Instruction Manual

for

Proximity Exhaust Noise Measuring System (Wireless)

TYPE 8301A

ACO Co., Ltd.

Safety precautions

To prevent bodily injury or damage to property, the following safety precautions must be observed.

This manual contains important safety and operating instructions for this equipment.

Read all instructions, before using the instrument.

After reading all instructions, keep this manual for quick reference

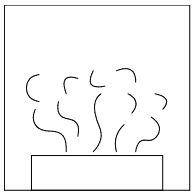
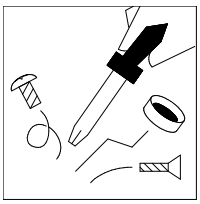
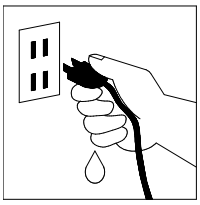
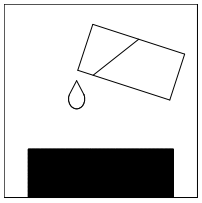
Expressions of safety instructions

WARNING
Calls attention to a procedure, practice, or condition that could possibly cause death or bodily injury.

CAUTION
Calls attention to a procedure, practice, or condition that could possibly cause bodily injury or damage to instrument.

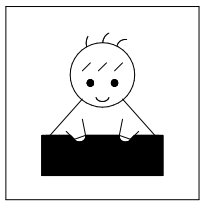
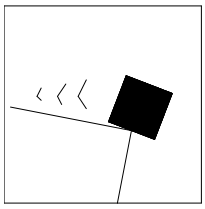
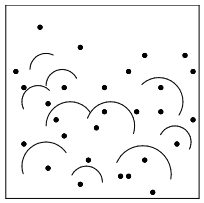
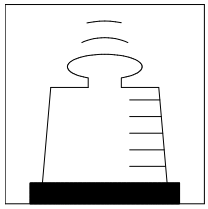
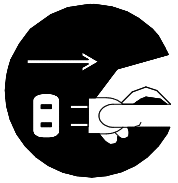
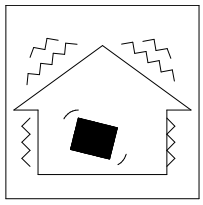
NOTE
It is an advisory explanation to use this equipment correctly. (It is not a safety instruction)

Important safety instructions

⚠ WARNING
Stop using the instrument, when producing smoke, bad smell or noise. It causes fire or shock hazard. Turn off the POWER switch from outlet as soon as possible. To reduce risk of injury, take it to a qualified serviceman when service or repair is required. Please contact ACO co. or the dealer when service or repair is required. 
Do not substitute parts or modify instrument. It causes bodily injury, fire or shock hazard. 
Do not touch the plug of AC adaptor with wet hands. It causes shock hazard. 
Stop using the instrument, when an object or liquid falls/spills into the instrument. It causes fire or shock hazard. Turn off the POWER switch from outlet as soon as possible. To reduce risk of injury, take it to a qualified serviceman when service or repair is required. Please contact ACO co. or the dealer when service or repair is required. 

Cautions for usage

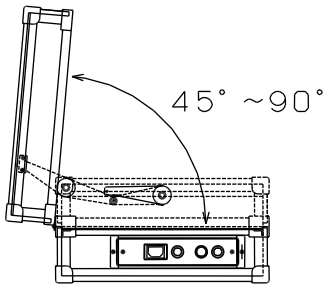
This equipment is assembled with precision parts. Placing it to a places such as exampled below may cause malfunction or failure, therefore care should be taken to avoid it.

⚠ CAUTION	
Keep the instrument away from the children. If the instrument falls down, it is very dangerous.	
Do not place it on an unstable place (shaky table or sloping place). If the instrument falls down, it is very dangerous.	
Do not expose the instrument to moisture or dust. It causes fire or shock hazard.	
Do not put heavy objects on the instrument. It causes damage to the instrument.	
Connect cable properly, it is instructed in this manual. Wrong connection causes fire hazard.	
Before you move the instrument to other place, turn off the POWER switch and remove all wiring.	
Do not put the instrument on the vibrating place. If the instrument falls down, it is very dangerous.	

4. Other cautions for usage

1) Charge of the battery inside of the Proximity Exhaust Noise Measuring System
   * Remaining battery level right after the delivery or after long storage will be very low. Charge the battery once a month for about 10 hours. (Battery is needed even when the AC power is used.)
   * Do not charge over 12 hours to prevent the battery life becomes shorter.
   * When the remaining battery level becomes low, normal operation such as printing by the printer cannot be made. In some cases, the main body will be re-set during the printing.
   * To charge the battery, turn the power switch to OFF and use AC power. Charging with the power switch ON will require long time for charging and full charge cannot be achieved.
2) Battery in the operation (wireless) part
   * Do not reverse the polarity of + and -.
   * Use the battery charger included with the system for charging of the battery. Charge 4 batteries at the same time and use them at the same time. Do not mix them with other rechargeable batteries or dry batteries. To make the battery last longer, charge it before it is used up.
   * The end of the battery life will be when the usable time becomes very short even after it is fully charged.
   * Remove the battery when the system is not used for a long time. Store the battery avoiding any metal objects come in contact with + and – terminals.
3) Do not use the system near any device that produces electrical noise. It may cause malfunction.
4) When the car battery (12 V) is used as a power source for the system, use the DC power cable included with the system and make connection by following procedure.
   ① Turn the power switch of the main body to OFF.
   ② Connect the black wire of the cable (earth) to the earth terminal of the battery.
   ③ Connect the red wire (12 V) of the cable to the 12 V power terminal of the battery.
   ④ Turn the power switch of the main body to ON.
5) Turn the power of the main body to OFF when connecting the microphone.
6) Do not touch the diaphragm surface of the microphone. Also attach the windscreen before use.
7) Be sure to hold the connector part for disconnecting the cables.
8) Place the cables so that excessive stress will not be applied to them.
9) For tachometer sensor, 3 types of sensors (AVL sensor, pulse sensor IP-292, IP-296) are included. Recent automobiles produces emits very little engine revolution noise to the outside of the vehicle, making it harder to detect it even with the tachometer sensor. Select most suitable sensor for reliable detection of the revolution speed.
10) When AVL sensor is used and if there is no metal parts near the engine, attach a metal clamp (screw type) etc. and then attach the AVL sensor to the clamp. (Clamp shall be prepared by user)
11) When pulse sensor is used, make sure that the cores are contacting closely with each other.

12) For outdoor usage, place the case if front of the sunlight and adjust the position of the lid of the case by opening or closing between 45 degrees and 90 degrees to avoid direct sunlight.



13) For storage, avoid hot and humid place and store the system so that the rubber foots of the main body are touching the ground / shelf (vertical / horizontal).
14) There will be version update for the software of the Proximity Exhaust Noise Measurement System for improvements of measurement accuracy.
15) Be sure that the operation part (wireless) is installed to the main body before turning ON the power.
16) Since the data acquisition time are different, indications of the sound level by sound level meter and LCD display of the operation part (wireless) may not coincides each other.

Contents

INSTRUCTION MANUAL

1. General

This document describes the instructions for operating Proximity Exhaust Noise Measurement System (wireless type).

This is the system for measurement of automobile exhaust noise using the proximity exhaust noise measurement method in accordance with the safety standards for road transport vehicles (final revision : August 31, 2001, Ministry of Land, Infrastructure, Transport and Tourism ordinance No. 122)

For detecting engine revolution speed, AVL sensor, which detects revolution speed by sound vibration, and non-contact type pulse sensor IP-292 or IP-296 are used.

Sound volume meter SV-6224 is used as the sound data input device and microphone can be easily placed using dedicated microphone stand.

Measurement of the proximity exhaust noise is made by measuring the sound level at a position rear outside, 45 degrees and 0.5 m from the exhaust pipe, while after keeping the rotation speed (measurement rotation speed) obtained from the engine rotation speed specified for each vehicle to be measured for more than several seconds and release the accelerator until it returns to idling speed, and then obtain the maximum value of the sound level.

Background noise and measurement results are printed by the printer.

2. Features

Engines of the vehicles subject for measurement are following 3 types.

AVL sensor is a dedicated vibration / acoustic type sensor that takes the data from pulse output from the preamplifier.

Pulse sensor utilizes electromagnetic induction method, and IP-292 is to be used by inserting to the low-voltage primary side and IP-296 to be used by inserting to the high-voltage secondary side cable.

* Gasoline engine 2 cycle - motorbikes, etc.
* Gasoline engine 4 cycle - General passenger cars, etc.
* Diesel engine - Passenger cars, freight cars, etc.

3. Components

1) Proximity Exhaust Noise Measurement System

(wireless type) main body	Type 8301A	1 ea

2) Accessories

* Microphone	Type 7146N	1 ea
* Windscreen	NA-0301	2 ea
* Microphone extension cable 10 m		1 ea
* Microphone stand		1 ea
* Arrow mark		1 ea
* Tachometer sensor (sound vibration type, made by AVL)	DiTEST Speed 2000	1 ea
* Tachometer sensor (non-contact type)	IP-292	1 ea
* Tachometer sensor (non-contact type)	IP-296	1 ea
* Tachometer monitor		1 ea
* Tachometer monitor cable 10 m		1 ea
* Printer paper (for UTP-58E) (1 roll included)		3 rolls
* AC power cable 2.0 m		1 ea
* DC power cable 3.5 m		1 ea
* Rechargeable battery for operation part		4 ea
* Battery charger		1 ea
* Stand		1 ea
* Arrow mark case		1 ea
* Microphone carrying case		1 ea
* Microphone stand carrying case		1 ea
* Accessories case		1 ea
* Instruction manuals		
Proximity Exhaust Noise Measurement System (wireless type)	Type 8301A	2 ea
Operation guide for Proximity Exhaust Noise Measurement System (wireless type)	Type 8301A	2 ea
Sound volume meter SV-6224		2 ea
Operation guide for SV-6224		2 ea

4. Warranty

Warranty term is 12 months after the shipment.

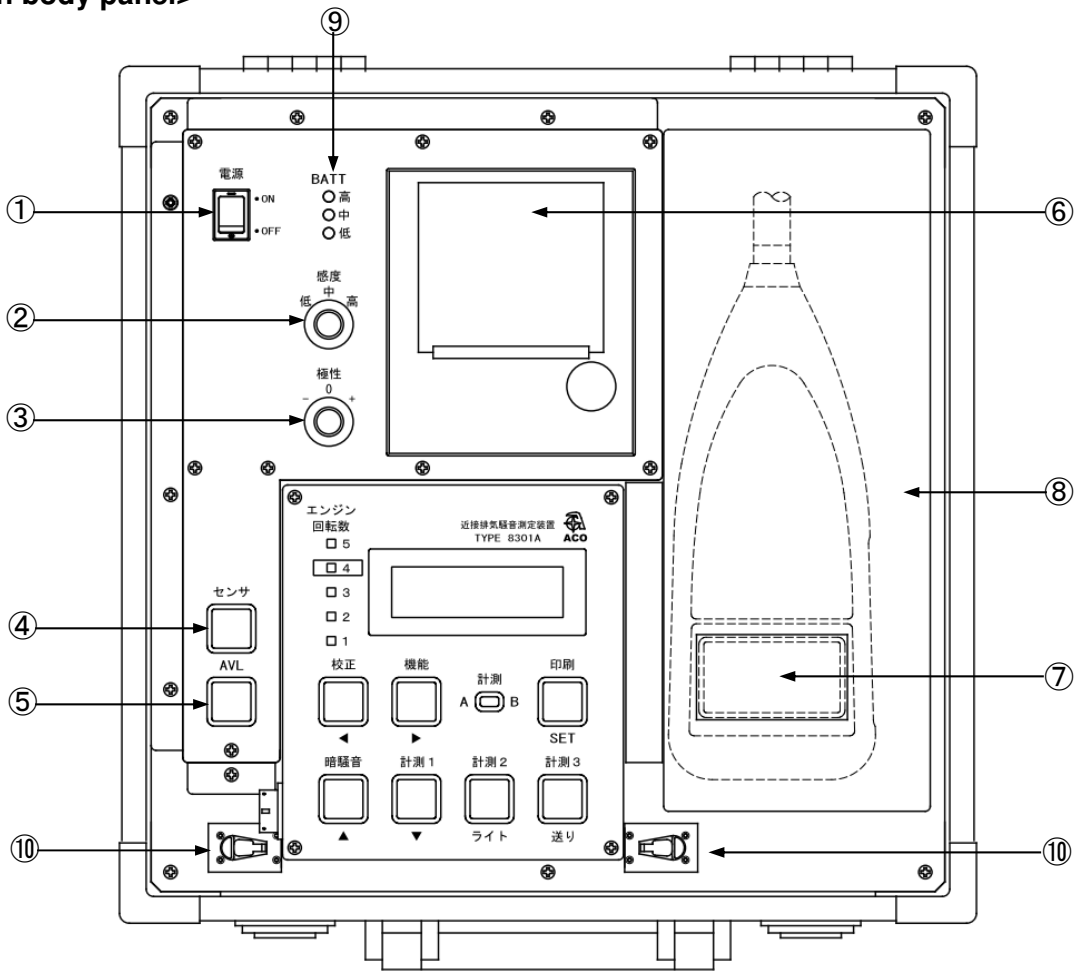
Failures occurring during above warranty term under normal usage without any mishandling, misuse or negligence by user will be repaired with free of charge.

Repair of failures caused by other reasons are not covered by the warranty and will be made with charge even if the product is in the warranty term.

5. Names of each part and functions

5-1 Proximity Exhaust Noise Measurement System main body

<Main body panel>



① Power ON/OFF : Power switch

② Sensitivity

High / Medium / Low : For adjusting the input level of the pulse sensor

③ Polarity - / 0 / + : For adjusting the polarity of the pulse sensor
"+" is for adjustment in positive direction, "-" is for reverse direction, "0" is for not adjusting the polarity.
(This is used for the change of polarity of the input pulse depending on the engine type.)

④ Sensor : The lamp blinks at a certain constant pace when the rotation pulse input from the sensor is regular and the buzzer synchronizes at the same time. The lamp will be turned off when there is input of irregular pulse. (Display only and there will be no switch function.)

⑤ AVL : AVL ON / OFF switch. Switching ON / OFF at each pressing. The lamp will be lit at ON and the AVL starts functioning. Turn OFF when using the pulse sensor.

⑥ Printer : Printer for printing the measurement results.

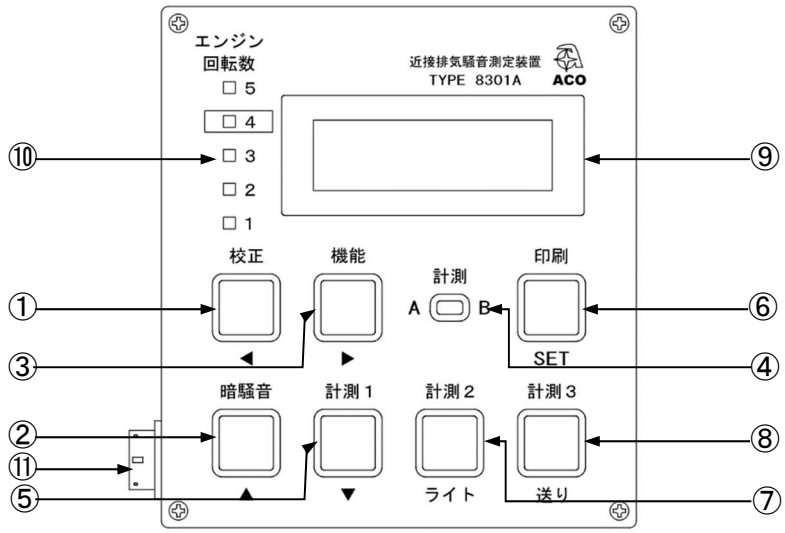
⑦ Sound volume meter
LCD : LCD for displaying the sound level

⑧ Sound volume meter
cover : Cover for the sound volume meter. Install by sliding it.

⑨ Battery level indicator : Displays the remaining level of the battery of the main body. Charge as soon as possible when it is “medium”. When it is at “low”, charge the battery before using the system.

⑩ Latch : Latch for locking the operation (wireless) part. Release the latch (raise the lever) and remove the operation part (wireless). Lock the latch (lower the lever) during transportation or storage.

<Operation part (wireless)>



① Calibration / ◀ : Switch for calibration. Perform calibration of sound volume meter (SV-6224) and revolution input circuit.

② Background noise / ▲ : Switch for background noise measurement. Background noise (noise before engine start) is measured.

③ Function / ▶ : Switch for selection of functions to enter the setting mode. Move the cursor using ◀▶ ▼▲.

④ Measurement A / B : Switch to change the measurement method.

⑤ Measurement 1 / ▼ : Switch for the 1st exhaust noise measurement.

⑥ Print / SET : Switch for printing. In the case of measurement method A, lamp will be lit after completion of the 2nd measurement and printing will be started. In the case of measurement method B, lamp will be lit after completion of the 3rd measurement and printing will be started.
Reprint of the same data is possible by pressing the switch.

⑦ Measurement 2 / Light : Switch for 2nd exhaust noise measurement.
Light (backlight of the LCD) will be lit when this switch is pressed.

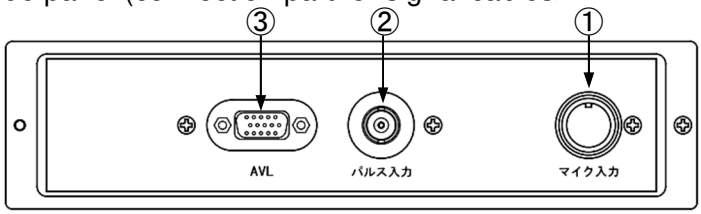
⑧ Measurement 3 / Feed : Switch for 3rd exhaust noise measurement.
It will feed the printer paper when the “Function” switch is pressed.

⑨ LCD display : LCD for displaying various functions and measurements.

⑩ Engine revolution speed : When the accelerator is depressed, the status of transition to inspection revolution speed will be displayed.
When lamp 4 (red) is lit, it is the inspection (setting) revolution speed.

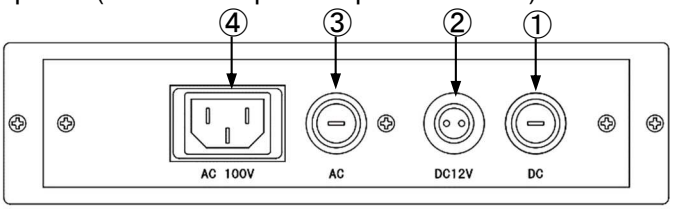
⑪ Tachometer monitor : Connector for connecting to external tachometer monitor.

<Right side panel (connection part for signal cables>



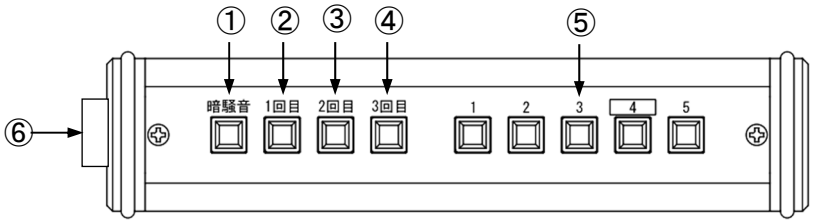
① Microphone input : Connector for microphone extension cable.
② Pulse input : Connector for the pulse sensor IP-292 or IP-296.
③ AVL : Connector for AVL sensor.

<Left side panel (connection part for power cables)>



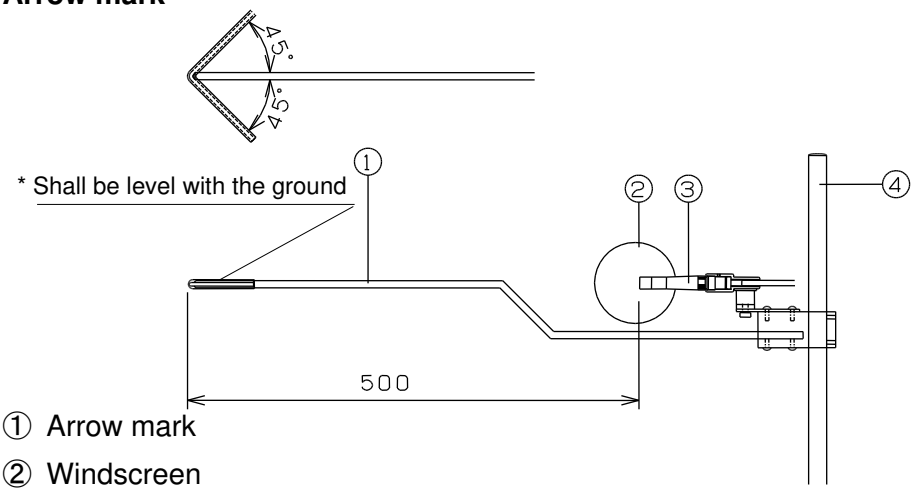
① DC : Fuse (3 A) for DC power source.
② DC 12 V : Connector for DC 12 V power input.
③ AC : Fuse (0.5 A) for AC power source.
④ AC 100 V : Connector for AC power input.

5-2Tachometer monitor



① Background noise : Lamp will be lit while the background noise is being measured.
② 1st : Lamp will be lit while the 1st measurement of the background noise.
③ 2nd : Lamp will be lit while the 2nd measurement of the background noise.
④ 3rd : Lamp will be lit while the 3rd measurement of the background noise.
⑤ 1 / 2 / 3 / 4 / 5 : Revolution speed (Displays engine revolution condition)
⑥ Signal input : Connector for signal input. Connect to the external tachometer monitor connector of the operation part (wireless) using the tachometer monitor cable.

5-3 Arrow mark



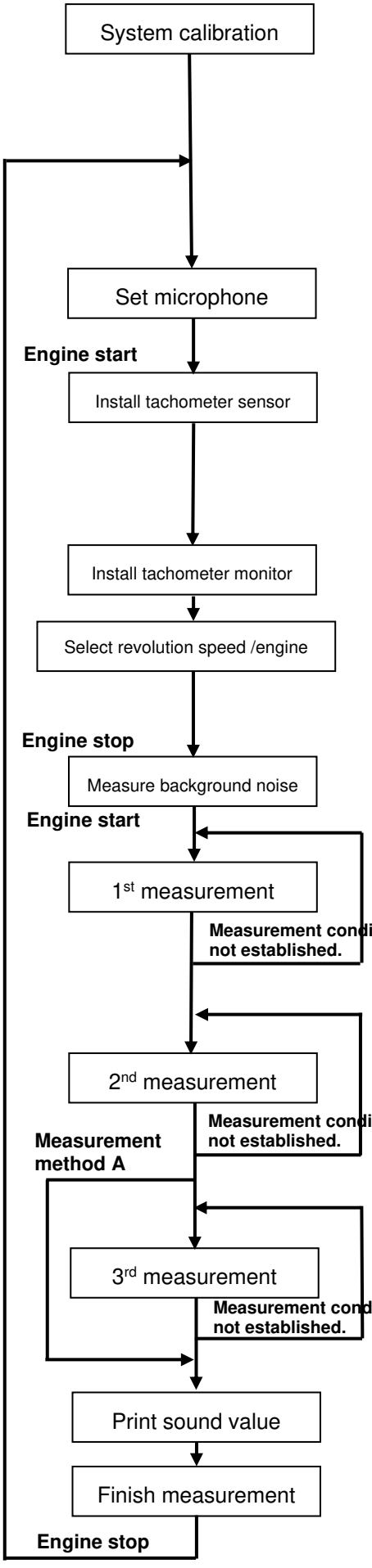
① Arrow mark
② Windscreen
③ Microphone
④ Microphone stand

CAUTION

Be sure to attach the wind screen to the microphone.

6. Preparation for measurement

6-1 Measurement flow



Measurement is automatically performed with the following operations / displays.

① Turn ON the power switch. "Function" LED will be lit and then turned off after 3 seconds.
② Press calibration switch.
③ Confirm the noise level monitor is 94 dB.
If not, remove the cover of the sound volume meter and refer to page 14 of the instruction manual for the sound volume meter.
④ Confirm that the revolution speed monitor is 2000 rpm.
If not, refer to page 22.
⑤ By pressing print switch, calibration result will be printed with the date and time.

① Using the gauge of the microphone stand, adjust the position at 50 cm from the exhaust pipe opening and 45 degrees outside of exhaust gas flow direction.

① When using the AVL sensor, press "AVL" switch (LED will be lit.)
Attach the AVL sensor at a suitable position. (AVL sensor can be used for diesel engine as well.)
② When using the pulse sensor, insert it into the high voltage cable for the spark plug.

① Set the external monitor where it is easy to see from the driver
(Setting not necessary when not used.)

① Adjust the revolution speed by revolution speed setting (select by the function switch).
② Select engine type (select by the function switch.)
2 cycle, 4 cycle, diesel, etc.

① Press "Background noise" switch (LED will blink.).
② After 10 seconds, background noise will be measured and automatically go to 1st measurement mode.

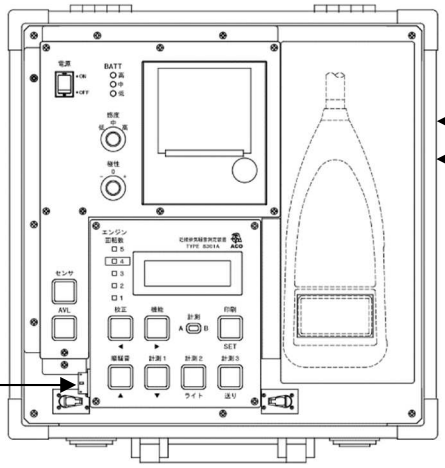
① 1st "Measurement 1" LED will be lit. (Will be lit when the 1str measurement is standby.)
② Increase gradually the engine revolution speed by the accelerator and LED "4" of the tachometer monitor will be lit.
③ "Measurement 1" LED will blink when the measurement condition is not established. → Release the accelerator
④ Go to 2nd measurement mode.

① 2nd "Measurement 2" LED will be lit. Hereafter same as the 1st measurement.
② In the case of measurement method A, sound value will be automatically printed.
In the case of measurement method B, go to 3rd measurement mode.

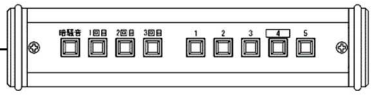
① In the case of measurement method B, 3rd "Measurement 3" LED will be lit. Hereafter same as the 1st measurement.

① Hereafter same as the 1st measurement.

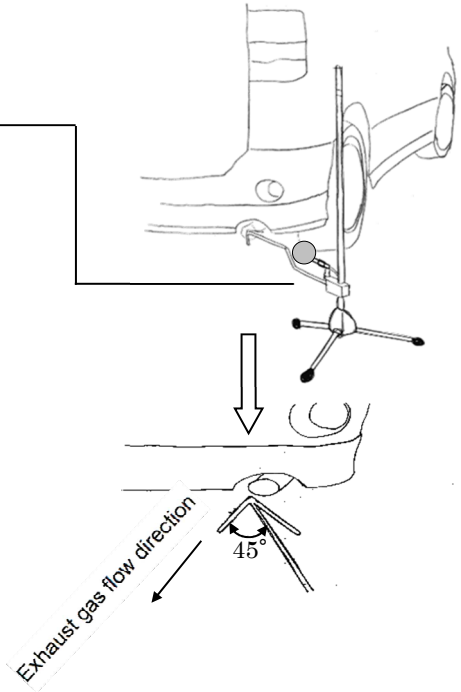
<Connection (Installation)>



Proximity exhaust noise measurement system main body

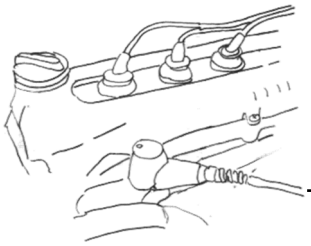


Tachometer monitor to be used for controlling the accelerator.

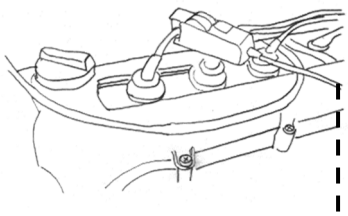


Using the gauge of the microphone stand, adjust the positon to 50 cm from the exhaust pipe opening and 45 degrees outside of exhaust gas flow direction.

When AVL is connected



When pulse sensor is connected



* Set the magnet of the sensor to the metal part for detecting the engine vibration.
* When normal revolution signal is detected while idling, LED on the upper part will change the color from red to yellow. Increase the revolution speed until the color changes to green.

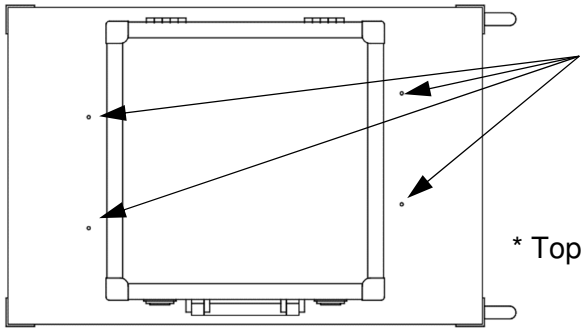
* Depending on the cable to be inserted or the vehicle type, select sensor direction, type, sensitivity and polarity, and select engine type by the main body.
* If the detection is difficult due to the fully covered engine room or direct ignition, use AVL sensor.

6-2 Connection of the system（installation）

<Installation to the stand>

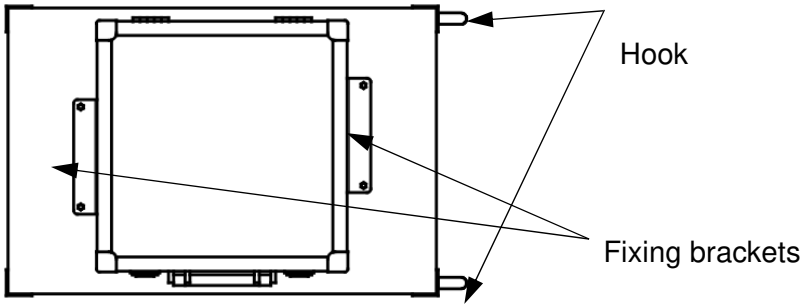
Main body of the Proximity Exhaust Noise Measurement System shall be installed to the stand using 2 ea of fixing brackets.

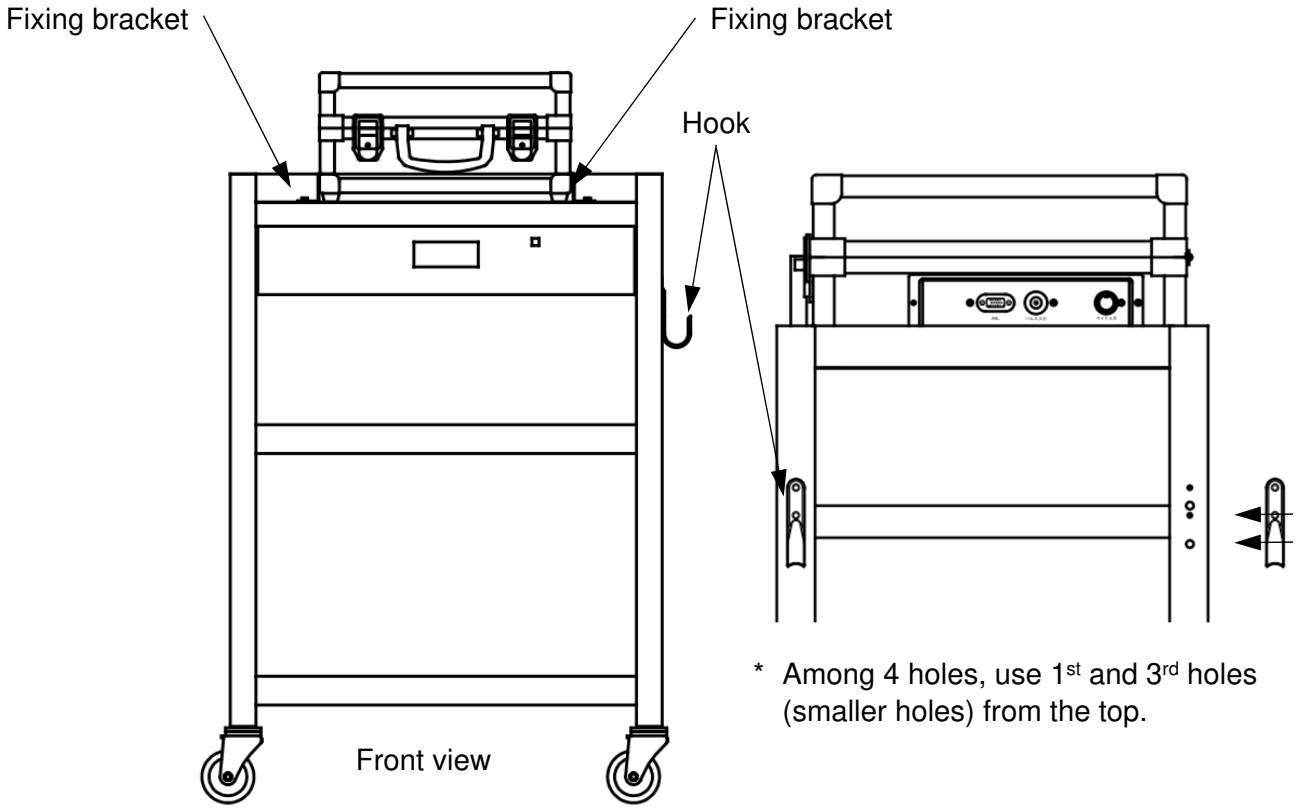
①Put the main body of the Proximity Exhaust Noise Measurement System (wireless) on the table of the stand.



② Hook the fixing brackets (2 ea) to the side panel as shown in the figure below and fix them using washers.

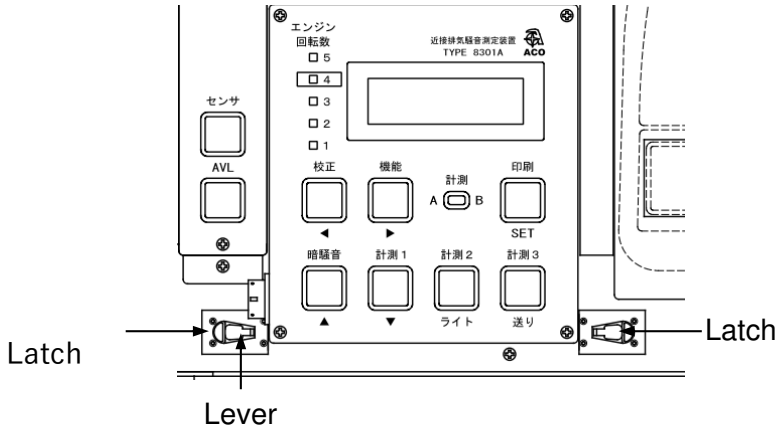
③ Install two hooks using the upper holes as reference by M4 X 15 (2 ea, with spring washer and washer).





* Among 4 holes, use 1st and 3rd holes (smaller holes) from the top.

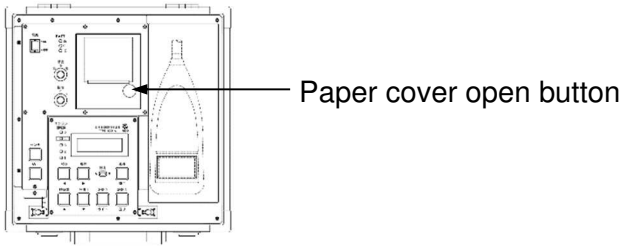
6-3 Removal of operation part (wireless)



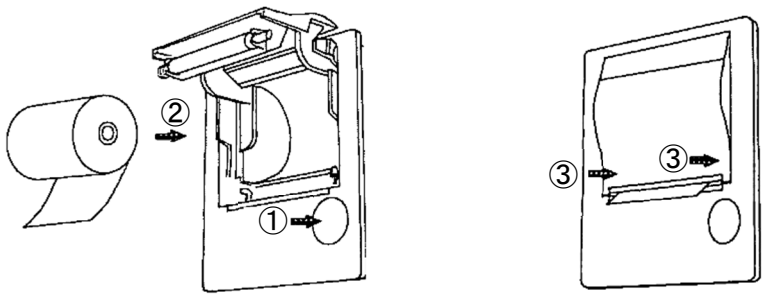
① Raise the levers (2 places) and unlock the latches.
② The operation part (wireless) can be removed by pulling it toward you.
③ When installing the operation part (wireless), connect the connector of the operation part to the connector of the main body and lower the levers (2 places) and lock the latches.
④ Battery box is on the back side of the operation part (wireless). When the battery level is low, remove the batteries from the battery box and charge them using the battery charger that is included with the system.
⑤ Turning ON the power shall be made with the operation part (wireless) installed to the main body. If the power is turned OFF while the operation part (wireless) is removed, “!! No Response !!” will be displayed and the system becomes inoperable. Install the operation part (wireless) to the main body and turn ON the power again.
⑥ 10 minutes after the removal of the operation part (wireless), the display will go to sleep mode (display will disappear). To return to normal operation, press any switch.
⑦ When using the operation part (wireless) while it is removed, use it within the distance of 10 m from the main body of the Proximity Exhaust Noise Measurement System. Use the case opened with the lid at 90 degrees position and avoid using the system at a place where interference is expected, such as near to devices that emits radio waves such as a radio.

6-4 Setting of printer paper

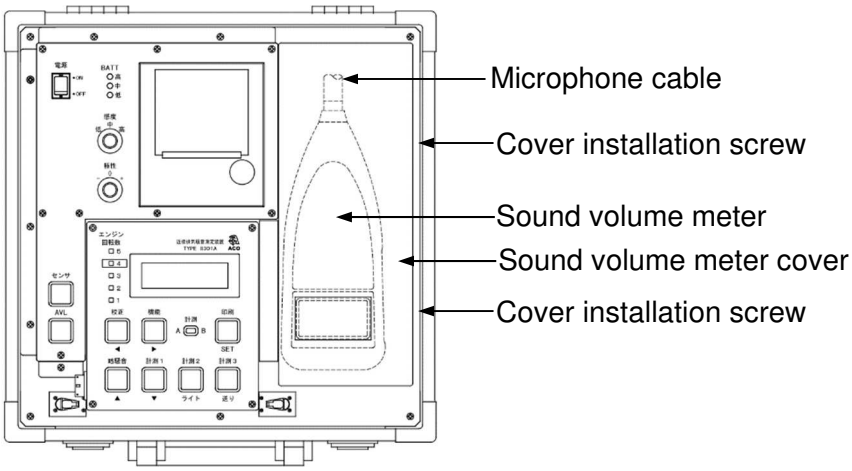
① Press paper cover open button and open the paper cover.



② Set the paper as shown in the following figure.
③ Make sure that the tip of the paper is outside of the cover and press the both sides of the top of the cover to close the cover.



6-5 Removal of the sound volume meter (for using the sound volume meter individually)



① Loosen two cover installation screws and remove the cover by pulling it to diagonally upward on the right side.

② Loosen fixing screw and remove the sound volume meter.

③ Remove communication cable and microphone cable (sound level meter front face connector) and use individually.

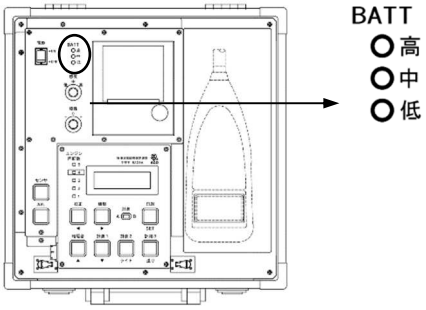
④ To install the sound volume meter, turn the power switch of the sound volume meter to OFF.

7. Measurement

7-1 Power ON

Confirm that the batteries of the main body of the Proximity Exhaust Noise Measurement System and the operation part (wireless) are fully charged.

1) Battery built in to the main body of the Proximity Exhaust Noise Measurement System.
   For the built-in battery, confirm by the battery level indicator on the main body panel.



High : Battery level is high and normal operation is possible.

Medium : Battery level is getting lower. Connect the system to AC 100 V and charge the battery as soon as possible.

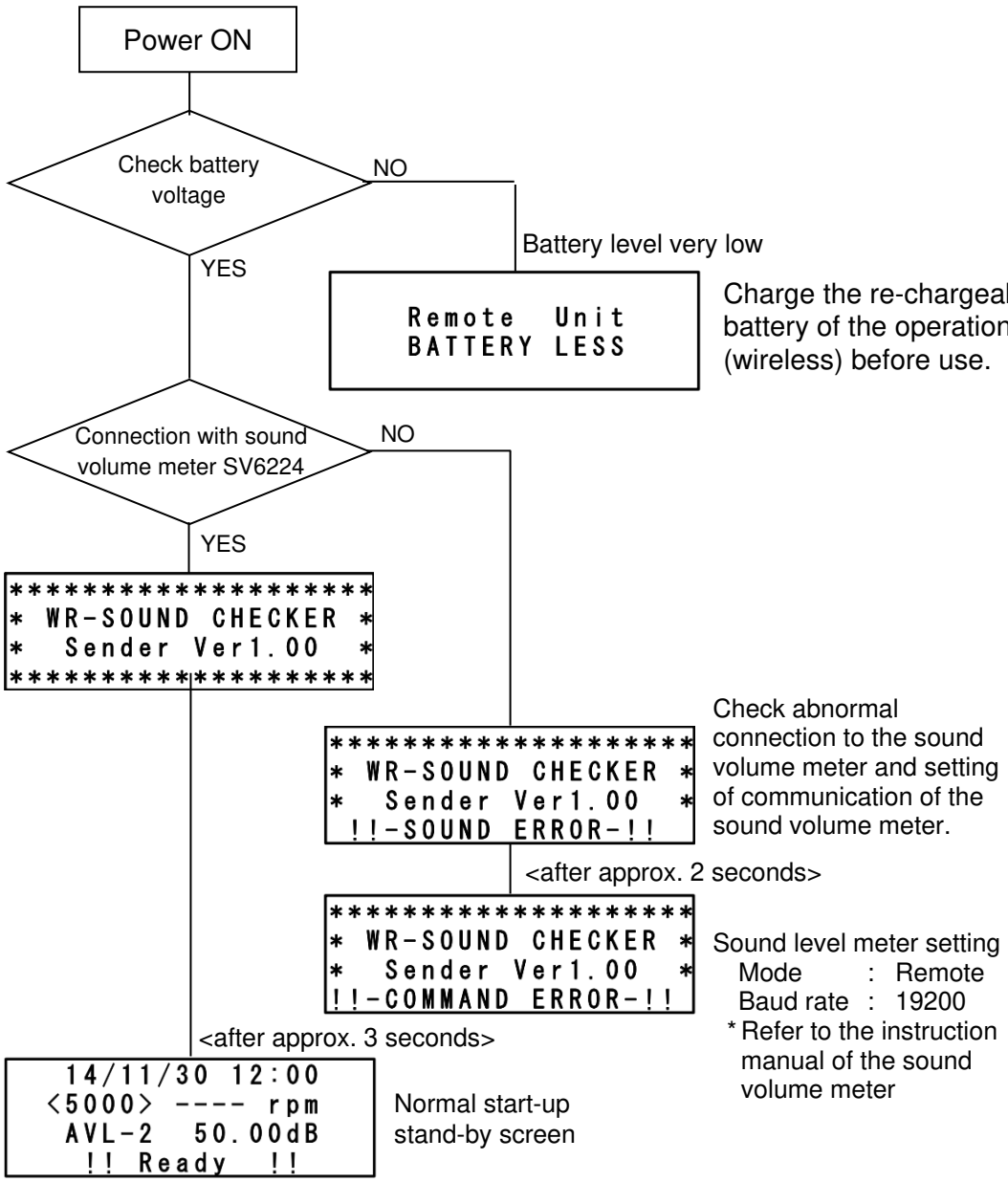
Low : Battery level is insufficient. Charge the battery before use.

* Remaining battery level right after the delivery or after long storage (for more than 1 month) will be very low. Charge the battery once a month for about 10 hours. (Battery is needed even when the AC power is used.)
* Do not charge over 12 hours to prevent the battery life becomes shorter.
* When the remaining battery level becomes low, normal operation such as printing by the printer cannot be made. In some cases, the main body will be re-set during the printing.
* To charge the battery, turn the power switch to OFF and use AC power. Charging with the power switch ON will require long time for charging and full charge cannot be achieved.

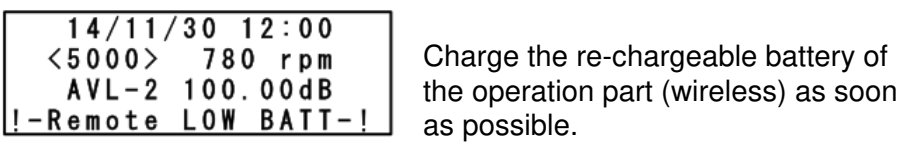
2) Operation part (wireless) re-chargeable battery

At the time of power ON, confirmation of sound volume meter and remaining level of operation part (wireless) re-chargeable battery will be automatically performed. If it is confirmed that there is no anomaly, display will turn to initial screen. Be sure that power ON is be made after the operation part (wireless) is installed to the main body.

After power ON. LED of the “Function” will be lit until the display turn to stand-by screen.

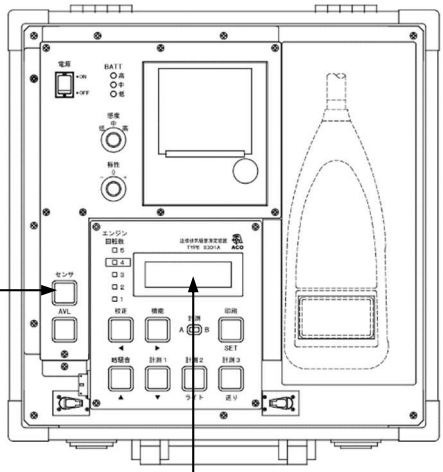


If the battery level decreased during operation



3) Stand-by screen

After normal start-up the display will turn to stand-by screen.



Sensor lamp
Blinks regularly.

```
 14/11/30 12:00
<5000> ---- rpm
 AVL-2  50.00dB
  !! Ready  !!
```

← Calendar
← Inspection revolution speed and measurement revolution speed
← Engine type, sound volume value
← Status

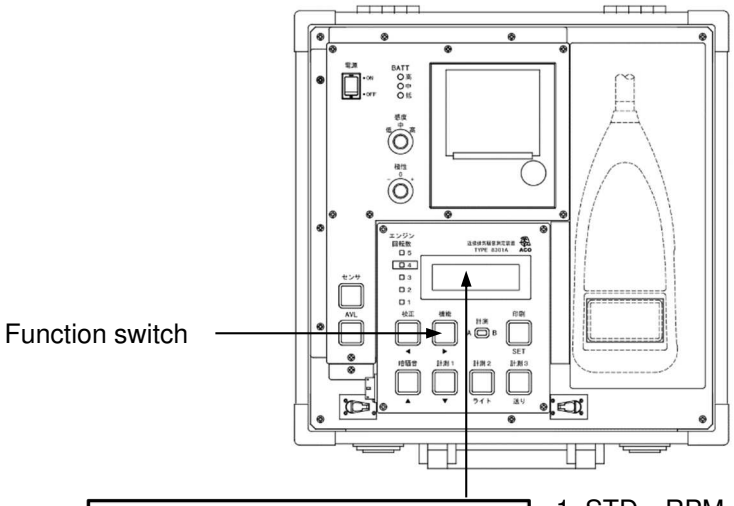
* Calendar will be updated every 1 minutes.
* With the input of the revolution signal, buzzer will beep regularly and the sensor lamp will blink regularly at the same time.
* If the buzzer does not beep regularly, it means that the tachometer sensor signal is not detecting the signal accurately. Re-install the tachometer sensor.
* If the tachometer sensor is connected, display will show engine revolution speed as shown below.

```
 14/11/30 12:00
<5000>  780 rpm
 AVL-2 100.00dB
  !! Ready  !!
```

← Current engine revolution speed

7-2Setting measurement conditions

At stand-by screen, press “Function” switch (LED will be lit) and following measurement conditions setting screen will be displayed. To return to stand-by screen, press “SET” switch at the measurement conditions setting screen.




```
*** Config Setup ***
1, STD-RPM   2, ENGINE
3, TIME      4, IDLE
Select UP-DOWN NO.1
```

1. STD−RPM : Set reference revolution speed and tolerance for measurement
2. ENGINE : Register engine type
3. TIME : Time / correction
4. IDLE : Set idling threshold value

7-2-1 Setting method for reference revolution speed and tolerance

1) At stand-by screen, select either A or B measurement methods by A/B selection switch.
2) Press “Function” switch and select [1] using [▲][▼] switches, and press “Function” switch.
3) Move the cursor to the revolution speed to change by [◀][▶] and select desired value using [▲][▼] switches. (With [▲] switch, after “9” is “0” to carry the digit, and the number in the next digit is carried by one, and with [▼] switch and after “0” it is carried down by “9”, and the number is the next digit is carried down by one.)
   When revolution speed is input, it is automatically calculated with the percentage of the tolerance.
4) Set the tolerance in the same manner and press “SET” switch.
   Input tolerance by either % or rpm. (If % is input, rpm will be automatically calculagted. If rpm is input % will be automatically calculated.)
   The tolerance at the power ON will be automatically set to ± 3 % for measurement method A, and ± 5 % for measurement method B.

```
**** STD-RPM SET ***
 STD-RPM   COMP(RPM)
  5000   9 %   450 rpm
++ Select  Cursol ++
```

← Reference revolution speed, Tolerance (%), Tolerance (rpm)

5) If “Light“ switch is pressed during the setting operation, setting values will not be saved and return to measurement condition setting screen.

7-2-2 Setting method for engine type

1) Press “Function” switch and select [2] using [▲][▼] switches, and press “Function” switch.
2) Select engine type using [▲][▼] switched and press “SET” switch.

```
** ENGINE SELECT ***

  ENGINE =  P4C-4
++ Select UP-DOWN ++
```

←Engine type

Engine can be selected from following 18 types.

Pulse sensor	RTE3 RTE2 RTE1	: For Rotary engine vehicle
	S4C-1 S2C-1	: When plug cable of 4 cycle engine is connected (secondary signal) : When plug cable of 2 cycle engine is connected (secondary signal)
AVL sensor	AVL-4 AVL-2 AVL-1	: Select when AVL sensor is used according to the idling speed. : (Can be used for diesel engine vehicle
Pulse sensor	P4C-16 P4C-12 P4C-8 P4C-6 P4C-5 P4C-4 P4C-3 P4C-2	: Select when primary signal of t4 cycle engine is connected, according to number of cylinders. : Compatible with 2 cylinders (P4C-2) ~ 16 cylinders (P4C-16)
	P2C-2 P2C-1	: When primary signal of 2 cycle, 2 cylinders engine is connected. : When primary signal of 2 cycle, 1 cylinder engine is connected.

* Explanation of engine type

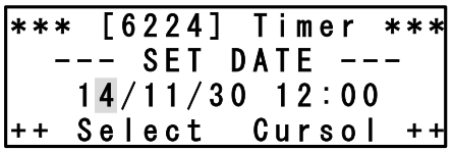
Select engine type according to vehicle type and measurement point.

1. RTE1 : When measuring rotary engine
   - 1 ; 1 pulse / 1 revolution
   - 2 ; 1 pulse / 2 revolutions
   - 3 ; 1 pulse / 3 revolutions
2. S4C1 : When measuring 4 cycle, 1 cylinder with secondary sensor.
   - 1 cylinder
   - 4 cycle
   - Secondary
3. AVL-1 : For AVL measurement and multiplication value is revolution speed compensation value.
   - Multiplication value
4. P4C16 : When measuring 4 cycle, 16 cylinder
   - 16 cylinder

3) If “Light“ switch is pressed during the setting operation, setting values will not be saved and return to measurement condition setting screen.

7-2-3 Setting method for time correction

1) Press “Function” switch and select [3] using [▲][▼] switches, and press “Function” switch.



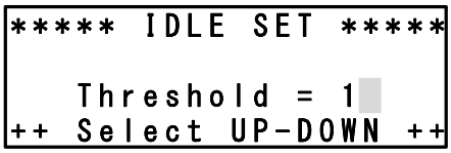
← Year / Month / Day Time

2) With the date and time displayed on the screen, move the cursor to desire value to change by [◀][▶] and change the value using [▲][▼] switches and set by “SET” switch.
3) Time information will be sent to the sound volume meter and time of the sound volume meter can be corrected.
4) Following comment will be displayed when the change is completed normally.

5) If “Light“ switch is pressed during the setting operation, setting values will not be saved and return to measurement condition setting screen.

7-2-4 Setting method for idling threshold value

1) Press “Function” switch and select [4] using [▲][▼] switches, and press “Function” switch.
2) Select “Threshold” using [▲][▼] switches and press “SET” switch.



← Threshold 1 ~ 3

When “1” is selected, engine revolution speed LED [1] will be lit, when “2” is selected LED [2] will be lit, and when “3” is selected [3] will be lit and set as the idling state.

Lighting of the engine revolution speed LED is set as follows.

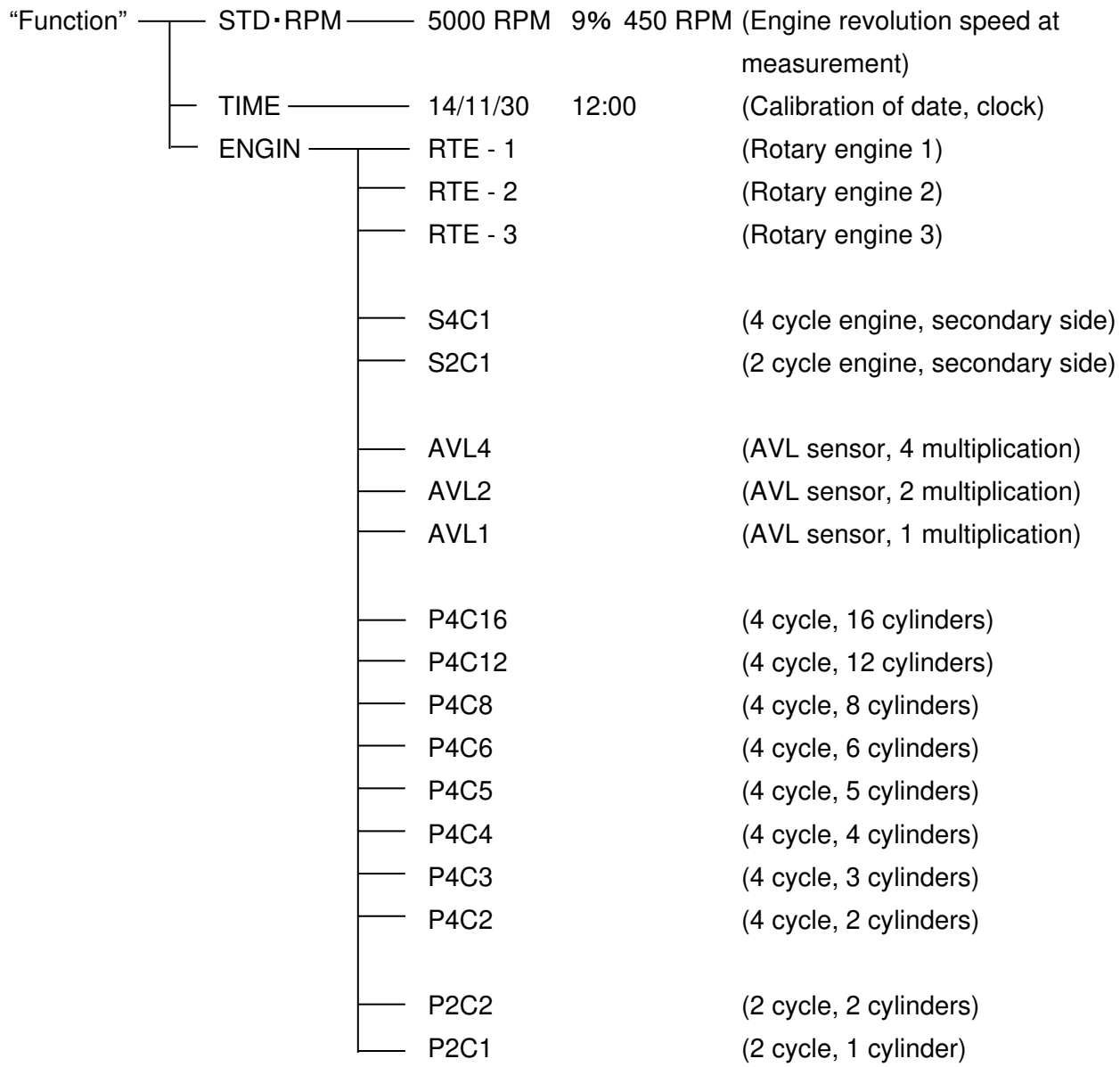
LED 1 : Will be lit at more than 300 rpm and less than 1/2 of the set revolution speed.
LED 2 : Will be lit at more than 1/2 of the set revolution speed and less than 2/3.
LED 3 : Will be lit at more than 2/3 of the set revolution speed and less than the minus tolerance.

Normally set to “1”.

In the case of the vehicle, with which the difference between the set revolution speed and idling revolution speed is small, such as hybrid vehicle, set to “2” or “3”. If measurement for such vehicles is made with “1”, measurement may not be completer because the idling condition cannot be detected.

3) If “Light“ switch is pressed during the setting operation, setting values will not be saved and return to measurement condition setting screen.

7-2-5 List of environment setting items



7-3Calibration

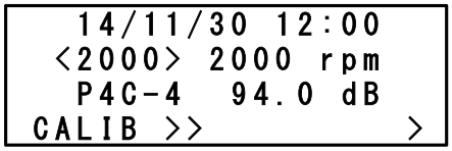
1) Setting

Perform calibration without connecting the tachometer sensor and with following switch positions.

* "Sensitivity" switch High
* "Polarity" switch 0
* "AVL" switch OFF (Lamp off)

2) Calibration

At the stand-by screen, press "Calibration" switch to start the calibration.

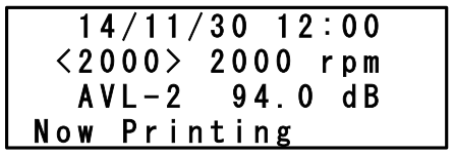


* If the level indication is not 94 dB, remove the cover of the sound volume meter and make adjustment. See page 15 of the instruction manual for the sound level meter.
  If the revolution speed indication is not within the range of 2000 rpm ± 10 rpm, there is a possibility of some anomaly. Contact distributor for check / calibration.

3) Finish calibration

Press "Calibration" switch, then calibration will be cancelled and the screen will return to stand-by screen.

Press "Print" switch. Calibration result will be printed, calibration finished and return to stand-by screen.



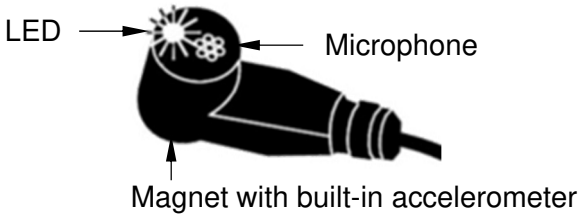
Example of print
```
Calib Time   14/11/30 12:00
Calib RPM    2000 rpm
Calib Max    94.0 dBA
```

Re-print of the calibration result is possible by pressing the "Print" switch again after the calibration is finished. If there is not measurement data," !! No Data !!" will be displayed when the "Print" switch is pressed. Printing is not possible if the calibration is cancelled.

7-4 Installation of revolution sensor

7-4-1 Sound-vibration type AVL sensor

This sensor can be used for many vehicles with gasoline engines and diesel engines.

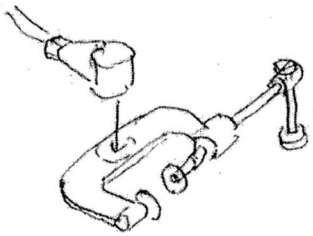


1) Installation procedure

① Connect to “AVL” connector on the side of the Proximity Exhaust Noise Measurement System main body.

② Press “AVL” switch on the main body panel (LED will be lit). Confirm that red LED of the AVL sensor LED is lit.

③ Attach the magnet part of the AVL sensor to the metal part of the engine so that it will not move or come off due to engine vibration. If there is no metal part of engine to attach the AVL sensor, attach an iron clamp (screw type), etc. to the engine and install the AVIL sensor to the clamp.



④ Run the warmed-up engine at idling speed, and after 3 to 20 seconds the LED of the AVL sensor will be lit in yellow. If the LED is not lit in yellow, confirm the installation condition or change the installation position.

⑤ Increase the engine revolution speed and continue until the LED turns to green. If the LED is not lit in green, confirm the installation condition or change the installation position.

⑥ When the pulse is detected, revolution speed will be displayed on the operation part (wireless).

2) Cautions for handling

* Keep the magnet clean and free from metal scraps, chips or dust. Make sure that the holes of the microphone are not blocked.
* Do not clean the microphone holes using sharp object or blow compressed air. Such actions may cause damage to the microphone.
* If the revolution speed jumps, change the installation position.

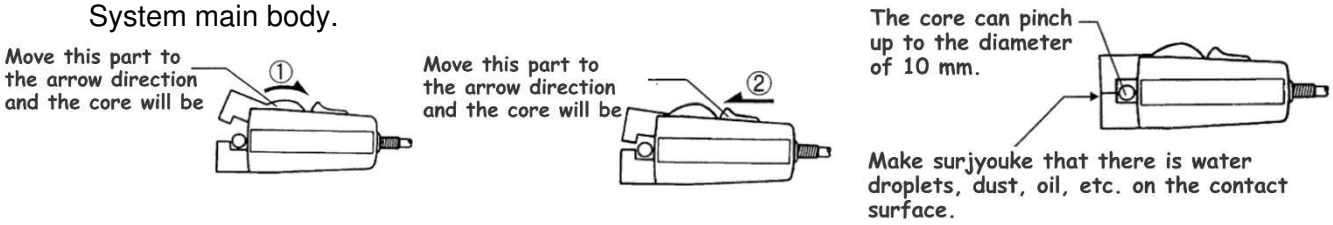
7-4-2 Non-contact type pulse sensor

This sensor is used mainly for the measurement for vehicles of 2 cycle / 4 cycle gasoline engine with distributor type ignition system.

1) Installation procedure

① Slide the bunchy part ① on the upper surface of the sensor and the core at the tip will be opened. Pinch the low voltage primary side cable for IP-292, or high voltage secondary side cable going to the plug for IP-296, and release the finger. The core will be closed but the tip will remain slightly opened because of the mechanism to prevent the damage to the core by colliding with each other. The tip can be completely closed by pushing the slide knob ② toward the opening.

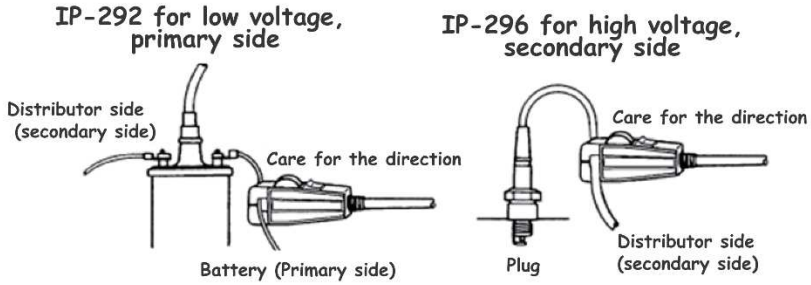
② Connect to “Pulse input” connector on the side of the Proximity Exhaust Noise Measurement System main body.



③ Run the engine at idling speed. When the pulse is detected, revolution speed will be displayed on the operation part (wireless). If the measurement is not stable, or if the detection is not possible, change the direction of the sensor or change the polarity (- / 0 / +) on the panel of the Proximity Exhaust Noise Measurement System main body.

2) Cautions for handling

* Confirm that cores are contacting closely with each other.
* Pinch the low voltage primary side cable of the ignition coil for IP-292, high voltage secondary side cable of the ignition coil for IP-296. Be careful that if the electrical system cable is pinched by mistake, it is not possible to measure the revolution speed.



* Handle with care so that there will be no water droplets, dust, or oil, etc. on the sensor, especially on the contact surface. If there is such contamination, wipe the surface cleanly with a soft cloth, etc. before use. If any contamination remains on the contact surface, it will prevent the accurate detection of the revolution.
* Place the sensor itself at a place with as little vibration as possible. Excessive vibration may degrade the close contact between cores and prevent the detection.
* Sensor core is made of very brittle material. Avoid applying excessive shock to it. Damaged core will prevent the accurate detection of the revolution.
* IP-292 (PRIMARY) is indicated on the yellow nameplate for the low voltage primary side, and IP-296 (SECONDARY) on the green nameplate for the high voltage secondary side. Correct me, and installation position for compatible sensors are different. Correct measurement will not be possible if the sensor for different purpose is used.

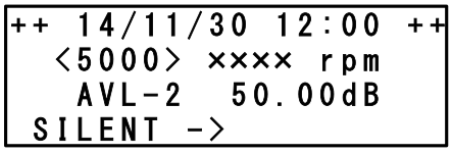
7-5 Measurement of background noise (engine stopped)

After the measurement of background noise, measurement will be automatically started with the measurement method set by the measurement A / B.

Result of the background noise measurement will be retained until the start of next background noise measurement, or until the power is turned OFF.

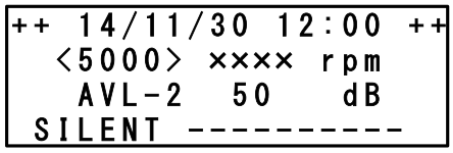
1) Start background noise measurement

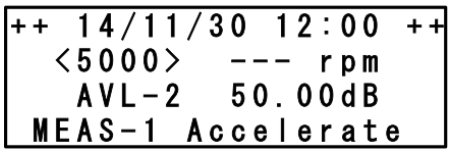
Press “Background noise” switch. Measurement of background noise will be started (LED blinks) and the measurement will be finished after 10 seconds.



2) Finish background noise measurement

Measurement will be stopped after 10 seconds and the result of background noise measurement will be displayed for 1 second, LED of “Measurement 1” will be lit, and the request to step on the accelerator will be displayed.





3) Interruption of background noise measurement

If the “Background noise” switch is pressed during the background noise measurement, measurement will be interrupted and “!! Pause !!” will be displayed.

Press “Background noise” switch again and the measurement will be re-started.

To stop the measurement, press “SET” switch. “!! Cansel !!” will be displayed and return to stand-by screen.

7-6 Measurement by measurement method A

Measurement will be started with measurement method A when “Measurement A / B” switch is set to “A”. “Measurement A / B” switch shall be set before pressing “Background noise” switch, or before pressing “Measurement 1” switch.

If “Measurement 1” switch is pressed without pressing “Background noise” switch, measurement is possible without measuring the background noise.

In the case if the background noise is not measured, background noise value on the printed result will be that of the latest value measured after the power is turned ON. If any background noise measurement was not made after the power is turned ON, the print will be (－－－－) without numerical value.

If the measurement was stopped by pressing “Function” and “SET” switches at the same time , data will be deleted.

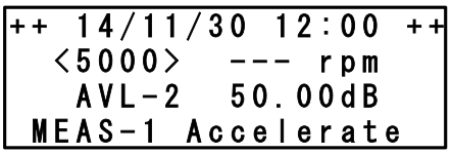
1) Measurement of background noise (engine stopped)

Press “Background noise” switch. Measurement of background noise will be started (LED blinks) and the measurement will be finished after 10 seconds. The result of background noise measurement will be displayed for 1 second, LED of “Measurement 1” will be lit automatically, and the request to step on the accelerator will be displayed.

If “Background noise” switch is pressed during the background noise measurement, measurement will be interrupted and “!! Pause !!” will be displayed.

Press “Background noise” switch again and the measurement will be resumed.

If “Function” and “SET” switches pressed at the same time, measurement will be stopped, “!! Cansel !!” will be displayed and return to stand-by screen.

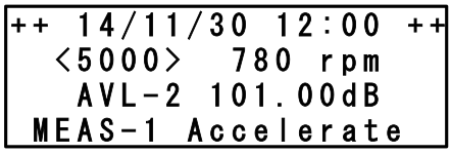


← Request to step on the accelerator for ” Measurement 1”.

2) Engine start and measurement of “Measurement 1”

If “Measurement 1” switch is pressed during the measurement, measurement will be interrupted and “!! Pause !!” will be displayed. Press “Measurement 1” switch again and the measurement will be resumed. If “Background noise” switch is pressed, the measurement will return to background noise measurement. If “Function” and “SET” switches are pressed at the same time, measurement will be stopped. “!! Cansel !!” will be displayed and return to stand-by screen.

① Start the engine and let it idle.

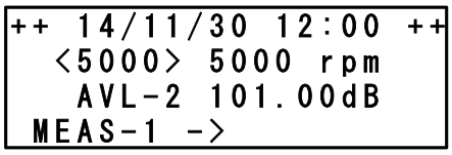


← Monitor the revolution speed

CAUTION

Confirm that the LED of "AVL" switch on the main body panel is lit while AVL sensor is used. The LED of AVL sensor is firstly lit in red and then it will be lit in yellow after 3 to 20 seconds.
If it is not lit in yellow, check the installation or change the position.
Increase the engine revolution speed and maintain it (for several seconds to approx. 15 seconds) until LED turns to green.
If it is not lit in green, check the installation or change the position.
When the pulse is detected, revolution speed will be displayed on the operation part (wireless).

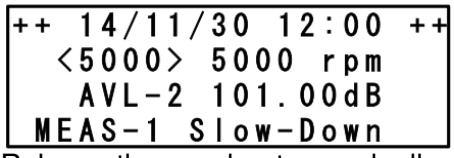
② Step on the accelerator gradually until the revolution speed is within the tolerance of the set revolution speed, and the engine revolution speed indicator LED 4 (red) is lit. Hold the revolution speed at LED 4 position for 5 seconds.



← Display 5 seconds count

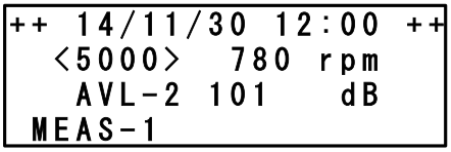
* Revolution speed and tolerance are set at "1. STD-RPM of the measurement conditions setting screen.
* If the revolution speed is decreased during the revolution holding period of 5 seconds, "Reset ACC" will be displayed. Release the accelerator and step on the accelerator again until the LED 4 position.
* If the revolution speed is increased during the revolution holding period of 5 seconds, "OVER R.P.M." will be displayed. Release the accelerator and step in the accelerator again until the LED 4 position.

③ If the revolution speed is held for 5 seconds, engine revolution speed indicator LED 4 and "Measurement 1" LED will blink and "Slow Down" will be displayed.

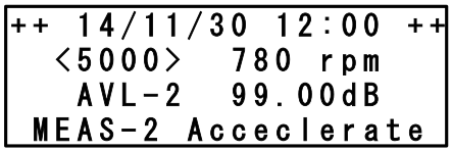


← Display to decrease the revolution speed

④ Release the accelerator gradually and when it reaches the engine speed indicator LED for idling, measurement result of "Measurement 1" will be displayed for 1 second. Then the LED for "Measurement 2" will be automatically lit and measurement of "Measurement 2" will be started.



← Display measurement result



← Request to step on the accelerator for " Measurement 2".

3) Measurement of “Measurement 2”

If “Measurement 2” switch is pressed during the measurement, measurement will be interrupted and “!! Pause !!” will be displayed. Press “Measurement 2” switch again and the measurement will be resumed. If “Background noise” switch is pressed, the measurement will return to background noise measurement. If “Measurement 1” switch is pressed, the measurement will return to “Measurement 1”. If “Function” and “SET” switches are pressed at the same time, measurement will be stopped, “!! Cansel !!” will be displayed and return to stand-by screen.

```
++ 14/11/30 12:00 ++
  <5000>  780 rpm
   AVL-2  99.00dB
 MEAS-2 Accecelerate
```

← Request to step on the accelerator for ” Measurement 2”.

① Step on the accelerator gradually until the revolution speed is within the tolerance of the set revolution speed, and the engine revolution speed indicator LED 4 (red) is lit. Hold the revolution speed at LED 4 position for 5 seconds.

```
++ 14/11/30 12:00 ++
  <5000> 5000 rpm
   AVL-2  99.00dB
 MEAS-2 ->
```

← Display 5 seconds count

* Revolution speed and tolerance are set at the measurement conditions setting screen.

② If the revolution speed is held for 5 seconds, engine revolution speed indicator LED 4 and “Measurement 2” LED will blink and “Slow Down” will be displayed.

```
++ 14/11/30 12:00 ++
  <5000> 5000 rpm
   AVL-2  99.00dB
 MEAS-2 Slow-Down
```

← Display to decrease the revolution speed

③ Release the accelerator gradually and when it reaches the engine revolution speed indicator LED for idling, measurement result of “Measurement 2” will be displayed for 1 second and measurement result will be printed.

```
++ 14/11/30 12:00 ++
  <5000>  780 rpm
   AVL-2  99   dB
 MEAS-2
```

← Display measurement result

```
++ 14/11/30 12:00 ++
  <5000>  780 rpm
   AVL-2  99   dB
 Now Printing
```

← Display now printing

Example of print

```
Time      14/11/30 12:00
SET RPM   5000 rpm
BGN         50  dBA
1st Max   101  dBA
2st Max    99  dBA
RESULT   100.0dBA
```

← Date and time
← Set revolution speed
← Background noise
← Result of “Measurement 1” in integer
← Result of “Measurement 2” in integer
← Calculation result of “Measurement 1” and “Measurement 2” in 1st place after the decimal point.

④ Return to stand-by screen after the printing.

7-7 Measurement by measurement method B

Measurement will be started with measurement method B when “Measurement A / B” switch is set to “B”. “Measurement A / B” switch shall be set before pressing “Background noise” switch, or before pressing “Measurement 1” switch.

If “Measurement 1” switch is pressed without pressing “Background noise” switch, measurement is possible without measuring the background noise.

In the case if the background noise is not measured, background noise value on the printed result will be that of the latest value measured after the power is turned ON. If any background noise measurement was not made after the power is turned ON, the print will be (－－－－) without numerical value.

If the measurement was stopped by pressing “Function” and “SET” switches at the same time , data will be deleted.

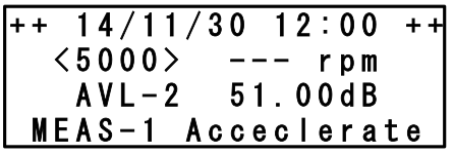
1) Measurement of background noise (engine stopped)

Press “Background noise” switch. Measurement of background noise will be started (LED blinks) and the measurement will be finished after 10 seconds. The result of background noise measurement will be displayed for 1 second, LED of “Measurement 1” will be lit automatically, and the request to step on the accelerator will be displayed.

If “Background noise” switch is pressed during the background noise measurement, measurement will be interrupted and “!! Pause !!” will be displayed.

Press “Background noise” switch again and the measurement will be resumed.

If “Function” and “SET” switches pressed at the same time, measurement will be stopped. “!! Cansel !!” will be displayed and return to stand-by screen.

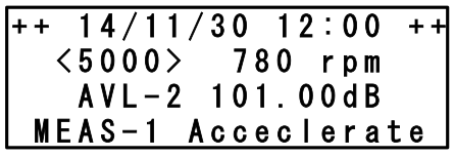


← Request to step on the accelerator for ” Measurement 1”.

2) Engine start and measurement of “Measurement 1”

If “Measurement 1” switch is pressed during the measurement, measurement will be interrupted and “!! Pause !!” will be displayed. Press “Measurement 1” switch again and the measurement will be resumed. If “Background noise” switch is pressed, the measurement will return to background noise measurement. If “SET” switch is pressed, measurement will be stopped, “!! Cansel !!” will be displayed and return to stand-by screen.

① Start the engine and let it idle.

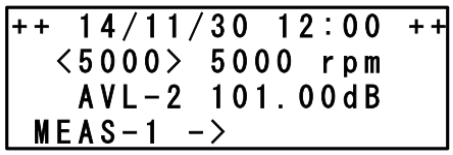


← Monitor the revolution speed

CAUTION

Confirm that the LED of “AVL” switch on the main body panel is lit while AVL sensor is used. The LED of AVL sensor is firstly lit in red and then it will be lit in yellow after 3 to 20 seconds.
If it is not lit in yellow, check the installation or change the position.
Increase the engine revolution speed and maintain it (for several seconds to approx. 15 seconds) until LED turns to green.
If it is not lit in green, check the installation or change the position.
When the pulse is detected, revolution speed will be displayed on the operation part (wireless).

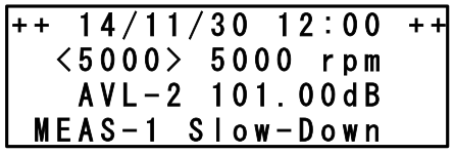
② Step on the accelerator gradually until the revolution speed is within the tolerance of the set revolution speed, and the engine revolution speed indicator LED 4 (red) is lit. Hold the revolution speed at LED 4 position for 1 second.



← Display 1 second count

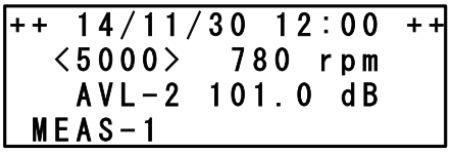
* Revolution speed and tolerance are set at “1. STD-RPM of the measurement conditions setting screen.
* If the revolution speed is decreased during the revolution holding period of 1 second, “Reset ACC” will be displayed. Release the accelerator and step on the accelerator again until the LED 4 position.
* If the revolution speed is increased during the revolution holding period of 1 second, “OVER R.P.M.” will be displayed. Release the accelerator and step on the accelerator again until the LED 4 position.

③ If the revolution speed is held for 1 second, engine revolution speed indicator LED 4 and “Measurement 1” LED will blink and “Slow Down” will be displayed.

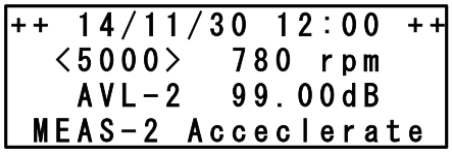


← Display to decrease the revolution speed

④ Release the accelerator gradually and when it reaches the engine speed indicator LED for idling, measurement result of “Measurement 1” will be displayed for 1 second. Then the LED for “Measurement 2” will be automatically lit and measurement of “Measurement 2” will be started.



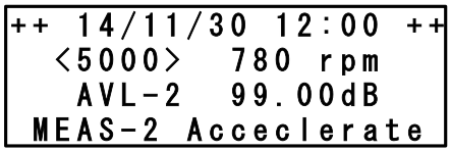
← Display measurement result



← Request to step on the accelerator for ” Measurement 2”.

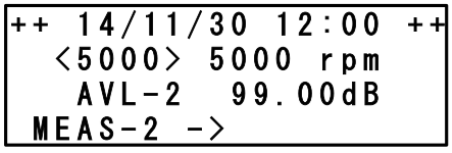
3) Measurement of “Measurement 2”

If “Measurement 2” switch is pressed during the measurement, measurement will be interrupted and “!! Pause !!” will be displayed. Press “Measurement 2” switch again and the measurement will be resumed. If “Background noise” switch is pressed, the measurement will return to background noise measurement. If “Measurement 1” switch is pressed, the measurement will return to “Measurement 1”. If “Function” and “SET” switches are pressed at the same time, measurement will be stopped, “!! Cansel !!” will be displayed and return to stand-by screen.



← Request to step on the accelerator for ” Measurement 2”.

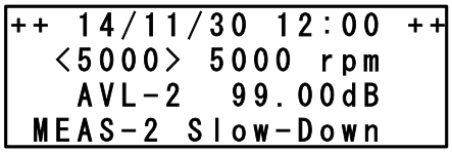
① Step on the accelerator gradually until the revolution speed is within the tolerance of the set revolution speed, and the engine revolution speed indicator LED 4 (red) is lit. Hold the revolution speed at LED 4 position for 1 second.



← Display 1 second count

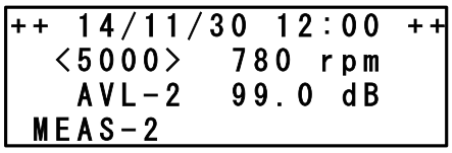
* Revolution speed and tolerance are set at the measurement conditions setting screen.

② If the revolution speed is held for 1 second, engine revolution speed indicator LED 4 and “Measurement 2” LED will blink and “Slow Down” will be displayed.



← Display to decrease the revolution speed

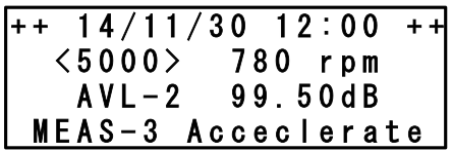
③ Release the accelerator gradually and when it reaches the engine revolution speed indicator LED for idling, measurement result of “Measurement 2” will be displayed for 1 second. Then the LED for “Measurement 3” will be automatically lit and measurement of “Measurement 3” will be started.



← Display measurement result

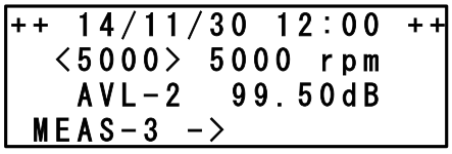
4) Measurement of “Measurement 3”

If “Measurement 3” switch is pressed during the measurement, measurement will be interrupted and “!! Pause !!” will be displayed. Press “Measurement 3” switch again and the measurement will be resumed. If “Background noise” switch is pressed, the measurement will return to background noise measurement. If “Measurement 1” or “Measurement2” switch is pressed, the measurement will return to “Measurement 1” or “Measurement 2”, respectively. If “Function” and “SET” switches are pressed at the same time, measurement will be stopped, “!! Cansel !!” will be displayed and return to stand-by screen.



← Request to step on the accelerator for ” Measurement 3”.

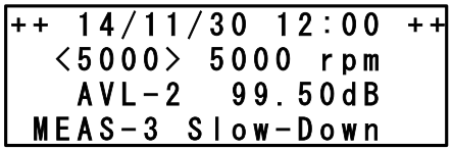
① Step on the accelerator gradually until the revolution speed is within the tolerance of the set revolution speed, and the engine revolution speed indicator LED 4 (red) is lit. Hold the revolution speed at LED 4 position for 1 second.



← Display 1 second count

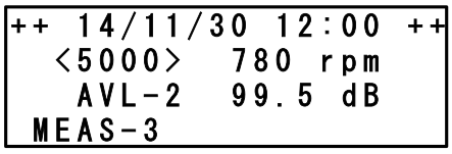
* Revolution speed and tolerance are set at the measurement conditions setting screen.

② If the revolution speed is held for 1 second, engine revolution speed indicator LED 4 and “Measurement 3” LED will blink and “Slow Down” will be displayed.

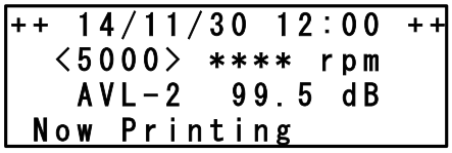


← Display to decrease the revolution speed

③ Release the accelerator gradually and when it reaches the engine revolution speed indicator LED for idling, measurement result of “Measurement 3” will be displayed for 1 second and measurement result will be printed.



← Display measurement result



← Display now printing

Example of print

```
Time       14/11/30  12:00  ← Date and time
SET RPM    5000 rpm         ← Set revolution speed
BGN         51.0dBA         ← Background noise
1st Max    100.0dBA         ← Result of "Measurement 1" in 1st place after the decimal point.
2st Max    101.0dBA         ← Result of "Measurement 2" in 1st place after the decimal point.
3st Max     99.5dBA         ← Result of "Measurement 3" in 1st place after the decimal point.
RESULT     100   dBA        ← Calculation result of "Measurement 1","Measurement 2" and
                                "Measurement 3" in integer.
```

④ Return to stand-by screen after the printing

7-8 Printing method

1) Printing will be started automatically at the time of the completion of the measurement. Calibration result can also be printed.
2) If printing is necessary again, press "Print" switch to print the result of measurement made immediately before.
3) If there is no measurement data exists, "!! No Data !!" will be displayed.
4) During the printing, if the printing paper is not installed correctly, such as no printing paper or the lid is open, "!! Paper End !!" will b displayed. Set the printing paper correctly, and press "Print" switch again.

* Make sure that the tip of the paper is outside of the cover. For the method for the setting of the printing paper, see Para. 6-4.

To stop the printing, press "Function" and "SET" switches at the same time.

When the printing is stopped, "!! No Data !!" will be displayed and it is not possible to re-print.

7-9 Printing paper feeding method

1) Press "Function" switch.
2) Press "Feed" switch to feed the printing paper.

8. Specification

1) Compatible vehicle type : 2 cycle or 4 cycle gasoline engine vehicle, diesel engine vehicle, rotary engine vehicle

2) Built-in sound volume meter : SV-6224

3) Measurement item : Background noise level

Average of ambient sound level for 10 seconds while the engine of the subject vehicle is stopped. (Equivalent sound level)

Maximum sound level

Maximum sound level during time from holding the engine revolution speed at a set tolerance of the measurement revolution speed for a set time period until accelerator is released and the engine revolution speed becomes idling state.

4) Measurement method : Measurement method A

Measure maximum sound level twice after measurement of background noise.

Measurement method B

Measure maximum sound level 3 times after measurement of background noise.

5) Processing of measured data : Measurement method A

Calculate arithmetic mean value of the maximum sound level measured two times.

The first and second measured values are displayed with a value rounded down to the first decimal place, and after the second measurement the arithmetic mean value for the two measured values is displayed to the first decimal place.

Measurement method B

Calculate arithmetic mean value of the maximum sound level measured three times.

The first, second and third measured values are rounded to the first decimal place, the results up to the first decimal place are displayed and after three measurements the arithmetic mean value for the three measured values is displayed with a value rounded to the nearest whole number.

6) Print item : Clock data (year / month / day / hour / minute)

Set revolution speed

Calibration sound level

Maximum sound level for the first measurement

Maximum sound level for the second measurement

Maximum sound level for the third measurement
(for measurement method B only)
Arithmetic mean value for the first and second measurements
(for measurement method A only)
Arithmetic mean value for the first, second and third measurements
(for measurement method B only)

7) Engine tachometer : 300 rpm ~ 9,999 rpm, detection accuracy ± 10 rpm

8) Revolution speed detection : Following tachometer sensor can be connected

Non-contact type

IP-292 (Primary side)

; Measure pulse of the distributor side

IP-296 (Secondary side)

; Utilize current magnetic field flowing through the spark plug.

Compatible vehicle type

; 2 cycle, 4 cycle gasoline engine vehicle, rotary engine vehicle

Revolution speed detection range

; 500 ~ 9,999 rpm

Sound vibration type

AVL DiTEST Speed 2000

; Utilize sound and vibration calibration signals

Compatible vehicle type

; 4 cycle gasoline engine vehicle, diesel engine vehicle

Revolution speed detection range

; 4 cycle engine vehicle 400 ~ 8,000 rpm
Diesel engine vehicle 400 ~ 6,000 rpm
Rotary engine vehicle 400 ~ 8,000 rpm

9) Setting range for measurement revolution speed
: 500 ~ 9,990 rpm, 1 rpm step

10) Setting of revolution speed tolerance range
: Setting of measurement revolution speed 1 ~ ± 9 %,
1 % step
Initial value at Power ON
Measurement method A ; ± 3 %
Measurement method B ; ± 5 %

11) Display : Sound level
Measurement method A
; 1 dB unit, 1 second interval

(Arithmetic mean value for two measurements is 0.1 dB unit)
Measurement method B
; 0.1 dB unit, 1 second interval
(Arithmetic mean value for three measurements is 0.1 dB unit)
Engine revolution speed
;4 digits, 1 rpm unit, 1 second interval

12) Engine revolution speed monitor lamp
: Displays engine revolution speed against measurement revolution speed in 5 steps

13) Measurement display lamp : Background noise measurement, first measurement, second measurement, third measurement

14) External tachometer monitor : Can be extended using cable so that the drive of the vehicle subject for measurement can monitor engine revolution speed monitor and turn-on and blink of the measurement display lamp.
- 1 ; Lit at 1/2 or less of the set revolution speed at more than 300 rpm.
- 2 ; Lit at more than 1/2 and less than 2/3 of the set revolution speed.
- 3 ; Lit at more than 2/3 ~ less than minus tolerance range of the set revolution speed.
- 4 ; Lit at within the range of tolerance of the set revolution speed.
- 5 ; Lit when the plus tolerance of the set revolution speed is exceeded.

15) Printer : Dot matrix type thermal printer
Printing paper UTP-58E, 58 mm (width) X 30 m (length)

16) Built-in clock : Year / month / day / hour / minute (quartz type),
Accurate with less than ± 60 seconds / month
(Sound volume meter built-in clock is used.)

17) Operating temperature / humidity : 0 ~ 50 °C, 10 ~ 90 % RH

18) Power source : Compatible with 3 types of power source.
Internal battery (Charging time 10 hours, life at continuous usage more than 5 hours)
AC 100 V commercial power supply (± 10 %, 50 / 60 Hz), power consumption 10 VA
DC 12 V external power supply, current consumption approx. 1 A
* Chargeable battery of the operation part is charged using the dedicated battery charger.

19) Dimensions and weight (main body)

: Approx 350 mm (D) × 350 mm (W) × 180 mm (H), approx. 10 kg.

20) Operation, control, display part construction

: Integrated singled body construction with wireless system (remote control is possible by removing from the main body)