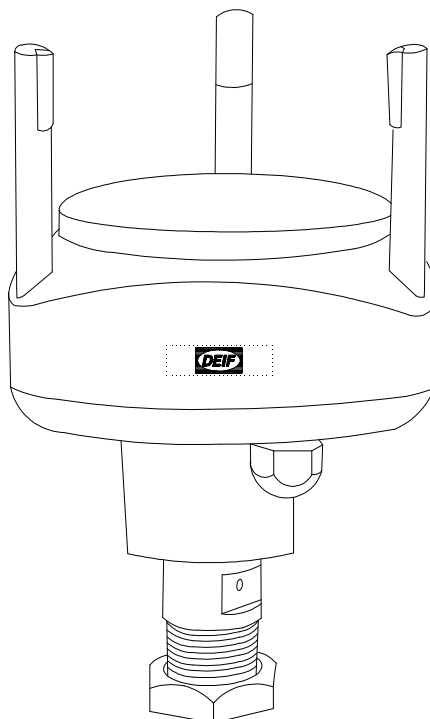


User's Manual



Ultrasonic wind measuring system WSI, WSDI, WSS or WSS-L

4189350034A



- *Sea-waterproof construction*
- *Accurate read-out of wind direction and wind speed*
- *NMEA data output*
- *1-3 displays per sensor*
- *Based on ultrasonic principle - no moving parts*
- *WSS version has a built-in, automatically activated heating element to prevent ice*



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1. General information

IMPORTANT: In this document, the term WSS will represent both WSS and WSS-L if no specific mentioning of the WSS-L is made.

Application

The wind measuring system WSS is a fast responding and accurate system designed for measurement of wind speed and wind direction on-board ships. The wind measuring system WSS is classified for residential, commercial and light industry plus industrial environment.

This system offers the advantage of reading the measuring results from several locations on-board, e.g. at control desks both on the bridge and on the bridge wings.

The displays are provided with data output for serial transfer of measuring values to the navigation computer of the ship via NMEA protocol.

The system indicates relative wind speed and wind direction. If indication of absolute wind speed and wind direction is required, these values must be calculated separately.

Design

The wind measuring system type WSS consists of three components: A **wind sensor**, an **interface box** and 1-3 **displays** for indication of wind speed and wind direction.

Anemometer sensor type WSS or WSS-L

The sensor is based on 3 ultrasonic transducers arranged in a triangle for measuring of wind speed and wind direction. By measuring the time it takes the ultrasound to travel from one transducer to the other two, the wind speed and the direction can be measured.

The wind sensor is available in two versions:

- The WSS with a built-in heater, which will automatically engage when risk of icing occurs during low temperatures.
- The WSS-L without the heater is intended for applications in geographic areas where the risk of icing is very low or where occasional dropouts caused by icing are acceptable.

WSS interface box type WSI

The interface box is connected between the sensor and the display. The interface box has to be supplied from an 18...32V DC supply able to deliver 0.9A at 24V DC (1.25A at 18V DC), and it will then supply the ultrasonic transducers and the built-in heating element and at the same time convert the data signal for wind direction and wind speed into a TTL signal intended for the WSDI display(s). This is to make it possible to replace an existing wind sensor type 879.3c with our new sensor type WSS and to be able to connect the sensor to the existing display type WSDI. Besides, the already mounted cable for the sensor can still be used.

Display type WSDI

The display(s) is (are) equipped with a digital display for read-out of wind speed plus a circle of red LEDs for indication of wind direction. In addition, the display(s) also has (have) an output for the NMEA communication.

By means of 3 push-buttons on the front panel the light intensity can be set to an adequate level, and it is possible to choose between indication of wind speed in either m/s or KTS.

The light intensity may be set at 8 different levels. The two push-buttons "▲" and "▼" are used to increase/decrease the light intensity. With each push on the "▲" button the light intensity is

increased by one level, while each push on the "▼" button decreases the light intensity by one level correspondingly.

The "MODE" key is used to switch measuring mode, which enables reading of the measurements either in m/s or in KTS. The selected mode is indicated by means of a red LED in m/s or KTS respectively, just below the speed indication.

2. Warnings and general information



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.



For cleaning of the wind sensor, if necessary, only use water with a little dish washer soap.



Avoid paint on the plastic parts of the wind sensor, especially on the 3 ultrasonic sensors, as paint will prevent correct function (measurement of wind speed and wind direction).



Make sure that the WSS wind sensor is grounded according to the installation instructions.



If there is a high risk of birds landing on top of the WSS and thereby interrupting wind measurements or even damaging the sensor heads (the black rubber heads may attract some birds), it is highly recommended to use

3. Mounting and connecting the wind sensor

Placing of wind sensor

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

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.

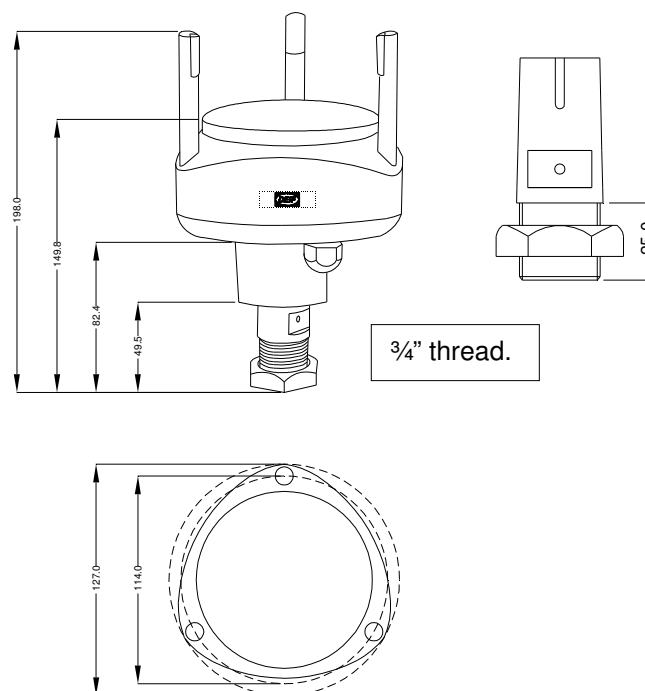


Keep away from the funnel.

The wind sensor is intended for installation on a vertical socket or a tube using the tap mounted on the wind sensor on delivery. See the drawing below for dimensions of the tap. **The tap is not to be removed from the wind sensor, as this will damage the waterproof sealing.**



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.



To ensure that the display represents the precise wind direction according to the ship, the wind sensor must be adjusted correctly. I.e. when mounting the wind sensor, the arrow printed on the bottom of the sensor must point towards the stem of the ship, and on land-based installations the arrow must point towards north.

Cable connection

The wind sensor is supplied with 2 metres fixed cable. From factory the cable is connected to the sensor via a waterproof gland, and this must not be replaced by another cable; the cable is extended by using a standard connection box or the optional IP67 connector kit for WSS.

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 installation 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 instrument is installed in a metal panel, this panel has to be carefully earthed, as well as the instrument itself.

Installation cable, e.g. UL2464 18AWG4C + AE, 4 x 0.75mm² screened, max. 300m, and max. 70nF capacity between the signal conductors. Suitable extension cable is available from DEIF.

Connection of the WSS wind sensor

Cable colour	Function		Note
Black	Supply voltage	-	30V DC supply for the WSS wind sensor
Red		+	
Orange	RS485 comm.	A	Wind speed and direction data output
Brown		B	
Shield	Cable shield		Shield is connected to the stainless steel tap inside the WSS

Connection of the WSS interface box WSI


Pin no.	Function		Note
1	Supply voltage	-	24V DC (1.25A) supply for the interface box
2		+	
3		NC	
4	RS485 comm.	A	Wind speed and direction data from the wind sensor
5		B	
6		GND	See IMPORTANT note!
7	Power supply out	+	
8		NC	
9		-	30V DC supply for the wind sensor
10	Wind speed	TTL out	
11	Direction	TTL out	
12	Common	GND	Do not connect
13		NC	
14		NC	
15		NC	



IMPORTANT!

The WSS stainless steel mounting base shall be connected to the ship's earth cable (or steel hull).

IP67 Connector kit assembly (OPTIONAL)

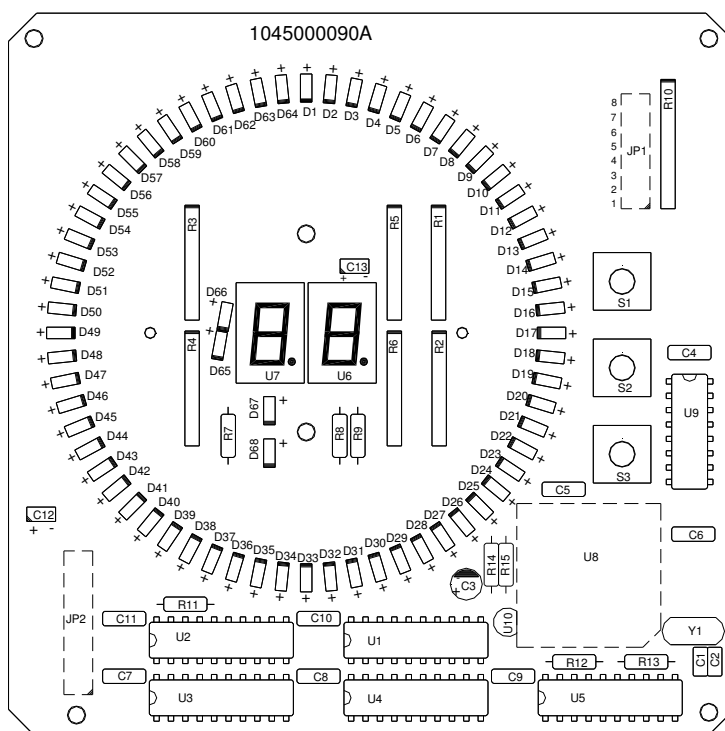
WSS/WSS-L fixed cable Male connector	 Connector pin no.	WSS extension cable xx meters Female connector	Signal comments
Black (-) ●	1	Black (-) ●	30V DC Supply for WSS/WSS-L
Red (+) ●	2	Red (+) ●	
Orange ●	3	Orange ●	RS485 Comm. from WSS/WSS-L
Brown ●	4	Brown ●	
Screen ●	5	Screen ●	Cable screen

Note: Male and female connectors must be soldered to the respective cables!

4. Configuration of the display

Communication type NMEA

Change between NMEA 1.5 and NMEA 2.x-3.0 is possible by removing the back plate and changing the position of the jumper located on the rear side of the display PCB, see the drawing below.



First locate the 2 x 8 pole plug (marked JP1).

NMEA 2.x-3.0 is activated by short-circuiting the two pins at position 1 on JP1 (facing the CPU, marked U8).

NMEA 1.5 is activated by removing the short circuit across the two pins at position 1 on JP1 (facing the CPU, marked U8).

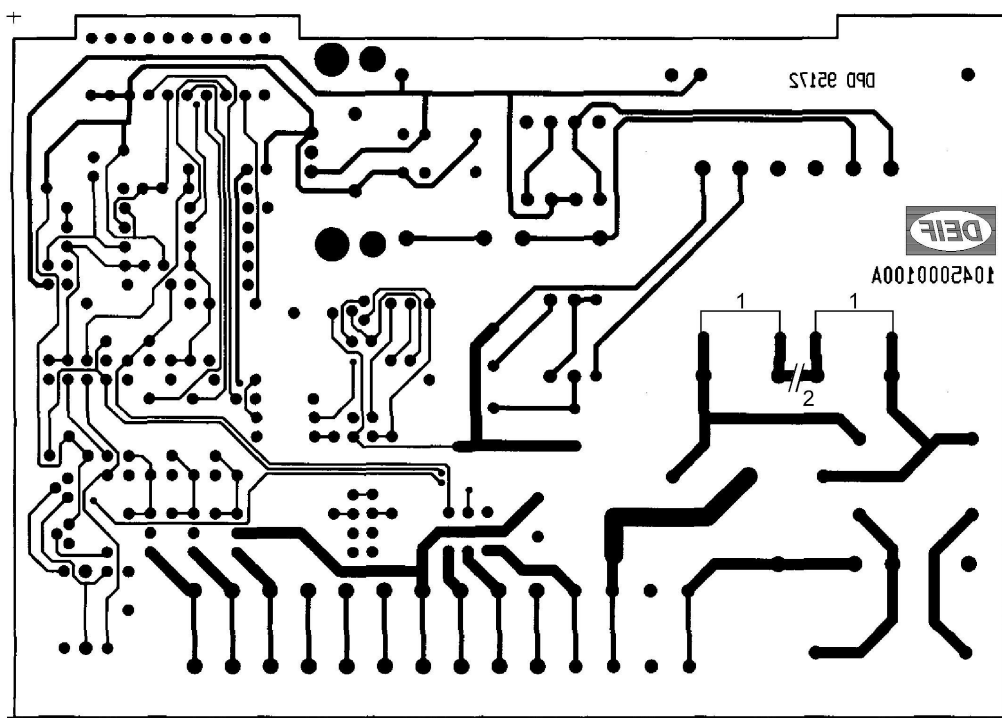
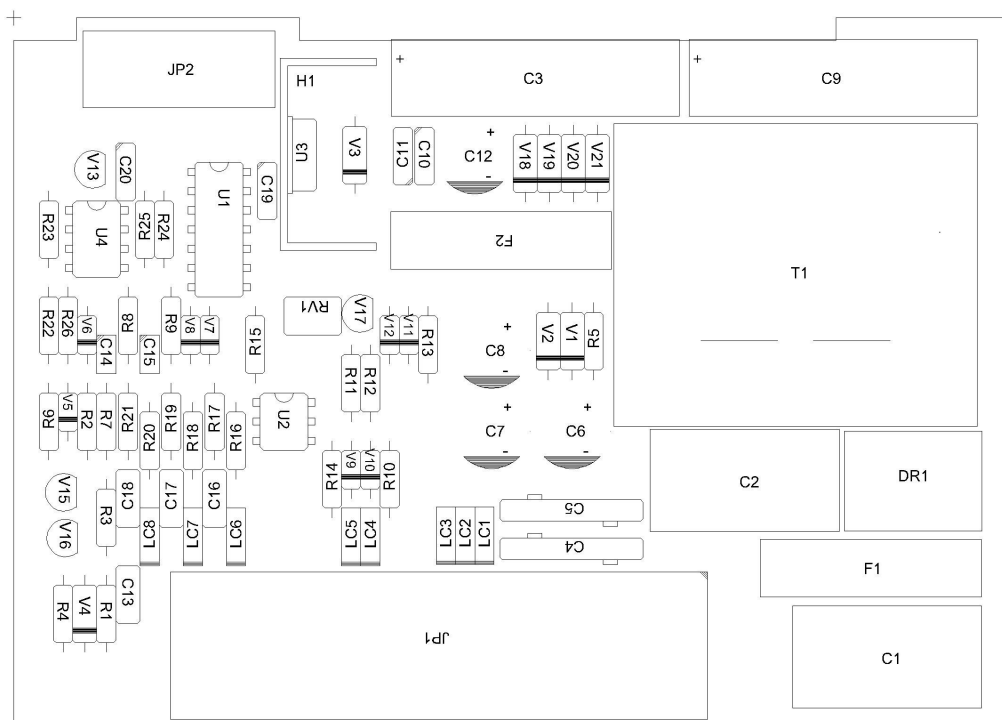
Read-out of wind direction

The indication of wind direction can be adjusted 180° compared to standard. Read-out of wind direction on the display is adjusted by 180°, meaning 360° pointing astern of the ship. This function is activated by short-circuiting the two pins at position 3 on JP1.

Please notice that the 180° adjusted wind indication has no influence on the NMEA output.

Aux. supply for the display

The display type WSDI can be supplied from 220V AC or 110V AC. If change of the supply is needed, the rear plate is removed and the power/input PCB is carefully pulled out, see the drawing on the next page.



Change from 110V AC to 220V AC by removing the jumpers across 1 and remounting the jumper across 2.

Change from 220V AC to 110V AC by mounting the 2 jumpers across 1 and removing the jumper across 2 (or by breaking the copper line by means of a knife).

Connection of the display type WSDI

Pin no.	Function		Note
AC	Supply	220V AC or 110V AC	To change from 220V AC to 110V AC or vice versa, see page 8
AC			
GND	EARTH		The ship's hull, it is not necessary to connect this terminal
1	AUX +5V DC	External mode control	For external dimmer and read-out of m/s or KTS in the display
2	0V	Input from WSS interface box	Terminal 12 on the interface box, WSI
3	Wind speed		Terminal 10 on the interface box, WSI
4	Direction		Terminal 11 on the interface box, WSI
5	Screen		The cable screen. Do not connect the other end
A	Signal	NMEA	NMEA0183 version 1.5 or 2.x-3.0, see page 7.
B	Return		
	Screen		The cable screen. Do not connect the other end
9	Mode shift	m/s or KTS	Read-out in the display
10	Dimmer	▼	Decrease illumination
11	Dimmer	▲	Increase illumination

5. Troubleshooting

Fault-finding

It is assumed in the following guidance that the fault-finding is carried out on a system that has been working. However, some of the procedures may also be useful when installing and commissioning the first time. First, the purpose is to locate the cause of e.g. a missing supply voltage, a blown fuse, a defective wind sensor, a defective interface box, a defective display or fault in the cable connection. Further fault-finding and possible repair must be carried out by DEIF A/S.

No light in the instrument

There is no light in the LED circle, nor in the display, the "m/s" or the "KTS" LED.

It is most likely caused by a fault in the internal 5V DC supply that supplies the electronic, meaning that the fault is possibly due to the fact that one of the two internal fuses has blown. The fuses are marked F1 and F2. F1 is the fuse for the aux. supply (220V AC or 110V AC) and the type is a 1A slow blow fuse, and F2 is the fuse for the 5V DC internal supply and the type is a 0.1A slow blow fuse. See the drawing on page 8.

Check that the correct AC supply voltage (220V AC or 110V AC) is present on the terminals marked "≈". The correct supply voltage is indicated by means of a cross (x) on the nameplate located on the rear side of the display.

Then check the 5V DC between terminals "1" (+5V) and "2" (0V) on the display. If the AC supply voltage is present on the terminals but 5V is missing, a fuse has probably blown. The rear panel of the display housing is then removed, and the defective fuse is replaced.

Flashing display

If the aux. supply voltage is less than the nominal voltage -20%, the voltage for the built-in processor is inadequate and the result is a flashing display.

If the speed is indicated as fixed "0" and the display is jumping from 0 degrees to approx. 240 degrees, the 24V DC supply is not able to deliver 1.25A.

Light in the display but inaccurate reading of wind speed and direction

Check the voltage level for wind speed input for the display between terminal "2" (0V) and terminal "3" on the display to approx. +2.5V DC. During this test the sensor must be exposed to a stable wind flow (no wind speed = 5V). Then check the voltage level for wind direction input between terminal "2" and "4" to approx. 1-3V DC. (Be aware that the measurement will fluctuate). If the voltage levels measured differ from the above, the fault can be related to either the WSS interface box or the WSS wind sensor itself.

Checking the WSS interface box

First check the voltage connected to terminal "2" (+) and terminal "1" (-) on the interface box. The voltage level has to be in the range 18-32V. Then check the voltage supply for the wind sensor on terminal "7" (+) and "9" (-). The voltage level must be 30V DC $\pm 0.5V$.

Checking the WSS wind sensor

Check the voltage level on terminals "4" (A) and "5" (B) with respect to terminal "6" (-) on the interface box. The voltage level measured on terminal "4" must be approx. 2-3V DC, and the voltage level on terminal "5" must be approx. 2-3V DC. If the voltage differs from the above, the fault can be related to the cable connection or the wind sensor. Then climb the mast and measure the voltage level between the red wire (+) and the black wire (-). The voltage has to be 30V DC

+0.5/-7V. If the voltage level is OK, then disconnect the brown and orange wires in the connection box. Check the voltage level on the brown and the orange wires with respect to the black wire on the cable end connected to the interface box. The voltage level measured on the brown wire must be $2.5V \pm 0.5V$ DC, and the voltage level measured on the orange wire must be $2.5V$ DC $\pm 0.5V$. If the voltage levels are OK, the fault is related to the wind sensor and a replacement is necessary. On the other hand, if the voltage level differs from the above, the fault is related to the cable.

Cable failure

If the read-out of the wind speed is zero and the direction is indicated at 0-90-180-270° every 0.5 second, the fault is probably a cable break or short circuit in the cable.

The display indicates wrong wind direction

Check the position of the wind sensor. An arrow is printed at the bottom of the wind sensor, check that this arrow is pointing directly to the ship's stem. If this is OK, the fault can be related to the display; check the position of the jumper setting on pin header JP1, see the section "Read-out of wind direction".

No data available on the NMEA output

If the wind direction is interrupted, the NMEA output stops. Check the wiring on terminal 4 on the display, and check the wiring on terminal 11 (D) on the interface box.

6. Technical information

Wind sensor type WSS

Power supply	12V DC $\pm 20\%$ (max. 1.1A) 24V DC $\pm 20\%$ (max. 0.6A)
Temperature working range	-52...+60° C
Weight	0.8kg
Dimensions	See drawing in chapter 3 of this manual

WSS interface box

Power supply	24V DC, working range 18-32V DC
Power consumption	0.9A at 24V DC (1.25A at 18V DC)
Fuse	Recommended fuse 2A slow blow
Weight	0.45kg
Dimensions	See drawing in chapter 7 of this manual

Display type WSDI

Power supply	110V AC or 220V AC
Power consumption	6W
Weight	0.8kg
Dimensions	See drawing in chapter 7 of this manual

NMEA 0183	Version 1.5 or version 2.x-3.0
Transmission speed	4800 Baud
Number of bits	8
Number of parity bits	0
Number of stop bits	1
Transmission interval	1 sec.

Communication protocol NMEA 0183 version 1.5

```
$IIMWD,xxx,T,,,yy.y,N,,*zz<CR><LF>
Wind direction (0...360°)      xxx
Wind speed (0.0...99.9 KTS)   yy.y
Hexadecimal check sum         zz
(XOR of all characters until the "*" -character (not included))
End of transmission (EOT)     <CR><LF>
```

Communication protocol NMEA 0183 version 2.x-3.0

```
$WIMWV,xxx.x,R,yy.y,N,A*zz<CR><LF>
Wind direction (0...360.0°)    xxx.x
Wind speed (0.0...99.9 KTS)   yy.y
Hexadecimal check sum         zz
(XOR of all characters until the "*" -character (not included))
End of transmission (EOT)     <CR><LF>
```

The receiver is connected to instrument type WSDI with a 2-wire screened cable. Terminal "A" is signal and terminal "B" is return (0V).

The NMEA 0183 standard requires the following signal levels:

"1" between -15 and +0.5V |Isink| ≥ 0mA
 "0" between +15 and +4V |Source| ≥ 15mA @ +4V

The instrument type WSDI releases the following levels:

"1" -9.5V +/-0.5V |Isink| ≥ 1mA @ -8V
 "0" +9.5V +/-0.5V |Source| ≥ 15mA @ +8V

Please notice that NMEA does not request that the output may settle power in "1" condition, but it is permissible. This is used in WSDI in order to make it compatible with RS-232C/V24. The NMEA 0183 signal is inverted like RS232.

The "A" and the "B" signals are galvanically separated as prescribed by NMEA.

An RS232C receiver may be connected. Applicable would be a PC with the following configuration:

Transmission speed	4800 Baud
Number of data bits	8
Parity bits	None
Number of stop bits	None

Number of connected receivers to the NMEA output

According to NMEA the receiver must be able to operate with a minimum differential voltage input of 2V and must not take more than 2mA from the transmitter. Based on this information the number of receivers connected to WSDI can be calculated.

The NMEA output in the WSDI is based on a 15mA constant source generator with an internal voltage of 9.5V.

Max. receivers: $15\text{mA}/2\text{mA} = 7.5$. This means that 7 receivers can be connected, if the receiver input is made according to the NMEA standard.

Type numbers

Wind sensor	Type WSS
Interface box	Type WSS interface box
Display	Type WSDI

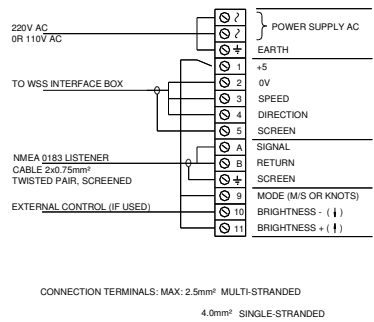
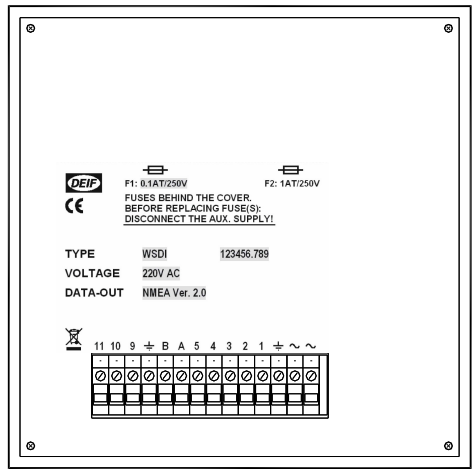
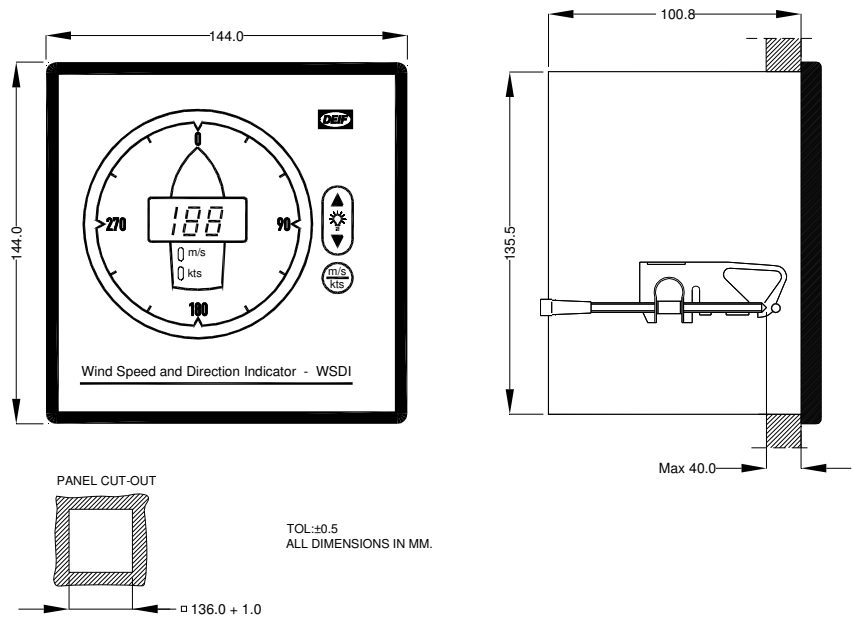
Spare parts

The following are recommended as spare parts (not included):

2 pcs. Fuse F1, 0.1AT, Ø5 x 20mm (item no. 1020500010)
 2 pcs. Fuse F2, 1AT, Ø5 x 20mm (item no. 1020500006)

7. Drawings

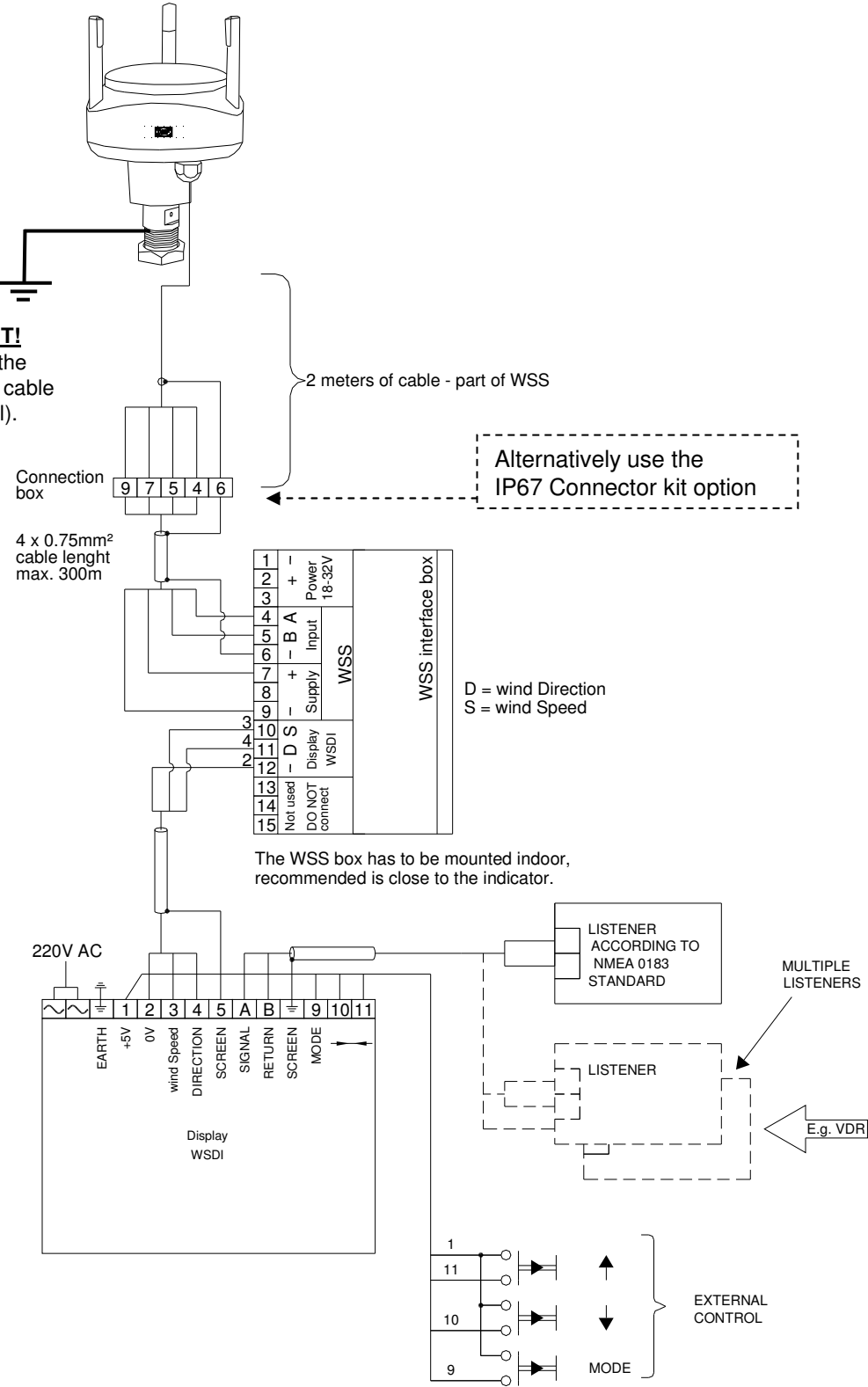
Display



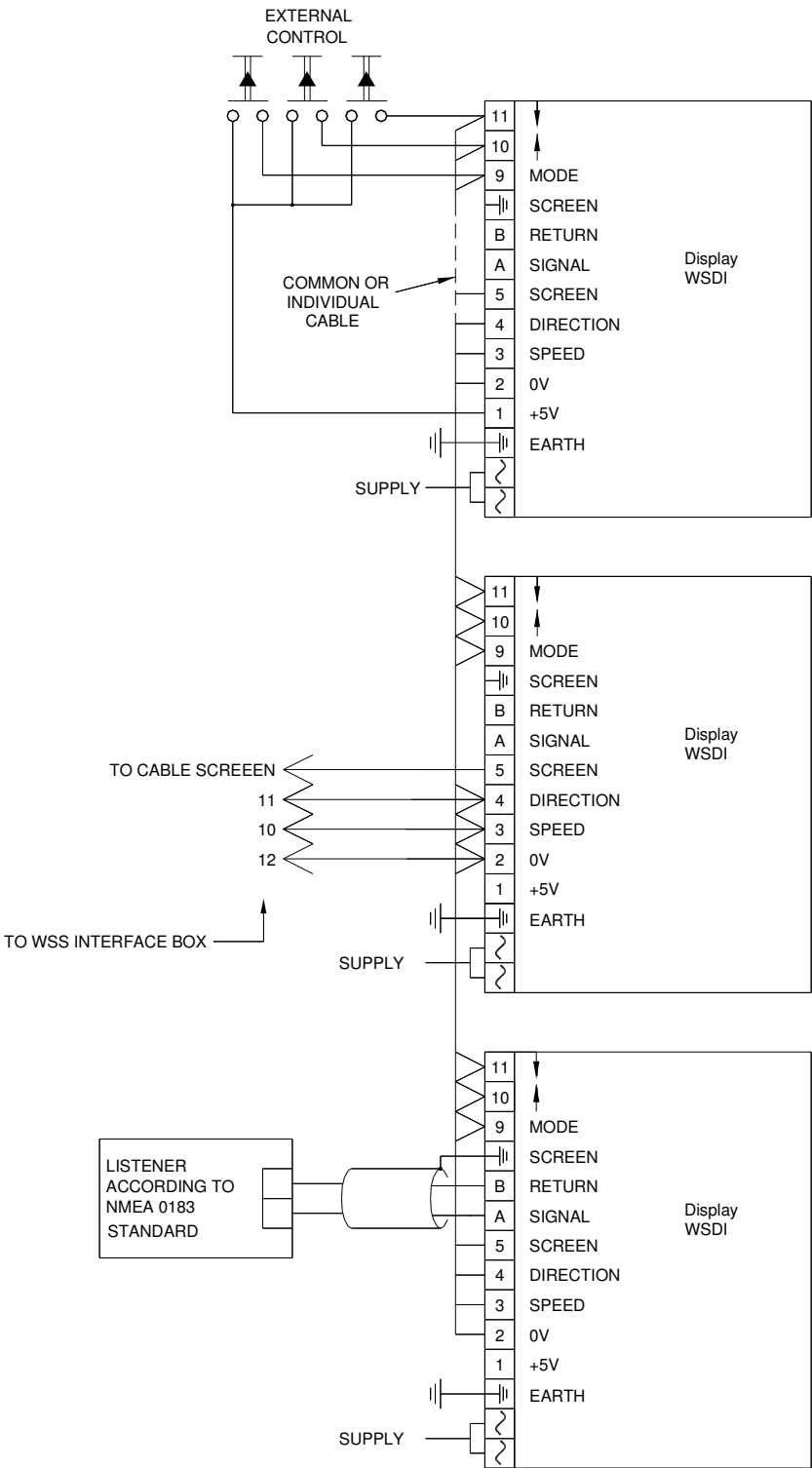
Connection diagram

IMPORTANT!

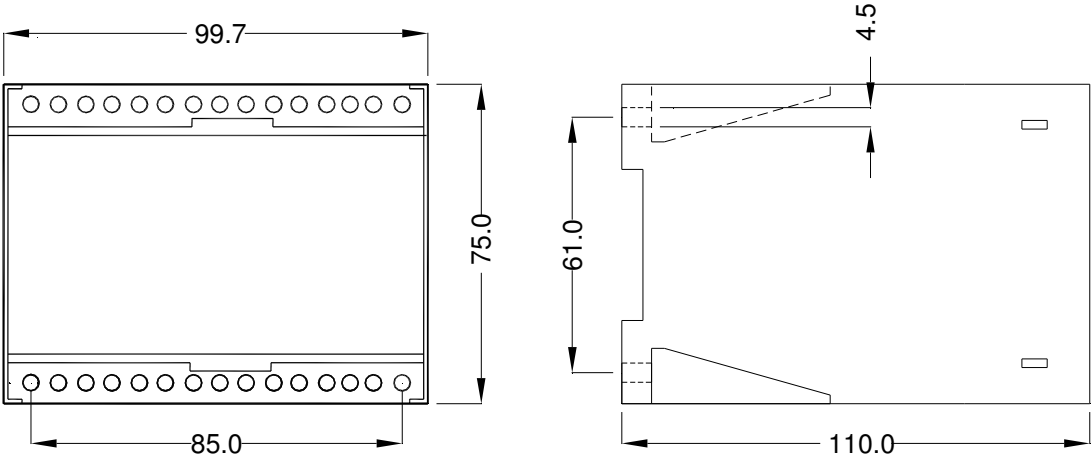
Connect to the ship's earth cable (or steel hull).







Connection diagram for 3 displays



Interface box



WSS interface box														
Item no. 2035000006										100V CAT III.				
DISPLAY WSDI - D S						WSS				POWER 18-32V + -				
						Supply - +		Input - B A						
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

DEIF A/S reserves the right to change any of the above.