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USER'S MANUAL AND INSTALLATION NOTE

WSS 700 SERIES
Wind Sensor Static

- Mounting
- Connecting
- Replace an old sensor
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1. Introduction

1.1 About the products

This document provides guidelines for mounting and connecting the WSS 700 series of high performance static wind sensors. The WSS 700 or WSS 750 can be directly connected to the DEIF WSDI-2 wind display to form a complete wind system.
WSS 700 wind sensor series can also be used as wind sensor for previous DEIF wind displays like WSDI and 879, but in that case it must be connected via the WSI interface box. The sensor may also be used as a component in a larger system; in that case the system must have a free RS485 or RS422 input with NMEA0183 capability.

The ultrasonic wind measuring system used in the WSS 700 series is fast responding, has high precision and a robust design for measuring the relative wind speed and wind direction on-board ships. The sensor is using three ultrasonic transducers arranged in a triangle transmitting ultrasonic burst of data from each sensor to the two other sensors in the triangle, and by measuring the time difference caused by the wind passing the sensor, it is able to precisely calculate the wind speed and wind direction. The physical size and the high transmitting power of the WSS 700 series makes them able to measure very precisely in almost any weather conditions.

The wind sensor is available in two different versions:
- The WSS 750 with high power heating built inside each sensor head, which will automatically be activated when risk of icing occurs during low temperatures (typically below 4°C).
- The WSS 700 without heating, is intended for applications in geographic areas where the risk of icing is very low.

ⓘ **Please be aware that the term WSS 7xx represents both WSS 700 and WSS 750.**

2. Unpacking instruction

2.1 How to unpack the product

When unpacking the wind sensor, remove the transportation support foam that carries the cable and protects the sensor body.

To avoid bending or twisting the three sensor arms, do not remove the protection cap, until you have installed the WSS 7xx in the mast.
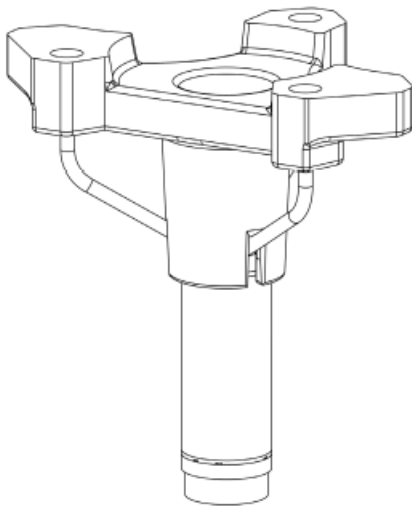
Fig. 1: WSS 7xx sensor with protection cap still mounted.

⚠ **Do not remove the protection cap before the sensor is mounted in the mast!**
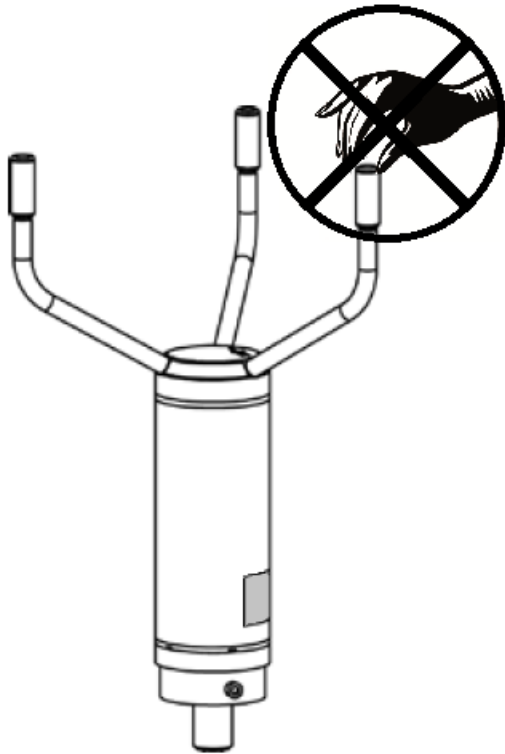
Fig. 2: WSS 7xx sensor heads are sensitive ceramic elements

> **CAUTION: When handlling WSS 7xx, do not rotate, pull, strike, bend, scrape or touch the sensor heads!**

The sensor is protected against ESD (static electricity), but it is recommended to avoid static discharge through the connection wires during installation.

2.2 Legal information and responsibility

DEIF takes no responsibility for installation or operation of the wind measuring system. If there is any doubt about how to install or operate the WSS 7xx, the company responsible for the installation or the operation of the product must be contacted.

> **Neither WSS 700 nor WSS 750 wind sensors must for any reason be opened! If opened despite this warning, the warranty will be lost.**

3. Mounting the wind sensor

3.1 Placing of the wind sensor

The wind sensor should be placed far from large objects that might influence the measuring results; however, in practice this is not always possible on-board a ship. The best result is achieved by placing the wind sensor at the top of a mast away from any large superstructure and especially the funnel.

(i) **Keep away from the funnel.**

Placing the sensor just above the superstructure is disadvantageous, especially where the superstructure consists of wide side faces, over which the wind is forced. This may result in turbulence, velocities and wind directions that are out of proportion to the actual, undisturbed wind speed and wind direction.

In situations where it is not possible to mount the wind sensor away from disturbing substructures, we have provided solutions where two wind sensors are installed with a switch to be able to use the best sensor in the given situation, e.g. mounted on each side of the vessel free of turbulence when wind is coming from the side free from obstacles.

The wind sensor is intended for installation on a vertical mast or a horizontal beam using the universal mounting bracket supplied as standard. See the drawing in chapter "Dimensions" for dimensions.

⚠ **Do not expose the cable connector to excessive torque when mounting the sensor. The connector tightening tools supplied should be used according to the included instruction.**
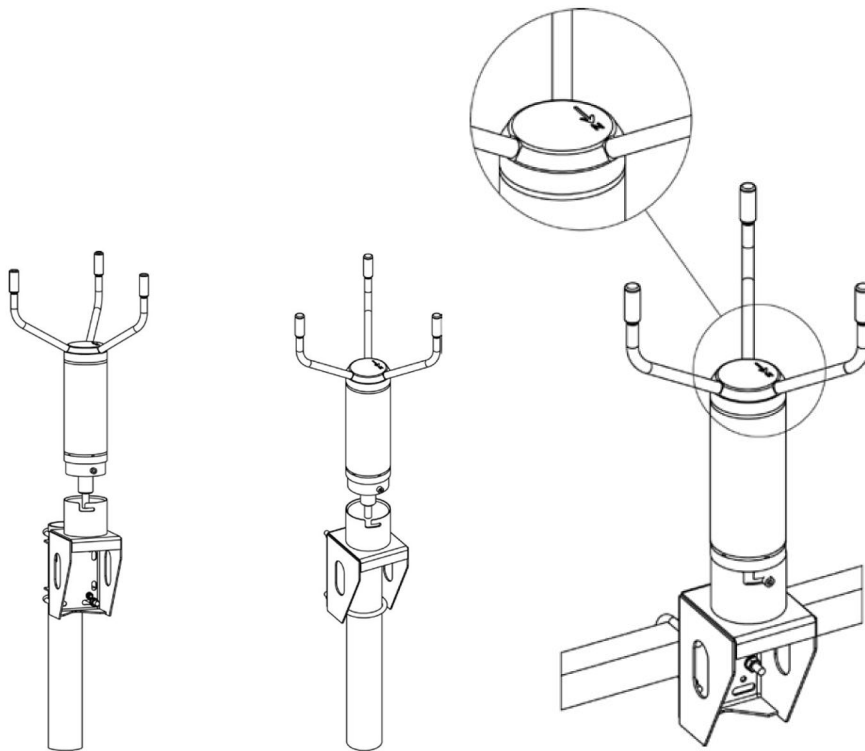
Fig. 3: Mounting on a vertical mast or horizontal beam.

The universal mounting bracket may also be mounted directly on a flat surface.

It is recommended to mount the 2 meter cable on the WSS 7xx prior to installing it on the universal mounting bracket.

When mounting the 2 meter cable with the preinstalled connector on the WSS 7xx, please use the special connector tightening tool, following the separate instruction included with this tool.

Fig. 4: Mount the "tightening tool" on the connector as shown above. See also separate instruction provided with the connector tightening tool.

ⓘ **Do not remove the tightening tool, it may be left on the connector also after the WSS 7xx is mounted on the mast.**
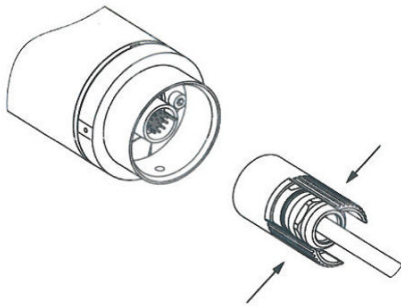
Fig. 5: Mount the cable connector on the WSS 7xx.

Push the cable connector totally in place and tighten the connector using the special tightening tool. Push and tighten again until you are sure that the connector is **fully** in place and waterproof. However, do not use excessive force.

> **IMPORTANT: If you don't tighten firmly, water may penetrate the connector and warranty may be lost.**

You may add a little grease (not included) on the treads of the WSS 7xx connector before mounting the cable connector. This makes it easier to tighten the ribbed part of the cable connector and also easier to disassemble it later - if needed.

Fig. 6: Please use the cable tightening tool and no other type of tool.

⚠ **Do not turn or twist the cable connector with a wrench!**
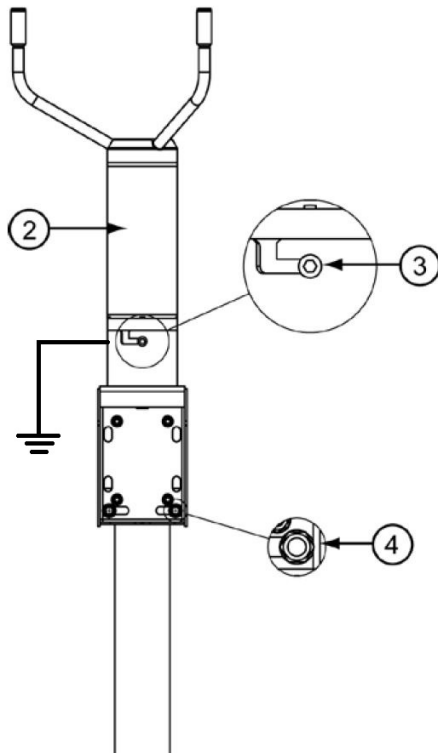
Fig. 7: Mount the mast bracket on top of the mast. Mount the supplied screw in the lower part of the sensor (2) and place it in the mast bracket, turn it slightly until the mounting screw is in the end position (3), tighten the screw to lock the sensor in place. Mount the 2nd screw in the mounti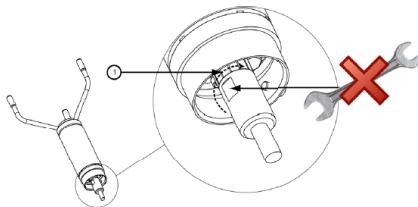ng bracket opposite to the first screw (3) and tighten it firmly to secure the sensor. Make sure that the senor is correctly aligned.

⚠ **IMPORTANT! The stainless steel housing of the mounting bracket must be connected to earth (eg. the steel hull).**

3.2 Grounding and shield termination

Grounding of the sensor in the mast top is important for EMC protection and reliable operation.
The WSS 700/750 sensor shall be grounded either by making sure that the mast mount bracket has a good connection to ground via the steel mast or alternatively, mount a ground wire on one of the screws on the sensor. This should be the only ground termination for the sensor and its shielded cable.
It is important to firmly connect the cable shields in the sensor cable to the shield of the extension cable inside the installation box.
However, do not connect the shield of the extension cable going to the WSDI-2 wind indicator (or going to other systems inside the ship) to anything!

3.3 Lightning protection

In order to protect the wind sensor and the personnel in the best possible way from lightning strokes, use a lightning rod installed with the tip at least one metre above the wind sensor. The lightning rod must be properly grounded in compliance with all applicable safety regulations. The wind sensor cable screen and the extension cable screen must be connected.
For further protection of the cable between the wind sensor and the connection box, as well as the installation cable between the connection box and the interface box, it is recommended to use a metal conduit pipe. If the wind indicator (e.g. WSDI-2) is installed in a metal panel, this panel has to be carefully connected to a good earth terminal.

3.4 Alignment of the wind sensor
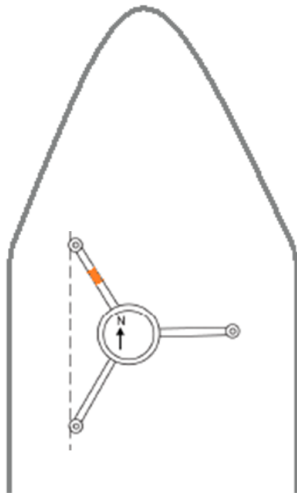
Fig. 8: Alignment of the WSS 7xx

To ensure that the display presents the precise wind direction relative to the ship, it is very important that the wind sensor is aligned correctly.The arrow on the top of the sensor body and the sensor arm with the orange marking, must point ahead, towards the bow of the ship, and the two arms on portside must be parallel with the centre axis of the ship.

4. Power supply

4.1 Power supply

WSS 700 or WSS 750 system requires a 24-30 V DC power supply.
It is recommended to use a separate galvanic isolated power supply to supply power to the wind measuring system, and the positive and negative power supply connections must not be connected to ground (earth).
For WSS 700, a 24-30 V DC/0.5 A power supply is sufficient.
For WSS 750, a 24-30 V DC/2.0 A power supply is recommended.

5. Cable connections

5.1 Cable types

The wind sensor is supplied with a 2 m cable. The cable can be extended using the standard WSS extension cable (30 m, 40 m, 50 m or 100 m), and the IP66 connection box kit. These parts are normally ordered as accessories, but it is included in some of the DEIF anemometer system packages.

For WSS 700, any length of WSS extension cable can be used.

For WSS 750 (heated, 35 W), the standard WSS extension cable (4 x 0.75 mm2 with shield) can be used up to 50 m.

Above 50 m, the following can be considered:
- Increase supply voltage to 28-30 V DC, this will work fine up to 100 m.
- Alternatively, increase the cable gauge for the power supply of the sensor/heating to at least 1.5 mm2. This will work up to 100 m.

If a longer cable is required, the cable gauge should be increased proportionally e.g. at least a 3 mm^2 cable for 200 m cable length.

The maximum recommended cable length for data transfer is 300 m, and maximum 70 nF capacity between the signal conductors.

An alternative installation cable could be UL2464 18AWG4C + AE, 4 x 0.75 mm^2 screened or UL2464 18AWG4C + AE, 4 x 1.5.

6. The WSS 7xx wind sensor cable connections

6.1 WSS cable connections

Function	WSS 700/750 Pin	WSS 750 cable # 228260 wire colour	WSS extension cable Wire colours	WSDI-2 display Terminal no.
+24 V DC operation	1	White	Red	2
+24 V DC heating	5 6	Grey, Green, Pink (3 wires parallel connected)		
0 V operation	11	Grey/Pink	Black	1
0 V heating	7 8	Blue, Black, Red, Yellow (4 wires parallel connected)		
RS485 A (COM2)	14	Red/Blue	Orange	7
RS485 B (COM2)	3	Brown	Brown	9
COM ground	10	Violet	Not connected	Not connected
Cable shield	shield	shield	shield	Not connected

⚠ **No supply voltage must be present during installation of the wind sensor, as this may damage the sensor circuits.**

Connection of other equipment

One standard NMEA0183 input for a VDR or integrated navigation system can be connected to terminal A and B. It is recommended to use a NMEA-buffer or NCI-1 if more than one NMEA input has to be connected. (See also "WSDI-2, user's manual and installation note 4189350032 UK" on www.deif.com).
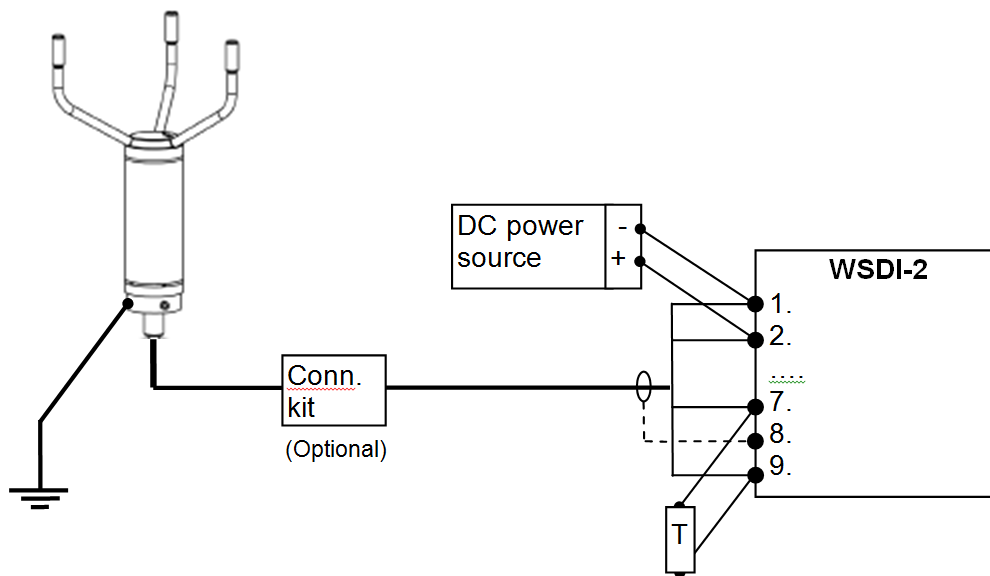
7. Connecting WSS 7xx to a WSDI-2 display

7.1 Connecting

WSS 700/750

WSDI-2

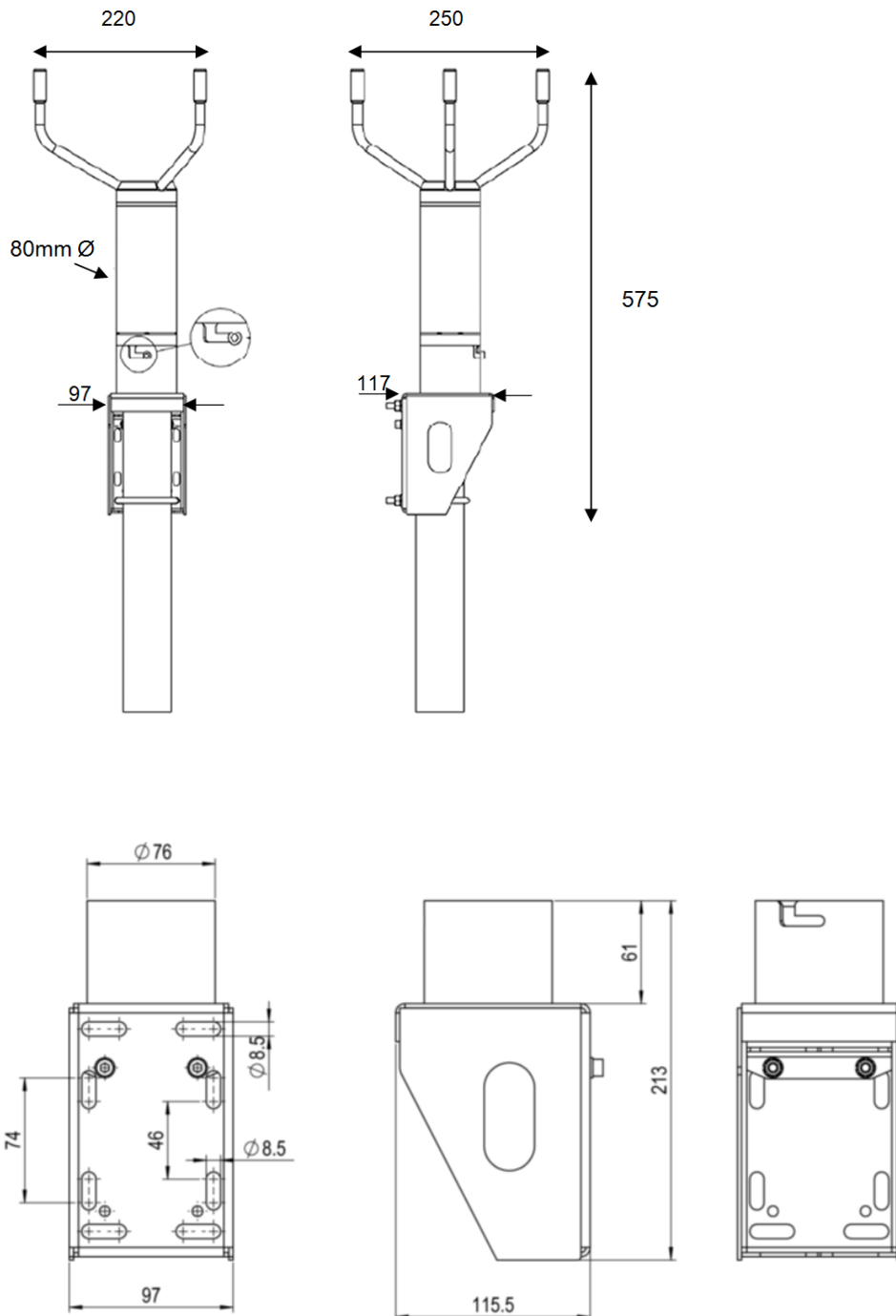The data bus must be terminated with the resistor (T) supplied with the WSDI-2.

Fig. 9: WSS 7xx and WSDI-2 system connection

(i) **WSDI-2 terminal 8 must not be connected in normal installations; only if recommended by DEIF support.**

8. Dimensions

8.1 Unit dimensions

9. Troubleshooting a WSS 700/750 and WSDI-2 installation

9.1 Troubleshooting

No.	Fault symptom on WSDI-2	Cause/solution
1	No light in LEDs, back-light or display	Aux. voltage is not available (18-31 V DC) or WSDI-2 is damaged.
2	Orange error LED is flashing	WSDI-2 is defective, contact DEIF or a sales/service representative.
3	Wind speed is "----" and direction is not changing	Cause: there is no valid wind data via RS485 from the wind sensor. Check if the RS485 port on WSDI-2 is terminated. See WSDI-2 manual: Check that "input select" is correct (0183 or r.183) Use the WSDI-2 "Error functions", to find the type of error: ● Communication error (noise or bad connection) ● Error message from WSS sensor received (sensor may be damaged or defective) ● LED indication for received and transmitted RS485 data If there is no data communication: ● Check voltage from WSDI-2 term 7-8 and 9-8, they must both be 2-3 V DC. If not, the com port may be damaged in WSS or WSDI-2 (lightning stroke - insufficient lightning protection) or ● Check cable connection (broken or short-circuit)
4	Wind speed and direction is periodically dropping out	● Bad connection ● WSS 700/750 sensor house is not grounded correctly ● Heavy electrical noise or insulation error in the ship's electrical system (AC or DC) ● WSS 700/750 is not able to calculate valid data - snow, ice, extreme rain or damaged sensor head (lightning)
5	Wind speed and direction is dropping out or instable when outdoor temperature is dropping below 5°C	● The sensor is a WSS 700 without heating - ice? ● WSS 750 aux. power supply is not able to supply current enough to drive the heater. (24 V DC power supply > 2 A is recommended) or extension cable is too thin.
6	Wind speed is "----" and direction is not changing when an additional device (VDR or Nav system) is connected in parallel on the RS485 port (A and B)	The added device is most likely overloading the RS485 bus (only one extra NMEA input is allowed).Termination on the RS485 bus is missing. The connection to the added device is damaged or short-circuited. Cable screen is wrongly connected making a noise loop. Solution: use a NCI-1 NMEA converter (out) or a NMEA buffer to solve the problem.
7	Wind direction is wrong	Check that the sensor is aligned correctly. The arrow in the bottom must point ahead and be parallel with the ship's centre line (see chapter "Mounting the wind sensor").

10. Replace WSS or WSS-L with WSS 700 or 750

10.1 How to replace

The WSS or WSS-L wind sensor can directly be replaced by either a WSS 700 or WSS 750 high perform-ance sensor, without major changes to the installation, and the existing extension cable and installation box can normally be used.

In a WSDI-2 wind indicator system:
● Make sure that the cable length and dimension are in line with the guidelines in chapter "Cable connec-tions".
● For WSS 750 (heated), make sure that the power supply is able to source at least 24 V DC 2 A continu-ously.

See chapters "The WSS 7xx wind sensor cable connections" and "Connecting a WSS 7xx series to a WSDI-2 display" for connection details.

In a WSS/WSS-L upgraded WSDI/879 indicator system:
● Make sure that the cable length and dimension are in line with the guidelines in chapter "Cable connec-tions".
● For WSS 750 (heated), make sure that the power supply is able to source at least 24 V DC 2 A continu-ously.
● For WSS 750 (heated), the WSI interface box must be rewired so that the power supply for the sensor is directly connected to the 24 V DC source. (The 30 V DC supply in WSI is limited to max. 20 W, where WSS 750 requires up to 35 W)

See chapter "Replacement of an old wind sensor type 879.3c by the new WSS 7xx" for detailed connection information to respectively WSS 700 and WSS 750.

11. Replacement of an old wind sensor type 879.3c by the new WSS 7xx

11.1 How to replace

WSS 700 or 750   WSI   879.50/879.521 or WSDI
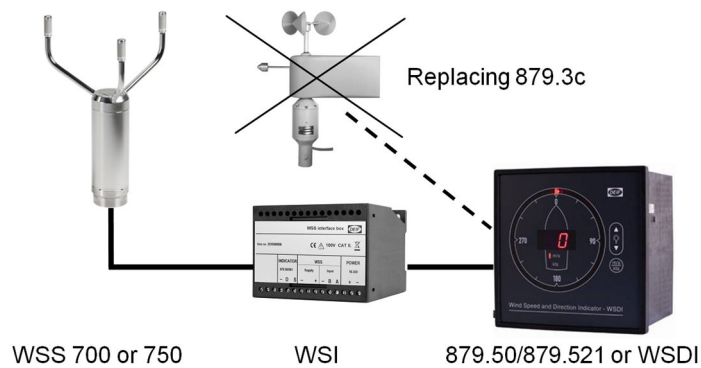
An older wind indicator system with a display type: 879.50/879.521 or WSDI (WSDI-1) can be upgraded with either a WSS 700 or WSS 750 sensor. It requires, however, one of the available upgrade kits to replace an old 879.3c dynamic wind sensor.

The kit includes the WSS 700 or WSS 750 wind sensor and the interface box type WSI. The WSI interface translates the incoming RS485 data signal from the new sensor into two separate TTL signals for respectively speed and direction, used by the 879.50/879.521 or WSDI display.

Follow the installation instructions in the beginning of this manual to mount and align the new sensor correctly.

To use the existing mast cable, please check:
● Make sure that the cable length and dimension is in line with the guidelines in chapter "Cable connections".
● For WSS 750 (heated), make sure that a power source able to source 24 V DC 2 A continuously is available.
● For WSS 700, a 24 V DC 0.5 A power source is recommended.
Before mounting the new sensor using the existing cable, remember to disconnect the cable from the 879 or WSDI wind display and check that the cable is not damaged.

The 2 m cable from the WSS 700 or WSS 750 is connected to the existing cable using a connection box. The existing box may also be reused. The WSI interface box must be mounted indoor. It is often practical to mount it close to the display, but it is not required.

11.1.1 WSS 700 wind sensor connection to WSI interface box

Wind sensor WSS 700 Wire colour	Extension cable Wire colour	Interface box WSI Terminal no.	Comments
		1 – Power	Connect to 24-30 V DC 0.5 A power supply, (WSS 700 only)
		2 + Power	
Red/blue (A)	Orange	4 Input A	RS485 comm.from WSS
Brown (B)	Brown	5 Input B	
Violet	Not available	6 Not connected	RS485 common
White	Red	7 + 30 V supply out-put	30 V DC output, power supply for WSS 700. (Max. 20 W can't supply enough power for WSS 750)
Grey/Pink	Black	9 – 0 V supply output	
Screen	Screen	Not connected	Cable screen is connected to earth when the sensor house is connected to GND (earth).

### 11.1.2 WSS 750 wind sensor connection to WSI interface box

Wind sensor WSS 750 Wire colour	Extension cable Wire colour	Interface box WSI Terminal no.	Comments
Grey/Pink and [Blue, Black, Red, Yellow]	Black	1 – Power	Connect to 24-30 V DC 2 A power supply continuously. (WSS 750 only)
White and [Grey, Green, Pink]	Red	2 + Power	
Red/blue (A)	Orange	4 Input A	RS485 comm. from WSS
Brown (B)	Brown	5 Input B	
Violet	Not available	6 Not connected	RS485 common
Screen	Screen	Not connected	Cable screen is connected to earth when the sensor house is connected to GND (earth).

11.1.3 WSI interface box connection to WSDI (WSDI-1) or 879 display

| Interface box WSI Terminal no.	Display WSDI Terminal no.	Comments
12 - (0 V)	2 0 V	Data 0 VWind direction (D) and wind speed (S)
11 D	4 Direction	
10 S	3 Speed	
	5 Screen	Screen cable between WSI and display, only connected in one end.
	AC	Aux. supply 110 V AC or 220 V AC
	AC	
	GND/Earth	Ground
	1 + 5 V	+5 V DC for external mode shift/dimmer
	A Signal	NMEA0183 output
	B Return	
	Screen	
	9	External mode shift/dimmer, see "879 installation instructions ext. dimmer 4189340009 UK" on www.deif.com.
	10	
	11	

11.1.4 Grounding the wind sensor

Please read the instruction in chapter "Mounting the wind sensor" regarding grounding and lightning protection.
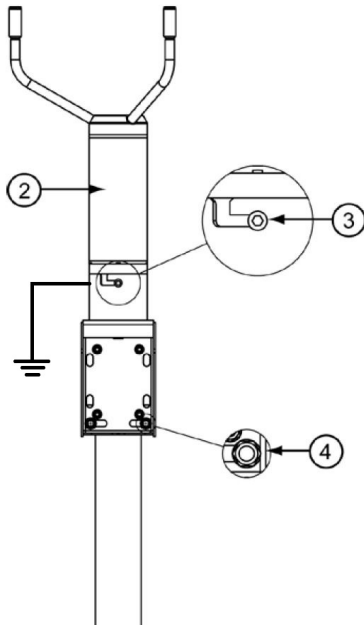
⚠ **IMPORTANT! The sensor's stainless steel house or mounting bracket must be connected to earth (eg. the steel hull).**

11.1.5 WSI interface box dimension

WSI interface box dimension
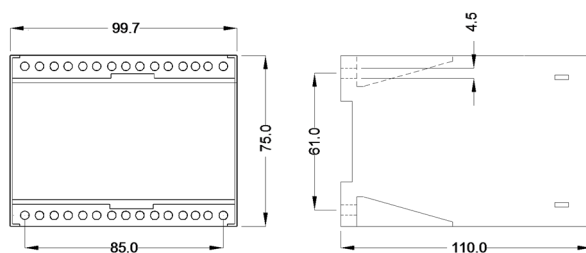
Before the replacement is carried out, it is recommended to carefully read the User's manual and installation note (this document).

11.2 Faults, causes and solutions

No.	Fault symptom on WSDI	Cause/solution
1	No light in LEDs, display	Internal fuse may be blown (see WSDI manual for details)
2	Flashing display	Aux. voltage is too low, 24 V power supply may not be able to supply enough current to drive WSI and WSS 7xx.
3	Direction LED jumps 0 to ~240 deg. and wind speed is 0	Aux. voltage is too low, (see point 2 above)
4	2 or 3 happens only when outdoor temperature is below 5°C	The aux. supply is not able to supply current enough to drive WSS 750 heating. (24 V DC power supply >2 A is recommended)
5	Direction LED jump 0-90-180-270-0 deg. and wind speed is 0	The connection from WSI to WSDI is most likely OK.Cause: WSI is not receiving data from WSS 7x0. Check aux. supply between WSI term 1(-) and 2(+): 18-31 V DC. Check voltage between WSI terminal 4(A) and 6(-) respective 5(B) and 6(-), both 2-3 V DC (may fluctuate due to data packages). If voltages are not right – possible cause: ● Bad cable connection from WSS 7x0 to WSI (disconnect or short-circuit) ● RS485 com port is damaged in WSS 7x0 or in WSI (close hit of lightning – insufficient lightning protection?) If voltages are OK – possible cause: ● Bad connection ● WSS 7xx not grounded correct on stainless house or mounting bracket ● Heavy electrical noise or insulation error in the ship's electrical system (AC or DC) ● WSS 7xx is not able to calculate valid data - snow, extreme rain or defective sensor head (lightning) ● A sensor head on WSS 7x0 is damaged.
6	Wind direction is wrong	Check that the sensor is aligned correctly. The arrow in the bottom must point ahead and be parallel with the ship's centre line (see chapter "Mounting the wind sensor").
7	No data on the NMEA output	There must be correct wind data on the WSDI display. ● NMEA data may be in the wrong NMEA format (see WSDI manual for more details). ● Terminal A and B may be wrongly connected to the external system's NMEA input. Try interchanging wire A and B.

12. References and disclaimer

12.1 References to other documents

- "WSS 700 series data sheet 4921250070 UK"
- "WSDI-2, user's manual and installation note 4189350032 UK"
- "Wind measuring systems, application notes 4189350050 UK"

Documents are available on www.deif.com.

12.1.1 Disclaimer

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