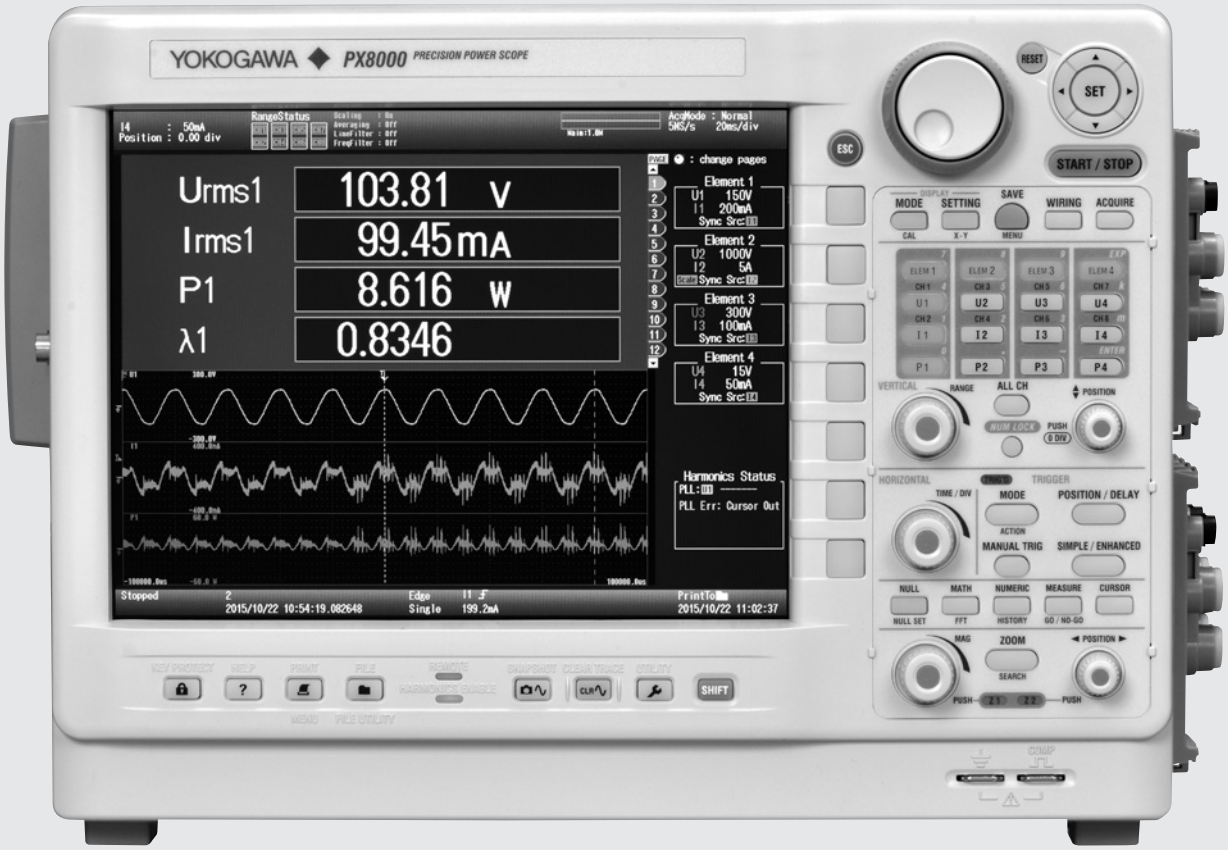
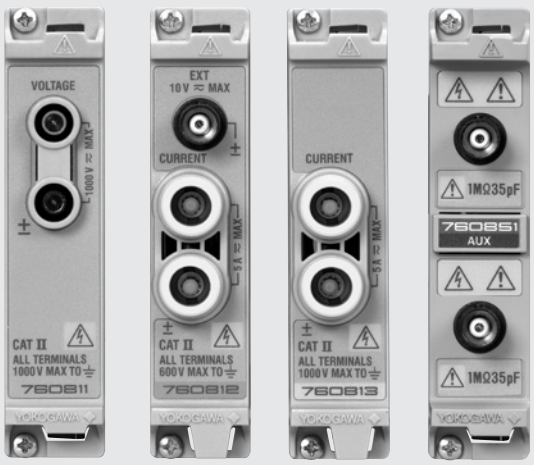
Test&Measurement

YOKOGAWA



Specifications



PX8000
Precision Power Scope

Bulletin PX8000-02EN

Specifications of PX8000, 760811, 760812, 760813 and 760851

Input

Item	Specification
Shape	Plug-in Input module Style
Module structure	Voltage module, Current module and Auxiliary (AUX) module Power measurement element: each one Voltage module and one Current module Max. 8 modules (max. 4 power measurement elements) can be installed AUX module can be installed max. 3 (at least one power measurement element must be installed).
Max. channel number	8 ch, combination of Voltage/Current modules and AUX module
Max. record length	Standard 10 M points for each voltage and current regardless of the installed number of modules.
	The memory cannot be combined, each memory of module is individual.
	50 M points for each voltage and current regardless of the installed number of input modules when /M1 option is installed.
	100 M points for each voltage and current regardless of the installed number of input modules when /M2 option is installed.

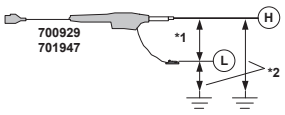
Voltage/Current input modules (760811/760812) Specifications

Item	Specification
Input terminal type	Voltage: Plug-in terminal (Female)
	Current: Direct input: Plug-in terminal (male)
	External current sensor input: isolated BNC (760812)
Input format	Voltage: Floating input, resistive voltage divider
	Current: Floating input through shunt
Measurement range	Voltage: 1.5/3/6/10/15/30/60/100/150/300/600/1000 Vrms (crest factor=2 at rated range input)
	Current: Direct input (5 A) 10 m/20 m/50 m/100 m/200 m/500 m/1/2/5 Arms (Crest factor=2 at rated range input)
	Current: External current sensor input (760812) 50 m/100 m/200 m/500 m/1/2/5/10 Vrms (Crest factor=2 at rated range input)
Input impedance	Voltage: Input resistance : Approx. 2 M Ohm Input capacitance: Approx. 10 pF
	Current: - Direct input: 5 A input element: approx. 100 m Ohm + approx. 0.19 uH - External current sensor input: approx. 1 M Ohm + approx. 17 pF (760812)
Instantaneous maximum allowable input (less than 20 ms)	Voltage: peak value of 2.2 kV or 1.5 kVrms, whichever is less.
	Current: - Direct input (5 A input element): peak value of 30 A or rms value of 15 A, whichever is less - External current sensor input (760812): peak value less than or equal to 10 times the range (1 M Ohm)
Instantaneous maximum allowable input (less than 1 s) Instantaneous	Current: - Direct input (5 A input element): peak value of 8.5 A or rms value of 6 A, whichever is less. - External current sensor input (760812): peak value less than or equal to 10 times the range (1 M Ohm)
Continuous maximum allowable input	Voltage: peak value of 2 kV or 1.1 kVrms, whichever is less. If input frequency is higher than 100 kHz: less than (1100 – f) Vrms, f is the frequency in kHz However, continuous maximum allowable input voltage is bigger than 3 Vrms.
	Current: - Direct input (5 A input element): peak value of 8.5 A or rms value of 6 A, whichever is less. - External current sensor input (760812): peak value less than or equal to 4 times the range (1 M Ohm)
Continuous maximum common mode voltage	Maximum allowable voltage that can be measured Voltage input terminals: 1000 Vrms Current input terminals: 1000 Vrms Rated voltage of EN61010-2-030 standard: 600 Vrms External current sensor input connector: 600 Vrms
Safety Note:	Do not touch the inside of the BNC connector of the External Current Sensor input for safety reasons. Current Module (760813) 1000 V CAT II: Rated voltage of EN61010-2-030
Rated voltage to ground	Maximum allowable voltage that can be measured Voltage input terminals: 1000 V Current input terminals: 1000 V Rated voltage of EN61010-2-030 standard: 600 V External current sensor input connector: 600 V
Safety Note:	Do not touch the inside of the BNC connector of the External Current Sensor input for safety reasons.
CMRR (Influence from common mode voltage)	When 1000 Vrms is applied between the input terminal and case with the voltage input terminals shorted, the current input terminals open, and the external current sensor input terminals shorted. • 50/60 Hz: ±(0.01% of range + 5 mV) or less. • Reference value for up to 100 kHz: ±{(maximum rated range)/(rated range) × 0.001 × f + 0.001 × f)% of range + 5 mV} or less 0.01% or greater. The unit of f is kHz. The maximum rated range in the equation is 1000 V.
	When 1000 Vrms is applied between the input terminal and case with the current input terminals open, and the external current sensor input terminals shorted. • 50/60 Hz: Direct input ±(0.01% of range + 10 uA) or less. Sensor input ±(0.01% of range + 25 uV) or less (760812) • Reference value for up to 100 kHz: ±{(maximum rated range)/(rated range) × 0.002 × f × 2^ (0.5 + f/1000)% + 0.002 × f of range + 10 uA} or less For external current sensor input, add maximum rated range/rated range × {0.003 × f × 2^ (0.5 + f/5000) + 0.003 × f of range + 25 uV} to the value above. 0.01% or greater. The unit of f is kHz. The maximum rated range in the equation is 5 A, or 10 V.
Line filter	Select from OFF, 500 Hz, 2 kHz, 20 kHz, and 1 MHz.
Frequency filter	Select from OFF, 100 Hz, 500 Hz, 2 kHz and 20 kHz.
A/D converter	Resolution: 12 bit Conversion ratio (sampling period): Approx. 10 ns. For harmonic measurement, please refer to harmonic function.
Max. sample rate	100 MS/s
Range change	You can set it each module individually.
Auto ranging function	Range up - When input rms level is more than 110% of the range or the peak is more than 200%.
	Range down - When input rms level is lower than 30% of the range rating and peak is less than below range 180% of the range rating of the lower range.

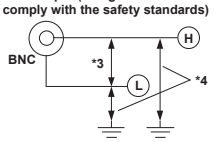
Auxiliary (AUX) module (760851) Specification

Item	Specification
Effective measurement range	20 div Two times of measurement range
Number of input channels	2, switchable analog or pulse input
Input coupling	AC, DC, or GND
Input connector	Isolated BNC
Input format	Isolated unbalanced
Frequency characteristics	DC to 20 MHz (–3 dB point when sine wave of amplitude ±3 div is applied)
Voltage-axis sensitivity setting	50 mV to 100 V (1-2.5-5 steps) (when using 1:1 probe attenuation)
Input impedance	1 M Ohm, ±1% Approx. 35 pF
–3 dB point when AC coupled low frequency attenuation point	10 Hz or less (1 Hz or less when using the 700929, 0.1 Hz or less when using the 701947)
Maximum input voltage	Combined with the 700929 (10:1) or 701947 (100:1):*1 1000 V (DC+ACpeak) CAT II Direct input or cable not complying with the safety standard:*3 200 V (DC+ACpeak)
Maximum allowable common mode voltage	Working voltage of safety standard Combined with the 700929 (10:1) or 701947 (100:1):*2 1000 Vrms (CAT II) Direct input or cable not complying with the safety standard:*4 42 V (DC+ACpeak) (0 and CAT II, 30 Vrms)
Influence of common mode voltage (CMRR)	–80 dB at 50/60 Hz (with input terminal shorten and 1000 Vrms (50/60 Hz) applies between input and case)
Bandwidth limit	Select from Full, 2 MHz, 1.28 MHz, 640 kHz, 320 kHz, 160 kHz, 80 kHz, 40 kHz, 20 kHz, and 10 kHz Cut-off characteristics: –18 dB/OCT (when 2 MHz, Typical)
Probe attenuation setting	Voltage probe: 1:1, 10:1, 100:1, 1000:1
Auto ranging function	Range up When one of following conditions is satisfied, range is changed to higher - DC input level is more than 110% of selected range rating - Input peak level is more than 200% of selected range rating (when motor mode is OFF) - Input peak level is more than 145% of selected range rating (when motor mode is ON) Range down When following all conditions are satisfied, range is changed to lower - DC input level is less than 30% of selected range rating - Input peak level is less than 180% of less range rating (when motor mode is OFF) - Input peak level is less than 140% of less range rating (when motor mode is ON)
A/D conversion resolution	12 bit
Withstand voltage	1500 Vrms for 1 minute (across each terminal and earth) (60 Hz)
Insulation resistance	500 VDC, 10 M Ohm or more (across each input terminal and earth)
Accuracy (analog)	DC: ±1% of range (typical) Measured under the standard operating conditions. See page. 5, Accuracy
Temperature coefficient (analog)	±(0.1 of range/°C) (typical)
Amplitude Input range (analog)	±110% of range rated
Amplitude input range (pulse)	±5 Vpeak
Frequency measurement range (pulse)	2 Hz to 1 MHz
Judged input amplitude (pulse)	H level: –9.9 V to +10.0 V, L level: –10.0 V to +9.9 V
Input waveform (pulse)	50% duty cycle square wave
Pulse width (pulse)	500 ns or wider
Accuracy (pulse)	±(0.05% of reading) ±1 count error (10 ns), Except, the observation time is greater than or equal to 300 times the period of the pulse.

In combination with the 700929/701947



Direct input (using a cable that does not comply with the safety standards)



Withstand voltage: 1500 Vrms (1 minute)
Allowable transient surge voltage (between the input terminals and earth): ±2100 Vpeak

Trigger Function

Item	Specification
Trigger mode	Auto, Auto Level, Normal, Single, N Single, or On Start
Selectable trigger level range	±5 div of center 0 div; when trigger source is set to voltage, current or power of a power measurement element. ±10 div of center 0 div; when trigger source is set to AUX module voltage input.
Trigger hysteresis	Select from ±0.1 div, ±0.5 div, ±1 div
Selectable trigger position range	0 to 100% (of the display record length; resolution: 0.1%)
Selectable trigger delay range	0 to 10 s (resolution: 10 ns)
Selectable hold-off time range	0 to 10 s (resolution: 10 ns)
Manual trigger key	A dedicated manual trigger key can be used.

Simple Trigger

Trigger source	Un, In, Pn, AUXn, EXT, or Time n=channel number (not when pulse input is selected)
Trigger slope	Rising, falling or rising or falling
Time Trigger	Date (year, month, and day), time (hour and minute), and time interval (10 seconds to 24 hours)

Specifications of PX8000, 760811, 760812, 760813 and 760851

Enhanced trigger

Trigger source	Un, In, Pn, AUXn or EXT (not when pulse input is selected)	
Trigger type	A → B(N):	After the trigger A conditions are met, the PX8000 triggers when the trigger B conditions are met N times. Count: 1 to 1000 Condition A: Enter/Exit Condition B: Enter/Exit
	A Delay B:	After the specified amount of time elapses after the trigger A conditions are met, the PX8000 triggers when the trigger B conditions are first met. Time: 0 to 10 s (resolution: 10 ns) Condition A: Enter/Exit Condition B: Enter/Exit
	Edge on A:	While the trigger A conditions are met, the period triggers on the OR of multiple trigger source edges.
	AND:	The PX8000 triggers on the AND of multiple state conditions.
	OR:	The PX8000 triggers on the OR of multiple trigger source edges or states (or Window triggers)
	Pulse Width: B<Time:	The PX8000 triggers when the time from when the trigger B conditions are met to when they change from being met to not being met is greater than the specified time. Time: 20 ns to 10 s (resolution: 10 ns)
	B>Time:	The PX8000 triggers when the time from when the trigger B conditions are met to when they change from being met to not being met is less than the specified time. Time: 20 ns to 10 s (resolution: 10 ns)
	B Time Out:	The PX8000 triggers when the trigger B conditions continue to be met for the specified period of time. Time: 20 ns to 10 s (resolution: 10 ns)
	B Between:	The PX8000 triggers when the period during which the trigger B conditions continue to be met is within the specified time range. Time: T1: 10 ns to 9.99999999 s T2: 20 ns to 10 s (resolution: 10 ns)
	Period:	The PX8000 triggers when the period during which the trigger B conditions continue to be met is within the specified time range.
	T>Time:	The PX8000 triggers when the period of the trigger T conditions is longer than the specified time. Time: 20 ns to 10 s (resolution: 10 ns)
	T<Time:	The PX8000 triggers when the period of the trigger T conditions is shorter than the specified time. Time: 20 ns to 10 s (resolution: 10 ns)
	T1<T<T2:	The PX8000 triggers when the period of the trigger T conditions is within the specified time range. Time T1; 20 ns to 10 s (resolution: 10 ns) T2; 30 ns to 10 s (resolution: 10 ns)
	T<T1, T<T2:	The PX8000 triggers when the period of the trigger T conditions is within the specified time range. Time T1; 20 ns to 10 s (resolution: 10 ns) T2; 30 ns to 10 s (resolution: 10 ns)
	Wave Window:	The PX8000 triggers when the period of the trigger T conditions is within the specified time range.

- The trigger A and B conditions can be set to High, Low, or Don't Care for each channel. The AND of the conditions (the parallel pattern) is used to determine the result.
- For OR and AND, the condition can be set to High, Low, IN, OUT, or Don't Care for each channel.

Time Base

Item	Specification
Time axis setting "Time/div"	Time/div setting: 100 ns/div to 1 s/div (1-2-5 step), 2 s/div, 3 s/div, 4 s/div, 5 s/div, 6 s/div, 8 s/div, 10 s/div, 20 s/div, 30 s/div, 1 min/div and 2 min/div
Accuracy of time scale	±0.005%
External Clock	Connector style BNC Input level TTL level Effective edge Rising edge Frequency bandwidth Max. 9.5MHz, Mimi. pulse width Longer than 50 ns for both High/Low level

Display

Item	Specification
Display	10.4 inch TFT LCD display
Number of dots	1024 × 768 XGA
Waveform displaying dot size	801 × 656 (Waveform Display)
Displaying format	Combination: Max. 2 types of format can be displayed Numeric 4 items/ 8 items/ 16 items/Matrix/All/Single List/Dual List/ Custom Wave 1/2/3/4/6/8/12/16 Bar Single/Dual/Triad Vector Single/Dual ZOOM1 and ZOOM2 (divided lower display area) FFT1 and FFT2 (divided lower display area) XY1 and XY2 (divided lower display area)
Display update	Depends on setting of observation time and record length

* Relative to the total number of pixels, 0.002% of the LCD screen may be defective.

Numerical Display

Max. digit of numeric display	Selected full 5 digits (displaying 99999), or 6 digits (999999)
Number of displayed items	Select from 4, 8, 16, Matrix, All, Single List, Dual List, and Custom

Waveform Display

Displaying items	Maximum 16 waveforms Voltage, current and power of Element 1 Voltage, current and power of Element 2 (or AUX3 and AUX4 of Element 2) Voltage, current and power of Element 3 (or AUX5 and AUX6 of Element 3) Voltage, current and power of Element 4 (or AUX7 and AUX8 of Element 4) MATH 1 to MATH 8

Vector Bar Graph Display (option)

Vector display	Display the phase angle between the fundamental voltage signal and fundamental current signal as a vector
Bar graph display	Display a bar graph of the amplitude of each harmonics when it is harmonic measurement.

Zoom Display

Zoom	Expand the displayed waveform along with the time axis (up to 2 separate locations). The zoom position can be automatically scrolled.

FFT Display

FFT	Power spectrum of input waveform, Max. two windows

X-Y display

X-Y Display	The X and Y axes can be selected from Un/In/Pn/AUXn, MATHn, (Max. four traces, two windows).

Functionalities
Measurement Function and Conditions

Crest Factor	Up to 200 (effective minimum input). Up to 2 (at the rated range input) CfU: Voltage crest factor, CfI: Current crest factor
Measurement period	Measurement period to calculate numerical values - Period of measurement update cycle based on zero crossing or external gate signal source signal - 8192 points for harmonic measurement from specified start cursor
Wiring method	1P2W (Single phase 2 wire), 1P3W (Single phase 3 wire), 3P3W (3 phase 3 wire), 3V3A (3 phase 3 wire, 3 power meter method), 3P4W (3 phase 4 wire) It depends on the quantify and type of the installed modules.
Scaling	0.0001 to 99999.9999 can be set for scaling of VT ratio, CT ratio and power ratio when external current sensor, VT or CT are used for the input Linear scaling function is available for AUX module (760851).
Averaging of numeric value	Normal measurement items, Using one of the following methods perform averaging on the normal measurement items; - Urms, Umn, Udc, Urmn, Uac, Irms, Imn, Idc, Irmn, Iac, P, S, Q - Power factor Lambda, Phase angle Phi, Crest Factor CfU/CfI, Corrected Power Pc, Efficiency Eta 1to Eta 4 are determined from the averaged Urms, Irms, P, S, and Q - Select either exponential averages or moving averages - Exponential average: Select the attenuation constant from a value between 2 to 64 (Harmonic measurement items, U (k), I (k), P (k), S (k), and Q (k) Power factor Lambda(k), Phase angle Phi(k) are determined from the averaged P (k) and Q (k)). - Moving average: Select the average count from a value between 8 and 64 - Parameters of Z, Rs, Xs, Rp, Xp, Uhdf, Ihdf, Phdf, Uthd, Ithd, Pthd, Uthf, Ithf, Utif, Itif, hvf, hcf, and K-factor are determined from the averaged U (k), I (k), and P (k) - Only Exponential averaging is available for harmonic measurement items Select the attenuation constant from a value between 2 to 64.
Zero level compensation /Null	Zero level can be compensated individually by module Following range can be compensated. Power element: Voltage/Current ±14% of range AUX module: Analog input ±60% of range: Pulse input

Frequency measurement

Item	Specification
Measurement Item	Normal measurement item; Voltage or current frequencies of all power measurement elements can be measured
Measurement method	Reciprocal method
Measurement range	10 Hz to 5 MHz, input amplitude is more than 30% of range
Max. frequency	5.0000 MHz
Accuracy	±(0.1% of reading) Conditions; - Time/div setting is more than 50 us - At least 5 cycles input should be measured. - "Sampling frequency setting/input frequency" is more than 2.5 - 20 kHz frequency filer should be ON when input frequency is lower than 20 kHz. - 2 kHz frequency filer should be ON when input frequency is lower than 2 kHz. - 500 Hz frequency filer should be ON when input frequency is lower than 500 Hz. - 100 Hz frequency filer should be ON when input frequency is lower than 100 Hz.
Number of displayed digits	Full 5 digits (99999)
Frequency Measurement filter	Select of OFF/100 Hz/500 Hz/2 kHz/20 kHz

Harmonics measurement

Item	Specification
Measurement items	All installed Power measurement elements
Method	PLL synchronization method (not available for external sampling clock function)
Frequency range	The range for the fundamental frequency of the PLL source is 20 Hz to 6.4 kHz, and sampling frequency is more than 2 MS/s. Time/div is longer than 2 msec/div and Acquisition Time Base is set to "Int".
PLL source	The range of the fundamental frequency of the PLL source is 20 Hz to 409.6 kHz, or 20 Hz to 6.4 kHz when the PLL source is EXT TRIG IN input. Sampling frequency is higher than 2 MS/s. Time/div is longer than 100 µ sec/div and Acquisition Time Base is set to "Int".
FFT data length	8192, the analysis (calculation) start point can be set freely in the acquisition memory data. The length of the acquisition data must be twice that of the window.
Window function	Rectangular
Anti-aliasing filter	Set as Line filter

FFT Sample rate, window width and upper limits of harmonic analysis

Fundamental freq.	FFT Sample rate	Window width	Upper limit of harmonics
20 Hz ≤ f ≤ 600 Hz	f × 1024	8 cycles	500 order
600 Hz < f ≤ 1200 Hz	f × 512	16 cycles	255 order
1200 Hz < f ≤ 2600 Hz	f × 256	32 cycles	100 order
2600 Hz < f ≤ 6400 Hz	f × 128	64 cycles	50 order
6.4 kHz < f ≤ 409.6 kHz	f × 64	128 cycles	30 order

When PLL source is EXT TRIG IN, fundamental frequency should be lower than 6.4 kHz.

Specifications of PX8000, 760811, 760812, 760813 and 760851

Minimum sample rate	Fundamental frequency / Minimum Sample rate 20 Hz ≤ f ≤ 6.4 kHz / 2 MS/S 6.4 kHz < f ≤ 12.8 kHz / 5 MS/S 12.8 kHz < f ≤ 25.6 kHz / 5 MS/S 25.6 kHz < f ≤ 51.2 kHz / 10 MS/S 51.2 kHz < f ≤ 102.4 kHz / 20 MS/S 102.4 kHz < f ≤ 204.8 kHz / 50 MS/S 204.8 kHz < f ≤ 409.6 kHz / 100 MS/S When PLL source is EXT TRIG IN fundamental frequency should be lower than 6.4 kHz.
Harmonic Accuracy	Conditions; PLL source signal is sine wave and DC component is stable PF=1. Accuracy range of voltage/current and frequency is same as normal measurement Accuracy range. Line filter OFF Add below expression/value to normal measurement accuracy Voltage & current: (0.001 × f + 0.001 × n)% of reading + 0.1% of range Power: (0.002 × f + 0.002 × n)% of reading + 0.2% of range n: order, f: frequency of the n-th order When it is voltage input, following values are added. When voltage range is set to 1.5 V to 10 V Voltage: 1.5 mV Power: (1.5 mV/voltage rated range) × 100% of range When voltage range is set to 15V to 100 V Voltage: 15 mV Power: (15 mV/voltage rated range) × 100% of range When it is direct current input, following values are added. Current: 50 uA Power: (50 uA/sensor current rated range) × 100% of range When sensor current range is set to 50 mV to 500 mV, following values are added. Current: 100 uV Power: (100 uV/sensor current rated range) × 100% of range When input frequency is over 100kHz, following values are added. Voltage & current : 0.3% of reading Power: 0.6% of reading When input is n-th component input, add ({n/(m + 1)}/50)% of (the n-th order reading) to the n + m th order and n-m th order of the voltage and current. And add ({n/(m + 1)}/25)% of (the n-th order reading) to the n + m th order and n – m th order of the power. When the frequency of the PLL source is less than 40 Hz, for n – th order component input, add following values. Voltage & current: (0.003 × n)% of reading Power: (0,006 × n)% of reading When Line filter is ON, add influence of Line filter to accuracy of Line filter OFF. Power accuracy of over 6.5 kHz is designed Values.

Waveform data acquisition and display

Item	Specification
Acquisition mode	Normal: Normal waveform data acquisition Envelop: The peak values are held at the maximum sample rate regardless of the Time/div setting. Averaging: The number of times to average can be set to 2 to 65536 in 2^n steps.
Record length	Selection of 100 kpoint/250 kpoint/500 kpoint/1 Mpoint/2.5 Mpoint/5 Mpoint/10 Mpoint/25 Mpoint (when /M1 or /M2 installed)/50 Mpoint (when /M1 or /M2 installed)/100 Mpoint (when /M2 installed)
Zoom	Expand the displayed waveform along time axis (up to 2 separate locations). The zoom position can be automatically scrolled.
Display format	1/2/3/4/6/8/12, and 16 analog waveform windows
Display interpolation	Sampled points can be displayed through the use of dots (OFF), sine interpolation, linear interpolation or pulse interpolation.
Graticule	Select of three types of graficule
Auxiliary display ON/OFF	Scale values, waveform labels, the extra window, the level indicator, and the numeric display can be turned ON and OFF.
X-Y Display	The X and Y axes can be selected from Un/In/Pn/AUXn, MATHn (Max. four traces, two windows).
Snapshot	The currently displayed waveforms can be retained on the screen. The Snapshot waveforms can be saved and loaded.
Clear trace	The displayed waveform can be cleared.
History	Maximum 1000 waveforms, depending on record length Arbitrary one waveform, all waveform or averaged waveform can be displayed.

Vertical and Horizontal Control

Item	Specification
Channel ON/OFF	Un, In, Pn, AUXn or MATHn can be turned ON and OFF separately
ALL CH menu	The setting of the all channels while waveforms are displayed. A USB keyboard or mouse
Vertical axis zooming	× 0.1 to × 100 Upper and lower limits can be used to set the scale.
Vertical position setting	Waveform can be moved in the range of ±5 divs from the center of the waveform display frame.
Scaling	0.0001 to 99999.9999 can be set for scaling of VT ratio, CT ratio and power ratio when external current sensor, VT or CT are used for the input.
Linear scaling	The linear scaling mode can be set separately for each channels (CHn). It can be set to AX+B or P1-P2 for AUX modules. Only when motor measurement is off for an AUX module.
Roll Mode	Roll mode is enabled automatically when the trigger mode is set to Auto, Auto Level, Single, or On Start, and the time axis setting is greater than or equal to 100 ms/div.

Analysis Functions

Item	Specification
Power parameters calculation	Calculate Voltage, Current. Power, Delta parameters, frequency and AUX values from captured waveforms Apparent power, reactive power and power factor and those Sigma values are calculated from the Voltage, Current and Power values
Zooming and Searching	Can search for and then expand and display a portion of the displayed waveform Can choose from the following search methods Edge: Searches for rising or falling edges Time: Searches for data and time
History search feature	Can search through history waveforms for specified conditions Zone search: Displays waveforms that pass through or do not pass through a specified area on the screen. Parameters search: Displays a waveform when the result of the automated measurement of its parameters meet the specified conditions
Cursor measurement	Horizontal, Vertical, H&V, Degree (only T-Y waveform display), and Marker.
Cursor measurement (Harmonic measurement)	Re-calculate harmonic parameters using 8192 points data from point of start cursor according to the input frequency
Automated measurement of waveform parameters	Automated measurement of waveform parameters Up to 24 items can be displayed P-P, Amp, Max, Min, High, Low, Avg, Mid, Rms, Sdev, +OvrShoot, –OvrShoot, Rise, Fall, Freq, Period, +Width, –Width, Duty, Pulse, Burst1, Burst2, AvgFreq, AvgPeriod, Int1TY, Int2TY, Int1XY, Int2XY, Int1hXY (IntegPower/IntegCurrent) Int2hXY (IntegPower/IntegCurrent)
Statistical processing	Application items: Automated measurement values of waveform parameters Statistical items: Max, Min, Avg, Sdv, and Cnt Maximum number of cycles: 64000 cycles (when the number of parameters is 1) Maximum total number of parameters: 64000 Maximum measurement range: 100 M points
Normal statistical processing	Statistical processing is performed while waveforms are acquired.
Cyclic statistical processing	Automatically measures the waveform parameters of the data in the acquisition memory and performs statistical processing on the parameters once per cycle period.
Statistical processing of the history data	Automatically measures the waveform parameters of each history waveform and performs statistical processing on the parameters.
User defined computation (MATH)	Max. 8 expressions for waveforms MATH1 to MATH8, Max. 4 M points of total, Regarding Digital filter function, please refer to waveform calculation (digital filter) Expressions can be created through the combination of the following operations and constants for waveforms. +, –, *, /, SHIFT, ABS, SQRT, LOG, EXP, NEG, SIN, COS, TAN, ATAN, PH, DIF, DDIF, INTG, IINTG, BIN, SQR, CUBE, F1, F2, FV, PWHH, PWHL, PWLH, PWLL, PWXX, DUTYH, DUTYL, FILT1, FILT2, HLBT, MEAN, LS-, PS-, PSD-, CS-, TF-, CH-, MAG, LOGMAG, PHASE, REAL, IMAG, TREND, TRENDM, TRENDD, TRENDF, _HH, _LL, _XX and ZC
User defined computation (numeric)	Expressions can be created through the combination of the following operations for numeric values, Max. 20 expressions, F1 to F20. +, –, *, /, ABS, SQRT, SQR, LOG, LOG10, EXP and NEG
Efficiency equation	Up to 4 efficiencies can be displayed by setting the items to measure with the efficiency equations
De-skew function	Compensate the phase difference between voltage and current modules of a power measurement element
GO/NO-GO determination	The following two types of GO/NO-GO determination are available - Determination using zones on the screen - Determination using the automated measurement values of waveform parameters The following operations can be performed at the time of determination: Output of screen, WDF binary capture data, saving of waveform data (to binary, ASCII, or floating-point), or sounding of a notification buzzer.
Recalculation of numeric parameters	Recalculation of numeric parameters can be done after changing the calculation condition

File Functions

Item	Specification
Save	Setup data, Waveform data (including History data), numeric data and image data can be saved external media
Read	Waveform data (including History data up to 1000 waveform) and setup data

FFT Function

Item	Specification
Waveform to be computed	Un, In, Pn, AUXn and MATHn
Number of channels	2
Computation range	From the specified computation start point until the specified number of points have been computed.
Computed points	1 k, 2 k, 5 k, 10 k, 20 k, 50 k, or 100 k
Time windows	Rectargular, Hanning, Hamming, Flat top, or Exponential When the Exponential time window is selected, the following settings must be configured. Damping rate: 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% Selectable range: 1 to 100% Resolution: 1% Force1: 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%. Selectable range: 1 to 100% Resolution: 1% Force2: The setting applies to the output (response) signal (second parameter) of a two-waveform FFT Selectable range: 1 to 100% Resolution: 1%
Displaying window	The FFT computation results are displayed in a separate window independent from the normal waveform display. Display range: Set the display range by setting Center and Sensitivity

Built-in Printer (/B5 Option)

Item	Specification
Print system	Thermal line dot system
Dot density	8 dot/mm
Sheet width	112 mm
Effective print width	104 mm (832 dots)
Used for	Producing a hard copy of the screen

Storage Functions
SD Card

Item	Specification
Number of slot	1
Max. capacity	16 GB
Supported cards	SD and SDHC compliant memory card
Compatible USB storage devices	Mass storage devices that are compliant with USB Mass Storage Class Ver. 1.1 Maximum capacity: 2 TB, Format of partition: MBR, File format: FAT32/FAT16

USB Peripheral Interface

Item	Specification
Number of ports	2

Connector type	USB type A (receptacle)
Electrical and mechanical specifications	USB Rev. 2.0 compliant
Supported transfer mode	HS (High Speed, 480 Mbps), FS Full Speed, 12 Mbps), and LS Low Speed, 1.5 Mbps)
Power supply	5 V, 500 mA for each port

Input/Output
EXT TRIG IN

Item	Specification
Connector type	BNC
Input level	TTL
Minimum pulse width	100 ns
Detected edge	Rising or falling
Trigger delay time	Within 100 ns + 1 sample

EXT TRG OUT

Item	Specification
Connector type	BNC
Output level	5 V CMOS
Logic	Low when a trigger occurs and high after acquisition is completed.
Trigger delay time	Within 100 ns + 1 sample
Output hold time	100 ns or more

EXT CLK IN

Item	Specification
Connector type	BNC
Input level	TTL
Minimum pulse width	50 ns
Detected edge	Rising
Sampling jitter	Within 100 ns + 1 sample
Frequency range	Max. 9.5 MHz

Video Output

Connector type	D-Sub 15 pin receptacle
Output format	Analog RGB
Output resolution	XGA-compliant output 1024x768 dots Approx. 60 Hz Vsync (dot clock frequency: 66 MHz)

GO/NO-GO Determination I/O

Connector type	RJ-11 modular jack
Input level	TTL or contact
Output level	5 V CMOS

External Start/Stop Input

Connector type	RJ-11 modular jack
Input level	TTL or contact

Comp Output

Output signal frequency	1 kHz ±1%
Output amplitude	1 Vp-p ±10%

Probe Power Output (/P4 Option)

Number of output terminals	4
Output voltage	±12 Vdc
Output current	Total max. of 1 A

Sensor Power Output (/PD option)

Number of output terminals	4
Output voltage	±15 V
Output current	Max. of 1 A/CH

Time Sync Signal Input (IRIG: /C20 option)

Input connector	BNC
Number of input connectors	1
Supported IRIG signals	A002, B002, A132 and B122
Input impedance	Can be switched between 50 Ohm and 5 k Ohm.
Maximum input voltage	±8 V
Used for	Synchronizing the PX8000 time Synchronizing the sample clock
Clock sync range	±80 ppm
Post-sync accuracy	No drift from the input signal

Safety terminal adapter (Voltage/Current)

Allowable maximum current	36 A
Withstand voltage	1000 V CAT III
Contact resistance	Less than 10 m Ohm
Material of contact	Brass and bronze with Nickel surface coat
Insulator	Polyamide (Voltage), polypropylene (Current)
Diameter of wire	Max. 1.8 mm (Voltage), 2.5 mm (Current)
thickness of covering	Max. 3.9 mm (Voltage), 4.0 mm (Current)

GP-IB

Usable devices	National Instruments Corporation PCI-GPIB or PCI-GPIB+ PCIe-GPIB or PCIe-GPIB+ PCMCIA-GPIB or PCMCIA-GPIB+ GPIB-USB-HS Use driver NI-488.2M Ver. 1.60 or later
Connector type	24-pin connector
Electrical specification	Complies with IEEE St'd 488-1978 (JIS C 1901-1987)
Functional specification	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, and C0
Protocol	IEEE St'd 488.2-1992
Code	ISO (ASCII)
Mode	Addressable mode
Address	Talker and listener addresses can be specified from 0 to 30.
Remote mode release	Remote mode can be cleared with the SHIFT + CLEAR TRACE key (except during Local Lockout).

Ethernet

Ports	1
Connector type	RJ-45 modular jack
Electrical and mechanical specifications	IEEE802.3
Transmission system	Ethernet (1000BASE-T, 100BASE-TX or 10BASE-T)
Communication protocols	TCP/IP
Supported services	DHCP, DNS, SNTP, FTP server and client, and VXI-11

USB

Number of ports	1
Connector type	USB type B receptacle
Electrical and mechanical specifications	USB Rev. 2.0 compliant
Supported transfer modes	HS (High Speed, 480 Mbps) and FS (Full Speed, 12 Mbps)
Supported protocols	USBTMC-USB488 (USB Test and Measurement Class Ver. 1.0)
PC system requirements	A PC with a USB port, running the English or Japanese version of Windows7 (32 bit), Windows Vista (32 bit)

Display Items
Numerical Values

Normal	Measurement functions for each channel (Power measurement element)
Voltage (V)	Urms: true rms value, Umn: rectified mean value calibrated rms value, Udc: simple average value, Urmn; rectified mean value, Uac: AC component
Current (A)	Irms: true rms value, Imn: rectified mean value calibrated rms value, Idc: simple average value, Irmn; rectified mean value, Iac: AC component
Active Power (W)	P
Apparent Power (VA)	S: selectable of Urms × Irms, Umn × Imn, Udc × Idc, Urmn × Irmn or Umn × Irms
Reactive Power (Var)	Q
Power Factor	Lambda (P/S)
Phase Angle (deg)	Phi ($\cos^{-1}$ P/S)
Frequency (Hz)*1	fU: Voltage frequency fI: Current frequency (when it is lower frequency of the range, customer can select Error or 0 for the data)
Voltage Peak value of ±(V)	U+pk: Voltage max. +peak value during one update period U-pk: Voltage max. –peak value during one update period
Current Peak value of ±(A)	I+pk: Current max. +peak value during one update period I-pk: Current max. –peak value during one update period
Instant Power Peak value of ±(W)	P+pk: Instant Power max. +peak value during one update period P-pk: Instant Power max. –peak value during one update period
Crest Factor	CfU: Voltage crest factor, CfI: Current crest factor
Corrected Power (W)	Pc: IEC76-1 (1976), IEEE C57.12.90-1993, or IEC76-1 (1993)

*1 Not available for External Clock input

Sigma Items

Item	Symbol and meaning
Normal	Sigma Measurement functions for both A and B wiring systems (power element combination)
Voltage (V)	UrmsSigima: true rms value, UmnSigma: rectified mean value calibrated rms value, UdcSigma: simple average value, UrmnSigma; rectified mean value, UacSigma: AC component
Current (A)	IrmsSigma: true rms value, ImnSigma: rectified mean value calibrated rms value, IdcSigma: simple average value, IrmnSigma; rectified mean value, IacSigma: AC component
Active Power (W)	PSigma
Apparent Power (VA)	SSigma (depends on Type, 1, 2 or 3)
Reactive Power (Var)	QSigma (depends on Type, 1, 2 or 3)
Power Factor	LambdaSigma
Phase Angle (deg)	PhiSigma
Corrected Power (W)	PcSigma: IEC76-1 (1976), IEEE C57.12.90-1993, or IEC76-1(1993)
Efficiency 1 to 4	Eta 1 to Eta 4 by setting of user

Harmonic analysis function (/G5 Option)

Item	Symbol and meaning
Harmonics	Measuring functions of Harmonic analysis
Voltage (V)	U (k): k-th order*1 voltage true rms value, U: total*2 voltage true rms value
Current (A)	I (k): k-th order current true rms value, I: total current true rms value When k=0, it shows DC component
Active Power (W)	P (k): k-th order active power value, P: total active power value When k=0, it shows DC component
Apparent Power (VA)	S (k): k-th order apparent power value, S: total apparent power value When k=0, it shows DC component
Reactive Power (Var)	Q (k): k-th order reactive power value, Q: total reactive power value When k=0, it shows 0
Power Factor	Lambda(k): k-th order power factor value, Lambda: total power factor value
Phase Angle (deg)	Phi (k): Phase angle between k-th order voltage and current, Phi: Phase angle of current refers to voltage waveform PhiU (k): Phase angle of k-th order voltage refers to the fundamental voltage U (1) PhiI (k): Phase angle of k-th order current refers to the fundamental current I (1)
Impedance of load circuit (Ohm)	Z(k): Impedance of load circuit of th k-th order harmonic waveform

Resistance and reactance of load circuit (Ohm)	Rs (k): Resistance of load circuit of k-th order harmonic waveform when resistor R, inductor L and capacitor C are connected in series Xs (k): Reactance of load circuit of k-th order harmonic waveform when resistor R, inductor L and capacitor C are connected in series Rp (k): Resistance of load circuit of k-th order harmonic waveform when resistor R, inductor L and capacitor C are connected in parallel Xp (k): Reactance of load circuit of k-th order harmonic waveform when resistor R, inductor L and capacitor C are connected in parallel
Harmonic distortion factor [%]	Uhdf (k): Ratio of k-th order voltage value of the voltage value, U (1) or U Ihdf (k): Ratio of k-th order current value of the current value, I (1) or I Phdf (k): Ratio of k-th order power value of the power value, P (1) or P
Total harmonic distortion [%]	Uthd: Ratio of the total harmonic voltage*3 of the voltage value, U (1) or U Ithd: Ratio of the total harmonic current of the current value, I (1) or I Pthd: Ratio of the total harmonic power of the power value, P (1) or P
Telephone harmonic factor*4 (IEC34-1 (1996))	Uthf: Telephone harmonic factor of voltage, Ithf: Telephone harmonic factor of current
Telephone influence factor*4 (IEEE Std 100 (1996))	Utif: Telephone influence factor of voltage, Itif: Telephone influence factor of current
Harmonic voltage factor*4 (IEC34-1 (1996))	hvf: Harmonic voltage factor
Harmonic current factor*4 (similar method of hvf)	hcf: Harmonic current factor
Frequency of PLL source	fU or fI, frequency of PLL source, voltage (fU) or current (fI) Shows [-------] when the PLL source is not set.
K-factor	K-factor

*1 Harmonic order k is the an integer from 0 to the upper limit of harmonic analysis. The 0-th order is the DC component. The upper limit is determined automatically according to the PLL source frequency. It can go up to the 500th harmonic order.
*2 The total value is determined from the fundamental waveform (1st order) and all harmonic components (2nd order to the upper limit of harmonics analysis). The DC component can also be included.
*3 Total harmonic values are determined from all harmonic components (the 2nd order to the upper limit of harmonic analysis)
*4 The expression may vary depending on the definitions in the standard IEC or IEEE. Please refer to the Function sheet.

Sigma Items

Item	Symbol and the meaning
Harmonic	Sigma Measurement functions for both A and B wiring systems (power element combination)
Voltage (V)	USigma (k): k is 1, fundamental voltage true rms value, or k is total, total voltage true rms value
Current (A)	ISigma (k): k is 1, fundamental current true rms value, or k is total, total current true rms value
Active Power (W)	PSigma (k): k is 1, fundamental active power value, or k is total, total active power value
Apparent Power (VA)	SSigma (k): k is 1, fundamental apparent power value, or k is total apparent power value
Reactive Power (Var)	QSigma (k): k is 1, fundamental reactive power value, or k is total, total reactive power value
Power Factor	LambdaSigma (k): k is 1, fundamental power factor value, or k is total, total power factor value

* The total value is determined from the fundamental waveform (1st order) and all harmonic components (2nd order to the upper limit of harmonics analysis). The DC component can also be included. As for Sigma values, only Total values and fundamental value are calculated.

Phase items

Item	Symbol and the meaning
Harmonic	Measurement functions of phase angles among power elements
Phase angle U1-U 2 (deg)	PhiU1-U2: Phase angle of power element 2 fundamental voltage (U2 (1)) refers to the power element 1 fundamental voltage (U1 (1))
Phase angle U1-U3 (deg)	PhiU1-U3: Phase angle of power element 3 fundamental voltage (U3 (1)) refers to the power element 1 fundamental voltage (U1 (1))
Phase angle U1-I1 (deg)	PhiU1-I1: Phase angle of power element 1 fundamental current (I1 (1)) refers to the power element 1 fundamental voltage (U1 (1))
Phase angle U2-I2 (deg)	PhiU2-I2: Phase angle of power element 2 fundamental current (I2 (1)) refers to the power element 2 fundamental voltage (U2 (1))
Phase angle U3-I3 (deg)	PhiU3-I3: Phase angle of power element 3 fundamental current (I3(1)) refers to the power element 3 fundamental voltage (U3(1))
Phase angle I1-I2 (deg)	PhiI1-I2: Phase angle of power element 2 fundamental current (I2(1)) refers to the power element 1 fundamental voltage (I1(1))
Phase angle I2-I3 (deg)	PhiI2-I3: Phase angle of power element 3 fundamental current (I3 (1)) refers to the power element 2 fundamental voltage (I2 (1))
Phase angle I3-I1 (deg)	PhiI3-I1: Phase angle of power element 1 fundamental current (I1 (1)) refers to the power element 3 fundamental voltage (I3 (1))

Delta Function

Item	Symbol and the meaning
Delta	Measurement function of Delta calculation by each Sigma wiring system
Voltage [V]	Delta U1 to Delta U3, and Delta Usigma Difference: differential voltage calculation of U1 to U2, 3P3W -> 3V3A: Line to Line voltage calculation between U1 and U2 DELTA -> STAR: Phase voltages calculation by Line to Line voltages STAR -> DELTA: Line to Line voltage calculation by Phase voltages
Current [A]	Delta I Difference: differential current calculation of I1 to I2, 3P3W -> 3V3A: Phase current calculation excepting I1 and I2 DELTA -> STAR: Neutral current calculation by Phase currents STAR -> DELTA: Neutral current calculation by Phase currents
Power [W]	Delta P1 to Delta P3, and Delta P Sigma DELTA -> STAR: Phase powers calculation by 3V3A wiring * Calculate each Sigma function

AUX analysis function
Torque and Speed input

When motor mode is on

Item	Symbols and Meanings
Rotating speed	Speed: Motor rotating speed
Torque	Torque: Motor torque
Monitor output (W)	Pm: Motor's mechanical output (mechanical power)

When motor mode is off

Item	Symbols and Meanings
Auxiliary input	Aux3 to Aux8

• Maximum display (OL conversion)
Analog: Displays up to 140% of the range rating
Overload display [-OL-] appears if 140% is exceeded.
Pulse: Displays up to 2 MHz (OF display at 10 GHz or higher if scaling is used)

• Minimum display (zero suppression)
Analog: None
Pulse: Displays pulse frequency down to 1.8 Hz
Frequencies less than 1.8 Hz are suppressed to zero.

AUX1, AUX2

A(X × NULL) + B
A: slope of the external signal
X: average value of the external signal's input voltage (AVG [AUX_input1(n)])
B: offset
NULL: null value

A(X × NULL) + B
A: slope of the external signal
X: Pulse [Hz]
B: offset
NULL: null value [Hz]

If the pulse level is lower than the measurement lower limit, "Error" or "0" can be selectable.

Accuracy

Accuracy (at 6 months) — Conditions

Accuracy: Within 6 months after calibration
- Standard operating conditions (Temperature: 23°C ±5°C. Humidity: 30%RH to 75%RH.)
- After the warm-up time has elapsed.
- Input signal: Sine wave
- Common mode voltage: 0 V
- Time/div is set to longer than 50 us
- Frequency filter ON when input frequency is lower than 1 kHz
- Line filter: OFF
- Sampling points: 5 points/cycle at least
- f is the frequency.
- Input signal is 5 cycles or less and there are 10 k points of sampled data or more observation time.
- If input signal is not 5 cycles and number of sampling data is not 10 k points, add following values (reference value)
(Reading error/10) × (5/measured cycle number) × (10 k/sampling point number)% of reading

Voltage:

Frequency	Accuracy
	DC: ±(0.2% of reading + 0.2% of range)
0.1 Hz ≤ f <	10 Hz: ±(0.2% of reading + 0.2% of range)
10 Hz ≤ f <	45 Hz: ±(0.2% of reading + 0.1% of range)
45 Hz ≤ f ≤	1 kHz: ±(0.1% of reading + 0.1% of range)
1 kHz < f ≤	10 kHz: ±(0.1% of reading + 0.1% of range)
10 kHz < f ≤	50 kHz: ±(0.2% of reading + 0.2% of range)
50 kHz < f ≤	100 kHz: ±(0.6% of reading + 0.4% of range)
100 kHz < f ≤	200 kHz: ±(0.6% of reading + 0.4% of range)
200 kHz < f ≤	400 kHz: ±(1% of reading + 0.4% of range)
400 kHz < f ≤	500 kHz: ±((0.1 + 0.003 × f*)% of reading + 0.4% of range)
500 kHz < f ≤	1 MHz: ±((0.1 + 0.003 × f*)% of reading + 4% of range)
1 MHz < f ≤	10 MHz: ±((0.1 + 0.003 × f*)% of reading + 4% of range)

* Measurement bandwidth 20 MHz (–3 dB, Typical)
* Accuracy over 1 MHz is design value

Current:

Direct (up to 5 A)

Frequency	Accuracy
	DC: ±(0.2% of reading + 0.2% of range) + 20 uA
0.1 Hz ≤ f <	10 Hz: ±(0.2% of reading + 0.2% of range)
10 Hz ≤ f <	45 Hz: ±(0.2% of reading + 0.1% of range)
45 Hz ≤ f ≤	1 kHz: ±(0.1% of reading + 0.1% of range)
1 kHz < f ≤	10 kHz: ±(0.1% of reading + 0.1% of range)
10 kHz < f ≤	50 kHz: ±(0.2% of reading + 0.2% of range)
50 kHz < f ≤	100 kHz: ±(0.6% of reading + 0.4% of range)
100 kHz < f ≤	200 kHz: ±(0.6% of reading + 0.4% of range)
200 kHz < f ≤	400 kHz: ±(1% of reading + 0.4% of range)
400 kHz < f ≤	500 kHz: ±((0.1 + 0.004 × f*)% of reading + 0.4% of range)
500 kHz < f ≤	1 MHz: ±((0.1 + 0.004 × f*)% of reading + 4% of range)

* Measurement bandwidth 10 MHz (–3 dB, Typical)

Sensor Frequency	Accuracy (760812)
	DC: ±(0.2% of reading + 0.2% of range) + 50 uV
0.1 Hz ≤ f <	10 Hz: ±(0.2% of reading + 0.2% of range)
10 Hz ≤ f <	45 Hz: ±(0.2% of reading + 0.1% of range)
45 Hz ≤ f ≤	1 kHz: ±(0.1% of reading + 0.1% of range)
1 kHz < f ≤	10 kHz: ±(0.1% of reading + 0.1% of range)
10 kHz < f ≤	50 kHz: ±(0.2% of reading + 0.2% of range)
50 kHz < f ≤	100 kHz: ±(0.6% of reading + 0.4% of range)
100 kHz < f ≤	200 kHz: ±(0.6% of reading + 0.4% of range)
200 kHz < f ≤	400 kHz: ±(1% of reading + 0.4% of range)
400 kHz < f ≤	500 kHz: ±((0.1 + 0.003 × f*)% of reading + 0.4% of range)
500 kHz < f ≤	1 MHz: ±((0.1 + 0.003 × f*)% of reading + 4% of range)
1 MHz < f ≤	10 MHz: ±((0.1 + 0.003 × f*)% of reading + 4% of range)

* Measurement bandwidth 20 MB (–3 dB, Typical)
* Accuracy over 1 MHz is design value

Power:

Direct (up to 5 A)

Frequency	Accuracy
	DC: ±(0.2% of reading + 0.4% of range) + 20 uA × U
0.1 Hz ≤ f <	10 Hz: ±(0.2% of reading + 0.2% of range)
10 Hz ≤ f <	45 Hz: ±(0.2% of reading + 0.1% of range)
45 Hz ≤ f ≤	1 kHz: ±(0.1% of reading + 0.1% of range)
1 kHz < f ≤	10 kHz: ±(0.1% of reading + 0.16% of range)
10 kHz < f ≤	50 kHz: ±(0.2% of reading + 0.2% of range)
50 kHz < f ≤	100 kHz: ±(0.6% of reading + 0.4% of range)
100 kHz < f ≤	200 kHz: ±(1.5% of reading + 0.6% of range)
200 kHz < f ≤	400 kHz: ±(1.5% of reading + 0.6% of range)
400 kHz < f ≤	500 kHz: ±((0.1 + 0.006 × f*)% of reading + 0.6% of range)
500 kHz < f ≤	1 MHz: ±((0.1 + 0.006 × f*)% of reading + 6% of range)

Sensor Frequency	Accuracy (760812)
	DC: ±(0.2% of reading + 0.4% of range) + 50 uV × U
0.1 Hz ≤ f <	10 Hz: ±(0.2% of reading + 0.2% of range)
10 Hz ≤ f <	45 Hz: ±(0.2% of reading + 0.1% of range)
45 Hz ≤ f ≤	1 kHz: ±(0.1% of reading + 0.1% of range)
1 kHz < f ≤	10 kHz: ±(0.1% of reading + 0.16% of range)
10 kHz < f ≤	50 kHz: ±(0.2% of reading + 0.2% of range)
50 kHz < f ≤	100 kHz: ±(0.6% of reading + 0.4% of range)
100 kHz < f ≤	200 kHz: ±(1.5% of reading + 0.6% of range)
200 kHz < f ≤	400 kHz: ±(1.5% of reading + 0.6% of range)
400 kHz < f ≤	500 kHz: ±((0.1 + 0.004 × f*)% of reading + 0.6% of range)
500 kHz < f ≤	1 MHz: ±((0.1 + 0.004 × f*)% of reading + 6% of range)

* The unit of f in the equation for the reading error is (kHz).
* U is voltage reading value.

Specifications of PX8000, 760811, 760812, 760813 and 760851

Conditions;
- Add ±(0.2% of reading) to Current accuracy when Sensor current input range is 50 mV to 500 mV, Direct current input range is 10 mA to 200 mA and input signal frequency is 1 kHz to 50 kHz.
- Add ±(0.2% of reading) to Power accuracy when Sensor current input range is 50 mV to 500 mV and input signal frequency is 1 kHz to 50 kHz.
- Add (Rated range/Max. rated range) × 0.005 × f of reading, when input voltage is over 400 Vrms (f unit: kHz)
- Influence of input level

When input level is 110% to 140% of range with sine waveform, reading error is twice.
When input level is ±(110% to 200%) of range with DC waveform, reading error is twice.
- Influence of temperature changes after zero-level compensation or range change

Add 0.02% of range/˚C to Voltage accuracy for DC
Add 20 uA/˚C to Direct current accuracy for DC
Add 50 uV/˚C to Sensor current accuracy
Add additional voltage value (V) × additional current value (A) to Power accuracy for DC
- Influence of self-generated heat caused by voltage input

Add the following values to the voltage and power accuracies:
AC input signal: 0.0000001 × U^2% of reading
DC input signal: 0.0000001 × U^2% of reading + 0.0000001 × U^2% of range
U is the voltage reading (V).
Even if the voltage input decreases, the influence from self-generated heat continues until the temperature of the input resistor decreases.
- Influence of self-generated heat caused by current input

Add the following values to the current and power accuracies.
AC input signal: 0.006 × I^2% of reading
DC input signal: 0.006 × I^2% of reading + 0.004 × I^2 mA
I is the current reading (A).
Add the following values to the current and power accuracies.
AC input signal: 0.0000001 × U^2% of reading
0.006 × I^2% of reading
DC input signal: 0.0000001 ×U^2% of reading + 0.0000001 × U^2% of range
0.006 × I^2% of reading + 0.004 × I^2 x U mW
U is the voltage reading (V), I is the current reading (A).
Even if the voltage input decreases, the influence from self-generated heat continues until he temperature of the input resistor decreases
- Guaranteed accuracy ranges for frequency, voltage, and current

All accuracy figures for 0.1 Hz to 10 Hz are design values.
The voltage and power accuracy figures for DC and 30 kHz to 100 kHz when the voltage exceeds 750 V are design values.
The current and power accuracy figures for 100 kHz to 1 MHz when the current exceeds 5 A are reference values.
- Effective input range

Udc, Idc: 0% to ±110% of the measurement range
Urms, Irms: 1% to 110% of the measurement range
Umn, Imn: 10% to 110% of the measurement range
Urmn, Irmn: 10% to 110% of the measurement range
Power:
DC measurement: 0% to ±110%
AC measurement: 1% to 110% of the voltage and current ranges; up to ±110% of the power range
However, the synchronization source level must meet the frequency measurement input signal level.
- Line filter influence

Voltage and current (Direct and Sensor)
45 Hz to 66 Hz: Add 0.2% of reading
Lower than 45 Hz: Add 0.5% of reading
At (Cutoff frequency of Line filter) /10 Hz: Add 0.8% of reading
Power
45 Hz to 66 Hz: Add 0.3% of reading
Lower than 45 Hz: Add 1% of reading
At (Cutoff frequency of Line filter) /10 Hz: Add 1.5% of reading
- Temperature coefficient (lower than 10 kHz input)

Add ±0.02% of reading/˚C within the range of 5˚C to 18˚C or 28˚C to 40˚C
- Power factor (λ) influence

When λ = 0 (S is Apparent power)
±0.15% of S for 45 Hz to 66 Hz.
For other frequency ranges, below figures are reference values.
±(0.017 × f)% of S (f is kHz).
Input level is 0.15% or more of apparent power
When 0 < λ < 1
(Power reading) × [(power reading error%) + (power range error%) × (power range/indicated apparent power value) + {tan Φ × (influence when λ = 0)%}],
where Φ is the phase angle between the voltage and current.
- Accuracy of apparent power S Voltage accuracy + current accuracy
- Accuracy of reactive power Q Accuracy of apparent power + ($\sqrt{(1.0004 - \lambda^2)} - \sqrt{(1 - \lambda^2)}$) × 100% of range
- Accuracy of power factor λ

±[(λ – λ/1.0002) + |cosΦ – cos{Φ + $\sin^{-1}$ ((influence from the power factor when λ = 0)%/100)}|] ±1 digit.
The voltage and current signals are rated range inputs.
- Accuracy of phase angle Φ

±[|Φ – {$\cos^{-1}$ (λ/1.0002)}| + $\sin^{-1}$ {(influence from the power factor when λ = 0)%/100}] deg ±1 digit.
The voltage and current signals are rated range inputs.
- Lead and lag detection (Phase angle Φ's D (lead) and G (lag))

The lead and lag of the voltage and current inputs can be detected correctly for the following:
Sine wave input
When the measured value is 50% or more of measurement range.
Frequency: 10 Hz to 10 kHz
Phase difference: ±(5 degree to 175 degree)
When frequency filter is ON, it is specified range of lower frequency of half of the cut off frequency.
However, Cutoff frequency is 100 Hz filter, it is specified lower than 60 Hz.
- Accuracy at 1 year 1.5 times the reading errors for the accuracy at 6 months

General Specifications

Item	Specification	
Standard operating conditions	Ambient Temperature: 23 ±5˚C Ambient humidity: 20 to 80%RH Supply Voltage and frequency Within ±1% of rating After the PX8000 has been warmed up and then calibration has been performed.	
Warm up time	At least 30 mins	
Storage environment	Temperature: Humidity: Altitude:	–25 to 60˚C 20 to 80% RH (no condensation) 3000 m or less
Operation environment	Temperature: Humidity: Humidity: Altitude:	5 to 40˚C normal position, 5 to 35˚C when the rear panel is parallele to the flower 20 to 80% RH without using the printer, no condensation 35 to 80% RH when the printer is used, no condensation 2000m or less
Rated supply voltage	100 to 120 VAC/220 to 240 VAC (Auto switching)	
Rated supply voltage range	90 to 132 VAC/198 to 264 VAC	
Rated supply frequency	50/60 Hz	
Permitted supply voltage frequency range	48 to 63 Hz	
Maximum power consumption	200 VA, 400 VA (with /B5 is used, when /PD is installed)	
Withstand voltage	1500 VAC for one minute between the power supply and case	
Insulation resistance	10 M Ohm or more for 500 VDC between the power supply and case	
External dimensions	355 mm (W) × 259 mm (H) × 180 mm (D), not including the handle and protrusions Approx. 355 mm (W) × 259 mm (H) × 245 mm (D), excluding the handle and protrusions (when /PD is installed)	
Weight	Approx. 6.5 kg (weight of the PX8000 only without paper and with the /M2, /B5, /C20, /M2, /G5 and /P4 options installed) Approx. 7.5 kg (main unit only with /B5/C20/G5/M2/P4/PD installed, excluding recording paper)	
Instrument cooling method	Forced air cooling. Exhaust on the left side and top panel. Forced air Air vents on the left and top panels, and back (when /PD is installed)	
Battery backup	The settings and clock are backed up with an internal lithium battery.	
Backup battery life	Approx. 5 years (at an ambient temperature of 25°C)	
Standard Accessories	Front panel protection cover 1 Cover panel 8 Rubber stoppers 4 Power cord 1 Pinter roll paper 1 (/B5 only) Getting started Guide 1 CD manual 1 Voltage Input Adapter 4 Current Input Adapter 4 Wrench 1	
Safety standard	Compliance standards	EN61010-1, EN61010-2-030, EN61010-031, EN 60825-1 - Over voltage category (installation category) II - Measurement Category II - Pollution degree 2
Emissions	Compliance standards	EN61326-1 Class A, EN61326-2-1, EN55011 Class A Group 1, RCM EN55011 Class A, Group1 - Class A Korean KC Standard *Warning for Class A instruments This is a Class A instrument based on Emission standards EN61326-1 and EN55011, and is designed for an industrial environment. Operation of this equipment in a residential area may cause radio interference, in which case users will be responsible for any interference which they cause.
	Test items	Power supply: EN61326: Class A Radiated emissions: EN61326: Class A Harmonics: EN61000-3-2 Voltage fluctuation and flicker: EN61000-3-3
Immunity	Compliance standards	EN61326-1 Table 2 (for industrial locations), EN61326-2-1
	Test items	Electrostatic discharge: EN61000-4-2 Radiated immunity: EN61000-4-3 Conducted immunity: EN61000-4-6 Fast transient/burst: EN61000-4-4 Power frequency magnetic field: EN61000-4-8 Surge immunity: EN6100-4-5 Voltage dip and interruption: EN61000-4-11

Model	Suffix Code	Description
PX8000		Precision Power Scope
Power Cord	-D	UL/CSA Standard
	-F	VDE standard
	-H	GB standard
	-N	NBR standard
	-Q	BS standard
	-R	AS standard
Languages	-HE	English menu
	-HG	German menu
	-HJ	Japanese menu
Options	/B5	Built-in printer (112 mm)
	/C20	IRIG function
	/G5	Harmonic measurement
	/M1	50 M memory expansion*
	/M2	100 M memory expansion*
	/P4	4 Outputs of probe power
	/PD	4 Outputs of sensor power

*Only one can be selected.

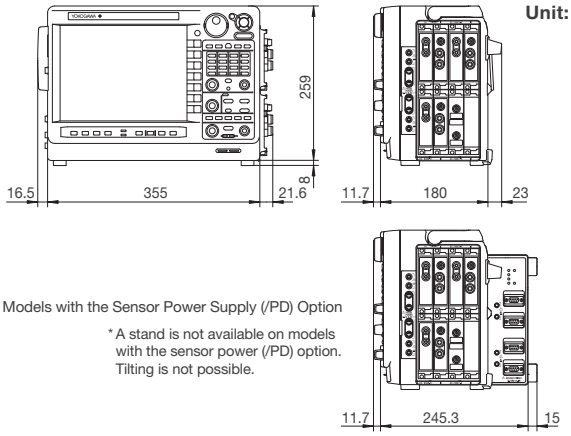
Name	Model	Description
Voltage Module	760811	Current module 760812 or 760813 must be ordered together
Current Module	760812	Voltage module 760811 must be ordered together
Current Module	760813	Voltage module 760811 must be ordered together
Auxiliary Module	760851	Auxiliary (AUX) module for sensor input, Torque/Speed

Name	Model	Description
PowerViewerPlus	760881	Viewer software dedicated for PX8000

- The German language menu will be released soon.
- Selection of both /M1 and /M2 is not available for one main frame. The standard memory length is 10 M points/CH.
- The power value will be calibrated using a pair of Voltage (760811) and Current (760812/760813) modules, therefore an equal quantity of these must be ordered together.
- A test Certificate of the Voltage Module includes the test results of the voltage and power values which are calibrated with one paired Current Module. Also the test Certificate of the Current Module includes the test results of the current and power values which are calibrated with one paired Voltage Module.

Standard Accessories;
Power cord (1 set), Front cover (1 set), Rubber foot (4 sets), Cover plate assy (8 sets), Current terminal adapter (4 sets), Voltage terminal adapter (4 sets), Printer chart (1 set for /B5), Getting started guide (1 set), CD (Getting started guide, Futures guide, User's Manual, Communication interface manual by PDF data)

Unit: mm



Models with the Sensor Power Supply (/PD) Option

* A stand is not available on models with the sensor power (/PD) option. Tilting is not possible.

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Safety Precautions for Laser Products
The voltage module (760811), the current modules (760812/760813) and the AUX module (760851) uses laser light sources internally. These modules or respond to Class 1 laser product as defined in the IEC60825-1: 2007 Safety of Laser Products-Part 1: Equipment Classification and Requirements.

Mode number		Product	Description
366924	⚠*1	BNC-BNC Cable	1 m
366925	⚠*1	BNC-BNC Cable	2 m
366926	⚠*1	1:1 BNC-Alligator Cable	Non-isolated 42 V or less 1 m
366961	⚠*1	1:1 Banana-Alligator Cable	Non-isolated 42 V or less 1.2 m
700924		Differential Probe	1400 Vpk, 1000 Vrms-CAT II
700929		10:1 Probe (for isolation BNC input)	1000 V (DC+ACpeak) CAT I
701901		1:1 Safety BNC Adapter Lead (in combination with followings)	1000 Vrms-CAT II
701902		Safety BNC-BNC Cable (1 m)	1000 Vrms-CAT II (BNC-BNC)
701903		Safety BNC-BNC Cable (2 m)	1000 Vrms-CAT II (BNC-BNC)
701906		Long Test Clip	For 700924 and 701926
701926		Differential Probe	Max. 7000 Vpk, 5000 Vrms
701947		100:1 Isolation Probe	1000 V (DC+ACpeak) CAT I
701948		Plug-On Clip	For 700929 and 701947
701954		Large Aligator-Clip (Dolphin type)	1000 Vrms-CAT II, 1 set each of red and black
701959		Safety Mini-Clip (Hook type)	1000 Vrms-CAT II, 1 set each of red and black
701963		Soft Carrying Case	For PX8000
720911		External I/O Cable	For external I/O connection
758917		Test Lead Set	A set of 0.8 m long, red and black test leads
758921	⚠	Fork Terminal Adapter	Banana-fork adapter, Two adapters to a set
758922	⚠	Small Alligator-clip	Rated at 300 V and used in a pair
758923		Safety Terminal Adapter	(spring-hold type) Two adapters to a set
758929	⚠	Large Alligator-clip	Rated at 1000 V and used in a pair
CT60		AC/DC Current Sensor	Max. 60 Apk, DC to 800 kHz (–3 dB)
CT200		AC/DC Current Sensor	Max. 200 Apk, DC to 500 kHz (–3 dB)
CT1000		AC/DC Current Sensor	Max. 1000 Apk, DC to 300 kHz (–3 dB)

Parts number	Product	Description	Order Q'ty
A1323EZ	Shunt Resistor Box	5 Ω ±0.05%	1
A1324EZ	Shunt Resistor Box	10 Ω ±0.02%	1
A1325EZ	Shunt Resistor Box	20 Ω ±0.02%	1
A1559WL	Current sensor cable	Cable length 3 m	1
A1560WL	Current sensor cable	Cable length 5 m	1
B8213ZA	Safety Terminal Adapter	(screw-fastened type) Two adapters to a set for current	4
B8213ZD	Safety Terminal Adapter	(screw-fastened type) Two adapters to a set for voltage	4
B9284LK ⚠	External Sensor Cable	Current sensor input connector, Length 0.5 m	1
B9317WD	Wrench	For B8213ZD and B8213ZA	1
B9988AE	Printer Roll Paper	For PX8000, 10 m × 10	1

⚠ Due to the nature of this product, it is possible to touch its mental parts. Therefore, there is a risk of electric shock, so the product must be used with caution.

*1: Use these products with low-voltage circuits (42 V or less).

Yokogawa's approach to preserving the global environment

- Yokogawa's electrical products are developed and produced in facilities that have received ISO14001 approval.
- In order to protect the global environment, Yokogawa's electrical products are designed in accordance with Yokogawa's Environmentally Friendly Product Design Guidelines and Product Design Assessment Criteria.

Notice

- Before operating the product, read the user's manual thoroughly for proper and safe operation.
- If this product is for use with a system requiring safeguards that directly involve personnel safety, please contact the Yokogawa offices.
- Warranty period of the PX8000 and modules is three years.

This is a Class A instrument based on Emission standards EN61326-1 and EN55011, and is designed for an industrial environment.
Operation of this equipment in a residential area may cause radio interference, in which case users will be responsible for any interference which they cause.

YOKOGAWA

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