







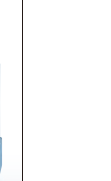
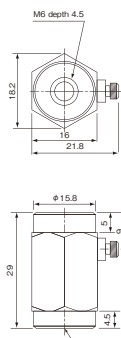
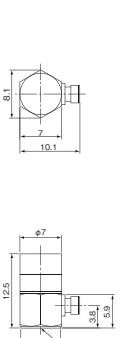
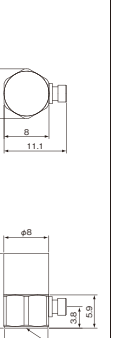
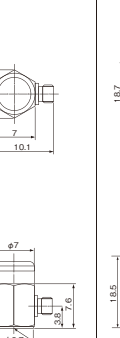
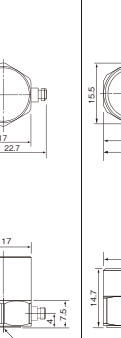
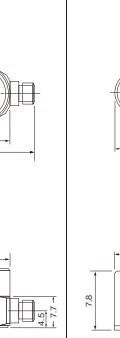
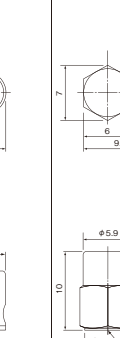
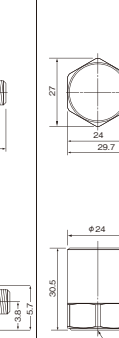
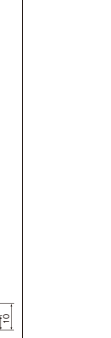




# ACCELEROMETER











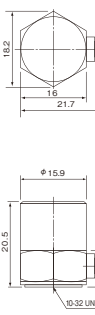
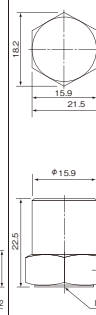
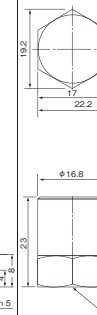
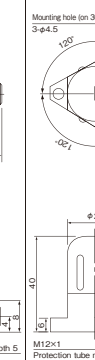
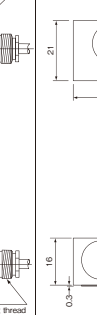
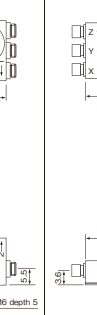
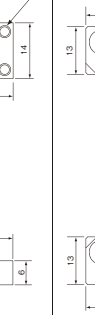
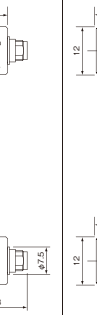
# Accelerometer Products

		Standard piezoelectric type	Compact, integrated amplifier			General type		Compact, lightweight type		High sensitivity type
Photo	Model	Can be supplied with JCSS calibration certificate	Compact, lightweight, High temperature	Compact, lightweight, High sensitivity	Compact, lightweight, TEDS compliant	Electric charge, general purpose	Electric charge, general purpose	Electric charge, Compact, lightweight	Electric charge, Compact, lightweight	Electric charge, High sensitivity
										
Outline / purpose		Standard accelerometer for secondary calibration	Compact, lightweight, high temperature resistance	Compact, high-temperature resistance, High sensitivity applicable	Compact, lightweight, TEDS applicable	General purpose standard accelerometer	Fairly compact general purpose standard accelerometer	For measurement of lightweight structures and mode analysis	For measurement of lightweight structures and mode analysis	High sensitivity accelerometer for measurement of large structures
Principle		Compression	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Mass g		38	1.8	3	2	23	9	0.7	1.2	115
Charge sensitivity pC/(m/s <sup>2</sup> ) *1		0.47	—	—	—	6.42	0.714	0.102	0.18	40
Voltage sensitivity mV/(m/s <sup>2</sup> ) *1		—	1	11	0.5	—	—	—	—	—
Vibration frequency range (±1dB) Hz *2		20 to 1 000 (±1 %) ≡Vibration frequency range where secondary calibration is possible	1 to 20 000 (±10 %)	1 to 15 000	1 to 20 000 (±10 %)	1 to 7 000	1 to 10 000	1 to 25 000	1 to 25 000	1 to 3 000
Mounting resonance frequency kHz *2		30	55	50	50	24/21	36	52	70	9
Transverse sensitivity		3 % or less	5 % or less	5 % or less	5 % or less	4 % or less	4 % or less	5 % or less	5 % or less	5 % or less
Standard mounting method Screw torque N·m *3		VP-56A M6 screws 2.0	VP-53K M3 screws 0.5	VP-53K M3 screws 0.5	VP-53K M3 screws 0.5	VP-53A M6 screws 3.5	VP-53A M6 screws 3.5	Bond	VP-53K M3 screws 0.5	VP-53A M6 screws 3.5
Maximum measurable acceleration m/s <sup>2</sup> (peak)		5 000	5 000	450	7 000	5 000	10 000	10 000	10 000	400
Base distortion sensitivity (m/s <sup>2</sup> ) / μstrain		0.002	0.006	0.005	0.05	0.003	0.004	0.3	0.01	0.008
Thermal transient response (m/s <sup>2</sup> ) / °C		—	0.04	0.07	1.0	0.1	3	17	10	0.05
Temperature range for use / °C		−50 to +200	−50 to +170	−50 to +170	−20 to +100 (TEDS: −20 to +85)	−50 to +160	−50 to +160	−50 to +160	−50 to +160	−50 to +160
Capacitance pF		270	—	—	—	720	360	410	410	780
Case material		Stainless steel	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Stainless steel
Connecting equipment		Charge amplifier	2 mA to 4 mA regulated power supply	2 mA to 4 mA regulated power supply	2 mA to 4 mA regulated power supply	Charge amplifier	Charge amplifier	Charge amplifier	Charge amplifier	Charge amplifier
Dimensions mm										
		15.8(Hex)×29(H)	7(Hex)×12.5(H)	8(Hex)×13.3(H)	7(Hex)×11.4(H)	17(Hex)×18.5(H)	14(Hex)×14.7(H)	5.5(φ)×7.8(H)	6(Hex)×10(H)	24(Hex)×30.5(H)
Supplied accessories	Cable	1 VP-51A (2 m)	9 VP-51LC (2 m)	9 VP-51LC (2 m)	9 VP-51LC (2 m)	1 VP-51A (2 m)	1 VP-51A (2 m)	6 VP-51J (38 cm)	4 VP-51L (2 m)	1 VP-51A (2 m)
		15 VP-56A 17 VP-56B×2	13 VP-53K×2 9 VP-53W ● Single-head spanner (7 mm) ● Hex wrench1.5	13 VP-53K×2 9 VP-53W ● Single-head spanner (8 mm) ● Hex wrench1.5	13 VP-53K×2 9 VP-53W ● Single-head spanner (7 mm) ● Hex wrench1.5	14 VP-53A×2 10 VP-53D	14 VP-53A×2 10 VP-53D	20 VP-53V	13 VP-53K×2 8 VP-53J×2 ● Single-head spanner (6 mm) ● Hex wrench1.5 ● Dual-sided adhesive tape	14 VP-53A×2 10 VP-53D

**Notes** \*1 Representative value; actual value is noted on calibration sheet supplied with accelerometer.

\*2 Representative value when mounted on flat surface according to standard mounting method (\*3).

● Please take care not to drop accelerometers and carefully handle them with attachments. There is likely to be trouble of piezoelectric accelerometers by (giving) excessive shock. The excessive shock carries some damages onto piezoelectric ceramic element.

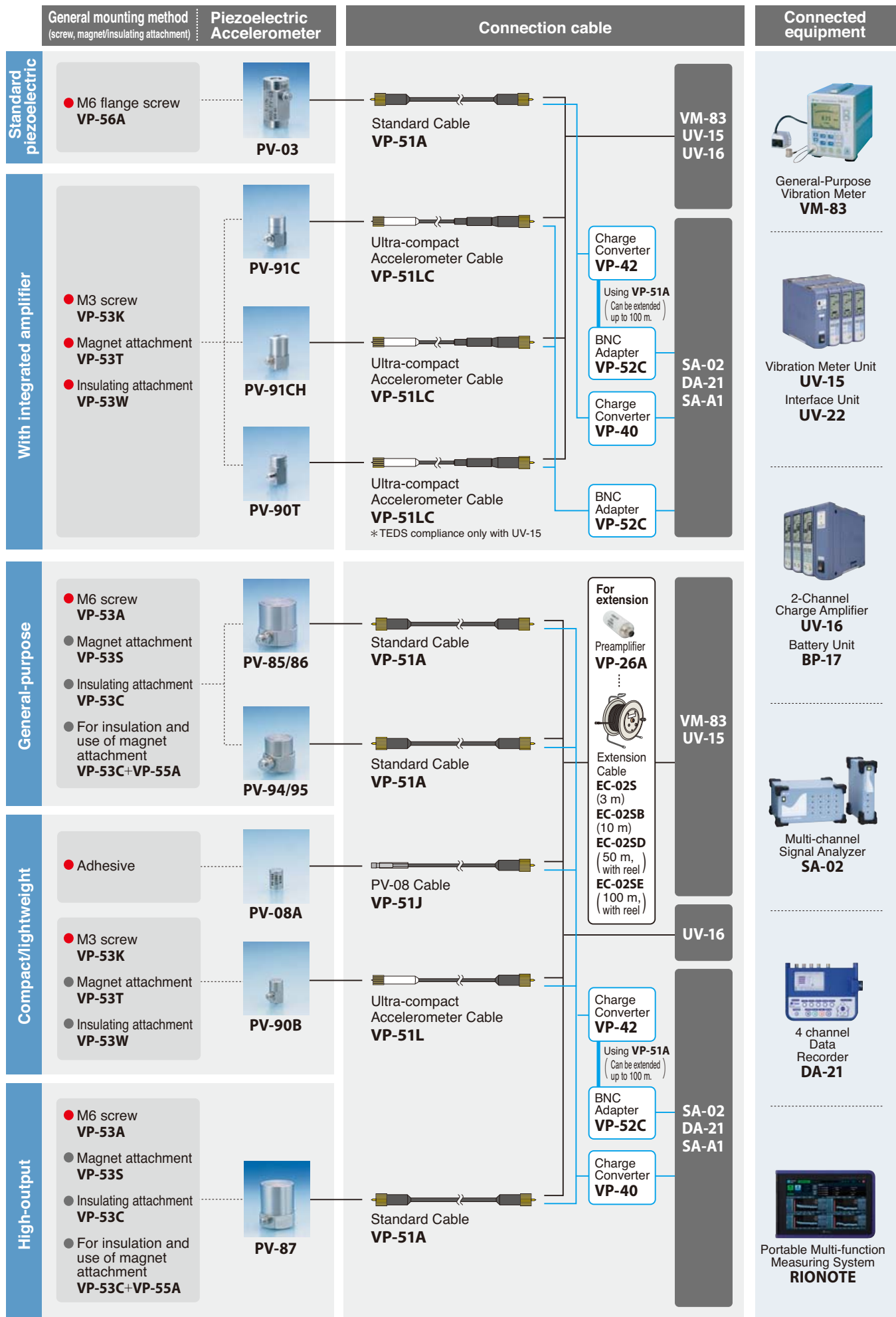
Heat resistant type					Waterproof insulation type	Triaxial type			
Photo	Electric charge, High temperature				Waterproof insulation	Electric charge, general purpose		Electric charge, High temperature	Compact, integrated amplifier
									
Model	PV-90H	PV-44A	PV-65	PV-63	PV-10B	PV-93	PV-97C	PV-97	PV-97I
Outline/purpose	Compact, lightweight, high temperature resistance	For measurement of machinery vibrations at high temperatures	For measurement of machinery vibrations at high temperatures	For nuclear reactor installations	Accelerometer with integrated amplifier, JIS C 0920 compliant protection class 8, waterproof to 2 at	General purpose triaxial accelerometer	Compact, lightweight triaxial accelerometer	Stable up to 200 °C Simultaneous 3-component measurement supported	Compact triaxial accelerometer with integrated amplifier
Principle	Shear	Compression	Shear	Shear	Compression	Shear	Shear	Shear	Shear
Mass g	2	29	26	28	120	30	4.7	10	8
Charge sensitivity pC/(m/s <sup>2</sup> ) <sup>※1</sup>	0.29	7.65	7.14	4.59	—	0.831	0.12	0.29	—
Voltage sensitivity mV/(m/s <sup>2</sup> ) <sup>※1</sup>	—	—	—	—	5.1	—	—	—	1.1
Vibration frequency range (±1dB) Hz <sup>※2</sup>	1 to 20 000 (±10 %)	1 to 10 000	1 to 9 000	1 to 8 000	3 to 8 000	1 to 8 000 (2-axis) 1 to 4 000 (1·3)	1 to 15 000 (Z) 1 to 10 000 (X·Y)	1 to 10 000	1 to 7 000 (Z) <sup>※4</sup> 1 to 5 000 (X·Y) (±10 %)
Mounting resonance frequency kHz <sup>※2</sup>	60	28	25	26	24	—	—	—	—
Transverse sensitivity	5 % or less	5 % or less	5 % or less	5 % or less	5 % or less	5 % or less	5 % or less	5 % or less	5 % or less
Standard mounting method	VP-53K M3 screws	VP-55K 10-32 UNF screws	VP-56A M6 screws	VP-56A M6 screws	M4 screws	VP-53A M6 screws	Bond	Bond	Bond
Screw torque N·m <sup>※3</sup>	0.5	2	3.5	3.5	1.5	3.5			
Maximum measurable acceleration m/s <sup>2</sup> (peak)	10 000	4 000	4 000	4 000	500	10 000	5 000	5 000	5 000
Base distortion sensitivity (m/s <sup>2</sup> ) / μstrain	0.05	0.04	0.01	0.01	0.1	0.6	0.1	0.1	0.1
Thermal transient response (m/s <sup>2</sup> )/°C	0.5	1	0.1	0.1	0.5	15	1.0	1.0	1.0
Temperature range for use / °C	-50 to +250	-50 to +260	-50 to +260	-20 to +300	-20 to +100	-50 to +160	-50 to +160	-50~+200	-20 to +125
Capacitance pF	500	970	3 900	2 800	—	410	420	500	—
Case material	Titanium	Stainless steel	Stainless steel	Stainless steel	Stainless steel	Titanium	Titanium	Titanium	Titanium
Connecting equipment	Charge amplifier	Charge amplifier	Charge amplifier	Charge amplifier	2 mA regulated power supply	Charge amplifier	Charge amplifier	Charge amplifier	2 mA to 4 mA regulated power supply
Dimensions mm									
Dimensions mm	7(Hex)×11(H)	16(Hex)×20.5(H)	15.9(Hex)×22.5(H)	17(Hex)×23(H)	23(φ)×40(H)	16(H)×21(W)×21(D)	6(H)×14(W)×14(D)	13(H)×13(W)×13(D)	12(H)×12(W)×12(D)
Supplied accessories	Cable	8 VP-51LB (2 m)	2 VP-51B (2 m)	2 VP-51B (2 m)	5 VP-51I (1 m)	3 VP-51C (2 m)	4 VP-51L×3 (2 m)	10 VP-51WL	7 VP-51W (3 m)
	Screw attachment	13 VP-53K×2 9 VP-53W ● Single-head spanner (7 mm) ● Hex wrench 1.5	18 VP-55K 16 VP-55L 10 VP-53D	14 VP-53A 10 VP-53D 16 VP-55L	1 VP-52A 15 VP-56A 17 VP-56B	● Direct-mount cable (5 m) (Without microdot connector fitted.) ● M4 hex socket bolt×3 (L10/SUS) ● 2L-4 flat head spring×3	14 VP-53A×2 10 VP-53D	● M3 hex socket bolt×2 (L20/SUS) ● Hex wrench 2.5	21 VP-57ES (Option)

※4 100 °C or less 1000 m/s<sup>2</sup> or less ※5 1 to 2 Hz (±15 %) at 150 to 170 degrees, 2 Hz to 20 kHz (±10 %).

※6 Maximum measurable acceleration depends on the temperature, charge sensitivity, and driving voltage. ※7 Typical value

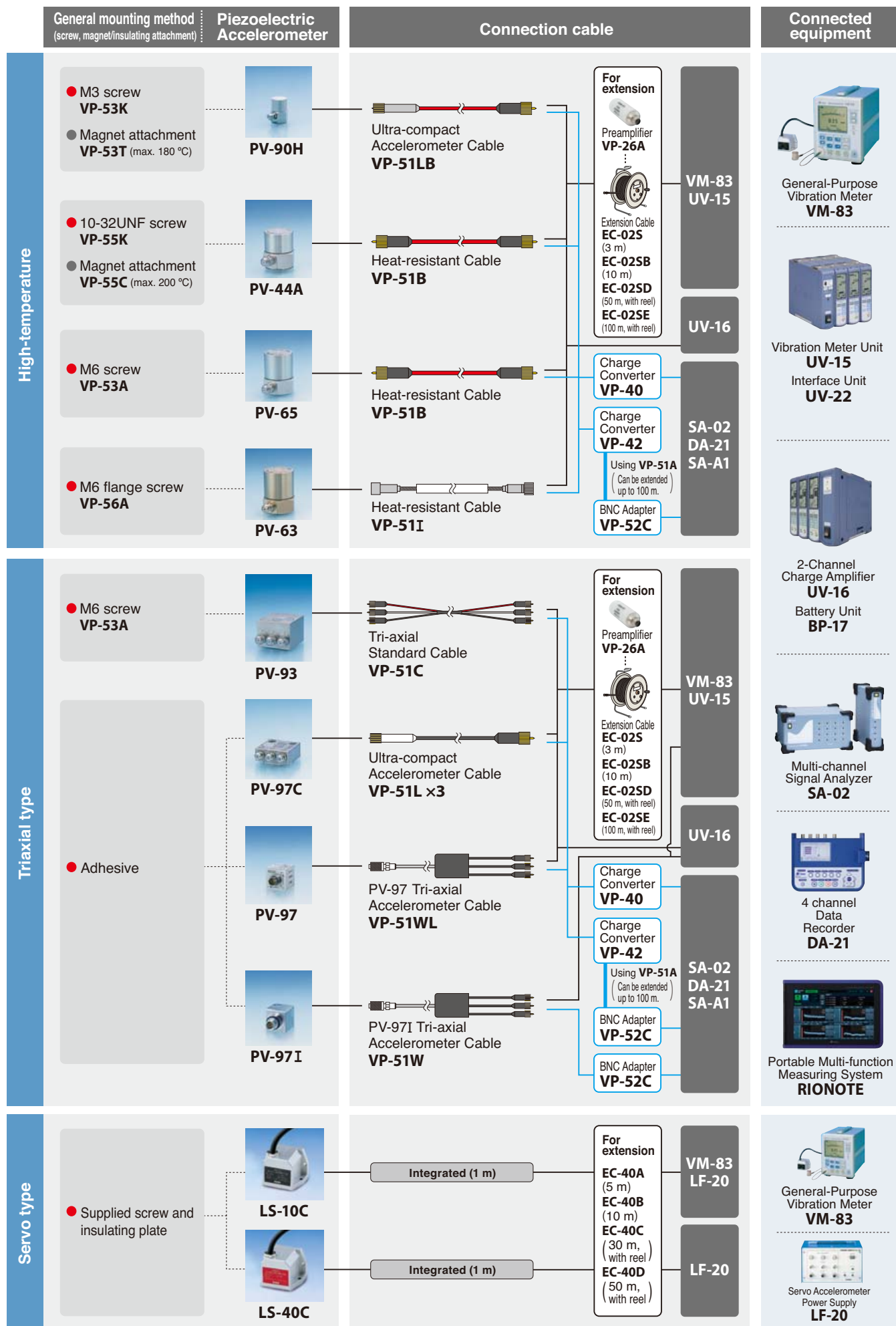
※8 0.6 Hz to 20 kHz (±20 %), 0.5 Hz to 20 kHz (±30 %)

# Accelerometer mounting and connection examples



● Standard mounting method    ● Other mounting methods





● Standard mounting method    ● Other mounting methods

## Low-noise coaxial cables

	Name	Model	Cable diameter	Connector screw thread	Capacitance	Max. temperature	Sheath material/color	Length
1	Standard cable*	VP-51A	φ2.1 mm	10-32UNF/10-32UNF	180 pF	105 °C	PVC · black	2 m 3 m 5 m 10 m
2	Heat-resistant cable*	VP-51B	φ2.1 mm	10-32UNF/10-32UNF	220 pF	260 °C	PTFE · red	2 m 3 m 5 m 10 m
3	Triaxial standard cable	VP-51C	φ2.1 mm	10-32UNF/10-32UNF	180 pF	105 °C	PVC · black/white/red	5 m 10 m
4	Ultra-compact accelerometer cable	VP-51L	φ1.2 mm	M3×0.5/10-32UNF	260 pF	160 °C	FEP · black	2 m 3 m 5 m 10 m
5	Heat-resistant cable	VP-51I	φ2 mm	10-32UNF/10-32UNF	150 pF	300 °C	Stainless steel plated	1 m
6	PV-08 standard cable	VP-51J	φ1.2 mm	M3×0.25/10-32UNF	60 pF	160 °C	FEP · black	38 cm
7	Tri-axial cable for PV-97I	VP-51W	φ2.4 mm	M5.5×0.5/10-32UNF	—	105 °C	PVC · gray	3 m 5 m 10 m
8	250 °C low-noise cable*	VP-51LB	φ1.35 mm	M3×0.5/10-32UNF	220 pF	250 °C	PTFE · red	2 m 3 m 5 m 10 m
9	Cable with 10-32 UNF connectors and ferrite core*	VP-51LC	φ1.2 mm	M3×0.5/10-32UNF	260 pF	160 °C	FEP · black	2 m 3 m 5 m 10 m
10	Tri-axial cable for PV-97	VP-51WL	φ3.2 mm	M5.5×0.5/10-32UNF	—	200 °C	PTFE · black	2 m 6 m

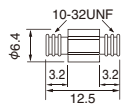
\*1 Besides the supplied VP-51C, the PV-93 can also be used with VP-51A x 3 or VP-51B x 3.

\*2 Besides the supplied VP-51L x 3, the PV-97C can also be used with VP-51LB x 3 or VP-51LC x 3.

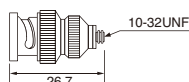
## Screws, attachments, other accessories

Unit : (mm)

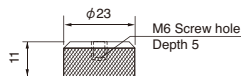
### 1 Link connector VP-52A



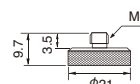
### 2 BNC adapter VP-52C



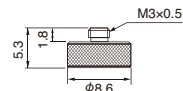
### 3 Magnet attachment VP-55A



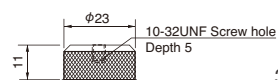
### 4 Magnet attachment VP-53S\*



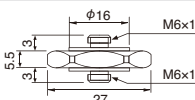
### 5 Magnet attachment VP-53T\*



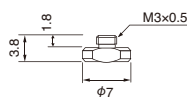
### 6 Magnet attachment VP-55C



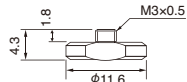
### 7 Insulation attachment VP-53C\*



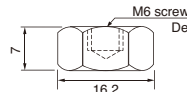
### 8 Insulation attachment VP-53J



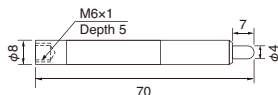
### 9 Insulation attachment VP-53W



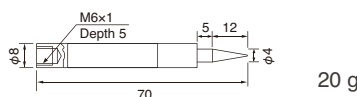
### 10 Flat hex attachment VP-53D



### 11 Round rod attachment VP-53E



### 12 Needle type bar attachment VP-53F



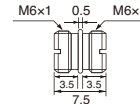
### 13 M3 screw VP-53K



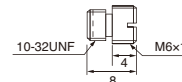
### 14 M6 screw VP-53A



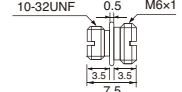
### 15 M6 barrel screw VP-56A



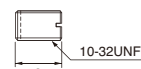
### 16 M6UNF screw VP-55L



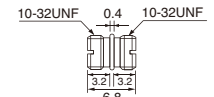
### 17 M6UNF barrel screw VP-56B



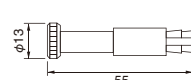
### 18 10-32 UNF screw VP-55K



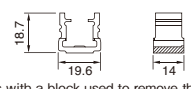
### 19 UNF barrel screw VP-56E



### 20 PV-08 mounting/removal tool VP-53V



### 21 Mounting kit VP-57ES (For PV-97I)



(Comes with a block used to remove the sensor)

\* The adhesive is used in attachments VP-53S, VP-53T and VP-53C. Please take caution, the operation temperature is -50 to 160 degrees C. If the temperature exceeds 160 degrees C, it could destroy its adhesiveness.

## For extension between accelerometer and vibration meter

### Vibration Meter Preamplifier VP-26A

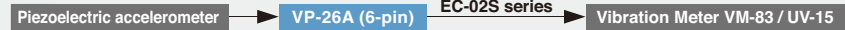


- Prevents sensitivity degradation by accelerometer cable
- Prevents increase in external noise
- Suitable for low-output accelerometers

#### Specifications

Sensitivity	1 mV/pC
Frequency range	0.16 Hz to 30 kHz
Supplied accessory	Cable (EC-02S, 3 m)

#### Extension examples



## Support for CCLD (Constant Current Line Drive)

### Charge Converter

(For direct connection to BNC input)

VP-40



### Charge Converter (Compact relay type)

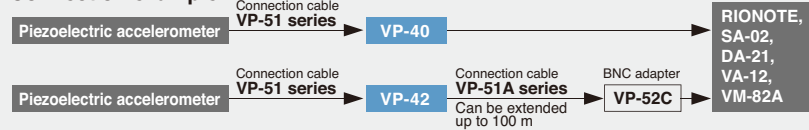
VP-42



#### Specifications

	VP-40	VP-42
Gain	1 mV/pC ±2.5 % (80 Hz)	1 mV/pC ±2.5 % (80 Hz)
Frequency range	1 Hz to 30 kHz (±5 %)	1 Hz to 30 kHz (±5 %)

#### Connection example



## Servo Accelerometer

These accelerometers support vibration measurement in the ultra-low frequency range from DC to about 100 Hz with flat frequency response. A low-noise vibration waveform can be obtained also when converting acceleration into velocity or displacement. Using the dedicated LF-20 power supply, the output can be supplied directly to an FFT analyzer, data recorder or similar device.

- The noise level rating of the LS-40C is 6 times lower than that of the LS-10C, making it suitable also for measurement of very low-level vibrations.
- Very low power consumption enables long-term measurements even when operating on battery power.

### Servo Accelerometer LS-40C



### Servo Accelerometer LS-10C



#### Specifications

	LS-40C	LS-10C
Maximum measurable acceleration	±20 m/s <sup>2</sup>	±30 m/s <sup>2</sup>
Sensitivity	Voltage sensitivity: 0.5 V/(m/s <sup>2</sup> ) ±1 % (DC) Thermal coefficient: 0.01 %/°C (typical value) Measurement frequency range: DC to 100 Hz (±10 %)	0.3 V/(m/s <sup>2</sup> ) ±1 % (DC) -0.0045 %/°C (typical value)
Residual noise*1 (representative value)	Max. 1.1×10 <sup>-7</sup> (m/s <sup>2</sup> )/√Hz (20 Hz)	Max. 7×10 <sup>-7</sup> (m/s <sup>2</sup> )/√Hz (10 Hz)
Self-test	Output vs. signal input 1/10 ±10 %	
Waterproof ranking	JIS C 920: 2003, class 7 (temporary submersion), IEC 60529: 2001, IPX7	
Dimensions	37(H)×37(W)×40(D)mm, Mounting flange 51 mm, mounting hole pitch 44 mm	
Weight	Approx. 230 g (including cable)	Approx. 220 g (including cable)
Supplied accessories	Insulating plate*2	

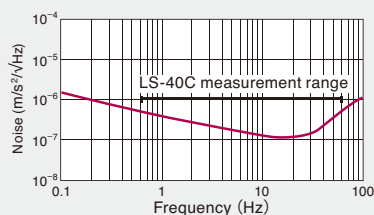
\*1 In the frequency range other than 10 Hz, noise will be higher than the given value.

\*2 The insulating board has a protrusion both on the front and on the back. If the insulation plate is to be used on the side where vibrations are to be measured, it may be necessary to make a modification.

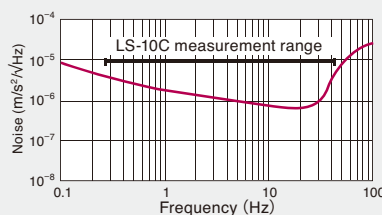
#### Extension cables for servo accelerometer

Name	Model	Cable diameter	Length
Extension cables for servo accelerometer	EC-40A	φ6.2	5 m
//	EC-40B	//	10 m
//	EC-40C	//	30 m (with reel, supplied with EC-40S)
//	EC-40D	//	50 m (with reel, supplied with EC-40S)
Servo accelerometer junction cable	EC-40S	//	5 m (for connection of LF-20 and reel)

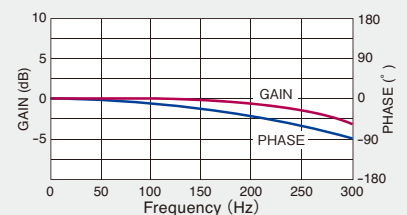
#### Noise characteristics (representative) LS-40C



#### Noise characteristics (representative) LS-10C



#### Frequency response and phase response (representative) LS-40C/10C



### Servo Accelerometer Power Supply LF-20

- Continuous operation with three LS-40C units approx. 50 hours, with three LS-10C units approx. 100 hours



### 3-Axis Mounting Base LS-13V

- Allows mounting of three servo accelerometers for simultaneous vibration measurement in three directions.



# What is the piezoelectric accelerometer?

Certain types of crystals will generate an electrical charge on their surface when pressure is applied. The amount of the charge is proportional to the external force. This phenomenon is called the piezoelectric effect, and the vibration acceleration sensor called a piezoelectric accelerometer makes use of it.

Piezoelectric accelerometers can be made compact and lightweight, allowing them to cover a wide vibration frequency range. Accuracy and reliability are also very good, and handling is simple.

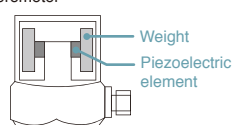
Thanks to these characteristics, piezoelectric accelerometers are widely used for many general applications, and also serve as reference accelerometers. There are two types of piezoelectric accelerometers, namely shear-type and compression-type, which differ in the way the piezoelectric element is used.

## Shear-type accelerometer

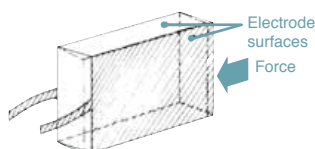
The accelerometer is constructed in such a way that the piezoelectric element is subjected to a shear force. Sensitivity is high, which allows for small dimensions. Pyronoise (pyroelectric output) caused by temperature changes is low, which is advantageous for measuring low-level vibrations and vibrations in the low frequency range. This type is useful for monitoring vibrations in machinery and buildings, and for seismometer applications.

Piezoelectric accelerometer types

Shear-type accelerometer



Principle of shear-type accelerometer

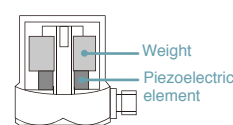


## Compression-type accelerometer

This type of accelerometer employs a weight on top of the piezoelectric element. The structure is simple and mechanical strength is high, making it suitable for high acceleration levels and shock measurements.

Piezoelectric accelerometer types

Compression-type accelerometer



- When using a piezoelectric accelerometer with a TEDS compliant measuring device, sensitivity setting must be performed.
- In case of a TEDS compliant piezoelectric accelerometer, sensitivity setting is not required.

# TEDS compliant piezoelectric accelerometer

This refers to a piezoelectric accelerometer that fulfills the **TEDS (Transducer Electronic Data Sheet)** requirements.

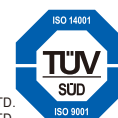
TEDS is a standard defined in IEEE1451.4, providing for sensor specific information such as manufacturer, model, sensitivity, mass etc. to be recorded in the piezoelectric accelerometer, allowing this information to be read by other equipment as needed. Some vibration meters and frequency analyzers are equipped with circuitry and software to read the sensor information. When connected to such equipment, sensor sensitivity will be automatically set. This is highly convenient especially when performing multi-point simultaneous measurement. Eliminating the need for making input settings for a large number of piezoelectric accelerometers saves time, and automatically adapting the sensitivity setting when a connection has been changed also helps to reduce measurement errors.



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