Intelligent Earthquake Sensor SES60 User's Manual

Thank you for purchasing the intelligent earthquake sensor SES60.
This manual contains information for ensuring correct use of the SES60. It also provides necessary information for installation, maintenance, and troubleshooting.
This manual should be read by those who design and maintain devices that use the SES60.
Be sure to keep this manual nearby for handy reference.
For details, refer to Intelligent Earthquake Sensor SES60 User's Manual "Design" CP-SP-1156E.

RESTRICTIONS ON USE

This product has been developed, designed and manufactured in accordance with the standards of explosion-protected electrical apparatus.
When using this product in application requiring particular safety, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.
The notified body and/or the applicable standards may vary by the model number. Be sure to confirm the specification for the details.

REQUEST

Ensure that this User's Manual is handed over to the user before the product is used.
Copying or duplicating this User's Manual in part or in whole is forbidden. The information and specifications in this User's Manual are subject to change without notice.
Considerable effort has been made to ensure that this User's Manual is free from inaccuracies and omissions.
If you should find any inaccuracies or omissions, please contact Yamatake Corporation.
In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

SAFETY PRECAUTIONS

Safety precautions are for ensuring safe and correct use of this product, and for preventing injury to the operator and other people or damage to property. You must observe these safety precautions. Also, be sure to read and understand the contents of this user's manual.

⚠ WARNING
Warnings are indicated when mishandling this product might result in death or serious injury to the user.

⚠ CAUTION
Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to this product.

⚠ WARNING

- For explosion-proof instrumentation, the installation and wiring must be performed conforming to the "Factory electrical facilities explosion-proof guidelines" by National Institute of Industrial Safety Independent Administrative Institution.
- This unit has acquired the flameproof construction (Exd II BT4).Install this unit at a location conforming to the conditions for the flameproof construction.
- When using a loader(optional unit), always use it in a non-hazardous area.
- Always use the cable gland and flameproof packing set supplied with this unit. If other components are used, the unit cannot be used as an authorized explosion-proof product.
- Always use cables with a heat resistance to withstand temperatures of 80˚C or more.
- After the wiring work has been completed, close the cover securely and tighten the set screw firmly.
- When opening the cover, always open it in a non-hazardous area.
- Never attempt to disassemble or modify this unit.

⚠ CAUTION

- Only authorized engineers who have proper knowledge and technical skill about the equipment and this unit are allowed to carry out the installation, wiring, inspection, and maintenance work.
- Lightning preventive measures are not taken for this unit. When necessary, take appropriate lightning preventive measures on the measuring instrument side.
- Do not use a walkie-talkie within 2m of this unit and cables connected to this unit. Doing so might cause this unit to malfunction.
- Always carry out the wiring work properly. Incorrect wiring may cause this unit to malfunction.
- Pay special attention so that the crimp type terminal lugs are not in touch with any adjacent terminals.
- If this unit malfunctions, the electrical output may not respond correctly. If the safety of the equipment cannot be ensured, appropriate failsafe design or redundancy design, such as classification of the controller and limit or dual safety measures must be taken.
- Do not remove the seal from the cable gland connecting port until the wiring work is started.
- Do not expose this product to excessive shock during handling or usage beyond operating ranges recommended in the specifications. Doing so might cause faulty operation.

CONVENTIONS USED IN THIS MANUAL

The following conventions are used in this manual:

! Handling Precautions: Handling Precautions indicate items that the user should pay attention to when handling the intelligent earthquake sensor SES60.

UNPACKING

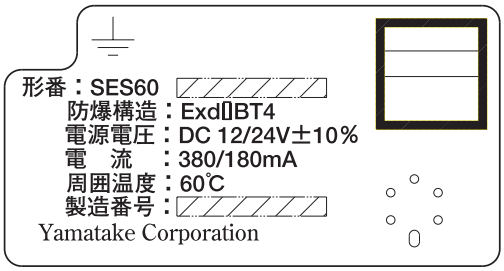
Check the following items when unpacking the SES60 from its package:

Name	Q'ty	Remarks
SES60	1	
Pressure-proof packings	1 set	Each set for cable outside diameters;9 to 9.5mm dia., 10 to 10.5mm dia., 11 to 12mm dia. Flameproof packing, 1pc. Washer, 2pcs
Cable gland set	1 set	cable gland, cable clamp, lock nut
Hexagon socket screw key	1	M3
Battery	1	Life, 10 years or longer;during power ON, 6 months; during power OFF at 20˚C
Hexagon socket head set screw	3	M6X10mm*
Cross recessed head screws with captive washer	3 sets	M5X30mm, M5X20mm
User's Manual	1	Manual number: CP-UM-5322E

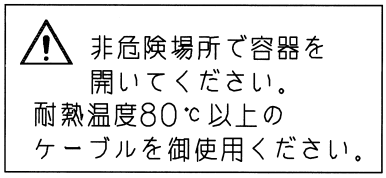
*: When using hexagon socket set screws for level adjustment, prepare hexagon socket screw key for M6.

■ Label and seal

The following nameplate, label and seal are attached to this unit:



Rating nameplate



Warning label

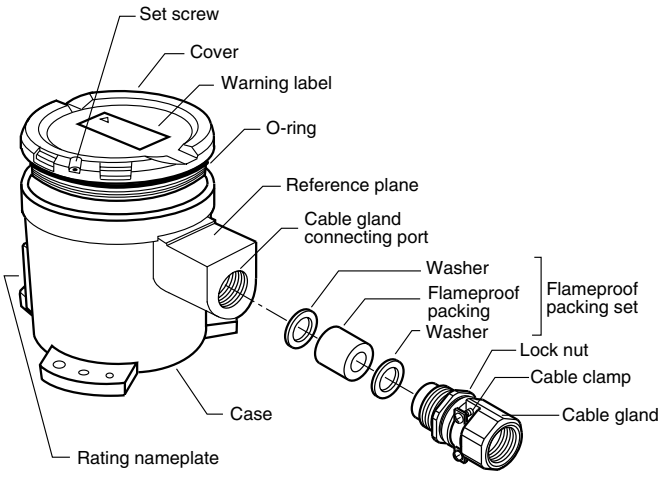
Seal

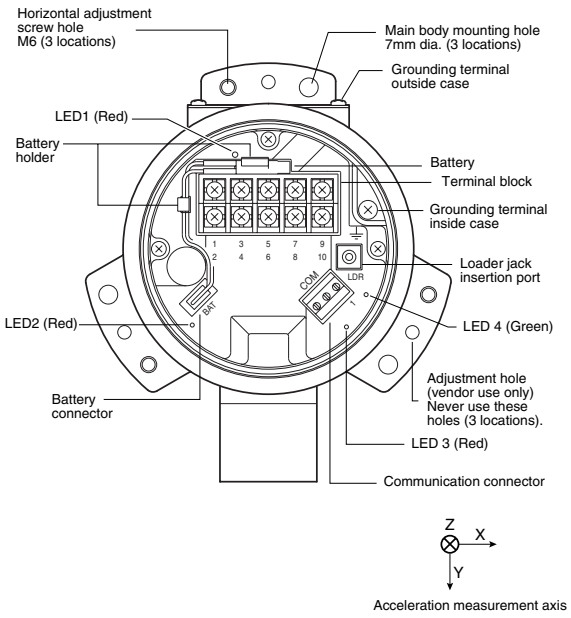
1. OVERVIEW

This intelligent earthquake sensor model SES60 (hereafter referred to as this unit) is designed to operate SI values and measuring vibration equivalent values, which are estimate values of the structure damage status, from the acceleration signals output from the built-in accelerometer.

Additionally, the unit judges the ground liquefaction from the acceleration waveforms characteristics, and then outputs the judgment results.

2. PART NAMES





3. INSTALLATION

⚠WARNING

For explosion-proof instrumentation, the installation and wiring must be performed conforming to the "Factory electrical facilities explosion-proof guidelines" by National Institute of Industrial Safety Independent Administrative Institution.

This unit has acquired the flameproof construction(Exd II BT4). Install this unit at a location conforming to the conditions for the flameproof construction.

⚠CAUTION

Lightning preventive measures are not taken for this unit. When necessary, take appropriate lightning preventive measures on the measuring instrument side.

Do not use a walkie-talkie within 2m of this unit and cables connected to this unit. Doing so might cause this unit to malfunction.

Do not expose this product to excessive impact/shock during handling or usage beyond its operating ranges as recommended in the specifications. Doing so might cause faulty operation.

■ Installation place

When installing this unit, do not install in the following locations where:

- Ambient temperature is beyond a range of -10 to +60˚C.
- Ambient humidity exceeds 90%RH.
- Temperature changes rapidly and dew condensation may occur.
- Corrosive gas or inflammable gas exists.
- A large amount of conductive material, such as dust, salt content, or iron particle, or organic solvent exists.
- Any impact or vibration other than the vibration caused by the earthquake is directly applied to the main body.
- Exposure to the direct sunlight.
- Water or rain splashes.
- Oil or chemical splashes.
- Strong magnetic field or electric field.

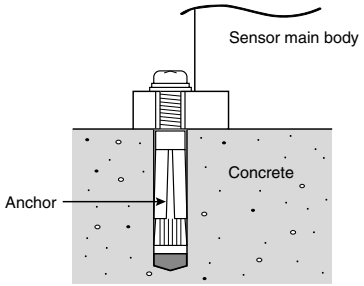
■ Installation procedures

This unit is an instrument that measures and calculates estimate values of the damage to the structure due to earthquake vibration. When installing this unit, it is recommended to install the unit on the concrete foundation of a building. When constructing a new concrete foundation for installation, it is recommended to connect it to the concrete foundation of the building.

Handling Precautions

- Do not use the adjustment hole (vendor use only) (at three locations) to install the unit.

When installing this unit, select one of the methods shown below depending upon the conditions of the installation location.



● **Levelness of the installation surface can be kept in a range of ±3°.**

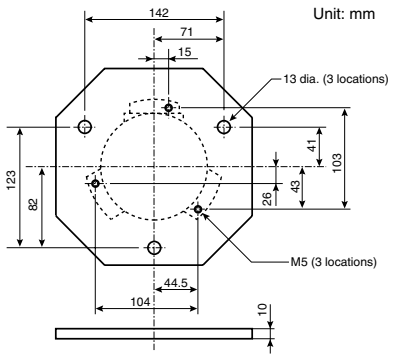
(1) Select a flat installation concrete surface.

(2) Construct anchors by matching the 7mm dia. main body mounting holes (at three locations) of this unit.

(3) Fix the sensor main body using three mounting screws (M5 X 30) supplied with this unit.

Note

Example of anchor:New AY plug PY4002 manufactured by Matsushita Electric Works, Ltd.



● **Levelness of the installation surface cannot be kept.**

(1) Prepare a mounting plate with 13mm dia. holes (three locations), which are commonly used for fixing the mounting plate to the concrete surface or for horizontal adjustment. Also, prepare a metallic plate (thickness 10mm or more) with M5 holes (three locations) to be used for fixing the main body. The following shows an example of the mounting plate:

Handling Precautions

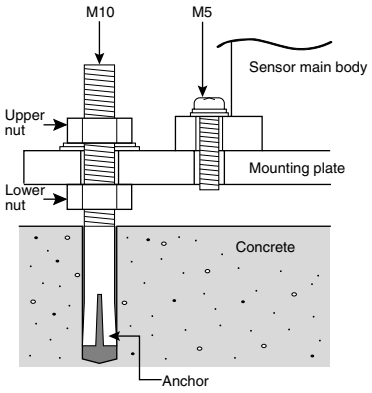
•When fixing the mounting plate to the concrete surface, use anchors with a size of M10 or more. In the above example, 13mm dia. holes are made in the mounting plate.

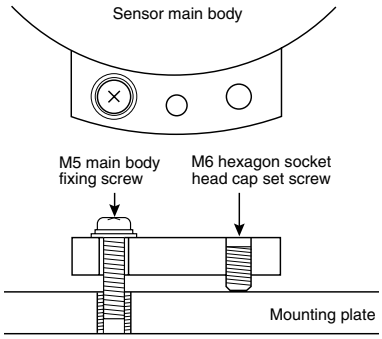
(2) Construct mounting plate fixing anchors (three locations) on the concrete surface.

(3) Fix the mounting plate to the anchors as shown in the following figure:

(4) Adjust the lower nuts at three locations so that the mounting plate is leveled.

(5) Fix the mounting plate using the upper nuts.





[!] Handling Precautions

- Tighten the upper nuts at three locations evenly so that the levelness does not change.
- After the mounting plate has been fixed, make sure that the levelness of the mounting plate is ±2° or less.

(6) Fix the main body temporarily using the mounting screws (M5 X 20) supplied with this unit.

(7) Check the levelness of the main body.

(8) Perform the fine adjustment of the levelness using the M6 hexagon socket head cap set screws for level adjustment.

(9) Tighten three mounting screws (M5 X 20), which have been fixed temporarily, to fix the main body firmly.

● Check items after installation

Put a level on the reference plane of this unit to check that the levelness is ±3° or less.

If the unit is not installed correctly, the unit may enter the failure status and may not function correctly.

4. WIRING

⚠WARNING

- For explosion-proof instrumentation, the installation and wiring must be performed conforming to the "Factory electrical facilities explosion-proof guidelines" by National Institute of Industrial Safety Independent Administrative Institution.
- Always use cables with a heat resistant temperature of 80°C or more.
- Always use the cable gland and flameproof packing set supplied with this unit. If other components are used, the unit cannot be used as an authorized explosion-proof product.
- Always turn OFF the power completely before starting the wiring work. Failure to do so might cause electrical shock.
- Do not turn ON the power with the cover opened in a hazardous area. Doing so might cause explosion or fire.

⚠CAUTION

- Always carry out the wiring work properly. Incorrect wiring may cause this unit to malfunction.
- Pay special attention so that the crimp type terminal lugs are not in touch with any adjacent terminals.

■ Installation place

(1) The cable lead-in method of this unit uses flameproof packings. The applicable cable outside diameter is 9 to 12mm dia. Three kinds of flameproof packing sets corresponding to the cable outside diameters are supplied with this unit. Always use a proper flameproof packing suitable for the outside diameter of the cable.

- Outside diameter of cable 9 to 9.5mm dia.: Flameproof packing set (Model No.: 81406180-001)
- Outside diameter of cable 10 to 10.5mm dia: Flameproof packing set (Model No.:81406180-002)
- Outside diameter of cable 11 to 12mm dia.: Flameproof packing set (Model No.:81406180-003)

(2) Loosen the set screws to open the cover.

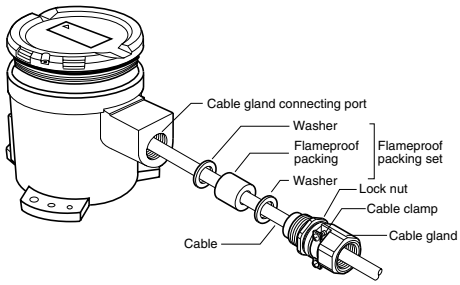
(3) Run the cable into the main body as shown in the figure below and connect it to the terminal block.

(4) Tighten the cable gland until the cable is no longer moved.

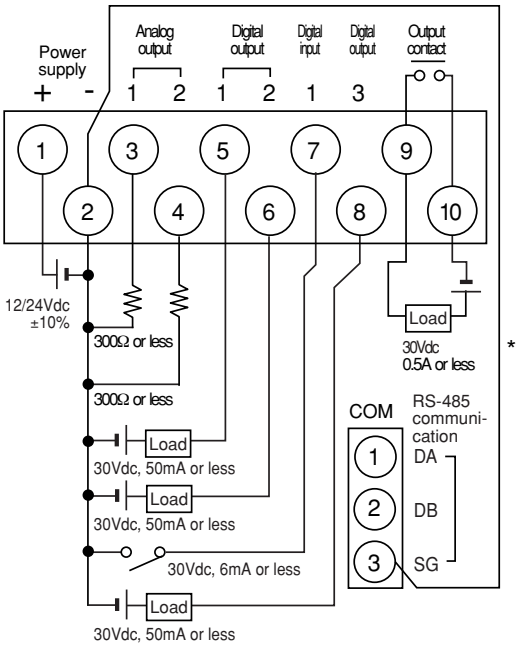
(5) Tighten the lock nut.

(6) Fix the cable using the cable clamp.

(7) Connect the cable of the battery supplied with this unit to the battery connector and insert the battery into the battery holder.



● **Wiring diagram**



*:The terminal block (2) and communication connector (3) are connected inside this unit.

● **Power supply and Input/Output terminal block**

Terminal No.	Signal name
1	Power supply (+) (12/24Vdc)
2	Power supply (-) (0Vdc)
3	Analog output 1, 4 to 20mA (Synthesized AC acceleration value, SI value, and measuring vibration equivalent value)
4	Analog output 2, 4 to 20mA (Synthesized AC acceleration value, SI value, and measuring vibration equivalent value)
5	Digital output 1 (Minor failure *1)
6	Digital output 2 (Serious failure *2)
7	Digital input 1 (Maintenance mode or standby mode transition request)
8	Digital output 3 (Liquefaction output)
9	Relay contact output (Vibration detection output)
10	Relay contact output (Vibration detection output)

*1: The minor failure does not affect the control outputs and is waveform memory or time data retention error, clock data error, and error status needing confirmation of the installation conditions.
In the minor failure status, the LED4 (green) is lit and the LED2 (red) is flashing.
The digital output 1 repeats ON and OFF in a mode other than the noise detection and measurement modes.
Additionally, it is possible to turn ON the digital output 1 only in the minor failure status by changing the setting.

*2: The serious failure is a failure that may affect the control functions, such as vibration detection output or liquefaction output.
The LED4 (green) is lit and LED1 to 3 (red) are flashing.
The minor failure output is also output in the serious failure status.

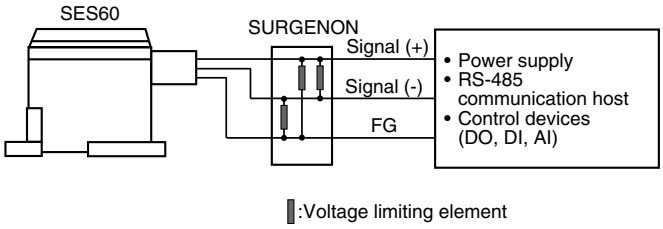
● **Communication connector**

Pin No.	Signal name
1	RS-485 communication DA
2	RS-485 communication DB
3	RS-485 communication SG

! Handling Precautions

- When constructing an explosion-proof instrumentation system, always use proper wiring cables according to the technical direction given by National Institute of Industrial Safety, Independent Administrative Institution, "Guidance to industrial explosion-proof electric facilities for users", (gas explosion-proof 1994).
- Keep the wiring cables away from the cables connected to the commercial power supply or motor drive power supply that may produce noise easily.
- Use shielded cables for the wiring and connect the shield line to the grounding terminal inside the case to form one-point grounding construction.
- For terminal block connections, use crimp type terminal lugs suitable for M3.5 screws.
- Use a cable with a cross-sectional area of 0.14 to 1.5mm^2 (AWG28-16) for the communication connector connection cable. At this time, the stripped length of the cable sheath should be 7 mm.
- Do not use soldered stranded wires for the cable connection part of the communication cable.
- A plug is inserted into the communication connector. Remove the plug before starting the wiring work. Additionally, use a screwdriver with a bit size of 0.4 X 2.5 X 80 mm.
- A component equivalent to the terminating resistor is built-into this unit. Do not connect any external terminating resistor during RS-485 communication wiring work.
- Connect the wires and cables properly while referring to the wiring diagram.
- Two grounding terminals are provided, one on the terminal block inside the case and another grounding terminal outside the case. Ground the either terminal to an earth of less than 100Ω.

- If the battery supplied with this unit is not used, the clock data and waveform memory data are not backed up in the non-energized state. If this happens, the unit enters the minor failure status.
- If the battery is not connected or if the clock is not set, the unit enters the minor failure status.
- When it is predicted that lightning surge occurs if the signal and power cables are extended, use Yamatake's FA SURGENON, an induced lightening surge preventive device (model No.: QN430C series).
  For details about wiring,
  ☞ refer to the User's Manual for FA SURGENON QN430A/B/C, CP-UM-1192E.



5. PREPARATIONS FOR START-UP

⚠WARNING

When using a loader (optional unit), always use it in a non-hazardous area.
Failure to do so might cause explosion or fire.

Use a Smart Loader Package SLP-SE6 (optional unit) to make the clock setting.

(1) Connect the loader.

(2) Turn ON the power to this unit and wait until the LED4 (green) is lit.

(3) Set the time of the sensor built-in clock using the loader.

(4) After the time has been set, wait until the LED4 is lit.

(5) Make sure that only the LED4 is lit (normal operation status).

[!] Handling Precautions

•If any other LED (red) is flashing, an error may have occurred. Check the contents of the error on the detailed error screen of the loader and take corrective actions. For details, refer to Chapter 5., TROUBLESHOOTING, of the Smart Loader Package SLP-SE6 for Intelligent Earthquake Sensor SES 60 User's Manual, CP-UM-5336E.

(6) After checking the normal operation status, turn OFF the power and disconnect the loader.

(7) Manually tighten the cover firmly until the flange of the cover is in contact with the case. Tighten the set screw securely using the hexagon socket screw key supplied with the unit.

(8) Turn ON the power. After approximately 60s have elapsed, the unit enters the earthquake measurement status.
For details about how to operate the loader,
☞ refer to the Smart Loader Package SLP-SE6 for Intelligent Earthquake Sensor SES 60 User's Manual, CP-UM-5336E.

[!] Handling Precautions

- If the clock is not set, the time is started from "00:00:00" on January 1, '50 and the unit enters the minor failure status.

6. MAINTENANCE AND TROUBLESHOOTING

■ Maintenance

Check the following items periodically:

- Check the case, cover, and cable gland for damage.
- Check for loose cable gland, cover, and set screw.
- Check for loose terminal screw.
- Check the cover O-ring for deterioration.
- Check that the angle of the reference plane does not exceed ±3° to the horizontal plane.

■ Troubleshooting

If this unit does not function or if the operation is faulty, check for the following items:

- Check for loose or faulty wiring.
- Check that the power voltage and/or the load resistance are correct.
- Check if any failure output occurs.
- Check also the following items using the loader (optional unit):
- Check if the acceleration and SI value are faulty.
- Check if any internal error is shown on the error detailed screen.
- Check if the manual output is set.

For details of corrective actions if any failure occurred,
☞ refer to the Intelligent Earthquake Sensor SES60 User's Manual "Design", CP-SP-1156E.

7. SPECIFICATIONS

■ Model selection guide

Standard product	SES60AV320-1010
Product with inspection certificate	SES60AV320-101D

■ Specifications

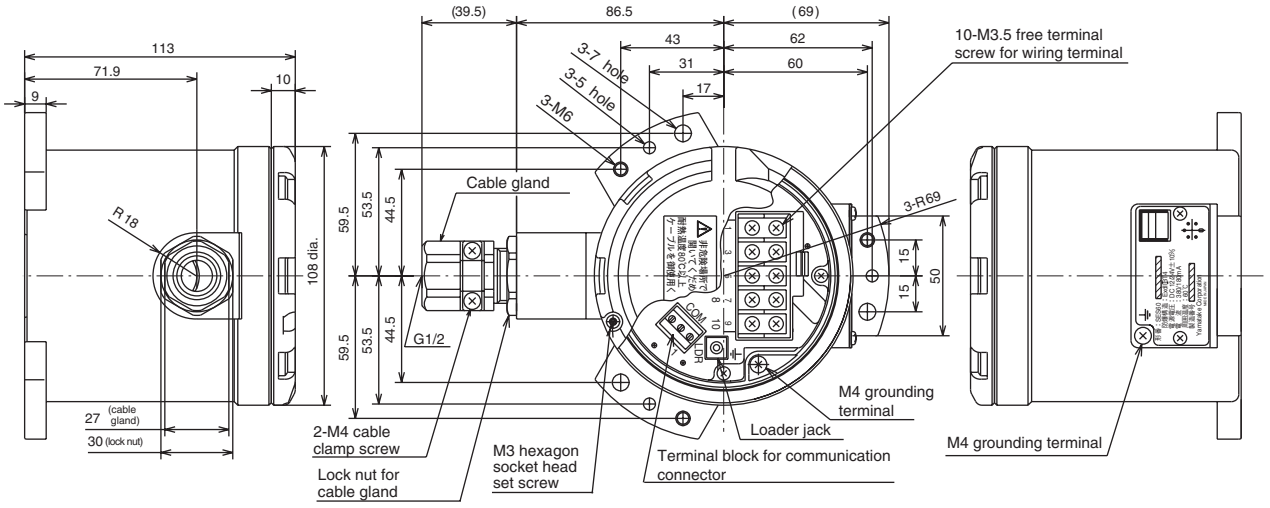
Item		Contents
Basic specifications	Explosion-proof standard	Exd II BT4 (Flameproof construction)
	Rated acceleration range	±2000Gal (X-, Y-, and Z-axis)
	Acceleration measuring range	±2200Gal (X-, Y-, and Z-axis)
	Measuring acceleration resolution	1Gal (by measurement of DC acceleration)
	FSG sensitivity	X-, Y-, and Z-axis: ±2%FSG (±980Gal) *1
	FSG middle point	X-, Y-, and Z-axis: ±3%FSG (±980Gal) *1
	Linearity	X-, Y-, and Z-axis: ±2%FSO (+2000Gal), ±2%FSO (-2000Gal) *1
	Other axis sensitivity	X-, Y-, and Z-axis: ±3%
	Noise	X-, Y-, and Z-axis: 2Gal (Acceleration filter: 30Hz)
	Acceleration sampling	10ms
	Acceleration waveform recording	10ms-sampling for 120s, X-, Y-, and Z-axis waveform, 10 records
Electrical specifications	Rated voltage	12Vdc±10% or 24Vdc±10%
	Current consumption	380/180mAdc
	Contact output (Vibration detection output)	Relay 1a (Default setting before shipment: turned ON when the SI value is 30kine or more.)
	Digital output 1 (Minor failure output)	NPN open collector (turned ON if serious failure occurs or flashes depending on the mode status.)
	Digital output 2 (Serious failure output)	NPN open collector
	Digital output 3 (Liquefaction output)	NPN open collector (turned ON if liquefaction is detected.)
	Analog output 1 *2	4 to 20mA current source (Default setting before shipment: synthesized AC acceleration is 0 to 2000Gal.)
	Analog output 2 *2	4 to 20mA current source (Default setting before shipment: SI value is 0 to 200kine.)
	Analog output load resistance	300Ω or less
	Digital input (diagnosis input)	Photo-coupler input current source
	RS-485 communication	3-wire, 19200bps
	Dielectric strength	500Vdc or 500Vac for 1min
	Insulation resistance	100MΩ or more (measured by 500Vdc Megger)
	Service life of battery	10 years (at 20°C): during power ON 6 months (at 20°C): during power OFF
Mechanical specifications	Material	Case/Cover: Aluminum alloy casting
	Allowable mounting angle	±3° or less to the horizontal mounting
	Cable gland shape	G1/2 (Pressure-proof packing)
	Mass	1.8 kg
Environmental specifications	Operating temperature	Ambient temperature: -10 to +60°C (non-condensing)
	Accuracy guarantee temperature	Ambient temperature: 0 to 50°C (non-condensing)
	Storage temperature	-20 to +70°C
	Water-proof and dust-proof ability	IP67 (submerged 1m for 30min), JISC0920 water-tight type (except for metallic cable piping)
	Vibration resistance	19.6 m/s^2 or less
	Shock resistance	490 m/s^2 or less
Accessories		• Each set of pressure-proof packings (for cable outside diameters; 9 to 9.5mm dia., 10 to 10.5mm dia., 11 to 12mm dia.) • Flameproof packing, 1 pc. • Washer, 2 pcs. • Cable gland set, 1 set (cable gland, cable clamp, lock nut) • Hexagon socket screw key for M3 • Battery • Hexagon socket head set screw (M6, 10 mm), 3 pcs. • Cross recessed head screws with captive washer, 3 pcs. (M5 X 30 mm, M5 X 20 mm) • User's Manual (Manual number: CP-UM-5322E)
Optional unit		Smart Loader Package (SLP-SE6)

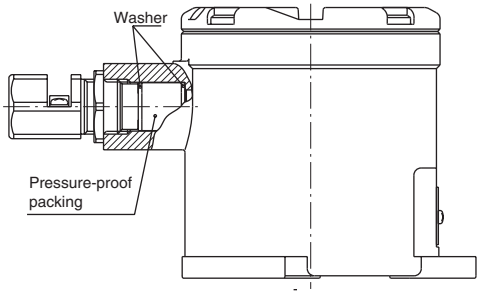
*1: Measuring conditions
- Power voltage: 12Vdc±10%, 24Vdc±10%
- Ambient temperature: 0 to 50°C
- Humidity: 50±20%RH

*2: Any of the SI value, synthesized AC acceleration, and measuring vibration equivalent value can be selected.

■ External dimensions

Unit: mm





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