SENSECOM-HPC

Communication unit for multiple Vibrating Wire Gauges / Sensors

Purpose

SENSECOM-HPC is designed to manage and measure multiple **vibrating wire** (VW) sensors (up to 5) and to send the measured values over **SIGFOX** IoT network.

The device is optimized for battery operation, with an estimated life of up to 4-7 messages per day being **> 10 years**.

Typical applications: accurate measurement of pore pressures and ground water elevation at boreholes / wells, tilt measurements of structures and slopes, displacement and crack motion measurements, etc. using VW sensors.

Device description:

SENSECOM-HPC device allows to oscillate the sensor string and scan its frequency in the range of 1.5-5kHz. The device is designed to operate with multiple VW sensors, there is one channel on board and positions for up to 4 other channels with plug-in modules **SENSECOM-HPCM**. There can be 5 VW sensors attached in total to single communication device.
The electronics of the device are mostly in sleep mode with minimal power consumption. By default, the device is activated twice a day, performs measurements on the connected sensors and sends the messages with the measured values of each sensor:

- Sensor string oscillation period
- Measurement noise level
- Sensor thermistor resistance

The measured values are transferred (without modification) via SIGFOX network to the cloud storage.
If there is no electromagnetic disturbance during the measurement (i.e. the measurement noise level does not exceed 5), the measurement accuracy is determined mainly by the accuracy of the sensor itself.

Data processing

Measured values are typically available for processing within 7 seconds after measurement in the **SIGFOX cloud**. In addition, the data, with recalculations and calibrations, can also be accessed at SENSEPARAM.COM portal, and similarly transferred to the customer. Data can be obtained using a call-back mechanism (push method), REST-API, or download to a CSV file (manually).

Device security

The device includes an accelerometer that indicates tampering. In case of violation, it sends immediately the alarm message. The device also sends 1x / day system Keep-Alive message with information about battery voltage and processor temperature. There is also a temperature and humidity sensor inside the device. Sensor disconnection status can also be identified from transmitted periodical messages.

Message transmission has assured integrity through the AES-128 algorithm (message spoofing avoidance).

Message types

Types of transmitted messages from **SENSECOM-HPC** to (from) the cloud:

- **Value message** - periodical message containing measured values from the sensor and values of device inner temperature, humidity and accelerometer.
- **Alarm message** - a message generated when the accelerometer, temperature or humidity change thresholds are exceeded.
- **Keep-Alive message** – 24h system periodical message sent by the device.
- **Downlink acknowledge message** - System response to received downlink.
- **Configuration message** - comes after successful receipt and processing of downlink.
- **Downlink message** - message received by the device from SIGFOX back-end as a part of sending the first message after each Keep-Alive message. It is used for eventual adjustment of the device.

Remote setup and FW upgrade

Period of measurement / value messages, inner sensors sensitivity or their de/activation can be set remotely once a day (via downlink). In places with poor coverage of the SIGFOX network, the device may not be able to receive a downlink message even though the uplink message has been received regularly by the network. Remote FW upgrade is not possible.

Device casing:

The device is designed to be attached to a wall or placed in small spaces to bracket (not included), eg in a casing of a borehole with a minimum inside diameter of 150mm.
The device is in a plastic case (ABS) with dimensions 171x121x80mm ((h-w-d, sizes without glands, cables and fixing feet), the case can be attached in all 4 corners. The housing is IP65 (IP67-68 with silicone). The device has one gland at the top for RG58 cable with the SMA antenna connector, and other glands are at the bottom for the cables from the VW sensors. Recommended external antenna has a hat design.

SmartImp s.r.o.
Antala Staška 455/64,
140 00 Praha 4, Czech Republic
www.smartimp.cz

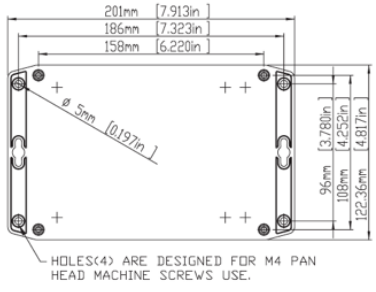
Technical parameters

Parameter	Value
Type and number of connectable sensors	Vibrating wave (VW) sensor 1-5 sensors (1 input on board, 4 positions for plug-in SENSECOM-HPCM modules)
The main measurement parameter	Oscillation period of the sensor string (µs) Frequency range: 1,5-5 kHz
Accuracy of main parameter	±10ns (±0,1Hz) accuracy and dependent further on sensor accuracy (for noise <5)
Secondary parameter	Thermistor resistance (if connected), 1-10kΩ
Transmission network	SIGFOX (ISM band 868MHz)
Uplink message types	Periodical with measured values Initial with measured values Configuration Alarm – tampering with device (accelerometer-based) Keep-Alive 24h Downlink acknowledgement
Period of sending messages with measured values	10min, 30min, 1h, 2h, 4h, **12h-default**, 24h [1]
Accessibility of data	SIGFOX back-end (12 Bytes payload messages) or SmartImp SENSEPARAM.COM back-end (with data normalization), data obtaining options: Call-back (push) REST-API (Sigfox only) Email or SMS (Senseparam only) CSV download
Device inner sensors	accelerometer, thermometer, humidity meter - adjustable sensitivity for alarms[1]
Antenna	Recommended external hat-type antenna for ISM band (868MHz), 6dBi
Power supply	Lithium battery (non-rechargeable) 3,6V, soldered, size D, type SAFT LS 33600 (17Ah), Terminal for spare replaceable battery (including casing) or external power supply
Expected battery life without battery replacement	>10 years with 7 messages a day (2 measurements, 5 sensors)
Sensor connection	Cable through the individual gland to the plug-in connector with screw terminals
Housing protection	IP65 (IP67-68 with silicon)
Weight	300g
Operational temperature	-25°C up to +75°C
Case dimensions	171x121x80 mm (option with 5 glands / sensor cables) 171x121x55mm (option with 2 glands / sensor cables) without glands and brackets
SIGFOX Certificate number	P_00B4_FE9C_01

[1]Remotely configurable

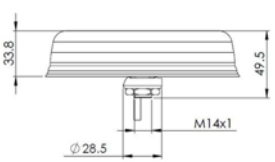
Device casing

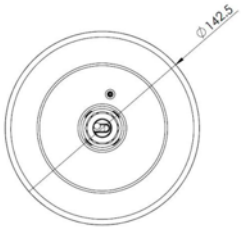
Case: material ABS, IP65 (IP67-68 with silicon)
Dimensions without glands and brackets:
171x121x80 mm designed with 1+5 glands (higher lid)
171x121x55 mm designed with 1+2 glands (lower lid)



Hat-type antenna

Bandwidth: ISM (868 MHz)
Casing protection: IP67
Cable: RG58 with SMA-M, standard length 0,5m (optional 2,5m)
Dimension: ∅143x34mm
Gain: 6dBi





SmartImp s.r.o.
Antala Staška 455/64,
140 00 Praha 4, Czech Republic
www.smartimp.cz