INSTALLATION AND USER INSTRUCTIONS

Ultrasonic wind sensor
WSS REC

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Contents

1. Introduction

This document provides guidelines for mounting and connecting the WSS REC static wind sensor.

The ultrasonic wind measuring system used in the WSS REC is a fast responding and accurate system designed for measurement of wind speed and wind direction. The sensor is based on three ultrasonic transducers arranged in a triangle for measuring of wind speed and wind direction. By measuring the time it takes for a set of ultrasound bursts to travel from each transducer to the other two, the wind speed and direction can be calculated.

The WSS REC has a built-in heater, which will automatically engage when risk of icing occurs during low temperatures.

1.1 Revision history

Apart from editorial changes the following changes have been made in this revision:

Date	Revision	Changes
2018-04-09	C	• Configuration and installation consideration section added • Restrictions when mounting two sensors added • Bird avoidance kit section added • Lightning zone protection box section added • Pictures updated
2011-12-20	B	First publish version

1.2 Conventions

The following conventions are used in this document:

Used in document	Description
`Monotype` font	Used when describing a path or text input in a machine human interface
	A yellow symbol that illustrates hazard type (this symbol is an example for general hazard). There are different types such as electrical, chemical and so on.
Danger!	A signal word used to indicate an imminently hazardous situation, which if not avoided, will result in death or serious injury. (ISO 3864)
Warning!	A signal word used to indicate an imminently hazardous situation, which if not avoided, could result in death or serious injury. (ISO 3864)
Caution!	A signal word used to indicate a potentially hazardous situation, which if not avoided, could result in minor or moderate injury. (ISO 3864)
	A blue symbol that illustrates a need for mandatory action. In this example read instructions. Other types of blue symbols exist and always indicate mandatory action.
	A symbol used to draw attention to extra information or an action that is not mandatory

2. Accessories and installation considerations

2.1 Bird avoidance kit

The bird avoidance kit is designed to reduce the risk of birds landing on the WSS REC and thereby interfering with measurements or even damaging the sensitive ultrasonic transducer heads. The black rubber heads are known to attract some birds' attention, due to the ultrasonic click sound they produce.

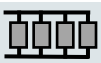
Please note that the kit does not provide complete protection against birds, but especially large birds will not be able to land, whereas small birds may still be able to squeeze in. Small birds may interrupt the wind measurement but will not be able to damage the sensor. The shape and location of the spikes is designed so the interference with wind measurements is negligible.

in special ice conditions (see section 2.3 on page 6) the bird avoidance kit may accumulate ice on the rods and prevent proper operation of the sensor. Consider the conditions in the actual area where the WSS REC is used in order to decide whether to use the bird kit or not.

2.2 Heating and supply voltage

The WSS REC sensor has an automatic heater that is used in cold weather. The heating elements heats the ultrasonic transducers and bottom plate. The heater is automatically turned ON when the temperature inside the sensor is below 15 ºC.

The heating power depends on the supply voltage (Vin). The heating elements are connected automatically in parallel or series depending on the supply voltage:

Vin	Heating power	heating elements connections
9 V DC	5.5 W	
12 V DC	10 W	
24 V DC	10 W	
30 V DC	15.5 W	

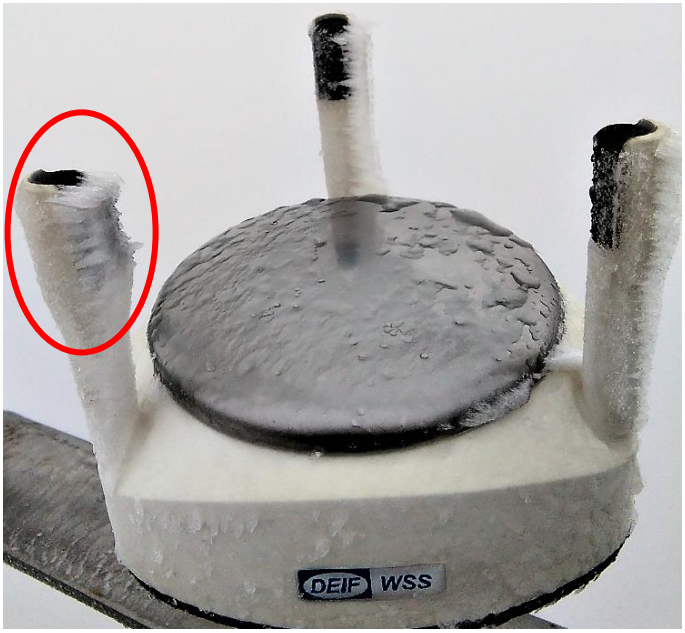
When installed in cold weather area, consider the supply voltage value, in order to achieve highest heating effect. It is not recommended to use supply voltage of 15.7 ± 0.2 V DC since the heating effect cannot be guaranteed and might therefore be too small.

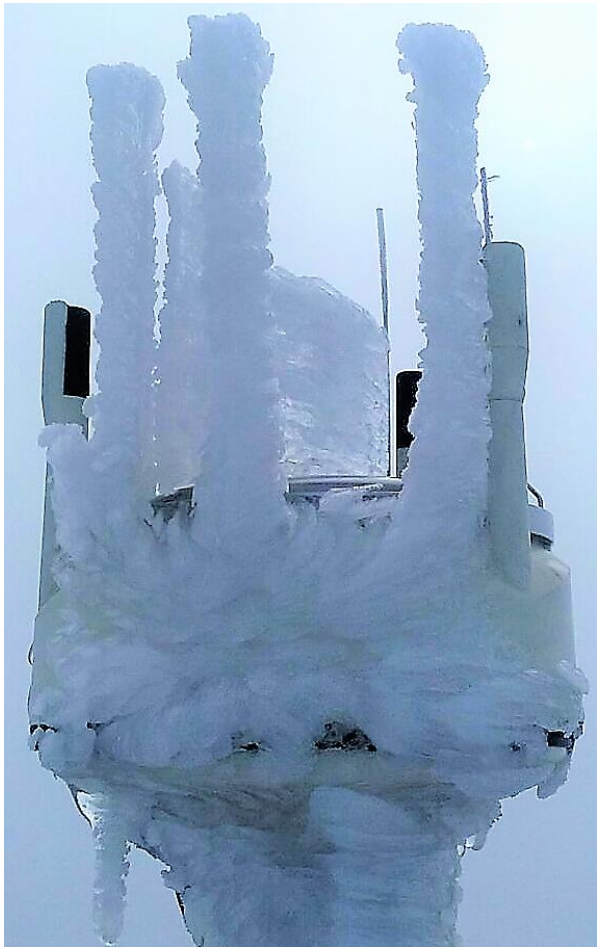
2.3 Special ice conditions considerations

In cold weather areas a special ice condition may arise if a combination of temperature around 0 ºC, medium or high wind, and snow/sleet or rain are all present at the same time. At worst cases ice might accumulate on the sensors or bird avoidance rods.

Anything that blocks a free straight passage between the three sensors will impair the function of the WSS REC. In worst case the WSS REC will not be able to measure wind at all.

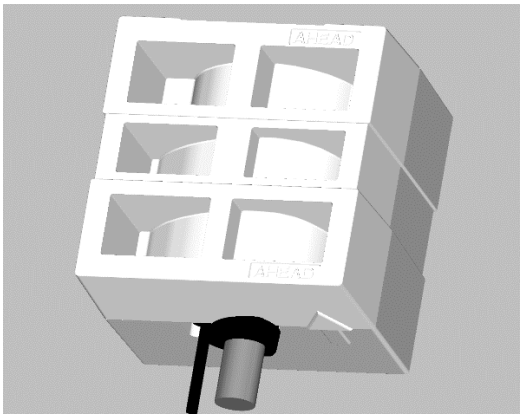
The following pictures shows a sensor when all worst-case ice conditions are met:





3. Unpacking

The WSS REC sensor is packed in a protective foamed polystyrene case inside a cardboard box. This effectively protects the delicate sensor heads.

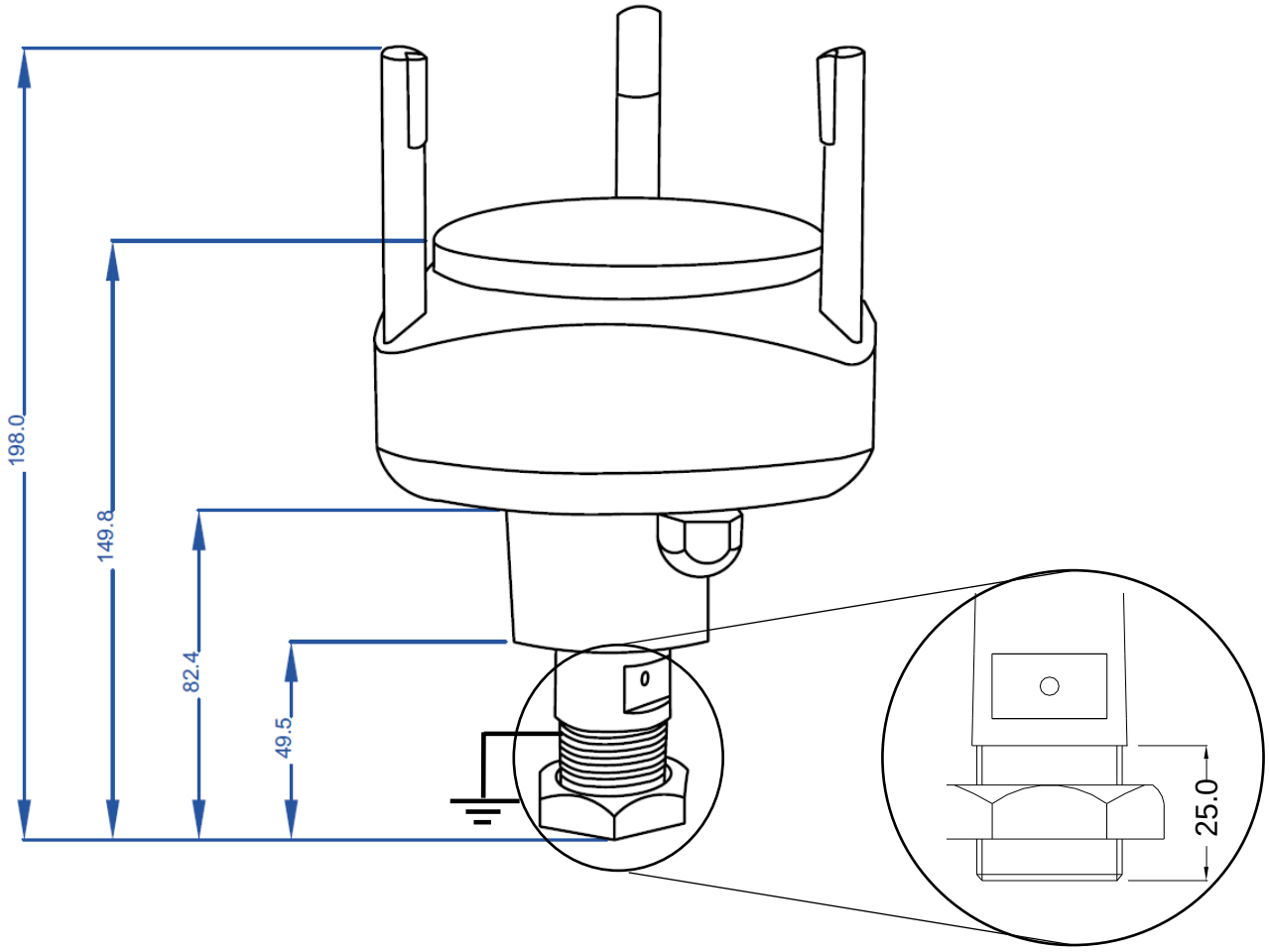


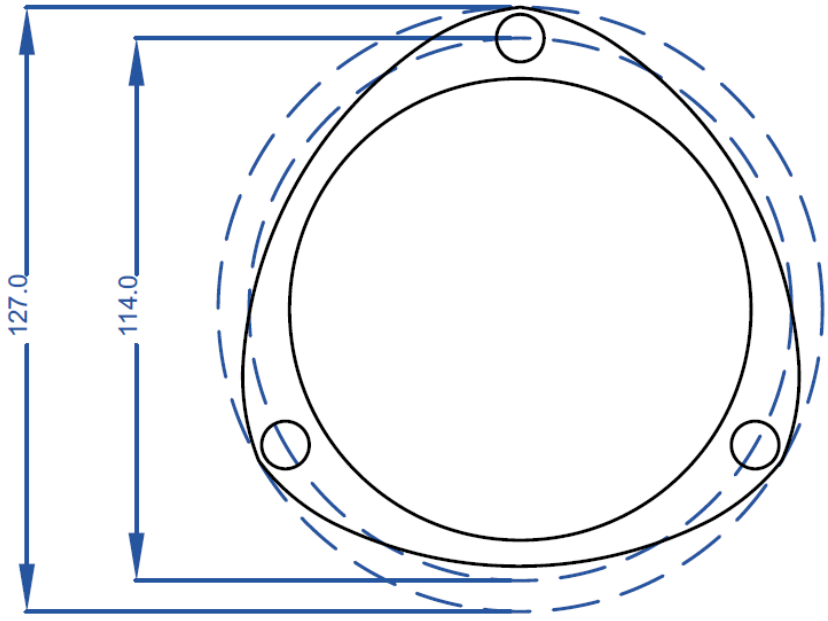
Attention

Do not remove the protective case or the tape keeping it in place, before the sensor is mounted on the weather-rack.

4. Mounting the wind sensor

4.1 Dimensions





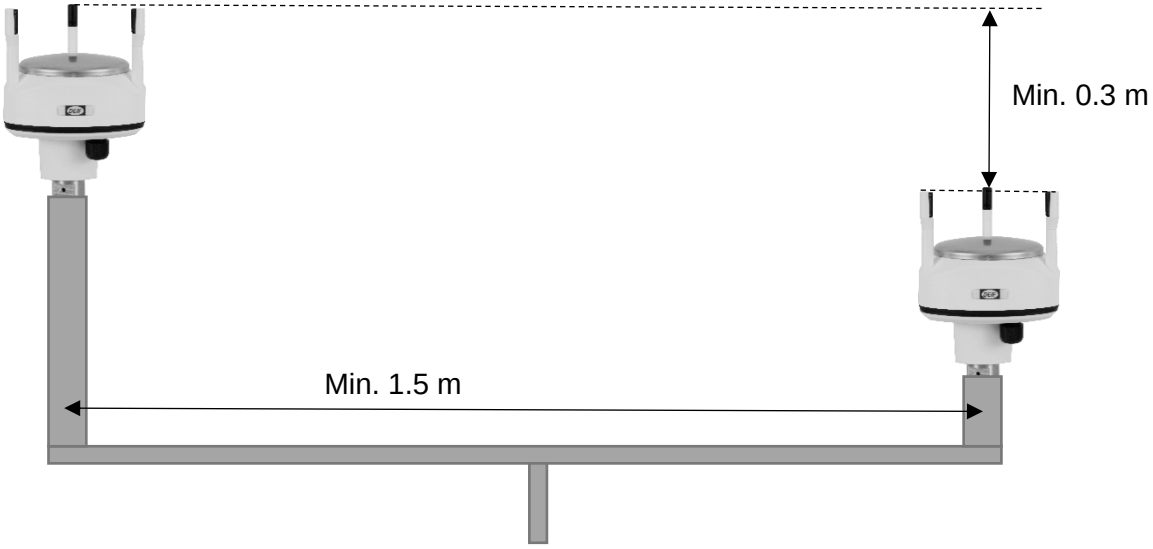
4.2 Location of the wind sensor

Ideally, the wind sensor should be located far from large objects that might influence the measuring results; however, in practice this is normally not possible on a wind turbine. The best result is achieved by placing the wind sensor at the top of a mast in the opposite end of the rotor.

Placing the sensor just above the nacelle and just behind the rotor is disadvantageous. This may result in turbulence, velocities and wind directions that are out of proportion to the actual, undisturbed wind speed and wind direction.

The wind sensor is intended for installation on a vertical socket or a tube using the stainless-steel tap mounting base. The tap must not be removed from the wind sensor, as this will damage the waterproof sealing and the warranty will become void.

If two sensors are to be mounted in the same place, there is a risk of interference. In such a case the following restrictions must be observed:



Attention
The sensor must be protected against lightning.

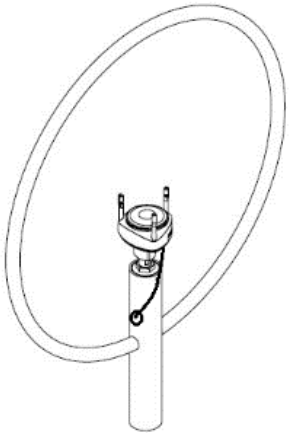
4.3 Lightning protection

Use a circular lightning protection in order to protect the wind sensor in the best possible way from lightning strokes. It is further recommended that the sensor's cable is routed inside a metal structure into the nacelle.

When using a circular lightning protection, the circle must face the rotor so that the lightning protection does not create wind interference around the sensor.

If a straight rod is used, the rod's tip must be at least one metre above the wind sensor.

The lightning protection must be properly earthed in compliance with all applicable safety regulations.



4.4 Mounting the wind sensor

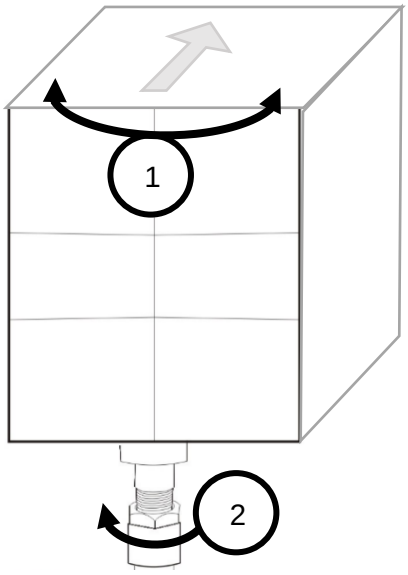
Attention

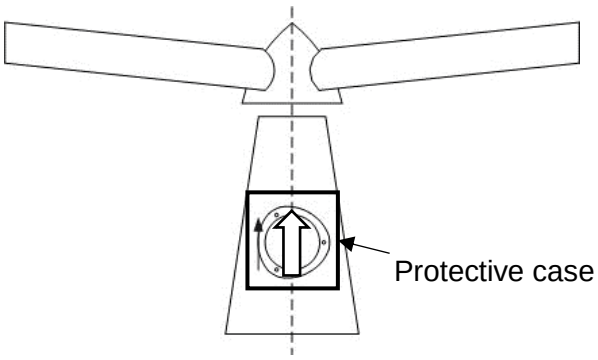
Do not expose the plastic part of the wind sensor to any torque when mounting the sensor; the tools used for fastening are only to be applied on the actual tap.

Disconnect power

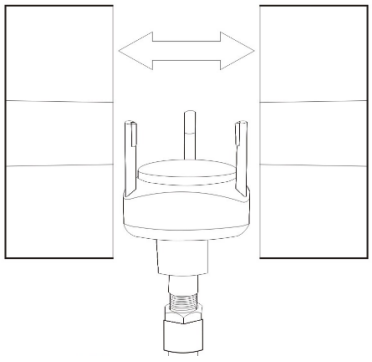
Ensure that the WSS REC sensor is not connected to power while mounting,

1. Mount the wind sensor on a ¾" pipe (1.04" outer diameter). Turn the sensor so that the arrow on top of the protective case is pointing parallel with the nacelle towards the rotor (1). Hand tighten the sensor onto the pipe (2).
   Do not remove the protective case before the sensor is hand tightened onto the pipe.





2. Cut the tape and remove the protective case



Attention:

Do not hit, squeeze or try to remove the three black rubber hoods!

3. To ensure that the measurement represents the precise wind direction relative to the turbine, the wind sensor must be aligned correctly. Align the sensor so that the arrow in the bottom of the sensor points parallel with the nacelle towards the rotor.

   Tighten the nut to lock the sensor in place.

   On land-based, non-rotating installations, the arrow must point towards North.

Info

A LASER alignment tool is available from DEIF.

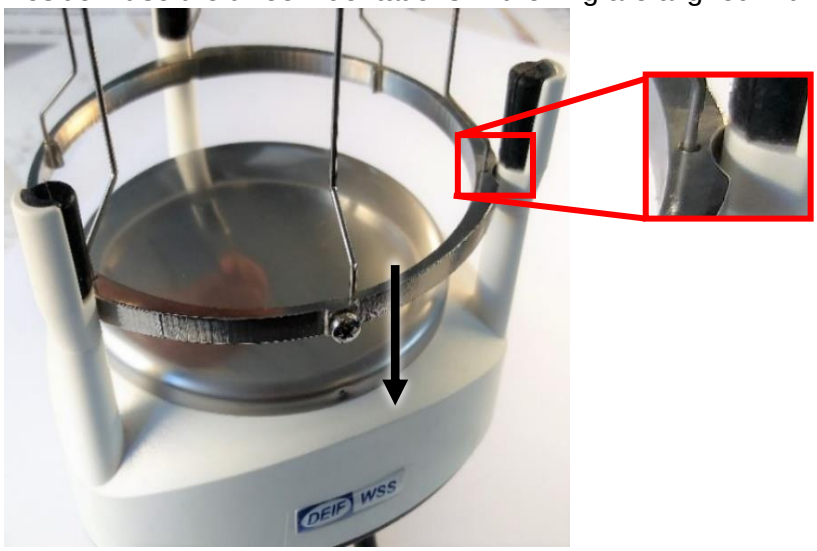
Attention

Ensure that pipe/fitting that the sensor is mounted on is properly earthed.

5. Mounting bird avoidance kit

In most cases the bird avoidance kit is mounted as standard. If, however there is a need to mount it on the sensor follow the following description:

1. Position the metal ring with spikes around the stainless steel top plate of the WSS REC sensor. Position it so the three indentations in the ring are aligned with the three sensors.



2. Secure the metal ring using the M3x6 screw provided.

3. Check that the kit is fitted tightly on the WSS REC.

6. Connections

The wind sensor is supplied with 10 metres fixed cable. The cable is connected to the sensor through a waterproof gland, and must not be replaced by another cable. If needed, the cable can be extended by using the connection box kit or the IP67 connector kit (both optional).

Suitable extension cable is available from DEIF at any length between one and 300 metres. Alternatively, an installation cable, for example UL2464 18AWG4C + AE, 4 x 0.75 mm2 screened, can be used. The maximum length is 300 m, and maximum 70 nF capacity between the signal conductors.

6.1 Wire connections

Table 1 WSS REC cable connection

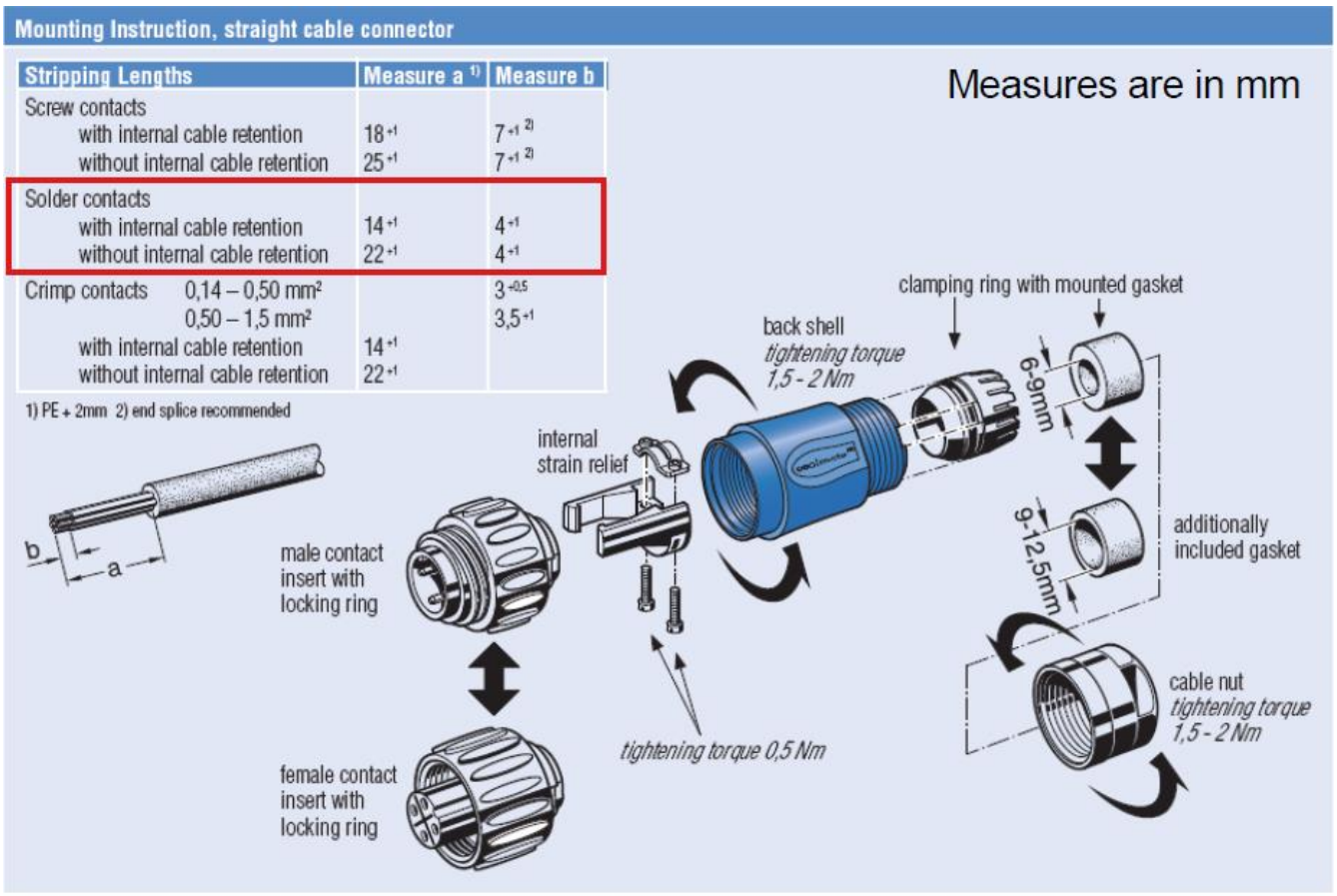
Colour	Function		Notes
Black	-	Supply voltage	9-31V DC supply for the WSS REC wind sensor
Red	+		
Orange	A	RS485 communication	Wind speed and direction data output
Brown	B		
Shield	EMC protection		Is connected to the stainless-steel tap inside the WSS REC

6.2 Connector kit assembly (optional wire extension)

The connectors must be soldered onto the cable according to the following instructions:

Table 2 Connector kit connections

WSS fixed cable Male connector	Connector pin no.	WSS extension cable Female connector	Comment
Plug male 7 pin.		Plug female 7 pin.	
Screw cap male, 10 29 92 00 02		Screw cap female, 10 29 92 00 03	
Black (-)	1	Black (-)	30V DC supply for WSS REC
Red (+)	2	Red (+)	
Orange	3	Orange	RS485 comm. from WSS REC
Brown	4	Brown	
Screen	5	Screen	Cable screen



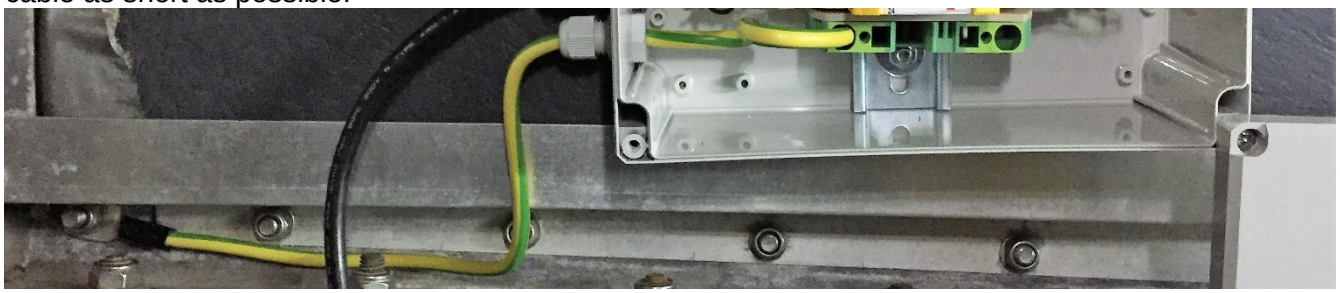
6.3 Lightning zone protection box

Typically, in a wind turbine where the WSS REC is mounted just outside the nacelle and protected by a lightning rod (LPZ0B) and connected to a cabinet inside the nacelle (LPZ1), a surge arrest box is mounted inside the nacelle where the cable comes in.

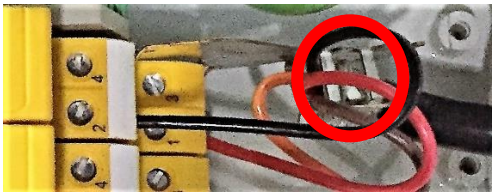
To mount the zone protection box:

1. Mount the lightning protection box in the closest possible place to where the cable is routed into the nacelle.

2. Strip off the isolation of the Earth cable (minimum 10^{mm2}, not supplied with the protection box) approximately 15 mm in one end. Pull it through the suitable cable gland in the lightning box and fasten it in the Earth terminal. Connect the other end to the metal structure of the turbine. Keep the cable as short as possible.



3. Cut the WSS sensor cable and strip off about 5 cm. Fold the screen backwards leave approximately 2 cm of screen and cut the access screen. Insert the cable end into the earthing spring. If necessary secure the cable in the spring with zip ties.



4. Connect the wires from both sides. It is recommended to use ferrules.

1F5/1: Orange	1F5/1: Orange
1F5/2: Brown	1F5/2: Brown
1F1/1: Red	1F1/1: Red
1F1/2: Black	1F1/2: Black

5. Close the box.

7. Glossary

7.1 Terms and abbreviations

WSS REC	Wind Sensor Static Renewable Energy Controls

7.2 Units

Unit	Unit Name	Quantity name	US unit	US name	Conversion	Alternative units
A	ampere	Current				
ºC	degrees Celsius	Temperature	ºF	Fahrenheit	$T[ºC] = \frac{(T[ºF] - 32º) \times 5}{9}$	
g	gram	Weight	oz	ounce	1 g = 0.03527 oz	
Hz	hertz	Frequency (cycles per second)				
kg	kilogram	Weight	lb	pound	1 kg = 2.205 lb	
m	metre	length	ft	foot (or feet)	1 m = 3.28 ft	
mA	milliampere	Current				
mm	millimetre	Length	in	inch	1 mm = 0.0394 in	
ms	millisecond	Time				
Nm	Newton metre	Torque	Lb-in	pound-force inch	1 Nm = 8.85 lb-in	
s	second	Time				
V	volt	Voltage				
V AC	volt (alternating current)	Voltage (alternating current)				
V DC	volt (direct current)	Voltage (direct current)				
W	watt	Power				
Ω	ohm	Resistance				