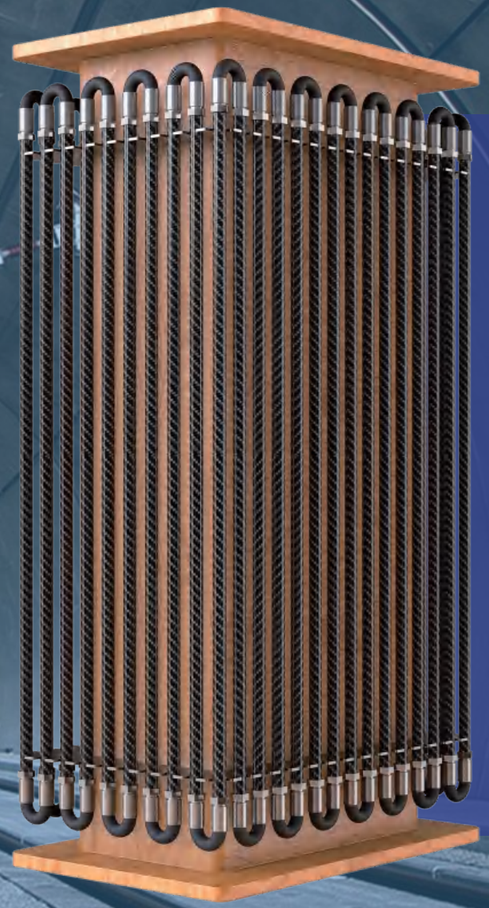
GINTEC®

AFIC systems

Model: AFIC-500, AFIC-1000



AFIC array flexible inclinometer is an automatic monitoring system released by HUASI. It consists of sensor chain, data logger and cloud software. The sensor chain can be installed in vertical, horizontal and circular, which means that the chain can monitor hole horizontal displacement, bridge settlement and tunnel convergence.

With Linux operation system inside, C2000 logger can calibrate the raw data and output final results directly. Users needn't install any calibration software. Integrated with 4G module, C2000 supports 4G SIM cards of all suppliers in the world. C2000 supports TCP, FTP, SFTP transmission protocols and can work with any third-part software.

Product Introduction

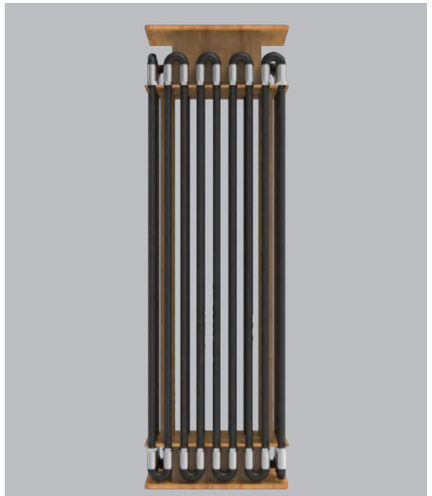
Flexible Inclinometer (Array Displacement Sensor)

Product Introduction

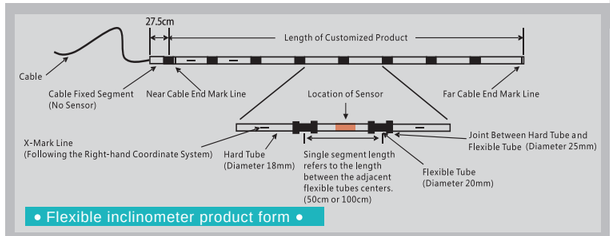
The GINTEC Measurement and Control AFIC series array displacement sensor is a flexible and versatile 3D measurement system. It uses a dense array of MEMS (Micro-Electro-Mechanical Systems) and validated model calculation programs to measure 2D and 3D deformations. The AFIC series array displacement sensor has no preferred axis and can be bent freely. It can be installed vertically, horizontally, or in a ring configuration.

The GINTEC Measurement and Control AFIC series array displacement sensor reflects the angular changes in the corresponding axis and gravity direction by measuring the acceleration changes in different axial directions and calculates the corresponding node's displacement changes based on the angle changes.

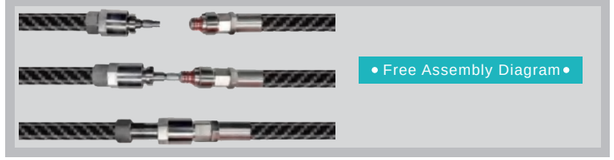
The GINTEC Measurement and Control AFIC series array displacement sensor utilizes advanced measurement and control technology, including gravity acceleration measurement, sensor temperature compensation, core algorithm modeling, etc., to achieve real-time online monitoring of X, Y, and Z three-dimensional deformations of the monitored object.



• Appearance of the Flexible Inclinometer •



• Flexible inclinometer product form •



• Free Assembly Diagram •

Structure of the Flexible Inclinometer (Array Displacement Sensor)

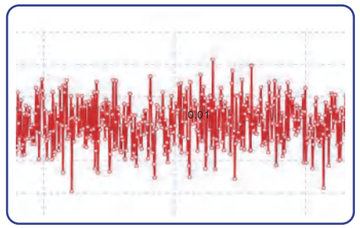
The flexible inclinometer, also known as an array displacement sensor, consists of a fixed-length steel pipe and a flexible joint at each node. Each steel pipe contains an independent intelligent MEMS (Micro-Electro-Mechanical System) device.

MEMS (Micro-Electro-Mechanical System) is a high-tech device composed of sensors, actuators, and micro-power sources.

Specifications

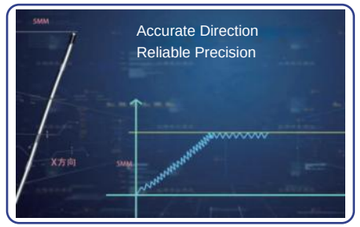
	AFIC	AFIL
Operation Mode	MEMS acceleration	
Installation	Vertical, horizonal, Curve	Vertical
Angle Resolution	±0.0003°(±1.08″)	±0.0028°(±10″)
Displacement Resolution	0.005mm@500mm	0.02mm@500mm
Deformation accuracy	±0.5mm(32m)	±2mm(32m)
Measure accuracy	±0.002°(0.0006%F.S.)(0.02mm@500mm)	±0.012°(0.003%F.S.)(0.1mm@500mm)
Temperature accuracy	±0.2℃	±1.8℃
Interval for data collection	Maximum 1 second	Maximum 1 minutes
Material	Carbon Fiber	Resin material
Power soumption	DC 12V, 3.2mA for each node	
Maximum tensile	550KGF	
Water proof	under water 200meters (2MPa)	
Operation temperature	-40℃ to +60℃	
Diameter	25mm withour node connector, 29mm with node connector	
Magnetic Interference	No interference	
Electric Interference	No interference	
Node Length	500mm and 1000mm (other length need customized producing)	
Maximum ange of joint band	180°	
Weight	0.6kg/m	
comunication cable	5meter in standard	
Segement Length	1m,2m,5m,10m,20m in standard(other length need customized producing)	

Key Features



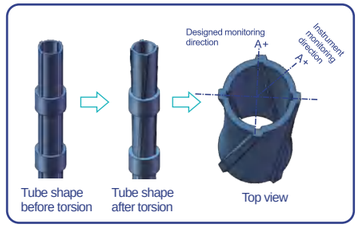
01 Temperature Compensation/Data Stability

The AFIC series flexible inclinometer utilizes MEMS (Micro-Electro-Mechanical Systems) technology and achieves highly integrated design, effectively eliminating errors between axes. The temperature compensation model is employed in the range of -40°C to +60°C to eliminate temperature drift, ensuring the stability of AFIC data acquisition. In experimental environments, this series of products exhibits optimal data fluctuation of only 0.01mm.



02 Accurate Direction/Reliable Accuracy

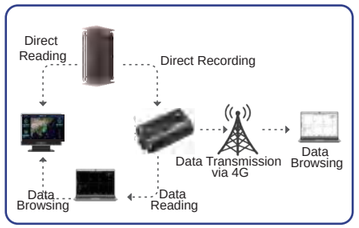
Before leaving the factory, each node of the AFIC series flexible inclinometer undergoes independent calibration using a high-precision automatic calibration system. After assembly, a comprehensive calibration is performed again to ensure the accuracy in the X, Y, and Z directions. The displacement resolution of the inclinometer is up to 0.005mm within a measurement range of 500mm.



03 Offset Correction/Torsion Correction

During the initial installation of the flexible inclinometer, if the inclinometer casing has undergone torsion, it can be corrected based on the angle between the initial Mark line direction of the flexible inclinometer during installation and the direction of the deformation to be measured. This ensures the accuracy of the monitoring direction.

After the installation of the flexible inclinometer is completed, during the monitoring process, if the inclinometer casing undergoes torsion, the angles generated by the twisting of the flexible inclinometer during the casing's torsion process can be corrected to ensure the accuracy of the measurement results



04 Online Transmission/Real-time Analysis

The AFIC series flexible inclinometer supports multiple communication methods such as 4G network and serial port. After installation, simply power it on and perform basic settings, and the monitoring data can be collected and transmitted online in real-time. The maximum sampling frequency can reach 1 time per second. Users can perform real-time analysis and download data through the monitoring cloud platform.

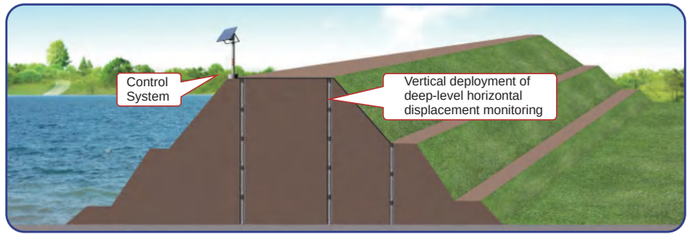
05 Secondary Development/Platform Compatibility

The AFIC series flexible inclinometer has an open protocol and strong compatibility. Users can connect the array displacement sensors to data loggers of other brands for data transmission according to their needs. They can also feed the monitoring data from the array displacement sensors back to other monitoring software for viewing.

06 Modular Design/Reusable

The AFIC series flexible inclinometer adopts a modular assembly design, allowing users to combine and freely assemble the array displacement sensors on-site according to different monitoring project requirements. This enables true reusability of the inclinometer, as the total length of the array displacement sensors can be customized and adjusted as needed.

Application Scenarios

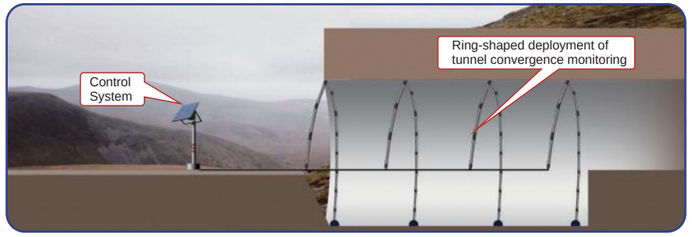


Vertical Installation

Application Scenarios: Deep-level horizontal displacement monitoring in hydraulic structures, slopes, excavations, and other areas.

Horizontal Installation

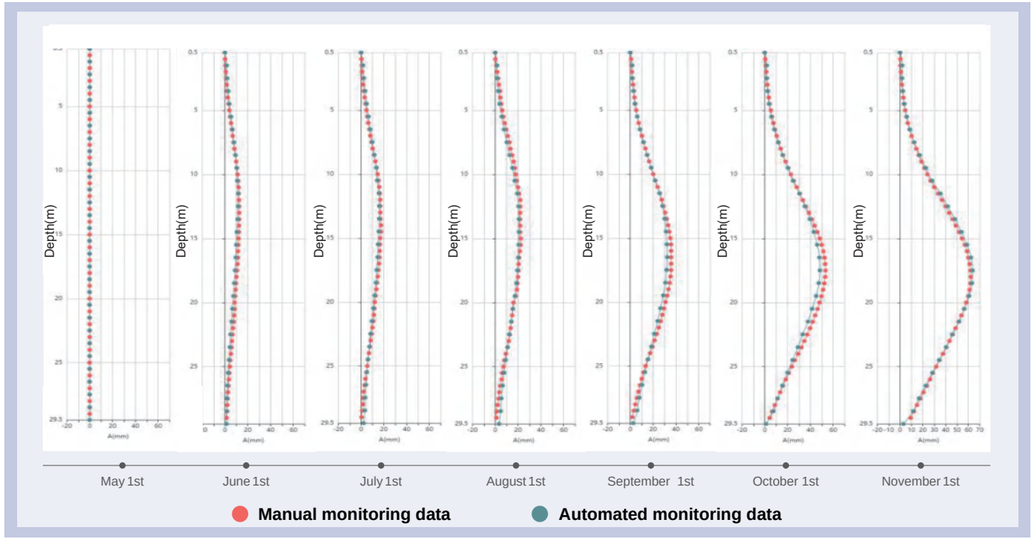
Application Scenarios: Monitoring of roadbed settlement, monitoring of embankment dam settlement, etc.



Ring-shaped Installation

Application Scenarios: Convergence monitoring in tunnels, underground facilities, etc.

Comparison of process lines for deep-level horizontal displacement



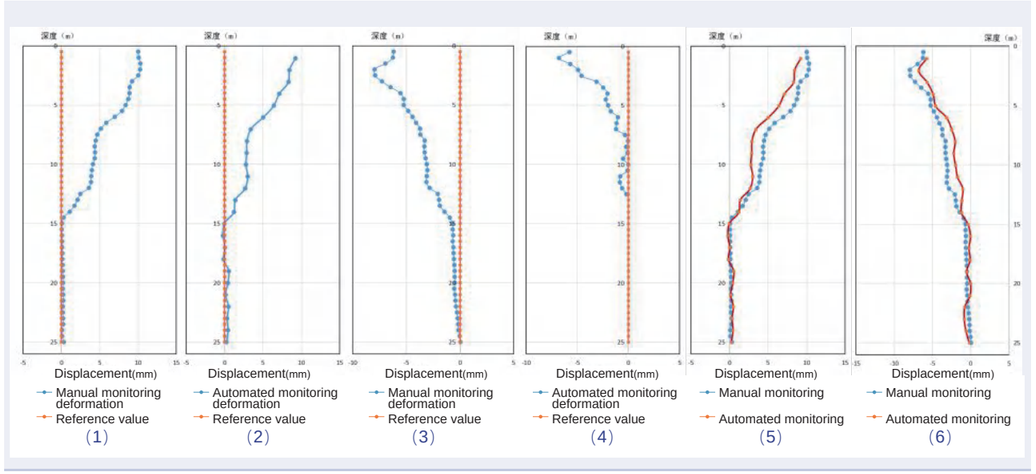
Automated comparison of adjacent borehole data between manual/flexible inclinometers

Test Site: Two adjacent inclinometer boreholes in a subway excavation during rail transit construction, with a distance of 20cm between them.

Comparison Method: Sliding inclinometer measures the deep-level horizontal displacement of Borehole 1, while the flexible inclinometer measures the deep-level horizontal displacement of Borehole 2.

Test Conclusion

By comparing and analyzing the process lines of adjacent boreholes over a six-month period, the monitoring results from both the flexible inclinometer and the sliding inclinometer show a high degree of agreement. The deformation trend in direction A is completely consistent between the two monitoring methods.



Automated comparison of data from the same borehole between manual/flexible inclinometers

Test Site: One inclinometer borehole in a specific project.

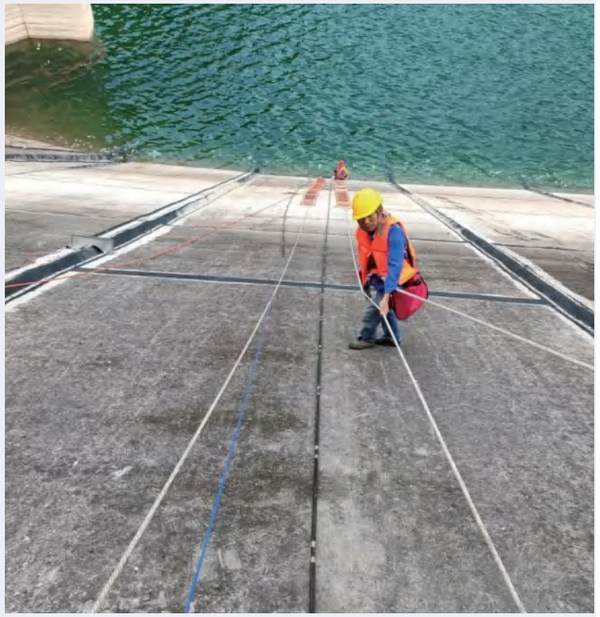
Comparison Method: First, a set of data in direction A and direction B is obtained using a sliding inclinometer as the initial values. Then, the flexible inclinometer is installed in the same borehole, with the initial values set and continuous monitoring performed for one whole year. Finally, the flexible inclinometer is removed, and the same borehole is measured again using the sliding inclinometer. The time displacement process lines of the sliding inclinometer and the flexible inclinometer over the course of one year are compared.

Test Conclusion

By comparing and analyzing the time displacement process lines of the same borehole over one year, the monitoring results from the flexible inclinometer and the sliding inclinometer show a high degree of agreement. The deformation trends in both direction A and direction B are completely consistent, with a maximum difference of <3mm.

Case Studies

Hubei Dam Monitoring



● Automation Monitoring of Reservoir Dam Displacement ●

South-to-North Water Diversion Project

- Automation Upgrade of Safety Monitoring Facilities at Risk Sites in the South-to-NorthWater Diversion Project

Tunnel Convergence Monitoring in Switzerland

- This project is in Switzerland, it need monitoring the convergence of Metro Tunnel