

INSTRUCTION MANUAL

**ENVIRONMENTAL SOUND MONITOR
(AN-37 correspondence)**

NA-37



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<http://www.rion.co.jp/english/>

Organization of this manual

This manual describes the features, operation, and other aspects of the Environmental Sound Monitor NA-37. If the unit is used together with other equipment to configure a measurement system, consult the documentation of all other components as well to ensure safety and accuracy.

The following pages contain important information about safety. Be sure to read and observe these in full.

This manual contains the following sections.

Outline

Gives basic information about the unit.

Names of Parts and Functions

Briefly identifies and explains the panel indicators, connectors, and other parts of the unit.

Preparations

Explains how to make connections to other system components.

Installation

Provides information and precautions to observe with regard to installation of the microphone and the unit itself.

Operation

Explains how to turn the unit on and perform other operation steps.

Maintenance

Explains maintenance procedures for long-term use of the unit.

Specifications

Lists the technical specifications of the unit and option units.

* All company names and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

FOR SAFETY

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

⚠ WARNING	Disregarding instructions printed here incurs the risk of death or severe injury to persons.
●	

⚠ Caution	Disregarding instructions printed here incurs the risk of injury to persons and/or damage to peripheral equipment.
●	

Important	Disregarding instructions printed here incurs the risk of damage to the unit.
●	



Note	Mentioned about the tips to use this unit properly. (This messages do not have to do with safety.)
●	

Precautions

- Operate the unit only as described in this manual.
- Observe the following precautions regarding storage and use of the unit.
 - Do not use or store the unit in locations where the permissible ambient temperature and humidity range (-10°C to +50°C, 10% to 90% RH) may be exceeded.
 - Do not use or store the unit in locations where condensation due to sudden changes in temperature may occur.
 - Do not use or store the unit in locations where the unit may be subject to splashes of water or other liquids.
 - Do not use or store the unit in locations where the unit may be subject to air with salt or sulphur content or to the influence of chemicals or gases.
 - Do not use or store the unit in locations that are not level or that do not provide stable support.
 - Do not use or store the unit in locations where the unit may be subject to shocks or vibrations.
- Before use, make sure that all connections are properly and safely established. Do not bend cables sharply or otherwise subject them to stress. When disconnecting cables, always hold the plug or connector and do not pull the cable.
- Power the unit only from a source that conforms to the requirements stated in the “Specifications” section. The source should be stable, with low voltage fluctuations and low electrical noise. Excessive electrical noise or voltage fluctuations can cause malfunction or damage to the unit.
- Use a 3-prong AC outlet to provide proper grounding for the unit. Otherwise there is a risk of electric shock when connecting the power.
- Make sure that the plug of the power cord is always accessible, so that it can be quickly disconnected from the AC outlet in case of an emergency. Do not block the vicinity of the AC outlet with any objects.

- Do not attempt to disassemble or modify the unit. In case of malfunction, do not attempt any repairs. Note the condition of the unit clearly and contact the supplier.
- Clean the unit only by wiping it with a soft, dry cloth or, when necessary, with a cloth lightly moistened with water.
Please make sure not to erase the printings, paintings, and markings when cleaning the unit. Do not use any solvents, cleaning alcohol or chemical cleaning agents.
- The LCD panel of the unit can easily become scratched. Do not tap the panel with a pointed object such as a pencil, screwdriver, etc.
- Do not insert any wire or other metallic objects or conductive plastic objects into the openings on the unit, as this can lead to damage.
- When shipping the unit back to the factory for maintenance or servicing, use the original packing to protect the unit from vibrations and shocks.
- When disposing of the unit, follow national and local regulations regarding waste disposal.

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



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Outline

The Environmental Sound Monitor NA-37 consists of a sound level meter section and a processing section. A range of measurements can be implemented through software such as the Sound Monitor Program (Environmental Noise) NX-37A or the Sound Monitor Program (Aircraft Noise) NX-37B.

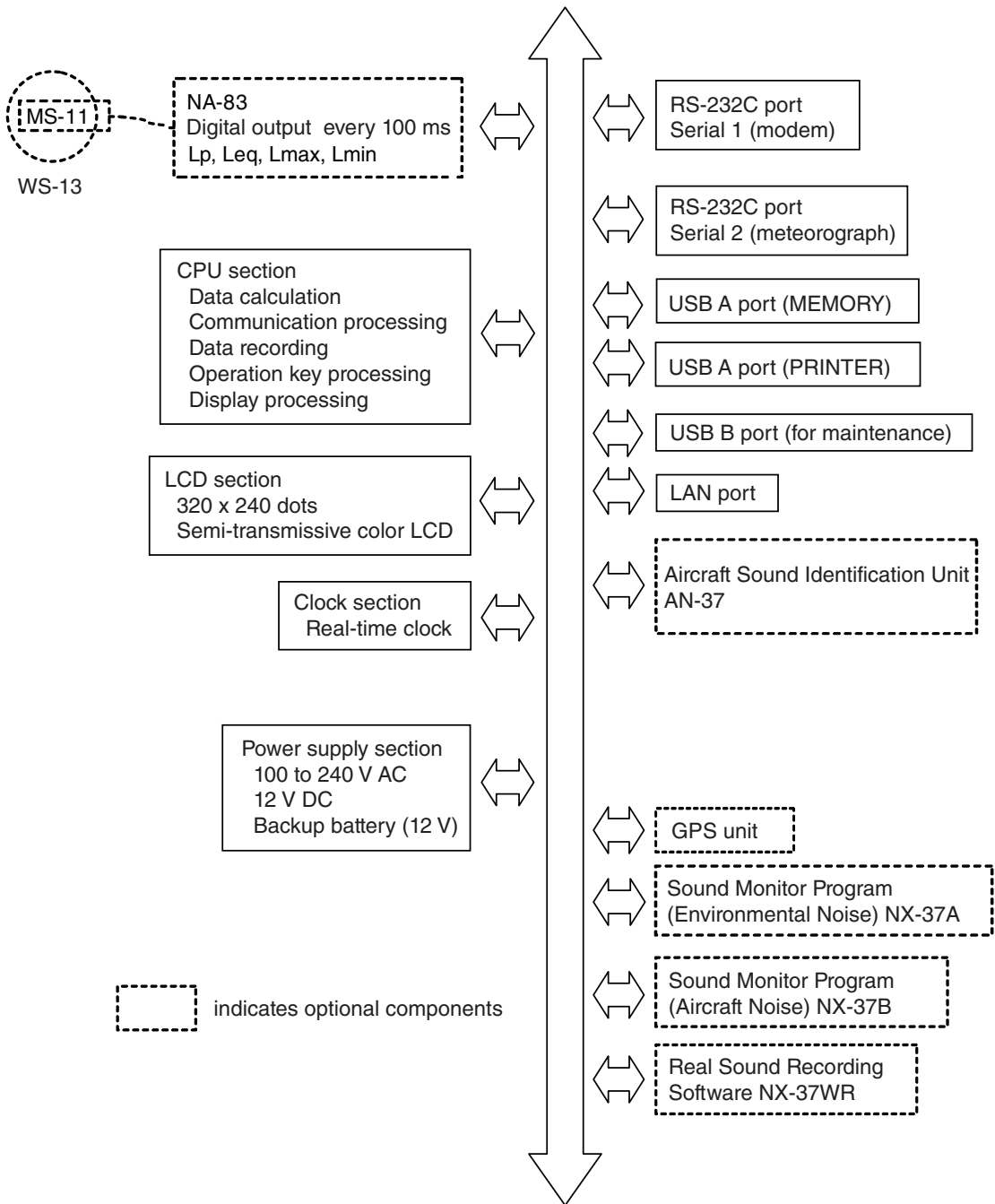
Measured data are stored in the internal memory of the unit and can be output via the RS-232C interface, USB interface, LAN interface, or USB flash memory.

An optional USB thermal printer can be connected to produce hard copy. Signal input from various kinds of data sources is supported, including Aircraft Sound Identification Unit data, meteorological data, and GPS data. Real sound monitoring is also possible.

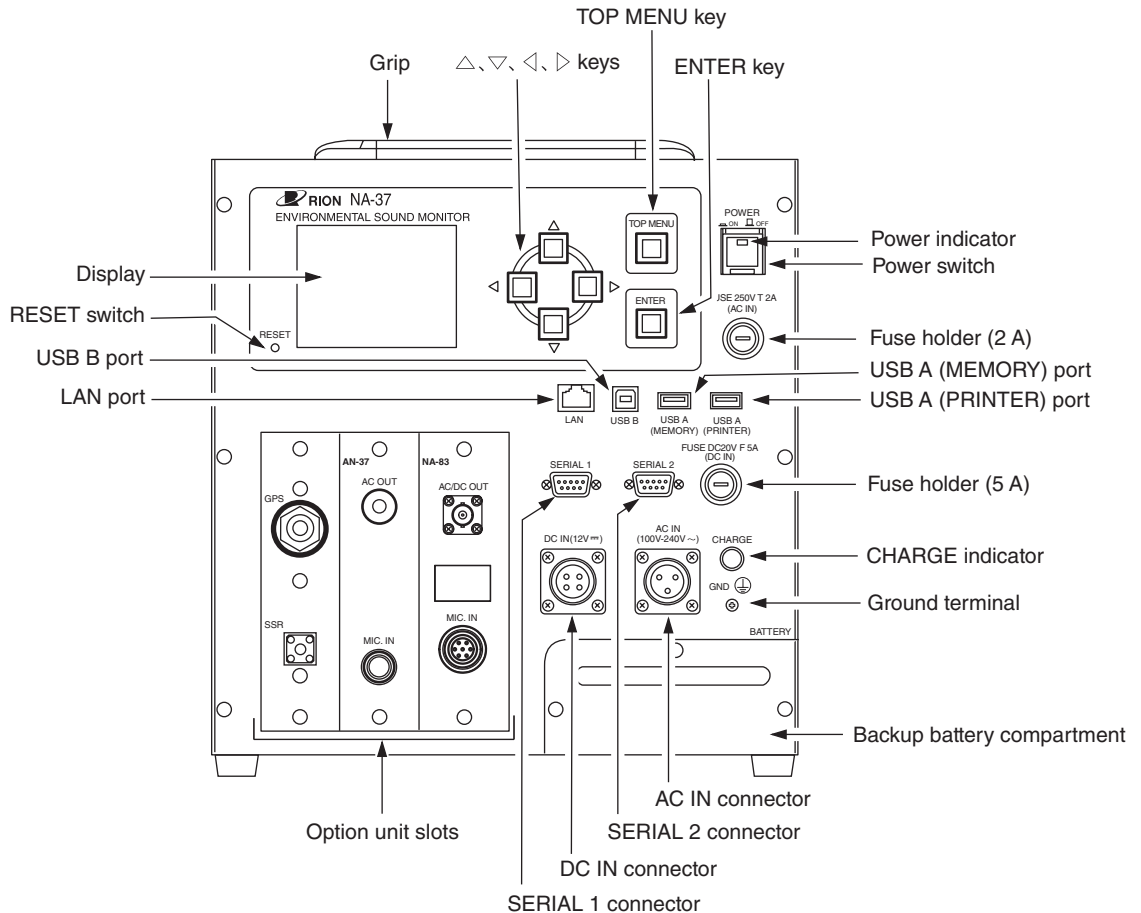
Features

- Combination with Measurement Law of Japan compliant Sound Level Meter NA-83 allows measurement with a 110 dB linearity range without range switching.
- Sound Level Meter NA-83 uses Outdoor Microphone MS-11 ensuring easy maintenance.
- Optional 3-axis microphone system provides the capability to identify incident sound direction for aircraft or other noise sources.
- LAN connectivity allows remote control and data transfer via an Ethernet link.
Remote control and data transfer via USB or RS-232C (modem) are also supported.
- Semi-transmissive color LCD panel provides good visibility both indoors and outdoors.
- Data can be saved on USB flash memory for easy transportability and processing in a computer.
- Support for software updating or rewriting via USB flash memory or the LAN interface enhances functional flexibility.
- Internal backup battery preserves data in case of a power failure, and connection of an external power source is also possible.

Block Diagram



Names of Parts and Functions



Power indicator

Lights up when power is on.

Power switch

Serves to turn power on and off. A transparent cover is provided to prevent inadvertent operation.

Fuse holder (2 A)

Contains a 2-ampere fuse for the AC IN line.

USB A (MEMORY) port

Allows installation of programs from USB memory and storing of data on USB memory.

USB A (PRINTER) port

Allows connection of a optional printer via a USB cable.

Fuse holder (5 A)

Contains a 5-ampere fuse for the DC IN line.

CHARGE indicator

Lights up when AC power is being supplied, regardless of the on/off position of the power switch. In this condition, the backup battery will also be charged.

Ground terminal

This terminal is at the same electrical current potential as the grounded pin of the AC IN connector.

Backup battery compartment

Contains a sealed lead acid rechargeable battery that serves to power the unit in case of an external power failure.

AC IN connector

This connector accepts an AC voltage from 100 to 240 V. A ground pin is also provided. Use the supplied power connection cord to connect the unit to an AC line.

DC IN connector

This connector accepts an external 12 V DC voltage to power the unit.

SERIAL 1 connector

This is an RS-232C interface. It can be used to connect a modem for data transfer via a public network telephone line.

SERIAL 2 connector

This is an RS-232C interface. It can be used to connect a meteorograph to obtain data and control operation.

Option unit slots

The following options and connector panel can be installed here.

- Sound Level Meter NA-83
- Aircraft Sound Identification Unit AN-37
- Connector panel for GPS

LAN port

Allows connection of the unit to a network for data transfer using Ethernet cable.

USB B port

This port serves for maintenance purposes. It is not used in normal operation.

RESET switch

Pressing this switch with a miniature screwdriver or similar causes a forced power-down.

Important

Use the RESET switch only in special cases, if power cannot be switched off normally after measurement and data processing are completed. If the switch is pressed during operation, data may be destroyed and the system may not function correctly the next time.

Display

This is a color LCD with backlight. It shows measurement data, parameter settings, and menu screens.

Note

For an explanation of items shown on the display, refer to the documentation of the installed Sound Monitor Program (Environmental Noise) NX-37A or Sound Monitor Program (Aircraft Noise) NX-37B.

Grip

Use this grip when carrying the unit.

△, ▽, ◀, ▶ keys

Serve to change the selection of operation buttons on the screen.

TOP MENU key

Returns to the top menu screen from any position.

ENTER key

Executes the operation corresponding to the selected operation button on the screen.

Preparations

Option units

Depending on the system configuration of the NA-37, one or more of the option units listed below will be installed in the option unit slots. (The installation is completed at the factory before shipping.)

- Sound Level Meter NA-83
- Aircraft Sound Identification Unit AN-37
- GPS unit

Power supply connection

Connection of protective ground wire

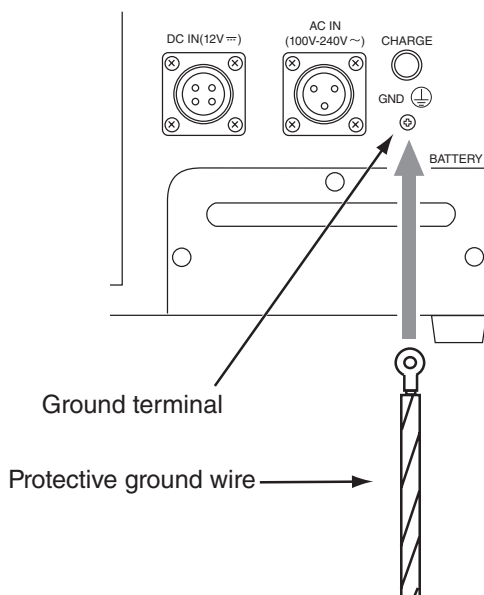
Before connecting power to the unit, be sure to connect the protective ground wire. When disconnecting power, disconnect the protective ground wire last.

Use the following type of cable (or equivalent) for the protective ground wire.

- UL AWM1431/AWG14 or thicker gauge, green/yellow spiral cable

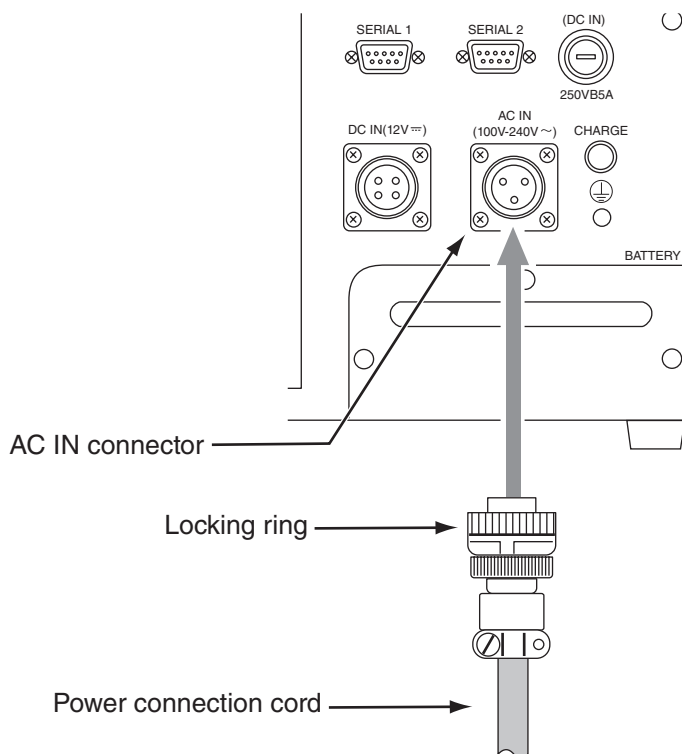
Connection procedure

1. Remove the screw from the ground terminal of the unit (dia. 4 mm).
2. Fasten the lug of the protective ground wire securely to the ground terminal with the screw.



AC power connection

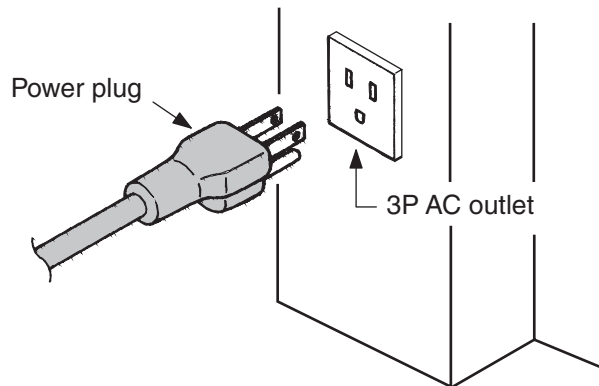
1. Plug the supplied power connection cord into the AC IN connector on the front panel of the NA-37 as shown in the illustration below. Turn the ring on the connector clockwise to securely lock the connector.



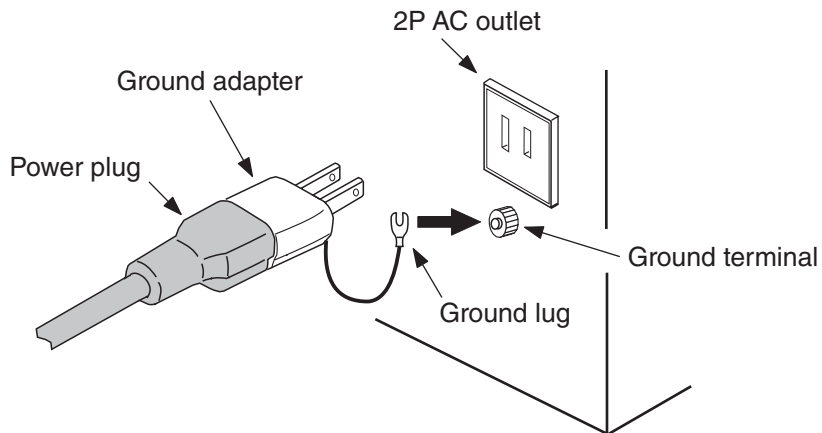
⚠ Caution

The supplied power connection cord is designed only for 100 V AC as used in Japan. Before using the unit in another country or with another AC voltage, contact your supplier.

2. Plug the other end of the power connection cord into a grounded 100 V AC outlet.



If the AC outlet is a two-pronged type with a ground terminal, use the ground adapter for connection to the outlet. In this case, be sure to connect the ground lug of the adapter to the ground terminal on the outlet.



After use, be sure to disconnect the power plug from the AC outlet.

⚠ WARNING

To prevent the risk of electric shock, use a properly grounded three-pronged AC outlet.

If the ground adapter is used, be sure to connect the ground lug of the adapter to the ground terminal on the outlet.

⚠ Caution

Make sure that the plug of the power cord is always accessible, so that it can be quickly disconnected from the AC outlet in case of an emergency. Do not block the vicinity of the AC outlet with any objects.

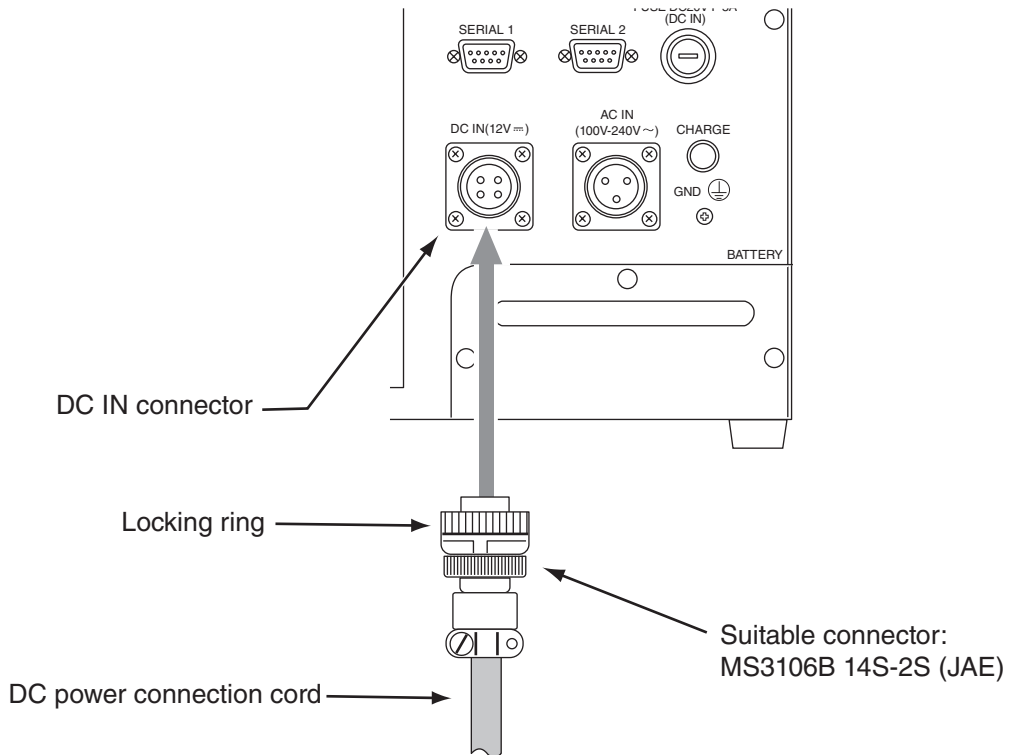
External DC power supply connection

Important

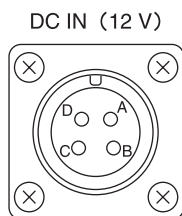
Use only an actual battery when powering the unit from the DC IN connector. Never connect the output of another type of device such as an AC-DC converter to the DC IN connector.

Plug the connector of the DC power connection cord into the DC IN connector on the front panel of the NA-37.

Turn the ring on the connector clockwise to securely lock the connector.



The type and pin assignment of the connector to be used with the DC IN connector are shown below. Make sure that the voltage/current rating of the cable is at least 20 V, 5 A.



Suitable connector: MS3106B 14S-2S (JAE)

- A: +12 V input
- B: +12 V output
- C: Ground
- D: Not connected

- * When a secondary battery is connected externally, short-circuit pins A and B and connect both to +12 V.

Microphone installation

About the microphone

The Outdoor Microphone MS-11 is to be connected to the NA-37.

Connect the microphone whose serial number is shown on the name plate of the integrated NA-83 unit. (Double-check the type and serial number indication.)

Important
Connecting another microphone may result in damage to the NA-37 and/or the microphone.

Microphone installation

Refer to the information given in the sections on installation (page 29) and maintenance (page 35) and select a suitable location for the microphone.

For long-term measurements, use the All-Weather Windscreen WS-13 and All-Weather Windscreen Tripod ST-81 or ST-88. The following accessories can be used with this unit.

- All-Weather Windscreen WS-13
- All-Weather Windscreen Tripod ST-81
- All-Weather Windscreen Tripod (for roof mounting) ST-88
- Microphone Extension Cable

EC-04 (2 m)

EC-04A (5 m)

EC-04B (10 m)

EC-04C (30 m + 5 m)

EC-04D (50 m + 5 m)

EC-04E (100 m + 5 m)

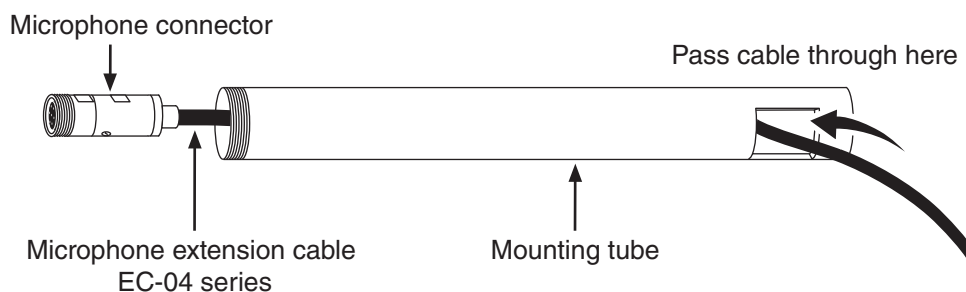
For Measurement Law of Japan compliance, the maximum allowable cable length is 35 meters.

Using the All-Weather Windscreen WS-13

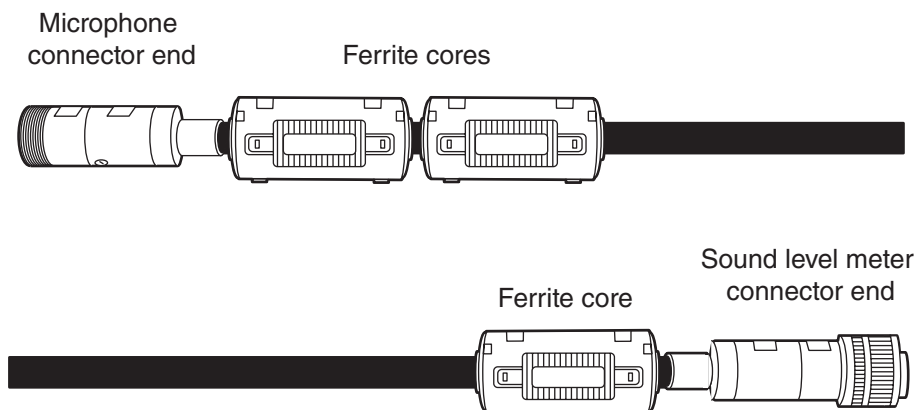
The All-Weather Windscreen WS-13 and Microphone Extension Cable EC-04 series are sold separately as options.

(Connecting the microphone extension cable)

1. Insert the microphone extension cable through the cable cutout on the side of the mounting tube.

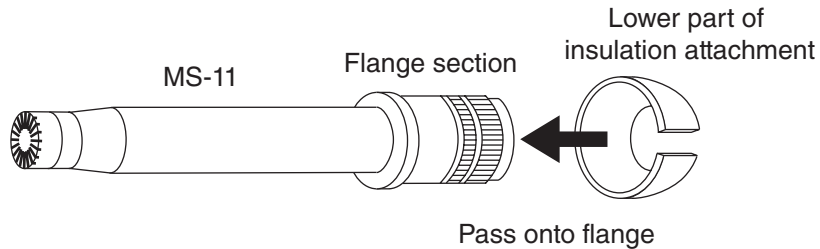


2. Attach the supplied ferrite cores to the microphone extension cable. Attach two cores near the microphone connector end and one core near the sound level meter connector end.

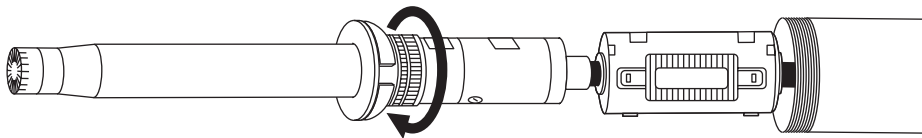


3. Pass the lower part of the insulation attachment onto the flange section of the MS-11.

The insulation attachment is not yet fixed at this point.

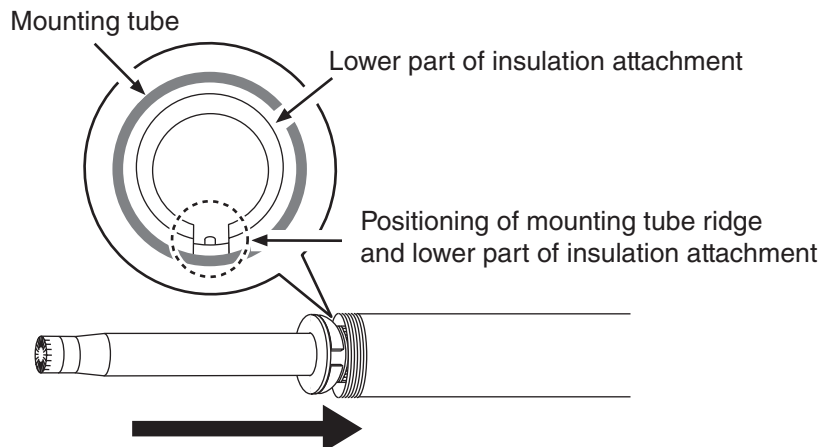


4. Connect the microphone extension cable to the MS-11. Rotate the outer part of the connector until the cable connector and the MS-11 are firmly joined by the screw thread.



(Fastening to mounting tube)

5. Insert the microphone into the mounting tube from the top. The inside of the mounting tube has a ridge that is designed to prevent the microphone from turning. The ridge must be aligned with the cutout on the lower part of the insulation attachment.



(Attaching the windscreen)

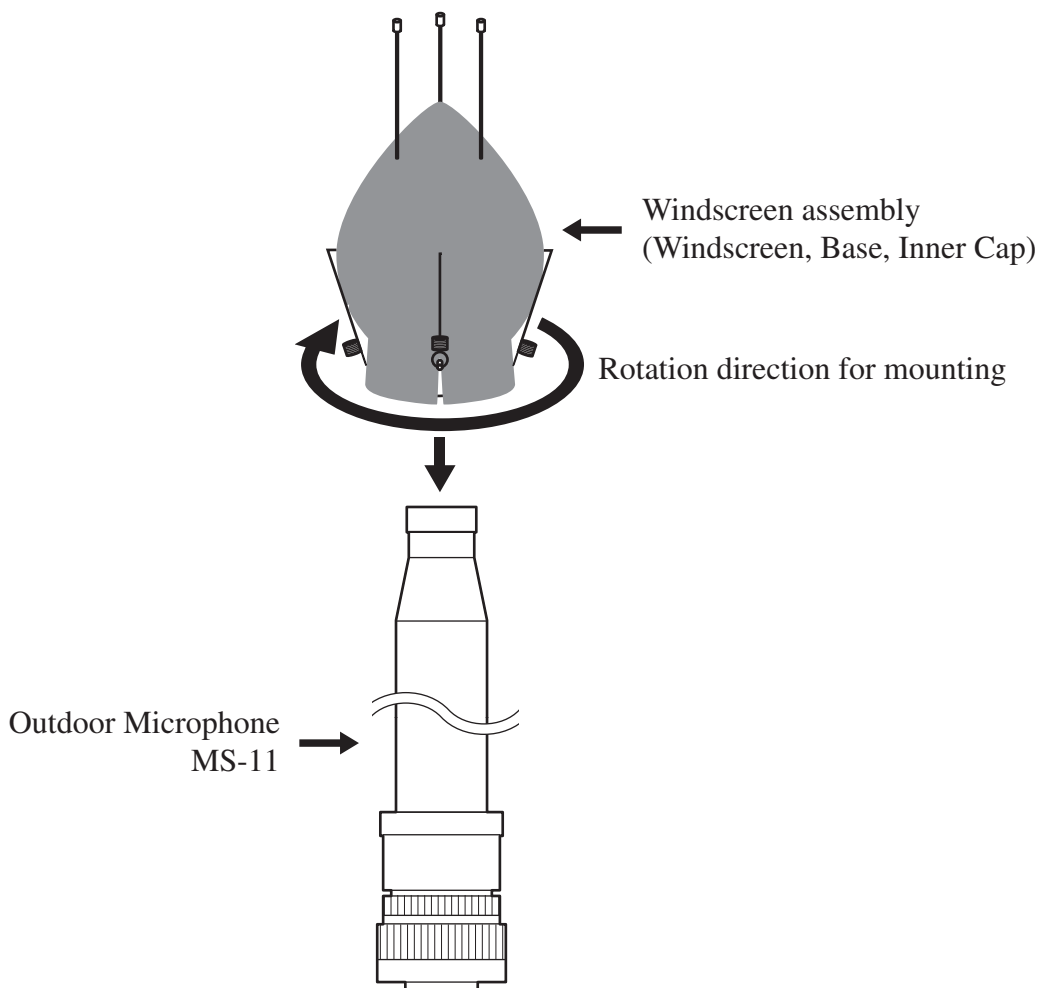
If windscreen and inner cap are to be reattached after replacing these parts, perform steps 7 to 9.

6. The windscreen is shipped from the factory with the base and inner cap attached. Insert the MS-11 directly into the assembly and rotate the base to attach it to the mounting tube.

Note

To remove the base and windscreen for maintenance, rotate the base section in the opposite direction than during installation. This lets you remove the base and windscreen together.

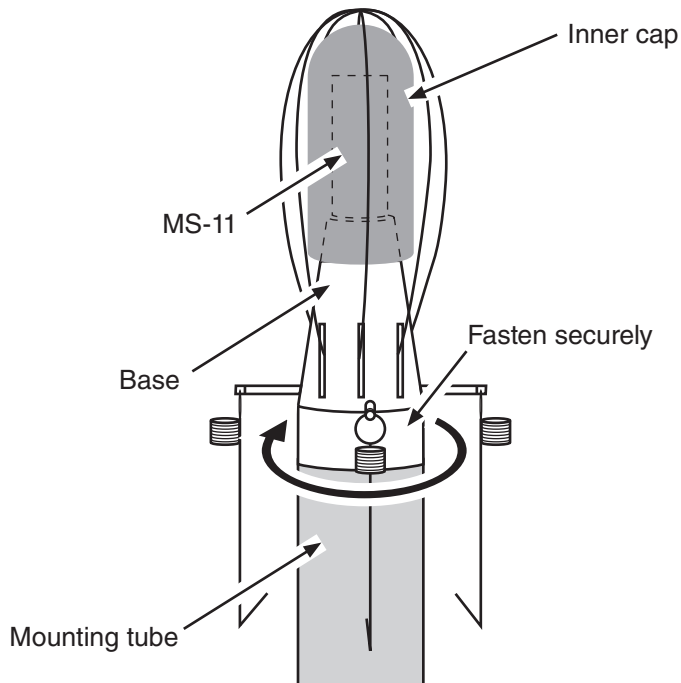
To remove the windscreen only, pull out the three spring hooks that are holding the windscreen.



(Procedure after replacing the inner cap)

7. Insert the microphone into the base and rotate the base to securely fasten it to the mounting tube.

While doing this, take care that the tips of the springs attached to the base do not come into contact with the MS-11 microphone.



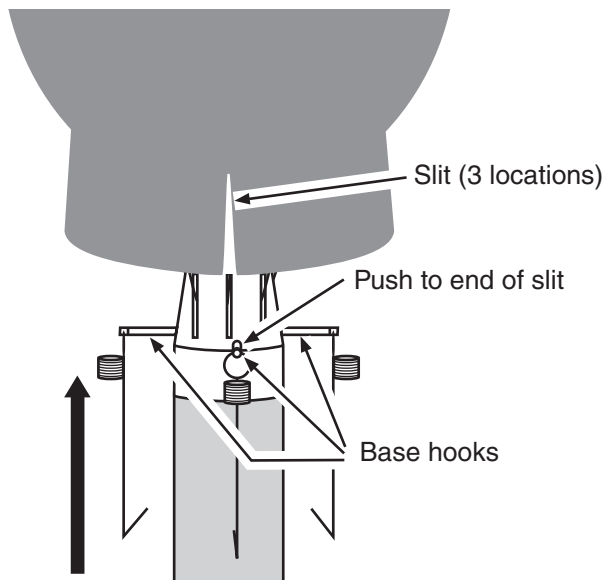
Important

When reconnecting after replacing the inner cap, trying to attach the windscreen to the base while the microphone is removed may cause the inner cap to shift, so that the microphone will later not properly fit into the hole of the inner cap.

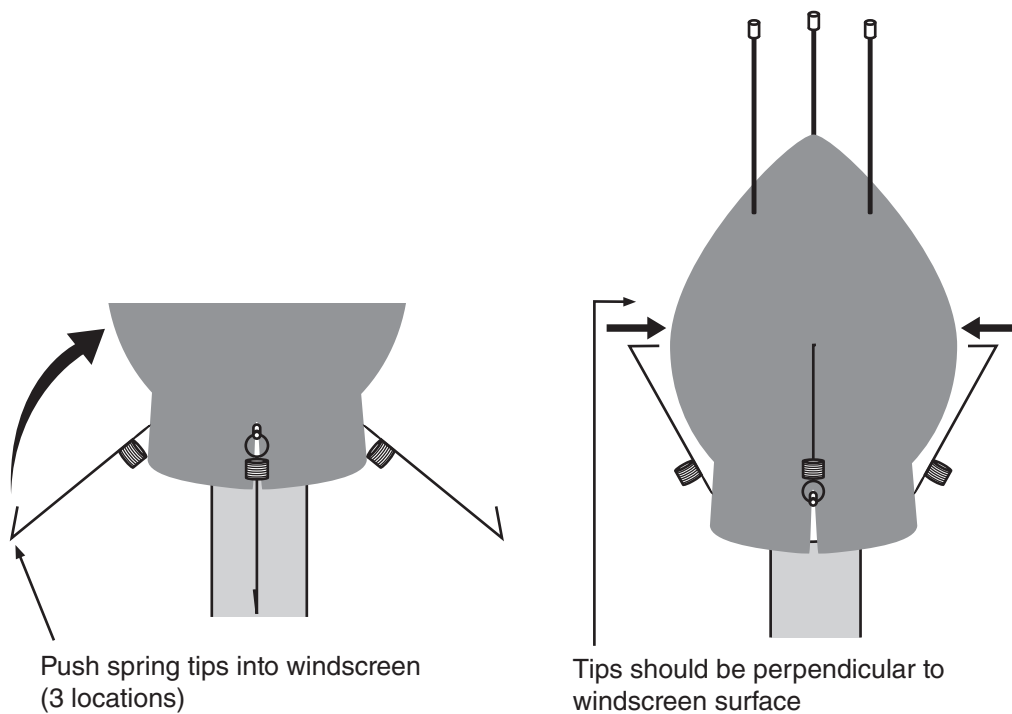
When the windscreen and base were removed as a unit, they can also be reattached as a unit.

(Mounting the windscreen)

8. In the lower part of the windscreen, there are three slits. Align these slits with the hooks on the base and push the windscreen fully onto the base.



9. Push the tips of the springs attached to the hooks firmly into the windscreen, at about the middle section.

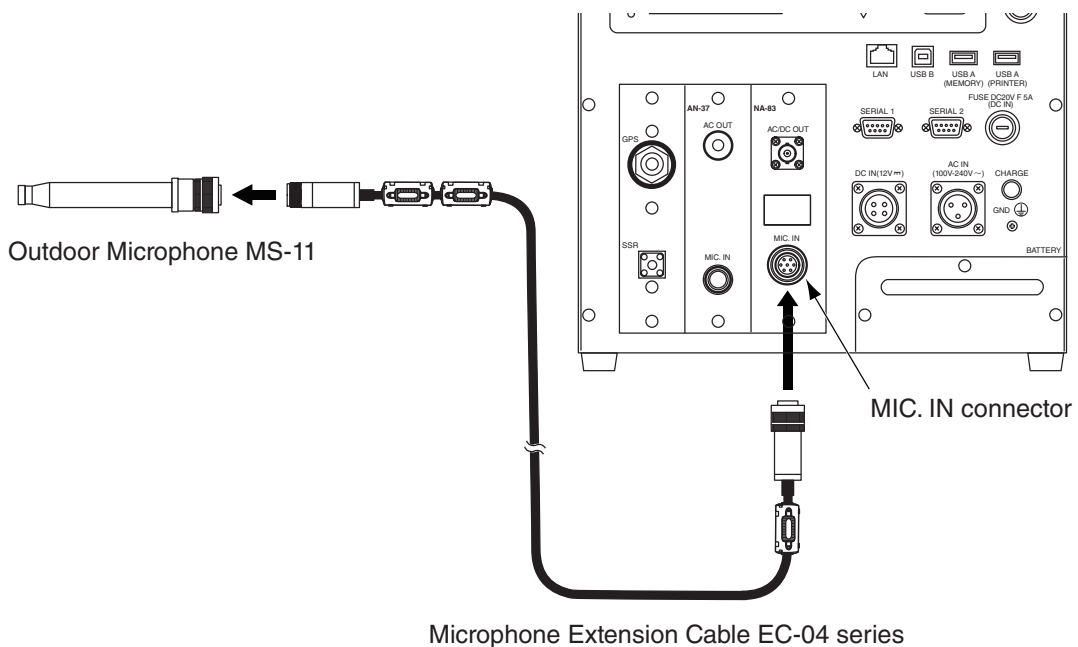


Microphone connection

When using the All-Weather Windscreen WS-13, refer to the preceding “Using the All-Weather Windscreen WS-13” section for information on connecting the microphone and microphone extension cable.

Important
Turn power to the unit OFF before making any connections.
The microphone also picks up vibrations. Ensure that the installed MS-11 does not vibrate due to wind or other causes.
The Microphone Extension Cable EC-04 series is a separate option. Select the required length for your installation. For IEC compliance, the maximum cable length is 35 meters. For CE marking compliance, the maximum cable length is 30 meters.

1. Connect the Outdoor Microphone MS-11 and Microphone Extension Cable EC-04 series. Mount the ferrite cores on the microphone extension cable (see step 2 on page 13).
2. Plug the microphone extension cable into the MIC. IN connector on the NA-83 unit installed in the NA-37.



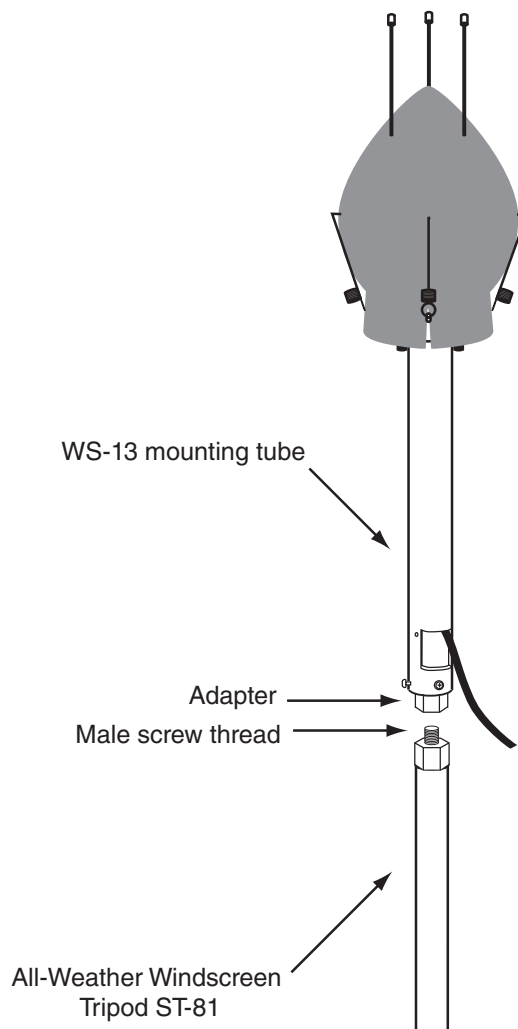
Mounting the microphone attached All-Weather Windscreen WS-13 on a tripod

The All-Weather Windscreen WS-13 attached to the microphone can be mounted to the optional All-Weather Windscreen Tripod ST-81 or ST-88.

Mounting on All-Weather Windscreen Tripod ST-81

Connect the adapter of the WS-13 mounting tube and the male screw thread at the tip of the ST-81, as shown below.

When finished, verify that the connection is firm and without play.

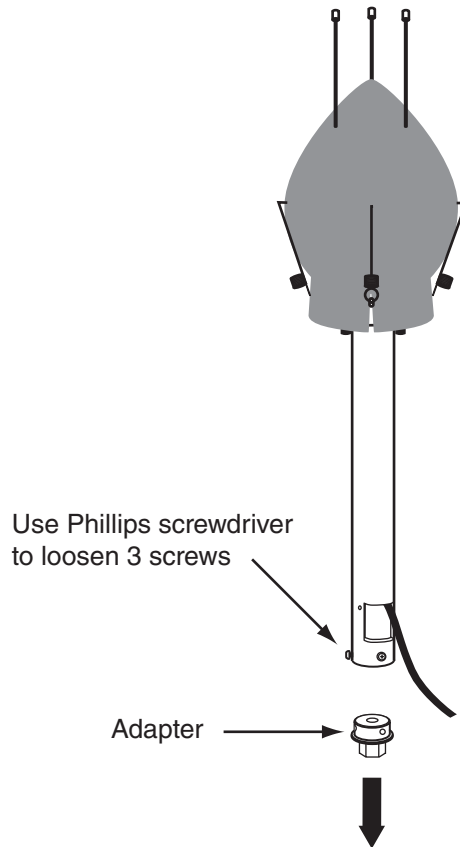


Note

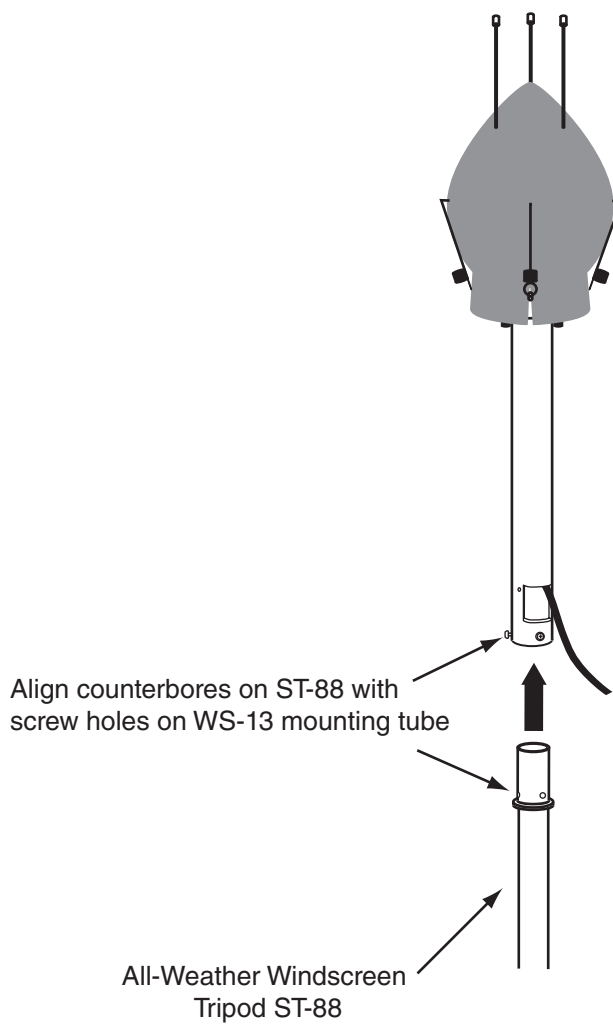
When mounting to the ST-81, the screw hole next to the cable cutout on the mounting tube is not used.

Mounting on All-Weather Windscreen Tripod ST-88

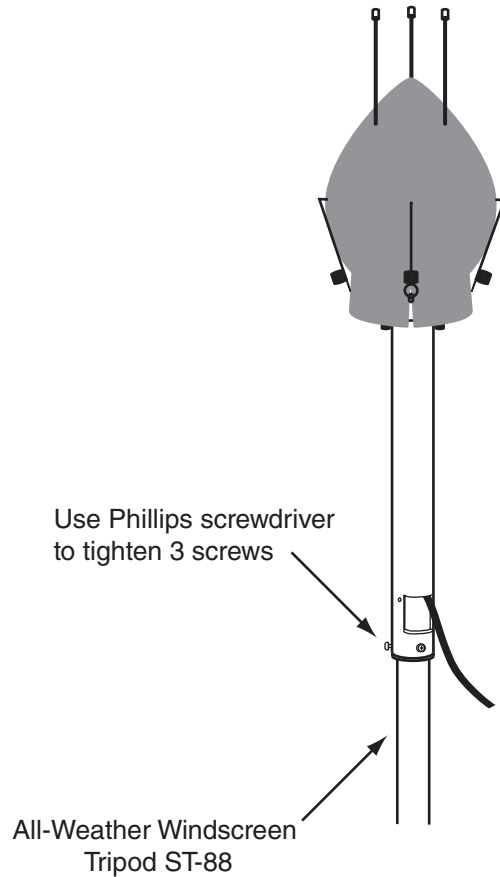
1. Loosen the three screws at the bottom of the WS-13 mounting tube and remove the adapter.



2. Push the WS-13 mounting tube into the tip of the ST-88.



3. Tighten the three screws on the WS-13 mounting tube.
When finished, verify that the connection is firm and without play.

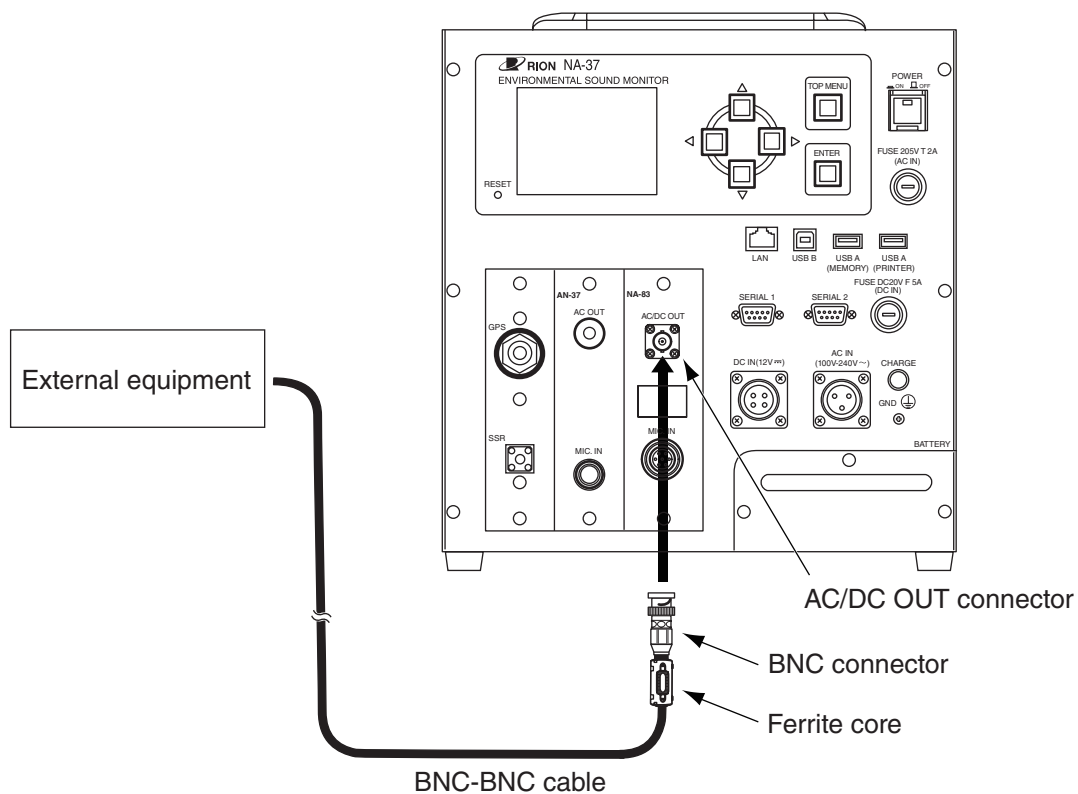


Note
When mounting to the ST-88, the screw hole next to the cable cutout on the mounting tube is not used.

Using the AC/DC OUT connector

When connecting the AC/DC OUT connector on the NA-37 to other equipment using a BNC-BNC cable, mount a ferrite core (option) on the BNC-BNC cable.

- * BNC-BNC cable NC-39A 1.5 m (option)
- * Ferrite core FCA8K 1 (option)

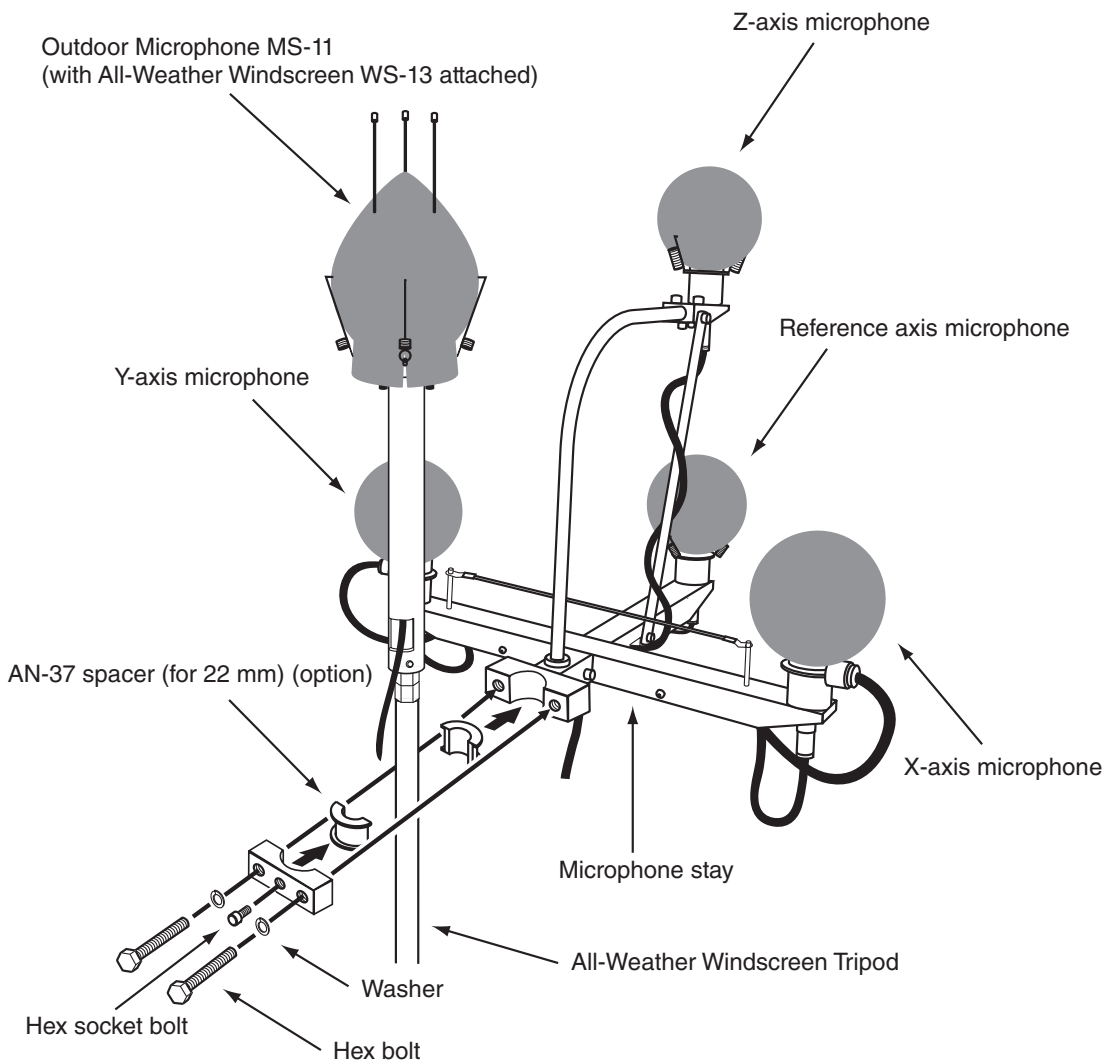


Using the Aircraft Sound Identification Unit AN-37

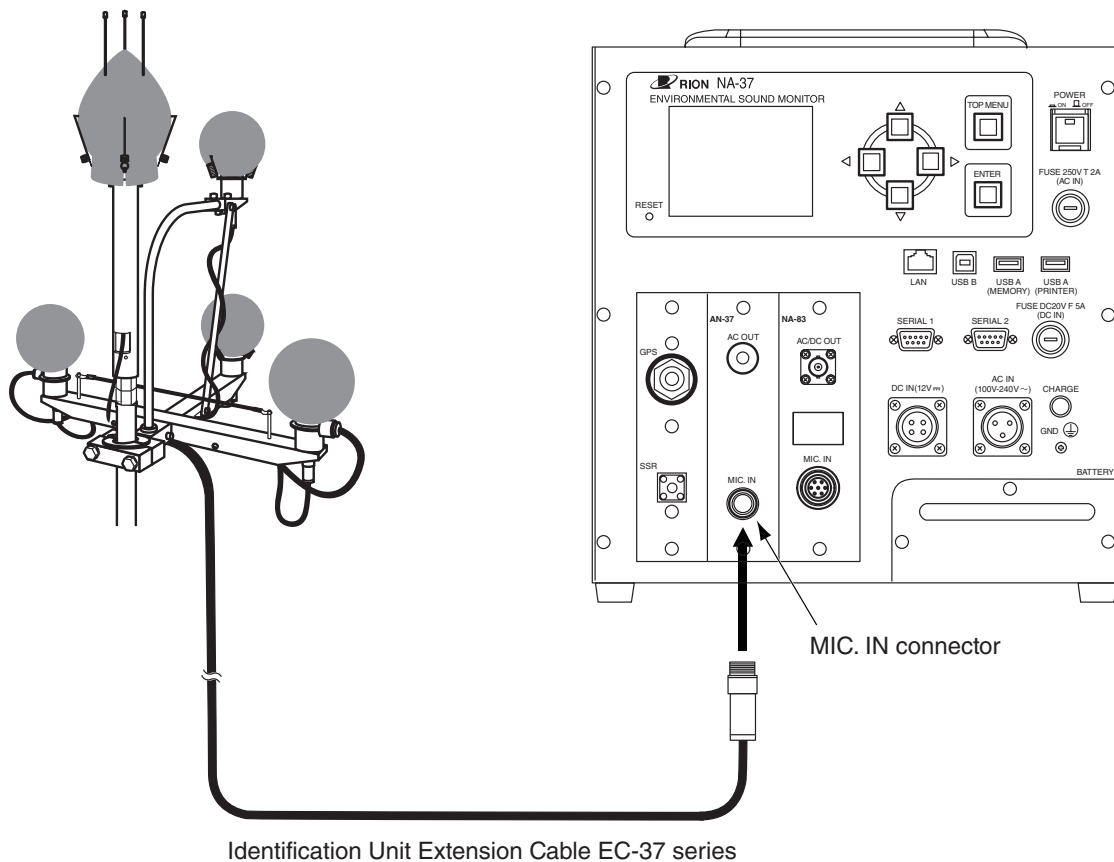
The AN-37 employs four microphones to determine the incident direction of a sound source. By detecting for example that a sound source is located overhead and is moving, it can be determined that the sound source is an aircraft.

1. Attach the microphones (with windscreens) supplied with the AN-37 to the tripod used for the MS-11, using the supplied hex bolts and hex socket bolts. The microphones (with windscreens) must be mounted on the supplied microphone stay first.

To attach the microphone to the ST-81 tripod, a set of AN-37 spacers (for 22 mm, option) must be used, as shown below.



2. Connect the cable from the microphones to the Identification Unit Extension Cable EC-37 series.
3. Connect the other end of the Identification Unit Extension Cable EC-37 series to the MIC. IN connector on the AN-37 unit installed in the NA-37.



Note

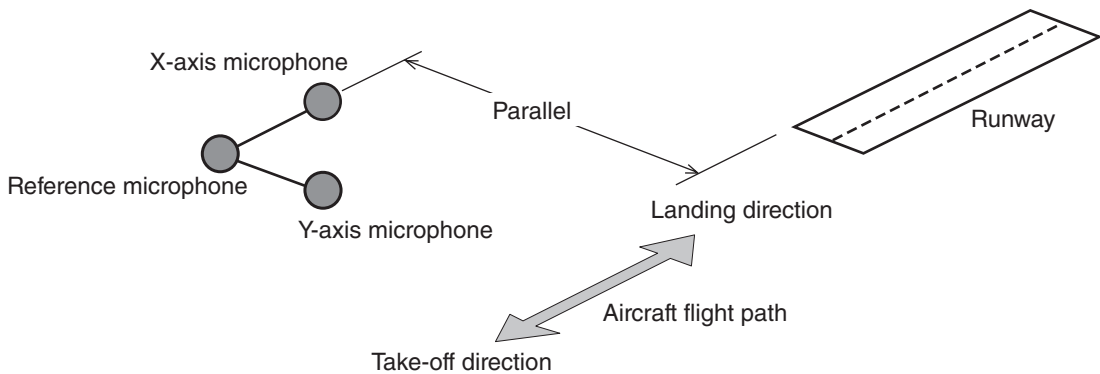
The following cables are available in the Identification Unit Extension Cable EC-37 series.

EC-37A	5 m
EC-37B	10 m
EC-37C	30 m, with reel
EC-37D	50 m, with reel
EC-37E	100 m, with reel

Performing XYZ (3-axis) identification with the Sound Monitor Program (Aircraft Noise) NX-37B

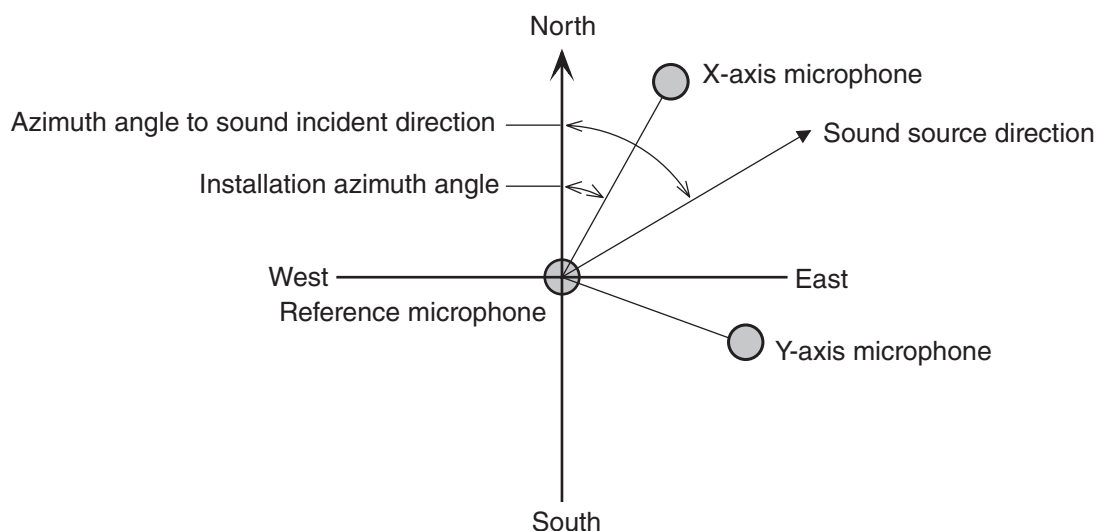
In order to accurately calculate the azimuth angle of the sound incident direction and allow correct identification of movement direction, observe the following points.

- 1) Ensure that the X-axis (between AN-37 reference microphone and X-axis microphone) runs parallel to the flight path of aircraft at the installation location. The X-axis microphone should be nearer to the landing position (on the runway side) in relation to the reference microphone.



Spatial relationship of AN-37 microphones and aircraft flight path

- 2) Verify that the Sound Monitor Program (Aircraft Noise) NX-37B is installed in the NA-37. From the [Measure] menu, specify the installation azimuth angle (called “Dir. Offset” in the menu) correctly. The installation azimuth angle is the angle between true North and the X-axis.



Directional relationship of AN-37 microphones and installation azimuth angle

The data obtained by 1) and 2) are as follows.

- When the “movement direction identification” value of the Sound Event data is “L” (left-direction movement), the aircraft is considered to be landing. When the value is “R” (right-direction movement), the aircraft is considered to be taking off.
- The azimuth angle of the “sound incident direction” data is always referenced to true North (0 degrees).

Note
<p>When using the Sound Monitor Program (Environmental Noise) NX-37A, the X-axis direction is taken as 0 degrees, and the angle is output as a value in the clockwise direction. Therefore, if the X-axis points to true North, East will be 90 degrees, South 180 degrees, and West 270 degrees.</p> <p>For details, refer to the documentation of the Sound Monitor Program (Environmental Noise) NX-37A.</p>

Connecting a printer

To use the USB printer BL-112UI (option), connect the USB A (PRINTER) port of the NA-37 to the printer with a USB cable (A male - B male, option).

Using USB flash memory

To use a USB flash memory for installing a program or saving data stored in the memory of the NA-37, plug the USB flash memory into the USB A (MEMORY) port on the NA-37.

Note
It is recommended to use USB flash memory sold by Rion Corporation.

Connection to a network

To perform data transfer via an Ethernet link, plug the LAN cable into the LAN port on the NA-37.

Using a meteorograph

To use a meteorograph (option), connect it to the SERIAL 2 connector on the NA-37.

Installation

Precautions for installation

Points that need to be considered when choosing a location and installing the Environmental Sound Monitor (including microphone) at a measurement point are listed below.

Take care to ensure the best possible environmental conditions. If the measurement purpose cannot be achieved, suitable countermeasures including possible relocation must be taken.

Acoustic environment

- General noise values in a certain location are to be obtained, without specifying a particular measurement target:
 - If a localized sound influences the overall readings, move the microphone further away from the source of the localized sound.
- Values for intermittent noise such as aircraft noise or train noise are to be obtained:
 - There must be sufficient difference between measurement target sound level and the background sound level. It must be possible to determine the noise source from the measurement point. The sound should be picked up directly from this direction, without reflections.
- Noise other than the measurement target is also picked up:
 - Road noise
 - Especially if large vehicles are passing at the same time when aircraft noise is being measured, the measurement results may be affected.
 - Factory noise
 - If regular noise is emitted by industrial plants etc., this will affect the background noise levels. If the noise is intermittent, it will be detected as a noise event.
 - Workshop and other operations noise
 - Noise from workshops, agricultural operations etc. will affect the background noise levels and may be detected as a noise event.
 - Animal noise
 - Noise from birds (crows in particular), frogs, cicadas, pet animals, etc. may be picked up during the measurement.

- Human noise

Noise levels often are higher in the vicinity of locations where many people gather such as schools and parks, and may be picked up as noise events. This applies in particular if there are any special events such as field days etc.

Natural environment factors

- Direct sunlight

Take care that temperature and humidity limits at the installation location are not exceeded.

- Temperature

Also without exposure to direct sunlight, temperature and humidity limits may sometimes be exceeded. If this is a possibility, proper countermeasures such as ventilation etc. must be provided. If low temperatures can occur, heating may have to be provided.

- Wind

The all-weather windscreen must be used to prevent a rise in noise levels due to strong wind hitting the microphone. Nearby trees may also become a source of noise if there is wind.

- Rain

Take care to protect the equipment from rainwater, and select the installation location carefully.

- Thunderstorms

The installation location must be provided with a proper lightning protection system.

- Salt

Even at locations several tens of kilometers from the sea coast, the air may have a high salt content, which can lead to deposits and corrosion.

- Wildlife

Animals that may cause damage to the equipment include squirrels, rabbits, rats or mice, birds, etc. Gnawing of extension cables and pecking at the windscreen are common problems.

Human environment factors

- Space requirements

Make sure that enough space is provided around the equipment to enable safe and swift maintenance and proper access.

- Piping work

Piping should be kept separate for power supply lines and microphone extension cables and signal lines. Proper termination such as entrance caps should be provided, and clay sealing should be used only as an additional measure.

- Fencing

Providing locked fencing around the equipment is a common approach to reducing the risk of theft and vandalism.

Electrical environment factors

- Power source

The power source must be stable and of good quality (no excessive voltage and frequency fluctuations).

Make sure that the plug of the power cord is always accessible, so that it can be quickly disconnected from the AC outlet in case of an emergency. Do not block the vicinity of the AC outlet with any objects.

- Grounding

Before connecting power to the unit, be sure to connect the protective ground line.

When disconnecting power, disconnect the protective ground line last. Use the following type of wire (or equivalent) for the protective ground line.

- UL AWM1431/AWG14 or thicker gauge, green/yellow spiral cable

- Radiation

Electrostatic pulses and electromagnetic noise pulses caused by power regulation circuitry in the vicinity (such as in vending machines etc.) can lead to malfunction of the equipment.

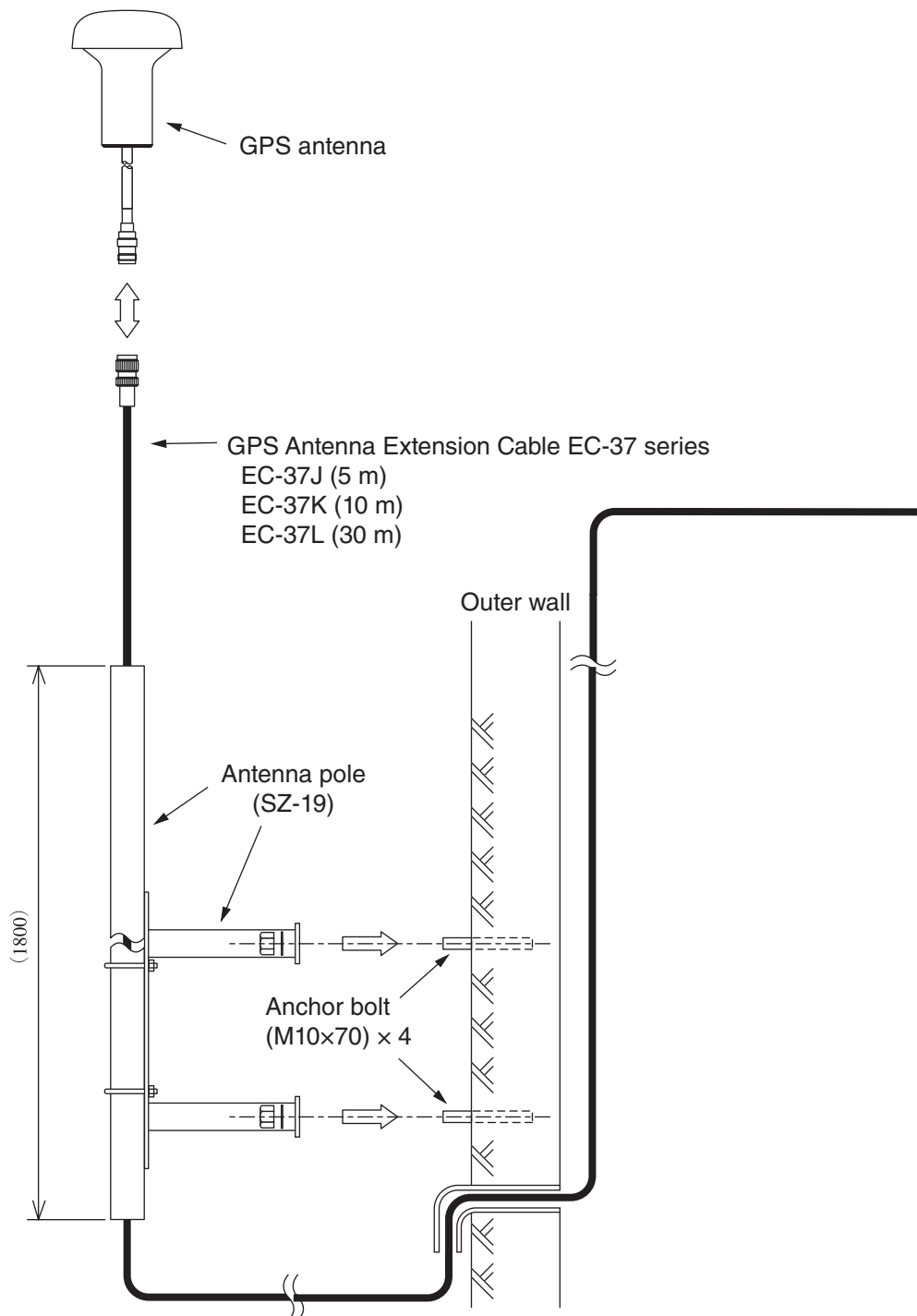
- RF influence

Analog circuits in the equipment may be affected by radio waves from broadcast or communications facilities, preventing the accurate measurement of background noise levels.

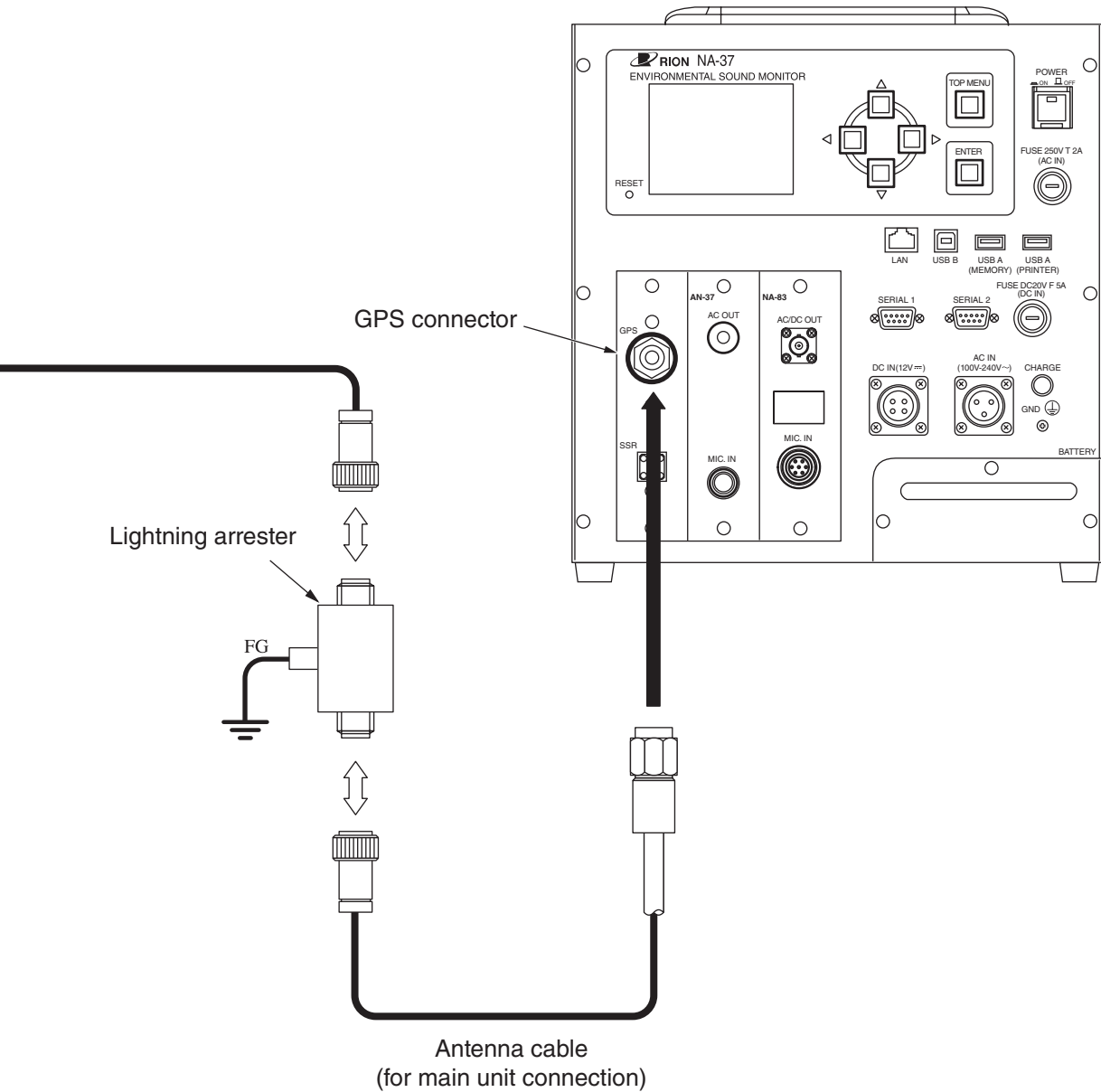
If the GPS functions is used, verify that radio reception conditions are good and operation is normal.

Installation and connection of GPS antenna

The GPS antenna consists of the GPS antenna set SZ-53C and GPS Antenna Extension Cable EC-37 series (EC-37J/K/L).



The SZ-53C also comprises the antenna cable from the GPS antenna for main unit connection (excluding the EC-37 series).

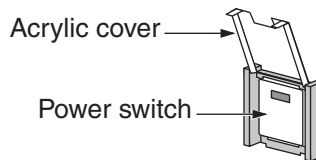


Operation

Power-on

The power switch is equipped with an acrylic cover to prevent inadvertent operation. To operate the switch, open the cover as shown below.

Pressing the switch while the power is off turns power on, and the power indicator lights up in red.



Power-off

Pressing the power switch while the power is on turns power off, and the power indicator goes out.

RESET switch

The small hole below the left side of the display houses the RESET switch. Pressing this switch with a miniature screwdriver or similar causes a forced power-down.

Important

Use the RESET switch only in special cases, if power cannot be switched off normally after measurement and data processing are completed. If the switch is pressed during operation, data may be destroyed and the system may not function correctly the next time.

Maintenance

There are several levels of maintenance. Perform the steps listed below as regularly as possible. The procedures are given as examples.

- Once a month
Sound level meter calibration, Clock calibration,
Internal memory data backup
- Once every three months
Sound level meter calibration, Clock calibration,
Check windscreen, Check for salt corrosion,
Internal memory data backup
- Once every six months
Sound level meter calibration, Clock calibration
Check windscreen, Check for salt corrosion,
Internal memory data backup,
Sound level meter characteristics check
- Once every year
Sound level meter calibration, Clock calibration,
Check windscreen, Check for salt corrosion,
Internal memory data backup,
Sound level meter characteristics check
- Once every three years
Sound level meter calibration, Clock calibration,
Check windscreen, Check for salt corrosion,
Internal memory data backup, Replace backup battery,
Sound level meter characteristics check

Sound level meter calibration: Perform acoustic calibration.

Sound level meter characteristics check:

Check frequency weighting and time weighting (dynamic characteristics)

Replace backup battery:

The backup battery must be able to supply power in case of a power failure in the regular power line.

Internal memory data backup:

Copy contents of internal memory to a computer via USB memory etc.

Fuse replacement

The NA-37 can be powered via either the AC IN or DC IN connectors. Two separate fuse holders are provided which contain fuses for the AC IN and DC IN line, respectively. (See page 3.)

The specifications for the fuses are as follows.

AC IN line fuse

Rated current:	2 A	Rated voltage:	250 V
Breaking capacity:	T		

DC IN line fuse

Rated current:	5 A	Rated voltage:	DC 20 V
Breaking capacity:	F		

If replacing a fuse has become necessary, proceed as follows.

1. Turn the power off and disconnect the plug of the power cord from the outlet.
2. Use a flat-blade screwdriver to rotate the fuse holder counterclockwise by 90 degrees. Then remove the fuse holder.
3. Replace the fuse in the fuse holder with a new fuse of the same type.
4. Insert the fuse holder into the unit. Use a flat-blade screwdriver to rotate the fuse holder clockwise by 90 degrees while pushing it in.

Caution

Before replacing a fuse, turn the power switch of the unit off and disconnect the power cord.

Take care not to mix up the AC IN line fuse and DC IN line fuse.

Replacing the backup battery

If the internal power-failure backup battery needs to be replaced, please contact your supplier.

If you are unable to contact your supplier, contact Rion Corporation (see front cover of manual).

Specifications

Standard compliance

WEEE Directive 2002/96/EC 2003/108/EC EN 50419

Electrical Appliance Safety Law

Display

Principle Semitransparent TFT color LCD with backlight

Number of dots 320 × 240

Display items Measurement data, parameter settings, menu screens

Controls

Principle Pushbutton switch

Number of keys 6 (excluding power switch)

Inputs/Outputs

USB A port Number of ports 2

USB 1.1 Full Speed

USB memory connection

Purpose For program installation and data transfer to external memory

Principle Storage device class

Printer connection Optional printer can be connected

USB B port Number of ports 1

USB 1.1 Full Speed

Computer connection

Purpose For maintenance setup / data transfer

Principle Communication device class
Storage device class

LAN port Number of ports 1

10BASE-T/100BASE-TX

Purpose For maintenance setup / data transfer via Ethernet connection to network

Principle TCP/IP

RS-232C port	Number of ports	2
	Communication principle	Full duplex
	Synchronization	Asynchronous transfer
	Data transfer rate	1200/2400/4800/9600/19200/ 38400/57600/115200 bps
	Data word length	8 bit
	Number of stop bits	1
	Parity	None/Even/Odd
	Modem connection	
	Purpose	For maintenance setup / data transfer via public phone line connection
	Meteorograph	
	Purpose	Obtaining meteorological data / control
	Data save capability	Calculated data and messages can be saved in internal memory in predetermined format Memory capacity is 256 MB, expandable to 2 GB
	Data transfer	Data transfer and unit control possible via network connection
Printing	Via optional printer connected to USB A port	
Supported printer model	BL-112UI	
Printing method	Thermal printer	
Print width	80 mm	
Printout contents	Data printing/hard copy	
Printer paper	P-112-30 (10 rolls)	
Clock section		
Accuracy	±10 ppm	
Format	Year/month/day/hour/minute/second	

Power supply section

AC power supply 100 to 240 V AC
 Power line frequency 50/60 Hz (47 to 63 Hz)
 Maximum current consumption

1 A

DC power supply 12 V (11.5 to 15 V)
 Maximum current consumption

3 A

Backup power supply

Type Sealed lead acid battery

Backup capacity approx. 2 h (NX-37WR not operating, LAN, USB not connected)

approx. 1.5 h (NX-37WR operating, LAN, USB connected)

Time can be extended by connecting an external DC supply.

Replacement cycle 3 years

Low battery voltage warning provided

Operation Environments

Indoor Use Only

Altitude Up to 2000 m

Supply Voltage Fluctuations

100 to 240 V AC $\pm 10\%$

Overvoltage Category II

Pollution Degree 2

Ambient conditions for operation

-10°C to +50°C, 10 to 90% RH (no condensation)

Ambient conditions for storage

-10°C to +50°C, 10 to 90% RH (no condensation)

Dimensions 270 (H) × 270 (W) × 188 (D) mm (without protruding parts)

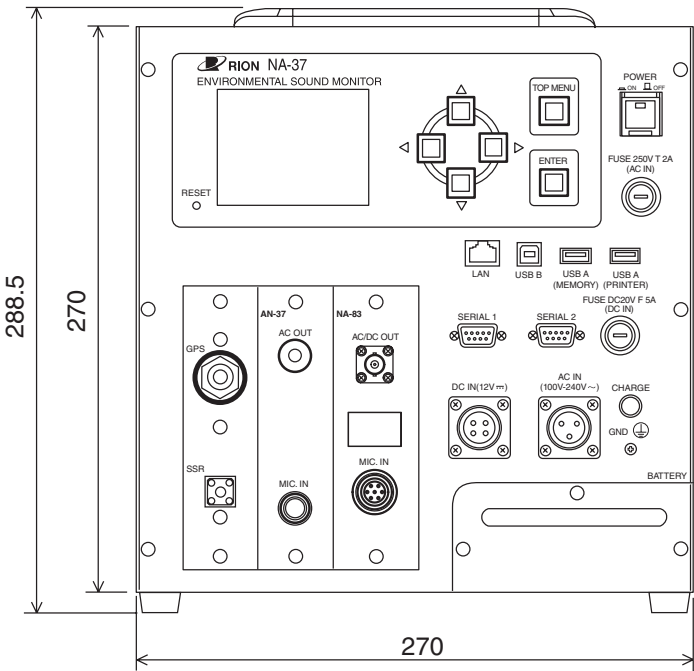
Weight 7 kg (including NA-83 unit)

Supplied accessories

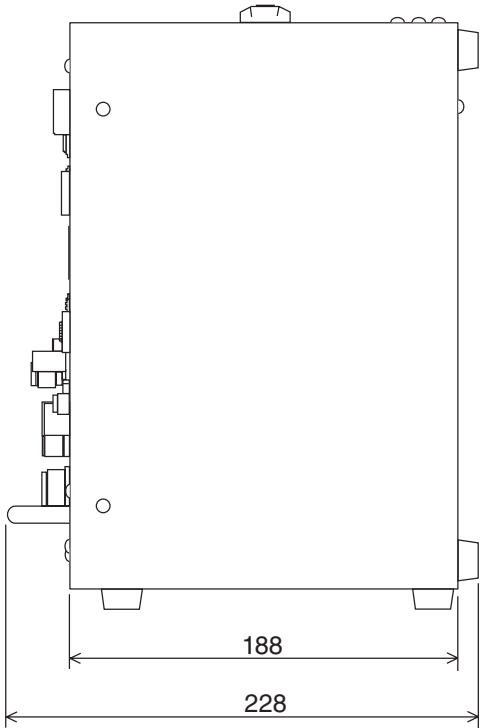
Power connection cord	1
Instruction manual	1
Inspection certificate	1

Options

Sound Level Meter	NA-83
Aircraft Sound Identification Unit	AN-37
Sound Monitor Program (Aircraft Noise)	NX-37B
Sound Monitor Program (Environmental Noise)	NX-37A
Environmental Noise Data Processing Software	AS-40PA1
Aircraft Noise Data Processing Software	AS-50PA1
Real Sound Recording Software	NX-37WR
GPS Antenna Set	SZ-53C
GPS Antenna Extension Cable (5 m)	EC-37J
GPS Antenna Extension Cable (10 m)	EC-37K
GPS Antenna Extension Cable (30 m)	EC-37L
All-Weather Windscreen Tripod	ST-81
All-Weather Windscreen Tripod (for roof mounting)	ST-88
Meteorograph	
USB Printer	BL-112UI
Rack Mount Flange	NA-37-S09
Splashproof Case	EF-37
USB flash memory	
Sealed lead acid battery	
Fuse	
USB cable (A male - B male)	



Front view



Right side view

Unit: mm

Dimensional Drawings

Specifications of option unit

Model	Sound level meter NA-83	
Applicable standards	Measurement Law of Japan - precision sound level meters IEC 61672-1:2002 Class 1 (JIS C 1509-1:2005 Class 1) (Microphone extension cable length max. 35 m) CE marking (EMC Directive: 2004/108/EC EN61326-1:2006/ IEC 61326-1:2005) (Microphone extension cable length max. 30 m) WEEE Directive	
Measurement functions		
Measurement items	Display data Time-weighted sound level L_p Maximum time-weighted sound level L_{max}	
Measurement level range		
	A-weighting	28 to 138 dB
	C-weighting	36 to 138 dB
	Z-weighting	42 to 138 dB
Total range (A-weighting, 1 kHz)	28 to 138 dB	
Self-generated noise		
	A-weighting	max. 20 dB
	C-weighting	max. 28 dB
	Z-weighting	max. 34 dB
Measurement frequency range	20 Hz to 20 kHz	
Frequency weighting	A, C, Z	
Time weighting	F (Fast), S (Slow)	
Linear operating range	110 dB	
Level range switching	None	
Bar graph indication range	30 to 130 dB	
RMS detection	digital processing (sampling cycle 20.8 μ s)	

Reference frequency

1 kHz

Reference sound pressure level

94 dB

Reference conditions

Ambient temperature 23°C

Relative humidity 50%

Static pressure 101.325 kPa

Microphone and preamplifier

Outdoor Microphone

MS-11

Sensitivity -29 dB (re. 1 V/Pa, in reference conditions)

Calibration

Acoustic calibration with microphone integrated sound source
(compliant with Measurement Law of Japan)

Calibration level 114 dB

Frequency 1 kHz

Calibration with external sound calibrator

(compliant with IEC 61672-1:2002 Class 1, JIS C 1509-1:2005 Class 1)

Model NC-74

Calibration level 94 dB

Frequency 1 kHz

Operation check with microphone integrated sound source

Temperature characteristics of integrated sound source

(-10°C to +50°C range, referenced to 23°C, atmospheric pressure 101.325 kPa)

Frequency 1 kHz

Sound pressure level 114.0 dB \pm 0.3 dB

Frequency characteristics of integrated sound source

(-10°C to +50°C range, referenced to 1 kHz, atmospheric pressure 101.325 kPa)

250 Hz \pm 0.5 dB

500 Hz \pm 0.5 dB

4 kHz \pm 1.5 dB

Windscreen correction function

Corrects frequency response for compliance with standard requirements also when All-Weather Windscreen WS-13 is mounted.

On/Off selectable by key operation or remote command

Display

TN positive display, reflective

Numeric readout 0.1 dB resolution (display update cycle 1 s)

Bar graph 100 dB range, 5 dB resolution (display update cycle 0.1 s)

Warning indications

Over-range indicator appears at 139 dB (at 1 kHz)

Under-range indicator appears at -0.6 dB from lower measurement limit

Input/output connectors

AC/DC output connector

AC or DC output, selectable by key operation or remote command

AC output Frequency weighting C-weighting

Output voltage 1 V_{rms} (at 110 dB)

Maximum output voltage

10 V_{rms} (at 130 dB, 1 kHz)

Output impedance 50 Ω

Load impedance 10 kΩ or higher

DC output Output voltage 5.5 V (at 130 dB), 50 mV/dB

Output impedance 50 Ω

Load impedance 10 kΩ or higher

Connection to NA-37

Power supply to NA-83

NA-83 hard reset signal handling

Reset triggered when NA-37 open-collector output is ON

NA-83 control by NA-37 and data output (serial communication)

NA-83 control

Transfer protocol

Sync. principle	asynchronous
Data word length	8 bit
Stop bits	1 bit
Parity check	none
Baud rate	19200 bps
Flow control	yes

NA-83 data output

Output data	$L_p, L_{\max}, L_{\min}, L_{\text{eq}}$
Output cycle	100 ms

Waveform sampling data

Frequency weighting	Z characteristics
Sampling cycle	20.8 μs
Data word length	16 bit
Full-scale range	90 dB, 110 dB, 130 dB, selectable
	* Only selectable by serial communication

Power requirements

Rated power supply voltage

12 V DC

Operation voltage range

10 to 15 V DC

AC adapter RC45-12L

Current consumption

approx. 200 mA (at 12 V DC)

Environmental conditions for operation

Sound level meter unit

-10°C to +50°C, 10 to 90% RH

Microphone MS-11

Operating -20°C to +50°C, 10 to 100% RH (no condensation)

Storage -10°C to +50°C, 10 to 90% RH

Dimensions 135 × 41 mm (panel section)

Weight 520 g (including MS-11)

Supplied accessories

Outdoor Microphone MS-11	1
Ferrite core FCA8K (for microphone extension cable)	3
MS-11 storage case	1
MS-11 calibration chart	1
Connector cover plate	1

Optional accessories

Sound Calibrator	NC-74
Pistonphone	NC-72A
All-Weather Windscreen	WS-13
Microphone Extension Cable (2 m)	EC-04 (CE marking compliance)
Microphone Extension Cable (5 m)	EC-04A (CE marking compliance)
Microphone Extension Cable (10 m)	EC-04B (CE marking compliance)
Microphone Extension Cable (30 m + 5 m)	EC-04C (no CE marking compliance)
Microphone Extension Cable (50 m + 5 m)	EC-04D (no CE marking compliance)
Microphone Extension Cable (100 m + 5 m)	EC-04E (no CE marking compliance)
BNC-BNC cable (1.5 m)	NC-39A
AC adapter	RC45-12L (third-party accessory, Futaba Electric)
Ferrite core	FCA8K (Morimiya Electric)
	For NC-39A 1
	For RC45-12L 6

Model	Aircraft Sound Identification Unit AN-37
Input section	
Input connector	6-pin circular connector
Measurement level range	45 dB to 130 dB
Measurement frequency range	100 Hz to 1.5 kHz
Level display frequency range	100 Hz to 35 kHz
A/D converter	24-bit resolution
Sampling frequency	80 kHz (for microphone spacing 25 cm)
Output section	
Output connector	6-pin circular connector
Gain	+26 dB
Processing section	
Batch processing based data processing, in 4 channels simultaneously	
Signal power calculation/auto-range control	
Cross-correlation function processing	
Frequency area whitening and bandwidth limiting used for 3-axis cross-correlation calculation	
Azimuth angle and elevation angle calculated from result of cross-correlation calculation	
Cross-correlation calculation and azimuth angle/elevation angle calculation performed in 200 ms intervals	
Power supply	
DC power supply	+5 V (current consumption approx. 200 mA) +15 V (current consumption approx. 40 mA)
Ambient conditions for operation	-10°C to +50°C, 30 to 90% RH
Dimensions	135 (H) × 35 (W) mm (panel section)
Weight	Approx. 300 g

Supplied accessories

Identification Microphone UC-52 (with windscreen and mounting hardware)	4
--	---

Options

AN-37 spacer (for 22 mm)	AN-37-S09
Identification Unit Extension Cable (5 m)	EC-37A
Identification Unit Extension Cable (10 m)	EC-37B
Identification Unit Extension Cable (30 m, with reel)	EC-37C
Identification Unit Extension Cable (50 m, with reel)	EC-37D
Identification Unit Extension Cable (100 m, with reel)	EC-37E

INSTRUCTION MANUAL

Sound Level Meter NA-83

Organization of This Manual

This manual describes the features, operation and other aspects of the Sound Level Meter NA-83. If the unit is used together with other equipment to configure a measurement system, consult the documentation of all other components as well. The following pages contain important information about safety. Be sure to read and observe these in full.

This manual contains the following sections.

Outline

Gives basic information about the unit.

Controls and Functions

Briefly identifies and explains the operation keys and connectors and all other parts of the unit. The display content is also explained.

Connections

Explains how to connect the microphone and AC adapter.

Menu Setup

Describes the various menu screens that are used for setting up the unit.

Calibration and Operation Check

Explains how to calibrate the unit and verify correct operation.

Measurement

Explains the basic procedure for making a measurement.

Connectors

Provides information about the MIC. IN connector on the front panel.

Default Values

Lists the settings that are active when power is supplied.

Technical Reference

Provides information about the configuration of the unit, electrical and acoustic specifications, IEC compliance, and other items.

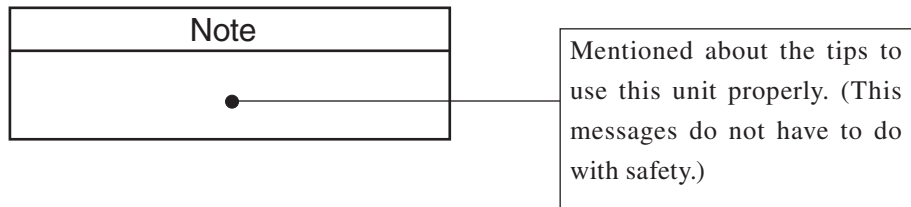
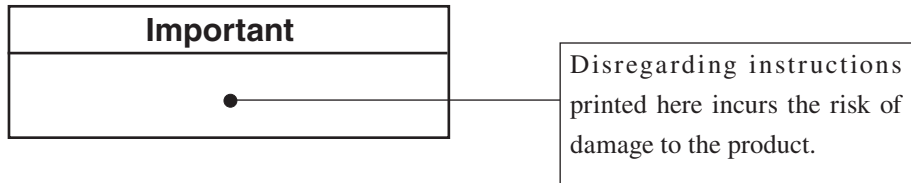
Specifications

Lists the technical specifications of the unit.

* All company names and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

FOR SAFETY

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

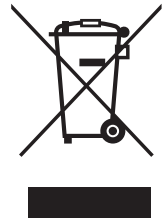


Precautions

- Operate the unit only as described in this manual.
- The NA-83 is a precision instrument. Protect it from shocks and vibrations. Take special care not to touch the microphone diaphragm. The diaphragm is a very thin metal film which can easily be damaged.
- Use only the microphone with the number as shown on the name plate of the unit.
- Do not use the unit in an environment where the specifications for ambient temperature and humidity may be exceeded (temperature range -10 to +50°C, relative humidity 10 to 90%).
- Protect the unit from water, dust, extreme temperatures, humidity, and direct sunlight during storage and use. Also keep the unit away from air with high salt or sulphur content, gases, and stored chemicals.
- Always turn the unit off after use. When disconnecting cables, always grasp the plug and do not pull the cable.
- Before using the unit and before putting it away, always check that the microphone grid has not become loose. If this has happened, refasten the microphone grid firmly and then use or store the unit.
- Clean the unit only by wiping it with a soft, dry cloth or, when necessary, with a cloth lightly moistened with water. Do not use any solvents, cleaning alcohol or chemical cleaning agents.
- Do not try to disassemble or alter the unit. Otherwise type certification will become invalid. In case of an apparent malfunction, do not attempt any repairs. Note the condition of the unit clearly and contact the supplier.
- Do not tap the LCD panel or other surfaces of the unit with a pointed object such as a pencil, screwdriver, etc.
- Take care that no conductive objects such as wire, metal scraps, conductive plastics etc. can get into the unit.

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

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



The product described in this manual is in conformity with the following standards;

EN61326-1:2006/IEC 61326-1:2005

Electrical equipment for measurement control and laboratory use.

RION Co., Ltd.

3-20-41 Higashimotomachi, Kokubunji, Tokyo 185-8533, Japan

RION Co., Ltd. Europe Representative Office Schaepmanlaan 66, 4623 XZ,
Bergen op Zoom, The Netherlands

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Outline

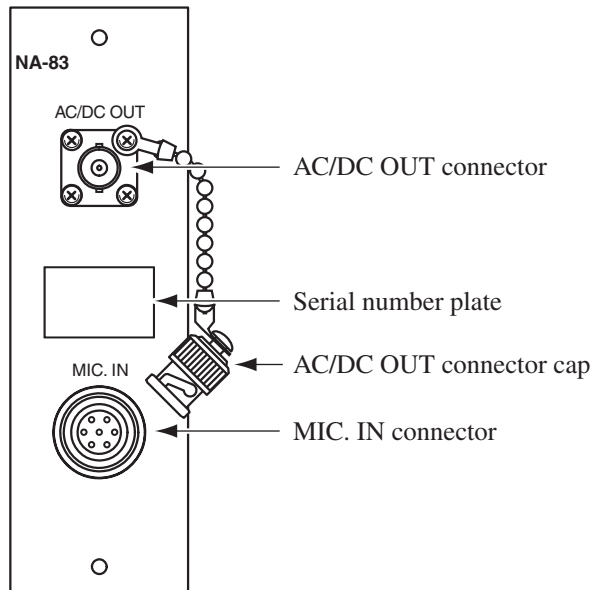
The NA-83 is a Sound Level Meter that conforms to Measurement Law of Japan requirements for precision sound level meters, IEC 61672-1:2002 Class 1 (JIS C 1509-1:2005 Class 1). It features a wide measurement range for sound levels from 28 dB to 138 dB without range switching. Measurement values are displayed on the integrated LCD panel.

Features

- Combination with Outdoor Microphone MS-11 with built-in heater and All-Weather Windscreen WS-13 allows continuous long-term outdoor use.
- Built-in sound source of Outdoor Microphone MS-11 allows acoustic calibration by remote operation.
- Windscreen correction feature of NA-83 ensures compliance with Measurement Law of Japan requirements for precision sound level meters, IEC 61672-1:2002 Class 1 (JIS C 1509-1:2005 Class 1) also when All-Weather Windscreen WS-13 is mounted.
- AC/DC output connector provides either AC or DC output signal (switchable).
- Serial communication with NA-37 enables data transfer and measurement control. Data for time-weighted sound level L_p sampling value, takt-max sound level L_{max} , minimum sound level L_{min} , and time-averaged sound level L_{eq} are sent simultaneously at intervals of 100 ms.
- Sound pressure waveform digital output function (16-bit, 48 kHz sampling) of the NA-37 enables you to convert sound pressure measurement data into WAVE file when using the Real Sound Recording Software NX-37WR.

Controls and Functions

Front panel



AC/DC OUT connector

Supplies either an AC or DC output signal (selectable). For details on the AC/DC OUT setup screen, see page NA83-26.

AC OUT is a frequency based signal using C weighting.

DC OUT is a level signal with logarithmic compression, based on the currently selected frequency weighting and time weighting settings.

Serial number plate

Shows the model type and serial number about the unit and microphone.

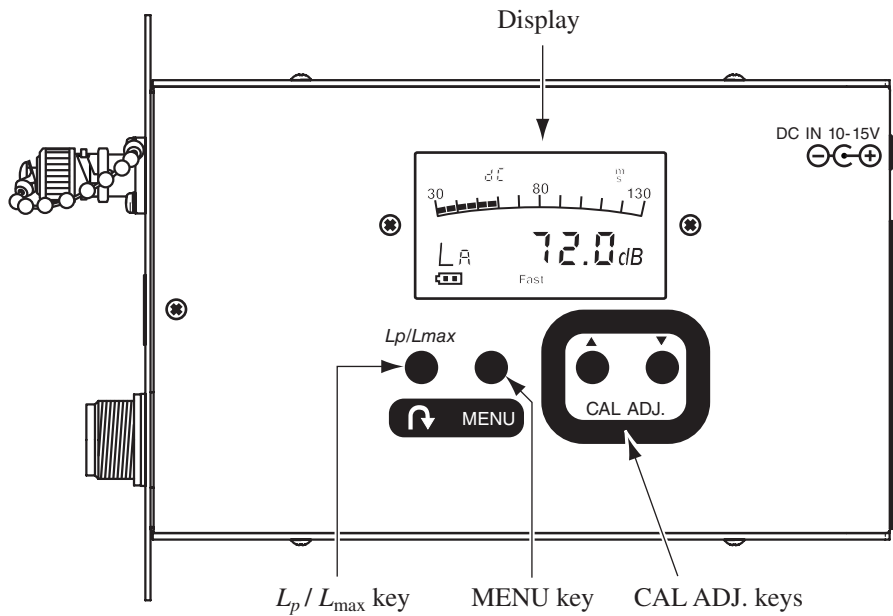
AC/DC OUT connector cap

This cover protects the connector from dust and other contamination. It should be in place when not using the connector.

MIC. IN connector

This is the microphone connector. The Outdoor Microphone MS-11 via its extension cable is to be connected here.

Right side panel

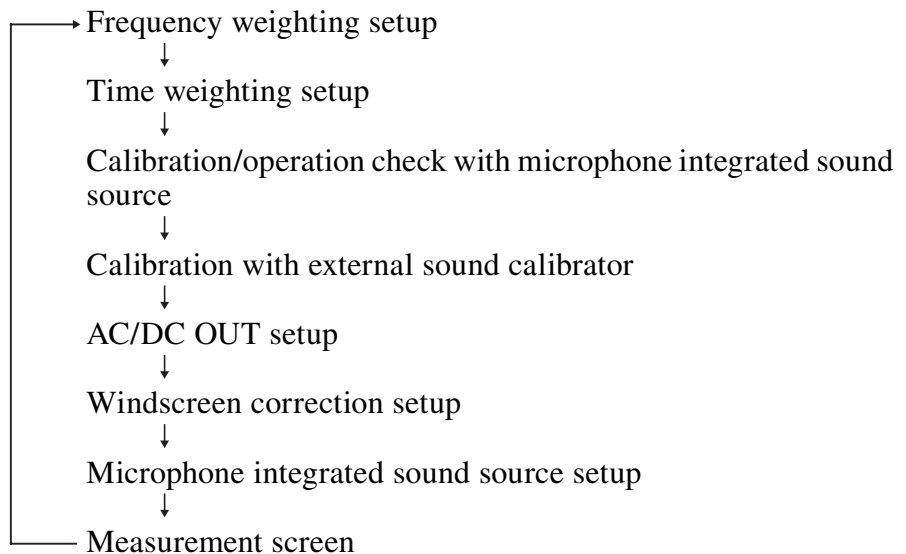


L_p/L_{max} key

Determines whether sound level measurement is for instantaneous value or maximum hold value. When a menu screen has been called up with the MENU key, the key serves for selecting a setting item.

MENU key

Each push of this key cycles through the menu screens listed below.



CAL ADJ. keys

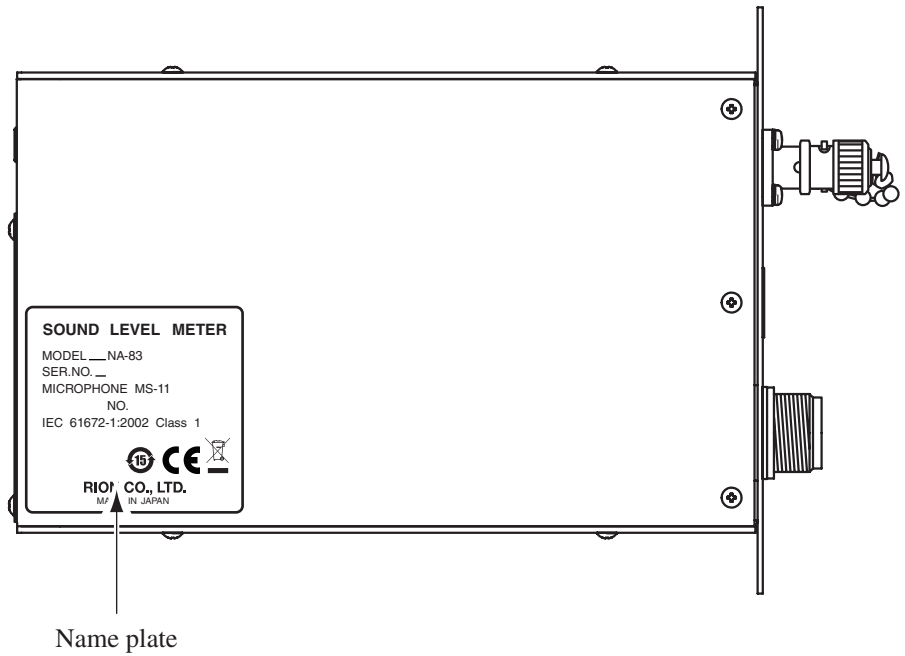
When the “Calibration/operation check with microphone integrated sound source” screen and “Calibration with external sound calibrator” screen is used, these keys serve to adjust the calibration level.

When another menu screen is shown, the keys serve for returning to the measurement screen. While the measurement screen is shown, the keys have no function.

Display

This LCD panel shows the sound level as well as information about settings, under-range and over-range condition, and other items.

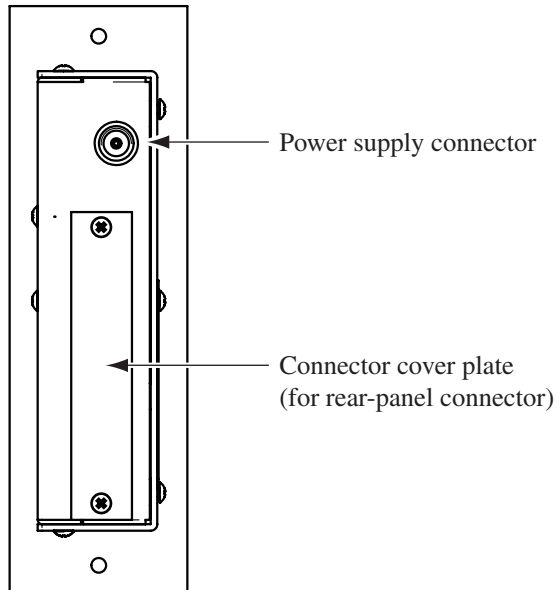
Left side panel



Name plate

Shows information about the model name, type, serial number, microphone serial number, standard compliance, etc.

Rear panel



Power supply connector

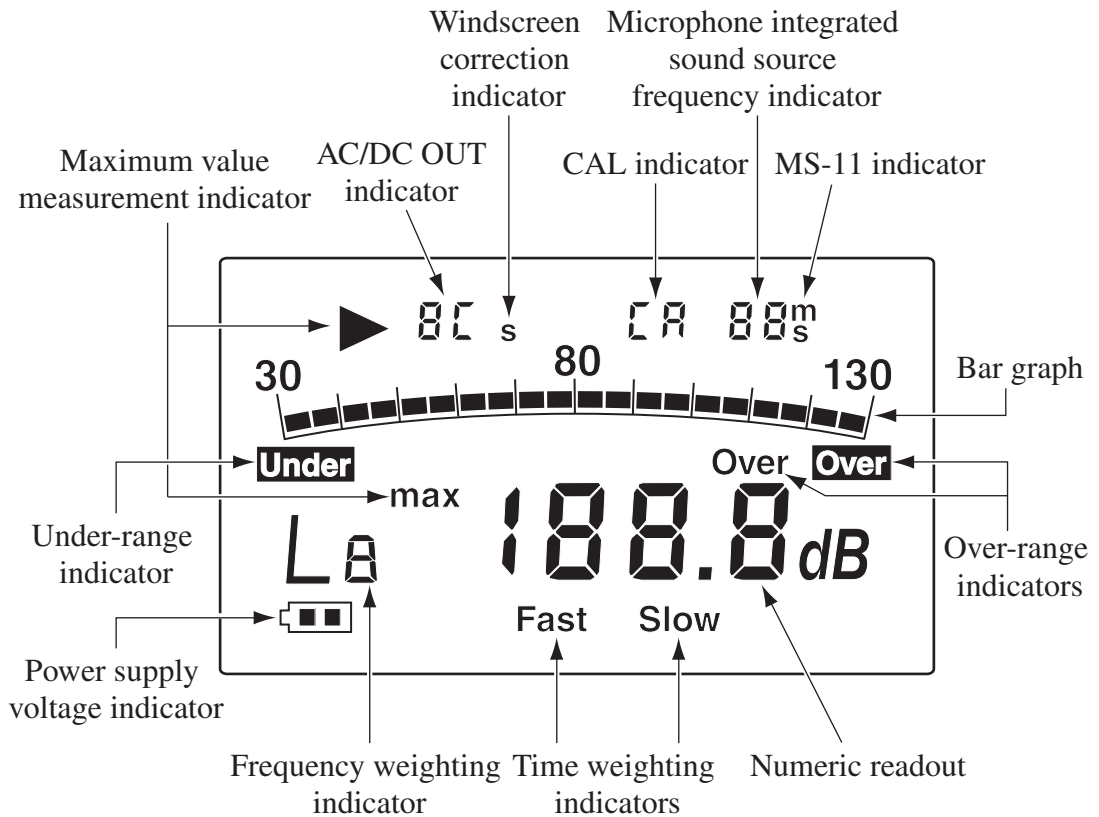
A DC source rated for 10 to 15 V can be connected here. The AC adapter RC45-12L should be used.

Connector cover plate

Protects the rear-panel connector.

To make a connection to the Environmental Sound Monitor NA-37, remove this cover.

Display panel



AC/DC OUT indicator

Shows the AC/DC OUT setting.

AC: AC OUT is selected.

dC: DC OUT is selected.

Windscreen correction indicator

Appears when the windscreen correction has been set to ON.

This setting can be made at the Windscreen correction setup screen (page NA83-27).

CAL indicator

This indicator is shown constantly when “Calibration with microphone integrated sound source” (page NA83-28) or “Operation check with microphone integrated sound source” (page NA83-32) is carried out.

When “Acoustic calibration with Sound Calibrator NC-74” (page NA83-30) is carried out, the indicator flashes.

Microphone integrated sound source frequency indicator

When “Calibration with microphone integrated sound source” or “Operation check with microphone integrated sound source” is carried out, the frequency of the integrated sound source is shown here. The following four indications are available.

“25”: 250 Hz “50”: 500 Hz “1”: 1 kHz “4”: 4 kHz

MS-11 indicator

This indicator is shown when the integrated sound source of the Outdoor Microphone MS-11 can be used.

The sound source is enabled by setting it to ON on the microphone integrated sound source setup screen (page NA83-23).

Bar graph

Shows the instantaneous value of the sound level (updated every 100 ms).

Over-range indicators

Indicate that the sound level signal has exceeded the upper limit of the allowable range.

If the instantaneous value of the sound level has exceeded the range, the right-side **Over** indicator is shown for at least 1 second.

If the sound level during maximum value measurement has exceeded the range at least once, the left-side **Over** indicator appears and is held until the end of maximum value measurement.

Numeric readout

Normally, the sound level is shown here as a dB value.

Time weighting indicators

Show the selected time weighting.

“Fast”: Time weighting F (Fast-response)

“Slow”: Time weighting S (Slow-response)

Frequency weighting indicator

Show the selected frequency weightings.

“A”: A weighting

“C”: C weighting

“p”: Z weighting

Power supply voltage indicator

Shows the voltage of the power supplied to the unit, as follows.

[■ ■] (2 segments on): approx. 11.3 to 15 V

[■] (1 segment on): approx. 9.8 to 11.3 V

[■ ■] (flashing): lower than approx. 9.8 V

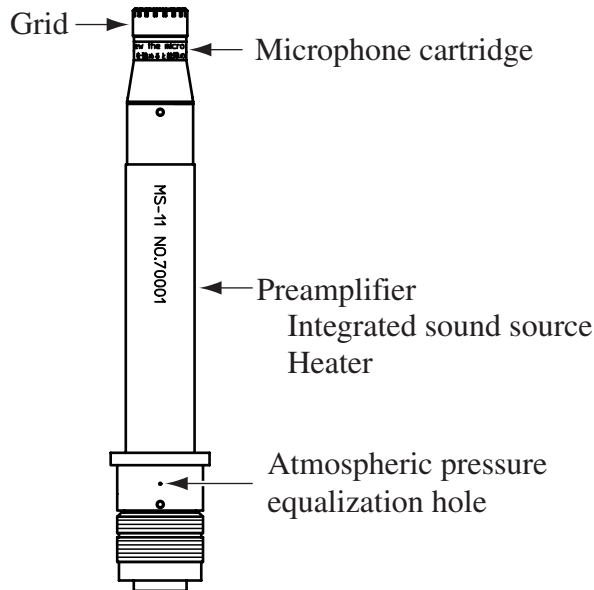
Under-range indicator (UNDER)

When the sound level signal has dropped below the lower limit of the allowable range, this indicator is shown for at least one second.

Maximum value measurement indicator

To make a maximum value measurement, press the L_p/L_{\max} key so that this indicator is shown.

Outdoor Microphone MS-11



Integrated sound source

This source is driven by a signal from the NA-83 and generates a calibration tone (1 kHz, 114 dB, at an atmospheric pressure of 101.3 kPa) within the microphone cartridge. It can be used to calibrate and verify operation of the system consisting of the microphone and sound level meter.

Heater

This device serves to prevent internal condensation in the MS-11. The heat value is about 0.9 W. It is integrated in the preamplifier section.

Atmospheric pressure equalization hole

This hole of 0.5 mm diameter equalizes differences in air pressure inside and outside of the MS-11.

Important
Never remove the microphone cartridge.
Do not remove the grid. Otherwise the diaphragm may become deformed or damaged, which will result in impaired performance.
Do not block the atmospheric pressure equalization hole with tape or similar. If pressure cannot be equalized, microphone performance will be impaired.

Connections

Using the All-Weather Windscreen WS-13

Important
Disconnect the power before making any connections (see page NA83-21).
Use only the microphone whose serial number is shown on the name plate of the unit.

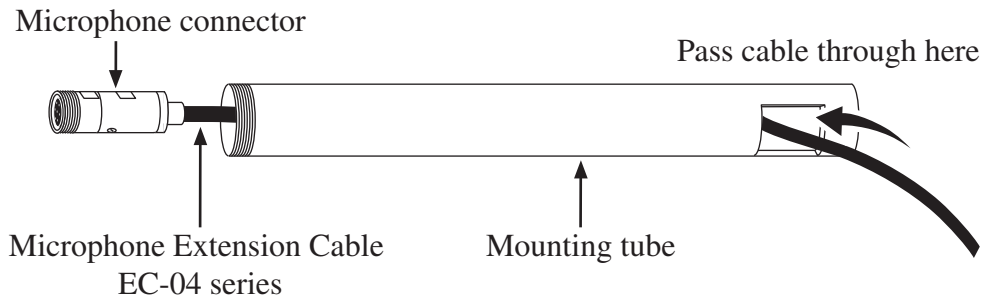
The All-Weather Windscreen WS-13 and Microphone Extension Cable EC-04 series are sold separately as options.

In addition, one of the following tripods can be used for installation.

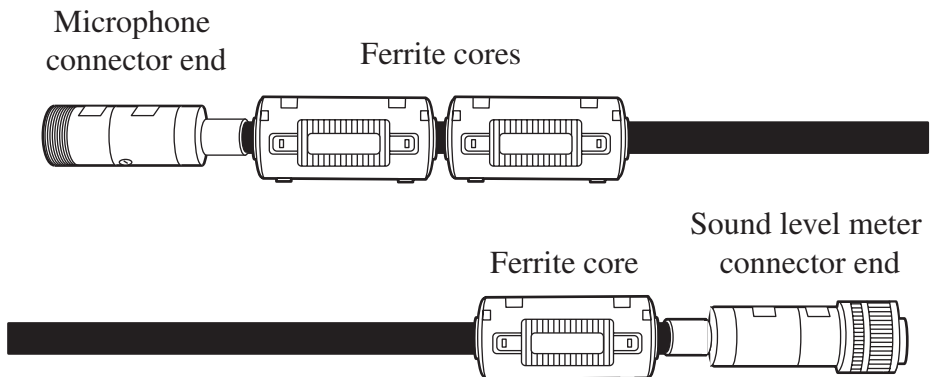
- All-Weather Windscreen Tripod ST-81, ST-88

(Connecting the microphone extension cable)

1. Insert the microphone extension cable through the cable cutout on the side of the mounting tube.

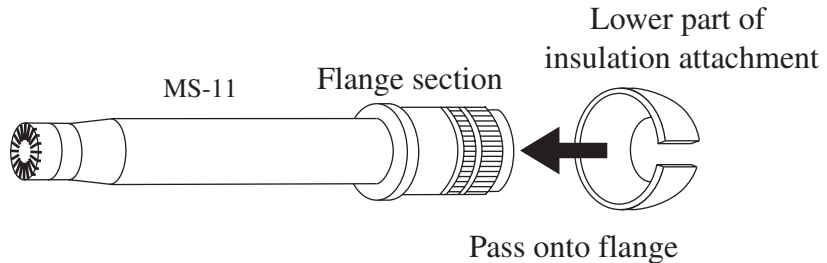


2. Attach the supplied ferrite cores to the microphone extension cable. Attach two cores near the microphone connector end and one core near the sound level meter connector end.

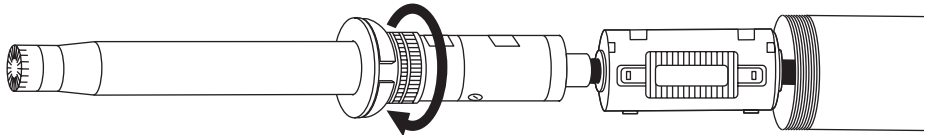


3. Pass the lower part of the insulation attachment onto the flange section of the MS-11.

The insulation attachment is not yet fixed at this point.

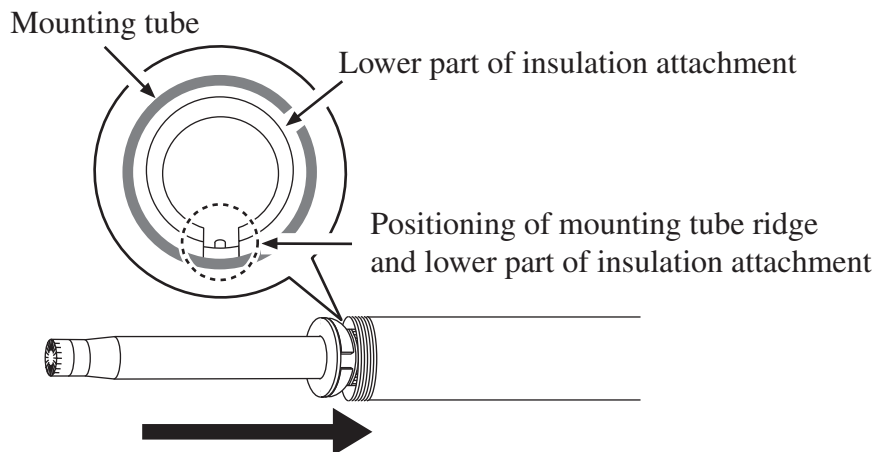


4. Connect the microphone extension cable to the MS-11. Rotate the outer part of the connector until the cable connector and the MS-11 are firmly joined by the screw thread.



(Fastening to mounting tube)

5. Insert the microphone into the mounting tube from the top. The inside of the mounting tube has a ridge that is designed to prevent the microphone from turning. The ridge must be aligned with the cutout on the lower part of the insulation attachment.

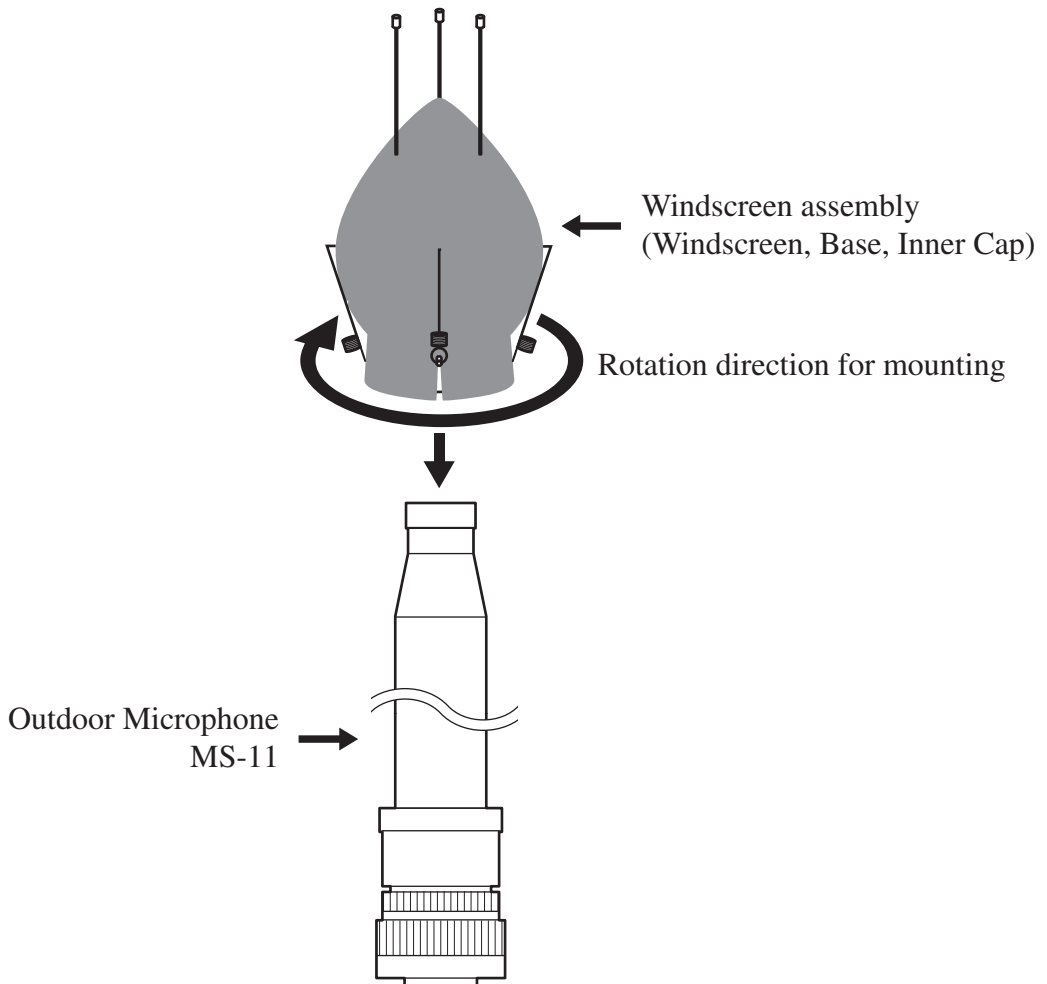


(Attaching the windscreen)

(If windscreen and inner cap are to be reattached after replacing these parts, perform steps 7 to 9.)

6. The windscreen is shipped from the factory with the base and inner cap attached. Insert the MS-11 directly into the assembly and rotate the base to attach it to the mounting tube.

Note
To remove the base and windscreen for maintenance, rotate the base section in the opposite direction than during installation. This lets you remove the base and windscreen together.
To remove the windscreen only, pull out the three spring hooks that are holding the windscreen.

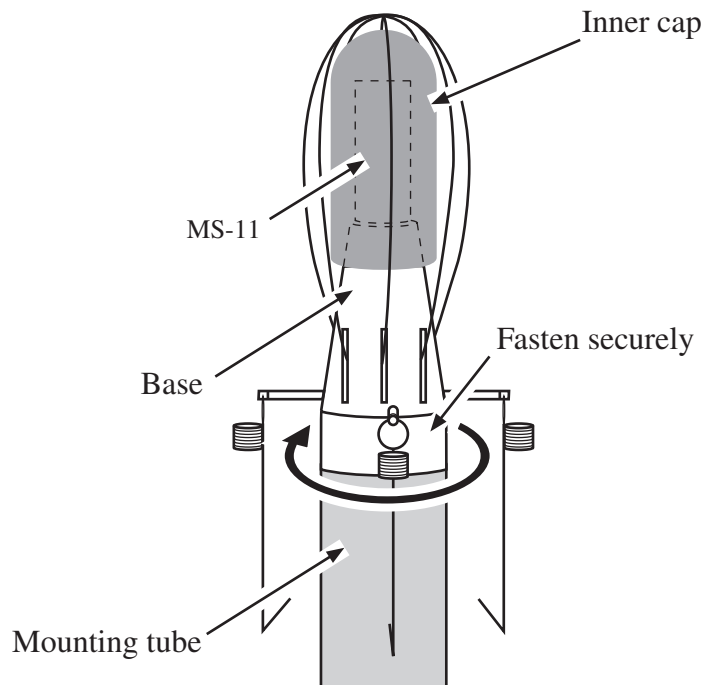


(Procedure after replacing the inner cap)

7. Insert the microphone into the base and rotate the base to securely fasten it to the mounting tube.

While doing this, take care that the tips of the springs attached to the base do not come into contact with the MS-11 microphone.

Next, attach the windscreen (steps 8 to 9).



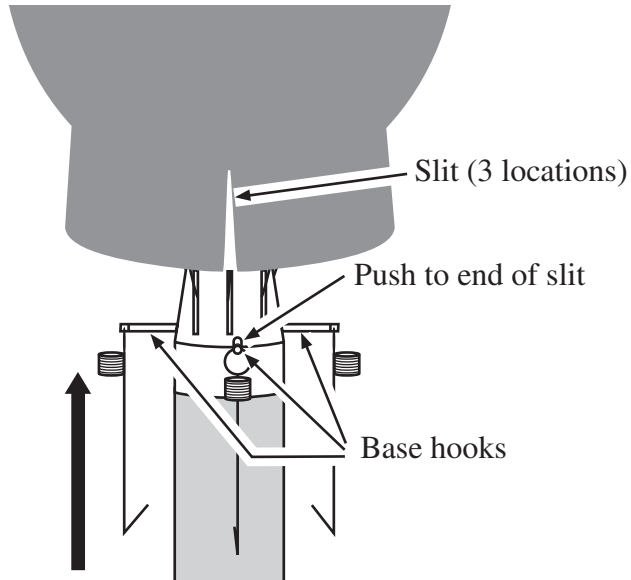
Important

When reconnecting after replacing the inner cap, trying to attach the windscreen to the base while the microphone is removed may cause the inner cap to shift, so that the microphone will later not properly fit into the hole of the inner cap.

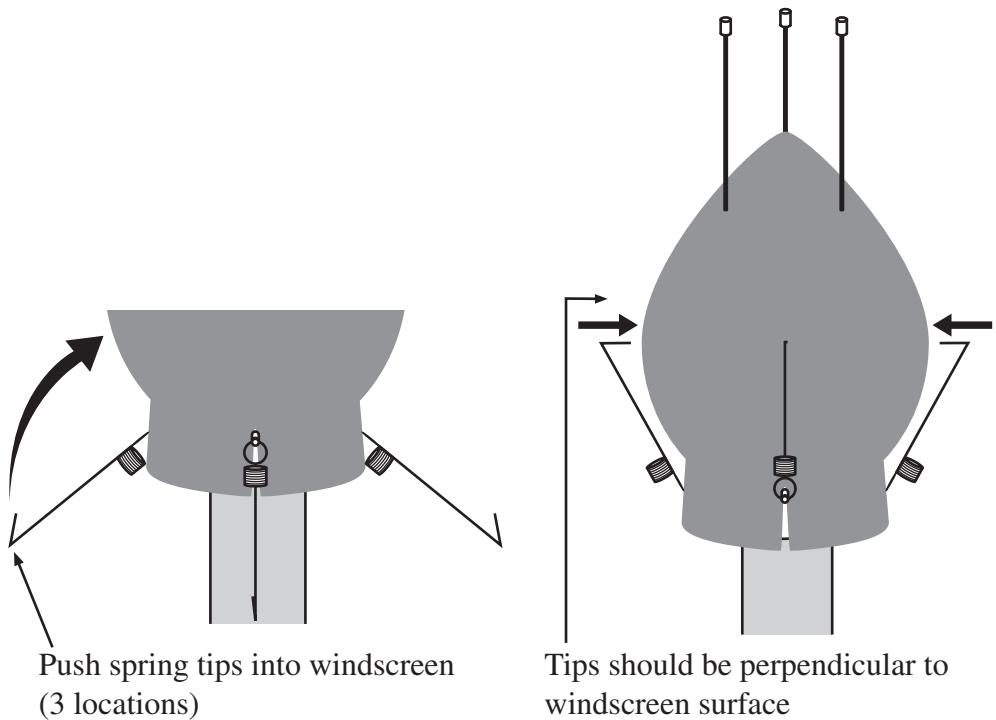
When the windscreen and base were removed as a unit, they can also be reattached as a unit.

(Mounting the windscreen)

8. In the lower part of the windscreen, there are three slits. Align these slits with the hooks on the base and push the windscreen fully onto the base.



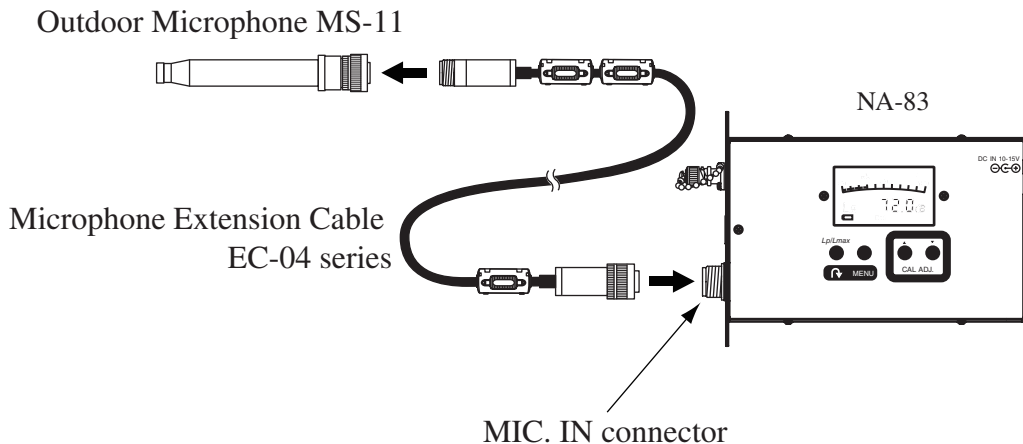
9. Push the tips of the springs attached to the hooks firmly into the windscreen, at about the middle section.



Microphone connection

When using the All-Weather Windscreen WS-13, refer to the preceding “Using the All-Weather Windscreen WS-13” section for information on connecting the microphone and microphone extension cable.

Important
Disconnect the power before making any connections (see page NA83-21).
Use only the microphone whose serial number is shown on the name plate of the unit.
The microphone also picks up vibrations. Ensure that the installed MS-11 and other equipment does not vibrate due to wind or other causes.
The Microphone Extension Cable EC-04 series is a separate option. Select the required length for your installation. For IEC compliance, the maximum cable length is 35 meters. For CE marking compliance, the maximum cable length is 30 meters.



1. Attach the three supplied ferrite cores to the microphone extension cable (see page NA83-11).
2. Connect the Outdoor Microphone MS-11 and Microphone Extension Cable EC-04 series.
3. Plug the extension cable into the MIC. IN connector.

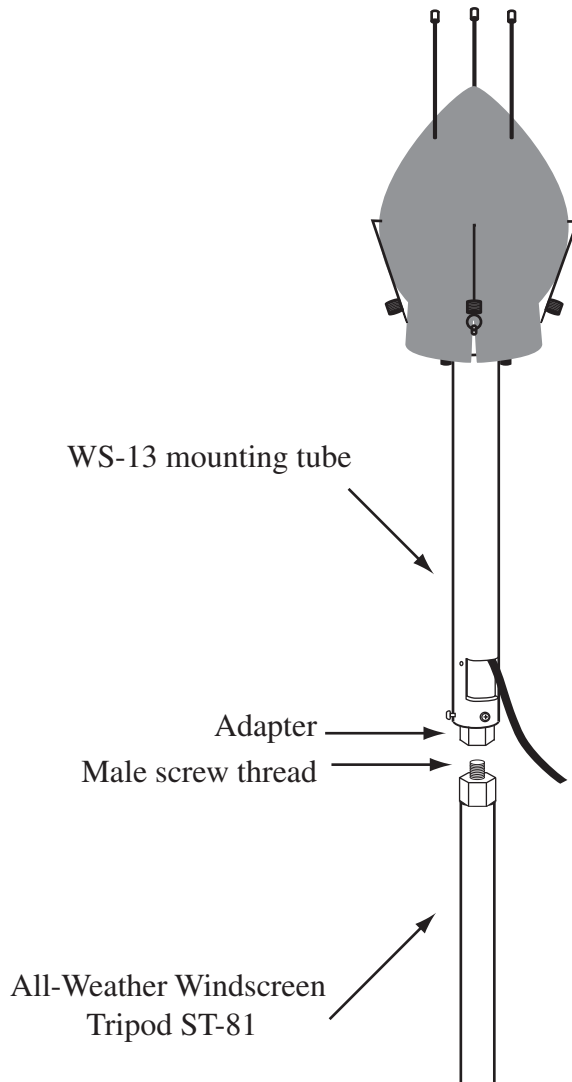
Mounting the All-Weather Windscreen WS-13 on a tripod

The All-Weather Windscreen WS-13 attached to the microphone can be mounted to the optional All-Weather Windscreen Tripod ST-81 or ST-88.

Mounting on All-Weather Windscreen Tripod ST-81

Connect the adapter of the WS-13 mounting tube and the male screw thread at the tip of the ST-81, as shown below.

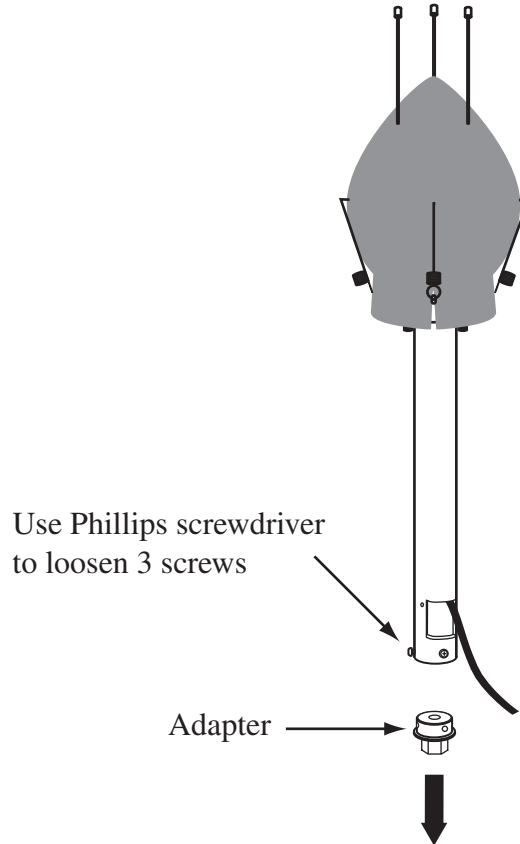
When finished, verify that the connection is firm and without play.



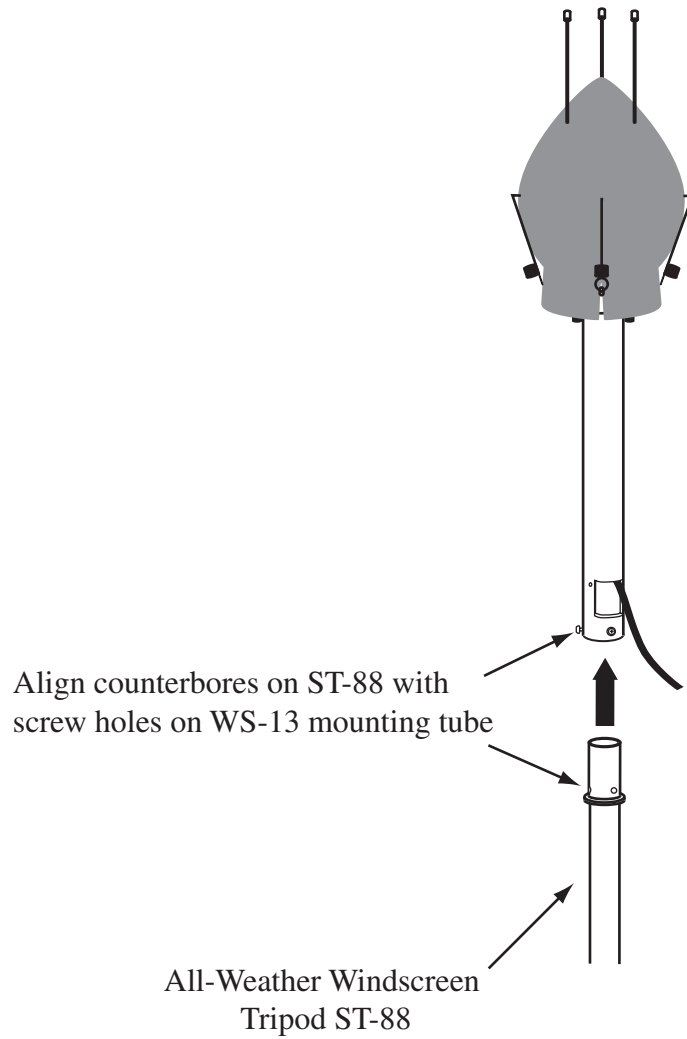
Note
When mounting to the ST-81, the screw hole next to the cable cutout on the mounting tube is not used.

Mounting on All-Weather Windscreen Tripod ST-88

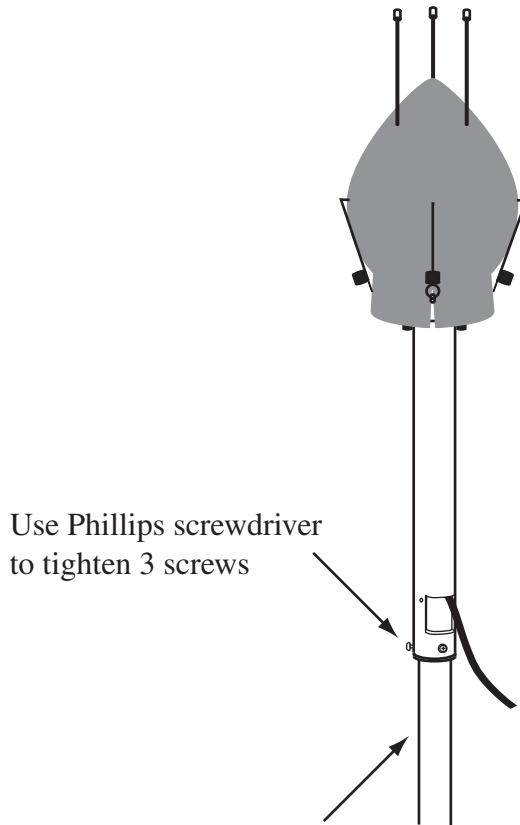
1. Loosen the three screws at the bottom of the WS-13 mounting tube and remove the adapter.



2. Push the WS-13 mounting tube into the tip of the ST-88.



3. Tighten the three screws on the WS-13 mounting tube.
When finished, verify that the connection is firm and without play.



All-Weather Windscreen
Tripod ST-88

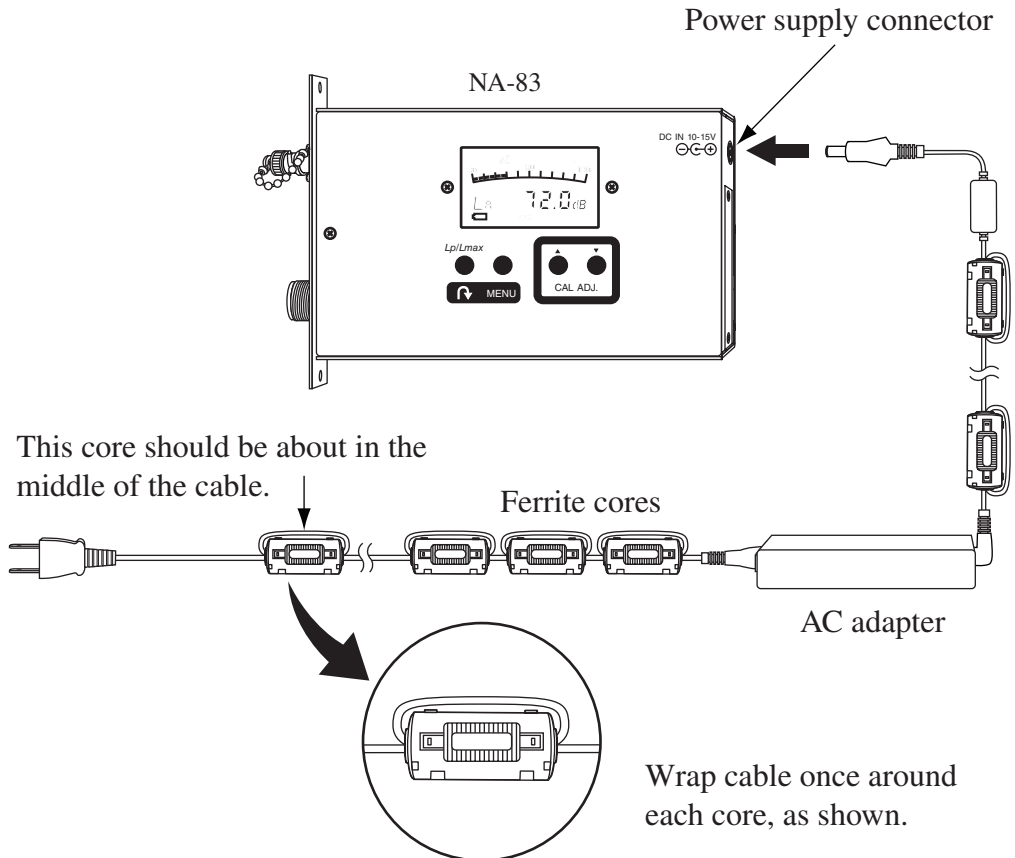
Note
When mounting to the ST-88, the screw hole next to the cable cutout on the mounting tube is not used.

Power on/off switching (AC adapter connection)

Power on/off to the NA-83 is controlled by connecting the AC adapter. The allowable power supply voltage range is 10 to 15 V DC. Use the specified AC adapter (RC45-12L, option).

Use six ferrite cores (option) together with the AC adapter, and wrap the cable once around each core, as shown below.

* Ferrite core FCA8K ×6 (option)



Power on

1. Plug the cable from the AC adapter into the power connector on the NA-83.
2. Connect the AC adapter to an AC outlet (100 to 240 V AC, 50/60 Hz).

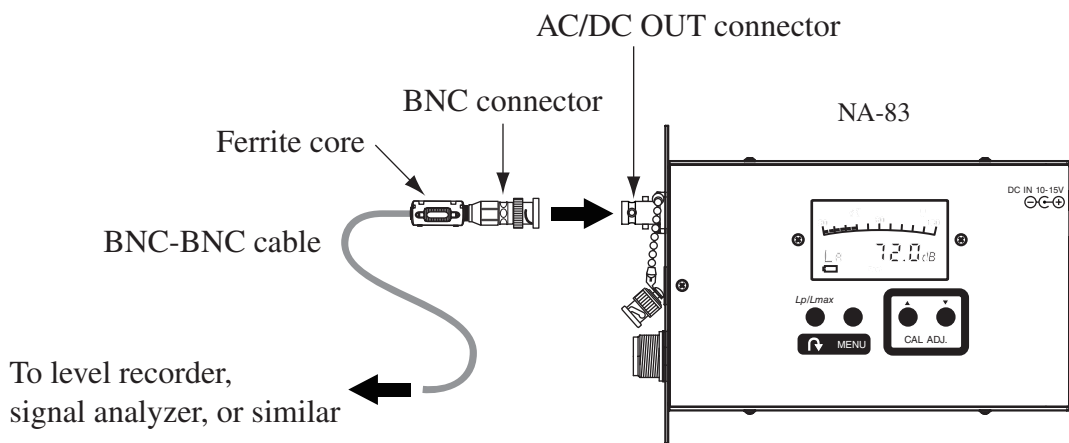
Power off

Carefully pull the plug of the AC adapter out of the power connector on the NA-83.

Connection of AC/DC OUT connector

The AC/DC OUT connector of the NA-83 is a BNC type connector which can be used to supply a signal to other equipment such as a level recorder or signal analyzer. Use a cable with BNC plug for the connection, and mount one ferrite core (option) on the cable.

- * BNC-BNC cable NC-39A 1.5 m (option)
- * Ferrite core FCA8K ×1 (option)



Menu Setup

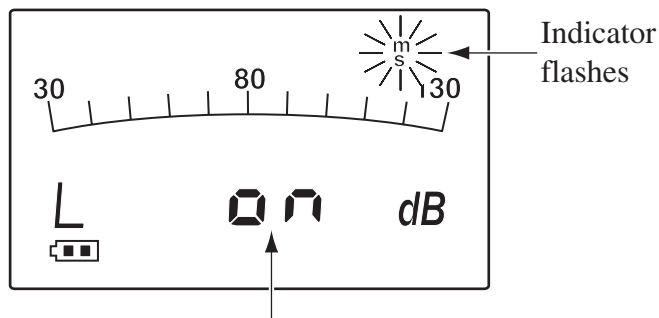
Microphone integrated sound source setup

You can turn the microphone integrated sound source on or off as described below.

Normally, the ON setting is used. This is also the default setting when power is supplied to the NA-83.

ON: The sound source integrated in the MS-11 can be used, for acoustic calibration including the microphone and NA-83.

OFF: The internal test signal generator (1 kHz, sinusoidal wave) of the NA-83 is used, for electrical calibration of the NA-83 only.



Turn this setting on or oFF

Microphone integrated sound source setup screen

1. From the normal measurement screen, press the MENU key seven times to bring up the microphone integrated sound source setup screen. The indicator (ms) on the upper right of the screen flashes.
2. Use the L_p/L_{max} key to select the microphone integrated sound source setting.
 - “on”: Microphone integrated sound source ON
 - “oFF”: Microphone integrated sound source OFF
3. Press the MENU key or a CAL ADJ. key to return to the measurement screen.

Frequency weighting setup

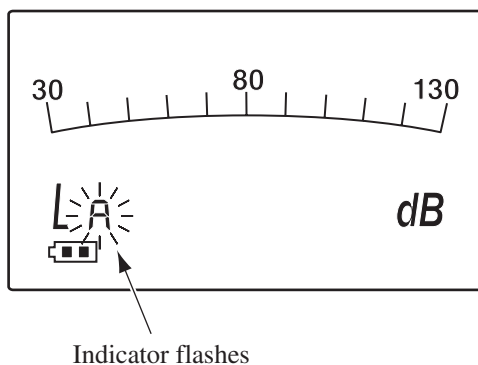
For regular sound level measurement, “A” weighting is normally used.

When “C” weighting is selected, sound pressure level is measured with flat response in the range from 31.5 Hz to 8 kHz.

When “Z” weighting is selected, sound pressure level is measured with flat response in the range from 20 Hz to 20 kHz.

For compliance with specifications and legal requirements, select the appropriate frequency weighting setting.

The default setting when power is supplied to the NA-83 is “A” weighting.



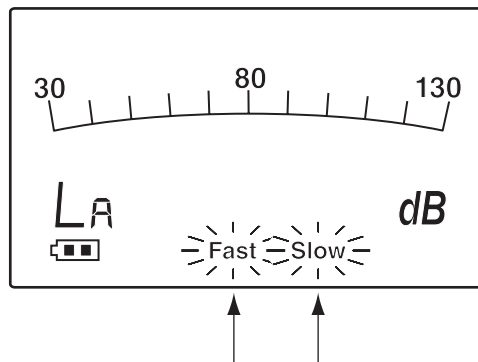
Frequency weighting setup screen

1. From the normal measurement screen, press the MENU key once to bring up the frequency weighting setup screen.
2. Use the L_p/L_{\max} key to select the frequency weighting setting.
 - “A”: A weighting
 - “C”: C weighting
 - “p”: Z weighting
3. Press the MENU key seven times to return to the measurement screen.
(The CAL ADJ. keys can also be used.)

Time weighting setup

For compliance with specifications and legal requirements, select the appropriate time weighting setting.

The default setting when power is supplied to the NA-83 is time weighting F (Fast).



One of these indicators flashes,
showing the selected setting

Time weighting setup screen

1. From the normal measurement screen, press the MENU key twice to bring up the time weighting setup screen.
2. Use the L_p/L_{max} key to select the time weighting setting.
 - “Fast”: Time weighting F (Fast)
 - “Slow”: Time weighting S (Slow)
3. Press the MENU key six times to return to the measurement screen. (The CAL ADJ. keys can also be used.)

AC/DC OUT setup

Lets you select the signal to be supplied from the AC/DC OUT connector.

AC OUT

An AC signal derived from the measurement data using C weighting is output.

An output level of 1.0 Vrms corresponds to sound level of 110 dB.

Example:

When the sound level is 90 dB, $90 \text{ dB} = 110 \text{ dB} - 20 \text{ dB}$, therefore the output voltage is 0.1 Vrms.

DC OUT

A DC signal using logarithmic compression and based on the currently selected frequency weighting and time weighting settings is output.

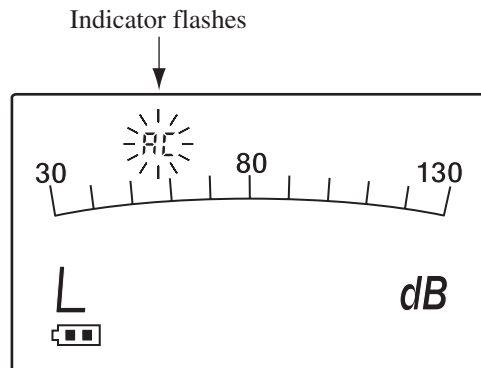
An output level of 5.5 V corresponds to sound level of 130 dB.

The signal voltage drops by 0.05 V per dB.

Example:

When the sound level is 120 dB, the output level is calculated as:
 $5.5 - 0.05 \times (130 - 120) = 5.0 \text{ (V)}$.

The default setting when power is supplied to the NA-83 is DC OUT.



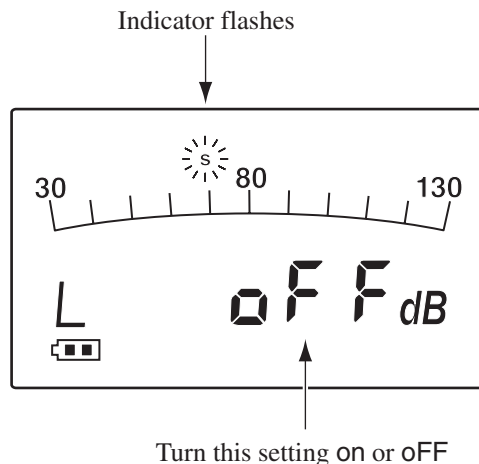
AC/DC OUT setup screen

1. From the normal measurement screen, press the MENU key five times to bring up the AC/DC OUT setup screen.
2. Use the L_p/L_{max} key to select the AC/DC OUT setting.
 - “AC”: AC output
 - “dC”: DC output
3. Press the MENU key three times to return to the measurement screen. (The CAL ADJ. keys can also be used.)

Windscreen correction setup screen

When the All-Weather Windscreen WS-13 is mounted on the Outdoor Microphone MS-11, frequency response will change due to the influence of the windscreen. Windscreen correction uses digital processing to correct for this change and ensure compliance with the Measurement Law of Japan requirements for precision sound level meters, IEC 61672-1:2002 Class 1 (JIS C 1509-1:2005 Class 1).

The default setting when power is supplied to the NA-83 is no windscreen correction.



Windscreen correction setup screen

1. From the normal measurement screen, press the MENU key six times to bring up the windscreen correction setup screen.
2. Use the L_p/L_{max} key to select the windscreen correction setting.
 - “on”: Windscreen correction ON
 - “oFF”: Windscreen correction OFF
3. Press the MENU key twice to return to the measurement screen. (The CAL ADJ. keys can also be used.)

Important

The AC OUT signal does not reflect the windscreen correction setting.

Calibration and Operation Check

Calibration with microphone integrated sound source

The integrated sound source of the Outdoor Microphone MS-11 can be used for acoustic calibration. The test tone is a 1 kHz sinusoidal wave signal, and the calibration level is 114.0 dB. Use the CAL ADJ. keys to adjust the calibration level.

Important

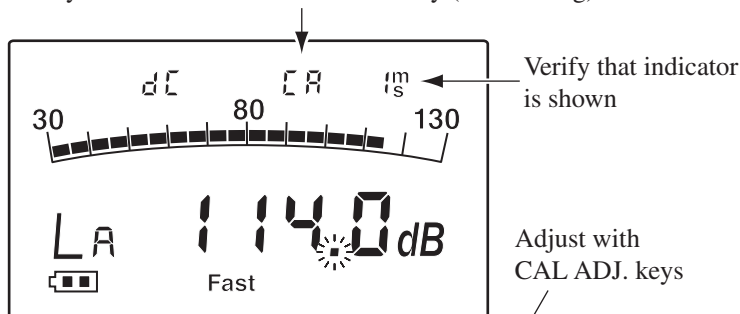
The microphone has an integrated heater to prevent internal condensation.

Before starting calibration, the microphone should have been powered for at least 5 to 10 minutes, to allow the heater to warm up.

The sensitivity of the integrated sound source differs for individual microphones. Sensitivity adjustment is therefore performed at the factory for each microphone individually, in conjunction with the respective NA-83. Verify that the serial number of the microphone matches the number shown on the name plate of the NA-83 unit.

The microphone also picks up vibrations. Ensure that the installed MS-11 does not vibrate due to wind or other causes.

Verify that indicator is shown constantly (not flashing)



Lp/Lmax



MENU



1. Set the frequency weighting to “A” (page NA83-24).
2. Verify that the MS-11 indicator (ms) is shown. If not, set the microphone integrated sound source to ON from the MENU screen (page NA83-23).
3. From the normal measurement screen, press the MENU key three times to bring up the screen for calibration and operation check with microphone integrated sound source. Make sure that the calibration indicator (CA) is shown constantly, not flashing.
4. Use the L_p/L_{\max} key to select the integrated sound source indication “CA 1” (1 kHz).
5. Use the CAL ADJ. keys to bring the indication on the numeric readout to “114.0 dB”.
6. Press the MENU key five times to return to the normal measurement screen. This completes the calibration procedure.

Atmospheric pressure correction

The output sound pressure of the integrated sound source fluctuates slightly depending on atmospheric pressure.

When pressure is low, the output will be slightly lower, and when pressure is high, the output will be slightly higher. If the atmospheric pressure can be verified, adjust the calibration as follows.

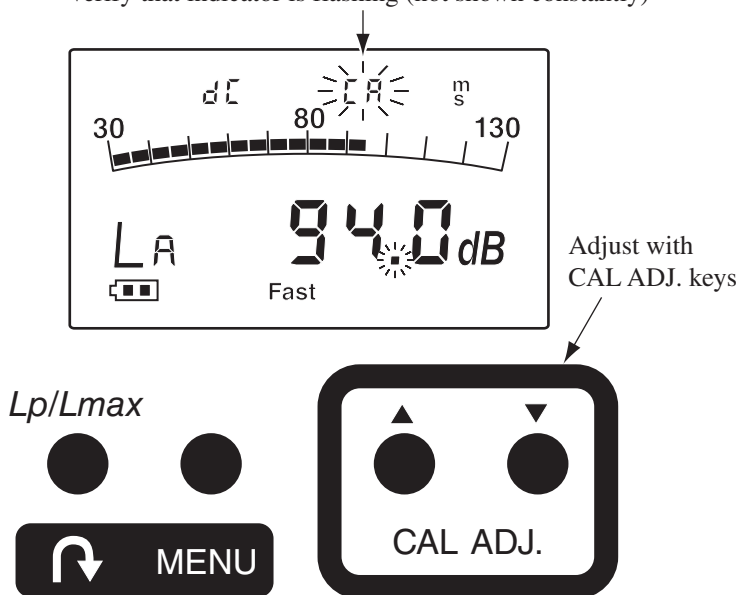
Atmospheric pressure (kPa)	Sound pressure level (dB)
91.7 to 93.8	113.6
93.9 to 95.9	113.7
96.0 to 97.9	113.8
98.0 to 100.1	113.9
100.2 to 102.3	114.0
102.4 to 104.7	114.1

Acoustic calibration with Sound Calibrator NC-74

This section describes how to perform acoustic calibration with the Sound Calibrator NC-74 attached to the Outdoor Microphone MS-11. The test tone is a 1 kHz sinusoidal wave signal, and the calibration level is 94.0 dB. Use the CAL ADJ. keys to adjust the calibration level.

Important
<p>The microphone has an integrated heater to prevent internal condensation. Before starting calibration, the microphone should have been powered for at least 5 to 10 minutes, to allow the heater to warm up.</p>
<p>Proceed very carefully and slowly when mounting the Sound Calibrator NC-74 on the microphone. Pushing the calibrator in or removing it too fast causes a rapid change in the pressure inside the coupler, which can cause fatal damage to the microphone diaphragm. For details on using the Sound Calibrator NC-74, refer to the documentation of that product.</p>

Verify that indicator is flashing (not shown constantly)



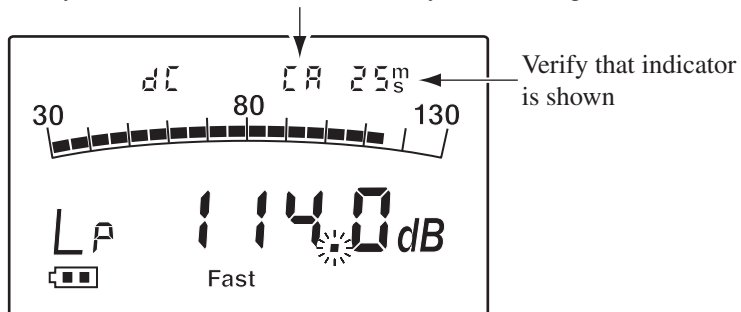
1. Turn power to the Sound Calibrator NC-74 off.
2. Set the frequency weighting to “A” (page NA83-24).
3. From the normal measurement screen, press the MENU key four times to bring up the screen for calibration with an external sound calibrator. Make sure that the calibration indicator (CA) is flashing, not shown constantly.
4. Proceeding slowly and carefully, insert the Outdoor Microphone MS-11 all the way into the coupler of the Sound Calibrator NC-74, and turn the NC-74 on.
5. Use the CAL ADJ. keys to bring the indication on the numeric readout to “94.0 dB”.
6. Press the MENU key four times to return to the normal measurement screen. This completes the calibration procedure.
7. Turn power to the Sound Calibrator NC-74 off, and slowly and carefully remove the microphone from the coupler.

Operation check with microphone integrated sound source

Using the integrated sound source of the Outdoor Microphone MS-11, perform an operation check as follows. The sound source frequencies for operation check are 250 Hz, 500 Hz, and 4 kHz (sinusoidal wave signals).

Important
The 250 Hz, 500 Hz, and 4 kHz sound source frequencies are for operation checking only. Do not use the CAL ADJ. keys for adjustment in this mode.
The information about atmospheric pressure given in the section “Atmospheric pressure correction” on page NA83-29 applies also to operation check.

Verify that indicator is shown constantly (not flashing)

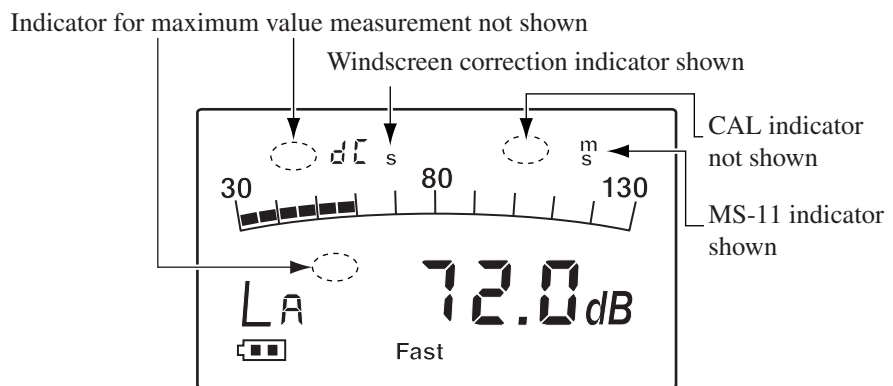


1. Set the frequency weighting to “Z” (indication “p”) (page NA83-24).
2. Verify that the MS-11 indicator (ms) is shown. If not, set the microphone integrated sound source to ON from the MENU screen (page NA83-23).
3. From the normal measurement screen, press the MENU key three times to bring up the screen for calibration and operation check with microphone integrated sound source. Make sure that the calibration indicator (CA) is shown constantly, not flashing.
4. Use the L_p/L_{max} key to select the frequency for the integrated sound source.
CA 25: 250 Hz CA 50: 500 Hz CA 4: 4 kHz
(The 1 kHz frequency is for calibration.)
5. Press the MENU key five times to return to the normal measurement screen.

Measurement

Measurement of time-weighted sound level L_p (instantaneous value)

The following explanation assumes that the steps for menu setup and calibration/operation check as explained in the preceding sections have been completed.



Measurement screen

1. Verify that the measurement screen is shown (no menu setup items, no CAL indication).
2. Verify that the indicator for maximum value measurement is not shown.

If the indicator is shown, press the L_p/L_{\max} key to turn it off.

If the measurement screen is being shown and the maximum value measurement indicator is not visible, measurement for instantaneous value has started.

3. Verify that the MS-11 indicator (ms) is shown.
4. Check the indication for windscreen correction. If using the All-Weather Windscreen WS-13, the setting should be ON.

5. Check the frequency weighting indication.

To measure sound level normally, frequency weighting should be set to “A”.

To measure C-weighted or Z-weighted sound level, frequency weighting should be set to “C” or “Z”.

To change the setting, use the frequency weighting setup screen (page NA83-24).

6. Check the time weighting indication.

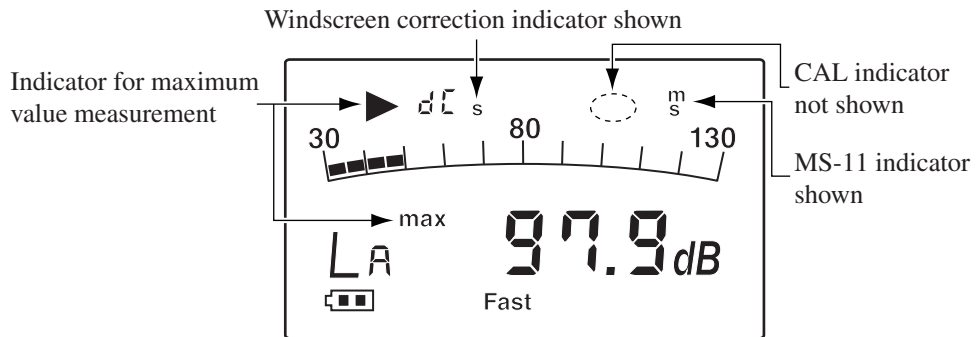
“Fast”: Time weighting F (Fast)

“Slow”: Time weighting S (Slow)

To change the setting, use the time weighting setup screen (page NA83-25).

Measurement of maximum time-weighted sound level L_{\max}

The following explanation assumes that the steps for menu setup and calibration/operation check as explained in the preceding sections have been completed.



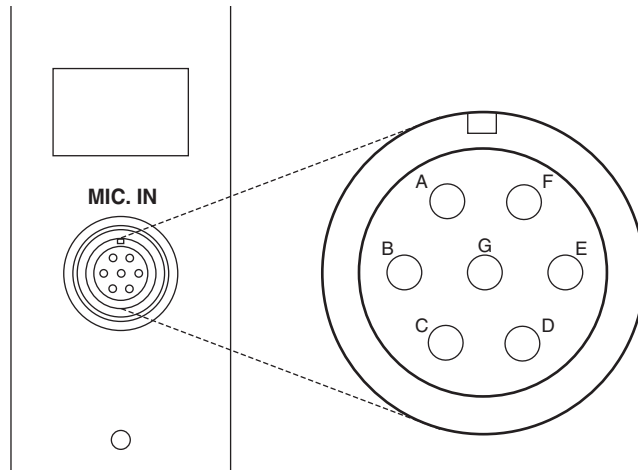
Measurement screen

1. Verify that the measurement screen is shown (no menu setup items, no CAL indication).
2. Verify that the indicator for maximum value measurement is not shown.
If the indicator is shown, press the L_p/L_{\max} key to turn it off. This will reset the maximum value.
3. Verify that the MS-11 indicator (ms) is shown.
4. Check the indication for windscreen correction. If using the All-Weather Windscreen WS-13, the setting should be ON.
5. Check the frequency weighting indication.
To measure sound level normally, frequency weighting should be set to "A".
To measure C-weighted or Z-weighted sound level, frequency weighting should be set to "C" or "Z".
To change the setting, use the frequency weighting setup screen (page NA83-24).

6. Check the time weighting indication.
“Fast”: Time weighting F (Fast)
“Slow”: Time weighting S (Slow)
To change the setting, use the time weighting setup screen (page NA83-25).
7. Use the L_p/L_{\max} key to turn on the maximum value measurement indicator. When “max” is shown on the display, maximum value measurement has started and the numeric readout is switched to show the maximum value.
8. To terminate maximum value measurement, press the L_p/L_{\max} key again. The maximum value measurement indicator goes out, and the numeric readout is switched back to show the instantaneous value.

Connectors

MIC. IN connector



- A: +15 V (preamplifier power supply)
- B: Ground
- C: Microphone signal input
- D: -15 V (preamplifier power supply)
- E: Calibration signal output
- F: Heater power supply (+)
- G: Heater power supply (-) (Ground)

The heater current for the MS-11 flows from F to G (approx. 100 mA).

Important

The MS-11 has connector pins for the integrated heater and integrated sound source. Do not connect the MS-11 to a sound level meter other than the NA-83. In particular, sound level meters that provide a bias voltage through the microphone connector may damage the MS-11.

Default Values

Each time when power to the NA-83 is supplied, the following settings are established. (The unit does not have a resume function.)

- Numeric readout
Time-weighted sound level L_p (instantaneous value)
- Frequency weighting A
- Time weighting F (Fast)
- Microphone integrated sound source ON
- Frequency of microphone integrated sound source 1 kHz
- AC/DC OUT setting DC OUT
- Windscreen correction setting OFF

Technical Reference

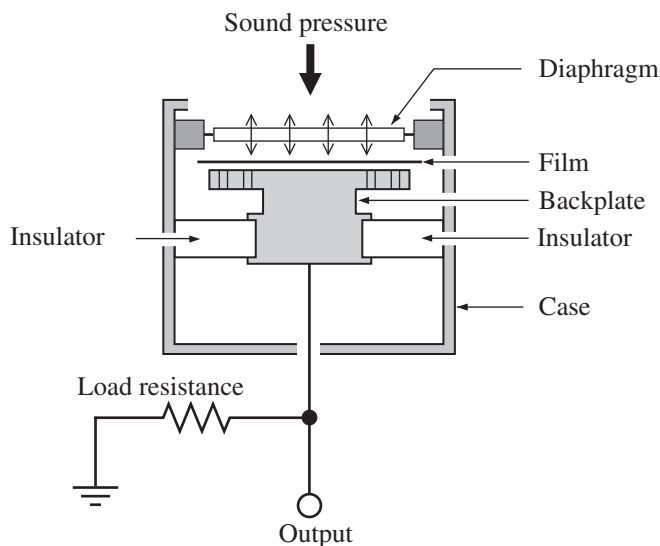
Microphone and Preamplifier

The Sound Level Meter NA-83 uses the MS-11 which incorporates a small and highly stable electret condenser microphone with a heater, internal sound source, and preamplifier. The MS-11 is suitable for long-term outdoor measurement of sound levels. The integrated sound source makes regular maintenance and calibration easy. For details, see the section “Outdoor Microphone MS-11” on page NA83-10.

The general microphone construction and operation principles as well as preamplifier requirements are explained below.

Construction and Operation Principle

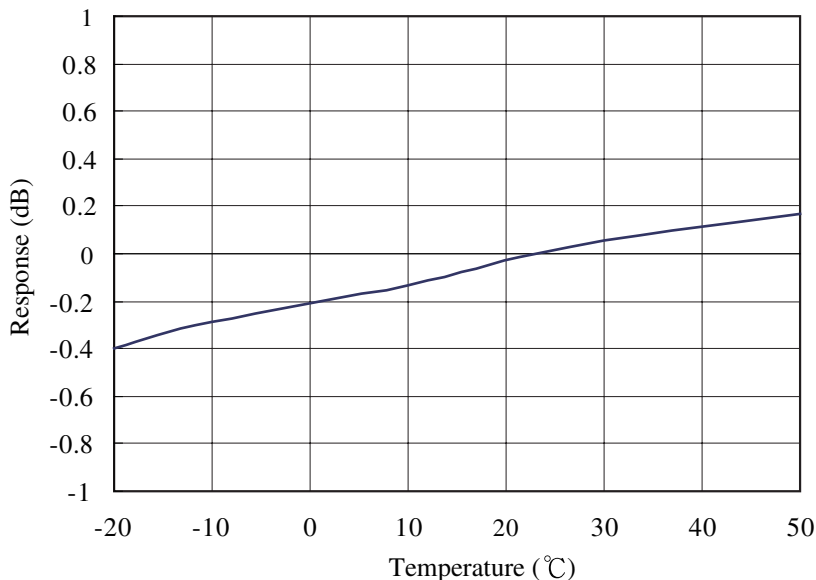
As shown in the illustration below, an electret condenser microphone normally consists of five main parts, namely the diaphragm, film, backplate, insulator, and case. A film with an electrical charge is normally mounted to the backplate. When sound pressure is applied to the diaphragm, the distance between the diaphragm and the backplate changes, thereby altering the capacitance. Using a load resistor, this change can be turned into a voltage change. The frequency response as well as the temperature and humidity characteristics of an prepolarized condenser microphone depend considerably on the type and properties of the materials used. The high frequency range is determined by the resonance frequency of the diaphragm assembly.



Construction of prepolarized condenser microphone

Thermal Characteristics

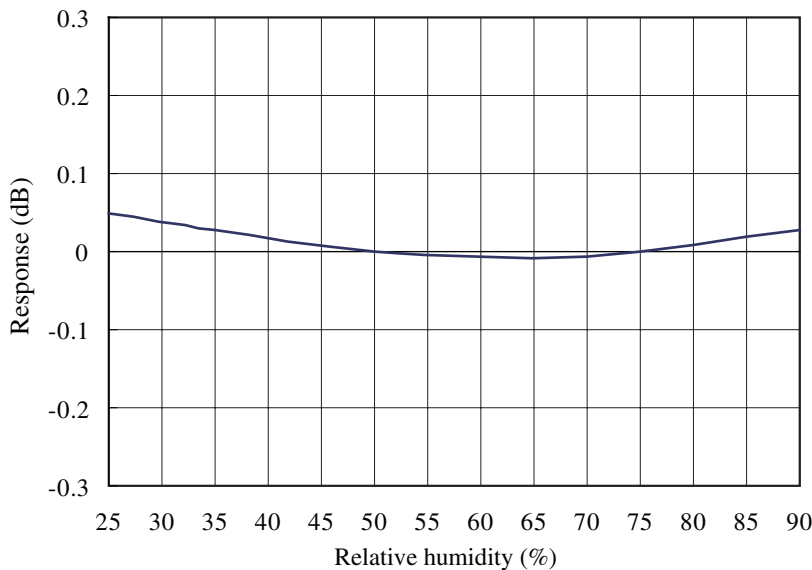
The thermal characteristics of a microphone indicate how sensitivity changes at various temperatures. This is influenced by the choice of materials and the design of the microphone. Normally, materials with a linear expansion coefficient are used. The diagrams below show the thermal characteristics of the microphone MS-11.



Thermal characteristics (at 250 Hz), reference temperature 23°C

Humidity Characteristics

The humidity characteristics of a microphone indicate how sensitivity changes at various humidity levels. The diagrams below show the microphone MS-11.



Humidity characteristics (at 250 Hz), reference relative humidity 50%

Preamplifier

Since the condenser microphone is a small-capacity transducer, it has high impedance, especially at low frequencies. Therefore a very high load resistance is required to ensure uniform response extending to the low frequency range. The relationship between the microphone capacitance and the low-range cutoff frequency can be expressed as follows.

$$f_0 = \frac{1}{2\pi \times Z_{in} \times C_m}$$

f_0 : Low-range cutoff frequency (Hz)

Z_{in} : Preamplifier input impedance (Ω)

C_m : Capacitance of condenser microphone (F)

If the output of the microphone were directly routed through a long shielded cable, the capacitance between the cable conductors would cause a sharp drop in sensitivity, as is evident from the following equation.

$$M_0 = \frac{C_m}{C_m + C_c} \cdot M_s$$

M_0 : Output voltage into directly connected shielded cable (V)

M_s : Output voltage in microphone open condition (V)

C_c : Cable capacitance of shielded cable (F)

For the above reasons, a preamplifier is connected directly after the microphone, to provide a low-impedance output signal.

Integrated sound source

The sound source integrated in the microphone is a balanced armature type magnetic transducer which creates a sound pressure in the microphone rear chamber. The four sinusoidal wave signal tones generated by this source (250 Hz, 500 Hz, 1 kHz, 4 kHz) are used for calibration and for operation checking of the microphone.

Condensation-preventing heater

Because it is designed for outdoor use, the MS-11 incorporates a thermofoil heater. This ensures that the chassis and internal temperature are higher than the ambient temperature, which prevents the formation of condensation.

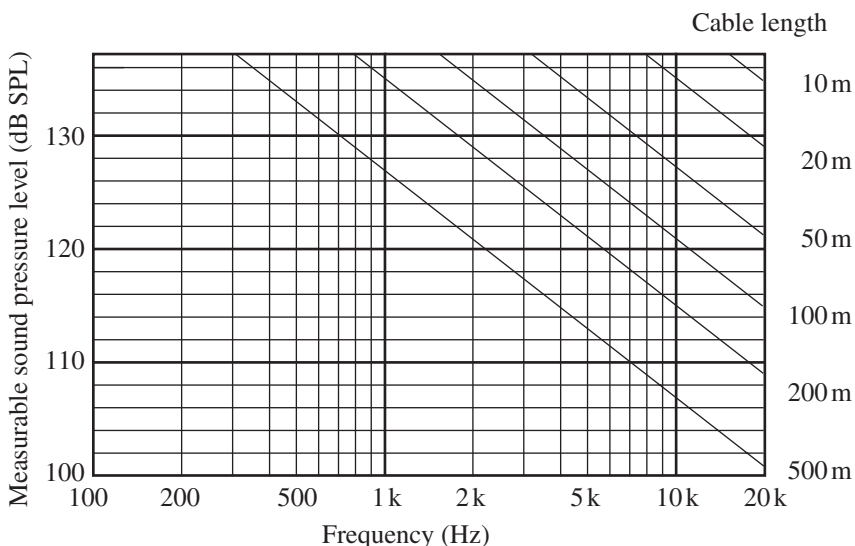
Influence of Microphone Extension Cable

When the output of the microphone/preamplifier is routed through an extension cable, certain limitations regarding measurable sound pressure level and frequency range will apply. This is due to the influence of the cable capacitance. The longer the cable, the lower the measurable sound pressure level and the lower the frequency limit. The diagram below shows the relationship among cable length, measurable sound pressure level, and frequency.

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

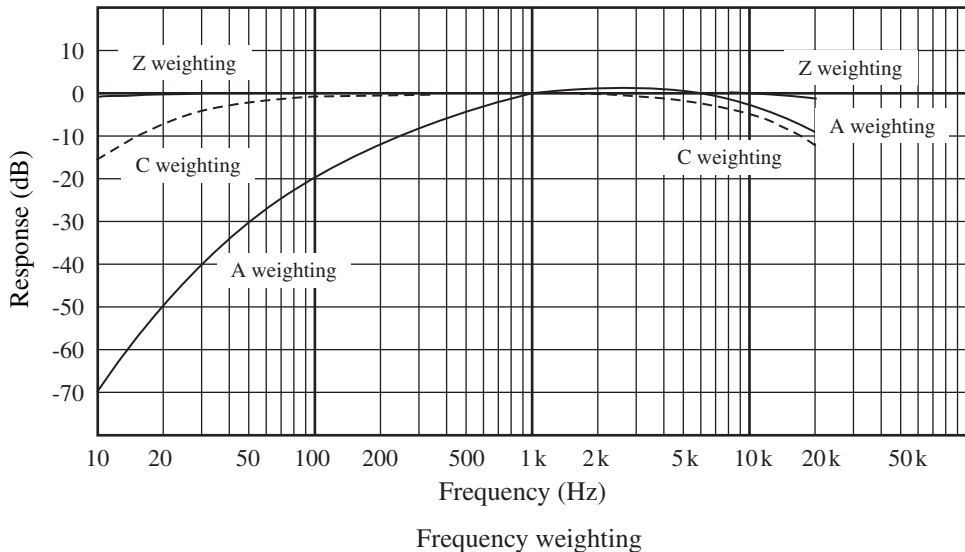
Extension cable EC-04 series

If for example a sound pressure level of 123 dB is to be measured up to 8 kHz, an extension cable length of up to 100 meters can be used



Frequency Weighting Network

The NA-83 provides frequency weightings A, C and Z. The electrical characteristics of the frequency weighting network are as shown below.



The volume impression (loudness) of a sound depends not only on the sound pressure level, but also on the frequency. At high or low frequencies, a sound is felt to be less loud than a sound of equal level in the midrange. The frequency weighting A compensates for this effect and produces measurement results which are close to the actual impression of loudness. For this reason, this type of frequency weighting is widely used for purposes such as sound level evaluation.

With the frequency weighting Z, frequency response is linear, which is suitable for sound pressure level measurements and for using the sound level meter output for frequency analysis.

The frequency weighting C curve produces almost flat response, but with a roll off below 31.5 Hz and above 8 kHz. This is suitable for sound pressure level measurements in situations with unwanted low-frequency or high-frequency components.

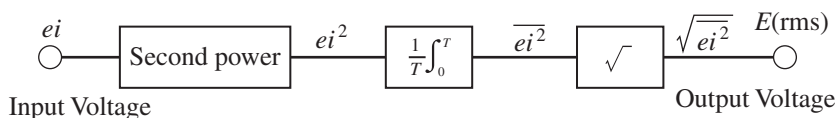
RMS Detection Circuit and Time Weighting

The sound level meter uses rms detection. The effective value E (rms) is defined by the following equation.

$$E(\text{rms}) = \sqrt{\frac{1}{T} \int_0^T e^2 dt}$$

The voltage e which changes over time is raised to the second power, and integration for the time interval T is performed. The result is divided by T and the square root is extracted. The circuit configuration for performing the above mathematical operation looks as follows.

The NA-83 uses digital processing to determine the rms value.



During sound level measurements, the level often fluctuates drastically, which would make it difficult to evaluate readings if some kind of averaging is not applied. Sound level meters therefore provide the capability for index weighting (index averaging) using the rms circuit. The parameters of this weighting process are called the time weightings, determined by the time constant (see next page).

Sound level meters usually have an F (Fast) and S (Slow) setting for the time weighting. The time range that is considered for averaging is narrow in the F setting and wide in the S setting. In the F setting, the instantaneous level has a larger bearing on the displayed value than in the S setting. From the point of view of the measurement objective, the F setting is more suitable to situations with swiftly changing sound level, whereas the S setting yields a more broadly averaged picture.

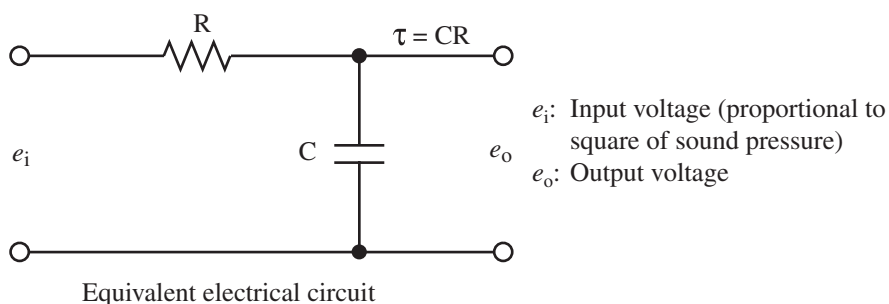
The F setting is more commonly used, and sound pressure level values given without other indication are usually made with F characteristics.

The S setting is suitable for measuring the average of sound with fairly constant levels. For example, in Japan aircraft noise and high-speed train noise is usually transient noise with high fluctuation, but the S setting is used to determine the maximum level for each noise event.

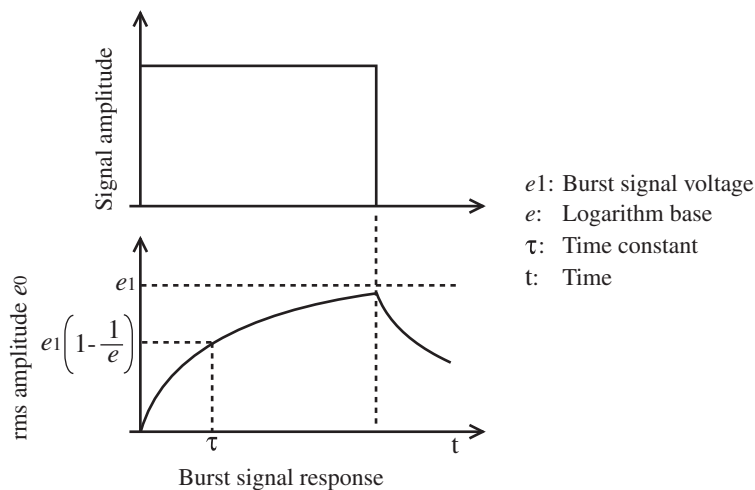
Time weightings and time constant

Time weightings	Time constant	
	Rise time	Decay time
F(Fast)	125 ms	125 ms
S(Slow)	1 s	1 s

The time weighting network of the sound level meter performs index averaging on the square of the sound pressure signal. The equivalent circuit is shown below. τ is the time constant, which equals CR .



The response of the index averaging circuit to a single burst signal is shown below.



Influence of Background Noise

When measuring a certain sound in a certain location, all other sounds present at that location except the measurement target sound are background noise. Since the sound level meter will display the combination of target sound and background noise, the amount of background noise must be taken into consideration when determining the level of the target sound.

If the difference between the meter reading in absence of the target sound and the reading with the target sound is more than 10 dB, the influence of background noise is small and may be disregarded. If the difference is less than 10 dB, the values shown in the table below may be used for correction, to estimate the level of the target sound.

Background noise correction

Display reading difference with and without target sound (dB)	4	5	6	7	8	9
Correction value (dB)	-2		-1			

If for example the measured sound level when operating a machine is 70 dB, and the background noise level when the machine is not operating is 63 dB, the correction value for the difference of 7 dB is -1 dB. Therefore the sound level of the machine can be taken to be $70 \text{ dB} + (-1 \text{ dB}) = 69 \text{ dB}$.

The above principle for correcting the influence of the background noise assumes that both the background noise and the target sound are approximately constant. If the background noise fluctuates, and especially if it is close in level to the target sound, correction is difficult and will often be meaningless.

Description for IEC 61672-1

Standard paragraph	Description	See also	Remark
5	Performance specifications		
5.1	General		
5.1.4	Configuration & normal mode of operation	9.2.1 b)	Configuration <ul style="list-style-type: none"> • NA-83 • MS-11 • WS-13 • Microphone extension cable • AC adapter • Ferrite cores (→ Connections) Normal mode of operation → Connections Unit powered and windscreen correction set to ON
5.1.6	Models of microphone Appropriate procedures for use the sound level meter	9.2.1 c) 9.2.5 b)	MS-11 → Connections, Calibration and Operation Check, Measurement
5.1.7	Mounting of microphone	9.2.1 b)	→ Connections
5.1.8	Identification of computer software		N/A
5.1.10	Description of frequency weightings that are provided	9.2.2 c)	A, C, Z
5.1.12	Description of level ranges (@ A- weighted SPL @ 1kHz) Instruction manual of the level range controls and function. Recommendation for selecting the optimum level range.	9.2.2 h) 9.2.5 c)	28 dB to 138 dB N/A N/A
5.1.13	Reference SPL reference level range, Reference orientation, reference position of microphone.	9.2.5 a), 9.3 a), b), c)	94.0 dB N/A Fig. 1 Reference incidence direction and reference point position
5.1.14	Operating of the hold facility and the means for clearing a display that is held.		→ Measurement: Measurement of maximum time-weighted sound level L_{\max}
5.1.15	Dummy microphone: Design goal and tolerance	9.3 g)	Capacitance of dummy microphone: 12 pF Tolerance: ± 1.5 pF
5.1.16	Highest SPL and Peak-Peak input voltage without causing damage.	9.3 i)	150 dB 30 V _{p-p}
5.1.17	Characteristics of each independent channel to be described		N/A
5.1.18	Initial time interval after switching on power	9.2.5 e)	Less than 2 minutes.
5.2	Adjustment to indicated levels		
5.2.1	Model of sound calibrator(s)	9.2.4 a)	NC-74 (RION)

Standard paragraph	Description	See also	Remark
5.2.3	Procedure for calibration & adjustment with sound calibrator	9.2.4 c)	→ Calibration and Operation Check: Acoustic calibration with Sound Calibrator NC-74 94.0 dB
5.2.4 5.2.5	Data for correction - with and without windscreen - for : - Deviation of average frequency response to uniform frequency response. - Case reflection and microphone diffraction Including values for expanded uncertainties. In 1/3 octave frequencies for 63 Hz to 1 kHz and 1/12 octave frequencies for 1 kHz to 16 kHz	9.2.4 d) 9.2.5 b)	Fig. 2 Frequency response of the microphone MS-11 (including the case reflection) Fig. 4 Influence of WS-13 on acoustic performance of MS-11 Fig. 5 Frequency response with windscreen correction Refer to IEC61672-1 (JIS C 1509-1) Frequency Response
5.2.7	Adjustment data for sound calibrator or electrostatic actuator (for A-weighted sound levels)	9.3 d)	Tab. 1 Adjustment data for sound calibrator
5.4	Frequency weightings		
5.4.12	Frequency response & tolerances of optional frequency responses	9.2.2 c)	N/A
5.5	Level linearity		
5.5.9	A, C and Z weighted levels for the lower and upper limit of the linear operating range. - For frequencies 31.5 Hz, 1, 4, 8 and 12.5 kHz	9.3 e)	Tab. 2 The lower and upper limits of the linear operating range
5.5.10	Starting point for the level linearity error - For frequencies 31.5 Hz, 1, 4, 8 and 12.5 kHz - At a specified level range	9.3 f)	Tab. 2 The lower and upper limits of the linear operating range
5.5.11	How to test level linearity if display range < linearity range	9.3 k)	N/A
5.6	Self generated noise		
5.6.1	Self-noise at the more sensitive ranges (including microphone)	9.2.5 o) 9.3 h)	Maximum value A: <20 dB C: <28 dB Z: <34 dB Typical value (MS-11) A: 16 dB C: 20 dB Z: 28 dB

Standard paragraph	Description	See also	Remark
5.6.3	Self-noise at the more sensitive ranges with dummy microphone	9.3 h)	Dummy microphone (12 pF) Maximum value Equal to 5.6.1 Typical value A: 13 dB C: 17 dB Z: 23 dB
5.6.5	Instruction to measure low level sounds with consideration of influence of self-noise	9.2.5 d)	→ Technical Reference: Influence of Background Noise
5.7	Time weighting F and S		
5.7.1	Description of time weightings that are provided	9.2.2 d)	F, S
5.10 - 5.11	Overload and Under-range indication		
5.10.1	Operation & interpretation of overload indicators	9.2.5 k)	→ Controls and Functions: Display
5.11.1	Operation & interpretation of under-range indicators		→ Controls and Functions: Display
5.12	Peak C sound level		
5.12.1	Nominal range of L_{Cpeak} at for each level range	9.2.2 i)	N/A
5.14	Thresholds		
5.14	Operation of user-selectable thresholds	9.2.5 l)	N/A
5.15	Display		
5.15.2	Description of the indication of displayed quantities	9.2.2 g)	→ Controls and Functions: Display
5.15.3	Description of the display	9.2.2 g)	→ Controls and Functions: Display
5.15.4	Description of the displayed quantities	9.2.2 a)	N/A
5.15.5	Statement of the display update rate	9.2.2 g)	1 second
5.15.6	Time interval for completion of the integration	9.2.5 f)	N/A
5.15.7	Description of method for transferring data to PC	9.2.5 m)	N/A

Standard paragraph	Description	See also	Remark
5.16	Analogue and digital outputs		
5.16.1	Electric output connector (AC output)	9.2.5 p)	Frequency weighting: C Output voltage: 1 Vrms (at 110 dB) Output range: 10 Vrms or less Output impedance: 50 Ω Load impedance: >10 k Ω
	Electric output connector (DC output)		Frequency weighting: A, C, Z Output voltage: 5.5 V (at 130 dB), 50 mV/dB Output range: 0.4 to 5.9 V Output impedance: 50 Ω Load impedance: >10 k Ω
5.17	Timing facilities		
5.17.1	Procedure to preset the integration time & time of the day	9.2.5 g)	N/A
5.17.2	Statement of the minimum & maximum integration time	9.2.5 h)	N/A
5.18	RF emissions and power supply disturbance		
5.18.1	Length & type of interface cable and characteristics of connected devices	9.2.5 n)	Microphone extension cable EC-04 series (up to 35 m) Output cable NC-39A (1.5 m) All cables shielded
5.18.2	Operating mode or highest radio frequency emissions	9.3 n)	Operation mode: normal operation Connection pattern: AC adapter (with ferrite cores): RC45-12L Output cable (with ferrite cores): NC-39A 1.5 m Microphone extension cable (with ferrite cores): EC-04 series 35 m
5.20	Power supply		
5.20.2	Maximum and minimum power supply voltage	9.3 j)	Maximum: 15 V Minimum: 10 V
5.20.3	Battery types & battery life	9.2.3 a)	N/A
5.20.4	Operation from an external power supply	9.2.3 c)	N/A
5.20.5	Public power supply voltage	9.2.3 d)	100 to 240 V AC (tolerance range 90 to 264 V), 50/60 Hz (± 3 Hz)
6	Environmental, electrostatic and radio frequency criteria		
6.1.2	Time interval for needed to stabilize after environmental changes	9.3 l)	Temperature change: < 1 hour Humidity change: < 1 hour Static pressure change: < 5 minutes
6.2.2 (Note)	Measurement when static pressure is < 85 kPa		Calibration and measurement performed in this environment using Sound Calibrator NC-74
6.5.2	Degradation of functions by electrostatic discharge	9.2.7 b)	Measurement value affected temporarily by electrostatic discharge

Standard paragraph	Description	See also	Remark
6.6.1	Operating mode with least immunity to AC power frequency fields and RF fields	9.3 o)	Fig. 6 Operation mode: normal operation Connection pattern: AC adapter (with ferrite cores): RC45-12L Output cable (with ferrite cores): NC-39A 1.5 m Microphone extension cable (with ferrite cores): EC-04 series 35 m
6.6.4 (Note)	Field strength for conforming (in case > 10 V/m)	9.3 m)	N/A
7	Provisions for use with auxiliary devices		
7.1	Correction for use of microphone cable	9.2.6 b)	N/A
7.2	Effect of optional accessories (windscreen)	9.2.6 a)	Directional Characteristics with WS-13 (Fig. 8)
7.3	Statement of conformance with optional accessories (windscreen)		Compliant with IEC 61672-1 (JIS C 1509-1), with Windscreen WS-13 mounted and windscreen correction ON
7.4	Operation of 1/1 - 1/3 octave band filters	9.2.6 c)	N/A
7.5	Details about connection & effects of auxiliary devices	9.2.6 d)	→ Connections
9	Instruction manual		
9.2.1	General		
9.2.1 a)	Description of type, classification (X, Y, Z) and class		Group Y, Class 1
9.2.1 b)	Overall configuration, Normal operation configuration (including windscreen)	5.1.4 5.1.7	Refer to 5.1.4 Refer to 5.1.7
9.2.1 c)	Models of microphones	5.1.6	Refer to 5.1.6
9.2.1 d)	Required microphone cable to conform		N/A
9.2.1 e)	Characteristics & operation each channel		N/A
9.2.2	Design features		
9.2.2 a)	Description of quantities which can be measured	5.15.4	time-weighted sound level maximum value of time-weighted sound level
9.2.2 b)	Relative free-field response as function of incidence angle and frequency (detailed tabular description)		Directional Characteristics of MS-11 (Fig. 7)
9.2.2 c)	Description of the frequency weightings	5.1.10 5.4.12	Refer to 5.1.10 Refer to 5.4.12
9.2.2 d)	Description of the time weightings	5.7.1	Refer to 5.7.1
9.2.2 e)	Identification of the level ranges (A-weighted @ 1 kHz)	5.1.12	Refer to 5.1.12

Standard paragraph	Description	See also	Remark
9.2.2 f)	Operation of the level range control	5.1.12	Refer to 5.1.12
9.2.2 g)	Description of the display and update rates	5.15.2-3-4-5	Refer to 5.15.2-3-4-5
9.2.2 h)	Total range of A- weighted SPL (@ 1 kHz)	5.1.12	Refer to 5.1.12
9.2.2 i)	Nominal range of L_{Cpeak} at for each level range	5.12.1	Refer to 5.12.1
9.2.2 j)	Computer software to operate the SLM	5.1.8	Refer to 5.1.8
9.2.2 k)	Design goals and tolerances for quantities which are not in the standard (T-weight 10 ms, LAIeq)		N/A
9.2.3	Power supply		
9.2.3 a)	Battery types & battery life	5.20.3	Refer to 5.20.3
9.2.3 b)	Description of the function of battery check		→ Controls and Functions: Display
9.2.3 c)	Operation from an external power supply	5.20.4	Refer to 5.20.4
9.2.3 d)	Public power supply voltage	5.20.5	Refer to 5.20.5
9.2.4	Adjustment to indicated levels		
9.2.4 a)	Model of sound calibrator(s)	5.2.1	Refer to 5.2.1
9.2.4 b)	Calibration check frequency		1 kHz
9.2.4 c)	Procedure for calibration & adjustment with sound calibrator	5.2.3	Refer to 5.2.3
9.2.4 d)	Data for correction - with and without windscreen - for : - Deviation of average frequency response to uniform frequency response. - Case reflection and microphone diffraction Including values for expanded uncertainties. In 1/3 octave frequencies for 63 Hz to 1 kHz and 1/12 octave frequencies for 1 kHz to 16 kHz	5.2.4 - 5.2.5	Refer to 5.2.4 - 5.2.5
9.2.5	Operating the sound level meter		
9.2.5 a)	Reference direction	5.1.13	Refer to 5.1.13
9.2.5 b)	Procedure to measure sound, Influence of the instrument case and operator.	5.1.6 5.2.4 5.2.5	Refer to 5.1.6 Refer to 5.2.4 Refer to 5.2.5
9.2.5 c)	Recommendation for selecting optimum level range	5.1.12	Refer to 5.1.12
9.2.5 d)	Instruction to measure low level sounds with consideration of influence of self-noise	5.6.5	Refer to 5.6.5

Standard paragraph	Description	See also	Remark
9.2.5 e)	Initial time interval after switching on power	5.1.18	Refer to 5.1.18
9.2.5 f)	Time interval for completion of the integration	5.15.6	Refer to 5.15.6
9.2.5 g)	Procedure to preset the integration time & time of the day	5.17.1	Refer to 5.17.1
9.2.5 h)	Statement of the minimum & maximum integration time	5.17.2	Refer to 5.17.2
9.2.5 i)	Operation of the "Hold" function		→ Measurement: Measurement of maximum time-weighted sound level
9.2.5 j)	Operation of the reset function or <i>Leq</i> , <i>LE</i> , <i>Lpeak</i> and overload		Measurement results (measurement values, overload indication, under-range indication) are reset when a new measurement is started. Time required for measurement initialization: < 1 second
9.2.5.k)	Operation & interpretation of overload indicators	5.10.1	Refer to 5.10.1
9.2.5 l)	Operation of user-selectable thresholds	5.14	Refer to 5.14
9.2.5 m)	Description of method for transferring data to PC	5.15.7	Refer to 5.15.7
9.2.5 n)	Length & type of interface cable and characteristics of connected devices	5.18.1	Refer to 5.18.1
9.2.5 o)	Self-noise at the more sensitive ranges (including microphone). Averaging time ≥ 30 s.	5.6.1	Refer to 5.6.1
9.2.5 p)	Characteristics of AC and DC output	5.16.1	Refer to 5.16.1
9.2.6	Accessories		
9.2.6 a)	Effect of windscreen (directional response and frequency weighting)	7.2	Refer to 7.2
9.2.6 b)	Corrections for microphone cable	7.1	Refer to 7.1
9.2.6 c)	Use of bandpass filters	7.4	Refer to 7.4
9.2.6 d)	Connection of auxiliary devices	7.5	Refer to 7.5
9.2.7	Influence of environmental conditions		
9.2.7 a)	Components intended for operation in controlled environment		None
9.2.7 b)	Degradation of functions by electrostatic discharge	6.5.2	Refer to 6.5.2
9.2.7 c)	Statement for conformance to AC power frequency fields and RF fields		Statement of conforming to the basic statement (Tab. 5)

Standard paragraph	Description	See also	Remark
9.3	Information for testing		
9.3 a)	Reference sound pressure level	5.1.13	Refer to 5.1.13
9.3 b)	Reference level range	5.1.13	Refer to 5.1.13
9.3 c)	Microphone reference point	5.1.13	Refer to 5.1.13
9.3 d)	For A-weighted sound levels: Adjustment data for multi-frequency sound calibrator and/or electrostatic actuator	5.2.7	Refer to 5.2.7
9.3 e)	Nominal A-weighted sound levels at the upper and lower limits of the linear operating range on each level range. - For frequencies 31.5 Hz, 1, 4, 8 and 12.5 kHz	5.5.9	Refer to 5.5.9
9.3 f)	Starting point for the level linearity error - For frequencies 31.5 Hz, 1, 4, 8 and 12.5 kHz - At the reference level range	5.5.10	Refer to 5.5.10
9.3 g)	Dummy microphone: Design goal and tolerance	5.1.15	Refer to 5.1.15
9.3 h)	Self-noise at the more sensitive ranges with microphone and with dummy microphone	5.6.1 / 5.6.3	Refer to 5.6.1 / 5.6.3
9.3 i)	Highest SPL and Peak-Peak input voltage to accommodate	5.1.16	Refer to 5.1.16
9.3 j)	Maximum and minimum power supply voltage	5.20.2	Refer to 5.20.2
9.3 k)	How to test level linearity if display range < linearity range	5.5.11	Refer to 5.5.11
9.3 l)	Time interval for needed to stabilize after environmental changes	6.1.2	Refer to 6.1.2
9.3 m)	Field strength for conforming (in case > 10 V/m)	6.6.4	Refer to 6.6.4
9.3 n)	Operating mode or highest radio frequency emissions	5.18.2	Refer to 5.18.2
9.3 o)	Operating mode with least immunity to AC power frequency fields and RF fields	6.6.1	Refer to 6.6.1

IEC61672-1 (JIS C 1509-1) Frequency Response

Nominal frequency (Hz)	Exact frequency (Hz)	MS-11 Frequency Response (dB)	Electrical Response (dB)	Wind-screen effect (dB)	Wind-screen correction (dB)	Wind-screen combined (dB)	Total Response (Wind-Screen combined) (dB)	Total expanded uncertainty (dB)
63	63.10	0.3	-0.1	0.0	0.0	0.0	0.2	0.3
80	79.43	0.3	-0.1	0.0	0.0	0.0	0.2	0.3
100	100.0	0.2	-0.1	0.1	0.0	0.1	0.2	0.3
125	125.9	0.2	0.0	0.1	0.0	0.1	0.3	0.3
160	158.5	0.2	0.0	0.1	-0.1	0.0	0.2	0.3
200	199.5	0.2	0.0	0.1	-0.1	0.0	0.2	0.3
250	251.2	0.1	0.0	0.2	-0.1	0.1	0.2	0.2
315	316.2	0.1	0.0	0.2	-0.2	0.0	0.1	0.2
400	398.1	0.2	0.0	0.3	-0.3	0.0	0.2	0.2
500	501.2	0.1	0.0	0.3	-0.3	0.0	0.1	0.2
630	631.0	0.1	0.0	0.4	-0.4	0.0	0.1	0.2
800	794.3	0.1	0.0	0.4	-0.5	-0.1	0.0	0.2
1 000	1 000.0	0.0	0.0	0.5	-0.5	0.0	0.0	0.2
1 060	1 059.3	0.0	0.0	0.4	-0.5	-0.1	-0.1	0.2
1 120	1 122.0	0.0	0.0	0.5	-0.5	0.0	0.0	0.2
1 180	1 188.5	0.0	0.0	0.4	-0.5	-0.1	-0.1	0.2
1 250	1 258.9	0.0	0.0	0.4	-0.5	-0.1	-0.1	0.2
1 320	1 333.5	-0.1	0.0	0.4	-0.5	-0.1	-0.2	0.3
1 400	1 412.5	-0.1	0.0	0.4	-0.5	-0.1	-0.2	0.3
1 500	1 496.2	0.0	0.0	0.5	-0.5	0.0	0.0	0.3
1 600	1 584.9	0.1	0.0	0.4	-0.5	-0.1	0.0	0.3
1 700	1 678.8	0.1	0.0	0.4	-0.4	0.0	0.1	0.3
1 800	1 778.3	0.0	0.0	0.3	-0.4	-0.1	-0.1	0.3
1 900	1 883.6	0.0	0.0	0.3	-0.4	-0.1	-0.1	0.3
2 000	1 995.3	0.1	0.0	0.4	-0.4	0.0	0.1	0.3
2 120	2 113.5	0.2	0.0	0.3	-0.4	-0.1	0.1	0.3
2 240	2 238.7	0.1	0.0	0.3	-0.3	0.0	0.1	0.3
2 360	2 371.4	0.1	0.0	0.3	-0.3	0.0	0.1	0.3
2 500	2 511.9	0.1	0.0	0.2	-0.3	-0.1	0.0	0.3
2 650	2 660.7	-0.1	0.0	0.2	-0.3	-0.1	-0.2	0.3

Nominal frequency (Hz)	Exact frequency (Hz)	MS-11 Frequency Response (dB)	Electrical Response (dB)	Wind-screen effect (dB)	Wind-screen correction (dB)	Wind-screen combined (dB)	Total Response (Wind-Screen combined) (dB)	Total expanded uncertainty (dB)
2 800	2 818.4	-0.2	0.0	0.2	-0.2	0.0	-0.2	0.3
3 000	2 985.4	-0.2	0.0	0.1	-0.2	-0.1	-0.3	0.3
3 150	3 162.3	-0.2	0.0	0.2	-0.2	0.0	-0.2	0.3
3 350	3 349.7	0.0	0.0	0.2	-0.2	0.0	0.0	0.3
3 550	3 548.1	0.2	0.0	0.2	-0.1	0.1	0.3	0.3
3 750	3 758.4	0.3	0.0	0.0	-0.1	-0.1	0.2	0.3
4 000	3 981.1	0.1	0.0	0.0	-0.1	-0.1	0.0	0.3
4 250	4 217.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.3
4 500	4 466.8	-0.1	0.0	-0.1	-0.1	-0.2	-0.3	0.3
4 750	4 731.5	-0.2	0.0	0.1	-0.1	0.0	-0.2	0.3
5 000	5 011.9	-0.1	0.0	0.0	-0.1	-0.1	-0.2	0.3
5 300	5 308.8	-0.2	0.0	-0.1	-0.1	-0.2	-0.4	0.3
5 600	5 623.4	0.1	0.0	-0.1	-0.1	-0.2	-0.1	0.3
6 000	5 956.6	0.0	0.0	-0.1	-0.1	-0.2	-0.2	0.3
6 300	6 309.6	-0.1	0.0	0.0	-0.1	-0.1	-0.2	0.3
6 700	6 683.4	0.1	0.0	-0.3	-0.2	-0.5	-0.4	0.3
7 100	7 079.5	0.1	0.0	0.0	-0.2	-0.2	-0.1	0.3
7 500	7 498.9	0.2	0.0	-0.3	-0.2	-0.5	-0.3	0.3
8 000	7 943.3	0.3	0.0	-0.2	-0.3	-0.5	-0.2	0.3
8 500	8 414.0	0.3	0.0	0.1	-0.3	-0.2	0.1	0.3
9 000	8 912.5	0.3	0.0	-0.1	-0.4	-0.5	-0.2	0.3
9 500	9 440.6	0.1	0.0	-0.1	-0.5	-0.6	-0.5	0.3
10 000	10 000.0	0.5	0.0	-0.5	-0.5	-1.0	-0.5	0.3
10 600	10 592.5	0.6	0.0	-0.6	-0.6	-1.2	-0.6	0.5
11 200	11 220.2	0.4	0.0	-0.3	-0.6	-0.9	-0.5	0.5
11 800	11 885.0	0.8	0.0	-0.5	-0.7	-1.2	-0.4	0.5
12 500	12 589.3	0.7	0.0	-0.6	-0.8	-1.4	-0.7	0.5
13 200	13 335.2	0.8	0.0	-0.8	-0.8	-1.6	-0.8	0.5
14 000	14 125.4	0.6	0.0	-0.9	-0.9	-1.8	-1.2	0.5
15 000	14 962.4	0.7	0.0	-0.6	-0.9	-1.5	-0.8	0.5
16 000	15 848.9	0.3	0.0	-0.9	-1.0	-1.9	-1.6	0.5

Reference incidence direction and reference point position

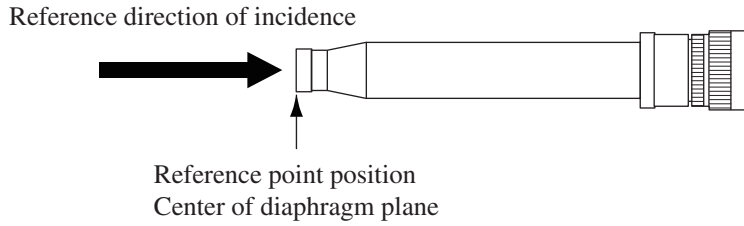


Fig. 1 Reference incidence direction and reference point position

Frequency Response

The frequency response of a sound field microphone is expressed as the frequency response in the reference direction of incidence (0°).

The diagram below shows an example for the frequency response of the microphone MS-11.

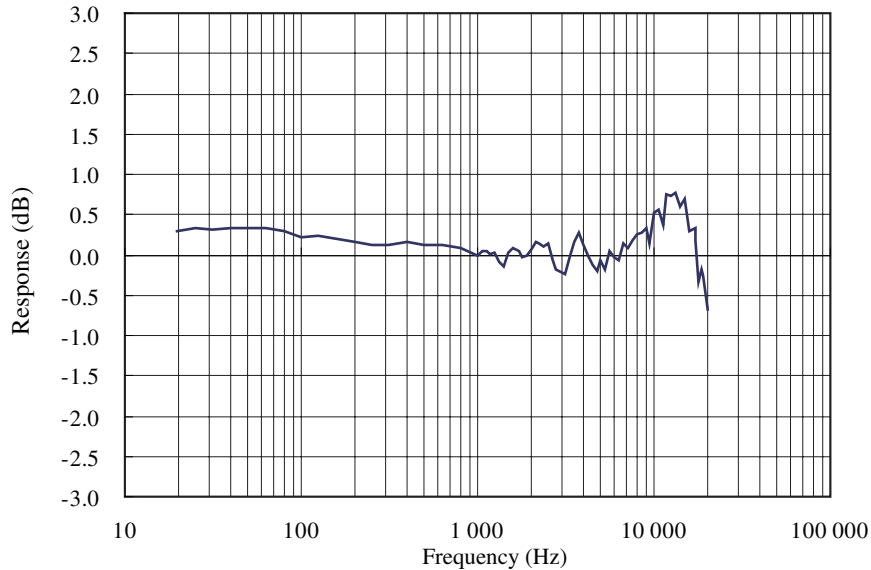


Fig. 2 Frequency response of the microphone MS-11

Effect of All-Weather Windscreen WS-13

The windscreen WS-13 not only reduces measurement errors due to wind noise, it also protects the microphone from rain.

The WS-13 characteristics are shown below.

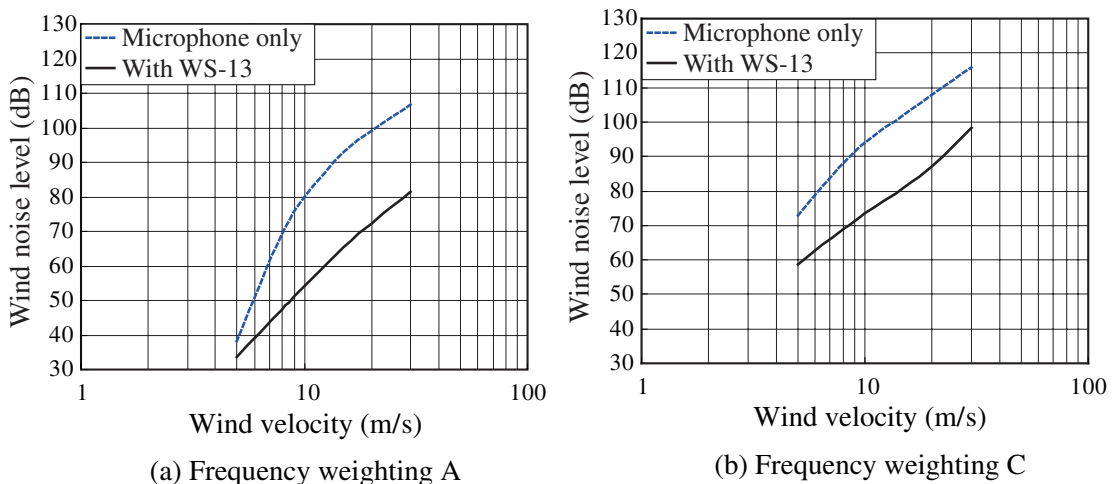


Fig. 3 Wind noise reduction effect

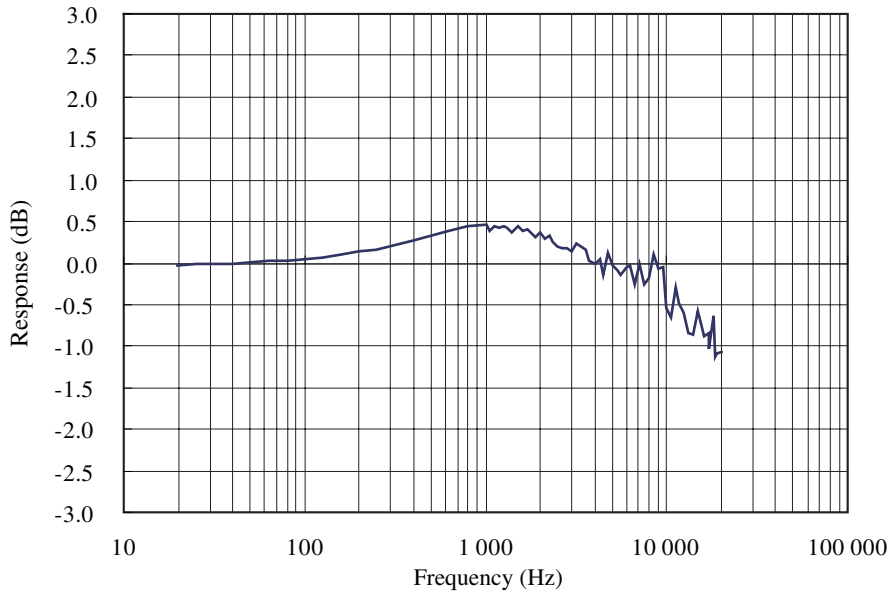


Fig. 4 Influence of WS-13 on acoustic performance of MS-11
(Referenced to microphone-only characteristics)

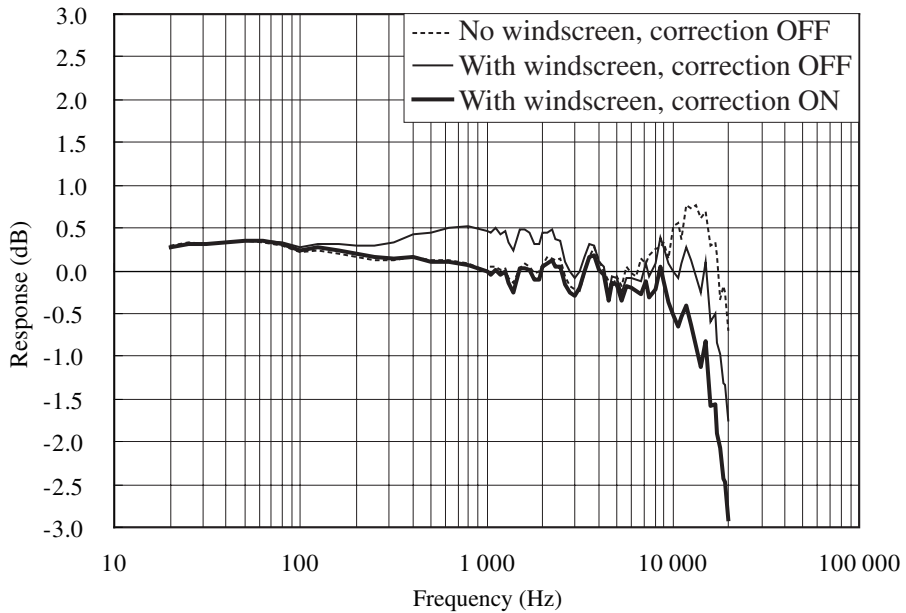


Fig. 5 Frequency response with windscreen correction

The greatest susceptibility configuration for radio frequency fields

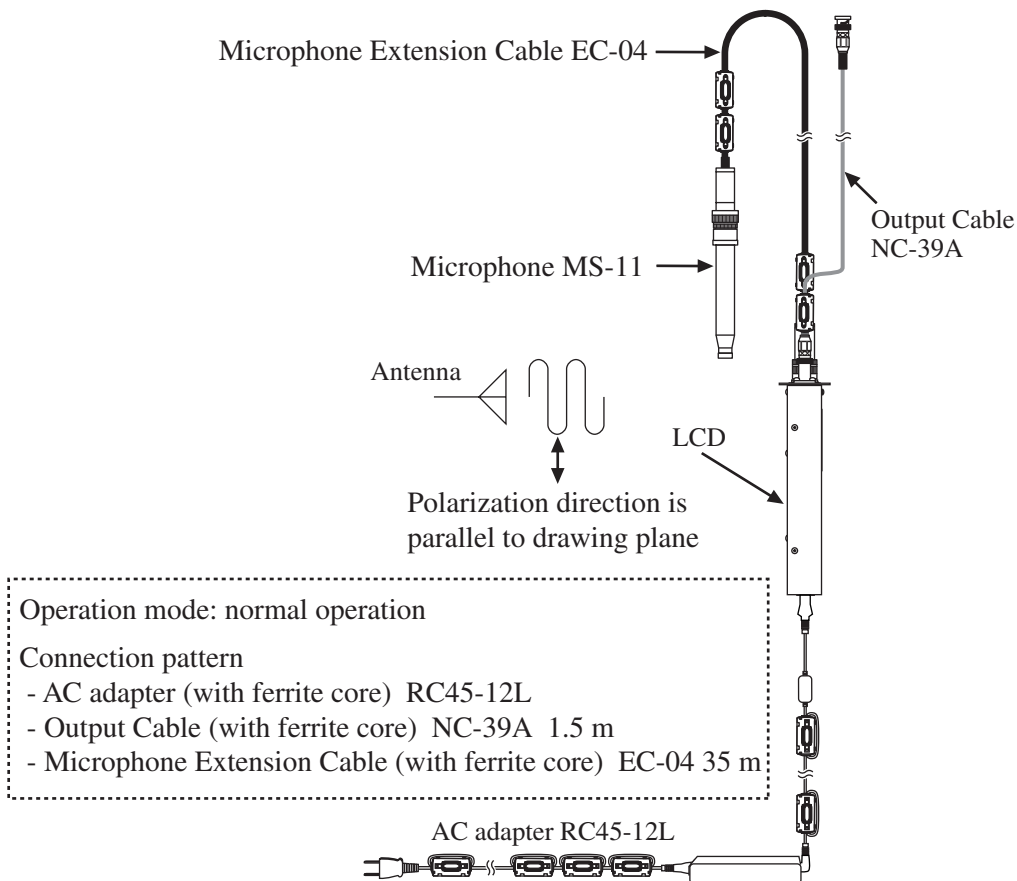


Fig. 6 The greatest susceptibility configuration for radio frequency fields

Frequency response adjustment data for periodic test

Tab. 1 Adjustment data for sound calibrator

Frequency (Hz)	Correction (dB)
31.5	-0.2
63	-0.2
125	-0.2
250	-0.2
500	-0.1
1 000	0.0
2 000	0.1
4 000	0.8
8 000	2.7
12 500	5.8
16 000	7.5

The lower and upper limits of the linear operating range

Tab. 2 The lower and upper limits of the linear operating range

A-weighting

Frequency (Hz)		Sound level (dB)				
		31.5	1 k	4 k	8 k	12.5 k
Upper	Microphone Extension Cable 5 m	98.0	138.0	137.0	134.0	131.0
	Microphone Extension Cable 10 m	98.0	138.0	137.0	134.0	131.0
	Microphone Extension Cable 35 m	98.0	138.0	136.0	131.0	124.0
Start		54.0	94.0	94.0	94.0	94.0
Lower		28.0	28.0	28.0	28.0	28.0

C-weighting

Frequency (Hz)		Sound level (dB)				
		31.5	1 k	4 k	8 k	12.5 k
Upper	Microphone Extension Cable 5 m	135.0	138.0	137.0	134.0	131.0
	Microphone Extension Cable 10 m	135.0	138.0	137.0	133.0	129.0
	Microphone Extension Cable 35 m	135.0	138.0	135.0	130.0	122.0
Start		94.0	94.0	94.0	94.0	94.0
Lower		46.0	36.0	36.0	36.0	36.0

Z-weighting

Frequency (Hz)		Sound level (dB)				
		31.5	1 k	4 k	8 k	12.5 k
Upper	Microphone Extension Cable 5 m	138.0	138.0	138.0	138.0	137.0
	Microphone Extension Cable 10 m	138.0	138.0	138.0	138.0	136.0
	Microphone Extension Cable 35 m	138.0	138.0	136.0	132.0	129.0
Start		94.0	94.0	94.0	94.0	94.0
Lower		52.0	42.0	42.0	42.0	42.0

Directional Characteristics

The directional characteristics of a microphone is a measure of its differing sensitivity for sound waves arriving from various angles. Since the prepolarized condenser microphone used in the MS-11 is a pressure-sensitive type, it should be equally sensitive in all directions. However, refraction and cavity effects cause a certain microphone directional response at high frequencies.

The diagrams on following pages shows the directional characteristics for the MS-11 and for the MS-11 with windscreen WS-13.

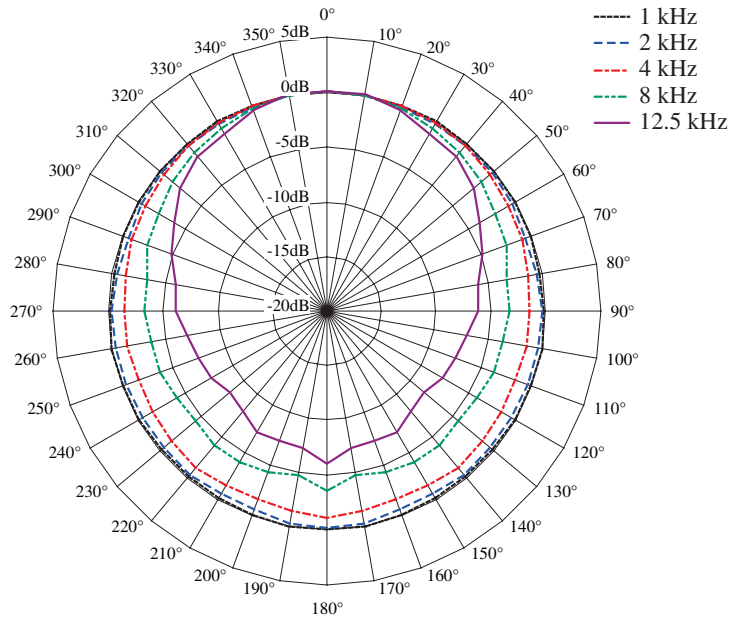


Fig. 7 Directional Characteristics of MS-11

Tab. 3 Directional Characteristics of MS-11

Angle	Frequency [Hz]				
	1k	2k	4k	8k	12.5k
0°	0.0	0.0	0.0	0.0	0.0
10°	0.0	-0.1	0.0	-0.1	0.1
20°	0.0	-0.2	-0.1	-0.3	-0.4
30°	-0.1	-0.3	-0.2	-0.7	-1.3
40°	-0.1	-0.4	-0.4	-1.1	-1.7
50°	-0.1	-0.4	-0.6	-1.6	-2.5
60°	-0.2	-0.5	-0.9	-2.3	-4.0
70°	-0.3	-0.7	-1.0	-2.6	-4.9
80°	-0.3	-0.6	-1.3	-3.3	-5.9
90°	-0.2	-0.4	-1.5	-3.3	-6.2
100°	-0.1	-0.4	-1.5	-3.7	-7.0
110°	-0.2	-0.5	-1.6	-3.8	-7.5
120°	-0.3	-0.6	-1.6	-4.3	-7.9
130°	-0.4	-0.5	-1.5	-4.3	-8.4
140°	-0.4	-0.4	-1.3	-4.0	-8.0
150°	-0.3	-0.7	-1.6	-4.1	-7.2
160°	-0.2	-0.7	-1.6	-4.3	-7.3
170°	-0.1	-0.3	-1.5	-4.8	-7.4
180°	-0.1	-0.2	-1.1	-3.6	-6.1

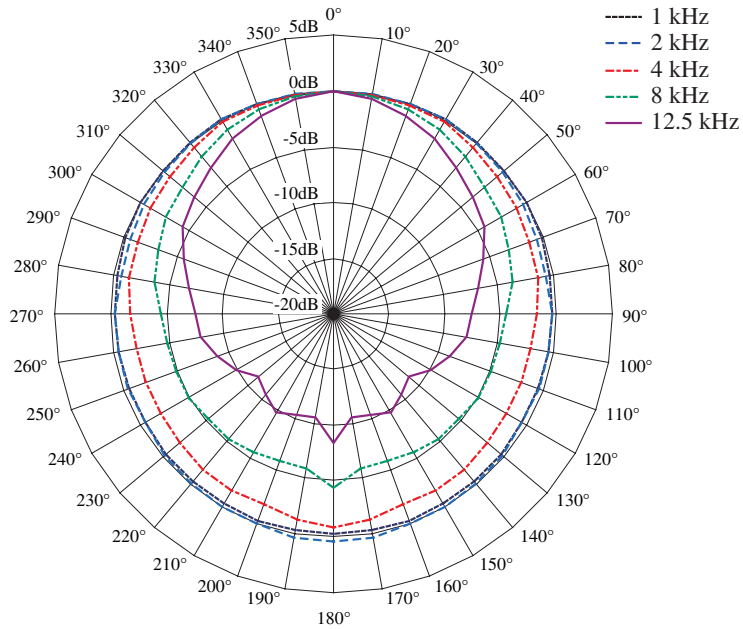


Fig. 8 Directional Characteristics with WS-13

Tab. 4 Directional Characteristics with WS-13

Angle	Frequency [Hz]				
	1k	2k	4k	8k	12.5k
0°	0.0	0.0	0.0	0.0	0.0
10°	0.0	0.0	-0.1	-0.1	-0.4
20°	0.0	0.0	-0.2	-0.5	-1.1
30°	0.1	0.1	-0.2	-1.0	-1.9
40°	0.1	0.0	-0.5	-1.7	-2.9
50°	0.0	-0.3	-0.9	-2.3	-3.7
60°	0.0	-0.4	-1.1	-2.7	-4.4
70°	-0.1	-0.6	-1.3	-3.3	-5.8
80°	-0.3	-0.6	-1.4	-3.7	-6.8
90°	-0.4	-0.4	-1.8	-4.5	-7.7
100°	-0.4	-0.4	-2.1	-4.8	-7.8
110°	-0.5	-0.4	-2.2	-4.9	-8.8
120°	-0.5	-0.5	-2.2	-5.0	-10.0
130°	-0.4	-0.3	-2.0	-5.3	-11.2
140°	-0.4	-0.1	-1.8	-5.3	-10.6
150°	-0.4	-0.1	-1.8	-5.7	-9.7
160°	-0.3	0.1	-1.8	-6.0	-10.4
170°	-0.3	0.4	-1.3	-5.9	-10.6
180°	-0.2	0.4	-0.9	-4.4	-8.4

Random incidence response

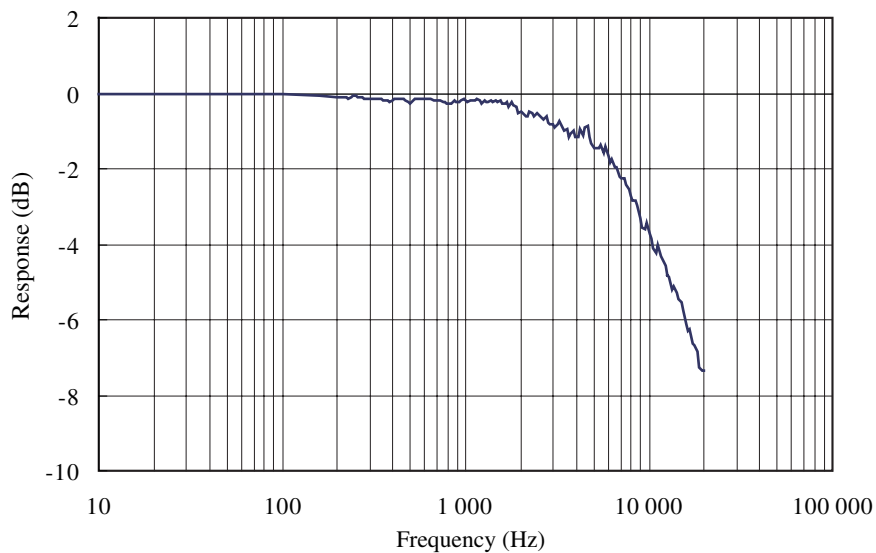


Fig. 9 Random incidence response (only MS-11)

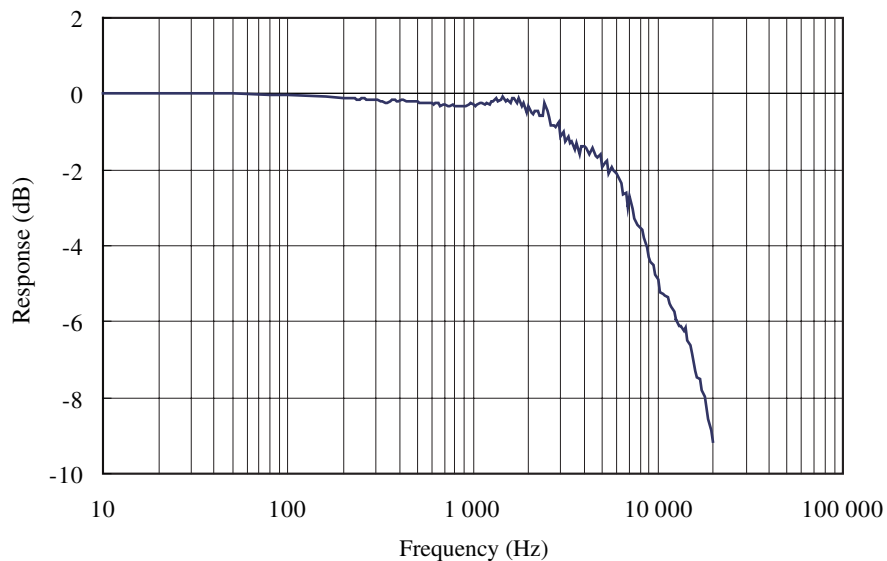


Fig. 10 Random incidence response (with WS-13)

Statement of conforming to the basic statement

Tab. 5 Statement of conforming to the basic statement

Immunity (a.c. power frequency field)	The specification of IEC 61672-1 Class 1 is satisfied
Immunity (Radio frequency field)	The specification of IEC 61672-1 Class 1 is satisfied
Emission	The specification of IEC 61672-1 Class 1 is satisfied

Specifications

Applicable standards

Measurement Law of Japan -precision sound level meters

IEC 61672-1:2002 Class 1 (JIS C 1509-1:2005 Class 1)

(Microphone extension cable length max. 35 m)

CE marking

(EMC Directive: 2004/108/EC EN61326-1:2006/IEC 61326-1:2005)

(Microphone extension cable length max. 30 m)

WEEE Directive

Measurement functions

Measurement items

Display data Time-weighted sound level L_p

Maximum time-weighted sound level L_{max}

Data output via serial interface

$L_p, L_{max}, L_{min}, L_{eq}$ for every 100 ms

Measurement level range

A-weighting 28 to 138 dB

C-weighting 36 to 138 dB

Z-weighting 42 to 138 dB

Total range (A-weighting, 1 kHz) 28 to 138 dB

Self-generated noise

A-weighting max. 20 dB

C-weighting max. 28 dB

Z-weighting max. 34 dB

Measurement frequency range

20 Hz to 20 kHz

Frequency weighting

A, C, Z

Time weighting F (Fast), S (Slow)

Linear operating range

110 dB

Level range switching

None

Bar graph indication range

30 to 130 dB

RMS detection digital processing (sampling cycle 20.8 μ s)

Reference frequency 1 kHz

Reference sound pressure level

94 dB

Reference conditions

Ambient temperature

23°C

Relative humidity

50%

Static pressure

101.325 kPa

Microphone and preamplifier

Outdoor Microphone MS-11

Sensitivity

-29 dB (re. 1 V/Pa, in reference conditions)

Calibration

Acoustic calibration with microphone integrated sound source (compliant with Measurement Law of Japan)

Calibration level 114 dB

Frequency 1 kHz

Calibration with external sound calibrator (Compliant with IEC 61672-1:2002 Class 1, JIS C 1509-1:2005 Class 1)

Model NC-74

Calibration level 94 dB

Frequency 1 kHz

Operation check with microphone integrated sound source

Temperature characteristics of integrated sound source

(-10°C to +50°C range, referenced to 23°C, atmospheric pressure 101.325 kPa)

Frequency 1 kHz

Sound pressure level 114.0 dB \pm 0.3 dB

Frequency characteristics of microphone integrated sound source

(-10°C to +50°C range, referenced to 1 kHz, atmospheric pressure 101.325 kPa)

250 Hz ± 0.5 dB

500 Hz ± 0.5 dB

4 kHz ± 1.5 dB

Windscreen correction function

Corrects frequency response for compliance with standard requirements also when All-Weather Windscreen WS-13 is mounted.

On/Off selectable by key operation or remote command

Display

TN positive display, reflective

Numeric readout 0.1 dB resolution (display update cycle 1 s)

Bar graph 100 dB range, 5 dB resolution (display update cycle 0.1 s)

Warning indications

Over-range indicator appears at 139 dB (at 1 kHz)

Under-range indicator appears at -0.6 dB from lower measurement limit

Input/output connectors

AC/DC output connector

AC or DC output, selectable by key operation or remote command

AC output Frequency weighting C-weighting

Output voltage 1 V_{rms} (at 110 dB)

Maximum output voltage

10 V_{rms} (at 130 dB, 1 kHz)

Output impedance 50 Ω

Load impedance 10 k Ω or higher

DC output Output voltage 5.5 V (at 130 dB), 50 mV/dB

Output impedance 50 Ω

Load impedance 10 k Ω or higher

Connection to NA-37

Power supply to NA-83

See power requirements section

NA-83 hard reset signal handling

Reset triggered when NA-37 open-collector output is ON

NA-83 control by NA-37 and data output (serial communication)

Transfer protocol

Sync. principle	asynchronous
Data word length	8 bit
Stop bits	1 bit
Parity check	none
Baud rate	19200 bps
Flow control	yes

NA-83 control

NA-83 data output

Output data	$L_p, L_{max}, L_{min}, L_{eq}$
Output cycle	100 ms

Waveform sampling data

Frequency weighting	Z-weighting
Sampling cycle	20.8 μ s
Data word length	16 bit
Full-scale range	90 dB, 110 dB, 130 dB, selectable

* Only selectable by serial communication

Power requirements

Rated power supply voltage

12 V DC

Operation voltage range

10 to 15 V DC

AC adapter RC45-12L

Current consumption

approx. 200 mA (at 12 V DC)

Environmental conditions for operation

Sound level meter unit

-10°C to +50°C, 10 to 90% RH

Microphone MS-11

Operating -20°C to +50°C, 10 to 100% RH (no condensation)

Storage -10°C to +50°C, 10 to 90% RH

Dimensions and mass 135 × 172.3 × 41 mm, 520 g (including MS-11)

Supplied accessories

Outdoor Microphone MS-11	1
Ferrite core FCA8K (for microphone extension cable)	3
MS-11 storage case	1
MS-11 calibration chart	1
Connector cover plate	1

Optional accessories

Sound Calibrator NC-74

Pistonphone NC-72A

All-Weather Windscreen WS-13

Microphone Extension Cable EC-04 series

EC-04, EC-04A, EC-04B (maximum cable length for
CE marking compliance: 30 meters)EC-04C, EC-04D, EC-04E (no CE marking compli-
ance)

BNC-BNC cable NC-39A (1.5 m)

AC adapter RC45-12L (third-party accessory, Futaba Electric)

Ferrite core FCA8K (Morimiya Electric)

For NC-39A	1
For RC45-12L	6

Outdoor Microphone MS-11 Specifications

Frequency response	Free-field type
Microphone cartridge	1/2 inch electret condenser microphone
Overall characteristics for microphone and preamplifier	
Sensitivity	-29 dB (typical) (re. 1 V/Pa at 1 kHz, in reference conditions)
Output impedance	300 Ω or less
Maximum input sound pressure level	138 dB (at 1 kHz)
Self-generated noise level	20 dB or less (A-weighting)
Power supply voltage	± 12 to ± 18 V
Current consumption	max. 5 mA
Frequency range	20 Hz to 20 kHz
Temperature dependent sensitivity level fluctuation	max. ± 0.4 dB from -10°C to $+50^{\circ}\text{C}$, referenced to sensitivity at 23°C
Humidity dependent sensitivity level fluctuation	max. ± 0.14 dB at humidity up to 90%, referenced to sensitivity at 23°C and 50% RH (no condensation)
Atmospheric pressure dependent sensitivity level fluctuation	± 0.4 dB in range from 85 to 108 kPa, referenced to sensitivity at 101.325 kPa ± 0.9 dB or less in range from 65 to 85 kPa
Microphone integrated sound source	
Signal frequencies	250 Hz, 500 Hz, 1 kHz, 4 kHz
Allowable input voltage	3.5 Vrms

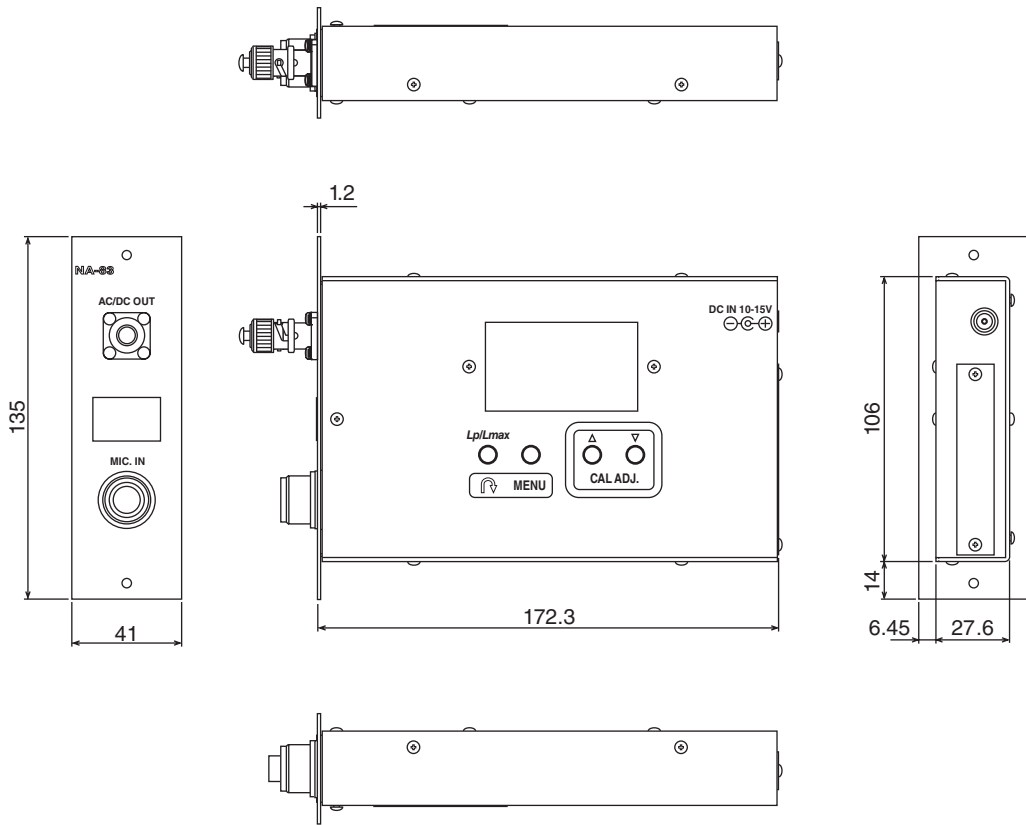
Heater**Heater power consumption**

0.9 W (typical with input current 94 mA DC)

Heater electrical resistance102 Ω (typical)**Ambient temperature/humidity conditions for operation**

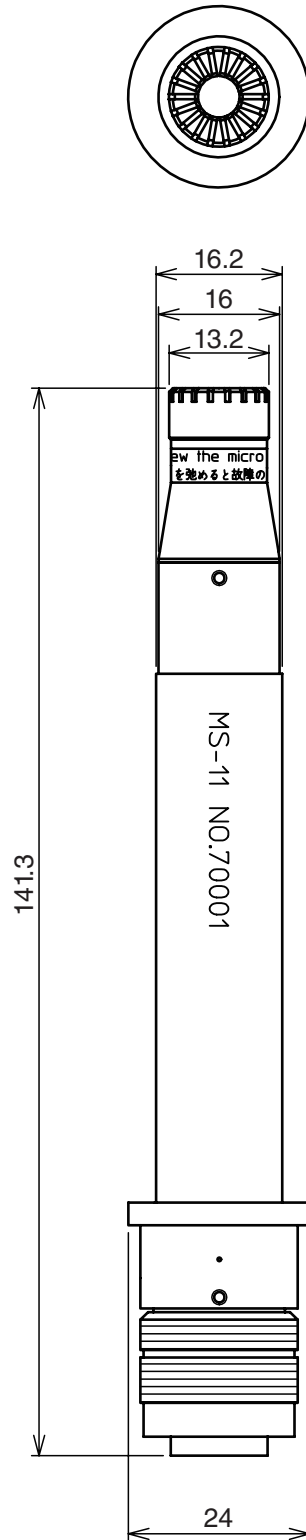
-20°C to +50°C, 10 to 100% RH (no condensation)

Dimensional drawing See Fig. 2**Mass** approx. 120 g



Unit: mm

Fig. 1 NA-83 Dimensional Drawings



Unit: mm

Fig. 2 MS-11 Dimensional Drawings

