AG3103

Charge Amplifier

INSTRUCTION MANUAL

1WMPD4003956A

A&D Company, Ltd.

CAUTION

(1) Turn off the power when an error occurs in behavior of product.
If it is impossible to trace the causes of an abnormal operation, please contact our sales representative.
(2) The contents of this manual are subject to change without notice.
(3) This manual is copyrighted with all rights reserved. This manual may not be reproduced, modified, or translated without the written permission of A&D Company, Limited. No parts of this manual may be transcribed without permission.
(4) Please let us know if there are any points that are unclear or missing in this manual.
(5) A&D Company, Limited. will not be held responsible for any damages or loss of income caused by the operation of this device or any direct, indirect, special, or inevitable damages caused by defects in the product, even if there is notice that the corresponding damages may occur. We will also not be held responsible for any third-party claims of rights. At the same time, we will not be held responsible for any loss of data. We will not be held responsible for any of such points as those indicated in item (4).
(6) Read carefully before using this amplifier. Place keep this manual with reach of this amplifier.

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Introduction

▲Introduction▼

Thank you very much for purchasing the **Charge Amplifier AG3103**.
Prior to using this amplifier, please carefully read the instruction manual so that you can correctly use it.
This instruction manual provides information necessary for you to safely and correctly operate the amplifier.
Please always place this instruction manual together with the amplifier whenever you use it so you can access and refer to the manual at any time.
If you have any questions about the content of this manual, please contact your local A&D dealer.

▲Examining contents in package▼

When opening the package in a warm room during the cold season, open the package after it has reached room temperature to avoid any operational failure due to condensation on the surface of the amplifier.

Be sure to observe the following instructions when using this amplifier. The warranty does not cover damages resulting from actions that go against instructions, cautions, or warnings mentioned in this manual.
This unit is delivered after a thorough examination at the factory prior to shipment.
However, please examine the product's condition and verify that no obvious shipping damage has occurred after opening the package. Also, examine the specifications of the inputs and accessories. If there are any missing or damaged items, please contact your local dealer.

Safety measures

Be sure to observe the following precautions when using this amplifier. The warranty does not cover damages resulting from actions that go against instructions, cautions, or warnings mentioned in this manual.

To safely use the amplifier, the following statements are used in this manual to call the readers' attention.

⚠WARNING

This sign indicates warnings if there is a risk of danger to the life or physical health of the operator, such as an electric shock, in order to avoid the danger.

⚠CAUTION

This sign indicates cautions if there is a risk of damage to the equipment or describes general precautions for handling.

⚠WARNING

- **Power supply**

  Be sure to check that the power supply is within the rating of this amplifier before turning it on.
  To prevent electric shock or fire, be sure to correctly use the power cable and connection cable provided by A&D.

- **Protective grounding and protective functions**

  Protective grounding must be used to safely use this amplifier and protect the user and surrounding equipment. Please read the following instructions.

  1) **Protective grounding**
     This amplifier uses a three-pole power cable with a ground wire in order to prevent electric shock. Be sure to connect to a power outlet with a protective ground terminal.

  2) **Caution for protective grounding**
     Make sure that the protective ground wire is not cut off or the protective ground terminal is not disconnected while power is supplied to this amplifier. If it is cut off or disconnected, the safety of this amplifier cannot be guaranteed.

  3) **Protective function failure**
     Avoid using this amplifier when it is suspected that there is a failure in protective grounding or protective functions. Confirm that there is no failure in the protective function before using this amplifier.

- **Use in gaseous atmosphere**

  Never use this amplifier in a flammable or explosive atmosphere or in an atmosphere of steam.
  Use in such atmospheres will result in danger to the user and the amplifier.

- **Removal of the housing case**

  Removing the housing case of the amplifier unit is extremely dangerous. Do not remove it from the unit except when operating the switch to select the power supply voltage from 100 VAC, OFF, or 200 VAC.

- **Input signal connection**

  Ground the grounding terminal of this amplifier securely before connecting to the input terminal. In order to prevent electric shock or burnout, make sure first that no signal or common-mode voltage is applied to the input line, and then perform the work.

- **Cautions during operation**

  During operation of this amplifier, high voltage may be generated between the input terminal (input signal line) and the housing (protective grounding) and between the input terminal and output (output signal line). Be careful of electric shock accidents.

- **Installation category and contamination level**

  This amplifier is of Installation Category II and Pollution Degree II. Use within this range. Be sure to check that the power supply is within the rating of this amplifier before turning it on.

⚠CAUTION

● **Cautions in handling**

Operate this amplifier with the following precautions.

1) **Restriction for operators**

Avoid operation by use except operator who know how to operate this amplifier.

2) **Storage and usage environment for this amplifier**

The storage temperature of this amplifier is -20 to 70 °C, and the storage humidity is 10 to 90 %RH. During hot seasons in particular, do not store this amplifier in a place where it is exposed to long-term sunlight or where the temperature becomes excessively high (such as in a car).
Do not store or use this amplifier at the following places.

1. Places where the temperature and humidity rise due to direct sunlight or a heater.
   (The operating environment of this amplifier; temperature: -10 to 50 °C, humidity: 20 to 85 %RH)
2. Locations in splash water, wet places.
3. Locations where salt, oil, or corrosive gas exist.
4. Wet locations. Dusty locations.
5. Locations subject to strong vibrations.

3) **Cautions on power supply**

1. Be careful of power supply voltage fluctuations. Do not use this amplifier when voltage is likely to exceed the rated voltage.
2. If the power supply includes much noise or high-voltage inductive noise, use noise filters to avoid operation errors.

4) **Calibration**

We recommend periodical calibration to maintain the product's accuracy. More reliable measurements are possible by calibrating this amplifier once a year (optional for extra cost).

Cautions in handling

Read the manual carefully before using this amplifier.

1. **In the sensor check function of this amplifier, a check signal (up to about 0.9 Vp-p) is applied to the sensor. Do not use if sensor damage is suspected.**
   Also, if the sensor cable common wire (negative) is connected to the object to be measured through the sensor case, the voltage is also applied to the object to be measured.
   Please electrically isolate the sensor or perform a sensor check before installing the sensor.

2. Be sure of attention to the input charge range of this amplifier, when using a piezoelectric acceleration sensor.
   1.35×10^5 pC (When input charge is 10,000 pC to 100,000 pC)
   1.35×10^4 pC (When input charge is 1,000 pC to 10,000 pC)
   1.35×10^3 pC (When input charge is 1,000 pC or less) Refer to "4.2.4 Maximum input charge".
   This amplifier does not equip an input protection circuit to keep high impedance of the input section.

3. Do not apply voltage or current to the output terminal of this amplifier from an external source.

4. Use this amplifier with power supply voltages from 85 to 132 VAC, 180 to 264 VAC, or 10 to 30 VDC. This amplifier equipps the voltage selection switch. If you switct this switch, refer to page 36.
   If the power fuse is blown, check the cause of fuse blowout. To replace the fuse, always disconnect the power plug and input and output signal cables first, and then replace the fuse in the fuse holder. For how to replace the fuse, refer to "6.3. How to replace fuses". Be sure of the rating of fuse (e.g. kind of AC or DC) when replacing.

5. Use this amplifier within the operation temperature is –10 to 50 °C and humidity is 20 to 85 %RH without condensation. If the product has been stored in a high-humidity or low-temperature environment, use only after it has reached room temperature to avoid any operational failure due to condensation on the surface of the amplifier. Avoid the following locations for storing this amplifier.
   - ○ High humidity locations.
   - ○ Location in direct sunshine.
   - ○ Location around high-temperature heat source.
   - ○ Locations subject to strong vibrations.
   - ○ Locations where dust, salt, water, oil or corrosive gases exist.

6. When using multiple channels, ventilate properly and install a fan unit.

7. Be sure to ground the housing when using this amplifier.

8. When connecting a microdot connector to the input connector, depending on the cable used, it may be necessary to remove the rubber ring attached to the seat of the input connector (INT) of the main unit.

9. This amplifier is equipped with flash memory to save setting parameters. Therefore, it is not necessary to replace battery.

10. This amplifier is equipped with control knobs using a rotary encoder. If the position of the knob is the middle position between click positions, though this seldom happens, the setting of the knob may change from the last setting when turning on. When the knob is at the click position, there is no problem.

Warranty

We ship our products after conducting quality control, which covers from design to manufacturing. But if the product may failure and does not operate correctly, please make a check of the power supply, cable connections, or other conditions before returning this product to us.
Contact your local dealer concerning of repair or calibration. Be sure to inform us of the model, serial number, and problematic points before returning.

The following is our warranty.

Limited warranty

1. **Warranty period:** Two years from our shipment.

2. **Warranty limit:** We will repair the defects of our product free of charge as necessary within the warranty period; however, this warranty does not apply in the following cases.
   (1) Damage or faults caused by incorrect use.
   (2) Damage or faults caused by fire, earthquake, traffic accident, or other natural disasters.
   (3) Damage or faults caused by a repair or modification that is carried out by someone other than a service representative of A&D Company, Limited.
   (4) Damage or faults caused by use or storage in environmental conditions that should be avoided.
   (5) Periodical calibration.
   (6) Damage or faults caused during transportation after delivery after our shipment.

3. **Liability:** We do not assume any liabilities for equipment other than that of A&D Company, Limited.

When disposing of the used product

In the European Union

EU-wide legislation as implemented in each Member State requires that used electrical and electronic products carrying this mark (left) must be disposed of separately from normal household waste. This includes electrical accessories, such as chargers or AC adaptors.
The mark on the electrical and electronic products only applies to the current European Union Member States.



Outside the European Union

If you wish to dispose of used electrical and electronic products outside the European Union, please contact your local authority and ask for the correct method of disposal.

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1. Overview

1.1. Features

The AG3103 is a charge amplifier allowing isolation of the input, output, and power supply system and enables wideband signal input (0.2 Hz to 100 kHz). The sensor is capable of multi-input ("voltage output" piezoelectric sensor with built-in amplifier or "charge output" piezoelectric type sensor) with the measurement range greatly expanded (10 times compared to previous product) from 1 to 50,000 m/s^2, thus enabling a wide range of vibration measurements such as impact, rotating body vibration, and noise. In addition, the product is designed with environmental conservation in mind, as seen by eliminating use of lead in the device and eliminating the batteries used for the storage memory for setting status, etc., and adopting flash memory. When several amplifiers are installed in the optional case, setting of the power supply, CAL application and key lock for all channels can be made by one operation.

If you have any problem, read the section for maintenance, and then contact with your local dealer if the problem is not solved.

1.2. Optional products

The following cases are available for AG3103.

Type	Model	Product name	Remarks
Bench top case	AS16-104	4 channel bench top case	All include CH ±CAL, BAL, Key-lock, Power supply switch can be operated/synchronized with other cases.
	AS16-105	6 channel bench top case	
	AS16-106	8 channel bench top case	
Rack mount case	AS16-107	8 channel rack mount case	

＊ The optional cases above can be used for the AG3103, the AC strain amplifier series (AS1603, AS1703, AS1803R, AS2503, AS2603, AS3503, AS3603, AS3703, AS3803, AS3903) and the DC amplifier series (AL1201A, AL1301A).

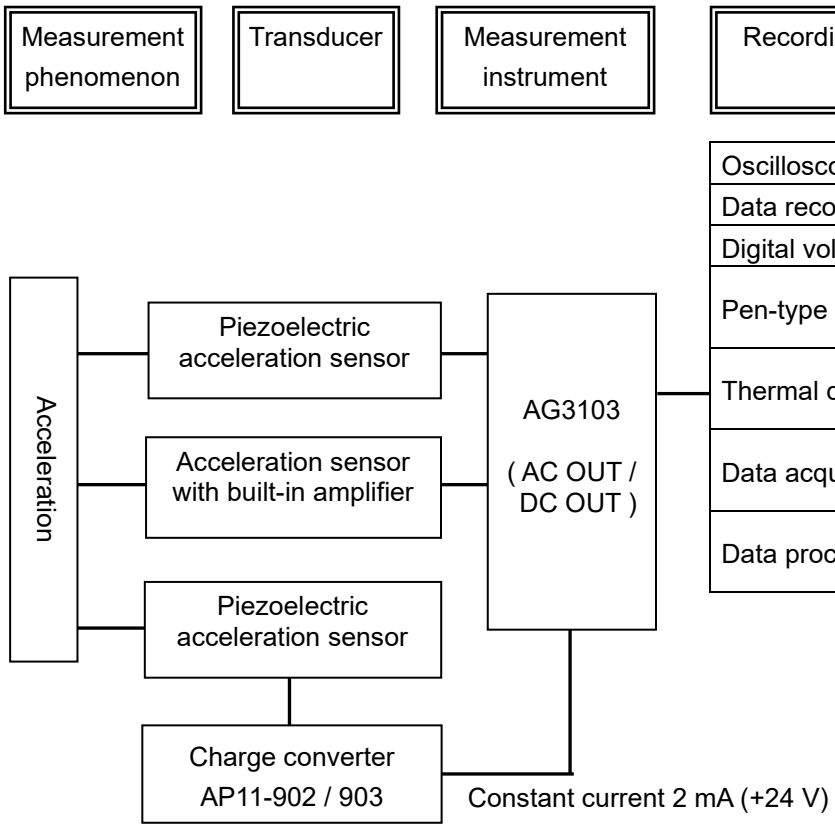
As the condition, if frequencies of bridge power supply (BV) of the AC strain amplifiers are different, these amplifiers cannot install in the same optional case.

1.3. Accessories

- Output cord 1 (AS30-503)
- Time-lag fuse
  - Fuse for AC power supply: 1 (0334-4306) 85 to 132 VAC or 180 to 264 VAC, 100 mA
  - Fuse for DC power supply: 1 (0334-4313) 10 to 30 VDC, 500 mA
- AC power cord 1 (AX-KO6165-200) 85 to 132 VAC
- Instruction manual 1

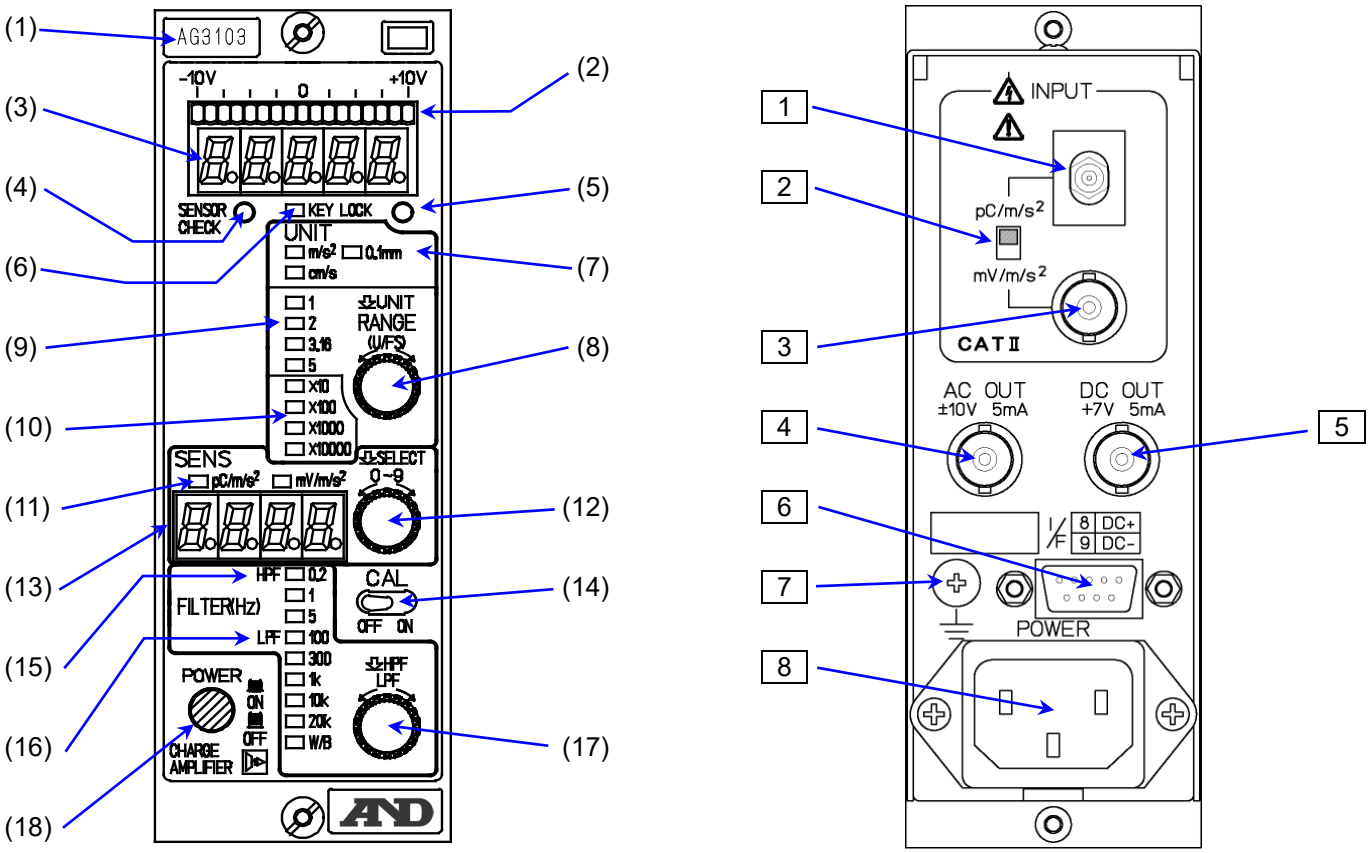
1.4. Block diagram of measurement

The following diagram illustrates a typical measurement system that broadly covers a variety of factors including signal amplitude, frequencies, and measurement time.



Oscilloscope	Waveform observation
Data recorder	Data recording device
Digital voltage meter	Numeric display
Pen-type oscilloscope	Low frequency waveform recording. DC to 120 Hz
Thermal dot recorder	Wide range waveform recording. DC to 20 kHz
Data acquisition system	High frequency waveform recording. DC to 100 kHz
Data processor	Statistical analysis of waveform, Data analysis

2. Part names and functions

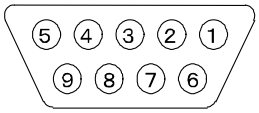


2.1. Names and functions of parts on front panel

No.	Name	Functions, operations and responses
(1)	Model	AG model number.
(2)	17-dot LED monitor meter	Checks the output of AC OUT [4]. The green LED at the center illuminates when the output is within ±100 mV. When the output voltage exceeds ±10.5 V, the LED at the over-voltage side flashes.
(3)	4-digit 1/2 digital LED monitor	Digitally displays the output voltage of DC OUT [5]. This value is the effective value converted from the amplitude value of the AC output [4].
(4)	Sensor check (SENSOR CHECK)	When the switch is pressed, a calibration voltage is applied to the sensor and the signal from the sensor is measured to automatically detect the presence of disconnection occurring between the sensor and the input connector [1] on the back of this amplifier. *Note: With sensor check, it is possible to set the disconnection judgment level. For details, Refer to page 21.*
(5)	Keylock switch (KEY LOCK)	Pressing the switch for one second switches on/off the keylock. While the keylock LED (6) is turned on, the switches on the front panel are locked. While locked, the switches other than the keylock (5), CAL (14) and power (18) switches cannot be used.
(6)	Keylock LED	Indicates whether keylock is enabled or not. On: Enabled. Off: Disabled.

No.	Name	Functions, operations and responses
(7)	Unit setting display (UNIT)	Pressing knob (8) changes the unit setting. The unit setting is displayed as follows. Acceleration: m/s^2. Velocity: cm/s. Displacement: 0.1 mm.
(8)	Measurement range and unit setting selection knob (RANGE / UNIT)	Pressing the knob switches the unit setting. Also, turning the knob switches the measurement range, with steps 1, 2, 3.16, and 5, from 1 to 50,000 at the maximum. There is a limit depending on the sensor sensitivity setting.
(9)	Measurement range LED	Displays the measurement range setting, with steps 1, 2, 3.16, and 5, and magnification LED (10). Indicates the measurement range in full scale. (Up to ±1 (peak value) with “1”.) The unit of the measurement range is the unit of UNIT display (m/s^2, cm/s, 0.1 mm).
(10)	Measurement range magnification LED	The value obtained by multiplying the measurement range value by the magnification displayed in this window is the full scale.
(11)	Sensor input selection display (RANGE / UNIT)	Displays the selection status of input connector selection switch [2] on the rear panel. Switches according to the type of sensor used (piezoelectric acceleration sensor or acceleration sensor with built-in amplifier). Indicates the unit of sensor sensitivity.
(12)	Sensor sensitivity setting knob	When changing the sensitivity of the sensor, press knob (12) to select a digit. To change the value, turn knob (12). For details, Refer to page 16.
(13)	Sensor sensitivity display	Displays the sensitivity of the sensor. The displayed value is in the range of 0.010 to 999. For switching, use knob (12).
(14)	Calibration voltage application switch (CAL)	This is the switch for calibration signal output. On the ON side, a sine wave with a full scale voltage of 10 V (single amplitude) and a frequency of 80 Hz is output to AC OUT [4]. To DC OUT, 7.07 V (RMS conversion value) is output.
(15)	High-pass filter (HPF) LED	Displays the setting value of high-pass filter LED. Pressing knob (17) switches the setting.
(16)	Low-pass filter (LPF) LED	Displays the setting value of low-pass filter LED. Turning knob (17) switches the setting.
(17)	Filter switch knob (FILTER HPF / LPF)	Pressing this knob switches the high-pass filter cutoff frequency from 0.2 Hz, 1 Hz, 5 Hz to 0.2 Hz in this order. Also, turning this knob to the right switches the cutoff frequency of the low-pass filter from W/B to 100 Hz and turning it to the left switches from 100 Hz to W/B.
(18)	Power switch (POWER)	When the switch is pressed, the yellow ring of the knob disappears and the power is turned on. When the button is pressed again, the yellow ring becomes visible and the power turns off.

2.2. Names and functions of parts on rear panel

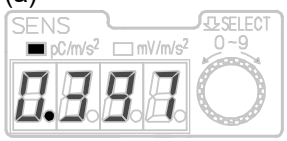
<table>
<tr><th>No.</th><th>Name</th><th>Functions, operations and responses</th></tr>
<tr><td>1</td><td>Input connector for piezoelectric acceleration sensor</td><td>Connects to the cable from a piezoelectric acceleration sensor. This is the dedicated input connector for a microdot connector (10-32 pitch coaxial receptacle). Use this connector to connect an input cable with a microdot connector.</td></tr>
<tr><td>2</td><td>Input connector selector switch</td><td>(1) When using a piezoelectric acceleration sensor, set this switch to the up position.
(2) When using an acceleration sensor with a built-in amplifier. Set this switch to the down position.</td></tr>
<tr><td>3</td><td>Input connector for acceleration sensor with a built-in amplifier</td><td>Connects to the cable from an acceleration sensor with a built-in amplifier. This is the dedicated input connector for a BNC connector.
When an acceleration sensor with a built-in amplifier is used, a constant current of +24 V / +2 mA is output from the connector as the power supply for the sensor.
Do not use any sensors other than those that operate at +24 V / +2 mA.</td></tr>
<tr><td>4</td><td>Output connector (AC OUT)</td><td>Output voltage: ±10 V. Current: 5 mA.</td></tr>
<tr><td>5</td><td>Output connector (DC OUT)</td><td>Outputs the RMS value of the signal which is output to AC OUT 4.</td></tr>
<tr><td>6</td><td>Interface connector (I/F)</td><td>This connector is the electrical interface between the amplifier and the optional case. Connecting the CAL terminal (I/F:1 pin) to the GND terminal (I/F 7 pin) applies the calibration value. The calibration value is applied when either this terminal or CAL switch (14) turns on. Similarly, connecting the KEY LOCK terminal (I/F 6 pin) to the GND terminal (I/F 7 pin) locks each setting switch. Each setting switch is locked when either this terminal or KEY LOCK switch (5) is turned on. The I/F connector’s pin layout is as follows.


I/F connector (on the real panel)
<table><tr><td>1 pin +CAL</td><td>2 pin N/A</td><td>3 pin N/A</td></tr><tr><td>4 pin NC</td><td>5 pin NC</td><td>6 pin KEYLOCK</td></tr><tr><td>7 pin GND</td><td>8 pin DC+</td><td>9 pin DC-</td></tr></table></td></tr>
<tr><td>7</td><td>Protective grounding terminal</td><td>If the 3-pin power cord cannot be connected, ground this terminal.</td></tr>
<tr><td>8</td><td>AC power input connector</td><td>Connects to the AC power cable. The withstand voltage of this product's AC power input section is 1.5 kV/min for input, output and the case.
Note: Please confirm that your local voltage and receptacle type.
For 85 to 132 VAC, use the AC power cord (AX-KO6165-200).
For 180 to 264 VAC, use the AC power cord of plug type adapting to your local region.</td></tr>
</table>

2.3. How to trim the sensor sensitivity (SENS)

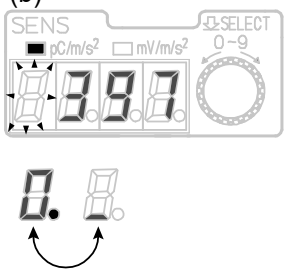
[Setting example: 1.00 to 9.99 pC/m/s^2]

(a)



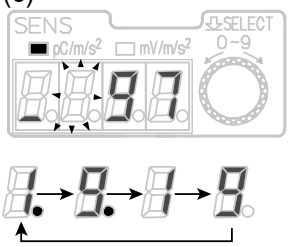
Press sensor sensitivity setting knob (12).

(b)



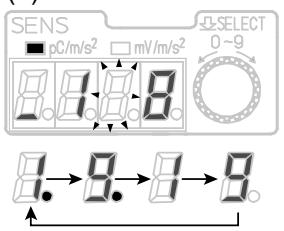
The leftmost LED flashes. Turn knob (12) to display "0." and "_". Select "_", then press the knob (12).

(c)



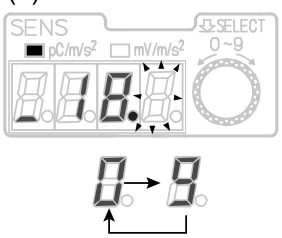
The second LED from the left flashes. Turn knob (12) to select "1", then press the knob (12).

(d)



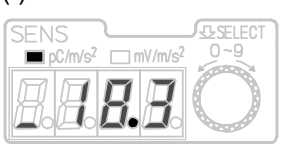
The third LED from the left flashes. Turn knob (12) to select "8", then press knob (12). (*Note 1*)

(e)



The fourth LED from the left flashes. Turn knob (12) to select "3", then press knob (12).

(f)

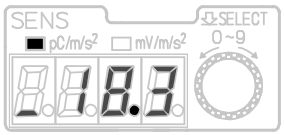


Finally, all LEDs are illuminated and 18.3 pc/m/s^2 setting is complete.

Note 1: Here, the value can be selected from
0., 1., 2., 2., 3., 4., 5., 6., 7., 8., 9., and 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
In sensor sensitivity setting,
Select "0." to "9." at (c) for 1.00 to 9.99 and
Select "0." to "9." at (d) for 10.0 to 99.9, respectively.

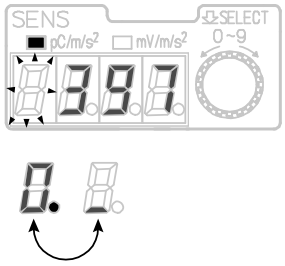
[Setting example: 0.100 to 0.999 pC/m/s^2]

(a)



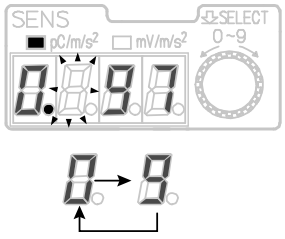
Press sensor sensitivity setting knob (12).

(b)



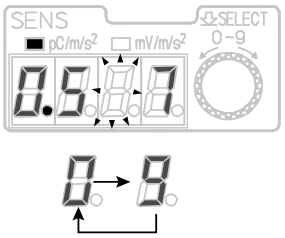
The leftmost LED flashes. Turn knob (12) to display "0." and "_". Select "0.", then press knob (12).

(c)



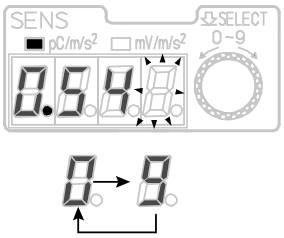
The second LED from the left flashes. Turn knob (12) to select "5", then press knob (12).

(d)



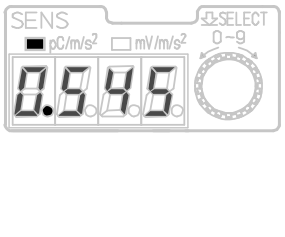
The third LED from the left flashes. Turn knob (12) to select "4", then press knob (12).

(e)



The fourth LED from the left flashes. Turn knob (12) to select "5", then press knob (12).

(f)



Finally, all LEDs are illuminated and 0.545 pc/m/s^2 setting is complete.

3. Preparation for measurement

3.1. Cable connections

3.1.1. Connecting the input cables

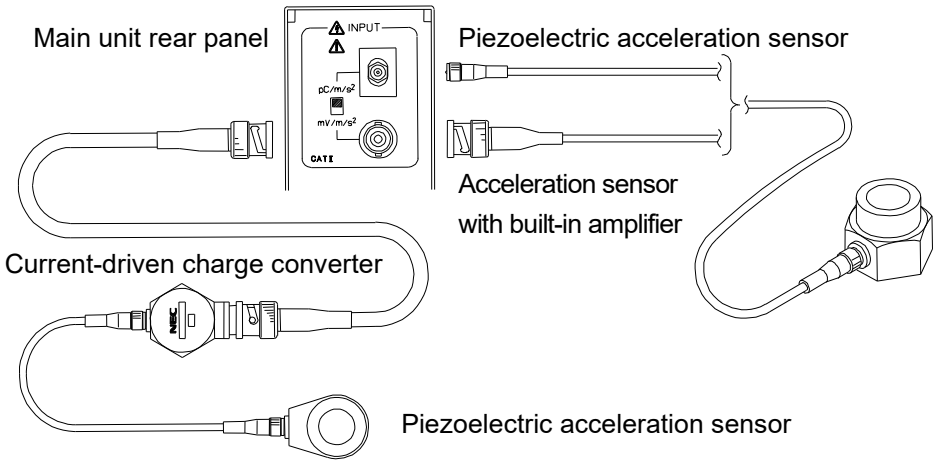


Fig. 3-1 Input connections

3.1.2. Connecting the power supply and output cables

(1) Use the AC power cord adapting to your local region.
For 85 to 132 VAC, use the AC power cord (AX-KO6165-200).
For 180 to 264 VAC, use the AC power cord of plug type adapting to your local region.
For 12 VDC, use the DC power cord adapting to 12 VDC.

(2) Connect the output cable according to the recorder to be connected.

(3) The housing of this amplifier is connected to the output common wire. Ground to the system common wire.

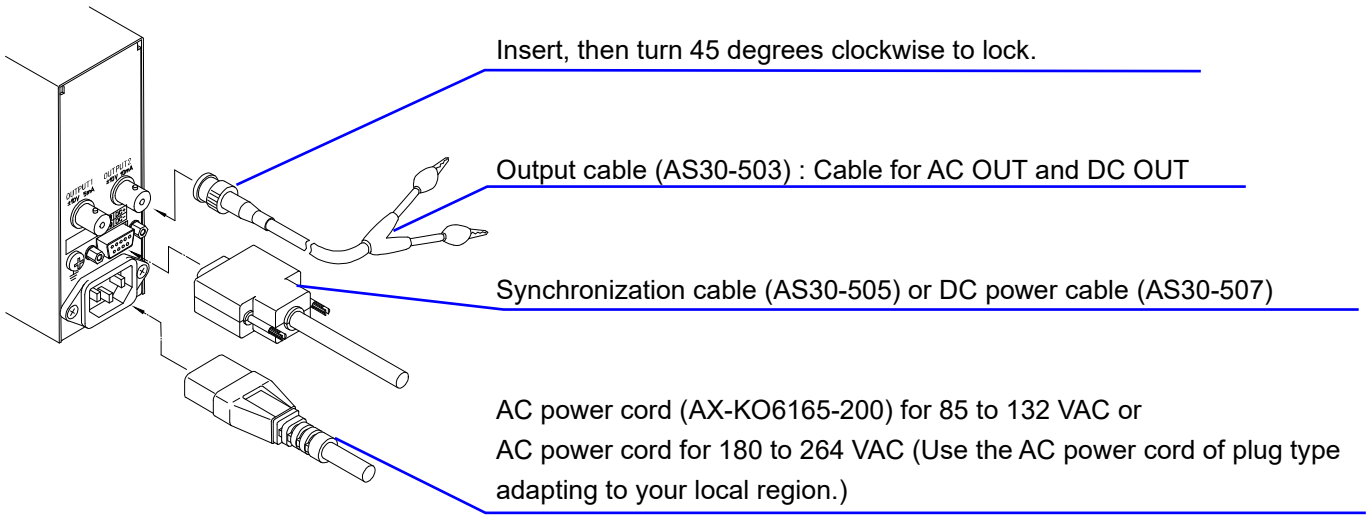


Fig. 3-2 Connections of output, I/F connector, and power supply

3.1.3. Connecting the output cable

This amplifier is equipped with two kinds of connection, AC OUT and DC OUT. They are both for connection to a voltage input device, such as a data recorder, thermal dot recorder, or oscilloscope.

AC OUT

The output voltage and current of this output are ±10 V / ±5 mA (2 kΩ or greater load). The signal waveform is output as is to this output. Connect here mainly devices to observe and record acceleration waveforms.

DC OUT

The output voltage and current of this output are +7.07 V/+5 mA. The AC OUT signal is converted into an average value detection equivalent effective value, and an effective value is output. Connect here to perform measurement of vibration phenomenon, amplitude value, or fluctuation trend.

Output cable (AS30-503) is shown in the figure below.

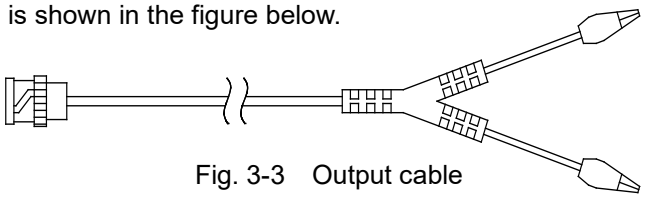


Fig. 3-3 Output cable

(1) Example of connecting the output recorder

Be careful to check the input level of the output recorder. If excessive voltage is inputted, data is saturated and cannot record. For that reason, this amplifier has a function to indicate excessive output voltage. As shown in the figure, the indicator on the side exceeding the excessive level (approx. ±10.5 V) flashes. The monitor meter can check excessive level up to approximately 100 Hz.

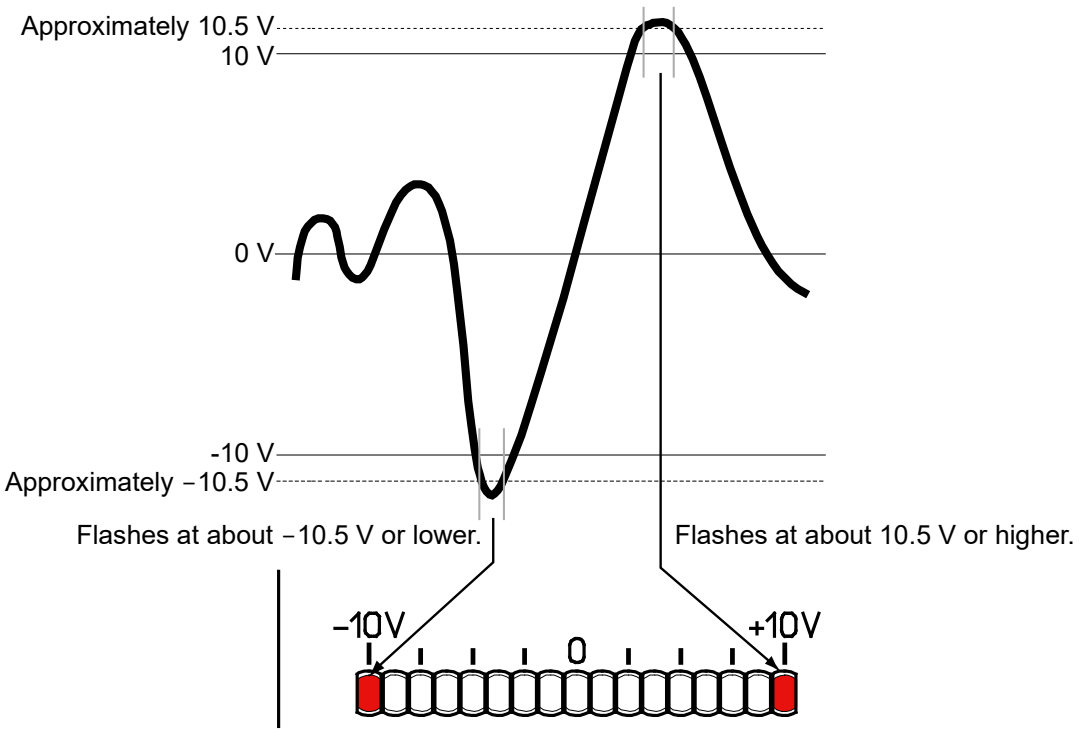


Fig. 3-4 The “Out of range” display

Note the following points when connecting to a data recorder.

a In case of direct connection

A data recorder allowing 20 Vp-p (±10 V) or greater input level power application can be directly connected.

b In case of requiring a voltage divider circuit into the input

A data recorder whose input level is ±1 V requires a voltage divider circuit.
In this case, take notice of impedance.

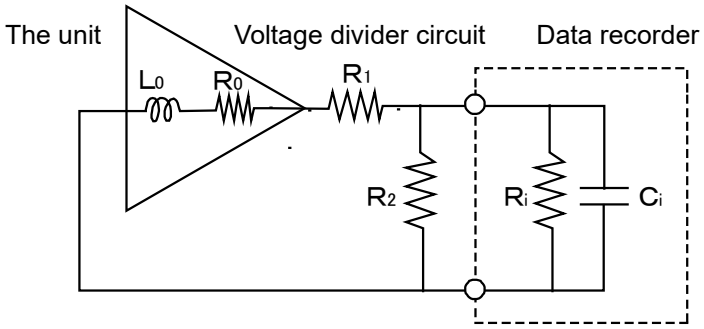


Fig. 3-5 Voltage divider

R2 is reduced to lower the influence of the data recorder's input impedance (Ri).

Example: When the partial pressure ratio is 1/10, the minimum values that R1 and R2 can take are as shown below.

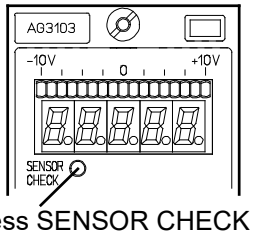
Table 3-1 Voltage divider resistances

	R_1	R_2
AC OUT	1.8 kΩ	200 Ω
DC OUT	1.26 kΩ	140 Ω

3.2. Operation of sensor check function

[Caution]

The sensor check function applies a signal (up to approx. 0.9 Vp-p) to the sensor. Do not use the function if it may cause damage to the sensor or voltage application to the object being measured.

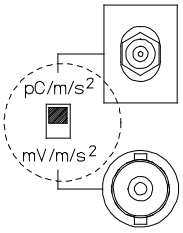


Press SENSOR CHECK

[Caution]

If the sensor is connected through a sensor case to the object being measured, insulate the sensor electrically or perform sensor check before installing the sensor.

In case of piezoelectric acceleration transducer input

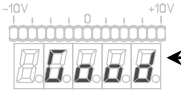


Displays error reference value.

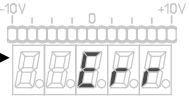
Measures the capacitance of the cable and sensor, and displays the capacitance.

Judges error based on error reference value and measured capacitance.

If the cable capacity is larger than the sensor capacity value, it may not be judged correctly.

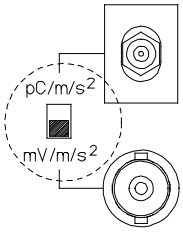


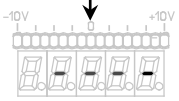
Good: No disconnection



Error: Disconnected

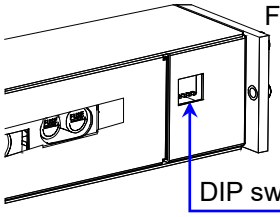
In case of piezoelectric acceleration transducer input with built-in amplifier



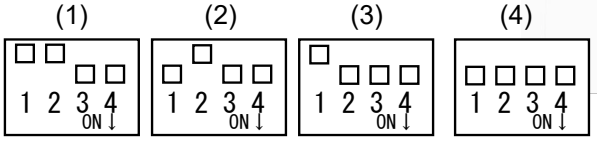


No sensor check.

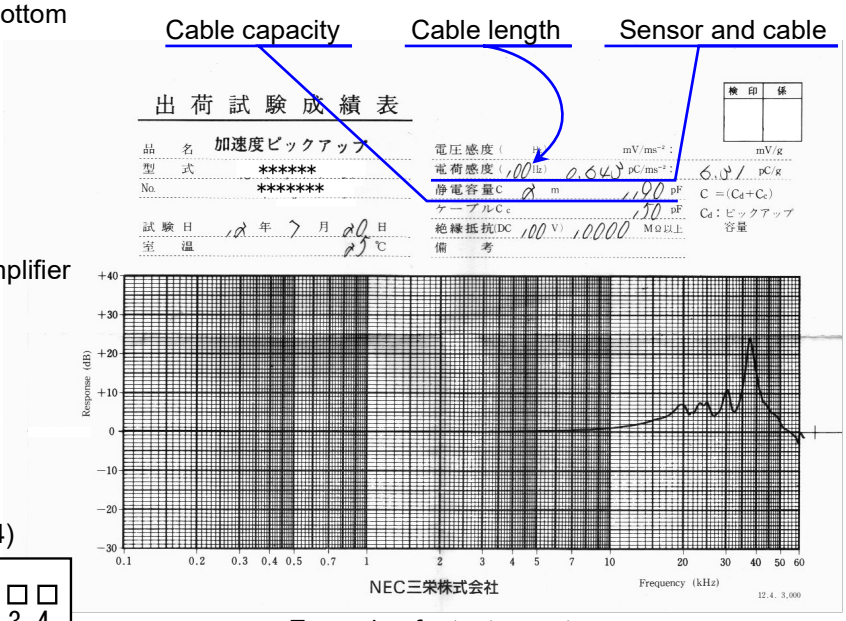
- Select the error reference value according to the cable length connected to the sensor. (Switching with the DIP switch on the bottom of this product.)
  - (1) No judgment criteria.
  - (2) When the cable length is 2 m.
  - (3) When the cable length is 5 m.
  - (4) When the cable length is 10 m.



Back side of amplifier



- When you hold down the sensor check button while “Err” is flashing, the sensor check is performed again.



Example of a test report

3.3. The gathering case

3.3.1. Parts names of the gathering case

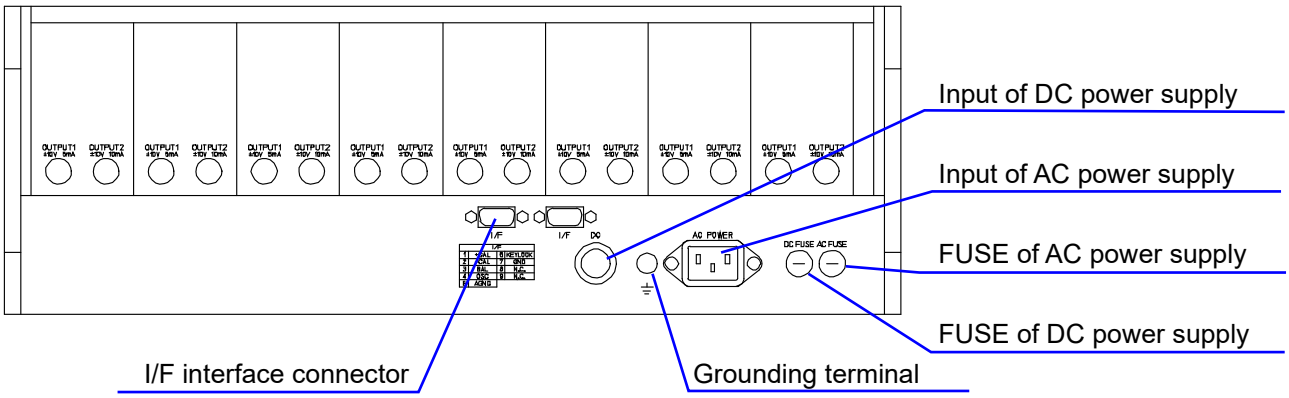


Fig. 3-6 Storage case rear view

- Use standard AC power cord (AX-KO-6165-200) that is attached to the case as a standard for 100 VAC power supply.
- Use optional DC power cord (AS30-508) for DC power supply.

3.3.2. Descriptions of the gathering case

(A) Power supply cable connection

When installing the unit in the case and using it with a battery (12 VDC: 10 to 30 VDC), consider that voltage drop due to the wire length and wire diameter of the DC power cord. A voltage drop occurs when multiple channels are used and the power cord is extended long, and then voltage may fall below the power input range of 10 V for the DC power input connector of this product.

For example, with the DC power cord (AS30-508) of 1.25 mm^2, when eight channels are installed, 0.4 A x 8 = 3.2 A flows, and when it is extended to 10 m in length, voltage drops by 0.5 V.

Similarly, with a 10 m cable of 0.75 mm^2, voltage drops by 1.65 V. Under a situation like this, it is necessary to supply power in anticipation of a voltage drop or to reconsider the wire diameter and length of the power cord.

(B) Simultaneous operation between cases and between amplifiers

When multiple units are installed in the cases, the control signals are wired inside the cases. The calibration value application and key lock can be applied to all units in the cases by using the all-channel calibration value application switch and all-channel key lock switch on the front of the case.

In addition, the same operation as above can be performed when connecting the cases using a dedicated sync cable. (See Fig. 3-7.)

Note that the BAL switch and negative CAL application switch do not operate with the AG3103 because the AG3103 is not equipped with a balancing function and negative calibration value application function.

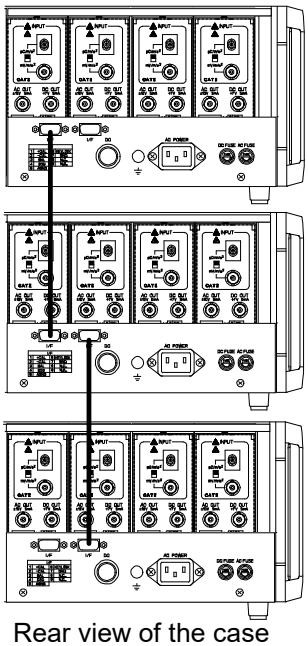


Fig. 3-7 Rear view of the case

All-unit balancing switch (1): Disconnection check, Line length correction, Auto balancing (Effective only for strain amplifier)

All-unit calibration value application switch (2)

All-unit key lock switch (3)

Case power switch (4)

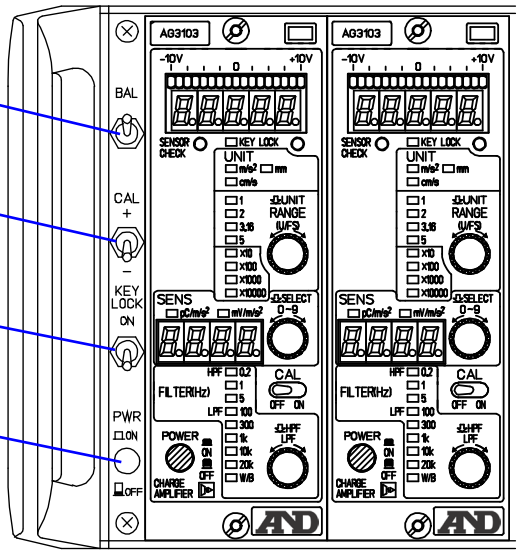


Fig. 3-8 Front view of the case

(C) All-unit calibration value application switch (2)

When the all-unit calibration value application switch (2) of the case is turned to the + side, the all-unit calibration value application switch takes precedence regardless of the ON/OFF position of the calibration value application switch (14) of each unit, and a calibration value is applied. The same applies when multiple units are connected with a dedicated sync cable. When applying a calibration value to a single unit with the calibration value application switch (14) on the unit, check that the all-unit calibration value application switch of the case is turned off.

(D) All-unit key lock switch (3)

When the all-unit key lock switch (3) of the case is turned to ON (upward), the key lock is applied to all units, and the key lock LEDs (6) on all units illuminate. The function is the same as each unit's key lock setting.
To unlock, turn the all-unit key lock switch (3) downward. When unlocked, the unit whose key lock is turned on remains locked. The same applies when multiple units are connected.

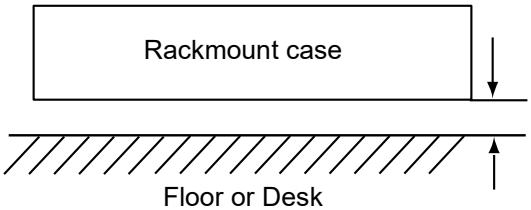
Table 3-2 Operation of each switch of the case

Switch on the front of the case		AG3103
AUTO		Doen't work
CAL	+	All channels, CAL
	-	Doen't work
Key Lock		All channels, key lock
PWR		Power is supplied

3.3.3. Measures for heat dissipation when installing amplifiers

(A) In case of installing a rackmount case

⚠CAUTION Do not place the rackmount case, which has no feet, directly on the surface of a desk, floor, etc. Heat that cannot be dissipated may cause a malfunction.



Lift up the case more than 20 mm.

Fig. 3-9 Installation of rackmount case

(B) In case of installing prual amplifiers or more into a rackmount cases

As the temperature inside the units rises depending on the number of mounted cases, load conditions, and ambient temperature, reliability is impaired, so, the number of fans to install should be decided referring to the table below.

Table 3-3 Numbers of rackmount cases and fans for heat dissipation

Number of rack mount case	Under extreme conditions (*Note*) Number of Fan units B
1 to 3	1
3 to 6	2
6 to 9	3

Note: Extreme conditions are as follows.

- Supply voltage: 110 VAC (+10 %)
- Output voltage/current: +10 V,10 mA
- Operating temperature: +50 °C (Ambient temperature)

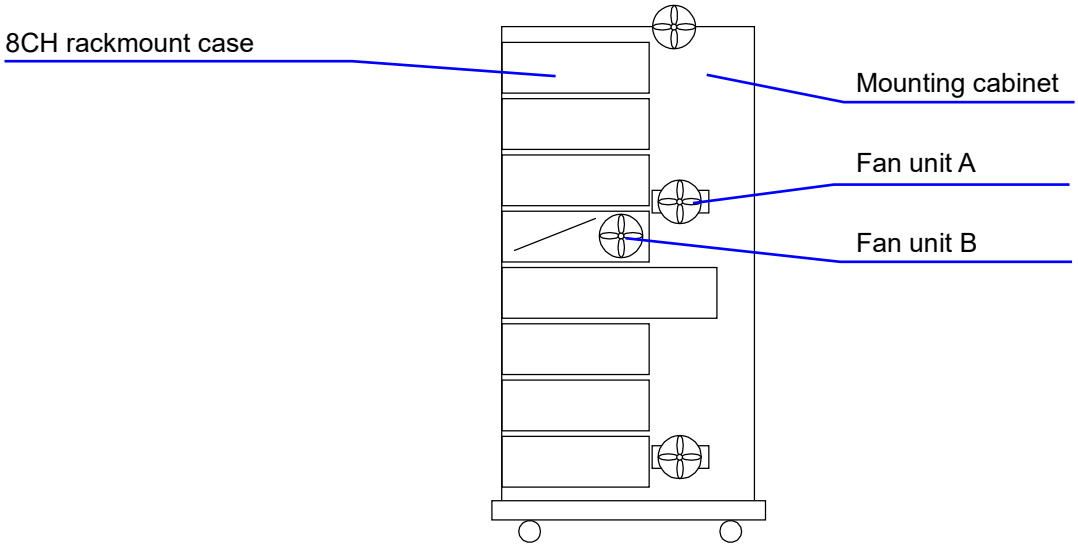


Fig. 3-10 Arrangement of fan units

As shown here, if there is a case that prevents the wind from flowing upward (a diagonal line shown in the figure or case with different length), install fan unit A just above that to improve ventilation, and fan unit B to promote natural convection. When multiple units are mounted, fan units B should be placed in close contact with the case at a ratio of 1 to 3.

Note: To install yourself, please contact your local dealer regarding the mounting method.

4. How to measure

4.1. Precautions before measurement

Be sure to check the following points in the table below before measuring.

Table 4-1 Precautions before measurement

Item	Points to check	Remarks
Installation environment for piezoelectric sensors	Use within the specification range of the sensor, and secure the mounting completely with studs.	・ Intrusion of noise ・ Errors in peak values and response characteristics
	Securely attach the connector.	・ Intrusion of noise ・ Unstable operation
	Avoid sudden temperature changes	・ Generation of low-frequency noise
	Keep the cable from the sensor as short as possible	・ Increase in noise
Installation environment for this amplifier (charge amplifier)	Ambient temperature and humidity should be -10 to + 50 °C and 20 to 85% RH (without condensation).	・ Unstable operation
	Vibration is within 3G.	・ Possible damage or noise
	Do not install in a strong magnetic field or electric field.	・ Intrusion of noise
	Be sure to ground the housing (especially when using AC power).	・ Intrusion of noise
Operation of this amplifier (charge amplifier)	Connect the connector securely.	・ Unstable operation ・ Contact failure
	The power supply voltage should be within specifications (85 to 132 VAC, 180 to 264 VAC, 10 to 30 VDC). Confirm the polarity when using a DC power supply.	・ Unstable operation when power supply voltage is low. If it is high, it generates heat and exceeds the rating of the element ・ Does not operate when the polarity of the DC power supply is reversed
	A low-pass filter should be used after understanding its characteristics.	・ Phase difference ・ Amplitude reduction
	Do not short the output cable.	・ The power supply may not start. ・ Heat generation of circuit
Countermeasures against noise	(1) Ground the case.	
	(2) Insulate the sensor from the base material	

4.2. Operation

4.2.1. Turning on the power

When the power switch (POWER) is pressed, current is supplied to the unit. Let it warm up for about 10 minutes.

4.2.2. Specifying the sensor sensitivity

Set the sensor sensitivity to be used with switch (12). The setting details are displayed on the sensor sensitivity display LED (13). The setting range is 0.010 pC/m/s2 to 999 pC/m/s^2 (or 0.010 mV/m/s^2 to 999 mV/m/s^2).

4.2.3. Specifying the range

Operate the range setting switch (8) according to the acceleration to be measured. When an input signal of the setting range value is input, the output voltage of this unit is ±10 V for AC OUT and +7.07 V for DC OUT.

The following table shows the measurable acceleration range according to the range setting.

Table 4-2 Relationship between sensor sensitivity and range when selecting charge sensor input (pC/m/s^2)

Sensor sensitivity	0.010 to 0.099	0.100 to 0.999	1.00 to 9.99	10.0 to 99.9	100 to 999	Input charge
SENS	pC/m/s^2	pC/m/s^2	pC/m/s^2	pC/m/s^2	pC/m/s^2	pC(max)
RANGE m/s^2/FS	100	10	1			10
	200	20	2			20
	316	31.6	3.16			31.6
	500	50	5			50
	1,000	100	10	1		100
	2,000	200	20	2		200
	3,160	316	31.6	3.16		316
	5,000	500	50	5		500
	10,000	1,000	100	10	1	1,000
	20,000	2,000	200	20	2	2,000
	31,600	3,160	316	31.6	3.16	3,160
	50,000	5,000	500	50	5	5,000
		10,000	1,000	100	10	10,000
		20,000	2,000	200	20	20,000
		31,600	3,160	316	31.6	31,600
		50,000	5,000	500	50	50,000
			10,000	1,000	100	100,000

＊ In the setting for the same line, the amplifier is set to the same gain range.

Table 4-3 Relationship between sensor sensitivity and range when selecting acceleration sensor with a built-in amplifier input (mV/m/s^2)

Sensor sensitivity	0.010 to 0.099	0.100 to 0.999	1.00 to 9.99	10.0 to 99.9	100 to 999
SENS	mV/m/s^2	mV/m/s^2	mV/m/s^2	mV/m/s^2	mV/m/s^2
RANGE m/s^2/FS	5,000	500	50	5	
	10,000	1,000	100	10	1
	20,000	2,000	200	20	2
	31,600	3,160	316	31.6	3.16
	50,000	5,000	500	50	5
		10,000	1,000	100	10
		20,000	2,000	200	20
		31,600	3,160	316	31.6
		50,000	5,000	500	50

＊ In the setting for the same line, the amplifier is set to the same gain range.

4.2.4. Maximum input charge

In order to keep the input impedance high, there is no protection circuit at the input.
Therefore, do not exceed the following maximum input charge.

Table 4-4 Relationship between each range and maximum input charge

Sensor sensitivity SENS	0.010 to 0.099 pC/m/s^2	0.100 to 0.999 pC/m/s^2	1.00 to 9.99 pC/m/s^2	10.0 to 99.9 pC/m/s^2	100 to 999 pC/m/s^2	Maximum input charge (pC)
RANGE m/s^2/FS	100 to 10,000	10 to 1,000	1 to 100	1 to 10	1	1,350
	20,000 to 50,000	2,000 to 10,000	200 to 1,000	20 to 100	2 to 10	13,500
		20,000 to 50,000	2,000 to 10,000	200 to 1000	20 to 100	135,000

4.2.5. Selection of the measurement unit

The AG3103 can measure not only acceleration but also velocity and displacement.
Press the UNIT/RANGE knob (8) to switch to the required unit.
The other settings are the same as for acceleration.
Since the basic measurement is acceleration, make sure that acceleration can be measured.

Acceleration: m/s^2
Velocity: cm/s
Displacement: 0.1 mm

4.2.6. Maintaining electrical insulation

In order to ensure that the sensor charge is transmitted to the charge amplifier, the connector that connects the piezoelectric sensor to the connection cable and the input connector of this unit should not be contaminated by dust, oil, water, etc.

4.2.7. The state after measurement

Turn the power switch off. The setting parameters are retained without power supply.

4.2.8. How to use the charge converter

When the distance between the piezoelectric accelerometer and the main unit (AG3103) is long, the influence of noise can be reduced by using a charge converter (optional).

The charge converters are two types, these specifications are as follows.

Table 4-5 Specifications of charge converter

Item		Model	
		AP11-902	AP11-903
Input		Single input	
Gain	Setting gain	1 mV/pC	0.1 mV/pC
	Gain accuracy (1 kHz)	±2.5 % (Input capacity: 1000 to 3000 pF)	
		±5.0 % (Input capacity: 3000 to 10000 pF)	
Frequency range		1.6 to 50 kHz ±3dB (Gain at 1kHz is 0dB)	
Maximum input charge		5000 pCp-p	50000 pCp-p
		(In the range of maximum output voltage 5.0 Vp-p)	
Maximum input capacity		10^4 pF	
Noise		100 μVrms	50 μVrms
Maximum output voltage		5.0 Vp-p or higher, (Depending on output cable capacity, drive current, frequency)	
Phase		180 degrees	
Output impedance		100 Ω max	50 Ω max
Power supply		12 to 25 VDC, 0.5 to 5 mA constant current	
Range of operation temperature & humidity		-20 to +110 °C, 20 to 80 %RH (No condensation)	
External dimension and weight		Hex 21 × 34 (H) mm, approximately 34 g	

Note 1: Input connector → Miniature connector (Screw: No.10-32UNF)

Note 2: Output/Power connector → BNC connector (Female)

Note 3: The amplifier is a non-insulating structure, so be careful when installing it if uses.

(1) When using AP11-902

Set the input connector selector switch to the side of the acceleration sensor with a built-in amplifier (mV/m/s^2). For the sensor sensitivity, consider the piezoelectric acceleration sensor and charge converter as one acceleration sensor with a built-in amplifier and set it and set it with the sensor sensitivity setting knob (12).

For the measurement range, refer to "Table 4-3 Relationship between sensor sensitivity and range when selecting acceleration sensor with a built-in amplifier input (mV/m/s^2)".

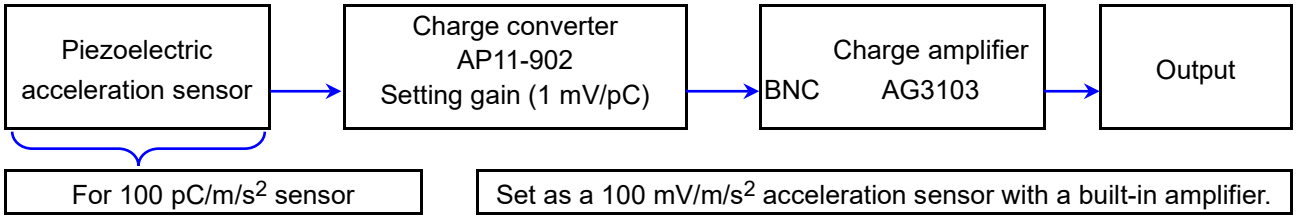


Fig. 4-1 Connection diagram when using charge converter (AP11-902)

(2) When using AP11-903

Set the input connector selector switch to the side of the acceleration sensor with a built-in amplifier (mV/m/s^2). For the sensor sensitivity, consider piezoelectric type acceleration sensor and charge converter as one acceleration sensor with a built-in amplifier and set it with the sensor sensitivity setting knob (12).
However, since this AP11-903 has a setting gain of 1/10 that of the AP11-902, the output voltage of this unit will also be 1/10.
For the measurement range, refer to "Table 4-3　Relationship between sensor sensitivity and range when selecting acceleration sensor with a built-in amplifier input (mV/m/s^2)".

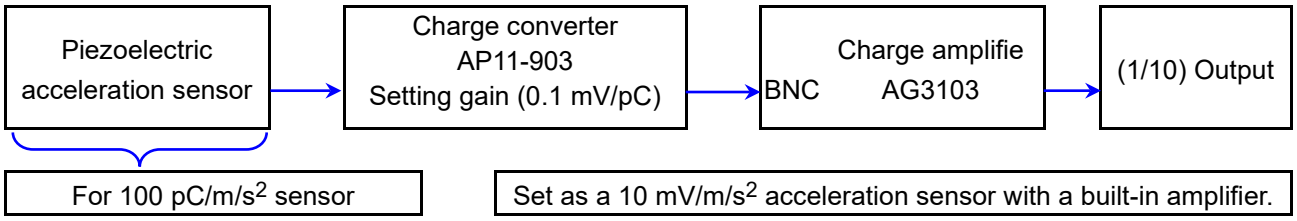


Fig. 4-2　Connection diagram when using charge converter (AP11-903)

4.3. Reading of measured values and calibration

4.3.1. How to read measured values

The input level can be determined from the output amplitude and input from (7), (9), and (10) on the panel. If the sensor sensitivity of the acceleration sensor to be used is set to the unit, the relationship between the output voltage and the measured acceleration is as follows.

$$\textbf{Measured acceleration}\ (m/s^2) = \textbf{Measured range}\ (m/s^2) \times \frac{\textbf{Measured voltage}\ (V)}{\textbf{Full scale voltage}\ (V)}$$

Here, the full-scale voltage value when measured with AC OUT is ±10 V, and the full-scale voltage value when measured with DC OUT is + 7.071 V. The input charge during this measurement is

Input charge (pC) = **Sensor sensitivity** ($pC/m/s^2$) × **Measured acceleration** (m/s^2)

Example: When using an acceleration sensor of 2.50 $pC/m/s^2$.

When the sensor sensitivity is set to "_2.50" $pC/m/s^2$ and the measurement range is set to "500" m/s^2, when the measured voltage at AC OUT is 5.000 V (pk), the measured acceleration is 250 m/s^2 (pk). The input charge at that time is 625 pC.

Table 4-6 Relationship between measured voltage and measured acceleration

Measured voltage Vpk	Full scale Vpk	Measured range m/s^2	Measurement acceleration m/s^2	Sensor sensibility $pC/m/s^2$	Input charge pC
5.000	10.000	500	250	2.50	625

4.3.2. Measurement of velocity and displacement

Example: When an acceleration sensor of 2.50 $pC/m/s^2$ is used.

(1) First, it is assumed that acceleration can be measured, so operate (push) the unit setting knob (8) and set UNIT (7) to m/s^2.
When Sensor sensitivity setting (13) is "_2.50" $pC/m/s^2$ and Range setting (10) is "5 x 100" m/s^2 with the above settings, if the output amplitude is 3.535 Vrms (DC OUT), acceleration = 250 m/s^2 (pk).

(2) Now, operate (push) the unit setting knob (8) to set UNIT (7) to cm/s.
In this state, the output corresponding to the speed (cm/s) is obtained corresponding to the acceleration m/s^2 of each range. In this case, the measurement range is "5 x 100" cm/s, and if the output amplitude is 353.5 mVrms (DC OUT), the velocity is 25 cm/s (pk).

(3) Similarly, operate (push) the unit setting knob (8) to set UNIT (7) to 0.1 mm.
In this state, an output corresponding to the displacement (0.1 mm) corresponding to the acceleration m/s^2 of each range is obtained. In this case, the measurement range is "5 x 100 x 0.1" mm. If the output amplitude is 35.35 mVrms (DC OUT), the displacement is 0.25 mm (pk).

4.3.3. Calibrating the amplifier

(1) When the calibration voltage application switch is used
The calibration voltage is output while the calibration voltage application switch is turned to the ON side. The calibration voltage in full scale (AC OUT: 10 Vpk, 20 Vp-p, DC OUT: 7.07 Vrms), 80 Hz sine wave, is output regardless of the range setting and sensor sensitivity setting, so it can be used to set the input range on the load side.

(2) When a remote input terminal is used
Calibration input can be added using the remote input terminal.

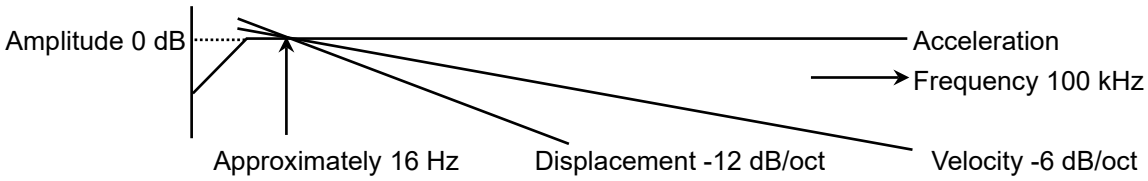
＊ When applying calibration values, set the LPF setting to 1 kHz or higher.

Cautions

(1) Dynamic range

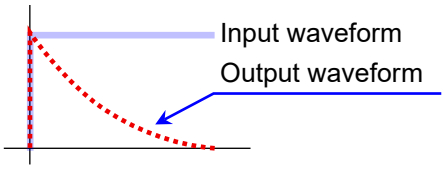
<u>Set the measurement range so that the output is below full scale when in acceleration mode.</u>

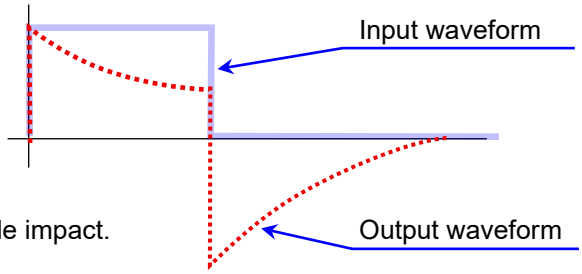
If waveform distortion occurs due to scale over in the acceleration signal, large errors will occur in the velocity and displacement. With this product, when the acceleration signal frequency is about 16 Hz, the amplitude is the same as the acceleration amplitude even if the acceleration, velocity, displacement and UNIT are switched. The output amplitude decreases at a rate of -6 dB/oct for the velocity amplitude and -12 dB/oct in relation to the displacement amplitude.



(2) Input waveform

Since the charge amplifier cuts off low frequency components, the DC component cannot be measured. Therefore, the response to the step input is as shown in the figure below, resulting in an error.





Therefore, care must be taken when measuring a single impact.

Reference

The relationships between velocity (V), displacement (D), and acceleration (A) are as follows.

$V = \int A\,dt, \quad D = \int V\,dt$

Since the charge amplifier cuts off the DC component, it is suitable for periodic vibration measurement. Here, when the maximum acceleration of periodic vibration is A_0 and the angular frequency of periodic vibration is W, they are expressed as follows.

Acceleration $A = A_0 \sin(wt)$

Velocity $V = \int A\,dt$, then $V = -\frac{A_0}{w} \cos(wt)$

Similarly, displacement $D = -\frac{A_0}{w^2} \sin(wt)$

5. Block Diagram

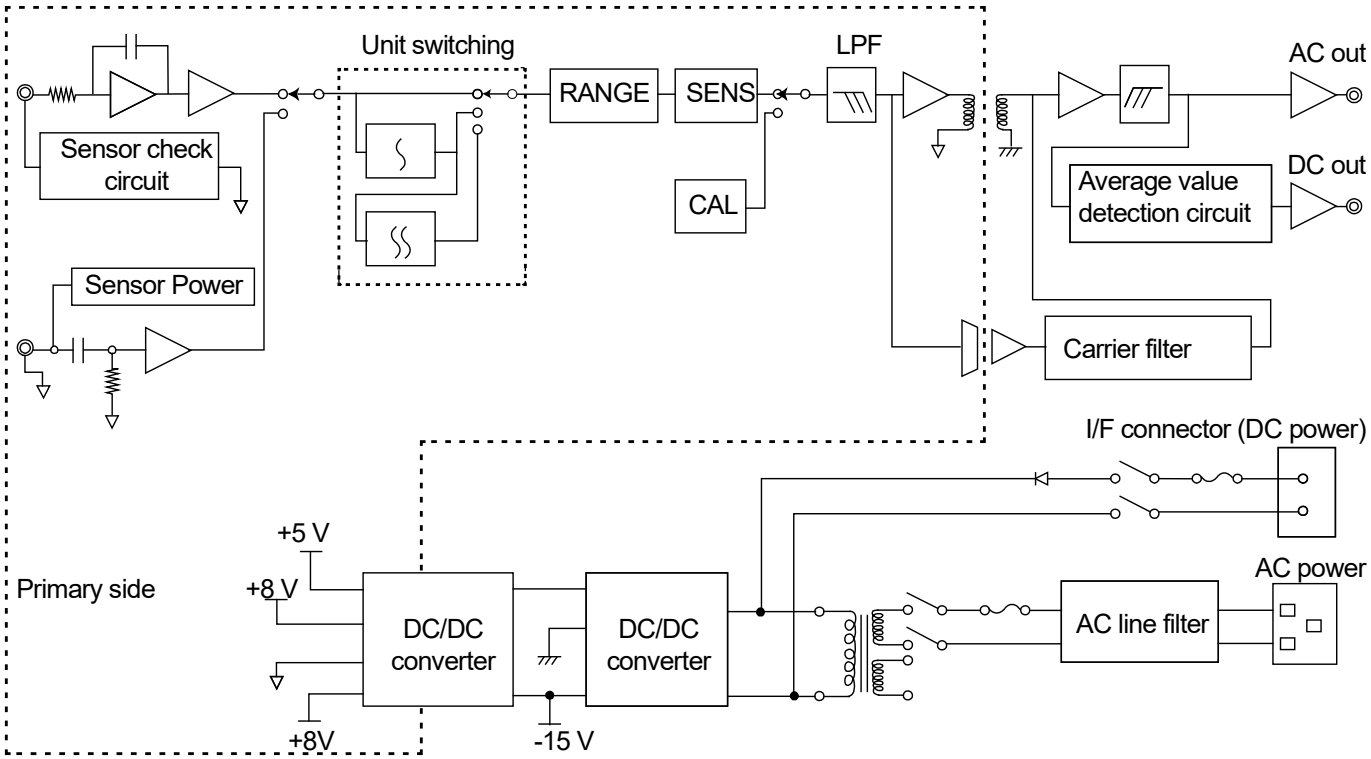


Fig. 5-1 Block diagram

5.1. Measurement signal flow

The sensor input can be switched with the slide switch on the rear panel.

The charge signal from the piezoelectric acceleration sensor is converted into a voltage by the charge input head amplifier (upper left in Fig. 5-1) and sent to the sensor input switching circuit. After that, it passes through the UNIT switching circuit (integration circuit) for acceleration, velocity, and displacement, and is amplified based on the RANGE setting and SENS setting. The low-pass filter removes unnecessary high frequency components, and the signal is sent to the isolation circuit (between input and output).

After isolation, the signal is output as AC OUT (ordinary waveform signal output) and DC OUT (AC OUT effective value (average value detection equivalent effective value) output) through a high-pass filter (removal of unnecessary components on the low frequency side). AC OUT is displayed on the 17-dot LED display, and DC OUT is displayed on the 7-segment 4-digit numerical display.

A constant current of 2 mA (maximum 24 V) for driving the sensor is supplied to the piezoelectric acceleration sensor input with a built-in amplifier, and it is sent to the aforementioned sensor input switching circuit as a voltage signal. Subsequent signal paths are the same as for piezoelectric accelerometers.

6. Maintenance

6.1. Confirmation Items

This product is shipped after strict checks, but abnormal operation may occur due to natural failure of parts, performance degradation caused by deterioration, failure, poor connection, etc.
If an abnormal operation occurs, you must identify the cause and take corrective action. If you think that sufficient performance cannot be obtained, check the following contents and also "4.1. Precautions before measurement".
If you still cannot find the cause or suspect that there is a malfunction, please contact your local dealer with as much details as possible about the situation, phenomenon, or location.

Table 6-1　Check items and countermeasures

Phenomenon	Countermeasure
The output fluctuates.	1. Connection of input cable（「3.1.1 Connecting the input cables」 2. Disconnection of input cable 3. Vibration of input cable If an ordinary coaxial cable is used, it may occur structural noise due to vibration, kinks, etc. To eliminate noise, use a cable treated for low noise. Structural noise (tripo-noise) means that occurs by changes in capacitance due to the change in the position of the shield cable.
No output.	1. Connection of output cable The load is heavier than the rating. Or, a short-circuit is present. 2. Disconnection of output cable Check the continuity with a tester.
Over display does not disappear.	1. Change the range switch and wait for a while. (Over-staggering longer than one minute is deemed to be an internal failure.)

6.2. Calibrating the amplifier

The calibration in "4.3.3. Calibrating the amplifier" does not include that for the input converter circuit.
The following measuring instruments and jigs are required for inspection purposes.

Jig parts (example)	Adapter: Microdot/BNC conversion adapter:	1 piece
	BNC seat 31-10	2 pieces
	100 pFstandard capacitor	1 piece
	Coaxial cable with BNC connector (as short as possible)	2 pieces
Measuring instruments (example)	Oscillator (0.1 Hz to 200 kHz)	1 unit
	AC voltmeter (3 digits or more)	1 unit

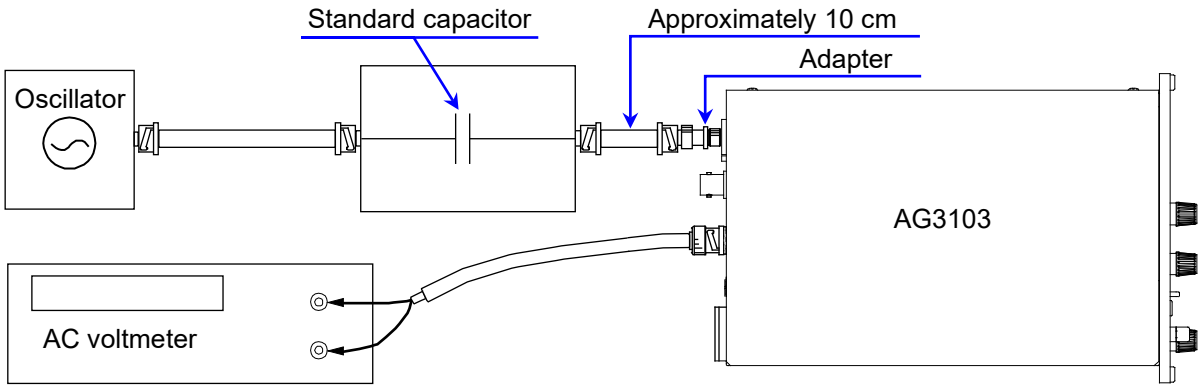


Fig. 6-1 Calibration method

With the setup shown in Fig. 6-1, an arbitrary charge can be applied to the input section of this unit.
When the capacitor capacity is C pF, the relationship between the charge Q pC and the output voltage E V of the transmitter is Q = C x E
For example, if you want to add 54 pC, C is 100 pF, so

$$E = \frac{54\ (pC)}{100\ (pF)} = 0.54\ (V)$$

If a sine wave of 0.54 V (pk) is added to the input, and the range setting (9) of this unit is 1 m/s^2 and sensitivity (13) is 54.0 pC/m /s^2, the output voltage is 7.07 V.

Note 1 *Since the AC voltmeter displays an effective value, set it to 7.07 V or less when the output of this unit is a sine wave.*

Note 2 *Since the accuracy of the capacitor is 1% and the accuracy of this unit is 1 %, the total accuracy is 2 % at worst.*

6.3. How to replace fuses

The procedure of replacing fuse is as follows.

1. Turn off the power switch. Disconnect all cables of power cord, input and output cables from the amplifier.
2. Place front side to left, bottom faces forward, and back side to right, as shown in Figure 6-2.
3. Use a flat-blade screwdriver and turn the fuses holder in the direction of the arrows marked on it. (Fig. 6-3, 90° counter-clockwise)

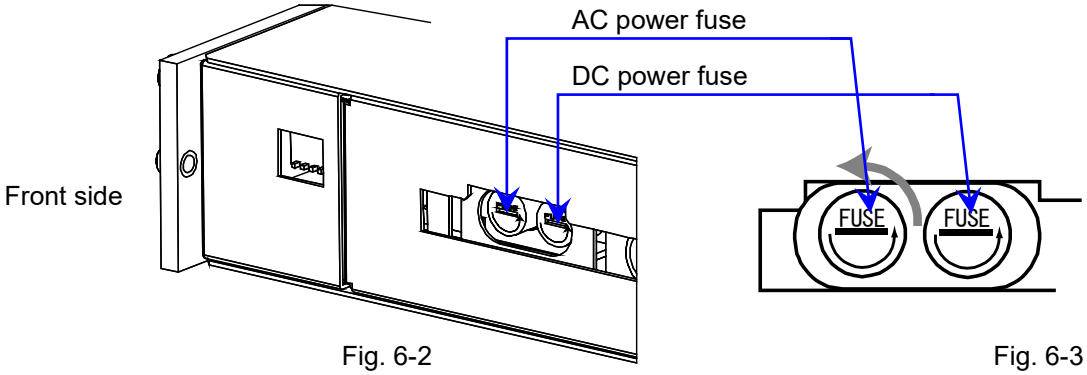


Fig. 6-2 Fig. 6-3

4. Replace the fuses at the ends of the fuse holders.
5. The fuse ratings are: 100 mA for AC power supply fuse and 500 mA time-lag fuse (slow blowing) for DC power supply fuse. When replacing, be careful not to mix up AC and DC.
6. When installing the fuse holder, use a flat-blade screwdriver. When pushing the fuse, keep the fuse holder slit (Fig. 6-4) vertical to the amplifier (Fig. 6-5, dotted line), and then press deeply and turn clockwise 90 degrees.

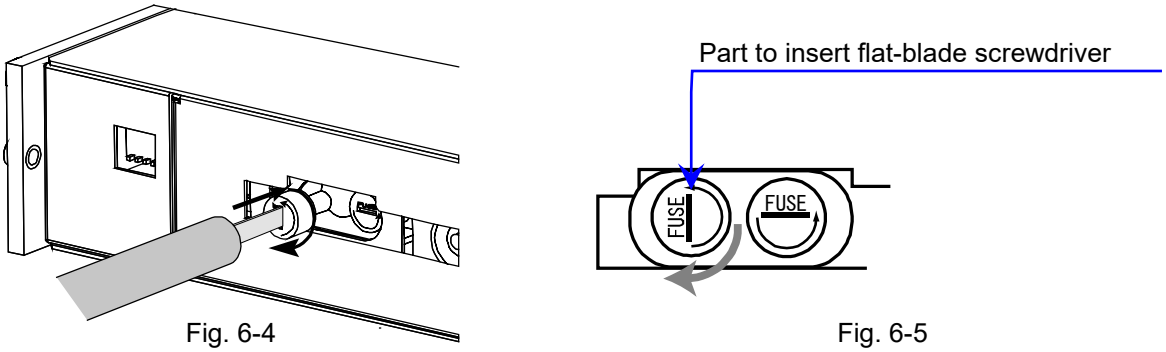


Fig. 6-4 Fig. 6-5

7. Confirm that the fuse holder is fully installed in the unit as shown in Fig. 6-2.
   Also, confirm that the fuse holder slit (flat-blade screwdriver contact portion) is parallel to the unit as shown in Fig. 6-3.
8. The fuse replacement is completed. Always investigate why the fuse blew.

⚠WARNING

Remove power cord, input and output cables from the amplifier surely.
Use rated fuses specified surely.

6.4. How to specify the power supply voltage

The procedure to select a voltage of the power supply is as follows.

1. Turn off the power switch. Disconnect all cables of power cord, input and output cables from the amplifier.

2. Remove the cover using two screws (M3) on the top side of the amplifier (Fig. 6-6).

3. Set the selection switch of AC power supply voltage.

   Amplifier of electric circuit board before 2017.
   The switch is located at the position of Figure 6-7. Selection to 200 VAC, OFF, and 100 VAC is available. Slide the switch to AC power supply voltage in use.

   Amplifier of electric circuit board after 2017.
   The switch is located at the position of Figure 6-8. Selection to 100 VAC, OFF, and 200 VAC is available. Slide the switch to AC power supply voltage in use.

4. Attach the amplifier cover so that the slit of the amplifier cover fits to the frame of the amplifier.

5. Fasten the screws on the top side of the amplifier.

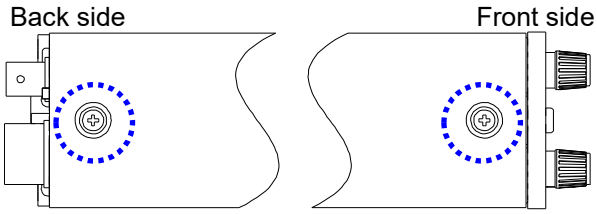


Fig. 6-6 Position of screws

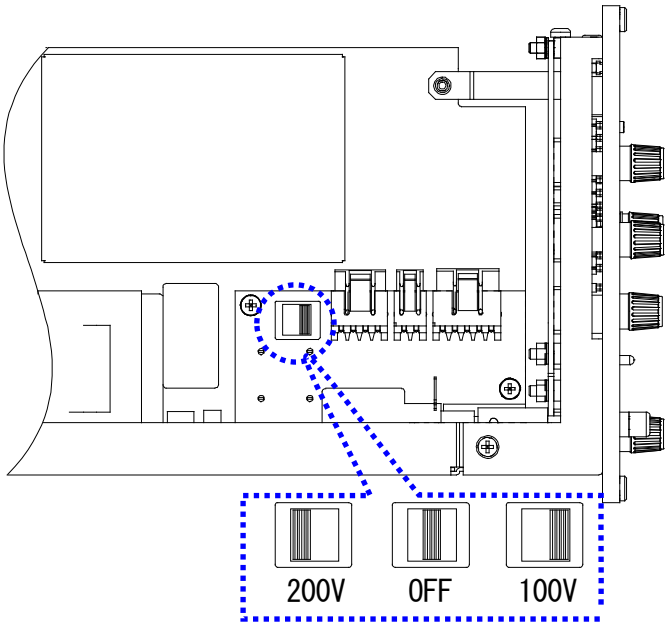


Fig. 6-7 Selection switch of AC power supply voltage
Electric circuit board before 2017.

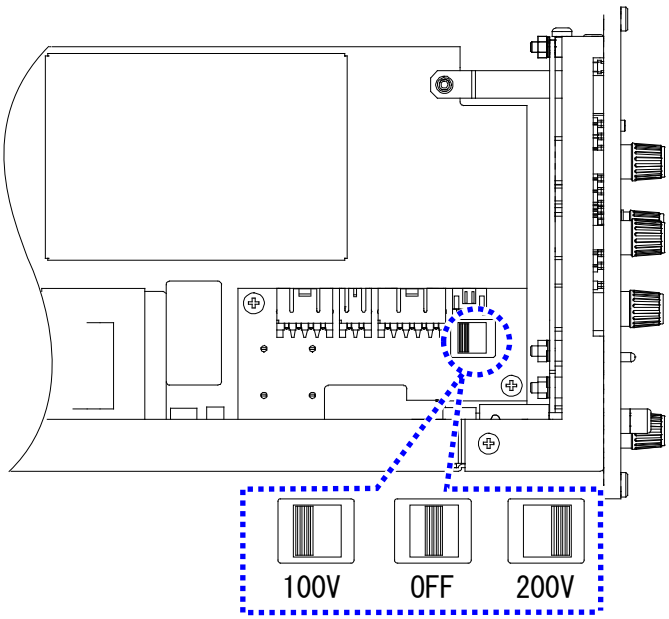


Fig. 6-8 Selection switch of AC power supply voltage
Electric circuit board after 2017.

Memo

Use the AC power cord of plug type adapting to your local region when selecting voltage of 180 to 264 VAC.

AC fuse can use both 200 VAC and 100 VAC.
The preinstalled fuse (100 VAC / 200 VAC, 100 mA: 0334-4306) can be used for both supply voltages.

⚠WARNING

Remove power cord, input and output cables from the amplifier surely.
After this selections, change voltage indication of the label on the amplifier cover surely.

6.5. How to switch special functions

The dip switches on the bottom side of the amplifier can switch for special functions.

- The selection of judgment level of sensor check.
- The switching of decimal point of the digital monitor (3).

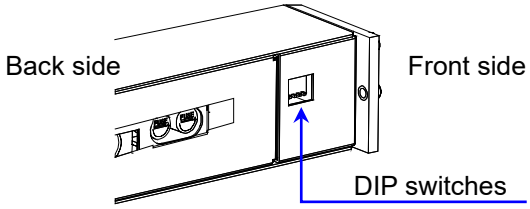
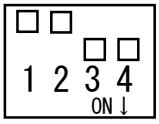
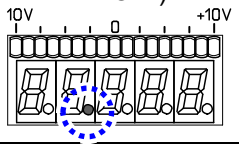
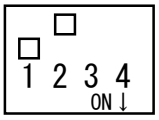
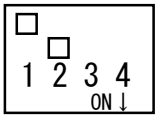
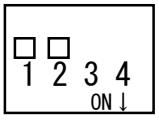
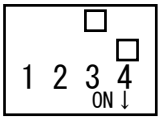
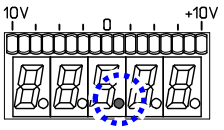
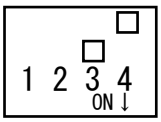
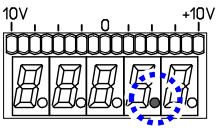
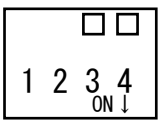
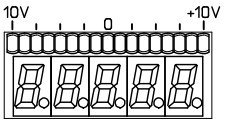


Fig. 6-9 Position of dip switches

Table 6-2 Functions of dip switches

DIP switch	Function	Description
	Standard settings (Factory settings)	No sensor check judgment (displays only measured capacitance value) Switches 1 and 2 both down: OFF Decimal point of digital monitor (3), displaying decimal point at the fourth place: 10.000 (Switches 3 and 4 are ON.) 
	Sensor check function judgment level setting (Switches 1 and 2 combination setting)	Set the sensor check function judgment level to 2 m input cable. (Switch 1 down: ON, Switch 2 up: OFF)
		Set the sensor check function judgment level to 5 m input cable. (Switch 1 up: OFF, Switch 2 down: ON)
		Set the sensor check function judgment level to 10 m input cable. (Switches 1 and 2 both down: ON)
	Decimal point display (Switches 3 and 4 combination setting)	Display the decimal point of digital monitor at the third place: 100.00 
		Display the decimal point of digital monitor at the second place: 1000.00 
		No decimal point displayed on digital monitor: 10000 

7. Specifications

Table 7-1 Specifications of AG3103

Item	Description
Number of channels	1 channel / unit
Piezoelectric acceleration transducer input	Input connector selector switch: Set to pC/m/s^2 Single input, Input impedance: 110 MΩ ±5 %
Sensor check function	When using a piezoelectric acceleration sensor, disconnection of the cable and sensor is checked by measurement of the capacitance value and displayed on the LED display.
Piezoelectric acceleration sensor with a built-in amplifier input	Input connector selector switch: Set to mV/m/s^2 Single input, Input impedance: Approximately 1 MΩ ±5% Sensor power supply: +2 mA (+24 V)
Measurement unit switching	Acceleration (m/s^2), Velocity (cm/s), Displacement (0.1 mm)
Pickup sensitivity	0.010 to 999 pC/m/s^2 (When a piezoelectric acceleration transducer is used) 0.010 to 999 mV/m/s^2 (When a piezoelectric acceleration sensor with a built-in amplifier is used)
Measurement range	Setting display with magnification: x1, x10, x100, x1,000, x10,000, Range values: 1, 2, 3.16, 5 (Without LED display and setting display of x1) 1 Input: pC/m/s^2 (Piezoelectric acceleration transducer input) Acceleration: Sensor sensibility 0.010 to 0.099 pC/m/s^2: 100 to 50,000 m/s^2 Sensor sensibility 0.100 to 0.999 pC/m/s^2: 10 to 50,000 m/s^2 Sensor sensibility 1.00 to 9.99 pC/m/s^2: 1 to 10,000 m/s^2 Sensor sensibility 10.0 to 99.9 pC/m/s^2: 1 to 1,000 m/s^2 Sensor sensibility 100 to 999 pC/m/s^2: 1 to 100 m/s^2 Velocity: Sensor sensibility 0.010 to 0.099 pC/m/s^2: 100 to 50,000 cm/s Sensor sensibility 0.100 to 0.999 pC/m/s^2: 10 to 50,000 cm/s Sensor sensibility 1.00 to 9.99 pC/m/s^2: 1 to 10,000 cm/s Sensor sensibility 10.0 to 99.9 pC/m/s^2: 1 to 1,000 cm/s Sensor sensibility 100 to 999 pC/m/s^2: 1 to 100 cm/s Displacement: Sensor sensibility 0.010 to 0.099 pC/m/s^2: 10 to 5,000 mm Sensor sensibility 0.100 to 0.999 pC/m/s^2: 1 to 5,000 mm Sensor sensibility 1.00 to 9.99 pC/m/s^2: 0.1 to 1,000 mm Sensor sensibility 10.0 to 99.9 pC/m/s^2: 0.1 to 100 mm Sensor sensibility 100 to 999 pC/m/s^2: 0.1 to 10 mm

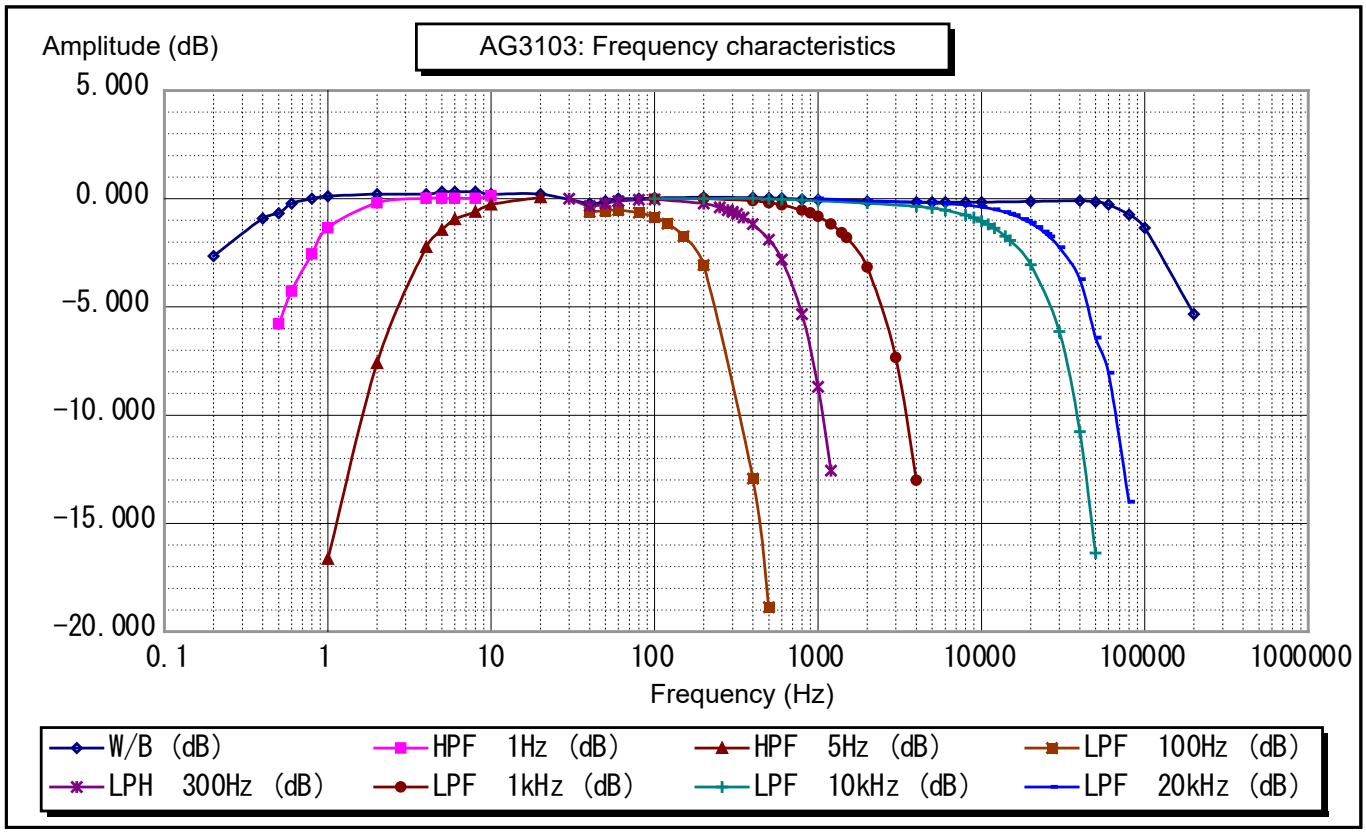
Item	Description
(Continued) Measurement range	2 mV/m/s^2 (Piezoelectric acceleration transducer with a built-in amplifier input) Acceleration: Sensor sensibility 0.010 to 0.099 mV/m/s^2: 5,000 to 50,000 m/s^2 Sensor sensibility 0.100 to 0.999 mV/m/s^2: 500 to 50,000 m/s^2 Sensor sensibility 1.00 to 9.99 mV/m/s^2: 50 to 5,000 m/s^2 Sensor sensibility 10.0 to 99.9 mV/m/s^2: 5 to 500 m/s^2 Sensor sensibility 100 to 999 mV/m/s^2: 1 to 50 m/s^2 Velocity: Sensor sensibility 0.010 to 0.099 mV/m/s^2: 5,000 to 50,000 cm/s Sensor sensibility 0.100 to 0.999 mV/m/s^2: 500 to 50,000 cm/s Sensor sensibility 1.00 to 9.99 mV/m/s^2: 50 to 5,000 cm/s Sensor sensibility 10.0 to 99.9 mV/m/s^2: 5 to 500 cm/s Sensor sensibility 100 to 999 mV/m/s^2: 1 to 50 cm/s Displacement: Sensor sensibility 0.010 to 0.099 mV/m/s^2: 500 to 5,000 mm Sensor sensibility 0.100 to 0.999 mV/m/s^2: 50 to 5,000 mm Sensor sensibility 1.00 to 9.99 mV/m/s^2: 5 to 500 mm Sensor sensibility 10.0 to 99.9 mV/m/s^2: 0.5 to 50 mm Sensor sensibility 100 to 999 mV/m/s^2: 0.1 to 5 mm
Gain accuracy	Acceleration (m/s^2): ±1 %(80 Hz) Velocity (cm/s): ±2 %(80 Hz) Displacement (0.1 mm): ±3 %(80 Hz)
Calibration voltage	At AC OUT 80 Hz, Sine wave: 10 V (pk) (20 Vp-p), Voltage accuracy: ±1%
Frequency characteristics (W/B)	0.2 Hz to 100 kHz +1 dB, -3 dB, 1 Hz to 20 kHz ±0.5 dB
Low-pass filter	100 Hz, 300 Hz, 1 kHz, 10 kHz, 20 kHz 4 pole vessel type (Descent characteristics -24 dB/oct)
High-pass filter	1 Hz, 5 Hz 2 pole vessel type (Descent characteristics -12 dB/oct)
Maximum input charge (Piezoelectric acceleration transducer input)	1.35×10^5 pC (Input charge: 10,000 to 100,000 pC) 1.35×10^4 pC (Input charge: 1,000 to 10,000 pC) 1.35×10^3 pC (Input charge: 1,000 pC or less)
Maximum input capacity (Piezoelectric acceleration transducer input)	1 µF (Input charge: 10,000 to 100,000 pC) 0.1 µF (Input charge: 1,000 to 10,000 pC) 0.01 µF (Input charge: 1,000 pC or less)
Noise level	1 When pC/m/s^2 (piezoelectric acceleration transducer) input, Input terminal: 1,000 pF connection, Measurement range 1.0 m/s^2, Within 0.05 pCp-p (RTI) at Pickup sensitivity 1.0 pC/m/s^2 2 When mV/m/s^2 (piezoelectric acceleration transducer) input, Input short circuit, Measurement range: 50m/s^2, Within 500 mVp-p (RTO) at Pickup sensitivity 1.0mV/m/s^2
Output	AC OUT ±10 V, ±5 mA DC OUT +7.07 V, +5 mA (Average value detection equivalent effective value output) Output impedance: 0.5 Ω or less, Capacitive load: Operable up to 0.1 µF
Output monitor display	17-dot LED display (AC OUT monitor), Green LED at center blinks when voltage is within approximately ±100 mV. LEDs at both ends blink when voltage is greater than approximately ±10.5 V.

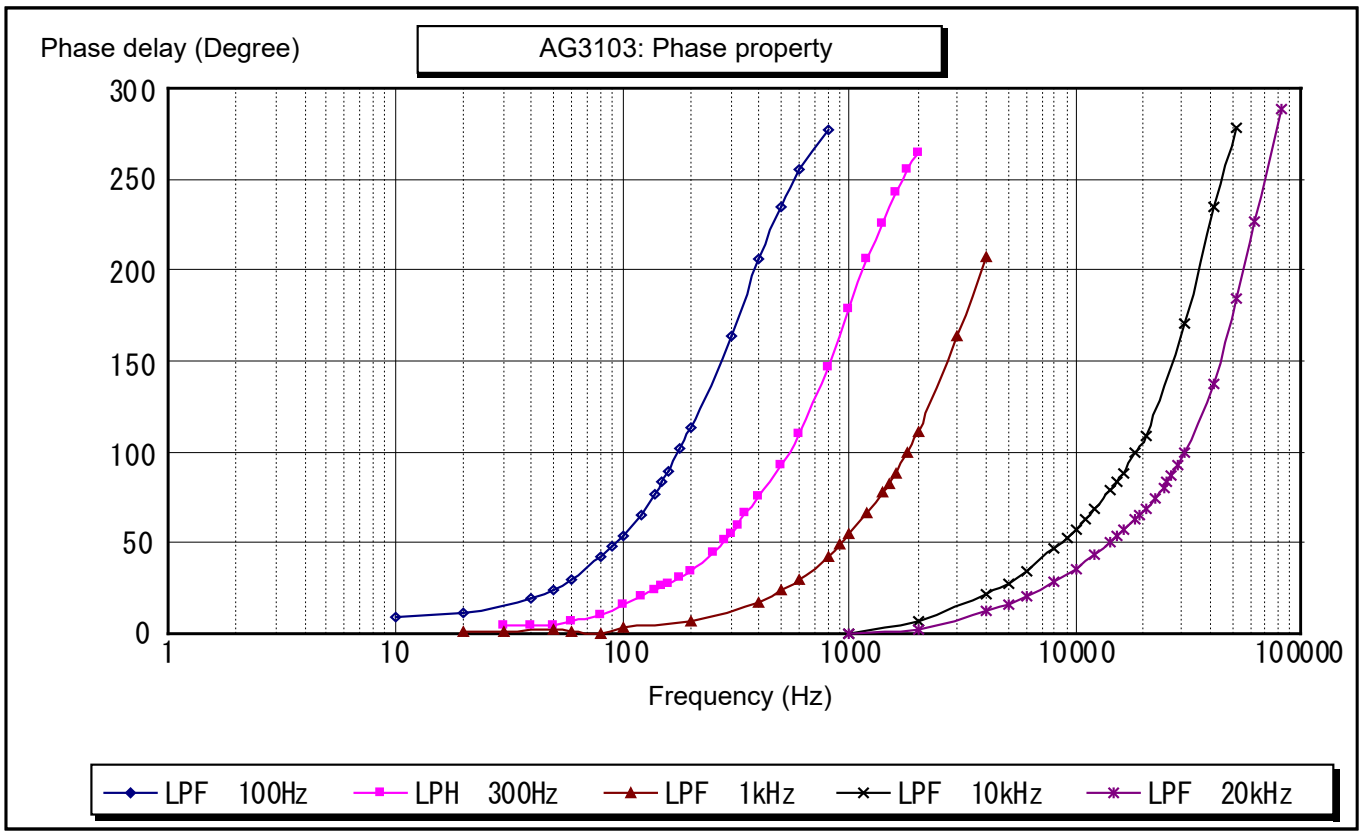
Item	Description
Digital display	4 1/2 digital display (DC OUT monitor), Accuracy: Within ±0.05% rdg ±1 count, Position of decimal point can be changed using DIP switches in the bottom.
Key lock function	The key lock function can alternate ON/OFF by pressing and holding the switch for one second. (Except CAL switch and input connector switch)
Setting value storage	Saving the parameters in flush memory. (Can be saved without back-up battery)
Vibration resistance	29.4 m/s^2 (50 Hz, X/Y/Z 10 minutes for each) and conforming to MIL-STD-810F 514.5C-1
Withstand voltage	Between each input terminal, output and housing case : 1 kVAC, for 1 minute Between AC power input and input, output and housing case : 1.5 k VAC, for 1 minute (AC power input: Includes serge resistor) Between DC power input and input : 1 kVAC, for 1 minute Between DC power input, output and housing case : 500 VAC, for 1 minute
AC power supply	85 to 132 VAC or 180 to 264 VAC (Internal switch to change), 7 VA or less
DC power supply	10 to 30 VDC, 5 VA or less
Range of operating temperature and humidity	Within -10 to 50 °C, 20% to 85 %RH (No condensation)
Range of storage temperature and humidity	Within -20 to +70 °C, 10 to 90 %RH (No condensation)
External dimension	H143 ± 1 × W49.5 ± 0.5 × D253 ± 2 mm ※ Excluding protrusions
Mass	Approximately 1.4 kg

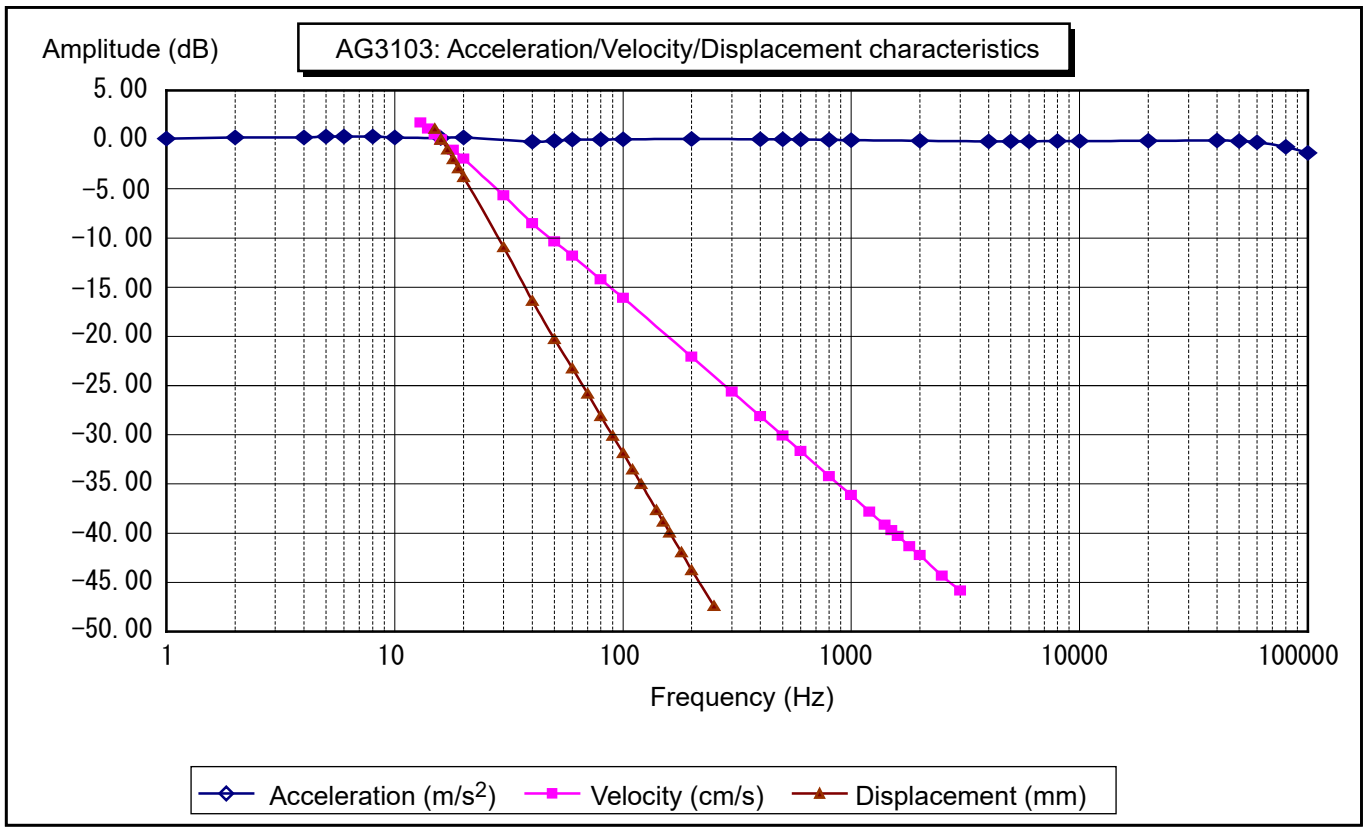
p-p : Peak to Peak.

8. References

8.1. Frequency characteristics and phase property

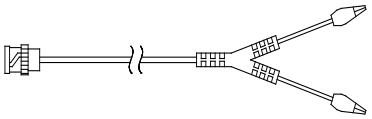
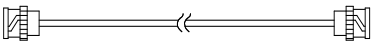
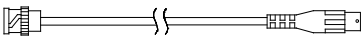
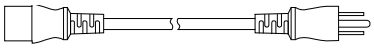
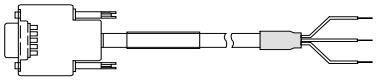
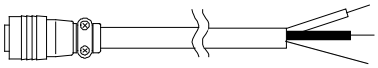
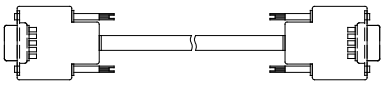
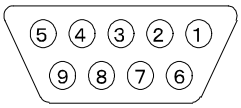





Amplitude (dB)
AG3103: Acceleration/Velocity/Displacement characteristics
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
1
10
100
1000
10000
100000
Frequency (Hz)
Acceleration (m/s2)
Velocity (cm/s)
Displacement (mm)

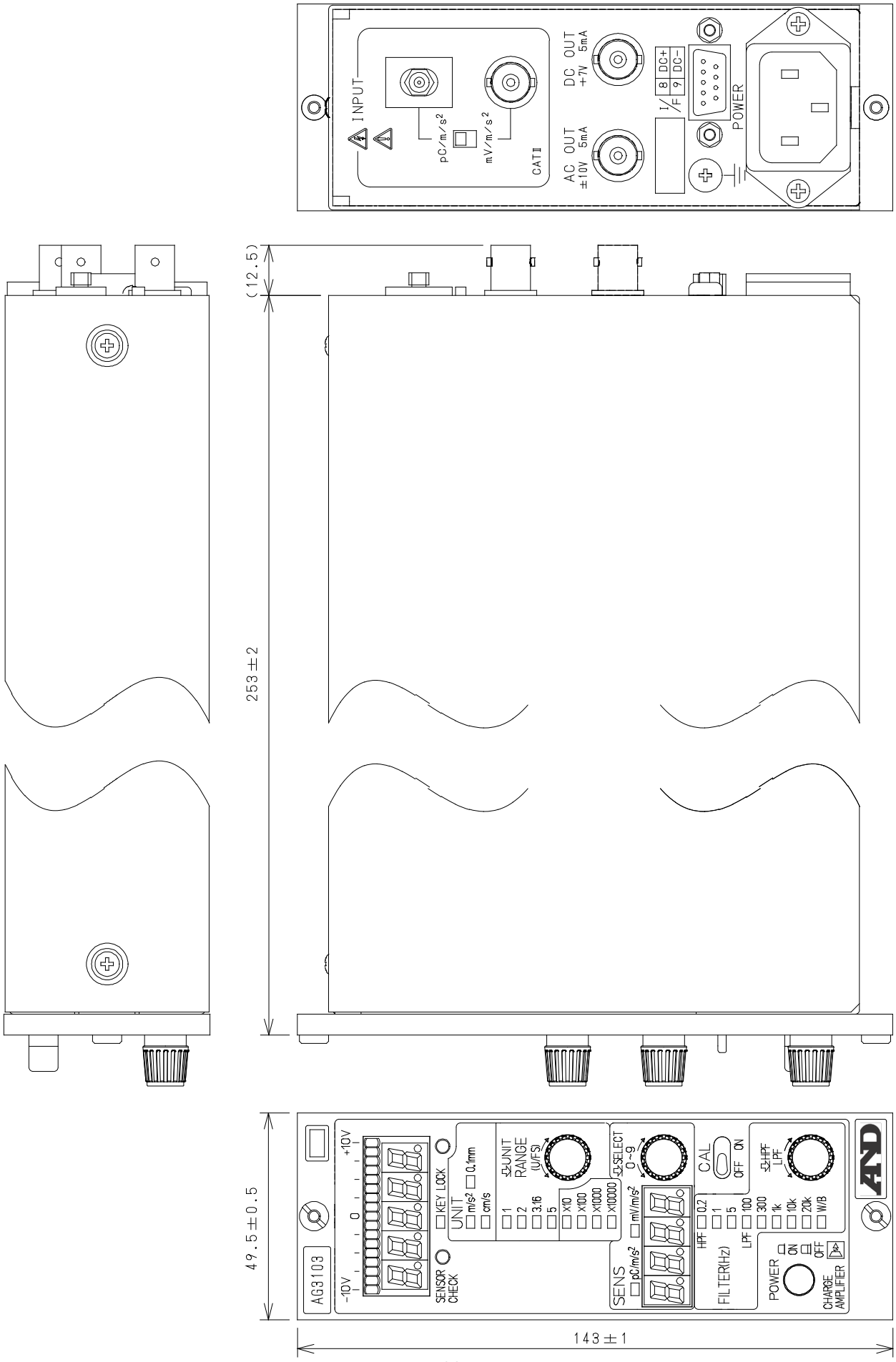
8.2. List of option cables

Table 8-1 Cable list

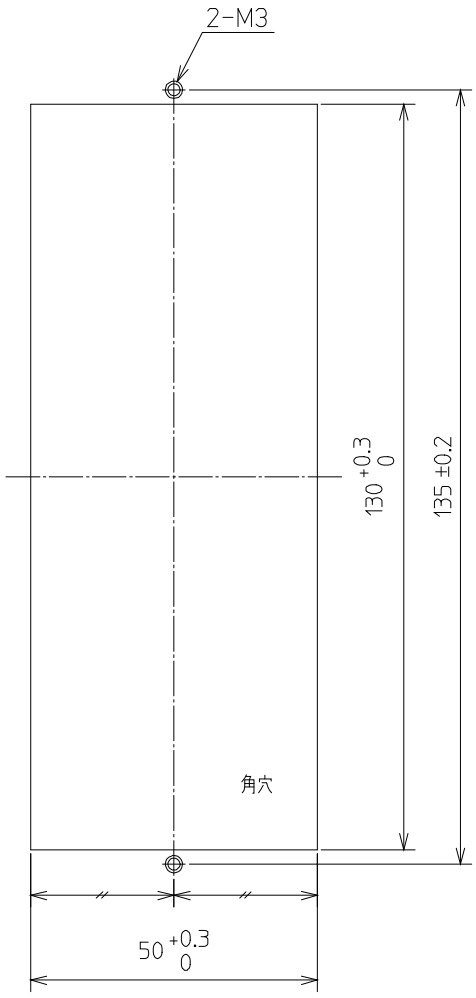
Name	Shape	Pin layout	Remarks
Output cable (Black mold) Type: AS30-503		Red : +Output (BNC core wire) Black : Common	Length: 2 m Metal BNC – alligator clip (+:Red, -:Black) For amplifier Standard accessory 1
Output cable Type: AS30-504		–	Length: 2 m Metal BNC – Metal BNC
Output cable Type: 0311-5200		–	Length: 2 m Insulated BNC – Metal BNC For RA,DL connection
AC power supply cable For amplifier and case Type: AX-KO6165-200		–	Length: 2 m For amplifier and case (AC 100V) Standard accessory 1
DC power supply cable Type AS30-507		Red : DC(+) Black : DC(-) Green : Shield	Length: 2 m D-sub 9pin male – Bare wire
DC power supply cable For case Type: AS30-508		Red : DC(+) Black : DC(-) Green : Shield	Length: 2.5 m External diameter of cable: ϕ10 Core wire: 1.25 mm^2
Synchronization cable for case Type: AS30-505	  (Rear side of the unit)	1: +CAL 2: -CAL 3: BAL 4: OSC 5: GND 6: KEYLOCK 7: GND 8: DC+ 9: DC-	Length: 1.8 m D-Sub 9pin male – D-Sub 9pin male Straight cable

8.3. External dimensions

8.3.1. Amplifier unit

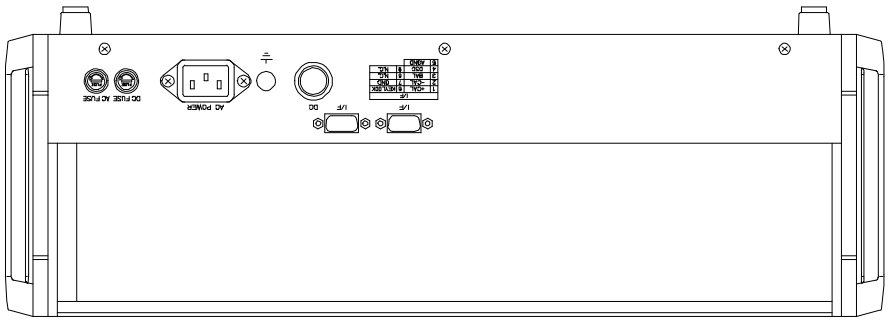


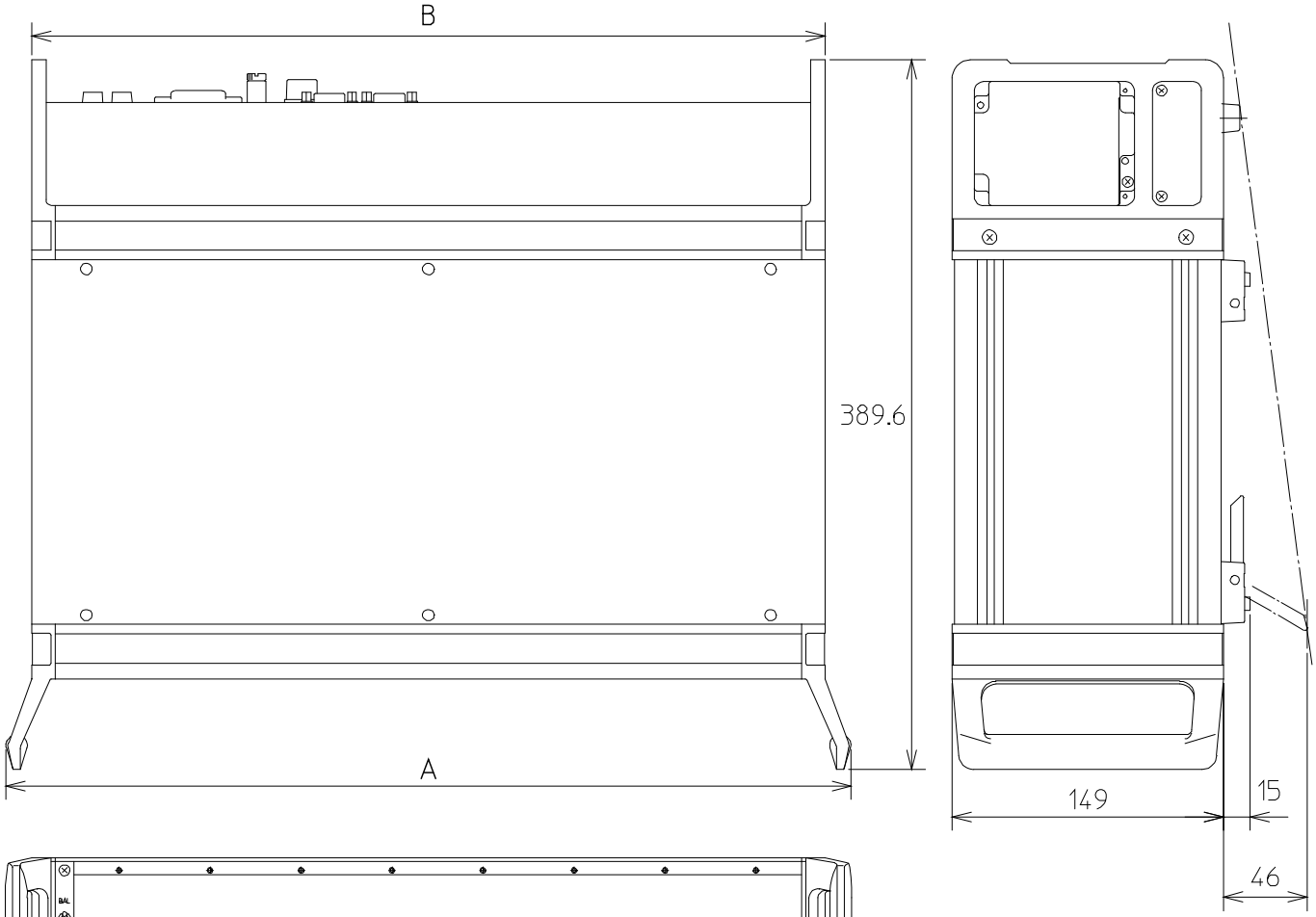
8.3.2. Panel cutout dimensions

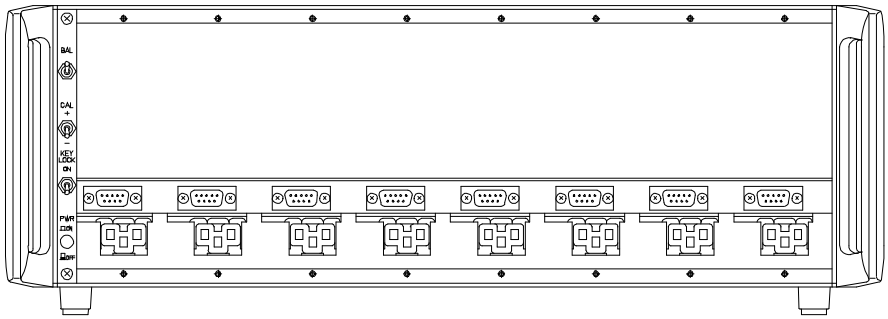


8.3.3. Bench top case

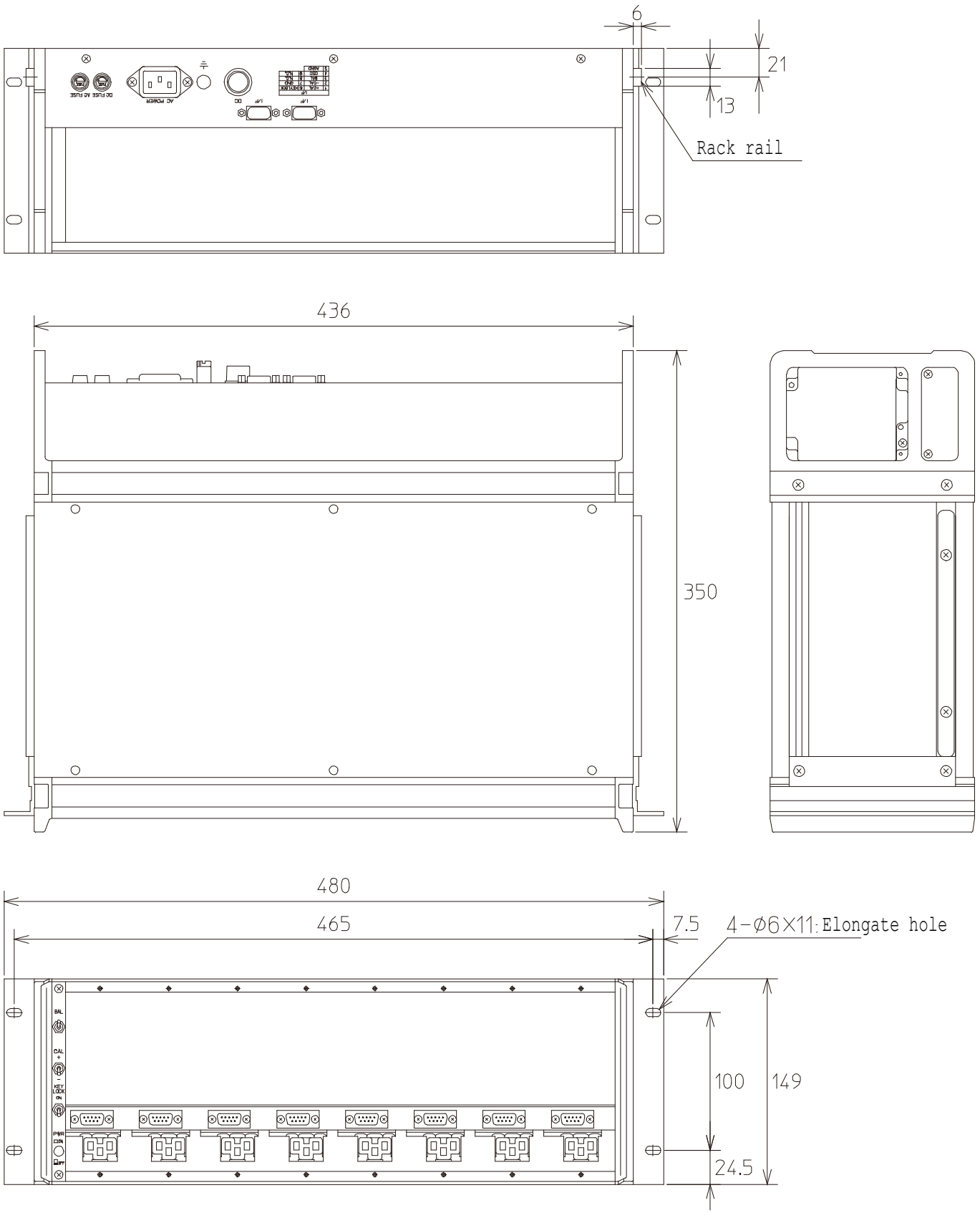
Name	Type	A	B
8CH benchtop case	AS16-106	462.6	436



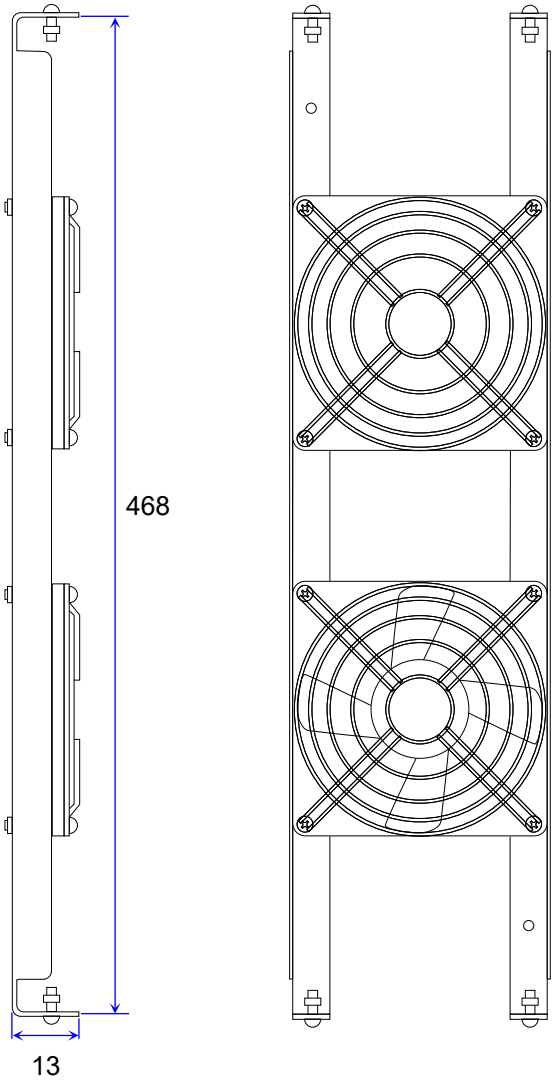


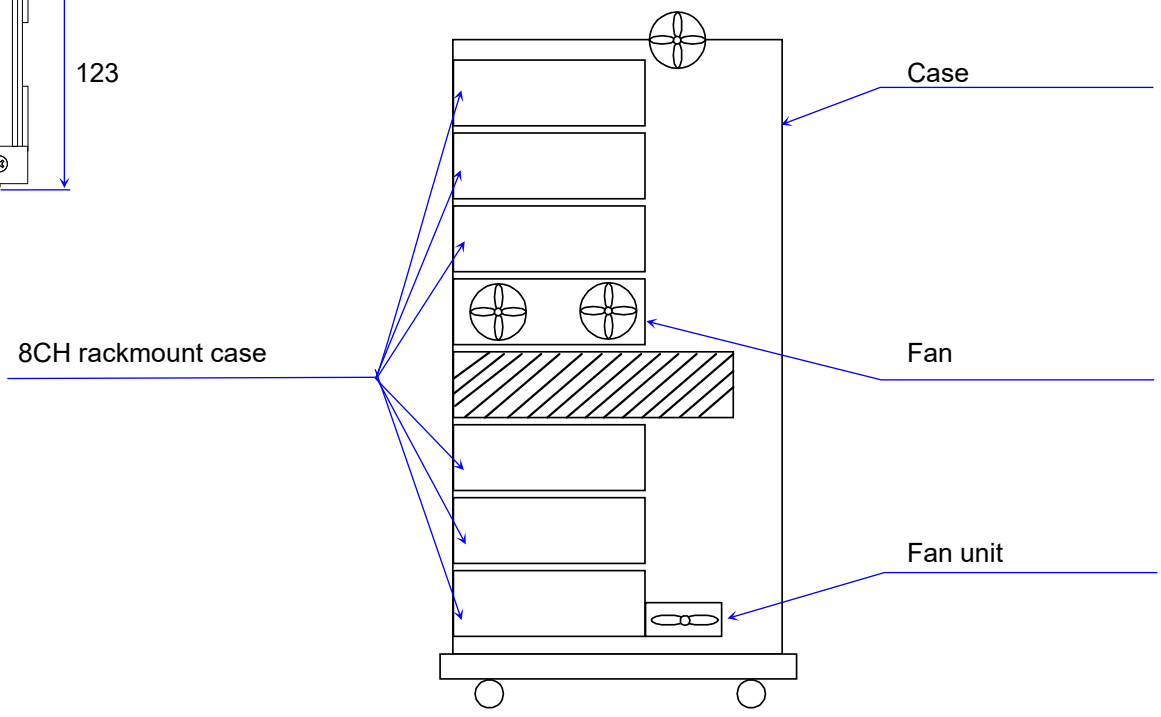


8.3.4. Rack mount case



8.3.5. Fan unit





To ensure prolonged use

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Thank you for purchasing an A&D Company, Limited. product.
To ensure prolonged use of the product that you have purchased, we offer the following lineup of maintenance services.

Warranty Period

The warranty period for this product is two years from the date of purchase.
In case of a failure, the product will be repaired free of charge (only if the failure is ascribable to the responsibility of A&D).

Maintenance service after warranty period

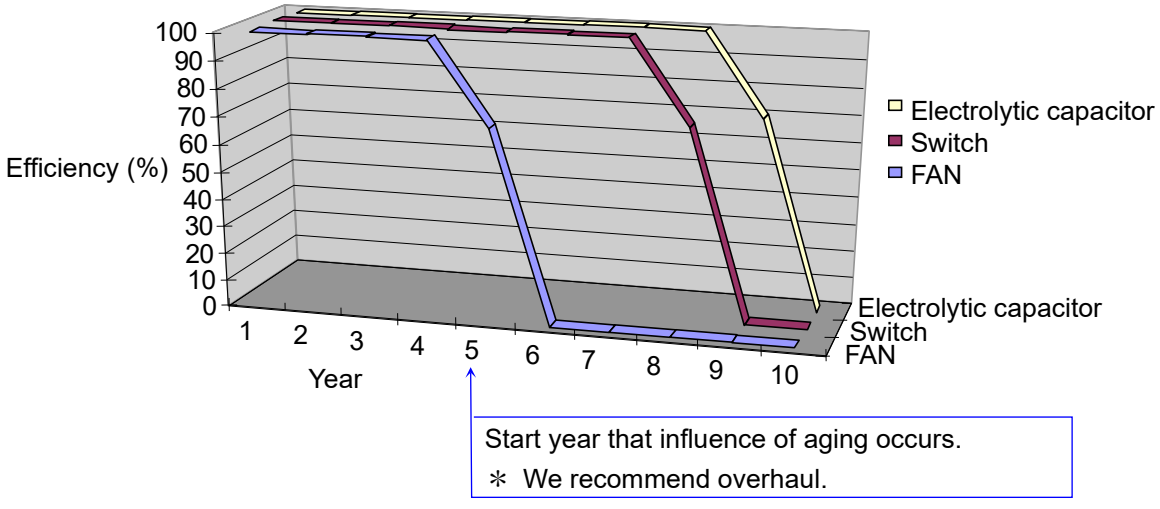
We accept the product repairing with charge after the warranty period.
Additionally, we accept overhaul of the product if you want.

Maintenance service

Our products use parts of electrolytic capacitor, variable resistance (volume), FAN, etc. that have lifetime. Lifetime of parts depends on operating environment and frequency of use, are different, we recommend periodic maintenance service for longer time use and for more efficient use. We recommend periodic checking and overhaul in perspective of repair and preventive maintenance so as to use the delivered product with safe and trust. We guess that principal users send periodically the product to testing laboratory and calibrate it so as to maintain accuracy management. But, foreign matter and dust etc. invade into the product, it may cause malfunction and accident. Therefore, we recommend periodic checking and overhaul.

Criterion of replacing parts that has life time

Condition of use: Use for 8 hours every day.



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Charge amplifier
AG3103

1WMPD4003956A

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