Alberding

.:A08 sensor:.

A08-Bake

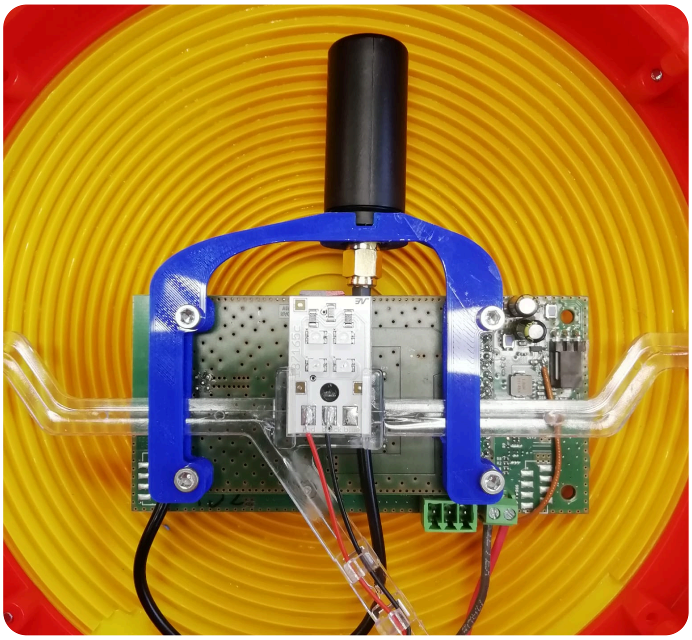
Telemetry and positioning system

Key features

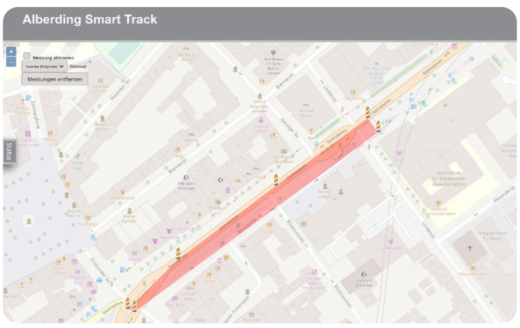
- Complete integration into the traffic bollard
- No additional power supply
- Easy commissioning
- Automated operation
- Remotely configurable measurement intervals
- Precise position determination (cm - dm)

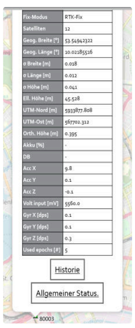
Integrated sensor hardware

- Scalable GNSS RTK module (L1, L1/L2)
- Cellular modem (4G, 2G fallback)
- Acceleration sensor
- Temperature sensor
- Processor for external sensor data acquisition
- BT/WLAN module (optional)



Sensor and Smart Track software





System description

The Alberding A08-Bake sensor is used for high-precision positioning of warning lights. For this application, the Alberding A08-IoT sensor was fully integrated into the warning lights so that the work flow of the construction site protection remains unchanged. The power supply of the A08 sensor is provided by the battery of the warning lights.

Immediately after the warning lights are put into operation, the sensor reports the setup time and its position to the IoT server. With the help of GNSS correction data, the position of the warning lights are determined in real time (RTK) or in post-processing (post-processing) with an accuracy of 5 cm - 5 dm (depending on the measurement conditions).

In addition to the position and placement, the sensor also provides information about the battery charge status, the traffic bollard inclination and the environment temperature to the server. The acquisition of additional sensor data (e.g. environment, traffic etc.) is possible via the external sensor interface of the A08.

Data acquisition and management as well as authentication and visualization of the sensors on the server is done by the Alberding Smart Track software. Via remote access, the road work security receives information on the state of charge of the batteries and on the measurement series. Forwarding of the information to other IoT platforms is supported.

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GNSS specifications

		A08-Bake (L1)	A08-Bake (L1/L2)
Tracking	GNSS signals:		
	GPS	L1C/A code and carrier	L1C/A & L2C code and carrier
	GLONASS	L1OF code and carrier	L1OF & L2OF code and carrier
	BeiDou	B1I code and carrier	B1I & B2I code and carrier
	Galileo	E1 code and carrier	E1-B/C & E5b
	Number of channels:	> 150	> 150
	Max. update rate:	RTK: 5 Hz RAW: 10 Hz	RTK: 5 Hz RAW: 10 Hz
Accuracy	Standalone:	2.5 m CEP	1.5 m CEP
	RTK[1] (horizontal):	0.025 m + 1 ppm[2] CEP	0.01 m + 1 ppm[2] CEP
	RTK[1] (vertical):	0.025 m + 1 ppm[2] CEP	0.01 m + 1 ppm[2] CEP
	RTK convergence time[1]:	~ 2-3 min	< 10 s
Time to First Fix	Cold start:	26 s	35 s
	Aided start:	2 s	2 s
	Reacquisition:	1 s	2 s

The information on GNSS positioning accuracy is taken from the module manufacturers' data sheets and applies to optimum measurement conditions.
For signal processing, standardized data formats for the global satellite navigation systems GPS and GLONASS as well as optionally Galileo and BeiDou are used.
The system complies with BSI data security and data protection standards.

GNSS positioning

The Alberding A08-Bake sensor uses GNSS satellites for precise positioning of the traffic bollard. The term GNSS (Global Navigation Satellite Systems) covers the globally available satellite navigation systems GPS (USA), GLONASS (Russia), Galileo (Europe) and BeiDou (China). Since all four systems operate on the same principle, GNSS receivers can use significantly more satellites than, for example, pure GPS receivers. In the open air, more than 20 satellites are now available around the clock for position determination.

The GNSS satellites are continuously monitored by the control centers of the respective operators. The orbits and clocks of the satellites are determined from the measurements of monitoring stations distributed around the world, and their behavior is predicted for the next few hours. The predicted values are transmitted from the control centers to the satellites via so-called uplink stations. The satellites in turn transmit this information via electromagnetic waves in the frequency range of 1 - 2 GHz.

Users gain access to this information via GNSS receivers, which can track the very weak GNSS signals using correlation techniques. The receivers perform measurements of the code and carrier waves to determine the signal propagation time. With the signal tracking, the receivers obtain information about the satellites (e.g. orbit and clock parameters) so that they can calculate three-dimensional positions of the user antenna in a global coordinate system from the satellite coordinates and the measured satellite distances.

Positioning accuracy

GNSS positioning accuracy depends on several factors, which can basically be divided into satellite-related (orbits and clocks), signal propagation time-related (correct estimation of propagation delays in the ionosphere and troposphere) and user-related effects (quality of the GNSS antenna, measurement conditions). The absolute position accuracy is about 2 - 10 m depending on the quality of the GNSS receiver and the measurement conditions.

An increase in accuracy is achieved by including correction data, whereby satellite-related and signal propagation time effects are largely eliminated by using differential methods. The achievable accuracies are 0.5 - 1 m for code measurements and a few centimeters in real time for carrier phase evaluation (e.g. RTK). The GNSS module in the Alberding A08-Bake sensor uses the carrier phases for position determination, so that in the ideal case position accuracies < 10 cm are achieved.

Since user-related effects cannot be eliminated by correction data services, the achievable position accuracy depends on the quality of the user system (GNSS chip and GNSS antenna) and the measurement conditions. In inner cities, shadowing (unfavorable satellite geometry) and multipath propagation (reflections of the signals) lead to a significant degradation of accuracy. Due to the proximity to buildings and to the road (trees, trucks), traffic bollard positioning is particularly affected by these effects.

The integration of suitable GNSS technology and an optimized measurement procedure can provide a remedy. Test measurements on a construction site in the Hanseatic city of Hamburg have shown that the A08-Bake sensor provides a position accuracy < 0.5 m (1 sigma). The goal is to achieve this accuracy up to 95% (2 sigma) under suitable measurement conditions. In heavily shadowed inner city areas, positioning with economically justifiable GNSS technology in this accuracy range is hardly possible.

The above accuracy data refers to the specifications of the GNSS receiver manufacturer.

[1]Depends on baseline length, number of satellites in view, satellite geometry, GNSS antenna, multipath, environment and atmospheric conditions
[2]ppm limited to baselines up to 30 km

Specifications subject to change without notice. © June 2023, Alberding GmbH
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