



DATA SHEET



AUTOMATED TOTAL STATION WITH CONTROL BOX (TCB)

For 3d Deformation Monitoring

INTRODUCTION

Project safety requires 24x7, high frequency and accurate monitoring systems. If used judiciously with geotechnical instrumentation, geodetic monitoring provides valuable information which is critical and is extensively used in civil construction and structural monitoring.

Encardio-rite offers an automatic three-dimensional (3D) deformation monitoring system with the highest accuracies achievable in the industry presently. Displacement data is measured from the prism targets by a high precision automatic total station (ATS) with a dedicated in-house developed control box (TCB) that includes a computer running advanced software.

FEATURES

- User friendly interface with one click access to all data.
- Automatic report generation
- User customizable combined graphs for selected arrays or areas
- Notifications via email (including full log)/SMS
- Resection solution with least squares solution for instrument position check

APPLICATION

- Tunnels metro, rail, road, sewage
- Dams
- Bridges
- High rise buildings
- Historical monuments
- Deep excavations, foundations

AUTOMATED TOTAL STATION (ATS) MONITORING SYSTEM

The automated 3D deformation monitoring system typically consists of optical targets, robotic total station and dedicated control box with advance software that controls total station. It is capable of measuring any optical target/prism position absolutely as a vector of combined X, Y and Z movement when the barometric and temperature corrections have been applied.

The total station and control box, once configured, measures all the targets at predefined frequency and transmits data continuously at regular intervals to the monitoring database at central server at site or on cloud. The system can monitor prisms at distance of 100 m around the total station location for maximum accuracy.

The system can be controlled remotely by dedicated surveyors of the project-for maintenance, changing frequency, making corrections, turning off/on or reset control box, etc. This makes the system very efficient, prompt, user friendly and economic ensuring minimal time lag between measurements and its evaluation.

The system ensures valuable and timely monitoring of the displacements, providing high measurements density, simultaneous wireless transmission and automatic entry of the real time data in the monitoring database at central server or cloud.

METHODOLOGY

- Installation of optical targets at locations to be monitored
- Installation of total station and control box at a proper and safe place – having required number of optical targets in line of sight
- Wired or wireless connection of the total station with a dedicated control box, with suitable power supply arrangement for total station
- Establishment of trigonometric micro-movement network outside the project's zone of influence
- Configuring and starting the measurement and recording

procedure at predefined frequency

- Regular transmission of the results to a dedicated central computer or server placed either at site or at a remote location
- Automated database feeding; presentation of the results in time & distortion graphs designed by database software
- Access to view data and results remotely can be given to all the concerned authorities related to the project's monitoring.
- Database administrator prepares reports on regular basis and submit to project authorities

Robotic total station

Automated 3D deformation monitoring system supports robotic total station of almost all the leading brands like Leica, Sokia, Topcon and Geomax. Total stations used are preferably with angle H, V measurement accuracy \pm 1" and distance accuracy \pm 1 mm + 1.5 ppm).

The total stations have ability of Auto Target Recognition (ATR) i.e. all the targets can be aimed automatically (accuracy \pm 1 mm) without any human interference. In case a target is not temporarily visible, the system automatically tries to aim it again before the end of the measurements cycle.

Total station Control Box (TCB)

The total station control box (TCB) is a combination of hardware and software to have a fully automated solution for real time 24x7 measurements. It manages total station, performing following activities:

- schedule frequency of measurements
- addition or subtraction of monitor benchmarks
- applying filters of acceptance or repetition of each measurement
- calculating and repositioning of the total station, etc.
- applying temperature and barometric correction factors automatically
- The control box can store all data internally and can





communicate with the main database server sending the real time data automatically to the central database. It has provision for 2 sim cards to ensure a steady internet connection. Still, if the connection to database is lost, control box can send all the unsent data once it reconnects to the database.

The control box has the provision of 12 V power supply and can provide power direct to the supported total station to save time consumed in replacement of batteries. It also includes a high capacity UPS which enables the system to work even without electric power supply for up to 5 hours.

The system has additional option to work with solar panel. The control box is a portable device with easy installation and comes in rugged weather proof box that is IP67, with IP-67 rated connectors.





To suit different requirements of projects and applications, Encardio Group offers different options of database software like DRISHTI and TERRAWEB. These are SQL based database system that supports small or large area projects for 3D points (x,y,z], level points (only z) and tunnel points. The soiftware covers alignment, points, measurements, point groups, monitoring arrays, tunnels sections, deformation groups and work areas.

Main features

- Filters raw data through moving average or by using least square filter equations removing the noise from measurements
- Supports different levels of alarms and alerts
- Combines work progress with instrument data (on right axes)
- Provides section and plan view diagrams of tunnel sections.
- Provides tunnel convergence monitoring data presentation with displacements vectors of target points in8jvstalled in a tunnel section
- Can provide deformation contour graphs which helps in understanding the movement between the points according to the DZ axis

In Terraweb, point groups and tunnel section groups can be created. In Tunnel section, there are 7 charts i.e. classic five (DXTH, DDCL, DX, DY, DZ) plus two more (section view and plan view).



Robotic total station installed at Doha Metro-Gold Line, with control box and solar panel.



Moving average filter applied

SPECIAL 3D SOFTWARE -TUNNELCAD





underground cavern or tunnel convergence monitoring methods with displacements vectors of target points with terraweb



A deformation contour with zero points and with triangles among points with Terraweb

TunnelCAD is a complete solution for graphic and numerical comparison of design vs. measured cross sections in tunnels.

Main features

- Automatic creation of 3D visualization from any measured line.
- Profile evaluation with graphic and/or numeric data analysis
- All project data in one screen
- 3D display of any measured line; real time display distance of points from a template line
- Layer thickness analysis (shotcrete, concrete).
- Section prints using custom or integrated layouts
- Interface to handle sections, alignment, template sections together
- Provides as built documentation
- Standalone drawing environment compatible with DWG/DXF/DGN
- Compact project that can be saved in one file.



Real time display of distance of points from a template line with TunnelCAD

HIGHLIGHTS OF WEB BASED DATA MANAGEMENT SYSTEM (WDMS)

- Comprehensive data management system that can store data from different sources
- Easy access to meaningful instrumentation data. Data is presented in graphical as well as numerical format
- Results are accessible on tablets and smartphones
- Access to different sensors on one screen
- Instant alerts via SMS or email to authorized personnel
- Combined charts in one report (mix water level, pumped water quantity)

- Live monitoring display of all the incoming measurements, updated in near real time
- Create diagrams from any combination of parameters & time period.
- Multiple authorized users at different locations can simultaneously interact with the software through a web-browser to view any real time data/changes, graphs or reports from any site
- Low operational cost
- User friendly for day-to-day operations



Terraweb Chart with: i) limits, ii) work progress, iii) points data

