

# MOVE SOLUTIONS

## SYSTEM FOR MONITORING

The Move Solutions monitoring system is composed of multiple types of sensors and wireless communication devices, capable of carrying out structural monitoring in both dynamic and static conditions. In addition, this system can integrate a wide range of geotechnical probes and sensors to provide data including: accelerations, displacement, angle variations, vibrations, static deformation, crack and joint movement, lateral or vertical ground movement, ground pore water pressure and strain.

### FEATURES

- High precision
- Data analysis with advanced algorithms
- No wiring
- Long-range communication
- Modular system
- High autonomy
- Complete management and customization
- Minimum maintenance required
- Strong design

### MEASUREMENTS

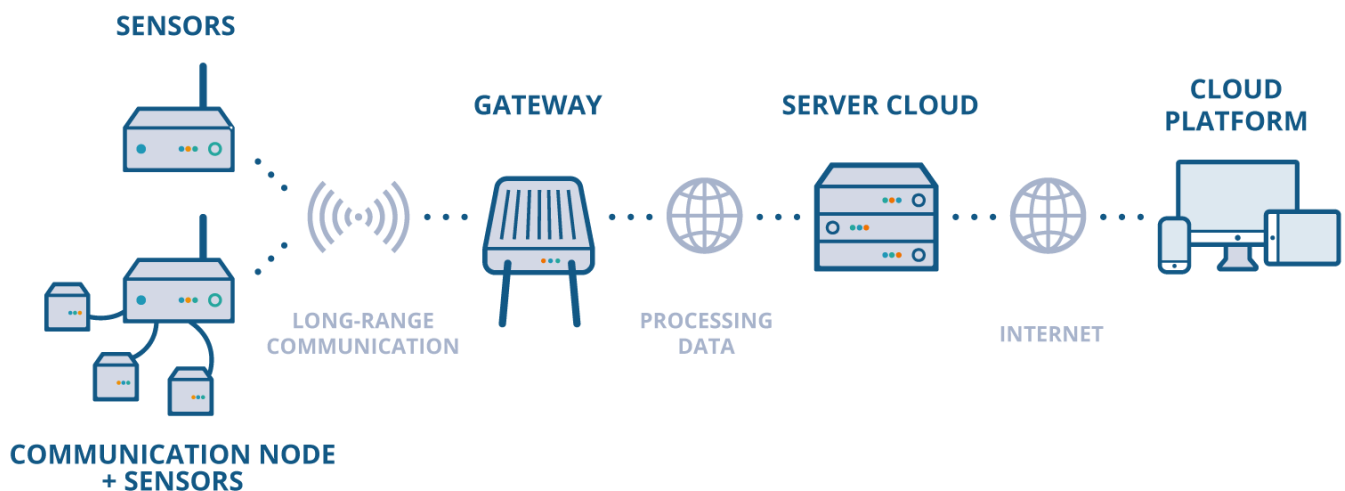
- Dynamic amplitude monitoring
- Modal frequency analysis of the structure
- Vibrational analysis of the structure
- Static monitoring of the inclination of the structure
- Accelerations, speed and dynamic displacement
- Geotechnical monitoring
- Monitoring of cracks and openings
- Water pressure monitoring
- Highlighting of seismic vibrations

## HOW IT WORKS

The installation of an entire wireless sensor system on site is quick and easy: simply mount each device with at least two screws on the structure you want to monitor and power the LoRaWAN Gateway. Furthermore, you can configure the entire system remotely, before, during or after installation, using your laptop or tablet. After installation and setup, the Move Wireless Monitoring System will start measuring and you can start monitoring from your desk.

The wireless sensor system automatically communicates measurement data via the LoRaWAN communication protocol (hundreds, thousands of meters away) with the on-site gateway. In turn, the Gateway sends the data received via 4G or LTE to the online servers.

To complete this system is the Move Cloud Platform. This service is a cloud-based web tool that allows you to access, view and export measurement data and configure the settings of the entire sensor system. You can access the Move Cloud platform 24/7 from any location or device around the world. One of the main advantages of the Move Cloud platform is that it offers remote access to measurement data and allows remote configuration of all installed sensors. This saves time and effort. Additionally, measurement data can be analyzed using processing algorithms included in the service, to perform complex calculations, correlations and analyzes automatically and effortlessly. You can also easily configure alerts for multiple recipients who will receive threshold cross notifications via email.



## DECK – DYNAMIC DISPLACEMENT SENSOR



Deck is the only sensor on the market for measuring the dynamic oscillation amplitude with an accuracy of 0.01 mm. It also detects the temperature and vibration frequency of any structure. Perfect for continuous remote monitoring of dams, bridges, viaducts and buildings and for dynamic load tests. A wireless device with battery power and LoRaWAN transmission.

### TECHNICAL SPECIFICATIONS

#### OPERATION

<b>Operation with programmed acquisitions</b>	Record of an event for each oscillation that exceeds the activation threshold set by the user. For each event: acquisition of displacement for 30 seconds (10 seconds before and 20 seconds after exceeding the threshold). Acquisition of the temperature at each event.
<b>Custom Operation Software</b>	It is possible to request custom features that the customer deems necessary for their business.
<b>Sampling Frequency</b>	50 Hz

#### MEASUREMENT

<b>Acquisition of</b>	<ul style="list-style-type: none"> <li>• Displacement</li> <li>• Temperature</li> </ul>
<b>Displacement Resolution</b>	0.012mm, 0.024mm
<b>Shift Accuracy</b>	±0,01 mm
<b>Measurement of Axis</b>	of the Parallel axis to the gravity axis (Z) or perpendicular (X or Y)
<b>Range</b>	± 1.5 mm, ± 3mm
<b>Displacement Bandwidth (-3DB)</b>	0.70 - 15 Hz
<b>Temperature accuracy</b>	0,5°C
<b>Temperature Resolution</b>	0,125°C

RADIO	
Central Processing Unit	ARM Cortex M0 32 Bit
Radio channel frequency	868 MHz (EU) - 125 KHz BW (LoRaWAN)
Transmission Power	14 dBm
Link coverage	1km (line of sight with the Gateway)*

GENERAL DATA	
Waterproof Rating	IP67
Reliability	Internal Watchdog (Inside the Microcontroller) External Watchdog (External to the Microcontroller)
Battery	4 lithium battery type "D" 19Ah 3.6V
Operating temperatures	-40°C/+85°C
Dimensions case	140 x 170 x 65 mm
Dimensions case+plate	200 x 200 x 80 mm
Weight	2.4 Kg

INSTALLATION	
Method	Four-point mounting using screws and plugs (Ø10mm, L:30mm)
Site	<ul style="list-style-type: none"> <li>• Fixing on wall</li> <li>• Fixing on ceiling</li> <li>• Fixing on ground</li> </ul>

BATTERY AUTONOMY	
Sample rate	Estimated autonomy
5 samplings/hour	2 years*

\* Wireless coverage of the device may vary depending on the scenario

\* Battery life may shorten when operating in extreme temperatures.

Note: Specifications are subject to review and change without notice.

## TRIAxIAL TILTMETER



The Tiltmeter measures the inclination and temperature of the point where it is installed relative to the gravitational axis. By installing a system composed of these sensors it is possible to reconstruct the deformation of the structure. All Tiltmeters can be perfectly synchronized with each other, perfect for static load tests. Battery-powered and LoRaWAN wireless transmission. The acquisition methods can be set by the user through the web interface provided in the service.

## TECHNICAL SPECIFICATIONS

### OPERATION

#### Operation with programmed acquisitions

Record of a tilted sample at a fixed rate set by the user (once every 2 minutes, 5 minutes, 15 minutes, 30 minutes). Each sample of inclination is derived from the average of the previous minute. All sensors can be synchronized with each other. Acquisition of the temperature at each event.

#### Custom Operation Software

It is possible to request custom features that the customer deems necessary for their business.

### MEASUREMENT

#### Technology

MEMS technology - Triaxial

#### Acquisition of

- Tilt angle
- Temperature

#### Resolution

0,000015°

#### Repeatability

±0,0005°

#### Accuracy

0,005°

#### Range

± 90° (on both angles)

#### Cross Axis Sensitivity

1%

#### Temperature resolution

0,125°C

RADIO	
Radio channel	LoRaWAN communication protocol
Radio channel frequency	ISM 868Mhz
Link coverage	1km (line of sight with the Gateway)*

GENERAL DATA	
Waterproof class	IP67
Battery	1 lithium battery type "D" 19Ah 3.6V
Operating temperatures	-40°C/+85°C
Dimensions	75 x 80 x 57 mm
Weight	1.1 Kg
Case material	Lega GD-ALSi12
Corrosion resistance	>1000 hours in salt spray

INSTALLATION	
Method	Two-point mounting using screws and plugs (Ø6mm, L:30mm)
Site	<ul style="list-style-type: none"> <li>• Fixing on wall</li> <li>• Fixing on ceiling</li> <li>• Fixing on ground</li> </ul>

BATTERY AUTONOMY	
Sample rate	Estimated autonomy
Every 30 minutes	8 years*

\* Wireless coverage of the device may vary depending on the scenario

\* Battery life may shorten when operating in extreme temperatures.

Note: Specifications are subject to review and change without notice.

## ACCELEROMETER SHM



The accelerometer measures the acceleration and temperature of the exact point where it is installed in relation to the structure. It is possible to measure the vibration frequencies and carry out a modal study of the structure. All accelerometers can be perfectly synchronised with each other. Battery power supply and LoRaWAN wireless transmission. The acquisition modes can be set by the user via the web interface provided in the service.

## TECHNICAL SPECIFICATIONS

OPERATION	
<b>Activation threshold mode</b>	Acquisition of 1024 triaxial acceleration samples subsequent to exceeding the activation threshold set by the user. Acquisition of the temperature in correspondence with each event.
<b>Planned acquisitions mode (Modal Analysis)</b>	Acquisition of 8192 triaxial acceleration samples with a fixed rate set by the user (every 1, 2, 6, 12, 24 hours), synchronized between all sensors. Acquisition of the temperature at each event.
<b>Custom Operation Software</b>	It is possible to request custom features that the client deems necessary for their business.
<b>Sample Rate</b>	40Hz - 80Hz - 160Hz - 320Hz - 640Hz All derived from a 4 kHz sampling by means of downsampling
<b>Absolute synchronization</b>	$\pm 2$ seconds
<b>Relative Synchronization (Modal Analysis)</b>	500 $\mu$ s



SAMPLE RATE	BANDWIDTH (-3 dB)	THRESHOLD ACQUISITION DURATION	PLANNED ACQUISITION DURATION
40Hz	13.5Hz	25.6s	204.8s
80Hz	27Hz	12.8s	102.4s
160Hz	54Hz	6.4s	51.2s
320Hz	108Hz	3.2s	25.6s
640Hz	216Hz	1.6s	12.8s

#### MEASUREMENT

<b>Technology</b>	MEMS technology - Triaxial
<b>Acquisition of</b>	<ul style="list-style-type: none"> <li>• Acceleration</li> <li>• Temperature</li> </ul>
<b>Resolution</b>	15bit (31.25µg, 62.5µg, 125µg)
<b>Range</b>	± 0.512g, ± 1.024mg, ± 2.048g
<b>Noise Density</b>	22.5 µg/√Hz

#### RADIO

<b>Radio channel</b>	LoRaWAN communication protocol
<b>Radio channel frequency</b>	ISM 868Mhz
<b>Link coverage</b>	1km (line of sight with the Gateway)*

#### GENERAL DATA

<b>Waterproof Rating</b>	IP67
<b>Battery</b>	1 lithium battery type "D" 19Ah 3.6V
<b>Operating temperatures</b>	-40°C/+85°C
<b>Dimensions</b>	75 x 80 x 57 mm
<b>Weight</b>	1.1 Kg
<b>Case material</b>	Alloy GD-ALSi12
<b>Corrosion resistance</b>	>1000 hours in salt spray



**INSTALLATION**

<b>Method</b>	Two-point mounting using screws and plugs (Ø6mm, L:30mm)
<b>Site</b>	<ul style="list-style-type: none"><li>• Fixing on wall</li><li>• Fixing on ceiling</li><li>• Fixing on ground</li></ul>

**BATTERY AUTONOMY**

<b>Operating mode</b>	<b>Estimated autonomy</b>
Activation threshold	2 years*
Planned acquisitions	3 years*

\* Wireless coverage of the device may vary depending on the scenario

\* Battery life may shorten when operating in extreme temperatures.

Note: Specifications are subject to review and change without notice.

## ANALOG COMMUNICATION NODE



The analogue communication node is compatible with most of the analogue interfaces used for geotechnical sensors. Once the sensors are connected to this wireless device and the system gateways are properly installed on-site, they are ready to acquire and send data.

## TECHNICAL SPECIFICATIONS

### OPERATION

<b>N° of sensors supported</b>	4 channels
<b>Sample rate</b>	2 min - 10 min - 30 min - 1 hour (can be set remotely)
<b>Power supply for external instruments</b>	5Vdc, 12vdc, 24Vdc -upon request-(250mA max)

### MEASUREMENT

<b>Readings supported</b>	<ul style="list-style-type: none"> <li>• Current Loop Reading (4-20mA) (2, 3, 4 wires -external power supply needed-)</li> <li>• Full Bridge Reading (mV / V)</li> <li>• pt100 reading (3, 4 wires)</li> </ul>
<b>Supply</b>	2 Lithium battery 3.6V (19Ah)
<b>Voltage reading accuracy</b>	±0.05% FS (±10Vdc)
<b>Current loop reading accuracy</b>	±0.05% FS
<b>Reading accuracy mV/V</b>	±0.1% FS
<b>Thermistor reading accuracy</b>	±0.5°C
<b>PT-100 reading accuracy</b>	±0.2°C

### RADIO

<b>Wireless communication system</b>	LoRaWAN
<b>Wireless coverage</b>	15 km (line of sight), 1 km (urban environment)

GENERAL DATA	
<b>Waterproof class</b>	IP67
<b>Processor</b>	ARM Cortex M4
<b>Clock</b>	RTC On-Board (Real Time Clock) and high precision
<b>Absolute synchronization</b>	±1 sec
<b>ADC</b>	24bit Delta-Sigma with self-calibration
<b>Size case</b>	180x119x61 mm
<b>Material</b>	Polycarbonate
<b>Operating temperature</b>	-40°C - 85°C
<b>Weight</b>	0.75 Kg
INSTALLATION	
<b>Input cable section</b>	24 - 20 AWG (Ø 0,5mm - Ø 0,8mm)
<b>Method</b>	Pole or wall mounting using special plates and screws
<b>Configuration</b>	<ul style="list-style-type: none"> <li>• Pole fixing</li> <li>• Mesh fixing</li> <li>• Wall fixing</li> <li>• Ceiling fixing</li> <li>• Floor fixing</li> </ul>

\* Wireless coverage of the device may vary depending on the scenario

\* Battery life may shorten when operating in extreme temperatures.

Note: Specifications are subject to review and change without notice.

## DIGITAL COMMUNICATION NODE



The digital communication node is compatible with digital sensors made by Sisgeo. Once the sensors are connected to this wireless device and the system gateways are properly installed on-site, they are ready to acquire, store and send data.

### TECHNICAL SPECIFICATIONS

#### OPERATION

<b>N° of sensors supported</b>	1 BUS, up to 30 sensors
<b>Sample rate</b>	2 min - 10 min - 30 min - 1 hour - 6 hours - 12 hours (can be set remotely)
<b>Power supply for external instruments</b>	12VDC (250mA max)

#### MEASUREMENT

<b>Readings supported</b>	All Sisgeo Modbus sensors
<b>Supply</b>	2 Lithium battery 3.6V (19Ah)
<b>Type of sensors supported</b>	<ul style="list-style-type: none"> <li>• In-place Inclinometer</li> <li>• Inclinometer chains</li> <li>• Crackmeters</li> <li>• Load cells</li> <li>• Humidity sensors</li> <li>• Tiltmeters</li> <li>• Settlement Gauges</li> <li>• Extensometers</li> <li>• Piezometers</li> </ul>

#### RADIO

<b>Wireless communication system</b>	LoRaWAN
<b>Wireless coverage</b>	15 km (line of sight), 1 km (urban environment)

#### GENERAL DATA

<b>Waterproof class</b>	IP67
<b>Processor</b>	ARM Cortex M4
<b>Clock</b>	RTC On-Board (Real Time Clock) and high precision
<b>Absolute synchronization</b>	±2 sec
<b>Case size</b>	180x119x61 mm
<b>Material</b>	Polycarbonate
<b>Operating temperature</b>	-40°C - 85°C
<b>Weight</b>	0.75 Kg
<b>INSTALLATION</b>	
<b>Input cable section</b>	24 - 20 AWG (Ø 0,5mm - Ø 0,8mm)
<b>Method</b>	Pole or wall mounting using special plates and screws
<b>Configuration</b>	<ul style="list-style-type: none"><li>• Pole fixing</li><li>• Mesh fixing</li><li>• Wall fixing</li><li>• Ceiling fixing</li><li>• Floor fixing</li></ul>

\* Wireless coverage of the device may vary depending on the scenario

\* Battery life may shorten when operating in extreme temperatures.

Note: Specifications are subject to review and change without notice.

## TRIAxIAL VIBROMETER



The triaxial Vibrometer is able to measure the velocity of the point where it is installed, providing complete frequency and amplitude analysis of vibrations.

With the use of Vibrometer devices, it is possible to highlight any seismic vibrations, mainly induced by external factors, and monitor their risks. Battery power supply and LoRaWAN wireless transmission.

The acquisition modes can be set by the user via the web interface provided in the service.

## TECHNICAL SPECIFICATIONS

### OPERATION

<b>Wireless Data Transmission of</b>	Maximum detected PPV, timestamp, maximum amplitude and frequency detected for each axis, maximum velocity detected for each axis, temperature.
<b>Local Storage of</b>	Up to 2000 acquisitions, one acquisition is composed of 1024 Datapoint. All the acquisitions are retrievable by USB Connection with a PC.
<b>Custom Operation Software</b>	It is possible to request custom features that the client deems necessary for their business.
<b>Sample Rate</b>	512Hz (Derived from a 4 kHz sampling rate by means of downsampling)
<b>Absolute Synchronization</b>	± 1 second
<b>Supportable Standards<sup>1</sup></b>	DIN4150, UNI9916, BS7385, SN 640 312a, RI8507

### MEASUREMENT

<b>Technology</b>	MEMS technology - Triaxial
<b>Acquisition of</b>	<ul style="list-style-type: none"> <li>Velocity</li> <li>Frequency</li> <li>Temperature</li> </ul>
<b>Resolution</b>	0.0015 mm/s

<b>Range</b>	± 50 mm/s
<b>Noise Density</b>	22.5 µg/√Hz

### RADIO

<b>Radio Channel</b>	LoRaWAN communication protocol
<b>Radio Channel Frequency</b>	ISM 868MHz / 915MHz
<b>Link Coverage<sup>2</sup></b>	1 km (line of sight with the Gateway)

### GENERAL DATA

<b>Waterproof Rating<sup>3</sup></b>	IP67
<b>Battery</b>	1 lithium battery type "D" 19Ah 3.6V
<b>Operating temperatures</b>	-40°C/+85°C
<b>Dimensions</b>	75 x 80 x 57 mm
<b>Weight</b>	1.1 Kg
<b>Case Material</b>	Alloy GD-AlSi12

### INSTALLATION

<b>Method</b>	Two-point mounting with screws and plugs (Ø6mm, L:30mm)
<b>Site</b>	<ul style="list-style-type: none"> <li>• Fixing on wall</li> <li>• Fixing on ceiling</li> <li>• Fixing on ground</li> <li>• Fixing underground</li> </ul>

### BATTERY LIFE

Acquisition Rate	Radio Connection Quality	Battery Estimation <sup>4</sup>
1 minute	Good	1.4 years
5 minutes	Good	1.5 years
1 minutes	Bad	1 year
5 minutes	Bad	1.3 years

<sup>1</sup> A calibration may be necessary to be fully compliant with the standards. Calibration service available on request.

<sup>2</sup> Wireless coverage of the device may vary depending on the scenario

<sup>3</sup> Guaranteed only with the dust cap or smart cable correctly screwed

<sup>4</sup> Battery life may shorten when operating in extreme temperatures

Note: Specifications are subject to review and change without notice.



## GATEWAY SHM



The SHM Gateway is a control unit for receiving and sending data with which, thanks to the LoRaWAN wide-area communication protocol, dozens of devices and sensors can be managed and communicated with simultaneously. This device, first of all, receives the information transmitted by the multiple sensors installed via LoRaWAN. Then, using cellular connectivity, it forwards this data to online servers.

## TECHNICAL SPECIFICATIONS

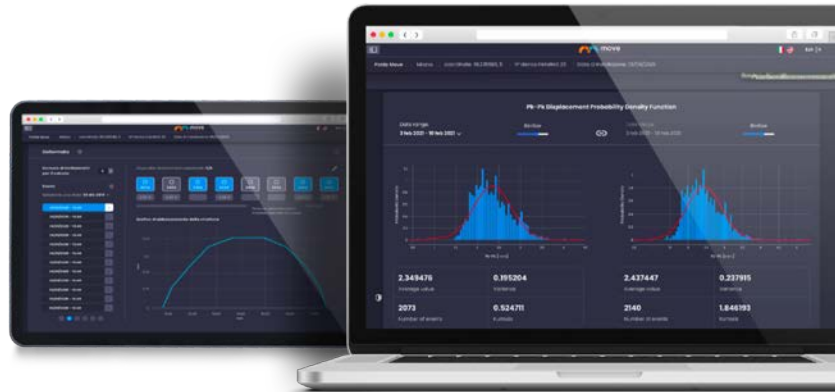
### GENERAL DATA

<b>Computing</b>	MT7628, DDR2RAM 128 MB
<b>Wi-Fi Feature</b>	<ul style="list-style-type: none"> <li>Frequency: 2.400-2.4835GHz(802.11b/g/n)</li> <li>RX Sensitivity: -95dBm (Min)</li> <li>TX Power: 20dBm (Max)</li> <li>Operation Channels: 2.4GHz: 1-13</li> </ul>
<b>LoRa Feature</b>	<ul style="list-style-type: none"> <li>Card: SX1301 Mini PCIe Card (connects maximum of two)</li> <li>Channels: 8 Channels (Optional: 16 channels)</li> <li>RX Sensitivity: -139dBm (Min)</li> <li>TX Power: 27dBm (Max)</li> <li>Frequency: EU433, CN470, EU868, US915 , AS923, AU915, KR920, IN865</li> </ul>
<b>Cellular Feature</b>	<ul style="list-style-type: none"> <li>Supports Quectel EG95-E / EG95-NA(IoT/M2M-optimized LTE Cat 4 Module)</li> <li>EG95 -E for EMEA Region :</li> <li>LTE FDD: B1/B3/B7/B8/B20/B28A</li> <li>WCDMA: B1/B8</li> <li>GSM/EDGE: B3/B8 EG95 -NA for North America Region</li> <li>TE FDD: B2/B4/B5/B12/B13</li> <li>WCDMA: B2/B4/B5</li> </ul>
<b>Power Supply</b>	PoE(IEEE 802.3af/at-Compliant) - 42~57VDC; Power Jack - 12V DC
<b>Power Consumption</b>	5 W (typical)

<b>ETH</b>	RJ45 (10/100Mbps)
<b>Antenna</b>	5 N-Type Connectors
<b>Ingress Protection</b>	IP67
<b>Enclosure Material</b>	Aluminum
<b>Weight</b>	3.15kg
<b>Dimension</b>	220 mm x 220 mm x 104 mm
<b>Operating Temperature</b>	da -30 C a +55 °C
<b>Storage Temperature</b>	da -40 C a +85 °C
<b>Operating Humidity</b>	Da 0% a 95% (non-condensing)
<b>Storage Humidity</b>	Da 0% a 95% (non-condensing)
<b>Installation method</b>	Montaggio su palo o a parete
<b>Certification</b>	CE, FCC, IC, RCM, RoHS
<b>LoRa</b>	
<b>Operating Frequency</b>	<ul style="list-style-type: none"> <li>• EU433, CN470, EU868, US915</li> <li>• AS923, AU915, KR920, IN865</li> </ul>
<b>Transmit Power</b>	27dBm (max)
<b>Receiver Sensitivity</b>	-139dBm (Min)
<b>WIFI</b>	
<b>Wireless standard</b>	IEEE 802.11b/g/n
<b>Operating Frequency</b>	ISM band: 2.412~2.472(GHz)
<b>Operation Channels</b>	2,4 GHz: 1-13
<b>Transmit Power</b> (The max. power may be different depending on local regulations) -per chain	802.11b <ul style="list-style-type: none"> <li>• 1Mbps: 19dBm</li> <li>• 11Mbps: 19dBm</li> </ul> 802.11g <ul style="list-style-type: none"> <li>• 6Mbps: 18dBm</li> <li>• 4Mbps: 16dBm</li> </ul> 802.11n (2.4G) <ul style="list-style-type: none"> <li>• MCS0 (HT20): 18dBm</li> <li>• MCS7 (HT20): 16dBm</li> <li>• MCS0 (HT40): 17dBm</li> <li>• MCS7 (HT40) : 15dBm</li> </ul>

\* Wireless coverage of the device may vary depending on the scenario

## PLATFORM



The Move Cloud Platform is a remotely accessible online portal where it is possible to view the data detected by the sensors, manage and configure the entire monitoring system and process the results using specially designed algorithms.

This portal is a service that Move Solutions offers to all its customers with the aim of facilitating and speeding up their work of analyzing and studying monitoring data. Indeed it offers multiple types of raw data visualization, but above all, it offers specific tools designed specifically in response to the most frequent requests. There are tools for every type of monitored structure, from bridges and viaducts to railways to static load tests. You can also access the historical data database to quickly retrieve all the desired data and compare or correlate them with each other.