



*Monitors visibility and obstruction
to vision caused by dust,
fog, rain, drizzle,
snow and hail*

*Designed for ease of integration;
includes digital, analogue and switching
relay outputs*

KEY FEATURES & BENEFITS

- Selectable measurement range from 10m to 99.99km
- Selectable measurement resolution of 1m or 10m (default)
- Compact forward scatter design
- Instantaneous and averaged visibility outputs
- Limited WMO 4680 present weather codes
- Hood heating for use in extreme environments
- Digital, analogue and switching relay outputs
- Comprehensive self-test and maintenance data
- 3 Years warranty

The SWS-100 is optimised for use in applications where accurate and reliable visibility measurements are required with the addition of fundamental WMO 4680 precipitation codes. The forward scatter design allows the sensor to be compact whilst the inclusion of serial, analogue and relay outputs make the sensor easy to interface to almost any system.

Visibility Measurement

The measurement of visibility by forward scatter as used by the SWS-100 is now widely accepted and seen as having significant advantages over more traditional techniques such as the use of transmissometers or backscatter sensors. Backscatter sensors share the SWS-100's advantage of being compact however the backscatter signal is strongly dependent on the type of obstruction to vision resulting in poor accuracy and limited upper range. Transmissometers were once considered the gold standard of visibility measurement due to their advantage of direct visibility measurement, however the limited measurement range, high cost of acquisition, large size and significant maintenance costs have resulted in their use being limited to a few specialist applications. The SWS-100 by contrast is compact, requires little maintenance and has a maximum visibility range of 10m to 75km, whilst its measurement performance has been proven to be comparable to that of a transmissometer. The calibration of the SWS sensor family was undertaken in accordance with the recommendations of ICAO 9328 and is traceable to a national weather service transmissometer.

Visibility measurements are reported as instantaneous and averaged forward scatter Meteorological Optical Range (MOR). Reporting of atmospheric Extinction Coefficient (EXCO) can be selected by the user if required. The default measurement range for the SWS-100 is 10m to 2km however maximum

visibility ranges up to 75km can be configured at time of manufacture. The features and accuracy of the SWS-100 in addition with its selectable 1m resolution, ensure it complies with ICAO and WMO specifications for aviation use including use in Runway Visual Range systems.

Present Weather Reporting

In some applications it is useful to know what is causing the reduction in visibility as this may fundamentally change the action to be taken by the user. For instance in a road weather information system reduced visibility due to snow would require quite a different response to that for reduced visibility due to fog. The SWS-100 therefore has the ability to identify and report the presence of drizzle, rain and snow precipitation types using WMO Table 4680 codes. Fog, haze, and unidentified precipitation codes are also reported.

Applications

The SWS-100 is a versatile sensor suited to a very wide variety of applications across the globe. It is used by national weather services, including the United Kingdom's MetOffice, as part of synoptic monitoring networks due to its wide measurement range, reliability and measurement accuracy. In aviation the ICAO 9328 compliant design and seamless integration with the ALS-2 Ambient Light Sensor allow the SWS-100 to be used for both general visibility monitoring and as part of instrumented Runway Visual Range (RVR) systems.



Increasingly legislation is allowing wind farm operators to reduce the intensity of aviation obstacle warning lights in conditions of good visibility which substantially reduces the light pollution nuisance for local communities. The SWS-100 is especially suited to this application due to its accuracy, wide measurement range and integrated relay contacts which can directly control light intensity.

In road weather applications the SWS-100 offers an affordable solution for dense networks providing not only visibility but also signalling if precipitation is the cause of reduced visibility. For remote or standalone applications where control of local signage is required the flexible SWS-100 relays can provide a perfect solution.

Interfacing, Connectivity and Cost of Ownership

The SWS sensor family is designed to be easily installed by a single person and has an interface which simplifies system integration. The ASCII text data message is transmitted at user



defined time periods or in response to a polled request using a RS232, RS422 or RS485 interface. The standard data message provides averaged and instantaneous Meteorological Optical Range (MOR) along with present weather codes according to WMO Table 4680. An optional interface to the ALS-2 Ambient Light Sensor simplifies use in aviation applications where RVR information is required. The ALS-2 Ambient Light Sensor data is appended to the standard sensor data message simplifying both installation and data processing.

To allow connection to older legacy systems the visibility measurement is available as an analogue voltage or optionally as a 4-20mA current. Three volt free contact change over relays offer user configurable outputs including visibility threshold, precipitation or snow detection and sensor failure.

To keep track of the operational status of the sensor abbreviated self-test information is included in every data message with a full self-test report available on request. Self-test features include window contamination monitoring which automatically corrects the output data and provides two stage warnings allowing maintenance to be performed most efficiently. Calibration checks and recalibration are simple and quickly accomplished in the field by a single person. The need for such procedures is limited however as the stability of the light source and receiver circuitry is such that recalibration intervals are typically measured in years.

The SWS-100 is DC powered with the capability to accept separate supplies for sensor electronics and the high power hood heaters. Hood heating is only required in regions where blowing snow is encountered and to conserve power the heaters activate at 2°C and switch off at 4°C.

Advanced Functional Test Mode

All Biral visibility and present weather sensors have the capability to temporarily output specific data via a test mode. In this mode the user can define visibility, present weather, window contamination and fault conditions for a pre-determined time period. This functionality is useful during Factory or Site Acceptance Testing (FAT or SAT), or system integration to test downstream processing of the output data.

Sensor Configuration Information

For a detailed explanation of the configuration options please refer to the table below.

SWS-100 Sensor

Housing:

- 10 – Powder paint coated aluminium (standard)
- 10A – Hard coat anodized, powder coated

Hood Heating:

- HV – With heating
- NH – Without heating

Data Output:

- J – Standard outputs
- K – 0-20 mA as well as standard output
- L – 4-20 mA as well as standard output

Self-Test and Monitoring:

- S – Standard self-test and monitoring
- A – Advanced self-test and monitoring

Cable Glands:

- PG – Standard plastic cable glands
- MG – Single metal cable glands

Ambient Light Sensor Interface (ALS-2):

- NA – Without ALS-2 Interface
- WA – With ALS-2 Interface

Configuration:

- RC – Regular configuration
- SC – Special configuration

Example: 10A.HV.J.A.PG.NA.RC (Please use this code when ordering your sensor).

Default visibility range: 10m to 2km. If a different range is required please order a 'special configuration' (SC) and state the required range on your order from the options below:

10m to 10km☐

10m to 20km☐

10m to 32km☐

10m to 50km☐

10m to 99.99km☐

Configuration Options Explained

Option	Description
Housing Options	The sensor enclosure is aluminium, it is corrosion protected using either a chemical conversion coat with a powder coat paint finish or hard coat anodizing and a powder coat paint finish. The hard coat anodized with paint finish is recommended for offshore and marine environments. Option 10: Powder coated aluminium (standard) Option 10A: Hard coat anodized, powder coated
Heating Options	Heated hoods are available to stop snow from accumulating around the optical window. The hood heating option is only required in regions where snow is experienced. Option HV: Hood heating included Option NH: No hood heating
Data Output	The sensor has RS232, RS422 and RS485 serial output capabilities as well as a 0-10V analogue output representing visibility (MOR) in the standard configuration. A current output is available as an option. Option J: Standard outputs Option K: Standard outputs plus 0-20mA Option L: Standard outputs plus 4-20mA
Self-Test & Monitoring	The sensor may be configured for either Standard or Advanced Self-Test. The standard self-test option provides monitoring of all the essential sensor functions and contamination of the transmitter window. The advanced self-test option adds receiver window contamination monitoring and receiver sensitivity monitoring. Monitoring of receiver contamination is useful in applications where different levels of contamination may occur on the sensor windows, for example where strong or gusty winds are experienced. Option S: Standard Self-Test Option A: Advanced Self-Test
Cable Glands	The sensor may be supplied with either four plastic cable glands or a single metal cable gland for user cable entry. The plastic glands accommodate cables from 3.5 to 10mm Ø. The metal gland is suitable for cables 9mm to 16mm Ø. Option PG: Four plastic cable glands Option MG: Single metal cable gland
ALS-2 Interface	The sensor may be configured to allow direct connection of the ALS-2 Ambient Light Sensor. The Ambient Light Sensor is typically used in airport applications where Runway Visual Range (RVR) must be calculated. Option NA: Without Ambient Light Sensor Interface Option WA: With Ambient Light Sensor Interface
Configuration	Reserved for customer specific configurations. Option RC: No customer specific configuration Option SC: Special customer specific configuration



SWS-100

Visibility Sensor Specifications



Visibility Measurement

Measures	Visibility (MOR)
Output	Digital, analogue and switching relays
Range (visibility) (Fixed, select at time of order)	Default 10m to 2km Selectable 10m - 10km, 10m - 20km, 10m - 32km, 10m - 50km or 10m - 99.99km
Measurement Error	≤4.2% at 600m ≤5.1% at 2km ≤6.8% at 5km ≤9.6% at 10km ≤12.3% at 15km ≤14.8% at 20km ≤17.1% at 25km ≤19.4% at 30km
Measurement resolution	1m or 10m (default)
Measurement principle	Forward scatter meter with 39° to 51° angle, centred at 45°

Outputs and Reports

Output rate (seconds)	10 to 300 (selectable)
Serial outputs	RS232, RS422 and RS485
Analogue outputs	0-10V (4-20mA or 0-20mA optional)
Switching Relays (providing flexible configurations)	Relay 1 = Fault Relay 2 = Visibility (user selectable value) Relay 3 = Precipitation yes/no or Snow yes/no or Visibility (user selectable)
Present Weather Output	Selected WMO Table 4680 codes

Power Requirements

Sensor Power	9-36Vdc (Mains power adaptor available)
Hood heating power	24Vac or dc
Basic sensor	3.5W
Window heaters	1.7W
Hood heaters	24W

Additional Features

Hood heaters	Fitted as an option to both sensor head hoods
Window contamination monitoring	Fitted as standard to the transmitter window. Optional on receiver
Window heaters	Fitted as standard to both sensor head windows

Environmental

Operating temperature	-40°C to +60°C
Operating humidity	0 – 100% RH
Protection rating	IP66/IP67

Certification & Compliance

CE Certified
EMC compliance with EN61326-1997, 1998, 2001
RoHS and WEEE compliant

Physical

Material	Aluminium. Powder paint finish, with optional hard anodize base layer.
Weight (incl. mounting kit)	4.3kg
Length	811mm
Warranty	3 years
Lifetime	>10 years

Maintenance

Self-test capability	As standard
User confidence check	6 months recommended
Window Cleaning	Automatic compensation and warnings
Field calibration	With optional calibration kit

Included with Sensor

The sensor is delivered in sturdy recyclable foam filled packaging with:
- Pole mounting kit (2 x U-bolt)
- User manual and calibration certificates

Accessories – Optional

00.SWS.CABLE-D	SWS Series Data Cable per metre
00.SWS.CABLE-P	SWS Series Power Cable per metre
SWS.CAL	SWS Series Calibration Kit
SWS.CASE	SWS Series Transit Case
SWS.SK.100	SWS Series Spares Kit
SWS.WTY100	1 Year extended warranty
PW.MAINS	Mains Power Adaptor

Specifications are subject to review and change without notice. E&OE.

