

HY-VT3K / HY-VT5K

Triaxial Vibration & Temperature Smart Sensors • On-board Spectral Processing • RS-485 Modbus RTU



HY-VT Series Triaxial Vibration & Temperature Sensor

Overview

The HY-VT series are contact-mounted triaxial vibration and temperature sensors designed for condition-based maintenance (CBM) of rotating machinery. A 32-bit floating-point DSP performs FFT, velocity integration and statistical feature computation inside the sensor, delivering ready-to-interpret diagnostic data over Modbus RTU — no external data acquisition unit required.

The housing combines 316 stainless steel with aluminium alloy and uses a single M12 connector carrying both power and communication. Bandwidth is identical on all three axes, and machine surface temperature is measured by direct contact.

Key Features

- Synchronous triaxial measurement, **identical bandwidth on all three axes** (including Z)
- Amplitude-accurate bandwidth: HY-VT3K **0.5 Hz – 3 kHz**, HY-VT5K **0.5 Hz – 5 kHz** (± 0.5 dB)
- HY-VT3K **noise density down to 20 $\mu\text{g}/\sqrt{\text{Hz}}$** ; HY-VT5K **$\pm 60$ g full scale, clipping-free**
- Spectral resolution **$\Delta f = 0.488$ Hz**, resolves $1\times / 2\times$ components at low shaft speeds
- RMS velocity to ISO 10816-3 / ISO 20816 with **zone A–D verdict output directly**
- **Frequency-axis accuracy ± 0.01 %** (crystal timebase) for trustworthy fault-frequency reading
- Contact surface-temperature measurement, not die temperature; usable bandwidth stated per mounting method
- Overload detection with data-validity flags — clipped data never enters the trend database
- $\varnothing 35 \times 27$ mm, 80 g body; RGB status LED; AES-128 encrypted field firmware update

Applications

Motors & pumps

Fans & blowers

Gearboxes

Low-speed mixers & rotating equipment

Marine auxiliaries

Cooling systems

Machine-tool spindles

Structural health monitoring

20 $\mu\text{g}/\sqrt{\text{Hz}}$

Low noise floor (HY-VT3K)

0.5 Hz – 5 kHz

Amplitude-accurate bandwidth
(HY-VT5K)

$\Delta f = 0.488$ Hz

Spectral resolution

± 1 °C

Contact surface temperature

CE The RMS velocity evaluation band conforms to ISO 10816-3 / ISO 20816 mechanical vibration measurement standards. RoHS compliant. Preliminary datasheet (Rev. 0.92); final specifications are subject to production qualification testing. Ordering information for the complete family is on page 5.

Parameter	HY-VT3K	HY-VT5K
Vibration Measurement		
Measurement axes	Triaxial (X / Y / Z), synchronous sampling	
Measuring range (selectable)	±4 / ±8 / ±16 g	±15 / ±30 / ±60 g
Frequency response (±0.5 dB)	0.5 Hz – 3 kHz	0.5 Hz – 5 kHz
Noise density	X/Y 20, Z 27 µg/√Hz (±4 g, HP mode)	X/Y 44, Z 55 µg/√Hz (±15 g, HP mode)
Resolution	16-bit	
Internal sampling rate	8 kHz	16 kHz
Frequency-axis accuracy	Better than ±0.01 % (crystal-derived timebase)	
Output Data		
Output parameters	Velocity / acceleration / displacement, FFT spectrum, time waveform, statistical features, shaft-order components and ISO zone verdict — see Measurement Functions on page 3	
Temperature Measurement		
Method	Contact NTC thermally coupled to the mounting face (machine surface temperature)	
Range / accuracy	–20 to +70 °C / ±1 °C (0 to +70 °C, look-up calibrated)	
Communication		
Interface / protocol	RS-485 half-duplex / Modbus RTU	
Baud rate	9.6 k – 921.6 kbps, with fail-safe biasing	
Register map	float32 measured values (byte order ABCD / CDAB selectable); parallel compatibility and extended register areas	
Related document	HY-VT Modbus Interface Specification IF-2026-004 — register map, status flags, paged spectrum protocol	
Diagnostics & Maintenance		
Data integrity	Sensing-chain overload detection (sticky flag); affected features are marked invalid	
Mounting health	Surface and die temperature compared continuously; abnormal drift indicates degraded thermal coupling	
Firmware update	AES-128 encrypted image, field update over RS-485, automatic recovery after power loss	
Power		
Supply	12 – 32 V DC, reverse-polarity protected	
Current consumption	20 mA typ. @ 24 V DC (auto-sleep between measurements)	
Indication	RGB LED (power / measurement / communication / alarm)	
Environmental & Mechanical		
Housing material / protection	316 stainless steel + aluminium alloy / IP67	
Operating temperature	–20 to +70 °C	
Shock rating	10,000 g at the sensing element (assembly rating per qualification report)	
Connector	M12 4-pin (A-coded): power + RS-485 on a single cable	
Dimensions	ø35 × 27 mm (body)	
Mounting / weight	M8 stud mount (standard) / 80 g body (hex-base version +112 g)	

Electrical Connection (M12 4-pin, A-coded)

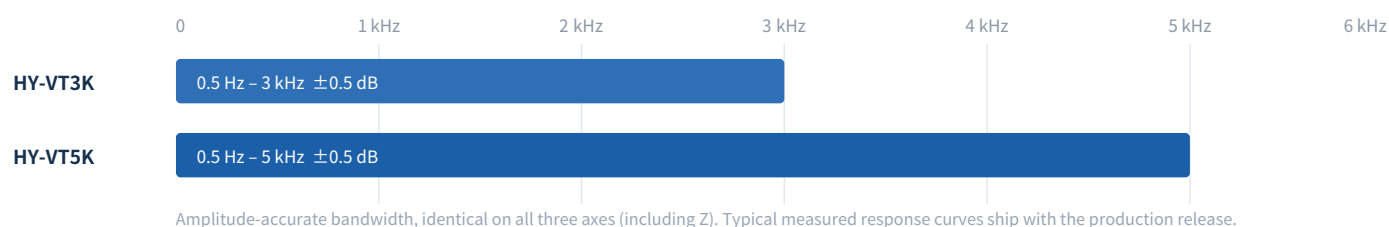
Pin	Signal	Pin	Signal	Notes
1	+V (12 – 32 V DC)	3	GND	Cable shield bonded to the connector body. 120 Ω bus termination provided by the system.
2	RS-485 A (+)	4	RS-485 B (–)	

Noise density is measured at the stated measuring range. Amplitude flatness (± 0.5 dB) applies with the factory-default digital equalisation filter enabled.

Measurement Functions

Function	HY-VT3K	HY-VT5K
RMS / peak velocity	10 – 1000 Hz (ISO 10816-3 / ISO 20816 evaluation band); upper limit configurable up to model bandwidth	
Acceleration RMS / true peak / p-p	Configurable band, from 0.5 Hz	
Displacement RMS / peak	2 – 1000 Hz (frequency-domain integration)	
True-peak detection rate	8 kHz (temporarily boosted to 32 kHz)	16 kHz (temporarily boosted to 64 kHz)
FFT spectrum	0 – 3 kHz / 6144 lines / Δf 0.488 Hz	0 – 5 kHz / 10240 lines / Δf 0.488 Hz
Time waveform	16384 samples @ 8 kHz (2.05 s)	32768 samples @ 16 kHz (2.05 s)
Statistical features	Crest factor / kurtosis / skewness / standard deviation	
Frequency analysis	Dominant-frequency detection; 1×, 2×, 3× shaft-order tracking (shaft speed written via Modbus register)	
ISO zone verdict	ISO 10816-3 Group 1–4 selectable; outputs zone A / B / C / D and exceedance flag	

Frequency Response Range



Design Highlights

A frequency axis you can trust. The sampling timebase is derived from a crystal oscillator, giving $\pm 0.01\%$ frequency-axis accuracy — bearing fault frequencies (BPFO / BPFI) and gear mesh frequencies stay readable without timebase drift.

Data integrity first. If the sensing chain overloads, a sticky overload flag is set and the affected feature set is marked invalid — clipped data never reaches the trend database and cannot cause a false verdict.

Measurement self-check. Surface (NTC) and die temperature are compared continuously; abnormal differential drift indicates a loose sensor or degraded thermal coupling, warning before the measured data becomes distorted.

Identical bandwidth on every axis. All three axes (including Z) share the same amplitude-accurate bandwidth and noise specification, so mounting orientation does not limit measurement capability.

Mounting Method and Usable Bandwidth

The high-frequency response of a contact vibration sensor is determined by the mounting interface. Guaranteed usable bandwidth is stated for each mounting method:

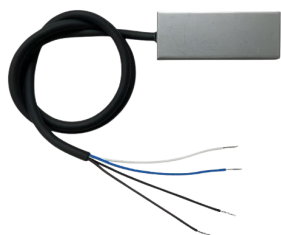
Mounting method	HY-VT3K	HY-VT5K
M8 stud mount (standard)	3 kHz (full bandwidth)	5 kHz (full bandwidth)
Adhesive (thin cyanoacrylate layer)	3 kHz	approx. 3 kHz
Magnetic base (accessory)	approx. 1.5 kHz	approx. 1.5 kHz



Hex-base version
(optional)

HY-VT2000

Overall Vibration Trending & Dual-Channel Temperature Sensor • IP68 • RS-485 Modbus RTU



HY-VT2000 Low-profile triaxial vibration sensor

Overview

HY-VT2000 is an overall-vibration trending and dual-channel temperature sensor that outputs triaxial RMS, peak, dominant frequency, overall vibration level and two temperature channels directly over Modbus RTU. A 60 × 25 × 7 mm low-profile housing, IP68 protection and a -40 to +85 °C operating range suit it to high-count deployment for trend-based predictive maintenance of motors, pumps, fans and gear reducers.

Difference from HY-VT3K / HY-VT5K: this model provides **no FFT spectrum or time waveform and does not support the ISO 10816 zone verdict** (its 550 Hz Z-axis bandwidth does not cover the 10 – 1000 Hz evaluation band); it is intended for overall-level trending. It does add a **second temperature channel** plus higher IP68 protection and a wider temperature range. Choose HY-VT3K / HY-VT5K where an ISO verdict is required; all three can be mixed on one gateway.

Key Features

- **Dual temperature channels** (equipment + ambient) monitored simultaneously, -40 to +125 °C, ±0.5 °C
- **IP68** protection, **all-316 stainless-steel housing**, -40 to +85 °C operating temperature
- Triaxial RMS acceleration, peak-to-peak, displacement, crest factor and overall vibration level
- Dominant-frequency measurement (0.1 Hz resolution): X/Y axes 0 – 1500 Hz, **Z axis 0 – 500 Hz**, for bearing, gear and misalignment indications
- Magnetic base or screw-bracket mounting; 4 × 0.25 mm² PUR shielded cable, 12 – 24 V DC supply

Product Specifications

Parameter	Specification	Parameter	Specification
Housing material / protection	All-316 stainless steel / IP68	Communication	RS-485 / Modbus RTU
Operating temperature	-40 to +85 °C	Supply	12 – 24 V DC
Frequency response	X/Y axes 0.5 – 1600 Hz; Z axis 0.5 – 550 Hz (bandwidth is not identical on all axes)		
Dimensions / mounting	60 × 25 × 7 mm; magnetic base or screw bracket	Cable	4 × 0.25 mm ² PUR, Al-foil shielded

Measurement Parameters

Parameter	Measuring range	Accuracy / resolution
Temperature 1 / Temperature 2	-40 to +125 °C	±0.5 °C
X / Y / Z RMS acceleration	±3 g (single range)	0.001 g
X / Y / Z overall vibration level	0 – 50 mm/s	0.01 mm/s
X / Y / Z displacement	0 – 2 mm (integration band 2 – 200 Hz)	0.01 mm
X / Y / Z dominant frequency	X/Y 0 – 1500 Hz; Z 0 – 500 Hz	0.1 Hz
X / Y / Z peak-to-peak	≤ 6 g p-p (limited by full scale)	0.022 g / LSB
X / Y / Z crest factor	0 – 10	0.001
X / Y / Z tilt	0 – 50 g	0.001 g

Specifications in this document are design values; the shipping production version governs. Product image is a conceptual rendering.

Model Selection Guide

All three models connect over RS-485 Modbus RTU and can be mixed on the same gateway. Select by the depth of diagnosis required.

Item	HY-VT2000	HY-VT3K	HY-VT5K
Positioning	Overall-level trending + temperature	Low-speed machines & structures, low noise	Standard CBM spectral diagnostics
Amplitude-accurate bandwidth	X/Y 0.5 – 1600 Hz; Z 0.5 – 550 Hz	0.5 Hz – 3 kHz (± 0.5 dB)	0.5 Hz – 5 kHz (± 0.5 dB)
Acceleration range	± 3 g	± 4 / ± 8 / ± 16 g	± 15 / ± 30 / ± 60 g
FFT spectrum	—	6144 lines, Δf 0.488 Hz	10240 lines, Δf 0.488 Hz
Time waveform	—	16384 samples	32768 samples
Temperature channels	2 (equipment + ambient), -40 to $+125$ °C	1 (contact surface), -20 to $+70$ °C	
ISO zone verdict on board	Not supported	Zone A / B / C / D output	
Housing / protection	All-316 stainless steel / IP68	316 stainless steel + aluminium alloy / IP67	
Operating temperature	-40 to $+85$ °C	-20 to $+70$ °C	
Connection	4 × 0.25 mm ² PUR shielded cable	M12 4-pin (A-coded)	
Mounting	Magnetic base / screw bracket	M8 stud / adhesive / magnetic base	

Ordering Information

Model	Part number	Description	Typical application
HY-VT2000-M / -B	HOYAN-VT2000-M / -B	Triaxial overall vibration + dual-channel temperature, IP68	Trend-based predictive maintenance
HY-VT3K-S / -H	HOYAN-VT3K-S / -H	Triaxial 3 kHz, low noise 20 $\mu\text{g}/\sqrt{\text{Hz}}$	Low-speed machines, structural monitoring
HY-VT5K-S / -H	HOYAN-VT5K-S / -H	Triaxial 5 kHz, ± 60 g, clipping-free	CBM spectral diagnostics, ISO 10816
Accessories			
VT-MAG	HOYAN-VT-MAG	Magnetic base (M8 thread), approx. 1.5 kHz usable	Route-based measurement
VT-CBL-05 / -10	HOYAN-VT-CBL-05 / -10	M12 shielded cable, 5 m / 10 m	Power and RS-485 on one cable

Part numbering: HOYAN-**product code**-**variant code**. Variant codes: **S** = M8 stud mount (standard), **H** = hex base (+112 g), **M** = magnetic base, **B** = screw bracket.