2024

Wireless Vibration Sensor System

Broadsens Corporation

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Broadsens

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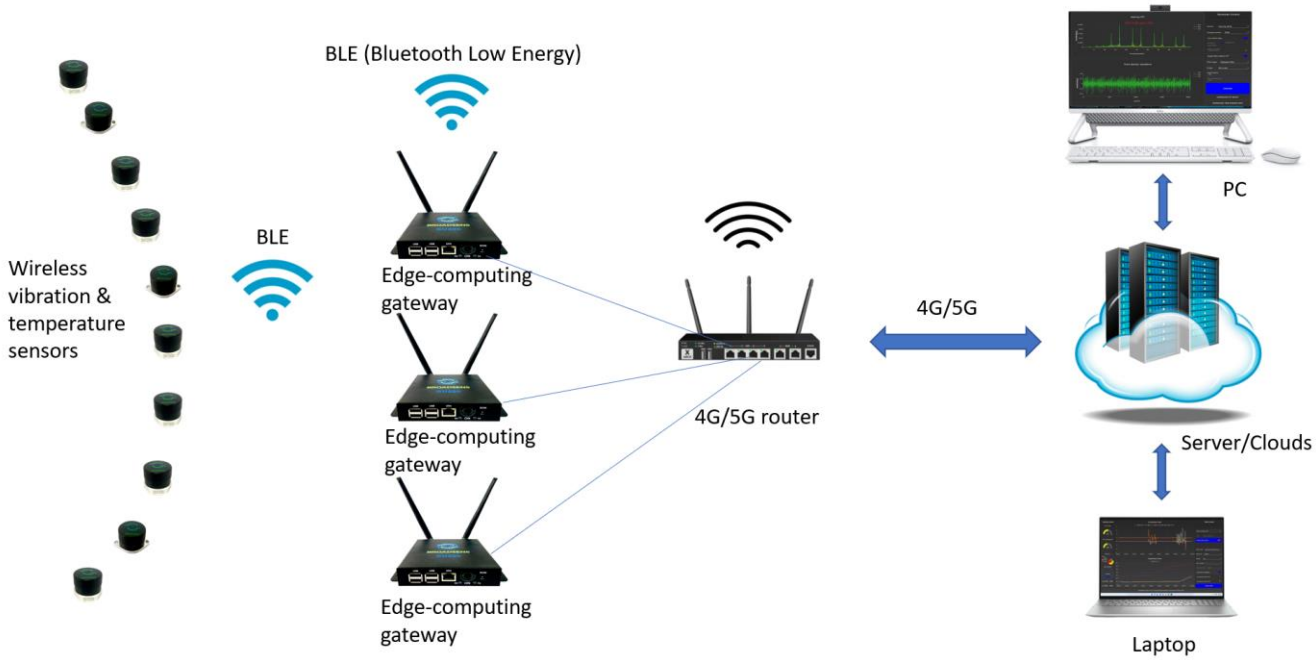
Introduction

Broadsens Corporation has the largest selection of wireless vibration sensor systems in the industry. The system consists of sensors, edge-computing gateways and vibration analysis software. The system can work standalone (no network required), or transfer data or results to clouds/servers in real time or by demands.



System features

- Ultra-low power. Simply the best battery efficiency in the industry
- Ultra-compact and light weight. Fit into tight spaces
- No subscription fees
- High performance. Advanced DAQ modes including multiple trigger modes
- True real-time ability with long lasting battery life
- Real-time data visualization
- Edge computing gateway with vibration analysis, large storage and integrated database
- Scalability. Scale easily to very large scale applications without gateway and sensor limitation
- Secure data and connection. Encrypted with AES 128-bit protection for secure data transfer
- Gateway software open to customers with customization right

Applications

- Manufacturing process
- Oil, gas and energy
- Civil engineering and buildings
- Mining & heavy machinery
- Power, nuclear and water plants
- Railroad and ships
- Bioengineering
- Aerospace, rockets, planes and UAVs
- Food & drinks
- Paper plants
- Chemical plants
- Steel plants, aluminum and metals

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- Cements
- Research & institutes
- Automobiles
- Semiconductors

Wireless Vibration Sensors

Broadsens wireless vibration sensors are ultra-compact and have the highest battery efficiency in the industry. The sensor battery typically lasts up to five years before replacement. The wireless vibration sensors are easy to install, easy to use, high-performance with up to 10kHz F_{Max}. Broadsens's wireless vibration sensors include:

- SVT-A series sensors that collect triaxial raw Acceleration data for advanced vibration analysis
- SVT-V series sensors for 24/7 true real-time vibration Velocity RMS monitoring
- SVT-C series sensors with connection Cable of external power supply
- SVT-L series sensors of Long range with high data rate and performance

All Broadsens wireless vibration sensors include triaxial accelerometer and precision temperature sensor. The temperature sensor has a resolution of 0.01 degree Celsius with +/-0.3 ^{0}C accuracy. Because the vibration sensors have auto-calibration capability, no calibration is required for both acceleration and temperature measurements in the field.

SVT-A series vibration sensors

SVT-A series wireless vibration sensors include SVT200-A, SVT300-A and SVT400-A. “A” stands for acceleration. They acquire raw triaxial acceleration data and temperature data by commands, manually or automatically. They are ideal for advanced vibration analysis, machine condition monitoring and predictive maintenance.

Parameters	SVT200-A	SVT300-A	SVT400-A
Acceleration range	±2g, ±4g, ±8g adjustable	±2g, ±4g, ±8g, ±16g adjustable	±8g, ±16g, ±32g, ±64g adjustable
Sampling rates	50Hz, 200Hz, 400Hz, 800Hz, 1.6kHz, 3.2kHz, 12.8kHz, 25.6kHz adjustable		
Acceleration resolution	16 bits		
Acceleration noise level	0.7mg RMS; 130ug/√Hz density	0.7mg RMS; 130ug/√Hz density	1.9mg RMS; 300ug/√Hz density

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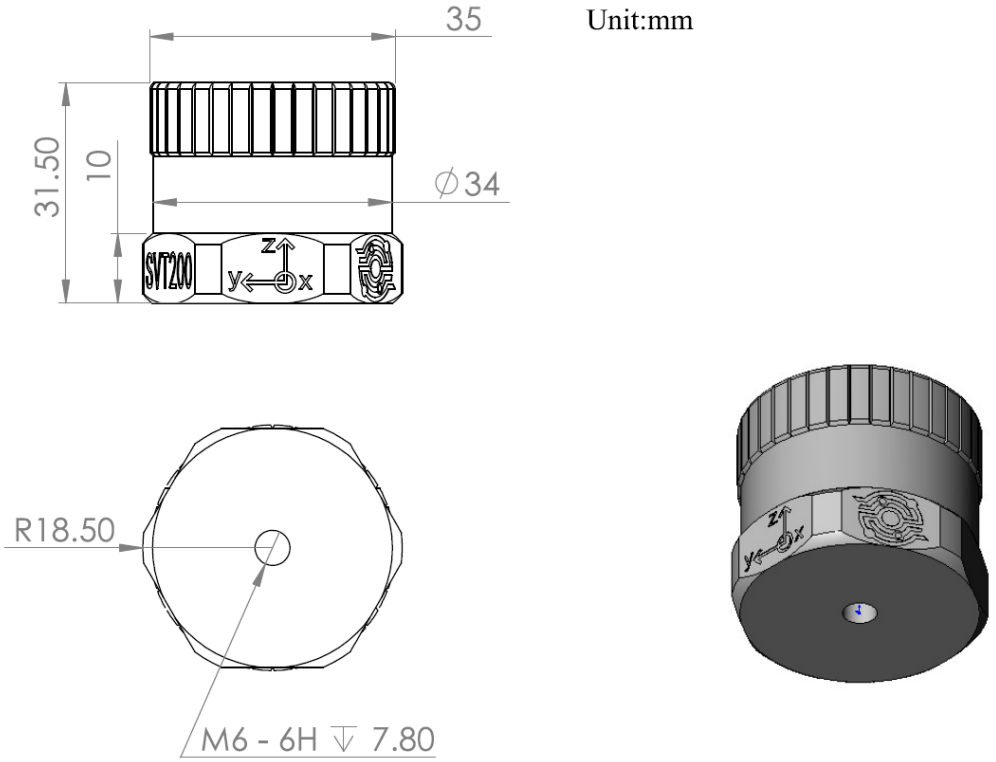
Parameters	SVT200-A	SVT300-A	SVT400-A
Temperature measurement	-40 - 125 ^{0}C		
Temperature accuracy	+/- 0.3 ^{0}C, no calibration required		
Temperature Measurement interval	Every 5 seconds when active with acceleration measurement in real-time mode		
Power consumption	Idle current: 2.2uA; DAQ & transmission current: <200uA (tested at 50Hz & 100Hz, real-time mode)		
Power supply	Replaceable 14250 battery, 1200mA capacity, intrinsic safe. Lasts up to 5 years (depending on usage)		
Wireless	2.4GHz; more than 300m/900ft distance in open space. FCC/IC approved		
Size	Diameter: 34mm/1.34in; Height: 31mm/1.22in		
Material and weight	Anodized aluminum alloy 6061 base, industrial plastic cover: 53g/1.87oz		
Mounting method	Magnet mount; epoxy; mounting pad (with M6 screw); stud mount (M8 to M6)		
Environment	Working temperature: -55-85 ^{0}C. Water proof: IP68 default (IP69K optional)		
Explosive atmosphere	Intrinsic safe. Ex ia IIC T4 Ga		

Mechanical drawing



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SVT-V series vibration sensors

SVT-V-series wireless vibration & temperature sensors continuously monitor vibration & temperature in real time 24/7. The sensors can detect accidents and send out alarm within 0.5 second typically, which is crucial for important assets. SVT-V series wireless vibration sensors include SVT200-V, SVT300-V and SVT400-V.

If there is a vibration event that exceeds 0.1g at any one of the x, y, z axes for more than 0.33s, then the sensors switch to 6.4kHz high-speed sampling rate, take a fixed number of samples and compute the vibration velocity RMS (mm/s or inch/s) and acceleration RMS (g), measures temperature and then transmit the result to the wireless gateway. If there is no vibration event detected, the sensor still toggles to high-speed mode,

Parameters	SVT200-V	SVT300-V	SVT400-V
Acceleration range	Up to 8g	Up to 16g	Up to 64g
Acceleration sampling rate	Low speed & 6.4kHz sampling rate dynamic adjustment based on vibration level		
Acceleration resolution	16 bits		
Temperature measurement range	-40 - 125 ^{0}C		
Temperature accuracy	+/- 0.3 ^{0}C		
Vibration & temperature measurement interval	True real-time continuous vibration measurement		
Power consumption	Ultra-low power design. 4-year battery life in typical applications		
Power supply	Replaceable 14250 battery, 1200mA.		
Wireless	2.4GHz; up to 300m/900ft in open space. FCC/IC approved		
Size	Single M6 screw-hole*: 34mm/1.34in x31mm/1.22in (diameter x height) Double-screw: 34mm/1.34in x 25mm/0.98in (diameter x height)		

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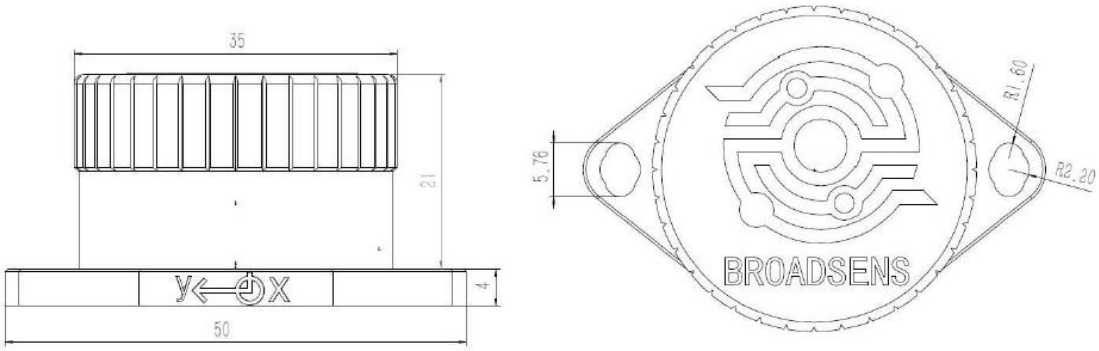
Parameters	SVT200-V	SVT300-V	SVT400-V
Weight	45g (1.59) oz for double-screw hole case; 53 g (1.9oz) for single M6 case		
Mounting method	Epoxy; Screw mount or wire mount; Magnet mount, pad mount or stud mount for single M6 screw hole case		
Environment	Working temperature: -55-85 degree Celsius. Water resistance: IP68 (IP69K optional)		
Explosive atmosphere	Intrinsic safe. Ex ia IIC T4 Ga		

*: SVT-V series sensors are provided in single M6 screw-hole case in default.

Mechanical drawing of double-screw case



Note: The size of single M6-screw case of SVT-V series sensors is the same as SVT-A series sensors.

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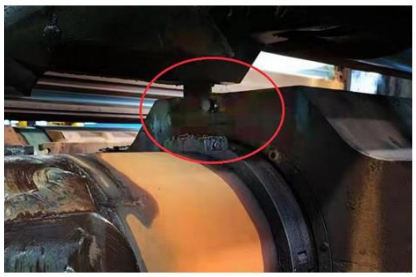
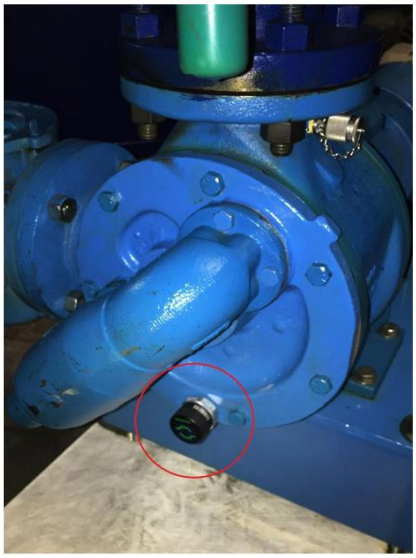


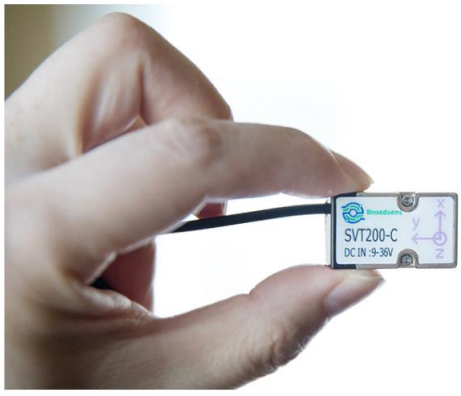






SVT-C series vibration sensors

SVT-C series wireless vibration & temperature sensors have the smallest footprint in the industry. They use external power supply (9v-36v DC) connection cable, which is ideal for applications having power source, such as spindle machines. The signal wire of the power supply cable should connect to positive input (9-36V DC), and the shielding of the power supply cable should connect to the ground.



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SVT-C series sensors include SVT-CA series and SVT-CV series, which matches the functions of SVT-A series sensors and SVT-V series sensors respectively.

SVT-CA series sensors

Parameters	SVT200-CA	SVT300-CA	SVT400-CA
Acceleration range	±2g, ±4g, ±8g adjustable	±2g, ±4g, ±8g, ±16g adjustable	±8g, ±16g, ±32g, ±64g adjustable
Sampling rates	50Hz, 200Hz, 400Hz, 800Hz, 1.6kHz, 3.2kHz, 12.8kHz, 25.6kHz adjustable		
Acceleration resolution	16 bits		
Acceleration noise level	0.7mg RMS; 130ug/√Hz density	0.7mg RMS; 130ug/√Hz density	1.9mg RMS; 300ug/√Hz density
Temperature measurement	-40 - 125 ^{0}C		
Temperature accuracy	+/- 0.3 ^{0}C, no calibration required		
Temperature Measurement interval	Every 5 seconds when active with acceleration measurement in real-time mode		
Power consumption	Idle current: 5uA; DAQ & transmission current: <200uA (tested at 50Hz & 100Hz, real-time mode)		
Power supply	External 9-36V DC; power supply cable length: 2.5m /8 ft		
Wireless	2.4GHz; more than 150m/500ft in open space. FCC/IC approved		
Size	30x18x13 mm /1.18x0.71x0.51 inch (LxWxH)		
Material and weight	Stainless steel, industrial plastic cover: 56g (1.98 oz)		
Mounting method	Epoxy, bracket		
Environment	Working temperature: -55-85 ^{0}C. Water proof: IP67 default (IP68, IP69K optional)		

SVT-CV series sensors

Parameters	SVT200-CV	SVT300-CV	SVT400-CV
Acceleration range	Up to 8g	Up to 16g	Up to 64g
Acceleration sampling rate	Low speed & 6.4kHz sampling rate dynamic adjustment based on vibration level		
Acceleration resolution	16 bits		
Temperature measurement range	-40 - 125 ^{0}C		
Temperature accuracy	+/- 0.3 ^{0}C		
Vibration & temperature measurement interval	True real-time continuous vibration measurement		
Power consumption	Idle current: 5uA; Full working mode: DAQ & transmission current: <200uA		
Power supply	External 9-36V DC; power supply cable length: 2.5m /8 ft		

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Parameters	SVT200-CV	SVT300-CV	SVT400-CV
Wireless	2.4GHz; more than 150m/500ft in open space. FCC/IC approved		
Size	30x18x13 mm /1.18x0.71x0.51 inch (LxWxH)		
Weight	Stainless steel, industrial plastic cover: 56g (1.98 oz)		
Mounting method	Epoxy, bracket		
Environment	Working temperature: -55-85 degree Celsius. Water proof: IP67 default (IP68, IP69K optional)		

Wireless vibration sensor mounted on panel

24-hour vibration data from the panel

SVT-L series long-range wireless vibration sensors

SVT-L series wireless vibration & temperature sensors have the longest range of high-data rate wireless vibration sensors in the industry. In open space line of sight, the distance from the sensors to the gateway can reach 1km (0.6 mile). They are ideal for applications of requiring long transmission distance or having obstacles/metal barriers/concrete walls.

SVT-L series wireless vibration sensors integrate seamlessly with existing Broadsens's edge-computing gateways. SVT-L series sensors include SVT-CA series and SVT-CV series, which matches the functions of SVT-A series sensors and SVT-V series sensors respectively. SVT-LA sub series includes SVT200-LA, SVT300-LA and SVT400-LA; SVT-LV sub series include SVT200-LV, SVT300-LV and SVT400-LV.

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SVT-LA series sensors

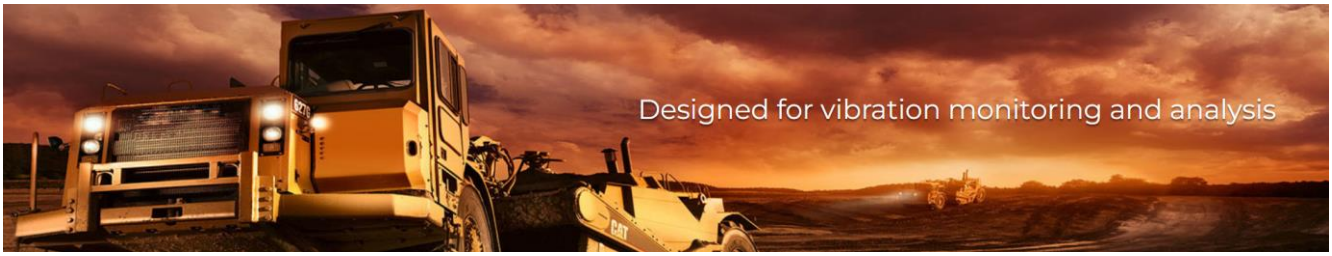
Parameters	SVT200-LA	SVT300-LA	SVT400-LA
Acceleration range	±2g, ±4g, ±8g adjustable	±2g, ±4g, ±8g, ±16g adjustable	±8g, ±16g, ±32g, ±64g adjustable
Sampling rates	50Hz, 200Hz, 400Hz, 800Hz, 1.6kHz, 3.2kHz, 12.8kHz, 25.6kHz adjustable		
Acceleration resolution	16 bits		
Acceleration noise level	0.7mg RMS; 130ug/√Hz density	0.7mg RMS; 130ug/√Hz density	1.9mg RMS; 300ug/√Hz density
Temperature measurement	Surface temperature -55 - 125 ^{0}C		
Temperature accuracy	+/- 0.3 ^{0}C, no calibration required		
Temperature Measurement interval	Every 5 seconds when active with acceleration measurement in real-time mode		
Power consumption	Idle current: 2.5uA; DAQ & transmission current: <1.3mA (tested at 50Hz & 100Hz, real-time mode)		
Power supply	ER18505 battery, 4000mAh, replaceable		
Wireless	2.4GHz; **up to 1km (0.6mile) in open space.** FCC/IC approved		
Size	37x71 mm (1.46x2.80 inch) diameter x height		
Material and weight	Aerospace aluminum 7075 industrial plastic cover: 117g (4.1 oz)		
Mounting method	Epoxy, bracket		
Environment	Working temperature: -55-85 ^{0}C. Water proof: IP68 (IP69K optional)		

SVT-LV series sensors

Parameters	SVT200-LV	SVT300-LV	SVT400-LV
Acceleration range	Up to 8g	Up to 16g	Up to 64g
Acceleration sampling rate	Low speed & 6.4kHz sampling rate dynamic adjustment based on vibration level		
Acceleration resolution	16 bits		
Temperature measurement range	Surface temperature -55 - 125 ^{0}C		
Temperature accuracy	+/- 0.3 ^{0}C		
Vibration & temperature measurement interval	True real-time continuous vibration measurement		
Power consumption	Idle current: 2.5uA; DAQ & transmission current: <1.3mA		
Power supply	ER18505 battery, 4000mAh, replaceable		
Wireless	2.4GHz; **up to 1km (0.6mile) in open space.** FCC/IC approved		

For more information, please visit Broadsens's website: broadsens.com

Parameters	SVT200-LV	SVT300-LV	SVT400-LV
Size	37x71 mm (1.46x2.80 inch) diameter x height		
Weight	Aerospace aluminum 7075 industrial plastic cover: 117g (4.1 oz)		
Mounting method	Epoxy, bracket		
Environment	Working temperature: -55-85 ^{0}C. Water proof: IP68 (IP69K optional)		



Wireless temperature sensor SVT200-T

Miniature wireless temperature sensor SVT200-T is designed for demanding industrial temperature monitoring. The wireless temperature sensor is ultra compact, light-weight and has a battery life of more than 10 years in continuous usage.

Key features

- Wide temperature range: up to 105 ^{0}C
- Fast measurement interval (every 15s)
- Long battery life: >10 years in continuous usage
- Measures contact temperature
- Easy installation
- Ultra-compact
- Reliable

Specifications

Parameters	Description
Temperature measurement range	-40 - 105 ^{0}C (-40 - 221 degree Fahrenheit)
Accuracy	+/- 0.3 ^{0}C accuracy; 0.01 ^{0}C resolution

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Parameters	Description
Measurement interval	Every 15 seconds
Power consumption	~4.3 uA including temperature measurements and data transmission
Power supply	CR2450W wide-temperature range battery. Lasts 10 years in continuous usage
Wireless	2.4GHz; more than 100m (300ft) distance in line of sight. FCC/IC approved
Size	39mm (1.54in) diameter; 14mm (0.55in) height
Weight	30 g (1 oz) with battery
Mounting method	Glue/epoxy
Environment	IP68 waterproof

Multiple SVT200-T sensors send data to Broadsens's wireless gateway in parallel. Up to 100 SVT200-T sensors can connect to one gateway (depending on distance to the gateway).

Each SVT200-T has a unique MAC address. The serial number of SVT200-T could be duplicated for different customers.

Mounting accessories

Wireless vibration sensor mounting accessories include magnet mount, mounting pad and mounting stud. Magnet mount has H-shape legs that allows the wireless vibration sensors to be mounted on both flat and curved areas quickly. Mounting stud offers the most reliable long-term mounting solution. Mounting pad can be bounded with epoxy to the structure and allows the sensor to be removed easily.

Accessories	Magnet base	Mounting pad	Mounting stud
Pictures			
Size	Height: 19mm (0.75 inch) including H-shape legs; diameter: 30mm (1.18 inch); screw thread: M6, 1mm thread	Diameter: 30mm (1.18 inch), height: 11mm (0.43 inch); screw thread: M8 (used with mounting stud)	Bottom: M8x10L (Length: 10mm (0.39 inch), 1.25mm thread); top: M6*6L (Length: 6mm (0.24 inch), 1mm thread)
Weight	62g (2.2oz)	58g (2.0oz)	5g (0.1oz)

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Materials	Stainless steel	Stainless steel	Stainless steel
Recommended frequency range	DC up to 5kHz	DC up to 10kHz	No limit
Installation examples			

Edge-computing gateways

Edge-computing gateways GU200S, GU300 and GU300S support Broadsens ultra-low power wireless vibration sensors. The gateway integrates 1.5GHz ARM Cortex quad-core processor with advanced data analysis ability. Vibration data can be visualized through a web browser in real time for quick time domain vibration analysis. Broadsens wireless gateways not only integrate FFT vibration analysis function and machine condition trend analysis function, but also have up to 128 GB large data storage. The gateways can divide the ultra-low power wireless vibration sensors into multiple groups to monitor different zones/areas.

GU200S GU300 GU300S

Specifications

Models	GU200S	GU300	GU300S
Processor	1.5GHz quad-core 64-bit ARM CPU		
Memory	2GB, 4GB or 8GB		
Data storage	32 GB or 64 GB	64GB or 128GB	
Communication with sensor	2.4GHz Bluetooth low energy with Adaptive Frequency Hop (AFH) technology, AES 128-bit encryption, EIRP up to 20dBm, up to 0.13w		
Network interface	Fast Ethernet, dual-band 802.11ac wireless		
Sensor support	Up to 190 (60 SVT-A, 30 SVT-V, and 100 SVT-T sensors)		
Operating system	Linux Debian 64-bit		
Software interface	BroadVibra software based on Node-RED		

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Models	GU200S	GU300	GU300S
Communication protocol	MQTT, TCP/IP, UDP, Modbus TCP, OPC UA	MQTT, TCP/IP, UDP, Modbus TCP & RTU, OPC UA	
Vibration analysis	Velocity, RMS, True peak, Peak-peak, STD, Crest factor, Kurtosis, trend analysis, FFT analysis, advanced filtering, frequency fine tuning, trigger modes		
Database	InfluxDB for easy data review and export		
Power supply	9-18v DC isolated		
Power consumption	<15w		
Size	141x127x31mm (5.55x5x1.22 inch)	141x121x31mm (5.5x4.7x1.2 inch)	141x125x28mm (5.5x4.9x1.1 inch)
Weight	555 g (1.22 lb.)	490 g (1.08 lb.)	460g (1.02 lb.)
Working environment	-30 - 60 Celsius (-22 - 140 Fahrenheit), 10% ~ 90%RH		
GPIO	No	Yes	Yes
Cellular network	No	No	Yes
Additional features	Edge computing, real time clock, OTA upgrade, USB	Edge computing, real time clock, OTA upgrade, USB, RS485 RTU, 2nd power connector	Edge computing, real time clock, OTA upgrade, USB, RS485 RTU, 2nd power connector

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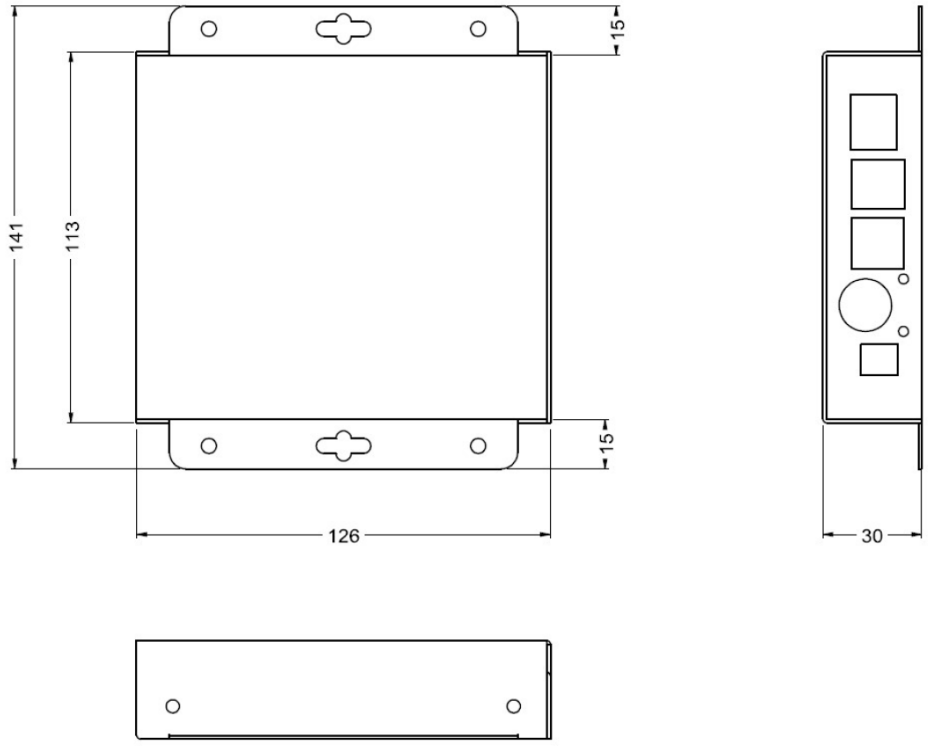
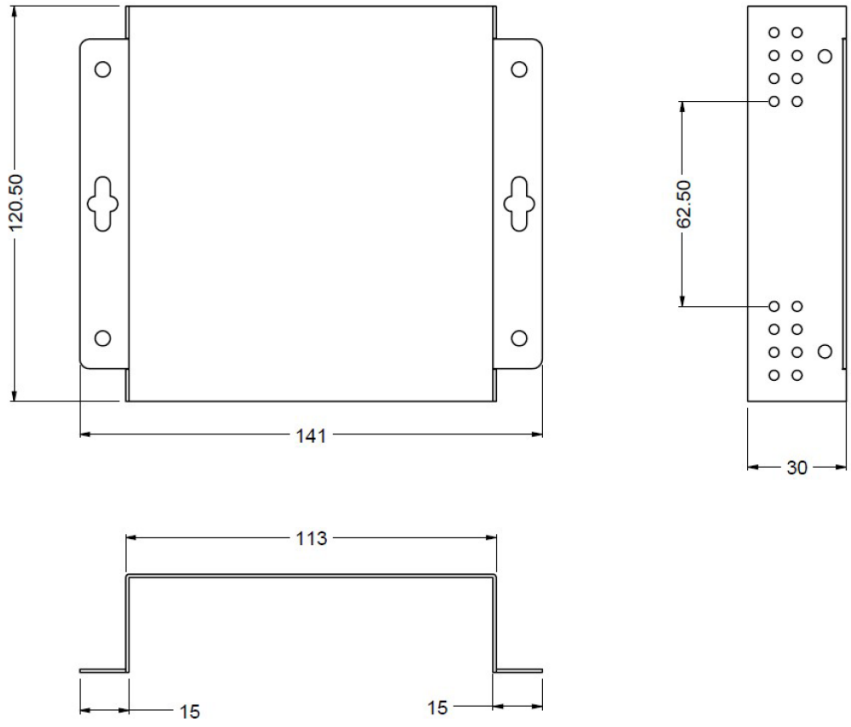


GU200S mechanical drawing



GU300 mechanical drawing

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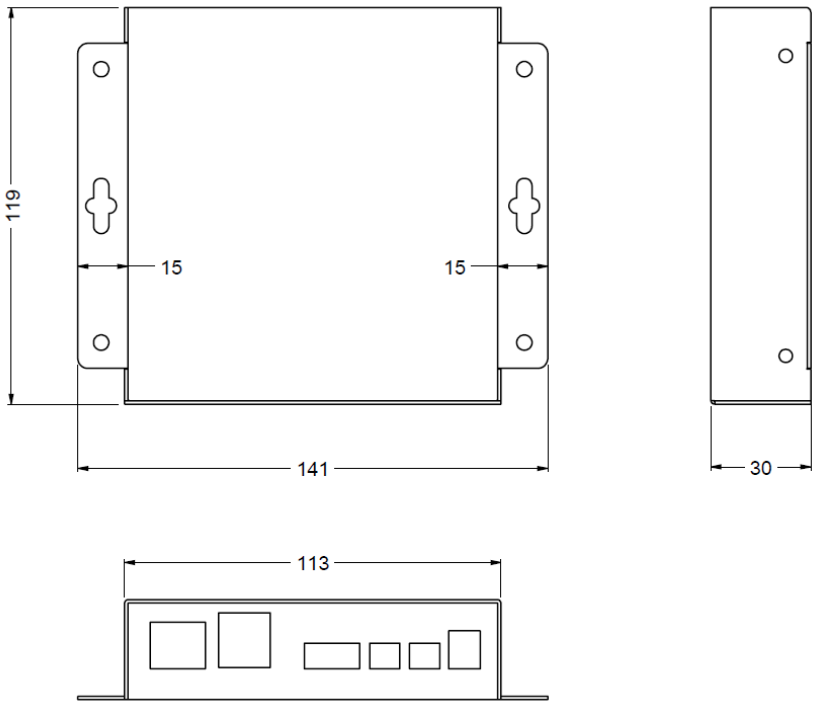


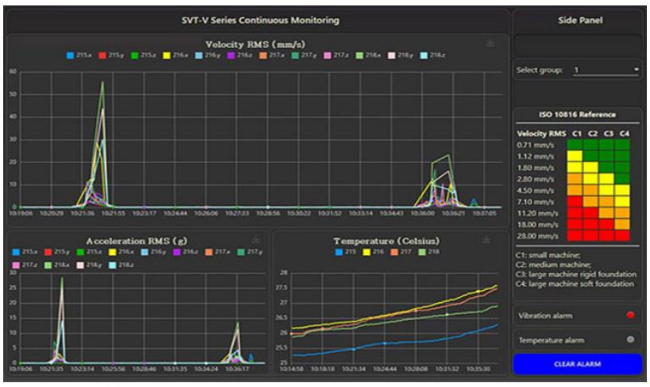
GU300S mechanical drawing

For environments with corrosive atmosphere such as coastline, the PCB and connector of the gateway can be conformally coated to protect the components.

Each gateway has a unique MAC address. The serial number of the gateway is GU200S-xxxxx, or GU300-xxxxx, or GU300S-xxxxx. The serial number is typically unique for each customer, but can be duplicated for different customers to keep the serial number small. Each gateway can also be given a unique name to identify it on the network.

Vibration analysis software

BroadVibra software is installed inside Broadsens's wireless gateway, and can be accessed with web browsers such as Chrome, Firefox or Edge from computers through network. There is no subscription fee for the software and there is life time license for the software. The software controls data collection of wireless vibration and temperature sensors, save data to the database, review the history data, export data, and send data to clouds based on user's request.



Real-time vibration monitoring ability

Advanced DAQ modes

With SVT-V series wireless vibration sensors, the BroadVibra software monitors the vibration velocity RMS, acceleration RMS and temperature in real time. The real-time vibration monitoring ability is extremely useful to detect accidents such as sudden impacts or operator errors.

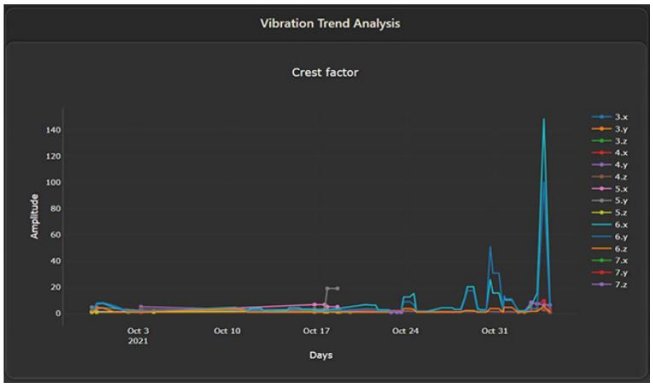
BroadVibra vibration analysis software provides multiple modes of data acquisition for SVT-A series wireless vibration sensors, including:

- real-time
- batch
- single DAQ
- multi DAQ
- single FFT
- live FFT
- trigger

Sampling rates in real-time mode range from 50Hz to 200Hz; sampling rates in batch, single DAQ, multi DAQ, FFT, live FFT and trigger mode range from 400Hz up to 25.6kHz. Real-time, batch, multi DAQ and live FFT mode provide unlimited data acquisition points. In single DAQ and single FFT mode, sampling points range from

2,048 up to 16,384. All DAQ modes support synchronization among sensors in the same group. Acceleration range is also adjustable from 2g up to 64g (depending on sensor type).

Database history data review

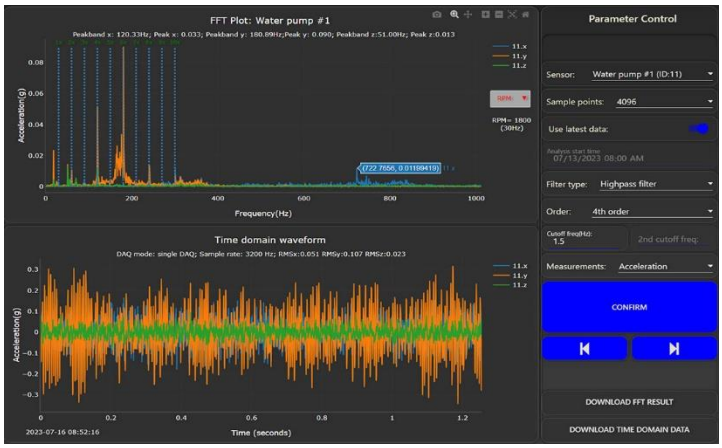


Vibration trend analysis

Integrated time-series database supports long-term vibration data review and analysis. SVT-A series sensor and SVT-V series sensor data can be reviewed and plotted easily with the software. The software supports latest data query or allows user to enter a date and time to review the data in a specific time period. The software allows flexible data points selection. Small data points query allows fast history data review, and large data points query allows user to check data in a long-time span. Data curve can be zoomed in for detailed view.

The software provides automatic vibration trend analysis. The trend analysis parameters include:

- RMS (root mean square)
- True peak (maximum absolute value)
- Peak-peak (envelope)
- Crest factor
- Kurtosis
- Skewness
- Mean
- Standard deviation



FFT analysis can be performed at each SVT-A sensor. In the figure, the top chart is the FFT waveform, and the bottom chart is the corresponding time-domain waveform. FFT result and time-domain data can be exported to CSV file. Advanced filters can be added for the time domain data and FFT analysis. User can select acceleration or velocity parameters for analysis.

For more information, please visit Broadsens's website: broadsens.com

The following features are also provided by the software:

- Advanced timers for each SVT-A sensor group
- Alarm and email notification, SMS text via emails
- Sensor configuration
- DAQ setup
- Database reset
- Internal MQTT broker
- External MQTT broker

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