



## **Specifications**

Seismic Monitoring System

Model: SW-52EX

Manufacturer	<b>IMV Corporation</b>
Specification No.	TVE-5-7315
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## 1. Outline of this system

SW-52EX is a seismic monitor conforming to the flame-proof standard of Ex db IIB+H<sub>2</sub> T6 Gb, and the dust- ignition -proof standard of Ex tb IIIC 120°C Db.

This system enables real-time calculation of a modified Mercalli intensity (MMI) scale (PGA estimated value) and SI value, which is one of the standards to express on earthquake's destructive power against structures, according to an acceleration signal detected by the built-in servo acceleration pickup.

### ■ Analog output

This system provides two channels of 4 to 20 mA DC level outputs. To specify output for each channel, "Acceleration", "MMI scale" and "SI value" can be selected.

### ■ Alarm output

This system provides one channel of contact output (Photo MOS relay output), and three channels of digital outputs (open-collector outputs). Seismic alarm (acceleration, measured seismic intensity, SI value) or FAULT alarm (system error + power failure) can be arbitrarily selected for each channel.

### ■ Digital input

This system provides one channel of open-collector input or non-voltage contact input. The function of input can be changed depending on the communication setting from a host system.

[Seismic alarm reset / Time correction / Pickup test]

### ■ Communication function

This system supports Modbus-RTU communication via RS-485 interface.

Measurement data collection, system setting change, status monitoring and remote maintenance are enabled from a host system.

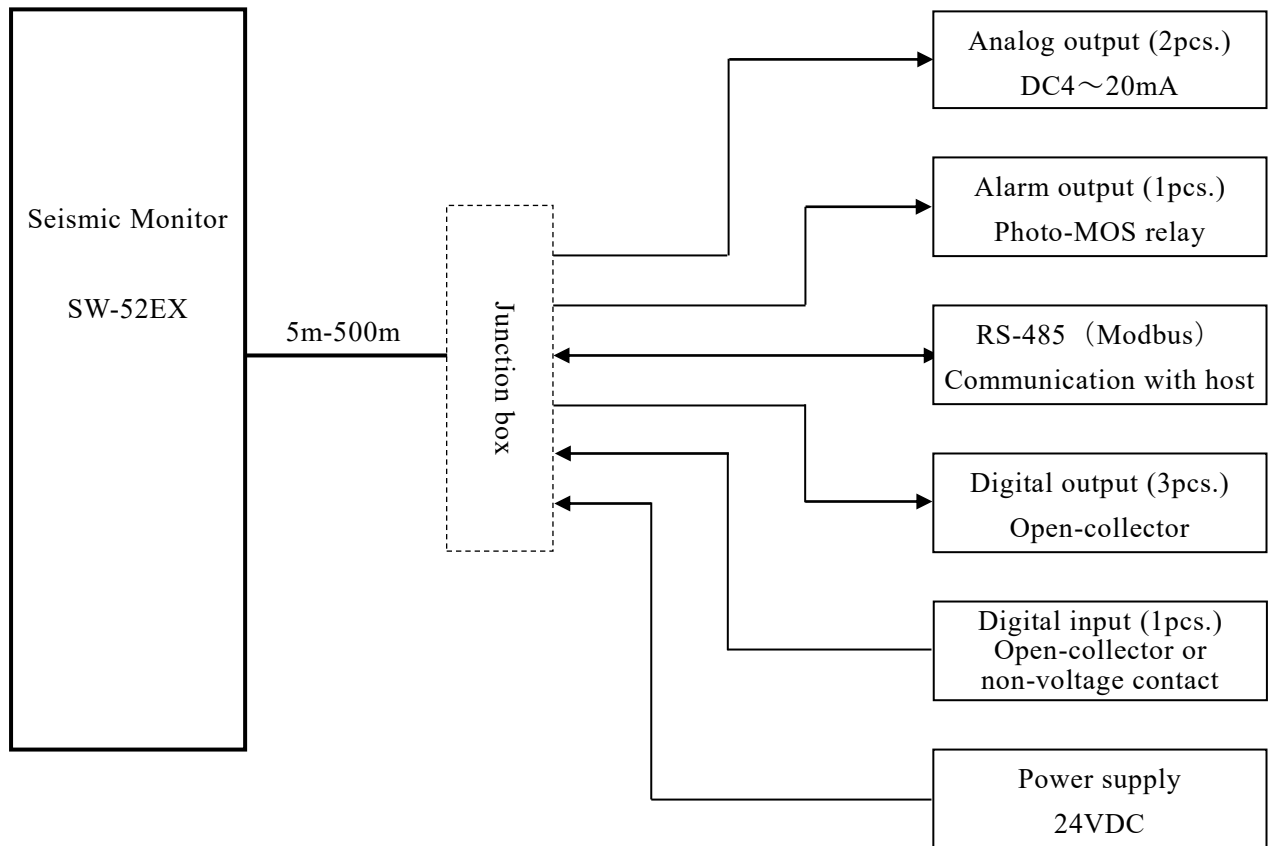
## 2. System configuration

### 2-1. Configuration of the equipment

	Product name	Model or size	Quantity	Remarks
Component	Seismic Monitor	SW-52EX	1	Flame-proof Dust- ignition -proof
	I/O cable	Length: 5 m	1	500m max.
	Installation plate		1	
Document	Specifications		1	
	Instruction manual		1	
	Inspection sheet		1	



2-2. System configuration diagram



NOTE:

When junction box is necessary in the explosion protection area, the explosion protection specification is also needed junction box .



### 3. Specifications of the system

#### 3-1. Seismic monitor (SW-52EX)

##### 1) Detecting method

All-directional detection based on vector composition acceleration

##### 2) Built-in pickup

Force-balancing servo acceleration pickup

Pickup sensitivity: 2.04 mV/Gal, ±5% (Based on gravity acceleration)

##### 3) Acceleration measurement

Maximum range: 0 to 5000 Gal (composite value of 3-component vector)

NS and EW axes: ±3000 Gal

UD axes: +2000 to -3000 Gal

Rated range: 0 to 3000 Gal (composite value of 3-component vector)

±3% FS (3000 Gal)

Frequency range: 0.3 to 10 Hz ±10%

##### 4) SI measurement

$$SI = \frac{1}{2.4} \int_{0.1}^{2.5} Sv(h * T) * dT$$

Real-time calculation of speed response spectrum at measuring acceleration through twenty-five simulation filters with 1-degree of freedom, Inherent cycle: 0.1 sec. step

Maximum range: 0 to 5000 Kine (composite value of 3-component vector)

(Cycle: 2 seconds, 5000 Gal, Damping: 2%)

Rated range: 0 to 600 Kine (composite value of 3-component vector)

±3% FS (6000 Kine)

(Cycle: 1 second, 3000 Gal, Damping: 20%)

Cycle range: 0.1 to 2.5 seconds (0.1 sec. step)

Damping: 2 to 30% (Arbitrary setting in 1% step)

##### 5) Low-pass filter

30 Hz (-3 dB), 4<sup>th</sup> order Butterworth filter

##### 6) A/D converter

24-bit, 100 Hz sampling

##### 7) Data recording

History data storage: 50 cases + 1 case (Nos. 0 to 50)

Waveform data: 20 cases + 1 case (Nos. 0 to 20)

Saving format: Selection of “Latest First” or “Largest First”

\* History data Nos. 0 to 20 always correspond to waveform data.

\* To download recorded data, the optional maintenance software is required.



- 8) Seismic intensity scale calculation method  
Modified Mercalli intensity scale (PGA estimated value)
- 9) Analog output  
4 to 20 mA DC × 2 pcs (Load resistance: 300Ω or less)  
Selection of “Acceleration”, “SI” or “MMI scale” for each output.  
(MMI scale: Full-scale is fixed, 10-level output in 1.6 mA step)
- 10) Relay output  
1a contact (Photo-MOS relay)  
Contact rating: 40 V, 0.8 A (For AC and DC, peak value)  
Output content: “Seismic alarm” or “FAULT alarm” can be selected.
- 11) Digital output  
Open-collector output × 3 pcs. (D-GND is common.)  
Output rating: 30 V, 50 mA  
Output content: “Seismic alarm” or “FAULT alarm” can be selected.
- 12) Seismic alarm  
Alarm is output when the system detects earthquake and the measured value exceeds a preset level.  
Upper limits of 4 levels (Digital output 1 to 3, Relay output) can be individually specified.  
Output factor: “Acceleration” or “SI value” can be selected.  
Output level: 0.1 to 999.9 (Gal/Kine)  
0.1 step, 0.0: Alarm is OFF.  
Reset time: 1 to 9999 seconds, 1-sec. step  
0 sec.: Auto-reset is disabled.
- 13) Seismic alarm reset  
Internal timer or digital input (Digital input setting is required.)
- 14) FAULT alarm  
The alarm is output at detection of any of the following errors:  
“Hardware self-diagnosis”, “Pickup self-diagnosis”, “Pickup test” or “System power failure”
- 15) Hardware self-diagnosis  
Content of diagnosis: Internal power supply voltage error monitoring  
Detection timing: Anytime
- 16) Pickup self-diagnosis  
Content of diagnosis: Angular displacement detection mechanism error monitoring  
Detection timing: At elapse of approx. 2 minutes after startup, 30-sec. intervals afterwards



17) Pickup test

Content of diagnosis: Servo mechanism error diagnosis

Detection timing: As scheduled (monthly or daily), or digital input (Digital input setting is required.)

Schedule setting: Schedule execution ON/OFF setting  
To be executed once a month depending on date, hour, minute and second settings.  
(Date setting of "0": To be executed everyday)

Time required for test: Approx. 90 seconds

\* During execution of pickup test, seismic monitoring is stopped.

18) Digital input

Open-collector or non-voltage contact input × 1 pcs. (D-GND is common.)

Open voltage: Approx. 13 V (ViH: 2.4 V or more, ViL: 0.8 V or less)

Input pulse width: 0.1 sec. or more

Function can be changed depending on communication setting:

[Seismic alarm reset / Time correction / Pickup test execution]

19) Serial I/F

Communication with host: Measurement data collection, system setting change, status monitoring,  
pickup test execution, digital input function changeover

Interface: RS-485 (2-wire type half-duplex communication)

Communication speed: 115,200 bps

Protocol: Modbus (RTU mode)

20) Clock

Accuracy: 20 ppm (monthly error: 50 seconds) or less

Calibration: ±30 sec. correction using digital input (Digital input setting is required.)

21) Operating temperature range

0°C to +50°C

22) Operating humidity range

10 to 100% RH (no condensation)

23) Power supply

24 V DC ±10%, 10 W or less



24) Protection rating

IP67 (Dustproof, watertight structure)

25) Pipe joint

G3/4

26) Explosion-proof standard

Marking

- TIIS: Ex d IIB+H<sub>2</sub> T6 Gb, Ex tb IIIC 120°C Db
- IECEX: Ex db IIB+H<sub>2</sub> T6 Gb, Ex tb IIIC 120°C Db
- ATEX: Ex db IIB+H<sub>2</sub> T6 Gb, Ex tb IIIC 120°C Db

Applicable standard

- TIIS: Explosion-protected electrical installations in general industries  
JNIOOSH-TR-46-1:2015, JNIOOSH-TR-46-2:2015, JNIOOSH-TR-46-9:2015
- IECEX: IEC60079-0: 2011, IEC60079-1: 2014-06, IEC60079-31: 2013
- ATEX: EN60079-0: 2012+A11: 2013, EN60079-1: 2014, EN60079-31: 2014

Certification No.

- TIIS: TC22341X
- IECEX: IECEX DEK 16.0004X
- ATEX: DEKRA 16ATEX0005 X

Classification of explosive gas

	450°C ≥ T1 > 300°C	300°C ≥ T2 > 200°C	200°C ≥ T3 > 135°C	135°C ≥ T4 > 100°C	100°C ≥ T5 > 85°C	85°C ≥ T6
IIA	Ammonia Carbon monoxide Ethane Toluene Propane Methane	Ethanol Butanol Butane Acetylacetone Vinyl chloride	Hexane Gasoline Kerosene Pentane	Acetaldehyde Trimethylamine		Ethyl nitrite
IIB	Hydrogen cyanide Acrylonitrile Coal gas	Furan Ethyl acrylate Ethylene	Dimethyl ether Cyclohexane Isoprene			
IIC	Hydrogen	Acetylene			Carbon disulfide	Ethyl nitrate





Classification of explosive dust (Group III)

	Type of dust	Electric resistance	Representative materials
IIIA	Combustible flyers Size > 500 $\mu\text{m}$	—	Textiles such as rayon, cotton, sisal hemp, jute
IIIB	Non-conductive dust Size $\leq$ 500 $\mu\text{m}$	Electric resistance > $10^3 \Omega\text{m}$	Powder such as cereal flour, sugar, toner, synthetic resin powder
IIIC	Conductive dust Size $\leq$ 500 $\mu\text{m}$	Electric resistance $\leq$ $10^3 \Omega\text{m}$	Metal powders such as carbon black, aluminum, magnesium

27) Installation method

Installation on floor (Fastened with anchors)

28) I/O cable

Cable gland (Connection via internal terminal block)

29) Size

See the outline dimension drawing.

30) Mass

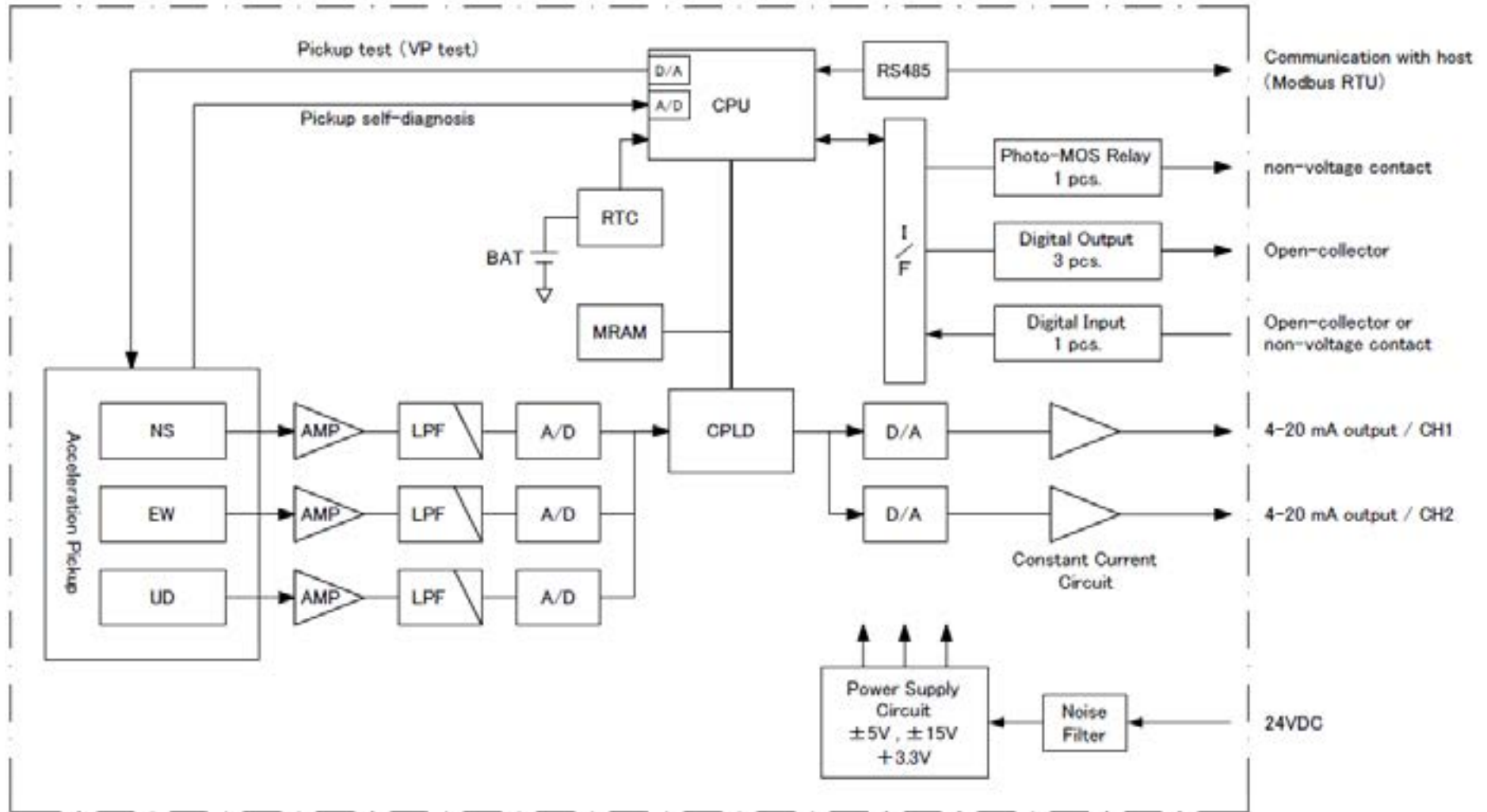
Approx. 5 kg

31) Coating color

Metallic Silver



### 3-2. Block diagram



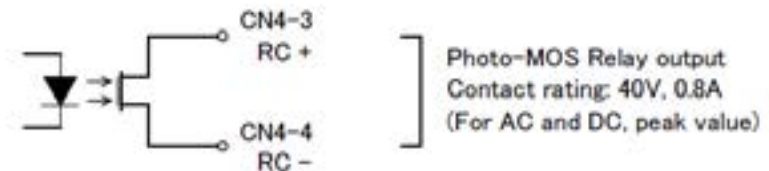
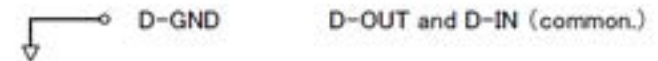
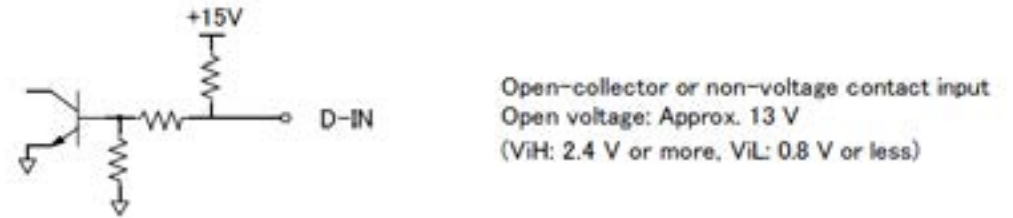
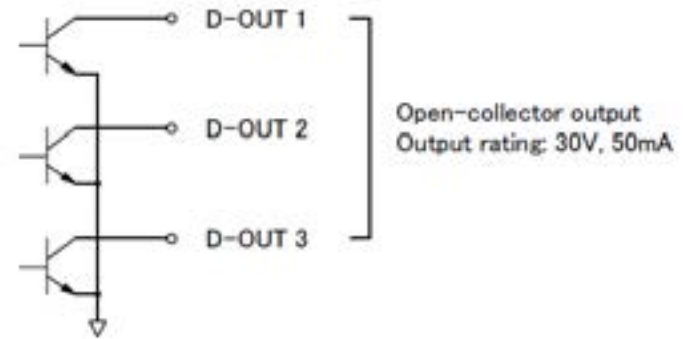


### 3-3. Connector pin assignment and digital I/O circuit

Terminal No.	Name	Signal function	Dedicated cable	
			Pair	Cable color
CN1	1	DC24V	1	Blue
	2	P-GND		White
	3	DA+	2	Yellow
	4	DB-		White
CN2	1	D-OUT1	3	Green
	2	D-OUT2		White
	3	D-OUT3	4	Red
	4	D-IN		White
CN3	1	D-GND	5	Purple
	2	A-GND		White
	3	A-OUT1	6	Blue
	4	A-OUT2		Brown
CN4	1	RC+	7	Yellow
	2	RC-		Brown
	3	(N.C.)	/	
	4	(N.C.)		
Screw Terminal	FG	Class D grounding	Shield	

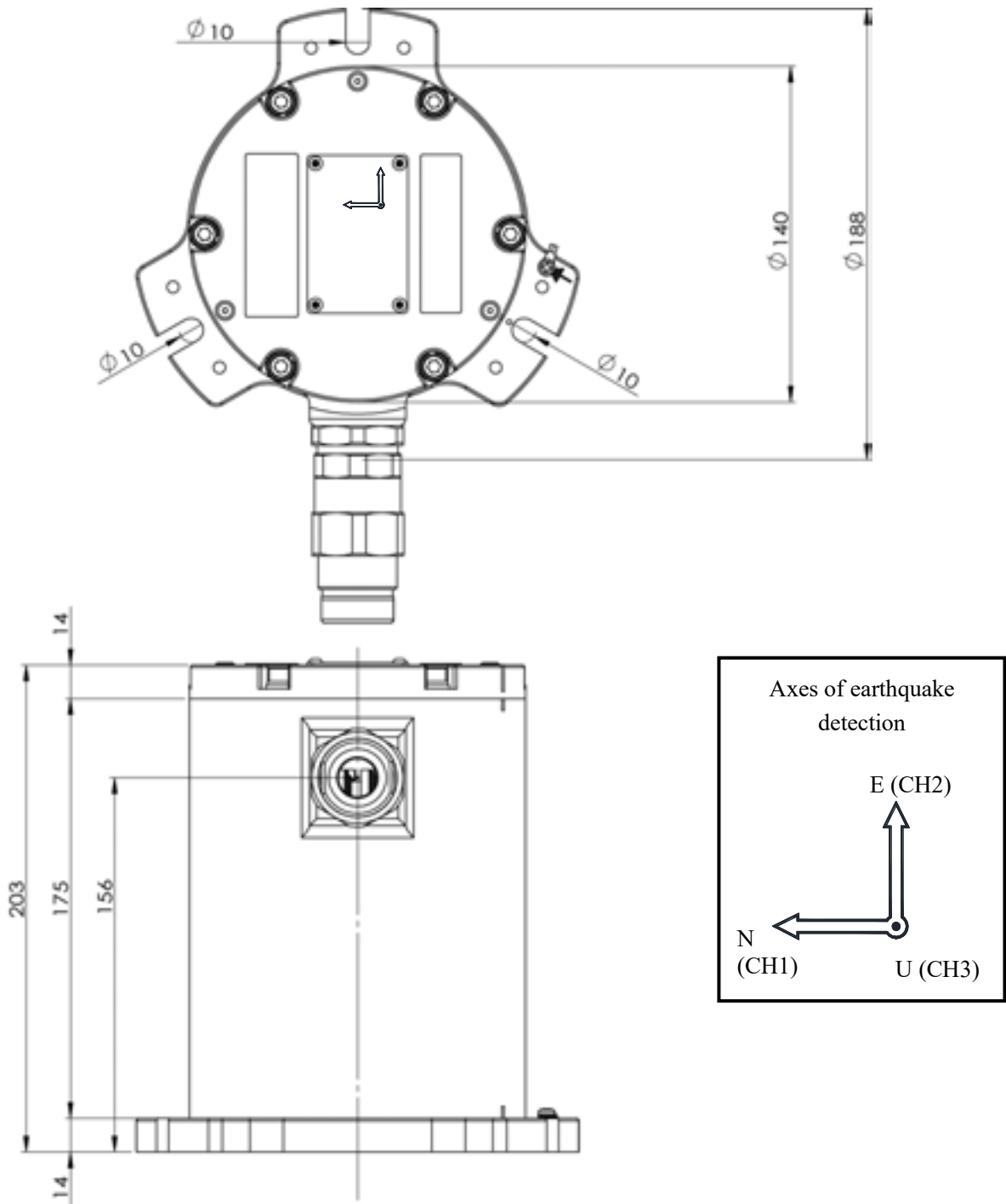
Terminal: Spring-lock type (Insulator peeling length :10 mm)

Cable: Twisted pair cable for instrumentation, 0.5 sq × 7 pairs (Finish outer diameter: Approx. 12.6 mm)





#### 4. Outline dimension drawings





## 5. Generals

### 5-1. Allocation of work

Regarding work related to electric equipment, piping, monitor panel, etc., allocation of work of the user and IMV shall be determined as follows:

Note: Special work other than those specified in this document, witnessed test, and changes in regulations shall be determined through separate discussion.

Scope of user's work: Installation, wiring and piping of power supply, installation and wiring of the equipment and related work

Scope of IMV's work: Manufacturing of the equipment, and delivery of the equipment to user's specified place

### 5-2. Seismic monitor installation place

Ambient temperature and humidity for installation of the equipment shall be 0 to +50°C, and 10 to 100%RH, respectively.

Do not install and use the equipment in the following places, even if the installation environment is within the above ranges.

- A place where the equipment is splashed with water or exposed to direct sunlight.  
(For outdoor installation, use a protective cover.)
- A place exposed to strong corrosive gas
- A place where artificial vibration is expected (many people access, or vibration source equipment is located near the equipment)
- A place with a hollow space under the floor

## 6. Warranty

If there is any breakdown caused by producing error, material fault, or obviously our fault, we repair or exchange with no charge. This condition is valid only in warranty term and the term is for 1 year after delivered.

However, even if it is under warranty, it will occur some charge on exchanging.

- (A) Any damage and breakdown caused by natural disaster such as fire, earthquake, flood, lightning amage.
- (B) Any transporting, moving, or dropping which does not related us after finishing our delivery.
- (C) Any error operation, unusual power supply input, and the fault caused by disassembling/repairing/modifying by customer.



## 7. List of seismic monitoring system settings

Detection trigger	Judgment component	Judgment condition	Acceleration detection level (Gal)	Velocity detection level (mKine)
Setting range	XYZ/XY/Z	OR/AND	0.1 – 99.9 (0.0: No judgment)	1 – 999 (0: No judgment)
Default setting	XYZ	OR	5.0	100

Alarm output	Type of alarm	Output factor (Seismic alarm only)	Level (Seismic alarm only)	Reset (sec) (Seismic alarm only)
Setting range	Seismic/FAULT	ACC (Acceleration) SI (SI value)	0.1–999.9 (0.0: No operation)	1–9999 (0: No operation)
Digital output 1	Seismic alarm	ACC (Acceleration)	80.0 (Gal)	300
Digital output 2	Seismic alarm	ACC (Acceleration)	250.0 (Gal)	300
Digital output 3	Seismic alarm	ACC (Acceleration)	400.0 (Gal)	300
Relay output	FAULT alarm	—	—	—

Analog output	Output factor	Full-scale
Setting range	ACC (Acceleration) SI (SI value) SCL (MMI scale)	10–3000 Gal 10–3000 Kine Fixed (Seismic intensity: 7)
4–20 mA CH1	ACC (Acceleration)	1000 (Gal)
4–20 mA CH2	SI (SI value)	200 (Kine)

Digital input	Function
Setting range	Seismic alarm reset / Time correction / Pickup test execution
Default setting	Time correction

Pickup test	Automatic VP test	Date	Time
Setting range	ON/OFF	0 (everyday) to 31 (specified day in every month)	00: 00: 00 – 23: 59: 59
Default setting	OFF	1	9: 00: 00