



Structural monitoring

Infrastructure | Buildings | Industrial structures

ROBO[®]CONTROL – Monitoring Solutions

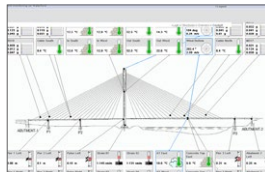
Providing long-term confidence



Incheon Grand Bridge, South Korea

ROBO[®]CONTROL “Permanent”

reliable, precise, web-based



mageba



Fully Remote Monitoring System

Concept

ROBO®CONTROL "Permanent" is a fully automated, independent and robust remote structural monitoring system which can be tailored to provide almost any type of information that may be required on the condition of a structure and its environment. As well as measuring loads, movements, vibrations and other parameters at any part of a structure (for example at its cables, bearings or expansion joints), the system can also be used to determine characteristic parameters such as natural frequency.

The installed systems measure parameters at predetermined intervals and transmit data by means of GPRS / GSM to a central computer system. There, the data is processed and authorized users can access information on a secured web page or a dedicated network system.

ROBO®CONTROL "Permanent" differs from mageba's alternative monitoring solution, ROBO®CONTROL "Portable", in that its use on a structure is long-term, made possible by permanent power supply, and data is transmitted "real time" for immediate use.

Design Features

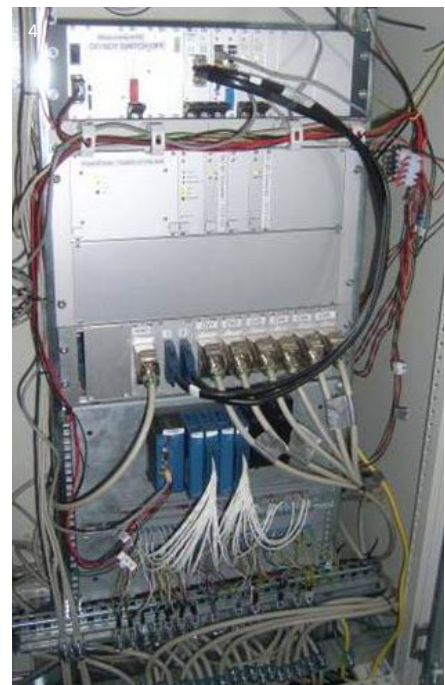
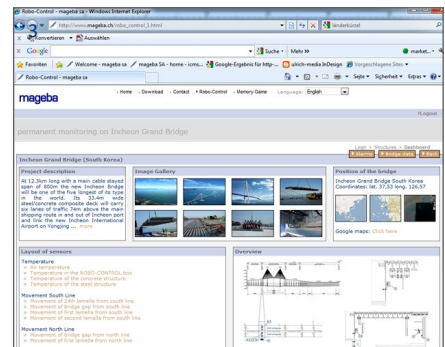
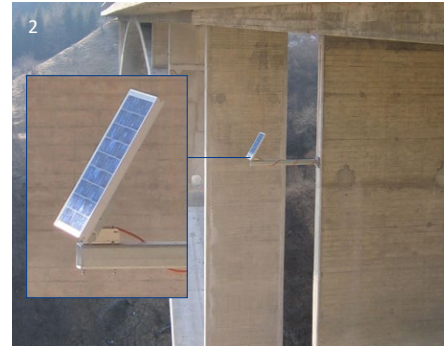
- Components designed for continuous operation
- All types of measurement technology can be integrated
- Data transmission via GPRS / GSM to mageba's or client's server, allowing location-independent monitoring
- Data presentation via secure internet portal or on dedicated network (download in CSV format possible)
- Alarm notification if boundary values are exceeded

Optional features:

- Grid-independent power supply
- Data processing and structural analysis by mageba
- Service contract for monitoring system (recommended)

Technical Features

- Reliable sensors that are available on the market and can therefore be easily exchanged or updated later on
- Data is processed automatically, and information is made available, real-time, to the end user through an intuitive and user-friendly interface
- Online access is protected by username and password (provided to the client only)
- Data can be downloaded at any time for further analysis
- mageba offers storage and processing of data on its own servers. Access to the information can be given through a password protected internet area. Thus, no server and software administration and maintenance is needed
- According to some countries' regulations, some critical data may not cross international borders. In such case, a dedicated server can be installed at the client's location
- Boundary and alarm values can be specified by the client. If any measured value exceeds or falls below the predefined alarm values, an e-mail or SMS message will be sent immediately to the client
- Ancillary devices such as cameras can be integrated with the system if desired



1 Installation of sensors on a cable stayed bridge

2 Optional solar panel

3 Online user interface

4 Example of installed "ADVANCED" system

End-User Oriented Surveillance Tools

End User Needs

End user needs are as varied as the structures that can benefit from a monitoring solution. The range of applications of a structural health monitoring system typically includes:

Safety Concerns

- Strength and stability of the structure or any of its parts

Engineering Data

- Enabling the condition and behavior of the structure to be fully understood, allowing actions to be taken to lengthen service life and optimize life-cycle costs
- Response of structure to external influences (e.g. wind, solar radiation, traffic, settlements, earthquakes)
- Statistics (traffic data, climatic data)

Usage Data

- Records of traffic events (speed, weight etc.)
- Decision support for maintenance / repair works, enabling the life-cycle economy of a structure to be optimized

Parameters Measured

Today, virtually any physical parameter can be measured to the accuracy required for project works. They include, for example:

- **Forces**
e.g. on bearings or anchor heads using preinstalled or retrofitted sensors
- **Displacements**
e.g. using ultrasonic or magnetorestrictive measurement technology
- **Crack Widths**
e.g. at a structure's critical concrete sections
- **Tilting of a Structure**
e.g. of a bridge pylon, using a 3D clinometer
- **Vibration and Acceleration**
e.g. on bridge cables, using conventional strain gauges, fiber optical sensors or 3D accelerators
- **Climatic Conditions**
e.g. temperature, solar radiation and wind

Services Provided

mageba offers the following services to clients:

Safety Monitoring

Main project drivers are specific concerns regarding the stability or usability of a structure. The condition or performance of key elements is monitored, with immediate alarm notification of critical events. The main goal is to ensure the safety of the structure.

Structural Health Monitoring

These systems are tailor-made solutions for the long-term monitoring of all types of structure. Assessment of behavior provides the information needed for detailed structural analysis. The client ideally benefits through an optimization of the structure's service life and life-cycle costs.

Inspection and Measurement Services

Data is monitored to satisfy a need for a detailed condition assessment, enabling conclusions to be drawn about a structure's condition, and possible further actions to be defined.

Consulting Services

mageba engineers will be pleased to support your monitoring project in related ways – for example, if remedial works change the static system of a structure, and the proposal works require definition, or optimization to reduce costs.



- 1 Automatic photographic records of "events"
- 2 ROBO®CONTROL box - the heart of the system
- 3 3D-acceleration sensor
- 4 Structural temperature sensor (wireless)



Structural monitoring

Web-based Data Presentation

Installation and System Calibration

The effort required to install a monitoring system depends on the complexity of the system and access conditions. The sensible positioning of sensors can sometimes present a challenge, but this can generally be overcome using widely available special access vehicles.

Most measuring devices are precalibrated and do not require adjustment on-site. However, it is possible to get a deviation from a theoretical expected value, particularly an alarm value. In this case, the settings can be adjusted later.

Data Compression and Transmission

Data is first pre-analyzed on site and compressed to reduce unnecessary transmission of data, and tailored to suit requirements (e.g. max. / min. / medium values).

The data is then transmitted in a data packet, either to a dedicated server at the client's offices or to a mageba shared server.

Presentation of Results

Measured data is graphically displayed on an intuitive and user-friendly web interface, with password-protected internet access.

An overview of the monitoring project is presented, and all measured characteristics, alarm parameters, general settings and a detailed description of the system can be viewed.

If required by the client, a cockpit solution with live streaming of all measured data can be provided (optional).



- 1 Installation of a solar panel
- 2 Graphical presentation of data at any time

Reference Projects – ROBO®CONTROL “Permanent”



Weyermannshaus (CH)



MacDonald Bridge (USA)



Alvsborg Bridge (SE)



Dintelhaven Bridge (NL)



River Suir Bridge (IR)



Incheon Grand Bridge (KR)

mageba ROBO®CONTROL Systems



“Portable”



Permanent “BASIC”



Permanent “ADVANCED”

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engineering connections®