



## Description

The ShapeAccelArray Field (SAAF) is a type of SAA that is most commonly used. All SAA models have rigid segments separated by flexible joints. Triaxial MEMS gravity sensors measure tilt in each individual segment. SAAFs produce data equivalent to inclinometer data. Each SAA is a fully-calibrated measuring instrument with a length of up to 100 meters, delivered on a reel, and installable in very small diameter casing. As a result, installation is rapid and lower in cost, and much larger deformations can be monitored.

An SAAF may be installed near vertical to track the magnitude and direction of lateral deformation, or near horizontal to track vertical deformation. It can be also be installed along the cross-section of tunnels and used in “mixed H/V” mode to measure convergence. Due to the MEMS sensors in the SAAF, it is possible to use the SAAF to monitor 3D vibration data at up to three selected locations along the instrument. Temperature data are collected every eight segments along the SAAF.

SAAF installations are designed for either manual or automated measurements with a PC or data logger and can be powered with either mains or solar power. Other custom solutions are also available, contact Measurand for more details. All communications in the array are digital and carried along a cable to the reading device. Standard software required to collect, process, and view SAAF data is available free of charge from the Measurand website within the SAASuite software package. A Measurand interface is required between an SAAF and logger or computer. Interface functions include protocol conversion, power control, and surge protection. Interfaces include SAA232, SAA Field Unit, and SAAUSB.

*Related products: SAA232, SAA232-5, SAA Field Power Unit, SAAUSB, SAAPZ*

## Specifications

### Physical Properties:

Segment length <sup>1</sup> :	305 mm or 500 mm (joint centre to joint centre)
Maximum length of SAAF:	100 m (500 mm segments) or 60.96 m (305 mm segments)
Maximum number of segments:	200
Length of unsensored bottom loop:	60 mm

Length of unsensorized top portion:	130 mm
Length of hardened cable (inside PEX):	175 mm
Length of PEX tubing	1.5 m standard
Length of communication cable:	Standard 15 m, (13.5 m extending past the PEX tubing)
Weight:	0.6 kg/m
Joint diameter in extension:	25 mm
Joint diameter in compression:	27 mm
Maximum tensile resistance:	320 kgf
Maximum axial compression:	45 kgf (in casing), 22 kgf (no casing)
Minimum axial compression to provide snug fit in casing:	10 kgf
Maximum joint bend angles:	45° (larger angles permitted when stored on factory reel in factory orientation)
Smallest bend radius which allows for extraction:	3.5 m
Storage temperature:	-40°C to 60°C
Installation temperature <sup>2</sup> :	-5°C to 60°C
Operating temperature:	-20°C to 60°C
Waterproof to:	980 kPa
Power requirements:	12 VDC at 2.5 mA/segment

### Dynamic Acceleration Measurements:

Range:	± 1.7 G
3dB Bandwidth:	50 Hz
Noise floor of MEMS:	110 µG/Hz <sup>0.5</sup>
Data rate:	SAA232: 38.4 kbps to 230.4 kbps

### Static Shape Measurements:

Angular range of MEMS sensors:	± 360° (software selection required for 2D/3D modes)
Range of 3D mode (vertical):	± 60° with respect to vertical (SAARecorder alert at ±70° w.r.t. vertical)
Range of 2D mode (horizontal):	± 60° with respect to horizontal
Range of 2D mode (mixed H/V):	± 180° with respect to horizontal
Long-term accuracy relative to starting shape <sup>3,5,6</sup> :	± 1.5 mm for 32 m SAA

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Short-term resolution relative to starting shape <sup>4,5,6</sup> :	$\pm 0.5$ mm for 32 m SAA
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Long-term accuracy of tilt/segment within 20° of vertical <sup>3, 5, 6</sup> :	$\pm 0.0005$ rad = 0.029°
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Azimuth error in joints:	$< \pm 0.25^\circ$
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Orthogonality within segments:	$\pm 0.1^\circ$
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<sup>1</sup> Custom segment lengths between 200 mm and 305 mm are available at extra cost, contact Measurand for more information.

<sup>2</sup> Note that most PVC cement for the 27 mm ID PVC conduit is limited to working temperature of 0°C, though special low temperature PVC cement which will work to -20°C is available. Also, flexible SAA joints may be damaged by abrupt bending at low temperatures. As such installation below -5°C ambient must be accompanied by a means of warming the SAA joints and any cemented PVC couplings.

<sup>3</sup> Value based on field measurements of vertical arrays for 1.5 years of operation.

<sup>4</sup> Short-term  $\leq 24$  h.

<sup>5</sup> Value based on averaging 200 – 1000 frames per reading.

<sup>6</sup> Specification is for 3D mode within  $\pm 20^\circ$  of vertical. Vertical accuracy degrades with angular deviation from the vertical.