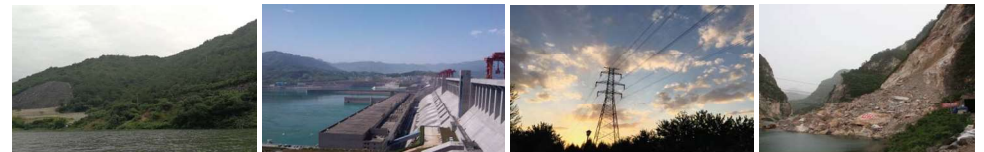




# tShape ADM Array Deformation Measurements



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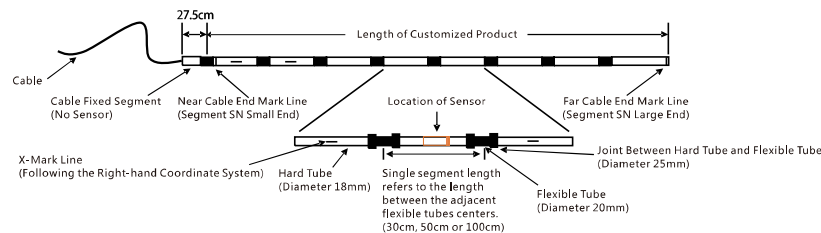
*Integrated by pizzi-terra s.r.l.*

## Product Drawing of ADM

The standard single segment length of ADM has 3 specifications: 0.3m/segment, 0.5m/segment and 1m/segment.

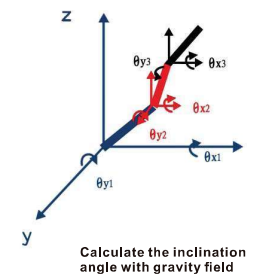
The hard tube part of each segment is processed by high-strength stainless steel and the joints are connected by high-strength flexible tube, which tensile strength is up to 550KGF. The first segment of ADM is equipped with a cable fixed segment which is not equipped with any sensor. Both the near cable end and far cable end have mark lines, and the number of segment increases gradually from the near cable end to the far cable end. There is X-axis mark line in every hard tube of ADM segment to indicate the X-axis direction.

- Length of cable fixed segment(without sensor): 27.5cm
- Length of ADM with sensors: length between near cable end mark line and far cable end mark line
- Total length of ADM: length of cable fixed segment(without sensor) + length of ADM with sensors
- Near cable end: the segment that connect to the cable, also the small number segment.
- Far cable end: the segment that far away from the cable, also the big number segment.
- Length of single segment: the length between the adjacent flexible tubes centers.
- Diameter of hard tube: 18mm
- Diameter of flexible tube: 20mm
- Maximum diameter of joint: 25mm

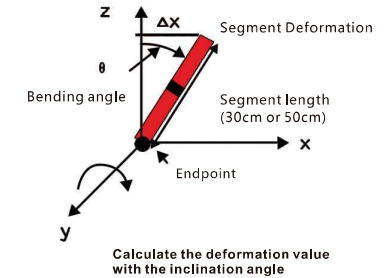


Product Drawing of Array Displacement Meter ADM

## Working Principle of ADM



1. Every segment contains an acceleration sensor to measure the acceleration value of corresponding segment, then the angle between corresponding axis and gravity direction can be calculated.



2. With the changing of inclination angle, the deformation value of each corresponding segment can be calculated.

3. If the length of each section is L, then the coordinate length of a single segment in the gravity direction coordinate system of segment I is

$$d = L \cdot \sin\theta$$

The coordinates of corresponding segment n in the overall coordinate system are the accumulated sum of segment 1 to segment n

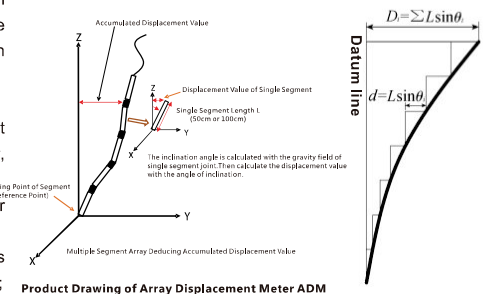
$$D_i = \sum L \cdot \sin\theta$$

d: The deformation value of a single segment relative to the datum line in the 3-D axis (x, y, z);

L: the length of single segment, 0.3m, 0.5m Or 1m

$\theta$ : the angle between the corresponding axis of single segment and the direction of gravity;

$D_i$ : the accumulated displacement value from the end point to the No.n segment at a certain time.

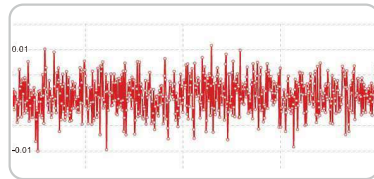


Product Drawing of Array Displacement Meter ADM

## Product Features of ADM

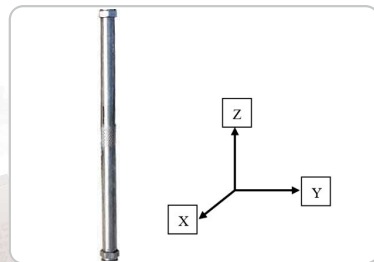
### A Temperature Compensation, Stable Data

- ADM adopts MEMS micro-electro mechanical system which perfectly eliminates the inter-axis system error by highly integration. It adopts temperature compensation mode to eliminate temperature drift during  $-40^{\circ} \sim 60^{\circ}$ , ensuring the stability of data collected by ADM. The data fluctuates only 0.01mm in experimental environment.



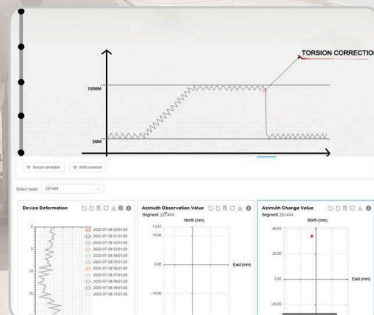
### B Accurate Direction, Reliable Accuracy

- Before assembling, every segment of ADM is separately calibrated for X, Y, Z axis with high-accuracy full-automatic calibration system. After assembling, the whole ADM is calibrated overall again to ensure the accuracy of X, Y and Z axis. Then it can reliably predict the deformation trend in engineering applications. The displacement resolution of each segment (500mm) is up to 0.005mm.



### C Torsion Algorithm, Deviation Correction

- ADM adopts professional torsion correction mode, which can correct the deformation value lead by torsion, ensuring accuracy and stability of measuring data.



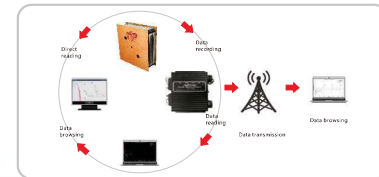
### D Sectional Assembly, Easy Installation

- ADM adopts innovative sectional assembly design that makes users can freely assembly and install ADM according to the depth of boreholes. The flexible ADM can be rapidly deployed in vertical, horizontal and convergence monitoring application.



### E Automation Transmission, Real-time Analysis

- ADM adopts 4G network to collect and transmit data. Once finishing installation and power on, the data can be automatically transmitted to the cloud platform. The frequency of data collection and transmission is up to 1 time/second. Users can check the data in the cloud platform in real time.



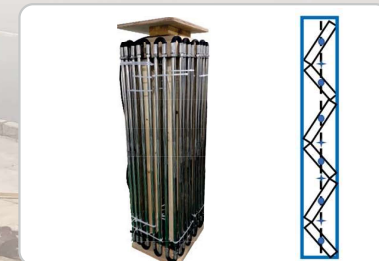
### F Secondary Development, Strong Compatibility

- ADM's protocol can be opened to compatible other equipment. Users can connect ADM to other brand data collectors to transmit data according to requirement. Also, the collected data can be transmitted to other monitoring software.



### G Humanized Design, Compression Check

- The second generation transport reel of ADM is more humanized than before, which is smaller size, easier to transport, quicker to install and can be reused. With the new compression kit, user can check the compression installation whether is right in the place, which is very convenient and efficient for installation.



### Technical Parameters of ADM

Operation mode	MEMS acceleration mode
Measurement direction	3 dimensions(X,Y,Z)
Angle measurement	0~360°
Angle resolution	±0.0003°(±1.08") (±0.000005rad)
Displacement resolution	0.005mm@500mm
Deformation Accuracy	± 0.5mm (32m )
Angle measurement accuracy	±0.002° (0.0006%F.S) (0.02mm@500mm)
Anti-twist accuracy	± 1°
Temperature measurement accuracy	± 0.2°C
Temperature record	± Record real-time (every segment)
Frequency for data collect	1 second
Power consumption	DC12V 3.2mA/segment
Maximum tensile	550kgf
Waterproof	200m under water(2MPa)
Operating temperature	-40°C~60°C(humidity≤95%)
Diameter	25mm (maximum diameter)
Magnetic field interference	No interference
Electric field interference	No interference
Deformation track	Track real-time
Segment Length	0.5m/1m per segment, length can be customized
Length of ShapeArray	Can be customized (For Details, Please contact us)
Maximum Joint Band Angle	180°
Weight	1kg/m
Communication Cable	Standard 10m(can be customized)
Length of Fiberglass Extension	2m
Length of Unsensorized Near cable Segment	20cm
Range of 3D Model Vertical	0~180°

### Integrated Data Collector

ADM adopts the integrated data collector to collect, convert, storage and upload data. It integrates data converter, data recorder and data transmitter in one. The integrated data collector have two models, HS-C1000 and HS-D200. The HS-C1000 adopts Linux system. With the specific branch box, it can import multiple ADM's monitoring data. The HS-D200 adopts low power consumption design. It's very useful for monitoring projects with limited power supply condition, which can extend the monitoring cycle to the most and improve automatic monitoring efficiency.

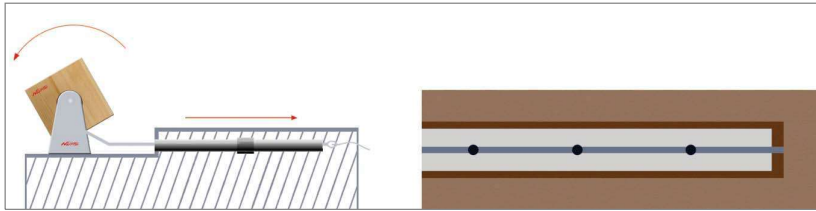


### Technical Parameter of Data Logger

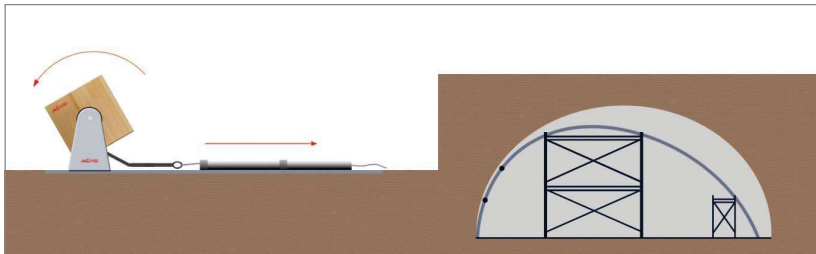
Technical Parameter	C1000	D200
Power consumption	DC12V 220mA	DC12V 180mA (Dormant state DC12 1mA)
RAM	8G	16M
System	Linux	None
Network	4G netcom(compatible with 3G、 2G)	
Power supply	DC9-36V	
Port	Power, 485, USB, DB, antenna	
Daily timing error	≤0.5s/day (Cloud platform corrects time every monoring)	
Status display	LED	
Operating Humidity	≤95%(@40°C)	
Operating temperature	-40°C~85°C	
Dimension	146x150x41mm (metal frame)	

## Application Scenarios

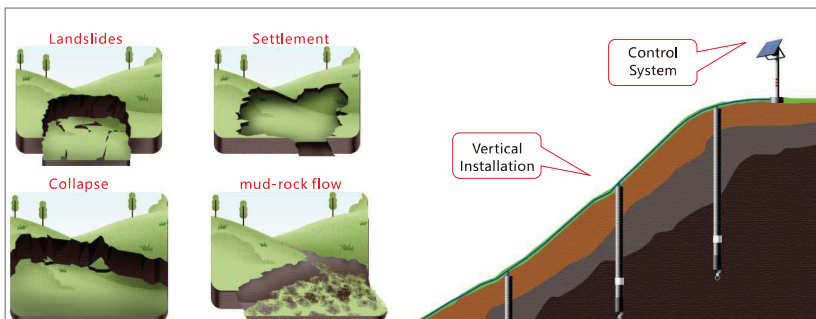
### Horizontal Installation



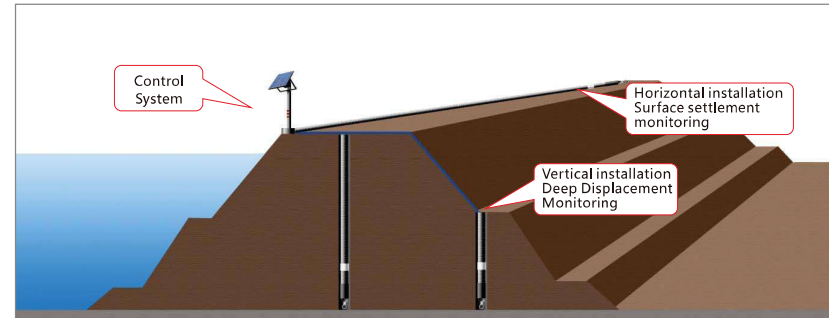
### Annular Installation



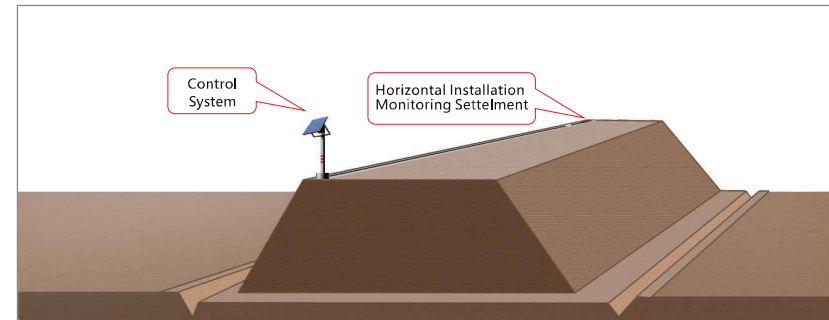
### Geological hazard monitoring



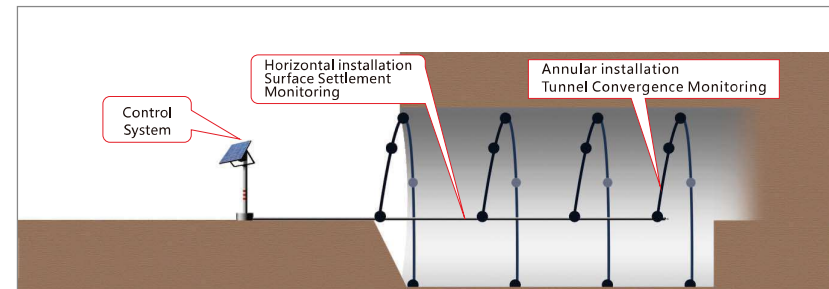
### Dam monitoring



### Subgrade settlement monitoring

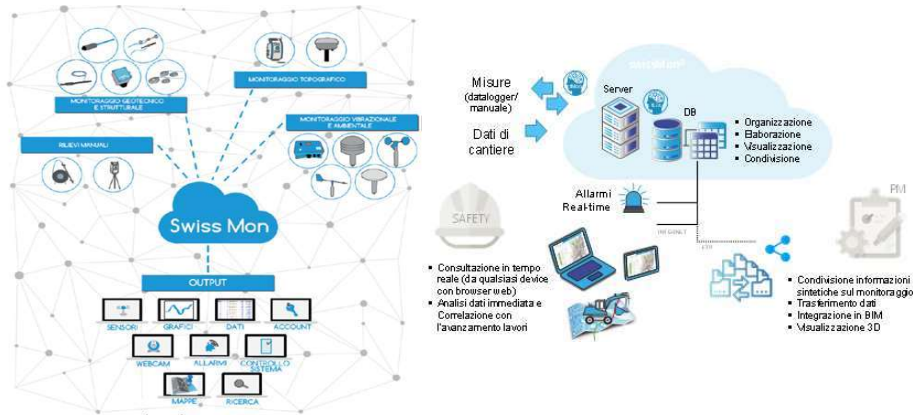


### Tunnel convergence and settlement monitoring



## Monitoring Early Warning Cloud Platform

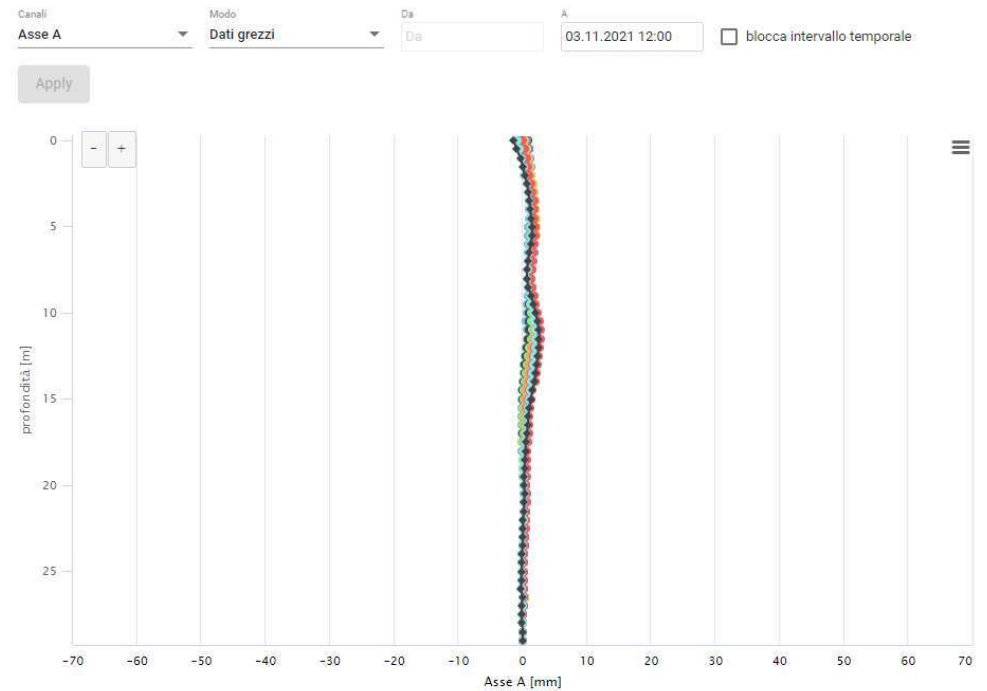
The Array Displacement Meter ADM real-time 3D deformation monitoring early warning cloud platform is suitable for multiple real-time monitoring projects, such as slope displacement, tunnel construction, road settlement, bridge deflection, dam settlement and lateral displacement, building construction, etc. Mainly monitor displacement, inclination, vibration. The cloud platform has functions such as real-time acquisition of monitoring data, cloud comprehensive processing, diversified chart display, professional correlation analysis, disaster warning and alarm, report statistics and so on. Besides, the cloud platform can manage multi-project and multi-equipment at the same time, and provide safe, reliable, real-time, comprehensive, timely and efficient information service.



## Classic Cases

### Profilo inclinometrico: IN01

Close All Tabs



10.05.2021 12:00:00 28.05.2021 12:00:00 16.06.2021 12:00:00 01.07.2021 12:00:00 12.07.2021 12:00:00  
 22.07.2021 12:00:00 11.08.2021 12:00:00 30.08.2021 12:00:00 14.09.2021 12:00:00 30.09.2021 12:00:00  
 21.10.2021 12:00:00 03.11.2021 12:00:00

- Gestione acquisizione automatica on-site e in remoto**
- Database archiviazione e protezione dati di monitoraggio**
- Validazione dati in tempo reale e segnalazione di stato allerta/allarme**
- Visualizzazione Web-GIS su mappa personalizzata e consultazione interattiva**
- Visualizzazione serie temporali, valori calcolati, profili, scavo avanzamento, Export dati**
- Repository dati e documenti progettuali e di cantiere**