



HOYAN VibroSense

Machine Condition Monitoring Solution

A complete condition monitoring solution built on ISO 10816, with the verdict made at the gateway

ETH-VHS-A2N Vibration Monitoring Gateway

HY-VT2000 / HY-VT3K / HY-VT5K Triaxial Vibration Sensors

HOYAN Technologies Co., Ltd.



ETH-VHS-A2N Vibration Monitoring Gateway

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HY-VT2000 / 3K / 5K

Why rotating machines need vibration monitoring

The cost of reactive repair

Bearing and gear failures usually show symptoms weeks in advance, yet are found only through noise, heat or a stoppage. Unplanned downtime costs far more than the part itself.

The value of predictive maintenance

Track the rate of degradation with quantified indicators and schedule repair before the zone becomes unacceptable — downtime turns from an accident into an appointment.

ISO 10816

The international standard for machine vibration, judging zones A to D from RMS velocity

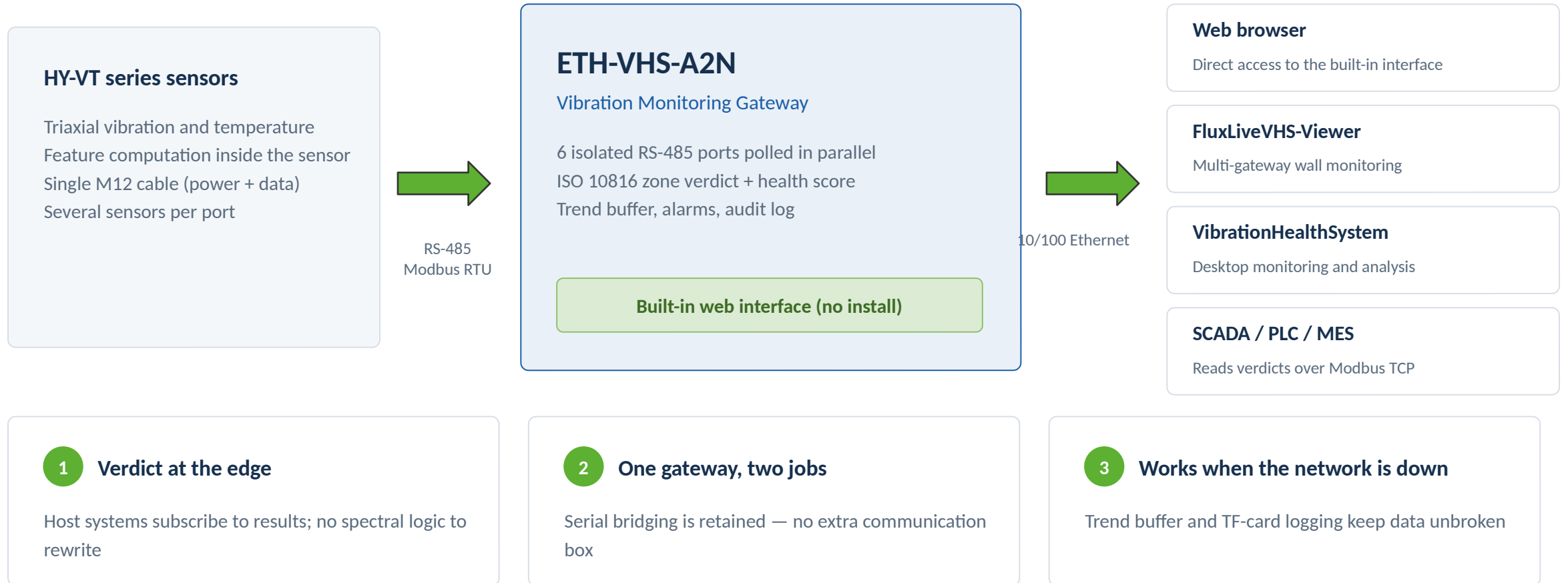
10 – 1000 Hz

The standard evaluation band, covering unbalance, misalignment and looseness

Triaxial

One mounting point covers radial and axial directions — no repeat installation per axis

System architecture



ETH-VHS-A2N Vibration Monitoring Gateway



ETH-VHS-A2N

- **6 × isolated RS-485 plus 1 × RS-232**
Role, baud rate and format set independently per port
- **Dual 10/100BASE-TX with separate MACs**
Device network and monitoring network kept apart
- **Built-in HOYAN-CBM criteria set**
Outputs ISO zones and a health score directly
- **Built-in four-language interface**
No installation, no licence — a browser is enough
- **MQTT northbound (TLS) and Modbus TCP mapping**
Cloud delivery and existing SCADA served at once
- **OTA update and dual-slot configuration**
Survives power loss; failed updates roll back

6 + 1

Isolated serial ports

2 × LAN

Separate MACs

4 languages

Web interface

ISO 10816

Verdict at the edge

Gateway specifications at a glance

Serial interfaces

- RS-485: 6 ports, half-duplex, isolated transceivers, fail-safe biasing
- RS-232: 1 port; 1200 – 921600 bps
- Port roles: sensor acquisition / context / host slave / bridge / disabled
- 3-pin pluggable screw terminal block, 24 – 14 AWG

Network and protocols

- 2 × 10/100BASE-TX, RJ-45, separate MAC and IP each
- Modbus TCP / Modbus RTU / MQTT (TLS) / HTTP / SNTP
- Transparent transmission: TCP server / TCP client / UDP
- Web interface supports 4 simultaneous connections

Power and environment

- 9 – 36 V DC input, 0.45 A max, 5.4 W max
- 5-pin terminal block, redundant dual supply supported
- Operating –25 to +70 °C; 5 – 95 % RH non-condensing
- Metal enclosure IP30; 35 mm DIN rail or wall mount

System and storage

- Internal non-volatile memory, configuration held in two slots
- TF card (microSD, 32 GB max, FAT32) for long-term logging
- USB-C maintenance port; OTA update with backup image
- Built-in RTC with SNTP synchronisation

Cyber security baseline

Designed in the spirit of IEC 62443-4-2. Once the gateway joins the plant network it becomes part of the security boundary, so these measures are enabled at the factory and need no extra setup.

1 Three-tier RBAC

Administrator / operator / viewer, centrally controlled

2 Password protection

SHA-256 with a per-account random salt; default password must be changed at first login

3 Login protection

Lock-out after consecutive failures with remaining time reported; configurable login banner

4 Session control

Idle plus absolute timeout; live session list with forced logout

5 Audit log

Login, logout, lock-out, configuration change and firmware update all recorded

6 Configuration and firmware

Dual-slot configuration; OTA with backup image and automatic rollback

Encrypted transport: MQTT northbound supports TLS with certificate management · Passwords are never stored in clear text on the TF card or in the internal configuration

Evaluation criteria set • three-layer architecture

The ISO 10816 / 20816 series answers one question: is the overall vibration of this machine too high? It shows that a problem exists but not what it is. HOYAN-CBM adds a diagnostic layer on top of ISO and, just as importantly, states which layer is standard and which is engineering practice.



Zone verdict (A / B / C / D)

Answers "how large is the vibration?" • boundary values taken directly from ISO 10816-3 / ISO 10816-1

Basis: international standard



Feature-based indication (crest factor / kurtosis / skewness / orders)

Answers "what might be wrong?" • defined by HOYAN engineering practice; ISO sets no limits here

Basis: engineering practice



Baseline comparison (against its own history)

Answers "how much has it changed relative to itself?" • 168 h learning period, later firmware

Planned

HOYAN-CBM v1.1 • 12 ISO zone tables, 24 boundary values • 12 feature rules • zone hysteresis 5 % • run threshold 0.30 mm/s

Two blind spots of the overall-level method

1 An early fault does not raise the overall level

Small bearing spalls produce impacts that are high in peak but low in energy, so RMS velocity barely moves — this is exactly why crest factor and kurtosis exist.

2 Same overall level, different cause

3.0 mm/s may be unbalance, misalignment or looseness, and the remedy differs completely. Shaft-order rules are the cheapest way to tell them apart.

Fault indications available

Unbalance

Misalignment

Mechanical looseness

Early bearing fault

Pronounced impacting

Gear fault

Rub

Rolling-element bearing anomaly

Journal bearing oil whirl

Statement of basis The zone verdict uses the ISO 10816-3 boundary values exactly as published: 12 tables, 24 boundary values, every one verifiable. The feature rules are indications defined by HOYAN from engineering practice; they give an early hint before the overall level changes, and the final verdict remains with a qualified person interpreting trends and spectra.

Zone coverage and health score

Basis	Tables	Applicable machines
ISO 10816-3 Group 1 – 4 (rigid / flexible support)	8	Large machines > 300 kW, medium machines 15 – 300 kW, pumps (separate or integrated driver)
ISO 10816-1 Class I – IV	4	Machines with no dedicated ISO part; from ISO 2372:1974 — setting a Group table is preferred
Custom thresholds	Unlimited	Set from site experience; highest priority

Evaluation priority Custom threshold > zone reported by the sensor > the 12 internal tables. The sensor value always wins; the internal tables are a fallback when the network is down or no zone is reported.

Health score 0 – 100

A

100 – 85

Good

B

85 – 60

Acceptable

C

60 – 30

Caution

D

30 – 0

Unacceptable

Scores are scaled from each machine's own ISO zone boundaries, so machines of different groups and sizes can be compared and ranked directly. It is a management indicator; the zone verdict remains decisive.

Built-in monitoring interface • no install, no licence

A browser is all that is needed. One screen shows the ISO zone, health state, RMS velocity, crest factor, temperature and trend of every sensor.



Dark theme — all four machines in zone A, health score 84-85



Light theme — two machines in zone C, cards turn to the warning colour

1 Live dashboard

ISO zone, health score, RMS velocity, crest factor and machine surface temperature

2 Trending

Stopped or offline periods are shaded and left unconnected

3 Layout and display

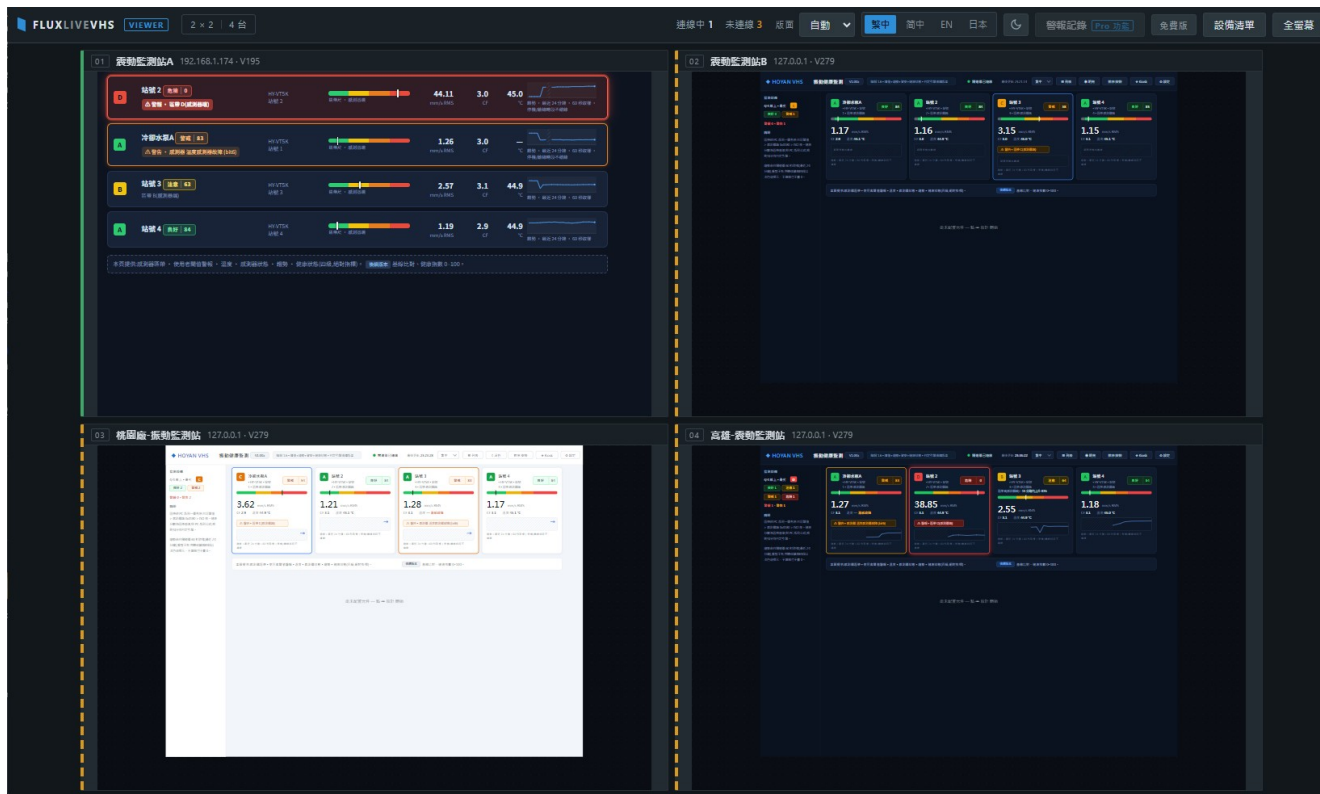
Card / list view, light / dark theme, selectable sort order, kiosk full screen

4 Language and status

TC / SC / English / Japanese switched live; header shows link state and last update

FluxLiveVHS-Viewer • multi-station monitoring

When a site runs several gateways, or gateways spread across plants, this places them side by side on one screen. Built on the FluxLiveCenter-Viewer architecture, each tile is the live screen of that gateway itself, not a second copy of the data — the control room and the field never hold two sets of numbers.



Tiled monitoring

Layout arranged automatically (2 × 2 and others); each tile shows station name, IP and firmware, colour-coded by link state

Device list

Add by URL or discover automatically by subnet scan; sort, locate, edit and remove

Single-station zoom

Scroll-wheel zoom and drag to pan; previous / next station, reload, full screen

Device detail

Triaxial velocity and zone, true peak / peak-to-peak / displacement, dominant frequency, 1× amplitude and comms statistics

Trend views

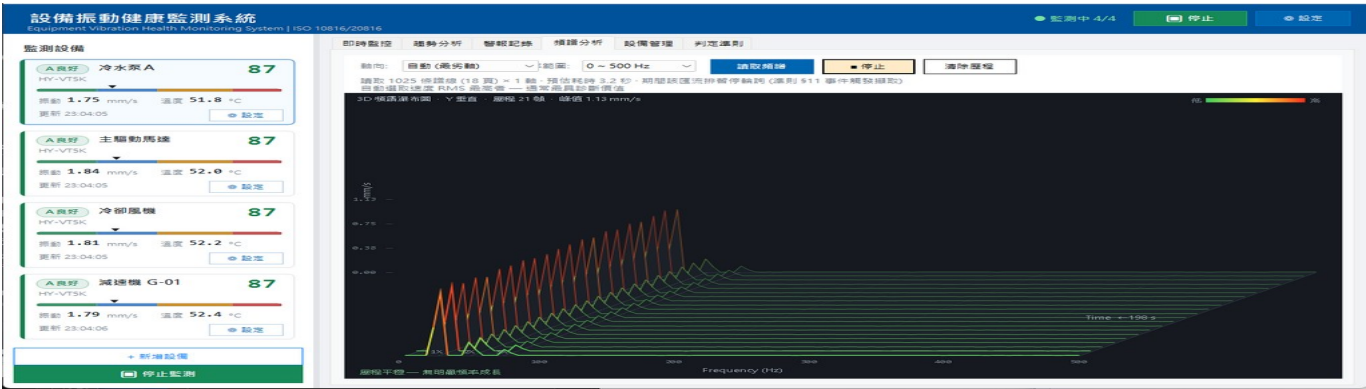
24 minutes / 24 h / 30 d; stopped periods shown as a break in the line, not interpolated

Free edition available; alarm log and auto-zoom are Pro features

VibrationHealthSystem • desktop monitoring and analysis

PC-side software providing the deeper analysis the gateway does not run continuously: on-demand spectrum capture, spectral history on a 3D waterfall and long-term trending.

The roles are complementary — the gateway handles routine monitoring and alarming, the desktop application handles diagnosis.



Spectrum analysis view (3D spectral waterfall)

Live monitoring	Zone, health score, velocity and temperature
Trend analysis	Long-term trend against the baseline
Alarm log	Event list with acknowledgement record
Spectrum analysis	Selectable axis or worst-axis auto-pick
Device management	Machine and sensor information
Evaluation criteria	Identical to the gateway

Spectrum capture is on demand, not continuous polling

Spectral data is far larger than feature values. Reading 1025 spectral lines (paged transfer) takes about 3.2 s, during which polling on that RS-485 bus is suspended and then resumes automatically.

Routine monitoring therefore keeps a stable update period, and the interface states the expected duration and scope of the interruption before it starts.

Monitoring and analysis software • three tiers

One gateway

Built-in interface

Shipped inside every unit; live monitoring, trend enquiry, alarm handling and configuration

No install, no licence

Many gateways

FluxLiveVHS-Viewer

Built on the FluxLiveCenter-Viewer architecture; gateways side by side on one screen

Free and Pro editions

Diagnosis

VibrationHealthSystem

Spectrum capture, 3D waterfall history, long-term trending and baseline analysis

Added as needed

Third-party systems

Existing SCADA / PLC / MES read the gateway verdicts directly over Modbus TCP — no HOYAN software required.

Sensor selection • HY-VT2000 / 3K / 5K

All three connect over RS-485 Modbus RTU and can be mixed on one gateway; choose by the depth of diagnosis required.



HY-VT2000

Overall-level trending and temperature

- ± 3 g (single range)
- X/Y 0.5–1600 Hz; Z 0.5–550 Hz
- Dual temperature -40 to $+125$ °C
- All-316 stainless steel / IP68
- No ISO zone verdict



HY-VT3K

Low-speed machines and structures

- ± 4 / ± 8 / ± 16 g
- 0.5 Hz – 3 kHz (± 0.5 dB)
- Low noise $20 \mu\text{g}/\sqrt{\text{Hz}}$
- FFT 6144 lines, Δf 0.488 Hz
- Zone output on board



HY-VT5K

Standard CBM spectral diagnostics

- ± 15 / ± 30 / ± 60 g
- 0.5 Hz – 5 kHz (± 0.5 dB)
- High range, clipping-free
- FFT 10240 lines, Δf 0.488 Hz
- Zone output on board

Triaxial synchronous sampling • M12 4-pin single cable (power + data) • Usable bandwidth: full with M8 stud mount, approx. 1.5 kHz on a magnetic base

Northbound delivery and integration • one gateway, two jobs

Inherited from the ETH-A2N serial device server platform. One gateway can send verdicts to the cloud, serve an existing SCADA by polling and keep the original serial devices transparently connected at the same time — adopting vibration monitoring needs no extra communication box and no rework of the existing serial architecture.

MQTT northbound

Publishes measured values, ISO zones, health scores and alarm events; TLS with certificate management

Cloud platforms, IoT data lakes, cross-plant monitoring

Modbus TCP mapping

Sensor registers mapped into the gateway address space; the host polls one IP

Existing SCADA / HMI reads directly, no field changes

Modbus RTU slave

Serves processed condition data to an existing PLC / HMI over a serial port

Older plants with no network access

Transparent bridge

Bidirectional serial to Ethernet tunnelling over TCP server / client / UDP

Serial devices online, protocol preserved



Dual ports and redundancy

Separate segments or a redundant pair



Black-box recording

Communication history for after-the-fact investigation



Diagnostics and TF logging

Per-port traffic and error counters; CSV logging

Ordering information

Model	Part number	Description
ETH-VHS-A2N	HOYAN-VHS-A2N-D	Vibration monitoring gateway: 6 × RS-485, 1 × RS-232, 2 × 10/100BASE-TX, TF card, USB-C
HY-VT2000-M / -B	HOYAN-VT2000-M / -B	Triaxial overall vibration + dual temperature, IP68 (M = magnet, B = bracket)
HY-VT3K-S / -H	HOYAN-VT3K-S / -H	Triaxial 3 kHz, low noise 20 µg/√Hz — low-speed machines, structural monitoring
HY-VT5K-S / -H	HOYAN-VT5K-S / -H	Triaxial 5 kHz, ±60 g high range — standard CBM spectral diagnostics
VT-MAG	HOYAN-VT-MAG	Magnetic base (M8 thread) for route-based measurement; approx. 1.5 kHz usable
VT-CBL-05 / -10	HOYAN-VT-CBL-05 / -10	M12 4-pin A-coded shielded cable, 5 m / 10 m, power and RS-485 on one cable
Part numbering HOYAN-product code-variant code • S = M8 stud mount • H = hex base • M = magnetic base • B = screw bracket		

Specifications in this presentation are design values; the shipping production version governs.

Three things to remember

1 The verdict is made at the edge

ISO zones and health scores are computed in the gateway, so an existing SCADA adopts condition monitoring without rewriting any logic

2 Standard and experience are kept apart

Zone values come straight from ISO 10816-3 and are verifiable; feature rules are clearly labelled as engineering practice

3 One gateway, two jobs

Serial bridging and several northbound paths are retained — no extra communication box to adopt monitoring