

# **INSTRUCTION MANUAL**

**INTEGRATING SOUND LEVEL METER NL-04**  
**PRECISION INTEGRATING SOUND LEVEL METER NL-14**



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# NL-04/NL-14 Instruction Manual

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Quantifier Notation of NL-04/NL-14, International Standards, and JIS  
(Excerpts from ISO 1996, 3891, IEC Pub. 804, JIS Z8202, 8731)

| NL-04/NL-14 notation    |                        | Description   | Frequency weighting | ISO notation                                       | IEC notation              | JIS notation                               |
|-------------------------|------------------------|---|---------------------|--|---------------------------|--|
| <i>L<sub>p</sub></i>    |                        | Sound pressure level                                  | Flat                | <i>L<sub>p</sub></i>                               | -                         | <i>L<sub>p</sub></i>                       |
| <i>L<sub>pA</sub></i>   |                        | A-weighted sound pressure level                       | A                   | <i>L<sub>pA</sub></i>                              | -                         | <i>L<sub>A</sub></i>                       |
| <i>L<sub>pC</sub></i>   |                        | C-weighted sound pressure level                       | C                   | <i>L<sub>pC</sub></i>                              | -                         | -  |
| <i>L<sub>Aeq</sub></i>  |                        | Equivalent continuous A-weighted sound pressure level | A                   | <i>L<sub>Aeq, T</sub></i>                          | <i>L<sub>Aeq, T</sub></i> | <i>L<sub>Aeq, T</sub></i>                  |
| <i>L<sub>Ceq</sub></i>  |                        | Equivalent continuous C-weighted sound pressure level | C                   | <i>L<sub>Ceq, T</sub></i>                          | <i>L<sub>Ceq, T</sub></i> | -  |
| <i>L<sub>AE</sub></i>   |                        | A-weighted sound exposure level                       | A                   | <i>L<sub>AE</sub></i>                              | <i>L<sub>AE, T</sub></i>  | <i>L<sub>AE</sub></i>                      |
| <i>L<sub>Ax</sub></i>   | <i>L<sub>A5</sub></i>  | Percentile A-weighted sound pressure level            | A                   | <i>L<sub>A5, T</sub></i>                           | -                         | <i>L<sub>5</sub></i>                       |
|                         | <i>L<sub>A10</sub></i> |   |                     | <i>L<sub>A10, T</sub></i>                          |                           | <i>L<sub>10</sub></i>                      |
|                         | <i>L<sub>A50</sub></i> |   |                     | <i>L<sub>AN, T</sub></i> <i>L<sub>A50, T</sub></i> |                           | <i>L<sub>x</sub></i> <i>L<sub>50</sub></i> |
|                         | <i>L<sub>A90</sub></i> |   |                     | <i>L<sub>A90, T</sub></i>                          |                           | <i>L<sub>90</sub></i>                      |
|                         | <i>L<sub>A95</sub></i> |   |                     | <i>L<sub>A95, T</sub></i>                          |                           | <i>L<sub>95</sub></i>                      |
| <i>L<sub>Amax</sub></i> |                        | Maximum A-weighted sound pressure level               | A                   | <i>L<sub>max</sub></i>                             | -                         | -  |

## ORGANIZATION OF THE MANUALS

The documentation for the integrating sound level meter NL-04 and precision integrating sound level meter NL-14 consists of the three manuals listed below.

Although there are certain differences in performance and functions, the NL-04 and NL-14 are essentially identical in operation. The manuals therefore apply to both units. When there are differences between the two models, this is indicated in the manuals.

- **Instruction Manual**

Describes connections, setup, and general operation of the NL-04/NL-14 as well as the optional filter units and printer.

- **RS-232-C Interface Manual**

Describes communication with a personal computer using the integrated RS-232-C interface of the NL-04/NL-14. Transfer protocols, commands for controlling the sound level meter, format of the sound level meter output data etc. are explained.

- **Technical Notes**

Gives technical background information covering circuit configuration and performance characteristics of the sound level meter, microphone principles and performance, influence of extension cables and windscreen on the measurement and other topics.



## PRECAUTIONS

- Operate the unit as described in this manual.
- Protect the unit from shocks and vibration.  
Be especially careful not to touch the delicate microphone membrane to avoid damage.
- Ambient conditions for operation of the unit are a temperature of  $-10$  to  $+50^{\circ}\text{C}$  and relative humidity from 10 to 90%.  
Protect the unit from water or dust, extreme temperatures or humidity, and direct sunlight during storage and use. Also avoid air with high salt or sulphur content, gases, and the vicinity of stored chemicals.
- Always turn the unit off after use.  
Remove the batteries from the unit if it is not to be used for a long time.  
When disconnecting cables, always hold the plug and do not pull the cable.
- 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 cleaning agents.
- Do not try to disassemble the unit.  
In case of an apparent malfunction, do not attempt any repairs. Note the condition of the unit clearly and contact the supplier.

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## OUTLINE

The integrating sound level meter NL-04 and precision integrating sound level meter NL-14 allow not only conventional sound pressure level measurements, but also incorporate processing functions which make it possible to determine:

- Equivalent continuous sound pressure level  $L_{eq}$
- Sound exposure level  $L_E$
- Percentile sound pressure level  $L_x$  ( $L_5$ ,  $L_{10}$ ,  $L_{50}$ ,  $L_{90}$ ,  $L_{95}$ )
- Maximum sound pressure level  $L_{max}$

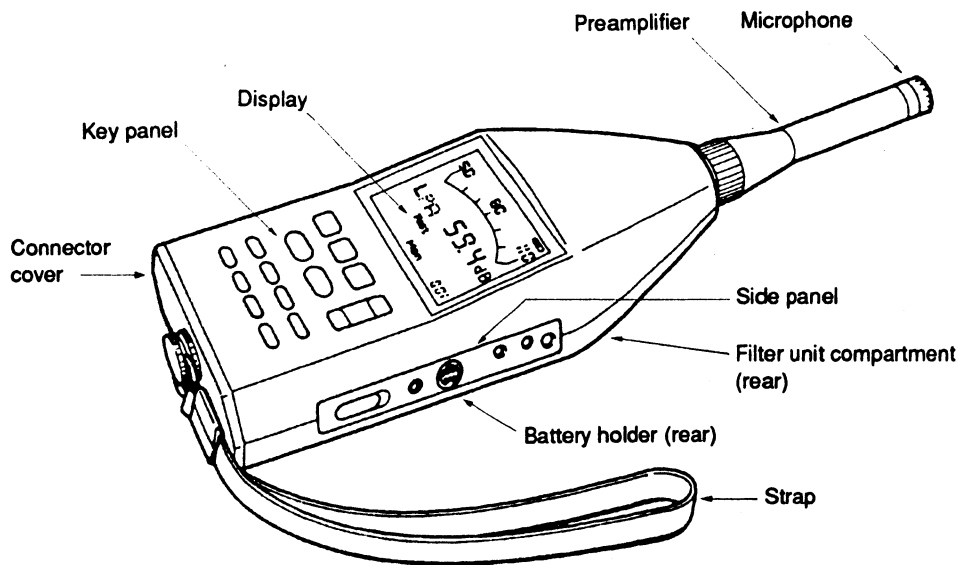
The large, backlit display shows measurement results in numerical form and on a graphical scale, and gives information on measurement parameters and settings. The wide display range of 70 dB for numerical indication and 60 dB for graphical indication makes range switching virtually unnecessary during normal measurements.

An internal memory can store measurement values and processing results, and the built-in RS-232-C interface permits external control from and data export to a computer. The following options are available to further enhance the usefulness of the unit:

- Filter unit NX-04/NX-05  
Allows frequency analysis with 1/1 or 1/3 octave bands.
- Printer CP-10  
Lets you get a hard copy of measurement data (including data stored in the internal memory).
- Level recorder LR-04/LR-06  
Allows recording the real-time sound pressure level and the results of frequency analysis with a filter unit.
- Memory card unit DA-05  
Allows storing of measurement data on a memory card, which has a much larger capacity than the internal memory.

This manual first describes the use of the NL-04/NL-14 for ordinary measurements and then explains the use of the above options. For information on the use of the RS-232-C interface, please refer to the separate RS-232-C Interface Manual.

## CONTROLS AND FUNCTIONS

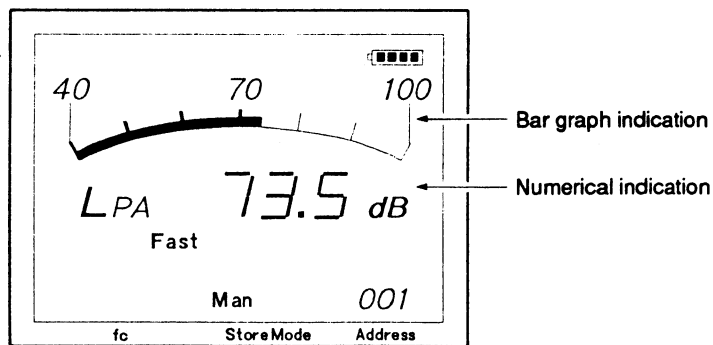


- **Microphone and preamplifier**

The microphone and preamplifier are combined in an integrated assembly. The assembly can be removed from the sound level meter and connected via an optional extension cable, for measurements a distance.

- **Display**

The backlit LCD panel shows numerical readings and a bar graph representing the measured sound pressure level value. It also displays information about the operation status and measurement parameters.

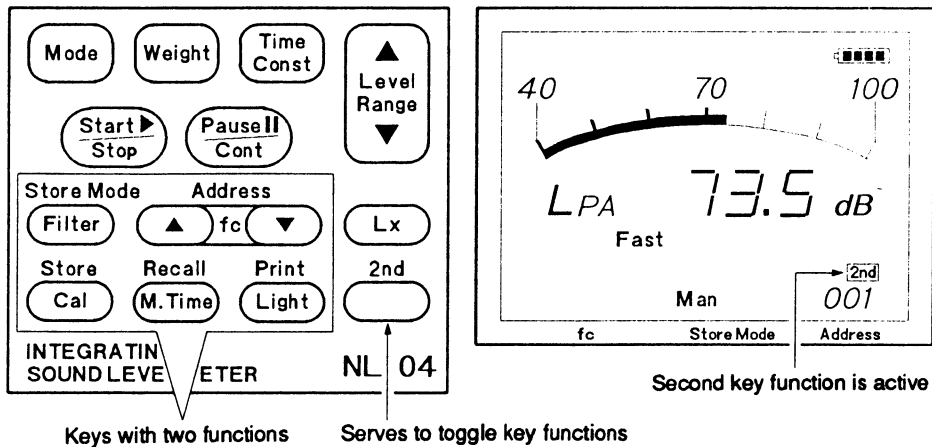


Reading the display

● **Key panel**

The keys on this panel serve to control operation of the unit. The six keys in the lower left each has two functions, one as printed on the keytop and one indicated above the key. The 2nd key serves to switch between these functions. When the second function is selected, the indication “2nd” appears in the bottom right of the display.

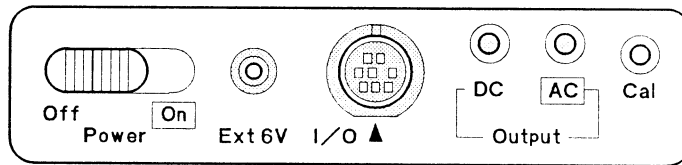
In this manual, a key is called by the name on the keytop when the first function is to be used, and by the name printed above it when the second function is to be used.



● **Key functions**

- Mode:** Selects either instantaneous value ( $L_P$ ) or processed values ( $L_{eq}/L_E/L_{max}$ ) for display.
- Weight:** Selects the frequency weighting.
- Time Const:** Sets the time weighting.
- Level Range:** Select the level range.
- Start/Stop:** Serves to start and stop the  $L_{eq}/L_E/L_{max}/L_x$  measurement.
- Pause/Cont:** Serves to pause and continue the measurement or auto store process.
- Filter:** Turns the filter function on and off.
- fc:** Select the filter center frequency.
- Lx:** Calls up the processed value  $L_x$ .
- Cal:** Activates the built-in oscillator for electrical calibration.
- M.Time:** Serves to set the measurement time for processing of  $L_{eq}/L_E/L_{max}/L_x$ .
- Light:** Activates the display backlight.
- 2nd:** Selects the second key function.
- Store Mode:** Selects the mode for storing data.
- Address:** Serve to select the address for data recall.
- Store:** Serves to store data in the internal memory.
- Recall:** Serves to recall data from the internal memory.
- Print:** Serves to print data (measurement results or data stored in memory) on the printer CP-10.

● **Side panel**



**Power:** Turns the unit on and off.

**Ext 6V:** This jack allows connection of an external power supply. Use the AC adapter NC-34 series (option) to power the unit from an AC line.

**I/O:** The input/output terminal has the following functions:

- Data output to printer CP-10
- Data output to level recorder LR-06
- Communication with a computer (RS-232-C interface)
- Filter switching under control of level recorder LR-04/LR06

**DC Output:** A DC signal corresponding to the measurement sound pressure is output here, after frequency weighting, rms detection and logarithmic compression.

**AC Output:** An AC signal corresponding to the measurement sound pressure is output here, after frequency weighting.

**Cal:** Calibration control for calibrating the sound level meter.

- **Filter unit compartment**

The octave filter NX-04 or the 1/1, 1/3 octave filter NX-05 can be installed here. When the filter unit is not used, the dummy case should be attached.

- **Battery holder**

Four IEC R6 (size AA) batteries are to be inserted here. When operating the sound level meter from the AC adapter, these batteries are not required.

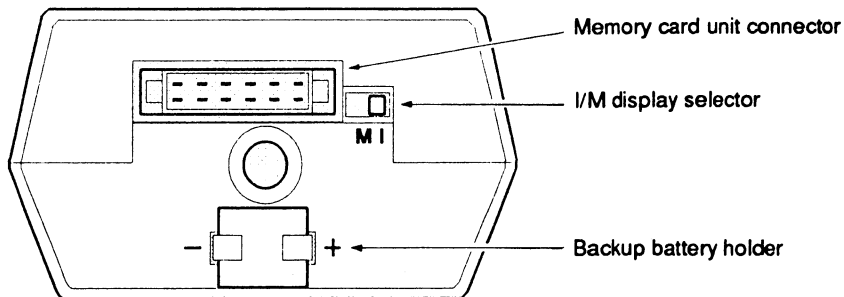
- **Strap**

Makes the unit easy to carry and hold on your palm.

- **Connector cover**

This cover can be taken off by removing the screw that also fastens the strap. Inside you will find a connector for the memory card unit DA-05, a memory backup battery holder, and the I/M display selector.

The position of the I/M display selector determines whether the numerical indication is updated continuously during measurement or shows peak readings for 1-second intervals.



Below connector cover

## PREPARATIONS

This section describes how to prepare the unit for use.

The Power switch should be set to Off while you make preparations.

### Power Supply

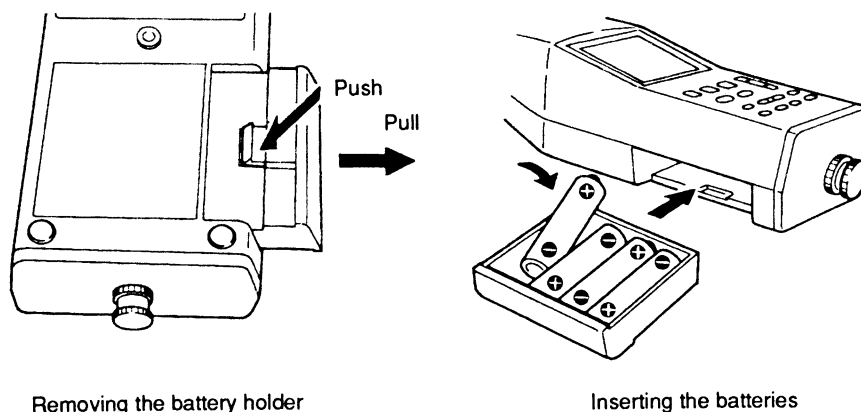
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The sound level meter can be powered from four IEC R6 (size AA) batteries or from the AC adapter. When the adapter is plugged in, the batteries are automatically disconnected. The unit also incorporates a memory backup battery which serves to preserve settings and data while the unit is switched off.

#### Inserting the Batteries

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1. Remove the battery holder.
2. Insert four IEC R6 (size AA) batteries with correct polarity as marked in the battery holder.
3. Slide the battery holder back into the unit.



- Battery life for continuous operation without display backlight is about 12 hours with alkaline batteries (LR6) and about 6 hours with manganese batteries (R6).

**Note:** When using the filter unit NX-04 or NX-05, battery life is about 10% shorter. When using the memory card unit DA-05, it is about 20% shorter.



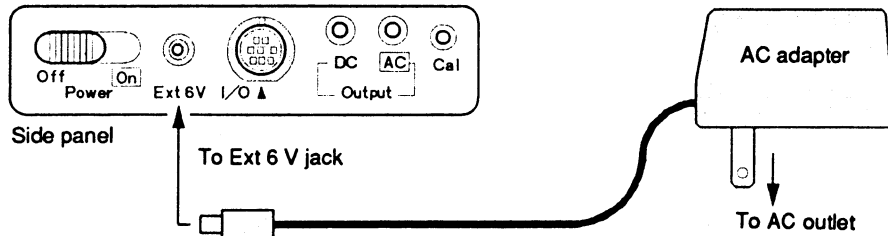
## Connecting the AC Adapter

Connect the AC adapter NC-34 series as shown below.

NC-34: for 100 V AC

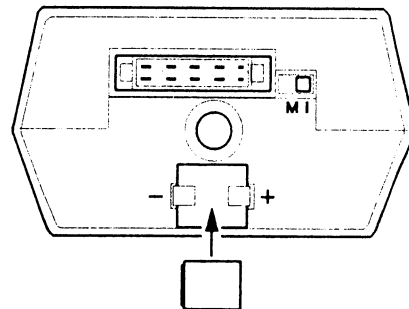
NC-34A: for 120 V AC

NC-34B: for 220 V AC



## Inserting the Backup Battery

1. Remove the screw fastening the strap and remove the connector cover.
2. Insert a CR-1/3N lithium battery into the backup battery holder, taking care to observe correct polarity as shown in the holder.
3. Replace the connector cover and strap.



Insert backup battery

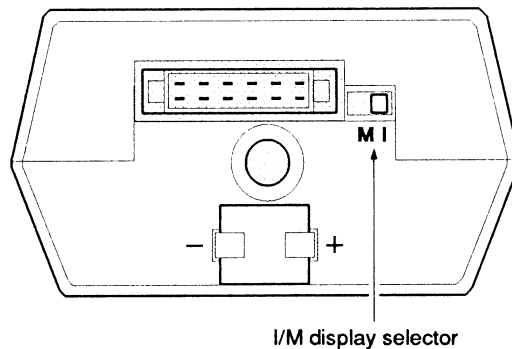
The life of the backup battery is about 2 years, but there is no facility for checking the battery condition. To be on the safe side, you should replace the battery every 1 to 1-1/2 years. If the backup battery is replaced while the unit is off, all internally stored data will be lost. Data can be retained by making sure that the unit is powered while replacing the backup battery.

## Setting the I/M Display Selector

This selector determines whether the numerical indication is updated continuously during measurement of instantaneous values (position "I") or shows peak readings for 1-second intervals (position "M"). For normal measurements, the "I" position should be used.

This selector affects only the numerical indication of instantaneous values. The bar graph is always updated continuously, and  $L_{eq}/L_E/L_{max}/L_x$  processing is performed using the instantaneous values.

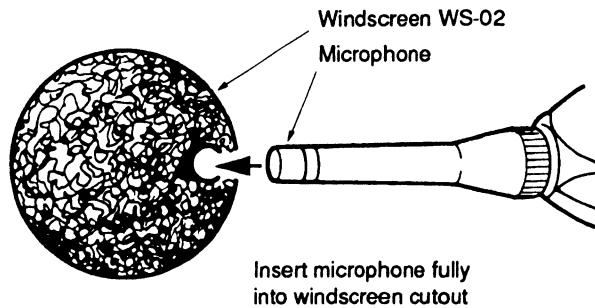
1. Remove the screw fastening the strap and remove the connector cover.
2. Set the I/M display selector to the desired position.  
I: Instantaneous value display  
M: Maximum value in 1-second intervals
3. Replace the connector cover and strap.



## Mounting the Windscreen

When making outdoor measurements in windy weather or when measuring air conditioning equipment or similar, wind noise at the microphone can cause measurement errors. To prevent this, you should use the supplied windscreen WS-02.

The windscreen will reduce wind noise by about 25 dB (with "A" weighting) or by about 15 dB (with "C" weighting). The acoustical influence of the windscreen on the microphone response is within  $\pm 1.0$  dB up to 12.5 kHz. For further details, please refer to the Technical Notes.

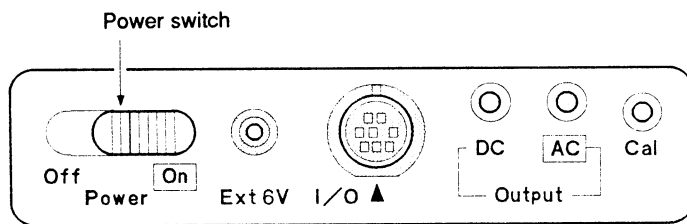


## BASIC OPERATION AND DISPLAY FUNCTIONS

### Turning the Unit On and Checking the Batteries

- **Turning the unit on**

Set the Power switch to On. If a memory backup battery is inserted, the measurement settings will be the same as when the unit was last switched off.

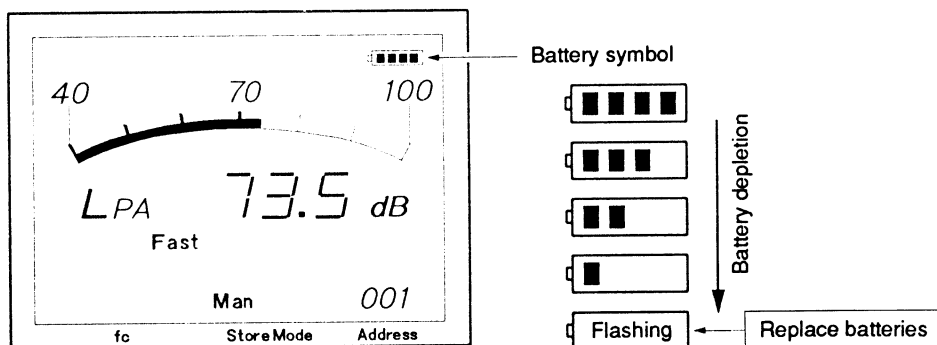


- **Checking the battery condition**

The battery symbol in the top right of the display shows the battery condition. Be sure to check this before starting to use the unit on batteries. When all four segments are visible, the batteries are fresh. During use, the segments will gradually go out. When the batteries are nearing exhaustion, all four segments will flash. In this condition, correct measurements are not assured, and you should replace all four batteries with fresh ones.

Battery life for continuous operation without display backlight is about 12 hours with alkaline batteries (LR6) and about 6 hours with manganese batteries (R6).

Before starting a longer measurement, you should make sure that the batteries are fresh, i.e. that all four segments of the battery symbol are visible.



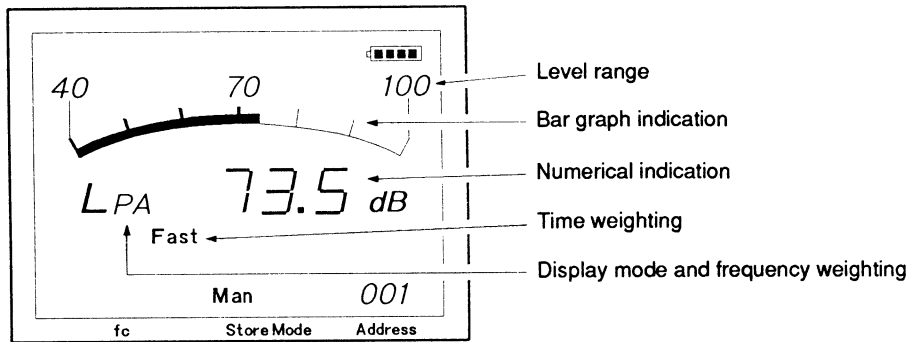
- **Turning the unit off**

Set the Power switch to Off. If a memory backup battery is inserted, measurement settings and stored data will be preserved.

If the unit will not be used for a long time, you should remove the batteries.

## Basic Setup Steps and Display Functions

This section explains how to set the level range, frequency weighting, time weighting, and other basic measurement parameters, and how to read the display. In the subsequent sections about various measurement types, items which go beyond this basic information will be explained. Refer to the sections “Measurement”, “Using the Internal Memory”, and “Optional Equipment”.



Reading the display

- **Setting the level range**

Press the Level Range keys to select a suitable range. The “▲” key increases the range and the “▼” key decreases it. The bar graph scale reflects the selected level range.

- **Selecting the frequency weighting characteristic**

Press the Weight key to cycle through the settings “Flat”, “A”, and “C”. The display mode and selected frequency weighting are shown on the display (see next page).

- **Selecting the time weighting**

Press the Time Const key to cycle through the available time weighting settings shown below.

NL-04: Fast / Slow / 10 ms

NL-14: Fast / Slow / 10 ms / Imp (Impulse) / Peak (Peak hold)

**Note:** Peak setting cannot be used for  $L_{eq}$ ,  $L_E$ ,  $L_{max}$ ,  $L_x$  measurement and data store with automatic modes (Auto 1 - Auto 6).

● **Bar graph Indication**

The bar graph indication has a resolution of 1 dB and a range of 60 dB. The indication is updated every 0.1 seconds.

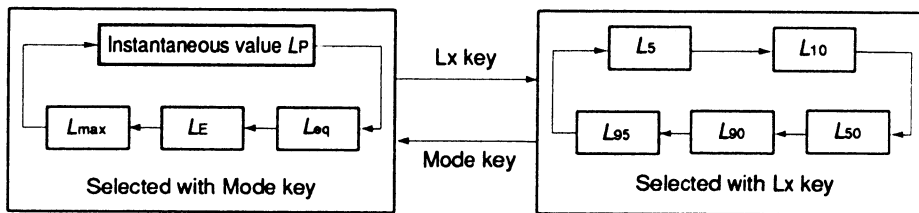
● **Numerical Indication**

The numerical reading has a resolution of 0.1 dB and is updated every second.

● **Selecting the display mode**

The Mode key and the Lx key are used to select the display function. The Mode key cycles through the settings for instantaneous value ( $L_P$ ) and the processed values  $L_{eq}$ ,  $L_E$ , and  $L_{max}$ . Pressing the Lx key cycles through the processed value  $L_x$  display settings (see illustration below).

The current display mode and frequency weighting are shown on the display.



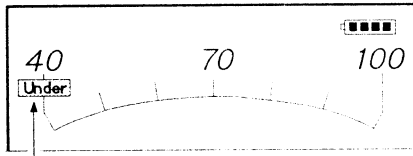
● **Indication of display mode and frequency weighting**

The display mode and frequency weighting are indicated on the display as follows.

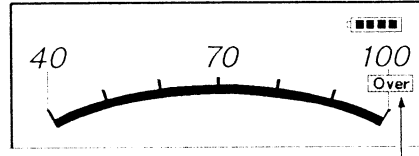
| Display mode | Frequency weighting | Display   | Display mode | Frequency weighting | Display    |
|--------------|---------------------|-----------|--------------|---------------------|------------|
| $L_P$        | Flat                | $L_P$     | $L_{max}$    | Flat                | $L_{Pmax}$ |
|              | A                   | $L_{PA}$  |              | A                   | $L_{Amax}$ |
|              | C                   | $L_{PC}$  |              | C                   | $L_{Cmax}$ |
| $L_{eq}$     | Flat                | $L_{Peq}$ | $L_x$        | Flat                | $L_{Px}$   |
|              | A                   | $L_{Aeq}$ |              | A                   | $L_{Ax}$   |
|              | C                   | $L_{Ceq}$ |              | C                   | $L_{Cx}$   |
| $L_E$        | Flat                | $L_{PE}$  |              |                     |            |
|              | A                   | $L_{AE}$  |              |                     |            |
|              | C                   | $L_{CE}$  |              |                     |            |

● **Under-range and overload indication**

When the input signal is too low for the selected level range, causing an under-range condition, the indication “Under” appears on the display. Likewise, when the input signal is too high, causing overload, “Over” is displayed. Use the Level Range keys to select a suitable setting.



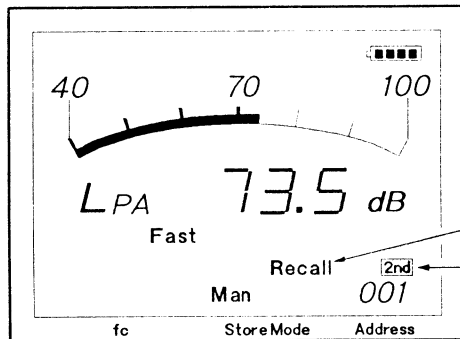
Under-range indication



Overload indication

● **Switching between measurement mode and recall mode**

Measuring the instantaneous value  $L_P$  or values such as  $L_{eq}$  is called the measurement mode. Calling up data stored in the internal memory of the unit is called the recall mode. To activate recall mode, press the 2nd key and then the Recall key. The indication “Recall” appears on the display. To return to the measurement mode, press the 2nd key again, so that the indication “2nd” disappears from the display.



Recall mode indication

2nd indication

● **Using the display backlight**

Pressing the Light key turns the display backlight on, which makes the display easier to read in dark locations. Press the key again to turn the backlight off.

Since backlighting drains the batteries quickly, you should use it only when necessary.



## MEASUREMENT

This section describes how to perform calibration, how to measure instantaneous sound pressure level,  $L_{eq}$ ,  $L_E$ ,  $L_{max}$ ,  $L_x$  values, and how to use the internal memory.

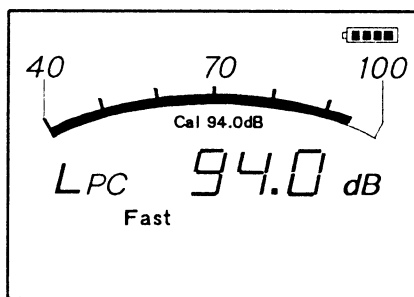
### Calibration

Before starting a measurement, calibration should be performed. There are two types of calibration, namely electrical calibration and acoustic calibration. Normally, electrical calibration only is required.

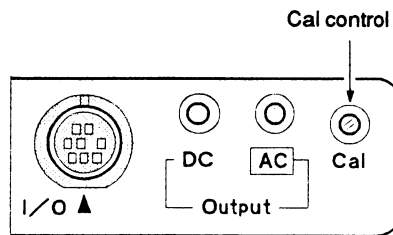
- **Electrical calibration:**  
Calibrates the electrical circuits of the unit, using the built-in oscillator. The microphone is not included in this type of calibration.
- **Acoustic calibration:**  
Calibrates the entire system including the microphone, using the pistonphone NC-72 (standard sound source) or sound level calibrator NC-73.

### Electrical Calibration

1. Turn on the sound level meter.
2. Press the Cal key to activate the calibration mode.  
The indication "Cal 94.0 dB" appears on the display (see illustration below).
3. Adjust the Cal control with the supplied screwdriver so that numerical indication reads "94.0 dB".
4. Press the Cal key to terminate the calibration mode and activate the measurement mode.



Calibration display



Side panel

## Acoustic Calibration

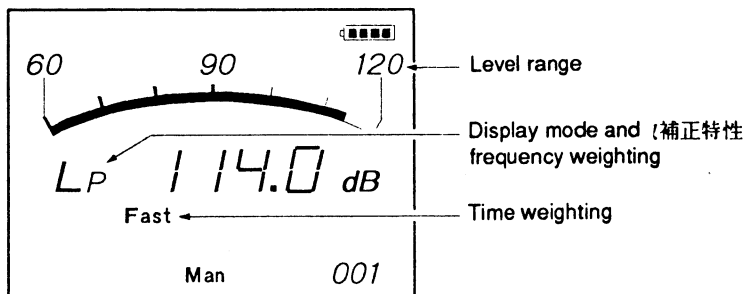
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For acoustic calibration, the Rion pistonphone NC-72 or sound level calibrator NC-73 is mounted to the sound level meter, and adjustment is performed so that the reading of the meter is equal to the sound pressure level inside the coupler. The sound pressure level in the coupler of the NC-72 and NC-73 is shown below.

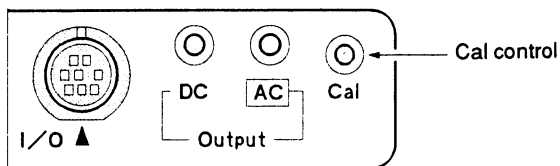
- Pistonphone NC-72: SPL 114 dB  $\pm$ 0.2 dB, frequency 250 Hz  $\pm$ 1%
- Sound level calibrator NC-73: SPL 94 dB  $\pm$ 1 dB, frequency 1000 Hz  $\pm$ 3%

**Note:** Insert and remove the microphone very carefully into and from the coupler, to avoid a sudden pressure buildup which could destroy the membrane of the microphone.

1. Turn off the sound level meter and the calibration equipment.
2. Mount a 1/2-inch adapter on the coupler of the calibration equipment, and carefully insert the microphone of the sound level meter all the way into the coupler.
3. Turn on the sound level meter and establish the following settings:
  - Display mode: Instantaneous value (LP)
  - Frequency weighting: Flat
  - Time weighting: Fast
  - Level range: 120 dB for NC-72, 100 dB for NC-73
4. Turn on the calibration equipment.
5. Adjust the Cal control of the sound level meter with the supplied screwdriver so that numerical indication corresponds to the sound pressure level inside the coupler (NC-72: 114 dB; NC-73: 94 dB).



Display during calibration  
with pistonphone NC-72



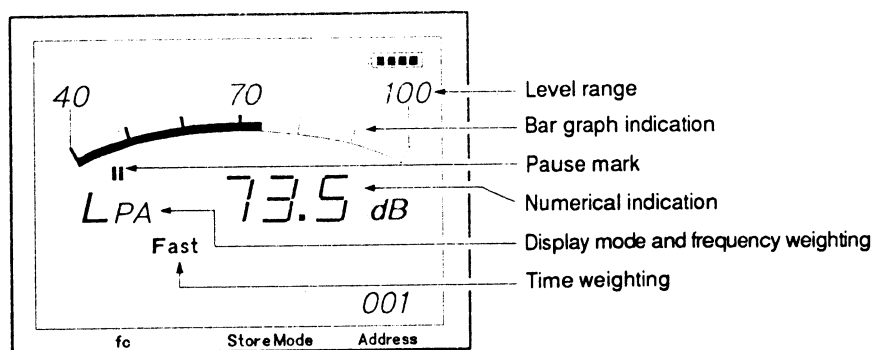
Side panel

6. Turn off the sound level meter and calibration equipment, and carefully remove the microphone from the coupler.

## Measurement of Instantaneous Sound Pressure Level

After turning on the unit and performing calibration, carry out the following steps for instantaneous value measurement.

1. Press the Mode key to select the instantaneous value display mode (LP).
2. Select the frequency weighting characteristic with the Weight key and the time weighting with the Time Const key. When carrying out a measurement according to a standard, establish the settings prescribed by the standard.
3. Set the level range with the Level Range keys so that the bar graph registers to about the center of the scale.
4. Read the measured instantaneous value from the numerical indication and the bar graph. The numerical indication is updated every second and the bar graph indication every 0.1 seconds. If the I/M display selector is set to "M", the numerical indication shows the maximum value in 1-second intervals.



Instantaneous value display

By using the Pause/Cont key, you can pause and resume the measurement. During pause, the pause mark (II) is displayed.

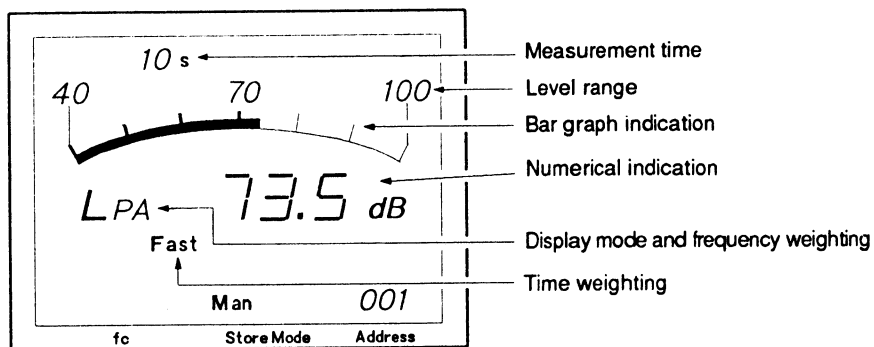
When measuring waveform peak value with Peak setting, you can reset the peak value and start new measurement by pressing the Start/Stop key.

## Leq, LE, Lmax, Lx Measurement

The NL-04/NL-14 simultaneously calculates the  $L_{eq}$  (equivalent continuous sound pressure level),  $LE$  (sound exposure level),  $L_{max}$  (maximum sound pressure level), and  $L_x$  (percentile sound pressure levels). After processing, the display can be switched to show any of the above values. The measurement procedure for  $L_{eq}$ ,  $LE$ ,  $L_{max}$ , and  $L_x$  is explained below. After turning on the unit and performing calibration, carry out the following steps:

1. Press the Mode key to select the instantaneous value display mode ( $L_P$ ).
2. Select the frequency weighting characteristics with the Weight key and the time weighting with the Time Const key. Note that Peak setting cannot be used for  $L_{eq}$ ,  $LE$ ,  $L_{max}$ ,  $L_x$  measurement.
3. Set the level range with the Level Range keys so that the bar graph registers to about the center of the scale.
4. Select the measurement time with the M.Time key. With each push, the key cycles through the following settings:  
 [no display] (manual start/stop) → 10 s → 1 m → 5 m → 10 m → 15 m → 30 m → 1 h → 8 h → 24 h → [no display]  
 (s = seconds, m = minutes, h = hours)

In the [no display] condition, you can start and stop the measurement manually with the Start/Stop key. Maximum measurement time in this case is 99 hours 59 minutes 59 seconds. However, maximum measurement time for  $L_x$  processing is 1 hour. Measurement will continue also after 1 hour, but correct  $L_x$  results are not assured.

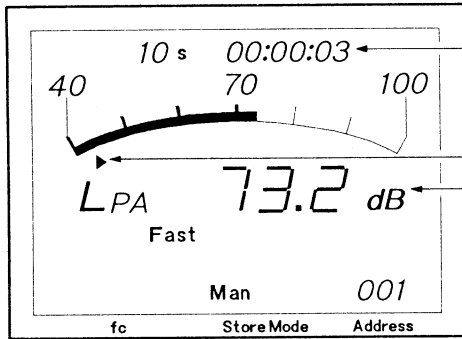


Settings for  $L_{eq}/LE/L_{max}/L_x$  measurement

5. Press the Start/Stop key to start the measurement.

A mark (▶) indicating that measurement is being carried out appears, and the elapsed measurement time is displayed. Measurement stops automatically when the time set in step 4 has elapsed. The measurement may also be stopped before the preset time by pressing the Start/Stop key. If no measurement time was selected, the Start/Stop key must be used to stop the measurement.

By using the Pause/Cont key, you can pause and resume the measurement. During pause, the pause mark (||) is displayed. The time during which measurement was paused will not be included in the measurement time.



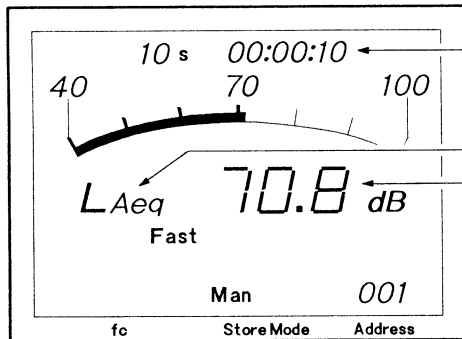
Elapsed measurement time (hours:minutes:seconds)

Measurement mark

Current instantaneous value  
During measurement, you can switch the display mode to show  $L_{eq}$ ,  $L_E$ , or  $L_{max}$  values. Refer to the next page.

Display during measurement

6. To read the results, use the Mode key to switch the display to  $L_{eq}$ ,  $L_E$ , or  $L_{max}$ . To see the  $L_x$  values, press the  $L_x$  key to cycle through the  $L_s$  through  $L_{95}$  values. To return to the  $L_{eq}$ ,  $L_E$ , or  $L_{max}$  indication from the  $L_x$  display, press the Mode key.



Actual measurement time (hours:minutes:seconds)

Display mode and frequency weighting

Processed value

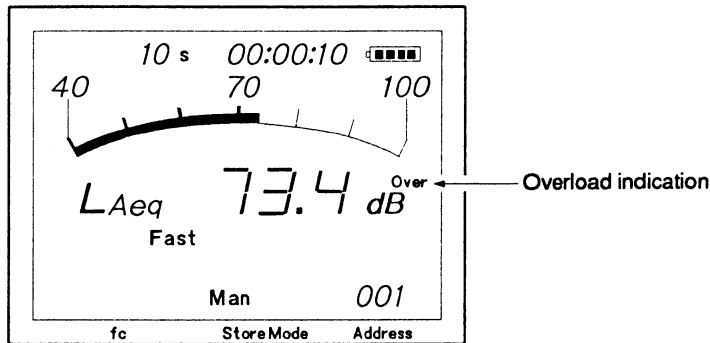
**Note:**

If the frequency weighting or time weighting setting was switched while the processed value is displayed, the displayed characteristics and the characteristics used for processing will be different.

Display of processed values

It is possible to switch the display mode to show  $L_{eq}$ ,  $L_E$ , or  $L_{max}$  values also while the measurement is being carried out (numerical indication only). However, the  $L_x$  value cannot be read during measurement (displayed values will not be significant).

If an overload condition occurs during the measurement, the indication appears on the display, to show that overload data were included in the processing (see illustration below).



Display when overload has occurred

## **USING THE INTERNAL MEMORY (DATA STORE AND RECALL)**

The NL-04/NL-14 has an internal memory that can be used to store measurement data (instantaneous value, processing results such as  $L_{eq}$  etc., measurement parameters such as frequency weighting and time weighting setting). The stored data can then be:

- Called up on the display (data recall)
- Printed out on the printer CP-10
- Sent to a computer via the RS-232-C interface.

This section explains how to store and recall data. For information about printing, please refer to page 43 of this manual, and for information about data transfer to the separate RS-232-C Interface Manual.

### **Types of Data Which Can Be Stored in the Internal Memory**

The NL-04/NL-14 offers one manual (Man) and six automatic modes (Auto 1 - Auto 6) for storing data. With the manual store method, selected data can be stored in single steps. With the auto store method, the type and number of data is preset, depending on which mode is chosen. Auto 1 through Auto 4 serve for continuous entry of instantaneous values and processed values, either measured with the sound level meter alone or with the optional filter unit in 1/1 or 1/3 octave bands. Auto 5 and Auto 6 are designed only for continuous storage of analysis results gained with the optional filter unit in 1/1 or 1/3 octave bands. If no filter unit is installed, these two modes cannot be used.

The memory areas for manual store and auto store in the NL-04/NL-14 are separate, so that both can be used to store data. However, the six auto store modes use the same memory. Therefore previous auto store data will be erased when a new auto store operation is started.



- Man:** The instantaneous value  $L_P$ , processing result  $L_{eq}$  etc. is stored. Up to 50 data sets can be stored manually.
- Auto 1:** The instantaneous value  $L_P$  is stored every 10 ms or 100 ms. Up to 9000 data sets can be stored, corresponding to 1 minute 30 seconds (with 10-ms intervals) or 15 minutes (with 100-ms intervals).
- Auto 2:** The instantaneous value  $L_P$  and maximum value  $L_{max}$  are stored as one set of data every second. Up to 3600 data sets can be stored, corresponding to 1 hour.
- Auto 3:** The processing results  $L_{eq}$ ,  $L_{max}$ ,  $L_x$  are stored as one set of data. Up to 999 data sets can be stored.
- Auto 4:** The processing results  $L_{eq}$ ,  $L_E$ ,  $L_{max}$  are stored as one set of data. Up to 999 data sets can be stored.
- Auto 5:** The instantaneous value  $L_P$  is stored for the all-pass condition and each 1/1 octave or 1/3 octave band. The store interval is 100 ms. Up to 100 data can be stored for each band, corresponding to 10 seconds.
- Auto 6:** The processing results  $L_{eq}$ ,  $L_E$ ,  $L_{max}$  are stored as one set of data for the all-pass condition and each 1/1 octave or 1/3 octave band, and these data sets are taken as one group. For 1/1 octave bands, 110 groups of data can be stored. For 1/3 octave bands, 40 groups of data can be stored.

**Note:** When retrieving data via the RS-232-C interface, the sound level meter can output 20 groups of data.

Details about the data stored in each mode are listed from page 24, and the store and recall procedures are explained.

## Steps for Storing and Recalling Data

This section explains the store and recall procedure for each mode. After turning on the unit and performing calibration, carry out the following steps.

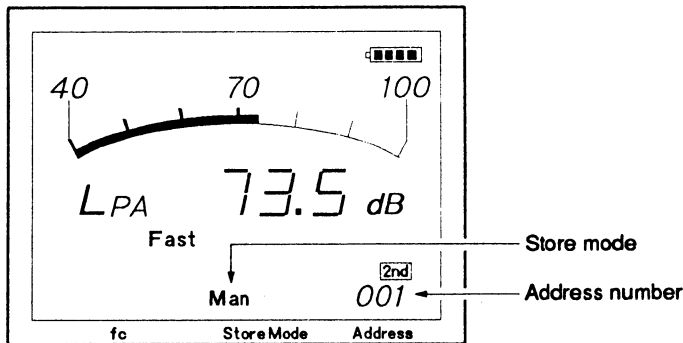
### Man (Manual Store)

First, you bring the data you want to store up on the display and then store them by pressing the Store key. This can be carried out up to 50 times.

#### ● Data store

1. Press the Store Mode key to activate the "Man" mode.

An address number appears in the bottom right of the display. If currently no data are stored, the address number will be 001. If some data are already stored, the first free address number is displayed. The new data will be stored in this address. It is not possible to select an address at will. For manual store, the address numbers 1 through 50 will be used.



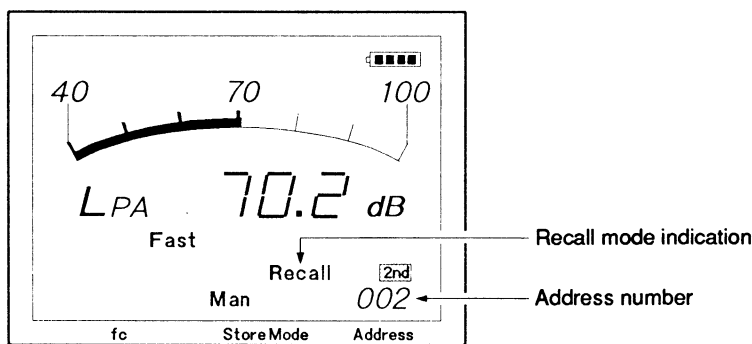
Store mode and address number display

2. Carry out the measurement, until the data you want to store are displayed. You may also store data while the unit is in the pause mode.  
To store a processed value such as  $L_{eq}$ , call this value up on the display. Processed values which are not displayed will not be stored.

3. Press the Store key.  
The displayed data are stored, and the address number is incremented by one count.
4. Repeat steps 2 and 3 if you wish to store more data. When the address number 50 is reached, the data store process will start again at address 1. Note that previous data will be overwritten when new data are stored.

- **Data recall**

1. Press the Store Mode key to activate the “Man” mode.
2. Press the Recall key.  
The indication “Recall” appears on the display, and manually stored data and the corresponding address are shown.



Stored data display

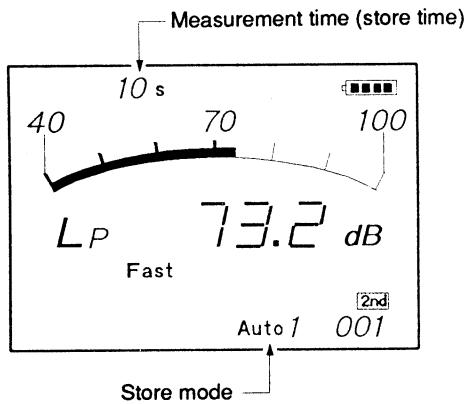
3. Use the Address keys to select the address whose data you want to display. The “▲” key increases the address number and the “▼” key decreases it. By keeping one of the keys depressed, you can switch address numbers continuously.
4. To terminate the recall mode and return to the measurement mode, press the 2nd key.

## Auto 1 (Auto Store 1)

This mode stores LP data in 10 ms or 100 ms intervals. Up to 9000 data sets can be stored, corresponding to 1 minute 30 seconds (with 10-ms intervals) or 15 minutes (with 100-ms intervals).

### ● Data store

1. Select the measurement time with the M.Time key. This setting determines the time during which data are stored, the sampling interval (data store interval), and the number of stored data (see table below).



Data store settings for Auto 1

Measurement time setting and store time, sampling interval, number of data

| Measurement time | Store time             | Interval | Data count |
|------------------|------------------------|----------|------------|
| 10 s             | 10 seconds             | 10 ms    | 1000       |
| 1 m              | 1 minute               |          | 6000       |
| No display       | 1 minute<br>30 seconds |          | 9000       |
| 5 m              | 5 minutes              | 100 ms   | 3000       |
| 10 m             | 10 minutes             |          | 6000       |
| 15 m             | 15 minutes             |          | 9000       |

If other measurement times than shown above are selected, the setting will automatically be corrected to 15 minutes when the store process is started.

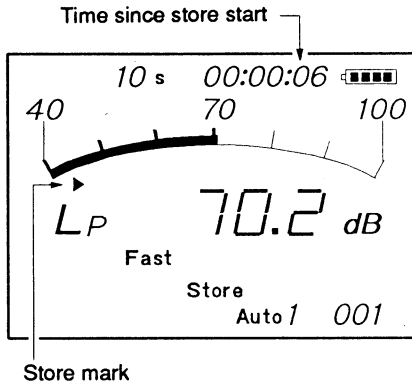
2. Establish the following settings.

- Display mode: Instantaneous value (LP) (Mode key)
- Frequency weighting: Any setting (Weight key)
- Time weighting: Any setting except Peak (Time Const key)
- Level range: Appropriate (Level Range keys)
- Store mode: Auto 1 (Store Mode key)

3. Press the Store key when you want to start the store process.

While data are being stored, the display shows a (▶) mark, the indication "Store" and the elapsed time since the store start point.

When the time set in step 1 has elapsed, the store process is terminated automatically.



Display during data store

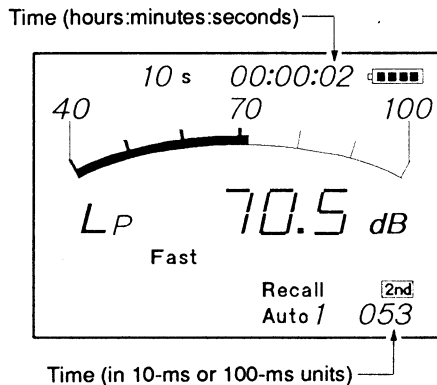
The data store process can be paused with the Pause/Cont key. During pause, the pause mark (II) replaces the store mark. The time during which the process was paused will not be included in the store time.

By pressing the Start/Stop key, the process can be manually terminated before the end of the preset store time.

### ● Data recall

1. Use the Store Mode key to select any of the modes Auto 1 through Auto 6.
2. Press the Recall key.

The indication "Recall" appears on the display, and stored data and the store time (time since start of store) are shown.



Stored data display

The time is displayed in two ways. In the upper section of the display, it is shown in hours, minutes, and seconds. In the lower right, it is shown in 10-ms or 100-ms units, depending on the sampling interval.

In the example shown at left, the store time is 10 seconds and the sampling interval therefore 10 ms. The displayed data store time is  $2 \text{ (s)} + 53 \times 10 \text{ (ms)} = 2.53 \text{ (s)}$

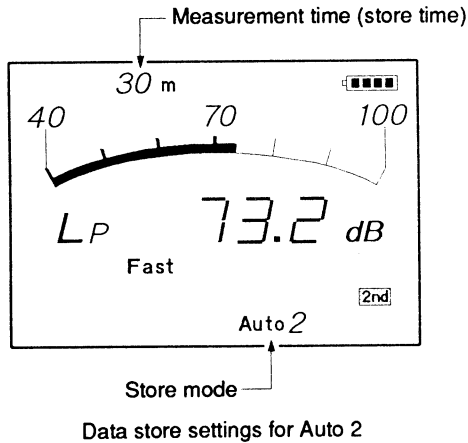
3. The Address keys can be used to select data you want to display. Press the "▲" key for next data and press the "▼" key for previous data. By keeping one of the keys depressed, you can switch data continuously.
4. To terminate the recall mode and return to the measurement mode, press the 2nd key.

## Auto 2 (Auto Store 2)

This mode stores  $L_P$  data and  $L_{max}$  data as a set every second. Up to 3600 data sets can be stored, corresponding to 1 hour of data.

### • Data store

1. Select the measurement time with the M.Time key. This setting determines the time during which data are stored and the number of stored data (see table below).



Measurement time setting and store time/number of data

| Measurement time | Store time | Data count |
|------------------|------------|------------|
| 10 s             | 10 seconds | 10         |
| 1 m              | 1 minute   | 60         |
| 5 m              | 5 minutes  | 300        |
| 10 m             | 10 minutes | 600        |
| 15 m             | 15 minutes | 900        |
| 30 m             | 30 minutes | 1800       |
| 1 h              | 1 hour     | 3600       |

If other measurement times than shown above are selected, the setting will automatically be corrected to 1 hour when the store process is started.

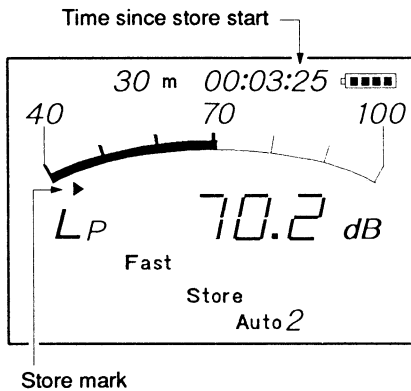
2. Establish the following settings.

- Display mode: Instantaneous value ( $L_P$ ) (Mode key)
- Frequency weighting: Any setting (Weight key)
- Time weighting: Any setting except Peak (Time Const key)
- Level range: Appropriate (Level Range keys)
- Store mode: Auto 2 (Store Mode key)

3. Press the Store key when you want to start the store process.

While data are being stored, the display shows a (▶) mark, the indication "Store" and the elapsed time since the store start point.

When the time set in step 1 has elapsed, the store process is terminated automatically.



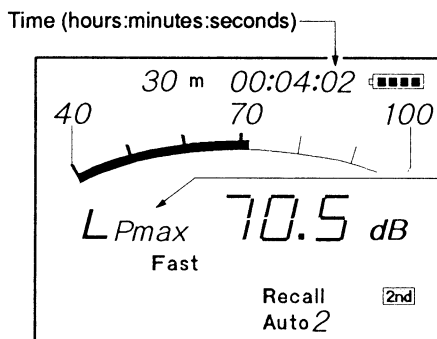
Display during data store

The data store process can be paused with the Pause/Cont key. During pause, the pause mark (||) replaces the store mark. The time during which the process was paused will not be included in the store time.

By pressing the Start/Stop key, the process can be manually terminated before the end of the preset store time.

## ● Data recall

1. Use the Store Mode key to select any of the modes Auto 1 through Auto 6.
2. Press the Recall key.  
The indication "Recall" appears on the display, and stored data and the store time (time since start of store) are shown.



Stored data display

Mode key can be used to switch between instantaneous value and maximum value

3. The Mode key can be used to switch the display between instantaneous value and maximum value. The Address keys can be used to select data you want to display. Press the "▲" key for next data and press the "▼" key for previous data. By keeping one of the keys depressed, you can switch data continuously.
4. To terminate the recall mode and return to the measurement mode, press the 2nd key.

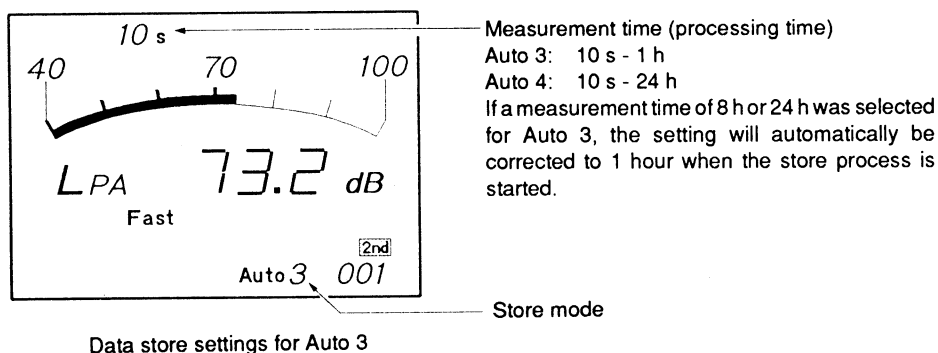
## Auto 3 (Auto Store 3), Auto 4 (Auto Store 4)

These two modes store processed values. The only difference between the two modes is the type of processed data. Otherwise, operation steps for storing and recall are identical for both modes.

The Auto 3 mode stores the processing results  $L_{eq}$ ,  $L_{max}$ ,  $L_x$  as one set of data, and the Auto 4 mode stores  $L_{eq}$ ,  $L_E$ ,  $L_{max}$ . Up to 999 data sets can be stored.

### • Data store

1. Select the measurement time for processing with the M.Time key. The setting range for Auto 3 is 10 s to 1 h, and for Auto 4 10 s to 24 h.



2. Establish the following settings.

- Display mode: Instantaneous value (LP) (Mode key)
- Frequency weighting: Any setting (Weight key)
- Time weighting: Any setting except Peak (Time Const key)
- Level range: Appropriate (Level Range keys)
- Store mode: Auto 3 or Auto 4 (Store Mode key)

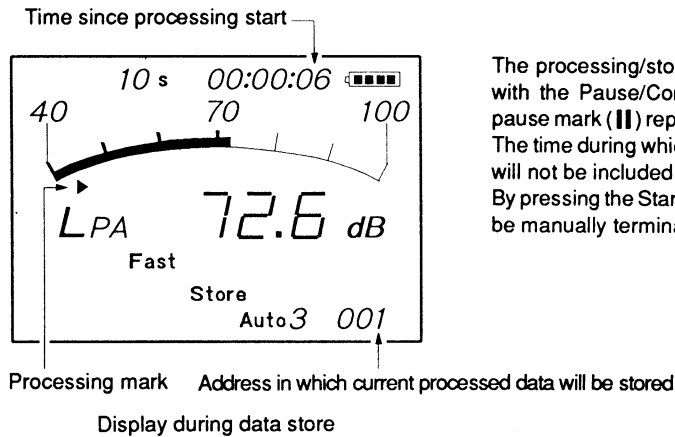
3. Press the Store key when you want to start the processing/store process.

While data are being processed, the display shows a (▶) mark, the indication "Store" and the elapsed time since the processing start point.

When the time set in step 1 has elapsed, processing ends and the results are stored in the address 1 as one set of data.

The above process is repeated until address 999. Then it stops automatically.

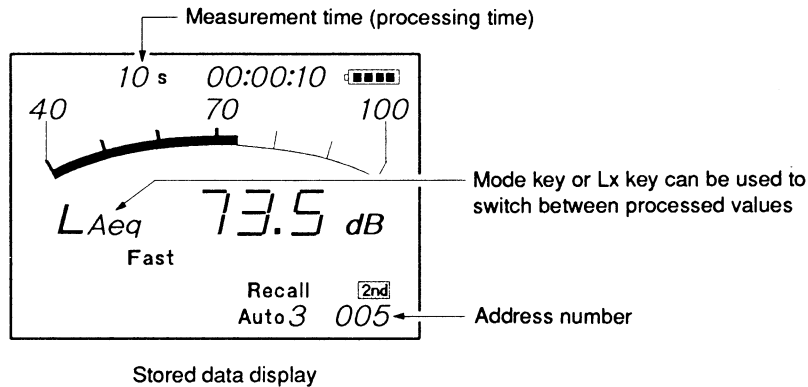




The processing/store process can be paused with the Pause/Cont key. During pause, the pause mark (||) replaces the processing mark. The time during which the process was paused will not be included in the processing time. By pressing the Start/Stop key, the process can be manually terminated before address 999.

### ● Data recall

1. Use the Store Mode key to select any of the modes Auto 1 through Auto 6.
2. Press the Recall key.  
The indication "Recall" appears on the display, and stored data are shown.



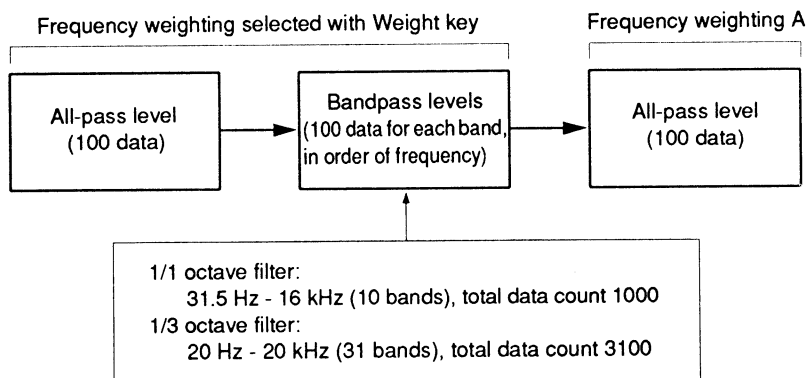
3. The Mode key or Lx key can be used to switch the display between various processed values.  
The Address keys can be used to select an address whose data you want to display. The "▲" key increases the address number and the "▼" key decreases it. By keeping one of the keys depressed, you can switch address numbers continuously.
4. To terminate the recall mode and return to the measurement mode, press the 2nd key.

## Auto 5 (Auto Store 5)

To use the Auto 5 mode, the optional filter unit NX-04 or NX-05 is required. The NX-04 allows storing instantaneous values in 1/1 octave bands, and the NX-05 in 1/1 or 1/3 octave bands.

The Auto 5 mode first stores 100 all-pass level data (sound pressure level without filter), then 100 bandpass level data for each frequency, and finally 100 all-pass level data weighted with the “A” characteristic. The data store interval is 100 ms.

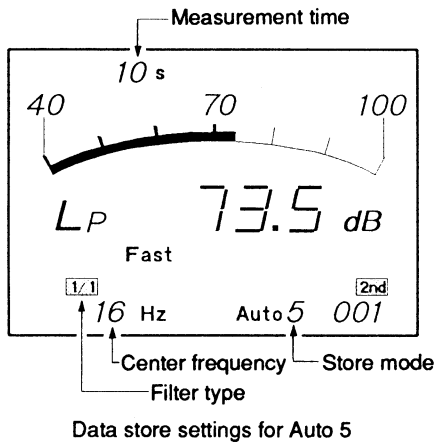
The first all-pass level and the bandpass levels for each frequency depend on the frequency weighting selected with the Weight key. The last all-pass level always uses “A” weighting, regardless of the Weight key setting.



Data store order with Auto 5

### ● Data store

1. Set the filter unit switch, as described on page 40.
  - NX-04: On (1/1 octave)
  - NX-05: 1/1 octave or 1/3 octave
2. Establish the following settings.
  - Display mode: Instantaneous value (LP) (Mode key)
  - Frequency weighting: Any setting (Weight key)
  - Time weighting: Any setting except Peak (Time Const key)
  - Level range: Appropriate (Level Range keys)
  - Filter function: On (Filter key)
  - Store mode: Auto 5 (Store Mode key)

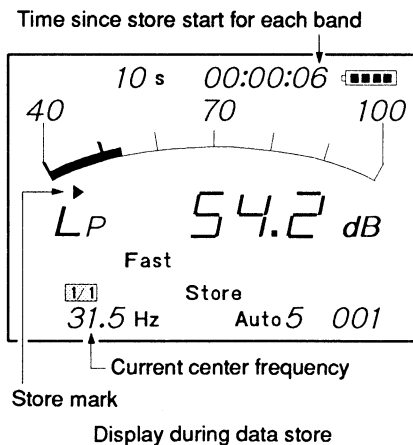


There is no need to set the measurement time. Regardless of which time is selected, the setting will automatically become 10 s when the store process is started.

There is also no need to set the filter center frequency, because it is selected and switched automatically during data store process.

3. Press the Store key when you want to start the data store process.

While data are being stored, the display shows a (▶) mark and the indication "Store", and the all-pass level, the bandpass levels, and A-weighted all-pass level are stored in turn. When the A-weighted all-pass level has been stored, the store process stops automatically.



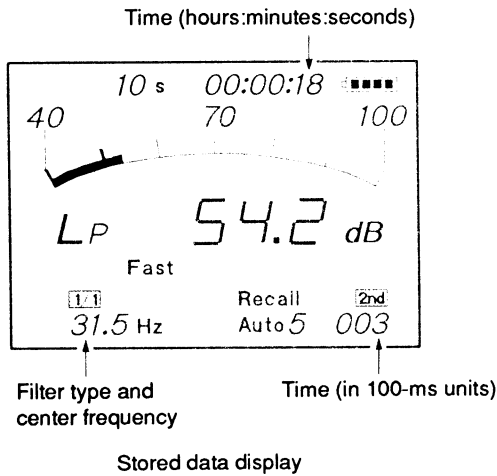
The data store process can be paused with the Pause/Cont key. During pause, the pause mark (||) replaces the store mark. The time during which the process was paused will not be included in the data store time.

When all-pass levels are being stored, no filter information appears.

By pressing the Start/Stop key, the process can be manually terminated before all levels have been stored.

● **Data recall**

1. Use the Store Mode key to select any of the modes Auto 1 through Auto 6.
2. Press the Recall key.  
The indication "Recall" appears on the display, and stored data and the store time (time since start of store) are shown.



The time is displayed in two ways. In the upper section of the display, it is shown in hours, minutes, and seconds. In the lower right, it is shown in 100-ms units.

In the example shown at left, the time is calculated as follows.

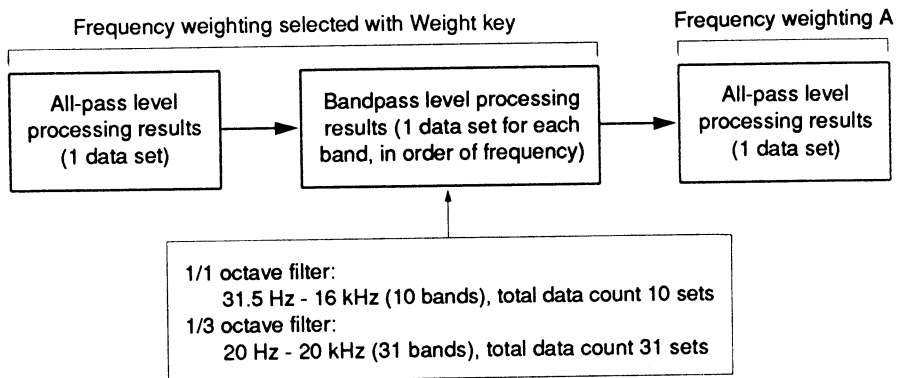
$$18 \text{ (s)} + 3 \times 100 \text{ (ms)} = 18.3 \text{ (s)}$$

3. The Address keys can be used to select data you want to display. Press the "▲" key for next data and press the "▼" key for previous data. By keeping one of the keys depressed, you can switch data continuously.  
When the displayed data are bandpass level data stored with the filter, the filter type (1/1 or 1/3) and the center frequency are displayed. When all-pass level data are shown, no filter information appears.
4. To terminate the recall mode and return to the measurement mode, press the 2nd key.

## Auto 6 (Auto Store 6)

To use the Auto 6 mode, the optional filter unit NX-04 or NX-05 is required. The NX-04 allows storing the processed values  $L_{eq}$ ,  $L_E$ , and  $L_{max}$  in 1/1 octave bands, and the NX-05 in 1/1 or 1/3 octave bands.

The Auto 6 mode first processes the all-pass level data (sound pressure level without filter) and stores the result ( $L_{eq}$ ,  $L_E$ ,  $L_{max}$ ) as one set of data in address 1. Next, processing is carried out for the bandpass levels, and finally for the all-pass level weighted with the "A" characteristic. The results are stored as subsequent data sets in addresses 2 and following (see illustration below).



Data store order for one group with Auto 6

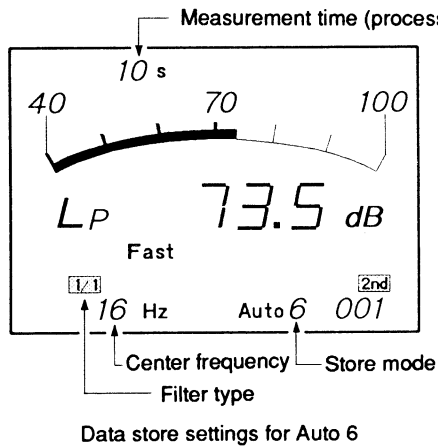
The above data are taken as one group. With a 1/1 octave filter, processing continues until 110 groups have been stored. With a 1/3 octave filter, the capacity is 40 groups.

The first all-pass level and the bandpass levels for each frequency depend on the frequency weighting selected with the Weight key. The last all-pass level always uses "A" weighting, regardless of the Weight key setting.

**Note:** When retrieving data via the RS-232-C interface, the sound level meter can output 20 groups of data.

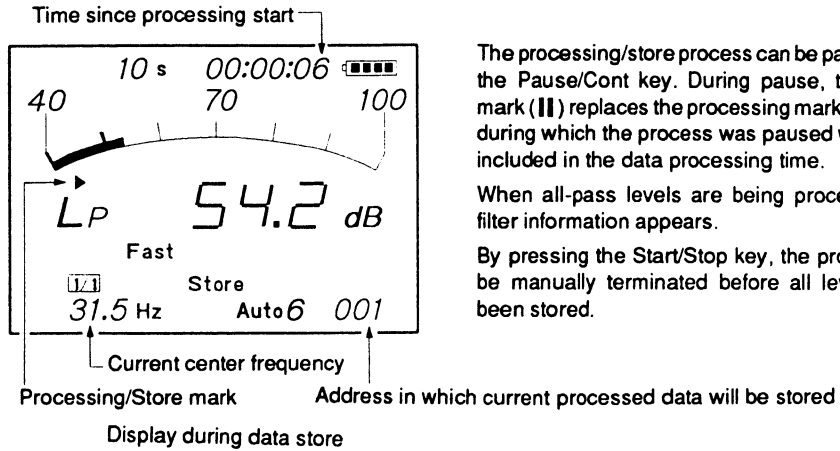
● **Data store**

1. Set the filter unit switch, as described on page 40.
  - NX-04: On (1/1 octave)
  - NX-05: 1/1 octave or 1/3 octave
2. Select the measurement time for processing with the M.Time key. The setting range is 10 s to 24 h.
3. Establish the following settings.
  - Display mode: Instantaneous value (LP) (Mode key)
  - Frequency weighting: Any setting (Weight key)
  - Time weighting: Any setting except Peak (Time Const key)
  - Level range: Appropriate (Level Range keys)
  - Filter function: On (Filter key)
  - Store mode: Auto 6 (Store Mode key)



There is no need to set the filter center frequency, because it is selected and switched automatically during data store process.

4. Press the Store key when you want to start the data processing/store process. While data are being processed, the display shows the time since processing start, a (▶) mark and the indication "Store". When the time set in step 2 has elapsed, the processing results are stored. Next, the same process is carried out for the bandpass levels and the A-weighted all-pass level. The entire process is repeated for other groups. When the data for the last group have been stored, the processing/store process stops automatically.



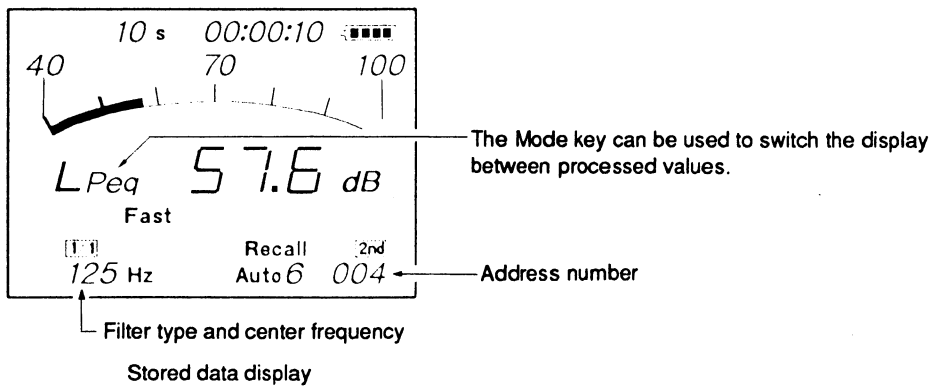
The processing/store process can be paused with the Pause/Cont key. During pause, the pause mark (||) replaces the processing mark. The time during which the process was paused will not be included in the data processing time.

When all-pass levels are being processed, no filter information appears.

By pressing the Start/Stop key, the process can be manually terminated before all levels have been stored.

● **Data recall**

1. Use the Store Mode key to select any of the modes Auto 1 through Auto 6.
2. Press the Recall key.  
The indication "Recall" appears on the display, and stored data and their address are shown.



3. The Mode key can be used to switch the display between processed values. The Address keys can be used to select an address whose data you want to display. The “▲” key increases the address number and the “▼” key decreases it. By keeping one of the keys depressed, you can switch address numbers continuously.

When the displayed data are bandpass level data stored with the filter, the filter type (1/1 or 1/3) and the center frequency are displayed. When all-pass level data are shown, no filter information appears.

4. To terminate the recall mode and return to the measurement mode, press the 2nd key.



## OPTIONAL EQUIPMENT

This section explains the use of the filter units, printer and other optional accessories to the sound level meter NL-04/NL-14.

- **Filter Unit NX-04/NX-05** (⇒ p. 40)  
One of the following two types of filter units can be installed, to allow easy and convenient frequency analysis.  
NX-04: For 1/1 octave band frequency analysis  
NX-05: For 1/1 and 1/3 octave band frequency analysis
- **Printer CP-10** (⇒ p. 43)  
Allows printout of measurement data (including data stored in the internal memory).
- **Level Recorder LR-04/LR-06** (⇒ p. 50)  
Using the AC output of the sound level meter, the sound pressure level changes over time can be recorded. Together with filter unit NX-04 or NX-05, 1/1 octave band frequency analysis or 1/3 octave band frequency analysis results can also be recorded.
- **Memory Card Unit DA-05** (⇒ p. 55)  
Allows storing of measurement data on a memory card instead of the internal memory.
- **Microphone Extension Cable EC-04 Series** (⇒ p. 56)  
Allows microphone placement at a distance from the main unit. Six types of cables with a length of 2 to 100 meters are available.
- **Other equipment** (⇒ p. 58)  
Using the AC output or DC output of the sound level meter, frequency analysis etc. can be carried out with special equipment.

## Filter Unit NX-04/NX-05

When the filter unit NX-04 or NX-05 is installed in the sound level meter, 1/1 octave band frequency analysis or 1/3 octave band frequency analysis can be carried out.

This section describes installation and use of the filter unit for frequency analysis.

When the level recorder LR-04/LR-06 is used, the filter center frequencies can be switched automatically while recording the results of frequency analysis. For details, please refer to page 50 of this manual and to the instruction manual of the level recorder.

Octave filter NX-04:

For 1/1 octave band frequency analysis

1/1, 1/3 octave filter NX-05:

For 1/1 and 1/3 octave band frequency analysis (switchable)

The center frequencies are as follows:

1/1 octave filter (attenuation characteristics according to IEC Pub. 255, JIS C 1513 type II)

|    |      |    |     |     |     |      |      |      |      |           |
|----|------|----|-----|-----|-----|------|------|------|------|-----------|
| 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000(Hz) |
|----|------|----|-----|-----|-----|------|------|------|------|-----------|

1/3 octave filter (attenuation characteristics according to IEC Pub. 255, JIS C 1513 type III)

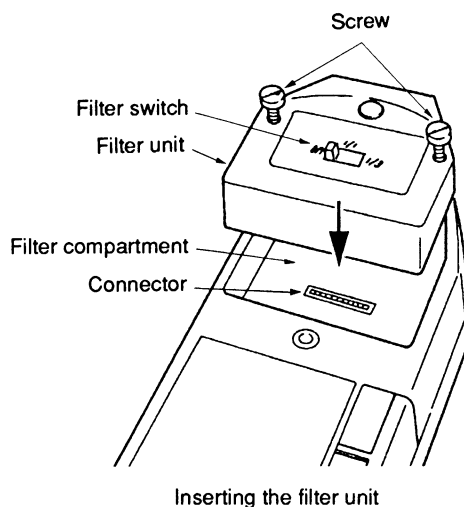
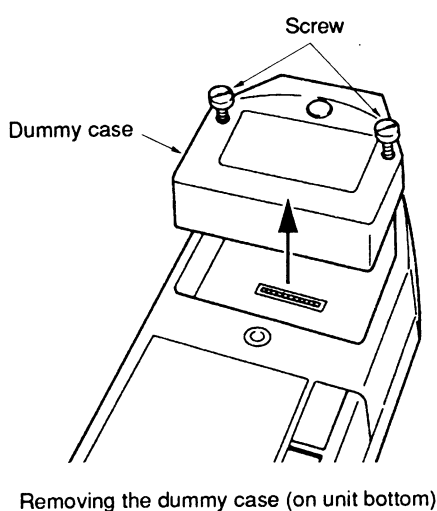
|       |       |       |           |      |      |      |      |      |      |
|-------|-------|-------|-----------|------|------|------|------|------|------|
|       | 12.5  | 16    | 20        | 25   | 31.5 | 40   | 50   | 63   | 80   |
| 100   | 125   | 160   | 200       | 250  | 315  | 400  | 500  | 630  | 800  |
| 1000  | 1250  | 1600  | 2000      | 2500 | 3150 | 4000 | 5000 | 6300 | 8000 |
| 10000 | 12500 | 16000 | 20000(Hz) |      |      |      |      |      |      |

**Note:** Because the frequency range of the NL-04 is 20 - 8000 Hz, and of the NL-14 20 -12500Hz, measurement results with frequencies outside of that range are not guaranteed.

## Installing the Filter Unit

The filter compartment of the NL-04/NL-14 contains a dummy case. Remove this case before installing the filter unit.

1. Turn off the sound level meter.
2. Loosen the dummy case screws, and remove the dummy case.
3. Insert the filter unit into the compartment, so that the connector of the filter unit matches with the connector on the unit.
4. Fasten the filter unit firmly with the screws.

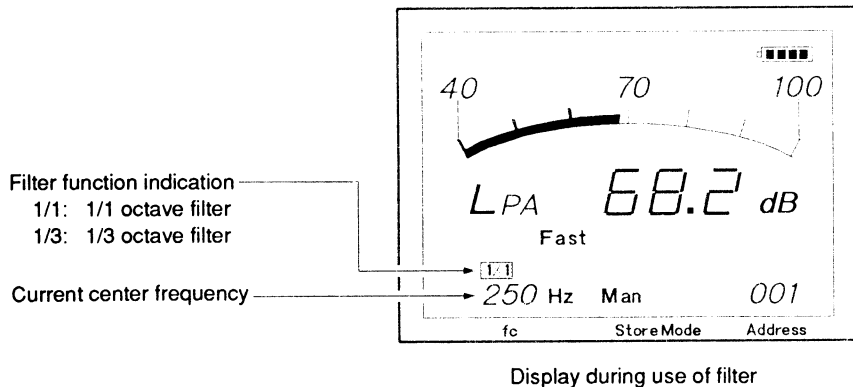


On the NX-04, the filter switch serves as on/off switch for the filter unit. On the NX-05, the switch also serves to select 1/1 octave or 1/3 octave operation.

When the filter is not used, the switch should be set to Off. If left at On or 1/1, 1/3, the battery life will be about 10% shorter

## Frequency Analysis Procedure

1. Turn on the sound level meter.
2. Set the filter switch of the filter unit.  
NX-04: On (1/1 octave)  
NX-05: 1/1 (1/1 octave) or 1/3 (1/3 octave)
3. Press the Filter key to activate the filter function. When the filter is operative, a “1/1” or “1/3” indication appears on the display and the current center frequency is shown. Other display functions are the same as when not using the filter.



4. The fc keys can be used to select the filter frequency. The “▲” key increases the frequency and the “▼” key decreases it.

Other operation steps are the same as when not using the filter. However, the lowest level range setting is 70 dB, not 80 dB.

When wishing to measure the all-pass level, press the Filter key to turn the filter function off.

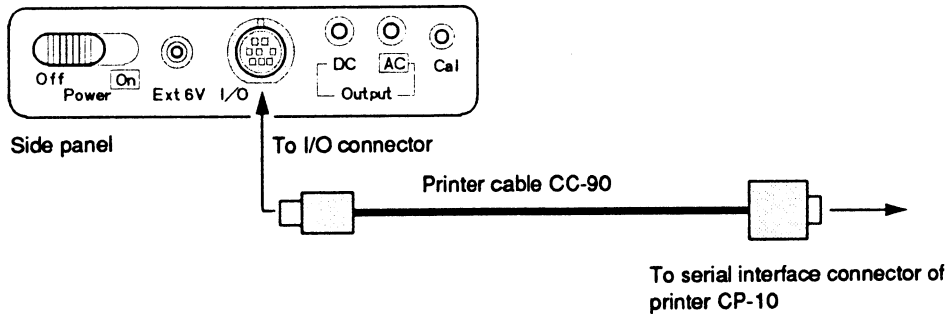
By using the above steps, you can measure and store the instantaneous value and  $L_{eq}$ ,  $L_E$ ,  $L_{max}$ , and  $L_x$  for each desired frequency band.

## Printer CP-10

The printer CP-10 can be used to print out measurement results or data stored in the internal memory. This section describes operation steps at the sound level meter. For details on operation of the printer, please refer to the instruction manual of the CP-10.

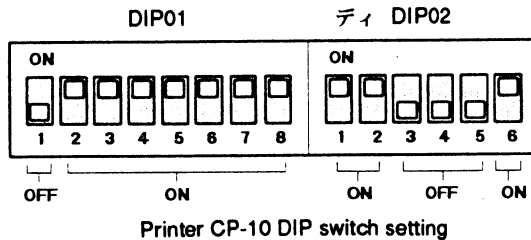
### Connecting the Printer

Connect the serial interface connector of the printer CP-10 to the I/O connector of the NL-04/ NL-14, using the printer cable CC-90.



### Setting the Printer DIP switches

Set the two DIP switches of the printer CP-10 as shown below.



## Printout Procedure and Print Sample

Turn on the CP-10 and set the printer to the on-line condition. Then perform the following steps.

### ● Printing data during measurement

1. Bring up the desired data on the display.
2. Press the Print key.

#### Instantaneous value printout sample

|     |      |      |      |   |
|-----|------|------|------|---|
| LpA | 54.6 | Fast | ←    | Data type, instantaneous value,<br>time weighting   |
| LpA | 91.6 | Fast | Over |   |
| LpC | 64.3 | Fast | ↑    | If overload has occurred,<br>"Over" is printed here |

#### Processed value printout sample

|      |          |      |      |      |   |                                 |
|------|----------|------|------|------|---|---------------------------------|
| 10s  | 00:00:10 | Fast | Over | ←    | Selected measurement time, actual<br>measurement time, time weighting |                                 |
| LAeq | LAE      | LAmx |      | ↑    | If overload data are included,<br>"Over" is printed here              |                                 |
| 65.1 | 75.1     | 79.5 |      |      |   |                                 |
| LA5  | LA10     | LA50 | LA90 | LA95 | ←   | Data type and processing result |
| 70.5 | 66.2     | 59.2 | 54.9 | 53.7 |   |                                 |

● **Printing data gained with manual store**

1. Press the Store Mode key to set the store mode to "Man".
2. Press the Recall key to display stored data.
3. Use the Address keys to select the data you want to print (the data will be shown on the display).
4. Press the Print key.

**Instantaneous value printout sample**

|   |     |      |           |
|---|-----|------|-----------|
| 1 | LpA | 54.6 | Fast      |
| 2 | LpA | 91.6 | Fast Over |
| 3 | LpC | 64.3 | Fast      |

Address number, data type, instantaneous value, time weighting

If overload has occurred, "Over" is printed here

**Processed value printout sample**

|   |      |          |           |
|---|------|----------|-----------|
| 1 | 10s  | 00:00:10 |           |
|   | LAeq | 57.9     | Fast      |
| 2 | 10s  | 00:00:10 |           |
|   | LAeq | 72.3     | Fast Over |

Address number, selected measurement time, actual measurement time

Data type, processing result, time weighting

If overload data are included, "Over" is printed here

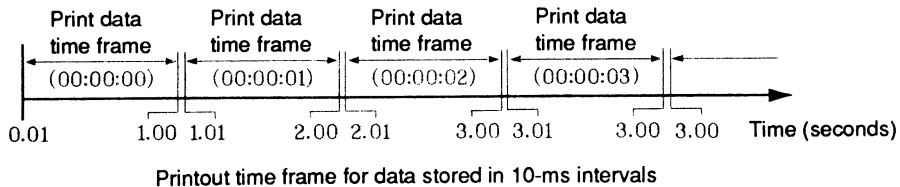
● **Printing data gained with auto store**

1. Press the Store Mode key to set the store mode to a setting from “Auto 1” through “Auto 6”.
2. Press the Recall key to display stored data.
3. The range of data that will be printed depends on which auto mode was used to store the data. Refer to the following section about selecting data for printout.
4. Press the Print key.

**Selecting data stored with Auto 1**

Data for 1 second can be printed at one time. This is equivalent to 100 data when the 10-ms interval was used, or 10 data when the 100-ms interval was used. The time frame of the displayed data determines the time frame of the printed data (see below).

Use the Address keys to select the time frame for printout. If data were stored for example at 10-ms intervals, and you want to print the 2.01 - 3.00 s data, display any data between 2.01 and 2.99 s.



**Printout sample**

|       |          |      |      |      |      |   |
|-------|----------|------|------|------|------|---|
| Autol |          |      |      |      |      | Store mode  |
| 10s   | 00:00:02 |      |      |      |      | Selected measurement time, printout time frame<br>(hours:minutes:seconds) |
| LpA   | Fast     |      |      |      |      | Data type, time weighting   |
|       | 76.8*    | 73.5 | 71.0 | 67.0 | 64.7 | Data (5 per row)  |
|       | 62.2     | 60.7 | 59.4 | 58.8 | 58.5 |   |
|       | 58.1     | 58.2 | 59.3 | 61.1 | 60.6 |   |
|       | 59.7     | 58.8 | 58.4 | 58.6 | 60.4 |   |
|       | :        | :    | :    | :    | :    |   |

If overload has occurred, a\* is printed after the data.



### Selecting data stored with Auto 2

100 data sets can be printed at one time, starting from the currently displayed data. Use the Address keys to select the beginning data.

Printout sample

|        |      |      |      |  |
|--------|------|------|------|--|
| Auto 2 |      |      |      | Store mode   |
| 5m     |      |      |      | Selected measurement time  |
|        | LpA  | LAmx | Fast | Data type, time weighting  |
| 01     | 68.0 | 68.5 |      | 1 set of data (time (s), data)                                   |
| 02     | 70.0 | 76.7 | Over |  |
| 03     | 70.3 | 72.0 |      | If overload data are included, "Over" is printed after the data. |
| :      | :    | :    |      |  |

### Selecting data stored with Auto 3

50 data sets can be printed at one time, starting from the currently displayed data. Use the Address keys to select the beginning data.

Printout sample

|        |      |      |      |      |      |  |
|--------|------|------|------|------|------|--|
| Auto 3 |      |      |      |      |      | Store mode   |
| 10s    |      |      |      |      |      | Selected measurement time  |
|        | Fast |      |      |      |      | Time weighting   |
|        | LLeq | LAmx |      |      |      | Data type and arrangement  |
|        | LA5  | LA10 | LA50 | LA90 | LA95 |  |
| 01     | 74.8 | 85.0 |      |      |      | 1 set of data  |
|        | 81.6 | 78.6 | 71.3 | 65.0 | 64.2 | Address number, Leq, Lmax, L5 - L95                              |
| 02     | 76.0 | 85.9 |      |      |      |  |
|        | 81.5 | 79.2 | 73.9 | 65.6 | 64.6 | Over   |
| 03     | 74.4 | 84.7 |      |      |      |  |
|        | 81.0 | 78.7 | 68.1 | 62.3 | 61.8 | If overload data are included, "Over" is printed after the data. |
| :      | :    | :    | :    | :    | :    |  |

### Selecting data stored with Auto 4

100 data sets can be printed at one time, starting from the currently displayed data. Use the Address keys to select the beginning data.

Printout sample

|        |       |      |        |      |  |  |
|--------|-------|------|--------|------|--|--|
| Auto 4 |       |      |        |      |  | Store mode   |
| 10s    |       |      |        |      |  | Selected measurement time  |
|        | Fast  |      |        |      |  | Time weighting   |
|        | L Aeq | LAE  | L Amax |      |  | Data type and arrangement  |
| 01     | 82.1  | 99.8 | 95.9   |      |  | 1 set of data (address number, data)                             |
| 02     | 80.7  | 98.5 | 93.7   | Over |  |  |
| 03     | 79.7  | 97.4 | 89.6   |      |  | If overload data are included, "Over" is printed after the data. |
| 04     | 74.9  | 92.7 | 82.5   |      |  |  |
| ⋮      | ⋮     | ⋮    | ⋮      |      |  |  |

### Selecting data stored with Auto 5

Data for one frequency band (100 data) can be printed at one time. The band to be printed depends on which band is currently displayed. Use the Address keys to select the desired frequency band data.

Printout sample (1/1 octave filter)

|        |      |      |      |      |      |  |   |
|--------|------|------|------|------|------|--|---|
| Auto 5 |      |      |      |      |      |  | Store mode  |
| 10s    |      |      |      |      |      |  | Selected measurement time                               |
| 1/1    | AP   |      |      |      |      |  | Filter type, frequency band                             |
| LpC    | Fast |      |      |      |      |  | Data type, time weighting                               |
|        | 76.8 | 73.5 | 71.0 | 67.0 | 64.7 |  | Data (5 per row)  |
|        | 62.2 | 60.7 | 59.4 | 58.8 | 58.5 |  |   |
|        | 58.1 | 58.2 | 59.3 | 61.1 | 60.6 |  |   |
|        | 59.7 | 58.8 | 58.4 | 58.6 | 60.4 |  |   |
|        | ⋮    | ⋮    | ⋮    | ⋮    | ⋮    |  |   |
|        |      |      |      |      |      |  | If overload has occurred, a* is printed after the data. |

### Selecting data stored with Auto 6

Data for one group ( $L_{eq}$ ,  $L_E$ ,  $L_{max}$  for all bands) can be printed at one time. The group to be printed depends on which group is currently displayed. Use the Address keys to select the desired group data.

Printout sample (1/1 octave filter)

|        | LC <sub>eq</sub> | LCE  | LC <sub>max</sub> |  |
|--------|------------------|------|-------------------|--|
| Auto 6 |                  |      |                   | Store mode                             |
| 10s    |                  |      |                   | Selected measurement time              |
| 1/1    |                  |      |                   | Filter type                            |
| Faast  |                  |      |                   | Time weighting                         |
| AP     | 65.0             | 75.0 | 72.9              | Data type and arrangement              |
| 31.5   | 56.7             | 66.7 | 73.0              | All-pass data ("AP", data)             |
| 63     | 57.5             | 67.5 | 61.9              | Bandpass data (center frequency, data) |
| 125    | 56.0             | 66.0 | 62.3              |  |
| 250    | 58.4             | 68.4 | 62.7              |  |
| 500    | 53.6             | 63.6 | 57.3              |  |
| 1k     | 48.9             | 58.9 | 55.8              |  |
| 2k     | 41.3             | 51.3 | 50.4              |  |
| 4k     | 58.3             | 68.3 | 75.7              | Over                                   |
| 8k     | 25.6             | 35.6 | 37.9              |  |
| 16k    | 21.3             | 31.3 | 33.4              |  |
| LpA    | 54.9             | 64.9 | 62.6              | A-weighted all-pass data ("LpA", data) |

If overload data are included, "Over" is printed after the data. The first all-pass data and the bandpass data depend on the frequency weighting selected with the Weight key. The last all-pass data always reflects "A" weighting, regardless of the Weight key setting.

## **Level Recorder LR-04/LR-06**

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By connecting the AC output of the sound level meter to the level recorder LR-04 or LR-06, the sound pressure level changes over time can be recorded. When the filter unit NX-04 or NX-05 is installed, 1/1 octave band frequency analysis or 1/3 octave band frequency analysis results can also be recorded.

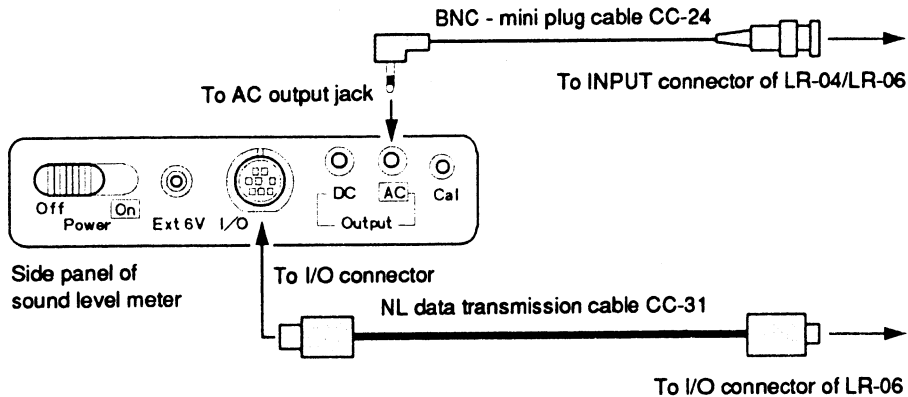
The level recorder LR-04/LR-06 has the capability to automatically select the center frequencies of the filter unit NX-04/NX-05. Using this function, the level recorder paper feed and the center frequency can be matched for synchronized frequency analysis.

This section describes connections and operation steps at the sound level meter for sound pressure level recording and synchronized frequency analysis. For details on operation of the level recorder, please refer to the instruction manual of the recorder.

## Sound Pressure Level Recording

This section describes connections and additional information for making a sound pressure level recording.

### ● Connections



The CC-31 cable serves for printout of measurement parameters, using the LR-06. The LR-04 does not have this capability, therefore this connection is not required. It may also be omitted with the LR-06 if measurement parameters are not to be printed out.

### ● Additional Information

By activating the calibration mode of the sound level meter, a calibration signal (1000 Hz sine wave, corresponding to 94 dB) can be supplied at the output. Use this signal to calibrate the level recorder. The calibration level is 6 dB below the full-scale value of the sound level meter. You should therefore adjust the level recorder so that the pen is 6 dB below the maximum point.

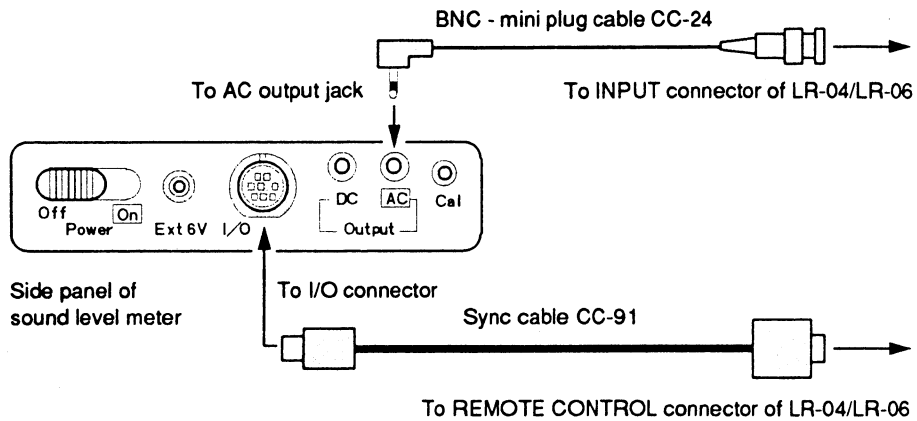
The signal at the AC output of the sound level meter reflects the frequency weighting. To record A-weighted sound pressure levels, you should therefore select the "A" weighting characteristic at the sound level meter. To record sound pressure levels, use the "Flat" setting. The time weighting is to be set at the level recorder.

When the filter unit is installed, the level recorded on the level recorder is the level in the frequency band selected with the fc keys.

## Synchronized Frequency Analysis

This section describes connections and operation steps for making a synchronized frequency analysis. Use the recording paper PR-33 (for frequency analysis) at the level recorder. For information on operation of the filter unit, please refer to page 40.

### ● Connections



### ● Procedure

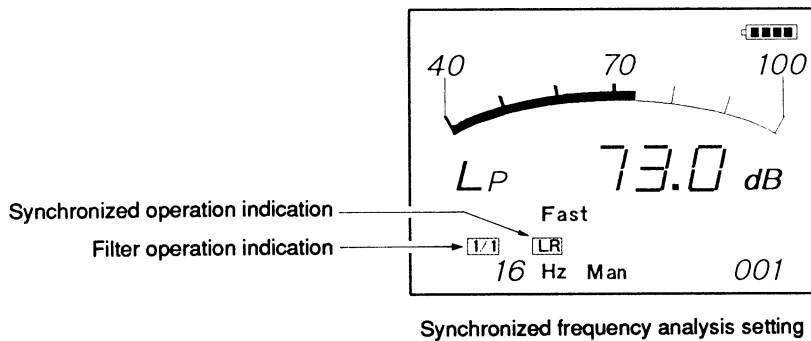
1. Turn on the sound level meter and level recorder, and set the filter switch of the filter unit to On or 1/1, 1/3.
2. Set up the level recorder as follows
  - Recording span (range): 50 dB or 25 dB
  - Input: Coupling AC
  - Dynamic characteristics (time weighting): Fast or Slow
  - Paper speed: Any setting  
(Avoid very high settings, because too fast band switching will cause pen lag.)
3. Set the sound level meter to the calibration mode and use the calibration signal to adjust the level recorder. The calibration signal level is  $-6$  dB from the full-scale value of the sound level meter. Adjust the level recorder so that the pen is 6 dB below the maximum point.

## 4. Set up the sound level meter as follows.

- Display mode: Instantaneous value (LP) (Mode key)
- Frequency weighting: Any setting (Weight key)
- Level range: Appropriate (Level Range keys)

The time weighting is set at the level recorder. The sound level meter setting does not matter.

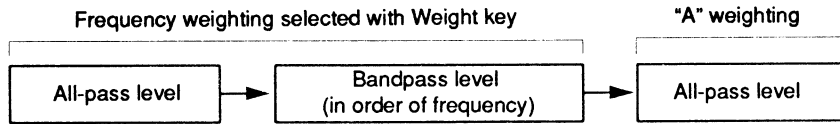
## 5. Press the Filter key of the sound level meter to activate the filter function. The indication "1/1" or "1/3" appears on the display, and the indication "LR" shows that synchronized operation with a level recorder is being carried out.



6. Lower the pen of the level recorder onto the paper and move the paper so that the pen is at the start position. (See the recording example on the next page.)
7. Set the Pen switch of the level recorder to On, and the Paper switch to Off. When the LR-06 is used, press the Standby switch to start pen operation.

8. Press the Start/Stop key of the sound level meter.

The frequency bands are automatically switched by a control signal from the level recorder, and the level in each band is recorded. The operation sequence is as follows.



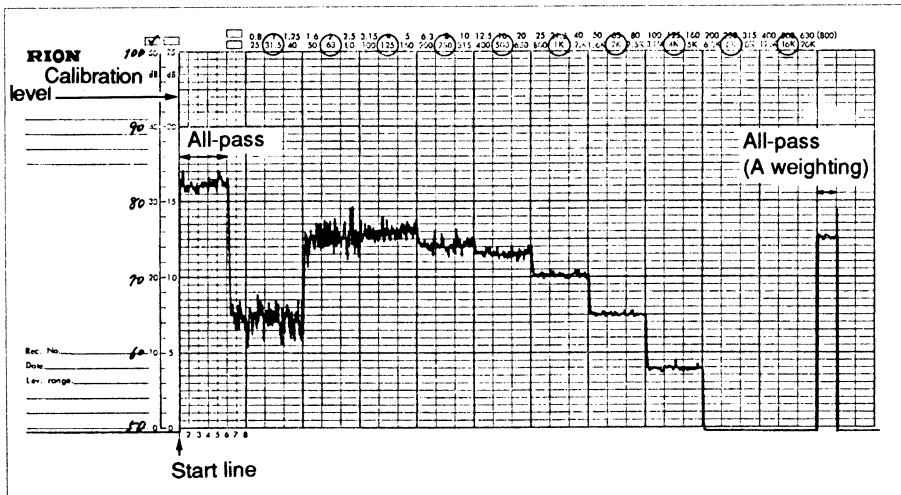
The first all-pass level and the bandpass level depend on the frequency weighting selected with the Weight key. The last all-pass level always reflects "A" weighting, regardless of the Weight key setting.

The number of bands depends on the filter in use.

- 1/1 octave filter: 10 bands (31.5 Hz - 16 kHz)
- 1/3 octave filter: 31 bands (20 Hz - 20 kHz)

**Recording sample (1/1 octave band frequency analysis, recording span: 50 dB)**

The example below was made with a sound level meter level range of 100 dB (full-scale). The top of the scale on the recording paper is 100 dB, and the calibration level position 94 dB. If a level range of 80 dB were used, the top of the scale on the recording paper would be 80 dB, and the calibration level position 74 dB.

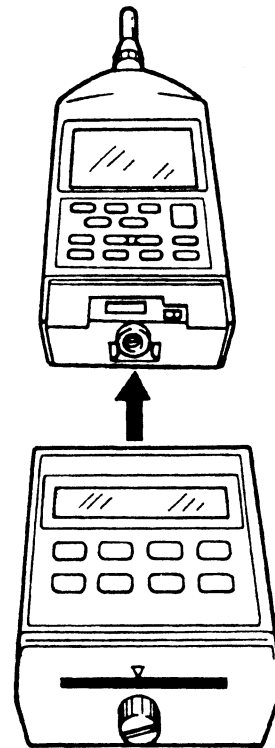




## Memory Card Unit DA-05

Using the memory card unit DA-05, measurement data of the NL-04/NL-14 can be stored on memory cards. The DA-05 is a compact and lightweight unit that can be directly attached to the NL-04/NL-14.

Data gained with one of the auto modes of the sound level meter can be stored on the DA-05. Whereas the internal memory of the sound level meter can only hold one set of auto data out of Auto 1 through Auto 6, a memory card can hold much more data, including data from different auto modes. Data stored on a memory card can be plotted on the level recorder LR-06 as a level waveform (Auto 1 and Auto 5 data). Data can also be read out using a memory card reader.



Memory card unit DA-05

**Note:** The DA-05 complies to the JEIDA (Japan Electronics Industry Development Association) IC Memory Card Guideline Version 4. The card size is a Type I SRAM card, with capacities of 64, 128, 256, 512 kilobytes, or 1 megabyte. Cards with a capacity of over 1 megabyte will be treated as 1 megabyte cards.

Operation of the following memory cards was verified with the DA-05:

|                     |                    |
|---------------------|--------------------|
| Fujitsu             | MB98A90002 series  |
| Matsushita Battery  | BN-HMC series      |
| Ascii               | AF-SR series       |
| Towa Electron       | MCSJ-A01 series    |
| Mitsubishi Electric | MF-L2DAT series    |
| Seiko Epson         | AWB-SD40 series    |
| MAXELL              | ML series, type TB |

## Microphone Extension Cable EC-04 Series

For measurements requiring special precision, the microphone can be removed from the main unit and connected by means of an extension cable. This reduces measurement deviations due to diffraction effects and the acoustic influence of the operator.

As shown in the table below, six types of cables with a length of 2 to 100 meters are available.

Microphone extension cables (EC-04 series)

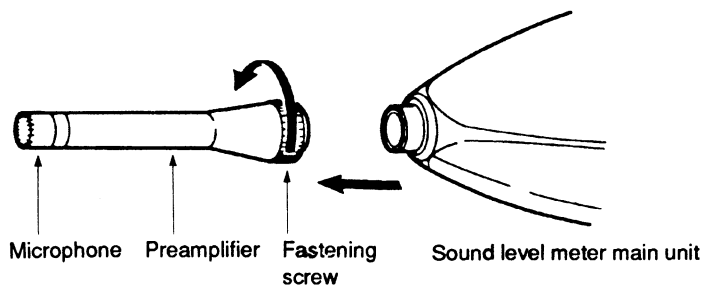
| Designation | Length | Designation | Length |
|-------------|--------|-------------|--------|
| EC-04       | 2 m    | EC-04C      | 30 m   |
| EC-04A      | 5 m    | EC-04D      | 50 m   |
| EC-04B      | 10 m   | EC-04E      | 100 m  |

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

### ● Using the extension cable

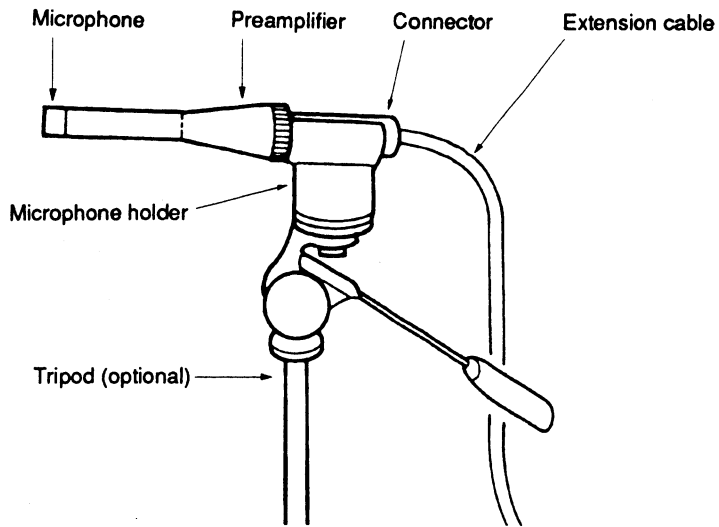
1. Turn off the sound level meter.
2. Loosen the preamplifier fastening screw and remove the preamplifier from the main unit.

**Note:** Do not separate the microphone and preamplifier.



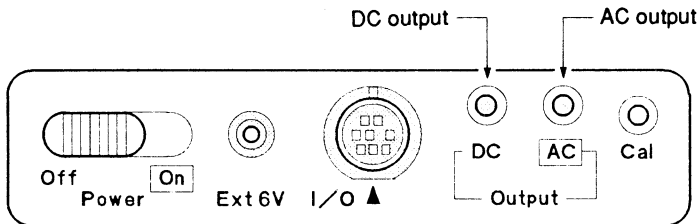
3. Connect the sound level meter and the preamplifier using the extension cable.

4. 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.



## Other Equipment (Use of the AC and DC Output Jacks)

This section lists other equipment such as analyzers which can be connected to the AC output and DC output of the NL-04/NL-14.

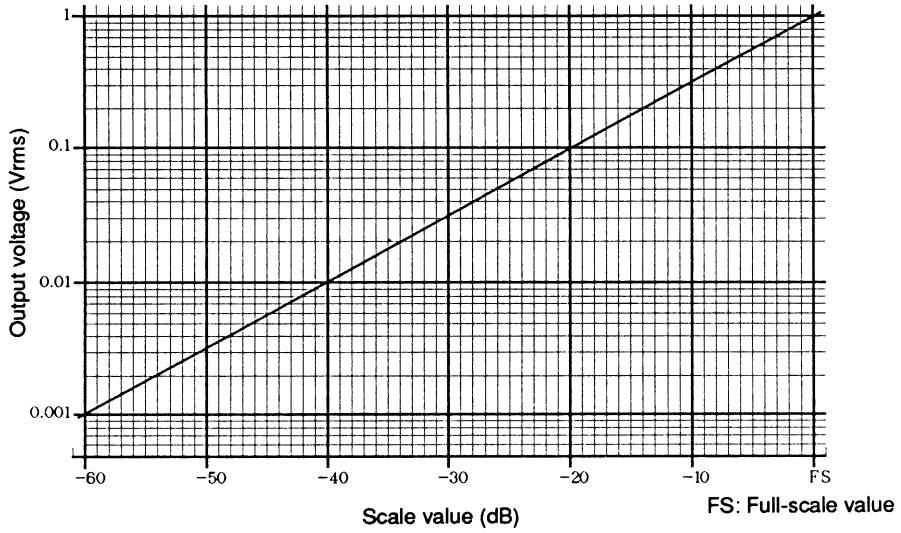


- **AC output**

The signal at the AC output of the sound level meter reflects the frequency weighting. When the filter unit is installed, the output level is the level in the frequency band selected with the fc keys.

- Output voltage: 1 Vrms (at full-scale)
- Output impedance: Approx. 600  $\Omega$
- Load impedance: 10 k $\Omega$  or more
- Cable type: BNC - mini plug cable CC-24 (supplied)
- Suitable equipment: Level recorder LR-04/LR-06
- 1/3 octave band real-time analyzer SA-25/SA-27
- FFT signal analyzer SA-71
- Signal analyzer SA-77
- Data recorder
- Other equipment with AC signal input

By activating the calibration mode of the sound level meter, a calibration signal (1000 Hz sine wave, corresponding to 94 dB) can be supplied at the output. Use this signal to calibrate the connected equipment. The calibration level is 6 dB below the full-scale value.



Scale values and AC output voltage

If the level range of the sound level meter is set to 100 dB (full-scale value = 100 dB), the output voltage will be as follows

At 60 dB: 0.01 V

At 80 dB: 0.1 V

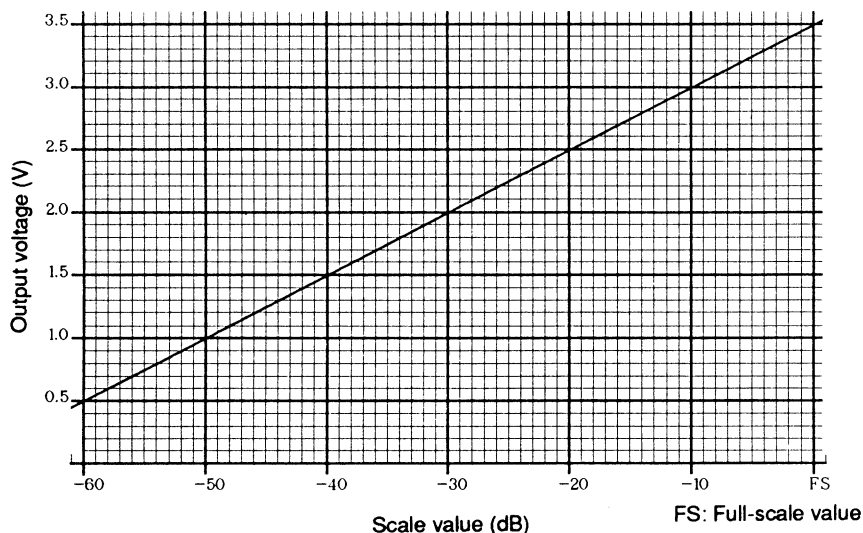
At 100 dB: 1 V

● **DC output**

The signal at the DC output of the sound level meter reflects the frequency weighting, rms detection, time weighting (except Peak setting) and logarithmic compression of the sound level meter. When measuring waveform peak value with Peak setting, the output signal will not reflect the peak value.

When the filter unit is installed, the output level is the level in the frequency band selected with the fc keys.

- Output voltage: 3.5 V (at full-scale), 0.5 V/10 dB
- Output impedance: Approx. 50 Ω
- Load impedance: 10 kΩ or more
- Cable type: BNC - mini plug cable CC-24 (supplied)
- Suitable equipment: Equipment with DC signal input



Scale values and DC output voltage

If the level range of the sound level meter is set to 100 dB (full-scale value = 100 dB), the output voltage will be as follows

- At 40 dB: 0.5 V
- At 70 dB: 2.0 V
- At 100 dB: 3.5 V

## SPECIFICATIONS

### Applicable standards

NL-04: JIS C 1502-1990, IEC 651:1979 Type 2, IEC 804:1985 Type 2

NL-14: JIS C 1505-1988, IEC 651:1979 Type 1, IEC 804:1985 Type 1

### Measurement functions

Instantaneous sound pressure level ( $L_P$ ) and 1-second interval maximum sound pressure level

Equivalent continuous sound pressure level ( $L_{eq}$ )

Sound exposure level ( $L_E$ )

Maximum sound pressure level ( $L_{max}$ )

Percentile sound pressure level ( $L_5, L_{10}, L_{50}, L_{90}, L_{95}$ )

1/1 or 1/3 octave frequency analysis available with optional filter unit

Measurement time (processing time for  $L_{eq}, L_E, L_{max}, L_x$ )

10 s, 1 min, 5 min, 10 min, 15 min, 30 min, 1 h, 8 h, 24 h, manual time setting (max. 99 h 59 min 59 s);  $L_x$  max. 1 h

Time keeping function and pause function provided

### $L_{eq}, L_E, L_{max}, L_x$ processing functions

Digital processing

Sampling interval 10 ms ( $L_{eq}, L_E, L_{max}$ ), 100 ms ( $L_x$ )

### Memory

Manual and auto store mode for instantaneous value and processing results

Manual mode: Up to 50 data

Auto mode: Auto 1 - Auto 6 for instantaneous values and processing results, up to 9000 instantaneous data

Stored data are retained by backup battery CR-1/3N

Backup battery life approx. 2 years

### Measurement range

|        | Frequency weighting | According to JIS | According to IEC |
|--------|---------------------|------------------|------------------|
| NL-04: | A                   | 28-130 dB        | 27-130 dB        |
|        | C                   | 33-130 dB        | 32-130 dB        |
|        | Flat                | 36-130 dB        | 35-130 dB        |
| NL-14: | A                   | 28-130 dB        | 25-130 dB        |
|        | C                   | 33-130 dB        | 30-130 dB        |
|        | Flat                | 36-130 dB        | 33-130 dB        |

## Specifications

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### Microphone and preamplifier

NL-04: 1/2-inch prepolarized condenser microphone UC-52,  
sensitivity  $-33$  dB (0 dB = 1 V/Pa)

Preamplifier NH-19

NL-14: 1/2-inch prepolarized condenser microphone UC-53A,  
sensitivity  $-28$  dB (0 dB = 1 V/Pa)

Preamplifier NH-20

### Calibration

Electrical calibration with 1000-Hz sine wave signal from built-in oscillator

### Frequency range

NL-04: 20 - 8000 Hz (including microphone), 10 - 20000 Hz (electrical characteristics)

NL-14: 20 - 12500 Hz (including microphone), 10 - 20000 Hz (electrical characteristics)

### Frequency weighting

A, C, Flat

### Time weighting

NL-04: Fast, Slow, 10 ms

NL-14: Fast, Slow, Impulse, 10 ms, Peak (peak hold)

### Display

Backlit LCD

Numerical: 4 digits, update cycle 1 s, resolution 0.1 dB

Bar graph: Scale range 60 dB in 1-dB steps, update cycle 0.1 s

Warning indicators: Overload (upper graph scale limit + 9 dB)  
Under range (lower graph scale limit  $-1$  dB)

Battery condition: 4-segment battery voltage indicator

### Inherent noise

|        | <u>According to JIS</u>               | <u>According to IEC 651, 804</u>      |
|--------|---------------------------------------|---------------------------------------|
| NL-04: | Lower measurement range limit $-6$ dB | Lower measurement range limit $-5$ dB |
| NL-14: | Lower measurement range limit $-8$ dB | Lower measurement range limit $-5$ dB |



**Level range**

7 ranges in 10-dB steps

20 - 80 dB, 30 - 90 dB, 40 - 100 dB, 50 - 110 dB, 60 - 120 dB, 70 - 130 dB, 80 - 140 dB

10 - 70 dB setting available with filter unit activated

**Crest factor capability**

CF 3 at upper graph scale limit

CF 10 at upper graph scale limit -10 dB

**Pulse range**

63 dB

**Linearity range**

60 dB

**Primary indicator range**

60 dB

**Reference range**

40 - 100 dB

**Reference sound pressure level**

94 dB

**Reference frequency**

1000 Hz

**Reference direction**

Perpendicular to microphone diaphragm

**AC output**Output voltage: 1 V<sub>rms</sub> (at full-scale)

Output impedance: Approx. 600 Ω

Load impedance: 10 kΩ or more

**DC output**

Output voltage: 3.5 V (at full-scale), 0.5 V/10 dB

Output impedance: Approx. 50 Ω

Load impedance: 10 kΩ or more

I/O connector

Functions

- Data transfer to computer and control signal input from computer
- Data output to printer CP-10
- Measurement parameter output to level recorder LR-06
- Filter control input from level recorder LR-04/LR-06

RS-232-C interface rating

- Flow control: Yes
- Transmission configuration: Asynchronous, half-duplex
- Data word length: 8 bits
- Stop bits: 2
- Parity: None
- Baud rate: 4800 bps

Power requirements

- Four IEC R6 (size "AA") batteries
- Continuous operation approx. 12 h (alkaline batteries), 6 h (manganese batteries)
- When using filter unit NX-04 or NX-05, battery life is about 10% shorter. When using memory card unit DA-05, it is about 20% shorter.

AC adapter NC-34 series (option)

- NC-34 (for 100 V AC)
- NC-34A (for 120 V AC)
- NC-34B (for 220 V AC)
- Current rating approx. 100 mA (6 V DC)

Ambient conditions for operation

- 10 to +50°C, 10 to 90% RH

Dimensions, weight

- NL-04: Approx. 29 (H) x 8 (W) x 6 (D) cm, approx. 600 g
- NL-14: Approx. 31 (H) x 8 (W) x 6 (D) cm, approx. 600 g

Supplied accessories

- Windscreen WS-02 1
- BNC - mini plug cable CC-24 1
- Miniature screwdriver D-62 1
- IEC R6 batteries 4
- Lithium battery CR-1/3N 1
- Carrying case 1
- Instruction manual 1
- RS-232-C interface manual 1
- Technical notes 1

Optional equipment

AC adapter

NC-34 (for 100 V AC)

NC-34A (for 120 V AC)

NC-34B (for 220 V AC)

Filter unit

Octave filter NX-04

1/1, 1/3 octave filter NX-05

Memory card unit DA-05

Printer CP-10

Printer cable CC-90 (for connection of CP-10)

RS-232-C interface cable CC-87E (for computer connection)

Level recorder LR-04

Level recorder LR-06

Sync cable CC-91 (for synchronized frequency analysis with LR-04/LR-06)

NL data transmission cable CC-31 (for measurement parameter input to LR-06)

Microphone extension cable EC-04 series

