Corecloud HVS5100 Series RS485 Vibration and Temperature Sensor — Specification

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Rev.C

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Revision History

Version	Date	Description	Status
Rev.A	2023-04-18	Initial release	Released
Rev.B	2024-12-23	Optimized lower bandwidth limit	Released
Rev.C	2026-09-01	1. Optimized size 2. Added envelope feature output 3. Waveform output adjusted to acceleration time-domain and frequency-domain waveforms	Released

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1 Product Overview



Figure 1-1 Product Image

The Corecloud HVS5100 Series RS485 Vibration and Temperature Sensor is an industrial-grade integrated vibration and temperature sensor that combines triaxial vibration and temperature measurement in one device, designed for machinery condition monitoring and predictive maintenance. A single device replaces two separate sensors (vibration sensor and thermometer), simplifying on-site installation and data integration — especially suitable for industrial sites with dense measurement points and complex wiring.

At its core is advanced MEMS sensor technology delivering a 2 Hz~6 kHz measurement bandwidth that covers the ISO 20816 measurement bands and high-frequency bearing fault bands. A built-in high-precision temperature sensor measures -50 °C~+150 °C with a typical accuracy of ±0.5 °C. The sensor integrates acceleration, velocity, displacement and envelope feature and waveform calculation algorithms on-chip, with up to 4096-point FFT spectrum analysis and a large built-in memory storing 100000-point waveforms per axis. It supports three operating modes — standard, command-controlled calculation and real-time calculation — and can enter sleep mode on command for low-power applications.

Using the Modbus RTU protocol over an RS485 interface to connect with the host, it integrates easily into existing monitoring systems. The IP68 fully sealed 7075 aluminum alloy housing with HBM 8 kV/15 kV ESD protection resists electromagnetic interference and UV radiation, ensuring long-term reliable operation.

2 Key Features

2.1 Integrated Vibration and Temperature Measurement

Vibration and temperature are integrated in a single device, reducing the number of on-site sensors and wiring complexity.

- **Triaxial vibration measurement:** 2 Hz~6 kHz bandwidth, range up to ±16 g, covering the ISO 20816 measurement bands and high-frequency mechanical vibration signals
- **Wide-range temperature measurement:** -50 °C~+150 °C, 0.0625 °C resolution, ±0.5 °C accuracy, providing temperature-correlated data for vibration analysis

2.2 On-Chip Edge Computing

All signal processing is completed at the sensor end, directly outputting engineering physical quantities and reducing host computing power and bandwidth overhead.

- **Multi-dimensional features:** acceleration peak and RMS, velocity peak and RMS, displacement peak and peak-to-peak, frequency peak and instantaneous temperature
- **Envelope features:** envelope peak, RMS and crest factor via band-pass filtering → rectification → low-pass demodulation, for early warning of impact-type faults such as bearing defects; 3 preset demodulation bands (default 500 Hz~6 kHz) or user-defined
- **Waveform output:** acceleration time-domain and frequency-domain waveforms
- **4096-point FFT:** multi-scale spectrum analysis to precisely identify equipment fault characteristic frequencies
- **Large-capacity storage:** 100000-point waveforms per axis stored locally, ensuring complete preservation of continuously acquired data

2.3 Industrial-Grade Environmental Adaptability and Interface Protection

Fully sealed 7075 aluminum alloy structure with IP68 protection, wide-temperature operation and built-in interface protection circuits, suitable for long-term harsh industrial deployments.

- **IP68:** fully sealed against dust, continuous immersion protection, waterproof aviation connector maintains sealing after repeated plugging
- **Aluminum alloy housing:** excellent heat dissipation, corrosion resistance and UV resistance with a design life exceeding 10 years
- **Wide temperature -40 °C~85 °C:** extended-temperature component screening, suitable for all climates
- **RS485 interface:** 30 kV air/contact discharge ESD protection with input overvoltage protection

2.4 Flexible Communication and Configuration

The standard Modbus RTU protocol communicates with the host over an RS485 interface, offering strong versatility and easy integration into existing monitoring systems.

- **Standard Modbus protocol:** the Modbus RTU industrial standard, compatible with mainstream PLC, RTU and SCADA systems without custom development
- **AT command configuration:** parameter settings are completed via AT commands over the shared communication interface, without dedicated tool software
- **Three operating modes:** standard, command-controlled calculation and real-time calculation, flexibly adapting to different monitoring requirements
- **Command sleep:** the device can enter sleep mode on command, supporting low-power application scenarios
- **OTA upgrades:** online remote firmware upgrades without on-site operations

3 Application Scenarios

- **Industrial Rotating Machinery Condition Monitoring and Predictive Maintenance**
  Vibration monitoring of rotating machinery such as pumps, fans, compressors, motors and gearboxes is the core of predictive maintenance. The HVS5100's 2 Hz~6 kHz wide frequency response covers everything from shafting fundamental frequencies to bearing fault characteristic bands, and the edge computing engine outputs acceleration, velocity, displacement and envelope features simultaneously; temperature measurement provides correlated data for shaft temperature anomalies. The standard Modbus protocol connects directly to PLC/DCS systems for vibration over-limit alarms and automatic shutdown interlocking.
  Typical monitored objects: industrial pump sets · centrifugal/axial fans · screw/centrifugal compressors · motors and bearing housings · gearboxes · conveyor systems

- **Machinery Fault Diagnosis and Vibration Analysis**
  Equipment fault diagnosis requires multi-dimensional data support from features, waveforms and spectra. HVS5100 completes acceleration/velocity/displacement/envelope feature and waveform calculation at the sensor end; up to 4096-point FFT spectrum analysis precisely identifies fault characteristic frequencies; and the large-capacity memory stores 100000-point waveforms per axis, providing a complete data source for offline deep analysis.
  Typical monitored objects: rotor unbalance diagnosis · bearing fault diagnosis · gear meshing analysis · looseness and friction diagnosis

- **Industrial Site Equipment Acceptance and Commissioning**
  During installation, commissioning and post-maintenance acceptance, the equipment vibration level must be precisely evaluated. HVS5100 can be deployed quickly next to the equipment — mounted via an adapter stud or magnetic base — outputting vibration features and waveforms in real time to help judge whether the operating status meets acceptance criteria.
  Typical monitored objects: equipment installation and commissioning · post-maintenance trial-run acceptance · vibration standard compliance verification · dynamic balancing correction

- **Smart Factory System Integration**
  The equipment management systems of modern factories need reliable equipment condition data sources. Through the RS485 Modbus RTU protocol, HVS5100 outputs all vibration features and temperature data to the factory host system simultaneously — no protocol conversion or additional gateways required, ready to use out of the box.
  Typical monitored objects: factory control cabinet integration · CMMS data source · PLC interlock protection · SCADA system access

4 Product Specifications

Unless otherwise specified, all parameters below are tested at room temperature (25 °C).

Table 4-1 Product Specifications

General Parameters	Operating Temperature Range	-40℃~85℃
	Storage Temperature Range	-40℃~105℃
	IP Protection Rating	IP68
	Dimensions	24 × 24 × 28 mm (1)
	Weight	Approx. 30 g
	Housing Material	7075 aluminum alloy
	ESD Rating	HBM contact discharge 8 kV, air discharge 15 kV
	Applicable Standards	IEC 61000-6-2:2016 / IEC 60529:2013 / IEC 60068-2-1 / IEC 60068-2-2
System Power	Supply Voltage	5~30 VDC
	Rated Power	100 mW
Configuration	Interface Type	RS485(2)
	Input Voltage Range	-7~12 VDC (3)
	Baud Rate	4.8k / 9.6k / 115.2k / 460.8k / 921.6k / 1M bps
	Communication Speed	1.6~25 KB/s
	Communication Protocol	Modbus RTU
	Configuration Method	AT commands, sharing the RS485 communication interface
	Firmware Update	Online OTA
System Resources	Memory	512 KB + 8 MB
	CPU	240 MHz, 800 CoreMark®
	Storage	100000-point waveforms per axis
Sensor Performance	Sensor Type	MEMS accelerometer (digital output)
	Axes	X / Y / Z triaxial
	Range	±2 / ±4 / ±8 / ±16 g
	Resolution	0.061 mg (±2 g range)

	3 dB Frequency Response	2 Hz~6000 Hz (4)
	Noise Density	Typical 75 μg/√Hz
	0-offset/1g Accuracy	2 mg
	Non-linearity	2% FS
Signal Processing	Sampling Rate	26667 / 13333 Hz
	FFT Points	128 / 256 / 1024 / 2048 / 4096 points
	Feature Output	Acceleration/velocity peak and RMS, displacement peak and peak-to-peak, frequency peak and instantaneous temperature, plus envelope peak, RMS and crest factor
	Envelope Demodulation Band	2 Hz~6 kHz configurable, with presets 500 Hz~6 kHz (default) / 1 kHz~6 kHz / 2 kHz~6 kHz or custom
	Waveform Output	Acceleration time-domain and frequency-domain waveforms
	Velocity Range	0~100 mm/s
	Velocity Resolution	0.01 mm/s
	Velocity Peak Accuracy	±1 mm/s or ±5% of reading, whichever is greater (guaranteed above 100 Hz) ±5 mm/s or ±5% of reading, whichever is greater (guaranteed above 20 Hz) ±10 mm/s or ±5% of reading, whichever is greater (guaranteed above 10 Hz)
	Velocity RMS Accuracy	±0.04 mm/s or ±5% of reading, whichever is greater (guaranteed above 2 Hz)
	Displacement Range	0~1000 μm
	Displacement Resolution	1 μm
	Displacement Peak Accuracy	±10 μm or ±5% of reading, whichever is greater (guaranteed above 50 Hz) ±100 μm or ±5% of reading, whichever is greater (guaranteed above 20 Hz) ±500 μm or ±5% of reading, whichever is greater (guaranteed above 10 Hz)
	Displacement Peak-to-Peak Accuracy	±10 μm or ±5% of reading, whichever is greater (guaranteed above 20 Hz) ±100 μm or ±5% of reading, whichever is greater (guaranteed above 5 Hz) ±500 μm or ±5% of reading, whichever is greater (guaranteed above 2 Hz)
	Envelope accuracy	Tolerance ±20% Trend metrics have no dedicated accuracy specification; the

		demodulation band is available in three options (500 Hz~6 kHz)
Temperature Measurement	Range	-50 °C~+150 °C
	Resolution	0.0625 °C
	Accuracy	-20 °C~85 °C: typical ±0.5 °C -50 °C~150 °C: typical ±0.75 °C
	Thermal Response Time	≤50 s (5)

⚠Notes

(1) Excluding the connector, see Mechanical Dimensions. (2) Non-isolated RS485: pay attention to the common-mode voltage to prevent equipment breakdown; when connecting to the RS485 bus, a 120 Ω termination resistor is required at the bus end. (3) Voltage difference between signal line A or B and ground.

(4) The maximum 3 dB frequency response is limited by the configured sampling rate and is always below 0.5 × the sampling rate.

(5) Time required for the sensor, placed in 85 °C silicone oil at room temperature (25 °C), to reach 63% of the final stabilized value.

⚠ Velocity and Displacement Accuracy Notes

Velocity peak accuracy grades: ±1 mm/s or ±5% of reading (whichever is greater, guaranteed above 100 Hz), ±5 mm/s or ±5% of reading (whichever is greater, guaranteed above 20 Hz), ±10 mm/s or ±5% of reading (whichever is greater, guaranteed above 10 Hz); velocity RMS accuracy ±0.04 mm/s or ±5% of reading (whichever is greater, guaranteed above 2 Hz). Displacement peak accuracy grades: ±10 μm or ±5% of reading (whichever is greater, guaranteed above 50 Hz), ±100 μm or ±5% of reading (whichever is greater, guaranteed above 20 Hz), ±500 μm or ±5% of reading (whichever is greater, guaranteed above 10 Hz); displacement peak-to-peak accuracy grades: ±10 μm or ±5% of reading (whichever is greater, guaranteed above 20 Hz), ±100 μm or ±5% of reading (whichever is greater, guaranteed above 5 Hz), ±500 μm or ±5% of reading (whichever is greater, guaranteed above 2 Hz). Below the stated frequencies, MEMS non-linearity errors are amplified through 1/f and $1/f^2$ integration, exceeding the guaranteed accuracy range; the output may deviate from the true value and is suitable only for trend judgment, not for precise quantitative measurement.

5 Interfaces and Indicators



Figure 5-1 Interface and Indicator Locations

The device connects externally through a 4-pin waterproof aviation connector that carries both power and RS485 communication; after tightening, the connector achieves IP68 protection.

Table 5-1 Interface and Indicator Definition

Interface Name		Definition
RS485 Aviation Connector	A / B	RS485 signal
	VDC / GND	9~30 VDC power supply

6 Mechanical Dimensions

Dimensions: 24 × 24 × 28 mm (excluding the connector). Mounting holes on the bottom allow fixing to the measured object via a magnetic base, adapter stud or adapter plate, suiting various installation scenarios.

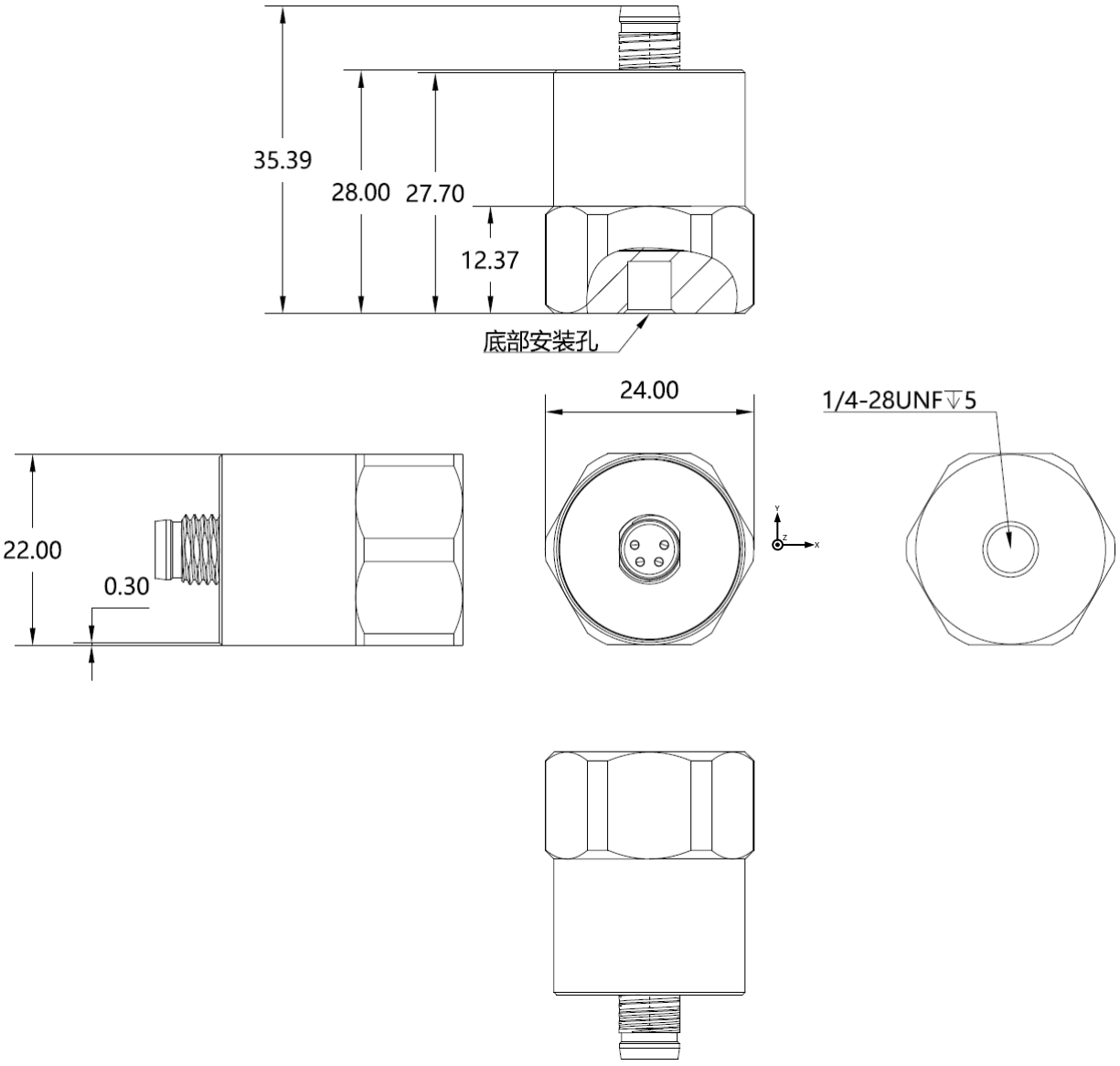


Figure 6-1 Mechanical Dimensions (unit: mm)

7 Accessories and Installation

Table 7-1 Accessories and Installation

Name	Specification	Image	Application
Aviation Connector	1 m M12 4-pin female to bare terminals Wiring: yellow (5-30 VDC), white (GND), red (RS485-A), black (RS485-B), black (shield)		Standard, RS485 and power connection
Magnetic Base	1/4-28UNF magnetic base Diameter: 24 mm		Standard, bottom mounting

8 Installation Notes

- Clean the mounting surface; fill rough surfaces with thermally conductive grease to ensure tight contact.
- When mounting with the magnetic base, move it gradually from the edge of the measured object onto its surface; impact is prohibited.
- Bolt tightening torque 1~3 N·m (M3/UNF fine threads — avoid damage from excessive torque).
- Tighten the aviation connector lock nut; for long-term outdoor use, add waterproof tape at the root as secondary protection.
- A 120 Ω termination resistor must be connected in parallel at the end of the RS485 bus, and the shield must be grounded at one end only.

9 Notes

- Impact is prohibited during use.
- Do not store the sensor at temperatures above 105 °C for extended periods, otherwise the accuracy will be seriously affected.
- Do not use excessive torque during installation to avoid damaging the threads.
- Envelope features are trend indicators; it is recommended to set thresholds by comparing against the device's own historical baseline. Frequency bands below 2 Hz are for reference only.
- Before connecting to the RS485 bus, verify the common-mode voltage does not exceed -7~12 VDC to prevent interface breakdown.

10 Ordering Information

Model code: HVS5100-[bandwidth]
Bandwidth: 6KT = 6000 Hz, triaxial

Table 10-1 Ordering Information Overview

Name	Model	Specification
RS485 Vibration and Temperature Sensor	HVS5100-6KT	6000 Hz bandwidth, triaxial