HIOKI

Instruction Manual

3144-20

NOISE SEARCH TESTER

HIOKI E. E. CORPORATION

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Contents

Introduction

Thank you for purchasing the HIOKI "Model 3144-20 NOISE SEARCH TESTER." To obtain maximum performance from the instrument, please read this manual first, and keep it handy for future reference.

Registered Trademarks:

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

Inspection

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.

Confirming package contents

- 9741 CLAMP ON VOLTAGE SENSOR.....1
- Instruction Manual.....1
- LR6 alkaline batteries.....6
- 9445-02 AC ADAPTER or
  9445-03 AC ADAPTER.....1
- PC software(CD-R).....1
- USB cable.....1
- Earphone.....1
- Strap.....1
- Carrying case.....1

Safety Notes

⚠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.

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.

Safety Symbols

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 double-insulated device.(9741)

Indicates a grounding terminal.

Indicates DC (Direct Current).

Symbols in Use

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.

	Indicates the prohibited action.
❖	Indicates the location of reference information.

Accuracy

We define measurement tolerances in terms of f.s. (full scale) and rdg. (reading) with the following meanings:

- f.s. (maximum display value or scale length)
  The maximum displayable value or scale length. This is usually the name of the currently selected range.
- rdg. (reading, displayed or indicated value)
  The value currently being measured and indicated on the measuring instrument.

Measurement categories

The 9741 CLAMP ON VOLTAGE SENSOR complies with CAT III 200 V safety requirements.

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.

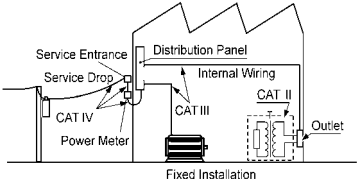
CAT II Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)
CAT II covers directly measuring electrical outlet receptacles.

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 device (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.

Before Use

- 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.
- Before using the instrument, make sure that the insulation on the 9741 CLAMP ON VOLTAGE SENSOR 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.

Installation, Operating Environment, and Handling of the Instrument

⚠WARNING

- Do not allow the instrument to get wet, and do not take measurements with wet hands. This may cause an electric shock.
- Do not use the instrument where it may be exposed to corrosive or combustible gases. The instrument may be damaged or cause an explosion.

⚠CAUTION

Operating Environment

Observe the following to avoid damage to the instrument.

- Installation and Operating Environment
  Between 0°C and 40°C; 80% RH or less; indoors only.
- Do not store or use the instrument where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the instrument may be damaged and insulation may deteriorate so that it no longer meets specifications.
- This instrument is not designed to be entirely water- or dust-proof. To avoid damage, do not use it in a wet or dusty environment.
- Do not use the instrument near a device that generates a strong electromagnetic field or electrostatic charge, as these may cause erroneous measurements.
- To avoid damage to the instrument, protect it from vibration or shock during transport and handling, and be especially careful to avoid dropping.

⚠CAUTION

- To avoid corrosion from battery leakage, remove the batteries from the product if it is to be stored for a long time.
- Adjustments and repairs should be made only by technically qualified personnel.
- If the protective functions of the product are damaged, either remove it from service or mark it clearly so that others do not use it inadvertently.

NOTE

Accurate measurement may be impossible in the presence of strong magnetic fields, such as near transformers and high-current conductors, or in the presence of strong electromagnetic fields such as near radio transmitters.

Handling of Cables

⚠CAUTION

- To avoid breaking the cables, do not bend or pull them.
- Avoid stepping on or pinching cables, which could damage the cable insulation.

Terminals

⚠WARNING

- The instrument is provided with various types of external connectors. When plugging cables into the connectors, be careful not to misconnect.
- The voltage sensor input terminal of the instrument is dedicated to the 9741 CLAMP ON VOLTAGE SENSOR. Be sure to use the 9741 sensor specified by HIOKI. Keep in mind that using any other type of sensor may result in electric shock or malfunction.
- Note the following maximum input voltage and maximum rated voltage to earth of the BNC input terminal. If their voltages are exceeded, this device will be damaged and personal injury will result. Therefore, do not perform measurement in this case.
  Maximum input voltage: 5 V_{PEAK}
  Maximum rated voltage to earth: 5 V

⚠CAUTION

To protect against dirt and dust, always leave the protective cover in place, unless using the terminals.

Care and Handling of CD-R

⚠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-R, or for any problem related to the purchase of a Hioki product.
- In the interests of ongoing product developments, there may be minor discrepancies between screen displays and the operating instructions, and in the data conversion process.
- Hioki shall not be held liable for any problems with a computer system that arises from the use of this CD-R, or for any problem related to the purchase of a Hioki product.

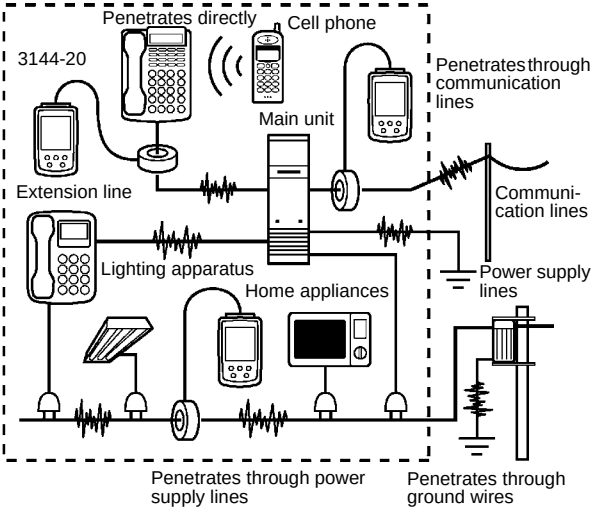
Overview Chapter 1

1.1 Product Overview

Noise is propagated through diverse routes such as communication lines and power supply lines. Many cases of trouble, including false operation and malfunction caused by noise, are currently on the rise. To avoid such trouble, it is essential to identify the noise frequency bands and routes through which noise enters, and to take appropriate corrective action.

The 3144-20 NOISE SEARCH TESTER can search for noise frequency bands and routes of penetration by simply clamping the 9741 CLAMP ON VOLTAGE SENSOR to the line being measured.

Moreover, the logging function of the instrument enables long-time monitoring. The USB interface allows recorded data to be transferred to a PC, displayed in graphs, and output to a printer.



Noise sources:
There are many noise sources, such as power transmission lines, electric railways, inverter units, and CB radios.

Penetration routes:
Some noise enters through communication lines, power supply lines, and ground wires, while other noise penetrates devices directly.

Propagation routes:
Noise is propagated through various routes, including communication lines and power supply lines.

The instrument can search for noise frequency bands and penetration routes by simply attaching the 9741 CLAMP ON VOLTAGE SENSOR.

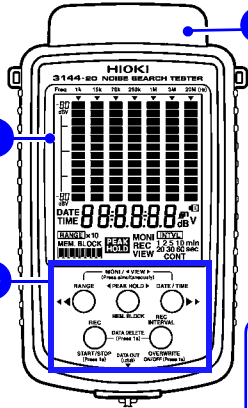
1.2 Features

- **Noncontact type of voltage sensor**
  Searches for noise in a system in operation, without affecting circuits currently in communication or damaging cables.
- **Measuring frequency band range: 500 Hz to 30 MHz**
  Covers a wide band ranging from noise on power transmission lines to that of CB radios.
- **Noise indicated on a large-LCD level meter**
  Indicates detected noise on a level meter, separately by frequency band.
- **PEAK HOLD function**
  Indicates the peak value in each frequency band and the time measured.
- **Memory function for up to 64,000 items of data**
  Records measurement data and measurement times for up to 64,000 items of data.
- **Equipped with USB interface**
  Using the PC software supplied with the instrument enables the transfer of data to a PC, display of time series data, and output to a printer.
- **Compatible with two different power sources: Batteries and AC adapter**
  Applicable to field measurements, given its portability and long-time monitoring capability.
- **Handy type**
  A compact, lightweight noise measuring tool that can be used just like a simple circuit-tester.

1.3 Names and Functions of Parts

3144-20 NOISE SEARCH TESTER

Front



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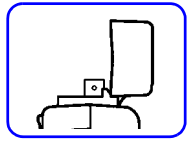
❖ page 18

Protective cover for the voltage sensor input terminal, BNC input terminal, and output terminal.
When not using the instrument, place the protective cover back in place.



Cover fastening method when instrument in use

Top

Voltage sensor input terminal

Connect the supplied 9741 CLAMP ON VOLTAGE SENSOR here.
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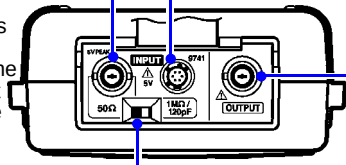
BNC input terminal

Input terminal for external signals, excluding signals from the 9741. Effective when the instrument is not connected to the 9741.
❖ page 34



Selector switch

Switch to select the input impedance of the BNC input terminal.
(50 Ω/1 MΩ approx. 120 pF)
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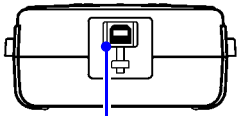
Output terminal

Output terminal for waveforms applied to the voltage sensor input terminal or BNC input terminal.
❖ page 41

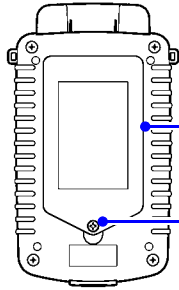
Bottom Surface



USB terminal

Plug the USB cable in this terminal.

Rear Side

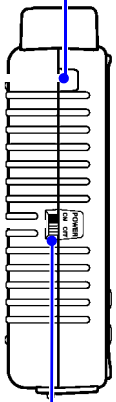


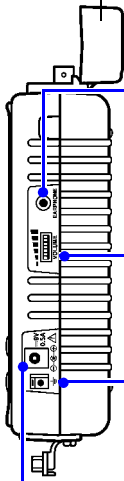
Battery cover

Setscrew

Left Side

Right Side





Protective cover
(when fastened)

Strap hole

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Earphone terminal

Audible band monitoring output terminal. Plug in the earphone used to listen to noise here.

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Volume control knob

Regulates the sound volume of the earphone.

Ground terminal

Ground terminal for this instrument.

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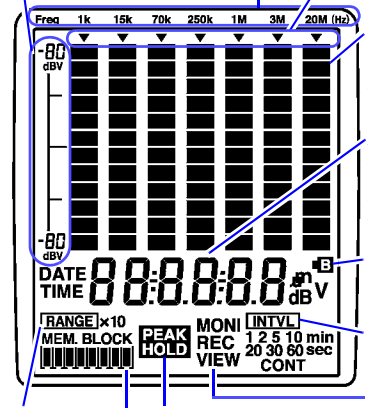
POWER switch

❖ page 38

AC adapter connection terminal

Plug in the 9445-02 or 9445-03 AC ADAPTER (supplied with the instrument) here.

Display Section



Scale indication [In decibels (dBV)]

Frequency range indication

Indicates the frequency range at peak detection, with the PEAK HOLD function ON.

Level meter (indicates for each frequency range in 12 steps).
Indicates when noise is detected.

Indicates the date and time, with the PEAK HOLD function OFF.
Indicates the peak detection time, with the PEAK HOLD function ON.

Battery mark
(Lights when the supply voltage drops below 6.5 V.)

Indication of recording time interval

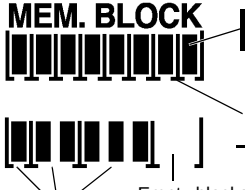
MONI: Remains on during monitoring.
REC: Remains on during recording.
VIEW: Remains on during display of recorded data.

Indication of measuring range

Remains on when the PEAK HOLD function is ON.

Indication of Memory Blocks

Indication of Memory Blocks



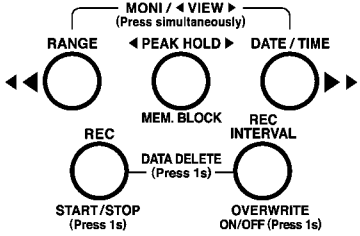
Blocks (Storage units of recorded data)
One block can hold up to 8,000 items of data.

Indicates the delimiter of files, with each file covering the start to the end of a recording. A file consists of one to eight blocks, depending on the number of data items recorded.

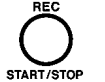
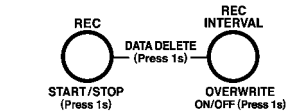
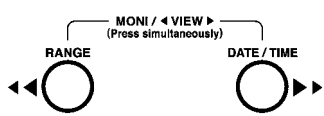
Empty blocks

Blocks occupied by files

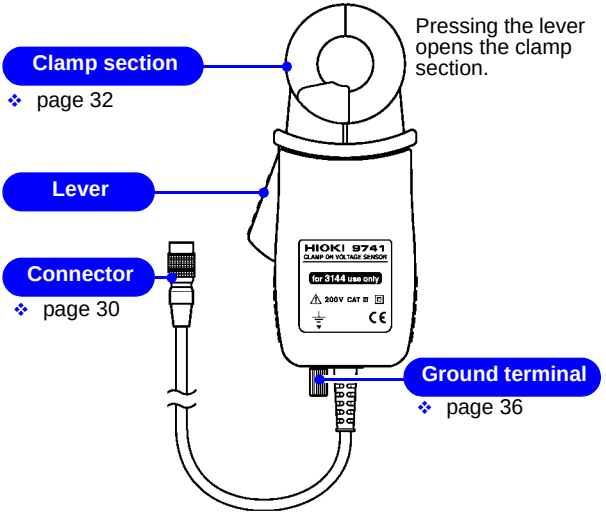
Operation Keys



Key Press for 1 sec.		Explanation (The functions of keys vary, depending on the settings made.)
RANGE	RANGE key	Selects the measuring range (on the monitoring screen [MONI] with the PEAK HOLD function OFF.)
	◀◀ key	Selects the frequency range corresponding to the peak detection time to be indicated (with the PEAK HOLD function ON). Scrolls recorded data (on the data view screen [VIEW]). Sets the date and time (in date and time setup). (Values DOWN)
◀ PEAK HOLD ▶ MEM. BLOCK	PEAK HOLD key	Sets the PEAK HOLD function on and off (on the monitoring screen [MONI] or recording screen [REC]). Each pressing of this key shifts flashing to the setting position in order of Year → Month → Day → Hour → Minute → Second (in date and time setup). Defines the settings of date and time.
	MEM.BLOCK key	Selects the memory block (on the data view screen [VIEW]).

	DATE/TIME key	Switches the current indication to a date or time (on the monitoring screen [MONI] with the PEAK HOLD function OFF).
	DATE/TIME key Press for 1 sec.	Enables date and time setup.
	▶▶ key	Selects the frequency range corresponding to the peak detection time to be indicated (with the PEAK HOLD function ON). Scrolls recorded data (on the data view screen [VIEW]). Sets the date and time (in date and time setup). (Values UP)
	REC key Press for 1 sec.	Starts or stops recording. (Starts on the monitoring screen [MONI]). (Stops on the recording screen [REC]).
	REC INTERVAL key	Sets the recording interval (on the monitoring screen [MONI]).
	OVERWRITE ON/OFF key Press for 1 sec.	Switches between Automatic Stopping Mode and Overwrite Recording Mode for recording (on the monitoring screen [MONI]).
		Deletes all recorded data (on the monitoring screen [MONI] or data view screen [VIEW]). (When pressed for 1 sec.)
		Switches between monitoring screen [MONI] and data view screen [VIEW] (when pressed simultaneously).

9741 CLAMP ON VOLTAGE SENSOR

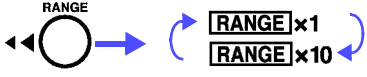


1.4 Quick Reference

[MONI]: Monitoring screen/ [REC]: Recording screen/
[VIEW]: Data view screen

Measuring Range
(On [MONI] with the PEAK HOLD function OFF)

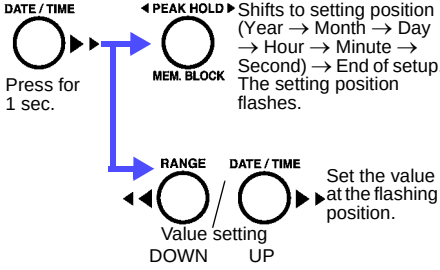
Switching of range



Date and Time Indication
(On [MONI] with the PEAK HOLD function OFF)

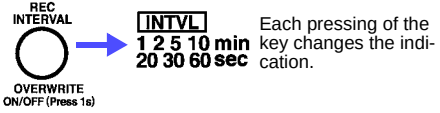
Switching of indication

Change of settings



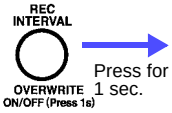
Recording Interval
(On [MONI])

Change of settings



Data Saving Method (On [MONI])

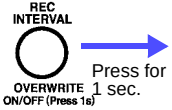
Save by overwriting



When memory becomes full, new data is written over old data to continue recording.

Save without overwriting

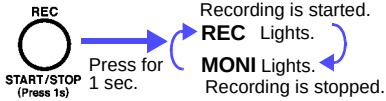
(**CONT** remains on.)



When memory becomes full, recording stops automatically.

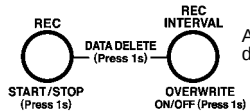
Start and Stop of Measurement
(Start on [MONI], Stop on [REC])

Start and stop of measurement



Data deletion (On [MONI] or [VIEW])

Deletion (Batch deletion)

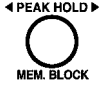


All recorded data is deleted.

Press for 1 sec simultaneously.

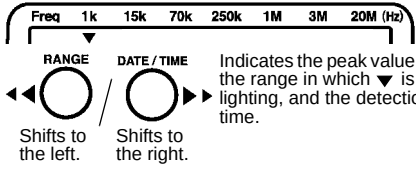
Peak Value Indication (PEAK HOLD function) (On [MONI] or [REC])

Activating the PEAK HOLD function



PEAK HOLD Lights.

Selecting the frequency range to be indicated (Effective only with PEAK HOLD ON)

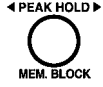


Shifts to the left.

Shifts to the right.

Indicates the peak value of the range in which ▼ is lighting, and the detection time.

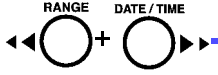
Deactivating the function



PEAK HOLD Goes off.

Switching of Screens

Switching between monitoring screen [MONI] and data view screen [VIEW]



Press simultaneously

Monitoring screen [MONI]

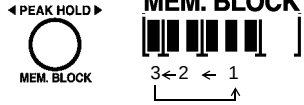
MONI Lights.

VIEW Lights.

Data view screen [VIEW] Allows monitoring recorded data.

Viewing of Recorded Data (On [VIEW])

Selecting the memory block



Each pressing of the key switches the blocks.

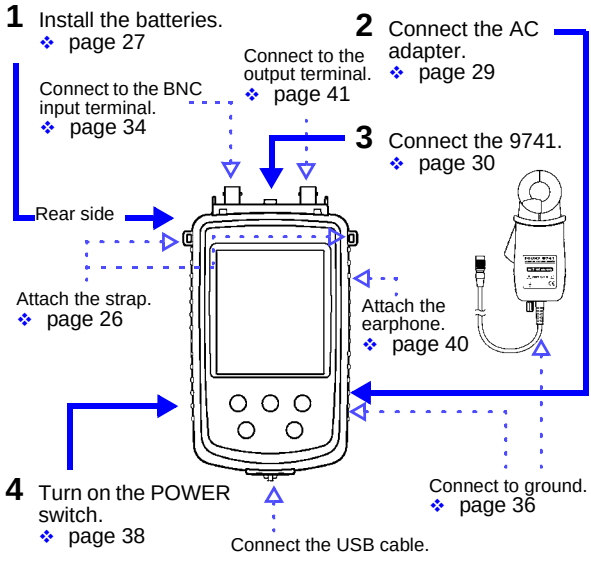
Scrolling the data

Back

Forward

Measurement Preparations Chapter 2

Please read the "Operating Precautions" (page 5) before setting up this instrument.

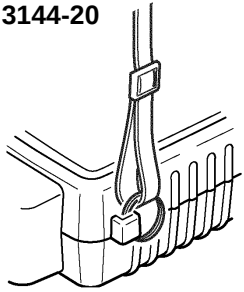


2.1 Attaching the Strap

Use the strap to carry the instrument, or to hang it up at the installation location.

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

3144-20



Attach the two rings of the strap to the respective locations in the 3144-20.

Tighten the strap sufficiently to prevent loosening or twisting.

2.2 Installing the Batteries

The instrument operates on battery power or AC through the adapter. When using the AC adapter and batteries together, AC adapter power is employed.

When powering the instrument using the batteries, the operating time is as follows:
About five hours when indications are shown on the monitoring screen [MONI]
(Ambient temperature: 23°C, reference value)
The operating time varies depending on the ambient temperature and type of batteries used.

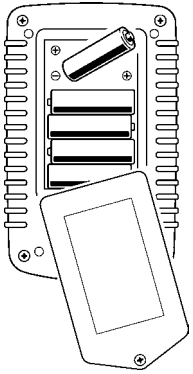
⚠WARNING Do not mix old and new batteries, or different types of batteries. Also, be careful to observe battery polarity during installation. Otherwise, poor performance or damage from battery leakage could result.

NOTE

- Do not use other than the specified type of batteries (LR6 alkaline batteries). Using manganese batteries will result in a shorter operating time than when using alkaline batteries.
- When measurement data must be recorded, use the AC adapter.
- The B indicator appears when battery voltage becomes low. Replace the batteries as soon as possible.
- After use, always turn OFF the power.
- To replace the batteries, see 6.1, "Battery Replacement" (page 93).

Tool required for installation:
Six LR6 alkaline batteries , Phillips-head screwdriver

3144-20



1. Make sure that the POWER switch of the 3144-20 is OFF and disconnect all cables.
2. Turn over the 3144-20, then loosen the setscrew to detach the battery cover.
3. Install six LR6 alkaline batteries in the battery compartment, and confirm the correct polarity.
   (Replace all batteries at the same time.)
4. Put the battery cover back in place, then tighten the screw.

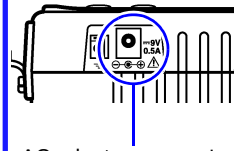
2.3 Connecting the AC Adapter

⚠WARNING

- Use only the supplied Model 9445-02 AC ADAPTER or 9445-03 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.
- Turn the instrument off before connecting the AC adapter to the instrument and to AC power.

⚠CAUTION To avoid damaging the power cord, grasp the plug, not the cord, when unplugging it from the power outlet.

Right side of the 3144-20



AC adapter connection terminal

1. Connect the output plug of the AC adapter to the AC adapter connection terminal.
2. Plug the AC adapter into a power outlet.

NOTE When using the AC adapter and batteries together, AC adapter power is employed.
If AC power supply is interrupted for some reason, the instrument will automatically switch to battery power.

2.4 Connecting the 9741 CLAMP ON VOLTAGE SENSOR

2.4.1 Connecting the Sensor to the Voltage Sensor Input Terminal

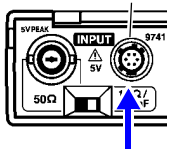
⚠WARNING The voltage sensor input terminal of the instrument is dedicated to the 9741 CLAMP ON VOLTAGE SENSOR. Always use the 9741 as designated by HIOKI. Keep in mind that connecting any other type to the terminal could result in electric shock or malfunction.

⚠CAUTION

- To prevent damage to the instrument and sensor, never connect or disconnect a sensor while the power is on, or while the sensor is clamped around a conductor.
- To avoid damaging the output cable, grasp the connector, not the cable, when unplugging the cable.
- Be careful to avoid dropping the clamps or otherwise subjecting them to mechanical shock, which could damage the mating surfaces of the core and adversely affect measurement.

Top side of the 3144-20

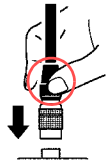
Voltage sensor input terminal



Tip of the 9741's connector

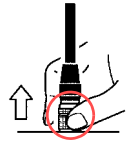
Insert the connector by aligning its protrusion with the groove of the voltage sensor input terminal.

Plug in the 9741 CLAMP ON VOLTAGE SENSOR.



Plugging in

Hold the upper part of the connector to plug it in. (The connector cannot be inserted if held by the metallic part.)



Unplugging

Hold the metallic part of the connector to unplug it. (The connector cannot be unplugged if held by the upper part.)

2.4.2 Connecting the Instrument to the Line being Measured

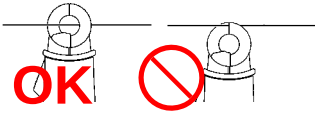
⚠DANGER The 9741 CLAMP ON VOLTAGE SENSOR should first be plugged into the 3144-20 before being connected to the live line being measured. To avoid short-circuiting or electric shock, observe the precautions below.

- To avoid short circuits and potentially life-threatening hazards, never attach the clamp to a circuit that operates at more than 200 VAC, or over bare conductors.
- The 9741 should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.

⚠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 prevent damage to the instrument and sensor, never connect or disconnect a sensor while the power is on, or while the sensor is clamped around a conductor.

NOTE Due to the principles of measurement, the detecting sensitivity of the 9741 varies with the diameter of the cable to be measured, cable position inside the clamp, permittivity of the cable covering, and other factors. See the typical characteristics data for the relationship between the diameter of cable being measured and the sensitivity, and between the cable position inside the clamp and the sensitivity (page 91). Especially when data must be recorded for an extended period of time, fix the position of the cable being measured inside the clamp.



Secure the conductor in the center of the clamp.

- Max. diameter of clamp: 20 mm
- Cable diameter that can be clamped: No larger than 20 mm

2.5 Connecting Signals to the BNC Input Terminal

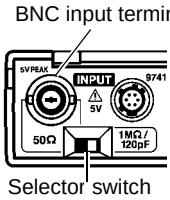
⚠WARNING Note the following maximum input voltage and maximum rated voltage to earth of the BNC input terminal. If their voltages are exceeded, this device will be damaged and personal injury will result. Therefore, do not perform measurement in this case.

Maximum input voltage: 5 V_{PEAK}
Maximum rated voltage to earth: 5 V

⚠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.

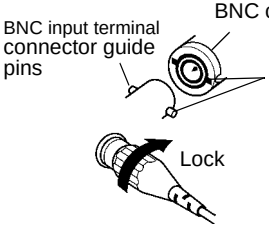
To apply external signals output from a near-magnetic field probe or antenna (excluding those from the 9741) to the instrument, connect the signals to the BNC input terminal.
The level in each frequency band can be checked or recorded in the same way as with the 9741.
Input to the BNC input terminal is effective when the instrument is not connected to the 9741.
The measuring range is the same as for input from the 9741 (0 to -50 dBV).

Top side of the 3144-20



1. Plug the BNC connector into the BNC input terminal.
2. Use the selector switch to select the input impedance (50Ω/ 1MΩ, approx. 120 pF).

Plugging in and unplugging the BNC connector



Insert the connector by aligning the groove of the BNC connector with the connector guide on the 3144-20 side.

Turn clockwise to lock.
To unplug the connector, unlock it by turning it counterclockwise, then pull it out.

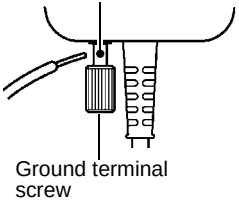
2.6 Connecting to Ground

Connect the ground terminal of the 9741 CLAMP ON VOLTAGE SENSOR or 3144-20 NOISE SEARCH TESTER to ground.
The noise detected when using the 9741 is that in a common mode which exists between communication lines/power supply lines and the earth. By connecting that terminal to ground, noise against the earth can be detected.
Moreover, ground connection reduces the influence of the surroundings (coupling with metallic materials in the surroundings), excluding the cable being measured, by means of the shielding effect.

NOTE Failure to connect the instrument to ground would make the measurement susceptible to effects from objects other than the cable being measured, thus making it impossible to conduct correct measurement.

Connecting the 9741 CLAMP ON VOLTAGE SENSOR to ground

Required tools: Ground wire
About ground wires
Applicable wires: Solid or stranded wire 2.1 mm or less in diameter



1. Loosen the screw of the 9741 ground terminal and pass the ground wire through the earthing hole.
2. Tighten the screw to lock the ground wire.
3. Connect the other end of the ground wire to ground.

Connecting the 3144-20 NOISE SEARCH TESTER

Required tools: Ground wire, flat-tip screwdriver
About ground wires

- Applicable wires
  Solid wire: 0.4 mm (AWG26) to 1.2 mm (AWG16) in dia.
  Stranded wire: 0.3 mm^2 (AWG22) to 1.25 mm^2 (AWG16) in dia.
  Diameter of strand: 0.18 mm or more
- Recommended applicable tool: Flat-tip screwdriver with tip width of 2.6 mm

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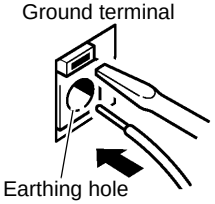
Right side of the 3144-20



1. Insert the ground wire into the earthing hole while pressing the ground terminal of the 3144-20 with a flat-tip screwdriver.
2. Release the screwdriver to lock the wire in place.
3. Connect the other end of the ground wire to ground.

2.7 Turning the Power On/Off

⚠WARNING Before turning the instrument on, make sure the supply voltage matches that indicated on the its power connector. Connection to an improper supply voltage may damage the instrument and present an electrical hazard.

Left side of the 3144-20

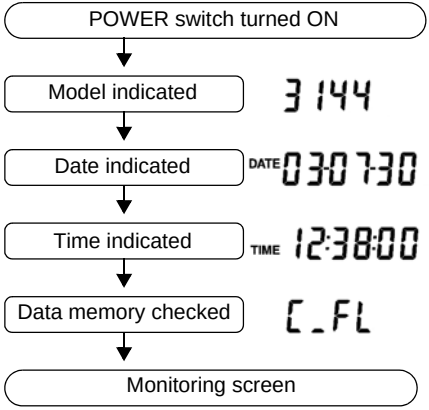
Switching the power on:
Turn on the POWER switch.
The screen will appear.

Switching the power off:
Turn off the POWER switch.

NOTE

- If the battery mark (B at the upper right of the screen) lights when power is turned on, the batteries are depleted. Replace with new ones.
  ❖2.2, "Installing the Batteries" (page 27)
  ❖6.1, "Battery Replacement" (page 93)
- The settings of the immediately preceding measurement are retained even when power is turned off. Turning power on again restores the immediately preceding settings. Note that any data recording in progress at the time is stopped.
- After use, always turn OFF the power.

The following are indicated on the screen when power is turned on:



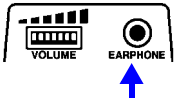
NOTE The checking time for data memory varies depending on the contents of memory.

2.8 Connecting the Earphone

⚠CAUTION To avoid damage to the instrument, do not apply current or voltage to Earphone terminal.

The earphone outputs a detected noise signal that is converted into an envelope component of the audible range.
It can be used as an aid, for example, in identifying the type of noise signal.

Right side of the 3144-20



Connect the earphone here.

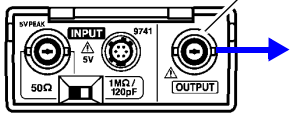
1. Plug the earphone into the earphone terminal.
   Insert the plug securely as far as it will go.
2. Adjust the sound volume by turning the VOLUME control knob.

2.9 Connecting Signals to the Output Terminal

⚠CAUTION To avoid damage to the instrument, do not short-circuit the output terminal and do not input voltage to the output terminal.

The instrument outputs the waveform of a detected noise signal.
This terminal can be used to check a detected signal by its waveform.

Top side of the 3144-20



Setup and Measurement Chapter 3

3.1 Sample Measurement

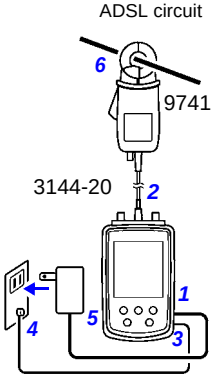
In this sample measurement, the frequency band of a noise signal propagated through an ADSL circuit will be identified.

- Location of measurement: Indoors
- Facility being measured: ADSL circuit
- Measured object: Noise signal
- Measurement period: 8 hours
- Data storage: Saved in internal memory.
- Measuring conditions: Range x1
  Recording interval: 1 min.

Equipment to be prepared :

- 3144-20
- 9445-02 or 9445-03 AC ADAPTER
- 9741 CLAMP ON VOLTAGE SENSOR
- USB cable
- Others (PC, PC software, ground wire, tools)

1 Connecting the instrument and peripherals



1. Connect the AC adapter to the instrument and to a power outlet.
2. Connect the 9741 CLAMP ON VOLTAGE SENSOR to the voltage sensor input terminal of the instrument.
3. Connect the ground wire to the ground terminal of the instrument.
4. Connect the ground wire to ground.
5. Turn on the POWER switch of the instrument.
6. Clamp the 9741 CLAMP ON VOLTAGE SENSOR to the ADSL circuit.

2 Setting up recording conditions

Set up the parameters according to the intended measurement.

1. Check the current time, then set the date and time.
   ❖ 3.6, "Setting Date and Time" (page 55)
2. Set the range to ×1.

RANGE ×1

3. Set the recording interval to one minute.

INTVL
1 min

4. Set up the recording method.
   ❖ 3.3, "Recording Data [REC]" (page 50)

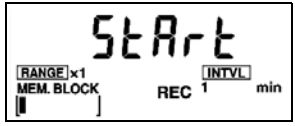
Press for 1 sec.

CONT

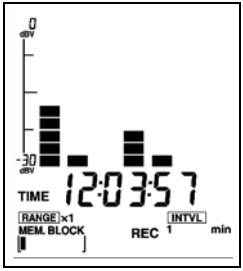
Lights.: Overwrite Recording Mode
Goes off.: Automatic Stopping Mode

3 Starting data recording

Press this key for 1 sec. to start recording.



Recording in progress



Peak Hold can be indicated, as required.

❖ "Activation/deactivation of PEAK HOLD function" (page 48)

4 Stopping data recording

1. REC START/STOP (Press 1s)

Press this key once again for 1 sec. to stop recording.

2. Remove the 9741 CLAMP ON VOLTAGE SENSOR from the ADSL circuit.

3. Turn off the POWER switch.

4. Disconnect the AC adapter, 9741, and ground wire from the instrument.

5 Analyzing recorded data on the PC

1. Connect the USB cable to the USB terminals of the instrument and the PC.

2. Turn on the POWER switch of the instrument.

3. Activate the PC software supplied with the instrument.
❖ Chapter 4, "Analysis of Recorded Data" (page 57)
Before using the instrument for this purpose for the first time, be sure to install the application program supplied.
❖ 4.2, "Installing Software Drivers" (page 58)
4.3, "Installing PC Application Software" (page 60)

4. Transfer recorded data from the 3144-20 to the PC.
❖ 4.5, "Transferring Data to the PC" (page 63)

5. Display time-series data in waveforms and check the noise level, peak value, peak detection time, etc., corresponding to each frequency band.
❖ 4.6, "Analyzing Recorded Data on the PC" (page 68)

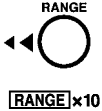
The waveform data can be saved in CSV format.
❖ 4.9, "Analyzing Saved Recorded Data with Excel" (page 78)

Moreover, the images of waveform windows can be saved in BMP format and output to a printer.
❖ 4.7, "Saving Images of Waveform Windows" (page 75)
❖ 4.8, "Printing a Waveform Window" (page 76)

3.2 Monitoring Measurement Data [MONI]

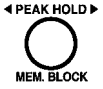
When the instrument is switched on, the monitoring screen appears (MONI lights), indicating the voltage levels of various frequency ranges on the level meter.

Selection of range



Select the range for the input voltage.
Each pressing of the **RANGE** key changes the indications of range and scale.
×1.....1V range
(Scale indication: 0 to -30 dBV)
×10.....0.1V range
(Scale indication: -20 to -50 dBV)

Activation/deactivation of PEAK HOLD function



When the PEAK HOLD function is currently active (ON), the instrument shows the peak value of the level detected in each frequency range and the detection time.

PEAK HOLD lights: Peak hold ON
PEAK HOLD goes off: Peak hold OFF

Each pressing of the **PEAK HOLD** key changes the ON/OFF setting of the PEAK HOLD function.

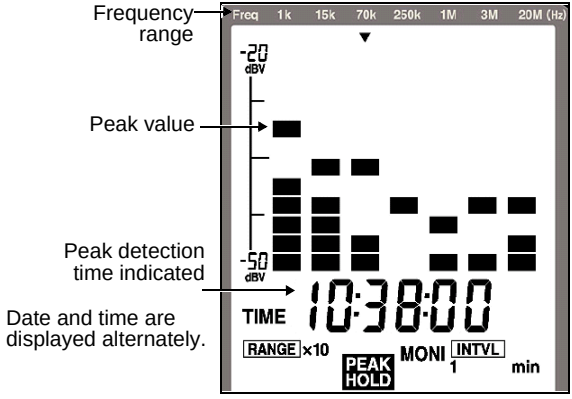
NOTE

- The indications of peak values and the detection times cover the time range from the start of recording to the present time. When the PC software is used, the indications of peak values and detection times cover all recorded data that was downloaded to the PC. For this reason, if data was acquired in overwrite recording mode, the 3144-20 and PC software may indicate different peak values and detection times.
- When there are multiple peak values, the time of the peak value detected first will be indicated.

Checking peak values and peak detection times

When PEAK HOLD is on, the frequency ranges can be switched to check the corresponding peak values and detection times.

Use the ◀◀ key or ▶▶ key to select the frequency range.



3.3 Recording Data [REC]

Pressing the REC key on the monitoring screen [MONI] for 1 sec. displays the recording screen (REC lights), and the instrument starts recording measurement data in memory at the preset interval.

Two recording modes are available. Either should be set before recording.

- **Automatic Stopping Mode**

  When memory becomes full (64,000 data items), recording stops automatically.

  When there are empty blocks in memory, recording can be repeatedly started and stopped to continue measurement.

  ❖ Memory Block: (page 17)

- **Overwrite Recording Mode**

  When memory becomes full, older data is overwritten to continue measurement.

  When data already exists before the start of recording, the data must be deleted to start recording.

  ❖ Data deletion: (page 53)

NOTE

- To record data, use the 9445-02 or 9445-03 AC ADAPTER. When the instrument is operated on batteries, all data may not be saved since the time of continuous use depends on the service life of batteries in use.
- Due to the principles of measurement, the detecting sensitivity of the 9741 varies with the diameter of the cable to be measured, cable position inside the clamp, permittivity of the cable covering, and other factors. See the typical characteristics data for the relationship between the diameter of cable being measured and the sensitivity, and between the cable position inside the clamp and the sensitivity (page 91). Especially when data must be recorded for an extended period of time, fix the position of the cable being measured inside the clamp.

Setup before recording

Make the following settings before starting recording (on the monitoring screen [MONI]). Once recording gets under way, the settings cannot be changed, except the ON/OFF setting of the peak value indication, until the recording is stopped.

1. Set the current time and measuring conditions.

- Date and time setup(page 55)
- Setup of measuring range and ON/OFF of peak value indication (page 48)

2. Set the recording interval.

This setting cannot be changed while recording is in progress.

Each pressing of the **REC** key switches the indication of recording intervals.

1/ 2/ 5/ 10/ 20/ 30 sec

1/ 2/ 5/ 10/ 20/ 30/ 60 min

The maximum recording time varies with the recording mode selected.

❖ "Recording Time" (page 85)

3. Set the recording mode.

Press the **OVERWRITE** key for 1 sec. to select the recording mode. Each pressing of the key switches the mode.

- When Overwrite Recording is ON (Overwrite Recording Mode): CONT remains on.
- When Overwrite Recording is OFF (Automatic Stopping Mode): CONT remains off.

Start of recording

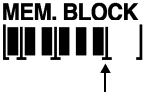
Press the REC key for 1 sec.

The recording screen [REC] opens. (REC lights.) The occupied state of memory is displayed on the screen.

End of recording

Press the REC key again for 1 sec.
(REC goes off.)

The instrument stops recording and returns to the monitoring screen [MONI].

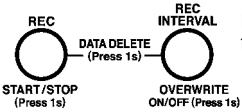


When measurement is stopped, a delimiter appears at the end of the blocks.

3.4 Deleting Memory

All recorded data is deleted. Before deleting recorded data, download the necessary data to the PC.

❖ 4.5, "Transferring Data to the PC" (page 63)



Press these keys simultaneously for 1 sec.

The following window appears:

Recorded data can be deleted through monitoring screen [MONI] or data view screen [VIEW]. After the data is deleted, operation returns to the monitoring screen [MONI].

NOTE

- Note that, once initiated, data deletion cannot be cancelled.
  It takes up to about 30 seconds to delete data.
- Data deletion cannot be executed block by block.

3.5 Viewing Recorded Data [VIEW]

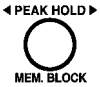
1. Open the data view screen [VIEW].

Press the **RANGE** key and **DATE/TIME** key simultaneously on the monitoring screen [MONI] to open the data view screen [VIEW]. (VIEW lights.)

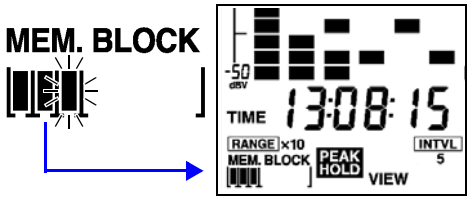
If there is no data stored in memory, an error (E_NULL) will be displayed. Pressing either key returns operation to the monitoring screen [MONI].

❖ 6.4, "Error Indications and Corrective Action" (page 95)

2. Select the memory block.



Press the **MEM.BLOCK** key to select the memory block from which you wish to display data. The last data of the block selected will be shown.



3. Select the data you want to display.

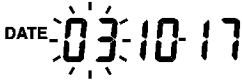
Use the ◀◀ key or ▶▶ key to scroll data recorded in the selected memory block.

3.6 Setting Date and Time

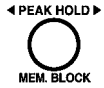
Set the current date and time on the 3144-20. Once saved, the date and time will be stored on the 3144-20.
When the instrument is connected to a PC through the USB cable, the time of the PC's system clock can also be set using the supplied PC software.
❖ 4.4, "Setting the Clock" (page 61)

1. Activate date and time setup mode.

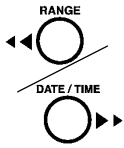
Press the **DATE/TIME** key for 1 sec. on the monitoring screen [MONI] (with the PEAK HOLD function OFF).
The digits of the year flash.



2. Set the date and time.

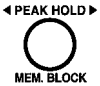


Move the flashing digits to the position you want to change.
Each pressing of **PEAK HOLD** shifts the flashing as follows:
Year → Month → Day → Hour → Minute → Second → End



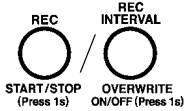
Change the flashing digits.
◀◀ : Values DOWN
▶▶ : Values UP

3. Define the setting.



Move the flashing position to second digit, then press the **PEAK HOLD** key again to define the setting.
Operation returns to the monitoring screen [MONI].

Cancellation of settings



Pressing either key shown at left before defining the settings will cancel the settings, and return operation to the monitoring screen [MONI].

Analysis of Recorded Data (Application Software) Chapter 4

4.1 General

Data recorded on the 3144-20 can be downloaded to a PC and analyzed using the PC software supplied with the instrument.
To download data from the 3144-20, you must install the driver and application of the PC software on the PC beforehand.
❖ (page 58), (page 60)

Operating Environment

Compatible OS	Windows 2000, XP, Vista, 7, 8 (Japanese or English; 64-bit support limited to Windows 7 or 8) The CPU, memory, display, and other hardware environments should conform to those recommended by the OS.
HDD capacity	10 MB or more of disk space
Interface	USB Ver.1.1 or later Only one 3144-20 unit can be connected to the PC at a time.

Composition of CD-R

Folder	File	Explanation
Japanese	driverSetup.msi	Driver Installer (Japanese)
	setup.exe	PC Software Installer (Japanese)
English	driverSetup.msi	Driver Installer (English)
	setup.exe	PC Software Installer (English)

NOTE Select "Small Font" for use with the OS. Using "Large Font" may cause irregularities in screen indications.

4.2 Installing Software Drivers

Perform this procedure before connecting the the instrument to the PC with a USB cable.
If already connected, disconnect the USB cable while you perform the procedure.

Installation Procedure

1. **Log into the PC using the "administrator" account or other account with administrative privileges.**

2. **Exit all applications running on the PC before installing the hardware drivers.**

3. **Execute the following software from the included CD:**
   X:\English\driverSetup.msi (where X: indicates the CD-ROM drive)
   After executing driverSetup.msi, follow the instructions on the screen to continue the installation.

   A warning message will be displayed since the software has not been certified under the Windows logo program. Continue the installation.

4. **Once the installation is complete, the 3144-20 will be automatically detected when the main unit is connected to the PC with a USB cable.**

   If the "Found New Hardware" wizard dialog box is displayed, select **[No, not this time]** under "Can Windows connect to Windows Update to search for software?" and select **[Install the software automatically]**.

When a 3144-20 unit with a different serial No. is connected, the instrument may indicate that a new device has been detected.In such case, install the device driver by following the instructions appearing on the screen.

A warning message will be displayed since the software has not been certified under the Windows logo program. Continue the installation.

Uninstallation Procedure

Select [Control Panel]-[Add and Remove Programs] and delete HIOKI USB Single Driver.

4.3 Installing PC Application Software

Installation Procedure

1. **Log into the PC using the "administrator" account or other account with administrative privileges.**

2. **Exit all applications running on the PC before installing the software.**

3. **Execute X:\English\setup.exe from the included CD. (where X: indicates the CD-ROM drive).**
   After executing setup.exe follow the instructions on the screen to continue the installation.

   A warning message will be displayed since the software has not been certified under the Windows logo program. Continue the installation.

4. **Once the installation is complete, make all the necessary connections and then launch the program by selecting [Programs]-[HIOKI]-[DATA VIEWER for 3144]-[DATA VIEWER for 3144].**

Uninstallation Procedure

Select [Control Panel]-[Add and Remove Programs] and delete HIOKI DATA VIEWER for 3144.

4.4 Setting the Clock

The clock of the 3144-20 can be set to the same date and time as the PC.

1. Switch on the 3144-20 and activate "DATA VIEWER for 3144-20."
2. Connect the 3144-20 and PC by using the USB cable supplied with the instrument (and insert the plugs securely).

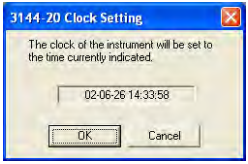
   The 3144-20 will display "USb" and all keys except the POWER switch will be disabled.

NOTE
- Only one 3144-20 unit can be connected to the PC at a time.
- If the 3144-20 is displaying an error, the USB cable will not be recognized even when connected to the 3144-20. Clear the error by pressing any key on the 3144-20.
- When connecting the 3144-20 and a PC by using the USB cable, limit the cable length to less than two meters to avoid effects of noise.

3. Select [**Communication**] - [**Clock setting**] from the menu bar of "DATA VIEWER for 3144-20," or left-click the mouse button on  (Clock) on the toolbar.

   The clock setting window will appear.

4. Left-click the mouse button on [**OK**].



5. When the following window appears, click [**OK**], disconnect the USB cable from the 3144-20 and PC, then switch off the 3144-20.

NOTE

- Dates are valid for the year 2000 and subsequent years. Data may not be handled for other years.
- Clock setting cannot be made while the instrument is recording data.
- When data transfer is not to be made, disconnect the USB cable from the 3144-20.
  Moreover, refrain from plugging in or unplugging the USB cable, unless absolutely necessary. When the instrument is operated on batteries, such action may shorten the time of continuous battery use.

4.5 Transferring Data to the PC

Recorded data is transferred from the 3144-20 to a PC. On the PC, the data can be saved in CSV format.

1. Switch on the 3144-20 and activate "DATA VIEWER for 3144-20" on the PC.
2. Connect the 3144-20 and the PC by using the USB cable supplied with the instrument (and insert the plugs securely).

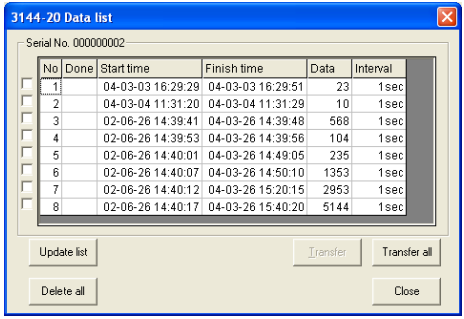
   The procedure is the same as that for "4.4, "Setting the Clock" (page 61).

NOTE

- Only one 3144-20 unit can be connected to the PC at a time.
- Recorded data cannot be transferred while the instrument is still recording.
- When connecting the 3144-20 and a PC by using the USB cable, limit the cable length to less than two meters to avoid effects of noise.
-

3. Select [**Communication**] - [**Data transfer**] from the menu bar of "DATA VIEWER for 3144-20," or left-click the mouse button on  (Transfer) on the toolbar to open the "3144-20 Data list" window.

A listing of files contained in memory of the 3144-20 will appear in the "3144-20 Data list" window.



Item on Screen	Explanation
Transfer all	All data recorded on the 3144-20 is transferred to the PC.
Transfer	Data of the selected file is transferred to the PC. Select the desired file by checking the check box located to the left of the file No.
Update list	The file list of the 3144-20 is acquired again. Execute this command when a 3144-20 unit with a different serial No. has been reconnected while the "3144-20 Data list" window is displayed.
Delete all	All data recorded on the 3144-20 is deleted. Keep in mind that recorded data cannot be restored once deleted.
Close	The "3144-20 Data list" window is closed.

4. Transfer recorded data to the PC.

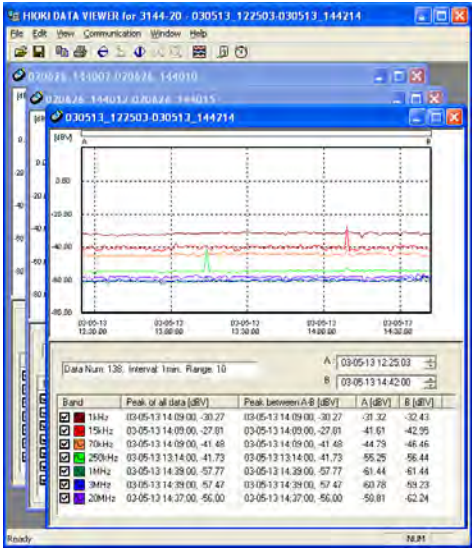
- **To transfer all data**:
  Left-click the mouse button on [**Transfer all**].
  All data recorded on the 3144-20 is transferred to the PC.
- **To transfer selected data**:
  Select the file to be transferred by checking the check box located to the left of the file No., then click [**Transfer**].

NOTE

- While data transfer is in progress, do not plug in or unplug the USB cable. Such action will hinder normal transfer.
- It takes up to about five minutes to transfer recorded data.

5. Left-click the mouse button on [**Close**] to close the "3144-20 Data list" window.

6. When recorded data has been transferred to the PC, a waveform window appears for each file transferred.



7. Save the recorded data that has been transferred.
❖ (page 67)

Delete any recorded data remaining on the 3144-20 that is no longer necessary.
❖ (page 67)

8. Disconnect the USB cable from the 3144-20 and PC, then switch off the 3144-20.

Saving the recorded data that has been transferred

1. Activate (display on top of other windows) the waveform window of the recorded data to be saved by left-clicking the mouse button in the window.
2. Select [**File**] - [**Save As**] from the menu bar or left-click the mouse button on  (Save As) on the toolbar.

   The "Save As" window will appear.
3. Specify the file name and saving location, then left-click the mouse button on [**Save**].
   Execute saving on all waveform windows displayed.
   The files are saved in CSV format, delimited with commas.

Deleting data recorded on the 3144-20

Delete all data recorded on the 3144-20 that is not necessary.

1. Select [**Communication**] - [**Data transfer**] from the menu bar of "DATA VIEWER for 3144-20," or left-click the mouse button on  (Transfer) on the toolbar to open the "3144-20 Data list" window.
   In this operation, leave the USB cable connected.
2. Left-click the mouse button on [**Delete all**] to delete all data recorded on the 3144-20.

NOTE

- It takes about 30 seconds to delete all data.
- Recorded data cannot be restored once deleted. Therefore, before deleting data recorded on the 3144-20, be sure to transfer the data to the PC.
- Recorded data can also be deleted through operation on the 3144-20 only.

❖ 3.4, "Deleting Memory" (page 53)

4.6 Analyzing Recorded Data on the PC

Recorded data saved on a PC can be displayed in waveforms for analysis purposes.

Displaying recorded data

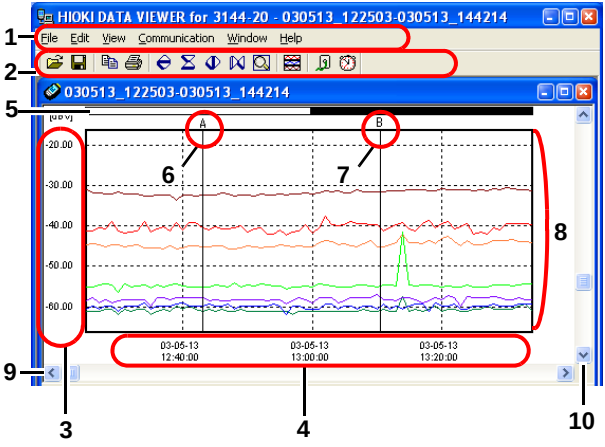
1. Activate "HIOKI Data Viewer for 3144-20."
2. Select [**File**] - [**Open**] from the menu bar or left-click the mouse button on  (Open) on the tool-bar. The "Open file" window will appear.
3. Select the recorded data saved on the PC, then left-click the mouse button on [**Open**].
   The waveform window of the recorded data will appear.

NOTE

- The operation above is not necessary when waveform windows are currently displayed, such as immediately after data transfer has been made from the 3144-20 to the PC.
- Waveforms may not be shown in waveform windows that are overly reduced. In such case, enlarge the window size.

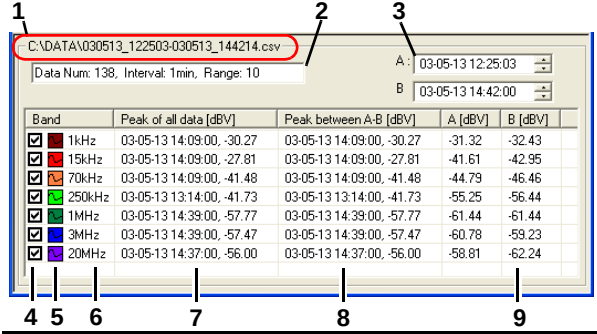
Explanation of Windows

Waveform Window



1	Menu bar	❖ "Menu" (page 71)
2	Toolbar	❖ "Toolbar" (page 73)
3	Level (Vertical axis)	Indication in dBV
4	Date and time (Horizontal axis)	
5	Display range	Indicates the range within which waveforms are displayed among all data.
6	Cursor A	Can be moved around when dragged with the left mouse button held down.
7	Cursor B	Can be moved around when dragged with the left mouse button held down.
8	Data recorded in each frequency range	
9	Horizontal axis scroll bar	Allows movement of the waveform to display when the horizontal axis is displayed in an enlarged size.
10	Vertical axis scroll bar	Allows movement of the waveform to display when the vertical axis is displayed in an enlarged size.

Information Window



1	File name	
2	Settings for recording	Settings of a recording performed with the 3144-20
3	Cursor position	Positions (dates and times) of cursors A and B in the waveform window. The Up and Down buttons located to the right allow corresponding cursor movement right and left.
4	ON/OFF of waveform indication	Allows whether to display the waveform of each frequency range in the waveform window.
5	Waveform color	Allows the waveform color of each frequency range in the waveform window to be changed. Select the desired color in the "Color Setup" window by left-clicking the mouse button, then left-click the mouse button on [**OK**].
6	Name of frequency range	
7	Peak of all data *	Detection times and values of peaks among all recorded data
8	Peak between A-B*	Detection times and values of peaks of recorded data covered between cursors A and B
9	Values of cursors A and B	Measurement values of each frequency range at the positions of cursors A and B

*: When there are multiple peak values, the time of the peak value detected first will be indicated.

Menu

File

Open	Selects a file and opens a waveform window.
Close	Closes the waveform window currently open.
Save As	Saves the recorded data currently open to another file.
Print	Prints waveforms. ❖ 4.8, "Printing a Waveform Window" (page 76)
Preview	Displays a sample of waveform printout.
Print Settings	Used to make print settings. ❖ 4.8, "Printing a Waveform Window" (page 76)
Exit	

Edit

Save Image	Saves the image of a waveform window in a bit map. ❖ 4.7, "Saving Images of Waveform Windows" (page 75)
Copy	Copies the images of a waveform window and information window to the Clipboard. Both images can be pasted to such software as Paint Brush or Word.

View

Zoom In	• Vertical axis: Creates an enlarged view of the vertical axis. • Time axis: Creates an enlarged view of the horizontal axis.
Zoom Out	• Vertical axis: Creates a reduced view of the vertical axis. • Time axis: Creates a reduced view of the horizontal axis.
Total View	Creates a reduced view showing all the data.
Color setting	• 1 kHz to 20 MHz: Allows the waveform color of each frequency range to be changed. • Background: Allows the background color of the waveform window to be changed. • Frame: Allows the frame color of the graph to be changed. • Default: Restores all the colors above to the standard colors.
Independently	Displays the waveforms of each frequency range divided into separate frames.
Toolbar	Allows whether to select display on the toolbar.
Status Bar	Allows whether to select display of the status bar.

Communication

Data transfer	Transfers recorded data from the 3144-20 to a PC. ❖ 4.5, "Transferring Data to the PC" (page 63)
Clock setting	Sets the clock of the 3144-20 to the same time as the PC. ❖ 4.4, "Setting the Clock" (page 61)

Window

New Window	Displays another of the same waveform window.
Cascade	Multiple open waveform windows are displayed in an overlapped form.
Tile	Multiple open waveform windows are displayed side by side.

Help

About Data Viewer for 3144-20	Shows the version information of "DATA VIEWER for 3144-20."

Toolbar

Open
Opens a file.

Save As
Saves a file.

Copy
Copies a window to the Clipboard.

Print
Prints a file.

Enlarge vertical axis
Enlarges the vertical axis of a graph.

Reduce vertical axis
Reduces the vertical axis of a graph.

Enlarge time axis
Enlarges the time base of a graph.

Reduce time axis
Reduces the time base of a graph.

Total View
Displays an entire graph.

Independently
Display a graph in a split form.

Transfer
Transfers recorded data from the 3144-20 to a PC.

Clock
Sets the clock of the 3144-20.

Popup Menu

Right-clicking the mouse button in a waveform window displays the Popup Menu.

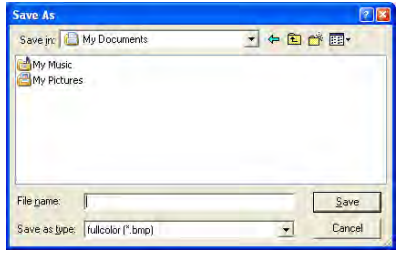
Copy	Performs the same function as [Edit] - [Copy] on the menu.
Zoom In	Performs the same function as [View] - [Enlarge] on the menu.
Zoom Out	Performs the same function as [View] - [Reduce] on the menu.
Total View	Performs the same function as [View] - [Total View] on the menu.
Color settings	Performs the same function as [View] - [Color Setup] on the menu.
Jump	Moves the cursor to the selected position when the time base is displayed in an enlarged size. The position can be selected from: "Start" (Beginning of data), "End" (Terminal end of data), "Cursor A," and "Cursor B."
Put cursor	Moves cursor A or B to the position where right-clicked on the mouse button.

4.7 Saving Images of Waveform Windows

The waveform windows and information windows can be saved in bit maps.

1. Activate (display on top of the others) the waveform window to be saved.
2. Select [**Edit**] - [**Save Image**] - [**Graph and Info.**] or [**Graph only**] from the menu bar.
   - **Graph and Info.**
     Saves the images of a waveform window and information window.
   - **Graph Only**
     Saves the image of a waveform window.

   The "Save As" window will appear.



3. Specify the saving location, file name, and type of file, then left-click the mouse button on [**Save**].
   The desired type of file can be selected from the following:
   - Full-color bit map
   - Monochromatic bit map
   - Gray scale bit map

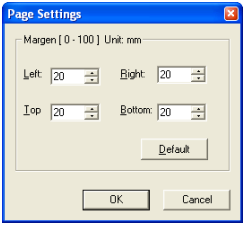
NOTE If any part of an image is hidden, it may not be saved normally. The same applies to copying to the Clipboard.

4.8 Printing a Waveform Window

Waveform images of the recorded data currently displayed can be output to the printer of a PC.

1. Make sure that the printer connected to the PC in use is ready to print.
2. Select [**File**] - [**Print Settings**] - [**Page Settings**] from the menu bar.

   The "Page Settings" window will appear. After setting the margins, if necessary, click [**OK**].



3. Select [**File**] - [**Print Settings**] from the menu bar, then left-click the mouse button on the color in which you wish to print.

   Make a selection according to the printer. "Color," "Gray Scale," or "Monochrome" can be selected.

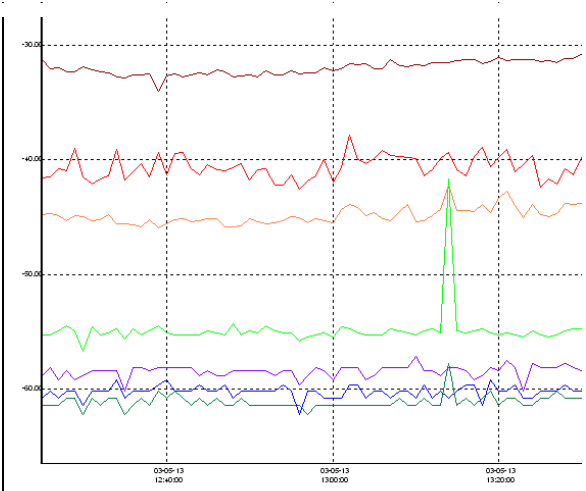
   To check a print image beforehand, select [**File**] - [**Preview**] from the menu bar.
4. Select [**File**] - [**Print**] from the menu bar or left-click the mouse button on  (Print) on the toolbar.

   The "Printer Settings" window will appear.
   For setting the printer, refer to the operation manual of the printer you are using.
5. Start printing by left-clicking the mouse button on [**OK**].

NOTE

- The image printed out may differ depending on the type of printer used.
- If excessively large margins are set, printing may be inhibited. In such case, set smaller margins. Likewise, printing may be inhibited when a paper size too small is selected.

Sample Printout



File Name: 030513_122503-030513_144214.csv
Data Num: 138, Interval: 1min, Range: 10
Cursor position A: 03-05-13 12:25:03 B: 03-05-13 14:42:00

Band	Peak of all data [dBV]	Peak between A-B [dBV]	A [dBV]	B [dBV]
1kHz	03-05-13 14:09:00, -30.27	03-05-13 14:09:00, -30.27	-31.32	-32.43
15kHz	03-05-13 14:09:00, -27.81	03-05-13 14:09:00, -27.81	-41.61	-42.95
70kHz	03-05-13 14:09:00, -41.48	03-05-13 14:09:00, -41.48	-44.79	-46.46
250kHz	03-05-13 13:14:00, -41.73	03-05-13 13:14:00, -41.73	-55.25	-56.44
1MHz	03-05-13 14:39:00, -57.77	03-05-13 14:39:00, -57.77	-61.44	-61.44
3MHz	03-05-13 14:39:00, -57.47	03-05-13 14:39:00, -57.47	-60.78	-59.23
20MHz	03-05-13 14:37:00, -56.00	03-05-13 14:37:00, -56.00	-58.81	-62.24

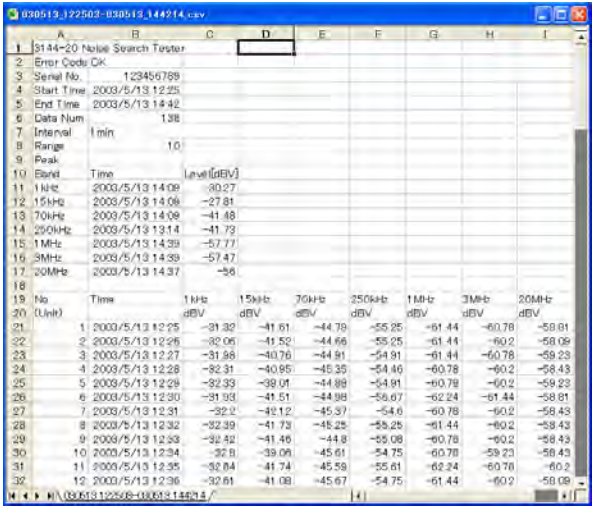
4.9 Analyzing Saved Recorded Data with Excel

The recorded data transferred to and saved on a PC can be loaded to Excel.

NOTE

- Note that data edited with Excel and saved may not be opened with "DATA VIEWER for 3144-20."
- If time must be indicated down to the second on a data sheet of Excel, the cell format must be set.
- The date and time indicated at the end of the "Time" row denote when measurement was completed.

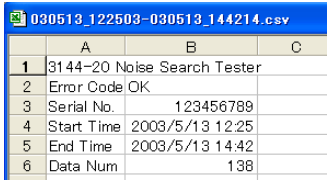
Sample display by Excel



	A	B	C	D	E	F	G	H	I
1	3144-20 Noise Search Tester								
2	Error Code	OK							
3	Serial No.	123456789							
4	Start Time	2003/5/13 12:25							
5	End Time	2003/5/13 14:42							
6	Data Num	138							
7	Interval	1 min							
8	Range	10							
9	Peak								
10	Band	Time	Level[dBV]						
11	1kHz	2003/5/13 14:09	-30.27						
12	15kHz	2003/5/13 14:09	-27.81						
13	70kHz	2003/5/13 14:09	-41.48						
14	250kHz	2003/5/13 13:14	-41.73						
15	1MHz	2003/5/13 14:39	-57.77						
16	3MHz	2003/5/13 14:39	-57.47						
17	20MHz	2003/5/13 14:37	-56						
18									
19	No	Time	1kHz	15kHz	70kHz	250kHz	1MHz	3MHz	20MHz
20	(Unit)		dBV	dBV	dBV	dBV	dBV	dBV	dBV
21	1	2003/5/13 12:25	-31.32	-41.61	-44.79	-55.25	-61.44	-60.78	-59.81
22	2	2003/5/13 12:26	-32.06	-41.52	-44.66	-55.25	-61.44	-60.2	-58.09
23	3	2003/5/13 12:27	-31.98	-40.76	-44.91	-54.91	-61.44	-60.78	-59.23
24	4	2003/5/13 12:28	-32.31	-40.95	-45.35	-54.46	-60.78	-60.2	-58.43
25	5	2003/5/13 12:29	-32.33	-39.01	-44.88	-54.91	-60.78	-60.2	-59.23
26	6	2003/5/13 12:30	-31.93	-41.51	-44.98	-56.67	-62.24	-61.44	-58.81
27	7	2003/5/13 12:31	-32.2	-42.12	-45.37	-54.6	-60.78	-60.2	-58.43
28	8	2003/5/13 12:32	-32.39	-41.73	-45.25	-55.25	-61.44	-60.2	-58.43
29	9	2003/5/13 12:33	-32.42	-41.46	-44.8	-55.08	-60.78	-60.2	-58.43
30	10	2003/5/13 12:34	-32.8	-39.06	-45.61	-54.75	-60.78	-59.23	-58.43
31	11	2003/5/13 12:35	-32.64	-41.74	-45.59	-55.61	-62.24	-60.78	-60.2
32	12	2003/5/13 12:36	-32.61	-41.09	-45.67	-54.75	-61.44	-60.2	-59.09

4.10Error Information

If an error occurs during data recording or file operation, the error information is recorded on the 2nd line of recorded data that is saved on the PC. This information can be checked when the file is loaded to Excel or Memo Pad.



030513_122503-030513_144214.csv

	A	B	C
1	3144-20 Noise Search Tester		
2	Error Code	OK	
3	Serial No.	123456789	
4	Start Time	2003/5/13 12:25	
5	End Time	2003/5/13 14:42	
6	Data Num	138	

The following describes the character strings and contents of error information.

Table of Error Indications

1. Errors arising from the 3144-20

Error	Description
Stop By Battery Low	Recording was stopped due to low battery voltage. Replace the batteries of the 3144-20 with new ones.
Stop By Memory Error	Recording was stopped due to frequent errors that occurred in 3144-20 memory. The error is related to flash memory of the 3144-20. The 3144-20 must be repaired.
Stop By FIFO Error	Recording was stopped due to a FIFO error that occurred in 3144-20 memory. The error is related to flash memory of the 3144-20. The 3144-20 must be repaired.

2. Errors arising from the 3144-20 or USB

Error	Description
Header Memory Error	Error involving abnormal end due to power outage, etc., during data recording, or error arising from USB data reception. Check the 3144-20 and PC connections according to the operation manuals. If this does not resolve the problem, an error involving an abnormal end due to a power outage, incorrect polarity of batteries during data recording, or other similar reason may be the cause.
End Memory Error	
Data Memory Error	
USB File No. Error	Error in the File No. at USB data reception. Check the 3144-20 and PC connections according to the operation manuals.
USB Start Time Error	Error in the recording start time at USB data reception. Check the 3144-20 and PC connections according to the operation manuals.
USB Interval Error	Error in the recording interval at USB data reception. Check the 3144-20 and PC connections according to the operation manuals.
USB Range Error	Error in range information at USB data reception Check the 3144-20 and PC connections according to the operation manuals.
USB End Time Error	Error in the recording end time at USB data reception. Check the 3144-20 and PC connections according to the operation manuals.
USB Data Num Error	Error in data count information at USB data reception Check the 3144-20 and PC connections according to the operation manuals.

2. Errors arising from the 3144-20 or USB

Error	Description
Data Number Error	Error in the data count at USB data reception. There is a discrepancy between the number of data items actually received and the data count information. Check the 3144-20 and PC connections according to the operation manuals, and then try reception again.

3. Errors arising from files stored on the PC

Error	Description
Open Time Error	Error in the recording start time at file opening. Possibility of error in normal file save of information. Or possibility that the file was overwritten using Excel or other application.
Open Interval Error	Error in the recording interval at file opening Possibility of error in normal file save of information. Or possibility that the file was overwritten using Excel or other application.
Open Range Error	Error in range information at file opening Possibility of error in normal file save of information. Or possibility that the file was overwritten using Excel or other application.
Open Peak Error	Error in the peak time at file opening Possibility of error in normal file save of information. Or possibility that the file was overwritten using Excel or other application.
Open Data Error	Data read error at file opening Possibility of error in normal file save of information. Or possibility that the file was overwritten using Excel or other application.

Specifications Chapter 5

5.1 Main Unit Specifications

General Specifications

Configuration of input section	Input terminal dedicated to the 9741. BNC input terminal (with priority given to the 9741)
Input impedance	• Input dedicated to the 9741: 50 Ω±10% (100 kHz) • BNC input: 50 Ω±10% (100 kHz), 1 MΩ±10%/ 120 pF±30 pF (Capacity: 100 kHz) (Selected with manual switch)
Maximum input voltage	5 V_{PEAK}
Maximum rated voltage to ground	5 V
Frequency band-width	500 Hz to 30 MHz Separated into the following seven bands (-3dB band) • 500 Hz to 3 kHz (1 kHz range) • 7.5 kHz to 22.5 kHz (15 kHz range) • 35 kHz to 105 kHz (70 kHz range) • 125 kHz to 375 kHz (250 kHz range) • 0.5 MHz to 1.5 MHz (1 MHz range) • 1.5 MHz to 4.5 MHz (3 MHz range) • 10 MHz to 30 MHz (20 MHz range) (BNC input terminated at 50 Ω)
Measuring range	• ×1 range: 0 dBV [1 V] f.s. Measuring range (0 dBV to -30 dBV) • ×10 range: -20 dBV [0.1 V] f.s. Measuring range (-20 dBV to -50 dBV)
Detection method	Effective value conversion

Detection accuracy	500 Hz to below 1 MHz: ±1.5 dBV 1 MHz to 30 MHz: ±2.0 dBV (BNC input terminated at 50 Ω) Accuracy is not guaranteed when the indicator is on.

Measuring Functions

1. Monitoring function

The measuring voltage level of each frequency range is displayed in levels on an LCD (equivalent to 2.5 dBV/SEG).

2. Logging function

Measurement data and time are saved in internal memory at each preset recording interval.

Internal memory	8 blocks (1 block: Up to 8,000 data items)
Amount of recorded data	Up to 64,000 data items (8 blocks × 8,000 data)
Number of measurements	1 to 8 measurements (depending on number of blocks used in each measurement)
Recording mode	• Automatic Stopping Mode When internal memory becomes full, the measurement is completed (up to 64,000 data items). • Overwrite Recording Mode (CONT) When internal memory becomes full, the measurement continues by overwriting older data. (Guaranteed minimum number of data items: 56,000)
Memory backup	Provided (By backup battery when power is turned off) Life of backup battery: About 5 years (Reference value)
Recording interval	1/ 2/ 5/ 10/ 20/ 30 seconds 1/ 2/ 5/ 10/ 20/ 30/ 60 minutes
Data deletion	All data is deleted.
Recording time	See the attached table (page 85)

Recording Time

(When using AC adapter)

Recording Interval	Automatic Stopping Mode	Overwrite Recording Mode (CONT)
	Max. Recording Time	Guaranteed Minimum Recording Time
1 second	17.7 hours	15.5 hours
2 seconds	1.4 days	1.2 days
5 seconds	3.7 days	3.2 days
10 seconds	7.4 days	6.4 days
20 seconds	14.8 days	12.9 days
30 seconds	22.2 days	19.4 days
1 minute	1.4 months	1.2 months
2 minutes	2.8 months	2.5 months
5 minutes	7.1 months	6.2 months
10 minutes	1.1 years	1 year
20 minutes	2.3 years	2.0 years
30 minutes	3.5 years	3.1 years
60 minutes	7.1 years	6.2 years

3. Data display function

- The recorded data of each frequency range acquired by the logging function is displayed on an LCD, along with the time it was measured.
- The data can be scrolled in the direction of the time base.
- The settings used in logging (measuring range, recording interval, recording mode) are displayed.
- The peak value of data recorded in each frequency range is displayed by the PEAK HOLD function.

4. PEAK HOLD function

The peak value and the peak detection time of each frequency range are displayed by the monitoring function, logging function, or data display function. (Only peak values are displayed when using the data display function.)

5. Output function

Waveform monitoring	Outputs input signals applied through input dedicated to the 9741 or BNC input.
Bandwidth	500 Hz to 30 MHz (-3 dB) (when terminated at 50Ω)
Output resistance	50Ω±10% (1 kHz)
Input/output ratio	2:1 (when terminated at 50Ω)
Output accuracy	±5%rdg.±10 mV (when terminated at 50Ω and 100 kHz)
Max. open voltage	±4.5 V
Audible band monitoring	Outputs an envelope of the detected signal (with volume control provided). Can be monitored through the earphone provided.

Display section

Display unit	TN Type LCD

Power supply

Rated voltage	• When using six LR6 alkaline batteries: 1.5 VDC x 6 • When using the 9445-02 AC ADAPTER or 9445-03 AC ADAPTER: 9 VDC, 500 mA, from rated supply voltage of 100 to 240 VAC(Voltage fluctuations of ±10% from the rated supply voltage are taken into account.), 50/60 Hz, maximum rated current: 250 mA
Maximum rated power	4.0 VA max (9741 included)
Time of continuous use	About 5 hours (when using batteries with monitoring function, and at ambient temperature of 23°C as reference value)

Communicating functions

Description of communication	Data recorded in internal memory of the 3144-20 is transferred to a PC.
Interface	USB Ver1.1

Ancillary functions

Battery life warning	The B mark appears when the supply voltage drops below 6.5 V.
Time setting	The year, month, day, hour, minute, and second are set by key operation.

Environment, standards, and others

Temperature and humidity for guaranteed accuracy	23±5°C (73±9°F), 80%RH or less (non-condensating)
Guaranteed accuracy period	1 year
Operating temperature and humidity	0 to 40°C (32 to 104°F), 80%RH or less (non-condensating)

Storage temperature and humidity	-10 to 50°C (14 to 122°F), 80%RH or less (non-condensating)
Operating environment	Indoors, altitude up to 2000 m (6562-ft.)
Applicable Standards	Safety: EN61010 Pollution degree 2 (anticipated transient overvoltage 330 V) EMC: EN61326 (When using the 9445-03 AC ADAPTER) EN61000-3-2 EN61000-3-3
Effect of conducted radio-frequency electromagnetic field	±5 dB at 3 V (max.)
Dimensions and Mass	Approx. 98W × 179H × 46D mm (3.86"W × 7.05"H × 1.81"D) Approx. 430 g (15.2 oz.) (without batteries)
Accessories	• 9741 CLAMP ON VOLTAGE SENSOR 1 • Carrying case..... 1 • PC software(CD-R)..... 1 • LR6 alkaline batteries ..... 6 • USB cable..... 1 • Strap ..... 1 • 9445-02 AC ADAPTER or 9445-03 AC ADAPTER..... 1 • Earphone ..... 1 • Instruction Manual 1

Application Software Supplied with Instrument

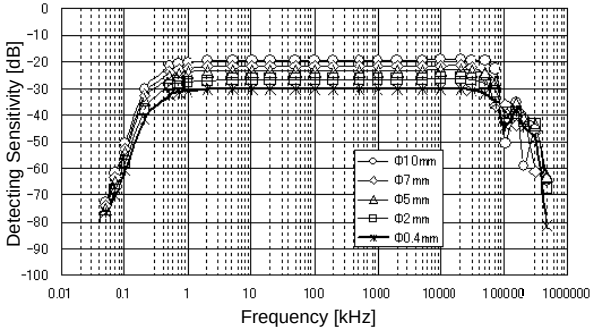
Functions	• Indication of data list • Data download • Indication of time-series data in waveforms • Indication of peak values and peak detection times • Enlarging and reducing functions • Pasting to the Clipboard • Data save • BMP save • Print function

5.2 Clamp Specifications

Sensor structure	Electrostatic coupling type of noncontact voltage sensor
Frequency band	600 Hz to 30 MHz (-3 dB or more with respect to 100 kHz)
Detecting sensitivity	Influence of conductor diameter For Typical Characteristics, see Figure 1 (page 91). (Condition: Conductor located in the center of the clamp) Fluctuation of sensitivity due to conductor position For Typical Characteristics, see Figure 2 (page 91).
Sensor output	Voltage output Outputs voltage corresponding to the detecting sensitivity.
Output impedance	50Ω±10%(1 kHz)
Max. clamp dia.	20 mm dia.
Maximum rated voltage to earth	200 VAC
Cord length	Approx. 1 m (39.37")
Functional ground terminal	Provided
Supply voltage	±5 V (Supplied through connection to the 3144-20)
Maximum rated power	0.5 VA max
Operating temperature and humidity	0 to 40°C (32 to 104°F), 80%RH or less (non-condensating)
Storage temperature and humidity	-10 to 50°C (14 to 122°F), 80%RH or less (non-condensating)
Operating environment	Indoors, altitude up to 2000 m (6562-ft.)

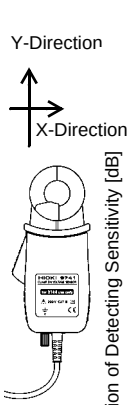
Applicable Standards	Safety EN61010 Pollution degree 2 Measurement Category III, (anticipated transient overvoltage 4000 V) EMC EN61326
Dimensions and Mass	Approx. 62W × 158H × 40D mm (2.44"W× 6.22"H×1.57"D) Approx. 260 g (9.2 oz.)
Temperature and humidity for guaranteed accuracy	23±5°C (73±9°F), 80%RH or less (non-condensating)
Guaranteed accuracy period	1 year

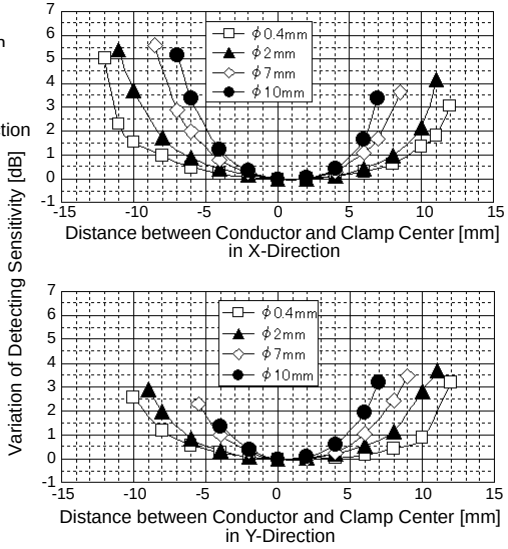
Figure 1. Frequency Characteristics



(Input voltage 1 V)

Figure 2. Fluctuation of Sensitivity due to Conductor Position





(Input voltage 1 V)

Maintenance and Service Chapter 6

6.1 Battery Replacement

⚠WARNING

- Before replacing the batteries, turn off the POWER switch and disconnect the cables to prevent accidents involving electric shock.
- After replacing the batteries, replace the cover and screws before using the instrument.
- Do not mix old and new batteries, or different types of batteries. Also, be careful to observe battery polarity during installation. Otherwise, poor performance or damage from battery leakage could result.

About used batteries

- To avoid the possibility of explosion, do not short circuit, disassemble or incinerate batteries.
- Handle and dispose of batteries in accordance with local regulations.

For precautions on and how to install the batteries, see the following subsection

❖ 2.2, "Installing the Batteries" (page 27)

6.2 Cleaning and Storage

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.

Storage

- To avoid corrosion from battery leakage, remove the batteries from the instrument if it is to be stored for a long time.
- After use, always turn OFF the power.

6.3 Repair and Servicing

⚠CAUTION 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.

- The instrument contains a built-in backup lithium battery, which offers a service life of about five years. 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.
- If the instrument seems to be malfunctioning, confirm that the batteries are not discharged before contacting.
- When sending the instrument for repair, remove the batteries and pack carefully to prevent damage in transit. Include cushioning material so the instrument cannot move within the package. Be sure to include details of the problem. Hioki cannot be responsible for damage that occurs during shipment.

6.4 Error Indications and Corrective Action

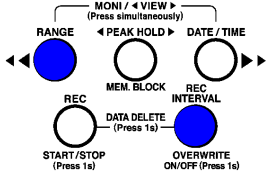
Error Indication	Explanation	Corrective Action
E_Cont	Error at start of recording in Overwrite Recording Mode (CONT) Indicates that memory already contains recorded data.	When recording in Overwrite Recording Mode (CONT) is desired, delete all data in memory. When not desired to delete recorded data in memory, execute recording in Automatic Stopping Mode.
E_FULL	Error at start of recording Indicates that there is no empty memory block.	If recording is still desired, delete all data in memory (this deletes all data). Download the necessary recorded data to a PC before deleting it. Data download (page 63)
E_nULL	Error at execution of memory deletion or switching from the monitoring screen [MONI] to the data view screen [VIEW] Indicates that there is no data in memory.	Memory deletion is not executed. Switching to the data view screen [VIEW] is invalidated.
Error	Other error	Some sort of malfunction is suspected. Conduct self-tests (see 6.5, "System Mode" (page 96)). If the above does not clear the error indication, contact your dealer or Hioki representative.

To clear the error indication, press any key.

6.5 System Mode

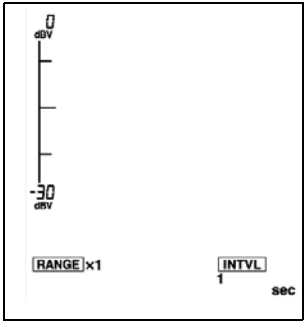
In System Mode, you can display information (program version, serial No.), check indications, conduct self-tests (ROM, data memory), and forcibly delete data memory.

1. Activating System Mode



Turn the power on by pressing the **RANGE** key and **REC INTERVAL** key at the same time.

The following window appears.

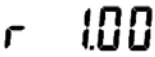


2. Displaying the program version

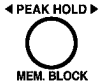
Press 

.

The program version is displayed.

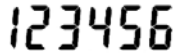


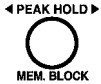
3. Displaying the serial No.

Press 

.

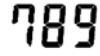
The 6 high-order digits of the serial No. are displayed.



Press 

again.

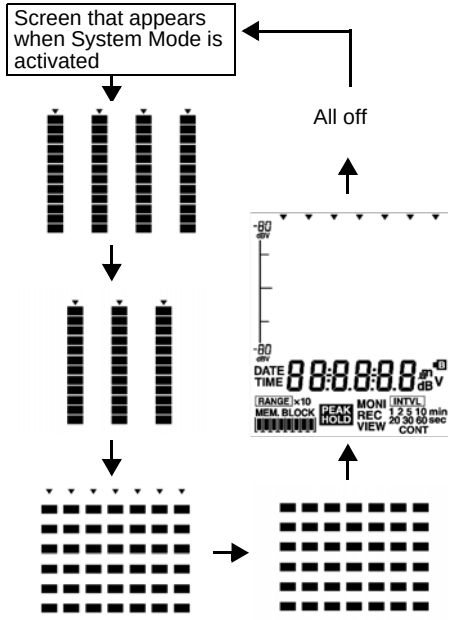
The 3 low-order digits of the serial No. are displayed.



4. Checking indications on the LCD screen

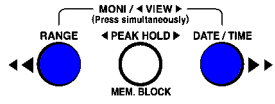
Press DATE / TIME

Each pressing of the key switches indications in the following order:



5. Checking memory

ROM check:



Press the RANGE key and DATE/ TIME key at the same time.

Indication during execution	C_ro	
Indication at the end	good	Normal
	E_ro	Abnormal (Repair required)

When the memory check results in normal, the function will check data memory next. If the memory check results in abnormal, the memory check is terminated.

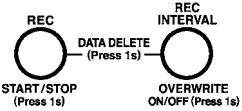
Data memory check:

Indication during execution	C_FL	
Indication at the end	good	Normal
	E_FLSH	Abnormal

NOTE If the data memory check results in abnormal, initialize data memory and repeat the data memory check.

6. Initializing data memory

Discard the data and initialize memory.



Press the **REC** key and **REC INTERVAL** key at the same time.

Indication during execution	CLEAr	
Indication at the end	(No indication)	Normal
	E_CLr	Abnormal (Repair required)

NOTE When data memory is initialized, all data contained in data memory will be discarded.

7. Deactivating System Mode

Turn off the POWER switch.

6.6 Instrument Disposal

This instrument contains a lithium battery for system backup.

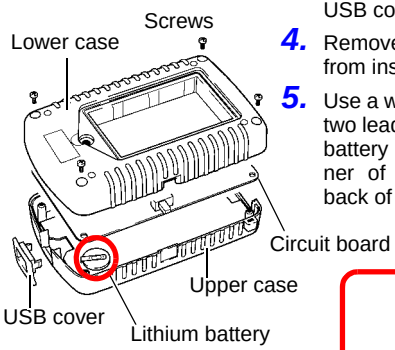
⚠WARNING To avoid electrocution, turn off the power switch and disconnect the AC adapter before removing the lithium battery.

⚠CAUTION

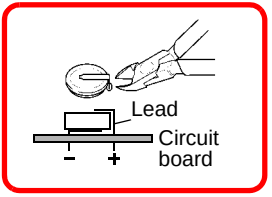
- If the protective functions of the instrument are damaged, either remove it from service or mark it clearly so that others do not use it inadvertently.
- When disposing of this instrument, remove the lithium battery and dispose of battery and instrument in accordance with local regulations.

Required tools

- Phillips screwdriver 1
- Wire cutter 1



1. Turn off the POWER switch, then remove the AC Adapter and batteries.
2. Turn over the instrument, then remove the four screws fastening the lower case.
3. Remove the lower case and USB cover.
4. Remove the circuit board from inside.
5. Use a wire cutter to cut off the two leads of the lithium button battery contained in the corner of the circuit board on back of the upper case.



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

HIOKI

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- For regional contact information, please go to our website at http://www.hioki.com.
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- In the interests of product development, the contents of this manual are subject to revision without prior notice.
-

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