
The wiring unit is a set of two or three elements of the same wiring system that are grouped to measure three-phase power. There can be up to two wiring units: ΣA and ΣB .

Σ Functions

The measurement function of a wiring unit is called a Σ function.

For example, “Urms ΣA ” corresponds to the average of the voltages of the elements that are assigned to the wiring unit ΣA . The average value represents the true rms value.

Illustration of modules installed in the PX8000 (right side panel)



Measurement Period

For information about the measurement period for computing measurement functions, see “Synchronization Source (Sync Source)” under “Fundamental Measurement Conditions.”

► [See here.](#)

2 Fundamental Measurement Conditions

Wiring System Settings (WIRING)

The wiring system settings are listed below.

- [Wiring System \(Wiring\)](#)
- [Efficiency Equation \(\$\eta\$ Formula\)](#)
- [Independent Element Configuration \(Element Independent\)](#)
- [Delta Computation \(\$\Delta\$ Measure\)](#)
- [External Current Sensor Range Display Type \(Sensor Range Display Type\)](#)
- [Deskewing the Transfer Time Difference between Input Signals \(Deskew Setup\)](#)

Wiring System (Wiring)

There are five wiring systems available on the PX8000. The selectable wiring systems vary depending on the number of installed elements.

- 1P2W: Single-phase, two-wire system
- 1P3W: Single-phase, three-wire system
- 3P3W: Three-phase, three-wire system
- 3P4W: Three-phase, four-wire system
- 3P3W(3V3A): Three-voltage, three-current method

Wiring Unit

Wiring units are sets of two or three elements of the same wiring system that are grouped together. You can define up to two wiring units: ΣA and ΣB .

- When there is one wiring unit, that unit is ΣA . You cannot make ΣB the first wiring unit.
- When there are two wiring units, those units are ΣA and ΣB .
- When there are multiple wiring units, element numbers are assigned to them in ascending order. The element numbers are assigned to ΣA and then ΣB .
- Wiring units are composed of elements that are next to each other. Wiring units cannot consist of elements that are not next to each other.

Σ Functions

The measurement function of a wiring unit is called a Σ function.

For example, “Urms ΣA ” corresponds to the average of the voltages of the elements that are assigned to the wiring unit ΣA . The average value represents the true rms value.

Wiring System Combinations

The following tables provide the wiring system combinations that you can use and the elements that you can assign to wiring system ΣA or ΣB depending on the number of installed elements.

For details about the relationship between wiring systems and how the values of the measurement functions are determined, see appendix 1 in the features guide, IM PX8000-01EN.

2 Fundamental Measurement Conditions

Element	1
Wiring system combination	1P2W

Element	1	2
Wiring system combination	1P2W	1P2W
	1P3W or 3P3W:ΣA	

Element	1	2	3
Wiring system combination	1P2W	1P2W	1P2W
	1P3W or 3P3W:ΣA		1P2W
	1P2W	1P3W or 3P3W:ΣA	
	3P4W or 3P3W:ΣA		

Element	1	2	3	4
Wiring system combination	1P2W	1P2W	1P2W	1P2W
	1P3W or 3P3W:ΣA		1P2W	1P2W
	1P2W	1P3W or 3P3W:ΣA		1P2W
	1P2W	1P2W	1P3W or 3P3W:ΣA	
	1P3W or 3P3W:ΣA		1P3W or 3P3W:ΣB	
	3P4W or 3P3W:ΣA			1P2W
	1P2W	3P4W or 3P3W:ΣA		



Select the wiring system to match the actual wiring of the circuit under measurement. The method in which the Σ functions (wiring unit measurement functions) are determined varies depending on the wiring system. If the selected wiring system does not match the wiring of the actual circuit, measurements and computation will not be correct.

Wiring System Display

The wiring system configuration is displayed on the right side of the screen. Because it is displayed behind the menu, to view it, you need to press the ESC key to hide the menu. The figure below shows wiring system display examples for a model with four elements installed.

When the wiring systems of elements 1 to 4 are set to single-phase, two-wire

Element 1
U1 100V
I1 5A
Sync Src: [I1]
Element 2
U2 100V
I2 5A
Sync Src: [I1]
Element 3
U3 100V
I3 5A
Sync Src: [I3]
Element 4
U4 100V
I4 5A
Sync Src: [I4]

When the wiring system of elements 1 and 2 is set to three-phase, three-wire and the wiring system of elements 3 and 4 is set to three-phase, three-wire

Σ A(3P3W)
Element 1
U1 100V
I1 5A
Sync Src: [I1]
Element 2
U2 100V
I2 5A
Sync Src: [I1]
Σ B(3P3W)
Element 3
U3 100V
I3 5A
Sync Src: [I3]
Element 4
U4 100V
I4 5A
Sync Src: [I3]

Wiring unit and system

The elements that compose the wiring unit are shown in the frame.

Wiring unit and system

The elements that compose the wiring unit are shown in the frame.

Settings of Elements Grouped in a Wiring Unit

If [independent element configuration](#) is off and a wiring system other than 1P2W is selected when the measurement range or valid synchronization source settings of each element are different, these settings are changed in the manner described below:

- The measurement range is set to the greatest of the measurement ranges of the elements assigned to the same wiring unit. The external current sensor input range has precedence over the direct input current range.
- The auto range on/off settings are changed to match the setting of the element whose measurement range is highest. If multiple elements are set to a common highest measurement range, the setting of the element with the smallest element number takes precedence.
- The synchronization source for a wiring unit is set to the element whose number is the smallest of the elements in the unit.

Efficiency Equation (η Formula)

You can create an efficiency equation by combining measurement function symbols. The PX8000 can determine the energy conversion efficiency of the device using the numeric values of the measurement functions.

$\eta 1$ to $\eta 4$

You can create four efficiency equations ($\eta 1$ to $\eta 4$), using the following measurement functions as operands.

- The active powers of each element (P1 to P4)
- The active powers of the Σ functions (P Σ A or P Σ B)
- The motor output (Pm; on models with the AUX module)
- Udef1 and Udef2

Udef1 and Udef2

To add active powers and motor output and use them in $\eta 1$ to $\eta 4$, use Udef1 and Udef2. You can add up to four operands consisting of the measurement functions listed above.

Equation Examples

- **Efficiency of a Single-Phase, Two-Wire Input/Single-Phase, Two-Wire Output Device**

Input: Power of element 1 (P1)

Output: Power of element 2 (P2)

Efficiency equation: $P2/P1 \times 100$ (%)



- **Efficiency of a Single-Phase, Two-Wire Input/Three-Phase, Three-Wire Output Device**

Input: Power of element 1 (P1)

Output: Σ power of elements 2 and 3 (P Σ A)

Efficiency equation: $P\Sigma A/P1 \times 100$ (%)

- **Efficiency of a Three-Phase, Three-Wire Input/Three-Phase, Three-Wire Output Device**

Input: Σ power of elements 1 and 2 (P Σ A)

Output: Σ power of elements 3 and 4 (P Σ B)

Efficiency equation: $P\Sigma B/P\Sigma A \times 100$ (%)

- **Efficiency of a Motor with a Single-Phase, Two-Wire Input**

Input: Power of element 1 (P1)

Output: Motor output (Pm)

Efficiency equation: $Pm/P1 \times 100$ (%)

- **Efficiency of a Motor with a Three-Phase, Three-Wire Input**

Input: Σ power of elements 1 and 2 (P Σ A)

Output: Motor output (Pm)

Efficiency equation: $Pm/P\Sigma A \times 100$ (%)



To correctly compute the efficiency, set the power coefficients of all elements so that all power units used in the computation are the same. For example, the efficiency cannot be computed correctly if elements or wiring units used in the computation have different power units, such as W (watt) and J (joule).

Independent Element Configuration (Element Independent)

In the wiring system settings, you can select whether to set the measurement range or sync source of elements in the same wiring unit collectively or independently.

Turning Independent Element Configuration On or Off

- If both types of current modules, the 760812 and 760813, are installed in the PX8000, independent element configuration is fixed to ON.
- If only a single type of current module, 760812 or 760813, is installed in the PX8000, you can set independent element configuration to ON or OFF.

For example, assume that the wiring system on a model with three elements is set as follows:

Elements 1 to 3: Three-phase, four-wire system (3P4W). Elements 1 to 3 are assigned to a single wiring unit ΣA .

- ON

The measurement range and sync source can be set independently for each element included in a wiring unit.

- OFF

The measurement range and sync source of elements 1 to 3 are set to the same setting. This is convenient because when you are measuring a three-phase device, you can set the range and sync source settings of all elements included in a wiring unit simultaneously.

Settings That Are Shared between Elements When Independent Element Configuration Is Turned Off

- Measurement range (including auto range on or off)
- Direct current input or external current sensor input
- Synchronization source

Settings That Can Be Configured Independently Even When Independent Element Configuration Is Turned Off

- External current sensor conversion ratio
- Scaling (turning scaling on and off, VT ratio, CT ratio, and power coefficient)
- Input filters (line filter and frequency filter)

These settings can be configured independently for each element regardless of whether independent element configuration is turned on or off.

How Settings Are Aligned When You Turn Independent Element Configuration from On to Off

When independent element configuration is switched from on to off, the measurement range and sync source settings of each element in a wiring unit (ΣA or ΣB) are changed as follows:

- The measurement range is set to the greatest of the measurement ranges of the elements assigned to the same wiring unit. The external current sensor input range has precedence over the direct input current range.
- The auto range on/off settings are changed to match the setting of the element whose measurement range is highest. If multiple elements are set to a common highest measurement range, the setting of the element with the smallest element number takes precedence.
- The synchronization source for a wiring unit is set to the element whose number is the smallest of the elements in the unit.

Delta Computation (Δ Measure)

The sum or difference of the instantaneous voltage or current values (sampled data) between the elements in a wiring unit can be used to determine various types of data such as the differential voltage and phase voltage. This operation is called delta computation.

Types of Delta Computation (Δ Measure Type)

The following types of delta computation are available:

- Differential voltage and differential current (Difference)
- Line voltage and phase current (3P3W > 3V3A)
- Star-delta transformation (Star>Delta)
- Delta-star transformation (Delta>Star)

The delta computation types that you can select vary as indicated below according to the wiring system.

Wiring System	Delta Computation Type
1P3W	Difference, 3P3W>3V3A
3P3W	Difference, 3P3W>3V3A
3P4W	Star>Delta
3P3W(3V3A)	Delta>Star

• Differential Voltage and Differential Current (Difference)

The differential voltage and differential current between two elements can be computed on a single-phase, three-wire system or on a three-phase, three-wire system.

When you perform delta computation on wiring unit ΣA , the available measurement functions are as follows.

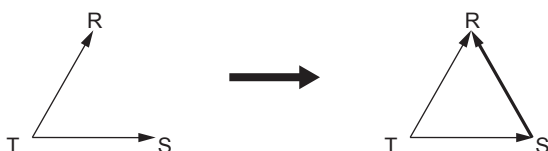
$\Delta U1_{rms}[U_{diffA}]$, $\Delta U1_{mn}[U_{diffA}]$, $\Delta U1_{dc}[U_{diffA}]$, $\Delta U1_{rmn}[U_{diffA}]$, $\Delta U1_{ac}[U_{diffA}]$

$\Delta I_{rms}[I_{diffA}]$, $\Delta I_{mn}[I_{diffA}]$, $\Delta I_{dc}[I_{diffA}]$, $\Delta I_{rmn}[I_{diffA}]$, $\Delta I_{ac}[I_{diffA}]$

* In the measurement functions, *rms*, *mn(mean)*, *dc*, *rmn(r-mean)*, and *ac* are the delta computation modes. A indicates the wiring unit.

• Line Voltage and Phase Current (3P3W > 3V3A)

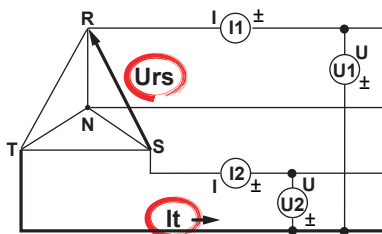
You can compute unmeasured line voltages and phase currents by converting the data of a three-phase, three-wire system to the data of the three-voltage, three-current method (3V3A).



When you perform delta computation on wiring unit ΣA , the available measurement functions are as follows.

$\Delta U1_{rms}[U_{rsA}]$, $\Delta U1_{mn}[U_{rsA}]$, $\Delta U1_{dc}[U_{rsA}]$, $\Delta U1_{rmn}[U_{rsA}]$, $\Delta U1_{ac}[U_{rsA}]$

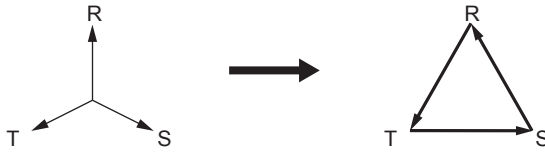
$\Delta I_{rms}[I_{tA}]$, $\Delta I_{mn}[I_{tA}]$, $\Delta I_{dc}[I_{tA}]$, $\Delta I_{rmn}[I_{tA}]$, $\Delta I_{ac}[I_{tA}]$



* In the measurement functions, *rms*, *mn(mean)*, *dc*, *rmn(r-mean)*, and *ac* are the delta computation modes. A indicates the wiring unit.

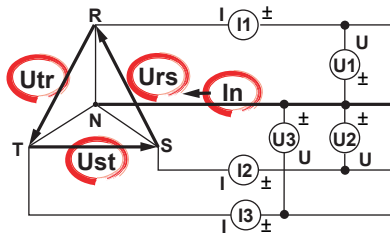
- **Star-delta transformation (Star>Delta)**

You can use the data from a three-phase, four-wire system to compute the data of a delta connection from the data of a star connection.



When you perform delta computation on wiring unit ΣA , the available measurement functions are as follows.

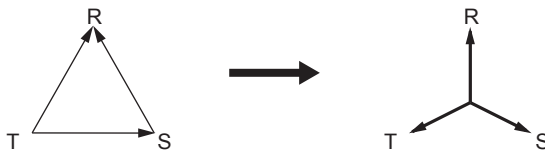
$\Delta U1rms[UrsA]$, $\Delta U1mn[UrsA]$, $\Delta U1dc[UrsA]$, $\Delta U1rmn[UrsA]$, $\Delta U1ac[UrsA]$
 $\Delta U2rms[UstA]$, $\Delta U2mn[UstA]$, $\Delta U2dc[UstA]$, $\Delta U2rmn[UstA]$, $\Delta U2ac[UstA]$
 $\Delta U3rms[UtrA]$, $\Delta U3mn[UtrA]$, $\Delta U3dc[UtrA]$, $\Delta U3rmn[UtrA]$, $\Delta U3ac[UtrA]$
 $\Delta U\Sigma rms[U\Sigma A]$, $\Delta U\Sigma mn[U\Sigma A]$, $\Delta U\Sigma dc[U\Sigma A]$, $\Delta U\Sigma rmn[U\Sigma A]$, $\Delta U\Sigma ac[U\Sigma A]$
 $\Delta Irms[InA]$, $\Delta Imn[InA]$, $\Delta Idc[InA]$, $\Delta Irmn[InA]$, $\Delta Iac[InA]$



* In the measurement functions, *rms*, *mn(mean)*, *dc*, *rmn(r-mean)*, and *ac* are the delta computation modes. A indicates the wiring unit.

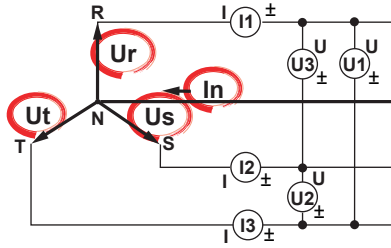
- **Delta-star transformation (Delta>Star)**

Using the data from a three-phase, three-wire system that uses a three-voltage, three-current method, you can compute the data of a star connection from the data of a delta connection. This function is useful when you wish to observe the phase voltage of an object that has no neutral line, such as a motor. The center N of the star connection is computed as the center of the delta connection. If the actual center of the star connection does not match the center of the delta connection, an error results.



When you perform delta computation on wiring unit ΣA , the available measurement functions are as follows.

$\Delta U1rms[UrA]$, $\Delta U1mn[UrA]$, $\Delta U1dc[UrA]$, $\Delta U1rmn[UrA]$, $\Delta U1ac[UrA]$
 $\Delta U2rms[UsA]$, $\Delta U2mn[UsA]$, $\Delta U2dc[UsA]$, $\Delta U2rmn[UsA]$, $\Delta U2ac[UsA]$
 $\Delta U3rms[UtA]$, $\Delta U3mn[UtA]$, $\Delta U3dc[UtA]$, $\Delta U3rmn[UtA]$, $\Delta U3ac[UtA]$
 $\Delta U\Sigma rms[U\Sigma A]$, $\Delta U\Sigma mn[U\Sigma A]$, $\Delta U\Sigma dc[U\Sigma A]$, $\Delta U\Sigma rmn[U\Sigma A]$, $\Delta U\Sigma ac[U\Sigma A]$
 $\Delta Irms[InA]$, $\Delta Imn[InA]$, $\Delta Idc[InA]$, $\Delta Irmn[InA]$, $\Delta Iac[InA]$
 $\Delta P1[PrA]$
 $\Delta P2[PsA]$
 $\Delta P3[PtA]$
 $\Delta P\Sigma [P\Sigma A]$



* In the measurement functions, *rms*, *mn(mean)*, *dc*, *rmn(r-mean)*, and *ac* are the delta computation modes. A indicates the wiring unit.

For information about equations, see appendix 1 in the features guide, IM PX8000-01EN.

For information about the measurement period, see “Synchronization Source.”

► [See here.](#)

Delta Computation Modes (Δ Measure Mode)

You can select the voltage or current mode to be displayed as delta computation values from the following:
rms, mean, dc, r-mean, ac



- We recommend that you set the measurement range and scaling (VT/CT ratio and coefficients) of the elements that are undergoing delta computation as closely as possible. Using different measurement ranges or scaling causes the measurement resolutions of the sampled data to be different. This results in errors.
- The numbers (1, 2, and 3) that are attached to delta computation measurement function symbols have no relation to the element numbers. The computation of all delta measurement functions, from $\Delta U1$ to $\Delta P\Sigma$, varies depending on the wiring system and the delta computation type. For details, see appendix 1 in the features guide, IM PX8000-01EN.
- When only one element is installed in the PX8000, this feature cannot be used, and its settings do not appear.
- Delta computation cannot be performed on a single-phase, two-wire (1P2W) wiring system.

External Current Sensor Range Display Type (Sensor Range Display Type)

- This menu appears when a 760812 (current module) is installed in the PX8000.
You can select the external current sensor range display type from the following options.
 - DIRECT (direct input value display)
Values are displayed within the external current sensor range (voltage). This setting is useful when you want to set the external current sensor range using the voltage received by the PX8000 from the external current sensor as a guide.
 - MEASURE (measurement range display)
The external current sensor range is divided by the external current sensor conversion ratio, and the resulting (current) range is displayed. This setting is useful when you want to set the external current sensor range using the current measured by the external current sensor as a guide. For example, if you are using a current sensor that produces 10 mV when it receives 1 A (external current sensor conversion ratio: 10 mV/A) and you set the external current sensor range to 1 V, the displayed current range is 100 A.
- This menu does not appear when a 760812 (current module) is not installed in the PX8000.

Deskewing the Transfer Time Difference between Input Signals (Deskew Setup)

To measure the power items correctly from the voltage and current of input signals, you must apply the voltage and current signals to the PX8000 signal input terminals with no transfer time difference between the signals. However, transfer time difference may occur between the two signals depending on the sensor or cable that you are using. The PX8000 allows you to deskew the transfer time difference between the two signals and then measure power items.

Deskewing (Diff Time U, Diff Time I, and Diff Time Sen)

Sets values for deskewing the transfer time difference between signals on each channel.

- Diff Time U: Correction value for voltage input
- Diff Time I: Correction value for direct current input
- Diff Time Sen: Correction value for external current sensor input*

* This can be set only on a 760812 (current module).

By selecting the Diff Time U, Diff Time I, and Diff Time Sen cells, you can collectively set the correction values for the transfer time differences of all channels.

Selectable range: -20000.000 ns to 20000.0 ns in 0.625-ns steps

When waveform data or numeric data is saved, the deskewed data is saved.

Power Measurement Element Settings (ELEM1 to 4)

The element settings are listed below.

- [Line Filter \(Line Filter\)](#)
- [Frequency Filter \(Freq Filter\)](#)
- [Turning Scaling On and Off \(Scaling\)](#)
- [VT Ratio \(VT Scaling\)](#)
- [CT Ratio \(CT Scaling\)](#)
- [Power Coefficient \(SF Scaling; scaling factor\)](#)
- [Synchronization Source \(Sync Source\)](#)

Line Filter (Line Filter)

There are two types of input filters, line filters and frequency filters.

Because the line filter is inserted into the voltage and current measurement input circuits, it directly affects voltage, current, and power measurements (see the block diagram in appendix 14 in the features guide, IM PX8000-01EN). When the line filter is turned on, measured values do not contain high frequency components. Thus, the voltage, current, and power of inverter waveforms, strain waveforms, etc., can be measured with their high frequency components eliminated.

Select the cutoff frequency from the options listed below.

OFF, 500 Hz, 2 kHz, 20 kHz, and 1 MHz

- If the filter of any of the elements is not set to OFF, the line filter setting is displayed as described below.
 - “On” appears to the right of Line Filter at the top of the screen.
 - Line F (Line Filter indicator) turns on in the element information area on the right side of the screen.
- Selecting OFF disables the line filter.

Frequency Filter (Freq Filter)

The frequency filter is inserted into the frequency measurement input circuit and affects frequency measurements. It also affects the detection of the measurement period for voltage, current, and power measurements (see appendix 4 in the features guide, IM PX8000-01EN). In this case, the filter also acts as a filter for detecting the [zero-crossing](#) of the synchronization source signal more accurately. The frequency filter is not inserted into the voltage and current measurement input circuits. Therefore, the measured values include high frequency components even when the frequency filter is turned on.

Select the cutoff frequency from the options listed below.

OFF, 100 Hz, 500 Hz, 2 kHz, and 20 kHz

- The PX8000 detects the zero-crossing point with a hysteresis of approximately 3% of the measurement range.
- If the filter of any of the elements is not set to OFF, the frequency filter setting is displayed as described below.
 - “On” appears to the right of Freq Filter at the top of the screen.
 - Freq F (Freq Filter indicator) turns on in the element information area on the right side of the screen.
- If the line filter described above is on, it affects the frequency measurement even when the frequency filter is off.

Turning Scaling On and Off (Scaling)

You can set coefficients for when you apply a voltage or current signal from an external VT (voltage transformer) or CT (current transformer).

You can select whether to apply the VT ratio, CT ratio, and power coefficient to applicable measurement functions.

When reading measured values directly by using a VT or CT (or current sensor), select ON.

If the scaling of an element is set to ON, the scaling setting is displayed as described below.

- “On” appears to the right of Scaling at the top of the screen.
- Scale (Scaling indicator) turns on in the element information area on the right side of the screen.

Applicable Measurement Functions

Voltage (U), current (I), power (P, S, and Q), maximum and minimum voltages (U+pk and U-pk), and maximum and minimum currents (I+pk and I-pk)

- ON: The measurement functions above are multiplied by the VT ratio, CT ratio, or power coefficient.
- OFF: The measurement functions above are not multiplied by the VT ratio, CT ratio, or power coefficient. The output values of the VT and CT are displayed directly as numeric data.

VT Ratio (VT Scaling)

Set the VT ratio when applying the secondary output of a VT to the voltage input terminal. Then, set the voltage range according to the maximum VT output.

Set the VT ratio to a value within the following range.

0.0001 to 99999.9999

CT Ratio (CT Scaling)

Set the CT ratio (or the conversion ratio of the current sensor that produces current) when applying the secondary output of a CT or clamp-type current sensor that produces current to the current input terminal. Then, set the current range according to the maximum CT or current sensor output.

Set the CT ratio to a value within the following range.

0.0001 to 99999.9999

Power Coefficient (SF Scaling; scaling factor)

By setting the power coefficient (SF), you can display the measured active power, apparent power, and reactive power after they have been multiplied by a coefficient.

Measurement Function	Data before Transformation	Transformation Result	
Voltage U	U_2 (secondary output of the VT)	$U_2 \times V$	V: VT ratio
Current I	I_2 (secondary output of the CT)	$I_2 \times C$	C: CT ratio
Active power P	P_2	$P_2 \times V \times C \times SF$	SF: Power coefficient
Apparent power S	S_2	$S_2 \times V \times C \times SF$	
Reactive power Q	Q_2	$Q_2 \times V \times C \times SF$	
Max./min. voltage Upk	Upk_2 (secondary output of the VT)	$Upk_2 \times V$	
Max./min. current Ipk	Ipk_2 (secondary output of the CT)	$Ipk_2 \times C$	

Set the power coefficient to a value within the following range.

0.0001 to 99999.9999



- If the value of the result of multiplying the measured value by the VT ratio, CT ratio, or power coefficient (scaling factor) exceeds 9999.99 M, “-OF-” will appear in the numeric data display frame.
- You can view the VT and CT ratios and the power coefficients of all elements by displaying the menu for configuring all channels (ALL CH).
▶ [See here.](#)
- To correctly compute the power and efficiency of Σ functions, set the power coefficients of all elements so that all power units used in the computation are the same. For example, the efficiency cannot be computed correctly if elements or wiring units used in the computation have different power units, such as W (watt) and J (joule). To compute the efficiency correctly, make all the power units the same (either all W or all J).

Synchronization Source (Sync Source), Voltage and Current Module

Select the signal to use as the sync source from the options listed below. The available options vary depending on the installed elements. When independent element configuration is off, elements in the same wiring unit have the same sync source.

U1, I1, U2, I2, U3, I3, U4, I4, External,* and None

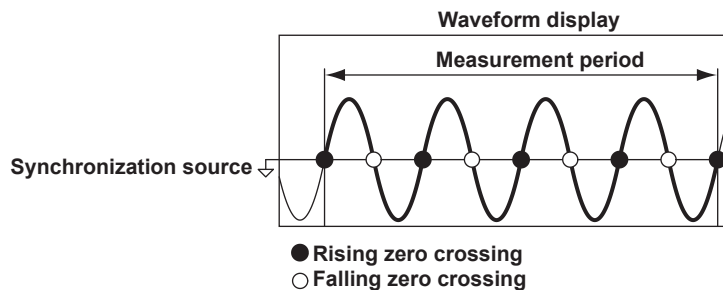
* When you select External, the external signal applied to the external trigger input connector (TRIGGER IN) on the side panel is used as the sync source. For the TRIGGER IN connector specifications, see section 5.1 in the getting started guide, IM PX8000-03EN.

Synchronization Source Setting Status

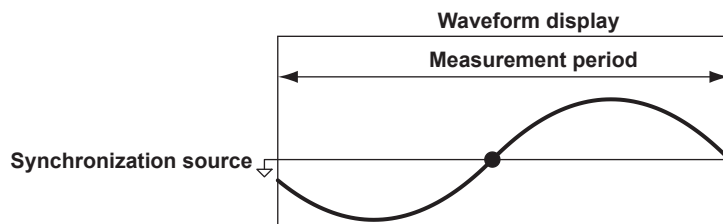
The synchronization source setting is shown in the element information area on the right side of the screen.

Measurement Period for Measurement Functions Used in Normal Measurement

The measurement period is determined by the input signal that is used as the reference (synchronization source). The measurement period is set within the waveform display between the first point where the sync source crosses the level-zero point (center of the amplitude) on a rising slope (or falling slope) and the last point where the sync source crosses the level-zero point (center of the amplitude) on a rising slope (or falling slope).



If there is not more than one rising or falling slope within the waveform display, the entire waveform display is set as the measurement period.



The measurement period for determining the numeric data of the peak voltage or peak current is always the entire waveform display. Therefore, the measurement period for the measurement functions that are determined on the basis of the maximum voltage or current value (U+pk, U-pk, I+pk, I-pk, CfU, and Cfl) is also the entire waveform display.

For details, see appendix 4 in the features guide, IM PX8000-01EN.

Measurement Period for Measurement Functions Used in Harmonic Measurement (Option)

The measurement period is 8192 points from the start point of harmonic measurement.

The PX8000 determines the harmonic sampling frequency automatically based on the period of the signal that is set as the PLL source. The sampling data and measurement period that are used to determine the values of harmonic measurement functions may be different from those used to determine the values of normal measurement functions.



- If you specify no sync source by selecting “None,” all of the sampled data within the the waveform display is used to determine the numeric data. When you are measuring DC signals, this method can be used to prevent noise from causing errors in the detection of the measurement period.
- If the sync source is not set correctly, the measured value may fluctuate or be incorrect. When you set the sync source, refer to appendix 4 in the features guide, IM PX8000-01EN.

AUX Module Settings (ELEM2 to 4)

The AUX module settings are listed below.

- [Turning Motor Mode On and Off \(Motor Mode\)](#)
- [Function Name \(Name\)](#)
- [Scaling \(Scaling\)](#)
- [Unit \(Unit\)](#)
- [Synchronization Source \(Sync Source\)](#)

Turning Motor Mode On and Off (Motor Mode)

The PX8000 can determine the motor rotating speed, torque, and output. It determines them using the revolution sensor signal, which is proportional to the motor rotating speed, and the torque meter signal, which is proportional to the motor torque.

If motor mode is set to OFF, the following items cannot be specified.

- Function Name (Name)
- Scaling (Scaling)
- Unit (Unit)

Function Name (Name)

Set the function name of measurement function Pm.

Scaling (Scaling)

You can specify the scaling factor for computing the motor output (mechanical power) from the rotating speed and torque. Set the factor to a value from 0.0001 to 99999.9999.

The equation is indicated below. The scaling factors of the rotating speed and torque are set so that the unit of the rotating speed is min^{-1} (or rpm) and the unit of torque is $\text{N}\cdot\text{m}$. When the scaling factor of the motor output specified here is 1, the unit of the motor output Pm is W. Because the [efficiency computation](#) uses W as the unit of Pm, we recommend that you set the scaling factor of each item so that the unit of Pm is W.

$$\text{Motor output Pm} = \frac{2\pi}{60} \times \text{Speed} \times \text{Torque} \times S$$

Speed: The rotating speed, determined from the number of pulses per revolution

Torque: The torque, determined from the torque signal pulse rating

S: The scaling factor

Unit (Unit)

- Number of characters: Up to eight
- Usable characters: Spaces and all characters that are displayed on the keyboard

Synchronization Source (Sync Source), AUX Module

- When you are measuring analog revolution and torque signals, you can select the element to use as the sync source from the following options. The available options vary depending on the installed elements.
U1, I1, U2, I2, U3, I3, U4, I4, External,* and None
 - * When you select External, the external signal applied to the external trigger input connector (TRIGGER IN) on the side panel is used as the sync source. For the TRIGGER IN connector specifications, see section 5.1 in the getting started guide, IM PX8000-03EN.
- The measurement period is determined according to the zero-crossing point of the selected synchronization source. The PX8000 uses the measurement period to measure the analog revolution and torque signals. If you specify no synchronization source by selecting "None," all the sampled data within the waveform display is used to determine the rotating speed and torque.
- When the revolution or torque signal is a pulse signal, its value is the pulse signal period averaged over the measurement period. The measurement period is determined according to the sync source. If the pulse signal period does not fit within the measurement period, the previous period is used to determine the measured value.
- To achieve stable motor efficiency measurements, we recommend that you set the sync source for motor efficiency measurement to the same [sync source](#) that is set in the fundamental measurement conditions. This ensures that the measurement period is in sync with the measurement functions, such as those for voltage, current, and active power.

3 Vertical Axis

This section explains how to configure the signal input settings and the amplitude-direction display settings. The items that can be set vary depending on the installed modules.

Input Settings

U1 to U4, I1 to I4, P1 to P4, CH3 to CH8 (When an AUX module is installed)

The channel menu that corresponds to the key you pressed appears. You can set the various vertical axis settings for each channel.

The waveform display turns on and off each time that you press the key.

- [Voltage Measurement \(U\)](#)
- [Current Measurement \(I\)](#)
- [Power Measurement \(P\)](#)
- [Sensor Input Voltage Measurement \(AUX\)](#)

ALL CH

You can configure the settings of all channels while viewing the settings in a list. You can also copy the various vertical axis settings of one channel to another channel. There are some items that cannot be configured from the ALL CH menu.

► [See here.](#)

Voltage Measurement (U)

For voltage measurement, the items that have to be set for each voltage input signal (U1 to U4) include measurement range (vertical scales), the vertical positions, the zoom method, the offset, and auto range.

- Waveform Display (Display)
- Labels (Label)
- [Measurement Range \(Vertical Scale, RANGE knob\)](#)
- [Waveform Vertical Position \(Vertical POSITION knob\)](#)
- [Zoom Method \(Vertical Scale\)](#)
- [Zooming by Setting a Magnification \(Vertical Zoom\)](#)
- [Zooming by Setting Upper and Lower Display Limits \(Upper/Lower\)](#)
- [Offset \(Offset\)](#)
- [Auto Range \(Auto Range\)](#)

Waveform Display (Display)

Select whether to display each channel's input signal waveform.

- ON: Displays the waveform
- OFF: Does not display the waveform

Labels (Label)

You can specify a name of up to sixteen characters in length for each channel.

You can set whether to display labels using the WAVE SETTING menu.

► [See here.](#)



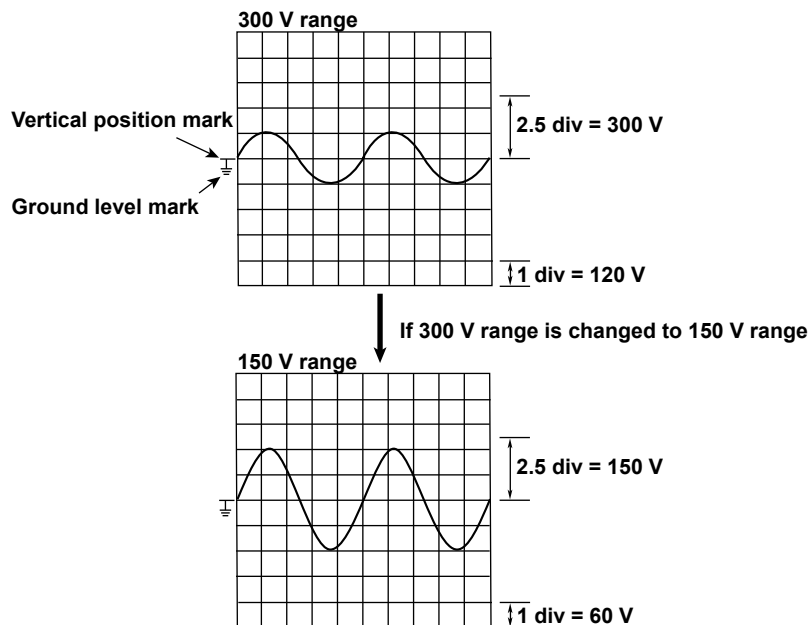
- The specified display label is used in labels, scale values, the numeric display, and cursor-measurement values.
- Depending on the display and zoom formats, label names may not appear when the waveform display is narrow.

Measurement Range (Vertical Scale, RANGE knob), Voltage

Voltage Measurement Range Setting

The measurement range is used to adjust the displayed waveform amplitude so that you can easily view signals. For the voltage measurement range, set the voltage that corresponds to 2.5 grid divisions on the waveform screen.

Example



Selectable range of the voltage measurement range

You can select from 1.5 V, 3 V, 6 V, 10 V, 15 V, 30 V, 60 V, 100 V, 150 V, 300 V, 600 V, and 1000 V.

The measurement range can be fixed (when auto range is set to off) or determined automatically (when auto range is set to on).

Fixed Ranges

When the measurement range is fixed, you can select a range from the available options. The selected measurement range does not change even if the amplitude of the input signal changes. Set the range in reference to the rms value of the input signal.

Auto Range

For auto range, see the auto range explanation.

► [See here.](#)



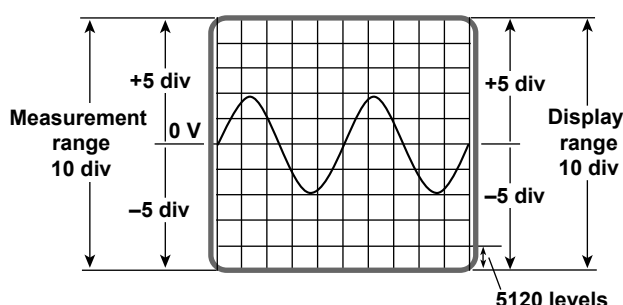
- Set the range in reference to the rms value of the input signal. For example, if you are applying a 100-Vrms sinusoidal signal, set the range to 100 V.
- When measuring a signal other than a sine wave (such as a distorted wave), you can obtain accurate measurements by selecting the smallest measurement range that does not produce any of the conditions below.
 - The range status indicator at the top left of the screen illuminates in red.
 - The measured values of the voltage and current are indicated as being overload values ("-OL-").

- The range status indicator may not illuminate or blink in the following cases.
 - If the pulse width is narrow, and the peak value of the waveform cannot be acquired at the sample rate of the PX8000.
 - If the high frequency components of the pulse waveform attenuate due to the bandwidth limitations of the PX8000 measurement circuit, causing the waveform peak value to be less than the peak over-range detection level.
- When a signal with the peak which becomes more than about 10 times of the range is input, it takes about 1 second to change the range.
- When the secondary output of a VT (voltage transformer) is being applied to the voltage input terminal, set the voltage range according to the maximum value of the VT output. Then, use the scaling feature to set the VT ratio.
- To display a list of the range settings of all elements, see displaying the menu for configuring all channels (ALL CH).
 - ▶ [See here.](#)
- While waveform acquisition is stopped, turning the RANGE knob will not change the displayed waveform. The changed measurement range will be applied the next time that waveform acquisition is started.
- While waveform acquisition is stopped, turning the RANGE knob will not change the cursor-measurement values or the automated measurement values of waveform parameters, they will continue to be based on the measurement range at the time of measurement.

Measurement Range and Display Range of Voltage and Current Signals

The measurement range and display range of the PX8000 is ± 5 div with 0 V (voltage signal) or 0 A (current signal) at the center (absolute span of 10 div). You can use the following features to move displayed waveforms and zoom in or out of displayed waveforms.

- Vertical position adjustment
- Offset voltage setting
- Vertical zoom



To display multiple waveforms so that they do not overlap without dividing the screen, you have to set the measurement range to a large value. This prevents you from taking advantage of the A/D converter's resolution. However, if you divide the screen and arrange the waveforms in the divided screens, they will not overlap, and you can down their measurement range.

Waveform Vertical Position (Vertical POSITION knob)

The PX8000 can display the waveforms of the voltage, current, power, and computed waveforms. Because the PX8000 can display so many waveforms, the waveforms may overlap and be difficult to view. If this happens, you can adjust the vertical display position to make waveforms easier to view (vertical position).

The vertical position can be moved within the range of ± 5 div.

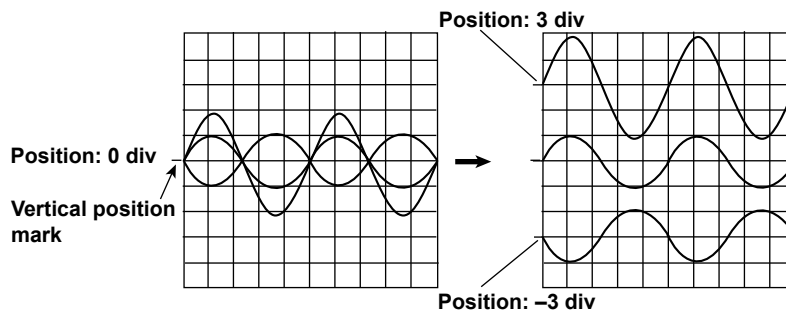
When you change the measurement range, the location of the vertical position mark does not change.

Use the POSITION knob to set the vertical position.

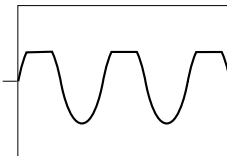
The same POSITION knob is used to adjust the position of each waveform display.

To change the position of a voltage, current, or power waveform, press the key from U1 to U4, I1 to I4, or P1 to P4 that corresponds to the waveform.

To change the position of a AUX input waveform, press the key from CH3 to CH8 that corresponds to the waveform.



- When the menu for configuring all channels (ALL CH) is displayed, you can use the job shuttle to change the vertical positions.
- When you change the vertical position, offset voltage, or upper or lower limit (when Vertical Scale is set to SPAN), data that is outside of the measurement range is handled as overflow data. As shown in the figure below, waveforms appear cut off when there is overflow data.



Zoom Method (Vertical Scale)

You can choose the method for zooming the waveform vertically.

- DIV: The waveform is zoomed by a set magnification.
- SPAN: The waveform is zoomed to fit within specified upper and lower display limits.

Zooming by Setting a Magnification (Vertical Zoom)

When Vertical Scale is set to DIV, you can set the vertical magnification and enlarge or reduce the waveform along the vertical axis. This method is useful when you want to change the vertical scale of the waveform after it has been displayed.

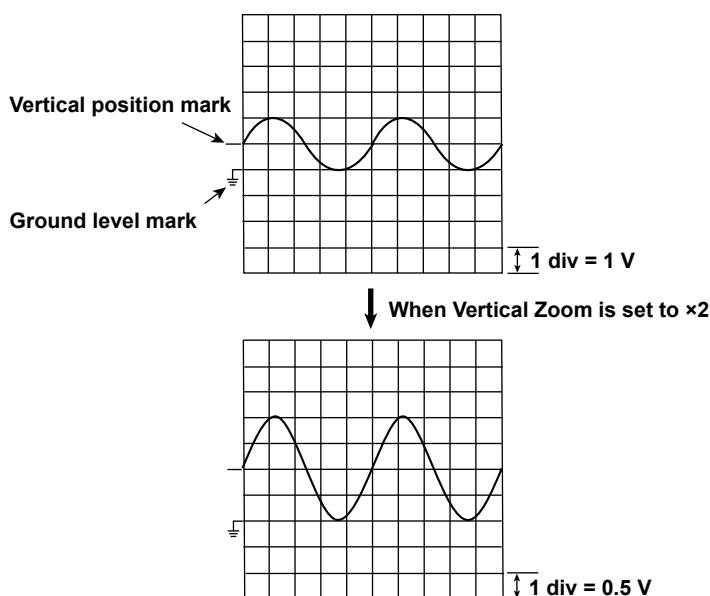
Zoom Factor (Vertical Zoom)

The magnifications that you can choose from are listed below.

x0.1, x0.111, x0.125, x0.143, x0.167, x0.2, x0.25, x0.33, x0.4, x0.5, x0.556, x0.625, x0.667, x0.714, x0.8, x0.833, x1, x1.11, x1.25, x1.33, x1.43, x1.67, x2, x2.22, x2.5, x3.33, x4, x5, x6.67, x8, x10, x12.5, x16.7, x20, x25, x40, x50, x100

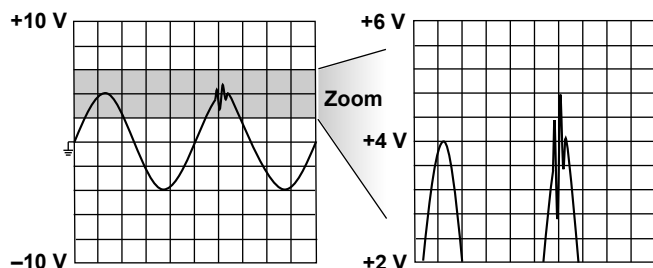
Zoom Position

Zooming is centered on the vertical position.



Zooming by Setting Upper and Lower Display Limits (Upper/Lower)

When Vertical Scale is set to SPAN, you can set the upper and lower vertical limits and enlarge or reduce the waveform along the vertical axis. By setting the appropriate upper and lower limits for the displayed waveform, you can zoom in vertically on the area of the waveform that you want to observe. You can also increase the display range to view parts of the waveform that were outside the range. Zooming the waveform does not change its A/D conversion resolution or accuracy.



Selectable Range of the Upper and Lower Limits

The upper and lower limits can be set within $\pm(20 \times \text{the specified measurement range})$. Set the limits so that the upper limit is greater than the lower limit.



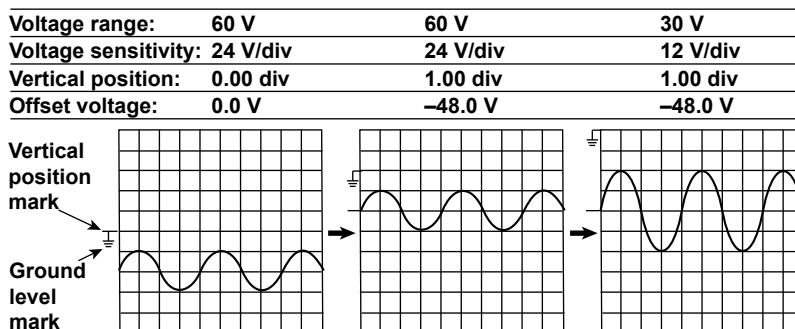
The displayed V/div will not change if you turn the RANGE knob after you set the upper and lower limits, but the measurable range will change. If you change the measurable range so that it is narrower than the range of the set upper and lower limits, when you start waveform acquisition, the parts of the waveform that do not fit within the measurable range may not appear. The measurable range is approximately ± 5 div (with 0 in the center) when Vertical Scale is set to DIV.

Offset (Offset)

By adding an offset, you can move the waveform to a vertical position that is easier to see. For example, when measuring a signal with a fixed voltage component, you can use the offset to cancel out the fixed voltage and measure the signal changes at a higher voltage sensitivity.

You can set the offset for each input waveform.

The offset is useful when you are measuring voltage or current.



Selectable Range of the Offset

±5 div

Notes about Setting the Offset

- When you are measuring voltage, changes to the offset are applied when acquisition is stopped.
- When you are measuring voltage, the offset will not change even if you change the voltage scale. However, if the offset goes outside the selectable range, the offset is set to the maximum or minimum value for the current voltage scale. If you set the vertical scale back to its original value without changing the offset, the offset returns to its original value.



- The offset does not affect cursor-measurement values, automated measurement values of waveform parameters, or computed values.
- You can change the position of the waveform relative to the vertical position (change the focus of the vertical zoom) by changing the offset.

Auto Range (Auto Range)

When you set the auto range ON, the range is set automatically. The measurement range is switched automatically depending on the amplitude of the input signal as described below. The different ranges used in the auto range are the same as those available for the fixed range.

Auto Range Setting Status

Setting auto range ON turns on AUTO (Auto range indicator) in the element information area on the right side of the screen.

Range Increase

The measurement range is increased when any of the following conditions is met.

- The data of measurement function Urms or Irms exceeds 110% of the measurement range.
- The data of Upk or Ipk exceeds 200% of the current measurement range.

When a wiring unit is configured and independent element configuration is off, the measurement range is increased on all elements in the wiring unit when any of the elements in the unit meets the range-increase conditions .

Range Decrease

The measurement range is decreased when all the following conditions are met.

- The data of Urms or Irms is less than 30% of the measurement range.
- The data of Upk or Ipk is less than or equal to 180% of the next lower range.

When a wiring unit is configured and independent element configuration is off, and all the elements in the unit meet the range-increase conditions, all their measurement ranges are increased.



When non-periodic pulse waveforms are applied, the range may not remain constant. If this happens, use the fixed range setting.

Conditions in Which Auto Range Is Disabled

If any of the conditions is met, auto range is disabled.

- Roll mode display (trigger mode is set to Auto, AutoLevel, Single, or On Start, and the time scale is set to 100 ms/div or higher)
- The acquisition mode is set to Average or Envelope.
- Numeric measurement is set to OFF.
- GO/NO-GO determination mode is set to Wave Zone or Parameter.
- Action mode is set to ON.
- The AUX input signal type is Pulse.

Current Measurement (I)

For current measurement, the items that have to be set for each current input signal (I1 to I4) include measurement range (vertical scales), the vertical positions, the zoom method, the offset, and auto range.

- Waveform Display (Display)
- Labels (Label)
- Measurement Range (Vertical Scale, RANGE knob)
- Waveform Vertical Position (Vertical POSITION knob)
- Zoom Method (Vertical Scale)
- Offset (Offset)
- Auto Range (Auto Range)
- External Current Sensor Input (Ext Sensor)*
- External Current Sensor Conversion Ratio (Sensor Ratio)*

* This can be set only on a 760812 (current module).

Waveform Display (Display)

Select whether to display each channel's input signal waveform.

- ON: Displays the waveform
- OFF: Does not display the waveform

Labels (Label)

This item is the same as labels of the voltage measurement.

▶ [See here.](#)

Measurement Range (Vertical Scale, RANGE knob), Current

Selectable range of the current measurement range

• Direct input

You can select from 10 mA, 20 mA, 50 mA, 100 mA, 200 mA, 500 mA, 1 A, 2 A, and 5 A.

• External current sensor input (/EX1, /EX2)

You can select from 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V, and 10 V.



When the secondary output of a CT (current transformer) or a clamp-type current sensor that outputs current is being applied to the current input terminal, set the current range according to the maximum value of the CT or current sensor output. Then, use the scaling feature to set the CT ratio or the conversion ratio of the clamp-type current sensor that outputs current.

Current Measurement Range Setting

This item is the same as range setting of the voltage measurement.

For the current measurement range, set the current that corresponds to 2.5 grid divisions on the waveform screen.

▶ [See here.](#)

Waveform Vertical Position (Vertical POSITION knob)

This item is the same as waveform vertical position of the voltage measurement.

▶ [See here.](#)

Zoom Method (Vertical Scale)

This item is the same as zoom method of the voltage measurement.

► [See here.](#)

Offset (Offset)

This item is the same as offset of the voltage measurement.

► [See here.](#)

Auto Range (Auto Range)

This item is the same as auto range of the voltage measurement.

► [See here.](#)

External Current Sensor Input (Ext Sensor)

This function can be set only on a 760812 (current module).

The output of current sensors that produce voltage, such as shunts and clamps, can be applied to an element's external current sensor input connector (EXT) and measured.

Select whether to use each channel's external current sensor input.

- ON: Uses the external current sensor input
- OFF: Does not use the external current sensor input

External Current Sensor Conversion Ratio (Sensor Ratio)

This function can be set only on a 760812 (current module).

Set the conversion ratio used to measure the signal received by the external current sensor input connector (EXT) from a current sensor that produces voltage. Set how many millivolts the current sensor transmits when 1 A of current is applied (conversion ratio). Then, the input signal can be made to correspond to the numeric data or waveform display data that is obtained when the current is directly applied to the input terminals. When using a current sensor that produces current, set the conversion ratio as the CT ratio.

Measurement Function	Conversion Ratio	Data before Transformation	Transformation Result
Current I	E	I_s (current sensor output)	I_s/E
Active power P	E	P_s	P_s/E
Apparent power S	E	S_s	S_s/E
Reactive power Q	E	Q_s	Q_s/E
Max./min. current Ipk	E	I_{pk_s} (current sensor output)	I_{pk_s}/E

External Current Sensor Range and Conversion Ratio Configuration Example

When you measure a current with a maximum value of 100 A using a current sensor that produces 10 mV when 1 A of current is flowing, the maximum voltage that the current sensor produces is $10 \text{ mV/A} \times 100 \text{ A} = 1 \text{ V}$. Therefore, configure the settings as indicated below.

- External current sensor range: 1 V
- External current sensor conversion ratio: 10 mV/A



- When you want to divide the external current sensor output by the conversion ratio and read the current of the circuit under measurement directly, turn the external VT/CT scaling feature off. If the feature is turned on, the value will be further multiplied by the CT ratio.
- When you are measuring a signal other than a sine wave (such as a distorted wave), you can obtain accurate measurements by selecting the smallest measurement range that does not produce any of the conditions below.
 - The range status indicator at the top left of the screen illuminates in red.
 - The measured values of the voltage and current are indicated as being overload values ("OL-").

Power Measurement (P)

For power measurement, the items that have to be set for each power input signal (P1 to P4) include the vertical positions, the zoom method, and the offset.

- Waveform Display (Display)
- Labels (Label)
- [Measurement Range](#)
- [Waveform Vertical Position \(Vertical POSITION knob\)](#)
- [Zoom Method \(Vertical Scale\)](#)
- [Offset \(Offset\)](#)

Waveform Display (Display)

Select whether to display each channel's input signal waveform.

- ON: Displays the waveform
- OFF: Does not display the waveform

Labels (Label)

This item is the same as labels of the voltage measurement.

▶ [See here.](#)

Measurement Range, Power

Power Range

For the power range on the waveform display screen, "voltage range × current range" is set to +5 div by setting the default zoom value to ×2.

Waveform Vertical Position (Vertical POSITION knob)

This item is the same as waveform vertical position of the voltage measurement.

▶ [See here.](#)

Zoom Method (Vertical Scale)

This item is the same as zoom method of the voltage measurement.

▶ [See here.](#)

Offset (Offset)

This item is the same as offset of the voltage measurement.

▶ [See here.](#)

Sensor Input Voltage Measurement (AUX)

For sensor input voltage measurement, the items that have to be set for each AUX input signal (AUX3 to AUX8) include measurement range (vertical scales), the vertical positions, the zoom method, the offset, and auto range.

- Waveform Display (Display)
- Labels (Label)
- [Measurement Range \(Vertical Scale, RANGE knob\)](#)
- [Waveform Vertical Position \(Vertical POSITION knob\)](#)
- [Zoom Method \(Vertical Scale\)](#)
- [Offset \(Offset\)](#)
- [Auto Range \(Auto Range\)](#)
- [AUX Settings \(Aux Settings\)](#)
- [Rotating Speed Settings \(Speed Settings\)](#)
- [Torque Settings \(Torque Settings\)](#)
- [Input Coupling \(Coupling\)](#)
- [Probe Attenuation and Current-to-Voltage Conversion Ratio \(Probe\)](#)
- [Bandwidth \(Bandwidth\)](#)
- [Pulse Reference Level \(Pulse Level High/Pulse Level Low\)](#)

Waveform Display (Display)

Select whether to display each channel's input signal waveform.

- ON: Displays the waveform
- OFF: Does not display the waveform

Labels (Label)

This item is the same as labels of the voltage measurement.

▶ [See here.](#)

Measurement Range (Vertical Scale, RANGE knob), AUX

Measurement range

- **When Motor Mode Is Set to OFF and Aux Settings Is Set to Analog**

- When the probe attenuation (Probe) is 1:1
You can select from 50 mV, 100 mV, 250 mV, 500 mV, 1 V, 2.5 V, 5 V, 10 V, 25 V, 50 V, and 100 V.
- When the probe attenuation (Probe) is 10:1
You can select from 500 mV, 1 V, 2.5 V, 5 V, 10 V, 25 V, 50 V, 100 V, 250 V, 500 V, and 1 kV.
- When the probe attenuation (Probe) is 100:1
You can select from 5 V, 10 V, 25 V, 50 V, 100 V, 250 V, 500 V, 1 kV, 2.5 kV, 5 kV, and 10 kV.
- When the probe attenuation (Probe) is 1000:1
You can select from 50 V, 100 V, 250 V, 500 V, 1 kV, 2.5 kV, 5 kV, 10 kV, 25 kV, 50 kV, and 100 kV.

- **When Motor Mode Is Set to ON and Speed Settings or Torque Settings Is Set to Analog**

You can select from 50 mV, 100 mV, 250 mV, 500 mV, 1 V, 2.5 V, 5 V, 10 V, 25 V, 50 V, and 100 V.

- **When Aux Settings, Speed Settings, or Torque Settings Is Set to Pulse**

You can select from 1 Hz, 2 Hz, 5 Hz, 10 Hz, 20 Hz, 50 Hz, 100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz, 50 kHz, 100 kHz, 200 kHz, 500 kHz, and 1 MHz.

Measurement Range Setting

This item is the same as range setting of the voltage measurement.

However, set the voltage that corresponds to 5 grid divisions on the waveform screen for the measurement range.

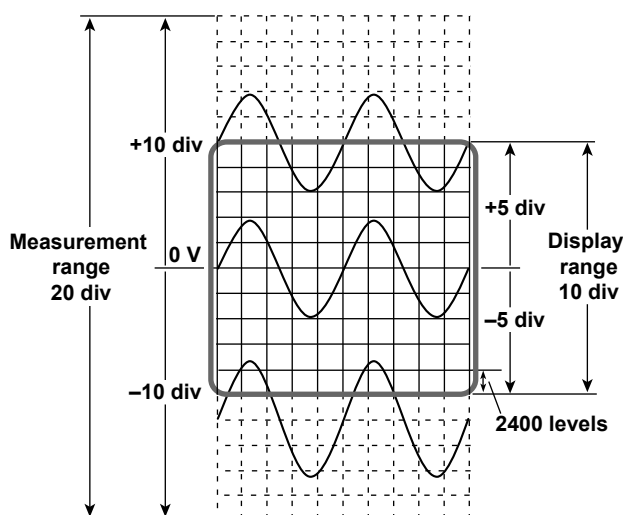
► [See here.](#)

Measurement Range and Display Range of AUX InputX

The measurement range of the PX8000 is ± 10 div, with 0 V in the center (the absolute width, or span, is 20 div).

The default display-range setting is ± 5 div (the span is 10 div). Using the features listed below, you can move and scale the displayed waveform so that parts of it that were outside of the display range are displayed.

- Vertical position adjustment
- Offset voltage setting
- Vertical zoom



Waveform Vertical Position (Vertical POSITION knob)

This item is the same as waveform vertical position of the voltage measurement.

▶ [See here.](#)

Zoom Method (Vertical Scale)

This item is the same as zoom method of the voltage measurement.

▶ [See here.](#)

Offset (Offset)

This item is the same as offset of the voltage measurement.

▶ [See here.](#)

Auto Range (Auto Range)**When the Input Signal Type Is Analog**

When you set the auto range ON, the range is set automatically. The measurement range is switched automatically depending on the amplitude of the input signal as described below. The different ranges used in the auto range are the same as those available for the fixed range.

Range Increase

The measurement range is increased when any of the following conditions is met.

- The computed value DC based on AUX measurement exceeds 110% of the measurement range.
- The peak value of measured AUX data exceeds 200% of the measurement range (when motor mode is set to OFF).
- The peak value of measured AUX data exceeds 145 of the measurement range (when motor mode is set to ON).

Range Decrease

The measurement range is decreased when all the following conditions are met.

- The computed value DC based on AUX measurement is less than 30% of the measurement range.
- The peak value of measured AUX data is less than or equal to 180% of the next lower range (when motor mode is set to OFF).
- The peak value of measured AUX data is less than or equal to 140% of the next lower range (when motor mode is set to ON).



When non-periodic pulse waveforms are applied, the range may not remain constant. If this happens, use the fixed range setting.

When the Input Signal Type Is Pulse

The auto range feature is disabled.

Auto Range Setting Status

Setting auto range ON turns on AUTO (Auto range indicator) in the element information area on the right side of the screen.

Conditions in Which Auto Range Is Disabled

The same conditions that auto range is disabled for voltage and current ranges.

▶ [See here.](#)

AUX Settings (Aux Settings)

This menu display varies depending on whether the motor mode is on.

- When motor mode is off: AUX settings (Aux Settings)
- When motor mode is on:
 - Odd channels (AUX3, AUX5, AUX7): Rotating speed settings (Speed Settings)
 - Even channels (AUX4, AUX6, AUX8): Torque settings (Torque Settings)

Set the following items for sensor input voltage measurement.

- Input Signal Type (Sense Type)
- Linear Scaling (Scaling)
- Display Type (Display Type)

Input Signal Type (Sense Type)

You can select which of the following two types of signals you want the PX8000 to receive from the sensor.

- Analog: Select this option when the PX8000 will receive analog signals.
- Pulse: Select this option when the PX8000 will receive pulse signals.

Linear Scaling (Scaling)

Linear scaling is a function that converts measured values into physical values and reads them directly.

Linear Scaling Modes (Scaling Mode)

- **OFF**

Linear scaling is not performed.

You can select this when Sense Type is set to Analog.

- **AX + B**

Using specified scaling coefficient A and offset B, the PX8000 performs the following computation to scale cursor-measurement values and automated measurement values of waveform parameters. You can specify the unit of the linearly scaled results.

$$Y = AX + B$$

X: Value before scaling

Y: Value after scaling

Selectable range for A and B: $-9.9999E+30$ to $+9.9999E+30$

Initial value of A: 1.0000

Initial value of B: 0.0000

• P1-P2

You can specify two measured values (P1:X, P2:X) and specify a scale value (P1:Y, P2:Y) for each. The scale-conversion equation ($y = ax + b$) is determined by these four values.

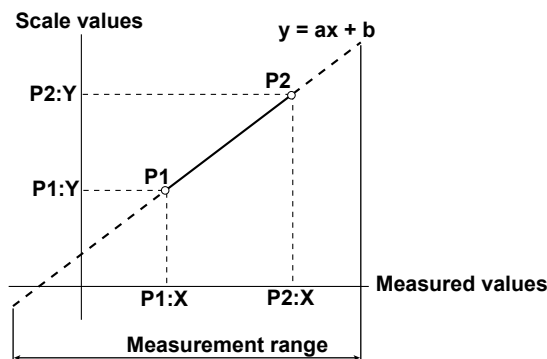
- Measured value (P1:X, P2:X) range: Same as the measurement range
- Scale value (P1:Y, P2:Y) range: $-9.9999\text{E}+30$ to $+9.9999\text{E}+30$
- Initial scale values

P1:X 1.0000, P1:Y 1.0000

P2:X 5.0000, P2:Y 5.0000

Get Value (Get Value)

Sets P1:X and P2:X to the current values, regardless of whether waveform acquisition is in progress or stopped.



Unit String (Unit String)

You can set the unit using up to eight alphanumeric characters.

Display Type (Display Type)

You can set the display type when the linear scaling mode is not set to OFF.

You can display the linearly scaled results using one of the following two methods (Mode).

Exponent: Values are displayed in exponential notation.

Floating: Values are displayed as decimal numbers.

For Decimal Number, set the number of digits after the decimal point to Auto or a number from 0 to 3. For SubUnit, set the unit prefix to Auto, p, n, μ , m, None, k, M, G, or T.

- If you set Decimal Number to a number from 0 to 3, the specified number of digits after the decimal point are displayed. If you select Auto, all numbers will be displayed using five digits (for example: 1.0000, 250.00). The default setting is Auto.
- If you set SubUnit to a setting other than Auto, numbers will be displayed with the specified unit prefix. If you select Auto, the PX8000 will automatically select appropriate unit prefixes. The default setting is Auto. The PX8000 displays values in exponential notation if it is unable to display them as decimal numbers.

Scale Value Display

You can display the linearly scaled values of the upper and lower vertical limits of each channel.

You can turn the scale value display on and off from the WAVE SETTING menu of the waveform display.

► [See here.](#)



- You can configure linear scaling for each channel.
- The specified scaling coefficient A and offset B are retained even after linear scaling is set to OFF.
- Computations are performed on the linearly scaled values.

Rotating Speed Settings (Speed Settings)

This menu display varies depending on whether the motor mode is on.

- When motor mode is off: AUX settings (Aux Settings)
- When motor mode is on:
 - Odd channels (AUX3, AUX5, AUX7): Rotating speed settings (Speed Settings)
 - Even channels (AUX4, AUX6, AUX8): Torque settings (Torque Settings)

Set the following items for sensor input voltage measurement.

- Input Signal Type (Sense Type)
- Unit (Unit)
- Analog settings (Analog) or Pulse settings (Pulse)
- Display Type (Display Type)

Input Signal Type (Sense Type)

You can select which of the following two types of signals you want the PX8000 to receive from the sensor.

- Analog: Select this option when the PX8000 will receive analog signals.
- Pulse: Select this option when the PX8000 will receive pulse signals.

Unit (Unit)

You can select from rps, rpm, and rph.

Analog settings (Analog)

Set the conversion ratio for converting input voltage signals into rotating speed.

This is the same feature as linear scaling of AUX settings.

▶ [See here.](#)

Pulse Settings (Pulse)

Revolution signal pulses per revolution (Pulse N)

Set the number of pulses per revolution to a value from 1 to 9999.

Display Type (Display Type)

This item is the same as display type of the AUX settings.

▶ [See here.](#)

Torque Settings (Torque Settings)

This menu display varies depending on whether the motor mode is on.

- When motor mode is off: AUX settings (Aux Settings)
- When motor mode is on:
 - Odd channels (AUX3, AUX5, AUX7): Rotating speed settings (Speed Settings)
 - Even channels (AUX4, AUX6, AUX8): Torque settings (Torque Settings)

Set the following items for sensor input voltage measurement.

- Input Signal Type (Sense Type)
- Unit (Unit)
- Analog settings (Analog) or Pulse settings (Pulse)
- Display Type (Display Type)

Input Signal Type (Sense Type)

You can select which of the following two types of signals you want the PX8000 to receive from the sensor.

- Analog: Select this option when the PX8000 will receive analog signals.
- Pulse: Select this option when the PX8000 will receive pulse signals.

Unit (Unit)

You can set the unit using up to eight alphanumeric characters.

Analog settings (Analog)

Set the conversion ratio for converting input voltage signals into torque.

This is the same feature as linear scaling of AUX settings.

▶ [See here.](#)

Pulse Settings (Pulse)

When the torque signal type is pulse, refer to the torque meter's specifications to set its rated positive and negative values.

Positive and Negative Rated Torque Signal Values (Rated Upper, Rated Lower)

Range: –10000.0000 to 10000.0000

Set the positive and negative rated torque signal pulse frequencies to the right of the colon.

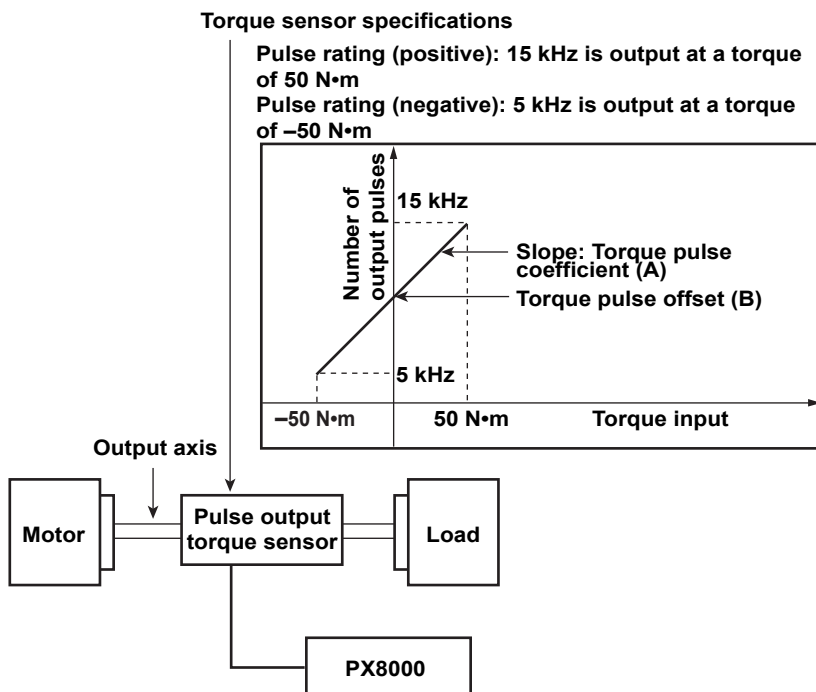
Range: 1 to 100000000 (Hz)

The Torque Signal Pulse Rating

When you use a torque meter with specifications in the figure below, configure the pulse rating settings as indicated below.

- Positive rated torque signal value (Rated Upper): 50.0000
- Negative rated torque signal value (Rated Lower): -50.0000
- Positive rated torque signal pulse frequency : 15000
- Negative rated torque signal pulse frequency : 5000

Also, set the unit to N·m



Display Type (Display Type)

This item is the same as display type of the AUX settings.

► [See here.](#)

Input Coupling (Coupling)

It is easier to measure the amplitude of an AC signal if you remove its DC component. On the other hand, there are times when you want to measure the ground level or observe the entire signal, including both the DC and AC components. In these kinds of situations, you can change the input coupling setting. By changing the setting, you can choose how the vertical-axis (voltage-axis) control circuit is coupled to the input signal.

- This setting is valid when Sense Type is set to Analog.
- This setting is not valid when Sense Type is set to Pulse.

You can set the input coupling to one of the available settings below.

AC (Only when measuring AC voltage)

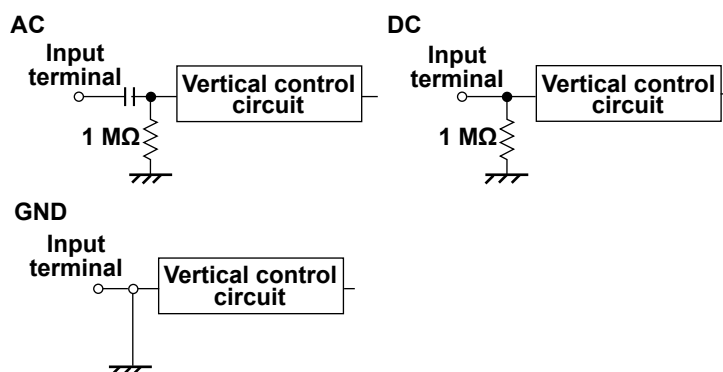
The input signal is coupled to the attenuator of the vertical control circuit through a capacitor. Set the input coupling to AC when you want to measure only the amplitude of the AC signal without the DC component.

DC

The input signal is coupled directly to the attenuator of the vertical control circuit. Set the input coupling to DC when you want to measure the entire signal, including both the DC and AC components.

GND

The input signal is coupled to the ground rather than to the attenuator of the vertical control circuit. Set the input coupling to GND to check the ground level on the screen.



Probe Attenuation and Current-to-Voltage Conversion Ratio (Probe)

When you use a probe, to read the measurement voltage correctly, you must set the attenuation on the PX8000 to match the probe attenuation.

This setting is valid when Motor Mode is set to OFF and Sense Type is set to Analog.

You cannot specify this setting when Motor Mode is set to ON or when Sense Type is set to Pulse.

Set the attenuation ratio as indicated below for each probe. (The probes are optional accessories that are sold separately.)

Probe Type	Attenuation
Isolated probe (700929)	10:1
Isolated probe (701947)	100:1
High voltage differential probe (701926)	1000:1, 100:1

The attenuation settings available on the PX8000 are 1:1, 10:1, 100:1, and 1000:1. If you use a probe other than one of the separately sold optional accessories provided by Yokogawa, set the attenuation ratio in accordance with that probe.



Use a probe that is appropriate for the input capacitance of the AUX module. The capacitance cannot be adjusted for an inappropriate probe.

Bandwidth (Bandwidth)

You can set bandwidth limitations on the analog signals by specifying a cutoff frequency.

You can view signals with frequency components above the specified frequency removed.

Set the cutoff frequency to one of the settings below.

Full (no bandwidth limit), 2 MHz, 1.28 MHz, 640 kHz, 320 kHz, 160 kHz, 80 kHz, 40 kHz, 20 kHz, or 10 kHz

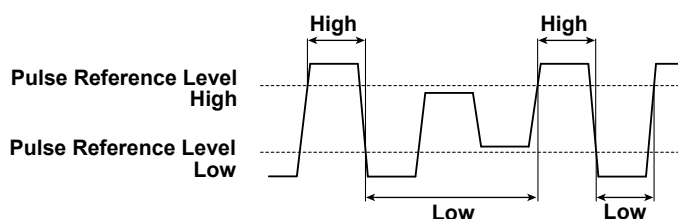
Pulse Reference Level (Pulse Level High/Pulse Level Low)

- This setting is not valid when Sense Type is set to Analog.
- This setting is valid when Sense Type is set to Pulse.

You can set the voltage level for counting pulses. The range is -10.0V to 10.0V , and the resolution is 0.1 V .

- Judgment condition for high pulse level
Between the point when the input waveform level changes from below the low pulse reference level to above the high pulse reference level to the point when the level changes from above the high pulse reference level to below the low pulse reference level
- Judgment condition for low pulse level
Between the point when the input waveform level changes from above the high pulse reference level to below the low pulse reference level to the point when the level changes from below the low pulse reference level to above the high pulse reference level

For all other conditions, the pulse is not detected as high or low level conditions. They are handled as sections where pulse judgment condition is not met.



Displaying the Menu for Configuring All Channels (ALL CH)

You can configure the settings of all channels while viewing the settings in a list. You can also copy the various settings of one channel to another channel. There are some items that cannot be configured from the ALL CH menu.

Settings of All Elements (All Elements)

You can configure the settings of all elements while viewing the settings in a list. By selecting the left most cell, you can collectively set all elements.

Sensor Conversio Ratio Preset (Sensor Preset)

When using the dedicated shunt box, preset the external current sensor conversion ratio. Select the preset name (shunt box) from one of the settings below.

Preset Name	External Current Sensor Conversion Ratio (Sensor Ratio)
Shunt20 (20 Ω)	20000.0000 mV/A (m Ω)
Shunt10 (10 Ω)	10000.0000 mV/A (m Ω)
Shunt5 (5 Ω)	5000.0000 mV/A (m Ω)

If you set this item, the external current sensor input ON/OFF (Ext Sensor) is set to ON. If you change the external current sensor conversion ratio (Sensor Ratio) after setting this item, an asterisk will be added to the preset name. To use other sensors, select Others. If you select Others, the external current sensor input ON/OFF and external current sensor conversion ratio do not change.

CT Ratio Preset (CT Preset)

When using the dedicated CT, preset the CT ratio. Select the preset name (CT) from one of the settings below.

Preset Name	CT Ratio (CT Scaling)
CT2000A	2000.0000
CT1000	1500.0000
CT200	1000.0000
CT60	600.0000

If you set this item, the scaling ON/OFF (Scaling) is set to ON. If you change the CT ratio (CT Scaling) after setting this item, an asterisk will be added to the preset name. To use other sensors, select Others. If you select Others, the scaling ON/OFF and CT ratio do not change.

Settings of All AUX Channels (All Auxiliaries)

You can configure the settings of all auxiliaries while viewing the settings in a list.

Independent Element Configuration (Element Independent)

This item is the same as independent element configuration of the fundamental measurement conditions.

► [See here.](#)

External Current Sensor Range Display Type (Sensor Range Display Type)

This item is the same as external current sensor range display type of the fundamental measurement conditions.

► [See here.](#)

Copy (Elements Copy to, or Auxiliaries Copy to)

You can copy the various vertical axis and linear scaling settings from one element to other elements. You can also copy the vertical and linear scaling settings of one AUX channel to other AUX channels.

Source Channel (Source)

Select the copy source element or AUX channel.

Destination Channels (Destination)

Select the copy destination element or AUX channel.

Execute (Execute)

Select Execute to copy the settings.

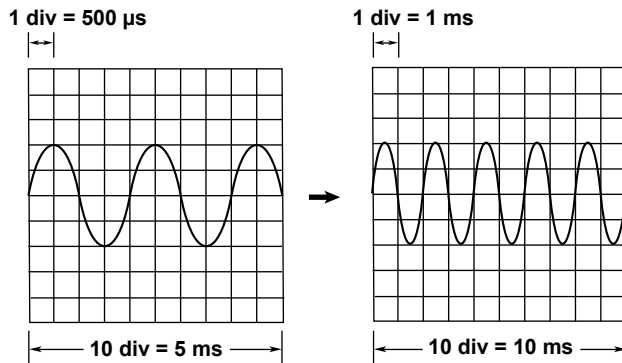
4 Horizontal Axis

Time Axis Setting (TIME/DIV)

When the internal clock is being used, the time axis scale is set as a length of time per grid division (1 div).

The time axis scale can be set within the following ranges: 100 ns/div to 30 s/div, 1 min/div, and 2 min/div. The transition from seconds to minutes occurs automatically.

The horizontal display range is 10 div. Therefore, the amount of time on the waveform that is displayed is equal to the time axis setting $\times 10$.



Internal and External Clocks (Time base selection)

Under the initial settings, the PX8000 samples the waveform data using the clock signal produced by its internal time-base circuit (internal clock).

You can also use an external clock signal to control sampling. Apply the external clock signal to the external-clock input terminal (EXT CLK IN) on the left panel of the PX8000. This external clock input is useful for synchronizing to the clock signal of the waveform that is being measured.

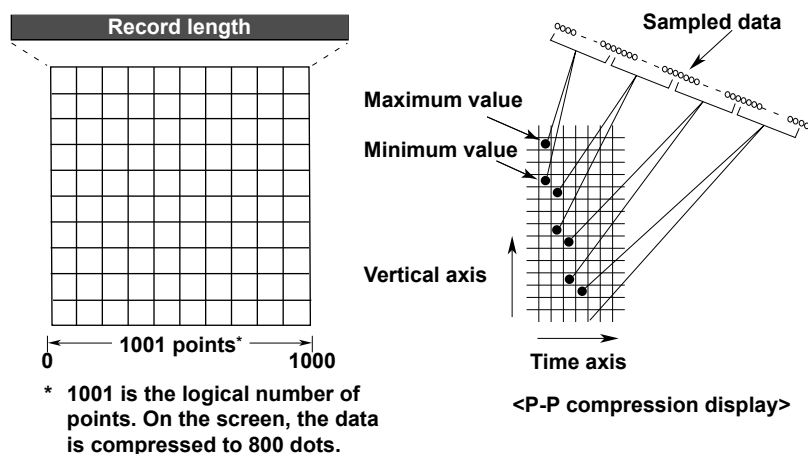


When you control sampling using an external clock, you cannot change the time axis setting. To change the time-axis display range, change the record length or zoom in on the time axis.

► [See here.](#)

How the Time Axis Relates to the Display of the Waveform

There are 10 div along the time axis, and 1001 points (logical number of points, not the dots on the screen) are used to draw the waveforms. Therefore, if the display record length is exactly 1 kpoint (the number of acquired data points is 1001), the waveform is displayed using 1001 points. However, if the display record length is greater than or equal to 2 kpoint, as shown in the figure on the right, the PX8000 draws the waveform by determining the maximum and minimum values at each fixed interval (P-P compression) and aligning them vertically at the same time position (total number of points: 2002).



Zooming Horizontally and Drawing Waveforms

The PX8000 can expand (zoom) the waveform horizontally. When the zoom factor of the waveform is increased, the number of displayed points decreases. The PX8000 displays the waveform using P-P compressed until the number of displayed points falls to 2002, but it cannot display the waveform using continuous lines when the number of displayed points falls below 1001. When this happens, the PX8000 [interpolates the display](#) data so that the number of displayed points is 1001.

Dot Display

Under the initial settings, display interpolation is performed automatically, but you can also disable display interpolation (set it to OFF) and display the waveform using dots. When interpolation is disabled, the waveform is displayed using 2002 P-P compressed dots.

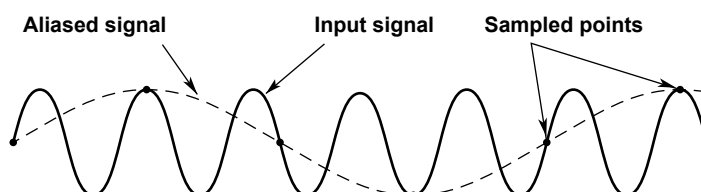
Relationship between the Time Axis Setting, Record Length, and Sample Rate

If you change the time axis setting, the sample rate and the acquisition-memory record length also change. For details, see appendix 7, "Relationship between the Time Axis Setting, Record Length, and Sample Rate" in the features guide, IM PX8000-01EN.

Sample Rate

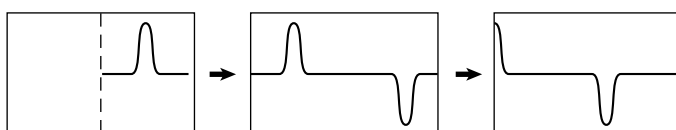
If you change the time axis setting, the sample rate also changes. The sample rate is the number of samples-per-second (S/s).

- * If the sample rate is comparatively low with respect to the input signal frequency, the harmonics contained in the signal are lost. When this happens, some of the harmonics will be misread as low-frequency waves due to the effects described by the Nyquist sampling theorem. This phenomenon is called aliasing. You can avoid aliasing by acquiring waveforms with the acquisition mode set to Envelope.



Time Axis Setting and Roll Mode Display

When the trigger mode is Auto, Auto Level, Single, or On Start and the time axis setting is 100 ms/div or longer, instead of updating waveforms through triggering (update mode), the PX8000 displays the waveforms in roll mode. In roll mode, waveforms scroll from right to left as new data is captured and the oldest values are deleted from the screen.



This allows waveforms to be observed in the same way as on a pen recorder. Roll mode is useful for observing signals with long repeating periods and signals that change slowly. It is also effective when you want to detect occasional glitches (pulse signals in the waveform).

5 Triggering

A trigger is a cue used to display the waveform on the screen. A trigger occurs when the specified trigger condition is met, and a waveform is displayed on the screen.

Trigger Mode (MODE)

The trigger mode determines the conditions for updating the displayed waveforms. There are six trigger modes.

Auto Mode (Auto)

If the trigger conditions are met before an approximately 50 ms timeout, the PX8000 updates the displayed waveforms on each trigger occurrence. If not, the PX8000 automatically updates the displayed waveforms. Even when Auto mode is specified, the PX8000 operates in Normal mode when the trigger source is set to Time and a simple trigger is used.

If the time axis is set to a value that would cause the display to switch to roll mode, roll mode display will be enabled.

Auto Level Mode (AutoLevel)

If a trigger occurs before a timeout (which is approximately 1 second), the PX8000 updates the waveform in the same way that it does in Auto mode. If a trigger does not occur, the PX8000 detects the center value of the trigger source amplitude, automatically changes the trigger level to the center value, triggers on that value, and updates the displayed waveform. Auto-level mode is valid only if the trigger source is an analog waveform on a channel between U1 to U4, I1 to I4, P1 to P4, or AUX3 to AUX8. For all other cases, Auto Level mode operates in the same way as Auto mode.

If the time axis is set to a value that would cause the display to switch to roll mode, roll mode display will be enabled.

Normal Mode (Normal)

The PX8000 updates the waveform display only when the trigger conditions are met. If no triggers occur, the display is not updated. If you want to view waveforms that the PX8000 cannot trigger on, or if you want to check the ground level, use Auto mode.

Single Mode (Single)

When the trigger conditions are met, the PX8000 updates the displayed waveform once and stops waveform acquisition.

If the time axis is set to a range that causes the display to switch to roll mode, the roll mode display will be enabled. When the PX8000 triggers, it begins recording data. When data has been acquired up to the amount specified by the set record length, the waveform display stops.

N Single Mode (SingleN)

The PX8000 acquires waveforms each time the trigger conditions are met until a specified number of waveforms have been acquired, and then displays all the acquired waveforms. If no triggers occur, the display is not updated.

Instant Start Mode (On Start)

Regardless of the trigger settings, when you press the START key, the PX8000 updates the displayed waveforms once and stops signal acquisition.

If the time axis is set to a value that would cause the display to switch to roll mode, roll mode display will be enabled. When data has been acquired up to the amount specified by the set record length, the waveform display stops.



-
- The trigger mode setting applies to all trigger types.
 - When waveforms are being acquired, the trigger condition appears in the center of the bottom of the screen.
-

Basic Trigger Settings (SIMPLE/ENHANCED)

- **Trigger types:** The trigger types.
- **Trigger source:** The trigger source signal.
- **Trigger slope:** Specifies which edge, rising or falling, the PX8000 will trigger on.
- **Trigger level:** The trigger determination level.
- **Trigger hysteresis:** The trigger level margin (the PX8000 does not trigger on changes in the signal level within this margin).
- **Trigger hold-off:** The amount of time to wait before the next trigger detection (applies to all triggers except for the simple trigger when the trigger source is Time, the period trigger, and the manual trigger).
- **Trigger position:** The position where the trigger point will be displayed (applies to all trigger types).
- **Trigger delay:** The delay from the trigger point (applies to all trigger types).

Trigger Types (Type)

The following trigger types are available.

Simple (Simple)

- **Simple trigger:** Simply triggers on a trigger source edge.
In addition to using the signals applied to the modules installed in the slots as trigger sources, you can also use the time, an external signal (the signal applied to the TRIGGER IN terminal), or the power line signal as a trigger source.

Enhanced (Enhanced)

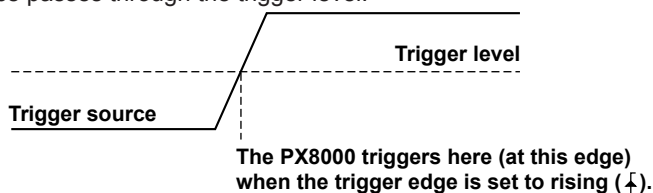
- **A -> B(N) trigger:** After state condition A is met, the PX8000 triggers when the state condition B is met N times.
 - **A Delay B trigger:** After state condition A is met and the specified amount of time elapses, the PX8000 triggers when the state condition B is first met.
 - **Edge On A trigger:** While state condition A is met, the PX8000 triggers on the OR of multiple trigger source edges.
 - **OR trigger:** The PX8000 triggers on the OR of multiple trigger source edges.
 - **AND trigger:** The PX8000 triggers on the AND of multiple trigger source conditions.
 - **Period trigger:** The PX8000 triggers on a specified period of occurrence of state condition B.
 - **Pulse Width trigger:** The PX8000 triggers after state condition B has been met for a specified duration (width).
 - **Wave Window trigger:** The PX8000 creates real-time templates (Wave Window) using a number of cycles directly preceding the current waveforms. The PX8000 compares the current waveforms to the real-time templates and triggers if one of the current waveforms falls outside of its real-time template.
- * A state condition is a condition that is met when the levels of specified trigger sources are High or Low relative to a specified trigger level. If you set a signal to X (Don't Care), the state of the specified signal is not used to determine whether the state condition is met.

Manual Trigger (MANUAL TRIG)

Regardless of the trigger settings, you can make the PX8000 trigger by pressing the MANUAL TRIG key on the front panel.

Simple Trigger (Simple)

The PX8000 triggers on trigger source edges (rising or falling edges). *Edge* refers to a point where the trigger source passes through the trigger level.



Trigger Source (Source)

The trigger source is the signal that is used to check for the trigger condition. You can set the source waveform to one of the waveforms below.

Analog Signal (U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8)

Select an analog signal being applied to the terminal of each module as the trigger source. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8*

* If Sense Type is set to Pulse and the trigger source is AUX3 to AUX8, waveform acquisition cannot be started.

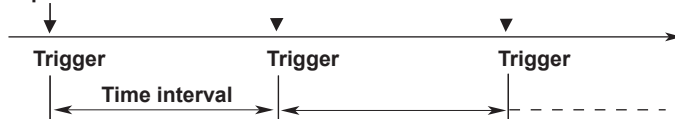
Time (Time)

Select Time to use the date and time as the trigger source. The trigger occurs at the specified date and time and at specified intervals afterwards.

- Specify the year, month, day, hour, minute, and second.
- You can select one of the time intervals listed below.

10sec, 15sec, 20sec, 30sec, 40sec, 50sec, 1min, 2min, 3min, 4min, 5min, 6min, 7min, 8min, 9min, 10min, 15min, 20min, 25min, 30min, 40min, 45min, 50min, 1hour, 2hour, 3hour, 4hour, 5hour, 6hour, 7hour, 8hour, 9hour, 10hour, 11hour, 12hour, 18hour, 24hour

Specified date and time



- Depending on the specified time interval, a trigger may occur while the waveform is being acquired or in the pre-trigger section (the section before the trigger that is acquired for observation). When this happens, the trigger is ignored.
- If the specified date and time fall within the pre-trigger section, a trigger occurs at the end of the pre-trigger section.
- If the specified date and time are in the past, triggers occur at the points in the present defined by the function (specified date and time) + (time interval × integer N).
- If you set the [number of acquisitions](#), the specified number of waveforms are acquired. When the specified number of acquisitions is infinite, waveform acquisition continues until you press START/STOP.

5 Triggering

External Signal (External)

Select External to use the signal that is received through the left-panel TRIGGER IN input terminal as the trigger source.




Power Line Signal (Line)

Select Line to use the power line signal received by the PX8000 as the trigger source. The PX8000 triggers only on the rising edge. This option enables you to observe waveforms in synchronization with the power supply frequency (50 Hz or 60 Hz).

Trigger Slope (Slope)

Slope refers to the movement of the signal from a low level to a high level (rising edge) or from a high level to a low level (falling edge). When a slope is used as one of the trigger conditions, it is called a trigger slope.

The following trigger slope settings are available for triggering the PX8000.

	The PX8000 triggers when the trigger source changes from a level below the trigger level to a level above the trigger level (rising).
	The PX8000 triggers when the trigger source changes from a level above the trigger level to a level below the trigger level (falling).
	The PX8000 triggers on both rising and falling edges.

*  can be selected only when a simple trigger is used with an analog trigger source.

Trigger Level (Level)

Trigger level refers to the signal level used as a reference for detecting a signal's rising and falling edges or high and low states. With simple triggers such as the edge trigger, the PX8000 triggers when the trigger source level passes through the specified trigger level.

The range and resolutions that you can use to set the trigger level vary depending on the type of signal being measured.

When Measuring Voltage, Current, or Power

Selectable range: ± 5 div (the display range)

Resolution: 0.01 div



You can normally set the trigger level using the jog shuttle and arrow keys. If you press the NUM LOCK key so that it illuminates, you can also enter numbers by pressing the CH key.

Trigger Hysteresis (Hysteresis)

Noise rejection establishes a trigger level margin (hysteresis) so that the PX8000 does not trigger if the signal level change is within the margin.

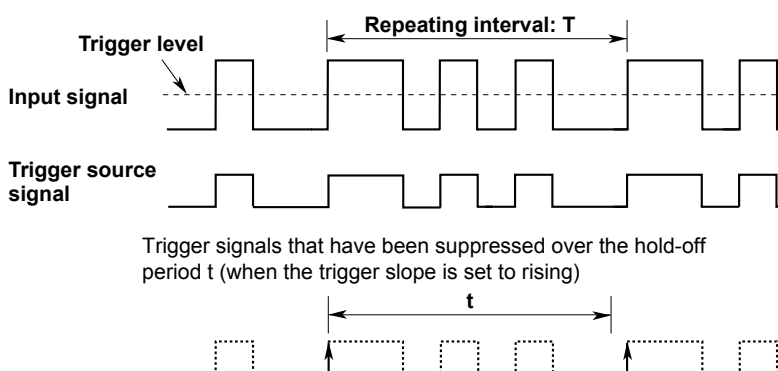
For each type of measured signal, you can set the hysteresis around the trigger level to one of the options listed below. You cannot set hysteresis when the trigger source is set to Time, External, or Line.

Approx. ± 0.1 div	Approx. ± 0.5 div	Approx. ± 1 div

* The above values are approximate values. They are not strictly warranted.

Trigger Hold-Off (Hold Off)

The trigger hold-off feature temporarily stops the detection of the next trigger once a trigger has occurred. This feature is useful in cases when you want to change the waveform acquisition interval, such as when you are observing a PCM (pulse code modulation) code or other pulse train signal or when you are using the history feature.



Selectable range: 0.00 μ s to 10000000.00 μ s (10 s). The default settings is 0.00 μ s

Resolution: 0.01 μ s



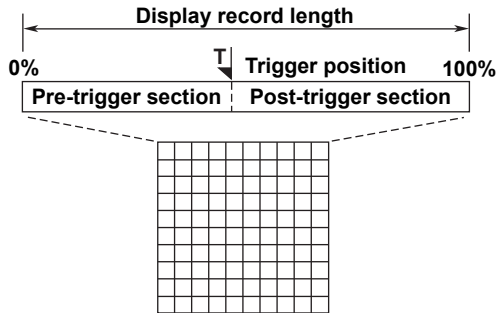
- To trigger with the hold-off time set to 50 ms or longer, set the trigger mode to Normal.
- For the A \rightarrow B(N) and A Delay B triggers, the hold-off time applies only to state condition B.
- The trigger hold-off time does not apply to the simple trigger when the trigger source is Time, to the period trigger, or to the manual trigger.

Trigger Position and Trigger Delay (POSITION/DELAY)

- [Trigger Position](#)
- [Trigger Delay](#)

Trigger Position (Position)

When you move the trigger position, the ratio of the displayed data before the trigger point (the pre-trigger section) to the data after the trigger point (the post-trigger point) changes. When the trigger delay is 0 s, the trigger point and trigger positions coincide.



Selectable range: 0.0 to 100% of the display record length.

Resolution: 0.1%



- When waveform acquisition is stopped, if you change the trigger position, the setting is not applied until you start waveform acquisition and update the waveforms.
- If you change the time axis setting (using the TIME/DIV knob), the location of the trigger position does not change.

Time Reference Point

In addition to the trigger position, a time reference point is indicated. The times that appear in the lower left and right of the screen are the times from this time reference point. The cursor time-measurement values are also based on this reference point.

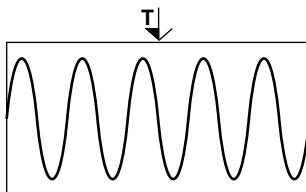
When waveform acquisition is stopped the displayed location of the time reference point varies as indicated below.

• In Update Mode

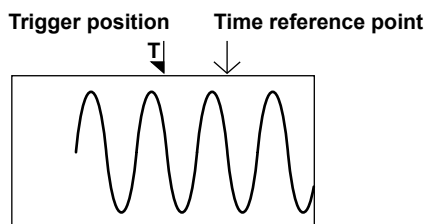
When the displayed waveform is updated by the trigger, the time reference point is displayed as indicated below. The time reference point and the trigger point are the same.

- Under Normal Waveform Update Conditions When All Pre-Trigger and Post-Trigger Data Has Been Acquired

The trigger position and the time reference point are displayed at the same position.



- When Waveform Acquisition Is Stopped before All Pre-Trigger and Post-Trigger Data Has Been Acquired
The trigger position and the time reference point are displayed separately.

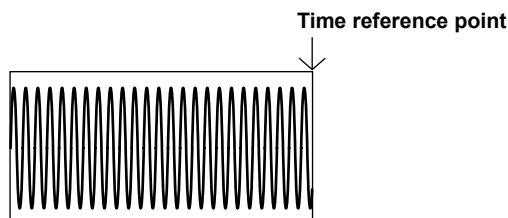


- In Roll Mode**

In roll mode, in which waveforms scroll from right to left, the time reference point is displayed as indicated below.

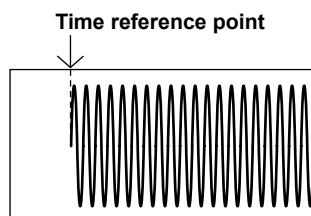
- When the Trigger Mode Is Auto Mode or Auto Level Mode

The point in time when waveform acquisition was stopped is the time reference point (right side of the screen).



- When the Trigger Mode Is Instant Start Mode (On Start)

The point in time when waveform acquisition was started is the time reference point.

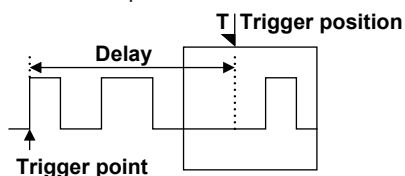


Trigger Delay (Delay)

The PX8000 normally displays waveforms before and after the trigger point. You can set a trigger delay to display waveforms that the PX8000 has acquired a specified amount of time after the trigger occurrence.

Selectable range: 0.00 μ s to 10000000.00 μ s (10 s). The default settings is 0.00 μ s

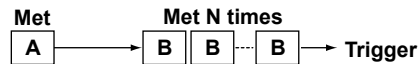
Resolution: 0.01 μ s



- If you change the time axis setting (using the TIME/DIV knob) so that the unit becomes larger, because of display-digit limitations, the delay time that you set when the unit was small will not appear in the setup menu, but it is retained.
- You cannot specify a trigger delay when an external clock is being used as the time base.

A -> B(N) Trigger (Enhanced)

After state condition A is met, the PX8000 triggers when state condition B is met N times.



Trigger Source

You can use U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8 as the trigger sources.

State Conditions (A State, B State)

To set state conditions A and B, select the states of the trigger sources in relation to the trigger level.

Example

	State Condition A	State Condition B
U1	H	H
I1	L	L
P1	L	L
U2	L	H
I2	H	X
.....
AUX8	X	L

H: The signal level must be high.
L: The signal level must be low.
X: The signal is not used as a condition.

State Condition Achievement Condition (A Condition, B Condition)

Select how the result of comparing the trigger source states to their specified conditions must change for a state condition to be considered met.

Enter	The result must change from not being met to being met.
Exit	The result must change from being met to not being met

Number of Times State Condition B Must Be Met

Set the number of times that state condition B must be met.
Selectable range: 1 to 10000. The default setting is 1.

Trigger Level (Level) and Trigger Hysteresis (Hys)

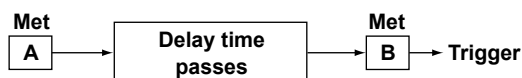
Set these items for each trigger source.
These items are the same as the [trigger level](#) and [trigger hysteresis](#) of the simple trigger.

Trigger Hold-Off (Hold Off), Trigger Position (Position), Trigger Delay (Delay)

These items are the same as [trigger hold-off](#), [trigger position](#), and [trigger delay](#) of the simple trigger.

A Delay B Trigger (Enhanced)

After state condition A is met and the specified amount of time elapses, the PX8000 triggers when state condition B is first met.



Trigger Source

You can use U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8 as the trigger sources.

State Conditions (A State, B State)

To set state conditions A and B, select the states of the trigger sources in relation to the trigger level.

Example

	State Condition A	State Condition B
U1	H	H
I1	L	L
P1	L	L
U2	L	H
I2	H	X
.....
AUX8	X	L

H: The signal level must be high.

L: The signal level must be low.

X: The signal is not used as a condition.

State Condition Achievement Condition (A Condition, B Condition)

Select how the result of comparing the trigger source states to their specified conditions must change for a state condition to be considered met.

Enter	The result must change from not being met to being met.
Exit	The result must change from being met to not being met

Delay Time

Set the amount of time that must pass after state condition A is met.

Selectable range: 0.0 μ s to 10000000.0 μ s (10 s). The default settings is 0.0 μ s.

Resolution: 0.1 μ s

Trigger Level (Level) and Trigger Hysteresis (Hys)

Set these items for each trigger source.

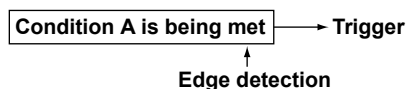
These items are the same as the [trigger level](#) and [trigger hysteresis](#) of the simple trigger.

Trigger Hold-Off (Hold Off), Trigger Position (Position), Trigger Delay (Delay)

These items are the same as [trigger hold-off](#), [trigger position](#), and [trigger delay](#) of the simple trigger.

Edge On A Trigger (Enhanced)

While state condition A is met, the PX8000 triggers on the OR of multiple trigger source edges.



Trigger Source

You can use U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8 as the trigger sources.

State Condition (A State)

To set state condition A, select the states of the trigger sources in relation to the trigger level.

Example

	State Condition A
U1	H
I1	L
P1	L
U2	L
I2	H
.....	...
AUX8	X

H: The signal level must be high.
 L: The signal level must be low.
 X: The signal is not used as a condition.

State Condition Achievement Condition (Condition)

Select whether the result of comparing the trigger source states to their specified conditions must be true or false for the state condition to be considered met.

True	The result must be true.
False	The result must be false.

Edge Detection Condition (Edge)

Set the condition for detecting the trigger source edge.

↗	An edge is detected when the trigger source changes from a level below the trigger level to a level above the trigger level (rising).
↘	An edge is detected when the trigger source changes from a level above the trigger level to a level below the trigger level (falling).
–	The signal is not used as a trigger condition.

Trigger Level (Level) and Trigger Hysteresis (Hys)

Set these items for each trigger source.

These items are the same as the [trigger level](#) and [trigger hysteresis](#) of the simple trigger.

Trigger Hold-Off (Hold Off), Trigger Position (Position), Trigger Delay (Delay)

These items are the same as [trigger hold-off](#), [trigger position](#), and [trigger delay](#) of the simple trigger.

OR Trigger (Enhanced)

The PX8000 triggers on the OR of multiple trigger source edges.

Trigger Source

You can use U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, and Ext* as the trigger sources.

* The signal that is received through the left-panel TRIGGER IN input terminal as the trigger source.

Edge Detection Condition (Edge)

Set the conditions for detecting each trigger source edge.

\uparrow	An edge is detected when the trigger source changes from a level below the trigger level to a level above the trigger level (rising).
\downarrow	An edge is detected when the trigger source changes from a level above the trigger level to a level below the trigger level (falling).
IN	An edge is detected when the trigger source enters the specified level range.
OUT	An edge is detected when the trigger source leaves the specified level range.
-	The signal is not used as a trigger condition.

* IN and OUT are selectable only when the trigger source is an analog signal (U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8).

Trigger Level (Level)

Set these items for each trigger source.

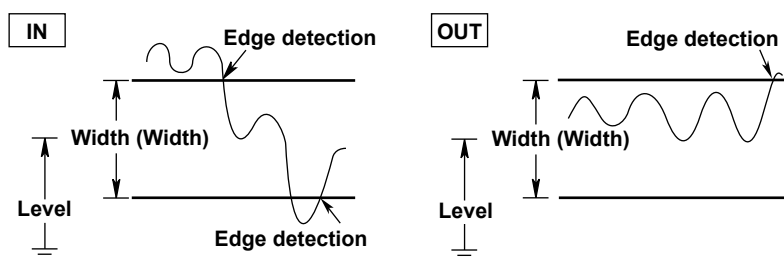
When the Edge Detection Condition Is \uparrow or \downarrow

Set the level used to detect the trigger source's rising or falling edge.

► [See here.](#)

When the Edge Detection Condition Is IN or OUT

An edge is detected when the trigger source enters (IN) or leaves (OUT) the specified level range. You can specify the level range settings for each analog signal trigger source.



Setting	Selectable Range	Resolution
Level (center value)	Same as the trigger level	
Width (Width)		

Trigger Hysteresis (Hys)

Set these items for each trigger source.

This item is the same as the [trigger hysteresis](#) of the simple trigger.

Trigger Hold-Off (Hold Off), Trigger Position (Position), Trigger Delay (Delay)

These items are the same as [trigger hold-off](#), [trigger position](#), and [trigger delay](#) of the simple trigger.

AND Trigger (Enhanced)

The PX8000 triggers on the AND of multiple trigger source conditions. The PX8000 triggers when all the specified conditions are met at a single point.

Trigger Source

You can use U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8 as the trigger sources.

Achievement Condition (Condition)

Set the achievement condition for each trigger source.

H	The signal level must be high.
L	The signal level must be low.
IN	The signal must be within the specified level range.
OUT	The signal must be outside of the specified level range.
-	The signal is not used as a trigger condition.

* IN and OUT are selectable only when the trigger source is an analog signal (U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8).

Trigger Level (Level)

Set this item for each trigger source.

When the Achievement Condition Is H or L

Set the level for determining whether the trigger sources are high or low.

▶ [See here.](#)

When the Achievement Condition Is IN or OUT

An edge is detected when the trigger source enters (IN) or leaves (OUT) the specified level range. You can specify the level range settings for each analog signal trigger source.

▶ [See here.](#)

Trigger Hysteresis (Hys)

Set these items for each trigger source.

This item is the same as the [trigger hysteresis](#) of the simple trigger.

Trigger Hold-Off (Hold Off), Trigger Position (Position), Trigger Delay (Delay)

These items are the same as [trigger hold-off](#), [trigger position](#), and [trigger delay](#) of the simple trigger.

Period Trigger (Enhanced)

The PX8000 triggers on a specified period of occurrence of state condition B. The PX8000 triggers when state condition B occurs again.



Trigger Source

You can use U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8 as the trigger sources.

State Condition (B State)

To set state condition B, select the states of the trigger sources in relation to the trigger level.

Example

	State Condition B
U1	H
I1	L
P1	L
U2	L
I2	H
.....	...
AUX8	X

H: The signal level must be high.

L: The signal level must be low.

X: The signal is not used as a condition.

Determination Mode (Mode)

Set what kind of relationship must be established between period T and the specified reference times (Time or T1 and T2) for the PX8000 to trigger.

T < Time	Period T must be shorter than the reference time (Time).
T > Time	Period T must be longer than the reference time (Time).
T1 < T < T2	Period T must longer than reference time T1 and shorter than reference time T2.
T < T1, T2 < T	Period T must be shorter than reference time T1 or longer than reference time T2.

Reference Times (Time, T1, T2)

You can set the reference times (Time, T1, and T2) within the following ranges.

Setting	Selectable Range	Default	Resolution
Time	0.02 μ s to 10000000.00 μ s (10 s)	0.02 μ s	0.01 μ s
T1	0.02 μ s to 9999999.99 μ s	0.02 μ s	
T2	0.03 μ s to 10000000.00 μ s (10 s)	0.03 μ s	

Trigger Level (Level) and Trigger Hysteresis (Hys)

Set these items for each trigger source.

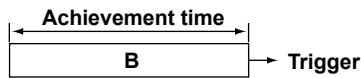
These items are the same as the [trigger level](#) and [trigger hysteresis](#) of the simple trigger.

Trigger Hold-Off (Hold Off), Trigger Position (Position), Trigger Delay (Delay)

These items are the same as [trigger hold-off](#), [trigger position](#), and [trigger delay](#) of the simple trigger.

Pulse Width Trigger (Enhanced)

The PX8000 triggers according to a specified duration (achievement time) for which state condition B has been met. The timing of the triggering varies depending on the determination mode.



Trigger Source

You can use U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8 as the trigger sources.

State Condition (B State)

To set state condition B, select the states of the trigger sources in relation to the trigger level.

Example

	State Condition B
U1	H
I1	L
P1	L
U2	L
I2	H
.....	...
AUX8	X

H: The signal level must be high.
L: The signal level must be low.
X: The signal is not used as a condition.

Determination Mode (Mode)

Set what kind of relationship must be established between the state condition B achievement time and the specified reference times (Time or T1 and T2) for the PX8000 to trigger.

B < Time	The PX8000 triggers when the achievement time is shorter than the reference time (Time), and the state condition changes to not met.
B > Time	The PX8000 triggers when the achievement time is longer than the reference time (Time), and the state condition changes to not met.
B TimeOut	The PX8000 triggers when the achievement time is longer than the reference time (Time).
B Between	The PX8000 triggers when the achievement time is longer than reference time T1 and shorter than reference time T2, and the state condition changes to not met.

Reference Times (Time, T1, T2)

You can set the reference times (Time, T1, and T2) within the following ranges.

Setting	Selectable Range	Default	Resolution
Time	0.02 μ s to 10000000.00 μ s (10 s)	0.02 μ s 0.01 μ s for B TimeOut	0.01 μ s
T1	0.01 μ s to 9999999.99 μ s	0.01 μ s	
T2	0.02 μ s to 10000000.00 μ s (10 s)	0.02 μ s	



Triggering may not function properly when the interval between achievement times is less than 0.01 μ s or when the duration of the achievement time is less than 0.01 μ s (Typical).

Trigger Level (Level) and Trigger Hysteresis (Hys)

Set these items for each trigger source.

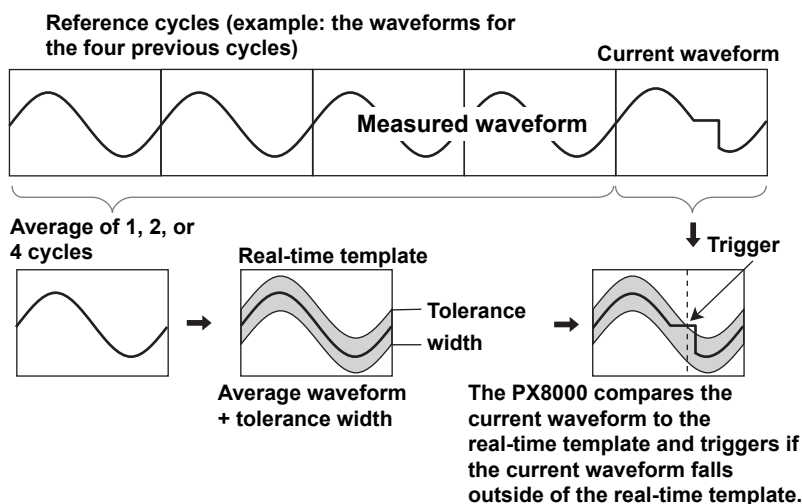
These items are the same as the [trigger level](#) and [trigger hysteresis](#) of the simple trigger.

Trigger Hold-Off (Hold Off), Trigger Position (Position), Trigger Delay (Delay)

These items are the same as [trigger hold-off](#), [trigger position](#), and [trigger delay](#) of the simple trigger.

Wave Window Trigger (Enhanced)

The PX8000 creates real-time templates (Wave Window) using a number of cycles directly preceding the current waveforms. The PX8000 compares the current waveforms to the real-time templates and triggers if one of the current waveforms falls outside of its real-time template.

**Trigger Source**

You can use U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8 as the trigger sources.

Template Channels (Condition)

Select which trigger sources to use to make real-time templates. The PX8000 triggers if the condition of even one of the channels is met.

ON	Use
OFF	Don't use

Tolerance Width (Width)

To create a real-time template for a channel, set the distance from the averaged waveform (of 1, 2, or 4 cycles before the current waveform) that will be tolerated.

Selectable range: $0.01 \times$ the voltage scale to $10 \times$ the voltage scale

Default: 0.01 div

Resolution: Same as the trigger level resolution

► [See here.](#)

For example, when Width is set to 2 V, the tolerance width is ± 1 V around the averaged waveform.

Cycle Frequency (Cycle Frequency)

Set the trigger source frequency. If the actually frequency is within $\pm 10\%$ of the specified value, it is automatically tracked.

Selectable range: 40 to 1000 Hz. The default setting is 50 Hz.

Resolution: 1 Hz

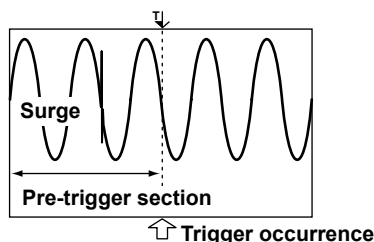
Reference Cycles (Reference Cycle)

Select how many waveforms before the current waveform are used to create the real-time templates.

1	One previous waveform is used.
2	Two previous waveforms are used.
4	Four previous waveforms are used.



If a surge or other abnormal waveform occurs in the reference cycle, the abnormal waveform will be included in the averaged waveform, so the PX8000 will trigger on the next normal waveform. This may make it appear as if the trigger has been delayed by a few cycles.



When you use the wave window trigger, we recommend that you set a pre-trigger length that is longer than the reference cycle so that you can observe waveform abnormalities that occur in the reference cycle.

Sync Channel (Sync. Ch)

Select the channel used to detect the points at which waveform comparison for the wave window trigger starts and stops. Select the synchronization channel by selecting Auto or a channel from U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8 that has a module that the wave window trigger can be used with.

Auto

Of the modules that the wave window trigger can be used with, the module with the smallest number is automatically selected.

Level for detecting the start and end points: The center of the amplitude of the sync-channel signal measured for 0.5 seconds after the start of waveform acquisition.

Detection hysteresis: Same as the edge [trigger hysteresis](#)

U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8

Select a channel whose module can be used with the wave window trigger. If triggering does not function properly when you select Auto, you can specify an appropriate channel.

For the selected channel, you need to set the level for detecting the start and end points and set the detection hysteresis.

Level for Detecting the Start and End Points (Level) and Detection Hysteresis (Hysteresis)

If you set the sync channel to a channel from U1 to U4, I1 to I4, P1 to P4, and AUX3 to AUX8, you need to set the level for detecting the start and end points and set the detection hysteresis.

These items are the same as the [trigger level](#) and [trigger hysteresis](#) of the simple trigger.

Trigger Hold-Off (Hold Off), Trigger Position (Position), Trigger Delay (Delay)

These items are the same as [trigger hold-off](#), [trigger position](#), and [trigger delay](#) of the simple trigger.



Operating Conditions of the Wave Window Trigger

You can use the wave window trigger with the following waveforms and settings. You cannot use the wave window trigger when the record length is 25 kpoint or less and the time axis setting is shorter than 10 ms/div.

Waveforms	AC waveforms and triangular waveforms between 40 kHz and 1 kHz. (The trigger cannot be used with rectangular waveforms, such as inverter waveforms, or waveforms with fast rising edges.)
Sample rate	10 kS/s to 500 kS/s
Acquisition mode	Normal
Trigger mode	Normal, Single, Single(N) When the trigger mode is Auto or Auto Level, it is difficult for the wave window trigger to occur.

6 Waveform Acquisition

ACQUIRE

Based on the data that has been stored in the acquisition memory, the PX8000 performs various operations, such as displaying waveforms on the screen, computing, measuring cursors, and automatically measuring waveform parameters.

This chapter explains how to set the number of data points to store in the acquisition memory (the record length), how to enable or disable the sample data averaging feature, and so on.

Record Length (Record Length)

Record length refers to the number of data points that are stored to the acquisition memory for each channel.

Display record length refers to the data points from the data stored in the acquisition memory that are displayed on the screen. Normally, the acquisition-memory record length and display record length are the same, but the time axis setting may cause them to differ. When you change the time axis setting, the sample rate and record length also change.

On the standard model of the PX8000, you can set the record length to a value between 100 kpoint and 10 Mpoint. On models with the /M1 option, you can set the record length to up to 50 Mpoint. On models with the /M2 option, you can set the record length to up to 100 Mpoint.

Use a long time axis setting when you want to observe a phenomenon over a long period of time. When you want to observe a phenomenon at a high time resolution, set a long record length, and raise the sample rate. When the record length is long, computation and measurement processing take longer than when the record length is short.

For example, the amounts of time for which you can record data to the acquisition memory when the record length is 100 Mpoint are listed below.

Sample Rate	In Seconds
100 MS/s	1
10 MS/s	10
5 MS/s	120
2 MS/s	50
1 MS/s	100
500 kS/s	200

The following limitations on waveform acquisition conditions and the number of waveforms that can be stored in the acquisition memory (the number of history waveforms) apply depending on the set record length.

► [See here.](#)



Notes about Setting the Record Length

- When the acquisition mode is set to Average, the maximum record length is 5 Mpoint on standard models, 10 Mpoint on models with the /M1 option, and 25 Mpoint on models with the /M2 option.
- When the trigger mode is Auto, Auto Level, Normal, or N Single and the display is not in roll mode, you can select only a record length that is less than 5 Mpoint on standard models, 10 Mpoint on models with the /M1 option, or 25 Mpoint on models with the /M2 option.
- On the PX8000, record lengths are expressed in units of points. There are some products, such as the DL750, for which record lengths are expressed in units of words.
- Numeric data is calculated on the basis of sampled data over the display record length.

Acquisition Mode (Acquisition Mode)

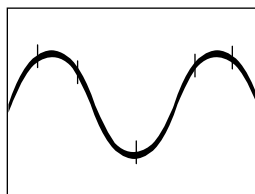
You can set the acquisition mode to one of the options below.

Normal Mode (Normal)

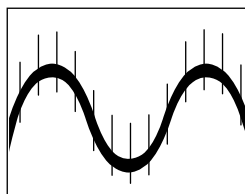
Displays waveforms without processing the sampled data.

Envelope Mode (Envelope)

The PX8000 determines the maximum and minimum values among the data sampled at the maximum sample rate for each module at a time interval that is twice the sampling period (the inverse of the sample rate) of Normal mode, saves the values as pairs in the acquisition memory, and uses the saved value pairs to display the waveforms. This mode is effective when you want to avoid aliasing, because the sample rate is essentially kept high regardless of the time axis setting. It is also effective when you want to detect glitches (narrow pulse signals) or when you want to display the envelope of a modulated signal.



Normal mode



Envelope mode



Numeric data will be invalid.

Averaging Mode (Average)

The PX8000 acquires waveforms multiple times, averages the same time points relative to the trigger point, saves them in the acquisition memory, and uses them to display averaged waveforms. Averaging mode is useful when you want to remove random noise from waveforms.

The averaging method varies depending on the acquisition count.

When Acquisition Count Is Set to Infinity

Exponential average

$$A_n = \frac{1}{N} \{(N-1)A_{n-1} + X_n\}$$

A_n : n^{th} averaged value

X_n : n^{th} measured value

N : Attenuation constant
(2 to 256 in 2^n steps)

When Acquisition Count Is Set to a Value between 2 and 65536 (in 2^n steps)

Linear average

$$A_N = \frac{\sum_{n=1}^N X_n}{N}$$

X_n : n^{th} measured value

N : Average count = acquisition count



- When waveforms are acquired in averaging mode, they are saved to the acquisition memory as a single record. This means that the history feature cannot be used.
- You cannot select averaging mode when:
 - The display is in roll mode.
 - The trigger mode is Single, N Single, or On Start.
- To average waveforms that have been acquired in N Single mode, set the acquisition mode to Normal, and set the history feature's display mode to Averaging.
- Power measurement in averaging mode is computed from the zero-crossing data of the last acquired waveform data.
- In averaging mode, the waveforms of AUX channels whose input signal type is set to Pulse are not averaged. Such waveforms are displayed without processing the sampled data.

Trigger Mode (Trigger Mode)

▶ [See here.](#)

Acquisition Count (Acquisition Count)

The ranges within which you can set the waveform acquisition count are indicated below. If you select Infinite, the PX8000 continues waveform acquisition until you stop it using the START/STOP key. The default setting is Infinite. Changes to the number of acquisitions are not applied during waveform acquisition. They are applied after acquisition stops.

- When the acquisition mode is set to Normal or Envelope
1 to 65536 (in steps of 1) or Infinite
- When the acquisition mode is set to Average.
2 to 65536 (in 2ⁿ steps) or Infinite



-
- The number of waveforms that have been stored to the acquisition memory appears in the lower left of the screen.
 - If the trigger mode is set to Single or On Start, you can set the acquisition count only when the [action mode](#) is on.
-

Time Base (Time Base)

Under the initial settings, the PX8000 samples the measured signals using the clock signal produced by its internal time-base circuit (internal clock). You can also use an external clock signal to control sampling. One data sample is stored to the acquisition memory at every pulse in the external clock signal. The external clock input is useful when you want to monitor the waveform using a clock signal that is in sync with the signal being measured.

Apply the external clock signal to the external-clock input terminal (EXT CLK IN) on the left panel. For the specifications of the external-clock input terminal, see section 5.3 in the getting started guide, IM PX8000-03EN.

Int	The internal clock signal is used as the time base (the TIME/DIV time axis setting is valid).
Ext	An external clock signal is used as the time base (the TIME/DIV time axis setting is invalid).

Pulses per Rotation (Pulse/Rotate)

When the time base is an external clock, you can specify how many pulses of the external clock signal (how many sampled data acquisitions) correspond to one mechanical rotation (or period). For example, if you set Pulse/Rotate to 100 pulses, when the record length is 100 kpoint, 1000 rotations worth of sampled data will be acquired. When Pulse/Rotate is set to 1 pulse, each point of sampled data corresponds to a single rotation. The Pulse/Rotate setting only affects the horizontal-cursor measurement values and how the time axis is displayed on the screen. For example, if you set Pulse/Rotate to 10000 pulses, when the record length is 100 kpoint, 1 div will correspond to 1 rotation. With these settings, if you move the cursor by 1 div, the measured horizontal value will increase or decrease by 1.

Selectable range for pulses: 1 to 24000



Notes about Sampling Using an External Clock Signal

- You cannot acquire waveforms when the acquisition mode is set to Envelope.
- You cannot display waveforms in roll mode.
- There is no function for dividing the frequency of the clock signal.
- The time axis cannot be changed. To change the time-axis display range, change the record length, or zoom in on the time axis.
- The measured time values in cursor measurements and automated measurements of waveform parameters indicate the number of clock signal pulses. For these measurements, units are not displayed.
- The trigger settings listed below are invalid.
Hold-off, trigger delay, period trigger, pulse width trigger
- Harmonic measurement and frequency measurement cannot be performed.

Maximum Sample Rates for Each Module

If you set the sample rate of the PX8000 to a rate that is higher than a module's maximum sample rate, because the data is updated at the module's maximum sample rate, all the data within the module's data update interval will be the same. The maximum sample rates for each module are listed below.

Module	Maximum Sample Rate	
	Internal Clock	External Clock
760811, 760812, 760813, 760851	100 MHz	9.5 MHz

Executing Logger Setup (Execute Logger Setup)

When you execute logger setup, the following features are turned off.

- [Turning Numeric Measurement On and Off \(Numeric Measure\)](#)
- [Cursor Measurement](#)
- [Automated Measurement of Waveform Parameters](#)
- [Waveform Computation](#)
- [Auto Calibration](#)

When these features are turned off, the computation time required on the PX8000 CPU is reduced, allowing data to be collected at high speeds (at short time intervals). This setting is effective when you want to use the PX8000 like a logger-acquire data at short time intervals and analyze on a PC the waveforms of input signals that change steeply. The time interval for acquiring data varies depending on the number of channels, time scale settings, record length, and the like. You can execute logger setup to turn off the above features and set them back on individually.

Waveform Acquisition (START/STOP)

When you start waveform acquisition, the PX8000 stores waveform data to the acquisition memory and updates the displayed waveforms each time it triggers. The acquisition memory is divided into many areas based on the set record length, and the maximum number of acquirable waveforms are stored in the memory. You can recall past waveforms that are stored in the memory by using the history feature when waveform acquisition is stopped.

PX8000 Operation When the Acquisition Mode Is Set to Averaging

- Averaging stops when you stop acquisition.
- If you start acquisition again, averaging starts from the beginning.

The START/STOP Key Is Disabled:

- When the PX8000 is in remote mode.
- When the PX8000 is printing to a printer, or when it is accessing a storage medium.
- When the key lock type is ALL and key lock is set to ON



- If you change the waveform acquisition conditions and start waveform acquisition, the past data stored in the acquisition memory is cleared.
- You can use the snapshot feature to retain the displayed waveform on the screen. This feature allows you to update the display without having to stop waveform acquisition.
- Regardless of the trigger settings, you can make the PX8000 trigger by pressing the MANUAL TRIG key on the front panel.

7 Display Mode and Display Settings

Display Mode (DISPLAY MODE)

Press DISPLAY MODE to select the display mode.

- Split displays with the numeric data display (Numeric+***)
- Split displays with the waveform display (Wave+***)
- [Numeric Data Display](#)
- [Waveform Display](#)
- [Bar Graph Display*](#)
- [Vector Display*](#)

* This item is available on models with the harmonic measurement option.

Split Displays with the Numeric Data Display (Numeric+***)

Numeric data is displayed in the top half of the screen. Select the display to show in the bottom half of the screen from the following options.

- Wave: Waveform
- Bar: Bar graph*
- Vector: Vector*

* This item is available on models with the harmonic measurement option.

Split Displays with the Waveform Display (Wave+***)

Waveforms are displayed in the top half of the screen. Select the display to show in the bottom half of the screen from the following options.

- Numeric: Numeric data
- Bar: Bar graph*
- Vector: Vector*

* This item is available on models with the harmonic measurement option.



The bottom half of the screen shows the zoom display, X-Y display, or FFT display when any of these displays are on.

Split displays with the numeric data display

Numeric data	Numeric data	Numeric data
Waveform	Bar graph	Vector

Split displays with the waveform display

Waveform	Waveform	Waveform
Numeric data	Bar graph	Vector

Single display

Numeric data	Waveform	Bar graph	Vector
--------------	----------	-----------	--------

Waveform Display Types

The waveform display consists of the following windows.

- T-Y (Time axis) Waveform Display Window
- X-Y Window (Window 1 and Window 2)
- FFT Window (FFT1 window and FFT 2 window)
- Extra Window

For details, see “Waveform Display.”

► [Click her](#)

Display Settings (DISPLAY SETTING)

Press DISPLAY SETTING to configure the display.

- [Numeric Data Display Settings](#)
- [Waveform Display Settings](#)
- [Bar Graph Display Settings](#)
- [Vector Display Settings](#)

Split Display Settings

Press DISPLAY SETTING to switch between the SETTING menus of the display that you assigned to the top half of the screen in the split display and the display that you assigned to the bottom half of the screen in the split display.

8 Numeric Data Display

When you select Numeric with the DISPLAY MODE key, numeric data is displayed.

Numeric Data Display Settings

You can set the following items.

- Display Format (Format)
- Settings other than the display format vary depending on the display that is shown.
 - [4-, 8-, and 16-Value Displays \(4 Items/8 Items/16 Items\)](#)
 - [Matrix Display \(Matrix\)](#)
 - [All Items Display \(All Items\)](#)
 - [Single Harmonics and Dual Harmonics Lists \(Hrm Single List/Hrm Dual List; option\)](#)
 - [Custom Display \(Custom\)](#)

Display Format (Format)

You can select the number of numeric data items that are displayed simultaneously from the choices below or choose to display a list of items.

4-Value Display (4 Items)

Four numeric data values are displayed in one column.

8-Value Display (8 Items)

- When the display mode is Numeric, eight numeric data values are displayed in one column.
- When the display is split, eight numeric data values are displayed in two columns.

16-Value Display (16 Items)

Sixteen numeric data values are displayed in two columns.

Matrix (Matrix) and All (All Items) Displays

A table of numeric data is displayed with measurement functions listed vertically and symbols indicating elements and wiring units listed horizontally. The number of displayed items varies depending on the number of elements that are installed in the PX8000.

Single Harmonics List Display (Hrm Single List; option)

- When the display mode is Numeric, up to 42 of the harmonic order data items of a single measurement function are displayed in two columns.
- When the display is split, up to 22 of the harmonic order data items of a single measurement function are displayed in two columns.

Measurement function display area
(Data concerning all harmonics)

Harmonic order data display area
Measurement functions

Order	U1 [V]	hdf [%]	Order	U1 [V]	hdf [%]
Total	5.0177		dc		
1	4.5268	90.217	2	0.0023	0.046
3	1.5688	30.070	4	0.0024	0.046
5	0.9052	18.039	6	0.0023	0.046
7	0.6464	12.882	8	0.0023	0.046
9	0.5029	10.022	10	0.0022	0.045
11	0.4113	8.197	12	0.0023	0.046
13	0.3481	6.938	14	0.0024	0.047
15	0.3017	6.013	16	0.0022	0.043
17	0.2662	5.306	18	0.0023	0.046
19	0.2381	4.746	20	0.0024	0.047
21	0.2155	4.296	22	0.0024	0.048
23	0.1988	3.922	24	0.0022	0.045
25	0.1811	3.610	26	0.0022	0.044
27	0.1677	3.342	28	0.0021	0.042
29	0.1581	3.111	30	0.0023	0.046
31	0.1460	2.910	32	0.0022	0.045
33	0.1373	2.737	34	0.0023	0.046
35	0.1294	2.578	36	0.0023	0.046
37	0.1222	2.435	38	0.0023	0.046
39	0.1162	2.316	40	0.0023	0.046

Numeric data for each harmonic

Distortion factors of each harmonic
(When the selected measurement function is U, I, or P, Uhdf, Ihdf, or Phdf is displayed.)

Dual Harmonics List Display (Hrm Dual List; option)

- When the display mode is Numeric, the numeric values of two measurement functions are displayed in two separate columns, each containing up to 22 numeric values.
- When the display is split, the numeric values of two measurement function are displayed in two separate columns, each containing up to 12 numeric values.

Measurement function display area
(Data concerning all harmonics)

Harmonic order data display area
Measurement function 1
Measurement function 2

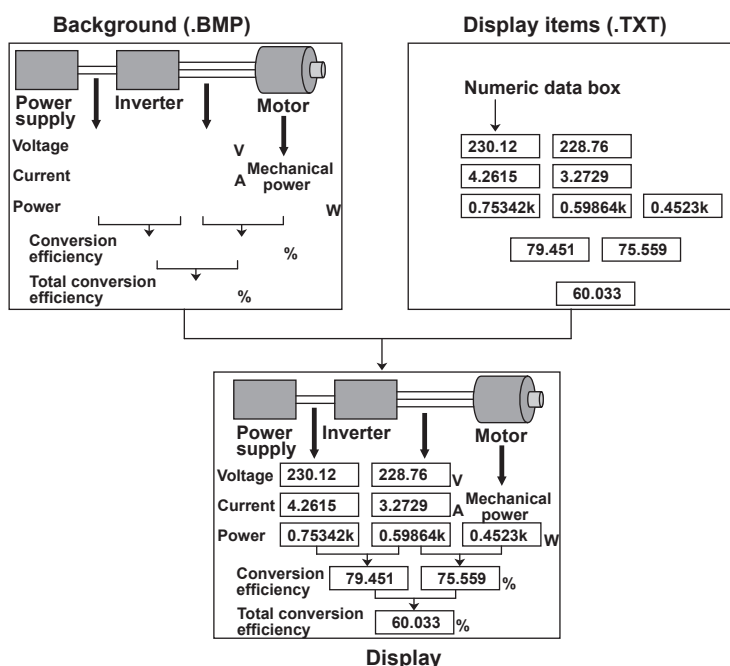
Order	U1 [V]	hdf [%]	Order	I1 [A]	hdf [%]
Total	5.0178		Total	2.908	
dc			dc		
1	4.5267	90.213	1	2.887	99.275
2	0.0000	0.000	2	0.000	0.004
3	1.5687	30.067	3	0.321	11.022
4	0.0001	0.002	4	0.000	0.009
5	0.9050	18.036	5	0.115	3.960
6	0.0001	0.003	6	0.000	0.008
7	0.6465	12.885	7	0.059	2.039
8	0.0002	0.003	8	0.000	0.003
9	0.5028	10.020	9	0.036	1.228
10	0.0001	0.003	10	0.000	0.002
11	0.4115	8.200	11	0.024	0.819
12	0.0000	0.000	12	0.000	0.003
13	0.3481	6.937	13	0.017	0.587
14	0.0001	0.003	14	0.000	0.005
15	0.3017	6.013	15	0.013	0.441
16	0.0001	0.002	16	0.000	0.009
17	0.2664	5.309	17	0.010	0.346
18	0.0001	0.002	18	0.000	0.004
19	0.2383	4.749	19	0.008	0.276
20	0.0002	0.003	20	0.000	0.001

Numeric data for each harmonic

Distortion factors of each harmonic
(When the selected measurement function is U, I, or P, Uhdf, Ihdf, or Phdf is displayed.)

Custom Display (Custom)

You can use an illustration (.BMP) or picture (.BMP) from a PC or other device as the background of the display. You can arrange numeric data boxes on top of this background to create a custom display. Numeric data appears in this custom display.



Switching the Displayed Page

You can switch the displayed page and display a new set of items.

- ▼ key: The next page is displayed.
- ▲ key: The previous page is displayed.

In the 4-, 8-, and 16-Value Displays

You can switch between and display pages 1 to 12.

In the Matrix Display

You can switch between and display pages 1 to 9.

In the All Items Display

The first page is always displayed in the top half of the screen. You can switch between pages 2 and later pages in the bottom half of the screen. When the display is split and the All Items display is shown, you can switch between all pages, including page 1, in order.

In the Single Harmonics List and Dual Harmonics List Displays

You can switch separately between the pages of the measurement function display (on the left side of the screen) and the harmonic order data display (on the right side of the screen). Use the left and right arrow keys to select the display whose pages you want to switch between.

In the Custom Display

When you have configured the custom display to contain multiple pages, you can switch between each of the pages.

Number of Displayed Digits (Display Resolution)

The number of displayed digits (display resolution) for voltage, current, active power, apparent power, reactive power, and so on is as follows:

- When the number of displayed digits is set to 5
 - If the value is less than or equal to 60000: Five digits.
 - If the value is greater than 60000: Four digits.
- When the number of displayed digits is set to 6
 - If the value is less than or equal to 600000: Six digits.
 - If the value is greater than 600000: Five digits.

For details, see appendix 3 in the features guide, IM PX8000-01EN. When the range rating (rated value of the specified measurement range) is specified, the Σ functions of the voltage, current, active power, apparent power, reactive power, and so on, are set to the decimal place and unit of the element with the lowest number of displayed digits (display resolution) in the wiring unit.

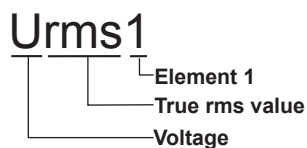
Display Item

For a list of the measurement functions and their descriptions, see “Items That This Instrument Can Measure.”

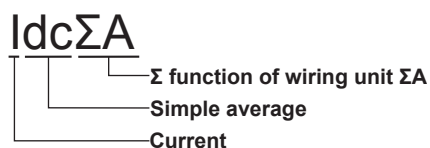
► [See here.](#)

Example of How Measurement Functions Are Displayed in the Numeric Data Display

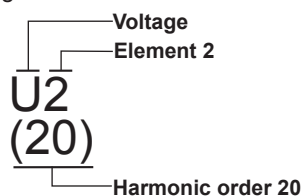
True rms voltage of element 1



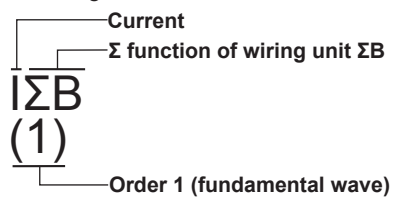
Simple average of the currents of the elements in wiring unit ΣA



Voltage of the 20th order of element 2



Simple average of the fundamental currents of the elements in wiring unit ΣB



Notes about the Numeric Data Display

- "-----" is displayed if a measurement function is not selected or if there is no numeric data.
- If Urms, Umn, Udc, Urmn, Uac, Irms, Imn, Idc, Irmn, or Iac exceeds 140% of the measurement range, "-OL-" is displayed to indicate an overload value.
- If the voltage or current exceeds 140% of the measurement range, "-OL-" is displayed to indicate an overload value for P.
- If the measured or computed result cannot be displayed using the specified decimal place or unit, "-OF-" (for overflow) is displayed.
- When the measured voltage or current value is at or below the percentage of the measurement range indicated below, the values of Urms, Umn, Urmn, Uac, Irms, Imn, Irmn, Iac, and other measurement functions that are based on them are displayed as zero (suppression to zero). The λ and Φ functions will return errors ("Error" is displayed).
 - When Urms, Uac, Irms, or Iac is 0.3% or less
 - When Umn, Urmn, Imn, or Irmn is 2% or less
- If the number of sampled data points is less than 8192, harmonic data is not measured, and no data display [-----] appears.
- There is no overload value indication ("-OL-") or zero indication (suppression to zero) for the numeric data of harmonic orders 0 (DC) to 500.
- If the measured frequency is outside the measurement range, the fU or fI function returns an error ("Error" is displayed).
- If the power factor λ is greater than 1 and less than or equal to 2, λ returns 1. Φ returns zero.
- If λ is greater than 2, λ and Φ return errors ("Error" is displayed).

4-, 8-, and 16-Value Displays (4 Items/8 Items/16Items)

Item Number to Set (Item No.)

Select the number of the item that you want to configure.

Function (Function)

You can select any of the measurement function types listed under “Items That This Instrument Can Measure.”

► [See here.](#)

If you select None, no measurement function is displayed for the selected item.

Element (Element/ Σ)

- You can select the element/wiring unit from the options below. The available options vary depending on the installed elements.
Element1, Element2, Element3, Element4, ΣA , and ΣB
- If the selected wiring unit does not have any elements assigned to it, because there is no data, “-----” (no data) is displayed. For example, if elements are assigned to ΣA but not to ΣB , the measurement function for ΣB is displayed as “-----” (no data).

Order (Order; option)

When you select a function that has harmonic data, you can set the displayed harmonic order within the following range.

Total (Total value) or 0 (dc) to 500

The numeric data corresponding to harmonic orders above the maximum measurable harmonic order is displayed as “-----” (no data). For information about the maximum measurable harmonic order, see “Maximum Harmonic Order to Be Measured (Max Order).”

► [See here.](#)

Resetting the Display Items (Reset Items)

You can select the reset method from the following options.

- Reset Items Exec: The numeric data for each element is displayed on each page. The pattern that the data is arranged in varies depending on the number of installed elements.
- Clear Current Page: All the measurement functions on the current page are set to None.
- Clear All Pages: All the measurement functions on every page are set to None.

Matrix Display (Matrix)

Item Number to Set (Item No.)

This is the same as setting the item number in the 4-, 8-, and 16-value displays.

▶ [See here.](#)

Function (Function)

This is the same as setting the function in the 4-, 8-, and 16-value displays.

▶ [See here.](#)



In the matrix display, if you choose a measurement function that does not require an element or wiring unit (such as $\eta 1$ to $\eta 4$, F1 to F20, etc.), data is displayed in the first column.

Order (Order; option)

This is the same as setting the order in the 4-, 8-, and 16-value displays.

▶ [See here.](#)

Columns (Column Settings)

Number of Columns (Column Num)

You can set the number of columns to 4 or 6.

Column Number (Column No.)

Select the number of the column that you want to configure.

Element (Element/ Σ)

- You can select the element/wiring unit from the options below. The available options vary depending on the installed elements.
None, Element1, Element2, Element3, Element4, ΣA , and ΣB
- If you select None, no measurement data is displayed in the selected column.
- If the selected wiring unit does not have any elements assigned to it, because there is no data, “-----” (no data) is displayed. For example, if elements are assigned to ΣA but not to ΣB , the measurement function for ΣB is displayed as “-----” (no data).

Resetting the Settings (Reset Columns)

Reset the column settings.

Resetting the Display Items (Reset Items)

This is the same as resetting the display items in the 4-, 8-, and 16-value displays.

▶ [See here.](#)

All Items Display (All Items)

You cannot change individual measurement functions. Change the display by pressing PAGE ▲ and PAGE ▼ soft keys or the up and down arrow keys.

The number of displayed pages varies as indicated below depending on the installed options.

Harmonic Measurement Option	Installed	10 pages
	Not installed	6 pages

Order (Order (k); option)

This setting is valid on the 7th or 8th page. On the 7th or 8th page, the order setting appears in the upper left of the screen. This is the same as setting the order in the 4-, 8-, and 16-value displays.

► [See here.](#)

Single Harmonics and Dual Harmonics Lists (Hrm Single List/Hrm Dual List; option)

For each measurement function, you can display the numeric data for a harmonic order from 0 (DC) to 500 or for all harmonic orders in two columns.

This item is available on models with the harmonic measurement option.

Item Number to Set (List Item No.)

- You can specify two lists to show in the harmonic order data display area (the right side of the screen). Select the number—1 or 2—of the list that you want to select.
 - When Hrm Single Lis is selected, the data of List Item No1 is listed in two columns.
 - When Hrm Dual List is selected, the data of List Item No1 is listed in one column, and the data of List ItemNo2 is listed in another column.
- You cannot change individual items in the measurement function display area (the left side of the screen). Change the display by pressing the up and down arrow keys.

Function (Function)

Select the measurement function to show in the harmonic order data display area from the following options.

U, I, P, S, Q, λ, Φ, ΦU, ΦI, Z, Rs, Xs, Rp, and Xp

Element (Element/Σ)

You can select the element or wiring unit to display in the harmonic order data display area. This is the same as setting the element in the 4-, 8-, and 16-value displays.

► [See here.](#)

Order

The Total value and 0 (DC) order numeric data is always displayed at the top of the harmonic order data display area. To switch between the displays of the numeric data for harmonic orders 1 to 500, use the up and down arrow keys.

The number of harmonic orders that switch when you change the page is indicated below.

	Normal display (1 screen)	Split display
Hrm Single List	40 orders	20 orders
Hrm Dual List	20 orders	10 orders

Custom Display (Custom)

Loading a Display Configuration File (Load Items)

On the file list, specify a file to load display configuration data from. The extension is .TXT.

For information about how to configure the file list display and how to operate files and folders, see “File Operations (FILE UTILITY).”

▶ [See here.](#)

Loading a Background File (Load Bmp)

On the file list, specify a background file to load. The extension is .BMP.

If you use a commercial graphics program to create an image that meets the following specifications, you can load the image to the PX8000.

- File format: BMP
- Resolution: 800 × 654 pixels
- Color scale: 16-bit high color (R: 5 bits, G: 6 bits, B: 5 bits) or 24-bit true color (R: 8 bits, G: 8 bits, B: 8 bits)
- Size: Approx. 1 MB (16 bit) or approx. 1.6 MB (24 bit)



- If you attempt to load an image that does not meet the above specifications, the image will not be displayed properly, or an error message will appear and you will not be able to load the image.
 - After you properly load a display configuration file and a background file, if you restart the PX8000 and the same background file is not in the same location, the background will return to its default.
 - A background file cannot be loaded from a network drive.
-

Simultaneously Loading a Display Configuration File and a Background File (Load Items & Bmp)

When you select a display configuration file (.TXT) from the file list and load it, if there is a background file with a .BMP extension and the same name as the display configuration file, that file is also loaded.



If there is no background file with the same name as the display configuration file in the same directory as the display configuration file, an error occurs.

Display Configuration (Edit Items)

Total Number of Items (Total Items)

You can set the total number of numeric data boxes to display to a number from 1 to 192.*

Number of Items per Page (Items Per Page)

You can set the total number of numeric data boxes to display per page to a number from 1 to 192.*

The total number of pages is Total Items/Items Per Page.

* The ranges of Total Items and Items Per Page are related as indicated below.

- Total Items: Items Per Page to Items Per Page × 12
- Items Per Page: Total Items/12 to Total Items

Customizing the Displayed Items (Custom Items)

- **Item Number to Set (Item No.)**

Select the number of the item that you want to configure.

- **Function (Function)**

This is the same as setting the function in the 4-, 8-, and 16-value displays.

▶ [See here.](#)

If you select None, you can display a character string in the numeric data box. Select the [String](#) menu item to enter the string.

- **Element (Element/ Σ)**

This setting is valid when Function is not set to None. This is the same as setting the element in the 4-, 8-, and 16-value displays.

▶ [See here.](#)

- **Order (Order; option)**

This is the same as setting the order in the 4-, 8-, and 16-value displays.

▶ [See here.](#)

If you set Function to None, instead of the Order menu item, a menu item for entering a string (String) appears.

- **String (String)**

This menu item appears when you set Function to None. Enter the character string to display in the numeric data box. You can enter a string of up to 15 characters in length.

If you do not set Function to None, instead of the String menu item, the Order menu item appears.

- **X Display Position (X Pos)**

Set the position where the left edge of the numeric data box will appear on the screen to a value from 0 (the left edge of the screen) to 800 (the right edge of the screen).

- **Y Display Position (Y Pos)**

Set the position where the top edge of the numeric data box will appear on the screen to a value from 0 (the top of the screen) to 654 (the bottom of the screen).

- **Font Size (Font Size)**

Select the font size from the options below.

14, 16, 20, 24, 32, 48, 64, 96, and 128

- **Font Color (Font Color)**

Select the font color from the options below.

Yellow, Green, Magenta, Cyan, Red, Orange, Light Blue, Purple, Blue, Pink, Light Green, Dark Blue, Blue Green, Salmon Pink, Mid Green, Gray, White, Dark Gray, Blue Gray, and Black

Saving the Display Configuration (Save Custom Items)

You can save the display configuration that you have created to the specified storage medium. The extension is .TXT.

- **Displaying a File List and Specifying the Save Destination (File List)**

On the file list, specify the save destination. For information about how to configure the file list display and how to operate files and folders, see “File Operations (FILE UTILITY).”

▶ [See here.](#)

- **File Name (File Name)**

Automatic File Naming (Auto Naming)

This is the same as the auto naming feature for saving and loading data.

▶ [See here.](#)

File Name (File Name)

This is the same as file name setting for saving and loading data.

▶ [See here.](#)

- **Saving (Save Exec)**

Saves the display configuration.



-
- Note that if there is a file with the same name in the save destination, it will be overwritten without warning.
 - File names are not case sensitive.
-

9 Numeric Computation

NUMERIC

You can set the following items.

- [Turning Numeric Measurement On and Off \(Numeric Measure\)](#)
- [Calculation Period \(Period\)](#)
- [Averaging \(Averaging\)](#)
- [User-Defined Functions \(User Defined Function\)](#)
- [Apparent Power, Reactive Power, and Corrected Power Equations \(Formula\)](#)
- [Phase Difference Display Format \(Phase\)](#)
- [Harmonic Measurement Conditions \(Harmonics; option\)](#)

Re-executing Computation

If you change the numeric computation settings when acquisition of sampled data is stopped, computation is re-executed. All computations including the data of measurement functions are re-executed with the exception of averaging. Averaging is cleared.

Turning Numeric Measurement On and Off (Numeric Measure)

Turn the measurement of all measurement functions, such as voltage, current, and power, on and off.

- ON

The PX8000 measures measurement functions from the acquisition data and shows numeric data on the numeric data display.

- OFF

The PX8000 does not measure measurement functions. All the numeric data on the numeric data display are set to no data display [———]. The computation time required on the PX8000 CPU is reduced, allowing data to be collected at high speeds (at short time intervals). This setting is effective when you want to use the PX8000 like a logger—acquire data at short time intervals and analyze on a PC the waveforms of input signals that change steeply.

Calculation Period (Period)

Select the calculation period for the measurement functions of normal measurement, such as voltage, current, and power.

- Zero Cross



The calculation period is set using the zero-crossings of the specified synchronization source input signal.

For details on the synchronization source and zero-crossing, see “Synchronization Source (Sync Source)” in “Fundamental Measurement Conditions.”

► [See here.](#)

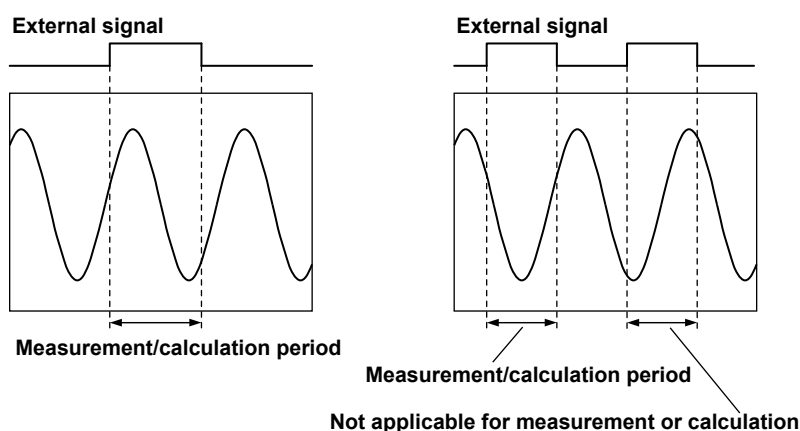
- Ext Gate

The calculation period is set using the external signal received through the TRIGGER IN terminal.

-  : The measurement/calculation period is when the external signal is at low level.
-  : The measurement/calculation period is when the external signal is at high level.

The measurement/calculation period is only during the first period that meets the above condition.

For example, if Ext Gate is set to , the PX8000 operates as follows:



- Cursor

Set the computation period using two cursors (start point and end point) that appear in the waveform display.

The period between the start point (Start Position) and end point (End Position) becomes the measurement or calculation period. The default settings are -5 div and +5 div.

Selectable range: -5 div to +5 div

The start and end point settings are similar to the cursor position settings in cursor measurement.

For details, see “Selectable Range of Cursor Positions” under “Cursor Measurement.”

► [See here.](#)



If you want the measurement period to cover the entire waveform display, select Zero Cross, and set the synchronization source to None.

Search Zero Cross (Search Zero Cross)

If the calculation period (Period) is set to Cursor, the PX8000 searches for a zero-crossing position and moves the computation period's start point (or end point) to the zero-crossing position.

Zero-Crossing Search Source (Source)

Select the signal to use as the zero-crossing search source from the options listed below. The available options vary depending on the installed elements.

U1, I1, U2, I2, U3, I3, U4, I4, and External*

- * When you select External, the external signal applied to the external trigger input connector (TRIGGER IN) on the side panel is used as the zero-crossing search source. For the TRIGGER IN connector specifications, see section 5.1 in the getting started guide, IM PX8000-03EN.

Edge (Edge)

Select the polarity to detect zero crossing from the options listed below.

- \nearrow : Rising
- \searrow : Falling
- \updownarrow : Rising or falling

Zero-Crossing Search

You can move the Start Position or End Position to the zero-crossing position of the zero-crossing search source.

- Search Next Move Start: Moves to the nearest zero-crossing position after the Start Position
- Search Previous Move Start: Moves to the nearest zero-crossing position before the Start Position
- Search Next Move End: Moves to the nearest zero-crossing position after the End Position
- Search Previous Move End: Moves to the nearest zero-crossing position before the End Position
- Search Next Move Start Link: Moves to the nearest zero-crossing position after the Start Position (while maintaining the cursor span)
- Search Previous Move Start Link: Moves to the nearest zero-crossing position before the Start Position (while maintaining the cursor span)



Because the computation method and correction method differ, numeric computation data in the range selected with cursors and the computed result of automated measurement of waveform parameters may be different. Numeric computation performs computation more accurately on all items simultaneously. Automated measurement of waveform parameters performs high-speed computation on selected computation items.

Averaging (Averaging)

You can take exponential or moving averages of the numeric data. The averaging function is effective when reading of the numeric display is difficult due to fluctuations. This occurs when the fluctuation of the power supply or the load is large or when the input signal frequency is low.

Off

Averaging is not performed.

Exponential Averaging (Exp)

With the specified attenuation constant, the numeric data is exponentially averaged according to the equation below.

$$D_n = D_{n-1} + \frac{(M_n - D_{n-1})}{K}$$

D_n : Displayed value that has been exponentially averaged n times. (The first displayed value, D_1 , is equal to M_1 .)

D_{n-1} : Displayed value that has been exponentially averaged $n - 1$ times.

M_n : Measured data at the n^{th} time.

K : Attenuation constant (select from 2 to 64)

Attenuation Constant (Count)

- Set the attenuation constant to a value within the following range.
2 to 64

Moving Average (Lin)

The specified average count is used to compute moving averages according to the equation below.

$$D_n = \frac{M_{n-(m-1)} + \dots + M_{n-2} + M_{n-1} + M_n}{m}$$

D_n : $n-(m-1)^{\text{th}}$ to the n^{th} time

$M_{n-(m-1)}$: Measured data at the $n-(m-1)^{\text{th}}$ time

.....

M_{n-2} : Measured data at the $n-2^{\text{th}}$ time.

M_{n-1} : Measured data at the $n-1^{\text{st}}$ time.

M_n : Measured data at the n^{th} time.

m : Average count (select a number from 8 to 64)

Average Count (Count)

- Set the average count to a value within the following range.
8 to 64

Averaging Status Display

The averaging status is shown at the top of the screen.

- When averaging is set to OFF: Averaging:Off is displayed.
- When averaging is set to Exp or Lin: Averaging:On is displayed.

Measurement Functions That Are Averaged

The measurement functions that are directly averaged are indicated below. Other functions that use these functions in their computation are also affected by averaging. For details about how the values of the measurement functions are determined, see appendix 1 in the features guide, IM PX8000-01EN.

Measurement Functions Used in Normal Measurement

The following measurement functions are averaged when averaging is set to Exp or Lin.

- Urms, Umn, Udc, Urmn, Uac, Irms, Imn, Idc, Irmn, Iac, P, S, and Q
- $\Delta U1$ to $\Delta P3$
- Aux3 to Aux8, Pm2 to Pm4
- λ , Φ , CfU, Cfl, Pc, and $\eta1$ to $\eta4$ are computed using the averaged values of Urms, Irms, P, S, and Q.

Measurement Functions Used in Harmonic Measurement (Option)

The following measurement functions are averaged when averaging is set to Exp. They are not averaged when averaging is set to Lin.

- $U(k)$, $I(k)$, $P(k)$, $S(k)$, and $Q(k)$
- $\lambda(k)$, and $\Phi(k)$ are computed using the averaged values of $P(k)$ and $Q(k)$.
- Z, Rs, Xs, Rp, Xp, Uhdf, Ihdf, Phdf, Uthd, Ithd, Pthd, Uthf, Ithf, Utif, Itif, hvf, hcf, and K-factor are computed using the averaged values of $U(k)$, $I(k)$, and $P(k)$.
- k: The harmonic order

Measurement Functions That Do Not Perform Averaging

The following measurement functions do not perform averaging.

Measurement Functions Used in Normal Measurement

fU, fI, U+pk, U-pk, I+pk, I-pk, P+pk, and P-pk

Measurement Functions Used in Harmonic Measurement (Option)

$\Phi U(k)$, $\Phi I(k)$, ΦU_i-U_j , ΦU_i-U_k , ΦU_i-I_i , ΦU_j-I_j , ΦU_k-I_k , ΦI_i-I_j , ΦI_j-I_k , ΦI_k-I_i , and f_{PLL}

* k: The harmonic order

Measurement Functions Used in Normal and Harmonic Measurement (Option)

F1 to F20



- When averaging is turned on, the average value of multiple measurements is determined and displayed. If the input signal changes drastically, it will take longer for the change to be reflected in the measured values when averaging is used.
- A larger attenuation constant (for exponential averaging) or average count (for moving averages) will result in more stable (and less responsive) measured values.
- When history data is recalled or manipulated, averaging will be cleared.
- When numeric computation settings are changed and recalculation is performed, averaging will be cleared.
- If you set the acquisition mode to averaging mode, waveforms are averaged but numeric data is not.

Resetting of Averaging

Averaging is reset when measurement conditions are changed. Below are some of the main settings that are affected.

- Measurement range
- Independent element configuration
- Wiring system
- Scaling values, linear scaling values
- Line filter, frequency filter, bandwidth
- Averaging types (Exp, Lin), attenuation constant, average count
- Time axis
- Record length
- Sample rate
- Synchronization source
- Maximum and minimum harmonic order to be measured
- Apparent power and reactive power equations

User-Defined Functions (User Defined Function)

You can combine function symbols to create equations and use the numeric data of the combined functions to determine the value of the equation. It is convenient to use a USB keyboard when entering multiple equations or particularly long equations.



User-defined functions allow you to determine physical values other than those of the measurement functions by combining operands. The measurement functions that you can specify for the [efficiency equation](#) are fixed at power and motor output. However, by using user-defined functions, you can create equations consisting of measurement functions other than power and motor output measurement functions to determine ratios other than efficiency.

Selecting Which User-Defined Function to Configure

Select the number of the user-defined function that you want to configure from the options below.

- User Defined F01 to F05: User-defined functions F1 to F5
- User Defined F06 to F10: User-defined functions F6 to F10
- User Defined F11 to F15: User-defined functions F11 to F15
- User Defined F16 to F20: User-defined functions F16 to F20

Turning the Computation of a User-Defined Function On or Off

Selecting Whether to Compute a User-Defined Function

User-Defined Function Name (Name)

- Number of characters: Up to eight
- Usable characters: Spaces and all characters that are displayed on the keyboard

Unit (Unit)

- Number of characters: Up to eight
- Usable characters: Spaces and all characters that are displayed on the keyboard

Expression (Expression)

Operation Type

You can use combinations of measurement functions and element numbers (e.g., Urms1) as operands to configure up to 20 equations (F1 to F20). There can be up to 16 operands in 1 equation.

The different types of operands are listed below (measurement function: operand).

- **Normal Measurement**

Voltage, current, and power

Urms: URMS()	Irms: IRMS()	P: P()
Umn: UMN()	Imn: IMN()	S: S()
Udc: UDC()	Idc: IDC()	Q: Q()
Urmn: URMN()	Irmn: IRMN()	λ: LAMBDA()
Uac: UAC()	Iac: IAC()	Φ: PHI()
fU: FU()	fI: FI()	Pc: PC()
U+pk: UPPK()	I+pk: IPPK()	P+pk: PPPK()
U-pk: UMPK()	I-pk: IMPK()	P-pk: PMPK()
CfU: CFU()	CfI: CFI()	—

Efficiency

$\eta 1$: ETA1() to $\eta 4$: ETA4()

User-defined functions

F1: F1() to F20: F20()

- Harmonic Measurement (Option)**

U(k): UK(,)	I(k): IK(,)	P(k): PK(,)
S(k): SK(,)	Q(k): QK(,)	$\lambda(k)$: LAMBDK(,)
$\Phi U(k)$: UPHI(,)	$\Phi I(k)$: IPHI(,)	$\Phi(k)$: PHIK(,)
Z(k): ZK(,)	Rs(k): RSK(,)	Xs(k): XSK(,)
—	Rp(k): RPK(,)	Xp(k): XPK(,)
Uhdf(k): UHDF(,)	Ihdf(k): IHDF(,)	Phdf(k): PHDF(,)
Uthd: UTHD()	lthd: ITHD()	Pthd: PTHD()
Uthf: UTHF()	lthf: ITHF()	—
Utif: UTIF()	litf: ITIF()	—
hvf: HVF()	hcf: HCF()	—
fPLL: PLLFRQ()	Kfactor: KFACT()	—
$\Phi U1-U2$: PHIU1U2()	$\Phi U1-U3$: PHIU1U3()	—
$\Phi U1-I1$: PHIU1I1()	$\Phi U2-I2$: PHIU2I2()	$\Phi U3-I3$: PHIU3I3()
$\Phi I1-I2$: PHII1I2()	$\Phi I2-I3$: PHII2I3()	$\Phi I3-I1$: PHII3I1()

- Delta Computation**

$\Delta U1()$: DELTAU1()	$\Delta I()$: DELTAI()	$\Delta P1()$: DELTAP1()
$\Delta U2()$: DELTAU2()	—	$\Delta P2()$: DELTAP2()
$\Delta U3()$: DELTAU3()	—	$\Delta P3()$: DELTAP3()
$\Delta U\Sigma()$: DELTAUSIG()	—	$\Delta P\Sigma()$: DELTAPSIG()
$\Delta U1rms()$: DELTAU1RMS()	$\Delta U1mean()$: DELTAU1MN()	$\Delta U1rmean()$: DELTAU1RMN()
$\Delta U2rms()$: DELTAU2RMS()	$\Delta U2mean()$: DELTAU2MN()	$\Delta U2rmean()$: DELTAU2RMN()
$\Delta U3rms()$: DELTAU3RMS()	$\Delta U3mean()$: DELTAU3MN()	$\Delta U3rmean()$: DELTAU3RMN()
$\Delta U\Sigma rms()$: DELTAUSIGRMS()	$\Delta U\Sigma mean()$: DELTAUSIGMN()	$\Delta U\Sigma rmean()$: DELTAUSIGRMN()
$\Delta U1dc()$: DELTAU1DC()	$\Delta U1ac()$: DELTAU1AC()	$\Delta Irms()$: DELTALRMS()
$\Delta U2dc()$: DELTAU2DC()	$\Delta U2ac()$: DELTAU2AC()	$\Delta Imean()$: DELTAIMN()
$\Delta U3dc()$: DELTAU3DC()	$\Delta U3ac()$: DELTAU3AC()	$\Delta Irmean()$: DELTAIRMN()
$\Delta U\Sigma dc()$: DELTAUSIGDC()	$\Delta U\Sigma ac()$: DELTAUSIGAC()	$\Delta Idc()$: DELTAIDC()
—	—	$\Delta Iac()$: DELTAIAC()

- Auxiliary Input**

Aux3: AUX3() to Aux8: AUX8()

- Output of the motor**

Pm2: PM2() to Pm4: PM4()

Setting Operand Parameters

The parameters that you need to enter depend on whether the function is followed by “(,)” or “()”.

- **Setting Parameters for Functions Followed by “(,)”**

Specify the element to the left of the comma, and specify the harmonic order to the right of the comma. For example: (E1,OR2).

- Symbols used to represent elements
 - E1 to E4: Elements 1 to 4
 - SA or SB: Wiring units ΣA or ΣB
 - Symbols that indicate the harmonic order (Order)*
 - ORT: Total value
 - OR0: dc
 - OR1: Fundamental wave
 - OR2 to OR500: Harmonic orders 2 to 500
- * On models with the harmonic measurement option

- **Setting Parameters for Functions Followed by “()”**

Specify the element. You do not need to specify a harmonic order. For example: (E1).

For information about the parameters that you can use with each operand, see appendix 6 in the features guide, IM PX8000-01EN.

Values Substituted in Operands

- $\eta 1$ to $\eta 4$ are displayed as percentages. However, in this section ETA1 to ETA4 are described as ratios.
Example When $\eta 1$ is 80%, ETA1 is 0.8
- The U1 in PHIU1U2 represents the voltage signal of the element whose element number is the smallest in the wiring unit (ΣA or ΣB). For example, if elements 2, 3, and 4 are assigned to wiring unit ΣA , PHIU1U2 is the phase difference between the voltage signals of elements 2 and 3.
- User-defined equations can use other user-defined equations with smaller numbers as operands. For example, the equation for user-defined function F3 can be set to F1() + F2(). This allows equations that would otherwise exceed 50 characters in length to be computed. This can be accomplished by for example setting equations in F1 and F2, and then adding or dividing those equations in F3. This feature is also convenient when defining multiple equations that include common operands. For example, you can set common operands in F1, and then set F4 as F3() divided by F1() and set F5 as F4() divided by F1(). However, if you enter a user-defined equation with a number that is greater than or equal to its own number, correct results will not be obtained. For example, if you set user-defined function F3 to F1()+F3() or to F1()+F4(), the computed result will be displayed as “-----” (no data) or “-OF-” (overflow).
- In the following situations, computed results are set to no data display [————], overflow display [–OF–], or error display [Error].
 - When a division by zero occurs.
 - When a negative value is specified in SQRT.
 - When a value less than zero is specified in a LOG or LOG10 function.
 - An operand in an equation is undetermined
 - Example 1: An element that is not installed is specified.
 - Example 2: The equation contains a delta computation measurement function, but delta computation is set to OFF.
 - When any of the operands is set to no data display [————], overflow display [–OF–], or error display [Error].

Operators

The following operators can be used in equations.

Operator	Example	Description
+, -, *, /	U(E1,OR1)-U(E2,OR1)	Basic arithmetic
ABS	ABS(P(E1,ORT) + P(E2,ORT))	Absolute value
SQR	SQR(I(E1,OR0))	Square
SQRT	SQRT(ABS(I(E1,OR3)))	Square root
LOG	LOG(U(E1,OR25))	Natural logarithm
LOG10	LOG10(U(E1,OR25))	Common logarithm
EXP	EXP(U(E1,OR12))	Exponent
NEG	NEG(U(E1,OR12))	Negation

Number and Type of Characters That Can Be Used in Equations

- Number of characters: Up to 50
- Usable characters: Spaces and all characters that are displayed on the keyboard

Equation Examples

- An equation to determine the rms value of the harmonic components of the voltage signal of element 2.

$$\sqrt{(\text{Total rms voltage value})^2 - (\text{Rms value of the fundamental voltage signal})^2}$$

$$\text{SQRT}(\text{SQR}(\text{U}(\text{E2},\text{ORT})) - \text{SQR}(\text{U}(\text{E2},\text{OR1})))$$

- Synchronous speed of the motor that the voltage signal (U2) of element 2 is being applied to
(When the motor's number of poles is 4)

$$\frac{120 \cdot \text{the frequency of U2 [Hz]}}{\text{Number of motor poles}} \quad [\text{min}^{-1} \text{ or rpm}]$$

$$(120 \cdot \text{FU}(\text{E2}))/4$$

- Slip when the rotating speed of the motor above is being measured using AUX module AUX 5
(When the user-defined function of the above rotating speed is set using F4)

$$\frac{\text{SyncSp} - \text{Speed}}{\text{SyncSp}} \cdot 100 \quad [\%]$$

$$(\text{F4}() - \text{AUX5}())/\text{F4}() \cdot 100$$

Apparent Power, Reactive Power, and Corrected Power Equations (Formula)

Equation for Apparent Power (S Formula)

You can select the voltage and current to use to compute the apparent power (voltage × current) from the following options.

- $U_{rms} \times I_{rms}$
The product of the true rms values of the voltage and current
- $U_{mean} \times I_{mean}$
The product of the voltage's and current's rectified mean values calibrated to the rms values
- $U_{dc} \times I_{dc}$
The product of the simple averages of the voltage and current
- $U_{mean} \times I_{rms}$
The product of the voltage's rectified mean value calibrated to the rms value and the current's true rms value
- $U_{rmean} \times I_{rmean}$
The product of the voltage's and current's rectified mean values

Apparent Power and Reactive Power Computation Types (S,Q Formula)

There are three types of power: active power, reactive power, and apparent power. In general, they are defined by the following equations.

$$\text{Active power } P = UI \cos \Phi \quad (1)$$

$$\text{Reactive power } Q = UI \sin \Phi \quad (2)$$

$$\text{Apparent power } S = UI \quad (3)$$

U = rms voltage; I = rms current; Φ = Phase difference between voltage and current

The power values are related as follows:

$$(\text{Apparent power } S)^2 = (\text{Active power } P)^2 + (\text{Reactive power } Q)^2 \quad (4)$$

The three-phase power is the sum of the power of each phase.

These definitions only apply for sine waves. The measured values for apparent power and reactive power vary for distorted waveform measurement depending on which of the above definitions are combined for the computation. Because the equations for deriving the apparent and reactive power for distorted waveforms are not defined, none of the equations can be said to be more correct than the other. Therefore, the PX8000 provides three equations, Type 1 to Type 3, for determining the apparent power and reactive power.

Unlike apparent power and reactive power, active power is derived directly from the sampled data, so errors resulting from different definitions do not occur.

Type 1 (The method used in the normal mode of conventional WT series power meters*)

The PX8000 calculates the apparent power of each phase using equation 3, calculates the reactive power of each phase using equation 2, and sums the results to derive the power.

$$\text{Active power for a three-phase, four-wire system} \quad P\Sigma = P1 + P2 + P3$$

$$\text{Apparent power for a three-phase, four-wire system} \quad S\Sigma = S1 + S2 + S3 \quad (= U1 \times I1 + U2 \times I2 + U3 \times I3)$$

$$\text{Reactive power for a three-phase, four-wire system} \quad Q\Sigma = Q1 + Q2 + Q3$$

$$(\text{= } s1 \times \sqrt{(U1 \times I1)^2 - P1^2} + s2 \times \sqrt{(U2 \times I2)^2 - P2^2} + s3 \times \sqrt{(U3 \times I3)^2 - P3^2} \text{)}$$

The signs for $s1$, $s2$, and $s3$ are negative when the current leads the voltage and positive when the current lags the voltage.

* WT210, WT230, WT1000 series, or WT2000 series, etc.

Type 2

The PX8000 calculates the apparent power of each phase using equation 3 and sums the results to derive the three-phase apparent power. The PX8000 calculates the three-phase reactive power from the three-phase apparent power and the three-phase active power using equation 4.

Active power for a three-phase, four-wire system $P\Sigma = P1 + P2 + P3$

Apparent power for a three-phase, four-wire system $S\Sigma = S1 + S2 + S3 (= U1 \times I1 + U2 \times I2 + U3 \times I3)$

Reactive power for a three-phase, four-wire system $Q\Sigma = \sqrt{S\Sigma^2 - P\Sigma^2}$

Type 3 (The method used in the harmonic measurement modes of the WT500, WT1600, WT1800, WT3000 and PZ4000)

The PX8000 calculates the reactive power of each phase using equation 2 and calculates the three-phase apparent power using equation 4. This equation is available on models with the harmonic measurement option.

Active power for a three-phase, four-wire system $P\Sigma = P1 + P2 + P3$

Apparent power for a three-phase, four-wire system $S\Sigma = \sqrt{P\Sigma^2 + Q\Sigma^2}$

Reactive power for a three-phase, four-wire system $Q\Sigma = Q1 + Q2 + Q3$

Corrected Power Equation (Pc Formula)

Some standards require that a voltage transformer's active power be corrected when the load connected to the voltage transformer is very small. You can select an equation to use for this correction and specify the coefficient.

Applicable Standard (Select standard)

Select from the following.

- IEC76-1 (1976)
- IEC76-1 (1993)

Equations for each applicable standard

IEC76-1(1976)

$$P_c = \frac{P}{P_1 + P_2 \left(\frac{U_{rms}}{U_{mn}} \right)^2}$$

IEC76-1(1993)

$$P_c = P \left(1 + \frac{U_{mn} - U_{rms}}{U_{mn}} \right)$$

Pc: Corrected power

P: Active power

U_{rms}: True rms voltage

U_{mn}: Voltage's rectified mean calibrated to the rms value

P1, P2: Coefficients specified by the applicable standard

Coefficients (P1 and P2)

You can set coefficients P1 and P2 to values within the range of 0.0001 to 9.9999.



The IEEE C57.12.90-1993 equation is the same as IEC76-1(1976).

Phase Difference Display Format (Phase)

The phase difference Φ between the voltage and current indicates the current phase relative to the voltage of each element. Set the display format to one of the options below.

- **180 degrees**

If the current phase is in the counterclockwise direction with respect to voltage, the current is leading (D) the voltage. If the current phase is in the clockwise direction with respect to the voltage, the current is lagging (G) the voltage. The phase difference is expressed by an angle between 0 and 180° (see appendix 2 in the features guide, IM PX8000-01EN).

- **360 degrees**

The phase difference is expressed as an angle between 0 and 360° in the clockwise direction.



- If the measured voltage or current value is zero, "Error" is displayed.
 - When both the voltage and current signals are sinusoidal waves and the ratios of the voltage and current inputs with respect to the measurement range do not differ greatly, the phase difference Φ lead and lag are still detected and displayed correctly.
 - If the computation result of power factor λ exceeds 1, Φ is displayed as follows:
 - If the power factor λ is greater than 1 and less than or equal to 2, Φ returns 0.
 - If λ is greater than 2, Φ returns an error ("Error" is displayed).
 - On models with the harmonic measurement option, the phase differences Φ_U and Φ_I of harmonic orders 1 to 500 of the voltage and current are always displayed using an angle between 0 and 180° (no sign for lead and negative sign for lag).
-

Harmonic Measurement Conditions (Harmonics; option)

Using harmonic measurement, you can measure functions that are based on the voltage, current, and power harmonics and their distortion factors; on the phase angle of each harmonic relative to the fundamental; etc. You can also compute the harmonic distortion factors for voltage and current.

For a list of the measurement functions that can be measured with harmonic measurement and their descriptions, see “Harmonic Measurement Functions” under “Items That This Instrument Can Measure.”

► [See here.](#)

Turning the Harmonic Measurement On and Off (Harmonics Mode)

- ON: The harmonic measurement is turned on.
- OFF: The harmonic measurement is turned off.

PLL Source (PLL Source)

For harmonics to be measured, the fundamental period (the period of the fundamental signal) that will be used to analyze the harmonics must be determined. The signal for determining the fundamental period is the PLL (phase locked loop) source.

Select the PLL source from the choices below. The available options vary depending on the installed elements. U1, I1, U2, I2, U3, I3, U4, I4, and External*

- * If you select External, the frequency of the signal applied to the external trigger input connector (TRIGGER IN) on the side panel is used as the fundamental frequency for harmonic measurement. For the TRIGGER IN connector specifications, see section 5.1 in the getting started guide, IM PX8000-03EN.



- Select a signal that has the same period as the signal that you want to measure the harmonics of. For stable harmonic measurement, choose an input signal for the PLL source that has as little distortion and fluctuation as possible. If the fundamental frequency of the PLL source fluctuates or if the fundamental frequency cannot be measured due to waveform distortion, correct measurements will not be obtained. When the measured item is a switching power supply and in other cases where the distortion of the voltage signal is smaller than that of the current signal, we recommend that the PLL source be set to the voltage.
- If all of the input signals are distorted or the amplitude is small compared to the measurement range, the specifications may not be met. To achieve stable, accurate measurements on high harmonics, set the PLL source to “External” and apply a signal with the same period as the input signal to the external trigger input connector.
- If the fundamental frequency contains high frequency components, we suggest that you turn on the frequency filter. This filter is only effective on the frequency measurement circuit.
- If the amplitude level of the signal applied to the element that is specified as the PLL source is small compared to the range, PLL synchronization may not be achieved. Set the measurement range so that the amplitude level of the PLL source is at least 50%.

Measured Harmonic Orders (Min Order/Max Order)

The harmonic measurement range can be specified. The harmonic orders specified here are used to determine the numeric data of the distortion factor.

► [See here.](#)

Minimum Harmonic Order to Be Measured (Min Order)

Select from the following.

- 0: The 0th order (DC) component is included when numeric harmonic waveform data is determined.
- 1: The 0th order (DC) component is not included when numeric harmonic waveform data is determined. The harmonic measurement data (the harmonic waveform data) is determined from the 1st order (the fundamental wave).

Maximum Harmonic Order to Be Measured (Max Order)

You can select a value between 1 and 500.

However, the maximum measurable harmonic order is smaller of the two orders listed below.

- The specified maximum harmonic order to be measured
- The value determined automatically according to the PLL source frequency (see section 7.5 in the getting started guide, IM PX8000-03EN)

The numeric data corresponding to harmonic orders above the maximum measurable harmonic order is displayed as "-----" (no data).



-
- If the minimum harmonic order to be measured is set to 1, the data of the DC component is not included when the distortion factor is determined.
 - There is no overload value indication ("-OL-") or zero indication (suppression to zero) for the numeric data of harmonic orders 0 (DC) to 500. For information about the overload value indication ("-OL-") and zero indication (suppression to zero) in normal measurement, see section 7.12 in the getting started guide, IM PX8000-03EN.
-

Distortion Factor Equation (Thd Formula)

When determining the harmonic measurement functions Uhdf, lhdf, Phdf, Uthd, lthd, and Pthd, you can select to use one of the denominators described below as the denominator for the equation. For information about equations, see appendix 1 in the features guide, IM PX8000-01EN.

1/Total

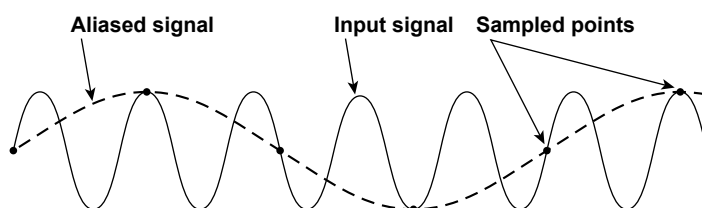
The denominator is the measured data of all orders from the minimum measured order (0 or 1st) to the maximum measured order (within the upper limit of harmonic analysis).

1/Fundamental

The denominator is the data of the fundamental signal component (1st order).

Anti-Aliasing Filter

When an FFT is taken through the performance of A/D conversion on a repetitive waveform, a phenomenon occurs in which frequency components that exceed half the frequency of the sampling frequency are detected as low frequency components. This is called aliasing.



Aliasing causes problems such as increased errors in measured values and incorrect measurements of the phase angles on each harmonic. An anti-aliasing filter is used to prevent aliasing and eliminate high frequency components that are irrelevant to the harmonic measurement.

For example, when an input signal with a fundamental frequency of 50 Hz is measured up to the 50th order, the frequency of the 50th order is 2.5 kHz. Thus, a 20-kHz anti-aliasing filter is used to eliminate high frequency components that are greater than or equal to approximately 20 kHz, which are irrelevant to harmonic measurement.

The PX8000 uses the line filter as an anti-aliasing filter for harmonic measurements. For information about how to configure the filter, see “Line Filter (LINE FILTER).”

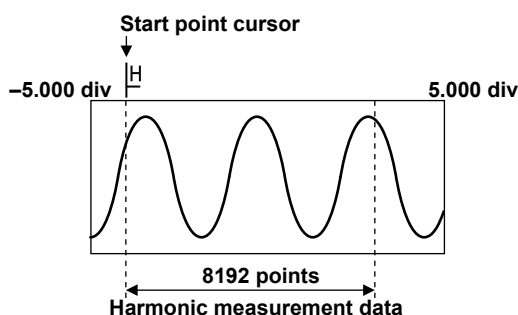
► [See here.](#)

The accuracy and the upper limit of the measurement bandwidth change when the anti-aliasing filter (line filter) is turned ON. For details, see appendix 7.5 in the getting started guide, IM PX8000-03EN.

Harmonic Measurement Start Point

When harmonic measurement is set to ON, set the start point of harmonic measurement using the start point cursor that is displayed. From the start point up to the 8192nd data point at the PLL sampling frequency are measured and computed.

If the number of sampled data points is less than 8192, no data display [————] appears.



Copying the Numeric Cursor Start Position Settings to Start Position (Copy Numeric Cursor Start Pos to Start Position)

Copies the Start Position settings of the computation period of the numeric computation's Cursor calculation period to Start Position.

This is useful when you want to align the start point of the computation period of the numeric computation's Cursor calculation period to the start point of harmonic measurement.

Harmonic Measurement Display

The PX8000 provides the following three displays for harmonic measurement.

- Harmonics enable indicator
- Harmonic setting status
- Harmonics status

Harmonics Enable Indicator

Located at the bottom center of the PX8000 LCD.

HARMONICS ENABLE



Harmonic measurement becomes possible when all the following conditions are met. When they are met, the harmonic enable indicator turns on.

- Acquisition mode (Acquisition Mode): Normal or Average
- Time base (Time Base): Int
- Time scale (TIME/DIV): 100 μ s/div or higher
- Sample rate: 2 MS/s or higher.

Sample rate varies depending on the record length and time scale settings. For details, see appendix 7, "Relationship between the Time Axis Setting, Record Length, and Sample Rate" in the features guide, IM PX8000-01EN.

Harmonic Setting Status

Displayed in the upper right of the screen.

Display Example

Harmonic setting status

Harmonic setting status does not appear when harmonic measurement is possible with the current settings. When harmonic measurement is not possible with the current settings, the causal condition (setting) is displayed.

- Display when the acquisition mode is set to Envelope
Hrm Disabled, ACQ Mode: Nrm/Avg
Solution: Set the acquisition mode to Normal or Average.
- Display when the time base is Ext
Hrm Disabled, ACQ Time Base: [Int]
Solution: Set the time base to Int.
- Display when the time scale (TIME/DIV) is less than 100 μ s/div
Hrm Disabled, T/div \geq 100 μ s/div
Solution: Set the time scale to 100 μ s/div or higher.
- Display when the sample rate is less than 2 MS/s
Hrm Disabled, T/div or Rec Len (Smp \geq 2MS/s)
Solution: Change the record length and time scale to set the sample rate to 2 MS/s or higher.

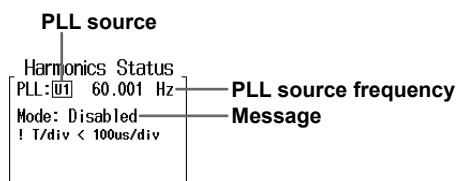
In either of the following conditions, harmonic setting status does not appear even if the above conditions are met.

- Numeric measurement ON/OFF (Numeric Measure) setting: OFF
- Harmonic measurement ON/OFF (Harmonics Mode) setting: OFF

Harmonics Status

Displayed on the right side of the screen.

Display Example



- **PLL Source Frequency**

The PLL source frequency appears when harmonic measurement completes successfully.

- **Messages**

- No messages appear if you execute a harmonic measurement, and it completes successfully.
- If harmonic measurement cannot be executed, Mode: Disabled appears. The reason also appears. For a description of the reasons, see “Harmonic Setting Status” described earlier.
- If harmonic measurement is executed and an error occurs, it is displayed as follows:
 - PLL Err: Freq Over: The PLL source frequency exceeds the upper limit.
 - PLL Err: Freq Under: The PLL source frequency is less than the lower limit.
 - PLL Err: Undetected: The frequency cannot be computed because the PLL cycles are not detected. This error may have occurred because the PLL source signal is a DC signal or the PLL source input level is too small.
 - PLL Err: Lack Cycle: Computation is not possible because the number of PLL cycles is insufficient within computation range.
 - PLL Err: Cursor Out: The start point of harmonic measurement is outside the numeric data computation range. This error may have occurred because the calculation period (Period) of numeric computation is set to Ext Gate and the start point of harmonic measurement is outside the numeric data computation range that is defined by the Ext Gate signal.
 - PLL Err: Invalid Ch: There is no sampled data of the PLL source. This error may have occurred because the appropriate file has not been loaded.
 - PLL Err: Low S.Rate: Computation is not possible because the sample rate* is insufficient for the PLL source frequency.

* See the conditions listed under “Lower limit of sample rate” under “Harmonic Measurement (Option)” in section 7.5, “Features,” in the Getting Started Guide, IM PX8000-03EN.



It may also be that the PLL source frequency could not be computed because the distortion in the PLL source waveform was too large. Set the appropriate frequency filter according to the fundamental frequency of the PLL source.

In either of the following conditions, harmonic status does not appear.

- Numeric measurement ON/OFF (Numeric Measure) setting: OFF
- Harmonic measurement ON/OFF (Harmonics Mode) setting: OFF

10 Waveform Display

Waveform Window Types

The PX8000 has the following types of windows.

T-Y (Time axis) Waveform Display Window

- Main window
Displays normal waveforms, which are not magnified
- Zoom window (Zoom1 and Zoom2)
Displays zoomed waveforms according to the settings specified using the ZOOM key

X-Y Window (Window 1 and Window 2)

Displays X-Y waveforms according to the settings specified using the X-Y key

FFT Window (FFT1 window and FFT 2 window)

Displays FFT waveforms according to the settings specified using the FFT key

Extra Window

This window displays cursor-measurement values, automated measurement values of waveform parameters, and so on. It can be used when values overlap with waveforms and are difficult to see.

Switching the Menu Area Display

You can switch between the full-screen waveform display, the channel information display, and the waveform numeric-monitor display.

Display Pattern Examples

The main display patterns are shown in the figure below.

<Main>, <Z1>, <Z2>, <W1>, <W2>, <FFT 1>, or <FFT 2>	<Main> <Z1>, <Z2>, <W1>, <W2>, <FFT 1>, or <FFT 2>	<Main> <Z1> <Z2>	<Main> <W1> <W2>	<Main> <FFT 1> <FFT 2>
<Main> <Z1> or <Z2> <W1> or <W2>	<Main> <Z1> or <Z2> <FFT 1> or <FFT 2>	<Main> <FFT 1> or <FFT 2> <W1> or <W2>	<Main> <Z1> <Z2>	<Main> <Z1> or <Z2> <FFT 1> or <FFT 2>
<W1> <W2>	<Z1> or <Z2> <W1> or <W2>	<Z1> or <Z2> <FFT 1> or <FFT 2>	<FFT 1> or <FFT 2> <W1> or <W2>	

- Zoom1 and Zoom2 are abbreviated to Z1 and Z2.
- You can create patterns in which the main window is not displayed.

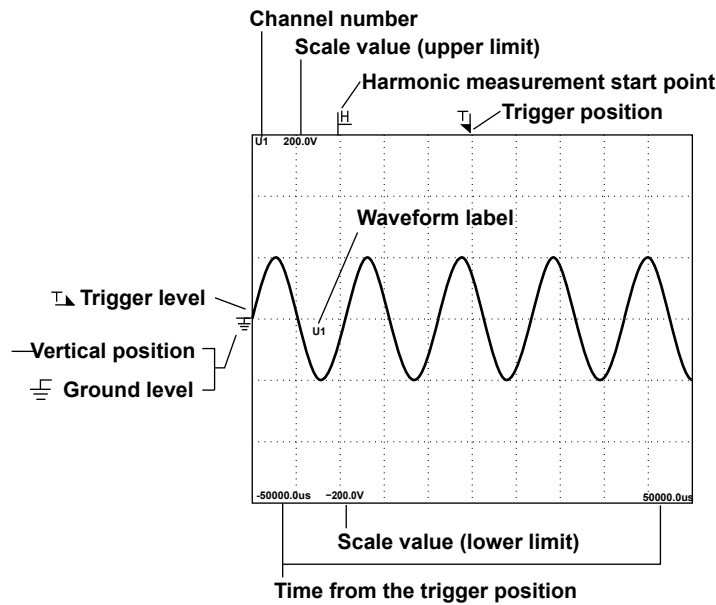


Under the following conditions, a total of 64 waveforms can be displayed on the main, Zoom1, and Zoom2 windows.

Trigger mode: Auto

TIME/DIV: 100 ms/div or 200 ms/div

Waveform Display Example



Waveform Display Settings

Press DISPLAY SETTING to configure the display.

- [Display Format \(Format\)](#)
- [Advanced Waveform Display Settings \(Wave Setup\)](#)
- [Interpolation Method \(Dot Connect\)](#)
- [Grid \(Graticule\)](#)
- [Turning the Scale Value Display On and Off \(Scale Value\)](#)
- [Trace Label Display \(Trace Label\)](#)
- [Extra Window \(Extra Window\)](#)

Display Format (Format)

You can evenly divide the T-Y waveform display window so that you can easily view input waveforms and computed waveforms. You can set the number of divisions to one of the values listed below.
1, 2, 3, 4, 6, 8, 12, or 16



The number of displayed points in each division varies depending on the number of divisions. Even if the number of displayed points changes, the vertical resolution does not change. The number of displayed points when only the Main window is displayed is as follows:

Divisions	Displayed Points	Divisions	Displayed Points	Divisions	Displayed Points
1	656 points	2	328 points	3	218 points
4	164 points	6	109 points	8	82 points
12	54 points	16	41 points		

Advanced Waveform Display Settings (Wave Setup)

The channels of the installed modules and Math1 to Math8 are displayed.

If FFT1 is set to ON, Math7 at the left edge is displayed as FFT1.

If FFT2 is set to ON, Math8 at the left edge is displayed as FFT2.

You can set the following items.

Turning the Display of Waveform On and Off (Disp)

Select whether to display waveform labels.

If the computation mode of waveform computation is set to OFF or if the operator of each waveform computation is set to OFF, the waveform display ON/OFF areas of Math1 to Math8 are blank.

Waveform display ON/OFF areas of FFT1 and FFT2 are blank.

Display Color (Color)

You can set the display color of each of the waveforms to one of 16 colors.

You can assign all waveforms regardless of whether their displays are turned on.

Mapping Mode (Map)

Set how to map channels to the divided screens on the mapping list.

- **Auto**

The waveforms whose displays are turned on are arranged by number from the top of the window.

- **User**

You can set how to map each waveform to the divided screens. You can assign all waveforms regardless of whether their displays are turned on.

Waveform Labels (Label)

You can set waveform labels using up to 16 characters.

Waveform labels of FFT1 and FFT2 are blank.

Zoom Method (V Scale)

This item is the same as zoom method of the vertical axis.

▶ [See here.](#)

- **When the Zoom Method Is Set to SPAN**

Zooming by Setting Upper and Lower Display Limits (Upper/Lower)

This item is the same as zooming by setting upper and lower display limits of the vertical axis.

▶ [See here.](#)

- **When the Zoom Method Is Set to DIV**

Offset (Offset)

This item is the same as offset of the vertical axis.

▶ [See here.](#)

Waveform Vertical Position (Position)

This item is the same as waveform vertical position of the vertical axis.

▶ [See here.](#)

Zooming by Setting a Magnification (V Zoom)

This item is the same as zooming by setting a magnification of the vertical axis.

▶ [See here.](#)

Interpolation Method (Dot Connect)

When the number of data points is within the interpolation zone of the T-Y waveform display,* the PX8000 displays waveforms by interpolating between sampled data points.

* Interpolation zone refers to the condition in which a given number of data points are not contained in the 10 div along the time axis. The number of data points that define the interpolation zone varies depending on the display record length and zoom ratio.

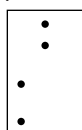
You can set the interpolation method to one of the options below.

- **OFF**
Displays the data using dots without interpolation.
- **Sine Interpolation (Sine)**
Interpolates a sine curve between two points using the $(\sin x)/x$ function. This method is suitable for the observation of sine waves.
- **Linear Interpolation (Line)**
Linearly interpolates between two points.
- **Pulse Interpolation (Pulse)**
Interpolates between two points in a staircase pattern.

Outside of the Interpolation Zone

If the interpolation method is set to Sine, Line, or Pulse, the dots are connected vertically.

If the number of data points is 2002 or greater, the PX8000 determines the P-P compression values (the maximum and minimum sampled-data values in a given interval), and displays vertical lines (rasters) connecting each pair of maximum and minimum P-P compression values.

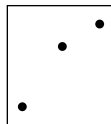


OFF

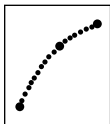


Sine/Line/Pulse

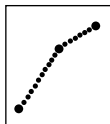
In the Interpolation Zone



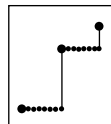
OFF



Sine



Line



Pulse






The interpolation method is set to Pulse when:

- The acquisition mode is Envelope.

Grid (Graticule)

You can set the window grid to one of the following options.

-  : Displays the grid using broken lines
-  : Displays the grid using crosshairs
-  : Displays a frame

Turning the Scale Value Display On and Off (Scale Value)

You can display the upper and lower limits (scale values) of each waveform's vertical or horizontal axes.

- ON: Displays the scale values
- OFF: Does not display the scale values

Trace Label Display (Trace Label)

You can display waveform labels next to the displayed waveforms. If the waveform display is narrow because of the display format settings, labels may not be displayed.

- ON: Displays labels
- OFF: Does not display labels

Extra Window (Extra Window)

When waveforms and measured values overlap and are difficult to see, you can use the extra window to display them separately. The extra window appears below the T-Y waveform display window. The following values appear in the extra window.

- Cursor-measurement values
- Automated measurement values of waveform parameters

Height of the Extra Window

Set the height of the extra window.

OFF: The extra window is not displayed.

1 to 8: The extra window is set to the selected height.

Auto: The extra window appears automatically when you perform cursor measurements and automated measurements of waveform parameters.

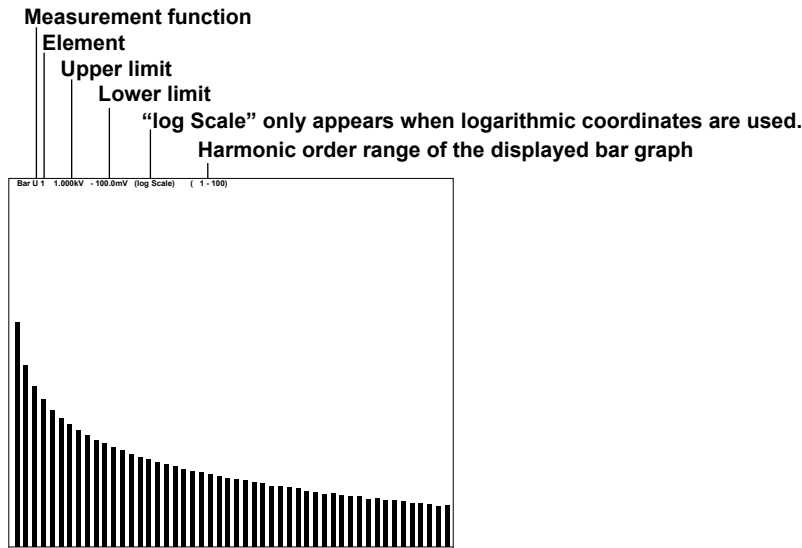


- The number of displayed points on the T-Y waveform display window varies depending on the height of the extra window. Even if the number of displayed points changes, the vertical resolution does not change.
- When the extra window is displayed, depending on the Zoom Format, the scale values may overlap and be difficult to read.

11 Bar Graph Display (Option)

On models with the harmonic measurement option, you can display harmonics using bar graphs. The harmonic orders are lined up on the horizontal axis, and the vertical axis represents the amplitude of each harmonic. You can configure three different bar graphs.

Bar Graph Display Example



- When logarithmic coordinates are used (Log Scale), if a value is negative, its absolute value is displayed with a red bar graph.
- If the number of sampled data points is less than 8192, harmonic data is not measured, and the bar graph does not appear.
- The bar graphs of harmonic orders that exceed the maximum measurable order are not displayed. For information about the maximum measurable harmonic order, see “Maximum Harmonic Order to Be Measured (Max Order).”

▶ [See here.](#)

Bar Graph Display Vertical Scale

- When the function is U, I, P, S, or Q, the scaling is logarithmic (Log).
- When the function is λ , Φ , ΦU , ΦI , Z, Rs, Xs, Rp, or Xp, the scaling is linear (Linear).
- The upper and lower limits of the bar graph window are automatically determined based on the maximum and minimum displayed trend data values. The lower and upper limits for λ are -1 and 1 . For Φ , ΦU , and ΦI , the minimum and maximum values are -180 to 180° . Negative values correspond to phase lagging and positive values correspond to phase leading.

Bar Graph Display Settings

Press DISPLAY SETTING to configure the display.

- [Display Format \(Format\)](#)
- [Bar Graph Number \(Item No.\)](#)
- [Function \(Function\)](#)
- [Element \(Element\)](#)
- [Bar Graph Display Range \(Start Order/End Order\)](#)
- [Turning the Display of Numeric Data On and Off \(Numeric\)](#)
- [Position of Marker \(x Order/+ Order\)](#)

Display Format (Format)

You can choose the number of windows from one of the following options:

- 1: No windows. The data of bar graph (Item No.) 1 is displayed.
- 2: Two windows. The data of bar graphs (Item No.) 1 and 2 is displayed.
- 3: Three windows. The data of bar graphs (Item No.) 1 to 3 is displayed.

Bar Graph Number (Item No.)

Select the number, from 1 to 3, of the bar graph that you want to select.

Function (Function)

You can select the measurement function to display from the following options.

U, I, P, S, Q, λ , Φ , ΦU , ΦI , Z, Rs, Xs, Rp, and Xp

Element (Element)

You can select the element from the following options. The available options vary depending on the installed elements.

Element1, Element2, Element3, and Element4

Bar Graph Display Range (Start Order/End Order)

- You can configure the range of harmonic orders to show in a bar graph.
- The range is the same for bar graphs 1 to 3.

Starting Harmonic Order (Start Order)

- You can select a value between 0 and 490. However, the starting harmonic order cannot be more than 10 orders less than the ending order.
- When the measurement function of a bar graph is Φ , order 0 has no values, so you cannot display it in the bar graph.
- When the measurement function of a bar graph is ΦU or ΦI , orders 0 and 1 have no values, so you cannot display them in the bar graph.

Ending Harmonic Order (End Order)

You can select a value between 10 and 500. However, the ending harmonic order cannot be more than 10 orders greater than the starting order. You cannot display bar graphs containing harmonic orders that are greater than the maximum measurable order (see section 7.5 in the getting started guide, IM PX8000-03EN).

Turning the Display of Numeric Data On and Off (Numeric)

You can select whether to show (ON) or hide (OFF) numeric data.

Measured Items

Y1x	The vertical-axis (Y-axis) value of marker x of bar graph 1
Y1+	The vertical-axis (Y-axis) value of marker + of bar graph 1
$\Delta Y1$	The difference between the vertical-axis (Y-axis) values of marker x and marker + of bar graph 1
Y2x	The vertical-axis (Y-axis) value of marker x of bar graph 2
Y2+	The vertical-axis (Y-axis) value of marker + of bar graph 2
$\Delta Y2$	The difference between the vertical-axis (Y-axis) values of marker x and marker + of bar graph 2
Y3x	The vertical-axis (Y-axis) value of marker x of bar graph 3
Y3+	The vertical-axis (Y-axis) value of marker + of bar graph 3
$\Delta Y3$	The difference between the vertical-axis (Y-axis) values of marker x and marker + of bar graph 3

Position of Marker (x Order/+ Order)

Position of Marker x (x Order)

Set the position of marker x to a value within one of the following ranges.

0 (DC) to 500 (the 500th order)

Position of Marker + (+ Order)

Set the position of marker +. The ranges within which you can set the position are the same as those for marker x (x Order).

Marker Movement

- Two markers (x and +) are displayed in each graph (Graph1 to Graph3).
- You can set the marker positions as orders.
- The bar graph display indicates what harmonic order each marker is located in. For example:
 - The location of marker x is indicated in this format: "Orderx:2."
 - The location of marker + is indicated in this format: "Order+:55."
- The orders indicating the locations of markers x and + are the same for each bar graph, from 1 to 3.



If immeasurable data exists, "****" is displayed in the measured value display area.

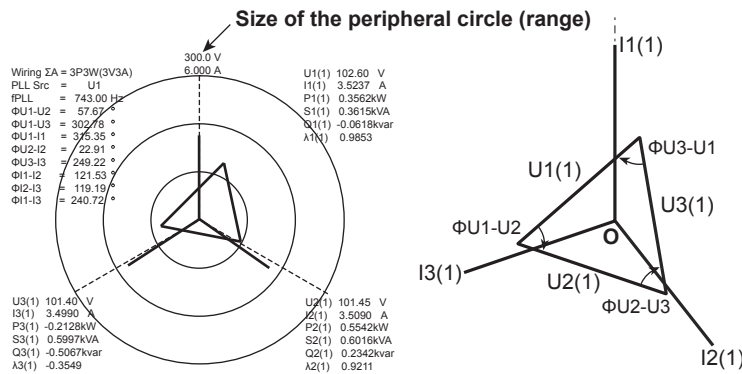
12 Vector Display (Option)

On models with the harmonic measurement option, you can select a wiring unit to display vectors of the phase differences and amplitudes (rms values) of the fundamental signals, U(1) and I(1), in each element in the unit. The positive vertical axis is set to zero (angle zero), and the vector of each input signal is displayed.

Vector Display Example

For a 3P3W system with a three-voltage, three-current method

- U1(1), U2(1), and U3(1) are line voltages.
- I1(1), I2(1), and I3(1) are line currents.



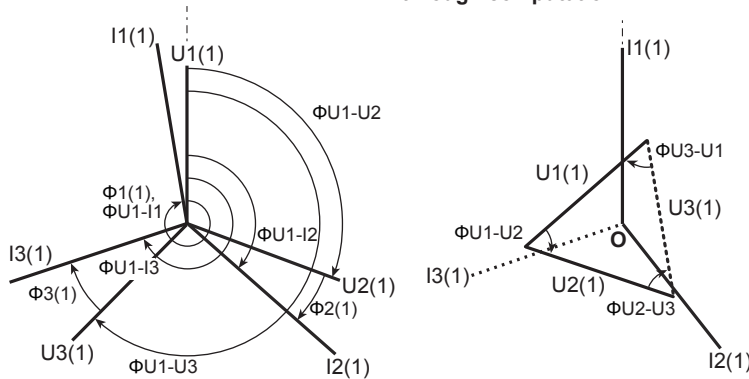
For a 3P4W (three-phase, four-wire system)

- U1(1), U2(1), and U3(1) are line voltages.
- I1(1), I2(1), and I3(1) are line currents.

For a 3P3W (three-phase, three-wire system)

- U1(1), U2(1), and U3(1) are line voltages.
- I1(1), I2(1), and I3(1) are line currents.

However, U3(1) and I3(1) are not actually measured for the 3P3W system. The vectors are displayed through computation.



If the number of sampled data points is less than 8192, harmonic data is not measured, and the vectors do not appear.

Vector Display Settings

Press DISPLAY SETTING to configure the display.

- [Display Format \(Format\)](#)
- [Vector Number \(Item No.\)](#)
- [Element or Wiring Unit \(Vector Object\)](#)
- [Setting Vector Zoom Factors \(U Mag/I Mag\)](#)
- [Turning the Display of Numeric Data On and Off \(Numeric\)](#)

Display Format (Format)

You can choose the number of windows from one of the following options:

- 1: No windows. The data of vector (Item No.) 1 is displayed.
- 2: Two windows. The data of vectors (Item No.) 1 and 2 is displayed. However, in the split display, the data of vector 1 is displayed.

Vector Number (Item No.)

Select the vector you want to set: 1 or 2.

Element or Wiring Unit (Vector Object)

You can select the element or wiring unit to display from the options below. The available options vary depending on the installed elements.

Element1, Element2, Element3, Element4, ΣA , and ΣB

Setting Vector Zoom Factors (U Mag/I Mag)

You can change the sizes of the vectors. You can specify separate zoom factors for the fundamental waves U(1) and I(1). When you zoom a vector, the value for the size of the peripheral circle of the vector changes according to the zoom factor.

Setting the Zoom Factor of the Vector of Fundamental Waveform U (1) (U Mag)

You can set the zoom factor to a value between 0.100 and 100.000.

Setting the Zoom Factor of the Vector of Fundamental Waveform I (1) (I Mag)

You can set the zoom factor to a value between 0.100 and 100.000.



If the zoom factor is too large, the vector will exceed the display range and will not be displayed properly. Reduce the zoom factor so that the vector is displayed within the display range.

Turning the Display of Numeric Data On and Off (Numeric)

You can select whether to show (ON) or hide (OFF) numeric data. You can display the size of each signal and the phase differences between signals. For information about phase difference display formats, see “Phase Difference Display Format.”

► [See here.](#)

13 Displaying X-Y Waveforms

X-Y

You can view the correlation between two waveform levels by assigning the level of one waveform to the X-axis (horizontal axis) and the level of the other waveform to the Y-axis (vertical axis). There are two X-Y waveform windows, and you can display four pairs of waveforms in each window (for a total of eight pairs).

You can perform cursor measurements on the displayed X-Y waveforms. You can also observe T-Y (time axis) waveforms and X-Y waveforms simultaneously.

X-Y Waveform Display Settings

- [Turning the X-Y Window Display On and Off \(Display\)](#)
- [Eight Pairs of X-Y Waveforms \(Setup\)](#)
- [Start Point and End Point \(Start Point and End Point\)](#)
- [Clearing Waveforms at Acquisition Start \(Trace clear on Start\)](#)
- [Display Ratio of the Main Window \(Main Ratio\)](#)
- [Window Layout \(Window Layout\)](#)
- [Combine Display \(Combine Display\)](#)
- [Interpolation Method \(Dot Connect\)](#)
- [Setting the Number of Data Points to Use for Waveform Display \(Decimation\)](#)

Turning the X-Y Window Display On and Off (Display)

You can select whether to display each X-Y window.

- ON: Displays the X-Y window
- OFF: Does not display the X-Y window

Eight Pairs of X-Y Waveforms (Setup)

You can display XY1 to XY4 in window 1 and XY5 to XY8 in window 2. You can configure the display settings of a total of 8 X-Y waveforms. You can configure the following settings for each X-Y waveform.

Display (DISPLAY)

You can select whether to display each X-Y waveform.

- ON: Displays the X-Y waveform
- OFF: Does not display the X-Y waveform

X Trace and Y Trace (X Trace and Y Trace)

For XY1 to XY4 and XY5 to XY8, you can select which waveforms to assign to the X and Y axes from the following options. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8



- X-Y waveforms can be created from normal T-Y waveforms. They cannot be created from zoomed waveforms.
- You cannot create an X-Y waveform using one trace whose horizontal-axis unit is time and another trace whose horizontal-axis unit is frequency.

Start Point and End Point (Start Point and End Point)

You can set the start and end points of the X-Y waveforms on the T-Y waveforms. You can set different start and end points for each X-Y window.

Selectable range: ± 5 div from the center of the T-Y waveform window

Clearing Waveforms at Acquisition Start (Trace Clear on Start)

Choose whether to clear the current X-Y waveforms when waveform acquisition is started through the pressing of the START/STOP key.

- ON: X-Y waveforms are cleared.
- OFF: X-Y waveforms are not cleared.

Display Ratio of the Main Window (Main Ratio)

This item is the same as display ratio of the main window of the zooming in on waveforms.

▶ [See here.](#)

Window Layout (Window Layout)

Set the display position of the X-Y window.

- Side: Horizontal
- Vertical: Vertical

Combine Display (Combine Display)

Choose whether to combine the two X-Y windows into one window.

- ON: The windows are combined.
- OFF: The windows are not combined.

Interpolation Method (Dot Connect)

When the number of data points is within the interpolation zone of the X-Y waveform display,* the PX8000 displays waveforms by interpolating between sampled data points.

- * Interpolation zone refers to the condition in which a given number of data points are not contained in the X-Y waveform display. The number of data points that define the interpolation zone varies depending on the display record length.

You can set the interpolation method to one of the options below.

- OFF: Displays the data using dots without interpolation.
- Linear Interpolation (Line): Linearly interpolates between two points.

For details, see “Interpolation Method” of the waveform display.

▶ [See here.](#)

Setting the Number of Data Points to Use for Waveform Display (Decimation)

In the X-Y waveform display, the PX8000 displays the acquired data by removing the data between fixed intervals. You can set the number of points to use to display waveforms to one of the options listed below.

2k

When the record length exceeds 2 kpoint, the PX8000 removes data until there are only 2 kpoint and displays two points on each vertical line. When the record length is less than 2 kpoint, all the points are displayed.

100k

When the record length exceeds 100 kpoint, the PX8000 removes data until there are only 100 kpoint and displays 100 points on each vertical line. When the record length is less than 100 kpoint, all the points are displayed.



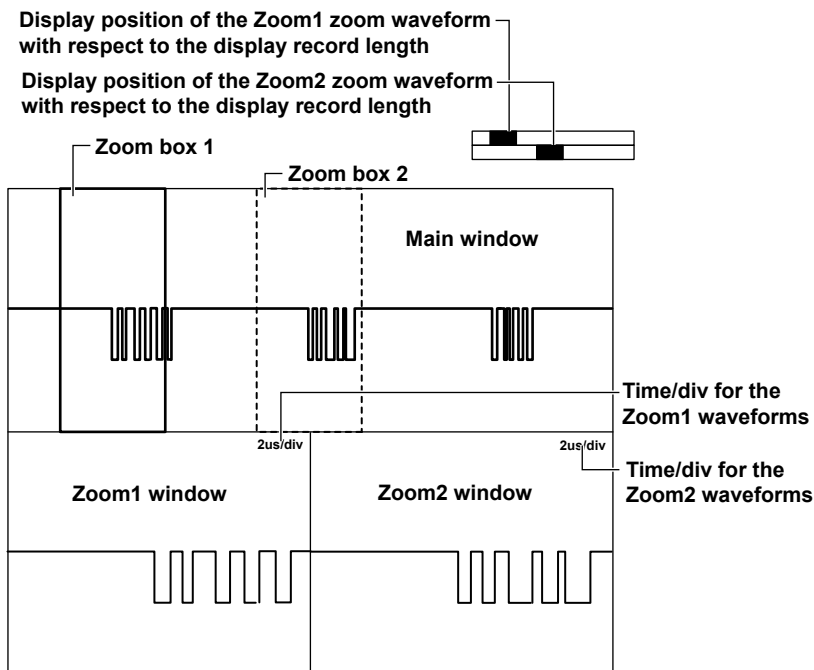
- To zoom in or out on an X-Y waveform, change the upper and lower limits (Upper and Lower) of the channel that you want to zoom, or change the vertical zoom (V Zoom).
 - To change the displayed position of an X-Y waveform, change the positions of the channels that it is based on.
-

14 Zooming in on Waveforms

ZOOM

You can magnify displayed waveforms along the time axis. The zoomed waveforms of two locations can be displayed simultaneously (the dual zoom feature). You can also specify which channel you want to zoom in on. You cannot zoom if the number of displayed points on the screen is less than or equal to 100.

Example of the Dual Zoom Display



If the Zoom1 or Zoom2 waveform window and the main waveform window (Main) are displayed at the same time, a zoom box appears in the Main window so that you can check the zoom position.

Vertical Zoom

You can magnify displayed waveforms along the vertical axis by using the menu that appears when you press a U1 to U4, I1 to I4, or P1 to P4 key.

▶ [See here.](#)

Zoom Window Display (Display)

You can set whether to display each of the zoom windows, Zoom1 and Zoom2. When a zoom window is displayed, a zoom bar appears at the top of the screen. This bar indicates what part of Main window is being zoomed in on.

- ON: Displays the zoom windows
- OFF: Does not display the zoom windows

Zoom Source Window (Zoom2 Source)

Select the waveforms that you want to enlarge in the Zoom2 window.

- Main (Main): Main window waveforms
- Zoom1: Zoom1 window waveforms

Zoom Factor (MAG knob)

Use the Mag knob to set the zoom factor. You can set separate horizontal zoom factors for Zoom1 and Zoom2. The zoom-window time-axis setting changes automatically based on the specified zoom factor.

Selectable Range

Two times the time axis setting (TIME/DIV) of the Main window to the point where the number of data points in the zoom window reaches 10 points per div.



When an external clock signal is being used as the time base, you can select one of the following magnifications. You can select any magnification up to the point where the number of data points in the zoom window reaches 10 points per div.

Up to 1000000 in 1-2.5-5 steps ($\times 2$, $\times 2.5$, $\times 5$, $\times 10$, $\times 25$, $\times 50$, $\times 100$, $\times 250$, $\times 500$, $\times 1000$, $\times 2500$, and so on)

Position (Zoom POSITION knob, Zoom1 Position, Zoom2 Position)

You can set the zoom position (position) using the zoom POSITION knob or the jog shuttle. Taking the horizontal center of the main window to be 0 div, set the center position of the zoom boxes in the range of -5 to 5 div. In the Main window, the box with solid lines is for Zoom1, and the box with dashed lines is for Zoom2. Waveforms are magnified around the centers of the zoom boxes.



The Z1 or Z2 indicator on the front panel illuminates to show when the Zoom1 or Zoom2 window can be moved by the Mag or zoom POSITION knob.

Zoom Link

If you press the Mag knob or zoom POSITION knob so that the Z1 and Z2 indicators both light, you can move the zoom boxes while maintaining the spatial relationship between them. The relationship between the zoom factors is also maintained.

Display Format (Format Zoom1 and Format Zoom2)

Select how to display the zoom windows from one of the options listed below. If you select a number, the zoom windows are divided evenly, and waveforms are displayed within the divisions.

- Main: Same as the display format of the main window of each display group.
- 1, 2, 3, 4, 6, 8, 12, 16: The window is broken up into the specified number of divisions.

Moving the Zoom Position to the Latest Position (Move Zoom1 to Front and Move Zoom2 to Front)

You can move the position of one of the zoom boxes to the right side of the screen (where the most recent data is). When the waveform flows from the right to the left of the screen, as in roll mode, you can zoom in on the waveform where it starts from, on the right side of the screen. These menu items do not appear when the source waveform of the Zoom2 window is set to Zoom1.

Display Ratio of the Main Window (Main Ratio)

Set the size of the main window in relation to the overall waveform display area.

- 50%: The main window appears in the upper half of the screen.
- 0%: The main window is not displayed.






Window Layout (Window Layout)

You can select the layout of the two zoom windows.

- Side: Horizontal
- Vertical: Vertical

Auto Scroll (Auto Scroll)

This feature automatically moves the zoom position in the specified direction. You can view the waveform and stop scrolling at the appropriate position.

	Zooms in on the left edge of the Main window
	Zooms in on the right edge of the Main window
	Starts scrolling to the left
	Starts scrolling to the right
	Stops scrolling

Speed (Speed)

You can select the auto scrolling speed.

Selectable range: 1 to 10. The default setting is 4.

Waveforms That Are Zoomed (Allocation)

The waveforms of the channels whose check boxes are selected in the allocation window and whose displays are turned on are displayed.

Changing the Range of the Automated Measurement of Waveform Parameters (Fit Measure Range)

Sets the range of the automated measurement of waveform parameters to the zoom range of Zoom1 or Zoom2.

This is valid even if the automated measurement of waveform parameters is turned OFF.

15 Cursor Measurement

CURSOR

You can move cursors on the waveforms displayed on the screen to view the measured values at the points where the cursors intersect the waveforms. You can select whether to measure the P-P compressed data values on the screen or the data values that have been acquired in the acquisition memory by cursor read mode.

► [See here.](#)

Window Selection (Select Window)

Select the window to perform cursor measurement in. This option appears when X-Y or FFT waveforms are being displayed.

- [T-Y](#): Displays T-Y waveform cursor-measurement values.
- [X-Y](#): Displays the cursor-measurement values for the waveform in an X-Y window.
- [FFT](#): Displays the cursor-measurement values for the waveform in an FFT window.

T-Y Waveforms

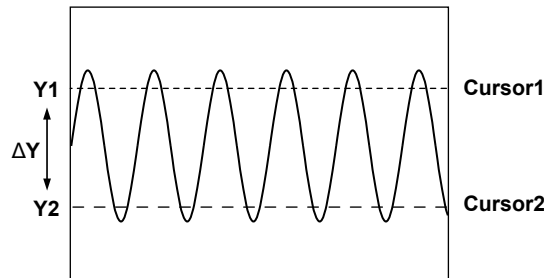
Cursor Types (Type)

The following types of T-Y waveform cursors are available.

- [OFF](#): Cursor measurement is not performed.
- [Horizontal cursors \(Horizontal\)](#): Two horizontal cursors are used to measure vertical values.
- [Vertical cursors \(Vertical\)](#): Two vertical cursors are used to measure time values.
- [Horizontal and vertical cursors \(H & V\)](#): Two horizontal cursors and two vertical cursors are used to measure vertical and time values.
- [Marker cursors \(Marker\)](#): Four marker cursors that move on the waveform are used to measure waveform values.
- [Angle cursors \(Degree\)](#): Two angle cursors are used to measure angles.

Horizontal Cursors (Horizontal) - T-Y waveforms

Two dashed lines (horizontal cursors) appear on the horizontal axis. You can measure the vertical value at the position of each horizontal cursor and measure the level difference between the horizontal cursors.



Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8

Moving the Cursors (Cursor1/Cursor2)

Use Cursor1 and Cursor2 to move the cursors.

Taking the center of the waveform display window to be 0 div, you can move the cursors within the range of -5 to 5 div in 0.01 div steps.

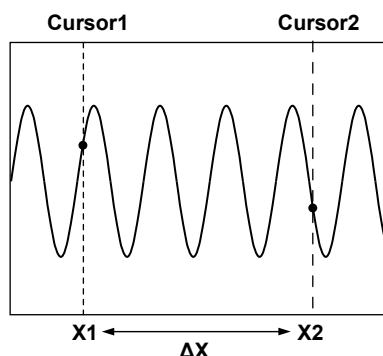
Measurement Items (Item Setup)

You can measure the following vertical values at the cursor positions.

Y1	Vertical value at Cursor1
Y2	Vertical value at Cursor2
ΔY	Difference between the vertical values of Cursor1 and Cursor2

Vertical Cursors (Vertical) - T-Y waveforms

Two straight dashed lines appear on the vertical axis (these are the vertical cursors). You can measure the time between the trigger position and each cursor, the time difference between the two cursors, and the reciprocal of the time difference between the two cursors. You can also measure the vertical signal value at each cursor position and the level difference between the two cursors.



Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8, All*

* Cursor measurement is performed on all channels. However, measured values that do not fit on the screen are not displayed.

Moving the Cursors (Cursor1/Cursor2)

Use Cursor1 and Cursor2 to move the cursors.

Taking the center of the waveform display window to be 0 div, you can move the cursors within the range of -5 to 5 div in steps of the following size: $\text{Time/div} \times 10 \div \text{display record length}$.

Cursor Jumping (Cursor Jump)

You can make Cursor1 and Cursor2 jump to the center of the specified zoom window.

Cursor1 to Zoom1: Cursor1 jumps to the Zoom1 window.

Cursor1 to Zoom2: Cursor1 jumps to the Zoom2 window.

Cursor2 to Zoom1: Cursor2 jumps to the Zoom1 window.

Cursor2 to Zoom2: Cursor2 jumps to the Zoom2 window.

Measurement Items (Item Setup)

You can measure the following horizontal values at the cursor positions.

X1	Time value at Cursor1
X2	Time value at Cursor2
ΔX	Difference between the time values of Cursor1 and Cursor2
1/ΔX	Reciprocal of the difference between the time values of Cursor1 and Cursor2
Y1	Vertical value at the intersection of Cursor1 and the waveform ¹
Y2	Vertical value at the intersection of Cursor2 and the waveform ²
ΔY	Difference between the vertical values at the intersections of the waveform with Cursor1 and Cursor2 ²

- 1 When Trace is set to All, the values for the channels of all installed modules and the Math channel are measured.
- 2 This option does not appear when Trace is set to All.

Horizontal and Vertical Cursors (H & V) - T-Y waveforms

Displays the horizontal and vertical cursors simultaneously.

Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8

Moving the Cursors (V Cursor1/V Cursor2, H Cursor1/H Cursor2)

Use V-Cursor1, V-Cursor2, H-Cursor1, and H-Cursor2 to move the cursors.

Taking the center of the waveform display window to be 0 div, you can move the cursors within the range of -5 to 5 div in steps of the following sizes: for horizontal cursors, 0.01 div; for vertical cursors, $\text{Time/div} \times 10 \div \text{display record length}$.

Cursor Jumping (Cursor Jump)

You can make V-Cursor1 and V-Cursor2 jump to the center of the specified zoom window.

Cursor1 to Zoom1: Cursor1 jumps to the Zoom1 window.

Cursor1 to Zoom2: Cursor1 jumps to the Zoom2 window.

Cursor2 to Zoom1: Cursor2 jumps to the Zoom1 window.

Cursor2 to Zoom2: Cursor2 jumps to the Zoom2 window.

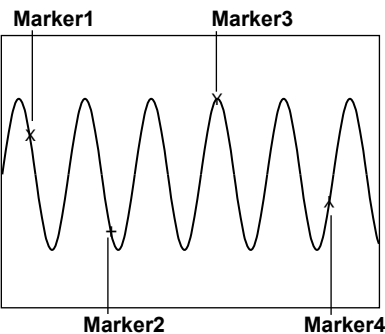
Measurement Items (Item Setup)

You can measure the following horizontal and vertical values at the cursor positions.

Horizontal Axis	
X1	Time value at V-Cursor1
X2	Time value at V-Cursor2
ΔX	Difference between the time values of V-Cursor1 and V-Cursor2
$1/\Delta X$	Reciprocal of the difference between the time values of V-Cursor1 and V-Cursor2
Vertical Axis	
Y1	Vertical value of H-Cursor1
Y2	Vertical value of H-Cursor2
ΔY	Difference between the vertical values of H-Cursor1 and H-Cursor2

Marker Cursors (Marker) - T-Y waveforms

Four markers are displayed on the selected waveform. You can measure the level at each marker, the amount of time from the trigger position to each marker, and the level and time differences between markers.



Markers (Marker1 through 4)

Select the markers, from Marker1 to 4, that you want to display. You can assign each marker to a different waveform.

Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below. You can select the channel of an installed module.

- OFF: Disables the marker
- U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8

Position (Position)

Set the position of the selected marker.

Taking the center of the waveform display window to be 0 div, you can move the markers within the range of -5 to 5 div in steps of the following size: $\text{Time/div} \times 10 \div \text{display record length}$.

Cursor Jumping (Cursor Jump)

You can make Marker1 to Marker4 jump to the center of the specified zoom window.

To Zoom1: The selected marker jumps to the Zoom1 window.

To Zoom2: The selected marker jumps to the Zoom2 window.

Marker Shape (Marker Form)

Set the shape of the displayed marker to one of the options below.

- Mark: A dot
- Line: A crosshair

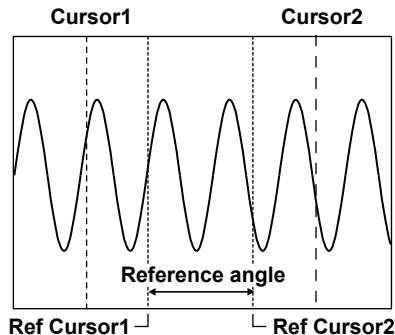
Measurement Items (Display Item)

Marker cursors move on the waveform data. You can measure the following values at the markers.

X1	Time value at Marker1
X2	Time value at Marker2
X3	Time value at Marker3
X4	Time value at Marker4
$\Delta(X2-X1)$	Difference between the time values of Marker1 and Marker2
$\Delta(X3-X1)$	Difference between the time values of Marker1 and Marker3
$\Delta(X4-X1)$	Difference between the time values of Marker1 and Marker4
$\Delta(X3-X2)$	Difference between the time values of Marker2 and Marker3
$\Delta(X4-X2)$	Difference between the time values of Marker2 and Marker4
$\Delta(X4-X3)$	Difference between the time values of Marker3 and Marker4
Y1	Vertical value at Marker1
Y2	Vertical value at Marker2
Y3	Vertical value at Marker3
Y4	Vertical value at Marker4
$\Delta(Y2-Y1)$	Difference between the vertical values of Marker1 and Marker2
$\Delta(Y3-Y1)$	Difference between the vertical values of Marker1 and Marker3
$\Delta(Y4-Y1)$	Difference between the vertical values of Marker1 and Marker4
$\Delta(Y3-Y2)$	Difference between the vertical values of Marker2 and Marker3
$\Delta(Y4-Y2)$	Difference between the vertical values of Marker2 and Marker4
$\Delta(Y4-Y3)$	Difference between the vertical values of Marker3 and Marker4

Angle Cursors (Degree) - T-Y waveforms

You can measure time values and convert them to angles. On the time axis, set the zero point (Ref Cursor1 position), which will be the measurement reference, the end point (Ref Cursor2 position), and the reference angle that you want to assign to the difference between Ref Cursor1 and Ref Cursor2. Based on this reference angle, you can measure the angle between two angle cursors (Cursor1 and Cursor2).



Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8, All*

* Cursor measurement is performed on all channels.

Moving the Cursors (Cursor1/Cursor2)

Use Cursor1 and Cursor2 to move the cursors.

Taking the center of the waveform display window to be 0 div, you can move the cursors within the range of -5 to 5 div in steps of the following size: $\text{Time/div} \times 10 \div \text{display record length}$.

Cursor Jumping (Cursor Jump)

You can make Cursor1 and Cursor2 jump to the center of the specified zoom window.

Cursor1 to Zoom1: Cursor1 jumps to the Zoom1 window.

Cursor1 to Zoom2: Cursor1 jumps to the Zoom2 window.

Cursor2 to Zoom1: Cursor2 jumps to the Zoom1 window.

Cursor2 to Zoom2: Cursor2 jumps to the Zoom2 window.

Reference Angle (Ref Value)

Set the reference angle you want to assign to the range defined by Ref Cursor1 and Ref Cursor2.

Selectable range: 1 to 720

References (Ref1/Ref2)

Set the zero point (Ref Cursor1) and the end point (Ref Cursor2).

Taking the center of the waveform display window to be 0 div, you can move the cursors within the range of -5 to 5 div in steps of the following size: $\text{Time/div} \times 10 \div \text{display record length}$.

Measurement Items (Item Setup)

The PX8000 measures the angle cursor (Cursor1 and Cursor2) positions as angles.

X1	Angle of Cursor1 from Ref Cursor1
X2	Angle of Cursor2 from Ref Cursor1
ΔX	Angle difference between Cursor1 and Cursor2
Y1	Vertical value at the intersection of Cursor1 and the waveform ¹
Y2	Vertical value at the intersection of Cursor2 and the waveform ²
ΔY	Difference in the vertical values at the points where Cursor1 and Cursor2 intersect the waveforms ²

- 1 When Trace is set to All, the values for the channels of all installed modules and the Math channel are measured.
- 2 This option does not appear when Trace is set to All.

X-Y Waveforms**Cursor Types (Type)**

The following types of X-Y waveform cursors are available.

- OFF: Cursor measurement is not performed.
- [Horizontal cursors \(Horizontal\)](#): Two horizontal cursors are used to measure vertical (Y axis) values.
- [Vertical cursors \(Vertical\)](#): Two vertical cursors are used to measure horizontal (X axis) values.
- [Horizontal and vertical cursors \(H & V\)](#): Two horizontal cursors and two vertical cursors are used to measure vertical (Y axis) and horizontal (X axis) values.
- [Marker cursors \(Marker\)](#): Four marker cursors that move on the waveform are used to measure waveform values.

Horizontal Cursors (Horizontal)

Two dashed lines (horizontal cursors) appear on the horizontal axis. You can measure the vertical (Y axis) value at the position of each horizontal cursor and measure the level difference between the horizontal cursors.

Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below.

XY1 to XY8

Moving the Cursors (Cursor1/Cursor2)

Use Cursor1 and Cursor2 to move the cursors.

Taking the center of the waveform display window to be 0 div, you can move the cursors within the range of -5 to 5 div in 0.01 div steps.

Measurement Items (Item Setup)

You can measure the following vertical (Y axis) values at the cursor positions.

Y1	Vertical (Y axis) value at Cursor1
Y2	Vertical (Y axis) value at Cursor2
ΔY	Difference between the vertical (Y axis) values of Cursor1 and Cursor2

Vertical Cursors (Vertical)

Two dashed lines (vertical cursors) appear on the vertical axis. You can measure the horizontal (X axis) value at the position of each vertical cursor and measure the level difference between the vertical cursors.

Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below.

XY1 to XY8

Moving the Cursors (Cursor1/Cursor2)

Use Cursor1 and Cursor2 to move the cursors.

Taking the center of the waveform display window to be 0 div, you can move the cursors within the range of -5 to 5 div in 0.01 div steps.

Measurement Items (Item Setup)

You can measure the following horizontal (X axis) values at the cursor positions.

X1	Horizontal (X axis) value at Cursor1
X2	Horizontal (X axis) value at Cursor2
ΔX	Difference between the horizontal (X axis) values of Cursor1 and Cursor2

Horizontal and Vertical Cursors (H & V)

You can display the horizontal and vertical cursors simultaneously and measure vertical (Y axis) and horizontal (X axis) values.

Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below.

XY1 to XY8

Moving the Cursors (V Cursor1/V Cursor2, H Cursor1/H Cursor2)

Use V-Cursor1, V-Cursor2, H-Cursor1, and H-Cursor2 to move the cursors.

Taking the center of the waveform display window to be 0 div, you can move the cursors within the range of -5 to 5 div in 0.01 div steps.

Measurement Items (Item Setup)

You can measure the following horizontal (X axis) and vertical (Y axis) values at the cursor positions.

Horizontal Axis (X axis)	
X1	Horizontal (X axis) value at V-Cursor1
X2	Horizontal (X axis) value at V-Cursor2
ΔX	Difference between the horizontal (X axis) values of V-Cursor1 and V-Cursor2
Vertical Axis (Y axis)	
Y1	Vertical (Y axis) value at H-Cursor1
Y2	Vertical (Y axis) value at H-Cursor2
ΔY	Difference between the vertical (Y axis) values of H-Cursor1 and H-Cursor2

Marker Cursors (Marker)

Four markers are displayed on the selected waveform. You can measure the level at each marker, the amount of time from the trigger position to each marker, and the level and time differences between markers.

Markers (Marker1 through 4)

Select the markers, from Marker1 to 4, that you want to display. You can assign each marker to a different waveform.

Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below.

XY1 to XY8

Position (Position)

Set the position of the selected marker.

Taking the center of the waveform display window to be 0 div, you can move the markers within the range of -5 to 5 div in steps of the following size: $\text{Time/div} \times 10 \div \text{display record length}$.

Marker Shape (Marker Form)

Set the shape of the displayed marker to one of the options below.

- Mark: A dot
- Line: A crosshair

Measurement Items (Item Setup)

Marker cursors move on the waveform data. You can measure the following values at the markers.

X1	Horizontal (X axis) value at Marker1
X2	Horizontal (X axis) value at Marker2
X3	Horizontal (X axis) value at Marker3
X4	Horizontal (X axis) value at Marker4
Y1	Vertical (Y axis) value at Marker1
Y2	Vertical (Y axis) value at Marker2
Y3	Vertical (Y axis) value at Marker3
Y4	Vertical (Y axis) value at Marker4
T1	Time from the trigger position at Marker1
T2	Time from the trigger position at Marker2
T3	Time from the trigger position at Marker3
T4	Time from the trigger position at Marker4
$\Delta(T2-T1)$	Time difference between Marker1 and Marker2
$\Delta(T3-T1)$	Time difference between Marker1 and Marker3
$\Delta(T4-T1)$	Time difference between Marker1 and Marker4

FFT Waveforms

Cursor Types (Type)

The following types of FFT waveform cursors are available.

- OFF: Cursor measurement is not performed.
- [Marker cursors \(Marker\)](#): You can use four marker cursors to measure frequencies, levels, and the distances between markers.
- [Peak cursors \(Peak\)](#): You can use peak cursors to measure peak frequency and level values.

Marker Cursors (Marker)

You can measure the frequency and level at each marker and the frequency and level differences between markers. You can select a measurement source waveform for each cursor.

Markers (Marker#)

The selected markers appear on the measurement source waveforms.

Measurement Source Waveform (Trace)

Set the measurement source waveform for each marker to one of the waveforms below.

- OFF: Disables measurement.
- FFT1: The waveform in the FFT1 window is measured.
- FFT2: The waveform in the FFT2 window is measured.

Position (Position)

Set the position of the selected marker.

You can move the markers within the range of -5 to 5 div of the frequency axis in 0.01 div steps.

Marker Shape (Marker Form)

Set the shape of the displayed marker to one of the options below.

- Mark: A dot
- Line: A crosshair

Measurement Items (Item Setup)

Marker cursors move on the waveform data. You can measure the following values at the markers.

X1	Frequency at Marker1
X2	Frequency at Marker2
X3	Frequency at Marker3
X4	Frequency at Marker4
$\Delta(X2-X1)$	Frequency difference between Marker1 and Marker2
$\Delta(X3-X1)$	Frequency difference between Marker1 and Marker3
$\Delta(X4-X1)$	Frequency difference between Marker1 and Marker4
$\Delta(X3-X2)$	Frequency difference between Marker2 and Marker3
$\Delta(X4-X2)$	Frequency difference between Marker2 and Marker4
$\Delta(X4-X3)$	Frequency difference between Marker3 and Marker4
Y1	Level at Marker1
Y2	Level at Marker2
Y3	Level at Marker3
Y4	Level at Marker4
$\Delta(Y2-Y1)$	Level difference between Marker1 and Marker2
$\Delta(Y3-Y1)$	Level difference between Marker1 and Marker3
$\Delta(Y4-Y1)$	Level difference between Marker1 and Marker4
$\Delta(Y3-Y2)$	Level difference between Marker2 and Marker3
$\Delta(Y4-Y2)$	Level difference between Marker2 and Marker4
$\Delta(Y4-Y3)$	Level difference between Marker3 and Marker4

Peak Cursors (Peak)

In the frequency range defined by FFT1 Range1 and Range2 and the frequency range defined by FFT2 Range1 and Range 2, the PX8000 detects peaks (Peak1 and Peak2) and measures their frequencies and levels. You can set the two frequency ranges in the range of -5 to 5 div.

Measurement Items (Item Setup)

The following values at the peaks are measured.

F1	Frequency at Peak1
F2	Frequency at Peak2
Y1	Level at Peak1
Y2	Level at Peak2

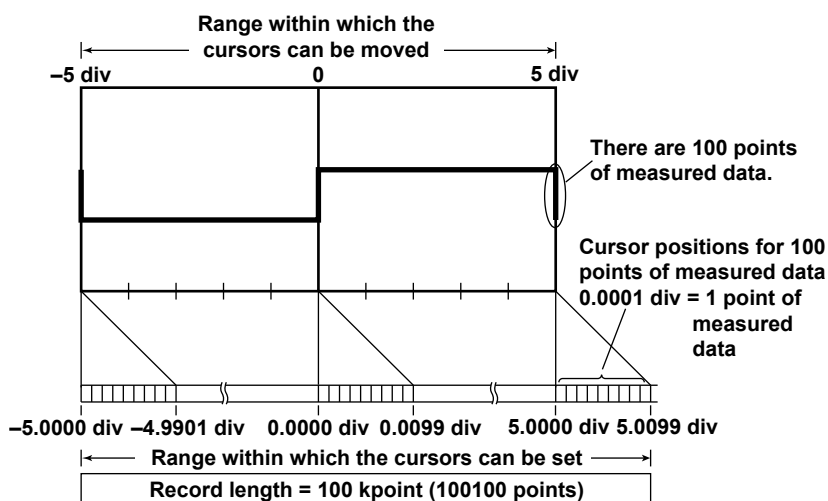
Notes about Cursor Measurement

Cursor Measurement

- You cannot perform cursor measurement on snapshot waveforms.
- For history waveforms, cursor measurement is performed on the waveform whose record number is selected.
- The measured time values are based on the trigger position.
- The measured value for data that cannot be measured appears as "***."
- The pulse/rotate setting affects only the X-axis (horizontal) cursor measurement values.

Selectable Range of Cursor Positions

When **Cursor Read Mode** is set to ACQ, in cursor measurements, measurement is performed on the data stored in the acquisition memory, not on the displayed data. Because 1001 points along the time axis are used to display the waveform, the number of acquired data points is equal to the set record length $\times 1.001$. If the record length is set to 100 kpoint, the number of acquired data points is 100100. Therefore, if the record length is set to 100 kpoint, there will be 100 points of measured data at the same position on the screen. The cursor display position is normally within ± 5 div of the center of the waveform display window. In this case, if the cursor display position is set to 5 div from the center of the window, only 1 point out of 100 points can be measured even if there are 100 points of measured data at the same time axis position. For these kinds of situations, the cursor position can be set in the range of -5 div to 5.0099 div (if the record length is set to 100 kpoint) from the center of the window. In other words, you can measure the data at the right end of the waveform display window by setting the cursor position to a value in the range of 5.0000 to 5.0099 div from the center of the window. Because the number of points at the same time axis position increases as the record length gets larger, the range varies depending on the record length (5.00000 to 5.00999 div for 1 Mpoint).



16 Automated Measurement of Waveform Parameters

MEASURE

The PX8000 can automatically measure various parameters of the displayed waveform, such as the maximum and minimum values. It can also compute statistics for the automatically measured data.

Mode Settings (Mode)

The following types of statistical processing are available for the automatically measured values of waveform parameters.

- OFF: Automated measurement is not performed.
- [Automated measurement of waveform parameters \(ON\)](#): Automated measurement is performed.
- [Normal statistical processing \(Statistics\)](#): Normal statistical processing is performed.
- [Cyclic statistical processing \(Cycle Statistics\)](#): Statistical processing is performed for each period (cyclic statistical processing).

Automated Measurement of Waveform Parameters (ON)

The PX8000 automatically measures the specified measurement items on the source waveform.

Measurement Items (Measure Setup)

Measurement Source Waveform (Trace)

Set the measurement source waveform to one of the waveforms below. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8, XY1 to XY8



When the AUX input signal type is set to Pulse, "*****" is displayed.

Measurement Item (Item)

You can choose from the 26 measurement items and delay measurement items listed below. The PX8000 can store a total of up to 64000 data values for all waveforms (U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, and Math1 to Math8). A total of up to 24 measurement items can be displayed on the screen.

• Vertical Axis Measurement Items

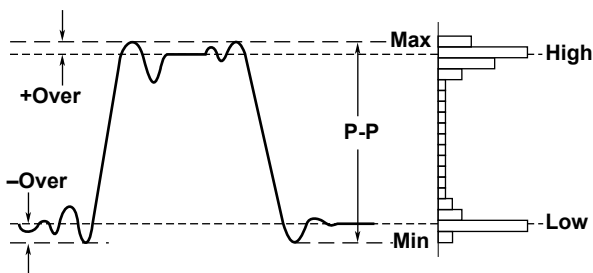
Voltage input signal measurement example

Peak to Peak(P-P)	P-P value (Max – Min) [V]
Amplitude(Amp)	Amplitude (High – Low) [V]
Maximum(Max)	Maximum voltage [V]
Minimum(Min)	Minimum voltage [V]
High	High voltage [V]
Low	Low voltage [V]
Average(Avg)	Average voltage $((1/n)\sum x_i)$ [V]
Middle(Mid)	$(\text{Max} + \text{Min})/2$ [V]
RMS ¹	Rms voltage $((1/n)(\sum x_i^2))^{1/2}$ [V]
Std.Deviation(SDev)	Standard deviation $(1/n(\sum x_i^2 - (\sum x_i)^2/n))^{1/2}$ [V]
+Overshoot(+Over)	Overshoot $((\text{Max} - \text{High})/(\text{High} - \text{Low}) \times 100)$ [%]
–Overshoot(–Over)	Undershoot $((\text{Low} - \text{Min})/(\text{High} - \text{Low}) \times 100)$ [%]

1 On a channel that has been set to [power spectrum computation](#) (PS or PSD), if RMS is set to ON, “Rms = overall value” appears on the screen. For details about the overall value, see appendix 9 in the features guide, IM PX8000-01EN.

* The names in parentheses are the measurement item names that appear when the measured values are displayed.

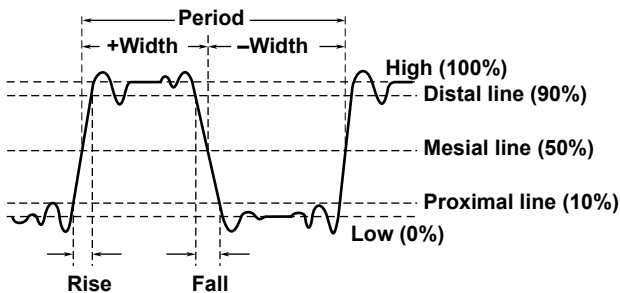
* The units are V for voltage, A for current, and W for power. The unit for AUX varies depending on the settings.



• Time Measurement Items

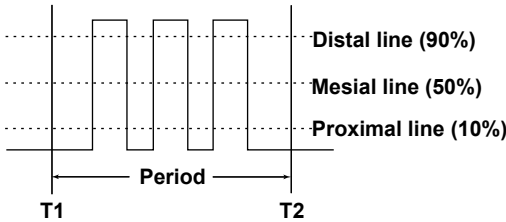
Rise	Rise time [s]
Fall	Fall time [s]
Frequency(Freq)	Frequency [Hz]
Period	Period [s]
+Width	Time width of the portion that is greater than the mesial value [s]
–Width	Time width of the portion that is less than the mesial value [s]
Duty	Duty cycle $(+Width/Period \times 100)$ [%]
Avg.Frequency(Avg.F)	Average frequency in the measurement time period [Hz]
Avg.Period(Avg.P)	Average period in the measurement time period [s]

* The names in parentheses are the measurement item names that appear when the measured values are displayed.

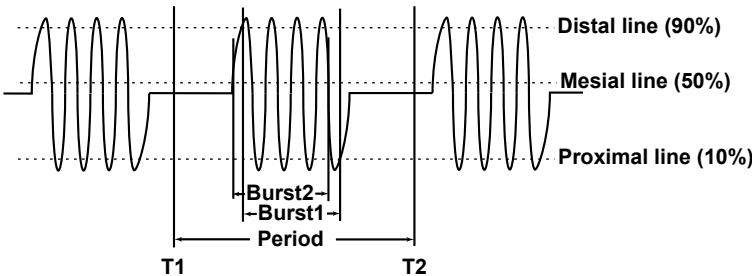


Pulse	Pulse count Set the measurement time period (Time Range) to a value appropriate for the pulse that you want to measure.
-------	--

When Pulse = 3



Burst1 and Burst2	Burst period [s] Set the measurement time period (Time Range) to a value appropriate for the burst period that you want to measure.
-------------------	--



• **Other Measurement Items**

When Trace Is Set to U, I, P, AUX, or Math

Integ1TY(Integ1)	Area of the positive amplitude
Integ2TY(Integ2)	Area of the positive amplitude – area of the negative amplitude

When Trace Is Set to XY

Integ1XY(Integ1)	Total triangular area of the X-Y waveform
Integ2XY(Integ2)	Total trapezoidal area of the X-Y waveform

* The names in parentheses are the measurement item names that appear when the measured values are displayed.

For detailed information about how the area of the X-Y waveform is computed, see appendix 8 in the features guide, IM PX8000-01EN.

All Clear (All Clear)

You can turn off all the items for the waveform selected for Trace at once.

Copy (Copy to)

You can copy the settings of the waveform selected for Trace to other traces.

- You can turn the following channels on and off separately: U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8. You can select the channel of an installed module.
- All ON: All traces are turned on.
- All OFF: All traces are turned off.
- Execute: Select Execute to copy the settings.



When Trace is set to XY, All Clear and Copy to are not available.

Detail Parameter (Detail Parameter)

Set the reference level that is used to measure various parameter values, such as the rise and fall times, for each measurement source waveform.

- **Distal, Mesial, and Proximal Unit Setting Method (Mode)**

Set the method for setting the three levels that are used as references in the measurement of various parameter values, such as the rise and fall times.

- %

You can set the distal, mesial, and proximal values as percentages of the specified trace (U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, or Math1 to Math8). The high value of the specified trace is equal to 100%, and the low value is equal to 0%.

- Unit

You can set the distal, mesial, and proximal values of the specified trace (U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, or Math1 to Math8) by specifying physical values, such as voltages or currents.

You can select the channel of an installed module.

- **Distal, Mesial, and Proximal (Distal, Mesial, Proximal)**

You can set the distal, mesial, and proximal values.

Selectable range: 0.0 to 100.0% (in 0.1% steps) or voltage, current, power or AUX input values that correspond to ± 10 div.

- **High/Low Specification Method (High/Low)**

The high and low levels are the 100% and 0% levels used to measure various parameter values, such as the rise and fall times. You can choose one of the following methods for setting the high and low levels.

- Auto

The PX8000 sets the high value to the high amplitude level and the low value to the low amplitude level based on the voltage level frequency of the waveform in the measurement time period while taking into account the effects of ringing, spikes, etc. This method is suitable for measuring square waves and pulse waves.

- Max-Min

The PX8000 sets the high and low values to the maximum and minimum values in the measurement time period. This method is suitable for measuring sinusoidal and saw waves. It is not suitable for waveforms that have ringing and spikes.

- **Integration Mode (Integ Mode)**

Select the measurement mode of Integ1TY(Integ1) and Integ2TY(Integ2) from the following two options. This setting is valid when measurement source waveform (Trace) is set to I or P.

- Normal

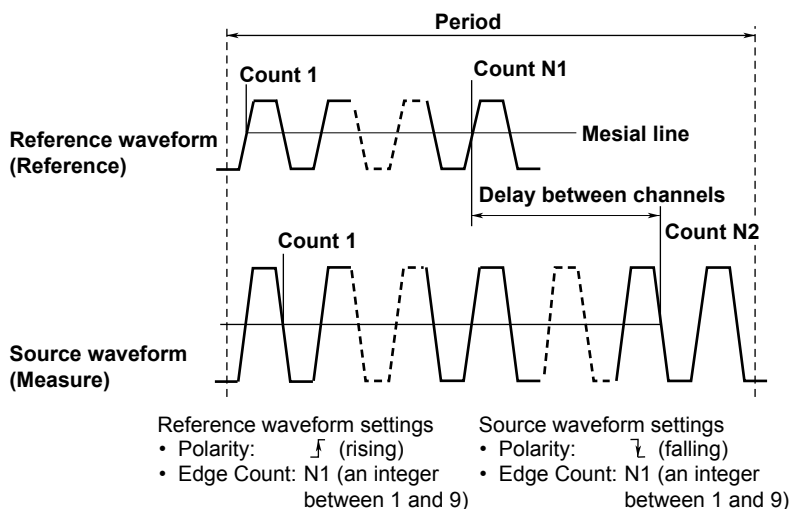
The area is measured.

- Hour

Integrated current (Ah) and integrated power (Wh) are measured.

Setting the Delay (Delay Setup)

The time difference between traces or the time difference from the trigger point to a rising or falling edge is called the delay between channels.



- **Mode**

Select a delay measurement mode.

- OFF: Delay measurement is not performed.
- Time: The delay between channels is displayed as a time.
- Degree: The delay between channels is displayed as an angle.

- **Polarity**

Select the slope of the edge you want to detect.

- \uparrow : Rising
- \downarrow : Falling

- **Edge Count**

Sets which edge counted from the start point (T Range1) of the measurement time period to use as a detected point (measured point).

Selectable range: 1 to 9

- **Reference**

Select whether to use a trace or trigger as the reference for the reference waveform.

- Trace: A trace is used.
- Trigger: A trigger is used.

- **Reference Waveform (Reference Trace)**

When Reference is set to Trace, set the reference waveform.

- Trace: Select a reference waveform. U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8. You can select the channel of an installed module.
- Polarity: Select the slope of the edge you want to detect (\uparrow : rising, \downarrow : falling).
- Edge Count: Sets which edge counted from the start point (T Range1) of the measurement time period to use as a detected point (reference point). Selectable range: 1 to 9



- The voltage level of the detected point is the mesial line.
- The measurement item name that appears when the measured values are displayed is (Delay).
- If Mode is set to Degree and Reference is set to Trigger, the measured value is displayed as '*****'.
- If you set the delay measurement's Reference to Trace, measurements will not be performed when the sample rates of the base waveform and the measurement source waveform are different. The measured value is displayed as '*****'.

Measurement Time Period (Time Range1/Time Range2)

Set the measurement time period using two vertical cursors. The position of the thin dashed line (Time Range1) is the measurement start point. The position of the thick dashed line (Time Range2) is the measurement end point. The default settings are -5 div and +5 div. The number of data points in the measured waveform can be up to 100 Mpoint from the measurement start point.

Selectable range: -5 div to +5 div

The Time Range1 and Time Range2 settings are similar to the cursor position settings in cursor measurement.

For details, see "Selectable Range of Cursor Positions" under "Cursor Measurement."

► [See here.](#)

1-Cycle Mode (1-Cycle Mode)

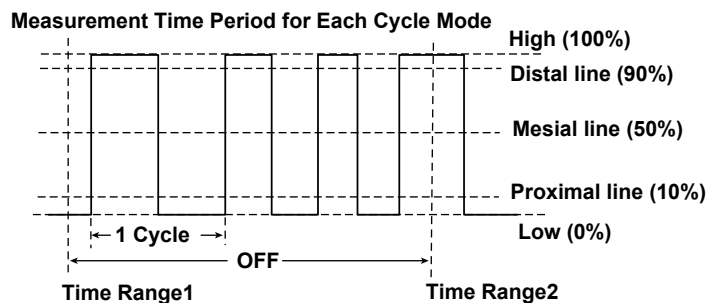
Instead of automatically measuring the measurement time period specified by Time Range1 and Time Range2, you can automatically measure the first period after Time Range1.

The method of determining the period is the same as the method for determining the Period measurement item.

In this mode, after the period is determined, the values of the measurement items related to voltage and area are computed. This mode is effective for measurement items, such as Rms or Avg, that may result in errors depending on the measurement time period setting.


The measurements of time axis items and X-Y areas are not affected.

- OFF: 1-cycle mode is disabled.
- ON: 1-cycle mode is enabled.



If the space between Time Range1 and Time Range2 is less than one period, '*****' is displayed for the measured value.

Notes about Automated Measurement of Waveform Parameters

- Measurements cannot be made on a snapshot waveform.
- Automated measurement is not possible when the measurement source waveform is AUX3 to AUX8 and Sense Type is set to Pulse.
- When an item is impossible to measure, its measured value is displayed as '*****'.
- The PX8000 may not measure correctly if the waveform amplitude is small.
- If there are two or more waveform periods within the measurement time period, the time-axis parameters are measured on the first period.
- Automated measurement may require additional time depending on settings such as the memory length, the number of measurement items, and the input waveform. During automated measurement,  appears in the center of the screen.
- To cancel automated measurement, set Mode to OFF. Measurement stops immediately.
- Only the Max and Min items can be measured for FFT waveforms. Only the overall rms power spectrum value can be measured.

Normal Statistical Processing (Statistics)

While acquiring waveforms, the PX8000 calculates the statistics of the waveforms that it has acquired so far. If you stop waveform acquisition and then restart it, the PX8000 will continue statistical processing and include the data from before waveform acquisition was stopped. The PX8000 also performs statistical processing for selected automatically measured items that are not displayed. The number of measured values used to calculate statistics (Count) is equal to the number of waveforms that have been acquired up to that point.

If you add an additional automatically measured item to apply statistical processing to, the number of measured values used to calculate the statistics (Cnt) is reset to 1 regardless of whether the PX8000 is acquiring waveforms.

Measurement Items (Measure Setup)

Statistical processing is performed on the same measurement items that the automated measurement of waveform parameters is performed on. The following five statistics are computed for the measurement items whose measurement has been turned on. The maximum number of measurement items that can be displayed on the screen is 3.

- Maximum: Maximum value
- Minimum: Minimum value
- Average: Average value
- SDev: Standard deviation
- Count: Number of measured values used to calculate statistics

The measurement items are the same as those for the automated measurement of waveform parameters.

▶ [See here.](#)



If you select U1 P-P as the automatically measured item, the number of measured values used to calculate the maximum, minimum, mean, and standard deviation values for U1 P-P appear at the bottom of the screen. The PX8000 can display the statistical results of three automatically measured items. If four or more automatically measured items are selected, the PX8000 displays the first three items ordered by ascending channel number and the order that the items appear in the Item Setup automated-measurement-item selection menu (P-P, Amp, Max, Min, ..., Init1XY, and Init2XY).

Example 1:

When U1: P-P, Amp; I1: Min; P1: Max, Min are selected, the following items are displayed: U1: P-P; I1: Min; P1:Max.

Example 2:

When U1: Max, Min; I1: P-P, Amp are selected, the following items are displayed: U1: Max, Min; I1: P-P.

You can view the statistics of other items in the following way.

- Load the items into a PC using the communication feature.
 - Save the statistical items as automated measurement values of waveform parameters, and load the data into a PC.
 - Scroll through the list of calculated statistics using the arrow keys.
-

Measurement Time Period (Time Range1/Time Range2)

This setting is the same as the measurement time period setting for the automated measurement of waveform parameters.

▶ [See here.](#)

1-Cycle Mode (1-Cycle Mode)

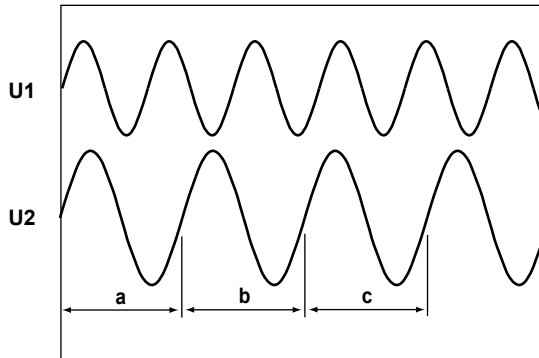
This setting is the same as the 1-cycle mode setting for the automated measurement of waveform parameters.

▶ [See here.](#)

Cyclic Statistical Processing (Cycle Statistics)

The PX8000 determines periods in order from the oldest data of the displayed waveform, measures the selected automatically measured items within each period, and performs statistical processing on the results of automated measurement. The method used to determine the period in cyclic statistical processing is the same as the method used to determine the Period waveform parameter. You can choose whether to determine the period for the selected waveform and use it on all source waveforms or to determine individual periods for each waveform.

Example in Which Cycle Trace Is Set to U2



Measures the items in ranges a, b, and c, and calculates statistics on the items in the order a, b, and c.

The items of other channels are also measured in ranges a, b, and c.

If you select Own, the items are measured over each waveform's period.

Measurement Items (Measure Setup)

These items are the same as those for the normal statistical processing.

► [See here.](#)



The following items are not measured:

- For waveforms that are used in period determination
Avg.Frequency, Avg.Period, Pulse (pulse count), Integ1XY (area), Integ2XY (area), Delay
- For other waveforms
Integ1XY (area), Integ2XY (area), Delay

Measurement Time Period (Time Range1/Time Range2)

This setting is the same as the measurement time period setting for the automated measurement of waveform parameters.

► [See here.](#)

Cycle Trace (Cycle Trace)

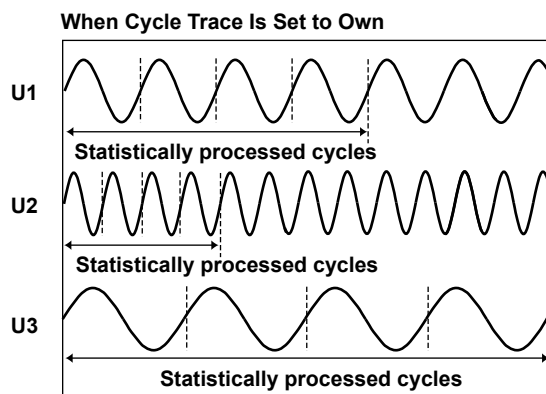
Selects the source waveform used to determine the period. You can select the channel of an installed module.

- **U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8, XY1 to XY8**

The period of the specified waveform is applied to all waveforms.

- **Own**

A period is determined for each source waveform. However, if signals that have different periods are applied to multiple channels, the number of iterations of automated measurement and statistical processing for each signal is equal to the number of periods in the slowest signal.



The number of cycles in the channel with the slowest cycle (U3) is four, so statistical processing is performed on the four oldest cycles of the data for U1 and U2. The remaining data is not used for statistical processing.



Statistical processing is performed in periods that are determined in order from the oldest data of the displayed waveform. It cannot be used at the same time as 1-cycle mode.

Execution of Measurement (Execute Measure)

Executes statistical processing. You can select Execute Measure when Mode is set to Cycle Statistics.

Press Abort to stop statistical processing.



- The number of cycles being used for the cyclic statistical processing is displayed in the statistical display's Count column.
- The number of cycles that can be used in cyclic statistical processing varies depending on the number of measured items that the PX8000 is calculating the statistics of.
64000/(the number of measured items that the PX8000 is calculating the statistics of)
- If the sample rates of the cycle trace and the displayed waveform are different, the displayed waveform will not be measured. The measured value and statistical processing value are both displayed as '*****'.

Result Display (Display Result)

Displays a list of calculated statistics. You can display the list of statistics when Mode is set to Cycle Statistics. Numbers are assigned to the data in order from the oldest cycle data or history data, and the automated measurement results for each number are displayed.

The maximum and minimum values for each parameter are indicated on the list by ↑ (maximum value) and ↓ (minimum value). If the same value appears in multiple locations, the oldest occurrence of the value is marked as the maximum or minimum value.

The number of data points that can be listed is 64000. If the number of data points exceeds 64000, the most recent data points in the history waveform or automatically measured item data are displayed. If the number of data points exceeds 64000, the maximum and minimum values may be outside of range of the displayed list. When this happens, ↑ (maximum value) and ↓ (minimum value) will not appear.

- **Sort**

Sorts the list in the specified order.

Forward (from the oldest) or Reverse (from the latest)

- **Statistics Max**

Moves to the maximum value (↑) for the selected measurement item.

- **Statistics Min**

Moves to the minimum value (↓) for the selected measurement item.



In cyclic statistical processing, you can select a waveform number (one period) with the jog shuttle and press the SET key to zoom in on it. Statistical processing is performed only on the number of data points that can be displayed in the list.

17 Waveform Computation

MATH

You can perform various computations on up to 4 Mpoint of data. (When more than 4 Mpoint of waveform data is displayed, computation is performed on the first 4 Mpoint of data from the computation start point.)

The results of computation are displayed in Math1 to Math8.

Turning Computation On and Off (Mode)

Select whether to use computation.

- ON: Computation is used.
- OFF: Computation is not used.

Computation Settings (Math Setup)

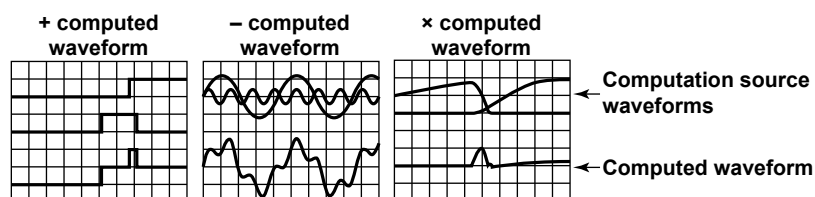
Operators and Functions (Operation)

Select an operator or function (operation definition) from the options below.

- OFF: Computation is not performed.
- **S1+S2**: Adds the waveforms assigned to Source1 and Source2
- **S1-S2**: Subtracts the waveform assigned to Source2 from the waveform assigned to Source1
- **S1*S2**: Multiplies the waveforms assigned to Source1 and Source2
- **S1/S2**: Divides the waveform assigned to Source1 by waveform assigned to Source2
- **Bin(S1)**: Converts the waveform assigned to Source to binary
- **PS(S1)**: Computes the power spectrum of the waveform assigned to Source
- **Shift(S1)**: Shows the waveform assigned to Source with its phase shifted
- **User Define**: Performs user-defined computation.

Basic Arithmetic ($S1+S2$, $S1-S2$, $S1*S2$, and $S1/S2$)

Performs addition, subtraction, multiplication, or division on the two waveforms assigned to Source1 and Source2.



Computation Source Waveforms (Source1 and Source2)

Select from the following. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math7¹

- 1 You can use other computed waveforms as computation source waveforms. If the waveform that you are configuring is MathX, you can use a computation waveform up to MathX – 1 as the computation source waveform. You cannot use another computation waveform as the computation source waveform for Math1.

In the equation shown on the Setup menu, computation source waveforms are expressed as follows.

Voltage	Current	Power	AUX	Math
U1:C1	I1:C2	P1:P1	AUX3:C3	Math1:M1
U2:C3	I2:C4	P2:P2	AUX4:C4	Math2:M2
U3:C5	I3:C6	P3:P3	AUX5:C5	Math3:M3
U4:C7	I4:C8	P4:P4	AUX6:C6	Math4:M4
			AUX7:C7	Math5:M5
			AUX8:C8	Math6:M6
				Math7:M7

For example, if the equation of $S1+S2$ is set as $U1+I1$, the equation on the Setup menu will show $C1+C2$.



When computation is performed on a linearly scaled channel, the scaled values are used.

Unit (Unit)

You can assign a unit of up to eight characters in length to the computed results. The specified unit is reflected in the scale values.

Label (Label)

You can create a label of up to 16 characters in length. The first eight characters of the specified label appears on the screen.

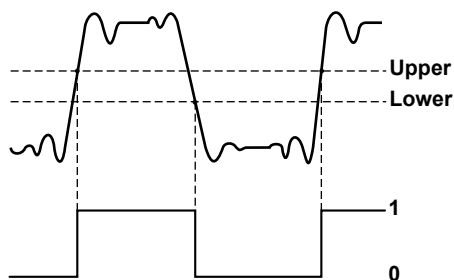
Turning the Display On and Off (Display)

Select whether to display the computed waveform.

- ON: Displays the computed waveform
- OFF: Does not display the computed waveform

Binary Conversion (Bin (S1))

Using the specified threshold levels, you can convert the waveform assigned to Source to a digital waveform.



Computation Source Waveform (Source), Unit (Unit), Label (Label), and Turning the Display On and Off (Display)

These settings are the same as those for basic arithmetic.

► [See here.](#)

Upper and Lower Thresholds (Thr. Upper/Thr. Lower)

Set the upper and lower threshold values. All values above the upper threshold on the computation source waveform are converted to ones, and all values below the threshold are converted to zeros.

Power Spectrum (PS (S1))

Performs an FFT (fast Fourier transform) on the waveform assigned to Source, and displays a power spectrum. You can use this function to view the frequency distribution of an input signal.

Computation Source Waveform (Source), Unit (Unit), Label (Label), and Turning the Display On and Off (Display)

These settings are the same as those for basic arithmetic.

► [See here.](#)

Phase Shift (Shift (S1))

You can shift the phase of the waveform assigned to Source, display the resulting waveform, and use the phase-shifted data in computations.

Computation Source Waveform (Source), Unit (Unit), Label (Label), and Turning the Display On and Off (Display)

These settings are the same as those for basic arithmetic.

▶ [See here.](#)

Shift (Shift)

You can shift waveforms within the following ranges.

- **When an Internal Clock Is Being Used as the Time Base**

Selectable range: The time values between $-(\text{record length}/2)$ points to $(\text{record length}/2)$ points

Step: $1 \div \text{sample rate}$

The sample rate varies depending on how the record length and Time/div settings are configured. For details, see appendix 2, "Relationship between the Time Axis Setting, Record Length, and Sample Rate" in the *Getting Started Guide*, IM PX8000-03EN.

- **When an External Clock Is Being Used as the Time Base**

Selectable range: $-(\text{record length}/2)$ points to $(\text{record length}/2)$ points

Step: 1

Computation Waveform Selection (Select Math Trace)

Select the computed waveform to set the scaling mode.

Math1 to Math8

Scaling Mode (Scaling Mode)

Set the method used to set the vertical display range of computed waveforms to one of the following options.

- Auto: The upper and lower limits are set automatically.
- Manual: The upper and lower limits must be set manually.

Upper and Lower Limits (Upper/Lower)

Set the upper and lower limits when Scaling Mode is set to Manual.

The selectable range is $-9.9999\text{E}+30$ to $9.9999\text{E}+30$.

Start Point and End Point (Start Point/End Point)

Set the range of computation by specifying a computation start and end point. The default settings are -5 div and +5 div.

Selectable range: -5 div to +5 div

The maximum range from the computation start point to the computation end point varies as indicated below depending on the number of computations.


- One computation: Up to 4 Mpoint
- Two computations: Up to 2 Mpoint
- Three or four computations: Up to 1 Mpoint
- Five to eight computations: Up to 500 kpoint

The start and end point settings are similar to the cursor position settings in cursor measurement.

For details, see “Selectable Range of Cursor Positions” under “Cursor Measurement.”

▶ [See here.](#)



An icon () appears in the center of the top of the screen when computations are being executed.

User-Defined Computation

You can perform user-defined computation.

Operators and Functions (Operation)

Select User Define.

Expression (Expression) - user-defined

Create an expression by combining computation source waveforms, variables, constants, functions, and operators.

You can create an expression using up to 80 characters.

Computation Source Waveforms and Variables

You can use the following waveforms and variables.

Menu Item	Description
C1, C3, C5, C7	Voltage waveforms C1:U1, C3:U2, C5:U3, C7:U4 AUX waveforms C3:AUX3, C5:AUX5, C7:AUX7
C2, C4, C6, C8	Current waveforms C2:I1, C4:I2, C6:I3, C8:I4 AUX waveforms C4:AUX4, C6:AUX6, C8:AUX8
P1 to P4	Power waveforms
M1 to M7	Math waveforms
T	Total number of data points in the time direction



When computation is performed on a linearly scaled channel, the scaled values are used.

17 Waveform Computation

Operators and Functions

You can use the following operators and functions.

Menu Item	Example	Description
$+$, $-$, $*$, $/$	C1+C2	Displays the result of performing basic arithmetic on two specified waveforms
SHIFT	SHIFT(C1, TIME)	Displays the result of shifting the specified waveform's phase
ABS	ABS(M1)	Displays the absolute values of the specified waveform
SQRT	SQRT(C2)	Displays the square root of the specified waveform
LOG	LOG(C1)	Displays the log of the specified waveform
EXP	EXP(C1)	Displays the exponent of the specified waveform
NEG	NEG(C1)	Displays the specified waveform inverted around 0
SIN	SIN(T)	Displays the sine of the specified waveform
COS	COS(C1)	Displays the cosine of the specified waveform
TAN	TAN(C1)	Displays the tangent of the specified waveform
ATAN	ATAN(C1)	Displays the arc tangent of the specified waveform (a value within $\pm\pi$)
PH	PH(C1, C2)	Displays the phase difference between the two specified waveforms
TREND	TREND(C1)	Displays the RMS value for each cycle of the specified waveform ²
TREND_HH	TREND_HH(C1)	Displays the RMS value for each cycle of the specified waveform (rising edge) ²
TREND_LL	TREND_LL(C1)	Displays the RMS value for each cycle of the specified waveform (falling edge) ²
TREND_XX	TREND_XX(C1)	Displays the RMS value for each half cycle of the specified waveform ²
TRENDM	TRENDM(C1)	Displays the MEAN value for each cycle of the specified waveform ²
TRENDM_HH	TRENDM_HH(C1)	Displays the MEAN value for each cycle of the specified waveform (rising edge) ²
TRENDM_LL	TRENDM_LL(C1)	Displays the MEAN value for each cycle of the specified waveform (falling edge) ²
TRENDM_XX	TRENDM_XX(C1)	Displays the MEAN value for each half cycle of the specified waveform ²
TREMDD	TREMDD(C1)	Displays the DC value for each cycle of the specified waveform ²
TRENDH_HH	TRENDH_HH(C1)	Displays the DC value for each cycle of the specified waveform (rising edge) ²
TRENDH_LL	TRENDH_LL(C1)	Displays the DC value for each cycle of the specified waveform (falling edge) ²
TRENDH_XX	TRENDH_XX(C1)	Displays the DC value for each half cycle of the specified waveform ²
TRENDF	TRENDF(C1)	Displays the frequency for each cycle of the specified waveform ²
TRENDF_HH	TRENDF_HH(C1)	Displays the frequency for each cycle of the specified waveform (rising edge) ²
TRENDF_LL	TRENDF_LL(C1)	Displays the frequency for each cycle of the specified waveform (falling edge) ²
ZC	ZC(C1)	Displays the zero-crossing of the specified waveform ²
ZC	ZC(EXT)	Displays the zero-crossing of the TRIGGER IN terminal input ²
DIF	DIF(C1)	Displays the derivative of the specified waveform
DDIF	DDIF(C1)	Displays the 2nd order derivative of the specified waveform
INTG	INTG(C1)	Displays the integral of the specified waveform
IINTEG	IINTEG(C1)	Displays the double integral of the specified waveform
BIN	BIN(C1, Up, Lo)	Displays the result of converting specified waveform to binary ³
SQR	SQR(C1)	Displays the square of the specified waveform
CUBE	CUBE(C1)	Displays the cube of the specified waveform
F1	F1(C1, C2)	Displays the result of computing $\sqrt{ C1^2+C2^2 }$ for the specified waveforms
F2	F2(C1, C2)	Displays the result of computing $\sqrt{ C1^2-C2^2 }$ for the specified waveforms
FV	FV(C1, Up, Lo)	Displays the inverse of the PWHH of the pulse width ³
PWHH	PWHH(M1, Up, Lo)	Displays the computation of the pulse widths between a rising edge and the next rising edge ³
PWHL	PWHL(C2, Up, Lo)	Displays the computation of the pulses width between a rising edge and the next falling edge ³
PWLH	PWLH(C1, Up, Lo)	Displays the computation of the pulse widths between a falling edge and the next rising edge ³
PWLL	PWLL(C1, Up, Lo)	Displays the computation of the pulse widths between a falling edge and the next falling edge ³
PWXX	PWXX(C2, Up, Lo)	Displays the computation of the pulse widths from a rising or falling edge to the next rising or falling edge ³
DUTYH	DUTYH(C1, Up, Lo)	Positive (high) duty cycle within each cycle of the specified waveform ³
DUTYL	DUTYL(C1, Up, Lo)	Negative (low) duty cycle within each cycle of the specified waveform ³
FILT1	FILT1(C1)	Displays the result of applying a filter to the specified waveform
FILT2	FILT2(C1)	Displays the result of applying a filter to the specified waveform
HLBT	HLBT(C1)	Displays the Hilbert transform of the specified waveform
MEAN	MEAN(C1)	Displays the 10th-order moving average of the specified waveform
LS-	LS-MAG(C1)	Displays the magnitude of the specified waveform's linear spectrum
	LS-LOGMAG(C1)	Displays the logarithmic magnitude of the specified waveform's linear spectrum
	LS-PHASE(C1)	Displays the phase of the specified waveform's linear spectrum
	LS-REAL(C1)	Displays the real part of the specified waveform's linear spectrum
	LS-IMAG(C1)	Displays the imaginary part of the specified waveform's linear spectrum
RS-	RS-MAG(C1)	Displays the magnitude of the specified waveform's RMS spectrum
	RS-LOGMAG(C1)	Displays the logarithmic magnitude of the specified waveform's RMS spectrum

Menu Item	Example	Description
PS-	PS-MAG(C1)	Displays the magnitude of the specified waveform's power spectrum
	PS-LOGMAG(C1)	Displays the logarithmic magnitude of the specified waveform's power spectrum
PSD-	PSD-MAG(C1)	Displays the magnitude of the specified waveform's power spectrum density
	PSD-LOGMAG(C1)	Displays the logarithmic magnitude of the specified waveform's power spectrum density
CS-	CS-MAG(C1, C2)	Displays the magnitude of the cross spectrum of the two specified waveforms
	CS-LOGMAG(C1, C2)	Displays the logarithmic magnitude of the cross spectrum of the two specified waveforms
	CS-PHASE(C1, C2)	Displays the phase of the cross spectrum of the two specified waveforms
	CS-REAL(C1, C2)	Displays the real part of the cross spectrum of the two specified waveforms
	CS-IMAG(C1, C2)	Displays the imaginary part of the cross spectrum of the two specified waveforms
TF-	TF-MAG(C1, C2)	Displays the magnitude of the transfer function of the two specified waveforms
	TF-LOGMAG(C1, C2)	Displays the logarithmic magnitude of the transfer function of the two specified waveforms
	TF-PHASE(C1, C2)	Displays the phase of the transfer function of the two specified waveforms
	TF-REAL(C1, C2)	Displays the real part of the transfer function of the two specified waveforms
	TF-IMAG(C1, C2)	Displays the imaginary part of the transfer function of the two specified waveforms
CH-	CH-MAG(C1, C2)	Displays the magnitude of the coherence function of the two specified waveforms

- 1 The unit of time is seconds. The number of clocks is used when the time base is an external clock signal (Ext).
- 2 For details, see appendix 9 in the features guide, IM PX8000-01EN.
- 3 Set the source waveform and the upper and lower threshold levels (Up and Lo).

Constants

Menu Item	Description
K1 to K8	► See here.
0 to 9	–
Exp	E notation. Selectable range: –30 to +30 Use this constant to enter values in E notation (1E+3 = 1000, 2.5E–3 = 0.0025). It is displayed as “E” in expressions to distinguish it from the “EXP” operator.

Automated Measurement Values of Waveform Parameters (Measure)

You can use the automated measurement values of waveform parameters in expressions. The PX8000 cannot retrieve waveform parameter values when the display of the measurement source waveform is off.

Combinations of Operators That Are Not Allowed

- An expression cannot be used in another expression with a smaller number.
Example: Math5 = M6 + M3
- Expressions containing only constants (K1 to K8) are not allowed.
Example: Math5 = K1 + K8
- An expression can contain only up to two FILT1 or FILT2 functions.
Example: FILT1(C1)+FILT1(C2)+FILT1(C3)
- A single FFT expression can contain only one operator.
Example: PS-MAG(C1+C2)
- Additional computations cannot be performed on FFT results.
Example: PS-MAG(C1)+C2
- Additional computations cannot be performed on pulse width computations.
Example: PWHH(C1)+C2
- Additional computations cannot be performed on cyclic computation (trend computation).
Example: TREND(C1)+C2
- Only one operator can be used in a single phase-shift computation, pulse-width computation, binary-conversion, or cyclic computation (trend computation) expression.
Example: SHIFT(C1+C2), BIN(C1–C2), PWHH(C1*C1), TREND(C1*C2)

If you want to perform an FFT, phase-shift, pulse-width, binary-conversion, or cyclic computation (trend computation) computation on the computed results of an expression such as C1+C2, create expressions like these: M1=C1+C2, M2=PS-MAG(M1).

Unit (Unit), Label (Label), and Turning the Display On and Off (Display)

These settings are the same as those for basic arithmetic.

▶ [See here.](#)

Scaling Mode (Scaling Mode)

▶ [See here.](#)

Upper and Lower Limits (Upper/Lower)

▶ [See here.](#)

Start and End Points (Start Point/End Point)

▶ [See here.](#)

FFT Settings (FFT Setup) - user-defined

FFT computation is performed when you specify an operator that uses FFT computation (LS, PS, PSD, CS, TF, or CH). Set the number of FFT points, the window function, the damping rate, and Force1 and Force2.

- **Number of FFT Points (FFT Points)**

You can set the number of points from the start of computation on the T-Y waveform to one of the options below.

1k, 2k, 5k, 10k, 20k, 50k, or 100k

- **Window Function (Window)**

You can select the window function from the following options.

Rect, Hanning, Flat Top, Hamming, Exponential

▶ [See here.](#)

- **Damping Rate (Damping Rate)**

You can configure this setting when Window is set to Exponential.

You can set the value in the range of 1 to 100% (1% resolution).

▶ [See here.](#)

- **Force1**

You can configure this setting when Window is set to Exponential.

You can set the area to a value from 1 to 100% (in 1% steps).

▶ [See here.](#)

- **Force2**

You can configure this setting when Window is set to Exponential.

You can set the area to a value from 1 to 100% (in 1% steps).

▶ [See here.](#)

The results of the FFT appear in the selected computation waveform. Other than the fact that no FFT window is displayed, this is the same as the FFT computation that can be performed from the FFT menu.

▶ [See here.](#)

Filter Settings (Filter Setup) - user-defined

When using FILT1 and FILT2 in user-defined computation, set the digital filter type, filter band, and cutoff frequency for each of the two filters (Filter1 and Filter2).

Filter Type (Filter Type)

The following filter types are available: Gauss, Sharp, and IIR. MEAN (moving average) can also function as a filter. The features of each filter are listed below.

Filter Type	Features	Operation Type
Gauss	<ul style="list-style-type: none"> Frequency characteristics with a smooth attenuation slope Linear phase and constant group delay No ripples present in the passband No overshoot in the step response Low order and short delay 	FIR
Sharp	<ul style="list-style-type: none"> Frequency characteristics with a sharp attenuation slope (-40 dB at 1 oct) Linear phase and constant group delay Ripples present in the passband Comb-shaped stopband 	FIR
IIR	<ul style="list-style-type: none"> Attenuation slope steepness between those of the SHARP and GAUSS filters Non-linear phase and non-constant group delay No ripples present in the passband and stopband Characteristics similar to those of analog filters Compared to Sharp and Gauss filters, lower cutoff frequency possible 	IIR
Mean	<ul style="list-style-type: none"> Comb-shaped frequency characteristics Linear phase and constant group delay No overshoot in the step response 	FIR

Filter Band (Filter Band)

Filter Type (Filter Type)	Filter Band (Filter Band)
Gauss	Low-Pass
Sharp	Low-Pass, High-Pass, Band-Pass
IIR (Butterworth)	Low-Pass, High-Pass, Band-Pass

CutOff1 and CutOff2 (CutOff1/CutOff2)

Set the cutoff frequency. When Filter Band is set to Low-Pass or High-Pass, set CutOff1; when Filter Band is set to Band-Pass, set CutOff1 and CutOff2.

Selectable range: 2.0 to 30.0% of the sample rate


Resolution: Steps of 0.2% of the sample rate

Constant Settings (Constant Setup) - user-defined

Set values for K1 to K8.

The selectable range is $-9.9999\text{E}+30$ to $9.9999\text{E}+30$.

Notes about Computation

- FFT computation can be performed through the configuration of settings in the Math menu or the FFT menu ([See here.](#)). In the FFT menu, you can set the display format and choose a linear or logarithmic frequency domain (horizontal axis) scale. The data point, window function and unit settings are shared for the Math and FFT menus. When you change the settings in one menu, the settings in the other menu are also changed.
- When you perform FFT computation on 50 kpoint or more of data using the FFT menu, you cannot use computed waveforms.
- An icon () appears in the center of the top of the screen when user-defined computation is being executed.

18 FFT

FFT

You can display the power spectrum of an input waveform in the FFT window. You can display up to two FFT waveforms.

You can analyze the following spectrums in addition to the power spectrum.

Linear spectrums, RMS spectrum, power spectrum densities, cross spectrums, transfer functions, and coherence functions

Turning FFT On and Off (Display)

Set whether to perform FFT analysis. If you set this to ON, the FFT windows appear. You can display separate FFT analysis results in the FFT 1 and FFT 2 windows.

- ON: FFT analysis is performed.
- OFF: FFT analysis is not performed.

FFT Settings (FFT Setup)

Set the spectrum type and the window function.

Spectrum Type (Type/Sub Type)

Set the spectrum type.

Type	Sub Type	Description
LS	MAG	Magnitude of the specified waveform's linear spectrum
LS	LOGMAG	Logarithmic magnitude of the specified waveform's linear spectrum
LS	PHASE	Phase of the specified waveform's linear spectrum
LS	REAL	Real part of the specified waveform's linear spectrum
LS	IMAG	Imaginary part of the specified waveform's linear spectrum
RS	MAG	Magnitude of the specified waveform's RMS spectrum
RS	LOGMAG	Logarithmic magnitude of the specified waveform's RMS spectrum
PS	MAG	Magnitude of the specified waveform's power spectrum
PS	LOGMAG	Logarithmic magnitude of the specified waveform's power spectrum
PSD	MAG	Magnitude of the specified waveform's power spectrum density
PSD	LOGMAG	Logarithmic magnitude of the specified waveform's power spectrum density
CS	MAG	Magnitude of the cross spectrum of the specified two waveforms
CS	LOGMAG	Logarithmic magnitude of the cross spectrum of the specified two waveforms
CS	PHASE	Phase of the cross spectrum of the specified two waveforms
CS	REAL	Real part of the cross spectrum of the specified two waveforms
CS	IMAG	Imaginary part of the cross spectrum of the specified two waveforms
TF	MAG	Magnitude of the transfer function of the specified two waveforms
TF	LOGMAG	Logarithmic magnitude of the transfer function of the specified two waveforms
TF	PHASE	Phase of the transfer function of the specified two waveforms
TF	REAL	Real part of the transfer function of the specified two waveforms
TF	IMAG	Imaginary part of the transfer function of the specified two waveforms
CH	MAG	Magnitude of the coherence function of the specified two waveforms

Analysis Source Waveforms (Source1 and Source2)¹

Set the analysis source waveform to one of the waveforms below. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math6²

1 You can set Trace2 when Type is set to CS, TF, or CH.

2 You cannot select Math7 or Math8.



- When analysis is performed on a linearly scaled channel, the scaled values are used.
- When the PX8000 performs FFT to determine active power (P1 to P4), FFT is performed on the waveform of active power (P). On the other hand, when the conventional PZ4000 performs FFT to determine active power, it computes the real part of the cross spectrum (CS) of the voltage (U) and current (I) waveforms. If you want to perform FFT of active power using the same computation method as the PZ4000, set the items in the FFT Setup dialog box as shown below so that the real part (REAL) of the cross spectrum (CS) of the voltage (U) and current (I) is calculated..
 - Type: CS
 - Sub Type: REAL
 - Source1: U1 to U4
 - Source2: I1 to I4 (same element number as U)

Window Function (Window)

You can select the window function from the following options.

Rect (Rectangular window)

The rectangular window is suited to transient signals, such as impulse waves, which attenuate completely within the time window.

Hanning (Hanning window)

The Hanning window encourages continuity of the signal by gradually attenuating the parts of the signal located near the ends of the time window down to the 0 level. Hence, it is suited to continuous signals. The Hanning window has a higher frequency resolution than the flattop window.

FlatTop (Flattop window)

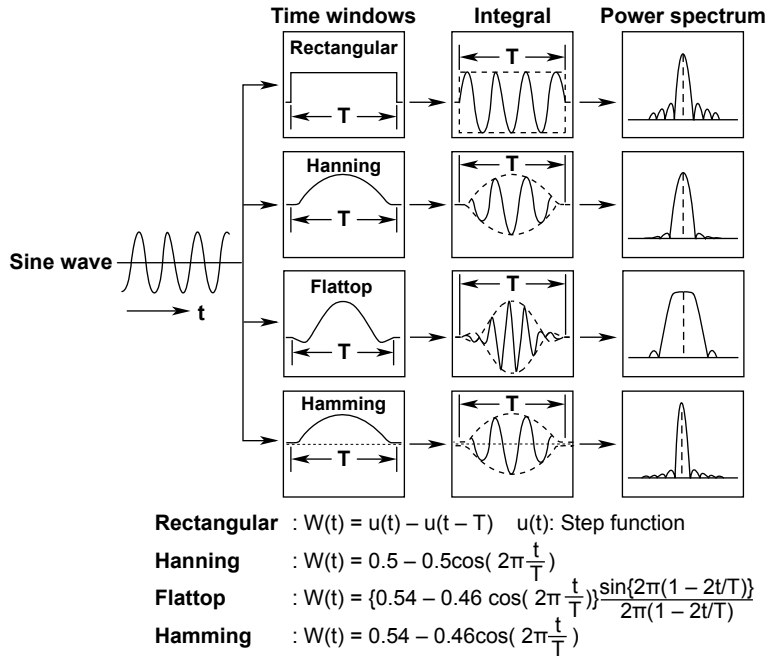
The flattop window encourages continuity of the signal by gradually attenuating the parts of the signal located near the ends of the time window down to the 0 level. Hence, it is suited to continuous signals. The flattop window has a higher spectral level accuracy than the flattop window.

Hamming (Hamming window)

In the Hanning window, the values at the ends become 0 and the signal components there do not affect the spectrum. The Hamming window is a corrected Hanning window. Its characteristics are similar to those of the Hanning window, but the frequency resolution of its main beam is greater than that of the Hanning window. The Hamming window is suited for dividing close signals.

Exponential (Exponential)

The exponential window removes noise from the signal. It can be selected only on models with the user-defined computation option. The exponential window is suited for the signals of impulse-excitation frequency-response tests and other similar signals.



For details about the exponential window, see appendix 9 in the features guide, IM PX8000-01EN.

- **Damping Rate (Damping Rate)**

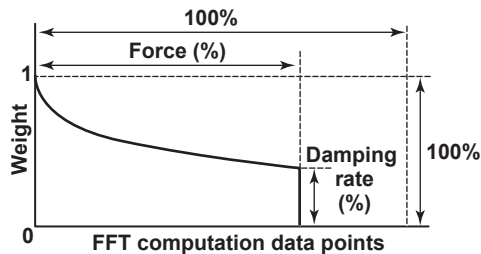
You can configure this setting when Window is set to Exponential. You can set the value in the range of 1 to 100% (1% resolution). The weight of the last data point is used as a damping rate, with the weight of the first data point of the FFT computation taken to be 100% (= 1). When the damping rate is set to 100%, the window functions like a rectangular window. This setting applies to the input and output (response) signals.

- **Force1**

You can configure this setting when Window is set to Exponential. Set the area over which computation is performed in terms of a percentage from the first FFT point, taking the number of FFT points to be 100%. You can set the area to a value from 1 to 100% (in 1% steps). When the area is set to 100%, the window functions like a rectangular window. The outer area is the average of the results of the window function for the data outside the area. This setting applies to the input signals (first parameter) of one-waveform and two-waveform FFTs.

- **Force2**

You can configure this setting when Window is set to Exponential. This setting applies to the output (response) signal (second parameter) of a two-waveform FFT. It can be set in the same manner as Force1.



Vertical Scale (Vert. Scale Mode)

You can select the method for setting the vertical scale from the following options.

- Auto: The center and scale of the vertical axis are set automatically.
- Manual: The center and scale of the vertical axis must be set manually.

Center/Scale (Center/Sensitive)

When Vert. Scale Mode is set to Manual, set the center and scale of the vertical axis.

Start Point and Number of FFT Points (Start Point and FFT Points)

Start Point (Start Point)

Set the computation start point. The default setting is -5 div.

Selectable range: -5 div to +5 div

The start point setting is similar to the cursor position settings in cursor measurement.

For details, see "Selectable Range of Cursor Positions" under "Cursor Measurement."

▶ [See here.](#)

Number of FFT Points (FFT Points)

You can set the number of points from the start of computation on the T-Y waveform to one of the options below.

1k, 2k, 5k, 10k, 20k, 50k, or 100k

Display Ratio of the Main Window (Main Ratio)

Set the size of the main window in relation to the overall waveform display area.

- 50%: The main window appears in the upper half of the screen.
- 0%: The main window is not displayed.

Window Layout (Window Layout)

Set the display position of the FFT window.

- Side: Horizontal
- Vertical: Vertical

Horizontal Scale (Horiz. Axis)

Select one of the following horizontal scale types.

- Hz: A normal (linear) scale is used.
- Log Hz: A logarithmic scale is used.

Unit (Unit)

You can set the unit using up to eight characters. The specified unit is reflected in the vertical scale values.

Horizontal Zoom (Horiz. Scale)

Select one of the following horizontal display ranges.

- Auto: The horizontal center point and span are set automatically (the entire range is displayed).
- Left/Right: You must set the left and right ends of the display range manually.
- Center/Span: You must set the horizontal center point and span manually. You can select this only when the horizontal scale is set to Hz.

Horizontal Range (Left/Right, Center/Span)

Horizontal Range (Left/Right)

When the horizontal zoom is set to Left/Right, set the left and right ends of the horizontal display range.

Selectable range: 0.00 kHz (DC) to the maximum frequency

Horizontal Range (Center/Span)

When the horizontal zoom is set to Center/Span, set the center point and span of the horizontal display range.

Selectable range of the center: 0.00 kHz (DC) to the maximum frequency


Selectable range of the span: the frequency resolution x10 to the maximum frequency

Notes about FFT Computation

Notes about Displaying Power Spectrums

- You cannot display a power spectrum if the display record length is less than the number of computed data points.
- The following settings are shared for all computation channel: FFT Points, Window, and Start Point.
- When using the commands in the menu that appears when you press the ZOOM key to zoom FFT waveforms horizontally, you cannot set the number of displayed waveform points to 50 or less.

Notes about Computation

- Computation is normally performed on the sampled data in the acquisition memory. For waveforms that are acquired in Envelope mode, computation is performed on the maximum and minimum values at each acquisition interval.
- FFT computation can be performed through the configuration of settings in the Math menu or the FFT menu. The data point, window function and unit settings are shared for the Math and FFT menus. When you change the settings in one menu, the settings in the other menu are also changed.
- When you perform FFT computation on 50 kpoint or more of data using the FFT menu, you cannot use computed waveforms.
- An icon () appears in the center of the top of the screen when FFT computation is being executed.

19 GO/NO-GO Determination

GO/NO-GO

The PX8000 determines whether the acquired waveform meets the reference condition (GO result) or not (NO-GO result). When the PX8000 produces a GO or NO-GO result, it executes the specified actions.

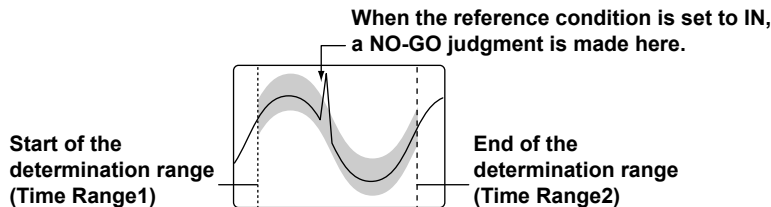
Mode (Mode)

Set the method for GO/NO-GO determination.

- OFF: GO/NO-GO determination is not performed.
- **Waveform zone (Wave Zone):** GO/NO-GO determination is performed using a waveform zone configured on the screen.
- **Waveform parameter (Parameter):** GO/NO-GO determination is performed through the use of the specified waveform parameters.

Waveform Zone (Wave Zone)

The PX8000 returns GO/NO-GO results based on whether waveforms leave or enter the zone that you create using a base waveform.



Editing a Waveform Zone (Edit Zone)

Select the number of the waveform zone you want to edit from the range indicated below. If a zone has already been created for that number, the zone will be displayed. If no zone has been created for a number, select a base waveform from the base waveform editing menu (New), and then edit the zone.

Zone 1 to Zone 6 (Zone1 to Zone6)

Editing a Base Waveform (New)

When you create a new waveform zone, you need to select the waveform that you will base it on (the base waveform). You can select the channel of an installed module. Select a waveform whose display is on.

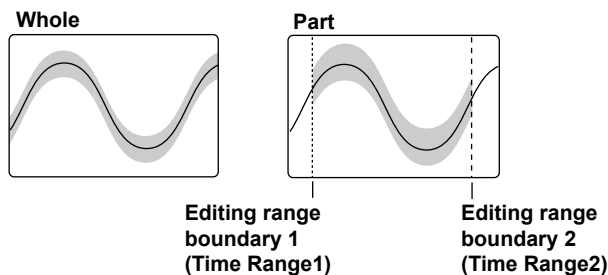
U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8, Cancel (Cancel)*

* The selected menu closes.

Specifying the Editing Range (Edit)

Select the part of the base waveform that you want to edit.

- Whole (Whole): The whole waveform is within the editing range.
- Part (Part): A portion of the waveform is within the editing range.



Zone Settings

When Edit is set to Whole, you can set the upper, lower, left, and right boundaries of the waveform zone. When Edit is set to Part, you can set the upper and lower boundaries of the zone.

- Upper and lower boundaries (Upper and Lower)
Selectable range: ± 10 div vertically from the base waveform
When Edit is set to Part, you can set the upper and lower boundaries of the area between Time Range1 and Time Range2.
- Left and right sides (Left and Right): These settings can be configured only when Edit is set to Whole.
Selectable range: ± 5 div from the center of the screen
- Time range 1 and time range 2 (Time Range1 and Time Range2): These settings can be configured only when Edit is set to Part.
Selectable range: ± 5 div on the time axis

Save Destination (Store as)

You can select one of the following save destinations for the waveform zone.

Zone 1 to zone 6 (Zone1 to Zone6): The save destination is changed to the selected zone number.

Saving a Waveform Zone (Execute Store)

Save the waveform zone.

Judgment Conditions (Judgement Setup)

For each of 16 judgment conditions, you can set the source waveform, zone number, and judgment criterion. You can also set the judgment logic, action condition, sequence, and acquisition count and enable or disable synchronization with a remote signal.

Judgment Criterion (Mode)

Select the judgment criterion from the following options.

- X: The condition is not used for GO/NO-GO determination.
- IN: The PX8000 returns a GO result when the source waveform is within the GO/NO-GO determination zone. If even part of the source waveform is outside of the determination zone, the PX8000 returns a NO-GO result.
- OUT: The PX8000 returns a GO result when the entire source waveform is outside the GO/NO-GO determination zone. If even part of the source waveform is inside the determination zone, the PX8000 returns a NO-GO result.

Source Waveform (Trace)

Set the waveform to use for GO/NO-GO determination to one of the waveforms below. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8

Zone Number (Zone No.)

Select the number of the waveform zone you want to use for GO/NO-GO determination from the range indicated below.

Zone 1 to zone 6 (Zone1 to Zone6)

Determination Logic (Logic)

You can select the determination logic from the following options.

- AND: The actions are performed when all the conditions from 1 to 16 are met.
- OR: The actions are performed when a condition from 1 to 16 is met.

Action Condition (ActCondition)

Set the action condition to one of the settings below.

- Always (Always): The actions are always performed. The actions will be executed each time that the PX8000 triggers.
- At failure (Fail): The actions are executed when the specified GO conditions are not met.
- At success (Success): The actions are executed when the specified GO conditions are met.

Sequence (Sequence)

Select the sequence for executing actions.

- Single (Single): Execution stops after the actions are performed once.
- Continue (Continue): Actions are executed repeatedly. However, the actions stop repeating after the number of specified waveform acquisitions (the Acquisition Count setting). If Acquisition Count is set to Infinite, the actions continue until waveform acquisition is stopped by the pressing of the START/STOP key.

Acquisition Count (Acquisition Count)

Set the number of waveform acquisitions.

- Infinite: Waveform acquisition continues until it is stopped by the pressing of the START/STOP key.
- 1 to 65536: The PX8000 stops waveform acquisition after it acquires the specified number of waveforms.

External Start (Remote)

You can perform GO/NO-GO determination and output the results in sync with an external signal applied to the GO/NO-GO I/O terminal (EXT I/O) of the PX8000.

- OFF: GO/NO-GO determination is not performed through the use of an external signal.
- ON: GO/NO-GO determination is performed through the use of an external signal.

Action (Action)

► [See here.](#)

Determination Period (Time Range1 and Time Range2)

You can set the determination period by setting Time Range1 and Time Range2. The default settings are -5 div and +5 div.

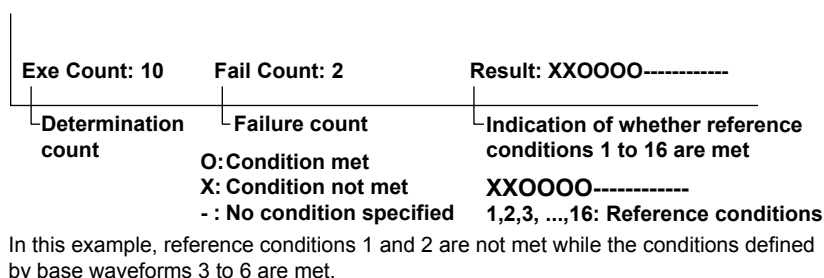
Selectable range: -5 div to +5 div

The Time Range1 and Time Range2 settings are similar to the cursor position settings in cursor measurement. For details, see "Selectable Range of Cursor Positions" under "Cursor Measurement."

► [See here.](#)

GO/NO-GO Determination Results

The results of GO/NO-GO determination (and the numbers of determinations and failures) appear at the bottom of the screen.



Waveform Parameters (Parameter)

Set the upper and lower limits for automated measurement values of waveform parameters, and perform GO/NO-GO determination based on whether the values are within or outside of the limits.

Judgment Conditions (Judgement Setup)

For each of 16 judgment conditions, you can set the source waveform, waveform parameter, and upper and lower waveform parameter limits. You can also set the judgment logic, action condition, sequence, and acquisition count and enable or disable synchronization with an external start signal.

Judgment Criterion (Mode)

Select the judgment criterion from the following options.

- X: The condition is not used for GO/NO-GO determination.
- IN: The PX8000 returns a GO result when the parameter is within the specified limits. The PX8000 returns a NO-GO result when the parameter is outside the specified limits.
- OUT: The PX8000 returns a GO result when the parameter is outside the specified limits. The PX8000 returns a NO-GO result when the parameter is inside the specified limits.

Source Waveform (Trace)

Set the waveform to use for GO/NO-GO determination to one of the waveforms below. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8

Waveform Parameter (Item)

You can use all automatically measured waveform parameters as reference conditions. You can perform GO/NO-GO determination on up to 16 parameters at the same time.

► [See here.](#)

Upper and Lower Parameter Limit Settings (Upper/Lower)

Selectable range: $-9.9999\text{E}+30$ to $9.9999\text{E}+30$.

Judgment Logic (Logic), Action Condition (ActCondition), Sequence (Sequence), Acquisition Count (Acquisition Count), and External Start (Remote)

These items are the same as those for the judgment conditions of waveform zone.

► [See here.](#)

Action (Action)

► [See here.](#)

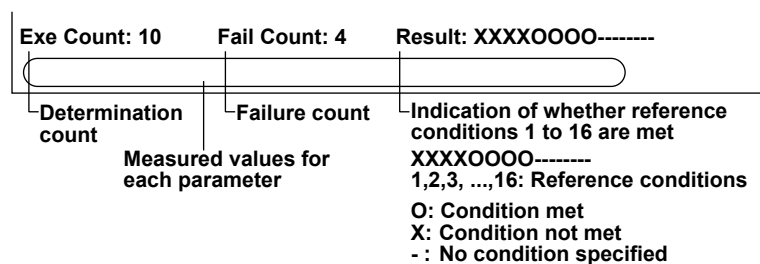
Determination Period (Time Range1 and Time Range2)

The determination period is the same as that of waveform zones.

► [See here.](#)

GO/NO-GO Determination Results

The results of GO/NO-GO determination (number of determinations, number of failures) appear at the bottom of the screen.



In this example, reference conditions 1 and 4 are not met while reference conditions 5 to 8 are met.

Notes about GO/NO-GO Determination

- During determination, all keys other than START/STOP are invalid.
- The determination interval is synchronized to the trigger. However, while actions are being performed after determination, the PX8000 will not trigger.
- While you are accessing the PX8000 through the FTP server, if one of the following operations is performed, actions cannot be executed until you finish accessing the PX8000.
 - Printing and saving of screen capture data and saving of waveform data

Notes about the “Save Data” and “Save Image” Actions

▶ [See here.](#)

20 Action

ACTION

If Mode is set to ON, the specified action (operation) is performed in the following situations. However, if the trigger mode is set to N Single, the PX8000 cannot start waveform acquisition when Mode has been set to ON.

- When the PX8000 triggers, and the corresponding waveform acquisition stops
- When the action condition of GO/NO-GO determination is met
- When waveform acquisition stops

Mode (Mode)

Select whether to use the actions.

- OFF: The actions are not used.
- ON: The actions are executed.

Action (Action Setup)

You can select the actions from the options below.

Beep (Beep)

The PX8000 sounds an alarm.

Screen Capture Printing (Print Image)

The PX8000 prints a screen capture to the specified printer. You can specify a printer in the PRINT menu by setting "Print to" to BuiltIn (built-in printer).

▶ [See here.](#)

Waveform Data Saving (Save Waveform), Numeric Data Saving (Save Numeric)

The PX8000 saves the waveform data to the specified destination (SD card, USB storage device, or network drive).

File Path (File Path)

Specify where to save the file.

▶ [See here.](#)

Auto Naming (Auto Naming), File Name (File Name), Data Format (Data Type)

These settings are the same as the auto-naming, file-name, and data-format settings for saving waveform data.

▶ [See here.](#)



Changing the auto-naming, file-name, and data-format settings for saving waveform or numeric data will change the auto-naming, file-name, and data-format settings under Waveform(SAVE), Numeric(SAVE), and Setup(SAVE) in the FILE menu.

Screen Capture Saving (Save Image)

The PX8000 saves the screen capture data to the specified destination (SD card, USB storage device, or network drive).

File Path (File Path), Auto Naming (Auto Naming), File Name (File Name)

These settings are the same as the file path, auto-naming, and file-name settings for saving waveform data.

▶ [See here.](#)



Changing the auto-naming and file-name settings for saving image data will change the auto-naming and file-name settings under Others(SAVE) in the FILE menu.

Notes about Action

- You cannot change settings while the action feature is active.
- The actions may be slow if there is network access while the following operations are being performed.
Printing and saving of screen capture data and saving of waveform data

Notes about the “Save Data” and “Save Image” Actions

- Do not set the storage medium's root folder as the save destination. The PX8000 can store only 512 files to the root folder of a storage medium that the PX8000 has formatted. A file whose name is longer than eight characters will be counted as two files. If such files exist, the number of files that can be stored will decrease.
- The maximum number of files that can be created in a single folder is 1000. Make sure that there are no files in the destination folder before you start the action feature.
- If you select waveform data saving (Save Waveform) and screen capture saving (Save Image) at the same time, use the FILE menu to specify separate folders to save to.
- In the FILE menu, if you set Auto Naming to Numbering, as the number of saved files increases, the amount of time required to save a file will also increase.
- Save Destination during Action Execution

In the specified drive, a folder is automatically created with the date (year, month, and day) as its name, and data is saved to that folder using file names specified by the auto naming feature. If the number of files in the save destination folder exceeds 1000, a new folder is automatically created with the date and an incremented sequence number (000 to 999) as its name, and the data continues to be saved in the new folder.



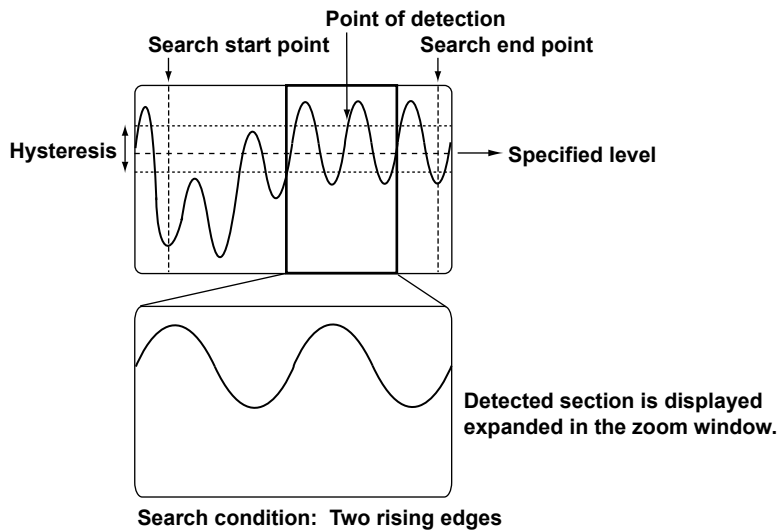
Select whether to enable the action feature when the power is turned on.

▶ [See here.](#)

21 Searching Waveforms

SEARCH

You can search the displayed waveforms for locations that match the specified conditions. You can zoom-in on the detected locations.



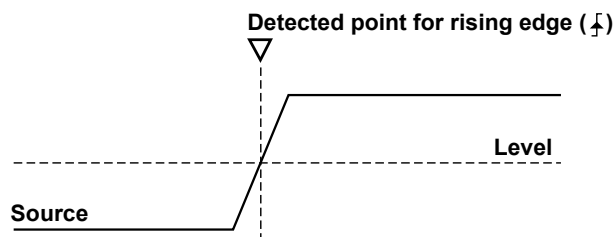
Search Type (Type)

Set the search type to one of the options below.

- **Edge:** The PX8000 searches for edges.
- **Time:** The PX8000 searches for a time.

Edge Search (Edge)

Search for positions where the rising or falling slope of the specified waveform passes through the specified level.



Search Conditions (Setup)

Set the search conditions, such as the waveforms to search, judgment level, polarity, hysteresis, and count.

Source Waveform (Trace)

Select the waveforms to search from the options listed below. You can select the channel of an installed module. U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8

Judgment Level (Level)

Set the level used to detect the rising or falling edges of the waveforms. You can set the level to a value within the 10 div of the screen. The resolution at which you can set the level varies depending on the module.

Polarity (Polarity)

Select which type of edge to detect from the options listed below.

- ↗: Rising
- ↘: Falling
- ↗↘: Rising or falling

Hysteresis (Hysteresis)

You can set a range (hysteresis) within which level changes are not treated as edges. You can set the hysteresis to one of the settings below. The hysteresis widths vary depending on the input module.

- : Low hysteresis
- : Medium hysteresis
- : High hysteresis

Count (Count)

Set the number of times the specified edge (↗, ↘, or ↗↘) must repeat. You can select a number from 1 to 1000000.

Searched Waveform Display (Result Window)

The waveform that includes the search point specified by the detected point number (Pattern No.) described later is displayed expanded in the zoom windows. If both the Zoom1 and Zoom2 windows are displayed, select the zoom window that you want to control the zoom factor, position, and detected point number (Pattern No.) of.

- If only one of the two zoom windows is displayed, you do not have to select the window.
- If both Zoom1 and Zoom2 are not displayed, Zoom1 will be displayed when you press SHIFT+ZOOM (SEARCH) to display the SEARCH menu.

Detected Point Number (Pattern No.)

Specify the number of the detected point to display in the zoom window. The maximum detected point number is 1000.

If the search does not yield any results, "No Match" appears.

Search Range (Start Point and End Point)

Set the search start and end points (Start Point and End Point). The default settings are -5 div and +5 div.

Selectable range: -5 div to +5 div

The start and end point settings are similar to the cursor position settings in cursor measurement.

For details, see "Selectable Range of Cursor Positions" under "Cursor Measurement."

► [See here.](#)

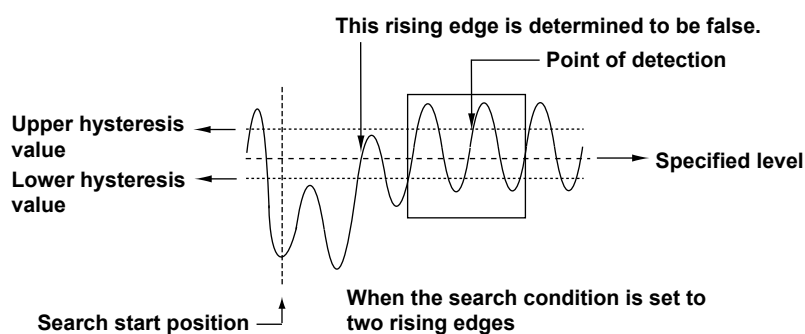
Executing a Search (Execute)

The PX8000 searches for positions where the specified search conditions are met. Then, the PX8000 displays the waveforms expanded in the zoom window with the detected point that corresponds to the number you specify at the center.

Up to 1000 points can be detected.

Edge Search Determination

If the peak is below the upper limit of the hysteresis immediately after a rising edge or above the lower limit of the hysteresis immediately after a falling edge, the PX8000 will not count the edge.



Time Search (Time)

Search for a specific year, month, day, and time.

Search Conditions (Setup)

Specify the time that you want to search for.

Set the year (Year), month (Month), day (Day), hour (Hour), minute (Minute), second (Second), and microsecond (μ Second).

Searched Waveform Display (Result Window)

This setting is the same as the searched waveform display for edge search.

▶ [See here.](#)

Executing a Search (Execute)

The PX8000 displays the waveforms of the area around the specified time expanded in the zoom window.

This feature is the same as the executing a search for edge search.

▶ [See here.](#)

Notes about Searching Waveforms

- You cannot search during data acquisition.
- The search results are invalid after you:
 - Start data acquisition.
 - Change the settings.
- If you invert or change the offset voltage of a waveform that has been selected as a waveform to search, the search is performed on the new waveform.

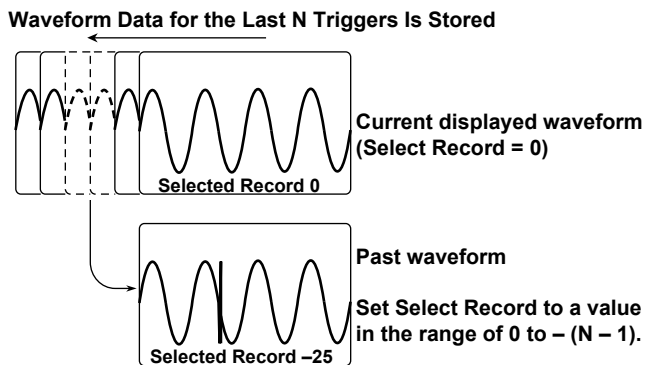
22 Displaying and Searching History Waveforms

HISTORY

Acquisition memory stores waveforms that are displayed on the screen and waveform data that have been acquired in the past. The history feature allows you to display or search past waveforms (history waveforms). You can perform the following operations on history waveforms:

Display

You can display any single waveform or display all waveforms (and highlight only the specified waveform). You can also list the timestamps (the times at the time references) of all history waveforms.

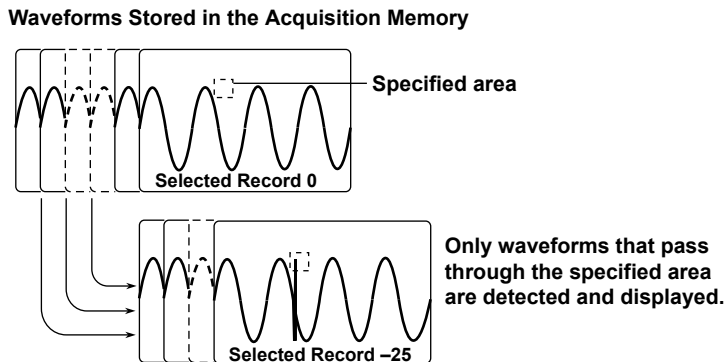


Search

You can search for waveforms that meet the specified conditions, display the detected history waveforms, and list the timestamps of the waveforms.

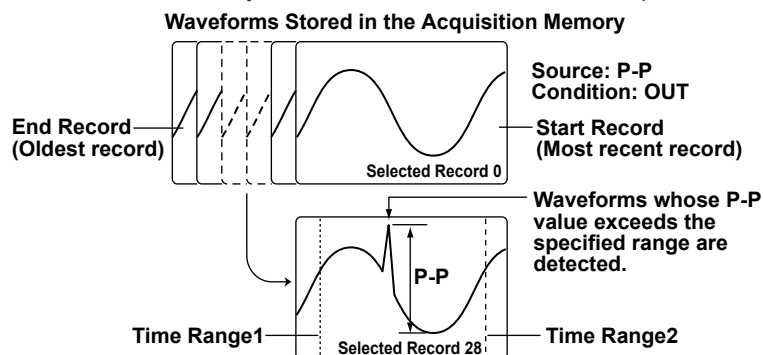
Zone Search

You can search for history waveforms that did or did not pass through a specified search zone.



Parameter Search

You can search for history waveforms that do or do not meet specified search parameter conditions.



History Waveform Search Range

The search range is from Start Record to End Record.

Search Method

The PX8000 starts searching in order from the newest waveform.

Calculation, Cursor Measurement, Automated Measurement, Statistical Processing, and FFT

You can perform calculations, cursor measurement, automated measurement of waveform parameters, or FFT analysis on the history waveform that you specified with Selected Record. You can also calculate statistics of automatically measured values on all history waveforms.

Displaying and Analyzing XY Waveforms

You can display XY waveforms and perform analysis on the history waveform you specified with Selected Record. If the display mode is set to All, XY waveforms of all history waveforms are displayed.

Display Mode (Display Mode)

Selects how history waveforms are displayed.

- One waveform (1 Record): Only the waveform that corresponds to the selected record number is displayed.
- All waveforms (All Record): Waveforms other than the highlighted waveform are displayed with normal intensity. All history waveforms between the specified start number (Start Record) and the end number (End Record) are displayed overlapped.
- Averaged waveform (Average Record): Linear averaging is performed on all history waveforms from the specified start (Start Record) to stop (End Record) number, and the results are displayed as a single waveform.



- An averaged waveform cannot be displayed for the following history waveforms.
 - Waveforms with record lengths of 250 kpoint or greater on the standard model, 1 Mpoint or greater on models with the /M1 option, or 2.5 Mpoint or greater on models with the /M2 option.
- The waveforms of AUX channels whose input signal type is set to Pulse are not averaged. For such waveforms, history waveforms at the start number (Start Record) are displayed.

Highlighting (Selected Record)

The latest history waveform is assigned the record number zero, and older waveforms are assigned numbers in descending order (-1, -2, -3, and so on).

The waveform and timestamp that correspond to the record number you specify here are highlighted.

Selectable range: 0 to -(the number of waveform acquisitions - 1)

Maximum Number of Waveform Acquisitions

(Maximum number of history waveforms that can be stored in the acquisition memory)

The number of history waveforms that can be stored varies depending on the selected record length and the installed memory options as follows:

Record Length	Number of Waveforms		
	No options (10 Mpoint)	/M1 Option (50 Mpoint)	/M2 Option (100 Mpoint)
100 kpoint	100	400	1000
250 kpoint	40	200	400
500 kpoint	20	100	200
1 Mpoint	10	40	100
2.5 Mpoint	4	20	40
5 Mpoint	1	10	20
10 Mpoint	1	4	10
25 Mpoint	-*	1	3
50 Mpoint	-*	1	1
100 Mpoint	-*	-*	1

* -: This record length cannot be set.

Display Range (Start and End Record)

Using record numbers, set the range of history waveforms to display when the display mode is set to All or Average.

Selectable range: 0 to -(the number of waveform acquisitions -1)

List of History Waveforms (List)

The history waveform record numbers and the timestamps when the waveforms were acquired are listed.

History Waveform Search Mode (Search Mode)

When waveform acquisition is stopped, you can search for history waveforms that meet the specified conditions.

- OFF: Searching is not performed. All history waveforms are displayed.
- Zone: The PX8000 searches for history waveforms that did or did not pass through a specified search zone.
- Parameter: The PX8000 searches for history waveforms that do or do not meet specified search parameter conditions.

Search Condition Settings for Zone Searching (Search Setup)

Search Zone (Select Zone)

You can register four search zones to Zone1 to Zone4. For each search zone, set the channels to search, the search condition, and the search range.

Search Condition (Condition)

- IN: The PX8000 searches for waveforms that pass through the specified search window.
- OUT: The PX8000 searches for waveforms that do not pass through the specified search window.
- OFF: The PX8000 does not search for waveforms.

Source Waveforms (Source)

Set the search source waveform to one of the waveforms below. You can select the channel of an installed module.

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8

The waveforms of channels that have not been specified as search source channels are also displayed.

Search Window Upper and Lower Limits (Upper and Lower)

You can set the limits within ± 5 div. You can set them in 0.01 div steps.

You cannot set the upper limit to a value that is less than the lower limit.

Left and Right Sides of the Search Window (Left and Right)

You can set the left and right sides within the range of ± 5 div. The resolution is 10 div/display record length.

You cannot set the left side to a value that is greater than the right side.

Search Logic (Logic)

- AND: The PX8000 searches for waveforms that meet all the search conditions specified for Zone1 to Zone4.
- OR: The PX8000 searches for waveforms that meet at least one of the search conditions specified for Zone1 to Zone4.

Search Condition Settings for Waveform Parameter Searching (Search Setup)

Search Parameter (Select Param)

You can register four search conditions to Param1 to Param4. For each search condition, you can change the channels to search, the search condition, and the search range.

Search Condition (Condition)

- IN: The PX8000 searches for waveforms in which the specified parameter is within the specified range.
- OUT: The PX8000 searches for waveforms in which the specified parameter is outside the specified range.
- OFF: The PX8000 does not search for waveforms.

Source Waveforms and Parameters (Source)

The PX8000 searches through the specified parameter of the specified trace (Trace). You can specify one type of automatically measured waveform parameter.

Search Condition Upper and Lower Limits (Upper and Lower)

Specify the range used to determine the condition of the specified parameter.

Search Logic (Logic)

- AND: The PX8000 searches for waveforms that meet all the search conditions specified for Param1 to Param4.
- OR: The PX8000 searches for waveforms that meet at least one of the search conditions specified for Param1 to Param4.

Parameter Measurement Time Period (Time Range1/Time Range2)

You can set the measurement time period for the specified parameter by setting Time Range1 and Time Range2. The default settings are -5 div and +5 div. The number of data points in the measured waveform can be up to 100 Mpoint from the start of the measurement time period.

Selectable range: -5 div to +5 div

The Time Range1 and Time Range2 settings are similar to the cursor position settings in cursor measurement.

For details, see "Selectable Range of Cursor Positions" under "Cursor Measurement."

▶ [See here.](#)


Search Execution (Execute Search)

Searches for waveforms that meet the specified search conditions and displays only the waveforms and timestamps that are detected.

Notes about Using the History Feature

- You can start waveform acquisition when the HISTORY menu is displayed. However, you cannot change the history feature settings while waveform acquisition is in progress.
- When the acquisition mode is set to Average, you cannot use the history feature.
- If you stop waveform acquisition, even if one complete screen's worth of waveform data has not been acquired, the waveform at which the trigger occurred is displayed as a single history waveform.
- If you stop waveform acquisition and then start it again without changing the waveform acquisition conditions, the waveform data continues to be stored in the acquisition memory.
- If you change the waveform acquisition conditions and start waveform acquisition, the past data stored in the acquisition memory is cleared.
- An averaged waveform cannot be displayed for the following waveforms.
Waveforms with record lengths of 250 kpoint or greater on the standard model, 1 Mpoint or greater on models with the /M1 option, or 2.5 Mpoint or greater on models with the /M2 option.
- The settings are restricted so that the following relationship is retained: Last record (End Record) \leq Selected Record \leq first record (Start Record).
- When you load waveform data from the specified storage medium, history waveforms up to that point are cleared. The loaded waveform data is placed in record number zero. If you load a file containing multiple history waveforms, the latest waveform is placed in zero, and earlier waveforms are placed in order to record numbers -1, -2, and so on.
- Computation and automated measurement of waveform parameters are performed on the waveform of the record number specified by Selected Record. You can analyze old data as long as you do not overwrite the acquisition memory contents by restarting waveform acquisition. If Display Mode is set to Average Record, analysis is performed on the averaged waveform.
- The times that are listed are the times at the time references. When the waveform display is in update mode, the time references are the trigger times. Furthermore, these times vary as indicated below depending on the trigger mode.

Trigger Mode	Condition	Time Displayed in the List
Auto/Auto Level	Roll mode	Stop time
Single	Roll mode, no trigger	Stop time
On Start	–	Start time

- When all the waveforms or averaged waveform are displayed, if a large number of records are selected, it may take time for them to be displayed completely. When the display is not complete,  appears in the center of the screen. If you want to stop the operation, set Display Mode to 1 Record.
- History waveforms are cleared when you turn the power off.

23 Printing and Saving Screen Captures

PRINT MENU

You can print screen captures from a built-in printer (option), save images to files, and so on.

Destination Type (Print To)

Select the screen capture output destination.

- **Built-in printer (BuiltIn):** You can select this option when the optional built-in printer is installed.
- **File (File):** You can save screen captures to files in PNG, BMP, and JPEG formats.

Printing from the Built-In Printer (BuiltIn; option)

Models that have the optional built-in printer installed can print from it. Images printed from the built-in printer are printed just as they are displayed on the PX8000.

Comment (Comment)

You can enter a comment of up to 26 characters in length. The comment that you create is displayed in the bottom of the screen.

Changing this comment also changes the file comments.

Saving Screen Captures (File)

You can save screen captures to files in PNG, BMP, and JPEG formats.

Data Format (Format)

You can select the format to save to from the options listed below.

- **PNG:** The extension is .PNG. The file size is approximately 50 KB for black and white mode and approximately 100 KB for color mode.
- **BMP:** The extension is .BMP. The file size is approximately 150 KB for black and white mode and approximately 2 MB for color mode.
- **JPEG:** The extension is .JPG. The file size is approximately 250 KB for color mode.



The file sizes listed here are for reference. Actual file sizes will vary depending on the image that is saved.

Color (Color)

You can select the color format to save to from the options below.

- **ON:** Saves data using 65536 colors.
- **ON (Gray):** Saves data using 16 grayscale levels.
- **ON (Reverse):** Saves data using 65536 colors. The screen background is not produced in color.
- **OFF:** Saves data in black and white.

Background Transparent or Opaque (Background)

For PNG format, you can save the waveform display area with a transparent background. This feature is convenient when you want to compare waveforms by overlaying screen captures on the PC.

- **Normal (Normal):** Saves data without changing the background (not made transparent).
- **Transparent (Transparent):** Saves data by making the background transparent.

Frame On or Off (Frame)

For JPEG format, you can add a white frame to the image to prevent the surrounding area from dropping out when the capture is printed.

- ON: The capture is saved with a frame.
- OFF: The capture is saved without a frame.

File Name Setting (File Setup)

You can set file names, comments, and so on. This is the same as the file feature.

However, the file name and comment are not the same as those when the following types of data are saved.

- Waveform data
- Numeric data
- Setup data
- Snapshot waveform data
- The results of the automated measurement of waveform parameters
- FFT analysis results

Changing the comment also changes the built-in printer comments.

▶ [See here.](#)



In addition to using the PRINT key, you can set save conditions and execute a save operation in the following manner.

• Save Conditions (SAVE MENU)

Press SHIFT and then SAVE to display the SAVE menu. On this menu, you can configure the waveform-data, numeric-data, and screen-capture-data save operations. On the menu for configuring the save operation (the SAVE menu), you cannot turn off all of the waveform-data, numeric-data, and screen-capture-data save operations.

• Saving (SAVE)

Press SAVE (without SHIFT) to save items whose save operation is set to ON.

Printing or Saving a Screen Capture (PRINT)

The screen capture is printed from the built-in printer or saved to the specified file.

24 Saving and Loading Data

FILE

You can save the following kinds of data to an SD memory card, USB storage device, or network drive.

Waveform data, numeric data, setup data, screen capture data, snapshot waveform data, automated measurement data, FFT analysis results of waveform parameters

You can load the following types of data from a storage medium into the PX8000.

Waveform data, setup data, snapshot waveform data

You can also rename and copy files and set or clear protection on files.

Storage Media You Can Save and Load From

The PX8000 can access the following three types of storage media for saving and loading data.

SD Memory Card (SD-1)

The SD memory card inserted into the SD memory card slot of the PX8000.

USB Storage Medium (USB-0 or USB-1)

A USB storage device that is connected to the PX8000 USB port. USB2.0 mass storage devices compatible with USB Mass Storage Class Ver. 1.1 can be connected to the PX8000.

Network Drive (Network)

A storage device on the network. You can use a network storage device by connecting the PX8000 to an Ethernet network.



Notes about Using the USB Memory

- Connect USB storage media directly, not through a USB hub.
 - Only connect a compatible USB keyboard, mouse, or storage device to the USB connector for peripherals.
 - Do not connect and disconnect multiple USB devices repetitively. Provide a 10-second interval between removal and connection.
 - Do not connect or remove USB cables from the time when the PX8000 is turned on until key operation becomes available (approximately 20 to 30 seconds).
 - You can use USB storage media that are compatible with USB Mass Storage Class Ver. 1.1.
 - The PX8000 can handle up to four storage media. If the connected medium is partitioned, the PX8000 treats each partition as a separate storage medium. As such, the PX8000 can handle up to four partitions.
-

Saving Data (Save)

The PX8000 saves data to the specified storage medium.



In addition to using the FILE key, you can set save conditions and execute a save operation in the following manner.

- **Save Conditions (SAVE MENU)**

Press SHIFT and then SAVE to display the SAVE menu. On this menu, you can configure the waveform-data, numeric-data, and screen-capture-data save operations. On the menu for configuring the save operation (the SAVE menu), you cannot turn off all of the waveform-data, numeric-data, and screen-capture-data save operations.

- **Saving (SAVE)**

Press SAVE (without SHIFT) to save items whose save operation is set to ON.

Saving Waveform Data (Waveform)

You can save the waveform data that the PX8000 has measured to a file in binary, ASCII, floating-point, or WDF binary format.

Save Destination (File List)

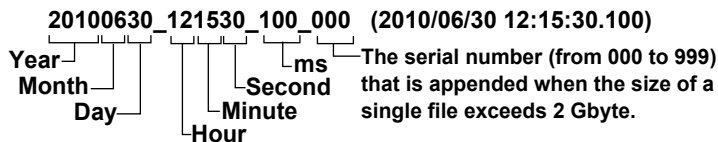
Specify the file to save to.

File Name (File Name)

Set the file name.

- You can use the auto naming feature to automatically assign file names.
- Whether Auto Naming is set to Numbering, Date, or OFF, when the size of a single file exceeds 2 Gbyte, an underscore and a three-digit serial number (000 to 999) are appended to the file names.

File Name Example for When Auto Naming Is Set to Date



- The underscore and three-digit serial number are not appended to the file name when the file size is 2 Gbyte or less.
- **Auto Naming (Auto Naming)**
 - **Numbering (Numbering)**
The PX8000 automatically adds a four-digit number from 0000 to 9999 after the common name specified using the File Name setting (up to four characters) and saves files.
 - **Date (Date)**
The file name is the date and time (down to ms) when the file is saved. The file name specified using the File Name setting is not used.
 - **OFF**
Disables the auto naming feature. The name that you specify using the File Name setting is used. If there is a file with the same name in the save destination folder, you cannot save the data.
 - **Save Destination during Action Execution**
In the specified drive, a folder is automatically created with the date (year, month, and day) as its name, and data is saved to that folder using file names specified by the auto naming feature. If the number of files in the save destination folder exceeds 1000, a new folder is automatically created with the date and an incremented sequence number (000 to 999) as its name, and the data continues to be saved in the new folder.

- **File Name (File Name)**

You can set the common file name that is used when the auto naming feature is turned off or when the auto naming feature is set to Numbering. The maximum number of characters that you can use for file names and folder names is 32 characters. The following restrictions apply.

- The following types of characters can be used: 0 to 9, A to Z, _, -, =, (,), {, }, [,], #, \$, %, &, ~, !, `, and @. @ cannot be entered consecutively.
- The following character strings cannot be used due to MS-DOS limitations.
AUX, CON, PRN, NUL, CLOCK, LPT1, LPT2, LPT3, LPT4, LPT5, LPT6, LPT7, LPT8, LPT9, COM1, COM2, COM3, COM4, COM5, COM6, COM7, COM8, or COM9
- Make sure that the full file path (absolute path from the root directory) is less than or equal to 260 characters in length. If it exceeds 260 characters, an error occurs when you perform a file operation (such as save, copy, rename, or create folder). When an operation is being performed on a folder, the full path is up to the name of the folder. When an operation is being performed on a file, the full path is up to the name of the file.

The following additional restrictions apply when you use the file name auto naming feature.

- If you set auto naming to Numbering, file names will be eight characters long. A file name will consist of the four characters that you entered for the file name and a four-character sequence number.
- If you set auto naming to Date (date and time), the characters that you entered for the file name will not be used. File names will consist of only the date information.

- **Comment (Comment)**

You can add a comment that consists of up to 120 characters when saving files. You do not have to enter a comment. All characters, including spaces, can be used in a comment.

Data Type (Data Type)

Set the data type to binary, ASCII, floating-point, or WDF binary.

- **Binary (Binary)**

- The sampled data stored to the acquisition memory is saved to a file in binary format. The extension is .WPF. A thumbnail file is also saved at the same time. The thumbnail file can be viewed in the File Property screen.
- You can load the saved binary format data into the PX8000, display the waveform of the data, and view the values that it contains.

- **ASCII (ASCII)**

- The sampled data stored in the acquisition memory is converted using the specified range and saved to a file in ASCII format. The extension is .CSV. You can use the file to analyze waveforms on your PC. When you save data for MATLAB (numeric analysis software), the extension will be .TXT.
- You cannot load the file into the PX8000.
- If you configure the record length and the number of channels so that the size of a file would exceed 2 Gbyte, the file cannot be created.

- **Floating Point (Float)**

- The sampled data stored in the acquisition memory is converted using the specified range and saved to a file in 32-bit IEEE floating format. The extension is .FLD. You can use the file to analyze waveforms on your PC. The data notation is little-endian (Intel format).
- You cannot load the file into the PX8000.
- If you configure the record length and the number of channels so that the size of a file would exceed 2 Gbyte, the file cannot be created.

- **WDF Binary (WDF Binary)**

- The sampled data stored to the acquisition memory is saved to a file in binary format. The extension is .WDF. This file is used to analyze waveforms using NI DIAdem. Thumbnails are also saved when the sampled data is saved. You can view the thumbnails on the File Property (File Property) screen.
- You cannot load the file into the PX8000.
- If you configure the record length and the number of channels so that the size of a file would exceed 2 Gbyte, the file cannot be created.

Data Size

The data sizes indicated below are for when the record length is 100 kpoint and you save the measured data of U1, I1, and P1 with all computed waveforms turned off and one history waveform.

Data Type	Extension	Size (In bytes)
Binary	.WPF	Approx. 900 K: (100 kpoint) × 3 channels × the number of history waveforms × 2
ASCII	.CSV	Approx. 4 M
Float	.FLD	Approx. 1.6 M: (100 kpoint) × 3 channels × the number of history waveforms × 4
WDF Binary	.WDF	Approx. 900 k

Save Range (Range)

When you save data in ASCII or floating point format, you can select the waveform save range (area) from one of the choices below.

- Main window (Main): Saves the data displayed in the main window
- Zoom 1 or Zoom 2 (Zoom1 or Zoom2): Saves the data displayed in the specified zoom window
- Cursor range (Cursor Range): Saves the data in the area between the cursors

Save Conditions (Waveform Save Setup)

- **Waveform to Save (Select Save Trace)**

- You can select All ON, U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, and Math1 to Math8*. The waveforms you select that are displayed are saved. You can select the channel of an installed module. Even if you select All ON, only the waveforms that are displayed are saved.
 - * You can select Math1 to Math8 to save data in ASCII or floating-point format.
 - If the computation mode on the MATH menu is set to OFF, Math1 to Math8 cannot be selected.
 - Any math channel (Math1 to Math8) on the MATH menu whose equation definition is set to OFF cannot be selected.
 - Any computation channels (Math1 to Math8) whose display is set to OFF on the MATH menu will not be displayed. Therefore, they will not be saved.
 - If the data type is set to binary, source waveforms for waveform computation on the MATH menu are saved even if they are not displayed. Therefore, even though Math1 to Math8 are cannot be specified to be saved when the data type is set to binary, when binary data is loaded, Math1 to Math8 may appear depending on the setup data of the MATH menu.
 - If the data type is set to ASCII or floating point and you select to save all history waveforms, math waveforms will not be saved. If you want to save math waveforms, set History to One.
- The vertical-axis, horizontal-axis, and trigger settings are also saved along with the waveforms.

- **Saving History Waveforms (History)**

You can set the source waveform to one of the waveforms below.

- One waveform (One): Only the waveform with the record number specified in the history menu is saved. To save an averaged history waveform, set the display mode in the history menu to Average Record, and set History to One.
- All waveforms (All): All history waveforms between the start and end numbers specified in the history menu are saved.

If you search for history waveforms, and then select All, only the detected waveforms will be saved. All waveforms (All) cannot be used when data is saved to WDF binary format.

- **Data Removal Interval (Interval)**

When you save data in ASCII format, you can thin out the data before you convert it to ASCII format. Set the data removal interval.

OFF (no data is removed), 5 points (Per 5), 10 points (Per 10), 20 points (Per 20), 50 points (Per 50), 100 points (Per 100), 200 points (Per 200), 500 points (Per 500), 1000 points (Per 1000), 2000 points (Per 2000), 5000 points (Per 5000)

For example, if you select Per 5, the data will be removed as indicated below.

First data point, +5, +10, +15...

- **Time Information (Time Info.)**

When you save data in ASCII format, you can choose whether to save time information.

- ON: Time information is saved.
- OFF: Time information is not saved.

- **Extension (Extension)**

When you save data in ASCII format, you can set the extension of the files that you save to .csv or .MATLAB (.txt).

- **Decimal Point (Decimal Point)**

When you save data in ASCII format, you can choose how to separate the data.

- Point (Point): The decimal point is a period, and the separator is a comma.
- Comma (Comma): The decimal point is a comma, and the separator is a semicolon.



- If you change the extension of the saved data file, by using a PC or some other device, the PX8000 will no longer be able to load it.
- Up to 1000 files and folders can be displayed in the file list. If there are more than a total of 1000 files and folders in a given folder, the file list for that folder will display only 1000 files and folders. There is no way to set which files and folders are displayed.
- Math waveforms are not saved if they are shorter than 10 div or if the computation start point is not -5 div.
- If deskewing the transfer time difference between inputs is configured, deskewed data is saved.

Data Format for Saving Multiple Records

The PX8000 saves data that contains multiple records, such as history waveforms, in the following data format.

ASCII format: CR+LF is inserted between records.

<Header>

U1 data 1-1, P1 data 1-1, I1 data 1-1, ..., [CR+LF]

U1 data 1-2, P1 data 1-2, I1 data 1-2, ..., [CR+LF]

⋮

U1 data 1-m, P1 data 1-m, I1 data 1-m, ..., [CR+LF]

[CR+LF]

U1 data 2-1, P1 data 2-1, I1 data 2-1, ..., [CR+LF]

U1 data 2-2, P1 data 2-2, I1 data 2-2, ..., [CR+LF]

⋮

U1 data 2-n, P1 data 2-n, I1 data 2-n, ..., [CR+LF]

[CR+LF]

⋮

One history
record

Float format: Data is saved separately by channel.

Measured data for U1 on record 1
Measured data for U1 on record 2
⋮
Measured data for U1 on record N
Measured data for P1 on record 1
Measured data for P1 on record 2
⋮
Measured data for P1 on record N
Measured data for I1 on record 1
Measured data for I1 on record 2
⋮
Measured data for I1 on record N
⋮

Saving Numeric Data (Numeric)

You can save the numeric data that the PX8000 has measured to a file in ASCII format.

Save Destination (File List), Auto Naming (Auto Naming), File Name (File Name), Comment (Comment)

These settings are the same as those for saving waveform data.

However, when saving numeric data, "N" is automatically appended to the name of the numeric data file.

► [See here.](#)

Items That Are Saved (Target)

- **Displayed Numeric Items (Displayed)**

The saved items vary as indicated below depending on the display.

- When Numeric Values Are Displayed in the 4-, 8-, or 16-Value Display or the Matrix Display
All the measurement functions on the page that is displayed when saving starts are saved in the order that they are displayed.
- When Numeric Values Are Displayed in the Single or Dual Harmonics List
In addition to the data described above, the data of harmonics that are not displayed on the screen is saved up to the maximum measurable order (Max Order).
- When Numeric Values Are Displayed in the All Items Display
The measurement functions belonging to the highlighted page number on the right side of the screen are saved.
 - When the entire screen is numeric display
The top half of the screen shows the measurement functions of the first page. The bottom half of the screen shows the measurement functions of the second and subsequent pages. Therefore, if page number 1 is highlighted, the measurement function in the top half of the screen are saved. Therefore, if page number 2 or higher is highlighted, the measurement function in the bottom half of the screen are saved.
 - When a split display that includes the numeric display is shown
All measurement functions of pages shown when the save operation is executed are saved.
- When Numeric Values Are Displayed in the Custom Display
All measurement functions of pages shown when the save operation is executed are saved.
- In Non-Numeric Displays (Waveform display, X-Y waveform display, etc.)
The PX8000 saves data according to the numeric display settings. For example, when waveforms are displayed, if switching the display to numeric display would cause a 16-value display to appear, the measurement functions of the pages that would appear on the 16-value display are saved.

- **Selected Items (Selected)**

You can select the types of numeric data to save.

Selecting Items (Select Items)

If you selected Selected, select which numeric data to save.

- **Element (Element)**
To select an element or wiring unit that you want to save the data of, select or clear its check box. You can select from the following options.
Element1, Element2, Element3, Element4, ΣA , and ΣB
 - **Function (Function)**
Select whether to store the data of a function by selecting or clearing its check box.
 - **Selecting All Functions (All ON)**
The data of all measurement functions is saved.
 - **Deselecting All Functions (All OFF)**
None of the data for any of the measurement functions is saved.
 - **Preset (Preset)**
The data of the following measurement functions is saved for all elements and wiring units.*
Urms, Irms, FreqU, FreqI, P, S, Q, λ , and Φ
- * If the wiring system setting (Wiring) is configured so that a wiring unit does not exist, the data for the functions of that wiring unit is not saved. For example, if ΣB does not exist, the data for ΣB is not saved.

Separator and Decimal Point When Data Is Saved in ASCII Format (.csv; Decimal Point for CSV File)

This settings is the same as that for saving waveform data.

► [See here.](#)



If deskewing the transfer time difference between inputs is configured, deskewed data is saved.

Saving Setup Data (Setup)

You can save the PX8000 setup information to the specified storage medium. The extension is .SET.

However, the date, time, and communication setup parameters are not saved.

Save Destination (File List), Auto Naming (Auto Naming), File Name (File Name), Comment (Comment)

These settings are the same as those for saving waveform data.

► [See here.](#)

Saving to Internal Memory

You can save setup data to internal memory from the storing and recalling setup data menu.

► [See here.](#)

Saving Other Types of Data (Others)

You can save the screen capture, snapshot waveforms, results of the automated measurement of waveform parameters, FFT analysis results.

Save Destination (File List), Auto Naming (Auto Naming), File Name (File Name), Comment (Comment)

These settings are the same as those for saving waveform data.

► [See here.](#)

Data Type (Data Type)

- [Screen capture \(Screen Image\)](#): You can save the displayed screen image to a file in PNG, BMP, or JPEG format. You can also save the screen image from the menu that appears when you press the PRINT MENU key.
- [Snapshot waveforms \(Snap\)](#): You can save the waveform data captured in a snapshot. The extension is .SNP.
- [Measure \(Measure\)](#): You can save the results of the automated measurement of waveform parameters to a file in CSV format.
- [FFT \(FFT\)](#): You can save FFT analysis results to a file in CSV format.

Screen capture (Screen Image)

You can save the displayed screen image to a file.

Data Format (Format), Color (Color), Background Transparent or Opaque (Background), Frame On or Off (Frame)

These settings are the same as those for saving screen captures.

► [See here.](#)

Automated Measurement Values of Waveform Parameters (Measure)

Save the results of automatic waveform parameter measurement to a file in CSV format. The extension is .CSV. CSV files are text files that contain data separated by commas. They are used to convert data between spreadsheet and database applications.

The maximum number of previous values that you can save is equal to $100000 \div \text{number of items that are turned on}$.

Data size in bytes = Number of measured items \times 15 \times number of history waveforms

Save Conditions (Measure Save Setup)

•Unit (Unit)

You can select whether to save the units of measure along with the measured results.

- ON: Units are saved.
- OFF: Units are not saved.

•Time information (Time Info.), Decimal Point (Decimal Point)

These settings are the same as those for saving waveform data.

► [See here.](#)

FFT Analysis Results (FFT)

You can save the analysis results of FFT1 or FFT2 to a file in CSV format. The extension is .CSV.

Save Conditions (FFT Save Setup)

•Frequency Information (Frequency Info.)

You can select whether to save frequency information along with computed results.

- ON: Frequency information is saved.
- OFF: Frequency information is not saved.

•Decimal Point (Decimal Point)

This setting is the same as that for saving waveform data.

► [See here.](#)

Saving (Execute Save)

Saves the data to the specified save destination with the specified file name.

You cannot save the following types of data while waveform acquisition is in progress. Press START/STOP to stop the waveform acquisition.

- Waveform data
- Numeric data
- Setup data
- The results of the automated measurement of waveform parameters
- FFT analysis results

Loading Data (Load)

You can load waveform data, setup data, and snapshot waveforms that have been saved by the PX8000. Numeric data cannot be loaded.

Loading Waveform Data (Waveform)

Waveform data in binary format (files with .WPF extensions) can be loaded.

You can load a specified waveform data file with the setup data. You can load the entirety of the specified waveform data file. Waveforms of computed data appear when computation is turned on. Because setup data is also loaded, the PX8000 settings change when you load waveform data. If you start waveform acquisition by pressing the START/STOP key, the loaded data is cleared.



- If the modules that are currently installed in the PX8000 are different from the modules that were installed when the waveform data was saved, you cannot load the waveform data.
- You cannot load waveform data saved by a module with a larger amount of memory on a module with a smaller amount of memory.
- You can load only waveform data that you saved with the save range set to the main window.

Loading Setup Data (Setup)

The setup data of the specified file is loaded. The extension is .SET.

* The following settings are not loaded.

Date and time, Time synchronization feature (option), Storage media format, USB keyboard language, USB communication feature, Menu font size, Menu background color, Click sound on/off, Key lock, Network

Recalling Data from the Internal Memory

You can recall setup data from the internal memory from the storing and recalling setup data menu.

▶ [See here.](#)



The PX8000 cannot load setup parameters that were saved by an instrument with a different module configuration, different options, etc.

Loading Other Types of Data (Others)

The snapshot waveforms of the specified file or the contents of a symbol definition file are loaded.

Snapshot Waveforms (Snap)

The extension is .SNP. The snapshot waveforms that you load are displayed in white on the screen.

Loading (Execute Load)

Loads the data of the specified file.

File Operations (FILE UTILITY)

You can perform file operations such as creating folders on the storage medium, deleting and copying files, and changing file names.

Sorting the List (Sort To)

You can sort the file list by file name, data size, date, etc.

Display Format

Select whether to display a list of files or to display thumbnails.

Selecting the Type of File to List (File Filter)

You can limit the type of files that appear in the list by selecting an extension.

Changing the Storage Medium (Change Drive)

You can select the storage medium that you want to access. The PX8000 displays various storage media as follows:

- SD-1: The SD memory card inserted into the SD memory card slot of the PX8000
- USB-0: The USB storage device that is connected to a PX8000's USB port (type A) for connecting peripheral devices (the first connected device)
- USB-1: The USB storage device that is connected to a PX8000's USB port (type A) for connecting peripheral devices (the second connected device).
- Network: A storage device on the network

Deleting Files and Folders (Delete)

You can delete the selected files and folders.

Renaming Files and Folders (Rename)

You can rename a selected file or folder.

Making Folders (Make Dir)

Make a folder.

You can use the same characters in folder names that you can in file names.

▶ [See here.](#)

Copying and Moving Files (Copy and Move)

You can copy or move the selected files and folders to other storage media or folders. You can copy or move multiple files at the same time.

File Property (File Property)

You can view information about the selected file, such as its name (File Name), file size (File Size), the date and time when it was saved (Date/Time), and its attributes (Attribute).

Turning File Protection On and Off (Protect ON and OFF)

You can turn protection on and off for the selected file. The change is reflected in the file attributes, displayed under the Attr column in the file list.

Protection	File Attribute	Description
ON	r	File protection is on for the selected file. The file can only be read. The file cannot be written to or deleted.
OFF	r/w	File protection is off for the selected file. The file can be read and written to.

Selecting Files (ALL SET, ALL RESET, and SET/RESET)

Selects or deselects all the files in the list.

You can also select or deselect only the highlighted files.



-
- To format the storage medium, press the UTILITY key to display the System Config menu, and then select Storage Manager.
▶ [See here.](#)
 - You can abort the file copy and delete operations, except for the file that is being processed at the time.
-

25 Ethernet Communication (Network)

You can configure TCP/IP parameters and use the optional Ethernet interface to perform the following tasks.

TCP/IP

TCP/IP settings for connecting to an Ethernet network.

Set the IP address, subnet mask, and default gateway.

▶ [See here.](#)

FTP Server (FTP Server)

You can connect the PX8000 as an FTP server to a network.

You can connect to the PX8000 from a PC on the same network and retrieve waveform data.

You can connect to the PX8000 from a PC on the same network and retrieve setup data, numeric data, waveform data, and screen image data.

▶ [See here.](#)

Network Drive (Net Drive)

You can save the PX8000's setup data, numeric data, waveform data, and screen image data to a network drive.

You can also load the setup data from a network drive into the PX8000.

▶ [See here.](#)

SNTP

The PX8000 clock can be set using SNTP. The PX8000 can be configured to automatically adjust its clock when it is turned on.

▶ [See here.](#)



To connect a PC to the PX8000, use a hub or router, and connect to a network. Do not connect a PC directly to the PX8000.

TCP/IP (TCP/IP)

Configure the settings that the PX8000 needs to connect to a network.

DHCP

DHCP is a protocol that temporarily allocates settings that a PC needs to connect to the Internet.

To connect to a network that has a DHCP server, turn the DHCP setting on. When DHCP is turned on, the IP address can be automatically obtained when the PX8000 is connected to a network. (You do not have to set it manually.)

When DHCP is turned off, you must set the appropriate IP address, subnet mask, and default gateway for the network.

DNS

DNS is a system used to associate Internet host names and domain names with IP addresses. Given AAA.BBBBBB.com, AAA is the host name and BBBBBB.com is the domain name. You can use host names and domain names to access the network instead of using IP addresses, which are just numbers. The PX8000 allows you to specify the host by name, instead of by IP address. Set the domain name and the DNS server address (0.0.0.0 by default). For details, consult your network administrator.

DNS Servers (DNS Server1/DNS Server2)

You can specify up to two DNS server addresses: primary and secondary. If querying fails with the primary DNS server, the secondary DNS server is automatically used to find the mapping of the host name and domain name to the IP address.

Domain Suffixes (Domain Suffix1/Domain Suffix2)

The domain suffix is a piece of information that is automatically added when a query is made to a DNS server using only a portion of the domain name. For example, if BBBBBB.co.jp is registered as a domain suffix and a query is made using "AAA," the name "AAA.BBBBBB.co.jp" is searched.

You can specify up to two domain suffixes: Domain Suffix1 and Domain Suffix 2.

You can use up to 127 characters. The characters that you can use are 0 to 9, A–Z, a–z, and dashes.

TCP/IP settings are applied when you press Bind and then SET or when you turn on the PX8000 the next time.

FTP Server (FTP Server)

You can connect the PX8000 as an FTP server to a network.

Set the user name and password that will be used by devices on the network to access the PX8000. Also, set the access timeout value.

User Name (User Name)

Set the user name that will be used to access the PX8000 from a PC. If you set the user name to “anonymous,” you can connect to the PX8000 without entering a password.

- Number of characters: Up to 15
- Usable characters: All ASCII characters that are displayed on the keyboard

Password (Password)

Set the password that will be used to access the PX8000 from a PC.

- Number of characters: Up to 15
- Usable characters: All ASCII characters that are displayed on the keyboard

Timeout (Time Out)

If an FTP connection cannot be established between the PX8000 and the PC within the amount of time specified here, the PX8000 aborts the connection process.

You can set the timeout time to a value between 30 and 3600 seconds.



To apply the settings that you specified, press Entry.

FTP Server Overview

When the PX8000 is connected to the network as an FTP server, the following features become available.

FTP Server

From a PC, you can view a list of files that are stored in the PX8000 storage medium (the internal memory or a storage medium that is connected to it) and retrieve files.

PC System Requirements

PC

A PC running Microsoft Windows 7 Professional or Mac OS X.

OS

Microsoft Windows 7 Professional or Mac OS X (10.9)

Internal memory

512 MB or more recommended.

Communication ports

100BASE-TX or 1000BASE-T Ethernet port. Use this port to connect the PC to the network.

Display

A display compatible with any of the above operating systems and with a resolution of 1024×768 or higher.

Mouse or pointing device

Mouse or pointing device compatible with any of the above operating systems

Web browser

Internet Explorer 8.0, Firefox 25.0, Safari (for Windows, 5.1.7), Safari (for Snow Leopard, 5.1.10)

Network Drive (Net Drive)

You can save the PX8000's setup data, numeric data, waveform display data, and screen image data to a network drive. You can also load the setup data from a network drive into the PX8000.

FTP Server (FTP Server)

Specify the IP address of an FTP server on the network. You can save numeric data, waveform display data, and screen image data to the server and load setup data from it. In a network with a DNS server, you can specify the host name and domain name instead of the IP address.

Login Name (Login Name)

Specify the login name.

- Number of characters: Up to 15
- Usable characters: All ASCII characters that are displayed on the keyboard

Password (Password)

Specify the password that corresponds to the login name.

- Number of characters: Up to 15
- Usable characters: All ASCII characters that are displayed on the keyboard

Passive Mode (Passive)

Turn passive FTP on or off.

In passive mode, the FTP client sets the port number for data transfer. Enable passive mode when you have set an external FTP server as a network drive or when you are accessing an FTP server through a firewall.

Timeout (Time Out)

If the PX8000 cannot transfer files for a certain amount of time, it disconnects from the FTP server.

You can set the timeout time to a value between 1 and 3600 seconds.

Connecting to the Network Drive(Connect/Disconnect)

When you press Connect, the PX8000 connects to the specified network drive. When you press Disconnect, the network drive is disconnected.

SNTP (SNTP)

The PX8000 clock can be set using Simple Network Time Protocol (SNTP). The PX8000 can be configured to automatically adjust its clock when it is turned on.

SNTP Server (SNTP Server)

Specify the IP address of the SNTP server that the PX8000 will use. In a network with a DNS server, you can specify the host name and domain name instead of the IP address.

Timeout (Timeout)

If the PX8000 cannot connect to the SNTP server for a certain amount of time, it aborts the operation. You can set the timeout time to a value between 1 and 60 seconds.

Executing Time Adjustment (Adjust)

The PX8000 clock is synchronized to the SNTP server clock.

Automatic Adjustment (Adjust at Power On)

You can configure the PX8000 so that its clock is automatically synchronized to the SNTP server clock when the PX8000 is turned on when it is connected to the network.



-
- If the time difference from GMT (Greenwich Mean Time) is set in the date/time setting, the PX8000 will make appropriate adjustments to the time information received from the SNTP server.
▶ [See here.](#)
 - If you do not want the PX8000 to synchronize with an SNTP server, do not set the SNTP server IP address.
-

26 Other Features

Calibration (Zero-level compensation, CAL)

Executing Calibration (Execute Calibration)

The following items are calibrated on all input modules. Execute calibration when you want to make accurate measurements.

- Vertical-axis ground level

Calibration is performed automatically when the power switch is turned on.

Notes about Calibration

- Allow the PX8000 to warm up for at least 30 minutes before you execute calibration. If you execute calibration immediately after power-on, the calibrated values may drift due to temperature changes or other environmental changes.
- Execute calibration in a stable temperature environment ranging from 5 to 40°C* (23 ± 5°C recommended).
 - * 35°C when the PX8000 is installed facing up.
- If the measurement range and input filter remain the same for a long period of time, the zero level may change due to the changes in the environment surrounding the PX8000. If this happens, we recommend that you execute calibration.

Auto Calibration

- **Voltage Modules (760811) and Current Modules (760812/760813)**

Calibration is performed automatically at the following two instances.

- Immediately after a measurement is started before triggers start operating
- Immediately after the completion of a measurement if measurement is performed continuously Calibration values take effect in the subsequent measurement.

Calibration That Is Performed When a Measurement Is Completed on an Input Element (Cal at End for Elements)

Select whether to execute calibration when a measurement is completed for voltage and current modules.

- OFF: Auto calibration is not executed.
- ON: Auto calibration is executed.

- **AUX Modules (760851)**

Calibration That Is Performed When AUX Modules Start (Cal on Start for Auxiliaries)

Select whether to execute calibration when signal acquisition is first started when the following time periods elapse after the power is turned on.

- Approx. 3 minutes
 - Approx. 10 minutes
 - Approx. 30 minutes and every 30 minutes thereafter
-
- OFF: Auto calibration is not executed.
 - ON: Auto calibration is executed.

NULL Feature (NULL SET)

You can use the NULL feature to subtract the DC offset while a measurement cable or external sensor is connected.

Turning NULL Value Subtraction On and Off (Affect NULL)

Select whether to subtract the NULL value from measured data of input signals for each module when the NULL feature is turned on. You can set this separately for each channel of installed modules.

You can use the Affect NULL box to collectively select whether to subtract the NULL value from measured data of input signals for all modules.

Updating the NULL Value (Update Value)

Select whether to update the NULL value of input signals for each module when the NULL feature is turned on.

You can set this separately for each channel of installed modules.

You can use the Update Value box to collectively select whether to update the NULL value of input signals for all modules.

NULL Values

The following displayed measured values that are measured when the NULL feature is turned on are used as NULL values.

- Udc1 to Udc4, Idc1 to Idc4 (the voltage and current simple averages)
- AUX3 to AUX8

Enabling and Disabling the NULL Feature (NULL)

Press NULL to enable or disables the NULL feature.

- When the NULL feature is enabled, the NULL values are set to the Udc, Idc, and AUX data values that are displayed. The NULL values are applied in the next set of measurement data. In the element information on the right side of the screen, NULL (NULL indicator) illuminates for channels whose Affect NULL check boxes are selected.
- If you press NULL while the NULL feature is enabled, the NULL indicators turn off, and the NULL feature is disabled.



- To make accurate measurements, we recommend that you execute calibration before enabling the NULL feature.
 - The NULL feature is not enabled if there are no displayed Udc, Idc, and AUX data values (data is NAN, OL, ERROR, etc.). For example, this would occur if you turn on the NULL feature immediately after turning the power on when no measurements have taken place.
-

Disabling the NULL Feature

The NULL feature is disabled in the following situations.

- The NULL feature on all channels is disabled when the power is turned on.
- The NULL feature on all channels is disabled when the settings are initialized.
- The NULL feature on all channels is disabled when a setup data file is loaded.
- If you change a current input from direct input to external current sensor input or cause it to change such as when the wiring system is changed, the NULL feature on the relevant current input channel is disabled. The stored NULL value is also cleared.
- If you change the input signal type (Sense Type) of an AUX module, the NULL feature on the relevant input channel is disabled. The stored NULL value is also cleared.

Influence of Measurement Range Change

If the NULL feature is ON, the NULL value is retained even when the measurement range is changed. However, if the NULL value falls outside $\pm 14\%$ of the new range, it is set to $\pm 14\%$ of the new range. This also holds true when the range is changed by the auto range feature.

Measurement Functions Affected by the NULL Feature

All measurement functions are affected by the NULL values.



-
- NULL values are subtracted from the acquisition data of voltage, current, and AUX inputs.
 - NULL values cannot be applied to waveforms that have already been acquired.
 - If the following settings that existed when the currently displayed data was acquired are different from the current settings, an error will occur when you turn NULL on.
 - Direct input or external current sensor input of a current input
 - Input signal type (Sense Type) of AUX modules

For example, an error will occur if you turn NULL on and acquire data, change the above settings, and then turn NULL on again.
 - The NULL feature is not disabled even if you load a saved waveform data file.
-

Snapshot (SNAPSHOT)

Retains the currently displayed waveforms on the screen. This feature allows you to update the display without having to stop waveform acquisition. It is a useful feature when you want to compare waveforms.

Snapshot waveforms are displayed in white.

You cannot perform the following operations on snapshot waveforms.

Cursor measurement, automated measurement of waveform parameters, zoom, or computation

You can save and load snapshot waveforms.

Clear Trace (CLEAR TRACE)

Clears all the waveforms that are displayed on the screen.

If you change the display format or perform other similar operations, the PX8000 redisplay the channel waveforms, computed waveforms, and loaded waveforms that were displayed before you executed the clear trace operation.

Snapshot and clear trace features are disabled:

- When the PX8000 is in remote mode.
- When the PX8000 is printing, when it is executing auto setup, or when it is accessing a storage medium.
- When go/no-go determination is in progress, when action is in progress, or when searching is in progress.

Utility (UTILITY)

You can specify the following settings.

System Configuration (System Config)

You can set the date and time, time synchronization, the menu and message languages, the LCD intensity, whether the backlight is on or off, the and USB keyboard language, and you can format storage media or initialize settings.

▶ [See here.](#)

Remote Control (Remote Ctrl)

You can select the method for connecting a PC to the PX8000 to control it.

▶ [See here.](#)

Ethernet Communication (Network)

You can configure TCP/IP, FTP server, network drive, and SNTP settings.

▶ [See here.](#)

Environment Settings (Preference)

You can set the action performed at power on, terminal setup, display setup, key and knob setup, frequency display when the frequency measurement is less than lower limit, and AUX display when the pulse frequency measurement is less than the lower limit.

▶ [See here.](#)

Self-Test (Self Test)

You can test the keyboard and memory operations.

▶ [See here.](#)

Storing and Recalling Setup Data (Setup Data Store and Recall)

You can save up to 16 sets of setup data to specific internal memory areas.

▶ [See here.](#)

Overview (Overview)

You can view the PX8000 system information.

▶ [See here.](#)

System Configuration (System Config)

You can specify the following settings.

- PX8000 date and time
- Language
- LCD adjustment
- Formatting Storage Media
- USB Keyboard Language

Date and Time Settings (Date/Time)

The PX8000 date and time.

Turning the Display On and Off (Display)

Set whether to display the date and time on the PX8000 screen.

Display Format (Format)

You can display the date in one of the following formats.

2013/06/30 (year/numeric month/day)

30/06/2013 (day/numeric month/year)

30-JUN-13 (day-English abbreviation of the month-last two digits of the year)

30 JUN 2013 (day month (English abbreviation) year)

Date and Time Settings (Date/Time)

Sets the date and time.

Time Difference from Greenwich Mean Time (Time Diff. GMT)

Set the time difference between the region where you are using the PX8000 and Greenwich Mean Time.

Selectable range: Set the time difference in the range of -12 hours 00 minutes to 13 hours 00 minutes.

For example, Japan standard time is ahead of GMT by 9 hours. In this case, set Time Hour to 9 and Minute to 00.

Checking the Standard Time

Using one of the methods below, check the standard time of the region where you are using the PX8000.

- Check the Date, Time, Language, Regional Options on your PC.
- Check the standard time at the URL on the right. <http://www.worldtimeserver.com/>



- The PX8000 does not support Daylight Savings Time. To set the Daylight Savings Time, reset the time difference from Greenwich Mean Time.
 - Date and time settings are backed up using the internal lithium battery. They are retained even if the power is turned off.
 - The PX8000 has leap-year information.
-

Time Synchronization Feature (Time Synchro; optional)

You can use this feature to use an IRIG (Inter Range Instrumentation Group) signal to synchronize the time on the PX8000 with the GPS (Global Positioning System). This feature has three conditions: Unlock, Lock, and Stable. When an IRIG signal is properly received, the PX8000 enters into the Lock condition and acquires time information.

Turning the Time Synchronization Feature On and Off (Time Synchro)

You can select whether to use an IRIG (Inter Range Instrumentation Group) signal for time synchronization (IRIG) or not (OFF).

IRIG Code Format (IRIG Format)

You can set the IRIG code format to A or B.

IRIG Code Modulation Type (Modulation)

You can set the IRIG code modulation type to AM or Pulse-width Code (PWCode).

Input Impedance (Impedance)

You can set the input impedance to 50 Ω or 5 k Ω .



The time synchronization feature has three conditions: Unlock, Lock, and Stable. When an IRIG signal is properly received, the PX8000 enters into the Lock condition. Time acquisition and synchronization are possible after 1 s. A few minutes after the PX8000 enters the Lock condition, it enters into the Stable condition. In the Stable condition, the internal clock of the PX8000 is synchronized to within 10 ppm of the GPS.

Language (Language)

Sets the language that is used in the setup menu and messages.



-
- Even if you set the menu or message language to a language other than English, some terms will be displayed in English.
 - You can specify different menu and message languages.
-

Adjusting the LCD (LCD)

You can turn off the LCD and adjust its brightness.

Turning Off the LCD (LCD Turn OFF)

You can turn off the LCD. When the LCD is off, you can turn it back on by pressing a key.

Automatically Turning Off the LCD (Auto OFF)

The LCD turns off automatically when there are no key operations for a given time period. The LCD turns back on when you press a key.

Auto Off Time (Auto OFF Time)

You can set the time after which the LCD turns off automatically to a value within the following range.

1 min to 60 min

Adjusting the Brightness (Brightness)

You can adjust the brightness in the range of 1 (darkest) to 9 (brightest). You can prolong the LCD service life by decreasing the LCD brightness or by turning off the LCD when you do not need to view it.

Formatting Storage Media (Storage Manager)

You can format storage media.



If you format a storage medium, all saved data is erased.

USB Keyboard Language (USB Keyboard)

Sets the USB keyboard language to English or Japanese. The USB keyboard can be used to enter file names, comments, etc.

All Setup (All Setup)

Initializing Settings (Initialize)

You can reset the PX8000 settings to their factory default values. This feature is useful when you want to cancel all the settings that you have entered or when you want to redo measurement from scratch. Default reset refers to the act of resetting the PX8000 settings to their factory default values.

Items That Cannot Be Reset

The following settings cannot be reset.

Date and time settings, communication settings, the language setting (Japanese or English), and environment settings

Undoing Default Reset (Undo)

If you perform default reset by mistake, you can undo it by pressing the Undo soft key.

To Reset All Settings to Their Default Values

While holding down the RESET key, turn the power switch on. All settings except the date and time settings (display on/off setting will be reset) and the setup data stored in internal memory will be reset to their factory default values. If you reset the settings using this method, the changes cannot be undone.

Remote Control (Remote Ctrl)

Communication interface for controlling the PX8000 from a PC. GP-IB, USB, and Network are the available communication interfaces.

For details, see the communication interface user's manual, IM PX8000-17EN.



- Only use one communication interface: GP-IB, USB, or Network. If you send commands simultaneously from more than one communication interface, the PX8000 will not execute the commands properly.
 - The REMOTE indicator at the bottom center of the PX8000 screen illuminates when the PX8000 is communicating with a PC in remote mode. All keys except SHIFT + CLEAR TRACE are disabled in Remote mode.
-

USB

Connects the PX8000 to a PC using USB.

To remotely control the PX8000 using communication commands through the USB port, select USBTMC and then carry out the following procedure.

- Install YOKOGAWA USB TMC (Test and Measurement Class) driver on your PC. For information about how to obtain the YOKOGAWA USB TMC driver, contact your nearest YOKOGAWA dealer. You can also access the YOKOGAWA USB driver download website and download the driver (<http://www.yokogawa.com/ymi/>).
- Do not use USB TMC drivers (or software) supplied by other companies.

GP-IB

Connects the PX8000 to a PC using GP-IB.

Address (Address)

- You can set the address to a value from 0 to 30.
- Each device that is connected by GP-IB has its own unique address in the GP-IB system. This address is used to distinguish one device from other devices. Therefore, you must assign a unique address to the PX8000 when connecting it to a PC or other device.



- Several cables can be used to connect multiple devices. However, no more than 15 devices, including the controller, can be connected on a single bus.
 - When connecting multiple devices, you must assign a unique address to each device.
 - When the controller is communicating with the PX8000 or with other devices through GP-IB, do not change the address.
 - Use cables that are 2 m or shorter in length to connect devices.
 - Keep the total length of the cables under 20 m.
 - When devices are communicating, have at least two-thirds of the devices on the bus turned on.
 - To connect multiple devices, use a star or daisy-chain configuration. Loop and parallel configurations are not allowed.
-

Network

Connects the PX8000 to a PC using Ethernet.

IP Address (IP Address)

Displays the TCP/IP setting that you specified in the Ethernet communication settings.

▶ [See here.](#)

Timeout (Time Out)

If a connection cannot be established between the PX8000 and the PC within the amount of time specified here, the PX8000 aborts the connection process.

You can set the timeout time to infinity or a value between 1 and 3600 seconds.



-
- You must set TCP/IP parameters to connect the PX8000 to an Ethernet network.

▶ [See here.](#)

- To connect the PX8000 to a PC, be sure to use straight cables through a hub. Correct operation is not guaranteed for a one-to-one connection using a cross cable.
 - Use one of the following types of network cable that conforms to the transfer speed of your network.
 - A UTP (Unshielded Twisted-Pair) cable
 - An STP (Shielded Twisted-Pair) cable
-

Clearing Remote Mode (LOCAL)

To clear remote mode, press SHIFT key and CLEAR TRACE key.

Environment Settings (Preference)

Action Performed at Power On (Power On Action)

Setting Whether to Start Waveform Acquisition (Start)

Select whether to start waveform acquisition at power on (ON) or not (OFF).

Setting Whether to Turn the Action Function On or Off (Action)

Select whether to enable the action function at power on (ON) or not (OFF).

- ON: When the power is turned on, the action mode setting is the same as it was when the power was turned off.
- OFF: When the power is turned on, the action mode is off.

Terminal Setup (Terminal Setup)

Enabling or Disabling the Remote High Edge (STOP) Signal (Remote Stop)

Select whether to enable (ON) the high edge (STOP) in the external start/stop remote signal or disable (OFF).

Trigger Output Signal (Trigger Out)

You can set the type of signal that is generated from the trigger output terminal to Normal or Pulse.

Trigger Output Signal Pulse Width (Pulse Width)

When you set the trigger output signal type to Pulse, you can set the pulse width to 1 ms, 50 ms, 100 ms, or 500 ms.

Configuring the Display (Display Setup)

Menu Font Size (Menu Font Size)

You can set the font size of the menu to Small or Large.

Menu Background Color (Base Color)

You can set the background color of the menu to Blue or Gray.

Scale Value Display Font Size (Scale Font Size)

You can set the font size of the scale value display to small or large.

Items Whose Scale Values Are Displayed (Scale On Item)

Set the items that you want to display when Scale Value is set to ON.

- ALL: The scale value of the vertical axis and horizontal axis are displayed.
- Time Scale: The scale value of the horizontal axis is displayed.

Turning the Numeric Display Frame On and Off (Numeric Frame)

Set whether to show the numeric display frame.

Display Digits (Numeric Resolution)

You can choose to display five digits or six digits of the numeric data.

Intensity (Intensity)

You can set the intensities of the grid (Grid), cursor (Cursor), and marker (Marker) to values within the range of 1 to 8.

Key and Knob Setup (Key/Knob Setup)

Turning On or Off the Click Sound (Click Sound)

You can turn on or off the click sound that is generated when you operate the jog shuttle.

START/STOP Key Response Time (START/STOP Response Time)

You can set the response time of the START/STOP key to instant (Quick) or 1 s or more (> 1sec).

Key Lock (Key Protect)

You can lock the operation keys to prevent unintentional changes to the current state of the PX8000.

- Type (Type)
Select whether to lock all the keys (ALL) or to lock all keys except the START/STOP key (Except START/STOP).
- Release Method (Release Type)
Select whether to release the key lock by pressing the KEY PROTECT key (Key) or by entering a password (Password).
- Password (Password)
Specify the password to use to release the key lock. Specify the password using up to eight alphanumeric characters. If you forget the password, you can release the key lock by turning the PX8000 on while holding down the RESET key. Note that all settings will be initialized when you do this.

▶ [See here.](#)

Frequency Display When the Frequency Measurement Is Less Than Lower Limit (Freq Display at Frequency Low)

When the frequency of the input signal is lower than the frequency that the PX8000 can measure, you can choose to display the frequency as "0" or "Error."

AUX Display When the Pulse Frequency Measurement Is Less Than the Lower Limit (Aux Display at Pulse Freq Low)

When the pulse frequency of the AUX input signal is lower than the frequency that the PX8000 can measure, you can choose to display the values of AUX functions as "0" or "Error."

Analysis Setup (Analysis Setup)

Cursor Read Mode (Cursor Read Mode)

You can select whether to perform cursor measurements on P-P compressed display data or the data that has been acquired in the acquisition memory.

- Display data (Display)
Cursor measurements are performed on the display data.
- Acquisition (ACQ)
Cursor measurements are performed on sampled data in acquisition memory.

▶ [See here.](#)

Self-Test (Self Test)

You can test the keyboard and memory operations.

Test Type (Self Test)

You can perform the following tests.

Key Test (Key Board)

Tests whether the front-panel keys are operating properly. If the name of the key that you press is highlighted, the key is operating properly.

Memory Test (Memory)

You can test the internal memory to determine whether it is functioning normally. If it is functioning normally, "Pass" appears. If an error occurs, "Error" appears.

SD Memory Card Test (SD Card)

You can test an SD memory card to determine whether it is functioning normally. If an error occurs, "Error" appears.

Printer Test (Printer)

Tests whether the optional built-in printer is operating properly. If the print density is correct, the built-in printer is operating properly. If an error occurs, the built-in printer does not print properly.

Keyboard Test (Soft Key)

This test appears when you set Test Item to Key Board. You can test whether the keyboard displayed on the screen is functioning properly. If the characters that you type appear correctly in the keyboard's input box, the keyboard is functioning properly.

Executing a Test (Test Exec)

The selected self-test starts.

If an Error Occurs during a Self-Test

If an error occurs even after you carry out the following procedure, contact your nearest YOKOGAWA dealer.

- Execute the self-test again several times.
- Check whether the media being tested is properly inserted.
- Check that the paper is set properly in the built-in printer and that paper is not jammed.

Storing and Recalling Setup Data (Setup Data Store and Recall)

You can save up to 16 sets of setup data to specific internal memory areas. It is convenient to save setup data that you use frequently. You can save a set of setup data to one of the following numbers.

1 to 16

By specifying these numbers, you can store and recall setup data easily.

You can attach comments in the same way that you can when you save waveform data.

▶ [See here.](#)

Overview (Overview)

You can display the following information about the PX8000. The instrument numbers of the PX8000 and each module are also displayed. However, the instrument numbers of the AUX module (760851) is not displayed.

- Model
- Record Length
- Serial No: Instrument number
- Product ID: Unique number assigned to each instrument. This number is necessary for the purchase of additional options.
- Slot: Names of the inserted modules, instrument number, instrument number of the pairing module, calibration time
- Installed options
- Default Language
- Firm Version: Firmware version number
- FPGA1/2 Version: FPGA1/2 version number

Key Lock (KEY PROTECT)

You can lock the operation keys to prevent unintentional changes to the current state of the PX8000. When the keys are locked, pressing any keys other than KEY PROTECT has no effect, and the USB mouse and keyboard cannot be used.

► [See here.](#)

NUM LOCK

Press this key to use the ELEM1 to ELEM4, U1 to U4, I1 to I4, and P1 to P4 keys to enter numbers. After you press NUM LOCK, you can press a key to enter the number, sign, unit prefix, or exponent displayed to the upper right of the key in white, or to confirm an entry or selection (ENTER).

Appendix

Appendix 1 Symbols and Determination of Measurement Functions

Measurement Functions Used in Normal Measurement

(Table 1/2)

Measurement Function		Methods of Computation and Determination For information about the symbols in the equations, see the notes on the next page.				
Voltage U [V]	True rms value: Urms Rectified mean value calibrated to the rms value: Umn Simple average: Udc Rectified mean value: Urmn AC component: Uac	Urms	Umn	Udc	Urmn	Uac
		$\sqrt{\text{AVG}[u(n)^2]}$	$\frac{\pi}{2\sqrt{2}} \text{AVG}[u(n)]$	AVG[u(n)]	AVG[u(n)]	$\sqrt{\text{RMS}^2 - \text{DC}^2}$
Current I [A]	True rms value: Irms Rectified mean value calibrated to the rms value: Imn Simple average: Idc Rectified mean value: Irmn AC component: Iac	Irms	Imn	Idc	Irmn	Iac
		$\sqrt{\text{AVG}[i(n)^2]}$	$\frac{\pi}{2\sqrt{2}} \text{AVG}[i(n)]$	AVG[i(n)]	AVG[i(n)]	$\sqrt{\text{RMS}^2 - \text{DC}^2}$
Active power P [W]		AVG[u(n) · i(n)]				
Apparent power S [VA]	TYPE1, TYPE2	Select from Urms · Irms, Umn · Imn, Udc · Idc, Umn · Irms, and Urmn · Irmn.				
	TYPE3	$\sqrt{P^2 + Q^2}$				
Reactive power Q [var]	TYPE1, TYPE2	$s \cdot \sqrt{S^2 - P^2}$ s is -1 for a lead phase and 1 for a lag phase				
	TYPE3	$\sum_{k=\min}^{\max} Q(k)$ Q(k) = Ur(k) · Ij(k) –Uj(k) · Ir(k) Ur(k) and Ir(k) are the real number components of U(k) and I(k) Uj(k) and Ij(k) are the imaginary components of U(k) and I(k) Valid only when harmonics are being measured correctly.				
Power factor λ		$\frac{P}{S}$				
Phase difference Φ [°]		$\cos^{-1}\left(\frac{P}{S}\right)$ The phase angle can be switched between lead (D)/lag (G) display and 360° display.				
Voltage frequency: fU (FreqU) [Hz] Current frequency: fI (FreqI) [Hz]		The voltage frequency (fU) and current frequency (fI) are measured by detecting the zero-crossing points. You can simultaneously measure frequencies of all the installed elements.				
Maximum voltage: U + pk [V]		The maximum u(n) for every data update				
Minimum voltage: U – pk [V]		The minimum u(n) for every data update				
Maximum current: I + pk [A]		The maximum i(n) for every data update				
Minimum current: I - pk [A]		The minimum i(n) for every data update				
Maximum power: P + pk [W]		The maximum u(n) · i(n) for every data update				
Minimum power: P – pk [W]		The minimum u(n) · i(n) for every data update				
Voltage crest factor: CfU Current crest factor: CfI		Voltage crest factor CfU = $\frac{Upk}{Urms}$ Upk = U + pk or U – pk whichever is larger			Current crest factor CfI = $\frac{Ipk}{Irms}$ Ipk = I + pk or I – pk whichever is larger	
Corrected Power Pc [W]		IEC76-1(1976), IEEE C57.12.90-1993			IEC76-1(1993)	
		$\frac{P}{P1 + P2 \left(\frac{Urms}{Umn}\right)^2}$ P1, P2: coefficients defined in the applicable standards			$P \left(1 + \frac{Umn - Urms}{Umn}\right)$	

(Continued on next page)

(Table 2/2)

Measurement Function		Methods of Computation and Determination For information about the symbols in the equations, see the notes.				
Σ functions	Wiring system	Single-phase, three-wire 1P3W	Three-phase, three-wire 3P3W	Three-phase, three-wire with three-voltage, three-current method. 3P3W(3V3A)	Three-phase, four-wire 3P4W	
	UΣ [V]	(U1 + U2) / 2		(U1 + U2 + U3) / 3		
	IΣ [A]	(I1 + I2) / 2		(I1 + I2 + I3) / 3		
	PΣ [W]	P1 + P2			P1 + P2 + P3	
	SΣ [VA]	TYPE1, TYPE2	S1 + S2	$\frac{\sqrt{3}}{2} (S1 + S2)$	$\frac{\sqrt{3}}{3} (S1 + S2 + S3)$	S1 + S2 + S3
		TYPE3	$\sqrt{P\Sigma^2 + Q\Sigma^2}$			
	QΣ [var]	TYPE1	Q1 + Q2			Q1 + Q2 + Q3
		TYPE2	$\sqrt{S\Sigma^2 - P\Sigma^2}$			
		TYPE3	Q1 + Q2			Q1 + Q2 + Q3
	PcΣ [W]	Pc1 + Pc2			Pc1 + Pc2 + Pc3	
	λΣ	$\frac{P\Sigma}{S\Sigma}$				
	ΦΣ [°]	$\cos^{-1}\left(\frac{P\Sigma}{S\Sigma}\right)$				

- u(n) denotes the instantaneous voltage.
- i(n) denotes the instantaneous current.
- n denotes the nth measurement period. The measurement period is determined by the synchronization source setting.
- AVG[] denotes the simple average of the item in brackets determined over the data measurement interval. The data measurement interval is determined by the synchronization source setting.
- PΣ denotes the active power of wiring unit Σ. Elements are assigned to wiring unit Σ differently depending on the number of elements that are installed in the PX8000 and the selected wiring system pattern.
- The numbers 1, 2, and 3 used in the equations for UrmsΣ, UmnΣ, UrmnΣ, UdcΣ, UacΣ, IrmsΣ, ImnΣ, IrmnΣ, IdcΣ, IacΣ, PΣ, SΣ, QΣ, and PcΣ indicate the case when elements 1, 2, and 3 are set to the wiring system shown in the table.
- Equation Type 3 for SΣ and QΣ can only be selected on models with the harmonic measurement option.
- On the PX8000, S, Q, λ, and Φ are derived through the computation of the measured values of voltage, current, and active power (however, when Type 3 is selected, Q is calculated directly from the sampled data). Therefore, for distorted signal input, the value obtained on the PX8000 may differ from that obtained on other instruments that use a different method.
- For Q [var], when the current leads the voltage, the Q value is displayed as a negative value; when the current lags the voltage, the Q value is displayed as a positive value. The value of QΣ may be negative, because it is calculated from the Q of each element with the signs included.

Measurement Functions Used in Harmonic Measurement (Option)

(Table 1/4)

Measurement Function	Methods of Computation and Determination			Total Value (Total) (No parentheses)
	Numbers and Characters in the Parentheses			
	dc (when k = 0)	1 (when k = 1)	k (when k = 1 to max)	
Voltage U() [V]	U(dc) =U _r (0)	U(k) = √ U _r (k) ² + U _j (k) ²		U = √ ∑ _{k = min} ^{max} U(k) ²
Current I() [A]	I(dc) = I _r (0)	I(k) = √ I _r (k) ² + I _j (k) ²		I = √ ∑ _{k = min} ^{max} I(k) ²
Active power P() [W]	P(dc) = U _r (0) · I _r (0)	P(k) = U _r (k) · I _r (k) + U _j (k) · I _j (k)		P = ∑ _{k = min} ^{max} P(k)
Apparent power S() [VA] (TYPE3)*	S(dc) = P(dc)	S(k) = √ P(k) ² + Q(k) ²		S = √ P ² + Q ²
Reactive power Q() [var] (TYPE3)*	Q(dc) = 0	Q(k) = U _r (k) · I _j (k) – U _j (k) · I _r (k)		Q = ∑ _{k = min} ^{max} Q(k)
Power factor λ ()	λ(dc) = $\frac{P(dc)}{S(dc)}$	λ(k) = $\frac{P(k)}{S(k)}$		λ = $\frac{P}{S}$
Phase difference Φ () [°]	—	Φ(k) = tan ⁻¹ { $\frac{Q(k)}{P(k)}$ }		Φ = tan ⁻¹ ($\frac{Q}{P}$)
Phase difference with U(1) ΦU() [°]	—	—	ΦU(k) = The phase difference between U(k) and U(1)	—
Phase difference with I(1) ΦI() [°]	—	—	ΦI(k) = The phase difference between I(k) and I(1)	—
Impedance of the load circuit Z() [Ω]	Z(dc) = $\left \frac{U(dc)}{I(dc)} \right $	Z(k) = $\left \frac{U(k)}{I(k)} \right $		—
Series resistance of the load circuit Rs() [Ω]	Rs(dc) = $\frac{P(dc)}{I(dc)^2}$	Rs(k) = $\frac{P(k)}{I(k)^2}$		—
Series reactance of the load circuit Xs() [Ω]	Xs(dc) = $\frac{Q(dc)}{I(dc)^2}$	Xs(k) = $\frac{Q(k)}{I(k)^2}$		—
Parallel resistance of the load circuit Rp() [Ω] (= 1/G)	Rp(dc) = $\frac{U(dc)^2}{P(dc)}$	Rp(k) = $\frac{U(k)^2}{P(k)}$		—
Parallel reactance of the load circuit Xp() [Ω] (= 1/B)	Xp(dc) = $\frac{U(dc)^2}{Q(dc)}$	Xp(k) = $\frac{U(k)^2}{Q(k)}$		—
Frequency of PLL source FreqPLL [Hz]	Frequency of the PLL source			

(Continued on next page)

- k denotes a harmonic order, r denotes the real part, and j denotes the imaginary part.
- U(k), U_r(k), U_j(k), I(k), I_r(k), and I_j(k) are expressed using rms values.
- The minimum harmonic order is denoted by min. min can be set to either 0 (the dc component) or 1 (the fundamental component).
- The upper limit of harmonic analysis is denoted by max. max is either an automatically determined value or the specified maximum measured harmonic order, whichever is smaller.

* For details on the type of S and Q equations, see “Apparent Power and Reactive Power Computation Types” under “Numeric Computation.”

(Table 2/4)

Measurement Function	Methods of Computation and Determination*1	
	The numbers and characters in the parentheses are dc (when k = 0) or k (when k = 1 to max).	
	When the Denominator of the Distortion Factor Equation Is the Total Value (Total)	When the Denominator of the Distortion Factor Equation Is the Fundamental Wave (Fundamental)
Harmonic voltage distortion factor Uhd _f () [%]	$\frac{U(k)}{U(\text{Total})^{*2}} \cdot 100$	$\frac{U(k)}{U(1)} \cdot 100$
Harmonic current distortion factor Ihd _f () [%]	$\frac{I(k)}{I(\text{Total})^{*2}} \cdot 100$	$\frac{I(k)}{I(1)} \cdot 100$
Harmonic active power distortion factor Phd _f () [%]	$\frac{P(k)}{P(\text{Total})^{*2}} \cdot 100$	$\frac{P(k)}{P(1)} \cdot 100$
Total harmonic voltage distortion Uthd [%]	$\frac{\sqrt{\sum_{k=2}^{\max} U(k)^2}}{U(\text{Total})^{*2}} \cdot 100$	$\frac{\sqrt{\sum_{k=2}^{\max} U(k)^2}}{U(1)} \cdot 100$
Total harmonic current distortion Ithd [%]	$\frac{\sqrt{\sum_{k=2}^{\max} I(k)^2}}{I(\text{Total})^{*2}} \cdot 100$	$\frac{\sqrt{\sum_{k=2}^{\max} I(k)^2}}{I(1)} \cdot 100$
Total harmonic active power distortion Pthd [%]	$\frac{\left \sum_{k=2}^{\max} P(k) \right }{P(\text{Total})^{*2}} \cdot 100$	$\frac{\left \sum_{k=2}^{\max} P(k) \right }{P(1)} \cdot 100$
Voltage telephone harmonic factor Uthf [%] Current telephone harmonic factor Ithf [%]	$U_{thf} = \frac{1}{U(\text{Total})^{*2}} \sqrt{\sum_{k=1}^{\max} \{\lambda(k) \cdot U(k)\}^2} \cdot 100 \quad I_{thf} = \frac{1}{I(\text{Total})^{*2}} \sqrt{\sum_{k=1}^{\max} \{\lambda(k) \cdot I(k)\}^2} \cdot 100$ <p style="text-align: center;">$\lambda(k)$: coefficient defined in the applicable standard (IEC34-1 (1996))</p>	
Voltage telephone influence factor Utif Current telephone influence factor Itif	$U_{tif} = \frac{1}{U(\text{Total})^{*2}} \sqrt{\sum_{k=1}^{\max} \{T(k) \cdot U(k)\}^2} \quad I_{tif} = \frac{1}{I(\text{Total})^{*2}} \sqrt{\sum_{k=1}^{\max} \{T(k) \cdot I(k)\}^2}$ <p style="text-align: center;">$T(k)$: coefficient defined in the applicable standard (IEEE Std 100 (1992))</p>	
Harmonic voltage factor hvf [%] ^{*1} Harmonic current factor hcf [%] ^{*1}	$hvf = \frac{1}{U(\text{Total})^{*2}} \sqrt{\sum_{k=2}^{\max} \frac{U(k)^2}{k}} \cdot 100 \quad hcf = \frac{1}{I(\text{Total})^{*2}} \sqrt{\sum_{k=2}^{\max} \frac{I(k)^2}{k}} \cdot 100$	
K-factor	$K\text{-factor} = \frac{\sum_{k=1}^{\max} \{I(k)^2 \cdot k^2\}}{\sum_{k=1}^{\max} I(k)^2}$	

*1 The expression varies depending on the definitions in the standard. For more details, see the standard (IEC34-1: 1996).

$$*2 \quad U(\text{Total}) = \sqrt{\sum_{k=\min}^{\max} U(k)^2}, \quad I(\text{Total}) = \sqrt{\sum_{k=\min}^{\max} I(k)^2}, \quad P(\text{Total}) = \sum_{k=\min}^{\max} P(k)$$

- k denotes a harmonic order, r denotes the real part, and j denotes the imaginary part.
- The minimum harmonic order is denoted by min.
- The upper limit of harmonic analysis is denoted by max. max is either an automatically determined value or the specified maximum measured harmonic order, whichever is smaller.

(Table 3/4)

Measurement Function		Methods of Computation and Determination			
Σ Function	Wiring system	Single-Phase, Three-Wire (1P3W)	Three-Phase, Three-Wire (3P3W)	Three-Voltage, Three-Current Method (3V3A)	Three-Phase, Four-Wire (3P4W)
	$U\Sigma$ [V]	$(U1 + U2) / 2$		$(U1 + U2 + U3) / 3$	
	$I\Sigma$ [A]	$(I1 + I2) / 2$		$(I1 + I2 + I3) / 3$	
	$P\Sigma$ [W]	$P1 + P2$			$P1 + P2 + P3$
	$S\Sigma$ [VA] (TYPE3)*	$\sqrt{P\Sigma^2 + Q\Sigma^2}$			
	$Q\Sigma$ [var] (TYPE3)*	$Q1 + Q2$			$Q1 + Q2 + Q3$
	$\lambda\Sigma$	$\frac{P\Sigma}{S\Sigma}$			

- The numbers 1, 2, and 3 used in the equations for $U\Sigma$, $I\Sigma$, $P\Sigma$, and $Q\Sigma$, indicate the case when elements 1, 2, and 3 are set to the wiring system shown in the table.
- Only the total value and the fundamental wave (1st harmonic) are computed for Σ .

* For details on the type of S and Q equations, see “Apparent Power and Reactive Power Computation Types” under “Numeric Computation.”

(Table 4/4)

Measurement Function	Methods of Computation and Determination
$\Phi U1-U2(^{\circ})$	Phase angle between $U1(1)$ and the fundamental voltage of element 2, $U2(1)$
$\Phi U1-U3(^{\circ})$	Phase angle between $U1(1)$ and the fundamental voltage of element 3, $U3(1)$
$\Phi U1-I1(^{\circ})$	Phase angle between $U1(1)$ and the fundamental current of element 1, $I1(1)$
$\Phi U2-I2(^{\circ})$	Phase angle between $U2(1)$ and the fundamental current of element 2, $I2(1)$
$\Phi U3-I3(^{\circ})$	Phase angle between $U3(1)$ and the fundamental current of element 3, $I3(1)$
$\Phi I1-I2(^{\circ})$	Phase angle between $I1(1)$ and the fundamental current of element 2, $I2(1)$
$\Phi I2-I3(^{\circ})$	Phase angle between $I2(1)$ and the fundamental current of element 3, $I3(1)$
$\Phi I3-I1(^{\circ})$	Phase angle between $I3(1)$ and the fundamental current of element 1, $I1(1)$

The numbers 1, 2, and 3 used in the equations indicate the case when elements 1, 2, and 3 are set to the wiring system shown in the table.

Measurement Functions Used in Delta Computation

Computed results are determined by substituting all of the sampled data in the table into the equations for voltage U and current I.* The synchronization source used in delta computation is the same source as the source of the first element (the element with the smallest number) in the wiring unit that is subject to delta computation.

* The equations for voltage U and current I listed in “Symbols and Determination of Measurement Functions.”

Measurement Function	Delta Computation Type	Data Determined with the Delta Computation and Corresponding Symbols The computation mode for ΔU1 to ΔU3, ΔUΣ, and ΔI can be set to rms, mean, dc, r-mean, or ac.		Substituted Sampled Data u (t), i (t)
Voltage [V]	Difference	Computed differential voltage	ΔU1[Udiff]	u1 – u2
	3P3W→3V3A	Unmeasured line voltage computed in a three-phase, three-wire system	ΔU1[Urs]	u1 – u2
	Delta→Star	Phase voltage computed in a three-phase, three-wire (3V3A) system	ΔU1[Ur]	$u1 - \frac{(u1 + u2)}{3}$
			ΔU2[Us]	$u2 - \frac{(u1 + u2)}{3}$
			ΔU3[Ut]	$-\frac{(u1 + u2)}{3}$
			Wiring unit voltage $\Delta U\Sigma = \frac{(\Delta U1 + \Delta U2 + \Delta U3)}{3}$	ΔUΣ[UΣ]
	Star→Delta	Line voltage computed in a three-phase, four-wire system	ΔU1[Urs]	u1 – u2
			ΔU2[Ust]	u2 – u3
			ΔU3[Utr]	u3 – u1
			Wiring unit voltage $\Delta U\Sigma = \frac{(\Delta U1 + \Delta U2 + \Delta U3)}{3}$	ΔUΣ[UΣ]
Current [A]	Difference	Computed differential current	ΔI[Idiff]	i1 – i2
	3P3W→3V3A	Unmeasured phase current	ΔI[It]	–i1 – i2
	Delta→Star	Neutral line current	ΔI[In]	i1 + i2 + i3
	Star→Delta	Neutral line current	ΔI[In]	i1 + i2 + i3
Power [W]	Difference	—	—	—
	3P3W→3V3A	—	—	—
	Delta→Star	Phase power computed in a three-phase, three-wire (3V3A) system	ΔP1[Pr]	$\left\{u1 - \frac{(u1 + u2)}{3}\right\} \cdot i1$
			ΔP2[Ps]	$\left\{u2 - \frac{(u1 + u2)}{3}\right\} \cdot i2$
			ΔP3[Pt]	$\left\{-\frac{(u1 + u2)}{3}\right\} \cdot i3$
			Wiring unit power ΔPΣ = ΔP1 + ΔP2+ ΔP3	ΔPΣ[PΣ]
	Star→Delta	—	—	—

For the 3P3W→3V3A computation, it is assumed that $i1 + i2 + i3 = 0$.

For the Delta→Star computation, it is assumed that the center of the delta connection is computed as the center of the star connection.

- u1, u2, and u3 represent the sampled voltage data of elements 1, 2, and 3, respectively. i1, i2, and i3 represent the sampled current data of elements 1, 2, and 3, respectively.
- The numbers (1, 2, and 3) that are attached to delta computation measurement function symbols have no relation to the element numbers.
- For details on the rms, mean, dc, rmean, and ac equations of delta computation mode, see page App-1.
- We recommend that you set the measurement range and scaling (conversion ratios and coefficients) of the elements that are undergoing delta computation as closely as possible. Using different measurement ranges or scaling causes the measurement resolutions of the sampled data to be different. This results in errors.

Measurement Functions for Auxiliary Input

When Motor Mode Is Enabled

Measurement Function	Methods of Computation and Determination
Rotating speed AUX3 AUX5 AXU7	<p>When the input signal from the revolution sensor is DC voltage (an analog signal):</p> $A(X - \text{NULL}) + B$ <p>A: slope of the input signal X: input voltage from the revolution sensor [V] B: offset NULL: null value [V]</p> <p>When the input signal from the revolution sensor is the number of pulses:</p> $A \frac{(X - \text{NULL})}{N}$ <p>A: Coefficient for converting Hz to rps, rpm, or rph X: pulse frequency [Hz] N: number of pulses per revolution NULL: null value [Hz] (Error or 0 can be selected for when the value is less than the lower limit of pulse measurement.)</p>
Torque AUX4 AUX6 AXU8	<p>When the input signal from the torque meter is DC voltage (an analog signal):</p> $A(X - \text{NULL}) + B$ <p>A: slope of the input signal X: input voltage from the torque meter [V] B: offset NULL: null value [V]</p> <p>When the input signal from the torque meter is a pulse signal:</p> $A(X - \text{NULL}) + B$ <p>A: torque pulse coefficient X: pulse frequency [Hz] B: torque pulse offset NULL: null value [Hz]</p> <p>The PX8000 computes the torque pulse coefficient and torque pulse offset from torque values (the unit is N•m) at the upper and lower frequency limits. Normally use a scaling factor of 1. If you are using a unit other than N•m, set the unit conversion ratio.</p>
Monitor output Pm2 Pm3 Pm4	$\frac{2\pi \cdot \text{Speed} \cdot \text{Torque}}{60} \cdot \text{Scaling factor}$ <p>When the unit of torque is N•m, and the scaling factor is 1, the unit of motor output Pm is W.</p>

Appendix

When Motor Mode Is Disabled

Measurement Function	Methods of Computation and Determination
AUX3 AUX4 AUX5 AUX6 AUX7 AUX8	<p>When the input signal from the sensor is DC voltage (an analog signal):</p> <p>$A(X - \text{NULL}) + B$</p> <p>A: slope of the input signal X: value of the input voltage from the sensor [V] B: offset NULL: null value [V]</p> <p>When the input signal from the sensor is the number of pulses:</p> <p>$A(X - \text{NULL}) + B$</p> <p>A: slope of the input signal X: pulse frequency [Hz] B: offset NULL: null value [Hz] (Error or 0 can be selected for when the value is less than the lower limit of pulse measurement.)</p>

Appendix 2 Power Basics (Power, harmonics, and AC RLC circuits)

This section explains the basics of power, harmonics, and AC RLC circuits.

Power

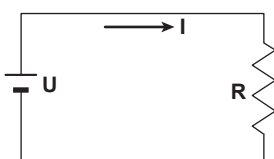
Electrical energy can be converted into other forms of energy and used. For example, it can be converted into the heat in an electric heater, the torque in a motor, or the light in a fluorescent or mercury lamp. In these kinds of examples, the work that electricity performs in a given period of time (or the electrical energy expended) is referred to as electric power. The unit of electric power is watts (W). 1 watt is equivalent to 1 joule of work performed in 1 second.

DC Power

The DC power P (in watts) is determined by multiplying the applied voltage U (in volts) by the current I (in amps).

$$P = UI \text{ [W]}$$

In the example below, the amount of electrical energy determined by the equation above is retrieved from the power supply and consumed by resistance R (in ohms) every second.

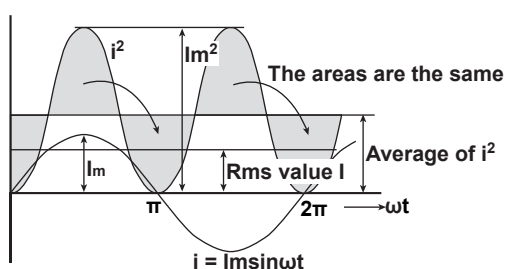


Alternating Current

Normally, the power supplied by power companies is alternating current with sinusoidal waveforms. The magnitude of alternating current can be expressed using values such as instantaneous, maximum, rms, and mean values. Normally, it is expressed using rms values.

The instantaneous value i of a sinusoidal alternating current is expressed by $I_m \sin \omega t$ (where I_m is the maximum value of the current, ω is the angular velocity defined as $\omega = 2\pi f$, and f is the frequency of the sinusoidal alternating current). The thermal action of this alternating current is proportional to i^2 , and varies as shown in the figure below.*

* Thermal action is the phenomenon in which electric energy is converted to heat energy when a current flows through a resistance.



The rms value (effective value) is the DC value that generates the same thermal action as the alternating current. With I as the DC value that produces the same thermal action as the alternating current:

$$I = \sqrt{\text{The mean of } i^2 \text{ over one period}} = \sqrt{\frac{1}{2\pi} \int_0^{2\pi} i^2 d\omega t} = \frac{I_m}{\sqrt{2}}$$

Because this value corresponds to the root mean square of the instantaneous values over 1 period, the effective value is normally denoted using the abbreviation "rms."

Appendix

To determine the mean value, the average is taken over 1 period of absolute values, because simply taking the average over 1 period of the sine wave results in a value of zero.

With I_{mn} as the mean value of the instantaneous current i (which is equal to $I_m \sin \omega t$):

$$I_{mn} = \text{The mean of } |i| \text{ over one period} = \frac{1}{2\pi} \int_0^{2\pi} |i| d\omega t = \frac{2}{\pi} I_m$$

These relationships also apply to sinusoidal voltages.

The maximum value, rms value, and mean value of a sinusoidal alternating current are related as shown below. The crest factor and form factor are used to define the tendency of an AC waveform.

$$\text{Crest factor} = \frac{\text{Maximum value}}{\text{Rms value}}$$

$$\text{Form factor} = \frac{\text{Rms value}}{\text{Mean value}}$$

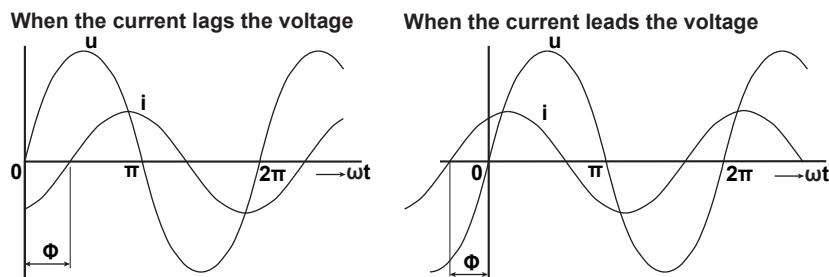
Vector Display of Alternating Current

In general, instantaneous voltage and current values are expressed using the equations listed below.

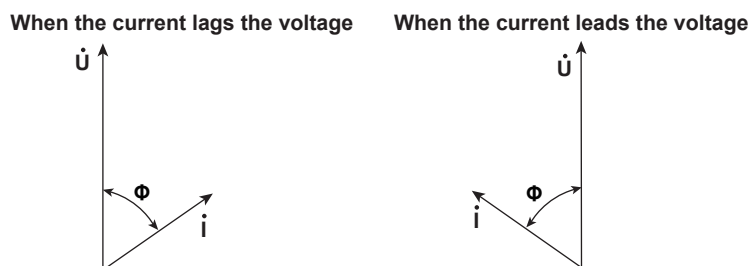
Voltage: $u = U_m \sin t$

Current: $i = I_m \sin(t - \Phi)$

The time offset between the voltage and current is called the phase difference, and Φ is the phase angle. The time offset is mainly caused by the load that the power is supplied to. In general, the phase difference is zero when the load is purely resistive. The current lags the voltage when the load is inductive (is coiled). The current leads the voltage when the load is capacitive.



A vector display is used to clearly convey the magnitude and phase relationships between the voltage and current. A positive phase angle is represented by a counterclockwise angle with respect to the vertical axis. Normally, a dot is placed above the symbol representing a quantity to explicitly indicate that it is a vector. The magnitude of a vector represents the rms value.



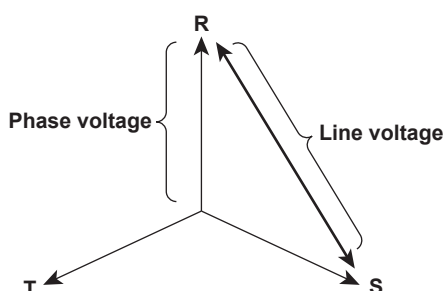
Three-Phase AC Wiring

Generally three-phase AC power lines are connected in star wiring configurations or delta wiring configurations.



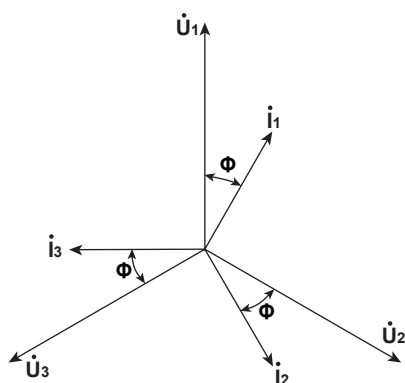
Vector Display of Three-Phase Alternating Current

In typical three-phase AC power, the voltage of each phase is offset by 120° . The figure below expresses this offset using vectors. The voltage of each phase is called the phase voltage, and the voltage between each phase is called the line voltage.



If a power supply or load is connected in a delta wiring configuration and no neutral line is present, the phase voltage cannot be measured. In this case, the line voltage is measured. Sometimes the line voltage is also measured when measuring three-phase AC power using two single-phase wattmeters (the two-wattmeter method). If the magnitude of each phase voltage is equal and each phase is offset by 120° , the magnitude of the line voltage is $\sqrt{3}$ times the magnitude of the phase voltage, and the line voltage phase is offset by 30° .

Below is a vector representation of the relationship between the phase voltages and line currents of a three-phase AC voltage when the current lags the voltage by Φ° .



AC Power

AC power cannot be determined as easily as DC power, because of the phase difference between the voltage and current caused by load.

If the instantaneous voltage $u = U_m \sin \omega t$ and the instantaneous current $i = I_m \sin(\omega t - \Phi)$, the instantaneous AC power p is as follows:

$$p = u \times i = U_m \sin \omega t \times I_m \sin(\omega t - \Phi) = UI \cos \Phi - UI \cos(2\omega t - \Phi)$$

U and I represent the rms voltage and rms current, respectively.

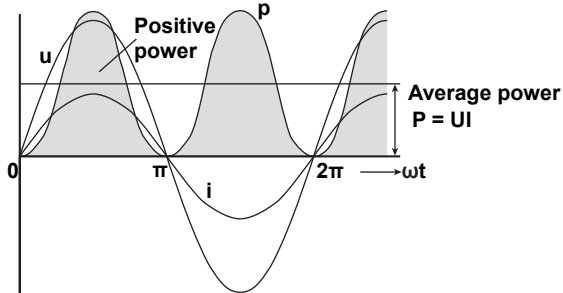
p is the sum of the time-independent term, $UI \cos \Phi$, and the AC component term of the voltage or current at twice the frequency, $-UI \cos(2\omega t - \Phi)$.

AC power refers to the mean power over 1 period. When the mean over 1 period is taken, AC power P is as follows:

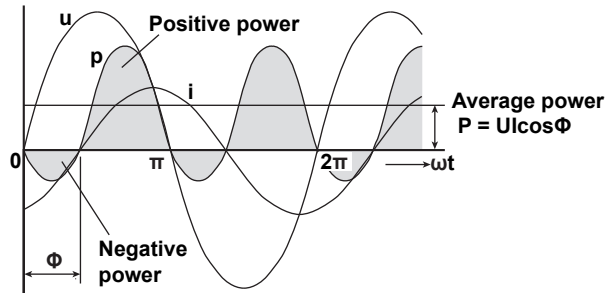
$$P = UI \cos \Phi \text{ [W]}$$

Even if the voltage and current are the same, the power varies depending on the phase difference Φ . The section above the horizontal axis in the figure below represents positive power (power supplied to the load), and the section below the horizontal axis represents negative power (power fed back from the load). The difference between the positive and negative powers is the power consumed by the load. As the phase difference between the voltage and current increases, the negative power increases. At $\Phi = \pi/2$, the positive and negative powers are equal, and the load consumes no power.

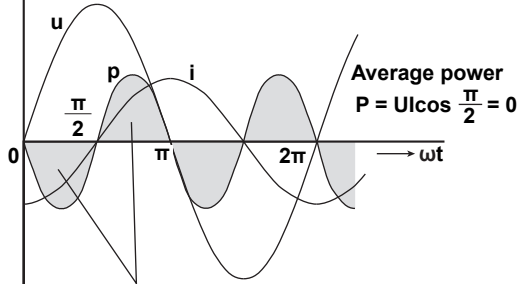
When the phase difference between voltage and current is 0



When the phase difference between voltage and current is Φ



When phase difference between voltage and current is $\frac{\pi}{2}$



The positive and negative powers are the same

Active Power and the Power Factor

In alternating electrical current, not all of the power calculated by the product of voltage and current, UI , is consumed. The product of U and I is called the apparent power. It is expressed as S . The unit of apparent power is the volt-ampere (VA). The apparent power is used to express the electrical capacity of a device that runs on AC electricity.

The true power that a device consumes is called active power (or effective power). It is expressed as P . This power corresponds to the AC power discussed in the previous section.

$$S = UI \text{ [VA]}$$

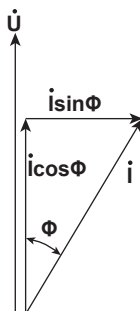
$$P = UI\cos\Phi \text{ [W]}$$

$\cos\Phi$ is called the power factor and is expressed as λ . It indicates the portion of the apparent power that becomes true power.

Reactive Power

If current I lags voltage U by Φ , current I can be broken down into a component in the same direction as voltage U , $I\cos\Phi$, and a perpendicular component, $I\sin\Phi$. Active power P , which is equal to $UI\cos\Phi$, is the product of voltage U and the current component $I\cos\Phi$. The product of voltage U and the current component $I\sin\Phi$ is called the reactive power. It is expressed as Q . The unit of reactive power is the var.

$$Q = UI\sin\Phi \text{ [var]}$$



The relationship between S , the apparent power, P , the active power, and Q , the reactive power is as follows:

$$S^2 = P^2 + Q^2$$

Harmonics

Harmonics refer to all sine waves whose frequency is an integer multiple of the fundamental wave (normally a 50 Hz or 60 Hz sinusoidal power line signal) except for the fundamental wave itself. The input currents that flow through the power rectification circuits, phase control circuits, and other circuits used in various kinds of electrical equipment generate harmonic currents and voltages in power lines. When the fundamental wave and harmonic waves are combined, waveforms become distorted, and interference sometimes occurs in equipment connected to the power line.

Terminology

The terminology related to harmonics is described below.

- **Fundamental wave (fundamental component)**
The sine wave with the longest period among the different sine waves contained in a periodic complex wave. Or the sine wave that has the fundamental frequency within the components of the complex wave.
- **Fundamental frequency**
The frequency corresponding to the longest period in a periodic complex wave. The frequency of the fundamental wave.
- **Distorted wave**
A wave that differs from the fundamental wave.
- **Higher harmonic**
A sine wave with a frequency that is an integer multiple (twice or more) of the fundamental frequency.
- **Harmonic component**
A waveform component with a frequency that is an integer multiple (twice or more) of the fundamental frequency.
- **Harmonic distortion factor**
The ratio of the rms value of the specified nth order harmonic contained in the distorted wave to the rms value of the fundamental wave (or all signals).
- **Harmonic order**
The integer ratio of the harmonic frequency with respect to the fundamental frequency.
- **Total harmonic distortion**
The ratio of the rms value of all harmonics to the rms value of the fundamental wave (or all signals).

Interference Caused by Harmonics

Some of the effects of harmonics on electrical devices and equipment are explained in the list below.

- **Synchronization capacitors and series reactors**
Harmonic current reduces circuit impedance. This causes excessive current flow, which can result in vibration, humming, overheating, or burnout.
- **Cables**
Harmonic current flow through the neutral line of a three-phase, four-wire system will cause the neutral line to overheat.
- **Voltage transformers**
Harmonics cause magnetostrictive noise in the iron core and increase iron and copper loss.
- **Breakers and fuses**
Excessive harmonic current can cause erroneous operation and blow fuses.
- **Communication lines**
The electromagnetic induction caused by harmonics creates noise voltage.
- **Controllers**
Harmonic distortion of control signals can lead to erroneous operation.
- **Audio visual equipment**
Harmonics can cause degradation of performance and service life, noise-related video flickering, and damaged parts.

AC RLC Circuits

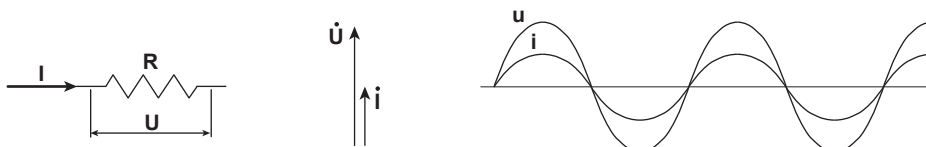
Resistance

The current i when an AC voltage whose instantaneous value $u = U_m \sin \omega t$ is applied to load resistance R [Ω] is expressed by the equation below. I_m denotes the maximum current.

$$i = \frac{U_m}{R} \sin \omega t = I_m \sin \omega t$$

Expressed using rms values, the equation is $I = U/R$.

There is no phase difference between the current flowing through a resistive circuit and the voltage.



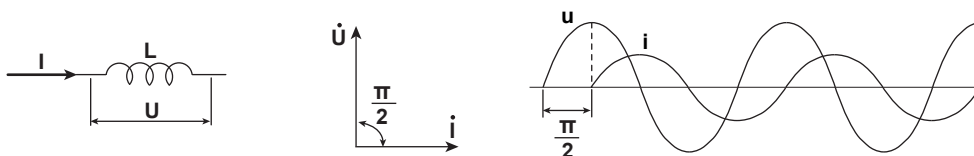
Inductance

The current i when an AC voltage whose instantaneous value $u = U_m \sin \omega t$ is applied to a coil load of inductance L [H] is expressed by the equation below.

$$i = \frac{U_m}{X_L} \sin \left(\omega t - \frac{\pi}{2} \right) = I_m \sin \left(\omega t - \frac{\pi}{2} \right)$$

Expressed using rms values, the equation is $I = U/X_L$. X_L is called inductive reactance and is defined as $X_L = \omega L$. The unit of inductive reactance is Ω .

Inductance works to counter current changes (increase or decrease), and causes the current to lag the voltage.



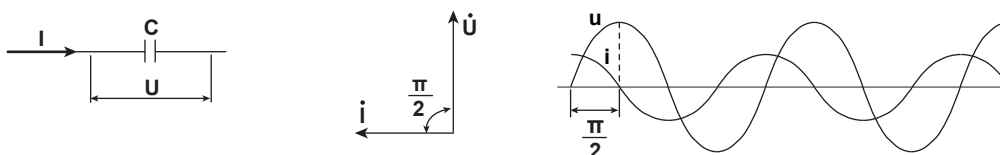
Capacitance

The current i when an AC voltage whose instantaneous value $u = U_m \sin \omega t$ is applied to a capacitive load C [F] is expressed by the equation below.

$$i = \frac{U_m}{X_C} \sin \left(\omega t + \frac{\pi}{2} \right) = I_m \sin \left(\omega t + \frac{\pi}{2} \right)$$

Expressed using rms values, the equation is $I = U/X_C$. X_C is called capacitive reactance and is defined as $X_C = 1/\omega C$. The unit of capacitive reactance is Ω .

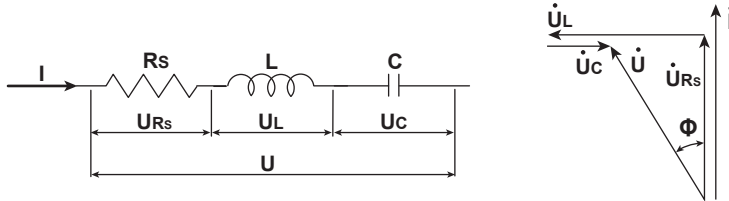
When the polarity of the voltage changes, the largest charging current with the same polarity as the voltage flows through the capacitor. When the voltage decreases, discharge current with the opposite polarity of the voltage flows. Thus, the current phase leads the voltage.



Series RLC Circuits

The equations below express the voltage relationships when resistance R_S [Ω], inductance L [H], and capacitance C [F] are connected in series.

$$\begin{aligned} U &= \sqrt{(U_{R_S})^2 + (U_L - U_C)^2} = \sqrt{(IR_S)^2 + (IX_L - IX_C)^2} \\ &= I\sqrt{(R_S)^2 + (X_L - X_C)^2} = I\sqrt{R_S^2 + X_S^2} \\ I &= \frac{U}{\sqrt{R_S^2 + X_S^2}}, \quad \Phi = \tan^{-1} \frac{X_S}{R_S} \end{aligned}$$



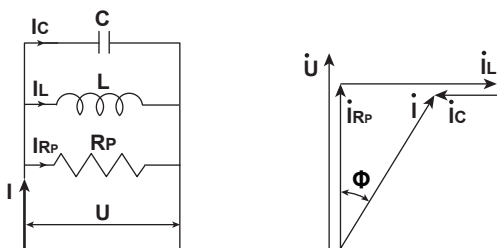
The relationship between resistance R_S , reactance X_S , and impedance Z is expressed by the equations below.

$$\begin{aligned} X_S &= X_L - X_C \\ Z &= \sqrt{R_S^2 + X_S^2} \end{aligned}$$

Parallel RLC Circuits

The equations below express the current relationships when resistance R_P [Ω], inductance L [H], and capacitance C [F] are connected in parallel.

$$\begin{aligned} I &= \sqrt{(I_{R_P})^2 + (I_L - I_C)^2} = \sqrt{\left(\frac{U}{R_P}\right)^2 + \left(\frac{U}{X_L} - \frac{U}{X_C}\right)^2} \\ &= U\sqrt{\left(\frac{1}{R_P}\right)^2 + \left(\frac{1}{X_L} - \frac{1}{X_C}\right)^2} = U\sqrt{\left(\frac{1}{R_P}\right)^2 + \left(\frac{1}{X_P}\right)^2} \\ U &= \frac{IR_P X_P}{\sqrt{R_P^2 + X_P^2}}, \quad \Phi = \tan^{-1} \frac{R_P}{X_P} \end{aligned}$$



The relationship between resistance R_P , reactance X_P , and impedance Z is expressed by the equations below.

$$\begin{aligned} X_P &= \frac{X_L X_C}{X_C - X_L} \\ Z &= \frac{R_P X_P}{\sqrt{R_P^2 + X_P^2}} \end{aligned}$$

Appendix 3 Power Range

- The table below shows actual voltage and current range combinations and the power ranges that result from them. The table shows the active power range (unit: W). The same ranges are set for apparent power (unit: VA) and reactive power (unit: var). Just read the unit as VA or var.
- The table is for when the number of displayed digits is six.
 - If the value is less than or equal to 600000: 6 digits. If the value is greater than 600000: 5 digits.
 - If the number of displayed digits is 5, the least significant digit is removed from the values in the table. For information on how to set the number of displayed digits, see “Environment Settings (Preference)” under “Other Features.”

Active Power Range of Each Element

Current Range	Voltage Range [V]					
[A]	1.50000	3.00000	6.00000	10.0000	15.0000	30.0000
10.0000m	15.000 mW	30.000 mW	60.000 mW	100.00 mW	150.00 mW	300.00 mW
20.0000m	30.000 mW	60.000 mW	120.00 mW	200.00 mW	300.00 mW	600.00 mW
50.0000m	75.00 mW	150.00 mW	300.00 mW	500.00 mW	0.75000 W	1.50000 W
100.000m	150.00 mW	300.00 mW	600.00 mW	1.00000 W	1.50000 W	3.00000 W
200.000m	300.00 mW	600.00 mW	1.20000 W	2.00000 W	3.00000 W	6.00000 W
500.000m	0.75000 W	1.50000 W	3.00000 W	5.00000 W	7.5000 W	15.0000 W
1.00000	1.50000 W	3.00000 W	6.00000 W	10.0000 W	15.0000 W	30.0000 W
2.00000	3.00000 W	6.00000 W	12.0000 W	20.0000 W	30.0000 W	60.0000 W
5.00000	7.5000 W	15.0000 W	30.0000 W	50.0000 W	75.000 W	150.000 W

Current Range	Voltage Range [V]					
[A]	60.0000	100.000	150.000	300.000	600.000	1000.00
10.0000m	600.00 mW	1.00000 W	1.50000 W	3.00000 W	6.00000 W	10.0000 W
20.0000m	1.20000 W	2.00000 W	3.00000 W	6.00000 W	12.0000 W	20.0000 W
50.0000m	3.00000 W	5.00000 W	7.5000 W	15.0000 W	30.0000 W	50.0000 W
100.000m	6.00000 W	10.0000 W	15.0000 W	30.0000 W	60.0000 W	100.000 W
200.000m	12.0000 W	20.0000 W	30.0000 W	60.0000 W	120.000 W	200.000 W
500.000m	30.0000 W	50.0000 W	75.000 W	150.000 W	300.000 W	500.000 W
1.00000	60.0000 W	100.000 W	150.000 W	300.000 W	600.000 W	1.00000 kW
2.00000	120.000 W	200.000 W	300.000 W	600.000 W	1.20000 kW	2.00000 kW
5.00000	300.000 W	500.000 W	0.75000 kW	1.50000 kW	3.00000 kW	5.00000 kW

Active Power Range of a Wiring Unit with a 1P3W or 3P3W System, or a 3P3W System That Uses a 3V3A

Method

Current Range	Voltage Range [V]					
[A]	1.50000	3.00000	6.00000	10.0000	15.0000	30.0000
10.0000m	30.000 mW	60.000 mW	120.000 mW	200.00 mW	300.00 mW	600.00 mW
20.0000m	60.000 mW	120.000 mW	240.00 mW	400.00 mW	600.00 mW	1200.00 mW
50.0000m	150.00 mW	300.00 mW	600.00 mW	1000.00 mW	1.50000 W	3.00000 W
100.000m	300.00 mW	600.00 mW	1200.00 mW	2.00000 W	3.00000 W	6.00000 W
200.000m	600.00 mW	1200.00 mW	2.40000 W	4.00000 W	6.00000 W	12.00000 W
500.000m	1.50000 W	3.00000 W	6.00000 W	10.00000 W	15.0000 W	30.0000 W
1.00000	3.00000 W	6.00000 W	12.00000 W	20.0000 W	30.0000 W	60.0000 W
2.00000	6.00000 W	12.00000 W	24.0000 W	40.0000 W	60.0000 W	120.0000 W
5.00000	15.0000 W	30.0000 W	60.0000 W	100.0000 W	150.000 W	300.000 W

Appendix

Current Range	Voltage Range [V]					
[A]	60.0000	100.000	150.000	300.000	600.000	1000.00
10.0000m	1200.00 mW	2.00000 W	3.00000 W	6.00000 W	12.00000 W	20.0000 W
20.0000m	2.40000 W	4.00000 W	6.00000 W	12.00000 W	24.0000 W	40.0000 W
50.0000m	6.00000 W	10.00000 W	15.0000 W	30.0000 W	60.0000 W	100.0000 W
100.000m	12.00000 W	20.0000 W	30.0000 W	60.0000 W	120.0000 W	200.000 W
200.000m	24.0000 W	40.0000 W	60.0000 W	120.0000 W	240.000 W	400.000 W
500.000m	60.0000 W	100.0000 W	150.000 W	300.000 W	600.000 W	1000.000 W
1.00000	120.0000 W	200.000 W	300.000 W	600.000 W	1200.000 W	2.00000 kW
2.00000	240.000 W	400.000 W	600.000 W	1200.000 W	2.40000 kW	4.00000 kW
5.00000	600.000 W	1000.000 W	1.50000 kW	3.00000 kW	6.00000 kW	10.00000 kW

Active Power Range of a Wiring Unit with a 3P4W Wiring System

Current Range	Voltage Range [V]					
[A]	1.50000	3.00000	6.00000	10.0000	15.0000	30.0000
10.0000m	45.000 mW	90.000 mW	180.000 mW	300.00 mW	450.00 mW	900.00 mW
20.0000m	90.000 mW	180.000 mW	360.00 mW	600.00 mW	900.00 mW	1800.00 mW
50.0000m	225.00 mW	450.00 mW	900.00 mW	1500.00 mW	2.25000 W	4.50000 W
100.000m	450.00 mW	900.00 mW	1800.00 mW	3.00000 W	4.50000 W	9.00000 W
200.000m	900.00 mW	1800.00 mW	3.60000 W	6.00000 W	9.00000 W	18.00000 W
500.000m	2.25000 W	4.50000 W	9.00000 W	15.00000 W	22.5000 W	45.0000 W
1.00000	4.50000 W	9.00000 W	18.00000 W	30.0000 W	45.0000 W	90.0000 W
2.00000	9.00000 W	18.00000 W	36.0000 W	60.0000 W	90.0000 W	180.0000 W
5.00000	22.5000 W	45.0000 W	90.0000 W	150.0000 W	225.000 W	450.000 W

Current Range	Voltage Range [V]					
[A]	60.0000	100.000	150.000	300.000	600.000	1000.00
10.0000m	1800.00 mW	3.00000 W	4.50000 W	9.00000 W	18.00000 W	30.0000 W
20.0000m	3.60000 W	6.00000 W	9.00000 W	18.00000 W	36.0000 W	60.0000 W
50.0000m	9.00000 W	15.00000 W	22.5000 W	45.0000 W	90.0000 W	150.0000 W
100.000m	18.00000 W	30.0000 W	45.0000 W	90.0000 W	180.0000 W	300.000 W
200.000m	36.0000 W	60.0000 W	90.0000 W	180.0000 W	360.000 W	600.000 W
500.000m	90.0000 W	150.0000 W	225.000 W	450.000 W	900.000 W	1500.000 W
1.00000	180.0000 W	300.000 W	450.000 W	900.000 W	1800.000 W	3.00000 kW
2.00000	360.000 W	600.000 W	900.000 W	1800.000 W	3.60000 kW	6.00000 kW
5.00000	900.000 W	1500.00 W	2.25000 kW	4.50000 kW	9.00000 kW	15.00000 kW

Appendix 4 Setting the Measurement Period

To make correct measurements on the PX8000, you must set its measurement period properly.

The PX8000 uses its frequency measurement circuit (see appendix 14) to detect the period of the input signal that is selected using the synchronization source setting. The measurement period is an integer multiple of this detected period. The PX8000 determines the measured values by averaging the data sampled in the measurement period. The input signal used to determine the measurement period is called the synchronization source.

The measurement period is automatically determined inside the PX8000 when you specify the synchronization source.

You can select the synchronization source signal from the options listed below.

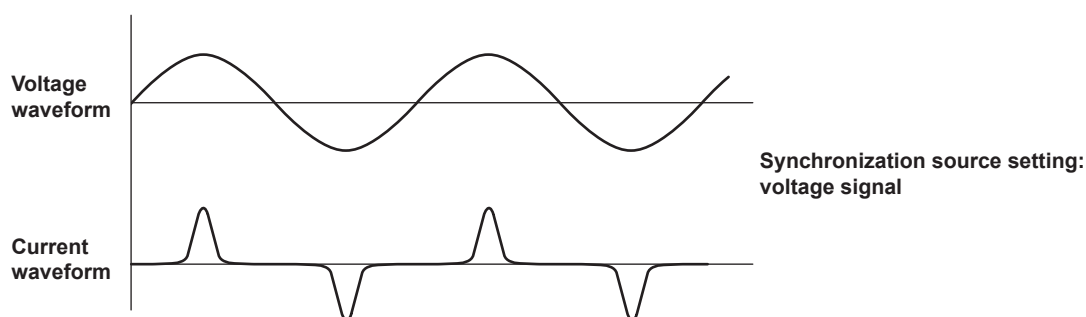
U1, I1, U2, I2, U3, I3, U4, I4, External, and None

* The available options vary depending on the installed elements.

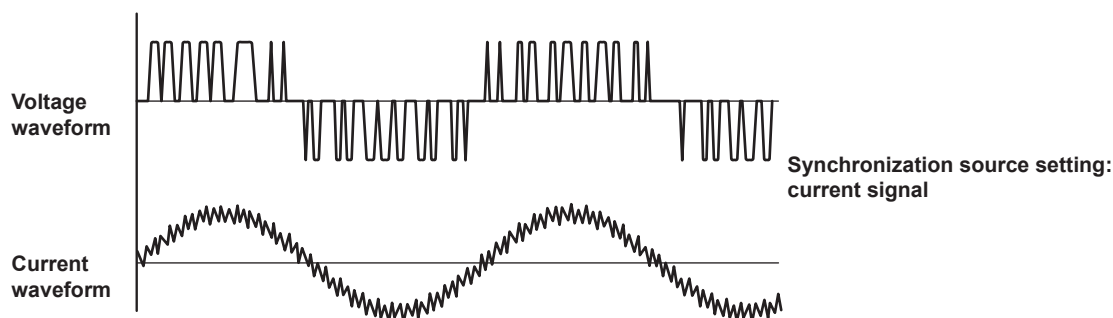
For example, if the synchronization source for element 1 is set to I1, an integer multiple of the period of I1 becomes the measurement period. By averaging the sampled data in this measurement period, the PX8000 computes the measured values for element 1, such as U1, I1, and P1.

Deciding Whether to Use Voltage or Current Input as the Synchronization Source

Select input signals with stable input levels and frequencies (with little distortion) as synchronization sources. Correct measured values can only be obtained if the period of the synchronization source signal is detected accurately. On the PX8000, display the frequency of the input signal that you have selected as the synchronization source, and confirm that the frequency is being measured correctly. The most suitable synchronization source is the input signal that is the most stable and that provides accurate measured results. For example, if a switching power supply is being measured and the voltage waveform distortion is smaller than the current waveform distortion, set the synchronization source to the voltage signal.

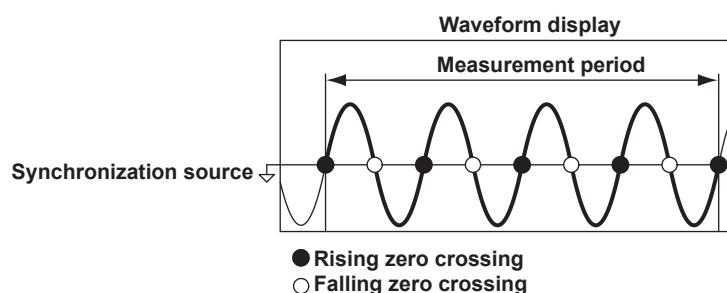


As another example, if an inverter is being measured and the current waveform distortion is smaller than the voltage waveform distortion, set the synchronization source to the current signal.



Zero Crossing

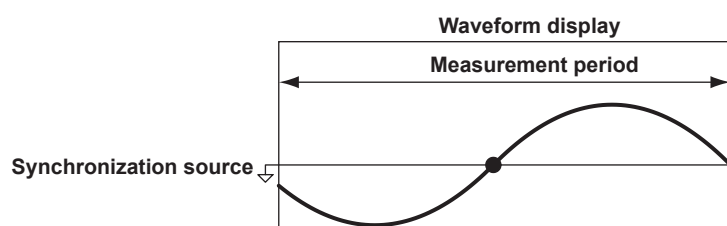
- The rising (or falling) zero crossing is the time when the synchronization source passes through level zero (the center of the amplitude) on a rising (or falling) slope. The measurement period on the PX8000 is between the first rising (or falling) zero crossing and the last rising (or falling) zero crossing in the waveform display.
- The PX8000 determines the measurement period on the basis of the first rising or falling zero crossing within the waveform display.



When the Period of the Synchronization Source Cannot Be Detected

If the total number of rising and falling zero crossings on the input signal that has been set as the synchronization source is less than two within the waveform display, the period cannot be detected. Also, the period cannot be detected if the AC amplitude is small. For information on the detectable frequency levels, see the conditions listed under "measurement range" under "Frequency" Measurement" in section 7.5, "Features," in the Getting Started Guide, IM PX8000-03EN.

If the period cannot be detected, the entire waveform display is used to average the sampled data.

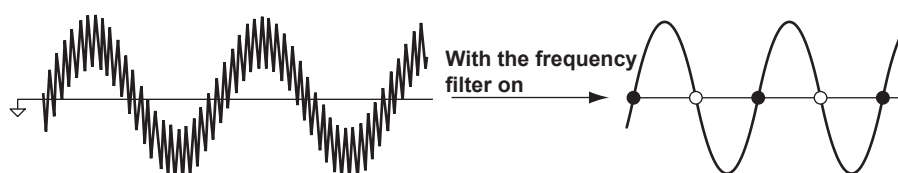


Because of the reasons described above, the measured voltage and current values may be unstable. If this happens, lengthen the time axis setting (TIME/DIV) so that more periods of the input signal fit within the waveform display.

When the Waveform of the Synchronization Source Is Distorted

Change the synchronization source to a signal that allows for more stable detection of the period (switch from voltage to current or from current to voltage). Also, turn on the frequency filter.

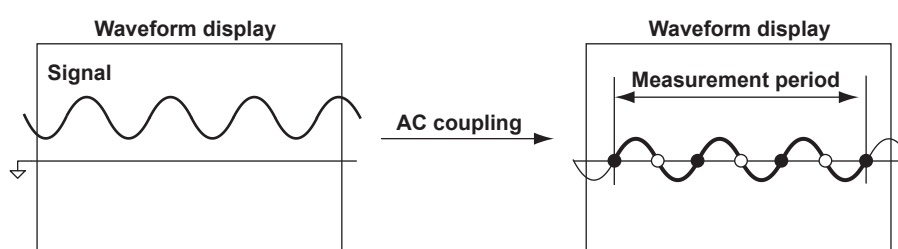
The PX8000 reduces the effects of noise by using hysteresis when it detects zero crossings. If the synchronization source is distorted or harmonics and noise are superposed on the signal to a level exceeding this hysteresis, harmonic components will cause zero crossing detection to occur frequently, and the zero crossing of the fundamental frequency will not be detected stably. Consequently, the measured voltage and current may be unstable. When high frequency components are superposed on the current waveform such as in the aforementioned inverter example, turn the frequency filter on to stably detect zero crossings. Use of the filter is appropriate if it makes the measured frequency accurate and more stable. Because the frequency filter can be used to facilitate the detection of the synchronization source's zero crossings, it is sometimes called the synchronization source filter or the zero-crossing filter.



When Measuring a Signal That Has No Zero Crossings Because of a DC Offset Superposed on the AC Signal

The measured values may be unstable if the period of the AC signal cannot be detected accurately. Change the synchronization source to a signal that allows for more stable detection of the period (switch from voltage to current or from current to voltage). The frequency detection circuit is AC coupled. Even with AC signals in which there are no zero crossings because of an offset, the period can be detected if the AC amplitude is greater than or equal to the detection level* of the frequency measurement circuit.

With this feature, the measurement period is set to an integer multiple of the period of the AC signal.

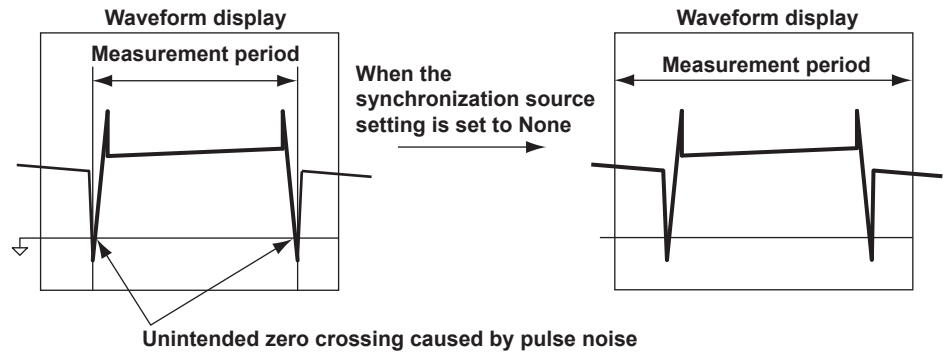


When Measuring a DC Signal

When there are ripples in the DC signal, if the level of the ripples is greater than or equal to the detection level* of the frequency measurement circuit and the period can be detected accurately and stably, a more accurate DC measurement is possible. If a large AC signal is superposed on a DC signal, you can achieve a more stable measurement by detecting the AC signal period and averaging it.

In addition, if a small fluctuating pulse noise riding on the DC signal crosses level zero, that point is detected as a zero crossing. As a result, sampled data is averaged over an unintended period, and measured values such as voltage and current may be unstable. You can prevent these kinds of erroneous detections by setting the synchronization source to OFF. All of the sampled data in the waveform display is used to determine measured values. Set the synchronization source according to the signal under measurement and the measurement objective.

* See the conditions listed under "measurement range" under "Frequency Measurement" in section 7.5, "Features," in the Getting Started Guide, IM PX8000-03EN.

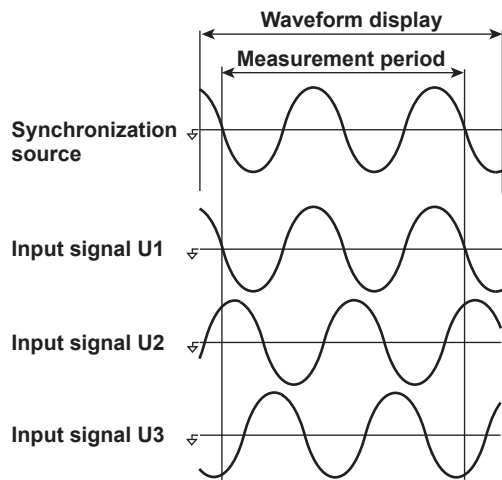


Setting the Synchronization Period When Measuring a Three-Phase Device

If a three-phase device is measured with elements 1 and 2 using a three-phase, three-wire system, set the synchronization source of elements 1 and 2 to the same signal. For example, set the synchronization source of elements 1 and 2 to U1 or I1. The measurement periods of elements 1 and 2 will match, and it will be possible to measure the Σ voltage, Σ current, and Σ power of a three-phase device more accurately.

Likewise, if a three-phase device is measured with elements 1, 2, and 3 using a three-phase, four-wire system, set the synchronization source of elements 1, 2, and 3 to the same signal.

To facilitate this sort of configuration, the synchronization source setting on the PX8000 is linked to the Σ wiring unit of the wiring system (when independent element configuration is turned off). If independent element configuration is turned on, the synchronization source of each element in the Σ wiring unit can be set independently.



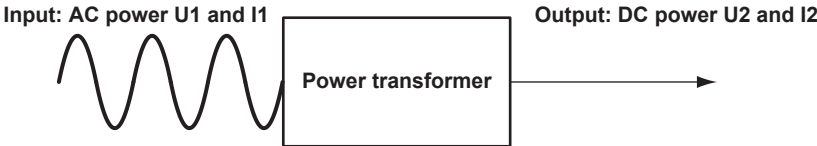
Synchronization Source Setup Example	
Element 1	U1 (or I1)
Element 2	
Element 3	

Setting the Synchronization Period When Measuring the Efficiency of a Power Transformer

Power Transformer with Single-Phase Input and Single-Phase Output

If you are using elements 1 and 2 to measure a device that converts single-phase AC power to single-phase DC power, set the synchronization source of elements 1 and 2 to the voltage (or current) on the AC power end. In the example shown in the figure below, set the synchronization source of elements 1 and 2 to U1 (or I1).

The measurement periods of element 1 (input end) and element 2 (output end) will match, and it will be possible to measure the power conversion efficiency at the input and output ends of the power transformer more accurately.



Synchronization Source Setup Example	
Element 1	U1 (or I1)
Element 2	

Likewise, if you are using elements 1 (DC end) and 2 (AC end) to measure a device that converts single-phase DC power to single-phase AC power, set the synchronization source of elements 1 and 2 to the voltage (or current) on the AC power end (element 2). In the example shown in the figure below, set the synchronization source of elements 1 and 2 to U2 (or I2).



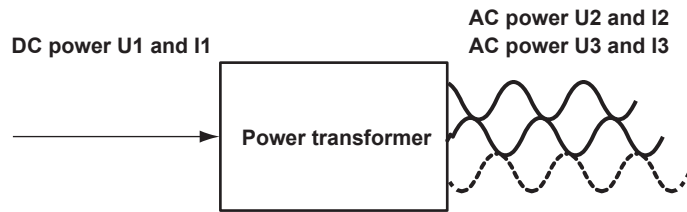
Synchronization Source Setup Example	
Element 1	U2 (or I2)
Element 2	

Power Transformer with Single-Phase DC Input and Three-Phase AC Output

If you are using the connections shown on the next page to measure a device that converts single-phase DC power to three-phase AC power, set the synchronization source of all elements to the same signal: the voltage or current of element 2 or 3 on the AC power end.

In this example, set the synchronization source of elements 1, 2, and 3 to U2 (or I2, U3, or I3). The measurement periods of the input signal and all output signals will match, and it will be possible to measure the power conversion efficiency of the power transformer more accurately.

- Single-phase DC power: Connect to element 1.
- Three-phase AC power: Connect to elements 2 and 3 using a three-phase, three-wire system.



Synchronization Source Setup Example	
Element 1	U2 (or I2, U3, or I3)
Element 2	
Element 3	

• **Power Transformer with Single-Phase AC Input and Three-Phase AC Output**

If you are using the connections shown in the figure below to measure a device that converts single-phase AC power to three-phase AC power, set the synchronization source of elements on the input end to the same signal and do the same for elements on the output end.

In this example, set the synchronization source of element 1 to U1 (or I1), and set the synchronization source of elements 2 and 3 to U2 (or I2, U3, or I3).

In this case, AC signals of different frequencies are measured. If the synchronization source of all elements is set to the same signal, the measurement period of either the input signal or the output signal will not be an integer multiple of the signal.

- Single-phase AC power: Connect to element 1.
- Three-phase AC power: Connect to elements 2 and 3 using a three-phase, three-wire system.



Synchronization Source Setup Example	
Element 1	U1 (or I1)
Element 2	U2 (or I2, U3, or I3)
Element 3	



- The measurement period for determining the numeric data of the peak voltage or peak current is the entire span of the waveform display, regardless of the measurement period settings discussed above. Therefore, the measurement period for the measurement functions that are determined using the maximum voltage or current value (U+pk, U-pk, I+pk, I-pk, CfU, and Cfl) is also the entire span of the waveform display.
- For details on the measurement period for measurement functions related to harmonic measurement, see "Harmonic Measurement Start Point" under "Numeric Computation."

Appendix 5 Measurement Accuracy and Measurement Error

Instruments such as power meters have specifications for measurement accuracy or measurement errors. For example, on the PX8000, the voltage and current accuracy in the range of 45 Hz to 1 kHz is $\pm(0.1\%$ of reading + 0.1% of range).

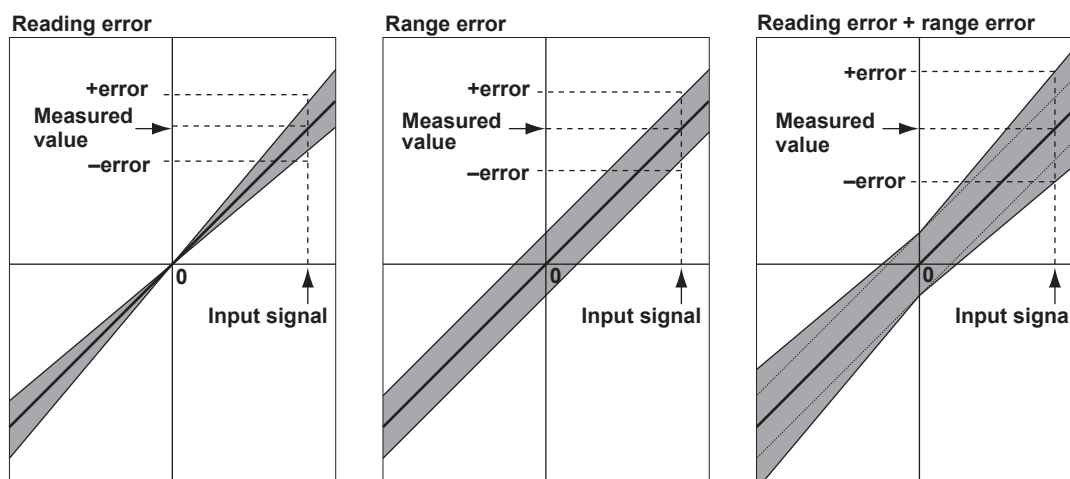
Reading Error and Range Error

Reading error: of reading

The error indicated by “of reading” is called reading error. The error is calculated on the basis of the measured reading (measured values). It is an error that is included at a given ratio of the measured values. The larger the measured value, larger the reading error that is included. The smaller the measured value, smaller the reading error that is included.

Range error: of range

The error indicated by “of range” is called range error. The error is calculated on the basis of the measurement range that is used in measurement. It is an error that is included at a given magnitude in the measured values. The range error that is included is of the same magnitude regardless of whether the measured value is large or small.



To see how much error is included in the measured values, let us look at several computation examples for a 60 Hz sine wave input signal.

The examples assume that the number of displayed digits on the PX8000 is set to 5.

Voltage and Current Measurement Error

Example 1: Measuring 1 Arms Using the 1 A Measurement Range

When the measured value is 1.0000 [A], the reading error and range error are as follows:

- Reading error: $1.0000 \text{ [A]} \times 0.1\% = 0.001 \text{ [A]}$
- Range error: $1 \text{ [A]} \times 0.1\% = 0.001 \text{ [A]}$

The error included in 1.0000 [A] is the sum of the reading and range errors, which is $\pm 0.002 \text{ [A]}$. This corresponds to 0.2% of the displayed value.



Application of an input signal whose value is the same as the name of the measurement range is referred to as rated range input. And, such input signals are called rated range signals.

Example 2: Measuring 1 Arms Using the 5 A Measurement Range

In this example, we measure the same input using the 5 A range. When the measured value is 1.0000 [A], the reading error and range error are as follows:

- Reading error: $1.0000 \text{ [A]} \times 0.1\% = 0.001 \text{ [A]}$
- Range error: $5 \text{ [A]} \times 0.1\% = 0.005 \text{ [A]}$

The error included in 1.0000 [A] is the sum of the reading and range errors, which is $\pm 0.006 \text{ [A]}$. This corresponds to 0.6% of the measured value.

The error has increased even though the same current signal as example 1 was measured. As this example illustrates, using a measurement range that is unnecessarily large for an input signal results in larger measurement errors. It is important to measure using a measurement range that is appropriate for the input signal.



If the input signal is not a sine wave and includes distortions and spikes, select a somewhat large measurement range that would not cause peak over-ranges to occur.

Example 3: Measuring 0.5 Arms Using the 1 A Measurement Range

Next, we measure 0.5 A using the 1 A measurement range (the same as example 1). When the measured value is 0.5000 [A], the reading error and range error are as follows:

- Reading error: $0.5000 \text{ [A]} \times 0.1\% = 0.0005 \text{ [A]}$
- Range error: $1 \text{ [A]} \times 0.1\% = 0.001 \text{ [A]}$

The error included in 0.5000 [A] is the sum of the reading and range errors, which is $\pm 0.0015 \text{ [A]}$. This corresponds to 0.3% of the measured value.

When we compare this result with that of example 1, we notice the following:

- The reading error has been reduced in accordance with the input amplitude.
- The range error has not changed.

As a result, the error is 0.3%, which is slightly larger than 0.2% of example 1. This is also because the measurement range is large relative to the input signal. In this case, we should use the 0.5 A measurement range.

Measurement Error of Active Power

On the PX8000, the power accuracy in the range of 45 Hz to 1 kHz is $\pm(0.1\% \text{ of reading} + 0.1\% \text{ of range})$.

Let us calculate the error for the following example.

- Voltage measurement range: 150 V, measured voltage: 100.00 V
- Current measurement range: 1A, measured current: 0.8000 A
- Measured power: 80.00 W
- 60 Hz sine wave for both voltage and current
- Phase difference between the voltage and current signals = 0°

Power Range

The power measurement range is defined as voltage measurement range \times current measurement range. In this example, the power measurement range is $150 \text{ V} \times 1 \text{ A} = 150 \text{ W}$. We use this power measurement range to calculate the range error.

The reading error and range error included in the measured power (80.00 W) are as follows:

- Reading error: $80.00 \text{ [W]} \times 0.1\% = 0.08 \text{ [W]}$
- Range error: $150 \text{ [W]} \times 0.1\% = 0.15 \text{ [W]}$

The error included in 80.00 [W] is the sum of the reading and range errors, which is $\pm 0.23 \text{ [W]}$. This corresponds to 0.2875% of the displayed value.

Power Factor Influence (Power Factor Error)

The previous example was for when the phase difference between the voltage and current signals was 0° , or in other words, when the power factor was 1. Next, we will calculate the error for an example in which the power factor is not 1.

When the Power Factor is 0

This is an example for when the phase difference is 90° , or in other words, when the power factor is 0. Theoretically, the active power is 0 W, apparent power is 80 VA, and the reactive power is 80 var. This assumes an ideal capacitive (C) load or an ideal inductive (L) load. For details, see appendix 2.

When the power factor (λ) = 0, the power error on the PX8000 is defined as follows:

$\pm 0.15\%$ of S (S: apparent power) in the $45 \text{ Hz} \leq f \leq 66 \text{ Hz}$ range

When the measured apparent power is 80.00 [VA], the error in the measured power (0.00 W) is as follows:

$80.00 \times \pm 0.15\% = \pm 0.12 \text{ [W]}$

When the Power Factor Is Greater Than 0 but Less Than 1

As an example, let us calculate the error for when the power factor is 0.5, or in other words, when the phase difference between the voltage and current (Φ) is 60° .

- The power accuracy in the range of 45 Hz to 1 kHz: $\pm(0.1\%$ of reading + 0.1% of range)
- Voltage measurement range: 150 V, measured voltage: 100.00 V
- Current measurement range: 1A, measured current: 0.8000 A
- Power measurement range: 150 W, measured power: 40.00 W, measured apparent power: 80.00 VA, measured reactive power: 69.28 var

When $0 < \lambda < 1$, the power error on the PX8000 is defined as follows:

$(\text{Power reading}) \times [(\text{power reading error } \%) + (\text{power range error } \%) \times (\text{power range/indicated apparent power value}) + \{\tan \Phi \times (\text{influence when } \lambda = 0)\} \%$,

If we substitute the above value into this equation, the power error becomes as follows:

$$\begin{aligned} & 40.00 \text{ [W]} \times [0.1\% + 0.1\% \times (150/80.00) + \{\tan 60^\circ \times (\text{influence } (\%) \text{ when } \lambda = 0)\}] \\ &= 40.00 \text{ [W]} \times \{0.1 + 0.1 \times (150/80.00) + \sqrt{3} \times 0.15\}\% \\ &= 0.2189 \text{ [W]} \end{aligned}$$

The error in the measured power (40.00 W) is $\pm 0.2189 \text{ [W]}$.

Error in Three-Phase Power

The error when measuring power of a three-phase, three-wire system using elements 1 and 2 of the PX8000 is explained with the next example.

- Voltage measurement range: 150 V, measured voltage: 100 V for U1, U2, and UΣ
- Current measurement range: 1 A, measured current: 0.8 A for I1, I2, and IΣ
- Measured power: P1 = 69.28 W, P2 = 69.28W, PΣ = 138.56 W
- 60 Hz sine wave for both voltage and current
- Phase difference between the voltage and current signals = 0°
- Phase angle between phases = 60°

Three-Phase Measurement Range

For the three-phase measurement range, refer to the table of Σ function equations on page App-2. This table shows the expressions that the PX8000 uses to internally calculate the measured values. This table also applies to how to think about the measurement range. In this example, we will apply the three-phase, three-wire (3P3W) column.

Voltage and Current

Three-phase voltage (UΣ) measurement range = (U1 measurement range + U2 measurement range)/2
= (150 + 150)/2 = 150

Three-phase current (IΣ) measurement range = (I1 measurement range + I2 measurement range)/2
= (1 + 1)/2 = 1

The reading error and range error included in the measured three-phase voltage (UΣ; 100.00 V) are as follows:

- Reading error: 100.00 [V]×0.1% = 0.1 [V]
- Range error: 150 [V]×0.1% = 0.15 [V]

The error included in 100.00 [V] is the sum of the reading and range errors, which is ±0.25 [V]. This corresponds to 0.25% of the displayed value. Because the measured values of U1 and U2 are the same, UΣ also has the same error. The same calculation method applies for the currents.

Power

Referring to the table of Σ function equations on page App-2, the power range is as follows:

Three-phase power (PΣ) measurement range
= P1 measurement range + P2 measurement range
= (U1 measurement range × I1 measurement range) + (U2 measurement range × I2 measurement range)
= (150 × 1) + (150 × 1)
= 300

The reading error and range error included in the measured three-phase power (PΣ; 138.56 W) are as follows:

- Reading error: 138.56 [W]×0.1% = 0.13856 [W]
- Range error: 300 [W]×0.1% = 0.3 [W]

The error included in 138.56 [W] is the sum of the reading and range errors, which is ±0.43856 [W]. This corresponds to approximately 0.317% of the displayed value.



Accuracy and Precision

Measurement accuracy refers to how close a measurement is to the true value. In other words, it indicates the deviation of a measured value from the true value. Measurement precision refers to how close measurements of the same quantity are to each other.

For example, let us consider the measured results of two voltmeters when 1.00 V is measured three times.

	Voltmeter A	Voltmeter B
1st measurement	1.02 V	1.04 V
2nd measurement	1.00 V	1.05 V
3rd measurement	0.98 V	1.06V

Voltmeter A measurements are closer to the true value (1.00 V). We can say that voltmeter A is more accurate than voltmeter B.

On the other hand, the three voltmeter B measurements are closer to each other than those of voltmeter A. We can say that voltmeter B is more precise than voltmeter A.

Measurement Error

A measurement error is the difference between the actual measurement and the true value.

Appendix 5 User-Defined Function Operands

The following is a list of operands that can be used in user-defined functions.

Measurement Functions Used in Normal Measurement

Measurement Function	User-Defined Function		Parameter in ()	
			Element E1 to E4	Wiring Unit SA, SB
Urms	URMS()	URMS(E1)	Yes	Yes
Umn	UMN()	UMN(E1)	Yes	Yes
Udc	UDC()	UDC(E1)	Yes	Yes
Urmn	URMN()	URMN(E1)	Yes	Yes
Uac	UAC()	UAC(E1)	Yes	Yes
Irms	IRMS()	IRMS(E1)	Yes	Yes
Imn	IMN()	IMN(E1)	Yes	Yes
Idc	IDC()	IDC(E1)	Yes	Yes
Irmn	IRMN()	IRMN(E1)	Yes	Yes
Iac	IAC()	IAC(E1)	Yes	Yes
P	P()	P(E1)	Yes	Yes
S	S()	S(E1)	Yes	Yes
Q	Q()	Q(E1)	Yes	Yes
λ	LAMBDA()	LAMBDA(E1)	Yes	Yes
Φ	PHI()	PHI(E1)	Yes	Yes
fU	FU()	FU(E1)	Yes	No
fI	FI()	FI(E1)	Yes	No
U+pk	UPPK()	UPPK(E1)	Yes	No
U-pk	UMPK()	UMPK(E1)	Yes	No
I+pk	IPPK()	IPPK(E1)	Yes	No
I-pk	IMPK()	IMPK(E1)	Yes	No
P+pk	PPPK()	PPPK(E1)	Yes	No
P-pk	PMPK()	PMPK(E1)	Yes	No
CfU	CFU()	CFU(E1)	Yes	No
CfI	CFI()	CFI(E1)	Yes	No
Pc	PC()	PC(E1)	Yes	Yes

Efficiency

Measurement Function	User-Defined Function		Parameter in ()	
			Element E1 to E4	Wiring Unit SA, SB
η_1	ETA1()	ETA1()	None or space*	
η_2	ETA2()	ETA2()	None or space*	
η_3	ETA3()	ETA3()	None or space*	
η_4	ETA4()	ETA4()	None or space*	

* You cannot omit the parentheses.

User-Defined Functions

Measurement Function	User-Defined Function		Parameter in ()	
			Element E1 to E4	Wiring Unit SA, SB
		Example		
F1	F1()	F1()	None or space*	
F2	F2()	F2()	None or space*	
F3	F3()	F3()	None or space*	
F4	F4()	F4()	None or space*	
F5	F5()	F5()	None or space*	
F6	F6()	F6()	None or space*	
F7	F7()	F7()	None or space*	
F8	F8()	F8()	None or space*	
F9	F9()	F9()	None or space*	
F10	F10()	F10()	None or space*	
F11	F11()	F11()	None or space*	
F12	F12()	F12()	None or space*	
F13	F13()	F13()	None or space*	
F14	F14()	F14()	None or space*	
F15	F15()	F15()	None or space*	
F16	F16()	F16()	None or space*	
F17	F17()	F17()	None or space*	
F18	F18()	F18()	None or space*	
F19	F19()	F19()	None or space*	
F20	F20()	F20()	None or space*	

* You cannot omit the parentheses.

Auxiliary Input (When motor mode is off)

Measurement Function	User-Defined Function		Parameter in ()	
			Element E2 to E4	Wiring Unit SA, SB
		Example		
Aux3	AUX3()	AUX3()	None or space*	
Aux4	AUX4()	AUX4()	None or space*	
Aux5	AUX5()	AUX5()	None or space*	
Aux6	AUX6()	AUX6()	None or space*	
Aux7	AUX7()	AUX7()	None or space*	
Aux8	AUX8()	AUX8()	None or space*	

* You cannot omit the parentheses.

Auxiliary Input (When motor mode is on)

Measurement Function	User-Defined Function		Parameter in ()	
			Element E2 to E4	Wiring Unit SA, SB
		Example		
Aux3 (Rotating speed)	AUX3()	AUX3()	None or space*	
Aux4 (Torque)	AUX4()	AUX4()	None or space*	
Pm2 (Monitor output)	PM2()	PM2()	None or space*	
Aux5 (Rotating speed)	AUX5()	AUX5()	None or space*	
Aux6 (Torque)	AUX6()	AUX6()	None or space*	
Pm3 (Monitor output)	PM3()	PM3()	None or space*	
Aux7 (Rotating speed)	AUX7()	AUX7()	None or space*	
Aux8 (Torque)	AUX8()	AUX8()	None or space*	
Pm4 (Monitor output)	PM4()	PM4()	None or space*	

* You cannot omit the parentheses.

Delta Computation

Measurement Function	User-Defined Function		Parameter in ()	
			Element	Wiring Unit
		Example	E1 to E4	SA, SB
$\Delta U1()$	DELTAU1()	DELTAU1(E5)	No	Yes
$\Delta U2()$	DELTAU2()	DELTAU2(E5)	No	Yes
$\Delta U3()$	DELTAU3()	DELTAU3(E5)	No	Yes
$\Delta U\Sigma()$	DELTAUSIG()	DELTAUSIG(E5)	No	Yes
$\Delta I()$	DELTAI()	DELTAI(E5)	No	Yes
$\Delta P1()$	DELTAP1()	DELTAP1(E5)	No	Yes
$\Delta P2()$	DELTAP2()	DELTAP2(E5)	No	Yes
$\Delta P3()$	DELTAP3()	DELTAP3(E5)	No	Yes
$\Delta P\Sigma()$	DELTAPSIG()	DELTAPSIG(E5)	No	Yes
$\Delta U1rms()$	DELTAU1RMS()	DELTAU1RMS(E5)	No	Yes
$\Delta U2rms()$	DELTAU2RMS()	DELTAU2RMS(E5)	No	Yes
$\Delta U3rms()$	DELTAU3RMS()	DELTAU3RMS(E5)	No	Yes
$\Delta U\Sigma rms()$	DELTAUSIGRMS()	DELTAUSIGRMS(E5)	No	Yes
$\Delta U1mean()$	DELTAU1MN()	DELTAU1MN(E5)	No	Yes
$\Delta U2mean()$	DELTAU2MN()	DELTAU2MN(E5)	No	Yes
$\Delta U3mean()$	DELTAU3MN()	DELTAU3MN(E5)	No	Yes
$\Delta U\Sigma mean()$	DELTAUSIGMN()	DELTAUSIGMN(E5)	No	Yes
$\Delta U1rmean()$	DELTAU1RMN()	DELTAU1RMN(E5)	No	Yes
$\Delta U2rmean()$	DELTAU2RMN()	DELTAU2RMN(E5)	No	Yes
$\Delta U3rmean()$	DELTAU3RMN()	DELTAU3RMN(E5)	No	Yes
$\Delta U\Sigma rmean()$	DELTAUSIGRMN()	DELTAUSIGRMN(E5)	No	Yes
$\Delta U1dc()$	DELTAU1DC()	DELTAU1DC(E5)	No	Yes
$\Delta U2dc()$	DELTAU2DC()	DELTAU2DC(E5)	No	Yes
$\Delta U3dc()$	DELTAU3DC()	DELTAU3DC(E5)	No	Yes
$\Delta U\Sigma dc()$	DELTAUSIGDC()	DELTAUSIGDC(E5)	No	Yes
$\Delta U1ac()$	DELTAU1AC()	DELTAU1AC(E5)	No	Yes
$\Delta U2ac()$	DELTAU2AC()	DELTAU2AC(E5)	No	Yes
$\Delta U3ac()$	DELTAU3AC()	DELTAU3AC(E5)	No	Yes
$\Delta U\Sigma ac()$	DELTAUSIGAC()	DELTAUSIGAC(E5)	No	Yes
$\Delta Irms()$	DELTAIrms()	DELTAIRMS(E5)	No	Yes
$\Delta Imean()$	DELTAIMN()	DELTAIMN(E5)	No	Yes
$\Delta Irmean()$	DELTAIRMN()	DELTAIRMN(E5)	No	Yes
$\Delta Idc()$	DELTAIDC()	DELTAIDC(E5)	No	Yes
$\Delta Iac()$	DELTAIAC()	DELTAIAC(E5)	No	Yes

Harmonic Measurement Option

Measurement Function	User-Defined Function		Left Parameter in (,) or Parameter in ()		Right Parameter in (,)			
			Element	Wiring Unit	Harmonic Order			
	Total Value	DC			Fundamental Wave	Harmonics		
		Example	E1 to E4	SA, SB	ORT	OR0	OR1	OR2 to OR500
U_k	UK(,)	UK(E1,OR3)	Yes	Yes	Yes	Yes	Yes	Yes
I_k	IK(,)	IK(E1,OR3)	Yes	Yes	Yes	Yes	Yes	Yes
P_k	PK(,)	PK(E1,OR3)	Yes	Yes	Yes	Yes	Yes	Yes
S_k	SK(,)	SK(E1,OR3)	Yes	Yes	Yes	Yes	Yes	Yes
Q_k	QK(,)	QK(E1,OR3)	Yes	Yes	Yes	Yes	Yes	Yes
λ_k	LAMBDAK(,)	LAMBDAK(E1,OR3)	Yes	Yes	Yes	Yes	Yes	Yes
Φ_k	PHIK(,)	PHIK(E1,OR3)	Yes	No	Yes	No	Yes	Yes
ΦU	UPHI(,)	UPHI(E1,OR3)	Yes	No	No	No	No	Yes
ΦI	IPHI(,)	IPHI(E1,OR3)	Yes	No	No	No	No	Yes
Z	ZK(,)	ZK(E1,OR3)	Yes	No	No	Yes	Yes	Yes
Rs	RSK(,)	RSK(E1,OR3)	Yes	No	No	Yes	Yes	Yes
Xs	XSK(,)	XSK(E1,OR3)	Yes	No	No	Yes	Yes	Yes
Rp	RPK(,)	RPK(E1,OR3)	Yes	No	No	Yes	Yes	Yes
Xp	XPk(,)	XPk(E1,OR3)	Yes	No	No	Yes	Yes	Yes
Uhdf	UHDF(,)	UHDF(E1,OR3)	Yes	No	No	Yes	Yes	Yes
Ihdf	IHDF(,)	IHDF(E1,OR3)	Yes	No	No	Yes	Yes	Yes
Phdf	PHDF(,)	PHDF(E1,OR3)	Yes	No	No	Yes	Yes	Yes
Uthd	UTHD()	UTHD(E1)	Yes	No				
Ithd	ITHD()	ITHD(E1)	Yes	No				
Pthd	PTHD()	PTHD(E1)	Yes	No				
Uthf	UTHF()	UTHF(E1)	Yes	No				
Ithf	ITHF()	ITHF(E1)	Yes	No				
Utif	UTIF()	UTIF(E1)	Yes	No				
Itif	ITIF()	ITIF(E1)	Yes	No				
hvf	HVF()	HVF(E1)	Yes	No				
hcf	HCF()	HCF(E1)	Yes	No				
K-factor	KFACT()	KFACT(E1)	Yes	No				
fPLL	PLLFRQ()	PLLFRQ()	No	No				
ΦU1-U2	PHIU1U2()	PHIU1U2(E5)	No	Yes				
ΦU1-U3	PHIU1U3()	PHIU1U3(E5)	No	Yes				
ΦU1-I1	PHIU1I1()	PHIU1I1(E5)	Yes	Yes				
ΦU2-I2	PHIU2I2()	PHIU2I2(E5)	No	Yes				
ΦI1-I2	PHII1I2()	PHII1I2(E5)	No	Yes				
ΦI2-I3	PHII2I3()	PHII2I3(E5)	No	Yes				
ΦI3-I1	PHII3I1()	PHII3I1(E5)	No	Yes				
ΦU3-I3	PHIU3I3()	PHIU3I3(E5)	No	Yes				

Appendix 7 Relationship between the Time Axis Setting, Record Length, and Sample Rate

When the Record Length Is 100 kpoint, 250 kpoint, 500 kpoint, or 1 Mpoint

Time/div	Record Length							
	100 kpoint		250 kpoint		500 kpoint		1 Mpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
100 ns	100 M	100	100 M	100	100 M	100	100 M	100
200 ns	100 M	200	100 M	200	100 M	200	100 M	200
500 ns	100 M	500	100 M	500	100 M	500	100 M	500
1 μ s	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k
2 μ s	100 M	2 k	100 M	2 k	100 M	2 k	100 M	2 k
5 μ s	100 M	5 k	100 M	5 k	100 M	5 k	100 M	5 k
10 μ s	100 M	10 k	100 M	10 k	100 M	10 k	100 M	10 k
20 μ s	100 M	20 k	100 M	20 k	100 M	20 k	100 M	20 k
50 μ s	100 M	50 k	100 M	50 k	100 M	50 k	100 M	50 k
100 μ s	100 M	100 k	100 M	100 k	100 M	100 k	100 M	100 k
200 μ s	50 M	100 k	100 M	200 k	100 M	200 k	100 M	200 k
500 μ s	20 M	100 k	50 M	250 k	100 M	500 k	100 M	500 k
1 ms	10 M	100 k	20 M	200 k	50 M	500 k	100 M	1 M
2 ms	5 M	100 k	10 M	200 k	20 M	400 k	50 M	1 M
5 ms	2 M	100 k	5 M	250 k	10 M	500 k	20 M	1 M
10 ms	1 M	100 k	2 M	200 k	5 M	500 k	10 M	1 M
20 ms	500 k	100 k	1 M	200 k	2 M	400 k	5 M	1 M
50 ms	200 k	100 k	500 k	250 k	1 M	500 k	2 M	1 M
100 ms	100 k	100 k	200 k	200 k	500 k	500 k	1 M	1 M
200 ms	50 k	100 k	100 k	200 k	200 k	400 k	500 k	1 M
500 ms	20 k	100 k	50 k	250 k	100 k	500 k	200 k	1 M
1 s	10 k	100 k	20 k	200 k	50 k	500 k	100 k	1 M
2 s	5 k	100 k	10 k	200 k	20 k	400 k	50 k	1 M
3 s	2 k	60 k	5 k	150 k	10 k	300 k	20 k	600 k
4 s	2 k	80 k	5 k	200 k	10 k	400 k	20 k	800 k
5 s	2 k	100 k	5 k	250 k	10 k	500 k	20 k	1 M
6 s	1 k	60 k	2 k	120 k	5 k	300 k	10 k	600 k
8 s	1 k	80 k	2 k	160 k	5 k	400 k	10 k	800 k
10 s	1 k	100 k	2 k	200 k	5 k	500 k	10 k	1 M
20 s	500	100 k	1 k	200 k	2 k	400 k	5 k	1 M
30 s	200	60 k	500	150 k	1 k	300 k	2 k	600 k
1 min	100	60 k	200	120 k	500	300 k	1 k	600 k
2 min	50	60 k	200	240 k	200	240 k	500	600 k

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

When the Record Length Is 2.5 Mpoint, 5 Mpoint, 10 Mpoint, or 25 Mpoint

Time/div	Record Length							
	2.5 Mpoint		5 Mpoint		10 Mpoint		25 Mpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
100 ns	100 M	100	100 M	100	100 M	100	100 M	100
200 ns	100 M	200	100 M	200	100 M	200	100 M	200
500 ns	100 M	500	100 M	500	100 M	500	100 M	500
1 μ s	100 M	1 k	100 M	1 k	100 M	1 k	100 M	1 k
2 μ s	100 M	2 k	100 M	2 k	100 M	2 k	100 M	2 k
5 μ s	100 M	5 k	100 M	5 k	100 M	5 k	100 M	5 k
10 μ s	100 M	10 k	100 M	10 k	100 M	10 k	100 M	10 k
20 μ s	100 M	20 k	100 M	20 k	100 M	20 k	100 M	20 k
50 μ s	100 M	50 k	100 M	50 k	100 M	50 k	100 M	50 k
100 μ s	100 M	100 k	100 M	100 k	100 M	100 k	100 M	100 k
200 μ s	100 M	200 k	100 M	200 k	100 M	200 k	100 M	200 k
500 μ s	100 M	500 k	100 M	500 k	100 M	500 k	100 M	500 k
1 ms	100 M	1 M	100 M	1 M	100 M	1 M	100 M	1 M
2 ms	100 M	2 M	100 M	2 M	100 M	2 M	100 M	2 M
5 ms	50 M	2.5 M	100 M	5 M	100 M	5 M	100 M	5 M
10 ms	20 M	2 M	50 M	5 M	100 M	10 M	100 M	10 M
20 ms	10 M	2 M	20 M	4 M	50 M	10 M	100 M	20 M
50 ms	5 M	2.5 M	10 M	5 M	20 M	10 M	50 M	25 M
100 ms	2 M	2 M	5 M	5 M	10 M	10 M	20 M	20 M
200 ms	1 M	2 M	2 M	4 M	5 M	10 M	10 M	20 M
500 ms	500 k	2.5 M	1 M	5 M	2 M	10 M	5 M	25 M
1 s	200 k	2 M	500 k	5 M	1 M	10 M	2 M	20 M
2 s	100 k	2 M	200 k	4 M	500 k	10 M	1 M	20 M
3 s	50 k	1.5 M	100 k	3 M	200 k	6 M	500 k	15 M
4 s	50 k	2 M	100 k	4 M	200 k	8 M	500 k	20 M
5 s	50 k	2.5 M	100 k	5 M	200 k	10 M	500 k	25 M
6 s	20 k	1.2 M	50 k	3 M	100 k	6 M	200 k	12 M
8 s	20 k	1.6 M	50 k	4 M	100 k	8 M	200 k	16 M
10 s	20 k	2 M	50 k	5 M	100 k	10 M	200 k	20 M
20 s	10 k	2 M	20 k	4 M	50 k	10 M	100 k	20 M
30 s	5 k	1.5 M	10 k	3 M	20 k	6 M	50 k	15 M
1 min	2 k	1.2 M	5 k	3 M	10 k	6 M	20 k	12 M
2 min	2 k	2.4 M	2 k	2.4 M	5 k	6 M	20 k	24 M

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

Appendix

When the Record Length Is 50 Mpoint or 100 Mpoint

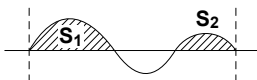
Time/div	Record Length			
	50 Mpoint		100 Mpoint	
	Sample Rate (S/s)	Display Record Length (Points)	Sample Rate (S/s)	Display Record Length (Points)
100 ns	100 M	100	100 M	100
200 ns	100 M	200	100 M	200
500 ns	100 M	500	100 M	500
1 µs	100 M	1 k	100 M	1 k
2 µs	100 M	2 k	100 M	2 k
5 µs	100 M	5 k	100 M	5 k
10 µs	100 M	10 k	100 M	10 k
20 µs	100 M	20 k	100 M	20 k
50 µs	100 M	50 k	100 M	50 k
100 µs	100 M	100 k	100 M	100 k
200 µs	100 M	200 k	100 M	200 k
500 µs	100 M	500 k	100 M	500 k
1 ms	100 M	1 M	100 M	1 M
2 ms	100 M	2 M	100 M	2 M
5 ms	100 M	5 M	100 M	5 M
10 ms	100 M	10 M	100 M	10 M
20 ms	100 M	20 M	100 M	20 M
50 ms	100 M	50 M	100 M	50 M
100 ms	50 M	50 M	100 M	100 M
200 ms	20 M	40 M	50 M	100 M
500 ms	10 M	50 M	20 M	100 M
1 s	5 M	50 M	10 M	100 M
2 s	2 M	40 M	5 M	100 M
3 s	1 M	30 M	2 M	60 M
4 s	1 M	40 M	2 M	80 M
5 s	1 M	50 M	2 M	100 M
6 s	500 k	30 M	1 M	60 M
8 s	500 k	40 M	1 M	80 M
10 s	500 k	50 M	1 M	100 M
20 s	200 k	40 M	500 k	100 M
30 s	100 k	30 M	200 k	60 M
1 min	50 k	30 M	100 k	60 M
2 min	20 k	24 M	50 k	60 M

When the time axis setting is 100 ms or greater (the settings surrounded by bold lines) and the trigger mode is Auto or Auto Level, waveforms are displayed in roll mode.

Appendix 8 How to Calculate the Area of a Waveform

Integ1TY

Area of the positive amplitude : $S_1 + S_2$



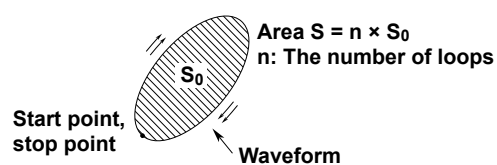
Integ2TY

Area of the positive amplitude – area of the negative amplitude:
 $S_1 + S_3 - S_2$

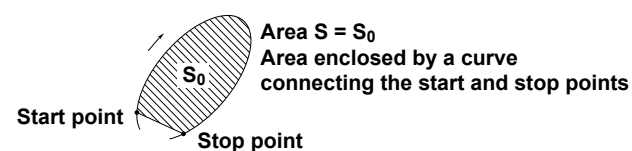


Integ1XY

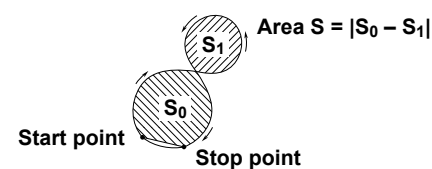
(1) Multiple Loops



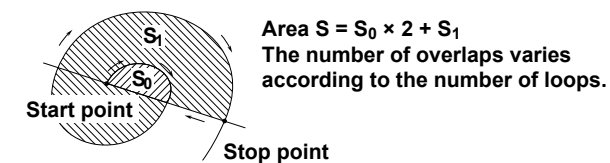
(2) Non-Closed Curve



(3) Loop Tracing a Figure-Eight



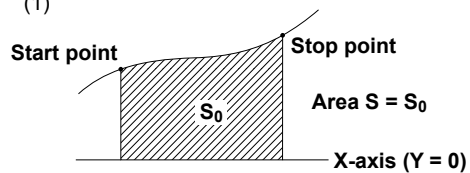
(4) Loop Tracing a Spiral



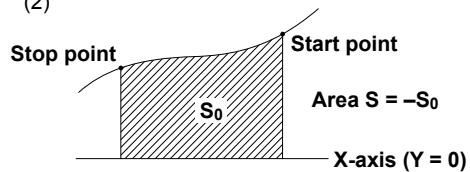
Integ2XY

(1) When Each Y Data Point Corresponds to a Single X Data Point

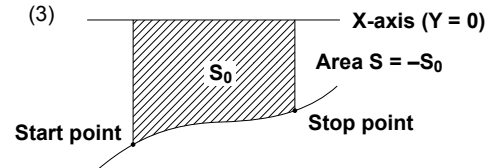
(1)



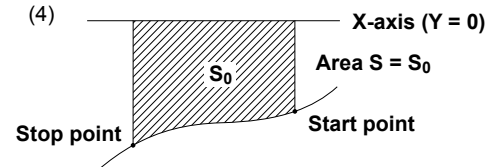
(2)



(3)

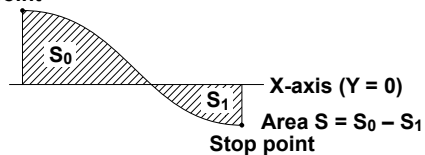


(4)

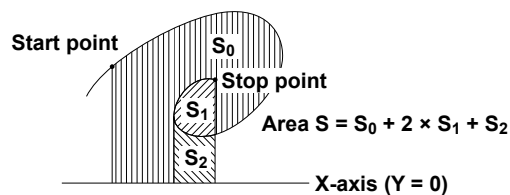
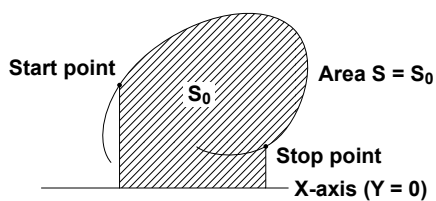


(2) When the Waveform Extends into the Negative Side

Start point



(3) When Multiple Y Data Corresponds to One Point of X Data



Appendix 9 User-Defined Computation

TREND, TRENDM, and TREND functions

Source channels: Voltage waveform, current waveform, power waveform, AUX waveform (C1 to C8, P1 to P4)

Calculation period reference signal: Synchronization source of the element that the source channel belongs to

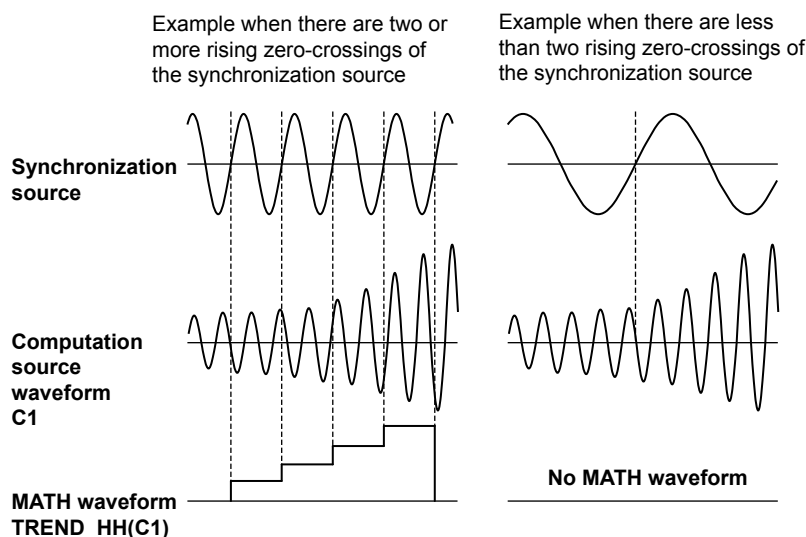
- TREND, TREND_HH, TREND_LL, TREND_XX**

The true rms (RMS) value of the source channel is calculated for the following calculation period.

Function	Calculation Period
TREND	(a) or (b) below by assuming the start point to be the first edge detected in the calculation period (a): For each cycle from the rising edge to the next rising edge (b): For each cycle from the falling edge to the next falling edge
TREND_HH	For each cycle from the rising edge to the next rising edge
TREND_LL	For each cycle from the falling edge to the next falling edge
TREND_XX	(c) or (d) below by assuming the start point to be the first edge detected in the calculation period (c): For each half cycle from the rising edge to the falling edge (d): For each half cycle from the falling edge to the rising edge

If the synchronization source is set to None, the rms value of the entire calculation period is calculated.

For example, TREND_HH(C1) calculates the true rms (RMS) value for each cycle from the rising edge to the next rising edge of the voltage waveform of element 1.



- TRENDM, TRENDM_HH, TRENDM_LL, TRENDM_XX**

The rectified mean value calibrated to the rms value (MEAN) of the source channel is calculated. The calculation period is the same as above.

- TREND, TREND_HH, TREND_LL, TREND_XX**

The simple average (DC) of the source channel is calculated. The calculation period is the same as above.

TRENDF Function

Source channel: Voltage waveform, current waveform (C1 to C8)

Frequency for (a) or (b) below is calculated for the source channel by assuming the start point to be the first edge detected in the calculation period.

(a): For each cycle from the rising edge to the next rising edge

(b): For each cycle from the falling edge to the next falling edge

ZC Function

Source channel: Voltage waveform, current waveform (C1 to C8), input signal received through the TRIGGER IN terminal (EXT)

The zero-crossing of the source channel is detected.

Waveform Label	Description
0	Period until the first zero-crossing is detected
-1	Period where the signal is lower than the zero-crossing
1	Period where the signal is higher than the zero-crossing
0	Period where the last zero-crossing cannot be detected

Digital Filter

Type

Type	Bandwidth
Gauss (Gaussian)	LowPass
Sharp	LowPass/HighPass/BandPass
IIR (Butterworth)	LowPass/HighPass/BandPass

Filter Order

See the following table for the filter orders.

		2%	5%	10%	20%	30% (Cutoff)
Gauss	LowPass	49	21	9	5	5
Sharp	LowPass	88	36	18	9	8
	HighPass	159	65	33	17	13
IIR	LowPass	4	4	4	3	2
	HighPass	4	4	4	4	3

Filter Characteristics

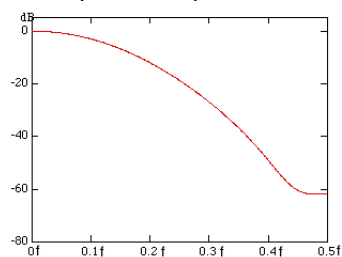
Filter	Pass-band Ripple	Attenuation Slope	Attenuation at the Stop-band	Phase
Gauss	0 dB	*	–	Linear phase
Sharp	± 0.3 dB	–40 dB at 1 oct (Lowpass),	–40 dB	Linear phase
		–40 dB at –1 oct (Highpass)	–	Linear phase
IIR	0 dB	–5 dB at 1/6 oct (Lowpass),	–	Non-linear phase
		–20 dB at –1 oct (Highpass)	–	

* For Gaussian filter: $-3.0 \times (f/f_c)^2$ dB (f: frequency, f_c : cutoff frequency)

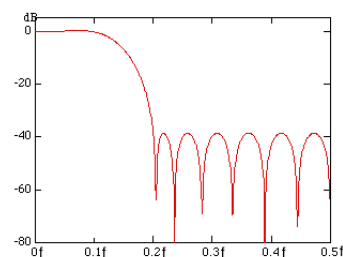
Frequency Characteristics of Filters

f: Sampling frequency (Hz)

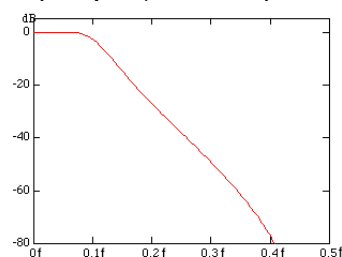
Gauss (10% cutoff)



Sharp (Low pass; 10% cutoff)



IIR (Low pass; 10% cutoff)



The higher the filter order the longer it takes for computation.

Hilbert Function (HLBT)

Normally, when we analyze real-time signals, it is useful to think of these signals as the real part of functions of complex variables, and to carry out the actual signal analysis using such functions.

If the real-time signal is considered to be the real part of the function, the imaginary part can be determined with the Hilbert transform of the real part.

The Hilbert transform does not change the order of the individual variables. The Hilbert transform of a time signal results in another time signal.

The Hilbert transform procedure is as follows.

When a time-domain signal is transformed, the signal is first transformed into the frequency domain through Fourier transform. Next, the phase of each frequency component is shifted by -90 degrees if the frequency is positive and $+90$ degrees if the frequency is negative. Lastly, taking the inverse Fourier transform completes the Hilbert transform.

Example

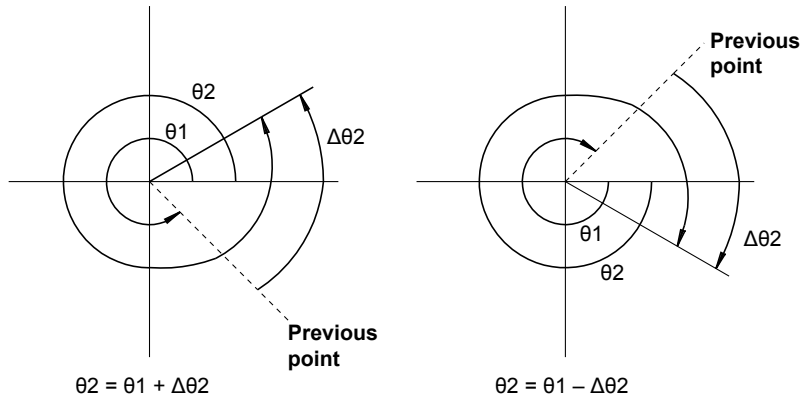
- The Hilbert transform can be used to analyze an envelope waveform.
 AM (amplitude modulation): $\text{SQRT}(C1 \times C1 + \text{HLBT}(C1) \times \text{HLBT}(C1))$
 Demodulation of an FM Signal: $\text{DIF}(\text{PH}(C1, \text{HLBT}(C1)))$

Phase Function (PH)

Phase function $\text{PH}(X1, Y1)$ computes $\tan^{-1}(X1/Y1)$.

The phase function takes the phase of the previous point into consideration and continues to sum even when the value exceeds $\pm\pi$ (the ATAN function reflects at $\pm\pi$).

The unit is radians.

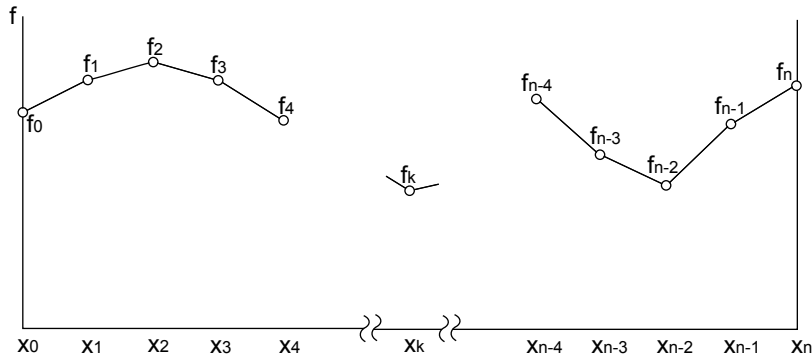


Differentiation and Integration (DIF, DDIF, INTG, and IINTG)

Differentiation (DIF, DDIF)

The computation of the first-order and second-order differentiated values uses the 5th order Lagrange interpolation formula to derive a point of data from the five points of data before and after the target.

The figure below shows data f_0 to f_n with respect to sampling times x_0 to x_n . The derivative and integrated values corresponding to these data points are computed as shown below.



- Equations for First Order Derivatives

Point x_0 $f_0' = \frac{1}{12h} [-25f_0 + 48f_1 - 36f_2 + 16f_3 - 3f_4]$

Point x_1 $f_1' = \frac{1}{12h} [-3f_0 - 10f_1 + 18f_2 - 6f_3 + f_4]$

Point x_2 $f_2' = \frac{1}{12h} [f_0 - 8f_1 + 8f_3 - f_4]$

Point x_k $f_k' = \frac{1}{12h} [f_{k-2} - 8f_{k-1} + 8f_{k+1} - f_{k+2}]$

Point x_{n-2} $f_{n-2}' = \frac{1}{12h} [f_{n-4} - 8f_{n-3} + 8f_{n-1} - f_n]$

Point x_{n-1} $f_{n-1}' = \frac{1}{12h} [-f_{n-4} + 6f_{n-3} - 18f_{n-2} + 10f_{n-1} + 3f_n]$

Point x_n $f_n' = \frac{1}{12h} [3f_{n-4} - 16f_{n-3} + 36f_{n-2} - 48f_{n-1} + 25f_n]$

$h = \Delta x$ is the sampling interval (s) (example: $h = 200 \times 10^{-6}$ at 5 kHz)

- Equations for Second Order Derivatives (DDIF)

Point x_0 $f_0'' = \frac{1}{12h^2} [35f_0 - 104f_1 + 114f_2 - 56f_3 + 11f_4]$

Point x_1 $f_1'' = \frac{1}{12h^2} [11f_0 - 20f_1 + 6f_2 + 4f_3 - f_4]$

Point x_2 $f_2'' = \frac{1}{12h^2} [-f_0 + 16f_1 - 30f_2 + 16f_3 - f_4]$

Point x_k $f_k'' = \frac{1}{12h^2} [-f_{k-2} + 16f_{k-1} - 30f_k + 16f_{k+1} - f_{k+2}]$

Point x_{n-2} $f_{n-2}'' = \frac{1}{12h^2} [-f_{n-4} + 16f_{n-3} - 30f_{n-2} + 16f_{n-1} - f_n]$

Point x_{n-1} $f_{n-1}'' = \frac{1}{12h^2} [-f_{n-4} + 4f_{n-3} + 6f_{n-2} - 20f_{n-1} + 11f_n]$

Point x_n $f_n'' = \frac{1}{12h^2} [11f_{n-4} - 56f_{n-3} + 114f_{n-2} - 104f_{n-1} + 35f_n]$

Integration (INTG, IINTG)

The first and second order integrated values are derived using the trapezoidal rule.

- Equations for First Order Integration (INTG)

Point $x_0 \quad I_0 = 0$

Point $x_1 \quad I_1 = \frac{1}{2} (f_0 + f_1)h$

Point $x_2 \quad I_2 = \frac{1}{2} (f_0 + f_1)h + \frac{1}{2} (f_1 + f_2)h = I_1 + \frac{1}{2} (f_1 + f_2)h$

Point $x_n \quad I_n = I_{n-1} + \frac{1}{2} (f_{n-1} + f_n)h$

- Equations for Second Order Integration (IINTG)

Point $x_0 \quad I_{I0} = 0$

Point $x_1 \quad I_{I1} = \frac{1}{2} (I_0 + I_1)h$

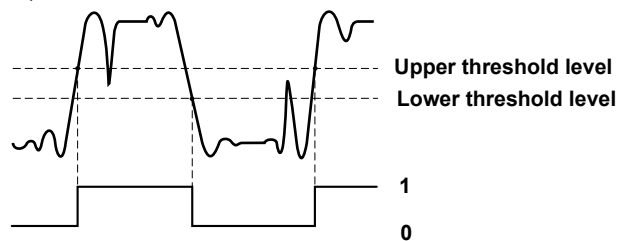
Point $x_2 \quad I_{I2} = \frac{1}{2} (I_0 + I_1)h + \frac{1}{2} (I_1 + I_2)h = I_{I1} + \frac{1}{2} (I_1 + I_2)h$

Point $x_n \quad I_{In} = I_{In-1} + \frac{1}{2} (I_{n-1} + I_n)h$

Binary Conversion (BIN)

Binary conversion is performed through the use of the specified threshold levels.

BIN(C1)



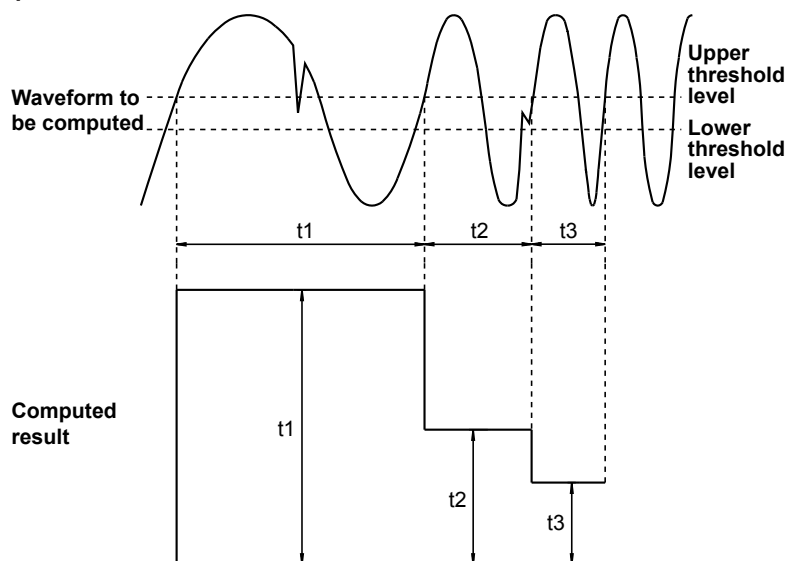
Pulse Width Computation

The signal is converted to binary values according to the preset threshold levels, and the time of the pulse width is plotted as the Y-axis value for that interval.

You can select one of the following interval.

- PWHH From a rising edge to the next rising edge.
- PWHL From a rising edge to the next falling edge.
- PWLH From a falling edge to the next rising edge.
- PWLL From a falling edge to the next falling edge.
- PWXX From a rising or falling edge to the next rising or falling edge.
- FV Inverse of PWHH

Example for PWHH



FFT Function - user-defined

Each frequency component G of a linear spectrum is represented by $G = R + jI$, where R is the real part and I is the imaginary part.

Linear Spectrum

The linear spectrum can be directly determined with the FFT. Through this spectrum, the magnitude and phase of each frequency component included in the measured waveform can be found. The power spectrum and cross spectrum can also be determined from the linear spectrums of one or two signals.

The FFT is a complex function. The linear spectrum produces the real part and imaginary part of the frequency components. The magnitude and phase of the linear spectrum can also be determined from this result.

The PX8000 can determine the following spectrums.

Item	Expression	Computation
Real part	LS-REAL	R
Imaginary part	LS-IMAG	I
Magnitude	LS-MAG	$\sqrt{R^2 + I^2}$
Log magnitude	LS-LOGMAG	$20 \times \log \sqrt{R^2 + I^2}$
Phase	LS-PHASE	$\tan^{-1}(I/R)$

Log magnitude reference (0 dB): 1 V_{peak}

RMS Spectrum

The RMS spectrum expresses the amplitudes of the linear spectrum with RMS values. It does not contain phase information.

The PX8000 can determine the following spectra.

Item	Expression	Computation
Magnitude	RS-MAG	$\sqrt{(R^2 + I^2)/2}$
Log magnitude	RS-LOGMAG	$20 \times \log \sqrt{(R^2 + I^2)/2}$

Log magnitude reference (0 dB): 1 Vrms

Power Spectrum

The power spectrum expresses the power (squared value) of each frequency component included in the measured signal. It is determined by taking the product of the linear spectrum and its complex conjugate. It does not contain phase information.

The PX8000 can determine the following spectrums.

Item	Expression	Computation
Magnitude	PS-MAG	DC component $R^2 + I^2$ AC component $(R^2 + I^2)/2$
Log magnitude	PS-LOGMAG	DC component $10 \times \log(R^2 + I^2)$ AC component $10 \times \log\{(R^2 + I^2)/2\}$

Log magnitude reference (0 dB): 1 Vrms²

Power Spectrum Density

The power spectrum density expresses the power spectrum per unit frequency. It is determined by dividing the power spectrum by the frequency resolution Δf found during the analysis of the power spectrum. The computation varies depending on the window function.

Power spectrum density is used to compare power spectrums analyzed at different frequency bands. However, it is not necessary for signals having a line spectrum such as sine waves.

The PX8000 can determine the following spectrums.

Item	Expression	Computation
Magnitude	PSD-MAG	$PS-MAG/(\Delta f \times k)$
Log magnitude	PSD-LOGMAG	$10 \times \log PS-MAG/(\Delta f \times k)$

Log magnitude reference (0 dB): 1 Vrms²

Overall Value

The overall value is the total RMS value determined from the frequency spectrum included in the signal. The overall value is the square root of the summation of the power spectrums of all frequencies.

$$\text{Overall value} = \sqrt{\frac{2 \times PS_0 + \sum PS_i}{k}} \quad (\text{Vrms})$$

“Rms = overall value” appears on the screen when automated measurement of waveform parameters is being performed (MEASURE is set to ON) on the channel that has been selected for power spectrum computation (PS or PSD) and Rms is set to ON.

However, when Window is set to Exponential, overall values are not displayed.

k

k varies as indicated below depending on the selected time window.

Time Window Type	k
Rect (rectangular window)	1
Hanning (hanning window)	1.5
FlatTop (flattop window)	3.19693
Hamming (hamming window)	1.3628

Cross Spectrum

The cross spectrum is determined from two signals. It is the product of the linear spectrum of one signal (G_y) and the complex conjugate (G_x^*) of the linear spectrum of the other signal (G_x).

If the linear spectrums of the two signals are represented by

$$G_x = R_x + jI_x$$

$$G_y = R_y + jI_y$$

then the cross spectrum G_{yx} is

$$\begin{aligned} G_{yx} &= G_y \times G_x^* \\ &= (R_y + jI_y)(R_x - jI_x) = R_{yx} + jI_{yx} \end{aligned}$$

$$\text{where } R_{yx} = R_y R_x + I_y I_x$$

$$I_{yx} = R_x I_y - R_y I_x$$

The PX8000 can determine the following spectrums.

Item	Expression	Computation
Real part	CS-REAL	$R_{yx}/2$
Imaginary part	CS-IMAG	$I_{yx}/2$
Magnitude	CS-MAG	$\sqrt{(R_{yx}^2 + I_{yx}^2)}/2$
Log magnitude	CS-LOGMAG	$10 \times \log (\sqrt{(R_{yx}^2 + I_{yx}^2)}/2)$
Phase	CS-PHASE	$\tan^{-1}(I_{yx}/R_{yx})$

Transfer Function

The transfer function expresses the frequency responses of the input to and the output from the transfer system. The transfer function is determined by the ratio of the output linear spectrum (G_y) and the input spectrum (G_x) at each frequency. Also, as can be seen from the following equation, the transfer function can be defined as the ratio of the cross spectrum of the input and output (G_{yx}) and the input power spectrum (G_{xx}).

$$\begin{aligned} \text{Transfer function} &= G_y/G_x = (G_y \times G_x^*)/(G_x \times G_x^*) = G_{yx}/G_{xx} \\ &= (R_{yx} + jI_{yx})/(R_x^2 + I_x^2) \end{aligned}$$

The PX8000 can determine the following items.

Item	Expression	Computation
Real part	TF-REAL	$R_{yx}/(R_x^2 + I_x^2)$
Imaginary part	TF-IMAG	$I_{yx}/(R_x^2 + I_x^2)$
Magnitude	TF-MAG	$\sqrt{(R_{yx}^2 + I_{yx}^2)}/(R_x^2 + I_x^2)$
Log magnitude	TF-LOGMAG	$20 \times \log \sqrt{(R_{yx}^2 + I_{yx}^2)}/(R_x^2 + I_x^2)$
Phase	TF-PHASE	$\tan^{-1}(I_{yx}/R_{yx})$

The magnitude of the transfer function shows the ratio of the magnitudes of the output linear spectrum and the input linear spectrum while the phase shows the phase difference of the two.

Coherence Function

The coherence function expresses the ratio of the output power generated by the input signal to the transfer system and the total output power.

$$\text{Coherence function} = G_{yx} \times G_{yx}^*/(G_{xx} \times G_{yy})$$

Item	Expression	Computation
Phase	CH-MAG	$\tan^{-1}(R_{yx}^2 + I_{yx}^2)/(G_{xx} \times G_{yy})$

If the output signal is due entirely to the input signal, the coherence function becomes 1. As the ratio decreases, it falls below 1. Thus, the coherence function always takes on a value between 0 and 1.

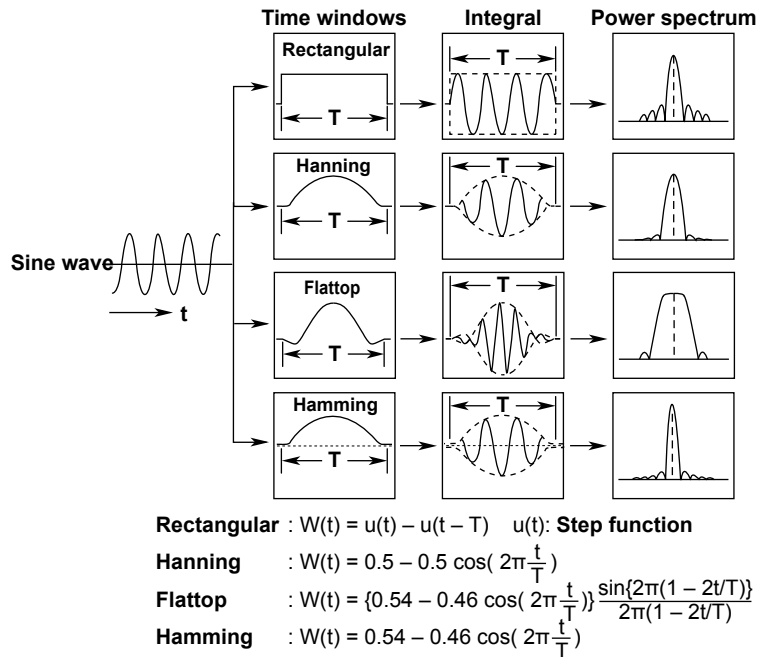


On one data acquisition, the coherence function becomes 1 across all frequencies. Make sure to take the frequency average of the computation.

Time Windows

You can use a rectangular, Hanning, flattop, Hamming, or exponential time window.

The rectangular window is suited to transient signals, such as impulse waves, which attenuate completely within the time window. The Hanning, flattop, and Hamming windows allow continuity of the signal by gradually attenuating the parts of the signal located near the ends of the time window down to the 0 level. Hence, they are suited to continuous signals. The Hanning window provides a higher frequency resolution compared to the flattop window. However, the flattop window has a higher level of accuracy. The Hamming window is a corrected Hanning window. The frequency resolution of its main beam is greater than that of the Hanning window. The Hamming window is best suited for dividing close signals. When the waveform being analyzed is a continuous signal, consider the above characteristics in selecting the proper window to be applied. When the waveform being analyzed is a continuous signal, consider the above characteristics in selecting the proper window to be applied.



The exponential window is used to eliminate noise components from the signal. It is suited for the signals of impulse-excitation frequency-response tests and other similar signals. On the PX8000, the exponential window and force window are activated simultaneously.

Exponential Window

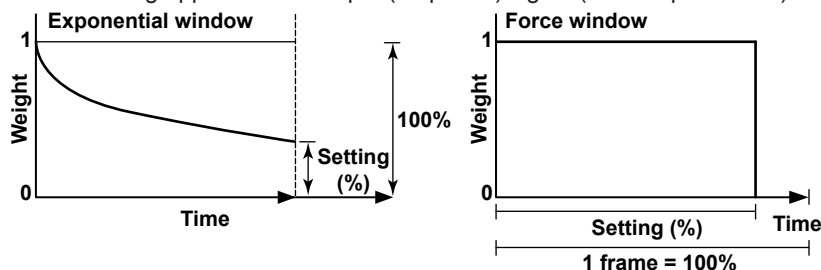
The damping rate is set in terms of the weight of the last data point, with the weight of the first data point in the specified number of FFT points taken to be 100% (= 1). You can set the damping rate in the range of 1 to 100% (1% resolution). The exponential window damps the signal exponentially along the time axis. It is effective when the signal does not attenuate fully within the record length. When the damping rate is set to 100%, the window functions like a rectangular window.

Force Window

Set the area over which computation is performed in terms of a percentage from the first FFT point, taking the set number of FFT points to be 100%. The areas (force 1 and force 2) can be set in the range of 1 to 100% (1% resolution) of the input/output signal. When an area is set to 100%, the window functions like a rectangular window. On the PX8000, the outer area is the average of the results of the window function for the data outside the area.

Force1: This setting applies to the input signals of one-waveform and two-waveform FFTs.

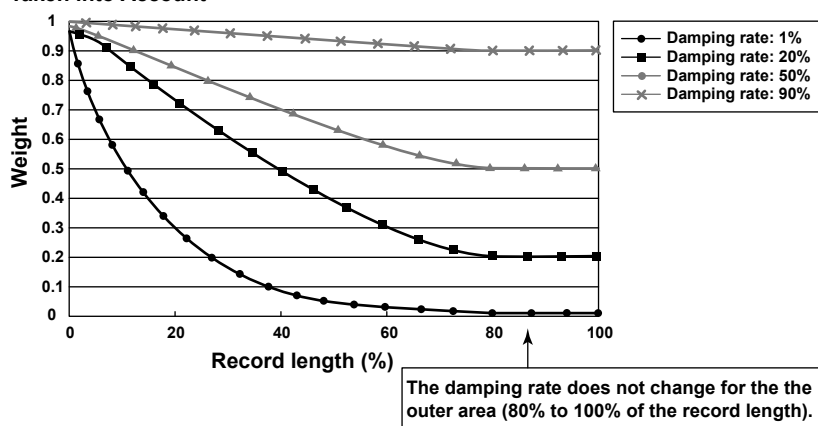
Force2: This setting applies to the output (response) signal (second parameter) of a two-waveform FFT.



Combined Form of the Exponential and Force Windows

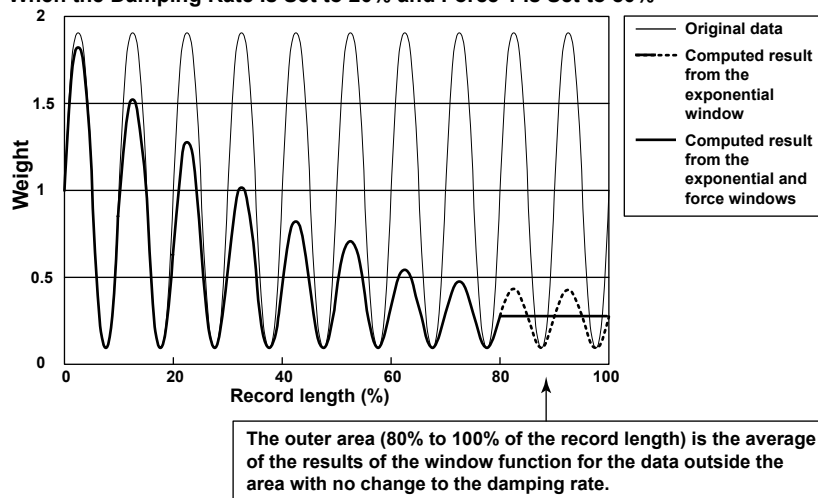
The PX8000 uses a window function that combines the exponential window and force window to perform computations. The outer area of the force window is the average of the results of the window function for the data outside the area.

When the Force Window Area Is Set to 80% and the Data Outside the Area Is Taken into Account



- Application Example on the PX8000

When the Damping Rate Is Set to 20% and Force 1 Is Set to 80%



Notes about Executing FFT Computation

Computation is normally performed on the sampled data in the acquisition memory. However, for waveforms that have been acquired in envelope mode, computation is performed on the maximum and minimum values per acquisition interval.

Appendix 10 USB Keyboard Key Assignments

PX8000	USB Keyboard
AQUIRE	CTRL+A
MATH	CTRL+B
Execute PRINT	CTRL+C or PRINT SCREEN
DISPLAY MODE	CTRL+D
DISPLAY SETTING	CTRL+E
FILE	CTRL+F
HELP	CTRL+G
NUMERIC	CTRL+H
Execute SAVE	CTRL+I
MANUALTRIG	CTRL+J
KEY PROTECT	CTRL+K
ALL CH	CTRL+L
MEASURE	CTRL+M
NUM LOCK	CTRL+N
POSITION/DELAY	CTRL+P
Execute CLEAR TRACE	CTRL+Q
Execute RESET	CTRL+R
SHIFT	CTRL+S
MODE (TRIGGER)	CTRL+T
CURSOR	CTRL+U
SIMPLE/ENHANCED	CTRL+W
NULL	CTRL+Y
ZOOM	CTRL+Z
U1 (CH1)	CTRL+1
I1 (CH2)	CTRL+2
U2 (CH3) or AUX3 (CH3)	CTRL+3
I2 (CH4) or AUX4 (CH4)	CTRL+4
U3 (CH5) or AUX5 (CH5)	CTRL+5
I3 (CH6) or AUX6 (CH6)	CTRL+6
U4 (CH7) or AUX7 (CH7)	CTRL+7
I4 (CH8) or AUX8 (CH8)	CTRL+8
SET	CTRL+ENTER
UTILITY	CTRL+/
ELEM1	CTRL+F1
ELEM2 or Pm2	CTRL+F2
ELEM3 or Pm3	CTRL+F3
ELEM4 or Pm4	CTRL+F4
P1	CTRL+F5
P2	CTRL+F6
P3	CTRL+F7
P4	CTRL+F8
Turn ZOOM POSITION to the right	CTRL+INSERT
Turn VERTICAL POSITION to the right	CTRL+HOME
Turn ZOOM POSITION to the left	CTRL+DELETE
Turn VERTICAL POSITION to the left	CTRL+END
START/STOP	CTRL+* or F12
FFT	CTRL+SHIFT+B
PRINT MENU	CTRL+SHIFT+C
CAL	CTRL+SHIFT+D
X-Y	CTRL+SHIFT+E
FILE UTILITY	CTRL+SHIFT+F
HISTORY	CTRL+SHIFT+H
SAVE MENU	CTRL+SHIFT+I
GO/NO-GO	CTRL+SHIFT+M
ACTION	CTRL+SHIFT+T
NULL SET	CTRL+SHIFT+Y
SEARCH	CTRL+SHIFT+Z
EXP (ELEM4 or Pm4)	E when NUM LOCK is illuminated on the PX8000
k (U4 (CH7) or AUX7 (CH7)) + ENTER (P4)	K when NUM LOCK is illuminated on the PX8000

Appendix


PX8000	USB Keyboard
m (I4 (CH8) or AUX8 (CH8)) + ENTER (P4)	M when NUM LOCK is illuminated on the PX8000
1 (I1 (CH2))	1 when NUM LOCK is illuminated on the PX8000
2 (I2 (CH4) or AUX4 (CH4))	2 when NUM LOCK is illuminated on the PX8000
3 (I3 (CH6) or AUX6 (CH6))	3 when NUM LOCK is illuminated on the PX8000
4 (U1 (CH1))	4 when NUM LOCK is illuminated on the PX8000
5 (U2 (CH3) or AUX3 (CH3))	5 when NUM LOCK is illuminated on the PX8000
6 (U3 (CH5) or AUX5 (CH5))	6 when NUM LOCK is illuminated on the PX8000
7 (ELEM1)	7 when NUM LOCK is illuminated on the PX8000
8 (ELEM2 or Pm2)	8 when NUM LOCK is illuminated on the PX8000
9 (ELEM3 or Pm3)	9 when NUM LOCK is illuminated on the PX8000
0 (P1)	0 when NUM LOCK is illuminated on the PX8000
ENTER (P4)	ENTER when NUM LOCK is illuminated on the PX8000
. (P2)	. when NUM LOCK is illuminated on the PX8000
– (P3)	– when NUM LOCK is illuminated on the PX8000
ESC	ESC or F8
Select soft key 1	F1
Select soft key 2	F2
Select soft key 3	F3
Select soft key 4	F4
Select soft key 5	F5
Select soft key 6	F6
Select soft key 7	F7
SNAPSHOT	PAUSE
Turn ZOOM MAG to the right	INSERT
Turn VERTICAL SCALE to the right	HOME
Turn HORIZONTAL TIME/DIV to the right	PAGE UP
Turn ZOOM MAG to the left	DELETE
Turn VERTICAL SCALE to the left	End
Turn HORIZONTAL TIME/DIV to the left	PageDown
Right arrow	→
Left arrow	←
Up arrow	↑
Down arrow	↓

Appendix 11 Default Values


Example for a Model with Four Power Measurement Elements Installed

The default settings vary depending on the number of installed input modules and what options are installed.

Item	Setting
WIRING	
Wiring	1P2W
η Formula	
$\eta 1$	PΣB/PΣA
$\eta 2$	PΣA/PΣB
$\eta 3$	OFF/OFF
$\eta 4$	OFF/OFF
Udef1	P1+None+None+None
Udef2	P1+None+None+None
Element Independent	OFF
ΔMeasure	
ΔMeasure Type	-
ΔMeasure Mode	rms
Sensor Range Display Type	Direct
Deskew Setup	
Diff Time U	0.000 ns
Diff Time I	0.000 ns
Diff Time Sen	0.000 ns
ELEM1 to ELEM4 (voltage module and current module)	
Line Filter	OFF
Freq Filter	OFF
Scaling	OFF
VT Scaling	1.0000
CT Scaling	1.0000
SF Scaling	1.0000
Sync Source	ELEM1: I1
	ELEM2: I2
	ELEM3: I3
	ELEM4: I4
CT Preset	Others
ELEM2 to ELEM4 (AUX module)	
Motor Mode	OFF
Name	ELEM2: Pm2
	ELEM3: Pm3
	ELEM4: Pm4
Scaling	1.0000
Unit	W
Sync Source	None
U1 to U4 (voltage module)	
Range	1000 V
Position	0.00 div
Display	ON
Label	Channel name
Vertical Scale	DIV
Vertical Zoom	×1
Offset	0.0 V

Auto Range	OFF
Item	Setting
I1 to I4 (current module)	
Range	5A
Position	0.00 div
Display	ON
Label	Channel name
Vertical Scale	DIV
Vertical Zoom	×1
Offset	0.00 A
Auto Range	OFF
Ext Sensor	OFF
Sensor Ratio	10.0000 mV/A (mΩ)
Sensor Preset	Others
P1 to P4 (voltage module and current module)	
Position	0.00 div
Display	ON
Label	Channel name
Vertical Scale	DIV
Vertical Zoom	×2
Offset	0W
U2 to U4, I2 to I4 (AUX module)	
Range	250 V
Position	0.00 div
Display	ON
Label	Channel name
Vertical Scale	DIV
Vertical Zoom	×1
Offset	0.0 V
Auto Range	OFF
Aux Settings	Analog
Coupling	DC
Probe	10:1
BandWidth	Full
Pulse Level High	2.4 V
Pulse Level Low	0.4 V
TIME/DIV	
	50 ms/div
MODE	
	Auto
POSITION/DELAY	
Position	50.0%
Delay	0.00 μs
SIMPLE/ENHANCED	
Setting	Simple
Source	U1
Slope	Rising
Level	0.0 V
Hysteresis	
Hold Off	0.00 μs
ACQUIRE	
Record Length	1 M
Acquisition Mode	Normal
Trigger Mode	Auto
Acquisition Count	Infinite
Time Base	Int

Appendix


Item	Setting
DISPLAY MODE	
	Numeric+Wave
DISPLAY SETTING (Numeric)	
Format	4 Items
Item No.	1
Function	Urms
Element/ Σ	Element1
Order	Total
DISPLAY SETTING (Wave)	
Format	3
Wave Setup	
Display	ON
Map	Auto
Label	Channel name
V Scale	DIV
Offset	U1 to U4: 0.0 V I1 to I4: 0.00 A P1 to P4: 0 W AUX3 to AUX8: 0.0 V
Position	0.00 div
V Zoom	U1 to U4: $\times 1$ I1 to I4: $\times 1$ P1 to P4: $\times 2$ AUX3 to AUX8: $\times 1$
Dot Connect	Line
Graticule	Grid ()
Scale Value	ON
Trace Label	OFF
Extra Window	OFF
DISPLAY SETTING (Bar)	
Format	1
Item No.	1
Function	U
Element	Element1
Start Order	1
End Order	100
Numeric	OFF
x Order	1
+ Order	15
DISPLAY SETTING (Vector)	
Format	1
Item No.	1
Vector Object	ΣA
U Mag	1.000
I Mag	1.000
Numeric	ON

Item	Setting
NUMERIC	
Numeric Measure	ON
Period	Zero Cross
Averaging	OFF
User Defined Function	ON/OFF
Function1	OFF
Function2	OFF
Function3	OFF
Function4	OFF
Function5	OFF
Function6	OFF
Function7	OFF
Function8	OFF
Function9	OFF
Function10	OFF
Function11	OFF
Function12	OFF
Function13	OFF
Function14	OFF
Function15	OFF
Function16	OFF
Function17	OFF
Function18	OFF
Function19	OFF
Function20	OFF
Formula	
S Formula	Urms*Irms
S,Q Formula	Type1
Pc Formula	IEC76-1(1976)
IEC76-1(1976)'s P1 and P2	P1 = 0.5000, P2 = 0.5000
Phase	180 Lead/Lag
Harmonics	
Harmonics Mode	ON
PLL Source	U1
Min Order	1
Max Order	100
Thd Formula	1/Total
Start Position	-5.000 div
X-Y	
Window1/2	OFF
Display	OFF
Setup	
Display	ON: XY1, XY5 OFF: XY2 to XY4, XY6 to XY8
X Trace	U1
Y Trace	I1
Start Point	-5.00 div
End Point	5.00 div
Trace clear on Start	ON
Main Ratio	50%
Window Layout	Side
Combine Display	OFF
Dot Connect	Line
Decimation	100k

Appendix

Item	Setting
ZOOM	
Display(Zoom1)	OFF
Display(Zoom2)	OFF
Zoom1/2 Position	0.0000 div
Format Zoom1/2	Main
Main Ratio	50%
Window Layout	Side
Auto Scroll	
Target	Zoom1
Speed	4
Allocation	All ON
CURSOR	
Type	OFF
Horizontal	
Trace	U1
Cursor1	3.00 div
Cursor2	-3.00 div
Vertical	
Trace	U1
Cursor1	-4.000 div
Cursor2	4.000 div
Marker	
Marker #	Marker1 X
Trace	U1
Position	-3.000 div
Marker From	Mark
Degree	
Trace	U1
Cursor1	-4.000 div
Cursor2	4.000 div
Ref1	-2.000 div
Ref2	2.000 div
RefValue	360
H & V	
Trace	U1
V-Cursor1	-4.000 div
V-Cursor2	4.000 div
H-Cursor1	3.00 div
H-Cursor2	-3.00 div
MEASURE	
Mode	OFF
Measure Setup	
Trace	U1
Detail Parameter	
Distal/Mesial/Proximal	
Mode	%
Distal	90.00%
Mesial	50.00%
Proximal	10.00%
High/Low	Auto
Intg Mode	Normal
Delay Setup	
Mode	OFF
Polarity	Rising
Edge Count	1
Reference	Trace
Reference Trace	
Trace	U1
Polarity	Rising
Edge Count	1
Time Range1	-5.00 div

Item	Setting
Time Range2	5.00 div
(When Mode is set to ON, Statistics)	
1-Cycle Mode	OFF
(When Mode is set to Cycle Statistics)	
Cycle Trace	U1
MATH	
Mode	OFF
Math Setup	All OFF
Select Math Trace	1
Scaling Mode	Auto
Upper	1.0000
Lower	-1.0000
Start Point	-5.00 div
End Point	5.00 div
FFT Setup	
FFT Points	1k
Window	Hanning
Filter Setup	
Filter Type	Gauss
Filter Band	Low-Pass
CutOff1	10.0%
Constant Setup	
K1 to K8	1.0000
FFT	
FFT1/2 Display	OFF
FFT Setup	
Type	PS
Sub Type	LOGMAG
Source	U1
Window	Hanning
Vert. Scale Mode	Auto
Center	0.0000
Sensitivity	200.00E-03
Start Point	-5.00 div
FFT Points	1k
Main Ratio	50%
Window Layout	Side
Horiz. Axis	Log Hz
Unit	
Horiz. Scale	Auto
GO/NO-GO	
Mode	OFF
Judgement Setup	
Mode	X
Trace	U1
Zone No.	Zone1
Logic	AND
ActCondition	Fail
Sequence	Continue
Acquisition Count	Infinite
Remote	OFF
Action Setup	
Beep	OFF
Print Image	OFF
Save Waveform	OFF
Save Numeric	OFF
Save Image	OFF
Time Range1	-5.00 div
Time Range2	5.00 div

Item	Setting
ACTION	
Mode	OFF
Action Setup	
Beep	OFF
Print Image	OFF
Save Waveform	OFF
Save Numeric	OFF
Save Image	OFF
SEARCH	
Type	Edge
Edge	
Trace	U1
Level	0.0 V
Polarity	Rising
Hysteresis	
Count	1
Result Window	Zoom1
Pattern No.	No Match
Start Point	-5.00 div
End Point	5.00 div
Time	
Absolute Time	Current date and time
Result Window	Zoom1
HISTORY	
Display Mode	1 Record
Select Record	0
Start Record	0
End Record	Oldest number
Search Mode	OFF
PRINT MENU	
Print To	File
Format	PNG
Color	ON
Background	Normal
File Setup	
Auto Naming	Numbering
File Name	
Comment	
FILE	
Save_Waveform	
Auto Naming	Numbering
Data Type	Binary
Range	Main
History	One
Save Trace	All ON
Save_Numeric	
Auto Naming	Numbering
Target	Selected
Select Items	Element1
	Urms, Irms, P, S, Q, λ, Φ, FreqU, FreqI
Decimal Point for CSV	Point
File	
Save_Setup	
Auto Naming	Numbering
Save_Others	
Auto Naming	Numbering
Data Type	Screen Image
Format	PNG
Color	ON
Background	Normal

Item	Setting
CAL	
Cal at End for Elements	ON
Cal on Start for Auxiliaries	Auto
NULL SET	
NULL Setup	All ON
UTILITY	
System Config	
Date/Time	
Display	ON
Format	Year/Month/Day
Time Diff .GMT	Hour: 9, Minute: 0
Time Synchro	
Time Synchro	OFF
IRIG Format	A
Modulation	AM
Impedance	50
Language	
Menu	English
Message	Depends on the language suffix code
LCD	
Auto OFF	OFF
Auto OFF Time	1 min
Brightness	3
Storage Manager	
Media	SD
USB Keyboard	Depends on the language suffix code
Remote Ctrl	
GP-IB Address	1
Network Time Out	Infinite
Network	
TCP/IP	
DHCP	ON
DNS	Auto
FTP Server	
User Name	anonymous
TimeOut(s)	1800
Net Drive	
LoginName	anonymous
Passive	OFF
TimeOut(s)	15
SNTP	
TimeOut(s)	3
Adjust at Power ON	OFF
Preference	
Power On Action	
Start	OFF
Action	OFF
Terminal Setup	
Remote Stop	ON
Trigger Out	Normal
Pulse Width	1 ms
Display Setup	
Menu Font Size	Large
Base Color	Blue
Scale Font Size	Small
Scale On Item	All
Numeric Frame	ON
Numeric Resolution	5 dgts

Appendix

Item	Setting
Intensity	
Grid	3
Cursor	8
Marker	7
Key/Knob Setup	
Click Sound	ON
START/STOP Response Time	Quick
Key Protect	
Type	All
Release Type	Key
Freq Display at Frequency Low	Error
Aux Display at Pulse Freq Low	Error
Self Test	Keyboard
Setup Data Store/Recall No.	1

Numeric Data Display Order (Example for a Model with Four Power Measurement Elements Installed)

If you reset the order of the numeric data using Reset Items Exec, the data of each measurement function is displayed in the order indicated in the table below.

4 Items Display

Page											
1	2	3	4	5	6	7	8	9	10	11	12
Urms1	Urms2	Urms3	Urms4	UrmsΣA	UrmsΣB	η1	F1:P-loss	F5:D-UrmsS	F9:D-UmnT	F13	F17
Irms1	Irms2	Irms3	Irms4	IrmsΣA	IrmsΣB	η2	F2:U-ripple	F6:D-UrmsT	F10:PhiU3-U2	F14	F18
P1	P2	P3	P4	PΣA	PΣB	η3	F3:I-ripple	F7:D-UmnR	F11:Pp-p	F15	F19
λ1	λ2	λ3	λ4	λΣA	λΣB	η4	F4:D-UrmsR	F8:D-UmnS	F12	F16	F20

8 Items Display

Page											
1	2	3	4	5	6	7	8	9	10	11	12
Urms1	Urms2	Urms3	Urms4	UrmsΣA	UrmsΣB	P1	F1:P-loss	F9:D-UmnT	F17	-	-
Irms1	Irms2	Irms3	Irms4	IrmsΣA	IrmsΣB	P2	F2:U-ripple	F10:PhiU3-U2	F18	-	-
P1	P2	P3	P4	PΣA	PΣB	P3	F3:I-ripple	F11:Pp-p	F19	-	-
S1	S2	S3	S4	SΣA	SΣB	P4	F4:D-UrmsR	F12	F20	-	-
Q1	Q2	Q3	Q4	QΣA	QΣB	η1	F5:D-UrmsS	F13	-	-	-
λ1	λ2	λ3	λ4	λΣA	λΣB	η2	F6:D-UrmsT	F14	-	-	-
φ1	φ2	φ3	φ4	φΣA	φΣB	η3	F7:D-UmnR	F15	-	-	-
fU1	fU2	fU3	fU4	-	-	η4	F8:D-UmnS	F16	-	-	-

16 Items Display

Page											
1	2	3	4	5	6	7	8	9	10	11	12
Urms1	Urms2	Urms3	Urms4	UrmsΣA	P1	F1:P-loss	F17	-	-	-	-
Irms1	Irms2	Irms3	Irms4	IrmsΣA	P2	F2:U-ripple	F18	-	-	-	-
P1	P2	P3	P4	PΣA	P3	F3:I-ripple	F19	-	-	-	-
S1	S2	S3	S4	SΣA	P4	F4:D-UrmsR	F20	-	-	-	-
Q1	Q2	Q3	Q4	QΣA	PΣA	F5:D-UrmsS	-	-	-	-	-
λ1	λ2	λ3	λ4	λΣA	PΣB	F6:D-UrmsT	-	-	-	-	-
φ1	φ2	φ3	φ4	φΣA	-	F7:D-UmnR	-	-	-	-	-
Pc1	Pc2	Pc3	Pc4	PcΣA	-	F8:D-UmnS	-	-	-	-	-
fU1	fU2	fU3	fU4	UrmsΣB	η1	F9:D-UmnT	-	-	-	-	-
fl1	fl2	fl3	fl4	IrmsΣB	η2	F10:PhiU3-U2	-	-	-	-	-
U+pk1	U+pk2	U+pk3	U+pk4	PΣB	η3	F11:Pp-p	-	-	-	-	-
U-pk1	U-pk2	U-pk3	U-pk4	SΣB	η4	F12	-	-	-	-	-
I+pk1	I+pk2	I+pk3	I+pk4	QΣB	-	F13	-	-	-	-	-
I-pk1	I-pk2	I-pk3	I-pk4	λΣB	-	F14	-	-	-	-	-
CfU1	CfU2	CfU3	CfU4	φΣB	-	F15	-	-	-	-	-
Cfl1	Cfl2	Cfl3	Cfl4	PcΣB	-	F16	-	-	-	-	-

Appendix

Matrix Display

Page											
1	2	3	4	5	6	7	8	9	10	11	12
Urms	Urms	Irms	-	-	-	-	-	-	-	-	-
Irms	Umn	Imn	-	-	-	-	-	-	-	-	-
P	Udc	Idc	-	-	-	-	-	-	-	-	-
S	Urmn	Irmn	-	-	-	-	-	-	-	-	-
Q	Uac	Iac	-	-	-	-	-	-	-	-	-
λ	U+pk	I+pk	-	-	-	-	-	-	-	-	-
ϕ	U-pk	I-pk	-	-	-	-	-	-	-	-	-
fU	CfU	Cfl	-	-	-	-	-	-	-	-	-
fl	fU	fl	-	-	-	-	-	-	-	-	-

All Items Display

Page									
1	2	3	4	5	6	7*	8*	9*	10*
Urms	Urms	Irms	F1:P-loss	η_1	ΔU_{1rms}	U(k)	Uhdf(k)	Uthd	K-factor
Irms	Umn	Imn	F2:U-ripple	η_2	ΔU_{2rms}	I(k)	Ihdf(k)	Ithd	$\Phi U_i - U_j$
P	Udc	Idc	F3:I-ripple	η_3	ΔU_{3rms}	P(k)	Phdf(k)	Pthd	$\Phi U_i - U_k$
S	Urmn	Irmn	F4:D-UrmsR	η_4	$\Delta U_{\Sigma rms}$	S(k)	Z(k)	Uthf	$\Phi U_i - I_i$
Q	Uac	Iac	F5:D-UrmsS		ΔI_{rms}	Q(k)	Rs(k)	Ithf	$\Phi U_j - I_j$
λ	U+pk	I+pk	F6:D-UrmsT		ΔP_1	$\lambda(k)$	Xs(k)	Utif	$\Phi U_k - I_k$
ϕ	U-pk	I-pk	F7:D-UmnR		ΔP_2	$\Phi(k)$	Rp(k)	Itif	$\Phi I_i - I_j$
fU	CfU	Cfl	F8:D-UmnS		ΔP_3	$\Phi U(k)$	Xp(k)	hvf	$\Phi I_j - I_k$
fl	Pc		F9:D-UmnT		ΔP_{Σ}	$\Phi I(k)$		hcf	$\Phi I_i - I_k$
	P+pk		F10:PhiU3-U2						
	P-pk		F11:Pp-p						
			F12						
			F13						
			F14						
			F15						
			F16						
			F17						
			F18						
			F19						
			F20						

* Displayed on models with the harmonic measurement option

Left Side of the Single List Screen* and Dual List Screen*

Page							
1	2	3	4	5	6	7	8
Urms1	Urms2	Urms3	Urms4	UrmsΣA	UrmsΣB	F1	F17
Irms1	Irms2	Irms3	Irms4	IrmsΣA	IrmsΣB	F2	F18
P1	P2	P3	P4	PΣA	PΣB	F3	F19
S1	S2	S3	S4	SΣA	SΣB	F4	F20
Q1	Q2	Q3	Q4	QΣA	QΣB	F5	
λ_1	λ_2	λ_3	λ_4	$\lambda_{\Sigma A}$	$\lambda_{\Sigma B}$	F6	
ϕ_1	ϕ_2	ϕ_3	ϕ_4	$\Phi U_i - U_j$	$\Phi U_i - U_j$	F7	
Uthd1	Uthd2	Uthd3	Uthd4	$\Phi U_i - U_k$	$\Phi U_i - U_k$	F8	
Ithd1	Ithd2	Ithd3	Ithd4	$\Phi U_i - I_i$	$\Phi U_i - I_i$	F9	
Pthd1	Pthd2	Pthd3	Pthd4	$\Phi U_j - I_j$	$\Phi U_j - I_j$	F10	
Uthf1	Uthf2	Uthf3	Uthf4	$\Phi U_k - I_k$	$\Phi U_k - I_k$	F11	
Ithf1	Ithf2	Ithf3	Ithf4	$\Phi I_i - I_j$	$\Phi I_i - I_j$	F12	
Utif1	Utif2	Utif3	Utif4	$\Phi I_j - I_k$	$\Phi I_j - I_k$	F13	
Itif1	Itif2	Itif3	Itif4	$\Phi I_i - I_k$	$\Phi I_i - I_k$	F14	
hvf1	hvf2	hvf3	hvf4			F15	
hcf1	hcf2	hcf3	hcf4			F16	
Kfact1	Kfact2	Kfact3	Kfact4				

* Displayed on models with the harmonic measurement option

Appendix 12 TCP and UDP Port Numbers

The TCP and UDP port numbers that are used on the Ethernet interface of the PX8000 are listed below.

TCP Port Numbers

Port Number	Description	Used For
20	File Transfer [Default Data]	FTP server and FTP client*
21	File Transfer [Control]	FTP server and FTP client
25	Simple Mail Transfer Protocol	SMTP client
515	–	LPR client
111	–	Instrument control through the Ethernet interface

UDP Port Numbers

Port Number	Description	Used For
67	Bootstrap Protocol Server	DHCP client
68	Bootstrap Protocol Client	(listen port)
123	Network Time Protocol	SNTP client

- * The port number when FTP passive mode is disabled. When FTP passive mode is enabled, you can set any port number. When FTP passive mode is disabled, connections are established from the server. If you are connecting the PX8000 from behind a firewall, enable FTP passive mode.

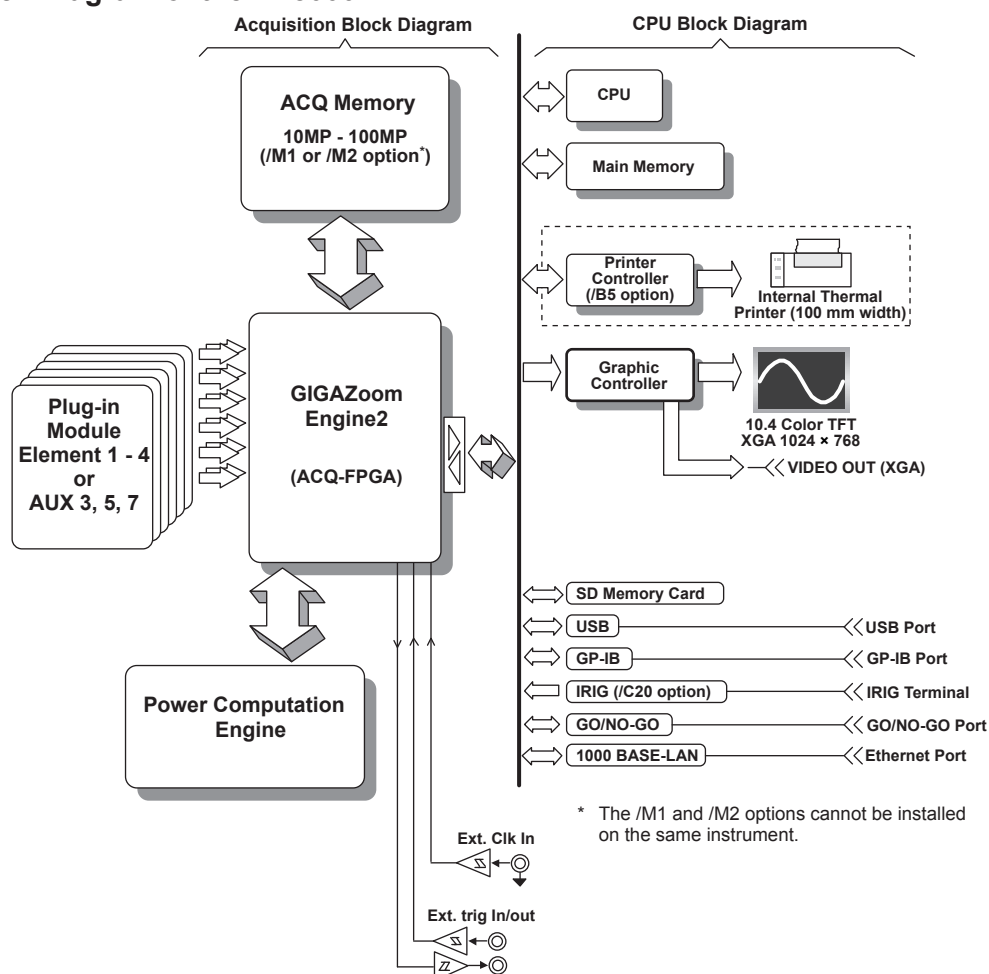
Appendix 13 Firmware Version

This manual covers firmware versions 1.01 and later of the PX8000.

To view the firmware version, press UTILITY and then the Overview soft key and check Firm Version on the Overview screen that is displayed.

Appendix 14 Block Diagram

Block Diagram of the PX8000



Signal Flow of the PX8000

A power measurement element consists of a voltage module (760811) and a current module (760812/760813). The modules are mutually isolated. They are also isolated from the case.

The voltage signal that is applied to the 760811 is normalized using the voltage divider and the operational amplifier (op-amp) of the voltage input circuit. It is then sent to an A/D converter.

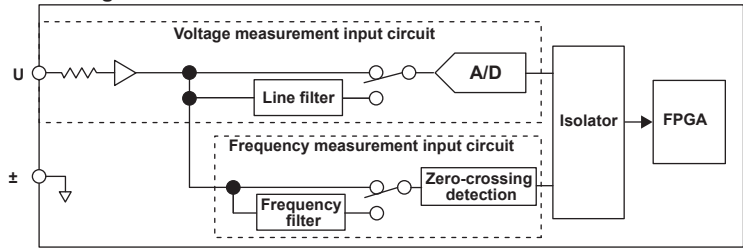
The 760812 is equipped with two types of input terminals: a current input terminal and an external current sensor input connector (EXT). Only one can be used at any given time. The voltage signal from a current sensor is applied to the external current sensor input connector. The voltage signal is normalized using the voltage divider and the operational amplifier (op-amp). It is then sent to a current A/D converter. On the other hand, a current input signal is applied to a current input terminal. The current signal is converted to a voltage signal by a shunt. Then, it is sent to the A/D converter in the same fashion as the voltage signal from the current sensor. The 760813 is a current module without an external current sensor input connector (EXT). It only has a current input terminal.

The voltage signals that are applied to the A/D converters on the 760811, 760812, and 760813 are converted to digital values at an interval of approximately 10 ns. These digital values are isolated by the isolator and passed to the ACQ_FPGA. The ACQ_FPGA stores digital values in ACQ memory.

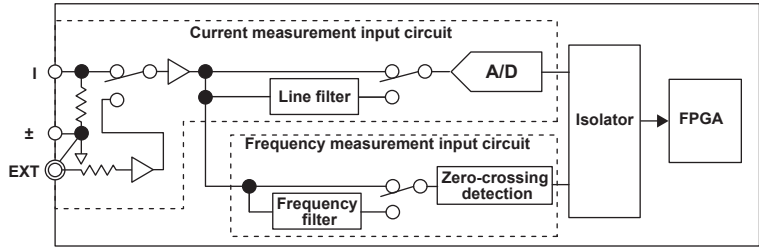
The digital values in ACQ memory are compressed at high speeds by GIGAZoom Engine2 to produce waveform display data, and this data passes through the graphics controller and is displayed on the XGA TFT color display. In addition, the power computation engine determines various power values from the digital values. The measured values are then transmitted to the CPU. Various computed values are determined from the measured values. The measured values and computed values are displayed and transmitted as measurement functions of normal measurement.

Plug-in Module Block Diagram

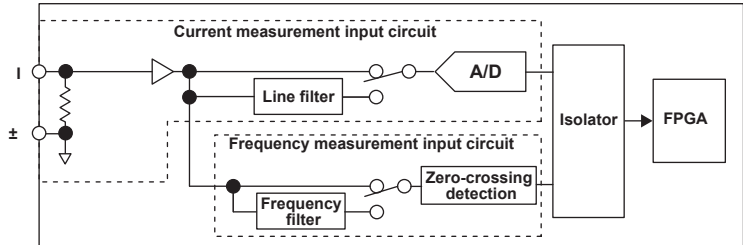
760811 Voltage module



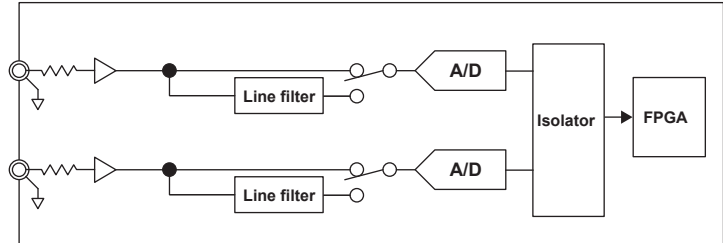
760812 Current module



760813 Current module



760851 AUX module



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PX8000

Precision Power Scope

U S E R ' S M A N U A L

Thank you for purchasing the PX8000 Precision Power Scope (hereafter referred to as the PX8000). This User's Manual explains how to use the PX8000. To ensure correct use, please read this manual thoroughly before beginning operation.

Keep this manual in a safe place for quick reference in the event a question arises. The following manuals, including this one, are provided as manuals for the PX8000. Please read all manuals.

List of Manuals

The following four manuals, including this one, are provided as manuals for the PX8000. Read them along with this manual.

Manual Title	Manual No.	Description
PX8000 Precision Power Scope Features Guide	IM PX8000-01EN	This manual explains all the PX8000 features other than the communication interface features.
PX8000 Precision Power Scope User's Manual	IM PX8000-02EN	This manual. The manual explains how to operate the PX8000.
PX8000 Precision Power Scope Getting Started Guide	IM PX8000-03EN	Provided as a printed manual. This guide explains the handling precautions, basic operations, and specifications of the PX8000.
PX8000 Precision Power Scope Communication Interface User's Manual	IM PX8000-17EN	This manual explains the PX8000 communication interface features and how to use them.
Model PX8000 Precision Power Scope	IMPX8000-92Z1	Document for China

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

The pdf data of all the manuals listed in the above table is in the supplied manual CD.

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

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

Notes

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

- January 2014 1st Edition
- January 2014 2nd Edition
- August 2014 3rd Edition
- December 2015 4th Edition
- June 2017 5th Edition
- October 2017 6th Edition

Conventions Used in This Manual

Notes

The notes and cautions in this manual are categorized using the following symbols.



Improper handling or use can lead to injury to the user or damage to the instrument. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the user's manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

WARNING

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

CAUTION

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

French

AVERTISSEMENT

Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures graves (voire mortelles), et sur les précautions de sécurité pouvant prévenir de tels accidents.

ATTENTION

Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures légères ou d'endommager l'instrument ou les données de l'utilisateur, et sur les précautions de sécurité susceptibles de prévenir de tels accidents.

Note

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

Unit

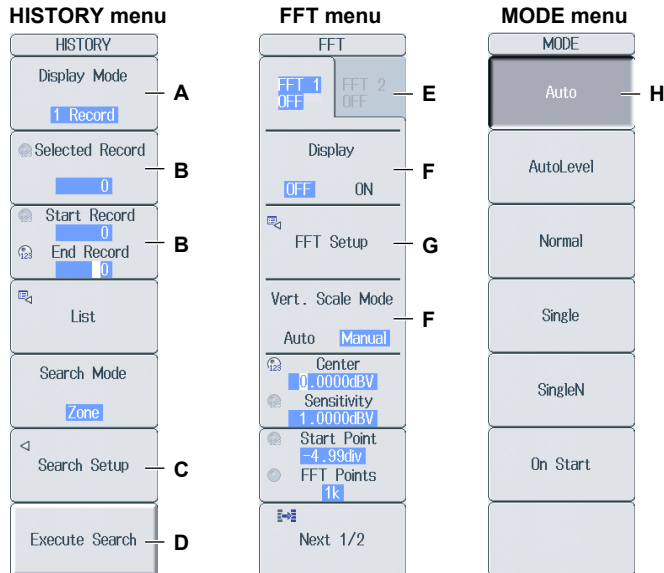
k	Denotes 1000. Example: 100 kHz (frequency)
K	Denotes 1024. Example: 720 KB (file size)

Key and Jog Shuttle Operations

Key Operations

How to Use Setup Menus That Appear When Keys Are Pressed

The operation after you press a key varies depending on the key that you press.



- A: Press the soft key to display a selection menu.
Press the soft key that corresponds to the appropriate setting.
- B: Press the soft key to use the jog shuttle to configure this setting. Use the jog shuttle or the arrow keys to set the value or select an item.
For a numeric setting, you can press NUM LOCK to use the ELEM 1 to P 4 keys to enter numbers.
- C: A related setup menu appears when you press the soft key.
- D: Press the soft key to execute the specified feature.
- E: Selects which item to configure when configuring a feature that consists of two items that operate with different settings, such as the FFT1 and FFT2 features.
- F: The selected setting switches each time you press the soft key.
- G: A dialog box or the keyboard appears when you press the soft key.
Use the jog shuttle, SET key, and arrow keys to configure the settings in the dialog box or operate the keyboard.
- H: Press the soft key to apply the value assigned to the key.

How to Display the Setup Menus That Are Written in Purple below the Keys

In the explanations in this manual, "SHIFT+key name (written in purple)" is used to indicate the following operation.

1. Press **SHIFT**. The SHIFT key illuminates to indicate that the keys are shifted.
Now you can select the setup menus written in purple in the manual.
2. Press the key that you want to display the setup menu of.

ESC Key Operation

If you press **ESC** when a setup menu or available options are displayed, the screen returns to the menu level above the current one. If you press **ESC** when the highest level menu is displayed, the setup menu disappears.

RESET Key Operation

If you press **RESET** when you are using the jog shuttle to set a value or select an item, the setting is reset to its default value (depending on the operating state of the PX8000, the setting may not be reset).

SET Key Operations

The operation varies as indicated below depending on what you are setting.

- For a soft key menu that has two values that you use the jog shuttle to adjust
Press **SET** to switch the value that the jog shuttle adjusts.
- For a menu that has the jog shuttle + SET mark (ⓘ+Ⓢ) displayed on it
Press **SET** to confirm the selected item.

Arrow Key Operations

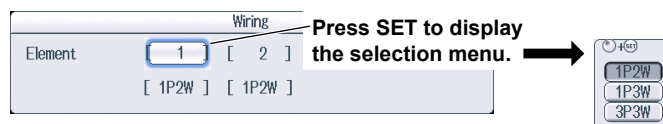
The operation varies as indicated below depending on what you are setting.

- When setting a value
 - Up and down **arrow** keys: Increases and decreases the value
 - Left and right **arrow** keys: Changes which digit to set
- When selecting the item to set
 - You can use the up, down, left, and right arrow keys.

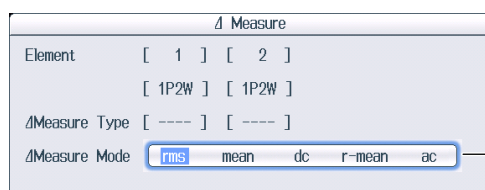
How to Enter Values in Setup Dialog Boxes

1. Use the keys to display the appropriate setup dialog box.
2. Use the **jog shuttle** or the **arrow** keys to move the cursor to the setting that you want to set.
3. Press **SET**. The operation varies as indicated below depending on what you are setting.
 - A selection menu appears.
 - A check box is selected or cleared.
 - An item is selected.
 - A table of settings is selected.

Displaying a Selection Menu and Selecting an Item



After selecting an item with the jog shuttle, press SET to confirm it.



Press SET to select rms, mean, dc, r-mean, or ac.

Setting Items in a Table

#	Mode	Trace	Item	Upper	Lower
1	IN	U1	Peak to Peak	0.0000	0.0000
2	X	U1	Peak to Peak	0.0000	0.0000
3	X	U1	Peak to Peak	0.0000	0.0000
4	X	U1	Peak to Peak	0.0000	0.0000
5	X	U1	Peak to Peak	0.0000	0.0000
6	X	U1	Peak to Peak	0.0000	0.0000
7	X	U1	Peak to Peak	0.0000	0.0000
8	X	U1	Peak to Peak	0.0000	0.0000
9	X	U1	Peak to Peak	0.0000	0.0000
10	X	U1	Peak to Peak	0.0000	0.0000
11	X	U1	Peak to Peak	0.0000	0.0000
12	X	U1	Peak to Peak	0.0000	0.0000
13	X	U1	Peak to Peak	0.0000	0.0000
14	X	U1	Peak to Peak	0.0000	0.0000
15	X	U1	Peak to Peak	0.0000	0.0000
16	X	U1	Peak to Peak	0.0000	0.0000

Logic: **AND** OR

ActCondition: Always **Fail** Success

After moving the cursor to the table, press SET to select the setting in the table that you want to change.
To exit from the list, press ESC.

#	Mode	Trace	Item
1	IN	U1	Peak to Peak
2	X	U1	Peak to Peak
3	X	U1	Peak to Peak

Press SET to select the item that you want to set.

How to Clear Setup Dialog Boxes

Press **ESC** to clear the setup dialog box from the screen.

Entering Values and Strings

Entering Values

Using Dedicated Knobs

You can use the following dedicated knobs to enter values directly.

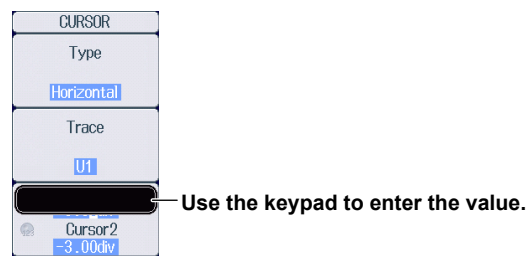
- **◆**POSITION knob (vertical POSITION knob)
- RANGE knob
- TIME/DIV knob
- MAG knob (magnification knob)
- **◀**POSITION**▶** knob (zoom POSITION knob)

Using the Jog Shuttle

Select the appropriate item using the soft keys, and change the value using the jog shuttle and the SET key or using the arrow keys. This manual sometimes describes this operation simply as “using the jog shuttle.”

Using the Keypad

Press **NUM LOCK** to illuminate the NUM LOCK key, and use the ELEM1 to P4 keys to enter a value. After you enter the value, press **ENTER** to confirm it.




Note

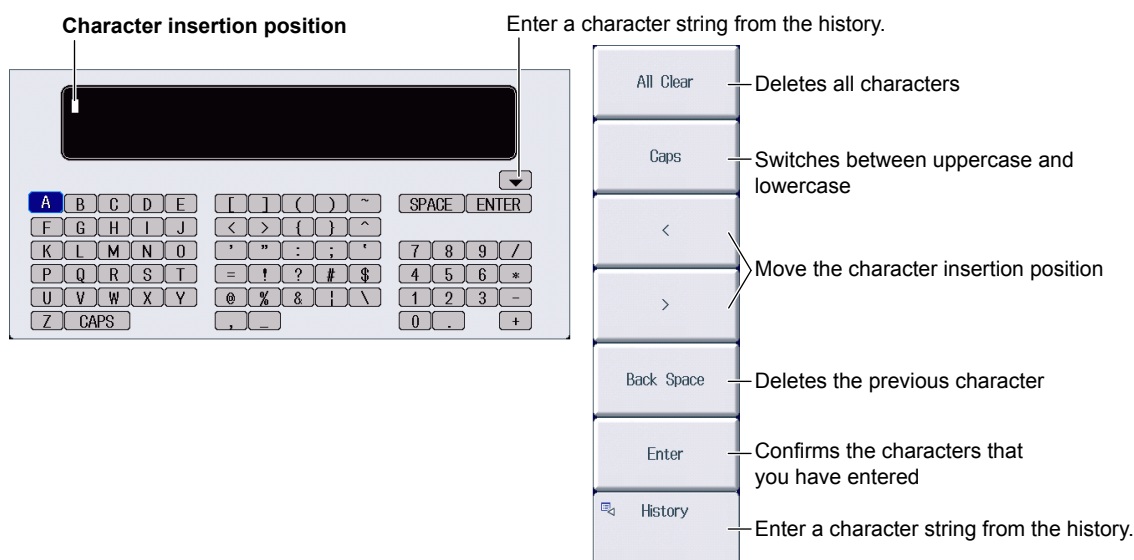
Some items that you can set using the jog shuttle are reset to their default values when you press the RESET key.

Entering Character Strings

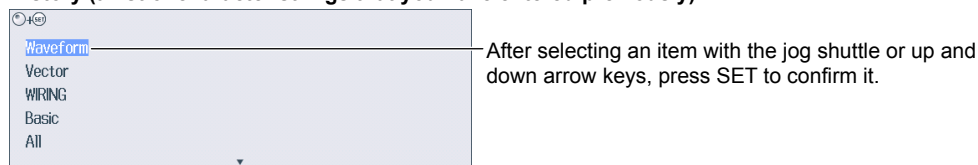
Use the keyboard that appears on the screen to enter character strings such as file names and comments. Use the jog shuttle, SET key, and arrow keys to operate the keyboard and enter a character string.

How to Operate the Keyboard

1. After bringing up the keyboard, use the **jog shuttle** to move the cursor to the character that you want to enter. You can also move the cursor using the up, down, left, and right **arrow** keys.
2. Press SET to enter the character.
 - If a character string has already been entered, use the **arrow** soft keys (< and >) to move the cursor to the position you want to insert characters into.
 - To switch between uppercase and lowercase letters, press the **Caps** soft key or move the cursor to **CAPS** on the keyboard, and then press **SET**.
 - To delete the previous character, press the **Back Space** soft key.
 - To delete all the characters, press the **All Clear** soft key.
3. Repeat steps 1 and 2 to enter all of the characters in the string.
 Select  on the keyboard or press the **History** soft key to display a list of character strings that you have entered previously. Use the jog shuttle to select a character string, and press **SET** to enter the selected character string.
4. Press the **Enter** soft key, or move the cursor to ENTER on the keyboard, and press **SET**.
 The character string is confirmed, and the keyboard disappears.



History (a list of character strings that you have entered previously)



Note

- @ cannot be entered consecutively.
- File names are not case-sensitive. Comments are case-sensitive. The following file names cannot be used due to MS-DOS limitations:
 AUX, CON, PRN, NUL, CLOCK, COM1 to COM9, and LPT1 to LPT9
 For details on file name limitations, see the Features Guide, IM PX8000-01EN.
- When a character string is confirmed, it is stored in a list of previously entered strings. Up to 50 character strings are stored. The new character string appears at the top of the list of previously entered strings.

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1.1 Configuring Wiring System Settings

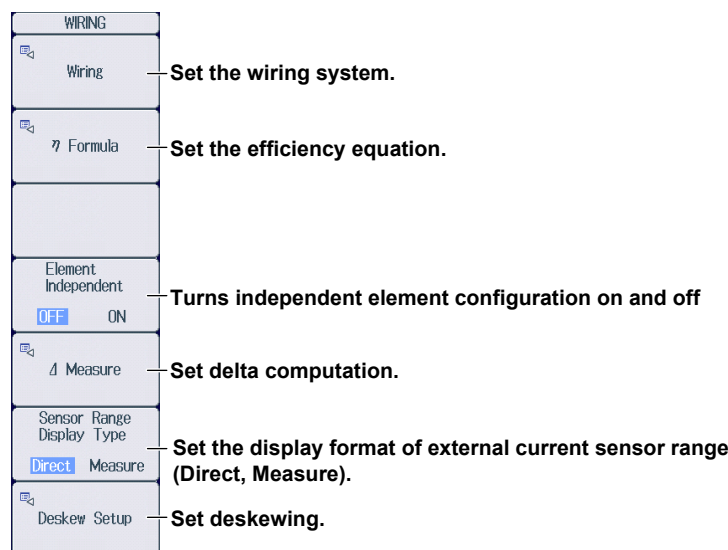
This section explains the following wiring system settings.

- Wiring system
- Efficiency equation
- Turning independent element configuration on and off
- Delta computation
- Display format of external current sensor range
- Deskewing (correcting the transfer time difference between input signals)

► **Features Guide: “Wiring System Settings (WIRING)”**

WIRING Menu

Press **WIRING** to display the following menu.

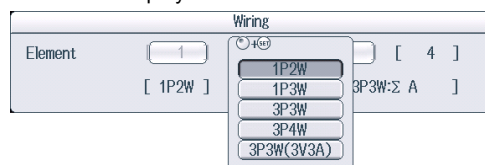


Setting the Wiring System

Press the **Wiring** soft key to display the following screen.

Set the wiring system (1P2W, 1P3W, 3P3W, 3P4W, 3P3W(3V3A)).

When you select an element, the wiring systems that you can select are displayed. Select the wiring system from those displayed.



Wiring System Combination

- If you select 1P3W, 3P3W, 3P4W, or 3P3W(3V3A) for the wiring system, the wiring unit is set with the two or three elements adjacent to the selected element whose element numbers are larger than the selected element.
- On models that have four elements installed, up to two wiring units (ΣA and ΣB) are automatically set. The wiring unit symbols ΣA and ΣB are attached to the element numbers in order, starting with the smallest number.

Note

- Because the wiring system with the largest element number is automatically determined according to the settings of the wiring system with the smallest element number, the element with the largest element number cannot be selected.
- You cannot set the wiring units for larger element numbers before the wiring units for smaller element numbers.

Setting the Efficiency Equation (η Formula)

Press the η Formula soft key to display the following screen.

Element

[1] [2] [3] [4]

[3P3W-Σ A] [1P3W-Σ B]

PΣB

PΣA

η1 =

* 100[%]

η2 =

* 100[%]

PΣA

PΣB

η3 =

* 100[%]

η4 =

* 100[%]

OFF

OFF

η3 =

* 100[%]

η4 =

* 100[%]

OFF

OFF

Udef1 =

P1

+

None

+

None

+

None

+

None

Udef2 =

P1

+

None

+

None

+

None

+

None

Installed elements

The set wiring systems

Set the denominator and numerator of the efficiency equation to the active power and motor power measurement functions.
(P1-P4¹, PΣA-PΣB², Pm2-Pm4³, Udef1, Udef2)
You can set up to four equations: η1 to η4.

Define Udef1 and Udef2
(P1-P4¹, PΣA-PΣB², Pm2-Pm4³).

To add active powers and motor output and use them in efficiency equations, use Udef1 and Udef2.

- 1 P1 to P4 can be set within the range of the installed elements.
- 2 PΣA to PΣB can be set within the range of the wiring unit that is automatically determined by the installed elements.
- 3 Pm2, Pm3, and Pm4 can be set when AUX modules are installed in slots 3, 5, and 7, respectively.

Setting Delta Computation (Δ Measure)

Press the Δ Measure soft key to display the following screen.

Element

[1] [2] [3] [4]

[3P3W-Σ A] [1P3W-Σ B]

ΔMeasure Type

3P3W>3V3A

Difference

ΔMeasure Mode

rms

mean

dc

r-mean

ac

Installed elements

The set wiring systems

Set the delta computation type.
The available options vary depending on the set wiring systems.

Wiring System	Delta Computation Type
1P3W	Difference, 3P3W>3V3A
3P3W	Difference, 3P3W>3V3A
3P4W	Star>Delta
3P3W(3V3A)	Delta>Star

Set the delta computation mode
(rms, mean, dc, r-mean, ac).

Setting Deskewing (Deskew Setup)

Press the Deskew Setup soft key to display the following screen.

Deskew Setup

All

U1/I1

U2/I2

U3/I3

U4/I4

Diff Time U

0.000 ns

0.000 ns

0.000 ns

0.000 ns

Diff Time I

0.000 ns

0.000 ns

0.000 ns

0.000 ns

Diff Time Sen

0.000 ns

0.000 ns

0.000 ns

0.000 ns

Voltage (U) or current (I) of the installed elements

Manual deskewing

- Set the correction value for voltage signals.
- Set the correction value for current signals.
- Set the correction value for external current sensor signals.

To set or execute on all channels, set or execute the items in the All row.

1-2

IM PX8000-02EN

1.2 Configuring Power Measurement Element Settings

This section explains the following element settings.

- Line filter
- Frequency filter
- Turning the scaling feature on and off
- VT ratio
- CT ratio
- Power coefficient
- Synchronization source

► [Features Guide: “Power Measurement Element Settings \(ELEM1 to 4\)”](#)

Check that a voltage module and current module are installed in appropriate slots.

ELEM Menu

Of the **ELEM1** to **ELEM4** keys, press the key corresponding to the element in which the voltage and current modules are installed. The following menu appears.

ELEM1	
Line Filter OFF	Set the line filter (OFF, 500Hz, 2kHz, 20kHz, 1MHz).
Freq Filter OFF	Set the frequency filter (OFF, 100Hz, 500Hz, 2kHz, 20kHz).
Scaling OFF ON	Turns the scaling feature on and off*
VT Scaling 1.0000	Set the VT ratio.
CT Scaling 1.0000	Set the CT ratio.
SF Scaling 1.0000	Set the power coefficient.
Sync Source I1	Set the synchronization source (U1-U4, I1-I4, External, None).

* When you are trying to read the current of the circuit under measurement directly by multiplying the external current sensor output by the conversion ratio, if the scaling feature is set to ON, the CT ratio will end up being multiplied on top of the result. To avoid the influence of the CT ratio, set the CT ratio to 1.0000.

1.3 Setting the Motor Mode

This section explains the following motor mode settings.

- Turning motor mode on and off
- Function name
- Scaling
- Unit
- Synchronization source

► **Features Guide: “Turning Motor Mode On and Off (Motor Mode)”**
“Function Name (Name)”
“Scaling (Scaling)”
“Unit (Unit)”
“Synchronization Source (Sync Source), AUX Module”

Check that an AUX module is installed in slot 3, 5, or 7.

Pm Menu

Of the **ELEM 2 to ELEM 4** keys, press the key corresponding to the slot in which the AUX module is installed. The following menu appears.

When motor mode is off

Pm3	
Motor Mode	Set Motor Mode to OFF.
OFF ON	
Name	
None	
Scaling	
1.0000	
Unit	
W	
Sync Source	Set the synchronization source (U1-U4, I1-I4, External, None).
None	

When motor mode is on

Pm3	
Motor Mode	Set Motor Mode to ON.
OFF ON	
Name	Set the function name.
Pm3	
Scaling	Set the scaling.
1.0000	
Unit	Set the unit.
W	
Sync Source	Set the synchronization source (U1-U4, I1-I4, External, None).
None	

2.1 Configuring Voltage Measurements

This section explains the following settings for the vertical axis of voltage measurements.

- Waveform display on and off
- Display labels
- Zoom method
 - DIV: Magnification for zooming waveforms, offset
 - SPAN: Upper and lower display limits for zooming waveforms
- Auto range on and off
- Voltage measurement range (vertical scale)
- Voltage waveform vertical position

► [Features Guide: “Voltage Measurement \(U\)”](#)

Check that a voltage module and current module are installed in appropriate slots.

U Menu

Of the **U1** to **U4** keys, press the key corresponding to the element in which the module is installed. The following menu appears.

When the zoom method is set to DIV

	U1 (CH1)
Display	OFF ON
Label	U1
Vertical Scale	DIV SPAN
Vertical Zoom	X 1
Offset	0.0V
Auto Range	OFF ON

Turns the waveform display on and off

Set the display label.

Set the zoom method to DIV.

Set the zoom magnification.

Set the offset.

Turns the auto range on and off

When the zoom method is set to SPAN

	U1 (CH1)
Display	OFF ON
Label	U1
Vertical Scale	DIV SPAN
Upper	250.0V
Lower	-250.0V
Auto Range	OFF ON

Turns the waveform display on and off

Set the display label.

Set the zoom method to SPAN.

Set the upper and lower limits of the display range.

Turns the auto range on and off

Note

The U key whose display setting is ON illuminates. If the U key is not illuminated, you can press it to turn on the waveform display and the key. If the U key is illuminated, you can press it to turn off the waveform display and the key.

Setting the Voltage Measurement Range (Vertical Scale, RANGE Knob)

This section explains how to set a fixed range.

(If Auto Range in the U menu is set to ON, the measurement range changes depending on the amplitude of the input signal.)

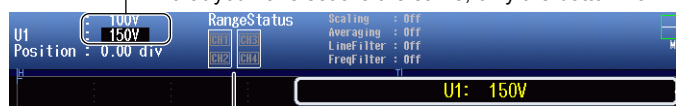
Turn the **RANGE** knob to set the voltage measurement range.

- Select from 1.5V, 3V, 6V, 10V, 15V, 30V, 60V, 100V, 150V, 300V, 600V, and 1000V.
- Auto Range in the U menu is set to OFF.
- If you turn the RANGE knob when waveform acquisition is stopped, two values are shown on the measurement range screen. The upper value is the measurement range for the displayed waveforms. The lower value is the measurement range that you have specified. The new range will be applied the next time waveform acquisition is started.
- If you do not operate the RANGE knob for approximately 3 seconds, the measurement range that you are setting with the knob will disappear from the screen.

Top row: Measurement range for the displayed waveforms

Bottom row: Measurement range that you have specified

When the displayed waveform's measurement range and the measurement range that you have set are the same, only the bottom row is displayed.



Use the RANGE knob to display the measurement range that is currently being set.

Range status

Indicates the wiring units.

Display example

When the wiring system is 1P2W



Because the wiring unit is separate for each element, set the measurement range of each element.

When the wiring system is 1P3W or 3P3W



Element 1 (CH1, CH2) and element 2 (CH3, CH4) are grouped into a single wiring unit. Changing the measurement range of one element will change that of the other element to the same value.*

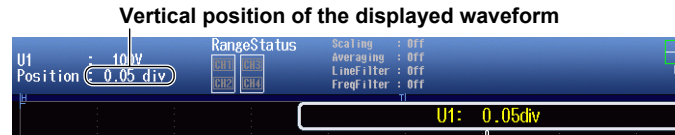
* If independent element configuration (see section 1.1) to ON, you need to set the measurement range for each element.

Setting the Voltage Waveform Vertical Position

When the Zoom Method is Set to DIV (Vertical POSITION Knob)

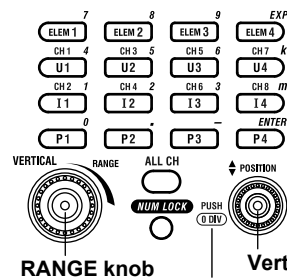
Turn the **vertical POSITION** knob to set the waveform vertical position.

- Set in the range of -5.00 div to 5.00 div.
- If you do not operate the vertical POSITION knob for approximately 3 seconds, the vertical position that you are setting with the knob will disappear from the screen.



Use the vertical POSITION knob to display the vertical position that is currently being set.

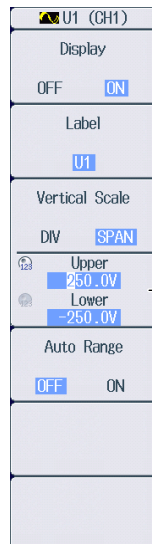
- You can set the vertical position to 0 div by pressing the knob.



This indicates that you can press the vertical POSITION knob to set the vertical position to 0 div.

When the Zoom Method is Set to SPAN (Upper and Lower Limits)

Using the **Upper/Lower** soft key and the **jog shuttle**, set the voltage at the top edge of the waveform screen (upper limit) and the voltage at the bottom edge of the screen (lower limit) to set the waveform vertical position.



2.2 Configuring Current Measurements

This section explains the following settings for the vertical axis of current measurements.

- Waveform display on and off
- Display labels
- Zoom method
 - DIV: Magnification for zooming waveforms, offset
 - SPAN: Upper and lower display limits for zooming waveforms
- Auto range on and off
- Current measurement range (vertical scale)
 - Direct input, external current sensor (conversion ratio, input coupling)
- Current waveform vertical position

► [Features Guide: “Current Measurement \(I\)”](#)

Check that a voltage module and current module are installed in appropriate slots.

I Menu

Of the **I1** to **I4** keys, press the key corresponding to the element in which the module is installed. The following menu appears.

When the zoom method is set to DIV

CH1 (CH2)	
Display	Turns the waveform display on and off
OFF ON	
Label	Set the display label.
I1	
Vertical Scale	Set the zoom method to DIV.
DIV SPAN	
Vertical Zoom	Set the zoom magnification.
x 1	
Offset	Set the offset.
0.00A	
Auto Range	Turns the auto range on and off
OFF ON	
Ext Sensor	Turns the external current sensor on and off*
OFF ON	
Sensor Ratio [mV/A(mS)]	Set the external current sensor conversion ratio.* Set this when the external current sensor (Ext Sensor) is set to ON.
10.0000	

When the zoom method is set to SPAN

CH1 (CH2)	
Display	Turns the waveform display on and off
OFF ON	
Label	Set the display label.
I1	
Vertical Scale	Set the zoom method to SPAN.
DIV SPAN	
Upper	Set the upper and lower limits of the display range.
10.00A	
Lower	
-10.00A	
Auto Range	Turns the auto range on and off
OFF ON	
Ext Sensor	Turns the external current sensor on and off*
OFF ON	
Sensor Ratio [mV/A(mS)]	Set the external current sensor conversion ratio.* Set this when the external current sensor (Ext Sensor) is set to ON.
10.0000	

- In the case of a 760813 (current module), Ext Sensor and Sensor Ratio do not appear.

Note

The **I** key whose display setting is ON illuminates. If the **I** key is not illuminated, you can press it to turn on the waveform display and the key. If the **I** key is illuminated, you can press it to turn off the waveform display and the key.

Setting the Current Measurement Range (Vertical Scale, RANGE Knob)

This section explains how to set a fixed range.

(If Auto Range in the I menu is set to ON, the measurement range changes depending on the amplitude of the input signal.)

Direct Input Measurement Range Settings (When Ext Sensor is set to OFF)

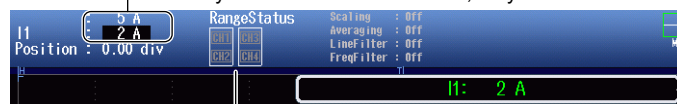
Turn the **RANGE** knob to set the current measurement range.

- Select from 10mA, 20mA, 50mA, 100mA, 200mA, 500mA, 1A, 2A, and 5A.
- Auto Range in the I menu is set to OFF.
- If you turn the RANGE knob when waveform acquisition is stopped, two values are shown on the measurement range screen. The upper value is the measurement range for the displayed waveforms. The lower value is the measurement range that you have specified. The new range will be applied the next time waveform acquisition is started.
- If you do not operate the RANGE knob for approximately 3 seconds, the measurement range that you are setting with the knob will disappear from the screen.

Top row: Measurement range for the displayed waveforms

Bottom row: Measurement range that you have specified

When the displayed waveform's measurement range and the measurement range that you have set are the same, only the bottom row is displayed.



Use the RANGE knob to display the measurement range that is currently being set.

Range status

Indicates the wiring units.

Display example

When the wiring system is 1P2W



Because the wiring unit is separate for each element, set the measurement range of each element.

When the wiring system is 1P3W or 3P3W



Element 1 (CH1, CH2) and element 2 (CH3, CH4) are grouped into a single wiring unit. Changing the measurement range of one element will change that of the other element to the same value.*

* If independent element configuration (see section 1.1) to ON, you need to set the measurement range for each element.

External Current Sensor Input Measurement Range Settings (When Ext Sensor is set to ON)

When the External Current Sensor Range Display Format (see section 1.1) Is Direct

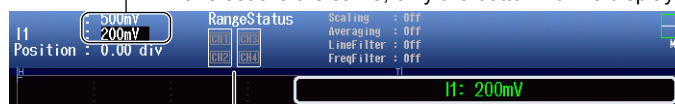
Turn the **RANGE** knob to set the current measurement range.

- Select from 50mV, 100mV, 200mV, 500mV, 1V, 2V, 5V, and 10V.
- Auto Range in the I menu is set to OFF.
- If you turn the RANGE knob when waveform acquisition is stopped, two values are shown on the measurement range screen. The upper value is the measurement range for the displayed waveforms. The lower value is the measurement range that you have specified. The new range will be applied the next time waveform acquisition is started.
- If you do not operate the RANGE knob for approximately 3 seconds, the measurement range that you are setting with the knob will disappear from the screen.

Top row: Measurement range for the displayed waveforms

Bottom row: Measurement range that you have specified

When the displayed waveform's measurement range and the measurement range that you have set are the same, only the bottom row is displayed.



Range status
See page 2-5.

Use the RANGE knob to display the measurement range that is currently being set.

When the External Current Sensor Range Display Format (see section 1.1) Is Measure

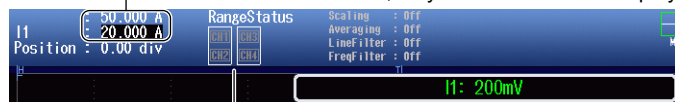
Turn the **RANGE** knob to set the current measurement range.

- Select from 50mV, 100mV, 200mV, 500mV, 1V, 2V, 5V, and 10V.
- Auto Range in the I menu is set to OFF.
- If you turn the RANGE knob when waveform acquisition is stopped, two values are shown on the measurement range screen. The upper value is the measurement range for the displayed waveforms. The lower value is the measurement range that you have specified. The new range will be applied the next time waveform acquisition is started.
- If you do not operate the RANGE knob for approximately 3 seconds, the measurement range that you are setting with the knob will disappear from the screen.

Top row: Measurement range for the displayed waveforms

Bottom row: Measurement range that you have specified

- The measurement range is set to the value that results when the measurement range set with the RANGE knob is divided by the external current sensor conversion ratio (see page 2-4).
- When the displayed waveform's measurement range and the measurement range that you have set are the same, only the bottom row is displayed.



Range status
See page 2-5.

Use the RANGE knob to display the measurement range that is currently being set.

Setting the Current Waveform Vertical Position

When the Zoom Method is Set to DIV (Vertical POSITION Knob)

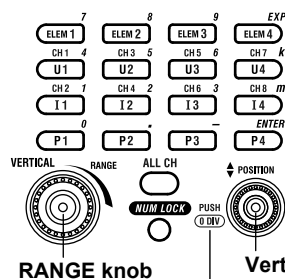
Turn the **vertical POSITION** knob to set the waveform vertical position.

- Set in the range of -5.00 div to 5.00 div.
- If you do not operate the vertical POSITION knob for approximately 3 seconds, the vertical position that you are setting with the knob will disappear from the screen.



Use the vertical **POSITION** knob to display the vertical position that is currently being set.

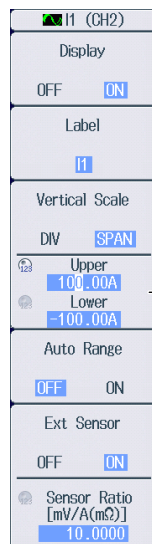
- You can set the vertical position to 0 div by pressing the knob.



This indicates that you can press the vertical **POSITION** knob to set the vertical position to 0 div.

When the Zoom Method is Set to SPAN (Upper and Lower Limits)

Using the **Upper/Lower** soft key and the **jog shuttle**, set the current at the top edge of the waveform screen (upper limit) and the current at the bottom edge of the screen (lower limit) to set the waveform vertical position.



Set the upper and lower limits of the display range.

2.3 Configuring Power Measurements

This section explains the following settings for the vertical axis of power measurements.

- Waveform display on and off
- Display labels
- Zoom method
 - DIV: Magnification for zooming waveforms, offset
 - SPAN: Upper and lower display limits for zooming waveforms
- Power waveform vertical position

► [Features Guide: “Power Measurement \(P\)”](#)

Check that a voltage module and current module are installed in appropriate slots.

POWER Menu

Of the **P1** to **P4** keys, press the key corresponding to the element in which the module is installed. The following menu appears.

When the zoom method is set to DIV

POWER1

Display

OFF ON

Label

P1

Vertical Scale

DIV SPAN

Vertical Zoom

x 2

Offset

0W

Turns the waveform display on and off

Set the display label.

Set the zoom method to DIV.

Set the zoom magnification.

Set the offset.

When the zoom method is set to SPAN

POWER1

Display

OFF ON

Label

P1

Vertical Scale

DIV SPAN

Upper

1000.0W

Lower

-1000.0W

Turns the waveform display on and off

Set the display label.

Set the zoom method to SPAN.

Set the upper and lower limits of the display range.

Note

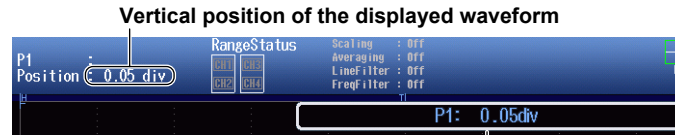
The P key whose display setting is ON illuminates. If the P key is not illuminated, you can press it to turn on the waveform display and the key. If the P key is illuminated, you can press it to turn off the waveform display and the key.

Setting the Power Waveform Vertical Position

When the Zoom Method is Set to DIV (Vertical POSITION Knob)

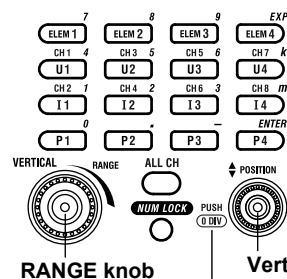
Turn the **vertical POSITION** knob to set the waveform vertical position.

- Set in the range of -5.00 div to 5.00 div.
- If you do not operate the vertical POSITION knob for approximately 3 seconds, the vertical position that you are setting with the knob will disappear from the screen.



Use the vertical **POSITION** knob to display the vertical position that is currently being set.

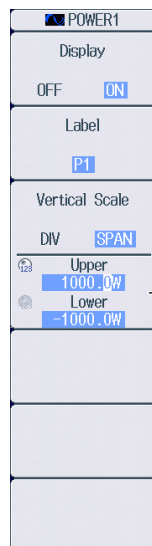
- You can set the vertical position to 0 div by pressing the knob.



This indicates that you can press the vertical **POSITION** knob to set the vertical position to 0 div.

When the Zoom Method is Set to SPAN (Upper and Lower Limits)

Using the **Upper/Lower** soft key and the **jog shuttle**, set the power at the top edge of the waveform screen (upper limit) and the power at the bottom edge of the screen (lower limit) to set the waveform vertical position.



Set the upper and lower limits of the display range.

2.4 Configuring Sensor Input Voltage Measurements

This section explains the following settings for the vertical axis of sensor input voltage measurements.

- Waveform display on and off
- Display labels
- Zoom method
 - DIV: Magnification for zooming waveforms, offset
 - SPAN: Upper and lower display limits for zooming waveforms
- Auto range on and off
- AUX settings
 - Input signal type, linear scaling, display format
- Input coupling
- Probe attenuation
- Bandwidth limit
- Upper and lower pulse reference levels
- Sensor input voltage measurement range
- Sensor input voltage waveform vertical position

► [Features Guide: “Sensor Input Voltage Measurement \(AUX\)”](#)

Check that an AUX module is installed in slot 3, 5, or 7.

Pm Menu

Of the **ELEM 2 to ELEM 4** keys, press the key corresponding to the slot in which the AUX module is installed. On the menu that appears, set Motor Mode to OFF.

The screenshot shows a vertical menu titled "Pm3". The menu items are: "Motor Mode" with "OFF" and "ON" options; "Name" with a blue button; "Scaling" with a blue button; "Unit" with a blue button; and "Sync Source" with a "None" button. Annotations point to the "OFF" option for Motor Mode and the "None" option for Sync Source.

Pm3	
Motor Mode	OFF ON
Name	[Blue Button]
Scaling	[Blue Button]
Unit	[Blue Button]
Sync Source	None

Set Motor Mode to OFF.

Set the synchronization source. ► section 1.3

AUX Menu

- Press **U2(CH3)**, **I2(CH4)**, **U3(CH5)**, **I3(CH6)**, **U4(CH7)**, or **I4(CH8)** to select a channel on an installed AUX module. The following menu appears.

When the zoom method is set to **DIV**

Display	Turns the waveform display on and off
Label	Set the display label.
Vertical Scale	Set the zoom method to DIV.
Vertical Zoom	Set the zoom magnification.
Offset	Set the offset.
Auto Range	Turns the auto range on and off*
Aux Settings (Analog/Pulse)	AUX settings
Next 1/2	Displays the second page of the menu

When the zoom method is set to **SPAN**

Display	Turns the waveform display on and off
Label	Set the display label.
Vertical Scale	Set the zoom method to SPAN.
Upper/Lower	Set the upper and lower limits of the display range.
Auto Range	Turns the auto range on and off*
Aux Settings (Analog/Pulse)	AUX settings
Next 1/2	Displays the second page of the menu

* You can turn auto range on and off when the AUX input signal type is set to Analog. If the type is set to Pulse, auto range is fixed to OFF.

Note

The U or I key whose display setting is ON illuminates. If the U or I key is not illuminated, you can press it to turn on the waveform display and the key. If the U or I key is illuminated, you can press it to turn off the waveform display and the key.

- Press the **Next 1/2** soft key to display the 2/2 menu.

When the AUX input signal type is **Analog**

Coupling	Set the input coupling (AC, DC, GND).
Probe	Set the probe attenuation (1:1, 10:1, 100:1, 1000:1).
Bandwidth	Set the bandwidth limit (10kHz, 20kHz, 40kHz, 80kHz, 160kHz, 320kHz, 640kHz, 1.28MHz, 2MHz, Full).
Pulse Level High/Low	
Next 2/2	Displays the first page of the menu

When the AUX input signal type is **Pulse**

Coupling	
Probe	Set the bandwidth limit (10kHz, 20kHz, 40kHz, 80kHz, 160kHz, 320kHz, 640kHz, 1.28MHz, 2MHz, Full).
Bandwidth	
Pulse Level High/Low	Set the upper and lower pulse reference levels.
Next 2/2	Displays the first page of the menu

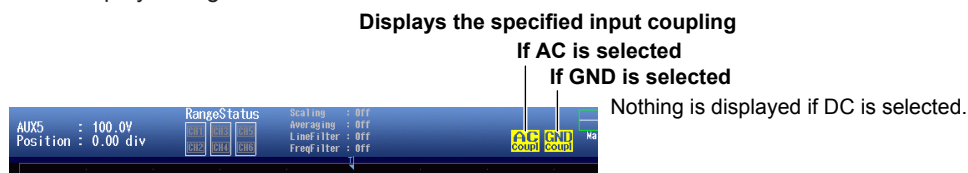
2.4 Configuring Sensor Input Voltage Measurements

Setting the Input Coupling (Coupling)

AC: Only displays the waveform produced from the input signal's AC component.

DC: Displays the waveform produced from both the DC and AC components of the input signal.

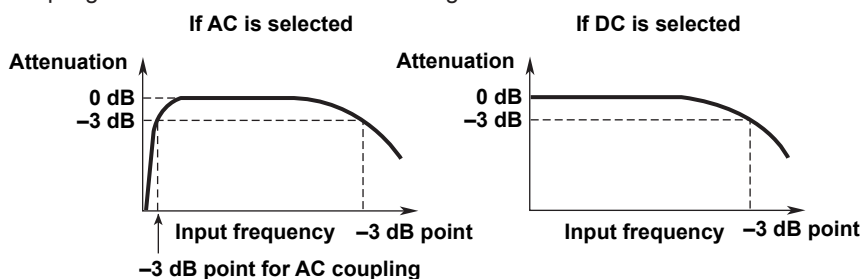
GND: Displays the ground level.



Input Coupling and Frequency Response

The frequency responses when the input coupling is set to AC and DC are shown below.

Note that the PX8000 does not acquire low-frequency signals or signal components if the input coupling is set to AC as indicated in the figure below.



CAUTION

If the input coupling is AC, in accordance with the frequency response, the input signal is attenuated more in lower frequencies. As a result, even when a high voltage signal is actually applied, it may not be measured as a high voltage signal. Furthermore, the PEAK OVER message may not be displayed on the screen. As necessary, switch the input coupling to DC to check the input signal voltage. Applying an input signal whose voltage exceeds the maximum input voltage of the AUX module may damage the input section.

French



ATTENTION

Si le courant du couplage d'entrée est alternatif (CA), conforme à la réponse en fréquence, le signal d'entrée est davantage atténué aux fréquences plus basses. Par conséquent, même si vous appliquez un signal de tension élevée, ce dernier risque de ne pas être mesuré comme tel. De plus, le message de dépassement de plage (PEAK OVER) risque de ne pas s'afficher à l'écran. Le cas échéant, basculez le couplage d'entrée sur CC (courant continu) afin de vérifier la tension du signal d'entrée.

Si la tension du signal d'entrée dépasse la tension d'entrée maximale du module AUX, la section d'entrée risque d'être endommagée.

Setting the Probe Attenuation (Probe)

1:1, 10:1, 100:1, 1000:1: Displays the voltage probe attenuation

Note

If the probe attenuation is not set correctly, the input signal voltage will not be displayed correctly. For example, if you use a 10:1 voltage probe but set the probe type to 1:1, the automatically measured amplitude of the waveform will be 1/10 the real value.

AUX Settings (Aux Settings)

Press the **Aux Settings** soft key to display the following screen.

When the input signal type is Analog

- When the linear scaling mode is AX+B

Set the input signal type to Analog.

The screenshot shows the 'Auxiliaries Settings' screen. The 'Sense Type' is set to 'Analog'. Under the 'Scaling' section, 'Scaling Mode' is set to 'AX+B'. The 'A' coefficient is set to '1.0000' and the 'B' offset is set to '0.0000'. The 'Unit String' field is empty. Under the 'Display Type' section, 'Mode' is set to 'Floating', 'Decimal Number' is set to 'Auto', and 'Sub Unit' is set to 'Auto'.

When the input signal type is Pulse

- When the linear scaling mode is AX+B

Set the input signal type to Pulse.

The screenshot shows the 'Auxiliaries Settings' screen. The 'Sense Type' is set to 'Pulse'. Under the 'Scaling' section, 'Scaling Mode' is set to 'AX+B'. The 'A' coefficient is set to '1.0000' and the 'B' offset is set to '0.0000'. The 'Unit String' field is empty. Under the 'Display Type' section, 'Mode' is set to 'Floating', 'Decimal Number' is set to 'Auto', and 'Sub Unit' is set to 'Auto'.

- When the linear scaling mode is P1-P2

Set the input signal type to Analog.

The screenshot shows the 'Auxiliaries Settings' screen. The 'Sense Type' is set to 'Analog'. Under the 'Scaling' section, 'Scaling Mode' is set to 'P1-P2'. Below this, there are four input fields for measured values: 'P1[X]' (1.0000), 'P1[Y]' (1.0000), 'P2[X]' (5.0000), and 'P2[Y]' (5.0000). Each field has a 'Get Value' button next to it. The 'Unit String' field is empty. Under the 'Display Type' section, 'Mode' is set to 'Floating', 'Decimal Number' is set to 'Auto', and 'Sub Unit' is set to 'Auto'.

- When the linear scaling mode is P1-P2

Set the input signal type to Pulse.

The screenshot shows the 'Auxiliaries Settings' screen. The 'Sense Type' is set to 'Pulse'. Under the 'Scaling' section, 'Scaling Mode' is set to 'P1-P2'. Below this, there are four input fields for measured values: 'P1[X]' (1.0000), 'P1[Y]' (1.0000), 'P2[X]' (5.0000), and 'P2[Y]' (5.0000). Each field has a 'Get Value' button next to it. The 'Unit String' field is empty. Under the 'Display Type' section, 'Mode' is set to 'Floating', 'Decimal Number' is set to 'Auto', and 'Sub Unit' is set to 'Auto'.

Setting the Sensor Input Voltage Measurement Range (Vertical Scale, RANGE Knob)

This section explains how to set a fixed range.

(If Auto Range in the AUX menu is set to ON, the measurement range changes depending on the amplitude of the input signal.)

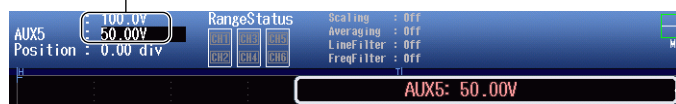
Turn the **RANGE** knob to set the sensor input voltage measurement range.

- Auto Range in the AUX menu is set to OFF.
- If you turn the RANGE knob when waveform acquisition is stopped, two values are shown on the measurement range screen. The upper value is the measurement range for the displayed waveforms. The lower value is the measurement range that you have specified. The new range will be applied the next time waveform acquisition is started.
- If you do not operate the RANGE knob for approximately 3 seconds, the measurement range that you are setting with the knob will disappear from the screen.

Top row: Measurement range for the displayed waveforms

Bottom row: Measurement range that you have specified

When the displayed waveform's measurement range and the measurement range that you have set are the same, only the bottom row is displayed.



Use the **RANGE** knob to display the measurement range that is currently being set.

Measurement Range Options and Units

Below are the available options for the RANGE knob, measurement range values, and measurement range units that appear on the screen for when the zoom method is set to DIV and the zoom magnification is set to $\times 1$. If you change the zoom method or zoom magnification, what appears on the screen will change accordingly.

• When Waveform Acquisition Is Stopped

Input Signal Type	Linear Scaling Mode	Available Options for the RANGE Knob	Measurement Range Values (that appear on the screen)	Measurement Range Units (that appear on the screen)
Analog	OFF	(When the probe attenuation is 10:1) 500.0mV, 1.000V, 2.500V, 5.000V, 10.00V, 25.00V,	Upper value: RANGE knob value for the displayed waveform Lower value: Available option value of the RANGE knob	Upper unit value: Same unit as the available options for the RANGE knob Lower unit value: Same unit as the available options for the RANGE knob
	AX+B, P1–P2	50.00V, 100.0V, 250.0V, 500.0V, 1.000kV The available options vary depending on the probe attenuation setting.	Upper value: Value obtained by multiplying the available option value of the RANGE knob by the linear scaling coefficient. Lower value: Available option value of the RANGE knob	Upper unit value: Unit specified on the AUX setting screen Lower unit value: Same unit as the available options for the RANGE knob
Pulse	—	1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k, 20k, 50k, 100k, 200k, 500k, 1M	Upper value: No display Lower value: Available option value of the RANGE knob	Upper unit value: No display Lower unit value: Unit specified on the AUX setting screen

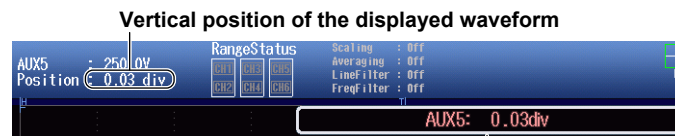
• When Waveform Acquisition Is Running

Input Signal Type	Linear Scaling Mode	Available Options for the RANGE Knob	Measurement Range Values (that appear on the screen)	Measurement Range Units (that appear on the screen)
Analog	OFF	(When the probe attenuation is 10:1) 500.0mV, 1.000V, 2.500V, 5.000V,	Upper value: No display Lower value: Available option value of the RANGE knob	Upper unit value: No display Lower unit value: Same unit as the available options for the RANGE knob
	AX+B, P1–P2	10.00V, 25.00V, 50.00V, 100.0V, 250.0V, 500.0V, 1.000kV The available options vary depending on the probe attenuation setting.	Upper value: Value obtained by multiplying the available option value of the RANGE knob by the linear scaling coefficient. Lower value: Available option value of the RANGE knob	Upper unit value: Unit specified on the AUX setting screen Lower unit value: Same unit as the available options for the RANGE knob
Pulse	—	1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k, 20k, 50k, 100k, 200k, 500k, 1M	Upper value: No display Lower value: Available option value of the RANGE knob	Upper unit value: No display Lower unit value: Unit specified on the AUX setting screen

Setting the Sensor Input Voltage Waveform Vertical Position When the Zoom Method is Set to DIV (Vertical POSITION Knob)

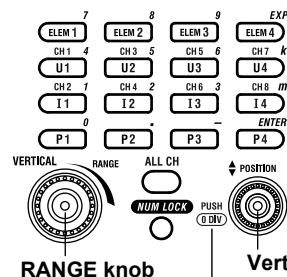
Turn the **vertical POSITION** knob to set the waveform vertical position.

- Set in the range of –5.00 div to 5.00 div.
- If you do not operate the vertical POSITION knob for approximately 3 seconds, the vertical position that you are setting with the knob will disappear from the screen.



Use the vertical **POSITION** knob to display the vertical position that is currently being set.

- You can set the vertical position to 0 div by pressing the knob.



This indicates that you can press the vertical **POSITION** knob to set the vertical position to 0 div.

When the Zoom Method is Set to SPAN (Upper and Lower Limits)

Using the **Upper/Lower** soft key and the **jog shuttle**, set the voltage at the top edge of the waveform screen (upper limit) and the voltage at the bottom edge of the screen (lower limit) to set the waveform vertical position.



2.5 Configuring Rotating Speed Measurements

This section explains the following settings for the vertical axis of rotating speed measurements.

- Waveform display on and off
- Display labels
- Zoom method
 - DIV: Magnification for zooming waveforms, offset
 - SPAN: Upper and lower display limits for zooming waveforms
- Auto range on and off
- Rotating speed measurement
 - Input signal type, linear scaling, display format
- Input coupling
- Bandwidth limit
- Upper and lower pulse reference levels
- Rotating speed measurement range
- Rotating speed waveform vertical position

► **Features Guide: “Sensor Input Voltage Measurement (AUX)”**
“Rotating Speed Settings (Speed Settings)”

Check that an AUX module is installed in slot 3, 5, or 7.

Pm Menu

Of the **ELEM 2 to ELEM 4** keys, press the key corresponding to the slot in which the AUX module is installed. On the menu that appears, set Motor Mode to ON.

Pm3	
Motor Mode	
OFF	ON
Name	
Pm3	
Scaling	
1.0000	
Unit	
W	
Sync Source	
None	

Set Motor Mode to ON.

Set the function name.

Set the scaling coefficient.

Set the unit.

Set the synchronization source. ► section 1.3

AUX Menu

- Press **U2(CH3)**, **U3(CH5)**, or **U4(CH7)** to select a channel on an installed AUX module. The following menu appears.

When the zoom method is set to **DIV**

Display OFF ON	Turns the waveform display on and off
Label AUX5	Set the display label.
Vertical Scale DIV SPAN	Set the zoom method to DIV.
Vertical Zoom x 1	Set the zoom magnification.
Offset 0.00rpm	Set the offset.
Auto Range OFF ON	Turns the auto range on and off*
Speed Settings (Analog/Pulse) Analog	Configure rotating speed measurement.
Next 1/2	Displays the second page of the menu

When the zoom method is set to **SPAN**

Display OFF ON	Turns the waveform display on and off
Label AUX5	Set the display label.
Vertical Scale DIV SPAN	Set the zoom method to SPAN.
Upper 25.00rpm Lower -25.00rpm	Set the upper and lower limits of the display range.
Auto Range OFF ON	Turns the auto range on and off*
Speed Settings (Analog/Pulse) Analog	Configure rotating speed measurement.
Next 1/2	Displays the second page of the menu

* You can turn auto range on and off when the rotating-speed input signal type is set to Analog. If the type is set to Pulse, auto range is fixed to OFF.

Note

The U key whose display setting is ON illuminates. If the U key is not illuminated, you can press it to turn on the waveform display and the key. If the U key is illuminated, you can press it to turn off the waveform display and the key.

- Press the **Next 1/2** soft key to display the 2/2 menu.

When the rotating-speed input signal type is **Analog**

Coupling DC	Set the input coupling (AC, DC, GND).
Probe Full	
Bandwidth Full	Set the bandwidth limit (10kHz, 20kHz, 40kHz, 80kHz, 160kHz, 320kHz, 640kHz, 1.28MHz, 2MHz, Full).
Pulse Level High 2.4V	
Pulse Level Low 0.4V	
Next 2/2	Displays the first page of the menu

When the rotating-speed input signal type is **Pulse**

Coupling DC	
Probe Full	Set the bandwidth limit (10kHz, 20kHz, 40kHz, 80kHz, 160kHz, 320kHz, 640kHz, 1.28MHz, 2MHz, Full).
Pulse Level High 2.4V	Set the upper and lower pulse reference levels.
Pulse Level Low 0.4V	
Next 2/2	Displays the first page of the menu

Setting the Input Coupling (Coupling)

This is the same feature as the input coupling of sensor input voltage measurement. ► [section 2.4](#)

Configuring Rotating Speed Measurements (Speed Settings)

Press the **Speed Settings** soft key to display the following screen.

When the input signal type is Analog

- When the linear scaling mode is AX+B

The screenshot shows the 'Motor Speed Settings' screen. The 'Sense Type' is set to 'Analog'. The 'Unit' is set to 'rpm'. Under the 'Analog' section, 'Scaling Mode' is set to 'AX+B'. The 'A' coefficient is '1.000' and the 'B' offset is '0.0000'. Under the 'Display Type' section, 'Mode' is 'Floating', 'Decimal Number' is 'Auto', and 'Sub Unit' is 'Auto'. Callouts point to these settings with instructions: 'Set the input signal type to Analog.', 'Select the rotating speed unit (rps, rpm, rph).', 'Set the linear scaling mode to AX+B.', 'Set the scaling coefficient.', 'Set the offset.', 'Select the display mode.', 'Select the number of decimal places.', and 'Select the unit prefix.'

- When the linear scaling mode is P1-P2

The screenshot shows the 'Motor Speed Settings' screen with 'Sense Type' set to 'Analog' and 'Unit' set to 'rpm'. 'Scaling Mode' is set to 'P1-P2'. There are four input fields for scale values: 'P1[X]' (1.0000), 'P1[Y]' (1.000), 'P2[X]' (5.0000), and 'P2[Y]' (5.000). Each has a 'Get Value' button next to it. The 'Display Type' section is the same as in the previous screen. Callouts include: 'Set the input signal type to Analog.', 'Select the rotating speed unit (rps, rpm, rph).', 'Set the linear scaling mode P1-P2.', 'Retrieve the current measured values.', 'Set the measured values.', 'Set the scale values.', and 'Same feature as when linear scaling mode is set to AX+B'.

When the input signal type is Pulse

The screenshot shows the 'Motor Speed Settings' screen with 'Sense Type' set to 'Pulse'. The 'Unit' is set to 'rpm'. Under the 'Pulse' section, 'Pulse N' is set to '60' with the unit 'Pulses/Revolution'. The 'Display Type' section is the same as in the previous screens. Callouts include: 'Set the input signal type to Pulse.', 'Select the rotating speed unit (rps, rpm, rph).', 'Set the number of pulses per rotation (1-9999).', and 'Same feature as when the input signal type is set to Analog'.

Setting the Rotating Speed Measurement Range (Vertical Scale, RANGE Knob)

This section explains how to set a fixed range.

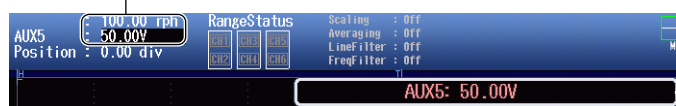
(If Auto Range in the AUX menu is set to ON, the measurement range changes depending on the amplitude of the input signal.)

Turn the **RANGE** knob to set the rotating speed measurement range.

- Auto Range in the AUX menu is set to OFF.
- If the input signal type is analog and you turn the RANGE knob when waveform acquisition is stopped, two values are shown on the measurement range screen. The upper value is the measurement range for the displayed waveforms. The lower value is the measurement range that you have specified. The new range will be applied the next time waveform acquisition is started.
- If you do not operate the RANGE knob for approximately 3 seconds, the measurement range that you are setting with the knob will disappear from the screen.

Top row: Measurement range for the displayed waveforms

Bottom row: Measurement range that you have specified



Use the **RANGE** knob to display the measurement range that is currently being set.

Measurement Range Options and Units

Below are the available options for the RANGE knob, measurement range values, and measurement range units that appear on the screen for when the zoom method is set to DIV and the zoom magnification is set to $\times 1$. If you change the zoom method or zoom magnification, what appears on the screen will change accordingly.

• When Waveform Acquisition Is Stopped

Input Signal Type	Linear Scaling Mode	Available Options for the RANGE Knob	Measurement Range Values (that appear on the screen)	Measurement Range Units (that appear on the screen)
Analog	OFF	50.00mV, 100.0mV, 250.0mV, 500.0mV, 1.000V, 2.500V, 5.000V,	Upper value: RANGE knob value for the displayed waveform Lower value: Available option value of the RANGE knob	Upper unit value: Unit selected on the rotating speed measurement setting screen Lower unit value: Same unit as the available options for the RANGE knob
	AX+B, P1-P2	10.00V, 25.00V, 50.00V, 100.0V	Upper value: Value obtained by multiplying the available option value of the RANGE knob by the linear scaling coefficient. Lower value: Available option value of the RANGE knob	Upper unit value: Unit selected on the rotating speed measurement setting screen Lower unit value: Same unit as the available options for the RANGE knob
Pulse	—	1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k, 20k, 50k, 100k, 200k, 500k, 1M	Upper value: No display Lower value: Available option value of the RANGE knob	Upper unit value: No display Lower unit value: Unit selected on the rotating speed measurement setting screen

• When Waveform Acquisition Is Running

Input Signal Type	Linear Scaling Mode	Available Options for the RANGE Knob	Measurement Range Values (that appear on the screen)	Measurement Range Units (that appear on the screen)
Analog	OFF	50.00mV, 100.0mV, 250.0mV, 500.0mV, 1.000V, 2.500V, 5.000V,	Upper value: Available option value of the RANGE knob Lower value: Available option value of the RANGE knob	Upper unit value: Unit selected on the rotating speed measurement setting screen Lower unit value: Same unit as the available options for the RANGE knob
	AX+B, P1–P2	10.00V, 25.00V, 50.00V, 100.0V	Upper value: Value obtained by multiplying the available option value of the RANGE knob by the linear scaling coefficient. Lower value: Available option value of the RANGE knob	Upper unit value: Unit selected on the rotating speed measurement setting screen Lower unit value: Same unit as the available options for the RANGE knob
Pulse	—	1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k, 20k, 50k, 100k, 200k, 500k, 1M	Upper value: No display Lower value: Available option value of the RANGE knob	Upper unit value: No display Lower unit value: Unit selected on the rotating speed measurement setting screen

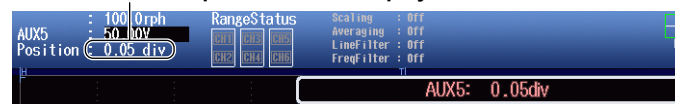
Setting the Rotating Speed Waveform Vertical Position

When the Zoom Method is Set to DIV (Vertical POSITION Knob)

Turn the **vertical POSITION** knob to set the waveform vertical position.

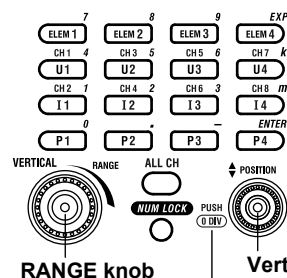
- Set in the range of –5.00 div to 5.00 div.
- If you do not operate the vertical POSITION knob for approximately 3 seconds, the vertical position that you are setting with the knob will disappear from the screen.

Vertical position of the displayed waveform



Use the vertical **POSITION** knob to display the vertical position that is currently being set.

- You can set the vertical position to 0 div by pressing the knob.



RANGE knob

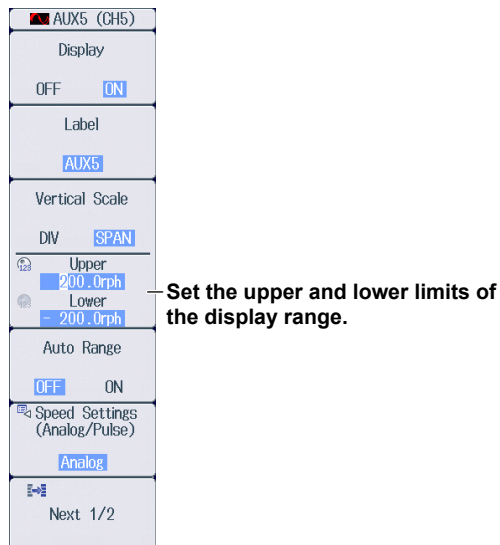
Vertical **POSITION** knob

This indicates that you can press the vertical **POSITION** knob to set the vertical position to 0 div.

2.5 Configuring Rotating Speed Measurements

When the Zoom Method is Set to SPAN (Upper and Lower Limits)

Using the **Upper/Lower** soft key and the **jog shuttle**, set the number of rotations at the top edge of the waveform screen (upper limit) and the number of rotations at the bottom edge of the screen (lower limit) to set the waveform vertical position.



2.6 Configuring Torque Measurements

This section explains the following settings for the vertical axis of torque measurements.

- Waveform display on and off
- Display labels
- Zoom method
 - DIV: Magnification for zooming waveforms, offset
 - SPAN: Upper and lower display limits for zooming waveforms
- Auto range on and off
- Torque measurement
 - Input signal type, linear scaling, display format
- Input coupling
- Bandwidth limit
- Upper and lower pulse reference levels
- Torque measurement range
- Torque waveform vertical position

► **Features Guide: “Sensor Input Voltage Measurement (AUX)”**
“Torque Settings (Torque Settings)”

Check that an AUX module is installed in slot 3, 5, or 7.

Pm Menu

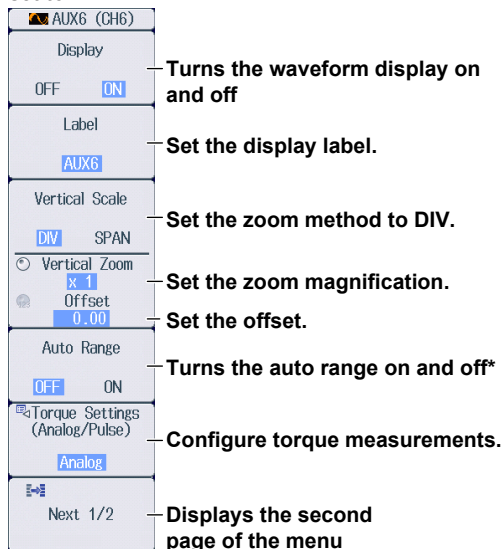
Of the **ELEM 2 to ELEM 4** keys, press the key corresponding to the slot in which the AUX module is installed. On the menu that appears, set Motor Mode to ON.

Pm3	
Motor Mode	
OFF ON	Set Motor Mode to ON.
Name	
Pm3	Set the function name.
Scaling	
1.0000	Set the scaling coefficient.
Unit	
W	Set the unit.
Sync Source	
None	Set the synchronization source. ► section 1.3

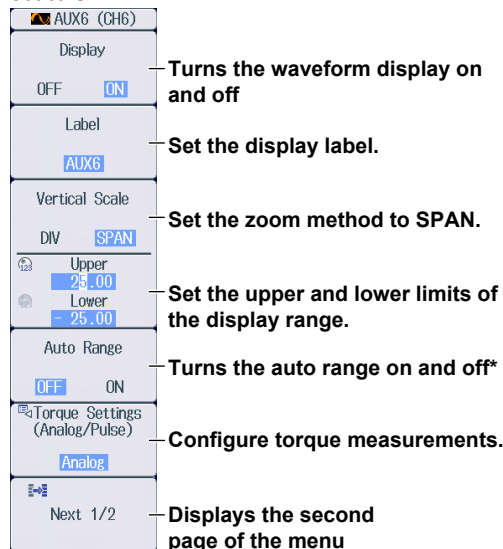
AUX Menu

- Press **I2(CH4)**, **I3(CH6)**, or **I4(CH8)** to select a channel on an installed AUX module. The following menu appears.

When the zoom method is set to DIV



When the zoom method is set to SPAN



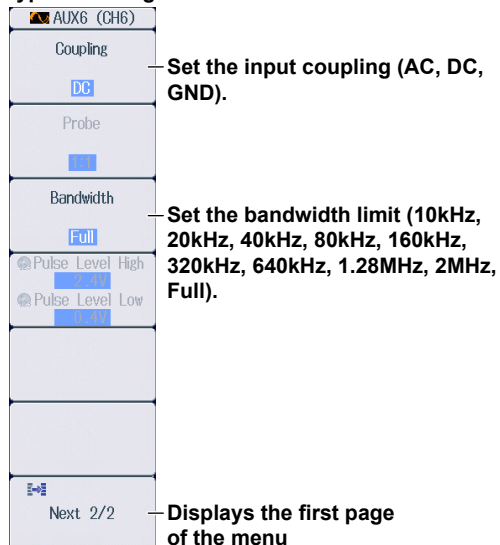
* You can turn auto range on and off when the torque input signal type is set to Analog. If the type is set to Pulse, auto range is fixed to OFF.

Note

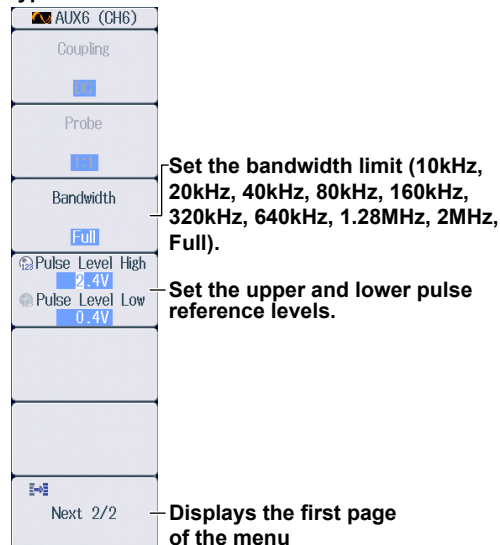
The I key whose display setting is ON illuminates. If the I key is not illuminated, you can press it to turn on the waveform display and the key. If the I key is illuminated, you can press it to turn off the waveform display and the key.

- Press the **Next 1/2** soft key to display the 2/2 menu.

When the torque input signal type is Analog



When the torque input signal type is Pulse



Setting the Input Coupling (Coupling)

This is the same feature as the input coupling of sensor input voltage measurement. ► [section 2.4](#)

Configuring Torque Measurements (Torque Settings)

Press the **Torque Settings** soft key to display the following screen.

When the input signal type is Analog

- When the linear scaling mode is AX+B

The screenshot shows the 'Motor Torque Settings' screen. The 'Sense Type' is set to 'Analog'. The 'Unit' field is empty. Under the 'Analog' section, 'Scaling Mode' is set to 'AX+B'. The 'A' coefficient is 1.0000 and the 'B' offset is 0.0000. Under the 'Display Type' section, 'Mode' is 'Floating', 'Decimal Number' is 'Auto', and 'Sub Unit' is 'Auto'. Callouts on the right point to these settings with instructions: 'Set the input signal type to Analog.', 'Set the torque unit.', 'Set the linear scaling mode to AX+B.', 'Set the scaling coefficient.', 'Set the offset.', 'Select the display mode.', 'Select the number of decimal places.', and 'Select the unit prefix.'

- When the linear scaling mode is P1-P2

The screenshot shows the 'Motor Torque Settings' screen with 'Sense Type' set to 'Analog' and 'Unit' empty. Under the 'Analog' section, 'Scaling Mode' is set to 'P1-P2'. There are four input fields for scale values: P1[X] (1.0000), P1[Y] (1.0000), P2[X] (5.0000), and P2[Y] (5.0000). Each has a 'Get Value' button next to it. Under the 'Display Type' section, 'Mode' is 'Floating', 'Decimal Number' is 'Auto', and 'Sub Unit' is 'Auto'. Callouts on the right provide instructions: 'Set the input signal type to Analog.', 'Set the torque unit.', 'Set the linear scaling mode P1-P2.', 'Retrieve the current measured values.', 'Set the measured values.', 'Set the scale values.', and 'Same feature as when linear scaling mode is set to AX+B'.

When the input signal type is Pulse

The screenshot shows the 'Motor Torque Settings' screen with 'Sense Type' set to 'Pulse' and 'Unit' empty. Under the 'Pulse' section, there are two pairs of input fields: 'Rated Upper' (50.0000) and 'Rated Lower' (-50.0000) for torque, and '15000Hz' and '5000Hz' for pulse frequency. Callouts on the right provide instructions: 'Set the input signal type to Pulse.', 'Set the torque unit.', 'Set the positive and negative rated torque signal values (-10000.0000 to 10000.0000).', 'Set the positive and negative rated torque signals' pulse signal values (1Hz-100000000Hz).', and 'Same feature as when the input signal type is set to Analog'.

Setting the Torque Measurement Range (Vertical Scale, RANGE Knob)

This section explains how to set a fixed range.

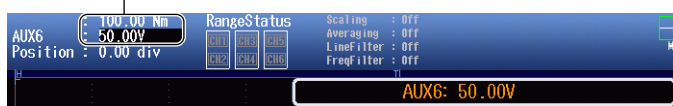
(If Auto Range in the AUX menu is set to ON, the measurement range changes depending on the amplitude of the input signal.)

Turn the **RANGE** knob to set the torque measurement range.

- Auto Range in the AUX menu is set to OFF.
- If the input signal type is analog and you turn the RANGE knob when waveform acquisition is stopped, two values are shown on the measurement range screen. The upper value is the measurement range for the displayed waveforms. The lower value is the measurement range that you have specified. The new range will be applied the next time waveform acquisition is started.
- If you do not operate the RANGE knob for approximately 3 seconds, the measurement range that you are setting with the knob will disappear from the screen.

Top row: Measurement range for the displayed waveforms

Bottom row: Measurement range that you have specified



Use the **RANGE** knob to display the measurement range that is currently being set.

Measurement Range Options and Units

Below are the available options for the RANGE knob, measurement range values, and measurement range units that appear on the screen for when the zoom method is set to DIV and the zoom magnification is set to $\times 1$. If you change the zoom method or zoom magnification, what appears on the screen will change accordingly.

• When Waveform Acquisition Is Stopped

Input Signal Type	Linear Scaling Mode	Available Options for the RANGE Knob	Measurement Range Values (that appear on the screen)	Measurement Range Units (that appear on the screen)
Analog	OFF	50.00mV, 100.0mV, 250.0mV, 500.0mV, 1.000V, 2.500V,	Upper value: RANGE knob value for the displayed waveform Lower value: Available option value of the RANGE knob	Upper unit value: Unit selected on the torque speed measurement setting screen Lower unit value: Same unit as the available options for the RANGE knob
	AX+B, P1-P2	5.000V, 10.00V, 25.00V, 50.00V, 100.0V	Upper value: Value obtained by multiplying the available option value of the RANGE knob by the linear scaling coefficient. Lower value: Available option value of the RANGE knob	Upper unit value: Unit selected on the torque speed measurement setting screen Lower unit value: Same unit as the available options for the RANGE knob
Pulse	—	1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k, 20k, 50k, 100k, 200k, 500k, 1M	Upper value: No display Lower value: Available option value of the RANGE knob	Upper unit value: No display Lower unit value: Unit selected on the torque speed measurement setting screen

- When Waveform Acquisition Is Running

Input Signal Type	Linear Scaling Mode	Available Options for the RANGE Knob	Measurement Range Values (that appear on the screen)	Measurement Range Units (that appear on the screen)
Analog	OFF	50.00mV, 100.0mV, 250.0mV, 500.0mV, 1.000V, 2.500V,	Upper value: Available option value of the RANGE knob Lower value: Available option value of the RANGE knob	Upper unit value: Unit selected on the torque speed measurement setting screen Lower unit value: Same unit as the available options for the RANGE knob
	AX+B, P1–P2	5.000V, 10.00V, 25.00V, 50.00V, 100.0V	Upper value: Value obtained by multiplying the available option value of the RANGE knob by the linear scaling coefficient. Lower value: Available option value of the RANGE knob	Upper unit value: Unit selected on the torque speed measurement setting screen Lower unit value: Same unit as the available options for the RANGE knob
Pulse	—	1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k, 20k, 50k, 100k, 200k, 500k, 1M	Upper value: No display Lower value: Available option value of the RANGE knob	Upper unit value: No display Lower unit value: Unit selected on the torque speed measurement setting screen

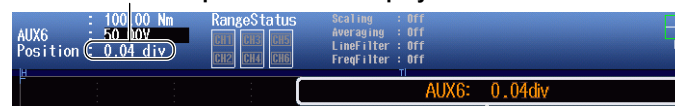
Setting the Torque Waveform Vertical Position

When the Zoom Method is Set to DIV (Vertical POSITION Knob)

Turn the **vertical POSITION** knob to set the waveform vertical position.

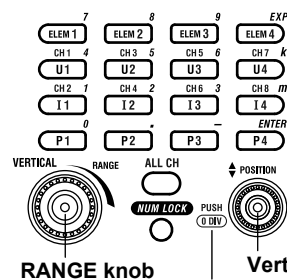
- Set in the range of –5.00 div to 5.00 div.
- If you do not operate the vertical POSITION knob for approximately 3 seconds, the vertical position that you are setting with the knob will disappear from the screen.

Vertical position of the displayed waveform



Use the vertical **POSITION** knob to display the vertical position that is currently being set.

- You can set the vertical position to 0 div by pressing the knob.



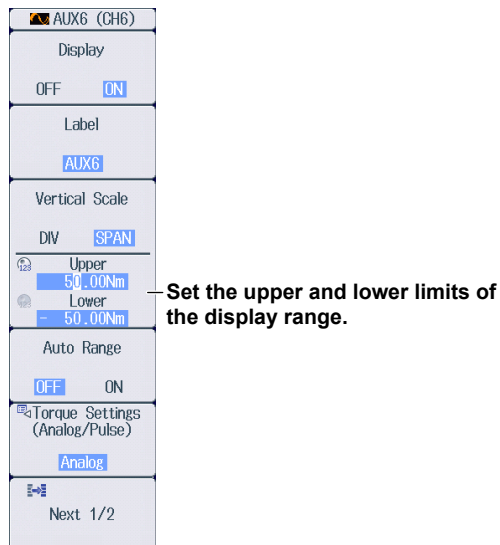
RANGE knob

Vertical **POSITION** knob

This indicates that you can press the vertical **POSITION** knob to set the vertical position to 0 div.

When the Zoom Method is Set to SPAN (Upper and Lower Limits)

Using the **Upper/Lower** soft key and the **jog shuttle**, set the torque at the top edge of the waveform screen (upper limit) and the torque at the bottom edge of the screen (lower limit) to set the waveform vertical position.



2.7 Displaying the Menu for Configuring All Channels

This section explains the following settings for configuring all channels.

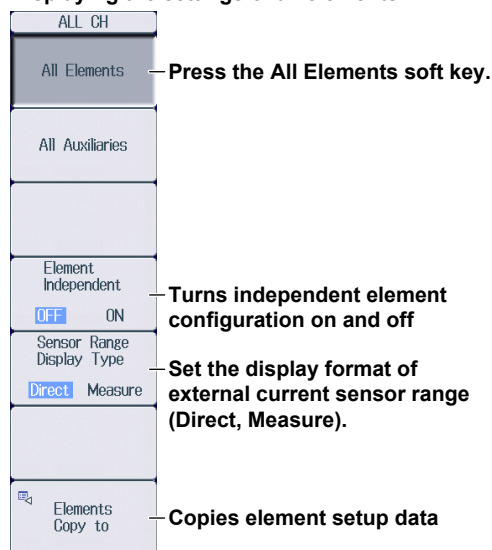
- Settings of all elements
- Settings of all AUX channels
- Copying setup data

► **Features Guide: “Displaying the Menu for Configuring All Channels (ALL CH)”**

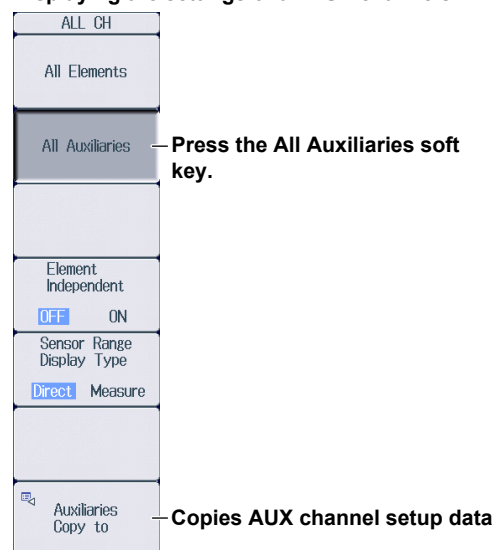
ALL CH menu

Press **ALL CH** to display the following menu.

Displaying the settings of all elements



Displaying the settings of all AUX channels



Settings of All Elements (All Elements)

1. Press the **All Elements** soft key to display the following screen.

Use the **jog shuttle** to select the setting that you want to change, and then press **SET** to display the available options or an input box.

To set all elements to the same setting at once, change the settings in the All column.

All Elements Setup				
All	Element 1	Element 2		
Wiring	1P2W	1P2W		
U Auto Range	OFF	OFF		
U Range	100V	100V		
Ext Sensor	OFF	OFF		
I Auto Range	OFF	OFF		
I Range	5A	5A		
Sensor Rreset	Preset	Preset		
Sensor Ratio	10.000mV/A(mC)	10.000mV/A(mC)		
CT Rreset	Preset	Preset		
Scaling	OFF	OFF		
VT Scaling	1.0000	1.0000		
CT Scaling	1.0000	1.0000		
SF Scaling	1.0000	1.0000		
Sync Source	I1	I2		
Line Filter	OFF	OFF		
Freq Filter	OFF	OFF		

Use the jog shuttle to select the item that you want to set.

2.7 Displaying the Menu for Configuring All Channels

Copying Element Setup Data (Elements Copy to)

2. Press the **Elements Copy to** soft key to display the following screen.

Copy to

Source: **Element 1**

Destination: **All ON** **All OFF**

☐ Element 1

☒ Element 2

Execute

Annotations:

- Set the copy source element.
- Selects all elements except the copy source to be copy destinations
- Clears all elements from being copy destinations
- Select the element check boxes separately to set the copy destination.
- Starts copying

Settings of All AUX Channels

1. Press the **All Auxiliaries** soft key to display the following screen.

Use the **jog shuttle** to select the setting that you want to change, and then press **SET** to display the available options or an input box.

	CH5 AUX 5	CH6 AUX 6				
Motor Mode	OFF					
Pm Name	Pm3					
Pm Scaling	1.0000					
Pm Unit	W					
Sync Source	None					
Sense Type	Analog	Analog				
Unit						
Auto Range	OFF	OFF				
Range	250V	250V				
Scaling Mode	OFF	OFF				
A	1.0000	1.0000				
B	0.0000	0.0000				
P1[X]	1.0000	1.0000				
P1[Y]	1.0000	1.0000				
P2[X]	5.0000	5.0000				
P2[Y]	5.0000	5.0000				
Pulse N	60					
Rated Upper		50.0000				
Rated Freq Upper		15000Hz				
Rated Lower		-50.0000				
Rated Freq Lower		5000Hz				
Bandwidth	Full	Full				
Coupling	DC	DC				
Probe	10:1	10:1				
Pulse Level High	2.4V	2.4V				
Pulse Level Low	0.4V	0.4V				

Use the jog shuttle to select the item that you want to set.

Copying AUX Channel Setup Data (Auxiliaries Copy to)

2. Press the **Auxiliaries Copy to** soft key to display the following screen.

Copy to

Source: **AUX5**

Destination: **All ON** **All OFF**

☐ AUX5 ☒ AUX6

Execute

Annotations:

- Set the copy source channel.
- Selects all channels except the copy source to be copy destinations
- Clears all channels from being copy destinations
- Select the channel check boxes separately to set the copy destination.
- Starts copying

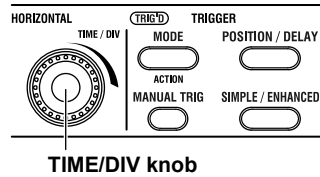
2.8 Configuring the Horizontal Axis (Time axis)

This section explains how to set the time scale (the time per grid (1 div) displayed on the screen).

► [Features Guide: “Horizontal Axis”](#)

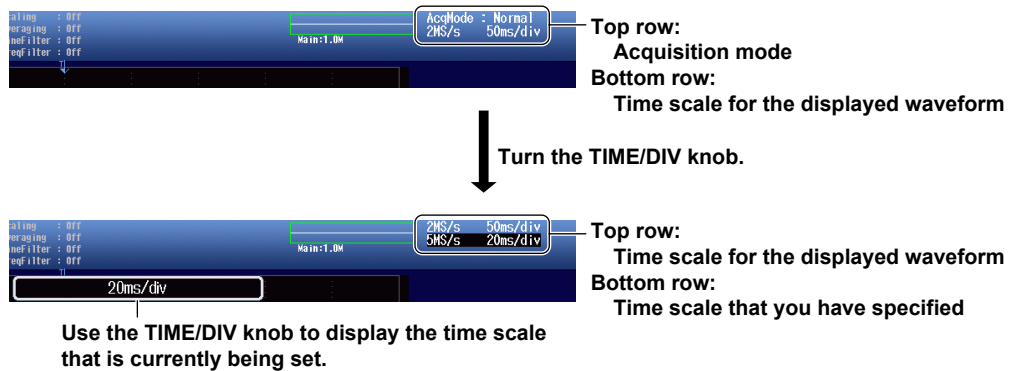
Configuring the Horizontal Axis (Time axis)

Turn the **TIME/DIV** knob to set the time scale.



Time Scale (TIME/DIV) Display

- If you turn the TIME/DIV knob when waveform acquisition is stopped, the time scale display shows the time scale for the currently displayed waveform in the upper row and the changed time scale in the lower row. The new time scale will be applied the next time waveform acquisition is started.
- If you do not operate the TIME/DIV knob for approximately 3 seconds, the time scale that you are setting with the knob will disappear from the screen.



3.1 Setting the Trigger Mode

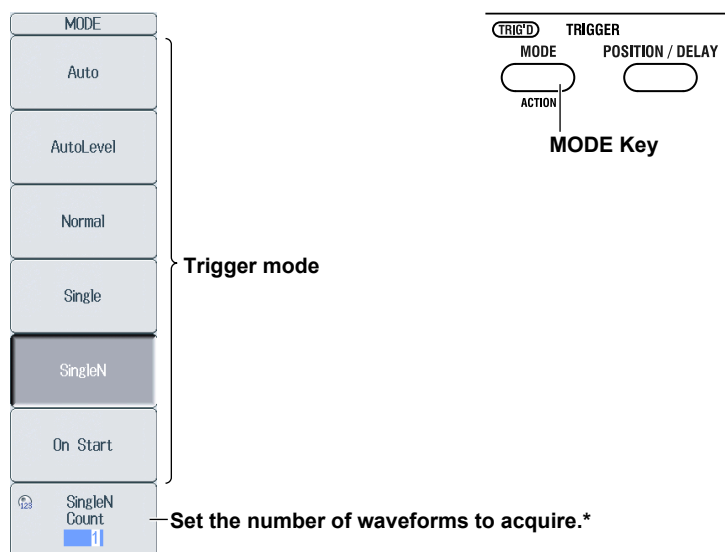
This section explains the following setting for updating the displayed waveform.

- Trigger mode

► [Features Guide: “Trigger Mode \(MODE\)”](#)

MODE menu

Press **MODE** to display the following menu.



* Displayed when the trigger mode is set to SingleN.

Setting the Trigger Mode (Mode)

- Auto:** If the trigger conditions are met within 50 ms, the PX8000 updates the displayed waveforms on each trigger occurrence. If not, the PX8000 automatically updates the displayed waveforms. If the time axis is set to a value that would cause the display to switch to roll mode, the roll mode display will be enabled.
- AutoLevel:** If a trigger occurs before a timeout (which is approximately 1 second), the PX8000 updates the waveform in the same way that it does in Auto mode. If a trigger does not occur before a timeout, the PX8000 automatically changes the trigger level to the center value of the trigger source amplitude, triggers on that value, and updates the displayed waveform.
- Normal:** The PX8000 only updates the waveform display when the trigger conditions are met.
- Single:** When the trigger conditions are met, the PX8000 updates the displayed waveform once and stops signal acquisition. If the time axis is set to a value that would cause the display to switch to roll mode, the roll mode display will be enabled. When the PX8000 triggers, it begins recording data. When data has been acquired up to the amount specified by the set record length, the waveform display stops.
- SingleN:** The PX8000 acquires signals each time the trigger conditions are met until a specified number of signals have been acquired, and then displays all of the acquired signals. If no triggers occur, the display is not updated.
- On Start:** Regardless of the trigger settings, when you press the START key, the PX8000 updates the displayed waveforms once and stops signal acquisition. If the time axis is set to a value that would cause the display to switch to roll mode, the roll mode display will be enabled. When data has been acquired up to the amount specified by the set record length, the waveform display stops.

3.2 Setting the Trigger Position and Trigger Delay



This section explains the following settings for updating the displayed waveform.

- Trigger position
- Trigger delay

► [Features Guide: “Trigger Position \(Position\)”](#)
[“Trigger Delay \(Delay\)”](#)

POSITION/DELAY Menu

Press **POSITION/DELAY** to display the following menu.

POSITION/DELAY	
 Position 50.0%	Set the trigger position.
Set to 10%	Set the trigger position to 10%.
Set to 50%	Set the trigger position to 50%.
Set to 90%	Set the trigger position to 90%.
 Delay 0.00us	Set the trigger delay.

3.3 Setting the Trigger Hold Off

This section explains the following setting for updating the displayed waveform.

- Hold-off time

► [Features Guide: “Trigger Hold Off \(Hold Off\)”](#)

SIMPLE/ENHANCED Menu

Press **SIMPLE/ENHANCED** to display the following menu.

SIMPLE/ENHANCED	
Setting	
Simple	Enhanced
Source	
U1	
Slope	
f	f↑ f↓
Level	
0.0V	
Hysteresis	
≠	≠≠ ≠≠≠
Hold Off	
0.00us	

— Set the trigger hold off.

Setting the Hold-off Time (Hold Off)

The trigger hold-off feature temporarily stops the detection of the next trigger once a trigger has occurred.

3.4 Triggering on an Edge Trigger (Simple)

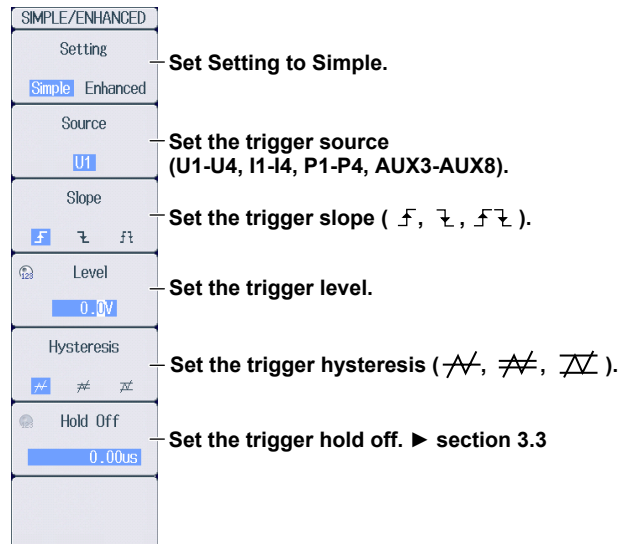
This section explains the following settings for triggering on the edges of a signal applied to an installed module.

- Trigger source
- Trigger slope
- Trigger level
- Trigger hysteresis

► **Features Guide:** “Simple Trigger (Simple),” “Trigger Source (Source),” “Trigger Slope (Slope),” “Trigger Level (Level),” and “Trigger Hysteresis (Hysteresis)”

SIMPLE Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Simple. The following menu appears.



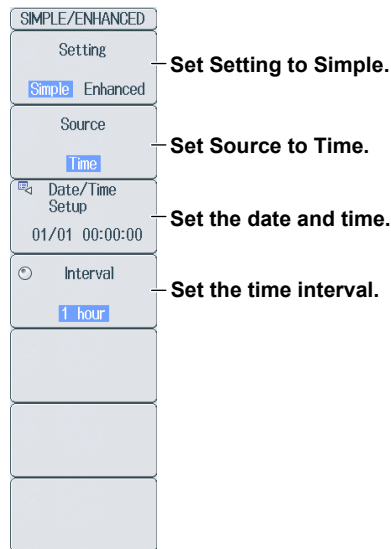
3.5 Triggering on a Timer Trigger (Simple)

This section explains the settings that are used when triggering on a specific date and time.

► [Features Guide: “Time \(Time\)”](#)

SIMPLE Time Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Simple. The following menu appears.

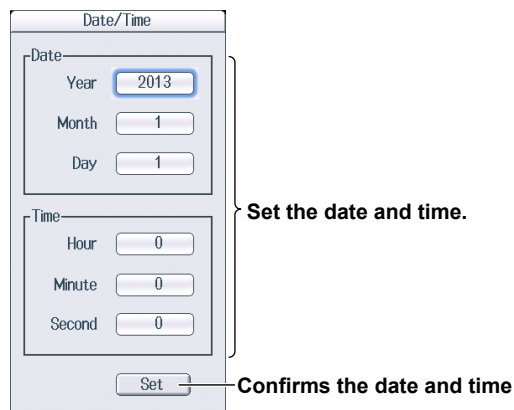


The screenshot shows a vertical menu with the following options and annotations:

- SIMPLE/ENHANCED** (Header)
- Setting** (with **Simple** and **Enhanced** sub-options) — **Set Setting to Simple.**
- Source** (with **Time** sub-option) — **Set Source to Time.**
- Date/Time Setup** (with **01/01 00:00:00**) — **Set the date and time.**
- Interval** (with **1 hour**) — **Set the time interval.**
- Three empty menu items at the bottom.

Setting the Date and Time (Date/Time Setup)

Press the **Date/Time Setup** soft key to display the following screen.



The screenshot shows the **Date/Time Setup** screen with the following fields and annotations:

- Date/Time** (Header)
- Date** section:
 - Year**: 2013
 - Month**: 1
 - Day**: 1
- Time** section:
 - Hour**: 0
 - Minute**: 0
 - Second**: 0
- Set** button — **Confirms the date and time**

A bracket on the right side of the screen groups the Date and Time sections with the annotation: **Set the date and time.**

3.6 Triggering on an External Trigger (Simple)

This section explains the settings that are used when triggering on an external signal.

► [Features Guide: “External Signal \(External\)”](#)
“Trigger Slope (Slope)”

SIMPLE External Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Simple. The following menu appears.

SIMPLE/ENHANCED	
Setting	Set Setting to Simple.
Simple Enhanced	
Source	Set Source to External.
External	
Slope	Set the trigger slope (\uparrow , \downarrow).
\uparrow \downarrow	
Hold Off	Set the trigger hold off. ► section 3.3
0.00us	

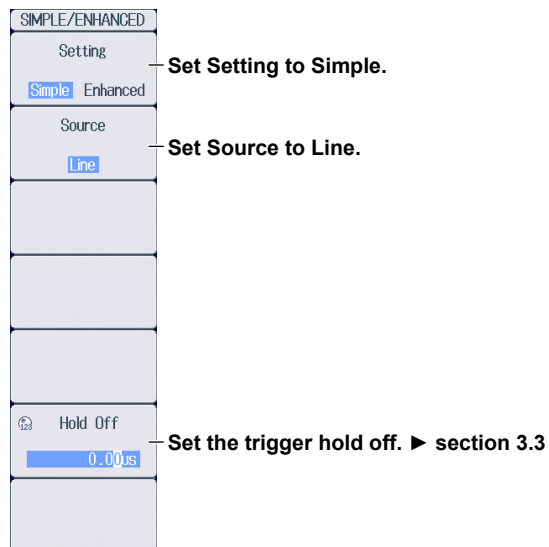
3.7 Triggering on a Power Line Signal (Simple)

This section explains the settings that are used when triggering on a power line signal.

► [Features Guide: “Power Line Signal \(Line\)”](#)

SIMPLE Line Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Simple. The following menu appears.



3.8 Triggering on an A -> B(N) Trigger (Enhanced)

This section explains the following settings for triggering on an A -> B(N) trigger.

- Trigger source
- State condition
- State condition achievement condition
- Number of times state condition B must be met
- Trigger condition

► [Features Guide: “A -> B\(N\) Trigger \(Enhanced\)”](#)

ENHANCED_A->B(N) Trigger Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Enhanced. The following menu appears.

SIMPLE/ENHANCED

Setting

Simple **Enhanced**

Type

A -> B(N)

Set Pattern

Hold Off

0.00us

Setting the State and Trigger Conditions (Set Pattern)

Press the **Set Pattern** soft key to display the following menu.

Set the state condition (H, L, or X (do not use as a trigger source)).

Set the trigger level.

Set the hysteresis (∇ , ∇ , ∇).

	A State	B State	Level	Hys
U1	H	H	0.0V	∇
I1	X	X	0.00A	∇
P1	X	X	0W	∇
U2	X	X	0.0V	∇
I2	X	X	0.00A	∇
P2	X	X	0W	∇
AUX5	X	X	0.0V	∇
AUX6	X	X	0.0V	∇

A Condition

Enter **Exit**

B Condition

Enter **Exit**

Count

1

Met Met N times

A → B B → Trigger

3.9 Triggering on an A Delay B Trigger (Enhanced)

This section explains the following settings for triggering on an A Delay B trigger.

- Trigger source
- State condition
- State condition achievement condition
- Delay time
- Trigger condition

► [Features Guide: “A Delay B Trigger \(Enhanced\)”](#)

ENHANCED A Delay B Trigger Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Enhanced. The following menu appears.

The screenshot shows a vertical menu with the following options and annotations:

- SIMPLE/ENHANCED** (header)
- Setting** (header)
- Simple** and **Enhanced** (radio buttons). Annotation: **Set Setting to Enhanced.**
- Type** (header)
- A Delay B** (radio button). Annotation: **Set Type to A Delay B.**
- Set Pattern** (header). Annotation: **Set the state and trigger conditions.**
- Hold Off** (header)
- 0.00us** (value). Annotation: **Set the trigger hold off. ► section 3.3**

Setting the State and Trigger Conditions (Set Pattern)

Press the **Set Pattern** soft key to display the following menu.

The screenshot shows the **Set Pattern** menu with the following sections and annotations:

- A Delay B** (header)
- Set the state condition (H, L, or X (do not use as a trigger source)).**
- Set the trigger level.**
- Set the hysteresis (\overline{A} , \overline{B} , $\overline{A/B}$).**
- A Condition** (table with columns: A State, B State, Level, Hys). Annotation: **Set the state condition achievement conditions (Enter, Exit).**
- B Condition** (table with columns: A State, B State, Level, Hys). Annotation: **Set the state condition achievement conditions (Enter, Exit).**
- Delay** (header)
- 0.00us** (value). Annotation: **Set the delay time.**
- Met A** → **Delay time passes** → **Met B** → **Trigger** (diagram).

	A State	B State	Level	Hys
U1	H	H	0.0V	\overline{A}
I1	X	X	0.00A	\overline{B}
P1	X	X	0W	$\overline{A/B}$
U2	X	X	0.0V	\overline{A}
I2	X	X	0.00A	\overline{B}
P2	X	X	0W	$\overline{A/B}$
AUX5	X	X	0.0V	\overline{A}
AUX6	X	X	0.0V	\overline{B}

3.10 Triggering on an Edge On A Trigger (Enhanced)

This section explains the following settings for triggering on an Edge On A trigger.

- Trigger source
- State condition
- State condition achievement condition
- Edge detection condition
- Trigger condition

► [Features Guide: “Edge On A Trigger \(Enhanced\)”](#)

ENHANCED Edge On A Trigger Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Enhanced. The following menu appears.

SIMPLE/ENHANCED

Setting
Simple **Enhanced** — Set Setting to Enhanced.

Type
Edge On A — Set Type to Edge On A.

Set Pattern — Set the state and trigger conditions.

Hold Off
0.00us — Set the trigger hold off. ► section 3.3

Setting the State and Trigger Conditions (Set Pattern)

Press the **Set Pattern** soft key to display the following menu.

Set the state condition (H, L, or X (do not use as a trigger source)).

Set the edge detection condition (f, l, —).

Set the trigger level.

Set the hysteresis (Δ , ∇ , ∇).

Set the state condition achievement conditions (True, False).

	A State	Edge	Level	Hys	Condition
U1	H	—	0.0V	Δ	True
I1	X	f	0.00A	Δ	
P1	X	—	0W	Δ	
U2	X	—	0.0V	Δ	
I2	X	—	0.00A	Δ	
P2	X	—	0W	Δ	
AUX5	X	—	0.0V	Δ	
AUX6	X	—	0.0V	Δ	

Condition A is being met → Trigger
↑
Edge detection

3.11 Triggering on an OR or AND Trigger (Enhanced)

This section explains the following settings for triggering on an OR or AND trigger.

- Trigger source
- Edge detection condition (OR trigger)
- Achievement condition (AND trigger)
- Trigger condition

► **Features Guide: “OR Trigger (Enhanced)” and “AND Trigger (Enhanced)”**

ENHANCED OR Trigger Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Enhanced. The following menu appears.

The screenshot shows a vertical menu with the following items and annotations:

- SIMPLE/ENHANCED** (header)
- Setting** (soft key) — **Set Setting to Enhanced.**
- Simple** and **Enhanced** (options) — **Enhanced** is selected.
- Type** (soft key) — **Set Type to OR.**
- OR** (option) — **OR** is selected.
- Set Pattern** (soft key) — **Set the state and trigger conditions.**
- Hold Off** (soft key) — **Set the trigger hold off. ► section 3.3**
- 0.00µs** (value) — **0.00µs** is displayed.

Setting the State and Trigger Conditions (Set Pattern)

Press the **Set Pattern** soft key to display the following menu.

The screenshot shows the **Set Pattern** menu with the following annotations:

- Set the edge detection condition (\uparrow , \downarrow , IN, OUT, —).** — Points to the **Edge** column header.
- Set the trigger level (set to the center value of the level width if the edge detection condition is set to IN or OUT).** — Points to the **Level** column header.
- Set the level width (when the edge detection condition is set to IN or OUT).** — Points to the **Width** column header.
- Set the hysteresis (∇ , ∇ , ∇).** — Points to the **Hys** column header.

	Edge	Level	Width	Hys
U1	\uparrow	0.0V	4.0V	∇
I1	—	0.00A	0.20A	∇
P1	—	0W	40W	∇
U2	—	0.0V	4.0V	∇
I2	—	0.00A	0.20A	∇
P2	—	0W	40W	∇
AUX5	—	0.0V	5.0V	∇
AUX6	—	0.0V	5.0V	∇
Ext	—			

ENHANCED AND Trigger Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Enhanced. The following menu appears.

SIMPLE/ENHANCED

Setting

Simple Enhanced

Type

AND

Set Pattern

Hold Off

0.00us

Set Setting to Enhanced.

Set Type to AND.

Set the state and trigger conditions.

Set the trigger hold off. ► section 3.3

Setting the State and Trigger Conditions (Set Pattern)

Press the **Set Pattern** soft key to display the following menu.

Set the achievement condition (H, L, IN, OUT, —).

Set the trigger level (set to the center value of the level width if the achievement condition is set to IN or OUT).

Set the level width (when the achievement condition is set to IN or OUT).

Set the hysteresis (∇ , ∇ , ∇).

AND

	Condition	Level	Width	Hys
U1	—	0.0V	4.0V	∇
I1	—	0.00A	0.20A	∇
P1	—	0W	40W	∇
U2	—	0.0V	4.0V	∇
I2	—	0.00A	0.20A	∇
P2	—	0W	40W	∇
AUX5	—	0.0V	5.0V	∇
AUX6	—	0.0V	5.0V	∇

3.12 Triggering on a Period Trigger (Enhanced)

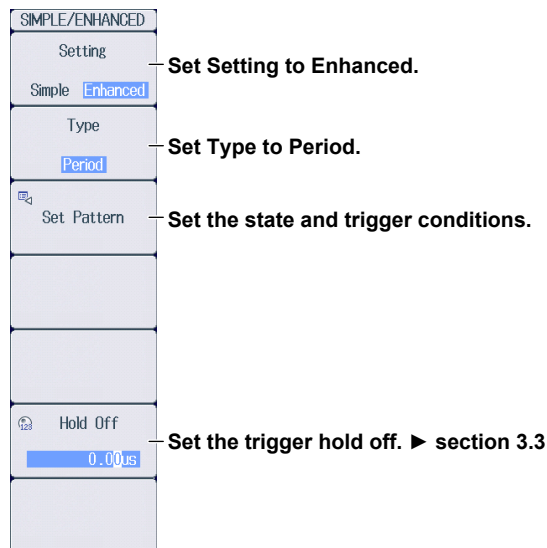
This section explains the following settings for triggering on a period trigger.

- Trigger source
- State condition
- Determination mode
- Reference time
- Trigger condition

► [Features Guide: “Period Trigger \(Enhanced\)”](#)

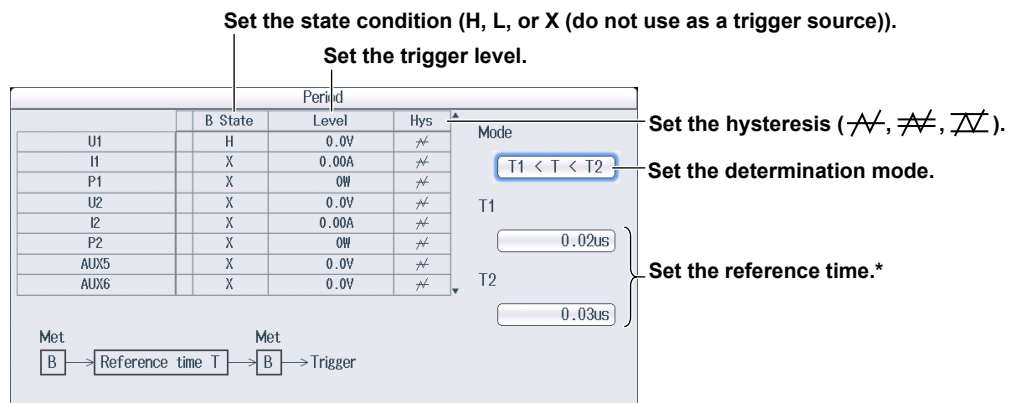
ENHANCED Period Trigger Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Enhanced. The following menu appears.



Setting the State and Trigger Conditions (Set Pattern)

Press the **Set Pattern** soft key to display the following menu.



- * Set T1 and T2 when the determination mode is T1 < T < T2 or T < T1, T2 < T.
Set Time when the determination mode is T < Time or T > Time.

3.12 Triggering on a Period Trigger (Enhanced)

Setting the Reference Mode (Mode)

Set what kind of relationship must be established between period T and the specified reference times (Time or T1 and T2) for the PX8000 to trigger.

T < Time	Period T must be shorter than the reference time (Time).
T > Time	Period T must be longer than the reference time (Time).
T1 < T < T2	Period T must be longer than reference time T1 and shorter than reference time T2.
T < T1, T2 < T	Period T must be shorter than reference time T1 or longer than reference time T2.

3.13 Triggering on a Pulse Width Trigger (Enhanced)

This section explains the following settings for triggering on a pulse width trigger.

- Trigger source
- State condition
- Determination mode
- Reference time
- Trigger condition

► [Features Guide: “Pulse Width Trigger \(Enhanced\)”](#)

ENHANCED Pulse Width Trigger Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Enhanced. The following menu appears.

Setting the State and Trigger Conditions (Set Pattern)

Press the **Set Pattern** soft key to display the following menu.

	B State	Level	Hys
U1	H	0.0V	\cancel{V}
I1	X	0.00A	\cancel{A}
P1	X	0W	\cancel{W}
U2	X	0.0V	\cancel{V}
I2	X	0.00A	\cancel{A}
P2	X	0W	\cancel{W}
AUX5	X	0.0V	\cancel{V}
AUX6	X	0.0V	\cancel{V}

- * Set T1 and T2 when the determination mode is B Between.
Set Time when the determination mode is B < Time, B > Time, or B TimeOut.

3.13 Triggering on a Pulse Width Trigger (Enhanced)

Setting the Reference Mode (Mode)

Set what kind of relationship must be established between the state condition B achievement time and the specified reference times (Time or T1 and T2) for the PX8000 to trigger.

B < Time	The PX8000 triggers when the achievement time is shorter than the reference time (Time), and the state condition changes from being met to not being met.
B > Time	The PX8000 triggers when the achievement time is longer than the reference time (Time), and the state condition changes from being met to not being met.
B TimeOut	The PX8000 triggers when the achievement time is longer than the reference time (Time).
B Between	The PX8000 triggers when the achievement time is longer than reference time T1 and shorter than reference time T2, and the state condition changes from being met to not being met.

3.14 Triggering on a Wave Window Trigger (Enhanced)

This section explains the following settings for triggering on a wave window trigger.

- Source channel
Tolerance width, cycle frequency, and reference cycle
- Synchronization channel
- Trigger condition

► [Features Guide: “Wave Window Trigger \(Enhanced\)”](#)

ENHANCED Wave Window Trigger Menu

Press **SIMPLE/ENHANCED** and then the **Setting** soft key to select Enhanced. The following menu appears.

SIMPLE/ENHANCED

Setting
Simple Enhanced

Type
Wave Window

Set Pattern

Hold Off
0.00us

Set Setting to Enhanced.

Set Type to Wave Window.

Set the trigger conditions.

Set the trigger hold off. ► section 3.3

Setting the Trigger Conditions (Set Pattern)

Press the **Set Pattern** soft key to display the following menu.

Wave Window

	Condition	Width
U1	OFF	0.2V
I1	OFF	0.01A
P1	OFF	0.5W
U2	OFF	0.2V
I2	OFF	0.01A
P2	OFF	0.5W
AUX5	OFF	0.5V
AUX6	OFF	0.5V

Cycle Frequency
50Hz

Reference Cycle
1

Sync. Ch
U1

Level
0.0V

Hysteresis
✓

Set the source channel (ON, OFF).

Set the tolerance width.

Set the cycle frequency.

Set the reference cycle.

Set the synchronization channel (Auto, U1-U4, I1-I4, P1-P4, AUX3-AUX8).

Set the level for detecting the start and end points, and set the detection hysteresis.*

* Set when the synchronization channel is U1 to U4, I1 to I4, P1 to P4, or AUX3 to AUX8.

3.15 Triggering the PX8000 Manually (Manual Trigger)

This section explains how to trigger the PX8000 manually.

► [Features Guide: “Trigger Types \(Type\)”](#)

Press **MANUAL TRIG**.

4.1 Setting Conditions for Waveform Acquisition

This section explains the following settings for acquiring waveforms.

- Record length
- Acquisition mode
- Number of waveforms to acquire and attenuation constant
- Time base
- Executing logger setup

► [Features Guide: “Waveform Acquisition”](#)

ACQUIRE Menu

Press **ACQUIRE** to display the following menu.

When the Acquisition Mode Is Set to Normal or Envelope

ACQUIRE	
Record Length 1M	Set the record length.
Acquisition Mode Normal	Set the acquisition mode to Normal or Envelope.
Trigger Mode Auto	Set the trigger mode. ► section 3.1
Acquisition Count Infinite	Set the number of waveform acquisitions.
Time Base Int Ext	Set the time base (Int, Ext).
Execute Logger Setup	Execute Logger Setup.*

Time Base Int Ext	
Pulse/Rotate Pulse	Set the pulse/rotation.
Execute	

When the time base is Ext

* A confirmation message will appear.

When the Acquisition Mode Is Set to Average

ACQUIRE	
Record Length 1M	Set the record length.
Acquisition Mode Average	Set the acquisition mode to Average.
Trigger Mode Auto	Set the trigger mode. ► section 3.1
Acquisition Count Infinite	Set the number of waveform acquisitions.
Weight 16	Set the attenuation constant.
Time Base Int Ext	Set the time base (Int, Ext).
Execute Logger Setup	Execute Logger Setup.*

Time Base Int Ext	
Pulse/Rotate Pulse	Set the pulse/rotation.
Execute	

When the time base is Ext

* A confirmation message will appear.

Setting the Acquisition Mode (Acquisition Mode)

- Normal: Displays waveforms without processing the sampled data. You can set the number of waveforms to acquire with the jog shuttle.
- Envelope: Displays waveforms in envelope mode. You can set the number of waveforms to acquire with the jog shuttle.
- Average: Displays averaged waveforms. You can set the attenuation constant and the number of times to average with the jog shuttle.

4.2 Starting and Stopping Waveform Acquisition

This section explains how to start and stop waveform acquisition.

► [Features Guide: “Waveform Acquisition \(START/STOP\)”](#)

Waveform Acquisition (START/STOP)

Press **START/STOP** to start or stop waveform acquisition.

When the START/STOP key is illuminated, the PX8000 is acquiring waveforms.

Note

If every numeric data (see chapter 6) is displayed as no data (-----) even when you start waveform acquisition, check the following items.

- Is the numeric measurement setting set to ON? ► [section 7.1](#)
 - Is the trigger set properly?
 - Trigger mode ► [section 3.1](#)
 - Trigger position and trigger delay ► [section 3.2](#)
 - Trigger hold off ► [section 3.3](#)
 - Trigger conditions according to trigger type ► [sections 3.4 to 3.15](#)
-

5.1 Selecting the Display Mode

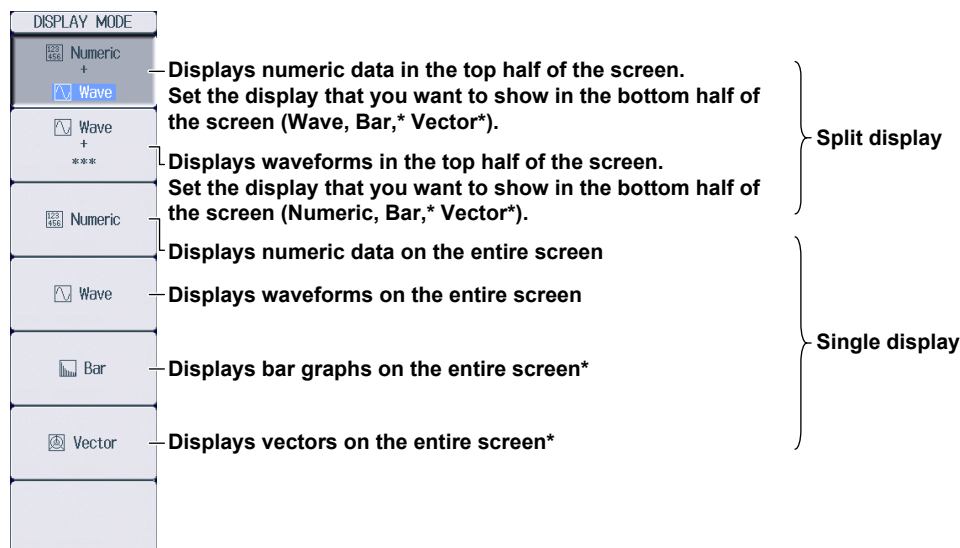
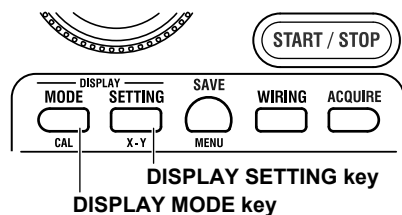
This section explains how to set the type of display to show.

- Display mode

► [Features Guide: “Display Mode and Display Settings”](#)

DISPLAY MODE menu

Press **DISPLAY MODE** to display the following menu.



* These settings are available on models with the harmonic measurement (/G5) option.

DISPLAY SETTING Menu

Press **DISPLAY SETTING**. The SETTING menu of the display you specified on the DISPLAY MODE menu appears.

If you specified a split display in which the half of the screen is set to Numeric or Wave on the DISPLAY MODE menu, the SETTING menu for the top half of the screen and that of the bottom half of the screen toggles each time you press DISPLAY SETTING.

For details on the different SETTING menus, see the following sections.

NUMERIC SETTING menu ► [section 6.1](#)

WAVE SETTING menu ► [section 8.1](#)

BAR SETTING menu ► [section 9.1](#)

VECTOR SETTING menu ► [section 10.1](#)

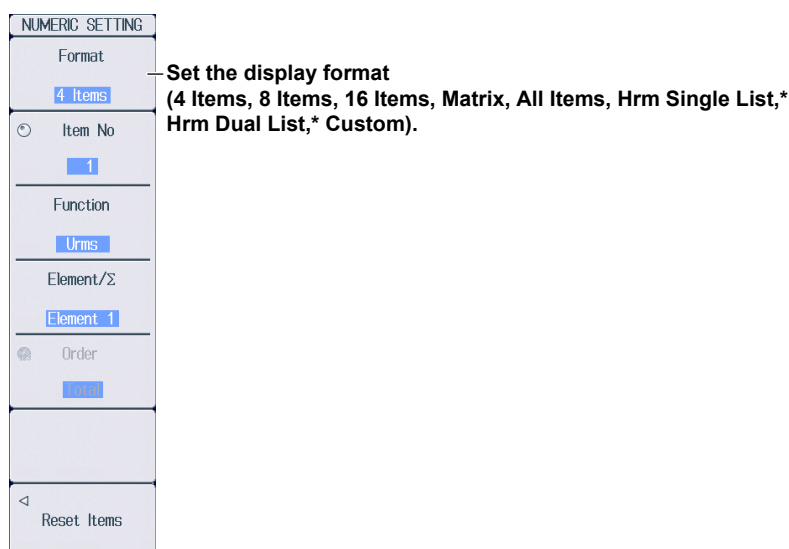
6.1 Switching the Displayed Page

This section explains how to switch the displayed numeric data page.

► [Features Guide: “Numeric Data Display Settings”](#)
[“Switching the Displayed Page”](#)

NUMERIC SETTING menu

1. Use the **DISPLAY MODE** and **DISPLAY SETTING** keys as explained in section 5.1 to display the NUMERIC SETTING menu.



* These settings are available on models with the harmonic measurement (/G5) option.

2. Set the display format, and then press **ESC** to clear the menu.

Note

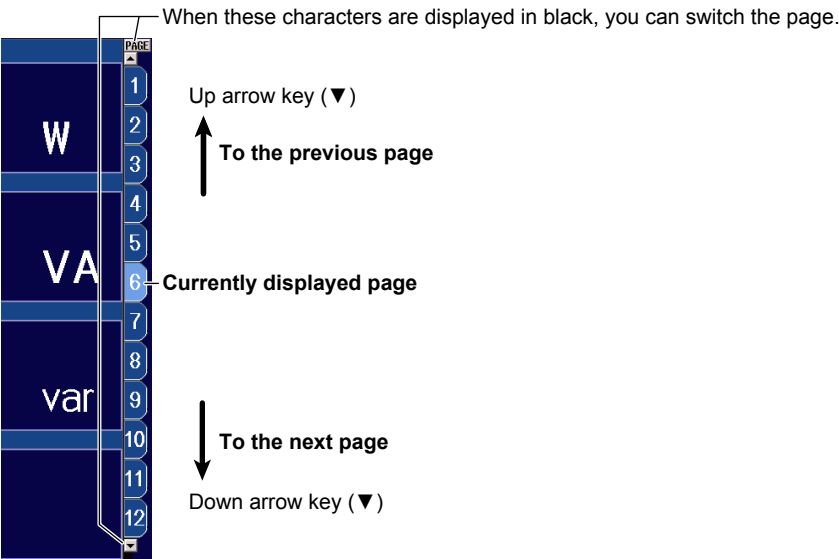
If every numeric data is displayed as no data (-----), check the following items.

- Is waveform acquisition running? ► [section 4.2](#)
- Is the numeric measurement setting set to ON? ► [section 7.1](#)
- Is the trigger set properly?
 - Trigger mode ► [section 3.1](#)
 - Trigger position and trigger delay ► [section 3.2](#)
 - Trigger hold off ► [section 3.3](#)
 - Trigger conditions according to trigger type ► [sections 3.4 to 3.15](#)

When the Display Format Is 4 Items, 8 Items, 16 Items, Matrix, All Items, or Custom

Press the up and down **arrow** keys (▲, ▼) to switch the page.

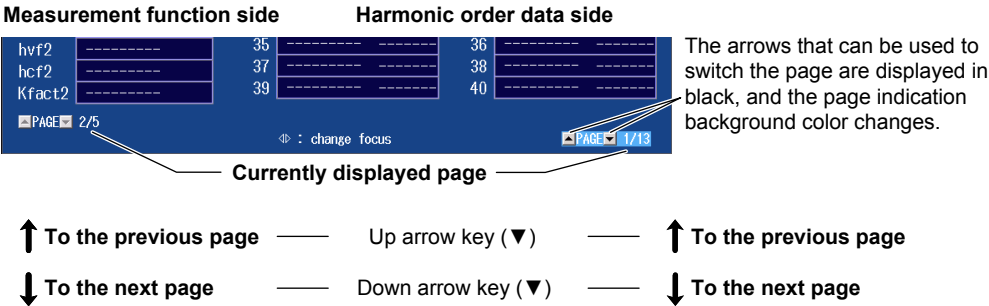
- You can switch the displayed page separately for the 4 Items, 8 Items, 16 Items, Matrix, All Items, and Custom displays.
 - If the display format is set to All Items in single display mode (see section 5.1), the top half of the display of page 1 is constantly displayed, and the bottom half of the display changes for subsequent pages. In split display mode (see section 5.1), the entire numeric data displayed in the top or bottom half of the screen switches.
- In addition, if the display format is set to All Items, you can switch pages using soft keys without clearing the menu as explained in step 2 on the previous page.
- For the Custom display, you can switch between pages when the display is set so that the total number of displayed items is more than the number of items that can be displayed on one page (see section 6.6).



When the Display Format Is Hrm Single List or Hrm Dual List (/G5 Option)

1. Press the left and right **arrow** keys (◀, ▶) to select either the measurement function side (the left side of the screen) or the harmonic order data side (the right side of the screen).
2. Press the up and down **arrow** keys (▲, ▼) to switch the page.

Use the left and right arrow keys (◀, ▶) to switch between the measurement function side and harmonic data side.



6.2 Changing the Displayed Items on the 4-, 8-, and 16-Value Displays

This section explains the following settings for the displayed items on the 4-, 8-, and 16-value displays.

- Item number
- Measurement function
- Element and wiring unit
- Order (harmonic order, /G5 option)
- Resetting the displayed items

► **Features Guide: “4-, 8-, and 16-Value Displays (4 Items/8 Items/16 Items).”**

NUMERIC SETTING Menu

Use the **DISPLAY MODE** and **DISPLAY SETTING** keys as explained in section 5.1 to display the NUMERIC SETTING menu.

NUMERIC SETTING	
Format 4 Items	Set the display format to 4 Items, 8 Items, or 16 Items.
Item No 1	Select the item number that you want to set. (For 4 Items: 1-48 For 8 Items: 1-96 For 16 Items: 1-192)
Function Urms	Set the measurement function (None, other functions—for details on the various measurement functions, see “Items That This Instrument Can Measure” in the Features Guide).
Element/Σ Element 1	Set the element and wiring unit (Element 1-Element 4, ΣA, ΣB).
Order Total	Set the harmonic order (Total, 0-500).* You can set this setting only when you have selected a measurement function that includes a harmonic order.
Reset Items	Set the resetting of displayed items.

* These settings are available on models with the harmonic measurement (/G5) option.

Example of the 4 Items Display

Urms1	0.00	V
Irms1	0.0000	A
P1	0.00	W
Umn1	0.00	V

Note

If every numeric data is displayed as no data (-----), check the referenced sections under “Note” in section 6.1.

Resetting the Displayed Items (Reset Items)

Press the **Reset Items** soft key to display the following menu.

NUMERIC SETTING

Format

4 Items

Item No

1

Function

Urms

Element/ Σ

Reset Items

Reset Items Exec

Clear Current Page

Clear All Pages

Resets the arrangement of the displayed items on all pages

The arrangement pattern varies depending on the number of installed elements.

Sets all displayed measurement functions to None*

Sets all measurement functions on all pages to None*

* The measurement functions displayed on the screen are cleared, and every numeric data is displayed as no data.

Switching the Page

To set items on pages that are not currently shown, switch to these pages. For details on how to switch pages, see section 6.1.

6.3 Changing the Displayed Items on the Matrix Display

This section explains the following settings for the displayed items on the Matrix display.

- Item number
- Measurement function
- Order (harmonic order, /G5 option)
- Display column
 - Number of columns, element and wiring unit
- Resetting the displayed items

► [Features Guide: “Matrix Display \(Matrix\)”](#)

NUMERIC SETTING Menu

Use the **DISPLAY MODE** and **DISPLAY SETTING** keys as explained in section 5.1 to display the NUMERIC SETTING menu.

NUMERIC SETTING	
Format Matrix	Set the display format to Matrix.
Item No 1	Select the item number that you want to set (1-81).
Function Urms	Set the measurement function (None, other functions—for details on the various measurement functions, see “Items That This Instrument Can Measure” in the Features Guide).
Order Total	Set the harmonic order (Total, 0-500).* You can set this setting only when you have selected a measurement function that includes a harmonic order.
Column Settings	Configure the columns to display.
Reset Items	Set the resetting of displayed items.

* These settings are available on models with the harmonic measurement (/G5) option.

Matrix Display Example

		Element 1	Element 2	Σ A(3P3W)	-----	-----	-----
Urms	[V]	0.00	0.00	0.00			
Irms	[A]	0.084m	0.159m	0.122m			
P	[W]	-0.0000	-0.0000	-0.0000			
S	[VA]	0.0000	0.0000	0.0000			
Q	[var]	0.0000	0.0000	0.0000			
λ	[]	Error	Error	Error			
φ	[°]	Error	Error	Error			
Umn	[V]	0.00	0.00	0.00			
Iac	[A]	0.083m	0.103m	0.093m			

Note

If every numeric data is displayed as no data (-----), check the referenced sections under “Note” in section 6.1.

6.3 Changing the Displayed Items on the Matrix Display

Setting the Columns to Display (Column Settings)

Press the **Column Settings** soft key to display the following menu.

Column Settings

Columns

4 6

Column No

||

Element/Σ

Element 1

Reset Columns

Set the number of columns (4, 6).

Set the column number (1-6).

Set the element and wiring unit (None, Element 1-Element 4, ΣA, ΣB).

Resets the element and wiring unit settings of each column

Resetting the Displayed Items (Reset Items)

Press the **Reset Items** soft key to display the following menu.

NUMERIC SETTING

Format

Matrix

Item No

1

Function

Urms

Reset Items

Reset Items Exec

Clear Current Page

Clear All Pages

Resets the arrangement of the displayed items on all pages
The arrangement pattern varies depending on the number of installed elements.

Sets all displayed measurement functions to None*

Sets all measurement functions on all pages to None*

* The measurement functions displayed on the screen are cleared, and every numeric data is displayed as no data.

Switching the Page

To set items on pages that are not currently shown, switch to these pages. For details on how to switch pages, see section 6.1.

6.4 Changing the All Items Display

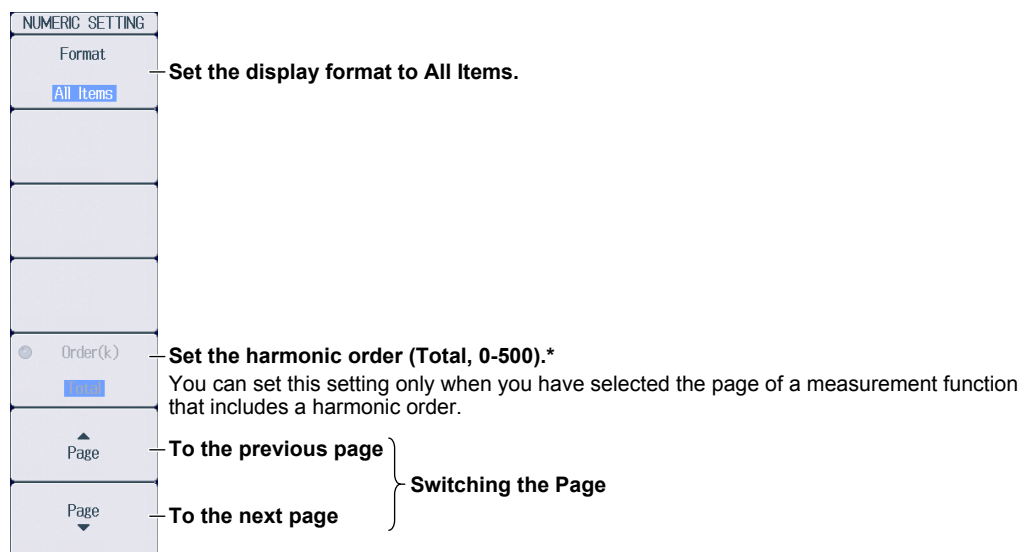
This section explains the following All Items display settings.

- Order (harmonic order, /G5 option)
- Switching the Page

► Features Guide: “All Items Display (All Items)”

NUMERIC SETTING Menu

Use the **DISPLAY MODE** and **DISPLAY SETTING** keys as explained in section 5.1 to display the NUMERIC SETTING menu.



All Items Display example

	Element 1	Element 2	Σ A(3P3W)
Voltage	100V	100V	
Current	10mA	10mA	
Urms [V]	0.00	0.00	0.00
Irms [A]	0.084m	0.165m	0.125m
P [W]	-0.0000	-0.0000	-0.0000
S [VA]	0.0000	0.0000	0.0000
Q [var]	0.0000	0.0000	0.0000
λ []	Error	Error	Error
φ [°]	Error	Error	Error
fU [Hz]	Error	Error	
fI [Hz]	Error	Error	

Note

- On the All Items display, you cannot select individual display items and change their measurement function, element, or wiring unit. If you switch to the Matrix display, you can change the measurement functions, elements, and wiring units using the displayed table (see section 6.3).
- If every numeric data is displayed as no data (-----), check the referenced sections under “Note” in section 6.1.

6.5 Changing the Harmonics List Display (Option)

This section explains the following settings for the harmonics list display (Hrm List). These settings are available on models with the harmonic measurement (/G5) option.

- List number
- Measurement function
- Element and wiring unit

► **Features Guide: “Single Harmonics and Dual Harmonics Lists (Hrm Single List/Hrm Dual List; option)”**

NUMERIC SETTING Menu

Use the **DISPLAY MODE** and **DISPLAY SETTING** keys as explained in section 5.1 to display the NUMERIC SETTING menu.

The screenshot shows the NUMERIC SETTING menu with the following options and annotations:

- Format:** Hrm Single List. **Set the display format to Hrm Single List or Hrm Dual List.**
- Item No:** 1. **Select the list number that you want to set (1, 2).** Function, element, and wiring unit settings that you make for list number 2 are also reflected in the right column of the harmonic order data of the dual harmonics list.
- Function:** U. **Set the measurement function (U, I, P, S, Q, λ , Φ , ΦU , ΦI , Z, Rs, Xs, Rp, Xp).**
- Element/ Σ :** Element 1. **Set the element and wiring unit (Element 1-Element 4, ΣA , ΣB).**

Hrm Single List Display Example

Measurement function side				Harmonic order data side			
fPLL:U1	60.001 Hz	Order	U1 [V]	hdf [%]	Order	U1 [V]	hdf [%]
Urms1	3.956 V	Total	3.545		dc		
Irms1	349.58 A	1	2.706	76.316	2	1.786	50.377
P1	0.7715 kW	3	0.670	18.893	4	0.229	6.472
S1	1.3831 kVA	5	0.644	18.173	6	0.556	15.676
Q1	1.1479 kvar	7	0.169	4.760	8	0.222	6.256
$\lambda 1$	0.5578	9	0.392	11.048	10	0.288	8.121
$\Phi 1$	G56.10 °	11	0.025	0.702	12	0.210	5.913
		13	0.277	7.807	14	0.160	4.504
		15	0.043	1.219	16	0.193	5.443
		17	0.202	5.703	18	0.080	2.258
		19	0.080	2.268	20	0.173	4.875

PAGE 1/14 : change focus PAGE 1/20

Note

If every numeric data is displayed as no data (-----), check the referenced sections under “Note” in section 6.1.

Hrm Dual List Display Example

Measurement function side			Harmonic order data side					
fPLL:U1 Urms1 Irms1 P1 S1 Q1 λ1 φ1	60.001 Hz	Order Total dc 1 2 3 4 5 6 7 8 9 10	U1 [V]	hdf [%]	Order Total dc 1 2 3 4 5 6 7 8 9 10	I1 [A]	hdf [%]	
			3.545			348.77		
			-----			-----		
			2.706	76.316		314.64	90.212	
			1.786	50.377		2	0.01	0.004
			0.670	18.893		3	104.88	30.070
			0.229	6.472		4	0.01	0.002
			0.644	18.173		5	62.92	18.039
			0.556	15.676		6	0.01	0.003
			0.169	4.760		7	44.93	12.883
			0.222	6.256		8	0.01	0.002
			0.392	11.048		9	34.95	10.021
			0.288	8.121		10	0.01	0.002
PAGE 1/14		⏏ : change focus		PAGE 1/50				

Note

On the harmonics list displays, you can change the measurement function, element, and wiring unit for the selected list, but you cannot change these settings for each individual display item.

Switching the Page

You can switch the page to display other items. For details on how to switch pages, see section 6.1.

6.6 Setting the Custom Display

This section explains the following Custom display settings.

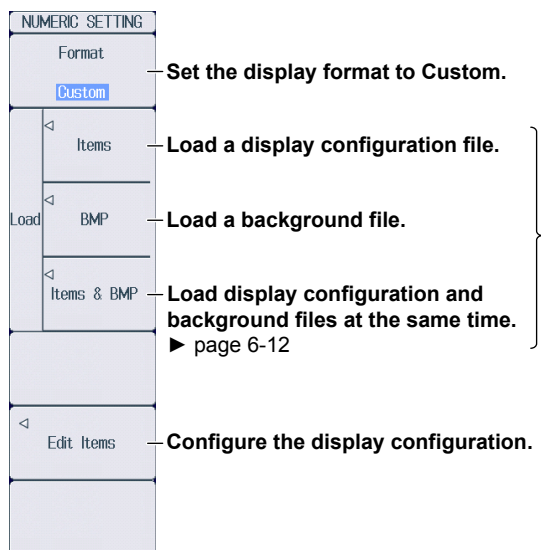
- Loading display configuration files
- Loading background files
- Display configuration

Total items, items per page, custom items (item number, measurement function, element and wiring unit, harmonic order, display position, font size, font color), saving custom display configuration files

► [Features Guide: “Custom Display \(Custom\)”](#)

NUMERIC SETTING Menu

Use the **DISPLAY MODE** and **DISPLAY SETTING** keys as explained in section 5.1 to display the NUMERIC SETTING menu.



The screenshot shows the NUMERIC SETTING menu with the following options and annotations:

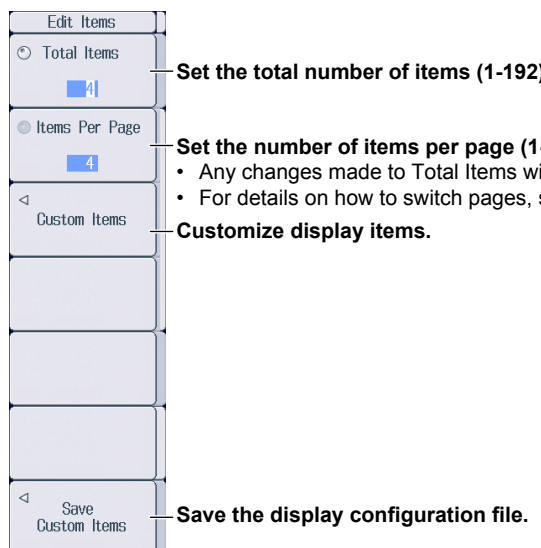
- Format**: Set the display format to Custom.
- Load**: Load a display configuration file.
- Items**: Load a background file.
- BMP**: Load display configuration and background files at the same time. (page 6-12)
- Items & BMP**: Load display configuration and background files at the same time. (page 6-12)
- Edit Items**: Configure the display configuration.

You can load files for the custom display.
Display configuration files: TXT format
Background file: BMP format

- You can use the “Edit Items” menu described below to change the display configuration that you have loaded.
- To load both a display configuration file and background file at the same time, load the display configuration file.

Setting the Display Configuration (Edit Items)

1. Press the **Edit Items** soft key to display the following menu.



The screenshot shows the Edit Items menu with the following options and annotations:

- Total Items**: Set the total number of items (1-192).
- Items Per Page**: Set the number of items per page (1-192).
 - Any changes made to Total Items will change the Items Per Page setting, and vice-versa.
 - For details on how to switch pages, see section 6.1.
- Custom Items**: Customize display items.
- Save Custom Items**: Save the display configuration file.

Customizing Display Items (Custom Items)

- Press the **Custom Items** soft key to display the following screen.

(X, Y)

Element 1

Voltage rms **Current rms** **Power**

0.0164 **0.083 m** **0.000 m**

mean 0.0000 mean 0.000 m VA 0.001 m
 dc 0.0009 dc 0.013 m var -0.001 m
 r-mn 0.0000 r-mn 0.000 m PF 0.0119
 ac 0.0164 ac 0.082 m deg D89.32
 max 0.0621 max 0.400 m max 0.015 m
 min -0.0579 min -0.375 m min -0.013 m
 CF 3.785 CF 4.791

Voltage frequency **Error** Current frequency **Error**

Custom Items

Item No 2

Function Urms

Element/Σ Element 1

Order

X Pos 20

Y Pos 100

Font Size 48

Font Color Yellow

Select the item number that you want to set (1-the Total Items setting).

Set the measurement function (None, other functions—for details on the various measurement functions, see “Items That This Instrument Can Measure” in the Features Guide).

Set the element and wiring unit (Element 1-Element 4, ΣA, ΣB).

When Function is set to None:
Set the character string (up to 15 characters).

When the measurement function includes a harmonic order:
Set the harmonic order (Total, 0-500; G5 option).

Set the display position.

- X Pos: 0 (left edge of the screen)-800 (right edge of the screen)
- Y Pos: 0 (top of the screen)-671 (bottom of the screen)

Set the font size (14, 16, 20, 24, 32, 48, 64, 96, 128).

Set the font color (Yellow, Green, Magenta, Cyan, Red, Orange, Light Blue, Purple, Blue, Pink, Light Green, Dark Blue, Blue Green, Salmon Pink, Mid Green, Gray, White, Dark Gray, Blue Gray, Black).

Note

If every numeric data is displayed as no data (-----), check the referenced sections under “Note” in section 6.1.

Saving Display Configuration Files (Save Custom Items)

- Press the **Save Custom Items** soft key to display the following menu.

Save Custom Items

File List Set the save destination. ► section 22.3

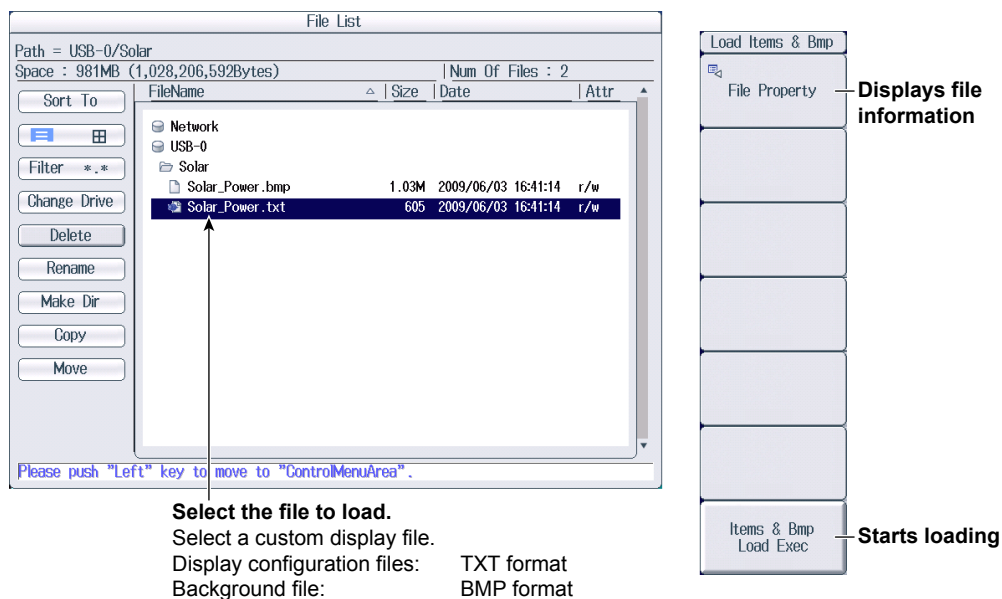
File Name Set the file name. ► section 22.3

Execute Save Starts saving

Note that if a file with the same name exists in the destination folder, it will be overwritten without warning.
File names are not case-sensitive.

Loading Display Configuration and Background Files at the Same Time (Load Items & Bmp)

On the NUMERIC SETTING menu on page 6-10, click the **Items & Bmp** soft key to display the following screen.

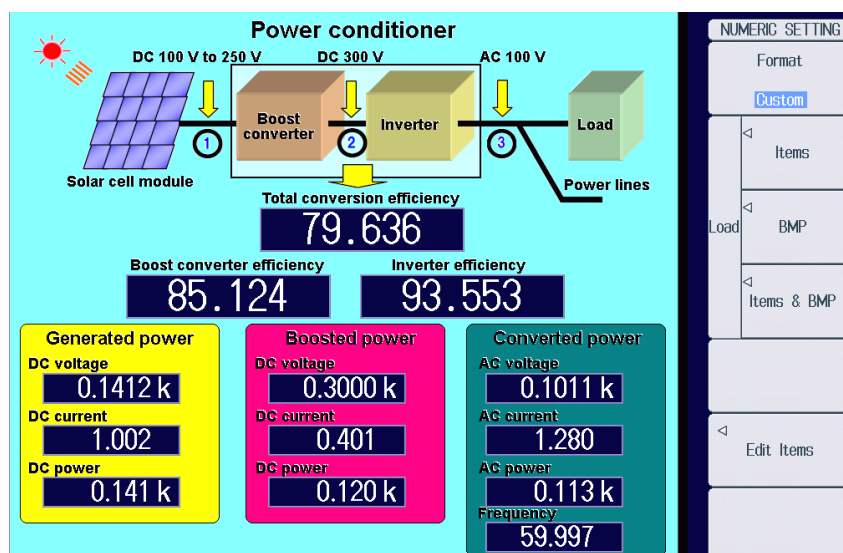


To load both a display configuration file and background file at the same time, load the display configuration file.

However, an error will occur if a background file that has the same name as the display configuration file is not present in the save destination folder of the display configuration file.

For the operating procedure, see section 22.10.

Example of Loading a File for the Custom Display



Note

After you properly load a display configuration file and a background file, if you restart the PX8000 and the same background file is not in the same location, the background will return to its default.

Switching the Page

You can switch between pages when the display is set so that the total number of displayed items is more than the number of items that can be displayed on one page. For details on how to switch pages, see section 6.1.

7.1 Turning Numeric Measurement On and Off

This section explains how to turn numeric measurement on and off.

► [Features Guide: “Turning Numeric Measurement On and Off \(Numeric Measure\)”](#)

NUMERIC Menu

Press **NUMERIC** to display the following menu.

NUMERIC	
Numeric Measure	OFF ON
Period	Zero Cross
◀	Harmonics
▶	Next 1/2

Turns numeric measurement on and off

To measure voltage, current, power, and other measurement functions, set this to ON. If this is set to OFF, none of the measurement functions will be measured, and every numeric data will be displayed as no data (-----).

Note

If every numeric data (see chapter 6) is displayed as no data (-----) even when you turn numeric measurement on, check the following items.

- Is waveform acquisition running? ► [section 4.2](#)
- Is the trigger set properly?
 - Trigger mode ► [section 3.1](#)
 - Trigger position and trigger delay ► [section 3.2](#)
 - Trigger hold off ► [section 3.3](#)
 - Trigger conditions according to trigger type ► [sections 3.4 to 3.15](#)

7.2 Setting the Calculation Period

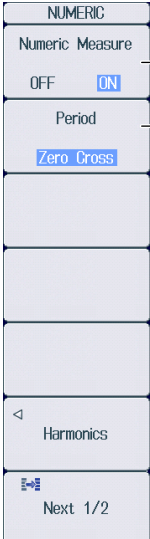
This section explains the following settings for measuring and computing measurement functions of normal measurement.

- Calculation period
- External signal status
- Cursor start and end points
- Search zero cross

► Features Guide: “Calculation Period (Period)”

NUMERIC Menu


Press **NUMERIC** to display the following menu.



Set Numeric Measure to ON.


Calculation period (Zero Cross, Ext Gate, Cursor)

When the calculation period is Ext Gate



Set the external signal status (,)

When the calculation period is Cursor




Set the cursor start and end points.

Set the search zero cross

Setting Search Zero Cross (Search Zero Cross)

Press the **Search Zero Cross** soft key to display the following menu.

When Start Position is selected for the cursor start and end point setting



Set the cursor start and end points.


Set the zero-crossing search source.

Set the edge.

Moves to the nearest zero-crossing position after the Start Position

Moves to the nearest zero-crossing position before the Start Position

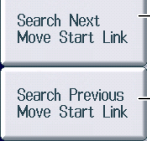
When End Position is selected for the cursor start and end point setting



Moves to the nearest zero-crossing position after the End Position

Moves to the nearest zero-crossing position before the End Position

When both Start Position and End Position are selected for the cursor start and end point setting



Moves to the nearest zero-crossing position after the Start Position while maintaining the cursor span

Moves to the nearest zero-crossing position before the Start Position while maintaining the cursor span

7.3 Setting Numeric Data Averaging

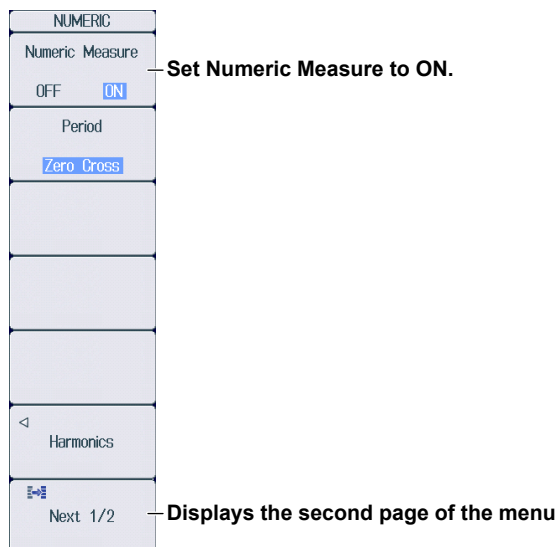
This section explains the following settings for exponential averaging (Exp) and moving averaging (Lin) of numeric data.

- Averaging type
- Attenuation constant
- Averaging count

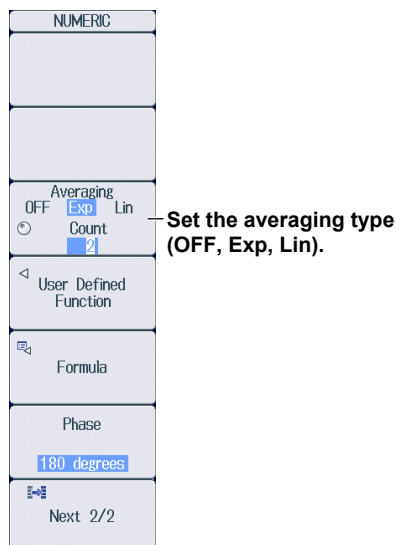
► [Features Guide: “Averaging \(Averaging\)”](#)

NUMERIC Menu

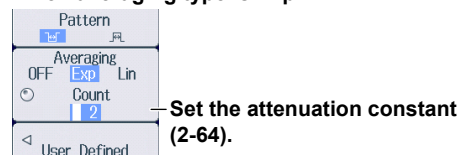
1. Press **NUMERIC** to display the following menu.



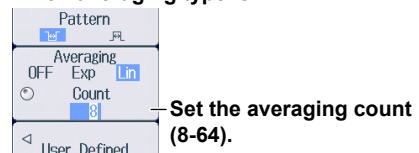
2. Press the **Next 1/2** soft key to display the 2/2 menu.



When averaging type is Exp



When averaging type is Lin



7.4 Setting User-Defined Functions

This section explains the following settings for user-defined functions.

- Turning computation on and off
- Computation name
- Unit
- Equation

► [Features Guide: “User-Defined Functions \(User Defined Function\)”](#)

NUMERIC Menu

1. Press **NUMERIC** to display the following menu.

NUMERIC

Numeric Measure

OFF **ON** — Set Numeric Measure to ON.

Period

Zero Cross

Harmonics

Next 1/2 — Displays the second page of the menu

2. Press the **Next 1/2** soft key to display the 2/2 menu.

NUMERIC

Averaging

OFF **Exp** Lin

Count **2**

User Defined Function — Set the user-defined function.

Formula

Phase

180 degrees

Next 2/2

Setting User-Defined Functions (User Defined Function)

Press the **User Defined Function** soft key to display the following screen.

Set the equation.

User Defined Function		Settings		
Function 1	<input type="checkbox"/> OFF <input checked="" type="checkbox"/> ON	Name	P-loss	Unit
Expression	P(E1)-P(E2)			
Function 2	<input type="checkbox"/> OFF <input checked="" type="checkbox"/> ON	Name	U-ripple	Unit
Expression	(UPPK(E1)-UMPK(E1))/2/UDC(E1)*100			
Function 3	<input type="checkbox"/> OFF <input checked="" type="checkbox"/> ON	Name	I-ripple	Unit
Expression	(IPPK(E1)-IMPK(E1))/2/IDC(E1)*100			
Function 4	<input type="checkbox"/> OFF <input checked="" type="checkbox"/> ON	Name	D-UrmsR	Unit
Expression	DELTAU1RMS(SA)			
Function 5	<input type="checkbox"/> OFF <input checked="" type="checkbox"/> ON	Name	D-UrmsS	Unit
Expression	DELTAU2RMS(SA)			
F01-F05		F06-F10		F11-F15

User Defined
User Defined
F01-F05

Displays the setup screen for
user-defined functions F1 to F5

User Defined
User Defined
F06-F10

Displays the setup screen for
user-defined functions F6 to F10

User Defined
User Defined
F11-F15

Displays the setup screen for
user-defined functions F11 to F15

User Defined
User Defined
F16-F20

Displays the setup screen for
user-defined functions F16 to F20

7.5 Setting Apparent Power, Reactive Power, and Corrected Power Equations

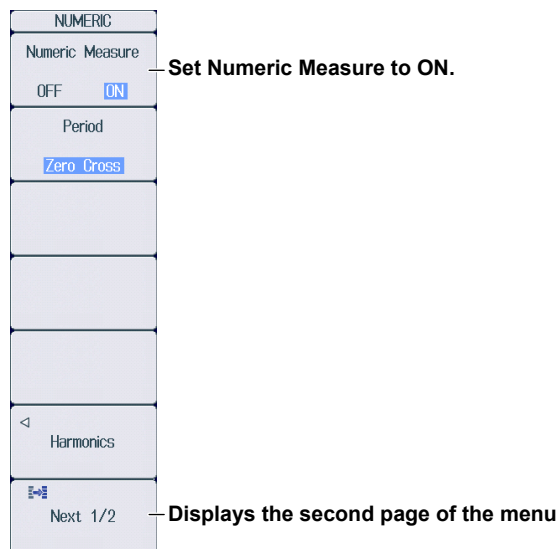
This section explains the following settings for the apparent power, reactive power, and corrected power equations.

- Apparent power equation
 - Apparent power and reactive power computation types
 - Corrected power equation
- Applicable standard and coefficients

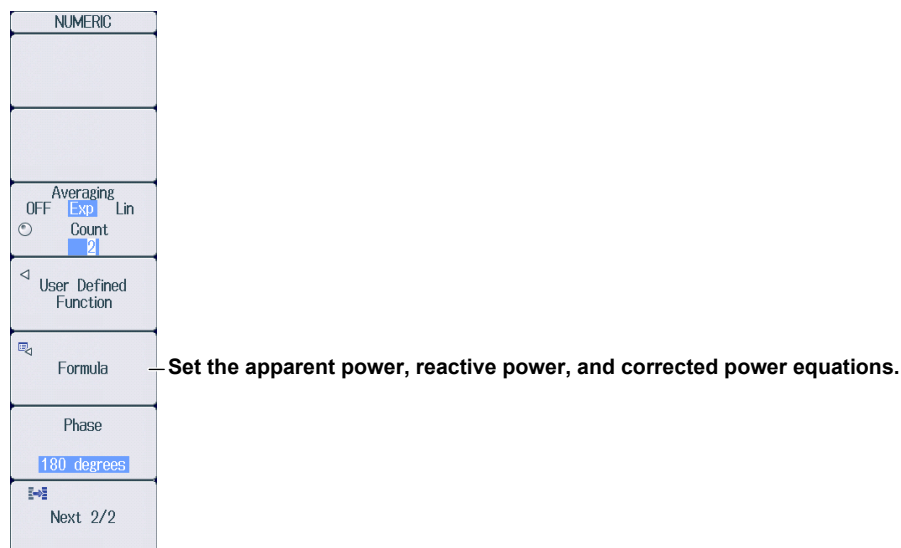
► [Features Guide: “Apparent Power, Reactive Power, and Corrected Power Equations \(Formula\)”](#)

NUMERIC Menu

1. Press **NUMERIC** to display the following menu.



2. Press the **Next 1/2** soft key to display the 2/2 menu.



Setting Apparent Power, Reactive Power, and Corrected Power Equations (Formula)

Press the **Formula** soft key to display the following screen.

Set the apparent power equation
(Urms*Irms, Umean*Imean, Udc*Idc, Umean*Irms, Urmean*Irmean).

S Formula

S,Q Formula Type 2 Type 3

$P\Sigma = P1+P2+P3$

$S\Sigma = S1+S2+S3$

$Q\Sigma = Q1+Q2+Q3$ For 3P4W

Pc Formula

Select standard

P1 =

P2 =

Corrected power equation

Set the apparent power and reactive power computation types (Type 1, Type 2, Type 3†).

Set the applicable standard (IEC76-1(1976), IEC76-1(1993)).

Set the coefficients (0.0001-9.9999).
When Select standard is IEC76-1(1976), set coefficients P1 and P2.

† These settings are available on models with the harmonic measurement (/G5) option.

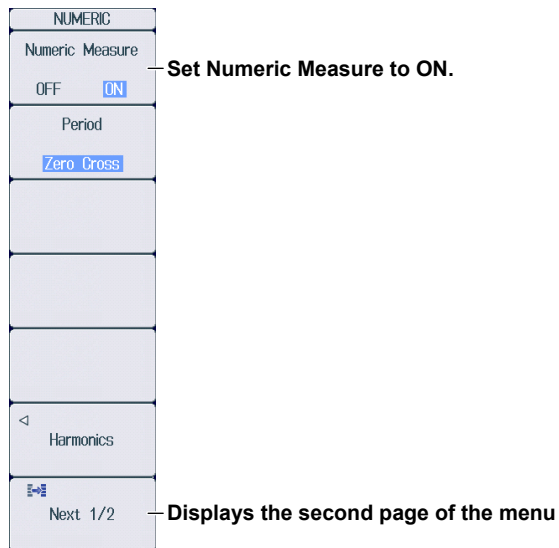
7.6 Setting the Phase Difference Display Format

This section explains how to set the phase difference display format.

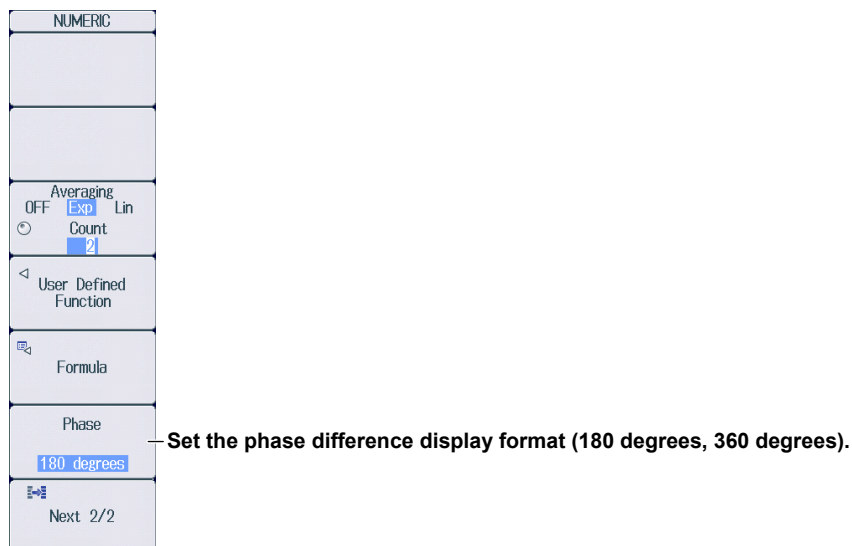
► [Features Guide: “Phase Difference Display Format \(Phase\)”](#)

NUMERIC Menu

1. Press **NUMERIC** to display the following menu.



2. Press the **Next 1/2** soft key to display the 2/2 menu.



7.7 Setting Harmonic Measurement Conditions

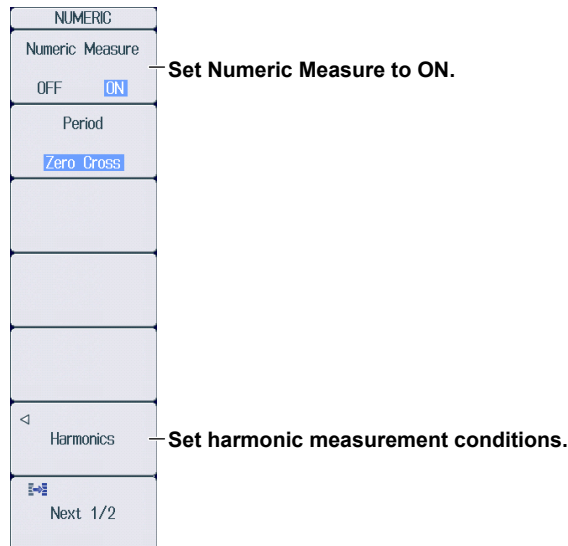
This section explains the following settings for harmonic measurement conditions. These settings are available on models with the harmonic measurement (/G5) option.

- Turning harmonic measurement on and off
- PLL source
- Measured harmonic order
- Distortion factor equation
- Harmonic measurement start point

► [Features Guide: “Harmonic Measurement Conditions \(Harmonics; option\)”](#)

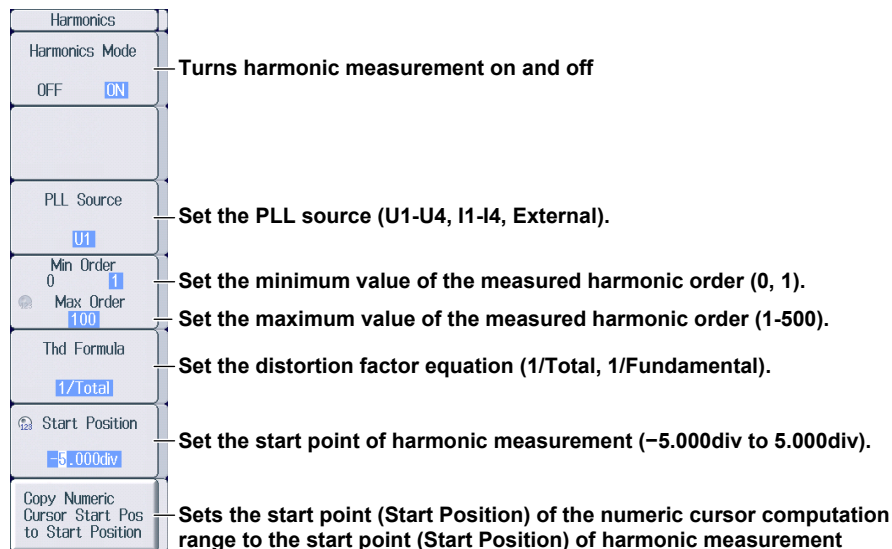
NUMERIC Menu

Press **NUMERIC** to display the following menu.



Harmonics Menu

Press the **Harmonics** soft key to display the following menu.



8.1 Setting the Waveform Display

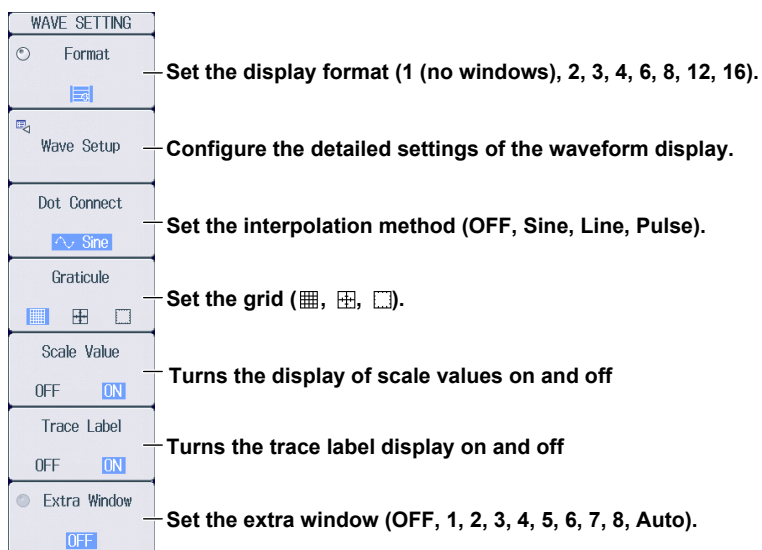
This section explains the following settings for displaying waveforms.

- Waveform display format
- Detailed settings of the waveform display
Turning waveform display on and off, waveform color, waveform mapping, waveform label, vertical zoom
DIV: Offset value, waveform's vertical position, magnification
SPAN: Upper and lower limits of the display range
Horizontal (time scale) zoom ► chapter 12
- Interpolation method
- Grid
- Turning the display of scale values on and off
- Turning the trace label display on and off
- Extra window

► **Features Guide: “Waveform Display Settings”**

WAVE SETTING Menu

Use the **DISPLAY MODE** and **DISPLAY SETTING** keys as explained in section 5.1 to display the WAVE SETTING menu.



Configuring Detailed Settings of the Waveform Display (Wave Setup)

Press the **Wave Setup** soft key to display the following screen.

These settings are shared between the U menu, I menu, POWER menu, and AUX menu. ► **chapter 2**

Turns the waveform display on and off
Set this to turn all waveforms on and off.

Set the waveform label.
Set the vertical zoom.
For DIV: Set the offset value, waveform's vertical position, and magnification.
For SPAN: Set the upper and lower limits of the display range.

	Disp	Map	Label	V Scale	Offset	Position	V Zoom
All	ON	User					
CH1 (U1)	ON	1	U1	DIV	0.0V	0.00div	x 1
CH2 (I1)	ON	2	I1	SPAN	10000mA	-10000mA	
P1	ON	3	P1	DIV	0W	0.00div	x 2
CH3 (U2)	OFF	4	U2	DIV	0mV	0.00div	x 1
CH4 (I2)	OFF	5	I2	DIV	0mA	0.00div	x 1
P2	OFF	6	P2	DIV	0mW	0.00div	x 2
CH5 (AUX5)	ON	7	AUX5	DIV	0mV	0.00div	x 1
CH6 (AUX6)	OFF	8	AUX6	DIV	0.00E+03	0.00div	x 1
Math1	ON	9	Math1				
Math2	ON	10	Math2				
Math3	ON	11	Math3				
Math4	ON	12	Math4				
Math5	ON	13	Math5				
Math6	ON	14	Math6				
Math7	ON	15	Math7				
Math8	ON	16	Math8				

When the mapping mode is set to User, you can set how to map each waveform to the divided screens.

Set the waveform mapping mode (Auto, User).

Set the waveform color.

When computation mode is OFF: Blank
When computation mode is ON: Depending on the operator set for each computation, the setting is as follows.
When computation is defined: ON or OFF can be selected
When set to OFF: Blank

If FFT1 is set to ON, FFT1 appears in the Math7 position.
If FFT2 is set to ON, FFT2 appears in the Math8 position.

FFT1	-		
FFT2	-		

Label: Blank

Map: -

Set the FFT waveform color.

Disp: Blank

8.2 Using the Snapshot and Clear Trace Features

This section explains how to use the snapshot feature (which retains the currently displayed waveforms on the screen) and the clear trace feature (which clears all displayed waveforms).

► [Features Guide: “Snapshot \(SNAPSHOT\)”](#)
[“Clear Trace \(CLEAR TRACE\)”](#)

Snapshot (SNAPSHOT)

Press **SNAPSHOT** to retain the currently displayed waveform on the screen as a snapshot waveform in white. Snapshot waveforms remain on the screen until you execute a clear trace operation.

Clear Trace (CLEAR TRACE)

Press **CLEAR TRACE** to clear all the waveforms that are displayed on the screen.

Note

Click **SHIFT+SNAPSHOT** to clear only the snapshot waveforms.

9.1 Configuring the Bar Graph Display

This section explains the following settings for displaying bar graphs. These settings are available on models with the harmonic measurement (/G5) option.

- Bar graph display format
- Bar graph number
- Measurement function
- Element
- Bar graph display range (displayed harmonics)
- Turning the numeric data display on and off
- Marker position (harmonic)

► [Features Guide: “Bar Graph Display \(Option\)”](#)

BAR SETTING Menu

Use the **DISPLAY MODE** and **DISPLAY SETTING** keys as explained in section 5.1 to display the BAR SETTING menu.

BAR SETTING	
Format	Set the display format (1 (no windows), 2, 3).
Item No	Set the bar graph number (1-3).
Function	Set the measurement function (U, I, P, S, Q, λ , Φ , ΦU , ΦI , Z, Rs, Xs, Rp, Xp).
Element	Set the element (Element 1-Element 4).
Start Order	Set the bar graph display range.
End Order	<ul style="list-style-type: none"> • The display's starting harmonic order (0-490) • The display's ending harmonic order (10-500) You can set the range to any value provided that the end harmonic order is larger than the start harmonic order by 10 or more.
Numeric	Turns the numeric data display on and off
× Order	Set the harmonic order of the bar graph to measure with markers x and + (0-500). If you press this soft key and select both × Order and + Order, you can change both orders while maintaining the relationship between the two.
+ Order	

10.1 Configuring the Vector Display

This section explains the following settings for displaying vectors. These settings are available on models with the harmonic measurement (/G5) option.

- Vector display format
- Vector number
- Element and wiring unit
- Zooming vectors
- Turning the numeric data display on and off

► [Features Guide: “Vector Display \(Option\)”](#)

VECTOR SETTING Menu

Use the **DISPLAY MODE** and **DISPLAY SETTING** keys as explained in section 5.1 to display the VECTOR SETTING menu.

VECTOR SETTING	
Format	Set the display format (1 (no windows), 2).
Item No	Set the vector number (1, 2).
Vector Object	Set the element and wiring unit (Element 1-Element 4, ΣA , ΣB).
U Mag	Set the magnification of vectors of the fundamental waves U(1) and I(1) (0.100-100.000). The value that indicates the size of the vector display's peripheral circle changes according to the zoom factor, and the size of the vectors that indicate U (1) and I (1) change accordingly as well. If you press this soft key to select both U Mag and I Mag, you can change both magnifications while maintaining the relationship between the two.
I Mag	
Numeric	Turns the numeric data display on and off
OFF ON	

11.1 Displaying X-Y Waveforms

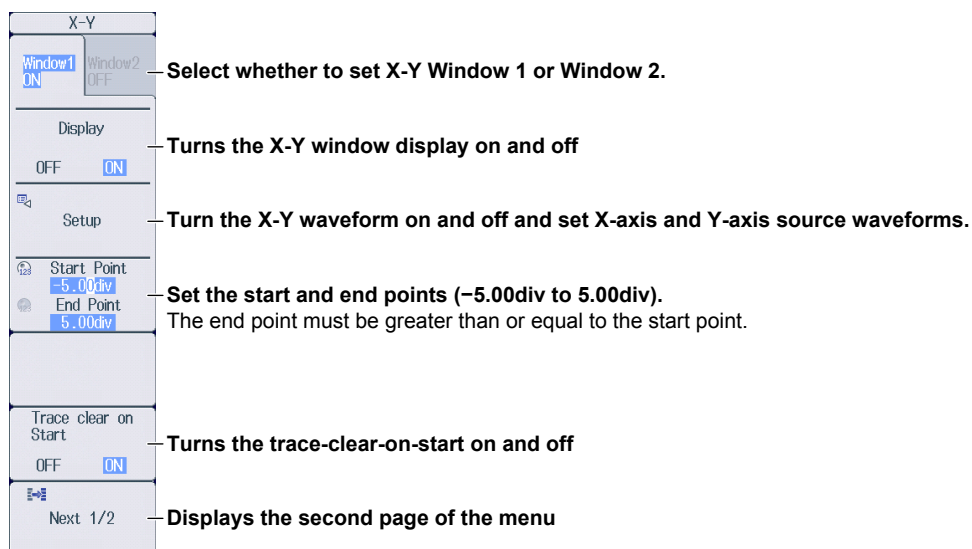
This section explains the following settings for displaying X-Y waveforms.

- Turning the X-Y window display on and off
- Turning the X-Y waveform on and off and X-axis and Y-axis source waveforms
- Start and end points
- Turning the trace-clear-on-start on and off
- Main window's display ratio
- Window layout
- Turning combine display on and off
- Interpolation method
- The number of data points that are used to display waveforms

► [Features Guide: “Displaying X-Y Waveforms”](#)

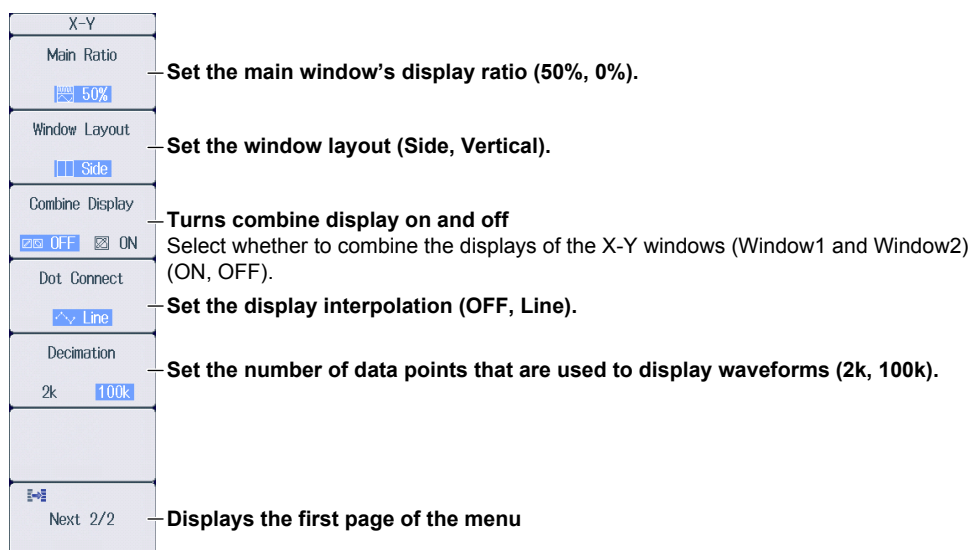
X-Y Menu

1. Press **SHIFT+SETTING** (X-Y) to display the following menu.



11.1 Displaying X-Y Waveforms

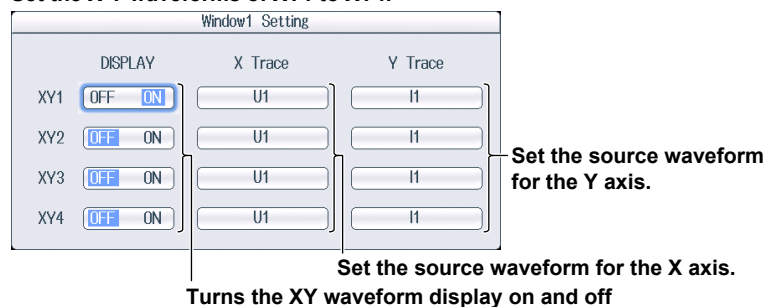
2. Press the **Next 1/2** soft key to display the 2/2 menu.



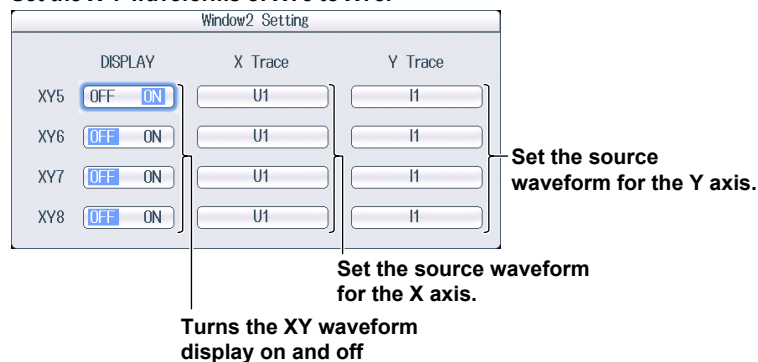
Turning the X-Y Waveform On and Off and Setting X-Axis and Y-Axis Source Waveforms

Press the **Setup** soft key to display the following screen.

**When X-Y Window 1 is selected,
Set the X-Y waveforms of XY1 to XY4.**



**When X-Y Window 2 is selected,
Set the X-Y waveforms of XY5 to XY8.**



12.1 Zooming in on or out of Waveforms

This section explains the following settings for zooming in on or out of waveforms horizontally (time scale). For details on vertical zoom settings, see sections 2.1 to 2.6 or section 8.1.

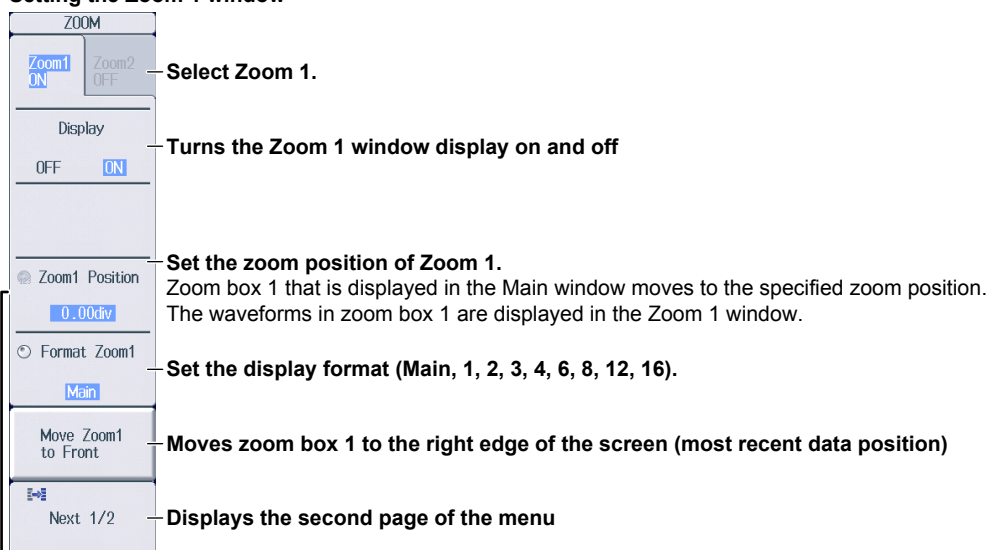
- Turning the zoom window display on and off
- Zoom position and zoom box
- Zoom display format
- Zoom 2 source window
- Main window's display ratio
- Window layout
- Auto scrolling
- Zoom source waveform
- Changing the range for performing automated measurement of waveform parameters
- Zoom position using the zoom POSITION knob and magnification

► [Features Guide: “Zooming in on Waveforms”](#)

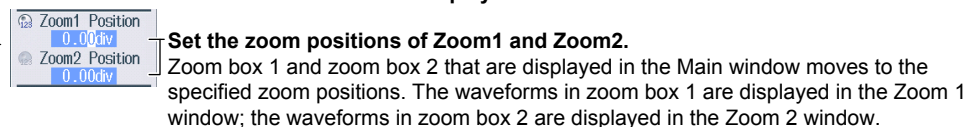
ZOOM Menu

1. Press **ZOOM** to display the following menu.
 - If you press **ZOOM** while no zoom window is displayed on the screen, zoom box 1 is automatically turned on (Z1 ON).
 - Set the menu items separately for zoom windows Zoom 1 and Zoom2.

Setting the Zoom 1 window



When both Zoom 1 and Zoom 2 window displays are on



12.1 Zooming in on or out of Waveforms

Setting the Zoom 2 window

The screenshot shows the ZOOM menu with the following options and annotations:

- Zoom1 ON** and **Zoom2 ON**: Select Zoom 2.
- Display** (OFF/ON): Turns the Zoom 2 window display on and off.
- Zoom2 Source** (Main/Zoom1): Select the zoom source window for Zoom 2 (Main, Zoom 1). When Zoom 1 window is on, select Main or Zoom 1.
- Zoom2 Position** (0.00div): Set the zoom position of Zoom 2. Zoom box 2 that is displayed in the Main window moves to the specified zoom position. The waveforms in zoom box 2 are displayed in the Zoom 2 window.
- Format Zoom2** (Main, 1, 2, 3, 4, 6, 8, 12, 16): Set the display format (Main, 1, 2, 3, 4, 6, 8, 12, 16).
- Move Zoom2 to Front**: Moves zoom box 2 to the right edge of the screen (most recent data position). This is available when Zoom 2 Source (shown above) is set to Main.
- Next 1/2**: Displays the second page of the menu.

2. Press the **Next 1/2** soft key to display the 2/2 menu.

The screenshot shows the ZOOM 2/2 menu with the following options and annotations:

- Main Ratio** (50%): Set the main window's display ratio (50%, 0%).
- Window Layout** (Side): Set the window layout (Side, Vertical).
- Auto Scroll**: Configure auto scrolling.
- Allocation**: Set the zoom source waveforms.
- Fit Measure Range to Zoom1**: Change the range for performing automated measurement of waveform parameters. The range over which automated measurement of waveform parameters is performed is set to the zoom range of Zoom1 when the Zoom 1 window is on and the zoom range of Zoom2 when the Zoom 2 window is on.
- Next 2/2**: Displays the first page of the menu.

When both Zoom 1 and Zoom 2 window displays are on

The diagram shows the flow from the **Fit Measure Range** menu to two options: **Fit to Zoom1** and **Fit to Zoom2**. A bracket indicates that these options are used to select which zoom range: Zoom 1 or Zoom 2.

Setting Auto Scrolling (Auto Scroll)

Press the **Auto Scroll** soft key to display the following menu.

Auto Scroll

Target

Zoom1 Zoom2

Speed

4

▶▶

▶

■

◀

◀◀

Select the zoom box to auto scroll.

When both Zoom 1 and Zoom 2 window displays are on, select Zoom 1 or Zoom 2.

Set the scroll speed (1-10).

Moves to the right edge of the Main window

Starts scrolling to the right

Stops auto scrolling

Starts scrolling to the left

Moves to the left edge of the Main window

Allocating Zoom Source Waveforms (Allocation)

Press the **Allocation** soft key to display the following screen.

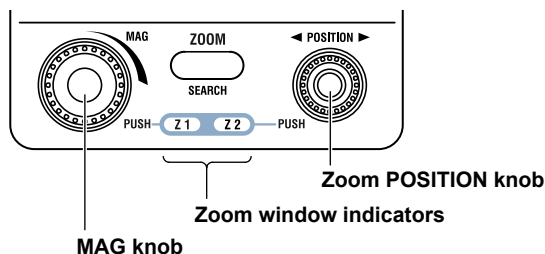
Allocation			
✓U1	-	-	-
✓I1	-	-	-
✓P1	-	-	-
✓U2	-	-	-
✓I2	-	-	-
✓P2	-	-	-
✓AUX5	-	-	-
✓AUX6	-	-	-
✓Math1	-	-	-
✓Math2	-	-	-
✓Math3	-	-	-
✓Math4	-	-	-
✓Math5	-	-	-
✓Math6	-	-	-
✓Math7	-	-	-
✓Math8	-	-	-

Select the zoom source waveforms.
The waveforms that can be selected are displayed.

Setting the Magnification (MAG knob)

Use the **MAG** knob to set the magnification.

- The MAG knob controls the waveforms in the zoom window whose corresponding indicator, Z1 or Z2, is illuminated.
- The MAG knob has a push switch. Push the knob to illuminate the Z1 indicator, Z2 indicator, or both indicators. When both the Z1 and Z2 indicators are illuminated, you can set both zoom windows to the same magnification at the same time.



Setting the Zoom Position (zoom POSITION knob)

Turn the zoom **POSITION** knob to set the zoom position.

- The zoom POSITION knob controls the waveforms in the zoom window whose corresponding indicator, Z1 or Z2, is illuminated.
- The zoom POSITION knob has a push switch. Push the knob to illuminate the Z1 indicator, Z2 indicator, or both indicators. When both the Z1 and Z2 indicators are illuminated, you can set both zoom windows to the same zoom position at the same time.

13.1 Measuring with Horizontal Cursors

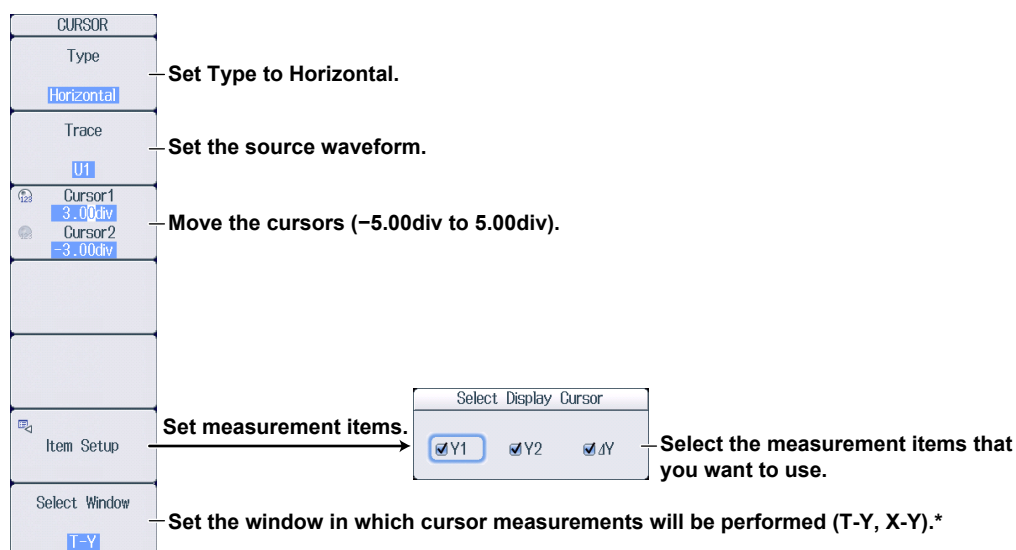
This section explains the following settings for measuring with horizontal cursors:

- Cursor type
- Source waveform
- Moving the cursors
- Measurement items
- Windows that cursor measurements will be performed in

► **Features Guide: “Horizontal Cursors (Horizontal) - T-Y waveforms”**
“Horizontal Cursors (Horizontal) (X-Y)”
“Turning the X-Y Window Display On and Off (Display)”

CURSOR Horizontal Menu

Press **CURSOR**, the **Type** soft key, and then the **Horizontal** soft key to display the following menu.



* This is available when the X-Y window display is turned on.

Setting the Source Waveform (Trace)

The waveforms that you can select differ depending on the window that cursor measurements will be performed in.

- T-Y: U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8
- X-Y: XY1 to XY8

13.2 Measuring with Vertical Cursors

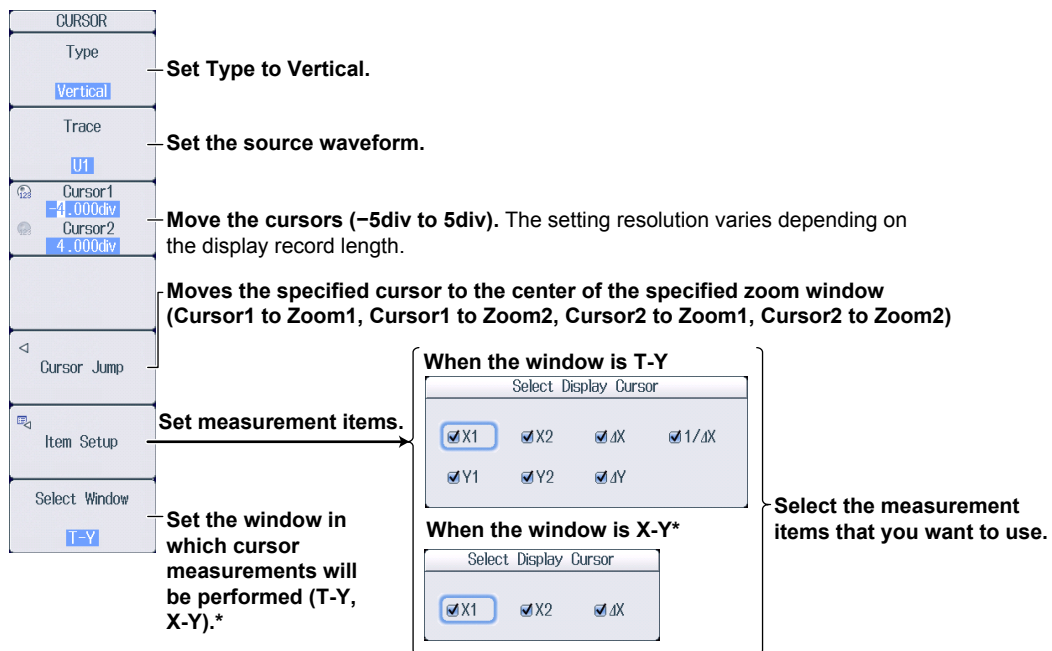
This section explains the following settings for measuring with vertical cursors:

- Cursor type
- Source waveform
- Moving the cursors
- Jumping the cursors
- Measurement items
- Windows that cursor measurements will be performed in

► **Features Guide: “Vertical Cursors (Vertical) - T-Y waveforms”**
“Vertical Cursors (Vertical) (X-Y)”
“Turning the X-Y Window Display On and Off (Display)”
“Record Length (Record Length)”

CURSOR Vertical Menu

Press **CURSOR**, the **Type** soft key, and then the **Vertical** soft key to display the following menu.



* This is available when the X-Y window display is turned on.

Setting the Source Waveform (Trace)

The waveforms that you can select differ depending on the window that cursor measurements will be performed in.

- T-Y: All, U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8
- X-Y: XY1 to XY8

13.3 Measuring with Marker Cursors (Marker)

This section explains the following settings for measuring with marker cursors.

- Cursor type
- Source waveform
- Moving the cursors
- Jumping the cursors
- Marker display format
- Measurement items
- Windows that cursor measurements will be performed in

► **Features Guide: “Marker Cursors (Marker) - T-Y waveforms”**

“Marker Cursors (Marker) (X-Y)”

“Marker Cursors (Marker) (FFT)”

“Turning the X-Y Window Display On and Off (Display)”

“Turning FFT On and Off (Display)”

“Record Length (Record Length)”

“Start Point and Number of FFT Points (Start Point and FFT Points)”

CURSOR Marker Menu

Press **CURSOR**, the **Type** soft key, and then the **Marker** soft key to display the following menu.

The diagram illustrates the CURSOR Marker Menu and its sub-menus. The main menu is shown on the left, with arrows pointing to specific options and their functions. The sub-menus are shown on the right, with arrows pointing to specific options and their functions.

CURSOR Marker Menu:

- Type** (Set the cursor type to Marker.)
- Marker #** (Select the marker cursor to use (Marker1 X, Marker2 +, Marker3 Y, Marker4 Y).)
- Trace** (Set the source waveform.)
- Position** (Move the cursors (-5div to 5div). The setting resolution varies depending on the display record length. The setting resolution when the window is FFT varies depending on the number of FFT points.)
- Cursor Jump** (Moves the specified cursor to the center of the specified zoom window (to Zoom1, to Zoom2))
- Item & Marker Form** (Set measurement items.)
- Select Window** (Set the window in which cursor measurements will be performed (T-Y, X-Y, FFT).*)

When the Source Window is T-Y or FFT*

Select Display Cursor

Marker Form: Mark, Line

Set the marker display format (Mark, Line).

Display Item:

<input checked="" type="checkbox"/> X1	<input checked="" type="checkbox"/> X2	<input checked="" type="checkbox"/> X3	<input checked="" type="checkbox"/> X4
<input checked="" type="checkbox"/> d(X2-X1)	<input checked="" type="checkbox"/> d(X3-X1)	<input checked="" type="checkbox"/> d(X4-X1)	
<input type="checkbox"/> d(X3-X2)	<input type="checkbox"/> d(X4-X2)	<input type="checkbox"/> d(X4-X3)	
<input checked="" type="checkbox"/> Y1	<input checked="" type="checkbox"/> Y2	<input checked="" type="checkbox"/> Y3	<input checked="" type="checkbox"/> Y4
<input checked="" type="checkbox"/> d(Y2-Y1)	<input checked="" type="checkbox"/> d(Y3-Y1)	<input checked="" type="checkbox"/> d(Y4-Y1)	
<input type="checkbox"/> d(Y3-Y2)	<input type="checkbox"/> d(Y4-Y2)	<input type="checkbox"/> d(Y4-Y3)	

Select the measurement items that you want to use.

When the window is X-Y*

Select Display Cursor

<input checked="" type="checkbox"/> X1	<input checked="" type="checkbox"/> X2	<input checked="" type="checkbox"/> X3	<input checked="" type="checkbox"/> X4
<input checked="" type="checkbox"/> Y1	<input checked="" type="checkbox"/> Y2	<input checked="" type="checkbox"/> Y3	<input checked="" type="checkbox"/> Y4
<input checked="" type="checkbox"/> T1	<input checked="" type="checkbox"/> T2	<input checked="" type="checkbox"/> T3	<input checked="" type="checkbox"/> T4
<input checked="" type="checkbox"/> d(T2-T1)	<input checked="" type="checkbox"/> d(T3-T1)	<input checked="" type="checkbox"/> d(T4-T1)	

* This is available when the X-Y window display or FFT window display is turned on.

Setting the Source Waveform (Trace)

The waveforms that you can select differ depending on the window that cursor measurements will be performed in.

- T-Y: OFF, U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8
- X-Y: OFF, XY1 to XY8
- FFT: OFF, FFT1, FFT2

13.4 Measuring with Angle Cursors (Degree)

This section explains the following settings for measuring with angle cursors. You can use angle cursors when the T-Y window is displayed.

- Cursor type
- Source waveform
- Moving the cursors
- Zero and end reference angles
- Jumping the cursors
- Measurement items
- Reference angle
- Windows that cursor measurements will be performed in

► **Features Guide: “Angle Cursors (Degree) - T-Y waveforms”**
“Record Length (Record Length)”

CURSOR Degree Menu

1. Press **CURSOR**, the **Select Window** soft key, and then the **T-Y** soft key.
2. Press the **Type** soft key and then the **Degree** soft key to display the following menu.

The image shows the CURSOR Degree Menu and the Select Display Cursor dialog. The menu is a vertical list of options: CURSOR, Type, Trace, Cursor1, Cursor2, Ref1, Ref2, Cursor Jump, Item & RefValue, and Select Window. The Type option is highlighted with 'Degree' below it. The Trace option is highlighted with 'U1' below it. The Cursor1 and Cursor2 options are highlighted with '-4.000div' and '4.000div' respectively. The Ref1 and Ref2 options are highlighted with '-2.000div' and '2.000div' respectively. The Select Window option is highlighted with 'T-Y' below it. The Select Display Cursor dialog is shown to the right of the Item & RefValue option. It has a RefValue field set to 360 and a Display Item section with checkboxes for X1, X2, ΔX, Y1, Y2, and ΔY. X1 is selected.

CURSOR

Type
Degree

Trace
U1

Cursor1
-4.000div

Cursor2
4.000div

Ref1
-2.000div

Ref2
2.000div

Cursor Jump

Item & RefValue

Select Window
T-Y

Set the cursor type to Degree.

Set the source waveform (All, U1-U4, I1-I4, P1-P4, AUX3-AUX8, Math1-Math8).

Move the cursors (-5div to 5div). The setting resolution varies depending on the display record length.

Set the zero and end reference angles (-5div to 5div). The setting resolution varies depending on the display record length.

Moves the specified cursor to the center of the specified zoom window (Cursor1 to Zoom1, Cursor1 to Zoom2, Cursor2 to Zoom1, Cursor2 to Zoom2)

Set measurement items.

Set the window in which cursor measurements will be performed to T-Y.

Select Display Cursor

RefValue 360

Display Item

☒ X1 ☒ X2 ☒ ΔX

☒ Y1 ☒ Y2 ☒ ΔY

Set the reference angle (1-720).

Select the measurement items that you want to use.

13.5 Measuring with Horizontal and Vertical Cursors (H & V)

This section explains the following settings for measuring with horizontal and vertical cursors:

- Cursor type
- Source waveform
- Moving the vertical cursors
- Moving the horizontal cursors
- Jumping the cursors
- Measurement items
- Windows that cursor measurements will be performed in

► **Features Guide:** “Horizontal and Vertical Cursors (H & V) - T-Y waveforms”
“Horizontal and Vertical Cursors (H & V) (X-Y)”
“Turning the X-Y Window Display On and Off (Display)”
“Record Length (Record Length)”

CURSOR H & V Menu

Press **CURSOR**, the **Type** soft key, and then the **H & V** soft key to display the following menu.

The screenshot shows the CURSOR H & V menu with the following options and annotations:

- CURSOR** (Title)
- Type**: Set Type to H & V. (Option: H & V)
- Trace**: Set the source waveform. (Option: U1)
- V-Cursor1**: Move the vertical cursors (–5div to 5div). The setting resolution varies depending on the display record length. (Value: 4.000div)
- V-Cursor2**: (Value: 4.000div)
- H-Cursor1**: Move the horizontal cursors (–5.00div-5.00div). (Value: 3.00div)
- H-Cursor2**: (Value: –3.00div)
- Cursor Jump**: Moves the specified cursor to the center of the specified zoom window (Cursor1 to Zoom1, Cursor1 to Zoom2, Cursor2 to Zoom1, Cursor2 to Zoom2)
- Item Setup**: Set measurement items. (When the window is T-Y: Select Display Cursor. Options: ☒ X1, ☒ X2, ☒ ΔX, ☒ 1/ΔX, ☒ Y1, ☒ Y2, ☒ ΔY. When the window is X-Y*: Select Display Cursor. Options: ☒ X1, ☒ X2, ☒ ΔX, ☒ Y1, ☒ Y2, ☒ ΔY. Select the measurement items that you want to use.)
- Select Window**: Window in which cursor measurements will be performed (T-Y, X-Y)*. (Option: T-Y)

* This is available when the X-Y window display is turned on.

Setting the Source Waveform (Trace)

The waveforms that you can select differ depending on the window that cursor measurements will be performed in.

- T-Y: U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8
- X-Y: XY1 to XY8

13.6 Measuring with Peak Cursors (Peak)

This section explains the following settings for measuring with peak cursors. You can use peak cursors when the FFT window is displayed.

- Cursor type
- Two measurement ranges
- Measurement items
- Windows that cursor measurements will be performed in

► **Features Guide: “Peak Cursors (Peak)”**

“Turning FFT On and Off (Display)”

“Start Point and Number of FFT Points (Start Point and FFT Points)”

CURSOR Peak Menu

1. Press **CURSOR**, and then press the **Select Window** soft key and then the FFT soft key.
2. Press the **Type** soft key and then the Peak soft key to display the following menu.

The image shows a screenshot of the CURSOR Peak Menu with several annotations. The menu is divided into sections: Type, FFT1 Range1, FFT1 Range2, FFT2 Range1, FFT2 Range2, Item Setup, and Select Window. Annotations point to specific settings and actions:

- Set Type to Peak.** Points to the **Peak** button in the Type section.
- Set the FFT1 measurement time period (–5div to 5div). The setting resolution varies depending on the number of FFT points.** Points to the **–5.00div** and **5.00div** values in the FFT1 Range1 and Range2 sections.
- Set the FFT2 measurement time period (–5div to 5div). The setting resolution varies depending on the number of FFT points.** Points to the **–5.00div** and **5.00div** values in the FFT2 Range1 and Range2 sections.
- Set measurement items.** Points to the **Item Setup** section.
- Set Select Window to FFT.** Points to the **FFT** button in the Select Window section.
- Select the measurement items that you want to use.** Points to the **Select Display Cursor** dialog box, which shows checkboxes for **F1**, **F2**, **Y1**, and **Y2**.

14.1 Automatically Measuring Waveform Parameters

This section explains the following settings for automatically measuring waveform parameters.

- Turning automated measurement on and off
- Source waveform and measurement items
- Measurement time period
- Turning cycle mode on and off
- Parameter details
- Delay settings

► **Features Guide: “Automated Measurement of Waveform Parameters”**
“Record Length (Record Length)”

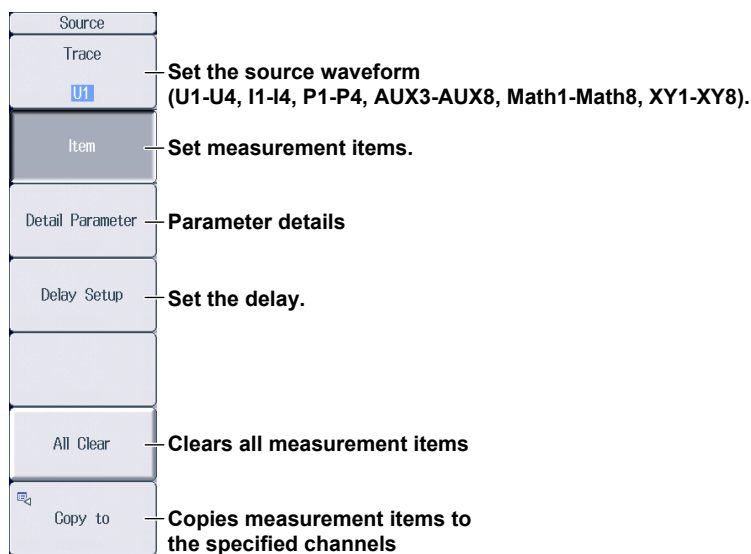
MEASURE Menu

Press **MEASURE**, the **Mode** soft key, and then the **ON** soft key to display the following menu.

MEASURE	
Mode	Set Mode to ON.
ON	
◀ Measure Setup	Set the source waveform and measurement items.
Time Range1 5.00div	Set the measurement time period (–5div to 5div). The setting resolution varies depending on the display record length. Time period 2 (Time Range2) must be greater than or equal to Time period 1 (Time Range1). The maximum number of data points that are measured is 100 Mpoint from Time Range 1.
Time Range2 5.00div	
1-Cycle Mode	Turns cycle mode on and off If the measurement time period (the spacing between Time Range1 and Time Range2) is less than 1 cycle, the measured value will be “*****.”
OFF ON	

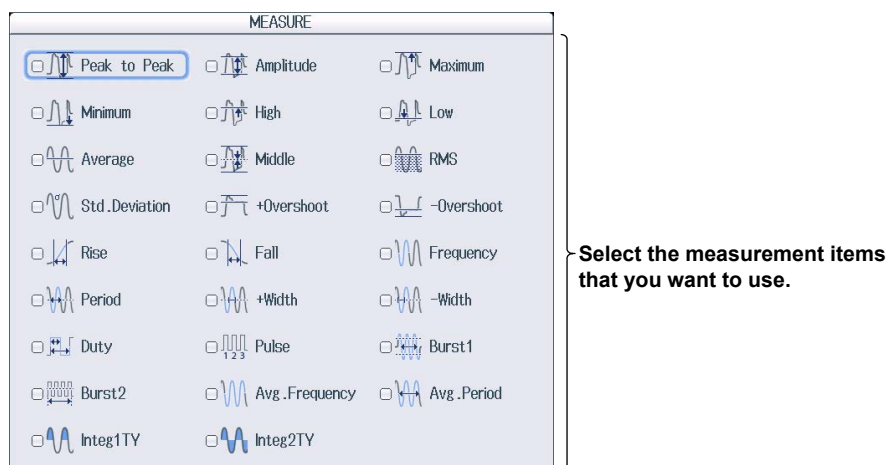
Setting the Source Waveform and Configuring the Measurement Items (Measure Setup)

1. Press the **Measure Setup** soft key to display the following menu.

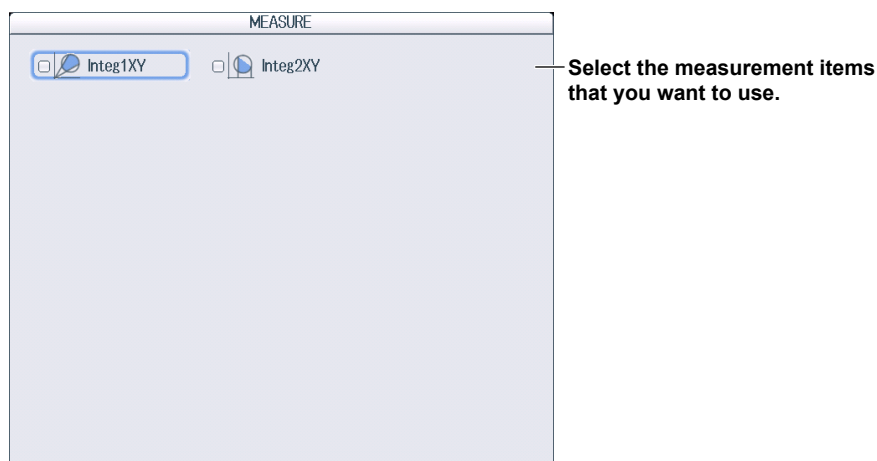


Setting Measurement Items (Item)

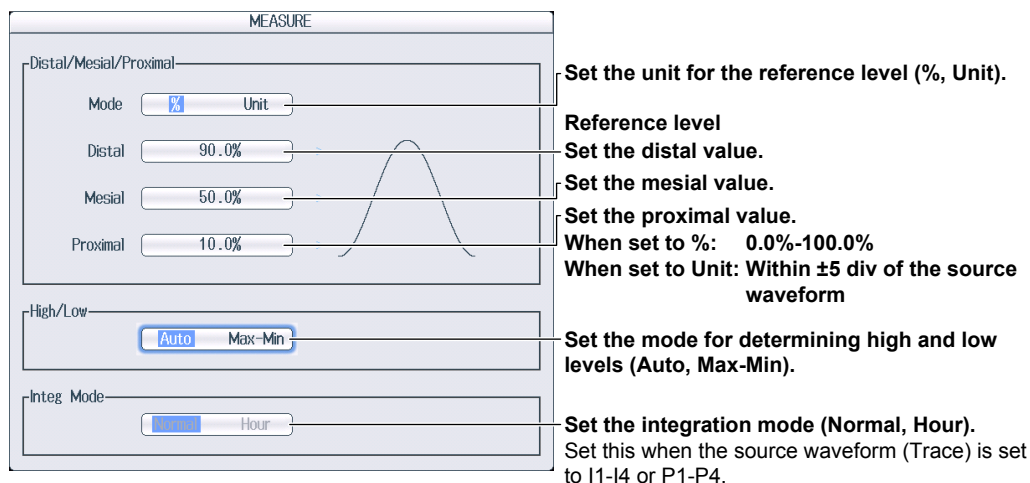
2. Press the **Item** soft key to display the following screen.
 - When the Source Waveform Is U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8



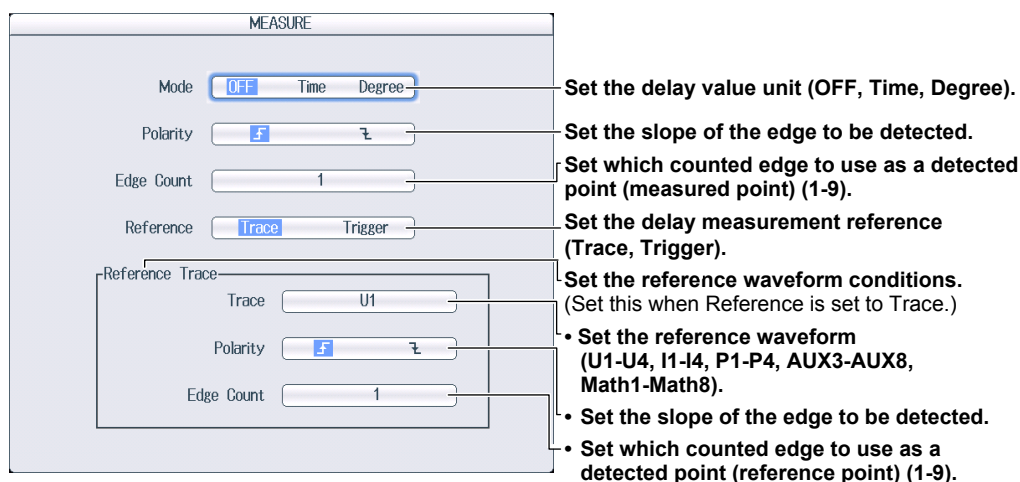
- When the Source Waveform Is XY1 to XY8



2. Press the **Detail Parameter** soft key to display the following screen.

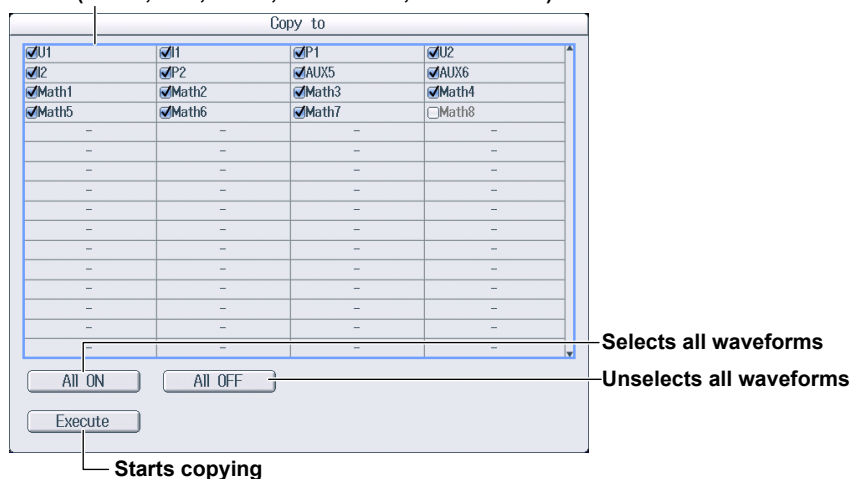


2. Press the **Delay Setup** soft key to display the following screen.



2. Press the **Copy to** soft key to display the following screen.

Copies the contents specified by measurement item (Item) to the selected waveforms (Trace) (U1-U4, I1-I4, P1-P4, AUX3-AUX8, Math1-Math8)



14.2 Performing Normal Statistical Processing

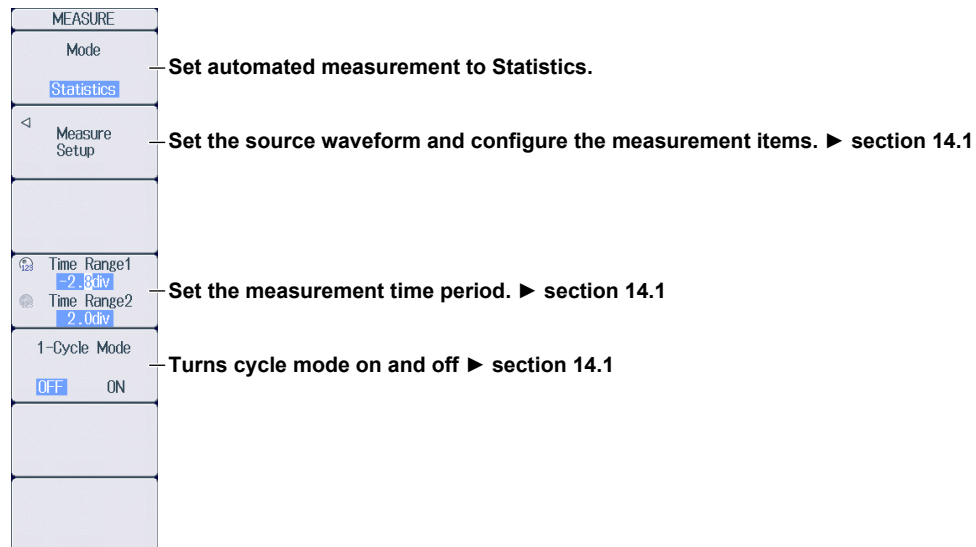
This section explains the following settings for performing normal statistical processing on automatically measured waveform parameters.

- Normal statistical processing

► [Features Guide: “Normal Statistical Processing \(Statistics\)”](#)

MEASURE Menu

Press **MEASURE**, the **Mode** soft key, and then the **Statistics** soft key to display the following menu.



14.3 Performing Cyclic Statistical Processing

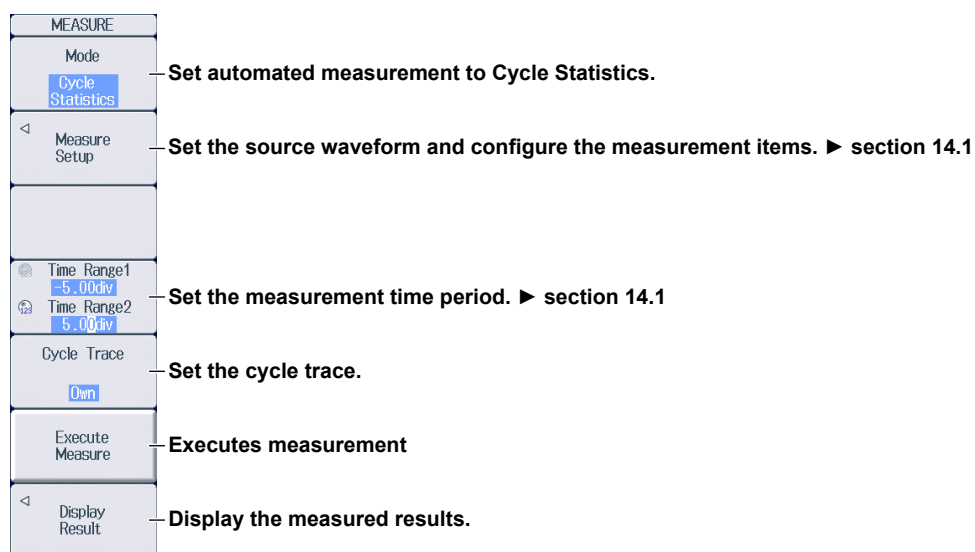
This section explains the following settings for performing cyclic statistical processing on automatically measured waveform parameters.

- Cyclic statistical processing
- Cycle trace (source waveform for determining the cycle)
- Result display

► [Features Guide: “Cyclic Statistical Processing \(Cycle Statistics\)”](#)

MEASURE Menu

Press **MEASURE**, the **Mode** soft key, and then the **Cycle Statistics** soft key to display the following menu.



Setting the Cycle Trace (Cycle Trace)

U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, Math1 to Math8:

The PX8000 automatically measures the waveform parameters of all the source waveforms and performs statistical processing on the measured values once per cycle of the specified waveform.

Own:

The PX8000 determines the cycle of each source waveform. It then automatically measures the waveform parameters and performs statistical processing once per cycle of each waveform. However, if multiple waveforms with different cycles are measured, the number of iterations of automated measurement of waveform parameters and statistical processing performed on all waveforms is equal to the number of cycles in the slowest waveform.

Displaying the Measured Results (Display Result)

Press the **Display Result** soft key to display the following screen.

- ↑: Displayed next to the maximum value of each measurement item.
↓: Displayed next to the minimum value of each measurement item.

Cycle Statistics					Jump & Sort	
	Min(AUX5)	High(AUX5)	Low(AUX5)	Avg(AUX5)	<	Sort
3	-1.33333mV	994.667mV	2.00000mV	498.805mV		Forward
4	0.00000V ↑	994.667mV	2.00000mV	498.897mV		
5	-2.66667mV	993.333mV ↓	2.00000mV	498.862mV		
6	-1.33333mV	994.667mV	2.00000mV	498.813mV		
7	-2.66667mV	994.667mV	2.00000mV	499.126mV		
8	-4.00000mV	994.667mV	2.00000mV	499.108mV		
9	-2.66667mV	994.667mV	2.00000mV	498.927mV		
10	-4.00000mV	994.667mV	3.33333mV ↑	499.148mV		
11	-1.33333mV	993.333mV	2.00000mV	499.110mV		
12	-2.66667mV	994.667mV	2.00000mV	499.092mV		
13	-1.33333mV	996.000mV ↑	2.00000mV	499.123mV		
14	-2.66667mV	994.667mV	2.00000mV	499.216mV		
15	-1.33333mV	994.667mV	2.00000mV	499.269mV		
16	-5.33333mV	994.667mV	3.33333mV	499.067mV		Statistics Max
17	0.00000V	996.000mV	2.00000mV	499.063mV		
18	-2.66667mV	994.667mV	666.667uV ↓	498.896mV		
19	-1.33333mV	994.667mV	3.33333mV	499.128mV		
20	-2.66667mV	994.667mV	2.00000mV	498.854mV		
21	-6.66667mV ↓	994.667mV	666.667uV	498.828mV		
22	-2.66667mV	994.667mV	2.00000mV	498.858mV		
23	-1.33333mV	994.667mV	666.667uV	498.941mV		
24	-2.66667mV	994.667mV	2.00000mV	498.888mV		
25	-1.33333mV	993.333mV	666.667uV	498.885mV		
26	-1.33333mV	993.333mV	3.33333mV	499.135mV		
27	-2.66667mV	994.667mV	2.00000mV	499.066mV		
28	-4.00000mV	994.667mV	666.667uV	498.890mV		
29	-1.33333mV	993.333mV	2.00000mV	499.077mV		
30	0.00000V	994.667mV	2.00000mV	499.372mV ↑		

If scroll bars are displayed, you can press the arrow keys (▲, ▼, ◀, ▶) to scroll the list.
You can scroll vertically also using the jog shuttle.

15.1 Performing Addition, Subtraction, Multiplication, and Division

This section explains the following settings for performing addition, subtraction, multiplication, and division.

- Computation
Operator (+, −, *, /), computation source waveform, unit, label, turning the waveform display on and off
- Scaling
Math waveform to scale (computed waveform), scaling mode, upper and lower limits of the display range
- Computation start and end points

► **Features Guide: “Basic Arithmetic (S1+S2, S1-S2, S1*S2, and S1/S2)”**
“Scaling Mode (Scaling Mode)”
“Record Length (Record Length)”

MATH Menu

Press **MATH** to display the following menu.

The MATH menu is shown on the left, and the Setup screen is on the right. Arrows point from the MATH menu options to the Setup screen and to descriptive text.

- MATH Mode**: OFF, ON. **Set Mode to ON.**
- Math Setup**: **Set the computation.**
- Select Math Trace**: 1. **Set the scaling.**
 - Select the Math waveform (computed waveform) to scale (1-8).
- Scaling Mode**: Auto, Manual. **Set the scaling mode (Auto, Manual).**
- Upper**: 2.5000. **Set the upper and lower limits of the display range (−9.9999E+30-9.9999E+30).**
- Lower**: −2.5000.
- Start Point**: −5.00div. **Set this when the scaling mode is Manual.**
- End Point**: 5.00div. **Set the computation start and end points (−5div to 5div).**
 The end point must be greater than or equal to the start point.
 Note that there is a limitation in the number of data points that is used depending on the number of equations to be computed.
 Not all the data points may be used.

The Setup screen on the right shows Math1 through Math8, all set to OFF.

Configuring Computations (Math Setup)

1. Press the **Math Setup** soft key.
2. Press a soft key from **Math1** to **Math8** to display the following screen.

The Math1 setup screen is shown with the following fields and annotations:

- Operation**: S1 + S2. **Select the operation (S1+S2, S1-S2, S1*S2, S1/S2).**
- Source1**: U1. **Select the computation source waveform (U1-U4, I1-I4, P1-P4, AUX3-AUX8, Math1-Math7).**
- Source2**: I1.
- Unit**: **Set the unit.**
- Label**: Math1. **Set the label.**
- Display**: OFF, ON. **Turns the waveform display on and off**

15.2 Performing Binary Conversion

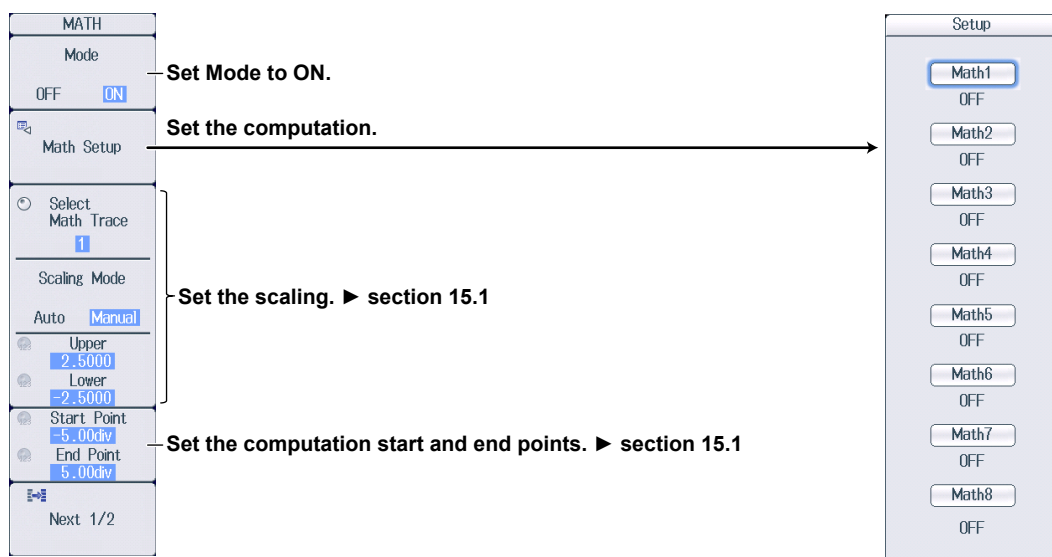
This section explains the following settings for performing binary conversions:

- Computation
Function (Bin(S1)), computation source waveform, threshold level, unit, label, turning the waveform display on and off
- Scaling
- Computation start and end points

► Features Guide: “Binary Conversion (Bin (S1))”

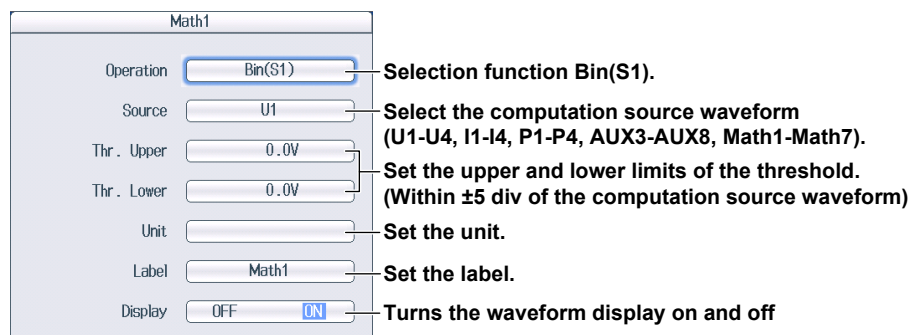
MATH Menu

Press **MATH** to display the following menu.



Configuring Computations (Math Setup)

1. Press the **Math Setup** soft key.
2. Press a soft key from **Math1** to **Math8** to display the following screen.



15.3 Shifting the Phase

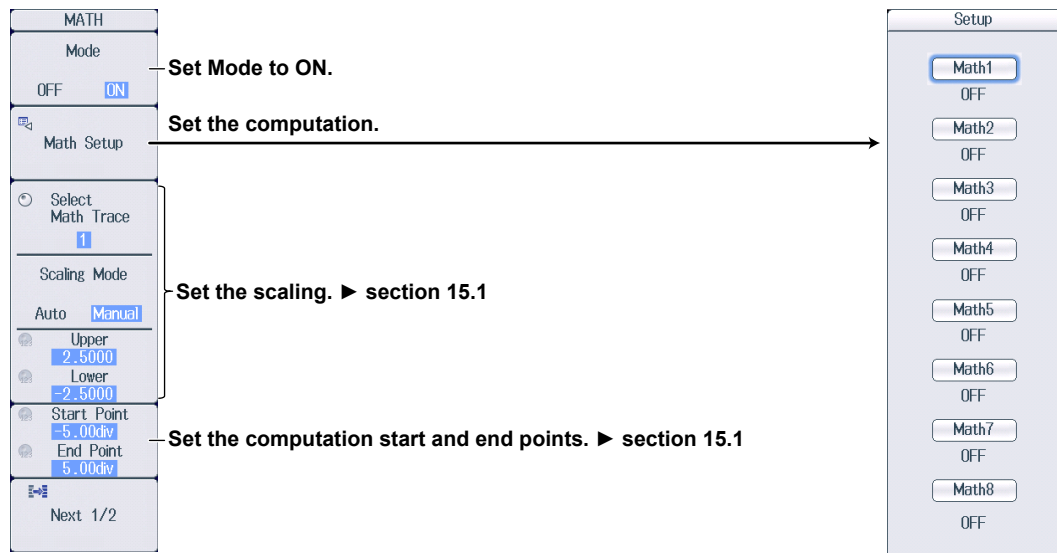
This section explains the following settings for shifting the phase:

- Computation
Function (Shift(S1)), computation source waveform, shift range, unit, label, turning the waveform display on and off
- Scaling
- Computation start and end points

► [Features Guide: “Phase Shift \(Shift \(S1\)\)”](#)
[“Record Length \(Record Length\)”](#)

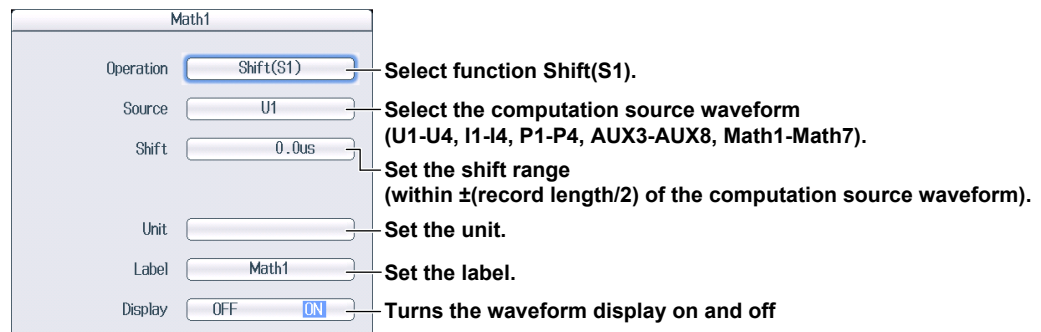
MATH Menu

Press **MATH** to display the following menu.



Configuring Computations (Math Setup)

1. Press the **Math Setup** soft key.
2. Press a soft key from **Math1** to **Math8** to display the following screen.



15.4 Displaying the Power Spectrum

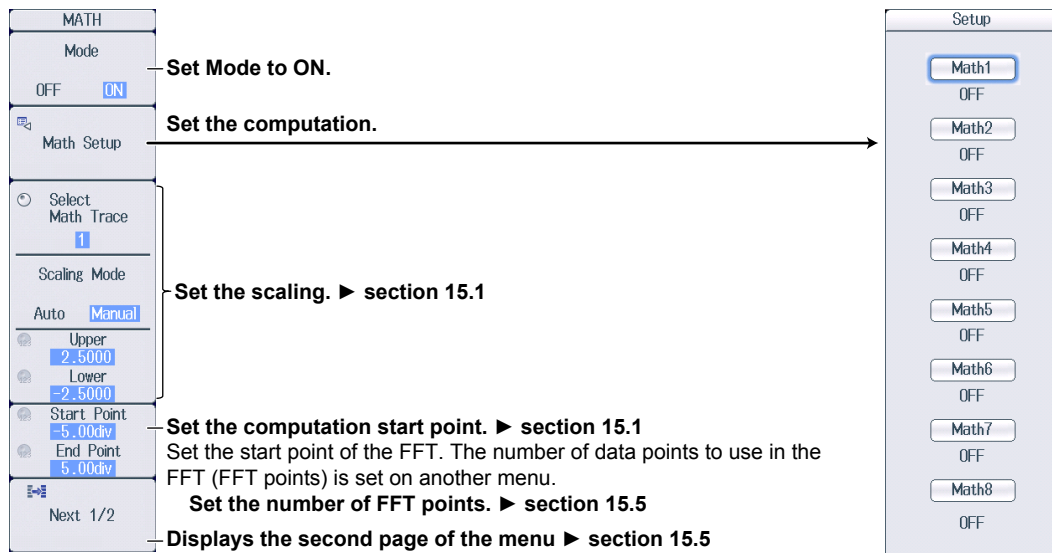
This section explains the following settings for performing FFT and displaying the power spectrum.

- Computation
Function (PS(S1)), computation source waveform, unit, label, turning the waveform display on and off
- Scaling
- Computation start point
- FFT

► [Features Guide: “Power Spectrum \(PS \(S1\)\)”](#)

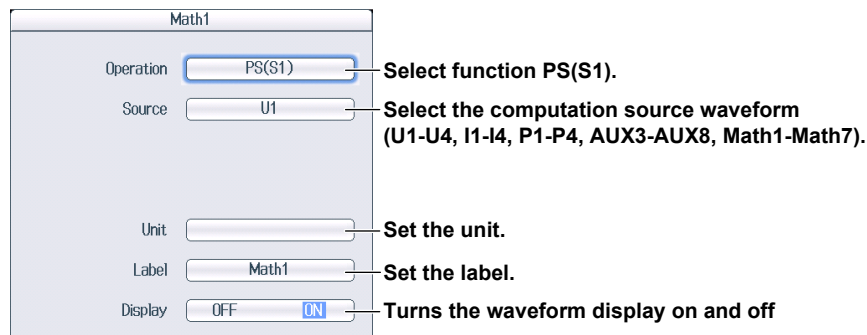
MATH Menu

Press **MATH** to display the following menu.



Configuring Computations (Math Setup)

1. Press the **Math Setup** soft key.
2. Press a soft key from **Math1** to **Math8** to display the following screen.



Configuring the FFT

Set the number of FFT points and window function. ► [section 15.5](#)

15.5 Performing User-Defined Computations

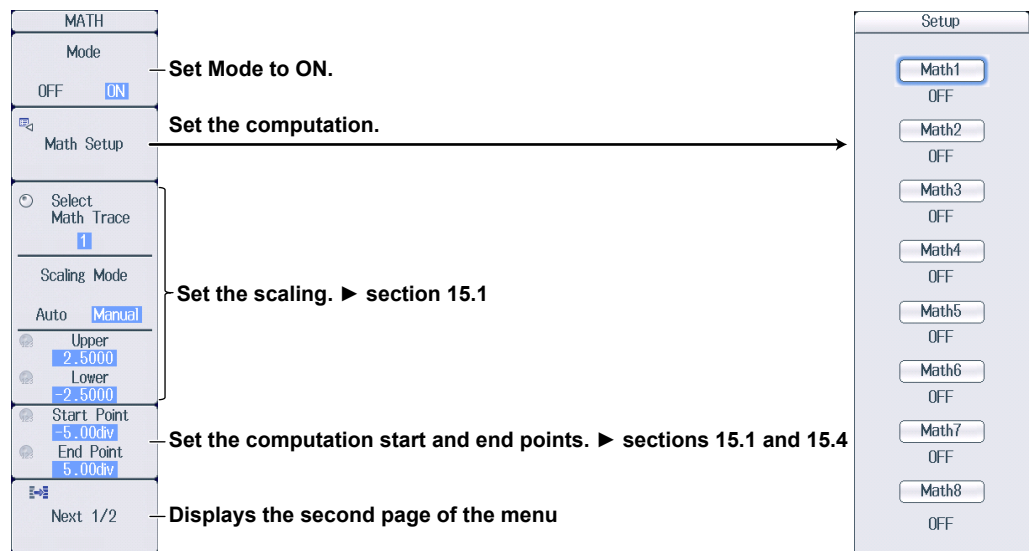
This section explains the following settings for performing user-defined computations.

- Computation
User definition (User Define), expression, unit, label, turning the waveform display on and off
- Scaling
- Computation start and end points
- FFT
- Filter
- Constant

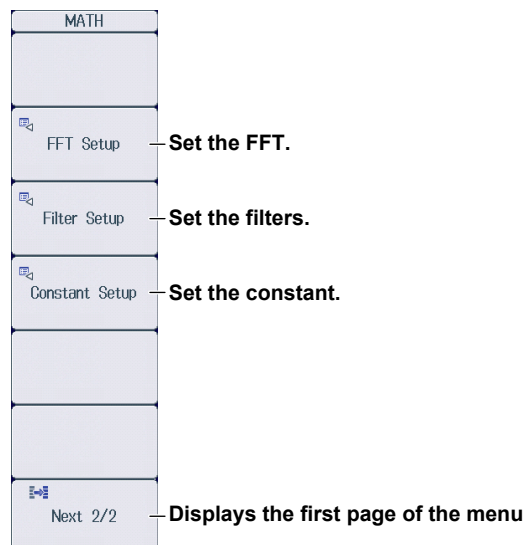
► Features Guide: “User-Defined Computation”

MATH Menu

1. Press **MATH** to display the following menu.

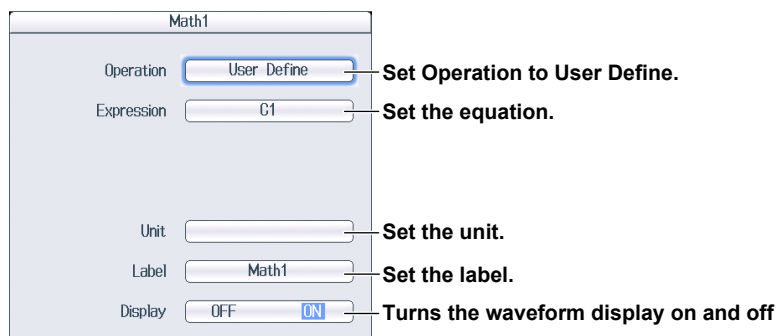


2. Press the **Next 1/2** soft key to display the 2/2 menu.



Configuring Computations (Math Setup)

1. Press the **Math Setup** soft key.
2. Press a soft key from **Math1** to **Math8** to display the following screen.



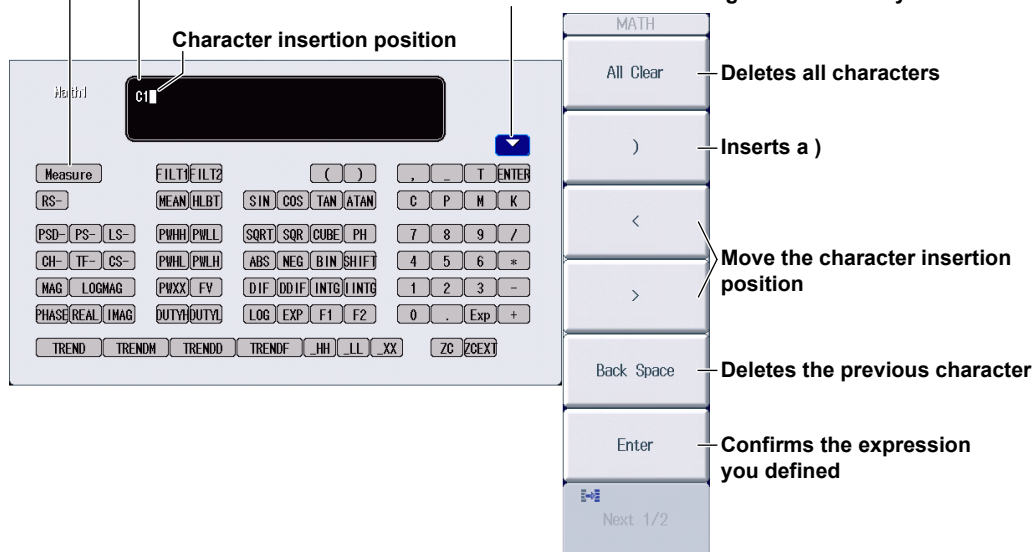
Setting the Expression (Expression)

3. Select **Expression** to display the following screen.

Add the results of automated measurement of waveform parameters to the expression.

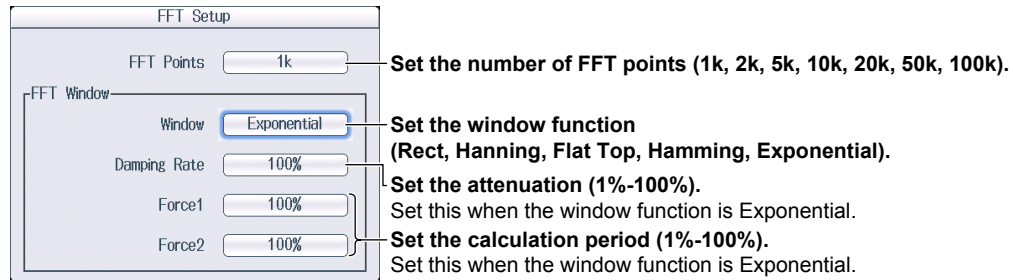
Define an expression by combining computation source waveforms, operators, and functions.

Enter a character string from the history.



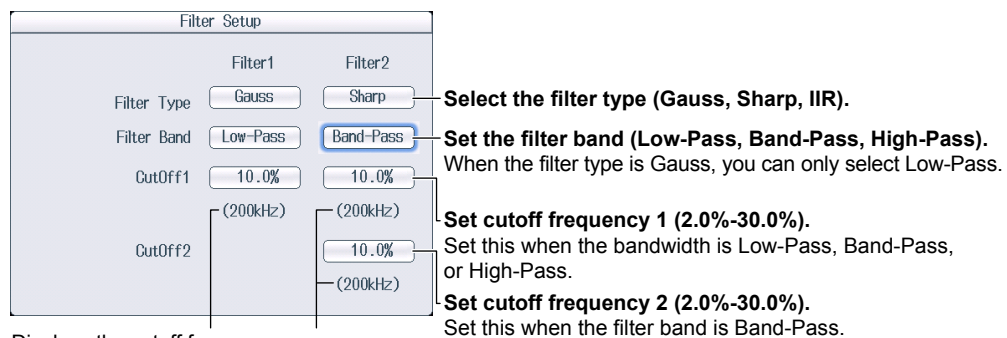
Configuring the FFT (FFT Setup)

Press the **FFT Setup** soft key to display the following screen.



Configuring Filters (Filter Setup)

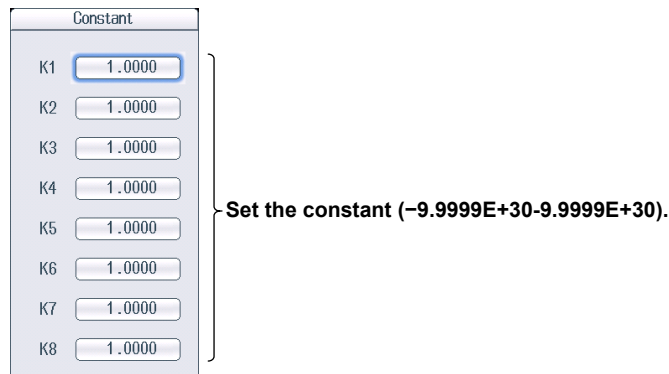
Press the **Filter Setup** soft key to display the following screen.



Displays the cutoff frequency as a percentage of the sample rate in use.

Defining Constants (Constant Setup)

Press the **Constant Setup** soft key to display the following screen.



16.1 Displaying FFT Waveforms

This section explains the following settings for displaying power spectrum waveforms in the FFT window.

- FFT waveform display
- FFT
 - Spectrum type and sub type, analysis source waveform, window function
- Vertical scale
- Computation start point
- FFT points
- Main window's display ratio
- Window layout
- Horizontal axis
 - Scale, unit, zoom (display range)

► [Features Guide: “FFT”](#)

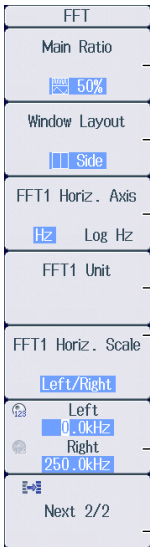
FFT Menu

1. Press **SHIFT+MATH** (FFT) to display the following menu.

	<p>Select whether to set FFT1 or FFT2.</p> <p>Turns the FFT display on and off</p> <p>Set the FFT.</p> <p>Set the vertical scaling mode (Auto, Manual).</p> <p>Set the vertical axis center and sensitivity.</p> <ul style="list-style-type: none"> • Center ($-9.9999\text{E}+30$ to $9.9999\text{E}+30$) • Sensitivity ($1\text{E}-30$ to $1.9999\text{E}+30$) <p>Set this when the vertical scale is Manual.</p> <p>Set the computation start point (-5div to -5div).</p> <p>The setting resolution varies depending on the display record length.</p> <p>Set the number of FFT points (1k, 2k, 5k, 10k, 20k, 50k, 100k).</p> <p>Displays the second page of the menu</p>
--	--

16.1 Displaying FFT Waveforms

- Press the **Next 1/2** soft key to display the following menu.



FFT

Main Ratio — Set the main window's display ratio (50%, 0%).

Window Layout — Set the window layout (Side, Vertical).

FFT1 Horiz. Axis Log Hz — Set the horizontal scale (Hz, Log Hz).

FFT1 Unit — Set the vertical scale unit.

FFT1 Horiz. Scale — Set the horizontal zoom mode (Auto, Left/Right, Center/Span).
Center/Span cannot be selected when the horizontal scale is set to Log Hz.


Left — Set the display range of the horizontal axis.

Right — When horizontal zoom is set to Left/Right

- Set the left and right edges (0Hz to maximum frequency).

The setting resolution varies depending on the number of FFT points.
The following relationship must be satisfied: (right edge – left edge) ≥ (10×setting resolution).

Next 2/2 — Displays the first page of the menu



Center — Set the display range of the horizontal axis.

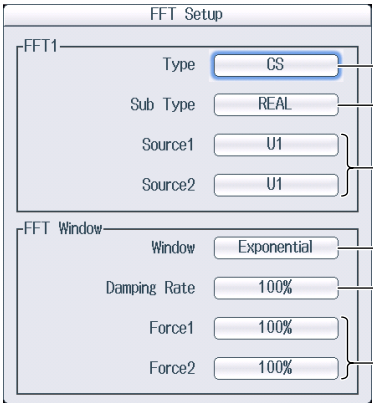
Span — When horizontal zoom is set to Center/Span

- Set the center (0Hz to maximum frequency).
- Set the Span ((frequency resolution×10) to maximum frequency).

The setting resolution varies depending on the number of FFT points.

Configuring the FFT (FFT Setup)

Press the **FFT Setup** soft key to display the following screen.



FFT Setup

FFT1

Type — Set the spectrum type (LS, RS, PS, PSD, CS, TF, or CH).

Sub Type — Set the spectrum sub type (REAL, IMAG, MAG, LOGMAG, PHASE).*

Source1 — Set the analysis source waveform (U1-U4, I1-I4, P1-P4, AUX3-AUX8, Math1-Math6).

Source2 — You can set Source 2 when the spectrum type is CS, TF, or CH.

FFT Window

Window — Set the window function (Rect, Hanning, Flat Top, Hamming, Exponential).

Damping Rate — Set the attenuation (1%-100%).

Force1 — Set this when the window function is Exponential.

Force2 — Set the calculation period (1%-100%).
Set this when the window function is Exponential.

* The available sub types vary depending on the spectrum type.

Type	Available Sub Types
LS, CS, TF	REAL, IMAG, MAG, LOGMAG, PHASE
RS, PS, PSD	MAG, LOGMAG
CH	MAG

17.1 Performing GO/NO-GO Determination with Waveform Zones

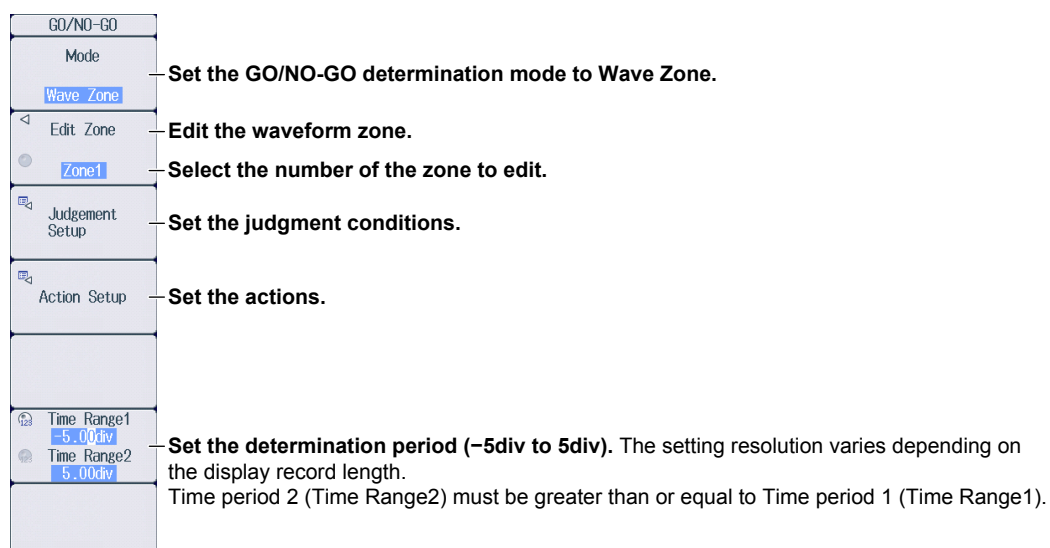
This section explains the following settings for performing GO/NO-GO determination with waveform zones:

- GO/NO-GO determination mode
- Editing the waveform zone
- Judgment condition
- Action
- Determination period

► [Features Guide: “Waveform Zone \(Wave Zone\)”](#)

GO/NO-GO Menu

Press **SHIFT+MEASURE** (GO/NO-GO) to display the following menu.



Editing Waveform Zones (Edit Zone)

1. Press the **Edit Zone** soft key described on the previous page to use the jog shuttle to adjust this setting.
If the jog shuttle is already controlling the Edit Zone soft key, proceed to step 2.
2. Use the **jog shuttle** to select the number of the zone that you want to edit (Zone1 to Zone6).
3. Press the **Edit Zone** soft key to display the following menu.

When in step 2, a zone number in which a created waveform zone does not exist is selected

Select the base waveform (U1-U4, I1-I4, P1-P4, AUX3-AUX8, Math1-Math8).

When you select the base waveform, the edit menu shown on the right appears.

When in step 2, a zone number in which a created waveform zone exists is selected

To clear the waveform zone that you are creating or have created and create a new waveform zone, select the base waveform on this menu.

Set the editing range (Whole, Part).

When the editing range is set to Whole

- Set the upper and lower limits (0.00div-10.00div).

- Set the left and right edges (0.00div-5.00div).

When the editing range is set to Part

- Set the time range (-5.00div to 5.00div).

Set the waveform zone save destination (Zone1-Zone6).

Saves the waveform zone

Setting the Judgment Conditions (Judgement Setup)

Press the **Judgement Setup** soft key to display the following screen.

You can set up to 16 conditions.

Set the judgment criterion (X, IN, OUT).

Set the source waveform (U1-U4, I1-I4, P1-P4, AUX3-AUX8, Math1-Math8).

Set the zone number (Zone1-Zone6).

#	Mode	Trace	Zone No.
1	X	U1	Zone1
2	X	U1	Zone1
3	X	U1	Zone1
4	X	U1	Zone1
5	X	U1	Zone1
6	X	U1	Zone1
7	X	U1	Zone1
8	X	U1	Zone1
9	X	U1	Zone1
10	X	U1	Zone1
11	X	U1	Zone1
12	X	U1	Zone1
13	X	U1	Zone1
14	X	U1	Zone1
15	X	U1	Zone1
16	X	U1	Zone1

Set the determination logic (AND, OR).

Set the action condition (Always, Fail, Success).

Set the sequence (Single, Continue).

Set the number of measurements (the number of waveform acquisitions) (Infinite, 1-65536).

Turns external start on and off

Setting Action Conditions (ActCondition)

Always: The action is always executed. The specified action, explained later, is executed each time a trigger occurs.

Fail: The action is executed when the GO conditions are not met.

Success: The action is executed when the GO conditions are met.

Setting the Sequence (Sequence)

Single: The action is executed once.

Continue: The action is executed repeatedly. It is repeated until the waveform is acquired the number of times specified by Acquisition Count. If Acquisition Count is set to Infinite, the action is repeated until waveform acquisition is stopped with the START/STOP key.

Setting Actions (Action Setup)

Press the **Action Setup** soft key to display the following screen.

Select the actions to execute (Beep, Print Image, Save Waveform, Save Numeric, Save Image).

The screenshot shows the 'Action Setup' dialog box. On the left, there is a list of actions with checkboxes: ☒ Beep, ☒ Print Image, ☒ Save Waveform, ☒ Save Numeric, and ☒ Save Image. The 'Save Image' checkbox is highlighted with a blue border. On the right, there are three configuration panels for 'Save Waveform', 'Save Numeric', and 'Save Image'. Each panel contains the following fields: 'File Path' (set to USB-0), 'Auto Naming' (set to Numbering), and 'File Name' (empty). The 'Save Waveform' panel also includes a 'Data Type' field set to Binary.

Set the waveform data save destination.

► section 22.3

Set this when Save Waveform is selected for the action.

Set the numeric data save destination.

► section 22.3

Set this when Save Numeric is selected for the action.

Set the screen capture save destination.

► section 22.3

Set this when Save Image is selected for the action.

17.2 Performing GO/NO-GO Determination with Waveform Parameters

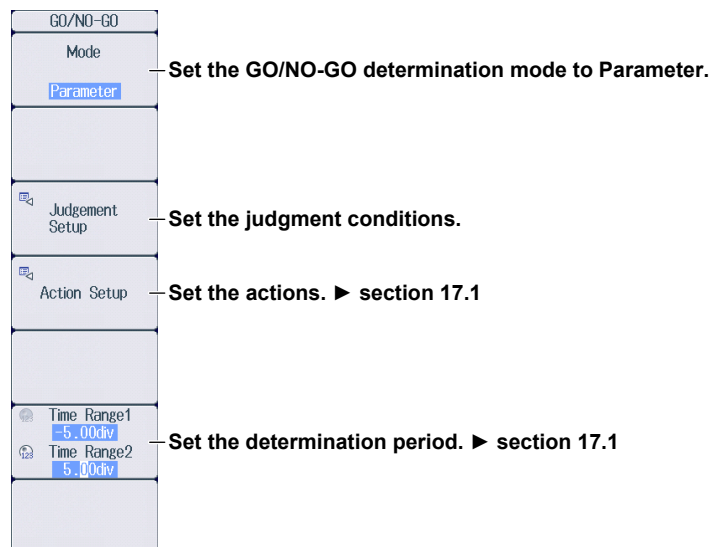
This section explains the following settings for performing GO/NO-GO determination with waveform parameters.

- GO/NO-GO determination mode
- Judgment condition
- Action
- Determination period

► [Features Guide: “Waveform Parameters \(Parameter\)”](#)
“Automated Measurement of Waveform Parameters”

GO/NO-GO Menu

Press **SHIFT+MEASURE** (GO/NO-GO) to display the following menu.



Setting the Judgment Conditions (Judgement Setup)

Press the **Judgement Setup** soft key to display the following screen.

You can set up to 16 conditions.

Set the judgment criterion (X, IN, OUT).

Set the source waveform (U1-U4, I1-I4, P1-P4, AUX3-AUX8, Math1-Math8).

Set the waveform parameters.

Judgement Setup					
#	Mode	Trace	Item	Upper	Lower
1	X	U1	Peak to Peak	0.0000	0.0000
2	X	U1	Peak to Peak	0.0000	0.0000
3	X	U1	Peak to Peak	0.0000	0.0000
4	X	U1	Peak to Peak	0.0000	0.0000
5	X	U1	Peak to Peak	0.0000	0.0000
6	X	U1	Peak to Peak	0.0000	0.0000
7	X	U1	Peak to Peak	0.0000	0.0000
8	X	U1	Peak to Peak	0.0000	0.0000
9	X	U1	Peak to Peak	0.0000	0.0000
10	X	U1	Peak to Peak	0.0000	0.0000
11	X	U1	Peak to Peak	0.0000	0.0000
12	X	U1	Peak to Peak	0.0000	0.0000
13	X	U1	Peak to Peak	0.0000	0.0000
14	X	U1	Peak to Peak	0.0000	0.0000
15	X	U1	Peak to Peak	0.0000	0.0000
16	X	U1	Peak to Peak	0.0000	0.0000

Logic: ☐ AND ☒ OR

ActCondition: ☐ Always ☒ Fail ☐ Success

Sequence: ☒ Single ☐ Continue

Acquisition Count:

Remote: ☒ OFF ☐ ON

Set the upper and lower limits of the parameters (-9.9999E+30 to 9.9999E+30).

Set the determination logic (AND, OR).

Set the action conditions. ► section 17.1

Set the sequence. ► section 17.1

Set the number of measurements (the number of waveform acquisitions) (Infinite, 1-65536).

Turns external start on and off

Setting Waveform Parameters (Item)

You can use all automatically measured waveform parameters as judgment conditions. Up to 16 parameters set as judgment conditions can be determined simultaneously. ► section 14.1

18.1 Setting Actions

This section explains the following settings for executing the action function.

- Action mode
- Action

► Features Guide: “Action”

ACTION Menu

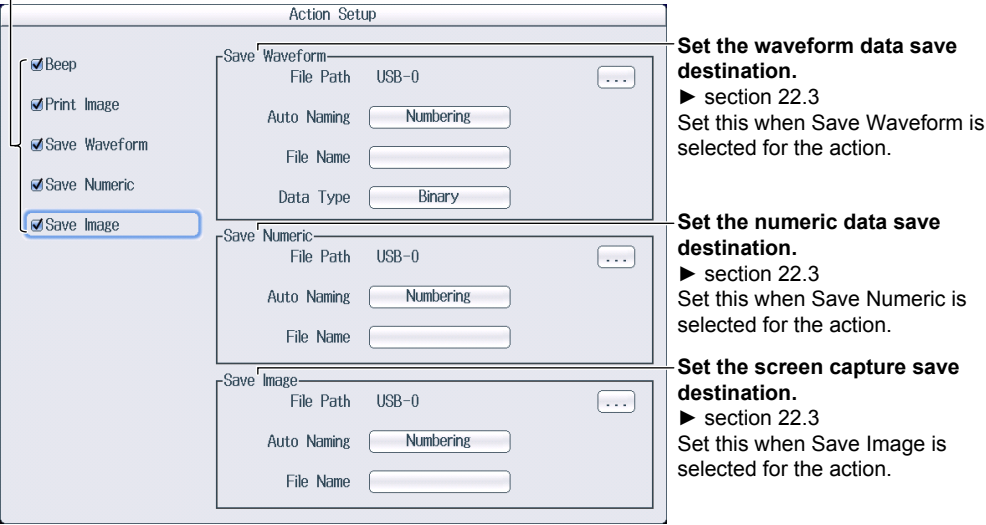
Press **SHIFT+MODE** (ACTION) to display the following menu.



Setting Actions (Action Setup)

Press the **Action Setup** soft key to display the following screen.

Select the actions to execute (Beep, Print Image, Save Waveform, Save Numeric, Save Image).



Executing Actions

Starting

1. Set the following functions, and press **START/STOP**. The actions are executed according to the settings.

An icon  appears in the top center of the screen when actions are being executed.

- Trigger ▶ chapter 3
- GO/NO-GO determination ▶ chapter 17

Stopping

2. Actions stop in the following conditions.
 - When the specified number of measurement count (waveform acquisition count) is reached
Measurement count (waveform acquisition count) ▶ section 4.1 or chapter 17
 - When waveform acquisition is stopped with the **START/STOP** key
When waveform acquisition is stopped with the **START/STOP** key, actions are executed once.

19.1 Searching for Edges

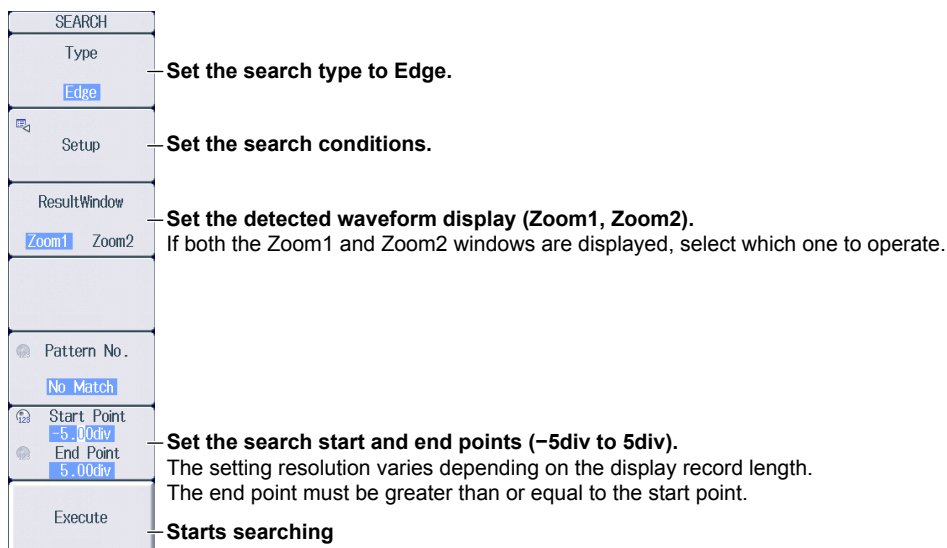
This section explains the following settings for searching for edges.

- Search type
- Search conditions
 - Source waveform, reference level to detect, edge polarity, hysteresis, and detection count
- Detected waveform display
- Detected point number
- Search start and end points
- Executing the search

► [Features Guide: “Edge Search \(Edge\)”](#)

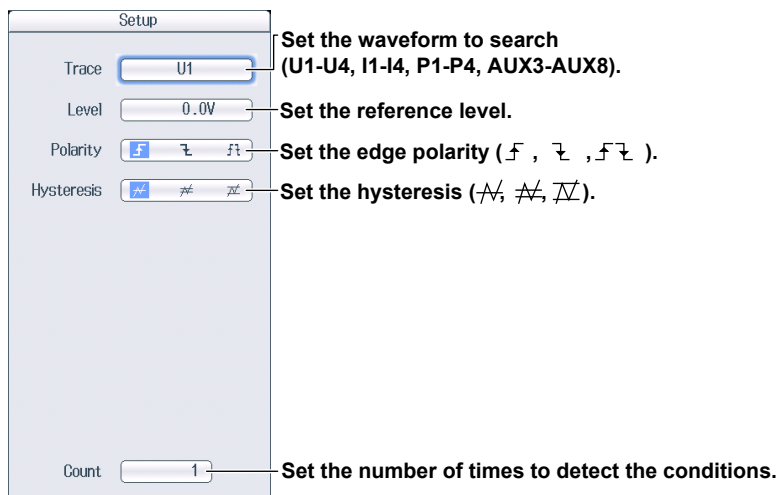
SEARCH Edge Menu

Press **SHIFT+ZOOM** (SEARCH), the **Type** soft key, and then the **Edge** soft key to display the following menu.



Setting Search Conditions (Setup)

Press the **Setup** soft key to display the following screen.



Setting the Detected Waveform Display (Result Window)

Press the **Result Window** soft key to select which zoom window displaying the search waveform to operate.

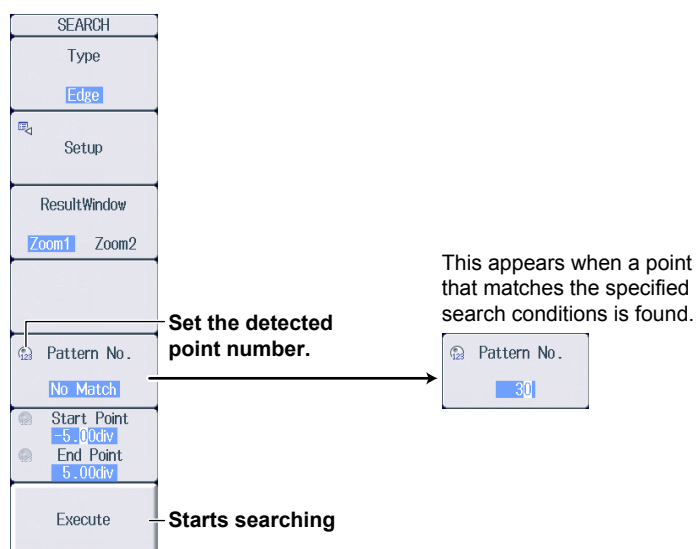
The search waveform that includes the search point specified by the detected point number (Pattern No.) described later is displayed in the zoom windows. If both the Zoom1 and Zoom2 windows are displayed, select which one to operate.

- If only one of the two zoom windows is displayed, you do not have to select the window.
- If both Zoom1 and Zoom2 are not displayed, Zoom1 will be displayed when you press SHIFT+ZOOM (SEARCH) to display the SEARCH menu.

Executing a Search (Execute)

Press the **Execute** soft key to execute the search.

If the PX8000 finds points that match the search conditions (detected points), it shows detected point numbers (0, 1, 2, etc.) from the left of the waveform display in the order that the points were detected.



Setting the Detected Point Number

Set the detected point number. The detected waveform appears in the zoom window with the detected point corresponding to the specified detected point number at the center.

19.2 Searching for a Specific Time

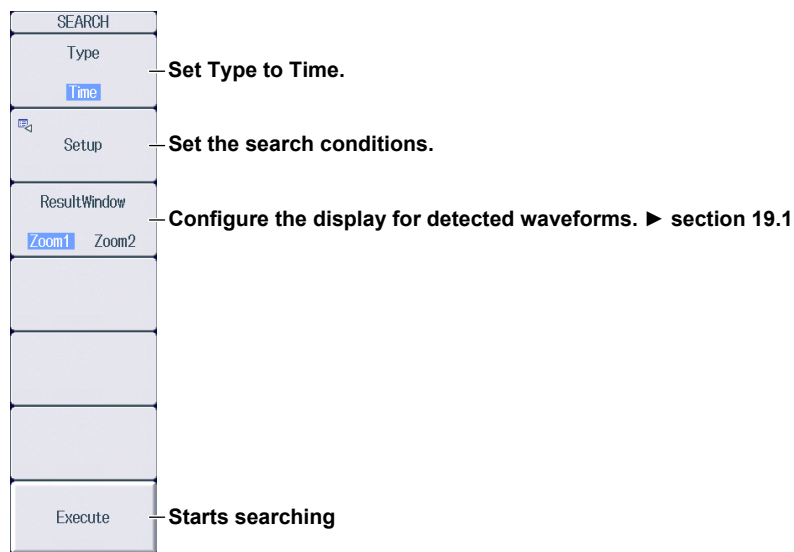
This section explains the following settings for searching for a specific time.

- Search type
- Search conditions
Year, month, day, time
- Executing the search

► [Features Guide: “Time Search \(Time\)”](#)

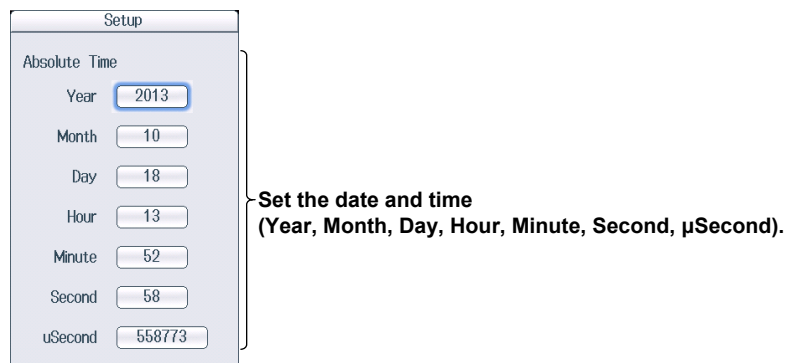
SEARCH Time Menu

Press **SHIFT+ZOOM** (SEARCH), the **Type** soft key, and then the **Time** soft key to display the following menu.



Setting Search Conditions (Setup)

Press the **Setup** soft key to display the following screen.



Executing a Search (Execute)

Press the **Execute** soft key to execute the search.

The detected waveform appears in the zoom window with the specified time at the center.

20.1 Displaying Waveform History Waveforms

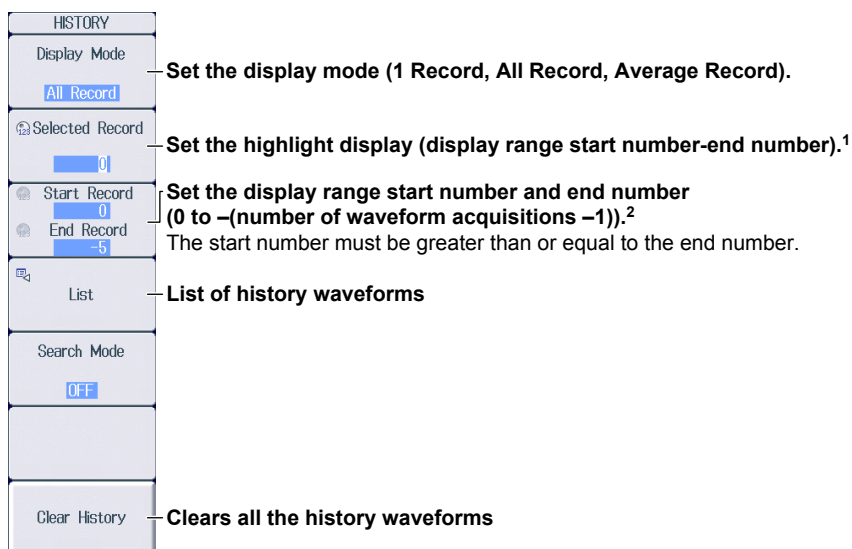
This section explains the following settings for displaying history waveforms, which are waveforms that were previously saved to acquisition memory.

- Display mode
- Highlight display
- Display range
- List of history waveforms
- Clearing all the history waveforms

► [Features Guide: “Displaying and Searching History Waveforms”](#)

HISTORY Menu

Press **SHIFT+NUMERIC** (HISTORY) to display the following menu.



¹ This setting appears when Display Mode is set to 1 Record or All Record.

² The number of waveform acquisitions that can be specified is up to the number of history waveforms that can be held in the acquisition memory.

Setting the Display Mode (Display Mode)

1 Record: Only the waveform corresponding to the selected record number is displayed.¹

All Record: All selected waveforms are superimposed on each other.² All other waveforms¹ are displayed in the normal color.

Average Record: All selected waveforms² are linearly averaged and displayed.

¹ Waveforms specified by Selected Record for highlighting

² Waveforms in the display range specified by Start Record and End Record

Note

- After you execute a search on the history waveforms, the only waveforms that are displayed are those that meet the search conditions. To display all the history waveforms in acquisition memory again, turn the history waveform search feature off.
- The averaging feature requires a certain amount of acquisition memory. If this is not available, you will not be able to display the Average Record.

List of History Waveforms (List)

Press the **List** soft key to display the following screen.

Record number

Timestamp (time reference time information of each history waveform)


List	
# 0000	12:50:25.572753
#-0001	12:50:25.254756
#-0002	12:50:24.894759
#-0003	12:50:24.576763
#-0004	12:50:24.258766
#-0005	12:50:23.940769

History waveform list

You can use the jog shuttle to scroll the list and specify the data to highlight.

Note

Notes on Using the History Feature

- You can start waveform acquisition when the HISTORY menu is displayed. However, you cannot change the history feature settings while waveform acquisition is in progress.
- When the acquisition mode is set to Average, you cannot use the history feature.
- If you stop waveform acquisition, even if one complete screen's worth of waveform data has not been acquired, the waveform at which the trigger occurred is displayed as a single history waveform.
- The settings are restricted so that the following relationship is retained: Last record (End Record) ≤ Selected Record ≤ first record (Start Record).
- When you load waveform data from the specified storage medium, history waveforms up to that point are cleared. The loaded waveform data is placed in record number zero. If you load a file containing multiple history waveforms, the latest waveform is placed in zero, and earlier waveforms are placed in order to record numbers -1, -2, and so on.
- Computation and automated measurement of waveform parameters are performed on the waveform of the record number specified by Selected Record. You can analyze old data as long as you do not overwrite the acquisition memory contents by restarting waveform acquisition. If Display Mode is set to Average Record, analysis is performed on the averaged waveform.
- If many history waveforms are selected, it may take a long time to display all waveforms or average waveforms. If this happens, the  icon appears at the top of the screen. To cancel the operation, set Display Mode to 1 Record.
- History waveforms are cleared when you turn the power off.

20.2 Searching History Waveforms

This section explains the following settings for searching history waveforms.

- Search mode
- Search conditions
Search zone, search parameters, search condition, source waveform, search window (upper and lower limits and left and right edges), search logic, and measurement time period of the parameters
- Executing the search

► **Features Guide: “Search Condition Settings for Zone Searching (Search Setup)”**
“Search Condition Settings for Waveform Parameter Searching (Search Setup)”

HISTORY Menu

Press **SHIFT+NUMERIC** (HISTORY) to display the following menu.

HISTORY	
Display Mode	
All Record	
Selected Record	
0	
Start Record	
0	
End Record	
-5	
List	
Search Mode	
OFF	
Clear History	

Set the search mode (OFF, Zone, Parameter).

Setting the Zone Search (Search Setup)

Press the **Search Mode** soft key, the **Zone** soft key, and then the **Search Setup** soft key to display the following menu.

Search Setup	
Select Zone	Select the search zone (Zone1-Zone4).
Zone1	
Condition	Set the search condition (OFF, IN, OUT).
OFF	
Source	Set the source waveform (U1-U4, I1-I4, P1-P4, AUX3-AUX8).
U1	
Upper	Set the upper and lower limits of the search window (-5.00div to 5.00div). The upper limit must be greater than or equal to the lower limit.
0.50div	
Lower	
-0.50div	
Left	Set the left edge and right edge of the search window (-5div to 5div). The setting resolution varies depending on the display record length.
-3.00div	
Right	The right edge must be greater than or equal to the left edge.
-2.50div	
Logic	Set the search logic (AND, OR).
AND	
Execute Search	

Proceed to executing the search on the next page.

Setting the Waveform Parameter Search (Search Setup)

1. Press the **Search Mode** soft key, the **Parameter** soft key, and then the **Search Setup** soft key to display the following menu.

Search Setup	
Select Param	Select the search parameter (Param1-Param4).
Param1	
Condition	Set the search condition (OFF, IN, OUT).
OFF	
Source	Set the waveform to search and parameters.
Upper	Set the upper and lower limits of the search condition (-9.9999E+30 to 9.9999E+30).
0.0000	
Lower	
0.0000	
Logic	Set the search logic (AND, OR).
AND	
Time Range1	Set the parameter measurement time period (-5div to 5div). The setting resolution varies depending on the display record length.
-5.00div	
Time Range2	Time period 2 (Time Range2) must be greater than or equal to Time period 1 (Time Range1). The maximum number of data points that are measured is 100 Mpoint from Time Range 1.
5.00div	
Execute Search	

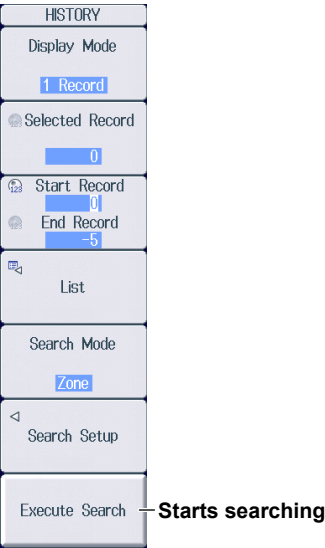
Setting the Waveform to Search and the Parameter (Source)

2. Press the **Source** soft key to display the following menu.

Source	
Trace	Set the source waveform (U1-U4, I1-I4, P1-P4, AUX3-AUX8).
U1	
Item	Set the waveform parameter type. ► section 14.1
Peak to Peak	

Executing a Search (Execute Search)

After setting the search conditions, press **ESC** to return to the HISTORY menu.



21.1 Loading Roll Paper Into the Built-In Printer (Optional)

This section explains how to load roll paper into the built-in printer (/B5 option).

Printer Roll Paper

Only use YOKOGAWA roll paper for the PX8000. When using the printer for the first time, use the roll paper supplied with the PX8000. When you need extra roll paper, please contact your nearest YOKOGAWA dealer.

Part Number: B9988AE

Specifications: Heat-sensitive paper, 10 m

Minimum Quantity: 10 rolls

Handling Roll Paper

The roll paper is made of heat-sensitive paper that changes color thermochemically. Please read the following information carefully.

Storage Precautions

The heat-sensitive paper changes color gradually at temperatures of approximately 70°C or higher. The paper can be affected by heat, humidity, or chemicals, whether something has been recorded on it or not. As such, please follow the guidelines listed below.

- Store the paper in a cool, dry, and dark place.
- Use the paper as quickly as possible after you break its protective seal.
- If you attach a plastic film that contains plasticizing material such as vinyl chloride film or cellophane tape to the paper for a long time, the recorded sections will fade due to the effect of the plasticizing material. Use a holder made of polypropylene to store the roll paper.
- When starching the record paper, do not use starches containing organic solvents such as alcohol or ether. Doing so will change the paper's color.
- We recommend that you make copies of the recordings if you intend to store them for a long period of time. Because of the nature of heat-sensitive paper, the recorded sections may fade.

Handling Precautions

- Only use genuine YOKOGAWA roll paper.
- If you touch the roll paper with sweaty hands, there is a chance that you will leave fingerprints on the paper or smudge the recorded sections.
- If you rub the surface of the roll paper against something hard, there is a chance that the paper will change color due to frictional heat.
- If the roll paper comes into contact with chemicals, oil, and the like, there is a chance that the paper will change color or that the recorded sections will disappear.

Loading the Roll Paper



CAUTION

- Do not touch the print head. If you do, you may burn yourself.
- Do not touch the roll paper cutter section at the end of the printer cover. Doing so may cause injury.

21.1 Loading Roll Paper Into the Built-In Printer (Optional)

French



ATTENTION

- Ne pas toucher la tête d'impression. Vous pourriez vous brûler.
- Ne pas toucher la section du coupe-papier à l'extrémité du cache de l'imprimante. Vous pourriez vous blesser.

1. **Raise the handle.**
2. **Press the OPEN COVER button to open the printer cover.**
3. **Set the roll paper in the orientation shown in the figure.**
4. **Align the ends of the roll paper with the guides and set the roll in place.**
5. **Close the printer cover and press LOCK at the center of the cover until you hear a click.**

21.2 Printing on the Built-in Printer (Option)

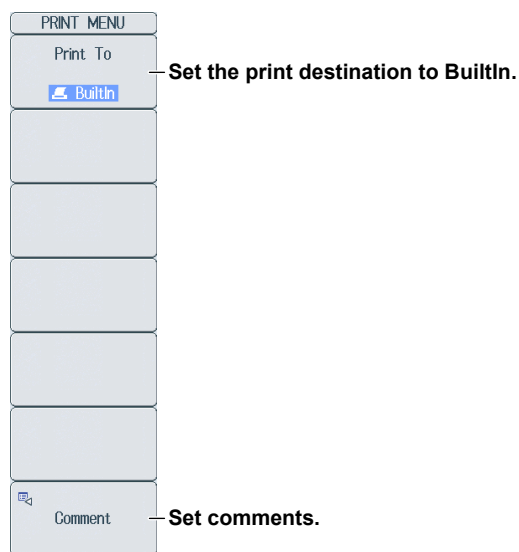
This section explains the following settings for printing the image that is displayed on the PX8000 using the built-in printer (/B5 option).

- Print destination
- Comment

► [Features Guide: “Printing from the Built-In Printer \(BuiltIn; option\)”](#)

PRINT MENU Menu

Press **SHIFT+PRINT** (MENU), the **Print To** soft key, and then the **BuiltIn** soft key to display the following menu.



Starting to Print

Press **PRINT** to print the image that is displayed on the screen using the built-in printer.

21.3 Saving Screen Captures to Files

This section explains the following settings for saving screen captures to files.

- Print destination
- Data format
- Color
- Background transparency, frame on/off
- Save destination and file name

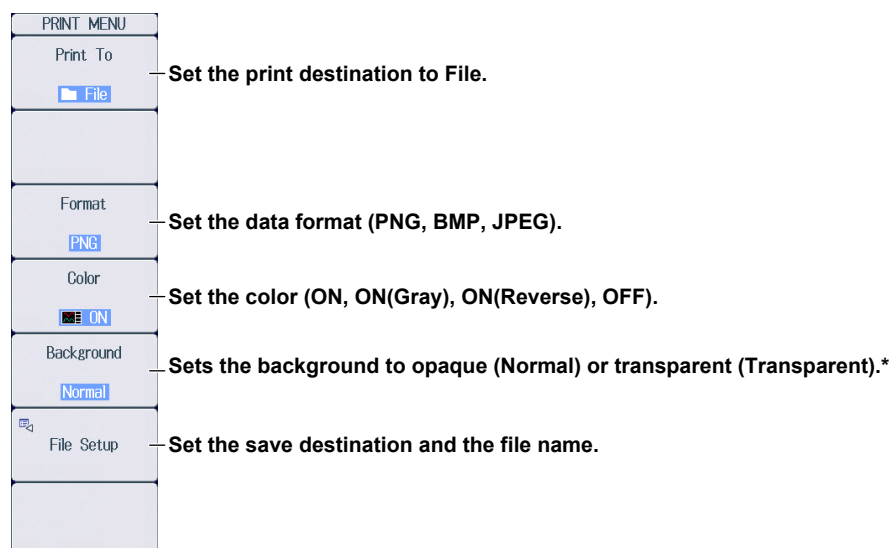
You can save screen captures from the PRINT MENU menu, SAVE menu, and FILE Others Save menu. The screen capture settings are shared among these menus.

This section describes how to save screen captures from the PRINT MENU menu and SAVE menu. For instructions on how to save from the FILE Others Save menu, see section 22.6.

► [Features Guide: “Saving Screen Captures \(File\)”](#)

PRINT MENU Menu

Press **SHIFT+PRINT** (MENU), the **Print To** soft key, and then the **File** soft key to display the following menu.



* This appears when the data format is set to PNG.
When the data format is set to JPEG, the frame on/off setting appears.

Setting the Save Destination and the File Name (File Setup)

Press the **File Setup** soft key to display the following screen.

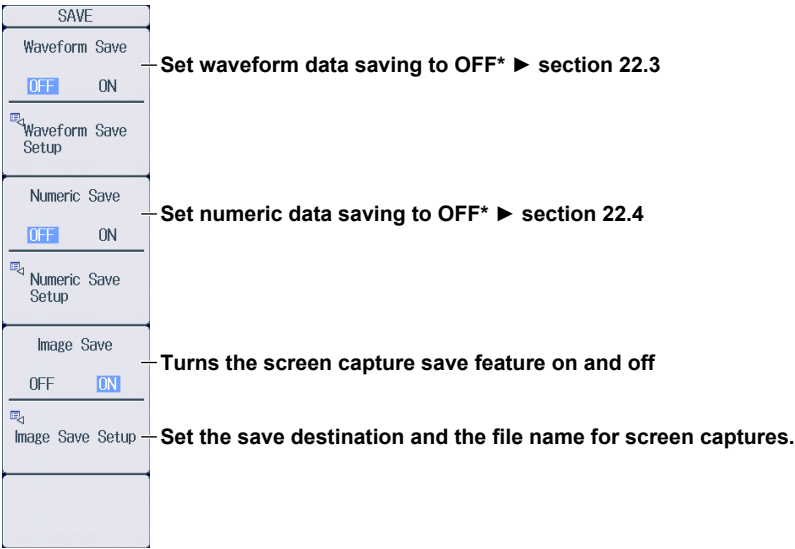


Starting to Save

Press **PRINT** to save the screen capture file to the specified folder.

SAVE Menu

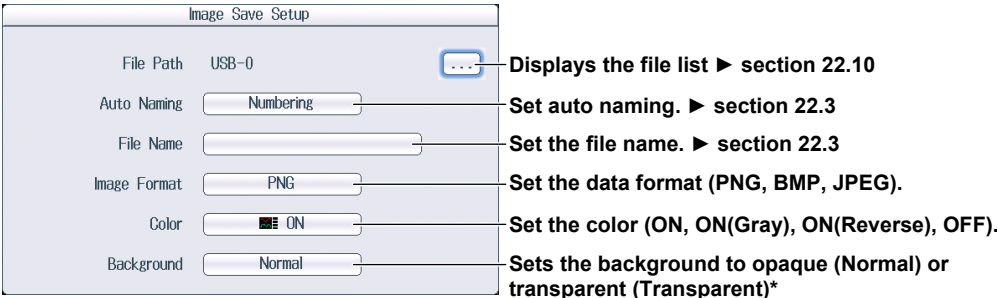
Press **SHIFT+SAVE** (MENU) to display the following menu.



* If the saving of waveform data and numeric data is turned on, the corresponding data will also be saved according to the specified save destinations and file names. Here, the settings for saving only the screen capture are shown.

Setting the Save Destination and the File Name of the Screen Capture (Image Save Setup)

Press the **Image Save Setup** soft key to display the following screen.



* This appears when the data format is set to PNG.
When the data format is set to JPEG, the frame on/off setting appears.

Starting to Save

Press **SAVE** to save the screen capture file to the specified folder.

22.1 Connecting Storage Media


This section explains how to connect the following types of storage media for saving and loading data from the PX8000.

- SD memory card
- USB storage device

SD Memory Card




CAUTION

- Do not orient the SD memory card in the wrong direction, and force it into the PX8000. Doing so may damage the SD memory card and the PX8000.
- Inserting and removing the SD memory card quickly (within the span of a second) may damage the PX8000.
- Removing the SD memory card from the PX8000 while the card is being accessed may corrupt the data on the SD memory card.
- An icon  centered at the top of the screen indicates when the SD memory card is being accessed.

French



ATTENTION

- Ne placez pas la carte mémoire SD dans le mauvais sens et ne l'insérez pas en forçant dans le PX8000. Vous risqueriez d'endommager la carte mémoire SD et le PX8000.
- Le fait d'insérer et de retirer la carte mémoire SD rapidement (en une seconde) peut endommager le PX8000.
- Le fait de retirer la carte mémoire SD du PX8000 pendant que le dispositif accède à cette carte risque d'endommager les données qu'elle contient.
- Une icône  au centre de la partie supérieure de l'écran indique que le dispositif est en train d'accéder à la carte mémoire SD.

SD Memory Cards That Can Be Used

You can use memory cards that conform to the SD or SDHC standard with the PX8000. For details, contact your nearest YOKOGAWA dealer.

Note

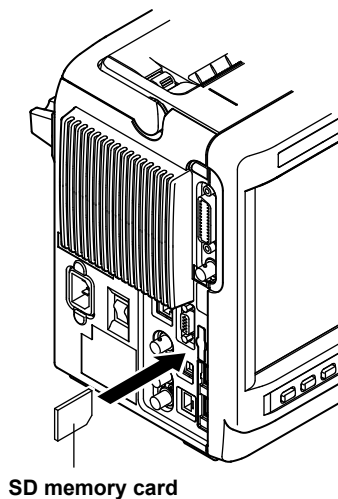
When using an SD memory card with a PC, make sure that the PC is compatible with the SD memory card. Also, depending on the type of PC, some of the SD cards listed above may not function properly. Make sure that the card that you intend to use is compatible with your PC.

How to Insert an SD Memory Card

Insert the SD memory card into the slot. The front of the card should be facing you.

The SD memory card slot is on the left side panel of the PX8000.

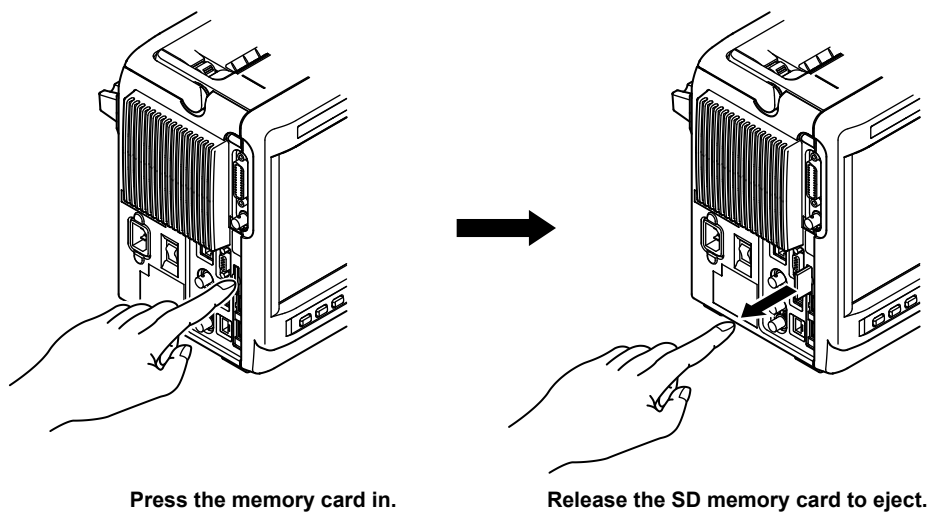
If you are using an SD memory card that has a write-protection feature and you want to save data to or format the card, disable the write-protection feature before you insert the SD memory card into the PX8000.



Removing the SD Memory Card

Push the SD memory card with your finger and release to eject the card.

Remove the SD memory card.




General SD Memory Card Handling Precautions

Follow the general handling precautions that are provided with your SD memory card.


USB Storage Device

CAUTION

- Do not remove the USB storage device or turn off the power when the device is being accessed. If you do so, the data on the USB storage device may be corrupted.
- An icon  centered at the top of the screen indicates when the USB storage medium is being accessed.

French

ATTENTION

- Pendant que le dispositif accède au support de stockage USB, ne retirez pas ce dernier et ne mettez pas l'alimentation hors tension. Vous risqueriez d'endommager les données sur le support de stockage USB.
- Une icône  au centre de la partie supérieure de l'écran indique que le dispositif est en train d'accéder au support de stockage USB.

Compatible USB Storage Devices

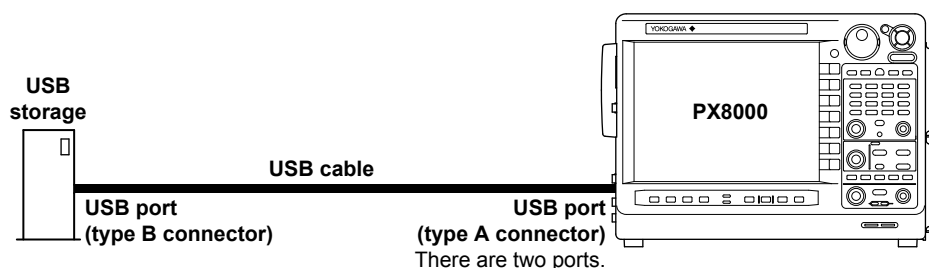
You can use USB storage devices that are compatible with USB Mass Storage Class version 1.1.

Note

- Only connect a USB keyboard, mouse, printer, or storage device to the USB connector for peripherals.
- The PX8000 can handle up to four storage devices. If the connected device is partitioned, the PX8000 treats each partition as a separate storage device.
- Connect USB storage device directly, not through a USB hub.
- Do not connect and disconnect the two USB devices repetitively. Provide a 10-second interval between removal and connection.

How to Connect a USB Storage Device

When connecting a USB storage device to the PX8000 USB port, connect the USB cable directly as shown in the figure below. You can connect/disconnect a USB cable at any time regardless of whether the PX8000 is on or off (hot-plugging is supported). Connect the type A connector of the USB cable to the PX8000, and connect the type B connector to the USB storage device. If you connect a USB storage device when the power switch is on, the device becomes available for use after the PX8000 identifies it. The PX8000 has two USB ports: USB-0 and USB-1. The port numbers are not fixed. The port at which the first USB storage device is detected becomes USB-0. The second detected USB storage device becomes USB-1.



General USB Storage Device Handling Precautions

Follow the general handling precautions that are provided with your USB storage device.

22.2 Formatting Storage Media

This section explains how to format storage media.

Storage management

- Selecting the storage medium to format
- Executing the format

CAUTION

- When you format a storage medium, all the data that is stored on the medium is deleted.
- If a formatted storage medium cannot be detected by the PX8000, use the PX8000 to format the storage medium again.

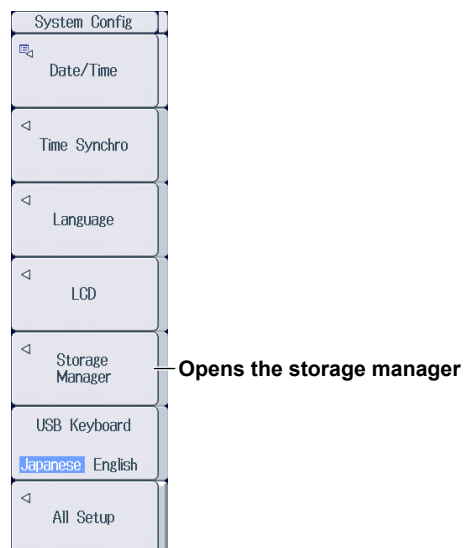
French

ATTENTION

- Lorsque vous formatez un support de stockage, toutes les données qu'il contient sont supprimées.
- Si le DL850E/DL850EV ne détecte pas un support de stockage formaté, utilisez le PX8000 pour formater de nouveau le support de stockage.

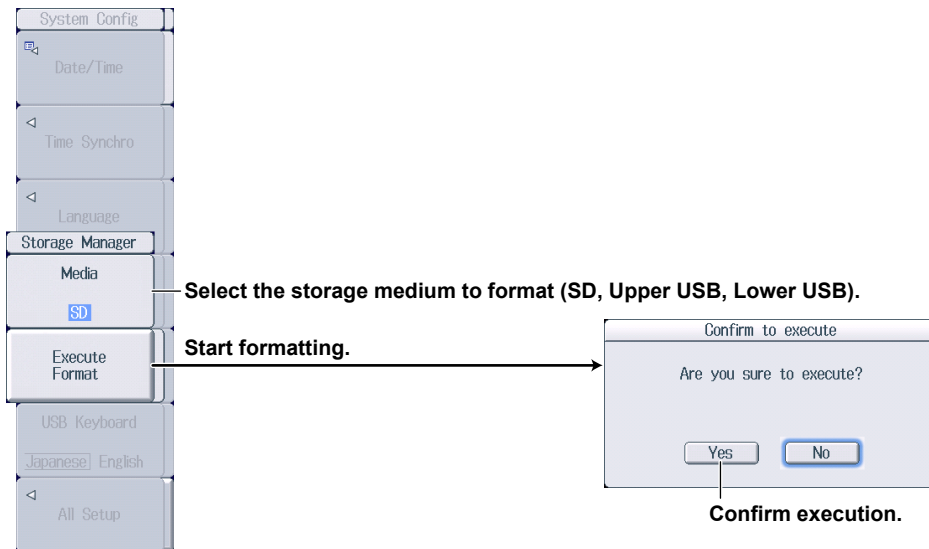
UTILITY System Config Menu

Press **UTILITY** and then the **System Config** soft key to display the following menu.



Setting Storage Management (Storage Manager)

Press the **Storage Manager** soft key to display the following menu.



Storage Medium to Format (Media)

SD: SD memory card

Upper USB: The USB storage device that is connected to the PX8000's upper USB port (type A) for connecting peripheral devices.

Lower USB: The USB storage device that is connected to the PX8000's lower USB port (type A) for connecting peripheral devices.

22.3 Saving Waveform Data

This section explains the following settings for saving waveform data.

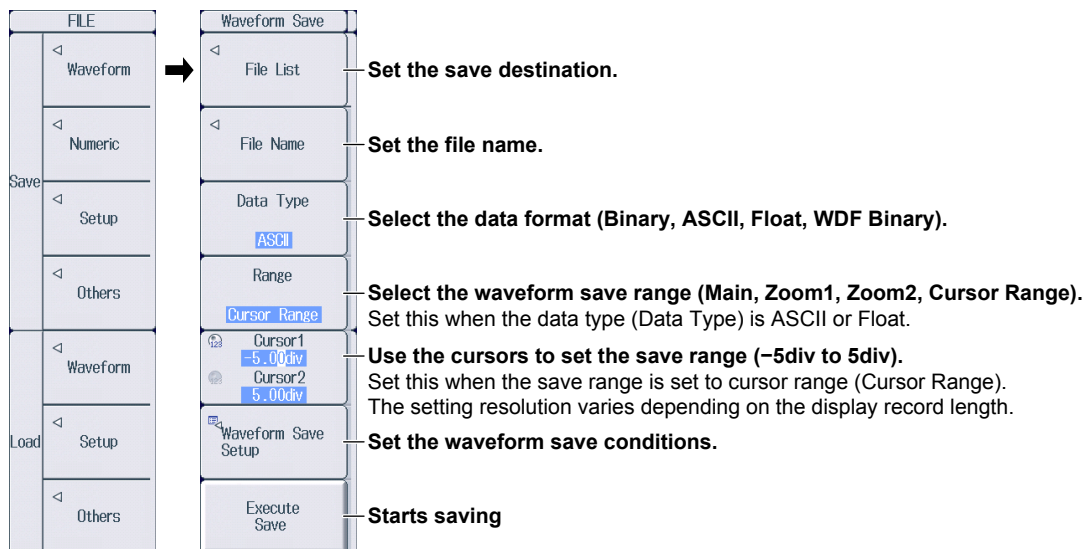
- Save destination
Drive (medium), folder
- File name
Auto naming, file name, comment
- Data type
- Save range
- Save conditions
Waveforms to save, history data range of waveforms to be saved, data removal interval, etc.
- Starting to Save

You can save waveform data from the FILE Waveform Save menu and SAVE menu. The settings for saving waveform data are shared among these menus.

► [Features Guide: “Saving Waveform Data \(Waveform\)”](#)

FILE Waveform Save Menu

Press **FILE** and then the **Waveform** soft key next to Save to display the following menu.



Selecting the Data Type (Data Type)

Binary:

The sampled data stored in the acquisition memory is saved to a file in binary format. The extension is .WPF. You can load this type of data into the PX8000.

ASCII:

The sampled data stored in the acquisition memory is converted using the specified range and saved to a file in ASCII format. The extension is .CSV. To save the data for MATLAB (numeric analysis software), the extension is .TXT. You cannot load either of these types of data into the PX8000.

Float:

The sampled data stored in the acquisition memory is converted using the specified range and saved to a file in 32-bit IEEE floating format. The extension is .FLD. You cannot load this type of data into the PX8000. If the file size would exceed 2 GB to create the file, it cannot be saved.

WDF Binary:

- The sampled data stored in the acquisition memory is saved to a file in binary format. The extension is .WDF. This file is used to analyze waveforms using NI DIAdem.
- You cannot load this type of data into the PX8000.
- If the combination of the record length and the number of channels causes the file size to exceed 2 GB, the file cannot be created.

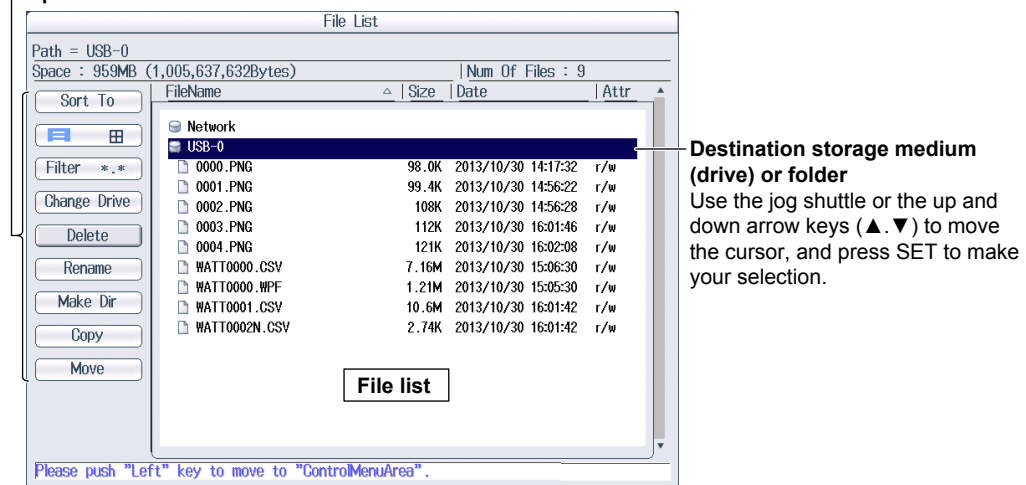
Selecting the Waveform Save Range (Range)

Main: The range of data displayed in the main window is saved.
 Zoom1: The range data displayed in the Zoom1 window is saved.
 Zoom2: The range of data displayed in the Zoom2 window is saved.
 Cursor Range: The range of data specified by Cursor1 and Cursor2 is saved.

Setting the Save Destination (File List)

Press the **File List** soft key to display the following screen.

Operation menu ► section 22.10

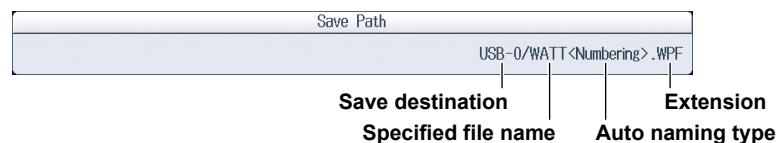


Note

You can also set the save destination drive by using the Change Drive item on the operations menu.

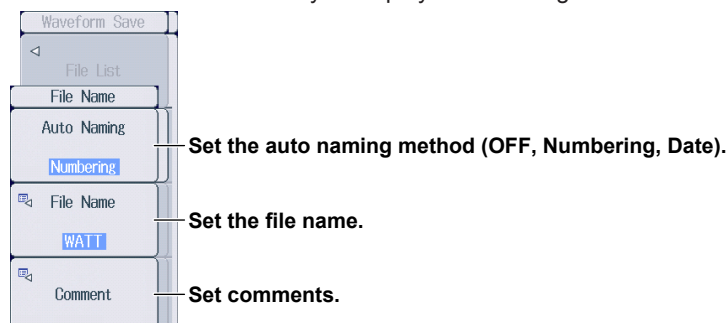
Save Destination (Save Path) Display Box

The save destination box appears at the bottom of the screen when the FILE Save menu is displayed. This box displays the file save destination, file name, and so on.



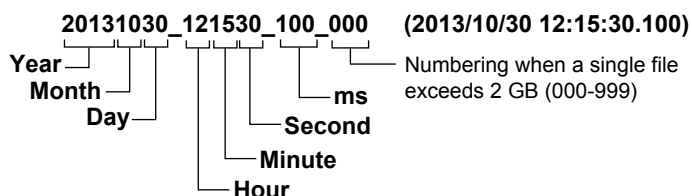
Assigning File Names (File Name)

Press the **File Name** soft key to display the following menu.



Setting Auto Naming (Auto Naming)

- OFF:** The auto naming feature is disabled. The name that you specify using the File Name setting is used. If there is a file with the same name in the save destination folder, you cannot save the data.
- Numbering:** The PX8000 automatically adds a four-digit number between 0000 to 9999 after the common name specified using the File Name setting (up to four characters) when it saves files.
- Date:** The file name is the date and time (down to ms) when the file is saved. The file name specified for the File Name setting is ignored.



Regardless of whether the auto naming feature is set to OFF, Numbering, or Date, if the data size of a single file exceeds 2 GB, an underscore and a three-digit sequence number (000 to 999) is appended to the file name. The sequence number is incremented by one each time a file is added. This is appended only if the file exceeds 2 GB.

Setting the Comment (Comment)

You can add a comment that consists of up to 120 characters when you save a file. You do not have to enter a comment. All characters, including spaces, can be used in comments.

Setting the Waveform Save Conditions (Waveform Save Setup)

Press the **Waveform Save Setup** soft key to display the following screen.

History data range of the waveforms to be saved (One, All)
Set this when Data Type is set to Binary, ASCII, or FLOAT.
This is fixed to One for WDF Binary.

Select the waveforms that you want to save.

Select Save Trace	
<input type="checkbox"/> All ON	
<input checked="" type="checkbox"/> U1	<input checked="" type="checkbox"/> AUX8
<input checked="" type="checkbox"/> I1	
<input checked="" type="checkbox"/> P1	<input checked="" type="checkbox"/> Math1
<input checked="" type="checkbox"/> U2	<input checked="" type="checkbox"/> Math2
<input checked="" type="checkbox"/> I2	<input checked="" type="checkbox"/> Math3
<input checked="" type="checkbox"/> P2	<input checked="" type="checkbox"/> Math4
<input checked="" type="checkbox"/> U3	<input checked="" type="checkbox"/> Math5
<input checked="" type="checkbox"/> I3	<input checked="" type="checkbox"/> Math6
<input checked="" type="checkbox"/> P3	<input checked="" type="checkbox"/> Math7
<input checked="" type="checkbox"/> AUX7	<input checked="" type="checkbox"/> Math8

Set these when Data Type is set to ASCII.

Interval (data removal interval): OFF, Per5, Per10, Per20, Per50, Per100, Per200, Per500, Per1000, Per2000, Per5000

Time Info. (whether to save time information): OFF, ON

Extension (file name extension): csv, MATLAB*

Decimal Point (decimal point): Point, Comma

* If MATLAB is selected, the extension will be set to .TXT.

History Data Range of Waveforms to Be Saved (History)

One: The one waveform that is specified with Selected Record on the HISTORY menu will be saved. To save an averaged history waveform, set the history feature's display mode to Average Record, and then select One.

All: All history waveforms within the range bounded by Start Record and End Record on the HISTORY menu will be saved. If you search for history waveforms, and then select All, only the detected waveforms will be saved. All waveforms (All) cannot be used to save waveforms when the data format is WDF Binary.

Selecting the Waveforms to Save (Select Save Trace)

You can select All ON, U1 to U4, I1 to I4, P1 to P4, AUX3 to AUX8, and Math1 to Math8 waveforms. The displayed waveforms that you select are saved. The setup data for the saved waveforms are also saved.

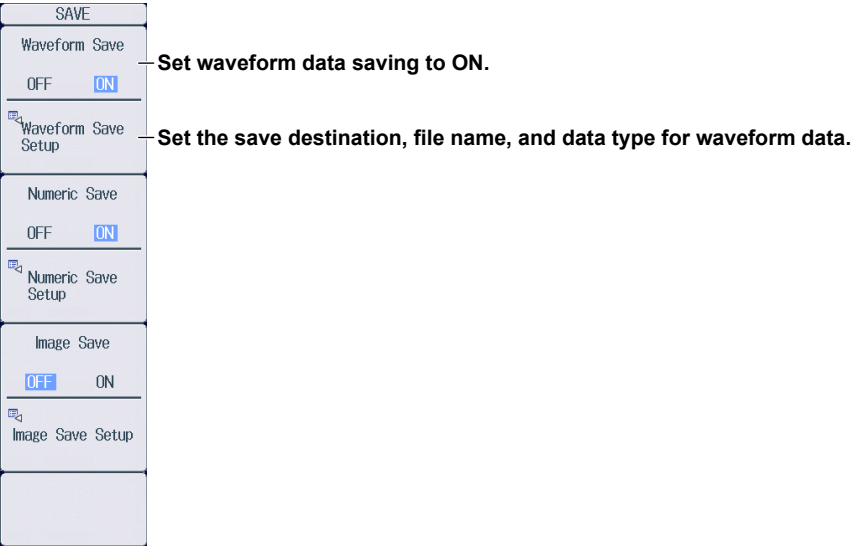
- Waveforms that are not displayed will not be saved even if you select them.
- Math1 to Math8 are available when the data type (Data Type) is ASCII or Float.
 - If the computation mode on the MATH menu is set to OFF, Math1 to Math8 cannot be selected.
 - Any computation channels (Math1 to Math8) whose operation is set to OFF on the MATH menu cannot be selected.
 - Any computation channels (Math1 to Math8) whose display is set to OFF on the MATH menu will not be displayed. Therefore, they will not be saved.
- If the data type is set to Binary, source waveforms for waveform computation on the MATH menu are saved even if they are not displayed. Therefore, even though Math1 to Math8 are cannot be specified to be saved when the data type is set to Binary, when binary data is loaded, Math1 to Math8 may appear depending on the setup data of the MATH menu.
- If the data type is set to ASCII or Float and you select All for saving history waveforms, Math1 to Math8 will not be saved. If you want to save Math1 to Math8, set History to One.

Starting to Save (Execute Save)

Press the **Execute Save** soft key to save the waveform data file to the specified folder.

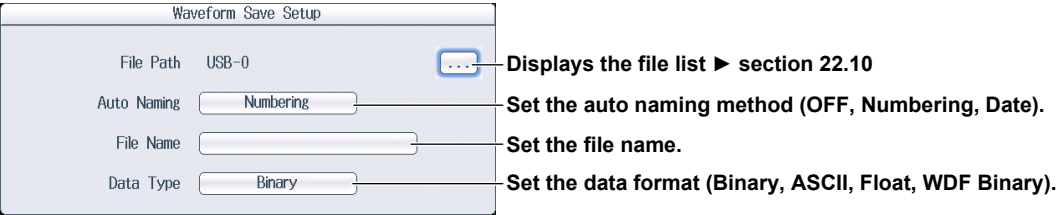
SAVE Menu

Press **SHIFT+SAVE** (MENU) to display the following menu.



Setting the Save Destination, File Name, and Data Type for Waveform Data (Data Save Setup)

Press the **Waveform Save Setup** soft key to display the following screen.



Starting to Save

Press **SAVE** to save the waveform data file to the specified folder.

If Numeric Save or Image Save on the SAVE menu is set to ON, the numeric data or screen capture data will also be saved.

Save Destination for Action Execution

In the specified drive, a folder is automatically created with the date (year, month, and day) as its name, and data is saved to files in that folder using names that are specified by the auto naming feature.

If the number of files in the save destination folder exceeds 1000, a new folder is automatically created with the date and an incremented sequence number (000 to 999) as its name, and the data continues to be saved in the new folder.

22.4 Saving Numeric Data

This section explains the following settings for saving numeric data.

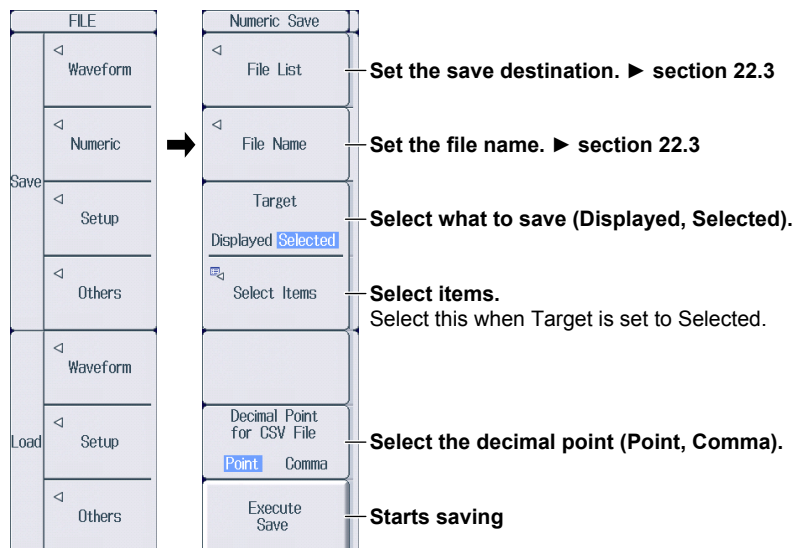
- Save destination
- File name
- Data to save
- Decimal point
- Starting to Save

You can save numeric data from the FILE Numeric Save menu and SAVE menu. The settings for saving numeric data are shared among these menus.

► [Features Guide “Saving Numeric Data \(Numeric\)”](#)

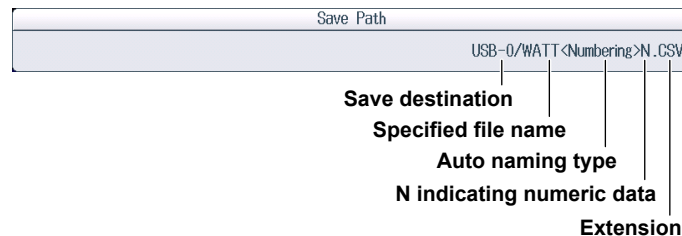
FILE Numeric Save Menu

Press **FILE** and then the **Numeric** soft key next to Save to display the following menu.



Save Destination (Save Path) Display Box

The save destination box appears at the bottom of the screen when the FILE Save menu is displayed. This box displays the file save destination, file name, and so on.



22.4 Saving Numeric Data

Selecting an Item

Press the **Select Items** soft key to display the following screen.

Selects all the numeric data items

Clears the selection of all the numeric data items

Selects the preset numeric data items

Items Settings							
Preset Element	All ON	All OFF	Preset				
<input checked="" type="checkbox"/> ΣA	<input checked="" type="checkbox"/> Element1	<input checked="" type="checkbox"/> Element2	<input checked="" type="checkbox"/> Element3				
Function	<input checked="" type="checkbox"/> Urms	<input type="checkbox"/> Umn	<input type="checkbox"/> Udc	<input type="checkbox"/> Urnn	<input type="checkbox"/> Uac	<input checked="" type="checkbox"/> FreqU	<input type="checkbox"/> CfU
	<input checked="" type="checkbox"/> Irms	<input type="checkbox"/> Inn	<input type="checkbox"/> Idc	<input type="checkbox"/> Irrn	<input type="checkbox"/> Iac	<input checked="" type="checkbox"/> FreqI	<input type="checkbox"/> CfI
	<input checked="" type="checkbox"/> P	<input checked="" type="checkbox"/> S	<input checked="" type="checkbox"/> Q	<input checked="" type="checkbox"/> λ	<input checked="" type="checkbox"/> ϕ	<input type="checkbox"/> Pc	
	<input type="checkbox"/> U+peak	<input type="checkbox"/> U-peak	<input type="checkbox"/> I+peak	<input type="checkbox"/> I-peak	<input type="checkbox"/> P+peak	<input type="checkbox"/> P-peak	
	<input type="checkbox"/> f1	<input type="checkbox"/> f2	<input type="checkbox"/> f3	<input type="checkbox"/> f4			
	<input type="checkbox"/> F1	<input type="checkbox"/> F2	<input type="checkbox"/> F3	<input type="checkbox"/> F4	<input type="checkbox"/> F5	<input type="checkbox"/> F6	<input type="checkbox"/> F7
	<input type="checkbox"/> F8	<input type="checkbox"/> F9	<input type="checkbox"/> F10	<input type="checkbox"/> F11	<input type="checkbox"/> F12	<input type="checkbox"/> F13	<input type="checkbox"/> F14
	<input type="checkbox"/> F15	<input type="checkbox"/> F16	<input type="checkbox"/> F17	<input type="checkbox"/> F18	<input type="checkbox"/> F19	<input type="checkbox"/> F20	
	<input type="checkbox"/> FreqPLL1						
	<input type="checkbox"/> U(k)	<input type="checkbox"/> I(k)	<input type="checkbox"/> P(k)	<input type="checkbox"/> S(k)	<input type="checkbox"/> Q(k)	<input type="checkbox"/> $\lambda(k)$	<input type="checkbox"/> $\Phi(k)$
	<input type="checkbox"/> $\Phi_U(k)$	<input type="checkbox"/> $\Phi_I(k)$	<input type="checkbox"/> Z(k)	<input type="checkbox"/> Rs(k)	<input type="checkbox"/> Xs(k)	<input type="checkbox"/> Rp(k)	<input type="checkbox"/> Xp(k)
	<input type="checkbox"/> Uthd	<input type="checkbox"/> Ithd	<input type="checkbox"/> Pthd	<input type="checkbox"/> Uhdf(k)	<input type="checkbox"/> Ihdf(k)	<input type="checkbox"/> Phdf(k)	
	<input type="checkbox"/> Uthf	<input type="checkbox"/> Ithf	<input type="checkbox"/> Utif	<input type="checkbox"/> Itif	<input type="checkbox"/> hvf	<input type="checkbox"/> hcf	<input type="checkbox"/> K-factor
	<input type="checkbox"/> Φ_{Ui-Uj}	<input type="checkbox"/> Φ_{Ui-Uk}	<input type="checkbox"/> Φ_{Ui-Ii}	<input type="checkbox"/> Φ_{Ui-Ij}	<input type="checkbox"/> Φ_{Uk-Ik}		
	<input type="checkbox"/> Φ_{ij-lj}	<input type="checkbox"/> Φ_{ij-lk}	<input type="checkbox"/> Φ_{ii-lk}				
	<input type="checkbox"/> ΔU_1	<input type="checkbox"/> ΔU_2	<input type="checkbox"/> ΔU_3	<input type="checkbox"/> $\Delta U\Sigma$	<input type="checkbox"/> ΔI		
	<input type="checkbox"/> ΔP_1	<input type="checkbox"/> ΔP_2	<input type="checkbox"/> ΔP_3	<input type="checkbox"/> $\Delta P\Sigma$			
	<input type="checkbox"/> AUX7	<input type="checkbox"/> AUX8	<input type="checkbox"/> Pm4				

- **Select the numeric items that you want to save.**

Starting to Save (Execute Save)

Press the **Execute Save** soft key to save the numeric data file to the specified folder.


SAVE Menu

Press **SHIFT+SAVE** (MENU) to display the following menu.

SAVE

Waveform Save

OFF ON

 Waveform Save Setup

Numeric Save

OFF ON



 Numeric Save Setup

Image Save

OFF ON

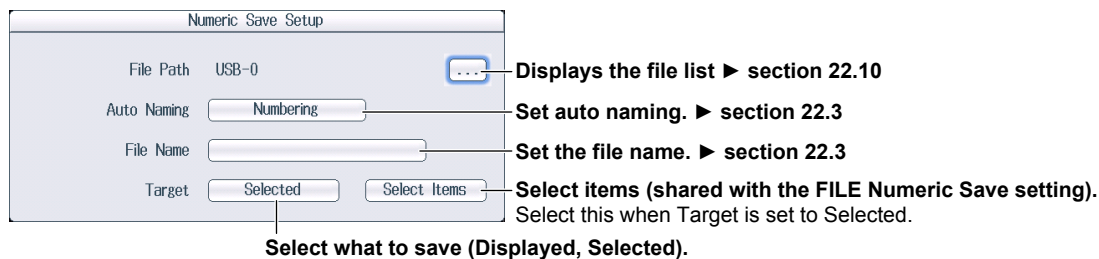
 Image Save Setup

- **Set numeric data saving to ON.**

- Set the save destination, file name, and data to save for numeric data.

Setting the Save Destination, File Name, and Data to Save for Numeric Data (Data Save Setup)

Press the **Numeric Save Setup** soft key to display the following screen.



Starting to Save

Press **SAVE** to save the numeric data file to the specified folder.

If Waveform Save or Image Save on the SAVE menu is set to ON, the waveform data or screen capture data will also be saved.

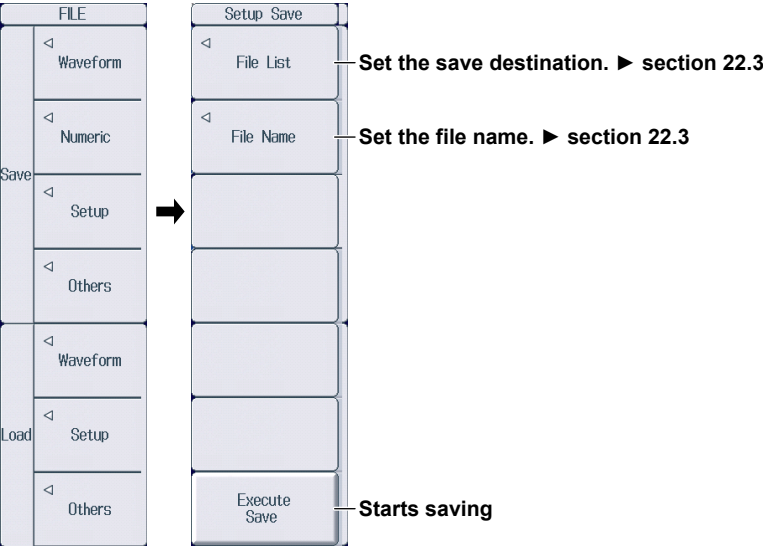
22.5 Saving Setup Data

- This section explains the following settings for saving setup data. You can save setup data to a file.
- Save destination
 - File name
 - Starting to Save

► [Features Guide: “Saving Setup Data \(setup\)”](#)

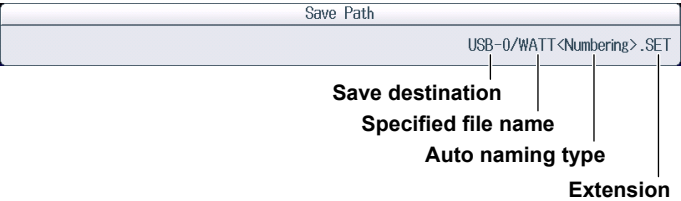
FILE Setup Save Menu

Press **FILE** and then the **Setup** soft key next to Save to display the following menu.



Save Destination (Save Path) Display Box

The save destination box appears at the bottom of the screen when the FILE Save menu is displayed. This box displays the file save destination, file name, and so on.



Starting to Save (Execute Save)

Press the **Execute Save** soft key to save the setup data file to the specified folder.

22.6 Saving Other Types of Data

This section explains the following settings for saving screen captures, snapshot waveforms, results of automated measurement of waveform parameters, and results of FFT.

- Save destination
- File name
- Data type to save
- Data format (for screen captures)
- Color (for screen captures)
- Starting to Save

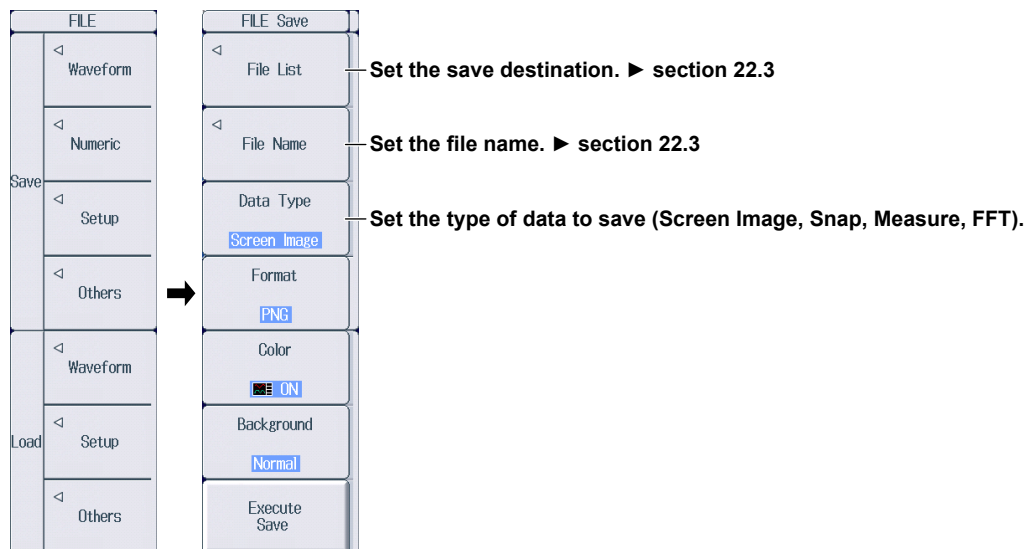
You can save screen captures from the FILE Others Save, PRINT MENU menu, and SAVE menu. The screen capture settings are shared among these menus.

This section describes how to save screen captures from the FILE Others Save menu. For instructions on how to save from the PRINT MENU menu and SAVE menu, see section 21.3.

► [Features Guide: “Saving Other Types of Data \(Others\)”](#)

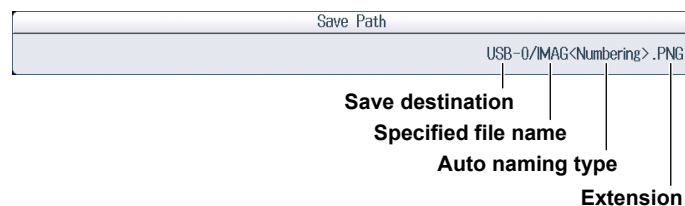
FILE Others Save Menu

Press **FILE** and then the **Others** soft key next to Save to display the following menu.



Save Destination (Save Path) Display Box

The save destination box appears at the bottom of the screen when the FILE Save menu is displayed. This box displays the file save destination, file name, and so on.



Setting the Data Type to Save (Data Type)

1. Press the **Data Type** soft key.

2. Set the type of data to save.

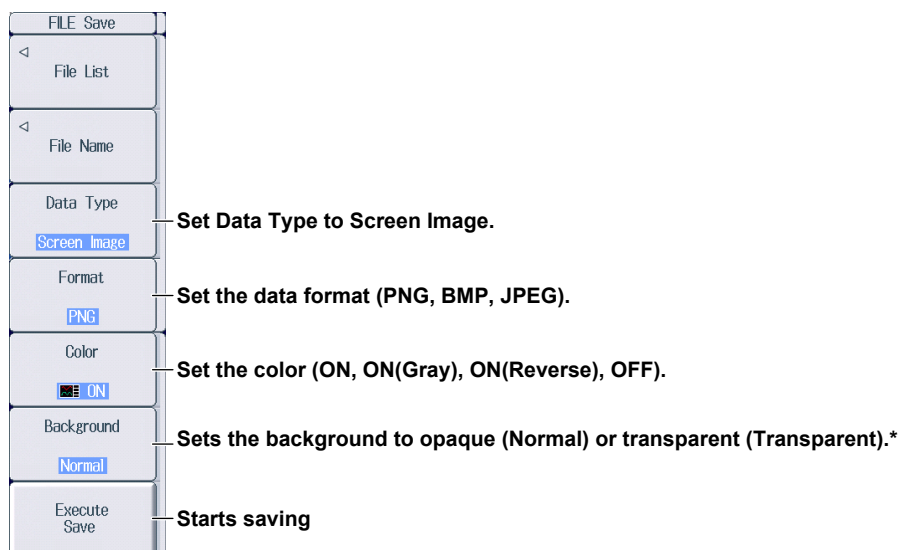
Screen Image: The displayed screen image is saved to a PNG, BMP, or JPEG file.

Snap: Waveform data captured in a snapshot is saved to an .SNP file.

Measure: The results of automated measurement of waveform parameters are saved to a CSV file.

FFT: The FFT analysis results are saved to a CSV file.

When Data Type Is Set to Screen Image



* This appears when the data format is set to PNG.
When the data format is set to JPEG, the frame on/off setting appears.

Setting the Data Format (Format)

Screen captures can be saved in the following data formats. The table below shows the extensions that are automatically assigned to each format and the approximate sizes of files in each format.

Data Format	Extension	File Size ¹
PNG	*.PNG	Approx. 100 KB (approx. 50 KB) ²
BMP	*.BMP	Approx. 2 MB (approx. 150 KB) ²
JPEG	*.JPG	Approx. 250 KB

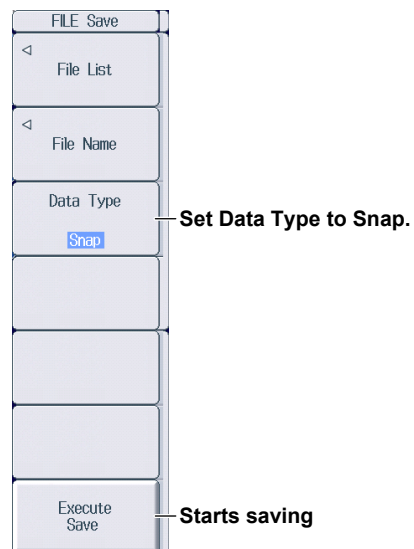
¹ When Color is set to ON

² The file sizes in parentheses indicate the file size when Color is set to OFF.

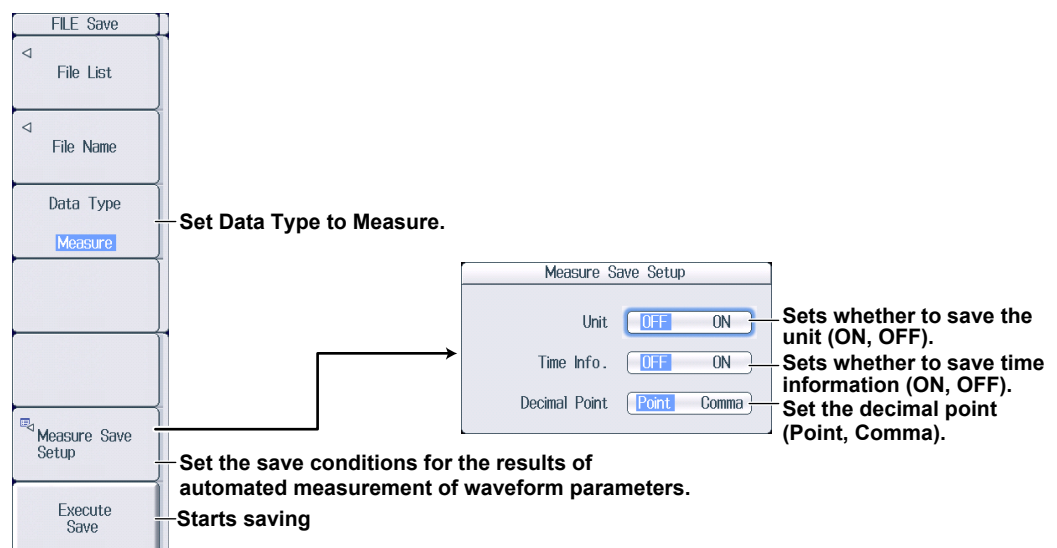
Setting the Color (Color)

ON	An screen capture is produced with a 65536-color palette.
ON(Gray)	An screen capture is produced with a 16-color grayscale palette.
ON(Reverse)	The screen background is not produced in color.
OFF	A black-and-white screen capture is produced.

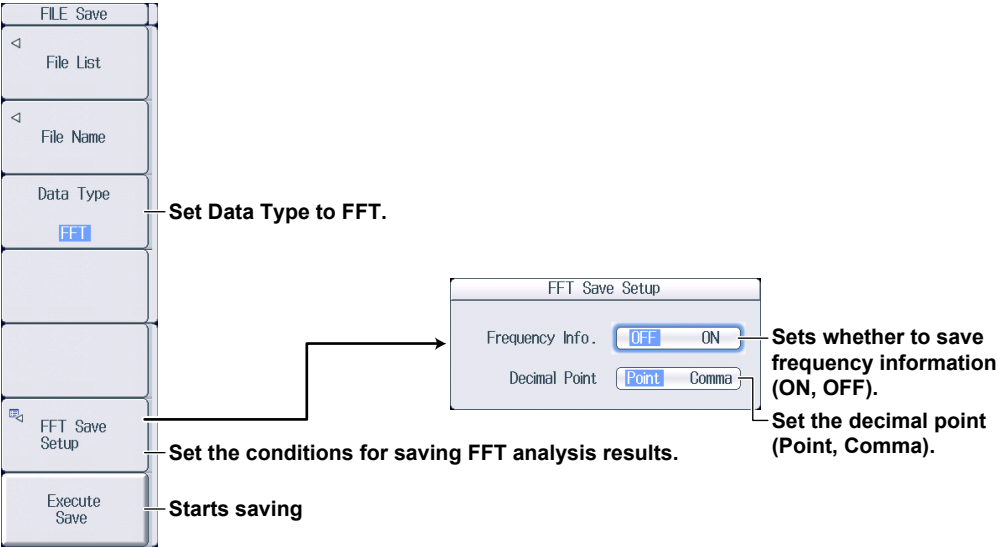
When Data Type Is Snap



When Data Type Is Measure



When Data Type Is FFT



Starting to Save (Execute Save)

Press the **Execute Save** soft key to save the appropriate data file to the specified folder.

22.7 Loading Waveform Data

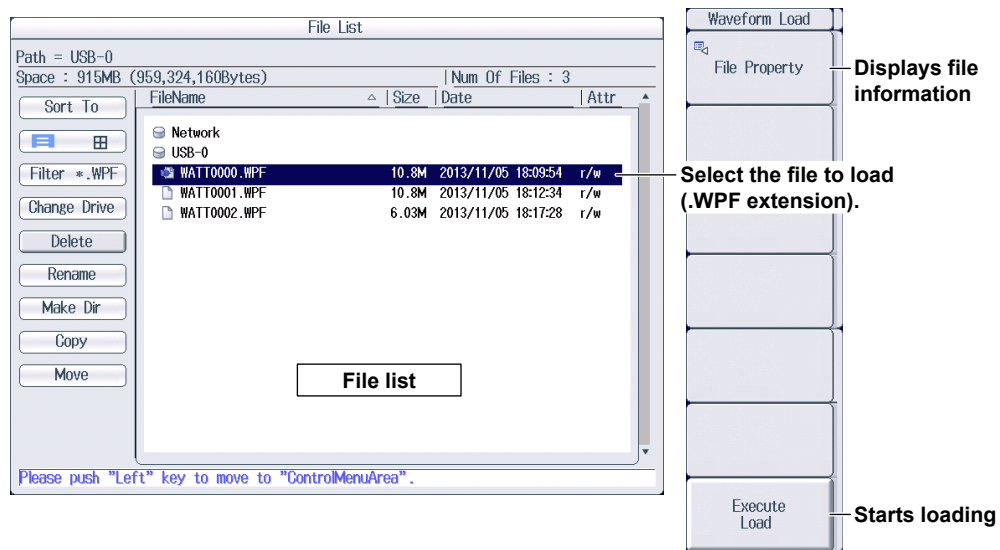
This section explains the following settings for loading waveform data.

- File to load
- Displaying file information
- Starting to load
- Clearing loaded waveforms

► [Features Guide: “Loading Waveform Data \(Waveform\)”](#)

FILE Waveform Load Menu

Press **FILE** and then the **Waveform** soft key next to Load to display the following screen and menu.



Selecting the File to Load

Select the waveform data file (.WPF extension) to load from the file list. ► [section 22.10](#)

Starting to Load (Execute Load)

Press the **Execute Load** soft key to load the waveform data file from the specified file.

- The setup data in the waveform data file is also loaded. When you start measurement, the loaded waveform data will be cleared, but the setup data that was loaded with the waveform data will remain.
- If the current PX8000 module configuration is different from the modules configuration in the waveform data, you cannot load the waveform data.
- Waveform data saved with a PX8000 model with large memory capacity cannot be loaded in to a model with small memory capacity.

Clearing Loaded Waveforms

Loaded waveforms are cleared in the following situations.

- When waveform acquisition is started with the START/STOP key
- When the Clear History soft key on the HISTORY menu is pressed
- When the PX8000 is initialized

22.8 Loading Setup Data

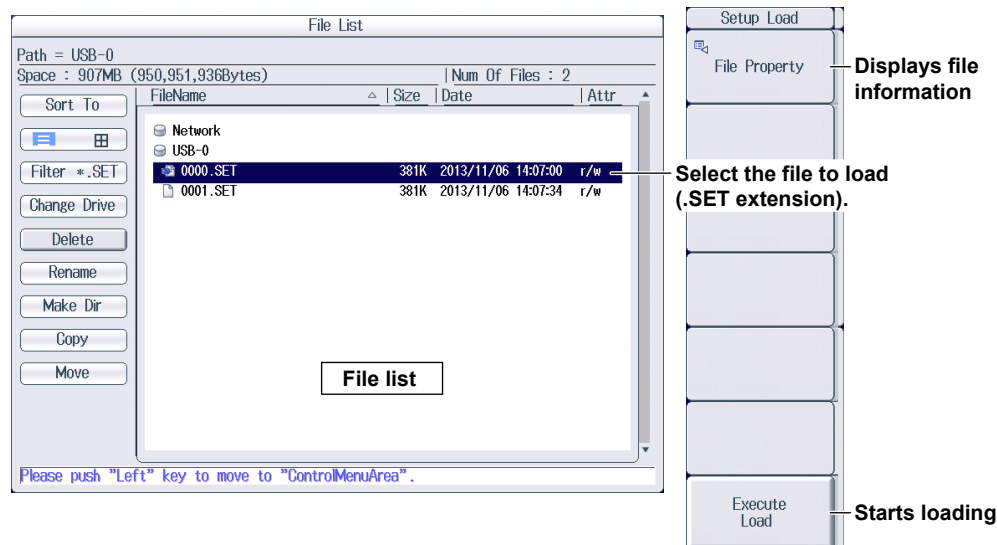
This section explains the following settings for loading setup data.

- File to load
- Displaying file information
- Starting to load

► [Features Guide: "Loading Setup Data \(Setup\)"](#)

FILE Setup Load Menu

Press **FILE** and then the **Setup** soft key next to Load to display the following screen and menu.



Selecting the File to Load

Select the setup data file (.SET extension) to load from the file list. ► [section 22.10](#)

Starting to Load (Execute Load)

Press the **Execute Load** soft key to load the setup data file from the specified file.

If the current PX8000 module configuration is different from the modules configuration in the setup data, you cannot load the setup data.

22.9 Loading Other Types of Data

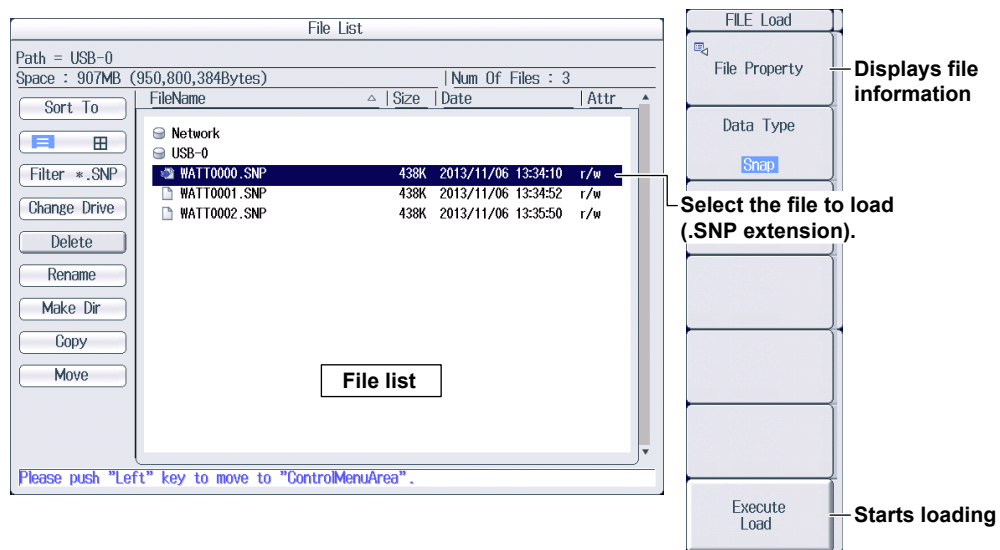
This section explains the following settings for loading snapshot waveforms.

- File to load
- Displaying file information
- Starting to load
- Clearing Loaded Waveforms

► [Features Guide: “Loading Other Types of Data \(Others\)”](#)

FILE Others Load Menu

Press **FILE** and then the **Others** soft key next to Load to display the following screen and menu.



Selecting the File to Load

Select the snapshot data file (.SNP extension) to load from the file list. ► [section 22.10](#)

Starting to Load (Execute Load)

Press the **Execute Load** soft key to load the snapshot waveform data file from the specified file.

Clearing Loaded Waveforms

Loaded waveforms are cleared when you press CLEAR TRACE or when you initialize the PX8000.

22.10 Performing File Operations

This section explains the following settings for performing various file operations from the file list or the file utility menu.

File list

- Sorting
- Display format
- Type of file to list
- Changing the storage medium (drive)
- Deleting files and folders
- Renaming files and folders
- Creating folders (directories)

- Copying files
- Moving files

FILE Utility Menu

- Displaying file information
- Turning file protection on and off
- Selecting files (All Set/All Reset and Set/Reset)

► [Features Guide: "File Operations \(Utility\)"](#)

File List and FILE Utility Menu

1. Press **FILE** and then the **Waveform**, **Numeric**, **Setup**, or **Others** soft key next to Save.
2. Press the **File List** soft key to display the file list and FILE Utility menu.

For details on the FILE Utility menu, see page 22-28.

File List (File List)

File path
Free space

Operation menu cursor
Use the arrow keys (▲▼) to move.

Sort the file list.
Set the display format.
Set the type of files to list.

Change the storage medium (drive).
Delete files and folders.
Rename files and folders.
Create folders (directories).
Copy files and folders.
Move files and folders.

Selection marks

If you want to perform an operation on a group of files at the same time, move the cursor to a file that you want to select, and then press the **SET/RESET** soft key or **SET** to display this icon next to the file.

To select multiple folders, press the **SET/RESET** soft key to display this mark next to the folders. If the cursor is on a folder, pressing **SET** will open the folder. All the files and folders that you have selected up to that point will be canceled.

If you want to perform an operation on a single file, move the cursor to the file you want to select to display this icon next to the file.

FileName	Size	Date	Attr
0000.PNG	62.2K	2013/11/06 13:37:54	r/w
0000.SET	381K	2013/11/06 14:07:00	r/w
0000.WPF	6.03M	2013/11/06 14:08:34	r/w
0000N.CSV	2.74K	2013/11/06 14:08:34	r/w
0001.PNG	147K	2013/11/06 14:08:58	r/w

Total number of files and folders that are contained within the storage medium or folder indicated by the path

File list cursor
Use the arrow keys (▲▼) to move.

FileName	Size	Date	Attr
0001.PNG	147K	2013/11/06 14:08:58	r/w
0001.SET	381K	2013/11/06 14:07:34	r/w
0002.PNG	10.8M	2013/11/05 18:09:54	r/w
WATT0000.CSV	438K	2013/11/06 13:34:52	r/w
WATT0001.WPF	10.8M	2013/11/05 18:12:34	r/w
WATT0001.SNP	438K	2013/11/06 13:35:50	r/w
WATT0002.SNP	6.03M	2013/11/05 18:17:28	r/w
WATT0002.WPF			

Please push "Left" key to move to "ControlMenuArea".

Operation menu ↔ **File list**
Use the arrow keys (◀▶) to switch between the operation areas.

Selects and unselects files and folders

Utility

File Property

Protect ON

Protect OFF

ALL SET

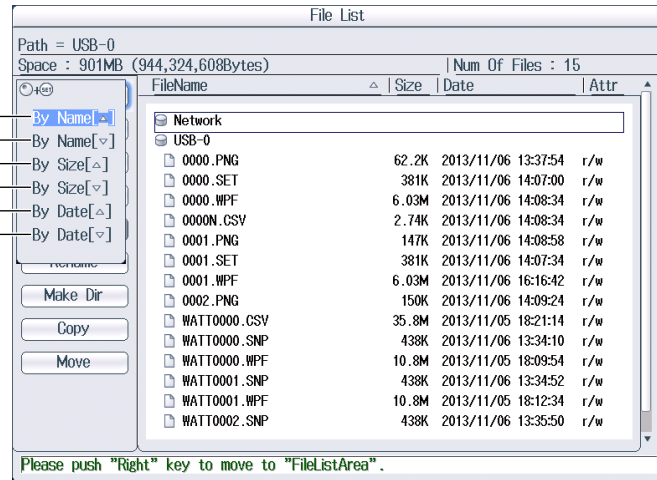
ALL RESET

SET/RESET

Sorting the File List (Sort To)

Select **Sort To** on the operation menu to display the following screen.

- Sort by file name in ascending order. — By Name[▲]
- Sort by file name in descending order. — By Name[▼]
- Sort by file size in ascending order. — By Size[▲]
- Sort by file size in descending order. — By Size[▼]
- Sort by date in ascending order. — By Date[▲]
- Sort by date in descending order. — By Date[▼]



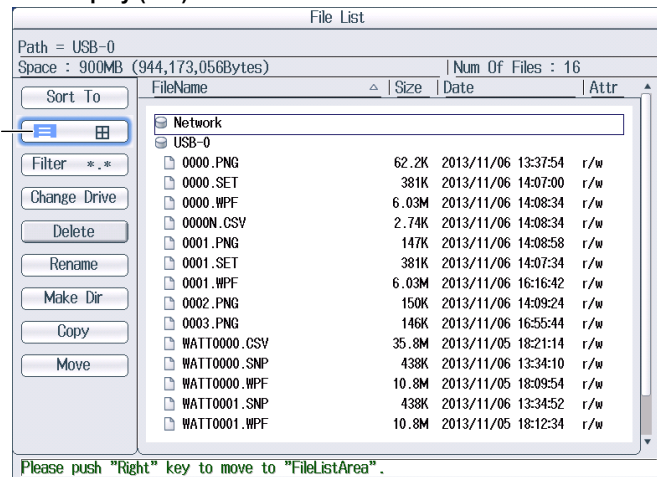
Display Format

Select **display format** on the operation menu to display the following screens.

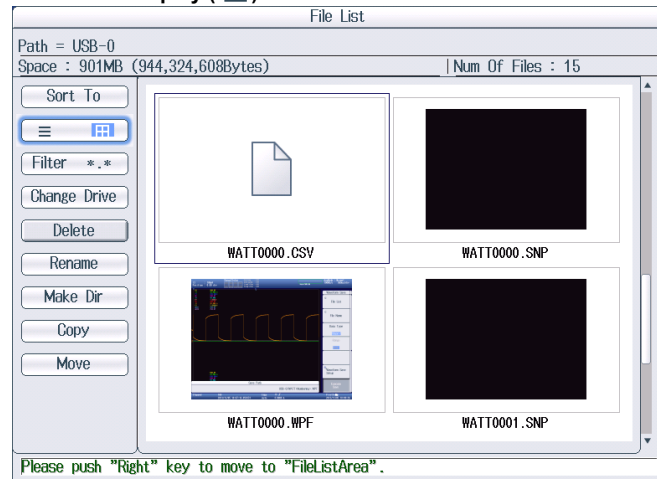
Press **SET** to switch between display formats.

List Display (≡)

Display format



Thumbnail Display (田)

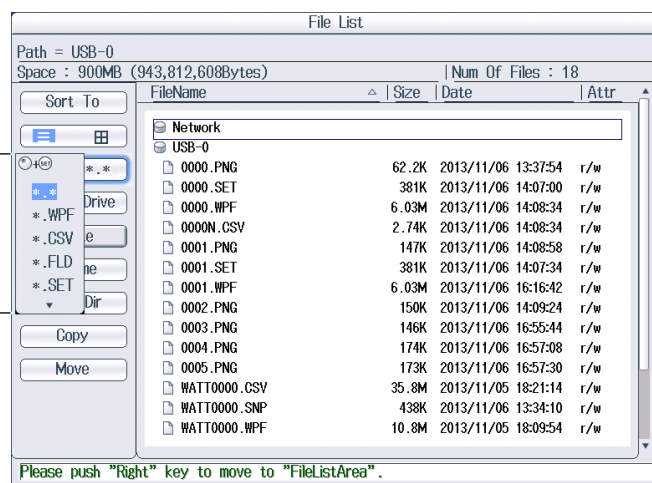


Selecting the Type of File to List (Filter)

Select **Filter** on the operation menu to display the following screen.

Select the type of files to list.

- *.*: All files
- *.WPF: Binary waveform files
- *.CSV: ASCII waveform files
- *.FLD: Floating-point waveform files
- *.SET: Setup files
- *.BMP: Bitmap image files
- *.PNG: PNG image files
- *.JPG: JPEG image files
- *.SNP: Snapshot waveform files
- *.TXT: Text files, custom display configuration files for numeric data, MATLAB waveform files
- *.WDF: WDF binary waveform files

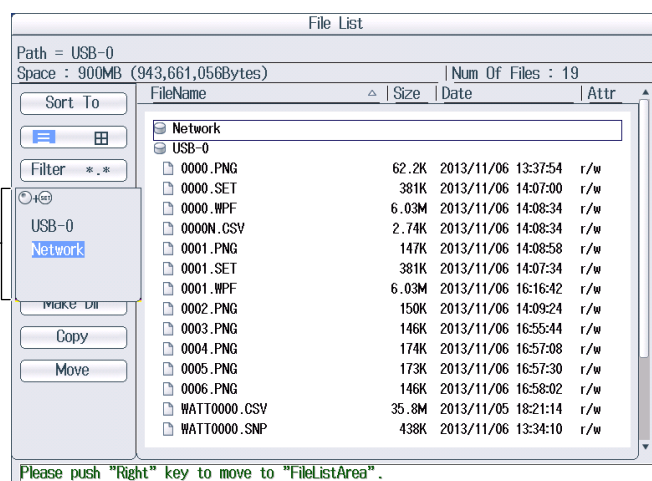


Changing the Storage Medium or Drive (Change Drive)

Select **Change Drive** on the operation menu to display the following screen.

Select the storage medium (drive).

- SD-1: SD card
- USB-0: The first detected USB storage medium
- USB-1: The second detected USB storage medium
- Network: Network Drive

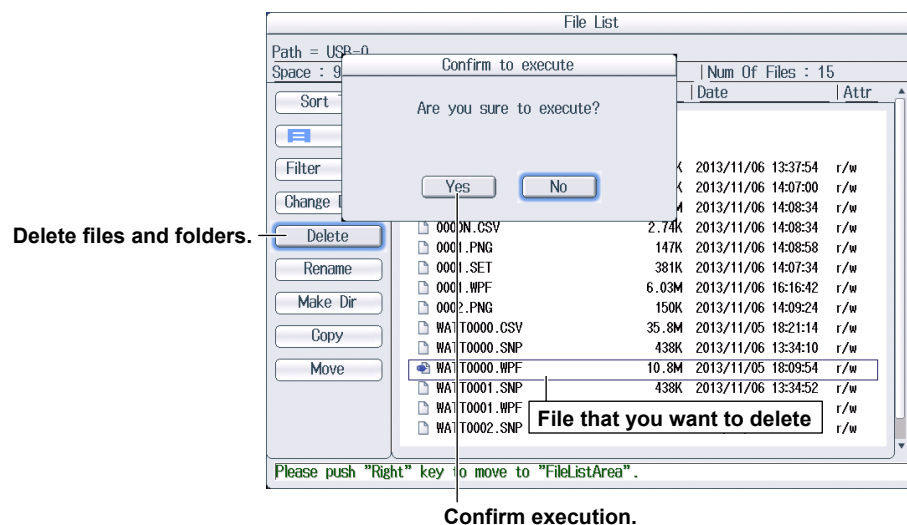


Note

You can also change the storage medium by highlighting the storage medium (drive) you want to change to in the file list and pressing **SET**.

Deleting Files and Folders (Delete)

1. Select the file or folder that you want to delete from the file list.
2. Select **Delete** on the operation menu to display the following screen.

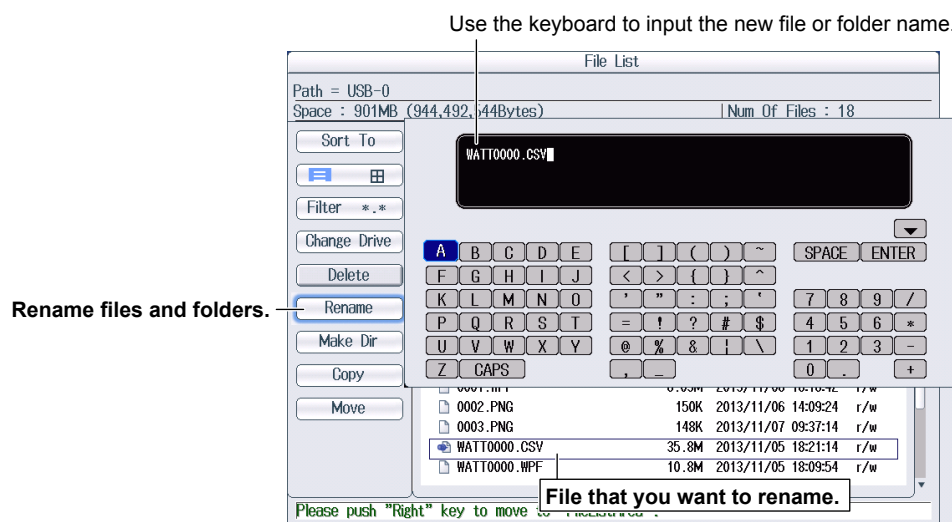


Note

- To delete multiple files or folders that are in the file list at the same time, move the cursor to the file or folder that you want to delete, and then carry out the following operations.
Files: Press **SET** or the **SET/RESET** soft key on the Utility menu.
Folders: Press the **SET/RESET** soft key on the FILE Utility menu. If the cursor is on a folder, pressing **SET** will open the folder. All the files and folders that you have selected up to that point will be canceled.
- You can abort file deleting. However, files that are already being processed are not applicable.

Renaming Files and Folders (Rename)

1. Select the file or folder that you want to rename from the file list.
2. Select **Rename** on the operation menu to display the following screen.

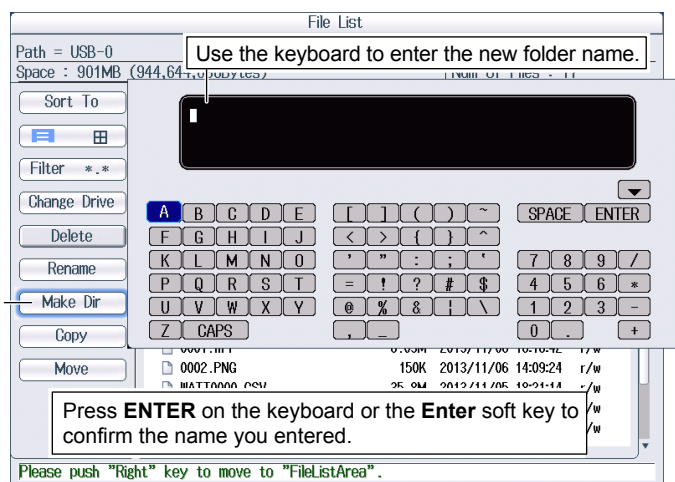


Press **ENTER** on the keyboard or the **Enter** soft key to confirm the name you entered.

Making Folders (Make Dir)

1. Select the drive or folder in the file list that you want to make the new folder in.
2. Select **Make Dir** on the operation menu to display the following screen.

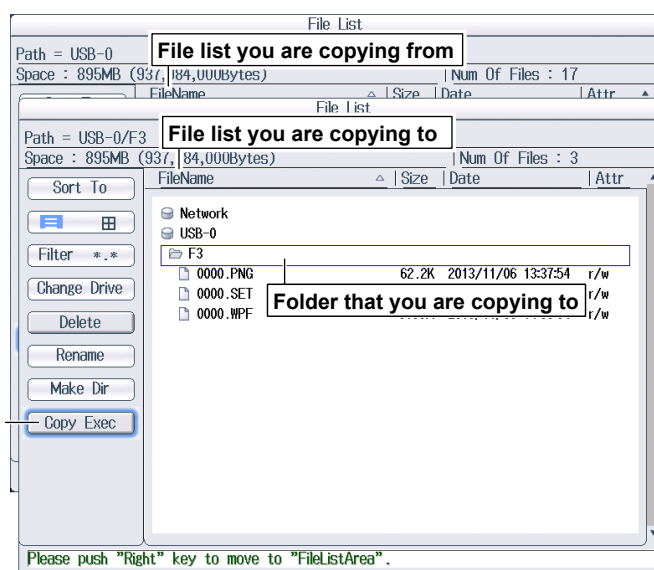
Create folders (directories).



Copying Files (Copy)

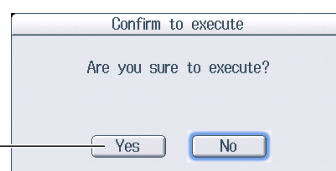
1. Select the file that you want to copy from the file list.
2. Select **Copy** on the operation menu to display the following screen.

Copies the selected files and folders



3. Select the drive or folder on the file list that you are copying to.
4. Select **Copy Exec** on the operation menu to display the following screen.

Confirm execution.

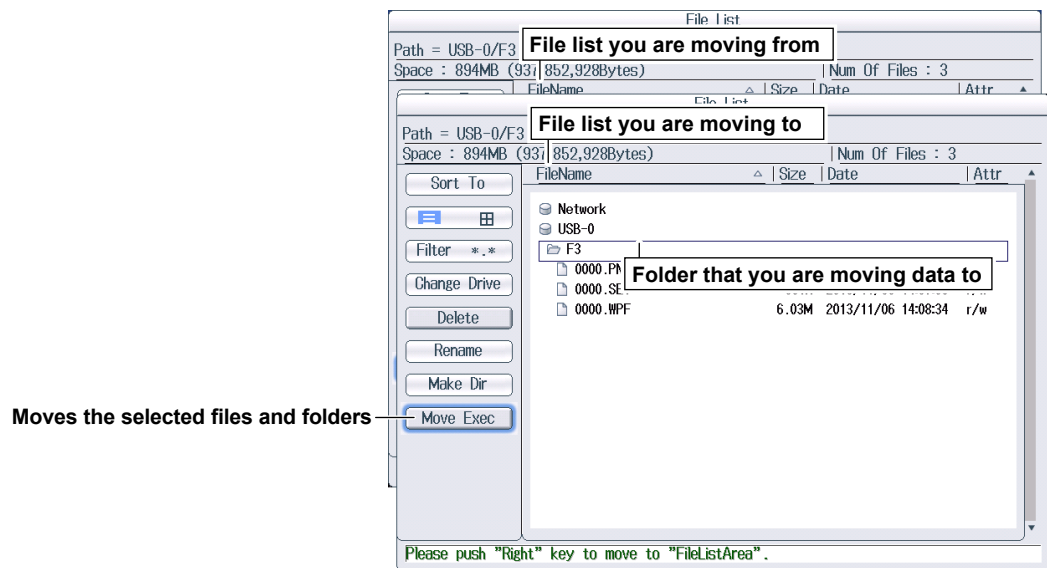


Note

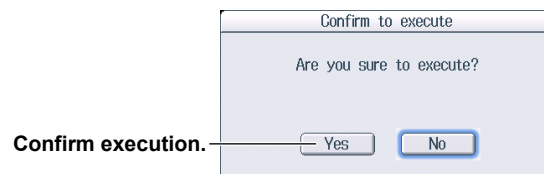
- The procedure for selecting multiple files or folders at the same time to copy them is the same as the procedure for selecting multiple files or folders at the same time to delete them. For more details, see the note on page 22-25.
- You can abort file copying.

Moving Files (Move)

1. Select the file that you want to move from the file list.
2. Select **Move** on the operation menu to display the following screen.



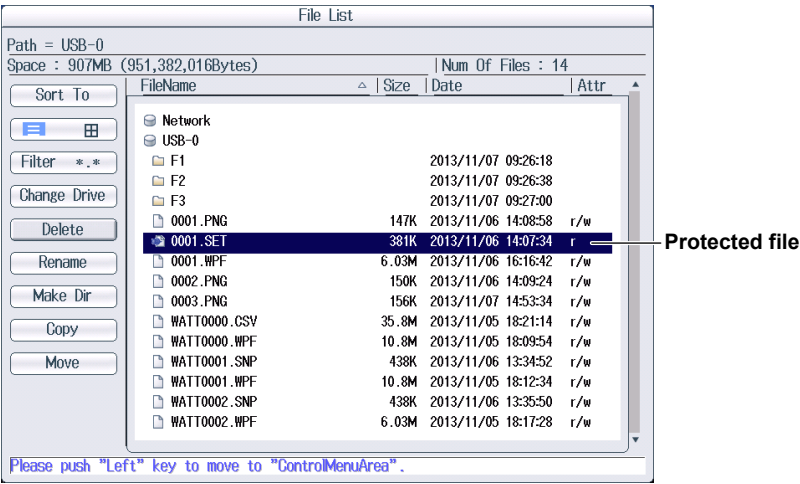
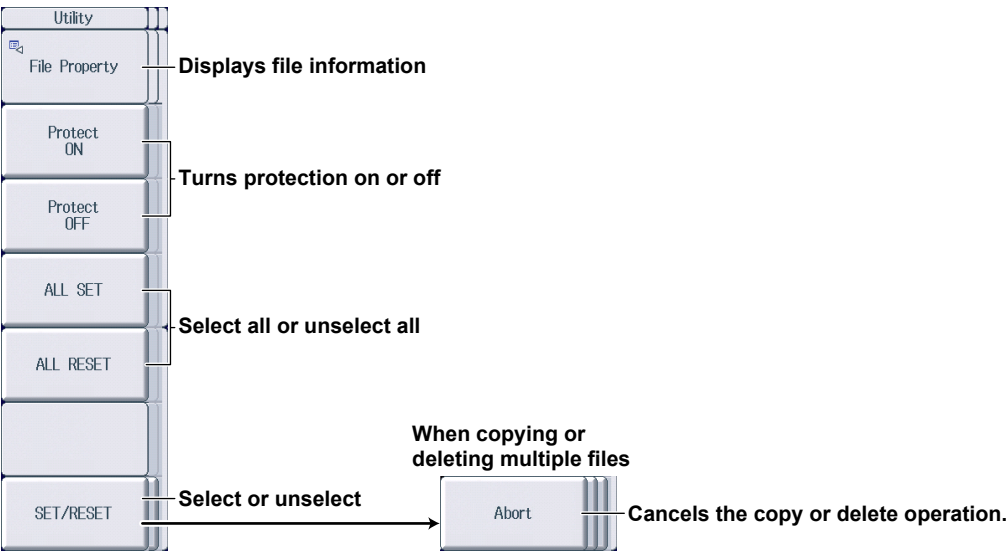
3. Select the drive or folder in the file list that you are moving to.
4. Select **Move Exec** on the operation menu to display the following screen.



Note

The procedure for selecting multiple files or folders at the same time to move them is the same as the procedure for selecting multiple files or folders at the same time to delete them. For more details, see the note on page 22-25.

FILE Utility Menu



Turning Protection On or Off (Protect ON/OFF)

These soft keys turn protection on and off for the selected file. The change is reflected in the file attributes, displayed under the Attr column in the file list.

Protection	File Attribute	Description
ON	r	File protection is on for the selected file. The file can be read from. Writing is not allowed. Deleting is also not allowed.
OFF	r/w	File protection is off for the selected file. The file has read and write access.

ALL SET and ALL RESET

- ALL SET: When a medium, folder, or file is highlighted in the file list, pressing this soft key selects all the files and folders in the corresponding medium or folder. Selection marks (see page 16-19) are displayed to the left of the selected files and folders.
- ALL RESET: Pressing this soft key clears all the selected files and folders.

SET/RESET

This soft key selects the file or folder in the file list that is highlighted or clears the selection. Selection marks (see page 22-22) are displayed to the left of the selected files.

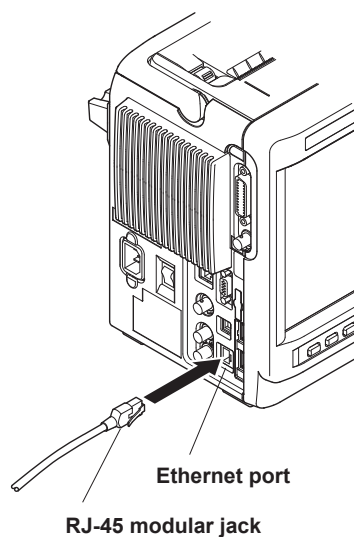
23.1 Connecting the PX8000 to a Network

This section explains how to connect the PX8000 to a network.

Ethernet Interface Specifications

There is a 1000BASE-T port located on the side panel of the PX8000.

Item	Specifications
Ports	1
Electrical and mechanical specifications	IEEE802.3 compliant
Transmission system	Ethernet (1000BASE-T, 100BASE-TX, 10BASE-T)
Communication protocol	TCP/IP
Supported services	Server: FTP and VXI-11 Client: FTP (Net Drive), SNMP, DHCP, and DNS
Connector type	RJ-45



Items Required to Connect the PX8000 to a Network

Cable

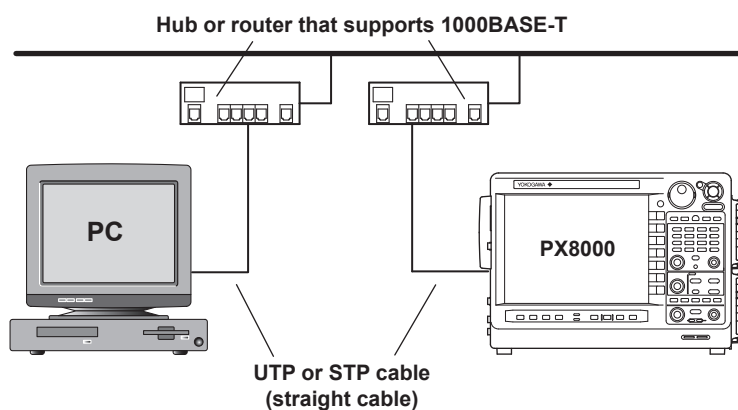
Use one of the following types of network cable that conforms to the transfer speed of your network.

- A UTP (Unshielded Twisted-Pair) cable
- An STP (Shielded Twisted-Pair) cable

Connection Procedure

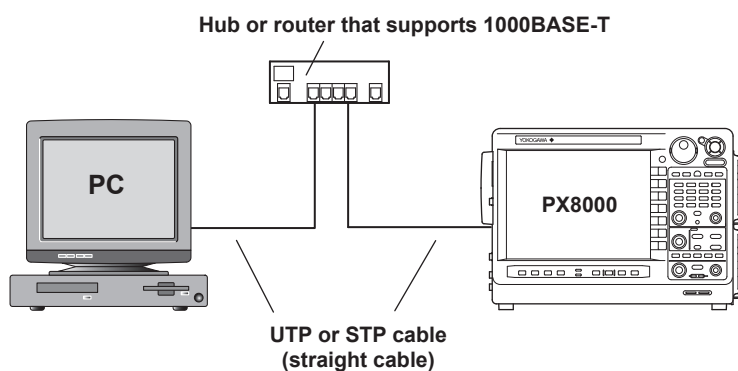
To Connect to a PC over a Network

1. Turn off the PX8000.
2. Connect one end of a UTP (or STP) cable to the ETHERNET 1000BASE-T port on the side panel.
3. Connect the other end of the UTP (or STP) cable to a hub or router.
4. Turn on the PX8000.



To Connect to a PC through a Hub or Router

1. Turn off the PX8000.
2. Connect one end of a UTP (or STP) cable to the ETHERNET 1000BASE-T port on the side panel.
3. Connect the other end of the UTP (or STP) cable to a hub or router.
4. Connect the PC to the hub or router in the same way.
5. Turn on the PX8000.



Note

- Use a hub or router that conforms to the transfer speed of your network.
 - When you connect a PC to the PX8000 through a hub or router, the PC must be equipped with an auto switching 1000BASE-T/100BASE-TX/10BASE-T network card.
 - Do not connect the PX8000 to a PC directly. Direct communication without a hub or router is not guaranteed to work.
-

23.2 Configuring TCP/IP Settings

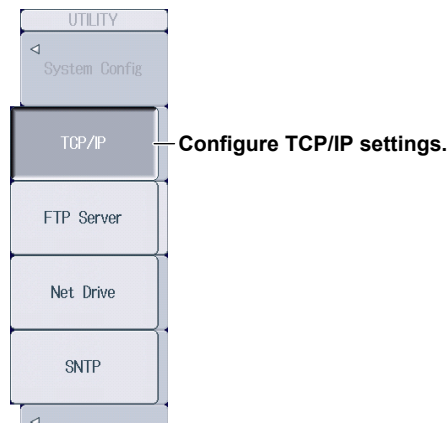
This section explains the following TCP/IP settings for connecting to a network.

- DHCP (IP address, subnet mask, and default gateway)
- DNS (domain name, DNS server IP address, and domain suffix)

► [Features Guide: "TCP/IP \(TCP/IP\)"](#)

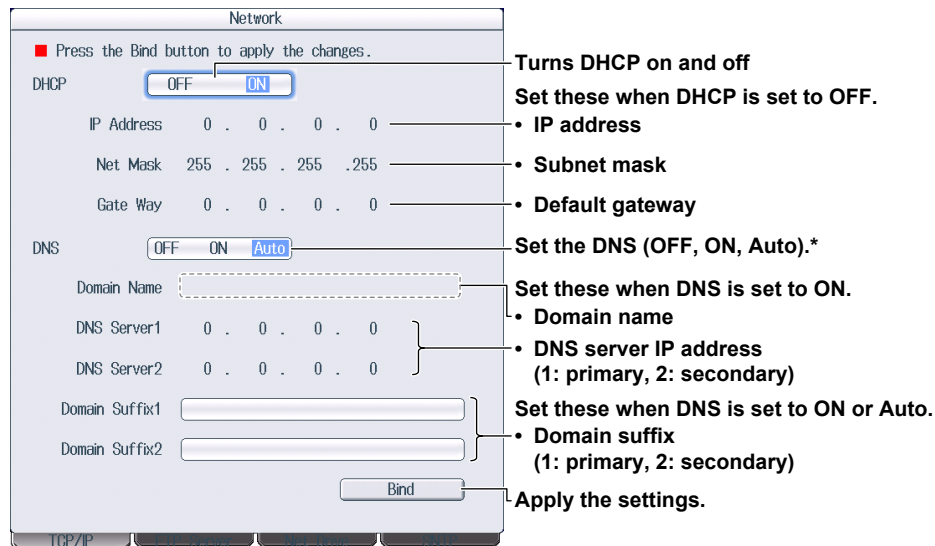
UTILITY Network Menu

Press **UTILITY** and then the **Network** soft key to display the following menu.



Configuring TCP/IP Settings (TCP/IP)

Press the **TCP/IP** soft key to display the following screen.



* Auto is displayed when DHCP is on.

DNS Settings (DNS)

OFF: DNS is disabled.

ON: DNS is enabled. Set the domain name, and the DNS server's primary and secondary IP addresses and domain suffixes.

Auto: DNS is enabled. Set the domain suffix. The domain name and the DNS server IP addresses are set automatically. This option can only be selected when DHCP is on.

23.3 Accessing the PX8000 from a PC (FTP Server)

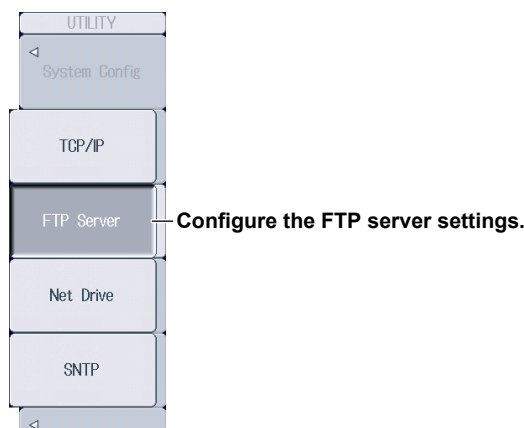
This section explains the following settings for accessing the PX8000 from a PC on a network.

- User name
- Password
- Timeout
- Starting an FTP Client

► [Features Guide: “FTP Server \(FTP Server\)”](#)

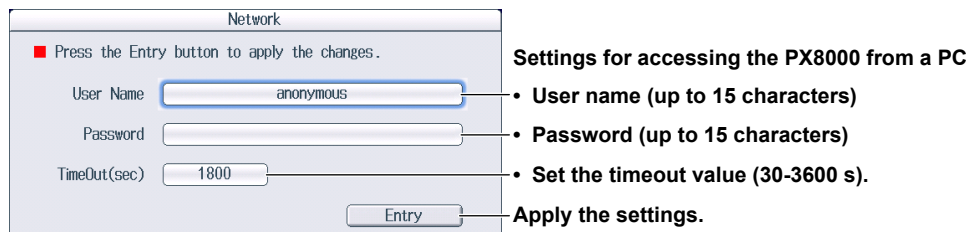
UTILITY Network Menu

Press **UTILITY** and then the **Network** soft key to display the following menu.



Configuring FTP Server Settings (FTP Server)

Press the **FTP Server** soft key to display the following screen.



Starting an FTP Client

Start an FTP client on a PC.

Enter the user name and password that you entered on the screen shown above to connect to the PX8000.

Note

If you set the user name to “anonymous,” you can connect to the PX8000 without entering a password.

23.4 Connecting to a Network Drive

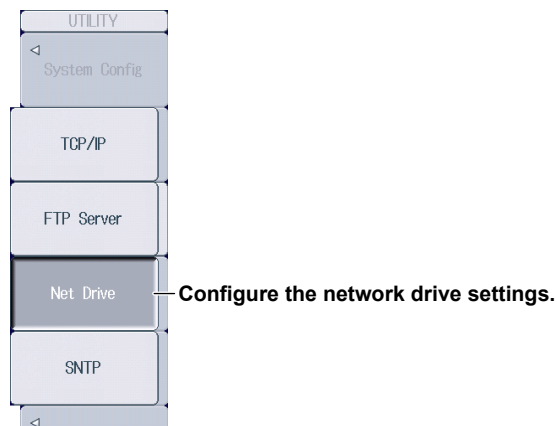
This section explains the following settings for accessing a network drive through an Ethernet connection to load or save various PX8000 data.

- FTP server (file server)
- Login name
- Password
- Turning FTP passive mode on and off
- Timeout
- Connecting to and disconnecting from network drives

► [Features Guide: “Network Drive \(Net Drive\)”](#)

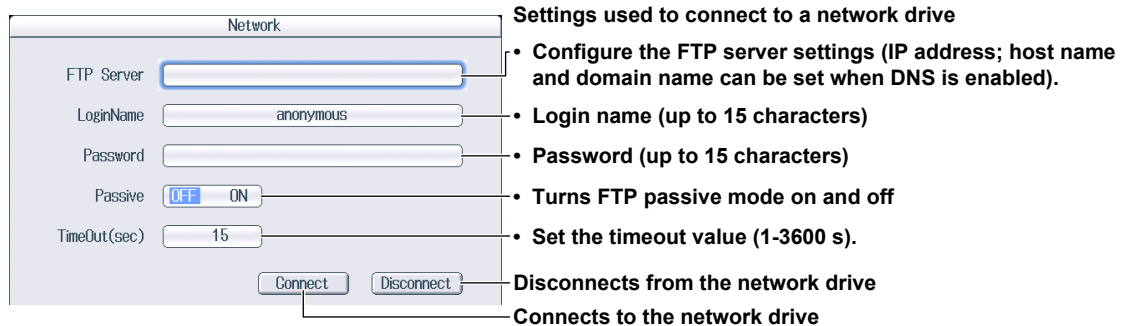
UTILITY Network Menu

Press **UTILITY** and then the **Network** soft key to display the following menu.



Configuring a Network Drive and Connecting to It (Net Drive)

Press the **Net Drive** soft key to display the following screen.



23.5 Using SNTP to Set the Date and Time

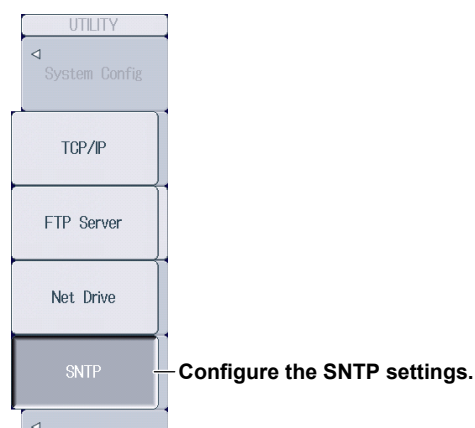
This section explains how to use SNTP to set the PX8000's date and time.

- SNTP server
- Timeout
- Executing time adjustment
- Automatic adjustment

► [Features Guide: "SNTP \(SNTP\)"](#)

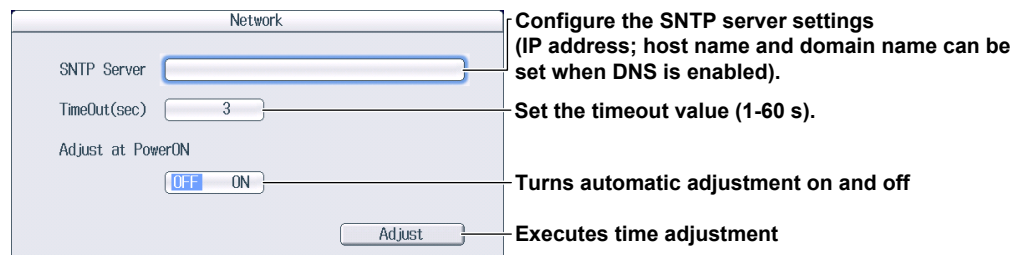
UTILITY Network Menu

Press **UTILITY** and then the **Network** soft key to display the following menu.



Configuring SNTP Settings (SNTP)

Press the **SNTP** soft key to display the following screen.



24.1 Calibrating the PX8000

This section explains how to calibrate the PX8000. Execute calibration when you want to make accurate measurements.

► [Features Guide: “Calibration \(Zero-level compensation, CAL\)”](#)

CAL Menu

Press **SHIFT+DISPLAY MODE** (CAL) to display the following menu.

CAL	
Execute Calibration	Executes calibration
Cal at End for Elements OFF ON	Turns on and off the calibration that is performed when a measurement is completed on an element
Cal on Start for Auxiliaries OFF AUTO	Set the calibration that is performed after starting signal acquisition on AUX modules (OFF, AUTO). This command does not appear if AUX modules are not installed.

24.2 Using the NULL Feature

This section explains the following settings for the NULL feature.

- Turning NULL value subtraction on and off
Turning on and off at once, setting each channel separately
- Turning NULL value updating on and off
Turning on and off at once, setting each channel separately
- Enabling and Disabling the NULL Feature

► [Features Guide: “NULL Feature \(NULL SET\)”](#)

Configuring NULL Feature Settings

Press **SHIFT+NULL** (NULL SET) to display the following screen.

To collectively set all the channels of installed modules, set the items in the All row.

Collectively turns NULL value subtraction on and off

Collectively turns NULL value updating on and off

All	Affect NULL	Update Value
U1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I1	<input type="checkbox"/>	<input type="checkbox"/>
U2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I2	<input type="checkbox"/>	<input type="checkbox"/>
U3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
I3	<input type="checkbox"/>	<input type="checkbox"/>
AUX7	<input type="checkbox"/>	<input type="checkbox"/>
AUX8	<input type="checkbox"/>	<input type="checkbox"/>

Set individual channels.
Select the channels on which to execute NULL value subtraction or NULL value updating.

Use the jog shuttle to select the item that you want to set.

Enabling and Disabling the NULL Feature

Press **NULL**. The NULL feature is executed, and a NULL indicator appears in the element information display area on the right side of the screen.

- The NULL value of each signal is used for those channel signals whose NULL feature is set to ON.
- If you press the NULL key again, the NULL feature is disabled, and the NULL indicator disappears.

NULL indicators

Element information
You cannot see this information when a setup menu is displayed.
To see the information, press ESC to clear the menu.

Note

If the measured value of the input signal used as a NULL value is not available (no measured value or measurement error), even if “NULL value updating” of the signal is set to ON, an error will occur because the NULL value will not be updated.

24.3 Setting Time Synchronization (Option)

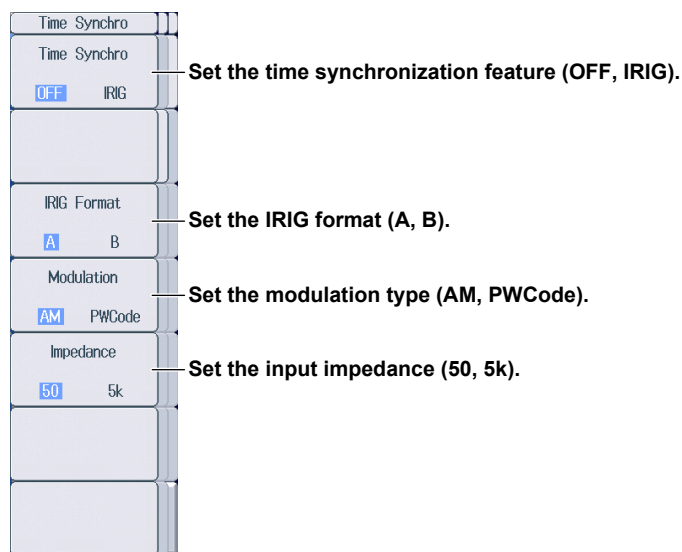
This section explains the following settings for synchronizing the PX8000 to GPS time.

- IRIG format
- Modulation type
- Input impedance

► [Features Guide: “Time Synchronization Feature \(Time Synchro; optional\)”](#)

UTILITY System Config Time Synchro Menu

Press **UTILITY**, the **System Config** soft key, and then the **Time Synchro** soft key to display the following menu.



Note

To enable the changes that you have made to the time synchronization settings, restart the PX8000.

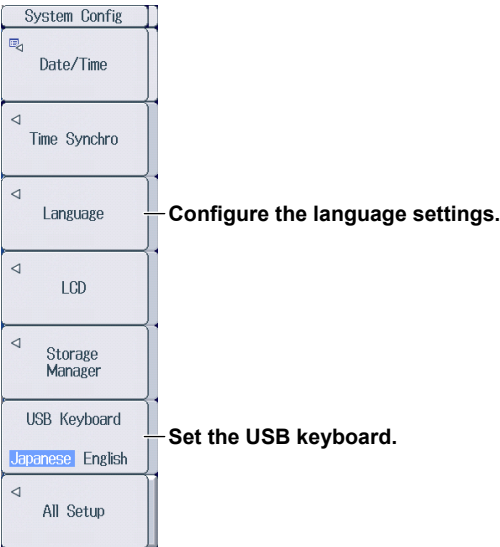
24.4 Changing the Message, Menu, and USB Keyboard Languages

This section explains the settings that you can use to change the message, menu, and USB keyboard languages.

► [Features Guide: “Language \(Language\)”](#)
[“USB Keyboard Language \(USB Keyboard\)”](#)

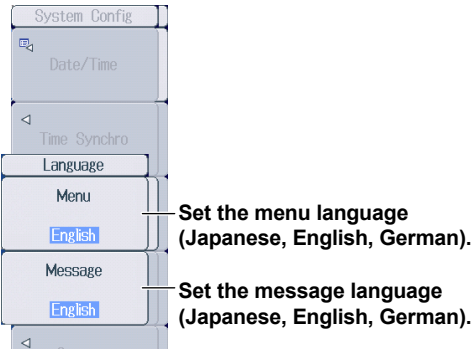
UTILITY System Config Menu

Press **UTILITY**, and then the **System Config** soft key to display the following menu.



Setting the Language (Language)

Press the **Language** soft key to display the following menu.



Note

Some terminology is always displayed in English.

Setting the USB Keyboard Language (USB Keyboard)

You can use the following keyboards that conform to USB Human Interface Devices (HID) Class Ver. 1.1.

English: 104-key keyboards

Japanese: 109-key keyboards

For details on how PX8000 keys are mapped to the keys on a USB keyboard, see appendix 10 in the Features Guide, IM PX8000-01EN.

24.5 Adjusting the Backlight

This section explains the following settings for adjusting the backlight.

Turning off the backlight

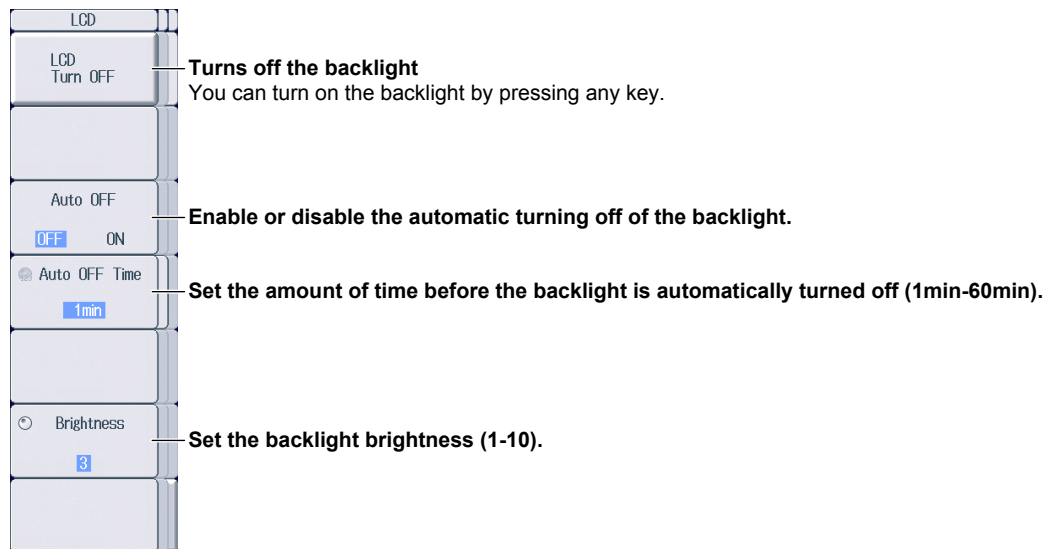
Automatically turning off the backlight

Adjusting the brightness

► [Features Guide: “Adjusting the LCD \(LCD\)”](#)

UTILITY System Config LCD Menu

Press **UTILITY**, the **System Config** soft key, and then the **LCD** soft key to display the following menu.



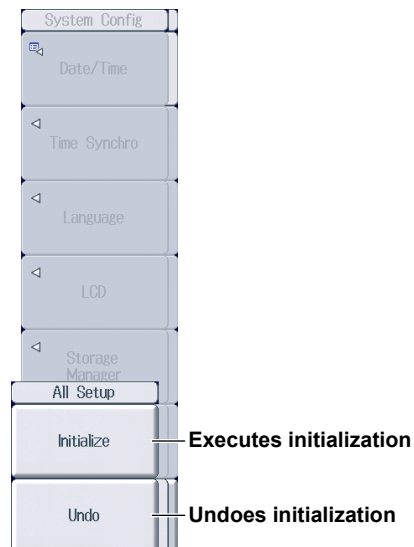
24.6 Initializing the Settings

This section explains how to initialize the PX8000 settings to their factory default values.

► [Features Guide: “Initializing Settings \(Initialize\)”](#)

UTILITY System Config All Setup Menu

Press **UTILITY**, the **System Config** soft key, and then the **All Setup** soft key to display the following menu.



24.7 Configuring the Environment Settings

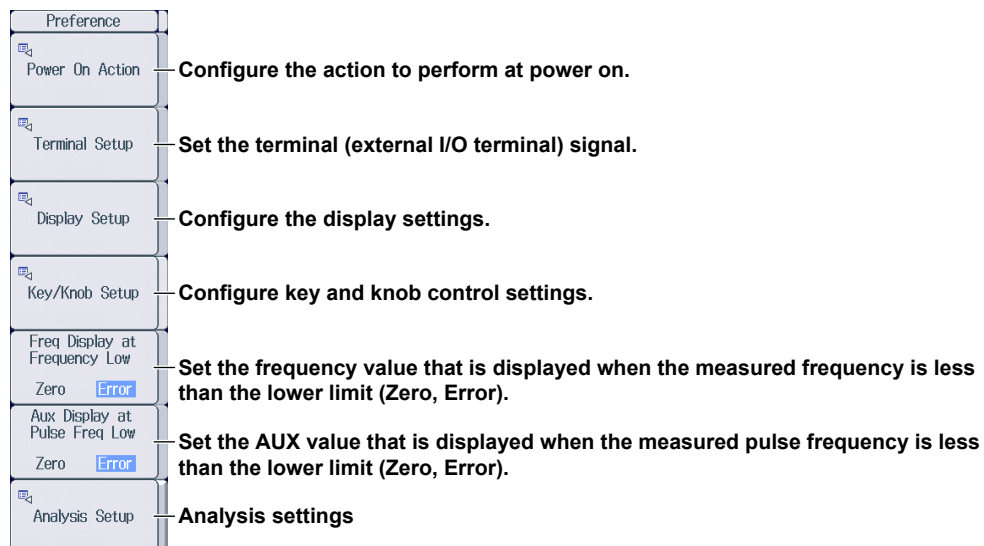
This section explains the following environment settings.

- Action to perform at power on
- Terminal (external I/O terminal) signal
- Display settings
Font size, menu background color, scale value display, numeric display frame, number of digits to display for numeric data, intensity
- Key and knob control settings
Turning the click sound on and off, start and stop response time, key lock type and release type
- Frequency display when the measured frequency is less than the lower limit
- AUX display when the measured pulse frequency is less than the lower limit
- Analysis settings
Cursor read mode

► [Features Guide: “Environment Settings \(Preference\)”](#)

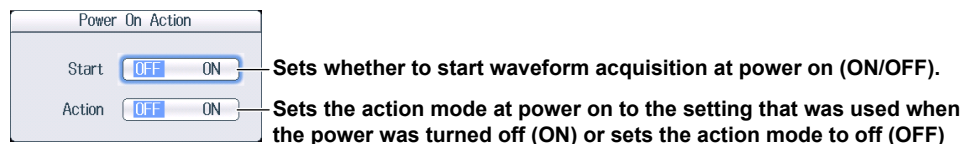
UTILITY Preference menu

Press **UTILITY** and then the **Preference** soft key to display the following menu.



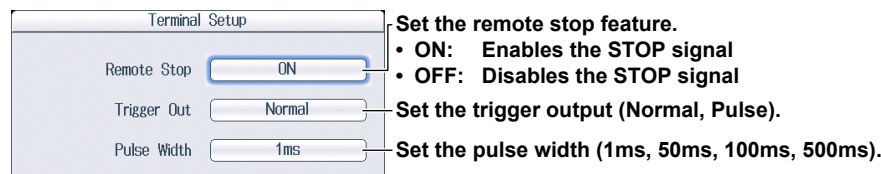
Setting the Action to Perform at Power On (Power On Action)

Press the **Power On Action** soft key to display the following screen.



Setting the Terminal (External I/O Terminal) Signal Settings (Terminal Setup)

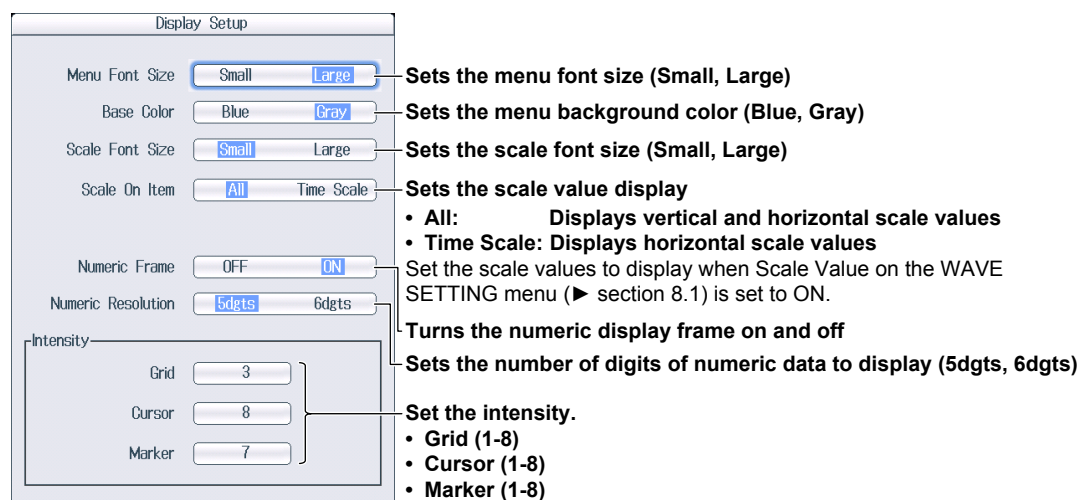
Press the **Terminal Setup** soft key to display the following screen.



Configuring the Display Settings (Display Setup)

(Font size, menu background color, scale value display, numeric display frame, number of digits to display for numeric data, intensity)

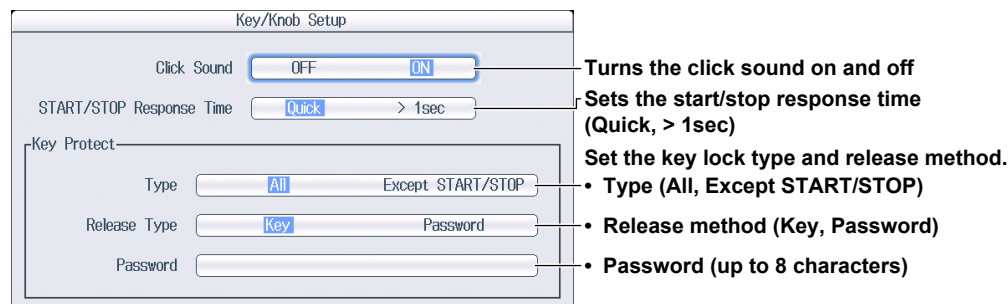
Press the **Display Setup** soft key to display the following screen.



Configuring Key and Knob Control Settings (Key/Knob Setup)

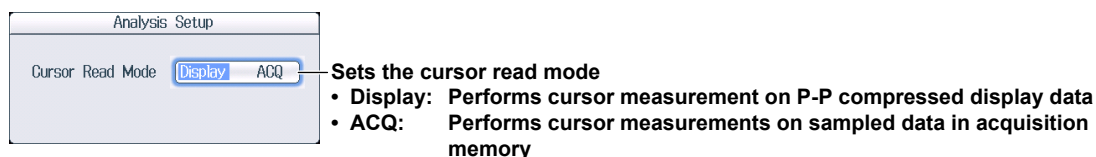
(Turning the click sound on and off, start and stop response time, key lock type and release type)

Press the **Key/Knob Setup** soft key to display the following screen.



Configuring Analysis Settings (Analysis Setup)

Press the **Analysis Setup** soft key to display the following screen.



24.8 Storing and Recalling Setup Data

This section explains how to store the PX8000 settings to the internal memory and how to recall settings from the internal memory.

► [Features Guide: “Storing and Recalling Setup Data \(Setup Data Store and Recall\)”](#)

UTILITY Store/Recall Menu

Press **UTILITY** and then the **Setup Data Store/Recall** soft key to display the following menu.

Store/Recall	
No.	Specify the store/recall number (1-16).
2	
2013/11/11 11:57:02	Date and time when the data was stored*
Comment	Set comments.
Store Exec	Starts storing
Recall Exec	Starts recalling*
Clear	Clears the stored setup data*

* This appears when data is stored in the internal memory at the specified store/recall number.

24.9 Locking the Keys

This section explains how to lock the panel keys, which prevents you from unintentionally changing the current state of the PX8000.

► [Features Guide: “Key Lock \(KEY PROTECT\)”](#)

Key Lock (KEY PROTECT)

Press **KEY PROTECT** to lock the panel keys. The KEY PROTECT key illuminates. When the keys are locked, pressing any keys other than **KEY PROTECT** has no effect. Press **KEY PROTECT** again to release the key lock and enable the panel keys. The KEY PROTECT key turns off.

Note

When the keys are locked, you cannot use a USB mouse or keyboard to operate the PX8000 either.

25.1 Messages and Corrective Actions

Message

Messages may appear on the screen during operation. This section describes the error messages and how to respond to them. With a few exceptions, you can display the messages in the language that you specify through the operations explained in section 24.4. If servicing is necessary to solve the problem indicated by a message, contact your nearest YOKOGAWA dealer.

In addition to the following error messages, there are also communications error messages. These messages are explained in the Communication Interface User's Manual (IM PX8000-17EN).

Information

Code	Message	Chapter or Section
53	Initializing is in progress.	24.6
54	Initializing has been completed.	24.6
55	Undo is in progress.	24.6
56	Undo has been completed.	24.6
59	Calibration is running...	24.1
60	Calibration is complete.	24.1
61	Media format is running.	22.2
62	Media format is complete.	22.2
64	File access is aborted.	—
65	Executed the firmware overwriting of the frequency module.	25.3
66	Overwriting firmware of the frequency module...	25.3
67	Key response time is more than 1 second. Push it more than 1 second.	24.7
68	Executed the firmware overwriting of the built-in parts.	25.3
69	Overwriting the built-in parts firmware.	25.3
70	Exit from GO/NO-GO mode.	Chapter 17
71	Image printing was aborted.	21.2
72	Completed action.	18.1
73	Aborted the search.	Chapter 19, section 20.2
74	Executed the search, but no record was found that matched the conditions.	Chapter 19, section 20.2
75	Executed the search, but no record was found that matched the pattern.	Chapter 19, section 20.2
77	Aborted the statistical measurement.	14.2, 14.3
80	Input module configuration was changed. Relevant settings have been initialized.	Appendix 11*
84	Turned on pressing the RESET key. Will initialize.	Appendix 11*
85	The instrument is set to remote mode by the communication control. Press the SHIFT + CLEAR TRACE key to change to local mode.	—
86	Push 'Zoom Mag' knob or 'Zoom Position' knob when change a target window.	12.1
87	Sensed the firmware version change. Will initialize.	Appendix 11*
92	Be careful not to exceed a current supply limit value to use the power supply for a current sensor.	2.11**
94	Executing abort process. It takes a few seconds.	—
96	Calibration failure of power measurement element has occurred. Power-supply frequency exceeded acceptable range for calibration.	24.1

* Features Guide, IM PX8000-01EN

**Getting Started Guide, IM PX8000-03EN

25.1 Messages and Corrective Actions

Code	Message	Chapter or Section
97	The history has been cleared due to one of the following reasons. - Wiring was changed. - Element Independent was changed. - Ext Sensor for Current Module or sense type for Aux Module was changed. - Executed "Elements Copy to" or "Aux Copy to".	1.1, 2.2, 2.4, 2.7
98	A module, which accuracy is not guaranteed, is installed. Or pairs of modules, which accuracy is not guaranteed, is installed. Check modules on the overview display (UTILITY-Overview).	25.3

File Errors

Code	Message	Chapter or Section
500	File access failure.	—
501	Invalid file name. The name contains prohibited characters, or file name is duplicated.	22.3, chapter 24*
502	Pass name over maximum number of characters. Full pass name should under 255 characters.	—
504	Out of disk space.	22.10
505	File not found. Check the file.	22.10
506	Duplicate file or directory name. Change the name.	22.10
507	The file name is not set. Set the file name.	22.3
508	Save data not found. Check for presence of data and channel.	22.3, 22.6
509	File system failure.	—
510	Cannot load this file format. Files stored on other models cannot be loaded.	22.7
511	File is now being accessed. Execute after access is made.	—
512	Cannot be executed while running. Press the START/STOP key to stop acquisition.	4.2
513	The specified file cannot be loaded on this Firmware version or this model.	22.7
514	No ch is displayed. Turn ON the display of the appropriate channel.	22.3
517	Unknown file format.	Chapter 22
518	Writing prohibited in the media. Unlock write protection of the media.	—
519	Cannot save in this format at the current record length. Specify a range and save a section of the data. * Cannot create a file of size 2 GB or larger.	22.3
520	Media error.	22.1
521	Directory can not be deleted.	22.1
522	Cannot load these files on a network drive. - The File which larger than 50 Mbyte. - The File which is saved by HistoryAll format. Copy the file to the local drive before loading it.	23.3
530	Assigned path does not exist. Check the network setting and configuration.	Chapter 23
531	Assigned file does not exist. Check the network setting and configuration.	Chapter 23
532	Assigned path does not exist. Check the network setting and configuration.	Chapter 23
533	Writing prohibited in this file.	22.10
534	An error occurred while network access. Confirm network conditions.	Chapter 23
535	Current path is not suitable. Set other path while use action on trigger.	22.3

* Features Guide, IM PX8000-01EN

Code	Message	Chapter or Section
536	Destination path is same as source path, or sub folder of source path.	—
538	Module configuration is not matched, so it couldn't loaded. Configuration of saved data can see by File property.	22.7
539	Module configuration is not matched, so it couldn't loaded. Configuration of saved data can see by File property.	22.7
541	Cannot detect the medium. Check the presence of the medium.	22.1
544	Cannot execute file operations or initialization while measure is in progress. To execute, wait for the end of measure or turn measure off.	14.1
545	Data read error.	—
547	Cannot execute file operations or initialization while numeric calculations are in progress. To execute, wait for the end of numeric calculation or turn numeric off.	7.1
548	Cannot load this bitmap file. Use file of 16-bit color or 24-bit color mode with less or equal size 800x654.	6.6, chapter 8*
549	Cannot load this text file. Confirm the contents of file.	6.6, chapter 8*

* Features Guide, IM PX8000-01EN

Printer Errors

Code	Message	Chapter or Section
570	Close the printer cover.	21.1
571	Paper empty. Load a roll chart.	21.1
572	The printer head temperature is abnormality. Printing will be aborted. Printing will not be possible until the printer head temperature comes normal.	—
573	Printer over heat. Power off immediately.	—
574	Printer power supply error. Maintenance service is required.	—
575	Printer time out. Maintenance service is required.	—
576	Printer error.	—

Network Errors

Code	Message	Chapter or Section
600	Unable to connect to the server. Check the network settings and configuration.	Chapter 23
601	Has not connect with ftp server yet. Confirm the network settings and connection.	Chapter 23
602	This ftp function in not supported.	—
603	FTP Error: Client Handle Confirm the network settings and connection.	Chapter 23
604	Cannot send data to a network printer. Confirm the network settings and connection.	Chapter 23
608	Failed to acquire time from SNTP server. Confirm the network settings and connection.	Chapter 23

25.1 Messages and Corrective Actions

Execution Errors (650 to 799)

Code	Message	Chapter or Section
650	Data is invalid.	—
651	The option is not equipped, so it cannot execute.	—
652	Undo is not possible since data that existed immediately before initialization is not available.	—
653	Can not be executed while running. Press START/STOP key to stop acquisition.	4.2
654	Cannot manipulate files while image printing is in progress. Wait until image printing is complete.	—
656	Calibration failure. Disconnect the input and execute again. If it fails again, servicing is necessary.	24.1
660	Can not operate while data out. Wait until output is completed.	—
663	Cannot start.	—
664	GO/NO-GO is available while trigger mode is - 'Single' or 'Normal' - 'Auto' or 'AutoLevel' (Faster than 50ms/div)	3.1
666	Failed to measure statistics. Waveform data may be missing. If Cycle Statistics is specified, the instrument may be configured in a way that fails to detect the cycle.	14.2, 14.3
667	Executing file access. Abort or wait until it is complete.	—
668	Image is being printed or saved. Wait until the execution of the command is complete.	—
672	Cannot be executed when the time base setting is to be an External clock.	4.1
674	Average practice can't be done because the record length of the history exceeds the record length that it can be carried out.	20.1
675	Average practice can't be done because the record length of the history exceeds the record length that it can be carried out.	20.1
677	Cannot do while selftest is executing.	25.2
679	Cannot start at the current record length. Shorten the record length or meet the following condition. - Set the trigger mode to Auto, decrease T/Div to less than 100 msec/div to enable roll mode. - Set the trigger mode to Single or On Start.	2.8, 3.1
680	Averaging mode is not possible when the trigger mode is Single, SingleN, or On Start. Change the trigger mode.	3.1
684	Cannot start when the time base set to external clock while the acquisition mode set to envelope.	4.1
686	Cannot be executed when the acquisition mode is set to average. Change the mode.	4.1
693	Cannot be executed when GO/NO-GO mode is Zone.	17.1
695	Set acquisition mode to Normal when using a wave window trigger.	4.1
696	The wave window trigger cannot be used if the sampling rate is faster than 500 kS/s or slower than 10 kS/s.	2.8
702	All search conditions are OFF. At least one condition should ON.	Chapter 19, section 20.2
703	Display setting of search source is OFF. Set it to ON.	8.1
704	Cannot execute Time search while T/div is faster than 100msec/div.	2.8
705	Cannot start Action mode while trigger mode is SingleN.	3.1
706	Cannot be executed when GO/NO-GO mode is ON. Set the GO/NO-GO mode to OFF.	Chapter 17
707	Cannot execute search while searched No. reached Maximum(1000).	—
708	Cannot execute or set while AutoScroll processing. Stop AutoScroll.	12.1
712	Cannot start while No GO/NO-GO condition.	Chapter 17
713	Cannot make wave zone from less than 2,000 points data, from more than 10,000,000 points data, or from less than 10division data.	—
714	Cannot start Action mode while PrintImage target is "File". Change target to "printer".	21.2
716	Set the Math and FFT Window to OFF to Start GO/NO-GO.	Chapter 15, section 16.1
717	Cannot abort this process.	—

Code	Message	Chapter or Section
719	Cannot execute Time search when the time base setting is to be an External clock.	4.1
723	Cannot update null value. No measured value, calculated by numeric, is available to set.	24.2
724	Calibration error occurred. Restart this machine. If it occurred again, maintenance service is required.	—
725	Cannot execute when GO/NO-GO traces contain an AUX channel with the sense type set to pulse.	2.4 to 2.6
726	Cannot execute when search trace contains an AUX channel with the sense type set to pulse.	2.4 to 2.6
727	Cannot execute when trigger sources contain an AUX channel with the sense type set to pulse.	2.4 to 2.6
728	Cannot execute or change while running. Press the START/STOP key to stop acquisition.	4.2
729	No measurable channel.	—

Setup Errors (800 to 899)

Code	Message	Chapter or Section
800	Illegal date-time. Set the correct date and time.	—
801	Cannot set these file name. - Over 32 characters. - Include inhibit characters. - Inhibit MS-DOS file name. Enter an other file name.	22.3
803	Cannot change this parameter while running. Press the START/STOP key to stop acquisition.	4.2
804	Cannot change settings during GO/NO-GO. Stop the GO/NO-GO (Stop the Acquire).	Chapter 17
805	Can not change display points with this T/div setting.	2.8
806	Cannot be changed when trigger A is not X. Set the state of the channel corresponding to condition A to 'X'.	3.8 to 3.10
807	Cannot set while TimeSynchro setting not Off.	24.3
808	Cannot change when Channel Display is OFF or Math settings are invalid. Set the channel display ON or make appropriate Math settings.	8.1, chapter 15
809	Cannot change when External Clock is active.	4.1
810	Cannot change while running.	4.2
811	Illegal math expression. Input a correct computing equation.	15.5
812	Cannot set this model	—
813	Cannot set anything other than Low Pass for a Gaussian filter. Change the Filter Type to another filter besides Gaussian.	15.5
815	Cannot change settings during Action mode. Stop the Action.	18.1
816	Cannot set the channels which do not have modules installed.	Chapter 2, section 25.3
817	Cannot Set or Execute.	—
818	If the trigger mode is set to Single, Single(N), or OnStart, the acquisition mode cannot be set to Average.	3.1
819	If the acquisition mode is Average, the trigger mode cannot be set to Single, Single (N), or OnStart.	4.1
820	The acquisition mode cannot be set in the current record length.	4.1
822	Cannot be configured or executed during the search operation.	Chapter 19
823	Cannot be configured or executed during the history search operation.	20.2
824	The record cannot be selected.	Chapter 20
825	History record does not exist.	Chapter 20
826	Cannot be configured or executed while computation is in progress. Aborted when history display mode is set to One.	20.1
827	Cannot be configured or executed while updating the history all display. Aborted when history display mode is set to One.	20.1

25.1 Messages and Corrective Actions

Code	Message	Chapter or Section
829	Zones cannot be edited in the following cases: - When the main window is not displayed. - When the relevant waveform is not displayed.	5.1, 8.1, 11.1, 12.1, 16.1, 17.1
830	The zone waveform does not exist.	17.1
832	Zones determination is not possible in the following cases: - When the main window is not displayed. - When the relevant waveform is not displayed. - When the zone waveform does not exist.	5.1, 8.1, 11.1, 12.1, 16.1, 17.1
833	Processing statistics. To perform other operations, abort the statistical processing.	14.2
834	The channel which couldn't be set up was specified.	—
835	Cannot be set when the acquisition mode is set to average.	4.1
836	Cannot be changed when VScale is SPAN.	8.1
838	It is an unacceptable parameter to set up to the present module.	—*
840	Cannot be set to a range of 20 sec/div to 2 min/div during roll display.	2.8
842	Zooming is not available when the number of displayed points of the FFT waveform is less than 50 in the Zoom window.	12.1, 15.5, 16.1
846	P-P compression cannot be used to save when a record length is 1K.	—
852	Cannot set Math to OFF while FFT Window ON.	16.1
853	Cannot select this trace because it already selected.	—
855	Cannot change to such Record length while running. Set the trigger mode to Auto, decrease T/Div to less than 100 msec/div to enable roll mode, or set the trigger mode to Single or On Start.	2.8, 3.1
856	Cannot Display setting to ON. This CH didn't acquisition to memory.	—
858	Cannot set while action mode is ON.	18.1
867	Cannot be specified when the print style is Numeric.	—
869	Cannot set while GO/NO-GO mode. Turn OFF GO/NO-GO mode first.	Chapter 17
871	No effective channel for Math Setup.	—
872	No effective channel for History Search Setup.	—
874	Cannot set Save Range except 'Main' while PP-Comp save mode.	—
876	Cannot frame setting to ON, except Image format on JPEG.	21.3
877	Cannot set to display points under 100.	12.1
879	Cannot set GO/NO-GO mode while Math or FFT Window is ON.	Chapter 15, section 16.1
882	Cannot set while Single-N running.	3.1
890	Illegal math expression. Input a correct computing equation.	7.4
891	Cannot simultaneously set current range when sense types differ. To copy or set ranges to other current channels, first unify sense type.	2.2
892	Cannot set when current module types differ.	2.2
893	Cannot execute. Select copy destination channels(elements).	2.7

* Communication Interface User's Manual, IM PX8000-17EN

System Errors (900 to 999)

Code	Message	Chapter or Section
900	No module installed. Install the module.	2.3*
901	Failed to backup setup data. Will initialize. Backup battery may be low.	2.4*
902	The firmware is not suitable for this system. Install the proper firmware.	—
903	The USB device's power consumption exceeded the capacity of the USB hub.	7.9*
906	Fan stopped. Maintenance service is required.	—

* Getting Started Guide, IM PX8000-03EN

Code	Message	Chapter or Section
907	Internal temperature is too high. Maintenance service is required. It will shutdown automatically.	—
908	Check the measured current and the number of probes that you are using.	2.12*
910	Key protect is enabled. To release the protection, press the PROTECT key or enter the password.	24.9
911	Fan for Input modules stopped. Cannot start. Maintenance service is required.	—
912	Fan for CPU stopped. Maintenance service is required. It will shutdown automatically.	—
913	LCD BackLight Failure. Maintenance service is required.	—
914	Cannot start while this module configuration. 760811 should use in Slot 1,Slot 3,Slot 5,Slot 7. 760812 should use in Slot 2,Slot 4,Slot 6,Slot 8. 760813 should use in Slot 2,Slot 4,Slot 6,Slot 8. 760851 should use in Slot 3,Slot 5,Slot 7. Slot 1 and slot 2 must be installed.	2.3*
915	It installed the module which cannot support by this machine. Or it installed the module which cannot be used in the slot.	2.3*
917	Hardware configuration error occurred. Restart this machine. If it occurred again, maintenance service is required.	—
918	Error occurred while ImageFile process.	—
919	Key operate not available while system error occurred	—
920	Firmware overwriting error occurred.	—
922	Internal hardware communication error has occurred.	—
923	An error has occurred in the power measurement element. Power off immediately. Maintenance service is required.	—
924	Unable to start because there is an error in the suffix code. Maintenance service is required.	—

* Getting Started Guide, IM PX8000-03EN

Note

If servicing is required, first see if initializing the instrument fixes the problem.

25.2 Carrying Out Self-Tests (Selftest)

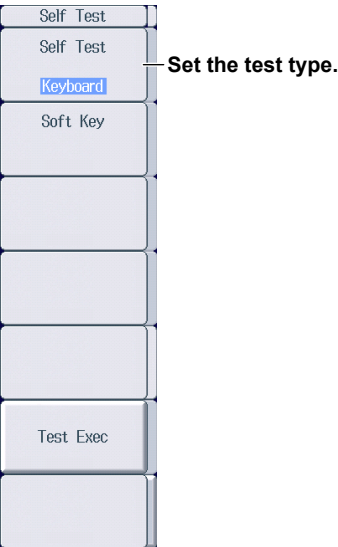
This section explains the following settings for testing whether the PX8000’s keyboard, memory, SD card interface, and printer are functioning properly.

- Test type
- Executing tests

► [Features Guide: “Self-Test \(Self Test\)”](#)

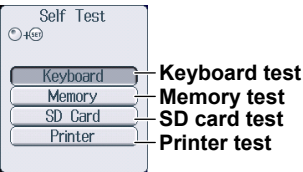
UTILITY Self Test Menu

Press **UTILITY** and then the **Self Test** soft key to display the following menu.



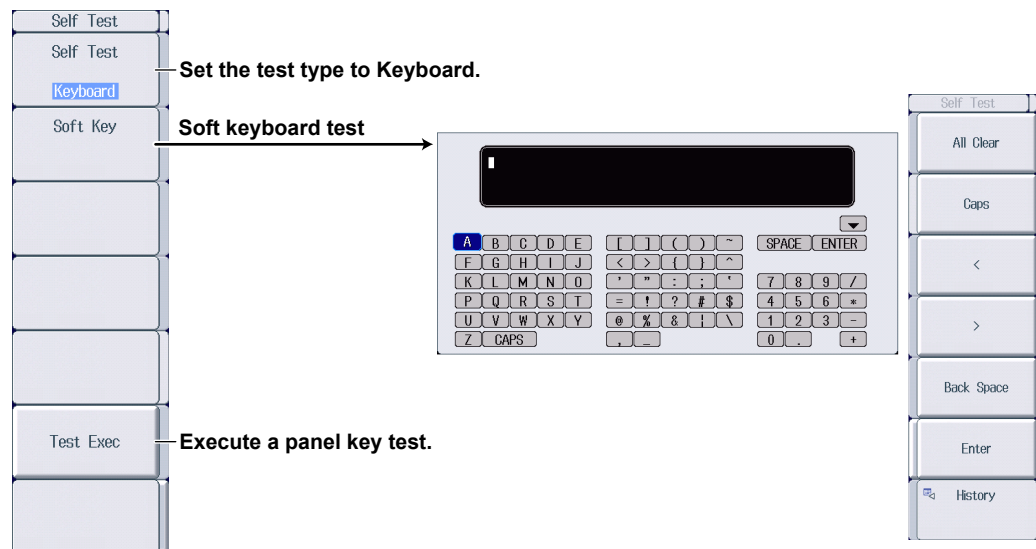
Setting the Test Type (Self Test)

Press the **Self Test** soft key to display the following menu.

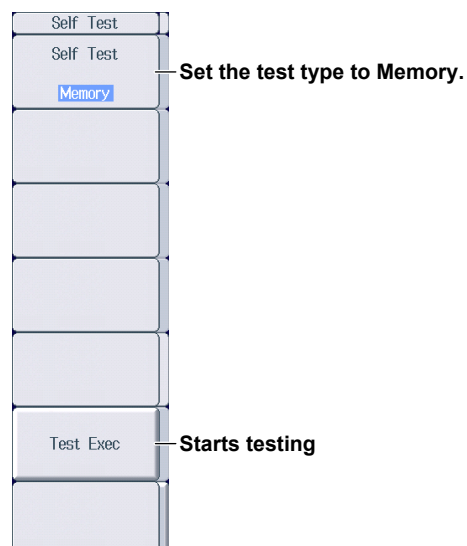


- Keyboard:** Tests whether or not the front panel keys are operating correctly and whether or not the soft keyboard accepts input properly. They are operating properly if the background color of the keys that you press changes from red to another color. The soft keyboard is operating properly if you can enter the specified characters.
- Memory:** Tests whether or not the internal CPU board RAM and ROM are operating properly. If they are operating properly, “Pass” appears. If an error occurs, “Error” appears.
- SD Card:** Tests whether the SD card interface is operating properly. If an error occurs, “Error” appears.
- Printer:** Tests whether or not the optional built-in printer is operating properly. The built-in printer is operating properly if the print density is correct. If an error occurs, the print density will not be correct.

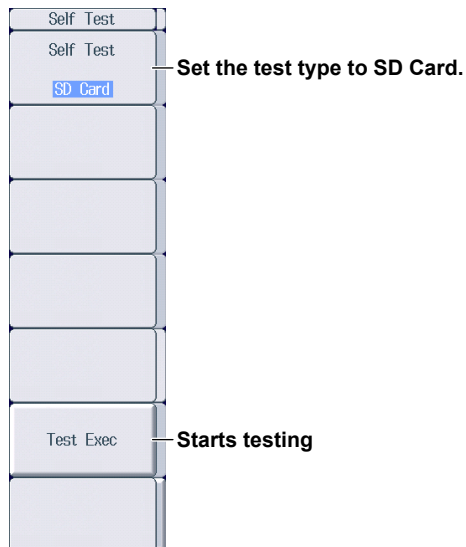
Keyboard Test



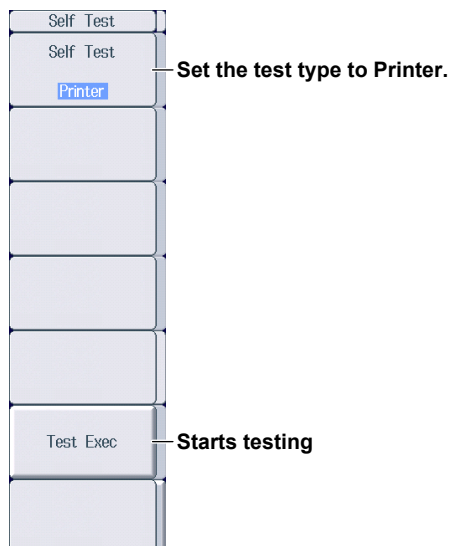
Memory Test



SD Card Test



Printer Test



If an Error Occurs during a Self-Test

If an error occurs even after you carry out the following procedure, contact your nearest YOKOGAWA dealer.

- Execute the self-test again several times.
- Confirm whether or not the media being tested is properly inserted.
- Check that the paper is set properly in the built-in printer and that paper is not jammed.

25.3 Viewing System Information (Overview)

This section explains how to view the PX8000 system information.

► Features Guide: “Overview (Overview)”

Viewing System Information (Overview)

Press **UTILITY** and then the **Overview** soft key to display the following screen.

Overview				
-Model		PX8000	RecordLength 100Mpts/CH	
Serial No / ProductID		91NA16947 / 7WGBCS2Z (MAC:00016494004)		
-Slot	Model	Serial No	/Pair Serial No	Adjustment Date
1:	760811	91NA16919/91NA16867		2013/12/25 19:28:34
2:	760812	91NA16867/91NA16919		2013/12/25 19:28:34
3:	760811	91NA16921/91NA16869		2013/12/25 19:28:36
4:	760812	91NA16869/91NA16921		2013/12/25 19:28:36
5:	760811	91NA16922/91NA16870		2013/12/25 19:28:40
6:	760812	91NA16870/91NA16922		2013/12/25 19:28:40
7:	760851			
8:	-			
-Options				
/M2	Memory expansion 100Mpts/CH			
/B5	Built-in printer			
/C20	IRIG interface			
/G5	Harmonic Measurement			
/P4	4 Probe power outputs			
/PD	4ch Sensor Power Supply			
-Default Language	English			
-Information				
Firm Version	2.11	15/06/16 11:24		
FPGA1 Version	ACQ(1.00.01, 20131209)	PCI(1.00.01, 20131212)		
FPGA2 Version	WATT[260](0.00.20)	GDC(0.50)	CIO(0.38)	

Displayed Information

Model, Record Length	Model and record length
Serial No / ProductID	Serial number and product number
Slot	Model and serial number of the module installed in each slot
Options	Installed options
Default Language	Default language
Information	Firmware and FPGA versions and other information

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