



[www.marine.vdo.com](http://www.marine.vdo.com)

AcquaLink<sup>®</sup>

# Nav Box and System AcquaLink<sup>®</sup>

# Installation Instruction

06/2016 - EN (3.0)





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## 1. Preliminary Remarks

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In purchasing the VDO AcquaLink Nav Box system you have decided on a high value product, which has been manufactured according to acknowledged technical standards. Modern production processes and compliance with currently applicable quality assurance standards guarantee that our products leave the factory in perfect condition.

We thank you for making a good choice, and we are convinced that this instrument will be reliable and a great help to you and keep you safe at sea.

In order to ensure easy and safe handling of your VDO system, you should familiarize yourself with all the features and functions.

Please take the time to read these instructions carefully and completely.

## 2. Safety Instructions

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### 2.1 Installation

This product has been developed, manufactured and tested in accordance with the requirements of EC and UL directives and the acknowledged state of the art.

Please follow all the instructions given in this handbook exactly.

#### **ATTENTION**



Please pay attention to all text passages labeled with this symbol. These are very important hints for operating and security of the instruments.



**DANGER!**

Before beginning work, the negative Terminal of the battery should be disconnected!

- Use of information provided by the VDO system does not release you from the responsibility over your ship and demands well seamanship. Always use your nautical experience in interpreting the displayed values.
- If you carry out this work yourself, wear suitable working clothes. Do not wear wide fitting clothes. If you have long hair, wear a hair-net. Clothes and hair can get caught in moving and rotating parts.
- Wearing of metallic or conductive jewellery, such as necklaces, bracelets, rings etc. is not allowed when working on the electrical installation on board.
- Please note that with disconnection of the battery, all volatile electronic memories lose their input values and must be reprogrammed.

**DANGER!**

Explosion hazard!

Before beginning work on the engine compartment of petrol engines, switch on the ventilator of the engine compartment.

- Ensure that necessary clearance is provided behind the cable opening, at the position where the gauge is to be installed.
- When selecting the installation position for gauges or displays, take care that no stringers are drilled. Be careful also of furniture, floorboards, superstructure boxes, cables etc.
- When carrying out installation work with a sealing compound, solvent vapours can be formed. Make sure of adequate ventilation and follow the instructions for use of the sealing compound manufacturer.
- Please note, that the Nav Box is not a ISO8846 certified product and should not be installed inside the engine compartment.

## 2.2 Preliminary Remarks

- For the installation only use VDO and NMEA 2000 approved cables.
- If you don't use standard cables, the wires used should be adequately insulated or should have sufficient electrical strength, and the contact point should be protected against electrical shock hazard. The electrical conducting components of the connected consuming devices should also be protected against direct contact through suitable measures. Installation of bare metallic wires and contacts is not allowed.
- Take account of the wire cross section. A reduction of the wire cross section results in a higher current density. This can cause the wire to heat up and potentially cause fire.
- Connect the wires only in accordance with the wiring diagram.

## 2.3 Safety Instructions for Maintenance

The VDO Nav Box system is maintenance-free. Do not use cleaning agents.

Repairs on the system should be carried out only by VDO authorized specialists !

## 3. The Nav Box System

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The Nav Box is the heart of the VDO AcquaLink system. To operate the AcquaLink system you need the Nav Box, at least one AcquaLink 4.3”TFT and one Nav Control. The system can be accomplished with 110mm and 52mm gauges and a wide array of sensors and transducers.

Additionally the Nav Box converts SAE J1939 and analogue signals to NMEA 2000.

In order to program and adjust the system you need to refer to the Nav Box operation manual. This instruction focuses on the installation and the connection of the Nav Box to optional sensors and transducers.

### **In the Box:**

- Nav Box
- 3 pin power cable
- 26 pin cable for analogue input
- Mounting screws
- Installation instruction
- Mounting template
- Operation manual
- 3x VDO Bus terminators

### 3.1 Installation of the Nav Box

Please use the mounting template to determine a proper installation location. The Nav Box can be mounted horizontally but it is recommended to mount the unit vertically on a bulkhead or other structure with the cable connections pointing to the bottom. This helps water to run off and protect the cables from bending and chaffing.

You also have a better access to the status LEDs on top of the unit.





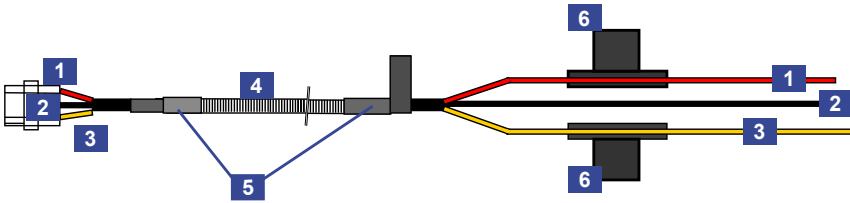
Position	Description
<b>1</b>	Mounting screw holes (Use all four screws to securely install the unit)
<b>2</b>	Status LEDs
<b>3</b>	Protection shield (protects connectors, offers additionally water spray protection)

## 3.2 Data Management

The Nav Box system supports various data inputs. The received data is prioritized in following order:

- Priority #1: Analogue Input
- Priority #2: NMEA 2000
- Priority #3: SAEJ 1939
- Priority #4: NMEA0183

### 3.3 Power Connection



Position	Description
1	Red (see table "Power Connection" for details)
2	Black
3	Yellow
4	Ribbed hose
5	Heat sink (2x)
6	Fuse 10 Amp

#### Power Connection

PIN No.	Color	Signal
1	Red	Terminal 30 (Battery)
2	Black	Terminal 31 (GND)
3	Yellow	Terminal 15 (Ignition)

## 4. Connections



Nav Box: Connections

The Nav Box features following connection types:

Position	Description
POWER	for 3 pin power cable
NMEA 2000 <sup>®</sup>	5 pin M12 Micro C
SAE J1939	1x SAE J1939 Input (5pin M12)
VDO Bus	3x VDO Bus (8 pin M12)
LOG 1 & LOG 2	2x Log Input (4 pin M12)
WMA	1x Wind Input (8 pin M12)
26 POLE AUX / SENSOR	26 pin Analogue/NMEA0183 Input
VDO Sensor	2x CAN BusVDO Sensor Input (5 pin M12)

### 4.1 NMEA 2000®

The Nav Box can be connected to an existing NMEA 2000 system. Please visit [www.NMEA.org](http://www.NMEA.org) to find information about NMEA 2000.



NMEA 2000 Pinout

PIN No.	Signal
1	Shield
2	NET-S (V+)
3	NET-C (V-)
4	NET-H (CAN H)
5	NET-L (CAN L)

For NMEA 2000 voltage drop calculations please refer to this LEN list:

Instrument	LEN
Nav Box	3
Nav Control	4
110 mm Gauge	4
52 mm Gauge	2
4.3" TFT	12

The Nav Box can receive and transmit NMEA 2000 data. It can also convert analogue, NMEA 0183 and SAE J1939.

It supports the reception of following NMEA 2000 PGNs:

PGN	HEX	Message Name
59904	00EA00	ISO Request
60928	00EE00	ISO Address Claim
65281	00FF01	VDO Bus Proprietary Single-Frame Message (End Of Line)
60416	00EC00	ISO Transport Protocol, Connection Management - RTS group function
60160	00EB00	ISO Transport Protocol, Data Transfer
59392	00E800	ISO Acknowledgment
126208	01ED00	NMEA - Request group function
130306	01FD02	Wind Data
129026	01F802	COG & SOG, Rapid Update
128259	01F503	Speed, Water Referenced
128267	01F50B	Water Depth
129025	01F801	Position, Rapid Update
129033	01F809	Local Time Offset
127250	01F112	Vessel Heading
127489	01F201	Engine Parameters, Dynamic
127488	01F200	Engine Parameters, Rapid Update
130312	01FD08	Temperature - DEPRECATED
130314	01FD0A	Actual Pressure
127251	01F113	Rate of Turn
127257	01F119	Attitude
130310	01FD06	Environmental Parameters - DEPRECATED
130311	01FD07	Environmental Parameters- DEPRECATED
127245	01F10D	Rudder

PGN	HEX	Message Name
127505	01F211	Fluid Level
127493	01F205	Transmission Parameters, Dynamic
126992	01F010	System Time
130316	01FD0C	Temperature, Extended Range
129283	01F903	Cross Track Error
129284	01F904	Navigation Data
127508	01F214	Battery Status
129291	01F90B	Set & Drift, Rapid Update

For transmitting PGNs please refer to Chapter “SAE J1939” and Analogue Inputs.

In case multiple instances of the same value are received from the NMEA 2000 network, the Nav Box has following priorities:

- For Time Data:
  - 1 - "System Time "
  - 2 - "Local Time Offset"
- For Barometric Date:
  - 1 - "ActualPressure"
  - 2 - "EnvironmentalParameters2"
  - 3 - "EnvironmentalParameters"
- For Temperature Data:
  - 1 - "Temperature\_Ext"
  - 2 - "Temperature"
  - 3 - "EnvironmentalParameters2"
  - 4 - "EnvironmentalParameters"

In general, if one message contains an error value, the next one is considered.

NMEA 2000 Engine Support

The Nav Box system supports up to four NMEA 2000 engines. The engines have to be properly programmed with individual instance numbers (0-3) by an engine technician.

Please refer to the Operation manual to set up the Tachometers with the right instance numbers.

## 4.2 SAE J1939



SAE J1939 Pinout



PIN No.	Signal
1	Shield (internally not connected)
2	Ignition (internally connected to battery when system is ON)
3	GND
4	CAN H
5	CAN L

The Nav Box has three SAE J1939 connections:

### [SAE J1939 Installation](#)

The Nav Box supports one SAE J1939 engine connection. .

### **Important:**

If you use any of the three SAE J1939 ports you need to terminate all three SAE J1939 ports with three 180 ohm resistors!

VDO offers an optional 180 ohm inline terminator (A2C99794200).

### Data Handling

The Nav Box has an interface that is SAE J1939 compatible. It is used to receive engine data and distributes them over VDO Bus and NMEA 2000 to make them available for both the NMEA2000 network and the AquaLink system.

### [SAE J1939 Multi Engine support](#)

Four Engines in one CAN Bus system

The Nav Box supports up to four SAE J1939 engines if they are in the same CAN Bus network system and have different source addresses (0-3).

Supported SAE J1939 Messages:

SAE J1939 supported SPNs	Description
PGN 61444 - SPN 190	Engine Speed
PGN 65270 - SPN 102	Engine Turbocharger Boost Pressure
PGN 65263 - SPN 100	Engine Oil Pressure
PGN 65262 - SPN 175	Engine Oil Temperature 1
PGN 65262 - SPN 110	Engine Coolant Temperature
PGN 65266 - SPN 183	Engine Fuel Rate
PGN 65253 - SPN 247	Engine Total Hours of Operation
PGN 65263 - SPN 109	Engine Coolant Pressure

SAE J1939 supported SPNs	Description
PGN 65276 - SPN 96	Fuel Level
PGN 65270 - SPN 173	Exhaust Gas Temperature
PGN 65269 - SPN 108	Barometric Pressure
PGN 65269 - SPN 171	Ambient Air Temperature
PGN 65272 - SPN 127	Transmission Oil Pressure
PGN 65272 - SPN 177	Transmission Oil Temperature
PGN 65279 - SPN 97	Water in Fuel Indicator

The Nav Box distributes the received SAE J1939 data to the NMEA 2000 network.

Following data is converted and transmitted:

SAE J1939 Input Data	NMEA 2000 output
Engine Speed (RPM)	127488 Eng. Parameters, Rapid Update
Boost Pressure	127488 Eng. Parameters, Rapid Update
Engine Oil Pressure	127489 Eng. Parameters, Dynamic
Engine Oil Temperature 1	127489 Eng. Parameters, Dynamic
Engine Coolant Temperature	127489 Eng. Parameters, Dynamic
Engine Fuel Rate	127489 Eng. Parameters, Dynamic
Engine Total Hours of Operation	127489 Eng. Parameters, Dynamic
Engine Coolant Pressure	127489 Eng. Parameters, Dynamic
Fuel Level	127505 Fluid Level
Exhaust Gas Temperature	130316 Temperature Ext
Barometric Pressure	130314 Actual Pressure
Ambient Air Temperature	130316 Temperature Ext
Transmission Oil Pressure	127493 Trans. Parameter Dynamic
Transmission Oil Temperature	127493 Trans. Parameter Dynamic

The Nav Box also receives all DM1 DTC messages of the SPN List above.

## 4.3 VDO Bus



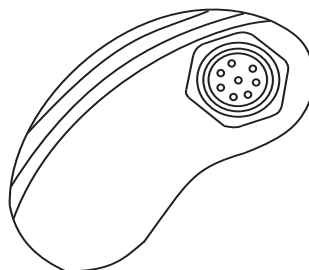
VDO Bus Pinout

PIN No.	Signal
1	Ignition / Terminal 15
2	GND / Terminal 31
3	Battery + / Terminal 30
4	CAN H
5	CAN L
6	Shield
7	Ignition / Terminal 15
8	GND / Terminal 31

The VDO Bus is an NMEA 2000-based communication used within the Acqua-link system to share the information gathered from the system interfaces as well as to distribute proprietary messages containing status information of the system itself. The VDO Bus uses M12 8 Pin cables and all devices are powered through the network.

The Nav Box has three VDO Bus ports, so three separate VDO Bus segments can be installed. This helps to reduce the power drop in the system and allows an easy installation in all areas of the vessel.

Every 110mm gauge, 4.3" TFT and Nav Control features two equal VDO Bus connectors in the rear.



The units are daisy chained together.

**Important:**

- All three VDO Bus segments have to be terminated with a VDO Terminator (included in box).
- If you haven't connected an instrument or Nav Control to a Nav Box port, connect the terminator directly to the not used Nav Box VDO port.
- If you have connected displays or gauges, use the terminator on last empty VDO port on the last unit in the chain.
- There mustn't be any empty connector

**VDO Bus Limitations**

The Nav Box provides power to all the 110mm gauges and 4.3" TFTs connected to the system. Due to the power consumption and the resistance of the cables, there are limitations of the maximum cable length and number of possible instruments in the system.

In order to have a properly working system the voltage drop of every of the three VDO Bus segments have to be calculated.

1 LEN = 0.05 Ampere

**Note:**

VDO Bus cables have two female connectors. In order to extent the cable length an optional gender changer connector is needed (A2C38805500).

LEN List for VDO Products:

Instrument	LEN
Nav Box	3
Nav Control	4
110 mm Gauge	4
52 mm Gauge	2
4.3" TFT	12

## Calculation

12V power supply:

The voltage drop for every segment of the VDO Bus is calculated as follow:

Ohm's Law:  $E$  (voltage drop) =  $I$  (circuit current) x  $R$  (wire resistance)

$R = 2/2x$  Cable Length (m) x Power Pair Resistance / 100

$I = LEN$  (Load Equivalency Number) x 0.050 amps

$L =$  Total length of VDO Bus cables in one segment

->  $E = 0.05 \times LEN \times L \times 0.057$

The voltage drop for each VDO Bus Segment shouldn't be higher than 3V

## 4.4 VDO Sensor

You can connect the VDO Navsensor and VDO NMEA 2000 Windsensor directly to the Nav Box without using the NMEA 2000 Network

### Note:

One 120ohm resistor has to be installed as close as possible to the sensor.

### Note:

VDO Bus has 2x AWG 22 Power/Ground cables -> so there is different voltage drop calculation than NMEA 2000.

24V power supply:

If using a 24V system the voltage drop may not be higher than 9V.

### Note:

The maximum Number of LEN in the Nav Box system is 120 equals 6 Am-pere.

## 4.5 NMEA 0183

The Nav Box can receive NMEA 0183 data and distributes it over VDO Bus and NMEA 2000 to make them available for both the AcquaLink system and the NMEA 2000 network.

The Nav Box supports following NMEA 0183 sentences:

NMEA 0183 supported sentences	Description
RMC	Recommended Minimum Navigation Information
MTW	Sea-Water temperature
DBT	Depth Below Transducer
VHW	Water Speed and Heading
VTG	Track Made Good and Ground Speed
XTE	Cross-Track Error, Measured
MWV	Wind Speed and Angle
HDM	Heading - Magnetic
HDG	Heading - Deviation & Variation
BWC	Bearing and Distance to Waypoint, Latitude, N/S, Longitude, E/W, UTC, Status



The received data is converted to following NMEA 2000 data:

NMEA 0183 sentence	Input Data	NMEA 2000 / VDO Bus output
RMC	UTC Time	126992 SystemTime
	Latitude	129025 PosRapidUpdate
	Longitude	129025 PosRapidUpdate
	Speed Over Ground	Not forwarded with this sentence Only over VTG so far
MTW	Water Temperature	130316 Temperature_Ext
DBT	Depth, meters	128267 WaterDepth
VHW	True Heading	–
	Magnetic Heading	127250 VesselHeading
	Speed Through Water	128259 Speed, Water Referenced
VTG	Speed Over Ground	129026 COGSOGRapidUpdate
XTE	Cross Track Error	129283Cross Track Error
MWV	Wind Angle	130306 Wind
	Wind Speed	130306 Wind
HDM	Magnetic Heading	127250 VesselHeading
HDG	Magnetic Heading	127250 VesselHeading
	Deviation	127250 VesselHeading
BWC	Bearing (True) To Waypoint	129284 Navigation Data

## NMEA 0183 Connection

To connect a NMEA 0183 device to the Nav Box use the analogue harness included in the box.

Sensor	Nav Box Pin	Color	Description
NMEA 0183 Rx	20	White/Red	NMEA 0183 Rx A
	14	Brown/Red	NMEA 0183 Rx B

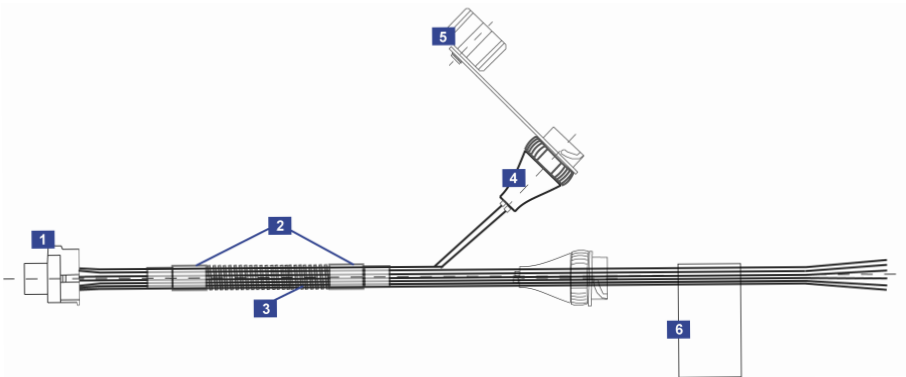
## 4.6 Analogue Inputs

The Nav Box allows supports several analogue inputs. The received data is displayed in the AcquaLink system and converted to NMEA 2000 messages

### 26 Pole Aux/Sensor



26 Pole Pinout



Position	Description
1	Connector type: Tyco Super Seal 1.0 mm (Tyco PN: 1473416-1)
2	Shrink tube (2x)
3	Ribbed hose
6	Label imprint

Pin	Signal	In-/output range	Coding TBD
1	Low Side Switch (Buzzer)	0.5A max	brown
6	0-5V GND		black
7	High Side (Aux)	0.7A max	red
8	Engine Freq. GND	-	brown-blue
9	Engine Freq. (universal WWG)	0-4kHz; W, 1, Ind, Generator, Lightning Coil	white-blue
10	Engine Cool Water Temp	0-500 Ohm	blue
11	NMEA0183 B (Talker)	RS422	white
12	NMEA0183 A (Talker)	RS422	white-grey
13	Engine Oil Temp	0-500 Ohm	violet
14	NMEA0183 B (Listener)	RS422	brown-red
15	Engine Oil Pressure	0-500 Ohm	green
16	Rudder Angle	0-500 Ohm	yellow
17	Fuel 1	0-500 Ohm	white-green
18	Fuel 1 GND	-	brown-green
19	Transmission oil pressure	0-500 Ohm; 0-30 Bar	pink
20	NMEA0183 A (Listener)	-	white-red
21	Fresh Water	4-20 mA	white-yellow
22	Black Water	4-20 mA	grey
23	Amperemeter (-)	+/-60 mV	yellow-brown
24	Amperemeter (+)	+/-60 mV	red-blue
25	Signal GND	-	pink-brown
26	0-5V (Signal 1)	0-5V	grey-brown

## 4.6.1 Resistive Inputs

The Nav Box implements six resistive inputs to allow the connection of the following sensors:

- Fuel Level sensor
- Rudder Angle sensor
- Engine Oil Temperature sensor
- Engine Oil Pressure sensor
- Transmission Oil Pressure sensor
- Engine Coolant Water Temperature sensor

### Fuel Level

There are three different Ohm ranges for the fuel sensor input available:

- 2-90 ohm
- 3-180 ohm
- 240-33.5 ohm

Available VDO products:

A2C Number	Description
226-801-015-001G	Adjustable Lever Arm Sensor 10–180 ins grd
A2C59510162	Adjustable Fuel Lever Arm Sensor 10–180 $\Omega$ w/c
A2C59510163	Adjustable Fuel Lever Arm Sensor 240–33 $\Omega$ w/c
A2C59510164	Adjustable Fuel Lever Arm Sensor 90–0 $\Omega$ w/c
A2C59510165	Adjustable Lever Arm Sensor ALAS I
A2C59510166	Adjustable Lever Arm Sensor ALAS I
A2C59510167	Adjustable Lever Arm Sensor ALAS I
A2C59510168	Adjustable Fuel Lever Arm Sensor 10–180 $\Omega$ wo/c
A2C59510169	Adjustable Fuel Lever Arm Sensor 240–33 $\Omega$ wo/c
A2C59510170	Adjustable Fuel Lever Arm Sensor 90–0 $\Omega$ wo/c
A2C59510171	Adjustable Lever Arm Sensor ALAS I
A2C59510172	Adjustable Lever Arm Sensor ALAS I
A2C59510173	Adjustable Lever Arm Sensor ALAS I

## Connection

Sensor	Nav Box Pin	Color	Description
Fuel	17	White/Green	Fuel Input
GND	18	Brown/Green	Fuel GND

For calibration please refer to the Operation manual.

## Rudder Angle

The Nav Box system supports one resistive rudder sensor input.

Ohm range: 5–190 Ohm

A2C Number	Description
A2C110295001	Rudder angle sensor single station 10–180 $\Omega$

## Connection

Sensor	Nav Box Pin	Color	Description
Rudder	16	Yellow	Rudder Angle
GND	25	Pink/Brown	Signal GND

For calibration please refer to the Operation manual.

## Temperature Sensors

The Nav Box supports one input for engine oil and one for coolant oil temperature.

Available VDO sensors:

A2C Number	Description
323-801-001-006N	Temp Sender 120°C (Earth Ret) M14 x 1.5
323-801-001-007N	Temp Sender 120°C (Earth Ret)
323-801-001-008N	Temp Sender 120°C(Earth Ret)5/8-18UNF-3A
323-801-001-009N	Temp Sender 120°C (Earth Ret)
323-801-001-010N	Temp Sender 120°C (Earth Ret) 1/2-14NPTF
323-801-001-022N	Temp Sender 120°C (Earth Ret)
323-801-001-029N	Temp Sender 250F M16X1.5 801/1/29
323-801-001-040N	Temp Sender 120°C (Earth Ret) M16 x 1.5
323-801-001-058C	Temp Sender, Elec.
323-801-004-002N	Temp Sender 150°C (Earth Ret) M14 x 1.5
323-801-004-003D	Temp Sender 150°C (Earth Ret) R1/2
323-801-004-007D	Temp Sender 150°C (Earth Ret) 1/2-14NPTF
323-801-004-012C	Temp Sender 150°C (Earth Ret) M16 x 1.5
323-801-004-017D	Temp Sender 150°C (Earth Ret)
323-801-004-039D	Temp Sender 150°C (Earth Ret) M14 x 1.5
323-801-005-001D	Temp Sender 250F 1/8-27NPT
323-801-008-002D	Temp Sender Outside Air -25°+1
323-801-010-001D	Temp Sender 150°C (Earth Ret) M10 X 1.5
323-801-012-001D	Temp Sender 150°C (Earth Ret)
323-801-012-002D	Temp Sender 150°C (Earth Ret)
323-801-012-003D	Temp Sender 150°C (Earth Ret)
323-801-017-001N	Temp Sender 120°C (Earth Ret) M10 X 1



A2C Number	Description
323-805-001-001N	TRAS.VDO 14*1,5 120° PI
323-805-001-002C	Temp Sender 120°C(Insul/Ret)5/8
323-805-001-004N	Temp Sender 120°C (Insul/Ret)
323-805-001-005N	Temp Sender 120°C(Insul) 3/8-18 NPTF
323-805-001-015N	Temp Sender 120°C (Insul/Ret) M18 x 1.5
323-805-003-001N	Temp Sender 150°C (Insul/Ret) M14 x 1.5
323-805-003-002N	Temp Sender 150°C (Insul) 1/4-18NPFT
323-805-003-003N	Temp Sender 150°C (Insul/Ret) 5/8-18UNF
323-805-039-001C	TRASM.130°C 14x1.5
323-805-042-001C	Temp Sender 140°C (Insul) M14x1.5 Spec Con
A2C59515306	Temp Sender (Neutral Version A2C59900814)
A2C59515307	Temp Sender (Neutral Version A2C59900815)
A2C59900813	Temp Sender (PDMA2C53025662:323-805-55-1)
A2C59900816	Temp Sender (PDMA2C53308318:40250127)
323-803-001-001D	Temp Sender 120°C (Earth) WC100° M14 x 1.5
323-803-001-004D	Temp Sender 120°C (Earth) WC90° M14 x 1.5
323-803-001-006D	Temp Sender 120°C (Earth) WC96°
323-803-001-007D	Temp Sender 120°C (Earth) WC110°
323-803-001-008D	Temp Sender 120°C (Earth) WC110° M14x 1.5
323-803-001-009D	Temp Sender 120°C (Earth) WC102° M14x 1.5
323-803-001-011D	Temp Sender 120°C (Earth) WC98° 5/8-18NF-3
323-803-001-012D	Temp Sender 120°C (Earth) WC100° 5/8-18NF
323-803-001-013D	Temp Sender 120°C (Earth) WC106° M14x 1.5
323-803-001-016D	Temp Sender 120°C (Earth) WC94° M14x 1.5
323-803-001-019D	Temp Sender 120°C (Earth) WC95° 1/2-14NPT
323-803-001-022D	Temp Sender 120°C (Earth) WC118° M14x 1.5
323-803-001-025D	Temp Sender 250F WC217F 1/2-14NPT
323-803-001-028D	Temp Sender 120°C (Earth) WC98° M14x 1.5

A2C Number	Description
323-803-001-030D	Temp Sender 120°C (Earth) WC100° 1/2-14NPT
323-803-001-032D	Temp Sender 250F WC230F 1/2-14NPT
323-803-001-059D	Temp Sender 120°C (Earth) WC105° 5/8-18NF
323-803-001-060D	Temp Sender 120°C (Earth) WC105° 1/2-14NPT
323-803-002-002D	Temp Sender 150°C (Earth) WC120° M14X 1.5
323-803-002-007D	Temp Sender 150°C (Earth) WC130° M14X 1.5
323-803-002-010C	Temp Sender 150°C (Earth) WC135° M14x 1.5
323-803-002-016D	Temp Sender 150°C (Earth) WC130° M14x 1.5
323-803-002-017D	Temp Sender 150°C (Earth) WC120° M14x 1.5
323-803-002-019D	Temp Sender 150°C (Earth) WC135° M14x 1.5
323-803-002-020D	Temp Sender 150°C (Earth) WC110° M14x 1.5
325-805-003-001C	Temp Sender 120°C (Insul) 1/4-18 D/Stat.
325-805-003-003C	Temp Sender 120°C (Insul) 3/8-18
323-809-019-003A	Temp Sender 120°C (Insul) M18x1.5 Spec Con

## Connection

Sensor	Nav Box Pin	Color	Description
Temp	10	Blue	Coolant Water Temp
	13	Violet	Engine Oil Temp
GND	25	Pink/Brown	Signal GND

For calibration please refer to the Operation manual.

## Pressure Sensors

The Nav Box supports one input for engine oil and one for transmission oil pressure.

Available VDO products:

A2C Number	Description
360-081-029-001C	Press Sender 5Bar (E/Ret) M10 x 1(Short)
360-081-029-001C	Press Sender 5Bar (E/Ret) M10 x 1(Short)
360-081-029-004C	Press Sender 80PSI 1/8-27NPT 29/4
360-081-029-008C	Press Sender 5Bar (E/Ret) 1/4-
360-081-029-012C	Press Sender 150PSI 1/8-27NPT 29/12
360-081-029-013C	Press Sender 10Bar (E/Ret) M12x1.5
360-081-029-020C	Press Sender 10Bar (E/Ret) 1/4-18NPTF
360-081-029-026C	Press Sender 5Bar (E/Ret) M14
360-081-029-026K	Press Sender 5Bar (E/Ret) M14 x 1.5
360-081-029-033C	Press Sender 10Bar (E/Ret) M14 x 1.5
360-081-029-041C	Press Sender 5Bar (E/Ret) 1/8-27NPTF
360-081-029-042C	Press Sender 10Bar (E/Ret) 1/8-27NPTF
360-081-029-059C	Press Sender 5Bar (E/Ret) M18 x 1.5
360-081-029-062C	Press Sender 10Bar 1/8-28BSP 2
360-081-029-085C	Press Sender 5Bar (E/Ret) M12
360-081-037-003C	Press Sender 25Bar (E/Ret) M18 x 1.5
360-081-037-006C	Press Sender 16Bar (E/Ret) M14 x 1.5
360-081-037-007C	Press Sender 16Bar (E/Ret) 1/8-27NPTF
360-081-037-008C	Press Sender 25Bar (E/Ret) M10 x 1
360-081-037-010C	Press Sender 25Bar (E/Ret) 1/8-27NPTF
360-081-037-017C	Press Sender 25Bar (E/Ret) M14 x 1.5
360-081-037-018C	Press Sender 25Bar (E/Ret) M18 x 1.5
360-081-037-019C	Press Sender 16Bar (E/Ret) M12 x 1.5
360-081-032-001C	Press Sender 5Bar (Insul/Ret) 1/8-27NPTF
360-081-032-002C	Press Sender 5Bar (Insul/Ret) M10x1
360-081-032-003C	Press Sender 10Bar (Insul/Ret) M10x1
360-081-032-004C	Press Sender 10Bar (E/Ret) M12 x 1.5
360-081-032-006C	Press Sender 10Bar (Insul/Ret) M14 x 1.5
360-081-032-007C	Press Sender 5Bar (Insul/Ret) 1/8-27NPTF
360-081-032-011C	Press Sender 2Bar (Insul/Ret) M12 x 1.5
360-081-032-013C	Press Sender 5Bar (Insul/Ret) M18 x 1.5

A2C Number	Description
360-081-032-014C	Press Sender 150PSI FG 1/8-27NPT 32/14
360-081-032-025C	Press Sender 2Bar (Insul/Ret)1
360-081-032-053C	Press Sender 10Bar (Insul/Ret) M12 x 1.5
360-081-032-057C	Press Sender, Elec.
360-081-032-058C	Press Sender, Elec.
360-081-032-060C	Press Sender 5Bar (Insul/Ret) M14 x 1.5
360-081-038-001C	Press Sender 25Bar (Insul/Ret)
360-081-038-002C	Press Sender 25Bar (Insul/Ret)
360-081-038-003C	Press Sender 25Bar (Insul/Ret)1/8-27nptf
360-081-038-005C	Press Sender 25Bar (Insul/Ret) M18 x 1.5
360-081-051-012C	Press Sender 10Bar (Insul/Ret) M16 x 1.5
360-081-051-013C	Press Sender 7Bar (Insul/Ret)1/8-27NPTF
360-081-030-004C	Press Sender 5Bar (E/Ret) W/C
360-081-030-008C	Press Sender 5Bar (E/Ret) W/C 0.5 M12
360-081-030-009C	Press Sender 150PSI WC7 M10X1K 30/9
360-081-030-010C	Press Sender 5Bar (E/Ret) W/C1.4 1/8-27
360-081-030-015C	Press Sender 10BAR WC0.8 1/8-27NPT
360-081-030-017C	Press Sender 10Bar (E/Ret) W/C0.9 M10x1
360-081-030-018C	Press Sender 5Bar (E/Ret) W/C1.2 M10x1
360-081-030-019C	Press Sender 10Bar (E/Ret) W/C1.5 M12
360-081-030-020C	Press Sender 80PSI(E/Ret) W/C8
360-081-030-022C	Press Sender 10Bar (E/Ret) W/C
360-081-030-023C	Press Sender 80PSI WC7 1/8-27NPT 30/23
360-081-030-028C	Press Sender 5Bar(E/Ret)W/C0.5
360-081-030-030C	Press Sender 10Bar(E/Ret)W/C0.7 M14x1.5
360-081-030-032C	Press Sender 10Bar(E/Ret)W/C0.5 M14x1.5
360-081-030-036C	Press Sender 5Bar(E/Ret)W/C0.5 M18x1.5
360-081-030-037C	Press Sender 10Bar(E/Ret)W/C0.75 M18x1.5
360-081-030-039C	Press Sender 10Bar(E/Ret)W/C0.75 M10x1
360-081-030-041C	Press Sender 10Bar(E/Ret)W/C2.
360-081-030-049K	Press Sender 5Bar(E/Ret)W/C0.4 1/8-27NPT
360-081-030-052C	Press Sender 10Bar(E/Ret)W/C0.4 1/8-27NP

A2C Number	Description
360-081-030-063C	Press Sender 10Bar (E/Ret) W/C1.0 M14x1.5
360-081-030-070C	Press Sender 10Bar (E/Ret) W/C0.5 M18x1.5
360-081-030-071C	Press Sender 5Bar (E/Ret) W/C0.4 M14x1.5
360-081-030-074C	Press Sender 10Bar (E/Ret) W/C0.5 M18x1.5
360-081-030-086C	Press Sender 5Bar (E/Ret) W/C0.5 1/8-27NPT
360-081-030-097C	Press Sender 5Bar (E/Ret) W/C0.5 M14x1.5
360-081-030-100C	Press Sender 10Bar (E/Ret) WC4.0 1/8-27NPT
360-081-030-107C	Press Sender 10Bar (E/Ret) W/C5.
360-081-030-112C	Press Sender 10Bar(E/Ret)W/C1.35 M10x1
360-081-030-119C	Press Sender 5Bar(E/Ret)WC1.4 1/8-27NPTF
360-081-030-122C	Press Sender 10Bar (E/Ret) W/C0.75 M18x1.5
360-081-030-138C	Press Sender 10Bar (E/RET) W/C1.25 1/8-27
360-081-030-152C	Press Sender 10Bar (E/Ret) W/C5.2 M10x1
360-081-030-157C	Press Sender 5Bar (E/Ret) W/C0.5 M18x1.5
360-081-034-002C	Press Sender 5Bar (E/Ret) W/C0.25 M14x1.5
360-081-053-003C	Press Sender 25Bar (E/Ret) W/C5.5 M18x1.5
360-081-061-002C	Press Sender 10Bar (E/Ret) W/C0.7 M14x1.5
360-081-061-006C	Press Sender 10Bar (E/Ret) W/C5.0 M12x1.5
360-081-062-002A	Press Sender 5Bar (E/Ret) W/C0.4 M14x1.5
360-081-062-003C	Press Sender 10Bar (E/Ret) W/C5.5 M14x1.5
360-081-062-004A	Press Sender 5Bar (E/Ret) W/C1.0 M14x1.5
360-081-062-005A	Press Sender 10Bar (E/Ret) W/C3.0 M14x1.5
360-081-039-002C	Press Sender 5Bar (Insul) WC0.8 1/8-27NPTF
360-081-039-003C	Press Sender 10Bar (Insul) WC0.8 1/8-27NPT
360-081-039-004C	Press Sender 80PSI (Insul) WC10 1/8-27NPTF
360-081-039-007C	Press Sender 10Bar (Insul) WC1.0 M14 x 1.5
360-081-039-015C	Press Sender 5Bar (Insul) WC0.25 1/8-27
360-081-063-001C	Press Sender 10Bar (Insul) WC5.2 M12 x 1.5
360-081-064-001C	Press Sender 5Bar (Insul) WC0.25 M18 x 1.5
360-081-064-003C	Press Sender 5Bar (E/Ret) W/C0.25 M18x1.6
360-081-064-004C	Press Sender 10Bar (Insul) WC0.6 M18 x 1.5
362-081-001-002C	Press Sender 150PSI 1/8-27NPT

A2C Number	Description
360-081-030-085C	Press Sender, Elec.
362-081-001-002K	Press Sender, Elec., DUAL-STATIO
362-081-002-001K	Press Sender 350PSI 1/8-27NPT
362-081-002-003C	Press Sender 400PSI (E/Ret) 1/
362-081-002-004C	Press Sender 400PSI (E/Ret) 1/
362-081-003-002K	Press Sender 150PSI 1/8-27NPT DUAL
362-081-004-001C	Press Sender 350PSI DUAL 4:1
365-100-010-121C	Electronic Press Sensor 10bar (40692031)
365-100-016-121C	Electronic Press Sensor 16bar (40692032)
365-100-030-121C	Electronic Press Sensor 30bar (40692033)

### Connection

Sensor	Nav Box Pin	Color	Description
Pressure	15	Green	Engine Oil Pressure
	19	Pink	Transmission Oil Pressure
GND	25	Pink/Brown	Signal GND

For calibration please refer to the Operation manual.

## 4.6.2 Resistive Data Conversion

The received data is converted to NMEA 2000 data and transmitted to a NMEA 2000 network

Resistive Input Data	NMEA 2000 / VDO Bus output
Fuel Level	127505 Fluid Level
Rudder Angle	127245 Rudder
Engine Oil Temperature	127489 Eng. Parameters,
Engine Oil Pressure	127489 Eng. Parameters,
Transmission Oil Pressure	127493 Trans. Parameter Dynamic
Coolant Water Temperature	127489 Eng Parameters



## Current Inputs (4...20mA)

The Nav Box implements two 4...20mA current inputs to allow the connection of the following sensors:

- Fresh Water sensor
- Waste Water sensor

Available VDO products:

A2C Number	Description
N02-240-802	OL Watertanksensor 600mm
N02-240-902	Sender Black Water 600mm 4–20mA 12/24V
N02-240-904	Sender Black Water 1200mm 4–20mA 12/24V
N02-240-906	Sender Black Water 1500mm 4–20mA 12/24V
N02-240-402	Sensor Fresh water 600mm 4–20mA 12/24V
N02-240-404	Sensor Fresh water 1200mm 4–20mA 12/24V
N02-240-406	Sender Fresh Water 1500mm 4–20mA 12/24V

## Connection

Sensor	Nav Box Pin	Color	Description
4...20mA	21	White/Yellow	Fresh Water
	22	Grey	Waste Water
GND	25	Pink/Brown	Signal GND

For calibration please refer to the Operation manual.

## Data Conversion

The received data is converted to NMEA 2000 data and transmitted to a NMEA 2000 network

Current Input Data	NMEA 2000 / VDO Bus output
Fresh Water Level	127505 Fluid Level
Waste Water Level	127505 Fluid Level

### 4.6.3 Frequency Input

The Nav Box supports one frequency input to allow the connection of the following sensors:

- Engine Speed signal (pulses)

The frequency range for this input is 0 to 4kHz.

Supported VDO products:

A2C Number	Description
340-216-005-001C	Generator Sender 90mm Alt. 2159-50004201
340-216-005-002C	Generator Sender 63mm Alt. 2159-50004401
340-216-010-003C	Generator Sender 25mm Alt. 2159-50004601
A2C59513983	Blocking Oscillator
340-216-010-004C	Generator Sender 90.2mm M18x1.5 21.5-30V
340-804-005-001C	Inductive Sender 35mm (Kostal)
340-804-005-007C	Inductive Sender 35mm (Kostal)
340-804-005-013A	Inductive Sender 71.4mm (Kostal) M18x1.5
340-804-005-028C	Inductive Sender 63.4mm (Kostal) M18x1.5
340-804-005-033C	Transm. Inductive 18x1.5 L.T.63
340-804-006-002C	Inductive Sender Unit, Elec.
340-804-006-007C	Inductive Sender 34mm (Blade) M18x1.5
340-804-007-002A	Inductive Sender 28.5mm (Blade) M18x1.5
340-804-007-003C	Inductive Sender 34mm (Blade) M18x1.5
340-804-007-004C	Inductive Sender 28.5mm (Blade)3/4-16UNF
340-804-007-011C	Inductive Sender 34mm (Blade) M18x1.5
340-804-007-011G	Inductive Sender 34mm (Blade) M18x1.5
340-804-007-019C	Inductive Sender 70.7mm (Blade) M18x1.5
340-804-030-005B	Inductive Sender 25mm M18x1.5
340-804-077-007C	Sensor Turbo Speed DDC
340-807-001-001C	Generator Type Sender 3000RPM
340-807-001-003C	Generator Type Sender 3000RPM

A2C Number	Description
340-808-001-001C	Generator Type Sender 3000RPM
340-808-001-002C	Generator Type Sender 3000RPM

### Connection

Sensor	Nav Box Pin	Color	Description
Freq.	9	White/Blue	Engine Freq.
GND	8	Brown/Blue	Engine Freq. GND

For calibration please refer to the Operation manual.

### Data Conversion

The received data is converted to NMEA 2000 data and transmitted to a NMEA 2000 network.

Current Input Data	NMEA 2000 / VDO BUS output
Engine Speed (RPM)	127488 Eng. Parameters, Rapid Update

## 4.6.4 Ampere Input

The Nav Box supports one ampere input.

The voltage range for this input shall be 0 to +/-60mV.

Supported VDO products:

A2C Number	Description
A2C59514043	SHUNT AMMETER 60A
A2C59514047	SHUNT AMMETER 150A

## Connection

Sensor	Nav Box Pin	Color	Description
Ampere	23	Yellow/Brown	Amperemeter (-)
	24	Red/Blue	Amperemeter (+)

For calibration please refer to the Operation manual.

### Data Conversion

The received data is converted to NMEA 2000 data and transmitted to a NMEA 2000 network.

Current Input Data	NMEA 2000 / VDO BUS output
Battery Current	127508 - Battery Status

## 4.7 Buzzer Output

The Nav Box buzzer output can be activated in alarm situations and configured through the alarm menu.

### Connection

Sensor	Nav Box Pin	Color	Description
Buzzer (LSS)	1	Brown	Buzzer Out (Low Side Switch)
GND	25	Pink/Brown	Signal GND

## 4.8 USB

In the current software version the USB connection can only be used for service functions.

## 4.9 Log Port



Log Port Pinout

PIN No.	Signal	In-/output range
1	Sensor Power	8V
2	LOG IN	0.2–800Hz
3	GND	0.2–800Hz

The Nav Box supports two VDO Sumlog sensors. The system automatically detects the sensor with the faster speed through water data and distributes it to the system.

All VDO Sumlog sensors are compatible.

Please refer to the Sumlog installation instruction for details.

### Data Conversion

PGN	Description
128259	Speed, Water Referenced

## 4.10 WMA Port



WMA Port Pinout

PIN No.	Signal	In-/output range
1	Power	8V
2	Not Used	
3	COS	2-6V
4	GND	0V
5	SIN	2-6V
6	Wind Speed	0.8-100Hz
7	Not Used	
8	Not Used	

The Nav Box supports one analogue VDO Wind-sensor

Following sensors are supported:

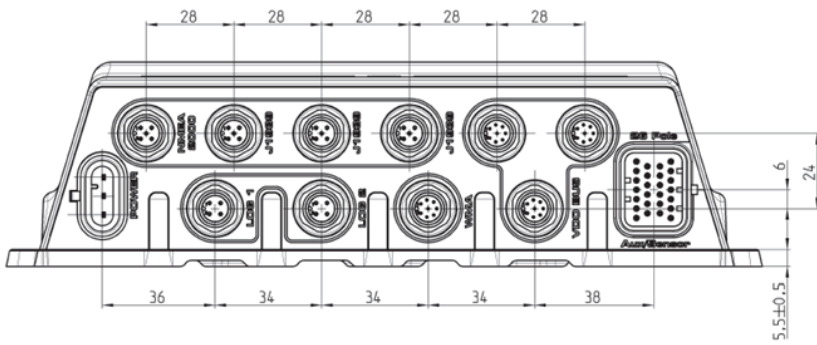
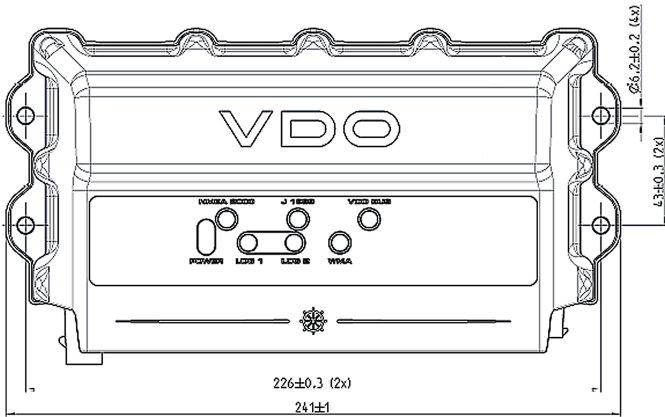
- “Standard” Series Sensors
- Logic Series Sensors
- AcquaLink analogue Sensors

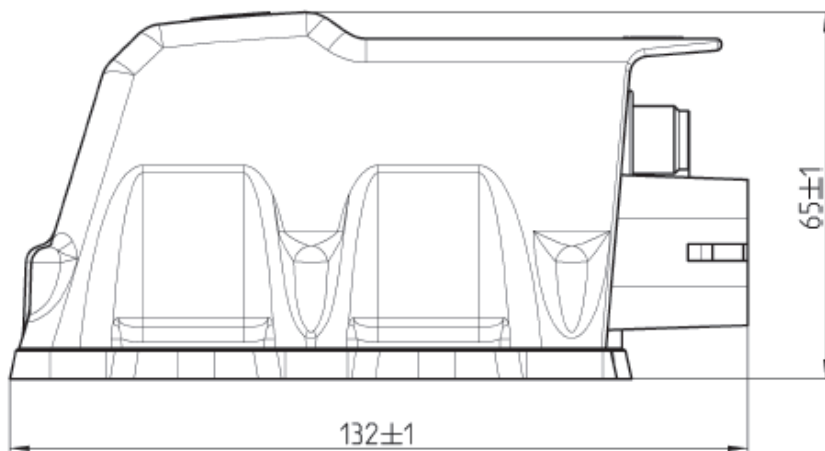
Please refer to the Windsensor installation instruction for details.

### Data Conversion

PGN	Description
130306	Wind Data

## 5. Hardware Specifications





Position	Description
Housing Material	Al Mg9 F/ e-coated (epoxy based) black RAL9005
Top Cover	PBT GB20 black
Connectors	VDO Bus: 3x M12 8 Pin; Power: 3 Pin AMP Superseal; NMEA 2000: 1x M12 5 Pin; SAE J1939: 1x M12 5 Pin; WMA: 1x M12 8 Pin, Log: 2x M12 4 Pin; 26 Pin Analogue Harness
Operating temperature	$-20^{\circ} / +70^{\circ}$
Storage temperature	$-40 / +85^{\circ}$
Operating voltage range	8 – 28 VDC
Protection Class	IP 67
	According to IEC 60529:2001; in nominal position
EMC	DIN-EN 61000-6-2:2006 IEC 60945:2002
Approval	CE





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