INDUSTRIAL EDGE INTELLIGENCE / PRODUCT DATASHEET

PYXIS

Smart 3-Axis Vibration Sensor

Edge vibration and temperature intelligence for continuous rotating-equipment monitoring, condition classification, spectral analysis and predictive-maintenance integration over Modbus RTU.

3 AXIS	DC-6 kHz	20 x 3	RS-485
ACCELERATION, VELOCITY AND DISPLACEMENT	MEASUREMENT BANDWIDTH	HARMONIC FREQUENCY AND AMPLITUDE ARRAYS	MODBUS RTU WITH AUTOMATIC BAUD DETECTION

ENGINEERING SUMMARY PyXis processes vibration and temperature information at the machine and exposes compact condition indicators to PLC, SCADA, historian and CMMS platforms. The host can read severity, spectral, rotational, diagnostic and prognostic information without continuously transporting raw waveforms.

MODEL **PyXis-Modbus** DOCUMENT **TTN-DS-2026-002** REVISION **Rev 08** ISSUE DATE **22 July 2026**

BUILT FOR CONTINUOUS CONDITION MONITORING

Motors • Pumps • Fans • Compressors • Gearboxes • Conveyors

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01 PRODUCT OVERVIEW

Condition intelligence at the machine

PyXis combines three-axis MEMS vibration sensing, thermal measurement and edge analytics in a sealed industrial sensor with direct Modbus RTU access.

Purpose and deployment

The sensor is designed for permanent or route-based monitoring of rotating assets. It publishes processed indicators so control and maintenance systems can trend condition without a separate vibration-analysis computer at every machine.

Machine context - including speed, gear ratio, gear teeth, bearing geometry, filters and thresholds - can be configured to improve the relevance of condition outputs for the actual asset.

The register model supports basic monitoring as well as firmware-dependent diagnostic and prognostic extensions.

Typical applications

- Electric motors and generators
- Centrifugal and axial pumps
- Industrial fans and blowers
- Reciprocating and screw compressors
- Gearboxes and geared drives
- Conveyors and material-handling machinery
- Remote pump stations and unattended assets

Key product capabilities

Tri-axis condition metrics

Independent X, Y and Z acceleration, velocity and displacement results with RMS, peak, peak-to-peak and crest-factor indicators.

Spectral and harmonic data

Up to twenty harmonic frequencies and twenty corresponding acceleration amplitudes for each axis.

Severity and fault states

Per-axis severity and fault-analysis status for direct supervisory display, alarming and maintenance workflows.

Speed and order context

Current RPM, tachometer quality, speed state and 1X order information for speed-referenced interpretation.

Advanced diagnostic indices

Envelope kurtosis, sideband density, harmonic consistency, cepstrum gear index, spectral kurtosis and cyclostationary index.

Prognostic outputs

Firmware-dependent remaining useful life, failure probability, degradation index, time to maintenance, baseline state and ageing factor.

Asset-aware configuration

Motor frequency, gear ratio, gear teeth, bearing geometry and analysis-filter parameters.

Thermal correlation

Internal sensor temperature and an additional motor-temperature data point where supported by the firmware/profile.

APPLICATION BOUNDARY Fault interpretation depends on mounting, speed, load, machine geometry, baseline quality and firmware profile. Final alarm limits must be commissioned on the actual asset. PyXis is not a safety device unless the complete safety function is separately assessed and validated.

02 FUNCTIONAL ARCHITECTURE

Edge-processing data path

The sensing, conditioning, analysis and publication layers are separated so the host receives deterministic condition values and configuration state.

01	02	03	04	05
SENSE	**CONDITION**	**ANALYSE**	**INTERPRET**	**PUBLISH**
X/Y/Z vibration and temperature	Filtering and axis handling	Time metrics and harmonics	Severity, fault and order context	Modbus data and configuration

Analysis and configuration layers

Measurement layer Orthogonal X, Y and Z acceleration plus internal temperature acquisition.	**Signal-conditioning layer** Configurable high-pass and low-pass filtering to suit the expected machine spectrum.
Feature layer RMS, peak, peak-to-peak, crest factor, velocity, displacement and harmonic arrays.	**Machine-reference layer** Motor frequency, RPM, tachometer quality, 1X order, gear ratio, gear teeth and bearing geometry.
Condition layer Per-axis severity and fault state plus advanced impulsive and spectral indices.	**Prognostic layer** Baseline, degradation, probability, RUL and time-to-maintenance outputs where supported.
Interface layer Read-only condition data and writable communication, machine-model, filtering and threshold settings.	**Lifecycle control** Persistent save, reboot, factory reset and watchdog behaviour through common management registers.

BASELINE MANAGEMENT Capture representative healthy operation across the normal speed and load range before relying on degradation or prognostic outputs. Record firmware version, machine profile, filter settings and baseline update count in the asset history.

03 COMMUNICATIONS AND INTEGRATION

RS-485 Modbus RTU integration

The product uses two-wire half-duplex RS-485 and a Modbus RTU slave data model. Communication parameters and lifecycle commands are available through common holding registers.

1-247	0-50 ms	4 + auto	8E1 / 8O1 / 8N1 / 8N2
SLAVE ID RANGE	RESPONSE DELAY	BAUD SELECTION	SERIAL FORMATS

PARAMETER	SPECIFICATION / BEHAVIOUR
Physical interface	2-wire half-duplex RS-485. Cable, common, shield, biasing and termination follow the network design.
Slave address	1 to 247.
Baud selection	Automatic detection or fixed 9600, 19200, 38400 and 115200 bps.
Parity / stop bits	Even, odd or none; 8E1, 8O1, 8N1 and 8N2 formats.
Response delay	0 to 50 ms for host timing and multi-drop compatibility.
Watchdog	Configurable communication-loss supervision through the common management area.
Lifecycle commands	Persistent save, reboot and factory reset. Apply only under controlled commissioning conditions.
Identity data	Device code, hardware/firmware revision, manufacturing date and serial number support automated asset records.

Supported Modbus access

FUNCTION	REGISTER CLASS	TYPICAL USE
0x04	Input Registers	Read identity, temperatures, motion metrics, harmonics, condition, rotational, diagnostic and prognostic values.
0x03	Holding Registers	Read communication, machine profile, filters and threshold configuration.
0x06 / 0x10	Holding Registers	Write one or multiple configuration values and lifecycle commands.
0x02 / coils	Profile-dependent	Read or control status bits only where implemented by the released firmware/register map.

NETWORK PRACTICE Use a daisy-chain trunk, termination at the two physical ends, short stubs, unique slave IDs and a documented shield/common strategy. Avoid star wiring and undocumented bias networks.

04 DATA MODEL AND CONFIGURATION

Register-backed condition data and controls

PiLoT-V in the supplied PiLoT Standard Modbus Register workbook corresponds to PyXis. Use the register-map revision that matches the installed firmware.

Read-only monitoring groups

REGISTER FAMILY	DATA CONTENT	ENGINEERING USE
Identity / inventory	Device code, hardware and firmware version, manufacturing date and serial number.	Asset discovery, traceability and version control.
Temperature	Sensor temperature and profile-dependent motor temperature.	Thermal trending and correlation with vibration changes.
X/Y/Z motion	Acceleration RMS/peak/peak-to-peak/crest factor; velocity and displacement values.	Primary condition trends and threshold comparison.
Harmonic arrays	20 frequency values and 20 associated acceleration amplitudes per axis.	Compact spectral review without continuous raw-waveform transfer.
Condition state	Per-axis severity and fault-analysis state.	Alarm annunciation and maintenance workflow routing.
Rotational context	RPM, tachometer quality, speed state and 1X order.	Speed-referenced condition interpretation.
Advanced indices	Envelope, sideband, harmonic, cepstrum, spectral-kurtosis and cyclostationary indicators.	Bearing, gear and impulsive-condition analysis.
Prognostics	RUL, failure probability, degradation, time to maintenance, baseline state/count and ageing factor.	Planning and predictive-maintenance integration; firmware dependent.

Writable configuration groups

CONFIGURATION GROUP	PARAMETERS	CONTROL PURPOSE
Common management	Slave ID, baud, parity/stop format, response delay, watchdog and system commands.	Network commissioning and lifecycle control.
Machine profile	Active profile and motor running frequency.	Select analysis behaviour for the target asset.
Gear model	Gear ratio and gear-tooth count.	Gear-mesh and order interpretation.
Bearing model	Rolling-element count, ball size, pitch diameter and contact angle.	Bearing characteristic-frequency calculations.
Analysis filters	High-pass and low-pass cut-off frequency.	Reject irrelevant low- or high-frequency content.
Warning / alarm thresholds	Per-axis velocity, acceleration and displacement thresholds plus temperature limits.	Local condition classification; V2 definitions are firmware dependent.
Persistent apply	Save/apply, reboot and factory-reset commands as defined by firmware.	Controlled configuration release and recovery.

ENGINEERING DATA NOTE Do not infer units, decimal scaling, signedness, enumerations or V2 availability from a register name alone. The released Modbus register map and firmware release note are authoritative for integration.

05 TECHNICAL SPECIFICATIONS

Sensing, electrical and environmental data

The values below consolidate the supplied product datasheet and register workbook. Items marked as design or firmware dependent must be confirmed for the ordered variant.

Measurement and processing

ITEM	SPECIFICATION / CAPABILITY
Sensing element	3-axis digital MEMS accelerometer with orthogonal X, Y and Z measurement axes.
Frequency bandwidth	DC to 6 kHz, specified at the -3 dB point.
Primary outputs	Acceleration, velocity and displacement metrics; harmonic arrays; condition and fault status.
Harmonic capacity	20 frequency and 20 acceleration-amplitude values per axis.
Temperature measurement	Internal surface-temperature measurement from -40 to +125 °C; final accuracy and calibration declaration per production release.
Advanced analytics	Rotational, diagnostic and prognostic indicators according to firmware profile.
Configuration context	Machine profile, speed, gear and bearing geometry, filters and thresholds.

Data quality and interpretation

ITEM	ENGINEERING REQUIREMENT
Engineering units	Use the firmware-specific register map for unit scaling, signedness and decimal position.
Sample / update timing	Dependent on firmware profile and enabled analysis functions; confirm in the release note.
Severity interpretation	Machine class, mounting, speed and operating state affect severity interpretation.
Fault-state coding	Decode status values using the released enumeration table; do not treat the raw word as a universal fault code.
Baseline traceability	Store mounting method, axis orientation, machine profile, filters and baseline date with each trend.

SPECIFICATION BASIS Values originate from the supplied product information and Modbus workbook. Final production limits, tolerances and supported firmware features remain subject to the applicable engineering release.

06 PRODUCT ENGINEERING DATA

Electrical, construction and environmental data

Connection, protection and environmental limits for the ordered sensor variant.

Electrical, communications and construction

ITEM	SPECIFICATION / CAPABILITY
Input supply	4.75 to 28 VDC; compatible with nominal 12 VDC and 24 VDC systems.
Power consumption	Less than 0.15 W typical, approximately 5 mA at 24 VDC.
Protection	Reverse-polarity protection, undervoltage lockout, short-circuit protection, thermal shutdown and surge protection as stated in the source design.
Communications	2-wire half-duplex RS-485; Modbus RTU slave; automatic or fixed baud rate.
Connection options	A-coded M12 5-pin male connector or high-flex integral-cable option.
Ingress protection	IP67 / IP68 sealed construction, subject to connector, cable and installation method.
Mounting	M5 threaded stud or high-force magnetic mounting option.
Operating / storage	-40 to +85 °C operating; -40 to +125 °C storage.
Humidity	10 to 95% RH, non-condensing.
Physical node count	Depends on transceiver loading, cable length, bias, termination and installation conditions; confirm the final network design.

Mechanical and installation controls

ITEM	REQUIREMENT
Ingress performance	IP67 / IP68 depends on the complete connector or cable assembly, sealing, mating and mounting practice.
Connector configuration	A-coded M12 5-pin male or integral-cable version; use the drawing for the ordered part.
Mechanical interface	M5 stud or magnetic mounting option; surface preparation and coupling stiffness affect bandwidth.
Network loading	Maximum node count depends on cable, termination, biasing, transceiver loading and baud rate.
Environmental validation	Confirm chemical compatibility, washdown exposure, cable jacket and temperature cycling for the installation.
Dimensional control	Use the released mechanical drawing for body, connector, wrench-flat and clearance dimensions.

RELEASE VERIFICATION Confirm dimensional drawing, connector pin assignment, production calibration, ingress declaration and firmware/register-map revision before design freeze or procurement.

07 INSTALLATION AND MECHANICAL INTEGRATION

Mounting, cabling and network practice

Mechanical coupling and axis orientation determine repeatability. Install the sensor on a rigid machine surface near the bearing or load path and document its orientation.

Illustrative product image

Mounting and axis discipline

- Prepare a clean, flat, rigid surface and remove paint, rust or debris from the mounting interface.
- Place the sensor close to the bearing housing or structural load path rather than on a thin guard or flexible panel.
- Align and record the X, Y and Z directions relative to radial, axial and vertical machine directions.
- Route the cable with strain relief and avoid rubbing, unsupported loops and high-current switching conductors.
- Use the same mounting method and location for baseline and subsequent trend comparison.

Mounting method selection

METHOD	ADVANTAGE	ENGINEERING LIMITATION
M5 stud	Highest repeatability and bandwidth when correctly torqued to a prepared rigid surface.	Requires threaded mounting point and controlled installation torque.
Magnetic base	Fast installation for temporary surveys, commissioning or assets where drilling is not permitted.	Reduced high-frequency coupling and greater sensitivity to surface condition; not preferred for permanent precision trending.
Integral cable / M12	Integral cable minimises connector interfaces; M12 allows cable replacement.	Ingress and vibration performance depend on correct mating, sealing and strain relief.

PLACEMENT ACCEPTANCE Mount close to the bearing or structural load path; use a rigid clean surface; record axis orientation; retain the same location and mounting method for trend comparison; and provide cable strain relief.

08 FIELD WIRING

Connector, field cable and RS-485 wiring

Electrical integration requirements for the sensor and multi-drop serial network.

ITEM	INSTALLATION REQUIREMENT
Connector / cable	Use the released M12 pin-assignment or integral-cable drawing for the ordered variant. Do not infer pinout from another product.
Power	Provide 4.75 to 28 VDC within polarity and surge limits. Verify voltage at the sensor under maximum cable drop.
RS-485 pair	Use a twisted pair, observe A/B polarity and keep the trunk continuous through junctions.
Common / shield	Follow the plant grounding strategy. Avoid shield-current loops and undocumented common bonds.
Termination / bias	Terminate only the two physical ends of the trunk and provide one defined bias network where required.
Addressing	Assign a unique slave ID and record the final baud/parity configuration in the asset database.
Cable routing	Separate low-level communications from motor, contactor, VFD and welding conductors where practical.

Recommended RS-485 commissioning sequence

01	02	03	04	05	06
DE-ENERGISE	**TERMINATE**	**BIAS**	**ADDRESS**	**POLL**	**VALIDATE**
Verify cable and connector	Only both physical ends	One defined network	Unique ID and format	Start at conservative timing	Check errors and cable drop

NETWORK CHECK	ACCEPTANCE GUIDANCE
A/B polarity	All nodes follow the same convention; reverse polarity is corrected before broad troubleshooting.
Cable continuity	Shield, pair and common are continuous as designed with no unintended branch or star.
Termination	Measured only at the two trunk ends; no duplicated termination in intermediate nodes.
Biasing	One documented fail-safe bias source; no competing bias networks.
Voltage at sensor	Within 4.75-28 VDC during startup and maximum cable current.
Response timing	No repeated timeout, CRC or framing errors at the selected baud and poll interval.

INSTALLATION ACCURACY Mounting stiffness, surface flatness, cable strain and axis orientation directly affect measurement repeatability. Record the installed orientation and mounting method in the asset record.

09 COMMISSIONING AND DIAGNOSTICS

From installation to trusted condition data

Commissioning establishes communications, machine context, healthy baseline and alarm behaviour before data is used for maintenance decisions or process interlocking.

01	02	03	04	05	06
INSTALL	**COMMUNICATE**	**CONFIGURE**	**BASELINE**	**VALIDATE**	**RELEASE**
Rigid mount and axis record	Address and serial format	Machine, gear and bearing data	Healthy speed and load range	Thresholds and fault response	Document firmware and settings

Acceptance and diagnostic checks

CHECK	ACCEPTANCE GUIDANCE
Device identity	Read device code, hardware/firmware version, manufacturing date and serial number; compare with the asset record.
Communication quality	Check for stable polling, correct response timing and no recurring CRC, framing or timeout errors.
Axis plausibility	Confirm X/Y/Z response and orientation using controlled machine operation or a known vibration source.
Temperature plausibility	Compare the sensor temperature with a trusted reference after thermal stabilisation.
Speed / tachometer	Verify RPM, speed state and tachometer quality over the normal operating range.
Harmonic arrays	Check that dominant frequency values correspond to known running speed, gear mesh or machine excitation.
Baseline / degradation	Confirm baseline-active state, update count and repeatability before enabling prognostic use.
Alarm thresholds	Test warning and alarm behaviour using controlled thresholds; restore commissioned values afterwards.
Restart / persistence	Power-cycle under controlled conditions and confirm communication and configuration persistence.

MAINTENANCE-SYSTEM INTEGRATION Trend the underlying condition values as well as the status word. Store firmware, profile, filters, thresholds, baseline date and mounting details with every alarm or work order so later analysis remains traceable.

10 ORDERING AND COMPANION DOCUMENTS

Configuration and release documentation

Specify the mechanical, electrical and firmware configuration required by the application. Companion engineering documents must match the delivered hardware and firmware.

Ordering configuration

ORDERING ITEM	REQUIREMENT
Base product	PyXis 222x Series / PyXis-Modbus.
Connection	A-coded M12 connector or integral cable; specify required cable length where applicable.
Mounting	M5 stud, magnetic mounting accessory or approved permanent mounting arrangement.
Machine application	Motor, pump, fan, compressor, gearbox, conveyor or other rotating asset.
Firmware profile	Required diagnostic/prognostic feature set and V1/V2 register availability.
Network plan	Slave ID, baud/parity format, response delay, termination and watchdog philosophy.
Documentation revision	Mechanical drawing, pinout, installation guide, firmware note and Modbus register map must match the ordered release.

Related engineering documents

DOCUMENT	PURPOSE
PiLoT Standard Modbus Register.xlsx	Source workbook for common registers and PyXis / PiLoT-V data families.
PyXis Modbus register map	Released addresses, data types, scaling, access rights and enumerations.
Mechanical dimensional drawing	Body, connector, mounting stud and clearance dimensions.
Connector and installation guide	Pin assignment, cable, grounding, termination, mounting and torque requirements.
Commissioning procedure	Axis verification, healthy baseline, filters, machine model and alarm acceptance tests.
Firmware release note	Supported diagnostic/prognostic functions, limitations and corrections.

RELEASE PACKAGE The datasheet summarises product capability. Detailed design work must use the matching mechanical/terminal drawing, installation guide, firmware release note and Modbus register map.

11 DOCUMENT CONTROL

Revision history, release checklist and contact information

Document identification and release status for procurement, design and commissioning records.

Revision history

REVISION	DATE	DESCRIPTION
Rev 01	10 June 2026	Initial product datasheet.
Rev 02	19 July 2026	Professional layout and Modbus feature summary.
Rev 03	22 July 2026	Unified design system and expanded technical/register content.
Rev 04	22 July 2026	Updated company contact details.
Rev 05	22 July 2026	Standardised both products to a common master layout.
Rev 06	22 July 2026	A4 master template, Inter typography for DOCX/PDF, and enhanced technical content following established industrial datasheet conventions.
Rev 08	22 July 2026	Fixed-layout A4 Word edition generated from the Inter-embedded PDF to eliminate font substitution on systems without the Inter font family.

Design-release checklist

CONTROL	RELEASE REQUIREMENT
Hardware revision	Matches the product label and ordered variant.
Firmware revision	Matches the required functions and register map.
Mechanical / terminal drawing	Released drawing is included in the project file.
Network settings	Slave ID, baud, parity, delay, termination and watchdog are recorded.
Commissioning record	Acceptance tests, thresholds/safe states and baseline/configuration are retained.
Change control	Any later hardware, firmware or register-map update is assessed before deployment.

DOCUMENT STATUS Specifications are subject to engineering release and may change without notice. Verify the hardware, firmware and Modbus register-map revision before design freeze, commissioning or safety-related use.

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