HIOKI

INSTRUCTION MANUAL

3196

POWER QUALITY ANALYZER

EN50160 MODE

HIOKI E. E. CORPORATION

Contents

Introduction

3196 EN50160 mode is available on Ver1.30 or later. Note that EN50160 mode is not available in versions prior to Ver1.30.

NOTE For operating environment, maintenance, and disposal at end of life, the same conditions apply as to the main 3196.
Refer to the 3196 Instruction Manual for details regarding basic operation procedures.

Symbols

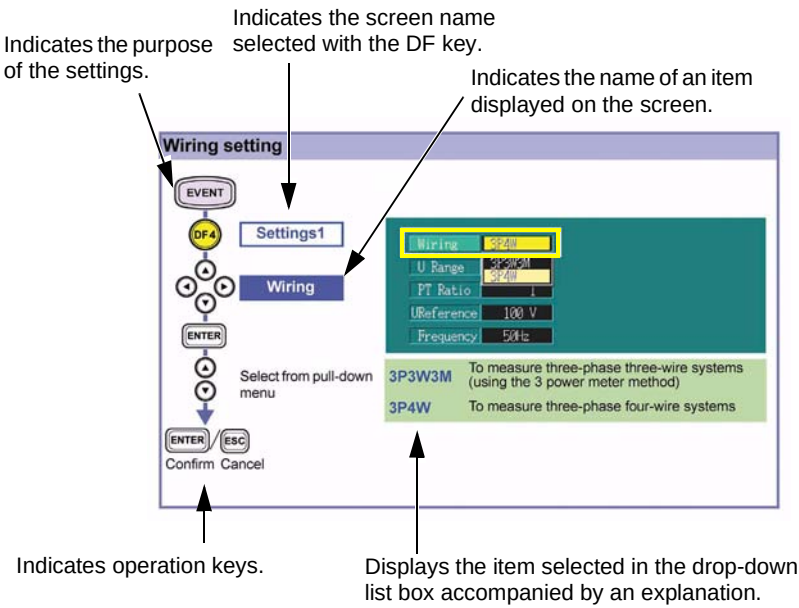
The following symbols in this manual indicate the relative importance of cautions and warnings.

⚠CAUTION	Indicates that incorrect operation presents a possibility of injury to the user or damage to the product.
NOTE	Advisory items related to performance or correct operation of the product.
❖	Indicates the reference.

Safety

Read the Instruction Manual supplied with the 3196 unit very carefully, and follow the indications given under "DANGER," "WARNING," "CAUTION," and "NOTE."

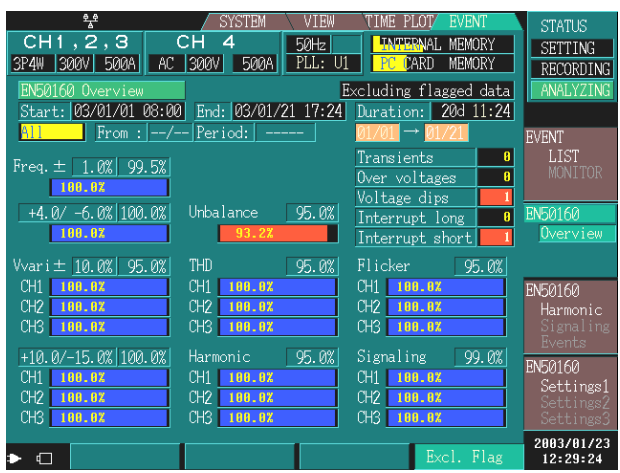
Outlook of Operating Procedures



Overview 1

1.1 Product Overview

The EN50160 version of the 3196 can measure and analyze the power supply voltage characteristics in accordance with the definitions stated in the European standard EN50160:1999 “Voltage characteristics of electricity supplied by public distribution systems”.



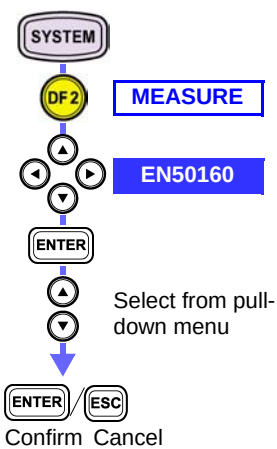
EN50160 Overview Screen

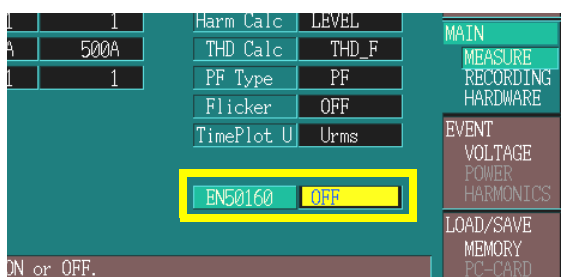
Preparation for Measurement 2

2.1 EN50160 Mode and Normal Mode

Model 3196 (Ver1.30 or later) can be used to measure in EN50160 mode in addition to the normal measurement of Model 3196 (normal mode).
When EN50160 mode is selected, the measurement function for EN50160 is added to the normal mode, and some functions in normal mode will be limited.
Refer to Section 2.4, "Limitations in EN50160 mode" (page 8) for details of the limitations.
Be sure to check that you are in the correct measurement mode before using the 3196.

Changing the mode

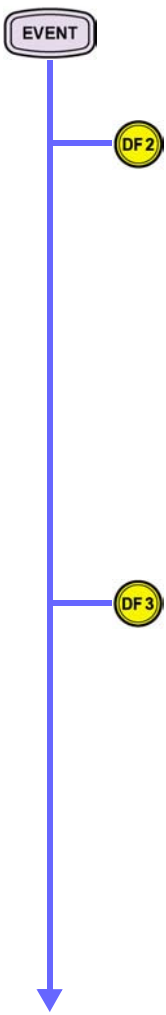


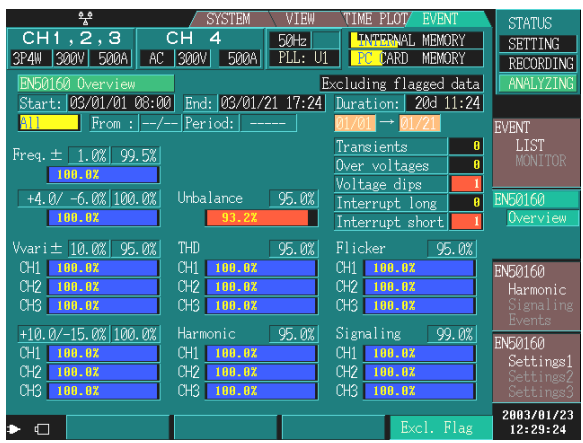


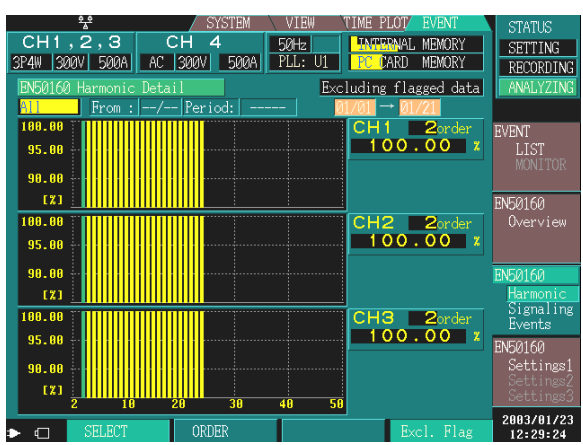
OFF	Normal mode
ON	EN50160 mode

2.2 EN50160 Screen

In EN50160 mode, the screen for EN50160 is accessible from the "EVENT" screen.
In general, there are 3 screen types, and measurement in EN50160 mode is possible only in these screens.
In addition, screens for normal mode (e.g., Timeplot and DMM) can be displayed during EN50160 measurement.







DF4

2.3 PC Card

When EN50160 mode is selected, the detailed data for EN50160 is saved into the PC card in real time, and only data for the display is saved in the internal memory.

Using a PC card is recommended for further analysis after measurement by using the PC application software.

❖ Section 4.5, "PC Card" (page 42)

2.4 Limitations in EN50160 mode

The limitations are indicated below.

Items	Fixed value
Wiring (123ch)	3P3W3M or 3P4W
Frequency	50Hz
U Calc Type	PHASE-N (3P4W), LINE-LINE (3P3W3M)
Harm Calc	For EN *1
THD Calc	THD_F
Flicker	Pst, Plt
Filter	230V lamp
MemoryFull	LOOP
Interval	10 min
Auto Save	BINARY

note *1: Harm Calc For EN
Harmonic Calculation of Voltage is % of Un (Nominal voltage).
Harmonic Calculation of Current and Power are % of Fundamental.

Events	Fixed value
U Transient	123ch ON, 4ch OFF
Urms SWELL	ON
Urms DIP	ON
U Interrupt	ON
Frequency	ON (common to Freq.A of EN50160 settings)
U THD (123ch)	123ch ON, 4ch OFF
U unb	ON
U Harmonics	123ch ON, 4ch OFF

2.5 Default Values

When pressing the default key (F1 key) in the EN50160 setting screen [EVENT]-[DF4_Setting], the settings related to EN50160 mode is reset to the following default values that are set forth by the EN50160 standard. The settings for other parameters are not reset.

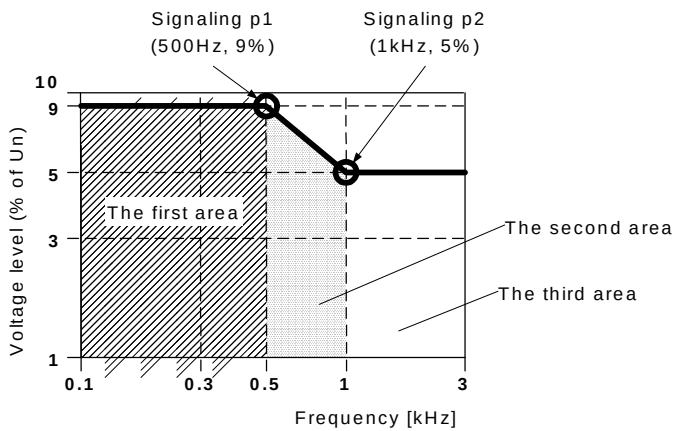
Default Values

Items	Default	Good% Default
Wiring	3P4W	-----
U Range	300V	-----
PT Ratio	1	-----
U Reference	230V	-----
Freq. A (±)	±1.0%	99.5%
Freq. B +	+4.0%	100.0%
Freq. B –	-6.0%	
V Variation A (±)	±10.0%	95.0%
V Variation B +	+10.0%	100.0%
V Variation B -	-15.0%	
Flicker	1.0	95.0%
Unbalance	2.0%	95.0%
THD	8.0%	95.0%
Harmonics(h2-h50)	refer to next table	95.0%
Signaling p1 Hz	500Hz	99.0%
Signaling p1 %	9.0%	
Signaling p2 Hz	1000Hz	
Signaling p2 %	5.0%	
Signaling spec1	off (110Hz)	
Signaling spec2	off (110Hz)	
Transient	180.0%	-----
Over voltage(swell)	110.0%	-----
Dips	90.0%	-----
Interruption	1.0%	-----
Short int time	180s	-----

Default value of each Harmonic order

Order	% of Un	Order	% of Un	Order	% of Un
---	---	11	3.5	21	0.5
2	2.0	12	0.5	22	0.5
3	5.0	13	3.0	23	1.5
4	1.0	14	0.5	24	0.5
5	6.0	15	0.5	25-50	OFF
6	0.5	16	0.5		
7	5.0	17	2.0		
8	0.5	18	0.5		
9	1.5	19	1.5		
10	0.5	20	0.5		

Signaling



Signaling p1:
Threshold level and the End of frequency in the First area
Signaling p2:
Threshold level and the Start of frequency in the Third area

The threshold level of the first area and the third area is the same value from the starting frequency to the ending frequency, and the second area is their transition area.
The threshold level of the second area is decided automatically by the first and the third areas.

Measurement 3

3.1 Setting Default Values

To simplify the settings, Model 3196 is programmed with the settings as described in the EN50160 standard as default.
By initializing the settings before starting measurement, EN50160 measurement can be started without making further complicated settings.
In addition, changing each setting is possible. Please refer to 4. Detailed settings for details.

Setting default values

3.2 Starting Measurement

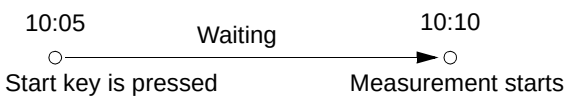
Start measurement by pressing the START key after wiring and settings have been completed.

NOTE

Punctual time measurement start

EN50160 mode starts measurement at the punctual times as shown below immediately after the START key is pressed.
xx:00:00, xx:10:00, xx:20:00, xx:30:00, xx:40:00, xx:50:00
Until the above times are reached, the 3196 is in waiting status.

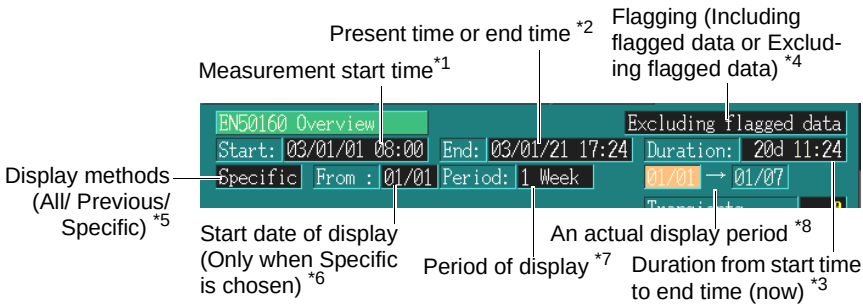
(Example)
When the start key is pressed at 10:05, the 3196 waits to start measurement until 10:10.



3.3 The EN50160 Screen during Measurement

The EN50160 screen is changeable after as well as during measurement. Also, the analysis start date and period to display can be switched arbitrarily.
The data is displayed on the main unit in one-day units except for the measurement start date and the last date (including the current date).
Select either "Excl. Flag" or "Incl. Flag" in each screen to choose whether or not to analyze the parameters when a dip, swell or interruption event occurs.

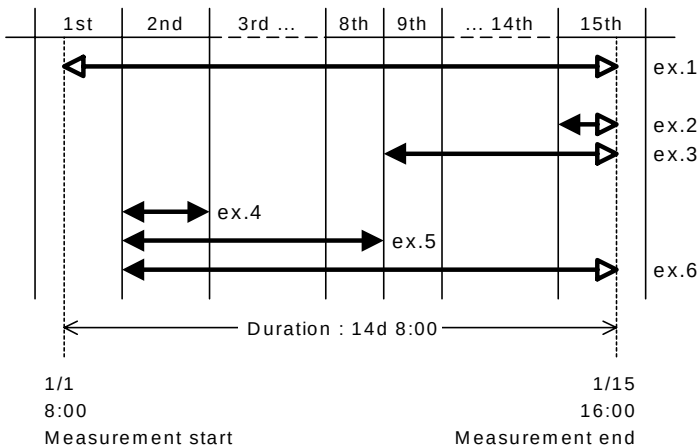
3.3.1 Common Display Areas



*1 Start	Indicates measurement start date and time.
*2 End	Indicates date and time during measurement or measurement end date and time.
*3 Duration	Indicates duration from start time to end time (now)
*4 Flagging	This is offered to see the judgment without the effect of dip, swell and interruption events which affect all parameters. When the F4 button is pushed, the indication in the upper right switches between "Including flagged data" and "Excluding flagged data". The display will also change. Including flagged data: Include flagged data in the statistics Excluding flagged data: Do not include flagged data in the statistics
*5 Display methods	There are three display methods. All — Display the data from measurement start to the present (or end) time Previous — Display the data for a designated period recorded prior to the present (or end) time Specific — Display the data for a designated period from a specified date
*6 Start date of display	When "Specific" is chosen as the display method, the date can be input. When "Previous" is chosen as the display method, "Before:Now" or "Before:End" is displayed.
*7 Period of display	When "Previous" or "Specific" is chosen as the display method, the period can be selected. Note that only periods shorter than the recorded period can be selected. (e.g.)Recorded period:10 days, choose from 1 day or 1 week only.
*8 An actual display period	Indicate an actual display date from the display start date to the display end date. The time is not displayed, but it means from 00:00 of the start date to 23:59 of the end date. When the background turns orange, this indicates that data on the display start date or the display end date did not reach a day.

Sample combinations of the display method and period

	Method	Start date	Period
ex.1	All	---	---
ex.2	Previous	---	1 day
ex.3	Previous	---	1 week
ex.4	Specific	01/02 (Jan./2nd)	1 day
ex.5	Specific	01/02 (Jan./2nd)	1 week
ex.6	Specific	01/02 (Jan./2nd)	2 weeks

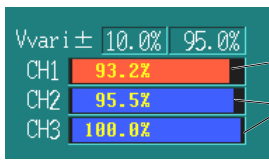


Note:

Indicates data does not reach a day.
Background turns red for the item of an actual display period.

NOTE The latest data is always displayed when "Previous" is chosen during the measurement.

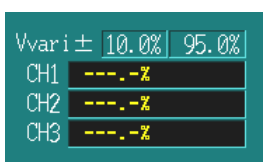
The ratio of Good judgment in the designated period is displayed as a numeric value and bar graph.
The left end of the bar graph indicates 0% and the right end indicates 100%.
Also, the results of the comparison ratio and the Good% is expressed by the color.



Red: the ratio of Good judgment is less than Good%.
Blue: the ratio is more than or equal to Good%.

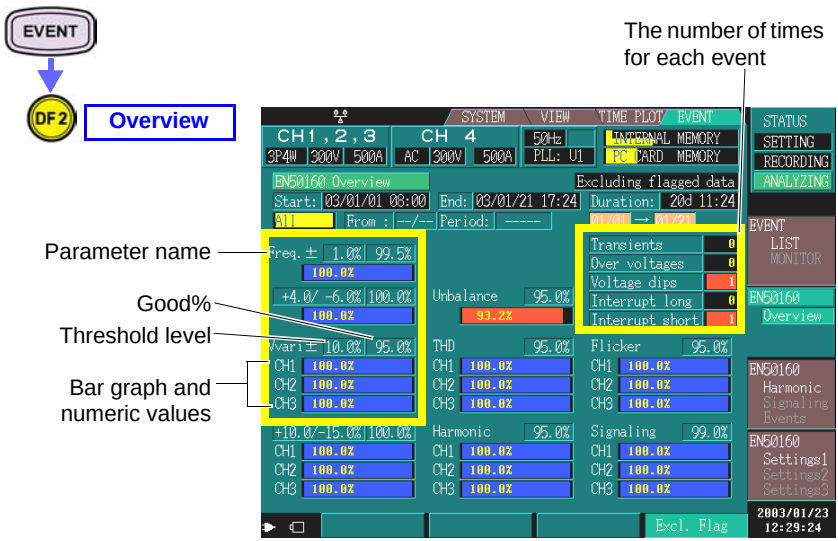
When there are no recorded data, it is displayed as the following figure.
e.g.) Right after measurement start.

or When Excl. Flag is chosen under the conditions which flagging occurs in frequently.

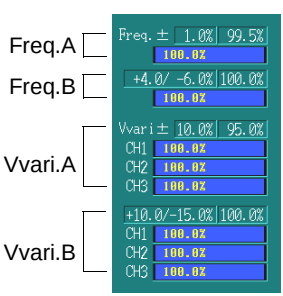


3.3.2 Overview Screen

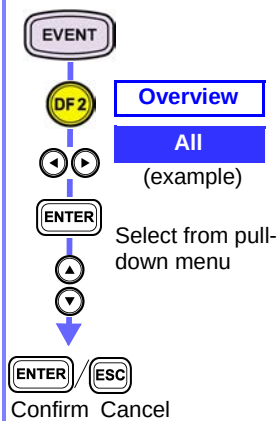
Display all the measurement parameters for EN50160 measurement.
The details of each screen are explained as follows.

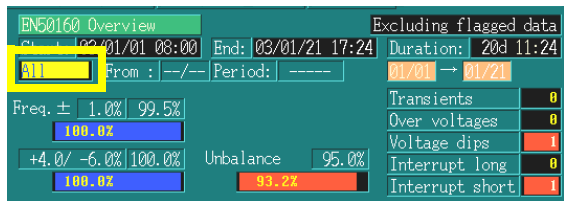


The following 4 parameters are simplified and displayed.



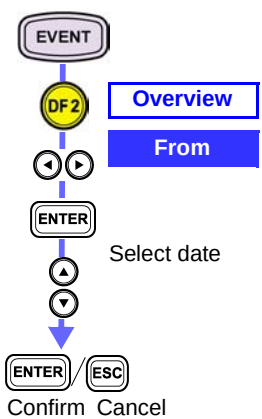
Changing the display method

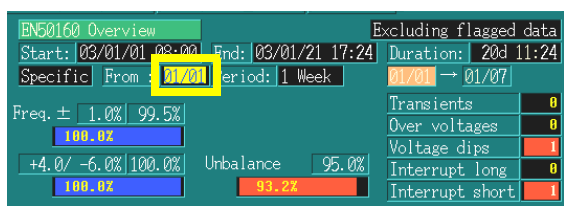




All	Display the data from measurement start to the present (or end) time
Previous	Display the data for a designated period recorded prior to the present (or end) time
Specific	Display the data for a designated period from a specified date

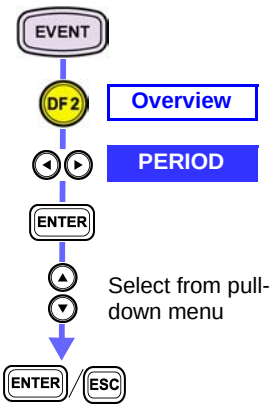
Changing the start date of display

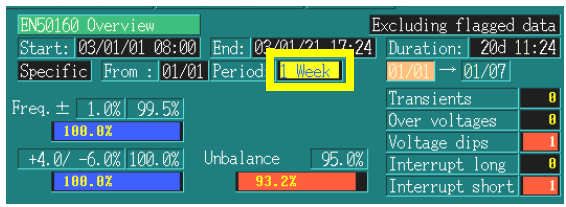




When "Specific" is chosen as the display method, input the date.

Changing the period of display

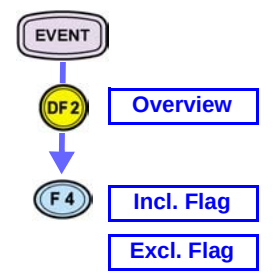


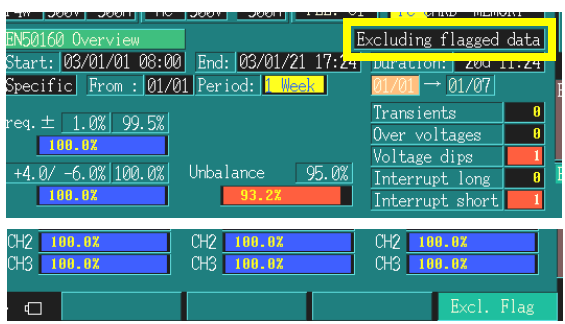


1 day, 1 week, 2 weeks, 3 weeks, 4 weeks

When "Previous" or "Specific" is chosen as the display method, the period can be selected.
Note that only periods shorter than the recorded period can be selected.
(e.g.)Recorded period:10 days, chose from 1 day or 1 week only.

Changing the flagging



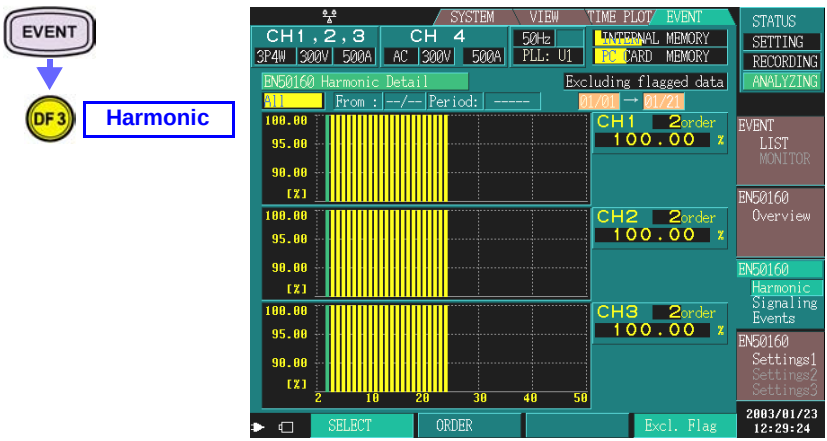


Including flagged data	Include flagged data in the statistics
Excluding flagged data	Do not include flagged data in the statistics

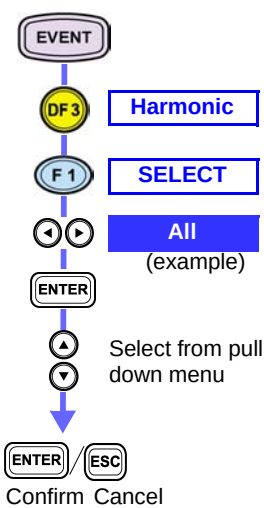
This is offered to see the judgment without the effect of dip, swell and interruption events which affect all parameters.
When the F4 button is pushed, the indication in the upper right switches between "Including flagged data" and "Excluding flagged data".

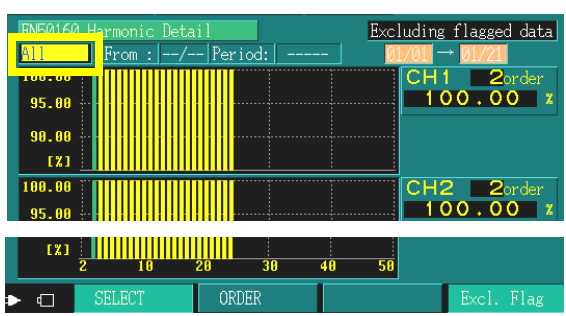
3.3.3 Harmonic Screen

Display each order of Harmonic.



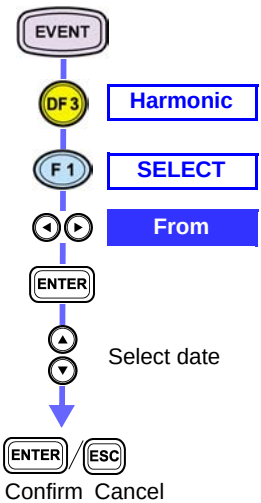
Changing the display method

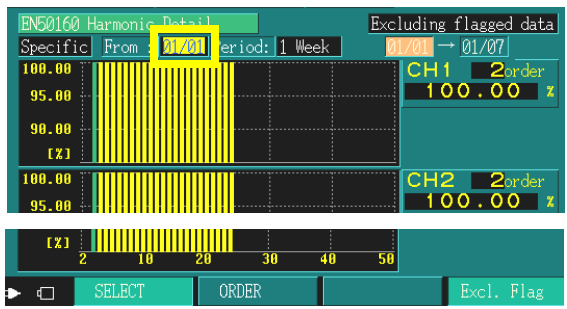




All	Display the data from measurement start to the present (or end) time
Previous	Display the data for a designated period recorded prior to the present (or end) time
Specific	Display the data for a designated period from a specified date

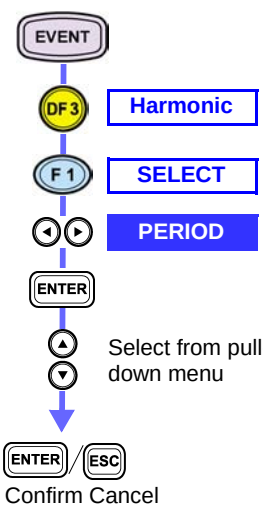
Changing the start date of display

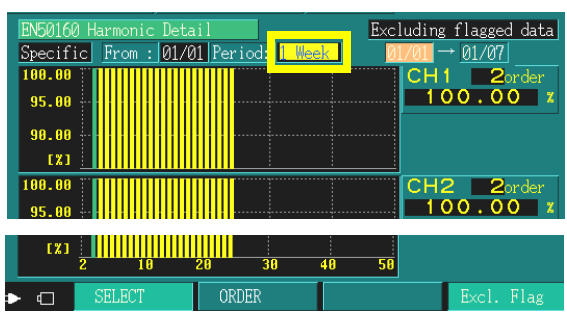




When "Specific" is chosen as the display method, the date can be input.
When "Previous" is chosen as the display method, "Before:Now" or "Before:End" is displayed.

Changing the period of display

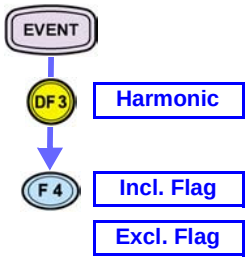


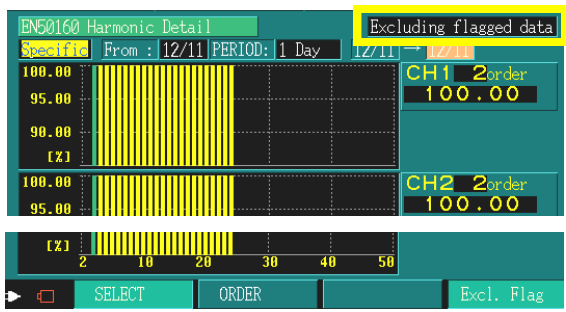


1 day, 1 week, 2 weeks, 3 weeks, 4 weeks

When "Previous" or "Specific" as the display method, the period can be selected.
Note that only periods shorter than the recorded period can be selected.
(e.g.) Recorded period:10 days, chose from 1 day or 1 week only.

Changing the flagging

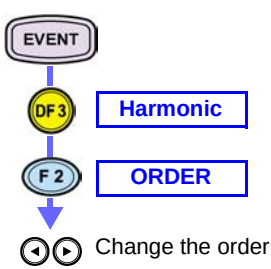


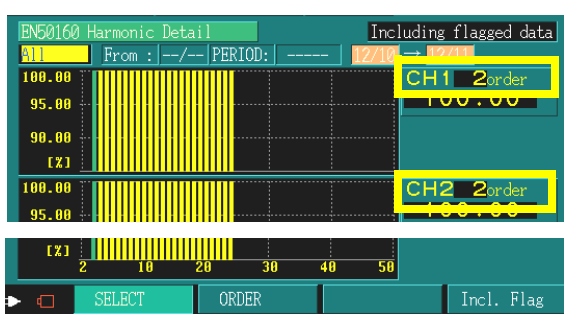


Including flagged data	Include flagged data in the statistics
Excluding flagged data	Do not include flagged data in the statistics

This is offered to see the judgment without the effect of dip, swell and interruption events which affect all parameters.
When the F4 button is pushed, the indication in the upper right switches between "Including flagged data" and "Excluding flagged data".
The display will also change.

Changing the order indicated

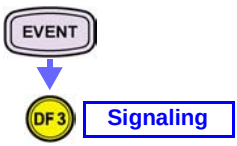




The selected order becomes green on the bar graph.
If you change the order, the values change along with the bar graph.

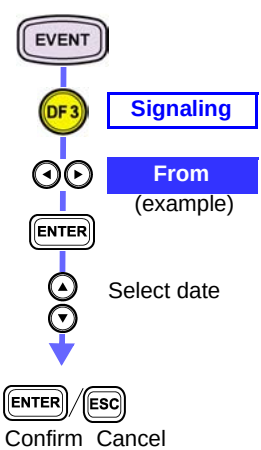
3.3.4 Signaling Screen

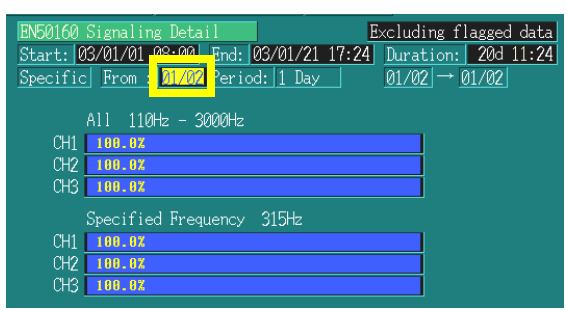
Display the results of an analysis for all and specified frequency.



NOTE The data displayed in the Signaling screen is one-day data of the specified date, because EN50160 standards require that signaling be assessed terms of one-day periods. However, signaling in the Overview screen is the result of statistics from the same period as other parameters.

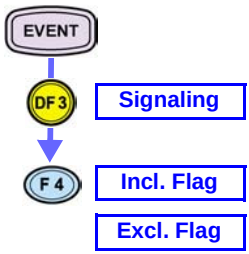
Changing the start date of display





Input the date.

Changing the flagging

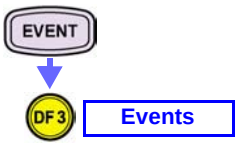


Including flagged data	Include flagged data in the statistics
Excluding flagged data	Do not include flagged data in the statistics

This is offered to see the judgment without the effect of dip, swell and interruption events which affect all parameters.
When the F4 button is pushed, the indication in the upper right switches between "Including flagged data" and "Excluding flagged data".
The display will also change.

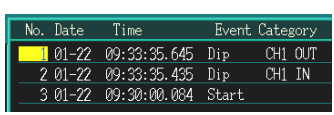
3.3.5 Events Screen

Display a detailed table which indicates Dips, Swells, Interruptions and Transients.
The time and level cannot be changed.



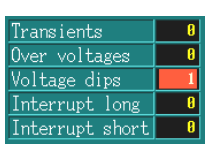
In the normal mode, when an event occurs, an event is counted twice.
e.g.) "Event IN", "Event OUT"

However in the EN50160 events screen, one event is counted only once.

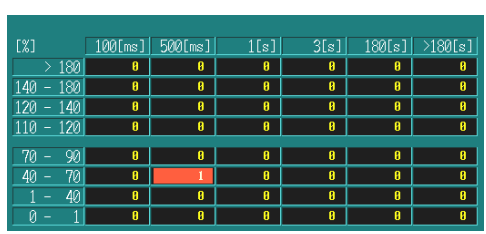


Normal event list

Normal event monitor



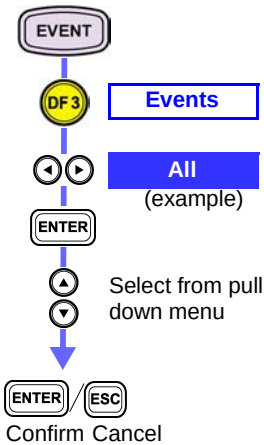
EN50160 Overview

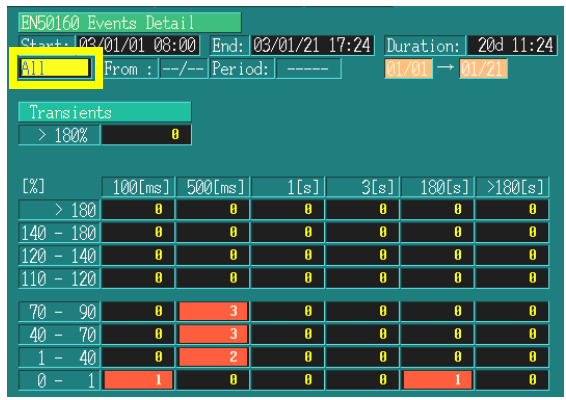


EN50160 Event screen

The above screens (normal mode and EN50160 screen) display the same event.

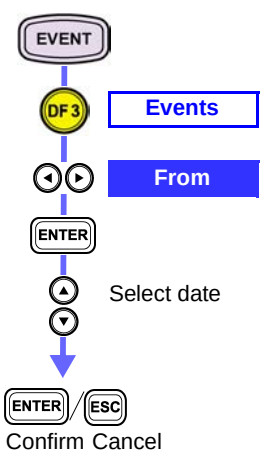
Changing the display method

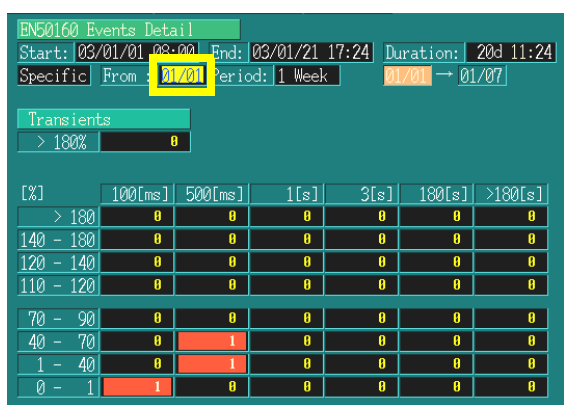




All	Display the data from measurement start to the present (or end) time
Previous	Display the data for a designated period recorded prior to the present (or end) time
Specific	Display the data for a designated period from a specified date

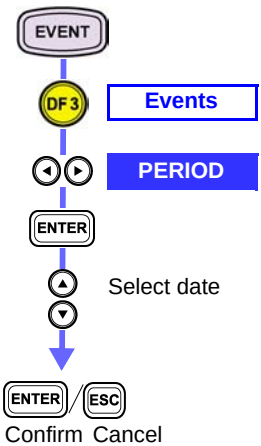
Changing the start date of display

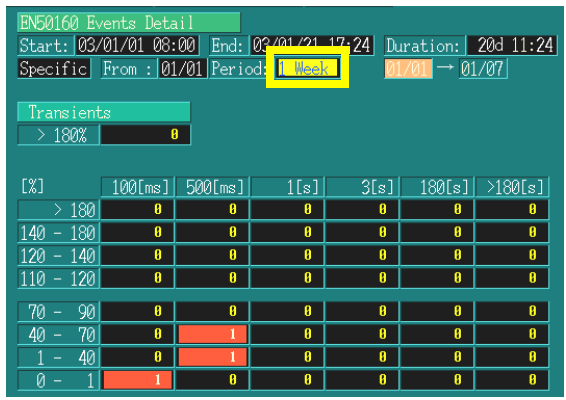




When "Specific" is chosen as the display method, the date can be input.
When "Previous" is chosen as the display method, "Before:Now" or "Before:End" is displayed.

Changing the period of display

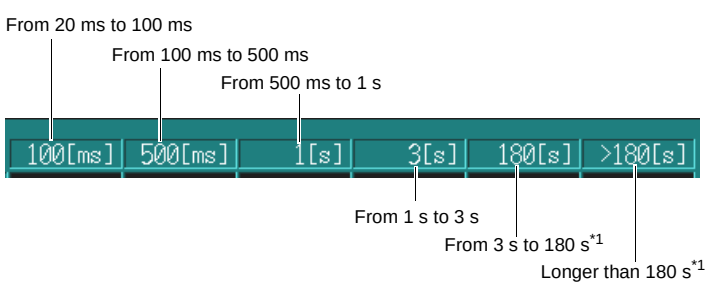




1 day, 1 week, 2 weeks, 3 weeks, 4 weeks

When "Previous" or "Specific" is chosen as the display method, the period can be selected.
Note that only periods shorter than the recorded period can be selected.
(e.g.) Recorded period:10 days, chose from 1 day or 1 week only.

NOTE The displayed time in the table indicates event duration.
The displayed time equals to the time range shown below.

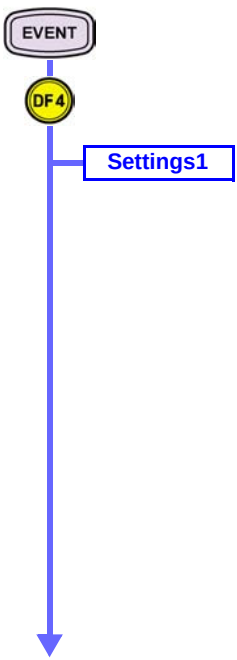


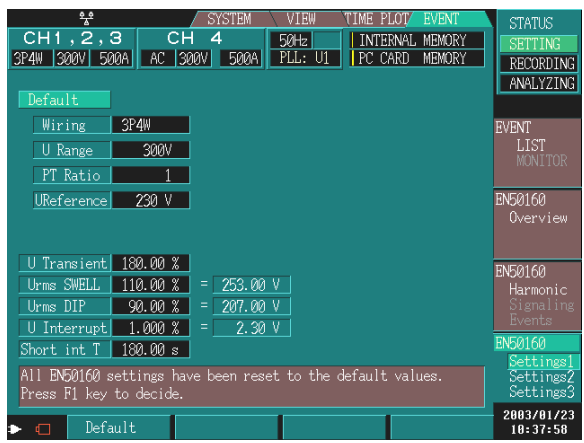
*1: Setting value of Short interruption time (default 180 s)

Detailed Settings 4

4.1 Selecting EN50160 mode

Settings for EN50160 mode are made in the EN50160 setting screen.
Details for each setting are as follows:





Settings for the Measurement system ..... 4.2 (page 29)
Settings for threshold of Event..... (page 32)

Settings2

Settings for threshold of parameter ..... (page 35)
Settings for Good % ..... (page 39)

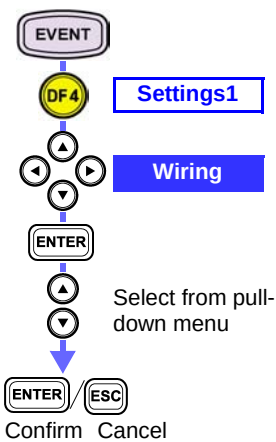
Settings3

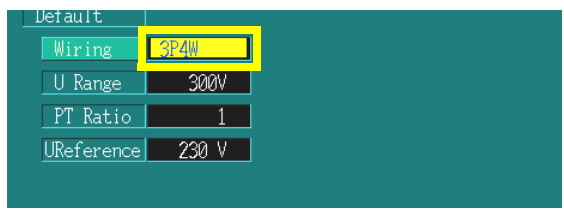
Settings for threshold of Harmonic ..... (page 40)

4.2 Settings for the Measurement System

The following (Wiring setting, U range setting, VT(PT) Ratio, U Reference) are settings for installation. Please set the values according to your measurement system.
The setting contents are similar to those available in the normal 3196 mode but the settings conducted here will take priority when EN50160 mode is selected. As such, setting in the system screen of normal mode will not be possible.

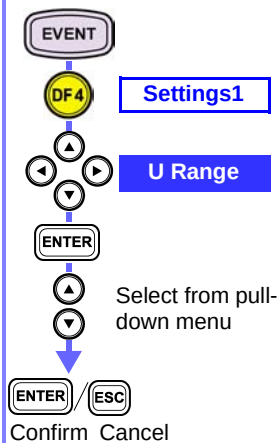
Wiring setting

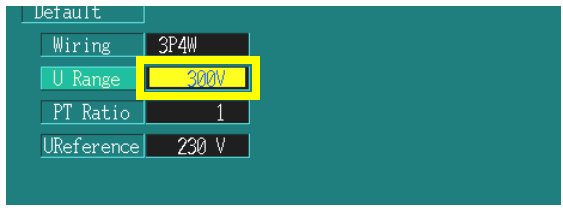




3P3W3M	To measure three-phase three-wire systems (using the 3 power meter method)
3P4W	To measure three-phase four-wire systems

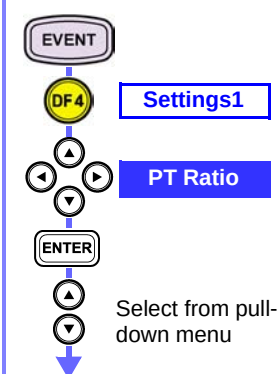
U range setting

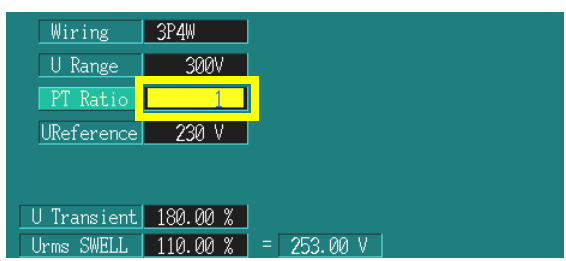




Set 123ch range only.
4ch range is set on the SYSTEM screen.

PT(VT) ratio settings



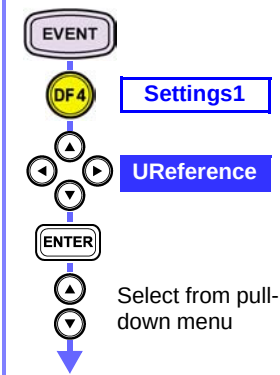


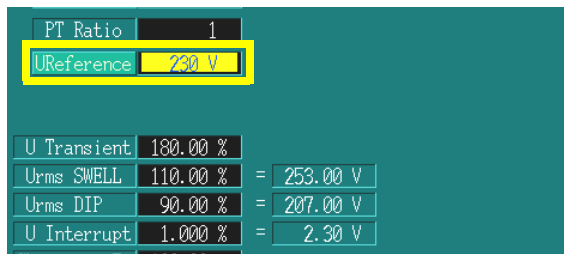
VARIABLE,1, 60, 100, 200, 300, 600, 700, 1000, 2000, 2500, 5000

You can set the optional PT ratio within the 0.01 to 9999.99 range.
When setting Optional:

Moving between values	: Moves up through the values : Moves down through the values
Setting value	: Increases the value : Lowers the value

Nominal voltage settings





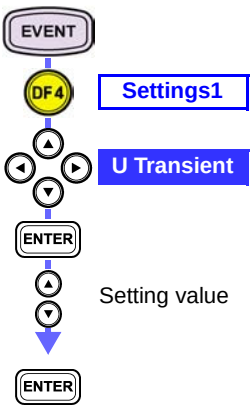
100V, 101V, 110V, 120V, 200V, 202V, 208V, 220V, 230V, 240V, 277V, 346V, 380V, 400V, 415V, 480V, 600V, VARIABLE

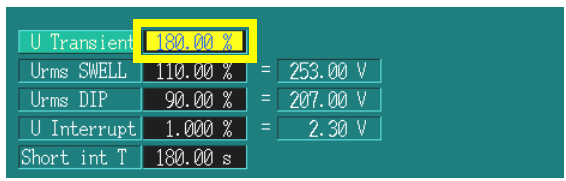
Nominal voltage is effective for channels 1 to 3.
You can set the optional nominal voltage within the 50 to 600 range.

Moving between values	: Moves up through the values : Moves down through the values
Setting value	: Increases the value : Lowers the value

Settings for threshold of Event

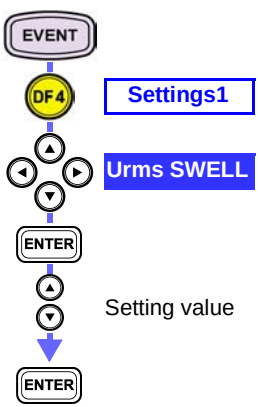
Transient

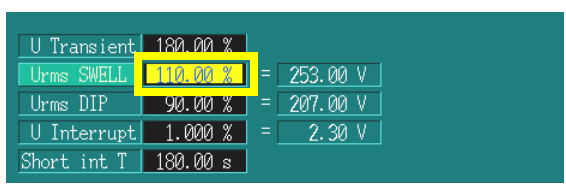




Set transient value.
Nominal voltage (UReference) is standard (100%).

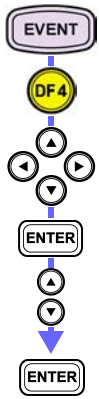
Over voltage(swell)

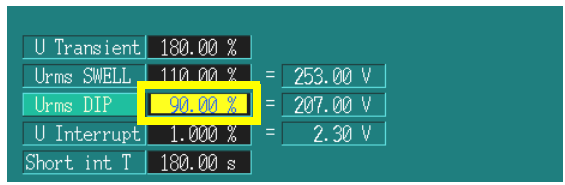




Set swell value.
Nominal voltage (UReference) is standard (100%).

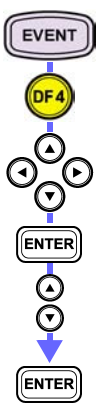
Dip

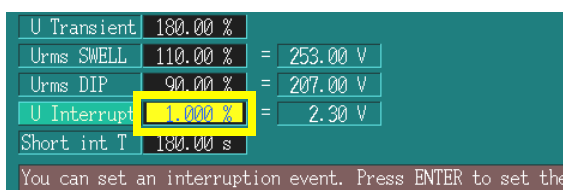




Set dip value.
Nominal voltage (UReference) is standard (100%).

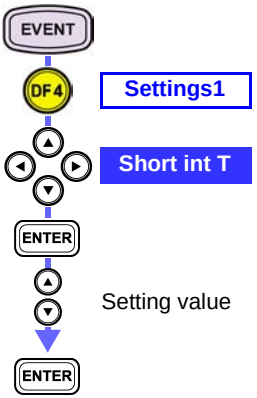
Interruption

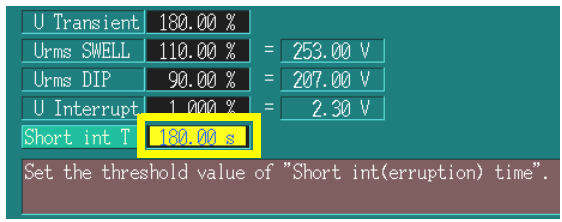




Set interruption value.
Nominal voltage (UReference) is standard (100%).

Short interruption time





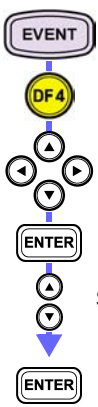
The time for a short interruption is specified.
An interruption up to this period is identified as a "short interruption."
An interruption longer than this period will be identified as a "long interruption."

4.3 Threshold Setting

The threshold values set here are compared to the measured power supply voltage characteristics for the High/Low judgment. The default values are set forth by the EN50160 standard, but they can be modified arbitrarily. Once set, these values cannot be changed during or after measurement because the calculated data during measurement will not be stored and therefore cannot be re-analyzed. The measured data will be judged “good” or “no good” against these thresholds.

Settings for threshold of parameter

Frequency A,B



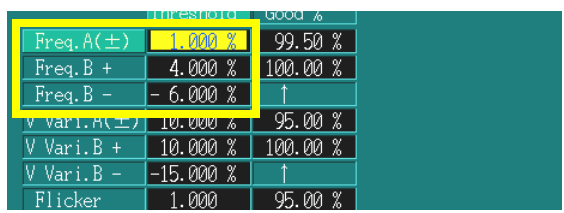
Settings2

Freq.A(±)

Freq.B+

Freq.B–

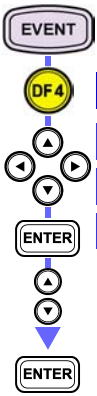
Setting value



Freq.A(±) The decision range is narrow.
(Plus and minus values are the same)

Freq.B +/– The decision range is wide.
(Plus and minus values are different)

Voltage variation A,B



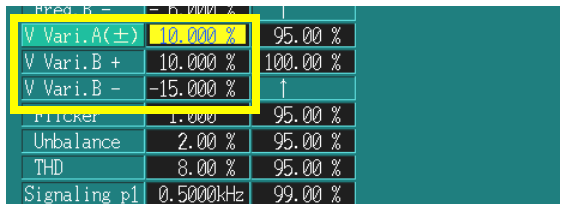
Settings2

V Vari.A(±)

V Vari.B+

V Vari.B–

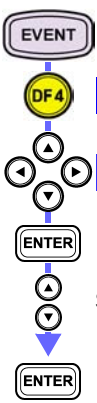
Setting value



V Vari.A(±) The decision range is narrow.
(Plus and minus values are the same)

V Vari.B +/– The decision range is wide.
(Plus and minus values are different)

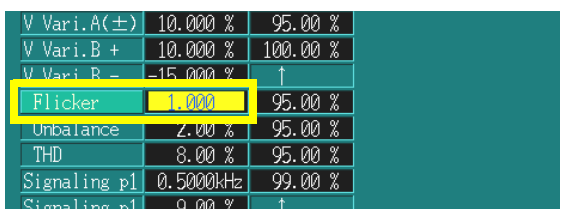
Flicker



Settings2

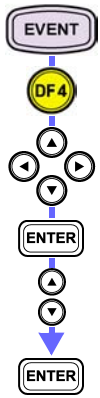
Flicker

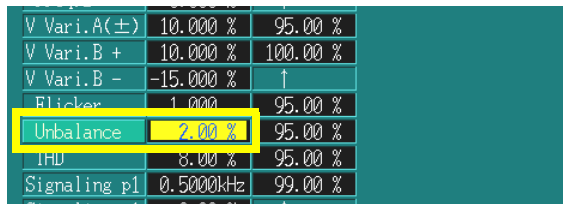
Setting value



Set Plt value of Flicker.

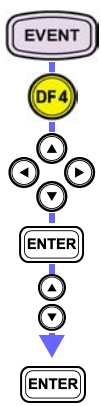
Unbalance

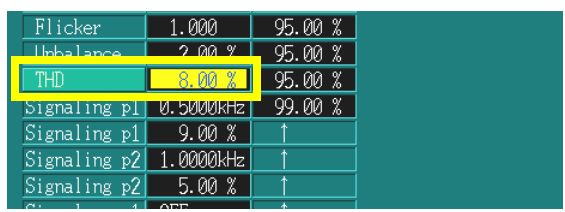




Set unbalance value.

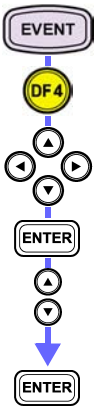
THD





Set THD value.

Signaling

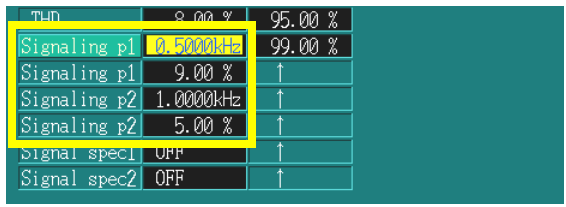


Settings2

Signaling p1

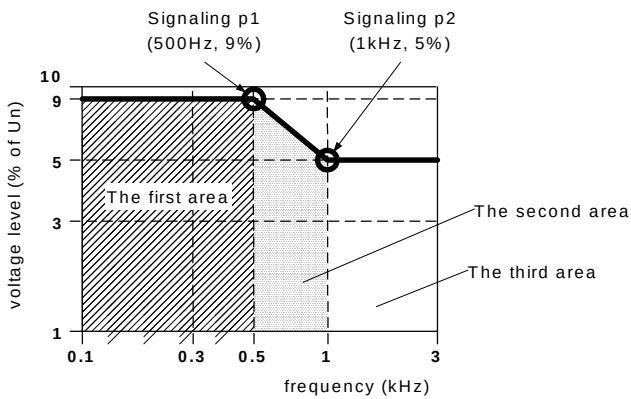
Signaling p2

Setting value



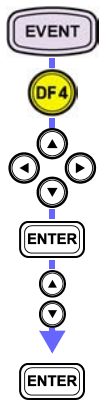
Signaling p1 Threshold level and the End of frequency in the First area

Signaling p2 Threshold level and the Start of frequency in the Third area



"Good percentage" Setting

Good%



Settings2

Setting value

Set the threshold for the ratio of “Good” judgments for the measurement period or the specified display period.

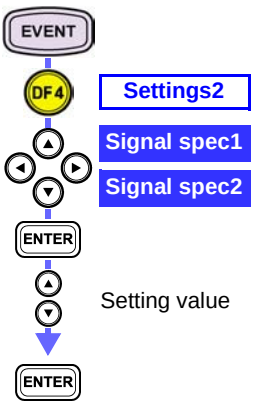
This setting does not affect the measurement calculations directly. The ratio is indicated in the statistics display against a blue background if the “Good” percentage is more than the set value and against a red background if the percentage is less than that set for the “Good” ratio.

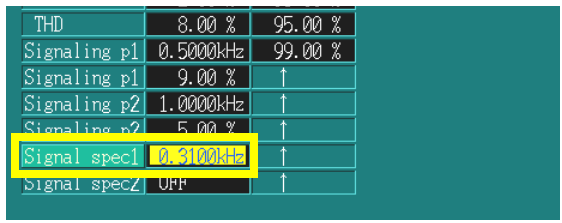
The default values are set forth by the EN50160 standard, but they can be modified arbitrarily.

The set value cannot be changed during measurement, but can be modified after measurement.

Special Settings

Signaling specified frequency

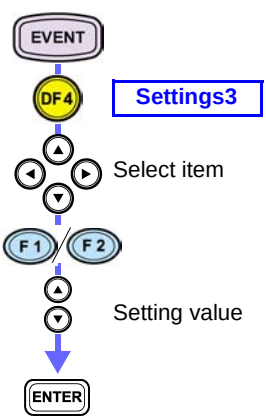


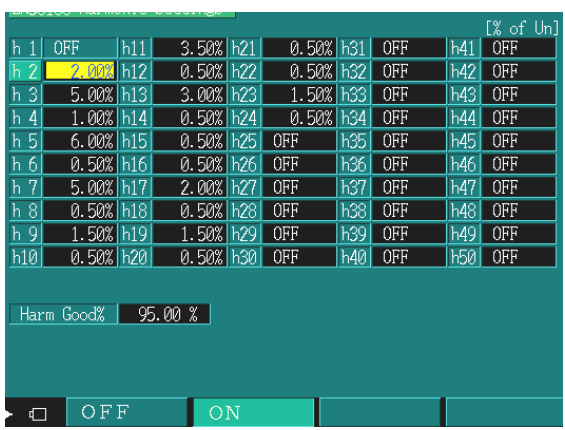


To monitor a specific frequency, two optional frequencies can be specified.
The frequency range is from 110 Hz to 3000 Hz in 5 Hz steps.

Settings for threshold of Harmonic

Harmonic (from 2nd to 50th)





Set each harmonic order.
Nominal voltage (UReference) is standard (100%).

4.4 Settings in 3196 Mode Screen

Normal measurement and various settings in normal mode are possible in addition to EN50160 measurement except for the limitations explained earlier.
Set the values in normal mode as required.

4.5 PC Card

In EN50160 mode, 3 files consisting of detailed data, event data and display data are created and saved as dedicated files in addition to normal measurement data. All of these data files are stored in the same directory as normal measurement data.
The file names are “EN50160.EN”, “EVENT.EN” and “EN_DISP.EN”.
These files are always stored in the PC card and it is not possible to turn off this function manually. “EN_DISP.EN” files are also stored in internal memory.
If a PC card is not inserted, there will be a warning message, but please note that the internal memory will store only “EN_DISP.EN” files.
“EN_DISP.EN” data can also be saved manually after measurement has been completed.

NOTE

- Using a PC card during measurement is strongly recommended.
- Normal storage data: Data stored in normal mode
- In EN50160 mode, setting of "Autosave" is fixed at "BINARY."

❖ See Section 9.2.3 of the Instruction Manual (CD-R) for the main unit.

How Each File is Used

Detailed data and event data are the files used for further analysis and print out via the PC application software. However, these data cannot be loaded to the 3196 unit.
Display data “EN_DISP.EN” is data used for displaying information on the EN50160 screen of the 3196. This data can be loaded on the 3196 main unit only.

Specifications 5

The specifications not indicated in this document are stated in the standard specifications for Model 3196.

5.1 Basic Specifications

Applicable version	Ver1.30 or later
Mode	EN50160 mode (EN50160 ON), Normal mode (EN50160 OFF) The mode is selectable under the EN50160 item in the “SYSTEM-MAIN-MEASURE” screen.
Measurement system	Measurement frequency: 50Hz Amplitude of supply voltage: 230V Supply system: 3-phase 4-wire or 3-phase 3-wire

5.2 In EN50160 mode, items that differ from normal 3196 specifications

1. Setting function specifications

When EN50160 mode is selected, some functions in normal mode will be limited. The limitations are described in below.

System settings

Measured Line	3P3W3M/3P4W
Measured line frequency	50 Hz (fixed)
RMS voltage measurement	Automatically set depending on the measured line. Phase-to-neutral voltage (3P4W) Line-to-line voltage (3P3W3M)
Harmonic measurement	For EN (fixed) Harmonic voltage calculation: “% of Un” (nominal voltage) Harmonic current and power calculations: “% of fundamental” (percentage content)
Harmonic distortion factor measurement	THD-F (fundamental standard)(fixed)
Flicker measurement	Pst, Plt (fixed)
Filter	230V lamp (fixed)

Measurement time control settings

Timed start	ON/OFF OFF After the start button is pressed, the start time will be automatically set to the next 10-minute unit on the internal clock, and the end time will be automatically set to 1 month after the start time. ON Manually set the start time in 10-minute units and end time in 1-minute units.

Time series data settings

Interval settings	10 min (fixed)

PC card settings

Auto-save settings	BINARY (fixed)

Event settings

The following items are fixed values and cannot be changed.

Transient overvoltage	CH1,2,3: ON, CH4:OFF
Voltage swell	CH1,2,3: ON
Voltage dip	CH1,2,3: ON
Voltage interruption	CH1,2,3: ON
Voltage frequency	ON common with Freq.A
Voltage unbalance factor	ON (fixation)
Harmonic voltage	CH1,2,3: ON, CH4: OFF
Total voltage harmonic distortion factor	CH1,2,3: ON, CH4: OFF

2. Measurement function and analysis function specifications

The following screens are added to the "EVENT" screen.

(1) EN50160 Overview (display)
(2) EN50160 Harmonic (display)
(3) EN50160 Signaling (display)
(4) EN50160 Events (display)
(5) EN50160 Settings1 (display)
(6) EN50160 Settings2 (display)
(7) EN50160 Settings3 (display)

5.3 EN50160 Measurement Parameters

Parameter name use in EN50160 standards	Parameter name used in Model 3196 normal mode	Equivalent name on 3196 EN50160 screen
Power frequency	Voltage frequency	Freq.A, Freq.B
Supply voltage variations	RMS voltage value	Vvari.A, Vvari.B
Flicker severity	Long interval IEC voltage flicker	Flicker
Supply voltage dips	Voltage dip	Voltage dips
Short interruptions of the supply voltage	Voltage interruption	Interrupt short
Long interruptions of supply voltage	Voltage interruption	Interrupt long
Temporary power frequency overvoltages between live conductors and earth	Voltage swell	Over voltages
Transient overvoltages between live conductors and earth	Transient overvoltage	Transients
Supply voltage unbalance	Voltage unbalance factor	Unbalance
Harmonic voltage	Harmonic voltage	THD, Harmonic
Mains signaling voltage on the supply voltage	None	Signaling

5.4 EN50160 Display Specifications

EN50160 Overview display

Contents of display	All measurement results of EN50160 measurement parameters are displayed in the bar graph as well as under the number of event occurrences.
Bar graph display	The ratio of Good results in the display period is displayed as a value and a bar graph.
Displayed parameters as bar-graph	Freq.A, Freq.B, Vvari.A, Vvari.B, Unbalance, THD, Harmonic, Flicker, Signaling
Displayed parameters as the number of event occurrences	Transients, Over voltages, Voltage dips, Interrupt long, Interrupt short
Display selection	• Display Methods: All/ Previous/ Specific All Display the data from measurement start to the present (or end) time. Previous Display the data for a designated period recorded prior to the present (or end) time. Specific Display the data for a designated period from a specified date. • From: Display start date is input. • Period: 1day/ 1week/ 2weeks/ 3weeks/ 4weeks Note that only periods shorter than the recorded period can be selected
Flagging selection	Incl. Flag/Excl. Flag
Display renewal period	3 seconds signaling 10 secondsFreq.A, Freq.B 10 minutes Vvari.A, Vvari.B, Unbalance, THD, Harmonic, Flicker

EN50160 Harmonic display

Contents of display	Measurement results of the voltage harmonic in each order are displayed as a bar graph for each channel.
Display form	Three division display CH1, CH2, CH3

EN50160 Harmonic display

Display selection	• Display Methods: All/ Previous/ Specific All: Display the data from measurement start to the present (or end) time. Previous: Display the data for a designated period recorded prior to the present (or end) time. Specific: Display the data for a designated period from a specified date. • From: Display start date is input. • Period: 1day/1week/ 2weeks/ 3weeks/ 4weeks Note that only periods shorter than the recorded period can be selected
Cursor measurement	Cursor read-out value of order (from 2nd to 50th)
Flagging selection	Incl. Flag/Excl. Flag
Display renewal period	10 minutes

EN50160 Signaling display

Contents of display	Measurement results of signaling are displayed as a bar graph for each channel.
Display form	Three division display (All and specific frequency1,2)
Display selection	Display Method: Specific (fixed) From: Display start date
Display period	Display the data for 1 day from a specified date
Flagging selection	Incl. Flag/Excl. Flag
Display renewal period	3 seconds

EN50160 Events display

Contents of display	Display the number of transient occurrences. Display a table which indicates the relation with the period and the depth of the event. Used events: Over voltages, Voltage dips, Interrupt long, Interrupt short
Display form	Three division display

EN50160 Events display

Sorting	Depth: 0 to 1%[*1], 1 to 40%, 40 to 70%, 70 to 90%[*2] 110[*3] to 120%, 120 to 140%, 140 to 180%[*4], 180%[*4] or more Period: 20ms to 100ms, 100ms to 500ms, 500ms to 1s, 1s to 3s, 3s to 180s[*5], 180s[*5] or more *1: Setting value of Interruption(default 1%) *2: Setting value of Dip(default 90%) *3: Setting value of Swell(default 110%) *4: Setting value of Transient(default 180%) *5: Setting value of Short Interruption time(default 180s) Depth is given as a percentage of the nominal voltage (Un).
Display selection	• Display Methods: All/ Previous/ Specific All Display the data from measurement start to the present (or end) time. Previous Display the data for a designated period recorded prior to the present (or end) time. Specific Display the data for a designated period from a specified date. • From: Display start date is input. • Period: 1day/1week/2weeks/3weeks/4weeks Note that only periods shorter than the recorded period can be selected

Flagging display

Including Flagged data	Including flagged data in the statistics
Excluding Flagged data	Excluding flagged data in the statistics

5.5 EN50160 Setting Specifications

Settings1

Measurement system settings and parameter settings

Setting items	Setting range	Default
Measured line	3P3W3M, 3P4W	3P4W
Voltage range	150V/300V/600V	300V
VT(PT) ratio	1/60/100/200/300/600/700/1000/2000/2500/5000/ variable(0.01 to 9999.99)	1
Nominal voltage	100/101/110/120/200/202/208/220/230/240/277/ 346/380/400/415/480/600/ variable (50 to 600V in 1V steps)	230V
Transient overvoltage	40.0 to 800.0% (50V ≤ nominal voltage ≤ 200V) 40.0 to 500.0% (200V ≤ nominal voltage ≤ 400V) 40.0 to 300.0% (400V < nominal voltage ≤ 600V)	180.0%
Voltage swell	100.0 to 120.0%	110.0%
Voltage dip	70.0 to 100.0%	90.0%
Voltage interruption	0.0 to 40.0%	1.0%
Short interruption time	3 to 300s	180s

Setting items	Threshold		Good%	
	Setting range	Default	Setting range	Default
Freq.A(±)	0.0 to 10.0%	1.0%	80.0 to 100.0%	99.5%
Freq.B +	0.0 to 10.0%	4.0%	80.0 to 100.0%	100.0%
Freq.B -	-10.0 to 0.0%	-6.0%		
Vvari.A(±)	0.0 to 20.0%	10.0%	80.0 to 100.0%	95.0%
Vvari.B +	0.0 to 20.0%	10.0%	80.0 to 100.0%	100.0%
Vvari.B -	-20.0 to 0.0%	-15.0%		
Flicker	0.0 to 20.0	1.0	80.0 to 100.0%	95.0%
Unbalance	0.0 to 100.0%	2.0%	80.0 to 100.0%	95.0%
THD	0.0 to 100.0%	8.0%	80.0 to 100.0%	95.0%

Setting items	Threshold		Good%	
	Setting range	Default	Setting range	Default
Signaling p1 (frequency)	110Hz to (p2 freq-5Hz)	500Hz	80.0 to 100.0%	99.0%
Signaling p1 (level)	0.0 to 100.0%	9.0%		
Signaling p2 (frequency)	(p1 freq+5Hz) to 3000Hz	1000Hz		
Signaling p2 (level)	0.0 to 100.0%	5.0%		
Signaling spec1	110 to 3000Hz/OFF	OFF		
Signaling spec2	110 to 3000Hz/OFF	OFF		

Settings3

Settings of voltage harmonic

Setting order	2nd to 50th
Threshold default value	Refer to the following table
Good% setting range	80.0 to 100.0%
Good% default value	95.0%

Threshold default values of individual voltage harmonic for orders up to 50th

Order	%ofUn	Order	%ofUn	Order	%ofUn	Order	%ofUn	Order	%ofUn
---	---	6	0.5	11	3.5	16	0.5	21	0.5
2	2.0	7	5.0	12	0.5	17	2.0	22	0.5
3	5.0	8	0.5	13	3.0	18	0.5	23	1.5
4	1.0	9	1.5	14	0.5	19	1.5	24	0.5
5	6.0	10	0.5	15	0.5	20	0.5	25-50	OFF

5.6 Data Storage

<table>
<tr><td>Stored data</td><td>EN50160.EN, EVENT.EN, EN_DISP.EN</td></tr>
<tr><td>Auto save</td><td>ON (fixed)</td></tr>
<tr><td>Stored directory</td><td>The same directory as normal measurement data</td></tr>
<tr><td>File form</td><td>Binary only</td></tr>
<tr><td>File load</td><td>•: Possible / ×: Not possible
<table>
<tr><th>File name</th><th>Contents</th><th>Unit load</th><th>9624-10*1</th></tr>
<tr><td>EN50160.EN</td><td>All parameter data</td><td>×</td><td>•</td></tr>
<tr><td>EVENT.EN</td><td>Events detailed data for EN50160</td><td>×</td><td>•</td></tr>
<tr><td>EN_DISP.EN</td><td>Display data for EN50160</td><td>•</td><td>×</td></tr>
</table>
*1: Future release
By specifying a directory to load the data, the 3196 will load the display data for EN50160 along with the time plot data and event data, which are normal measurement data.</td></tr>
</table>

5.7 EN50160 Measurement Specifications

The results of calculations are compared to the threshold at every interval. When a result is less than the threshold, it is recorded as a “Good” judgment.
(Refer to the appendix for details regarding the ”ten-minute mean rms value” as well as the “three-second mean value” and “$U_{rms(1/2)}$” calculation methods.)

1. Flagged data

During a voltage dip, voltage swell or voltage interruption, the other parameters are recorded as Flagged data.

2. Measurement parameters

Power frequency (Voltage frequency)

Interval	10 seconds
Calculation method	The mean value for 10 seconds Calculated from the number of cycles within 10 seconds of the internal clock (absolute time).
Threshold default value	Freq.A ±1.0%, Freq.B +4.0%/-6.0% (Given as a percentage of 50Hz)
Good% default value	Freq.A: 99.5%, Freq.B: 100.0%

Supply voltage variations (RMS voltage value)

Interval	10 minutes
The basic measurement time interval	10 cycles (about 200ms)
Calculation method	Ten-minute mean rms value
Threshold default value	Vvari.A ±10.0%, Vvari.B +10.0%/-15.0% (Given as a percentage of the nominal voltage(Un))
Good% default value	Vvari.A 95.0%, Vvari.B 100.0%

Flicker severity (Long interval IEC voltage flicker)

Interval	10 minutes

Flicker severity (Long interval IEC voltage flicker)

Calculation	Plt (Plt is calculated from Pst available every 10 minutes) Plt is calculated using the following formula if “Flagging” occurs. $Plt(flg) = \sqrt[3]{\frac{1}{N}\sum_{i=1}^{N}(Pst_i)^3}$ [N = 12 - (number of Pst*i* not flagged)] However, Plt(flg)=0 (if all Pst*i* are flagged)
Threshold default value	1.0
Good% default value	95.0%

Supply voltage unbalance (Voltage unbalance factor)

Interval	10 minutes
The basic measurement time interval	10 cycles (about 200ms)
Calculation method	Ten-minute mean rms value
Threshold default value	2.0%
Good% default value	95.0%

Harmonic voltage

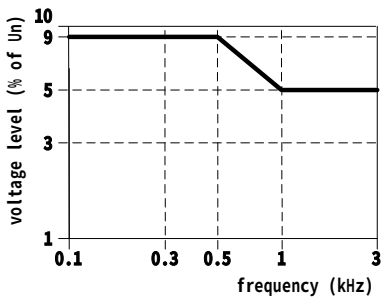
Interval	10 minutes
The basic measurement time interval	10 cycles (about 200ms)
Calculation method	Ten-minute mean rms value
Used order for THD	2nd to 50th
Threshold default value	THD 8.0%, Refer to the following table for each order.
Good% default value	95.0%

Threshold default values of individual voltage harmonic for orders up to 50th

Order	%ofUn	Order	%ofUn	Order	%ofUn	Order	%ofUn	Order	%ofUn
---	---	6	0.5	11	3.5	16	0.5	21	0.5
2	2.0	7	5.0	12	0.5	17	2.0	22	0.5
3	5.0	8	0.5	13	3.0	18	0.5	23	1.5
4	1.0	9	1.5	14	0.5	19	1.5	24	0.5
5	6.0	10	0.5	15	0.5	20	0.5	25-50	OFF

Mains signaling voltage on the supply voltage

Interval	3 seconds
The basic measurement time interval	10 cycles (about 200ms)
Calculation method	Three-second mean value
Frequency range	110Hz to 3,000Hz in 5Hz steps
Threshold default value	Refer to the following figure (Given as a percentage of the nominal voltage (Un))
Good% default value	99.0%



Mains signaling voltage on the supply voltage threshold default value

Supply voltage dips (Voltage dip)

Detection method	A dip begins when the $U_{rms(1/2)}$ voltage of one or more channels is below the dip threshold and ends when the $U_{rms(1/2)}$ voltage on all measured channels is equal to or above the dip threshold plus the hysteresis voltage. When an interruption occurs during a voltage dip, this event is not detected as a "Voltage dip" but as a "Voltage interruption".
Threshold default	90.0% (Given as a percentage of the nominal voltage(Un))
Voltage dip duration	The time difference between the beginning and the end of the voltage dip.
Voltage dip depth	The lowest $U_{rms(1/2)}$ value measured on any channel during the dip.

Temporary power frequency overvoltages between live conductors and earth (Voltage swell)

Detection method	A swell begins when the Urms(1/2) voltage of one or more channels is above the swell threshold and ends when the Urms(1/2) voltage on all measured channels is equal to or below the swell threshold minus the hysteresis voltage.
Threshold default	110.0% (Given as a percentage of the nominal voltage(Un))
Voltage swell duration	The time difference between the beginning and the end of the voltage swell.
Maximum swell voltage	The largest $U_{rms(1/2)}$ value measured on any channel during the swell.

Short interruptions of the supply voltage (Voltage interruption)
Long interruptions of the supply voltage (Voltage interruption)

Detection method	A voltage interruption begins when the $U_{rms(1/2)}$ voltage of one or more channels is below the voltage interruption threshold and ends when the $U_{rms(1/2)}$ voltage on all measured channels is equal to or greater than the voltage interruption threshold plus the hysteresis voltage. An interruption up to the short interruption time is identified as a "short interruption." An interruption longer than the short interruption time is identified as a "long interruption."
Threshold default	1.0% (Given as a percentage of the nominal voltage(Un))
Short interruption time default	180 seconds
Voltage interruption duration	The time difference between the beginning and the end of the voltage swell.
Voltage interruption depth	The lowest $U_{rms(1/2)}$ value measured on any channel during the interruption.
Frequency during the interruption	50 Hz

Transient overvoltages between live conductors and earth (Transient overvoltage)

Detection Method	Data sampled at 2MHz and those sampled in one waveform/256 points are compared and the threshold is set above those values.
Default threshold	Given as a percentage of nominal voltage (Un)
Size of Transient	Maximum value within 2MHz sampling (absolute value)
Transient Period	Transient Detection Period (4 ms max)

5.8 Calculation Formulas

Ten-minute mean rms value

$$\text{Ten-minutes mean rms value} = \sqrt{\frac{1}{N_{10}}\sum_{i=1}^{N_{10}}(V_{r200}i)^2}$$

N_{10}: Number of the basic measurement time intervals during 10min of absolute time.

V_{r200}: Calculated value in a basic measurement time interval of 10 cycles (200ms)

The basic measurement time interval of all parameters using the ten minutes mean rms value calculation formula is 10 cycles (200ms), so that $N_{10} \cong 3000$.

There is a possibility that 10 cycles may not equal 200ms due to frequency fluctuations, and because 10min of absolute time and the basic measurement time interval is not exactly the same.

Three-second mean value

$$\text{Three-second mean value} = \sqrt{\frac{1}{N_3}\sum_{i=1}^{N_3}(V_{r200}i)^2}$$

N_3 Number of basic measurement time intervals during 3s of absolute time.

V_{r200} Calculated value in a basic measurement time interval of 10 cycles (200ms)

$N_3 \cong 15$ for this calculation.

$U_{rms(1/2)}$

$U_{rms(1/2)}$RMS voltage refreshed each half cycle

Value of the rms voltage measured over one cycle, commencing at a zero-crossing of PLL CH, and refreshed each half cycle.

HIOKI 3196 POWER QUALITY ANALYZER
EN50160 MODE
Instruction Manual

Publication date: December 2006 Revised edition 1

Edited and published by HIOKI E.E. CORPORATION
Technical Support Section

All inquiries to International Sales and Marketing Department
81 Koizumi, Ueda, Nagano, 386-1192, Japan
TEL: +81-268-28-0562 / FAX: +81-268-28-0568
E-mail: os-com@hioki.co.jp
URL http://www.hioki.co.jp/

Printed in Japan 3196A986-01

HIOKI

HIOKI E. E. CORPORATION

HEAD OFFICE
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 / FAX +81-268-28-0568
E-mail: os-com@hioki.co.jp / URL http://www.hioki.co.jp/

HIOKI USA CORPORATION
6 Corporate Drive, Cranbury, NJ 08512, USA
TEL +1-609-409-9109 / FAX +1-609-409-9108

3196A986-01 06-12H

Printed on recycled paper