INSTRUCTION MANUAL

SOUND LEVEL METER

NA-28

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Organization of the NA-28 Documentation

Documentation for the Sound Level Meter NA-28 comes in three parts, as listed below.

- **Instruction Manual (this document)**

  Describes operating procedures for the Sound Level Meter NA-28, connection and use of peripheral equipment such as a level recorder and printer, and use of the memory card.

- **Serial Interface Manual**

  Describes communication with a computer, using the serial interface built into the Sound Level Meter NA-28. The manual covers the communication protocol, use of control commands for the sound level meter, format of data output by the sound level meter, and other topics.

- **Technical Notes**

  This document provides in-depth information about sound level meter performance, microphone construction and characteristics, influence of extension cables and windscreen on the measurement, and other topics.

Organization of This Manual

This manual describes the features, operation and other aspects of the Sound Level Meter NA-28 (with 1/3 octave analysis function). If the unit is used together with other equipment to configure a measurement system, consult the documentation of all other components as well. The following pages contain important information about safety. Be sure to read and observe these in full.

This manual contains the following sections.

Outline

Gives basic information about the unit.

Controls and Functions

Briefly identifies and explains the operation keys and connectors and all other parts of the unit.

Preparations

Explains how to check the unit before use and how to install and set up the unit for measurement.

Calibration

Explains how to calibrate the unit for measurement.

Power On/Off

Explains how to operate the power switch of the unit.

Reading the Display

Explains symbols and other information shown on the display of the unit.

Measurement

Explains the basic procedures for measurement.

Store Operation

Explains how to store measurement data.

Memory Card

Explains how to use a memory card with the unit.

Input/Output Connectors

Explains the input and output connectors of the unit.

Default Settings

Lists the factory default settings of the unit.

Setup File

Explains how to start up the unit using settings saved in a setup file.

Optional Accessories

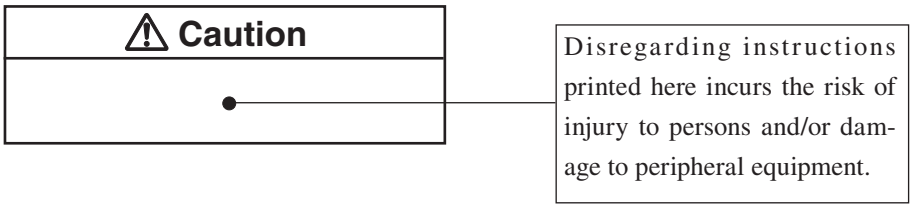
Explains how to use the optional microphone extension cable, printer, and level recorder with the unit.

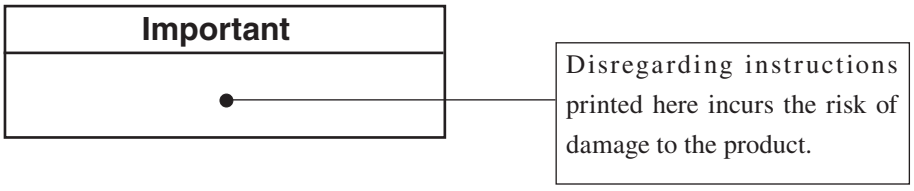
Specifications

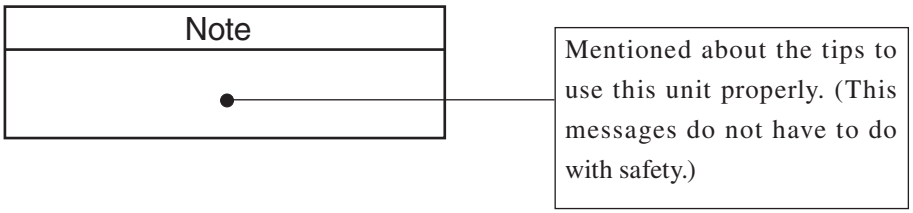
Lists the technical specifications of the unit.

FOR SAFETY

In this manual, important safety instructions are specially marked as shown below. To prevent the risk of death or injury to persons and severe damage to the unit or peripheral equipment, make sure that all instructions are fully understood and observed.







Quantifier notation

(Sound level and sound pressure level are expressed uniformly as sound pressure level, distinguished by the use of frequency weighting.)

	Measurement value	The time weighting characteristics	
		F, S, 10 ms	I
L_p Sound pressure level	A-weighted sound pressure level	L_{AF}, L_{AS}, L_{A10ms}	L_{AI}
	C-weighted sound pressure level	L_{CF}, L_{CS}, L_{C10ms}	(L_{CI})
	Z-weighted sound pressure level	L_{ZF}, L_{ZS}, L_{Z10ms}	(L_{ZI})
L_{eq} Equivalent continuous sound level	Equivalent continuous A-weighted sound level	L_{Aeq}	L_{AIeq}
	Equivalent continuous C-weighted sound level	L_{Ceq}	(L_{CIeq})
	Equivalent continuous Z-weighted sound level	L_{Zeq}	(L_{ZIeq})
L_E Sound exposure level	A-weighted sound exposure level	L_{AE}	(L_{AIE})
	C-weighted sound exposure level	L_{CE}	(L_{CIE})
	Z-weighted sound exposure level	L_{ZE}	(L_{ZIE})
L_{max}, L_{min} Maximum sound level	Maximum A-weighted sound level	L_{AFmax}, L_{ASmax}, $L_{A10msmax}$	L_{AImax}
	Maximum C-weighted sound level	L_{CFmax}, L_{CSmax}, $L_{C10msmax}$	(L_{CImax})
	Maximum Z-weighted sound level	L_{ZFmax}, L_{ZSmax}, $L_{Z10msmax}$	(L_{ZImax})
L_N Percentile sound level	Percentile A-weighted sound level	L_{AFNn}, L_{ASNn}, $L_{A10msNn}$	(L_{AINn})
	Percentile C-weighted sound level	L_{CFNn}, L_{CSNn}, $L_{C10msNn}$	(L_{CINn})
	Percentile Z-weighted sound level	L_{ZFNn}, L_{ZSNn}, $L_{Z10msNn}$	(L_{ZINn})
L_{peak} Peak sound level	A-weighted peak sound level	(L_{Apeak})	---
	C-weighted peak sound level	L_{Cpeak}	---
	Z-weighted peak sound level	L_{Zpeak}	---
L_{tm5} Takt-max sound level	Takt-max A-weighted sound level	L_{Atm5}	---
	Takt-max C-weighted sound level	(L_{Ctm5})	---
	Takt-max Z-weighted sound level	(L_{Ztm5})	---

- Z-weighted level is the same as a existing flat-weighted level.
- The combination of peak sound pressure level and takt-max with I characteristics does not exist.
- Measurement value shown in brackets ( ) indicates items that can be displayed as operation steps but are not used or not suitable.

Quantifier Notation of Sound Level Meter NA-28 According to International Standards and JIS
(Excerpts from ISO 1996, 3891, IEC 61672-1, JIS Z 8202, 8731)

NA-28 notation		Description	Frequency weighting	ISO notation		IEC notation	JIS notation	
L_{Z}		Sound level	Z	L_{p}		—	L_{p}	
L_{A}		A-weighted sound level	A	L_{pA}		—	L_{pA}	
L_{C}		C-weighted sound level	C	—		—	—	
L_{Zeq}		Equivalent continuous sound level	Z	—		—	—	
L_{Aeq}		Equivalent continuous A-weighted sound level	A	$L_{Aeq,T}$		$L_{Aeq,T}$	$L_{Aeq,T}$	
L_{Ceq}		Equivalent continuous C-weighted sound level	C	—		$L_{Ceq,T}$	—	
L_{ZE}		Sound exposure level	Z	—		—	—	
L_{AE}		A-weighted sound exposure level	A	L_{AE}		$L_{AE,T}$	L_{AE}	
L_{CE}		C-weighted sound exposure level	C	—		—	—	
L_{AN}	L_{A05}	Percentile A-weighted sound level	A	$L_{AN,T}$	$L_{A5,T}$	—	$L_{AN,T}$	$L_{A5,T}$
	L_{A10}				$L_{A10,T}$	—		$L_{A10,T}$
	L_{A50}				$L_{A50,T}$	—		$L_{A50,T}$
	L_{A90}				$L_{A90,T}$	—		$L_{A90,T}$
	L_{A95}				$L_{A95,T}$	—		$L_{A95,T}$
L_{Amax}		Maximum A-weighted sound level	A	—		—	—	
L_{Amin}		Minimum A-weighted sound level	A	—		—	—	
L_{Cpk}		C-weighted peak sound level	C	—		L_{Cpeak}	—	

- Z-weighted level is the same as a existing flat-weighted level.

Precautions

- Operate the unit only as described in this manual.
- The NA-28 is a precision instrument. Protect it from shocks and vibrations. Take special care not to touch the microphone diaphragm. The diaphragm is a very thin metal film which can easily be damaged.
- Use only the microphone/preamplifier assembly with the number as shown on the name plate of the unit.
- Ambient conditions for operation of the unit are as follows: temperature range -10 to +50°C, relative humidity 10 to 90%RH.
  Protect the unit from water, dust, extreme temperatures, humidity, and direct sunlight during storage. Also keep the unit away from air with high salt or sulphur content, gases, and stored chemicals during storage and use.
- Always turn the unit off after use. Remove the batteries from the unit if it is not to be used for a long time (a week or more).
- When disconnecting cables, always grasp the plug and do not pull the cable.
- Before using the unit and before putting it away, always check that the microphone grid has not become loose. If this has happened, refasten the microphone grid firmly and then use or store the unit.
- Clean the unit only by wiping it with a soft, dry cloth or, when necessary, with a cloth lightly moistened with water. Do not use any solvents, cleaning alcohol or chemical cleaning agents.
- Do not try to disassemble or alter the unit. In case of an apparent malfunction, do not attempt any repairs. Note the condition of the unit clearly and contact the supplier.
- Do not tap the LCD panel or other surfaces of the unit with a pointed object such as a pencil, screwdriver, etc.
- Take care that no conductive objects such as wire, metal scraps, conductive plastics etc. can get into the unit.

- To ensure continued accuracy, have the unit checked and serviced at regular intervals. Contact the supplier.
- Dispose of the unit and of batteries only according to national and local regulations at the place of use.

To conform to the EU requirement of the Directive 2002/96/EC on Waste Electrical and Electronic Equipment, the symbol mark on the right is shown on the instrument.

Contents

Outline

The Sound Level Meter NA-28 allows octave and 1/3 octave band analysis in real time. It conforms to legal requirements for quantity measurements and to JIS and IEC standards. It supports diffuse sound field measurements and also meets standard requirements when the supplied windscreen is mounted.

The NA-28 consists of the 1/2-inch electret condenser microphone UC-59, preamplifier NH-23, and the main unit. The main unit is equipped with an LCD panel, operation keys, AC and DC output connector, USB port, comparator output, external trigger input, and infrared remote control sensor.

The unit supports real-time octave band analysis in the range from 16 Hz to 16 kHz, and real-time 1/3 octave band analysis in the range from 12.5 Hz to 20 kHz. It is also possible to perform octave and 1/3 octave band analysis simultaneously. (In this case, the upper limit is 8 kHz for octave band and 12.5 kHz for 1/3 octave band.)

Measurement results are stored directly on a CompactFlash memory card (called CF card in this manual).

Communication with a computer is possible via the built-in USB port. Because the USB port conforms to storage specifications, the NA-28 will be recognized as a removable disk when connected to a computer. This allows transfer of data from the CF card to the computer without having to remove the CF card from the NA-28. USB host functionality is also provided, allowing the use of a USB printer.

The infrared remote control available as an option allows control of the NA-28 without a cable link.

The comparator output is an open collector type, which can be used for control of external equipment. Conversely, the trigger input allows control of the NA-28 from another device.

Optional program cards for implementing waveform recording, architectural acoustics measurements and FFT Analysis of measurement are also supported.

The Sound Level Meter NA-28 allows the following quantity measurements.

Main processing (sound level meter mode, analyzer mode)

Simultaneous measurement of all items with selected time weighting and frequency weighting characteristics

- Sound level L_p
- Equivalent continuous sound level L_{eq}
- Sound exposure level L_E
- Maximum sound level L_{max}
- Minimum sound level L_{min}
- Percentile sound level L_N (1 to 99) 1-increment steps, max. 5 values, calculated from L_p or $L_{eq,1sec}$

In sound level meter mode, one of the following measurements can be selected for the sub channel.

- Peak sound level L_{peak}
- Takt-max sound level L_{tm5}

Frequency weighting characteristics are the same as for the sub channel.

- Frequency weighting characteristics A, C, Z
- Time weighting characteristics
  (main channel) F, S, 10 ms
  (sub channel) F, S, 10 ms, I

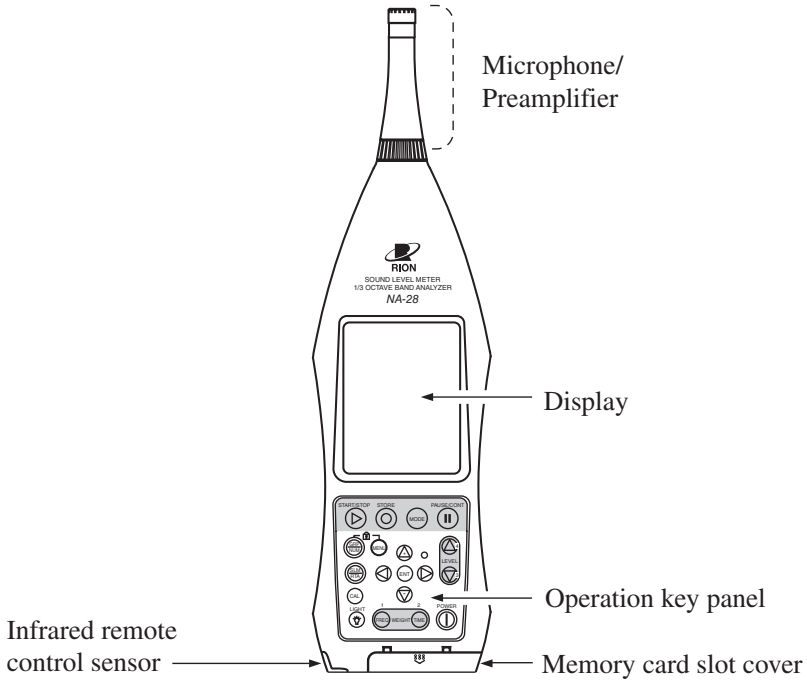
A color LCD with backlight shows measurement parameters and measurement values in sound level meter mode and analyzer mode.

The following options are available separately, to further enhance the range of applications for the product.

- USB printer BL-112UI
  For producing hard copy of measurement data (including stored memory data).
- Level recorder LR-07, LR-20A (No CE)
  For recording sound level changes over time.

Controls and Functions

Front View



Microphone/Preamplifier

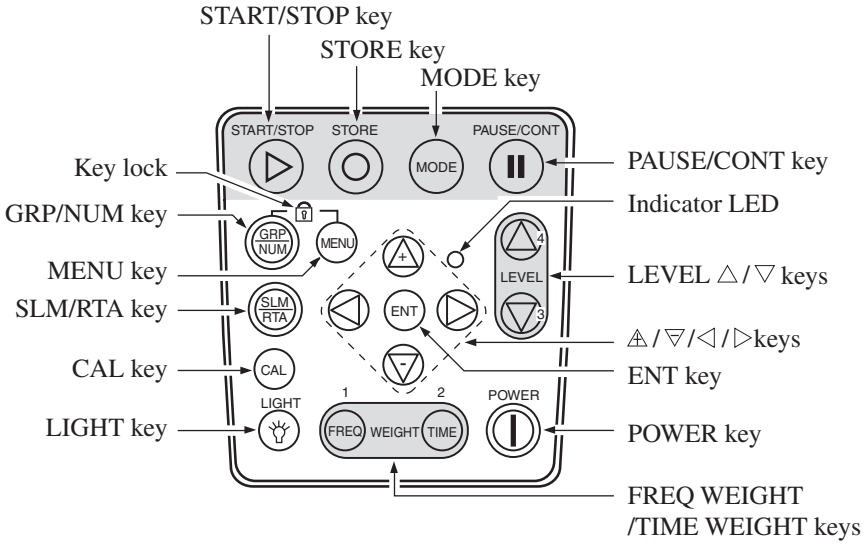
The microphone/preamplifier unit can be detached from the main unit and connected via an optional extension cable. This allows use at a separate location.

Be sure to use only the microphone/preamplifier assembly with the number as shown on the name plate of the unit. Otherwise the product no longer conforms to specifications.

Display

The display of the unit is a backlit LCD panel. It shows the measured sound level as a numeric indication and as a bar graph. It also indicates the operation status of the unit and shows measurement parameters as well as warning indications and other information.

Operation key panel



START/STOP key

Press to start or stop the measurement (including the various processing functions).

STORE key

Serves to start the auto store process or to perform manual store for entering data into the memory.

MODE key

Switches the processing mode.

Each push of this key cycles through the results of the respective processing functions selected on the menu screens.

PAUSE/CONT key

During a measurement, this key can be used to exclude unwanted portions from processing. Press the key to pause measurement, and press the key again to resume measurement.

The back-erase function makes it possible to exclude data from an interval of 5 seconds before the key was pressed from processing.

During pause, the indicator LED flashes in blue.

Indicator LED

Indicates the operation status of the unit by red, blue, and green flashing.

LEVEL △/▽ keys (Level range switching keys)

Serve for selecting the level range for measurement.

In sound level meter mode, the following six settings are available.

20 to 80, 20 to 90, 20 to 100, 20 to 110, 20 to 120, 30 to 130 dB

In analyzer mode, the following six settings are available.

-10 to 80, 0 to 90, 10 to 100, 20 to 110, 30 to 120, 40 to 130 dB

△/▽/◁/▷ keys

These four keys serve for selecting and setting items on menu screens. Holding the △/▽ keys down causes a fast change.

ENT key (Enter key)

Press this key to make or finalize the setting of an item in a menu or any other setting.

When the key is pressed at the sound level measurement screen, the menu list screen comes up.

POWER key

Turns power to the unit on and off. The key must be held down for at least 1 second to take effect.

FREQ WEIGHT/TIME WEIGHT keys

The FREQ WEIGHT key selects the frequency weighting characteristic for the main channel.

The TIME WEIGHT key selects the time weighting characteristic for the main channel.

Frequency weighting and time weighting characteristics for the sub channel can be selected on a MENU screen.

Also, pressing the FREQ WEIGHT key while holding down the MENU key brings up the sub channel frequency weighting characteristics, and pressing the TIME WEIGHT key while holding down the MENU key brings up the sub channel time weighting characteristics.

However, release the keys and press them again for each new setting.

LIGHT key

This key turns on the display backlight, for easier reading in a dark location. Press the key again to turn the backlight off.

When the automatic light out function was selected from the menu, the backlight will turn itself off automatically after the preset time.

CAL key (Calibration key)

This key is used for calibration of the unit and for level calibration of connected equipment.

SLM/RTA key

This key switches between sound level meter display and analysis screen.

MENU key

This key serves to bring up a menu screen for setting measurement parameters and making other settings. Pressing the key again closes the menu.

GRP/NUM key (Graph/Numeric key)

This key switches the measurement screen between graphical and numeric display.

Key lock

Pressing the GRP/NUM and MENU keys together activates the key lock. A red lock symbol appears in the bottom left corner of the display, and the operation keys except for the LIGHT key are disabled.

If a key other than the LIGHT key is pressed, a key lock indication appears.

Pressing the GRP/NUM and MENU keys together once more cancels the key lock.

To turn the unit off, you must first cancel the key lock and then hold down the POWER key.

The key lock does not function on the calibration screen.

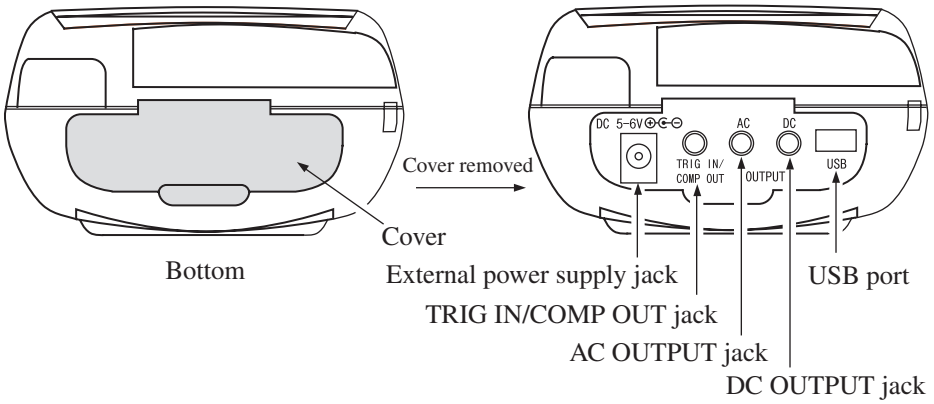
Memory card slot cover

Open this cover to insert or remove the CF card (see page 14).

Infrared remote control sensor

Using an optional infrared remote control allows operation of the unit from a distance.

Bottom View



Cover

This cover protects the connectors on the bottom during transport or storage. Removing the cover gives access to the connectors shown above.

External power supply jack

The supplied AC adapter NC-94A can be connected here for powering the unit from an AC outlet.

Important
To prevent the risk of damage, do not use any AC adapter other than the specified type.

TRIG IN/COMP OUT jack

Allows input of an external trigger signal and output of a comparator signal.

AC OUTPUT/DC OUTPUT jacks

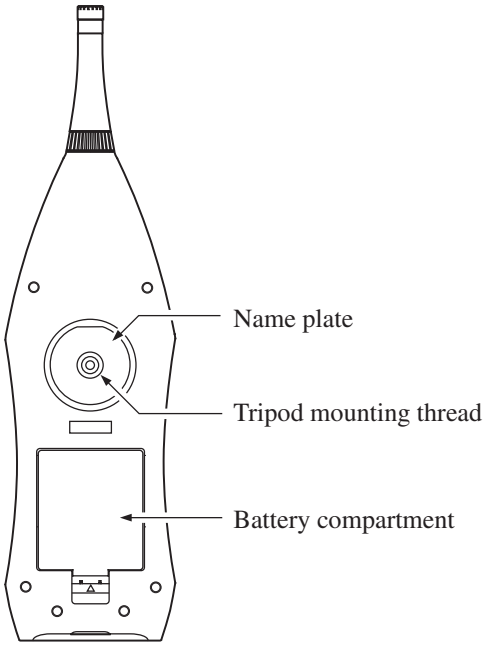
AC OUTPUT: An AC signal with frequency weighting is output here.

DC OUTPUT: A DC signal corresponding to sound pressure level is output here.

USB port

Serves for connection to a computer or a dedicated USB printer.

Rear View



Name plate

Shows various information including model number of the unit, microphone number, preamplifier number, serial number, and date of manufacture.

Tripod mounting thread

The unit can be mounted on a camera tripod using this thread.

Battery compartment

Four batteries (IEC R14, size C) are inserted here.

Preparations

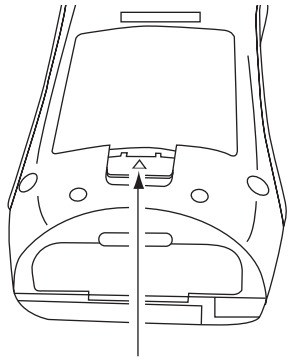
Power

The NA-28 can be powered by four IEC R14, size C batteries (alkaline or manganese), the supplied AC adapter NC-94A.
Rechargeable batteries may also be used, but the NA-28 does not have a facility for charging the batteries.

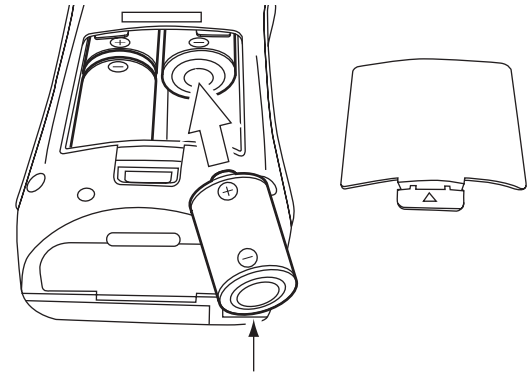
Note
When the AC adapter is connected, the unit will be powered from the adapter, also when batteries are inserted. (The AC adapter has priority.) In case of a power failure or other interruption of AC power, the unit will automatically switch to battery power and continue to operate.

Inserting the batteries

1. Open the cover of the battery compartment as shown below.
2. Insert four IEC R14, size C batteries, paying attention to the polarity as indicated in the compartment.
3. Replace the cover.



Push in the direction of the arrow to open



Four IEC R14, size C batteries (R14P, R14PU or LR14)

Important
Take care not to reverse the (+) and (-) polarity when inserting the batteries. Always replace all four batteries together. To prevent the risk of damage, do not mix old and new batteries or batteries of different type. To prevent the risk of battery fluid leakage, remove the batteries from the unit when the unit is not used.

The life of a set of batteries depends on usage conditions and manufacturers. Some reference values are shown below.

Battery life (at 23°C)	Manganese batteries	R14PU	6 hours
	Alkaline batteries	LR14	16 hours

With alkaline batteries, keeping the display backlight continuously ON will result in a battery life of 10 hours.

When either AC output or DC output is ON, battery life will be about 20 percent shorter.

When auto store is used, battery life will be 10 to 20 percent shorter.

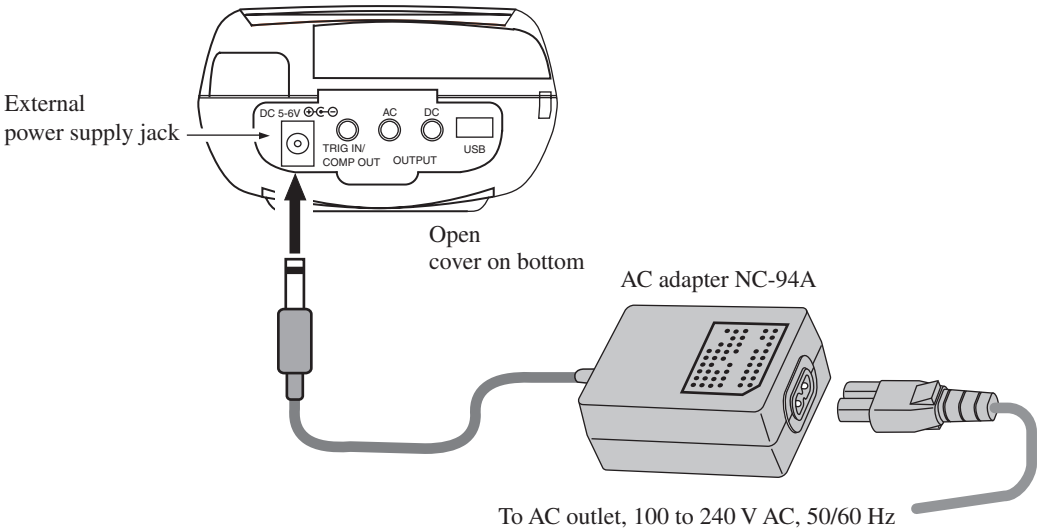
Battery life may also be shorter when the optional program is operating.

Note
In the factory default condition, both AC output and DC output are set to "MAIN". For a slight increase in battery life, you can select [Input/Output] (see page 52) from the menu list screen and set both AC output and DC output to "OFF" (see page 111 to 113).

AC adapter

Connect the AC adapter as shown below.

Important
To prevent the risk of damage, do not use any AC adapter other than the NC-94A.



Backup Battery

The NA-28 uses a backup battery (rechargeable battery) to retain internal settings and memory data and to operate the clock.

While power to the unit is on, the backup battery will be charged.

The relationship between charging time and retention period is shown below.

A full charge of the backup battery is achieved after 24 hours.

Charging time	Retention period
1 hour	2 days
6 hours	8 days
24 hours	30 days

The service life of the backup battery is limited. You should have the battery replaced about once every five years. Please contact your supplier.

Note
When the backup battery is old, the data retention period will be shorter.

Windscreen (WS-10)

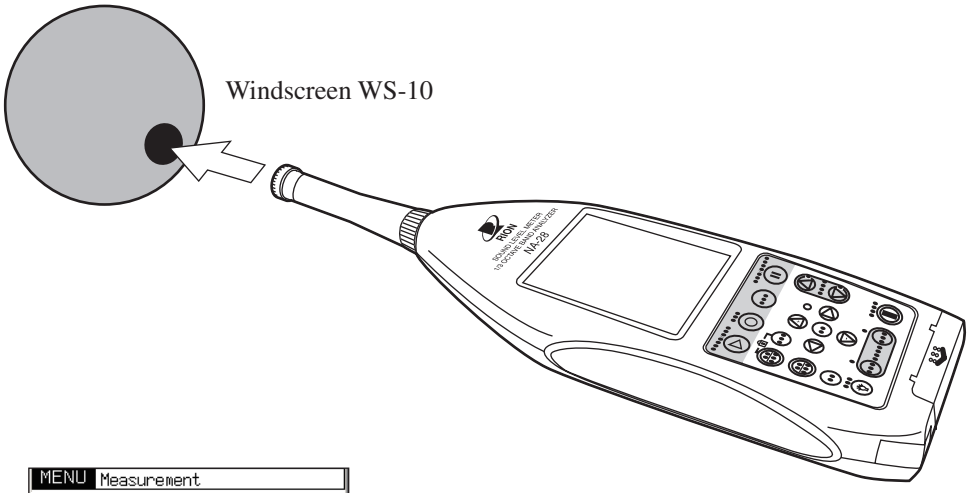
When making outdoor measurements in windy weather or when measuring air conditioning equipment or similar, wind noise at the microphone can cause measurement errors. Such effects can be reduced by using the windscreen WS-10.

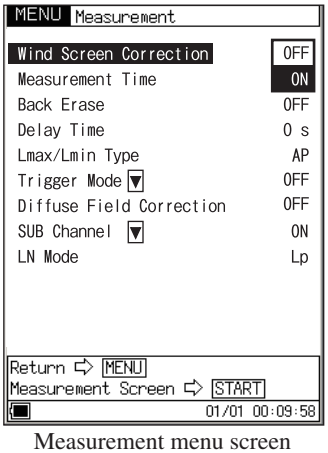
When using the windscreen, set the windscreen correction to ON, as described below.

Mounting the windscreen on the microphone will cause a slight change in frequency response, as shown in the Technical Notes.

You can use the correction to ensure flat frequency response when the windscreen WS-10 is mounted.

1. Select [Measurement] from the menu list and press the ENT key.
2. Select [Wind Screen Correction] from the menu and set it to ON.
3. Press the MENU key to return to the measurement screen.





Measurement menu screen

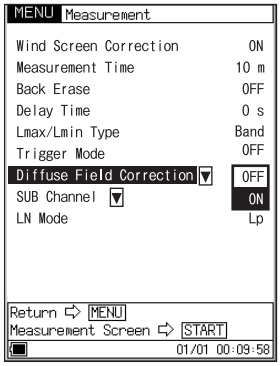
Set Wind Screen Correction to ON

Be sure to set this item to OFF when performing acoustic calibration with a Sound Calibrator, as described on page 36.

Diffuse Field Correction

When using the unit as an ANSI compliant device, set the diffuse field correction to ON.
This compensation feature is designed to ensure flat frequency response in a diffuse sound field.

1. Select [Measurement] from the menu list and press the ENT key.
2. Select [Diffuse Field Correction] from the menu and set it to ON.
3. Press the MENU key to return to the measurement screen.

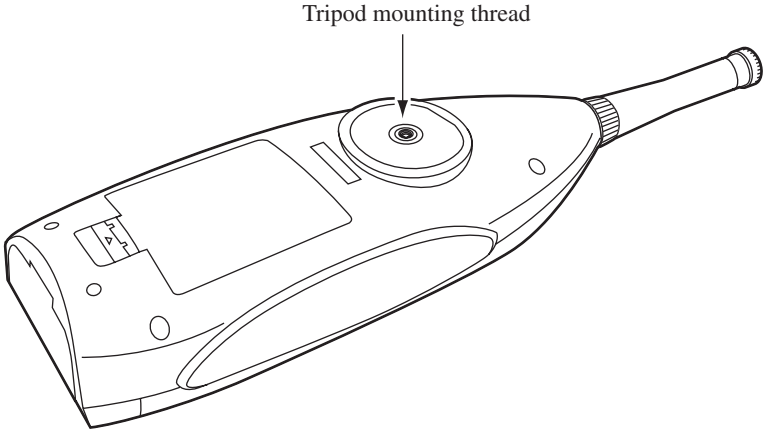


Set Diffuse Field Correction to ON

Measurement menu screen

Tripod Mounting

For long-term measurements, the unit can be mounted on a camera tripod. Proceed carefully, to avoid dropping the unit or tipping over the tripod.



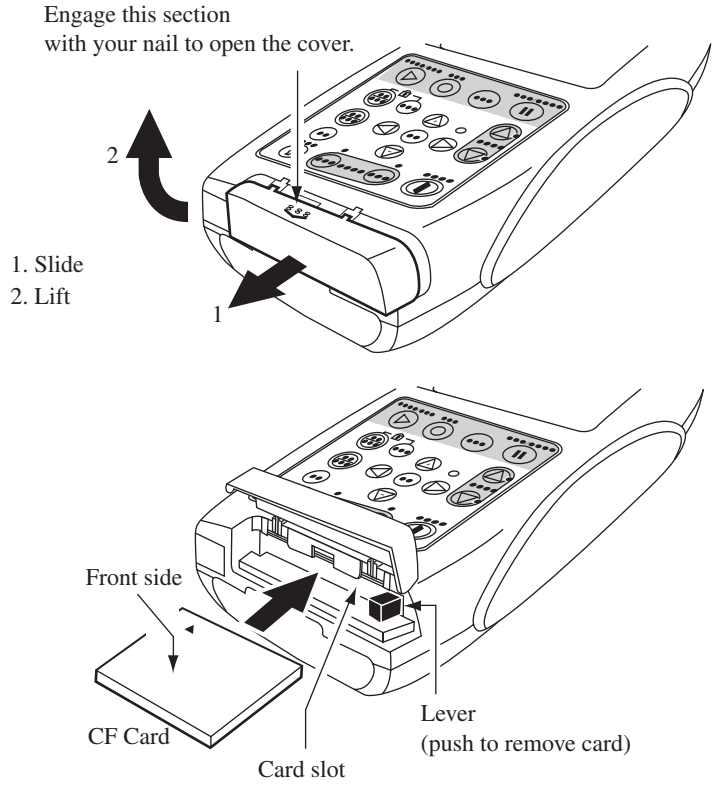
Memory Cards (CF Card) and Program Cards

Measurement data can be stored on a memory card for use and further processing in a computer. Optional program cards can also be used for loading software into the NA-28 to expand the measurement functions of the unit.

Inserting a card

Important
Make sure that power is OFF before inserting or removing a card.

1. Open the memory card slot cover.
2. Insert the card.
   Take care not to try inserting the card with wrong orientation. Push the card in carefully, until it is properly seated.
3. To remove the card, push the black lever. The card will pop out and can be removed.



Microphone Extension Cables (EC-04 series)

Be sure to turn power to the unit OFF before separating the microphone from the main unit.

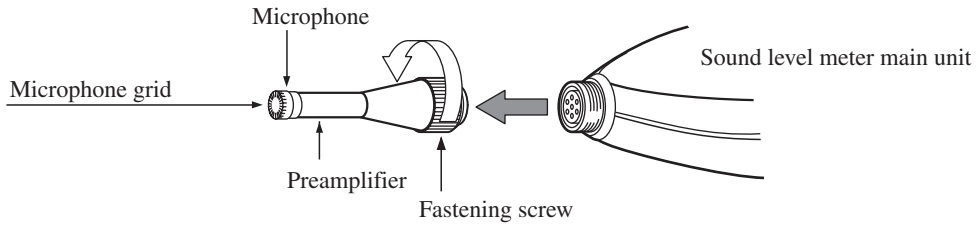
To reduce measurement deviations due to refraction effects and the acoustic influence of the operator, the microphone can be detached from the unit and connected via an extension cable. Available cables are listed in the table below. Cable runs of up to 35 meters are supported for measurement law of Japan. Combining multiple cables is also possible.

Type	Length	Type	Length
EC-04	2 m	EC-04C	30 m (reel) + 5 m (connection cable)
EC-04A	5 m	EC-04D	50 m (reel) + 5 m (connection cable)
EC-04B	10 m	EC-04E	100 m (reel) + 5 m (connection cable)

Important

With long extension cables, the cable capacitance restricts the upper measurement frequency and measurement level. For details, refer to the Technical Notes.

1. Loosen the preamplifier fastening screw and remove the preamplifier from the main unit.



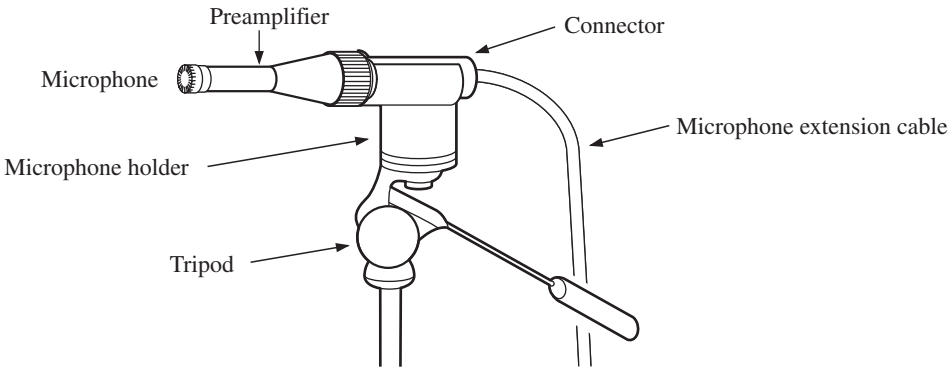
Important

Never separate the microphone and preamplifier, because this can lead to damage.

Before using the unit and before putting it away, always check that the microphone grid has not become loose. If this has happened, refasten the microphone grid firmly and then use or store the unit.

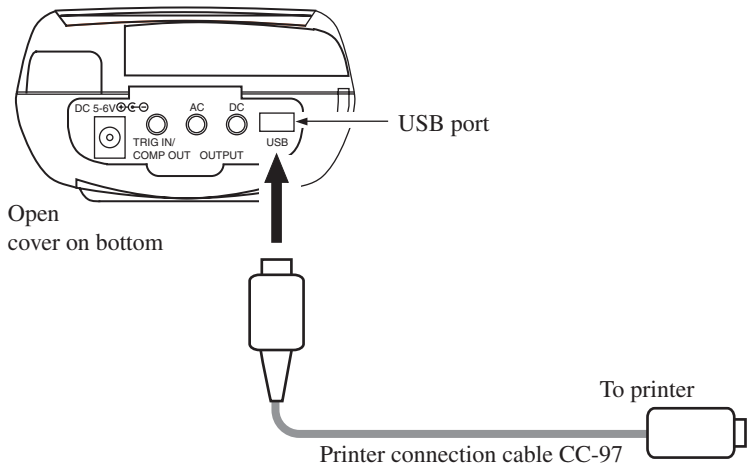
Never remove the microphone grid, because this can lead to damage.

2. Connect the extension cable to the preamplifier and to the main unit and fasten the connectors with the fastening screw.
3. When mounting the microphone on a tripod, first fasten the microphone holder (supplied with the extension cable) to the tripod. Then insert the extension cable connector into the microphone holder.



Connection to a Printer (BL-112UI)

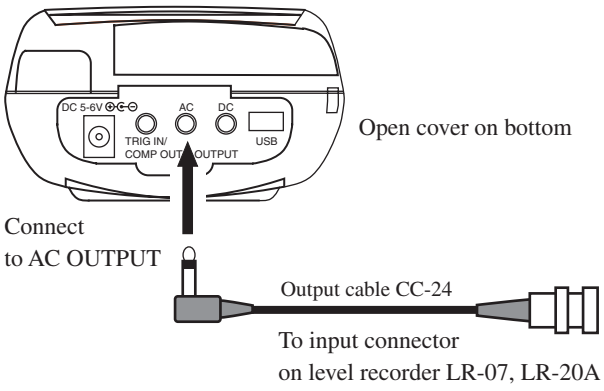
The USB port on the bottom of the unit can be used for connection to a USB printer, using the optional printer connection cable CC-97.



Connection to a Level Recorder (LR-07, LR-20A)

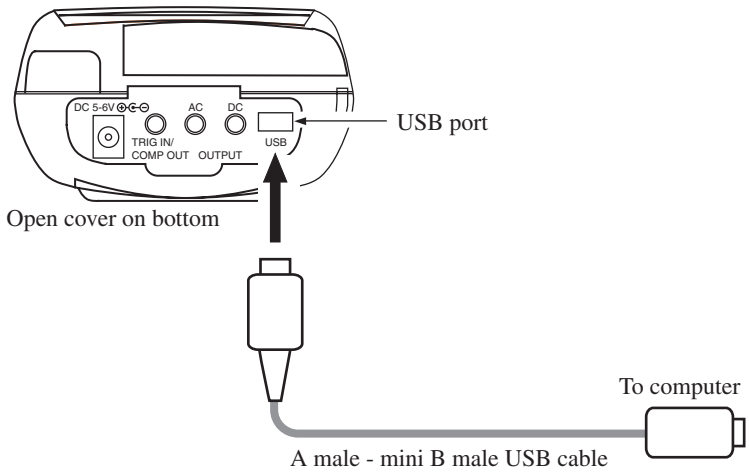
Sound level recording

Connect the AC OUTPUT jack on the bottom to a level recorder, as shown below.



Connection to a Computer

The USB port on the bottom of the unit can be used for connection to the USB port of a computer, using the generic A male - mini B male USB cable.
A memory card inserted in the unit will be recognized as a removable disk by the computer when connected via USB, without having to install a USB driver.
When not using the communication function, set the USB communication to OFF from the [Input/Output] menu screen. When USB communication is enabled, a message requesting installation of a USB driver for USB communication will appear when the unit is connected to a computer.
For detail using the communication function, refer to the serial interface manual for NA-28.

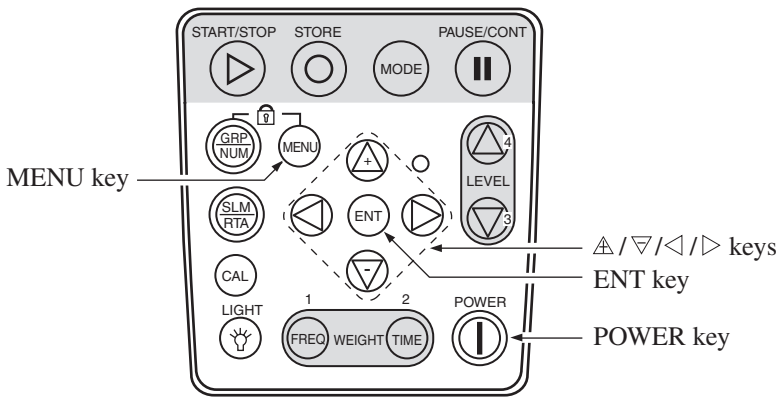


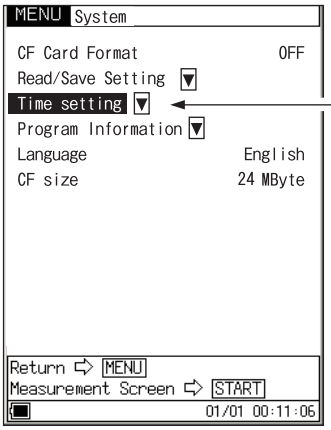
Setting the Date and Time

The NA-28 incorporates a clock which allows recording the date and time along with measurement data.
Set the date and time as described below.

1. Press the POWER key to turn the unit on.
2. Press the MENU key. The menu list screen appears on the display.
3. Use the △/▽/◁/▷ keys to select [System] and press the ENT key.
4. Use the △/▽ keys to select [Time setting] and press the ENT key.
5. Use the △/▽ keys to select [Year/Month/Day] or [Hour/Min/Sec].
6. Use the ◁/▷ keys or the ENT key to select the setting item [Year/Month/Day] [Hour/Min/Sec].
7. Use the △/▽ keys to change the setting of the selected item. Press the ENT key to terminate the setting. The clock starts moving with the new setting.
8. Press the START/STOP key to return to the measurement screen.

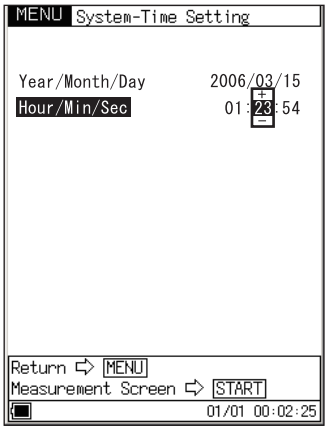
Note
The clock IC used in this unit has an error of about 1 minute per month. Before measurement, be sure to check and set the time if required.





Use △/▽ keys
to select [Time setting]
and press ENT key

System menu screen



Use △/ ▽ keys
to select item to set

Use ◁ / ▷ keys or ENT key
to select digit

Use △/ ▽ keys to change value

Press ◁ / ▷ keys or ENT key
to move to next digit

Press ENT key to accept

Press START/STOP key
to return to the measurement screen

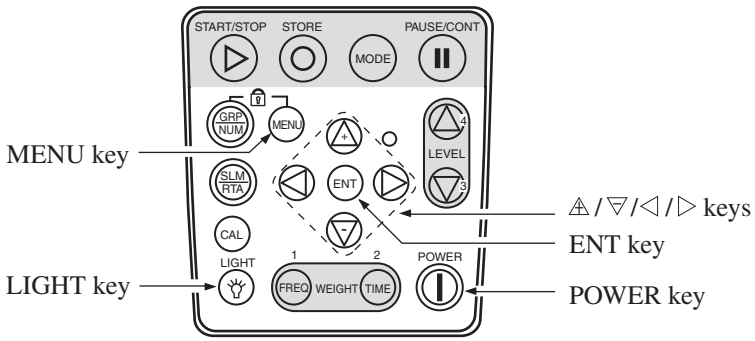
System - Time Setting screen

Note
An internal rechargeable backup battery serves to keep clock setting on the unit. The backup battery is automatically charged by the main batteries, but the retention period for clock setting depends on charging time (see page 11). Full charge of the backup battery requires approximate 24 hours.
If the unit is not to be used for an extended period, the main batteries should be taken out to prevent possible damage due to battery fluid leakage. After reinserting the batteries, be sure to set the date and time.

Measurement in a dark location

Pressing the LIGHT key will turn on the display backlight, for easier reading in a dark location. The backlight operation pattern can be controlled via a menu, as follows.

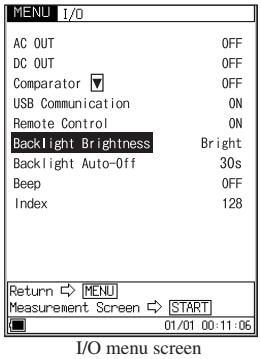
1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [I/O] and press the ENT key.
3. Use the △/▽ keys to select [Backlight Brightness] and press the ENT key.
4. Use the △/▽ keys to select [Bright] or [Dark] and press the ENT key.
5. Use the △/▽ keys to select [Backlight Auto-Off] and press the ENT key.
6. Use the △/▽ keys to select the automatic turn-off interval and press the ENT key.



To turn the backlight off before the automatic turn-off point, press the LIGHT key.

The [Bright] setting for backlight brightness will reduce battery life by about 30 percent, and the [Dark] setting by about 10 percent.

In the case there is only one segment (red) on indication of battery status during store operation on memory card (CompactFlash card), the display backlight does not turn on.



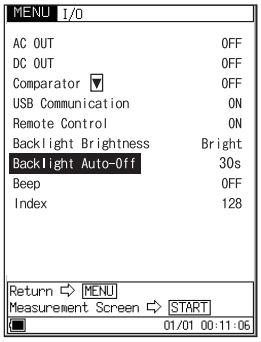
I/O menu screen

Use △/▽keys to select [Backlight Brightness]

Press ENT key

Bright
Dark is displayed

Use △/▽ keys to select desired setting, then press ENT key



I/O menu screen

Use △/▽ keys to select [Backlight Auto-Off]

Press ENT key

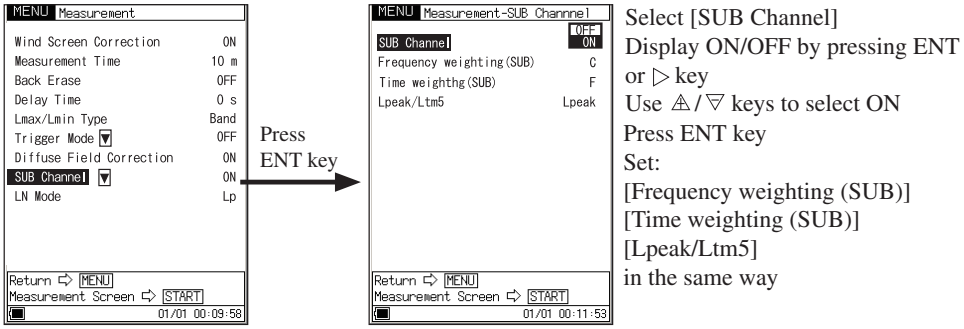
30s
3m
Cont is displayed

Use △/▽ keys to select desired setting, then press ENT key

Sub Channel Settings

To use the sub channel, you must make certain settings on a menu screen.

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [Measurement] and press the ENT key.
   The measurement menu screen appears.
3. Use the △/▽ keys to select [Sub Channel] and press the ENT key.
   The sub channel menu appears (next menu level).
4. Use the △/▽ keys or ENT key to set [Sub Channel] to ON.
5. Use the △/▽ keys or ENT key to set the required frequency weighting and time weighting characteristics.
6. Press the MENU key to return to the previous screen.
   Press the START/STOP key to return to the measurement screen.



Measurement menu screen　　Sub Channel menu screen

Note
There is no frequency analysis function for the sub channel. Only the all-pass value is measured.

Trigger Mode Settings

The NA-28 offers a trigger mode whereby measurement is initiated by one of three kinds of trigger: time trigger (time-controlled triggering), level trigger (sound level controlled triggering), and external trigger (triggering by an external signal).

Time trigger: Measurement is controlled by a start time and stop time setting.

Setting items

Trigger start time, trigger stop time

Trigger interval: OFF, 5, 10, 15, 30 (minutes), 1, 8, 24 (hours)

Sleep mode: ON, OFF

Level trigger 1:

Measurement starts when trigger level is exceeded and ends after a preset duration.

Setting items

Trigger level: 25 to 130 dB, 1-dB steps

Trigger bands: MAIN AP/SUB AP/16 Hz/31.5 Hz/63 Hz/125 Hz ... 16 kHz (1/3 octave bands)

Slope: +, -

Level trigger 2:

Single measurement is made when trigger level is exceeded.

Setting items

Trigger level: 25 to 130 dB, 1-dB steps

Trigger bands: MAIN AP/SUB AP/16 Hz/31.5 Hz/63 Hz/125 Hz ... 16 kHz (1/3 octave bands)

External trigger:

Measurement starts at falling edge of logic-level signal at external trigger connector.

Time Trigger Setting

For Auto1

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [Store] and press the ENT key.
3. Use the △/▽ keys to select [Store Mode] and press the ENT key.
4. Use the △/▽ keys to select [Auto1] and press the ENT key.
5. Press the MENU key to bring up the menu list screen.
6. Use the △/▽/◁/▷ keys to select [Measurement] and press the ENT key.
7. Use the △/▽ keys to select [Trigger Mode] and press the ENT key.
8. The Measurement-Trigger menu screen is shown.
   Select [Trigger Mode] again and press the ENT key.
9. Use the △/▽ keys to select [Time] and press the ENT key.
10. Use the △/▽ keys to select [Trigger Start Time]. Use the ◁/▷ keys or ENT key to respectively select Month, Day, Hour, Minute.
11. Use the △/▽ keys to set the value and press the ENT key.
12. Set [Trigger Stop Time] in the same way.
13. Press the MENU key to return to the previous screen.
    Press the START/STOP key to return to the measurement screen.

For Auto2

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [Store] and press the ENT key.
3. Use the △/▽ keys to select [Store Mode] and press the ENT key.
4. Use the △/▽ keys to select [Auto2] and press the ENT key.
5. Press the MENU key to bring up the menu list screen.
6. Use the △/▽/◁/▷ keys to select [Measurement] and press the ENT key.
7. Use the △/▽ keys to select [Trigger Mode] and press the ENT key.
8. The Measurement-Trigger menu screen is shown.
   Select [Trigger Mode] again and press the ENT key.
9. Use the △/▽ keys to select [Time] and press the ENT key.
10. Use the △/▽ keys to select [Trigger Start Time]. Use the ◁/▷ keys or ENT key to respectively select Month, Day, Hour, Minute.
11. Use the △/▽ keys to set the value and press the ENT key.
12. Set [Trigger Stop Time] in the same way.

Note
If the trigger stop time setting is the same or earlier as the trigger start time setting, the stop time setting will not be valid. Make sure that the trigger stop time setting is later than the trigger start time.

13. Set [Interval Time] in the same way.
14. Press the MENU key to return to the previous screen.
    Press the START/STOP key to return to the measurement screen.

Sleep Mode

If time trigger has been selected for the Auto1 or Auto2 mode, you can enable sleep mode (power-saving standby mode).

When sleep mode is enabled, the unit will enter a power-saving standby condition before the measurement is started and during intervals between measurements. In this mode, power consumption is reduced to about 1/3. The LCD panel is off, and the indicator LED flashes in blue once every 5 seconds (see next page).

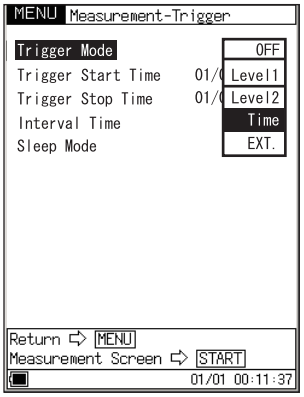
One minute before the start of measurement, the unit will wake up and go into standby until measurement begins.

To check the measurement settings in standby mode, simply press any key except the POWER key. The display will come on temporarily and will turn itself off again if no further operation steps are taken. During standby, the LCD panel is off, and the AC and DC outputs, USB port, remote control, and comparator functions are also disabled. If one of these functions is required, set the sleep mode to OFF.

During time trigger standby, the "store name", "trigger start time", "trigger stop time", and "Interval time" are shown.

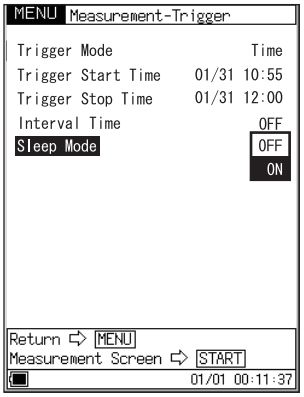
If the sleep mode has been set to OFF, the unit will consume the normal amount of power also during standby.

1. Select [Measurement] from the menu list and press the ENT key.
2. Use the △/▽ keys to select [Trigger Mode] and press the ENT key.
3. The Measurement-Trigger menu screen is shown.
   Select [Trigger Mode] again and press the ENT key.
4. Use the △/▽ keys to select [Time] and press the ENT key.
5. Use the △/▽ keys to select [Sleep Mode] and press the ▷ key or ENT key.
   Use the △/▽ keys to select [ON] and press the ENT key.
6. Press the MENU key several times to return to the measurement screen.



Measurement - Trigger menu screen

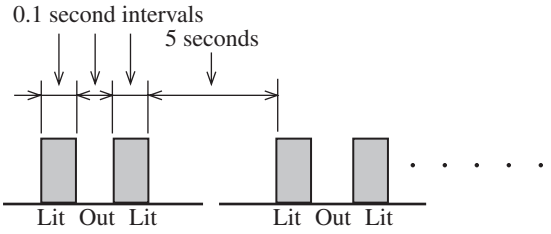
Select "Time" as trigger mode



Measurement - Trigger menu screen

Set sleep mode to ON

In the measurement standby condition, the indicator LED flashes in blue using the following pattern.



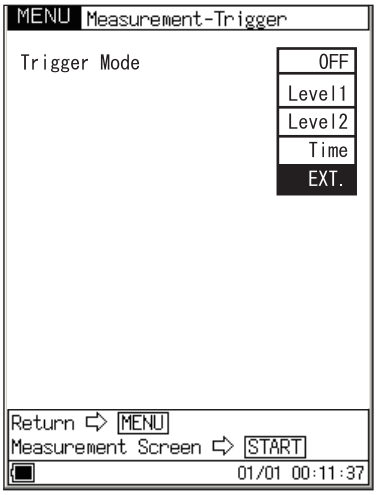
Note
When sleep mode was set to On, power consumption will be reduced to about one third while the unit is in the measurement standby condition (sleep state). In this condition, the remote control, USB, and comparator functions are disabled and the AC and DC output are turned off.
When waking up from the measurement standby condition, a brief high-level signal may appear in the output. This is a transient phenomenon caused by the powering up of internal circuits, and is not a defect.

Level Trigger Setting

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [Measurement] and press the ENT key.
3. Use the △/▽ keys to select [Trigger Mode] and press the ENT key.
4. The Measurement-Trigger menu screen is shown.
   Select [Trigger Mode] again and press the ENT key.
5. Use the △/▽ keys to select [Level∗] and press the ENT key.
   Level1: Measurement starts when trigger level is exceeded and ends when preset measurement time has elapsed.
   Level2: A single measurement is carried out when trigger level is exceeded.
6. Use the △/▽ keys to select [Trigger Level], and use the ▷ key or ENT key to set the value (25 to 130). Then press the ENT key.
7. Use the same procedure to set [Trigger Band], and press the ENT key.
8. When Level1 trigger is used, set the +/- slope.
   For Level2 trigger, there is no slope setting.
   When the setting is complete, press the ENT key.
9. Press the MENU key to return to the previous screen.
   Press the START/STOP key to return to the measurement screen.

External Trigger Setting

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [Measurement] and press the ENT key.
3. Use the △/▽ keys to select [Trigger Mode] and press the ENT key.
4. The Measurement-Trigger menu screen is shown.
   Select [Trigger Mode] again and press the ENT key.
5. Use the △/▽ keys to select [EXT.] and press the ENT key.
6. Press the MENU key to return to the previous screen.
   Press the START/STOP key to return to the measurement screen.

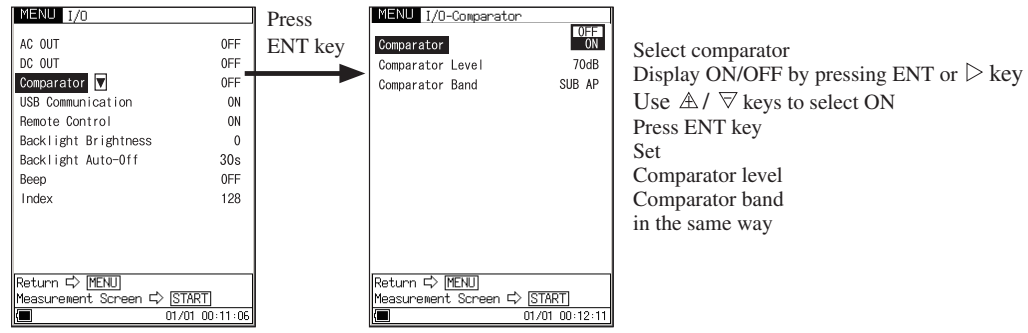


Measurement - Trigger
menu screen

Comparator Output

This is an open collector output that can be used to control external equipment.

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [I/O(Input/Output)] and press the ENT key.
3. The input/output menu screen is shown. Use the △/▽ keys to select [Comparator] and press the ENT key.
4. The I/O - Comparator menu screen appears.
   4-1. Use the △/▽ keys to select [Comparator] and press the ▷ key or ENT key to display the ON/OFF setting. Use the △/▽ keys to select [ON] and press the ENT key.
   4-2. In the same way, select [Comparator Level], set the level, and press the ENT key. (Setting range 25 to 130 dB, 1-dB steps)
   4-3. In the same way, select [Comparator Band], set the band, and press the ENT key. (SUB AP/MAIN AP/12.5 Hz/16 Hz/20 Hz/25 Hz ... 20 kHz, 1/3 octave bands) (see next page)
5. Press the MENU key to return to the previous screen.
   Press the START/STOP key to return to the measurement screen.



I/O (Input/Output) menu screen

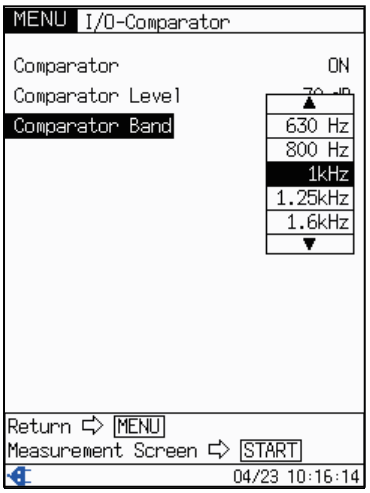
I/O (Input/Output) - Comparator menu screen

Comparator band

Use the △/▽ keys to select [Comparator Band] and press the ENT key. The following menu appears.

Use the △/▽ keys to set the band, and press the ENT key.

When the △/▽ keys are kept pressing, the band values are fast-forwarded.



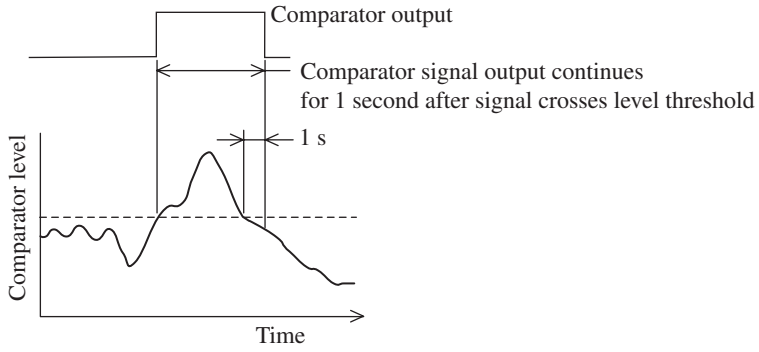
I/O - Comparator menu screen

About the comparator output

When the sub channel is OFF, the comparator will not function if sub channel is selected as comparator band.

Similarly, if analyzer mode is set for simultaneous analysis of octave and 1/3 octave bands, and 16 kHz or 20 kHz is selected as comparator band, the comparator will not function.

The comparator signal output timing pattern is as shown below.

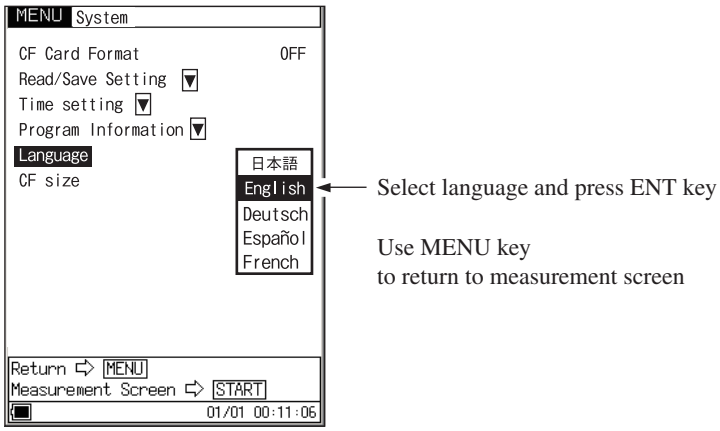


Note
In sound level meter mode, when the sub channel is selected as comparator band, a comparator level bar indication will be shown above the bar graph, but because the bar graph shows the main channel, the comparator indication and the bar graph indication will not be matched.

Language Selection

The language used for displaying messages and menus can be selected as follows.

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [System (Language)] and press the ENT key.
3. The system menu screen appears. Use the △/▽ keys to select [Language], press the ▷ key or the ENT key, and use the △/▽ keys to select the language.
4. Press the ENT key to accept the setting.
5. Press the START/STOP key to return to the measurement screen. The language selection is memorized by the unit and will be active also the next time the unit is turned on.



System menu screen

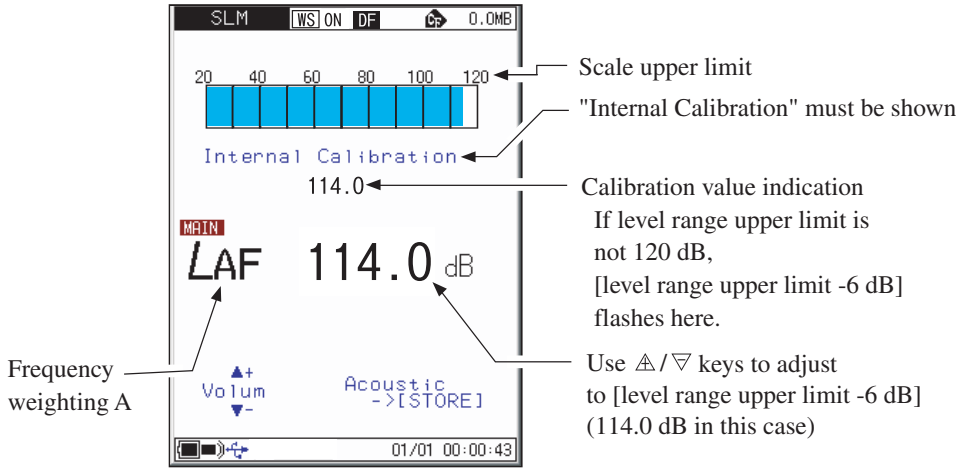
Calibration

Before starting a measurement, the NA-28 must be calibrated. There are two types of calibration, namely electrical calibration using an internally generated signal and acoustic calibration using an external sound calibrator.

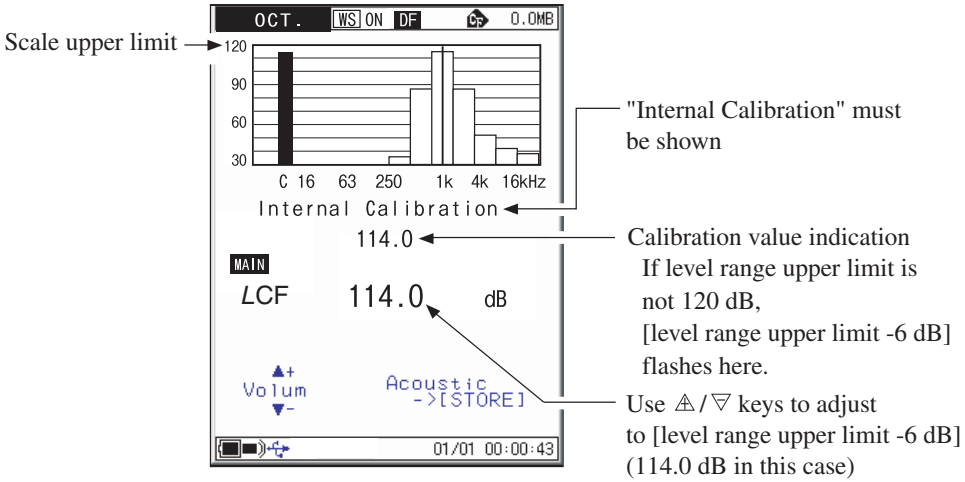
Electrical calibration

Calibration is carried out using a signal generator (1 kHz, sinusoidal wave) built into the unit.

1. Press the POWER key to turn the unit on.
2. Use the FREQ WEIGHT key to set frequency weighting to "A". (This setting cannot be done on the calibration screen.)
3. Use the LEVEL △ / ▽ keys to set the level range to scale upper limit 120 dB.
4. Press the CAL key. A display such as shown below appears.
   If the level range setting is not scale upper limit 120 dB, a value of [level range upper limit -6 dB] will be flashing as the "114 dB" value on the calibration value indication.
   If "Acoustic Calibration" is shown under the bar graph, press the STORE key. The indication will change to "Internal Calibration".
5. Use the ▲/▽ keys to bring the level indication to the specified value (114.0 dB).
6. When calibration to 114.0 dB is completed, press the CAL key once more to return to the measurement screen.



Sound level meter mode indication



Analyzer mode indication

Signal output for calibration of external equipment

The normal level range setting for calibration is scale upper limit 120 dB, but for calibration of external equipment, another level range setting can also be chosen. In this case, "xx dB" flashes on the calibration value indication.

The calibration value indication will always be 6 dB below the upper limit of the level range setting.

Using the AC or DC output, calibration of connected equipment can be carried out as follows.

1. Press the CAL key.
2. Use the ▲/▽ keys to adjust the level indication to scale upper limit -6 dB.

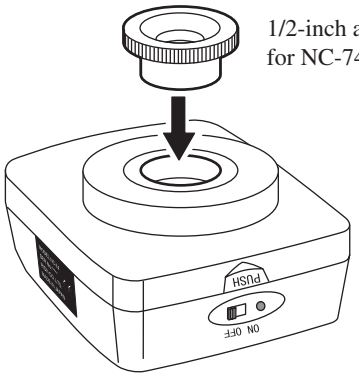
   A calibration signal is supplied at the AC OUTPUT and DC OUTPUT jack on the bottom panel of the NA-28.
3. Press the CAL key once more to return to the measurement screen.

Note
During a measurement of a quantity other than sound level (including when a triangle symbol is flashing in the top left of the display, and when the unit is in pause mode), calibration cannot be performed. Perform calibration after measurement is completed (START/STOP key has been pressed).

Acoustic calibration with Sound Calibrator NC-74

For acoustic calibration, a sound calibrator is mounted to the microphone of the sound level meter, and adjustment is performed so that the reading of the meter is equal to the sound pressure level inside the coupler.

1. Turn off the Sound Calibrator NC-74.
2. Turn on the NA-28.
3. At the measurement screen, use the FREQ WEIGHT key to set frequency weighting for the main channel to "A".
4. Use the LEVEL △ / ▽ keys to set the level range to scale upper limit 120 dB.
5. Mount the 1/2-inch adapter on the coupler of the Sound Calibrator NC-74.



Sound Calibrator NC-74

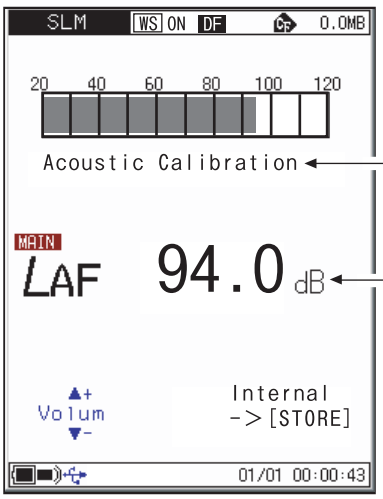
6. Insert the microphone very carefully and slowly all the way into the coupler.

Important
Be very careful when inserting and removing the microphone to and from the sound calibrator NC-74, to avoid a sudden pressure buildup which could destroy the membrane of the microphone.

7. Set the power switch of the Sound Calibrator NC-74 to ON.

8. Press the CAL key. If "Internal Calibration" is shown under the bar graph, press the STORE key. The indication will change to "Acoustic Calibration".
9. Use the △/▽ keys to adjust the reading of the NA-28 to the value shown below.
   Sound Calibrator NC-74: 94.0 dB
10. Press the CAL key. The measurement screen returns.
11. Turn off the Sound Calibrator NC-74 and the NA-28.
12. Remove the microphone very carefully and slowly from the coupler.

Note
For details on the Sound Calibrator NC-74, refer to the documentation of that product.



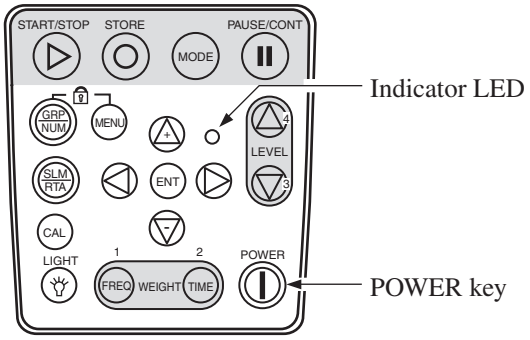
Sound level meter mode indication

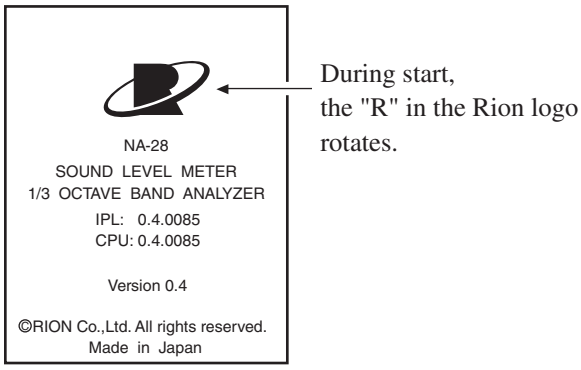
Power On/Off

To turn the unit on

Hold down the POWER key until the power-on screen (mosaic pattern Rion logo mark) appears (at least 1 second). When the screen is shown, release the POWER key. After the unit has been started, the measurement screen appears.

During start up, the indicator LED flashes blue → green → red.



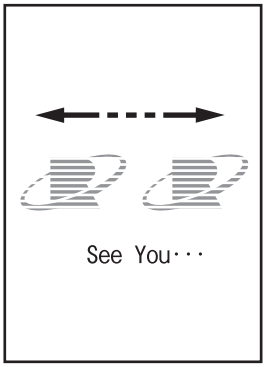


Power-on screen

To turn the unit off

Hold down the POWER key until the unit is turned off (several seconds). When the power-off screen appears, release the POWER key.

Note
After turning the unit off, wait at least 10 seconds before turning it on again.
If the key lock has been activated, pressing the POWER key has no effect. Press the GRP/NUM key and MENU key simultaneously to cancel the key lock condition, and then press the POWER key.

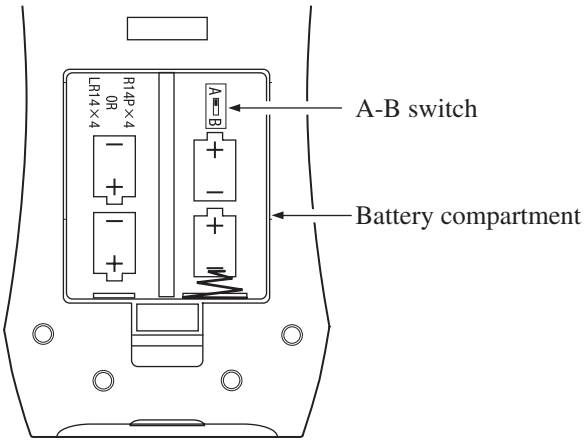


The Rion logo separates into two parts and goes off.

Power-off screen

Power-on mode

Opening the battery compartment as shown below gives access to a switch labeled "A-B". Normally the "A" position is used. Setting this switch to the "B" position allows the NA-28 to be turned on simply by supplying power to the external power supply jack. In this case, the POWER switch on the operation panel of the NA-28 has no effect.

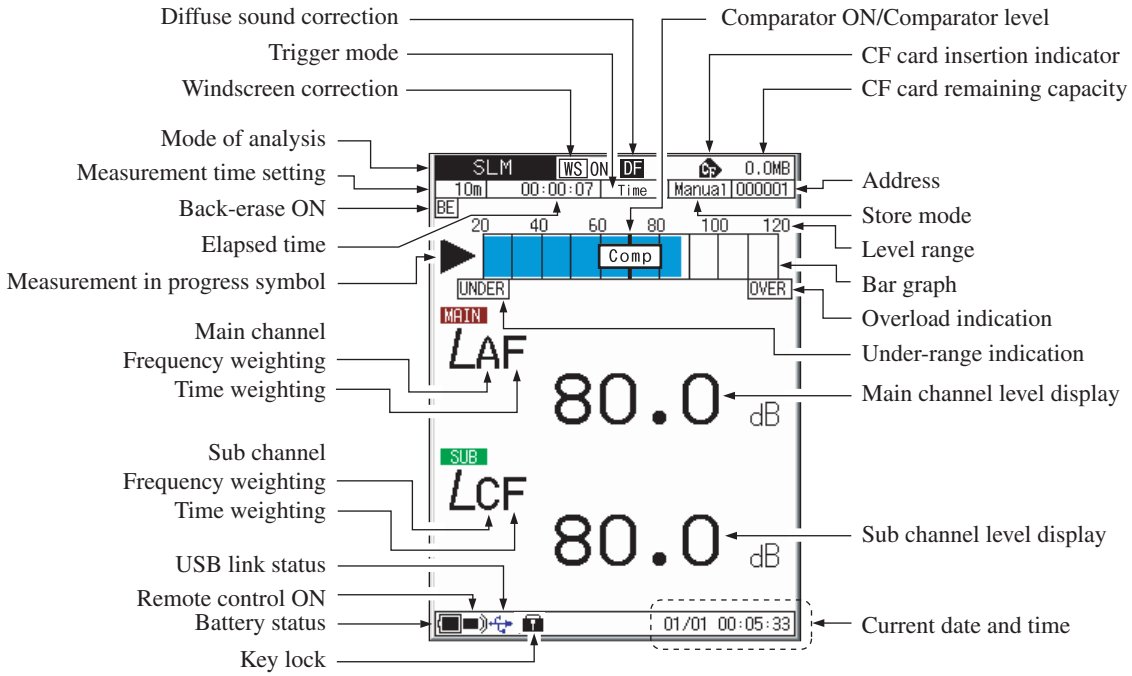


When using the unit with the switch in the "B" position, do not insert batteries.

Reading the Display

Sound level meter display

The illustration below shows all elements of the display for explanation purposes. In actual operation, such a screen will not be shown, and the size and font of the actual display may be slightly different.



Comparator ON/Comparator level

When the comparator function has been set to ON, the comparator level is shown as an orange line on the bar graph. When a signal exceeds that level, the indication [Comp] appears, and a signal is output from the COMP OUT jack on the bottom panel (open collector).

CF card insertion indicator

Shown when a CF card is inserted in the unit.

CF card remaining capacity

Shows the remaining capacity of an inserted CF card.

Address

Shows the current memory address. In manual store mode, the indication is red if there are data in that address. In Auto1 mode, the store cycle is shown.

Store mode

Shows the selected mode for storing data in memory (Manual, Auto1, or Auto2).

Level range

Shows the upper and lower limit of the bar graph. Can be switched with the LEVEL △ / ▽ keys.

Bar graph

Shows the sound level as a bar graph indication. (The display is updated every 100 msec.)

Overload indication

When a signal overload condition is detected, the indication **OVER** (white on black) is shown for at least 1 second. If this indication appears frequently, use the LEVEL △ / ▽ keys to increase the level range setting.

If processed data contain signal overload data, the indication OVER is shown. This indication remains on the display until the next processing measurement is started.

Under-range indication

When a signal under-range condition is detected, the indication **UNDER** (white on black) is shown. If this indication appears frequently, use the LEVEL △ / ▽ keys to decrease the level range setting.

If processed data contain signal under-range data, the indication UNDER is shown. This indication remains on the display until the next processing measurement is started.

Note
When the sub channel is set to On, the under-range indication is based on the frequency weighted measurement value in the channel in which the measurement lower limit is lower.
When A-weighting and C-weighting, or A-weighting and Z-weighting are selected (in either channel), the under-range indication is based on the A-weighted measurement value.
When C-weighting and Z-weighting are selected, the under-range indication is based on the C-weighted measurement value.

Main channel level display

Shows the measured sound level in the main channel. (The display is updated every second.)

Sub channel level display

Shows the measured sound level in the sub channel. (The display is updated every second.)

Current date and time

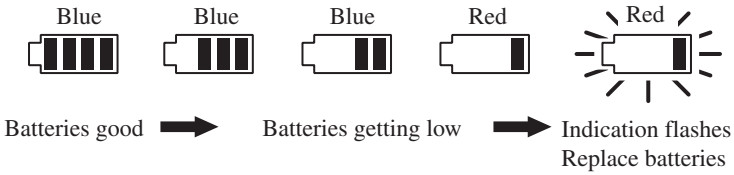
Shows the current date and time.

Key lock

Pressing the GRP/NUM key and MENU key simultaneously activates the key lock condition and causes this symbol to appear. To cancel the condition, press the GRP/NUM key and MENU key once more together.

Battery status

When the unit is operated on battery power, you should regularly check this indication. The number of blue segments will decrease as the batteries get used up. When the indication starts to flash, replace the batteries with a fresh set.



When the unit is being powered from an AC adapter, power plug symbol ( ) is shown.

Remote control ON

This indication is shown when infrared remote control of the unit has been enabled.

USB link status

When the unit has been connected as a removable disk, this symbol is shown in blue. When USB communication has been enabled, symbol is shown in green.

Sub channel time weighting

Indicates the sub channel time weighting characteristic.

F: Fast, S: Slow, τ : 10 ms, I: Impulse

The sub channel time weighting characteristic is set from a menu.

Sub channel frequency weighting

Indicates the sub channel frequency weighting characteristic.

A: A-weighting, C: C-weighting, Z: Z-weighting (Flat response)

The sub channel frequency weighting characteristic is set from a menu.

Main channel time weighting

Indicates the main channel time weighting characteristic.

F: Fast, S: Slow, τ : 10 ms

Main channel frequency weighting

Indicates the main channel frequency weighting characteristic.

A: A-weighting, C: C-weighting, Z: Z-weighting (Flat response)

Measurement in progress symbol

When a measurement is in progress, the ▶ symbol flashes. The indicator LED also flashes in green.

During auto store, the ▶ symbol also flashes. The indicator LED flashes in red.

During measurement standby, the ■ symbol is shown.

During measurement pause, the II symbol is shown. The indicator LED flashes in blue.

Elapsed time

Shows the elapsed time in seconds during processing and during memory store.

Back-erase ON

Indicates that the back-erase function has been set to ON.

Measurement time setting

Shows the measurement time that has been set with the menu. The available setting range is 1 sec (second) to 1000 h (hours).

However, the maximum measurement time is 24 hour when store mode is Manual or Auto2

Mode of analysis

Indicates the condition of the display screen.

SLM:	Sound level meter display
OCT.:	Octave band analysis screen
1/3OCT.:	1/3 octave band analysis screen
OCT&1/3OCT:	Simultaneous octave and 1/3 octave band analysis screen

Windscreen correction

[WS OFF] symbol is shown when windscreen correction is OFF.

[WS ON] symbol is shown when windscreen correction is ON.

Trigger mode

Controls the measurement and memory store start behavior. Available modes are Level1, Level2, Time, and EXT.

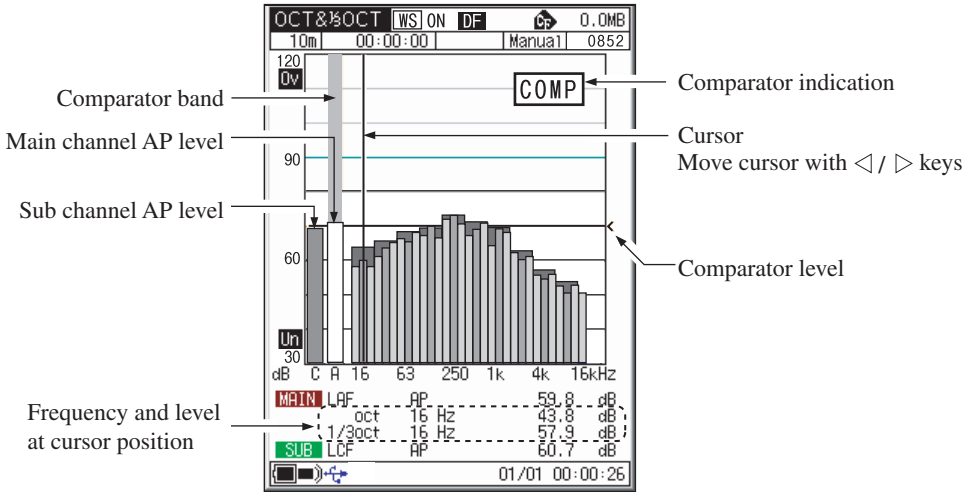
Diffuse sound correction

Indicates that the unit has been set up for measurement in a diffuse sound field.

Analysis screen

An example for the OCT & 1/3 OCT analysis screen is shown below.

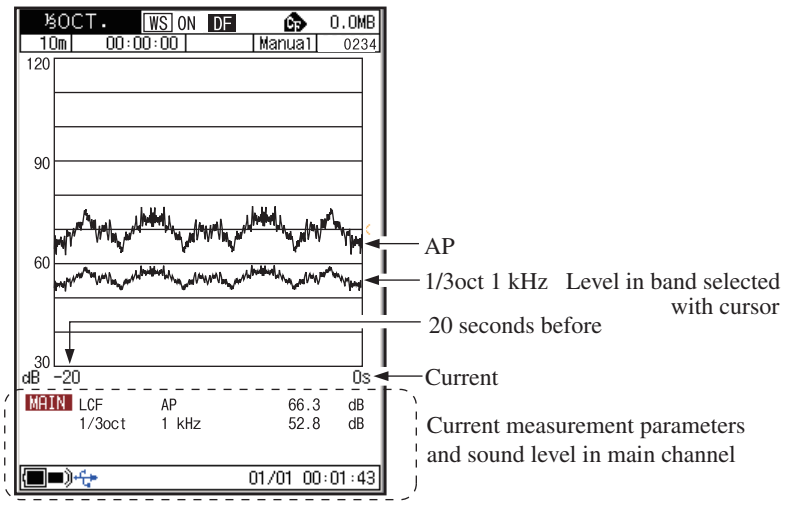
Use the ◁ and ▷ keys of the △/▽/◁/▷ keys to move the cursor to the target frequency.



OCT & 1/3OCT analysis screen

T-L (Time/Level) display screen

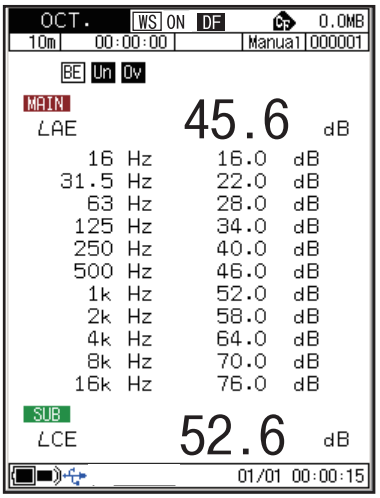
An example for the 1/3 OCT. analysis screen is shown below.



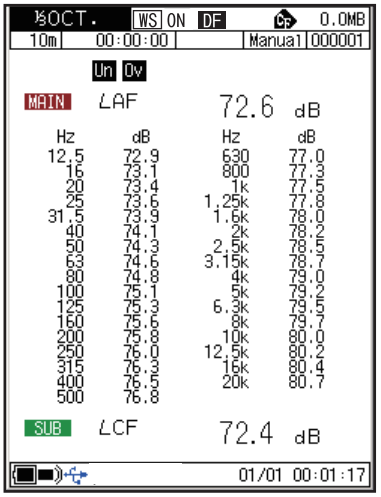
T-L display screen

Numeric display screen

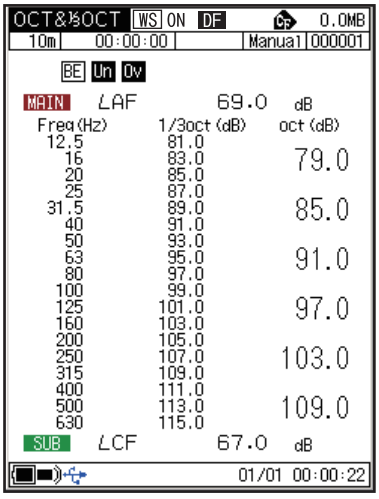
Examples for OCT., 1/3 OCT., and OCT & 1/3 OCT analysis screens are shown below.



Numeric display (OCT) screen



Numeric display (1/3 OCT) screen



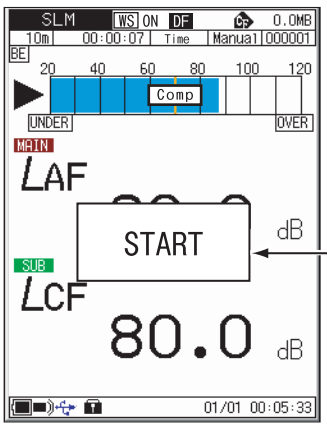
Numeric display (OCT, 1/3 OCT) screen

Frequencies that are currently not displayed can be called up with the ◁/▷ keys.

Indicator messages

When keys such as START/STOP or STORE are pressed, indicator messages such as shown below will appear on the display for about 1 second.

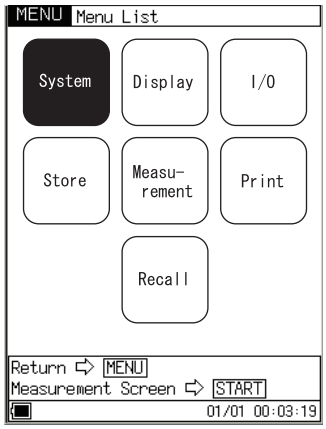
START	When START/STOP key was pressed and processing has started
STOP	When START/STOP key was pressed and processing has ended
STORE 0003	When STORE key was pressed (store address is also shown)
PAUSE	When PAUSE/CONT key was pressed and operation is paused
BACK ERASE	When PAUSE/CONT key was pressed during processing (with back-erase function set to ON)
CONTINUE	When PAUSE/CONT key was pressed and processing has resumed



Indicator message display example

Menu List Screen

Pressing the MENU key brings up the menu list screen as shown below. Use the △/▽/◁/▷ keys to select the desired menu and press the ENT key.



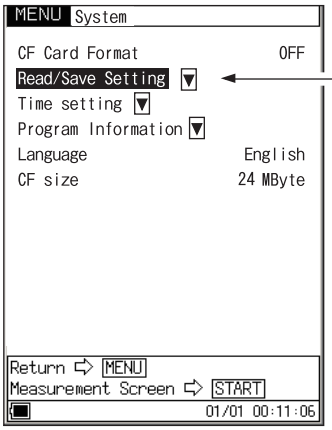
Menu list screen

System

Use the △/▽/◁/▷ keys to select [System] and press the ENT key. The system menu comes up.

CF Card Format — OFF/EXEC. (can only be selected when CF card is inserted)

1. Use the △/▽ keys to select [CF Card Format] and press the ENT key.
2. Use the △/▽ keys to select EXEC. and press the ENT key.

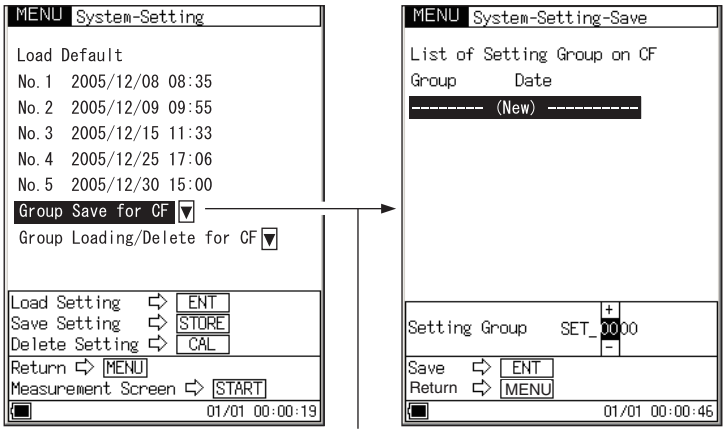


Symbol shows that a next menu level exists. Use △/▽/◁/▷ keys to select the item and press the ENT key. The next menu level appears.

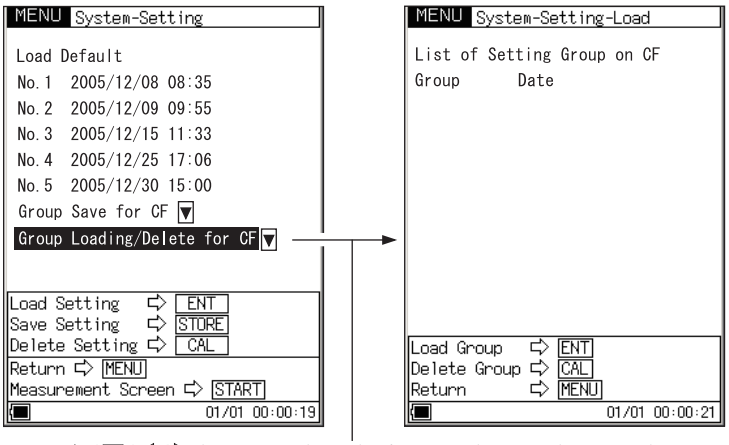
System menu screen

Read/Save Setting ▼

Bring the cursor to [Read/Save Setting] and press the ENT key. The [System - Setting] screen appears.



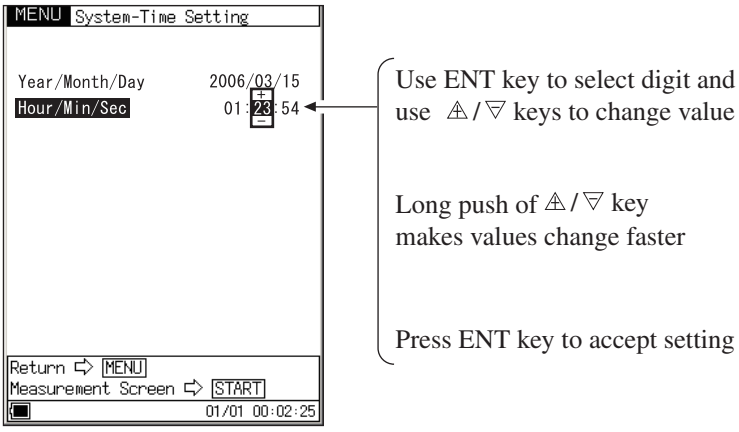
Use △/▽/◁/▷ keys to select the item and press the ENT key. The [System - Settings - Save] screen appears.



Use △/▽/◁/▷ keys to select the item and press the ENT key. The [System - Settings - Load] screen appears.

Time setting ▼

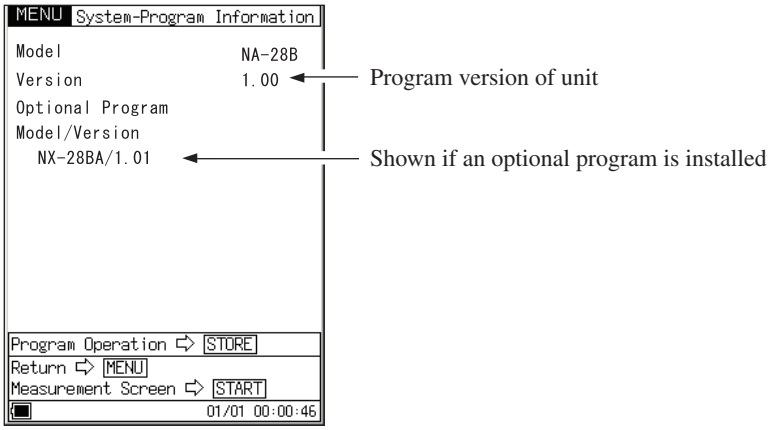
Bring the cursor to [Time Setting] and press the ENT key. The [System - Time Setting] screen appears.



[System - Time Setting] screen

Program Information ▼

Bring the cursor to [Program Information] and press the ENT key. The [System - Program Information] screen appears.



[System - Program Information] screen

Language 日本語/English/Deutsch/Español/French (see page 33)

CF size ** MByte: Shows the space on the CF card.

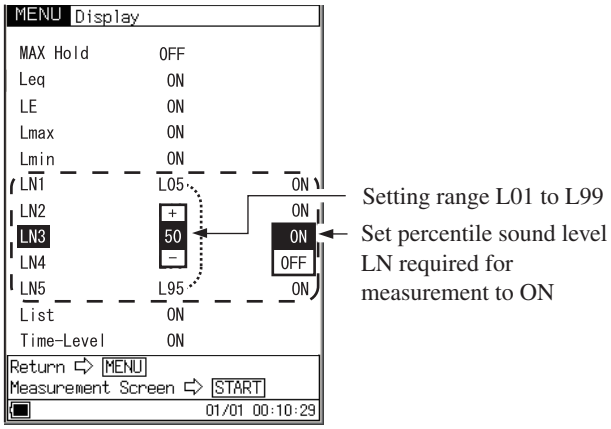
Display

Use the △/▽/◁/▷ keys to select [Display] and press the ENT key. The display menu screen appears.

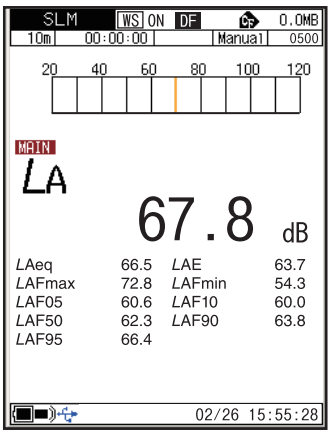
MAX Hold	ON/OFF (can be selected in analyzer mode)
Leq	ON/OFF
LE	ON/OFF
Lmax	ON/OFF
Lmin	ON/OFF
LN1 (L01 to L99)	ON/OFF
LN2 (L01 to L99)	ON/OFF
LN3 (L01 to L99)	ON/OFF
LN4 (L01 to L99)	ON/OFF
LN5 (L01 to L99)	ON/OFF
List	ON/OFF
Time - Level	ON/OFF

To set the L01 to L99 value for LN1 to LN5, use the △/▽ keys to change the value and the ENT key to accept.
When you next press the ENT key, ON/OFF is displayed.
Use the △/▽ keys to select the ON/OFF setting, and the ENT key to accept.

Note
List display is available only in sound level meter mode.



Display menu screen



List display example
Shown when switching MODE with "List" set to ON

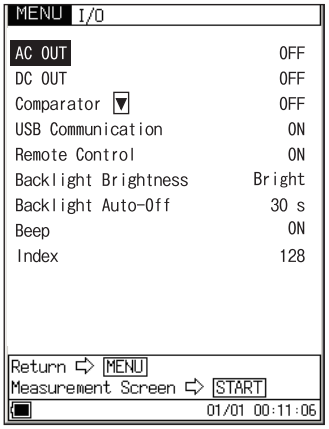
I/O (Input/Output)

Use the △/▽/◁/▷ keys to select [I/O (Input/Output)] and press the ENT key. The Input/Output menu screen appears.

AC Out	OFF/MAIN/SUB
DC Out	OFF/MAIN/SUB
Comparator ▼	ON/OFF
USB Communication	ON/OFF
Remote Control	ON/OFF
Backlight Brightness	Dark/Bright
Backlight Auto-Off	30 s/3 m/Cont
Beep	ON/OFF
Index	1 to 255 (a number for identifying the unit when multiple units are used in a parallel measurement setup)

Press the ENT key to display ON/OFF/etc. Use the △/▽ keys to select ON/OFF/etc. and press the ENT key.

When beep tones are set to ON, a long beep will be heard at the end of a measurement and a short and long beep when a store operation is complete.

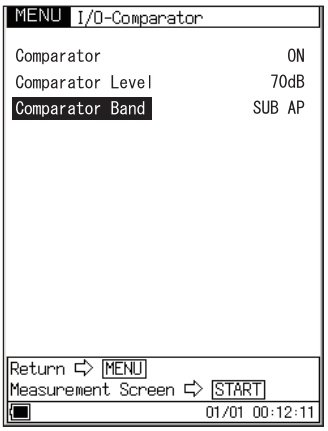


Input/Output menu screen

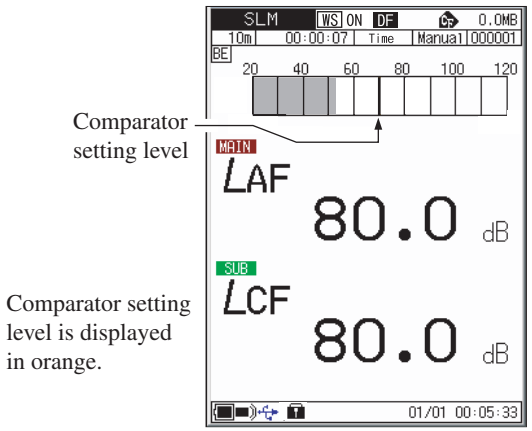
Comparator next menu level

Use the △/▽ keys to move the cursor to [Comparator] and press the ENT key. The following next menu level appears.

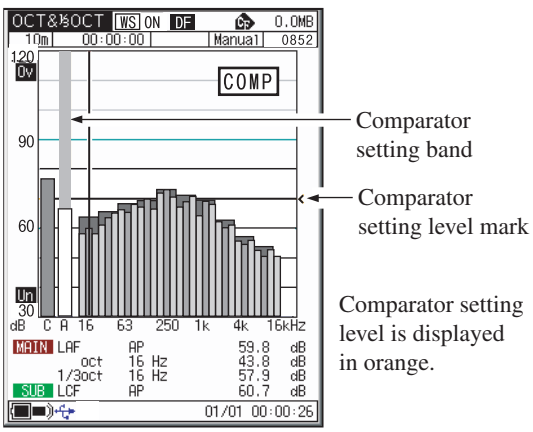
Comparator	ON/OFF
Comparator Level	25 to 130 dB (1-dB steps)
Comparator Band	SUB AP/MAIN AP/12.5 Hz/16 Hz/20 Hz/25 Hz ... 20 kHz (1/3 octave bands)



Input/Output - Comparator menu screen



Sound level meter mode indication



Analyzer mode indication

Store

Use the △/▽/◁/▷ keys to select [Store] and press the ENT key. The store menu appears.

Store Mode Manual/Auto1/Auto2

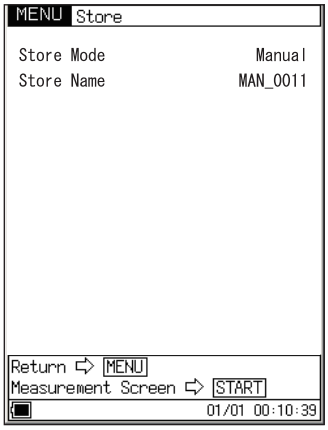
Store Name MAN_**** AU1_****
AU2_****
**** is a 4-digit number from 0000 to 9999

Store name is settable when CF card is inserted.

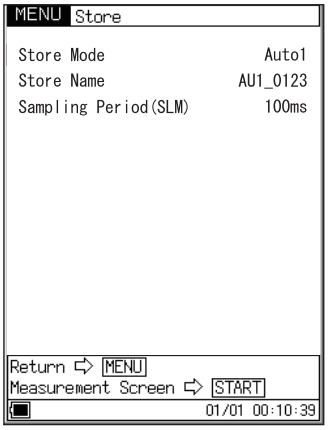
Sampling Period (SLM/RTA) (only shown in Auto1 mode)

SLM: 100 ms (fixed)

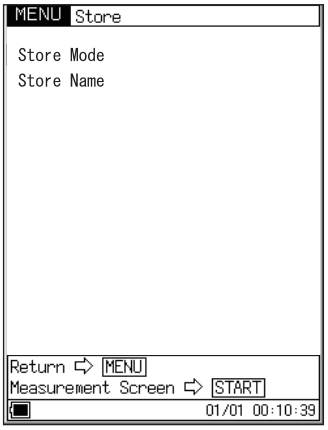
RTA: 1 to 10 ms (1-ms steps), 10 to 1000 (10-ms steps), $L_{eq,1s}$



Manual store menu screen



Auto1 store menu screen

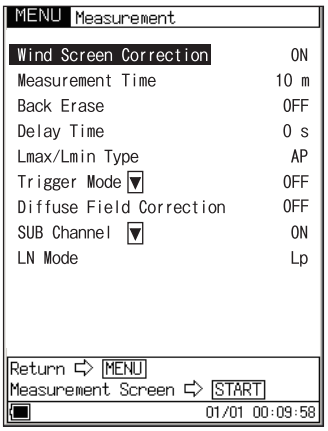


Auto2 store menu screen

Measurement

Use the △/▽/◁/▷ keys to select [Measurement] and press the ENT key. The measurement menu appears.

Wind Screen Correction	
	ON/OFF
Measurement Time	Auto1: 1 s to 1000 h
	Auto2 or normal measurement: 1 s to 24 h
Back-Erase	OFF/5 s
Delay Time	0 to 10 s
Lmax/Lmin Type	BAND/AP/AP(S) (can be selected only in analyzer mode)
Trigger Mode ▼	OFF/Level1/Level2/Time/EXT.
Diffuse Field Correction	
	ON/OFF
Sub Channel ▼	ON/OFF
LN Mode	Lp/Leq, 1s

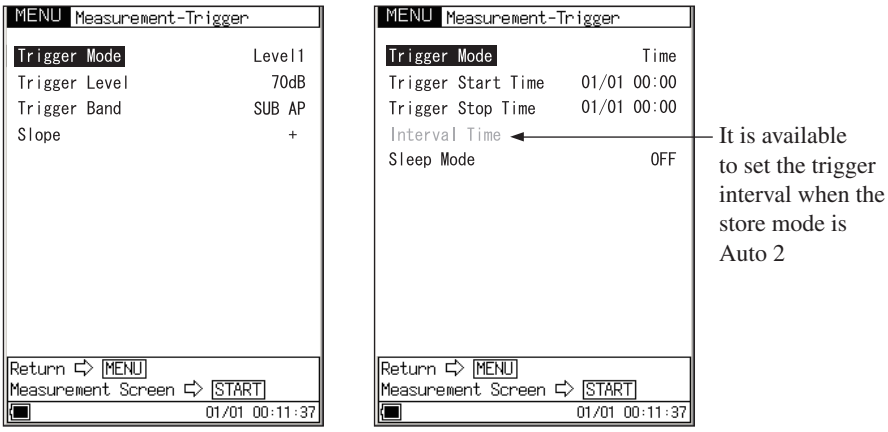


Measurement menu screen

Trigger mode next menu level

Use the △/▽ keys to select [Trigger Mode] and press the ENT key. The following next menu level appears.

Available trigger mode settings are Level 1, Level 2, Time, and EXT.



Measurement-Trigger menu screen

Level 1

Setting items

Trigger level 25 to 130 dB, 1-dB steps

Trigger band MAIN AP/SUB AP/12.5 Hz/16 Hz/20 Hz/25 Hz ... 20 kHz (1/3 octave bands)

Slope: +, -

Level 2

Setting items

Trigger level 25 to 130 dB, 1-dB steps

Trigger band MAIN AP/SUB AP/12.5 Hz/16 Hz/20 Hz/25 Hz ... 20 kHz (1/3 octave bands)

Time

Setting items

Trigger start time, trigger stop time

Interval time: OFF, 5, 10, 15, 30 (minutes), 1, 8, 24 (hours)
Settable when store mode is Auto2

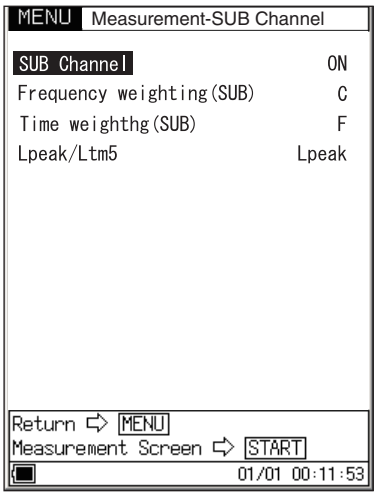
Sleep mode: ON, OFF

EXT.

Select this to use an external trigger.

Sub channel next menu level

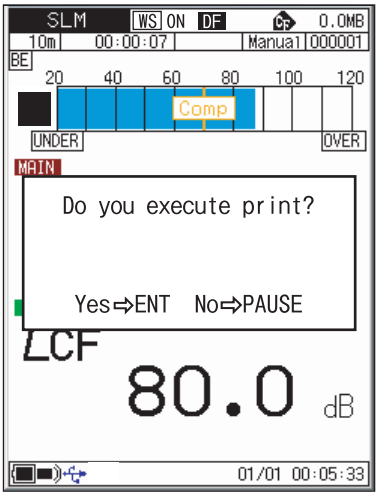
Use the △/▽ keys to select [Sub Channel] and press the ENT key. The following next menu level appears.



Measurement-SUB Channel menu screen

Print

Use the △/▽/◁/▷ keys to select [Print] and press the ENT key. The print menu screen appears.



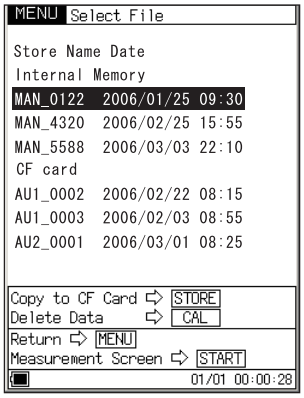
Printing screen

At the recall screen, it is possible to select a range for simultaneous printing of data for multiple addresses. However, the print format will depend on the screen that is shown at the time of printing, as listed in the table below.

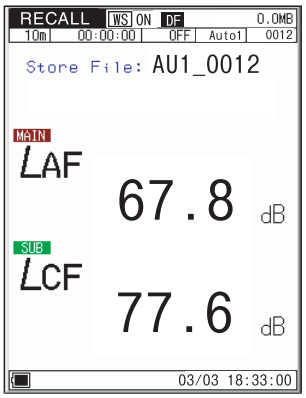
	Numeric display	Graph display	T-L display
SLM	————	Range/List print	Hard copy
RTA	Range/List print	Range/Hard copy	Hard copy

Recall

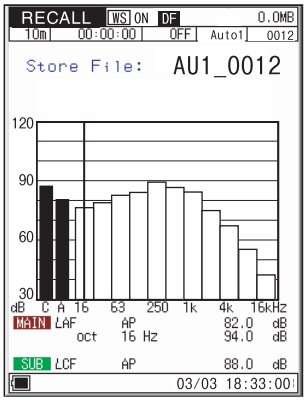
Use the △/▽/◁/▷ keys to select [Recall] and press the ENT key. The Select File menu appears.



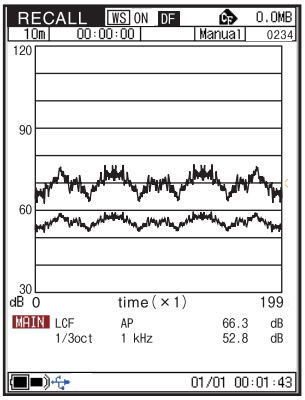
Select File menu screen



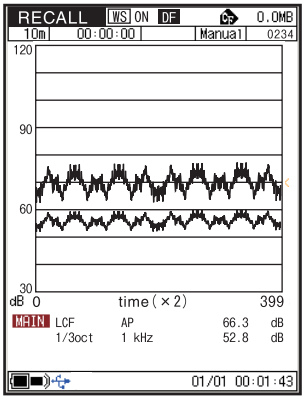
Recall screen, sound level meter mode



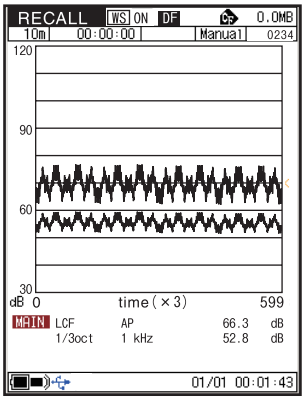
Recall screen, analyzer mode



Horizontal axis time (×1)



Horizontal axis time (×2)



Horizontal axis time (×3)

At the T-L display screen of RECALL, use the LEVEL △/▽ keys to change the time axis (horizontal axis). The zoom factor for the time axis can be set to ×1, ×2, ×3, ×6, ×9, ×12, and ×15.

Menu List Items

System
- CF Card Format
- Read/Save Settings ▼---------- Load Default
  - Group Save for CF card ▼---------- List of setting groups on CF card
  - Group Loading/Delete for CF card ▼---- List of setting groups on CF card
- Time Setting ▼ ----------Year/Month/Day Hour:Min:Sec
- Program Information ▼---------- Model, Version
- Language
- CF size

Display
- MAX Hold, Leq, LE, Lmax, Lmin, LN1, LN2, LN3, LN4, LN5, List, Time - Level

I/O(Input/Output)
- AC OUT
- DC OUT
- Comparator ▼---------- Comparator ON/OFF, Comparator Level, Comparator Band
- USB Communication
- Remote Control
- Backlight Brightness
- Backlight Auto-Off
- Beep
- Index

Store
- Store Mode
- Store Name
- Sampling Period*

Measurement
- Windscreen Correction
- Measurement Time
- Back-Erase
- Delay Time
- Lmax/Lmin Type
- Trigger Mode ▼---------- OFF, Level 1, Level 2, Time, EXT.
- Diffuse Field Correction
- Sub Channel ▼ ---------- Sub channel measurement ON/OFF, frequency weighting, time weighting, Lpeak/Ltm5

Print
- Enable/disable screen content printout

Recall
- Recall data list

▼------: Items displayed when proceeding to next menu level

* Sampling Period SLM mode: 100 ms
RTA mode: 1 to 10 ms (1-ms steps), 10 to 1000 (10-ms steps), $L_{eq,1sec}$

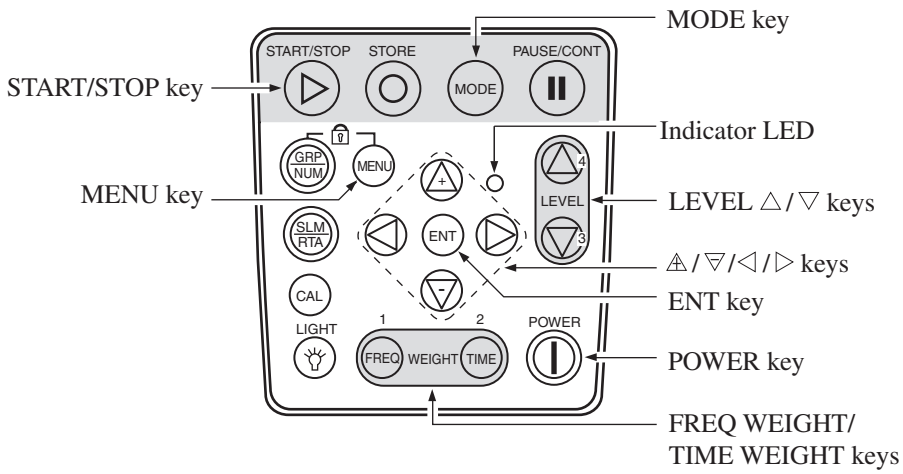
Measurement

When using the NA-28 in a mode other than "sound level measurement", all processing functions provided by the unit (L_{eq}, L_E, L_{max}, L_{min}, L_N) are carried out simultaneously. (However, for the sub channel, only the additional processing function set to "ON" in the menu screen is carried out.) For example, when equivalent continuous sound level measurement is selected, the sound exposure level and percentile level are also determined. However, the time percentage setting for the percentile level (5 values) must be selected beforehand. Also, make sure that the date and time are set correctly, as described on page 19 to 20.

Sound Level Measurement

The procedure for sound level measurement is described below.
Preparations as described in the "Preparations" chapter must be completed first.

1. Press the POWER key to turn the unit on.
   After the power-on screen has been shown, the measurement screen appears.
   The measurement parameter settings that were active before the unit was turned off will be established again. Therefore the actual display may not always be the same.



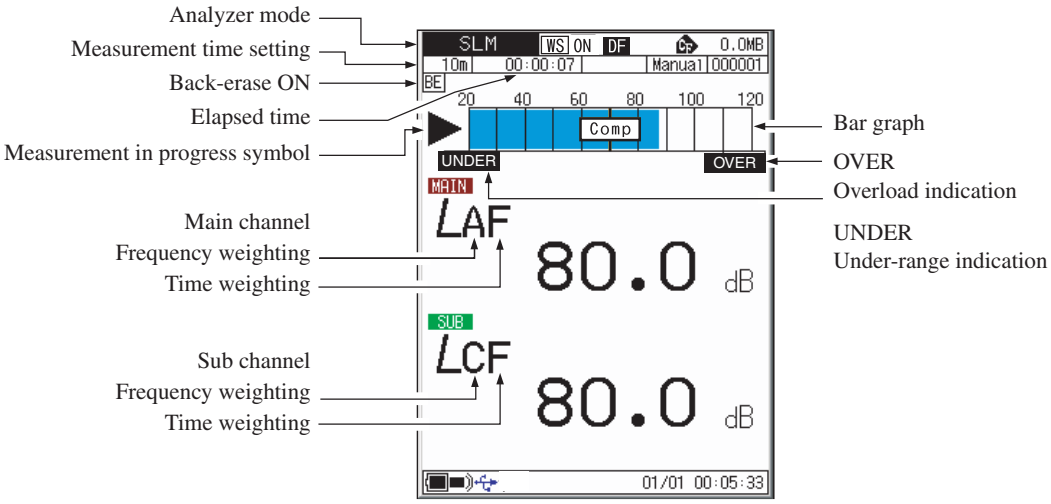
2. Use the FREQ WEIGHT key to select the frequency weighting characteristic. For normal sound level measurements, select the "A" setting.
   When *L*Z (Flat) is selected for display, the sound pressure level from 10 Hz to 20 kHz is measured with flat characteristics.
   When *L*C is selected for display, the sound pressure level from 31.5 Hz to 8 kHz is measured with flat characteristics.
   To set the frequency weighting characteristics for the sub channel, use the menu screen or press the FREQ WEIGHT key while holding down the MENU key.

3. Use the TIME WEIGHT key to select the time weighting (dynamic) characteristics. For normal sound level measurements, select the "F" (Fast) setting.
   When performing measurements in compliance with IEC or another standard, set the frequency weighting and time weighting characteristics as required by that standard.
   To set the time weighting characteristics for the sub channel, use the menu screen or press the TIME WEIGHT key while holding down the MENU key.

4. Use the LEVEL △ / ▽ keys to set the level range. Choose a setting in which the bar graph indication registers to about the middle of the range.
   If the "OVER" or "UNDER" indicators appear frequently, change the level range setting.

5. Press the START/STOP key to start the measurement.
   The measurement in progress symbol ▶ flashes and the indicator LED flashes in green.

6. The level indication shows the currently measured sound level (sound pressure level). The reading is updated once every second.
   The PAUSE/CONT key can be used to stop and resume the updating of level indication. In sound level meter mode, the bar graph indication will be updated also during pause. In the pause condition, a pause symbol (II) appears on the display, and the indicator LED flashes blue.



Important
During sound level measurement, do not press the MODE key. Otherwise other processing results will be shown. The sound level is being displayed when there is no character string after the basic indication. LAF: Sound level is being displayed LAeq: Sound level is not being displayed
During measurement, the LEVEL △ / ▽ keys, FREQ WEIGHT key, and TIME WEIGHT key function as markers.

Note
When setting the weighting characteristics for the sub channel with the FREQ WEIGHT or TIME WEIGHT key while holding down the MENU key, changing the setting continuously with holding down the MENU key is not possible. Release the keys and press them again for each new setting.

Equivalent Continuous Sound Level (L_{Aeq}) Measurement

The procedure for equivalent continuous sound level measurement is described below.

Preparations as described in the "Preparations" chapter must be completed first.

1. Turn power to the unit on.
2. Use the FREQ WEIGHT key to select the frequency weighting characteristic.

   For normal measurements, select "A" (A-weighting).

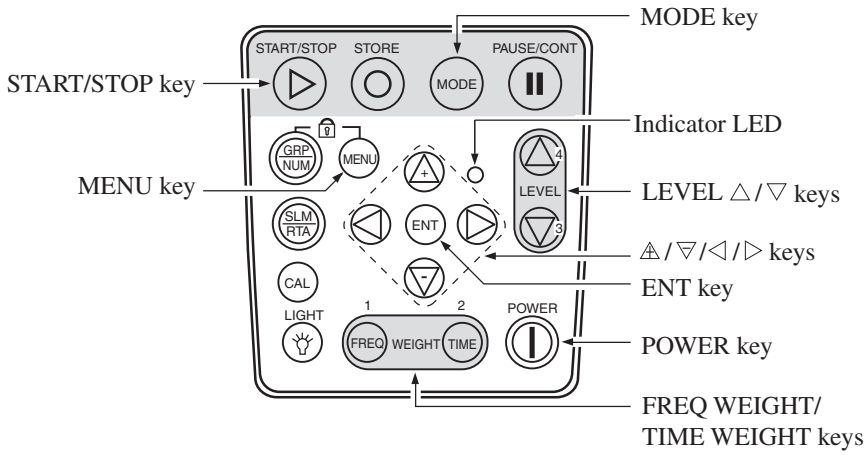
   When "C" (C-weighting) is selected, the equivalent continuous sound pressure level (L_{Ceq}) is measured.
3. Use the TIME WEIGHT key to select the time weighting characteristic.

   Normally, select the "F" (Fast) setting. (This setting does not affect a measurement result of equivalent continuous sound level.)

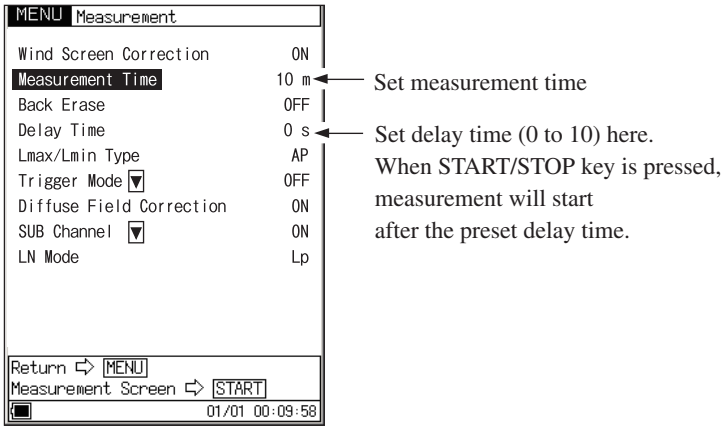
Note
The NA-28 performs high-speed sampling of the sound pressure waveform (15.6 µs; 20.8 µs when octave and 1/3 octave analysis is performed simultaneously) to determine L_{eq} and L_E. It is therefore not affected by time weighting characteristics.

4. Use the LEVEL △ / ▽ keys to set the level range. Choose a setting in which the bar graph indication registers to about the middle of the range.

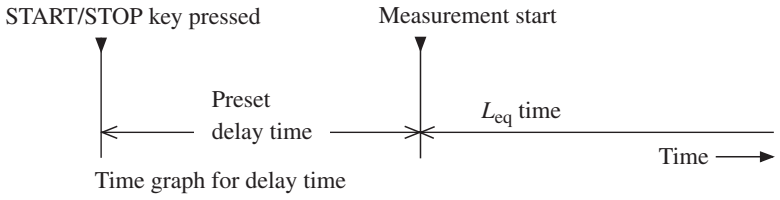
   If the "OVER" or "UNDER" indicators appear frequently, change the level range setting.
5. For information about how to store data, refer to the section starting on page 86.



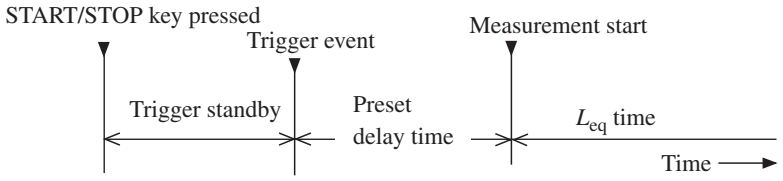
6. Set the measurement time from the menu.
   Press the MENU key to bring up the menu list screen.
7. Use the △/▽/◁/▷ keys to select [Measurement] and press the ENT key.
   The measurement menu screen appears.
8. Use the △/▽ keys to select [Measurement time] and press the ENT key.
9. Use the △/▽ keys to set the measurement time and the unit and press the ENT key.



Measurement menu screen

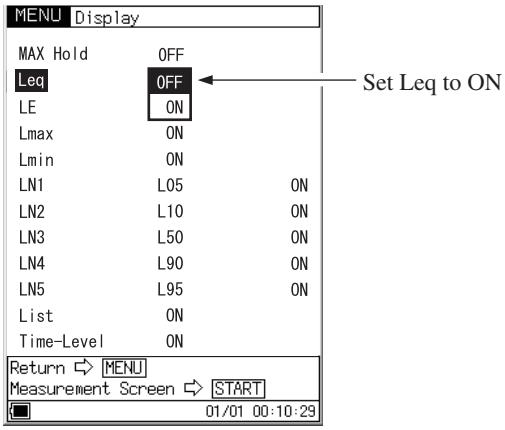


Time graph for delay time



Time graph for use of trigger function

10. Press the MENU key to return to the menu list screen and use the △/▽/◁/▷ keys to select [Display]. Press the ENT key. The display menu screen appears.
11. Use the △/▽ keys to select [Leq] and press the ENT key.
12. Use the △/▽ keys to select ON and press the ENT key.



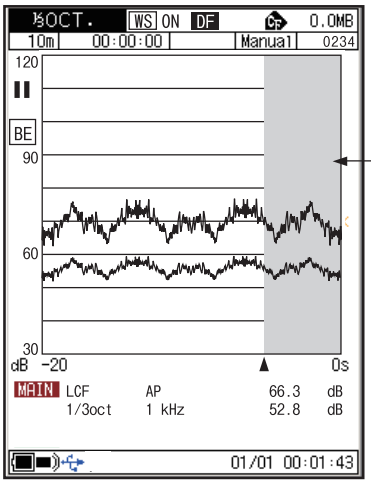
Display menu screen

13. Press the START/STOP key to return to the measurement screen. For information about how to use the back-erase function to exclude data, refer to page 80.

14. Press the START/STOP key to start the measurement.
    At this point, previous measurement values are cleared.
    While the measurement is in progress, the ▶ symbol flashes and the elapsed time is displayed. When the measurement time set in step 9 has elapsed, the measurement is terminated automatically.
    To terminate the measurement before the allocated time, press the START/STOP key.
    If signal overload or an under-range condition occurs at least once during measurement, the indication OVER or UNDER appears, to indicate that overload or under-range data are comprised in the processed values.
    During measurement, the PAUSE/CONT key can be used to pause and resume the measurement. During pause, the pause symbol (II) is shown. (The paused interval and the back-erase interval are not included in the measurement time.)

Important
During measurement, the LEVEL △ / ▽ keys, FREQ WEIGHT key, and TIME WEIGHT key function as markers. The START/STOP key, MODE key, PAUSE/CONT key, LIGHT key, and POWER key are operative. Be sure to complete all settings before starting the measurement.

If the back-erase function was enabled in steps 7 and 8, using the Time-Level screen is convenient. Data excluded by the back-erase function are indicated on the display as follows.



Time-Level screen

15. When the measurement is completed, use the MODE key to switch the display.

    L_{Aeq} means that the equivalent continuous sound level is displayed.

    If L_{Aeq} is not shown, check whether L_{eq} is set to ON on the menu screen.

    If the indication OVER is shown, the processed data include data where the sound level signal caused an overload condition.

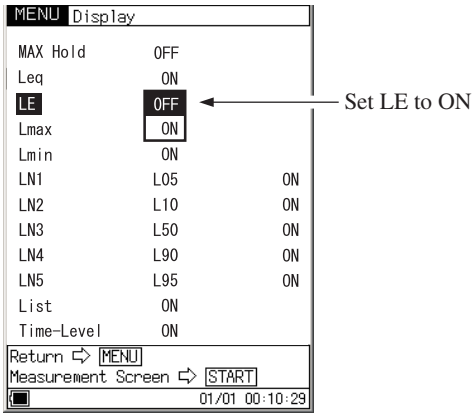
    If the indication UNDER is shown, the processed data include data where the sound level signal caused an under-range condition.

Note
During measurement, you can use the MODE key to check the equivalent continuous sound level as currently calculated. (This applies only to the numeric level display. The bar graph shows the sound level.) After the measurement is completed, changing the frequency weighting (A/C/Z), time weighting (Fast/Slow) or other settings hides the measurement value. Returning to the original settings redisplays the measurement value.

Sound Exposure Level (L_{AE}) Measurement

The procedure for sound exposure level measurement is similar to that for equivalent continuous sound level measurement, but the menu item selection differs. Preparations as described in the "Preparations" chapter must be completed first.

1. For information about how to store data, refer to the section starting on page 86.
2. Press the MENU key to bring up the menu list screen.
3. Use the △/▽/◁/▷ keys to select [Display] and press the ENT key. The display menu screen appears.
4. Use the △/▽ keys to select [LE] and press the ENT key.
5. Use the △/▽ keys to select ON and press the ENT key.



Display menu screen

6. Press the START/STOP key to return to the measurement screen.
7. Press the START/STOP key to start the measurement.
   While the measurement is in progress, the ▶ symbol flashes and the elapsed time is displayed. When the preset measurement time has elapsed, the measurement is terminated automatically.
   To terminate the measurement before the allocated time, press the START/STOP key.
   If signal overload or an under-range condition occurs at least once during measurement, the indication OVER or UNDER appears, to indicate that overload or under-range data are comprised in the processed values.

During measurement, the PAUSE/CONT key can be used to pause and resume the measurement. During pause, the pause symbol (II) is shown. (The paused interval and the back-erase interval are not included in the measurement time.)

Important
During measurement, the LEVEL △ / ▽ keys, FREQ WEIGHT key, and TIME WEIGHT key function as markers. The START/STOP key, MODE key, PAUSE/CONT key, LIGHT key, and POWER key are operative. Be sure to complete all settings before starting the measurement.

8. When the measurement is completed, use the MODE key to switch the display.

   L_{AE} means that the sound exposure level is displayed.

   If L_{AE} is not shown, check whether L_{AE} is set to ON on the menu screen.

   If the indication OVER is shown, the processed data include data where the sound level signal caused an overload condition.

   If the indication UNDER is shown, the processed data include data where the sound level signal caused an under-range condition.

Note
During measurement, you can use the MODE key to check the equivalent continuous sound level as currently calculated. (This applies only to the numeric level display. The bar graph shows the sound level.) After the measurement is completed, changing the frequency weighting (A/C/Z), time weighting (Fast/Slow) or other settings hides the measurement value. Returning to the original settings redisplays the measurement value.

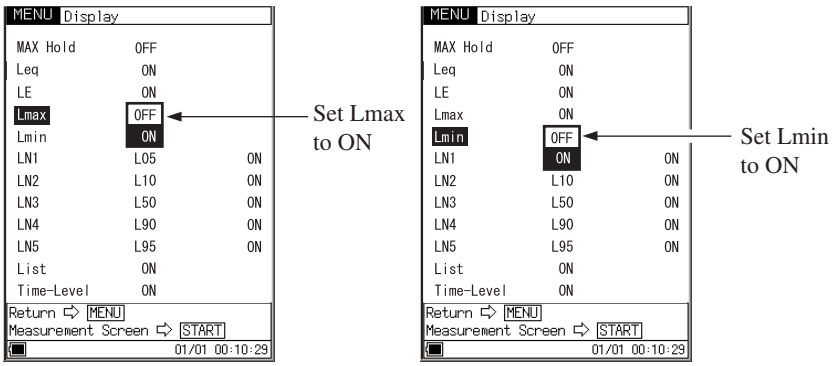
Maximum Sound Level (L_{max}) and Minimum Sound Level (L_{min}) Measurement

The procedure for maximum sound level and minimum sound level measurement is similar to that for equivalent continuous sound level measurement, but the menu item selection differs.

Preparations as described in the "Preparations" chapter must be completed first.

1. For information about how to store data, refer to the section starting on page 86.
2. Press the MENU key to bring up the menu list screen.
3. Use the △/▽/◁/▷ keys to select [Display] and press the ENT key. The display menu screen appears.
4. Use the △/▽ keys to select [L_{max}] and press the ENT key.
5. Use the △/▽ keys to select ON and press the ENT key.
6. Use the △/▽ keys to select [L_{min}] and press the ENT key.
7. Use the △/▽ keys to select ON and press the ENT key.

Note
To measure L_{max} only, verify that L_{min} is set to OFF and skip steps 6 and 7.
To measure L_{min} only, verify that L_{max} is set to OFF and skip steps 4 and 5.



Display menu screen

8. Press the START/STOP key to return to the measurement screen.

9. Press the START/STOP key to start the measurement.
   While the measurement is in progress, the ▶ symbol flashes and the elapsed time is displayed. When the preset measurement time has elapsed, the measurement is terminated automatically.
   To terminate the measurement before the allocated time, press the START/STOP key.
   If signal overload or an under-range condition occurs at least once during measurement, the indication OVER or UNDER appears, to indicate that overload or under-range data are comprised in the processed values.
   During measurement, the PAUSE/CONT key can be used to pause and resume the measurement. During pause, the pause symbol (II) is shown. (The paused interval and the back-erase interval are not included in the measurement time.)

Important
During measurement, the LEVEL △ / ▽ keys, FREQ WEIGHT key, and TIME WEIGHT key function as markers. The START/STOP key, MODE key, PAUSE/CONT key, LIGHT key, and POWER key are operative. Be sure to complete all settings before starting the measurement.

10. When the measurement is completed, use the MODE key to switch the display.
    L_{Amax} and L_{Amin} mean that the maximum and minimum sound level values are displayed, respectively.
    If L_{Amax} or L_{Amin} is not shown, check whether L_{Amax} or L_{Amin} is set to ON on the menu screen.
    If the indication OVER is shown, the processed data include data where the sound level signal caused an overload condition.
    If the indication UNDER is shown, the processed data include data where the sound level signal caused an under-range condition.

Note
During measurement, you can use the MODE key to check the equivalent continuous sound level as currently calculated. (This applies only to the numeric level display. The bar graph shows the sound level.) After the measurement is completed, changing the frequency weighting (A/C/Z), time weighting (Fast/Slow) or other settings hides the measurement value. Returning to the original settings redisplays the measurement value.
When you start another measurement, the L_{Amax} and L_{Amin} values are cleared.

Selecting the L_{max}/L_{min} type

BAND (Band maximum/band minimum):

The analysis result applies to the point where the level for each frequency band was maximum or minimum within the sampling period.

AP (All-pass maximum/all-pass minimum):

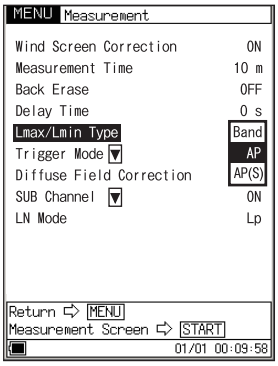
The analysis result applies to the sub channel all-pass and band-pass level values taken at the point where the all-pass level in the main channel was maximum/minimum within the sampling period.

AP(S) (All-pass maximum/all-pass minimum):

The analysis result applies to the band-pass level values (excluding the sub channel all-pass level) taken at the point where the all-pass level in the main channel was maximum/minimum within the sampling period. The sub channel all-pass level is taken at the maximum/minimum point within the sampling period, independently of the main channel level.

1. Press the MENU key to bring up the menu list screen.
2. Select [Measurement] and press the ENT key. The measurement menu screen appears.
3. Select [Lmax/Lmin Type] and press the ENT key.
4. From the indication "Band/AP/AP(S)", select the desired setting and press the ENT key.
5. Press the START/STOP key to return to the measurement screen.

This setting is effective only at analyzer mode.



Measurement menu screen

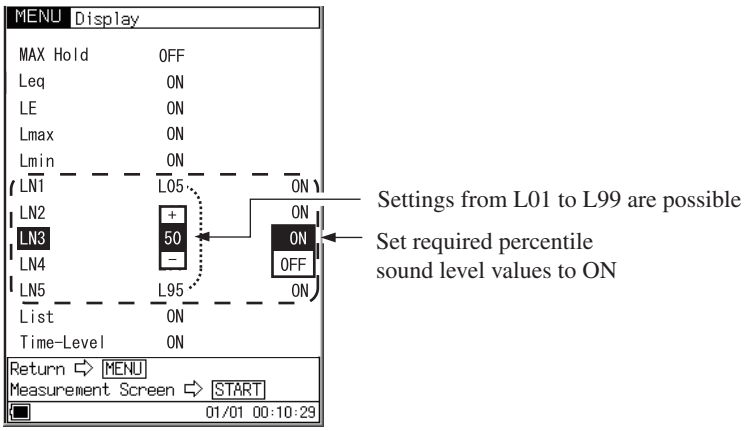
Select Lmax/Lmin type
Press ENT key

Select Band/AP/AP(S)
Press ENT key

Percentile Sound Level (L_N) Measurement

The procedure for percentile sound level measurement is similar to that for equivalent continuous sound level measurement, but the menu item selection differs. Preparations as described in the "Preparations" chapter must be completed first.

1. For information about how to store data, refer to the section starting on page 86.
2. Press the MENU key to bring up the menu list screen.
3. Use the △/▽/◁/▷ keys to select [Display] and press the ENT key. The display menu screen appears.
4. Use the △/▽ keys to select [LN1] to [LN5] and press the ENT key. In the factory default condition, the percentile sound level values for measurement are L05, L10, L50, L90, and L95. However, any value from L01 to L99 can be chosen (up to five values).
   Use the △/▽ keys to select the ON setting and press the ENT key.
5. Press the START/STOP key to return to the measurement screen.



Display menu screen

6. Press the START/STOP key to start the measurement.
   While the measurement is in progress, the ▶ symbol flashes and the elapsed time is displayed. When the preset measurement time has elapsed, the measurement is terminated automatically.
   To terminate the measurement before the allocated time, press the START/STOP key.
   If signal overload or an under-range condition occurs at least once during measurement, the indication OVER or UNDER appears, to indicate that overload or under-range data are comprised in the processed values.
   During measurement, the PAUSE/CONT key can be used to pause and resume the measurement. During pause, the pause symbol (II) is shown. (The paused interval and the back-erase interval are not included in the measurement time.)

Important
During measurement, the LEVEL △ / ▽ keys, FREQ WEIGHT key, and TIME WEIGHT key function as markers. The START/STOP key, MODE key, PAUSE/CONT key, LIGHT key, and POWER key are operative. Be sure to complete all settings before starting the measurement.

7. When the measurement is completed, use the MODE key to switch the display.
   L_N means that the percentile sound level is displayed.
   If L_N is not shown, check whether L_N is set to ON on the menu screen.
   If the indication OVER is shown, the processed data include data where the sound level signal caused an overload condition.
   If the indication UNDER is shown, the processed data include data where the sound level signal caused an under-range condition.

Note
During measurement, you can use the MODE key to check the equivalent continuous sound level as currently calculated. (This applies only to the numeric level display. The bar graph shows the sound level.) After the measurement is completed, changing the frequency weighting (A/C/Z), time weighting (F/S) or other settings hides the measurement value. Returning to the original settings redisplays the measurement value.

Additional Processing Value (L_{peak}, L_{Atm5}) Measurement

When the NA-28 is in sound level meter mode and the sub channel is ON, one of the following processing functions is available in addition to L_{eq}, L_E, L_{max}, L_{min}, and L_N.

L_{peak}: Peak sound level

L_{Atm5}: Time-weighted takt-max sound level

The peak sound pressure level is based on the sound pressure waveform peak level before being smoothed by time weighting.

L_{Zpeak} is the peak level with flat characteristics and L_{Cpeak} the peak level with C-weighting.

The time-weighted takt-max sound level L_{Atm5} is the power average of the maximum level for each 5-second interval.

Preparations as described in the "Preparations" chapter must be completed first.

1. Turn power to the unit on.
   Use the FREQ WEIGHT key to select the frequency weighting characteristic.
2. Set the measurement time from the menu.
   Press the MENU key to bring up the menu list screen.
3. Use the △/▽/◁/▷ keys to select [Measurement] and press the ENT key.
   The measurement menu screen appears.
4. Use the △/▽ keys to select [Measurement Time] and press the ENT key or ▷ key.
5. Use the △/▽ keys to set the measurement time and the unit and press the ENT key.
   For information about how to use the back-erase function to exclude data, refer to page 80.

Note
The NA-28 has a pause function and a back-erase function that allows excluding data for the immediately preceding 5 seconds from the measurement. However, the back-erase function cannot be used when L_{Atm5} is selected.

6. Use the △/▽ keys to select [Sub Channel] and press the ENT key.
7. Use the △/▽ keys to select [L_{peak}/L_{tm5}] and press the ENT key or ▷ key.
   Use the △/▽ keys to select L_{peak} or L_{tm5} and press the ENT key.
8. Press the START/STOP key to return to the measurement screen.
9. Use the LEVEL △ / ▽ keys to set the level range. Choose a setting in which the bar graph indication registers to about the middle of the range.
   If the "OVER" or "UNDER" indicators appear frequently, change the level range setting.
10. Press the START/STOP key to start the measurement.
    While the measurement is in progress, the ▶ symbol flashes and the elapsed time is displayed. When the preset measurement time has elapsed, the measurement is terminated automatically.
    To terminate the measurement before the allocated time, press the START/STOP key.
    If signal overload or an under-range condition occurs at least once during measurement, the indication OVER or UNDER appears, to indicate that overload or under-range data are comprised in the processed values.

Important
During measurement, the LEVEL △ / ▽ keys, FREQ WEIGHT key, and TIME WEIGHT key function as markers. The START/STOP key, MODE key, PAUSE/CONT key, LIGHT key, and POWER key are operative. Be sure to complete all settings before starting the measurement.

11. When the measurement is completed, use the MODE key to switch the display.
    If the indication OVER is shown, the processed data include data where the sound level signal caused an overload condition.
    If the indication UNDER is shown, the processed data include data where the sound level signal caused an under-range condition.

Important
L_{Al} is the time-weighted sound level. Processing for this value begins when the START/STOP key is pressed, and the display is updated accordingly. The display will not be updated when processing has stopped. Therefore using the MANUAL mode is recommended for L_{Al}.

Note
During measurement, you can use the MODE key to check the equivalent continuous sound level as currently calculated. (This applies only to the numeric level display. The bar graph shows the sound level.) After the measurement is completed, changing the frequency weighting (A/C/Z), time weighting (F/S) or other settings hides the measurement value. Returning to the original settings redisplays the measurement value.

Back-Erase Function

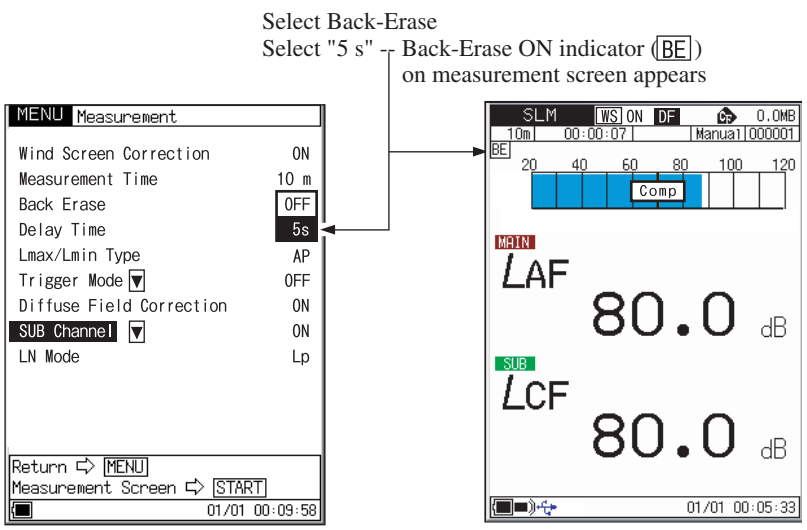
When a measurement is being carried out and data are being processed, the PAUSE/CONT key can be used to pause the measurement. Normally, data up to the point at which the PAUSE/CONT key was pressed will be included in processing, but the back-erase function makes it possible to exclude (back-erase) data from a 5-second interval before the key was pressed.

The data that will be back-erased are shown on the display as in the example on next page, for verification.

The procedure for using this function is described on next page.

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [Measurement] and press the ENT key. The measurement menu screen appears.
3. Use the △/▽ keys to select [Back Erase] and press the ENT key. The indication "5 s/OFF" appears.
4. Use the △/▽ keys to select "5 s" and press the ENT key.
5. Press the START/STOP key to return to the measurement screen.

Note
If the additional processing function L_{Atm5} is selected, the back-erase function cannot be used. The function also is not available during Auto1 store and during timer Auto2 store.



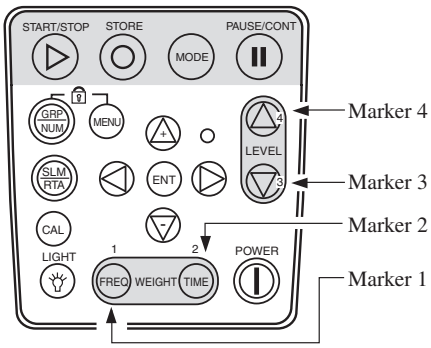
Measurement menu screen

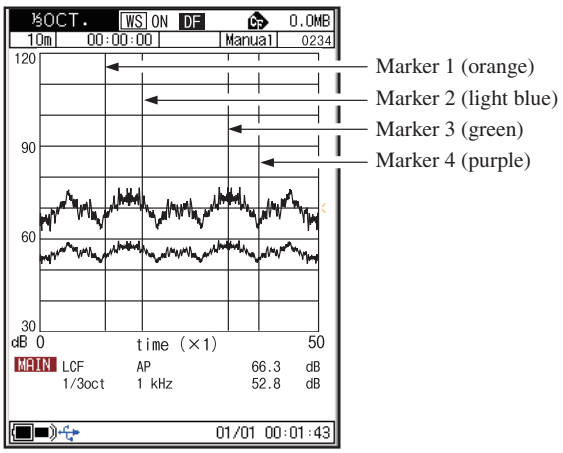
Measurement screen

Marker

During processing of L_{eq} and other values, it is possible to add markers to the data.

1. Select the store mode on the menu list screen.
   Also set the required measurement parameters such as frequency weighting and time weighting.
2. Press the START/STOP key to set the unit to the measurement condition.
3. The FREQ WEIGHT, TIME WEIGHT, LEVEL ▽ and LEVEL △ keys now function as markers. Pressing a key will insert the corresponding marker into the data.
4. Wait until the preset measurement time has ended, or stop the measurement with the START/STOP key.
5. Select the [Recall] on the menu list screen and press the ENT key.
6. On the file selection screen, use the △/▽ keys to select stored data, and press the ENT key. A recall screen such as shown below appears, showing the marker information.





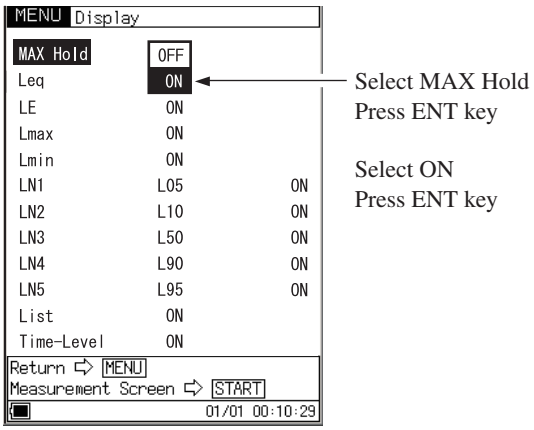
T-L display screen

Max Hold

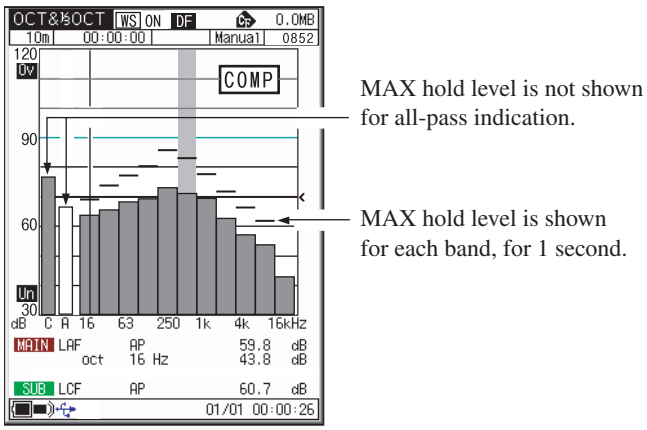
This function retains the maximum value for one second, for easier reading of the changing bar graph indication.
Max hold level is shown only on the analysis screen.

1. Press the MENU key to bring up the menu list screen.
2. Select [Display] to bring up the display menu screen.
3. Select [MAX Hold] and press the ENT key.
4. Select [ON] and press the ENT key.
5. Press the START/STOP key to return to the measurement screen.

Note
The MAX hold function is not available for the all-pass indication.



Display menu screen

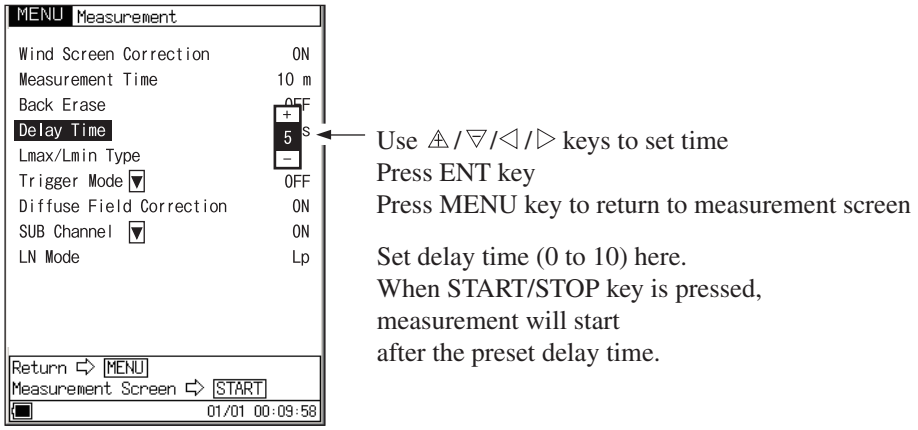


Analyzer screen example

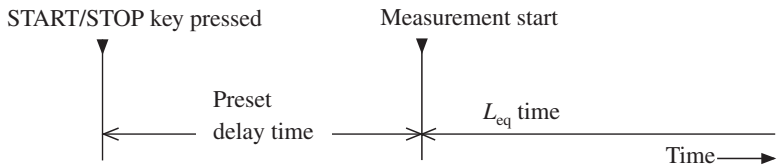
Delayed Measurement

The NA-28 allows setting a delay time to be inserted before the actual start of the measurement.

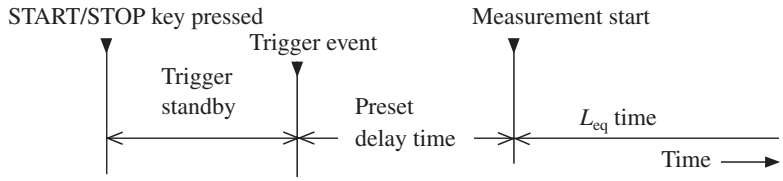
1. Press the MENU key to bring up the menu list screen.
2. Select [Measurement] and press the ENT key to bring up the measurement menu screen.
3. Select [Delay time] and press the ENT key.
4. Use the △/▽ keys to set the delay time. The setting range is 0 to 10 seconds, in 1-second steps.
5. When the time has been set, press the ENT key.
6. Press the START/STOP key to return to the measurement screen.



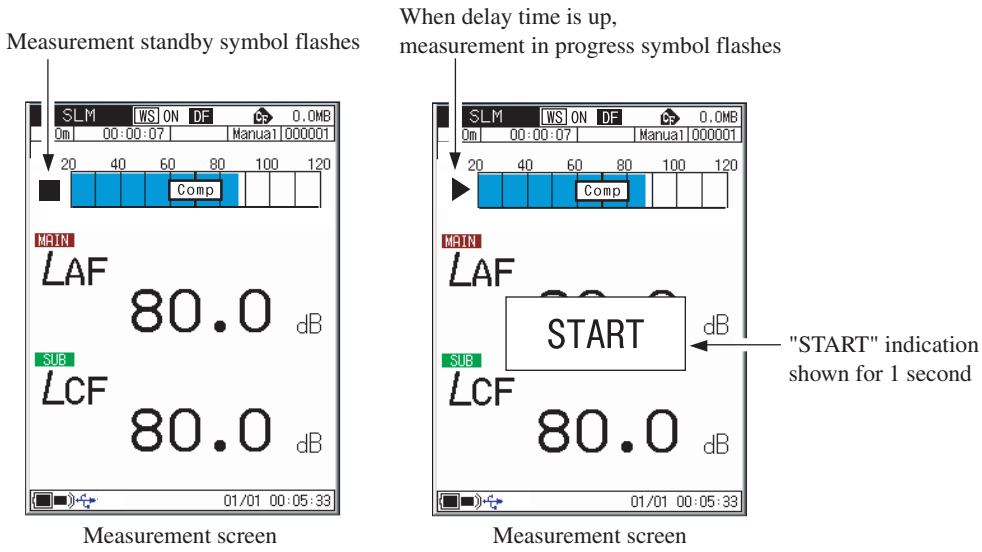
Measurement menu screen



When the trigger function is also used, the start of measurement will be delayed by the preset delay time from the trigger event point.



When a delay time has been set, the NA-28 will operate as follows. When the START/STOP key is pressed, the measurement standby symbol ■ starts to flash. When the delay time has elapsed, the symbol changes to a flashing ▶ and the measurement starts.



Store Operation

The NA-28 can store measurement data (processed data such as sound level and equivalent continuous sound level, and measurement parameters such as frequency weighting and time weighting characteristics) in the internal memory or on CF card.

This chapter describes how to store data in memory and how to recall data from memory. There are three different ways of storing data, as listed below.

If no CF card is inserted, the data will be stored in the internal memory of the NA-28. If a CF card is inserted, the data will automatically be stored on the card.

Store names can not be set when no CF card is inserted.

Manual

In this mode, the operator stores the measured sound level data and processed value data in the memory manually. Pressing the STORE key causes the current sound level and the processed values derived from the measurement, as well as the measurement parameters and time of measurement to be recorded.

Internal memory capacity: max. 1000 data sets

CF card capacity: max. 1000 data sets per store name, max. 100 store names

Auto1

This is the store function for recording the sound level waveform.

Measurement time: max. 1000 hours (when CF card is inserted)

Sound level meter mode

Continuous store of L_p, L_{eq}, L_{max}, L_{min} as 1 set every 100 ms

Sub channel measurement results cannot be stored.

Sampling cycle: 100 ms only (L_p, L_{eq}, L_{max}, L_{min} stored simultaneously every 100 ms)

Internal memory capacity:

max. 3 hours

Analyzer mode

Continuous store of sound level L_p values for each band and all-pass

Main channel: All-pass value and band level values

Sub channel: All-pass value

Sampling cycle: 1 ms to 1 sec, $L_{eq,1s}$

Internal memory: max. 10000 data (2.7 hours for 1 sec or $L_{eq,1s}$)

Auto2

Sound level meter mode

Continuous store of main channel and sub channel all-pass values and measurement start time, at preset measurement intervals

Analyzer mode

Continuous store of main channel band level values and all-pass value, sub channel all-pass value and measurement start time, at preset measurement intervals

Number of data

Internal memory: max. 1,000 sets

CF card: max. 300,000 sets

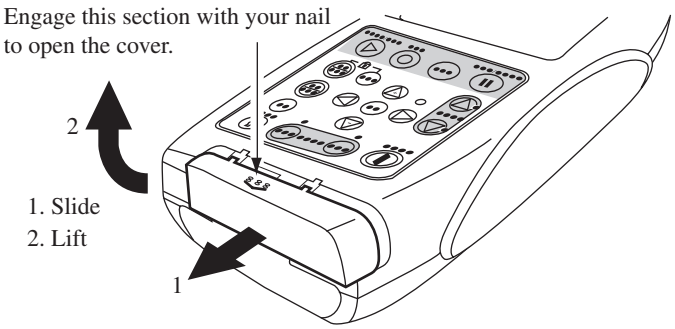
Important
Never turn off power to the unit or remove the CF card while a store operation is in progress. Otherwise internal data can be destroyed. When a CF card is inserted in the memory card slot of the unit, use of the internal memory for store is not possible.

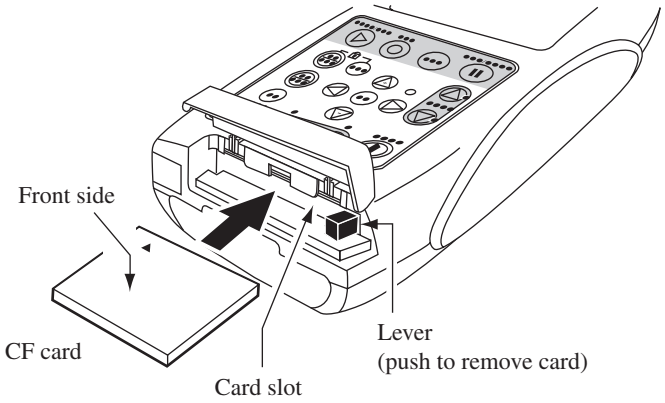
Note
It is recommended to copy data stored in the internal memory to CF card, to prevent data loss in case of backup battery failure or other problems.

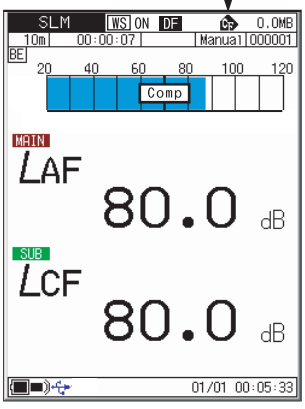
Inserting and Removing the CF Card

Insert or remove the CF card as shown below.

Note
Be sure to turn power OFF before inserting or removing a card.







CF card insertion indicator

This symbol is shown when a CF card is inserted

Manual

Memory Store

At the point where the STORE key is pressed, the current sound level and processing values are stored.

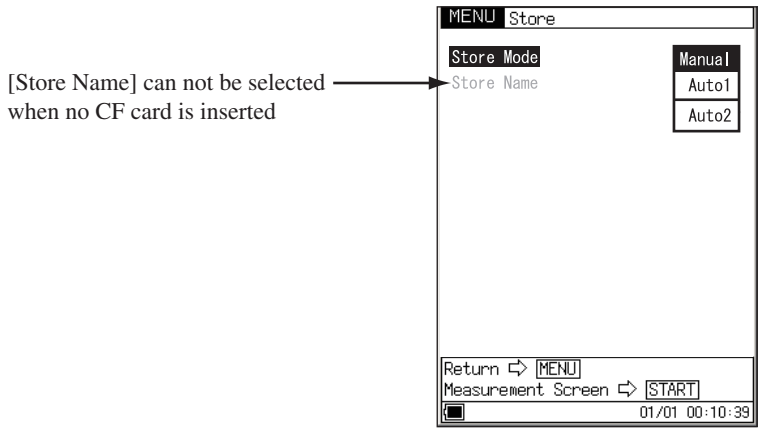
Immediately after turning power on, there will be no processing values, therefore only the sound level is stored when the STORE key is pressed.

If no CF card is inserted, data will be stored in internal memory.

If a CF card is inserted, data will be stored on the CF card.

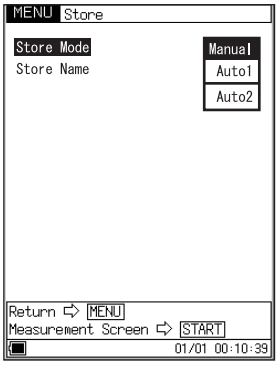
The procedure is as follows.

1. Turn power to the unit on.
2. Press the MENU key to bring up the menu list screen.
3. Use the △/▽/◁/▷ keys to select [Store] and press the ENT key.
   The store menu screen appears.
4. Use the △/▽ keys to select [Store Mode] and press the ENT key or ▷ key.
   The Store mode setting is shown.

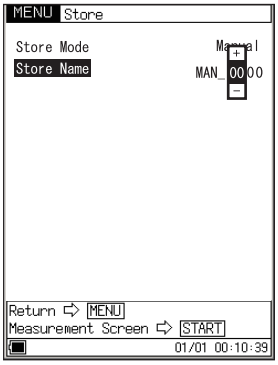


Store menu screen

5. Use the △/▽ keys to select [Manual] and press the ENT key.

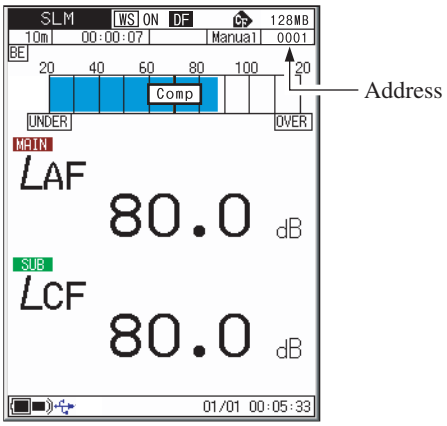


6. Specify the store name (When CF card is inserted).
   6-1. Use the △/▽ keys to select [Store Name] and press the ENT key.
   6-2. Use the △/▽ keys to specify the first two digits and press the ENT key.
   6-3. Press the ENT key or the ▷ key to move to the next two digits.
   6-4. Use the △/▽ keys to specify the final two digits and press the ENT key.



7. Press the START/STOP key to return to the measurement screen.
8. To store the sound level: (to store processed values only, skip steps 8 and 9 and proceed directly to step 10)
   Bring up the sound level screen.

9. Specify the store address.
   The currently selected address is shown on the screen. If the address is shown in red, it already contains data. Take care not to overwrite data that you want to keep.
   The △/▽ keys can be used to specify the address in the range from 0001 to 1000. Any data already present in the selected address will be overwritten (erased and replaced by the new data). For information on how to check existing data, see the section "Recalling Stored Data" on page 92.



10. Press the STORE key. The sound level at this point will be stored. If processing was being carried out, the processed values at the point where the STORE key is pressed will also be stored.
    The store process takes about 1 second. When it is completed, the address is incremented by one step, which allows you to store multiple data simply be pressing the STORE key repeatedly. The stored data includes the following information: date and time when STORE key was pressed, date and time when processing was started, measurement time, frequency weighting, time weighting (dynamic characteristics), trigger setting conditions, processing results, overload and under-range information, other information.
    The T-L (time-level graph) display screen is not stored.

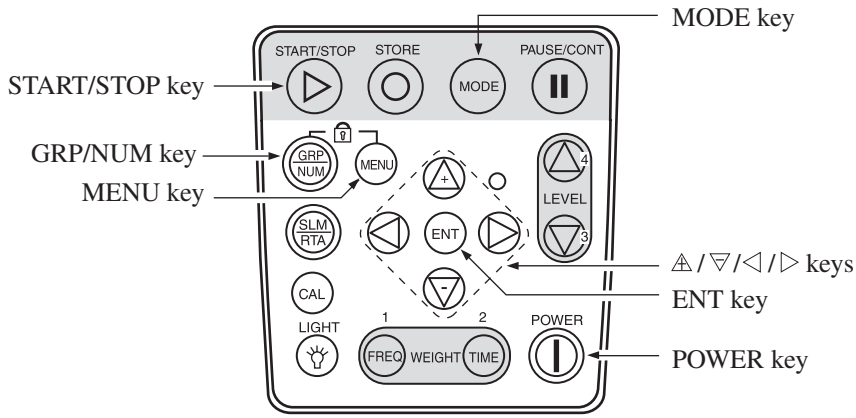
Important
Any measurement data present in the currently displayed address will be overwritten. If the address is shown in red, it contains data. Take care not to accidentally overwrite data.

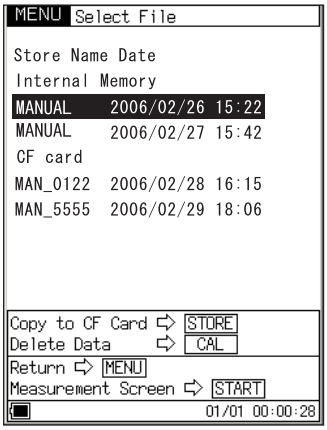
Note
When address 1000 is reached, it will be overwritten without confirmation. When the STORE key is pressed again after this, the "1000" indication flashes and no more data can be stored. If you change the address with the △ or ▽ key in this condition, the flashing will stop, and data can be stored in the newly selected address.

Recalling Stored Data

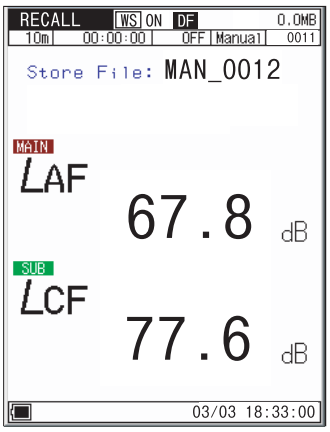
The procedure for recalling data stored in memory using manual mode is described below.

1. Turn power to the unit on.
2. Press the MENU key to bring up the menu list screen.
3. Use the ⏫/▽/◁/▷ keys to select [Recall] and press the ENT key.
   The file selection menu appears.
4. Use the ⏫/▽ keys to select the store name whose data you want to recall, and press the ENT key.
   The data stored in memory are displayed.
5. In analyzer mode, the GRP/NUM key can be used to switch between numeric display and graph display.

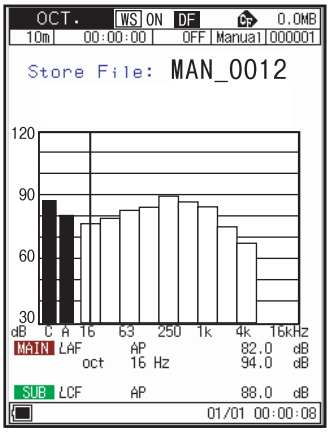




Select store name with △/▽ keys and press ENT key



Recall screen, sound level meter mode



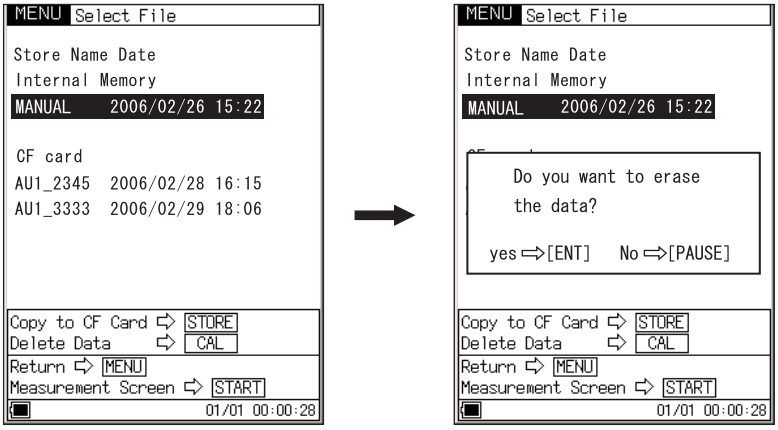
Recall screen, analyzer mode

Erasing Stored Data

To erase data stored in manual mode, proceed as follows.

Note
Data are erased in store name units. It is not possible to selectively erase data for a specific address.

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [Recall] and press the ENT key.
3. The file selection screen appears and stored data are displayed. Use the △/▽ keys to select the data that you want to erase.
4. Press the CAL key. A confirmation message appears. To erase the data, press the ENT key. To cancel the process, press the PAUSE key.



Select data to erase with △/▽ keys and press CAL key

Auto1

Memory Store

If no CF card is inserted, the data will be stored in the internal memory of the NA-28. If a CF card is inserted, the data will automatically be stored on the card.
Storing data on CF card is recommended.

Sound level meter mode

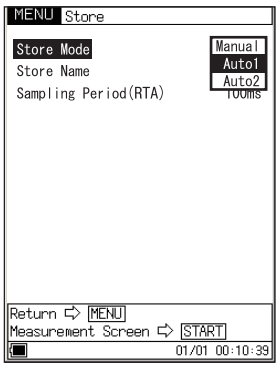
L_p, L_{eq}, L_{max}, L_{min} of main channel are stored as 1 set of data every 100 ms. Using a CF card, the maximum measurement duration is 1000 hours, and using the internal memory 3 hours.
Data is not stored even if the [SUB Channel] is set to ON.

Analyzer mode

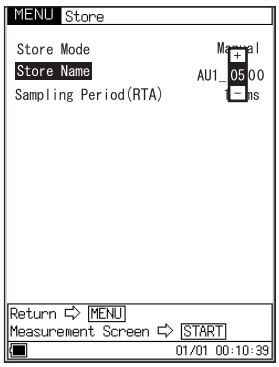
Continuous store of sound level L_p values for each band and all-pass

The procedure for storing data using Auto1 mode is as follows.
If a CF card is to be used, verify that the card is inserted in the card slot before starting the measurement.

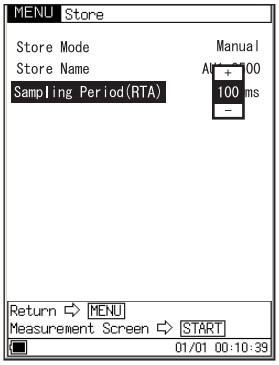
1. Turn power to the unit on.
2. Press the MENU key to bring up the menu list screen.
3. Use the △/▽/◁/▷ keys to select [Store] and press the ENT key.
4. Use the △/▽ keys to select [Store Mode] and press the ENT key. Then use the △/▽ keys to select [Auto1] and press the ENT key.



5. Specify the store name (When CF card is inserted).
   5-1. Use the △/▽ keys to select [Store Name] and press the ENT key.
   5-2. Use the △/▽ keys to specify the first two digits and press the ENT key.
   5-3. Press the ENT key or the ▷ key to move to the next two digits.
   5-4. Use the △/▽ keys to specify the final two digits and press the ENT key.



6. Use the △/▽ keys to select [Sampling Period] and press the ENT key. Use the △/▽ keys to set the sampling period and press the ENT key. In sound level meter mode, the setting is fixed to 100 ms.



7. Set other measurement parameters (measurement time, trigger mode, sub channel etc.) as required, using the MENU key to select setting items.
8. Press the START/STOP key to return to the measurement screen.

9. Press the STORE key to start the measurement.

Important
During measurement, only the START/STOP key, PAUSE/CONT key, LIGHT key, STORE key, MODE key and POWER key are operative. Other keys such as the FREQ WEIGHT key and TIME WEIGHT key have no effect. Be sure to complete all settings before starting the store process.

During normal Auto1 store, storing of measurement data will stop when the end of the measurement time is reached.

To stop the process earlier, press the START/STOP key or the STORE key.

When time trigger is being used, storing of measurement data will stop when the end of the measurement time or the preset measurement end time is reached.

Note
Relationship between elapsed measurement time and number of data When using Auto1 store and 100-ms sampling, 10 data sets are stored per second. Therefore, when 10 seconds of measurement time have elapsed, the number of stored data is 100 (10 when using 1-second sampling).
During Auto1 store, the pause function cannot be used.

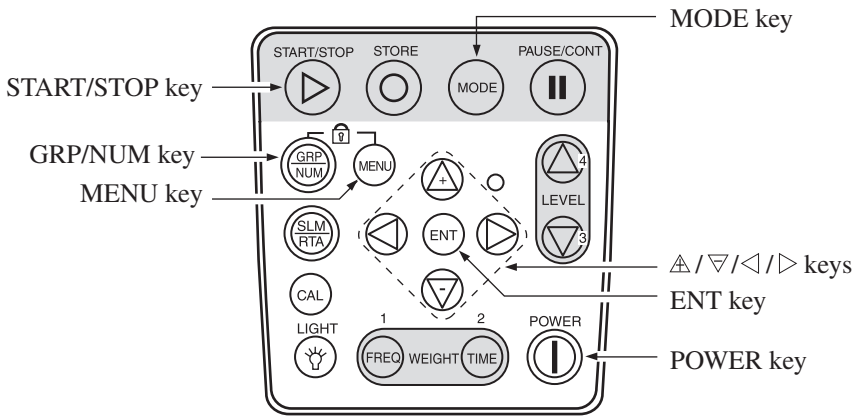
During Auto1 store, the address indication is based on elapsed measurement time.

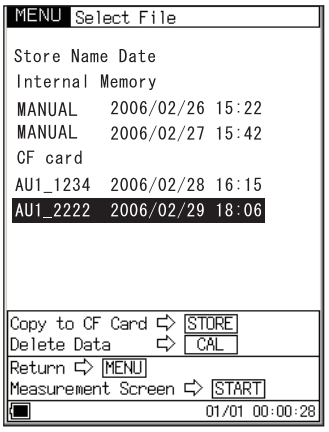
Note
During auto store with simultaneous octave and 1/3 octave analysis at sampling cycle settings of less than 100 ms, the display refresh rate (normally 100 ms) will be 200 ms.

Recalling Stored Data

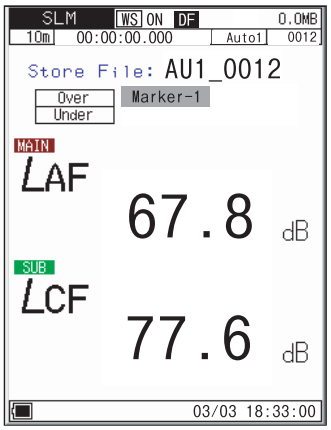
The procedure for recalling data stored in memory is described below.

1. Turn power to the unit on.
2. Press the MENU key to bring up the menu list screen.
3. Use the △/▽/◁/▷ keys to select [Recall] and press the ENT key. The file selection menu appears.
4. Use the △/▽ keys to select the store name whose data you want to recall, and press the ENT key.
5. The data stored in memory are displayed when the START/STOP key is pressed.
   The GRP/NUM key can be used to switch between numeric display and graph display.

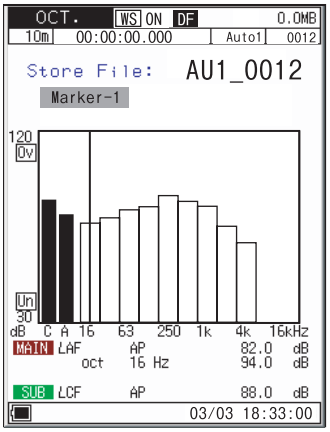




Select store name with △/▽ keys and press ENT key



Recall screen, sound level meter mode

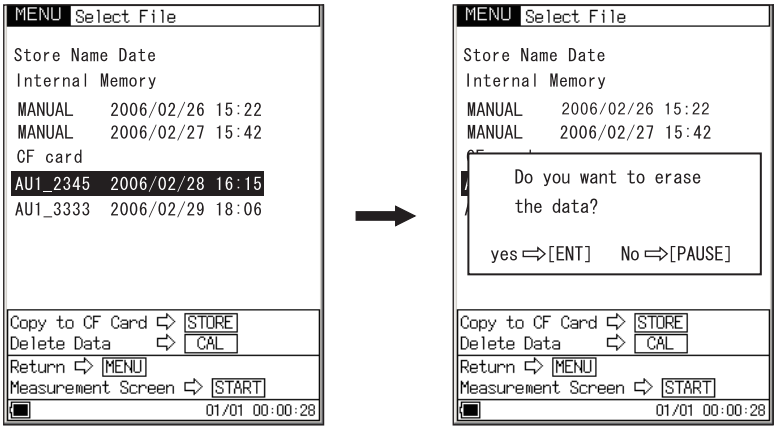


Recall screen, analyzer mode

Erasing Stored Data

To erase stored data, proceed as follows.

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [Recall] and press the ENT key.
3. The file selection screen appears and stored data are displayed. Use the △/▽ keys to select the data that you want to erase.
4. Press the CAL key. A confirmation message appears. To erase the data, press the ENT key. To cancel the process, press the PAUSE key.



Select data to erase with △/▽ keys and press CAL key

Auto2

Memory Store

If no CF card is inserted, the data will be stored in the internal memory of the NA-28. If a CF card is inserted, the data will automatically be stored on the card.
Storing data on CF card is recommended.

Sound level meter mode

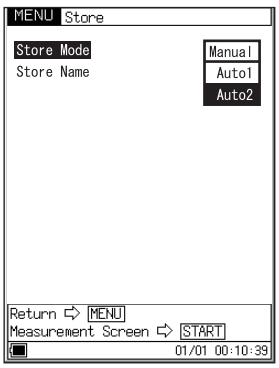
Continuous store of main channel and sub channel all-pass values and measurement start time, at preset measurement intervals

Analyzer mode

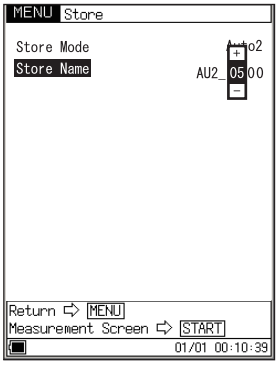
Continuous store of main channel band level values and all-pass value, sub channel all-pass value and measurement start time, at preset measurement intervals

The procedure for storing data using Auto2 mode is as follows.
If a CF card is to be used, verify that the card is inserted in the card slot (the CF card insertion indicator is shown) before starting the measurement.

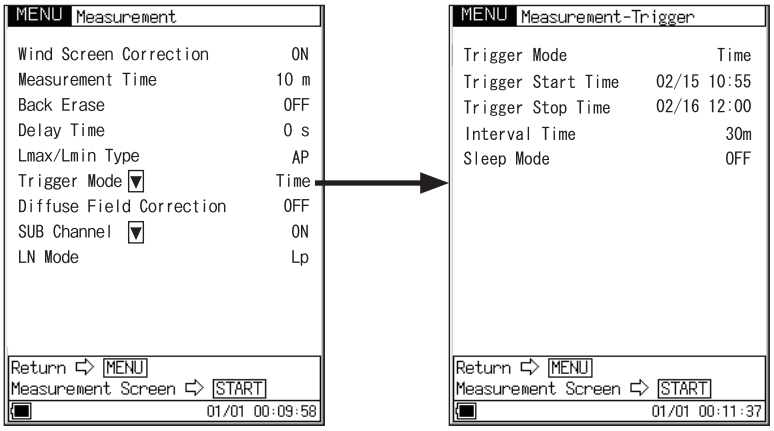
1. Turn power to the unit on.
2. Press the MENU key to bring up the menu list screen.
3. Use the △/▽/◁/▷ keys to select [Store] and press the ENT key.
4. Use the △/▽ keys to select [Store Mode] and press the ENT key. Then use the △/▽ keys to select [Auto2] and press the ENT key.



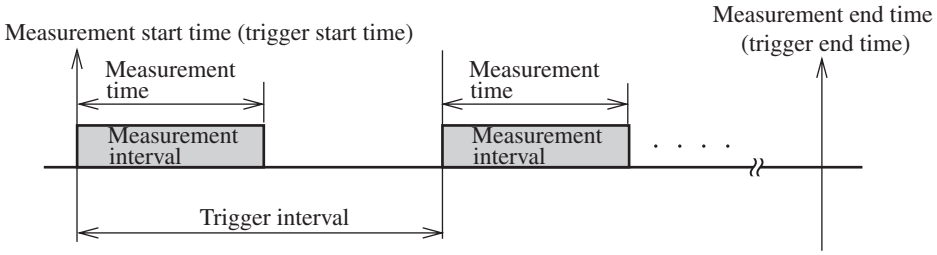
5. Specify the store name (When CF card is inserted).
   5-1. Use the △/▽ keys to select [Store Name] and press the ENT key.
   5-2. Use the △/▽ keys to specify the first two digits and press the ENT key.
   5-3. Press the ENT key or the ▷ key to move to the next two digits.
   5-4. Use the △/▽ keys to specify the final two digits and press the ENT key.



6. Use the △/▽ keys and ▷ key to specify the store name and press the ENT key.
7. Use the MENU key to return to the menu list screen, select [Measurement], and press the ENT key.
8. Use the measurement menu to set the [Measurement Time] and [Trigger Mode].
9. Set other measurement parameters (sub channel etc.) as required, using the MENU key to select setting items.
10. Press the START/STOP key to return to the measurement screen.
11. Press the STORE key to start the measurement.
    If a trigger has been set, measurement will start when the trigger conditions are met.



Measurement menu screen　　Time trigger menu screen



Note
During Auto2 store, the pause function cannot be used.

Recalling Stored Data

Same procedure as for Auto1 (see page 98).

Erasing Stored Data

Same procedure as for Auto1 (see page 100).

Screen Hard Copy

When you press the LEVEL ▽ key while holding down the MENU key, the current screen contents will be saved as a bitmap file on the CF card.

Store target folder:	\SCREENSHOT\
File name:	Time at which the file was stored
File name extension:	.BMP

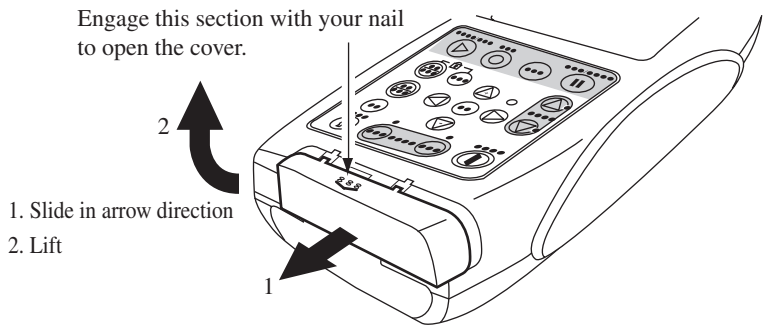
Memory Card

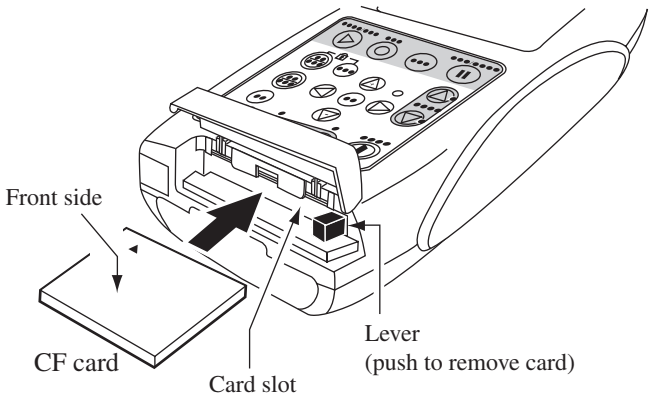
Using a memory card

Open the cover of the memory card slot and insert a CF card.

To remove the card, push the lever so that the card pops out.

Important
Make sure that power is OFF before inserting or removing a card.





Data Size Information

When using manual store

The approximate number of data sets that can be stored on a 128 MB memory card is as follows.

	Sizes per one data (Byte)	Number of data
SLM mode	1330	55000
OCT. mode	2059	28000
1/3 OCT. mode	3541	28000
OCT & 1/3 OCT mode	4291	18000

For example, when using manual store in OCT. mode, about 28000 data sets can be stored on the supplied memory card (128 MB). The maximum number of data sets that can be stored under one store name is 1000.
The above figures are determined by the allocation unit size.

When using Auto1 store

The approximate required storage capacity values are as listed below.

	Sizes per one data (Byte)	Data capacity (MByte)				
Measurement time		10 sec	30 sec	1 h	8 h	24 h
Sampling cycle		2 msec	5 msec	100 msec	100 msec	100 msec
SLM mode	35			1.26	10.1	30.3
OCT. mode	89	0.45	0.54	3.21	25.7	76.9
1/3 OCT. mode	221	1.11	1.33	7.96	63.7	191
OCT & 1/3 OCT mode	287	1.44	1.73	10.4	82.7	248

For example, when performing an 8-hour measurement in 1/3 OCT. mode, at a sampling cycle setting of 100 ms, the required storage capacity will be 63.7 MB according to the above table. Therefore the supplied memory card (128 MB) will be sufficient.

When using Auto2 store

The approximate number of data sets for various card capacity ratings are listed below.

	Sizes per one data (Byte)	Number of data			
Card size		128 M	256 M	1 G	2 G
SLM mode	301	390 k	800 k	3.2 M	6.2 M
OCT. mode	879	130 k	270 k	1.1 M	2.1 M
1/3 OCT. mode	2067	58 k	110 k	470 k	910 k
OCT & 1/3 OCT mode	2661	45 k	90 k	360 k	710 k

When performing an Auto2 store measurement in OCT. & 1/3 OCT. mode, the size of each data set will be about 2700 bytes.

For example, when performing a measurement in OCT. & 1/3 OCT. mode continuously for a day using a measurement interval setting of 1 minute, 1440 data sets will be generated, which require 1440 × 2700 = approx. 4 MB of space.

About memory cards

Be sure to use optional memory cards from Rion Co., LTD. The memory cards that can be used in this unit are CompactFlash ™ cards.

* CompactFlash is a trademark of San Disk Corporation.

Memory cards even from the same manufacturer and of the same type exhibit certain variations in specifications which may cause problems. For this reason, be sure to use only the memory cards offered by Rion Co., LTD.

A memory card inserted in the unit will be recognized as a removable disk by the computer when connected via USB, without having to install a USB driver.
To make the connection, use a generic USB cable (standard A male to mini B male connector). When not using the communication function, set the USB communication to OFF from the [Input/Output] menu screen. When USB communication is enabled, a message requesting installation of a USB driver for USB communication will appear when the unit is connected to a computer.

Note
When using spreadsheet software or other programs on a computer to retrieve data from memory cards, some programs may not be able to read the original file names from the card. In such a case, rename the file using the extension "txt" (for example "AU1_0001.txt"). For software that identifies files by the file name extension, set the software up for reading text files.

About the store data format

Data stored on the memory card are in CSV format. Various files and subdirectories are created on the card, depending on the store mode.

Manual store

The store name specified on the menu screen is created as a 4-digit number under the subdirectory name.
The file of one per one address is made.

Auto1 store

The store name specified on the menu screen is used for the subdirectory name and the lower four digits of the header file name.
The header file contains measurement parameters and other information.
The file extension is rnh.

The data file contains the sound pressure level, over-range information ("O"), under-range information ("U"), and pause information ("P") in CSV format.
The file extension is rnd.
Line returns are denoted by <CR><LF>.

One file contains up to 36000 data. When this number is exceeded, a new file is created.

Auto2 store

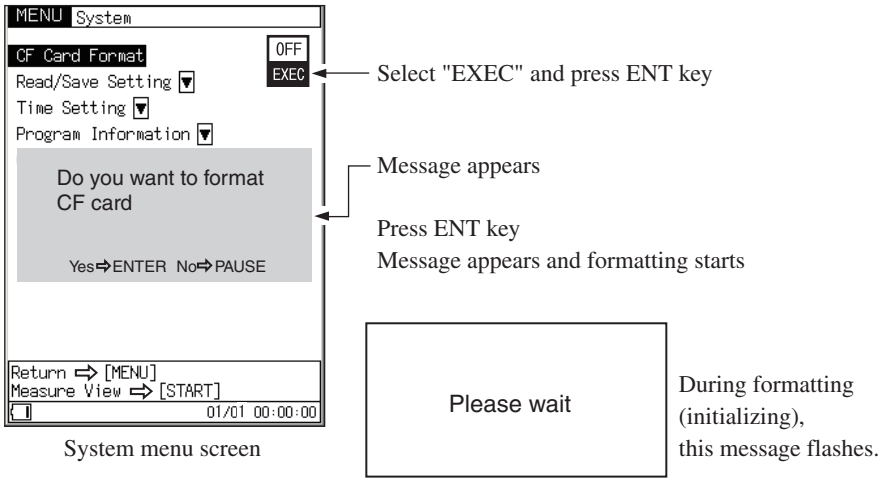
The store name specified on the menu screen is used for the subdirectory name and the lower four digits of the header file name.
A new file is created for every 6000 data.

Formatting (Initializing) a CF Card

Important
Formatting (initializing) a CF card will erase all data present on the card.

A CF card can be formatted either in a computer or in the NA-28.
The procedure for formatting the card in the NA-28 is described below.

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [System] and press the ENT key.
3. The system menu screen appears. Use the △/▽ keys to select [CF Card Format] and press the ENT key.
4. Use the △/▽ keys to select "EXEC" and press the ENT key. A message such as shown below appears. To proceed with the formatting, press the ENT key (Yes).



System menu screen

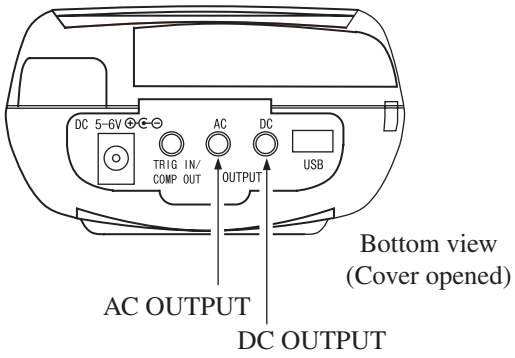
Note
If the logical structure of the CF card has been damaged (such as when the power failed or was turned off during a store process), you must format the card in a computer. When formatting (initializing) a CF card in a computer, select "FAT" or "FAT 32" as the file system.

Input/Output Connectors

AC OUTPUT

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [I/O (Input/Output)] and press the ENT key.
3. Use the △/▽/◁/▷ keys to select [AC OUT] and press the ENT key.
4. Use the △/▽/◁/▷ keys to select [MAIN/SUB] and press the ENT key.
   The signal is available at the AC OUTPUT jack on the bottom of the unit.
   It is a frequency-weighted AC signal derived from the main channel signal when you select "MAIN", or a frequency-weighted AC signal derived from the sub channel signal when you select "SUB".

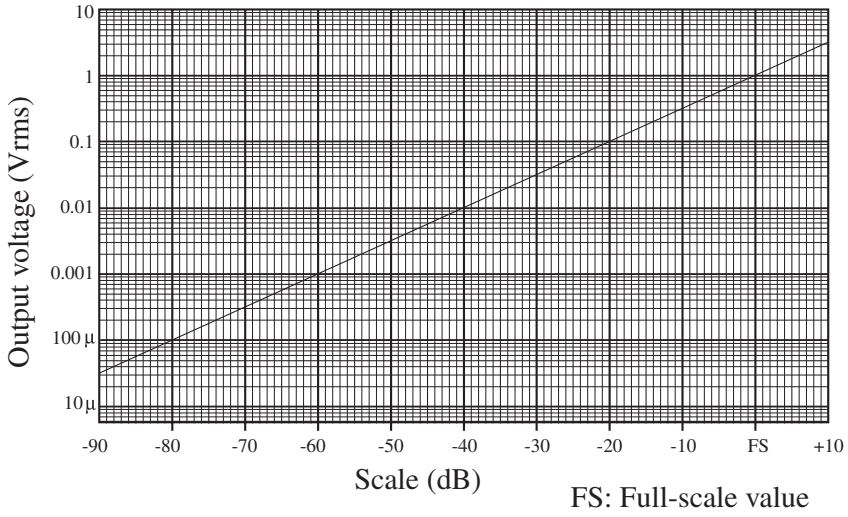
Output voltage:	1 Vrms ±50 mVrms (at scale upper limit)
Output impedance:	Approx. 600 Ω
Load impedance:	10 kΩ or more
Suitable cable:	Output cable CC-24 (BNC - RCA cable)



Note
Using this feature will reduce battery life by about 30 percent.

The relationship between the display value shown by the NA-28 and the output voltage is indicated below.

When the NA-28 is set to the calibration mode, the output signal (level range upper limit 120 dB -6 dB = 114 dB, 1000 Hz sinusoidal wave) is 0.5 Vrms.



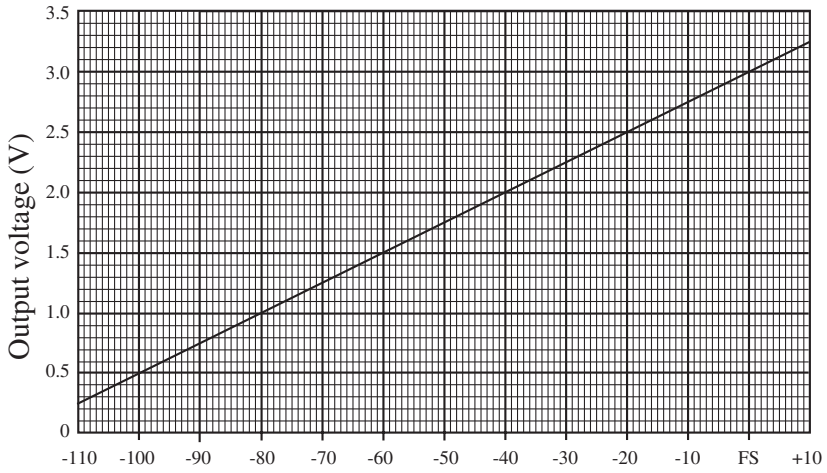
FS: Full-scale value

DC OUTPUT

1. Press the MENU key to bring up the menu list screen.
2. Use the △/▽/◁/▷ keys to select [I/O (Input/Output)] and press the ENT key.
3. Use the △/▽/◁/▷ keys to select [DC OUT] and press the ENT key.
4. Use the △/▽/◁/▷ keys to select [MAIN/SUB] and press the ENT key.
   The signal is available at the DC OUTPUT jack on the bottom of the unit as a level-converted signal. It is derived from the main channel signal when you select "MAIN", or from the sub channel signal when you select "SUB". The level-converted signal is obtained by frequency weighting, rms detection, and logarithmic compression, using the frequency weighting and time weighting settings of the unit.

   Output voltage: 3.0 V (at scale upper limit), 25 mV/dB
   Output impedance: Approx. 50 Ω
   Load impedance: 10 kΩ or more
   Suitable cable: Output cable CC-24 (BNC - RCA cable)

   The relationship between the display value shown by the NA-28 and the output voltage is indicated below.



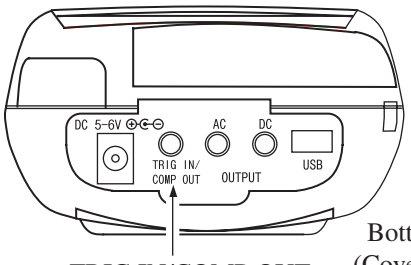
FS: Full-scale value

When the NA-28 is set to the calibration mode, the output signal (level range 120 dB, scale upper limit -6 dB) is 2.85 V.

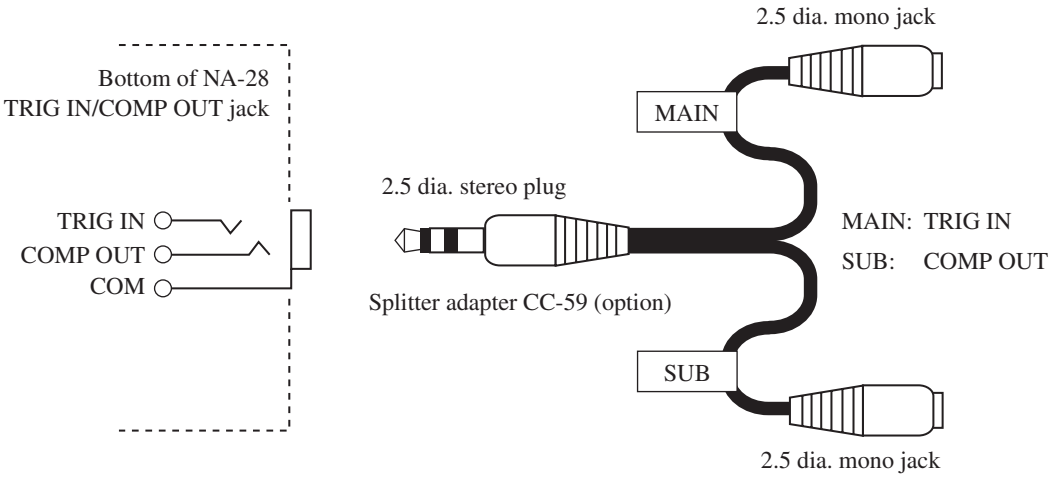
Note
Using this feature will reduce battery life by about 30 percent.

TRIG IN/COMP OUT jack

The TRIG IN/COMP OUT jack is located at the bottom of the unit.



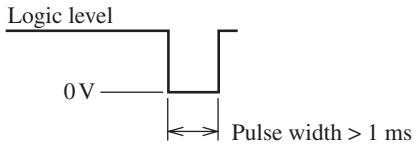
A connection diagram for the TRIG IN/COMP OUT jack is shown below. The optional splitter adapter CC-59 is required for using the TRIG IN/COMP OUT jack.



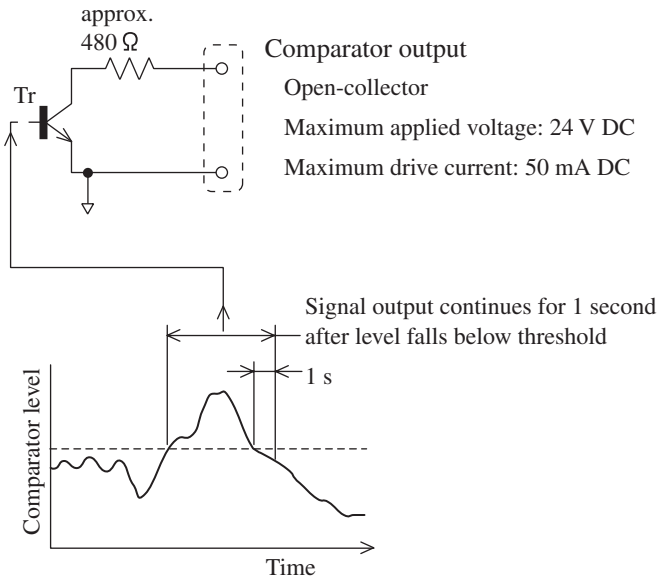
If the output cable CC-24 (monaural plug) is used, the connection functions as trigger input.

TRIG IN (Trigger input)

0 to 5 V logic-level signal, falling edge trigger, pulse width 1 ms or more



COMP OUT (Comparator output)



Default Settings

The factory default settings of the unit are listed below.

- SLM/RTA ..... SLM
- Mode ..... L_p
- Main channel frequency weighting ..... A
- Main channel time weighting ..... F
- Level range full scale 120
- Calibration mode ..... Internal
- Measurement time 10
- Measurement unit ..... m
- Back erase ..... OFF
- Delay time ..... 0 s
- L_{max}/L_{min} type ..... Band
- Windscreen correction ..... OFF
- Trigger mode ..... OFF
- Trigger level 70
- Slope ..... +
- Trigger band (1/3 Oct position in Oct) ..... Center (only communication)
- Trigger band (Oct or 1/3 Oct) ..... MAIN AP
- Trigger band (SLM) ..... MAIN AP
- Trigger Start time 01/01 00:00
- Trigger stop time 01/01 00:00
- Time trigger interval ..... OFF
- Diffuse field compensation ..... OFF
- Sub channel ..... OFF
- Sub channel frequency weighting C
- Sub channel time weighting ..... F
- Max hold ..... OFF
- L_{eq} ..... ON
- L_E ..... OFF
- L_{max} ..... ON
- L_{min} ..... OFF

L_{N1} (L05) ..... OFF
L_{N2} (L10) ..... OFF
L_{N3} (L50) ..... ON
L_{N4} (L90) ..... OFF
L_{N5} (L95) ..... OFF
List ..... ON
T-L (Time/Level) display ..... ON
Additional processing value (L_{peak}/L_{tm5}) ..... L_{peak}
Store mode ..... Manual
Store name ..... MAN_0000
RTA mode Auto1 sampling cycle ..... 100 ms
Sleep mode ..... ON
AC OUT ..... MAIN
DC OUT ..... MAIN
Comparator output ..... OFF
Comparator level ..... 70 dB
Comparator band (1/3 Oct position in Oct) ..... Center (only communication)
Comparator band (Oct or 1/3 Oct) ..... MAIN AP
Comparator band (SLM) ..... MAIN AP
USB Communication ..... OFF
Remote control ..... OFF
Back light auto-off ..... 30 s
Back light Brightness ..... Dark
Beep ..... ON
Index 1

When you turn power to the unit on while holding down the Start/Stop key, the unit will be initialized to the above settings. When wishing to set the unit to the factory default values, select [menu] → [system – Read/Save Setting] → [Load Default] and then press the ENT key. The time, language and store data are not initialized.

Setup File

Loading settings from a setup file at startup has the following advantages:

- Setup file stored on CF card is loaded automatically and establishes the desired settings, allowing quick measurement start.
- If settings were changed by mistake, simply turning the unit off and on again will restore the original settings.
- Storing different setup files on a number of CF cards allows changing settings simply by changing the CF card. This facilitates accurate parameter control for various measurements.

In order to automatically load settings from a file at startup, a special folder (NA-28\SETUP\STARTUP) must be created on the CF card, and a setup file (NA-28SET○.rns, where ○ is a number from 1 to 9) must be created in that folder.
Do not create the setup file more than one in this folder.
When the NA-28 is turned on with a CF card inserted, and if that CF card contains a setup file, a dialog asking whether to load the settings appears. Either selecting "Yes" at this dialog or waiting for 10 seconds will cause the settings in the file to be loaded.

Note
Setup file loading precaution The NA-28 has a resume function that will cause the same settings as used at the last time to be re-established when the unit is turned on again. If a setup file is loaded and the settings from that file are established, the settings memorized by the resume function will be overwritten. It is therefore recommended to save the current settings in memory or CF card before loading a setup file.

Preparing a setup file for automatic loading

1. Set the NA-28 to the intended condition, so that measurement parameters and other settings are as desired.
2. To enable automatic loading, a simple preparatory step is required using a computer. This can be realized in two ways:
   (1) Remove the CF card from the NA-28 and connect it directly to the computer, using a CF card reader or similar.
   (2) Leave the CF card in the NA-28 and connect the NA-28 via USB cable to the computer.
3. Check whether a folder named "NA-28\SETUP\SET_○○○○" exists on the CF card.
   If the folder does not exist, perform the steps described in the section "Copying a setup file to CF card" (see page 122).
4. Create a folder named "NA-28\SETUP\STARTUP" on the CF card. "STARTUP" is not case-sensitive (it can be upper case or lower case).
5. Copy the setup file to use from the folder in step 3 to the STARTUP folder.

This completes the preparation procedure.

Automatic loading of settings at startup

1. Insert a CF card prepared as described in the preceding section "Preparing a setup file for automatic loading" into the NA-28, and turn power on.
2. A dialog appears asking whether to load the settings. Select "Yes" at this dialog or wait for 10 seconds until the settings are loaded.
   If the dialog does not appear and the unit goes directly to the measurement screen, the preparation procedure may not have been successful. Check the folder name (STARTUP) and the file name (NA28SET○.rns).

The saved settings will be loaded and reflected in the operating condition of the NA-28.

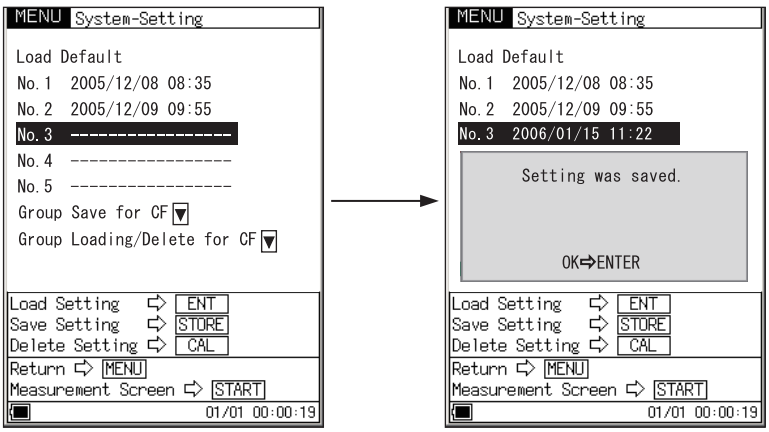
Saving a setup file

1. Set the NA-28 to the intended condition, so that measurement parameters and other settings are as desired.
2. On the menu screen, select [System], then select [Read/Save Setting] and press the ENT key.
3. Bring the cursor to any position between No. 1 and No. 5, and use the STORE key to save the settings.

   If settings are already stored in the specified number, a dialog confirming the overwrite will appear.

   When the indication "Setting was saved." appears, the process is completed.

   This procedure saves the settings in the internal memory of the NA-28 (up to five different settings numbered 1 through 5 can be saved).



Select No. and press STORE key
Save settings dialog appears
Press ENT key to proceed or wait about 5 seconds

Copying a setup file to CF card

Up to five setup files can be saved in internal memory. If you want to create more setup files, or if you want to automatically load a setup file at startup, the CF card can be used.

The NA-28 does not allow directly saving settings in a file on the CF card. The settings must first be saved in internal memory as described in the preceding section, and then the file(s) must be copied to the CF card.

1. To copy settings as saved in step 3 above from internal memory to CF card, select "Group Save for CF" → "---- (New) ----" → enter group name (SET_○○○○).

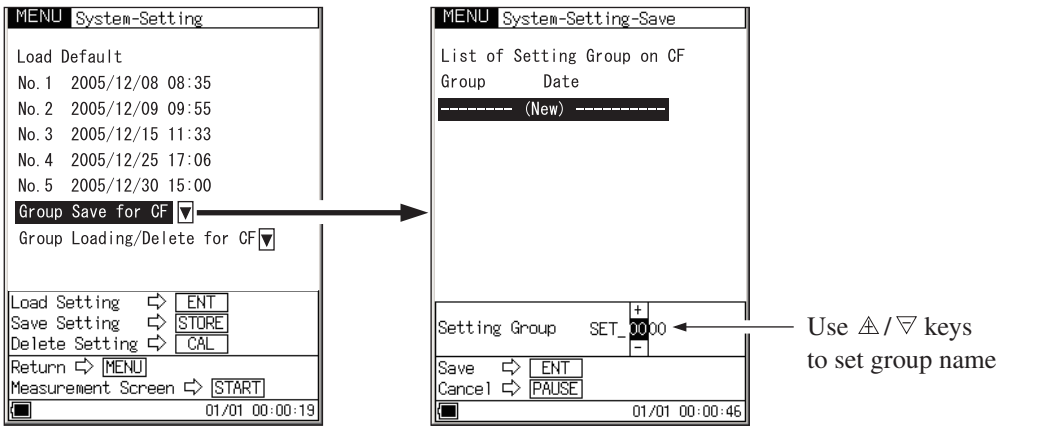
   This will cause a setup file to be copied to the folder "NA-28\SETUP\SET_○○○○" on the CF card.

   The SET_○○○○ group (folder) can contain up to five NA28SET○.rns setup files.

   Up to 100 setting groups can be created on one CF card. Consequently, up to 500 different settings can be saved on a CF card.

2. This completes the setup file to CF card copy procedure.

   Provided that the correct folder name (SET_○○○○), file name (NA28SET○.rns), and file format is used, the setup file may also be created with a text editor on a computer.



Optional Accessories

Microphone Extension Cables (EC-04 series)

For enhanced measurement accuracy, the microphone can be detached from the unit and connected via an extension cable. This will reduce measurement deviations due to refraction effects of the unit or the acoustic influence of the operator.

Six different cable types with lengths from 2 to 100 meters are available, as listed in the table below. It is also possible to combine multiple cables.

Cable runs of up to 35 meters are supported for measurement law of Japan.

Important
With long extension cables, the cable capacitance restricts the upper measurement frequency and measurement level. For details, refer to the Technical Notes.

Type	Length	Type	Length
EC-04	2 m	EC-04C	30 m (reel) + 5 m (connection cable)
EC-04A	5 m	EC-04D	50 m (reel) + 5 m (connection cable)
EC-04B	10 m	EC-04E	100 m (reel) + 5 m (connection cable)

Printer BL-112UI

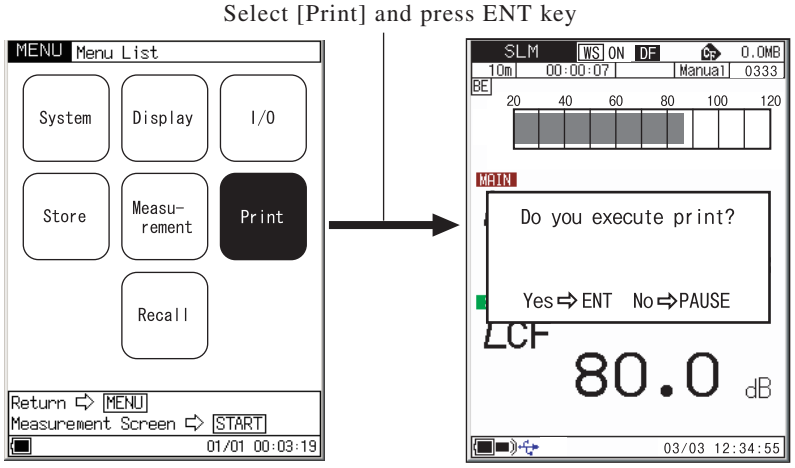
Data stored in the memory of the NA-28 and on CF card can be printed out on a printer. You can also produce hard copy of measurement screens. (The printer, printer paper, and printer cable are options.)
To print measurement data, turn the NA-28 and the printer on and set the printer to the online state. The steps described in the chapter "Preparations" (page 9) should be completed.

For details about printer operation, refer to the documentation supplied with the printer.

Printing a measurement screen

The steps for printing hard copy of a measurement screen are described below.

1. While the measurement screen is displayed, press the MENU key.
2. Use the △/▽/◁/▷ keys to select [Print] from the menu list screen.
3. When you press the ENT key, the following display appears.
   To print the screen, press the ENT key once more. To cancel the process, press the PAUSE key.



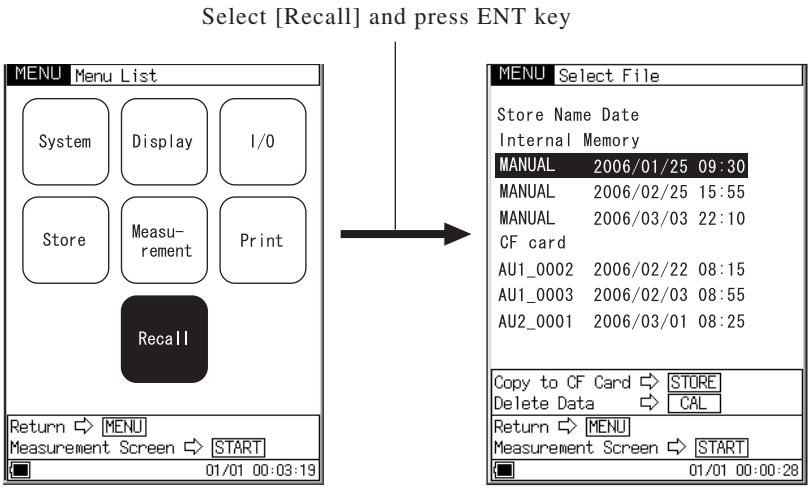
Menu list screen

Printing screen

Printing stored data

The steps for printing hard copy of a stored data screen are described below.

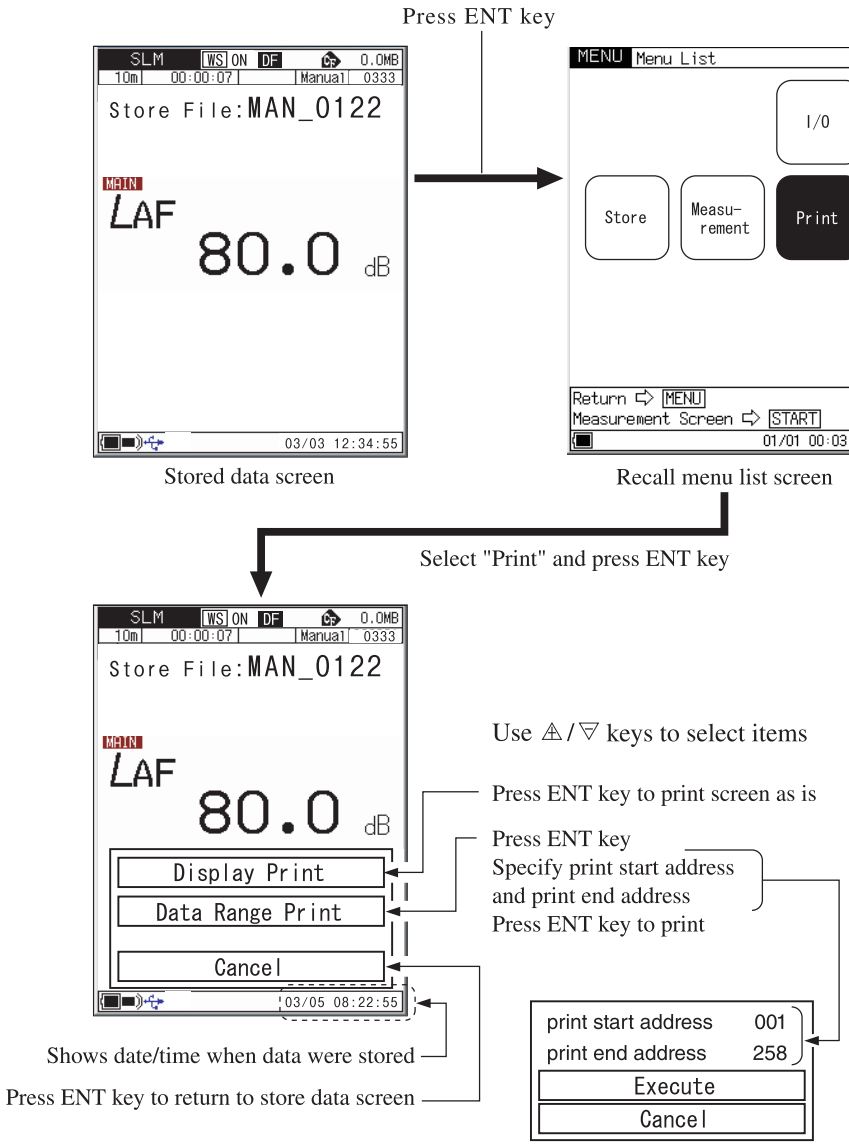
1. On the menu list screen, select [Recall] and press the ENT key.
2. Use the △/▽/◁/▷ keys to select the stored data that you want to print.
3. When you press the ENT key, the stored data are displayed.



Menu list screen　　Stored data list

4. When you press the ENT key once more, the recall menu list screen appears. Select [Print] and press the ENT key.

5. A display such as shown below appears. If you want to print only a range of data, select "Data Range Print" and specify the range. Then select "Execute" and press the ENT key to start printing.



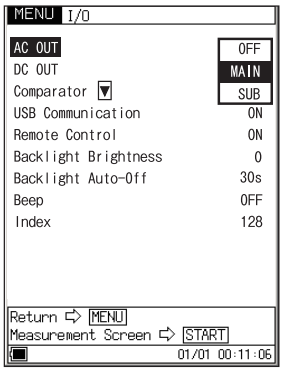
Level Recorder LR-07/LR-20A

By connecting a level recorder to the NA-28, the sound level changes over time can be recorded.

Sound level recording

The procedure for recording sound level changes over time is described below. Turn power to the NA-28 and the level recorder on. The steps described in the chapter "Preparations" (page 9) should be completed. For details about level recorder operation, refer to the documentation supplied with the level recorder.

1. Use the MENU key to bring up the menu list screen, select [I/O (Input/Output)] and press the ENT key.
2. Select [AC OUT] and press the ENT key.
3. Make the "MAIN/SUB" selection (main channel output or sub channel output).
4. Press the MENU key to return to the measurement screen.
5. Press the CAL key to set the unit to the calibration mode (Internal Calibration).



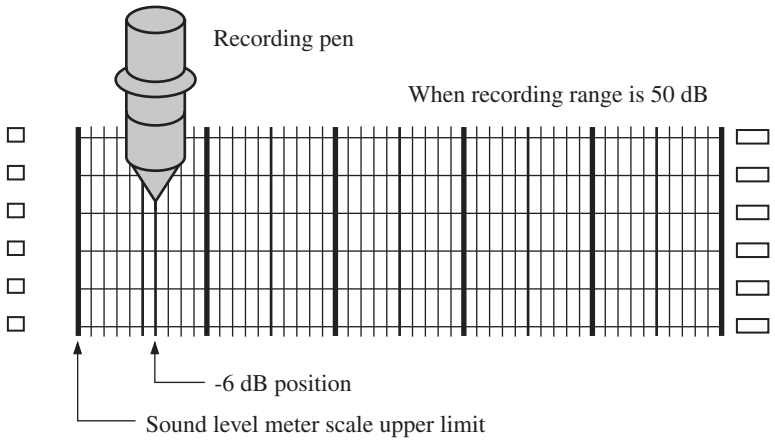
Input/Output menu screen

Select [AC OUT]
Press ENT key

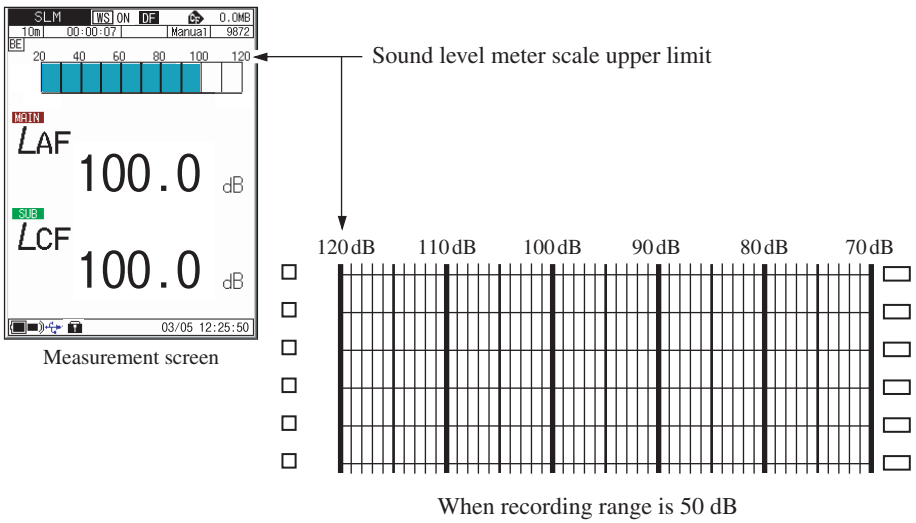
Select MAIN/SUB output channel
Press ENT key

Press MENU key to return to previous screen

6. Adjust the level control (Level adj) of the level recorder so that the pen registers at -6 dB from the top of the scale.



7. Press the CAL key once more to return the NA-28 to the measurement mode.
8. Use the FREQ WEIGHT key to set the frequency weighting characteristic. The time weighting characteristic is set at the level recorder.
9. Use the LEVEL △ / ▽ keys to adjust the level range. Make the setting so that the "OVER" or "UNDER" indication does not appear. The level range (scale upper limit) setting of the NA-28 becomes the scale upper limit of the level recorder.



Program Cards

The NA-28 can make use of a range of optional program cards.
For details on usage, refer to the documentation supplied with the respective card.

Remote control

The infrared remote control (NA-27RC1) can be used to control the basic functions and measurement parameters of the sound level meter. This is achieved by pressing buttons arranged on the panel of the remote control. The operation range of the remote control is about 3 meters.

START/STOP key

Serves for starting and stopping the measurement.

PAUSE/CONT key

Serves for pausing the measurement. When the back-erase function is enabled, data from a short interval before the key was pressed are excluded from processing.

LEVEL UP/DOWN key

Allows changing the level range.

FAST, SLOW, 10ms keys

Serve to select time weighting characteristic for the main channel.

Lp, Leq, LE, Lmax, Lmin keys

Serve to switch the measurement results shown on the display.

STORE key

Serves to start/stop the storing of data in internal memory.

A, C keys

Serve to select frequency weighting characteristic for the main channel.

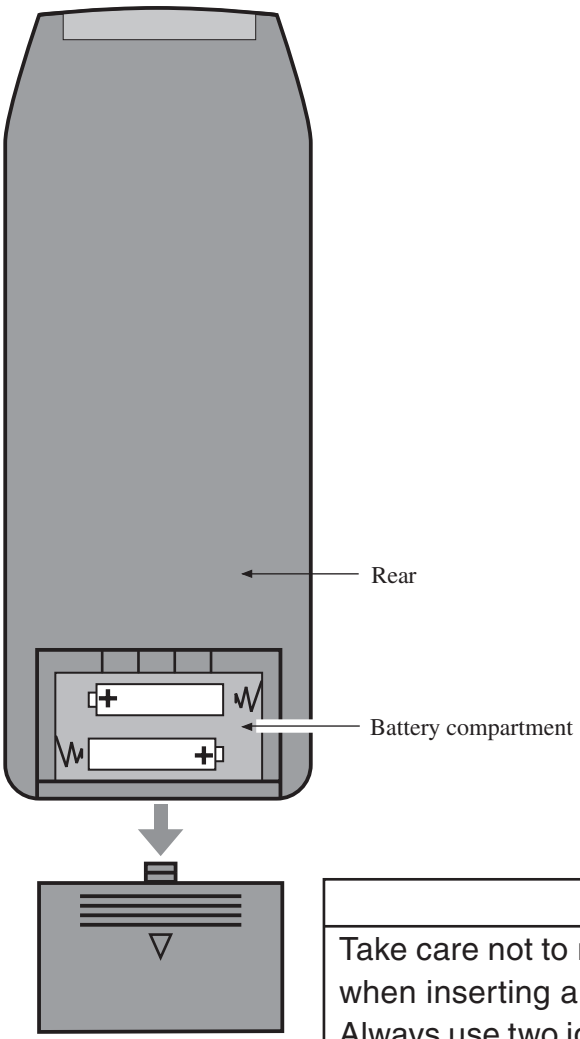
A: A-weighting C: C-weighting

PRINT key

Serves to print the content shown on the display or data stored in memory using an optional printer.

Insert two IEC R03, size AAA batteries (LR03 or R03) into the battery compartment on the rear of the remote control.

1. Pull the cover of the battery compartment down while pushing on the section marked with the ▽ symbol.
2. Insert two IEC R03, size AAA batteries, taking care to observe correct (+) (-) polarity.
3. Replace the cover of the battery compartment.



Important

Take care not to reverse the (+) and (-) polarity when inserting a battery.
Always use two identical batteries, and replace batteries only as a set. Mixing battery types or old and new batteries can lead to damage.
Remove the batteries from the unit if it is not to be used.

Specifications

Applicable standards

General measurement law of Japan: precision sound level meters
IEC 61672-1:2002 Class 1
IEC 61260:1995 Class 1
ANSI S1.11-2004 Class 1
ANSI S1.4-1983 Type 1
ANSI S1.43-1997 Type 1
JIS C 1509-1:2005 Class 1
JIS C 1513:2002 Class 1
JIS C 1514:2002 Class 1
IEC 60804:2000 Type 1, IEC 60651:1979 Type 1 were abolished in 2002 and replaced by IEC 61672-1:2002
JIS C 1505 was abolished in 2005 and replaced by JIS C 1509-1

Measurement functions

Simultaneous measurement of main channel and sub channel is possible for sound level meter mode and analyzer mode.
Frequency weighting characteristics and time weighting characteristics are set independently for main channel and sub channel.

Sound level meter mode

All-pass processing for the measurement items listed below is carried out, separately for main channel and sub channel.
For the sub channel, either L_{peak} or L_{tm5} can also be determined.

Analyzer mode

For the main channel, octave or 1/3 octave band real-time processing and all-pass processing are carried out. Simultaneous octave and 1/3 octave band real-time processing is also possible (with bandwidth limitations).
For the sub channel, only all-pass processing is carried out.

Measurement items

Simultaneous measurement of all items, using selected time weighting and frequency weighting

Sound level	L_p
Equivalent continuous sound level	L_{eq}
Sound exposure level	L_E
Maximum sound level	L_{max}
Minimum sound level	L_{min}
Percentile sound level	L_N (1 to 99, 1-increment steps, max. 5 values, calculated from L_p or $L_{eq,1sec}$)

Additional processing

In sound level meter mode, one of the following measurements can also be selected for the sub channel.

Peak sound level	L_{peak}
Takt-max sound level	L_{tm5}

Frequency weighting characteristic is the same as for the sub channel.

Measurement time 1 to 59 seconds, 1 to 59 minutes, 1 to 24 hours

Processing types in each operation mode

		Main processing		Additional processing
	Channel	Main	Sub	Add
Sound level meter mode	AP/OCT	AP	AP	AP
	Frequency weighting	A/C/Z	A/C/Z	Same as Sub
	Time weighting	F/S/10 ms	F/S/10 ms/I	---
	Measurement values	L_p, L_{eq}, $L_{E,}$ L_{max}, L_{min}, L_N	L_p, L_{eq}, L_E, L_{max}, L_{min}, L_N	L_{peak} or L_{Atm5}
Analyzer mode	AP/OCT	AP, OCT	AP	---
	Frequency weighting	A/C/Z	A/C/Z	
	Time weighting	F/S/10 ms	F/S/10 ms/I	
	Measurement values	L_p, L_{eq}, L_E, L_{max}, L_{min}, L_N	L_p, L_{eq}, L_E, L_{max}, L_{min}, L_N	

Microphone and preamplifier

	Microphone	UC-59
		Sensitivity -27 dB ±2 dB
		(re. 1 V/Pa)
	Preamplifier	NH-23

Measurement level range

	A-weighting	25 to 130 dB
	C-weighting	33 to 130 dB
	Z-weighting	38 to 130 dB

Total range 25 to 140 dB (A-weighting, 1 kHz)

Upper limit for peak sound level measurement 143 dB

Inherent noise	A-weighting	max. 17 dB
	C-weighting	max. 25 dB
	Z-weighting	max. 30 dB

Measurement frequency range

10 Hz to 20 kHz

Analysis frequency range

	Octave analysis	16 Hz to 16 kHz
	1/3 octave analysis	12.5 Hz to 20 kHz

With simultaneous octave and 1/3 octave analysis

	Octave analysis	16 Hz to 8 kHz
	1/3 octave analysis	12.5 Hz to 12.5 kHz

Frequency weighting	A, C, Z	
Time weighting	Main channel	F, S, 10 ms
	Sub channel	F, S, 10 ms, I

Linear operating range

	All-pass (A-weighting)	110 dB
		(30 to 130 dB range, 1 kHz)
	Spectrum	95 dB

Level range

Sound level meter mode

Bar graph display range max. 100 dB
30 to 130 dB
20 to 120 dB
20 to 110 dB
20 to 100 dB
20 to 90 dB
20 to 80 dB

Analyzer mode

Bar graph display range 90 dB
40 to 130 dB
30 to 120 dB
20 to 110 dB
10 to 100 dB
0 to 90 dB
-10 to 80 dB

Sampling cycle

L_{eq}, L_E, L_{max}, L_{min}, L_{peak} : 15.6 µs
(with simultaneous octave and 1/3 octave analysis: 20.8 µs)
L_N: 100 ms

Correction functions

Windscreen correction

Reduces influence of mounted windscreen on frequency response characteristics
Correction on/off setting via menu screen

Diffuse sound field correction

Frequency response correction to ensure standard compliance (ANSI S1.4) in diffuse sound field
Correction on/off setting via menu screen

Display	Backlit semitransparent color TFT LCD display (240 × 320 dots)
Update frequency:	100 ms (200 ms when performing auto store with simultaneous analysis at sampling cycles of less than 100 ms)
Trigger function	Controls measurement and memory store start
Level 1	Trigger level (1-dB steps) serves as threshold for starting measurement; measurement ends after preset time Slope +/- can be set
Level 2	Single measurement is carried out when trigger level is exceeded
External	External trigger connector for logic-level signal with falling edge detection
Time	Start time and trigger event recurrence interval are set
Delay function	Sets a delay interval between pressing of START/STOP key and actual measurement or trigger monitoring start
Setting range	0 to 10 seconds in 1-s steps
Back-erase function	When measurement is paused with PAUSE/CONT key, data from 5-second interval before key was pressed are excluded from processing
Store	Sound level values and processing results are stored in manual store or auto store mode. Data can be stored in internal memory or on CF card. Internal memory has 1 block, for which manual store, auto store 1 or auto store 2 can be selected.

Manual store
Data for measurement results and measurement start time are stored manually, in single address increments.
Data store capacity
Internal memory: max. 1000 data sets
CF card: max. 1000 data sets per store name, max. 100 store names

Auto store
Measurement results are stored continuously at preset intervals.
Up to 4 markers can be added to identify particular events during recording.
During Auto store, the pause function cannot be used.

Auto1
Measurement time: Max. 1000 hours (when using CF card; for information on time limit when using internal memory see below)
Sound level meter mode
Continuous store of L_p, L_{eq}, L_{max}, L_{min} as 1 set every 100 ms
Sub channel measurement results cannot be stored.
Sampling cycle: 100 ms (L_p, L_{eq}, L_{max}, L_{min}) only
Internal memory: max. 3 hours
Analyzer mode: Continuous store of sound level L_p values for each band and all-pass
Main channel: All-pass value and band level values
Sub channel: All-pass value only
Sampling cycle: 1 ms to 1 sec, $L_{eq,1s}$
Internal memory: max. 10000 data (2.7 hours for 1 sec or $L_{eq,1s}$)

Auto2	Sound level meter mode	
		Continuous store of main channel and sub channel all-pass value and measurement start time, at each measurement interval
	Analyzer mode	Continuous store of main channel band level and all-pass values, sub channel all-pass value, and measurement start time, at each measurement interval
	Number of data	Internal memory max. 1,000 sets
		CF card max. 300,000 sets
Data recall	Allows viewing of store data	
	Time-Level display also possible (for one selected band)	
Recall processing	None	
Setup memory	Up to five setup configurations can be saved in internal memory, for later recall	
	Automatic loading of settings from setup file saved on CF card possible	
Print functions	Printing of measurement results on dedicated USB printer	
	Screen print mode	Hard copy of current display screen
	Memory print mode	Continuous printout of specified address range in memory
Inputs and outputs		
AC output	Main channel or sub channel all-pass signal can be selected.	
	Output voltage	1 V (rms) at range full-scale point
	Output impedance	600 Ω
	Load impedance	10 kΩ or more

DC output — Main channel or sub channel all-pass signal can be selected.
- Output voltage: 3.0 V, 25 mV/dB at range full-scale point
- Output impedance: 50 Ω
- Load impedance: 10 kΩ or more

Comparator output
- Open-collector output
- Band-level determination also possible
- Connector is shared with external trigger input
- Maximum applied voltage: 24 V DC
- Maximum drive current: 50 mA DC

External trigger input
- Detection of 0 to 5 V logic-level signal, falling edge trigger
- Connector is shared with comparator output

USB — Allows connection to a computer as storage device, or use as communication device for unit control via communication commands
- Communication commands cannot be used for transfer of store data or for making store operation settings

Remote control sensor — Allows operation of NA-28 using infrared remote control (optional)

Power requirements — Four IEC R14, size C batteries or external DC power supply (5 to 6 V)

Battery life (at 23°C, normal operation)

Manganese batteries	R14PU	6 hours
Alkaline batteries	LR14	16 hours (10 hours with constant backlight (bright mode))
AC adapter	NC-94A	(100 to 240 V, 50/60 Hz)

External DC power supply
- 5 to 6 V (rated voltage 6 V)
- Current consumption 230 mA (normal operation, rated voltage)

Ambient conditions	-10 to +50°C, 10 to 90% RH
Dimensions	331 × 89 × 51 mm
Weight	Approx. 730 g (with batteries)

Supplied accessories

CF card	128 MB	1
Storage case		1
Soft case		1
AC adapter	NC-94A	1
Windscreen	WS-10	1
Output cable (BNC-RCA cable)	CC-24	1
Hand strap		1
Size C battery	LR14	4
Instruction manuals (Instruction Manual, Serial Interface Manual, Technical Notes, 1 each)		1 set
Inspection Certificate		1

Optional accessories

Sound Calibrator	NC-74
CF card	
Remote control	NA-27RC1
USB printer	BL-112UI
USB printer cable	CC-97
USB cable	A male - mini B male (generic)

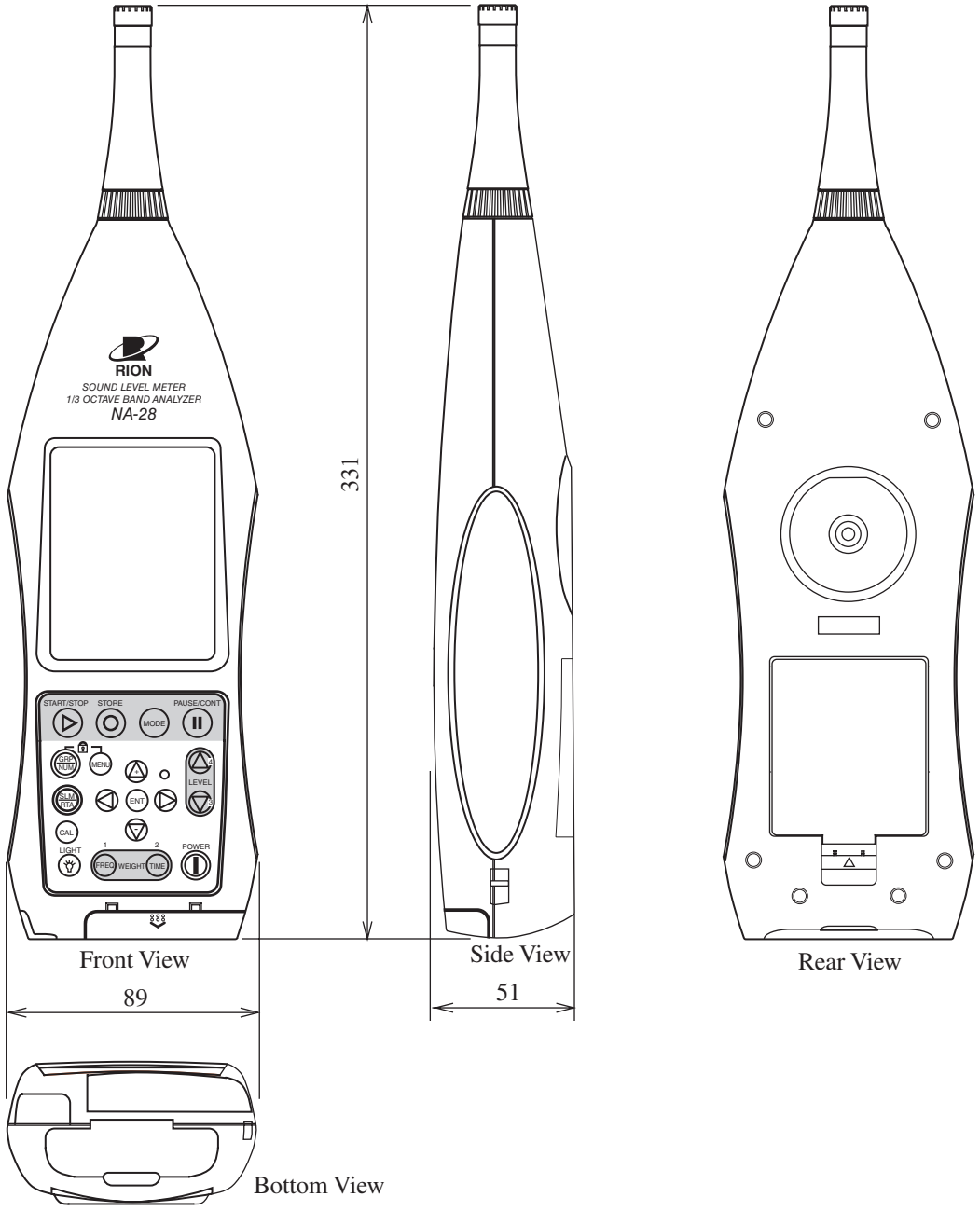
Optional program cards

Building acoustic card NX-28BA

(for measurement of sound pressure level differences between rooms, heavy floor impact sound level, light floor impact sound level, reverberation time)

Waveform recording card NX-28WR

FFT Analysis cards NX-28FT



Unit: mm

Dimensional Drawings

No. 50492 08-12