

BuildingEye[®] system



BuildingEye[®] system is an advanced technological solution for monitoring the structural health of buildings. This system is located in the structural joints and its function is to measure parameters of special relevance to diagnose pathologies or anomalies in a preventive manner to avoid accelerated deterioration that could affect the stability and safety of the structure.

This tool has been developed with Internet of Things (IoT) technology allowing continuous monitoring and full integration in smart buildings. In this way, the user can access the information of the structural critical points from the building control room (Supervisory Control And Data Acquisition - aka SCADA) or from a device with internet access.

Elements

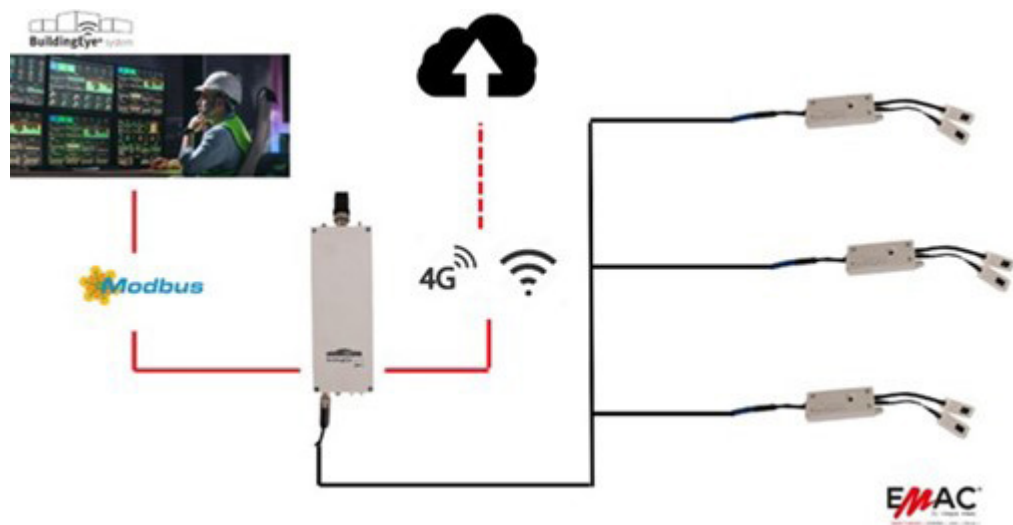
BuildingEye[®] system consists of the following elements:

- **Measuring nodes:** These nodes are equipped with precision sensors to register real-time data, including structural movements, temperatures, relative humidity, inclinations and vibrations.
- **Communication nodes:** These nodes collect data from the measuring nodes distributed throughout the building and transmit it to the BuildingEye[®] Platform or to the building's SCADA system. The communication protocol is Modbus via RS-485 cabling.
- **BuildingEye[®] platform:** This platform stores, interprets and presents data through an intuitive interface, allowing users to access and manage information from any device connected to the Internet.

The implementation of the BuildingEye® system not only improves the safety of the structure, but also provides architects, engineers and technicians with detailed knowledge of the building’s performance thanks to the use of a digital twin. This facilitates making decisions based on objective information and improves both maintenance and structural design.

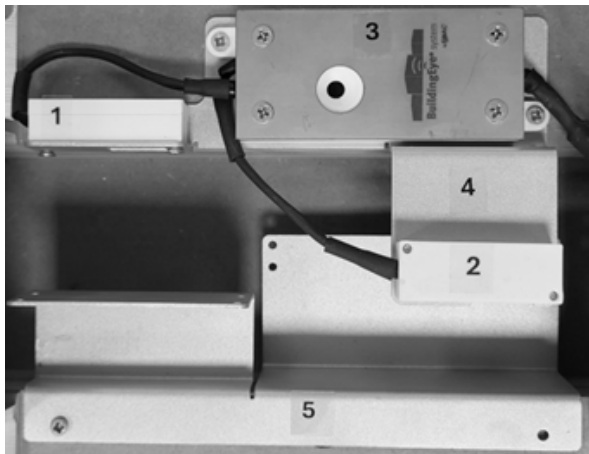
With the BuildingEye® system, building owners and managers have a tool that promotes a preventive approach to maintenance, ensuring greater optimization of resources and cost reduction and extending the useful life of the property.

System diagram



Measuring nodes

The measuring node of the BuildingEye® system takes measurements of distance, tilt, temperature, relative humidity and vibrations. These measurements are taken with sensors located in 3 housings:



- **Housing 1:** Horizontal movement sensor
- **Housing 2:** Vertical movement sensor
- **Housing 3:** Temperature sensor, relative humidity sensor, accelerometer sensor, gyroscope sensor

The sensors are mounted directly on the slab via a clamping plate (4). To capture the movement accurately, a measuring plate (5) is placed in front of the clamping plate. In this way, the sensor readings correspond closely to the movement of the slab.

Sensor features

- Structural joint horizontal movement sensor

- Range: 15 - 100 mm;
- Accuracy less than 1mm
- Average sensitivity = 9 mV/mm

- Structural joint vertical movement sensor

- Range: 15 - 100 mm;
- Accuracy less than 1mm
- Average sensitivity = 9 mV/mm

- Accelerometer and gyroscope sensor

- Range: +- 2.5 g.
- Noise: 45 ug/sqrt(Hz).
- Resolution 16 bits.
- Thermal stability < 0.4mg/°C.

- Temperature sensor

- Range -40 to 125°C.
- Accuracy +-0.1°C en 20-60°C.
- Resolution: 12 bits.

- Relative humidity sensor

- Range: 0 to 100%.
- Accuracy +-1.5% in range 20-80%.
- Resolution: 12 bits.

Communication nodes

The communication node of the BuildingEye® system receives the information transmitted by the measurement nodes and sends it to the BuildingEye® platform for further analysis. A communication node is limited to 30 Measurement Nodes.

Communication technologies

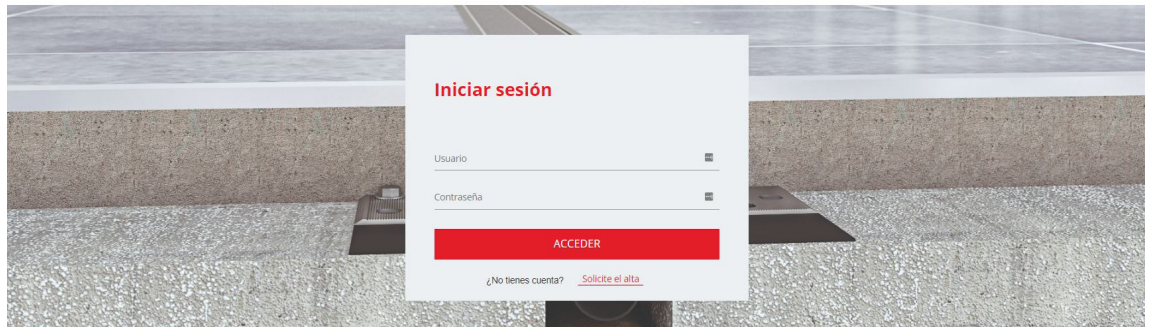
- Ethernet
- Wifi
- Mobile 4g/3g/GPRS

For the correct operation of the Communication Node and the Measuring Nodes of the BuildingEye® system, a 230V/110V power supply with a frequency of 50Hz/60Hz is required. Make sure that the electrical installation meets these requirements to ensure system operability and accuracy. The maximum power of each communication node is 500mA at 12V (6W).

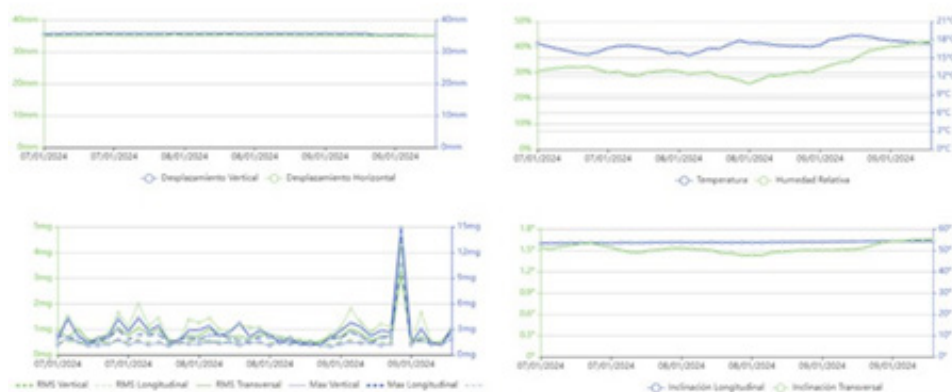
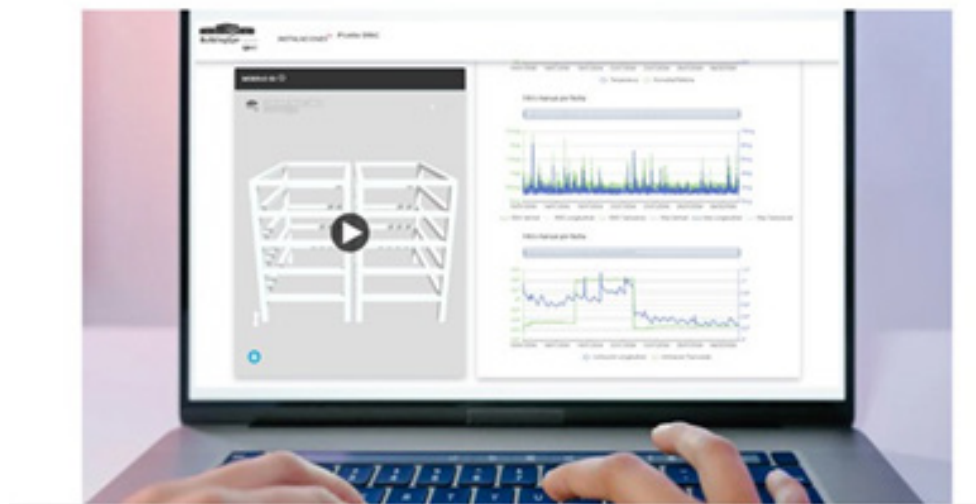
BuildingEye® platform

It is a web platform accessible from any device with internet access that allows you to view the evolution of the structural joint status and configure alerts when certain limits are exceeded in the structural joint.

The BuildingEye® Platform starts with a login page. Within the session the user selects his facility to access the stored data.



The digital twin is available on the BuildingEye® Platform. This digital twin is composed of graphs of the measured parameters, a 3D model of the building and alerts, facilitating a better understanding of the structural behavior. In addition, the information stored on the platform can be downloaded in .CSV format.



The platform includes an alert system that allows the definition of thresholds for each variable at each measurement point, which, if exceeded, sends an e-mail warning for the revision of the structure.

ID	Punto de medida	Parametro	Tipo	Valor	Fecha Primera Alerta	Fecha Última Alerta	Revisada	Observaciones
10	Planta 1 - Nodo 1	Desplazamiento	Horizontal	33.6 mm	29/1/2024 17:20:08	30/1/2024 9:20:07	✓	Todo OK
14	Planta 1 - Nodo 1	Sensor	Sin datos	-	30/1/2024 9:20:07	31/1/2024 9:20:07	✓	
16	Planta 1 - Nodo 1	Desplazamiento	Horizontal	33.6 mm	24/1/2024 16:20:07	30/1/2024 9:20:07	✓	
17	Planta 1 - Nodo 1	Desplazamiento	Vertical	10.25 mm	24/1/2024 16:20:07	30/1/2024 9:20:07	✓	

The data and the web platform is protected by an SSL (Secure Sockets Layer) certificate. Data is sent via SFTP (SSH File Transfer Protocol): SFTP is a secure extension of the SSH (Secure Shell) protocol that provides a secure mechanism for transferring files over an encrypted connection.

It uses cryptography to protect the confidentiality and integrity of data during transfer. Once on the web platform the data is protected by a SSL (Secure Sockets Layer) certificate. In addition, all databases are backed up daily on a 7-day rotation.

Installation

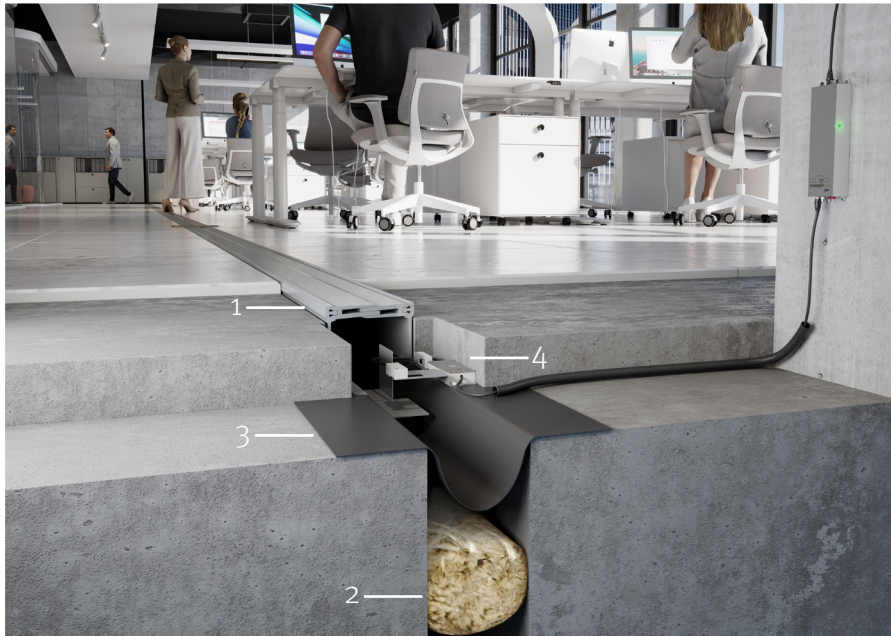
The measuring nodes are installed directly to the slab of the structure at the established structural joint monitoring points. These areas of the structural joint are finished with specifically designed covers that allow access to the system in case maintenance is required.

BuildingEye® system is custom designed for each project. The installation of the components is indicative and depends on the needs of the user and project. Specific information can be found in the user and installation manual.



EMAC® Structural joint system

BuildingEye® system integrates with EMAC’s complete structural joint solution consisting of the elements:



This image represents a model installation, the design of the installation varies according to the project.

- 1. Structural joint profile
- 2. Firewall cord
- 3. EPDM membrane
- 4. BuildingEye® system

Technical information

BuildingEye® system has been developed in collaboration with the Polytechnic University of Valencia.



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For any additional questions or further information about the technical features of the BuildingEye® system, please contact our specialist team at buildingeye@emac.es.