

## Ultra-Low Power Precision Sensing & Wireless Communication

### Typical Applications

- Bridge health monitoring
- Structural integrity monitoring (buildings, dams, tunnels, etc.)
- Monitoring of bridge bearing and expansion joints
- Monitoring width of cracks on structures
- Monitoring timber structures and bridges

### Benefits

- **Long lifetime** (battery life of 10 years)
- **Wireless communication** (IEEE 802.15.4)
- **Lightweight (about 245 grams)**
  - Wireless transmitter: 120 g (4.2 ounces)
  - Cable (1ft): 10 g (0.35 ounces)
  - Displacement sensing element (1"): 115 g (4.0 ounces)
- **Small size:**
  - Wireless transmitter: 50mm (1.96") x 50mm (1.96") x 34mm (1.34")
  - Displacement sensing element: 158mm (6.25") x 22mm (0.9") (1" displacement)
- **High-rate data transmission triggered by sudden strain changes:**
  - Perfect for recording the waveform of a sudden displacement change (e.g., displacement event) caused by live load (e.g., heavy trucks passing over a bridge, wind gust, loading cycles).



- User adjustable sampling rate for event detection and high-rate data from 10 to 100 samples per second
- User adjustable triggering threshold from 0.025mm for detecting displacement event

- **Adjustable sampling interval:** The regular sampling interval can be adjusted remotely by user from 100ms (10 samples/sec) to 15sec
- **Adjustable transmission interval:** Can be adjusted remotely by user from 18sec to 360sec.
- **Long communication range:** 1.0km (0.62mile) free space

### Specifications

- **Resolution:** 0.01mm (0.4mil)
- **Measurement Range:** 50mm (2"), 75mm (3"), 100mm (4"), 150mm (6"), 300mm (12")
- **Mechanical stroke length of the sensing element:** 53mm (2.1"), 78mm (3.1"), 103mm

(4.1"), 150mm (6"), 300mm (12")

- **Measurement non-linearity:**  $\leq \pm 0.10\%$  (Full Stroke)
- **Working temperature:** -40°C to +65°C (-40°F to +150°F)
- **Ingress Protection:** IP67, weatherproof. Protected against rain, snow, and UV exposure
- **Power source:** replaceable lithium-ion battery

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## Description

SenSpot™ provides an easy to install, scalable solution for distributed structural integrity monitoring. Resensys SenSpot™ technology offers a high-performance method for large-scale sensing, wireless synchronization, and ultra-energy efficient wireless communication.

SenSpot™ is designed to operate maintenance-free for more than a decade. After installation, SenSpot™ does not need calibration, battery replacement, or any other maintenance during its entire service life. Due to small size and light weight, adhesive-mount SenSpot™ sensors can be applied easily to as many critical spots on a structure as needed, with minimal installation effort.

SenSpot™ displacement meter can be used for measuring the progress of the existing cracks in a structure. This device has a sliding element which moves with displacement of structure or growth of a crack.

The displacement SenSpot™ comes with IP67 rated transducer from Novotechnik that is well known for its high-quality products but it can be customized per user request to work with other transducers from other third-party manufacturers such as OMEGA or Vishay.

The sampling interval can be remotely adjusted by user based on SenMax™ transmission interval. The highest sampling rate is 100ms or 10 samples/s when the SenMax™ transmission interval is 18s and the lowest sampling rate is every 15s when SenMax™ transmission interval is 360s.

Resensys wireless Displacement SenSpot™ comes in

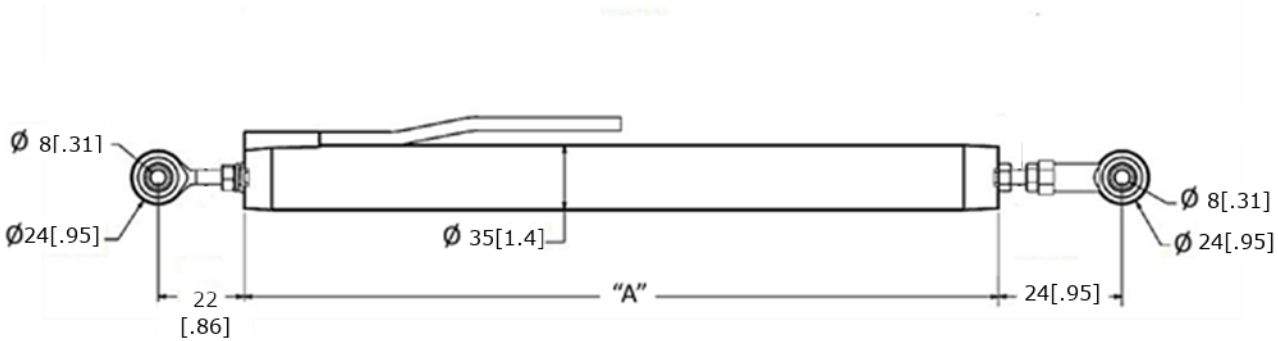
two different types:

Type A: this type can measure displacement values from 100ms to every 15s. This type does not have the capability of detecting sudden change of displacement (or event) values. But it is enough for most applications. Especially, when the main goal is just long-term monitoring such as crack monitoring. Since cracks inside structures typically develop slowly over long run.

Type E: In addition to the features of type A, it measures the displacement values with the nominal rate of 40 samples/s (every 25 ms) in the background. This data is used only for detecting high sudden change of displacement (e.g., an event) and is not transmitted. If an event is detected, data of one second pre-event together with eight seconds of post event data is transmitted with sampling rate of 40 samples/s. In this case, the user can capture the whole waveform of the event. One application of this type is live load monitoring when a change of the load on bridge such as passage of heavy trucks, causes sudden changes on the displacement values.

Sampling rate for event detection can be configured from 10 samples/s to 100 samples/s and the triggering threshold can be set from 0.25mm to full scale remotely by the user. This gives user a great flexibility at balancing between the SenSpot™ performance and battery life depending on bridge condition and location of the deployed SenSpot™.

# Displacement sensing element



Model	2"	3"	4"	6"	12"
Dimension "A" (mm)[inch]	176 [6.9]	201 [7.9]	227 [8.9]	277 [10.9]	430 [16.9]

Figure 1: Displacement SenSpot™ (sensing element) dimensions. All dimensions are in mm [inch].

# SenSpot™ - Wireless Transmitter

Wireless transmitter is universal and it reads the analog measurement from the sensing element and transmits the data wirelessly to SeniMax™. These units come in either self-adhesive or flange-mount form factors.

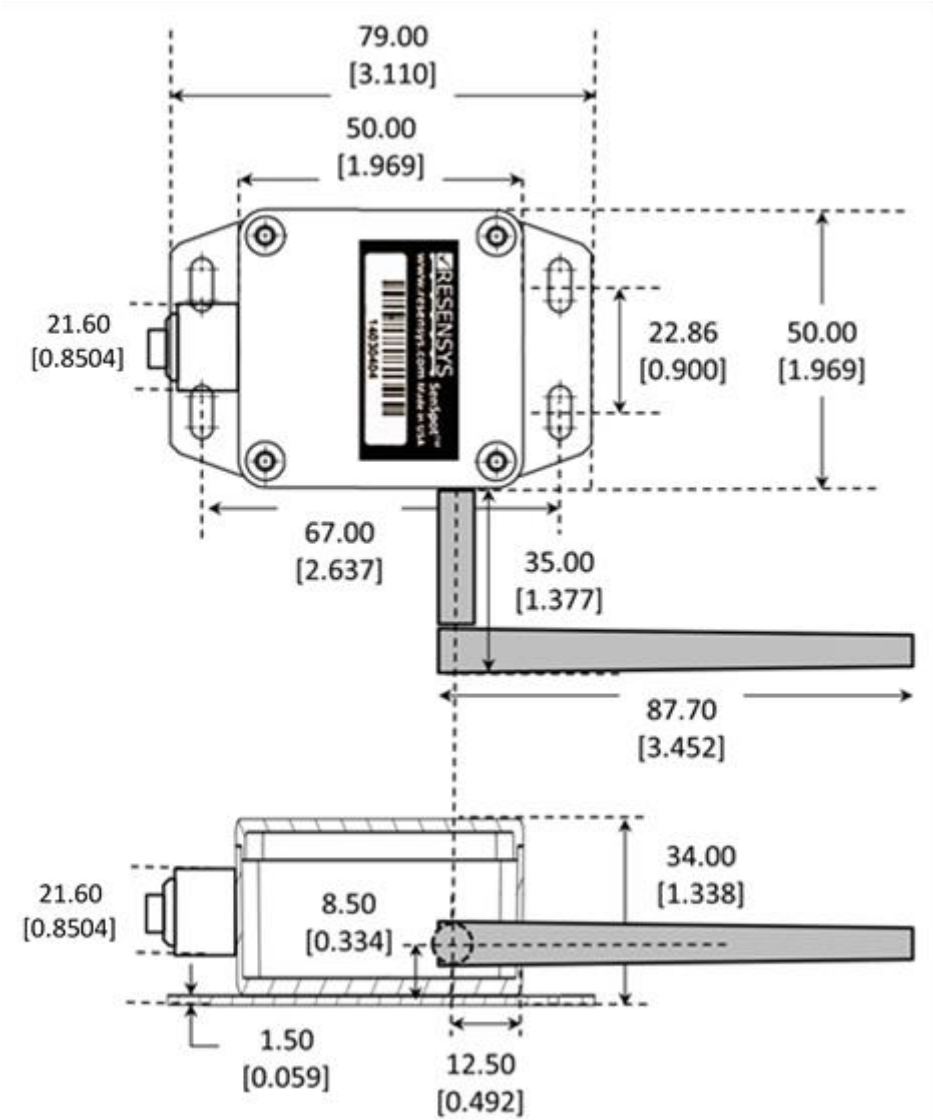


Figure 2: Wireless transmitter dimensions for Displacement SenSpot™. All dimensions are in mm [inch].

# The data shown in SenScope™

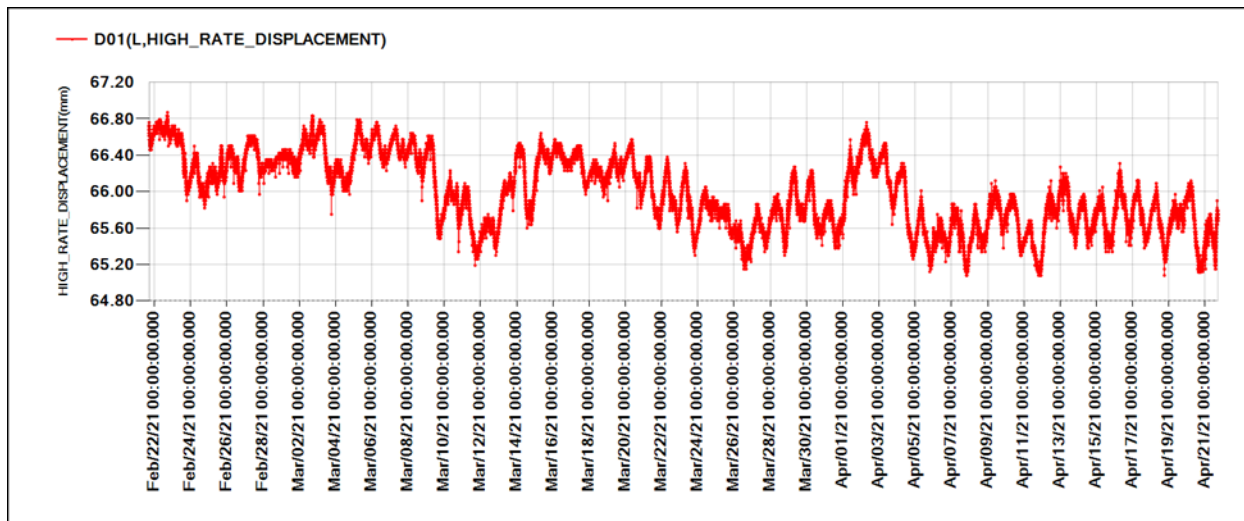


Figure 3: High-rate displacement measurements for a Displacement SenSpot™