



SAAV EXTEND

Model 001

ShapeArray and its cyclical installation are patented technology.

SAAV Extend—our latest innovation addresses the challenges of continual deformation monitoring during the raising of tailings dams. Inspired by direct feedback from clients in the tailings and mine waste sectors, SAAV Extend provides a continual deformation profile throughout multiple dam raises with unparalleled ease of installation and data interpretation.

SAAV Extend is a modular ShapeArray system that scales along with your project's scope. SAAV Extend includes a top assembly that connects to a base assembly that creates a continuous deformation profile of a borehole. When it is time to raise the tailings dam, SAAV Extend Lift Extension segments can be added between the top and base assemblies to increase the total sensorized length. SAAV Extend's connectors are keyed to ensure azimuth is maintained as Lift Extension segments are added in the field.

SAAV Extend is designed for the field. Our toolless connectors ensure that SAAV Extend produces continuous and reliable, long-term data while submerged in water-logged environments.

SAAV Extend can be installed into existing casings, even those that are too distorted for conventional use, which eliminates the need to drill new boreholes when converting from manual to automated monitoring. SAAV's patented cyclical installation method means it can be directly inserted into a range of casing sizes and widths, including both standard grooved inclinometer casings and smooth casing types, without assembly in the field. Measurand's software tracks the medial axis in the centre of the casing in 3D to produce traditional inclinometer plots.

All ShapeArray instruments are manufactured in a high-capacity ISO 9001:2015 certified facility.

SPECIFICATIONS



PHYSICAL PROPERTIES

SEGMENT LENGTH	500 mm (joint center to joint center)
MAXIMUM COMBINED LENGTH OF SAAV EXTEND	Up to 200 m (500 mm segments)
MINIMUM LENGTH OF SAAV LIFT EXTENSION SEGMENT	1 m
STANDARD LENGTH OF SAAV	Up to 150 m (500 mm segments)
CUSTOM LENGTH OF SAAV EXTEND	Over 150 m (Contact Measurand for details)
CONDUIT & CASING OUTSIDE DIAMETERS	70 mm and 85 mm inclinometer casing
SAAV EXTEND OD DIAMETER	49 mm, fits in 52 mm inside diameter schedule 40 PVC pipe (2" trade size)
JOINT DIAMETER	19 mm
LENGTH OF UNSENSORIZED SAAV EXTEND TOP ASSEMBLY	500 mm
LENGTH OF FIBERGLASS EXTENSION	1 m
LENGTH OF COMMUNICATION CABLE	Standard 15 m
WEIGHT	0.6 kg/m
MINIMUM AXIAL COMPRESSION TO PROVIDE SNUG FIT IN CASING	30 kgf
TENSILE STRENGTH	113 kgf (SAAV joint weakest point) 320 kgf (Connector)
MAXIMUM JOINT BEND ANGLES	90°
STORAGE TEMPERATURE	-40°C to 60°C
INSTALLATION TEMPERATURE	-20°C to 60°C
OPERATING TEMPERATURE	-35°C to 60°C polynomial temperature algorithm corrected
WATERPROOF TO	2000 kPa (200 m Water)
CONNECTOR RATINGS FOR WATER PRESSURE	700 m H2O (1000 psi) mated 140 m H2O (200 psi) open face
POWER REQUIREMENTS	12 VDC (12–16.5) at 1.8 mA/segment 12 VDC (12–16.5) at 0.4 mA/segment (low power mode)

SPECIFICATIONS



STATIC SHAPE MEASUREMENTS

ANGULAR RANGE OF MEMS SENSORS	$\pm 360^\circ$ (software selection required for 2D/3D modes)
RANGE OF 3D MODE (VERTICAL)	$\pm 60^\circ$ with respect to vertical
DEFORMATION ACCURACY ^{1,2,3}	± 1.5 mm for 32 m ShapeArray
RESOLUTION OF SINGLE SEGMENT	± 1 arcsecond ⁴
AZIMUTH ERROR IN JOINTS	$< \pm 0.01^\circ$
LONG-TERM RELIABILITY MTBF ⁵	38 years for 32 m ShapeArray

NOTES



¹ One-sigma value, based on cyclical installation in 59 mm ID casing. Accuracy degrades as square root of length.

² Value based on AIA (Average in Array) setting of 1000 samples.

³ Specification is for 3D mode within $\pm 20^\circ$ of vertical. Vertical accuracy degrades with angular deviation from the vertical.

⁴ RMS, calculated from published noise figure of sensor (verified by Measurand Instruments Inc.), and bandwidth of system using highest AIA setting of 25,600 samples.

⁵ Conservatively based on longevity data for electronic components used in ShapeArray, a) assuming total system failure if any single component fails, b) system powered on 100% of the time, c) ambient 6°C, d) internal temperature rise of 8°C above ambient due to 100% powered-on duty, and e) a benign ambient environment typical of geotechnical instrumentation. MTBF will increase for more typical duty cycles (not powered on 100% of the time). At higher temperatures, MTBF will decrease (e.g. by ~half at 52°C). MTBF is based on "MIL-HDBK-217F Notice 2" performed by, ALD/SoHaR.

PATENT INFORMATION

ShapeArray and its cyclical installation are patented technology.

Measurand's patents include, but are not limited to:

Shape-Acceleration Measurement Device and Method, Canadian Patent 2,472,421 & 2,747,236

Shape-Acceleration Measurement Device and Apparatus, US Patent 7,296,363

Cyclical Sensor Array, Canadian Application 2,815,199 & 2,911,178

Bipartite Sensor Array, Canadian Application 2,815,195 & 2,911,175

ShapeArray patents include coverage in: United States, Canada, France, United Kingdom, Italy, Japan and Germany.

Installation patents include coverage in United States, Canada, France, United Kingdom, Italy, Germany, China, Hong Kong, and Korea.

Patent families are sufficiently broad to capture most or all usage of ShapeArray in longer lists of countries.

SAAV EXTEND ASSEMBLY



Maximum diameter of array = 43.6 mm

Maximum diameter of connector = 25.5 mm

Capped array length = top assembly length + lift extension length + base array length

Base array length = (# of base array segments x 500) - 105

Extension length = # of lift extension segments x 500

Top assembly length = fiberglass extension length + 476

Packing = 1.9 mm/segment (70 mm SI casing), 3.4 mm/segment (85 mm SI casing)

**Fiberglass extension length should be minimized to reduce excavation requirements

*** Length varies based on springbox compression

