

INSTRUCTION MANUAL

SOUND LEVEL METER OCTAVE BAND ANALYZER

NA-29

NA-29E



RION CO., LTD.

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Symbols for sound levels used on Rion sound level meter

Symbols defined in ISO 1996, 3891 and IEC Pub.804 is also given in the table.

Symbol (Rion)	Frequency weighting	Quantity	Symbol	
			ISO	IEC
L_p	Flat	Sound pressure level	L_p	
	A	A-weighted sound pressure level	L_{pA}	
	C	C-weighted sound pressure level		
L_{eq}	A	Equivalent continuous A-weighted sound pressure level	$L_{Aeq, T}$	$L_{Aeq, T}$
	C	Equivalent continuous C-weighted sound pressure level		$L_{Ceq, T}$
L_{AE}	A	A-weighted sound exposure level	L_{AE}	$L_{AE, T}$
L_x	L_5	Percentile A-weighted sound pressure level	$L_{AN, T}$	$L_{A5, T}$
	L_{10}			$L_{A10, T}$
	L_{50}			$L_{A50, T}$
	L_{90}			$L_{A90, T}$
	L_{95}			$L_{A95, T}$
L_{max}	A	Maximum A-weighted sound pressure level	L_{max}	

PRECAUTIONS

- Always turn the unit off when not in use.
- When using the unit in locations exposed to direct sunlight or high temperatures, provide suitable heat protection.
- Avoid use of the unit in locations subject to excessive humidity or high levels of dust. Choose a dry location for storing the unit.
- When the unit is not to be used for an extended period of time, remove the batteries to prevent possible damage by battery leakage.
- Do not touch the microphone diaphragm.
- Protect the microphone from water and dust.
- The NA-29/NA-29E is a precision instrument. Protect it from shocks and vibrations.

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ABOUT THIS MANUAL

- The NA-29 uses the microphone UC-52 and conforms to IEC standard 651 type 2 (or JIS C 1502), while the NA-29E uses the microphone UC-53 and conforms to IEC standard 651 type 1 (or JIS C 1505). The functions and operation procedure of the NA-29 and the NA-29E are the same. All instructions in this manual are applicable to both the NA-29 and the NA-29E.
- The first section “Main Features” describes the kinds of measurements and calculations which can be carried out with the NA-29/NA-29E.
- The section “Preparations” explains the steps required prior to carrying out measurements with the NA-29/NA-29E as a stand-alone device.
- The section “Measurement” explains in detail the steps for sound level measurement, frequency analysis, determination of averaged SPL difference between two rooms, floor impact sound level measurements.
- The section “Special Functions” describes the various functions of this unit and gives usage examples.
- The section “Controls and Functions” serves for reference on the use of the operation keys and switches of this unit.
- The section “Specifications” contains block diagrams and technical specifications of the various unit sections.



The NA-29E described in this manual is in conformity with the following European standards;

EN 50081-1 (1992) Electromagnetic compatibility-Generic immunity standard

EN 50082-1 (1992) Electromagnetic compatibility-Generic emission standard

MAIN FEATURES

The NA-29 is an integral sound level meter with built-in octave band analyzer, permitting 1/1 octave analysis in real time. The unit also incorporates circuits for storage and data processing.

Thanks to these features, the following types of measurement are possible.

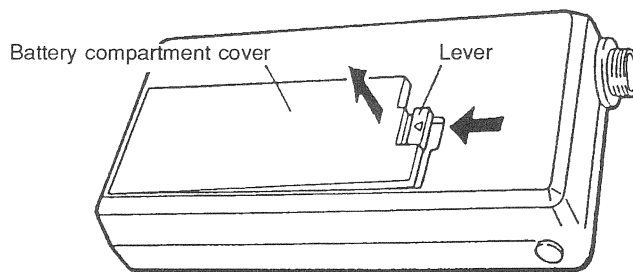
Feature	Refer to page
<ul style="list-style-type: none"> • As a wide-range sound level meter, the NA-29 permits simultaneous measurement of sound level (Lp), maximum sound level (Lmax), equivalent continuous sound level (Leq), and sound exposure level (LAE). 	15
<ul style="list-style-type: none"> • Real-time 1/1 octave band frequency analysis with center frequencies from 31.5 to 8000 Hz. 	18
<ul style="list-style-type: none"> • Measurement of averaged SPL difference between two rooms, floor impact sound level. 	47, 65, 85
<ul style="list-style-type: none"> • Display of level changes over time for each frequency band permits estimate of reverberation time and other factors. 	114
<ul style="list-style-type: none"> • Superimposed display of stored frequency analysis data and current data. 	111
<ul style="list-style-type: none"> • Calculation of power average and percentil level (Lx) from stored data. 	118
<ul style="list-style-type: none"> • Printout of display screen contents using optional printer CP-10. 	129
<ul style="list-style-type: none"> • Built-in RS-232-C interface permits transfer of measurement data to a computer and setting of measurement parameters from the computer. 	133

PREPARATIONS

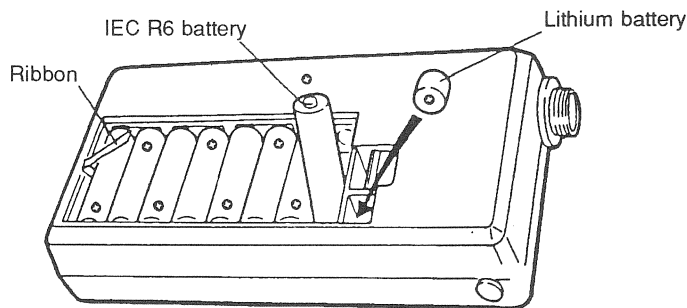
The NA-29 is powered by eight internal IEC R6 batteries (size AA) or by the external AC adapter NC-11 (option). The unit also uses a lithium battery (CR-1/3N) for memory backup, to preserve stored data.

Inserting the Batteries

- ① Push the lever of the battery compartment cover in the direction of the arrow and lift the cover off.



- ② Insert eight IEC R6 batteries into the battery compartment, taking care to observe correct polarity. The batteries should be placed over the ribbon. Then insert the lithium battery with correct polarity.

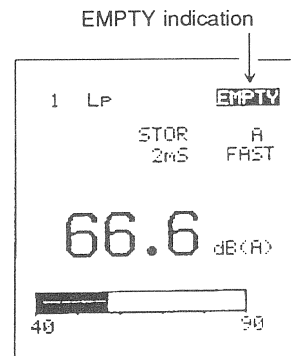


- ③ Note the date of the lithium battery replacement on the rear of the battery compartment cover and replace the battery compartment cover in its original position.

⊖	⊕
CR-1/3N (SANYO)	
DATE OF BATT. REPLACEMENT	
1	'89-2-6
2	
3	
4	
5	
6	
7	
8	
REPLACE BATT. EVERY YEAR	

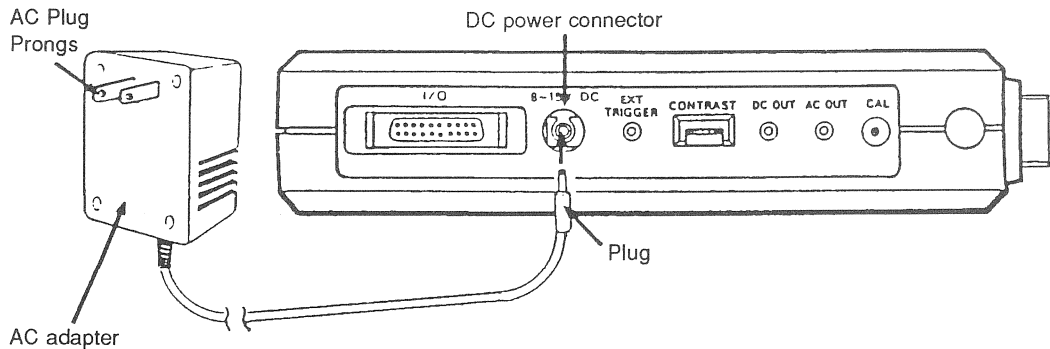
When the unit is operated on batteries and the indication "LOW" or "EMPTY" appears on the display, the batteries are exhausted. Replace the batteries as described in steps 1 and 2, or use the optional AC adapter NC-11.

The indication "LOW" appears when the battery voltage falls to 9 V and "EMPTY" appears when it falls to 8 V. The life of the lithium battery for memory backup is about two years.



Connection of AC Adapter

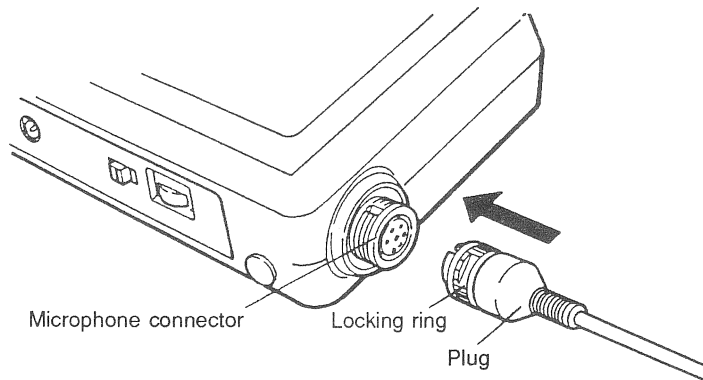
When using the unit with the AC adapter, connect the plug of the cable from the adapter to the DC power connector of the NA-29 and plug the adapter into an AC outlet.



Microphone Connection and Tripod Mounting

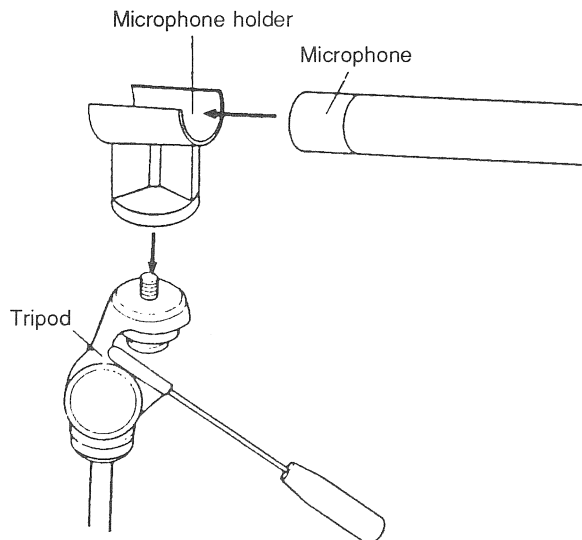
◆ Connection

Insert the plug of the electret condenser microphone into the microphone connector and turn the ring clockwise to lock the plug.



◆ Tripod Mounting

Attach the microphone holder UA-90 to the tripod and slide the microphone onto the holder until it is firmly gripped.



MEASUREMENT

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Organization of this Manual

The following conventions are followed throughout this manual.

• Operation Procedure

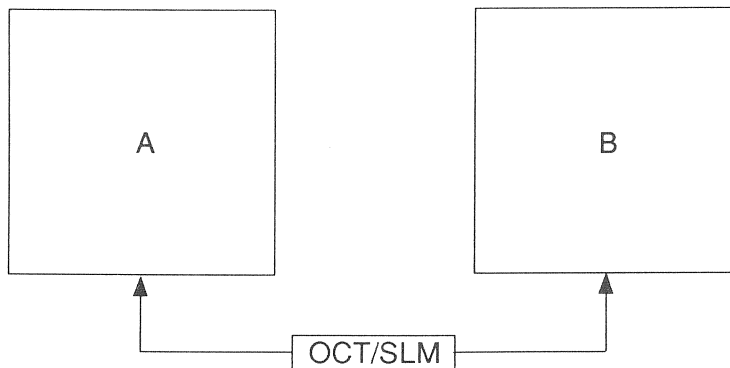
Step	Operation key	Description
1	PWR	Power is turned on and appears on display.
2	CAL OCT/SLM	Set to sound level measurement screen in calibration mode.

Step: Sequence of operation

Operation key: Key to press and release. Keys shown with dotted lines are to be pressed to establish a certain condition. In the above example, **OCT/SLM** key should be pressed when the frequency analysis screen is displayed in the calibration mode.

Description: Description of the results of pressing the operation key.

• Switching between display screens

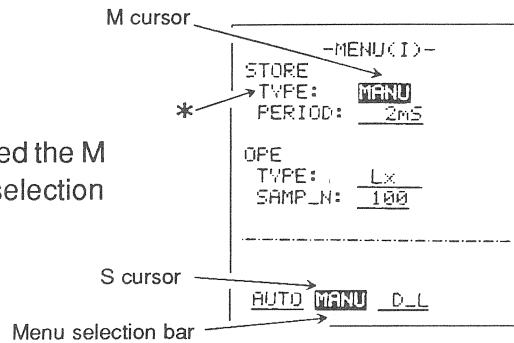


By pressing and releasing the **OCT/SLM** key, the display is switched between screens A and B.

- Setup screen conventions

*: Item to be set

The cursor on the item to be set is called the M cursor, and the cursor on the menu selection bar the S cursor.

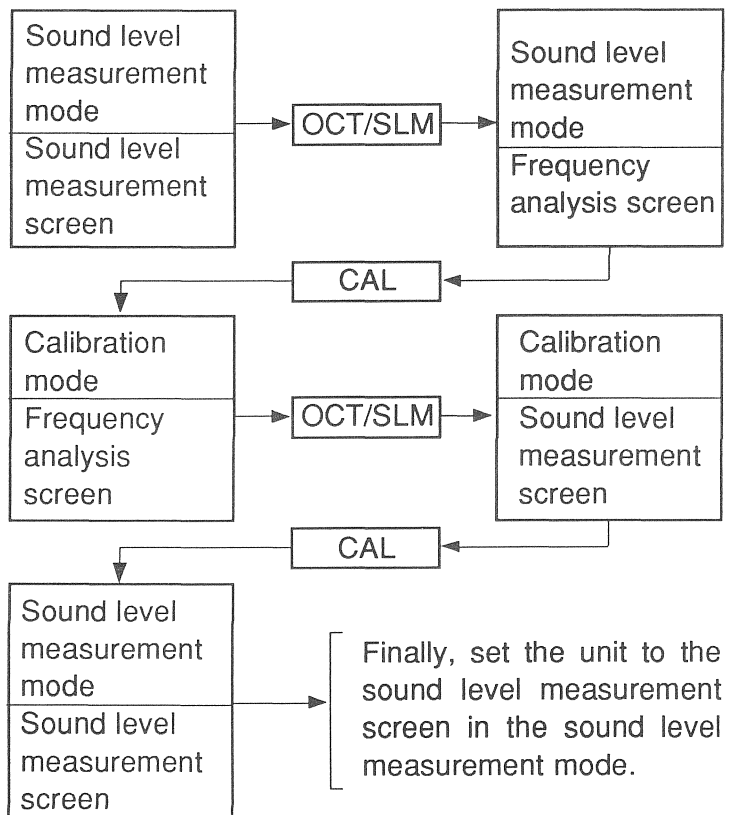


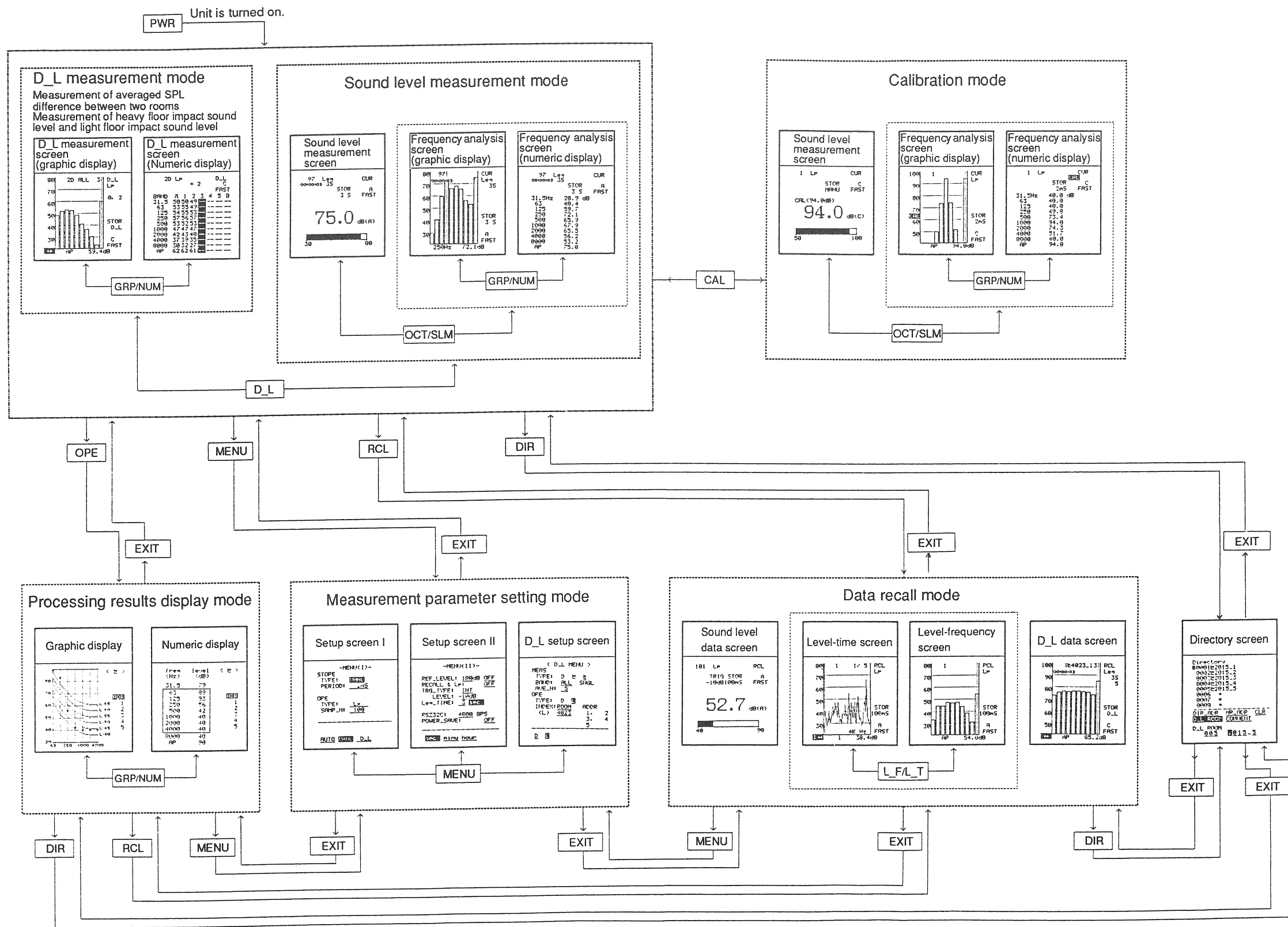
Setup screen example

Power-up and Contrast Adjustment

Step	Operation key	Description
1	PWR	The power is turned on and the same screen that was shown before the unit was turned off is shown. This can be one of the screens for the sound level measurement mode, D_L measurement mode, or calibration mode (see next page).
2		Adjust the CONTRAST control for best readability of the display. Use the OCT/SLM key, CAL key, etc. to switch between various screens, referring to the table on the next page.

Example

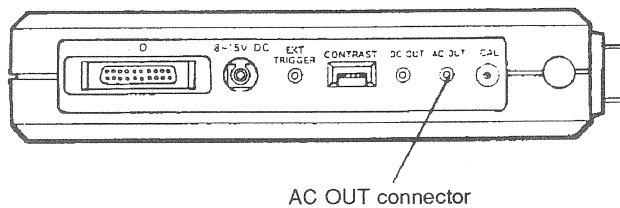




Calibration

Two kinds of calibration are possible with this unit: electrical and acoustic calibration.

For electrical calibration, the built-in oscillator produces a sine wave of 1000 Hz, 1.5 Vrms, corresponding to a sound level of 94 dB. This signal serves to adjust the gain of the amplifier of the unit, and it can also be used as a reference signal when a data recorder or other device is connected (1.5 Vrms from AC output connector).

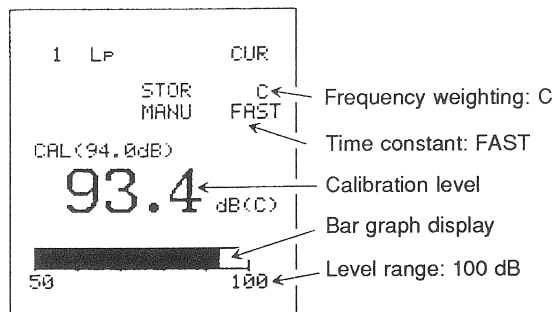


For acoustic calibration, a reference sound source such as a pistonphone is used to calibrate the entire unit including the microphone.

Calibration is not specified in the operation steps for measurement. Be sure to carry out either electrical or acoustical calibration before starting a measurement.

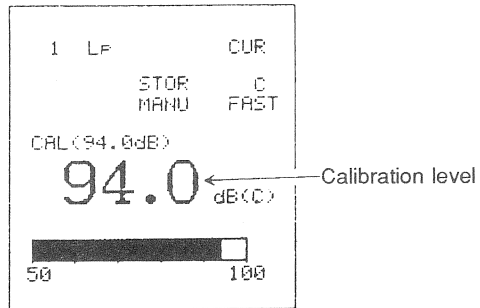
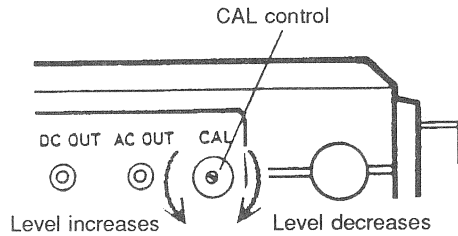
◆ Electrical Calibration

Step	Operation key	Description
1	CAL OCT/SLM	Display the sound level measurement screen of the calibration mode. The unit enters the calibration condition and the following parameters are automatically set.



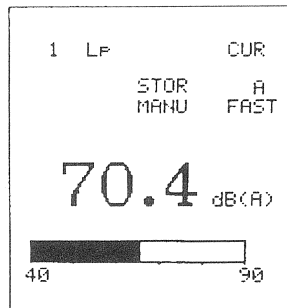
Sound level measurement screen in calibration mode

Step	Operation key	Description
2		Adjust the CAL control on the side panel to obtain a reading of 94.0 dB.



Screen after calibration

3	CAL	Terminate calibration and return to sound level measurement screen in sound level measurement mode
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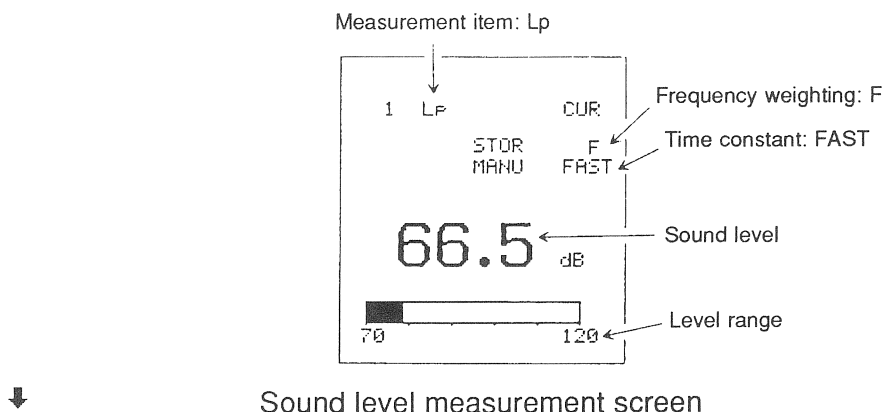


Sound level measurement screen

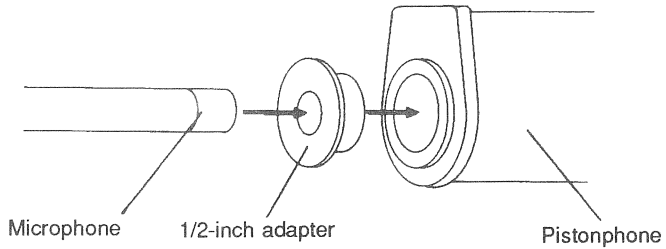
◆ Acoustic Calibration

The following example describes calibration using the Rion pistonphone NC-72 (option).

Step	Operation key	Description
1		Display the sound level measurement screen of the sound level measurement mode.
2	Lp	Set the measurement item to "Lp" (sound level).
3	UP DOWN LEVEL RANGE	Set the level range (measurement range, value at right most end of bar graph) to 120 dB.
4	A/C/F	Set frequency weighting to "F" (flat). With each push of the A/C/F key, the setting cycles through A → C → F → A etc.
5	TIME CONST	Set time constant (time weighting) to "FAST". With each push of the TIME CONST key, the setting cycles through FAST → SLOW → 10 ms → FAST etc.

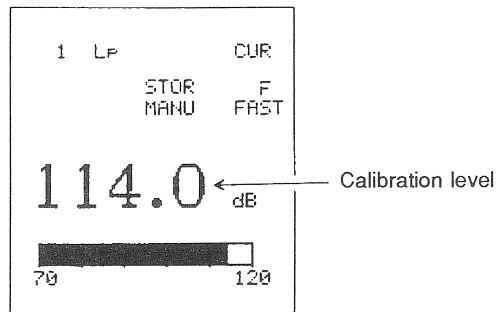
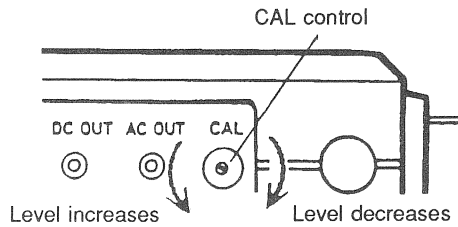


Step	Operation key	Description
6		Attach the 1/2-inch adapter (supplied with the NC-72) to the coupler of the pistonphone. Carefully insert the microphone all the way into the adapter opening.



7		Turn the pistonphone on and activate the calibration tone.
---	--	--

8		Adjust the CAL control on the side panel to obtain a reading of 114.0 dB.
---	--	---



Screen after calibration

9		Turn the pistonphone off and carefully remove the microphone from the pistonphone adapter.
---	--	--

Sound Level (Lp) Measurement

The SPL (sound pressure level) is a physical quantity which can be measured. The sound pressure (P_0) threshold which can be detected by humans with normal hearing ability is 2×10^{-5} Pa (Pascal). This sound pressure is taken as 0 dB (reference sound pressure). The relation between sound pressure and sound pressure level can therefore be expressed as follows.

$$\text{Sound pressure level (SPL)} = 20 \log_{10} \frac{P}{P_0} \text{ dB}$$

Where

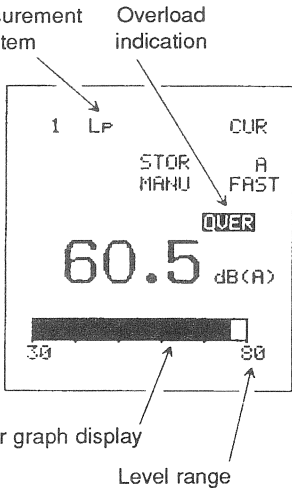
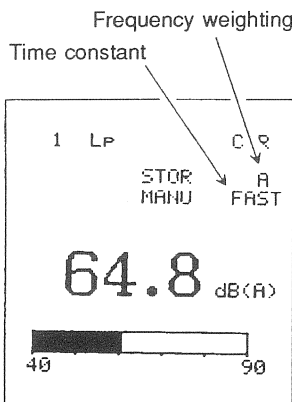
P_0 : Reference sound pressure (2×10^{-5} Pa)

P: Effective sound pressure


A device which measures sound pressure level and applies frequency weighting with the A characteristics is a sound level meter.

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◆ Measurement

Step	Operation key	Description
1		Select the sound level measurement screen in the sound level measurement mode.
2	Lp	Select Lp (sound level) measurement.
3	UP DOWN LEVEL RANGE	Select the level range. The level range can be set between 70 and 140 dB in 10-dB steps. If the indication "UNDER" or "OVER" appears on the display during the measurement, adjust the level range until the indication disappears.
		 <p>Measurement item: 1 LP Overload indication: OVER CUR A FAST STOR MANU 60.5 dB(A) Bar graph display: 30 to 80 Level range: 30 to 80</p>
4	A/C/F	Set frequency weighting to "A". With each push of the A/C/F key, the setting cycles through A → C → F → A etc.
5	TIME CONST	Set time constant to "FAST". With each push of the TIME CONST key, the setting cycles through FAST → SLOW → 10 ms → FAST etc.
		 <p>Frequency weighting: A Time constant: FAST 1 LP CUR C R STOR MANU 64.8 dB(A) 40 to 90</p>



Step	Operation key	Description
6		Read the sound level.
		The numeric reading and the bar graph indication on the display may differ momentarily. This is due to the fact that the numeric reading is updated every second, and the bar graph every 0.1 second.

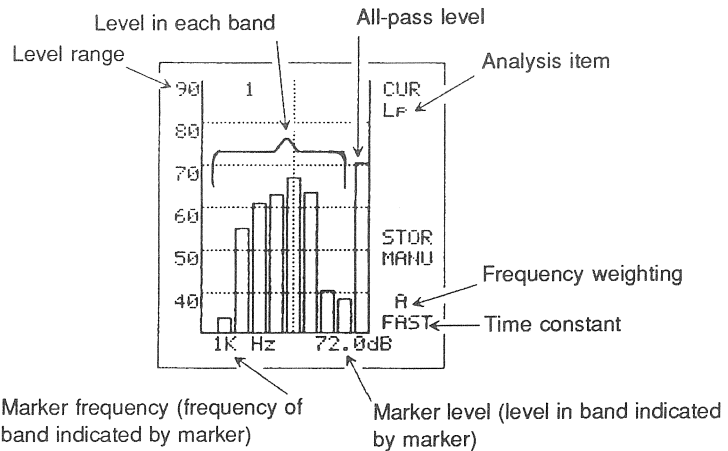
◆ **Frequency analysis**

The frequency analysis mode of this unit permits real-time 1/1 octave band frequency analysis with center frequencies from 31.5 to 8000 Hz or with the AP (all-pass) setting.

Step	Operation key	Description
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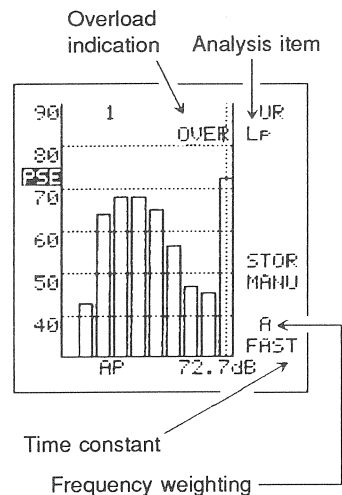
1	OCT/SLM GRP/NUM	Select the graphic frequency analysis screen in the sound level measurement mode.
---	----------------------------------	---

The frequency analysis screen shows the following items.



2	Lp	Set the analysis item to "Lp" (sound level).
---	-----------	--

3	UP DOEN LEVEL RANGE	Select the level range. The level range can be set between 70 and 140 dB in 10-dB steps. If the indication "OVER" appears on the display during the measurement, adjust the level range until the indication disappears.
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4	A/C/F	Set frequency weighting to "A". When measuring sound pressure level, choose the "F" setting.
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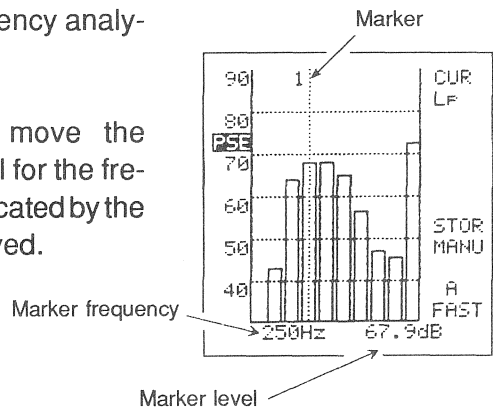


Step	Operation key	Description
5	TIME CONST	Select a suitable time constant for the analysis purpose.

- Read the levels in each band as follows.

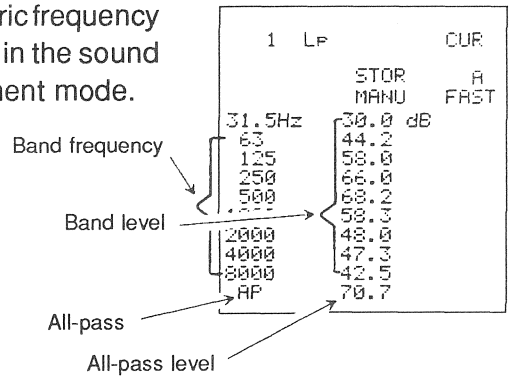
6 **PSE/CONT** Freeze the frequency analysis display.

7 **← →**
MARKER Press keys to move the marker. The level for the frequency band indicated by the marker is displayed.



- To display the levels in all bands, take the following steps.

8 **GRP/NUM** Select the numeric frequency analysis screen in the sound level measurement mode.



9 **PSE/CONT** Freeze the numeric frequency analysis display. The levels in all bands are displayed.

◆ **Storing Measurement Data**

Measurement data can be stored either manually or automatically. The trigger function can also be used to store data. Maximum storage capacity of the unit is 1500 screens.

● **Manual Store**

With this function, a screen of measurement data can be stored in any desired address by pressing the **[STOR]** key.

Step	Operation key	Description
------	---------------	-------------

1	[MENU] [MENU]	Select setup screen I in the measurement parameter setting mode.
---	--------------------------------	--

(Select store type)

2	[↑] [↓]	Move the M cursor to "STORE TYPE".
---	-----------------------	------------------------------------

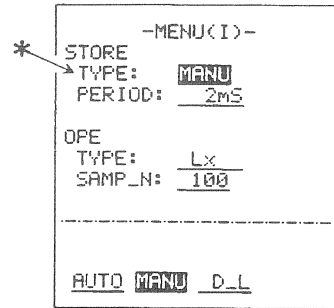
3	[←] [→]	Move the S cursor to "MANU".
---	-----------------------	------------------------------

4	[ENTER]	Store type is set to "Manual".
---	----------------	--------------------------------

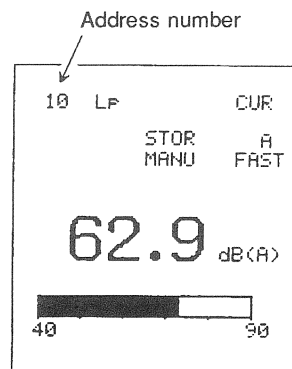
5	[EXIT] [OCT/SLM]	Select the sound level measurement screen in the sound level measurement mode.
---	-----------------------------------	--

6	[UP] [DOWN] ADDRESS	Select the address in which to store the measurement data.
---	--------------------------------------	--

7	[STOR]	Store the measurement data. The address number is automatically increased by 1. Data are stored with each push of the [STOR] key.
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Setup screen I

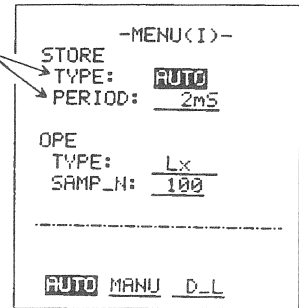


Select the sound level measurement screen

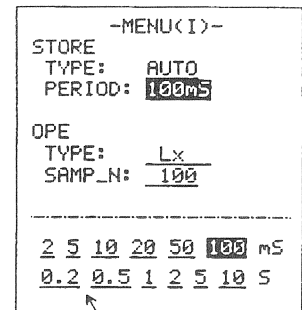
• Auto Store

With this function, measurement data are stored automatically at preset intervals.

Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
(Select store type)		
2	↑ ↓	Move the M cursor to "STORE TYPE".
3	← →	Move the S cursor to "AUTO".
4	ENTER	Store type is set to "Auto".
(Select store period)		
5	↑ ↓	Move the M cursor to "PERIOD".
6	← →	Select a suitable store period (store interval) by moving the S cursor on the menu bar.
7	ENTER	Selected store period is set.
8	EXIT OCT/SLM	Select the sound level measurement screen in the sound level measurement mode.
9	STOR	Address number is reset to 1, all previously stored data are cleared, and store starts automatically. When the address number 1500 is reached, store is terminated automatically.



Setup screen I



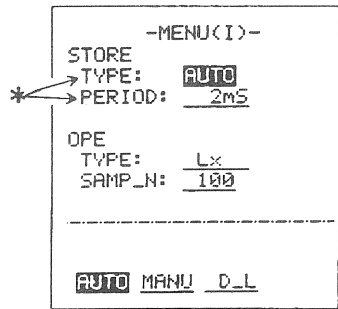
Store period

- To stop the store operation, press the **STRT/STP** key.
- To temporarily interrupt auto store, press the **PSE/CONT** key. To resume auto store, press the **PSE/CONT** key again.

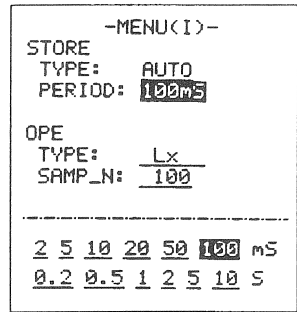
• **Auto Store With Trigger**

The NA-29 can use either an internal trigger (INT) or external trigger (EXT). The internal trigger works as follows: when the sound level exceeds a certain preset trigger level, the auto store operation starts. The external trigger works as follows: when the external trigger terminals are shorted, the auto store operation starts.

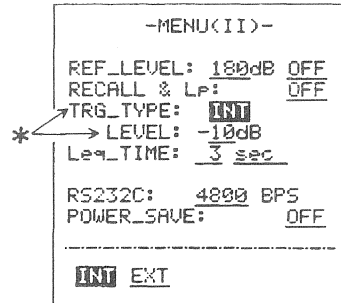
Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
(Select store type)		
2	↑ ↓	Move the M cursor to "STORE TYPE".
3	← →	Move the S cursor to "AUTO".
4	ENTER	Store type is set to "Auto".
(Select store period)		
5	↑ ↓	Move the M cursor to "PERIOD".
6	← →	Select a suitable store period by moving the S cursor on the menu bar.
7	ENTER	Selected store period is set.
	↓	



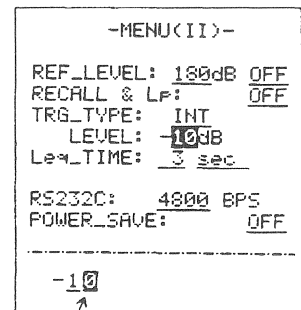
Setup screen I



Step	Operation key	Description
8	MENU MENU	Select setup screen II in the measurement parameter setting mode.
(Select trigger type)		
9	↑ ↓	Move the M cursor to "TRG TYPE".
10	← →	Move the S cursor to "INT" or "EXT".
11	ENTER	Trigger type is set.
(Select trigger level)		
12	↑ ↓	If "INT" was selected in step 10, move the M cursor to "LEVEL". If "EXT" was selected in step 10, steps 12, 13, and 14 are not required.
13	Numeric keys	Enter trigger level in 1-dB steps. This level indicates at how many dB below full-scale level the trigger is activated.
14	ENTER	Trigger level is set.
15	EXIT OCT/SLM	Set to sound level measurement screen of sound level measurement mode.



Setup screen II

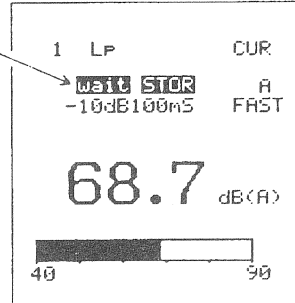


Trigger level input field



Step	Operation key	Description
16	TRIG	Set trigger function to ON.
17	STOR	Address number is reset to 1, and the unit enters the trigger wait condition. When the trigger level is reached, auto store starts with the preset store period. When the address number 1500 is reached, store is terminated automatically

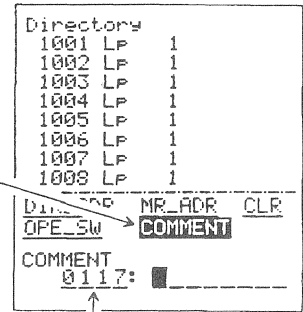
Wait for trigger



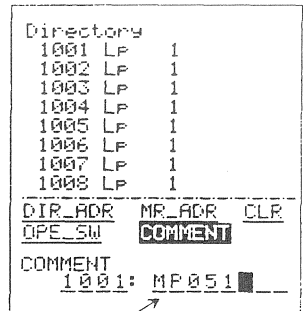
- To stop the store operation, press the **STRT/STP** key.
- To temporarily interrupt auto store, press the **PSE/CONT** key. To resume auto store, press the **PSE/CONT** key again.

• **Comment Input**

Step	Operation key	Description
1	DIR	Select directory screen.
2	↑ ↓	Move the M cursor to "COMMENT" on the menu.
3	← →	Move the S cursor to the address number input field.
4	Numeric keys	Enter the address number to which you want to add a comment.
5	← →	Move the S cursor to the comment input field.
6	Numeric keys ← → MARKER	Enter the comment. A comment can consist of any combination of alphanumeric characters. Each press of the → marker key changes the characters in the order A → B → C ... Y → Z → A ..., and each press of the ← marker key changes the characters in the reverse order.

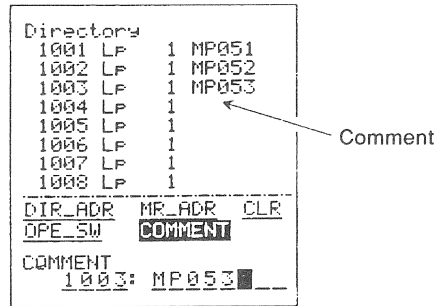


Address number input field



Comment input field

Step	Operation key	Description
7	ENTER	The comment is added to the selected address.

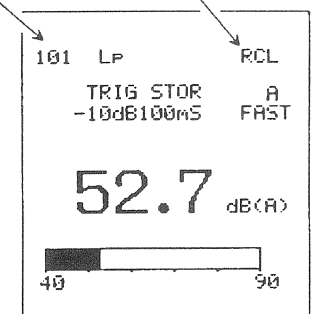


Comment setting example

◆ Recalling Stored Data

When data are stored in the memory, the data can be recalled as described below. If the stored data are graphic frequency analysis screens, superimposed display (overlay) of stored data and current data is possible. Level changes in a selected band over time (level-time) can also be displayed. For a detailed explanation of these functions, please refer to "Special Functions" on page 105.


Step	Operation key	Description
1	RCL	Select the recall mode. The data stored in an address are called up and shown on the screen. The number of the address is also shown.
2	UP DOWN ADDRESS	Select the address number for the data you want to recall.
3	EXIT OCT/SLM	To terminate the recall mode, return to the sound level measurement screen.



Recall screen example

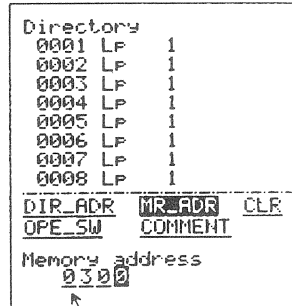
UP : Address numbers change upward by one count with each push

DOWN : Address numbers change downward by one count with each push.

 If the desired address number is far removed from the currently displayed number, selecting the number by the method described in step 2 takes some time. In such a case, it is faster to use the directory screen to enter the desired address number directly, as described below.

• Recalling data using the directory screen

Step	Operation key	Description
2-1	DIR	Select the directory screen.
2-2	↑ ↓	Move the M cursor to "MR_ADR" on the menu.
2-3	Numeric keys	Enter the desired address number in the address number entry field.
2-4	ENTER	The address number is entered.
2-5	EXIT	The data stored in the selected address are displayed.



Address number entry field

Maximum Sound Level (Lmax), Equivalent Continuous Sound Level (Leq), Sound Exposure Level (LAE) Measurement

The Lmax, Leq, LAE are defined as follows.

Lmax: Maximum sound level occurring within the measurement period

Leq: Constant level equivalent in energy to the fluctuating sound level within the measurement period

LAE: Constant (1-second) level equivalent to the energy of a single-event sound level

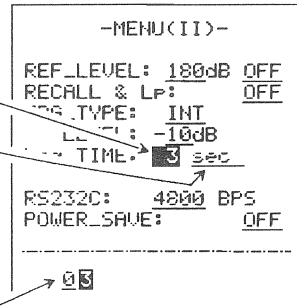
Measurement	30
Storing Measurement Data	33
Manual Store	33
Auto Store	36
Auto Store With Trigger	38
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◆ **Measurement**

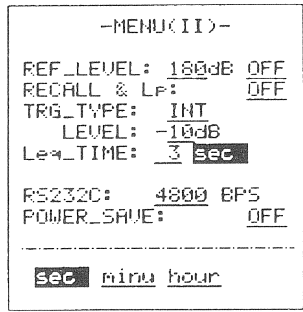
For this measurement, the sampling period is automatically set to 10 ms, and Lmax, Leq, and LAE are measured simultaneously for the duration of the selected measurement time.

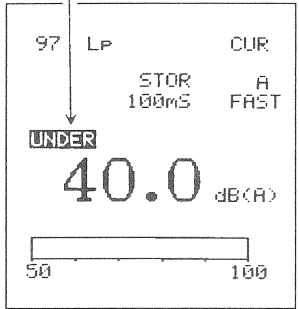
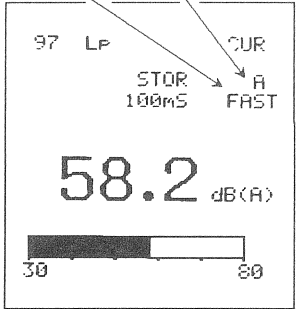
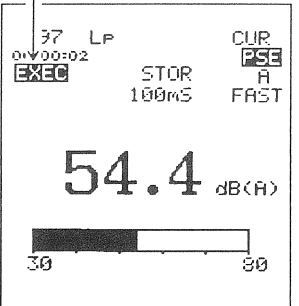
By pressing the **[OCT/SLM]** key, the frequency analysis screen of the sound level measurement mode can be called up.

Step	Operation key	Description
1	[MENU] [MENU]	Select setup screen II in the measurement parameter setting mode.
(Set measurement time)		
2	[↑] [↓]	Move the M cursor to the numerical value field of "Leq_TIME".
3	[Numeric keys]	Enter the measurement time in the numeric input field. The possible input range is as follows. Sec(onds): 1 to 59 Minu(tes): 1 to 59 Hour: 1 to 24
4	[ENTER]	Selected value is entered.
5	[↑] [↓]	Move the M cursor to the unit field of "Leq_TIME".
6	[←] [→]	Move the S cursor to the desired unit.
7	[ENTER]	The selected time unit is entered.
↓		



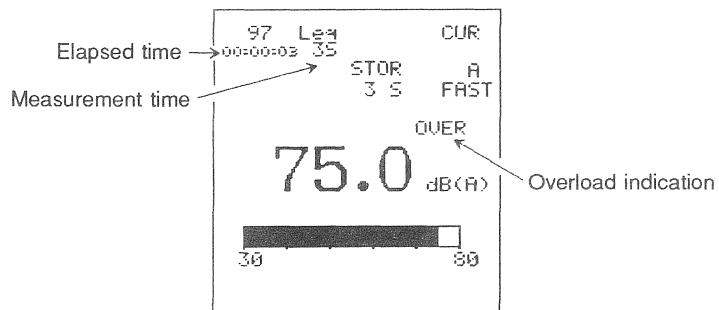
Setup screen II



Step	Operation key	Description	
8	CAL OCT/SLM	Select the sound level measurement screen in the sound level measurement mode.	<p>"UNDER" indication</p>  <p>The screen displays '97 LP' at the top left, 'CUR' at the top right, 'STOR 100ms' in the middle, and 'A FAST' at the bottom right. The central display shows '40.0 dB(A)'. Below the display is a horizontal bar with '50' on the left and '100' on the right. An arrow points from the text 'UNDER' to the 'UNDER' label on the screen.</p> <p>Sound level measurement screen</p>
9	UP DOWN LEVEL RANGE	Select the level range. The level range can be set between 70 and 140 dB in 10-dB steps. If the indication "UNDER" or "OVER" appears on the display during the measurement, adjust the level range until the indication disappears.	
10	A/F/C	Set frequency weighting to "A".	
11	TIME CONST	Set time constant to "FAST".	<p>Frequency weighting Time constant</p>  <p>The screen displays '97 LP' at the top left, 'CUR' at the top right, 'STOR 100ms' in the middle, and 'A FAST' at the bottom right. The central display shows '58.2 dB(A)'. Below the display is a horizontal bar with '30' on the left and '80' on the right. Arrows point from the text 'Frequency weighting' and 'Time constant' to the 'A' and 'FAST' labels on the screen, respectively.</p>
12	STRT/STP	Start the measurement. While the measurement is being carried out, the indication "EXEC" appears on the display. When the end of the preset measurement time is reached, the measurement is terminated and the indication disappears.	<p>During measurement</p>  <p>The screen displays '97 LP' at the top left, 'CUR' at the top right, 'STOR 100ms' in the middle, and 'A FAST' at the bottom right. The central display shows '54.4 dB(A)'. Below the display is a horizontal bar with '30' on the left and '80' on the right. The text 'EXEC' is visible on the left side of the screen, and 'PSE' is visible on the right side.</p>

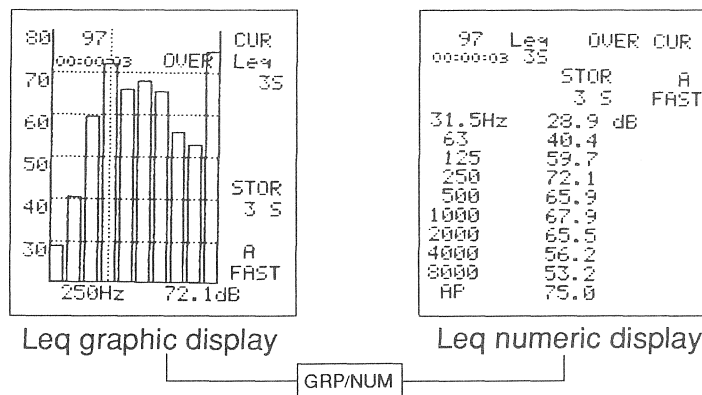


Step	Operation key	Description
13	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 5px;">Lmax</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 5px;">Leg</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">LAE</div>	The results of the Lmax, Leq, and LAE measurement can be called up by pressing the respective key. If the indication "OVER" appears along with the measurement result, levels exceeding the level range were encountered during measurement



Display example
(Leq measurement result)

14	<div style="border: 1px solid black; padding: 2px; display: inline-block;">OCT/SLM</div>	Display the measurement result as frequency analysis screen.
----	--	--



- To stop a currently running measurement, press the

STRT/STP

 key. The Lmax, Leq, and LAE for the time since the start of the measurement are displayed.
- To temporarily interrupt the measurement, press the

PSE/CONT

 key. To resume the measurement, press the

PSE/CONT

 key again. The time while the measurement was paused is not included in the measurement time.
- When the

STRT/STP

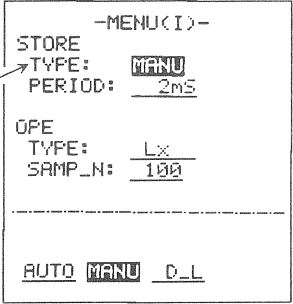
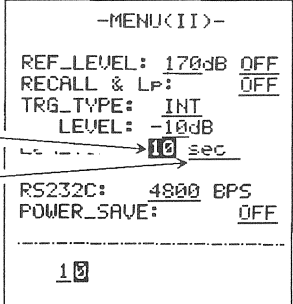
 key is pressed again after the measurement has been completed, another measurement starts.

◆ **Storing Measurement Data**

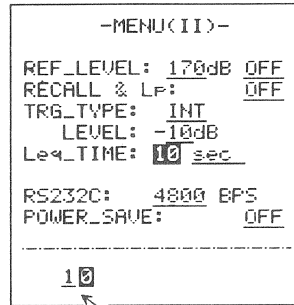
Measurement data can be stored either manually or automatically. The trigger function can also be used to store data. Maximum storage capacity of the memory is 1500 screens.

• **Manual Store**

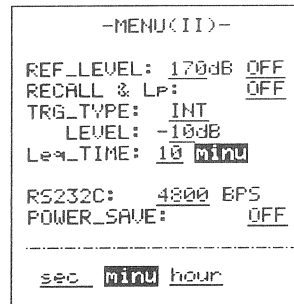
With this function, a screen of measurement data can be stored in any desired address by pressing the **[STOR]** key.

Step	Operation key	Description	
1	[MENU] [MENU]	Select setup screen I in the measurement parameter setting mode.	 <p>Setup screen I</p>
(Select store type)			
2	[↑] [↓]	Move the M cursor to "STORE TYPE".	
3	[←] [→]	Move the S cursor to "MANU".	
4	[ENTER]	Store type is set to "Manual".	
5	[MENU] [MENU]	Select setup screen II in the measurement parameter setting mode.	 <p>Setup screen II</p>
(Set measurement time)			
6	[↑] [↓]	Move the M cursor to the numerical value field of "Leq_TIME".	
	[↓]		

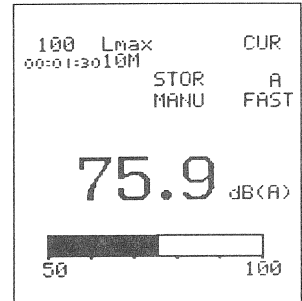
Step	Operation key	Description
7	Numeric keys	Enter the measurement time in the numeric input field. The possible input range is as follows. Sec(onds): 1 to 59 Minu(tes): 1 to 59 Hour: 1 to 24
8	ENTER	Selected value is entered.
9	↑ ↓	Move the M cursor to the unit field of "Leq_TIME".
10	← →	Move the S cursor to the desired unit.
11	ENTER	The selected time unit is entered.
12	EXIT	Return to the sound level measurement screen in the sound level measurement mode. To store the frequency analysis screen, press the OCT/SLM key.
13	UP DOWN ADDRESS	Set the address number from which to start data store.
14	Lmax Leg LAE	Select the measurement item to be stored: Maximum sound level (Lmax) Equivalent continuous sound level (Leq) Sound exposure level (LAE)
↓		



Numeric input field

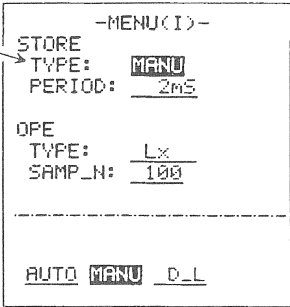
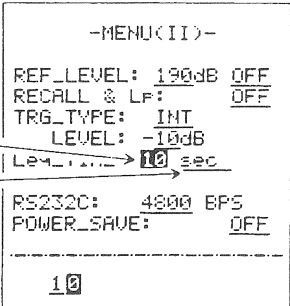


Step	Operation key	Description
15	STRT/STP	Start the measurement. When the end of the preset measurement time is reached, the measurement is terminated.
16	STOR	Store the measurement data. The address number is automatically increased by one count. Repeat steps 15 and 16 to store more measurement data.
17	Lp	When store is completed, return to the sound level measurement screen.



• **Auto Store**

With this function, measurement data are stored automatically at preset intervals.

Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p>(Select store type)</p> </div> <div style="flex: 2;">  <p style="text-align: center;">Setup screen I</p> </div> </div>		
2	↑ ↓	Move the M cursor to "STORE TYPE".
3	← →	Move the S cursor to "AUTO".
4	ENTER	Store type is set to "Auto".
5	MENU MENU	Select setup screen II in the measurement parameter setting mode.
<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p>(Set measurement time)</p> </div> <div style="flex: 2;">  <p style="text-align: center;">Setup screen II</p> </div> </div>		
6	↑ ↓	Move the M cursor to the numerical value field of "Leq_TIME".
7	Numeric keys	Enter the measurement time in the numeric input field. The possible input range is as follows.
		<p style="margin-left: 40px;">Sec(onds): 1 to 59</p> <p style="margin-left: 40px;">Minu(tes): 1 to 59</p> <p style="margin-left: 40px;">Hour: 1 to 24</p>



Step	Operation key	Description
8	ENTER	Selected value is entered.
9	↑ ↓	Move the M cursor to the unit field of "Leq_TIME".
10	← →	Move the S cursor to the desired unit.
11	ENTER	The selected time unit is entered.
12	EXIT	Return to the sound level measurement screen in the sound level measurement mode. To store the frequency analysis screen, press the OCT/SLM key.
13	Lmax Leq LAE	Select the measurement item to be stored: Maximum sound level (Lmax) Equivalent continuous sound level (Leq) Sound exposure level (LAE)
14	STOR	The address number is reset to 1, all previously stored data are cleared, and store starts automatically. When the address number 1500 is reached, store is terminated automatically.

```

-MENU(II)-
REF_LEVEL: 190dB OFF
RECALL & LP: OFF
TRG_TYPE: INT
LEVEL: -10dB
Leq_TIME: 10 sec
RS232C: 4800 BPS
POWER_SAVE: OFF
-----
sec minu hour

```

```

5 Leq CUR
00:00:03105
EXEC STOR A
10 S FAST
63.7 dB(A)
50 100

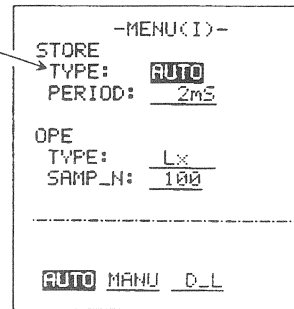
```

- To stop the store operation, press the **STRT/STP** key.
- To temporarily interrupt auto store, press the **PSE/CONT** key. To resume auto store, press the **PSE/CONT** key again.

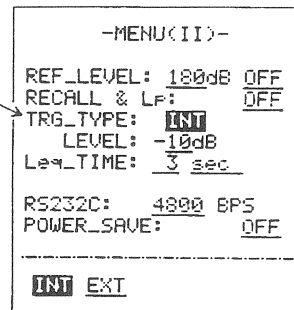
• **Auto Store With Trigger**

The NA-29 can use either an internal trigger (INT) or external trigger (EXT). The internal trigger works as follows: when the sound level exceeds a certain preset trigger level, the auto store operation starts. The external trigger works as follows: when the external trigger terminals are shorted, the auto store operation starts.



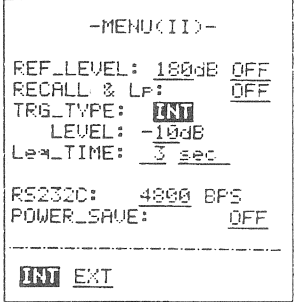
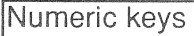
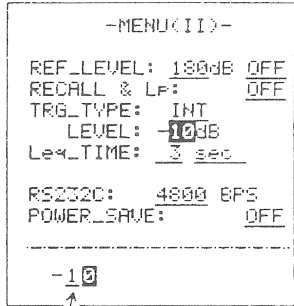




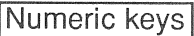
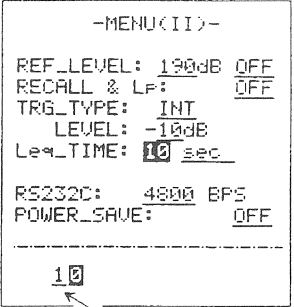


Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
(Select store type)		
2	↑ ↓	Move the M cursor to "STORE TYPE".
3	← →	Move the S cursor to "AUTO".
4	ENTER	Store type is set to "Auto".
5	MENU	Select setup screen II in the measurement parameter setting mode.
(Select trigger type)		
6	↑ ↓	Move the M cursor to "TRG TYPE".
7	← →	Move the S cursor to "INT" or "EXT".
8	ENTER	Trigger type is set.
↓		





Setup screen I

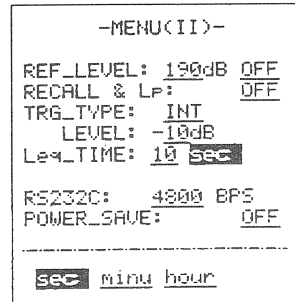



Setup screen II


Step	Operation key	Description
(Select trigger level)		
9	 	If "INT" was selected in step 7, move the M cursor to "LEVEL". If "EXT" was selected in step 7, steps 9, 10, and 11 are not required.
		
10		Enter trigger level in 1-dB steps. This level indicates at how many dB below full-scale level the trigger is activated.
		
11		Trigger level is set.
		
(Set measurement time)		
12	 	Move the M cursor to the numerical value field of "Leq_TIME".
13		Enter the measurement time in the numeric input field. The possible input range is as follows. Sec(onds): 1 to 59 Minu(tes): 1 to 59 Hour: 1 to 24
		
14		Selected value is entered.
		



Step	Operation key	Description
------	---------------	-------------



15	 	Move the M cursor to the unit field of "Leq_TIME".
----	---	--

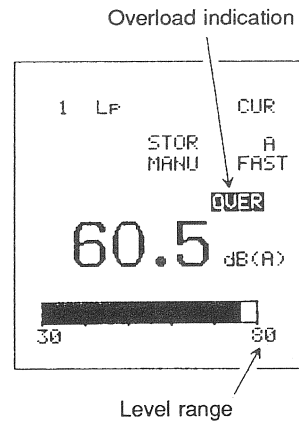



16	 	Move the S cursor to the desired unit.
----	---	--

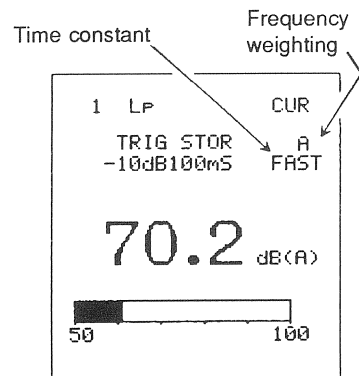
17		The selected time unit is entered.
----	---	------------------------------------

18		Return to the sound level measurement screen in the sound level measurement mode. To store the frequency analysis screen, press the  key.
----	---	--

19	  LEVEL RANGE	Select the level range. The level range can be set between 70 and 140 dB in 10-dB steps. If the indication "UNDER" or "OVER" appears on the display during the measurement, adjust the level range until the indication disappears.
----	--	---



20		Set frequency weighting to "A".
----	---	---------------------------------

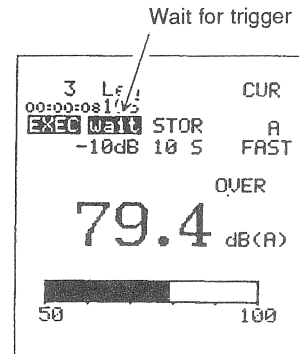


21		Set time constant to "FAST".
----	---	------------------------------

22		Set trigger function to ON.
----	---	-----------------------------

↓

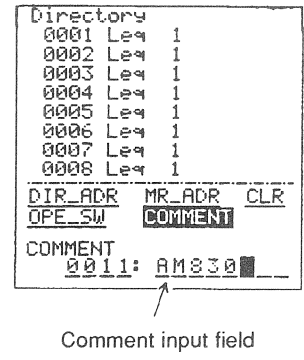
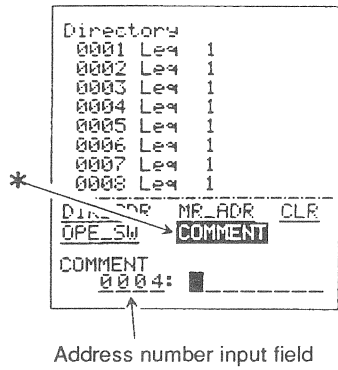
Step	Operation key	Description
23	Lmax	Select the measurement item to be stored: Maximum sound level (Lmax)
	Leq	Equivalent continuous sound level (Leq)
	LAE	Sound exposure level (LAE)
24	STOR	Address number is reset to 1, and the unit enters the trigger wait condition. When the trigger level is reached, auto store starts with the preset measurement time. When the address number 1500 is reached, store is terminated automatically.



- To stop the store operation, press the **STRT/STP** key.
- To temporarily interrupt auto store, press the **PSE/CONT** key. To resume auto store, press the **PSE/CONT** key again.

• **Comment Input**

Step	Operation key	Description
1	DIR	Select directory screen.
2	↑ ↓	Move the M cursor to "COMMENT" on the menu.
3	← →	Move the S cursor to the address number input field.
4	Numeric keys	Enter the address number to which you want to add a comment.
5	← →	Move the S cursor to the comment input field.
6	Numeric keys ← → MARKER	Enter the comment. A comment can consist of any combination of alphanumeric characters. Each press of the → marker key changes the characters in the order A → B → C ... Y → Z → A ..., and each press of the ← marker key changes the characters in the reverse order.



Step	Operation key	Description
7	EXIT	The comment is added to the selected address.

```
Directory
0011 Leq 1 AM830
0012 Leq 1 AM930
0013 Leq 1
0014 Leq 1
0015 Leq 1
0016 Leq 1
0017 Leq 1
0018 Leq 1
-----
DIR_ADR MR_ADR CLR
OPE_SW COMMENT
COMMENT
0012: AM930
```

Comment

Comment setting example

◆ **Recalling Stored Data**

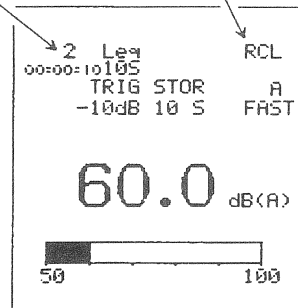
When data are stored in the memory, the data can be recalled as described below. If the stored data are graphic frequency analysis screens, superimposed display (overlay) of stored data and current data is possible. Level changes in a selected band over time (level-time) can also be displayed. For a detailed explanation of these functions, please refer to "Special Functions" on page 105.

Step	Operation key	Description
------	---------------	-------------

1 RCL

Select the recall mode. The data stored in an address are called up and shown on the screen. The number of the address is also shown.

Address number Recall indication



Recall screen example

2 UP DOWN
ADDRESS

Select the address number for the data you want to recall.

UP : Address numbers change upward by one count with each push

DOWN : Address numbers change downward by one count with each push.

3 EXIT
OCT/SLM

To terminate the recall mode, return to the sound level measurement screen.

If the desired address number is far removed from the currently displayed number, selecting the number by the method described in step 2 takes some time. In such a case, it is faster to use the directory screen to enter the desired address number directly, as described below.

- Recalling data using the directory screen

Step	Operation key	Description
2-1	<input type="button" value="DIR"/>	Select the directory screen.
2-2	<input type="button" value="↑"/> <input type="button" value="↓"/>	Move the M cursor to "MR_ADR" on the menu.
2-3	<input type="button" value="Numeric keys"/>	Enter the desired address number in the address number input field.
2-4	<input type="button" value="ENTER"/>	The address number is entered
2-5	<input type="button" value="EXIT"/>	The data stored in the selected address are displayed.

```

Directory
0013 Leq 1
0014 Leq 1
0015 Leq 1
0016 Leq 1
0017 Leq 1
0018 Leq 1
0019 Leq 1
0020 Leq 1
-----
DIR_ADR MR_ADR CLR
OPE_SW COMMENT
Memory address
0340

```

↑
Address number input field

Notes

Averaged SPL Difference Between Two Rooms

This unit can be used to make measurements according to JIS A 1417 (measurement of SPL difference in buildings). Internal software is provided for data processing and display of results.

For these measurements, the following settings are automatically chosen.

Time constant: FAST

Frequency weighting: C

Averaged SPL difference and background noise level measurement: Leq

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◆ **Basic Information**

Before starting the measurement, decide upon the sound source room, the sound receptor room, the location for the sound source speaker, and the measurement points (microphone placement).

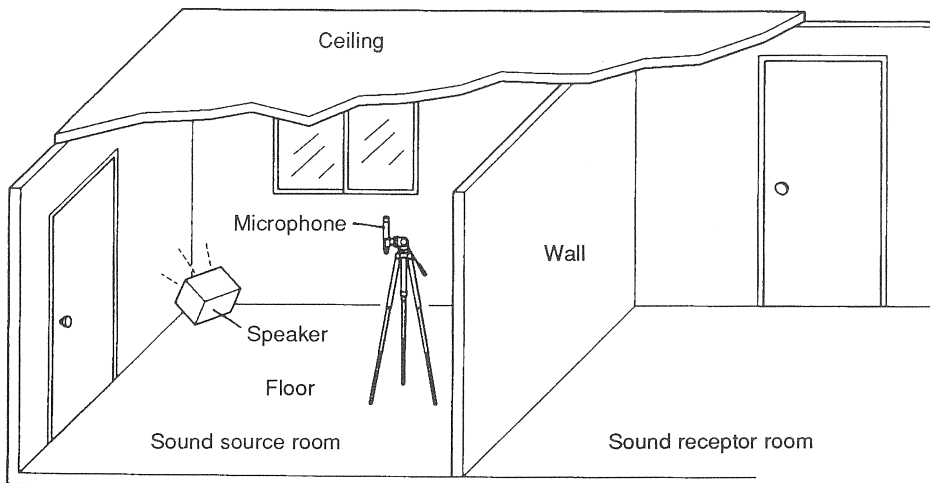
[1] Sound source speaker placement

Choose the location for the sound source speaker in such a way as to achieve uniform sound pressure distribution in the sound source room. The speaker should not point directly at the dividing wall between the sound source room and sound receptor room but rather at a corner of the sound source room. Provide a band noise generator (1-octave bands from 125 to 4000 Hz) and an amplifier to drive the sound source speaker.

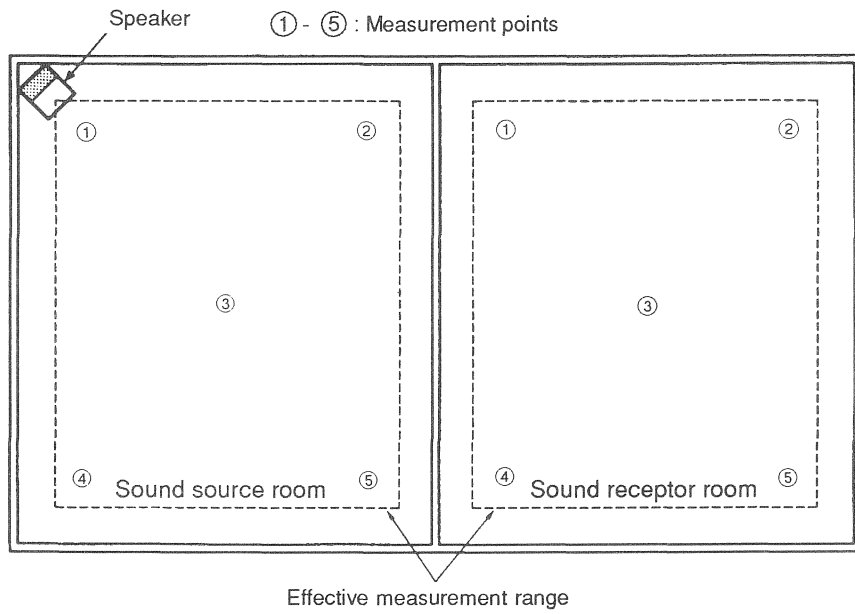
[2] Selecting the measurement points

Select five measurement points in the sound source room and sound receptor room. The microphone height should be between 1.2 and 1.5 meters from the floor, and the microphone should normally be pointed at the ceiling.

Refer to the illustrations for information on speaker and microphone placement and selection of measurement points.



Speaker and microphone placement



Measurement point examples

[3] Setting measurement parameters

The measurement parameters of course depend on the type and purpose of the measurement. Below is an example for what might be considered a typical case.

Sound source: Continuous band noise (125, 250, 500, 1000, 2000, 4000 Hz)

Measurement points: Five points in sound source room and sound receptor room

Measurement frequency bands: 125, 250, 500, 1000, 2000, 4000 Hz

Measurement time for a single measurement: 3 seconds

Number of measurement runs: 5 at each measurement point

[4] Measurement

Measurement steps are identical for sound source room and sound receptor room. The measurement data for the two rooms are stored in different address.

Address number display differs, depending on whether the D_L measurement screen, D_L setup screen or directory screen is displayed, but the actual addresses are the same.

	D_L measurement screen	D_L setup screen	Directory screen
Address number	1D - 250D	001 - 250	0001D - 0250D

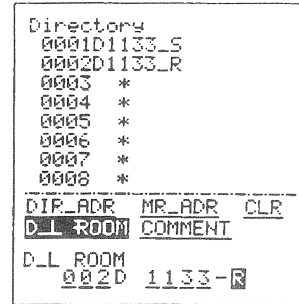
The following explanation uses the address numbers 1D and 2D, to store measurement results. If other data are stored in these addresses, these data will be erased

Measurement results can be displayed in the following two ways.

(1) Using room numbers

Use the directory screen to assign the same room number to the sound source room and sound receptor room, and add an identifying suffix (S for sound source room and R for sound receptor room) to the number. The averaged SPL difference between the two rooms is calculated and displayed.

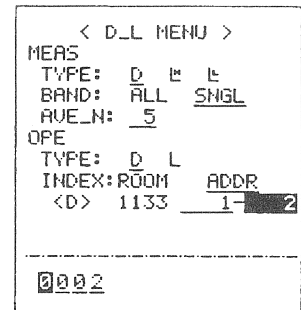
When this method is used, the data for the sound source room and the sound receptor room are treated as one set of data. It also makes it easy to see from the directory screen which data are for the sound source room and which are for the sound receptor room.



Directory screen

(2) Using address numbers

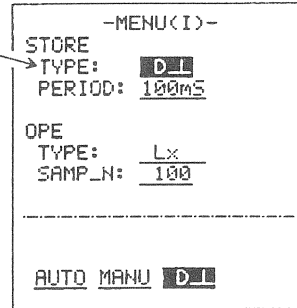
Address number for the sound source room and address number for the sound receptor room are selected separately from the D_L setup screen, and the averaged SPL difference between the two address numbers is calculated and displayed.



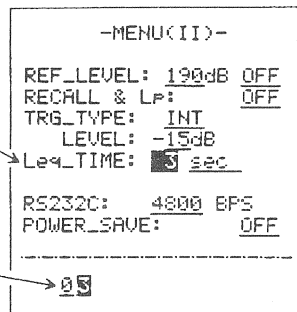
D_L setup screen

◆ Setting Measurement Parameters

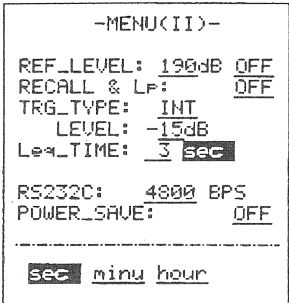
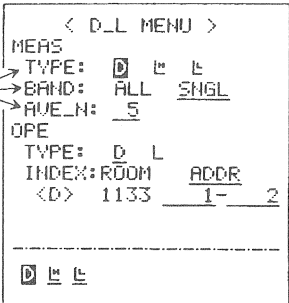
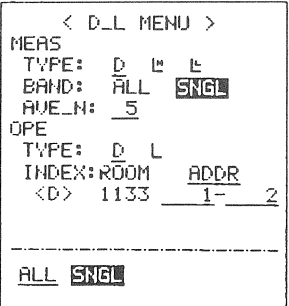
Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
(Select store type)		
2	↑ ↓	Move the M cursor to "STORE TYPE".
3	← →	Move the S cursor to "D_L".
4	ENTER	The measurement data to be stored will be defined as "averaged SPL difference between two rooms".
5	MENU MENU	Select setup screen II in the measurement parameter setting mode.
(Set measurement time)		
6	↑ ↓	Move the M cursor to the numerical value field of "Leq_TIME".
7	Numeric keys	Enter "3" in the numeric input field.
8	ENTER	"3" is entered.
↓		



Setup screen I



Setup screen II

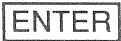
Step	Operation key	Description	
9	↑ ↓	Move the M cursor to the unit field of "Leq_TIME".	
10	← →	Move the S cursor to the "sec" unit.	
11	ENTER	The measurement time for one measurement is set to 3 seconds.	
12	MENU MENU	Select the D_L setup screen of the measurement parameter setting mode.	 <p style="text-align: center;">D_L setup screen</p>
(Set measurement type)			
13	↑ ↓	Move the M cursor to "MEAS TYPE".	
14	← →	Move the S cursor to "D".	
15	ENTER	The measurement type is set to "averaged SPL difference between two rooms".	
(Set measurement frequency)			
16	↑ ↓	Move the M cursor to "BAND".	
17	← →	Move the S cursor to "SINGL".	
18	ENTER	The measurement type is set to single frequency band measurement.	
↓			


Step	Operation key	Description
------	---------------	-------------

(Set number of measurements for averaging)

19	 	Move the M cursor to "AVE_N".
----	---	-------------------------------


20		Enter "5" in the numeric input field.
----	---	---------------------------------------

21		Number of measurements for each measurement point is set to 5.
----	---	--

22		Return to the sound level measurement screen in the sound level measurement mode.
----	---	---

```

< D..L MENU >
MEAS
TYPE:  D  L  L
BAND:  ALL  SNGL
AVE_N:  5
OPE
TYPE:  D  L
INDEX: ROOM  ADDR
<D> 1133  1- 2
    
```



Numeric input field

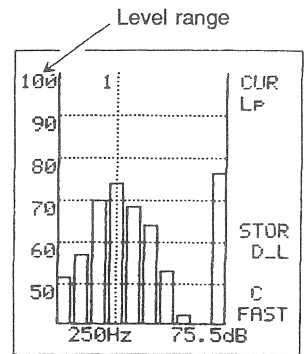
◆ Measurement

Step	Operation key	Description
1		Set up microphone in measurement point 1 of sound source room.

2 Generate 125 Hz band noise from sound source.

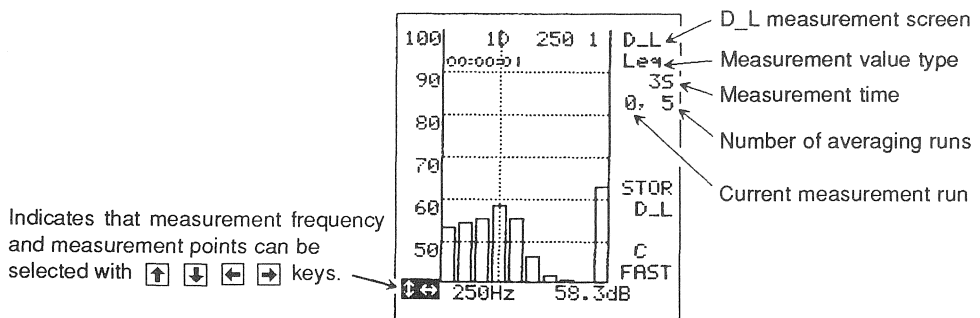
3 **OCT/SLM**
GRP/NUM Select the graphic frequency analysis screen in the sound level measurement mode.

4 **UP** **DOWN**
LEVEL RANGE Select the level range. The level range can be set between 70 and 140 dB in 10-dB steps. If the indication "OVER" appears on the display during the measurement, raise the level range until the indication disappears.



Frequency analysis screen

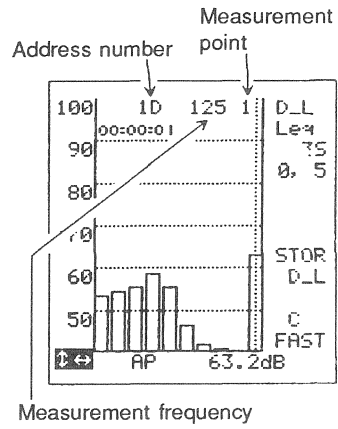
5 **B_L**
GRP/NUM Select the graphic D_L measurement screen in the D_L measurement mode.



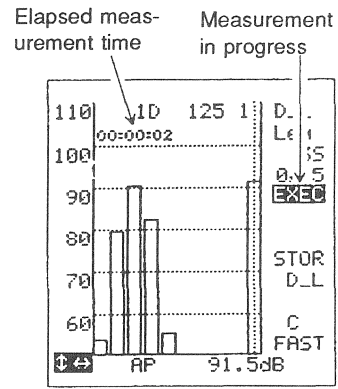
D_L measurement screen



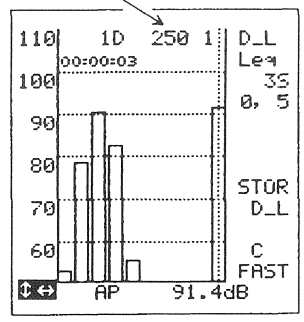
Step	Operation key	Description
6	← →	Select measurement point 1. With each push of a key, the measurement point is switched by one increment between 1 and 5, and "B". "B" is the measurement point for background noise.
7	↑ ↓	Select the 125 Hz measurement frequency. With each push of a key, the measurement frequency is switched by one increment between 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and "AP" (all-pass).
8	UP DOWN ADDRESS	Set the address number to 1D.
9	STRT/STP	The indication "EXEC" appears and the measurement starts. When the first measurement is completed, the "EXEC" indication disappears.
10	STRT/STP	Perform measurement in the same way until 5 measurement runs have been completed.
11	ENTER	The data for the five measurement runs are entered, and the measurement frequency changes to 250 Hz.
12		Generate 250 Hz band noise from sound source and repeat steps 9, 10, and 11
	↓	



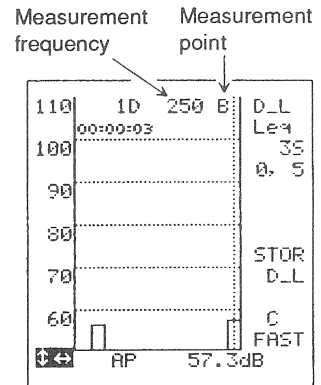
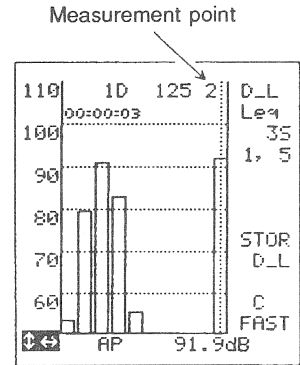
D_L measurement screen

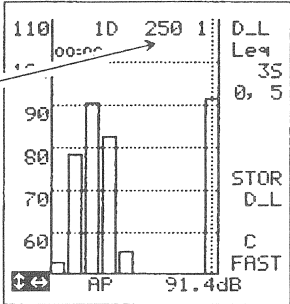


Measurement frequency



Step	Operation key	Description
13		Carry out steps 9, 10, and 11 for all other measurement frequencies (500, 1000, 2000, 4000 Hz).
14		Set up microphone in measurement point 2.
15	← →	Select measurement point 2.
16		Perform all measurements as for point 1.
17		Perform measurements for points 3, 4, and 5 in the same way.
18		Turn off the sound source and set up the microphone at any measurement point (1, 2, 3, 4, or 5).
19	← →	Select measurement point B.
20	↑ ↓	Select the 125 Hz measurement frequency.
21	STRT/STP	The indication "EXEC" appears and the background noise measurement starts. When the first measurement is completed, the "EXEC" indication disappears.
22	STRT/STP	Perform measurement in the same way until 5 measurement runs have been completed.
	↓	



Step	Operation key	Description
23	ENTER	<p>The data for the five measurement runs are entered, and the measurement frequency changes to 250 Hz.</p> 
24		Repeat steps 21, 22, and 23.
25		Carry out steps 21, 22, and 23 for all other measurement frequencies (500, 1000, 2000, 4000 Hz).
26	STOR	The measurement data for measurement points 1 to 5 and B are stored in the address 1D.
27		Move the microphone to measurement point 1 in the sound receptor room.
28		<p>Perform measurements in the sound receptor room according to steps 2 to 26.</p> <p>The address number in step 8 should be 2D.</p>
29	D_L OCT/SLM	To terminate the measurement, return to the sound level measurement screen in the sound level measurement mode.



◆ Display of Measurement Results

(1) Using Room Numbers

Step	Operation key	Description
1	DIR	Select the directory screen
		<p>Address number</p> <p>No stored data</p> <p>*</p> <p>Directory screen</p>
(Room number input)		
2	↑ ↓	Move the M cursor to "D_L ROOM" on the menu.
3	← →	Move the S cursor to the address number input field.
4	Numeric keys	Enter "001".
		<p>Address number input field</p>
5	← →	Move the S cursor to the room number input field.
6	Numeric keys	Enter the room number (example: 1133).
		<p>Room number input field</p>
↓		

Step	Operation key	Description
7	← →	Move the S cursor to the right of the room number input field.
8	← → MARKER	Enter an "S" (for sound source room).
9	ENTER	The room number for address number 001 becomes 1133-S.
10	← →	Move the S cursor to the address number input field.
11	Numeric keys	Enter "002".
12	← →	Move the S cursor to the room number input field.
13	Numeric keys	Enter "1133".
14	← →	Move the S cursor to the right of the room number input field.
15	← → MARKER	Enter an "R" (for sound receptor room).
16	ENTER	The room number for address number 002 becomes 1133-R.
17	EXIT	Return to the sound level measurement screen of the sound level measurement mode.
	↓	

```

Directory
0001D -
0002D -
0003 *
0004 *
0005 *
0006 *
0007 *
0008 *
-----
DIR_ADR MR_ADR CLR
D.L ROOM COMMENT
D.L ROOM
001D 1133-S
    
```

Input field for S or R

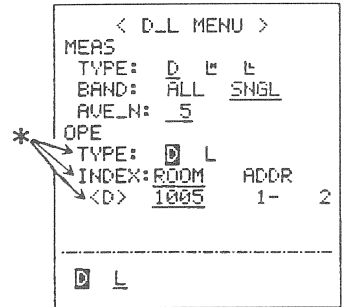
```

Directory
0001D1133_S
0002D -
0003 *
0004 *
0005 *
0006 *
0007 *
0008 *
-----
DIR_ADR MR_ADR CLR
D.L ROOM COMMENT
D.L ROOM
002D 1133-S
    
```

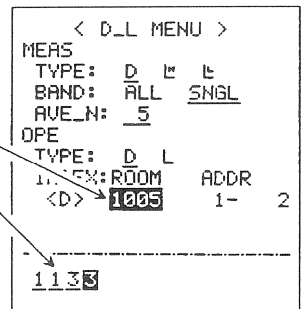
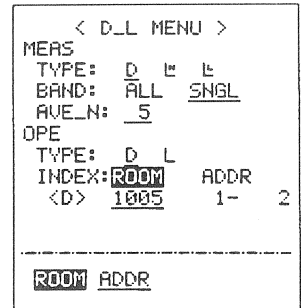
```

Directory
0001D1133_S
0002D1133_R
0003 *
0004 *
0005 *
0006 *
0007 *
0008 *
-----
DIR_ADR MR_ADR CLR
D.L ROOM COMMENT
D.L ROOM
002D 1133-R
    
```

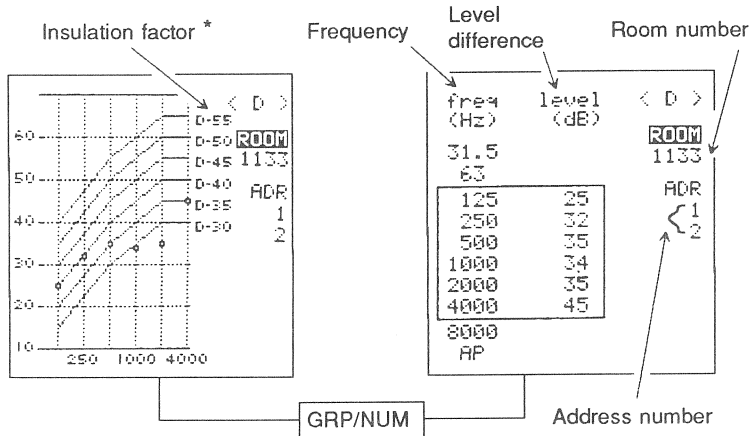
Step	Operation key	Description
18	MENU MENU	Select the D_L setup screen of the measurement parameter setting mode.
(Set operation type)		
19	↑ ↓	Move the M cursor to "OPE TYPE".
20	← →	Move the S cursor to "D".
21	ENTER	Operation type is set to "averaged SPL difference between two rooms".
(Set calculation by room number)		
22	↑ ↓	Move the M cursor to "INDEX".
23	← →	Move the S cursor to "ROOM".
24	ENTER	Calculation of averaged SPL difference between two rooms will use room numbers.
25	↑ ↓	Move the M cursor to the room number display field.
26	Numeric keys	Enter "1133" in the room number input field.
27	ENTER	Room number 1133 is chosen.
↓		



D_L setup screen



Step	Operation key	Description
28	EXIT D_L	Return to the D_L measurement screen in the D_L measurement mode.
29	OPE	The measurement result is shown on the display.

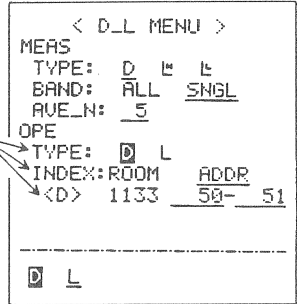


Example for measurement result display

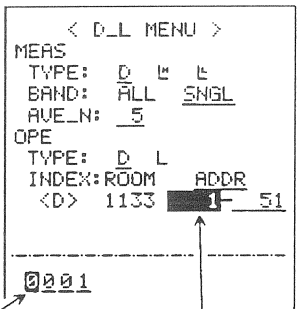
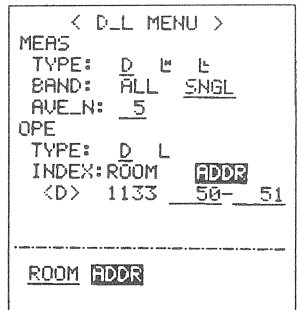
* The insulation factor is a value defined in JIS A 1419 for use in evaluating the insulation characteristics of buildings. For details, refer to the JIS documentation.

(2) Using Address Numbers

Step	Operation key	Description
1	MENU MENU	Select the D_L setup screen of the measurement parameter setting mode.
(Set operation type)		
2	↑ ↓	Move the M cursor to "OPE TYPE".
3	← →	Move the S cursor to "D".
4	ENTER	Operation type is set to "averaged SPL difference between two rooms".
(Set calculation by address number)		
5	↑ ↓	Move the M cursor to "INDEX".
6	← →	Move the S cursor to "ADDR".
7	ENTER	Calculation of averaged SPL difference between two rooms will use address numbers.
8	↑ ↓	Move the M cursor to the left address number display field.
9	Numeric keys	Enter "0001" in the address number input field.
10	ENTER	The left address number is set to 1.
↓		










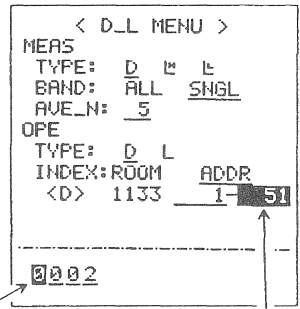
D_L setup screen



Address number input field

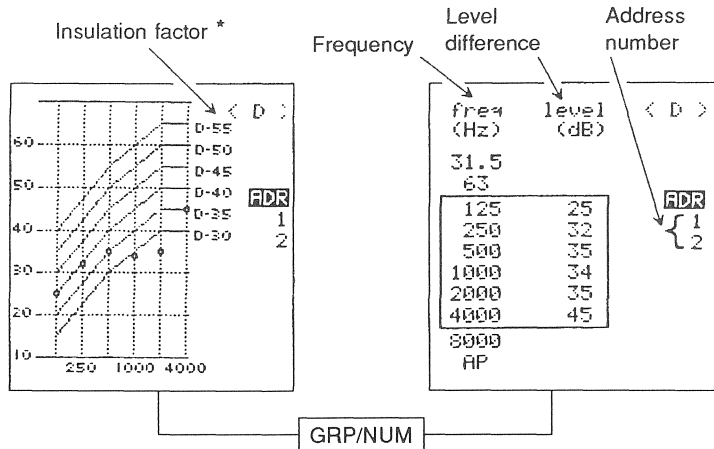
Left address number display field

Step	Operation key	Description
11	 	Move the M cursor to the right address number display field.
12		Enter "0002" in the address number input field.
13		The right address number is set to 2.
14	 	Return to the D_L measurement screen in the D_L measurement mode.
15		The measurement result is shown on the display.



Address number input field

Right address number display field



Example for measurement result display

* The insulation factor is a value defined in JIS A 1419 for use in evaluating the insulation characteristics of buildings. For details, refer to the JIS documentation.

Heavy Floor Impact Sound Level Measurement

This unit can be used to make measurements according to JIS A 1418 (measurement of heavy floor impact sound level in buildings). Internal software is provided for data processing and display of results.

For these measurements, the following settings are automatically chosen.

Time constant:	FAST
Frequency weighting:	C
Heavy floor impact sound level measurement:	Lmax
Background noise level measurement:	Leq

Basic Information	66
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Measurement	74
Display of Measurement Results	78
Using Room Numbers	78
Using Address Numbers	82

◆ **Basic Information**

Before starting the measurement, decide upon the upper (sound source) room, the lower (sound receptor) room, the location for the heavy floor impact sound generator (as specified in JIS A 1418), and the measurement point (microphone placement).

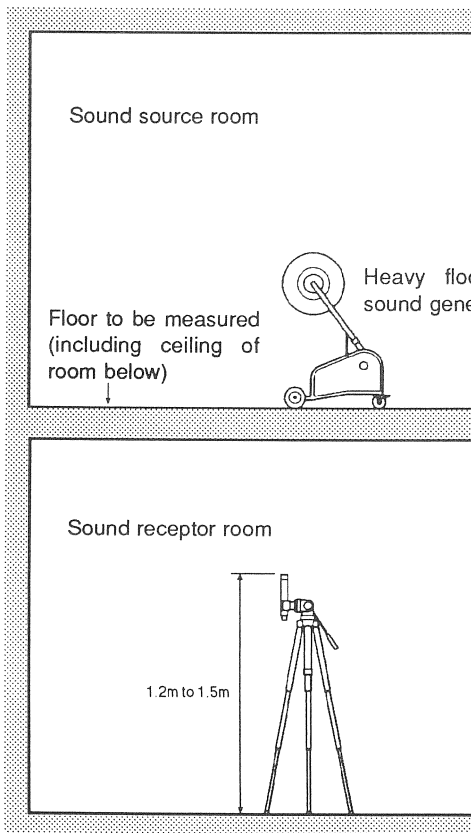
[1] Placement of heavy floor impact sound generator

Draw a measurement line on the floor and choose five placement locations for the generator, so as to achieve uniform sound pressure distribution in the room.

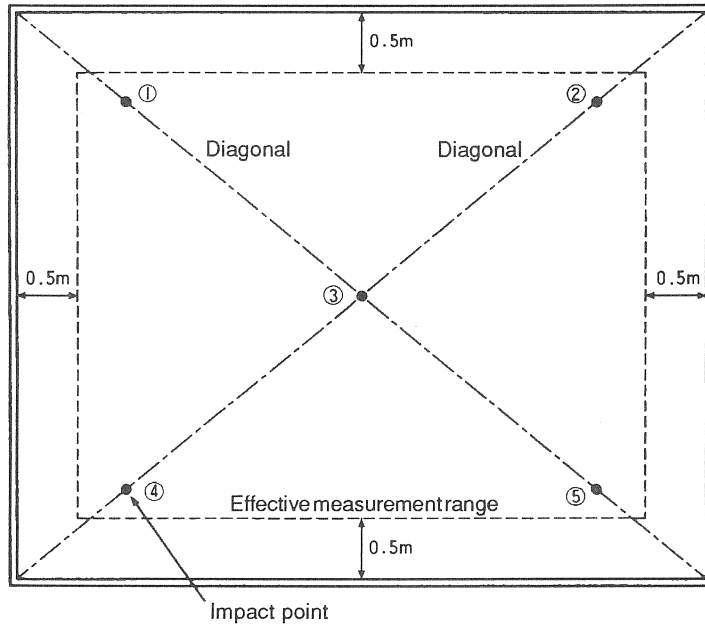
[2] Selecting the measurement points

Choose five measurement points distributed evenly in the sound receptor room and having a clearance of at least 0.5 meters from the room boundaries. The microphone height should be between 1.2 and 1.5 meters from the floor, and the microphone should normally be pointed at the ceiling.

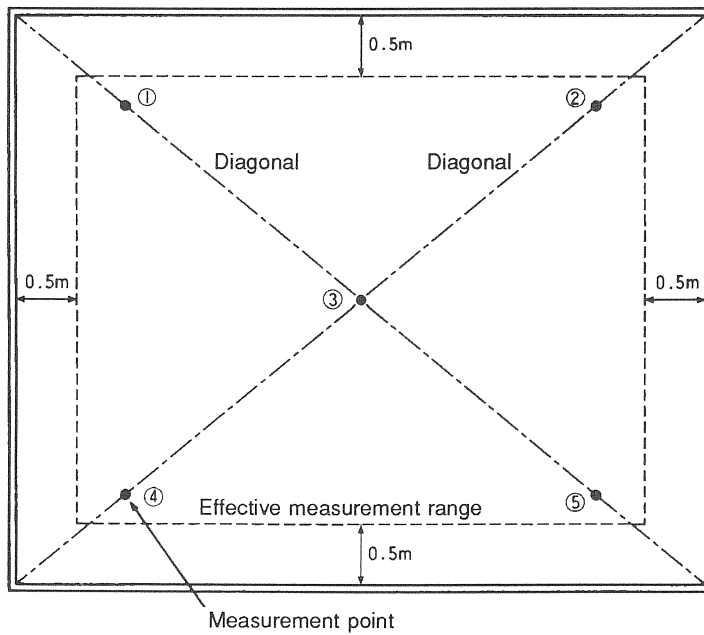
Refer to the illustrations for information on heavy floor impact sound generator placement and selection of measurement points.



Example for placement of heavy floor impact sound generator and microphone



Example for generator placement



Example for measurement point placement

[3] Setting measurement parameters

The measurement parameters of course depend on the type and purpose of the measurement. Below is an example for what might be considered a typical case.

Heavy floor impact sound generator placement:	Five points in sound source room
Measurement points:	Five points in sound receptor room
Trigger type:	Internal
Trigger level:	-15 dB from full scale point
Measurement time for a single measurement:	3 seconds
Measurement frequencies:	All-pass
Number of measurement runs:	5 at each measurement point

[4] Measurement

The impact is produced in the sound source room with a heavy floor impact sound generator and measured in the sound receptor room. Measurement data for different heavy floor impact sound generator positions are stored in different addresses.

Address number display differs, depending on whether the D_L measurement screen, D_L setup screen or directory screen is displayed, but the actual addresses are the same.

	D_L measurement screen	D_L setup screen	Directory screen
Address number	1L ^H - 250L ^H	001 - 250	0001L ^H - 0250L ^H

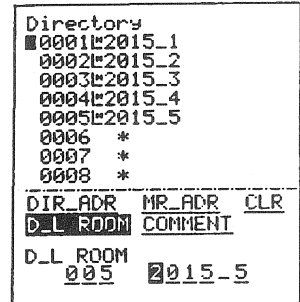
The following explanation uses the address numbers 1L^H to 5L^H, to store measurement results. If other data are stored in these addresses, these data will be erased

Measurement results can be displayed in the following two ways.

(1) Using room numbers

Use the directory screen to assign the same room number to the five measurement points, and add the numbers 1 to 5 as identifying suffixes to the numbers. The heavy floor impact sound level for this room is calculated using the five points.

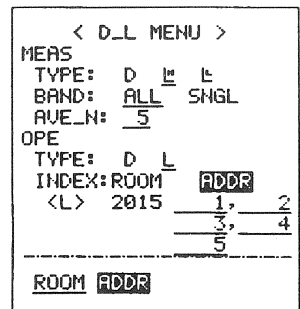
When this method is used, the data for the five measurement points are treated as one set of data. It also makes it easy to see from the directory screen which data belong to a given measurement point and room.



Directory screen

(2) Using address numbers

Address numbers for the measurement points are selected separately from the D_L setup screen, and the heavy floor impact sound level is calculated and displayed.

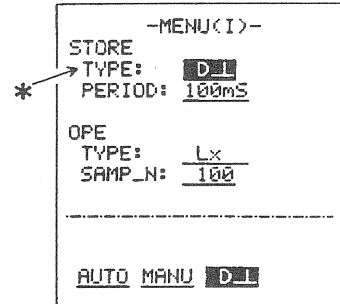


D_L setup screen

◆ Setting Measurement Parameters

Step	Operation key	Description
------	---------------	-------------

1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
---	----------------------------	--



Setup screen I

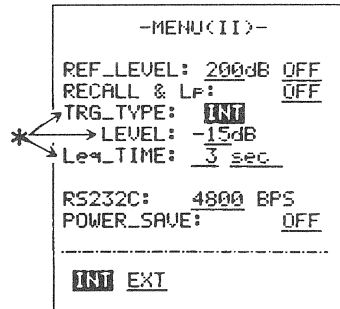
(Select store type)

2	↑ ↓	Move the M cursor to "STORE TYPE".
---	-------------------	------------------------------------

3	← →	Move the S cursor to "D_L".
---	-------------------	-----------------------------

4	ENTER	The measurement data to be stored will be defined as "heavy floor impact sound level".
---	--------------	--

5	MENU MENU	Select setup screen II in the measurement parameter setting mode.
---	----------------------------	---



Setup screen II



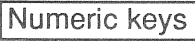
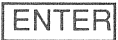


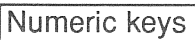




(Set trigger type)

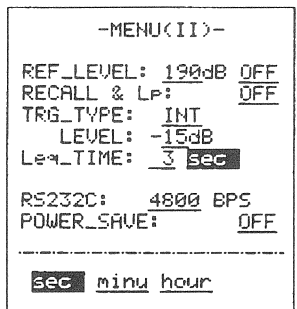
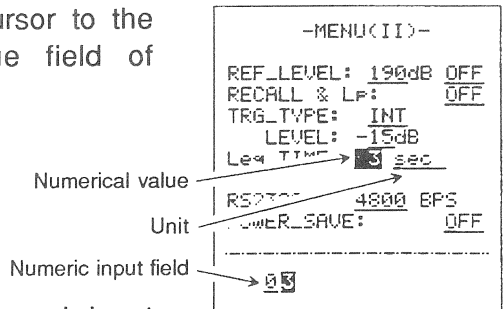
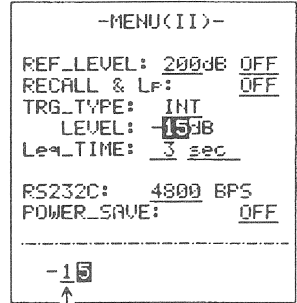
6	↑ ↓	Move the M cursor to "TRG_TYPE".
---	-------------------	----------------------------------



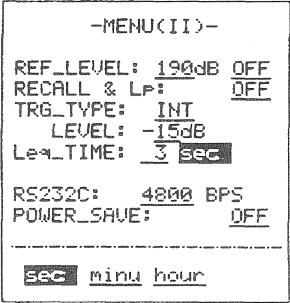







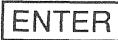
7	← →	Move the S cursor to "INT".
---	-------------------	-----------------------------

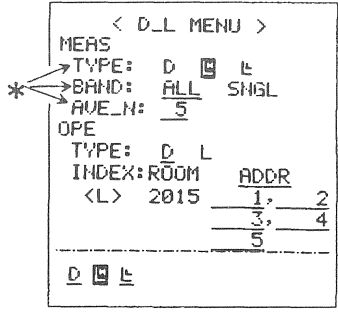
8	ENTER	Internal trigger is selected.
---	--------------	-------------------------------

↓







Step	Operation key	Description
(Set trigger level)		
9	 	Move the M cursor to "LEVEL".
10		Enter "15" in the trigger level input field. There is no need to input the minus sign.
11		The trigger level is set to "-15 dB".
(Set measurement time)		
12	 	Move the M cursor to the numerical value field of "Leq_TIME".
13		Enter "3" in the numeric input field.
14		"3" is entered.
15	 	Move the M cursor to the unit field of "Leq_TIME".
		

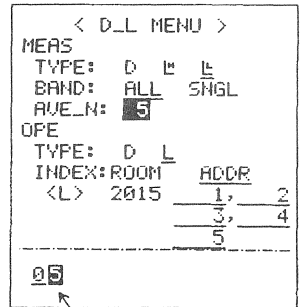
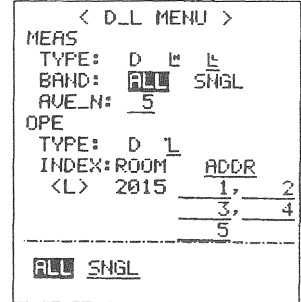


Step	Operation key	Description
16	 	Move the S cursor to the "sec" unit.
		
17		The measurement time for one measurement is set to 3 seconds.
18	 	Return to the D_L setup screen in the measurement parameter setting mode.
(Set measurement type)		
19	 	Move the M cursor to "MEAS TYPE".
20	 	Move the S cursor to "L ^H ".
21		The measurement type is set to "heavy floor impact sound level".
↓		



D_L setup screen

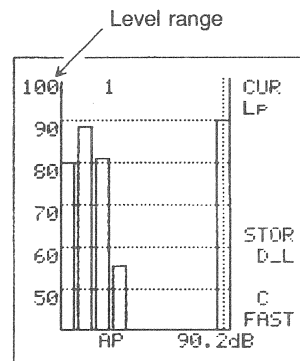
Step	Operation key	Description
(Set measurement frequency)		
22	 	Move the M cursor to "BAND".
23	 	Move the S cursor to "ALL".
24	ENTER	The measurement frequency is set to "all frequencies".
(Set number of measurements for averaging)		
25	 	Move the M cursor to "AVE_N".
26	Numeric keys	Enter "5" in the numeric input field.
27	ENTER	Number of measurements for each measurement point is set to 5.
28	EXIT	Return to the sound level measurement screen in the sound level measurement mode.



Numeric input field

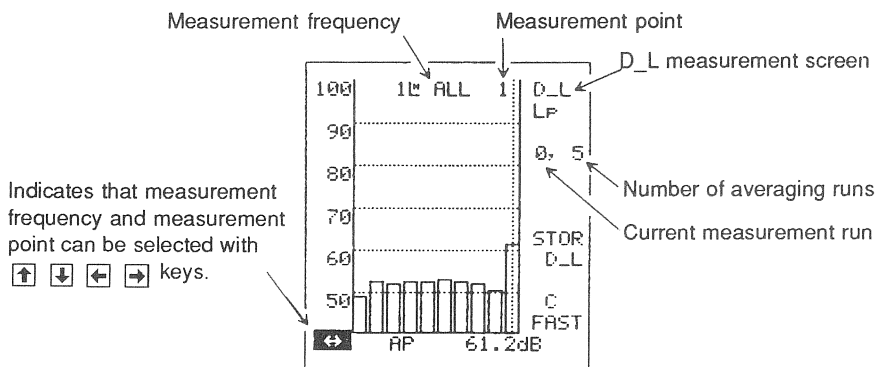
◆ Measurement

Step	Operation key	Description
1		Set up the heavy floor impact sound generator in point 1 of the sound source room and set up the microphone in measurement point 1 of the sound receptor room.
2	OCT/SLM GRP/NUM	Select the graphic frequency analysis screen of the sound level measurement mode.
3	UP DOWN LEVEL RANGE	Generate impact sound and select the level range. The level range can be set between 70 and 140 dB in 10-dB steps. If the indication "OVER" appears on the display, raise the level range until the indication disappears.



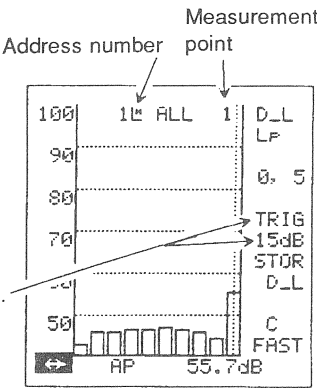
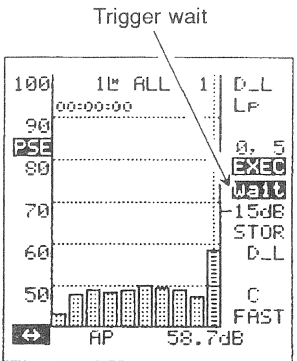
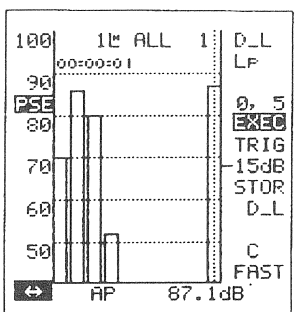
Frequency analysis screen

4	D_L GRP/NUM	Select the graphic D_L measurement screen of the D_L measurement mode.
---	------------------------------	--



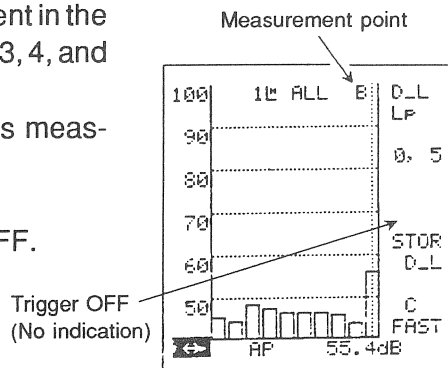
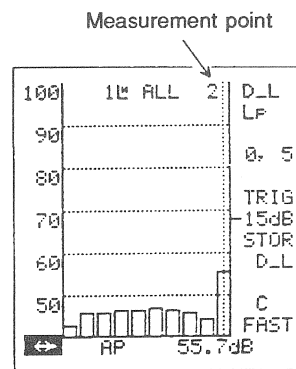
D_L measurement screen



Step	Operation key	Description
5	TRIG	Set trigger to ON.
6	UP DOWN ADDRESS	Select address number 1L ^H .
7	← →	Select measurement point 1.
		
8	STRT/STP	The indication "wait" is displayed and the unit enters the trigger wait condition.
		
9		Activate the heavy floor impact sound generator. When the trigger level is exceeded, the indication "wait" disappears and the first measurement starts. After 3 seconds, the measurement is terminated.
		

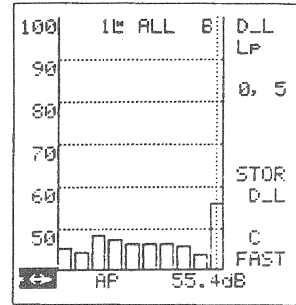


Step	Operation key	Description
10		Activate the heavy floor impact sound generator again. When the trigger level is exceeded, the indication "wait" disappears and the second measurement starts. After 3 seconds, the measurement is terminated.
11		Perform step 10 until all five measurements have been carried out.
12	ENTER	The data for measurement point 1 are entered and measurement point 2 is selected.
13		Move the microphone to measurement point 2.
14		Perform measurement at point 2 in the same way as for point 1.
15		Perform measurement in the same way for points 3, 4, and 5. The unit now selects measurement point B.
16	TRIG	Set the trigger to OFF.



Background noise measurement can be carried out at any measurement point (1, 2, 3, 4, or 5).

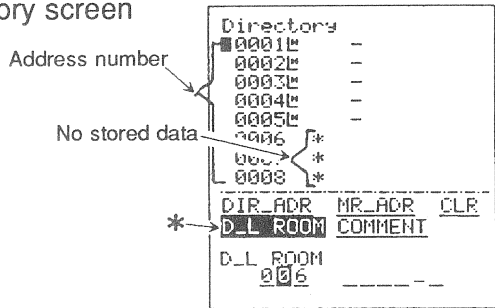
Step	Operation key	Description
17	STRT/STP	The indication "EXEC" appears and the background noise measurement starts. When the first measurement is completed, the "EXEC" indication disappears.
18	STRT/STP	Start the second background noise measurement.
19	STRT/STP	Perform measurement in the same way until five measurement runs have been performed.
20	ENTER	Data for the five background noise measurements are entered.
21	STOR	The measurement data for sound source point 1 are stored in the address 1L ^H , and the address number changes to 2L ^H .
22		Move the heavy floor impact sound generator to point 2 in the sound source room.
23		Perform measurements in the sound receptor room for sound source point 2 according to steps 3 to 21. The steps 4 and 6 are not required.
24		Perform measurement in the same way for sound source points 3, 4, and 5.
25	D_L OCT/SLM	To terminate the measurement, return to the sound level measurement screen of the sound level measurement mode.
	↓	



◆ Display of Measurement Results

(1) Using Room Numbers

Step	Operation key	Description
1	<input type="button" value="DIR"/>	Select the directory screen

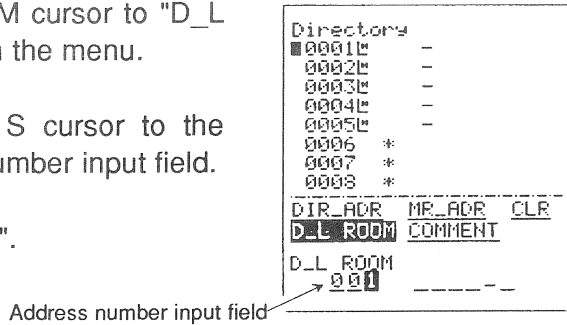


(Room number input)

2	<input type="button" value="↑"/> <input type="button" value="↓"/>	Move the M cursor to "D_L ROOM" on the menu.
---	---	--

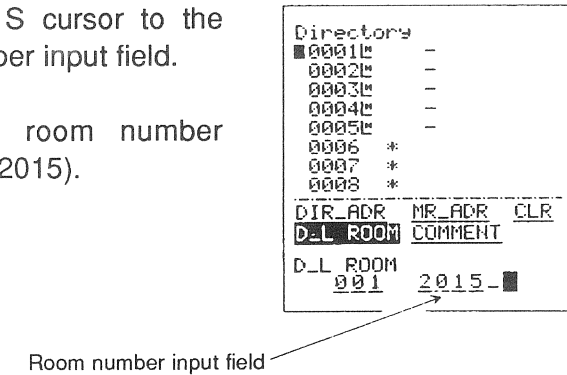
3	<input type="button" value="←"/> <input type="button" value="→"/>	Move the S cursor to the address number input field.
---	---	--

4	<input type="button" value="Numeric keys"/>	Enter "001".
---	---	--------------

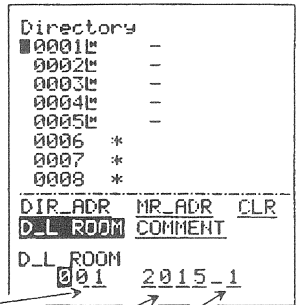


5	<input type="button" value="←"/> <input type="button" value="→"/>	Move the S cursor to the room number input field.
---	---	---

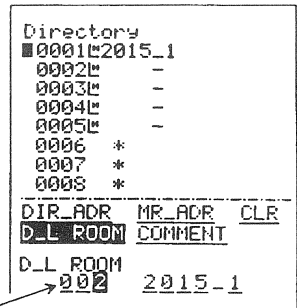
6	<input type="button" value="Numeric keys"/>	Enter the room number (example: 2015).
---	---	--



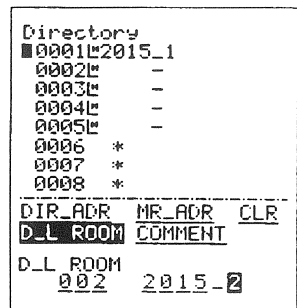
Step	Operation key	Description
7	← →	Move the S cursor to the right of the room number input field.
8	Numeric keys	Enter "1" (measurement point number).
9	ENTER	The room number 2015-1 is assigned to address number 001.
10	← →	Move the S cursor to the address number input field.
11	Numeric keys	Enter "002".
12	← →	Move the S cursor to the room number input field.
13	Numeric keys	Enter "2015".
14	← →	Move the S cursor to the right of the room number input field.
15	Numeric keys	Enter "2" (measurement point number).
	↓	



Address number →
 Room number →
 Measurement point number →



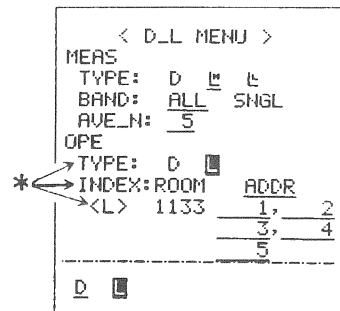
Address number input field →



Step	Operation key	Description
16	ENTER	The room number 2015-2 is assigned to address number 002.
17		Repeat steps 3 to 9 to assign room number 2015-3 to address number 003, room number 2015-4 to address number 004, and room number 2015-5 to address number 005. These 5 data are now treated as a set and will be used to calculate the heavy floor impact sound level.
18	EXIT	Return to the sound level measurement screen in the sound level measurement mode.
19	MENU MENU	Select the D_L setup screen of the measurement parameter setting mode.

(Set operation type)

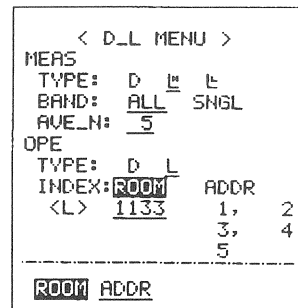
20	↑ ↓	Move the M cursor to "OPE TYPE".
21	← →	Move the S cursor to "L".
22	ENTER	Calculation type is set to "heavy floor impact sound level".





D_L setup screen

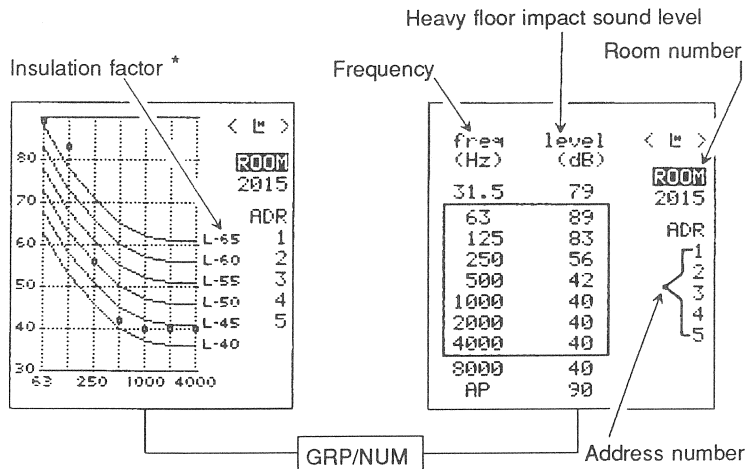
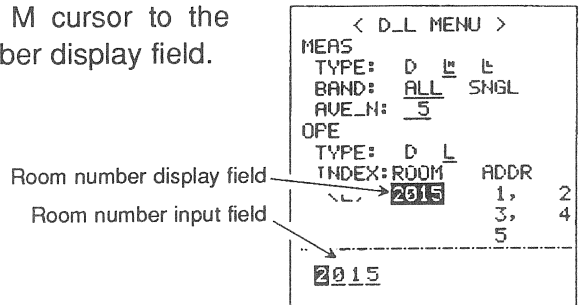
(Set calculation by room number)

23	↑ ↓	Move the M cursor to "INDEX".
24	← →	Move the S cursor to "ROOM".
25	ENTER	Calculation of heavy floor impact sound level will use room numbers.



↓

Step	Operation key	Description
26	 	Move the M cursor to the room number display field.
27	<input type="text" value="Numeric keys"/>	Enter "2015" in the room number input field.
28	<input type="text" value="ENTER"/>	Room number 2015 is chosen.
29	<input type="text" value="EXIT"/> <input type="text" value="D_L"/>	Return to the D_L measurement screen in the D_L measurement mode.
30	<input type="text" value="OPE"/>	The measurement result is shown on the display.

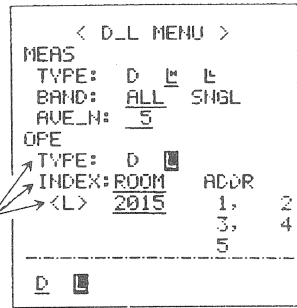


Example for measurement result display

* The insulation factor is a value defined in JIS A 1419 for use in evaluating the insulation characteristics of buildings. For details, refer to the JIS documentation.

(2) Using Address Numbers

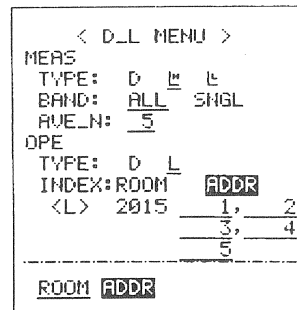
Step	Operation key	Description
1	MENU MENU	Select the D_L setup screen of the measurement parameter setting mode.
(Set operation type)		
2	↑ ↓	Move the M cursor to "OPE TYPE".
3	← →	Move the S cursor to "L".
4	ENTER	Calculation type is set to "heavy floor impact sound level".



D_L setup screen

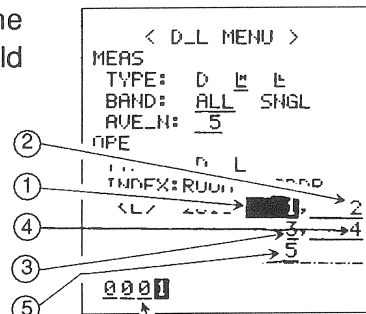
(Set calculation by address number)

5	↑ ↓	Move the M cursor to "INDEX".
6	← →	Move the S cursor to "ADDR".
7	ENTER	Calculation of heavy floor impact sound level will use address numbers.



8	↑ ↓	Move the M cursor to the address number display field ①.
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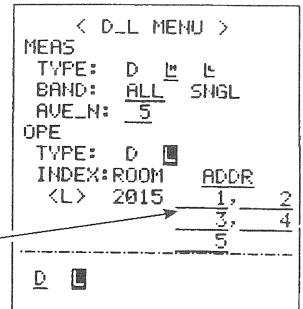
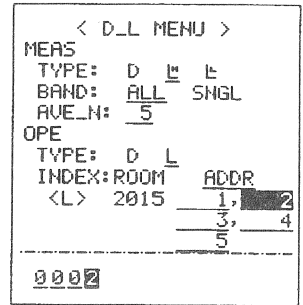
Address number display field



Address number input field

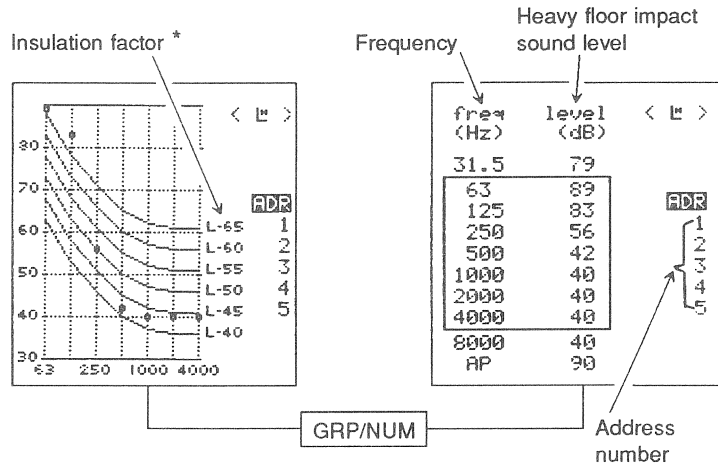


Step	Operation key	Description
9	Numeric keys	Enter "0001" in the address number input field.
10	ENTER	The address number 1 is set to ①.
11	↑ ↓	Move the M cursor to the address number display field ②.
12	Numeric keys	Enter "0002" in the address number input field.
13	ENTER	The address number 2 is set to ②.
14		Repeat steps 8, 9, and 10 to enter address numbers 3, 4, and 5 in the address number display fields ③, ④, and ⑤.
15	EXIT D_L	Return to the D_L measurement screen in the D_L measurement mode.
	↓	



Step	Operation key	Description
------	---------------	-------------

16	OPE	The measurement result is shown on the display.
----	------------	---



Example for measurement result display

* The insulation factor is a value defined in JIS A 1419 for use in evaluating the insulation characteristics of buildings. For details, refer to the JIS documentation.

Light Floor Impact Sound Level Measurement

This unit can be used to make measurements according to JIS A 1418 (measurement of light floor impact sound level in buildings). Internal software is provided for data processing and display of results.

For these measurements, the following settings are automatically chosen.

Time constant:	FAST
Frequency weighting:	C
Light floor impact sound level measurement:	Leq
Background noise level measurement:	Leq

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Using Address Numbers	101

◆ **Basic Information**

Before starting the measurement, decide upon the upper (sound source) room, the lower (sound receptor) room, the location for the light floor impact sound generator (as specified in JIS A 1418), and the measurement point (microphone placement).

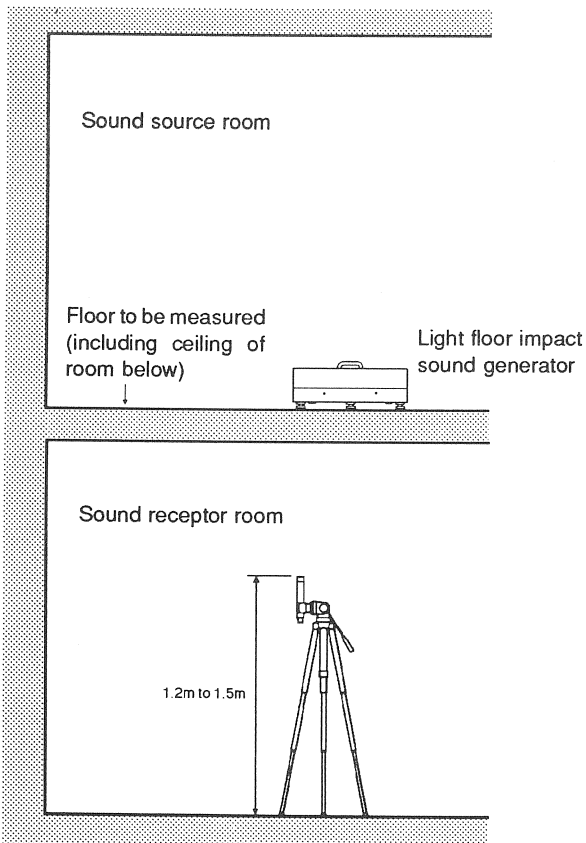
[1] Placement of light floor impact sound generator

Draw a measurement line on the floor and choose five placement locations for the generator, so as to achieve uniform sound pressure distribution in the room.

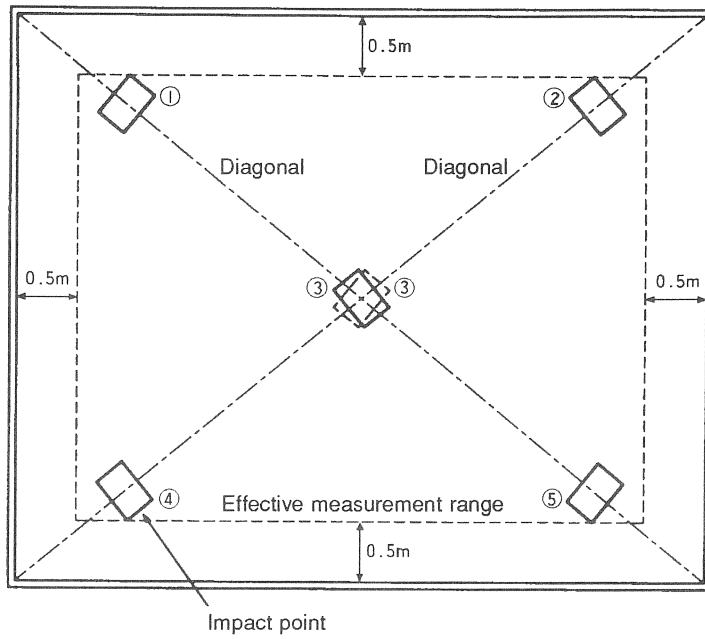
[2] Selecting the measurement points

Choose five measurement points distributed evenly in the sound receptor room and having a clearance of at least 0.5 meters from the room boundaries. The microphone height should be between 1.2 and 1.5 meters from the floor, and the microphone should normally be pointed at the ceiling.

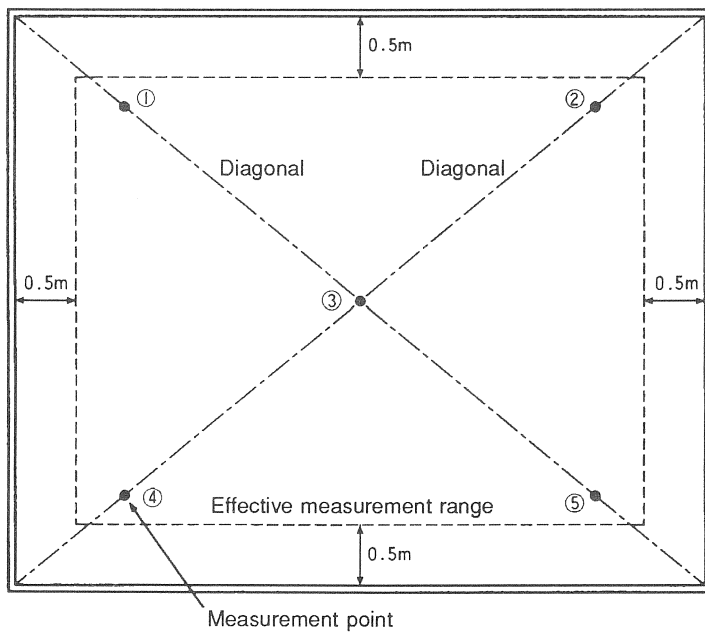
Refer to the illustrations for information on light floor impact sound generator placement and selection of measurement points.



Example for placement of light floor impact sound generator and microphone



Example for generator placement



Example for measurement point placement

[3] Setting measurement parameters

The measurement parameters of course depend on the type and purpose of the measurement. Below is an example for what might be considered a typical case.

Light floor impact sound generator placement:	Five points in sound source room
Measurement points:	Five points in sound receptor room
Measurement time for a single measurement:	3 seconds
Measurement frequencies:	All-pass
Number of measurement runs:	5 at each measurement point

[4] Measurement

The impact is produced in the sound source room with a light floor impact sound generator and measured in the sound receptor room. Measurement data for different light floor impact sound generator positions are stored in different addresses.

Address number display differs, depending on whether the D_L measurement screen, D_L setup screen or directory screen is displayed, but the actual addresses are the same.

	D_L measurement screen	D_L setup screen	Directory screen
Address number	1L ^L - 250L ^L	001 - 250	0001L ^L - 0250L ^L

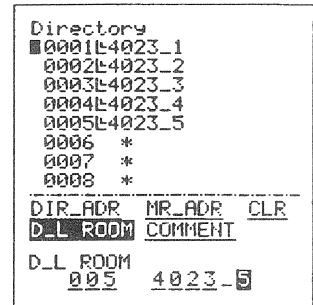
The following explanation uses the address numbers 1L^L to 5L^L, to store measurement results. If other data are stored in these addresses, these data will be erased

Measurement results can be displayed in the following two ways.

(1) Using room numbers

Use the directory screen to assign the same room number to the five measurement points, and add the numbers 1 to 5 as identifying suffixes to the numbers. The light floor impact sound level for this room is calculated using the five points.

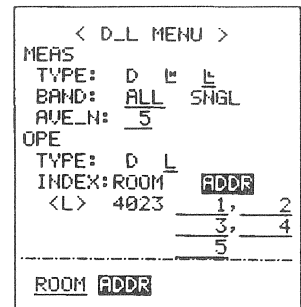
When this method is used, the data for the five measurement points are treated as one set of data. It also makes it easy to see from the directory screen which data belong to a given measurement point and room.



Directory screen

(2) Using address numbers

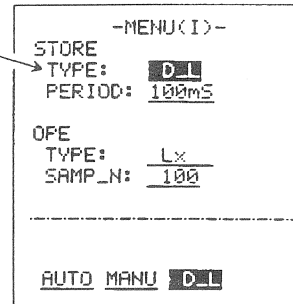
Address numbers for the measurement points are selected separately from the D_L setup screen, and the light floor impact sound level is calculated and displayed.



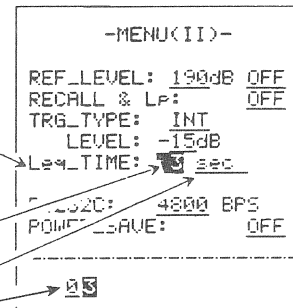
D_L setup screen

◆ **Setting Measurement Parameters**



















Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
(Select store type)		
2	↑ ↓	Move the M cursor to "STORE TYPE".
3	← →	Move the S cursor to "D_L".
4	ENTER	The measurement data to be stored will be defined as "light floor impact sound level".
5	MENU MENU	Select setup screen II in the measurement parameter setting mode.
(Set measurement time)		
6	↑ ↓	Move the M cursor to the numerical value field of "Leq_TIME".
7	Numeric keys	Enter "3" in the numeric input field.
8	ENTER	"3" is entered.
↓		



Setup screen I



Setup screen II

Step	Operation key	Description
9	 	Move the M cursor to the unit field of "Leq_TIME".
10	 	Move the S cursor to the "sec" unit.
11		The measurement time for one measurement is set to 3 seconds.
12	 	Return to the D_L setup screen in the measurement parameter setting mode.
(Set measurement type)		
13	 	Move the M cursor to "MEAS TYPE".
14	 	Move the S cursor to "L".
15		The measurement type is set to "light floor impact sound level".
(Set measurement frequency)		
16	 	Move the M cursor to "BAND".
17	 	Move the S cursor to "ALL".
18		The measurement frequency is set to "all frequencies".
		

```

-MENU<II>-
REF_LEVEL: 190dB OFF
RECALL & LP: OFF
TRG_TYPE: INT
LEVEL: -15dB
Leq_TIME: 3 sec
RS232C: 4800 BPS
POWER_SAVE: OFF
-----
sec minu hour
    
```

```

< D_L MENU >
MEAS
TYPE: D L L
BAND: ALL SNGL
AVE_N: 5
OPE
TYPE: D L
INDEX: ROOM ADDR
<L> 2015 1 2
          3 4
          5
-----
D L L
    
```



D_L setup screen

```

< D_L MENU >
MEAS
TYPE: D L L
BAND: ALL SNGL
AVE_N: 5
OPE
TYPE: D L
INDEX: ROOM ADDR
<L> 2015 1 2
          3 4
          5
-----
ALL SNGL
    
```

Step	Operation key	Description
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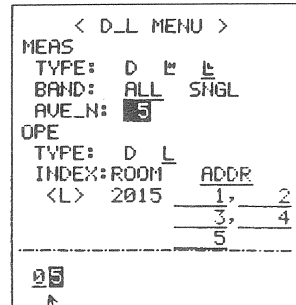
(Set number of measurements for averaging)

19	 	Move the M cursor to "AVE N".
----	---	-------------------------------

20	Numeric keys	Enter "5".
----	---------------------	------------

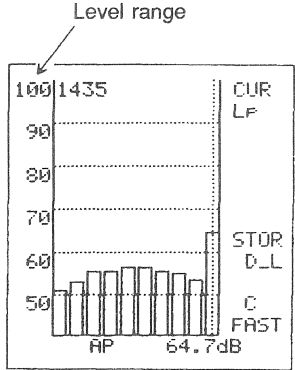
21	ENTER	Number of measurements for each measurement point is set to 5.
----	--------------	--

22	EXIT	Return to the sound level measurement screen in the sound level measurement mode.
----	-------------	---

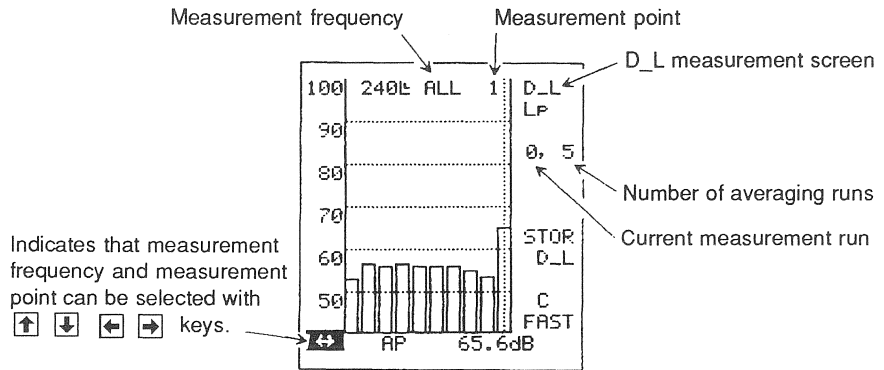


Numeric input field

◆ Measurement

Step	Operation key	Description
1		Set up the light floor impact sound generator in point 1 of the sound source room and set up the microphone in measurement point 1 of the sound receptor room.
2	OCT/SLM GRP/NUM	Select the graphic frequency analysis screen in the sound level measurement mode.
3	UP DOWN LEVEL RANGE	Generate impact sound and select the level range. The level range can be set between 70 and 140 dB in 10-dB steps. If the indication "OVER" appears on the display, raise the level range until the indication disappears.
		 <p>Frequency analysis screen</p>

4	D_L GRP/NUM	Select the graphic D_L measurement screen in the D_L measurement mode.
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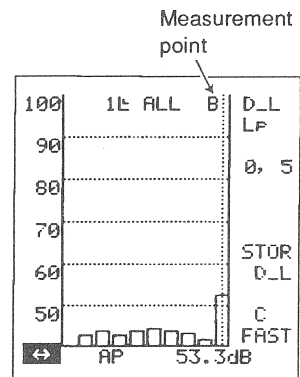
D_L measurement screen



Step	Operation key	Description
5	UP DOWN ADDRESS	Select address number 1L ^L .
6	← →	Select measurement point 1.
7		Activate the light floor impact sound generator.
8	STRT/STP	The indication "EXEC" appears and the first measurement starts. After 3 seconds, the "EXEC" indication disappears and the measurement is terminated.
9	STRT/STP	The indication "EXEC" appears and the second measurement starts. After 3 seconds, the "EXEC" indication disappears and the measurement is terminated.
10		Repeat steps 8 and 9 until all five measurement have been carried out.
11	ENTER	The data for measurement point 1 are entered and measurement point 2 is selected.
12		Move the microphone to measurement point 2.
13		Perform measurement at point 2 in the same way as for point 1.

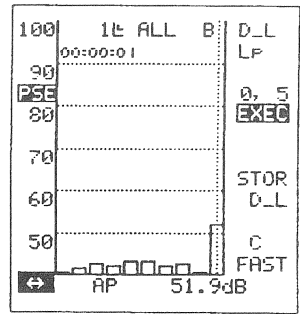


Step	Operation key	Description
14		Perform measurement in the same way for points 3, 4, and 5. The unit now selects measurement point B.
15		Turn off the light floor impact sound generator.



Background noise measurement can be carried out at any measurement point (1, 2, 3, 4, or 5).

16	STRT/STP	The indication "EXEC" appears and the background noise measurement starts. When the first measurement is completed, the "EXEC" indication disappears.
17	STRT/STP	Start the second background noise measurement.



18 **STRT/STP** Perform measurement in the same way until five measurement runs have been performed.

19 **ENTER** Data for the five background noise measurements are entered.

20 **STOR** The measurement data for sound source point 1 are stored in the address number 1L^L, and the address number changes to 2L^L.

21 Move the light floor impact sound generator to point 2 in the sound source room.

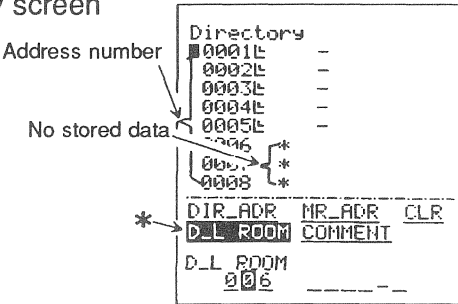
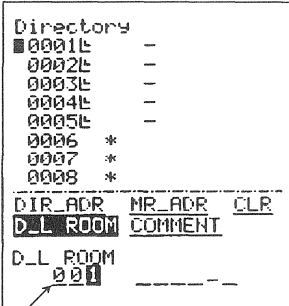
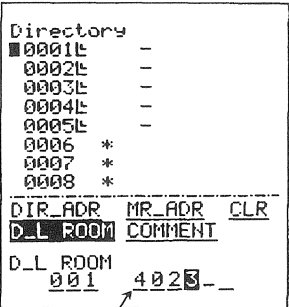
22 Perform measurements in the sound receptor room for sound source point 2 according to steps 6 to 20.



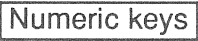
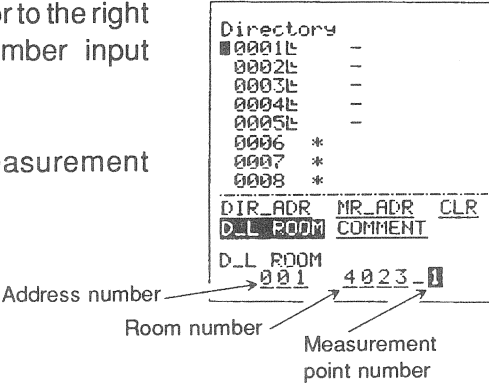
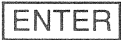


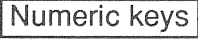
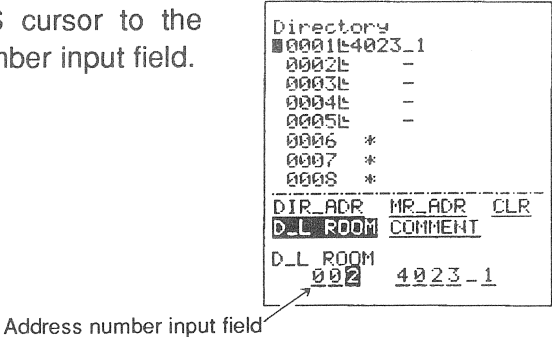


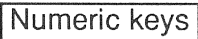


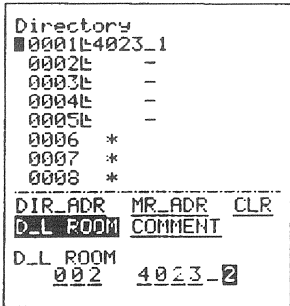
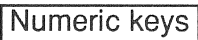



Step	Operation key	Description
23		Perform measurement in the same way for sound source points 3, 4, and 5.
24	D_L OCT/SLM	To terminate the measurement, return to the sound level measurement screen of the sound level measurement mode.

◆ Display of Measurement Results

(1) Using Room Numbers

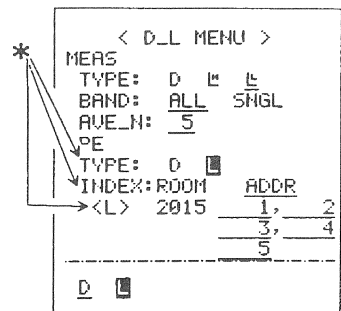
Step	Operation key	Description
1	<input type="button" value="DIR"/>	Select the directory screen
		 <p>Address number</p> <p>No stored data</p> <p>Directory screen</p>
(Room number input)		
2	<input type="button" value="↑"/> <input type="button" value="↓"/>	Move the M cursor to "D_L ROOM" on the menu.
3	<input type="button" value="←"/> <input type="button" value="→"/>	Move the S cursor to the address number input field.
4	<input type="button" value="Numeric keys"/>	Enter "001".
		 <p>Address number input field</p>
5	<input type="button" value="←"/> <input type="button" value="→"/>	Move the S cursor to the room number input field.
6	<input type="button" value="Numeric keys"/>	Enter the room number (example: 4023).
↓		 <p>Room number input field</p>

Step	Operation key	Description
7	 	Move the S cursor to the right of the room number input field.
8		Enter "1" (measurement point number).
		
9		The room number 4023-1 is assigned to address number 001.
10	 	Move the S cursor to the address number input field.
11		Enter "002".
		
12	 	Move the S cursor to the room number input field.
13		Enter "4023".
14	 	Move the S cursor to the right of the room number input field.
		
15		Enter "2" (measurement point number).
		

Step	Operation key	Description
16	ENTER	The room number 4023-2 is assigned to address number 002.
17		Repeat steps 3 to 9 to assign room number 4023-3 to address number 003, room number 4023-4 to address number 004, and room number 4023-5 to address number 005. These 5 data are now treated as a set and will be used to calculate the light floor impact sound level.
18	EXIT	Return to the sound level measurement screen in the sound level measurement mode.
19	MENU MENU	Select the D_L setup screen in the measurement parameter setting mode.

(Set operation type)

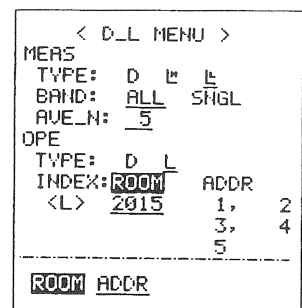
20	↑ ↓	Move the M cursor to "OPE TYPE".
21	← →	Move the S cursor to "L".
22	ENTER	Calculation type is set to "light floor impact sound level".



D_L setup screen

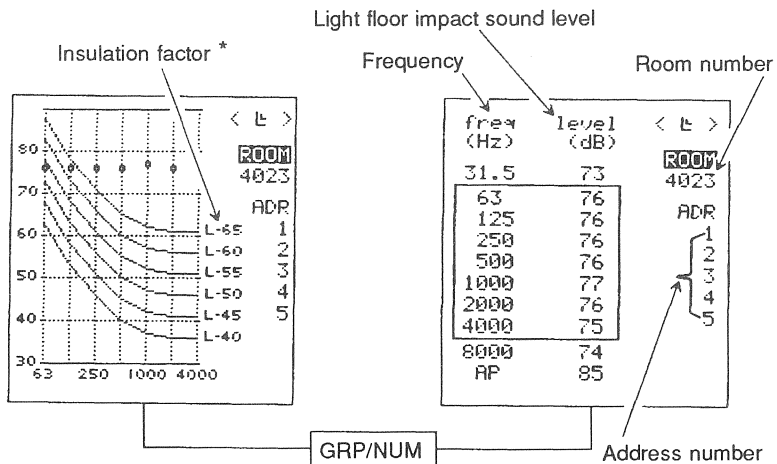
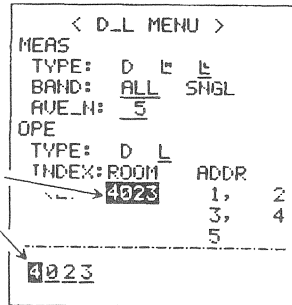
(Set calculation by room number)

23	↑ ↓	Move the M cursor to "INDEX".
24	← →	Move the S cursor to "ROOM".
25	ENTER	Calculation of light floor impact sound level will use room numbers.



↓

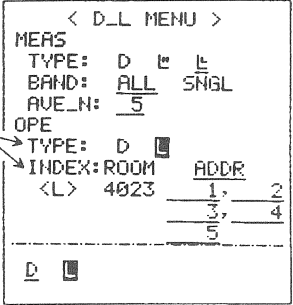
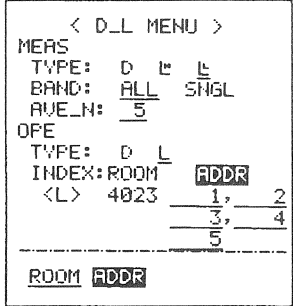
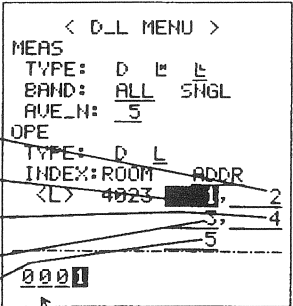
Step	Operation key	Description
26	↑ ↓	Move the M cursor to the room number display field.
27	Numeric keys	Enter "4023".
28	ENTER	Room number 4023 is chosen.
29	EXIT D_L	Return to the D_L measurement screen in the D_L measurement mode.
30	OPE	The measurement result is shown on the display.



Example for measurement result display

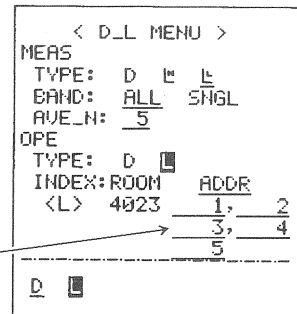
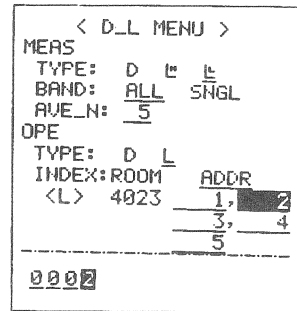
* The insulation factor is a value defined in JIS A 1419 for use in evaluating the insulation characteristics of buildings. For details, refer to the JIS documentation.

(2) Using Address Numbers

Step	Operation key	Description
1	MENU MENU	Select the D_L setup screen of the measurement parameter setting mode.
(Set operation type)		
2	↑ ↓	Move the M cursor to "OPE TYPE".
3	← →	Move the S cursor to "L".
4	ENTER	Calculation type is set to "light floor impact sound level".
		 <p>D_L setup screen</p>
(Set calculation by address number)		
5	↑ ↓	Move the M cursor to "INDEX".
6	← →	Move the S cursor to "ADDR".
7	ENTER	Calculation of light floor impact sound level will use address numbers.
		
8	↑ ↓	Move the M cursor to the address number display field ①.
		 <p>Address number display field ②</p> <p>Address number input field</p>

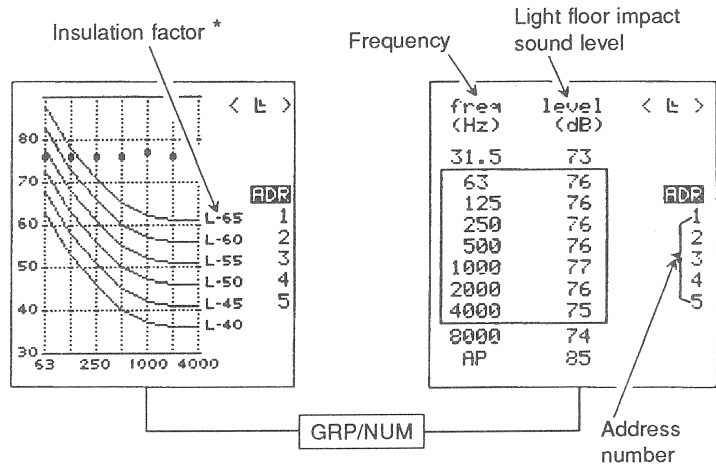


Step	Operation key	Description
9	Numeric keys	Enter "0001" in the address number input field.
10	ENTER	The address number 1 is set to ①.
11	↑ ↓	Move the M cursor to the address number display field ②.
12	Numeric keys	Enter "0002" in the address number input field.
13	ENTER	The address number 2 is set to ②.
14		Repeat steps 8, 9, and 10 to enter address numbers 3, 4, and 5 in the address number display fields ③, ④, and ⑤.
		Display example for input of address numbers
15	EXIT D_L	Return to the D_L measurement screen of the D_L measurement mode.
	↓	



Display example for input of address numbers

Step	Operation key	Description
16	OPE	The measurement result is shown on the display.



Example for measurement result display

* The insulation factor is a value defined in JIS A 1419 for use in evaluating the insulation characteristics of buildings. For details, refer to the JIS documentation.

Notes

SPECIAL FUNCTIONS

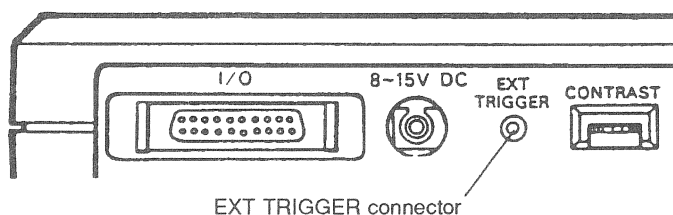
This section describes the various functions of this unit and gives usage examples.

Use of the Trigger	106
Storing Measurement Data	109
Superimposed Display of Stored and Current Data	111
Level-Time Display	112
Reverberation Time Estimate (Measurement)	114
Calculation of Power Average and Percentile Level	118
Reference Level Setting	123
Directory Screen Settings	125
Data Recording	129
Baud Rate Setting	132
Data Transfer to a Computer	133
Auto Power Off	134

◆ Use of the Trigger

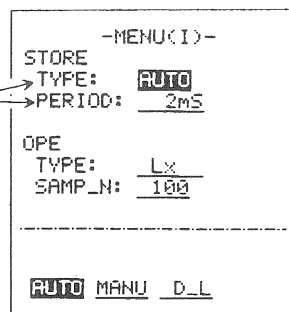
The NA-29 can use either an internal trigger (INT) or external trigger (EXT). The internal trigger monitors the sound level (or the all-pass level of the graphic frequency analysis screen). When this level exceeds the preset trigger level, the start of the following functions can be activated: continuous auto store; Lmax, Leq, and LAE calculation; or measurement data read-in in the D_L measurement mode.

The external trigger monitors the external trigger terminals. When these are shorted, the same functions as for internal trigger can be activated.
















The trigger function is set up as follows.

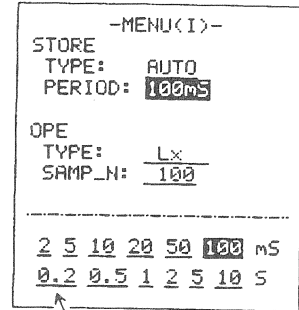
Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
(Select store type)		
2	↑ ↓	Move the M cursor to "STORE TYPE".
3	← →	Move the S cursor to "AUTO".
4	ENTER	Store type is set to "Auto".



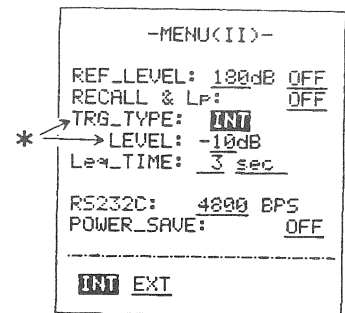
Setup screen I





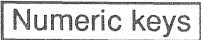



Step	Operation key	Description
(Select store period)		
5	 	Move the M cursor to "PERIOD". For Lmax, Leq, and LAE measurement, steps 5, 6, and 7 are not required.
6	 	Select a suitable store period (store interval) by moving the S cursor.
7		Selected store period is set.
8	 	Select setup screen II in the measurement parameter setting mode.
(Select trigger type)		
9	 	Move the M cursor to "TRG TYPE".
10	 	Move the S cursor to "INT" or "EXT".
11		Trigger type is set.
		

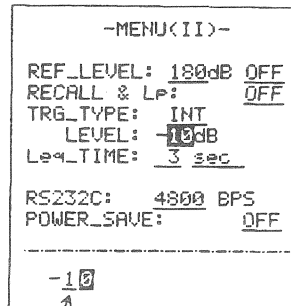


Store period



Setup screen II

Step	Operation key	Description
(Select trigger level)		
12	 	If "INT" was selected in step 10, move the M cursor to "LEVEL". If "EXT" was selected in step 10, steps 12, 13, and 14 are not required.
13		Enter value (trigger level) in 1-dB steps in the trigger level input field. This level indicates at how many dB below full-scale level the trigger is activated.
14		Trigger level is set.
15		Set to the sound level measurement screen in the sound level measurement mode.
16		Set trigger to ON.



Trigger level input field

Measurement with trigger can now be carried out.

◆ Storing Measurement Data

This unit provides three ways to store measurement data (except D_L data): manual (MANU), automatic (AUTO), and automatic with trigger.

- Manual Store

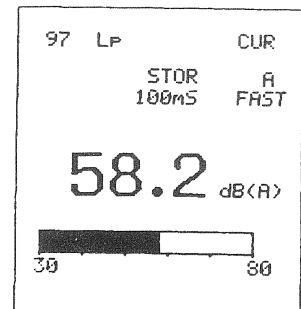
With each push of the **STOR** key, a screen of measurement data is stored in an address. Address numbers are then increased by one count.

- Auto Store

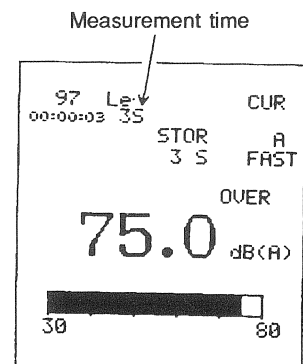
Measurement data are stored automatically at preset intervals, sequentially from address 1 to address 1500.

When the **STOR** key is pressed, displayed address number is reset to 1, all previously stored data are cleared, and the automatic store operation begins.

- If measurement data are sound level (Lp) data, up to 1500 screens are stored with the store period selected from setup screen I, or until the **STRT/STP** key is pressed.



- If measurement data are maximum sound level (Lmax), equivalent continuous sound level (Leq) and sound exposure level (LAE) data, up to 1500 screens are stored with the measurement time as selected from setup screen II, or until the **STRT/STP** key is pressed.



- Auto Store With Trigger

This function is activated by setting the store type to "Auto" from setup screen I and the trigger type to "INT" (and trigger level) or "EXT" from setup screen II. The trigger level is defined in dB below the full-scale point. When triggered, displayed address number is reset to 1, all previously stored data are cleared, and automatic store operation is carried out for up to 1500 screens or until the **STRT/STP** key is pressed.

- Storing D_L Data

Data measured in the D_L measurement mode can be stored as an entire set by pressing the **[STOR]** key. A set can consist of data for two rooms (averaged SPL difference between two rooms), or data of several measurements at one point (floor impact sound level). After data have been stored, the address number is increased by one count. Up to a maximum of 250 D_L data sets can be stored in the memory. The address numbering convention for averaged SPL difference between two rooms and floor impact sound level differs from the other operation modes.

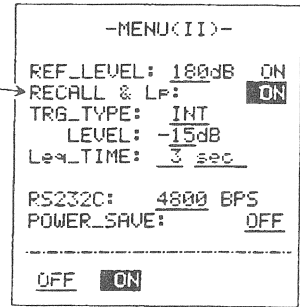
Measurement data	Address numbers
• Averaged SPL difference between two rooms	1D - 250D
• Floor impact sound level	1L - 250L

Note: When D_L data are entered into the memory while Lmax, Leq, and LAE data are already stored in the unit, all previous data are erased. The reverse also applies.

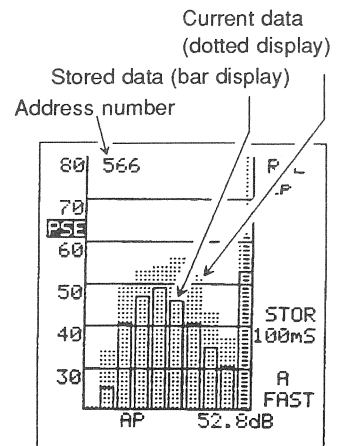
◆ Superimposed Display of Stored and Current Data

If the data stored in memory are frequency analysis data, it is possible to show stored data and current data on the same screen.

Step	Operation key	Description
1	MENU MENU	Select setup screen II in the measurement parameter setting mode.
2	↑ ↓	Move the M cursor to "RECALL & Lp".
3	← →	Move the S cursor to "ON".
4	ENTER	The mode for superimposed display of stored and current data is activated.
5	EXIT GRP/NUM	Select the graphic frequency analysis screen of the sound level measurement mode.
6	RCL	Activate the recall mode.
7	UP DOWN ADDRESS	Select the address number of the data you wish to recall. The data in that address and the current data are displayed together. The current data are shown according to the measurement parameters of the stored data.
8		To terminate the superimposed display function, set "RECALL & Lp" to "OFF".



Setup screen II

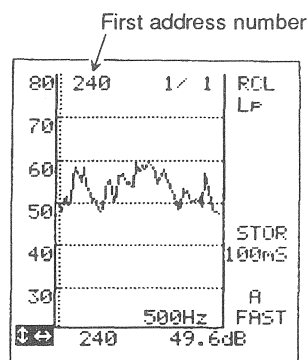


Recall mode screen

◆ Level-Time Display

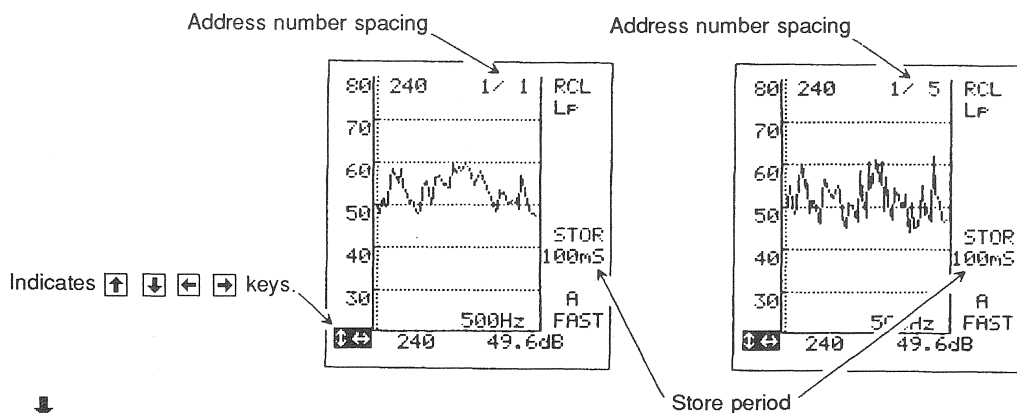
When the stored data are the graphic frequency analysis data using automatic store, the chronological change of level of any band (from 31.5 to 8000 Hz and all-pass) can be displayed. (This function is not available for manual store.) This function permits for example to estimate the reverberation time.





Step	Operation key	Description
1	RCL L_F/L_T	Select the level-time screen in the recall mode.
2	UP DOWN ADDRESS	Select the address number of the first (leftmost) data.

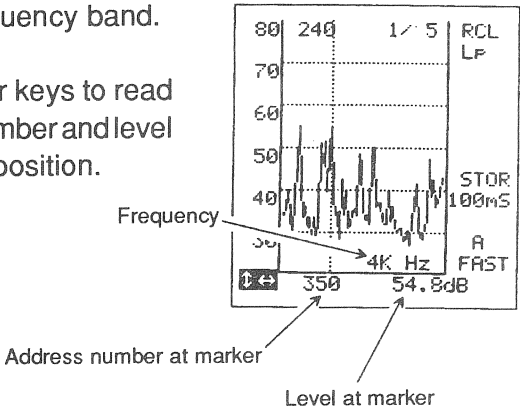



Level-time screen

- 3 **UP** **DOWN** Select the address number spacing. Five settings are possible: 1/1, 1/2, 1/5, 1/10, 1/20. Each screen consists of 75 data. Examples for 1/1 and 1/5 are shown below.

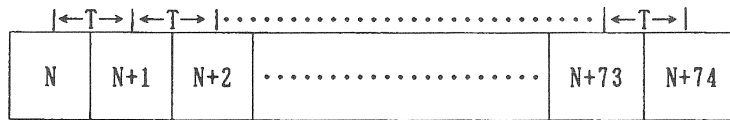


Step	Operation key	Description
4	 	Select the frequency band.
5	  MARKER	Use the marker keys to read the address number and level at the marker position.



 The chart below shows the relation on a time axis between the selected address number spacing and the displayed data.

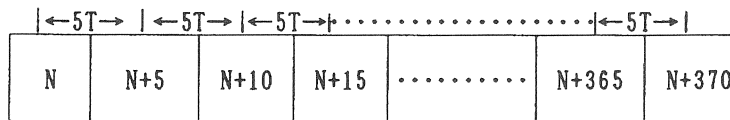
- Spacing 1/1



75 display data

T: Store period
N: First address number

- Spacing 1/5



75 display data

5T: Store period x 5
N: First address number

◆ **Reverberation Time Estimate (Measurement)**

The reverberation time is defined as the time required for the sound level to fall by 60 dB in a room after a continuous tone has ceased. As measurement of 60-dB attenuation is quite difficult, the 30-dB attenuation time is often multiplied by the factor 2.

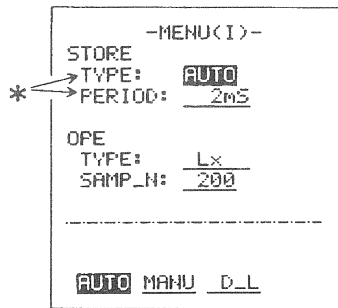
Install a sound source speaker facing a wall

Normally, band noise (octave band or 1/3-octave band) or a warble tone is used as sound source. The following example employs full-band pink noise.

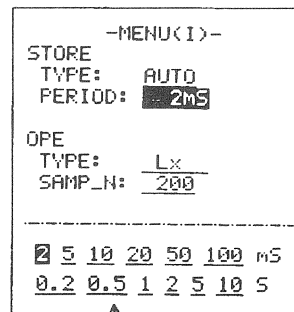
Install the microphone in the center of the room.

Perform the measurement as follows.

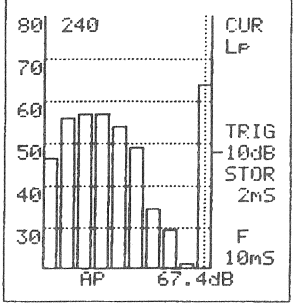

Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
(Select store type)		
2	↑ ↓	Move the M cursor to "STORE TYPE".
3	← →	Move the S cursor to "AUTO".
4	ENTER	Store type is set to "Auto".
(Select store period)		
5	↑ ↓	Move the M cursor to "PERIOD".
6	← →	Select a suitable store period (store interval) by moving the S cursor. This example uses 2 ms.
	↓	



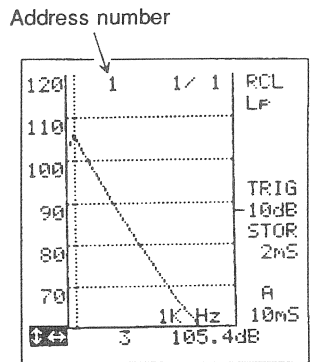
Setup screen I



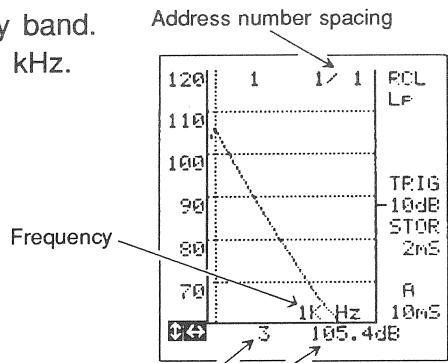
Store period

Step	Operation key	Description
7	ENTER	Store period of 2 ms is set.
8	EXIT OCT/SLM	Select the graphic frequency analysis screen in the sound level measurement mode.
9		Activate the sound source speaker.
10	UP DOWN LEVEL RANGE	Select level range (about -5 to -10 dB from full-scale level in all-pass band).
11	A/C/F	Set frequency weighting to "F".
12	TIME CONST	Set time constant to "10 ms".
13	STOR	Press STOR key simultaneously with stopping the sound from the speaker. The address number is reset to 1, all previously stored data are cleared, and store starts automatically. When the address number 1500 is reached, store is terminated automatically.
		
		<p> As the store period was set to 2 ms in step 7, the maximum time for store is 3 seconds (1500 x 2 ms).</p>
14	EXIT	Return to the frequency analysis screen in the sound level measurement mode.
	↓	



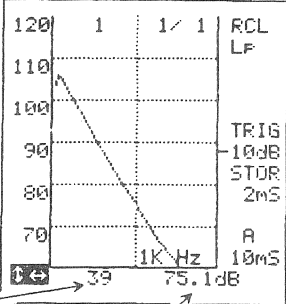
Step	Operation key	Description
15	RCL L_F/L_T	Select the level-time screen from the recall mode.
16	UP DOWN ADDRESS	Set address number to 1.
17	↑ ↓	Select the address number spacing. Five settings are possible: 1/1, 1/2, 1/5, 1/10, 1/20. Each screen consists of 75 data. This example uses 1/1.
18	← →	Select the frequency band. This example uses 1 kHz.
19	← → MARKER	Use the marker keys to shift the marker to the left edge of the attenuation curve on the level-time screen. Read the address number and the level at this point.



Level-time screen



Address number at marker

Step	Operation key	Description
20	  MARKER	<p>Move the marker to a point 30 dB below the point read in step 19 (105.4 dB). Read the address number at this point.</p>  <p>Address number at marker → 39</p> <p>Level at marker → 75.1 dB</p>

Determine the reverberation time according to the formula below.

$$\text{Reverberation time} = (B - A) \times T \times 2$$

A: First address number ("3" in step 19)

B: Address number at point of 30-dB attenuation ("39" in step 20)

T: Store period ("0.002" in step 7)

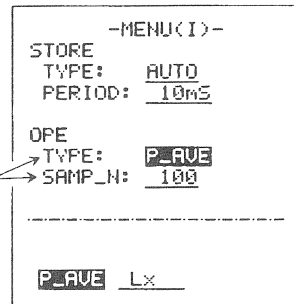
$$\text{Reverberation time} = (39 - 3) \times 0.002 \times 2 = 0.144 \text{ seconds}$$

◆ **Calculation of Power Average and Percentile Level**

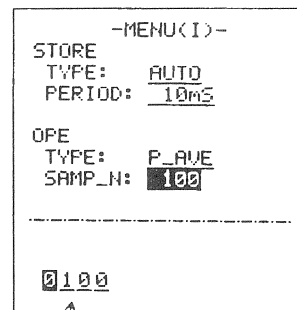
Frequency analysis data stored with the auto store function can be used to calculate the power average, percentile level L_x (L₅, L₁₀, L₅₀, L₉₀, L₉₅) and Leq. This function is not available if data were stored manually.

• Power Average (P_AVE)

Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
2	↑ ↓	Move the M cursor to "OPE TYPE".
3	← →	Move the S cursor to "P_AVE".
4	ENTER	Operation type is set to "power average".
5	↑ ↓	Move the M cursor to "SAMP_N".
6	Numeric keys	Enter the number of data (from 1 to 1500 in steps of 1 data) in the data number input field.
7	ENTER	The selected number is entered.
8	EXIT	Return to the sound level measurement screen of the sound level measurement mode.
↓		

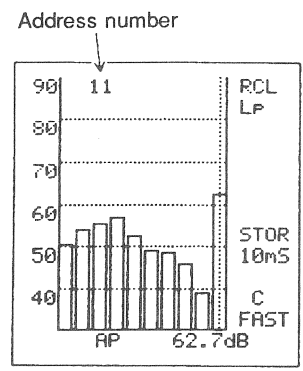


Setup screen I

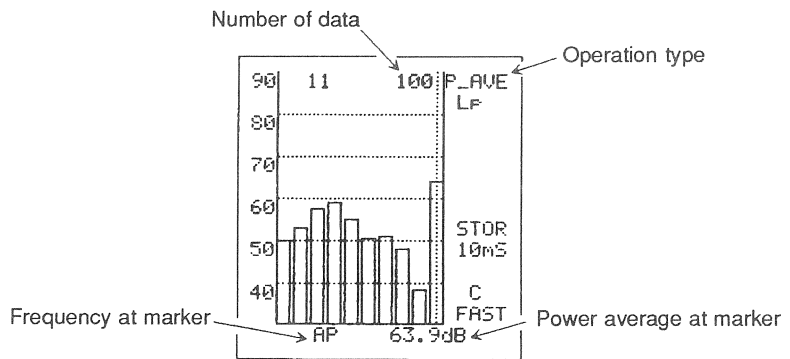


Data number input field


Step	Operation key	Description
9	RCL	Select the recall mode.
10	UP DOWN ADDRESS	Select the first address for processing.
11	OPE	Power average is displayed for the number of data set in step 7, starting with the address set in step 10.



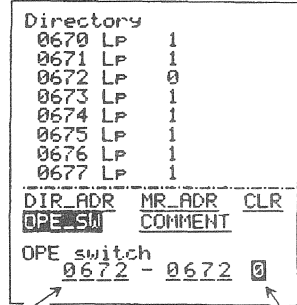
Recall screen



Power average display example

 If there are data which you want to exclude, the directory screen can be used even after activating the recall mode to specify the addresses to be excluded. See next page for details.

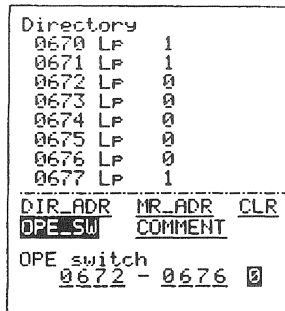
Step	Operation key	Description
1	DIR	Select the directory screen.
2	↑ ↓	Move the M cursor to "OPE_SW".
3	Numeric keys	Enter the address numbers for data to be excluded, using a "0" as suffix (exclude from processing).
4	ENTER	The address number range and "0" setting is entered. The number of data set in step 7 on page 118 decreases by the number of data to be excluded.
5	EXIT	Return to recall mode.



Address number input field

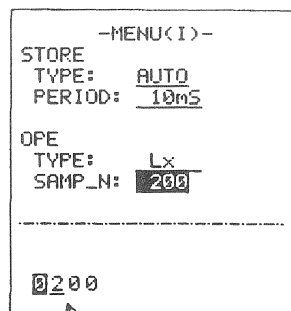
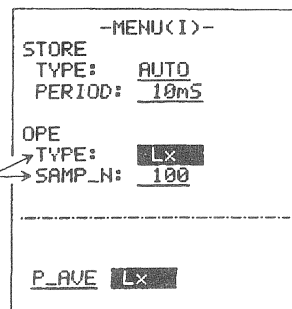
Exclude from processing

The illustration shows an example where data 672 to 676 are excluded from processing.



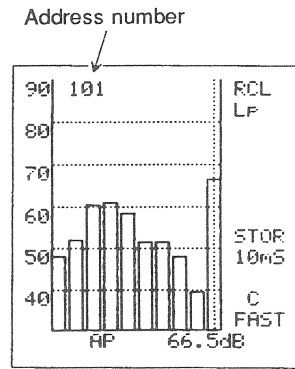
• Percentile level (Lx)

Step	Operation key	Description
1	MENU MENU	Select setup screen I in the measurement parameter setting mode.
2	↑ ↓	Move the M cursor to "OPE TYPE".
3	← →	Move the S cursor to "Lx".
4	ENTER	Operation type is set to "percentile level".
5	↑ ↓	Move the M cursor to "SAMP_N".
6	Numeric keys	Enter the number of data (from 100 to 1500 in steps of 100 data) in the data number input field.
7	ENTER	The selected number is entered.
8	EXIT	Return to the sound level measurement screen in the sound level measurement mode.
	↓	

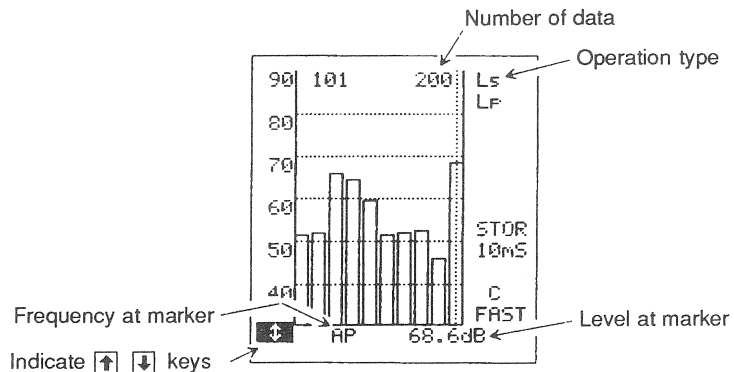


Data number input field

Step	Operation key	Description
9	RCL	Select the recall mode.
10	UP DOWN ADDRESS	Select the first address for processing.
11	OPE	Percentile level is displayed for the number of data set in step 7, starting with the address set in step 10.
12	UP DOWN MARKER	Move the marker to the frequency to be read.
13	↑ ↓	Press the keys to read the percentile level (L ₅ , L ₁₀ , L ₅₀ , L ₉₀ , L ₉₅) and Leq level.



Recall screen



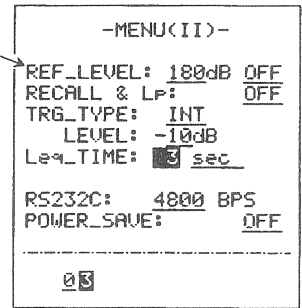
Example for L₅

◆ Reference Level Setting

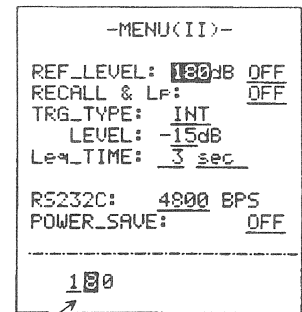
The reference level is used to convert the vertical scale value for the graphic frequency analysis screen in the sound level measurement mode.

The reference level can be set as follows.

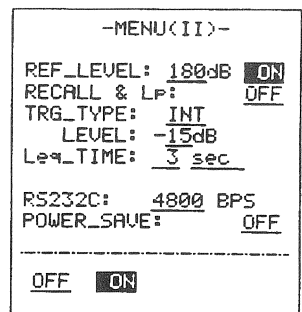
Step	Operation key	Description
1	MENU MENU	Select setup screen II in the measurement parameter setting mode. *
2	↑ ↓	Move the M cursor to the level indication in the "REF_LEVEL" field.
3	Numeric keys	Enter the desired reference level (full-scale value, 70 to 200 dB in 10-dB steps) in the reference level input field.
4	ENTER	The reference level is entered.
5	↑ ↓	Move the M cursor to the ON/OFF indication in the "REF_LEVEL" field.
6	← →	Move the S cursor to "ON".
7	ENTER	The reference level becomes active.
	↓	



Setup screen II

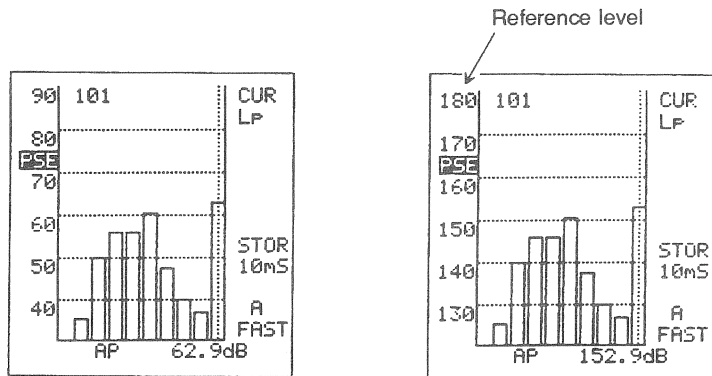


Reference level input field



Step	Operation key	Description
8	EXIT OCT/SLM	Return to the graphic frequency analysis screen in the sound level measurement mode.

The display is shown with the reference level. The examples below show the display not using reference level (left) and using reference level of 180 dB (right).



- 9 To cancel the display with reference level, choose the "OFF" setting in steps 6 and 7.

◆ Directory Screen Settings

The directory screen can be used to set various parameters. The display shown when the **DIR** key is pressed differs, depending on the data which displayed address currently contains.

- Jump to specified address (DIR_ADR)
- Display specified address (MR_ADR)
- Clear stored data (CLR)
- Choose data to be excluded from processing (OPE_SW)
- Input comments (COMMENT)
- Set room numbers for D_L measurement data (D_L ROOM)

```

Directory
0670 LP 1
0671 LP 1
0672 LP 0
0673 LP 1
0674 LP 1
0675 LP 1
0676 LP 1
0677 LP 1
-----
DIR_ADR MR_ADR CLR
OPE_SW COMMENT
OPE switch
0672 - 0672 0

```

Example for sound level
measurement data

```

Directory
0001# -
0002# -
0003# -
0004# -
0005# -
0006 *
0007 *
0008 *
-----
DIR_ADR MR_ADR CLR
D_L ROOM COMMENT
D_L ROOM
001# -

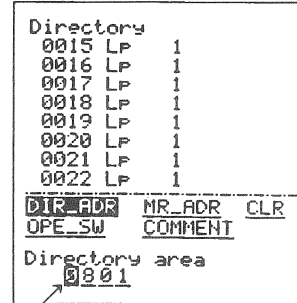
```

Example for D_L
measurement data

- Jump to specified address (DIR_ADR)

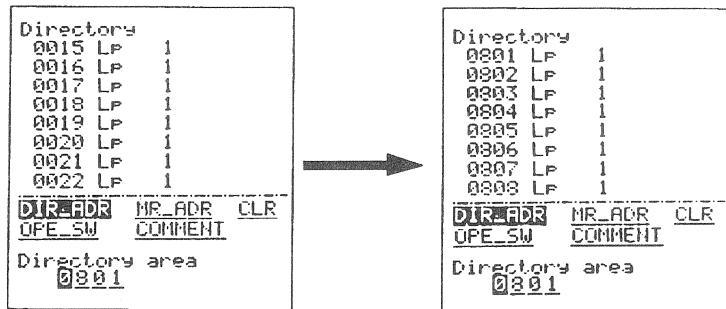
To change address number currently displayed on the screen, the marker keys are normally used. If the desired address number is far removed from the currently displayed number, selecting the number by this method takes time (about 20 seconds to move by 100 address numbers). In such a case, the directory screen can be used to jump directly to any desired address, as described below.

Step	Operation key	Description
1	DIR	Select the directory screen.
2	↑ ↓	Move the M cursor to "DIR_ADR".
3	Numeric keys	Enter the address number in the address number input field.
4	ENTER	The new address number is entered. Eight address numbers starting from the selected one are displayed.



Address number input field

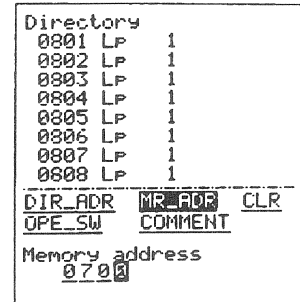
Directory screen



Example: Move from address number 15 to 801

• **Display stored data in specified address (MR_ADR)**

To display stored data in a desired address in the recall mode, the address number can be set with the directory screen. Follow the steps described on page 28 or 45.

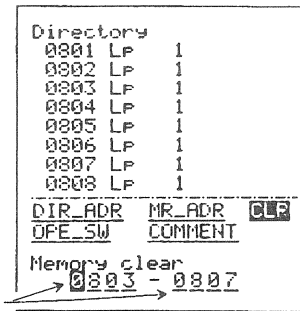


Directory screen

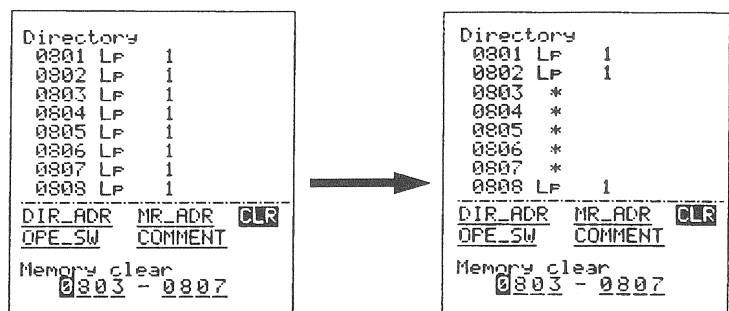
• **Clear stored data (CLR)**

The directory screen can be used to clear data from any address.

Step	Operation key	Description
1	DIR	Select the directory screen.
2	↑ ↓	Move the M cursor to "CLR".
3	Numeric keys	Enter the range of addresses to be cleared in the address number input field.
4	ENTER	The data in the selected address range are cleared.



Directory screen



Example: Clear data from addresses 803 to 807

• **Choose data to be excluded from processing (OPE_SW)**

When calculating the power average from stored frequency analysis data, any range of data can be excluded from processing, using the directory screen. The illustration at right shows an example for excluding addresses 0672 to 0676.

For operation steps, refer to page 120.

Directory		
0670 LP	1	
0671 LP	1	
0672 LP	0	
0673 LP	0	
0674 LP	0	
0675 LP	0	
0676 LP	0	
0677 LP	1	

<u>DIR_ADR</u>	<u>MR_ADR</u>	<u>CLR</u>
<u>OPE_SW</u>	<u>COMMENT</u>	
OPE switch		
0672 - 0676	0	

• **Input comments (COMMENT)**

The directory screen can be used to add a comment to any address. The illustration at right shows an example for adding measurement point numbers to addresses 0081 to 0083.

For operation steps, refer to page 25 or 42.

Directory		
0081 LP	1	MF007
0082 LP	1	MF008
0083 LP	1	MF009
0084 LP	1	
0085 LP	1	
0086 LP	1	
0087 LP	1	
0088 LP	1	

<u>DIR_ADR</u>	<u>MR_ADR</u>	<u>CLR</u>
<u>OPE_SW</u>	<u>COMMENT</u>	
COMMENT		
0083:	MF009	

• **Set room numbers for D_L data (D_L ROOM)**

The directory screen can be used to add room numbers to stored D_L data, to permit display of measurement results by room number. The illustration at right shows an example for adding room numbers 1133-S and 1133-R to addresses 0001D and 0002D.

For operation steps, refer to page 59 or 78.

Directory		
0001D1133_S		
0002D1133_R		
0003 *		
0004 *		
0005 *		
0006 *		
0007 *		
0008 *		

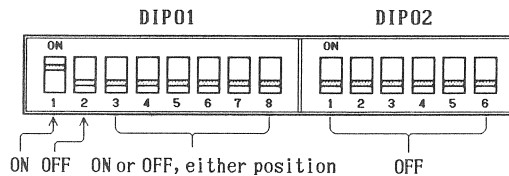
<u>DIR_ADR</u>	<u>MR_ADR</u>	<u>CLR</u>
<u>D_L_ROOM</u>	<u>COMMENT</u>	
D_L ROOM		
002D	1133-R	

◆ Data Recording

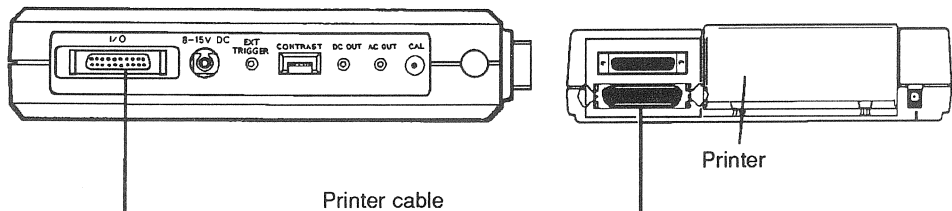
• Printing Display Screens With a Printer

The screen displays of the NA-29 can be printed out by the optional printer CP-10. All screens shown in this instruction manual were printed in this way. For details on use of the printer, please refer to the instruction manual of the printer.

Step	Description
1	Set the function selection dipswitches DIP01 and DIP02 of the printer as shown below.



- 2 Connect the parallel interface connector of the printer to the I/O connector on the NA-29, using the printer cable CC-81 (supplied with the printer).



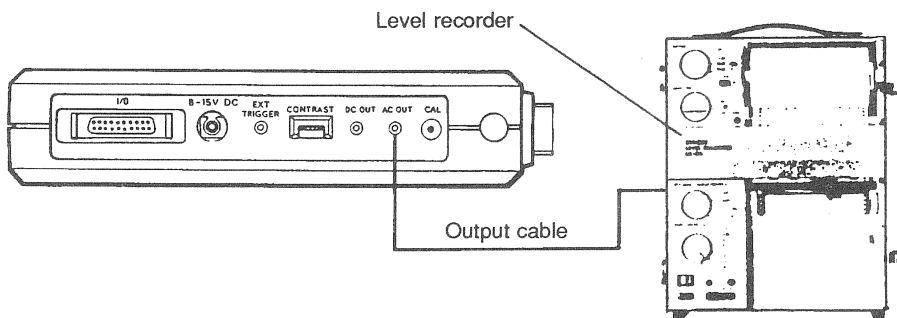
- 3 Turn the printer on and set it to the on-line condition.
- 4 Operate the NA-29, so that the information you want to print out is shown on the display.
- 5 Press the **PRINT** key.
The screen display is printed out.

Note: When printout is finished, first press the **PWR** key of the NA-29 to turn the unit off before switching off the printer.

• **Using a Level Recorder**

The NA-29 incorporates an AC output which provides a signal that corresponds to the current sound level. This signal can be used to drive an analog level recorder, such as the optional LR-04. For details on use of the level recorder, please refer to the instruction manual of the recorder.

Step	Description
1	Connect the input connector of the level recorder to the AC OUT connector on the NA-29, using supplied output cable CC-24.

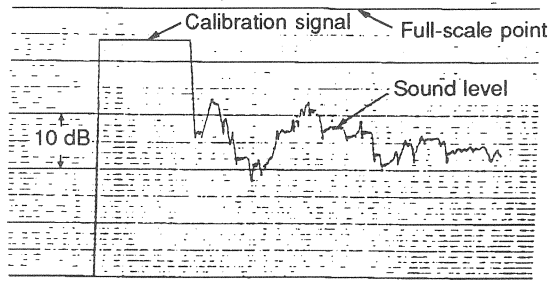


- 2 Set the NA-29 to the sound level measurement screen in the calibration mode by pressing the **CAL** key. A calibration signal (1000 Hz, 1.5 Vrms, corresponding to 94 dB) is supplied at the AC OUT connector.
- 3 Set the level recorder to the recording mode and record the calibration signal for a suitable length of time at a position -6 dB from full scale. This position becomes the 94-dB point.
- 4 Press the **CAL** key of the NA-29 to return the unit to the sound level measurement mode.
- 5 Select a level range with the LEVEL RANGE keys.

The full-scale point of the level recorder paper now corresponds to this range. If the level range is changed during the measurement, this should be noted on the level recorder paper.



Step	Description
6	To terminate data recording, stop the recorder.

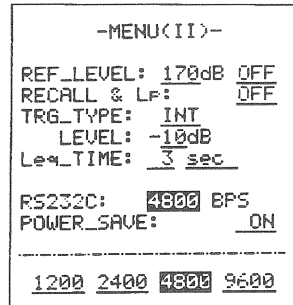


Level recorder print example

◆ **Baud Rate Setting**

When sending data to a computer via the RS-232-C interface of the NA-29, set the baud rate as follows.

Step	Operation key	Description
1	MENU MENU	Select setup screen II in the measurement parameter setting mode.
2	↑ ↓	Move the M cursor to "RS232C".
3	← →	Move the S cursor to the same baud rate setting as chosen at the computer.
4	ENTER	The selected baud rate becomes active.
5	EXIT	Return to the sound level measurement screen of the sound level measurement mode.
↓	OCT/SLM	



Setup screen II

◆ Data Transfer to a Computer

Using the RS-232-C interface of the NA-29, measurement data can be sent to a computer, and measurement parameters of the NA-29 can be set from the computer. However, baud rate setting, setup screen display, and directory screen display cannot be carried out at the computer.

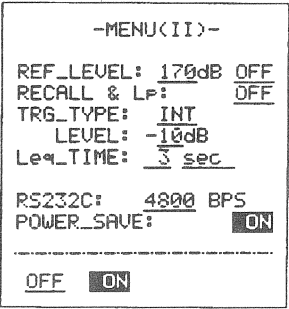
For a detailed listing of available commands and procedures for data transfer, please refer to the separate instruction manual "RS-232-C interface for NA-29".

For connection to the computer, use the optional connecting cable CC-80.

◆ **Auto Power Off**

This function helps to conserve battery power by turning the unit off automatically when no key was operated for about 10 minutes.

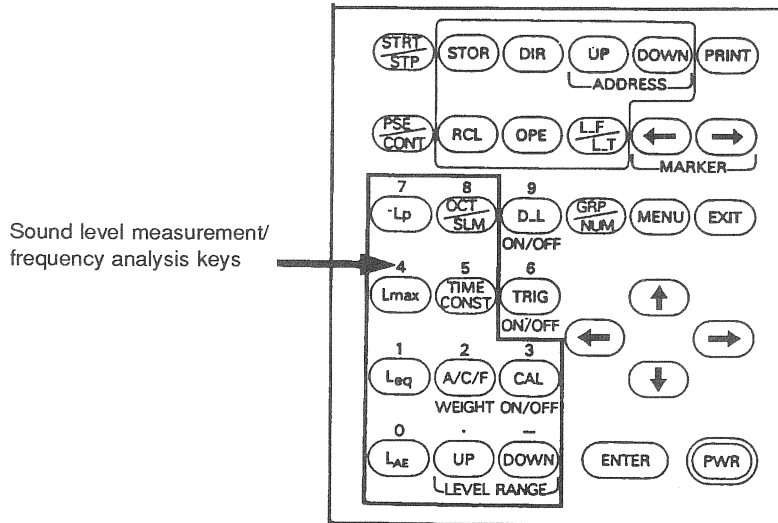
Step	Operation key	Description
1	MENU MENU	Select setup screen II in the measurement parameter setting mode.
2	↑ ↓	Move the M cursor to "POWER_SAVE".
3	← →	Move the S cursor to "ON".
4	ENTER	The power save function becomes active.
5	EXIT OCT/SLM	Return to the sound level measurement screen of the sound level measurement mode.
6		To cancel the power save function, choose the "OFF" setting in step 3.



Setup screen II

CONTROLS AND FUNCTIONS

◆ Front Panel

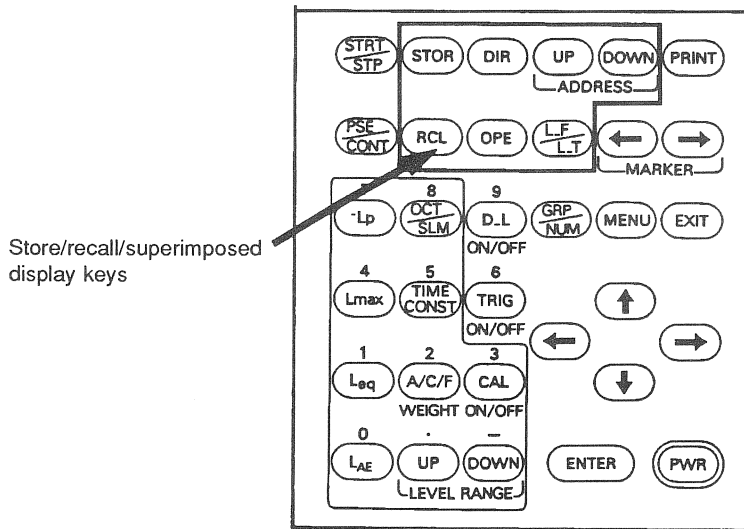


- Lp** : Selects instantaneous sound level (Lp) measurement. Also serves as numeral "7" key for setting of measurement parameters.
- Lmax** : Selects maximum sound level (Lmax) measurement. Also serves as numeral "4" key for setting of measurement parameters.
- Leq** : Selects equivalent continuous sound level (Leq) measurement. Also serves as numeral "1" key for setting of measurement parameters.
- LAE** : Selects sound exposure level (LAE) measurement. Also serves as numeral "0" key for setting of measurement parameters.
- OCT/SLM** : Toggles between frequency analysis and sound level measurement for the display. Also serves as numeral "8" key for setting of measurement parameters.
- TIME CONST** : Selects the time constant of the RMS detector circuit (FAST, SLOW, or 10 ms). Also serves as numeral "5" key for setting of measurement parameters.

A/C/F : Selects the frequency weighting characteristic (A, C, or F). Also serves as numeral "2" key for setting of measurement parameters.

CAL : Toggles between calibration mode and measurement mode. Also serves as numeral "3" key for setting of measurement parameters.

UP DOWN : Select the level range. Also serve as "." and "-" keys for setting of LEVEL RANGE of measurement parameters.



STOR : Stores measurement data.

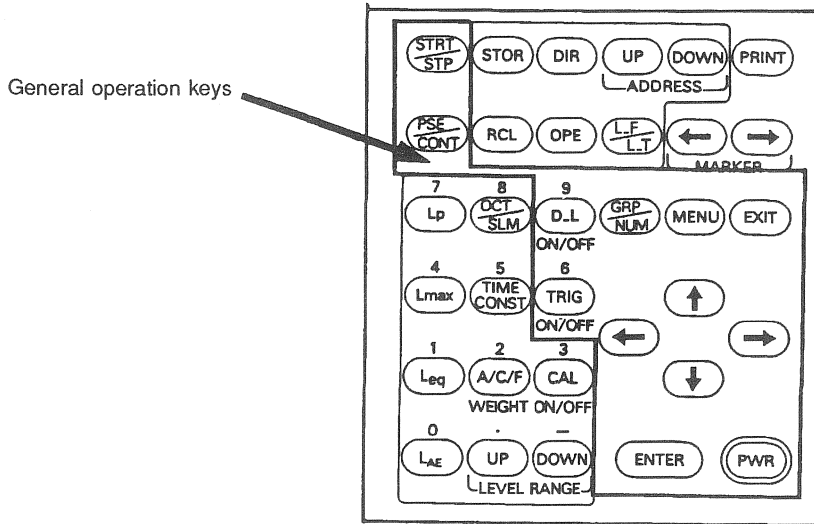
RCL : Recalls measurement data.

DIR : Calls up directory screen.

OPE : Displays processing results.

UP DOWN : Select address numbers.
ADDRESS

L_F/L_T : Toggles between level-frequency and level-time for display of recalled data.



STRT/STP : Serves to start and stop Lmax, Leq, and LAE processing and to stop the data store function.

PSE/CONT : This key has the following functions:







- Pause or resume the Lmax, Leq, and LAE calculation.
- Activate or release the hold function for instantaneous data display.
- Pause or resume the data store function.

D_L : Activates the D_L measurement screen. Also serves as numeral "9" key for setting of measurement parameters.

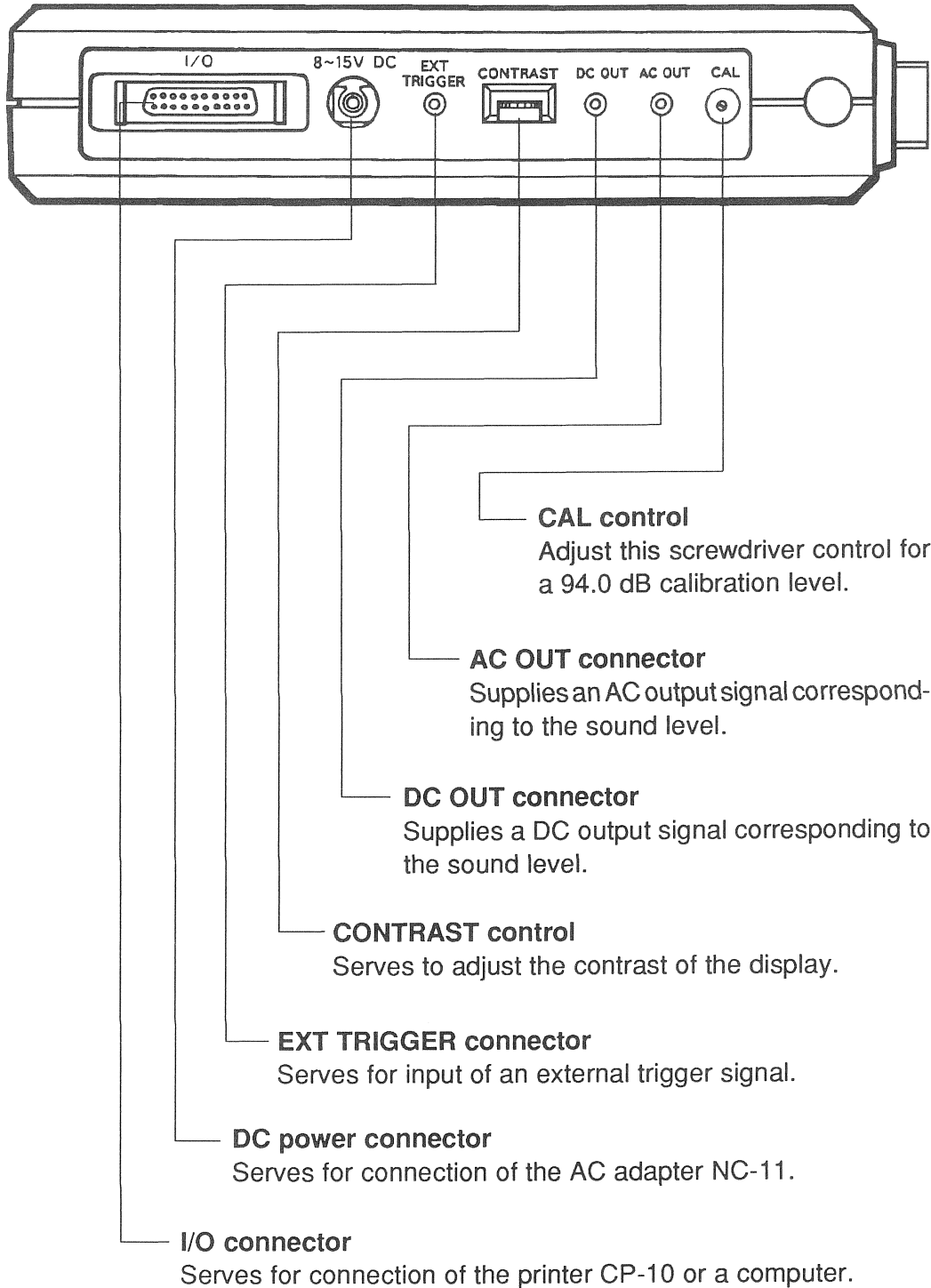
TRIG : Activates the trigger function. Also serves as numeral "6" key for setting of measurement parameters.

GRP/NUM : Toggles between graphic display and numerical display for the frequency analysis screen.

MENU : Calls up the setup screens.

- EXIT** : Serves to return to the measurement mode or D_L measurement mode from a setup or recall data screen.
- PRINT** : Initiates printout of display data on the optional printer CP-10.
- MARKER**   : Serve to shift the marker. The keys are also used to select alphabet letters for comment entry in the directory screen.
-     : Serve to select parameters on the setup screens and to select frequency band and address number spacing when recalling data.
- ENTER** : Serves to enter selected measurement parameters.
- PWR** : Turns the unit on and off.

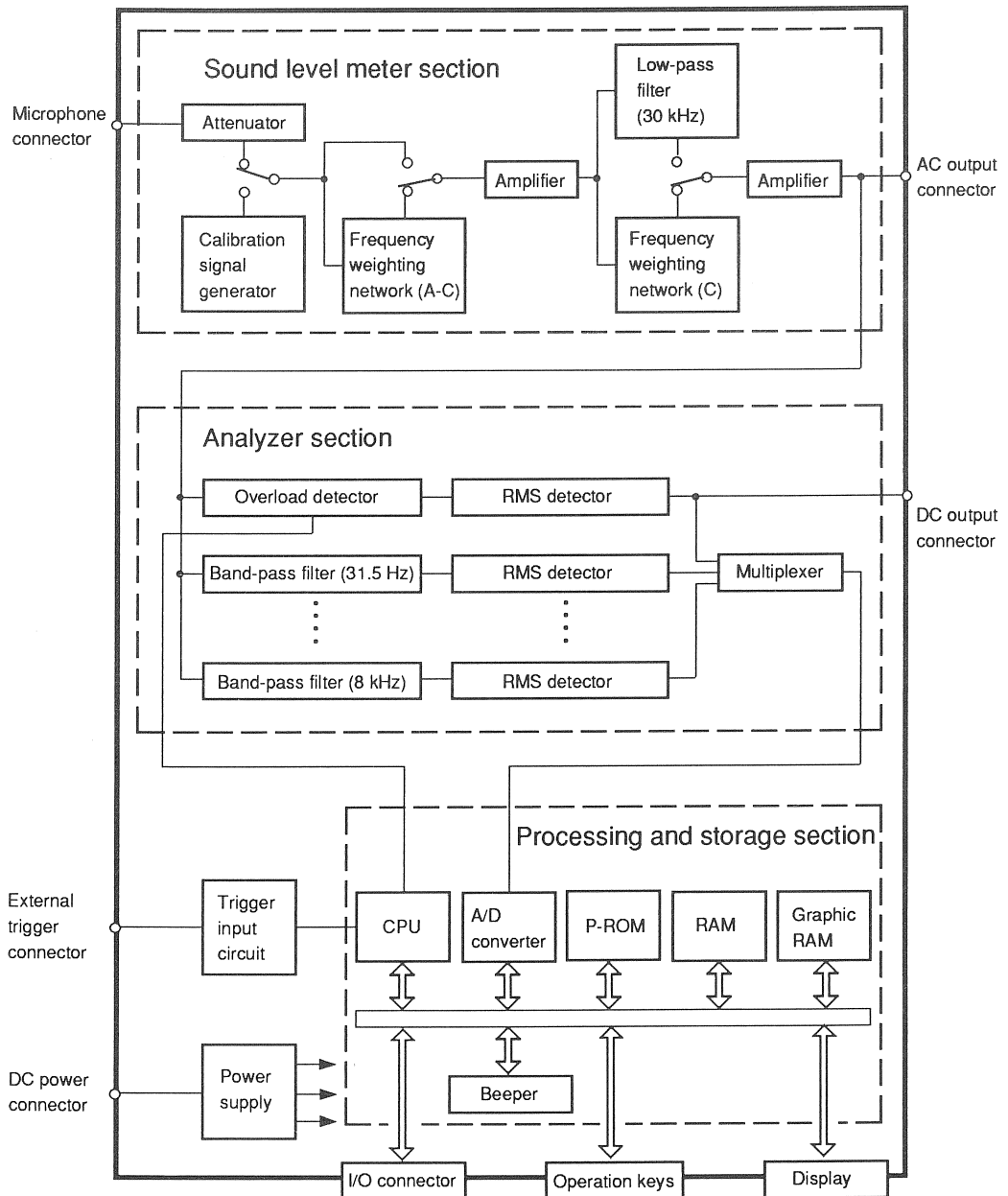
◆ Rear Panel



Notes

SPECIFICATIONS

◆ Block Diagram



• **Sound level meter section**

Applicable standards	NA-29: IEC 651 Type 2, JIS C 1502 NA-29E: IEC 651 Type 1, JIS C 1505
Measurement level range (according to IEC 651)	NA-29: 27 to 130 dB (A), 32 to 130 dB (C), 35 to 130 dB (FLAT) NA-29E: 25 to 130 dB (A), 32 to 130 dB (C), 35 to 130 dB (FLAT)
Internal noise level	5 dB below lower measurement limit
Frequency range	NA-29: 20 to 8000 Hz NA-29E: 20 to 12500 Hz
Frequency weighting network	FLAT, A, C characteristics
Microphone	NA-29: Electret condenser microphone UC-52 NA-29E: Electret condenser microphone UC-53
Time constant (time weighting)	Fast, slow, 10 ms
Detector circuit	True RMS Accuracy within 0.1 dB at crest factor 2, within 0.5 dB at crest factor 3
Dynamic range	50 dB
Level range settings	20 to 70, 30 to 80, 40 to 90, 50 to 100, 60 to 110, 70 to 120, 80 to 130, 90 to 140 dB
Display	
Sound level display	4-digit LCD, resolution 0.1 dB, update ratio 1 s
Overload	“OVER” appears at +7 dB over full-scale point in each range
Underload	“UNDER” appears at level below lower meas- urement limit in each range

Low battery	Two-step display, "LOW" when battery voltage falls to 9 V and "EMPTY" when voltage falls to 8 V
Calibration	Electrical calibration with built-in signal oscillator (sine wave, 1000 Hz)
• Analyzer section	
Applicable standards	IEC 225
Analysis center frequencies	31.5 to 8000 Hz (nine 1/1 octave bands)
Dynamic range	66 dB
Resolution	0.1 dB
Overload level	Full-scale +7 dB
Linearity	0.5 dB at -30 dB from full-scale 0.5 dB at -40 dB from full-scale 0.5 dB at -50 dB from full-scale 1.5 dB at -60 dB from full-scale
• Trigger section	
Internal trigger	Start processing or store operation when all-pass level exceeds trigger level.
External trigger	Start processing or store operation when external trigger terminals are shorted.
• Processing section	
Processing operations	Lmax, Leq, LAE
Measurement time	1 to 59 seconds, 1 to 59 minutes, 1 to 24 hours, selectable
Processing pause function	Yes
Sampling period	10 ms

• **Memory section**

Capacity	1500 screens
Store period	2 ms to 10 s (2, 5, 10 units)
Memory processing	Power average, Lx (L5, L10, L50, L90, L95), and Leq, chronological level change for each band

• **I/O section**

AC output connector	
Output impedance	Approx. 600 Ω
Load impedance	Above 10 k Ω
Output voltage	NA-29: 3 Vrms for full-scale point in each range NA-29E: 2.5 Vrms for full-scale point in each range

DC output connector	
Output impedance	Approx. 50 Ω
Load impedance	Above 10 k Ω
Output voltage	3 V (0.5 V/10 dB) for full-scale point in each range

RS-232-C interface	
Flow control	Yes
Transmission configuration	Half-duplex
Data word length	8 bit
Start bit	1
Stop bit	2
Parity check	None
Baud rate	1200, 2400, 4800, 9600 bps

• **Power supply**

IEC R6 (size AA) batteries x 8, battery life 4 hours minimum (continuous operation)

Optional AC adapter NC-11

- **Ambient conditions for operation**

0 to 40 °C, 10 to 90% relative humidity

- **Dimensions, Weight**

Dimensions: Approx. 20.0 (H) x 10.5 (W) x 4.1 (D) cm

Weight: Approx. 750 g

- **Supplied accessories**

Electret condenser microphone (with preamplifier) UC-52 for NA-29, UC-53 for NA-29E	1
Microphone holder UA-90	1
Wind screen WS-10	1
Output cable CC-24	1
IEC LR6 battery	8
Lithium battery CR-1/3N	1
Miniature screwdriver	1
Miniature phono plug	1
Soft carrying case	1
Instruction manual (main unit, RS-232-C interface)	1 set

