1 CESU TURNI — Product and Integration Guide

> **Preliminary technical information — September 2026.** This guide describes the current Cesu Turni engineering release. Specifications may be refined as production validation continues. Values identified as design values are based on component data and firmware configuration rather than production calibration. Contact EUB to confirm requirements for a specific installation.

Changes in a machine's vibration can reveal bearing damage and gear wear before they cause unplanned downtime. Cesu Turni measures vibration across three axes and performs spectral analysis onboard. The resulting frequency and amplitude data support condition monitoring, while the alarm variant also evaluates configured alarm conditions locally and signals the machine controller through relay outputs.

1.1 Variants

1.1.1 Monitoring variant

- Three-axis vibration analysis with peak frequencies, amplitudes and widths
- Modbus RTU over RS-485 for wired integration
- Vibration data over Bluetooth LE

1.1.2 Alarm variant — SP-VB-0020-A

- Two independently configurable vibration alarm channels evaluated locally
- Two potential-free relay outputs for integration with the machine controller
- Vibration data over Bluetooth LE, with no monitoring platform required for alarm operation

Both variants use the same three-axis measurement system, IP67 enclosure and 5-pin M12 A-coded male connector. The M12 wired interface provides either Modbus RTU or relay outputs, depending on the selected variant. See the **Cesu Turni — Alarm and Relay Option** sheet for alarm operation and integration details.

1.2 Technical specifications

Parameter	Value
Accelerometer	TDK IIM-42352, three-axis, 16-bit
Measurement range	±2 / ±4 / ±8 / ±16 g; default ±8 g
Spectral data	Peak frequencies, amplitudes and widths; overall vibration indicator
Protection class	IP67
Connector	5-pin M12 A-coded male
Supply voltage	12–24 V DC
Operating temperature	-20 to +70 °C ambient (design value)

Parameter	Value
Maximum peaks per frame	128 over Modbus RTU; 60 over the BLE register service
Sample rate	512–32768 Hz in powers of two; default 2048 Hz (see measurement notes)
Analysis window	512, 1024 or 2048 samples; default 2048
Measurement bandwidth	7–537 Hz at the default setting; up to 1.4 kHz at higher sample rates (see notes; design value)
Sampling-clock accuracy	±50 ppm worst case (±0.005%); ±10 ppm typical (±0.001%) (design value)
Calculated noise floor	1.7 mg RMS per axis; 2.9 mg RMS three-axis sum, at default settings (design value)
Default Modbus RTU settings	Unit ID 1; 19200 baud, 8 data bits, no parity, 2 stop bits
Configuration	Modbus RTU (monitoring variant); Bluetooth LE; NFC using Blippa (preliminary workflow)

1.3 Onboard vibration analysis

Bearing damage and gear wear can leave characteristic patterns in a machine's vibration spectrum. Cesu Turni analyzes each axis separately, combines their spectral power and reports selected peak frequencies, amplitudes and widths together with an overall vibration indicator. These measurements support analysis of harmonics and sidebands when investigating potential fault sources and following their development over time.

1.3.1 Measurement notes

- **Sampling and analysis window:** these settings control measurement bandwidth, frequency resolution and acquisition time. Use the table below to select a suitable operating point.
- **Measurement bandwidth:** frequencies above the stated upper limit are progressively attenuated and should be treated as indicative only.
- **Frequency resolution:** the ability to separate nearby components is 1.5 Hz at the default settings. Interpolation can refine the estimated position of a peak but cannot separate components inside this resolution.
- **Vibration level:** the reported spectral RMS value is a relative indicator, not a calibrated absolute RMS measurement. Use consistent measurement settings when establishing baselines and alarm thresholds.

1.3.2 Selecting a sample rate

Lower sample rates provide finer frequency resolution across a narrower band. Higher sample rates extend the measurement band where higher-frequency components are important.

Sample rate (Hz)	Reported band	Bin spacing
512	6 – 134 Hz	0.25 Hz
1024	7 – 268 Hz	0.5 Hz
2048 (default)	7 – 537 Hz	1 Hz
4096	8 Hz – 1.07 kHz	2 Hz
8192	16 Hz – 1.4 kHz	4 Hz
16384	32 Hz – 1.4 kHz	8 Hz
32768	64 Hz – 1.4 kHz	16 Hz

The default 2048 Hz rate is a suitable starting point for general vibration monitoring below a few hundred hertz. Use 8192 Hz when coverage up to 1.4 kHz is more important than fine frequency resolution, for example when monitoring gear mesh frequencies. Rates above 8192 Hz do not extend the 1.4 kHz measurement band.

1.4 Integration and support

Cesu Turni can feed an existing monitoring system over Modbus RTU (monitoring variant) or Bluetooth LE. EUB is developing a database-backed analytics dashboard around the same data, with spectral history and machine trends already running in the current implementation. Measurement data remains available to the customer for use in other systems. Contact EUB to discuss a suitable monitoring setup, configuration and integration for your application.

Contact: eub@eub.se · www.eub.se

1.5 Appendix A — Modbus RTU integration

This appendix applies to the **monitoring variant**. The alarm variant does not expose RS-485 on its wired connection.

Register numbers below are zero-based protocol addresses. Registers are 16-bit holding registers, read using FC03 and written using FC06 or FC16 where supported. Signed values use two's complement. Unless specified otherwise, decode engineering units by multiplying the raw register value by the listed scale. For example, a frequency value of 503 means 50.3 Hz.

1.5.1 Reading measurement frames

The peak frame at registers 200–594 updates after each analysis cycle:

1. Set the unit ID, serial configuration and measurement settings as required. Allow new measurement settings to take effect before collecting a baseline.
2. Read the sequence counter at register 594.
3. Read registers 200–593 in chunks of at most 125 registers per FC03 request.
4. Read register 594 again. Accept the data only if both sequence reads agree; otherwise discard the read and retry with a bounded retry count.

5. Decode the first `min(NUM_PEAKS, 128)` entries. Process new sequence values and repeat at a rate suitable for the application.

Frames may be produced faster than the host can transfer them. Skipped sequence values are therefore expected. Select a baud rate and polling interval suitable for the required update rate.

1.5.2 Measurement configuration registers

Defaults shown apply unless previously saved configuration is loaded. “Saved” means the write uses the persistent settings path; “session” means the value is not saved by this interface.

Reg	Name	Access	Default / encoding
10	SAMP_FREQ	Read/write, saved	2048 Hz; powers of two in 512–32768 Hz
11	FFT_SIZE	Read/write, saved	2048; 512, 1024 or 2048 in this build
12	INTERP_EN	Read/write, session	1; write 0 for bin estimates, 1 for interpolated peak-list estimates
13	WINDOW_FN	Read/write, saved	1; 0 = rectangular, 1 = Hann
20	SLAVE_ID	Read/write, saved	1; valid unit IDs 1–247
21	SERIAL_CFG	Read/write, saved	5; see serial configuration table

Registers 10 and 11 report settings used by the latest measurement and may lag a write until the next cycle. Register 12 controls which estimates appear in the peak list.

1.5.3 Serial configuration

All modes use 8 data bits. Unit ID and serial-setting changes schedule a communication restart after approximately 200 ms; update the host to match.

SERIAL_CFG	Baud rate	Parity	Stop bits
0	9600	Even	1
1	9600	Odd	1
2	9600	None	2
3	19200	Even	1
4	19200	Odd	1
5 (default)	19200	None	2
6	38400	Even	1
7	38400	Odd	1

SERIAL_CFG	Baud rate	Parity	Stop bits
8	38400	None	2
9	57600	Even	1
10	57600	Odd	1
11	57600	None	2
12	115200	Even	1
13	115200	Odd	1
14	115200	None	2

Writes to broadcast address 0 receive no reply and affect all connected units that accept the write. Isolate a device before assigning it a unique ID by broadcast, so multiple devices are not assigned the same address.

1.5.4 Peak frame (registers 200–594)

Reg	Field	Scale / meaning
200	NUM_PEAKS	Number of detected peaks; up to 128 entries follow
201	ALPHA	×0.01; estimated background spectral slope
202	TEMPERATURE	×0.1 °C, signed; sensor die temperature, not ambient temperature
203	SPECTRAL_RMS	mg; relative vibration indicator, see measurement notes
204	PEAK_FACTOR	×0.0001; spectral concentration metric, see below
205	ALARM_STATUS	Bits 0/1: alarms 0/1 raised; bits 2/3: corresponding values valid
206	ALARM_ PROGRESS	High byte: alarm 0 filter state, 0–100%; low byte: alarm 1 filter state, 0–100%
207–209	Reserved	Ignore
210–465	PEAKS	128 pairs: frequency ×0.1 Hz, amplitude in mg
466–593	WIDTHS	One width per peak, ×0.1 Hz
594	SEQ	Frame sequence counter, wraps after 65535

Unused peak entries are zero-filled. Count entries using register 200 and the transport limit.

Peak factor is a spectral concentration indicator used by the alarm configuration. It is not the time-domain crest factor.

Spectral slope and width are descriptive features that can be compared over time alongside machine operating conditions.

Alarm validity: only interpret an alarm's raised bit and progress byte when its corresponding valid bit is set. The progress percentage is a time-filter state, not a probability of failure.

1.6 Appendix B — Bluetooth LE and configuration

Both variants expose the BLE register service. Subscribe to the sequence notification, then read the frame characteristic when a new measurement is available. Use a client supporting a long characteristic read for the complete 382-byte frame; this is not Modbus RTU encapsulated over Bluetooth LE.

Service UUID: `91827b0c-800d-4345-8ccb-cfa3c21b0c30`. The characteristics share this UUID prefix, with the final two digits below:

Suffix	Characteristic	Operation / payload
31	Sequence	Notify; 16-bit sequence number
32	Peak frame	Read; 382 bytes, layout below
33	Measurement configuration	Read/write; four 16-bit values: sample rate in Hz, window size, interpolation, window function

Payload words are little-endian. The peak frame contains ten prefix words matching registers 200–209, 60 frequency/amplitude pairs, 60 widths and a trailing sequence word. Decode at most `min(NUM_PEAKS, 60)` peaks; the detected count may exceed the number transmitted. The data uses the same units and scales as the Modbus RTU peak list. Use the sequence in the returned frame to identify new measurements.

Write the complete eight-byte configuration payload in one operation. These four fields have the same meaning and persistence behavior as registers 10–13.

The BLE service is available for evaluation and integration development. Confirm throughput, operating range, concurrent-client behavior and access-control requirements with EUB for the intended installation.