Embedded Road and Runway Sensor DRS511

Vaisala DRS511 is an embedded road and runway sensor that takes a variety of measurements and observations of the road or runway surface. It is used in a road weather station to provide accurate and reliable information on the surface state.

Features

- Amount of de-icing chemical measurement
- Identifies road condition
- Water amount measurement
- Surface temperature measurement
- Subsurface temperature measurement −6 cm (−2.36 in)
- Freezing point
- Hoar frost detection

DRS511 is embedded directly in the pavement. It gathers its readings by being installed flush with the surface. The sensor design features open-end carbon fiber electrodes and optical fiber technology. These are molded into a solid sensor block consisting of an epoxy compound with properties matching the surface for thermal conductivity and emissivity.

Surface temperature

The sensor contains 2 Pt100 elements to measure the temperature of the road or runway surface. Temperature is a key decision factor for the formation of ice and snow on the pavement, and is used before an event to determine if snow or ice will stick to the surface.

The surface temperature is also key to determining how effective winter maintenance chemicals will work at the desired temperature, as air temperature can be many degrees different and is not a good decision point for determining chemical effectiveness.

Lastly, the surface temperature, when used with dew point, can accurately indicate when hoar frost formation is possible.

Surface state

DRS511 not only provides the temperature of the pavement, but it also detects the presence of moisture on the pavement. Using these readings, the Vaisala road weather station algorithm produces the road state such as dry, wet, ice, and snow to give you an estimate of surface conditions on the roadway or runway.

When used in Vaisala Road Weather Station RWS200, DRS511 also shows the sky condition: is it raining or not, are there clouds or not.

Without the weather stations' algorithm to process the readings, DRS511 provides only the surface temperature of the road or runway.

Chemical knowledge

A characteristic that is unique to DRS511 compared to all other embedded road and runway sensors is its ability to provide a calculation of the amount of chemical on the sensor's surface. The value is provided in the form of g/m^2 and lb/mi^2, which is a very effective way to determine how chemicals will perform if additional moisture is introduced. The greater the quantity of chemical present, the better the chance of the surface remaining unfrozen with the introduction of more ice or snow.

In addition to providing the amount of chemical present, DRS511 also calculates the freezing point of the current solution as another decision point used by many winter maintenance decision makers.

Tried and true

DRS511 offers many advantages as a surface sensor system, with the biggest being its location. It is placed directly where the tires of vehicles and aircraft interact with the surface of the road or runway. This means it is directly measuring its environment, which ensures accuracy.

DRS511 is a passive sensor, which means that it does not change or alter the environment that it resides in. This type of road and runway technology has been around for decades, so when using DRS511 the risk of failure or ineffectiveness in your operations is minimal. The passive technology found in the sensor has been tested by institutions and authorities for years, so you know exactly how the sensor can aid you in your operational decision making.

Technical data

Measurement performance

Surface temperature and temperature at 6 cm (2.36 in) below the surface [1]	
Observation range	−40 … +60 °C (−40 … +140 °F)
Pt100 accuracy	±(0.1 + 0.00167 × temperature) °C
Water layer thickness [1]	
Observation range	0 … 7 mm (0 … 0.28 in)
Accuracy	0.1 mm in the range of 0 … 1.0 mm [2]
Reported surface states [1]	
Vaisala classes	Dry, Moist, Wet, Snowy, Icy, Frosty [3], Moist and chemical, Wet and chemical
EN 15518-3 classes	Dry, Moist, Wet, Streaming water, Slippery
Sky condition	No rain, Rain, Cloudy, Clear
Chemicals	
Supported de-icing chemicals	Sodium chloride (NaCl), calcium chloride ($CaCl_2$), sodium acetate ($NaOOC_2H_3$), potassium formate (KOOCH), magnesium chloride (MgCl)

1) *Temperature at −6 cm (−2.36 in), water layer thickness, and surface state are only available when DRS511 is used with a Vaisala road weather station.*
2) *Applies to an even layer of water on the sensor. The detection accuracy of the average water layer thickness on the road depends on sensor installation, pavement material, and water impurities.*
3) *Requires dew point information.*

Operating environment

Operating temperature	−40 … +60 °C (−40 … +140 °F)
EU directives	EMC Directive (2014/30/EU) [1] RoHS Directive (2011/65/EU) amended by 2015/863 [1]
EMC immunity	EN 61326-1, industrial environment [1]
EMC emissions	CISPR 22 / EN 55022, Class B [1]

1) *When connected to a Vaisala weather station.*

Mechanical specifications

Temperature sensors	2 Pt100 elements at 0 cm (0 in) and −6 cm (−2.36 in) from the surface 1/3 IEC 751 Class B
Dimensions (H × W × D) [1]	DRS511AB: 75 × 84 × 30 mm, bottom 38 mm (2.95 × 3.31 × 1.18 in, bottom 1.50 in) DRS511BB for bridge applications: 50 × 84 × 30 mm, bottom 38 mm (1.97 × 3.31 × 1.18 in, bottom 1.50 in)
Cable length options	20 m (65 ft 7 in) 30 m (98 ft 5 in) 50 m (164 ft 1 in) 100 m (328 ft 1 in) 150 m (492 ft 2 in) 200 m (656 ft 2 in) 250 m (656 ft 2 in) 300 m (984 ft 3 in)
Type V extension cable option	Maximum 1524 m (5000 ft)
Weight including 50 m (165 ft 1 in) cable	3.1 kg (6.8 lb)
Materials	
Epoxy compound	Araldite D, HY 956, lamp black for color
Cable tubing	Stainless steel AISI 316L
Cable	4 × (2 × 0.22 mm^2 / 24 AWG and shield) PUR, high density polyethylene lead isolation
Sensing electrodes	Carbon fiber in epoxy
Optical sensor	Acrylic optical fibers

1) *To make sure that the sensor remains even with the road surface, the sensor can wear up to 35 mm (1.38 in).*

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