

WE MONITOR THE PRESENT WITH THE INSTRUMENTS OF THE FUTURE

VERTICAL ARRAY

AUTOMATIC 3D INCLINOMETER



VERTICAL **ARRAY**

Vertical Array is an innovative automatic inclinometer designed to monitor the **3D displacements** at different depths. It is composed by a sequence of IP69 hermetically sealed nodes in a chain joined by a Kevlar rope and a four-pole electrical cable. Each node (**Tilt Link HD V**) includes a high-resolution **3D MEMS** accelerometer sensor, a magnetometer and a thermometer.



Depending on project requirements, it is possible to **define** the **number** of measuring **sensors**, **spacing** and **total length** of the instrument. One or more **piezometric sensors** can be arranged in the same array in addition to the Tilt Link HD V sensors. The Vertical Array is usually supplied inside a plastic tube that serves as protection and permits to record larger displacements.

Detect the **shape** of a slope **monitoring** **3D** displacements in **Real-time.**



Tilt Link HD V
3D MEMS
Magnetometer
Thermometer

INSTALLATION

Vertical Array can be installed inside **piezometers** or **inclinometers casings**. If the overall lengths is less than 50 m, 3-inches diameters may be used, while a 4-inch diameter pipe is preferable for longer lengths. The instrument, once positioned, must be bonded to the borehole using **gravel** or **bentonite mix** as per the specifications provided by ASE S.r.l.

1



2



3



HOW IT WORKS

Knowing the **distance between** the **nodes**, the **position in space** of the sensors, calculated using the data recorded by the MEMS, and the **orientation** with respect to the North, using the magnetometer data, it is possible to identify the relative position of the instrument in space and consequently the **displacements** of the **monitored work** through special algorithms.



DATA FROM
SENSORS



STORAGE



ANALYSIS



DATA REPRESENTATION



RESULTS PROVIDED

- 3D displacements for every calculation point
- Resultant vector for 2D local displacements
- Resultant vector for 2D cumulative displacements
- Settlements at different depths calculated using MEMS sensor data
- Differential cumulative displacements vs time for every depth
- Differential local displacements vs time for every depth
- Displacement rate vs time data for every depth
- Acceleration vs time data for every depth
- Tilt angles vs time data for every depth
- Azimuth
- Temperature for every depth and its evolution along time



DATASHEET

Sensors	3D Accelerometer, 3D Magnetometer, Thermometer
Measurement range	360°
Accelerometer range	± 1.2 g
Accelerometer sensitivity	105 LSB/° (0.0095°) 6000 LSB/g (0.167 mg) 0.166 mm/m
Accelerometer sensitivity error	±0.7%
Accelerometer sensitivity dependence on temperature	±0.3%
Accelerometer linearity error	±4 mg
Offset error evaluating absolute positions	±1.15° ±20 mg
Offset dependance on temperature	±0.57° for X & Y axes, ±0.86° for Z axis ±10 mg for X & Y axes, ±15 mg for Z axis
Drift of the offset error	±0.23° for X & Z axes, ±0.34° for Y axis ±4 mg for X & Z axes, ±6 mg for Y axis
Accelerometer amplitude response	40 Hz
Accelerometer temperature operating range	-40 °C ÷ +125 °C
Thermometer measuring range	-50 °C ÷ +150 °C
Thermometer sensitivity	18.9 LSB/°C (0.053°C)
Magnetometer range	±4 Gauss
Magnetometer sensitivity	6842 LSB/Gauss (0.000146 Gauss)
Zero-gauss level	±1 Gauss
Magnetometer operating temperature range	-40 °C ÷ +85 °C
Total accuracy	Depending on MUMS chain configuration and length
Length and Diameter	125 mm – 37 mm
Centre-to-centre between sensors	50 cm (minimum distance) 100 cm (recommended distance)
Kevlar rope traction strength	15 kN
Node weight	0.2 kg
Electrical cable	CEI 20-35



OUR MISSION

Develop and disseminate new technologies for monitoring natural phenomena and structures in order to deepen the knowledge of their dynamics, strengthen the theoretical basis for theoretical interpretation and make safer, cheaper and more functional design activities of civil and environmental works as well as Civil Protection procedures.

ABOUT US

ASE is an SME based in Parma, founded in 2013 and sponsored by the University of Parma. Our company, born as a Start-Up, has established itself over time as a leader in the development of innovative tools for geotechnical and structural monitoring, as well as in the creation of state-of-the-art software and hardware for managing monitoring data from automatic systems, topographic surveys, and manual instruments.

What sets us apart is the multidisciplinarity of skills within the company. Within ASE, a team composed of Civil, Environmental, and Electronic Engineers, along with highly qualified expert programmers, collaborates to internally develop both the instruments and software solutions, allowing us to maintain a high level of control over the quality and efficiency of our products.

The core of the company is driven by a profound passion for research and development. We recognize the importance of staying at the forefront of the latest technological and scientific innovations to provide our customers with solutions tailored to their needs.

In summary, ASE is much more than just a company: it is a center of excellence, a reference point for monitoring, and a reliable partner in ensuring the safety and reliability of infrastructures worldwide.

CONTACT US TO RECEIVE MORE INFORMATION

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