HIOKI

Instruction Manual

3145-20

NOISE HiLOGGER

Contains explanation and instructions regarding the 3145-20 NOISE HiLOGGER's operating method and functions.

HIOKI E.E. CORPORATION

April 2013 Revised edition 5 3145A981-05 13-04H

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Contents

Introduction

Thank you for purchasing the HIOKI "Model 3145-20 NOISE HiLOGGER." To obtain maximum performance from the instrument, please read this manual first, and keep it handy for future reference.

The following instruction manuals are included with the 3145-20 NOISE HiLOGGER. Refer to them as they pertain to your usage of the instrument.

Manuals		Contents
1	Measurement Guide	**Read first.** Offers an introduction to the 3145-20's basic measuring method for first time users.
2	Instruction Manual (this manual)	Contains explanation and instructions regarding the instrument's operating method and functions.

CD		Contents
3	"DATA VIEWER for 3145" Instruction Manual	Contains information about PC software which can analyze the measurement data recorded by the instrument.
4	"Communications" Instruction Manual	Explains the communication functions which can be used via the LAN and RS-232C interfaces.
5	"Communication Commands" Instruction Manual	Explains the commands for remote control of the instrument via the LAN and RS-232C interfaces.

Use the optional Clamp on Noise Sensor for measuring current. Read the instruction manual included with the Clamp on Noise Sensor and follow all safety precautions.

User's License

The "DATA VIEWER for 3145" software is included with the instrument. This software requires a license agreement. Please use it only after reading and accepting the license agreement at the back of the book.

Registered Trademarks

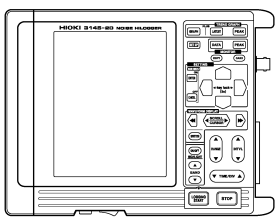
Windows, Microsoft Excel, and MS-DOS are registered trademarks of Microsoft Corporation in the United States and/or other countries.

Verifying Package Contents

- When you receive the instrument, inspect it carefully to ensure that no damage occurred during shipping. In particular, check the accessories, panel switches, and connectors. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.
- Use the original packing materials when transporting the instrument, if possible.

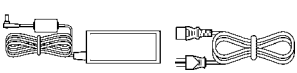
Please check to make sure that no items are missing from your package.

☐ Model 3145-20 NOISE HiLOGGER 1



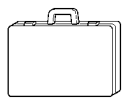
Accessories

☐ Model 9418-15 AC ADAPTER 1

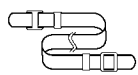


☐ Ferrite cores 3

☐ Carrying case 1



☐ Strap.....1



☐ CD (Software, Instruction Manuals)
.....1

- "DATA VIEWER for 3145" Software and Instruction Manual
- "Communications" Instruction Manual
- "Communication Commands" Instruction Manual

☐ Instruction Manual (this manual)/
Measurement Guide.....each one

Options
- ☐ Model 9754 CLAMP ON NOISE SENSOR
- ☐ Model 9418-15 AC ADAPTER
- ☐ Model 9447 BATTERY PACK (7.2 V, 2400 mAh)
- ☐ Model 9643 CHARGE STAND (For the 9447 BATTERY PACK)
- ☐ Model 9612 RS-232C CABLE
  (9-pin mini DIN to 9-pin Dsub, cross cable, for PC)
- ☐ Model 9721 RS-232C CABLE
  (9-pin mini DIN to 9-pin Dsub, straight cable, for modem)
- ☐ Model 9726 PC CARD 128M
- ☐ Model 9727 PC CARD 256M
- ☐ Model 9728 PC CARD 512M
- ☐ Model 9729 PC CARD 1G
- ☐ Model 9642 LAN CABLE

Safety Information

DANGER **This instrument is designed to comply with IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the instrument. Using the instrument in a way not described in this manual may negate the provided safety features.**
Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from instrument defects.

Notation

Safety Symbols

This manual contains information and warnings essential for safe operation of the instrument and for maintaining it in safe operating condition. Before using it, be sure to carefully read the following safety precautions.

	In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the instrument.
	The ⚠ symbol printed on the instrument indicates that the user should refer to a corresponding topic in the manual (marked with the ⚠ symbol) before using the relevant function.
	Indicates a grounding terminal.
	Indicates DC (Direct Current).
	Indicates the ON side of the power switch.
	Indicates the OFF side of the power switch.

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

DANGER	Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.
WARNING	Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.
CAUTION	Indicates that incorrect operation presents a possibility of injury to the user or damage to the instrument.
NOTE	Indicates advisory items related to performance or correct operation of the instrument.

Others

	Indicates a prohibited action.
(⇒ p.)	Indicates the location of reference information.
	Indicates quick references for operation and remedies for troubleshooting.
*	Indicates that descriptive information is provided below.

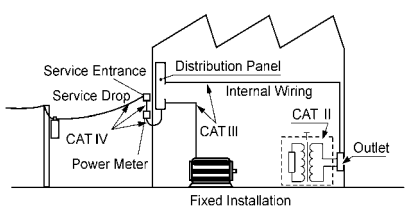
Accuracy We define measurement tolerances in terms of rdg. (reading) value, with the following meanings:
rdg. (reading or displayed value)
The value currently being measured and indicated on the measuring instrument.

Measurement categories

To ensure safe operation of measurement instrument, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT II to CAT IV, and called measurement categories.

CAT II	Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.) CAT II covers directly measuring electrical outlet receptacles.
CAT III	Primary electrical circuits of heavy equipment (fixed installations) 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 instrument (distribution panel).

Using a measurement instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.
Use of a measurement instrument that is not CAT-rated in CAT II to CAT IV measurement applications could result in a severe accident, and must be carefully avoided.



Operating Precautions

Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

Preliminary checks

Before using the instrument the first time, verify that it operates normally to ensure that the no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.

WARNING **Before using the instrument, make sure that the insulation on the test leads is undamaged and that no bare conductors are improperly exposed. Using the instrument in such conditions could cause an electric shock, so contact your dealer or Hioki representative for repair.**

Installing the instrument

Operating temperature & humidity: 0 to 40°C (32 to 104°F), 80%RH or less (non-condensating)
Operating temperature & humidity for guaranteed accuracy: 23 ± 5°C (73 ± 9°F), 80%RH or less

Avoid the following locations that could cause an accident or damage to the instrument.

Exposed to direct sunlight
Exposed to high temperature

In the presence of corrosive or explosive gases

Exposed to liquids
Exposed to high humidity or condensation

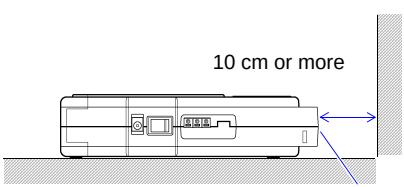
Exposed to strong electromagnetic fields
Near electromagnetic radiators

Exposed to high levels of particulate dust

Subject to vibration

Installing the instrument

- Vents must not be obstructed.
- The instrument should be operated only with the bottom side downwards.
- Do not place on an unstable stand or on an incline.



Handling the instrument

DANGER **To avoid electric shock, do not remove the instrument's case. The internal components of the instrument carry high voltages and may become very hot during operation.**

CAUTION To avoid damage to the instrument, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock from dropping.

NOTE To avoid problems with battery operation, remove the batteries from the instrument if it is to be stored for a long time.

Handling the CD

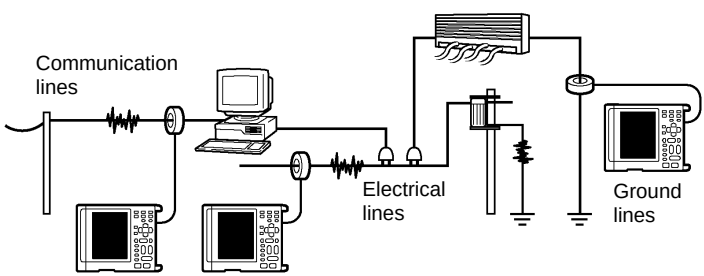
CAUTION

- Always hold the disc by the edges, so as not to make fingerprints on the disc or scratch the printing.
- Never touch the recorded side of the disc. Do not place the disc directly on anything hard.
- Do not wet the disc with volatile alcohol or water, as there is a possibility of the label printing disappearing.
- To write on the disc label surface, use a spirit-based felt pen. Do not use a ball-point pen or hard-tipped pen, because there is a danger of scratching the surface and corrupting the data. Do not use adhesive labels.
- Do not expose the disc directly to the sun's rays, or keep it in conditions of high temperature or humidity, as there is a danger of warping, with consequent loss of data.
- To remove dirt, dust, or fingerprints from the disc, wipe with a dry cloth, or use a CD cleaner. Always wipe radially from the inside to the outside, and do no wipe with circular movements. Never use abrasives or solvent cleaners.
- Hioki shall not be held liable for any problems with a computer system that arises from the use of this CD, or for any problem related to the purchase of a Hioki product.

Overview Chapter 1

1.1 Product Overview

The 3145-20 NOISE HiLOGGER is the ideal measuring instrument for measuring current on lines which can easily become channels for noise penetration, such as communication lines, electric power cords and ground lines which connect to electronic equipment.
By clamping with the 9754 CLAMP ON NOISE SENSOR the 3145-20 detects noise without touching the sample. Therefore it can perform measurements on instruments in their normal operational state, without worry of communication malfunction due to probe contact, or electrical shock or electrical short circuit accidents from electrical lines. Furthermore, it can reliably detect sudden surges which may occur unexpectedly, such as thunder surges and open-close surges.
With the use of the logging function, long term or cyclic noise level fluctuations can be understood. Recorded data is shown on the instrument's color LCD display as a chronological graph. Additionally, transferring data to a PC and checking the chronological graph can be done using the "DATA VIEWER for 3145" software on the included CD. This can be useful for examining noise counter-measures after an occurance of noise interference.



1.2 Features

Simple and safe measurements
With the use of the optional Clamp on Noise Sensor, noise can be measured on power cords, various communications lines, and ground lines without making contact or grounding.

Wide frequency range (5 kHz - 100 MHz)
The instrument is effective for detecting switching regulator noise, inverter noise, electrostatic discharge noise, and FM broadcast wave noise.

Surge detection
The instrument detects lightning surges, power-related switching surges, and electrostatic discharge noise.

Logging measurement function
Long-term and cyclic noise levels can be ascertained, and the times at which the noise and interference occured can be investigated.

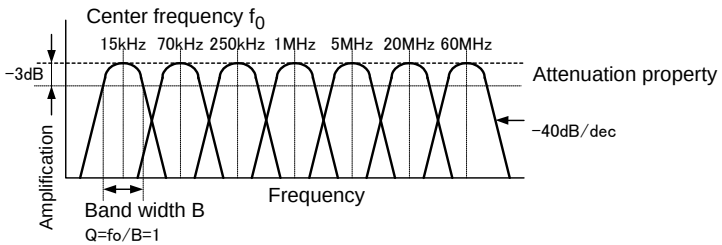
Alarm function and event mark function
An alarm level for alarm output can be set, and event marking can be enacted at the time an event occurs.

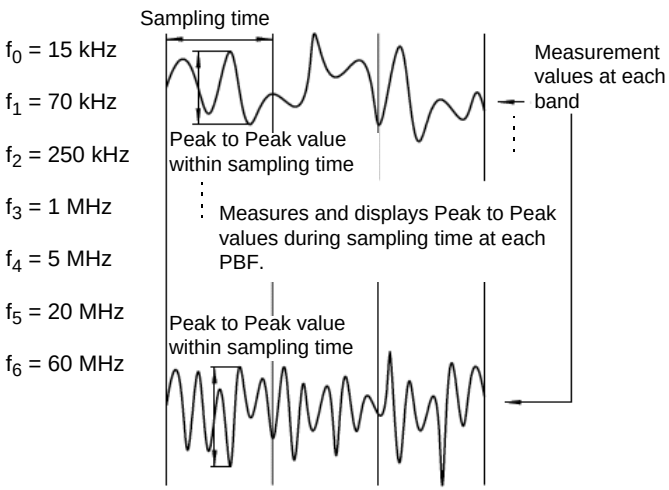
Remote measuring with an HTTP server
Remote control of the instrument's settings, data acquisition and data display can be performed using a web-based browser such as IE.

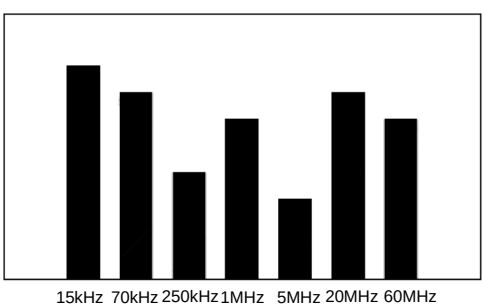
A portable, dedicated noise measurement instrument intended for on-site use
The instrument supports two types of power sources, recharchable batteries designed for on-site use, and an AC adaptor power supply for long period observation and remote measuring. The recharchable battery can also be used as a backup in case of power failure.

1.3 Measuring Principle

The instrument separates input noise waves into frequency bandwidths using a seven band-pass filter (7 frequency waves) and detects and displays peak values (Peak to Peak values) for each respective frequency range.



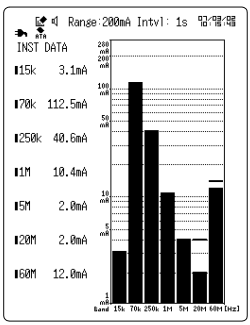




1.3.1 Monitor Measuring and Logging Measuring

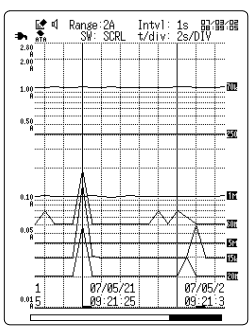
This instrument has two measuring modes, monitor and logging.

Monitor measurement

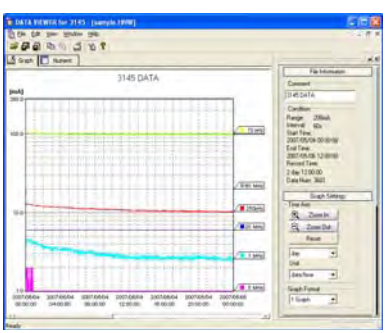


The current input levels of each frequency are displayed as a bar graph and numbers.
Noise measurement can be made easily in the tester interval.

Logging measurement



With the logging measurement function the change over time of the noise level of each frequency band is recorded. When and at what frequency band
noise penetrated can be easily ascertained. The time that the interference occured and the type of noise that occured at that time can be understood.
The peak value within the manually set recording interval segment is saved in the internal memory and displayed in a chronological bar graph. The recording interval can be set between 1 second and 60 seconds.

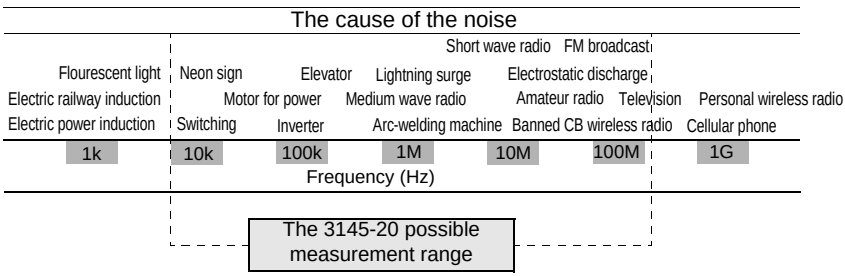


Measurement data can be saved on PC card. Daily and weekly changes in the noise can be observed using the "DATA VIEWER for 3145" software on the included CD to conduct daily and weekly calculation displays of the recorded data.

1.3.2 Merits of the Measurement Method of this Instrument

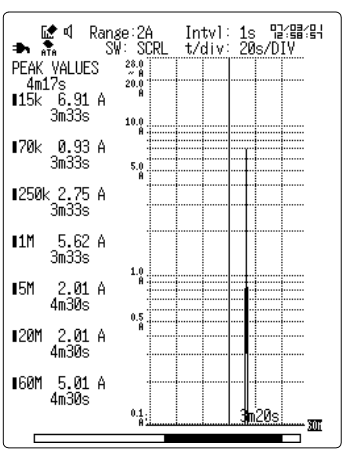
Simultaneous noise measurement of each frequency bandwidth from 10 kHz to 100 MHz.

Noise exists in a wide bandwidth and its frequency differs depending on its cause. With this instrument a wide bandwidth of noise can be checked all at once.



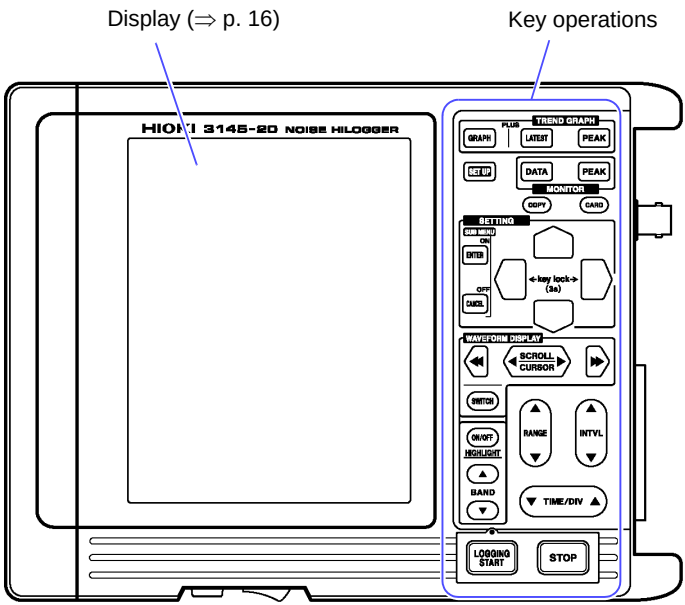
Peak-detection function for capturing surge events

Surge incidents of noise such as lightning surges and electrostatic discharge noise sometimes occur. Using the instrument's peak function, incidents of surge noise can be accurately captured.



1.4 Names and Functions of Parts

Front Panel

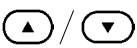
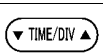


Key operations

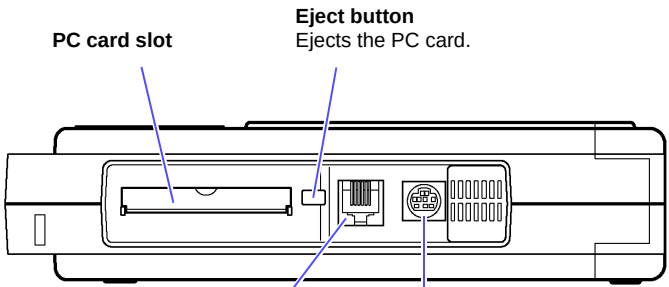
Logging (time series graph)	
GRAPH	Displays the waveforms on the full screen.
LATEST	Displays the latest value on the left side, and the waveforms on the right side of the screen.
PEAK	Displays the peak value on the left side, and the waveforms on the right side of the screen.

Monitor (level meter)	
DATA	Displays the instantaneous values as a bar graph. Displays the instantaneous values on the left side, and a bar graph on the right side of the screen.
PEAK	Displays the peak values as a bar graph. Displays the peak values on the left side, and the bar graph on the right side of the screen.

Key operations (continued)

SET UP	Displays the Set up screen (the screen for setting the measurement conditions).
COPY	Saves an image of the display screen to a PC card. Takes the alarm reference value from the measurement value.
CARD	Displays the PC card screen. Performs loading and saving of measurement and other data.
ENTER	Displays the settings contents summary. Turns off the settings contents display.
CANCEL	Cancels the item selected with the cursor.
	Moves the cursor up, down, left and right.
	Scrolls the waveform. Moves the A/B cursor.
SWITCH	Switches between waveform scroll and A/B cursor movement.
ON/OFF	Highlights and displays a particular waveform during logging measurement.
	Selects the band to highlight.
	Sets the range. When the input category is current sensor: selects between 200 mA, 2 A and 20 A. When the input category is voltage: selects between 10 mV, 100 mV and 1 V. The possible measurement range differs depending on the selected range.
	Sets the interval for taking data. Select 1s, 2s, 5s,10s, 20s, 30s or 60s to suit the object to be measured. Shortening the recording interval causes the maximum recording time to be decreased.
	Sets the logging measurement time axis (horizontal axis). Select 2s, 5s, 10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h,10h, 12h or 1d. The time axis indicates the time of 1 mass in the horizontal axis direction.
LOGGING START	Commences logging measurement. Adds an event marker if pressed during measurement. (regarding the key LED display) Green light : Performing logging measurement; backlight OFF Flashing green light : Performing settings; backlight OFF Red light : Performing battery charge with the power turned off.
STOP	Press twice to stop logging measurement.

Upper Panel



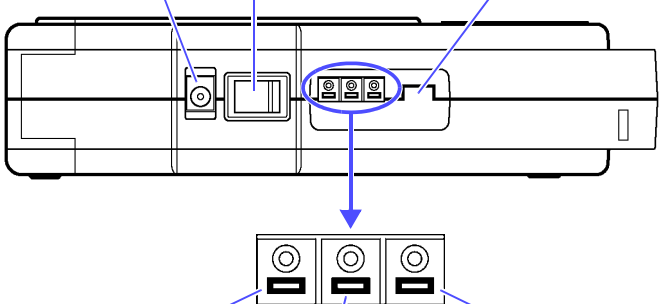
PC card slot

Eject button
Ejects the PC card.

10BASE-T Ethernet connection port
Connects with a 9642 LAN CABLE.

RS-232C port
Connects with the 9612 RS-232C CABLE (cross cable for PC use) or the 9721 RS-232C CABLE (straight cable for modem use).

Lower Panel



AC adaptor input connector

Power switch (POWER)

Contrast adjustment control (CONTRAST)

EXT TRIG terminal (external trigger)
Used for entering event markers during logging measurement. (⇒ p. A2)

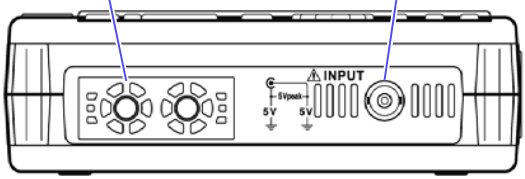
TRIG OUT terminal (trigger output)
Outputs a signal during warning. (⇒ p. A5)

GND terminal
Used in combination with the trigger terminals

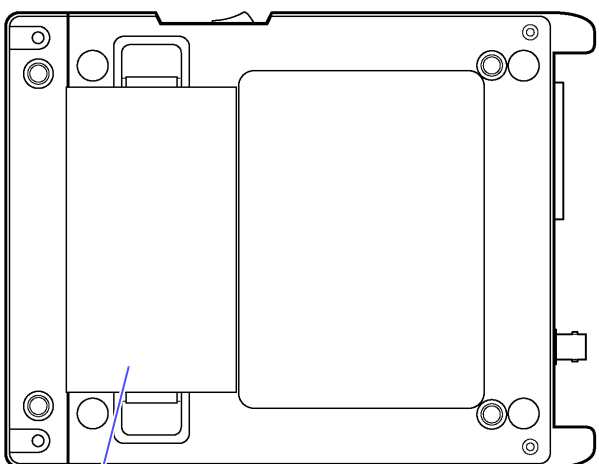
Right Panel

Ventilation holes

Input terminal
Connects with the Clamp on Noise Sensor.



Bottom Panel



Battery box
For installing the 9447 BATTERY PACK

1.5 Display Screen

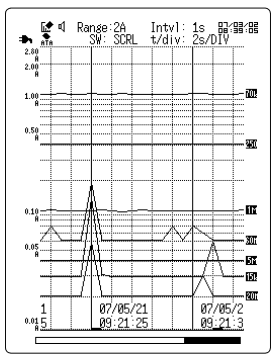
1.5.1 Screen Layout

Broadly classified, the instrument has the following 6 different display screen layouts.

Logging Screen

- Full
- Latest values
- Peak values

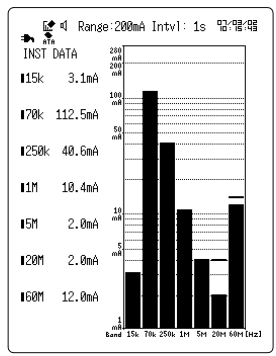
(Full screen shown right)



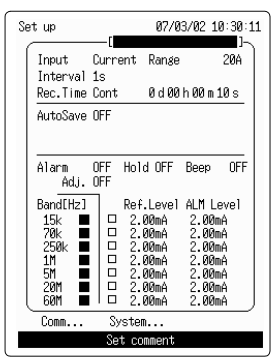
Monitor Screen

- Instantaneous values
- Peak values

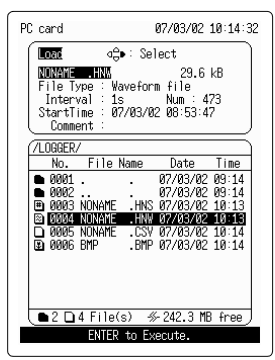
(Instantaneous value shown right)



Set up Screen

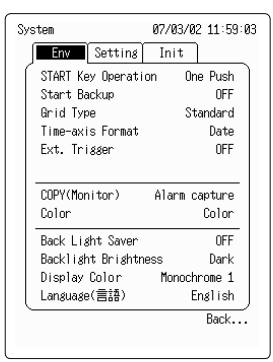


PC card Screen

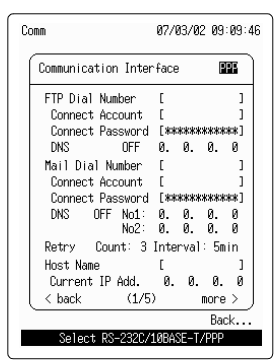


System Screen

- Env
- Setting
- Init



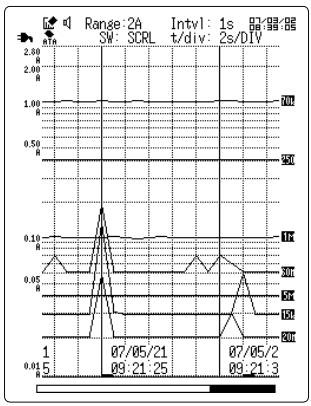
Comm Screen



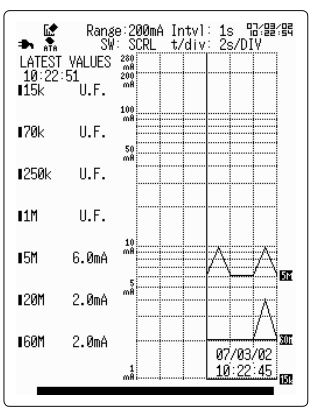
1.5.2 Logging Screen

The logging screen has three display types: full screen display, latest value display, and peak value display.

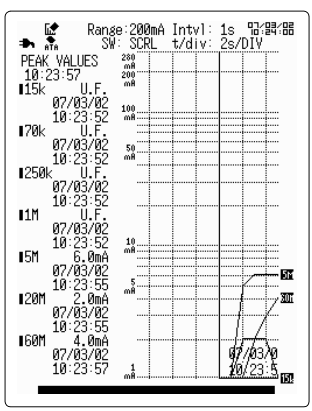
Displays the waveforms on the full screen.



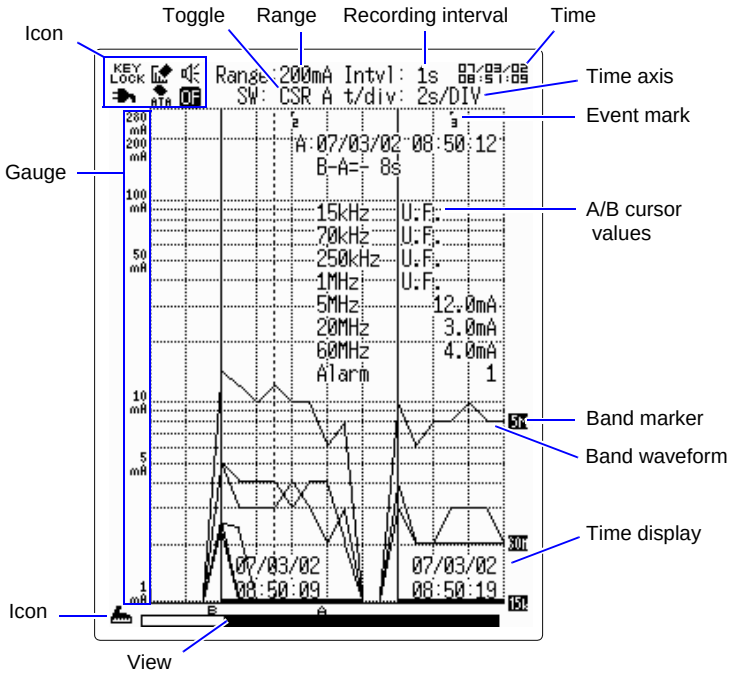
Displays the latest value on the left side, and the waveforms on the right side of the screen.



Displays the peak value on the left side, and the waveforms and date and time on the right side of the screen.



Logging screen



Icon Displays various aspects of the instrument's current state. (⇒ p. 22)

Gauge The vertical axis of the graph (logarithmic display).

Toggle Press SWITCH to toggle between the following functions:

Scroll: Scroll through the waveform using SCROLL CURSOR.

Cursor A: Move cursor A using SCROLL CURSOR.

Cursor B: Move cursor B using SCROLL CURSOR.

Range The measurement range. Use RANGE to set.

Recording interval The recording interval for logging measurement.

Use INTVL to set.

Time Displays the current time. Set using the System Init screen.

Time axis The period of time for 1 mass in the time access direction. Use ▼ TIME/DIV ▲ to set.

Event mark A mark can be added by pressing LOGGING START during logging measurement.

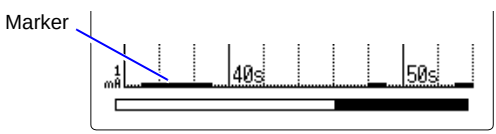
A/B cursor values The read value of the measurement value.

Band marker Indicates which waveform band is being displayed.

Individual band waveform The measurement waveforms for each individual band.

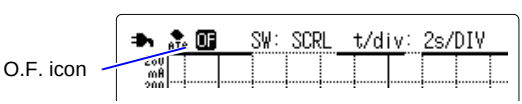
Time display The graph's horizontal axis (measurement time) display.
Toggles between time, date and time, and data number for the current display each time the key is pressed. For example, during full screen display the display format changes each time GRAPH is pressed.

Alarm waveform If the alarm function is set and the measurement value exceeds the judgment value a marker appears at the bottom of the graph.



View The display position of the currently displayed waveform (the section of waveform being displayed relative to the full waveform).
Also displays the positions of the A cursor and B cursor.

Overflow (O.F.) If the measurement value exceeds the measurement range, a marker appears at the top of the graph. Also, the OF icon is displayed in the upper left of the screen.

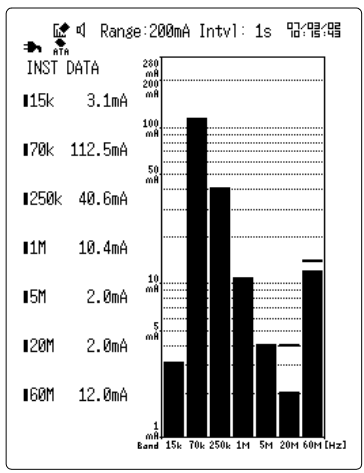


Underflow (U.F.) Underflow occurs when the measurement value is lower than the measurement range.

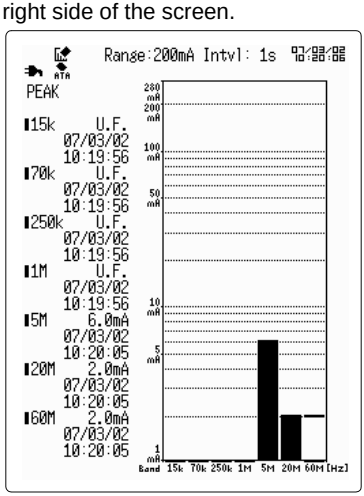
1.5.3 Monitor Screen

The monitor screen has two display types: instantaneous value display and peak value display.

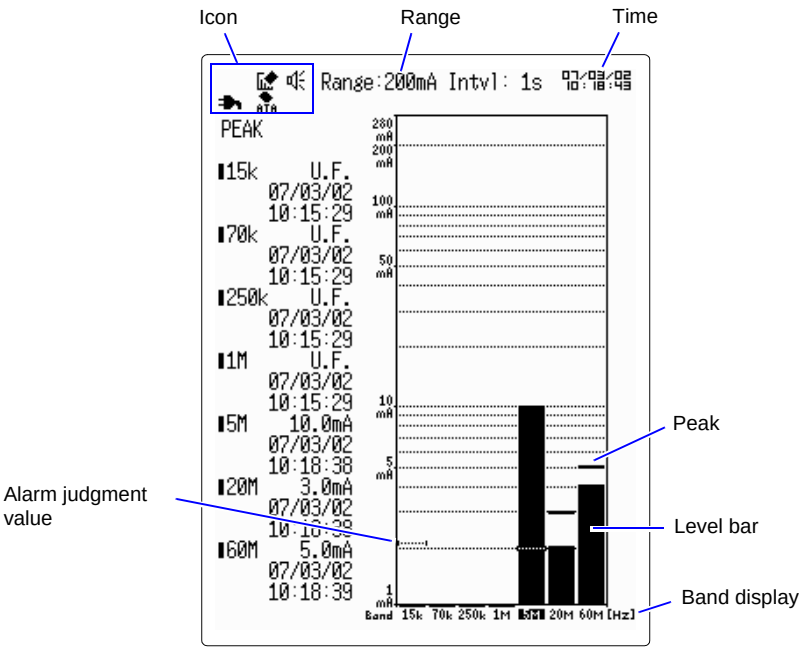
Displays the instantaneous values on the left side, and a bar graph on the right side of the screen.



Displays the peak value with its date and time on the left side, and a bar graph on the right side of the screen.



Monitor screen



Icon Displays various aspects of the instrument's current state. (⇒ p. 22)

Range The measurement range. Use RANGE to set.

Time Displays the current time. Set using the System Init screen.

Alarm judgment value The value at which an alarm is triggered at each band when using the alarm function.

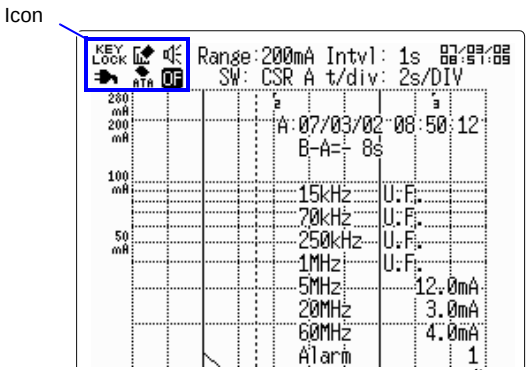
Peak The peak value at the time of the screen display.

Level bar The current input value.

Band display The frequency band display.

1.5.4 Icon Summary

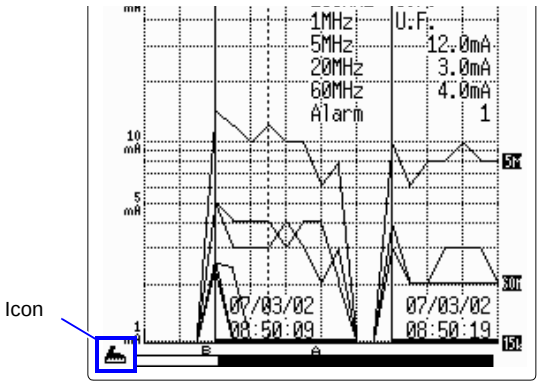
The following icons are displayed in the upper left of the logging and monitor screens.



(Logging screen shown above)

Icons	Explanations
KEY LOCK	Indicates that the instrument cannot receive commands from the front panel keys (Key lock). Simultaneously pressing 〈/〉 for 3 seconds or more will switch between Lock and Unlock.
	Indicates that the System Env screen copy key is set to "Screen capture". When COPY is pressed the display screen is BMP saved to the PC card. Refer to "7.1.7 Copy Key Function (Monitor)" (⇒ p. 116)
	Indicates that the System Env screen copy key is set to "Alarm capture". When COPY is pressed the alarm reference value is taken. Refer to "7.1.7 Copy Key Function (Monitor)" (⇒ p. 116)
	Indicates that the instrument is in alarm state.
	Indicates that the instrument is not in alarm state.
LOW CHG	Indicates the type of power source being used. Refer to "2.6 Turning the Power On and Off" (⇒ p. 36)
ATA	Indicates that a PC card is set in the instrument.
OF	Indicates that the measurement value is an overflow value. During the logging peak value screen or the monitor peak value screen the overflow display is retained.

The following icons are displayed in the lower left of the display screen. They indicate the save condition of the measurement data.



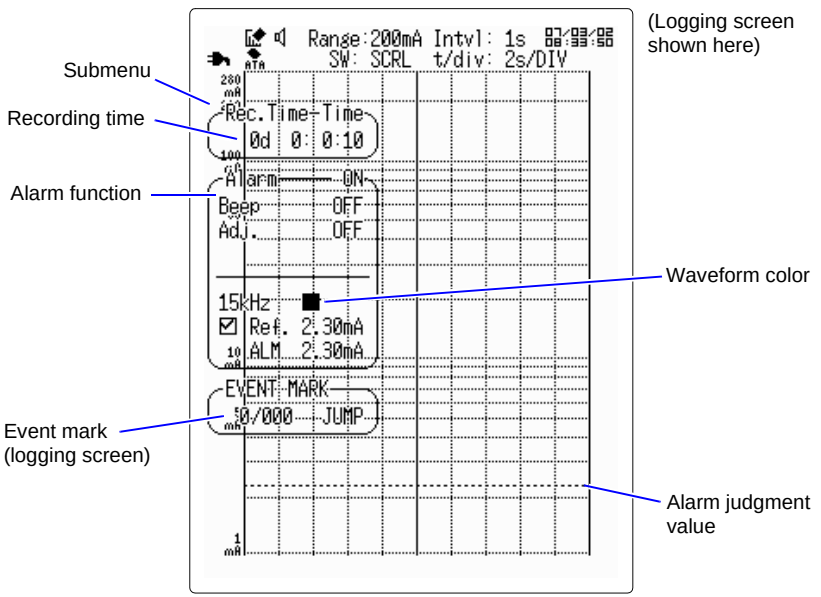
(Logging screen shown above)

Icons	Explanations
	Performing auto save (erase save).
	Performing auto save (file full).
	Performing auto save (endless).
	Text save is set.
	Auto save is not possible because there is not sufficient space on the PC card.
	Text save is not possible because there is not sufficient space on the PC card.

1.5.5 Submenus

From the logging display or the monitor display, press ENTER to display the submenu.

Measurement conditions can be set right on the screen. Press CANCEL to close the submenu.



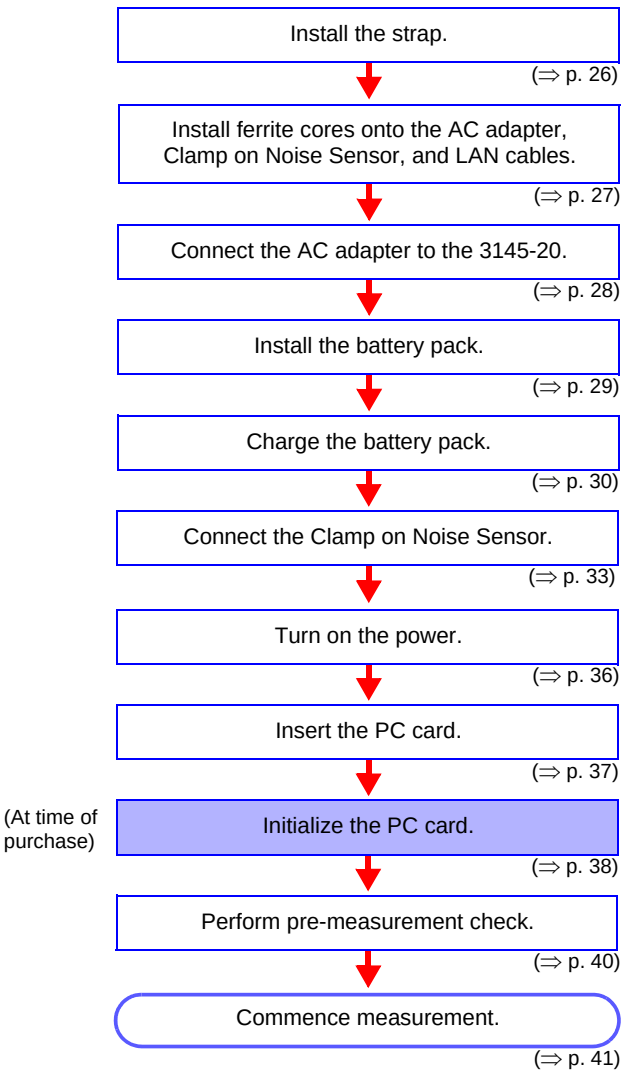
Changing the settings

1. Press the keys to move the blinking cursor to the position of the setting to be changed, and press ENTER to open the selection window.

2. Use the up and down / keys to select the desired item in the selection window, and press ENTER to set.

Measurement Preparations Chapter 2

The step-by-step preparations for measuring are as follows.



2.1 Attaching the Strap

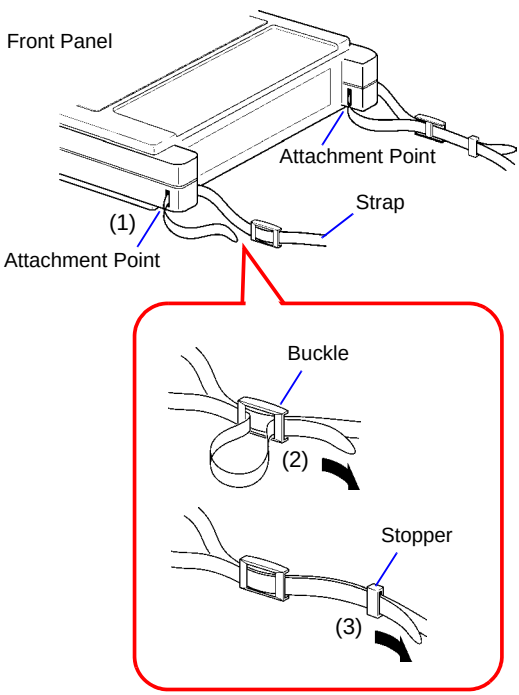
Attach the Strap at attachment point of the instrument.

⚠CAUTION Attach both ends of the Strap securely to the instrument. If insecurely attached, the instrument may fall and be damaged when carrying.

1. Insert each end of the Strap through an attachment point on the instrument.

2. Thread the end of the Strap through the buckle.

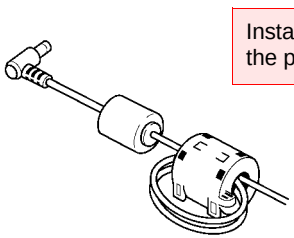
3. Finally, slide the stopper over the end of the Strap.



2.2 Install the Ferrite Cores

In order to prevent malfunctions due to external magnetic waves, install ferrite cores onto the AC adapter, Clamp on Noise Sensor, and LAN cables.

1. Wrap the output side of the cable two times around the ferrite core.

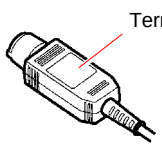


(AC adapter shown here)

2. Close the ferrite core until it makes a clicking sound.

NOTE

- In the case of the Clamp on Noise Sensor, install the ferrite core as close as possible to the termination box.



- In the case of the LAN cable, install the ferrite core as close as possible to the connector which connects to the 3145-20.

2.3 Connecting the AC Adapter

Connect the AC adapter to the 3145-20 and supply power to the instrument. The 3145-20 can receive power from two types of power sources: either AC adapter or battery pack. When both are supplied at the same time, the AC adapter is used.
Please use the instrument with the battery pack always in place, as it is also a countermeasure in the case of power outage.

⚠WARNING

- **Turn the instrument off before connecting the AC adapter to the instrument and to AC power.**
- **Use only the supplied Model 9418-15 AC ADAPTER. AC adapter input voltage range is 100 to 240 VAC (with ±10% stability) at 50/60 Hz. To avoid electrical hazards and damage to the instrument, do not apply voltage outside of this range.**

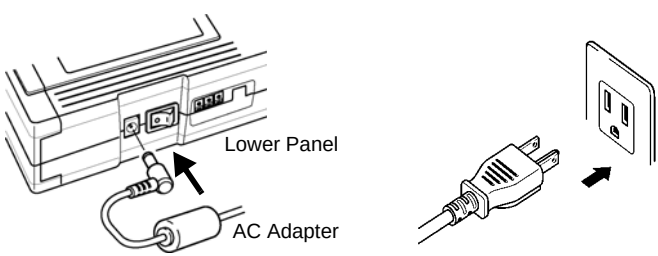
NOTE

- Data can be retained for about ten minutes after power is interrupted (when the Battery pack is not installed). Operation after power interruption depends on the setting for Resume Recording After Power Loss.
  Refer to "2.7.2 PC Card Initialization" (⇒ p. 38) and "7.1.2 Start Backup After Power Loss" (⇒ p. 111).
- This instrument will not run erratically under a momentary power outage lasting less than 40 ms. However, if a momentary outage of 40 ms or more occurs, the instrument turns off temporarily, so the power condition at the installation location should be considered beforehand. Therefore, consider the power supply conditions at your installation site before installing the instrument.

1. Make sure the instrument is OFF.

2. Connect the AC adapter to the instrument.

3. Plug the AC adapter into the power outlet.



2.4 Supplying Power with the Battery Pack

By using battery power to run the 3145-20 NOISE HiLOGGER, it can be used even in places with no commercial power outlets.
The 9447 BATTERY PACK is rated for approximately 1 hour of continuous use (backlight: bright; after approximately 2.5 hours charging the battery). When longer periods of continuous measurement are required, please prepare multiple battery packs.
The 3145-20 can also receive power from its AC adapter. When both are supplied at the same time, the AC adapter is used. Please use the instrument with the battery pack always in place, as it is also a counter-measure in the case of power outage.

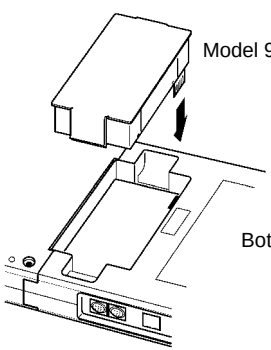
⚠WARNING

- **To avoid electric shock, turn off the power switch and disconnect the cables before replacing the batteries.**
- **For battery operation, use only the HIOKI Model 9447 BATTERY PACK. We cannot accept responsibility for accidents or damage related to the use of any other batteries.**

2.4.1 Installing the Battery Pack

At the time of purchase, the back side of the instrument is equipped with a battery box. Remove the battery box and install the 9447 BATTERY PACK.

1. **Turn off the power switch.**
2. **Remove the battery compartment.**
3. **Insert the 9447 BATTERY PACK until it clicks.**



NOTE The battery pack is subject to self-discharge. Be sure to charge the battery pack before initial use. (Please refer to the next page)

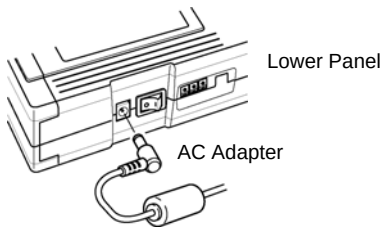
2.4.2 Charging the Battery Pack

The battery pack may be charged in the 3145-20 itself, or in the optional 9643 CHARGE STAND.

Charging with the 3145-20 NOISE HiLOGGER

The 9447 BATTERY PACK can be charged whether the 3145-20's power switch is turned ON or OFF (both during and after measurement).

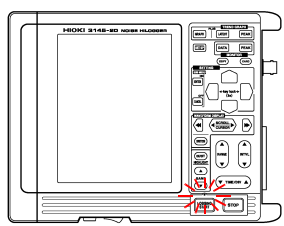
1. Install the battery pack and connect the AC adapter.



2. Rapid charge of the battery pack begins.

(When the power switch is OFF)

The LOGGING START LED lights up red, and turns off when rapid battery charge is completed.

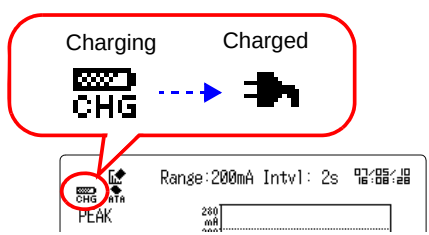


(When the power switch is ON)

The CHG mark is displayed at the top of the screen, and the mark is displayed when rapid battery charge is completed.

3. It takes approximately 2.5 hours to complete rapid charge.

Rapid charge alone provides approximately 70% of the battery life that full charge provides.
After completion of rapid charge, supplementally charging for approximately 10 additional hours will bring the battery pack to full charge.



NOTE Supplemental charging continues even after the battery pack is fully charged to prevent the battery pack self discharging.

Charging with the optional 9643 CHARGE STAND

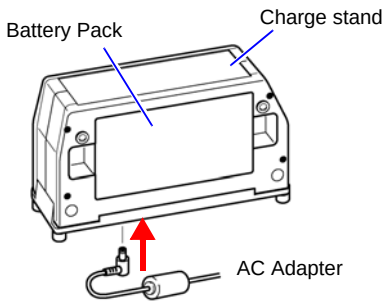
1. Place the battery pack in the charge stand.

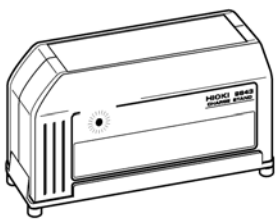
2. Connect the AC adapter to the charge stand.

The LED will blink red, and then continually remain lit as rapid charge commences.

3. Rapid charge is completed in approximately 2 hours.

The green LED lights up, and supplemental charging begins.



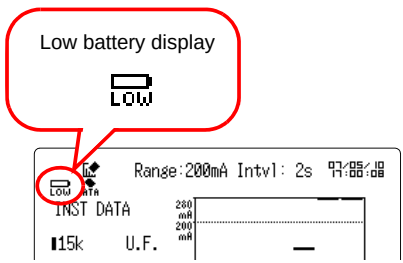


NOTE

- The ambient temperature should be between 0 and 40 °C when charging. If charging is done outside this temperature range, the battery material will degrade and the battery may not be able to be sufficiently charged, or the battery life may be shortened.
- Do not use chargers made by other companies.
- If the battery pack expires and the instrument automatically shuts off, be sure to turn off the power switch. If left as is with the power switch turned on for a long period of time, the battery pack may be in danger of overdischarging.
- The battery pack is subject to self-discharge. If stored or otherwise not used for a long time, the battery pack should be discharged and then recharged at least once every two months. Battery capacity may be degraded if stored for a long time without charging.

2.4.3 Battery Pack Life

If the battery life is considerably short even with correct charging, replace the battery pack with a new one. As the battery pack charge is depleted, the low battery mark LOW will be displayed in the upper left of the logging screen or monitor screen. Alternatively, the following warning is displayed: "WARNING 620: Battery low.". In such cases, please charge the battery pack.



2.5 Connect the CLAMP ON NOISE SENSOR

Connect the Clamp on Noise Sensor to the terminals of the 3145-20, and clamp the line to be measured.
Before using, read the instruction manual included with the Clamp on Noise Sensor and follow all safety precautions.

DANGER

- **To avoid electric shock, do not touch the portion beyond the protective barrier during use.**
- **To avoid short circuits and potentially life-threatening hazards, never attach the clamp to a circuit that operates at more than 600 V (CAT II) / 300 V (CAT II), or over bare conductors.**
- **To avoid electrical shock, be careful not to damage the insulation of the conductor being measured.**
- **To avoid electrical shock, follow the precautions below to ensure no dangerous voltage from the power of the instrument being connected to or its other measuring terminals (those not connected to this instrument) is impressed upon the 9754 CLAMP ON NOISE SENSOR. If dangerous voltage is impressed upon this instrument, dangerous voltage will be generated in its BNC connector and inner circuitry, presenting an extreme hazard.**
  Only connect to instruments which are constructed with double insulation and use a protective earth.
  Confirm that basic insulation which meets the measurement category, working voltage and pollution degree of the circuit being tested, is used to isolate the other measurement terminals of the instrument being connected to.
  If you are not sure basic insulation is used between the terminals of the measurement instrument, do not input voltage which exceeds the Separated Extra-Low Voltage Earthed (SELV-E) level into the other terminals of the instrument.
  Observe all safety precautions of the instrument you are using.
  Refer to the following standards regarding the meanings of underlined terms.
  IEC 61010-1
  IEC 61010-031
  IEC 61010-2-032

WARNING

To avoid electric shock when measuring live lines, wear appropriate protective gear, such as insulated rubber gloves, boots and a safety helmet.

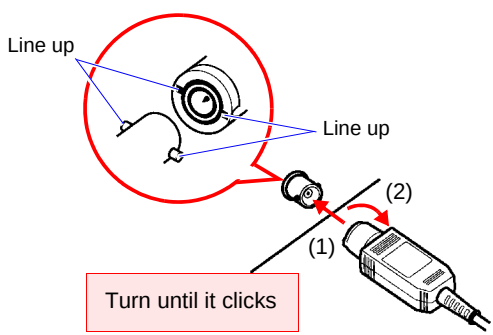
⚠CAUTION To avoid damaging the instrument, do not apply current that exceeds the maximum continuous input range.
* Maximum continuous input range:
This range is based on heat that is internally generated during sine wave input at a prescribed frequency at room temperature. It varies according to the frequency of the measured current. (Use the 9754 CLAMP ON NOISE SENSOR at the highest effective value within the maximum continuous input range.) In addition to the maximum continuous input range, there is also the "maximum peak current value 15 Apeak" product specification. This indicates an upper waveform response limit of 15 Apeak.

⚠CAUTION
- When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.
- To avoid damaging the instrument, always open the clamp by using the slider.

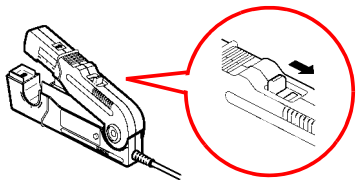
NOTE Apart from the Clamp on Noise Sensor, near magnetic field probes or antennae may be connected in a similar fashion to the Clamp on Noise Sensor to check and record individual band levels. Please use near magnetic field probes or antennae which match the characteristics of the Clamp on Noise Sensor. The measurement range, frequency characteristics and input impedance are as follows.

Measurement range	: 1 Vp-p to 0.15 mVp-p
Frequency bandwidth	: 5 kHz to 100 MHz (-3 dB bandwidth)
Input impedance	: 50 Ω

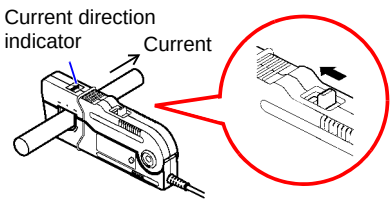
1. Connect the BNC connector of the 9754 CLAMP ON NOISE SENSOR to the input terminal of the instrument being connected to.



2. **Pull the slider on the sensor to open the clamp.**

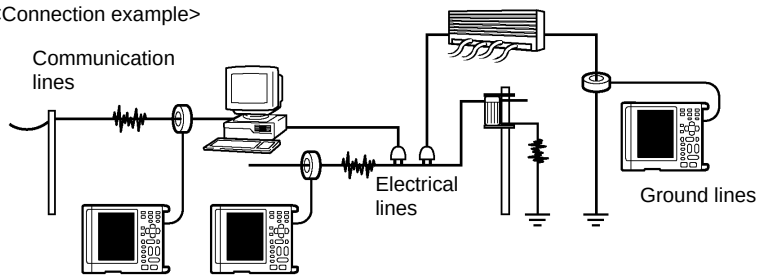


3. **Clamp the conductor to be measured and close the clamp.**



Make sure that the current direction indicator arrow matches the direction of current flow on the conductor being measured.
Make sure also that the conductor is clamped in the center of the clamp opening.

<Connection example>



4. **Press on the slider until it clicks to lock shut.**

Press the sensor slider until the "UNLOCK" message disappears and "LOCK" is displayed, and confirm that the slider is firmly locked and the clamp securely closed.

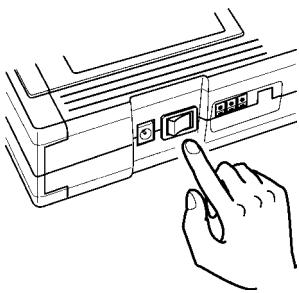
5. **When disconnecting the 9754 CLAMP ON NOISE SENSOR, pull the sensor slider to open the clamp and remove the Clamp on Noise Sensor from the conductor being measured.**

2.6 Turning the Power On and Off

Power On

1. Turns on (|) the POWER switch.

2. Depending on the type and condition of the power supplied to the instrument, one of the following messages appears on the display.



Marks	Explanations
	Operating with the AC adapter.
	Operating with the 9447 BATTERY PACK.
LOW	Battery capacity is low. Charge the battery pack.
CHG	Charging the battery pack

3. During initial use after purchasing, set the time using the System Init screen.

Refer to "7.3.1 Setting the Clock" (⇒ p. 127).

Power Off

1. Turns off (◯) the power switch.

2. Remove the Clamp on Noise Sensor from the conductor being measured.

3. Remove the AC adaptor plug from its electrical outlet.

NOTE

- After power is turned off, the last waveform data is retained for about 10 minutes.
- When power is turned on, the instrument restores the settings used immediately before power was turned off last (backup function).

2.7 Using the PC Card

⚠CAUTION Some PC Cards are susceptible to static electricity. Exercise care when using such products because static electricity could damage the PC Card or cause malfunction of the instrument.

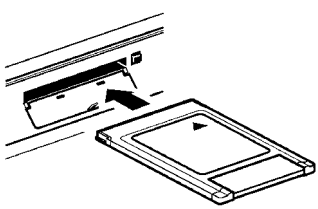
2.7.1 Inserting the PC card

When saving logging measurement data or setting conditions to a PC card, insert the PC card into the slot at the top of the 3145-20.

Important
Use only PC Cards sold by Hioki.
Compatibility and performance are not guaranteed for PC cards made by other manufacturers. You may be unable to read from or save data to such cards.
Hioki options PC cards (includes adapter)
Model 9726 PC CARD 128M, Model 9727 PC CARD 256M,
Model 9728 PC CARD 512M, Model 9729 PC CARD 1G

PC card insertion

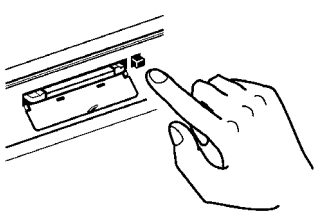
1. **Open the cover and insert the PC card with the arrow facing up and in the direction of the PC card slot, as far as it will go.**
   Inserting a PC card upside down, backwards or in the wrong direction may damage the instrument



2. **Before using a new PC Card, it must be initialized.**

Removing the PC card

1. **Press the eject button and pull out the PC card.**
2. **Always close the cover when no PC Card is installed.**



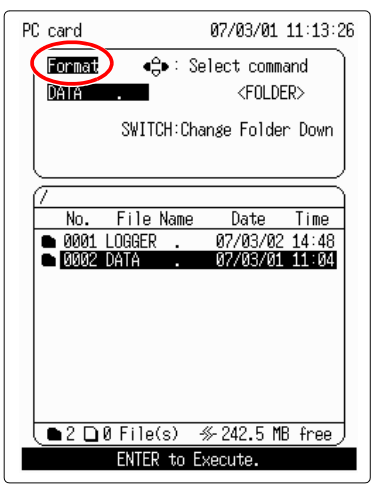
2.7.2 PC Card Initialization

Initialize the PC card. All files on the PC card will be erased, and a system file resistant to power outage will be created.

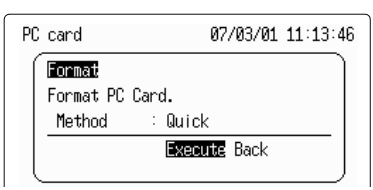
⚠CAUTION When using a PC card with the instrument, be sure to format the card before its initial use using the instrument. When formatting in "FAT 16" using a PC (personal computer), please note that the Power Fault Protection function will be ineffective. Furthermore, do not use the "FAT 32" format, as doing so will result in error.
When recording for long durations, format the card before measurement, and make a backup copy of the resulting waveform files on your PC or other storage media. When re-using a PC card, it is recommended that you re-format the card before measurement in order to obtain maximum performance.

1. Press CARD to open the PC card screen.

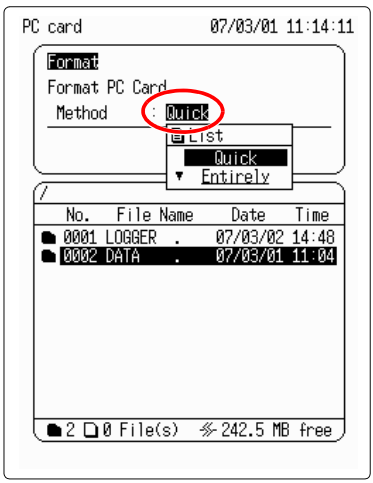
2. Press ◯/◯ to choose [Format].



3. Press ENTER to open the initialize screen.



4. **Press ▽ to move the flashing cursor to [Method], and press ENTER to open the contents.**



Selectable items	Explanations
Quick	The PC Card is not tested for bad sectors.
Entirely	The PC Card is tested for bad sectors, which are removed from use if possible. When using a brand new PC card for the first time, select **[Entirely]**.

5. **Use the up and down △/▽ keys to select [Entirely], and press ENTER to set.**

6. **Press ▽ to move the blinking cursor to [Execute], and press ENTER to execute initialization.**

To cancel, move the blinking cursor to **[Back]** and press ENTER.

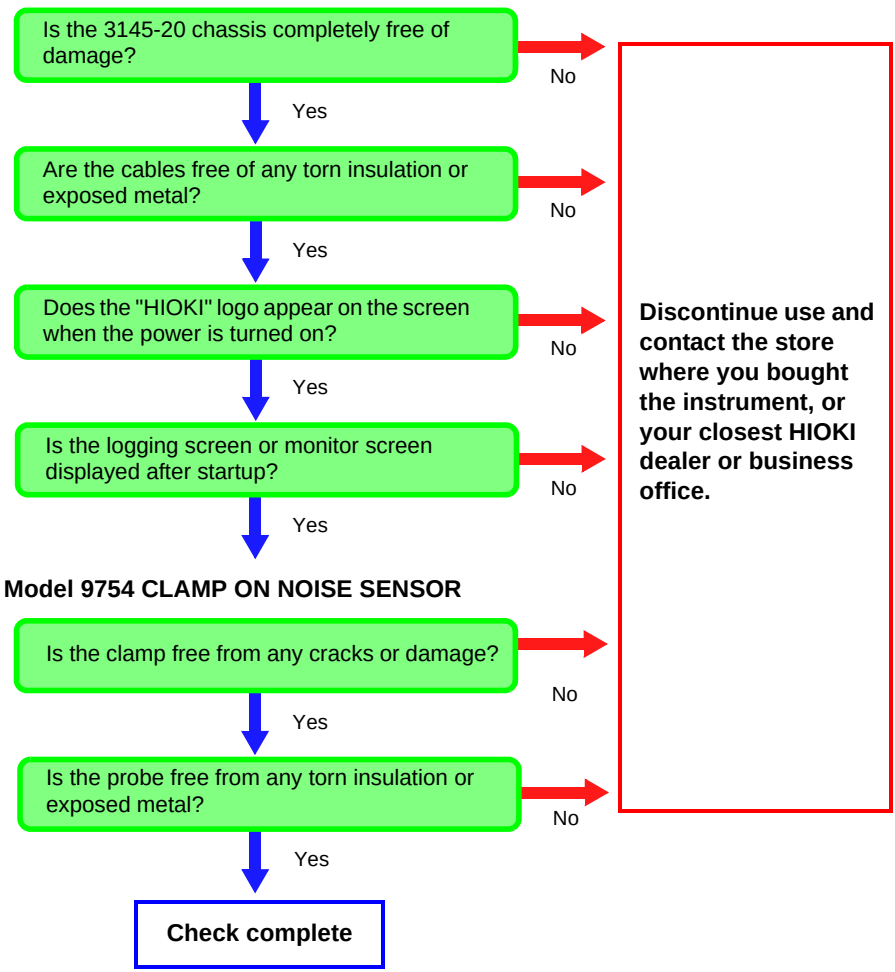
NOTE

- If a PC card is formatted by the instrument, a /LOGGER/ directory will be created, and when you attempt to save a file into the root directory automatically it will be saved to this directory instead. When the saving operation begins, you will automatically be moved to the /LOGGER/ directory.
- You cannot change the name of the /LOGGER/ directory or delete the directory.

2.8 Pre-Operation Inspection

Before beginning measuring, check the following points.

Model 3145-20 NOISE HiLOGGER



Model 9754 CLAMP ON NOISE SENSOR

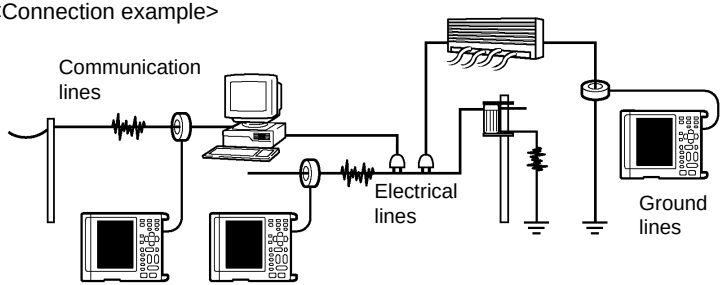
Measurement Chapter 3

DANGER

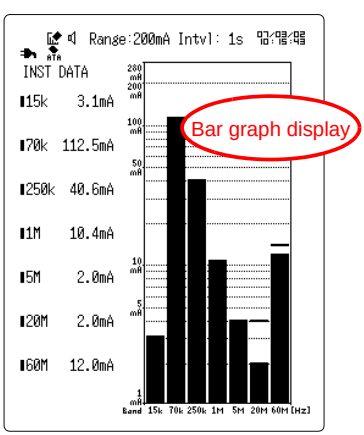
- **The maximum input voltage is 5 V peak. Attempting to measure voltage in excess of the maximum input could destroy the instrument and result in personal injury or death.**
- **The maximum rated voltage between input terminals and ground is 5 V. Attempting to measure voltages exceeding 5 V with respect to ground could damage the instrument and result in personal injury.**

Clamp the Clamp on Noise Sensor to the place to be measured on the communication line, power line or ground line. With monitor display, the measured values of each band * are shown as a bar graph. With logging measurement, change of the measurement values over time can be displayed and this data saved to a PC card.

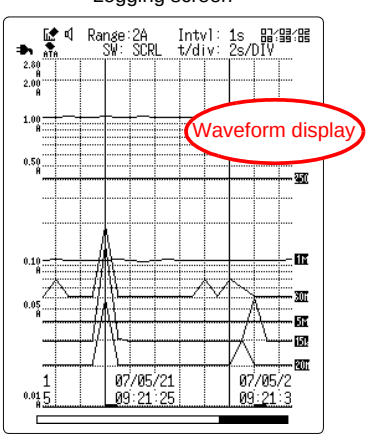
<Connection example>



Monitor screen



Logging screen



*** Band:** the frequency band of the measured waveform.

3.1 The Measurement Process

Check the current input

Monitor measurement (⇒ p. 43)

Pre-measurement preparations (⇒ p. 25)

↓

Set the input type. (⇒ p. 74)

↓

Display the monitor screen.

↓

Set the measurement range.

↓

Set the alarm function. (⇒ p. 56)

↓

Perform monitor measurement.

Record changes over time

Logging Measurement (⇒ p. 45)

Pre-measurement preparations (⇒ p. 25)

↓

Set the input type. (⇒ p. 74)

↓

Display the logging screen.

↓

Set the measurement range.

↓

Set the recording interval.

↓

Set the time axis.

↓

Set the recording time. (⇒ p. 77)

↓

Set automatic save. (⇒ p. 82)

↓

Set the alarm function (⇒ p. 56)

↓

Begin measurement.

↓

Complete measurement.

NOTE

To initialize settings, refer to "7.3.3 System Reset" (⇒ p. 129).

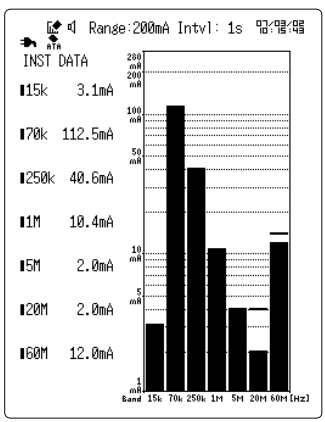
3.2 Check the Current Input (Monitor Measurement)

The measurement values for each individual band (15kHz, 70kHz, 250kHz, 1MHz, 5MHz, 20MHz, 60MHz) can be checked on the screen. The data cannot be saved.

1. **Make preparations for measurement referring to "Chapter 2 Measurement Preparations" (⇒ p. 25).**

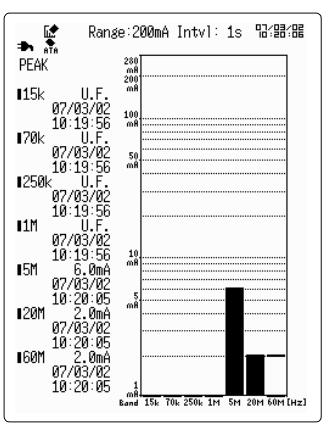
2. **Set the input type to [Current] or [Voltage] on the Set up screen. (⇒ p. 74)**

3. **Press DATA to display the instantaneous values.**



The instantaneous values for each band are displayed on the left side of the screen, and the level meter is displayed on the right.

4. **Press PEAK to display the peak values.**

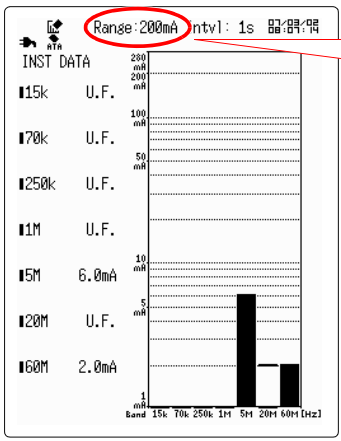


The peak values for each band are displayed on the left side of the screen, and the level meter is displayed on the right.

NOTE

The peak value during monitor measurement is the peak value from the time of switching to monitor display until the present. When switching from the logging screen back to the monitor screen, the peak value will have been cleared. The peak value is also cleared by pressing SWITCH.

5. **Press** RANGE **to select the range.**



Selectable ranges: 200mA, 2A, 20A

As a general reference, select 200mA for communications, 2A for power supply and 20A for lightning surge.

When checking using voltage levels, set the input type to "Voltage" on the Set up screen. (⇒ p. 74)
Set the range to 10mV, 100mV or 1V.

NOTE The noise measurement range differs depending on the current or voltage range selected. See the chart below.

Measurement object	Measurement range	Measurable noise range
Current (When using the 9754)	20 A	28 A_{P-P} to 200 mA_{P-P}
	2 A	2.8 A_{P-P} to 20 mA_{P-P}
	200 mA	280 mA_{P-P} to 2 mA_{P-P}
Voltage	1 V	1.4 V_{P-P} to 20 mV_{P-P}
	100 mV	140 mV_{P-P} to 2 mV_{P-P}
	10 mV	14 mV_{P-P} to 0.2 mV_{P-P}

"O.F." display (Overflow display)
If the measured value exceeds the upper value of the selected range, the numerical value on the left side of the screen will become **"O.F."** Increase the range in such a case.

"U.F." display (Underflow display)
If the measured value is lower than the lower value of the selected range, the numerical value on the left side of the screen will become **"U.F."** Decrease the range in such a case.

To sound an alarm when the measurement value exceeds the set value:
Set the alarm function. Refer to "4.5 Using the Alarm Function" (⇒ p. 56).

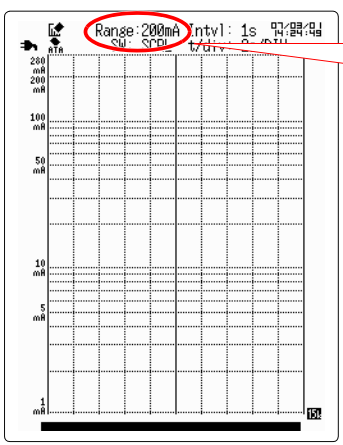
3.3 Record Changes Over Time (Logging Measurement)

With logging measurement, the change over time of the measurement values at each band (15kHz, 70kHz, 250kHz, 1MHz, 5MHz, 20MHz and 60MHz) can be viewed.

1. **Make preparations for measurement referring to "Chapter 2 Measurement Preparations" (⇒ p. 25).**

2. **Set the input type to [Current] or [Voltage] on the Set up screen. (⇒ p. 74)**

3. **Press GRAPH to display the logging full screen, and RANGE to select the range.**



Selectable ranges: 200 mA, 2 A, 20 A

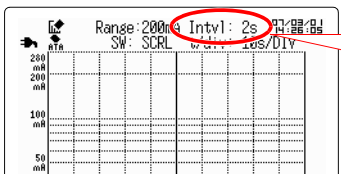
As a general reference, select 200mA for communications, 2A for power supply and 20A for lightning surge.

When checking using voltage levels, set the input type to "Voltage" on the Set up screen. (⇒ p. 74)
Set the range to 10mV, 100mV or 1V.

NOTE

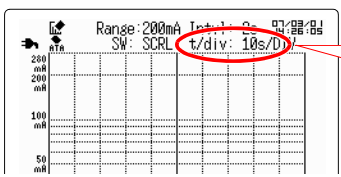
- The noise measurement range differs depending on the current or voltage range selected. See the left chart.
- Upon starting a new logging session, previously logged and recorded data will be automatically deleted from the internal memory. Be sure to save any required measurement data to the PC Card before starting a new logging session.

4. **Press** INTVL **to select the recording interval.**



Selectable ranges:
1s, 2s, 5s, 10s, 20s, 30s, 60s

5. **Press** ▼TIME/DIV▲ **to change the time axis.**



Selectable ranges:
2s, 5s, 10s, 20s, 30s, 1min, 2min,
5min, 10min, 20min, 30min,
1h, 2h, 5h, 10h, 12h, 1d

The selectable range of the time axis differs depending on the recording interval setting. See the chart below.

Recording interval	Possible time axis settings
1s	2s, 5s, 10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 1d
2s	10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 1d
5s	10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 1d
10s	20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 1d
20s	1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 1d
30s	1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 1d
60s	2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 1d

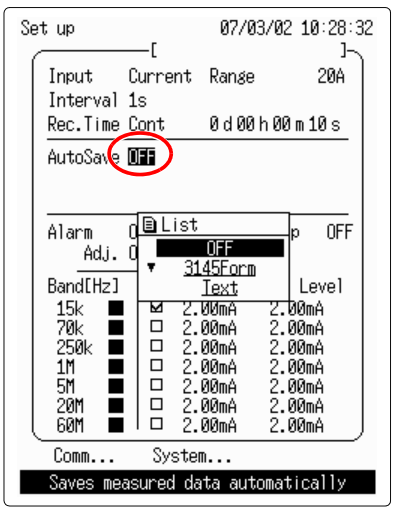
The range, recording interval and time axis can also be set with the Set up screen. Refer to "Chapter 5 Setting the Measurement Conditions" (⇒ p. 71).

NOTE The range and recording interval cannot be changed during logging measurement.

6. **In order to save data to the PC card simultaneously while measuring, press SET UP to open the Set up screen.**

When using a new PC card for the first time, initialize the PC card.

7. **Press ◇ to move the flashing cursor to [Auto Save] , and press SET UP to open the selection window.**



Selectable items	Explanations
OFF	Does not save data.
3145 Form	Auto saves in binary format readable by the instrument and the "DATA VIEWER for 3145" software on the included CD.
Text	Auto saves in text format readable by personal computer spreadsheet programs. (Cannot be read by the 3145-20)

8. **Use the up and down ◇/◇ keys to select [3145 Form], and press ENTER to set.**

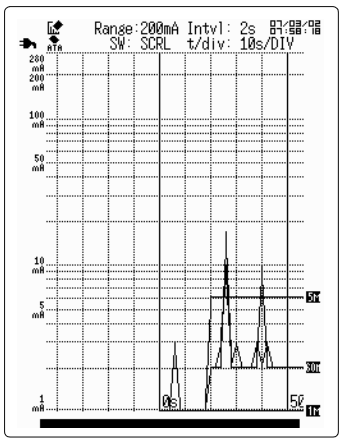
Normally, the save mode is set to **[Normal]**, **[Full]**. This setting saves a wave file for each measurement, then stops measurement when the PC card becomes full.
To perform detailed settings, refer to "6.1.3 Save Mode" (⇒ p. 84).

NOTE
- By setting auto save to "Text", after completion of measurement the data which remains in internal memory is auto-saved. (⇒ p. 90)
- By setting auto save to OFF, data is saved in the 3145-20 internal memory (32MB). Please note that when the internal memory becomes full, old data is erased. Data in the internal memory can be saved to PC card following measurement. (⇒ p. 91)

Setting the recording time:
Set the recording time to **[Time]** on the Set up screen.
Refer to "5.5 Setting the Recording Time" (⇒ p. 77).

To sound an alarm when the measurement value exceeds the set value:
Set the alarm function. Refer to "4.5 Using the Alarm Function" (⇒ p. 56).

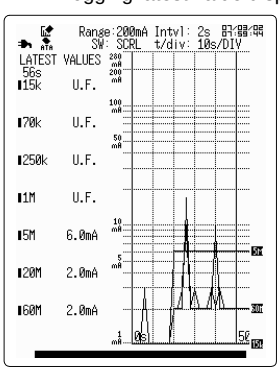
9. Press [LOGGING START] to commence logging measurement.



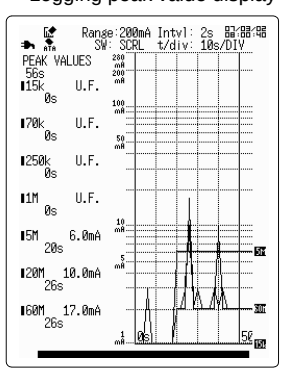
If auto save mode is set to **[Ref. Time]**, when starting measurement the "Sync fixed time" message is displayed until the recording interval synchronizes to reference time.

10. Press [LATEST] to view the latest value. Press [PEAK] to view the peak value.

Logging latest value display



Logging peak value display



If "O.F." or "U.F." is displayed on the screen, then the measurement value is outside of the measurement range. Please change the range.

11. Press [STOP] twice to stop logging measurement.

If the recording time has been specified and the recording time expires, then logging measurement automatically stops.

NOTE

- If the auto save setting is OFF in the Set up screen, when commencing a new measurement after a prior measurement the recorded data in the internal memory is erased. To retain the data, use the PC card screen to save it to PC card. Refer to "6.3 Saving Data after Measurement" (⇒ p. 91).

- If power is interrupted before the first data refresh, no data is stored, and a file is created with zero bytes.

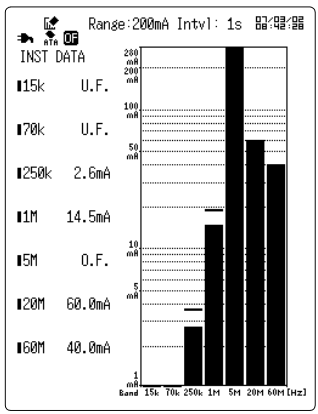
- When the recording period is set to **[Cont]** (Continuous) and automatic saving is set to **[Text]**, the data remaining on the internal memory will be saved automatically.

- During automatic saving, if an abnormality occurs on the PC Card while recording, one of the following messages appears near the bottom of the screen.

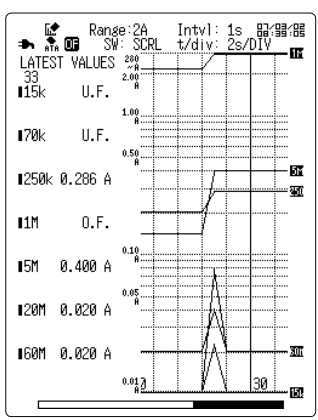
Messages	Descriptions
No PC Card	Appears when no PC Card is installed in the PC Card slot.
PC Card has error	Appears when a fault occurs on the PC Card, and when recording is not possible.
PC Card is full	Appears when the available space on the PC Card reaches or falls below the specified amount. Be sure to stop measurement before replacing the PC card. If the PC card is removed during measurement the data may be damaged. This message does not appear when deleting and saving files.

3.4 "O.F." Display and "U.F." Display

If the measurement value for each frequency wave range is lower than the selected measurement range, "U.F." (Underflow) will be displayed.
Alternatively, if the measurement value for each frequency wave range is higher than the selected measurement range, "O.F." (Overflow) will be displayed.



"O.F." (Overflow) display will also occur if the input value exceeds the measurement range.
In the case of "O.F." display, change the range.
If overflow occurs during logging measurement, the "O.F." marker will be displayed at the top of the graph display screen for the section where the overflow occurred. Also, the OF icon is displayed in the upper left of the screen. The icon remains displayed during the logging peak value screen or the monitor peak value screen.



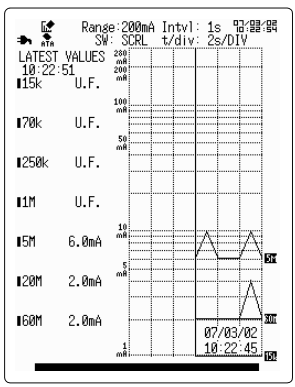
Useful Functions Chapter 4

The 3145-20 NOISE HiLOGGER has the following useful functions. Please make use of them as necessary.

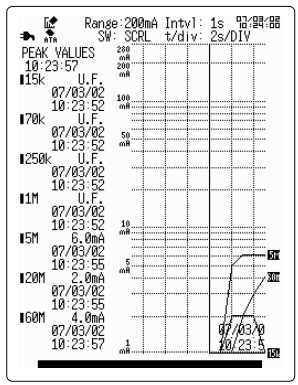
Functions	Logging	Monitor
"4.1 View the Latest Logging Measurement Value or Peak Value" (⇒ p. 52)	Available	--
"4.2 Check Using a Bar Graph (Monitor Measurement)" (⇒ p. 52)	--	Available
"4.3 View Past Waveforms (Scroll Function)" (⇒ p. 53)	Available	--
"4.4 A/B Cursor Measurement" (⇒ p. 55)	Available	--
"4.5 Using the Alarm Function" (⇒ p. 56)	Available	Available
"4.6 Adding Event Marks to Waveforms" (⇒ p. 66)	Available	--
"4.7 Highlighting a Specific Band" (⇒ p. 68)	Available	--
"4.8 Preventing Malfunctions (Key Lock)" (⇒ p. 69)	Available	Available
"4.9 Saving the Display Screen to PC Card (Screen Capture)" (⇒ p. 70)	Available	Available

4.1 View the Latest Logging Measurement Value or Peak Value

Displays the latest value on the left side, and the waveforms on the right side of the screen.

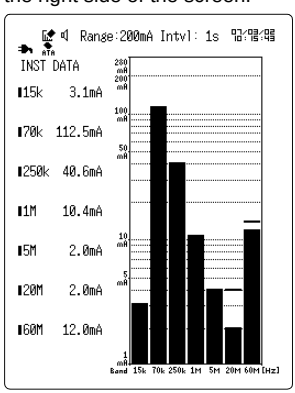


Displays the peak value on the left side, and the waveforms on the right side of the screen.

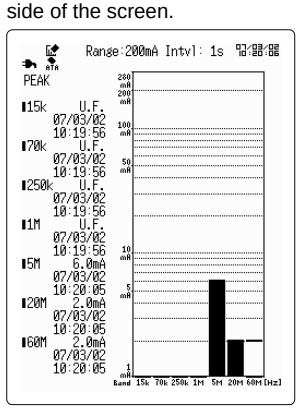


4.2 Check Using a Bar Graph (Monitor Measurement)

Displays the instantaneous values on the left side, and a bar graph on the right side of the screen.



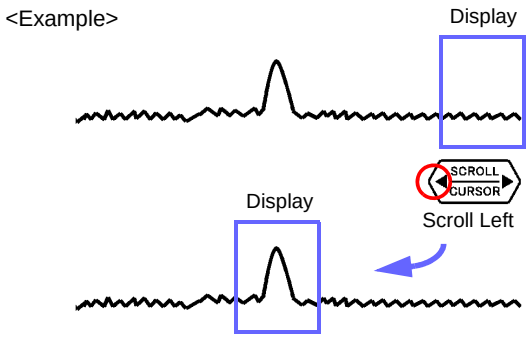
Displays the peak values on the left side, and the bar graph on the right side of the screen.



When saving a file there may be a delay before the graph is displayed.
You can clear the peak value during monitor measurement by pressing (SWITCH). When moving to the screen other than the monitor screen, the peak value will be cleared.

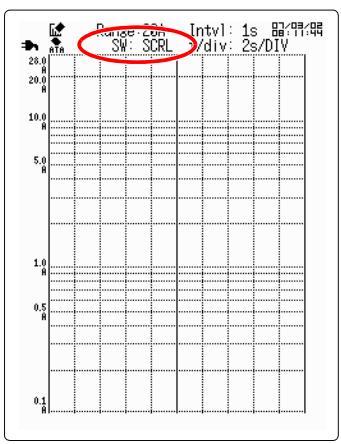
4.3 View Past Waveforms (Scroll Function)

Waveforms on the Logging screen can be scrolled horizontally.



4.3.1 Scrolling the Waveform

1. **Press SWITCH and switch the position to [SCRL].**



2. **Press SCROLL CURSOR to scroll the waveform.**

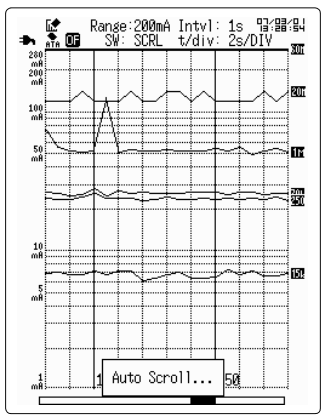
Scroll the waveform fast. : ◀◀ or ▶▶

Move to the head of the data stored in instrument memory. : ◀◀ and SCROLL CURSOR

Move back to the current waveform. : SCROLL CURSOR and ▶▶

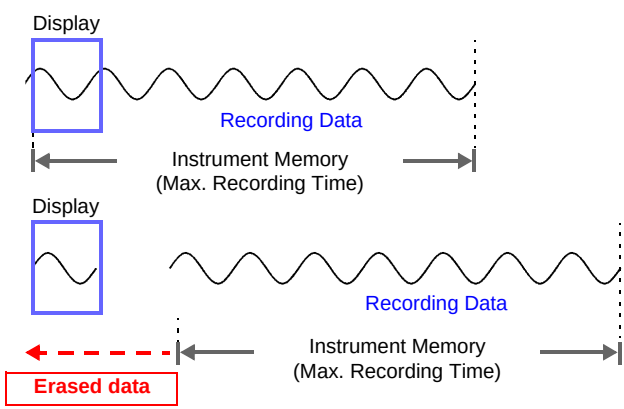
4.3.2 Auto Scrolling

Holding the SCROLL CURSOR for five seconds activates automatic waveform scrolling ("**Auto Scroll**" is displayed). Press any key to cancel auto scrolling.



NOTE

- During measurement auto scroll cannot be performed.
- The amount of time which can be saved (maximum recording time) in the instrument's internal memory differs depending on the recording interval setting, so please refer to "The relationship between recording interval and maximum recording time"(⇒ p. 78).
- When the recording time is **[Cont]** (Continuous), old data is erased when the instrument's internal memory capacity is exceeded. By scrolling the waveform past waveforms are displayed on the display screen, but take note that the data may not be saved in internal memory.
- When the recording time is **[Time]**, old data is not overwritten.

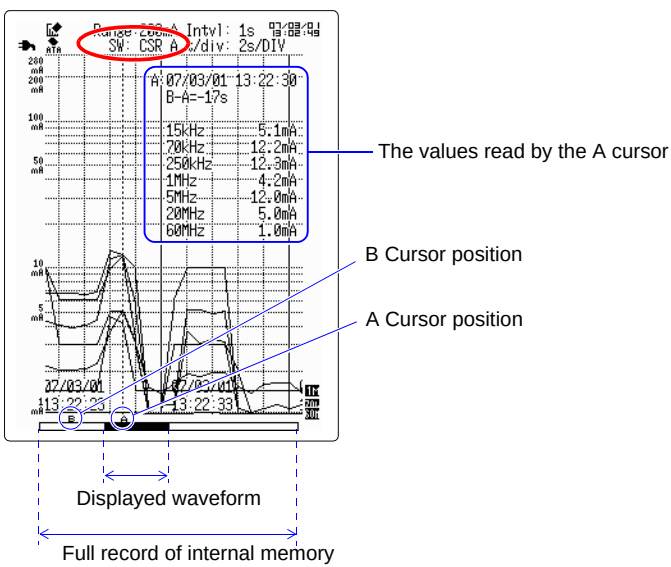


4.4 A/B Cursor Measurement

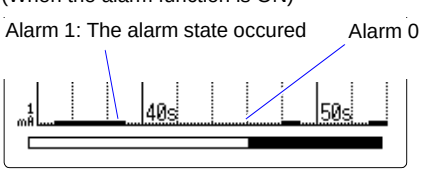
Measurement data at a particular position on a waveform can be read using the A-B cursors. The A-B cursor operations are available while measuring.
For the values read by the A and B cursors, values outside the measurement range are displayed as "O.F." or "U.F."

1. **Press SWITCH and switch the position to [CSR A] or [CSR B].**

2. **Press SCROLL CURSOR to move the cursor and read the measurement values.**



(When the alarm function is ON)



4.5 Using the Alarm Function

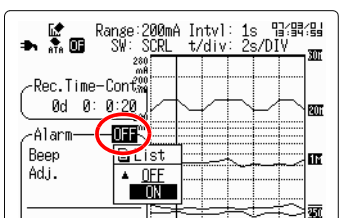
If the measurement values at each individual band exceed the alarm judgment values, the following actions are taken as notification.

- The alarm state notification icon is displayed on the screen.
- The alarm sound sounds
- A signal is output via the TRIG OUT terminal (LOW active)
- An email is sent to computer or cellular phone (only available during logging measurement)
  Refer to the "Communications" instruction manual on the included CD.

4.5.1 Settings on the Logging Screen or the Monitor Screen.

1. **Press ENTER to display the submenu.**

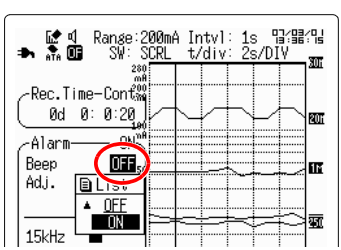
2. **Press ◁▷ to move the blinking cursor to [Alarm], and press ENTER to open the selection window.**



(Logging screen shown here)

3. **Press △/▽ to select [ON], and press ENTER to set.**

4. **Press ▽ to move the blinking cursor to [Beep], and press ENTER to open the selection window.**

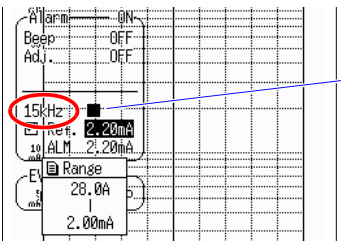


5. **Press △/▽ to select the alarm sound as ON or OFF, then press ENTER to set.**

6. **Press ▲/▼ to select the band for which to set the alarm.**

7. **Press ◇ to move the blinking cursor to the reference value position, and press ENTER to set it to ON.**

8. **Press ▷ to move the blinking cursor to the value position, and press ENTER to open the selection window.**



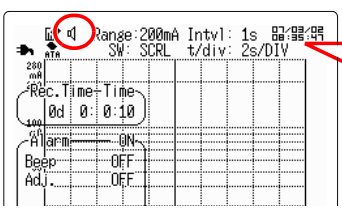
The band for setting the alarm

9. **Press △/▽ to select the reference value, and ENTER to set.**

If the compensation setting is OFF, then the reference value will be treated as the judgment value. If the measured value exceeds the judgment value, the instrument enters alarm state. To compensate the reference value to calculate the judgment value, refer to the next page to make the setting. To continue the state of alarm, set the alarm continue function to ON on the Set up screen. (⇒ p. 59)

10. **When performing logging measurement, press LOGGING START to commence measurement.**

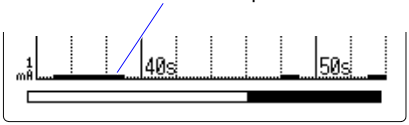
In the case of monitor measurement, press DATA to display the monitor screen.



: The instrument is not in alarm state.

: The instrument is in alarm state.

The time period when the alarm state occurred.

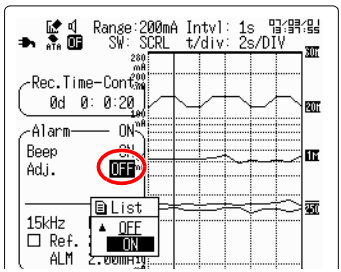


NOTE

- The alarm judgment takes place every recording interval during logging measurement, or every 100 ms during monitor measurement.
- During logging measurement, the alarm judgment takes place every recording interval even if the monitor screen is displayed.

Set the compensation value

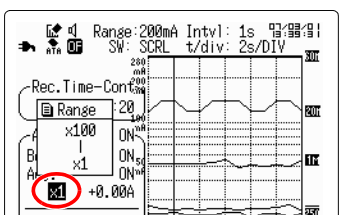
1. Press ◁▷ to move the blinking cursor to **[Adj.]**, and press ENTER to open the selection window.



Selectable items	Explanations
ON	Judgment Value = Reference Value x Gain + Offset
OFF	The reference value is the judgment value.

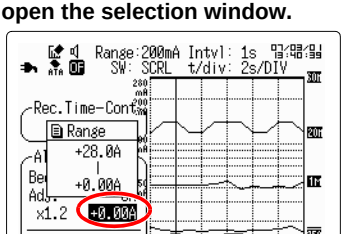
2. Press △/▽ to select **[ON]**, and press ENTER to set.

3. Press ◁▷ to move the blinking cursor to gain value, and press ENTER to open the selection window.



4. Press △/▽ to select the gain value, and ENTER to set.

5. Press ◁▷ to move the blinking cursor to offset value, and press ENTER to open the selection window.

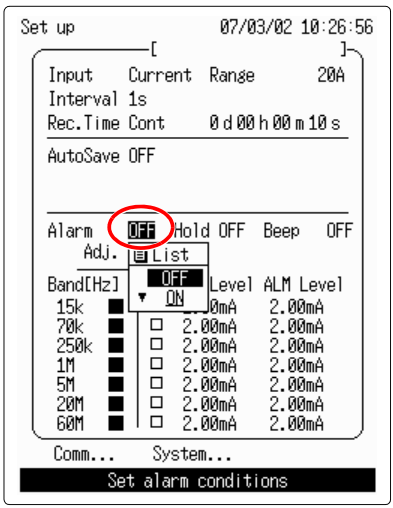


6. Press △/▽ to select the offset value, and ENTER to set.

4.5.2 Setting on the Set Up Screen

1. **Press SET UP to open the Set up screen.**

2. **Press ◇ to move the blinking cursor to [Alarm], and press ENTER to open the selection window.**



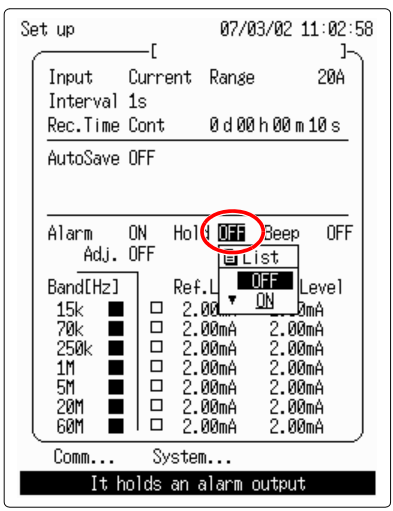
Selectable items	Explanations
ON	Turns the alarm function ON.
OFF	Turns the alarm function OFF.

3. **Press ◇/◇ to select [ON], and press ENTER to set.**

Set the time to continue the alarm

When alarm continue is set to ON, the alarm output continues even after one instance of exceeding the alarm judgment value.
Alarm output is stopped by stopping measurement.

1. **Press ◁▷ on the Set up screen to move the blinking cursor to [Hold], and press ENTER to open the selection window.**



Selectable items	Explanations
ON	If the measured value exceeds the alarm judgment value, the alarm state is continued.
OFF	The alarm state will not continue.

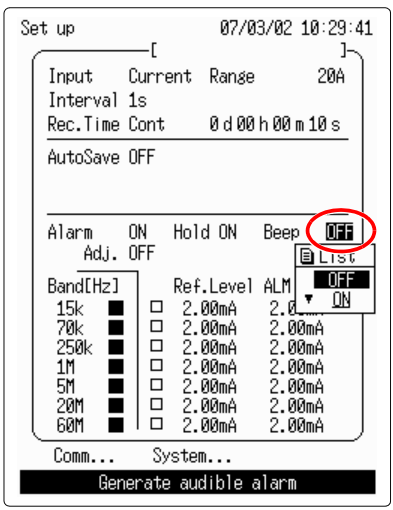
2. **Press △/▽ to select On or Off, and press ENTER to set.**

To cancel, press CANCEL.

Set the alarm sound

If the alarm sound is set to ON, when the alarm judgment value is exceeded the alarm sound will be output from the instrument's internal speakers.

1. Press ◇ on the Set up screen to move the blinking cursor to [Beep], and press ENTER to open the selection window.



Selectable items	Explanations
ON	When the measurement value exceeds the alarm judgment value, the alarm sound sounds.
OFF	The alarm sound does not sound.

2. Press △/▽ to select On or Off, and press ENTER to set.

To cancel, press CANCEL.

NOTE

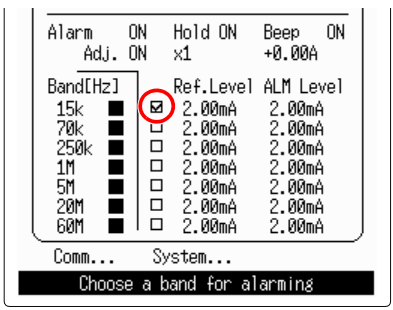
- The alarm sound can be set via submenu from the logging screen or the monitor screen. The submenu is displayed by pressing ENTER.
- **As the Set up screen cannot be displayed during logging measurement, please set using the submenu.**

Set the alarm reference value

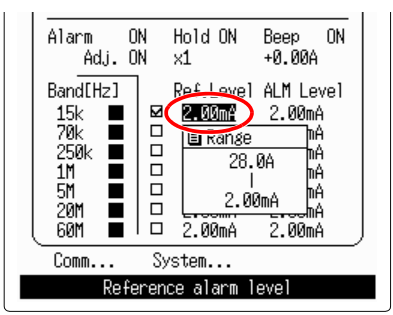
This reference value is used as the alarm function judgment value. It will be used as is for the alarm judgment value if the compensation function is OFF. If the compensation function is ON, the compensated reference value will be the judgment value.

1. **Press ◁△▷ on the Set up screen to move the blinking cursor to the position of the band for which to set the alarm.**

2. **Press ENTER to check.**



3. **Press ◁△▷ to move the blinking cursor to reference value and press ENTER to open the selection window.**



Input type	Setting range
Current	28.0 A to 2.00 mA
Voltage	1.40 V to 100 µV

4. **Press △/▽ to select the reference value, and ENTER to set.**

To cancel, press CANCEL.

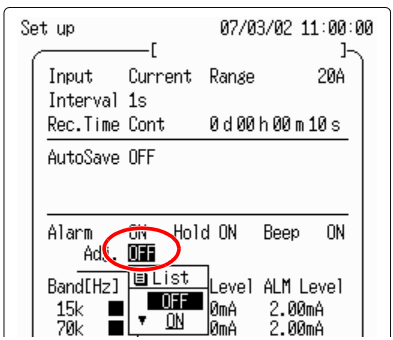
5. **To set the alarm for other bands, repeat the above steps 1 through 4.**

Alarm judgment will be performed only for the checked bands. Uncheck any bands for which alarm judgment is not desired.

Set the compensation value

To use the alarm reference value as the judgment value, set compensation to OFF. Alternatively, to calculate the judgment value by compensensating the reference value, turn compensation ON and set the gain and offset.

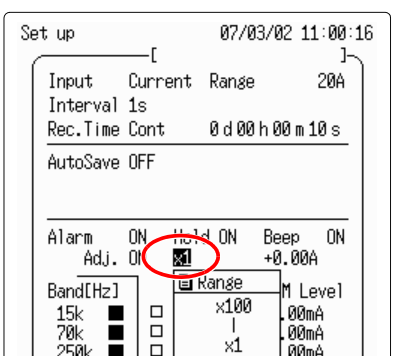
1. Press ◁▷ on the Set up screen to move the blinking cursor to [Adj.], and press ENTER to open the selection window.



Selectable items	Explanations
ON	Judgment Value = Reference Value x Gain + Offset
OFF	The reference value is the judgment value.

2. Press △/▽ to select On or Off, and press ENTER to set.

3. Press ◁▷ to move the blinking cursor to gain value, and press ENTER to open the selection window.

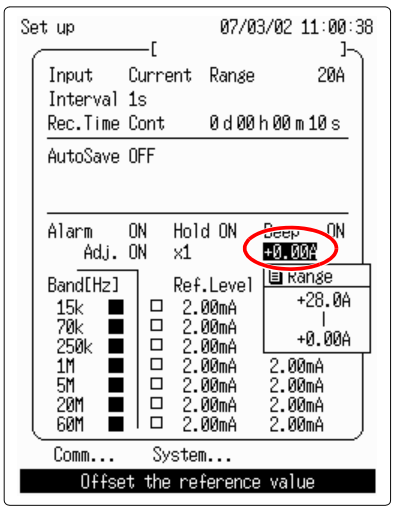


Setting range
×1 to ×100

For example, selecting "x 3" will make the judgment value equal to three times the reference value.

4. Press △/▽ to select the gain value, and ENTER to set.

5. **Press ◁▷ to move the blinking cursor to offset value, and press ENTER to open the selection window.**



Setting range
0.00 A to 28.0 A

6. **Press △/▽ to select the offset value, and ENTER to set.**

To cancel, press CANCEL.

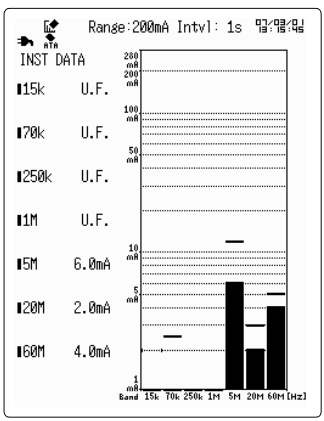
4.5.3 Take the Alarm Reference Value (Monitor Screen)

The monitor screen measurement value can be set to the alarm reference value. If the input value exceeds the alarm judgment value, the instrument enters alarm state.

1. **Check that the copy key function on the System Env screen is set to "Alarm capture". (⇒ p. 116)**

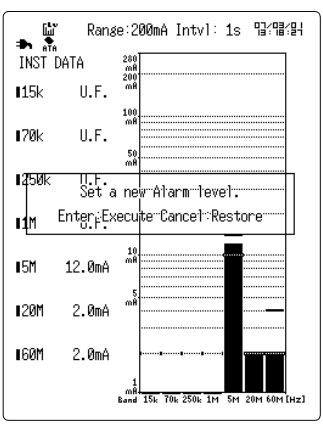
2. **Press DATA to take the current measurement value as the reference value.**

Press PEAK to take the maximum value (peak bar value) as the reference value.



(Monitor instantaneous screen shown here)

3. **Press COPY to display the confirmation message, then press ENTER to set.**



If the input value exceeds the judgment value, the instrument enters alarm state.

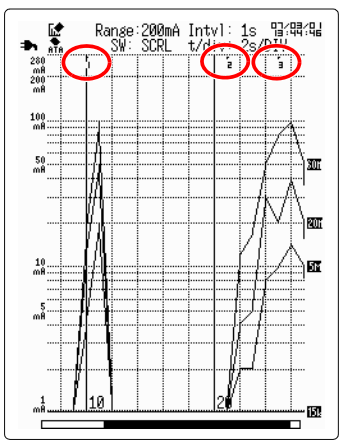
4.6 Adding Event Marks to Waveforms

By using the event mark function, an event mark can be added to any data during measurement (up to 100 marks maximum). Event marks can also be searched.

4.6.1 How to Add an Event Mark

1. **Press** LOGGING START **to commence logging measurement.**

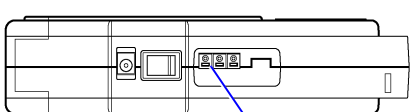
2. **Press** LOGGING START **to add an event mark at the desired moment.**



Each event mark is given a number in the order by which it is marked.

Adding an event mark via external signal input

Event marks can be added by inputting an external signal into the EXT TRIG input on the lower face of the 3145-20. To do this, set the external trigger input on the System Env screen to "Event".
Refer to "7.1.5 External Trigger Input (Event Marker)" (⇒ p. 114) and "Appendix 2.1 EXT TRIG Terminal" (⇒ p. A2).



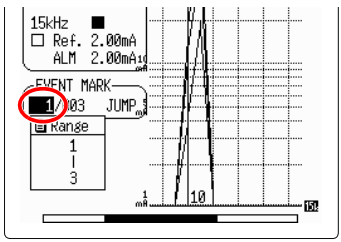
EXT TRIG Terminal (External Trigger)

4.6.2 Searching Event Marks

Each event mark can be searched.

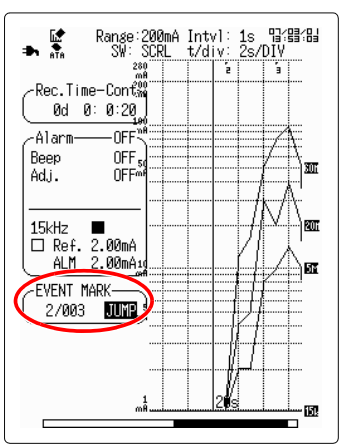
1. **Press ENTER to display the submenu.**

2. **Press ◁▽△▷ to move the blinking cursor to the event number, and press ENTER to open the selection window.**



3. **Press △/▽ to select the event number, and ENTER to set.**

4. **Press ▷ to move the blinking cursor to [Jump], and ENTER to search for the event number.**

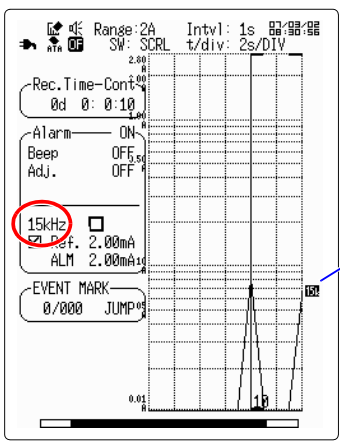


4.7 Highlighting a Specific Band

In order to more easily view a specific band, all bands other than the selected one are displayed as gray.

1. Press (ON/OFF) to enter highlighting display.

2. Press (▲)/(▼) to select the band to be highlight.



The highlight band

The color of all bands other than the selected band becomes gray.

3. Press (ON/OFF) again to return the display to normal.

NOTE

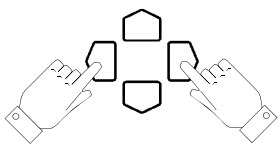
- When displaying the A/B cursors, only the highlight band value will be displayed.
- This function is only valid when the screen color scheme is set to color 1 or 2.

4.8 Preventing Malfunctions (Key Lock)

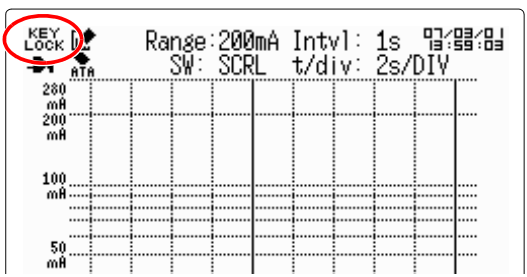
This feature disables input from all of the 3145-20's front panel keys. It prevents malfunctions during measurement.

1. Press 〈 〉 and 〉 〈 simultaneously for approximately 3 or more seconds to place the instrument in key lock mode.

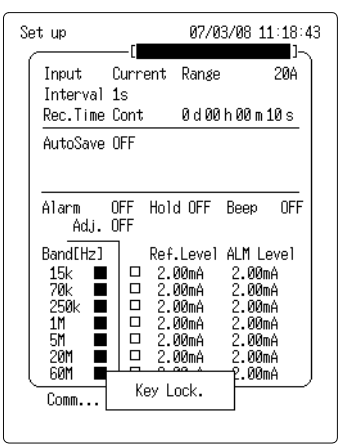
On the logging screen and the monitor screen, **[KEY LOCK]** is displayed in the upper left.



Press simultaneously for approximately 3 seconds or more.



On screens other than the logging screen and monitor screen, **[KEY LOCK]** is displayed at the bottom of the screen.



2. To cancel Key Lock, press 〈 〉 and 〉 〈 again for approximately 3 seconds or more.

4.9 Saving the Display Screen to PC Card (Screen Capture)

The display screen can be saved to PC card.

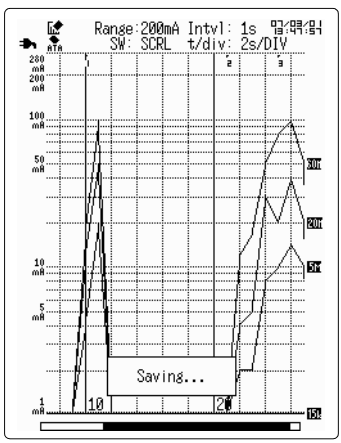
1. Check that a PC card is inserted into the 3145-20.

2. Display the screen to be saved.

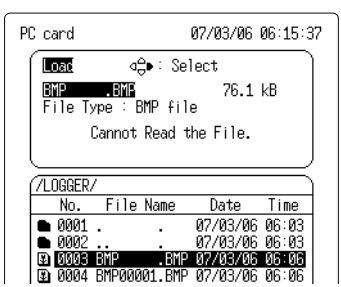
To save the monitor screen, set the copy key in the System Env screen to **[Screen capture]**. The initial setting is **[Alarm capture]**. (⇒ p. 116)

3. Press COPY.

The display screen is saved to the PC card.



4. Press CARD to check the saved file.



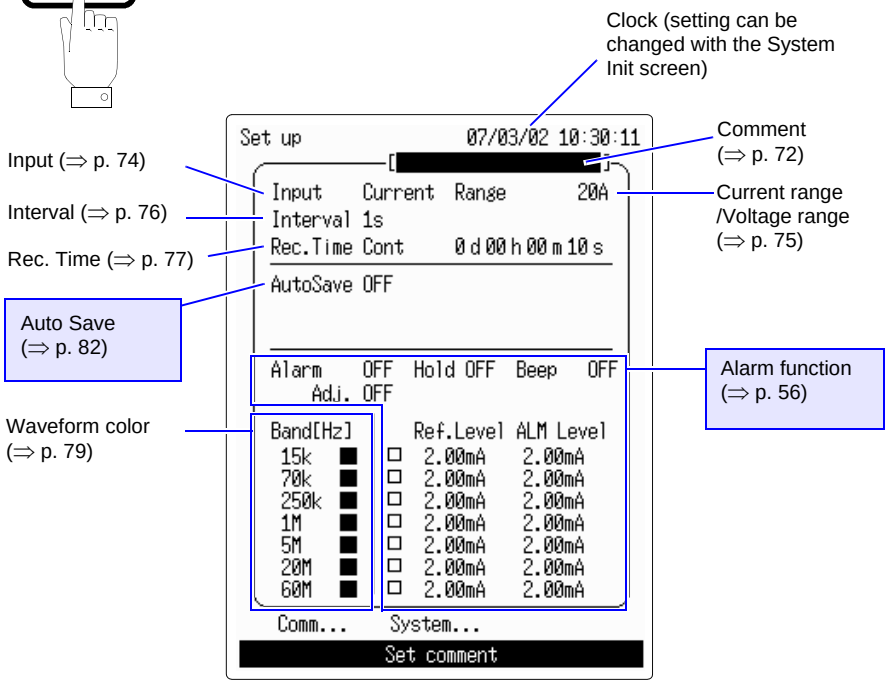
NOTE

- The color for saving the screen (color or grayscale) can be changed on the System Env screen.
- The saved file cannot be read by the 3145-20.

Setting the Measurement Conditions Chapter 5

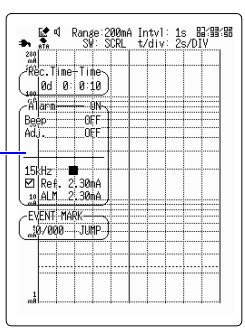
The following measurement conditions can be set with the Set up screen.

Press this key to open the Set up screen.



NOTE

On the logging screen or the monitor screen, pressing ENTER will display the submenu for setting the measurement conditions.



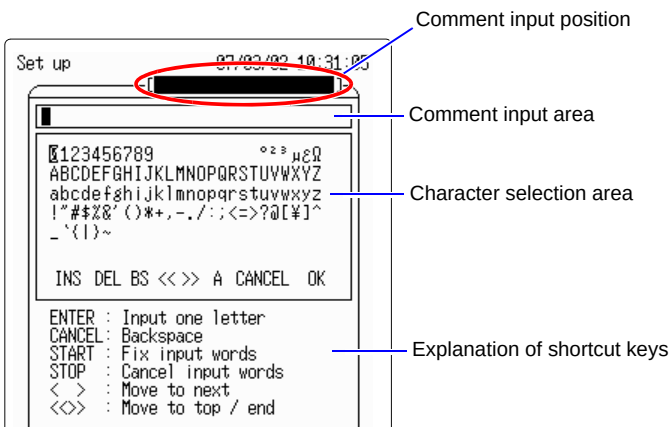
5.1 Inputting Comments

By inputting comments, they will be saved along with the logging measurement data onto the PC card. It can be useful to enter information such as the measurement location.
Set the comments only as deemed necessary. Measurement will not be effected even if no comments are entered.

1. Press SET UP to open the Set up screen.

2. Press ◁△▷ to move the blinking cursor to the comment input position.

3. Press ENTER to open the comment input window.



4. Press ◁△▷ to move the cursor to the character to be input, and press ENTER to select.

To erase a character, press CANCEL.
Refer to the following page for more a detailed explanation of the input method.

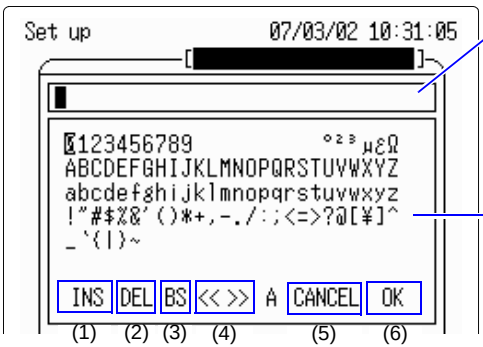
5. Once the comment is completely entered, press ◁△▷ to move the blinking cursor to [OK].

6. Press ENTER to confirm the comment.

To cancel, move the blinking cursor to **[CANCEL]** and press ENTER.

5.1.1 Comment Input Method Details

Comment input window



Comment input area
Move the cursor to the beginning:
Move the cursor to the end:

Move the cursor one space to the left or right: SCROLL CURSOR

Character selection area
Move the cursor:
Character input: ENTER

When the cursor is moved to (1) - (7) in the comment input window and ENTER is pressed, the following actions take place. Alternatively, the shortcut keys effect the same actions. However these are only valid within the comment input window.

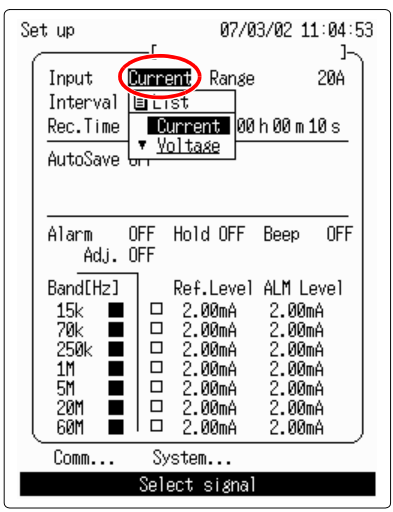
Action	Description	Shortcut key
(1) Write mode	Can be toggled between **[INS]** and **[OVER]** (Overwrite).	--
(2) Delete	Erases the character at the cursor.	--
(3) Backspace	Erases the character one space to the left of the cursor. When the cursor is at the first character, backspace acts the same as delete.	CANCEL
(4) Move input position	Moves the input position to the right or left within the comment input window.	SCROLL CURSOR
(5) Cancel	Returns to the Set up screen from the comment input window.	STOP
(6) Confirm	Confirms the comment input.	LOGGING START

5.2 Setting the Input Type

Depending on the type of object being measured, you can choose between **[Current]** and **[Voltage]** (general purpose) input. Select **[Voltage]** for using general purpose input, such as measuring radiant noise from antennae or measuring noise with a magnetic field probe.

1. **Press SET UP to open the Set up screen.**

2. **Press ◁▷ to move the blinking cursor to [Input], and press ENTER to open the selection window.**



Selectable items	Explanations
Current	Select when using the 9754 CLAMP ON NOISE SENSOR for measurement.
Voltage	Select when using products other than the 9754 CLAMP ON NOISE SENSOR for measurement.

3. **Press △/▽ to select the input type, and ENTER to set.**

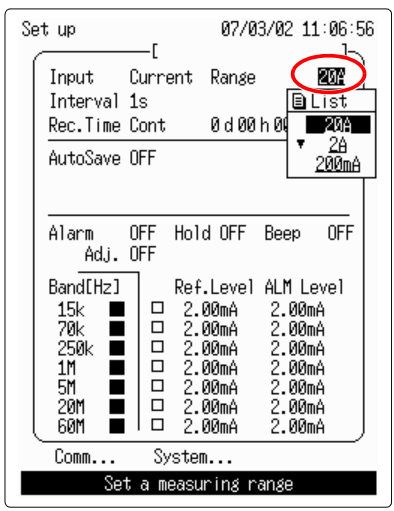
To cancel, press CANCEL.

5.3 Setting the Range

Set the current (or voltage) range. The possible measurement range differs depending on the selected range.
Refer to "9.2 Input Area Specifications" (⇒ p. 140) regarding the instrument's range configuration and measurement range. If the input value exceeds the measurement value, "O.F." (Overflow) will be displayed. Alternatively, if the input value is too low for the measurement range, "U.F." (Underflow) will be displayed.

1. **Press SET UP to open the Set up screen.**

2. **Press ⇧⇩⇦⇨ to move the blinking cursor to [Current Range] (Voltage Range), and press ENTER to open the selection window.**



Input type	Selectable ranges
Current	20 A, 2 A, 200 mA
Voltage	1 V, 100 mV, 10 mV

As a general rule, select 200mA for communications , 2A for power supply and 20A for lightning surge noise measurement.

3. **Press ⇧/⇩ to select the range, and ENTER to set.**

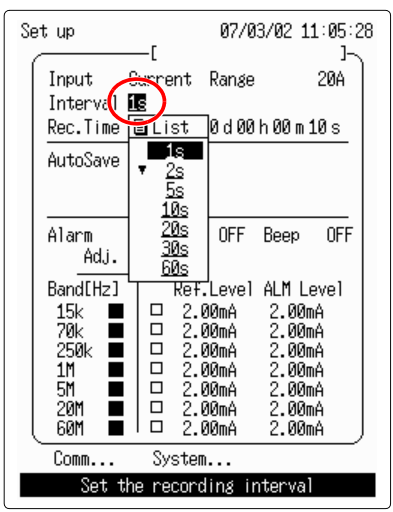
To cancel, press CANCEL.

5.4 Setting the Recording Interval

Sets the interval between each time data is taken. Please select a recording interval which suits the object being measured. Increasing the recording interval causes the maximum recording time to be increased. Regarding the maximum recording time, refer to "The relationship between recording interval and maximum recording time"(⇒ p. 78)."

1. **Press SET UP to open the Set up screen.**

2. **Press ◁▷ to move the blinking cursor to [Interval], and press ENTER to open the selection window.**



Recording interval
1s, 2s, 5s, 10s, 20s, 30s, 60s

3. **Press ▽/△ to select the recording interval, and ENTER to set.**

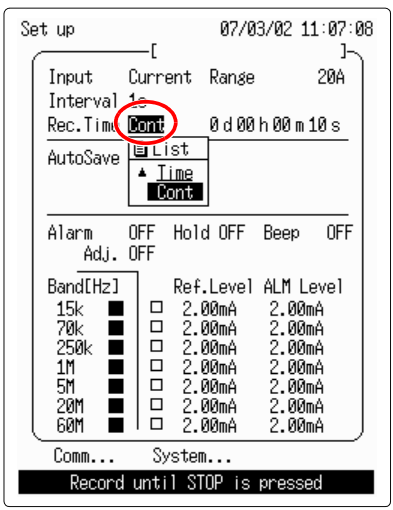
To cancel, press CANCEL.

5.5 Setting the Recording Time

Sets the amount of time to record a single logging measurement. The recording time is limited based on the recording interval.

1. **Press SET UP to open the Set up screen.**

2. **Press ◇ to move the blinking cursor to [Rec. Time], and press ENTER to open the selection window.**



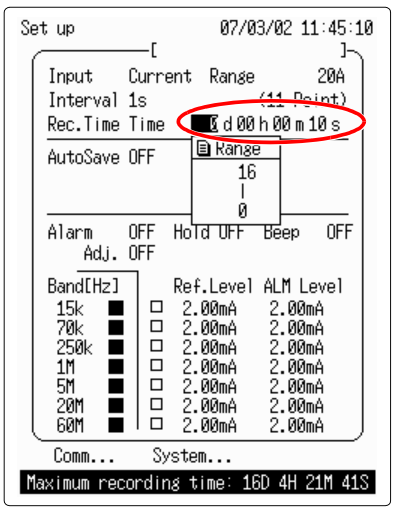
Selectable items	Explanations
Time	The recording time can be set to any value.
Cont	Continuous measurement between the start of measurement and pressing STOP twice can be performed.

3. **Press ◇/◇ to select the recording time, and ENTER to set.**

To cancel, press CANCEL.

4. **If set to [Time], continue on to set the recording time.**

Press ▷ to move the blinking cursor to the time to be set, and press ENTER to open the selection window.



Selectable items	Explanations
Day	0 to 970
Hour	0 to 23
Minute	0 to 59
Second	0 to 59

5. **Press △/▽ to select the recording time, and ENTER to set.**

To cancel, press CANCEL.

NOTE
- When "Continuous" is selected, the recording time setting will be ignored.
- When auto saving measurement data to PC card, if the measurement data exceeds the maximum recording time, please set to **[Cont]** (Continuous).
- If the measurement time exceeds the maximum recording time, the internal memory will be erased starting with the oldest data.

The relationship between recording interval and maximum recording time

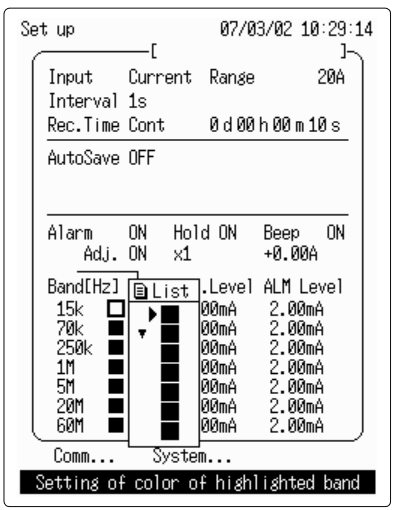
Recording interval	Maximum recording time (32 MB internal memory)
1s	16 days 4 hours 21 minutes 41 seconds
2s	32 days 8 hours 43 minutes 22 seconds
5s	80 days 21 hours 48 minutes 25 seconds
10s	161 days 19 hours 36 minutes 50 seconds
20s	323 days 15 hours 13 minutes 40 seconds
30s	485 days 10 hours 50 minutes 30 seconds
60s	970 days 21 hours 41 minutes 0 seconds

5.6 Setting the Waveform Color

Sets the waveform color for each band.

1. Press SET UP to open the Set up screen.

2. Press ◇ to move the blinking cursor to waveform, and press ENTER to open the selection window.



Selectable colors
Green, yellow, red, light blue, purple, blue and white (For color display)

3. Press ◇/◇ to select the waveform color, and ENTER to set.

To cancel, press CANCEL.

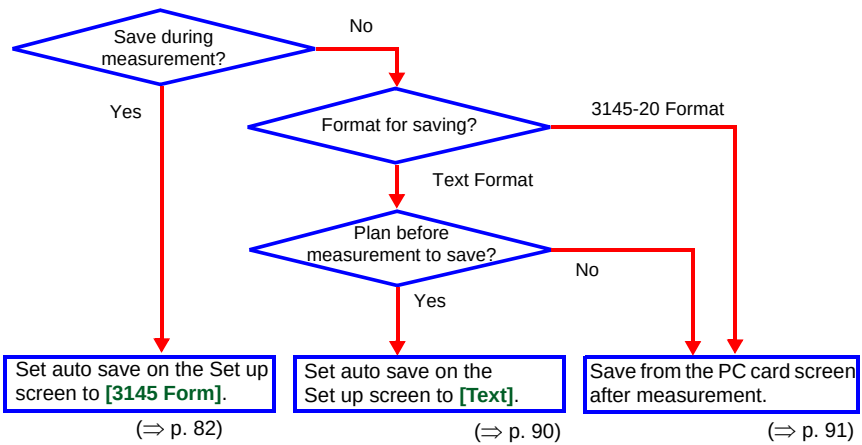
Saving and Reading Data Chapter 6

Logging measurement data and setting data can be saved to PC card to read by the 3145-20 NOISE HiLOGGER or by personal computer when needed.

NOTE

- Insert the PC card beforehand. When using a newly purchased PC card for the fist time, be sure to initialize it. (⇒ p. 38)
- The instrument's PC card can be externally accessed via FTP, but do not access and manipulate the files simultaneously with FTP or the 3145-20 and via telnet. This may cause unwanted file operations to occur.

Saving measurement data



Saving formats	Explanations	File extension
3145 Form	Auto saves in binary format readable by the instrument and the "DATA VIEWER for 3145" software on the included CD.	HNW
Text	Auto saves in text format readable by personal computer spreadsheet programs. (Cannot be read by the 3145-20.)	CSV

Setting data Data such as the range, recording time, and time axis data can be saved. As needed, the data can be loaded by the 3145-20 and measurement can repeatedly be performed under the same conditions. (File extension: HNS)

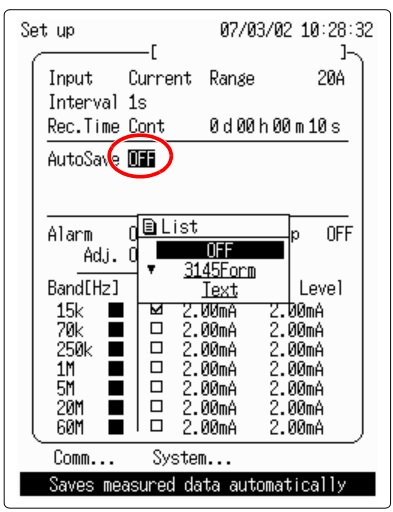
6.1 Saving Data during Measurement

6.1.1 Select "3145 Form"

Set auto save on the Set up screen to **[3145 Form]** When measurement is commenced, the data is automatically saved to the PC card.

1. **Press SET UP to open the Set up screen.**

2. **Press ◁▷ to move the blinking cursor to [Auto Save], and press ENTER to open the selection window.**



Selectable items	Explanations
OFF	Does not save data.
3145 Form	Auto saves in binary format readable by the instrument and the "DATA VIEWER for 3145" software on the included CD.
Text	Auto saves in text format readable by personal computer spreadsheet programs. (Cannot be read by the 3145-20.)

3. **Press △/▽ to select [3145 Form], and press ENTER to set.**

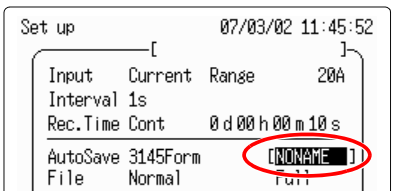
To cancel, press CANCEL.

NOTE
- The data save interval is one minute.
- Data saved in the “3145 Form” is readable by the 3145-20 and the "DATA VIEWER for 3145" software on the included CD.
- When using text format, save after measurement completion.

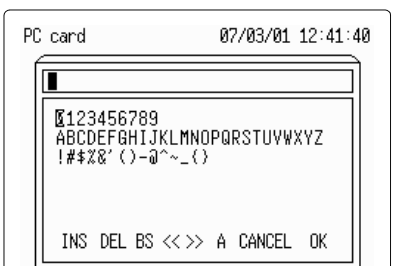
6.1.2 Filenames

By inputting a filename, auto save files will be saved with that name.

1. Press ◇ on the Set up screen to move the blinking cursor to the filename location.



2. Press ENTER to open the filename input window.



3. Press ◇ to move the cursor to the character to be input, and press ENTER to select.

Press CANCEL to erase a character.
Refer to "5.1 Inputting Comments" (⇒ p. 72) regarding the input method.

4. After completing the filename input, press ◇/◇ to move the cursor to [OK].

5. Press ENTER to confirm the filename.

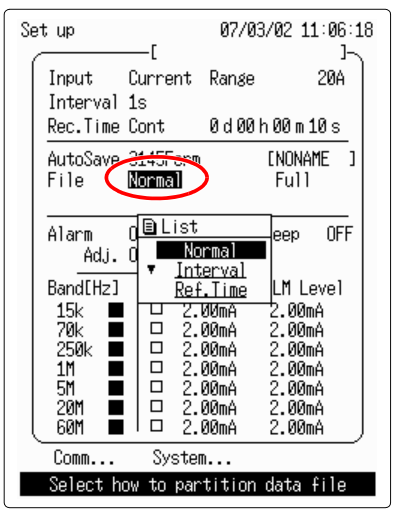
To cancel, move the blinking cursor to **[CANCEL]** and press ENTER.

NOTE
- Continually saving multiple times adds successive numbers to the filenames.
  Example: 3145D, 3145D001, 3145D002, 3145D003...
- If a filename has not been entered, the filename will default to "NONAME".
  Example: NONAME, NONAME01, NONAME02, NONAME03...
- Filenames using all 8 characters will appear as follows.
  Example: ABCDEFGH, ABCDEFG1, ABCDEFG2, ABCDEFG3...

6.1.3 Save Mode

Normally, the save mode is set to "Normal", "Full".

1. Press ◁▽▷ on the Set up screen to move the blinking cursor to [File], and press ENTER to open the selection window.



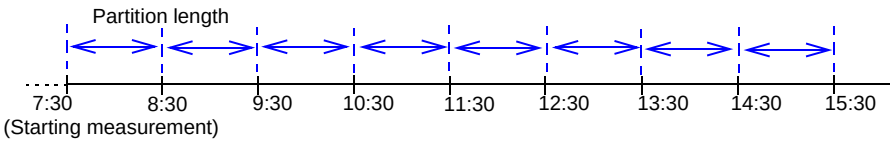
Selectable items	Explanations
Normal	Carrying out one measurement creates one file.
Interval	The file is created by dividing the data in a period of time (Partition length) from the starting measurement.
Ref. Time	Set the reference time in 24 hours and create a file by dividing the data in a period of time (Partition time) from the fixed reference time.

2. Use the up and down △/▽ arrow keys to select the method of wave measurement, and press ENTER to set.

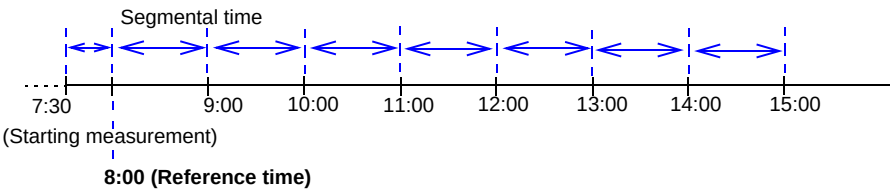
Normally, select "Normal".
When dividing a file per time and saving, select "Interval" or "Ref. Time".

<Example> Wave file

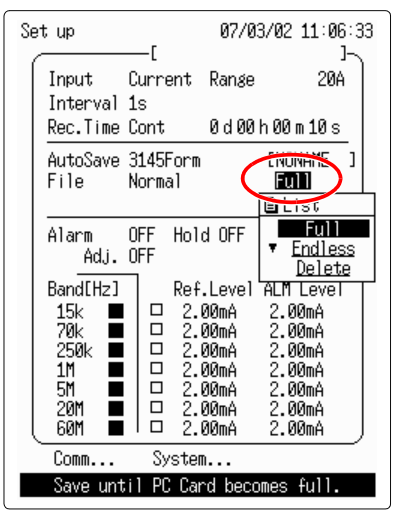
When selecting "Interval" and the partition length is 1 hour



When selecting "Ref. Time", reference time 8:00 and the partition length is 1 hour



3. Press ▷ to move the blinking cursor to the side, and ENTER to open the selection window.



Selectable items	Explanations
Full	If the PC card reaches full capacity, the save will be canceled.
Endless	If the PC card reaches full capacity, the earliest data in the recording file is overwritten. The latest data will be saved up to the file capacity.
Delete	At the beginning or in the midst of auto save if the available space on the PC card is not sufficient, then the oldest file in the folder currently being saved to will be erased. If it becomes impossible to erase files, the state will become the same as endless save.

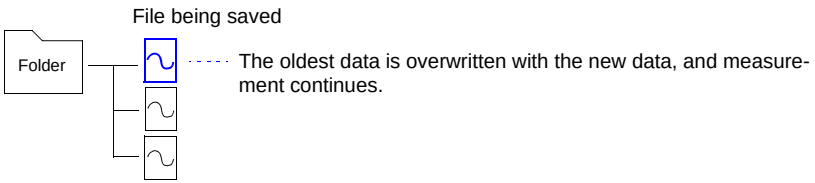
4. Press △/▽ to select the PC card saving method, and press ENTER to set.

[Full] is normally selected.

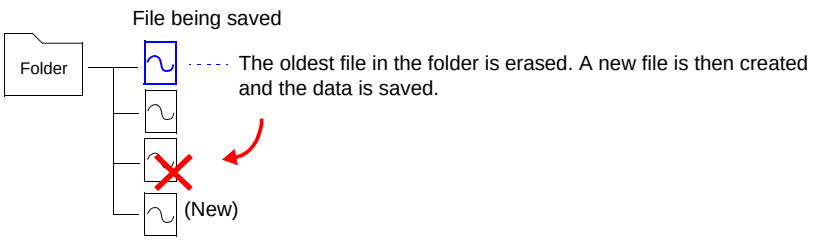
<Example>

Behavior when the PC card reaches full capacity.

When **[Endless]** is selected



When **[Delete]** is selected



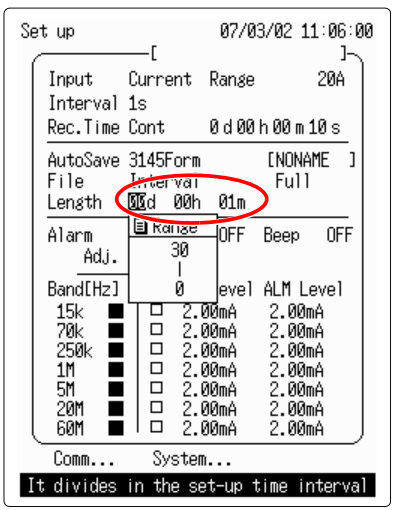
NOTE The conditions for erase save are as follows.

- Only files in the same folder in which the auto save file is being saved are deleted.
- Files with the extension ".HNW" are recognized as waveform files. Even if a file with the ".HNW" extension is not a waveform file, it will be recognized as one and may be deleted.
- The age of a file is determined by the file's time stamp (when it was created).
- If there is only one or less recorded file in the folder, no file will be erased. If the size of the file to be erased is too large relative to the capacity of the PC card, it may not be able to be erased. As a general rule, a single file should take up less than 1/4 the capacity of the PC card.
- No more than 10,000 files may be referenced in a single folder. If that number is exceeded, the oldest file may be erased.
- When saving in segments, the instrument acts the same as if normal non-segmented auto save is executed multiple times. In other words, out of a set of segmented files created from a single measurement, the one created first will be erased.

When selecting “Interval”

When selecting **[Interval]**, the length of data to partition can be set.

1. Press ◇ to move the blinking cursor to [Length], and press ENTER to open the selection window.



Selectable items	Explanations
Day	0 to 30
Hour	0 to 23
Minute	0 to 59

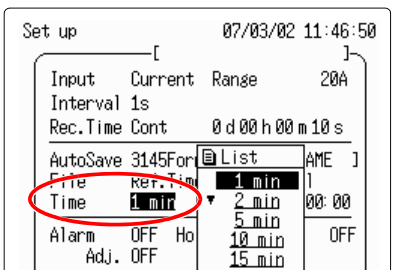
2. Press ◇/◇ to select the length of data to partition, and press ENTER to set.

To cancel, press CANCEL.

When selecting “Ref. time”

When selecting **[Ref. Time]**, set the length of the data partition and the reference time.

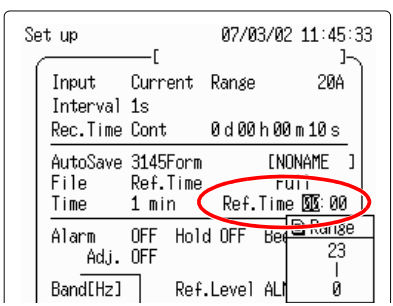
1. **Press ◁▽▷ to move the blinking cursor to [Time], and press ENTER to open the selection window.**



Selectable items
1 min, 2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 1 hour, 2 hour, 3 hour, 4 hour, 6 hour, 8 hour, 12 hour, 1 day

2. **Press △/▽ to select the length of the data partition, and press ENTER to set.**

3. **Press ▷ to move the blinking cursor to [Ref. Time], and press ENTER to open the selection window.**



Selectable items	Explanations
Hour	0 to 23
Minute	0 to 59

4. **Press △/▽ to select the reference time, and press ENTER to set.**

To cancel, press CANCEL.

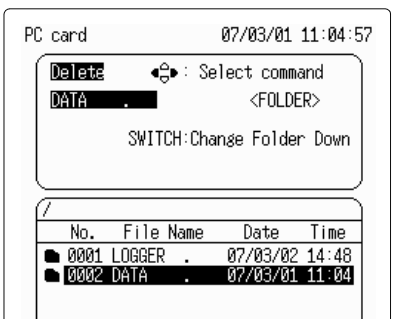
6.1.4 Specify the File Save Target

The folder in which files are saved during auto save is set in the following manner.

1. Press CARD to open the PC card screen.

2. Press / to select the folder to move to.

To move one folder up, select the ". ." folder.



3. Press SWITCH to move to the folder. Each time the key is pressed, it toggles between one level up and down.

4. Move to the logging screen and begin measurement.

The measurement data is auto saved to the set folder. If auto save is set to OFF, auto save will not be performed.

NOTE

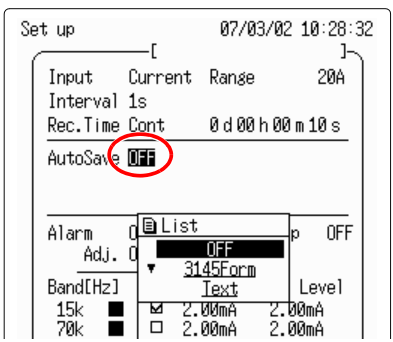
- If the root folder is selected and there is a /LOGGER/ folder, files will be saved in the /LOGGER/ folder. PC cards formatted with the 3145-20 contain a created /LOGGER/ folder. If there is no /LOGGER/ folder, files will be saved to the root folder.
- The root folder has an upper limit to the number of files which can be saved in it. When saving numerous files, please create new folders to save them in.
- When a folder has been moved to in the PC card screen, that folder becomes the auto save destination.

6.2 Planning to Save Text after Measurement

Set auto save to **[Text]** on the Set up screen. When measurement is completed, the data remaining in the instrument's internal memory (32 MB) will be automatically saved to the PC card. Data saved in the text format can be read by software such as personal computer spreadsheet programs. (It cannot be read by the 3145-20.)

1. Press SET UP to open the Set up screen.

2. Press ◇ to move the blinking cursor to [Auto Save], and press ENTER to open the selection window.



Selectable items	Explanations
OFF	Does not save data.
3145 Form	Auto saves in binary format readable by the instrument and the "DATA VIEWER for 3145" software on the included CD.
Text	Auto saves in text format readable by personal computer spreadsheet programs. (Cannot be read by the 3145-20.)

3. Press ◇/◇ to select [Text], and press ENTER to set.

To cancel, press CANCEL.

4. Set the file name. (⇒ p. 83)

5. Upon completion of logging measurement, the data is saved in text format to the PC card.

Saving takes a bit of time. Take note that pressing STOP while saving will interrupt and cancel the save.

NOTE

- When the recording time is set to **[Cont]**, the data remaining in the instrument's internal memory is auto saved. When set to "Time", it cannot be set to greater than the internal memory.
- If there is not sufficient space on the PC card, it will not be saved.
- The data which remains in the instrument (32MB of internal memory capacity) differs depending on the recording interval setting. (⇒ p. 78)
- During text format save, data at the time of a power outage is not saved.
- Files saved in text format are comparatively larger than those saved in “3145 Form”.
- Saving in “3145 Form” is recommended.

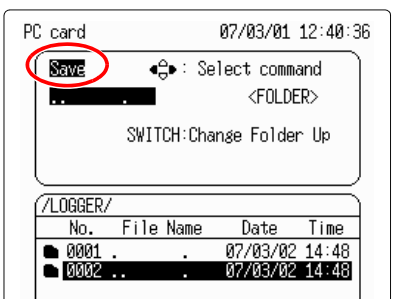
6.3 Saving Data after Measurement

Saves measurement data and settings data to the PC card. In order to save measurement data, it must be saved to the internal memory. (If measurement data is displayed on the logging screen, then the data exists in the internal memory.)

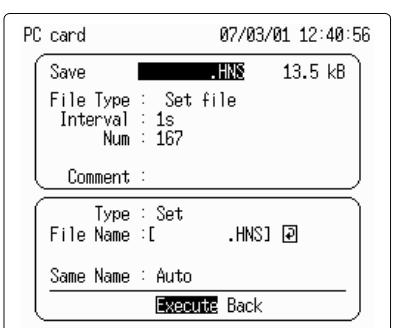
NOTE
- Up to four settings data items can be stored in the 3145-20's internal memory. Refer to "7.2 Setting Screen" (⇒ p. 122).
- For saving data during measurement, refer to "6.1 Saving Data during Measurement" (⇒ p. 82).

1. **Press CARD to open the PC card screen.**

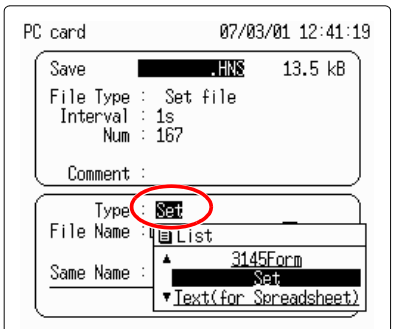
2. **Press ◯/◯ to select the [Save] command.**



3. **Press ENTER to open the save screen.**



4. **Press ◯ to move the blinking cursor to [Type], and press ENTER to open the selection window.**

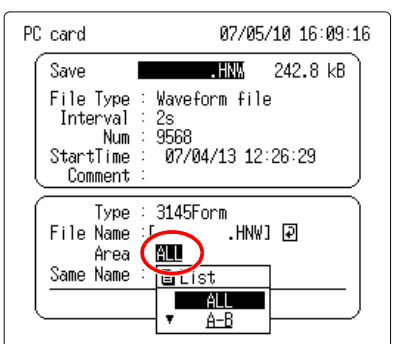


Selectable items	Explanations
3145 Form	Auto saves in binary format readable by the instrument and the "DATA VIEWER for 3145" software on the included CD.
Set	The settings are saved.
Text (for Spreadsheet)	Auto saves in text format readable by personal computer spreadsheet programs. (Cannot be read by the 3145-20.)

5. **Press ◯/▭ to select either [3145 Form] or [Text] (for spreadsheet), and press ENTER to set.**

6. **Set the file name. (⇒ p. 83)**

7. **Press ▭ to move the blinking cursor to [Area], and press ENTER to open the selection window.**

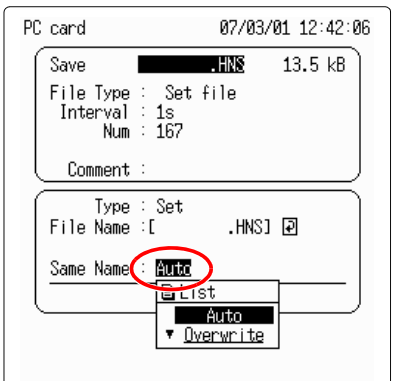


Selectable items	Explanations
ALL	Saves data for all captured waveforms.
A-B	If only the A cursor is enabled, data from the cursor to the end of input is saved. If both A and B cursors are enabled, only data between the cursors is saved.

8. **Press ◯/▭ to select [ALL] or [A-B].**

Display the A and B cursors on the logging screen and specify the saving range first.

9. **Press ▽ to move the blinking cursor to [Same Name], and press ENTER to open the selection window.**



Selectable items	Explanations
Auto	This mode saves files with the same name by automatically appending a number after the file name. If the last file was saved with a number appended, the next file is saved with the number incremented. <Example> TEST0001, TEST0002 . . . . .
Overwrite	This mode saves files with the same name, overwriting the previous the same namefile.

10. **Press △/▽ to select [Auto] or [Overwrite], and press ENTER to set.**

11. **Press ▽ to move the blinking cursor to [Execute] , and press ENTER to execute.**

To cancel, move the blinking cursor to **[Back]** and press ENTER.

NOTE
- When it is desired to view data which has been saved in **[3145 Form]** with a personal computer, the "DATA VIEWER for 3145" software can be used to easily view waveforms and convert the data to CSV file for analysis in spreadsheet software. Refer to the "DATA VIEWER for 3145" instruction manual on the included CD.
- Refer to "6.7 Calculation Method for “3145 Form” Files" (⇒ p. 106) regarding the capacity of “3145 Form” files.

Reference for calculating the approximate saving capacity in number of days

Recording interval PC card (Capacity after initializing)	1s	2s	5s	10s	20s	30s	60s
9726 PC CARD 128M (120.4 MB)	60 days	120 days	300 days	1.7 years	3.3 years	5 years	10 years

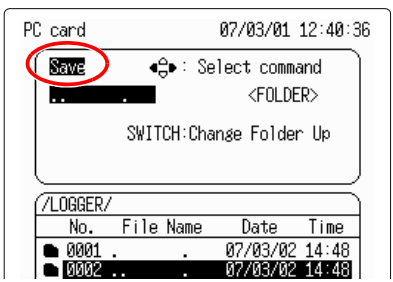
Use the above chart as a reference for calculating the approximate saving capacity in number of days for the 9727 PC CARD 256M, 9728 PC CARD 512M, and 9729 PC CARD 1G. However, the longest possible save time for a single measurement is 999 days, 23 hours, 59 minutes and 59 seconds.

6.4 Saving Settings Data

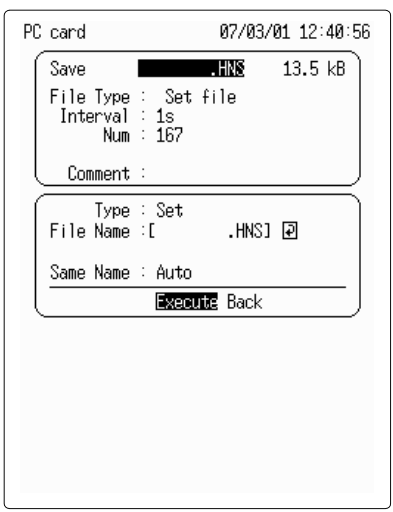
Data such as the range, recording time, and time axis data can be saved. As needed, the data can be loaded by the 3145-20 and measurement can repeatedly be performed under the same conditions. (File extension: HNS)
Up to four settings data items can also be saved in the instrument's internal memory. Refer to "7.2 Setting Screen" (⇒ p. 122).

1. **Press (CARD) to open the PC card screen.**

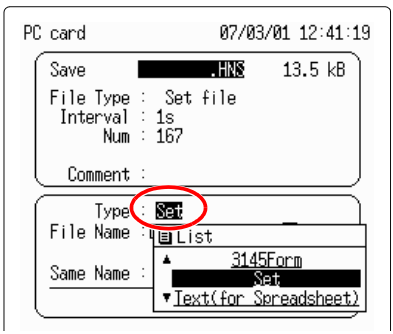
2. **Press ◯/◯ to select the [Save] command.**



3. **Press (ENTER) to open the save screen.**



4. **Press ▢ to move the blinking cursor to [Type], and press ENTER to open the selection window.**

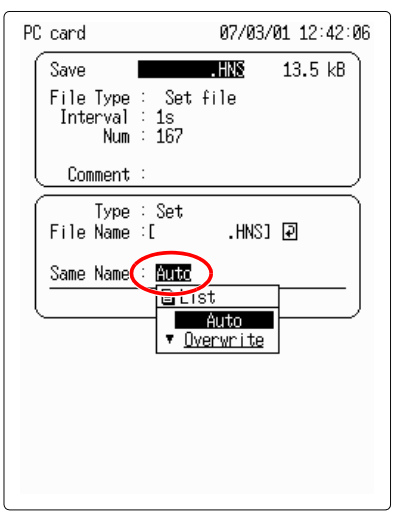


Selectable items	Explanations
3145 Form	Auto saves in binary format readable by the instrument and the "DATA VIEWER for 3145" software on the included CD.
Set	The settings are saved.
Text (for Spreadsheet)	Auto saves in text format readable by personal computer spreadsheet programs. (Cannot be read by the 3145-20.)

5. **Press ⬡/▢ to select [Set], and press ENTER to set.**

6. **Set the file name. (⇒ p. 83)**

7. **Press ▢ to move the blinking cursor to [Same Name], and press ENTER to open the selection window.**

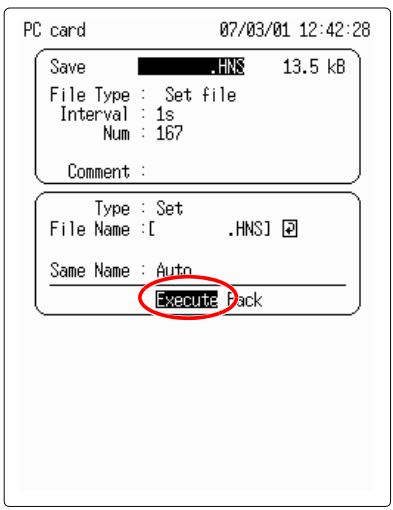


Selectable items	Explanations
Auto	This mode saves files with the same name by automatically appending a number after the file name. If the last file was saved with a number appended, the next file is saved with the number incremented. <Example> TEST0001, TEST0002 . . . . .
Overwrite	This mode saves files with the same name, overwriting the previous the same namefile.

8. **Press ◯/▭ to select [Auto] or [Overwrite], and press ENTER to set.**

9. **Press ▭ to move the blinking cursor to [Execute] , and press ENTER to execute.**

To cancel, move the blinking cursor to **[Back]** and press ENTER.

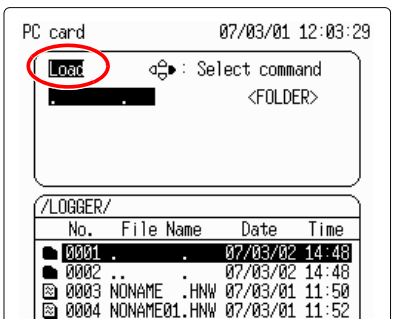


6.5 Reading Measurement and Settings Data

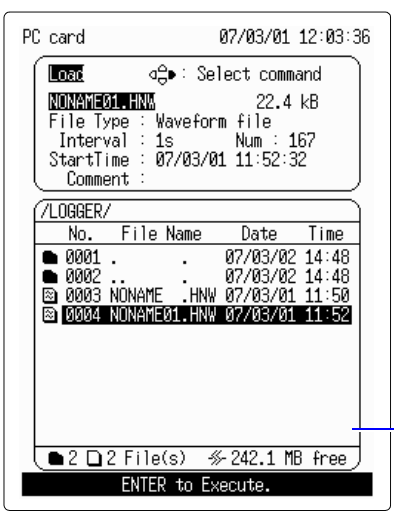
The instrument's settings state (HNS file extension) and measurement data (HNW file extension) can be transferred from PC card to the main instrument's internal memory. Data saved in the text format (for spreadsheets) cannot be read by the 3145-20.

1. **Press CARD to open the PC card screen.**

2. **Press ◯/◯ to select the [Load] command.**



3. **Press ◯/◯ to select the measurement data or settings data to read.**

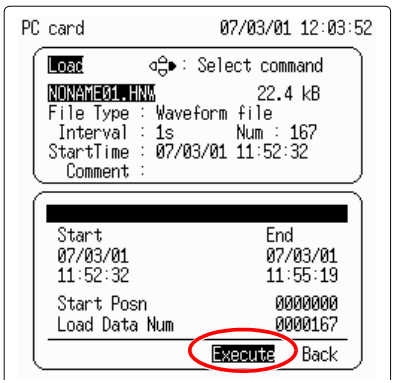


Selected data

Press SCROLL CURSOR to skip 10 files and select.

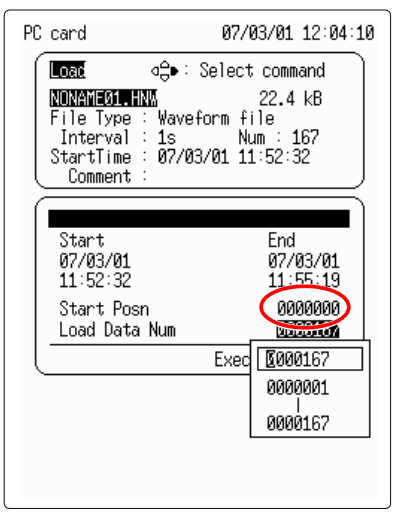
Press ◀◀/▶▶ to skip 100 files and select.

4. **Press ENTER to open the file read screen.**



5. **Press ENTER again to read the file.**

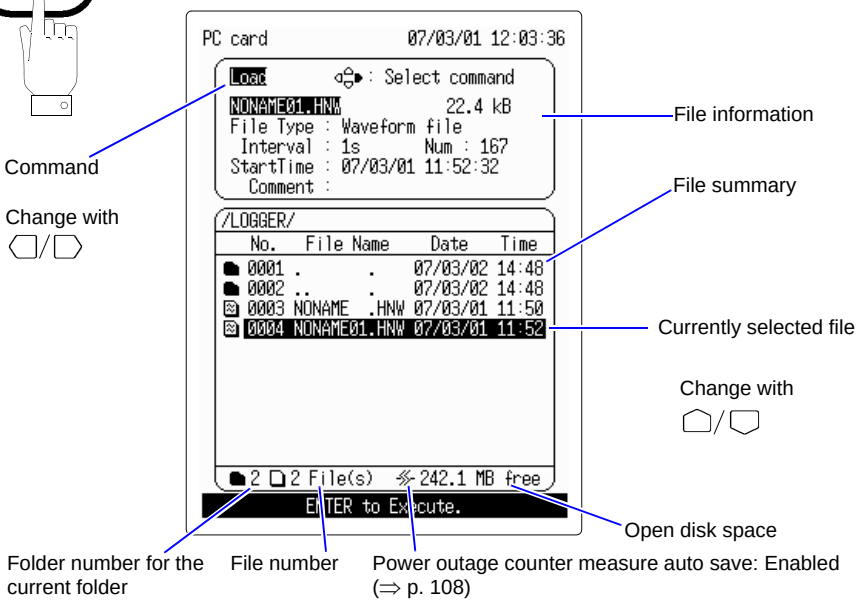
If there is too much data to all be read at once, set the amount of data to read and the position to begin reading. The maximum amount of data which can be read is 1398101.



NOTE When sectional reading has been done with peak value display (logging screen), if the data position where the peak occurred is not present, "- - -" is displayed.

6.6 File Operation

Press the this key to open the PC card screen.



Command	Explanations	Reference page
Load	Transfers setting conditions and measurement data from PC card to the 3145-20 main instrument's memory.	(⇒ p. 97)
Save	Saves measurement data and settings data to the PC card.	(⇒ p. 91)
Delete	Deletes files or folders.	(⇒ p. 101)
Make Fold	Creates subfolders.	(⇒ p. 102)
Format	Initializes the PC card.	(⇒ p. 38)
Rename	Changes file or folder names.	(⇒ p. 104)
Sort	Changes the file order.	(⇒ p. 105)

6.6.1 Moving between Folders

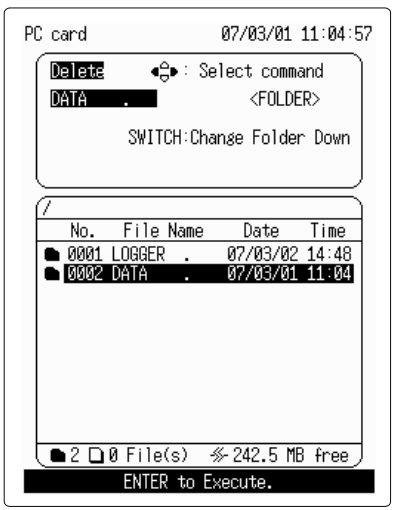
Moving from the current folder to another folder.

1. Press (CARD) to open the PC card screen.

2. Press ⬡/⬡ to select the folder to move to.

To move one folder up, select the ". ." folder.

3. Press (SWITCH) to move to the folder. Each time the key is pressed, it toggles between one level up and down.



NOTE

- Files cannot be moved from one directory to another with the instrument.
- The maximum number of files that can be saved in the root directory of a Flash ATA Card is 512 files (depending on the manufacturer). The power fault protection function requires at least 16 system files to be created in the root directory, reducing the total number of files (512 or less) that can be created in the root directory respectively.
- Always make sure that multiple files reside in subdirectories.
  For a memory card formatted by the instrument, automatic saving of a file to the root directory moves automatically to the /LOGGER/ directory where the file will be saved.

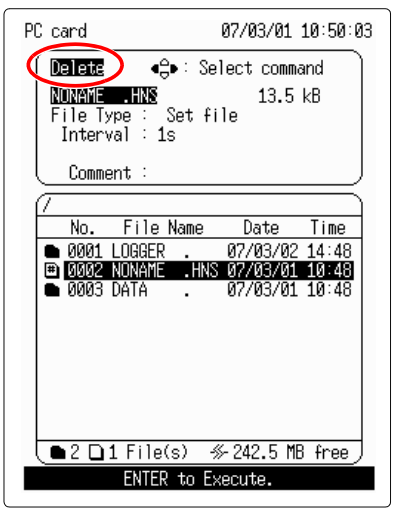
6.6.2 Deleting Files and Folders

Delete unnecessary files or folders on the PC card.

1. Press CARD to open the PC card screen.

2. Press / to select the measurement data or setting condition, or the folder to be deleted.

3. Press / to select the [Delete] command.



4. Press ENTER to display the confirmation message, then press ENTER to confirm.

To cancel, press CANCEL.

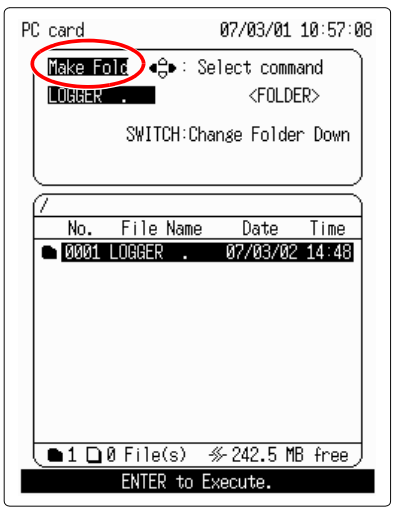
NOTE The instrument does not support Windows long file names (LFN). When a file created on a Windows PC is deleted on the instrument, the file is not completely deleted and an error will occur when drive check is performed on the PC.

6.6.3 Creating Folders

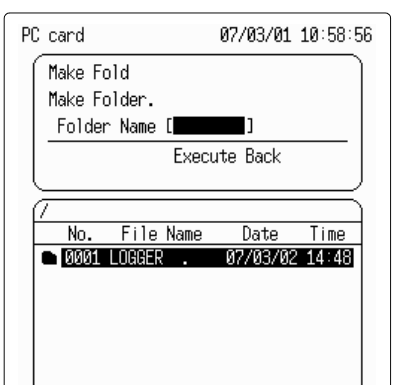
Create folders to be used for saving files.

1. **Press CARD to open the PC card screen.**

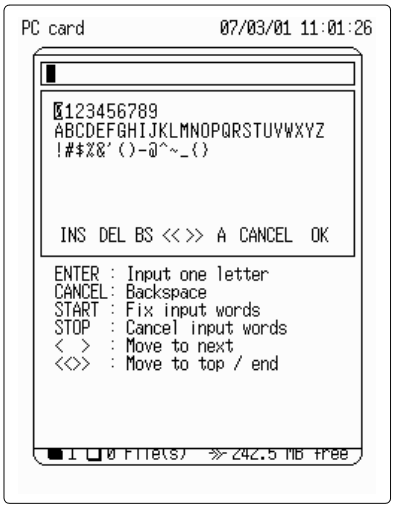
2. **Press ◯/◯ to select the [Make Fold] command.**



3. **Press ENTER to open the folder creation screen.**



4. **Press ENTER to open the input window.**

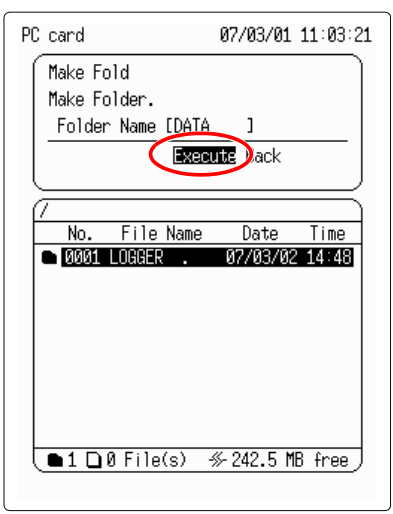


5. **Input the folder name, and press ENTER to confirm.**

Refer to "5.1 Inputting Comments" (⇒ p. 72) regarding the input method.

6. **Press ▢ to move the blinking cursor to [Execute] , and press ENTER to execute.**

To cancel, move the blinking cursor to **[Back]** and press ENTER.

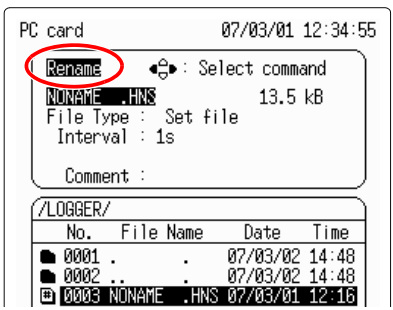


6.6.4 Changing File Names and Folder Names

Change saved file or folder names.

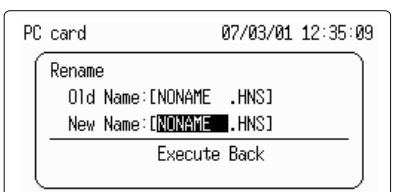
1. **Press CARD to open the PC card screen.**

2. **Press ◯/◯ to select the [Rename] command.**



3. **Press ◯/◯ to select the measurement data or setting data file name which is to be changed.**

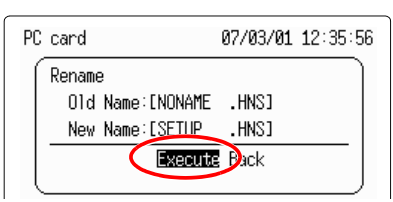
4. **Press ENTER to open the name change screen.**



5. **Set the file name. (⇒ p. 83)**

6. **Press ◯ to move the blinking cursor to [Execute] , and press ENTER to execute.**

To cancel, move the blinking cursor to **[Back]** and press ENTER.

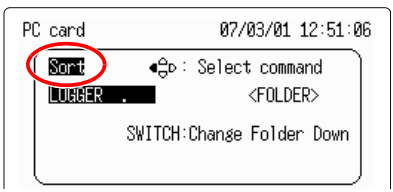


6.6.5 Changing the File Order

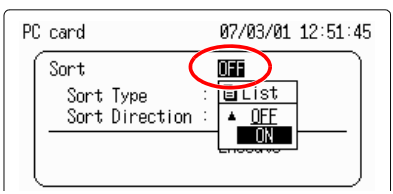
Change the order in which files on the PC card are displayed.

1. **Press (CARD) to open the PC card screen.**

2. **Press ◯/◯ to select the [Sort] command.**

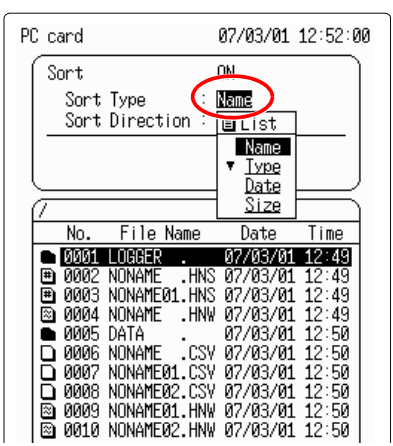


3. **Press (ENTER) to open the order change screen, and (ENTER) to open the selection window.**



4. **Press ◯/◯ to select [ON], and press (ENTER) to set.**

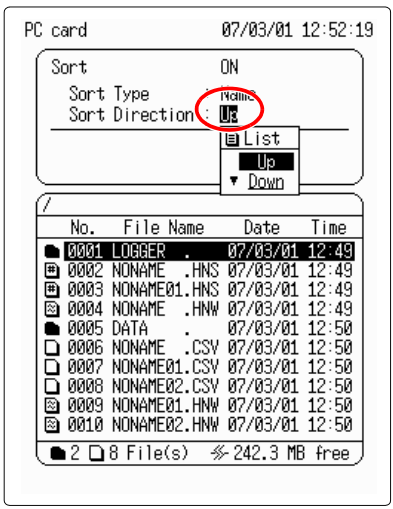
5. **Press ◯ to move the blinking cursor to [Sort Type], and press (ENTER) to open the selection window.**



Selectable items	Explanations
Name	Orders the files by filename.
Type	Orders the files by type.
Date	Orders the files by date.
Size	Orders the files by size.

6. **Press ◯/◯ to select sort type, and press ENTER to set.**

7. **Press ◯ to move the blinking cursor to [Sort Direction], and press ENTER to open the selection window.**



8. **Press ◯/◯ to select [Up] or [Down], and press ENTER to set.**

9. **Press ◯ to move the blinking cursor to [Execute] , and press ENTER to execute.**

To cancel, press CANCEL.

6.7 Calculation Method for "3145 Form" Files

File size = Header size + Data size (in bytes)
Header size = 18,944 (bytes)
Data size = 24 x data number (bytes)

6.8 Content Format for Text Format Files

Text format files are comprised of a header section and a data section. The header section contains the following information about the measurement data. (Text files are compatible with most spreadsheet software.)

(1) Equipment name
(2) Comment
(3) (4) From the left: Data number, recording interval, measurement range, measurement start date, measurement start time
(5) (6) From the left: Band, peak value, date of peak value, time of peak value
(7) Units
(8) (9) From the left: Date, time, individual band measurement values, alarm, event

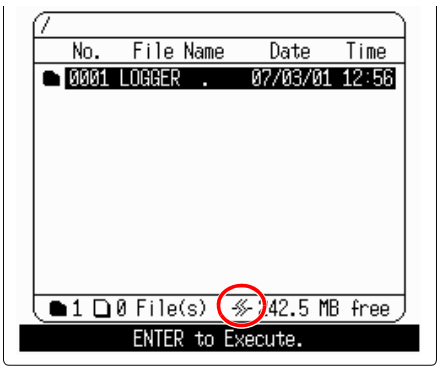
```
"3145 NOISE HiLOGGER" ..... (1)
"COMMENT ..... (2)"
"Data Num","Interval","Range","Start Date","Start Time" ..... (3)
"11","1s","200mA","2007/03/02","07:25:18" ..... (4)

"Band","Peak Value","Peak Date","Peak Time" ..... (5)
"15kHz","50.8mA","2007/03/02","07:25:22"
"70kHz","121.5mA","2007/03/02","07:25:22"
"250kHz","60.8mA","2007/03/02","07:25:24"
"1MHz","35.9mA","2007/03/02","07:25:22"
"5MHz","12.0mA","2007/03/02","07:25:21"
"20MHz","6.0mA","2007/03/02","07:25:22"
"60MHz","3.0mA","2007/03/02","07:25:21"
                                        ..... (6)

"","","A","A","A","A","A","A","A","","" ..... (7)
"Date","Time","15kHz","70kHz","250kHz","1MHz","5MHz","20MHz","60MHz","Alarm","Event" ....(8)
2007/03/02,07:25:18, 1.8E-03, 2.3E-03, 1.2E-03, 1.5E-03, 0.0E+00, 2.0E-03, 0.0E+00, 0,  0
2007/03/02,07:25:19, 1.7E-03, 2.6E-03, 2.6E-03, 1.5E-03, 0.0E+00, 2.0E-03, 1.0E-03, 0,  0
2007/03/02,07:25:20, 1.8E-03, 2.6E-03, 2.4E-03, 1.5E-03, 0.0E+00, 0.0E+00, 1.0E-03, 0,  0
2007/03/02,07:25:21, 35.9E-03, 83.3E-03, 39.0E-03, 26.6E-03, 12.0E-03, 5.0E-03, 3.0E-03, 1,  0
2007/03/02,07:25:22, 50.8E-03, 121.5E-03, 59.4E-03, 35.9E-03, 10.0E-03, 6.0E-03, 2.0E-03, 1,  0
2007/03/02,07:25:23, 46.5E-03, 103.7E-03, 52.3E-03, 30.3E-03, 6.0E-03, 5.0E-03, 1.0E-03, 1,  0
2007/03/02,07:25:24, 47.7E-03, 113.8E-03, 60.8E-03, 34.0E-03, 10.0E-03, 5.0E-03, 2.0E-03, 1,  0
2007/03/02,07:25:25, 1.7E-03, 2.6E-03, 2.3E-03, 1.5E-03, 0.0E+00, 0.0E+00, 0.0E+00, 0,  1
2007/03/02,07:25:26, 1.6E-03, 2.9E-03, 1.3E-03, 1.5E-03, 0.0E+00, 0.0E+00, 0.0E+00, 0,  0
2007/03/02,07:25:27, 1.7E-03, 2.5E-03, 2.3E-03, 1.5E-03, 0.0E+00, 0.0E+00, 0.0E+00, 0,  0
2007/03/02,07:25:28, 1.8E-03, 2.6E-03, 2.2E-03, 1.5E-03, 0.0E+00, 0.0E+00, 0.0E+00, 0,  0
                                                                                    .... (9)
```

If the measurement value is an O.F. or U.F. value, the value for (9) becomes as displayed in the chart below.

Ranges / Measurement value	200 mA	2 A	20 A	10 mV	100 mV	1 V
U.F.	0 A	0 A	0 A	0 V	0 V	0 V
O.F.	300 mA	3 A	30 A	15 mV	150 mV	1.5 V

Power fault protection while recording to a PC card

System files are automatically created for the power fault protection function during initialization (formatting). These files are not displayed in the File selection window, but the ⚡ symbol is displayed at the bottom of the PC card screen.
The system files for the power fault protection function occupy about 1.5 MB of file space on the PC Card.



If power is interrupted while a real-time data file is being recorded to a PC Card, the data file is recovered automatically. In this event, turn the power back on before removing the PC Card. If real-time saving was interrupted, data recorded up to the point of the last file refresh can be read from the PC Card.

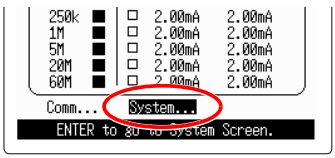
Precautions regarding the system files for power fault protection

- During real-time saving, files are refreshed at regular intervals. The refresh interval is 1 min.
- If power is interrupted before the first data refresh, no data is stored, and a file is created with zero bytes.
- The system files occupy a particular area on the PC Card. When a PC Card is used the first time, or when a Card that has been used in another instrument for a long time, we recommend performing an "Entirely" initialization to check for bad sectors on the PC Card.
- If a PC Card is written to by a instrument other than a instrument, the power fault protection system files may become corrupted. We therefore recommend that after using a PC Card in another instrument, it be reformatted before use in the instrument.
- Do not remove a PC Card while recording a file, as the PC Card electronics could be damaged. In such a case, the power fault protection file system may be unable to recover data.

System Screen Chapter 7

The system screen contains 3 screens: environment, setting conditions, and initialize.

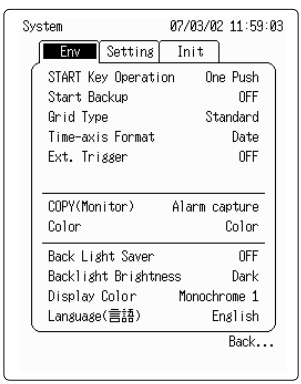
1. **Press SET UP to open the Set up screen, and ◁▷ to move the blinking cursor to [System].**



2. **Press ENTER to open the System screen.**

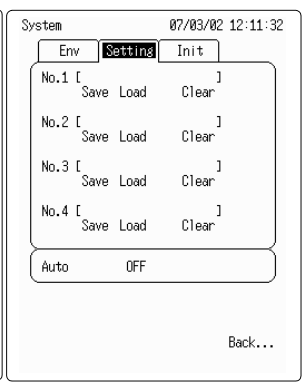
Use ◀◀ / ▶▶ to toggle between the System Env screen, the System Setting screen, and the System Init screen.

The following items can be set on each screen.



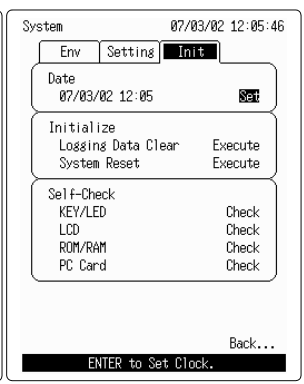
Env screen

- "Start Key Receive Condition (Malfunction Prevention)"(⇒ p. 110)
- "Start Backup After Power Loss"(⇒ p. 111)
- "Grid Type"(⇒ p. 112)
- "Time Format when Saving Text"(⇒ p. 113)
- "External Trigger Input (Event Marker)"(⇒ p. 114)
- "Copy Key Function (Monitor)"(⇒ p. 116)
- "Save Color"(⇒ p. 117)
- "Backlight Saver"(⇒ p. 118)
- "Backlight Brightness"(⇒ p. 119)
- "Screen Color Scheme"(⇒ p. 120)



Setting screen

- "Saving Settings"(⇒ p. 122)
- "Loading Setting Conditions"(⇒ p. 124)
- "Deleting Setting Conditions"(⇒ p. 125)
- "Automatically Loading"(⇒ p. 126)
- "Auto Setup"(⇒ p. 126)



Init screen

- "Setting the Clock"(⇒ p. 127)
- "Erasing Logging Measurement Data"(⇒ p. 128)
- "System Reset"(⇒ p. 129)
- "Self-check"(⇒ p. 130)

7.1 Env (Environment) Screen

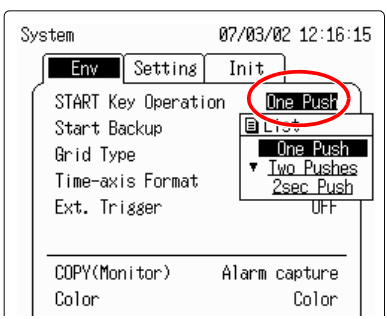
7.1.1 Start Key Receive Condition (Malfunction Prevention)

Normally, pressing LOGGING START once will start measurement, but in order to prevent starting measurements accidentally the start key receive condition can be changed to "Two Pushes" or "2s Push".

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◁▷ to move to **[System]** → Press ENTER to open the System screen → Press ◀◀ or ▶▶ to open the Env screen)

2. Press ◁▷ to move the blinking cursor to [START Key Operation], and press ENTER to open the selection window.



Selectable items	Explanations
One Push	Start measuring with one press of the LOGGING START.
Two Pushes	Start measuring with two presses of the LOGGING START.
2s Push	Start measuring with pressing LOGGING START for two seconds.

3. Press △/▽ to select the receive condition, and press ENTER to set.

To cancel, press CANCEL.

NOTE When the LOGGING START activation condition is set to 2s Push, Waiting for 2s... is displayed when the LOGGING START is pressed. After holding the LOGGING START for two seconds, this message disappears and measurement begins.

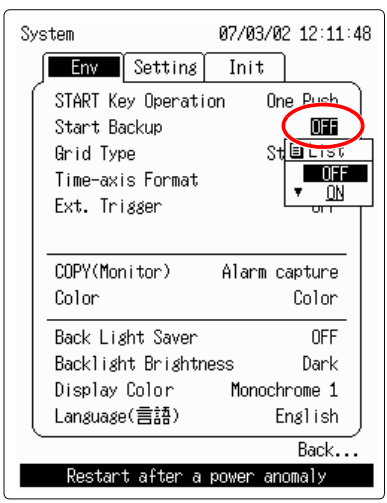
7.1.2 Start Backup After Power Loss

By setting Start backup to ON, if the instrument suddenly loses power, such as by power outage, during logging measurement, recording will restart when the power is turned on again. (The data before the power cut off will be lost.)
If Start backup is set to OFF, when the power is cut off the measurement will be canceled and the data recorded up until then will be saved in internal memory. The time of data backup is approximately 10 minutes.

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◇ to move to **[System]** → Press ENTER to open the System screen → Press ◁ or ▷ to open the Env screen)

2. Press ◇ to move the blinking cursor to [Start Backup], and press ENTER to open the selection window.



Selectable items	Explanations
OFF	If power is restored within 10 minutes of the power outage, the data will remain in the internal memory.
ON	When power is restored after a power failure, the instrument will restart and data will not remain in the internal memory (in the instance that the power failure occurred during measurement). If it did not occur during measurement, the effect will be the same as if the setting was OFF. In order to retain data, use auto save.

3. Press ◇/◇ to select ON or OFF, and press ENTER to set.

To cancel, press CANCEL.

NOTE Having the 9447 BATTERY PACK installed can help protect against power interruption. When the AC adapter and a battery pack are both installed, the AC adapter takes priority.

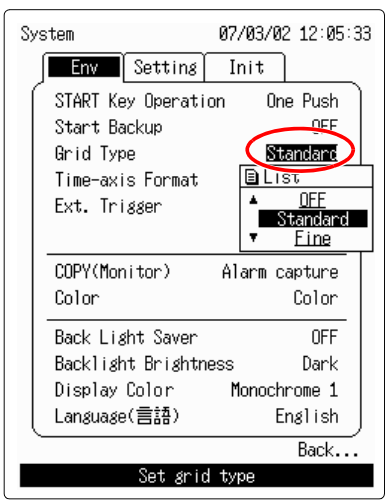
7.1.3 Grid Type

The grid on the display screen can be changed. The three options are: OFF, standard, and Fine.

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◁▷ to move to **[System]** → Press ENTER to open the System screen → Press ◁◁ or ▷▷ to open the Env screen)

2. Press ◁▷ to move the blinking cursor to [Grid Type], and press ENTER to open the selection window.



Selectable items
OFF, Standard, Fine

3. Press △/▽ to select the grid type, and press ENTER to set.

To cancel, press CANCEL.

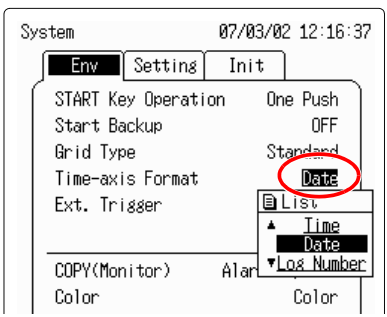
7.1.4 Time Format when Saving Text

Time, date or data number can be selected as the time format of the data when saving in text format.

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◇ to move to **[System]** → Press ENTER to open the System screen → Press ◁ or ▷ to open the Env screen)

2. Press ◇ to move the blinking cursor to [Time-axis Format], and press ENTER to open the selection window.



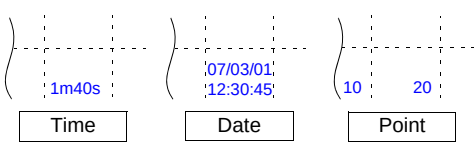
Selectable items	Explanations
Time	Time since the start of measurement (hours, minutes and seconds) is displayed.
Date	Date and time of data acquisition is displayed.
Point	Number of data acquisitions since the start of measurement is displayed.

3. Press △/▽ to select the time-axis format, and press ENTER to set.

To cancel, press CANCEL.

<Reference>

To change the time display on the logging screen during full screen display, for example, press GRAPH to change from time → date → data number. (However, if there is no waveform, nothing will be displayed.)



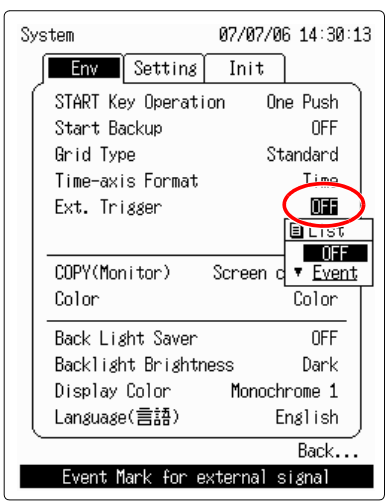
7.1.5 External Trigger Input (Event Marker)

This sets the action to take when the signal input to the external trigger terminal changes from the HIGH level (2.5-5.0 V) to the LOW level (0-1.0 V).
The external trigger terminal can be set as an external trigger input signal or as an event marking signal.
Refer to "4.6 Adding Event Marks to Waveforms" (⇒ p. 66) and "Appendix 2.1 EXT TRIG Terminal" (⇒ p. A2).

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◁▷ to move to **[System]** → Press ENTER to open the System screen → Press ◁ or ▷ to open the Env screen)

2. Press ◁▷ to move the blinking cursor to [Ext. Trigger], and press ENTER to open the selection window.



Selectable items	Explanations
OFF	External trigger input is not used.
Event	The external trigger terminal is used for event marking.

3. Press ◁/▷ to select the external trigger, and press ENTER to set.

To cancel, press CANCEL.

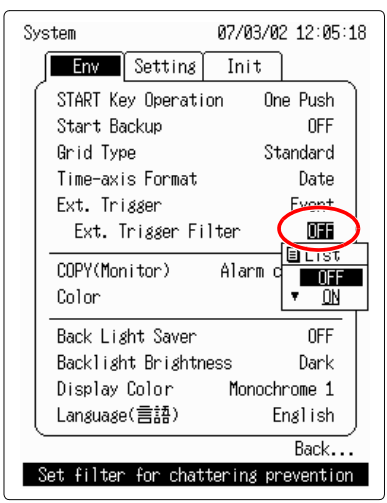
7.1.6 External Trigger Filter

When the external trigger input is set to "Event", an external trigger filter can be used to prevent chattering of the external trigger input. Refer to "Appendix 2 Trigger Terminals" (⇒ p. A2).

1. Open the System Env screen.

(Press SET UP to open the Set up screen → Press ◁△▽▷ to move to **[System]** → Press ENTER to open the System screen → Press ◀ or ▶ to open the Env screen)

2. Press ◁△▽▷ to move the blinking cursor to [Ext. Trigger Filter], and press ENTER to open the selection window.



3. Press △/▽ to select ON or OFF, and press ENTER to set.

To cancel, press CANCEL.

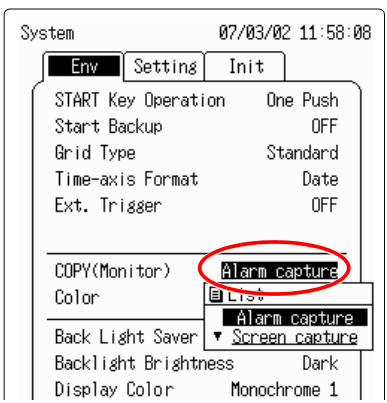
7.1.7 Copy Key Function (Monitor)

This function applies to the copy key being pressed on the monitor display. "Alarm capture" or "Screen capture" can be chosen. On all screens other than the monitor screen, pushing the COPY key will effect BMP save.

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◁▷ to move to **[System]** → Press ENTER to open the System screen → Press ◀◀ or ▶▶ to open the Env screen)

2. Press ◁▷ to move the blinking cursor to [COPY (Monitor)], and press ENTER to open the selection window.



Selectable items	Explanations
Alarm capture	Pressing COPY will take the value as the alarm reference value.
Screen capture	Pressing COPY causes the display screen to be saved to PC card.

3. Press △/▽ to select the copy key function, and press ENTER to set.

To cancel, press CANCEL.

NOTE
- For information on how to take the alarm reference value, refer to "4.5.3 Take the Alarm Reference Value (Monitor Screen)" (⇒ p. 65).
- For information on how to save BMP images, refer to "4.9 Saving the Display Screen to PC Card (Screen Capture)" (⇒ p. 70).

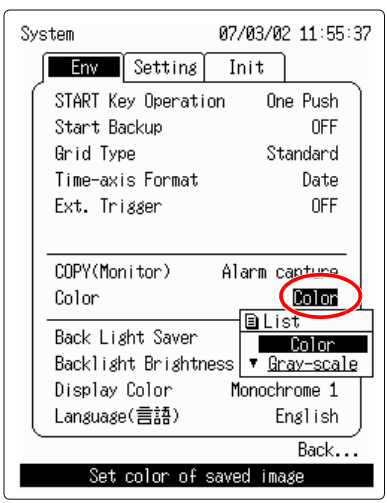
7.1.8 Save Color

When saving a BMP image using the COPY key, the display screen can be saved either in grayscale or in color.

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◁▷ to move to **[System]** → Press ENTER to open the System screen → Press ◀ or ▶ to open the Env screen)

2. Press ◁▷ to move the blinking cursor to [Color], and press ENTER to open the selection window.



Selectable items
Color, Gray-scale

3. Press △/▽ to select the save color, and press ENTER to set.

To cancel, press CANCEL.

7.1.9 Backlight Saver

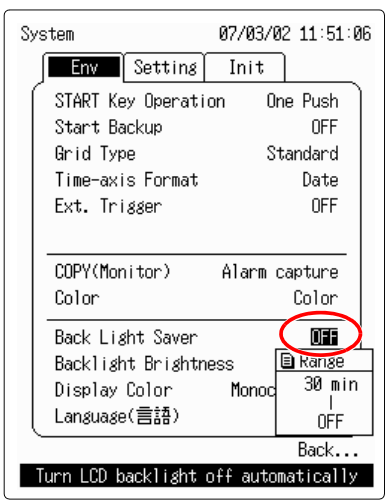
When the backlight saver is enabled, the display backlight turns off automatically when no key is pressed for a specific time. The backlight turns on again when any key is pressed. Allowing the backlight to turn off when not needed increases the life of the backlight and operating time per battery charge.

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◇ to move to **[System]** → Press ENTER to open the System screen → Press ◁ or ▷ to open the Env screen)

2. Press ◇ to move the blinking cursor to [Backlight Saver], and press ENTER to open the selection window.

You can set the time by minutes. The time after which the backlight turns off automatically (set to no more than five minutes when operating from the battery).



3. Press ◇/◇ to select OFF or select how much time it takes for the backlight saver to turn ON, and press ENTER to set.

To cancel, press CANCEL.

NOTE When the backlight saver activates during measurement, the green LED remains lit. When the backlight saver activates while making a setting, the LED blinks.

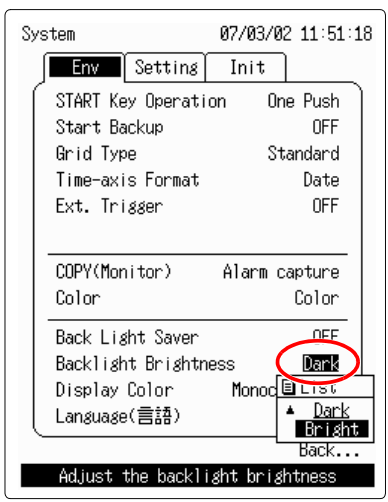
7.1.10 Backlight Brightness

The brightness of the backlight can be adjusted. Using the instrument with the backlight set to "Dark" lengthens the operation time with the battery pack.

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◇ to move to **[System]** → Press ENTER to open the System screen → Press ◁ or ▷ to open the Env screen)

2. Press ◇ to move the blinking cursor to [Backlight Brightness], and press ENTER to open the selection window.



Selectable items
Bright, Dark

3. Press ◇/◇ to select the backlight brightness, and press ENTER to set.

To cancel, press CANCEL.

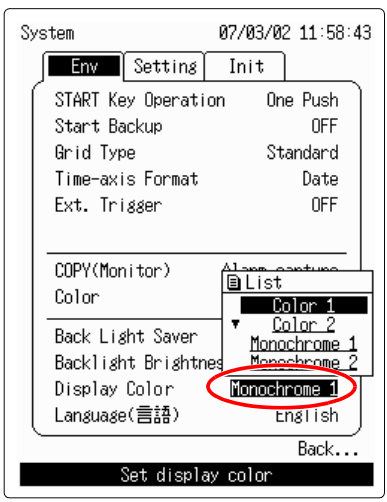
7.1.11 Screen Color Scheme

The color scheme of the display screen can be selected.

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◇ to move to **[System]** → Press ENTER to open the System screen → Press ◁ or ▷ to open the Env screen)

2. Press ◇ to move the blinking cursor to [Display Color], and press ENTER to open the selection window.



Selectable items	Explanations
Color 1	Color display with a blue background.
Color 2	Color display with a black background.
Monochrome 1	Black characters with a white background.
Monochrome 2	White characters with a black background.

3. Press ◇/◇ to select the screen color scheme, and press ENTER to set.

To cancel, press CANCEL.

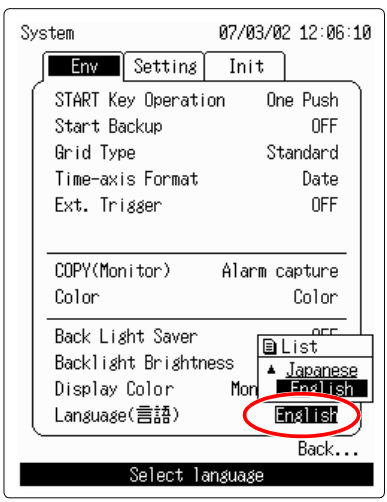
7.1.12 Display Language

The display language can be set to either English or Japanese.

1. Open the System Env screen.

(Press SETUP to open the Set up screen → Press ◁▷ to move to **[System]** → Press ENTER to open the System screen → Press ◀ or ▶ to open the Env screen)

2. Press ◁▷ to move the blinking cursor to [Language], and press ENTER to open the selection window.



Selectable items
Japanese, English

3. Press △/▽ to select the display language, and press ENTER to set.

To cancel, press CANCEL.

7.2 Setting Screen

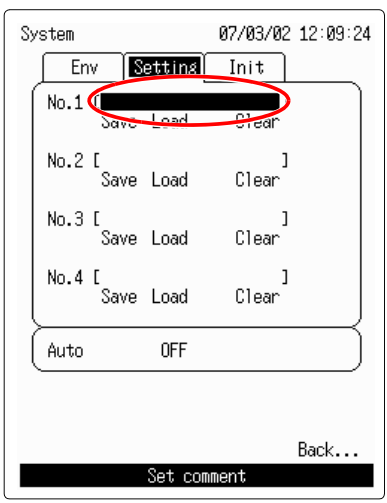
7.2.1 Saving Settings

All current settings can be saved to internal memory. Up to four setting conditions can be saved.

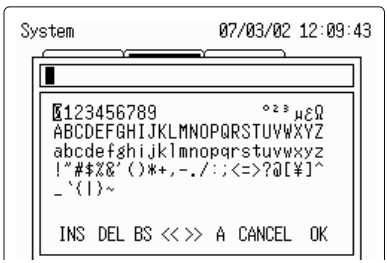
1. Open the System Setting screen.

(Press SETUP to open the Set up screen → Press ◇ to move to **[System]** → Press ENTER to open the System screen → Press ◁ or ▷ to open the Setting screen)

2. Press ◇ to move the blinking cursor to the position of the setting condition to be saved.



3. **Press ENTER to open the comment input window.**



4. **Press ◁△▽▷ to move the cursor to the character to be input, and press ENTER to select.**

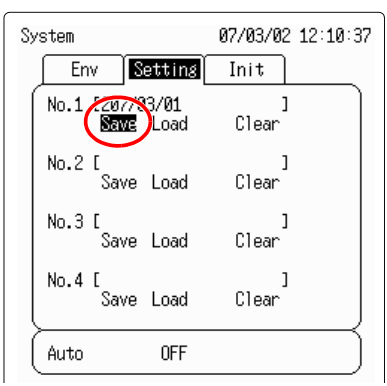
Refer to "5.1 Inputting Comments" (⇒ p. 72) for a detailed description of the input method.

5. **Once the comment is completely entered, use △/▽ to move the blinking cursor to [OK].**

6. **Press ENTER to confirm the comment.**

To cancel, press CANCEL.

7. **Press ◁△▽▷ to move the blinking cursor to [Save] , and press ENTER to save.**



8. **A confirmation window will be displayed, so press ENTER to confirm.**

To cancel, press CANCEL.

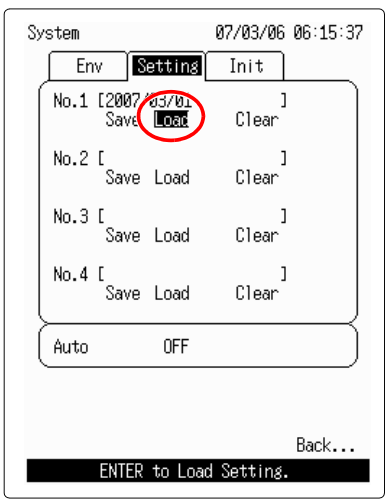
7.2.2 Loading Setting Conditions

Previously saved settings conditions can be loaded.

1. Open the system System Setting screen.

(Press SETUP to open the Set up screen → Press ◁▷ to move to **[System]** → Press ENTER to open the System screen → Press ◀◀ or ▶▶ to open the Setting screen)

2. Press ◁▷ to move the blinking cursor to [Load] for the setting condition number to be read, and press ENTER.



3. A confirmation window will be displayed, so press ENTER to confirm.

To cancel, press CANCEL.

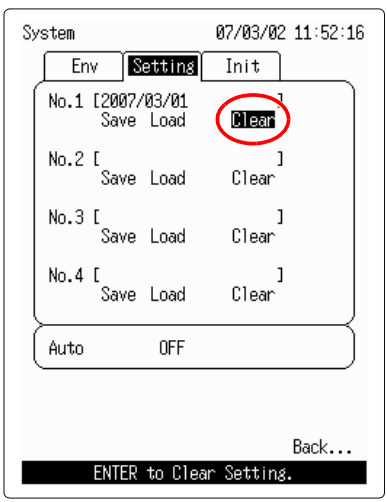
7.2.3 Deleting Setting Conditions

Saved setting conditions can be deleted.

1. Open the system System Setting screen.

(Press SETUP to open the Set up screen → Press ◁▷ to move to **[System]** → Press ENTER to open the System screen → Press ◀ or ▶ to open the Setting screen)

2. Press ◁▷ to move the blinking cursor to [Clear] for the setting condition number to be deleted, and press ENTER.



3. Press ◁▷ to move the blinking cursor to [Clear], and press ENTER.

4. A confirmation window will be displayed, so press LOGGING START to confirm.

To cancel, press CANCEL.

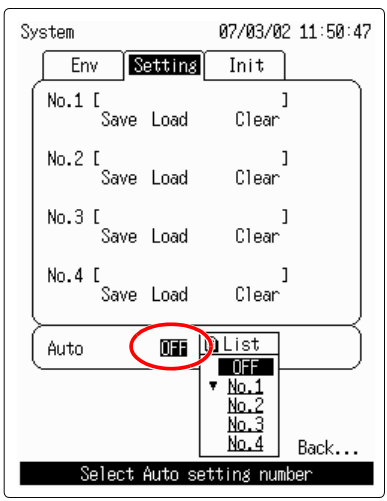
7.2.4 Automatically Loading

Turning power on automatically loads the specified (No.) setting conditions.

1. Open the system System Setting screen.

(Press SETUP to open the Set up screen → Press ↕ to move to **[System]** → Press ENTER to open the System screen → Press ◀ or ▶ to open the Setting screen)

2. Press ↕ to move the blinking cursor to [Auto], and press ENTER to open the selection window.



3. Use ↕ to select OFF or the number to be read, and press ENTER to set.

To cancel, press CANCEL.

NOTE
- Selecting a No. for which no settings have been saved is equivalent to setting this feature to OFF.
- The setting conditions can be saved to a PC Card.
  Refer to "Chapter 6 Saving and Reading Data" (⇒ p. 81).

7.2.5 Auto Setup

Settings can be loaded automatically when power is turned on by creating a file named STARTUP.HNS in the root directory on the PC card.

NOTE If Auto Setup and the Autosetting on this screen are enabled at the same time, Auto Setup has priority.

7.3 Init (Initialization) Screen

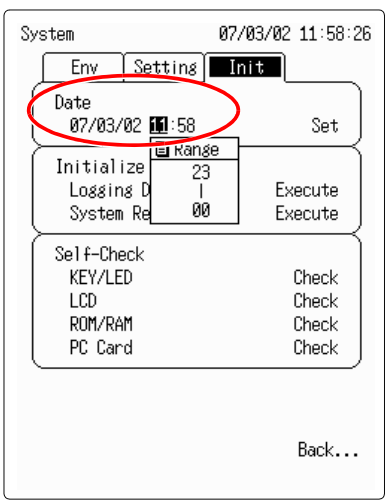
7.3.1 Setting the Clock

The date and time displayed at the upper right of the screen can be changed by taking the following steps. The 3145-20 NOISE HiLOGGER's clock is a 24-hour clock and auto-calendar which compensates for leap year.

1. Open the System Setting screen.

(Press SETUP to open the Set up screen → Press ◁▷ to move to **[System]** → Press ENTER to open the System screen → Press ◀◀ or ▶▶ to open the Init screen)

2. Press ◁▷ to move the blinking cursor to [Date], and press ENTER to open the selection window.



Items	Selectable ranges
Year	00 to 99
Month	01 to 12
Day	01 to 31
Hour	00 to 23
minute	00 to 59

3. Press △/▽ to select the numerical value, and ENTER to set.

To cancel, press CANCEL.

4. Press ▷ to move to [Set], and ENTER to set.

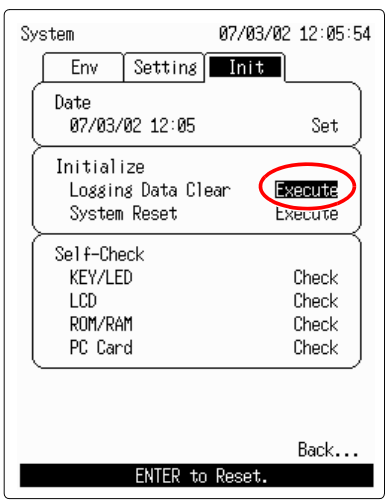
7.3.2 Erasing Logging Measurement Data

Erase the logging measurement data saved in the 3145-20's internal memory. The waveform displayed on the logging screen will be cleared.

1. Open the System Init screen.

(Press SETUP to open the Set up screen → Press ↕ to move to **[System]** → Press ENTER to open the System screen → Press ◀ or ▶ to open the Init screen)

2. Press ↕ to move the blinking cursor to [Logging Data Clear], and press ENTER.



3. A confirmation window will be displayed, so press ENTER to confirm.

To cancel, press CANCEL.

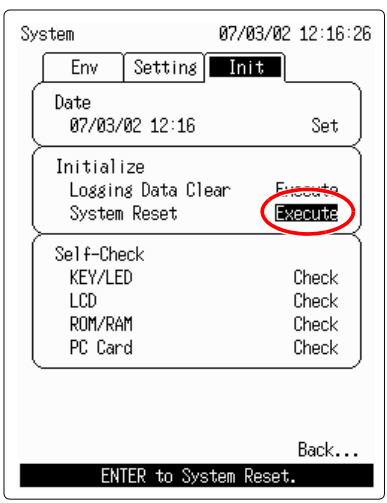
7.3.3 System Reset

Returns all settings other than communications-related settings (RS-232C, 10BASE-T LAN, PPP) to the initialized state.

1. Open the System Init screen.

(Press SETUP to open the Set up screen → Press ◇ to move to **[System]** → Press ENTER to open the System screen → Press ◀ or ▶ to open the Init screen)

2. Press ◇ to move the blinking cursor to [System Reset], and press ENTER.



3. A confirmation window will be displayed, so press ENTER to confirm.

To cancel, press CANCEL.

NOTE System reset can also be performed by turning on the power while pressing STOP.
To return all settings including communications-related settings to the initialized state, press LOGGING START and STOP simultaneously while turning on the power.

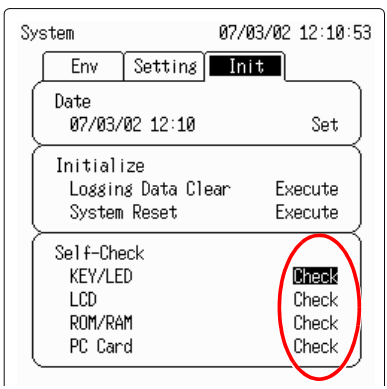
7.3.4 Self-check

If self-check is performed and the result is a "NG" message or any abnormality is found, then repair is necessary.

1. Open the System Init screen.

(Press SET UP to open the Set up screen → Press ◇ to move to **[System]** → Press ENTER to open the System screen → Press ◁ or ▷ to open the Init screen)

2. Press ◇ to move the blinking cursor to the item to be self-checked, and press ENTER.



Selt-Check	Explanations
KEY/LED Check	The Key check requires pressing each key. If a malfunction is found, press the LOGGING START and STOP keys simultaneously to abort checking. To check LED operation, confirm that the LED lights green when the LOGGING START is pressed.
LCD Check	The LCD check tests display of characters and solid patterns. Press any key to change screens.
ROM/RAM Check	The following items can be checked: ROM : OK/NG Storage RAM : OK/NG Backup RAM : OK/NG Work RAM : OK/NG Video RAM : OK/NG Address bus : OK/NG
	The PC Card check tests the following items, which are the same as the PC Card self check on the PC card screen. PC Card Type : ATA card RAM Size : Capacity of the installed card

Using the CD Chapter 8

8.1 CD Contents

A CD containing the following applications and instruction manuals is included with the 3145-20 NOISE HiLOGGER.

Contents	Explanations
"DATA VIEWER for 3145" Instruction Manual	Software and instruction manual for analyzing measurement data recorded by the 3145-20 with a personal computer.
"Communications" Instruction Manual	Explains the communication functions which can be used via the LAN and RS-232C interfaces.
"Communication Commands" Instruction Manual	Explains the commands for remote control of the instrument via the LAN and RS-232C interfaces.

The instruction manual is in PDF format. Use Adobe Reader to view it. The most recent version of Adobe Reader can be downloaded from the Adobe website. http://www.adobe.co.jp

Adobe and Reader are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States and/or other countries.

8.2 Installing the Software

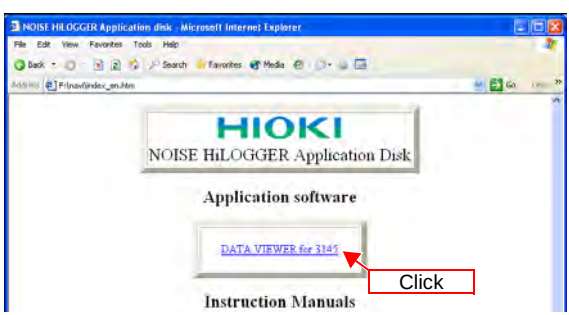
Complete the following steps to install "DATA VIEWER for 3145". An explanation for installing on a Windows XP system is given here. Depending on your OS, there may be a number of differences in the messages.

Operating environment

Compatible OS: Windows 2000, XP, VISTA, 7, 8 (64-bit support limited to Windows 7 or 8)
For system environment settings such as CPU, memory and display, use an environment which conforms to that recommended by your OS.
Required hard disk space: at least 10 MB
Printer : Use when utilizing the printing function.
Compact Flash reader:
Needed for a personal computer to read data saved to compact flash card by the 3145-20 main instrument. Measurement data can also be transferred to personal computer via LAN.

Important
If using any virus protection software, be sure to exit that software before beginning the installation. Correct installation may not be possible if virus software is running.

1. **Start up Windows.**
   Exit all running applications.
2. **Insert the included CD into the computer's CD-ROM drive, and [index.htm] will open automatically.**
3. **Click [English] as the display language.**
4. **Click [DATA VIEWER for 3145] to display the installer.**



5. **Install the software following the steps on screen.**

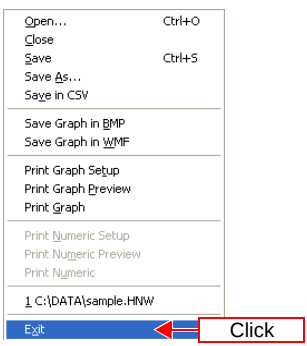
8.3 Running the Software

How to open

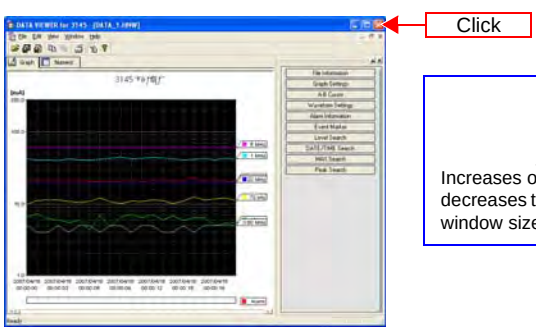
From the Windows Start Menu, click on **[All Programs] - [HIOKI] - [DATA VIEWER for 3145] - [DATA VIEWER for 3145]**.

How to exit

From the "DATA VIEWER for 3145" menu bar, click on **[File]-[Exit]**.



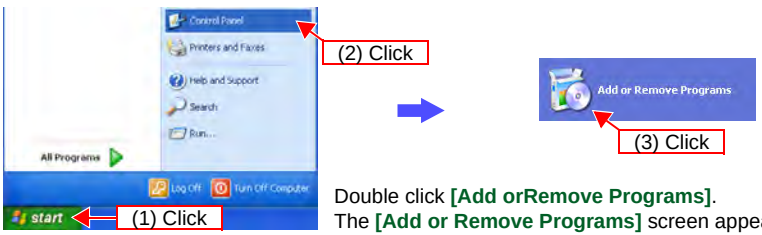
Alternatively, click on the **[x]** box in the upper right of the window.



8.4 Deleting the Application (Uninstall)

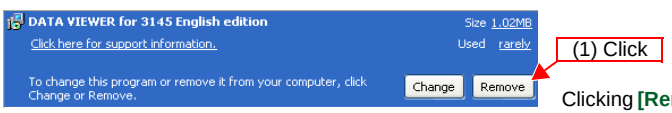
Complete the following steps to delete the software.

1. **From the Windows Start Menu, click on [Control Panel], then double-click on [Add/Remove Programs].**

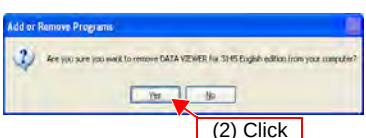


Double click **[Add orRemove Programs]**.
The **[Add or Remove Programs]** screen appears.

2. **From the list of currently installed programs, select [DATA VIEWER for 3145] and delete.**



Clicking **[Remove]** displays a confirmation screen.



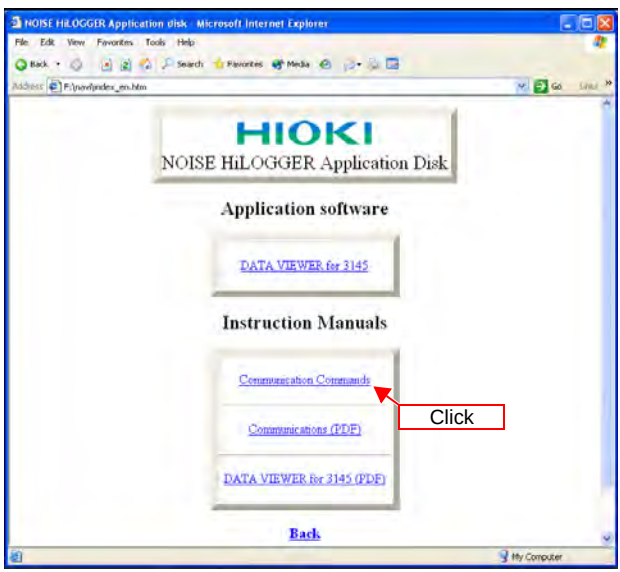
Uninstall begins.
The progress state will be displayed while uninstalling.

Uninstall is finished

Return to the **[Add/Remove Programs]** dialog.

8.5 Opening the Instruction Manual (PDF Format)

1. **Start up Windows.**
2. **Insert the included CD into the CD-ROM drive.**
3. **Click on the instruction manual to be opened.**



Specifications Chapter 9

9.1 General Specifications

General Specifications	
Internal memory capacity	32 MB
Clock	Auto calendar with automatic leap year, 24-hour clock Clock Accuracy : Power ON ± 0.2 s/ day, Power OFF ± 3 s/ day Time Axis Accuracy : During measurement ± 0.2 s/ day (at 23°C/73°F)
Backup battery and life	Time and Settings : Approx. 10 years (at 23°C/73°F) Measurement Data : After power off, Approx. 10 minutes
Battery charge possible temperature range	0 to 40°C (32 to 104°F)
Charging	The 9447 BATTERY PACK rapid charges with the 9418-15 AC ADAPTER. Rapid charging time: Approx. 2.5 hours (at 23°C/73°F) After rapid charging has been completed, carry out trickle charging (to prevent discharge of the battery).
Continuous operating time	Approx. 1 hour (at 23°C/73°F, bright backlight, when the battery has been rapid charged)
Fuse	250VF2.0A (located inside the main instrument; cannot be replaced by user)
Size	Approx. 203H × 170W × 52D mm (7.99”H × 6.69”W × 2.05”D)
Weight	Approx. 1.2 kg (42.3 oz.)

Display	
Type	5.7-inch STN Color LCD (320 x 240 dots)
Display characters	Japanese/English selectable
Dot pitch	0.36H × 0.36V mm
Backlight life	Approx. 25,000 hours (at 23°C/73°F)
Backlight	Manual or automatic off selectable

External Memory (PC Card)	
PC card slot	One 68-pin PC Card standard compliant slot (Type I and II cards supported)
Card type	Flash ATA Card (HIOKI's)
File system	MS-DOS
Memory contents	Settings, measurement data (binary or text), screen data (BMP) Partial measurement data can be selected between A-B cursors for saving.

Environmental and Safety Specifications		
Power supply	• Using the 9418-15 AC ADAPTER (driving at DC12 V ± 5%) AC adapter rated supply voltage: AC100 to 240 V (Voltage fluctuations of ± 10% from the rated supply voltage are taken into account.) AC adapter rated supply frequency: 50/60 Hz • Model 9447 BATTERY PACK (AC adapter takes priority) • Accuracy is not guaranteed when the indicator is on.	
Maximum rated power	30 VA (using the AC adapter and with the maximum load) 20 VA (using the battery and with the maximum load)	
Operating environment	Indoors, < 2000 m (6562 feet) ASL	
Operating temperature and humidity	Temperature Humidity	: 0 to 40°C (32 to 104°F) : 80%RH or less (non-condensating)
Storage temperature and humidity	Temperature Humidity	: -10 to 50°C (14 to 122°F) : 80%RH or less (non-condensating)
Operating temperature and humidity for guaranteed accuracy	Temperature Humidity	: 0 to 40°C (32 to 104°F) : 80%RH or less (non-condensating)
Period of guaranteed accuracy	For one year	
Guaranteed accuracy	For one year	
Effect of radiated radio-frequency electromagnetic field	At 3 V/m (Used with the 9754; Model 9754's cable, AC adapter, LAN cable, and RS-232C equipped with the included ferrite cores (2 turns)) 15 kHz, 70 kHz, 250 kHz, 1 MHz range 5 MHz, 20 MHz range 60 MHz range	: 10 mA_{P-P} : 20 mA_{P-P} : 60 mA_{P-P}

Environmental and Safety Specifications	
Effect of conducted radio-frequency electromagnetic field	At 3 V/m (Used with the 9754; Model 9754's cable, AC adapter, LAN cable, and RS-232C equipped with the included ferrite cores (2 turns)) 15 kHz, 70 kHz, 250 kHz range : 2 mA_{P-P} 1 MHz range : 15 mA_{P-P} 5 MHz, 20 MHz, 60 MHz range : 20 mA_{P-P}
Applying standards	Safety EN61010 EMC EN61326 EN61000-3-2 EN61000-3-3

Accessories and Options	
Accessories	Model 9418-15 AC ADAPTER Carrying case Strap Ferrite cores × 3 CD ("DATA VIEWER for 3145" Software and Instruction manual, "Communications" Instruction manual, Communication commands Instruction manual) Instruction manual, Measurement guide
Options	Model 9754 CLAMP ON NOISE SENSOR Model 9447 BATTERY PACK (7.2 V, 2400 mAh) Model 9418-15 AC ADAPTER Model 9643 CHARGE STAND (For the 9447 BATTERY PACK) Model 9612 RS-232C CABLE (9-pin mini DIN to 9-pin Dsub, cross cable, for PC) Model 9721 RS-232C CABLE (9-pin mini DIN to 9-pin Dsub, straight cable, for modem) Model 9726 PC CARD 128M Model 9727 PC CARD 256M Model 9728 PC CARD 512M Model 9729 PC CARD 1G Model 9642 LAN CABLE

9.2 Input Area Specifications

Input terminal	BNC terminal
Maximum input voltage (between terminals)	5 V peak
Maximum rated voltage to earth	5 V anticipated transient overvoltage 330 V
Frequency band	5 kHz to 100 MHz (-3 dB bandwidth)

Measurement range, Measurable noise range

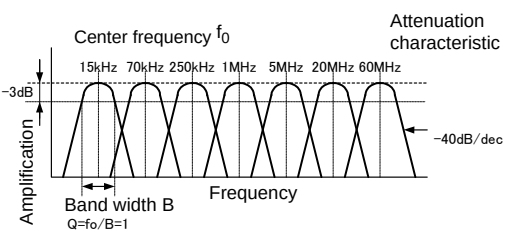
Measurement object	Measurement range	Measurable noise range
Current (When using the 9754)	20 A	28.00 A_{P-P} to 0.20 A_{P-P}
	2 A	2.800 A_{P-P} to 0.020 A_{P-P}
	200 mA	280.0 mA_{P-P} to 2.0 mA_{P-P}
Voltage	1 V	1.400 V_{P-P} to 0.020 mV_{P-P}
	100 mV	140.0 mV_{P-P} to 2.0 mV_{P-P}
	10 mV	14.00 mV_{P-P} to 0.20 mV_{P-P}

* The Current range is the range for use with the 9754 CLAMP ON NOISE SENSOR

Voltage range input resistance	50 Ω ± 5% (1 MHz)
Measurement method	A 7-band frequency range is created by band-pass filter (BPF). Measures the peak value of each frequency range.

BPF structure (BPF characteristics: Q=1, attenuation characteristic: -40 dB/dec)

Center frequency
f_0 = 15 kHz
f_0 = 70 kHz
f_0 = 250 kHz
f_0 = 1 MHz
f_0 = 5 MHz
f_0 = 20 MHz
f_0 = 60 MHz



BPF Characteristics Chart

Peak value detection method	Peak detection (frequency range: f_0=15 kHz, 70 kHz, 250 kHz, 1 MHz) Detection with Level Comparator (frequency range: f_0=5 MHz, 20 MHz, 60 MHz)

Comparator threshold

Measurement object	Range	Threshold (frequency range: f_0=5 MHz, 20 MHz, 60 MHz)
Current*	20 A	± (200 mA/300 mA/500 mA/700 mA/1 A/2 A/3 A/5 A/7 A/10 A/O.F.)
	2 A	± (20 mA/30 mA/50 mA/70 mA/100 mA/200 mA/300 mA/500 mA/700 mA/1 A/O.F.)
	200 mA	± (2 mA/3 mA/5 mA/7 mA/10 mA/20 mA/30 mA/50 mA/70 mA/100 mA/O.F.)
Voltage	1 V	± (10 mV/15 mV/25 mV/35 mV/50 mV/100 mV/150 mV/250 mV/350 mV/500 mV/O.F.
	100 mV	± (1.0 mV/1.5 mV/2.5 m/3.5 mV/5.0 mV/10 mV/15 mV/25 mV/35 mV/50 mV/O.F.
	10 mV	± (0.10 mV/0.15 mV/0.25 mV/0.35 mV/0.5 mV/1 mV/1.5 mV/2.5 mV/3.5 mV/5 mV/O.F.)

* When using the 9754 CLAMP ON NOISE SENSOR.

9.3 Accuracy

Operating temperature and humidity for guaranteed accuracy: temperature 0 to 40°C (32 to 104°F), humidity 80%RH or less
Period of guaranteed accuracy: for one year
(For the center frequency f_0 of each frequency range)

Frequency Ranges (15 kHz, 70 kHz, 250 kHz, 1 MHz)

Range	Signal Level	Center frequency f_0 of range			
		15 kHz	70 kHz	250 kHz	1 MHz
20 A	20 A_{P-P} to 2 A_{P-P}	± 15%rdg.	± 15%rdg.	± 15%rdg.	± 20%rdg.
2 A	2 A_{P-P} to 200 mA_{P-P}	± 15%rdg.	± 15%rdg.	± 15%rdg.	± 20%rdg.
200 mA	200 mA_{P-P} to 20 mA_{P-P}	± 20%rdg.	± 20%rdg.	± 20%rdg.	± 25%rdg.
1 V	1.0 V_{P-P} to 100 mV_{P-P}	± 15%rdg.	± 15%rdg.	± 15%rdg.	± 20%rdg.
100 mV	100 mV_{P-P} to 10 mV_{P-P}	± 15%rdg.	± 15%rdg.	± 15%rdg.	± 20%rdg.
10 mV	10 mV_{P-P} to 1.0 mV_{P-P}	± 20%rdg.	± 20%rdg.	± 20%rdg.	± 25%rdg.

Frequency Ranges (5 MHz, 20 MHz, 60 MHz)

Range	Signal Level	Center frequency f_0 of range		
		5 MHz	20 MHz	60 MHz
20 A	20 A_{P-P}	± 20%rdg.	± 20%rdg.	± 25%rdg.
2 A	2 A_{P-P}	± 20%rdg.	± 20%rdg.	± 25%rdg.
200 mA	200 mA_{P-P}	± 25%rdg.	± 25%rdg.	± 30%rdg.
1 V	1.0 V_{P-P}	± 20%rdg.	± 20%rdg.	± 25%rdg.
100 mV	100 mV_{P-P}	± 20%rdg.	± 20%rdg.	± 25%rdg.
10 mV	10 mV_{P-P}	± 25%rdg.	± 25%rdg.	± 30%rdg.

Accuracy used with the 9754 CLAMP ON NOISE SENSOR
(Frequency 15 kHz, in the center of the clamp opening, Temperature: 23 ± 5°C (73 ± 9°F), Humidity: 80%RH or less)

Range	Signal Level	Accuracy
20 A	20 A_{P-P}	± 18%rdg. ± 3 mA_{P-P}
2 A	2 A_{P-P}	± 18%rdg. ± 3 mA_{P-P}
200 mA	200 mA_{P-P}	± 23%rdg. ± 3 mA_{P-P}

9.4 Function Specifications

Monitor measurement

Function description	Displays Peak to Peak values for each frequency range with a real-time level meter.
Measurement value	Peak to Peak value
Display method	Select either [Level meter + instantaneous value] or [Level meter + peak value]
Sampling time	100 ms
Data renewal interval	100 ms
Maximum value retention function	Retains and displays the maximum measurement value of each frequency range. Retains the maximum value from the instant the monitor screen is displayed.

Logging measurement

Function description	Stores to the main instrument's internal memory and displays as a waveform the maximum Peak to Peak value for each frequency range at the set recording interval.
Recording interval	1 sec / 2 sec / 5 sec / 10 sec / 20 sec / 30 sec / 60 sec
Sampling time	100 ms
Recording time	Recording time to main instrument's internal memory:

Recording interval	1 sec	2 sec	5 sec	10 sec	20 sec	30 sec	60 sec
Recording time	16 days	1 month	2.5 months	5 months	10 months	15 months	2.5 years

Display method	Select one from the following • Full screen display (full waveform) • Latest value (latest value and waveform) • Peak value (peak value and waveform)
Zooming in and out on the waveform	Zooming in and out are possible along the time axis. 1/2/5/10/20/30 seconds, 1/2/5/10/20/30 minutes, 1/2/5/10/12 hours, 1 day
Waveform scroll	Scrolling is possible in the time axis direction. Past data can be viewed during or after measurement.
Cursor function	Display of measurement data at the cursor position. Specify data to be saved with the cursors.

Alarm function

Function description	During logging measurement or monitor display, performs a specified action when a particular condition is met.
Condition	Level setting possible at each band (OR condition)
Action	Beep sound output: Outputs until key is pressed. Display screen: Blinking screen; Alarm position always displayed in the bottom area of the display screen (only enabled during logging measurement). Trigger output: Outputs signal at alarm time. Email notification: Notification of the alarm level, band and time (only enabled during logging measurement.)

Event mark function

Function description	During logging measurement, up to 99 event marks can be input.
Input via keys	Manual event marking with the logging LOGGING START key
External trigger input	Event marking via signal input from the EXT TRIG terminal

External input and output terminals

External trigger input	Event marking during logging measurement is possible. Voltage use range: HIGH level 2.5 to 5.0 V, LOW level 0 to 1.0 V Response pulse width: When the external trigger filter is OFF, HIGH period: 1 ms or more, LOW period: 2μs or more when the external trigger filter is ON. HIGH period: 2.5 ms or more, LOW period: 2.5 ms or more Maximum input voltage: -5 to 10 V DC
Trigger output	Signal output during alarm; Open collector output (additional 5 V output, active: Low), 100 ms or higher pulse width

File function

Media	PC card
Saving formats	• Binary (exclusive format for reading into the 3145-20's internal memory) • Text (CSV format, cannot be read into the main instrument's internal memory) • Settings file • Screen data BMP save (display screen 256 color BMP save)

Communication functions

LAN interface	Compatible with IEEE802.3 Ethernet 10BASE-T DHCP, DNS • Screen display, remote control via HTTP server • Acquiring data from internal memory or PC card via FTP server • Email notification delivered at time of alarm
RS-232C interface	Conforms with ETA RS-232C, mini DIN round 9-pin connector Communication function via PPP connection (functions similarly to LAN connection)

9.5 Application Software Specifications

Compatible operating systems	Windows 2000, XP, Vista, 7, 8 (Japanese or English; 64-bit support limited to Windows 7 or 8)
Computer	PC-AT compatible machines
Hard disk	10MB or more (space for installation)
Disk location	CD-ROM drive (use at time of installation)
Data reading	Reads 3145 format data (.HNW file extension; cannot read text).
Measurement data display	Displays the read 3145 measurement data (as waveform, numerical values).
Cursor function	Displays the measurement value at the cursor location.
Search function	Multiple-type search function (level, date and time, maximum value, peak value, event, alarm)
Time axis zooming and scaling	Day, week or month display
Text conversion	Converts read 3145 format files into CSV files.
Printing function	Prints waveform or numerical value data.
Screen hard copy	Copies the waveform to the clipboard (in BMP or Enhanced Meta File format)

Maintenance and Service Chapter 10

⚠CAUTION

- Calibration and repair of this instrument should be performed only under the supervision of qualified technicians knowledgeable about the dangers involved.
- Never modify the instrument. Only Hioki service engineers should disassemble or repair the instrument. Failure to observe these precautions may result in fire, electric shock, or injury.

Shipping Precautions

- Use the original packing materials when transporting the instrument, if possible.
- Pack the instrument so that it will not sustain damage during shipping, and include a description of existing damage. We cannot accept responsibility for damage incurred during shipping.
- To avoid damage to the instrument, be sure to remove the cables and PC card before shipping.

List of replacement parts

Part	Life
Fan motor	Approximately 10,000 hours
Backlight	Approximately 25,000 hours (at half brightness)
Battery pack	Approximately 1 year
Electrolytic capacitor	Approximately 3 years
Lithium battery	Approximately 10 years

- The life of the electrolytic capacitor varies greatly depending on the usage environment. If used in a severe environment (where the surrounding temperature is 40°C), it will degrade in approximately 3 years and will need to be changed regularly.
- The fuse is housed in the power unit of the instrument. If the power does not turn on, the fuse may be blown. If this occurs, a replacement or repair cannot be performed by customers. Please contact your dealer or Hioki representative.
- The instrument contains a built-in backup lithium battery. If the date and time deviate substantially when the instrument is switched on, it is the time to replace that battery. Contact your dealer or Hioki representative.

10.1 Troubleshooting

If damage is suspected, check the "Troubleshooting" section before contacting your dealer or Hioki representative.
If none of the above conditions apply, and the cause of the problem is not evident, try performing a system reset. All settings will revert to the factory defaults.
Also refer to the "10.2 Warning Messages" (⇒ p. 150) in the Appendix and Index for more information.

10.1.1 Before Returning for Repair

Symptom	Check Items
The screen and indicators do not light when powered on.	• Is the AC adapter correctly connected and the battery pack correctly installed? Correctly connect the AC adapter. (⇒ p. 28) Correctly install the battery pack. (⇒ p. 29) • Has the battery pack's charge expired? If the battery usage time is considerably short even with correct charging, replace the battery pack with a new one. (⇒ p. 153) • Is the contrast adjustment set to dark? Turn the contrast knob on the bottom side of the main instrument to brighten. • Is the power supply fuse burned out? The instrument contains an electric fuse in its power supply region. If the power will not turn on, the fuse may be burned out. Since replacement or repair cannot be performed by the customer, contact your dealer or Hioki representative.
The normal screen does not appear when power is turned on.	• Has the battery pack's charge expired? If the battery usage time is considerably short even with correct charging, replace the battery pack with a new one. (⇒ p. 153)
When the power switch is turned on, the date and time are completely inaccurate.	• The instrument contains a built-in backup lithium battery. If the date and time deviate substantially when the instrument is switched on, it is the time to replace that battery. Contact your dealer or Hioki representative.
There is absolutely no variation in the recorded waveform.	• Is the range appropriate? If the measurement value is less than the lower limit of the selected range, it will cause "U.F.". Switch the range and double-check. (⇒ p. 44) • Is the Clamp on Noise Sensor correctly connected? Correctly connect the Clamp on Noise Sensor. (⇒ p. 33)
The LED lights but the screen does not appear.	• The backlight has been switched off by the backlight saver function. Press any key to switch on the backlight. To cancel the backlight saver, make the setting in the System Env screen. (⇒ p. 118)

10.1.2 System Reset

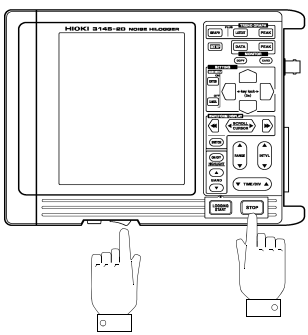
When system reset is performed, the 3145-20 returns to its initialized state.

Initialize all settings (All reset)

1. Turn on the power while simultaneously pressing STOP and LOGGING START.

Release the keys once "All reset" appears on the screen.

2. All instrument settings will return to the initialized state.



Initialize all settings not related to communications

1. Turn the power on while pressing STOP.

Release the key once "System reset" appears on the screen.

2. All settings other than communications-related settings (RS-232C, 10BASE-T LAN, PPP) are returned to their initialized states.

10.2 Warning Messages

Warning messages can be cleared by pressing any key.

Warning No. and messages		Check Items
51	System files are damaged.	The power fault protection system files are damage. Perform a complete format. (⇒ p. 149)
52	File cannot be repaired.	The power fault protection system files are damage. Perform a complete format. (⇒ p. 149)
53	Cannot change to initial directory.	The directory stored when power was turned off could not be found.
54	Card is not logger formatted.	Format the PC card using this instrument. (⇒ p. 38)
55	File is locked.	Protected files or directories cannot be manipulated on this instrument.
71	Cannot load.	Data cannot be loaded, either because it is text data, or was not created by the instrument.
72	Illegal format.	The media does not have the correct MS-DOS format.
73	Write Protected.	The media is write-protected. Release the write protection.
75	File is read only.	File cannot be written or deleted because it is read-only.
76	General failure.	The media is not accessible due to an error such as a bad format or corrupt file.
80	Insert PC card.	No card is present in the PC Card slot.
90	File already exists.	Rename the file.
91	Directory full.	Only a limited number of files (including directories) can be created in the root directory.
93	Disk full.	There is no more disk space available. Delete files or replace the media.
94	Path name error.	Path names are limited to 127 characters.
95	Empty directory name.	Name the directory.
96	Directory already exists.	Another directory exists with the same name. Saving cannot be performed with this directory name.
205	Invalid. (START)	The key pressed is not valid during measurement operation.
210	Cannot Save (File Lock)	Do not write, edit, or delete a file in the PC card using the FTP during automatic text save or at the start of the real-time save operation.

Warning No. and messages		Check Items
300	Cannot START.	Measurement cannot be started from a screen displayed by pressing the CARD.
364	Saving was interrupted.	Operation was forcibly interrupted while saving text.
370	Cannot change while measuring.	Press the STOP twice to stop measurement, then change the setting.
375	Invalid event marker.	You have attempted to go to an event marker that is no longer in memory.
382	No waveform data.	There is no waveform data to display on the Waveform Screen. Data must be acquired before processing can start.
398	A-B cursor positions invalid.	Move the cursors to valid positions.
520	Bad MAC address.	The MAC address is illegally rewritten. Contact us.
521	Bad IP address.	Check the IP address.
522	Bad server IP address.	Check the server's IP settings.
523	Can not connect to server.	Check the settings and connection.
525	Connection timed out.	Check the connected instrument.
526	Transfer was aborted.	Check the connected instrument.
527	Network error.	Check the instrument and connected instrument.
528	Server not found or DNS failed.	Check the DNS IP address or the line connection.
529	DHCP failed.	Check the connected instrument.
530	Password error.	Check the password. Password recognition is case-sensitive.
531	Can not change while server is working.	Stop the monitor server and edit the setting.
532	Bad FTP server IP address.	Check IP settings for automatic transfer of FTP data.
533	Can not connect to FTP server.	Check settings and connections for automatic transfer of FTP data.
534	Can not find FTP server / DNS failed.	Check settings, DNS IP address, and connections for automatic transfer of FTP data.
535	Bad Mail server IP address.	Check IP settings of the mail server.
536	Can not connect to Mail server.	Check mail server settings and connections.
537	Can not find Mail server / DNS failed.	Check settings, DNS IP address, and connections for the mail server.

Warning No. and messages		Check Items
538	PPP: Connection failed.	Check the telephone number, AT command, etc.
539	PPP: Bad Telephone number.	Set the correct telephone number.
540	PPP: Connection was aborted.	PPP settings were modified or the STOP was pressed.
541	PPP: MODEM error.	Check the power supply for the modem, AT command, etc.
542	PPP: Login failed.	Check the calling user name, password, and PC settings.
560	Can not change while communication.	This item cannot be modified in remote operation.
561	FTP Auto Transfer has been changed.	Because auto save was modified, settings for automatic transfer of FTP data were also modified.
562	Please set Auto Save to Binary.	Unless auto save is binary, FTP data cannot be automatically transferred.
620	Battery low.	Recharge or replace the batteries.

10.3 Cleaning

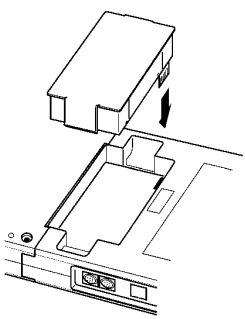
- To clean the instrument, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.
- Wipe the LCD gently with a soft, dry cloth.

10.4 Replacing the Backup Battery

The battery pack is a replaceable part. If the battery usage time is considerably short even with correct charging, replace the battery pack with a new one. The 9447 BATTERY PACK provides approximately 1 hour of continuous use (backlight: bright; after approximately 2.5 hours charging the battery). The life of the battery pack is approximately 500 charges or 1 year.

⚠WARNING

- **For battery operation, use only the HIOKI Model 9447 BATTERY PACK. We cannot accept responsibility for accidents or damage related to the use of any other batteries.**
- **To avoid electric shock, turn off the power switch and disconnect the cables before replacing the batteries.**
- **To avoid the possibility of explosion, do not short circuit, disassemble or incinerate battery pack. Handle and dispose of batteries in accordance with local regulations.**



1. **Turn off the power switch.**

2. **Turn off the power switch.**

3. **Install a new battery pack.**

10.5 Removing the Battery Before Discarding the Instrument

The 3145-20 uses a lithium battery for internal memory backup.
When disposing of this instrument, remove the lithium battery and dispose of battery and instrument in accordance with local regulations.

⚠WARNING

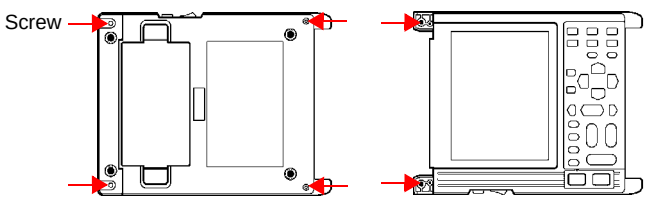
- **To avoid electric shock, turn off the power switch and disconnect the cables before removing the lithium battery.**
- **Keep batteries away from children to prevent accidental swallowing.**

1. **Prepare two Phillips head screwdrivers (sizes M3 and M2.6) and one pair of wire clippers.**

2. **Turn off the power switch.**

3. **Remove the four screws on the rear, and remove the cover.**

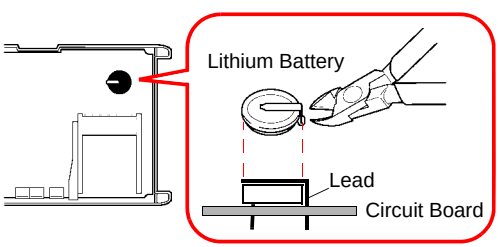
4. **Remove the printer attachment compartment cover.**
Remove the two hidden screws in the cover using a Phillips screwdriver.



5. **Remove the upper case (front).**

6. **Pry the battery upwards, and cut the positive (+) connection with wire cutters.**

7. **Pry the battery up further. Cut the negative (-) connection underneath the battery.**



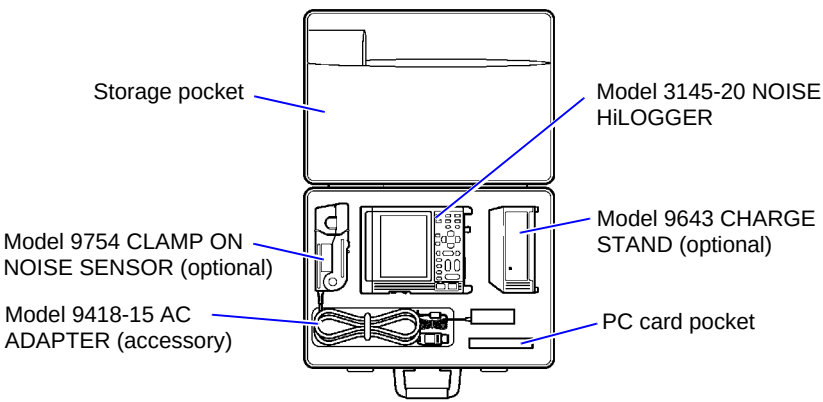
CALIFORNIA, USA ONLY
This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply. See www.dtsc.ca.gov/hazardouswaste/perchlorate

Appendix

Appendix 1 The Carrying Case

⚠CAUTION To avoid damage to the instrument, when storing the Noise HiLOGGER in its carrying case be sure to remove the battery pack and PC card, and disconnect all cables from the Noise HiLOGGER's body.

The carrying case is included with the main instrument. Use it for storing accessories and optional equipment as well. Consult the diagram below regarding positioning of the items.



Appendix 2 Trigger Terminals

Appendix 2.1 EXT TRIG Terminal

⚠WARNING **To avoid electric shock or damage to the equipment, always observe the following precautions when connecting to EXT TRIG-terminal.**

- **Always turn off the power to the instrument and to any instruments to be connected before making connections.**
- **Additionally, do not input voltage less than -5 V or greater than +10 V.**

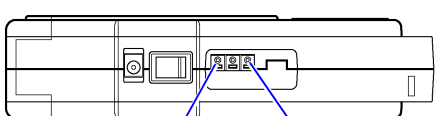
⚠CAUTION

- The trigger terminal is not insulated from the main instrument. Do not input voltage which differs from the instrument's GND potential into the GND terminal. This may cause damage to the 3145-20 and connected equipment.
- When using the AC adapter, the instrument's GND potential is a direct path to ground potential. Connect the GND terminal of the trigger terminal to a ground potential.
- To avoid electric shock, use the recommended wire type to connect to the current input terminals, or otherwise ensure that the wire used has sufficient current handling capacity and insulation.

  Recommended wire
  Single strand : 1.0 mm dia. (AWG #18)
  Multi-strand : 0.75 mm^2
  Acceptable limits
  Single strand : 0.4 to 1.0 mm dia. (AWG #26 to #18)
  Multi-strand : 0.3 to 0.75 mm^2 (AWG #22 to #20)
  Strand diameter : minimum 0.18 mm
  Standard insulation stripping length: 10 mm
  Button pressing tool : Blade screwdriver (tip width 2.6 mm)

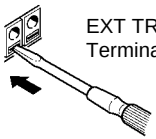
Using the trigger terminal, event marks can be added to the waveform during logging measurement. There are two methods for adding event marks.

- Shorting the connection between the EXT TRIG terminal and the GND terminal.
- Inputting a HIGH level (2.5 to 5 V) to LOW level start signal into the EXT TRIG terminal. (In this case, set "External trigger input" on the System Env screen to "Event". Refer to "7.1.5 External Trigger Input (Event Marker)" (⇒ p. 114).

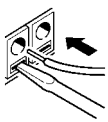


Trigger signal inputs

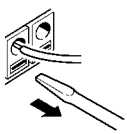
1. **Push the tab with a flat-blade screwdriver or similar implement.**



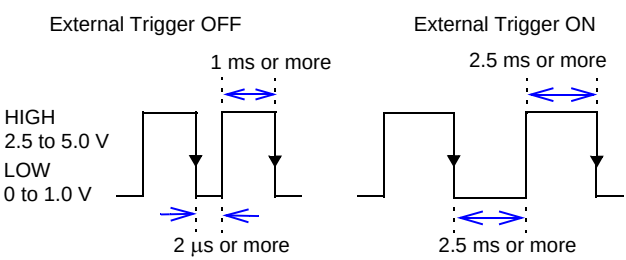
2. **While keeping the tab depressed, insert a stripped wire into the connector opening.**



3. **Release the tab to lock the wire.**



Voltage Range	HIGH level : 2.5 to 5.0 V LOW level : 0 to 1.0 V
Pulse Width	External Trigger Filter OFF HIGH : 1 ms or more LOW : 2 µs or more External Trigger Filter ON HIGH : 2.5 ms or more LOW : 2.5 ms or more
Maximum Input Voltage	DC -5 to +10 V
Recommended Wire	Single-strand : ϕ 1.0 mm (AWG18) Multi-strand : 0.75 mm^2
Usable Limits	Single-strand : ϕ 0.3 to 1.0 mm (AWG26 to 18) Multi-strand : 0.3 to 0.75 mm^2 (AWG22 to 20) Strand diameter: ϕ 0.18 mm or more
Standard Insulation Stripping Length	10 mm

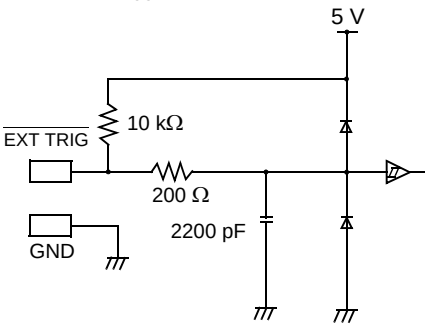


External trigger filter is available for chattering prevention.
Refer to "7.1.6 External Trigger Filter" (⇒ p. 115).

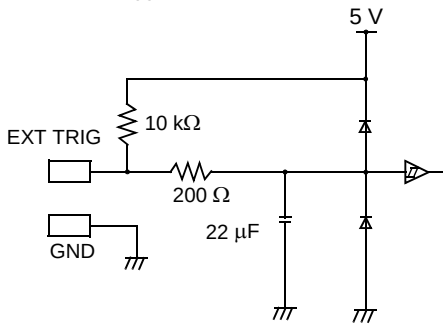
App

External trigger input circuit diagram

External Trigger OFF



External Trigger ON



NOTE

- When using the external trigger, please set external trigger input to ON in the System Env screen.
- External trigger filter is available for chattering prevention. Refer to "7.1.6 External Trigger Filter" (⇒ p. 115).

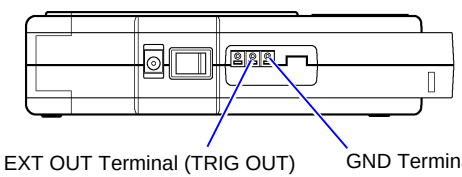
Voltage Range	HIGH level : 2.5 to 5.0 V LOW level : 0 to 1.0 V
Pulse Width	External Trigger Filter OFF HIGH : 1 ms or more LOW : 2 µs or more External Trigger Filter ON HIGH : 2.5 ms or more LOW : 2.5 ms or more
Maximum Input Voltage	DC -5 to +10 V
Maximum Input Voltage	Single-strand : ϕ 1.0 mm (AWG18) Multi-strand : 0.75 mm^2
Usable Limits	Single-strand : ϕ 0.3 to 1.0mm (AWG26 to 18) Multi-strand : 0.3 to 0.75 mm^2 (AWG22 to 20) Strand diameter : ϕ 0.18 mm or more
Standard insulation stripping length	10 mm

Appendix 2.2 TRIG OUT Terminal

A signal is output when the alarm state occurred.

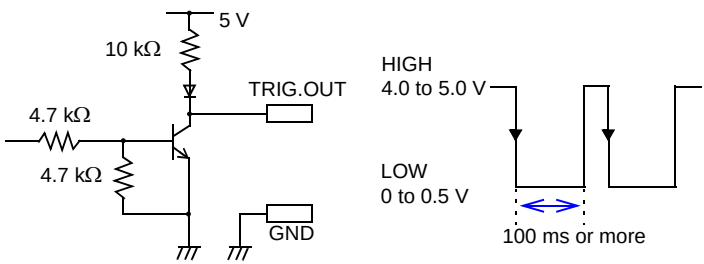
⚠CAUTION

- The trigger terminal is not insulated from the main instrument. Do not input voltage which differs from the instrument's GND potential into the GND terminal. This may cause damage to the 3145-20 and connected equipment.
- When using the AC adapter, the instrument's GND potential is a direct path to ground potential. Connect the GND terminal of the trigger terminal to a ground potential.
- To avoid electric shock, use the recommended wire type to connect to the current input terminals, or otherwise ensure that the wire used has sufficient current handling capacity and insulation.
  Recommended wire
  Single strand : 1.0 mm dia. (AWG #18)
  Multi-strand : 0.75 mm^2
  Acceptable limits
  Single strand : 0.4 to 1.0 mm dia. (AWG #26 to #18)
  Multi-strand : 0.3 to 0.75 mm^2 (AWG #22 to #20)
  Strand diameter : minimum 0.18 mm
  Standard insulation stripping length: 10 mm
  Button pressing tool : Blade screwdriver (tip width 2.6 mm)



App

Output Signal	Open-collector signal (with voltage output), active Low
Output Voltage Range	HIGH level: 4.0 to 5.0 V LOW level: 0 to 0.5 V
Pulse Width	LOW level: 100 ms or more
Maximum Input Voltage	-20 V to +30 V, 500 mA max., 200 mW max.
Recommended Wire	Single-strand : ϕ 1.0 mm (AWG18) Multi-strand : 0.75 mm^2
Usable Limits	Single-strand : ϕ 0.3 to 1.0mm (AWG26 to 18) Multi-strand : 0.3 to 0.75 mm^2 (AWG22 to 20) Strand diameter : ϕ 0.18 mm or more
External Trigger Filter OFF	10 mm



Appendix 3 Glossary of Terms

Noise

Electrical disturbance in electrical circuits or devices is called "noise". Relative to the necessary signal depicted in diagram 1, diagram 2 shows an instance of switching noise, and diagram 3 shows a superimposed signal. Switching noise and surges become unwanted signals, and can lead to malfunction and breakdown of electronic equipment. Such unwanted signals are referred to generally as "noise". Further, diagram 2 shows a 100 kHz sine wave output, but due to the influence of the power supply switching noise, approximately 500 kHz of switching noise is superimposed.

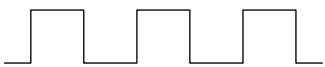


Diagram 1

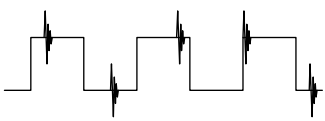


Diagram 2

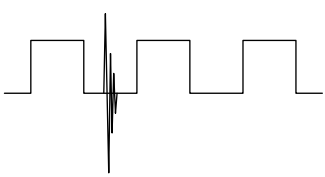


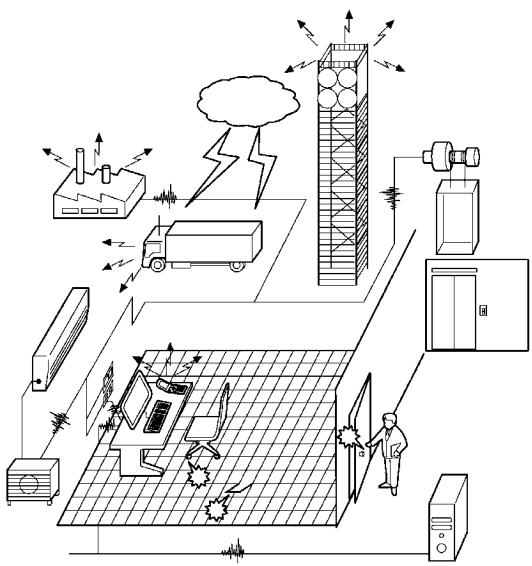
Diagram 3

The cause of the noise

There are many existing causes for noise.

- Power transmission lines and electric train noise
- Noise from uninterruptible power supply equipment such as air conditioning and lighting equipment
- Power motor noise
- The frequencies of waves such as AM waves, FM waves, amateur wireless, CB wireless, television broadcast waves, and cellular phones cover a broad bandwidth. Surges also exist with strong pulsatile noise.

There are lightning surges from lightning discharge and induced lightning, static electric surges, and surges generated by motors, solenoids, and relays when switching ON and OFF. The influence of such noise can cause electronic equipment malfunction and breakdown. (See the diagram below)

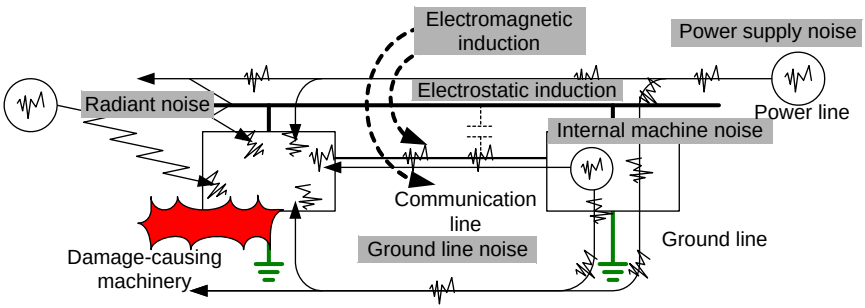


Paths of noise penetration

There are 2 types of paths by which noise penetrates electronic equipment.

- Radiant noise
  Penetrates inside equipment directly in the form of radio waves.

- Conduction noise
  There is noise which penetrates directly through communications lines, power lines and ground lines, and noise which penetrates via induction (electrostatic induction or electromagnetic induction).



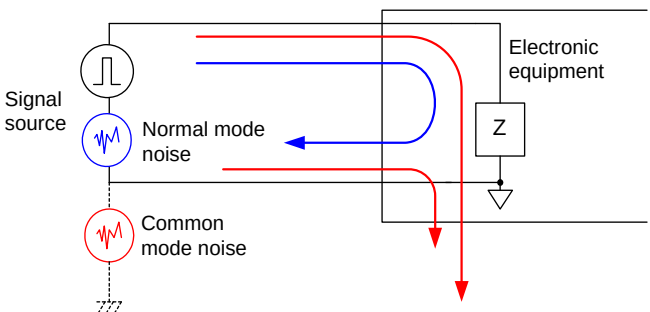
If noise penetrates electronic equipment, it may break the electronic device, or cause the device to not operate properly.
The degree of the influence varies according to the energy and frequency of the noise, and the path of noise penetration. Also, it varies depending on the electronic equipment's resistance to noise and its location relative to the noise source.

Normal mode noise and common mode noise

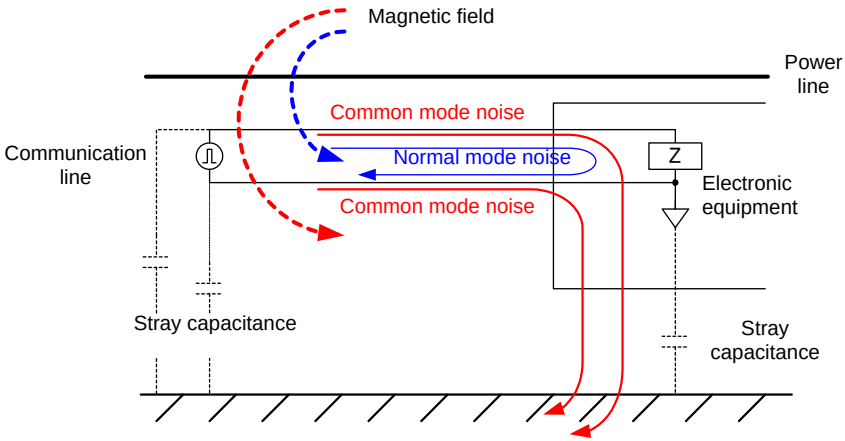
There are two types of noise which penetrate electronic equipment and can cause damage: normal mode and common mode noise.

- Normal mode noise
  Transmitted via potential difference between communications lines or power supply lines.

- Common mode noise
  Due to grounding, noise which is common on 2 power lines or communications lines and becomes amplified. Both normal and common mode noise become causes of noise obstruction when they penetrate an electrical device.



Noise penetration due to electromagnetic induction



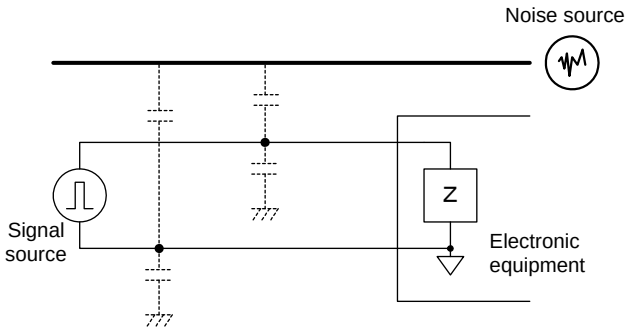
A magnetic field is generated when electric current travels through a power line. If the magnetic field created by the power line travels between communications lines, voltage is generated due to electromagnetic induction. This voltage becomes normal mode noise generated in the communication lines, and causes a distorting of the signal sine wave.

Also, if the magnetic field generated at the power line passes between communication lines and ground, noise is generated due to electromagnetic induction. This causes an instance of common mode noise amplified between 2 communications lines.

How can noise be avoided?

- Use twisted pair cable, as is used for LAN and other cables. Alternatively, wire in such a way as to avoid machinery or power lines which generate strong magnetic fields.
- Balance the impedance of the communication lines, or insulate them from ground contact. Additionally, wire in such a way as to avoid machinery or power lines which generate strong magnetic fields. Apart from distancing power lines from the signal line, also place distance between the input and output lines, and the ground line and signal line.

Noise penetration due to electrostatic induction



Separate signal lines, especially those running between electroconductive materials such as surrounding metals, can be connected through stray capacitance. The result of this connection is noise due to electrostatic induction. Since stray capacitance is inversely proportional to distance, an effective measure against electrostatic induction noise is to create distance from the noise source. Shielding the signal line also helps.

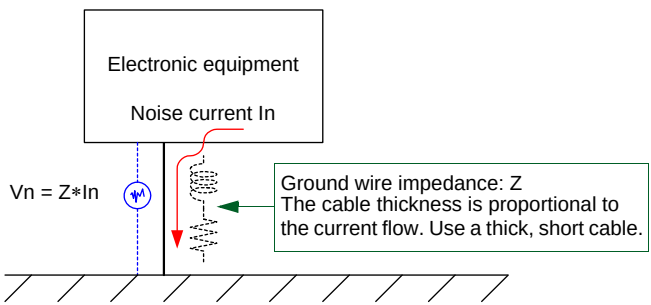
Similarly, place distance between different types of signal lines, power lines and signal lines, input and output lines, and ground lines and signal lines.

Noise due to grounding

Because earth is a steady potential, grounding is used to stabilize the potential of electronic equipment. However, depending on the grounding method this can be counterproductive with respect to limiting noise.

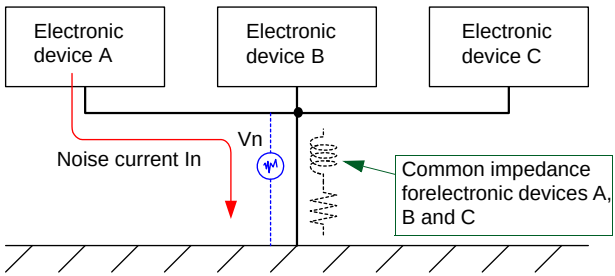
Ground wire impedance

When current flows to the ground line, voltage is generated at the ground terminal due to the ground resistance and ground line impedance. The potential of the electronic equipment becomes unstable due to this voltage fluctuation. It is necessary to lower the impedance of the ground resistance and ground line, taking into account the amperage and frequency composition of the current running in the ground line.
Using short, thick wire for the ground connection lowers the ground wire impedance.



Common impedance influence

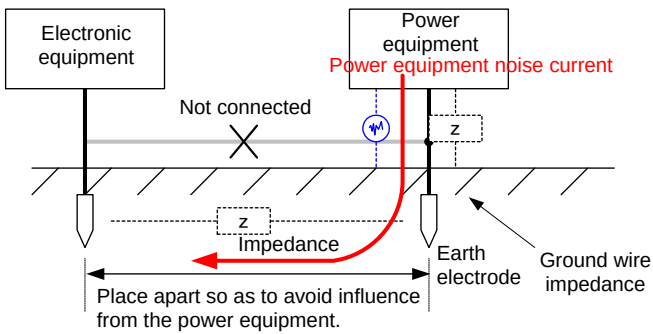
When using a single ground line to ground multiple electronic devices, the grounding resistance and ground line impedance will be a common impedance for all devices. (See the diagram below)



In the diagram above, the voltage noise Vn generated at the grounding terminal due to current flowing from device A to the ground line also affects the potential of electronic devices B and C. The same can be said of voltage generated at the grounding terminals of electronic devices B and C due to flow to the ground line. Regarding the influence of common impedance as well, it is necessary to lower the impedance of the ground resistance and ground line, taking into account the amperage and frequency composition of the current running to the ground line from all electronic devices. Alternatively, each device can be grounded separately.

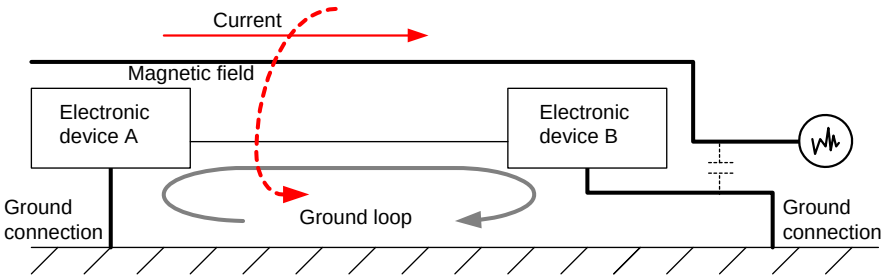
Common grounding

A relatively high amount of current flows through the ground lines of power equipment such as elevator and air conditioner motors. Electronic devices such as communications equipment should be grounded separately from power equipment so as not to be influenced by voltage fluctuations which arise from power equipment grounding. To avoid influence it is also necessary to position the earth electrode at a distance.



Ground line induction noise

If the ground line forms a GND loop or is run long and around in circles, it will pick up induction noise.



In general, electronic equipment causes primarily high frequency noise problems. Therefore in the case that grounding is used to stabilize the potential of the electronic equipment, it is necessary to lower the impedance of the ground wire relative to the high frequency noise.
By lowering the ground wire impedance, it is possible to limit the ground terminal voltage fluctuation at the time of noise penetration. As the impedance of ground wire is proportional to its length, use as short a wire as possible.

Ground construction standards

Construction standards for grounding are regulated for the purpose of preserving safety and preventing electric shock accidents.

Ground construction standards

Grounding construction type	Ground resistance
Type A grounding construction	10 Ω
Type B grounding construction	Number of Ohms equal to the amperage value minus 150 (amperage-150) of the 1 line grounding current of the high voltage side or extra high voltage side of a power transformer electrical circuit (summary definition only)
Type C grounding construction	10 Ω (or 500 Ω when equipment is in place to automatically shut off the circuit within 0.5 seconds whenever an earth fault occurs on a low voltage circuit)
Type D grounding construction	100 Ω (or 500 Ω when equipment is in place to automatically shut off the circuit within 0.5 seconds whenever an earth fault occurs on a low voltage circuit)

These standards regulate DC resistance values (Type A: DC resistance value 10 Ω or less; Type D: DC resistance value 100 Ω or less, etc.), but do not regulate high frequency impedance. Measurement of grounding resistance is also performed with comparatively low frequencies. When grounding is intended as a noise counter-measure for electronic equipment, since it is necessary to lower the impedance at high frequencies, the above grounding construction standard resistance values cannot be applied as is. Even if the ground resistance is low, if it is shared with a power equipment safety ground, it may be easily influenced by electric power noise.

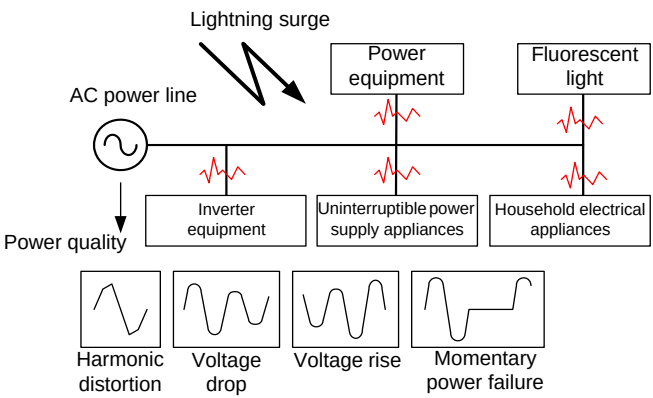
Noise from power supply lines

Many types of equipment are connected to AC power lines to supply power, and noise from many types of equipment penetrates the lines. Noise from switching power supply and inverters used in each piece of electronic equipment, noise that occurs when relays or motors are turned ON/OFF, and lightning surges are representative examples. Also, since commercial power lines are drawn out long in order to supply AC power, surrounding noise is picked up via induction.

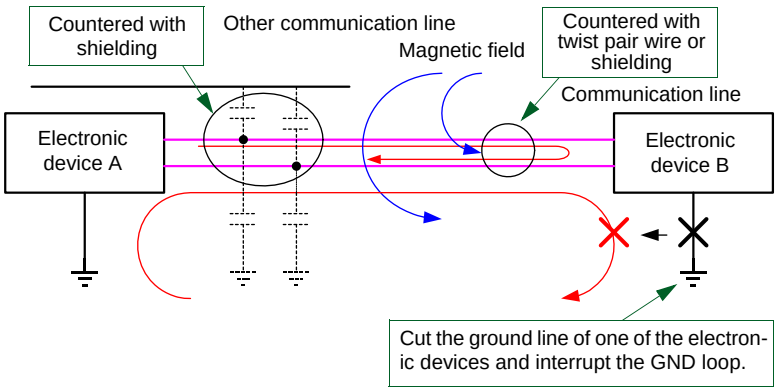
As counter measures against AC power line noise, AC power noise filters or noise-reducing insulated transformers are used so that the noise does not penetrate from the AC power line to the electronic device.

In addition to noise problems, power lines also present problems of power quality, such as momentary power failure, voltage dipping and swelling, and harmonic current.

These can act along with noise problems to lead to electronic device malfunction and breakdown.



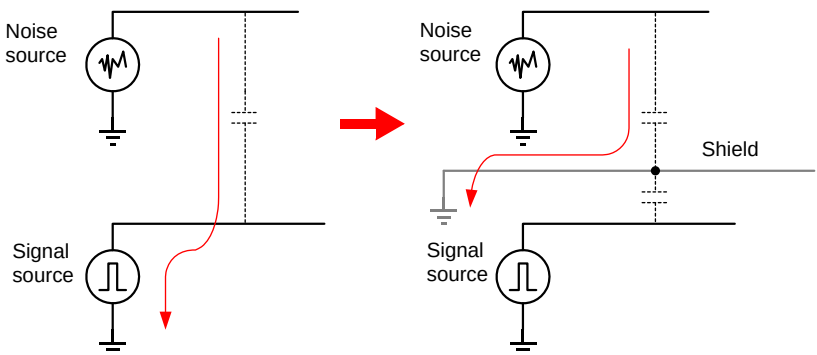
Noise from communication lines



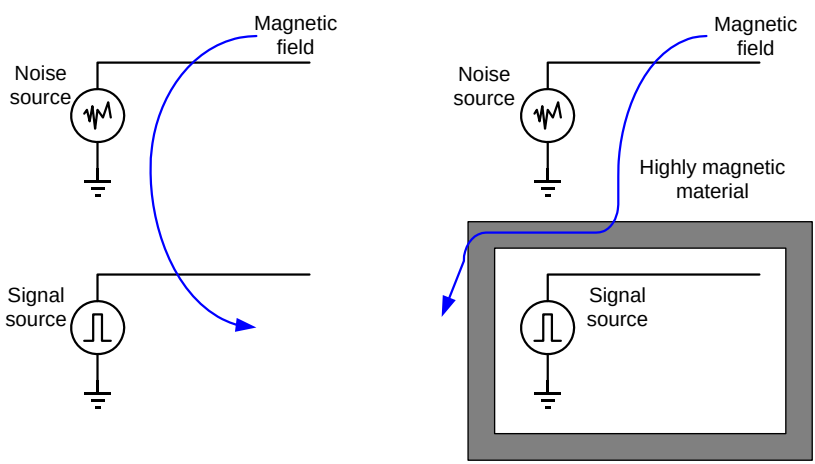
Similarly to power supply lines, communication lines also require two wires, a send and a return line.
A loop is created between the send and return lines, causing noise to be generated via induction. The presence of surrounding power lines or other communications lines also causes noise. Normally this is countered with shielding or using twist pair cables.
Moreover, common mode noise is generated by the loop created between the GND of electronic devices A and B and the earth. As a counter measure to common mode noise, one side of the communications equipment is disconnected from the ground to avoid the formation of a ground loop.

Shielding

Material which blocks noise penetration due to electrostatic induction is called electrostatic shielding, and material which blocks noise penetration due to electromagnetic induction is called magnetic shielding. Electrostatic shielding outlets noise to the GND by dropping the shielding to the GND. (See the diagram below)
Ideally either the noise source or the side receiving the noise is completely encased with shielding.

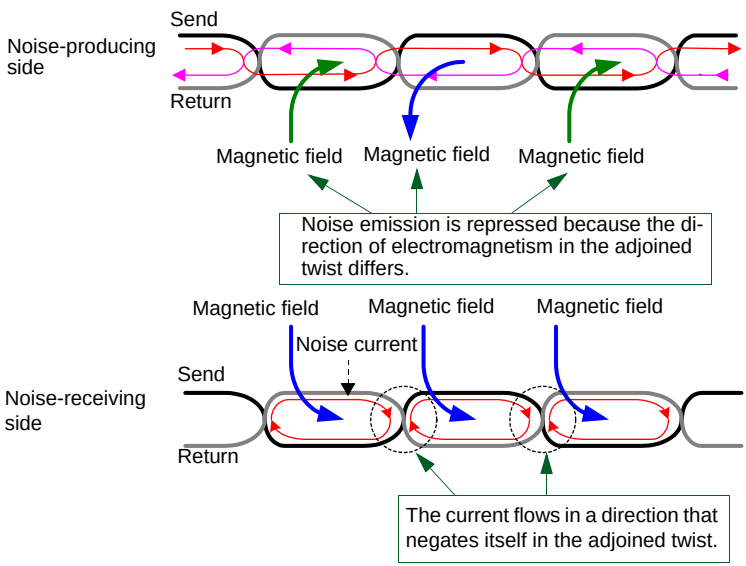


With magnetic shielding, the side receiving the noise is encased with high permeability magnetic substance. A magnetic field will not be generated in the area inside the magnetic shielding. There is also shielding which cuts electromagnetic waves.



Twisted pair wire

Twisted pair wire exists as a means of countering electromagnetic induction noise. The signal line of the noise-receiving side is made of two lines, the send and return lines. When the electromagnetism generated on the noise-producing side passes this loop, electromagnetic induction noise is generated.
Using twisted pair wire on the noise-receiving side causes voltage occurring via electromagnetic induction to be produced in a direction that is negated by the adjoined twist, thereby suppressing noise penetration. On the noise-producing side, noise emission is repressed because the direction of the electromagnetism in the adjoined twist differs.
When possible, it is effective to use twisted pair wire on both the noise-producing and noise-receiving wires.



Noise-preventing products

Items to be used with power supply lines

- AC power line filter
  Obstructs the penetration and outflow of noise.
  Generally these must be grounded as they divert common mode noise to ground. However, there are also AC power line filters for which grounding is not needed.

- Surge absorber
  Protects electronic equipment from over-voltage caused by lightning and open-close surges or electrostatic discharge noise. Prevents damage to the electrical equipment by suddenly lowering the electrical resistance value to suppress the voltage level if over-voltage occurs. Some such devices are called varistors and arrestors.

- Ferrite core
  Common mode noise reduction
  Transforms the electromagnetism due to noise current in a wire into heat. Effective for attenuating common mode noise and radiation noise penetration. Effective against common mode noise, and counters noise without influencing the signal.

- Noise cut transformer
  An element for reducing and discharging normal mode noise as well as common mode noise. Causes noise energy to be consumed and converted into heat along the internal magnetic path. Intercepts a broad band of noise which penetrates from AC power lines, spanning from low audio frequencies to approximately 100 MHz. Acts moreover to block noise from a secondary connected device from being sent back to the primary device.

For use with communication lines

- Communication line filter
  Compatible with all communication lines (Analog/ADSL, ISDN, LAN lines, bus wiring) Because the frequency band of noise which can be attenuated by each filter is limited, it is necessary to choose the appropriate noise filter to suit the particular noise problem.

- Ferrite core
  Transforms the electromagnetism due to noise current in a wire into heat. Effective for attenuating common mode noise and radiation noise penetration. Effective against common mode noise, and counters noise without influencing the signal.

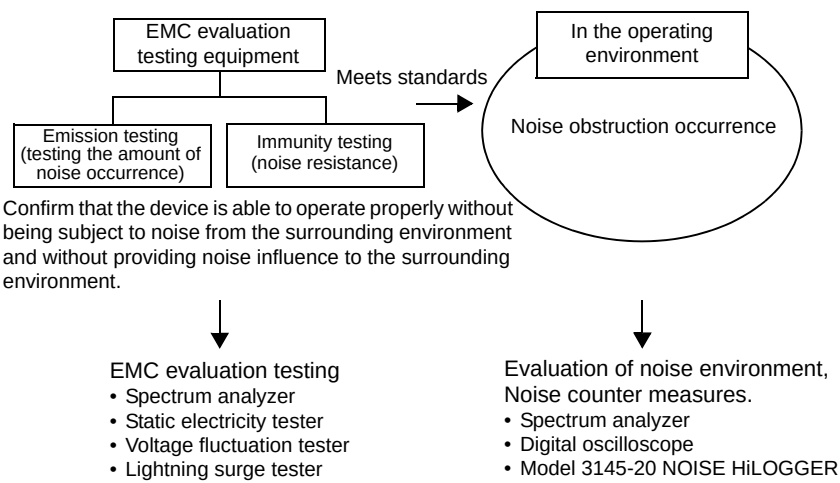
- Surge absorber
  Protects electronic equipment from over-voltage caused by lightning and open-close surges or electrostatic discharge noise. Prevents damage to the electrical equipment by suddenly lowering the electrical resistance value to suppress the voltage level if over-voltage occurs. Some such devices are called varistors and arrestors.

EMC (Electromagnetic compatibility) and noise measuring instruments

As electronic equipment picks up noise from its surroundings, it also emits some noise to its surroundings, which in turn influences other electronic equipment. In such an operating environment it is therefore necessary to make each electronic device resistant to incoming noise, and to reduce the noise originating in each device.
Methods for evaluating EMC include emission testing (amount of noise generated) and immunity testing (noise resistance), which make use of various EMC testing equipment to make evaluations.

Evaluation method	EMC testing equipment
Emission testing	• Spectrum analyzer • Electric field strength meter • Antenna LISN (pseudo power supply network), etc.
Immunity testing	• Static electricity tester • Voltage fluctuation tester • Lightning surge tester, etc.

When used in the actual operating environment, electronic devices appropriate for EMC evaluation testing are also subject to noise influence and may malfunction. It is necessary to examine the actual noise environment and adopt counter measures to this. In general, measuring devices such as spectral analyzers and oscilloscopes are used to observe the frequency composition and waveform of the noise, and then counter measures are considered. The 3145-20 NOISE HiLOGGER is suitable for such testing when noise interference occurs.



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