HIOKI

2003

3196 POWER QUALITY ANALYZER

Power Measuring Instruments

Investigate All Your Power Quality Problems

- Remote control and data collection via LAN modem
- A full range of clamp sensors
  (Five types with ratings from 5 to 5000 A AC)
- 9624 PQA-HiVIEW software for flexible PC analysis

- Power waveform observation
- Abnormal waveform recording
- Harmonic measurement
- Flicker measurement
- Power measurement

All in a single unit !

New EN50160

ISO14001
JQA-E-90091

INTERNET HIOKI Website
http://www.hioki.co.jp/

HIOKI company overview, new products, environmental considerations and other information are available on our website.

Capture all power anomalies without fail!

Problems with power quality are all around us

Have you ever experienced any of the following ?

- Flickering lights
- Light bulbs burn out quickly
- Electronic office equipment does not function properly
- Sometimes devices operate abnormally
- Overheating in facilities using condensers fitted with reactors
- 3E (electrical overload, reverse phase, or phase loss) relays sometimes trip

These types of problems and others are often due to degraded power quality.

Discovering the cause can be difficult

The quickest way to solve power problems is to have a clear understanding of the cause, and be able to determine where the phenomenon occurred. However, it is not always possible to accurately grasp all of the various types of anomalies that may occur on power lines, even when using recording or harmonic analysis devices to investigate them.

▼

Dedicated measuring instruments are required in order to accurately grasp these kinds of anomalies.

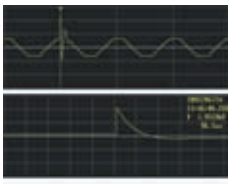
Fully identify the many phenomenon hiding in your power lines

Overlooking the smallest of power anomalies can lead to enormous financial loss. Checking the quality of your power lines is the best way to prevent problems before they occur.

● Transient Overvoltage (Impulse)

Phenomenon :
Occurs due to lightning or circuit breaker/relay contact damage or closure. Often involves radical changes in voltage with high voltage peaks.

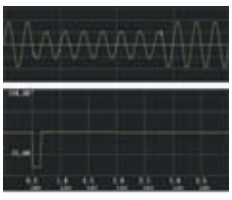
Damage :
In the vicinity of the event, high voltage often damages equipment power supplies or causes devices to reset.



● Voltage Dip

Phenomenon :
Caused by momentary voltage drops resulting from large rush current in loads, such as when starting up a motor.

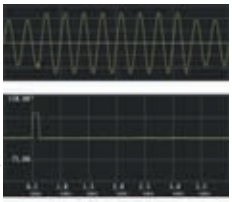
Damage :
The drop in voltage may cause devices to stop operating or reset.



● Voltage Swell

Phenomenon :
Caused by lightning strikes or opening/closing power lines with heavy loads, causing the voltage to swell momentarily.

Damage :
The surge in voltage may damage equipment power supplies or cause devices to reset.



● Flicker (IEC, ΔV10)

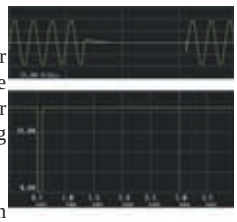
Phenomenon :
Caused by blast furnaces, arc welding, and thyristor-controlled loads, and involving regularly repeated voltage impulses spanning one or more cycles.

Damage :
Because this phenomenon is cyclically repeated, it may cause lights to flicker or devices to malfunction.

● Instantaneous interruptions

Phenomenon :
An instantaneous or short/long term power supply interruption caused by accident at the power company (such as interruption of power transmission due to lightning strike) or tripping of breakers due a power supply short.

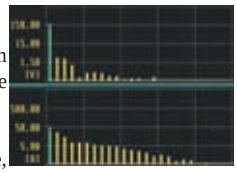
Damage :
Thanks to the increasingly widespread adoption of uninterruptible power supplies, equipment such as computers is increasingly protected against this problem. However, it may still cause other devices to stop operating or reset.



● Harmonics

Phenomenon :
Often occurs due to voltage/current waveform distortion when a semiconductor control device is used in a device's power supply.

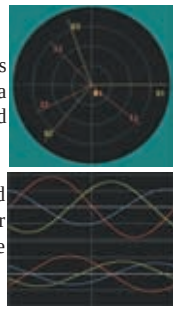
Damage :
When harmonic components become too large, they can cause serious malfunctions, such as overheating in motor transformers, or burn-out of reactors connected to phase advance capacitors.



● Unbalance factor

Phenomenon :
Voltage/current waveform distortion and voltage drops or voltage phase reversals can occur when the load on a particular power line phase increases due to load fluctuations or imbalances.

Damage :
Voltage imbalance, reverse phase voltage, and harmonics can result in events such as uneven motor rotation, tripping of 3E breakers, and overheating due to transformer overloading.



The 3196 can simultaneously measure, record, and analyze all of the above phenomena.

Supports data analysis with a wide range of functions!

The 3196 measures, records and analyzes power line quality

Features

■ Supports single-phase 2-wire, single-phase 3-wire, three-phase 3-wire and three-phase 4-wire systems. Further, the unit has an extra input channel providing enhanced analysis capabilities.

An isolated CH4 terminal is provided for AC and DC measurement.

- Neutral line measurement you can use for ground fault detection!
- Performs DC power analysis for equipment such as communications devices
- Performs simultaneous analysis of two isolated systems, such as single phase and three phase lines

■ Comes equipped with Δ-Y and Y-Δ conversion functions

Supports Δ-Y voltage conversion for three-phase, 3-wire systems, and Y-Δ voltage conversion for three-phase, 4-wire systems. Selectable display of inter-line voltage and phase voltage.

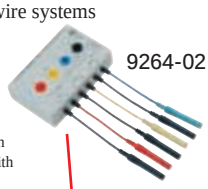
■ Five types of clamp-on current Sensors

In addition to clamp-on current sensor Models 9660 (100 A rating), 9661 (500 A rating), 9669 (1000 A rating), and 9667 (5000 A rating, flexible), HIOKI also provides the 9694 (5 A rating) sensor, which is ideal for CT terminal measurement.

■ Three-phase voltage wiring adapter (optional)

Use the wiring adapter to simplify voltage wiring procedures.

- 9264-01 for three-phase, 3-wire systems
- 9264-02 for three-phase, 4-wire systems



* The 9264 adapter is designed to reduce voltage cord wiring to a bare minimum.
* The 9264 adapter is designed for use with specific power lines. It cannot be used with power lines other than those specified.

CH4 terminal
for measuring DC voltage

■ Simultaneous measurement and continuous processing

All data are measured simultaneously and processing is performed continuously, so important fault data is not missed.
Further, transient overvoltages up to 2000 V with durations as low as 0.5 µs are captured without fail.

■ Six different display languages

Select a display language from Japanese, English, German, French, Spanish, or Italian.You can switch between the different display languages to suit your location.

■ 6.4-inch color LCD

The unit uses TFT color LCD screen, providing bright display with a wide viewing angle.The color display provides easy viewing of waveforms, both indoors and out.

■ Extended measurement of up to one month

The unit's internal memory (13 MB) supports up to one month of continuous recording.

* The amount of time available for continuous measurement can be checked when setting the measurement interval.
* By installing a PC card, you can use shorter measurement intervals with measurements extending over longer periods. (This can be used for storage along with internal memory.)

Interval	MAX/MIN/ AVG	Power Saving RMS only	P&Harm Saving RMS + harmonics	ALL DATA Save all data
1 s	MAX/MIN	2 h 01 m	8 m	5 m
	AVE	5 h 32 m	25 m	17 m
10 m	MAX/MIN	31 days	3 days 12 h	2 days 9 h
	AVE	31 days	10 days 13 h	7 days 4 h
1 h	MAX/MIN	31 days	21 days 5 h	14 days 9 h
	AVE	31 days	31 days	31 days

* For details on recorded items, see the specifications at the end of this document.
* PC card storage period (up to 31 days)
With 32 MB : above interval × approximately 2.5
With 64 MB : above interval × approximately 5

■ PC card can be used to allow

Flash ATA cards up to 528 MB can be used to allow more detailed data collection.
Compact flash cards can also be used with an adapter.

■ LAN and RS-232C support

The 3196 features an HTTP server function.
This supports easy configuration and data analysis through a Web browser from a remote location.

■ External event input/output terminals

Event output :
Outputs a signal when events occur-either as an alarm or device control signal.
Event input :
Accepts a trigger signal to initiate measurement.

■ Optional printer for easy hard copy output

Connect the optional 9670 printer to the RS-232C terminal for easy hard copy output of screens.

Printing method : Thermal line dot
Printing width : 72 mm (2.83")
Printing speed : 47.5 mm/sec (1.87"/sec)
Power supply : 9671 AC ADAPTER or the 9672 BATTEEY PACK
Dimensions and mass : 119 (4.69") × 77 (3.03") × 174 (6.85") mm, approx. 500 g (17.6 oz.)

■ Two types of carrying case available (optional)

Choose from the soft (9339) or hard (9340) carrying case and measure while the 3196 is safely stored.

Model 9339
soft case

The top side of the case holds the 3196.

The bottom side of the case holds accessories.

■ Small and Lightweight

The 3196 comes in a compact A4 size, and weighs only 2.25 kg (79.4 oz.).

Real-time data display for power supplies

Display waveform, vector, DMM, and harmonic data in real-time

The VIEW screen displays voltage/current waveforms, vector diagrams, DMM values (voltage, current, and power), and harmonic data. All data can be measured and processed simultaneously, and power conditions such as distortion factor, K factor, and the unbalance factor for three-phase lines can be monitored using the various data displays.

Connect the 3196 to a power source to display power line data in real-time

All power line conditions can be monitored from the VIEW screen!

■ Display data in real-time

-1. Waveform display (voltage/current display, 4-channel voltage display, 4-channel current display)
-2. Vector display
-3. DMM display (power, voltage, and current displays)
-4. Harmonics (graph and list displays)

■ Supports power management through a variety of information

-1. Check the distortion of power waveforms using electronic devices and electrical overloads.
-2. Manage the phase of power lines. Check the phase and wiring of the VT (PT) and CT terminals.
-3. Manage, maintain and check the unbalance factor, peak values, and distortion factor of power lines.
-4. Assess and develop countermeasures to prevent the occurrence of harmonic power flow.

Check for proper instrument connection using the numerical value or vector display

Connect the 3196 to the power line to be monitored while viewing the connection diagram.Upon connection, you can confirm voltage, current, and power values. Further, through the vector display, you can verify proper connection of clamp-on current sensors to the VT (PT) and CT terminals.

Waveform display

This displays the voltage and current waveforms for each phase.
Waveform display makes it easy to understand distortion conditions that (as with harmonics) are difficult to grasp from numerical values alone.

Select a waveform display range of 2, 4, 10, or 12 cycles.

Display either dual screens for voltage and current, or waveforms for individual voltage and current phases.

The cursor value is displayed.

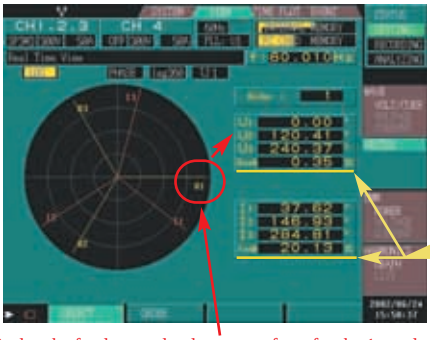
DMM display

This displays detailed data for voltage, current, and power.
View the data necessary for power management or maintenance and inspection of power lines at a single glance.

Detailed values for voltage, current and power are displayed.

Vector display

This displays the voltage and current vectors for each phase, as well as RMS values and phase angles as numerical values.
Easily check the phase of three-phase lines and harmonics.



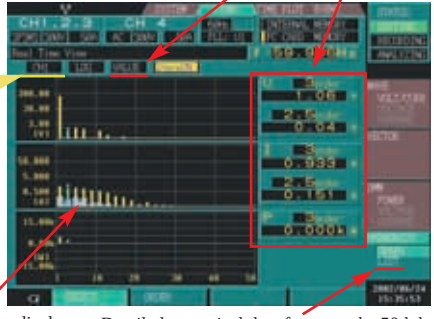
Displays the unbalance factor when measuring three-phase power lines. (For 3P3W3M and 3P4W settings)

Display the fundamental voltage waveform for the 1st order (U1, U2, and U3) as a phase angle of 360° as a standard.
Ideal for checking three-phase power lines.

Harmonics display

This displays harmonics and inter-harmonics data in a graph or list.
You can also display the phase difference for each harmonic order, and work out the current direction for harmonics.

You can select all of the connected channels.



The harmonic order cursor value is displayed.

Inter-harmonics display (light blue)

Detailed numerical data for up to the 50th harmonic order is displayed in a list.

Capture anomalies while using time series measurement to monitor power lines

Provides simultaneous time series monitoring for RMS fluctuations, voltage fluctuations, harmonics fluctuations, and flickering

RMS fluctuation, voltage fluctuation, harmonic fluctuation, and flicker (IEC and ΔV10) time series data is displayed on the TIME PLOT screen. In addition to cursor measurement, you can enlarge events that occur in the voltage fluctuation event screen if a voltage dip, swell, or instantaneous interruption event occurs during the measurement period.

If you set the interval and start time series measurement, events are displayed in the fluctuation graph

Time series fluctuation results are displayed in the TIME PLOT screen

■ All measurement results are automatically recorded

-1. RMS fluctuation (dual screen display selection)
-2. Voltage fluctuation (interval and event displays)
-3. Harmonic fluctuation (harmonics and inter-harmonics displays)
-4. Flicker (graph and list displays)
   - Pst and Plt measurement conditions according to IEC standards
   - ΔV10 measurement (according to domestic guidelines)

Continuous data calculation processing of all data without fail!

■ Calculation method for measured data

-1. RMS fluctuations/Harmonic fluctuations : Values are calculated continuously every 200 ms. The maximum, minimum, and average values are those applicable within the specified interval.
-2. Voltage fluctuations : Values are calculated for a single waveform shifted by a half wave. The maximum and minimum values are those applicable within the specified interval. Detailed measurement of voltage fluctuations is possible because values are calculated every half wave.
-3. Flicker : Values are calculated in accordance using calculation methods defined in the IEC and ΔV10 standards.

In addition to displaying the various measurements in fluctuation graphs, the 3196 also displays the maximum, minimum, and average values for each specified interval.
Further, when the 3196 captures a power anomaly, an event marker appears in the upper part of the graph.

RMS fluctuation display

When a power anomaly occurs during measurement, the event is indicated using the ▼ marker.

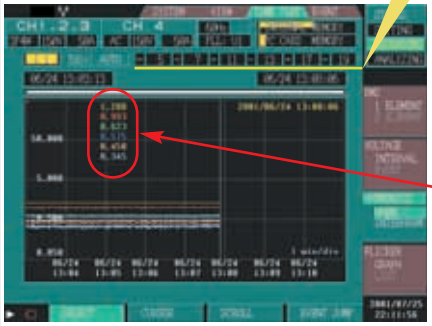
All RMS measurement items can be selected for display.

Dual screen display is possible for combinations such as voltage and current.

Cursor values (maximum, minimum, and average values for the specified interval) are displayed.

Harmonic fluctuation display

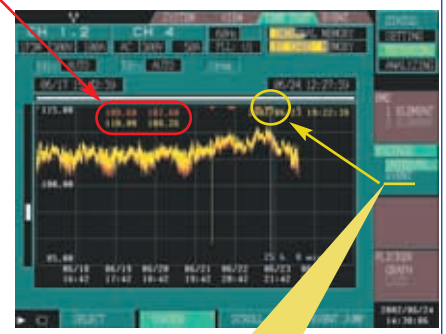
You can specify display of up to six harmonic orders.



Cursor values are displayed for the specified orders.

Voltage fluctuation display

Cursor values (maximum and minimum values for the specified interval) are displayed.



Even when a long interval is set, momentary voltage fluctuations are accurately captured.

Markers are displayed in blue. (▼ marker)

Event display
When an event such as a dip, swell, or instantaneous interruption occurs, the time axis is enlarged on the event screen.

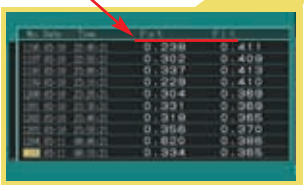
Flicker display

IEC flicker display

Displays the Pst and Plt values as a graph once every ten minutes.

The Pst and Plt cursor values are displayed.

Displays a list of detailed data for Pst and Plt values once every ten minutes.



Use event data to analyze the cause of power anomalies!

The 3196 can display details for power anomalies captured using event triggers

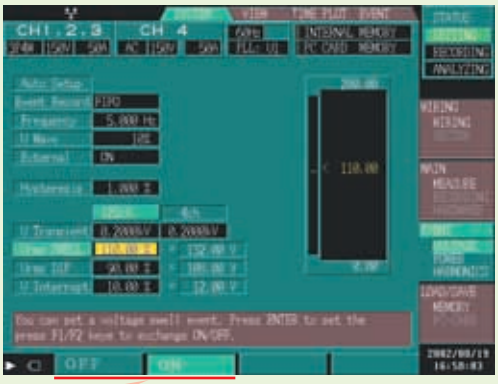
You can capture a variety of power anomalies by setting the individual trigger levels on the event setting screen. Captured data is displayed in the event list. This enables you to quickly confirm detailed data for phenomena (such as date/time, waveforms, RMS values, and harmonics), that are the source of problems, and effectively assess the cause of the problem.

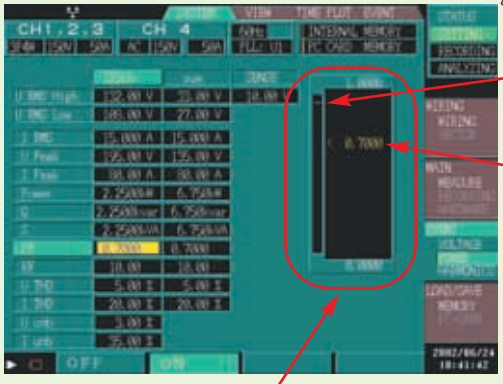
Set event triggers, start measurement → Capture power anomalies → Search list → Display details

Make event trigger settings and start measurement!

1. Select a trigger threshold value that is suitable for the item being measured.

Set thresholds along with other settings. You can make threshold settings while monitoring the actual input level, input waveform, and harmonics graph.





All trigger settings can be made at once, enabling accurate capture of complex power anomalies.

When using the unit's internal memory to save events, up to 100 events are automatically saved, or up to 1000 events when using a PC card.

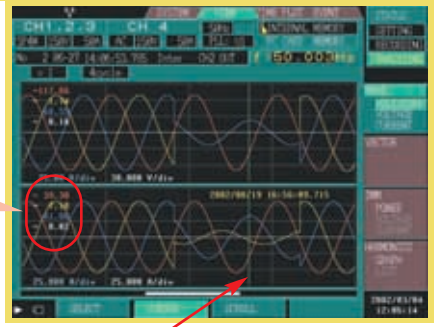
Once measurement is finished, search the event list to confirm detailed data for events-even during measurement

2. Confirm the details for events in the list screen.

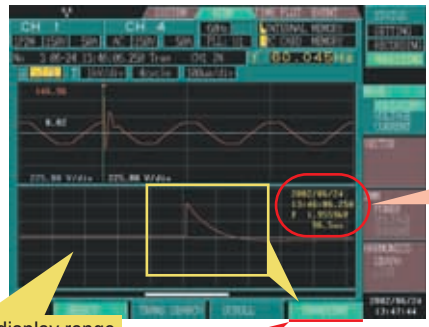
The capture date and event category are displayed.

Waveform display range:
14 waveforms at 50 Hz
16 waveforms at 60 Hz

Simultaneously display voltage and current waveforms for instantaneous interruptions.



For transient capture



3. Confirm the number of captured events in the monitor screen.

The number of times each event occurred is visible at a glance.
You can also check the events while they are being measured.

Transient overvoltages up to 2000 Vpk with durations as low as 0.5 µs are captured without fail.

Remote measurement is simplified using the HTTP server function

Real-time measurement/control and downloading of measurement data are possible over the Web

■ Addition of the HTTP server function as a standard feature makes remote measurement even more convenient

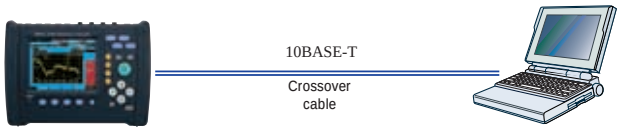
You can perform remote observation and control using an ordinary Web browser, such as Internet Explorer, without the need for special software. Further, you can download measurement data that has been saved onto a PC card.

Using the 3196 and your PC, you can observe power anomalies at overseas plants and analyze measurement data

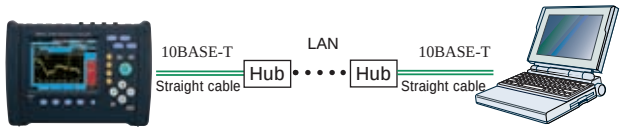
■ Choose from a variety of network measurement plans

By connecting a PC to the 3196, you can set up all types of network measurement systems through a LAN or RS-232C interface.

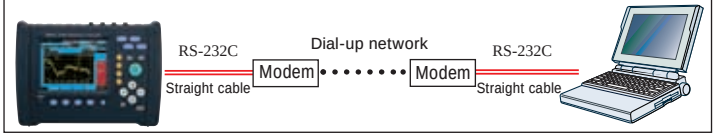
Ex. 1. Direct connection with a LAN cable



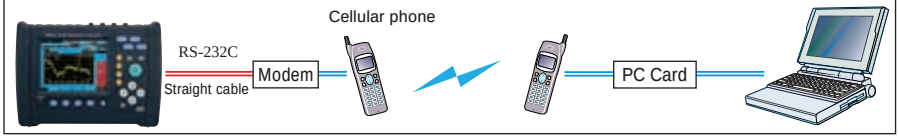
Ex. 2. Remote connection with a LAN through a hub



Ex. 3. Remote RS-232C connection through a modem



Ex. 4. Remote RS-232C connection through a modem

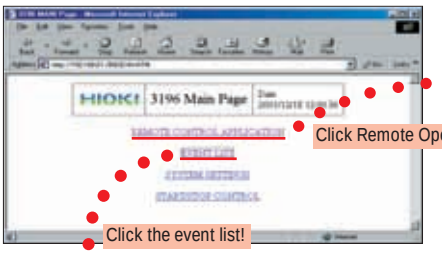


Remote transfer of data stored on a PC card

* To transfer data stored on a PC card (binary data), special data transfer software is required. Specialist software can be downloaded from the HIOKI Web site.
* Transferred data can be analyzed using 9624 PQA HiVIEW.
* Before using the special data transfer software, you must upgrade the 3196. (Ver. 1.21 or later is required)

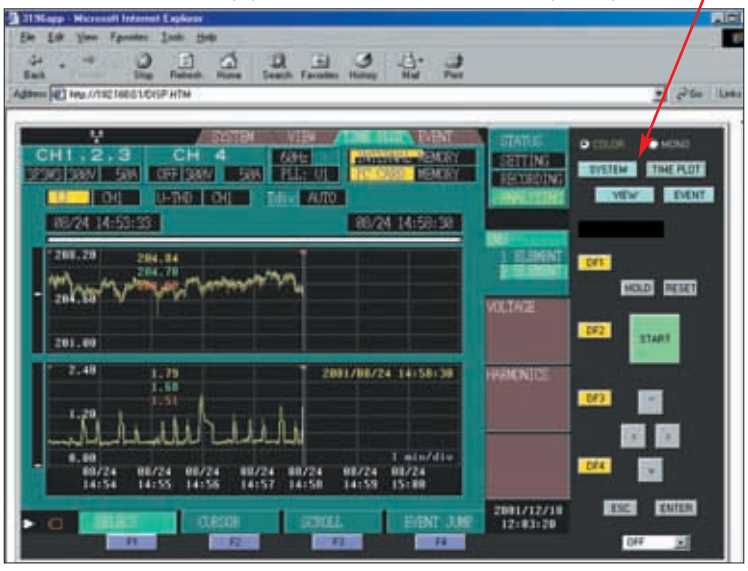
View your 3196 screen on your PC as soon as you open the remote application from your Web browser!

1. Open the IP address for the 3196 on the Web to display the main screen.

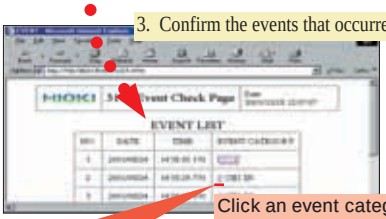


2. A display screen and operation keys identical to those for the 3196 appear, allowing full control of remote operation.

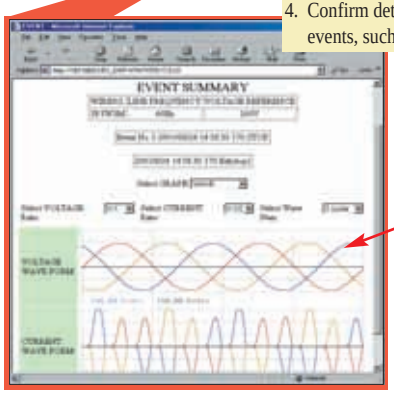
Because the various key operations are identical to those for the 3196, the keys are easy to use.



3. Confirm the events that occurred in the list.

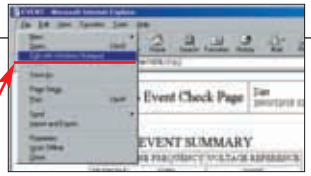


4. Confirm detailed data for events, such as waveforms.



Convenient Feature

5. You can also convert waveform data into text.
Click the waveform data. Microsoft Excel starts, and you can save the text data for the waveforms.



6. Using the report creation function, you can paste the event screen displayed into Microsoft Word*.

*When Microsoft Word is selected as the Internet Explorer HTML editor; Compatible with Microsoft Word 97 or later.

9624 PQA-HiVIEW software

Analyze measurement data stored in the PC card on your computer

Features

■ Viewer function

Use this function to display screens similar to those used for the 3196.
Select from the **TIME PLOT screen** (voltage fluctuation, RMS fluctuation, harmonic fluctuation, inter-harmonic fluctuation), **event list screen**, **event data screen** (waveforms, vectors, DMM, harmonics, event details), Δ**V10 screen**(Japanese standard), or **settings screen**. In the TIME PLOT screen, and use the two cursors (A and B) to calculate waveforms within a specified interval.

■ Demand/integral power consumption function

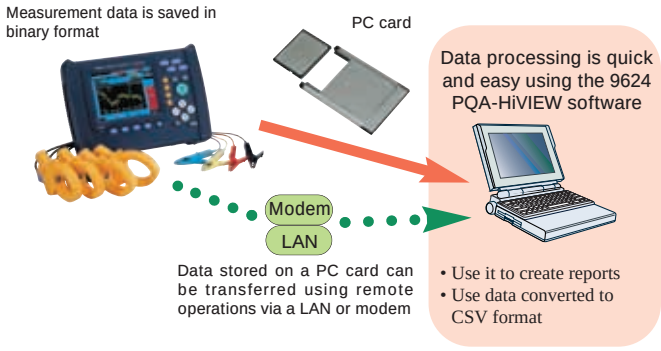
Calculate demand and integral power consumption from TIME PLOT data for effective power.

■ Binary CSV format conversion function

Convert binary data into CSV format for event waveforms within the specified range in the TIME PLOT screen or event waveforms selected in the event waveform screen. Files saved in CSV format can be used with spreadsheet software on your PC.

■ Print function

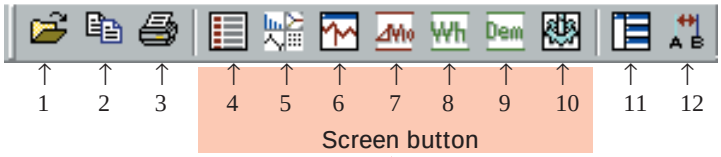
Use this function in each screen to output reports to a printer connected to your PC.



Load measurement data and then select the desired display from the toolbar

1. After loading the data, the possible displays are shown on the toolbar

Click the Screen button on the toolbar to display the data screen.

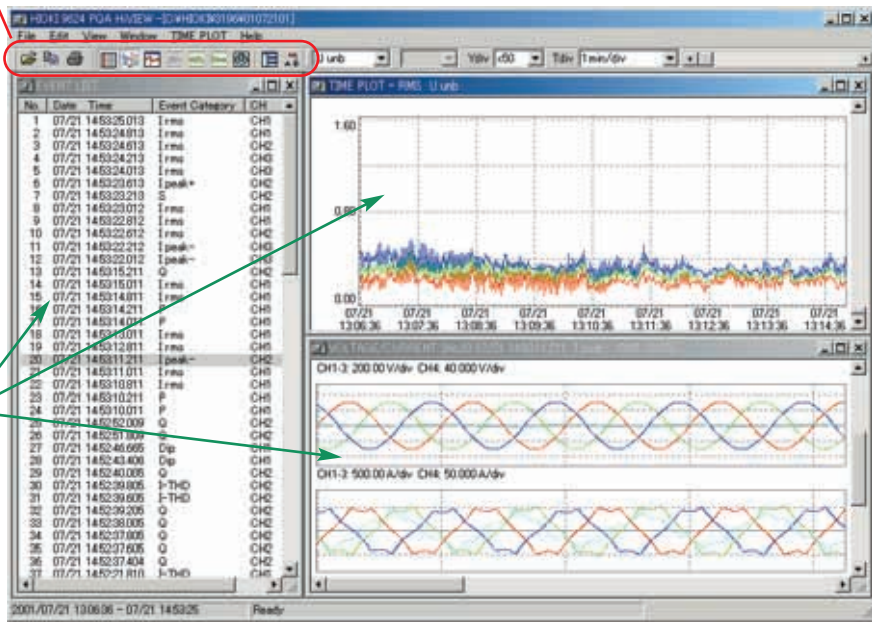


1. Open a file
2. Copy (a screen)
3. Print
4. Event list screen
5. Event data screen
6. TIME PLOT screen
7. ΔV10 screen
8. Integral power consumption screen
9. Demand screen
10. Settings screen
11. Arrange windows
12. A and B cursors

*The 9624 will only load binary data recorded with the 3196. You cannot load text data or data saved in CSV format.
*9624 PQA HiVIEW cannot be used to analyze the following data recorded with the 3196:
1. IEC flicker data (Pst, Plt, and S(t))
2. Voltage fluctuation event data

2. Simultaneously display multiple screens

Display multiple data items in windows simultaneously. If you press the Arrange Windows button, all of the screens that are currently open are automatically arranged in the window.



3. Copy screens with the touch of a button

Press the Copy button to copy the currently active screen to the clipboard.
You can paste copied screens into most common word processing programs.

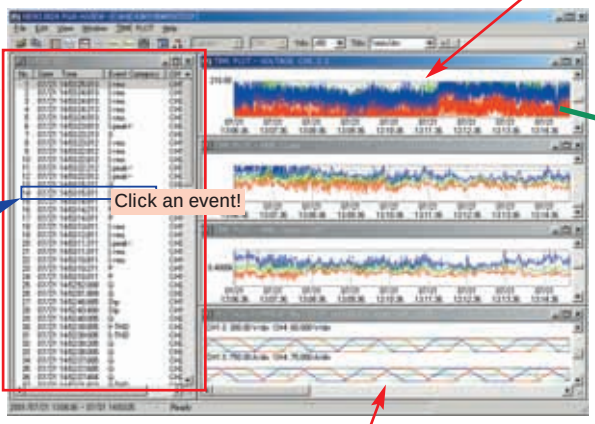
Display multiple 3196 screens simultaneously on your PC. The 9624 also supports calculation and analysis using cursors.

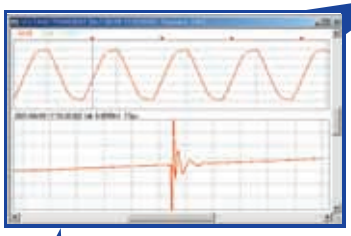
■ TIME PLOT screen

This screen enables you to select four different types of data, including RMS fluctuation, voltage fluctuation, harmonic fluctuation, and inter-harmonic fluctuation data, and display the data in graphs corresponding to the TIME PLOT screen of the 3196.

■ Event list screen

This screen displays an event list corresponding to the event list on the 3196.



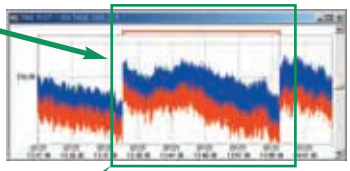


■ Event data screen

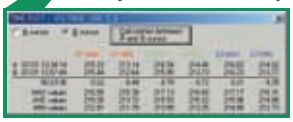
1. Displays detailed data for the event that you selected in the event list.
2. Displays nine different screens that correspond to the VIEW screen on the 3196, such as the waveform, vector, harmonics, and DMM screens.

■ Spot analysis using the cursor

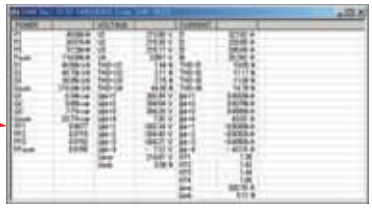
Conduct spot analysis of time series data using the A and B cursors.



Calculations for the details within the specified interval are displayed.



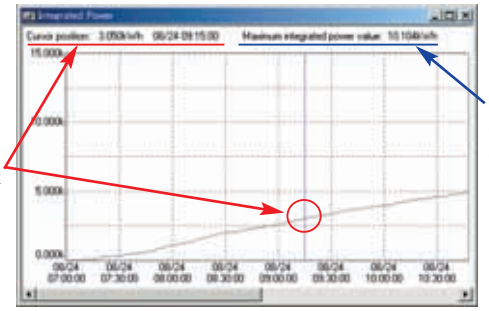
View power, voltage, and current data at a single glance in the DMM screen!



Analyze power consumption and demand using acquired

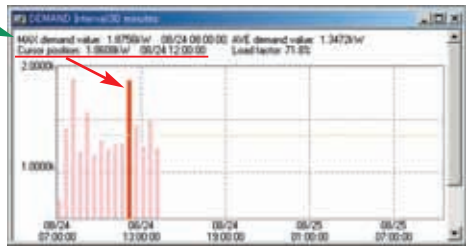
■ Integral power consumption analysis and demand analysis screens

These screens allow you to calculate measurement data and display it in the integral power consumption graph or demand graph. (You can display the maximum demand, average demand, and load ratio values.) Further, you can confirm the power data for a specific interval using the cursor function.



Cursor measurement

General power consumption is displayed.



Quickly print reports and apply data

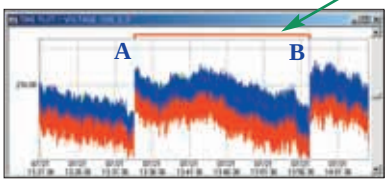
■ CSV format conversion function

Convert data displayed in the TIME PLOT or event waveform screen into CSV format. Converted data can be used with spreadsheet software on your PC.

Convenient Feature

You can specify a range using the A and B cursors, and convert the data within that range into CSV format.

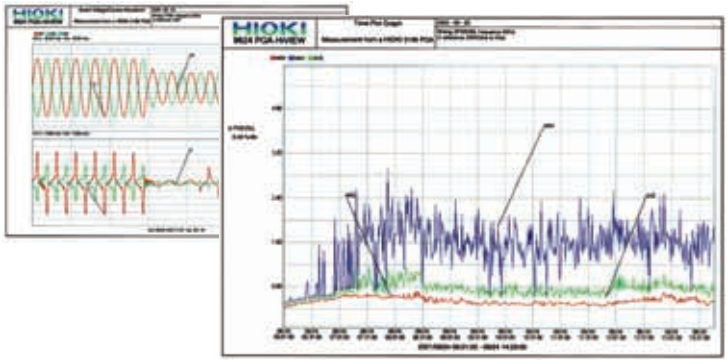
The interval between the A and B cursors is displayed in red.



■ Print function

Print a hard copy of the event list screen, event data screen, ΔV10 screen, integral power consumption screen, or demand screen, one at a time. In the TIME PLOT screen, you can collect all of the screens that are currently open and print them on a single sheet.

Print example: Event waveform screen printed on A4 paper



Print example: TIME PLOT screen (U-THD RMS fluctuation) printed on A4 paper

9624 Specifications

-1. Function specifications

Data loading functions

Data that can be loaded : Binary data recorded using the 3196
- SET files : Settings data
- ITV files : TIME PLOT data
- EVT files : Event data (lists, voltage and current waveforms, transient waveforms, numerical values)
- FLC files : Flicker data (ΔV10 only)
- TRN files : Transient waveforms

Loading method : Data is loaded in folder units, including files contained in those folders

Maximum data capacity : Up to 528 MB

Data display functions

SYSTEM display function

Screen display : SYSTEM (settings) content screen

TIME PLOT display function

Screen display : RMS fluctuation, voltage fluctuation, harmonic fluctuation, inter-harmonic fluctuation

Number of display screens : Up to 4 screens

Cursor function : A and B cursors (interval calculation function provided)

EVENT list display function

Screen display : EVENT list content display

Display method selection : Order events occurred in, or order of priority

EVENT data display function

Display function : Display the event data selected in the EVENT list display screen

Screen display : Display one of the following screens ((1) to (4))

(1) Waveform display :
Select from the voltage/current waveform, 4-channel voltage waveform, 4-channel current waveform, and voltage/transient overvoltage waveform displays.

(2) Vector display :
Select from the harmonic RMS value and phase angle displays.

(3) DMM display :
Displays power, voltage, and current values.

(4) Harmonics display:
Select from the harmonics bar graph and list displays.

Cursor function : A and B cursors (interval calculation function provided) for the waveform display screen

Integral power consumption calculation function

Settings : Analysis start time : Set the year, month, day, hours, minutes, and seconds.

Analysis period : 1 to 31 days

Display method and calculation items :

Integral power consumption graph

Integral power consumption
(consumption + regeneration, and cursor measurement functions provided)

Maximum integral power consumption
(final integral power consumption for the specified analysis period)

Demand calculation function

Settings : Analysis start time : Set the year, month, day, hours, minutes, and seconds.

Demand interval settings : 5, 10, or 30 minutes, 1, 2, 3, 6, or 12 hours
(A longer measurement interval can be set.)

Analysis period : 1 to 31 days

Display method and calculation items :

Demand graph (for consumption only)

Average demand (average demand value for the specified analysis period)

Maximum demand (maximum demand value for the specified analysis period)

Load ratio (average demand/maximum demand × 100 [%])

Copy function

Copy content : Saves the various screens in BMP format

Print function

Print format : Prints screen images

Printing paper size : A4 and Letter

Print preview : Yes

CSV format conversion function

Screens that can be converted : TIME PLOT and event waveform screens

Conversion settings : Specified interval conversion
(TIME PLOT screen only)

Conversion setting selection
(TIME PLOT screen only)

-2. Basic specifications

Compatible devices : 3196 Power Quality Analyzer

Supplied accessories : CD-R × 1

Operating environment : PC/AT-compatible devices

OS : English or Japanese versions of the following
- Microsoft Windows 95 (OSR2 or later versions only supported, Internet Explorer 3 or later required)
- Microsoft Windows 98
- Microsoft Windows Me
- Microsoft Windows NT 4.0
- Microsoft Windows 2000

Memory : At least 128 MB

3196 Specifications

-1. Measurement and recording items

Recording item	Power	P&Harm	ALL_D	Recording item	Power	P&Harm	ALL_D
Transient overvoltage	❍	❍	❍	Voltage unbalance factor	❍	❍	❍
Voltage swell	❍	❍	❍	Current unbalance factor	❍	❍	❍
Voltage dip	❍	❍	❍	Harmonic voltage	×	❍	❍
Instantaneous interruption	❍	❍	❍	Harmonic current	×	❍	❍
Frequency	❍	❍	❍	Harmonic power	×	❍	❍
RMS voltage	❍	❍	❍	Harmonic voltage-current phase difference	×	❍	❍
RMS current	❍	❍	❍	Inter-harmonic voltage	×	×	❍
Voltage peak	❍	❍	❍	Inter-harmonic current	×	×	❍
Current peak	❍	❍	❍	Total harmonic voltage distortion factor	❍	❍	❍
Effective power	❍	❍	❍	Total harmonic current distortion factor	❍	❍	❍
Apparent power	❍	❍	❍	Total inter-harmonic voltage distortion factor	×	×	❍
Reactive power	❍	❍	❍	Total inter-harmonic current distortion factor	×	×	❍
Power factor/Displacement power factor	❍	❍	❍	K factor	❍	❍	❍
				Flicker (ΔV10/Pst, Plt)	❍	❍	❍

* You can select from a total of six different patterns when recording data. These consist of three available data patterns (Power, P&Harm, or ALL DATA), combined with two patterns, AVE and ALL (maximum, minimum, and average), of detailed data for each measurement item.

-2. Basic specifications

Power quality measurement standards conformance : IEEE1159, EN50160:1999

Clock functions : Auto calendar, auto leap year, 24-hour clock

Real-time clock accuracy : Within ±0.3 s/day (when the 3196 is turned on)

Internal memory capacity for data : 13 MB (time series and event data)

Maximum recording interval : 1 month

Measurement time control : Manual/Specified time

Time series data settings

Recording item setting patterns : Power, P&Harm, and ALL DATA

MAX/MIN/AVE values : AVE values, ALL values (maximum, minimum, and average values)

Interval selections : 1, 3, 15, or 30 seconds, 1, 5, 10, or 30 minutes, 1 or 2 hours

Event settings

Event settings : All measurement settings except flicker and inter-harmonics

Event threshold value setting : OFF or desired numerical value

Maximum number of recording events : 100 (internal memory)
(Simultaneous events count as 1 event.)

Power supply : 12 V DC from the 9458 AC ADAPTER or 9459 BATTERY PACK

Maximum rated power : 40 VA

Continuous operating time with battery : Approximately 30 minutes (9459 battery pack)

External dimensions : Approximately 298W (11.73") × 215H (8.46") × 67D (2.64") mm (not including projections)

Mass : Approximately 2.25 kg (79.4 oz.) (including 9459 battery pack)

3196 Specifications

-3. Input specifications

Measurement line types: Single-phase 2-wire, Single-phase 3-wire, Three-phase 3-wire (3P3W2M, 3P3W3M) or Three-phase 4-wire, plus one extra input channel

Input channels: Voltage: 4 channels (U1 to U4) (channel U4 can be switched between AC and DC)
Current: 4 channels (I1 to I4)

Input methods: Voltage between U1, U2, and U3 without inter-channel isolation
Voltage between U1 to U3 and U4 with inter-channel isolation
Current input by clamp-on sensor

Input resistance: Voltage : 4 MΩ ±10% (differential input)
Current : 200 kΩ ±10%

Measurement method: Simultaneous digital sampling of voltage and current
PLL synchronization (automatically switches to fixed clock during dropouts, so sampling is never interrupted)

PLL synchronization channel source : Voltage at either U1, U2, or U3

PLL synchronization frequency range : 42.5 to 69 Hz

Sampling frequency :
- For calculations (including DC measurement) : 256 points/cycle
- For harmonic and inter-harmonic analysis : 2048 points/10 cycles (for 50 Hz)
  2048 points/12 cycles (for 60 Hz)
- For transient overvoltage (impulse) : 2 MHz

A/D converter resolution :
- For calculations (including DC measurement) : 16 bits
- For transient overvoltage (impulse) : 12 bits

Voltage measurement range :
- Channels 1 to 3 : 150.00, 300.00, 600.00 Vrms
- Channel 4 : 60.000, 150.00, 300.00, 600.00 Vrms
  ±60.000, 600.00 V pk (DC measurement)

Voltage crest factor : 3 or less

Current measurement range :
- With Model 9694 sensor : 5.0000, 50.000 Arms
- With Model 9660 sensor : 50.000, 100.00 Arms
- With Model 9661 sensor : 50.000, 500.00 Arms
- With Model 9667 sensor : 50.000, 500.00 A or 500.00 A, 5.0000 kArms
- With Model 9669 sensor : 100.00 A, 1.0000 kArms

Current crest factor : 4 or less

-4. Measurement specifications

RMS voltage
- Measurement method : True RMS (calculated continuously every 10 or 12 cycles at 50 or 60 Hz respectively)
- Range selection : Manual (channels 1 to 3 are set in the same operation)
- Measurement accuracy : AC : ±0.2% rdg. ±0.1% f.s.
  DC : ±0.3% rdg. ±0.4% f.s.

RMS current
- Measurement method : True RMS (calculated continuously every 10 or 12 cycles at 50 or 60 Hz respectively)
- Range selection : Manual (channels 1 to 3 are set in the same operation)
- Measurement accuracy : ±0.2% rdg. ±0.1% f.s. + clamp-on sensor accuracy

Transient overvoltage (impulse)
- Measurement method : 2 MHz sampling
- Measurement range : 2000 Vpk
- Display items : 4 ms waveform (2 ms before and after center peak)
- Period : Period exceeding threshold (max. 4 ms)
- Minimum detectable duration : 0.5 µs
- Measurement accuracy : ±5.0% rdg. ±20 V (1000 V DC and 700 Vrms/100 kHz)

Voltage swell (rise in RMS voltage)
- Measurement method : True RMS (a single cycle is calculated by overlapping each half cycle)
  (The voltage between lines is measured for three phase 3-wire lines, and phase voltage is measured for three phase 4-wire lines.)
- Display items : Amplitude and duration of swell
- Measurement accuracy : Same as RMS voltage

Voltage dip (drop in RMS voltage)
- Measurement method : True RMS (a single cycle is calculated by overlapping each half cycle)
  (The voltage between lines is measured for three phase 3-wire lines, and phase voltage is measured for three phase 4-wire lines.)
- Display items : Amplitude and duration of dip
- Measurement accuracy : Same as RMS voltage

Instantaneous Interruption
- Measurement method : Same as voltage dip

Frequency
- Measurement range : 42.500 to 69.000 Hz
- Measurement source : Voltage (same as the PLL synchronization source)
- Measurement accuracy : ±10 mHz (10 to 110% of range, with sine wave)

Active power
- Measurement method : Calculated continuously every 10 or 12 cycles at 50 or 60 Hz respectively
- Measurement accuracy : ±0.2% rdg. ±0.1% f.s. + clamp-on sensor accuracy

Reactive power
- Measurement accuracy : ±1 dgt. from the calculation of each measurement value (±3 dgt. for the sum)

Power factor
- Measurement range : -1.000 (lead) to 0.000 to +1.000 (lag)
- Measurement accuracy : ±1 dgt. from the calculation of each measurement value (±3 dgt. for the sum)

Displacement power factor
- Measurement method : Calculated from the phase difference between the fundamental waveforms of voltage and current
- Measurement range : -1.000 (lead) to 0.000 to +1.000 (lag)
- Measurement accuracy : ±0.5% rdg. ±0.2% f.s. ±1 dgt.(±3 dgt. for the sum)

Voltage unbalance factor
- Measurement method : Calculation for three-phase 3-wire (3P3W3M) and three phase 4-wire fundamental waveforms of voltage

Current unbalance factor
- Measurement method : Calculation for three-phase 3-wire (3P3W3M) and three-phase 4-wire fundamental waveforms of current

ΔV10 flicker
- Display items : ΔV10, ΔV10 (average over one hour, fourth maximum over one hour, maximum over one hour, overall maximum (during the measurement period)), ΔU (deviation with respect to nominal voltage)
- Standard voltage: Auto : Same operation as AGC for IEC flicker
- Measurement accuracy : ±2% rdg.

IEC flicker (short period flicker Pst, long period flicker Plt)
- Measurement method : Per IEC61000-4-15
  Pst is measured for 10 minutes, and Plt is measured for 2 hours
- Measurement accuracy : ±5% rdg. or less of the limit value

Harmonic voltage, current and power (including fundamental waveform components)
- Analysis window : Rectangular
- Analysis orders : 1 to 50
- Measurement accuracy : Voltage/current : 1st to 20th orders : ±0.5% rdg. ±0.2% f.s.
  21st to 50th orders : ±1.0% rdg. ±0.3% f.s.
  Power : 1st to 20th orders : ±0.5% rdg. ±0.2% f.s.
  21st to 30th orders : ±1.0% rdg. ±0.3% f.s.
  31st to 40th orders : ±2.0% rdg. ±0.3% f.s.
  41st to 50th orders : ±3.0% rdg. ±0.3% f.s.
  (for 50/60 Hz, clamp-on sensor accuracy must be included for current and power)

Inter-harmonic voltage and current
- Analysis window : Rectangular
- Analysis orders : 0.5 to 49.5

Harmonic voltage/current phase difference (including fundamental waveform content)
- Measurement method : Difference between voltage and current phase angle components
- Display items : Sum of all or multiple channels
- Measurement accuracy : 1st to 3rd orders : ±2°
  4th to 50th orders : ±(0.02° × k+2°), k = harmonic order
  (for 50/60 Hz, clamp-on sensor accuracy must be included for current and power)

-5. Display specifications

Display device : 6.4" TFT color LCD (640 × 480 dots)

Text display : English, German, French, Italian, Spanish or Japanese

-6. External interface specifications

(1) External control terminals : External event input and output

(2) PC card interface Slot : Compliant with PCMCIA/JEIDA PC Card Standard, Type II slot × 1
- Compatible cards : Flash ATA cards up to 528 MB

(3) RS-232C interface
- Standard : EIA RS-232C-compliant (with 9-pin D-sub connector)
- Destination device : Printer or modem
- Printer interval selections : OFF, 1, 5, 10, or 30 minutes, 1 or 2 hours

(4) LAN interface
- Communications protocol : Ethernet and TCP/IP (with 10BASE-T RJ-45 connector)

-7. Environment & safety specifications

Operating environment : Indoors, up to a height of 2000 m (6562.2 ft)

Storage temperature & humidity : -20 to 50°C, max. 80% rh (non-condensating)

Operating temperature and humidity : 0 to 40°C, max. 80% rh (non-condensating)

Maximum measurement terminal voltage : Voltage terminals : 780 Vrms AC, 1103 V peak
Current terminals : 1.7 Vrms AC, 2.4 V peak

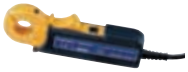
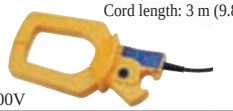
Maximum in-phase voltage : 600 Vrms AC (50/60 Hz, voltage input terminals)

Withstand voltage : 5.55 kVrms AC/1 minute
(50/60 Hz, 1 mA current sensitivity)
Between voltage and clamp input terminals, between the voltage input terminal and 3196 casing, and between voltage input terminals (U1 to U3) and voltage input terminal (U4)

Enclosure protection : IP30 (per EN60529)

Standards conformance : EMC : EN61326-1:1997+A1:1998 CLASS A, EN61000-3-2:1995+A1:1998+A2:1998, and EN61000-3-3:1995
Safety : EN61010-1:1993+A2:1995
Voltage input unit : Contamination Level 2, Measurement Category III
(Anticipated transient overvoltage: 6000 V)

■ Option Specifications

Clamp On Sensors	9694	9660	9661	9669
Appearance	Cord length: 3 m (9.84 ft)  CE CAT III 300V	Cord length: 3 m (9.84 ft)  CE CAT III 300V	Cord length: 3 m (9.84 ft)  CE CAT III 600V	Cord length: 3 m (9.84 ft)  CE CAT III 600V
Primary current rating	5A AC	100 A AC	500 A AC	1000 A AC
Output voltage	10 mV/A AC	1 mV/A AC	1 mV/A AC	0.5 mV/A AC
Accuracy (45 to 66 Hz) Amplitude	±0.3% rdg. ±0.02% f.s.	±0.3% rdg. ±0.02% f.s.	±0.3% rdg. ±0.01% f.s.	±1.0% rdg. ±0.01% f.s.
Accuracy (45 to 66 Hz) Phase	±2° or less	±1° or less (±1.3° for 90 A or more)	±0.5° or less	±1° or less
Frequency characteristic	±1.0% or less for 66 Hz to 5 kHz (deviation from specified accuracy)			±2.0% or less for 66 Hz to 5 kHz (deviation from specified accuracy)
Effect of external magnetic field	Corresponding to 0.1 A or less (with magnetic field of 400 A/m AC)			Corresponding to 1 A or less (with magnetic field of 400 A/m AC)
Effect of conductor position	±0.5% or less			±1.5% or less
Maximum rated voltage to earth	300 Vrms (insulated conductor)	300 Vrms (insulated conductor)	600 Vrms (insulated conductor)	600 Vrms (insulated conductor)
Maximum allowable input (45 to 66 Hz)	50 A continuous	130 A continuous	550 A continuous	1000 A continuous
Measurable conductor diameter	ϕ15 mm (0.59") or less	ϕ15 mm (0.59") or less	ϕ46 mm (1.81") or less	ϕ55 mm (2.17") or less, 80 (3.15") × 20 (0.79") mm busbar
Dimensions and weight	46W (1.81") × 135H (5.31") × 21D (0.83") mm, 230 g (8.1 oz.)	46W (1.81") × 135H (5.31") × 21D (0.83") mm, 230 g (8.1 oz.)	77W (3.03") × 151H (5.94") × 42D (1.65") mm, 360g (12.7 oz.)	99.5W (3.92") × 188H (7.40") × 42D (1.65") mm, 590g (20.8 oz.)

Clamp On Sensor	9667
Appearance	Cord length Sensor to circuit: 2 m (6.56 ft) Circuit to connector: 1 m (3.28 ft) CE CAT III 1000V 
Primary current rating	500 A AC, 5000 A
Output voltage	500 mV AC f.s.
Accuracy (45 to 66 Hz) Amplitude	±2.0% rdg. ±1.5 mV (for input 10% or more of the range)
Accuracy (45 to 66 Hz) Phase	±1° or less
Frequency characteristic	±3 dB or less for 10 Hz to 20 kHz (deviation from specified accuracy)
Effect of external magnetic field	Corresponding to 5 A, 7.5 A max. (with magnetic field of 400 A/m AC)
Effect of conductor position	±3.0% or less
Maximum rated voltage to earth	1000 Vrms (insulated conductor)
Maximum allowable input (45 to 66 Hz)	10000 A continuous
Measurable conductor diameter	ϕ254 mm (10") or less
Dimensions and weight	Sensor length: 910 mm (2.99 ft), 240 g (8.5 oz.), Circuit: 57W (2.24") × 86H (3.39") × 30D (1.18") mm, 140 g (4.9 oz.)
Power supply	LR03 alkaline battery × 4 (continuous operation max. 168 hours) or 9445 AC ADAPTER(optional)

9290-10 CLAMP-ON ADAPTER

Cord length : 3 m (9.84 ft)
Up to 1500 A AC, CT ratio : 10:1
Measurable conductor diameter :
ϕ55 mm (2.17"), width : 80 mm (2.17") bus bar

9339 CARRYING CASE

(soft case)

450W (17.72") × 350H (13.78") × 200D (7.87") mm, 3.0 kg (106.01 oz.)

9340 CARRYING CASE

(hard case)

380W (14.96") × 560H (22.05") × 260D (10.24") mm, 6.3 kg (222.2 oz.)

Standard accessories

9458 AC ADAPTER

100 to 240 V AC, 1.2 A 50/60 Hz

104W (4.09") × 51H (2.01") × 18D (0.71") mm, 250 g (8.83 oz.)

9459 BATTERY PACK

7.2 V DC, 2700 mAh

9670 PRINTER option components

The 9671 AC ADAPTER should be purchased along with the 9670 PRINTER. Also, the 9638 RS-232C CONNECTION CABLE or RS-232C cable (9- to 25-pin crossover) is required to connect to the 3196.

9671 AC ADAPTER

100 to 240 VAC, 50/60 Hz
134W (5.28") × 70H (2.76") × 41D (1.61") mm
350 g (12.37 oz.)

■ Accessories

3196 POWER QUALITY ANALYZER
(9438-02 VOLTAGE MEASUREMENT CABLE (one each of red, yellow, blue and gray, plus four black lines, Cord length: 3 m (9.84 ft), 9459 BATTERY PACK, 9458 AC ADAPTER, Strap, LAN connector cover, Input Cord Label, Operating Manual (CD-R), Quick Start Manual)

By itself, the 3196 is only capable of voltage measurement. Purchase the optional 9660 or 9661 CLAMP-ON SENSOR for current and power measurement.

● Standard combination example

Supports three-phase 3-wire (3P3W3M) and three-phase 4-wire measurements
Models 3196 + 9661 (500 A) × 3 + 9339 + PC card (64 MB)

■ Options

9660	CLAMP ON SENSOR (100 A AC) Voltage output type
9661	CLAMP ON SENSOR (500 A AC) Voltage output type
9667	FLEXIBLE CLAMP ON SENSOR (5000 A AC) Voltage output type
9445-02	AC ADAPTER (for the 9667, for America, Japan)
9445-03	AC ADAPTER (for the 9667, for Europe)
9669	CLAMP ON SENSOR (1000 A AC) Voltage output type
9694	CLAMP ON SENSOR (5 A AC) Voltage output type
9290-10	CLAMP ON ADAPTER
9264-01	WIRING ADAPTER (3P3W)
9264-02	WIRING ADAPTER (3P4W)
9438-02	VOLTAGE MEASUREMENT CABLE (standard accessory)
9459	BATTERY PACK (standard accessory)
9670	PRINTER (with one roll recording paper)
9671	AC ADAPTER (for 9670)
9237	RECORDING PAPER (80 mm (3.15") x 25 m (82.03 ft), 4 rolls, for 9670)
9638	RS-232C CABLE (1.5 m (4.92 ft), for printer connection)
9642	LAN CABLE (5m (16.41 ft), with straight and crossover connectors)
9339	CARRYING CASE (soft)
9340	CARRYING CASE (hard)
9624	PQA HiVIEW (PC application software)
9626	PC CARD 32 M
9627	PC CARD 64 M
9726	PC CARD 128 M
9727	PC CARD 256 M
9728	PC CARD 512 M

Operating Manual (bound version)

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