INSTRUCTION MANUAL

POWER QUALITY ANALYZER

KEW 6310

KYORITSU ELECTRICAL INSTRUMENTS WORKS, LTD.
TOKYO, JAPAN

● Unpacking Procedure

We thank you for purchasing the Power Quality Analyzer "**KEW6310**". Please check the contents and instrument before use.

● Items listed below are included with the standard set:

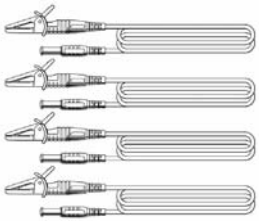
1	Main unit	KEW6310 : 1 unit
2	Voltage test lead	MODEL7141 : 1 set (red, black, green, blue: 1pce for each)
3	Power cord	MODEL7170 : 1 pce
4	USB cord	MODEL7148 : 1 pce
5	Quick manual	1 pce
6	CD-ROM	1 pce
7	Battery	Alkaline size AA battery LR6: 6pcs
8	Compact flash card	1 pce
9	Carrying case	MODEL9125 : 1 pce
10	Input terminal plate	1 pce
11	Cable marker	8-color x 4pcs each (red, blue, yellow, green, brown, gray, black, white)
12	Card Reader	MODEL8319

Optional parts

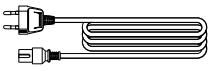
13	Clamp sensor	Depending on model purchased
14	Instruction manual for clamp sensor	1 pce
15	Compact flash card	64M/ 128M/ 256M/ 1GB
16	Carrying case for Main unit (with magnet)	MODEL9132
17	Power supply adapter	MODEL8312

1. Main unit

2. Voltage test lead

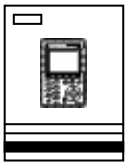


3. Power cord

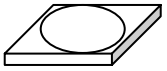


4. USB cord

5. Quick manual

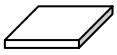


6. CD-ROM



7. Battery

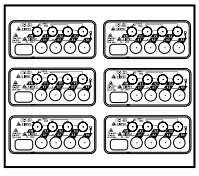
8. Compact flash card



9. Carrying case

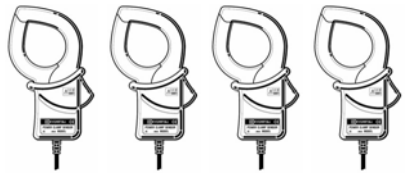
11. Cable marker

10. Input terminal plate



12. Card Reader : M-8319

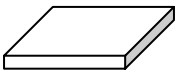
13. Clamp sensor
(depending on model purchased)



50A Type(ϕ24mm)	M-8128
100A Type(ϕ24mm)	M-8127
200A Type(ϕ40mm)	M-8126
500A Type(ϕ40mm)	M-8125
1000A Type(ϕ68mm)	M-8124
3000A Type(ϕ150mm)	M-8129
10A Type(ϕ24mm)	M-8146
10A Type(ϕ40mm)	M-8147
10A Type(ϕ68mm)	M-8148
1A Type(ϕ24mm)	M-8141
1A Type(ϕ40mm)	M-8142
1A Type(ϕ68mm)	M-8143

14. Instruction manual for clamp sensor

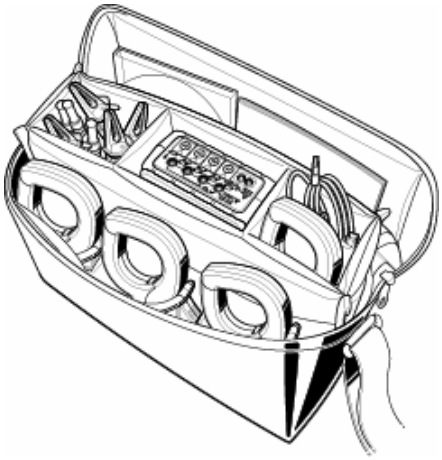
15. Compact flash card



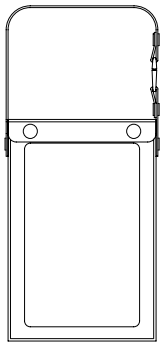
32MB	M-8305
64MB	M-8306
128MB	M-8307
256MB	M-8322
1GB	M-8323

● Storage

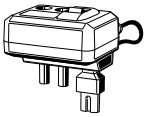
Store the items as shown below after use.



16. Carrying case for Main unit (with magnet)



17. Power supply adapter



● In case any of the items listed above are found to be damaged or missing or if the printing is unclear, please contact your local KYORITSU distributor from where the instrument was purchased.

● Safety warnings

This instrument has been designed, manufactured and tested according to IEC 61010: Safety requirements for Electronic Measuring apparatus, and delivered in the best condition after passing quality control tests.

This instruction manual contains warnings and safety rules which have to be observed by the user to ensure safe operation of the instrument and to maintain it in safe condition. Therefore, read through these operating instructions before using the instrument.

⚠ WARNING

- Read through and understand the instructions contained in this manual before using the instrument.
- Keep the manual at hand to enable quick reference whenever necessary.
- The instrument is to be used only in its intended applications.
- Understand and follow all the safety instructions contained in the manual.
- Read the enclosed Quick manual after reading this instruction manual.
- As to the Clamp sensor use, refer to the instruction manual supplied with the sensor.

It is essential that the above instructions are adhered to. Failure to follow the above instructions may cause injury, instrument damage and/or damage to equipment under test.

The symbol ⚠ indicated on the instrument, means that the user must refer to the related parts in the manual for safe operation of the instrument. It is essential to read the instructions wherever the ⚠ symbol appears in the manual.

⚠ **DANGER**	:	is reserved for conditions and actions that are likely to cause serious or fatal injury.
⚠ **WARNING**	:	is reserved for conditions and actions that can cause serious or fatal injury.
⚠ **CAUTION**	:	is reserved for conditions and actions that can cause injury or instrument damage.

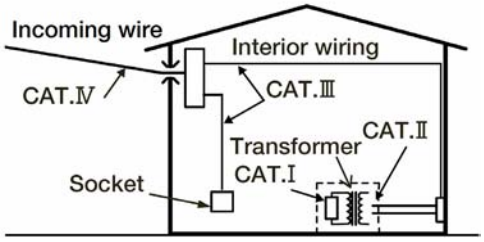
This instrument meets CAT. III 600V. To ensure safe operation of measuring instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT.I to CAT.IV, and called measurement categories. Higher-numbered categories correspond to electrical environments with greater momentary energy, so a measuring instrument designed for CAT.III environments can endure greater momentary energy than one designed for CAT.II.

CAT.I: Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.

CAT.II: Primary electrical circuits of equipment connected to an AC electrical outlet by a power cord.

CAT.III: Primary electrical circuits of the equipment connected directly to the distribution panel, and feeders from the distribution panel to outlets.

CAT.IV: The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).



⚠ DANGER

- Verify proper operation on a known source before use.
- Verify proper operation on a known source before use or taking action as a result of the indication of the instrument.
- Never make measurement on a circuit in which the electrical potential exceeds AC600V.
- Do not attempt to make measurement in the presence of flammable gasses. Otherwise, the use of the instrument may cause sparking, which can lead to an explosion.
- Never attempt to use the instrument if its surface or your hand are wet.

- Measurement -

- Do not exceed the maximum allowable input of any measuring range.
- Never open the Battery cover and CF card connector cover during a measurement.

- Battery -

- Never open the Battery Cover during a measurement.
- Brand and type of the batteries to be used should be harmonized.

- Power cord -

- Connect the Power cord mains plug to a mains socket outlet
- Use only the Power cord supplied with this instrument.

- Power supply connector -

- Never touch the Power supply connector although it is insulated while the instrument is operating with batteries.

- Voltage test leads -

- Use only the ones supplied with this instrument.
- Confirm that the measured voltage rating of the test lead is not exceeded.
- Do not connect a Voltage test lead unless required for measuring the parameters desired.
- Connect Voltage test leads to the instrument first, and only then connect them to the circuit under test.
- Never disconnect Voltage test leads while the instrument is in use.
- Connect to the downstream side of a circuit breaker since a current capacity at the upstream side is large.
- Do not touch two lines under test with the metal tips of the test leads.
- Never touch the metal tips of the test leads.

- Clamp sensor -

- Use only the ones dedicated for this instrument.
- Confirm that the measured voltage rating of the test lead is not exceeded.
- Do not connect a Camp sensor unless required for measuring the parameters desired.
- Connect sensors to the instrument first, and only then connect them to the circuit under test.
- Never disconnect sensors while the instrument is in use.
- Connect to the downstream side of a circuit breaker since a current capacity at the upstream side is large.
- Do not touch two lines under test with the metal tips of the test leads.

⚠ WARNING

- Connection -

- Confirm that the instrument is off, and then connect the Power cord.
- Connect the Voltage test leads and clamp sensors to the instrument first. Cord to be firmly inserted.
- Never attempt to make any measurement if any abnormal conditions, such as a broken cover or exposed metal parts are present on the Instrument, Voltage test leads, Power cord and Clamp sensor.

- Measurement –

- Ensure that the Current input terminal cover, USB connector cover and CF card connector cover are closed when not in use during a measurement.

- Not in use for a long period -

- Remove the Power cord from the outlet if the instrument will not be in use for a long period.

- Repair -

- Do not install substitute parts or make any modification to the instrument. Return the instrument to your local KYORITSU distributor for repair or re-calibration in case of suspected faulty operation.

- Battery -

- Do not try to replace the batteries if the surface of the instrument is wet.
- Ensure that the Power cord, Voltage test leads and Clamp sensor are removed from the instrument, and that the instrument is switched off when opening the Battery cover for battery replacement.
- Do not use dry-cell batteries with the Selector Switch set to “RECHARGEABLE BATTERY” position. It may cause electrical shock accident.
- Never mix new and old batteries.
- Install batteries in correct polarity as marked inside.

- Power cord -

- Do not use the damaged cord.
- Don’t put heavy things on, step on or pinch the cord, moreover, not to touch any heating material.
- When unplugging the cord from the mains socket outlet, do so by removing the plug first and not by pulling the Power cord.

- Measures against abnormal symptoms -

- If the instrument begins to emit smoke, becomes too hot, or gives off an unusual smell, immediately power it off and disconnect the power cord from the outlet. Also power off the power to the object under test. If any anomalies as noted, contact your local KYORITSU distributor.

- Use of protective gears -

- Use insulated gloves, boots or head gears at measurements to ensure user’s safety.

⚠ CAUTION

- Caution should be taken since conductors under test may be hot.
- Never apply currents or voltages exceeding the maximum allowable input for the instrument for a long time.
- Don't apply currents or voltages to Voltage test leads or Clamp sensors while the instrument is in off status.
- Don't use the instrument at dusty places or to be spattered.
- Don't use the instrument under a strong electric storm or in the vicinity of energized object.
- Never give strong vibrations or drop shocks.
- Do not place or remove a CF card while CF card is being accessed. (CF flashes while CF card is being accessed.) Otherwise saved data in the card or the instrument may be damaged.

- Clamp sensor -

- Do not bend or pull the cable of the Clamp sensor.

- Treatment after use -

- Power off the instrument and disconnect the Power cord, Voltage test leads and Clamp sensors from the instrument.
- Remove the batteries if the instrument is to be stored and will not be in use for a long period.
- Remove the CF card when carrying the instrument.
- Never give strong vibrations or drop shocks when carrying the instrument.
- Do not expose the instrument to direct sunlight, high temperatures, humidity or dew.
- Use a damp cloth with neutral detergent for cleaning the instrument. Do not use abrasives or solvents.
- Do not store the instrument if it is wet.

Carefully read and follow the instructions: ⚠**DANGER,** ⚠**WARNING**, ⚠**CAUTION** and **NOTE (** **)** described in each section.

The following symbols are used in this manual:

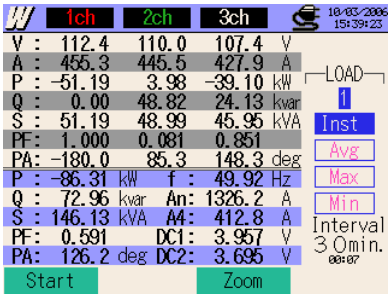
⚠	User must refer to the explanations in the instruction manual.
⧈	Instrument with double or reinforced insulation, Class II insulation
~	AC
⏚	(Functional) Earth terminal

1. Instrument Overview

1. 1 Functional Overview

Instantaneous value measurement

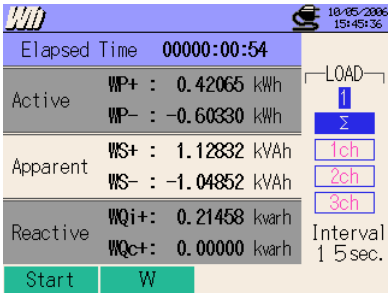
Measures average/max/min values of instantaneous values of current, voltage and electric power.



See **Section 6 "Instantaneous value measurement"** for further details.

Integration value measurement

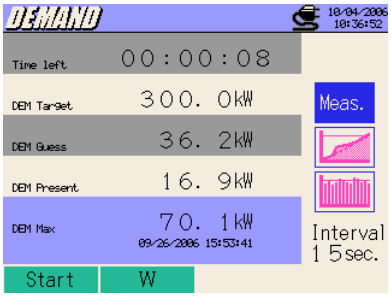
Measures active/ apparent/ reactive powers on each CH.



See **Section 7 "Integration value measurement"** for further details.

Demand measurement

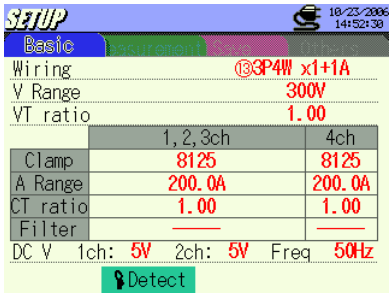
Measures demand values based on the preset target values. Digital output signals alert the user that the predicted value may exceed a target value.



See **Section 8** "**DEMAND Measurement**" for further details.

SET UP

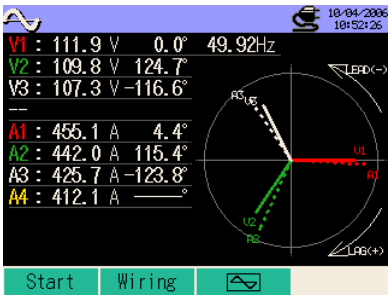
Setting of KEW6310 or for measurements

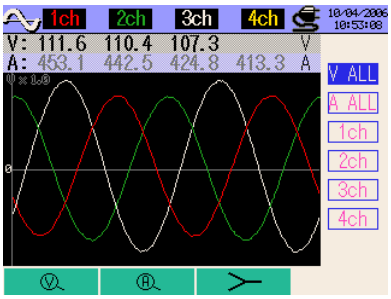


See "**Setting (Section 4)**" for further details.

Measurement at WAVE Range

Displays vector / waveform of voltages and currents per CH

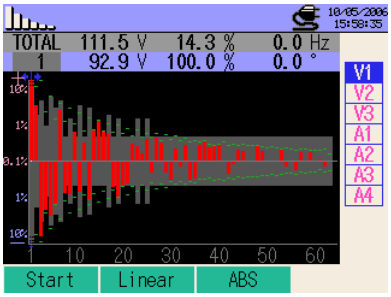




See "**WAVE Range (Section 9)**" for further details.

Harmonic measurement

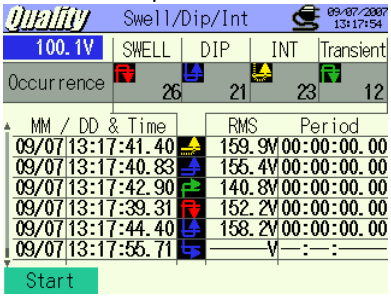
Measures / analyzes harmonic components of current & voltages



See "**Harmonic Analysis (Section 10)**" for further details.

Power quality analysis

Measures swell, dip, int, transient, inrush current, unbalance ratio and flicker, and also simulates power factor correction with capacitor banks.



* Flicker measurement function is only available with ver.2.00 or later.

See "**Power Quality (Section 11)**" for further details.

1.2 Features

This is a Power Quality Analyzer that can be used for various wiring systems. It can be used for simple measurements of instantaneous/ integration/ demand values, and also for monitoring waveforms and vectors, analyzing harmonics and measuring the fluctuations in supply voltages and can perform Capacitance Calculation. Data can be saved either in the internal memory or a CF card, and can be transferred to a PC either via a USB lead or a CF Card reader.

Safety Construction

Designed to meet the international safety standard IEC 61010-1 CAT.III 600V/ CATII. 1000V

Wiring configuration

KEW6310 supports : Single-phase 2-wire, Single-phase 3-wire, Three-phase 3-wire, Three-phase 4-wire.

Measurement and caluclation

KEW6310 measures voltage (RMS), current (RMS), and calculates active/reactive/apparent power, power factor, phase angle, frequency, neutral current and active/ reactive/ apparent electric energy. (RMS)

Demand measurment

Electricity consumption can be easily monitored so as not to exceed the target maximum demand values.

Waveform / Vector display

Voltage and current can be displayed by waveform or vector.

Harmonic analysis

Harmonic components of voltage and current can be measured and analyzed.

Power quality analysis

Measuring Swell/ Dip/ Int, Transient, Inrush current, Unbalance ratio and flicker*, moreover, simulating power factor correction with capacitor banks.

* Flicker measurement function is only available with ver.2.00 or later.

Saving data

KEW6310 is endowed with a logging function with a preset recording interval. Data can be saved by manual operation or at pre-set time & date. Screen data can be saved by using Print Screen function.

Dual power supply system

KEW6310 operates either with AC power supply or with batteries. Both dry-cell batteries (alkaline) and rechargeable batteries (Ni-MH) can be used. In the event of interruption, while operating with AC power supply, power to the instrument is automatically restored by the batteries in the instrument.

Large display

Color display with large screen

Light & compact design

Clamp sensor type, compact and light weight design

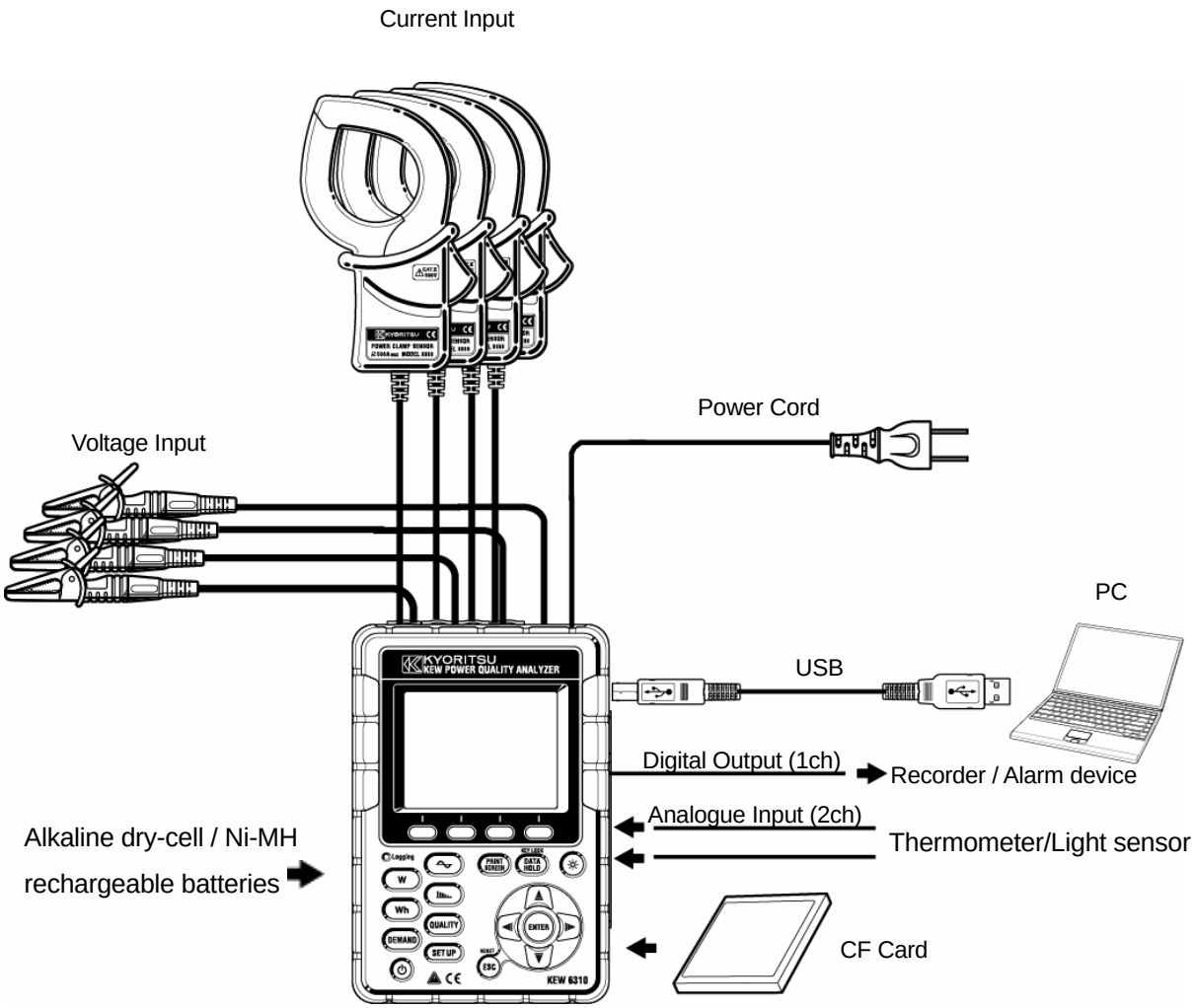
Application

Data in the internal memory or CF card can be transferred to a PC via a USB lead or a CF Card reader. As well supplied software facilitates setting, optional analysis software facilitates data analysis.

Input/output function

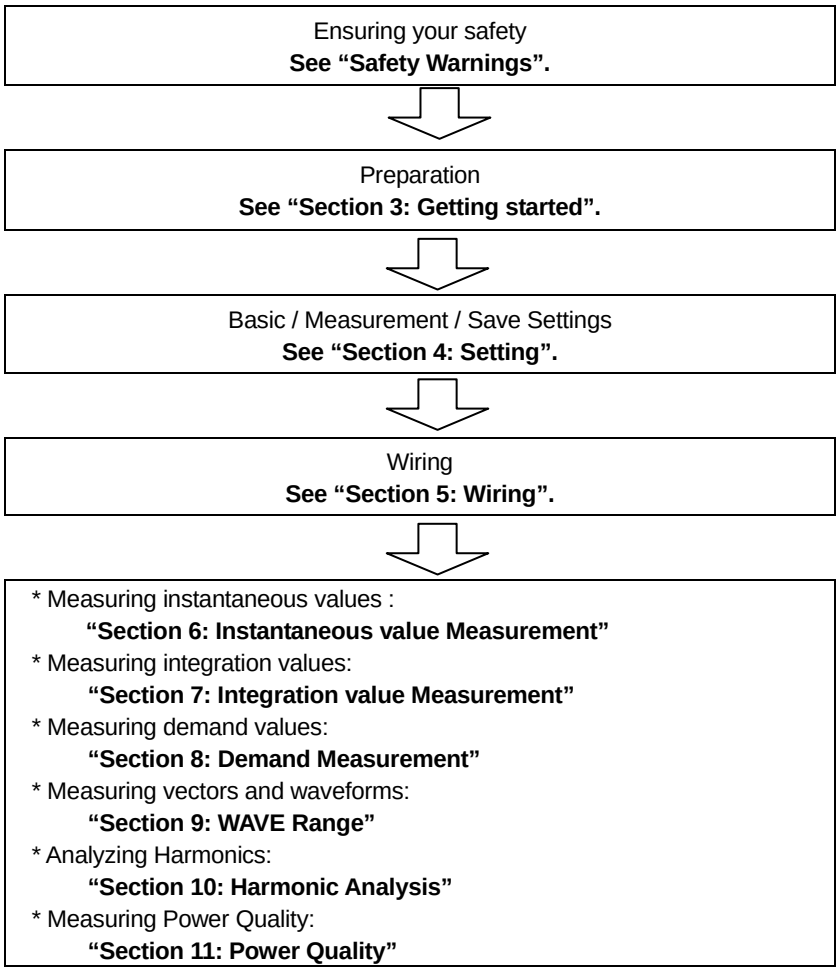
Analogue signals from thermometers or light sensors can be measured simultaneously with electrical power data via 2 analogue inputs (DC voltage); signals exceeding preset threshold values at each range can be transmitted to alarm devices via 1 digital output (DC voltage)

1.3 Connection Diagram



1.4 Measuring Procedure

● Steps for measurement



1.5 Outline of max demand measurement concept

In some countries, large consumers of electricity will usually have a maximum demand contract with the power company. Such contract varies from country to country. The following is an explanation of a typical Japanese maximum demand contract.

● Maximum Demand contract

In such a contract the electricity tariff rates (i.e. for kWhr units) are based upon the consumer's maximum power demand. The maximum demand is the maximum of average powers recorded over a 30min intervals. This is measured by the maximum demand meter belonging to the power company. Let's assume that a power company has the following applicable rates.

$2 per KWhr unit for a recorded max demand 300KW during a year

$4 per KWhr unit for a recorded max demand 500KW during a year

$5 per KWhr unit for a recorded max demand 600KW during a year

Assuming that the consumer is on the 500kW/year rate (ie. $4), and the recorded max demand during a particular day(say 15th January) is 600kW . Then the new applicable rate from 1st February onwards will be the 600kW/year rate (ie. $5) for the next 365 days. If a year later, on February 1st the recorded maximum demand is 300kW, then the new applicable rates will be changed to 300kW/year rate (i.e. $2) for the subsequent 365 days. However if during this period, the max demand goes up again, and say 600kW is recorded on 15th March, the applicable rates change again to the 600kW/year rate (i.e.$5) for the subsequent 365 days.

● Benefits of maximum demand control

It is thus important for consumers with such contracts to monitor closely fluctuations in their power demand to ensure that their max demand limits are not exceeded and thus incur higher tariffs. Maximum Demand control is more effective in countries with higher electricity tariffs.

● Status of maximum demand contract

In the past, in Japan, only consumers whose electricity supply was rated at 600kW or more used to enter into a demand contract. However, nowadays power companies install maximum demand meters at all consumers whose supply is rated 70kW or more.

● Maximum Demand measurement limitations

N.B. The readings from power company maximum demand meter and from the 6300 will not match completely due to an obvious time-lag difference in the start of the integration period (eg.30mins) over which the max demand is taken.

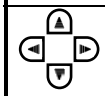
2. Instrument Layout

2.1 Front View

Display (LCD) / Keys

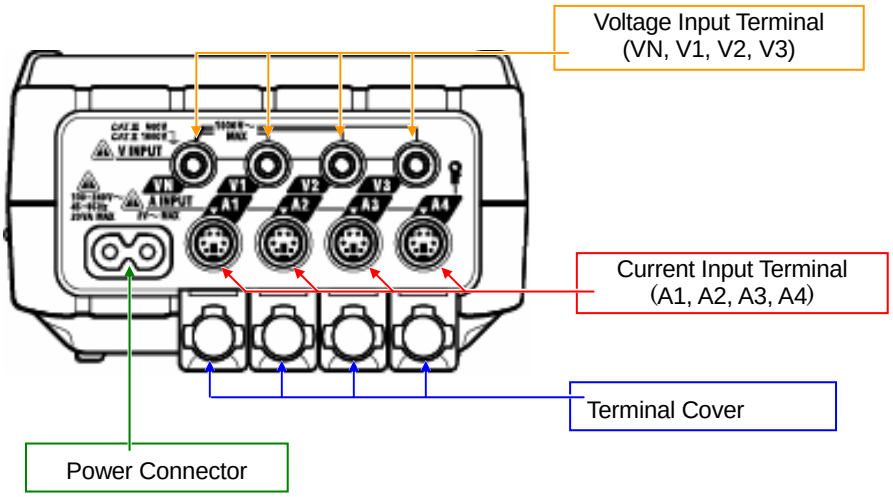
LED status indicator
Green lights up : Recording & measuring
Green flashes : Stand-by (lights up when preset time comes)
Red flashes : Charging batteries

Key Operations

Keys		Details
	Power Key	Power on / off the instrument
	LCD ON/OFF Key	Display / hide the indications on the LCD
	Cursor Key	Select the setting items, switches screens
	ENTER Key	Confirm entries
	ESC Key/ RESET Key	Cancel setting changes, clear integration / demand data selected by Cursor Keys.
	PRINT SCREEN Key	Save the displayed screen as a BMP (bitmap) file.
	DATA HOLD Key/ KEY LOCK Key	● Hold the readings. (can view the item and system with Cursor Keys) * Measurement continues even if screen is frozen. ● Key Lock Pressing 2 sec or more disables all Keys to prevent operational error. Another long press (2 sec or more) is required to restore the disabled Keys.
	Menu Key	W : Measure instantaneous values Wh : Measure integration values DEMAND : Measure demand values : Waveform measurement : Harmonic measurement QUALITY: Select any Ch and set threshold values to record swell/ dip/ int/ transient with time information. SET UP : Basic, Measurement, Save and Other settings
	Function Key	Execute the displayed function F1, F2, F3, F4 Key (from left to right)

2.2Connector

Descriptions

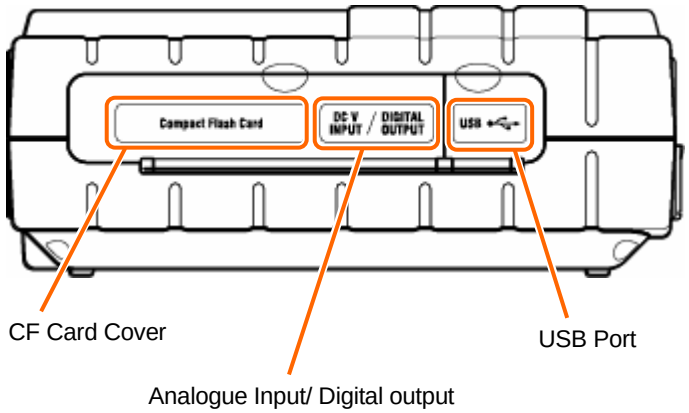


Wiring configuration	Voltage Input Terminal	Current Input Terminal	
Single-phase 2-wire (1ch)	“1P2W×1”	VN, 1	A1
Single-phase 2-wire (2ch)	“1P2W×2”	VN, 1	A1, 2
Single-phase 2-wire (3ch)	“1P2W×3”	VN, 1	A1, 2, 3
Single-phase 2-wire (4ch)	“1P2W×4”	VN, 1	A1, 2, 3, 4
Single-phase 3-wire (1ch)	“1P3W×1”	VN, 1, 2	A1, 2
Single-phase 3-wire (2ch)	“1P3W×2”	VN, 1, 2	A1, 2, 3, 4
Single-phase 3-wire (1ch) + 2 Current	“1P3W×1+2A”	VN, 1, 2	A1, 2, 3, 4
Three-phase 3-wire (1ch)	“3P3W×1”	VN, 1, 2	A1, 2
Three-phase 3-wire (2ch)	“3P3W×2”	VN, 1, 2	A1, 2, 3, 4
Three-phase 3-wire (1ch) + 2 Current	“3P3W×1+2A”	VN, 1, 2	A1, 2, 3, 4
Three-phase 3-wire 3A	“3P3W3A”	V1, 2, 3	A1, 2, 3
Three-phase 4-wire (1ch)	“3P4W×1”	VN, 1, 2, 3	A1, 2, 3
Three-phase 4-wire (1ch) + 1 Current	“3P4W×1+1A”	VN, 1, 2, 3	A1, 2, 3, 4

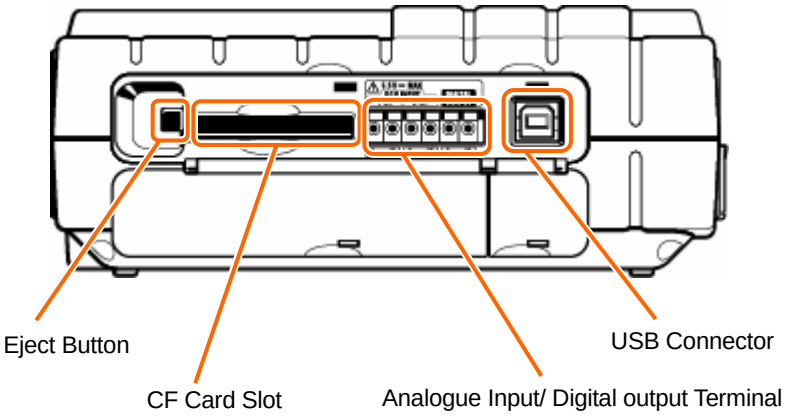
2.3 Side Face

Descriptions

<when the Connector Cover is closed>

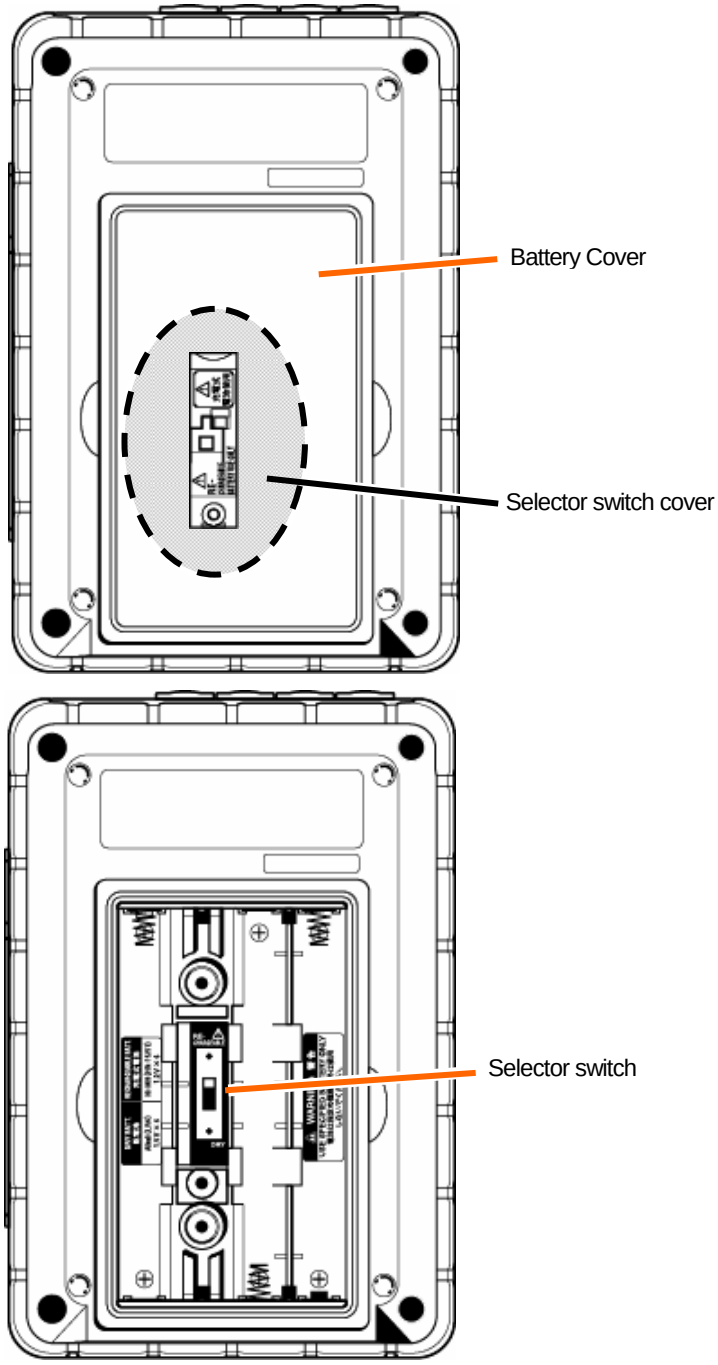


<when the Connector Cover is closed>



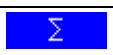
2.4 Battery Case

Descriptions



* Set the Selector Switch to either “DRY BATTERY” (alkaline) or “RECHARGEABLE BATTERY” (Ni-MH) position depending on the battery you use.

2.5 Marks displayed on the LCD

	Flash while saving data
	Flash in stand-by mode
	Flash while saving data to a CF Card
	Flash while saving data to the internal memory
	Displayed when the capacity of CF Card or the internal memory is full
	Displayed when KEW6310 is operating with AC power supply
	Displayed when KEW6310 is operating with batteries
	Displayed while Data hold function is activated
	Displayed when measured voltage exceeds a certain condition
	Displayed when measured current exceeds a certain condition
	Displayed on the screen for Instantaneous value measurement
	Displayed on the screen for Integration value measurement
	Displayed on the screen for Demand measurement
	Displayed on the WAVE Range screen
	Displayed on the screen for Harmonic analysis
	Displayed on the screen for Power quality measurement
	Displayed on the screen for Capacitance calculation
	Displayed on the Setting screen
	Displayed while Keys are locked
	Displayed when swell occurs at Power quality measurement
	Displayed when dip occurs at Power quality measurement
	Displayed when short-interruption (int) occurs at Power quality measurement
	Displayed with sum of values measured at each CH

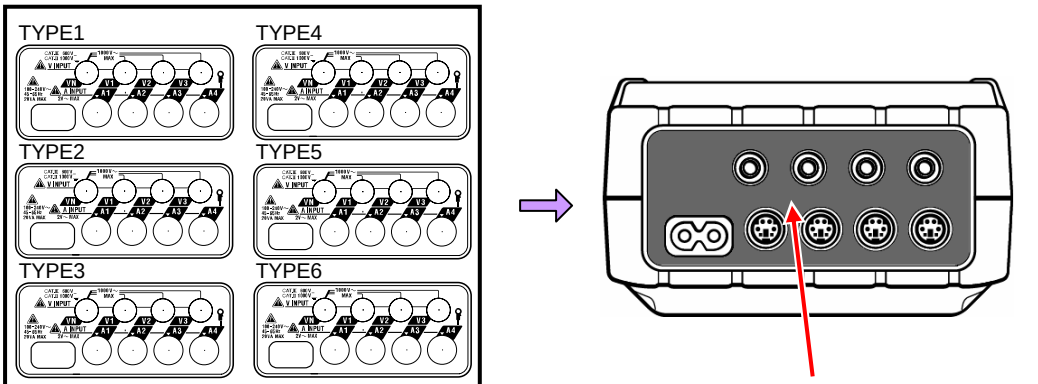
Marks for Function Keys	
W	Switch to the screen for Instantaneous value measurement
W h	Switch to the screen for Integration value measurement
DEMAND	Switch to the screen for Demand measurement
	Switch to the screen for Waveform measurement
	Switch to the Vecory display screen
	Change scale of voltage at the screen for Waveform measurement
	Change scale of current at the screen for Waveform measurement
W/Wh/DEMAND	Switch to W/ Wh/ DEMAND Setting screen
	Switch to WAVE Range Setting screen
	Switch to Harmonic analysis Setting screen
QUALITY	Switch to Power quality Setting screen

3. Getting started

3.1 Preparation

3.1.1 Putting Input terminal plate on the Input terminal

Six Input terminal plates are supplied with this instrument. Choose one Plate which matches the standard cord colors where the instrument is used. Put the Plate to the Input terminal observing the orientation.
* Clean the Input terminal before putting the Plate and confirm it isn't wet.

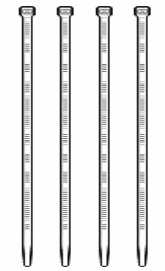


Input terminal plate.

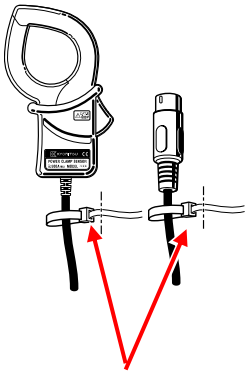
	VN	V1/A1	V2/A2	V3/A3	A4
TYPE 1	Blue	Red	Green	Black	Yellow
TYPE 2	Blue	Brown	Black	Gray	Yellow
TYPE 3	Black	Yellow	Green	Red	White
TYPE 4	Blue	Black	Red	White	Yellow
TYPE 5	White	Black	Red	Blue	Yellow
TYPE 6	Black	Red	Yellow	Blue	White

3.1.2 Attaching Markers to Voltage test leads and Clamp sensors

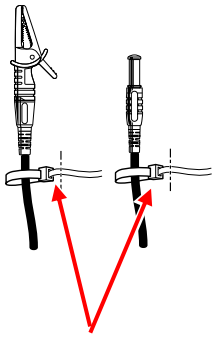
Attach Markers to the both ends of the Voltage test leads and Clamp sensors harmonized with the Input terminals. * Supplied Markers are 32 pcs in total : 4pcs each color (red, blue, yellow, green, brown, gray, black, white).



Marker (32 pcs in total)



Attach Markers to the both ends of a Sensor.



Attach Markers to the both ends of the Voltage test lead.

3.2 Power Supply

3.2.1 Battery

KEW6310 operates with either an AC power supply or batteries. Capable of performing measurements in the event of AC power interruption, power to the instrument is automatically restored by the batteries installed in the instrument. Dry-cell batteries (alkaline) and rechargeable batteries (Ni-MH) can be both used. It is also possible to charge rechargeable batteries in the instrument.
* Dry-cell batteries (alkaline) are supplied as accessories.

⚠ DANGER

- Never open the Battery Cover during a measurement.
- Brand and type of the batteries to be used should be harmonized.
- Never touch the Power supply connector although it is insulated while the instrument is operating with batteries.

⚠ WARNING

- Remove Power Cord, Voltage test leads and Clamp sensors from the instrument and power off the instrument before replacing the batteries.
- Remove the Selector Switch Cover, and slide the Selector Switch to left or right depending on the batteries to be used. Do not use dry-cell batteries with the Selector Switch set to “RECHARGEABLE BATTERY” position. It may cause electrical shock accident.

Position of Selector Switch	Battery can be used
RECHARGEABLE BATTERY	size AA Ni-MH rechargeable battery (HR-15/51)
DRY BATTERY	size AA dry-cell alkaline battery (LR6)

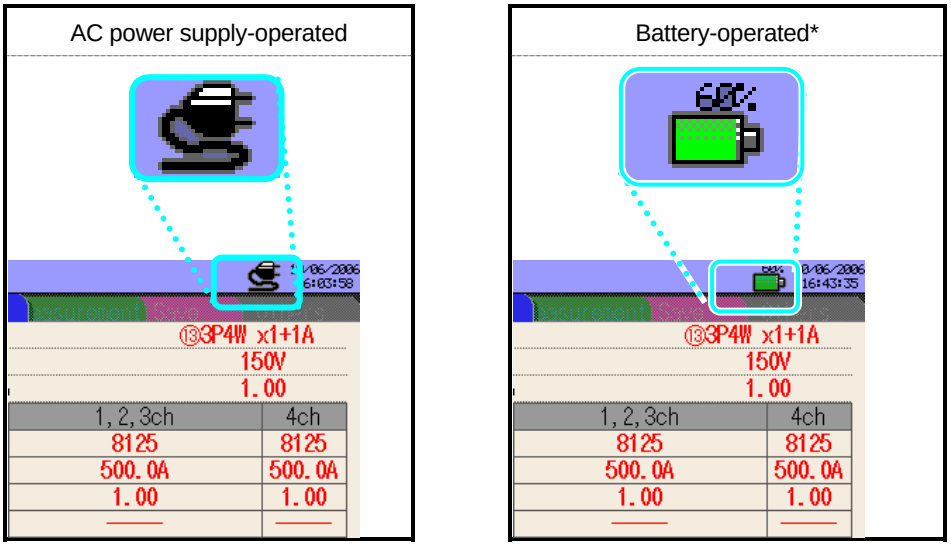
⚠ CAUTION

- Do not mix new and old batteries.
- Install batteries in correct polarity as marked inside.

Batteries are not in the instrument at the time of purchase. Please insert the supplied batteries in the instrument. Battery power is consumed even if the instrument is being off. Remove all the batteries if the instrument is to be stored and will not be in use for a long period. When the instrument is powered by an AC power supply, it doesn’t operate with batteries.
If an AC supply is interrupted and the batteries have not been inserted, the instrument goes off and all data may lost.

Display

Mark of power supply changes as follows.



mark flashes while charging batteries.

Battery Condition

Battery mark varies as follows depending on battery condition.

	Alkaline dry battery (LR6)	Ni-MH Rechargeable battery (HR-15/51)
	about 2 hours* autonomy	about 5 hours* autonomy
	Batteries are exhausted. (Accuracy of readings cannot be guaranteed) In this case, the instrument operates as follows automatically.	

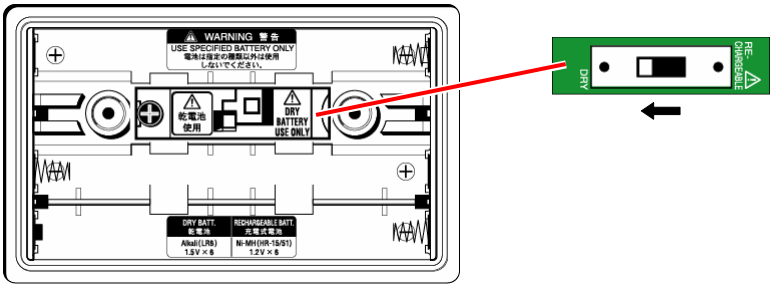
W ~ Hz	Measurement continues, but data saving stops. (Measured data is saved)
Wh DEMAND QUALITY	Measurement / data saving stops. (Measured data is saved)

Battery level is displayed by 20% levels.

* reference time when using the instrument with indications on the LCD hide

Inserting dry-cell batteries

1. Loosen two Battery Cover-fixing screws and remove the Cover.
2. Take out all the batteries.
3. Loosen the screws and remove the Selector Switch Cover.
   Attention should be paid so as not to lose the screws.
4. Slide to left and set the Selector Switch to “DRY” position.
5. Install the Selector Switch Cover with the marking of dry battery faced up, and tighten the screws.



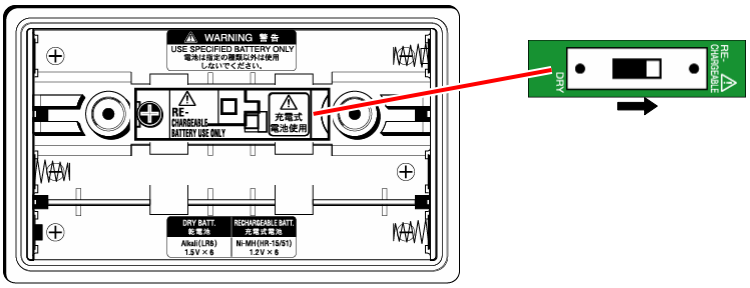
6. Insert batteries (LR6 : size AA alkaline batteries) in correct polarity.
7. Install the Battery Cover and tighten two screws.
8. Connect the AC Power Cord and power on the instrument.

Slide and set the Selector Switch to the proper position prior to installing the Selector Switch Cover.
The instrument should be used with the Switch set to a proper position. Never make measurement without installing the Cover.

Rechargeable batteries

This instrument can charge rechargeable batteries via AC power supply.

1. Loosen two Battery Cover-fixing screws and remove the Cover.
2. Take out all the batteries.
3. Loosen the screws and remove the Selector Switch Cover.
   Attention should be paid so as not to lose the screws.
4. Slide to left and set the Selector Switch to “RE-CHARGEABLE” position.
5. Install the Selector Switch Cover with the marking of rechargeable battery faced up, and tighten the screws.



6. Insert batteries (HR-15/51 : size AA Ni-MH rechargeable batteries) in correct polarity.
7. Install the Battery Cover and tighten two screws.
8. Connect the AC Power Cord and power on the instrument.

~ Battery charge ~

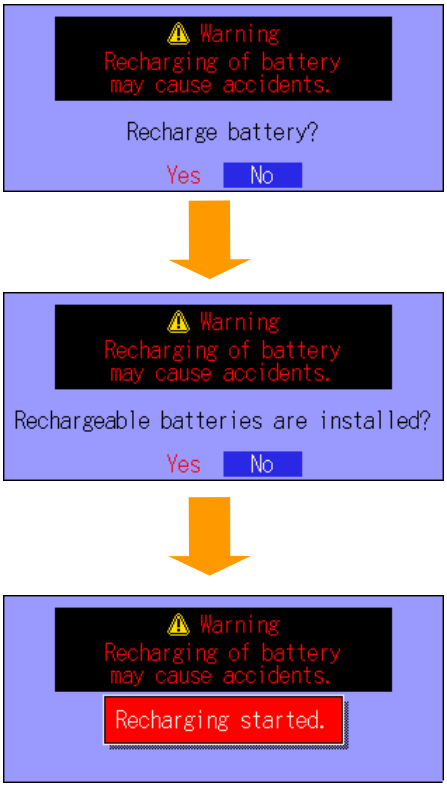
Message windows on the next page appear when starting the instrument under following conditions and with battery level of 40% or less.

* Install rechargeable batteries (Ni-MH)
* Slide and set the Selector Switch to “RE-CHARGEABLE” position.
* Connect the AC Power cord and power on the instrument.

Refer to **“4.2.4 Other Settings”** and see the procedure to start battery charge any time.

9. Follow the message displayed on the LCD and press the ◀ ▶ Cursor and ENTER Keys to start charging batteries. Selecting “No” returns to the normal screen.

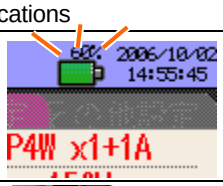
Battery charge doesn’t initiate only by installing rechargeable batteries and connecting an AC power cord. Above operation is required to start a battery charge.



Battery charge starts and the screen returns to normal.

● Charging batteries

Indications on the instrument during a charging are as follows.

	Indications	
LCD ON		Battery mark on the LCD flashes. LED status indicator doesn't light up.
LCD OFF or Instrument is OFF		LED status indicator flashes in red. LED status indicator flashes in green while recording data.

Slide and set the Selector Switch to the proper position prior to installing the Selector Switch Cover.
The instrument should be used with the Switch set to the proper position. Never make measurement without installing the Cover.

Charging cycle is 5 min, and charging patterns vary as follows depending on the instrument condition. This is to control temperature rises on the instrument resulting from battery charge.

Pattern	Charging	Pause	Total charging time
I. Power ON (LCD_ON)	0.7 min	4.3 min	48h
II. Power ON (LCD_OFF)	2.1 min	2.9 min	14h
III. Power OFF	4.2 min	0.8 min	7h

3.2.2 AC Power Supply

Check the followings before connecting the Power cord.

DANGER

- Use only the Power cord supplied with this instrument.
- Connect the Power cord mains plug to a mains socket outlet. The mains supply voltage must not exceed AC240V. (max rated voltage of supplied Power cord MODEL7169 : AC125V)

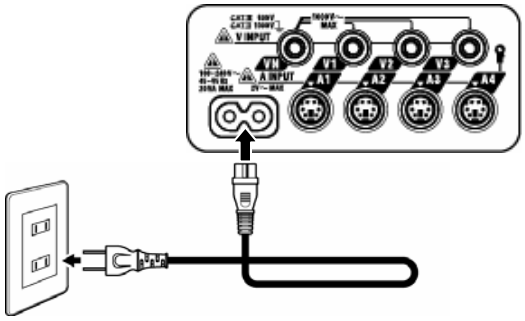
WARNING

- Confirm that the instrument is powered off, and then connect the Power cord.
- Connect the Power cord to the instrument first. Cord to be firmly inserted.
- Never attempt to make measurement if any abnormal conditions such as abnormal conditions are noted, such as a broken Cover and exposed metal parts.
- When the instrument is not in use, disconnect the Power cord from the outlet.
- When unplugging the cord from the mains socket outlet, do so by removing the plug first and not by pulling the cord.

Power cord connection

Follow the procedure below, and connect the Power cord.

1 Confirm that the instrument is powered off.
2 Connect the Power cord to the Power connector on the instrument.



3 Connect the Power cord plug to a mains socket outlet.

Power supply rating

Following table shows the Power supply rating.

Rated supply voltage	:	100 ~ 240V AC(±10%)
Rated power supply frequency	:	45 ~ 65Hz
Max power consumption	:	20VA max

3.3 Voltage test leads and Clamp sensor connection

Check the followings before connection.

⚠ DANGER

- Use only the Voltage test leads supplied with this instrument.
- Use the dedicated Clamp sensor for this instrument, and confirm that the measured current rating of the Clamp sensor is not exceeded.
- Do not connect all the Voltage test leads or Clamp sensors unless required for measuring the parameters desired.
- Connect the test leads and sensors to the instrument first, and only then connect them to the circuit under test.
- Never disconnect the Voltage test leads and sensors while the instrument is in use.

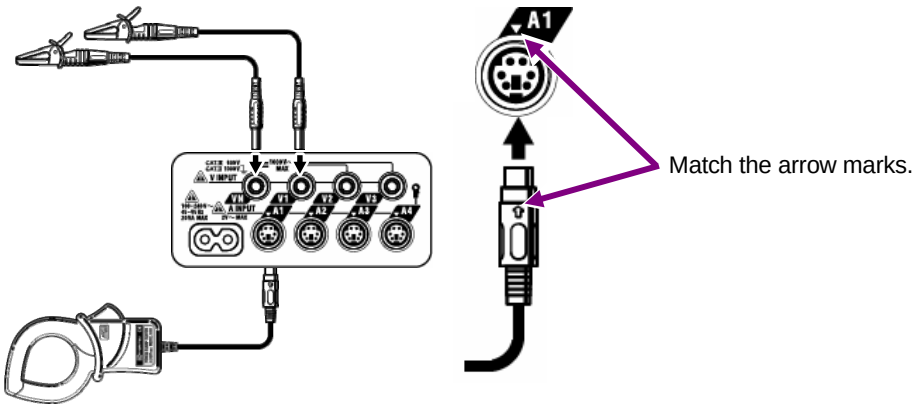
⚠ WARNING

- Confirm that the instrument is powered off, and then connect the Power cord.
- Connect the Power cord to the instrument first. Cord to be firmly inserted.
- Never attempt to make measurement if any abnormal conditions such as abnormal conditions are noted, such as a broken Cover and exposed metal parts.

Voltage test leads and Clamp sensor connection

Follow the procedure below, and connect the Voltage test leads and Clamp sensors.

1 Confirm that the instrument is powered off.
2 Connect the appropriate Voltage test leads to the Voltage input terminal on the instrument.
3 Connect the appropriate Clamp sensors to the Current input terminal on the instrument. Match the direction of the arrow mark indicated on the output terminal of the clamp sensor and the mark on the Current input terminal on the instrument.



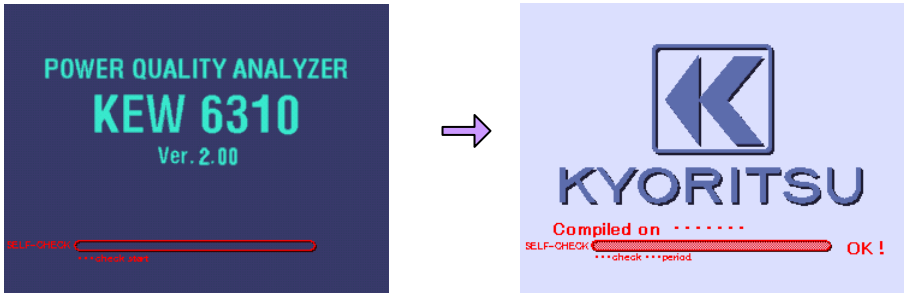
* Number of Voltage test leads and Clamp sensors to be used depends on the wiring configuration under test. For further details, refer to "**5.2 Basic Wiring Configuration**" in this manual.

3.4 Start KEW6310

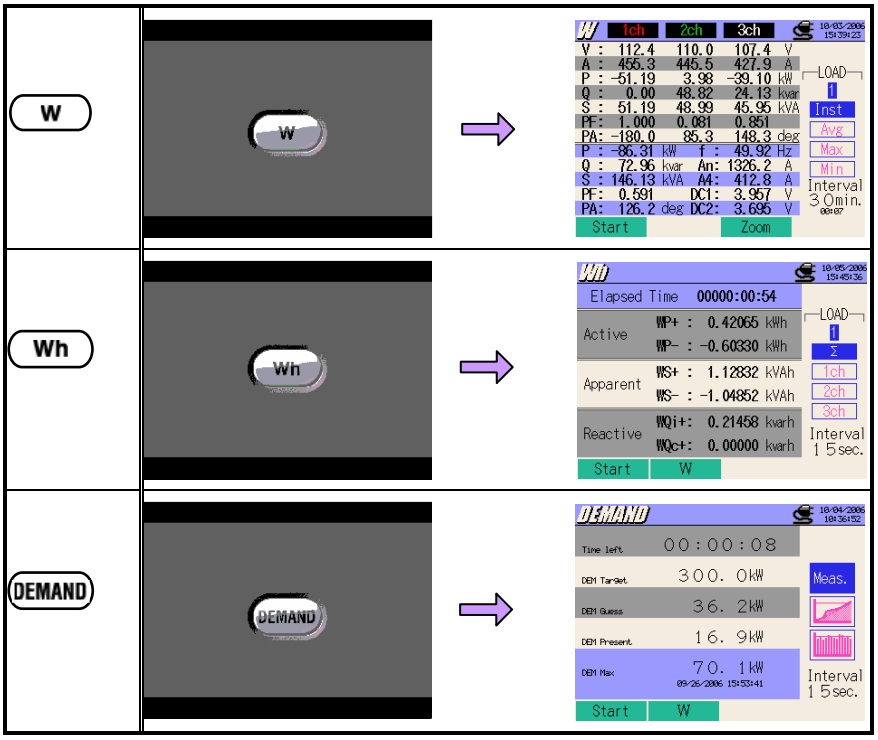
3.4.1 Start-up Screen

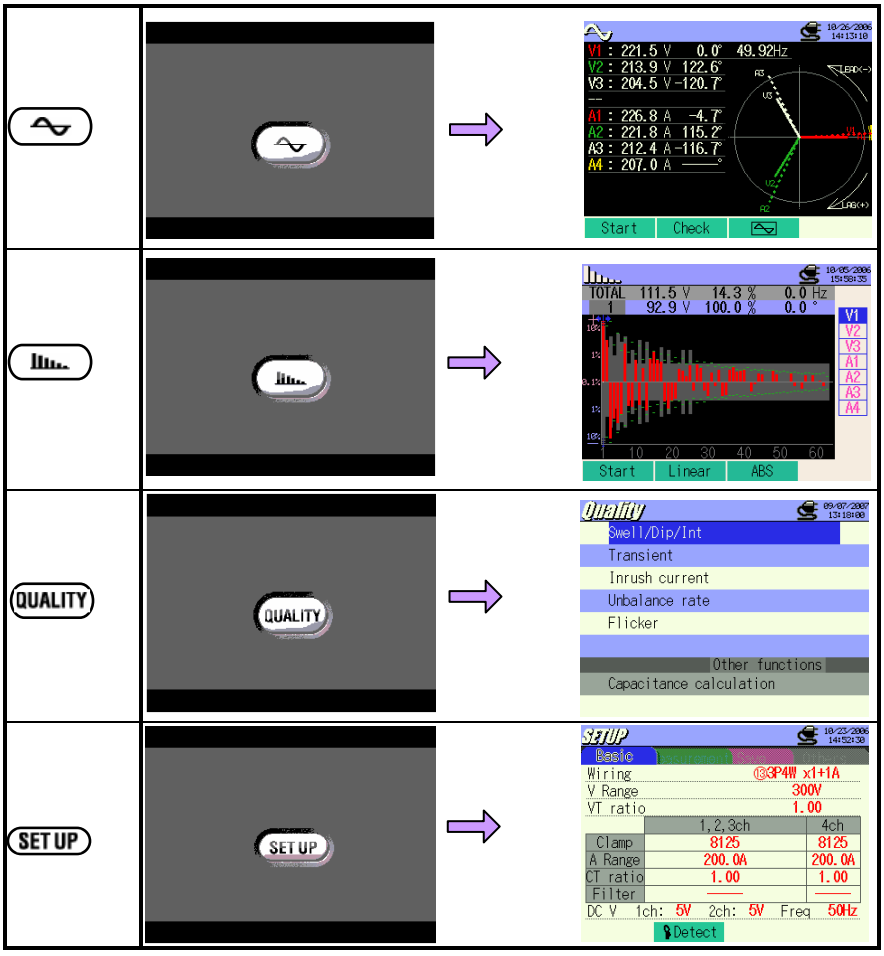
Hold down the POWER Key until the Start-up screen is displayed. Pressing the POWER Key for 2 sec or more powers off the instrument. Following screen is displayed when the instrument is on.

1 MODEL/VERSION screen is displayed, and a self-check routine starts. Then KEW logo will appear.



2 Previous screens displayed at last operation are back on.




QUALITY
SET UP
Start
Check
Linear
ABS
Swell/Dip/Int
Transient
Inrush current
Unbalance rate
Flicker
Other functions
Capacitance calculation
Basic
Wiring
V Range
VT ratio
Clamp
A Range
CT ratio
Filter
Detect

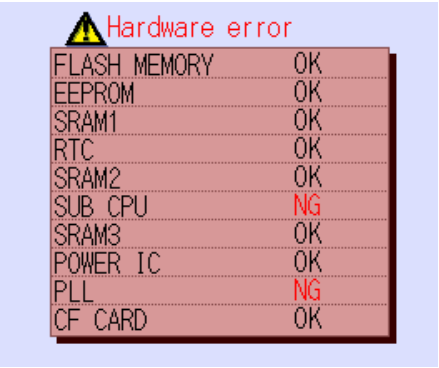
3.4.2 Error message

Following screen may appear after a self-check routine.

● When a failure is detected;

This instrument automatically checks the internal circuit immediately after it is powered on.

If a suspect failure in the internal circuit is detected, the error screen below will be displayed for about 5 sec.



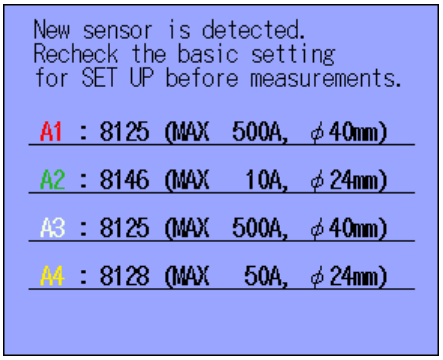
In this case, refrain from using the instrument and refer to **"Section15: Troubleshooting"** in this manual.

CAUTION

Notwithstanding the error screen, the measurement screen will appear and the instrument will take measurements anyway. However, accurate readings may not be obtained.

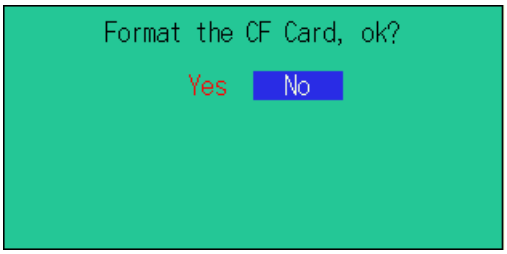
● When connected sensors are changed;

Clamp sensors connected are displayed for 5 sec as follows. When no sensor is connected, previous settings are kept.



● **When CF card needs to be formatted;**

Following screen is displayed for 5 sec when a CF Card has to be formatted.
* Only the CF Card formatted via FAT system can be used with this instrument.



Select “Yes” to format the CF Card.
* All the data saved in the CF Card will be cleared.
CF Card cannot be selected as a destination to save data if “No” is selected.

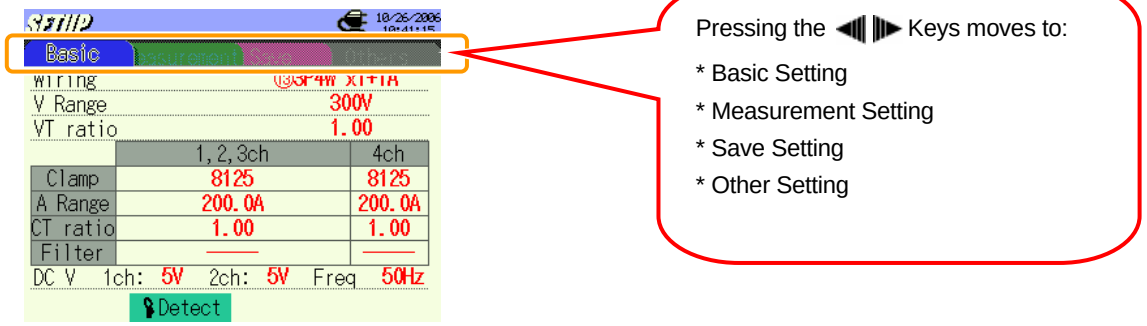
Refer to **“12.3 CF Card / Internal memory”** in this manual which shows how to format a CF Card.

4. Setting SET UP

4.1 List of Setting items

Settings for measurement condition and data saving are necessary prior to making measurements. Press the SET UP Key to enter into SET UP mode and do necessary settings.

Setting screens consists of following screens.



Basic Setting	Basic	Wiring V Range VT Ratio Clamp A Range CT Ratio Filter DC V Frequency
Measurement Setting	Measurement (W/Wh/DEMAND) F1	Interval Save Items Target Demand Demand Inspection Cycle
	Measurement ( ) F2	Interval Save Items
	Measurement ( ) F3	Interval THD Calculation Allwoable Range MAX HOLD Save Items

	Measurement (QUALITY) F4	Swell / Dip / Int Measurement	Interval* Reference Voltage Transient* Swell Dip Int (short-interruption) Hysteresis Trigger point
		Transient Measurement	Interval* Voltage Range Threshold value Hysteresis Trigger point
		Inrush current Measurement	Interval* Clamp Current Range Reference Current Filter Threshold value Hysteresis Trigger point
		Unbalance rate measurement	Interval Output threshold value
		Flicker*	V Range Filter Output item Output Threshold
		Capacitance calculation	Interval Target Power Factor
Save Setting	Save (1/2)	Recording Method Recodring Start Recording End Destination to Save data Destination to Save screenshot	
	Save (2/2)	Formatting CF Card Deleting the data in CF Card Formatting Internal Memory Deleting the data in Internal Memory Data transfer (from Internal Memory to CF Card) Loading Setting Save Setting	
Other Setting	Other (1/2)	Language Date Format Time and Date Buzzer CSV File ID Number LCD Contrast CH Color	
	Other (2/2)	Auto-Power-Off LCD-Auto-Off Battery Charge System Reset	

* Flicker measurement function is only available with ver.2.00 or later.

4.2 Settings

4.2.1 Basic Setting

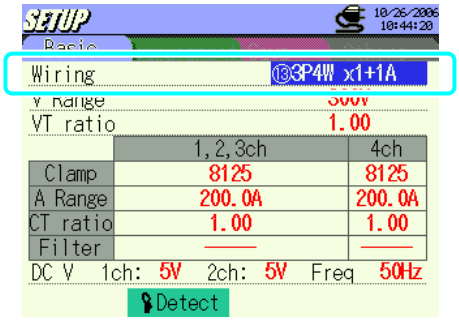
Wiring Configuration

① 1P2W×1	Single-phase 2-wire (1ch)	⑩ 3P3W×1+2A	Three-phase 3-wire (1ch) + 2-current
② 1P2W×2	Single-phase 2-wire (2ch)	⑪ 3P3W3A	Three-phase 3-wire 3A
③ 1P2W×3	Single-phase 2-wire (3ch)	⑫ 3P4W×1	Three-phase 4-wire (1ch)
④ 1P2W×4	Single-phase 2-wire (4ch)	⑬ 3P4W×1+1A	Three-phase 4-wire (1ch) + 1-current
⑤ 1P3W×1	Single-phase 3-wire (1ch)		
⑥ 1P3W×2	Single-phase 3-wire (2ch)		
⑦ 1P3W×1+2A	Single-phase 3-wire (1ch) + 2-current		
⑧ 3P3W×1	Three-phase 3-wire (1ch)		
⑨ 3P3W×2	Three-phase 3-wire (2ch)	⓪ 4A	4-current

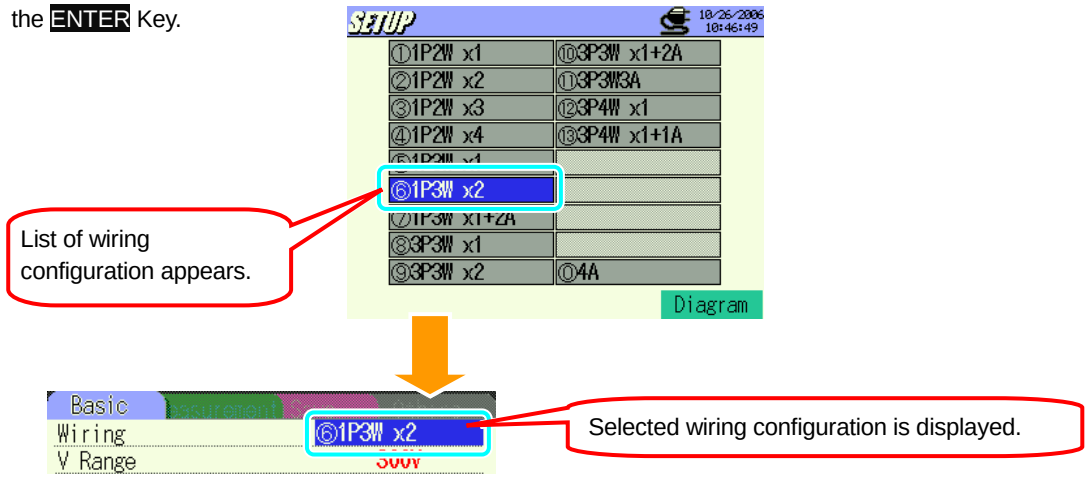
* Default value (or after system reset) : ⑬ 3P4W×1+1A

* Wiring of ⓪ 4A can be selected only at W Range. Default value is adopted when selecting the other Ranges.

1 Press the ▲▼ Cursor Keys and select [Wiring], and then press the ENTER Key.



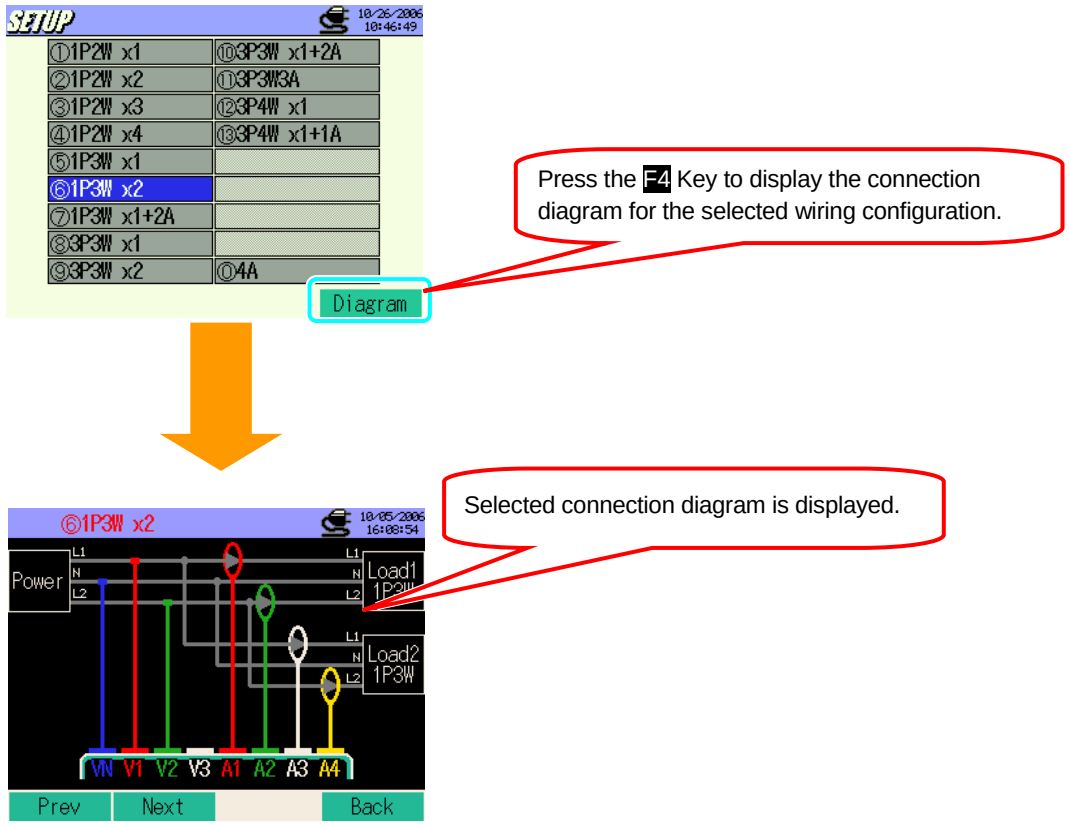
2 Press the ▲▼◀▶ Cursor Keys and select a proper wiring configuration, and then press the ENTER Key.



Check of Connection diagram

Connection diagram can be viewed at selecting a wiring configuration.

Move to a screen for selecting a wiring configuration. Use the Cursor Keys to select a wiring configuration, and then press the F4 Key.



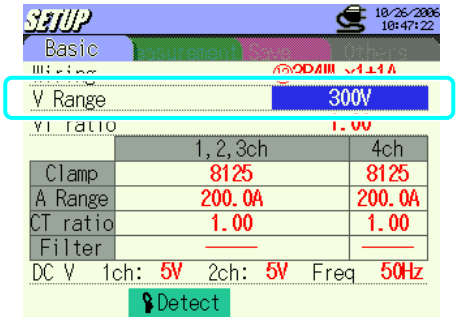
F1 Key / ◀ Key	: to view preceding connection diagram
F2 Key / ▶ Key	: to view subsequent connection diagram
F4 Key / ESC Key	: returns to SET UP screen for selecting wiring configuration
ENTER Key	: confirms the selected wiring configuration and returns to Basic Setting Screen

Setting for Voltage Range

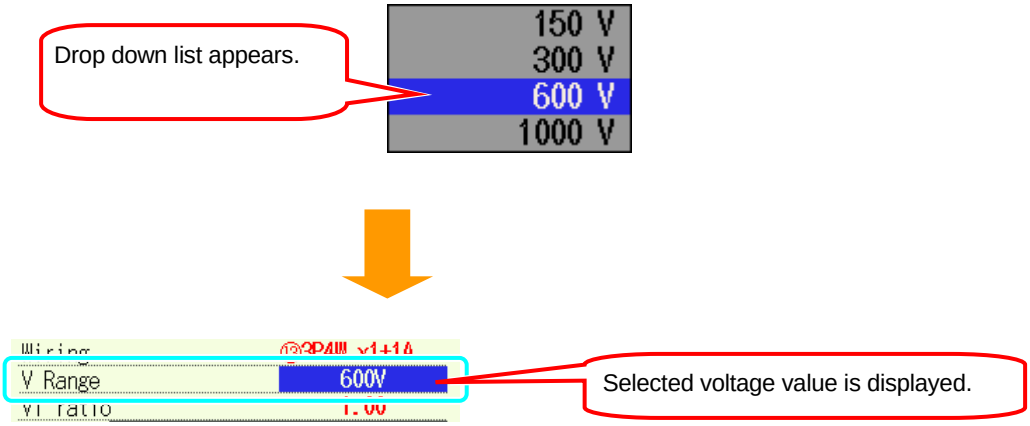
150V	300V	600V	1000V

* Default value (or after system reset) : 300V

1 Press the ▲▼ Cursor Keys and select [V Range], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select a desirable voltage value, and then press the ENTER Key.



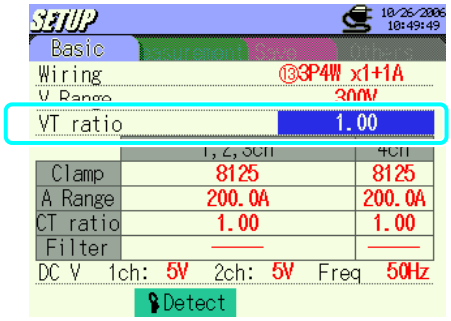
Setting for VT Ratio

0.01 ~ 9999.99 (can be set by 0.01)

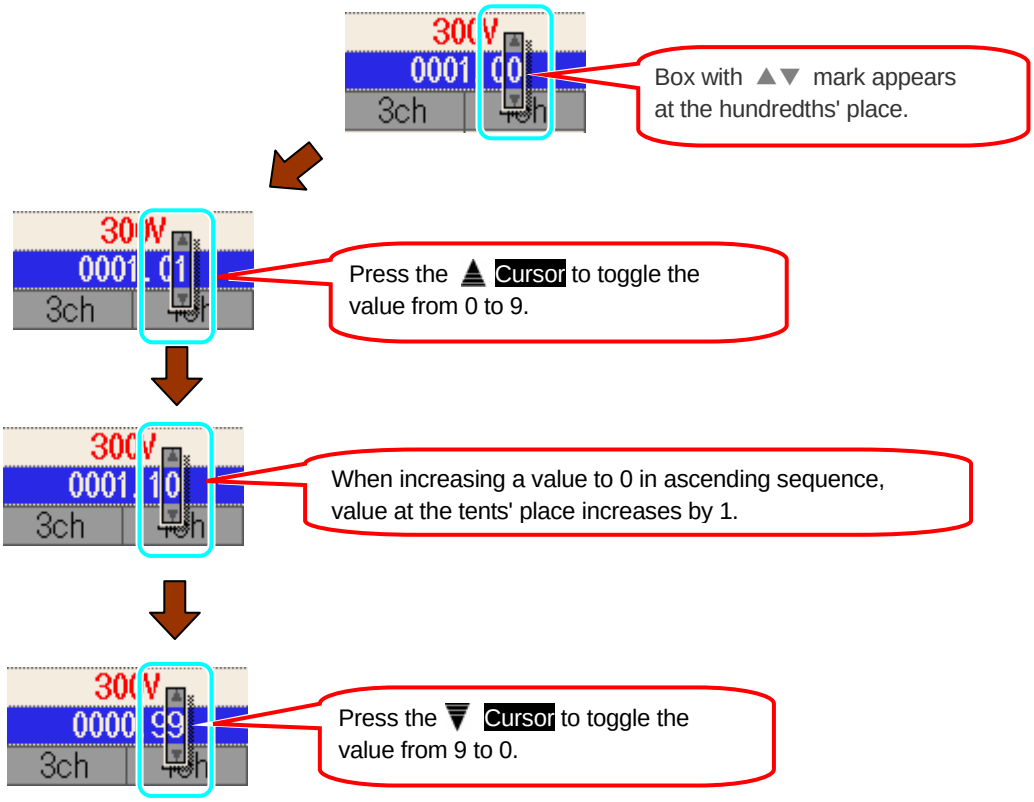
* Default value (or after system reset) : 1.00

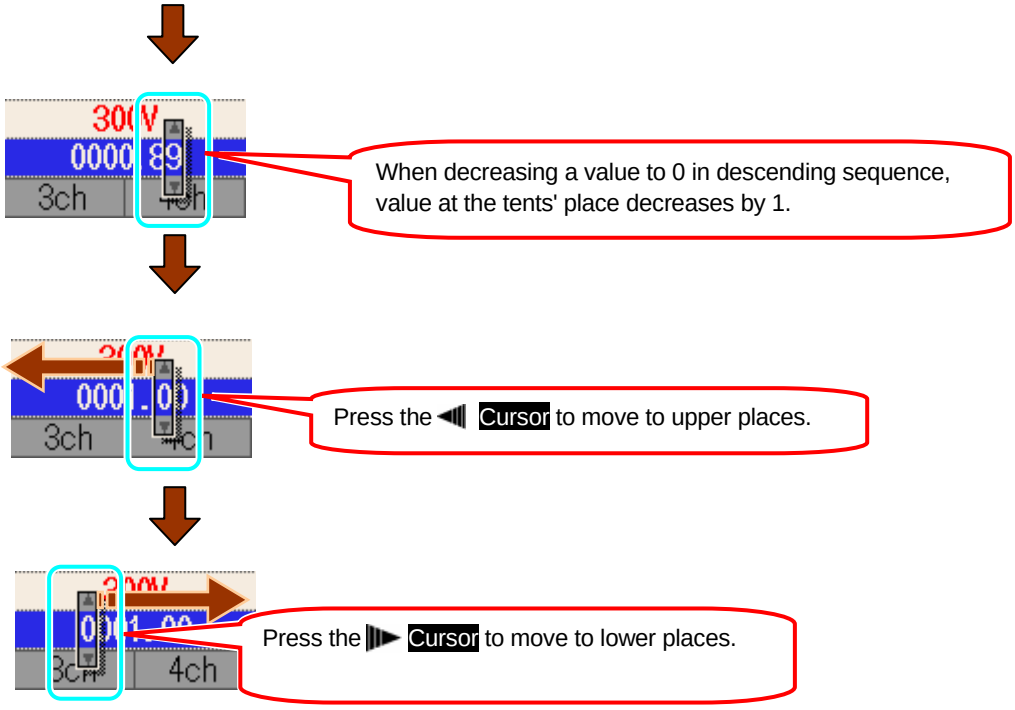
For the details of VT ratio, refer to "**5.4 VT / CT Ratio**" in this manual.

1 Press the ▲▼ Cursor Keys and select [VT Ratio], and then press the ENTER Key.

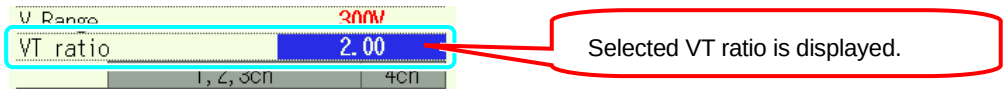


2 Press the ▲▼◀▶ Cursor Keys and alter the values, and press the ENTER Key to fix it.





In case that a preset value is 0000.01, the hundreds' place cannot be altered in descending sequence. Similarly, if a preset value is 9999.99, thousand's place cannot be altered in ascending sequence.



Setting for Clamp sensor

Model names and rated currents of Clamp sensors are listed as follows.

Clamp sensors for Power measurement		Leakage Clamp sensor	
8128	50A type	**8141**	1A type
8127	100A type	**8142**	1A type
8126	200A type	**8143**	1A type
8125	500A type	**8146**	10A type
8124	1000A type	**8147**	10A type
8129	3000A type	**8148**	10A type

* Default value (or after system reset) : 8125
* Clamp sensors for measurements other than power are available only at following wiring configurations.

Number of available Clamp sensor depends on a wiring configuration to be measured.

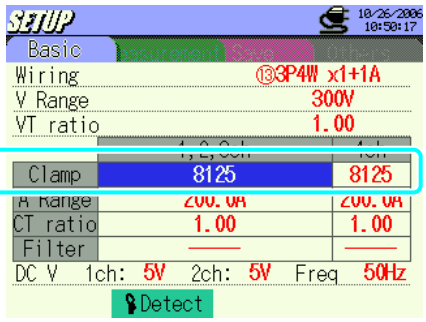
① 1P2W×1	1ch			
② 1P2W×2	1ch	2ch		
③ 1P2W×3	1ch	2ch	3ch	
④ 1P2W×4	1ch	2ch	3ch	4ch
⑤ 1P3W×1 ⑧ 3P3W×1	1,2ch			
⑥ 1P3W×2 ⑨ 3P3W×2	System 1(1,2ch)		System 2(3,4ch)	
⑦ 1P3W×1+2A ⑩ 3P3W×1+2A	1,2ch		3ch	4ch
⑪ 3P3W3A ⑫ 3P4W×1	1,2,3ch			
⑬ 3P4W×1+1A	1,2,3ch			4ch
⓪ 4A	1ch	2ch	3ch	4ch

* Default value (or after system reset) : ⑩ 1,2,ch 3, 4ch
* Channels highlighted in light yellow are applicable only to Clamp sensors for power measurement.
* Channels highlighted in gray are applicable to Clamp sensors for power measurement and Leakage Clamp sensors.

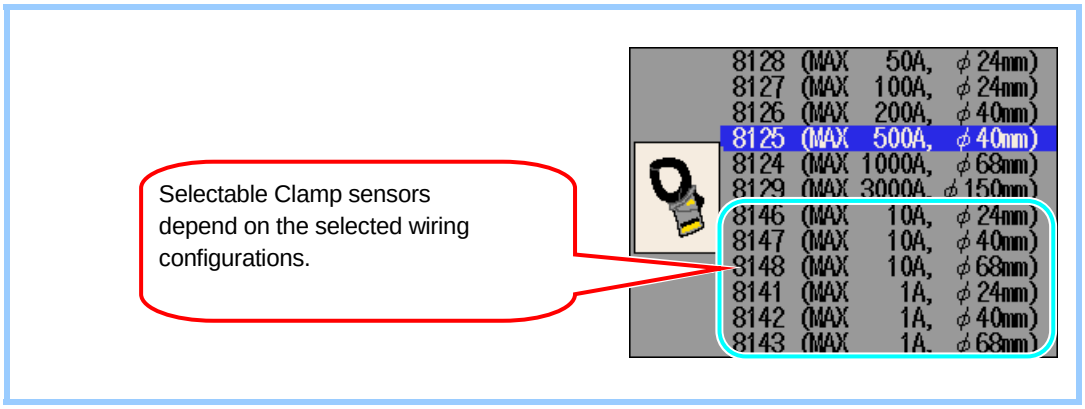
Manual setting and auto setting both are available for Clamp sensors.

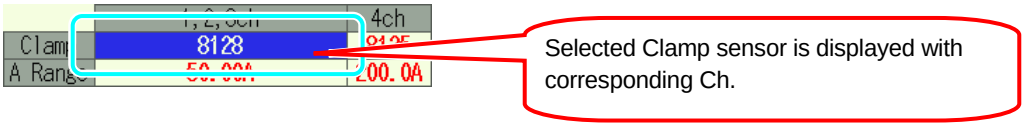
<< Manual Setting >>

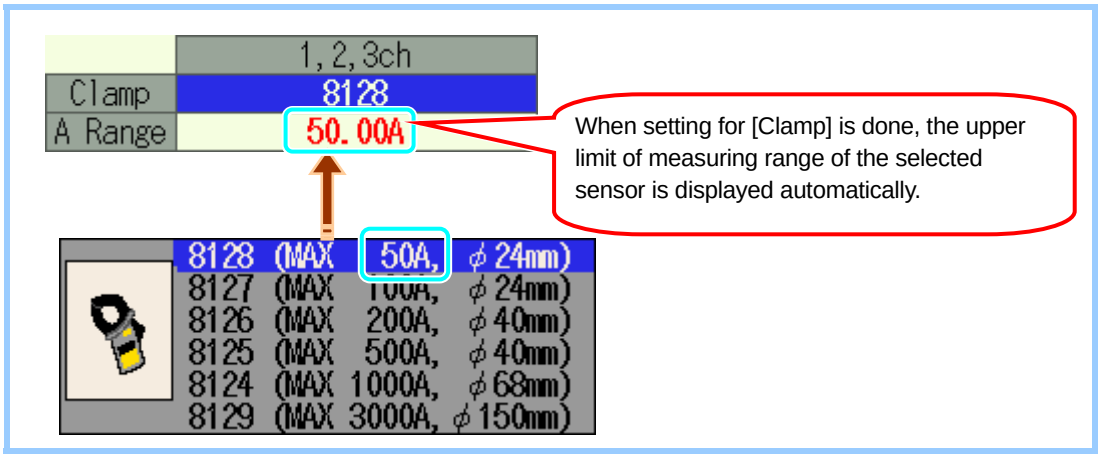
1 Press the ▲▼ Cursor Keys and select [Clamp], and then press the ENTER Key.



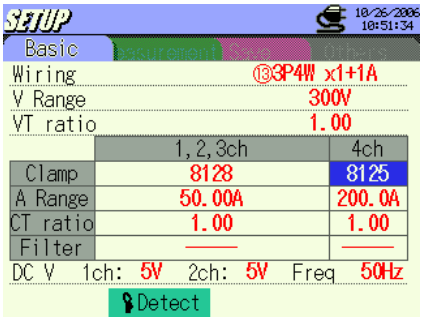
2 Press the ▲▼ Cursor Keys and select a Clamp sensor to be used, and then press the ENTER Key.







3 Press the ◀ ▶ Cursor Keys and select Clamp sensors to be used at the other CH, and make settings in the same way.

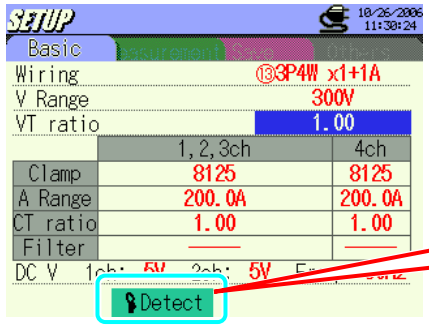


Settings for [Clamp] and [A Range] are active in subsequent measurements, but they will change when preset wiring configurations are changed. The highest Range is applied to all Chs when the [A Range] at each Ch should be harmonized due to a change of wiring configurations.

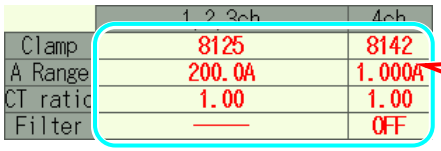
<< Auto Setting >>

Model name of the Clamp sensor connected to the Current Terminal of the instrument is detected automatically at Auto setting mode. Setting for [Wiring] should be done to advance Auto setting.

1 Confirm that settings for [Wiring] are made, and then press the F2 Key.



Pressing the F2 Key initiates auto setting for Clamp sensor.



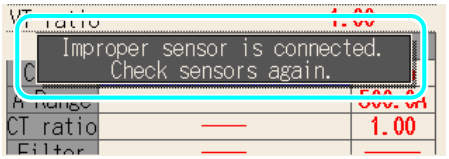
Connected Clamp sensors are automatically detected, and settings for [A Range], [CT ratio] and [Filter] are made automatically.

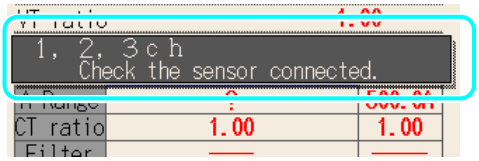
The max measurable values on Clamp sensor are reflected in setting for [A Range].
[CT ratio] is automatically set to 1.00.
For [Filter], bars are displayed when the detected sensors are MODEL812X series and OFF is displayed when the sensors are MODEL814X series.

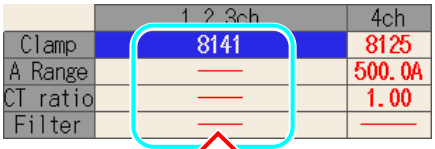
Setting will be changed if new sensors are detected at powering on the instrument.

The instrument detects and checks the connected Clamp sensors and the selected wiring configuration, and displays following messages when improper Clamp sensors are connected.

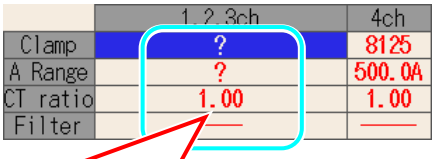
< Improper Clamp sensor is detected >







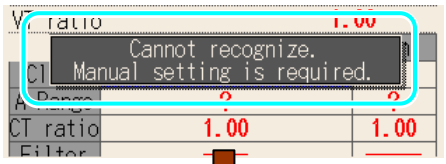
Model names of the connected Clamp sensors are displayed. Bars are displayed at A range, CT ratio and Filter boxes.

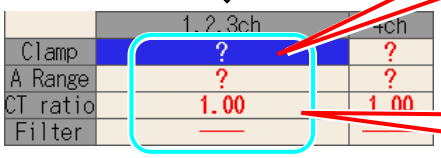


Question mark "?" is displayed at Model name and Current range boxes. CT ratio is automatically set to 1.00. Bars are displayed at Filter box.

Recheck and connect proper Clamp sensors.

< No sensor is detected >





Question mark "?" is displayed at Model name box.

CT ratio is automatically set to 1.00.
Bars are displayed at Filter box.

Check the Clamp sensor connected to the Current input terminal corresponding to the Ch number displayed with question mark.
When starting measurement with the question mark displayed at the [Clamp] box, previous setting is applied automatically.

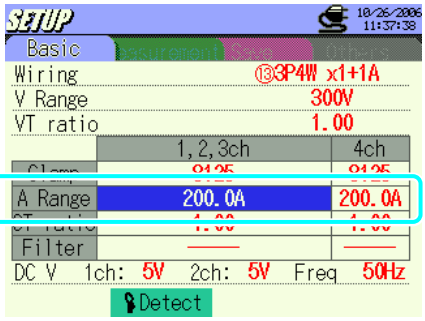
Setting for Current Range

Available Current Range varies depending on the Clamp sensor to be used.

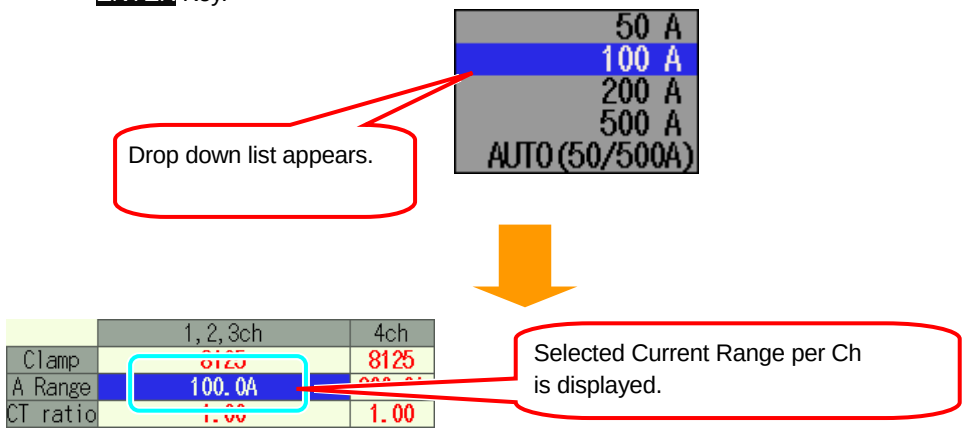
8128	1/5/10/20/50A/AUTO
8127	10/20/50/100A/AUTO
8126	20/50/100/200A/AUTO
8125	50/100/200/500A/AUTO
8124	100/200/500/1000A/AUTO
8129	300/1000/3000A
8141	100mA/500mA/1A/AUTO
8142	
8143	
8146	500mA/1/5/10A/AUTO
8147	
8148	

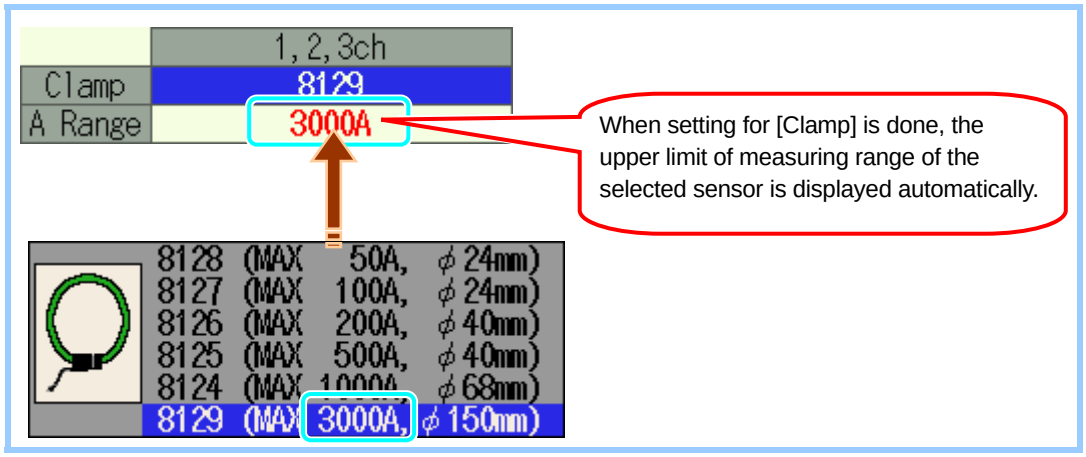
* Default value (or after system reset) : 200A(8125)

1 Press the ▲▼ Cursor Keys and select [A Range], and then press the ENTER Key.

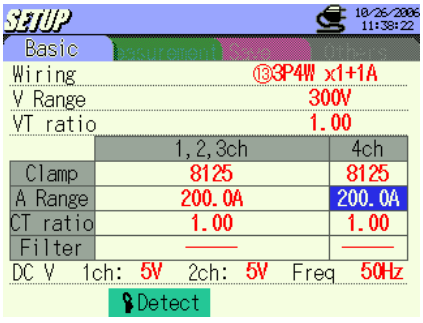


2 Press the ▲▼ Cursor Keys and select a Current Range to be used, and then press the ENTER Key.



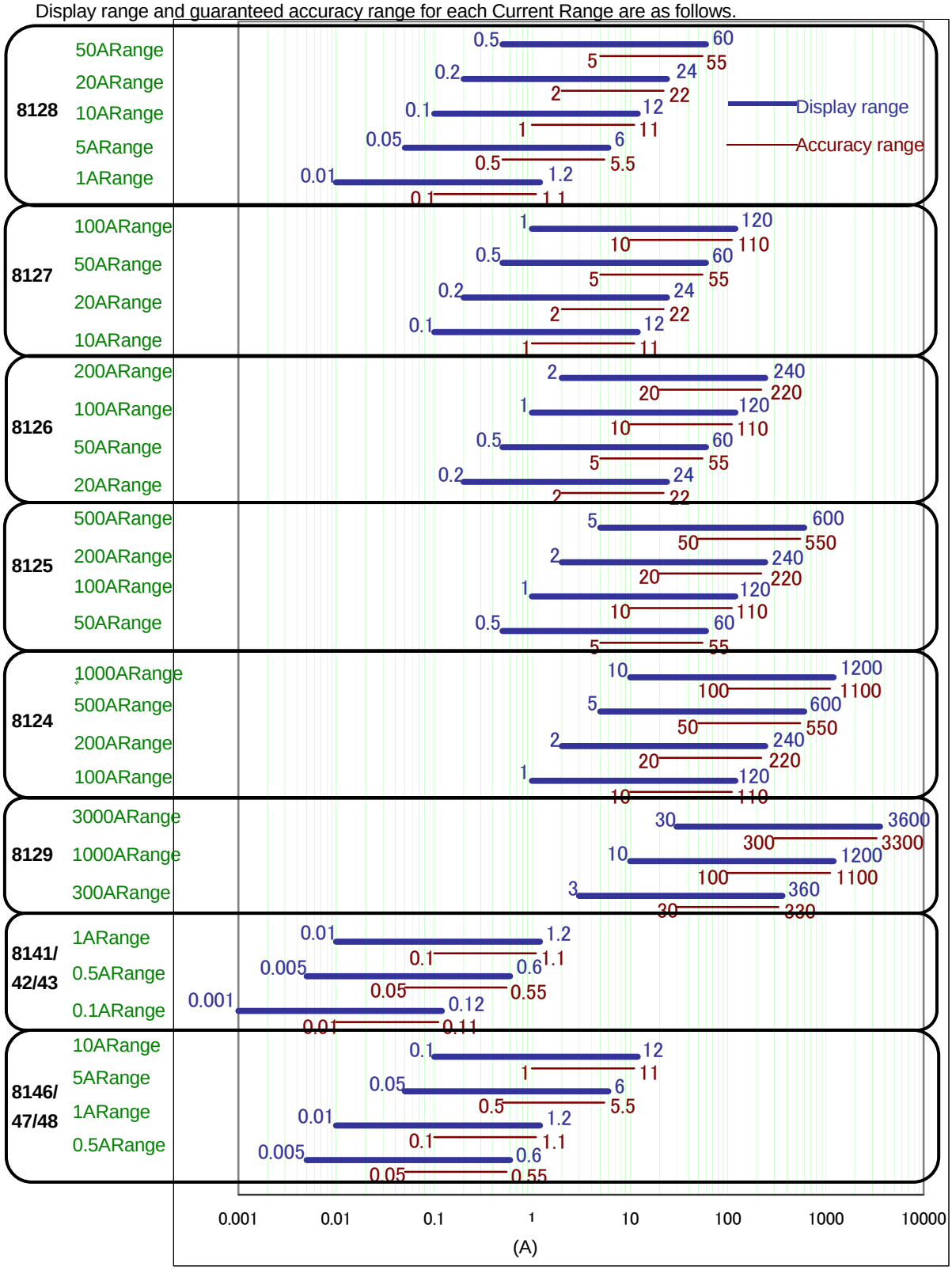


3 Press the ◀▶ Cursor Keys and select Clamp sensors to be used at the other Ch, and make settings in the same way.



Settings of [Clamp] and [A Range] are active in following measurements, but they will change when preset wiring configurations are changed. The highest Range is applied to all Chs when the [A Range] at each Ch should be harmonized due to a change of wiring configurations.

Display range and guaranteed accuracy range for each Current Range are as follows.



Sensors: 8141/42/43 and 8146/47/48 cannot be used for power measurements.

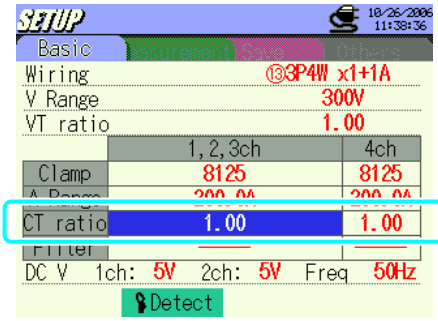
Setting for CT ratio

0.01 ~ 9999.99 (can be set by 0.01)

* Default value (or after system reset) : 1.00

For the details of CT ratio, refer to "**5.4 VT / CT Ratio**" in this manual.

1 Press the ▲▼ Cursor Keys and select [CT Ratio], and then press the ENTER Key.



2 Setting procedure is same to that for VT ratio. Refer to the procedure described in the preceding pages.

3 Press the ◀▶ Cursor Keys and select CT ratio for the other Chs, and make settings in the same way.

Setting for Filter

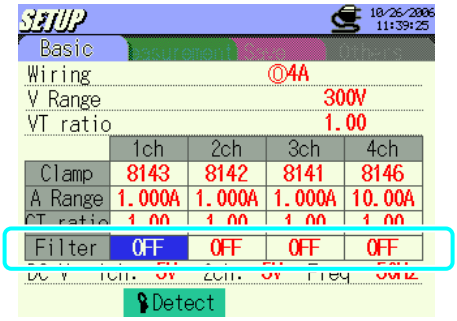
Lowpass filter activate to cut frequencies in higher harmonic band when set the Filter function “ON”.
(Cutoff frequency : approx 160Hz)

Filter	Available (ON⇔OFF)	Not available (------)
Wiring	⑦1P3W x 1+2A 3,4ch ⑩3P3W x 1+2A 3,4ch ⑬3P4W x 1+1A 4ch ⓪ 4A	
Clamp Sensor	8141/42/43/46/47/48	8128/27/26/25/24/29

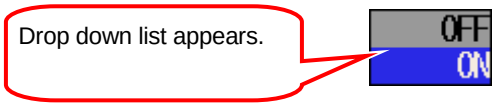
* Default value (or after system reset) : ----- or OFF

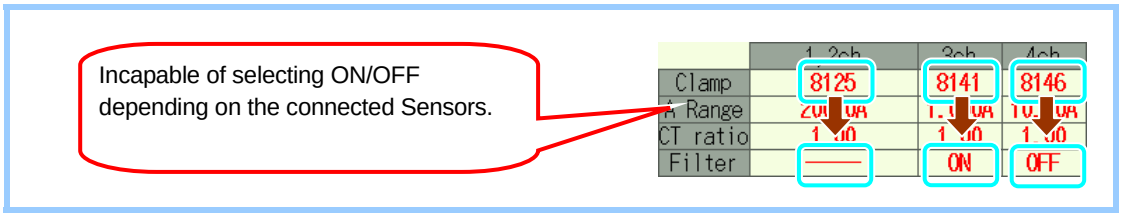
* Bar “------“ is displayed for the Filter other than listed above, and a setting cannot be made.

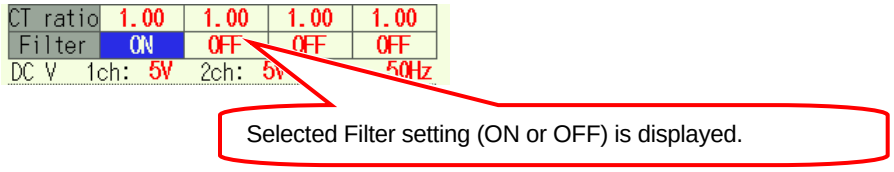
1 Press the ▲▼ Cursor Keys and select [Filter], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select “ON” or “OFF”, and then press the ENTER Key.







3 Press the ◀▮ ▮▶ Cursor Keys and select ON / OFF for the other Chs, and make settings in the same way.

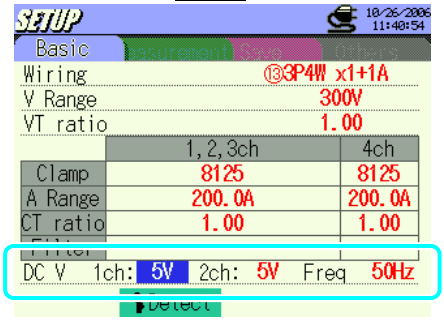
Setting for DC V

Setting for Voltage Range at analogue input terminal can be made according to the procedure below.

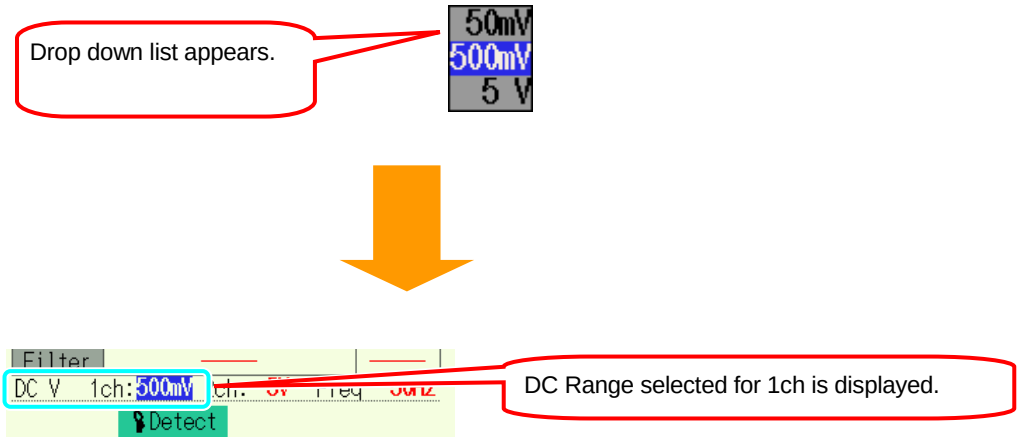
50mV	500mV	5V

* Default value (or after system reset) : 5V

1 Press the ▲▼ Cursor Keys and select [DC V], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select a DC Range to be used, and then press the ENTER Key.



3 Press the ◀▮ ▮▶ Cursor Keys and select DC Range for 2ch, and make settings in the same way.

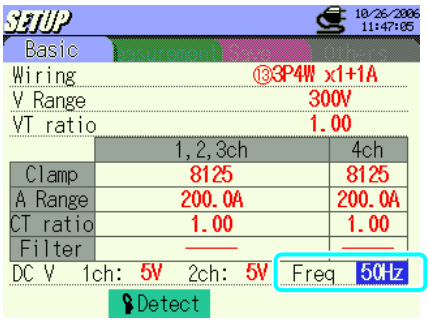
Setting for Frequency

Frequency of the fixed clock can be changed according to following procedure when PLL synchronized measurement cannot be made.

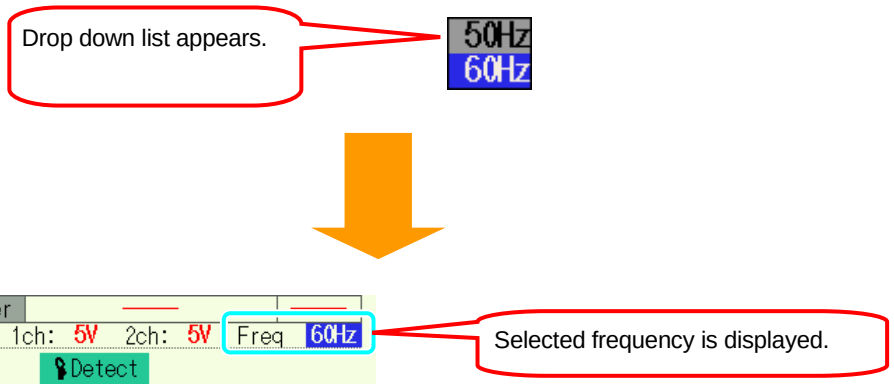
50Hz	60Hz

* Default value (or after system reset) : 50Hz

1 Press the ▲▼◀▶ Cursor Keys and select [Freq], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select “50Hz” or “60Hz”, and then press the ENTER Key.



4.2.2 Measurement setting

W/ Wh/ DEMAND

Press the F1 Key at Measurement setting screen to move to the setting screen for W/ Wh/ DEMAND Range.

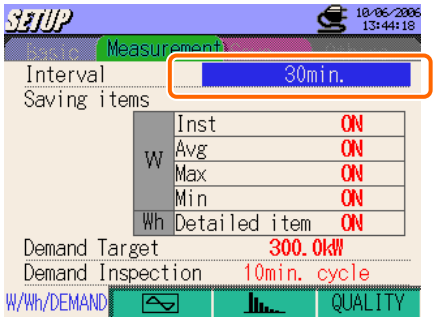
Setting for interval

Interval is a space of the time between data savings; data is saved in a CF card or Internal memory.

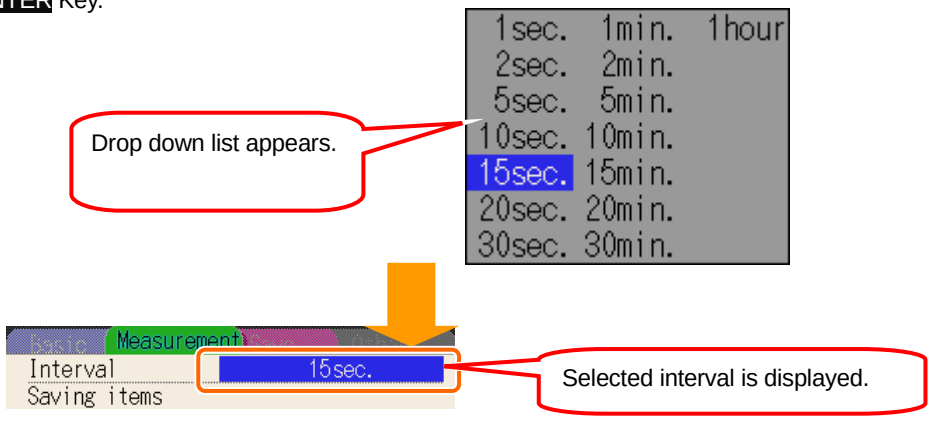
1 sec	1 min	
2 sec	2 min	
5 sec	5 min	
10 sec	10 min	1 hour
15 sec	15 min	
20 sec	20 min	
30 sec	30 min	

* Default value (or after system reset) : 30 min

1 Press the ▲▼ Cursor Keys and select [Interval], and then press the ENTER Key.



2 Press the ▲▼◀▶ Cursor Keys and select any desirable interval, and then press the ENTER Key.



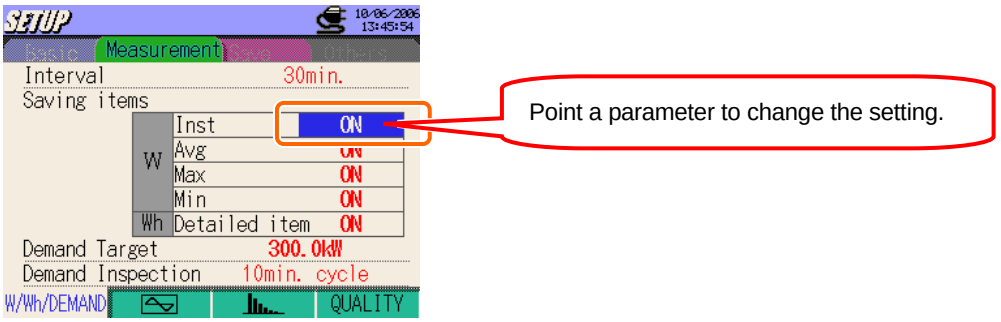
Setting for inst / avg / max / min values

Select “ON” for the parameters to be saved.

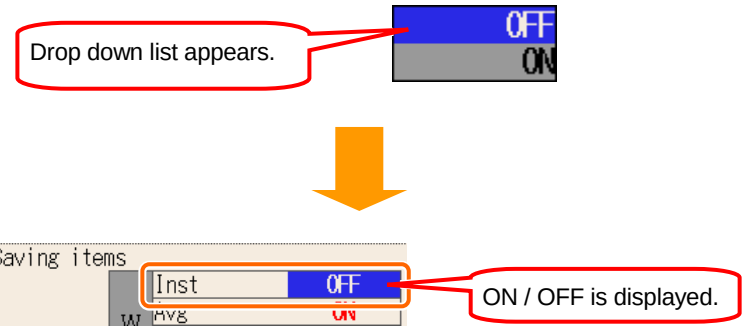
ON⇔OFF

* Default value (or after system reset) : ON

1 Press the ▲▼ Cursor Keys and select any of [Inst / Avg / Max / Min], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select “ON” or “OFF”, and then press the ENTER Key.



When an interval is set to 1 sec, Inst value= Avg value= Max value = Min value. In this case, only Inst values are recorded. (“ON” is available only for Inst) Incapable of applying “OFF” to all the items.

3 Press the ▲▼ Cursor Keys and make settings for [Avg / Max / Min] as well.

Setting for detailed items

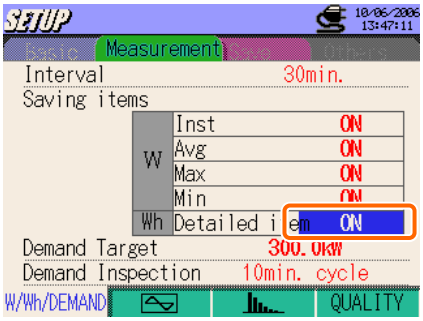
Parameters saved under ON or OFF setting for Detailed item are listed below.

	ON	OFF
WP+ / WP-	O	O
WS+ / WS-	O	X
WQi+ / WQc+	O	O
WQi- / WQc-	O	X
Each CH	O	X

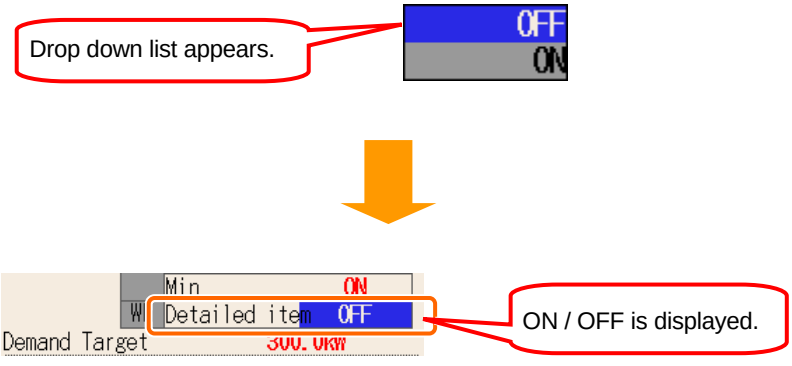
ON⇔OFF

* Default value (or after system reset) : ON

1 Press the ▲▼ Cursor Keys and select [Detailed item], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select “ON” or “OFF”, and then press the ENTER Key.



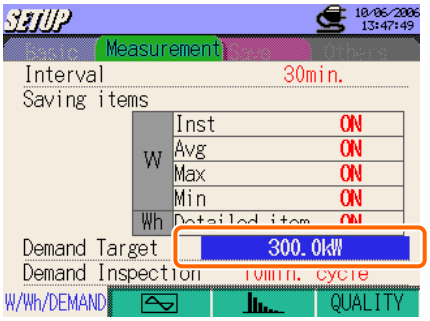
Setting for Target demand

For the details of target demand, refer to "**Section8 Demand measurement**" in this manual.

1.000 ~ 999.9(can be set by 0.1)	mW/W/kW/MW/GW/TW

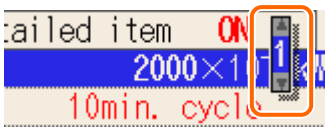
* Default value (or after system reset) : 300.0kW

1 Press the ▲▼ Cursor Keys and select [Demand Target], and then press the ENTER Key.



2 Press the ▲▼◀▮ ▮▶ Cursor Keys and alter the values.

3 Use the ▲▼◀▶ Cursor Keys and set multipliers.



Multiplier Setting

As a target demand, values within a range between 1000 and 9999 can be used.

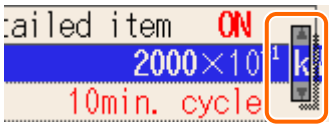
To select a value 1000 or less, minus multiplier should be used.

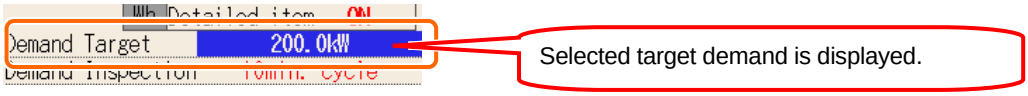
$100.0 = 1000 \times 10^{-1}$

$10.00 = 1000 \times 10^{-2}$

$1.000 = 1000 \times 10^{-3}$

4 Press the ▲▼◀▶ Cursor Keys and a select proper unit, and then press the ENTER Key.





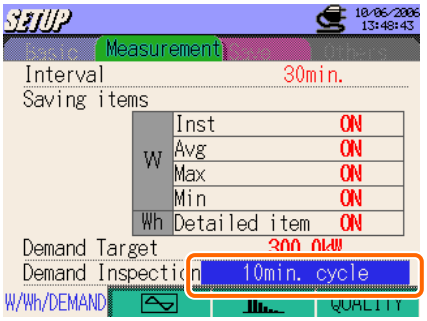
Setting for Demand inspection cycle

For the details of Demand inspection cycle, refer to "**Section 8 Demand measurement**" in this manual.

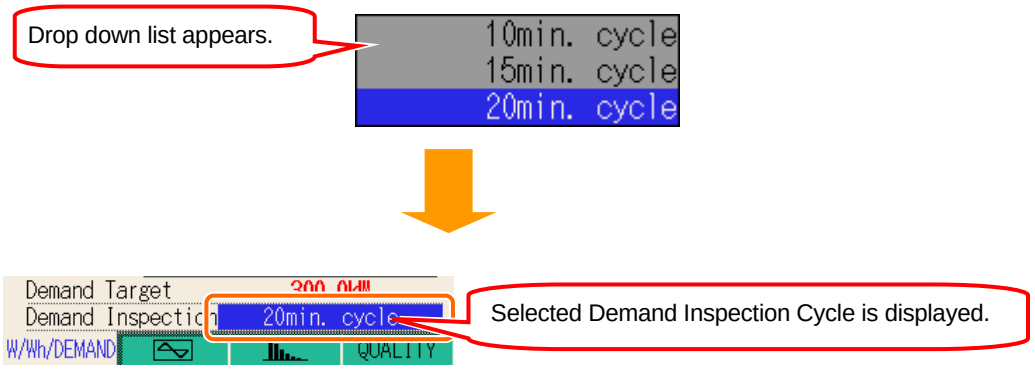
Demand Interval	Demand Inspection Cycle
1 sec	invalid
2 sec	
5 sec	
10 sec	1sec/2sec/5sec
15 sec	2sec/5sec/10sec
20 sec	5sec/10sec/15sec
30 sec	10sec/15sec/20sec
1 min	15sec/20sec/30sec
2 min	20sec/30sec/1min
5 min	30sec/1min/2min
10 min	1min/2min/5min
15 min	2min/5min/10min
20 min	5min/10min/15min
30 min	10min/15min/20min
1 hour	15min/20min/30min

* Default value (or after system reset) : 10 min

1 Press the ▲▼ Cursor Keys and select [Demand Inspection], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select a desirable cycle, and then press the ENTER Key.



Demand Inspection Cycle listed on the drop down list depends on the selected interval.
Change the interval setting first when a desirable cycle isn't listed on the drop down list.

WAVE Range Setting

Press the F2 Key at each Measurement setting screen, and move to the screen for WAVE Range Setting.

Setting for interval

* Default value (or after system reset) : 30 min
* Setting procedure is same to that for interval Setting for W/ Wh/ DEMAND.Refer to the procedure described in the preceding pages.

Interval listed on the drop down list depends on the number of save items with “ON” setting. Alter the number of save items with “ON” setting when desirable interval isn’t listed on the drop down list.

Interval	Number of “ON”
1 sec	1
2 sec	2 or less
5 sec or more	5 or less

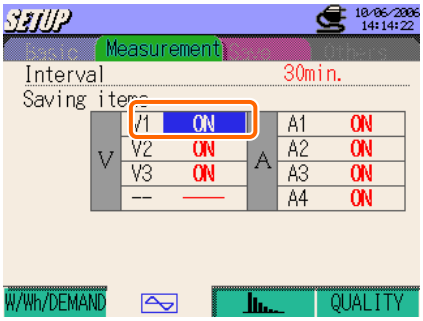
Setting for saving Waveform data

Parameters with “ON” setting will be saved.

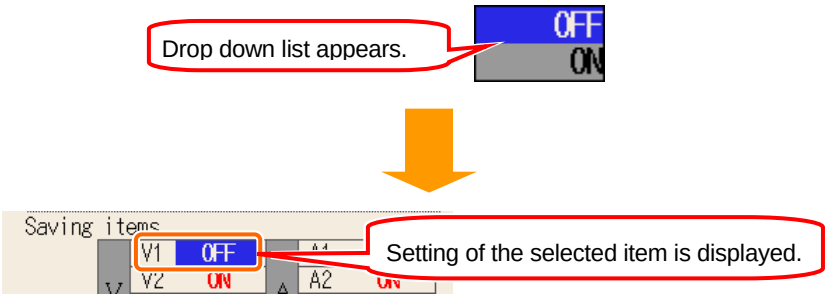
V	ON⇔OFF
A	

* Default value (or after system reset) : ON (all items)

1 Press the ▲▼ Cursor Keys and select a parameter to be changed, and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select “ON” or “OFF”, and then press the ENTER Key.



Harmonic Analysis

Press the F3 Key at each Measurement setting screen, and move to the screen for Harmonic Analysis Setting.

Setting for interval

* Default value (or after system reset) : 30 min
* Setting procedure is same to that for interval Setting for W/ Wh/ DEMAND.Refer to the procedure described in the preceding pages.

Interval listed on the drop down list depends on the number of save items with “ON” setting. Alter the number of save items with “ON” setting when desirable interval isn’t listed on the drop down list. Interval of 1 sec is not available.

Interval	Number of “ON”
2 sec	1
5 sec	2
10 sec	5

THD Calculation Setting

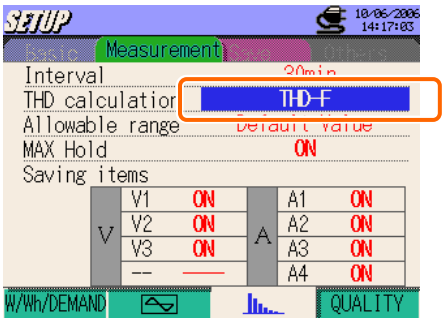
THD stands for “Total Harmonic Distortion”.

THD-F	THD-R

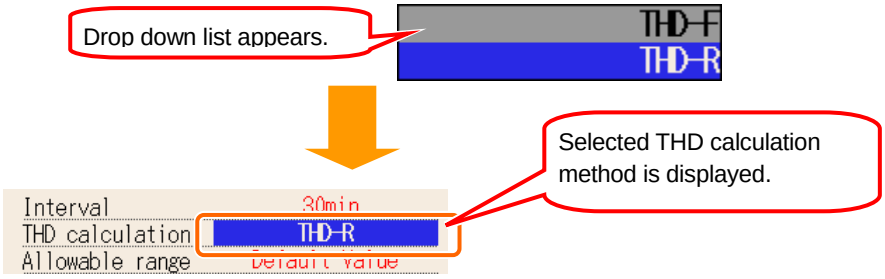
* Default value (or after system reset) : THD-F

THD-F	Fundamental waveform-basis
THD-R	Total RMS value-basis

1 Press the ▲▼ Cursor Keys and select [THD Calculation], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select “THD-F” or “THD-R”, and then press the ENTER Key.



Setting for allowable range

For the details of allowable range of Harmonic Analysis, refer to "**Section10 Harmonic analysis**" in this manual.

Default value (can be set by 0.1)	Customize (can be set by 0.1)

* Default value (or after system reset) : Default value

Either default values listed in the below table or customized values can be used.

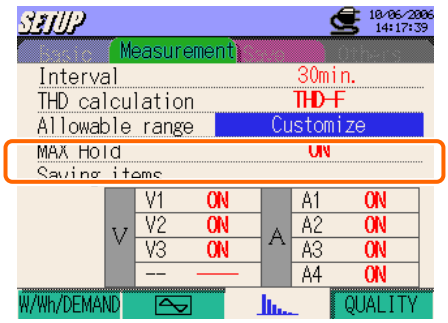
Default values									
1	**----**	2	**2.0**	3	**5.0**	4	**1.0**	5	**6.0**
6	**3.0**	7	**5.0**	8	**0.5**	9	**1.5**	10	**0.5**
11	**3.5**	12	**0.5**	13	**3.0**	14	**0.5**	15	**0.5**
16	**0.5**	17	**2.0**	18	**0.5**	19	**1.5**	20	**0.5**
21	**0.5**	22	**0.5**	23	**1.5**	24	**0.5**	25	**1.5**
26	**0.5**	27	**0.5**	28	**0.5**	29	**0.5**	30	**0.5**
31	**0.5**	32	**0.5**	33	**0.5**	34	**0.5**	35	**0.5**
36	**0.5**	37	**0.5**	38	**0.5**	39	**0.5**	40	**0.5**
41	**0.5**	42	**0.5**	43	**0.5**	44	**0.5**	45	**0.5**
46	**0.5**	47	**0.5**	48	**0.5**	49	**0.5**	50	**0.5**
51	**0.5**	52	**0.5**	53	**0.5**	54	**0.5**	55	**0.5**
56	**0.5**	57	**0.5**	58	**0.5**	59	**0.5**	60	**0.5**
61	**0.5**	62	**0.5**	63	**0.5**				

* These values are applied as default values or after system reset.

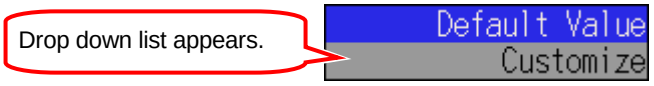
Customize	
1 ~ 63	**0.0 ~ 99.9**

< Adopting default values >

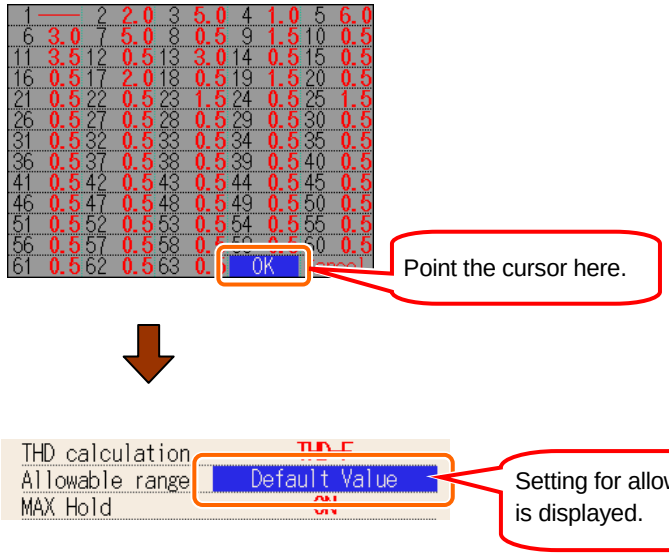
1 Press the ▲▼ Cursor Keys and select [Allowable range], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select [Default Value], and then press the ENTER Key.

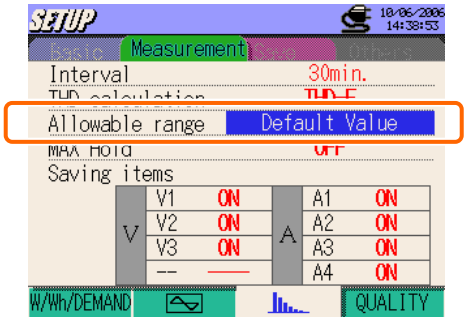


3 Selectable default value is displayed. Press the ◀▶ Cursor Keys and point [OK] to accept the value and press the ENTER Key. Point [Cancel] with ◀▶ Cursor Keys, and press the ENTER Key to select the values other than the ones listed below. (or press the ESC Key) Then screen returns to 1. Select [Customize] and set a desirable value. See “Adopting customized values” which indicates how to customize the values.

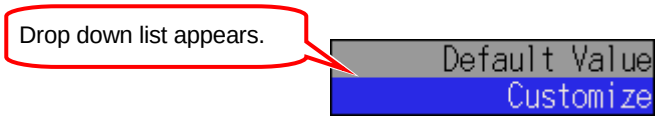


< Adopting customized values >

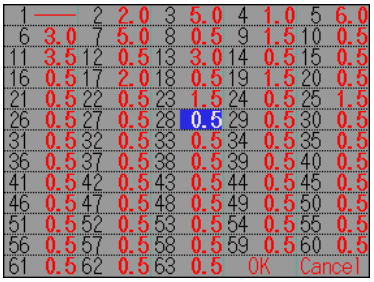
1 Press the ▲▼ Cursor Keys and select [Allowable range], and then press the ENTER Key.



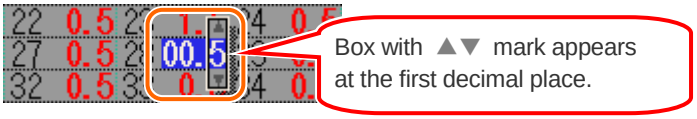
2 Press the ▲▼ Cursor Keys and select [Customize], and then press the ENTER Key.



3 Press the ▲▼ ◀▮ ▮▶ Cursor Keys and select the order to be changed, and then press the ENTER Key.



4 According to the procedure to change VT ratio described at preceding page and alter the values.



5 Press the ▲▼◀▶ Cursor Keys and move the cursor to [OK], and press the ENTER Key.
To cancel the alternations of values, move the cursor to [Cancel], and press the ENTER Key.
Then Screen returns to 1 .

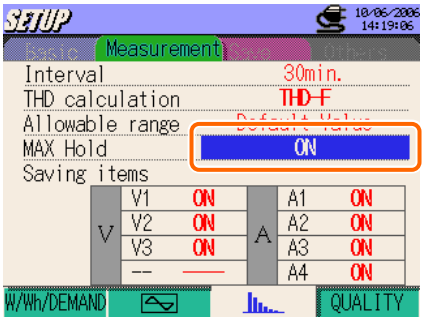
Setting for MAX HOLD

For the details of Max Hold in Harmonic Analysis, refer to "**Section10 Harmonic analysis**" in this manual.

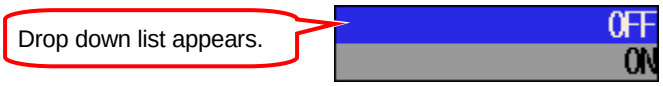
ON⇔OFF

* Default value (or after system reset) : ON

1 Press the ▲▼ Cursor Keys and select [MAX Hold], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select "ON" or "OFF", and then press the ENTER Key.



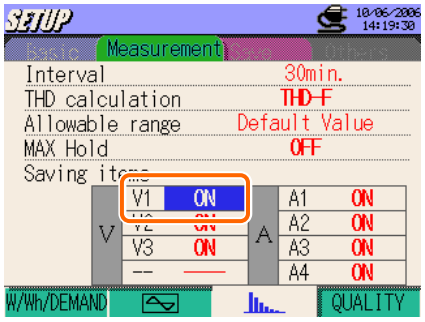
Setting for saving items

Parameters with “ON” setting will be saved.

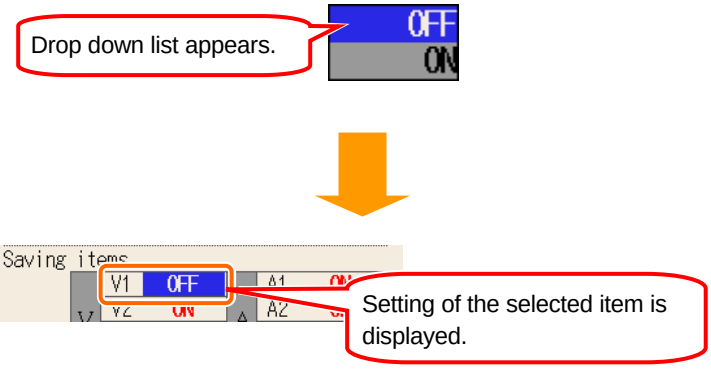
V	ON⇔OFF
A	

* Default value (or after system reset) : ON (all items)

1 Press the ▲▼◀▶ Cursor Keys and select a parameter to be changed, and then press the ENTER Key.



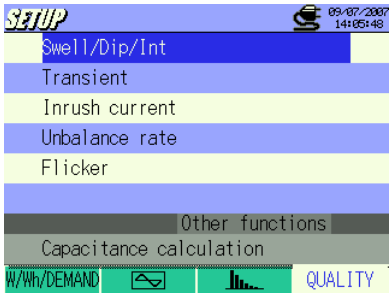
2 Press the ▲▼ Cursor Keys and select “ON” or “OFF”, and then press the ENTER Key.



Measured data won’t be saved at the channel with “OFF” setting, nor displayed during measurement.

QUALITY

Press the F4 Key at Measurement setting screens to move to the QUALITY setting screen.



Access to “QUALITY” from Measurement Setting Tab, and press the Cursor Keys and select : Swell / Dip / Int, Transient, Inrush current, Unbalance rate, Capacitance calculation and Flicker measurement*.

* Flicker measurement function is only available with ver.2.00 or later.

Setting for Swell / Dip / Int Measurement

For the details of Swell / Dip / Int measurement, refer to “**11.2 Swell / Dip / Int measurement**” in this manual.

Setting Items		
Interval*2	:	set interval time
Reference Voltage*1	:	set a standard voltage (70 ~ 1000V)
Transient*2	:	set Vpeak against Voltage Range(50～2000Vpeak)
Swell *1	:	set a threshold value greater than the reference voltage (100 ~ 200%)
Dip *1	:	set a threshold value smaller than the reference voltage (5 ~ 100%)
Int *1	:	set a threshold value smaller than the reference voltage (5 ~ 98%)
Hysteresis	:	set a hysteresis for Swell / Dip / int (1 ~ 10%)
Trigger Point	:	set the number of data save point prior to / following an event of trigger

* Voltage value is automatically calculated when setting percentages for Swell / Dip / Int / Hysteresis.

*1 Each values should be;

- (Int + Hysteresis) < (Dip)
- (Dip + Hysteresis) < (Swell)

*2 Flicker measurement function is only available with ver.2.00 or later.

Setting for interval

Interval is a space of the time between data savings; data is saved in a CF card or Internal memory.

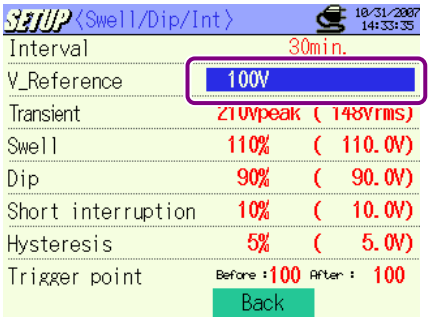
* Default value (or after system reset) : 30 min
* Setting procedure is same to that for interval Setting for W/ Wh/ DEMAND.Refer to the procedure described in the preceding pages.

Setting for reference voltage

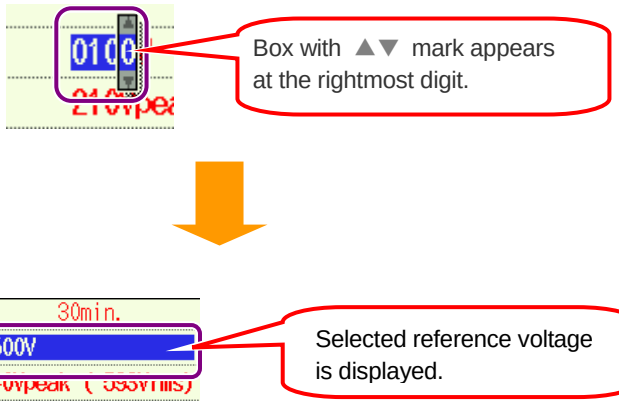
70 ~ 1000V (can be set by 1V)

* Default value (or after system reset) : 100V

1 Press the ▲▼ Cursor Keys and select [V_Reference], and then press the ENTER Key.



2 Press the ▲▼◀▮ ▮▶ Cursor Keys and alter values, and then press the ENTER Key.

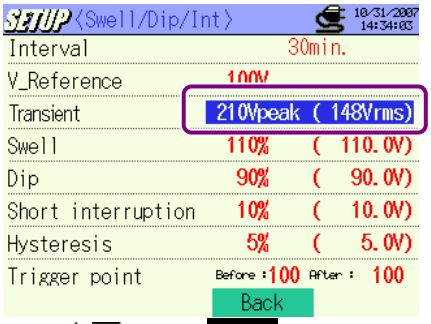


Setting for Transient

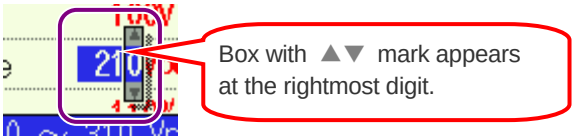
Voltage Range	70~150V	151~300V	301~600V	601~1000V
Transient (on 1V basis)	50~310Vpeak	90~630Vpeak	170~1270Vpeak	340~2000Vpeak

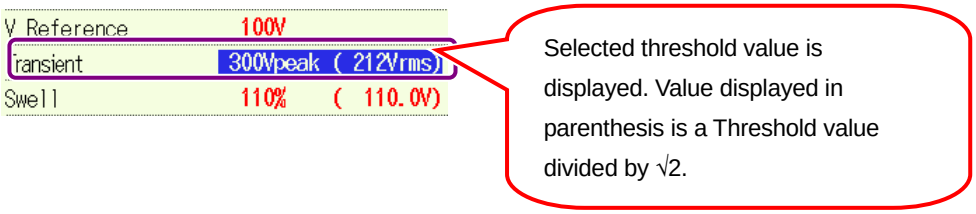
* Default value (or after system reset) : 210V
* Vrms value (Vpeak divided by √2) is automatically calculated when Vpeak is set.

1 Press the ▲▼ Cursor Keys and select [Transient], and then press the ENTER Key.



2 Press the ▲▼◀▮ ▮▶ Cursor Keys and alter the values, and press the ENTER Key to fix it.



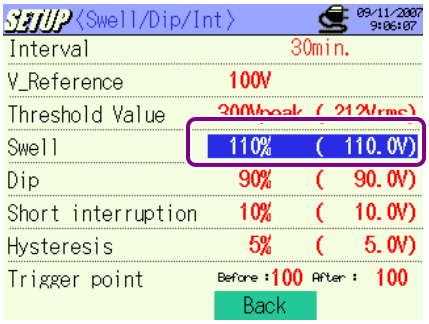


Setting for swell

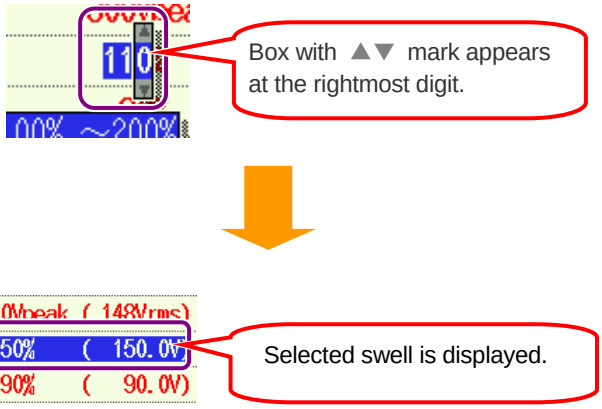
100 ~ 200% (can be set by 1%)

* Default value (or after system reset) : 110%

1 Press the ▲▼ Cursor Keys and select [Swell], and then press the ENTER Key.



2 Press the ▲▼◀▶ Cursor Keys and alter values, and then press the ENTER Key.

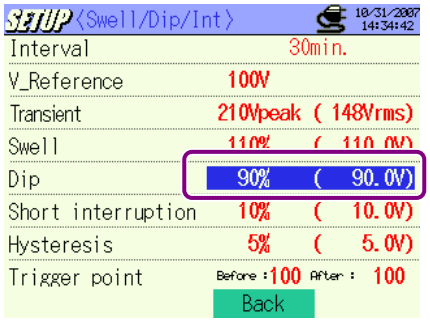


Setting for dip

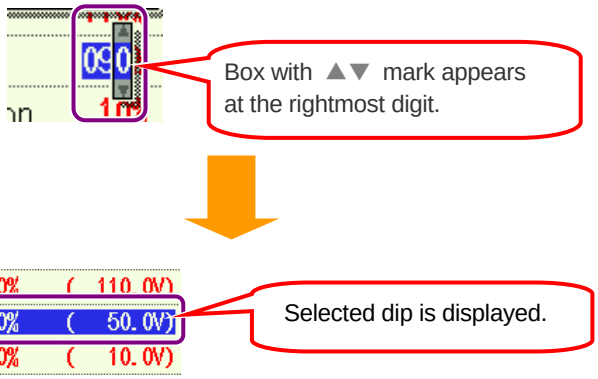
5~ 100% (can be set by 1%)

* Default value (or after system reset) : 90%

1 Press the ▲▼ Cursor Keys and select [Dip], and then press the ENTER Key.



2 Press the ▲▼◀▶ Cursor Keys and alter values, and then press the ENTER Key.



Lower limit varies depending on the selected reference voltage.

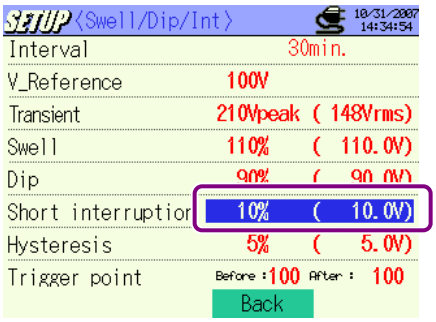
- 70 ~ 150V : percentage to obtain values of 7.5 or more
- 151 ~ 300V : percentage to obtain values of 15.0 or more
- 301 ~ 600V : percentage to obtain values of 30.0 or more
- 601 ~ 1000V : percentage to obtain values of 50.0 or more

Setting for int (short interruption)

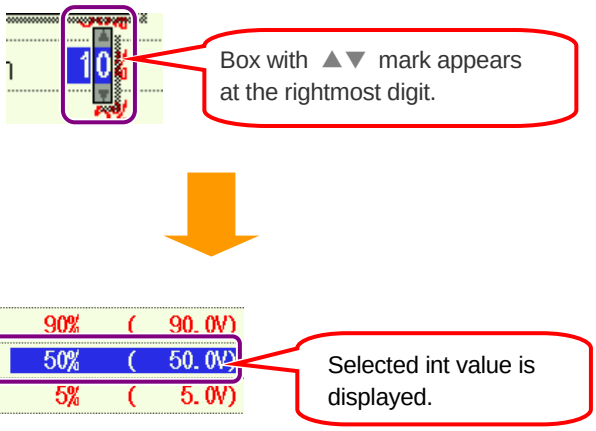
5 ~ 98% (can be set by 1%)

* Default value (or after system reset) : 10%

1 Press the ▲▼ Cursor Keys and select [Short interruption], and then press the ENTER Key.



2 Press the ▲▼◀▶ Cursor Keys and alter values, and then press the ENTER Key.



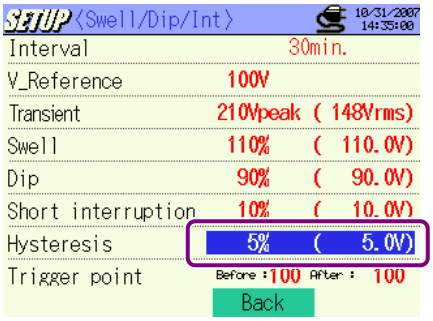
Lower limit varies depending on the selected reference voltage. Alter the reference voltages to change the lower limit.

Setting for hysteresis

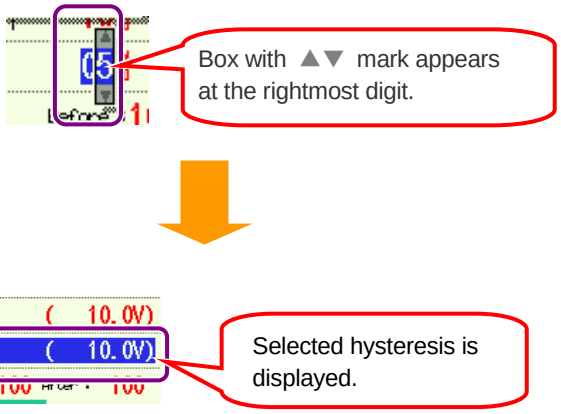
1 ~ 10% (can be set by 1%)

* Default value (or after system reset) : 5%

1 Press the ▲▼ Cursor Keys and select [Hysteresis], and then press the ENTER Key.



2 Press the ▲▼◀▶ Cursor Keys and alter values, and then press the ENTER Key.



Setting for trigger point

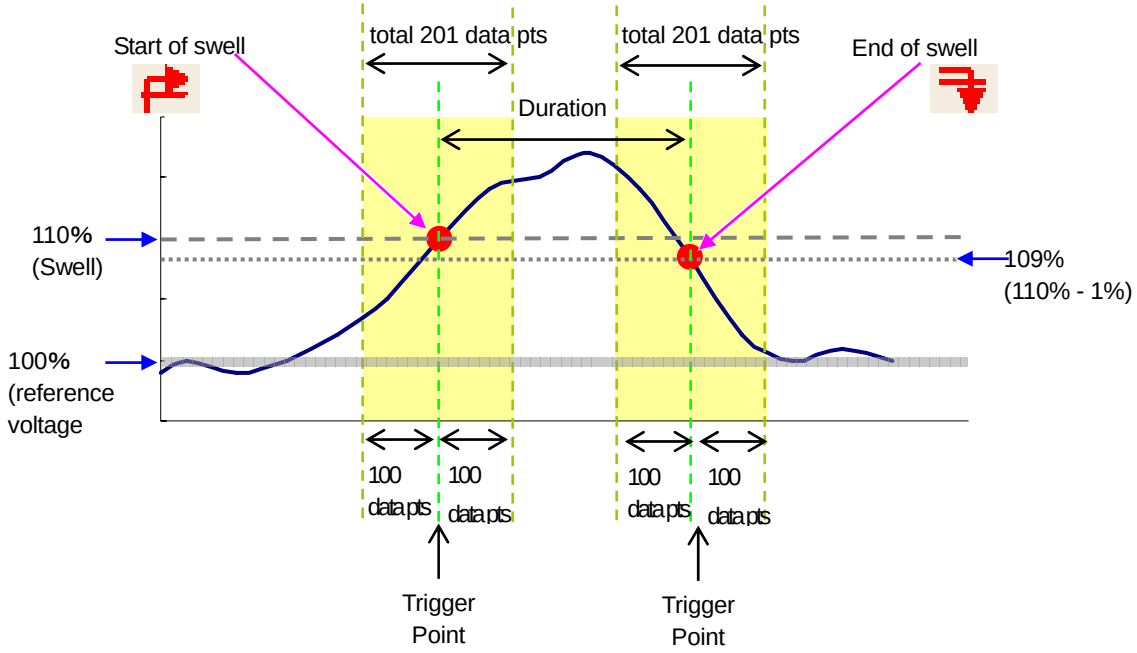
Trigger to start and stop recording, when a preset threshold is exceeded, is decided based on the number of recorded data.

Past: 0 ~ 200 (can be set by 1)	Next : 200 ~ 0 (can be set by 1)

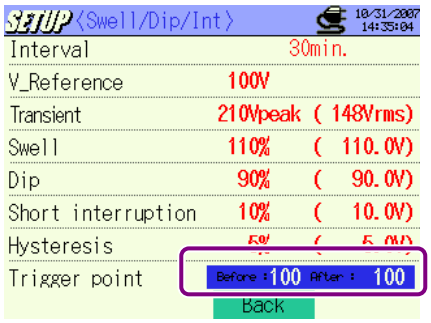
* Default value (or after system reset) : 100

Example of Trigger Pint Setting:

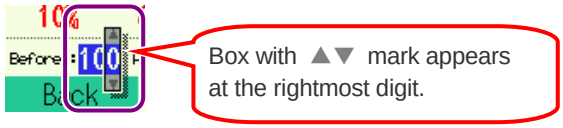
Setting item	e.g.
Reference voltage	100V
Swell	110%
Hysteresis	1%
Trigger point	Past: 100, Next: 100

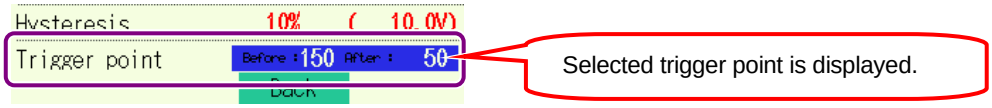


1 Press the ▲▼ Cursor Keys and select [Trigger point], and then press the ENTER Key.



2 Press the ▲▼◀▮ ▮▶ Cursor Keys and alter values, and then press the ENTER Key.





When setting a trigger point for “Past”, the point for “Next” is automatically decided.
(total 200 data pts)

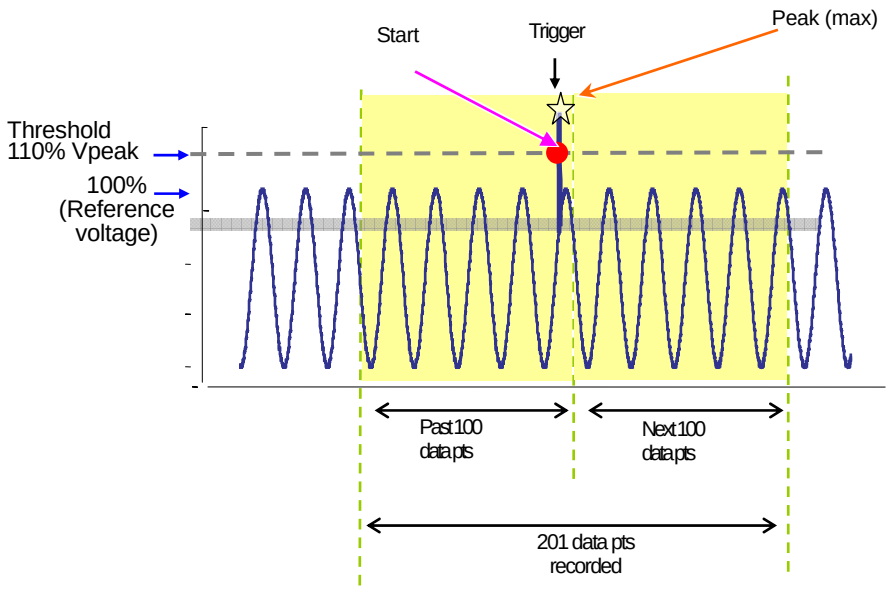
Setting for transient measurement

For the details of Transient Measurement, refer to "**11.3 Transient measurement**" in this manual.

Setting Items		
Interval*1		set interval time
V Range	:	select a base Voltage Range(150～1000V)
Threshold value	:	set Vpeak against Voltage Range(50～2000Vpeak)
Hysteresis	:	set a hystereis in percentage against Voltage Range(1～10%)
Trigger point	:	set a number of data save point prior to / following an event of trigger

* Selectable range for threshold (Vpeak) is automatically displayed when selecting Voltage Range (V).

*1 Flicker measurement function is only available with ver.2.00 or later.



Setting for interval

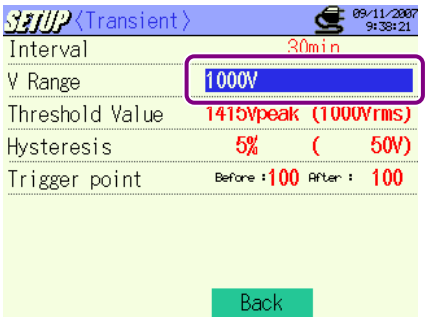
* Default value (or after system reset) : 30 min
* Setting procedure is same to that for interval Setting for W/ Wh/ DEMAND.Refer to the procedure described in the preceding pages.

Setting for voltage range

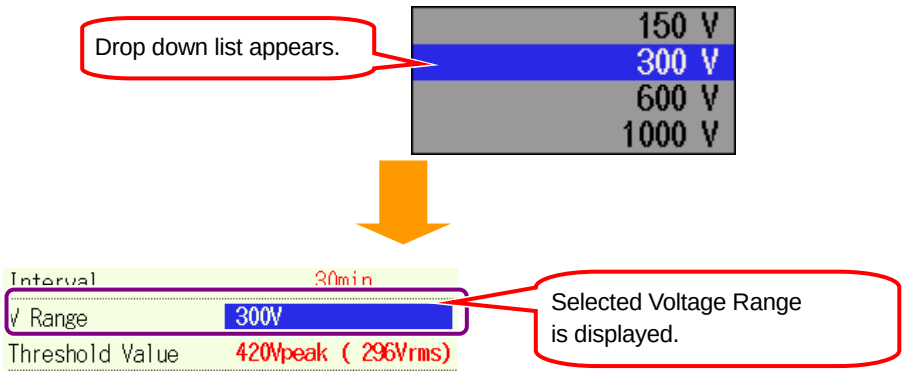
150/ 300/ 600/ 1000V

* Default value (or after system reset) : 1000V

1 Press the ▲▼ Cursor Keys and select [V Range], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select a Voltage Range and then press the ENTER Key.

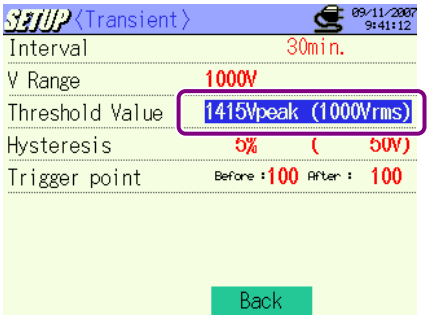


Setting for threshold

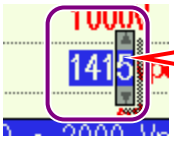
Voltage Range	150V	300V	600V	1000V
Threshold (on 1V basis)	50~310Vpeak	90~630Vpeak	170~1270Vpeak	340~2000Vpeak

* Default value (or after system reset) : 1415V
* Vrms value (Vpeak divided by √2) is automatically calculated when Vpeak is set.

1 Press the ▲▼ Cursor Keys and select [Threshold Value], and then press the ENTER Key.



2 Press the ▲▼◀▮ ▮▶ Cursor Keys and alter the values, and press the ENTER Key to fix it.



Box with ▲▼ mark appears at the rightmost digit.

Selected threshold value is displayed. Value displayed in parenthesis is a threshold value divided by √2.

Setting for hysteresis

1 ~ 10% (can be set by 1%)

* Default value (or after system reset) : 5%
* Setting procedure is same to that for Hysteresis Setting for Swell, Dip, Int measurement. Refer to the procedure described in the preceding pages.

Setting for trigger point

Past: 1 ~ 200 (can be set by 1)	Next : 200 ~ 0 (can be set by 1)

* Default value (or after system reset) : 100

* Trigger to start and stop recording when a preset threshold exceeded will be decided based on the number of recorded data.

* Setting procedure is same to that for Trigger Point Setting for Swell, Dip, Int measurement. Refer to the procedure described in the preceding pages.

Setting for Inrush Current Measurement

For the details of Inrush Current, refer to "**11.4 Inrush Current Measurement**" in this manual.

Setting Items		
Interval*1		set interval time
Clamp sensor	:	refer to Basic setting
A Range	:	refer to Basic setting
Reference current	:	select a Current Range of reference
Filter	:	refer to Basic setting
Threshold value	:	set in percentage against reference current
Hysteresis	:	set in percentage against reference current
Trigger Point	:	set a number of data save point prior to / following an event of trigger

* Selectable range for reference current (A/mA) is automatically displayed after selecting a Current Range for 1ch at Basic setting.*1 Flicker measurement function is only available with ver.2.00 or later.

Setting for interval

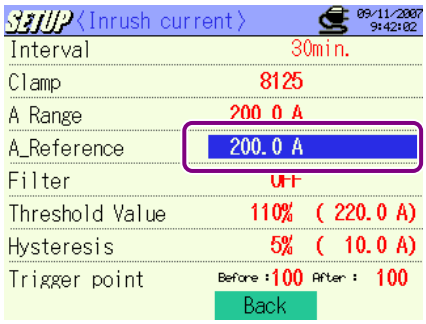
* Default value (or after system reset) : 30 min
* Setting procedure is same to that for interval Setting for W/ Wh/ DEMAND.Refer to the procedure described in the preceding pages.

Setting for referent current

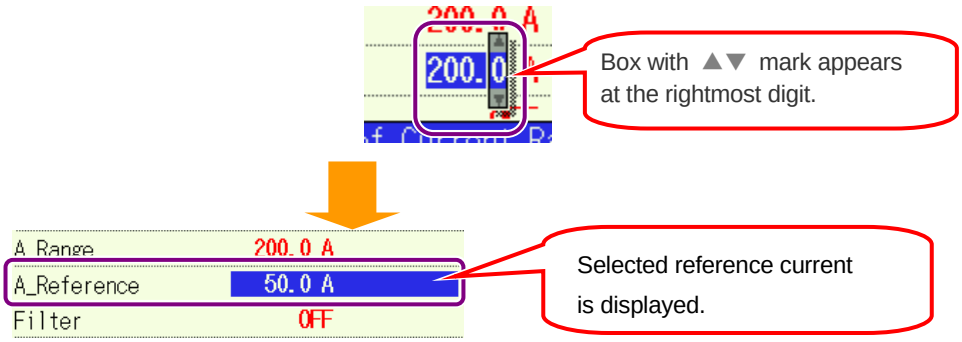
Current Range	Selectable range	Resolution
100mA	10 ~ 100mA	0.1mA
500mA	50 ~ 500mA	0.1mA
1A	0.1 ~ 1A	0.001A
5A	0.5 ~ 5A	0.001A
10A	1 ~ 10A	0.01A
20A	2 ~ 20A	0.01A
50A	5 ~ 50A	0.01A
100A	10 ~ 100A	0.1A
200A	20 ~ 200A	0.1A
500A	50 ~ 500A	0.1A
1000A	100 ~ 1000A	1A
3000A	300 ~ 3000A	1A

* When "AUTO" is selected as a Current Range for A1, the max Range of Clamp sensor is set automatically.
* Selectable range is within 10 to 100% of Current Range.

1 Press the ▲▼ Cursor Keys and select [A_Referene], and then press the ENTER Key.



2 Press the ▲▼◀▮ ▮▶ Cursor Keys and alter the values, and press the ENTER Key to fix it.



Setting for Threshold

100 ~ 200% (can be set by 1%)

* Default value (or after system reset) : 110%
* Setting procedure is same to that for Threshold Setting for Swell, Dip, int measurement. Refer to the procedure described in the preceding pages.

Setting for hysteresis

1 ~ 10% (can be set by 1%)

* Default value (or after system reset) : 5%
* Setting procedure is same to that for Hysteresis Setting for Swell, Dip, Int measurement. Refer to the procedure described in the preceding pages.

Setting for trigger point

Past: 0 ~ 200 (can be set by 1)	Next : 200 ~ 0 (can be set by 1)

* Default value (or after system reset) : 100
* Trigger to start and stop recording, when a preset threshold exceeded, will be decided based on the number of recorded data.
* Setting procedure is same to that for Trigger Point Setting for Swell, Dip, Int measurement. Refer to the procedure described in the preceding pages.

Setting for unbalance rate measurement

For the details of Voltage Unbalance Rate Measurement, refer to "**11.5 Unbalance Rate**" in this manual.

Setting Items		
Interval	:	set interval time
Output threshold	:	set threshold for the output of voltage unbalance rate

Setting for interval

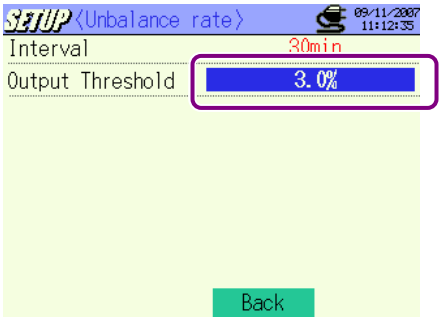
* Default value (or after system reset) : 30 min
* Setting procedure is same to that for interval Setting for W/ Wh/ DEMAND.Refer to the procedure described in the preceding pages.

Setting for output threshold

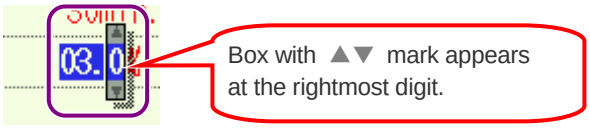
1 ~ 20% (can be set by 0.1%)

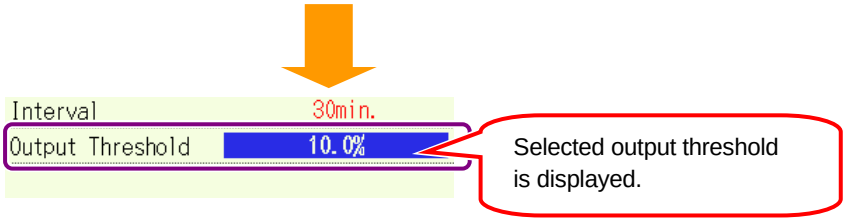
* Default value (or after system reset) : 3%

1 Press the ▲▼ Cursor Keys and select [Output Threshold], and then press the ENTER Key.



2 Press the ▲▼◀▮ ▮▶ Cursor Keys and alter values, and then press the ENTER Key.





Setting for Flicker measurement

For the details of Flicker measurement, refer to "**11.6 Flicker measurement**" in this manual.

Setting Items		
V Range	:	select a desirable Voltage Range（150～600V）
Filter	:	select a visibility filter for flicker calculation
Output item	:	set conditions for output to Output terminal
Output Threshold	:	select a threshold value for Output terminal

Setting for voltage range

150／300／600V

* Default value (or after system reset) : 300V

* Setting procedure is same to that for Voltage Range described in the clause of "Setting for Transient measurement". Refer to the procedure described in the preceding pages.

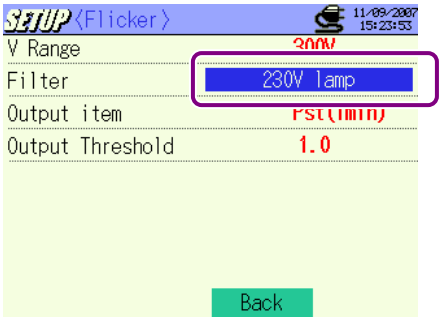
Setting for Filter

Follow the procedure below and select any filter factor.

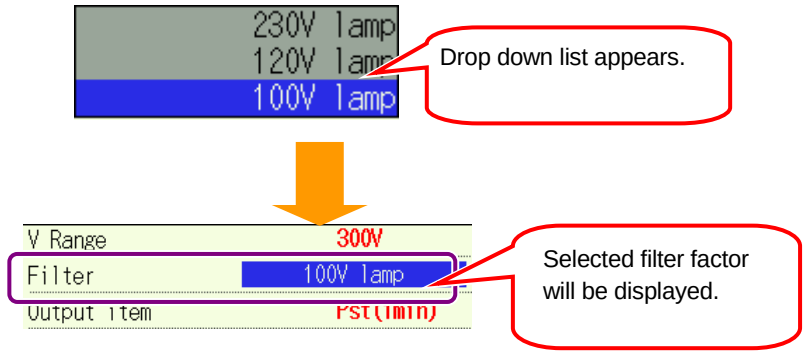
230V／120V／100V

* Default value (or after system reset) : 230V

1 Select any desirabe [Filter] with ▲▼ Cursor Key and press the ENTER Key.



2 Select a desirable filter factor with ▲▼◀▶ Cusor Key and press the ENTER Key.



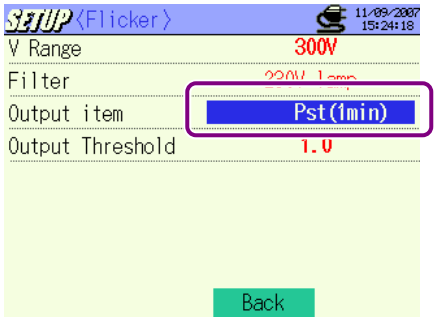
Setting for Output item

Follow the procedure below to make setting for output items. (conditions for output to Output terminal)

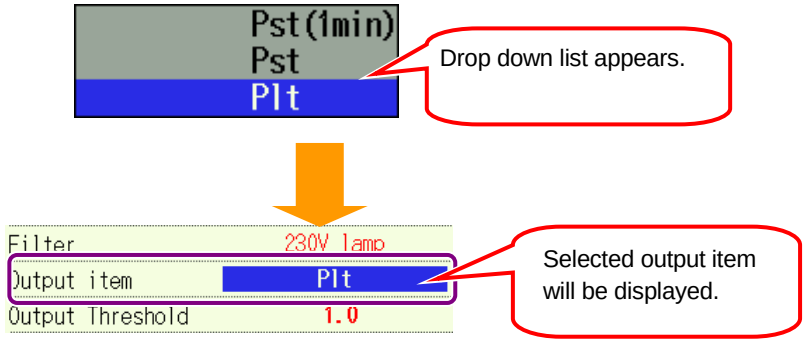
Pst(1min)／Pst／Plt

* Default value (or after system reset) : Pst(1miin)
* where :
  Output item = Pst, Output threshold = 1.0,
  threshold check is done when Pst is refreshed (every 10 min)

1 Select any desirable [Output item] with ▲▼ Cursor Key and press the ENTER Key.



2 Select a desirable filter factor with ▲▼◀▶ Cusor Key and press the ENTER Key.



Setting for output threshold

0.8～20.0(can be set by 0.1)

* Default value (or after system reset) :1.0

* Setting procedure is same to that for Output Threshold described in the clause of “Setting for Unbalance rate“. Refer to the procedure described in the preceding pages.

Setting for capacitance calculation

For the details of unbalance rate Measurement, refer to "**11.7 Capacitance Calculation**" in this manual.

Setting items		
Interval	:	select interval
Target power factor	:	simulating power factor correction with capacitor banks

Setting for interval

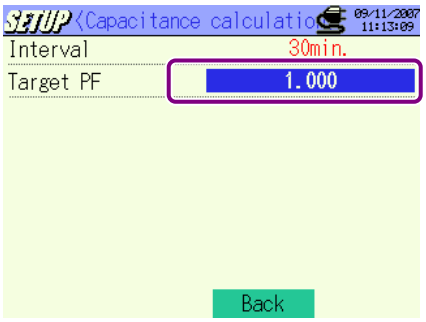
* Default value (or after system reset) : 30 min
* Setting procedure is same to that for interval Setting for W/ Wh/ DEMAND.Refer to the procedure described in the preceding pages.

Setting for target power factor

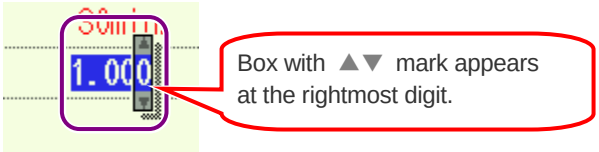
0.5 ~ 1 (can be set by 0.001)

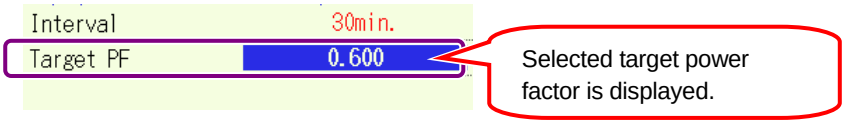
* Default value (or after system reset) : 1.000

1 Press the ▲▼ Cursor Keys and select [Target PF], and then press the ENTER Key.



2 Press the ▲▼◀▶ Cursor Keys and alter values, and then press the ENTER Key.





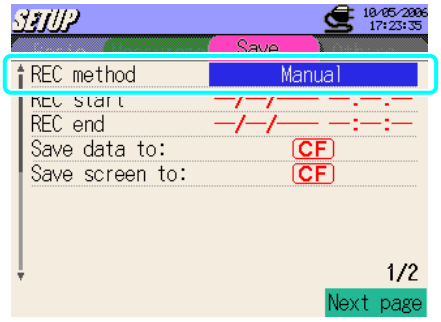
4.2.3 Save Setting

Setting for recording

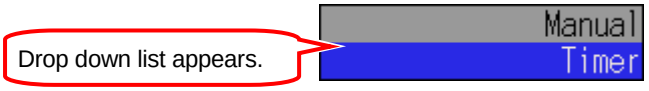
Manual⇔ Timer

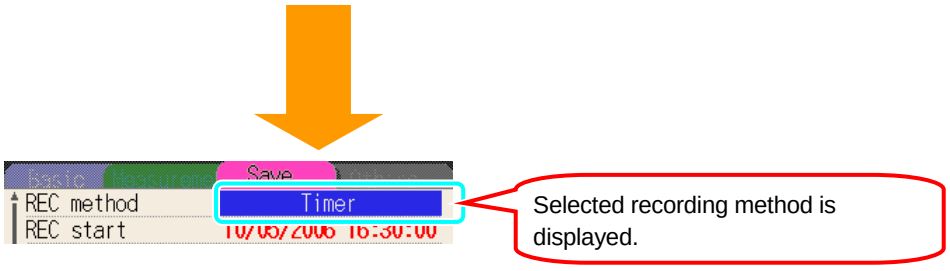
* Default value (or after system reset) : Timer

1 Press the ▲▼ Cursor Keys and select [REC method], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select Manual or Timer, and then press the ENTER Key.





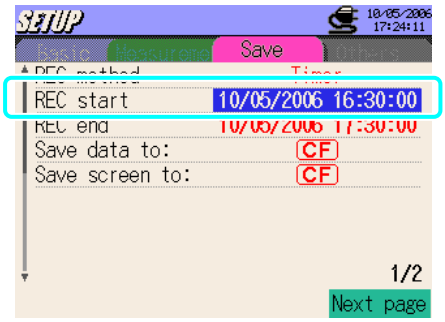
Setting for recording start

Recording starts when a preset date and time comes.

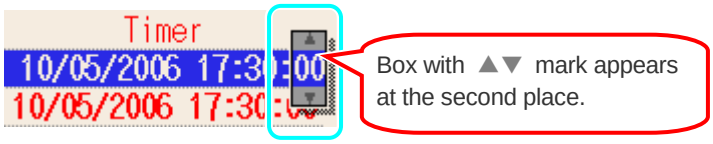
Recording method	MANUAL	TIMER
Display	-----/--/-- --:--:--	Year//Month/Date Hour:Minute:Second
Display at setting (at step 1 below)	Invalid	Minute indication is rounded to the nearest 30 min ahead. When present time is 28 ~ 30 min or 58 ~ 00 min, time indication is rounded to the nearest 1 hour ahead.

* Default value (or after system reset) : 00/00/0000 00:00:00

1 Press the ▲▼ Cursor Keys and select [REC start], and then press the ENTER Key.

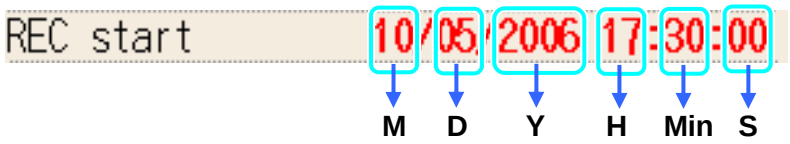


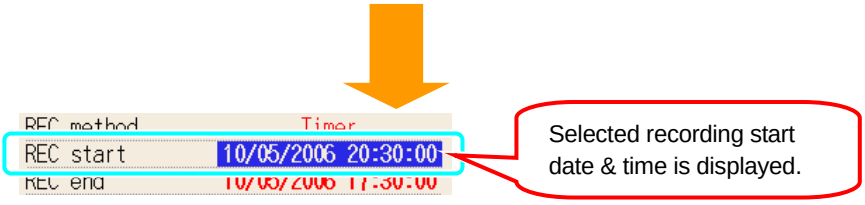
2 Press the ▲▼◀▶ Cursor Keys and set time to start recording, and then press the ENTER Key. * Start date and time cannot be set in the past.



Date and time indication

Recording start / end date and time is displayed as follows.





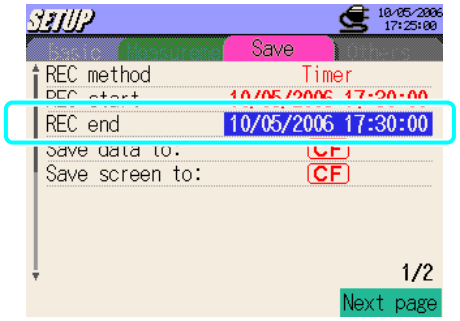
Setting for recording end

Recording stops when preset date and time comes.

Recording method	MANUAL	AUTO
Display	-----/--/-- --:--:--	Year//Month/Date Hour:Minute:Second
Display at setting (at step 1 below)	Invalid	Start time + 1 hour When a preset start time is behind the present time, time indication is rounded to the nearest 30 min ahead plus 1 hour.

* Default value (or after system reset) : 00/00/0000 00:00:00

1 Press the ▲▼ Cursor Keys and select [REC end], and then press the ENTER Key.



Time: Start time + 1 hour is displayed automatically.

2 Date and time setting procedure is same to that for setting a start time. Refer to “Setting for recording start” described at the preceding pages.

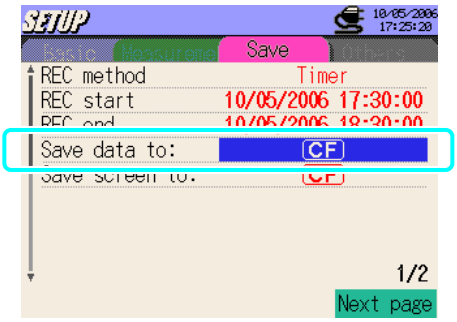
* End date and time cannot be set in the past.

Destination for saving data

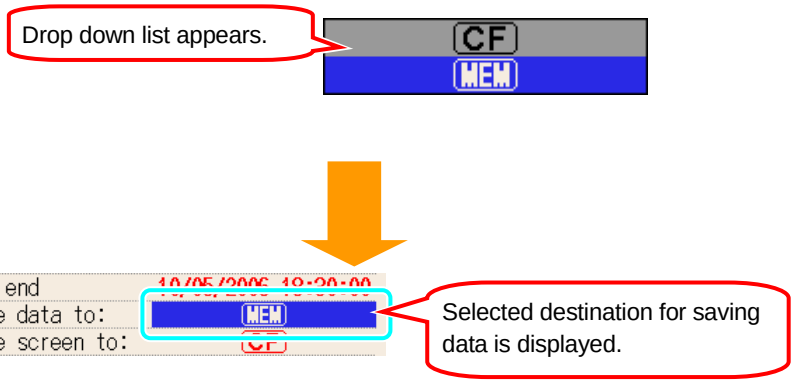
Internal Memory / CF Card

* Data is saved to a CF card automatically under default setting or after system reset when a CF card has been inserted before powering on the instrument.
* For the details of destination for saving data, refer to "**12.1 CF Card / Internal Memory**" in this manual.

1 Press the ▲▼ Cursor Keys and select [Save data to:], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select CF (CF card) or MEM (internal memory), and then press the ENTER Key.



when CF Card hasn't been inserted,

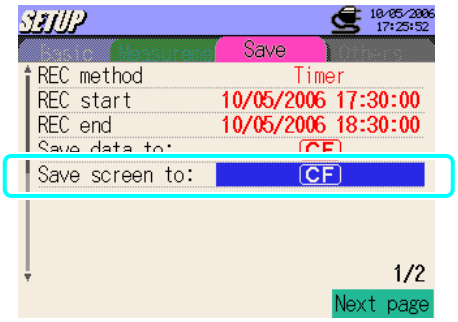
CF Card cannot be selected at a drop down list.

Destination for saving screenshot

Internal Memory / CF Card

* Data is saved to a CF card automatically under default setting or after system reset when a CF card has been inserted before powering on the instrument.
* For the details of destination to save data, refer to "**12.1 CF Card / Internal Memory**" in this manual.

1 Press the ▲▼ Cursor Keys and select [Save screen to], and then press the ENTER Key.

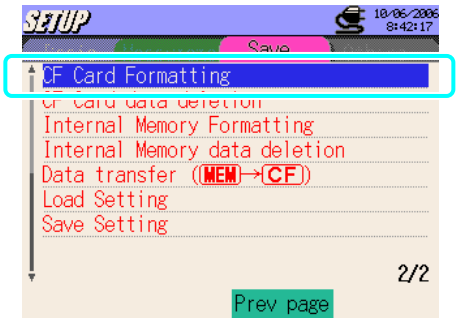


2 Setting procedure is same to that for destination for saving data. Refer to "Destination for saving data" described at the preceding pages.

Formatting CF Card

All the saved data in the CF Card is cleared after formatting the CF Card. Backing up the necessary data prior to a format is recommended.

1 Press the ▲▼ Cursor Keys and select [CF Card Formatting], and then press the ENTER Key.



2 Press the ◀ ▶ Cursor Keys and select “Yes” or “No”, and then press the ENTER Key.

Dialogue appears.

if a CF Card isn’t inserted;
above dialogue doesn’t appear and a message “No CF Card” is displayed.

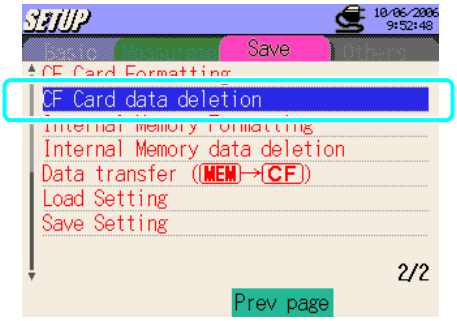
3 Selecting “Yes” initiates formatting CF Card.

Formatting completes when a message “Finished!” is displayed on the LCD.

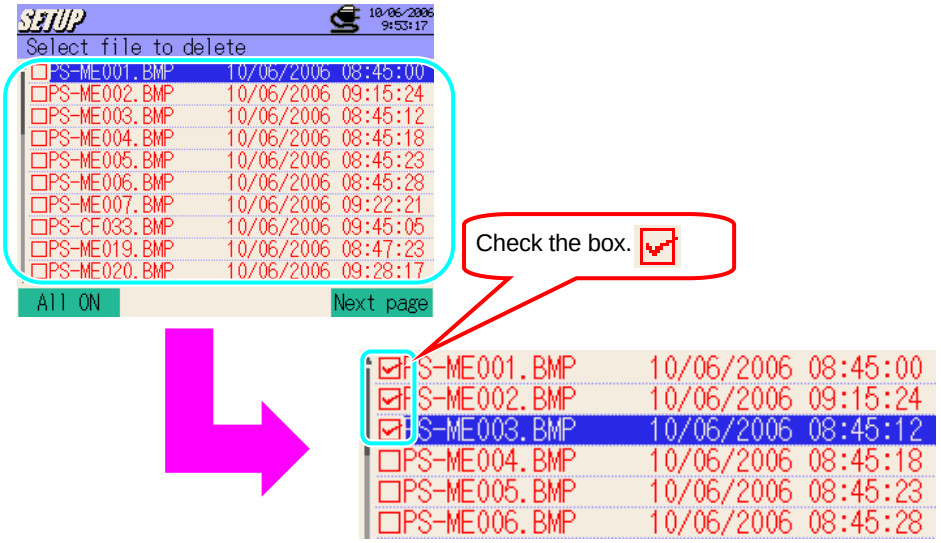
Formatting doesn’t start when “No” is selected, and return to Save setting screen

Deleting the data in CF Card

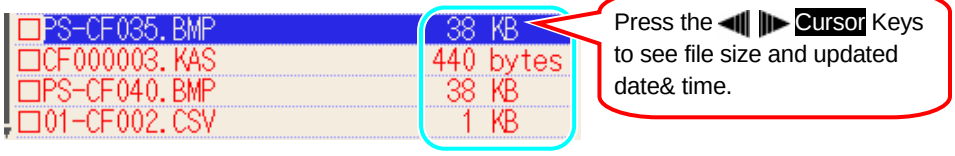
1 Press the ▲▼ Cursor Keys and select [CF Card data deletion], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select a file to be deleted and check the box with the ENTER Key.



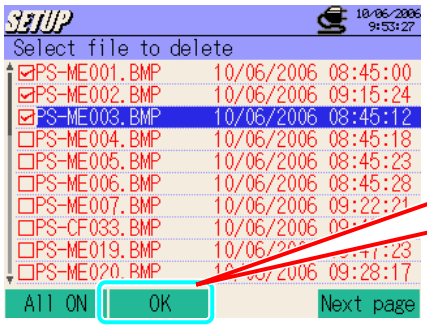
File size display:



if a CF Card isn't inserted;
above dialogue doesn't appear and a message "No CF Card" is displayed.
if no deletable file exists;
dialogue doesn't appear and a message "No deletable file" is displayed.

Press the F1 Key to select all files. Press the F1 Key again to cancel the selection.

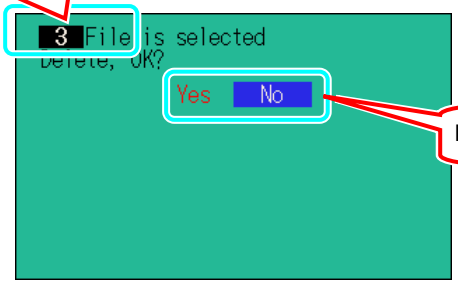
3 Press the F2 Key to confirm the selection.



Check boxes, and then "OK" Button appears.

4 Press the ◀ ▶ Cursor Keys and select "Yes" or "No", and then press the ENTER Key.

Number of selected file is displayed.



Dialogue appears.

5 Selecting "Yes" initiates deleting the data in CF Card.

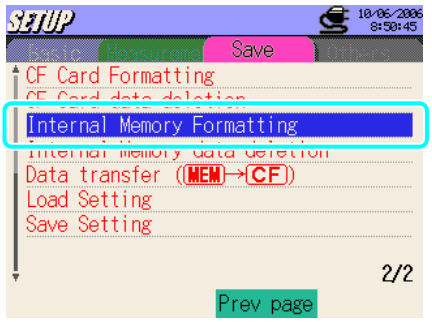
Deletion completes when a message "Finished!" is displayed on the LCD.

Formatting doesn't start when "No" is selected, and returns to Save setting screen.

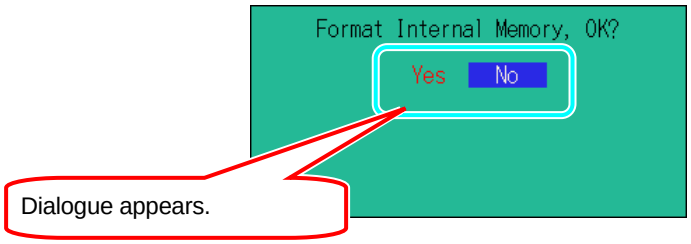
Formatting internal memory

* All data in the Internal memory will be deleted after formatting. Backing up necessary data prior to a format is recommended.

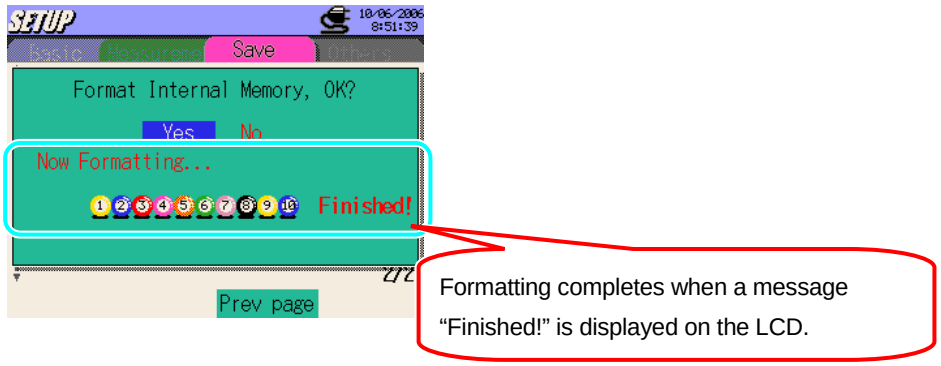
1 Press the ▲▼ Cursor Keys and select [Internal Memory Formatting], and then press the ENTER Key.



2 Press the ◀ ▶ Cursor Keys and select “Yes” or “No”, and then press the ENTER Key.



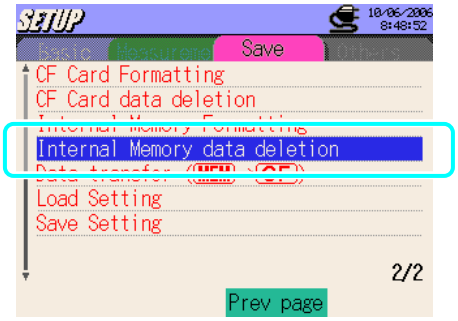
3 Selecting “Yes” initiates formatting the Internal Memory.



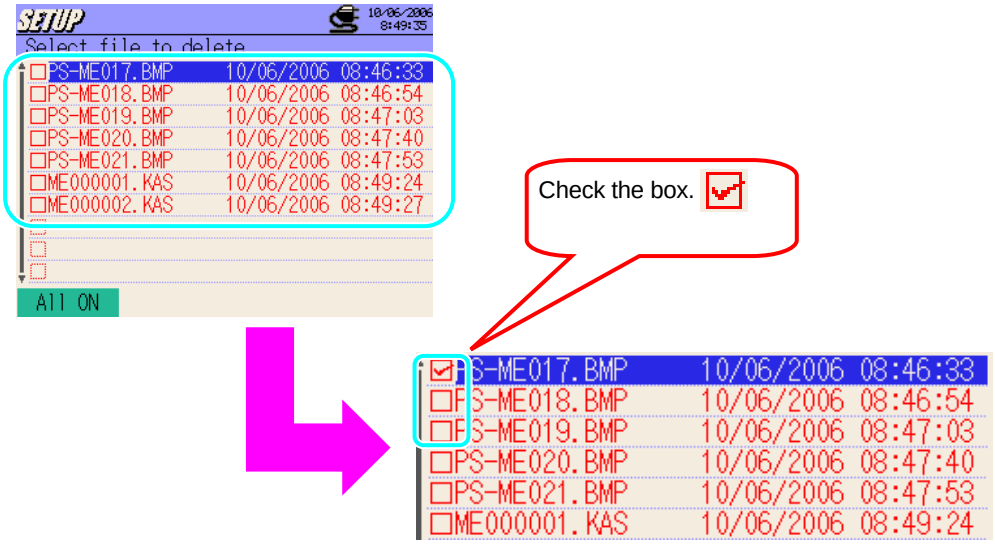
* Formatting doesn’t start when “No” is selected, and return to Save setting screen.
* Select “No” and press the ESC Key to cancel the selection and return to Save setting screen.

Deleting the data in Internal Memory

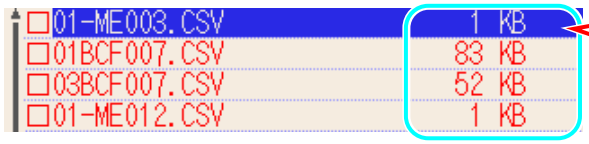
1 Press the ▲▼ Cursor Keys and select [Internal Memory data deletion], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select a file to be deleted, and check the box with the ENTER Key.



File size display:



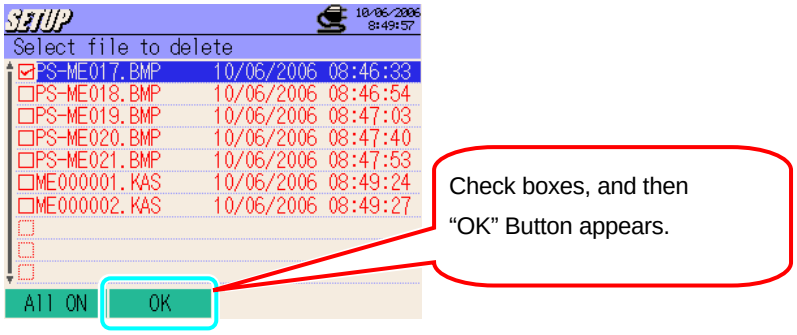
Press the ◀ ▶ Cursor Keys to see file size and updated date& time.

if no deletable file exists;

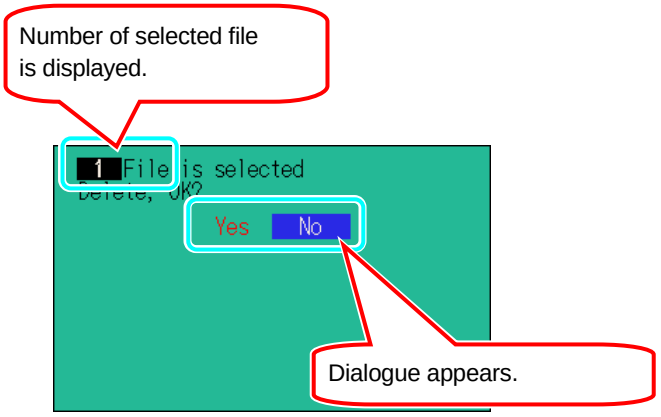
dialogue doesn't appear and a message "No deletable file" is displayed.

Press the F1 Key to select all the files. Press the F1 Key again to cancel the selection.

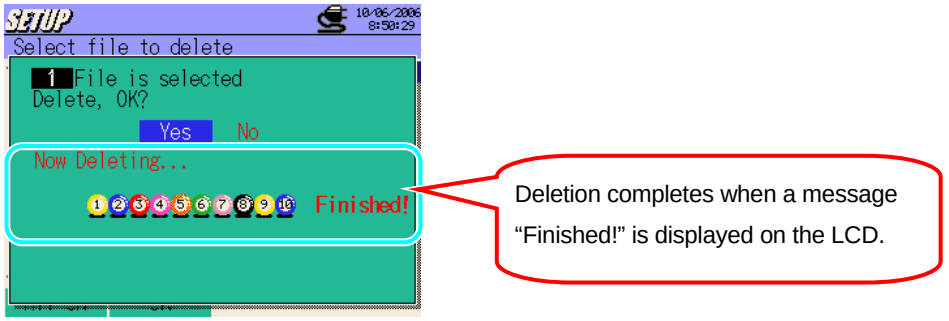
3 Press the F2 Key to confirm the selection.



4 Press the ◀ ▶ Cursor Keys and select "Yes" or "No", and then press the ENTER Key.



5 Selecting "Yes" initiates deleting the data in Internal Memory.

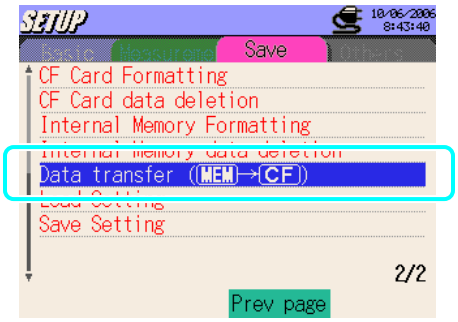


Formatting doesn't start when "No" is selected, and returns to File selection screen.
* Press the ESC Key to return to the Save setting screen.

Data Transfer

* Data saved in the internal memory remains after data transfer.

1 Press the ▲▼ Cursor Keys and select [Data transfer (MEM → CF)], and then press the ENTER Key



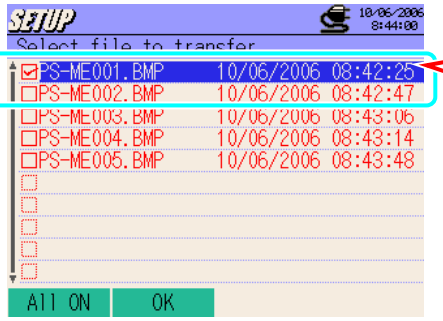
if a CF Card isn't inserted;
no dialogue appears and a message "No CF Card" is displayed.

if a CF Card hasn't been formatted;
no dialogue appears and a message "Unformatted CF Card" is displayed.

if no procesable file exists;
dialogue doesn't appear and a message "No processable file" is displayed.

2 Press the ▲▼ Cursor Keys and select the file to be transferred, and then press the ENTER Key.

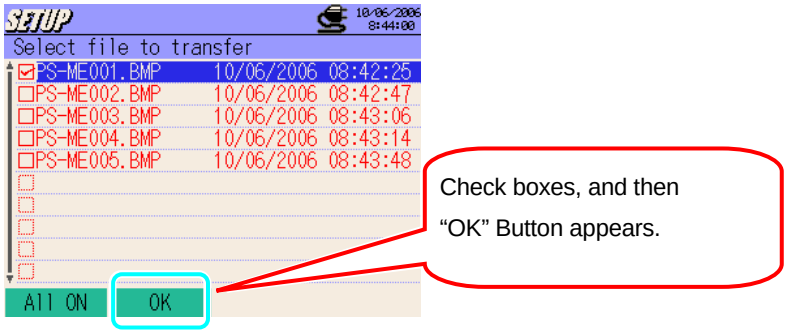
Check the box.



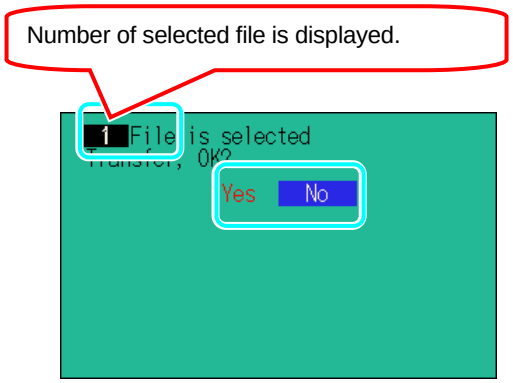
Press the ◀ ▶ Cursor Keys to see file size and updated date& time.

Press the F1 Key to select all files. Press the F1 Key again to cancel the selection.

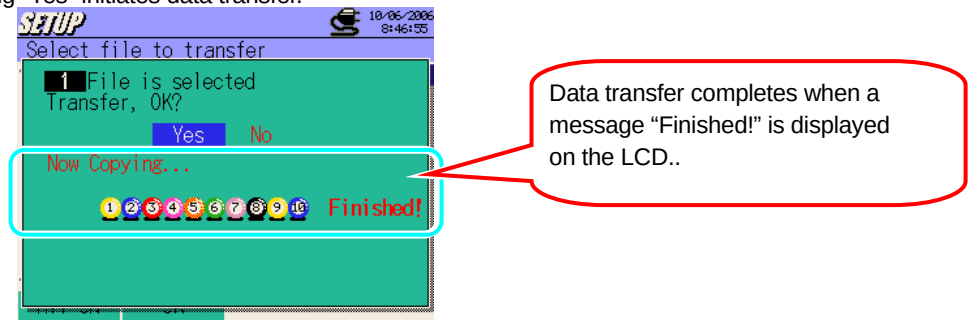
3 Press the F2 Key to determine the selection.



4 Press the ▲▼ Cursor Keys and select "Yes" or "No", and then press the ENTER Key.

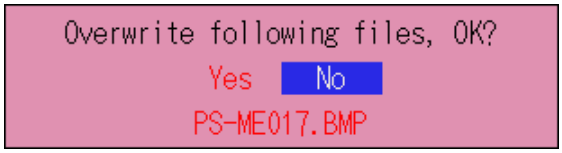


5 Selecting "Yes" initiates data transfer.



Formatting doesn't start when "No" is selected, and return to File selection screen.
* Press the ESC Key to return to the Save setting screen.

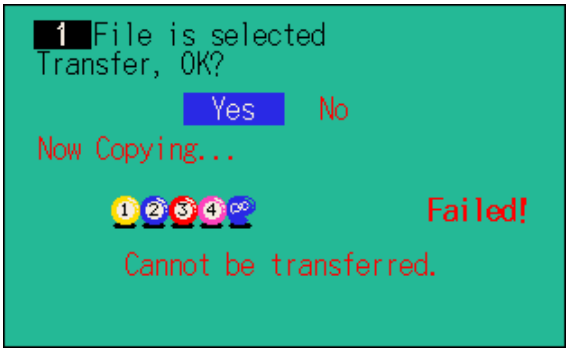
If the same file name exists, following dialogue appears.



Press the ◀ ▶ Cursor Keys and select “Yes” or “No”, and then press the ENTER Key.
Selecting “Yes” initiates data transfer and old files are overwritten.
Selecting “No” cancels data transfer.

* Backing up the necessary data prior to data transfer to prevent old data from being overwritten.

If data transfer fails, following dialogue appears.

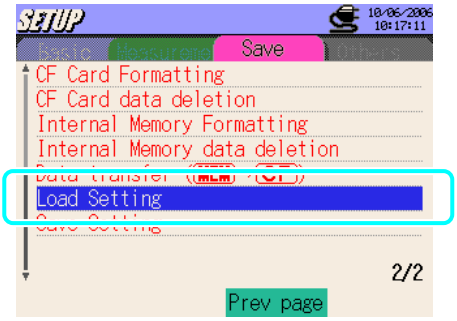


Check free area and number of files in a CF card, and try again.

Load setting

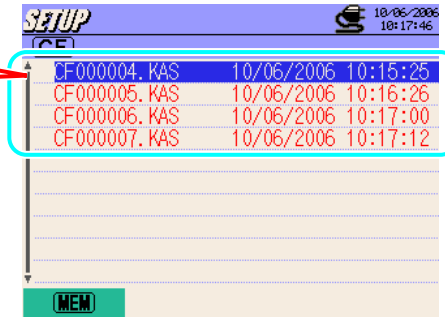
Preset settings saved at [Save Setting] is loaded.

1 Press the ▲▼ Cursor Keys and select [Load Setting], and then press the ENTER Key.



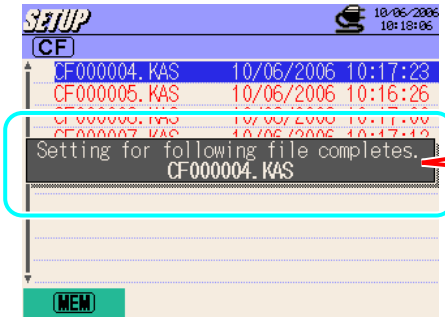
2 Press the ▲▼ Cursor Keys and select a file to be loaded, and then press the ENTER Key.

Select a file to be Loaded.



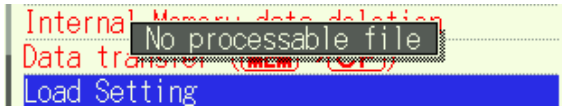
Press the F1 Key to switch the list of the files in Internal memory and CF Card.

3 Load of setting starts.



A message “Setting for following file completes.” is displayed.

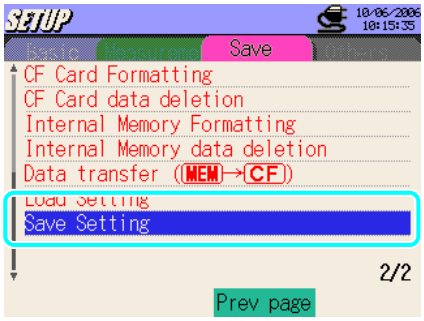
if no file exits;
following window appears.



Setting save

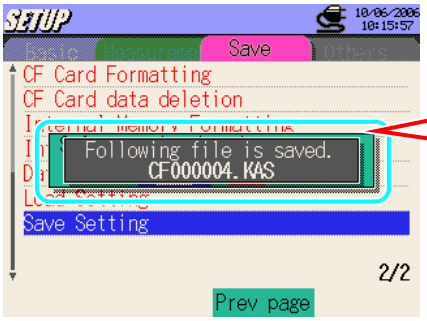
This instrument can memorize and recall user's preferred settings once it has been saved.

1 Press the ▲▼ Cursor Keys and select [Save Setting], and then press the ENTER Key.



2 Press the ◀ ▶ Cursor Keys and select CF (CF Card) or MEM (Internal memory) to save settings, and then press the ENTER Key.

3 Setting is saved.



A message "Following file is saved." is displayed.

4.2.4 Other Setting

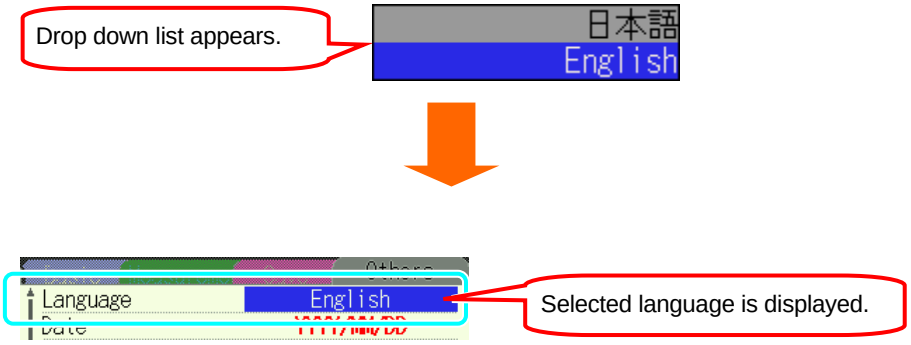
Language Selection

Japanese ⇔ English

* System reset doesn't affect language setting.

1 Press the ▲▼ Cursor Keys and select [Language], and then press the ENTER Key.

2 Press the ▲▼ Cursor Keys and select "Japanese" or "English", and then press the ENTER Key.



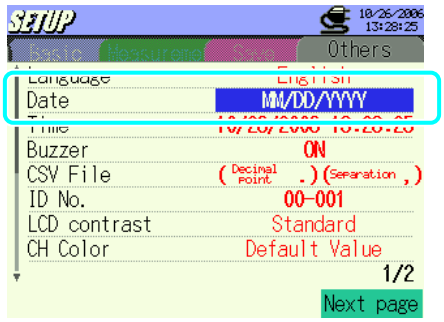
Setting for date format

e.g. June 15th, 2006

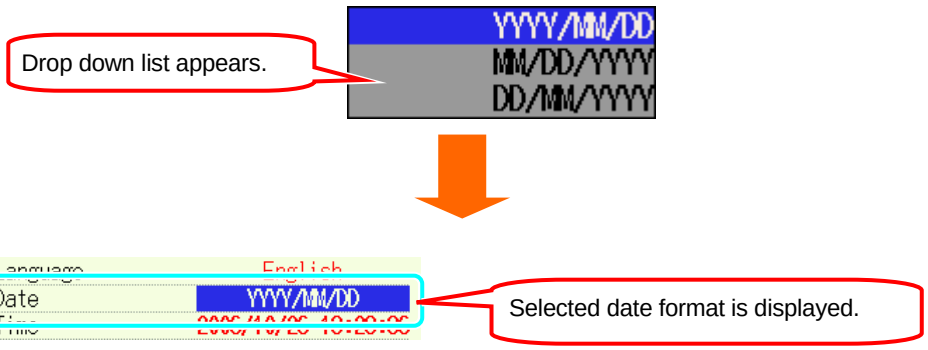
YYYY / MM / DD	2006 / 06 / 15
MM / DD / YYYY	06 / 15 / 2006
DD / MM / YYYY	15 / 06 / 2006

* Default value (or after system reset) : MM / DD / YYYY

1 Press the ▲▼ Cursor Keys and select [Date], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select a desirable date format, and then press the ENTER Key.



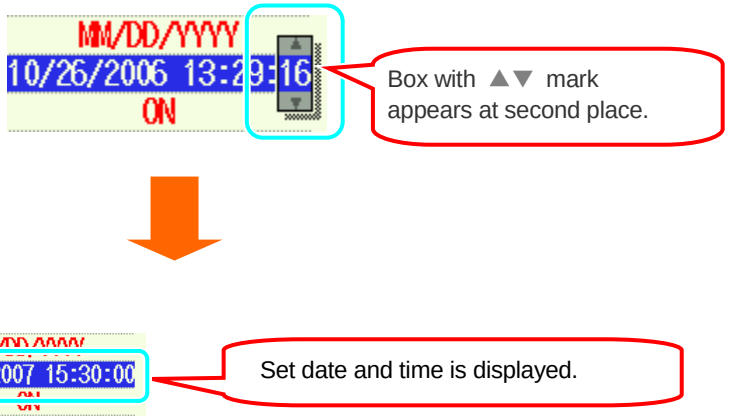
Setting for current date & time

2000 / 01 / 01 00:00:00 ~ 2099 / 12 / 31 23:59:59

* System reset doesn't affect the preset current date and time.

1 Press the ▲▼ Cursor Keys and select [Time], and then press the ENTER Key.

2 Select and modify the date/time parameters desired with ▲▼◀▶ Cursor Keys, and then press the ENTER Key.



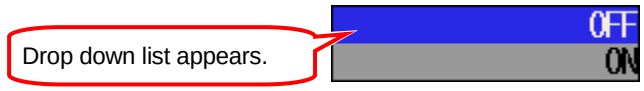
Setting for buzzer

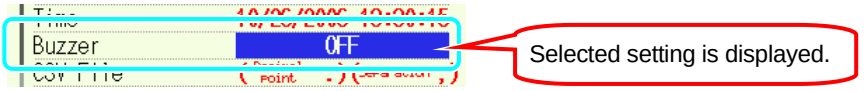
ON⇔OFF

* Default value (or after system reset) : ON

1 Press the ▲▼ Cursor Keys and select [Buzzer], and then press the ENTER Key.

2 Press the ▲▼ Cursor Keys and select “ON” or “OFF”, and then press the ENTER Key.





Setting for CSV file

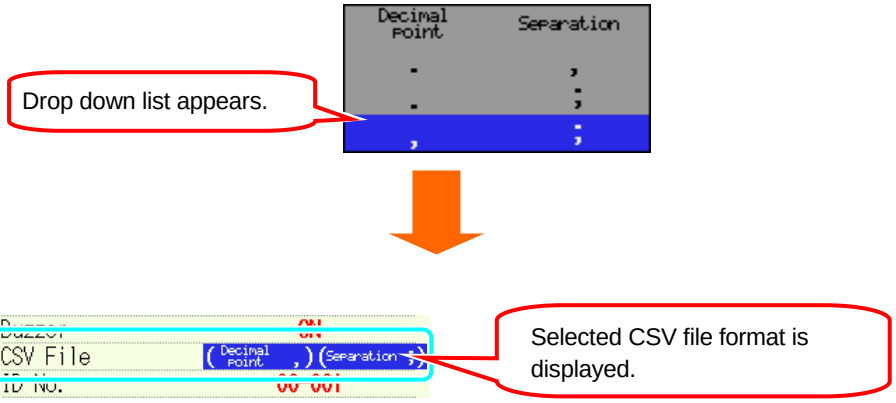
Select the decimal points and separators to be used in the saved data. Setting needs to be changed depending on the language setting. Default setting is applicable to normal use.

Decimal Point / Separator
. ／,
. ／;
, ／;

* Default value (after system reset) : Decimal point/ Separator = . / ,

1 Press the ▲▼ Cursor Keys and select [CSV File], and then press the ENTER Key.

2 Press the ▲▼ Cursor Keys and select a desirable one, and then press the ENTER Key.



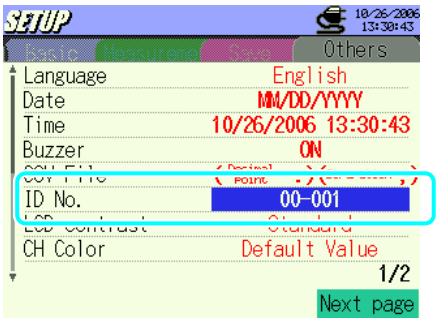
Setting for ID number

The number selected at the step is saved in save files. It is useful to identify data when using multiple instruments and recorded data at various places.

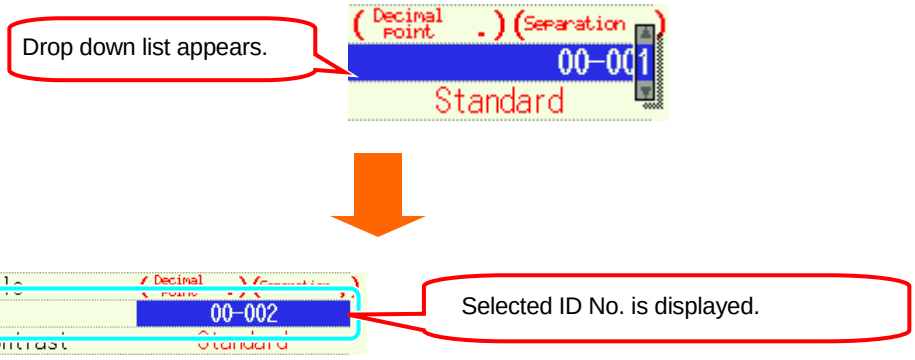
00-001 ~ 99-999

* Default value (or after system reset) : 00-001

1 Press the ▲▼ Cursor Keys and select [ID No.], and then press the ENTER Key.



2 Press the ▲▼◀▶ Cursor Keys and select a desirable number, and then press the ENTER Key.



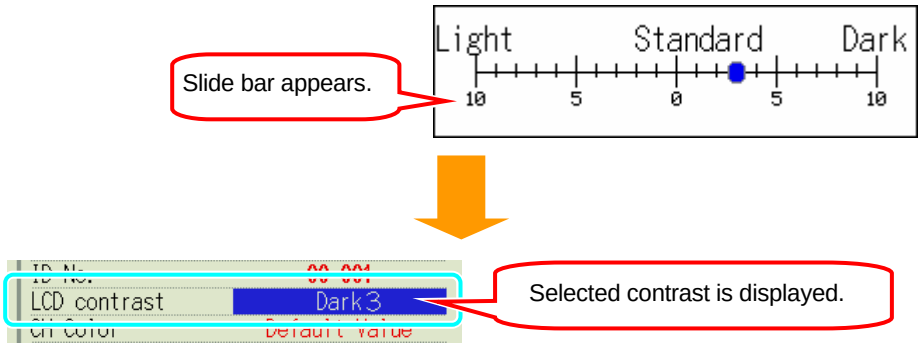
Setting for LCD contrast

Light ⇔ Standard ⇔ Dark
10 ⇔ 0 ⇔ 10

* Default value (or after system reset) : Standard

1 Press the ▲▼ Cursor Keys and select [LCD contrast], and then press the ENTER Key.

2 Press the ◀ ▶ Cursor Keys and select a desirable contrast level, and then press the ENTER Key.



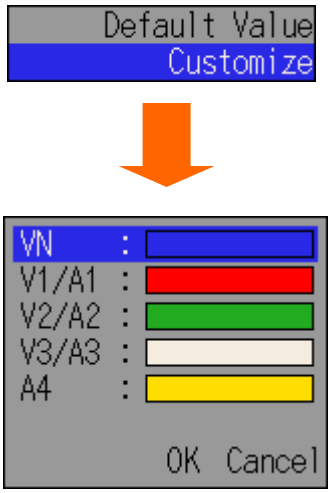
Setting for CH color

Default setting	Customization

* System reset doesn't affect the setting for CH Color..

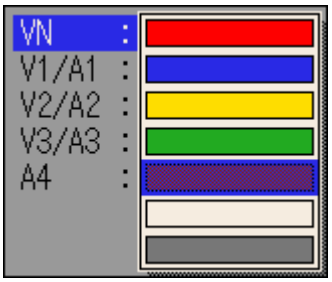
1 Press the ▲▼ Cursor Keys and select [CH Color], and then press the ENTER Key.

2 Press the ▲▼ Cursor Keys and select "Customize", and then press the ENTER Key.
* Default color setting becomes effective when selecting "Default Value".

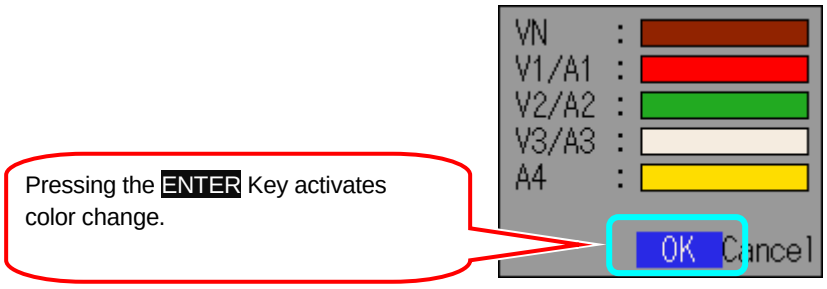


3 Press the ▲▼ Cursor Keys and select the color which is subject to change, and then press the ENTER Key.

4 Press the Cursor Keys and choose desirable colors and then press the ENTER Key.



5 Press the Cursor Keys and point “OK”, and then press the ENTER Key.



Color change doesn’t activate when selecting “Cancel”, and return to Setting screen.

System reset doesn’t affect the customized settings.

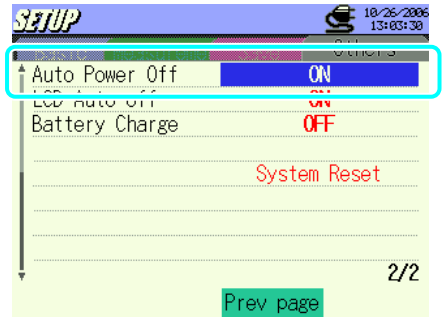
Setting for Auto-power-off

ON⇔OFF

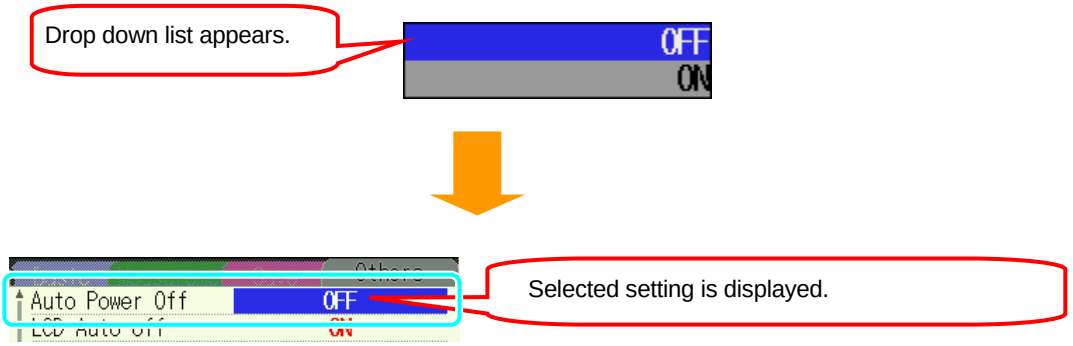
* Default value (or after system reset) : ON
* The instrument is automatically powered off when 5 min passes without any Key operation.
(O = Auto-power-off / activate , X = Auto-power-off / disable)

	AC-power-supply operated	Battery operated
LCD OFF	O	O
LCD ON	X	O
Recording (stand-by)	X	X

1 Press the ▲▼ Cursor Keys and select [Auto Power Off], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select “ON” or “OFF”, and then press the ENTER Key.



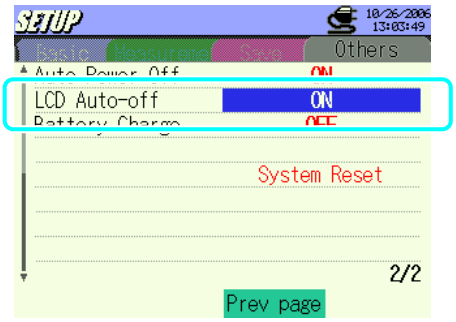
Setting for LCD Auto-off

Indications on the LCD are hidden with “ON” setting to prevent screen from burning and to save battery during recordings

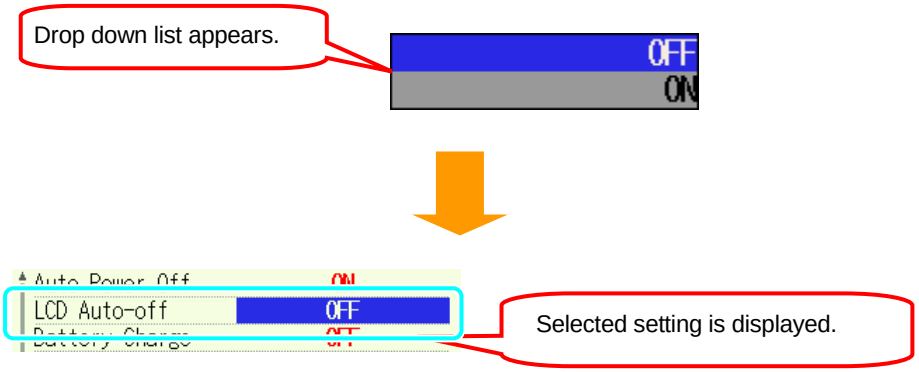
ON⇔OFF

* Default value (or after system reset) : ON
* Indications on the LCD disappear automatically powered off when 5 min passes without any Key operation.

1 Press the ▲▼ Cursor Keys and select [LCD Auto-off], and then press the ENTER Key.



2 Press the ▲▼ Cursor Keys and select “ON” or “OFF”, and then press the ENTER Key.



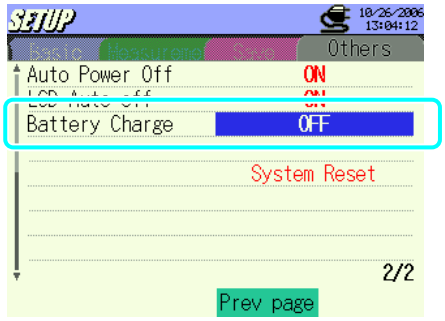
Battery charge

Set the Selector switch to “RE-CHARGEABLE” position prior to starting battery charge. For further details, refer to “**3.2 Power supply**” in this manual.

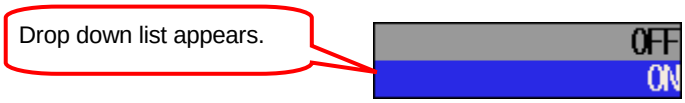
ON⇔OFF

* Default value (or after system reset) : OFF

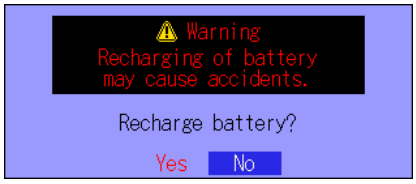
1 Press the ▲▼ Cursor Keys and select [Battery Charge], and then press the ENTER Key.

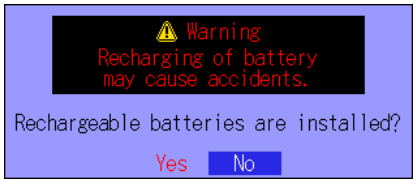


2 Press the ▲▼ Cursor Keys and select “ON” or “OFF”, and then press the ENTER Key.



3 Follow the messages displayed on the LCD and select “Yes” or “No” with ◀ ▶ Cursor Keys, and then press the ENTER Key.

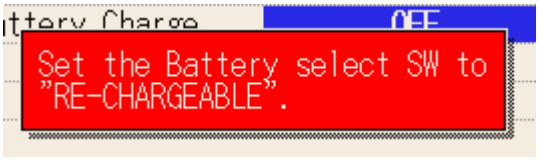




The window closes and Setting screen appears when “No” is selected. In this case, batteries aren’t charged.

when the Selector switch isn’t set to “RE-CHARGEABLE” position,

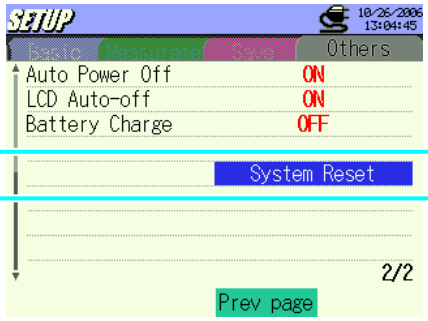
following message appears and battery charge won’t start.



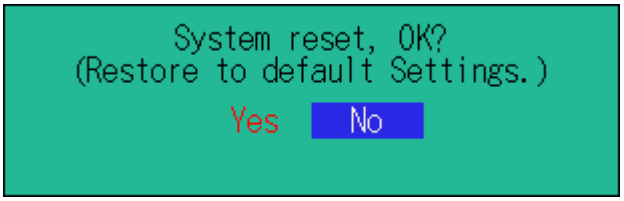
System reset

Settings restore to default after system reset.

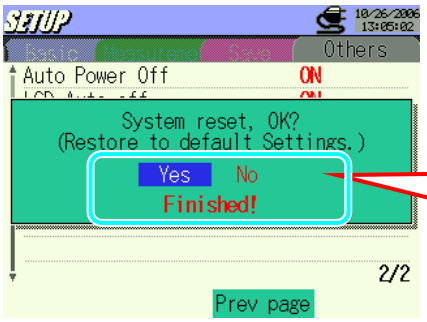
1 Press the ▲▼ Cursor Keys and select [System Reset], and then press the ENTER Key.



2 Press the ◀ ▶ Cursor Keys and select “Yes” or “No”, and then press the ENTER Key.



3 Select “Yes” to initiates system reset.



System reset completes when “Finished!” is displayed on the LCD.

Selecting “No” returns to Setting screen.

Following parameters don’t restore to default after system reset.

- Language
- Time and date
- CH color

5. Wining Configurations

5.1 Important preliminary checks

DANGER

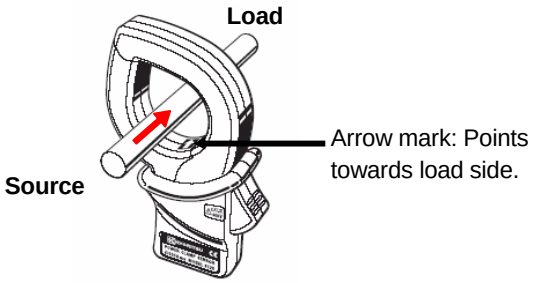
- Do not make measurements on a circuit in which electrical potential exceeds AC600V.
- Connect the Power cord to a socket outlet. Never connect it to the socket outlet of AC240V or more.
- The Clamp sensor, Voltage test leads and Power cord are to be connected to the instrument first.
- The Voltage test leads or Clamp sensors should not be connected to the input terminals of the instrument if not required for measurement.
- The instrument should always be connected on the downstream side of a circuit breaker, which is safer than the upstream side.
- Do not open-circuit the secondary side of a supplementary CT while it is energized because of the high voltage generated at the secondary side terminals.
- Be careful to avoid short-circuiting the power line with the un-insulated part of the voltage test probes during the setting up of the instrument. Transformer jaw tips are designed in such a way to avoid short-circuiting. If the circuit under test has exposed conductive parts, extra care should be taken to minimize the possibility of shorting.

WARNING

- To avoid possible electric shock and short-circuit, always turn off the line under test when setting up the instrument.
- Do not touch the un-insulated tip of Voltage test probes. The use of safety insulted gloves is recommended.

Direction for correct measurements

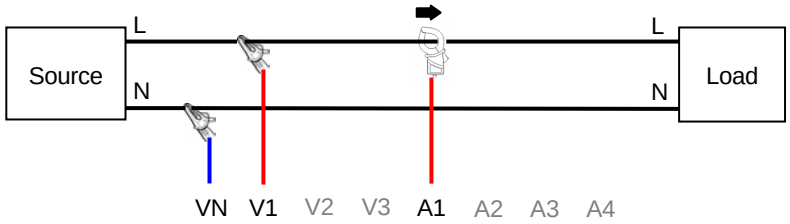
- Proper setting of wiring configuration should be made.
- Ensure that the arrow mark on the clamp sensor points towards to load side.



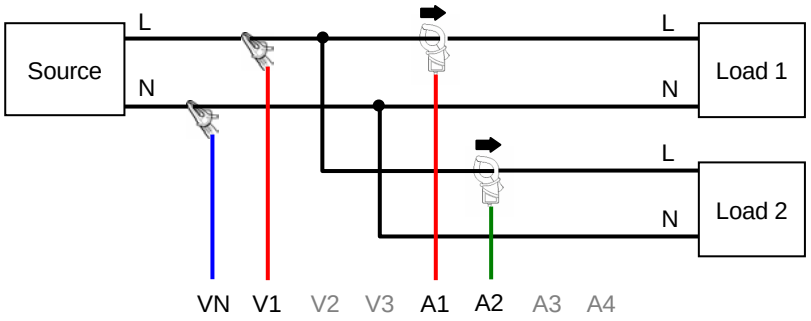
* Reverse clamping switches the symbols (+/-) for active power [P].

5.2 Basic Wiring Configuration

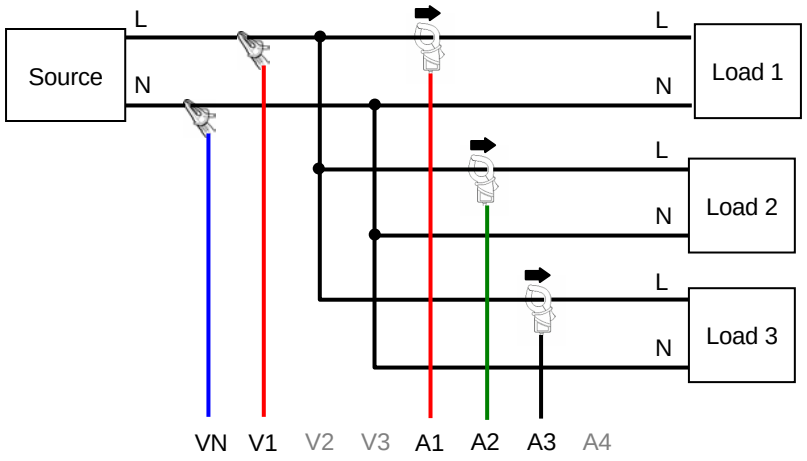
1. “1P2W x 1” Wiring method for single-phase 2-wire (1ch)



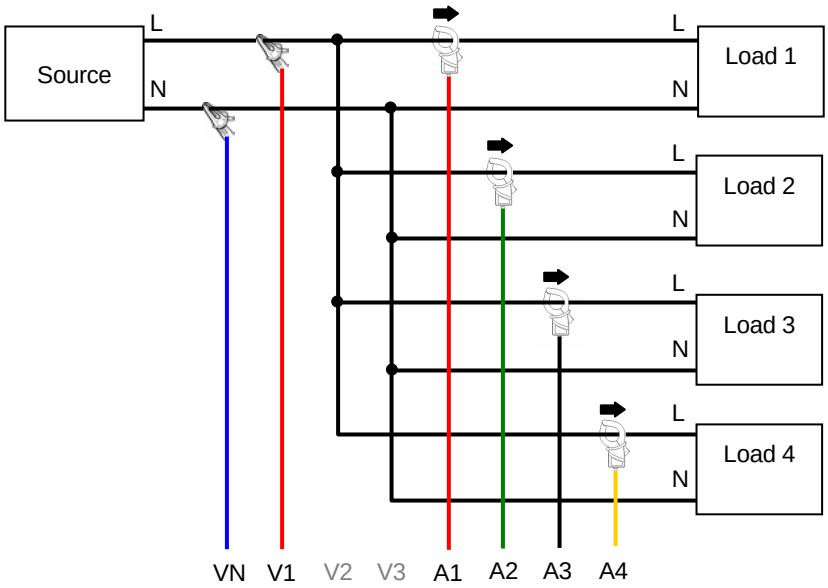
2. “1P2W x 2” Wiring method for single-phase 2-wire (2ch)



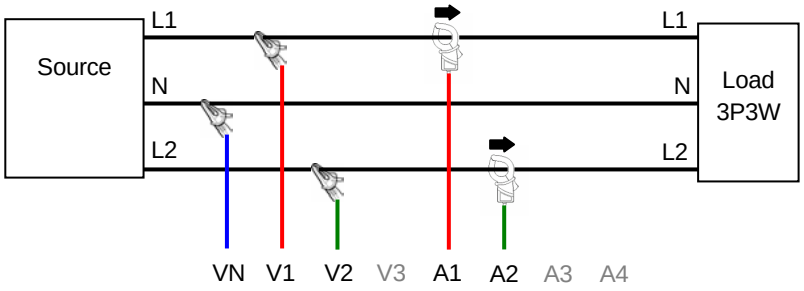
3. “1P2W x 3” Wiring method for single-phase 2-wire (3ch)



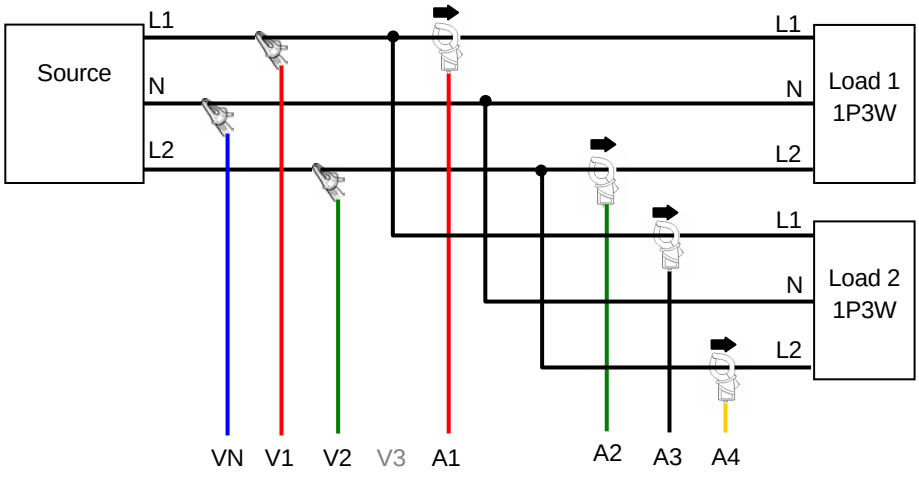
4. “1P2W x 4” Wiring method for single-phase 2-wire (4ch)



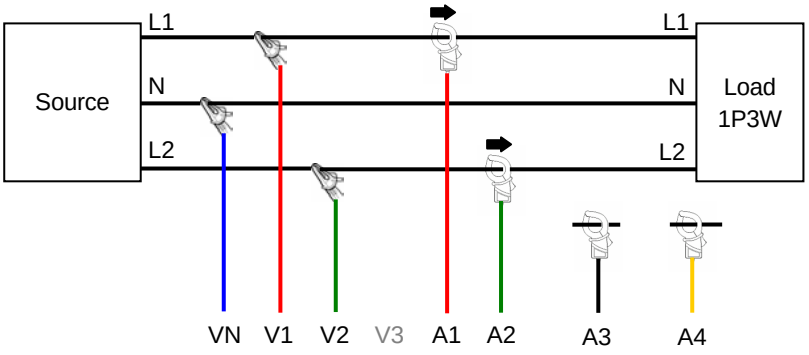
5. “1P3W x 1” Wiring method for single-phase 3-wire (1ch)



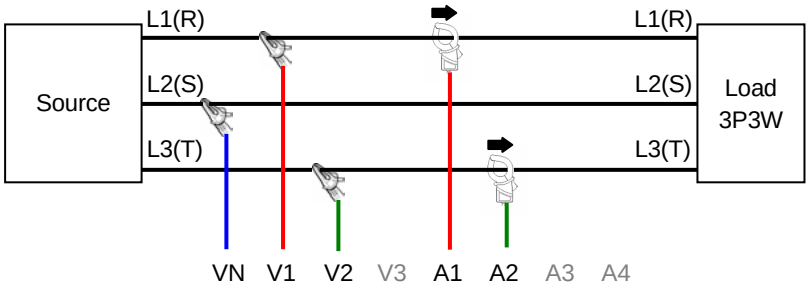
6. “1P3W x 2” Wiring method for single-phase 3-wire (2ch)



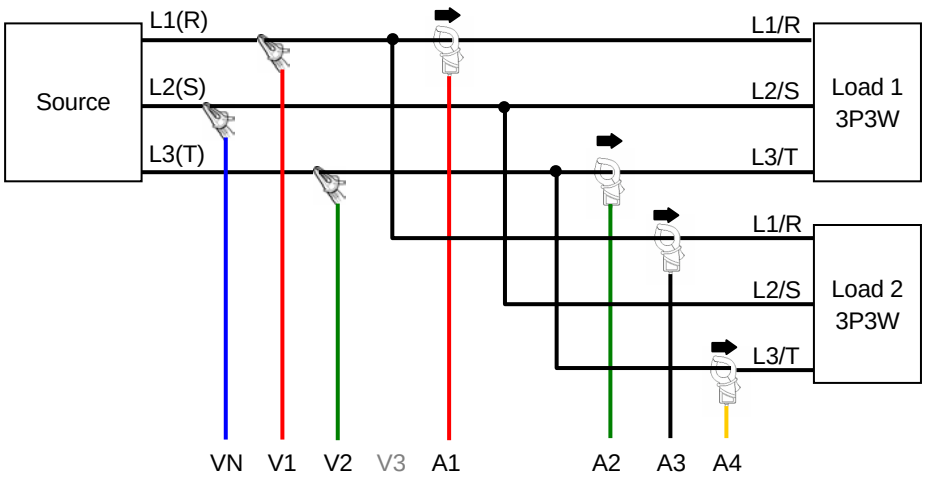
7. “1P3W x1 +2A” Wiring method for single-phase 3-wire (1ch) + 2-current



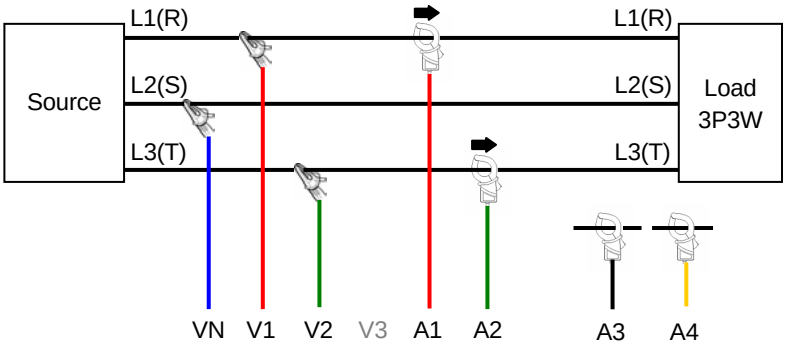
8. “3P3W x1” Wiring method for three-phase 3-wire (1ch)



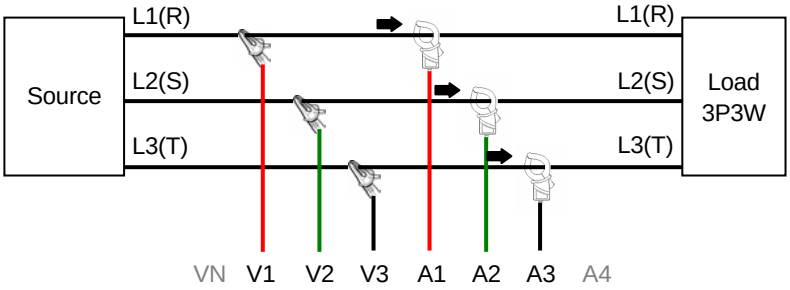
9. “3P3W x2ch” Wiring method for three-phase 3-wire (2ch)



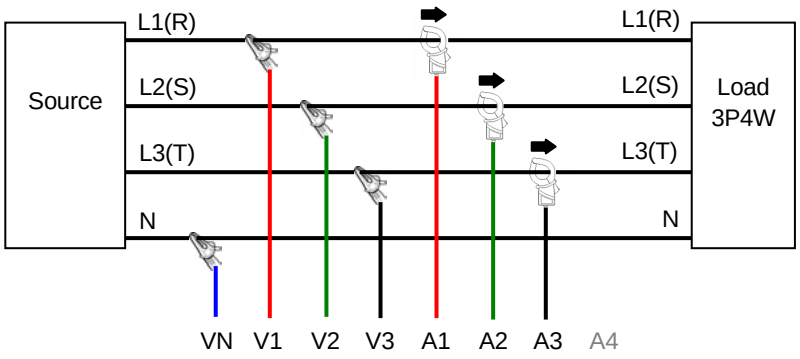
10. “3P3W x1 +2A” Wiring method for three-phase 3-wire (1ch) + 2-current



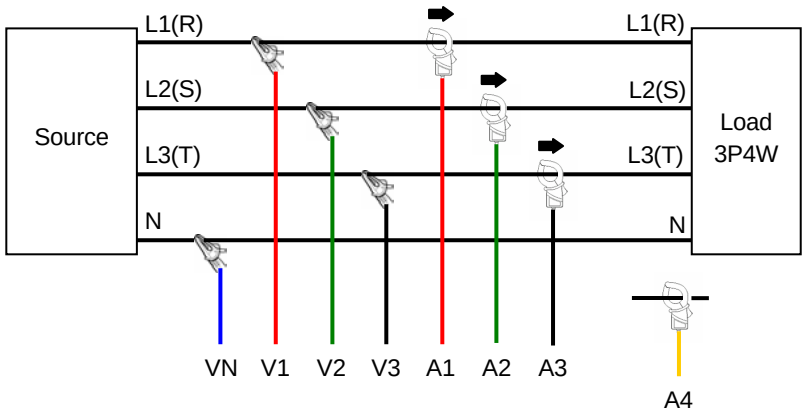
11. “3P3W 3A” Wiring method for three-phase 3-wire + 3-current



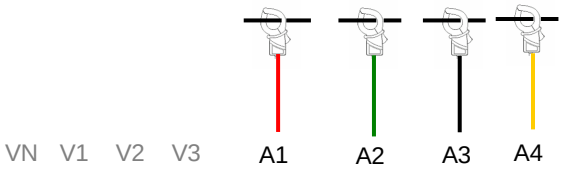
12. “3P4W (1ch)” Wiring method for three-phase 4-wire (1ch)



13. “3P4W x1 +1A” Wiring method for three-phase 4-wire (1ch) + 1-current



⓪ 4A 4-current

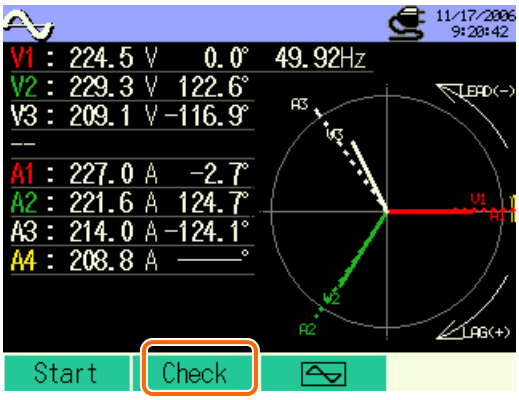


5.3 Wiring check

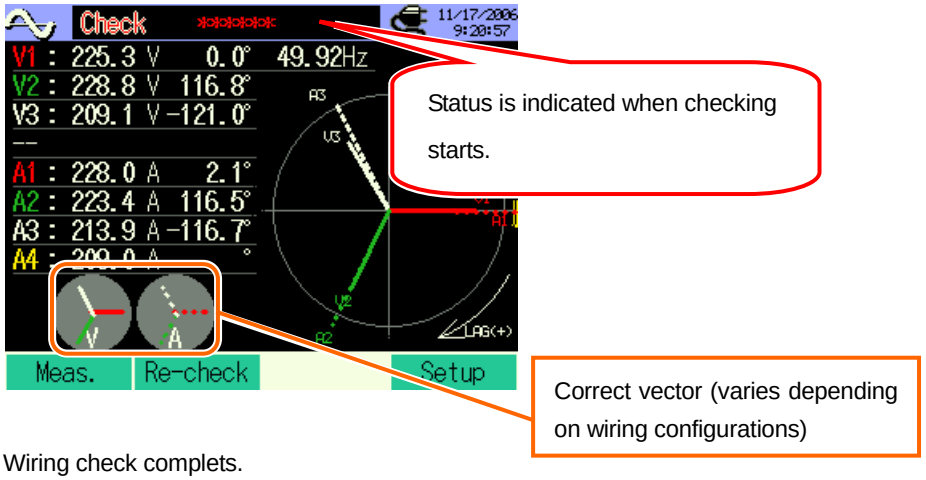
Proper wirings can be checked at WAVE Range.

5.3.1 Checking procedure

1 Select the WAVE Range with ( ) Key and press the F2 Key.

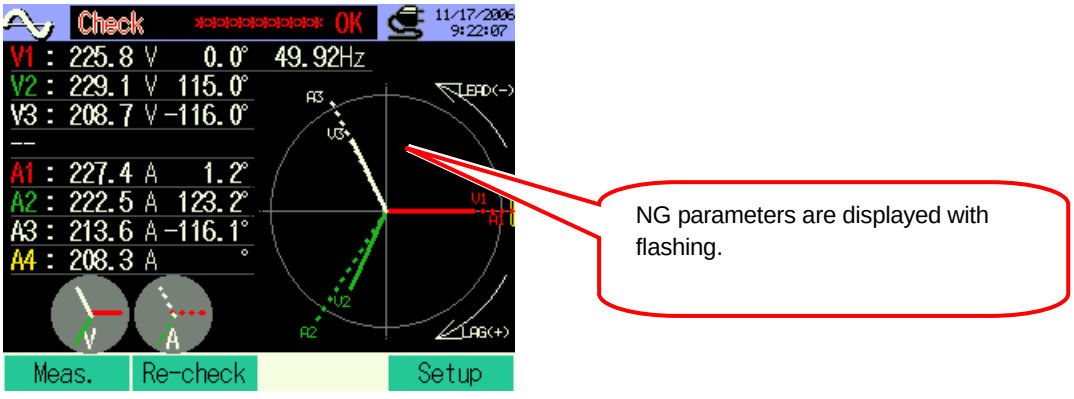


2 Wiring check routine starts.



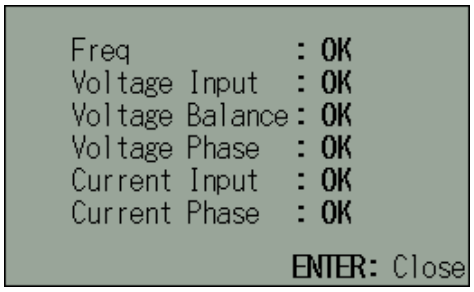
3 Wiring check complets.

OK is indicated if the connection is appropriate, and NG is displayed if the connection is improper.



Check screen

In case of NG, Error message appears. (Press the ENTER Key when OK is displayed.)



* Check results may be affected if great power factors exist at the measurement sites.

5.3.2 Criteria of Judgment

Check	Criteria of Judgment	Cause
Frequency	Frequency of V1 is between 42 and 68Hz.	• Voltage clip is firmly connected to the DUT? • Measuring too high harmonic components?
Voltage input	Voltage input is 10% or more of (Voltage Range x VT).	• Voltage clip is firmly connected to the DUT? • Voltage test leads are firmly connected to the Voltage input terminals on the instrument?
Voltage balance	Voltage input is within ±30º of reference voltage (V1) * (not judged by single-phase wiring)	• Setting against the wiring under test are matched? • Voltage clip is firmly connected to the DUT? • Voltage test leads are firmly connected to the Voltage input terminals on the instrument?
Voltage phase	Phase of voltage input is within ±10º of reference value (proper vector).	• Voltage test leads are properly connected? (Connected to proper channels?)
Current input	Current input is 5% or more of (Current Range x CT).	• Clamp sensors are firmly connected to the Power input terminals on the instrument? • Setting for Current Range is appropriate for input levels?
Current phase	Current input is within ±60° of reference value (proper vector).	• Arrow mark on a Clamp sensor and the orientation of flowing current is matched? (Power supply to Load) • Clamp sensors are connected properly?

5.4 Using supplementary VT/CT's (not supplied with the instrument)

⚠ DANGER

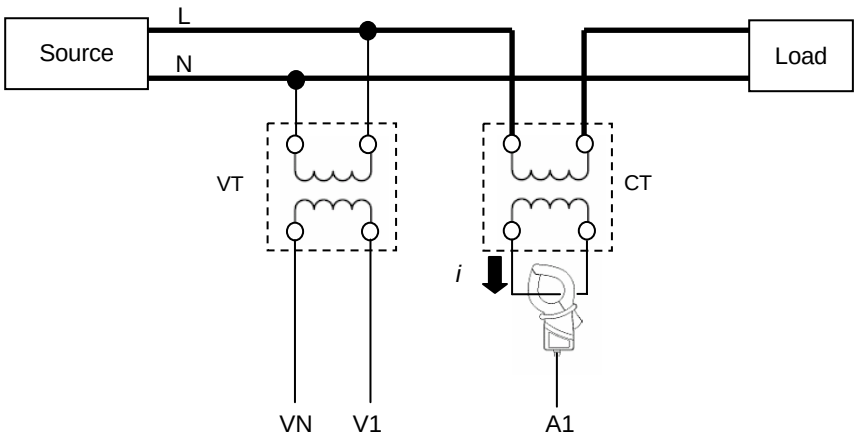
- Never make measurement on a circuit in which electrical potential exceeds AC600V.
- Connect the Power cord to a socket outlet. Never connect it to the socket outlet of AC240V or more.
- This instrument must be used on the secondary side of VT(transformer) and CT(current transformer).
- Do not open-circuit the secondary side of a supplementary CT while it is energized because of the high voltage generated at the secondary side terminals.

⚠ CAUTION

- When a VT or CT is used the measurement accuracy is not guaranteed due to several factors namely phase characteristics and VT/CT accuracies.

The use of supplementary VT/CT's may be required if the voltage/current values of the circuit under test fall outside the instrument measuring range. In this case the value at the primary side of circuit can be obtained directly by measuring the secondary side with appropriate a VT or CT installed in the line under test as follows.

< Example of single-phase 2-wire (1ch) "1P2W x 1" >



When rating of the secondary side of CT is 5A, use of Clamp sensor 8128 (50A type) and testing at 5A Range is recommended.

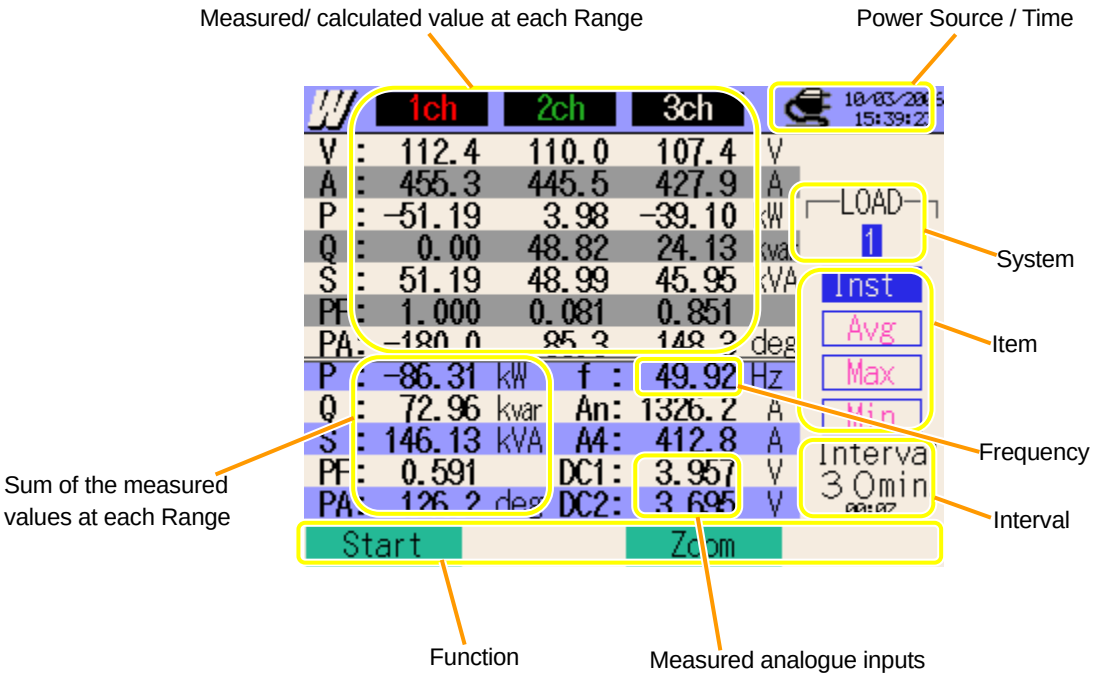
In this case, set the actual ratio of VT and CT to be used.
* VT ratio: see "**Section 4**"
* CT ratio: see "**Section 4**"

6. Instantaneous value measurement

6.1 Indications on LCD

6.1.1 Display Screen

Press the W Key to display a list for W Range.



Symbol displayed on the LCD												
V	Voltage	A	Current			P	Active Power	+	consumption	Q	Reactive Power	+	Lagging
								−	regenerating			−	leading
S	Apparent Power	PF	Power Factor	+	Lagging	PA	Phase Angle	+	Lagging	f	Frequency		
				−	leading			−	leading				
An	Neutral Current	DC1	Analogue input voltage at CH1			DC2	Analogue input voltage at CH2						

Displayed contents are depending on the selected wiring configurations.

Followings are displayed in a list depending on the selected wiring configurations.

1. 1P2W × 1 Single-phase 2-Wire (1CH)

V	●		
A	●		
P	●	f	●
Q	●		
S	●		
PF	●	DC1	●
PA	●	DC2	●

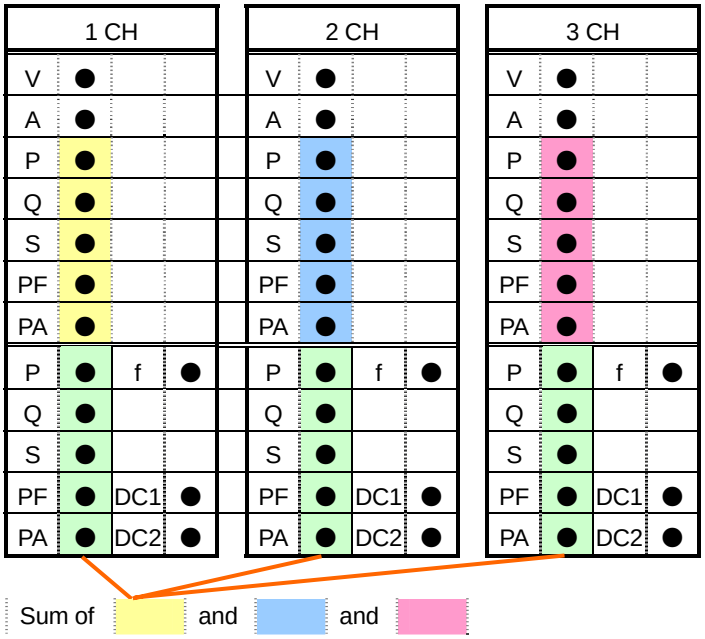
2. 1P2W × 2 Single-phase 2-Wire (2CH)

1 CH			
V	●		
A	●		
P	●		
Q	●		
S	●		
PF	●		
PA	●		
P	●	f	●
Q	●		
S	●		
PF	●	DC1	●
PA	●	DC2	●

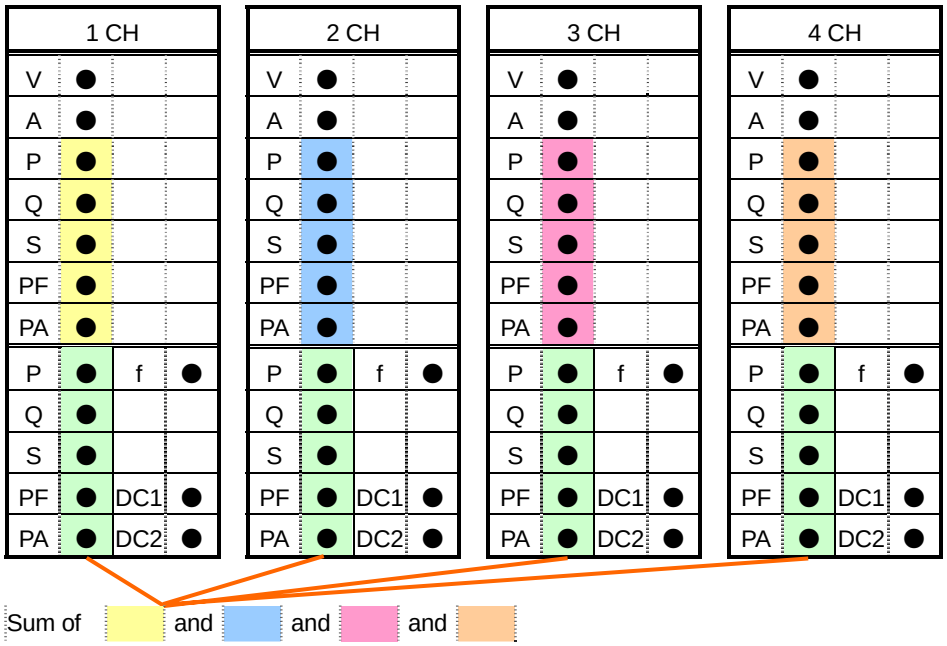
2 CH			
V	●		
A	●		
P	●		
Q	●		
S	●		
PF	●		
PA	●		
P	●	f	●
Q	●		
S	●		
PF	●	DC1	●
PA	●	DC2	●

Sum of and

3. 1P2W × 3 Single-phase 2-Wire (3CH)



4. 1P2W × 4 Single-phase 2-Wire (4CH)



5. 1P3W × 1 Single-phase 3-Wire (1CH),
7. 1P3W × 1 + 2A Single-phase 3-Wire (1CH) + 2-current

	1ch	2ch	
V	●	●	
A	●	●	
P	●	●	
Q	●	●	
S	●	●	
PF	●	●	
PA	●	●	
P	●	f	●
Q	●	* A3	●
S	●	* A4	●
PF	●	DC1	●
PA	●	DC2	●

* is displayed only when making setting of 7. 1P3W×1 + 2A

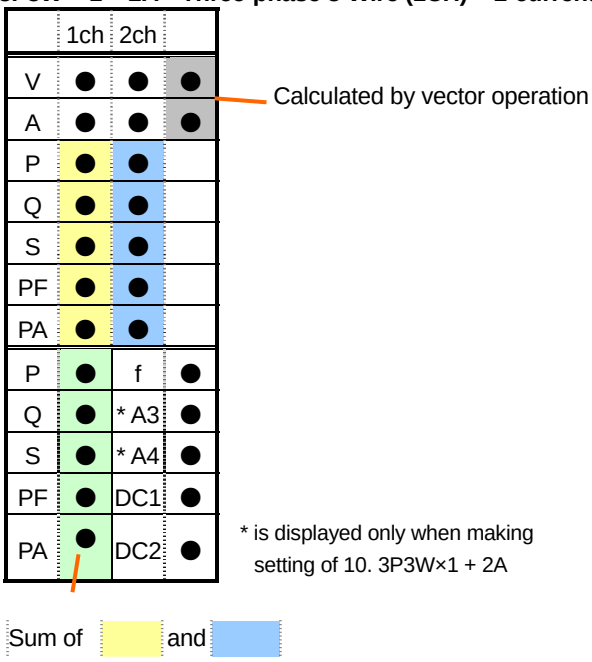
Sum of and

6. 1P3W × 2 Single-phase 3-Wire (2CH)

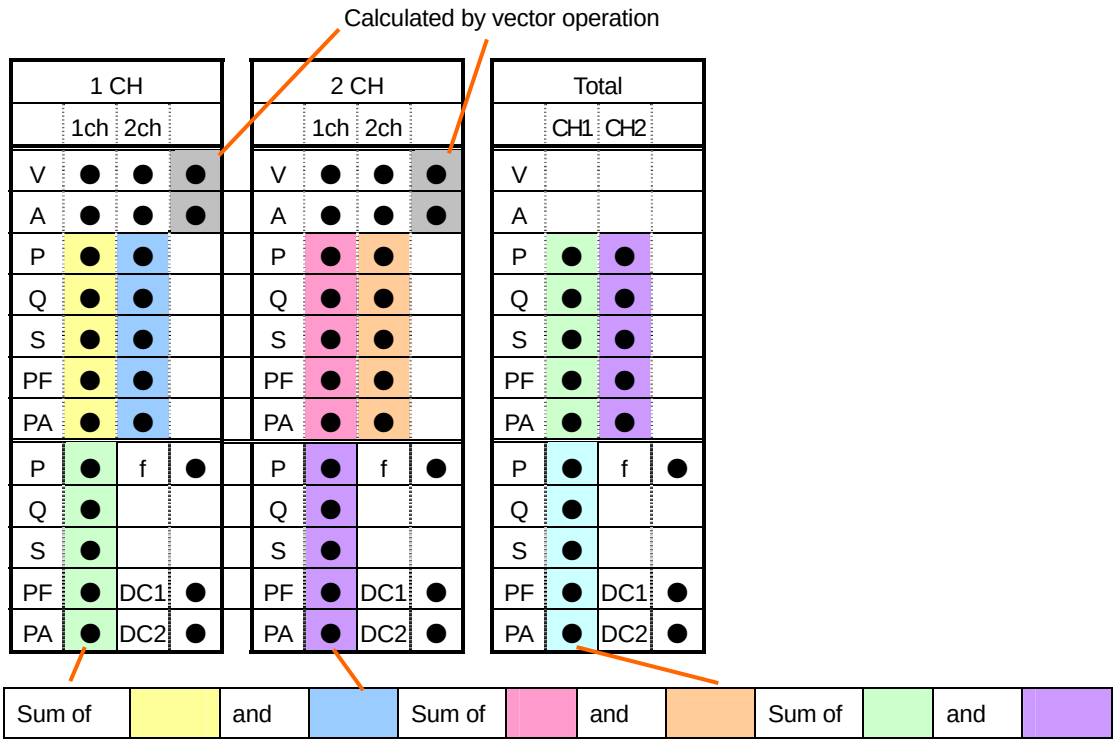
1 CH				2 CH				Total			
	1ch	2ch			1ch	2ch			CH1	CH2	
V	●	●		V	●	●		V			
A	●	●		A	●	●		A			
P	●	●		P	●	●		P	●	●	
Q	●	●		Q	●	●		Q	●	●	
S	●	●		S	●	●		S	●	●	
PF	●	●		PF	●	●		PF	●	●	
PA	●	●		PA	●	●		PA	●	●	
P	●	f	●	P	●	f	●	P	●	f	●
Q	●			Q	●			Q	●		
S	●			S	●			S	●		
PF	●	DC1	●	PF	●	DC1	●	PF	●	DC1	●
PA	●	DC2	●	PA	●	DC2	●	PA	●	DC2	●

Sum of and Sum of and Sum of and

8. 3P3W × 1 Three-phase 3-Wire (1CH),
10. 3P3W × 1 + 2A Three-phase 3-Wire (1CH) + 2-current



9. 3P3W × 2 Three-phase 3-Wire (2CH)



11. 3P3W3A Three-phase 3-Wire 3A

	1ch	2ch	3ch
V	●	●	●
A	●	●	●
P	●	●	●
Q	●	●	●
S	●	●	●
PF	●	●	●
PA	●	●	●
P	●	f	●
Q	●		
S	●		
PF	●	DC1	●
PA	●	DC2	●

Sum of and and

12. 3P4W × 1 Three-phase 4-Wire (1CH),
13. 3P4W × 1 +1A Three-phase 4-Wire (1CH) + 1-current

	1ch	2ch	3ch
V	●	●	●
A	●	●	●
P	●	●	●
Q	●	●	●
S	●	●	●
PF	●	●	●
PA	●	●	●
P	●	f	●
Q	●	An	●
S	●	* A4	●
PF	●	DC1	●
PA	●	DC2	●

* is displayed only when making setting of 13. 3P3W×1 + 1A

Sum of and and

⓪ **4A**

1CH			
A1	●		
A2	●		
A3	●		
A4	●		
		DC1	●
		DC2	●

6.1.2 Switching displays

Switching systems

Press the ◀ ▶ Cursor Keys and view displays for each system.

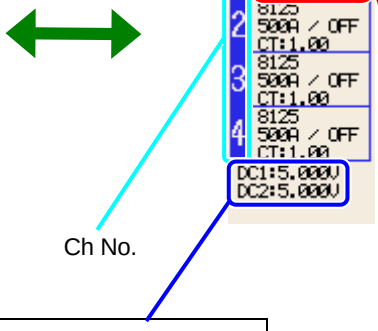
Switching items

Press the ▲ ▼ Cursor Keys and view the instantaneous, average values etc.

* Displayed contents are depending on the selected wiring configurations.
* ∑ means the total of the values at each channel.

Viewing the present settings

Press the ENTER Key to check the present settings.
Press the ENTER Key again to return to the Display change screen.



Wiring	
V Range	
VT Ratio	
Frequency	

Ch No.

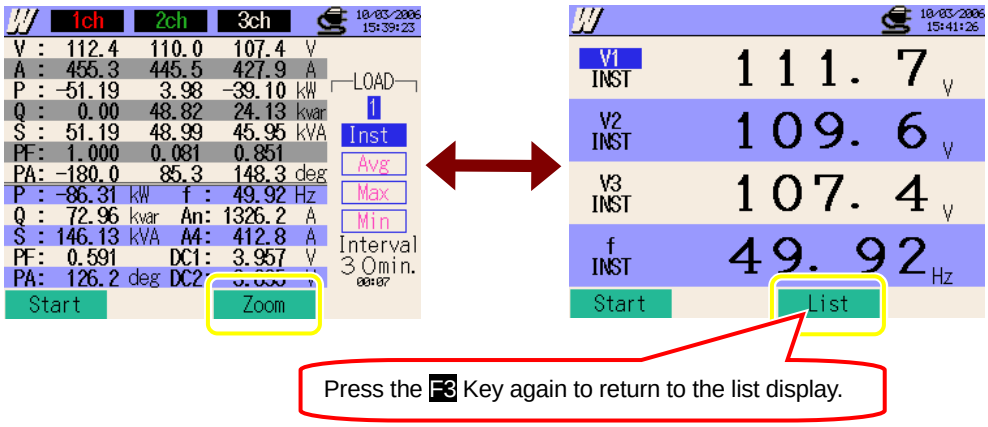
8125	Clamp Sensor
500A/OFF	A Range / Filter
CT:1.00	CT Ratio

DC1:5.000V	Analogue Input DC Range

6.1.3 Zoom

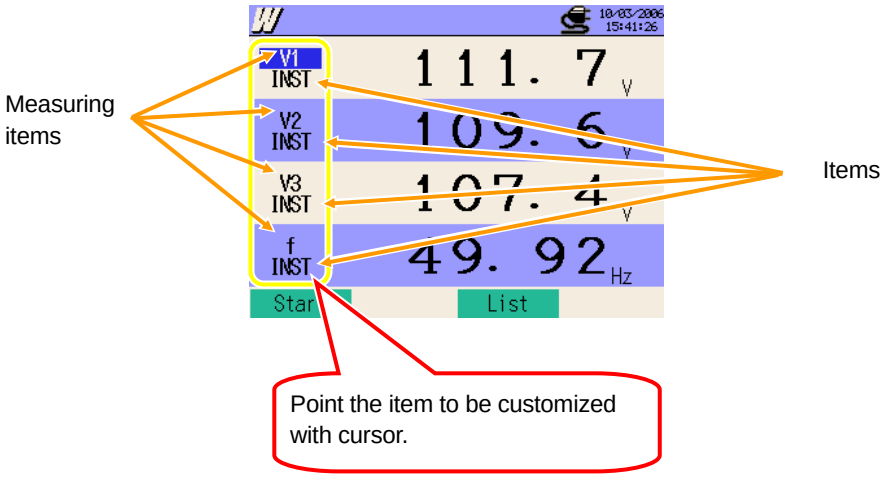
Default setting or the setting after system reset is depending on the selected wiring configurations.

Pressing the F3 Key while a list for Instantaneous Value Measurement is being displayed zooms the list.

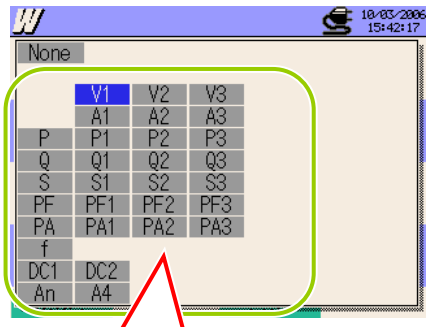


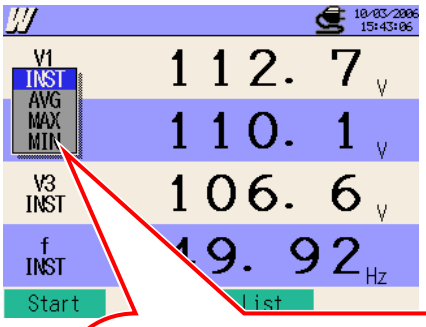
Customizing the Zoom screen

1 Press the ▲▼ Cursor Keys and select the item to be customized, and then press the ENTER Key.



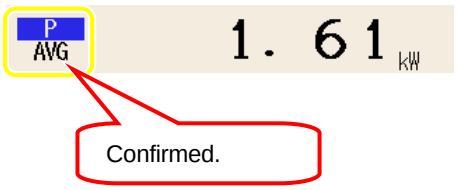
2 Press the ▲▼◀▶ Cursor Keys and select any items, and then press the ENTER Key.





Drop-down list appears when a parameter is pointed by cursor.

Item	
INST	Instantaneous value
AVG	Average value
MAX	Max value
MIN	Min value



6.2 Measuring Procedure

Steps for measurement

Ensuring your safety	See **“Safety Warnings”**.
↓	
Getting started	See **“Section 3 Getting started”**.
↓	
Setting	See **“Section 4 Setting”**.
↓	
Wiring	See **“Section 5 Wiring Configuration”**.
↓	
Inst value measurement	See this section.

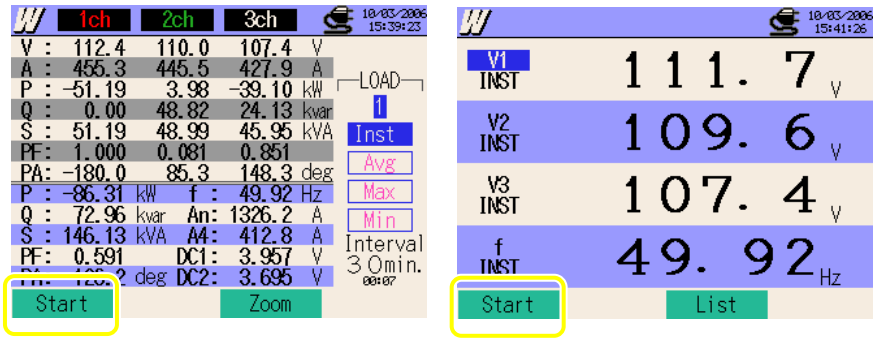
Basic Setting	Measurement Setting	Save Setting
Wiring	Interval	Recording method
V Range	Save item (W)	Recording start
VT Ratio	∗ Inst value	Recording termination
Clamp Sensor	∗ Avg value	Destination to save data
A Range	∗ Max value	Destination to save screenshot
CT Ratio	∗ Min value	
Filter		
DC V		
Frequency		

6.3 Data Saving

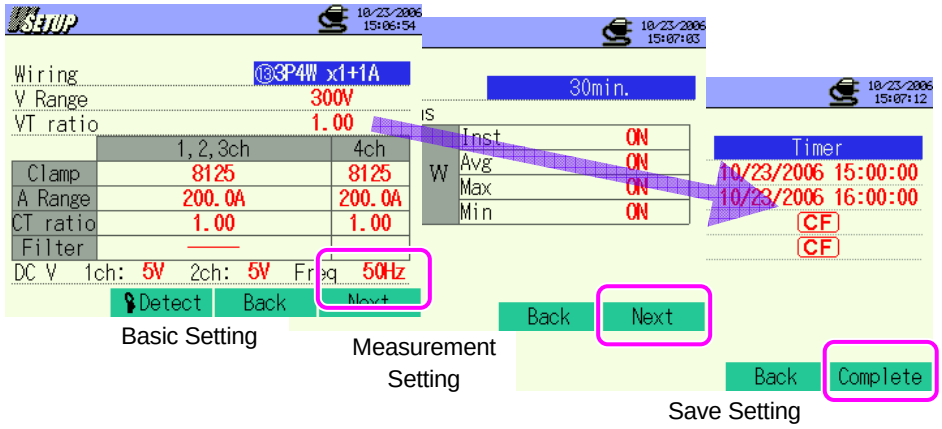
6.3.1 Saving Inst measurement data

Saving procedure

1 Press the F1 Key at the List or Zoom screen.



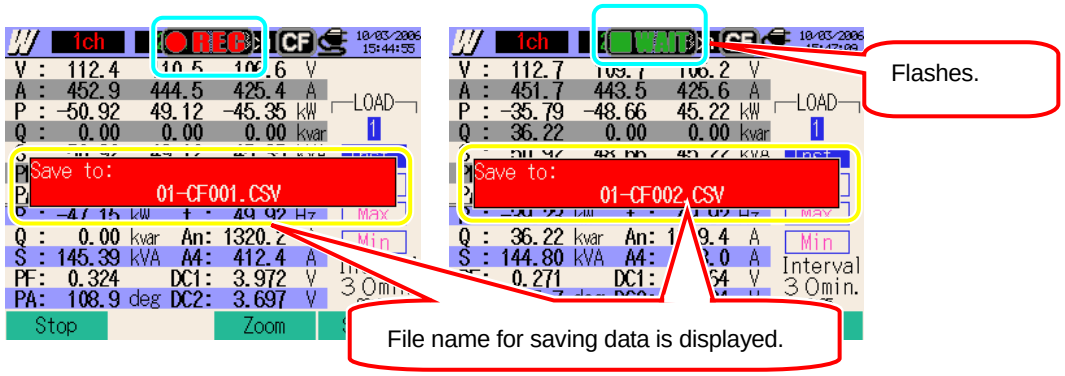
2 Press the F4 Key and check the Basic, Measurement and Save settings. Press the Cursor Keys to select and modify the settings. Pressing the F3 Key returns to the previous screen.



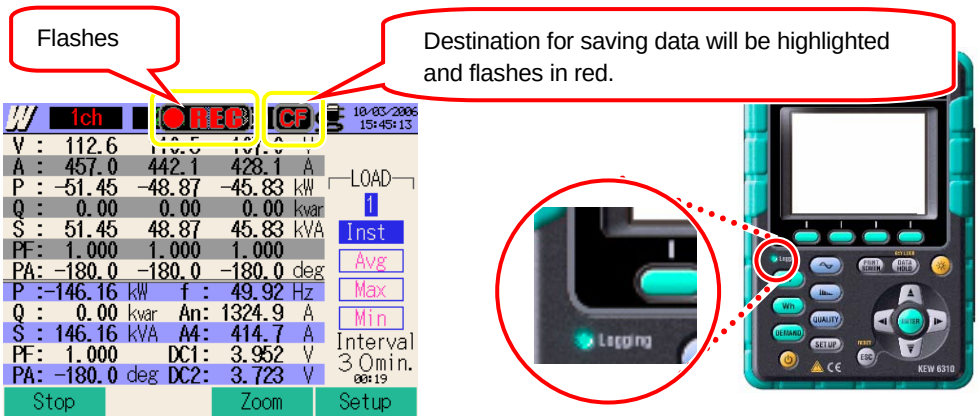
* Pressing down the F1 Key for 2 sec or more while in the status 1, step 2 can be skipped and start data saving.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.

3 Manually start saving data, or press the F4 Key. Stand-by screen (WAIT) appears if saving start date and time has been specified.



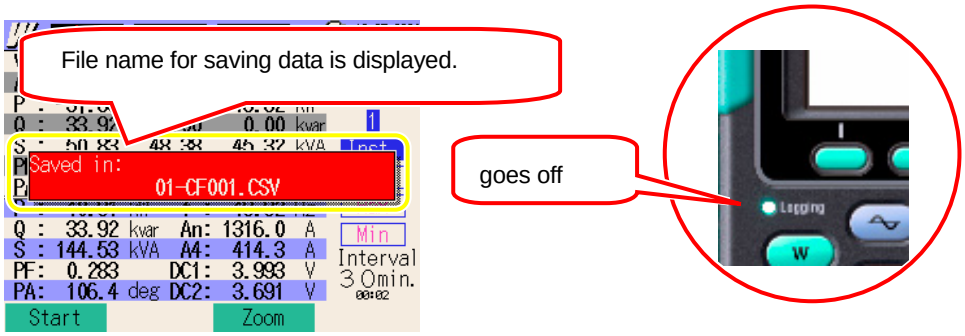
4 Saving starts and the LED status indicator lights up.



No setting change can be made during data saving . Press the F4 Key to check the settings.

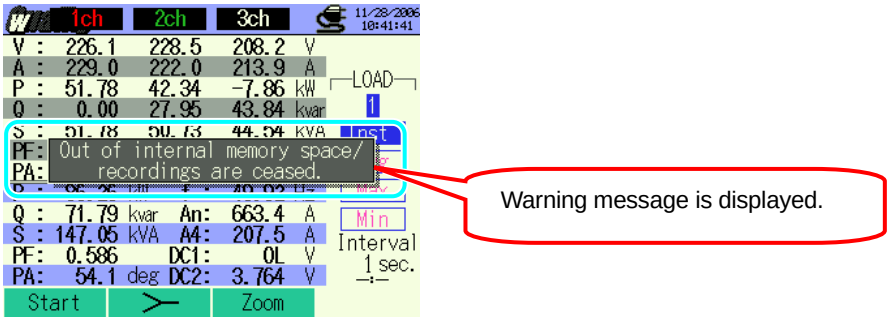
5 Press the F1 Key to stop measurement. (At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off.



6.3.2 Limitations of saving

When data cannot be saved during a measurement,



Further data cannot be saved when max number of file or a capacity is exceeded. Previously saved files should be deleted or replaced the CF Card with a new one. For further details, see "**Section 12 CF Card / Internal Memory**" in this manual.

6.3.3 Saved data

Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID number
WIRING	:	Wiring configuration
VOLT RANGE	:	Voltage Range
VT RATIO	:	VT ratio
SENSOR TYPE	:	Model name of Clamp sensor
CURRENT RANGE	:	Current Range
CT RATIO	:	CT ratio
CURRENT FILTER	:	Current Filter
DC RANGE	:	DC Range
FREQUENCY	:	Frequency
INTERVAL	:	Interval
START	:	Saving start time

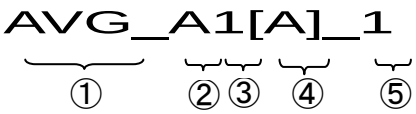
Save data

File ID : 6310-01						
Saved time & date		Elapsed time	Instantaneous	Average	Max	Min
DATE	TIME	ELAPSED TIME	INST	AVG	MAX	MIN
yyyy/mm/dd	h:mm:ss	h:mm:ss	(±)x.xxxE±nn			
Year/Month/Date	Hour:Min:Sec	Hour:Min:Sec	(±) value x $10^{\pm n}$			

* e.g. of measured data

$$1.234E+5 = 1.234 \times 10^{5}$$
$$= 123400$$

Header of the saved data



①	INST	:	Instantaneous value
	AVG	:	Average value
	MAX	:	Max value
	MIN	:	Min value
②	V	:	Voltage of each phase
	A	:	Current of each phase
	f	:	Frequency
	P	:	Active power
	Q	:	Reactive power
	S	:	Apparent power
	PF	:	Power factor
	PA	:	Phase angle
	DC	:	Analogue input voltage
③	CH number	:	* 1 ~ 4
④	Unit		
⑤	System		

* Saved data with no number at this space means the sum of the measured values.

File format and name

Measurement data is saved in CSV format, and the file name is assigned automatically.

File name : 01 – CF 001 . csv

① ② ③ ④

①	Measuring items	01: Inst value (W Range)
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

6.4 Ranges and Over-range indications
6.4.1 Ranges

Ranges and decimal points for the measuring items will be automatically adjusted depending on the settings for Voltage, Current Ranges and VT / CT ratio.

Voltage Range : V, Max digit : 4-digit	
(V Range) x (VT ratio) x (120%)	Decimal point & Unit
1.8 ~ 9.999 V	9.999 V
10 ~ 99.99 V	99.99 V
100 ~ 999.9 V	999.9 V
1 ~ 9.999 k V	9.999 k V
10 ~ 99.99 k V	99.99 k V
100 ~ 9.999 k V	999.9 k V
1 ~ 9.999 MV	9.999 MV
10 ~ 12.0 MV	12.00 MV

Current Range : A, Max digit : 4-digit	
(A Range) x (CT ratio) x (120%)	Decimal point & Unit
1.2 ~ 9.999 mA	9.999 mA
10 ~ 99.99 mA	99.99 mA
100 ~ 999.9 mA	999.9 mA
1 ~ 9.999 A	9.999 A
10 ~ 99.99 A	99.99 A
100 ~ 999.9 A	999.9 A
1 ~ 9.999kA	9.999kA
10 ~ 99.99kA	99.99kA
100 ~ 999.9kA	999.9kA
1 ~ 9.999 MA	9.999 MA
10 ~ 36.00 MA	36.00 MA

Power Range : P, Q, S, Max digit : 4-digit, Max digit (to display sum): 5-digit	
Power x VT x 120% x A x CT x 120%	Decimal point & Unit
2.1 ~ 9.999 mW	9.999 mW
10 ~ 99.99 mW	99.99 mW
100 ~ 999.9 mW	999.9 mW
1 ~ 9.999 W	9.999 W
10 ~ 99.99 W	99.99 W
100 ~ 999.9 W	999.9 W
1 ~ 9.999kW	9.999kW
10 ~ 99.99kW	99.99kW
100 ~ 999.9kW	999.9kW
1 ~ 9.999 MW	9.999 MW
10 ~ 99.99 MW	99.99 MW
100 ~ 999.9 MW	999.9 MW
1 ~ 9.999 GW	9.999 GW
10 ~ 99.99 GW	99.99 GW
100 ~ 999.9 GW	999.9 GW
1 ~ 9.999 TW	9.999 TW
10 ~ 99.99 TW	99.99 TW
100 ~ 432.0 TW	432.0 TW

Power Range corresponding to each Voltage / Current Range												
		Current Range										
		1.000A	5.000A	10.00A	20.00A	50.00A	100.0A	200.0A	300.0A	500.0A	1000A	3000A
Voltage Range	150.0V	150.0	750.0	1.500k	3.000k	7.500k	15.00k	30.00k	45.00k	75.00k	150.0k	450.0k
	300.0V	300.0	1.500k	3.000k	6.000k	15.00k	30.00k	60.00k	90.00k	150.0k	300.0k	900.0k
	600.0V	600.0	3.000k	6.000k	12.00k	30.00k	60.00k	120.0k	180.0k	300.0k	600.0k	1.800M
	1000V	1.000k	5.000k	10.00k	20.00k	50.00k	100.0k	200.0k	300.0k	500.0k	1.000M	3.000M

Power factor: PF, Max : 4-digit
－1．000 ~ 1．000PF

Phase Angle : PA, Max : 4-digit
－1．000 ~ 1．000PA

Frequency: f, Max : 4-digit
40．00 ~ 70．00Hz

6.4.2 Over-range / Bar indication

Check the followings.

WARNING

- When the over-range indication appears on the maximum chosen range, this means that the input exceeds the maximum allowable input for the instrument. Never apply such an input to the instrument.
- When a measured value exceeds the maximum allowable input, the use of VT/CT's is recommended. Refer to "**5-3 VT/ CT**" in this manual and follow the instruction

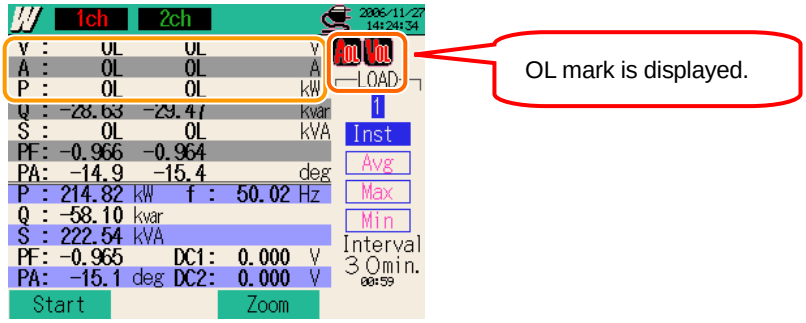
CAUTION

- When over-range indication appears on the screen, calculations are still performed. However their accuracy may not be guaranteed.

Over-range indication

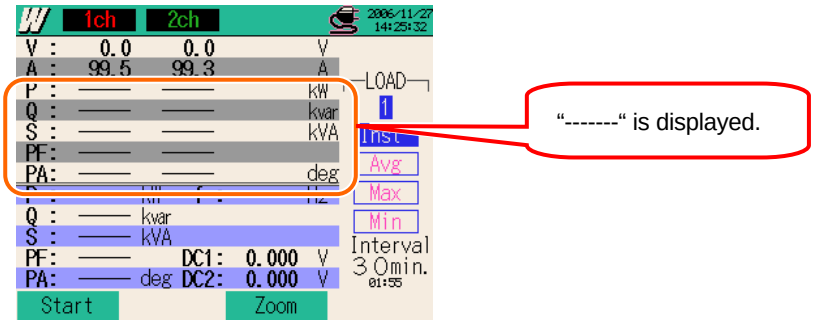
A message "OL" is displayed when measured items exceed following conditions.

Voltage	:	Voltage Range x VT ratio x 120%	e.g. Voltage Range : 300V, VT ratio : 1 => 360.0V
Current	:	Current Range x CT ratio x 120%	e.g. Current Range : 200A, CT ratio : 2 => 480.0A
Power	:	Power x VT ratio x CT ratio x 120%	e.g. Power : 60kW, VT ratio : 1, CT ratio : 2 => 144.0kW



Bar Indication

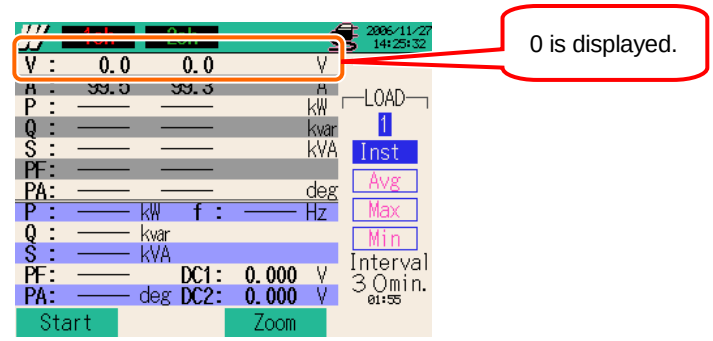
The calculations and measurements performed by this instrument are based on the voltage and frequency of V1. If the value of V1 is less than 5% of the chosen range or if the frequency is not within 40 ~ 70Hz, all the parameters (except for voltage and current) cannot be computed and thus displayed. In such a case, the numerical digits will be replaced by a bar indication **("- - - -")** as shown:



Zero Indication

Zero "0" is displayed when measured items exceeds following conditions.

Voltage	:	Voltage Range x VT ratio x 5%	e.g. Voltage Range : 300V, VT ratio : 1 => 15V
Current	:	Current Range x CT ratio x 1%	e.g. Current Range : 200A, CT ratio : 2 => 4A

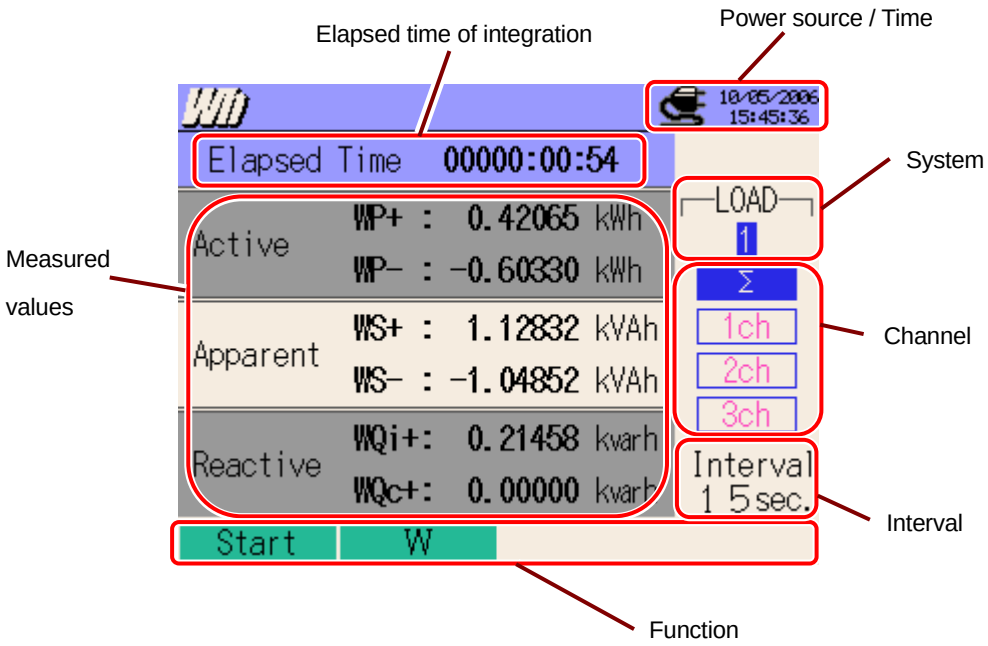


7. Integration measurement

7.1 Indications on LCD

7.1.1 Display Screen

Press the Wh Key to view WH Range screen.



Symbol displayed on the LCD	
WP+	Active power energy (consumption)
WP-	Active power energy (regenerating)
WS+	Apparent power energy (consumption)
WS-	Apparent power energy (regenerating)
WQi+	Reactive power energy (lagging)
WQc+	Reactive power energy (leading)

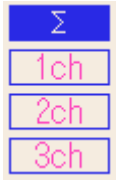
7.1.2 Switching displays

Switching systems

Press the Cursor Keys and view displays for each system.

Switching channels

Press the Cursor Keys and view displays for each channel.



* Displayed contents depends on the selected wiring configurations.

* ∑ means the sum of the values at each channel.

Wiring Configuration	①1P2W × 1	②1P2W × 2	③1P2W × 3	④1P2W × 4
Selection of System	1	1・2・Σ	1・2・3・Σ	1・2・3・4・Σ
Selection of Channel	–	–	–	–
	–	–	–	–
	–	–	–	–
	–	–	–	–
Wiring Configuration	⑤1P3W x 1 ⑦1P3W x 1+2A ⑧3P3W x 1 ⑩3P3W x 1+2A	⑥1P3W x 2 ⑨3P3W x 2	⑪3P3W3A ⑫3P4W x 1 ⑬3P4W x 1+1A	
Selection of System	1	1・2・Σ	1	
Selection of Channel	Σ	Σ	Σ	
	1ch	1ch	1ch	
	2ch	2ch	2ch	
	–	–	3ch	

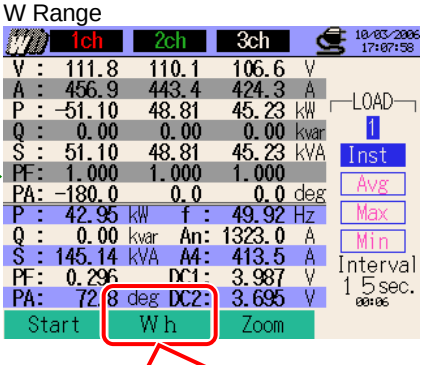
7.1.3 W Range display

It is possible to access the W Range display screen from the Wh Range screen.

1 Press the F2 Key.

Wh Range

W Range



Pressing the F2 Key again returns to Wh Range display screen.

7.2 Measuring Procedure

Steps for measurement

Ensuring your safety	See **"Safety Warnings"**.
↓	
Getting started	See **"Section 3 Getting started"**.
↓	
Settings	See **"Section 4 Setting"**.
↓	
Wiring	See **"Section 5 Wiring Configuration"**.
↓	
Integration value measurement	See this section

* Readings are displayed right after the recording of integration value measurement starts.

Basic Setting	Measurement Setting	Save Setting
Wiring configuration	Interval	Recording method
V Range	Save item (Wh)	Recording start
VT Ratio	∗ Inst value	Recording termination
Clamp (manual / auto)	∗ Avg value	Destination to save data
A Range	∗ Max value	Destination to save screenshot
CT Ratio	∗ Min value	
Filter	∗ Details	
DC V		
Frequency		

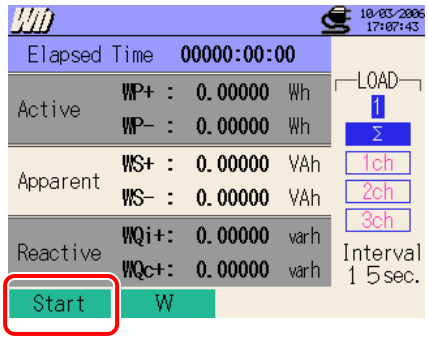
7.3 Data Saving

7.3.1 Saving Integration measurement data

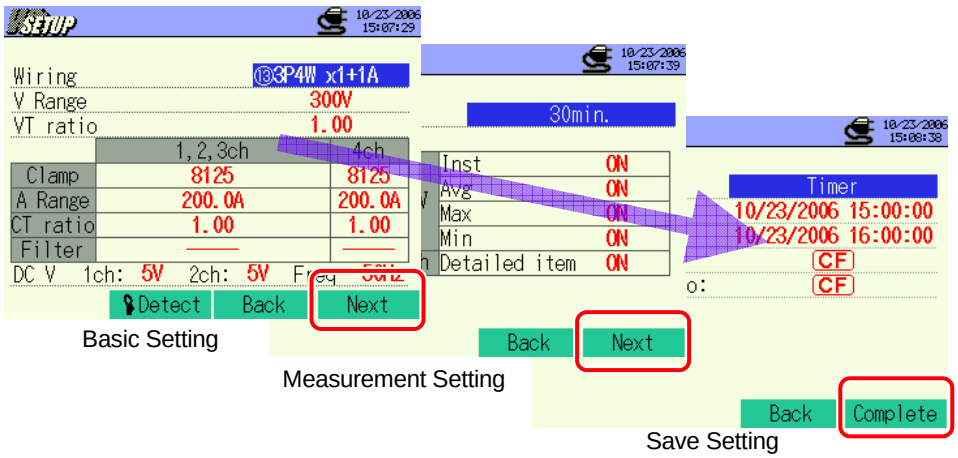
Saving procedure

Instantaneous and integration data is saved at the same time when saving integration measurement data.

1 Press the F1 Key at the Wh Range screen.



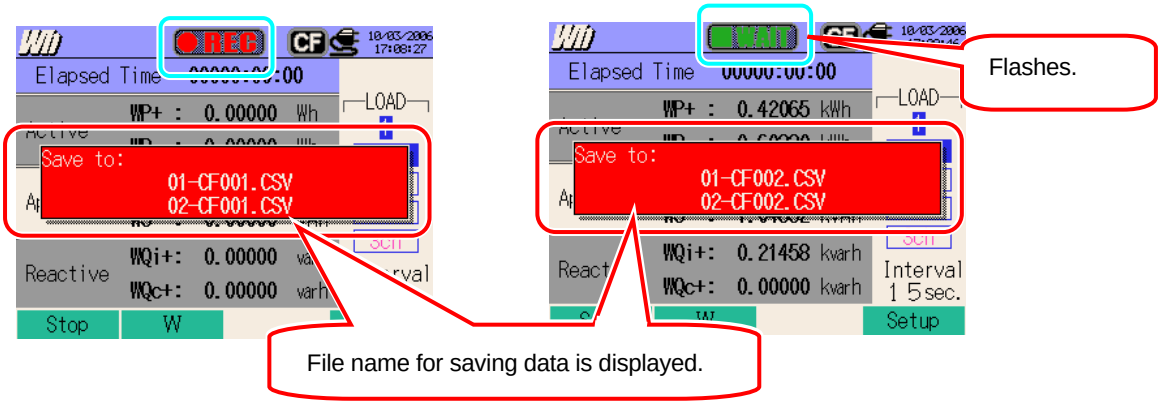
2 Press the F4 Key to check Basic, Measurement and Save Settings. Press the Cursor Keys to select and modify the settings. Pressing the F3 Key returns to the previous screen.



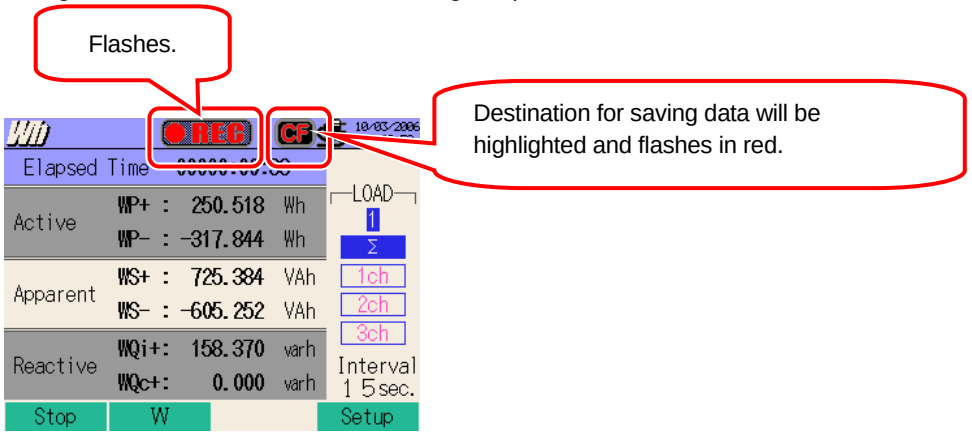
* Pressing down the F1 Key for 2 sec or more while in the status 1 skips step 2 and starts data saving.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.

3 Manually start saving data, or press the F4 Key. Stand-by screen (WAIT) appears if saving start date and time has been specified.



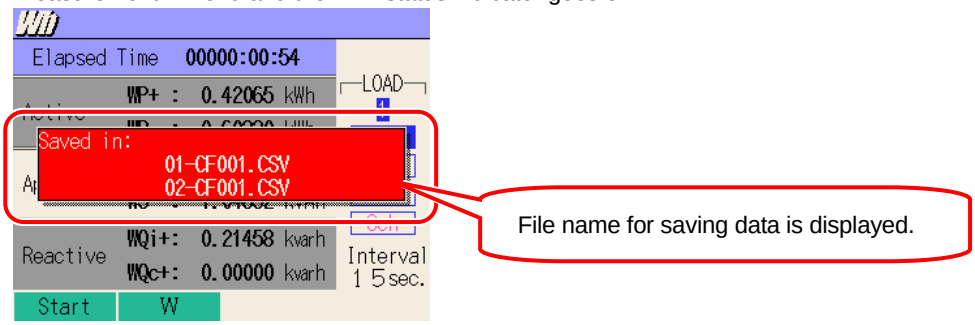
4 Saving starts and the LED status indicator lights up.



No setting change can be made during data saving . Press the F4 Key to check the settings.

5 Press the F1 Key to stop measurement. (At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off.



7.3.2 Limitations of saving

Refer to "**6.3.2 Limitations of saving**" in this manual.

7.3.3 Saved data

Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID number
WIRING	:	Wiring configuration
VOLT RANGE	:	Voltage Range
VT RATIO	:	VT ratio
SENSOR TYPE	:	Model name of Clamp sensor
CURRENT RANGE	:	Current Range
CT RATIO	:	CT ratio
CURRENT FILTER	:	Current Filter
DC RANGE	:	DC Range
FREQUENCY	:	Frequency
INTERVAL	:	Interval
START	:	Saving start time

Save data

File ID : 6310-02					
Saved time & date		Elapsed time	Active power energy (consumption / regenerating)	Apparent power energy (consumption / regenerating)	Reactive power energy (consumption / regenerating)
DATE	TIME	ELAPSED TIME	INTEG_WP	INTEG_WS	INTEG_WQ
yyyy/mm/dd	h:mm:ss	h:mm:ss	(±)x.xxxxxE±nn		
year/month/ date	hour:min:sec	hour:min:sec	(±) value x $10^{\pm n}$		

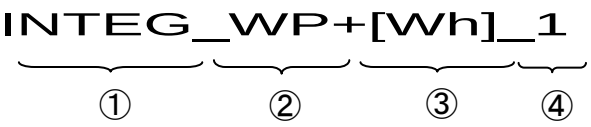
* Reactive power (consumption :+ / regenerating :-) will be recorded with phase information: lagging (i) or leading (c).

* At Wh Range, data measured at W Range and above measurement data are recorded at the same time.

* e.g. of measured data $1.23456E+7 = 1.23456 \times 10^{7}$

$= 12345600$

Header of the saved data



①	INTEG	:	Integration value
②	WP+	:	Active power energy (consumption)
	WP-	:	Active power energy (regenerating)
	WS+	:	Apparent power energy (consumption)
	WS-	:	Apparent power energy (regenerating)
	WQi+	:	Reactive power energy (consumption) – lagging
	WQc+	:	Reactive power energy (consumption) – leading
	WQi-	:	Reactive power energy (regenerating) – lagging
	WQc-	:	Reactive power energy (regenerating) – leading
③	Unit		
④	System		

File format and name

Measurement data is saved in CSV format, and the file name is assigned automatically.

File name : 02 – CF 001 . csv

① ② ③ ④

①	Measuring item	01: Integration value (Wh Range)
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

7.4 Ranges and Over-range indications

7.4.1 Ranges

Ranges and decimal points for the measuring items will be automatically adjusted depending on the Range selected. A range shifts up when integration vaues exceed 999999.

Power Range : WP, WS, WQ, Max : 6-digit	
	Decimal point & Unit
0.00000 ~ 9. 99999 m	9.99999 m
10.0000 ~ 99.9999 m	99. 9999 m
100.000 ~ 999. 999 m	999. 999 m
1000.00 ~ 9999.99 m	9999.99 m
10.0000 ~ 99.9999	99.9999
100.000 ~ 999. 999	999. 999
1000.00 ~ 9999.99	9999.99
10.0000 ~ 99. 9999k	99.9999k
100.000 ~ 999. 999k	999. 999k
1000.00 ~ 9999.99k	9999.99k
10.0000 ~ 99.9999 M	99.9999 M
100.000 ~ 999. 999 M	999. 999 M
1000.00 ~ 9999.99 M	9999.99 M
10.0000 ~ 99.9999 G	99.9999 G
100.000 ~ 999. 999 G	999. 999 G
1000.00 ~ 9999.99 G	9999.99 G
10.0000 ~ 99.9999 T	99.9999 T
100.000 ~ 99.99 T	999.9999 T
1000.00 ~ 9999. 99	9999. 99T

* “OL” is displayed when integration vaues exceed 9999.99T.

7.4.2 Over-range / Bar indication

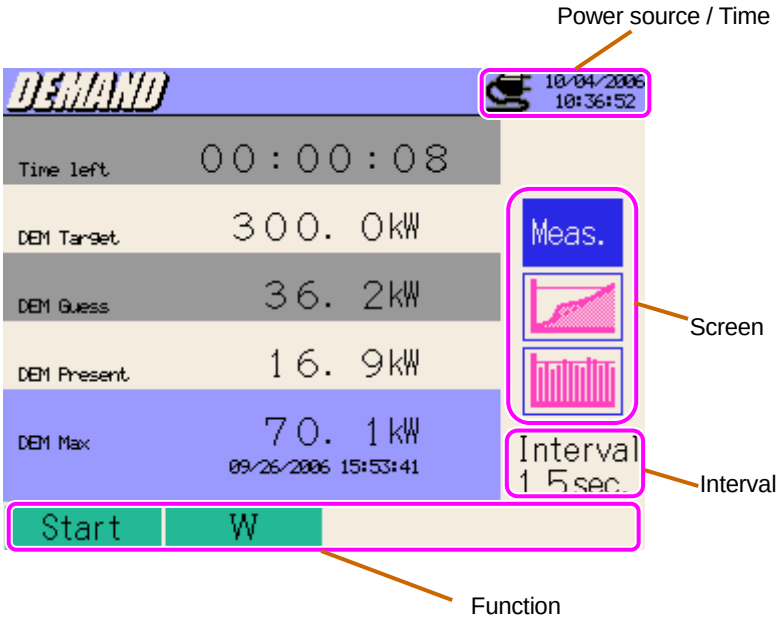
Refer to “**6.4.2 Over-range / Bar indication Limitations**” in this manual.

8. Demand Measurement

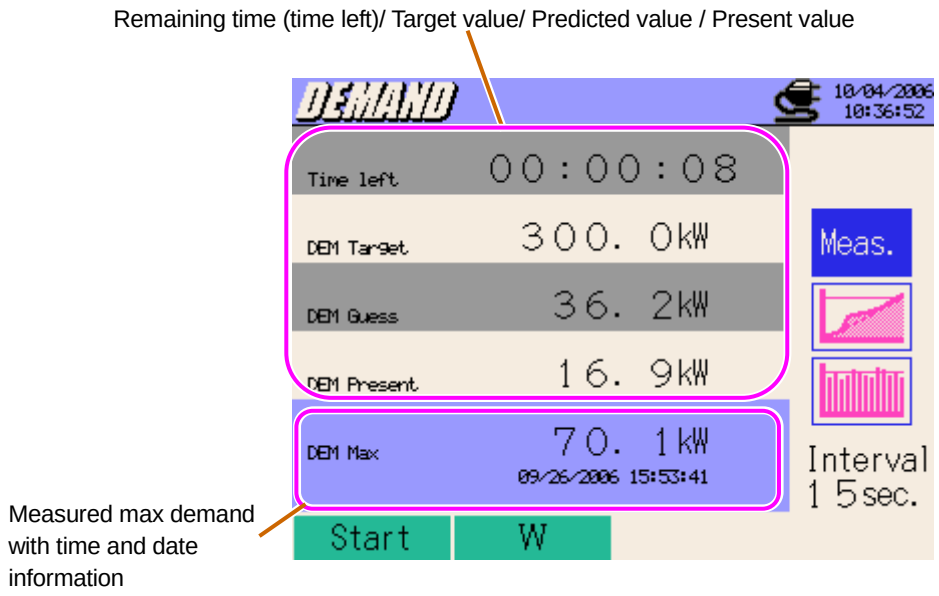
8.1 Indications on LCD

8.1.1 Display Screen

Press the DEMAND Key to view Demand measurement screen.

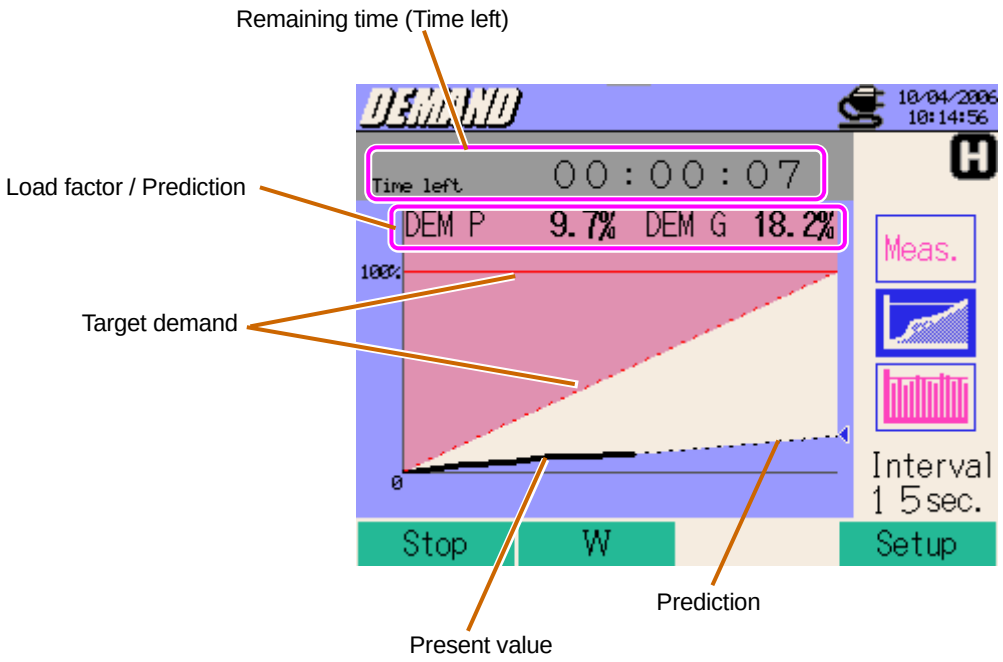


Measurement screen



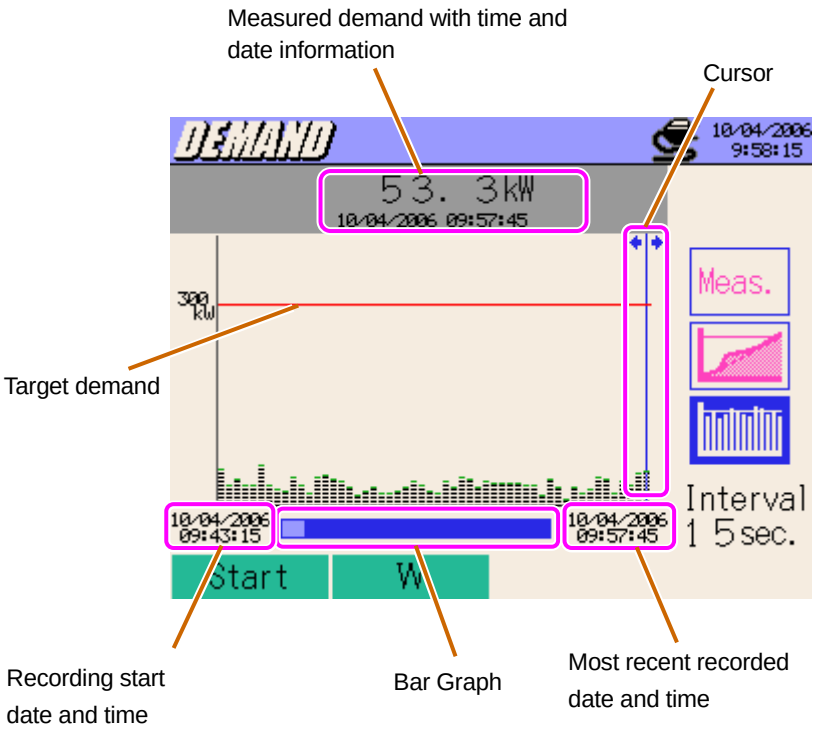
Displayed parameters	Details
Remaining time (time left)	Demand interval is counted down.
Target value	Should be set for each measurement.
Predicted value	Predicted demand value (average power) when preset demand interval elapses under present load. **(Present value) x (Preset interval)** **(Elapsed time)** * Integration and calculations are done as time elapses.
Present value	Demand value (average power) within a demand interval. **"WP+ x 1 hour"** **Interval** * Integration and calculations are done as time elapses.
Max demand	Max demand recorded in a measuring period is displayed. Displayed value will be refreshed if any higher demand is detected.

Shifts in specific period



Displayed parameters	Details
Load Factor	Percentage of the present value against the target value. **(Present value)** **(Target value)**
Prediction	Percentage of the predicted value against the target value. **(Predicted value)** **(Target value)** Arrow mark on the graph (◄) is blue while the graph is within the target demand, and becomes red when the target value is exceeded.

Demand change



A long press of Cursor Keys changes pages.

Displayed parameters	Details
Cursor	Use the Cursor Key to move the cursors.
Measured max demand with time and date information	Demand value is displayed with recorded time & date info where a cursor points.
Bar Graph	White bar : Percentage of hidden pages Blue bar: Percentage of the present displayed pages
Recording start date & time	Time and date when the 1st recording started Time info of the oldest data in recent 1500 data pts is displayed when number of data exceeds 1500.
Most recent recorded date & time	Time and date of the latest recorded data is displayed.

8.1.2 Switching screens

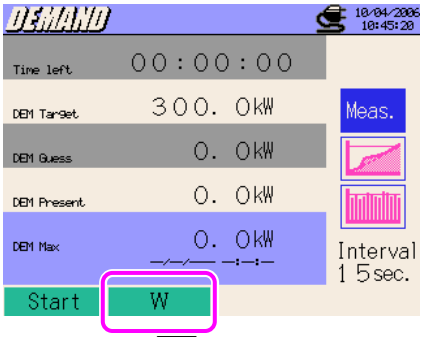
Press the ▲▼Cursor Keys to switch screens.

8.1.3 W Range / Wh Range display

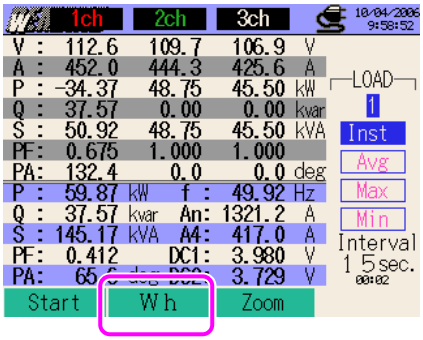
It is possible to access the W / Wh Range display screens from the Demand screen.

1 Press the F2 Key.

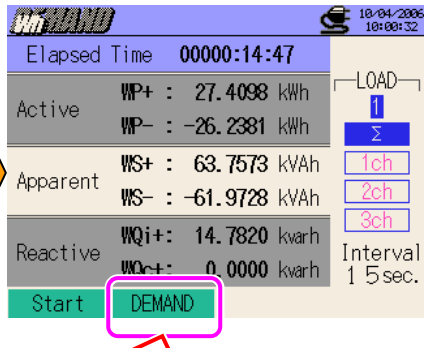
DEMAND Range



W Range



Wh Range



Pressing the F2 Key again returns to Demand screen.

8.2 Measuring Procedure

Steps for measurement

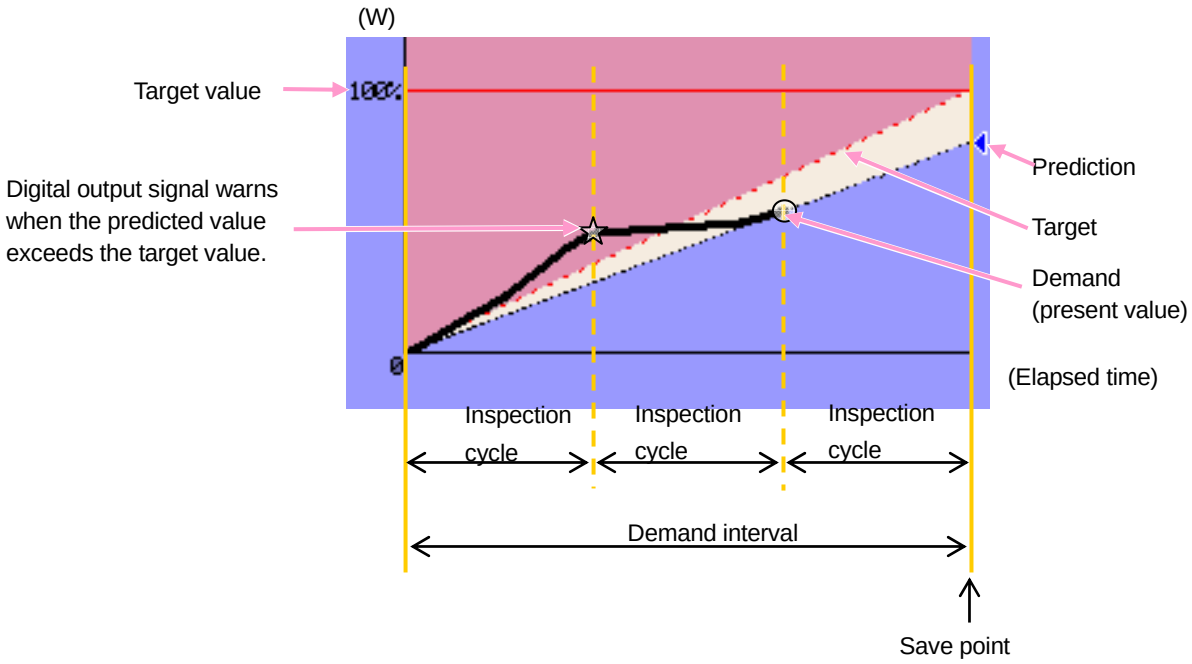
Ensuring your safety	See **"Safety Warnings"**.
↓	
Getting started	See **"Section 3 Getting started"**.
↓	
Settings	See **"Section 4 Setting"**.
↓	
Wiring	See **"Section 5 Wiring Configuration"**.
↓	
Demand measurement	See this section.

* Readings are displayed right after the recording of demand measurement starts.

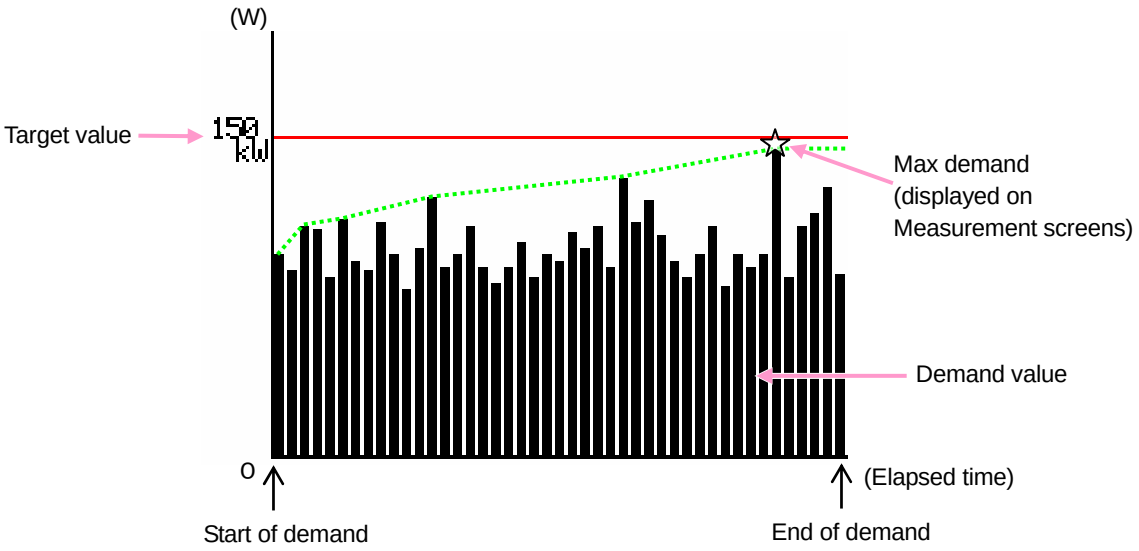
Basic Setting	Measurement Setting	Save Setting
Wiring configuration	Interval	Recording method
V Range	Save item (W)	Recording start
VT Ratio	* Inst value	Recording termination
Clamp (manual / auto)	* Avg value	Destination to save data
A Range	* Max value	Destination to save screenshot
CT Ratio	* Min value	
Filter	* Details	
DC V	Target demand	
Frequency	Demand inspection cycle	

8.3 Data Saving

Operations within demand intervals



Max demand and data saving point

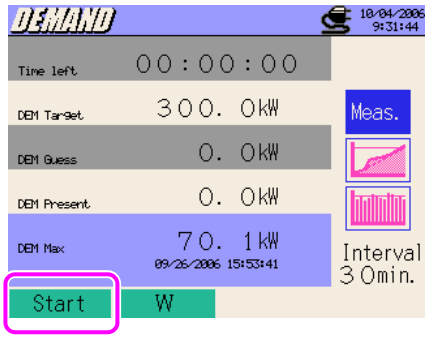


8.3.1 Saving Demand measurement data

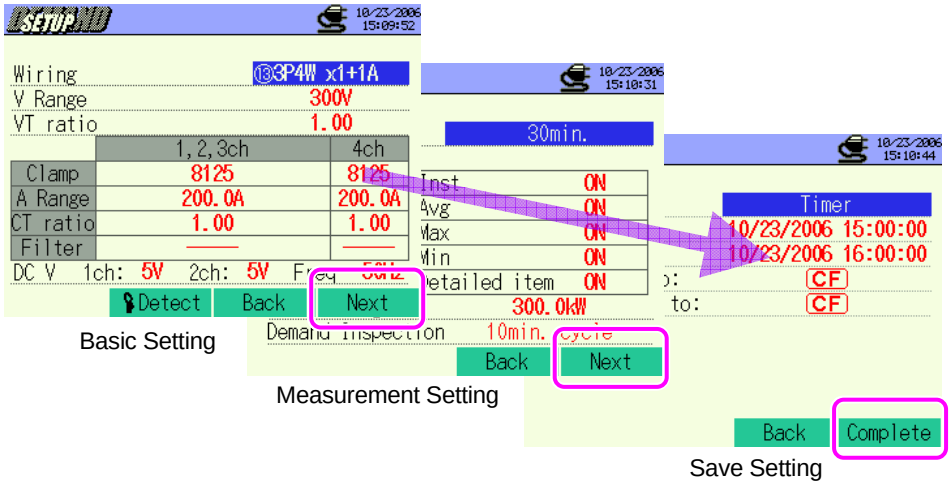
Saving procedure

Inst measurement data is saved as well as demand data when saving demand measurement data.

1 Press the F1 Key at the Measurement screen.



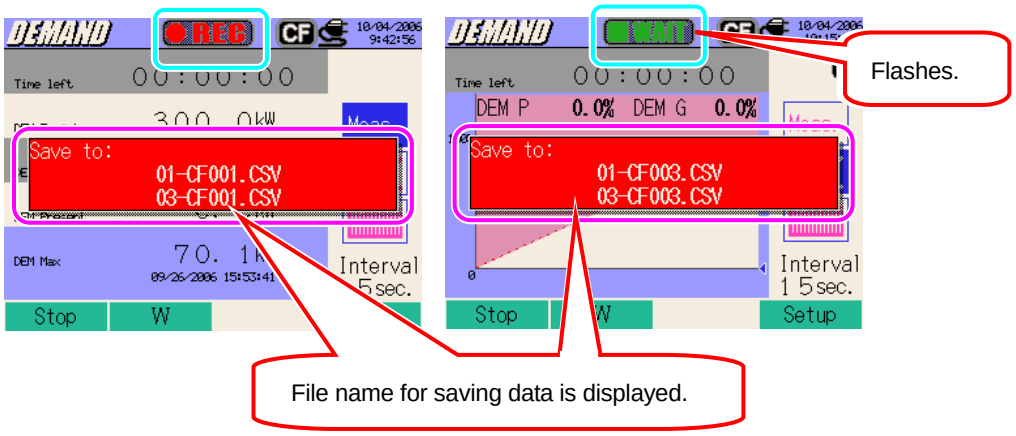
2 Press the F4 Key to check Basic, Measurement and Save Settings.



* Pressing down the F1 Key for 2 sec or more while in the status 1 skips step 2 and starts data save.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.

3 Manually start saving data, or stand-by screen (WAIT) appears if saving start date and time has been specified.

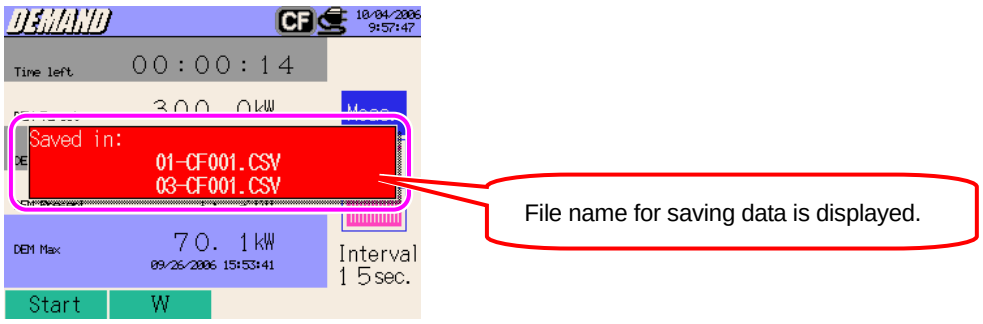


4 Saving starts and the LED status indicator lights up.

No setting change can be made during data saving . Press the F4 Key to check the settings.

5 Press the F1 Key to stop measurement. (At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off.



8.3.2 Limitations of saving

Refer to "**6.3.2 Limitations of saving**" in this manual.

8.3.3 Saving data

Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID number
WIRING	:	Wiring configuration
VOLT RANGE	:	Voltage Range
VT RATIO	:	VT ratio
SENSOR TYPE	:	Model name of Clamp sensor
CURRENT RANGE	:	Current Range
CT RATIO	:	CT ratio
CURRENT FILTER	:	Current Filter
DC RANGE	:	DC Range
FREQUENCY	:	Frequency
INTERVAL	:	Interval
START	:	Saving start time

Save data

<table>
<tr><td colspan="9">File ID : 6310-03</td></tr>
<tr><td colspan="2">Saved time & date</td><td>ELAPSED TIME</td><td></td><td>Active power energy (consumption/ regenerating)</td><td>Apparent power energy (consumption/ regenerating)</td><td>Reactive power energy (consumption/ regenerating)</td><td>DEMAND</td><td>TARGET</td></tr>
<tr><td rowspan="2">DATE</td><td rowspan="2">TIME</td><td rowspan="2">ELAPSED TIME</td><td>Integration</td><td>INTEG_WP</td><td>INTEG_WS</td><td>INTEG_WQ</td><td rowspan="2">DEM</td><td rowspan="2">TARGET</td></tr>
<tr><td>Variation in interval</td><td>INTVL_WP</td><td>INTVL_WS</td><td>INTVL_WQ</td></tr>
<tr><td>yyyy/mm/d</td><td>h:mm:ss</td><td>h:mm:ss</td><td></td><td colspan="3">(±)x.xxxxxxE±nn</td><td>(±)x.xxxE±nn</td></tr>
<tr><td>year/month/ date</td><td>hour:min:sec</td><td>hour:min:sec</td><td></td><td colspan="3">(±) value x $10^{±n}$</td><td></td></tr>
</table>

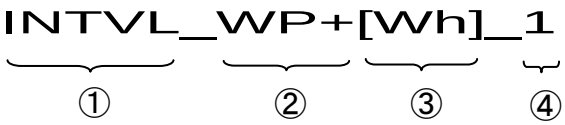
* Measured reactive power (consumption (+) / regenerating (-)) will be saved with lagging (i) / leading (c) info.

* At DEMAND Range, data measured at W Range and above measurement data are saved at the same time.

* e.g. of measured data

$$1.234E+5 = 1.234\times10^{5} = 123400$$

Header of the saved data



①	INTEG	:	Integration value
	INTVL	:	Variations in interval
	DEM	:	Total demand
	TARGET	:	Target value
②	WP+	:	Active Power energy (consumption)
	WP-	:	Active Power energy (regenerating)
	WS+	:	Apparent Power energy (consumption)
	WS-	:	Apparent Power energy (regenerating)
	WQi+	:	Reactive Power energy (consumption) – lagging
	WQc+	:	Reactive Power energy (consumption) – leading
	WQi-	:	Reactive Power energy (regenerating) – lagging
	WQc-	:	Reactive Power energy (regenerating) – leading
③	Unit		
④	System		

* ②,③,④ will be blank if ① is DEM or TARGET.

File format and name

Measurement data is saved in CSV format, and the file name is assigned automatically.

File name : 03 – CF 001 . csv
① ② ③ ④

①	Measuring item	03: Demand value (DEMAND Range)
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

8.4 Ranges and Over-range indications

8.4.1 Ranges

Ranges and decimal points for the measuring items will be automatically adjusted depending on the preset target values.

Target value : DEM T, Max : 4-digit	Predicted value : DEM G, Present value : DEM P, Max demand : DEM max, Max : 6-digit Decimal point & Unit
1.000 ~ 999.9 mW	99999.9 mW
1.000 ~ 999.9 W	99999.9 W
1.000 ~ 999.9kW	99999.9kW
1.000 ~ 999.9 MW	99999.9 MW
1.000 ~ 999.9 GW	99999.9 GW
1.000 ~ 999.9 TW	99999.9 TW

* “OL” is displayed when integration vaues exceed 99999.9.

Load factor : %, Max : 6-digit
0.0 ~ 9999.99%

Prediction : %, Max : 6-digit
0.0 ~ 9999.99%

8.4.2 Over-range / Bar indication

Refer to “**6.4.2 Over-range / Bar indication Limitations**” in this manual.

9. WAVE Range

9.1 Indications on LCD

9.1.1 Display Screen

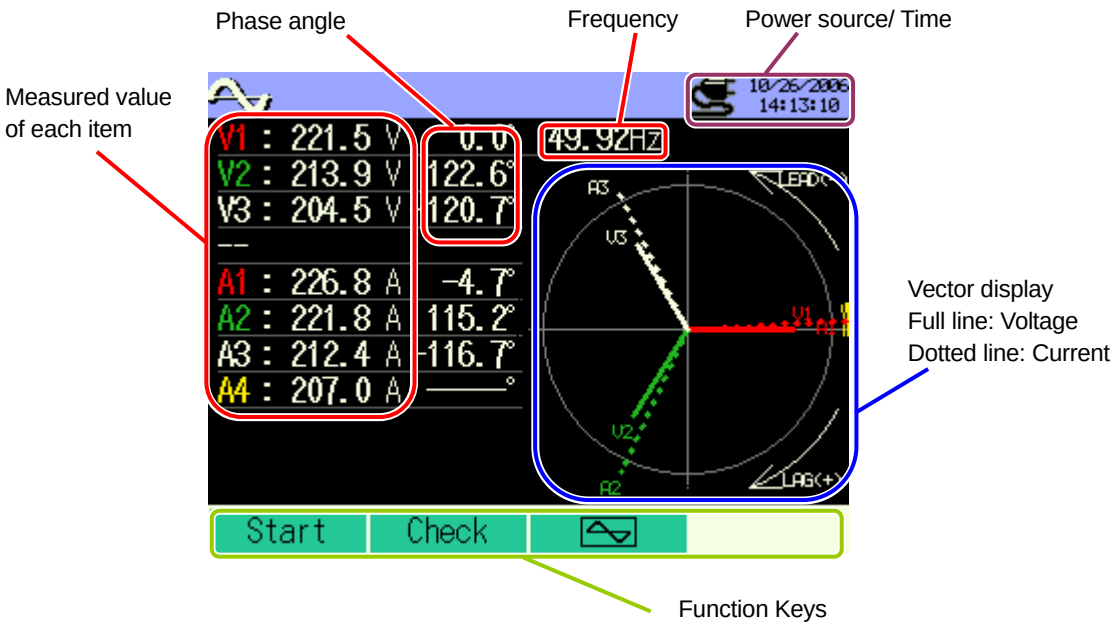
Press the [~] Key to view Vector screen.

Switching screens

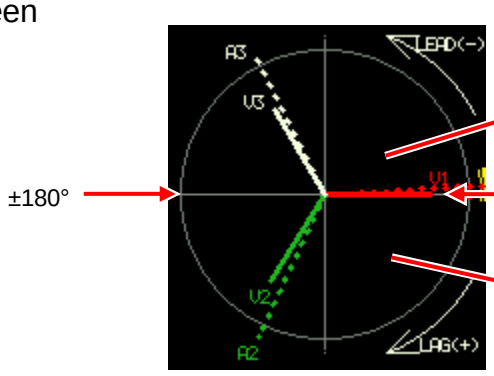
Press the F3 Key to switch Vector and Waveform screens.

Vector screen

Voltage and current vectors are displayed. Number of Ch for displayed vector depends on the selected wiring configuration.

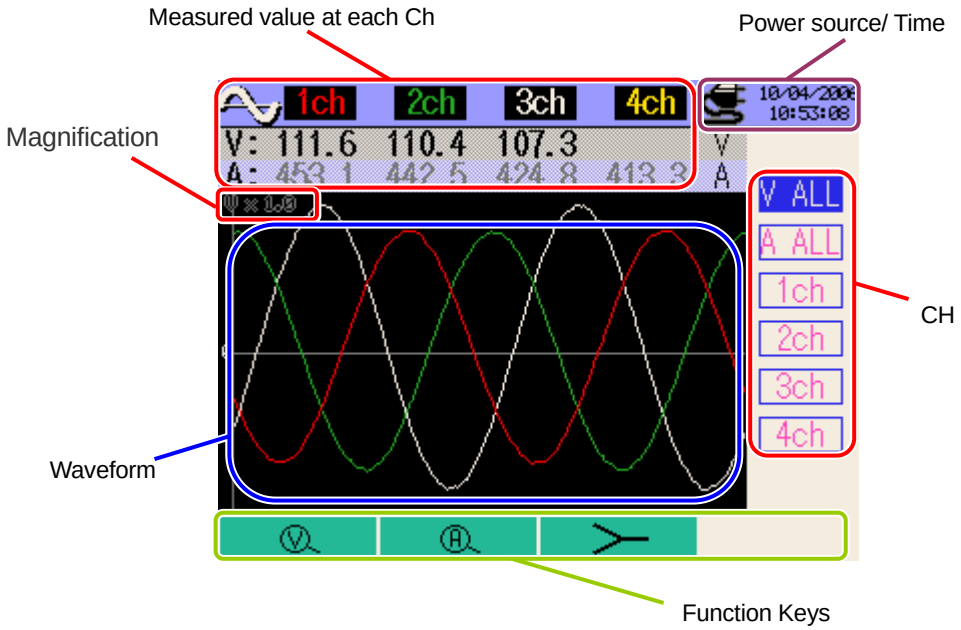


Enlarged Vector screen



Waveform screen

Voltage and current waveforms can be displayed together or displayed channel by channel.
Number of Ch for displayed waveform depends on the selected wiring configuration.



Symbols displayed on the LCD	
	changing a magnification of voltage
	changing a magnification of current
	switching to Vector screen
	switching to Waveform screen

9.1.2 Switching displays

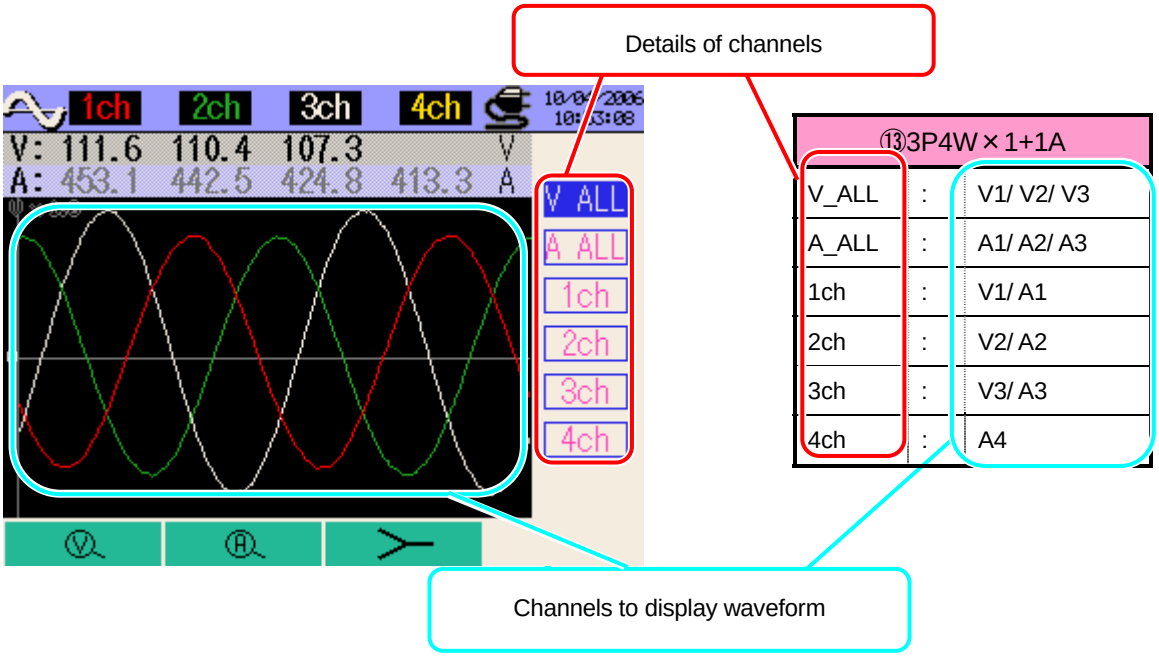
Switching channels (waveform screen)

Press the ▲▼ Cursor Keys to switch channels.

Displayed parameters depend on the selected wiring configuration.

Right table indicates:

Wiring configuration ⑬3P4W x 1A (Three-phase 4-Wire (1ch) + 1-current)



①1P2W x 1			②1P2W x 2			③1P2W x 3		
V	:	V1	V	:	V1	V	:	V1
A	:	A1	A_ALL	:	A1/A2	A_ALL	:	A1/A2/A3
1ch	:	V1/A1	1ch	:	V1/A1	1ch	:	V1/A1
			2ch	:	V1/A2	2ch	:	V1/A2
						3ch	:	V1/A3
④1P2W x 4			⑤1P3W x 1 ⑧3P3W x 1			⑥1P3W x 2 ⑨3P3W x 2		
V	:	V1	V_ALL	:	V1/V2	V_ALL	:	V1/V2
A_ALL	:	A1/A2/A3/A4	A_ALL	:	A1/A2	A_ALL	:	A1/A2/A3/A4
1ch	:	V1/A1	1ch	:	V1/A1	1ch	:	V1/A1
2ch	:	V1/A2	2ch	:	V2/A2	2ch	:	V2/A2
3ch	:	V1/A3				3ch	:	V1/A3
4ch	:	V1/A4				4ch	:	V2/A4
⑦1P3W x 1+2A ⑩3P3W x 1+2A			⑪3P3W3A ⑫3P4W x 1			⑬3P4W x 1+1A		
V_ALL	:	V1/V2	V_ALL	:	V1/V2/V3	V_ALL	:	V1/V2/V3
A_ALL	:	A1/A2/A3/A4	A_ALL	:	A1/A2/A3	A_ALL	:	A1/A2/A3/A4
1ch	:	V1/A1	1ch	:	V1/A1	1ch	:	V1/A1
2ch	:	V2/A2	2ch	:	V2/A2	2ch	:	V2/A2
3ch	:	A3	3ch	:	V3/A3	3ch	:	V3/A3
4ch	:	A4				4ch	:	A4

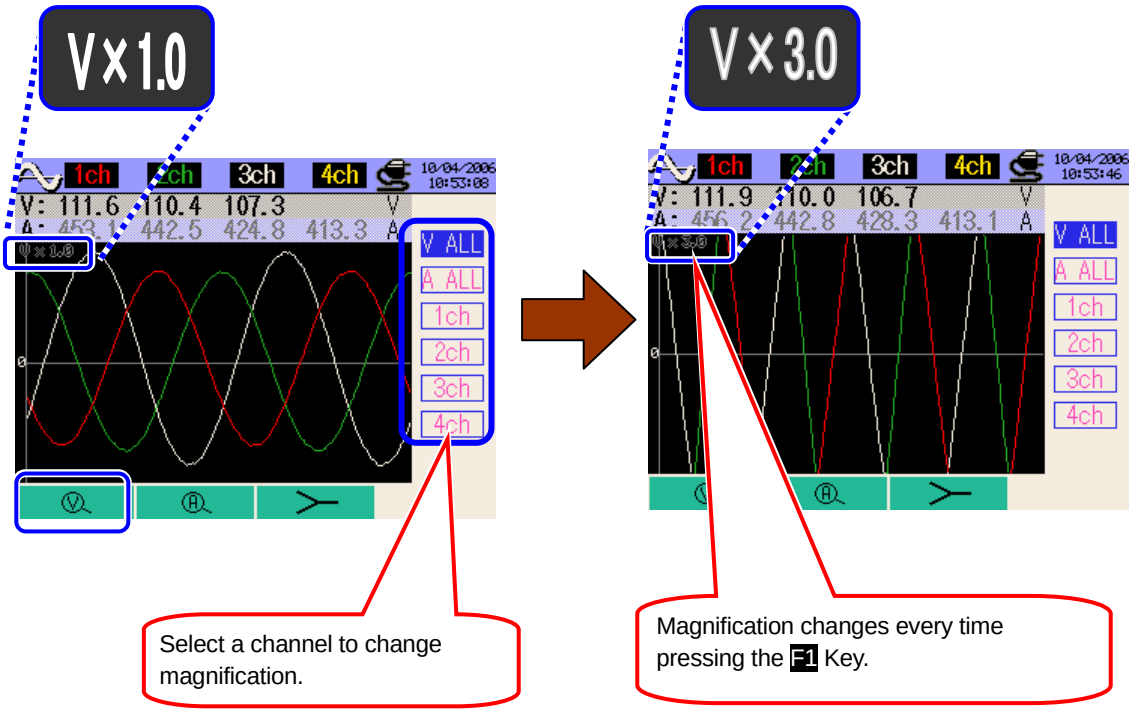
9.1.3 Zooming/ downsizing

	Magnification					
Voltage(Ⓥ)	3	2	1	0.5	0.2	0.1
Current(Ⓐ)						

* Default value (or after system reset) : 1

Zooming/ downsizing of Voltage display

Press the ▲▼ Cursor Key and select the channel to be zoomed in or out, and then press the F1 Key.



Zooming/ downsizing of Current display

Press the ▲▼ Cursor Key and select the channel to be zoomed in or out, and then press the F2 Key.
Magnification changes every time pressing the F2 Key.

9.2 Measuring Procedure

Steps for measurement

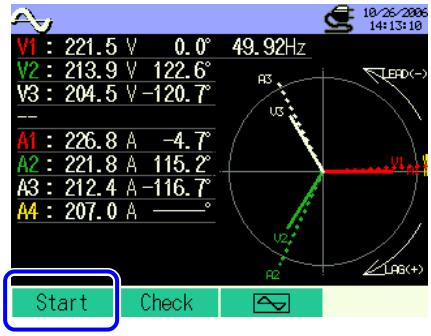
Ensuring your safety	See **"Safety Warnings"**.
↓	
Getting started	See **"Section 3 Getting started"**.
↓	
Settings	See **"Section 4 Setting"**.
↓	
Wiring	See **"Section 5 Wiring Configuration"**.
↓	
Measurement at WAVE Range	See this section

Basic Setting	Measurement Setting	Save Setting
Wiring configuration	Interval	Recording method
V Range	Save item (waveform)	Recording start
VT Ratio		Recording termination
Clamp (manual / auto)		Destination to save data
A Range		Destination to save screenshot
CT Ratio		
Filter		
DC V		
Frequency		

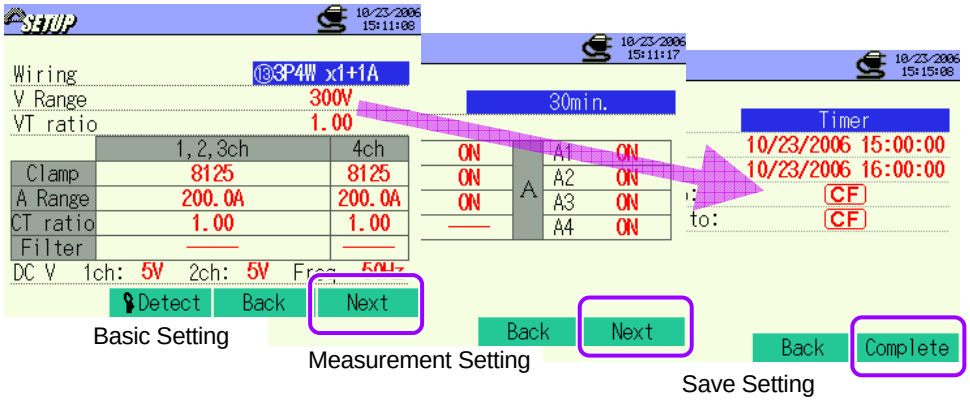
9.3 Data Saving

9.3.1 Saving Procedure

1 Press the F1 Key at the Vector screen.



2 Press the F4 Key to check Basic, Measurement and Save Settings. Press the Cursor Keys to select and modify the settings. Pressing the F3 Key returns to the previous screen.



Basic Setting

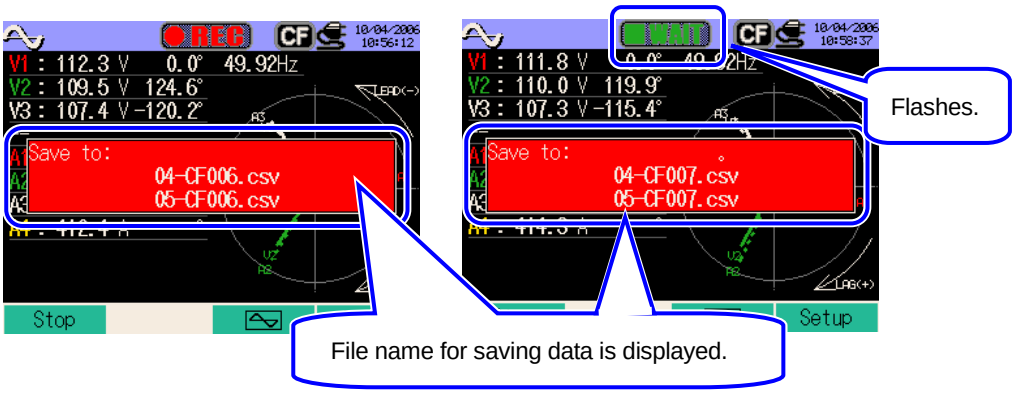
Measurement Setting

Save Setting

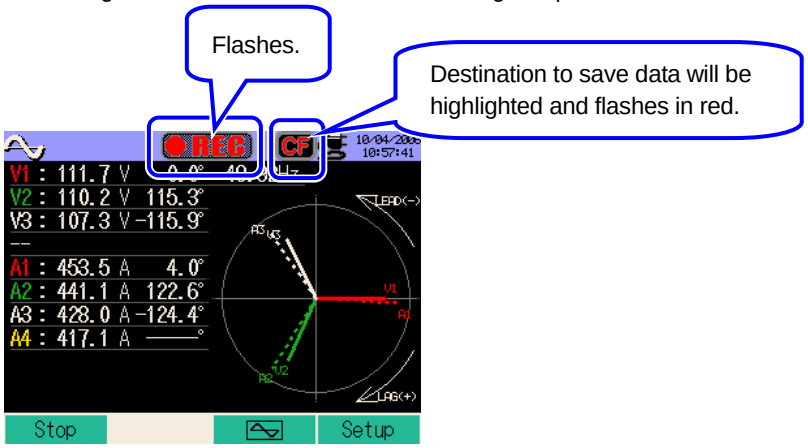
* Pressing down the F1 Key for 2 sec or more while in status 1, you can skip step 2 and start data saving.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.

3 Manually start saving data, or stand-by screen (WAIT) appears if saving start date and time has been specified.



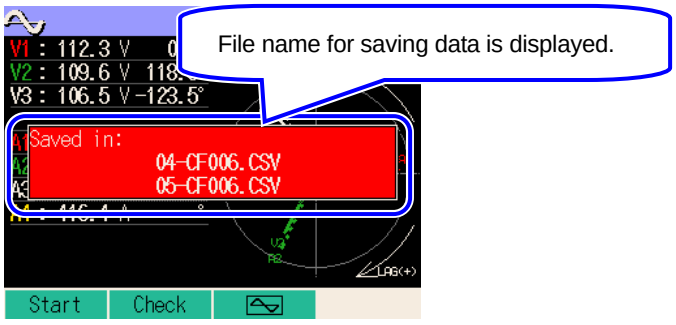
4 Saving starts and the LED status indicator lights up.



No setting change can be made during data saving . Press the F4 Key to check the settings.

5 Press the F1 Key to stop measurement. (At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off.



9.3.2 Limitations of saving

Refer to “**6.3.2 Limitations of saving**” in this manual.

9.3.3 Saving data

Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID number
WIRING	:	Wiring configuration
VOLT RANGE	:	Voltage Range
VT RATIO	:	VT ratio
SENSOR TYPE	:	Model name of Clamp sensor
CURRENT RANGE	:	Current Range
CT RATIO	:	CT ratio
CURRENT FILTER	:	Current Filter
FREQUENCY	:	Frequency
INTERVAL	:	Interval
START	:	Saving start time

Save data

File ID : 6310-04 (waveform data)					
Saved time & date		Elapsed time	Channel	Inst value	
DATE	TIME	ELAPSED TIME	CH	*Line 1/ Line 2	1 / 128 ~ 129 / 256
yyyy/mm/d	h:mm:ss	h:mm:ss	Ai/Vi	(±)x.xxxxE±nn	
year/month/ date	hour:min:sec	hour:min:sec	Current / Voltage	(±) value x $10^{\pm n}$	

*1st ~ 128th measured instantaneous values are saved to the 1st line, 129th ~ 256th are to 2nd line.

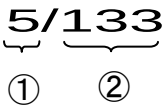
File ID : 6310-05 (vector data)						
Saved time & date		Elapsed time	Instantaneous value	Average value	Max value	Min value
DATE	TIME	ELAPSED TIME	INST	AVG	MAX	MIN
yyyy/mm/d	h:mm:ss	h:mm:ss	(±)x.xxxxE±nn			
year/month/ date	hour:min:sec	hour:min:sec	(±) value x $10^{\pm n}$			

* e.g. of measured data

$$1.234E+5 = 1.234\times10^{5}$$
$$= 123400$$

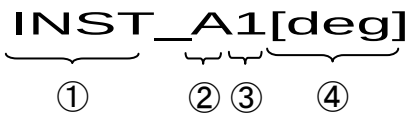
Header of the saved data

* File ID: 6310-04 (waveform data)



①	1 ~ 128 : sampling sequence
②	129 ~ 256 : ditto (① + 128)

* File ID: 6310-05 (vector data)



①	INST	:	Instantaneous value
	AVG	:	Average value
	MAX	:	Max value
	MIN	:	Min value
②	V	:	Voltage of each phase
	A	:	Current of each phase
③	CH number	:	1 ~ 4
④	Unit		

* when [deg] is displayed at space ④, it means phase angle

File format and name

Measurement data is saved in CSV format, and the file name is assigned automatically.

File name : 04 – CF 001 . csv
① ② ③ ④

①	Measuring item	04 : Measured waveform data
		05 : Measured vector data
②	Save in	CF : CF card ME : Internal memory
③	File number	001 ~ 999
④	Saving format	CSV

9.4 Ranges and Over-range indications

9.4.1 Ranges

Ranges and decimal points for the measuring items will be automatically adjusted depending on the Range selected. For further details, refer to "**6.5.1 Ranges**" in this manual.

9.4.2 Over-range / Bar indication

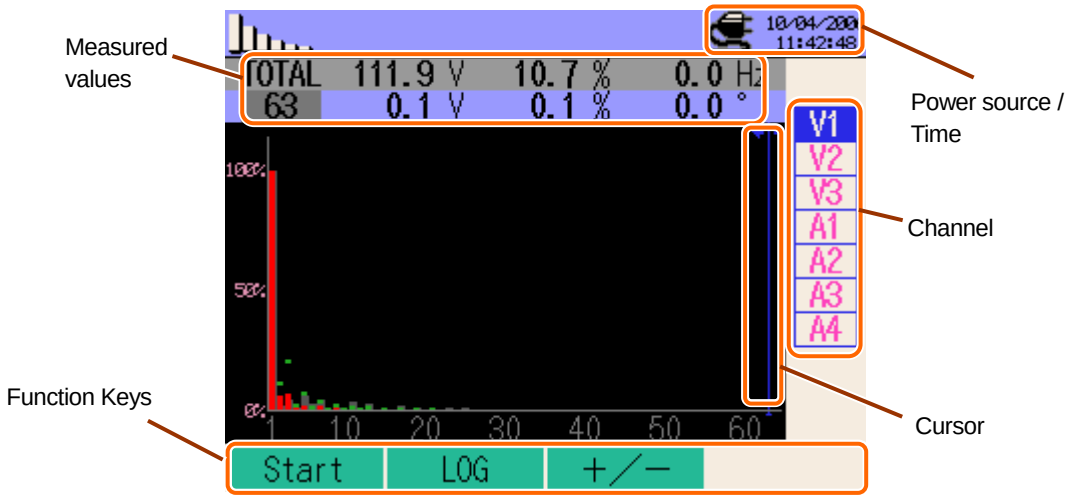
Refer to "**6.4.2 Over-range / Bar indication Limitations**" in this manual.

10. Harmonic Analysis

10.1 Indications on LCD

10.1.1 Display Screen

Press the Key to view bar graph for harmonics.

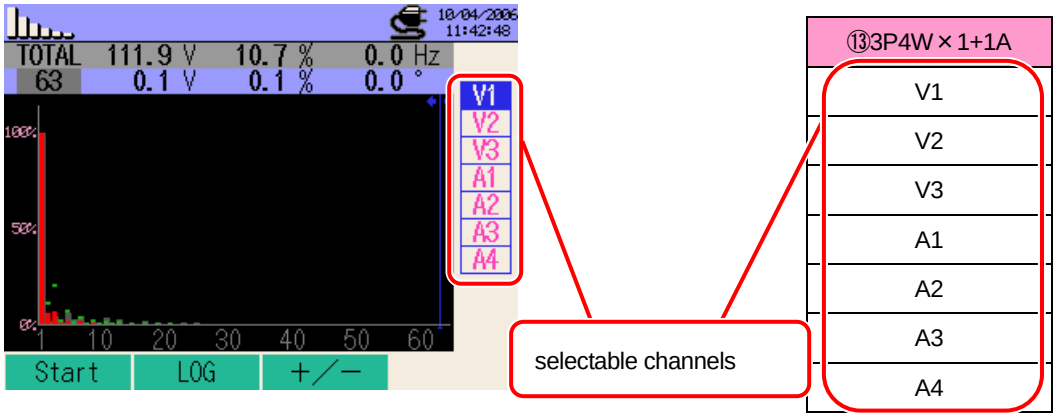


① Measured value					
TOTAL	sum	V/A	RMS at each Ch	%	THD at each Ch

② Measured value (values of each order pointed by cursor)							
1 ~ 63	Harmonic order	V/A	RMS	%	Percentage of the fundamental wave (1st)	°	Phase angle

Displayed contents depend on the selected wiring configuration.

Right table indicates wiring configuration ⑬3P4W x 1A (Three-phase 4-Wire (1CH) + 1-current)

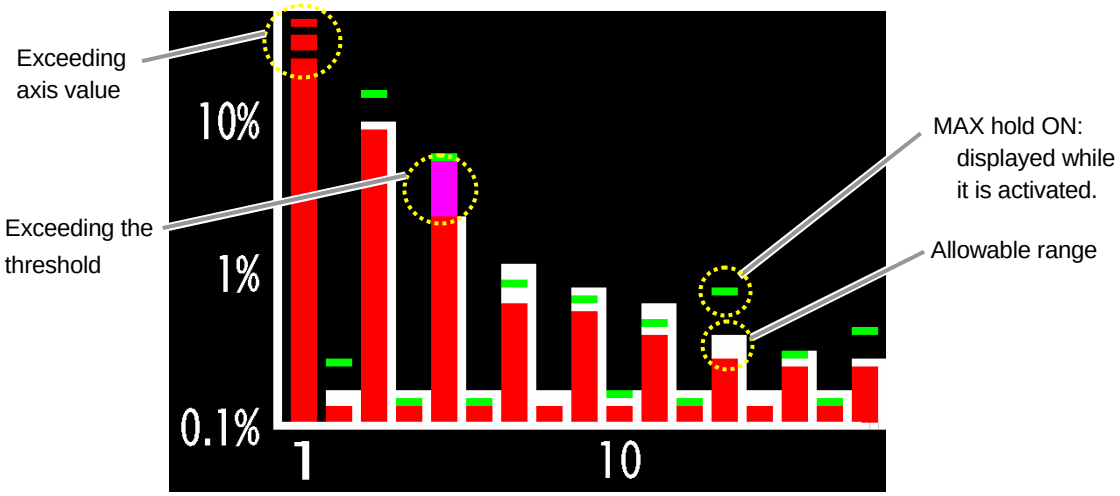


①1P2W x 1	②1P2W x 2	③1P2W x 3
V1	V1	V1
A1	A1	A1
	A2	A2
		A3

④1P2W x 4	⑤1P3W x 1 ⑧3P3W x 1	⑥1P3W x 2 ⑦1P3W x 1+2A ⑨3P3W x 2 ⑩3P3W x 1+2A
V1	V1	V1
A1	V2	V2
A2	A1	A1
A3	A2	A2
A4		A3
		A4

⑪3P3W3A ⑫3P4W x 1	⑬3P4W x 1+1A
V1	V1
V2	V2
V3	V3
A1	A1
A2	A2
A3	A3
	A4

Graph



Red bar graph	: present value
White bar graph	: preset allowable range (refer to clause **4.2.2** for further details)
Green mark	: max recorded value during a measurement, displayed while MAX HOLD function is activated. Refer to clause **4.2.2** for further details about MAX HOLD function.

* Max value will be reset when;
- pressing the ESC Key at least 2 sec,
- switching channels with ▲▼ Cursor Keys. (except when saving data), or
- starting data saving.

10.1.2 Switching displays

Switching channels

Press the Cursor Keys to switch channels.

Press the Cursor to switch values per order.

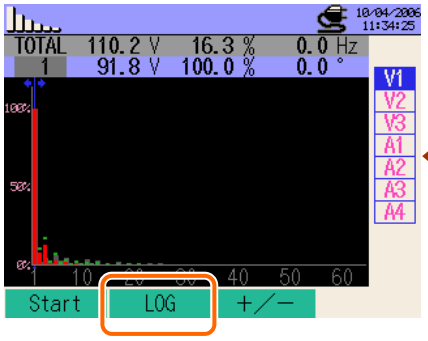
10.1.3 Logarithm display

Logarithm and +/- displays can be switched over according to following procedures.

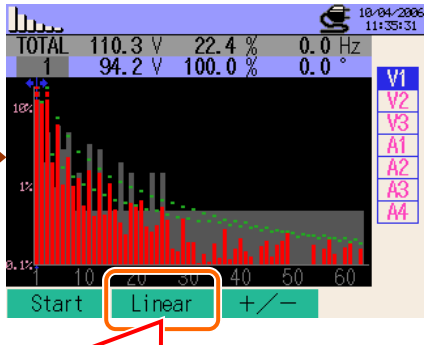
Logarithm display

1 Press the F2 Key.
Linear display with ticks of 0% to 100% and Logarithm display with ticks of 0.1% to 10% are switchable on vertical axis.

Linear display



Logarithm display

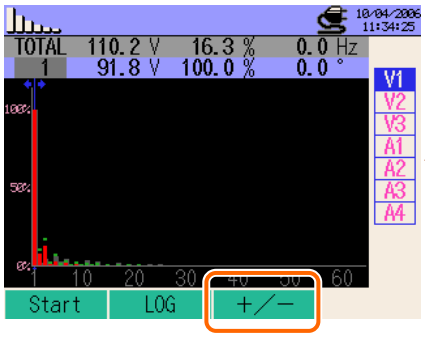


Press the F2 Key again to return to Linear display.

+/- display

1 Press the F3 Key.
Absolute value display with ticks of 0% to 100% and "+/-" display with ticks of -100% to 100% are switchable on vertical axis.

Logarithm display



+ / - display

Press the F3 Key again to return to Absolute value display.

10.2 Measuring Procedure

Steps for measurement

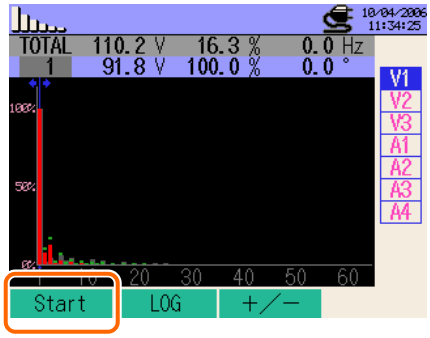
Ensuring your safety	See **"Safety Warnings"**.
↓	
Getting started	See **"Section 3 Getting started"**.
↓	
Settings	See **"Section 4 Setting"**.
↓	
Wiring	See **"Section 5 Wiring Configuration"**.
↓	
Harmonic analysis	See this section

Basic Setting	Measurement Setting	Save Setting
Wiring configuration	Interval	Recording method
V Range	THD calculation	Recording start
VT Ratio	Allowable range	Recording termination
Clamp (manual / auto)	MAX HOLD	Destination to save data
A Range	Save item	Destination to save screenshot
CT Ratio		
Filter		
DC V		
Frequency		

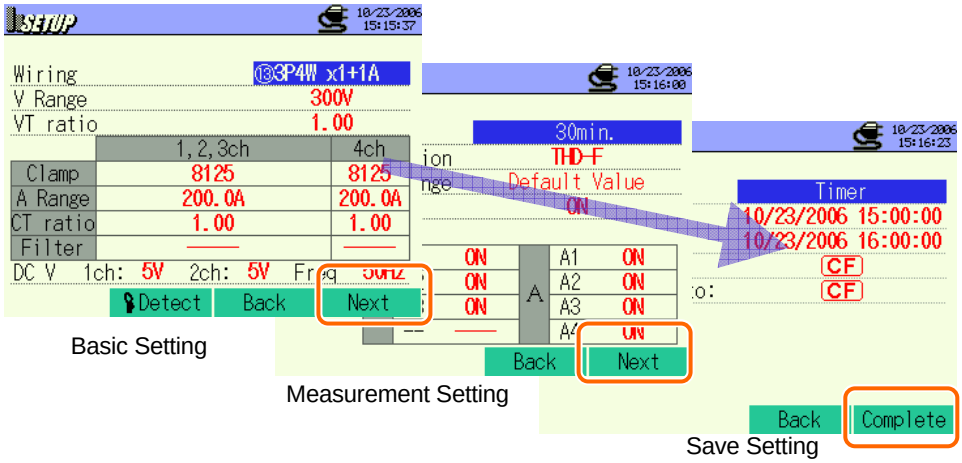
10.3 Data Saving

10.3.1 Saving Procedure

1 Press the F1 Key first.



2 Press the F4 Key to check Basic, Measurement and Save Settings.

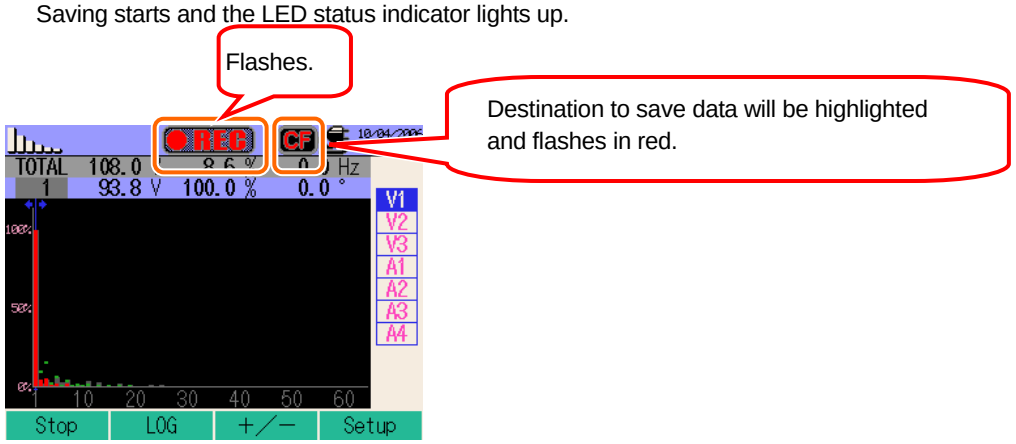


* Pressing down the F1 Key for 2 sec or more skips step 2 and start data saving.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.

3 Manually start saving data, or stand-by screen (WAIT) appears if saving start date and time has been specified.

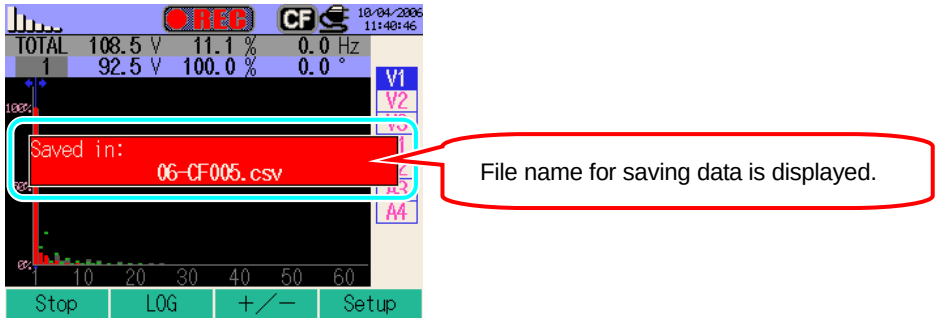
4 Saving starts and the LED status indicator lights up.



No setting change can be made during data saving . Press the F4 Key to check the settings. The channels with “OFF” setting aren’t displayed.

5 Press the F1 Key to stop measurement. . (At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off.



10.3.2 Limitations of saving

Refer to "**6.3.2 Limitations of saving**" in this manual.

10.3.3 Saving data

Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID number
WIRING	:	Wiring configuration
VOLT RANGE	:	Voltage Range
VT RATIO	:	VT ratio
SENSOR TYPE	:	Model name of Clamp sensor
CURRENT RANGE	:	Current Range
CT RATIO	:	CT ratio
FREQUENCY	:	Frequency
INTERVAL	:	Interval
START	:	Saving start time

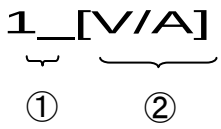
Save data

File ID : 6310-06							
Saved time & date		Elapsed time	Channel	RMS	Total THD	Inst at each order	
DATE	TIME	ELAPSED TIME	CH	TOTAL	THD	1_[V/A] ~ 63_[V/A]	1_[deg] ~ 63_[deg]
yyyy/mm/dd	h:mm:ss	h:mm:ss	Vi / Ai	(±)x.xxxxE±nn			
year/month/ date	hour:min:sec	hour:min:sec	V / A	(±) value x $10^{±n}$			

* e.g. of measured data

$$1.234E+5 = 1.234 \times 10^{5}$$
$$= 123400$$

Header of the saved data



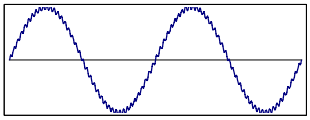
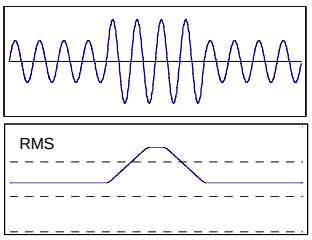
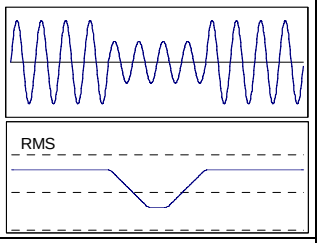
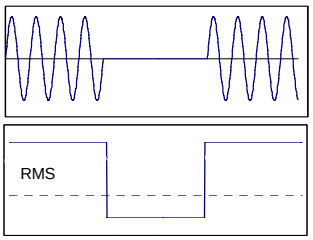
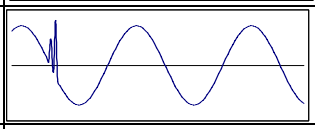
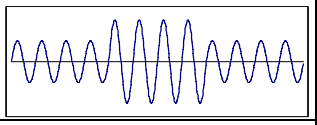
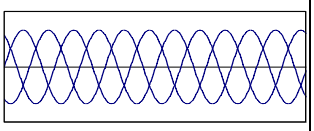
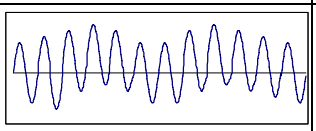
①	1 ~ 63	:	Order
②	V/A	:	Voltage / Current
	deg	:	Phase angle

File format and name

File Name : 06 – CF 001 . csv
① ② ③ ④

①	Measuring item	06 : Harmonic Analysis
②	Save in	CF : CF card ME : Internal memory
③	File number	001 ~ 999
④	Saving format	CSV

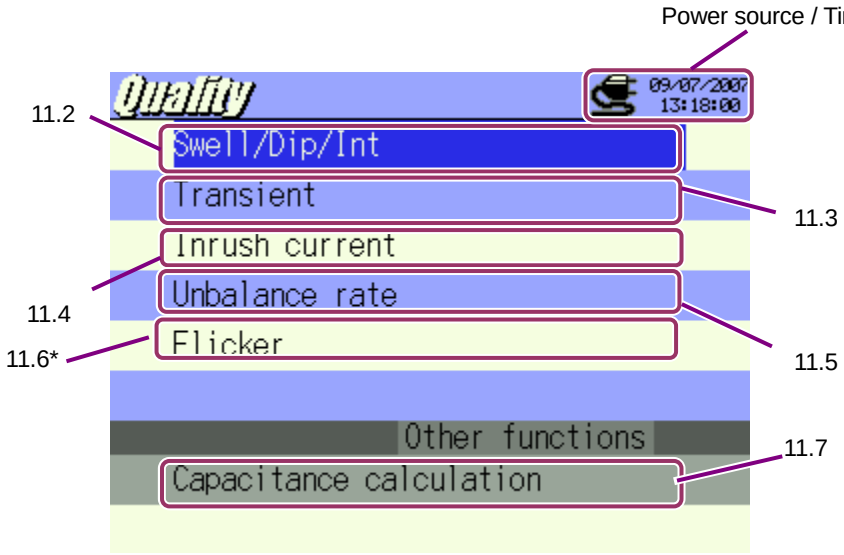
11. Power Quality

Power Quality	Waveform	Symptoms	Adverse effects
Harmonic		Inverter and thyristor circuits (phase-control circuit) are used for the control circuit of general devices; these circuits affect currents and causes harmonics.	Burnout of capacitors and reactors, buzzes from transformers, malfunction of circuit beakers, flicker in screen or noises on stereos due to currents with harmonic components.
Swell		Inrush currents occur when switches for power lines are on, and then voltages increase instantaneously.	Shutdown of devices or robots or reset on PC and business machines may be caused.
Dip		Inrush currents occur when motor loads are activated, and dip in current occurs.	
Int		Power supply is interrupted for a second due to lightning strikes.	
Transient, Over-voltage (impulse)		Contact failure at a circuit breaker, magnet or relay.	Damage to a power source or reset of the device may occur due to a drastic voltage fluctuation (spike).
Inrush current		Instantaneous large currents (surge) flow on devices with a motor, incandescent lamp and flat capacitor when powering them on.	Influences on welded contacts for Power switch, blowing fuse, trip on breaker, rectifier circuit and fluctuations in power supply voltage may occur.
Unbalance rate		Heavy loading on specific phase due to fluctuations in load of power line or drastic extension of installations. Distortions of voltage / current waveforms, dip and negative sequence voltages are caused.	Influences on voltage, current, motor operation occur; negative sequence voltage and harmonics occur.
Flicker*		Too much load is caused on certain phases due to increase and decrease of the loads connected to each phase such as supply lines or heavy use of specific equipments, as a result, Distortions on voltage and current waveforms, dip and reversed voltages are observed.	Unbalanced or reversed voltages and harmonics occur and result in motor unstability, trip of 3E circuit breaker or heating due to overload.

* Flicker measurement function is only available with ver.2.00 or later.

11.1 Display Screen

Press the QUALITY Key to view List display.

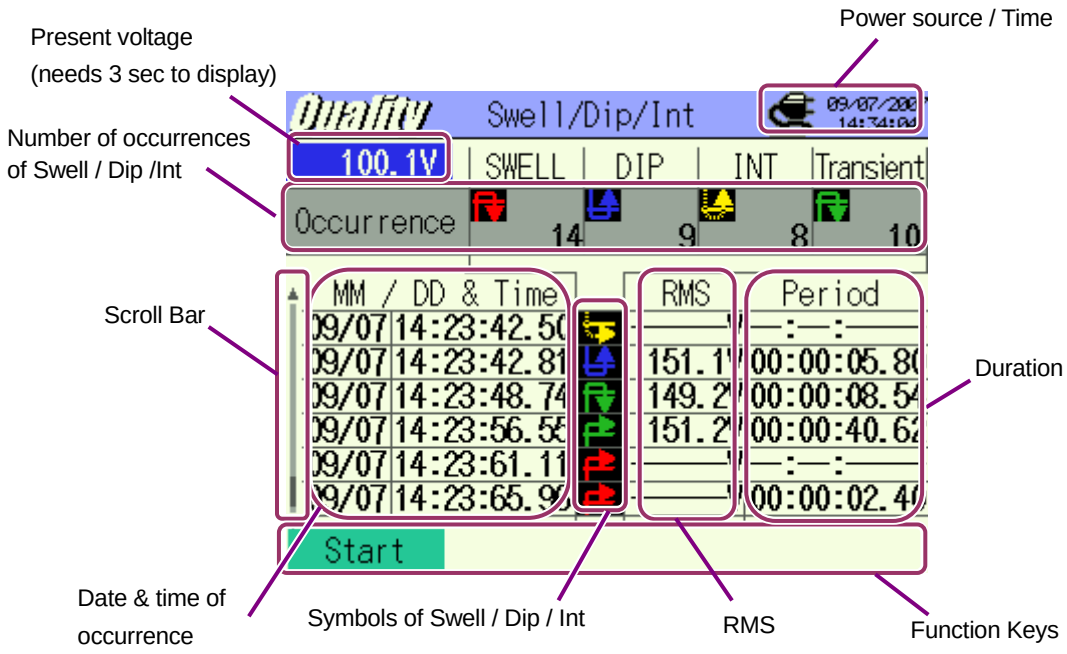


* Flicker measurement function is only available with ver.2.00 or later.

Press the ▲▼ Cursor Keys and select any parameters, and then press the ENTER Key to display each measurement screen. Pressing the ESC Key returns to list display.

11. 2 Swell / Dip / Int measurement

11.2.1 Display Screen



* At Swell measurement, max RMS (voltages in duration period) is displayed and at Dip & Int measurements, min RMS is displayed respectively.

Scroll Bar

Scroll bar is associated with the ▲▼ Cursor Keys.

Symbols displayed on the LCD

	Start to End	Start	End
Swell			
Dip			
Int			
Transient*			

* Function available with ver2.00 or later.

11.2.2 Measuring Procedure

Steps for measurement

Ensuring your safety	See **"Safety Warnings"**.
↓	
Getting started	See **"Section 3 Getting started"**.
↓	
Settings	See **"Section 4 Setting"**.
↓	
Wiring	See **"Section 5 Wiring Configuration"**.
↓	
Swell/ Dip/ Int measurement	See this section

* At Swell/ Dip/ Int measurements, measured values will be displayed as recording starts.

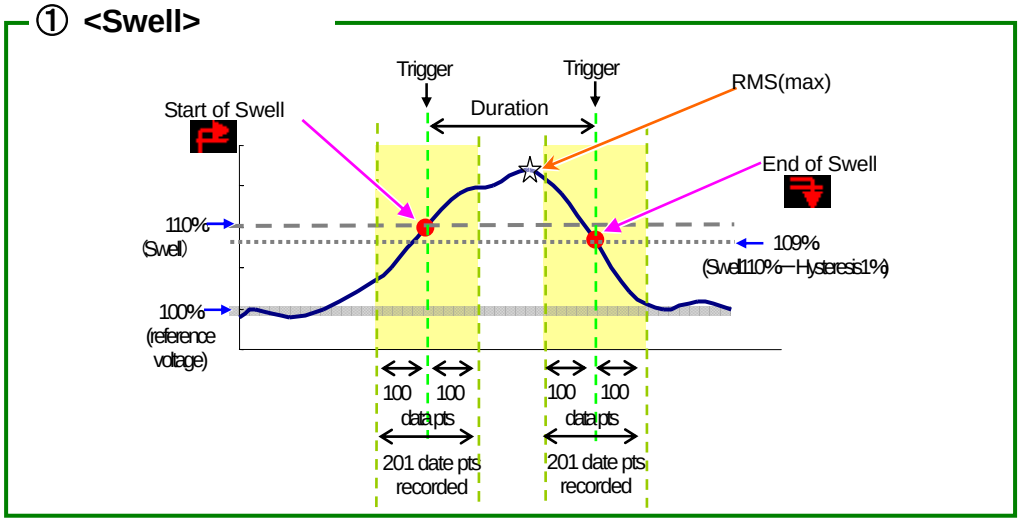
Measurement Setting	Save Setting
Interval*	Recording method
Reference voltage	Recording start
Transient*	Recording termination
Swell	Destination to save data
Dip	Destination to save screenshot
Short-interruption (Int)	
Hysteresis	
Trigger point	

* Function available with ver2.00 or later.

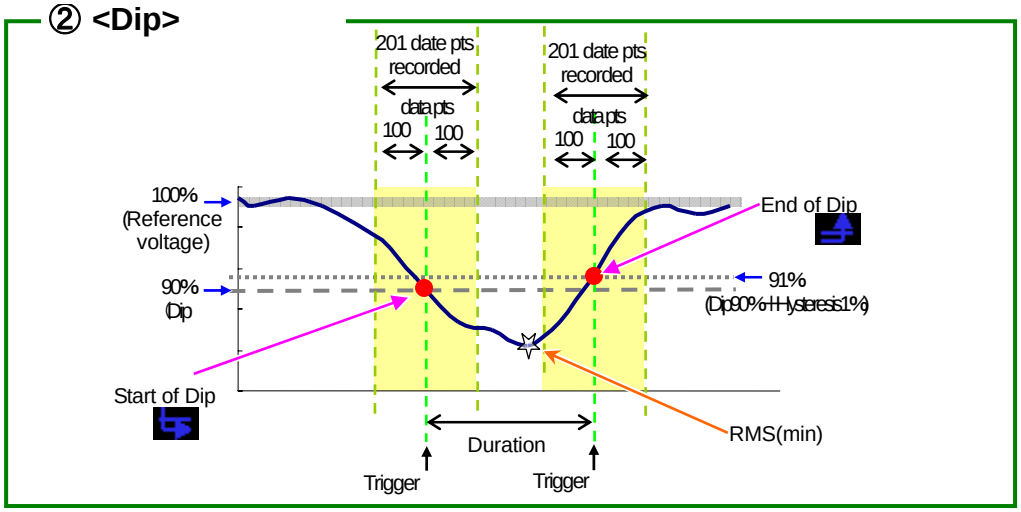
Timing of data recording

＜Recording at event occurrence＞

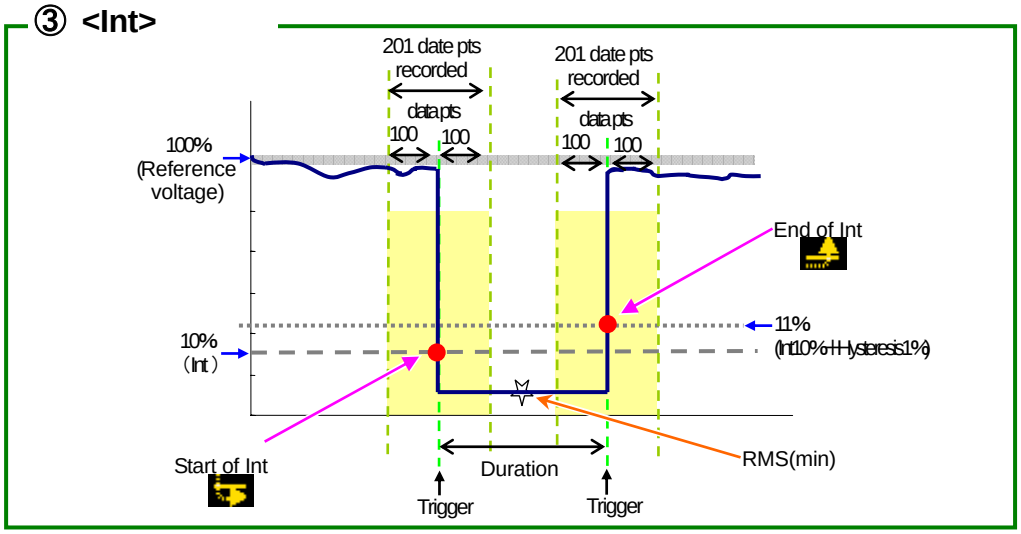
① <Swell>



② <Dip>

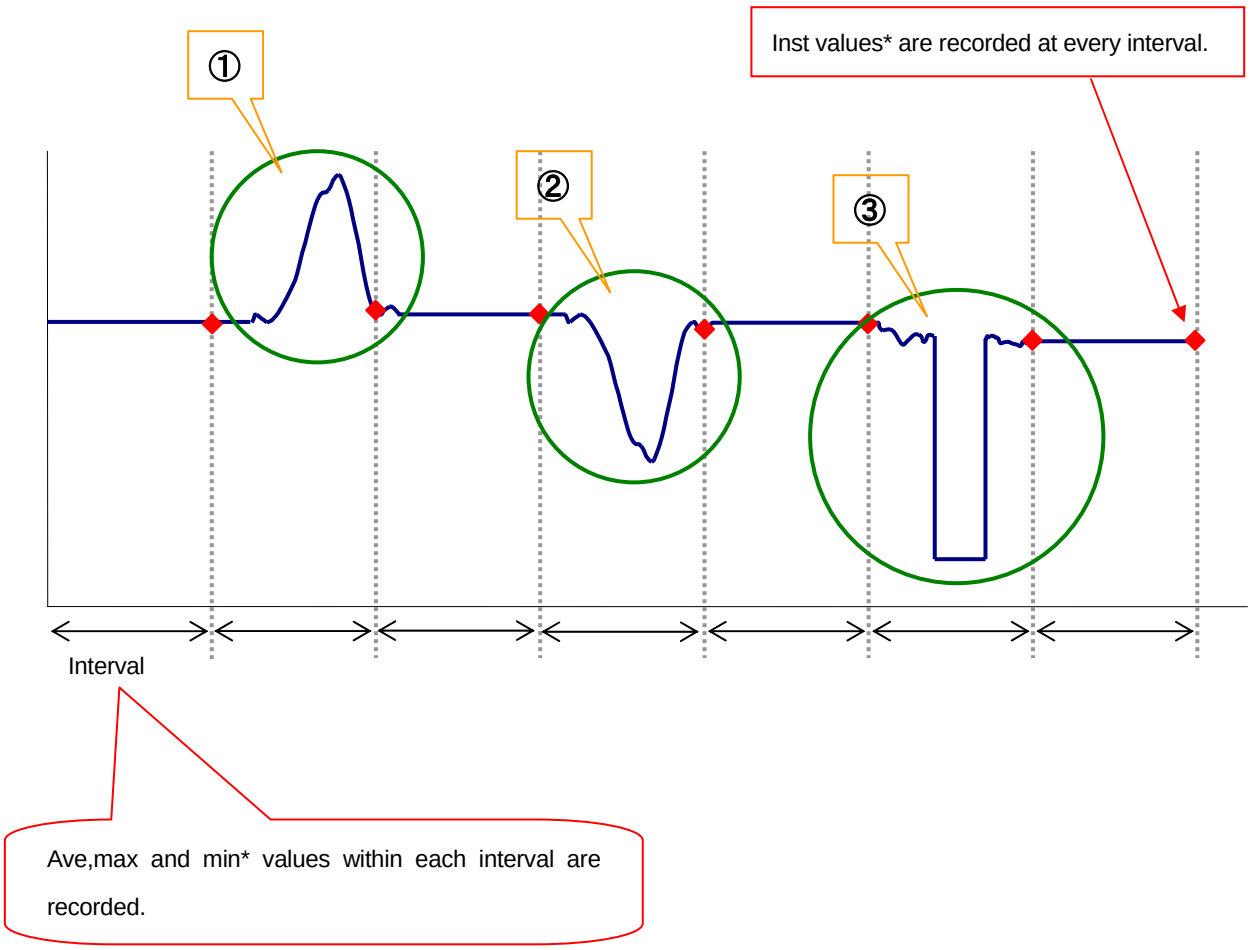


③ <Int>



＜Recording at every interval＞

.* Function available with ver2.00 or later.



※Inst value : Avg of 100 data (@50Hz) obtained in the preset inst interval of 1 sec (RMS)

Avg value : Avg of rms values obatained in the preset inst interval

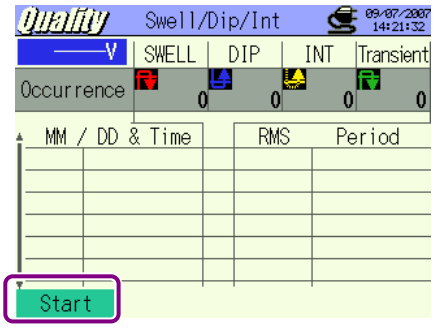
Max value : Max rms values obtained in the preset inst interval

Min value : Min rms values obtained in the preset inst interval

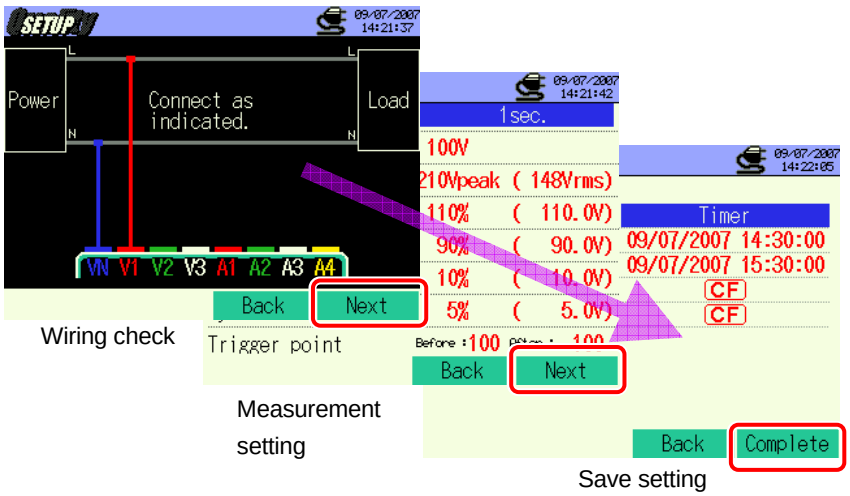
11.2.3 Data Saving

Saving procedure

1 Press the F1 Key first.



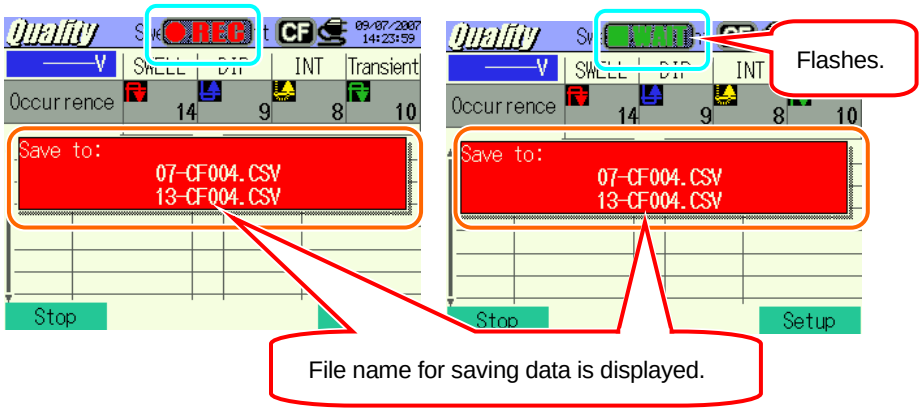
2 Press the F4 Key to check Wiring, Measurement and Save Settings.



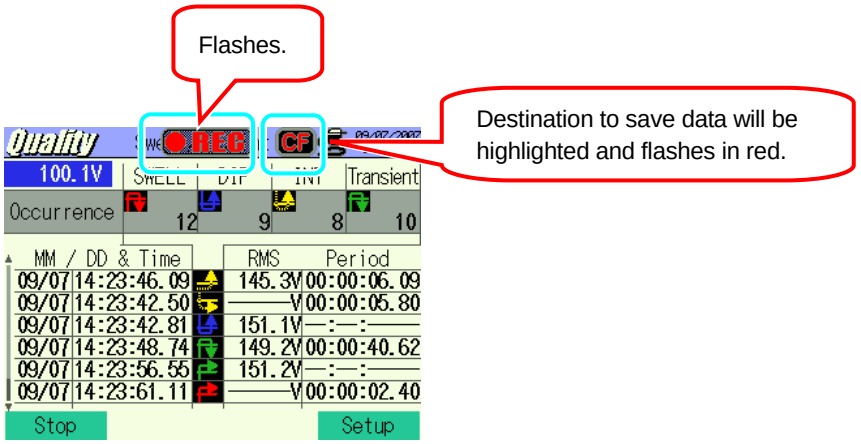
* Pressing down the F1 Key for 2 sec or more skips step 2 and start data saving.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.
Terminals to be used in these measurements are VN and V1 only.

3 Manually start saving data, or stand-by screen (WAIT) appears if saving start date and time has been specified.



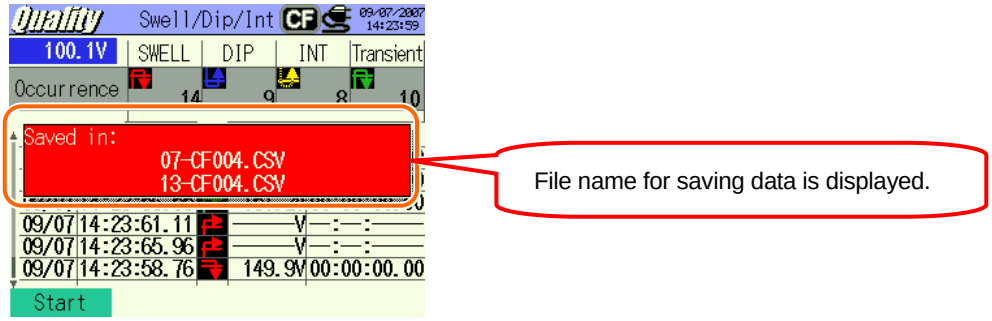
4 Saving starts and the LED status indicator lights up.



No setting change can be made during data saving. Press the F4 Key to check the settings.

5 Press the F1 Key to stop measurement. (At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off.



11.2.4 Limitations of saving

Refer to "**6.3.2 Limitations of saving**" in this manual.

11.2.5 Saving data

Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID Number
FREQUENCY	:	Frequency
REFERENCE VOLTAGE	:	Reference Voltage
SWELL	:	Threshold value for SWELL (%)
DIP	:	Threshold value for DIP(%)
INT	:	Threshold value for INT(%)
HYSTERESIS	:	Hysteresis (%)
TRIGGER POINT	:	Trigger point
START	:	Save start time

Save data

File ID : 6310-07							
Saved time & date		Item			Start / End		
DATE	TIME	ITEM*			I/O		
yyyy/mm/dd	h:mm:ss	SWELL	DIP	INT	1	0	1/0
Year/Month/Day	Hour:Min:sec	Swell	Dip	Int	START	END	START to END

Duration		Max / Min		Data
DURATION		MAX/MIN		201 data pts
--:--:--.--	h:mm:ss.ss	Swell	Dip/Int	(±)x.xxxxE±nn
Start	End	Max	Min	* (±) value x $10^{\pm n}$

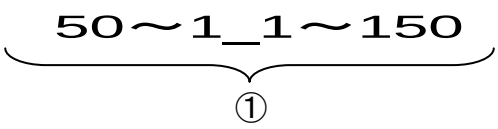
* END is recorded when a power supply is interrupted and START is recorded when power is restored.

* e.g. of measured data 1.234E+5 = 1.234×10^{5}
= 123400

File ID : 6310-013*						
Saved time & date		Elapsed time	Instantaneous	Average	Max	Min
DATE	TIME	ELAPSED TIME	INST	AVG	MAX	MIN
yyyy/mm/dd	h:mm:ss	h:mm:ss	(±)x.xxxE±nn			
Year/Month/Date	Hour:Min:Sec	Hour:Min:Sec	(±) value x $10^{\pm n}$			

* Function available with ver2.00 or later.

Header of the saved data



When Trigger point has been set to Past : 50 and Next : 150:

①	201 data pts in total : Data No.

File format and name

File Name : 07 — CF 001 . csv

① ② ③ ④

①	Measuring item	07 : Swell / Dip / Int Measurement
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

File Name : 13 — CF 001 . csv

① ② ③ ④

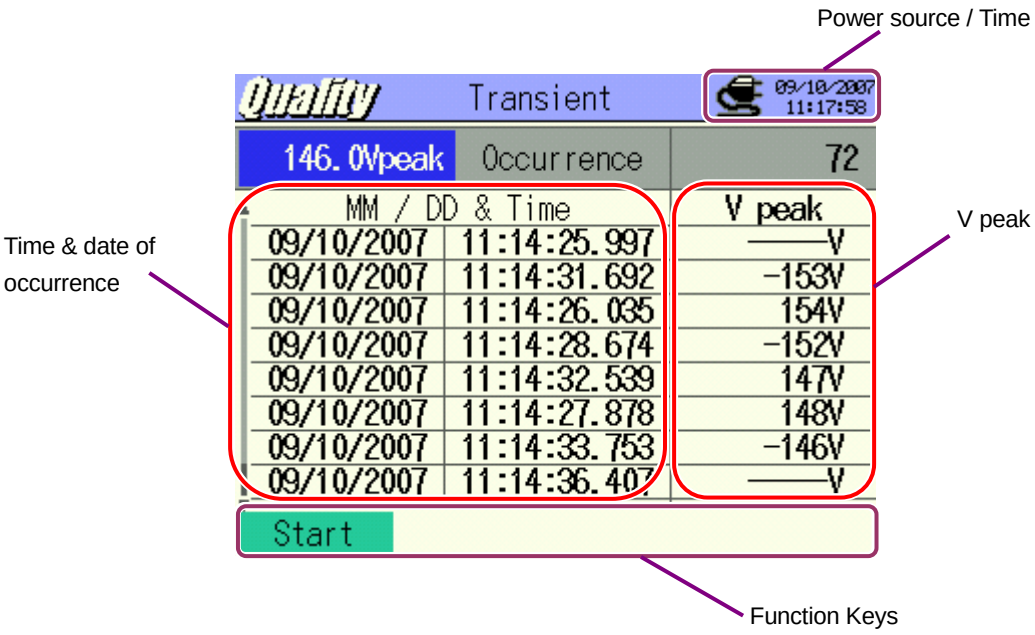
①	Measuring item	13 : Voltage Interval data
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

* File Name: 13-CF001.CSV is used when saving data on ver2.00 or later.

11.3 Transient measurement

11.3.1 Display Screen

Select “Transient” and press the ENTER Key to view Transient Measurement screen.



11.3.2 Measuring Procedure

Steps for measurement

Ensuring your safety	See **"Safety Warnings"**.
↓	
Getting started	See **"Section 3 Getting started"**.
↓	
Settings	See **"Section 4 Setting"**.
↓	
Wiring	See **"Section 5 Wiring Configuration"**.
↓	
Transient measurement	See this section

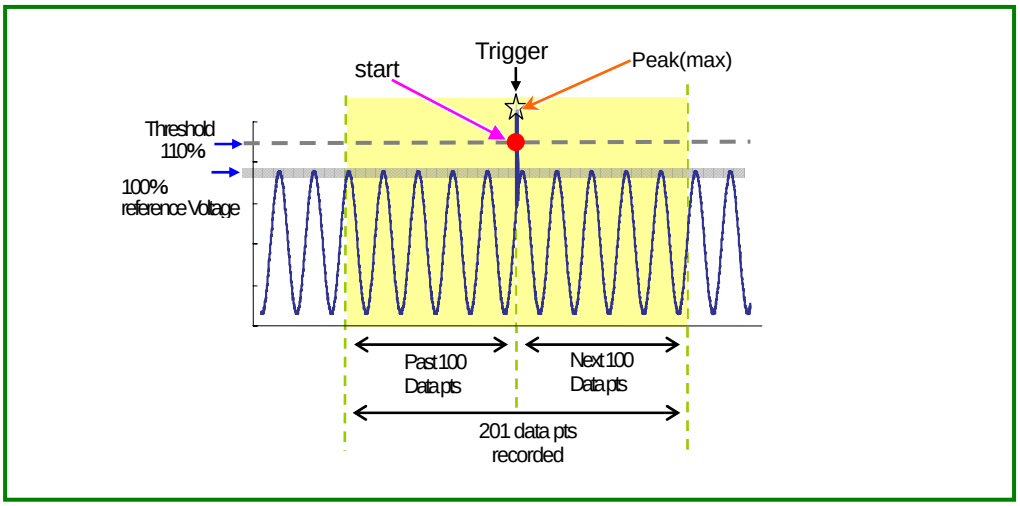
* At Transient measurements, measured values are displayed when recording starts.

Measurement Setting	Save Setting
Interval*	Recording method
V Range	Recording start
Threshold	Recording termination
Hysteresis	Destination to save data
Trigger Point	

* Flicker measurement function is only available with ver.2.00 or later.

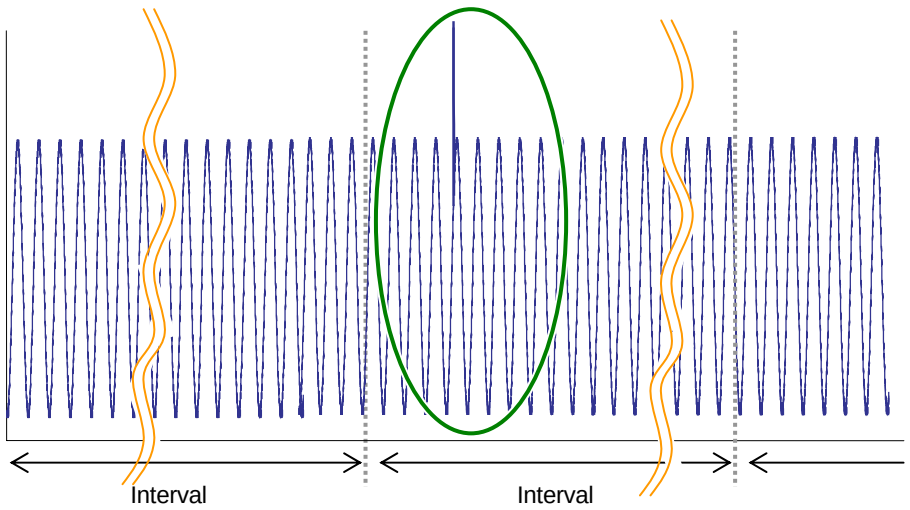
Timing of data recording

＜Recording at event occurrence＞



＜Recording at every interval＞

* Function available with ver2.00 or later.



Avg,max and min* values within each interval are recorded.

※Inst value : max value of 10,000 data obtained by sampling at 100us 1sec before the preset interval comes

Avg value : Avg of inst values obtained in the preset inst interval

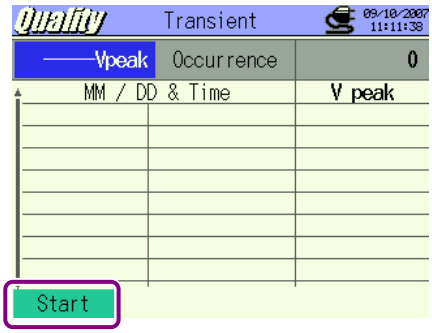
Max value : Max inst values obtained in the preset inst interval

Min value : Min inst values obtained in the preset inst interval

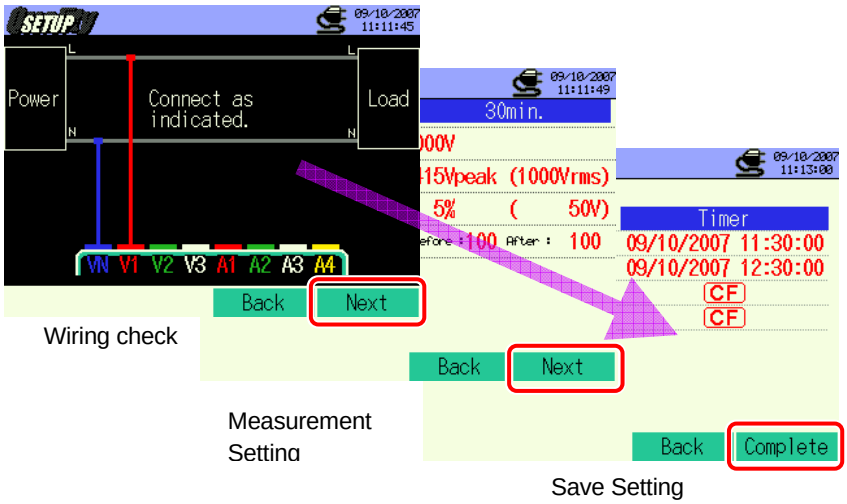
11.3.3 Data Saving

Saving Procedure

1 Press the F1 Key first.



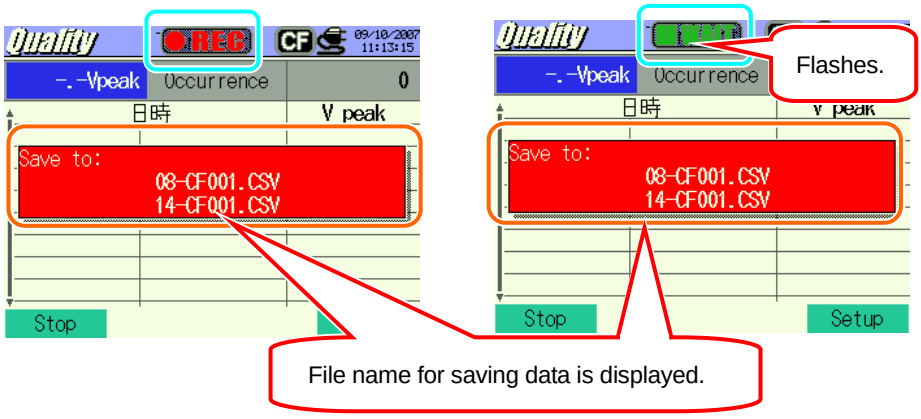
2 Press the F4 Key to check Wiring, Measurement and Save Settings.



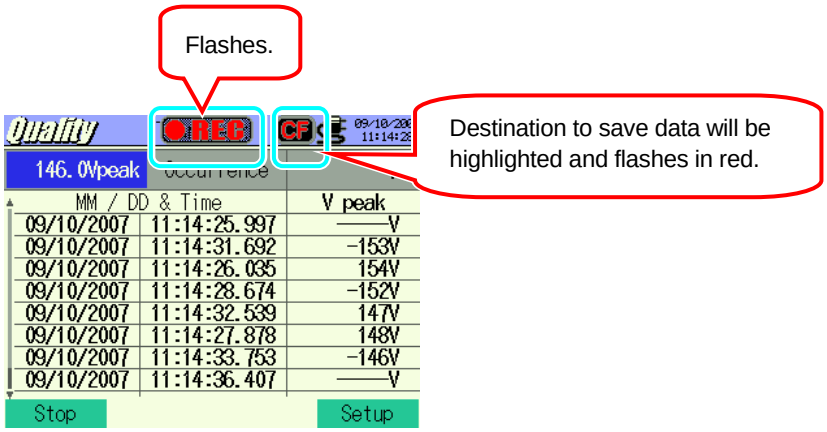
* Pressing down the F1 Key for 2 sec or more skips step 2 and start data saving.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual. Terminals to be used in these measurements are VN and V1 only.

3 Manually start saving data, or stand-by screen (WAIT) appears if saving start date and time has been specified.



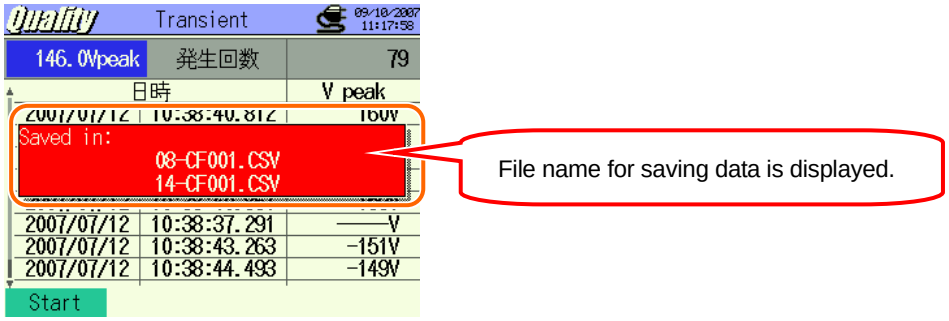
4 Saving starts and the LED status indicator lights up.



No setting change can be made during data saving. Press the F4 Key to check the settings.

5 Press the F1 Key to stop measurement. (At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off.



11.3.4 Limitations of saving

Refer to "**6.3.2 Limitations of saving**" in this manual.

11.3.5 Saving data

Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID number
VOLT RANGE	:	Voltage Range
FEQUENCY	:	Frequency
TRANSIENT	:	Threshold for Transient
HYSTERESIS	:	Hysteresis
TRIGGER POINT	:	Trigger point
START	:	Save start time

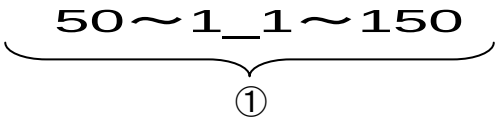
Save data

File ID : 6310-08			
Saved time & date		Max value	Data
DATE	TIME	MAX	201 data pts
yyyy/mm/dd	h:mm:ss	(±)x.xxxxE±nn	
Year/Month/Day	Hour:Minute:second	Max value (Peak)	(±) value x $10^{\pm n}$

File ID : 6310-014*						
Saved time & date		Elapsed time	Instantaneous	Average	Max	Min
DATE	TIME	ELAPSED TIME	INST	AVG	MAX	MIN
yyyy/mm/dd	h:mm:ss	h:mm:ss	(±)x.xxxE±nn			
Year/Month/Date	Hour:Min:Sec	Hour:Min:Sec	(±)value x $10^{\pm n}$			

* Function available with ver2.00 or later.

Header of the saved data



When Trigger point has been set to Past : 50 and Next : 150:

①	201 data pts in total : Data No.

File format and name

File format is CSV format and file names are assigned automatically.

File Name : 08 — CF 001 . csv
① ② ③ ④

①	Measuring item	08 : Transient measurement
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

File Name : 14 — CF 001 . csv
① ② ③ ④

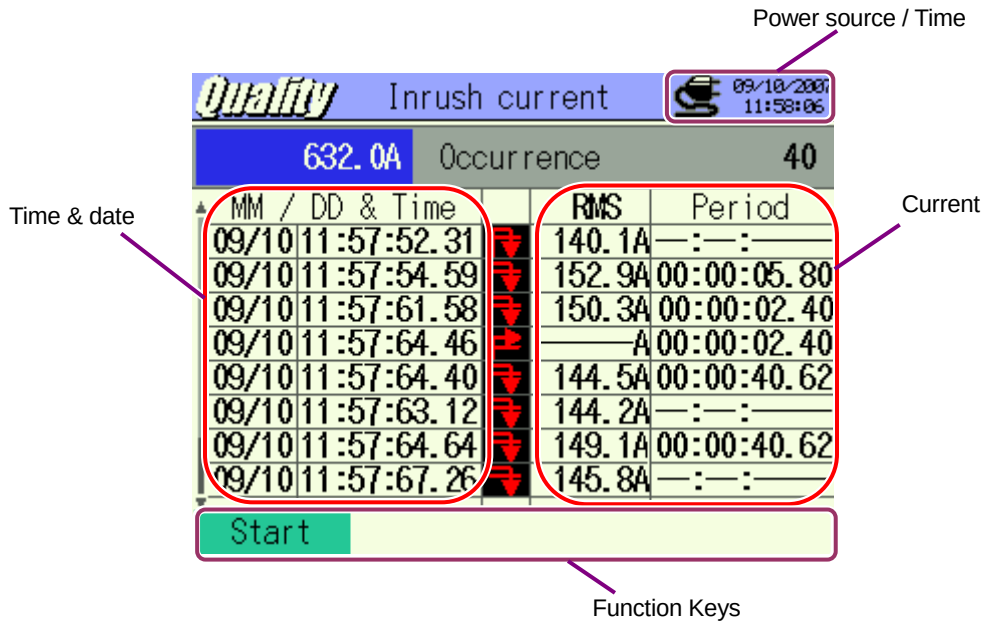
①	Measuring item	14 : Voltage Interval data
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

* File Name: 14-CF001.CSV is used when saving data on ver2.00 or later.

11.4 Inrush Current Measurement

11.4.1 Display Screen

Select “Inrush current” and press the ENTER Key to view Inrush measurement screen.



Symbols displayed on the LCD		
Start to End	Start	End
		

11.4.2 Measuring Procedure

Steps for measurement

Ensuring your safety	See **"Safety Warnings"**.
↓	
Getting started	See **"Section 3 Getting started"**.
↓	
Settings	See **"Section 4 Setting"**.
↓	
Wiring	See **"Section 5 Wiring Configuration"**.
↓	
Inrush current measurement	See this section

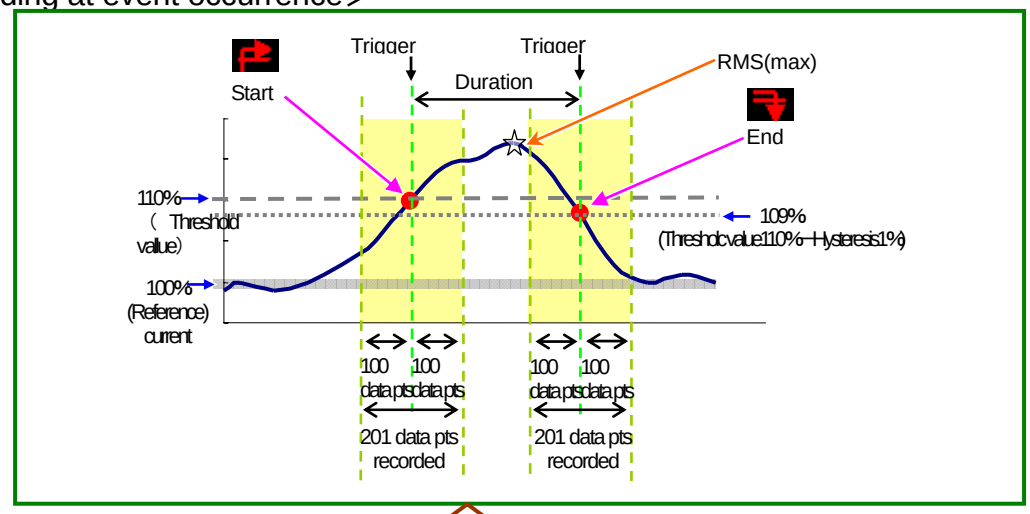
* Readings are displayed right after the inrush current measurement starts.

Measurement Setting	Save Setting
Interval*	Recording method
Clamp	Recording start
A Range	Recording termination
Reference current	Destination to save data
Filter	
Threshold	
Hysteresis	
Trigger point	

* Function available with ver2.00 or later.

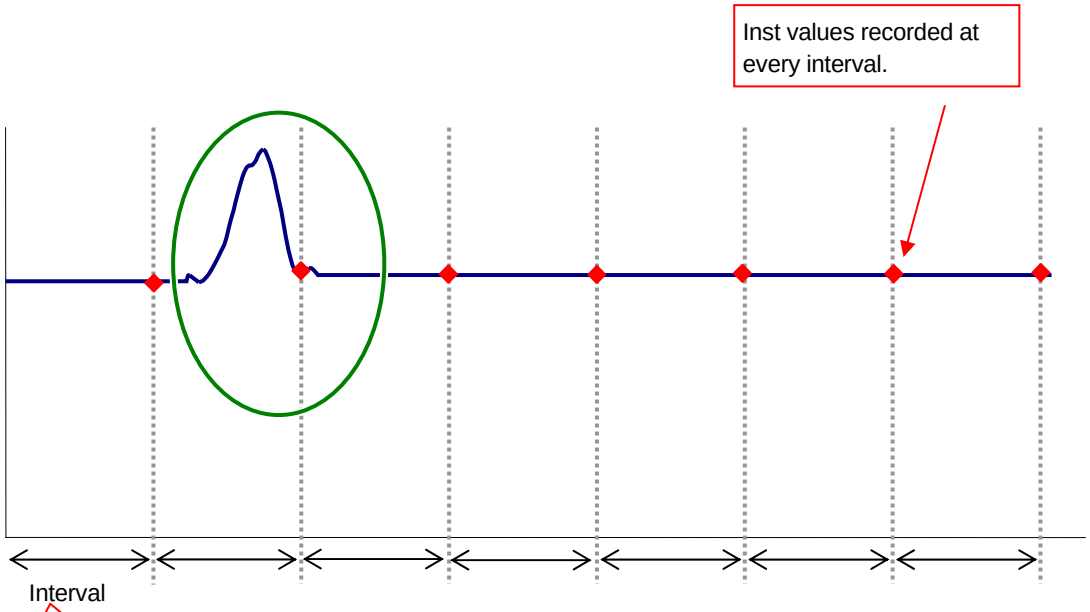
Timing of data recording

＜Recording at event occurrence＞



＜Recording at every interval＞

* Function available with ver2.00 or later.



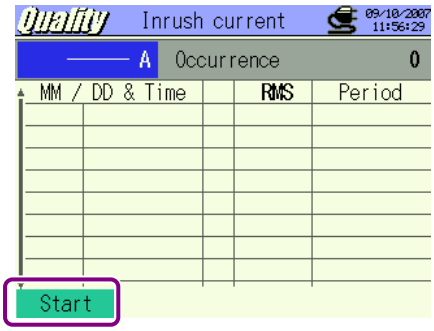
Ave,max and min values within each interval are recording.

※Inst value : Avg of 100 data (@50Hz) obtained in the preset inst interval of 1sec(RMS)
Avg value : Avg of rms values obtained in the preset inst interval
Max value : Max rms values obtained in the preset inst interval
Min value : Min rms values obtained in the preset inst interval.

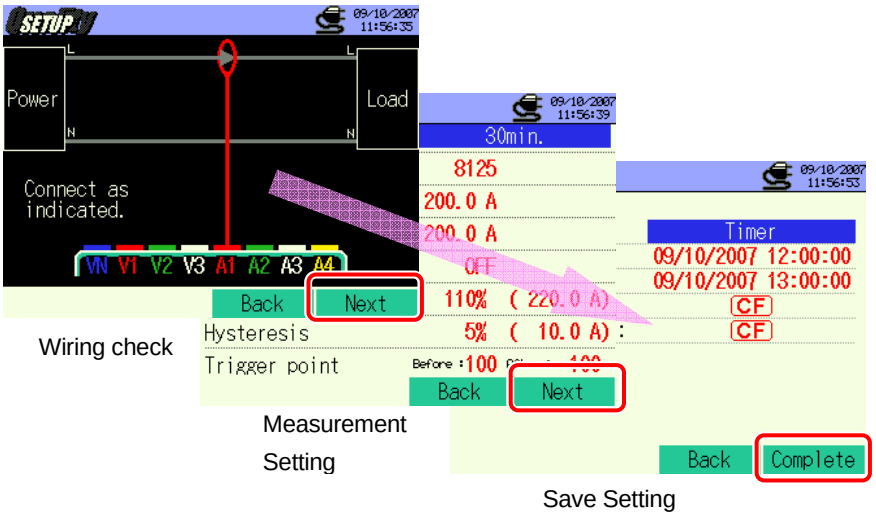
11.4.3 Data Saving

Saving Procedure

1 Press the F1 Key first.



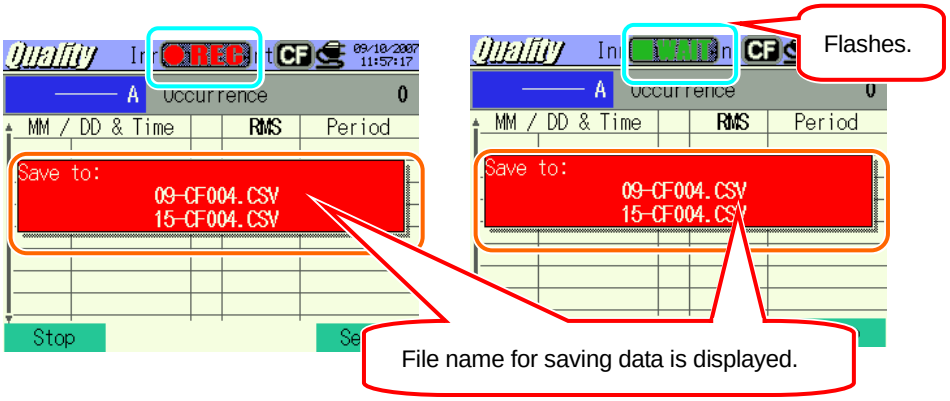
2 Press the F4 Key to check Wiring, Measurement and Save Settings.



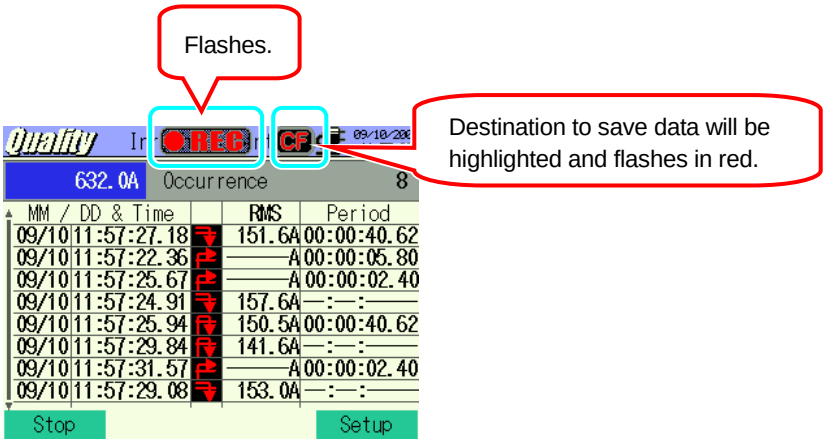
* Pressing down the F1 Key for 2 sec or more skips step 2 and start data saving.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.
Terminal to be used in this measurement is A1 only.

3 Manually start saving data, or stand-by screen (WAIT) appears if saving start date and time has been specified.



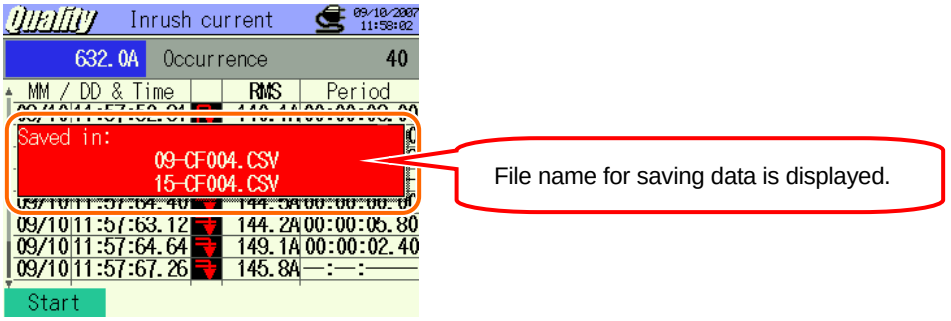
4 Saving starts and the LED status indicator lights up.



No setting change can be made during data saving. Press the F4 Key to check the settings.

5 Press the F1 Key to stop measurement. (At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off.



11.4.4 Limitations of saving

Refer to "**6.3.2 Limitations of saving**" in this manual.

11.4.5 Saving data

Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID number
SENSOR TYPE	:	Model name of Clamp sensor
CURRENT RANGE	:	Current Range
CURRENT FILTER	:	Current Filter
FREQUENCY	:	Frequency
REFERENCE CURRENT	:	Reference current
INRUSH CURRENT	:	Threshold for Inrush current
HYSTERESIS	:	Hysteresis
TRIGGER POINT	:	Trigger point
START	:	Saving start time

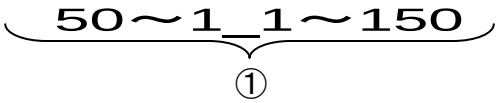
Save data

File ID : 6310-09								
Saved time & date		Start / End			Duration		Max / Min	Data
DATE	TIME	I/O			DURATION		MAX/MIN	201 data pts
yyyy/mm/dd	h:mm:ss	1	0	1/0	--:--:--.--	h:mm:ss.ss	(±)x.xxxxE±nn	
Year/Month/Day	Hour:Min:sec	START	END	START to END	Start	End	Max / Min	(±) value x $10^{±n}$

File ID : 6310-015*						
Saved time & date		Elapsed time	Instantaneous	Average	Max	Min
DATE	TIME	ELAPSED TIME	INST	AVG	MAX	MIN
yyyy/mm/dd	h:mm:ss	h:mm:ss	(±)x.xxxE±nn			
Year/Month/Date	Hour:Min:Sec	Hour:Min:Sec	(±)value x $10^{±n}$			

* File ID: 6310-15 is used when saving data on ver2.00 or later.

Header of the saved data



When Trigger point has been set to Past : 50 and Next : 150:

①	201 data pts in total	:	Data No.

File format and name

File format is CSV format and file names are assigned automatically.

File Name : 09 — CF 001 . csv
① ② ③ ④

①	Measuring item	09 : Inrush current
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

File Name : 15 — CF 001 . csv
① ② ③ ④

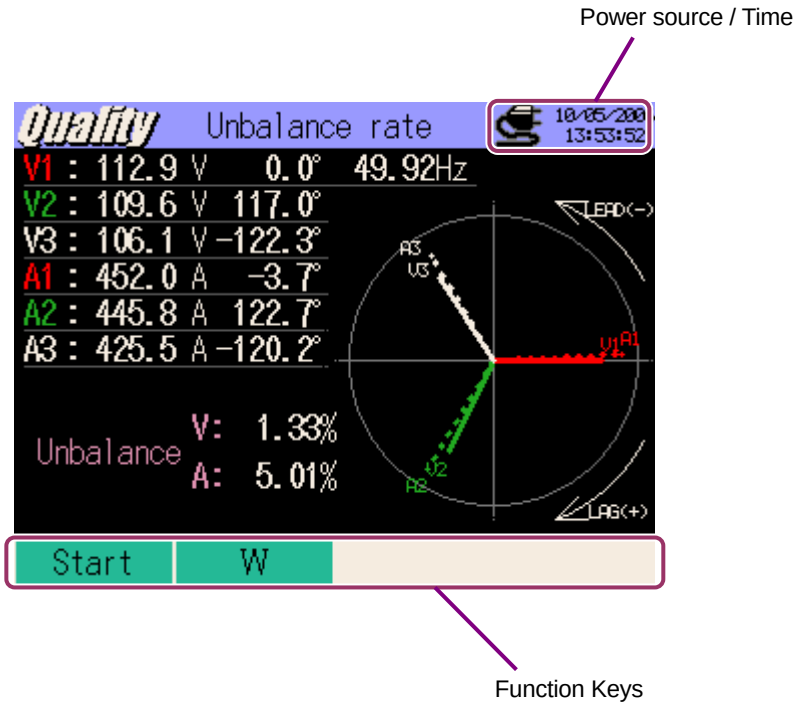
①	Measuring item	15 : Current Interval data
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

* File ID: 6310-15 is used when saving data on ver2.00 or later.

11.5 Unbalance rate measurement

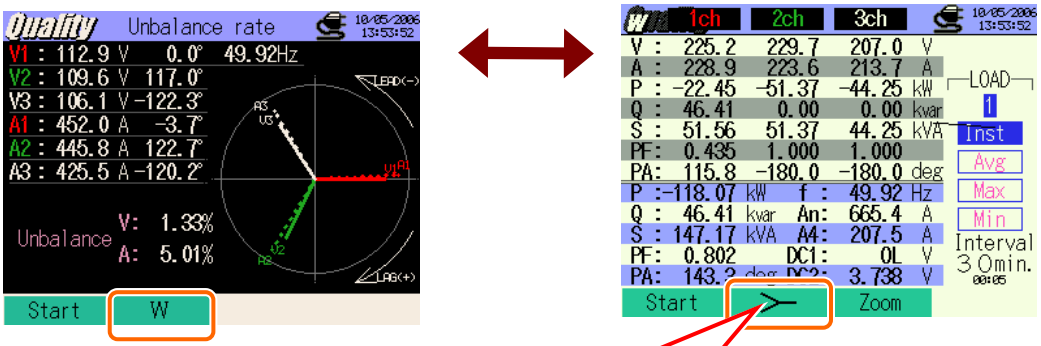
11.5.1 Display Screen

Select “Unbalance Rate”, and press the ENTER Key to view Unbalance rate measurement screen.



Switching screens

1 Press the F2 Key.



11.5.2 Measuring Procedure

Steps for measurement

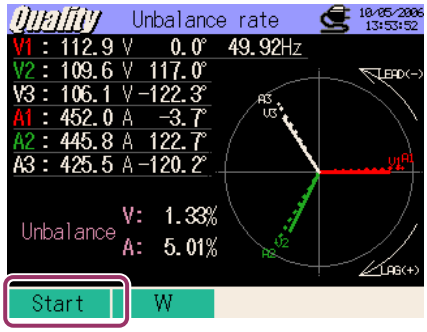
Ensuring your safety	See **"Safety Warnings"**.
↓	
Getting started	See **"Section 3 Getting started"**.
↓	
Settings	See **"Section 4 Setting"**.
↓	
Wiring	See **"Section 5 Wiring Configuration"**. * measurements are possible at wiring configurations: ⑪, ⑫ and ⑬.
↓	
Unbalance rate	See this section

Basic Setting	Measurement Setting	Save Setting
Wiring configuration	Interval	Recording method
V Range	Output threshold	Recording start
VT Ratio		Recording termination
Clamp		Destination to save data
A Range		Destination to save screenshot
CT Ratio		
Filter		
DC V		
Frequency		

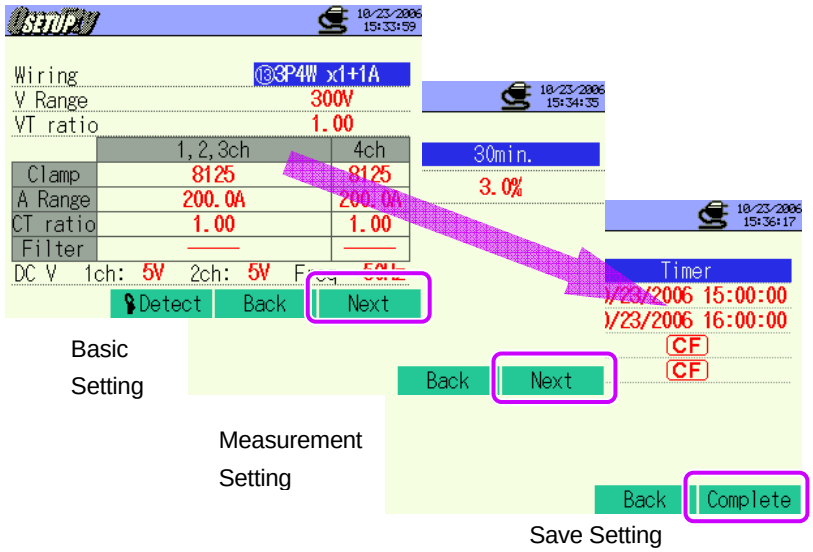
11.5.3 Data Saving

Saving Procedure

1 Press the F1 Key first.



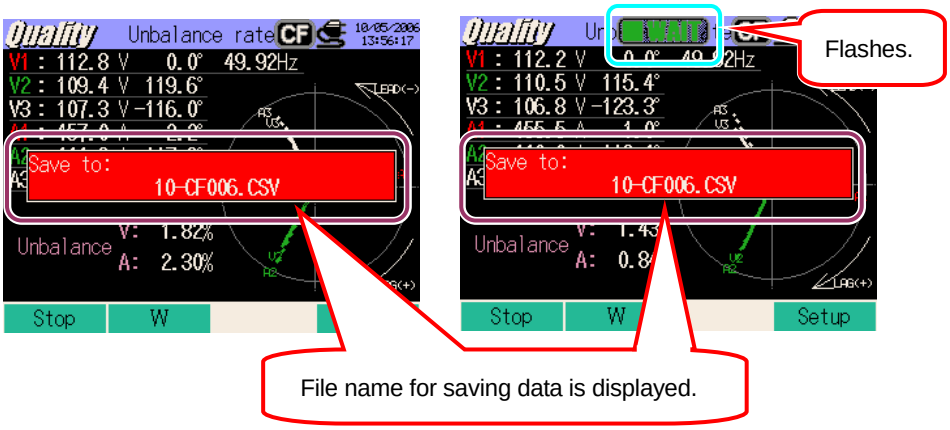
2 Press the F4 Key to check Basic, Measurement and Save Settings.



* Pressing down the F1 Key for 2 sec or more skips step 2 and start data save.

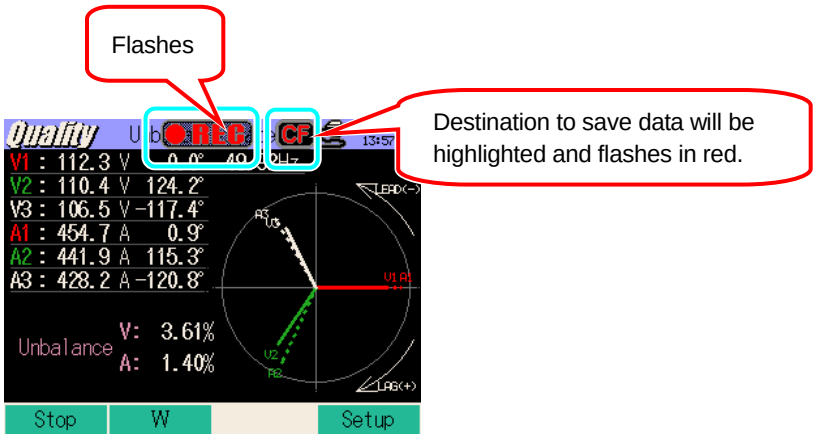
For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.

3 Manually start saving data, or stand-by screen (WAIT) appears if saving start date and time has been specified.



4 Saving starts and the LED status indicator lights up.

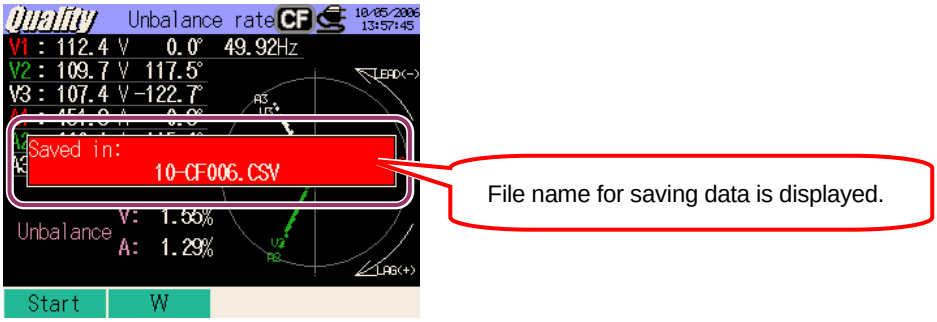
.



Settings cannot be done during a data saving. Press the F4 Key to check the settings.

5 Press the F1 Key to stop measurement.
(At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off.



11.5.4 Limitations of saving

Refer to "**6.3.2 Limitations of saving**" in this manual.

11.5.5 Saving data

Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID number
WIRING	:	Wiring Configuration
VOLT RANGE	:	Voltage Range
VT RATIO	:	VT Ratio
SENSOR TYPE	:	Model name of Clamp sensor
CURRENT RANGE	:	Current Range
CT RATIO	:	CT Ratio
CURRENT FILTER	:	Current Filter
DC RANGE	:	DC Range
FREQUENCY	:	Frequency
INTERVAL	:	Interval
START	:	Saving start time

Save data

File ID : 6310-10						
Saved time & date		Elapsed time	Instantaneous value	Average value	Max value	Min value
DATE	TIME	ELAPSED TIME	INST	AVG	MAX	MIN
yyyy/mm/dd	h:mm:ss	h:mm:ss	(±)xxxxE±nn			
Year/Month/Day	Hour:Min:sec	Hour:Min:sec	(±) value x $10^{\pm n}$			

Header of the saved data

AVG_A1[A]_1

① ②③ ④ ⑤

①	INST	:	Instantaneous value
	AVG	:	Average value
	MAX	:	Max value
	MIN	:	Min value
②	UV	:	Voltage unbalance rate
	UA	:	Current unbalance rate
	V	:	Voltage of each phase
	A	:	Current of each phase
	f	:	Frequency
	P	:	Active power
	Q	:	Reactive power
	S	:	Apparent power
	PF	:	Power factor
	PA	:	Phase angle
	DC	:	Analogue input voltage
③	CH number	:	* 1 ~ 4
④	Unit		
⑤	System		

* Saved data with no number at this space contaons the sum of the measured values

File format and name

File format is CSV format and file names are assigned automatically.

File Name : 10 — CF 001 . csv

① ② ③ ④

①	Measuring item	10 : Unbalance rate measurement
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

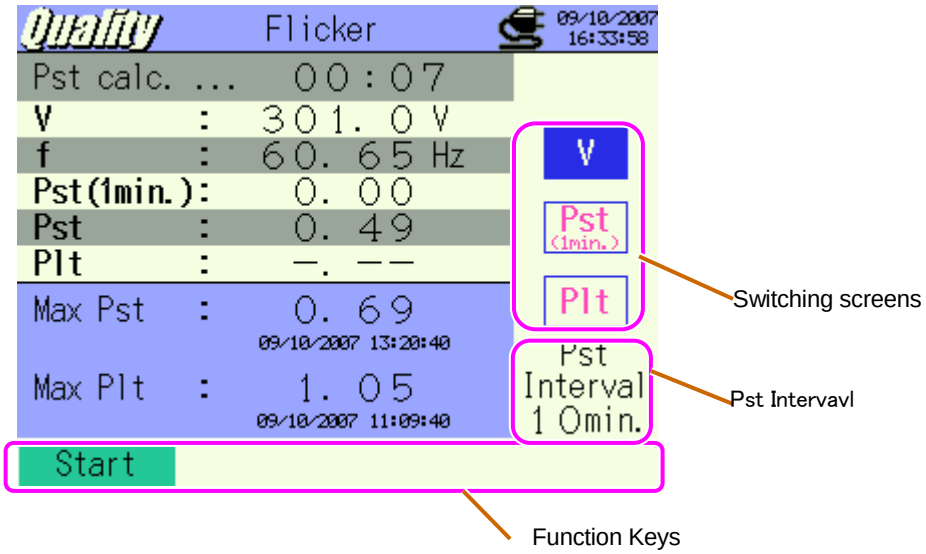
11.6 Flicker

* Flicker measurement function is only available with ver.2.00 or later.

An optional voltage sensor KEW8325F is required for Flicker measurements.

11.6.1 Display Screen

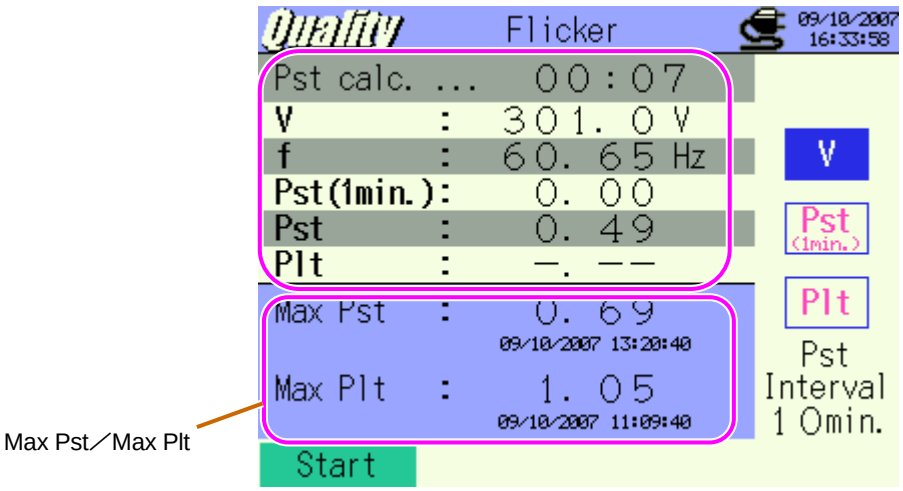
Select “Flicker”, and press the ENTER Key to view Flicker measurement screen.



Switching screens

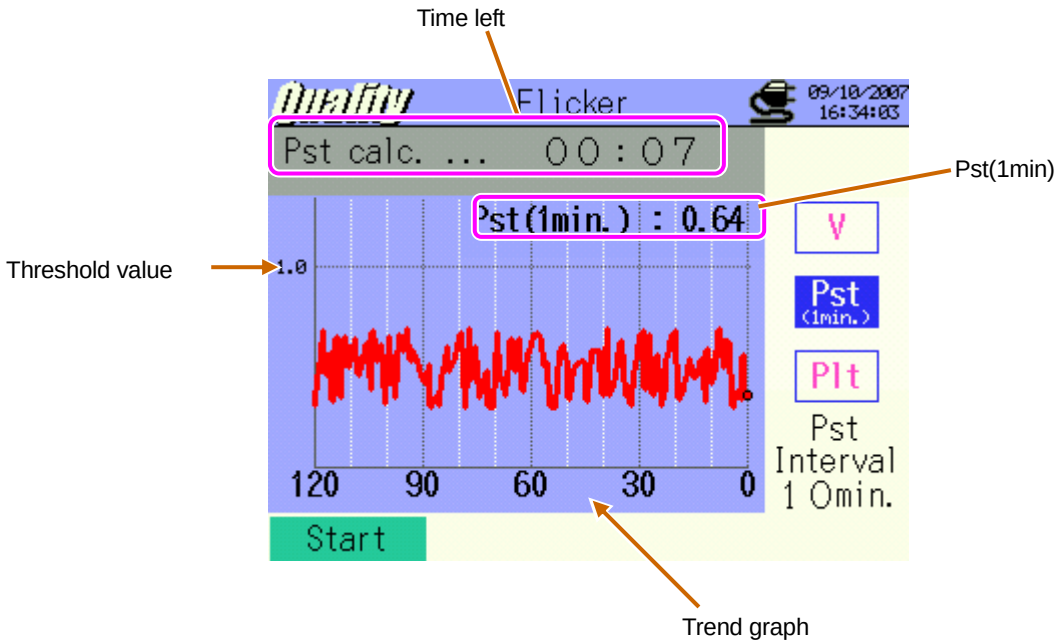
Press the ▲▼Cursor Keys to switch screens.

Measurement screen



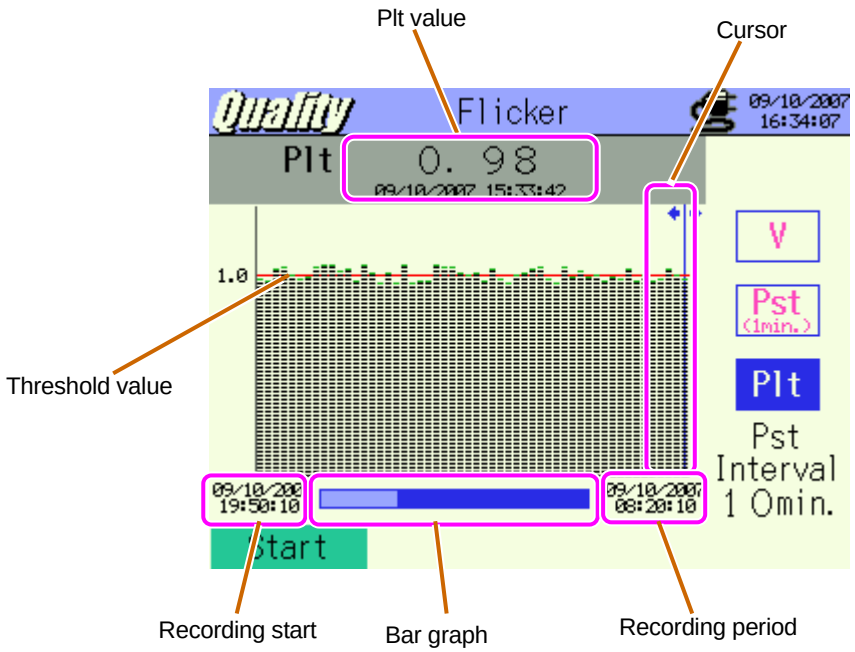
Displayed parameters	Details
Time left	Counted down until a Pst calculation completes.
V	Avg voltage in 1 sec.
f	Refreshed at every 1 min.
Pst(1min.)	Pst is displayed at every 1 min.It takes time to calculate Pst.The value displayed here before a calculation completes is just for reference.
Pst	Pst is calculated and displayed at every 10 min.
Plt	Calculated cased on the latest 12 Pst values.(data in 2 hours)
Max Pst	Max Pst(short time intensity) through a beginning to the end of measurement is displayed. It is refreshed every time when the max values is exceeded.
Max Plt	Max Plt(long time intensity) through a beginning to the end of measurement is displayed. It is refreshed every time when the max value is exceeded.

Measurement screen



Displayed parameters	Details
Pst(1min)	The latest Pst(1min.)
Trend graph	Change of the latest 120 data Pst(1min.) can be observed.

Measurement screen



A long press of ◀▮▮▶ Cursor Keys changes pages.

Displayed parameters	Details
Cursor	Press the Cursor Keys ◀▮▮▶ to move.
Plt value	Plt value with recorded date & time info at where the cursor locates.
Bar graph	White bar：percentage of whole pages.(including the hidden pages) Blue bar：percentage of the present displayed pages.
Recording start	Time and date when the 1st recording started Time info of the oldest data in recent 1500 data pts is displayed when number of data exceeds 1500.
Recording period	Time and date of the latest recorded data is displayed.

11.6.2 Measuring procedure

Steps for measurement

Ensuring your safety	See **“Safety Warnings”**.
↓	
Preparatin for measurement	See **“Section 3 Getting started”**.
↓	
Setting	See **“Section 4 Setting”**.
↓	
Wiring	See **“Section 5 Wiring Configuration”**.
↓	
Flicker	See this section.

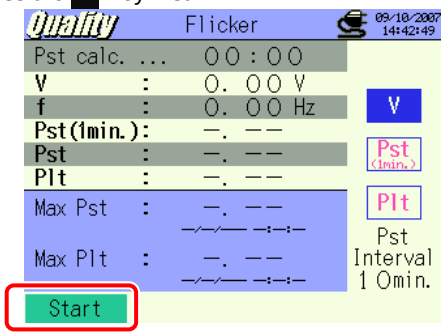
* Preliminary measurement (for 10 sec) will be done automatically prior to Flicker measurement.

Measurement Setting	Save Setting
V Range	Recording method
Filter	Recording start
Output item	Recording termination
Output Threshold	Destination to save data
	Destination to save screenshot

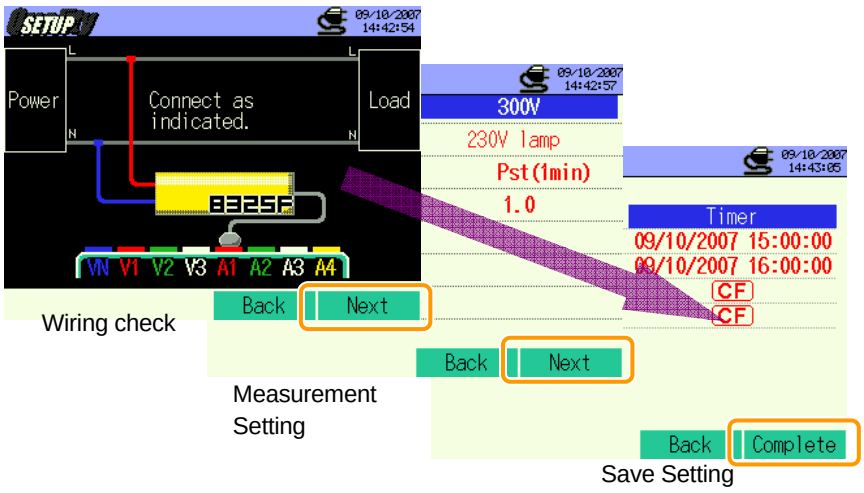
11.6.3 Date Saving

Saving procedure

1 Press the F1 Key first.



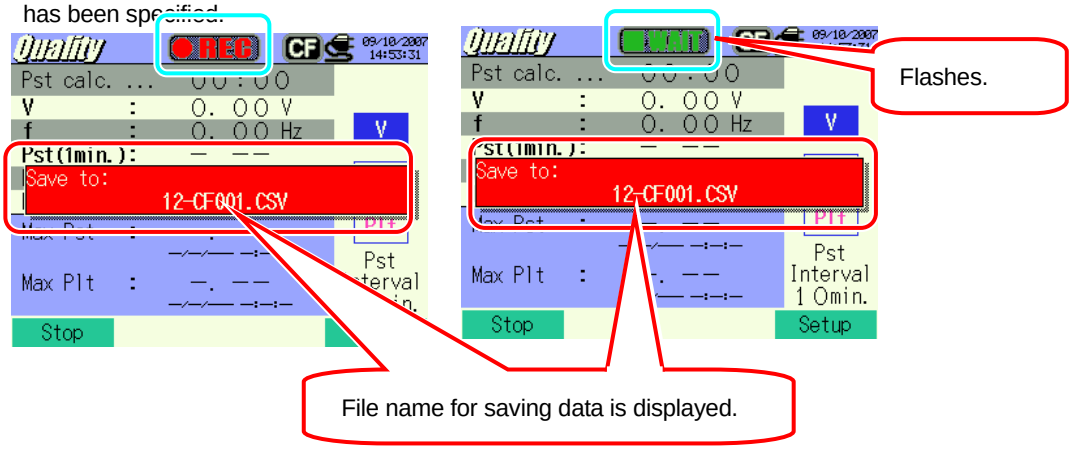
2 Press the F4 Key to check Wiring, Measurement and Save Settings.



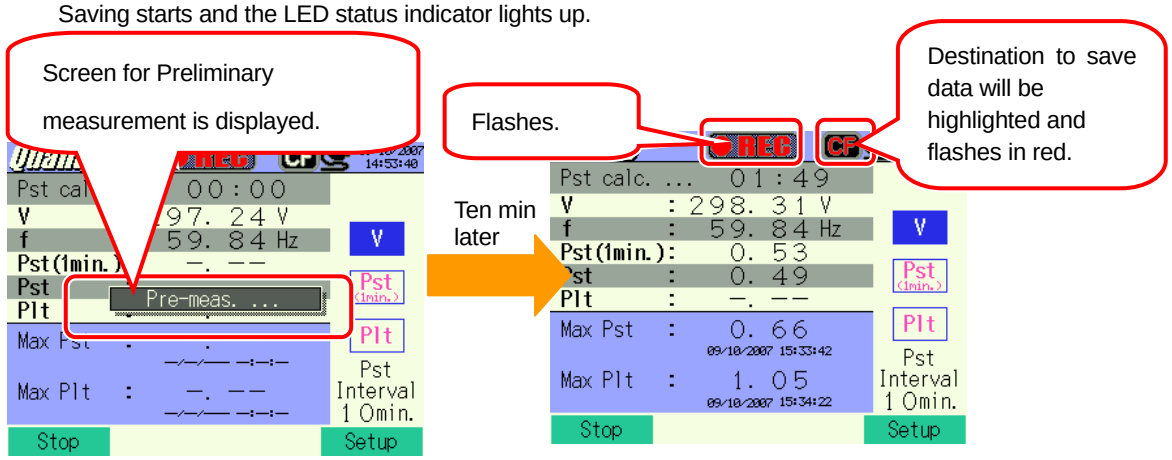
※Pressing down the F1 Key for 2 sec or more skips step 2 and start data saving.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.

3 Manually start saving data, or stand-by screen (WAIT) appears if saving start date and time has been specified.



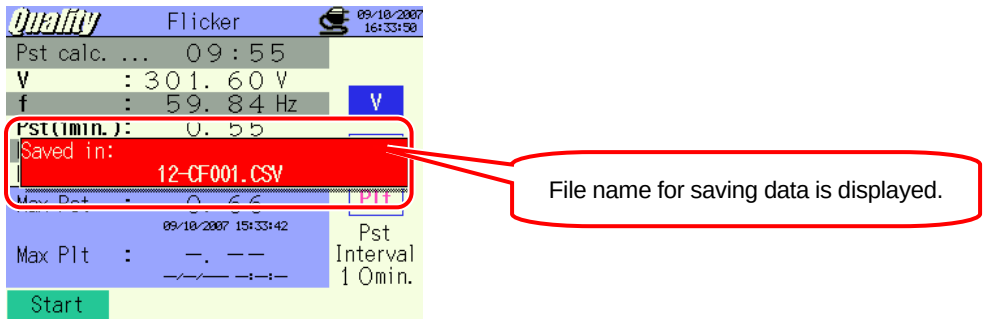
4 Saving starts and the LED status indicator lights up.



Setting cannot be done during a data saving. Press the F4 Key to check settings.
LCD will be automatically blank in 1min when Flicker measurements start.
Key operation confirmation sound is disabled during measurements.

5 Press the F1 Key to stop measurement.
(At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off



11.6.4 Limitations of saving

Refer to "6.3.2 Limitations of saving" in this manual.

11.6.5 Saving data

Settings

FILE ID	:	File name
VERSION	:	Version info
PLACE	:	Measuring place signal
VOLT RANGE	:	Voltage Range
FILTER	:	Filter
Pst_INTERVAL	:	Pst Interval
Pst_CAL_NUMBER	:	Number of Pst used for Plt calculation
START	:	Save start time

Save data

File ID6310-12									
Saved time &date		Elapsed time	Frequency	Voltage			Pst	Pst	Plt
				Avg	Max	Min			
DATE	TIME	ELAPSED TIME	f	AVG_V	MAX_V	MIN_V	Pst (1min)	Pst	Plt
yyyy/mm/dd	h:mm:ss	h : mm : ss	(±)x. xxxE±nn	(±)x. xxxxxE±nn			(±)x. xxxE±nn		
Year/ month/ date	Hour:min: sec	Hour : min : sec	(±)value ×10$^{\pm n}$						

* Data is saved per min, but Pst is saved at every 10 min and Plt is saved at every 10 min in 2 hours later.

Header of the saved data

f	:	Fresuency
AVG_V	:	Averaged voltage
MAX_V	:	Max voltage
MIN_V	:	Min voltage
Pst(1min)	:	severity evaluated over a short period (1 min)
Pst(1)	:	severity evaluated over a short period
Plt	:	severity evaluated over a long period

File format and name

File format is CSV format and file names are assigned automatically.

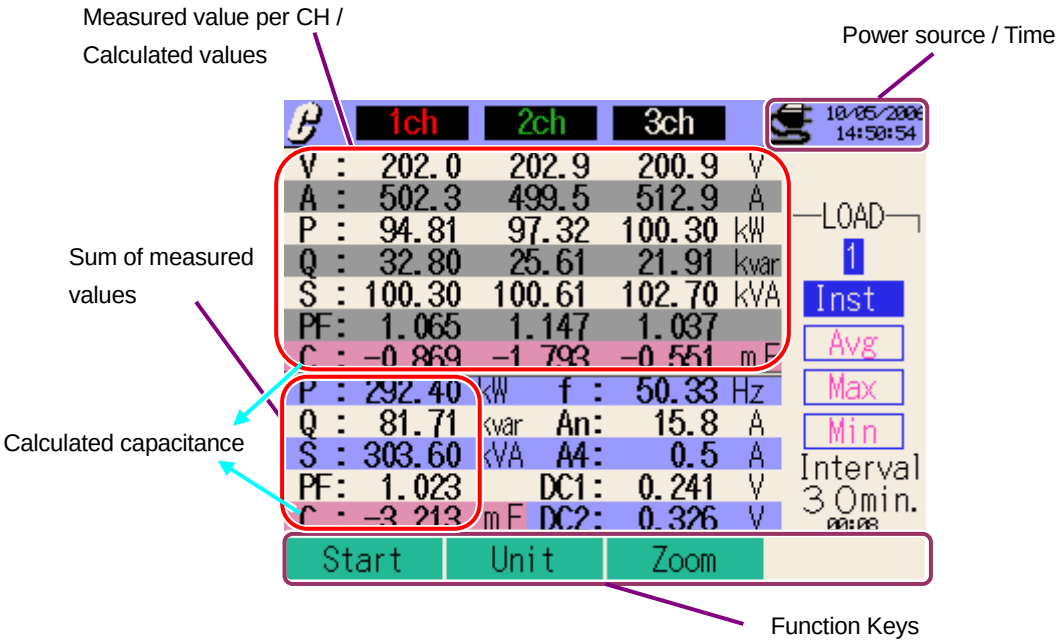
File name : 12 — CF 001 . csv
① ② ③ ④

①	Measuring item	12：Flicker
②	Save in	CF：CF card ME：Internal memory
③	File number	001～999
④	Saving format	CSV

11.7 Capacitance Calculation- Sizing of capacitor banks for Power factor correction (PFC)

11.7.1 Display Screen

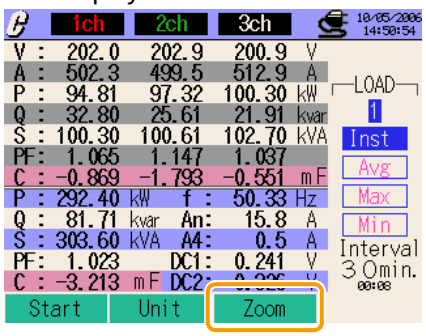
Select “Capacitance calculation”, and press the ENTER Key to view Capacitance calculation screen.



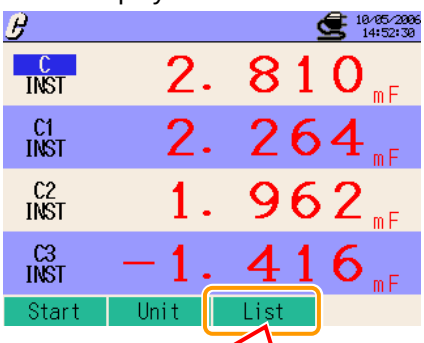
Zooming

1 Press the F3 Key.

List display



Zoom display



Press the F3 Key again to return to List display.

11.7.2 Measuring procedure

Steps for measurement

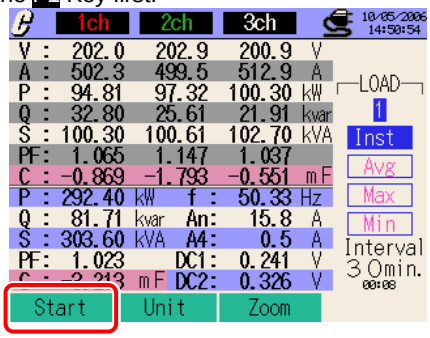
Ensuring your safety	See **“Safety Warnings”**.
↓	
Getting started	See **“Section 3 Getting started”**.
↓	
Settings	See **“Section 4 Setting”**.
↓	
Wiring	See **“Section 5 Wiring Configuration”**.
↓	
Capacitance calculation	See this section.

Basic Setting	Measurement Setting	Save Setting
Wiring configuration	Interval	Recording method
V Range	Target power factor	Recording start
VT Ratio		Recording termination
Clamp		Destination to save data
A Range		Destination to save screenshot
CT Ratio		
Filter		
DC V		
Frequency		

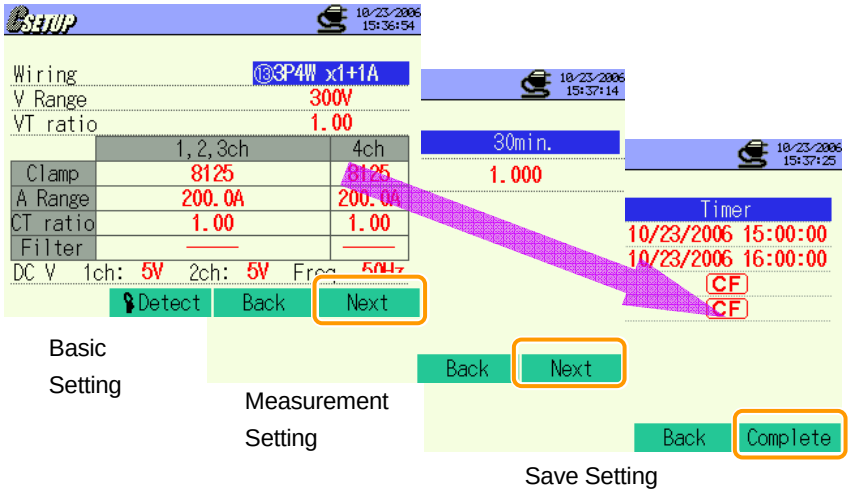
11.7.3 Data Saving

Saving Procedure

1 Press the F1 Key first.



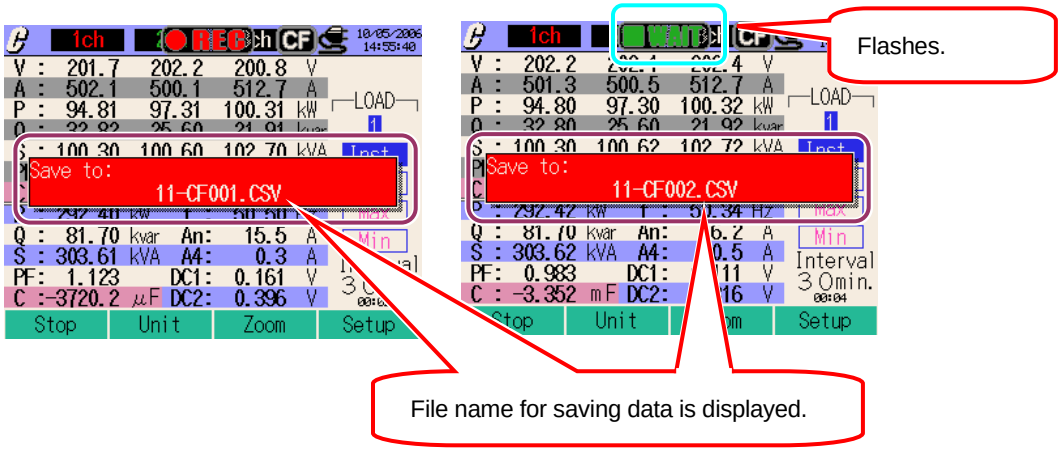
2 Press the F4 Key to check Basic, Measurement and Save Settings.



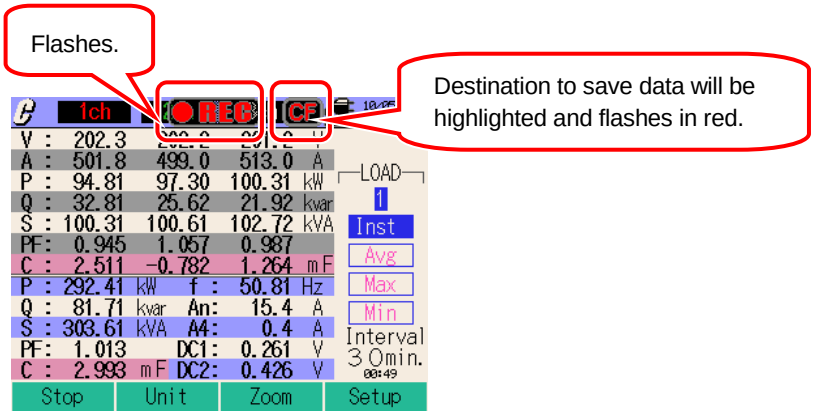
* Pressing down the F1 Key for 2 sec or more skips step 2 and start data saving.

For further details of Basic, Measurement and Save Settings, refer to "**Section 4 Settings**" in this manual.

3 Manually start saving data, or stand-by screen (WAIT) appears if saving start date and time has been specified.



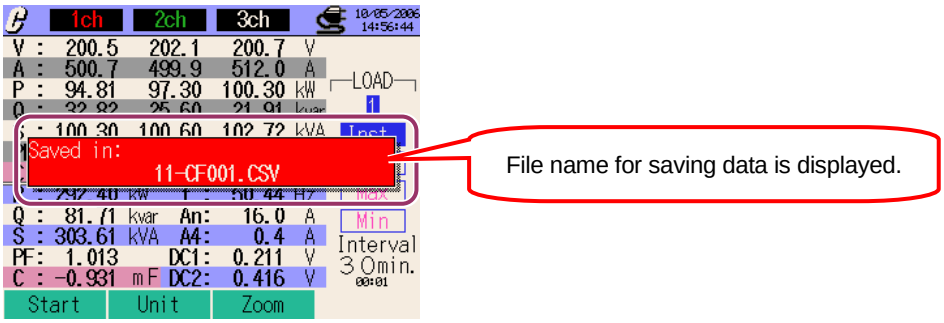
4 Saving starts and the LED status indicator lights up.



Setting cannot be done during a data saving. Press the F4 Key to check settings.

5 Press the F1 Key to stop measurement.
(At measurements with Timer function activated, this Key activates in the same way.)

6 Measurement will end and the LED status indicator goes off



11.7.4 Limitations of saving

Refer to "**6.3.2 Limitations of saving**" in this manual.

11.7.5 Saving data

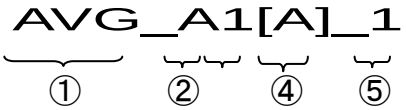
Settings

FILE ID	:	File name
VERSION	:	Version info
ID NUMBER	:	ID number
WIRING	:	Wiring Configuration
VOLT RANGE	:	Voltage Range
VT RATIO	:	VT Ratio
SENSOR TYPE	:	Model name of Clamp sensor
CURRENT RANGE	:	Current Range
CT RATIO	:	CT Ratio
CURRENT FILTER	:	Current Filter
DC RANGE	:	DC Range
FREQUENCY	:	Frequency
INTERVAL	:	Interval
C_Unit	:	Capacitance unit
Interval	:	Interval
START	:	Save start time

Save data

File ID : 6310-11						
Saved time & date		Elapsed time	Instantaneous value	Average value	Max value	Min value
DATE	TIME	ELAPSED TIME	INST	AVG	MAX	MIN
yyyy/mm/dd	h:mm:ss	h:mm:ss	(±)xxxxE±nn			
Year/Month/Day	Hour:Min:sec	Hour:Min:sec	(±) value x $10^{\pm n}$			

Header of the saved data



①	INST	:	Instantaneous value
	AVG	:	Average value
	MAX	:	Max value
	MIN	:	Min value
②	V	:	Voltage of each phase
	A	:	Current of each phase
	f	:	Frequency
	P	:	Active power
	Q	:	Reactive power
	S	:	Apparent power
	PF	:	Power factor
	C	:	Capacitance
	DC	:	Analogue input voltage
③	CH number	:	* 1 ~ 4
④	Unit		
⑤	System		

* Saved data with no number at this space contaons the sum of the measured values

File format and name

File format is CSV format and file names are assigned automatically.

File Name : 11 — CF 001 . csv
① ② ③ ④

①	Measuring item	11 : Capacitance calculation
②	Save in	CF : CF Card ME : Internal Memory
③	File number	001 ~ 999
④	Saving format	CSV

12. CF card / Internal memory

12.1 Instrument and CF card / Internal memory

Measurement data can be saved in CF card and the internal memory of the instrument.

CF card

Available capacity	32MB/ 64MB/ 128MB/ 256MB/ 512MB/ 1GB
Slot type	Type I / II
Format	FAT16

* (CF card with more or less capacity cannot be used.)

Capacity	32MB	64MB	128MB	256MB	512MB	1GB
SanDisk Corp.	SDCFB-32	SDCFB-64	SDCFB-128	SDCFB-256	SDCFB-512	SDCFG-1
Adtec co., Ltd.	AD-CFG32	AD-CFG64	AD-CFG128	AD-CFG256	-----	AD-CFX 40T1G
BUFFALO INC.	-----	-----	RCF-X128MY	RCF-X256MY	-----	RCF-X1GY

* CF Card with more or less capacity other than listed above cannot be used with this instrument.
* Company name and model name are the trademark or the registered trademark.
* A Compact Flash Card (CF card) may not operate properly even if any of the above are used due to manufacture's specification change, etc. The use of supplied CF Card or optional Kyoritsu CF Card is recommended.

Internal memory

Memory type	Flash memory
Storage capacity	1.8MB
Data communication method	USB communication (see "**Section 13 Communication / Supplied software**" in this manual)

Max number of data / Estimated time

Destination to save data		CF Card						Internal Memory
Capacity		32MB	64MB	128MB	256MB	512MB	1GB	1.8MB
Instantaneous value measurement	1sec	15H	1D	2D	5D	10D	20D	7min
	1min	10D	20D	1M	2M	5M	10M	2H
	30min	10M	1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	2D
Integration value measurement	1sec	6H	13H	1D	2D	4D	8D	3min
	1min	7D	15D	1M	2M	4M	8M	1H
	30min	7M	1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	1D
DEMAND measurement	1sec	4H	8H	17H	1D	2D	5D	2min
	1min	6D	12D	24D	1M	3M	6M	1H
	30min	6M	1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	1D
WAVE Range	10sec	1D	3D	7D	14D	28D	1M	20min
	1min	10D	21D	1M	2M	5M	11M	2H
	30min	10M	1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	2D
Harmonic anaysis	15sec	3D	7D	15D	1M	2M	4M	44min
	1min	15D	1M	2M	4M	8M	1 年	2H
	30min	1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	3D
Swell / Dip / Int measurement	1sec	2D	5D	11D	22D	1M	2M	32min
	1min	5M	11M	1Y	Over 1Y	Over 1Y	Over 1Y	1D
	30min	Over 1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	1M
Transient measurement	1sec	3D	6D	12D	24D	1M	3M	35min
	1min	6M	1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	1D
	30min	Over 1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	1M
Inrush Current measurement	1sec	2D	5D	11D	22D	1M	2M	32min
	1min	5M	11M	1Y	Over 1Y	Over 1Y	Over 1Y	1D
	30min	Over 1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	1M
Unbalance Rate	1sec	21H	1D	3D	7D	14D	27D	10min
	1min	14D	29D	1M	3M	7M	1Y	2H
	30min	1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	3D
Flicker*1	1min	7M	1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	1D
Capacitance calculation	1sec	15H	1D	2D	5D	10D	19D	7min
	1min	10D	20D	1M	2M	5M	10M	1H
	30min	10M	1Y	Over 1Y	Over 1Y	Over 1Y	Over 1Y	2D
Max number of file	Measurement data file (CSV)	512						6
	Graphics file (BMP)							7
	Configuration file (KAS)							20

* In case that no file exist in the CF card or the Internal memory.

where : H= hour(s), D=day(s), M=month(s), Y=year(s)

Numbers and time listed above are the minimum ones.

*1 Assumed one event occur per minute and calculated.

* Flicker measurement function is only available with ver.2.00 or later.

Be sure to verify proper operation of CF card on a well-known hardware.
As to the manipulation of the FC card, please refer to the instruction manual attached to the card.
The available recoding period varies depending on each interval.
In order to save the data without any problem, make sure to delete the file other than the data measured with this instrument in the CF card.
Use of a Card reader or CF card adaptor is required to read the data in a CF card.

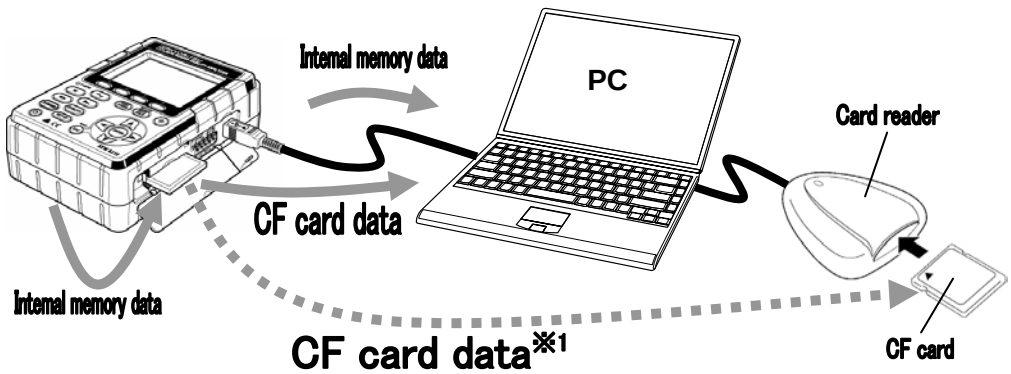
Data transfer

Data in the CF card or internal memory can be transferred to a PC via a USB lead or a CF card reader.

	Transfer to PC via:	
	USB	Card reader
CF card data (file)	△*1	○
Internal memory data (file)	○	--------*2

*1 : It is reccomended to transfer the data with big size by a use of CF card reader since trasfer of such data via USB takes time. (transfer time : approx 4MB/ hour)
*2 : Data in the internal memory can be tranferred to a CF card.

* As to the manipulation of the CF card, please refer to the instruction manual attached to the card.
* In order to save the data without any problem, make sure to delete the file other than the data measured with this instrument in the CF card.



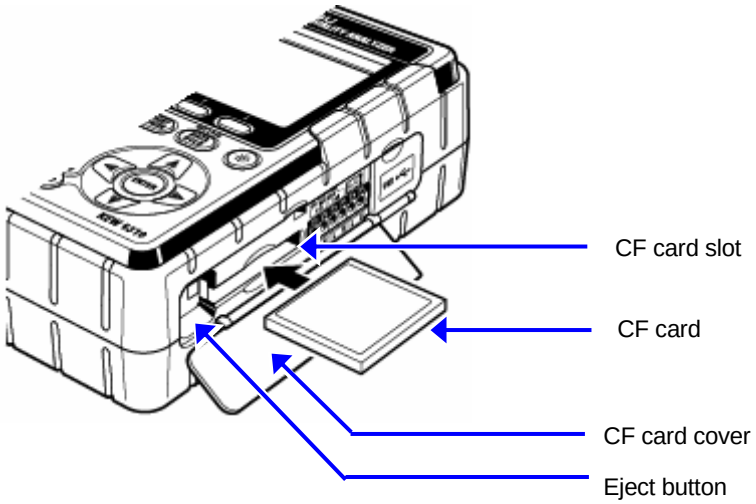
12.2 Placing / removing the CF card

⚠ CAUTION

* Do not place or remove a CF card while CF card is being accessed. (CF) flashes while CF card is being accessed.) Otherwise saved data in the card or the instrument may be damaged.
* Remove the CF card when carrying the instrument.

How to place:

1. Open the CF card cover.
2. Turn the CF card obverse side up, and firmly place it in the CF card connector. Then the Eject button is popped-out.
3. After inserting the card, close the CF card cover.



The instrument automatically detects the CF card when the card is inserted.

When placing the CF card in the connector, pay attention to the orientation of the arrow mark indicated on the obverse side of the CF card. The available recoding period varies depending on each interval.
The instrument automatically detects the CF card when the card is inserted.

How to remove:

1. Open the CF card cover.
2. The card can be removed by pushing the Eject button beside the card connector. The Eject button is being pressed down.
3. Remove the card, and then close the CF card cover.

12.3 CF card and Internal memory

Formatting CF card

Format the CF card to be used when using it at the first time.
* Only the CF cards formatted via FAT system can be used with this instrument.

1 Confirm that the instrument is off, and place the CF card.

2 Power on the instrument.

3 Follow the procedure described at “Formatting CF Card” in Section 4 and format the card.

Deleting of files in CF card

Follow the procedure described at “Deleting the data in CF Card” in **Section 4** and delete the files.

Formatting Internal memory

Follow the procedure described at “Formatting Internal memory” in **Section 4** and format the memory.

Deleting of files in Internal memory

Follow the procedure described at “Deleting the data in Internal memory” in **Section 4** and delete the files.

Saving data

Measurement data can be saved to the CF card or the internal memory in CSV format, which can be edited on spreadsheet software. File number is given automatically.

File format and name

● Measurement file (CSV file)

01-CF001.CSV

① ② ③ ④ ⑤

① Function identification code		
	01	W Range Measurement data
	02	Wh Range Measurement data
	03	DEMAND Range Measurement data
	04	Waveform Measurement data
	05	Vector Measurement data
	06	Harmonics Measurement data
	07	Swell/ Dip/ Int Measurement data
	08	Transient Measurement data
	09	Inrush current Measurement data
	10	Unbalance rate Measurement data
	11	PFC calculation data
② File identification code		
	—	Save file
	B	Backup file
③ Destination identification code		
	CF	CF card
	ME	Internal memory
④ File number		
	001 ~ 999	Number increases one by one after every recording. It restores to 001 after system reset.
⑤ Extension		
	CSV	Fixed (capital letters)

● Image file (BMP file)

PS-CF001.BMP

① ② ③ ④

① Print Screen		
	PS	Fixed
② Destination identification code		
	CF	CF card
	ME	Internal memory
③ File number		
	001 ~ 999	Number increases one by one after every recording. It restores to 001 after system reset.
④ Extension		
	BMP	Fixed (capital letters)

● Configuration file (KAS file)

ME000123.KAS

① ② ③

① Destination identification code		
	CF	CF card
	ME	Internal memory
② File number		
	0001 ~ 9999	Number increases one by one after every recording. It restores to 0001 after system reset.
③ Extension		
	KAS	Fixed (capital letters)

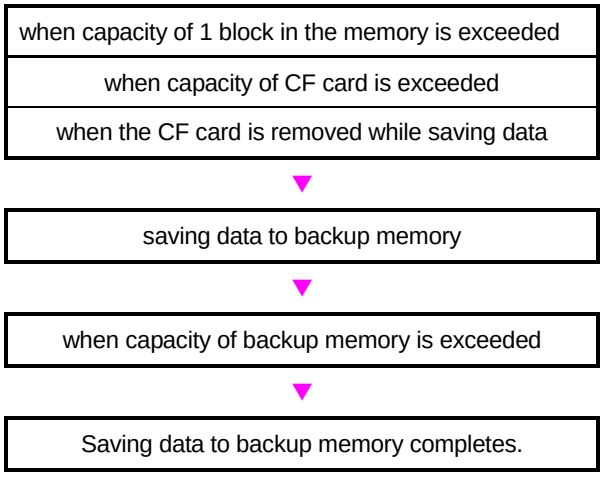
Mark displayed on the LCD	MEM mark flashes while saving data to the internal memory.
FULL	Displays when saved data exceeds the save capacitance. Further data saving cannot be done while this mark is being displayed. (Measurement continues and readings are refreshed accordingly, but the data isn't saved.)

Data can be saved in the internal memory with a CF card inserted in the instrument.

12.4 Backup memory

The Internal memory works as a backup memory when a CF card has been selected as a destination for saving data. If writing data to the CF card fails during saving, data will be written in the backup memory instead.

Using Backup memory



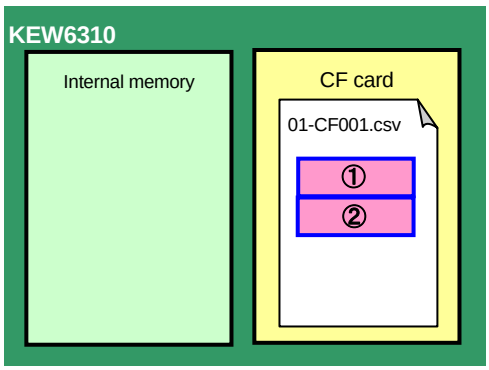
Data saved in the backup memory is kept after powering off the instrument, however, it will be overwritten every time starting backup function.

Data processing in Backup memory

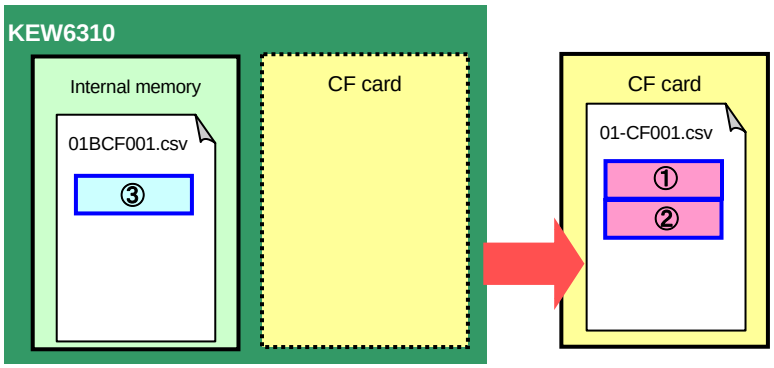
One CF card is placed/ removed during saving data;

Saving

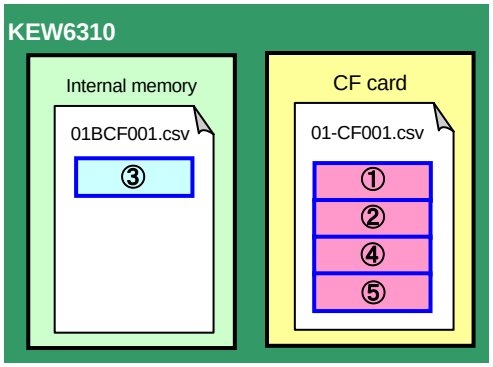
① A file is created in the CF card, when CF card is selected as a destination for saving data, and measurement data is saved to the CF card.



② A backup file is created in the internal memory when a CF card is removed at saving data. Further data is saved to the internal memory.

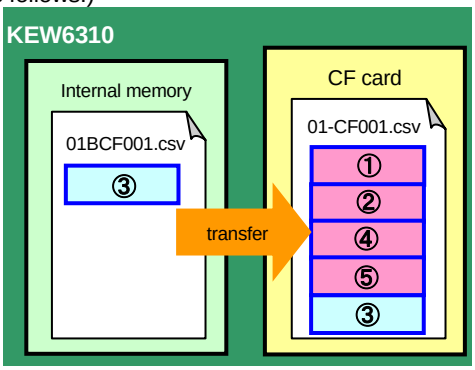


③ When inserting the CF card again during a data saving, further data will be saved to the last available space in CF card. (behind the ①& ②).



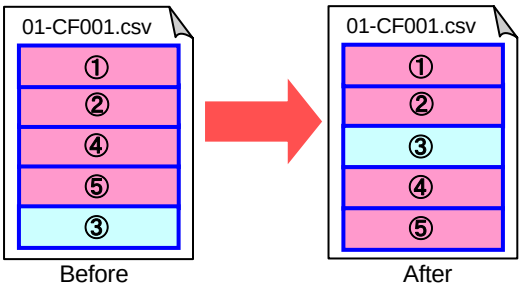
Saving completes

Backup files in the internal memory are automatically transferred to the last available space in a CF card.
(Time-series is as follows.)



Download completes

Use of supplied software [KEW PQA MASTER] enables to sort files in time-series.



For further details, please refer to the HELP for “KEW PQA MASTER”.

13. Communication function/ Interface software

● Interface

This instrument is equipped with USB interface.
Communication method: USB Ver1.1
Followings can be done by USB communication:
* Downloading a file in the internal memory of the instrument to PC
* Making settings of the items on **SET UP** Range via PC.

● Software

KEW PQA MASTER (supplied CD-ROM)

● System requirements

* OS (Operation system)
  Windows 2000/ XP (CPU: Pentium III 500MHz or higher)
* Memory
  128Mbyte or more
* Display
  Resolution 1024 x 768 dots, 65536 colors or more
* Hard-disk space required
  100Mbyte or more

● Trademark

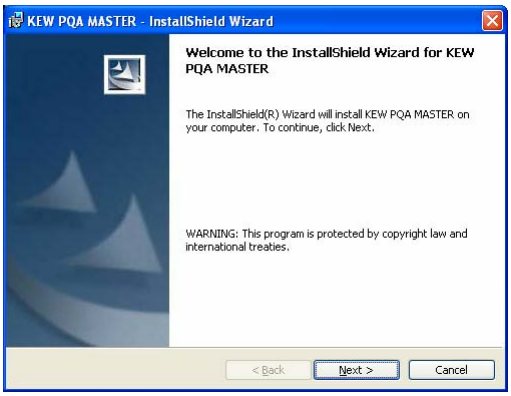
* Windows® and Microsoft® Excel are the registered trademark of Microsoft in the United States.
* Pentium is a registered trademark of Intel in the United States.

13.1 Software Installation (KEW PQA MASTER)

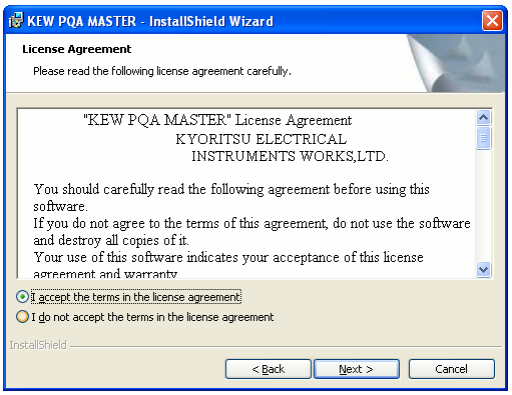
(1) Followings shall be checked before installing “KEW PQA MASTER”.
* To prepare your system to install this software, please close all open programs.
* Be sure NOT to connect the instrument with USB until install is completed.
* On Windows2000/ XP, install shall be done with administrative right.

(2) Insert the CD “KEW PQA MASTER” in your PC's CD-ROM drive.
Then, KEW PQA MASTER installer sets up automatically. When it doesn't run automatically, double click the "setup_eng.exe".

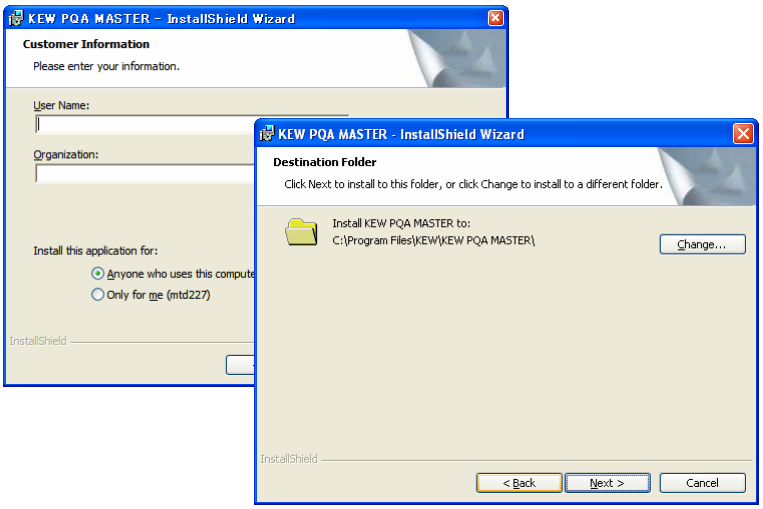
Then, following window appears. Click “Next”.



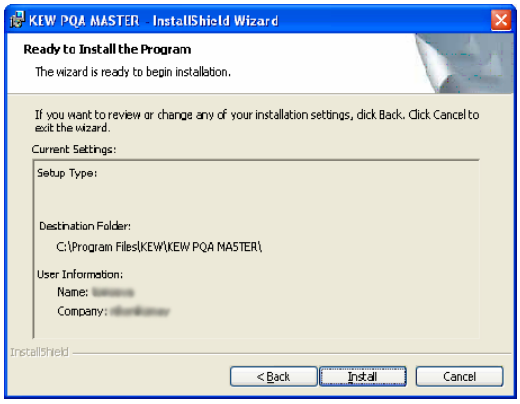
(3) Read through and understand the License Agreement, and check “I accept….”.
Then click “Next”.



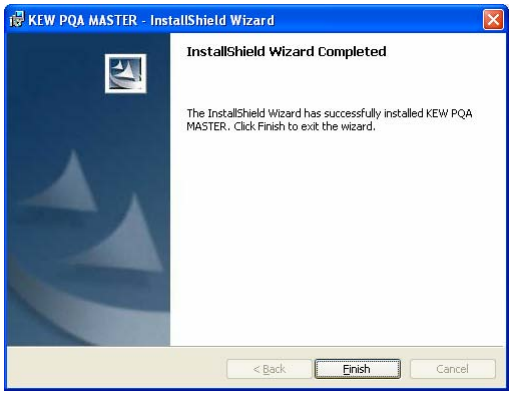
(4) Enter the user information and specify the location to where install the software. Then click “Next”.



(5) Confirm the information on install, and click “Install” to start installing.



(6) Click “Finish” when install completes.



.

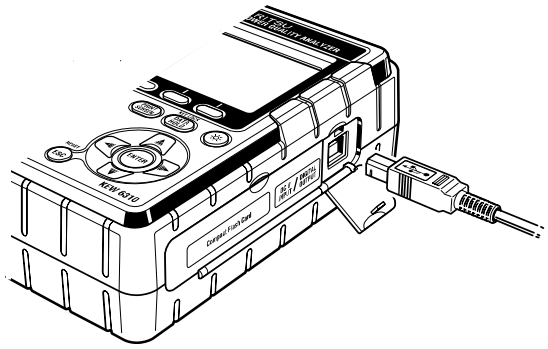
NOTE

* If you need to remove “KEW PQA MASTER”, use the "Add/Remove Programs" tool in Control Panel.

13.2 USB driver installation

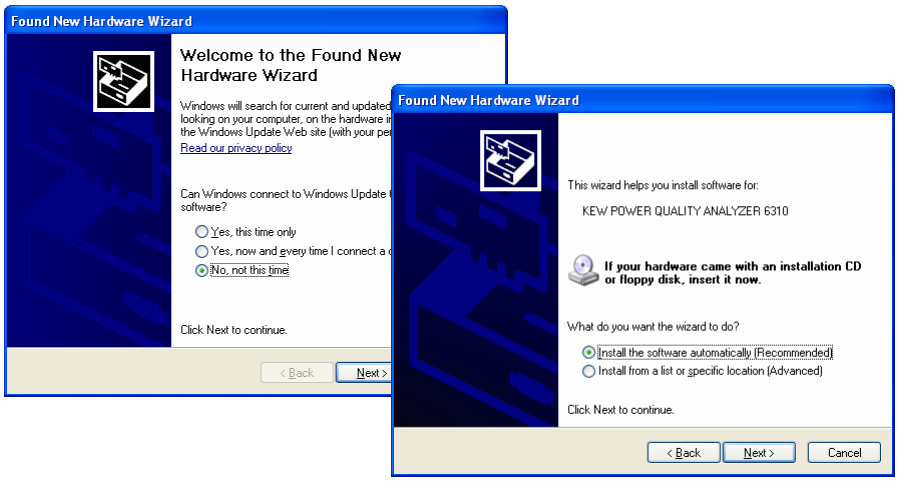
(1) Connect one end of a USB cord to your PC.

(2) Connect the other end of USB cord to the instrument.

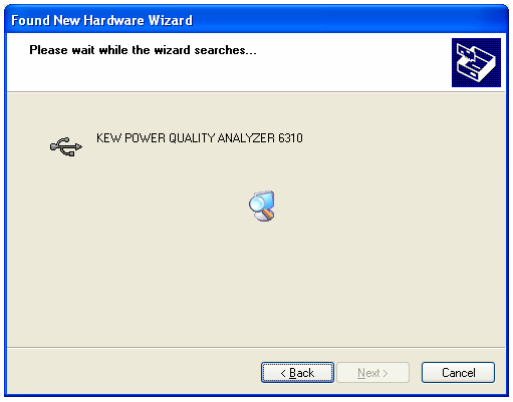


(3) When your PC and the instrument are connected properly, install starts.

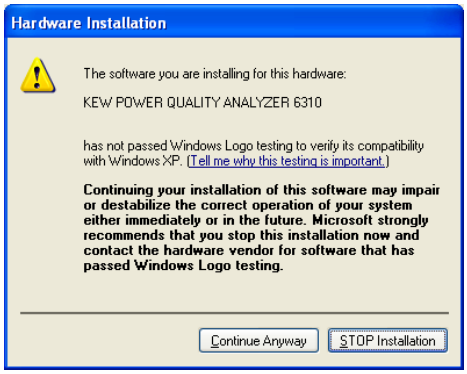
(4) Click “Install the software automatically (recommended)”, and insert the “KEW PQA MASTER” in your PC's CD-ROM drive. Then Click “Next”.

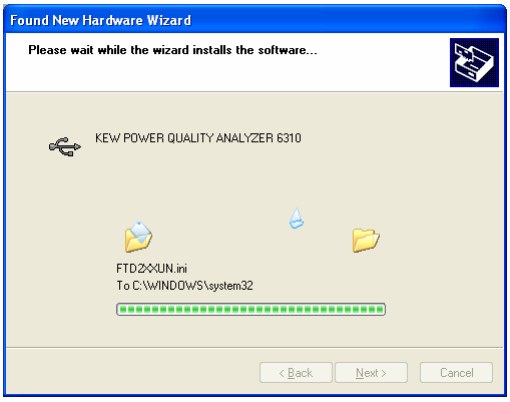


* When a device driver is not found automatically, click “kew_power.inf” of KEW PQA MASTER, which Is in the CD-ROM drive.

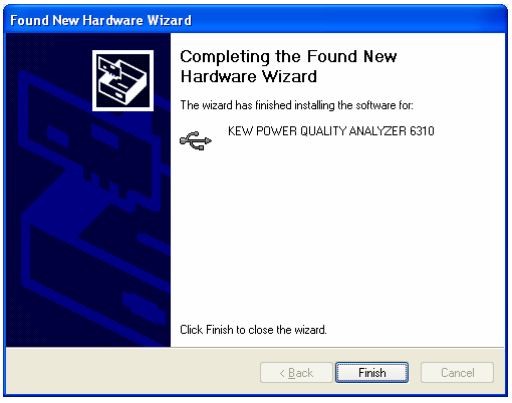


In case that following window appears on Windows XP, click “Continue anyway”. (It is an operation check, and no problem happens if install is continued.)





(5) Install is completed when the wizard finishes. Click “Finish”.



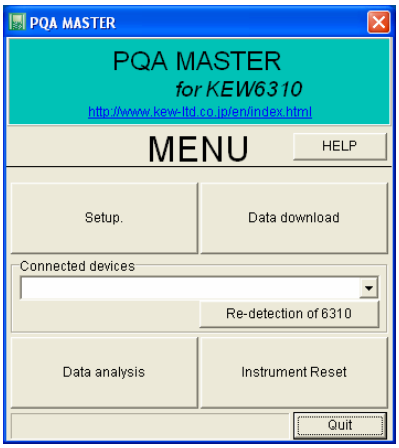
NOTE

* When install of the driver is interrupted and reinstall cannot be done, or when install cannot be done properly, refer to “**13.4 USB driver un-installation**” in this manual..

13.3 Starting “KEW PQA MASTER”

- Start and quit

  Start the software by; 1) clicking the icon for [KEW PQA MASTER] on the desktop, or 2) clicking [Start] → [Program] → [KEW] → [KEW PQA MASTER]. Then the main window for “KEW PQA MASTER” appears. Click [Data download] or [Setup]. Clicking [Quit] or [x] box at the upper right of the window quits the program.



- [Download]

  Downloads the file to the internal memory of the instrument.

  When data has recorded in the internal memory of the instrument, it can be saved to PC in CSV format. The saved data can be loaded in Microsoft ® Excel, and be edited and printed.
  (CSV format : is a comma-separated text data, and can be loaded in Microsoft ® Excel.)

- [Setup]

  Makes setting for instrument.

  Can make settings for the items in setup mode and confirm the present settings on your PC. Moreover, settings can be saved/ recalled as a “configuration file (.kps)”. So the settings can be changed easily via a PC.

  * When using this instrument for the first time, time should be set.

- [Data analysis]

  Analyzes measurement data (CSV format data).

- [Instrument Reset]

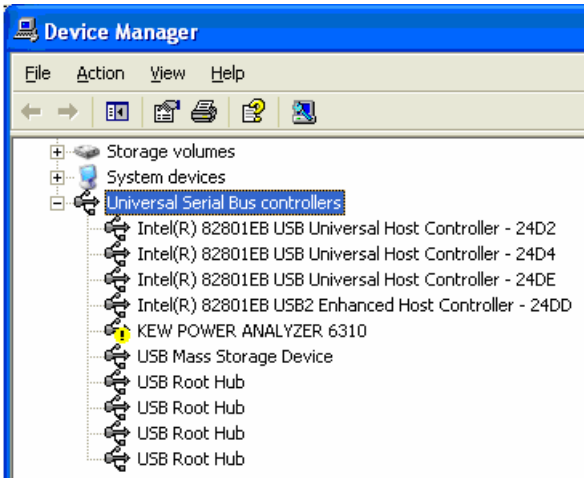
  Restores setting for the instrument to default.

  Parameters in setup mode are reset.

13.4 USB driver un-installation

When install of the USB driver is interrupted and reinstall cannot be done, follow the procedure below and delete the existing USB driver. Then install it again.

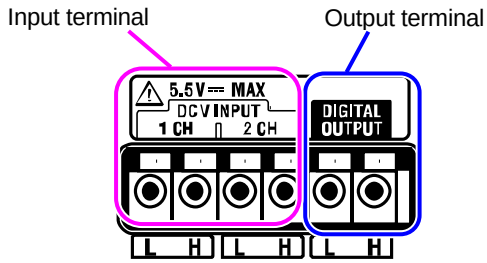
(1) Connect a PC and the instrument with a USB cord.
(2) Click [Control Panel] in the Start menu at the lower left on the Windows screen.
(3) Click [System] in the control panel.
(4) Then click [Device Manager].
(5) Right click on [KEW POWER QUALITY ANALYZER 6310" in the "Universal Serial Bus controllers"
(6) Click [Uninstall] and uninstall the USB driver.



(7) Remove the USB cord connecting your PC and the instrument once, and connect them again.
(8) When "Found New Hardware Wizard" window appears, follow the procedure described at "**13-2 USB driver installation**" and install the driver.

14. Other functions

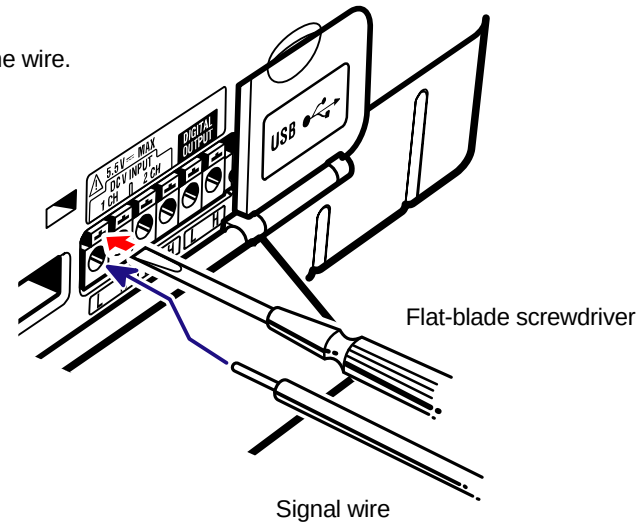
14.1 Input/ Output terminals



Connection

1 Press the recutangular protrusion above a terminal with a flar-blade screw driver, and insert a signal wire.

2 Release the driver and fix the wire.



Connect wires to the proper terminals.

Wires of following dimensions can be used.

Suitable wire : single-wire Φ1.2 (AWG16), twisted wire 1.25mm^2 (AWG16),
Strand sizeΦ 0.18mm or more

Usable wire : single-wire Φ0.4 ~ 1.2 (AWG26 ~ 16), twisted wire 0.2 ~ 1.25mm^2 (AWG24 ~ 16)
Strand sizeΦ 0.18mm or more

Standard length of bare wire 11mm

[Input terminal]

Capable of measuring and recording DC voltage signals.
Number of Ch: 2ch
Input resistance : approx 225kΩ

⚠ CAUTION

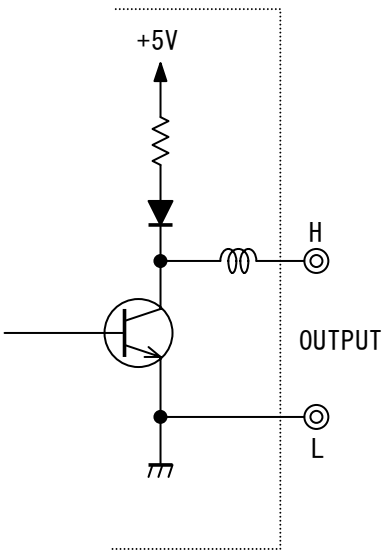
Roots of the L terminals for each Ch are integrated. Never connect inputs with various grand levels to the terminal at the same time.

[Output terminal]

Capable of generating outputs when events occur during measurements below.

Measurement menu	Conditions for Output : Lo	Remarks
Demand	(Predicted value) > (Target value)	------
Harmonic	exceeding preset allowable range	Lo output; when an alowable range is exceeded at any Ch.
Swell/ Dip/ Int/ Transient/ Inrush	new event is added and displayed on the LCD	Lo is kept for 1 sec, Hi is restored
Unbalance rate	exceeding preset threshold	------

Output format : Open collector output
Max input : 30V, 50mA, 200mW
Output voltage : Hi – 4 ~ 5V
Lo – 0 ~ 1V



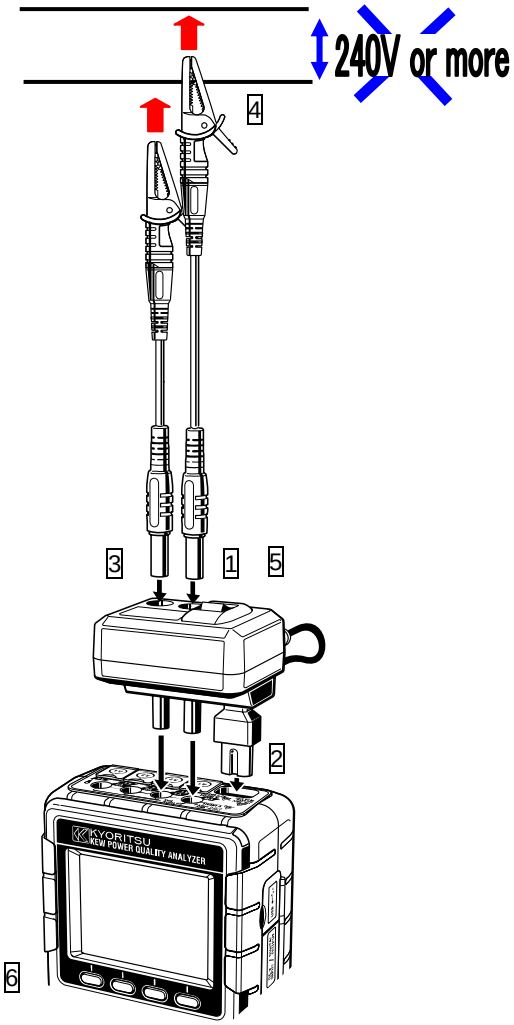
14.2 Getting power from measured lines

When there is difficulties in getting power from an outlet, KEW6310 operates with powers on the measured line by using Voltage test leads with Power supply adapter MODEL8312.

Connect the Adapter according to following procedure.

1. Confirm that the Adapter is off.
2. Connect the Plug of the Adapter to VN and V1 terminals on KEW6310/6300 and Power Plug to the Power connector respectively.
3. Connect the Voltage test leads to VN and V1 terminals of the Adapter.
4. Connect the Alligator clips of the Voltage test leads to the circuit under test.
5. Power on the Adapter.
6. Power on KEW6310/ 6300.

* Reversed procedure is applied to remove the Adapter from KEW6310/ 6300.



Fuse rating: AC500mA/ 600V,
Fast acting, Φ6.3 x 32mm

For further details, refer to the Instruction manual for MODEL 8312.

14.3 Auto-ranging

Auto-ranging function is available at W, Wh, DEMAND and WAVE Ranges. Current values in wide range can be measured with this function; it is helpful when load capacitances vary dramatically according to day and time.

- Range : 2-range-auto/ max and min range of each Clamp sensor
- Range shift to upper one when crest values equal to twice as much as F.S (sine wave) at min range is detected.

Accurate values may not be obtained when substantial fluctuations in 1 sec.

14.4 Operation at AC power interruption

When an AC power supply is interrupted during recording, KEW6310 operates as follows.

- Power supply : restores to battery when batteries have been installed
- Measurement data : saved until the last interval before an interruption
- Operation after interruption : recording restarts with preset settings if a power is interrupted during recording. In this case, occurrence of interruption is recorded with time and date information. (STOP) Restoration is also recorded as well. (START)

  Instrument doesn't power on again automatically when a power interruption occurs and restores other than recording period.

Files in CF card or Internal memory may be destroyed if an AC power is interrupted while accessing to them. Use of AC power supply and batteries at the same time is recommended if power interruptions are concerned.

15. Troubleshooting

15.1 General troubleshooting

When defect or breakdown of the instrument is suspected, check the following points first. If your problem isn't listed in this section, contact your local Kyoritsu distributor.

Symptom	Check
(1) Instrument cannot be powered on.	operating with an AC power supply - Power cord is connected firmly and properly? - No break in the Power cord? - Supply voltage is within the allowable range? operating with batteries - Batteries are installed with observing correct polarity? - Ni-HM batteries are full-charged? - Alkaline batteries are not exhausted?
(2) Error message "Hardware error" appears when powering on the instrument.	● Power off the instrument, and power it on again. There is no problem when an error message doesn't appear; the internal circuit may be damaged when the same error message appears. Contact your local Kyoritsu distributor. ● In case that NG is found only on RTC item, it means internal coin battery for backup is exhausted. (Date and time may be wrong every time when powering off the instrument) Contact your local Kyoritsu distributor. Backup battery life is approx 5 years.
(3) Any key doesn't work.	● Key lock function is inactivated? ● Check the effective Keys on each Range.
(4) Readings are not stable or inaccurate	Confirm that: * Voltage test leads and clamp sensors are connected properly. * Setting for the instrument and the selected wiring configuration are appropriate. * Proper sensors are used with proper settings. * There is no break in the voltage test leads. * Input signal is not interfered. * Strong electric magnetic field does not exist in close proximity. * Use environment meets the specification of this instrument.
(5) Incapable of saving data to the internal memory	● Check the number of files in the memory. ● Check that the destination for saving data is set to internal memory.

Symptom	Check
(6) Data cannot be saved in a CF card.	● CF card is inserted correctly? ● CF card has been formatted? ● Is there available space in a CF card? ● Destination for saving data is set to “CF card”? ● Check the max number of files or capacity of CF card. ● Confirm that the operation of CF card to be used is checked. ● Verify the proper operation of CF card on other hardware.
(7) Download and setting cannot be done via USB communication.	Confirm that: * instrument and PC are connected with USB cord correctly, * SET UP Range is selected, and * device are recognized on KEW PQA MASTER. A USB driver may not be installed correctly if no device is recognized. See Section 13.

15.2 Error messages and actions

Error messages may appear on the LCD while using the instrument. Followings are the messages displayed and corresponding actions.

Message	Detail & Action
" Cannot recognize. "	A Clamp sensor is connected properly to the Current input terminal displayed with “?” mark on the LCD? press the “Detect” Key again or setting should be done manually. See “4.2.1 Basic setting (Setting for Clamp sensor).
" Improper sensor is connected. ”	Check the connected sensor again, and press the “Detect” Key again. Leakage clamp sensors cannot be used at the Ch measuring power. See “4.2.1 Basic setting (Setting for Clamp sensor).
“ No CF card ”	Check the CF card is inserted correctly. See “4.2.3 Save setting”.
“ Format failed ”	Confirm a CF card is inserted correctly, and format the card again. See “4.2.3 Save setting (Formatting CF card)”.
“Some files are left undeleted. ”	Try to delete the files again. See “4.2.3 Save setting”.
“ Unformatted CF card ”	A CF card isn’t FAT16 format. It should be formatted. See “4.2.3 Save setting (Formatting CF card)”.
“ Some files were not transferred.”	Try to transfer the data again. See “4.2.3 Save setting (Data transfer)”.
“ No processable file ”	There is no file to be deleted or transferred in the memory. See “4.2.3 Save setting”.
“ Internal memory isn’t formatted. “	Format the internal memory. See “4.2.3 Save setting (Formatting Internal memory)”.
“ No save space ”	Unnecessary data should be deleted or format is required. See “4.2.3 Save setting”.

- continued on the next page -

Message	Detail & Action
“ Max number of file is exceeded. ”	Unnecessary data should be deleted or format is required. See “4.2.3 Save setting”.
“ No space in CF card; start recording in internal memory. ”	Remove the CF card and make available space, and then insert the card again. See “4.2.3 Save setting”.
“ Available space in CF card is small. ”	Insert another CF card, or delete the data or format the card. See “4.2.3 Save setting”.
“ No external power supply”	Check an AC power supply is connected or not. See “3.2.2 AC Power supply”.
“ Set the Battery select SW to [RE-CHARGEABLE]. “	Set the selector switch to [RECHARGEABLE] position. See “3.2.1 Battery”.
“ Cannot be deleted ”	Try to delete the files again. See “4.2.3 Save setting”.
“ Cannot be transferred. ”	Try to transfer the data again. See “4.2.3 Save setting (Data transfer)”.
“ Failed to access CF card”	Check a CF card is inserted correctly, and file format is FAT16.
“ Failed to save screenshot ”	Memory where to save data has max number of files. Delete unnecessary data and take screenshot again.

16. Specification

16.1 General specification

Location for use	: In door use, Altitude up to 2000m
Temperature & humidity range (guaranteed accuracy)	: 23ºC±5ºC, Relative humidity 85% or less (no condensation)
Operating Temperature & humidity range	: 0ºC±40ºC, Relative humidity 85% or less (no condensation)
Storage Temperature & humidity range	: -20ºC±60ºC, Relative humidity 85% or less (no condensation)
Measured line	: single-phase 2-wire (1ch ~ 4ch), single-phase 3-wire (1ch ~ 2ch), three-phase 3-wire (1ch ~ 2ch), three-phase 4-wire
Withstand voltage	: AC5320V / for 5 sec between (Voltage input terminal) and (Enclosure) AC3320V / for 5 sec between (Voltage input terminal) and (Current input terminal, Power connector, Communication (USB) Connector) AC2710V / for 5 sec between (Power connector) and (Current input terminal, Communication (USB) Connector, Enclosure)
Insulation resistance	: 50MΩ or more / 1000V between (Voltage/Current input terminal, Power connector) and (Enclosure)
Display	: 320 x 240(RGB) Pixel, 3.5-inch color STN display
Indication renewal	: every 1 sec
LCD Auto-off	: Pressing the LCD_ON/OFF Key hides the indications on the LCD; another press restores the indications. (Menu or Power Key activates in the same way.)
Applicable standards	: IEC61010-1, Measurement CAT. III 600V Pollution degree 2, IEC 61010-031, IEC61326
Dimension	: 175(L) x 120(W) x 68(D) mm
Weight	: approx 900g (including batteries)
Accessories	: Voltage test leads M7141 (red/ green/ black, blue w/alligator clip) x 1 set Power cord M7170 x 1 pce Input terminal plate (6-kind) x 1 pce Alkaline size AA battery (LR6) x 6 pcs CD-ROM x 1 pce - Communication software (KEW PQA MASTER) - Instruction manual (PDF file) USB cable M7148 (with Filter) x 1 pce Carrying case M9125 x 1 pce Quick manual x 1 pce Cable marker x 32 pce Compact flash card x 1 pce Card reader M8319 x 1 pce
Optional parts	Compact flash card 128MB (M-8307) Compact flash card 256MB (M8322) Compact flash card 1GB (M8323) 8128(Clamp sensor 50A Φ24mm) M-8127(Clamp sensor 100A Φ24mm) M-8126(Clamp sensor 200A Φ40mm) M-8125(Clamp sensor 500A Φ40mm) M-8124(Clamp sensor 1000A Φ68mm) M-8129(Flexible sensor 3000A Φ150mm) M-8141(Leakage sensor 1A Φ24mm) M-8142(Leakage sensor 1A Φ40mm) M-8143(Leakage sensor 1A Φ68mm) M-8146(Leakage sensor 10A Φ24mm) M-8147(Leakage sensor10A Φ40mm) M-8148(Leakage sensor10A Φ68mm) Power supply adopter M8312 Carrying case (for instrument) M9132 Small alligator clip M7198

16.2 Inst measurement (W Range)

(1) Voltage Vi [V]

Range	150/ 300/ 600V/ 1000V
Display digit	4 digits
Allowable input	10 ~ 110% of each range (1000V range : 20%~)
Display range	5 ~ 120% of each range
Crest factor	2.5 or less (100% or less of each range)
Accuracy	±0.3%rdg±0.2%f.s. (sine wave, 45 ~ 65Hz)
Instantaneous overload	1200Vrms(1697Veak):10 sec
Input impedance	approx 2.7MΩ

(2) Current Ai [A]

Range	8128(50A type) : 1/ 5/ 10/ 20/ 50A 8127(100A type) : 10/ 20/ 50/ 100A 8126(200A type) : 20/ 50/ 100/ 200A 8125(500A type) : 50/ 100/ 200/ 500A 8124(1000A type) : 100/ 200/ 500/ 1000A 8129(3000A type) : 300/ 1000/ 3000A
Display digit	4 digits
Allowable input	10 ~ 110% of each range
Display range	1 ~ 120% of each range
Crest factor	3.0 or less (90% or less of each range)
Accuracy	±0.3%rdg±0.2%f.s.+ Accuracy of Clamp sensor (sine wave, 45 ~ 65Hz)
Instantaneous overload	2Vrms(2.828Veak): for 10 sec
Input impedance	approx 100kΩ

(3) Active power Pi [W]

Range	Depending on combinations of (V Range) x (A Range)		
Display digit	4 digits		
Accuracy	±0.3%rdg±0.2%f.s.+ Accuracy of Clamp sensor (Power factor 1, Sine wave 45 ~ 65Hz)		
Influence of power factor	±1.0%rdg (reading at power factor 0.5 against power factor 1)		
Polarity indication	Consumption: + (no mark) , Regenerating: -		
Formula	1P2W	×1	$P = P\_1$
		×2	$P = P\_1 + P\_2$
		×3	$P = P\_1 + P\_2 + P\_3$
		×4	$P = P\_1 + P\_2 + P\_3 + P\_4$
	1P3W	×1	$P = P1 + P2$
		×2	$P = P\_1 + P\_2$ $(P\_1 = P1\_1 + P2\_1, P\_2 = P1\_2 + P2\_2)$
	3P3W	×1	$P = P1 + P2$
		×2	$P = P\_1 + P\_2$ $(P\_1 = P1\_1 + P2\_1, P\_2 = P1\_2 + P2\_2)$
	3P4W	×1	$P = P1 + P2 + P3$

(4) Frequency f [Hz]

Accuracy	±0.1%rdg±2dgt
Display digit	4 digits
Allowable input	10 ~ 110% of each Voltage range (sine wave. 45 ~ 65Hz) (1000V range : 20%~)
Display range	40.00 ~ 70.00Hz
Signal source	V1-fixed

(5) Analogue input DCi [V]

Number of input	2 channel (i = 1,2)
Range	50m/ 500m/ 5V (selectable at each channel)
Accuracy	±0.5%f.s
Display digit	4 digits
Input resistance	approx 225kΩ

(6) Item and formula

Apparent power S [VA]

Display digit	same to the indication for active power		
Formula	1P2W	×1	$S = V \times A$
		×2	$S\_i = V1 \times Ai(i = 1,2)$, $S = S\_1 + S\_2$
		×3	$S\_i = V1 \times Ai(i = 1,2,3)$, $S = S\_1 + S\_2 + S\_3$
		×4	$S\_i = V1 \times Ai(i = 1,2,3,4)$, $S = S\_1 + S\_2 + S\_3 + S\_4$
	1P3W	×1	$Si = Vi \times Ai(i = 1,2)$, $S = S1 + S2$
		×2	$S = S\_1 + S\_2$ $(S\_1 = S1\_1 + S2\_1, S\_2 = S1\_2 + S2\_2)$
	3P3W	×1	$Si = Vi \times Ai(i = 1,2)$, $S = \sqrt{3}/2\,(S1 + S2)$
		×2	$S = S\_1 + S\_2$ $(S\_1 = \sqrt{3}/2\,(S1\_1 + S2\_1)$, $S\_2 = \sqrt{3}/2\,(S1\_2 + S2\_2))$
	3P3W3A 3P4W	×1	$Si = Vi \times Ai(i = 1,2,3)$, $S = S1 + S2 + S3$

Reactive power Q [Var]

Display digit	same to the indication for active power		
Mark	-		: leading phase (current phase against voltage)
	+		: lagging phase (ditto)
Formula	1P2W	×1	$Q = \sqrt{S^2 - P^2}$
		×2	$Q\_i = \sqrt{S\_i^2 - P\_i^2}\,(i = 1,2)$, $Q = Q\_1 + Q\_2$
		×3	$Q\_i = \sqrt{S\_i^2 - P\_i^2}\,(i = 1,2,3)$, $Q = Q\_1 + Q\_2 + Q\_3$
		×4	$Q\_i = \sqrt{S\_i^2 - P\_i^2}\,(i = 1,2,3,4)$, $Q = Q\_1 + Q\_2 + Q\_3 + Q\_4$
	1P3W	×1	$Qi = \sqrt{Si^2 - Pi^2}\,(i = 1,2)$, $Q = Q1 + Q2$
		×2	$Q = Q\_1 + Q\_2$ $(Q\_1 = Q1\_1 + Q2\_1, Q\_2 = Q1\_2 + Q2\_2)$
	3P3W	×1	$Qi = \sqrt{Si^2 - Pi^2}\,(i = 1,2)$, $Q = Q1 + Q2$
		×2	$Q = Q\_1 + Q\_2$ $(Q\_1 = Q1\_1 + Q2\_1, Q\_2 = Q1\_2 + Q2\_2)$
	3P3W3A 3P4W	×1	$Qi = \sqrt{Si^2 - Pi^2}\,(i = 1,2,3)$, $Q = Q1 + Q2 + Q3$

Power factor PF

Display digit	-1.000 ~ 0.000 ~ 1.000		
Mark	- : leading phase + : lagging phase		
Formula	1P2W	×1	$PF = \left\lvert P/S \right\rvert$
		×2	$PFi = \left\lvert Pi/Si \right\rvert (i = 1,2),\ PF = \left\lvert P/S \right\rvert$
		×3	$PFi = \left\lvert Pi/Si \right\rvert (i = 1,2,3),\ PF = \left\lvert P/S \right\rvert$
		×4	$PFi = \left\lvert Pi/Si \right\rvert (i = 1,2,3,4),\ PF = \left\lvert P/S \right\rvert$
	1P3W	×1	$PFi = \left\lvert Pi/Si \right\rvert (i = 1,2),\ PF = \left\lvert P/S \right\rvert$
	3P3W	×1	$PFi = \left\lvert Pi/Si \right\rvert (i = 1,2),\ PF = \left\lvert P/S \right\rvert$
	3P3W3A 3P4W	×1	$PFi = \left\lvert Pi/Si \right\rvert (i = 1,2,3),\ PF = \left\lvert P/S \right\rvert$

Neutral current

Formula	$An = A1 \times A2\cos\theta_2 \times A3\cos\theta_3$ *$\theta 2$: Phase difference between A1-A2 $\theta 3$: Phase difference between A1-A3

16.3 Integration measurement (Wh Range)

Display item	Consumption : $WP+$ Regenerating : $WP-$	
Display range	0.00Wh ~ 999999GWh (Display digit and unit are unified to the bigger ones of $\left\lvert WS+ \right\rvert$ and $\left\lvert WS- \right\rvert$.)	
Formula	Consumption (WP+)	Each phase : $WPi+ = \sum (+Pi)/h$ Total : $WP+ = \sum (WPi+)$
	Regenerating (-WP)	Each phase : $WPi- = \sum (-Pi)/h$ Total : $WP- = \sum (WPi-)$

* when $+Pi$: $P \geqq 0$, $-Pi$: P < 0
* h : integration period
* i = 1(1P2W×1)
* i = 1,2 (1P2W×2, 1P3W, 3P3W)
* i = 1,2,3 (1P2W×3, 3P3W3A, 3P4W)
* i = 1,2,3,4 (1P2W×4)

Apparent power energy WS [VAh]

Display item	Consumption : $WS+$ Regenerating : $WS-$	
Display range	0.00VAh ~ 999999GVAh (Display digit and unit are unified to the bigger ones of $\lvert WS+\rvert$ and $\lvert WS-\rvert$.)	
Formula	Consumption (WS+)	Each phase : $WSi+ = \sum (+Si)/h$ Total : $WS+ = \sum (WSi+)$
	Regenerating (WS-)	Each phase : $WSi- = \sum (-Si)/h$ Total : $WS- = \sum (WSi-)$

* when $+Si$: $P \geqq 0$, $-Si$, S at $P < 0$
* h : integration period
* i = 1 (1P2W×1)
* i = 1,2 (1P2W×2, 1P3W, 3P3W)
* i = 1,2,3 (1P2W×3, 3P3W3A, 3P4W)
* i = 1,2,3,4 (1P2W×4)

Reactive power energy WQ [varh]

Display item	Consumption : (lagging) WQ_i+, (leading) WQ_c+ [Regenerating: (lagging) WQ_i-, (leading) WQ_c-] No mark	
Display range	0.00varh ~ 999999Gvarh (Display digit and unit are unified to the bigger ones of $\lvert WS+\rvert$ and $\lvert WS-\rvert$.)	
Formula	Consumption_ lagging (WQi+)	Each phase : $WQi+ = \sum (+Q_i i)/h$ Total : $WQ_i+ = \sum (WQ_i i+)$
	Consumption_ leading (WQc+)	Each phase : $WQ_c i+ = \sum (+Q_c i)/h$ Total : $WQ_c+ = \sum (WQ_c i+)$
	Regenerating_ lagging (WQi-)	Each phase : $WQ_i i- = \sum (-Q_i i)/h$ Total : $WQ_i- = \sum (WQ_i i-)$
	Regenerating_ leading (WQc-)	Each phase : $WQ_i i- = \sum (-Q_i i)/h$ Total : $WQ_c- = \sum (WQ_c i-)$

* Q when +WQci : P≧0 and Q≧0, Q when +WQii: P≧0 and Q<0
  Q when –WQci : P<0 and Q≧0, Q when –WQii : P<0 and Q<0

Elapsed time : time passed from the start of recording

Display item	hhhhh : mm : ss (Hour : Minute : Second)
Display range	00000:00:00 ~ 99999:59:59

16.4 Demand measurement (DEMAND Range)

(1) Target value (DEM Target)

Display range	Fixed set value (1.000mW ~ 999.9TW)

(2) Predicted value (DEM Guess)

Display range	Same decimal point place and unit to target value
Formula	$DEM_{GUESS} = \sum DEM \times \frac{Demand\_interval}{Period\_from\_beginning\_of\_demand\_interval}$

(3) Demand value (present value) (ΣDEM)

Display range	Same decimal point place and unit to target value
Formula	$\Sigma DEM = (+WP) \times \frac{1hour}{interval}$ where: $\Sigma DEM = \sum \Sigma DEMi$

* $_{i=1}$ (1P2W×1)
* $_{i=2}$ (1P2W×2,1P3W,3P3W)
* $_{i=3}$ (1P2W×3,3P3W3A,3P4W)
* $_{i=4}$ (1P2W×4)

(4) Load factor

Display range	0.00 ~ 9999.99%
Formula	$\Sigma DEM / DEM_{Target}$

16.5 Waveform measurement (Range)

Displayed data	2 waveforms (256 points)
Scale change	0.1/ 0.2/ 0.5/ 1.0/ 2.0/ 3.0 times of rating

16.6 Harmonic measurement (Range)

Meas. Method	PLL synchro system
Measuring range	45 ~ 65Hz
Analysis order	1 ~ 63rd
Window width	2 cycles
Window type	Rectangular
Analysis data	512 points
Analyzing rate	approx once / 2 sec
Display item	(1) Voltage, current, THD, frequency (2) Voltage/ Rate of content/ Phase angle at each order
Save item	(1) Voltage, current, THD (2) Voltage/ Phase angle at each order

16.7 Power quality (QUALITY Range)

16.7.1 Swell/ Dip/ Int measurement

Meas. Method	Calculate RMS values based on an overlapped waveform at every half waveform. Judges the presence of events at every 1s.
Detection CH	VN - V1
Display item	(1) 1-sec avg (2) Number of occurrence of Swell/ Dip/ Int (3) Month/ date/ time when event began (4) Month/ date/ time when event finished (5) Duration
Save item	Display items (3) ~ (5) Data at the occurrence of event or before/ after the event (201 in total) Recording start and end date and time

16.7.2 Transient measurement

Meas. Method	Sampling at every 100µs, and calculating the max value at every 2ms Judges the presence of events at every 1s.
Detection CH	VN - V1
Display item	(1) max value in 1 sec (2) Number of event (3) Year/ month/ date/ time when max voltage occurred (4) Max voltage
Save item	(3) & (4) of display items Data before/ after the max voltage is recorded (201 in total) Recording start and end date and time

16.7.3 Inrush current measurement

Meas. Method	Calculate RMS values based on an overlapped waveform at every half waveform. Judges the presence of events at every 1s.
Detection CH	A1
Display item	(1) 1-sec avg (2) Number of event (counting at the start of event) (3) Month/ date/ time when event begin (4) Month/ date/ time when event finish (5) Max current (6) Duration
Save item	Display items (3) & (4) Data before/ after the max voltage is recorded (201 in total) Recording start/ end date and time

16.7.4 Unbalance rate measurement

Meas. Method	( ) vector display Voltage / current unbalance rate
Save item	(Measurement data at W Range) + (Unbalance rate)
Measurable wiring configuration	⑪3P3W3A, ⑫3P4W×1, ⑬3P4W×1+1A
Formula	$umb = \frac{reversed\_phase\_voltage(current)}{positive\_phase\_voltage(current)}$

16.7.5 Capacitance calculation

Display item	Same to W Range (except for the change from PA to C)
Save item	(Measurement data at W Range) + (calculated capacitance value)
Formula	$C = P \times \left(\left(\sqrt{\frac{1}{\cos^{-2}\theta_1}} - 1 \right) - \sqrt{\frac{1}{\cos^{2}\theta_{-0}}} - 1) \right) [k\,\mathrm{var}] = \frac{P \times 10^{-9}}{2\pi f \times V^2} \times \left(\left(\sqrt{\frac{1}{\cos^{-2}\theta_1}} - 1 \right) - \sqrt{\frac{1}{\cos^{2}\theta_{-0}}} - 1) \right) [\mu F]$ C : Capacitance needs for improvement P : Load power [kW] f : Frequency V : Voltage $\cos\theta_1$: Measured power factor $\cos\theta_0$: New power factor (target)

16.8 Other specifications

(1) AC power supply

Voltage range	AC100 ~ 240V±10%
Frequency	45 ~ 65Hz
Power consumption	20VA max

(2) DC power supply

	Dry battery	Rechargeable battery
Type	Alkaline (LR6)	Ni-MH(HR-15-51)
Rated voltage	DC9V (=1.5Vx6)	DC7.2V (=1.2Vx6)
Current consumption	500mA typ.(@9V)	560mA typ.(@7.2V)
Possible measurement time	Backlight ON: 1 hour Backlight OFF: 2 hours (ref. at 23ºC)	Backlight ON: 2 hours Backlight OFF: 5 hours (ref. at 23ºC after full-charge)

(3) Battery charge

Charging voltage	approx 9V
Charging current	approx 400mA
Charging pattern	Charging pattern is as follows to control whole current consumption.

Pattern	Charging	Pause	Total charging time
I. Power ON, LCD_ON	0.7	4.3	48
II. Power ON, LCD_OFF	2.1	2.9	14
III. Power OFF	4.2	0.8	7
		[min]	[hour]

Start charging	Following should be completely met. - Supply of power from AC power supply - Selector switch is set to “Rechargeable battery” position. - Operation to start battery charge
Finish charging	Battery charge stops if any of following is met. <For Pattern I, II> (1) power from AC power supply is stopped, (2) selector switch is set to “Dry battery” position, (3) 48hours later from the start of battery charge, (4) Battery voltage becomes lower than that checked at previous pause period, (5) charging voltage is 9.5V or more (batteries are removed), (6) specific charging cycle is exceeded. <For Pattern III> Battery charge stops if Any of (1), (4), (5), (6) is met.

(4) Battery check function

Power supply		Mark	Battery voltage [V] (±0.2V)	
			Dry battery	Rechargeable battery
AC power supply			---	---
DC power supply (battery)	Effective range	 20 ~ 100% (by 20%)	6.0 ~ 10.5V	6.9 ~ 10.5V
	Warning	 0%	6V or less	6.9V or less

* AC power supply has priority.

* Recording stops when battery level drops to the warning level, and indications on the LCD disappear.

(5) Recording data

Internal memory

Memory	FLASH memory
Recording capacity	1.8MB Measurement file (CSV) : 256kB × 6 blocks (=1.536MB) Screen file (BMP) : 32kB × 7 blocks (=0.224MB) Configuration file (KAS) : 32kB
Max number of files	Measurement file (CSV) : 6 files Screen file (BMP) : 7 files Configuration file (KAS) : 20 files

PC Card

Card type	Compact flash card (CF card)
Slot	Type I / II
Format	FAT16
Capacity	32M/ 64M/ 128M/ 256M/ 512M/ 1GB
Max number of file	max 512 files (with name of one-byte 8 characters or less)
Save format	CSV format
File name	Refer to the sections for Internal memory
Mark	“CF” mark appears if the data is being saved in the CF card.
FULL indication	Appears when saved data size or number of saved file exceeds the capacity. Data cannot be saved while this mark is being displayed. (measurement can be done and indications are refreshed accordingly, but data isn’t saved)

(6) External communication function

Communication method	USB Ver1.1
USB identification no.	Vendor ID : 12EC(Hex) Product ID : 6310(Hex) Serial no. : 0+７ digit individual no
Communication speed Baud rate	19200bps

* Connecting some KEW6310 (max 10pcs) in daisy chain via HUB enables individual identification.

(data transfer to PC can be done one by one)

* USB cable of 2m or less is recommended. (max 5m)

(6) External communication function

Output format	Open collector
Max input	30V, 50mA, 200mW
Out put voltage	Hi : 4 ~ 5V Lo : 0 ~ 1V

16.9 Specification of Clamp sensor

	< MODEL8128 >	< MODEL8127 >	< MODEL8126 >
			
Rated current	AC 5Arms (max rating: AC50Armns)	AC 100Arms (141Apeak)	AC 200Arms (283Apeak)
Output voltage	0 ~ 50Arms (AC 50mV/AC 5A) (AC 500mV/AC50A)	AC0 ~ 500mV (AC500mV/AC100A) : 5mV/A	AC0 ~ 500mV (AC 500mV/AC200A) : 2.5mV/A
Measuring range	AC0 ~ 50Arms(70.7Apeak)	AC0 ~ 100A	AC0 ~ 200A
Accuracy (sine input)	±0.5%rdg±0.1mV (50/60Hz) ±1.0%rdg±0.2mV (40Hz ~ 1kHz)		
Phase characteristics	within ±2.0° (0.5 ~ 50A/ 45 ~ 65Hz)	within ±2.0° (1 ~ 100A/ 45 ~ 65Hz)	within ±1.0° (2 ~ 200A/ 45 ~ 65Hz)
Temp. & humidity range (guaranteed accuracy)	23±5°C, relative humidity 85% or less (no condensation)		
Operating temp. range	0 ~ 50°C, relative humidity 85% or less (no condensation)		
Storage temp. range	-20 ~ 60°C, relative humidity 85% or less (no condensation)		
Allowable input	AC50Arms (50/60Hz)	AC100Arms (50/60Hz)	AC200Arms (50/60Hz)
Output impedance	approx 20Ω	approx 10Ω	approx 5Ω
Location for use	indoor use, altitude 2000m or less		
Applicable standard	IEC 61010-1, IEC 61010-2-032 Measurement CAT.III (300V) Pollution degree 2 IEC61326		IEC 61010-1, IEC 61010-2-032 Measurement CAT.III (600V) Pollution degree 2 IEC61326
Withstand voltage	AC3540V/ 5 sec between Jaws – enclosure, enclosure – output terminal, Jaws – output terminal	AC3540V/ 5 sec between Jaws – enclosure, enclosure – output terminal, Jaws – output terminal	AC5350V/ 5 sec between Jaws – enclosure, enclosure – output terminal, Jaws – output terminal
Insulation resistance	50MΩ or more/ 1000V between Jaws – enclosure, enclosure – output terminal, Jaws – output terminal		
Max conductor size	Φ24mm		Φ40mm
Dimension	100(L) × 60(W) × 26(D)mm		128(L) × 81(W) × 36(D)mm
Cable length	approx 3m		
Output terminal	MINI DIN 6PIN		
Weight	approx 160g		approx 260g
Accessory	Instruction manual, Cable marker		
Option	7146 (Φ4 Banana plug), 7185 (Extension lead)		

< MODEL8125 >	< MODEL8124 >	< KEW8129 >
		
AC 500Arms (707Apeak)	AC 1000Arms (1414Apeak)	AC 300/1000/3000 Arms
AC0 ~ 500mV (AC500mV/500A) : AC 1mV/A	AC0 ~ 500mV (AC500mV/1000A) : 0.5mV/A	300A Range : AC500mV/AC300A(1.67mV/A) 1000A Range : AC500mV/AC1000A(0.5mV/A) 3000A Range : AC500mV/AC3000A(0.167mV/A)
AC0 ~ 500Arms	AC0 ~ 1000Arms	300A Range : 30 ~ 300Arms (424Apeak) 1000A Range 100 ~ 1000Arms (1414Apeak) 3000A Range : 300 ~ 3000Arms(4243Apeak)
±0.5%rdg±0.1mV (50/60Hz) ±1.0%rdg±0.2mV (40Hz ~ 1kHz)	±0.5%rdg±0.2mV (50/60Hz) ±1.5%rdg±0.4mV (40Hz ~ 1kHz)	±1.0%rdg (45 ~ 65Hz) (at the center of sensor)
within ±1.0° (5 ~ 500A/ 45 ~ 65Hz)	within ±1.0° (10 ~ 1000A/ 45 ~ 65Hz)	within ±1.0º (within the measuring range of each Range at frequency of 45 ~ 65Hz)
23±5°C, relative humidity 85% or less (no condensation)		
0 ~ 50°C, relative humidity 85% or less (no condensation)		
-20 ~ 60°C, relative humidity 85% or less (no condensation)		
AC500Arms (50/60Hz)	AC1000Arms (50/60Hz)	AC3600Arms (50/60Hz)
approx 2Ω	approx 1Ω	approx 100Ω or less
indoor use, altitude 2000m or less		
IEC 61010-1, IEC 61010-2-032 Measurement CAT.III (600V), Pollution degree 2 IEC61326		
AC5350V/ 5 sec between Jaws – enclosure, enclosure – output terminal, Jaws – output terminal		AC5350V/ 5 sec between circuit – sensor
50MΩ or more/ 1000V between Jaws – enclosure, enclosure – output terminal, Jaws – output terminal		50MΩ or more/ 1000V between circuit – sensor
Φ40mm	Φ68mm	Φ150mm
128(L) × 81(W) × 36(D)mm	186(L) × 129(W) × 53(D)mm	111(L) × 61(W)× 4 3(D)mm (protrusions are not included)
approx 3m		Sensor part : approx 2m Output cable : approx 1m
MINI DIN 6PIN		
approx 260g	approx 510g	8129-1 : approx410g 8129-2 : approx680g 8129-3 : approx950g
Instruction manual, Cable marker		Instruction manual, Output cable (M-7199) Carrying case
7146 (Φ4 Banana plug), 7185 (Extension lead)		

	＜MODEL8141 ＞	＜MODEL8142 ＞	＜MODEL8143 ＞
			
Rated current	AC1000mA		
Output voltage	AC0 ~ 100mV (AC100mV/ AC1000mA)		
Measuring range	AC0 ~ 1000mA		
Accuracy (sine input)	±1.0%rdg±0.1mV (50/ 60Hz) ±2.0%rdg±0.1mV (40Hz ~ 1kHz)		
Phase characteristics	----------		
Temp. & humidity range (guaranteed accuracy)	23±5°C, relative humidity 85% or less (no condensation)		
Operating temp. range	0 ~ 50°C, relative humidity 85% or less (no condensation)		
Storage temp. range	-20 ~ 60°C, relative humidity 85% or less (no condensation)		
Allowable input	AC100Arms (50/60Hz)	AC200Arms (50/60Hz)	AC500Arms (50/60Hz)
Output impedance	approx 180Ω	approx 200Ω	approx 120Ω
Location for use	indoor use, altitude 2000m or less		
Applicable standard	IEC 61010-1, IEC 61010-2-032 Measurement CAT.III (300V) Pollution degree 2 IEC61326 (EMC standard)		
Withstand voltage	AC3540V / 5 sec between Jaws - enclosure between enclosure – output terminal between Jaws – output terminal		
Insulation resistance	50MΩ or more/ 1000V between Jaws - enclosure between enclosure – output terminal between Jaws – output terminal		
Max conductor size	Φ24mm	Φ40mm	Φ68mm
Dimension	100(L) × 60(W) × 26(D)mm (protrusions are not included)	128(L) × 81(W) × 36(D)mm (protrusions are not included)	186(L) × 129(W) × 53(D)mm (protrusions are not included)
Cable length	approx 2m		
Output terminal	MINI DIN 6PIN		
Weight	approx 150g	approx 240g	approx 490g
Accessory	Instruction manual, Carrying case		
Option	7146 (Φ4 Banana plug), 7185 (Extension lead)		

< KEW8146 >	< KEW8147 >	< KEW8148 >
		
AC 30Arms (42.4Apeak)	AC 70Arms (99.0Apeak)	AC 100Arms (141.4Apeak)
AC0 ~ 1500mV(AC50mV/A)	AC0 ~ 3500mV(AC50mV/A)	AC0 ~ 5000mV(AC50mV/A)
AC0 ~ 30Arms	AC0 ~ 70Arms	AC0 ~ 100Arms
0 ~ 15A ±1.0%rdg±0.1mV (50/60Hz) ±2.0%rdg±0.2mV (40Hz ~ 1kHz) 15 ~ 30A ±5.0%rdg (50/60Hz) ±10.0%rdg (45 ~ 1kHz)	0 ~ 40A ±1.0%rdg±0.1mV (50/60Hz) ±2.0%rdg±0.2mV (40Hz ~ 1kHz) 40 ~ 70A ±5.0%rdg (50/60Hz) ±10.0%rdg (45 ~ 1kHz)	0 ~ 80A ±1.0%rdg±0.1mV (50/60Hz) ±2.0%rdg±0.2mV (40Hz ~ 1kHz) 80 ~ 100A ±5.0%rdg (50/60Hz) ±10.0%rdg (45 ~ 1kHz)

23±5°C, relative humidity 85% or less (no condensation)		
0 ~ 50°C, relative humidity 85% or less (no condensation)		
-20 ~ 60°C, relative humidity 85% or less (no condensation)		
AC30Arms (50/60Hz)	AC70Arms (50/60Hz)	AC100Arms (50/60Hz)
approx 90Ω	approx 100Ω	approx 60Ω
indoor use, altitude 2000m or less		
IEC 61010-1, IEC 61010-2-032 Measurement CAT.III (300V), Pollution degree 2 IEC61326		
AC3540V/ 5 sec between Jaws - enclosure between enclosure – output terminal between Jaws – output terminal		
50MΩ or more/ 1000V between Jaws – enclosure, between enclosure – output terminal, between Jaws – output terminal		
Φ24mm	Φ40mm	Φ68mm
100(L) × 60(W) × 26(D)mm	128(L) × 81(W) × 36(D)mm	186(L) × 129(W) × 53(D)mm
approx 2m		
MINI DIN 6PIN		
approx 150g	approx 240g	approx 510g
Instruction manual, Cable marker		
7146 (Φ4 Banana plug), 7185 (Extension lead)		

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