

AUTOMATED CONSTRUCTION CONDITION MONITORING SYSTEM

TITAN



- automated measuring and recording of physical quantities characterizing the construction condition;
- automated measuring and recording of natural and industrial parameters influencing on the construction condition;
- automatic signaling on exceeding of rated values for parameters under measuring.



BANCOMZVJAZOK

AUTOMATED CONDITION MONITORING SYSTEM PROVIDES:

Automated measuring and recording of physical quantities characterizing the construction condition:

- sizes of temperature joints of concrete-steel constructions;
- inclination of supporting constructions according to the horizontal level;
- tension of material of supporting structures and bases;
- displacement of the construction relative to reference (control) points;
- displacement of horizontal planes relative to each other;
- deformation of the construction and bases of concrete structures.

Automated measuring and recording of natural and industrial parameters, influencing on the construction condition:

- level and temperature of ground water;
- level and temperature of river (channel) water;
- volume of water flowing over drainage system of the construction;
- water pressure on the level of construction base;
- rain capacity, atmospheric pressure, air temperature and humidity, wind direction and force.

Automated comparison of sensors readings with rated values and signaling on exceeding on predetermined level of values.

«TITAN» SYSTEM APPLICATION:

- hydraulic facilities HPPs, PSPPs.

«Titan» system can be adapted to various facilities:

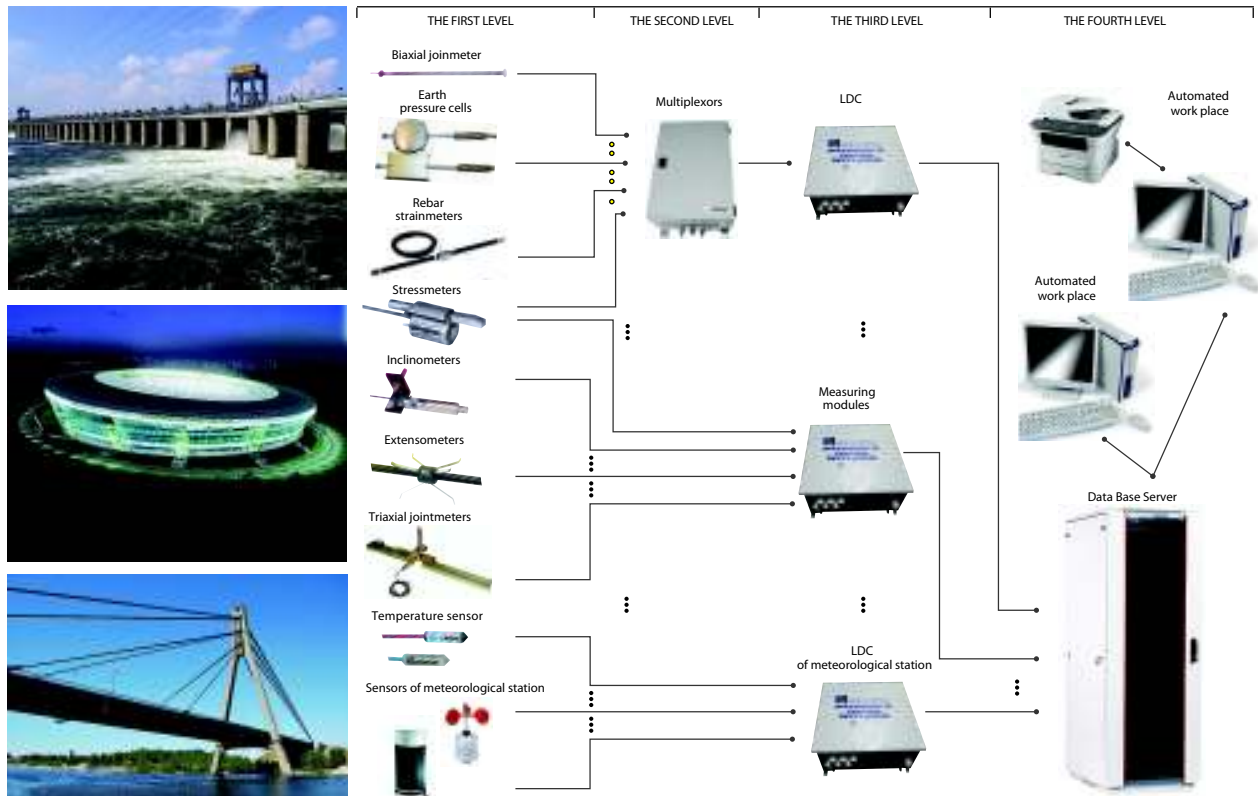
- bridges;
- tunnels;
- mines;
- NPPs;
- high-rise buildings;
- other constructions.



STRUCTURE OF AUTOMATED CONDITION MONITORING SYSTEM

«TITAN» system has traditional multilevel structure:

- the first level - sensors;
- the second level - multiplexors;
- the third level – local data concentrators;
- the fourth level – central unit of data processing.



THE FIRST LEVEL – provides data about object condition in the form of analog signals.

On the facilities, according to the model of the weakest points, the following sensors of the first level of the automated condition monitoring system are installed:

JOINTMETERS

Are used to measure displacement of concrete constructional blocks, and to control dynamics of cracks deformation in brickwork or stonework, concrete constructions or rock.

Subject to controlled parameters requirements, jointmeters can be fixed in uniaxial, biaxial and triaxial types with the control range from 2 to 250 mm.



SENSORS FOR PRESSURE PIEZOMETERS AND MEASURING OF HYDROSTATICAL AND PORE PRESSURE

Are used to measure water pressure on the line of concrete construction and its base, and also to measure hydrostatical and pore pressure in constructions and bases of hydraulic structures. These sensors are installed while facilities are under construction.



DEVICES TO CONTROL STRESS AND STRAIN STATE OF CONSTRUCTIONS

Are used to measure:

- rebar strain and compression forces (measuring are started directly after installation and conducted during construction works and following exploitation until strain and deformation are fully stabilized or devices service life (e.i.25 years) is over; are installed at the stage of facilities construction);
- linear deformation in supporting constructions (are installed at the stage of facilities construction, as well as during exploitation. Embedment strain gages are fixed by welding to metal structures or metal parts or are fixed by anchoring to the existing structures of constructions.
- earth pressure (control contact pressure in the soil on the line of concrete constructions and tension in soil bodies; are installed while facility is under construction).



STRESSMETERS

Are used to measure pressure in:

- foundations of dams, bridges and other heavy solid concrete structures;
- stone walls of tunnels and mines;
- concrete piers and pillars.



EXTENSOMETERS

Are used to measure displacement of earth-fill dams, changes of basic sizes and to control flashes in soft soil. They are differ according to the type of usage and type of construction:

- for embankments (inspection of the transverse tension control) and fixed (control of flashes or embankments growth);
- for boreholes (multi-components) – to control the space around engineering facility;
- for flashes control – long-term supervision over engineering construction.



NORMAL AND INVERTED PENDULEUMS

Are used to measure:

- displacement of the parts of concrete and metal constructions, situated far apart relative to each other;
- displacement relative to vertical direction of drilling of the holes and wells at the stage of their creation;
- rock beds movement;
- inclination of high-altitude towers and support constructions, as well as level of their movements.



SENSORS FOR NON-PRESSURE PIEZOMETERS

Are used to measure drainage water pressure in the earth dam borehole.



SENSORS OF METEOROLOGICAL STATION

Are used to measure environmental parameters:

- rain capacity;
- air temperature and humidity;
- atmospheric pressure;
- wind power and direction.



INCLINOMETERS (INCLINATION SENSOR)

Are used to measure:

- inclination of buildings, dams, bridges, mines sites or their construction parts;
- tunnels, bridges, mines deformation;
- deflection and deformation of support constructions, walls and beams;
- side displacement of mountain massifs and soil in sliding areas;
- displacement of flats in earthfill dams;
- flashes of foundations and embankments (horizontal sensors).

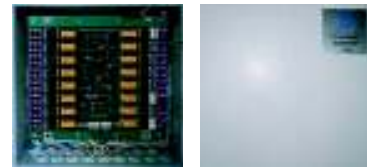


THE SECOND LEVEL – provides multiplexing of analog signals of control and measuring equipment to local data concentrators.

Hardware of the second level – 16- ports 4-channels multiplexers BKC-MUX manufactured by «Bancomzvjazok» JSC.

MULTIPLEXOR

It is used to reduce the number of local data concentrators. Multiplexor is intended for commutation of single – or double pair analog outputs of 16 single-type sensors into one measuring input of local data concentrator.



THE THIRD LEVEL – provides storage of readings of control and measuring equipment in the memory of local data concentrators with their further transferring to the central data processing unit.

Hardware of the third level - local data concentrators BKC-LOCON manufactured by «Bancomzvjazok» JSC.



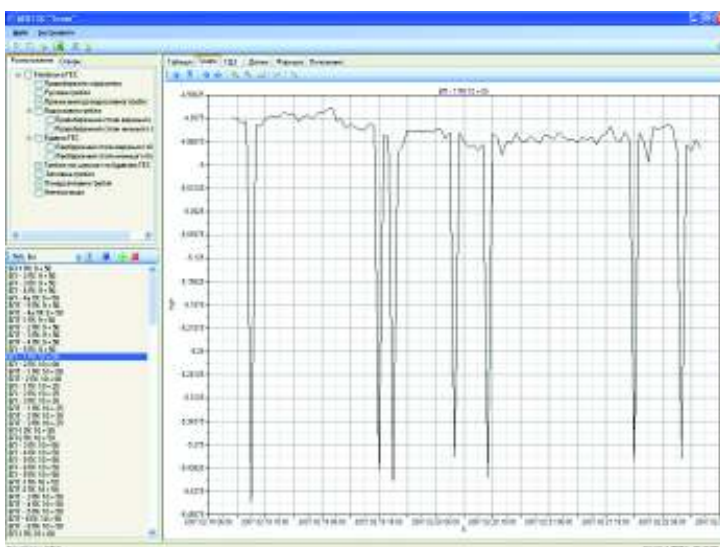
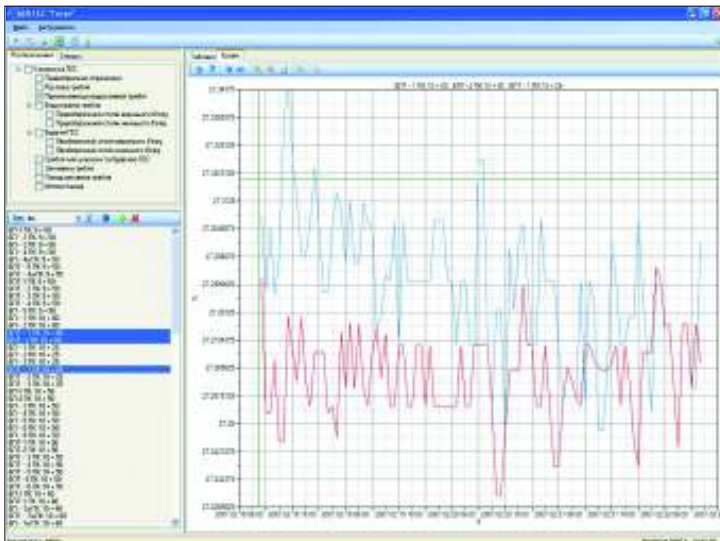
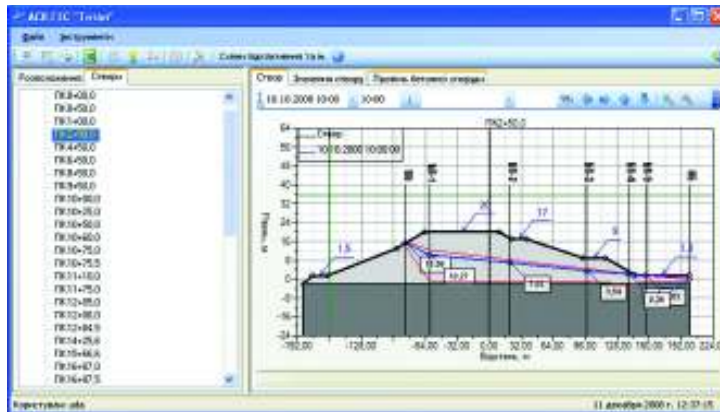
LOCAL CONCENTRATOR

It is designed on the basis of industrial computer CR-10/ CR-1000. Concentrator is equipped with the means of transformation of analog signals of measuring channel into digital, non-volatile energy for data storage, and means of data transferring for connection with central data processing unit.

THE FOURTH LEVEL – provides collecting and storage of data from local concentrators with its further processing.

Hardware of the fourth level:

- data collection servers;
- data base servers.

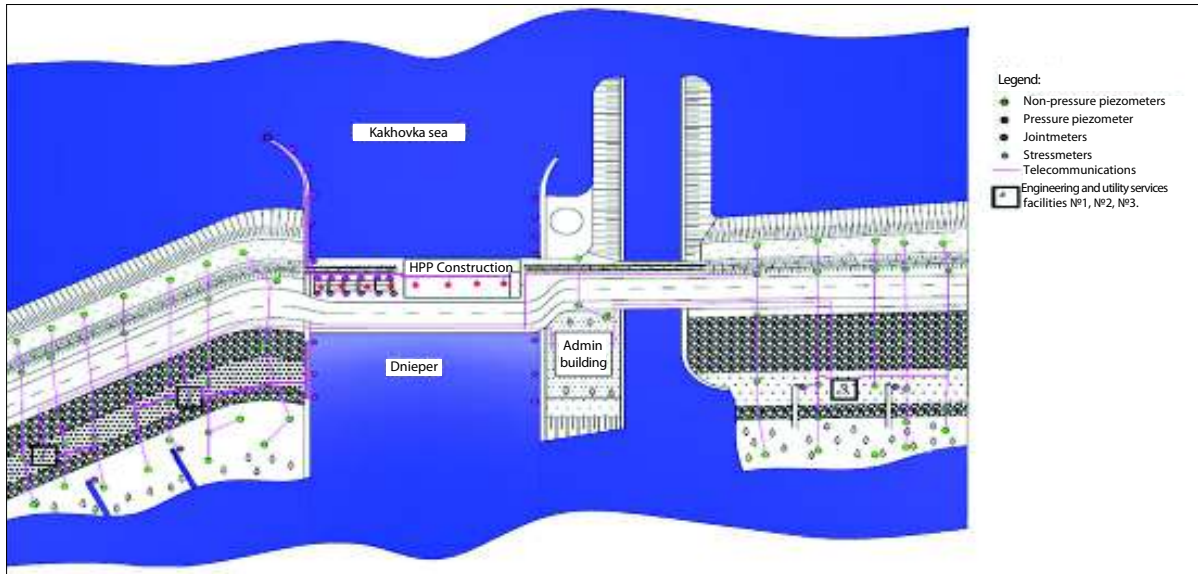


The fourth level of automated condition monitoring system also covers automated work places, connected in one local net net with data base servers and on which **customized software «Titan»** is installed.

FUNCTIONS OF CUSTOMIZED SOFTWARE «TITAN»:

- sampling of remote sensors in automatic mode;
- connection of different sources of measurement (meteorological stations, GPS and others);
- recalculation of sensors readings into physical values, comparison with maximum rated values, automatic signaling on exceedings;
- control of timeliness and completeness of the field studies schedule;
- diagnostics of condition and control measuring equipment condition;
- generation of information on the control and measuring equipment condition;
- data export for further processing and reports creation;
- visualization of processing results in the form of diagrams and tables;
- results displaying with reference to topographic map; isolines.

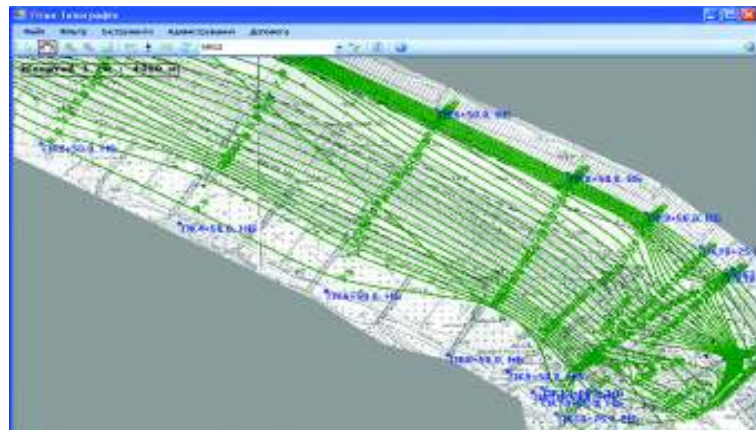
EXPERIENCE OF «TITAN» SYSTEM IMPLEMENTATION KAKHOVKA HPP



In 2005-2006 the safety monitoring system of Kakhovka HPP based on manual measuring was modernized. In summer 2006 automatic safety monitoring system «Titan» was put into operation.

Total length of the dam – 4200 meters.

Level difference between forebay and tail water – 15 meters.



Automated safety monitoring system «Titan» on Kakhovka HPP includes more than 400 different control measuring units, server and computer equipment:

vibrating-wire pressure sensor PWS Roctest	210 pcs.
ultrasonic range finding sensors as jointmeters	3 pcs.
triaxial jointmeters based on sensor БКС ДЩ-01	72 pcs.
pressure sensors ATM/N as flow meters	8 pcs.
pressure sensors DMP 331 and test pressure gauges	51 pcs.
meteorological station Roctest	1 pcs.
tiltmeter Roctest 904 TH	3 pcs.
data collection system БКС-LOCON-01	9 pcs.
multiplexer 16-channels БКС MUX-02	38 pcs.
technical constructions for active equipment installation	3 pcs.
server equipment and software	1 pcs.
automated work places with software	2 pcs.

OUR PROJECTS:

- Kakhovka HPP – implemented «Titan» system;
- Dnipro HPP - in progress;
- Kaniv HPP – in progress;
- Dniprodzerzhynsk HPP – in progress;
- Dnister PSPP - in progress;
- Dnister HPP - in progress.



JSC «Bancomzvjazok» - design, construction and maintenance of telecommunication and special systems for corporate clients.

OUR PARTNERS:

- Leica Geosystems AG – Switzerland;
- GKM Consultants, Inc. (Canada).

OUR SERVICES:

- initial investigation;
- modelling of system operation, choice of optimal realization version;
- project development;
- construction and commissioning;
- staff training and operational testing;
- maintenance and servicing.