



*The primary objective of mine safety monitoring is the swift identification and proactive management of safety concerns and potential disaster risks within mining operations. This goal is pursued to enable the timely implementation of appropriate measures aimed at both preventing and responding effectively to any accidents that may arise. This comprehensive approach hinges on the utilization of diverse technical methodologies to collect, analyze, and continuously monitor data derived from the mining environment.*

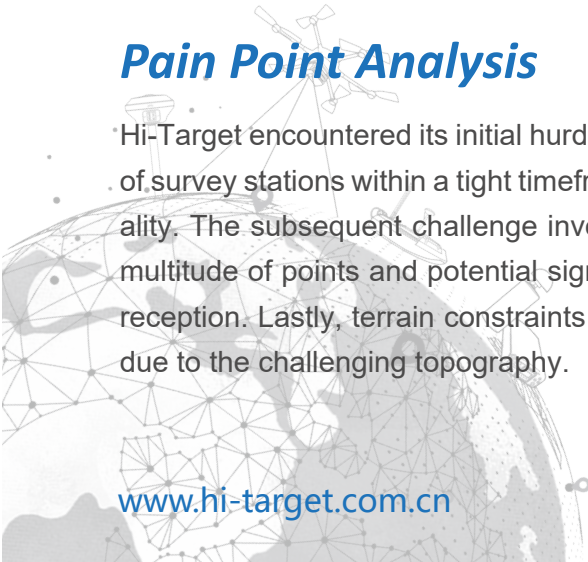


## ***Enhancing Mine Safety in Serbia: The Utilization of MS401 GNSS Receiver for Monitoring***

### ***Project Background***

In a competitive bid for a copper mine safety monitoring system in Serbia, Hi-Target was selected as the contractor for a comprehensive online monitoring solution. This achievement followed meticulous assessment and led to deploying GNSS high-precision devices. The realization of this environmentally conscious and technologically advanced mine marks a significant milestone. Hi-Target played a key role in establishing Serbia's first green, digital mine, a significant milestone that supports the nation's sustainable economic growth. This underscores Hi-Target's commitment to innovation and contributing to Serbia's prosperity.

### ***Pain Point Analysis***



Hi-Target encountered its initial hurdle in meeting a demanding schedule, necessitating the prompt setup of survey stations within a tight timeframe while ensuring precision and uninterrupted monitoring functionality. The subsequent challenge involved navigating the intricate mining environment, encompassing a multitude of points and potential signal interference due to nearby metal ores affecting GNSS Receiver reception. Lastly, terrain constraints posed a final obstacle, offering limited space for device installation due to the challenging topography.

## Implementation Program

The Hi-Target compact all-in-one MS401 GNSS receiver is distinguished by its exceptional performance and unwavering stability. Housing a Linux operating system, a high-performance positioning board, an antenna, MEMS sensor, and a range of 4G modules, it facilitates vital functions such as MEMS decoding integration, remote control, diverse configuration modes, intelligent communication, and more. The device's straightforward, compact structure is complemented by features like effortless installation, an IP68 protection rating, and remarkably low power consumption. This amalgamation of attributes renders it eminently suitable for a spectrum of applications, including geo-hazard monitoring, mining, reservoir management, slope assessment, bridge analysis, and beyond.



Hi-Target MS401 GNSS Receiver FIG1

## Workflow

The intricacies of the project's survey area posed significant construction challenges, and Hi-Target's compact all-in-one GNSS receiver proved to be an ideal fit for this monitoring scenario.

Initially, technicians conduct a site survey to identify a stable location beyond the survey area's boundaries for erecting a GNSS Receiver base station. This strategic placement ensures heightened precision in positioning and capturing displacements for the monitoring stations within the survey area.

Within the survey area itself, technicians establish monitoring stations at each significant feature. These stations are streamlined, comprising just a pole, a solar panel, and an all-in-one GNSS receiver atop. This simplified setup eliminates the need for intricate construction processes or cumbersome transportation methods.



MS401 GNSS Receiver to Monitoring Station FIG2

Ultimately, the technicians conclude the process by linking the GNSS Receiver to the "Monitoring Cloud" platform. Upon receiving data from these devices, the platform undertakes automated data collection, interpretation, and warning issuance in accordance with user-defined thresholds.

| X angle(°) | Y angle(°) | Z angle(°) | Collect Time        |
|------------|------------|------------|---------------------|
| -3.8259    | 0.3661     | 86.1566    | 2023-08-02 16:27:26 |
| -3.8259    | 0.3661     | 86.1566    | 2023-08-02 16:26:29 |
| -3.8259    | 0.3661     | 86.1566    | 2023-08-02 16:25:26 |
| -3.8259    | 0.3661     | 86.1566    | 2023-08-02 16:24:26 |
| -3.8259    | 0.3661     | 86.1566    | 2023-08-02 16:23:29 |
| -3.8259    | 0.3661     | 86.1566    | 2023-08-02 16:22:26 |
| -3.8259    | 0.3661     | 86.1566    | 2023-08-02 16:21:26 |
| -3.8259    | 0.3661     | 86.1566    | 2023-08-02 16:20:26 |
| -3.8259    | 0.3661     | 86.1566    | 2023-08-02 16:19:26 |
| -3.8342    | 0.3572     | 86.1482    | 2023-08-02 16:18:26 |

Raw Data (FIG3)

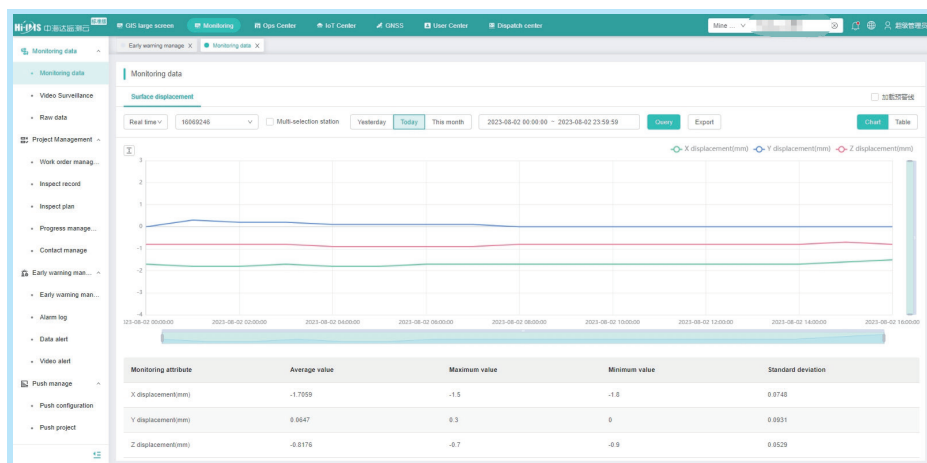
Warning Config (FIG4)

## Result

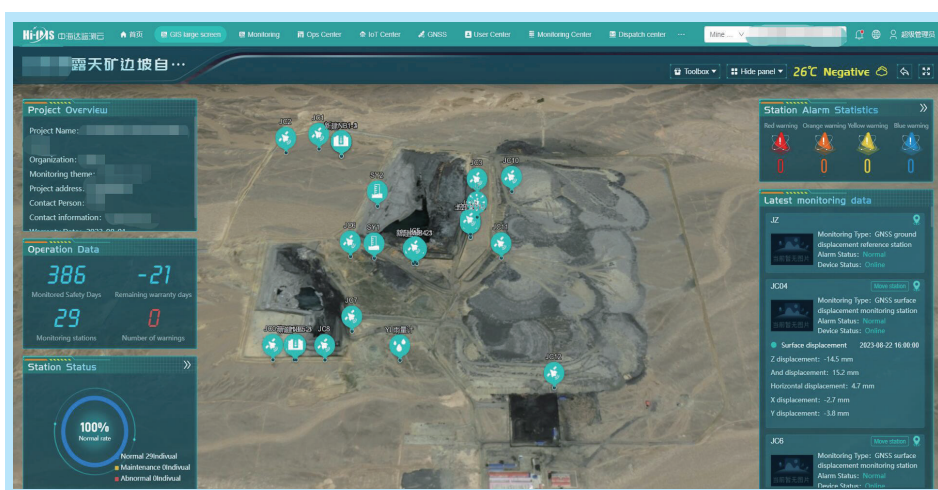
The system achieves real-time collection, transmission, calculation, and analysis of critical operational data from key segments of mine slopes. It captures absolute slope displacement data, enabling a real-time assessment of overall quarry slope safety. This effort establishes a comprehensive deformation monitoring network. By organizing and analyzing this data, the system offers real-time forecasts and early warnings.

Furthermore, the platform visually presents the historical progression and current status of each monitoring and surveillance dataset. This interface provides an uncomplicated, lucid, and efficient point of reference for mine safety management personnel. In the event of an emergency, the system promptly issues warning notifications through various channels, such as audible alarms, animated screen alerts, monitoring screen prompts, and tiered notifications via text message or email to pertinent management and supervisory staff.





Result FIG5



Result 2 FIG6

## Project Summary

The Hi-Target compact all-in-one GNSS receiver offers convenient installation and minimal transportation expenses, coupled with outstanding performance and precision. Its capability for both horizontal and vertical displacement monitoring is remarkable, achieving millimeter-level accuracy. The monitoring frequency is flexible and adjustable, spanning from 5 minutes to 6 hours, catering to specific user needs. Moreover, the establishment of the GNSS Receiver base station beyond the survey area further enhances reliability. This strategic positioning imparts stable positioning correction for monitoring stations within a radius of 3 kilometers, bolstering the overall accuracy of the system.

Lastly, the Hi-Target GNSS Receiver ensures round-the-clock monitoring and instant alerts, thereby safeguarding the survey area's safety. This comprehensive suite of features underscores the receiver's efficacy in providing robust and dependable monitoring solutions.



More information at <https://en.hi-target.com.cn/become-our-partner/>

## About Hi-Target

Established in 1999, Hi-Target is the first professional high-precision surveying and mapping instrument brand to be successfully listed in China.

Hi-Target provides a wide range of surveying equipment including GNSS receivers, CORS stations, Total Stations, 3D Laser Scanners, GIS Data Collectors, UAV/UAS, and Hydrographic products to offer complete commercial solutions for various industries.

As the leading brand in the geospatial industry, Hi-Target invests heavily in research and development, on top of collaborating with more than 100 universities globally to bring the latest positioning technology and innovation for product development.

For over 20 years, Hi-Target has approximately 2,500+ employees worldwide, with an established network of 20+ subsidiaries, 28 branches and more than 200 partners in 100+ countries / regions to service and support our customers.

Visit us at: [www.hi-target.com.cn](http://www.hi-target.com.cn)

E-mail: [sales@hi-target.com.cn](mailto:sales@hi-target.com.cn)

Phone: +86 20 2868 8296